GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS

SPECIAL ASSISTANCE FOR PROJECT FORMATION (SAPROF) FOR DEDICATED FREIGHT CORRIDOR PROJECT

FINAL REPORT
(Volume 2)

JANUARY 2010

JAPAN INTERNATIONAL COOPERATION AGENCY

NIPPON KOEI CO., LTD.
JAPAN RAILWAY TECHNICAL SERVICE

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Appendix 3-1 S-ESIMMS Report

Supplemental Environmental and Social Impact Mitigation Measures Study (S-ESIMMS) for Western Corridor of the DFC Project between Rewari and Vadodara

Final Report

August 2009

MINISTRY OF RAILWAYS
DFCC of India Ltd.

Supplemental ESIMMS (S-ESIMMS)

for Western Corridor of the DFC Project

between Vadodara and Rewari

Final Report

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List of Abbreviation

AF_S	:	Affected Families
BIS	:	Bureau of Indian Standard
BOD	:	Biological Oxygen Demand
BPL	:	Below Poverty Line
BSR	:	Basic Schedule of Rates
cc	:	Cubic Centimetre
CF	:	Conservator of Forest
Cl	:	Chlorine
COD	:	Chemical Oxygen Demand
COI	:	Corridor of Impact
CPCB	:	Central Pollution Control Board
CPR	:	Common Property Resources
CSO	:	Civil Society Organisation
CSR	:	Common Schedule of Rates
CS	:	Construction Supervision
CWC	:	Central Water Commission, India
DC	:	District Collector
DDP	:	Desert Development Programme
DFC	:	Dedicated Freight Corridor
DFC	:	Dedicated Freight Corridor
DFCCIL	:	Dedicated Freight Corridor Corporation of India Limited
DFO	:	Divisional Forest Offices
DO	:	Dissolve Oxygen
DPR	:	Detailed Project Report
DSP	:	Density of the Species
EIA	:	Environment Impact Assessment
EMAP	:	Environmental Management Action Plan
EMP	:	Environment Management Plan
EMU	:	Environment Management Unit
EP	:	Entitled Person
ESCS	:	Environmental and Social Considerations Study
ESIMMS	:	Environmental and Social Impact Mitigation Measure Study
Fe		Iron (Ferrum)
GOI	:	Government of India
GRC	:	Grievance Redressal Committee
GSFC	:	Gujarat State Fertilizer Company
Hg	:	Mercury (Hydrargyrum)
IBG	:	Important Broad Gauge
ICD_S	:	Inland Container Depot
ILO	:	International Labour Organisation
IS	:	Indian Standard
JARTS	:	Japan Railway Technical Services
JBIC	:	Japan Bank for International Cooperation
JICA		Japan International Corporation Agency
K	:	Potassium (Kalium)
LA	:	Land Acquisition
LA Act	:	Land Acquisition Act
LA_E	:	Exposure Noise Level
LAeq	:	Equivalent Noise Level
M&E	:	Monitoring and Evaluation
MLA	:	Member of Legislative Assembly
MOEF	:	Ministry of Environment and Forest
MOR	:	Ministry of Railways
NGO	:	Non Government Organization
NPRR	:	National Policy on Resettlement and Rehabilitation
NRCP	:	National River Conservation Plan
NRP	:	National Rehabilitation Policy

NTH	:	Non Titleholder
ODA	:	Official Development Assistance
OBC		Other Backward Caste
PAF_S	:	Project Affected Families
PAH	:	Project Affected Household
PAP_S	:	Project Affected Person
PCCF	:	Principal Conservator of Forest
PI	:	Performance Indicator
PIAW	:	Potential Impact Area of Wildlife
PUC	:	Pollution Under Control
PVAC	:	Property Valuation Assessment Committee
RAP	:	Resettlement Action Plan
RF	:	Reserved Forest
RFM	:	River Flow Measurement
ROB	:	Railway Over Bridge
ROW	:	Right of Way
R&R	:	Resettlement and Rehabilitation
RRO	:	Resettlement and Rehabilitation Officer
RRP	:	Resettlement and Rehabilitation Plan
RRS	:	Resettlement and Rehabilitation Specialist
RUB	:	Railway Under Bridge
SAC	:	Space Application Centre
SAL	:	Study Area Location
SC	:	Scheduled Caste
SC	:	Supervision Consultant
SIA	:	Social Impact Assessment
SiI	:	*Sighting of Individuals*
SPCB	:	State Pollution Control Board
SR	:	Sensitive Receptor
ST	:	Scheduled Tribe
TH	:	Title Holder
TOR	:	Term of Reference
U/s	:	Under Section
VRC	:	Village Rehabilitation Committee
WB	:	World Bank
WHH	:	Women Headed Households
WHO	:	World Health Organization
WLS	:	Wild Life Sanctuaries

CHAPTER I-1 INTRODUCTION

1.1 BACKGROUND

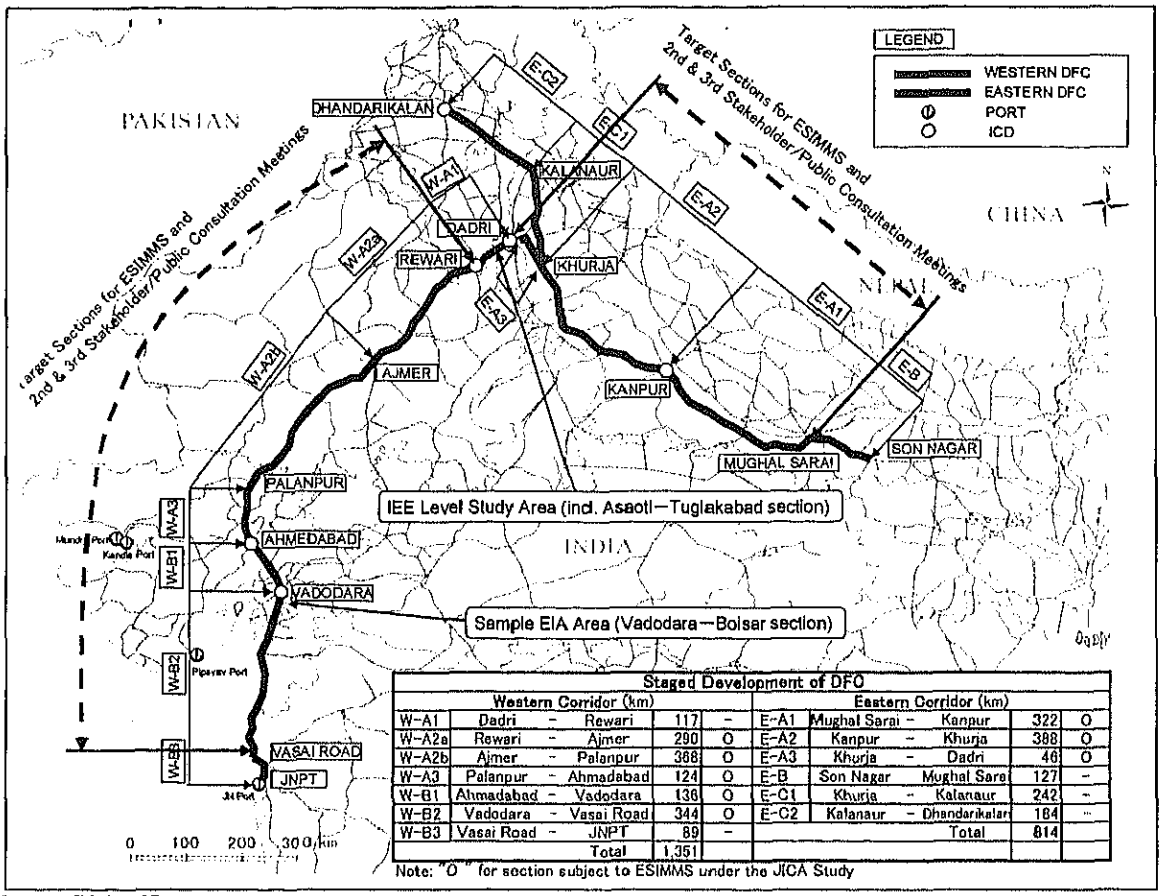
Corridors which connect major urban centres of Mumbai, Delhi, Kolkata and Chennai are called as "Golden Quadrilateral" and these corridors are placed as the most important and indispensable corridors for economic growth of India. Railway transport has been playing a significant role along the corridors in passenger and freight transport market. However, the task of drastic expansion of railway transport capacity in India has become the most important and urgent issues, because the existing railways transport system can not catch up with the increases demand for both passenger traffic and freight traffic which have been derived from recent rapid economic growth in India. Therefore, the Government of India (GOI) officially requested Government of Japan (GOJ) for the execution of Japan's technical corporation to assess the feasibility on the development of Dedicated Multimodal High-axel Load Freight Corridors with computerized control for Delhi-Mumbai and Delhi- Howrah in India.

In response to the request from GOI (July 2005), GOJ and Japan International Cooperation Agency (JICA) decided to conduct the feasibility study on the development of Dedicated Freight Corridors (DFC) for Delhi-Mumbai and Ludhiana - Sonnagar in India (JICA F/S). Objective of JICA F/S was to review the PETS and Final Location Survey (FLS) of DFC Project that was prepared by the GOI. Since the FLS could not be handed over to JICA Study Team (JST) within sufficient time to incorporate within JICA F/S, the JST devised the Guideline Design (GLD) and General Arrangement Drawing (GAD) which GOI agreed to follow in principle for the preparation of FLS. At the end of the JICA F/S, an agreement was reached between Ministry of Railways (MOR) and JST that the FLS works will continue in conformity to the principle of GLD and GAD.

The Environmental and Social Considerations Study (ESCS), an Initial Environmental Examination (IEE) level study, was conducted from November 2006 to March 2007 in the First Year of JICA F/S. The ESCS area consisted of the development stage sections between Dadri, Uttar Pradesh and JNPT, Maharashtra (approx. 1,400 km) for the Western Corridor and the development stage sections between Luhdiana Punjab and Sonnagar, Bihar (approx. 1,200 km) for the Eastern Corridor as shown in Figure 1-1. The first stage of Public Consultation Meetings was also held in this period in 10 states accordingly. In the ESCS, important environmental and social items to be assessed further as an EIA level study were identified. Based on these results of ESCS, the Environmental and Social Impact Mitigation Measures Study (ESIMMS) was conducted based on GLD. The study area of ESIMMS was narrowed down to 37 districts in 5 states. In these 37 districts, the ESIMMS consisting of natural environmental study, pollution control study, social environmental study, and a series of Stakeholder/Public Consultation Meetings (PCMs) at the 2nd and 3rd stages were conducted. Various environmental and social impacts mitigation measure together with the Environmental Management Plan (EMAP) and Environmental Monitoring Plan (EMOP) have been proposed in ESIMMS.

However, supplemental surveys and studies to ESIMMS have been still requested as EIA level study such as consideration of seasonal changes of flora and fauna in the area, more detailed noise and vibration study taking into consideration the distribution of sensitive receptors, and wider socio-economic survey for social impact assessment (SIA). In addition, after JICA F/S, the FLS works have progressed and it has been identified that there are deviations between the alignments proposed in GLD and described in FLS. The deviations of the alignments between Vadodara and Rewari have been reviewed during the study on Special Assistance for Project Formation (SAPROF) of the DFC Project, which has been conducted since July 2008, and the alignments have been finalized together with locations of other important railway facilities such as junction stations. Therefore, the Supplemental Environmental and Social Impact

Mitigation Measures Study (S-ESIMMS) has been conducted based on the finalized alignments of the DFC Project between Vadodara and Rewari.



Staged Development of DFC

Western Corridor (km)						Eastern Corridor (km)					
W-A1	Dadri	–	Rewari	117	–	E-A1	Mughal Sarai	–	Kanpur	322	O
W-A2a	Rewari	–	Ajmer	290	O	E-A2	Kanpur	–	Khurja	388	O
W-A2b	Ajmer	–	Palanpur	368	O	E-A3	Khurja	–	Dadri	46	O
W-A3	Palanpur	–	Ahmadabad	124	O	E-B	Son Nagar		Mughal Sarai	127	–
W-B1	Ahmadabad	–	Vadodara	136	O	E-C1	Khurja	–	Kalanaur	242	–
W-B2	Vadodara	–	Vasai Road	344	O	E-C2	Kalanaur	–	Dhandarikalan	184	–
W-B3	Vasai Road	–	JNPT	89	–				Total	814	
			Total	1,351							

Note: "O" for section subject to ESIMMS under the JICA Study

Source: ESIMMS

Figure 1-1 Study Area of ESCS and ESIMMS

1.2 OBJECTIVES OF S-ESIMMS

The broad objective of the S-ESIMMS is to conduct supplemental environmental and social considerations study for the DFC Project based on the finalized alignments in order to formulate the DFC Project in more sustainable and effective manner, especially in environmental and social aspects, so that the expected outputs from the Project would be satisfactory for the beneficiaries. The specific objectives of the S-ESIMMS are summarised below.

- To confirm the consistency between the FLS and GLD/GAD of JICA F/S from the environmental and social considerations points of view,
- To review the environmental and social considerations of ESIMMS taking into consideration the finalized alignments,
- To conduct supplemental surveys and studies based on the findings from the above,
- To formulate additional mitigation measures based on the results of above supplemental surveys and studies,
- To review and update EMAP and EMOP which are proposed in ESIMMS.

1.3 STUDY AREA OF S-ESIMMS

The study area of the S-ESIMMS is along the 1st priority section between Vadodara and Rewari in the electrified Western DFC as shown in Figure 1-2.

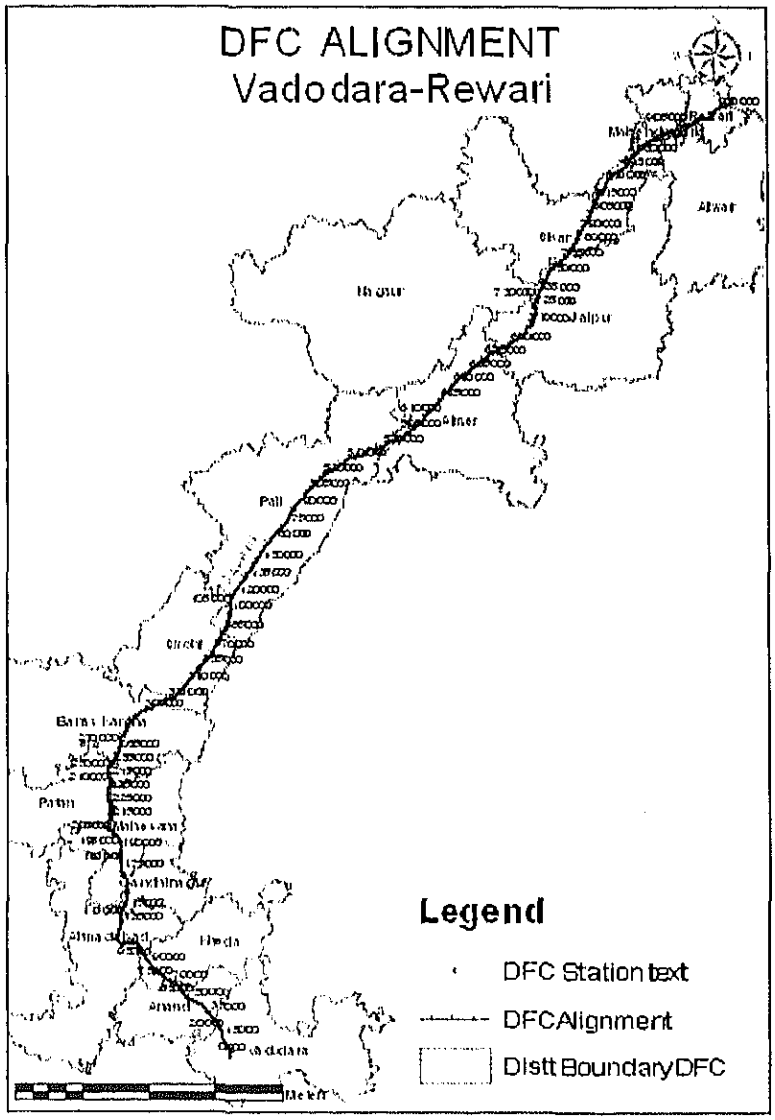


Figure 1-2 Study Area of S-ESIMMS

CHAPTER I-2 OUTLINE OF THE PROJECT

2.1 LOCATION OF THE PROJECT

The DFC project subject to implementation by Japanese Yen loan extends approximately 920 km across Vadodara (Gujarat) and Rewari (Haryana) via Ajmer (Rajasthan).

As shown in the following figure, the geodetic survey of the Project alignment, carried out by DFCCIL, consists of eleven sections, from Section 5 to Section 15.

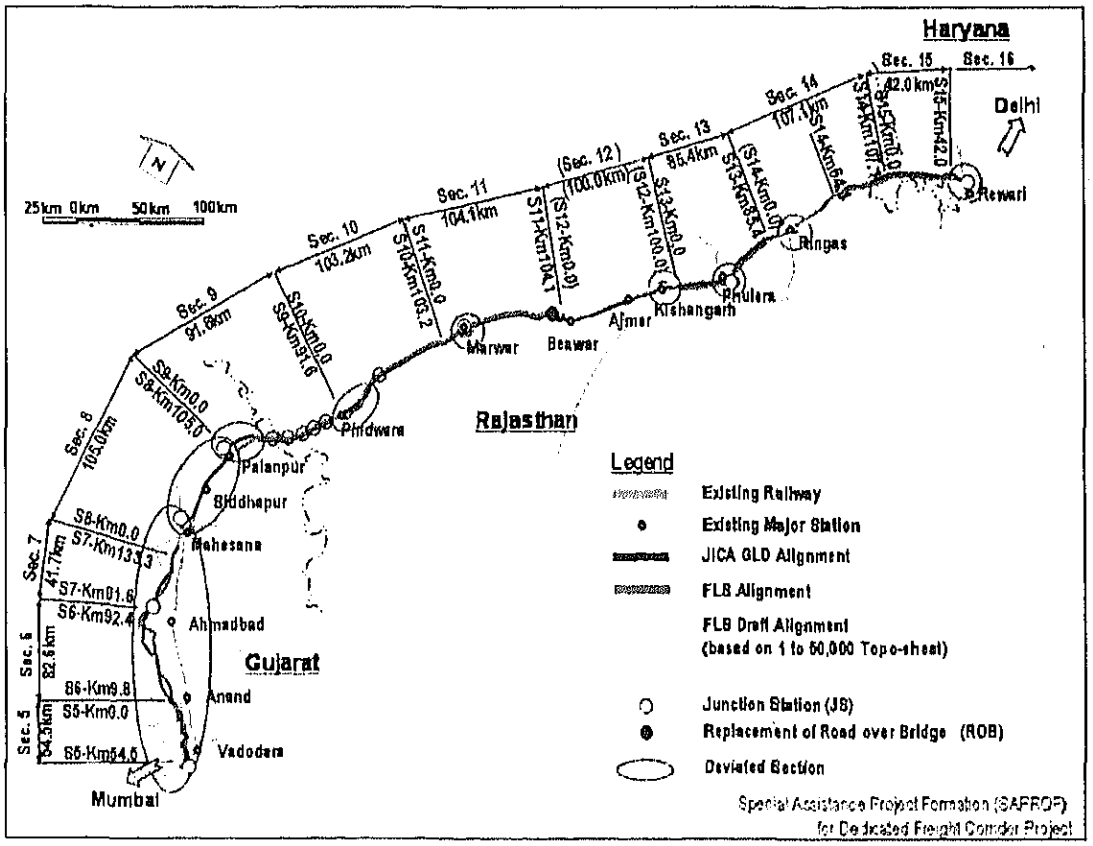


Figure 2-1 Schematic Overview of Deviations between FLS and JICA GLD

2.2 SCOPE OF THE PROJECT

The following is the scope of the Project agreed in the Minutes of Discussion, dated 28th March 2008, between JICA (Ex-JBIC) and MOR.

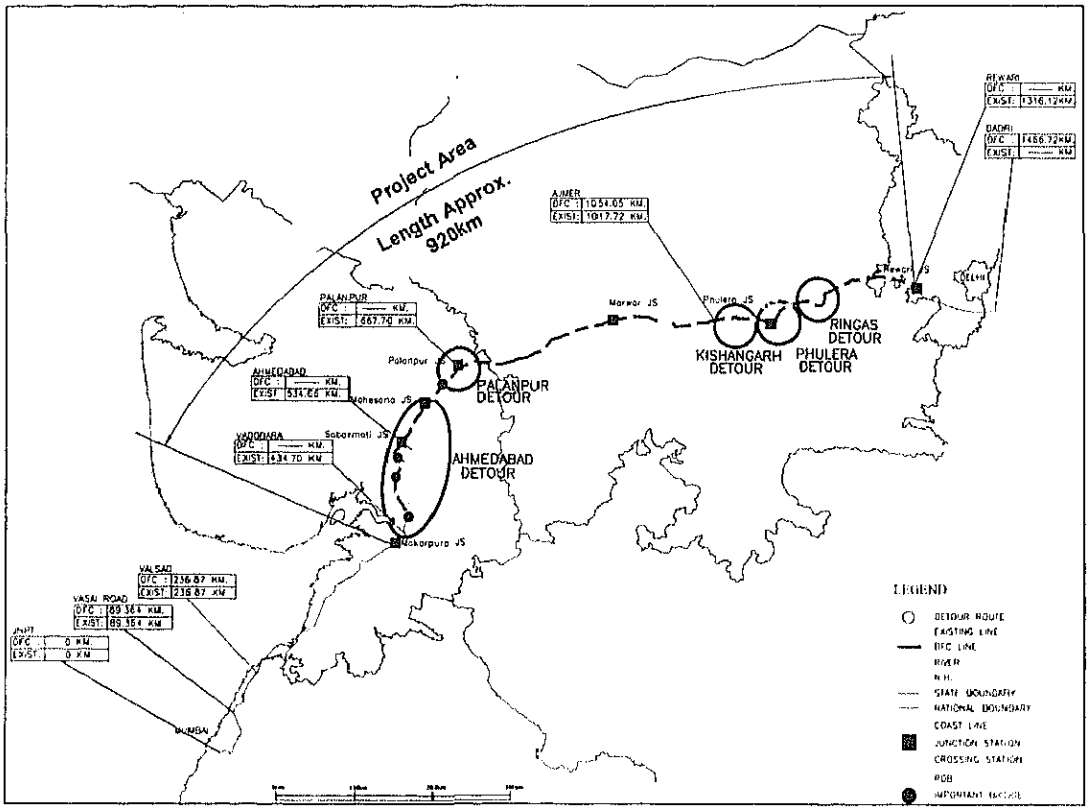
- Civil and Building works
- Track works
- Electrical works
- Mechanical works
- Signalling and telecommunication works
- ICD construction works
- Procurement of locomotive and other equipment
- Social development
- Consulting services

The decision to include the above as Project components depends on the outcome of the SAPROF study. It is noted that the examination of the environmental and social consideration study for the ICD was not conducted since the location as well as the availability of land was not confirmed by DFCCIL.

2.3 PROJECT PLANNING

2.3.1 Guideline Design by the JICA Study

(1) Alignment



Western route of dedicated freight corridor subject to implementation by Japanese Yen Loan is traversing Vadodara – Ahmedabad – Palanpur – Rewari as double track. The proposed alignment passes through the states of Gujarat, Rajasthan and Haryana.

For reviewing the route alignment, considering for construction method, economical efficiency, etc. were kept in mind besides the following basic concepts. About any portion considered necessary for modification, it will only be proposed by stating clear reason.

1) The majority of alignment plan of RITES is kept mostly same as much as possible. (It will not be changed or modified without assigning a clear reason)

2) The plan should be made such that the social / natural environmental impact, such as relocation of inhabitants, to be as minimum as possible.

3) The plan is made based on the technical principle of the railway alignment parameters such as the minimum curve radius is about 700 m, with the maximum gradient of 5‰, considered compensation due to the affect of vertical curve, etc.

4) Existing ROBs in parallel section are basically to be replaced. For considerably difficulty in ROBs replacement and a large scale/size of ROBs and/or for the ones located in

congested area, detour of DFC will be considered.

5) The route is considered on the presumption that the level crossings in parallel section are to be grade separated, and all crossing roads along DFC detour section are to be RUBs.

However, it is also considered based on the assumption that the construction of ROBs will be isolated from the DFC project, and their implementation will continue even after the completion of DFC. The level crossing can be converted to an automatic level crossing during the period until ROB is fully built and operational.

In the case of sections that comprise of many level crossings which have to be grade separated such as for TVU ≥ 900,000, and the total number of level crossing are more than one in every 2 km in between DFC stations, it will be an objective decision to consider elevating DFC. It will be decided whether or not to do so, by considering the surrounding topographical features, soil conditions and locations, etc.

6) When crossing a river, a highway, etc. (Important Bridges), it should cross at right-angle as far as possible. Even when it is unavoidable, in order to prevent designing a structure with an extreme angle of skew, the crossing angle shall be maintained at least 60 degrees or more, in principle.

7) Each Crossing Station of DFC is constructed on ground level in principle, however in case of detour section, it may have to be constructed on embankment or viaduct.

Alignment of the project is summarized in following table

Table 2-1 Summary of alignment for Yean Loan Parts (JICA Study)

Route Description	Total Length	Detour Length	Remarks
Vadodara – Ahmedabad	136.0	136.0	Ahmedabad Detour
Ahmedabad - Mahesana – Palanpur	123.6	71.5	Ahmedabad Detour
Palanpur – Ajmer	366.0	36.2	Palanpur Detour
Ajmer – Rewari	290.3	48.8	Kishangarh Detour, Phulera Detour, Ringas Detour
Total Length	915.9	292.5	

As a result of review based on the above policy, some portions of modifications are proposed in Section 2.5.2.

(2) Junction Station

Basic policy of station planning indicated in JICA Feasibility Study

The basic policy of planning is described as follows:

1) Layout of station yards are planned based on the forecasted number of trains in 2031 for through traffic and entry/exit by direction as calculated in the demand forecast of the JICA Feasibility Study. Reference is made to PETS-II.

2) At-grade crossing is planned in case the number of trains entering and leaving the station is low (less than 10 trains per day crossing the main tracks). In this case departure/arrival tracks between both main tracks are provided.

3) In case that the number of trains entering/leaving is less than 6 trains per day for the total of switch-back operation, switch-back operation is adopted and an engine turn-around track is provided. If the number of train is assumed to be very few, the main line can be used for engine turn-round.

4) In order that the trains entering and leaving do not interfere with the smooth operation on the main tracks as they wait for clearing of the forward route, a departure/arrival track is provided for each direction. In addition, at least one refuge track is provided to accommodate malfunctioning trains.

5) At junction stations where the crew of almost all trains change, necessary stopping times are considered in calculating the required number of loops. (In such stations the main tracks can be used for trains to stop for crew change, since almost all trains stop at this station.)

6) In case that a part from the main yard area turnouts are installed for entry /exit between the DFC line and a crossing feeder line, a waiting track at the entry side is provided (A signal station under the junction station).

7) Effective track length is considered to be 1,500 m. At stations where at-grade crossing is planned, a loop for uncoupling is provided out of the DFC main yard so that two uncoupled trains will not cross the main track.

8) Track layout for grade separation at the station yards is to be planned to minimise outstanding. For this purpose the crossing axes angle is to be minimized. If both tracks are to be newly constructed, the angle should be 15 degrees using reinforced concrete tunnel-like structures seen from the track below. If the track is constructed over operating tracks, the angle should be 30 degrees using through-type steel girders/trusses. For both can case the structures of upper tracks to be designed as low as possible.

9) In order to prevent lengthening of approach banks due to curve compensation for maximum gradient and exclusion of coexistence of a vertical curve with a transition curve, curves are to be applied to the tracks on the ground as far as possible to make the alignment of the tracks on the flyover suitable for steeper gradient. Vertical curves are to be located on the over bridge in order to shorten approach banks, although this will make the highest point even higher.

10) Prevention of degradation of road traffic situation is considered.

11) Width of formation of yard is considered as 100m for space for various works and for locating buildings. At some junction stations located on detour route and elevated, buildings are to be constructed on the existing ground if suitable based on their purpose.

12) The planning is to be carried out with due consideration to future grade separation of the at-grade crossings with roads of existing lines.

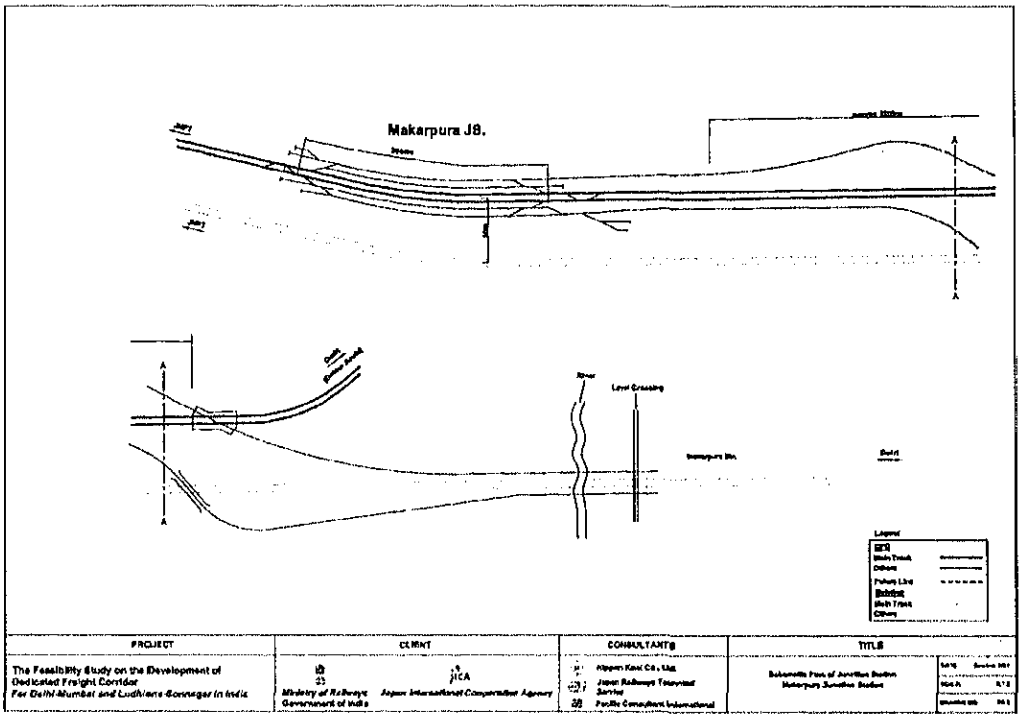
13) Possibility of future construction of crossing roads in long sections were considered.

14) Even though station yards are planned following the above principles, station yard require vast acquisition of land, and therefore selection of the sites for junction stations requires serious examination. Locations which will result in resettlement of the whole community or dividing a village is avoided.

JICA Guideline Design for each Junction Station

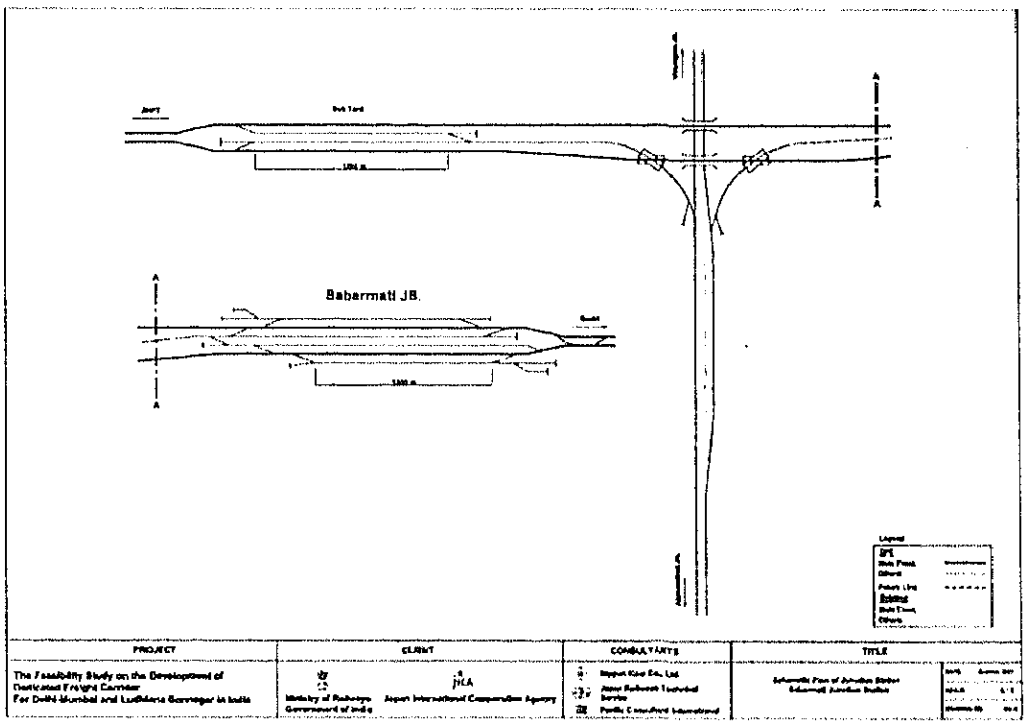
A 750m continuous standing room (CSR) is considered; however, the JICA Guideline Design is drawn up of 1,500 m CSR since it is necessary to secure necessary land and to select suitable location for double coupled train operation which requires a 1,500 m CSR.

Guideline Design of each Junction station was presented in the JICA Feasibility Study Final Report Volume 5 (Annex 2) October 2007 – Preliminary Design Drawings for Proposed Phase I-a Section. The following are the excerpts.



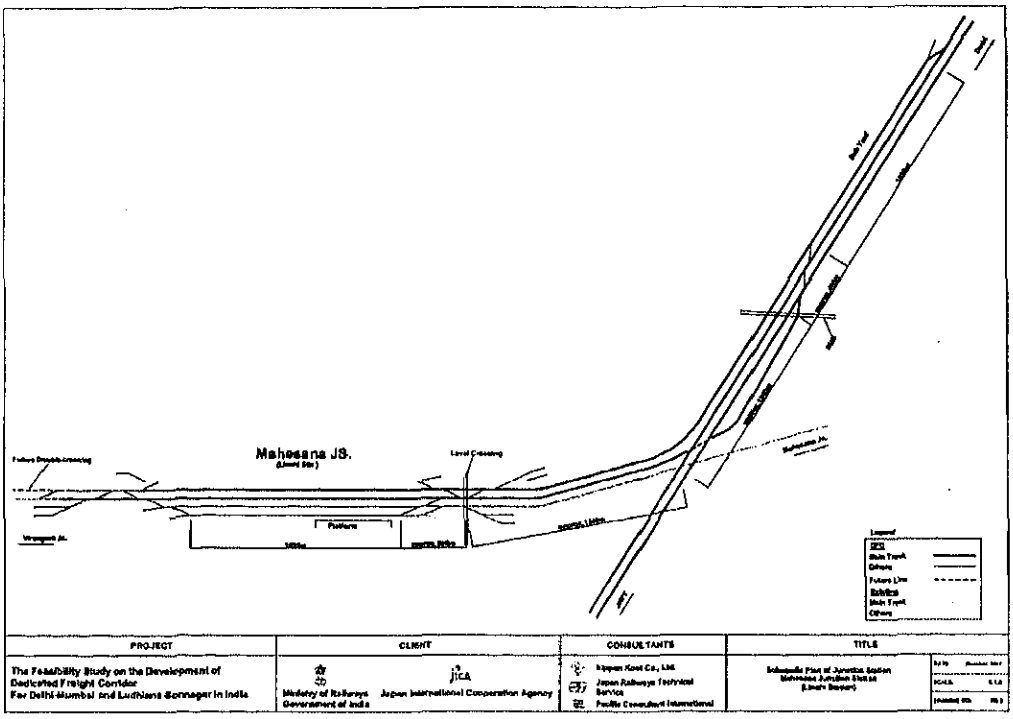
Source: JICA Feasibility Study Final Report Volume 5 (Annex 2) October 2007 – Preliminary Design Drawings for Proposed Phase I-a Section

Figure 2-2 Makarpura Junction Station of JICA GLD



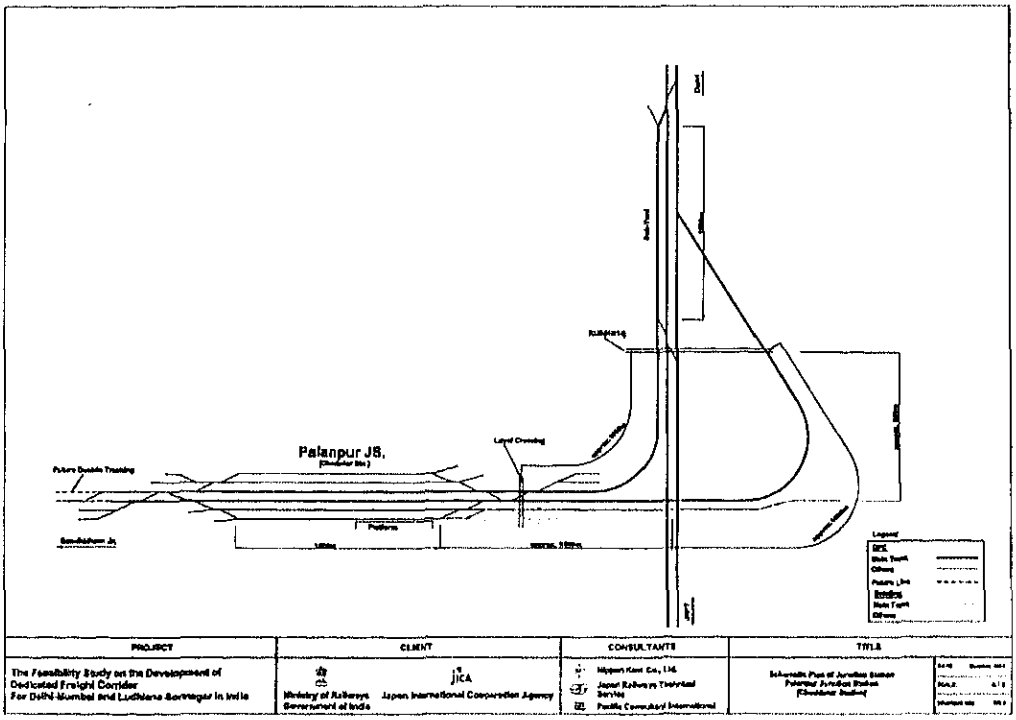
Source: JICA Feasibility Study Final Report Volume 5 (Annex 2) October 2007 – Preliminary Design Drawings for Proposed Phase I-a Section

Figure 2-3 Sabarmati Junction Station of JICA GLD



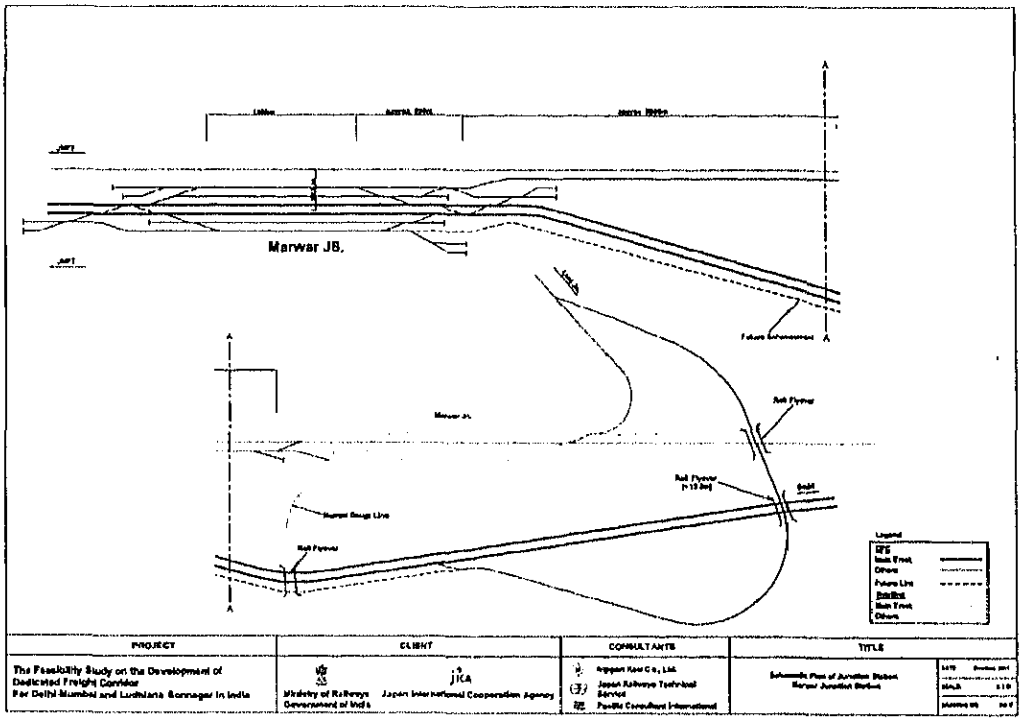
Source: JICA Feasibility Study Final Report Volume 5 (Annex 2) October 2007 – Preliminary Design Drawings for Proposed Phase I-a Section

Figure 2-4 Mahesana Junction Station of JICA GLD



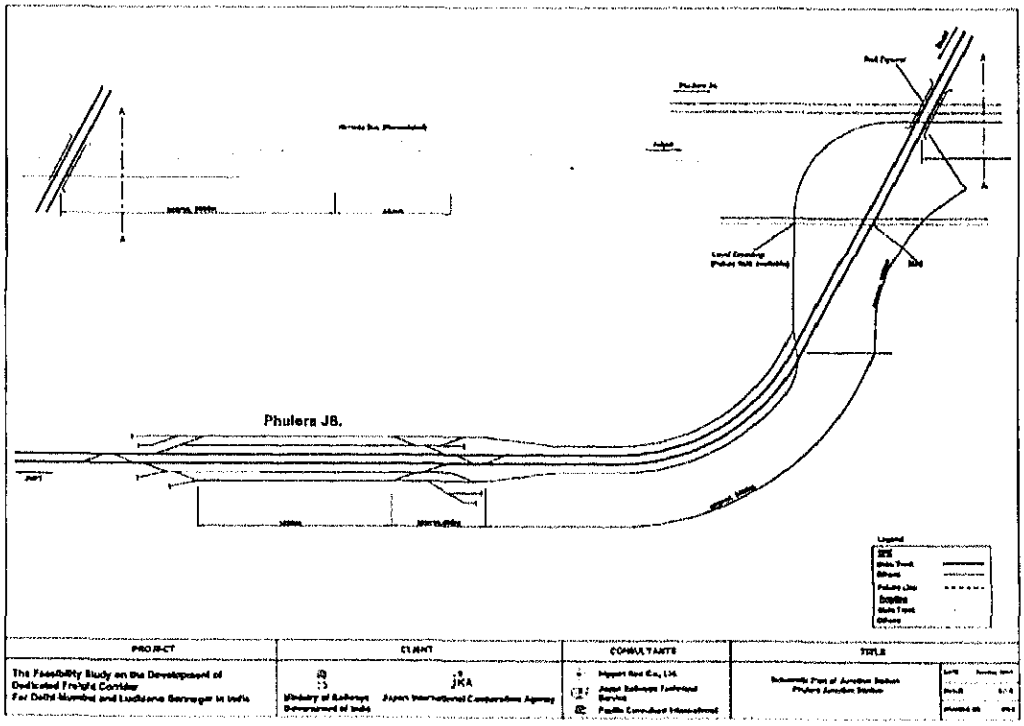
Source: JICA Feasibility Study Final Report Volume 5 (Annex 2) October 2007 – Preliminary Design Drawings for Proposed Phase I-a Section

Figure 2-5 Palanpur Junction Station of JICA GLD



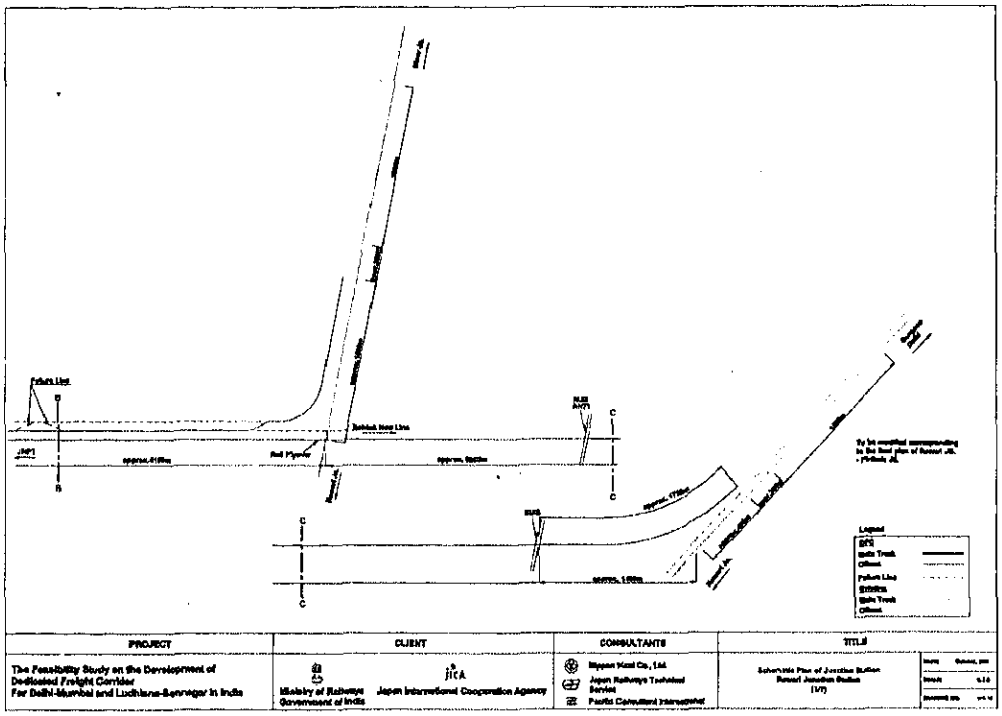
Source: JICA Feasibility Study Final Report Volume 5 (Annex 2) October 2007 – Preliminary Design Drawings for Proposed Phase I-a Section

Figure 2-6 Marwar Junction Station of JICA GLD



Source: JICA Feasibility Study Final Report Volume 5 (Annex 2) October 2007 – Preliminary Design Drawings for Proposed Phase I-a Section

Figure 2-7 Phulera Junction Station of JICA GLD



Source: JICA Feasibility Study Final Report Volume 5 (Annex 2) October 2007 – Preliminary Design Drawings for Proposed Phase I-a Section

Figure 2-8 Rewari Junction Station of JICA GLD

2.3.2 Finalized Project Planning by the SAPROF Study

(1) Alignment

In the S-ESIMMS, checking for consideration for avoidance of local communities, wildlife sanctuary, city planning area, marble stone factories, residential area, large excavation and others Minimised diverted. And also reviewing "Design conditions (Gradient, Minimum Curve Radius, Maximum Gradient etc)" and "location gap between GLD and FLS"

Agreed alignment between SAPROF Study Team and DFCCIL is summarized in following table.

Table 2-2 Summary of alignment for Yean Loan Parts (SAPROF Study)

Sec No.	Section Length	Detour Length	Total Length	Detour Total
Sec5 (Makarpura – Anand)	59.4 km	59.4 km	922.6 km	338.5 km
Sec6 (Anand – Sabarmati)	82.7 km	82.7 km		
Sec7 (Sabarmati – Mahesana)	39.6 km	39.6 km		
Sec8 (Mahesana – Palanpur)	95.0 km	95.0 km		
Sec9 (Palanpur – Shirohi Rd)	98.9 km	36.9 km		
Sec10 (Shirohi Rd – Bhinwaliya)	101.4 km	2.7 km		
Sec11 (Bhinwaliya – Amarpura)	102.2 km	0.0 km		
Sec12 (Amarpura – Gehlota)	98.4 km	11.8 km		
Sec13 (Gehlota – Badhal)	85.4 km	7.2 km		
Sec14 (Badhal – Amarpur)	106.8 km	0.0 km		
Sec15 (Amarpur – Rewari)	52.8 km	3.2 km		

Major change from JICA GLD is

Section between Mahesana and Palanpur was detour in SAPROF Study, however it was parallel at JICA GLD. Therefore, totally became detour section from Vadodara upto Palanpur.

Deviation between GLD and FLS and agreed alignment shows in Section 2.5.3

(2) Junction Station

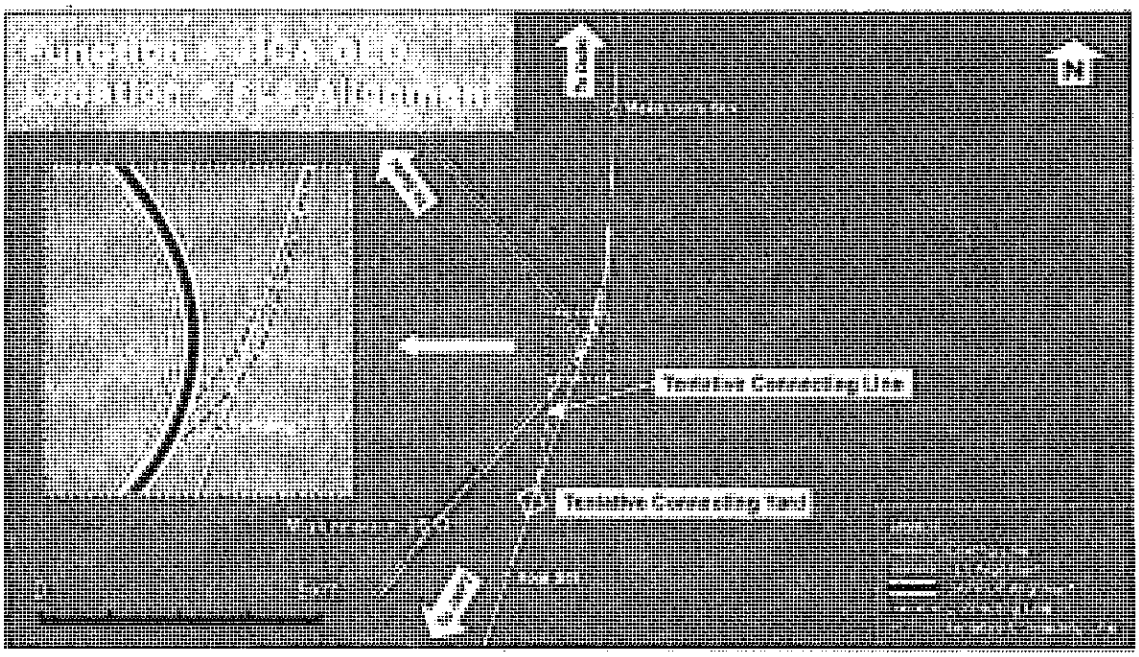
The location of the junction stations and its connectivity to existing IR lines depend on the existing operation of the IR lines, natural and social environmental constraints on site, as well as topographical condition on site.

The finalised junction station plans are shown as follows:

Table 2-3 Conceptual Design of Junction Station Determined in SAPROF Study

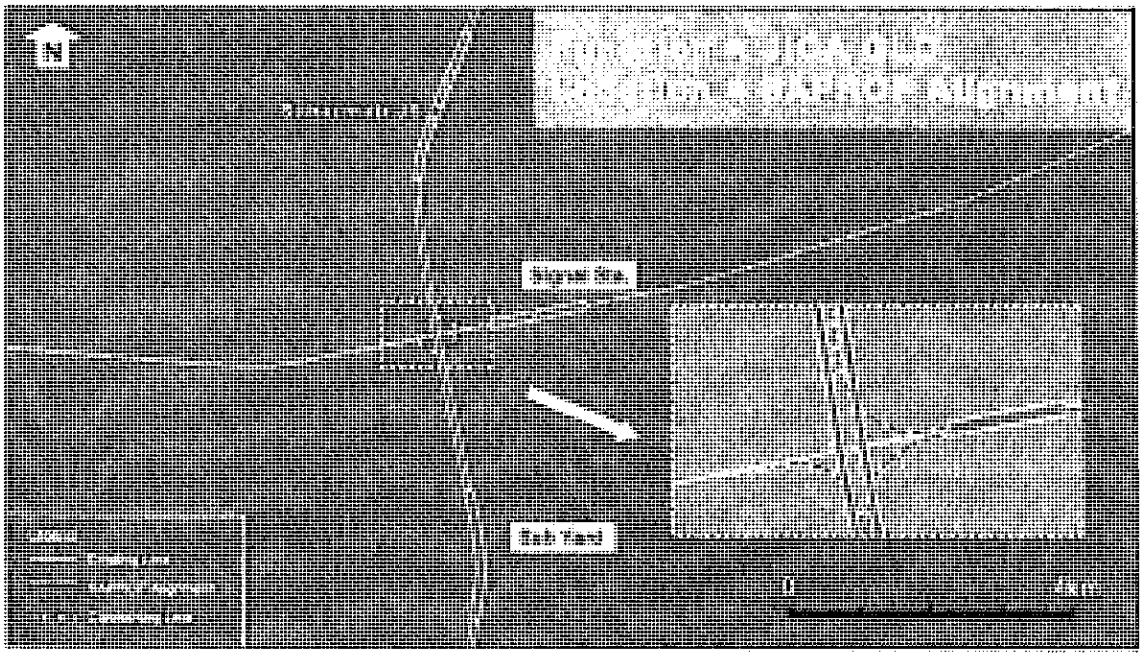
Figure No. /Junction Station	FLS Sec.	JICA GLD Chainage (km)	Remark
Figure 2.3-8 Makarpura	5	420	- Connection point of JS at JNPT side to follow the FLS alignment. - DFCCIL will provide connectivity to the existing IR line. - Information on profile of Makarpura JS will be provided by DFCCIL – i.e. whether it is at Grade or not. - Function = JICA GLD; Location = FLS Alignment
Figure 2.3-9 Sabarmati	6&7	560	- Route is shifted towards west. - Clover-type layout is rationalised into compact scale preserving the connectivity and function of the JS enclosed by track, as well as minimising land enclosed by track. - Provision of connecting line from JNPT to Viramgam is made. - Function = JICA GLD; Location = SAPROF Alignment
Figure 2.3-10 Mahesana	7&8	611	- Provision of waiting track is made as a buffer for at-grade crossing. - Function = JICA GLD; Location = SAPROF Alignment
Figure 2.3-11 Palanpur	Sec 8	673	- Provision of waiting track is made as a buffer for at-grade crossing. - Southbound connection is provided. - Function = JICA GLD; Location = SAPROF Alignment
Figure 2.3-12 Marwar	11	881	- MG line is shifted to accommodate the waiting track and DFC line. - Function = JICA GLD; Location = SAPROF Alignment
Figure 2.3-13 Phulera	13	1,100	- Layout improved to avoid enclosing broad area and reflect the principle of GLD - Function = JICA GLD; Location = SAPROF Alignment
Figure 2.3-14 Rewari	15&16	1,310	- Logistic park needs to be planned separately along the existing line. - Function = JICA GLD; Location = SAPROF Alignment

Finalised Conceptual Design of Junction Station



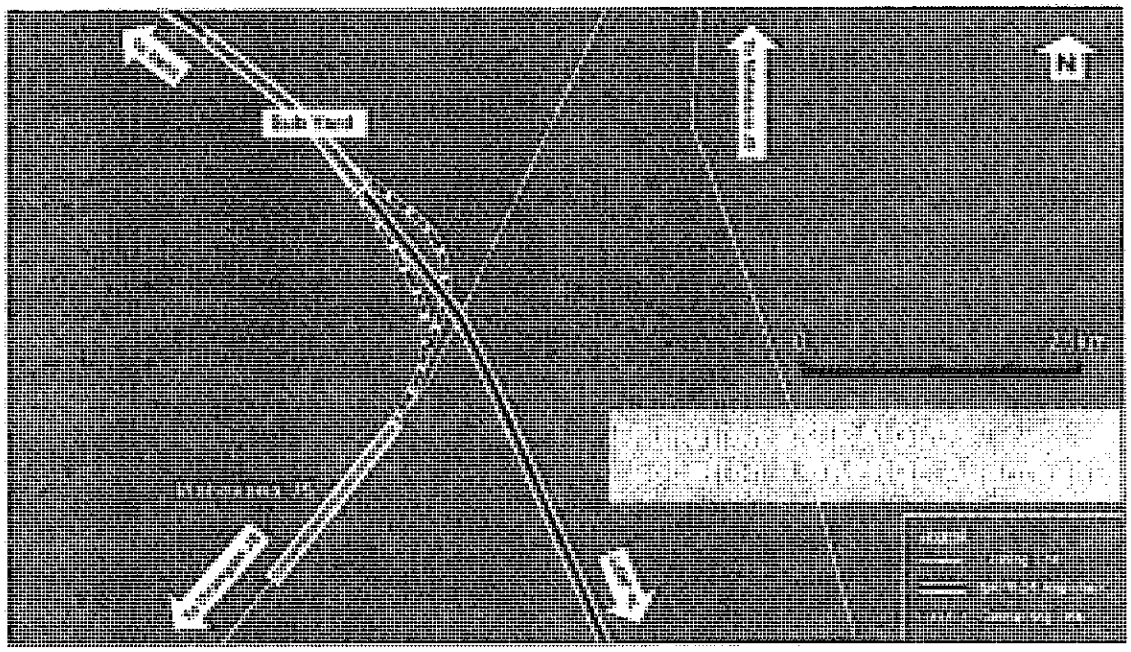
Source: SAPROF Study Team

Figure 2-9 Makarpura JS



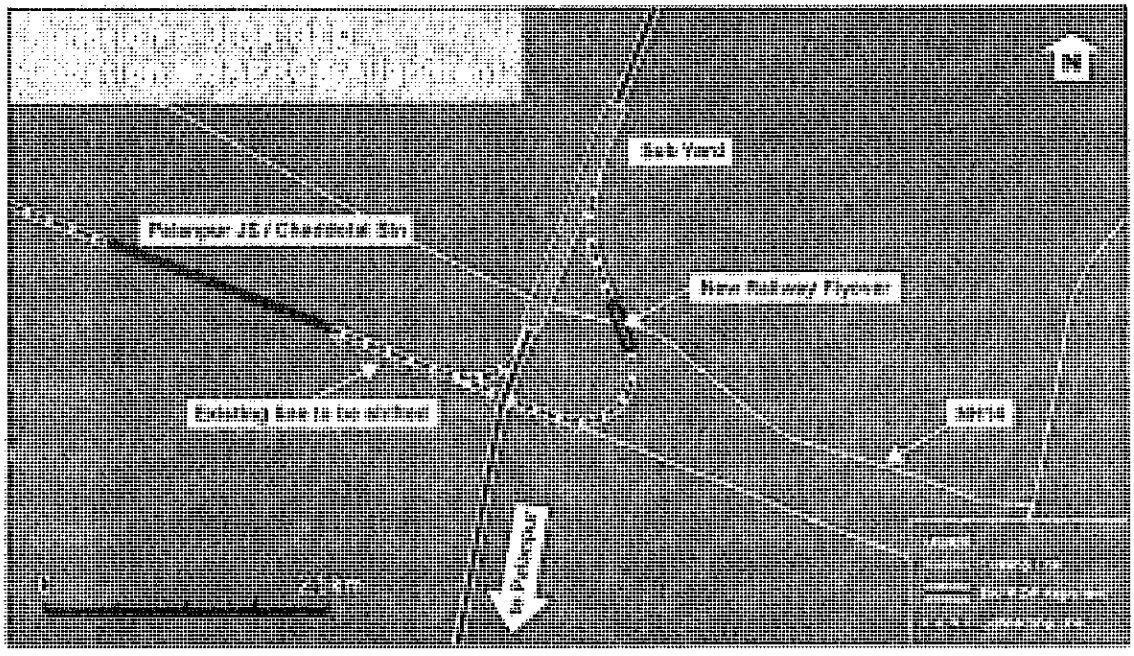
Source: SAPROF Study Team

Figure 2-10 Sabarmati JS



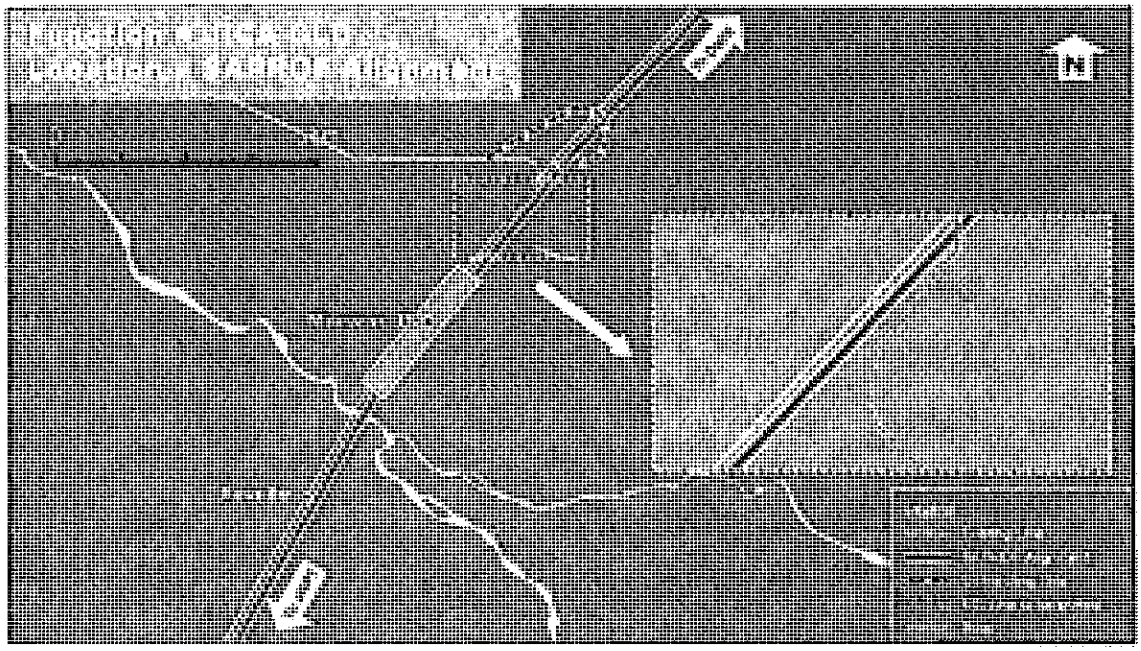
Source: SAPROF Study Team

Figure 2-11 Mahesana JS



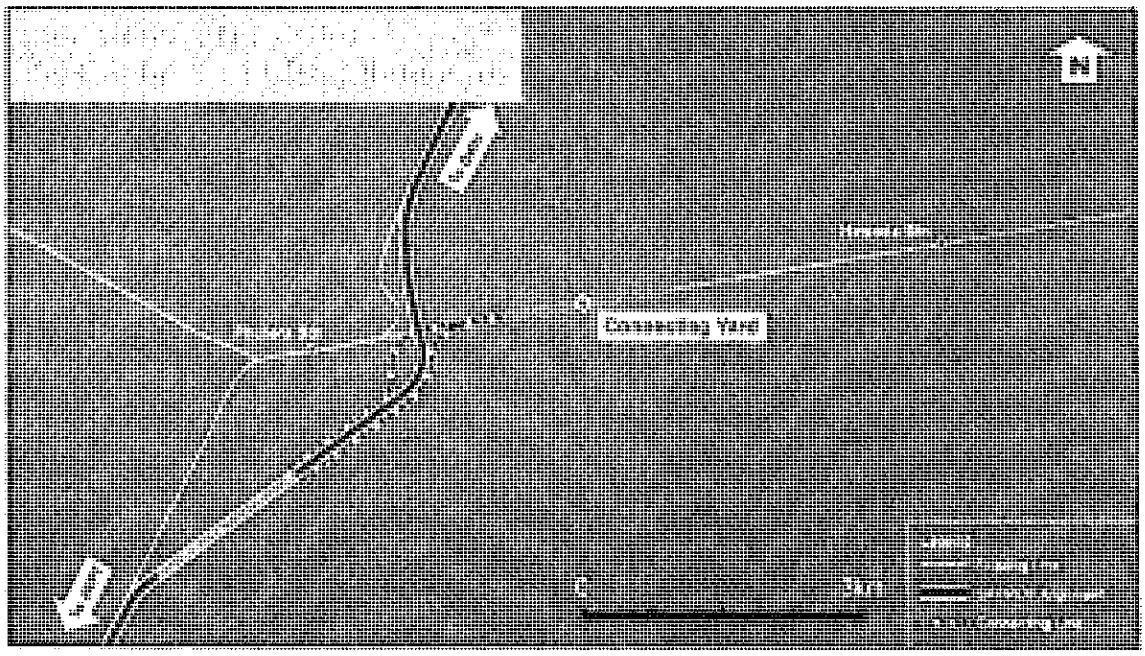
Source: SAPROF Study Team

Figure 2-12 Palanpur JS



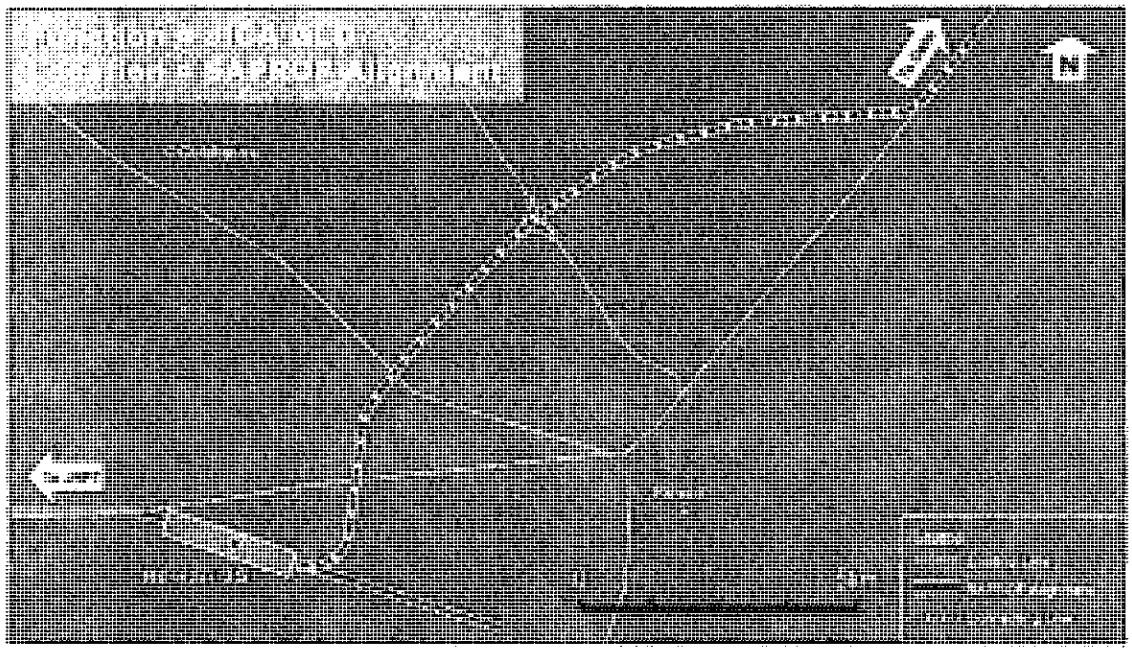
Source: SAPROF Study Team

Figure 2-13 Marwar JS



Source: SAPROF Study Team

Figure 2-14 Pulera JS



Source: SAPROF Study Team

Figure 2-15 Rewari JS

2.4 IMPLEMENTATION PLAN OF THE PROJECT

2.4.1 Project Implementation Schedule

The following figure shows the project implementation schedule.

The duration of project implementation can be shortened by following measures.

- Early commencement of preparation of tender design for civil works (Earth Work, Station, Bridge, Culvert, etc)
- Early commencement of critical works (civil work and procurement of track material) by Indian side with GOI budget in advance

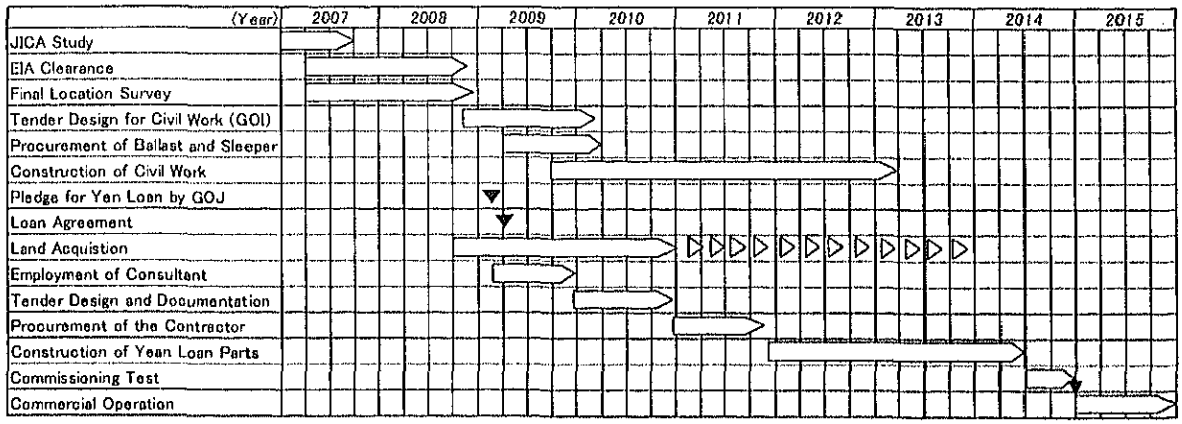


Figure 2-16 Implementation schedule

2.4.2 Implementation Structure

The Project amounts to approximately 920 km of new railway line, and in order to complete the Project within the scheduled timeframe, a firm implementation structure is required to be setup. DFCCIL is the executing agency responsible for the construction of infrastructure, in which the DFCCIL is contemplating to forming a lean management organisation, and outsource resources for the implementation of the Project. If the Project is financed under Yen Loan (STEP), a project implementation system requires to conform to JBIC Guidelines, which differs from those adopted by the Indian Railways for the implementation of past railway projects, becomes a mandatory procedure. Procedures would include procurement of consultants, and employment of contractor(s) by international competitive bidding. The employment of an international consultant as the General Consultant (GC) will be required for overall project management. The GC will carry out the detailed design, preparation of the tender document, assist the tender, supervise the works, and carry out the training of the operation and maintenance.

(1) Organization in Implementation of Project

Figure 2-17 shows a suggested organization during the implementation of the Project including the units working for the environment and social considerations. It is imperative to implement preparation works at the time of feasibility study to the detailed design stage of the Project. As soon as the land acquisition is complete, resettlement operation should commence. Thus the following organization is suggested to establish as soon as possible:

- Consultants for detailed design, bidding documents and construction supervision of the

Project should provide personnel for socio-economic environment and natural environment;

- NGO experienced with planning and operation of the resettlement and rehabilitation plan in India should be employed for elaboration of TOR on the resettlement package of DFC Project;
- Based on the TOR for resettlement and rehabilitation plan, local NGOs who have adequate experiences and capability for implementing the resettlement and rehabilitation plan are employed and that each NGO is assigned a number of districts where DFC Project's railway line passes but not more than 200 km for implementation of the resettlement and rehabilitation action plan;
- A team of local consultants is assigned at each section of DFC Project implementation in collaboration with the detailed design team as well as to supervise NGOs implementing the resettlement and rehabilitation action plan;

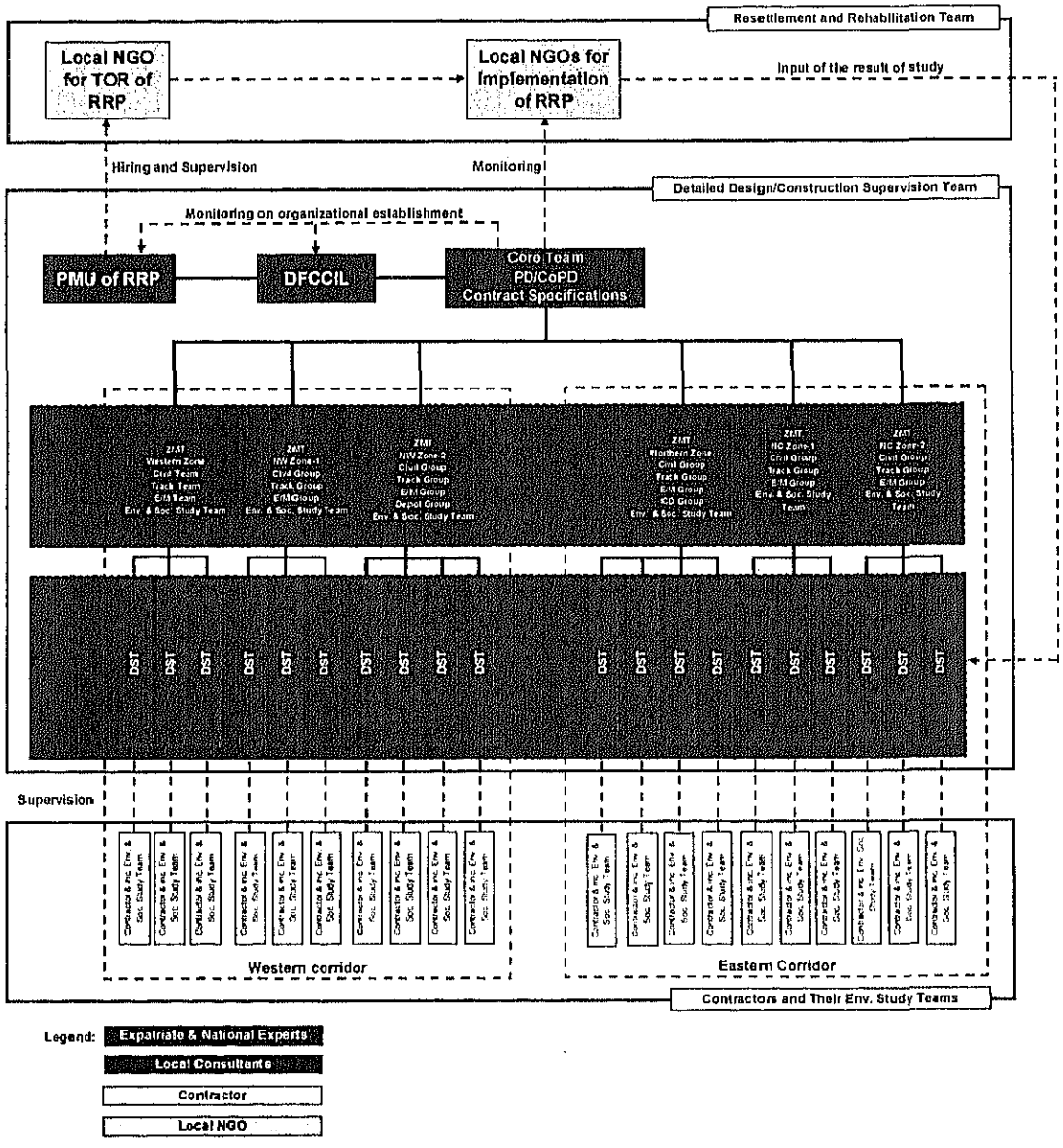


Figure 2-17 Organization of Supervision for Implementation of RRP

2.5 ALTERNATIVES DISCUSSED DURING THE JICA STUDY

2.5.1 Study of Alternatives

Study of alternatives was conducted for the sake of justification of construction of the Dedicated Freight Corridor (DFC) by setting other alternatives. As the base case for the project evaluation, Without-Project (Zero Option) is also studied. Alternatives study are mention as follows;

1) Construction of New Freight Lines (Alt.1),

2) Construction of New Passenger Lines (Alt.2),

3) Improvement of Existing Lines (Alt.3),

4) Zero Option (Without-Project)

(1) Route Setting in the Alternatives Study

Alt.1: Construction of New Dedicated Freight Corridor (DFC)

The setting of the routes of this Alternative shall be made according to the proposal stipulated in the RITES report, in principle, as described below and shown in Figure 2-18.

Eastern Corridor: Ludhiana-Khurja-Allahabad-Sonngar

- The route, Ludhiana-Khurja-Allahabad-Sonnagar, is currently the main route for the predominant bulk commodity transportation (e.g. coal).

- Section between Sonnagar and Howrah, is excluded from this study according to the Minute of Meeting of the First Steering Committee Meeting.

- The section between Dadri and Khurja, the connection of the West and East corridors, should be considered from the standpoint of the overall Indian logistics and the relevant data is collected in the preliminary site survey to form the basic policy. Especially, as Dadri is the terminal ICD of the West Corridor, detailed study is required taking into account, the policies of MOR and the RITES Phase- II Study. Proposals for this section should be discussed in detail during the next stage of the Study.

Western Corridor: Mumbai-Ahmedabad-Ajmer-Phulera-Rewari-Delhi (North Route)

Since a large amount of the container and cargo traffic is moving directly from the JNP and Gujarat ports to Delhi and the northern region of India, this route is best suited as the West Corridor study route from viewpoint of port connectivity with these major ports. The North Route is also superior to the South Route (Mumbai-Vadodara-Kota-Delhi) in terms of ease of construction and its economical costs.

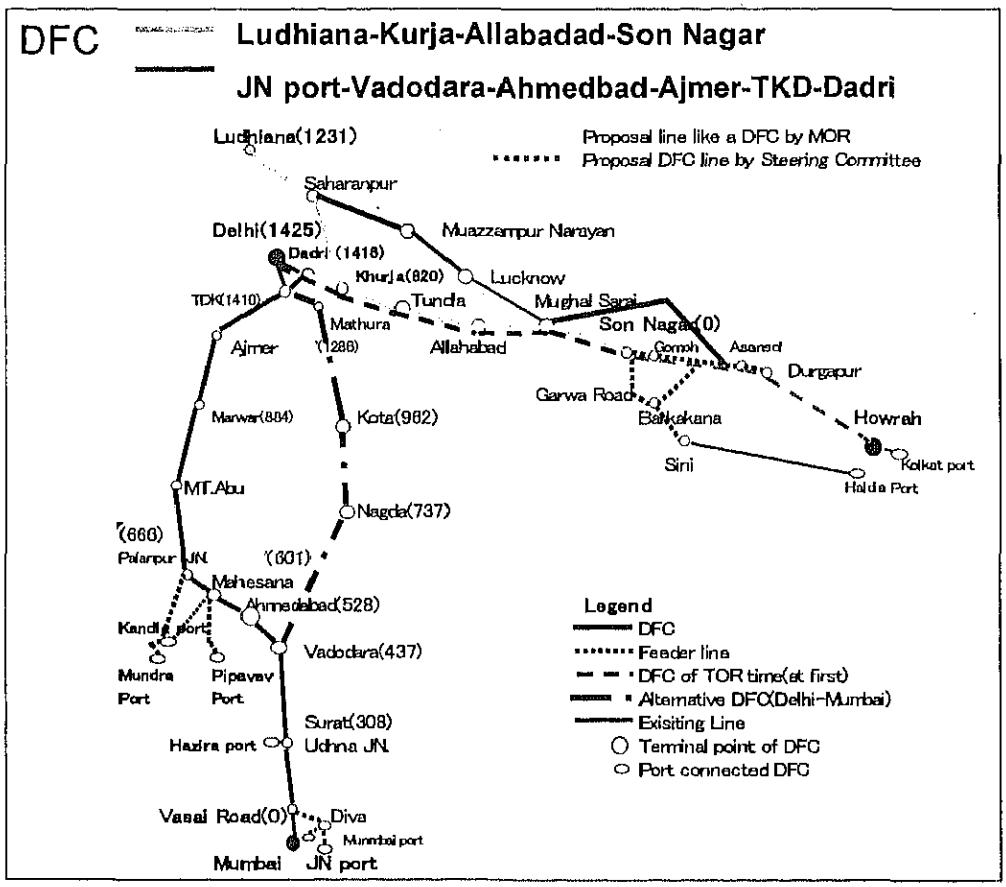


Figure 2-18 Proposed Route for Alt.1 (New Dedicated Freight Corridors)

Alt.2: Construction of New Dedicated Passenger Corridor

The line of this alternative was selected as the route which has the potential of passenger demand and is being also used for trunk freight transport targeted by the Project as mention below and shown in Figure 2-19.

Eastern Corridor: Khurja - Sonnagar

- There are many large cities along the route and passenger traffic will grow further according to the RITES report. This route is proper as a study route for the new passenger line construction.

- The Sonnagar—Howrah section is excluded due to the same reason as presented earlier in Alternative 1.

- The Ludhiana-Khurja section has a smaller volume of passenger traffic in relation to its passenger carrying capacity. Therefore, it is assumed not to include this section in the study route.

Western Corridor: Mumbai-Vadodara-Kota-Delhi (South Route)

- Along the South Route, Vadodara-Kota-Mathra-Delhi, there are many large cities and both passenger and freight traffic demands are great. Therefore, the south route is proper as a route of this alternative.

- Along the North Route, Vadodara-Ahmedabad-Marwar-Delhi, there are no large cities other than Ahmedabad, and, therefore, this route is not proper as a route of this alternative.

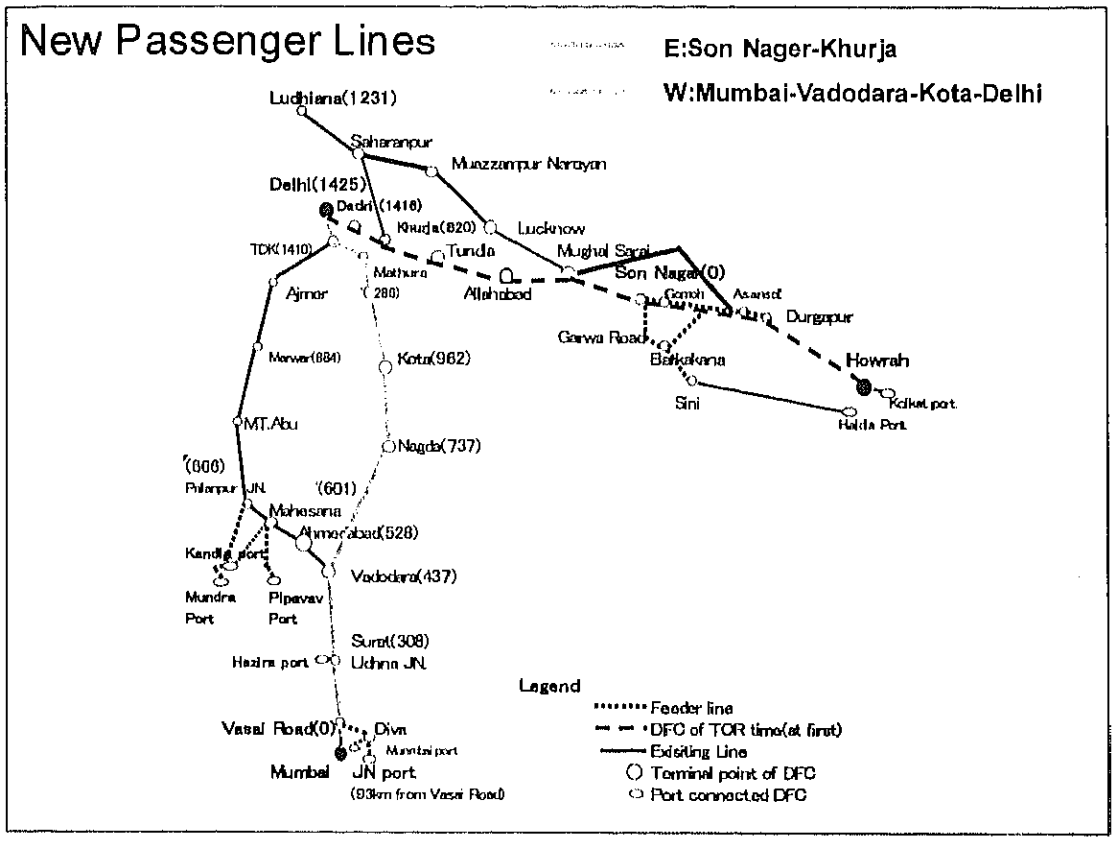


Figure 2-19 Proposed Route for Alt.2 (New Dedicated Passenger Corridors)

Alt.3: Improvement of Existing Lines

The routes of this alternative are defined as the ones, now operating the long-distance freight transport, which is the objective of this project. Both for Eastern and Western Corridors, two routes, one that is the most critical and the other that is the primary bypass route, are selected. These selected routes are those being classified as the Important Broad Gauge (IBG) Routes.

East Corridor:
a) Ludhiana-Khurja-Allahabad-Sonnagar
b) Ludhiana-Moradabad-Lucknow-Mugal Sarai

a) Route, entirely of BG, double-track and electrified, is the main and most busy freight/passenger route of the Eastern Corridor.

b) Route is mainly BG, though non-electrified and partially single-track, is the important by-pass route and is proper route for existing line improvement.

Western Corridor:
a) Mumbai-Vadodara-Kota-Mathura-Delhi
b) . Vadodara-Ahmedabad–Ajmer–Jaipur–Bandikuni-Rewari-Delhi

a) Route, entirely of BG, double-tracked and electrified, is the main and busiest route connecting Mumbai and Delhi, and both the passenger and freight traffic on this route continues to increase substantially in the future.

b) Route, though of BG, single-track and non-electrified, is the main transportation route from Mundra, Kandla ports of the Gujarat state via Ahmedabad to Delhi including the northern regions of India. The double-stack container train operations have been carried out on this route.

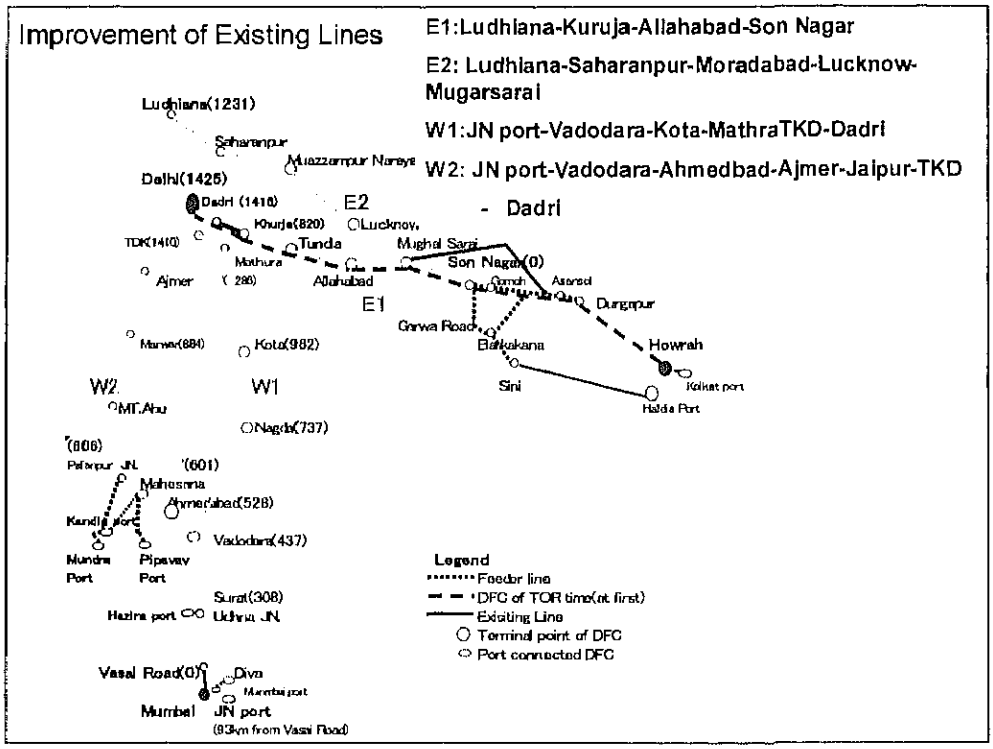


Figure 2-20 Proposed Route for Alt.3 (Improvement of Existing Lines)

Zero Option (Without Project)

For both the Eastern and Western Corridors, the study routes are the same as those selected for the existing line improvement (Alt.3). The study is conducted on the premise that, in principle, no new projects are undertaken to increase their line capacities.

(2) Evaluation of Zero Option

In the zero option, the transport of all freight demand - 21.8 million tons in 2013-14, 96.4 million tons in 2023-24, and 168.4 million tons in 2033-34, is assumed to be borne by railways. The transport of passenger demand in 2033-34 which is projected as 31.9 billion passenger-kilometre also is borne by the railways. In this case, the NH8 between Mumbai-Ahmedabad is projected to accommodate a daily traffic volume of 4,300 container truck, 1,300 ten ton capacity trucks, and 1,300 buses. On NH2, in addition to the above, a daily traffic volume of 3,600 ten ton capacity trucks, a maximum of 7,000 on some section, is projected. Hence construction of an additional four-lane road becomes inevitable to accommodate the future traffic volume. The JST observes that plans of 6-laning of the existing roads and construction of highway laid out in the National Road Development Plan alone will aggravate the traffic congestion, and result in stagnant logistic movement. Hence, the zero option is concluded to be an unrealistic option and that reinforcement of freight transport capacity of the railway was confirmed to be crucial.

(3) Evaluation of IEL, DPC and DFC

Summary of Chronological Relation between Demand / Capacity

Table 2-4 and Table 2-5 shows the Chronological Relation between Traffic Demand and Line Capacity for the Eastern and the Western Corridor respectively. Meanings of the respective cells classified by deferent color background are as follows.

i) Yellow color cell: means saturation of the capacity of single track. It needs double track improvement without automatic signaling system for the single track section

ii) Blue color cell: means saturation of the capacity of double track without automatic signaling system. It needs improvement of the double track section by means of automatic signaling system

iii) Red Color cell: means saturation of the capacity of double track with automatic signaling system. It needs improvement by construction of an additional new line

Table 2-4 Chronological Relation between Demand and Capacity for the Eastern Corridor

Line Capacity

Existing Line	Single Track	20 trains/day
	Double Track	50 trains/day
	Double Track with Auto Signal	110 trains/day

DFC	140 trains/day
DPC	140 trains/day

(Number shows the Demand)

Item			Existing Track	2004-05	2011-12	2016-17	2021-22	2026-27	2031-32
Improvement of Existing Line									
Route E1	Mughal Sarai-Allahabad		Double	80	111	126	141	156	187
	Kanpur-Tundla		Double	92	122	137	151	168	199
Route E2	Luknow-Rosa		Double	51	59	67	76	95	112
DPC									
Route E1	Mughal Sarai-Allahabad	DPC	Double		40	43	46	53	61
		Existing Line	Double	80	71	83	95	103	126
	Kanpur-Tundla	DPC	Double		52	56	60	69	80
		Existing Line	Double	92	70	81	91	99	119
Route E2	Luknow-Rosa	Existing Line	Double	51	59	67	76	95	112
DFC									
Route E1	Mughal Sarai-Allahabad	DFC	Double		52	61	69	74	91
		Existing Line	Double	80	59	65	72	82	96
	Kanpur-Tundla	DFC	Double		53	61	68	73	89
		Existing Line	Double	92	69	76	83	95	110
Route E2	Luknow-Rosa	Existing Line	Double	51	59	67	76	95	112

Capacity Saturation of Double Track (DT)
Capacity Saturation of DT with Auto Signal

Improvement of Single Track: i) Double Tracking, ii) Auto Signallization
Improvement of Double Track: i) Auto Signallization

Table 2-5 Chronological Relation between Demand and Capacity for the Western Corridor

Line Capacity

Existing Line	Single Track	20 trains/day
	Double Track	50 trains/day
	Double Track with Auto Signal	110 trains/day

DFC	140 trains/day
DPC	140 trains/day

(Number shows the Demand)

Item			Existing Track	2004-05	2011-12	2016-17	2021-22	2026-27	2031-32
Improvement of Existing Line									
Route W1	Udhna-Surat		Double	86	119	145	171	212	255
	Ratlam-Nagda		Double	65	93	115	137	167	199
Route W2	Mahesana-Palanpur		Single	26	45	58	71	85	99
DPC									
Route W1	Udhna-Surat	DPC	Double		54	59	65	74	85
	(Mumbai - Vadodara)	Existing Line	Double	86	65	86	106	138	170
	Ratlam-Nagda	DPC	Double		24	26	29	33	38
	(Vadodara - Kota)	Existing Line	Double	65	69	89	108	134	161
Route W2	Mahesana-Palanpur	Existing Line	Single	26	45	58	71	85	99
	(Ahmedabad - Delhi)								
DFC									
Route W1	Udhna-Surat	DFC	Double		33	49	64	89	114
	(Mumbai - Vadodara)	Existing Line	Double	86	86	96	107	123	141
	Ratlam-Nagda	Existing Line	Double	65	73	86	98	114	131
	(Vadodara - Kota)								
Route W2	Mahesana-Palanpur	DFC	Double		43	62	82	112	142
	(Ahmedabad - Delhi)	Existing Line	Single	26	23	25	28	32	36

Capacity Saturation of Single Track

Capacity Saturation of Double Track (DT)

Capacity Saturation of DT with Auto Signal

Improvement of Single Track: i) Double Tracking, ii) Auto Signallization

Improvement of Double Track: i) Auto Signallization

(4) Comparison of the DPC Option and DFC Option by Construction Cost

As studied in the previous clauses, the DPC is not a preferable option from the view point of relationship between the traffic demand and the line capacity and hence has no advantage. Since the DPC has only one advantageous factor, that is DPC can reduce the construction cost of bridges due to adoption of lower axle load. Table 2-6 shows design condition of DPC and DFC option applied for the cost comparison and Table 2-7 shows the result of the cost estimate of both DPC and DFC options in comparison.

Though the DPC routes were generally aligned along the DFC, to serve passengers, the new DPC lines must enter the central city areas to be connected to the existing stations to ensure accessibility of the passengers. To avoid additional traffic interference to the road traffic by DPC and minimize resettlement problem in the urban area, the DPC should have new elevated stations, constructed above the existing stations, which inevitably increase the civil construction costs substantially. Consequently despite the cost reduction by the narrowed right of way (ROW) and lower axle load, the total construction cost of DPC is higher than that of the DFC by 50% for Western corridor and 40% for Eastern corridor.

Based on these results, DPC option was judged to be totally disadvantageous over the DFC, and was dropped as a viable alternative.

Table 2-6 Summary of Design Condition and Other Assumptions for the Cost Comparison

Corridor	Eastern Corridor		Western Corridor	
Option	DFC	DPC	DFC	DPC
Route and Section to be Compared	Sonnagar – Khurja		Vasai Rd. – TKD via Ahmedabad	Vasai Rd. – TKD via Kota
Route Length	821 km	821 km	1,364 km	1,318 km
Usage of New Track	Freight only	Passenger only	Freight only	Passenger only
Type of Structure	Embankment	Embankment + Viaduct (City Area)	Embankment	Embankment + Viaduct (City Area)
Traction System	Electrified	Electrified	Diesel	Diesel*)
Type of Track	Ballasted Double-Track	Ballasted Double-Track	Ballasted Double-Track	Ballasted Double-Track
Distance of Track	5.5 m	5.3 m	5.5 m	5.3 m
Axle Load	25.0 Ton	20.3 Ton	25.0 Ton	20.3 Ton
Design load of Bridge	30.0 Ton	20.3 Ton	30.0 Ton	20.3 Ton
Nos. of Station	7Stations	25 Stations	11 Stations	33 Stations
Length of Platform	1,500 m	605 m	1,500 m	605 m

Note: *) Although electrification should be preferable for DPC option, diesel traction system is assumed for DPC option in this study for comparison purpose only

Table 2-7 Comparison of Construction Cost of DPC&DFC Options

Item (all costs are in Rs. Crores)	(1) DPC	(2) DFC	Difference (1) – (2)
East corridor (Sonnagar-Khruja) 812 km	10,601 Cr. 13.06 Cr./km	7,039 Cr. 8.67 Cr./km	3,562 Cr. 4.39 Cr./km
West Corridor DPC (Vasai Rd-Kota-TKD) 1,316 km DFC (VasaiRoad-Ahmedabad-Dadri-TKD) 1,364 km	15,373 Cr. 11.68 Cr./km	10,928 Cr. 8.01 Cr./km	4,445Cr. 3.67 Cr./km
Total DPC 2,128 km DFC 2,176 km	25,974 Cr. 11.68 Cr./km	17,967 Cr. 8.01 Cr./km	8,007 Cr. 3.67 Cr./km

(5) Comprehensive Evaluation Result

The evaluation results are summarized in Table 2-8. This table says that;

1) Improvement of Existing Line cannot satisfy the future traffic demand in 2011 from the viewpoint of line capacity.

2) The Dedicated Freight Corridor is the most advantageous from the viewpoint of line capacity.

3) Improvement of Existing Line is the most advantageous from viewpoint of construction cost, and the Dedicated Freight Corridor follows it.

4) Improvement of Existing Line has advantage to other two alternatives from viewpoint of social environment impact.

From above evaluation results, it is concluded that Dedicated Freight Corridor is the optimum option among three alternatives.

Table 2-8 Comprehensive Evaluation Results of Alternatives

	DFC		DPC		IEL	
	Eastern	Western	Eastern	Western	Eastern	Western
Construction Cost (Cr. Rs.)	7,039	10,928	10,601	15,373	6,125 (Total of 4 routes)	
	B	B	D	D	A	A
Saturation Year of Line Capacity of Existing Line	2022	2030	2025	2020	2011	2011
	B	B	C	C	D	D
Possibility of Resettlement and Land Acquisition (Initial Screening)	Resettlement and Land Acquisition in the Detoured Section	Resettlement and Land Acquisition in the Detoured Section Two areas of protection fores	Large Number of Resettlement in Urbanized Sections	Large Number of Resettlement in Urbanized Sections "Keoladeo Ghana Lake Bird Sanctuary"	No Direct Serious Impact	No Direct Serious Impact
	C	C	D	D	B	B
Comprehensive Evaluation	A	A	C	C	B	B

2.5.2 JICA Guideline Design of Route Alignment Plan for Western DFC

The JICA Study Team (JST) reviewed the results of Feasibility Study (PETS-II) carried out by RITES, and a concept of design was made available. However, the engineering design for the structures and facilities were not made available during the study period.

The result of the review by JICA Study Team of the conceptual alignment indicated in the PETS-II report are presented below:

a) Vadodara - Ahmedabad Detour (Figure 2-21 and Figure 2-22)

This section was modified into a lengthy detour, because the city areas are fully developed, with many built-up areas and also due to the existence of 20 ROBs along the existing line. The detour route which RITES had proposed bypasses the city area of Vadodara, and runs parallel for about 10 km with the existing line near Vasad, and further takes a large detour route which avoids the city areas of Anand, Nadiad, Ahmedabad, Kalol, and Mahesana.

There is an existing ROB in this parallel section near Vasad, and it is also noticed on the route plan, local communities exist, and the line also crosses the Mahi River by an acute angle. Although JST detour is almost similar to that of RITES proposal except in Vasad area, some modification was required in order to avoid local communities and a wildlife sanctuary. The length of the proposed detour line is about 211.4 km, while the existing line length of this section is about 189.5 km. The length of the detour route proposed by RITES is about 216.6 km.

b) Palanpur Detour (Figure 2-23)

Although the detour route proposed by RITES was about 18.1 km which avoids the existing city area and reverts back to the parallel section with existing line, since a wildlife sanctuary exists between Chitrasani-Jethi of the existing line, JST proposed the route which avoids this. As shown in the figure, although the existing line is running through the wildlife sanctuary for only about 2.5 km, there is no other option except for taking a detour route through the northern side of the Ghats because the area is blocked by the Ghats and Dry Valleys. Therefore, the length of the detour route became 34.6 km, while the length of the existing line of this section is about 29.1 km.

c) Kishangarh Detour (Figure 2-24)

JST purchased higher resolution satellite images to examine the on ground situation of this area, and it became clear that the 13.3 km detour route proposed by RITES runs through a marble stone processing facility, and on different sections the alignment passes through mountain area requiring deep excavation along the existing line. JST proposed a detour alignment which is approximately 16.6 km long. The existing line length of this section is about 13.4 km.

d) Phulera Detour (Figure 2-25)

The 23.6 km detour route which RITES proposed passes through a few built-up areas. JST proposed a route which avoids this. The length of the detour route is approximately 19.4 km while the existing line length of this section is about 16.3 km.

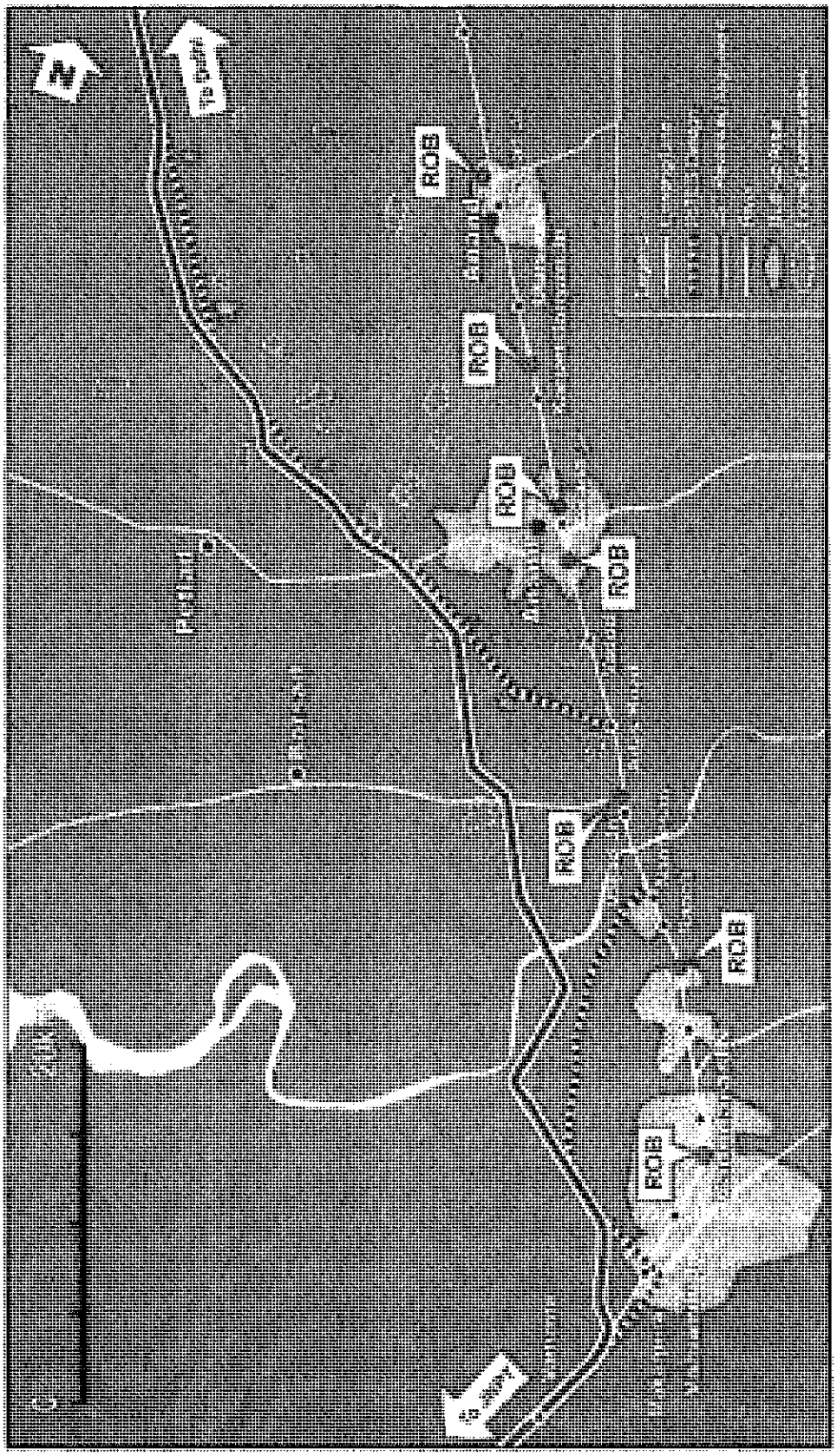
e) Ringas Detour (Figure 2-26)

The 36.7km detour route proposed by RITES crosses a 'Wadi'(Dry Valley) which turns into a river during the rainy season at three places, which results as a requirement of a bridge having a total length of more than 3km. The construction costs for this bridge is likely to become prohibitive, which would make the parallel route alternative a optimal alternative which requires replacement of the existing ROB. The JST proposed a shorter detour since the parallel route requires a extensive rail flyover, having an embankment height over 20 m, to cross over the existing branch line and the adjacent existing ROB. The length of the detour is about 11.4 km, while the length of the existing line of this section is about 10.4 km.

f) Rewari Alignment (Figure 2-27)

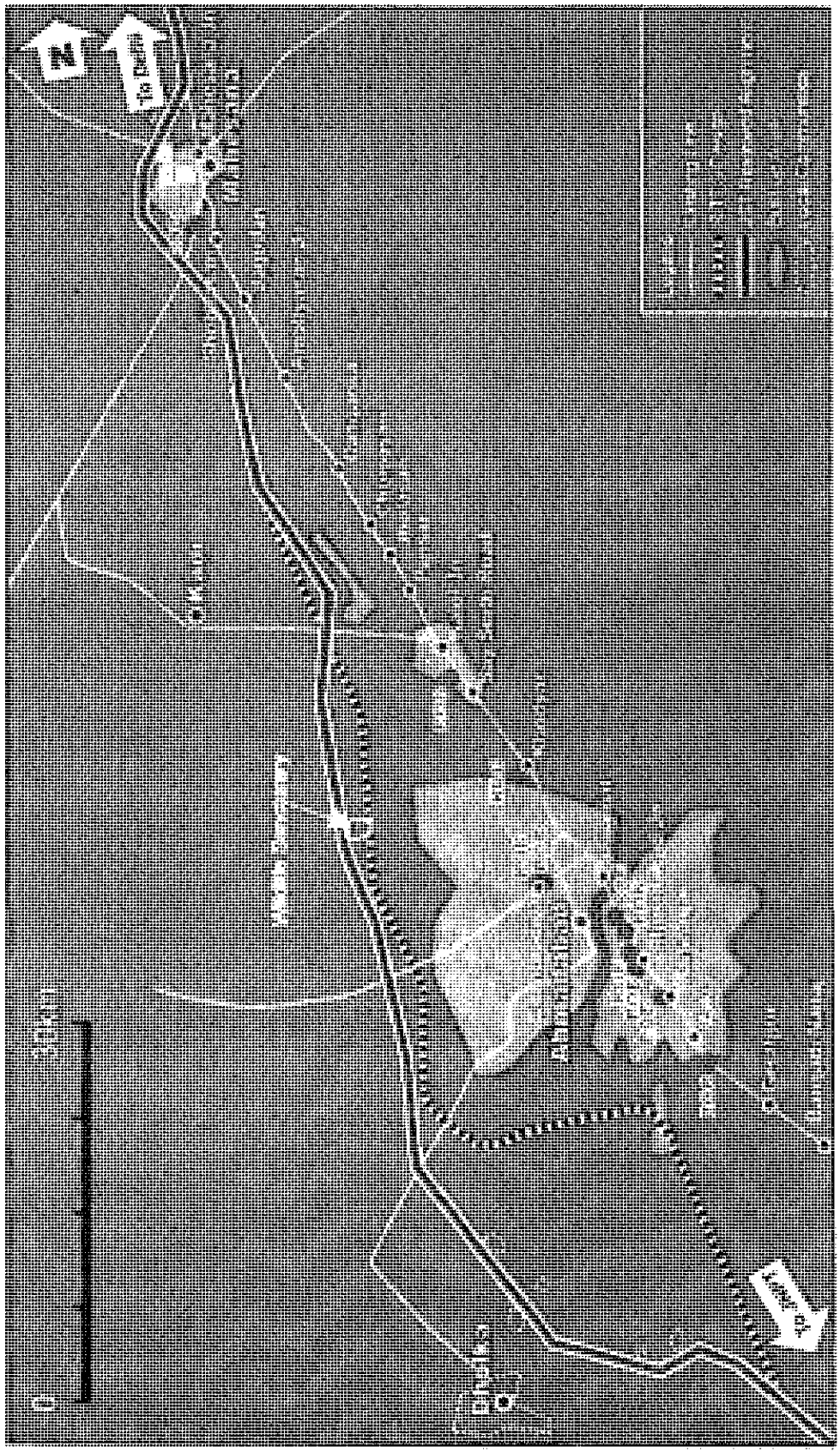
Since a new line from Rewari to Dadri, and connection of the Western and Eastern Corridor is provided at Dadri is planned, this section was not considered to be included in Phase I-a since detailed investigations are required to address technical issue such as for the long tunnel and viaduct.

On the other hand, since the connection of container traffic to Delhi Metropolitan Area is an important component of the DFC project, it is necessary to provide transportation route from Rewari towards Gurgaon, in the direction of Delhi. For this reason, the JICA study team proposed a connecting line linking Rewari Junction Station and the existing line towards Gurgaon. This line avoids planned facilities indicated on the Rewari City Master Plan, and over-passes three existing lines, and also to the existing track towards Hisar.



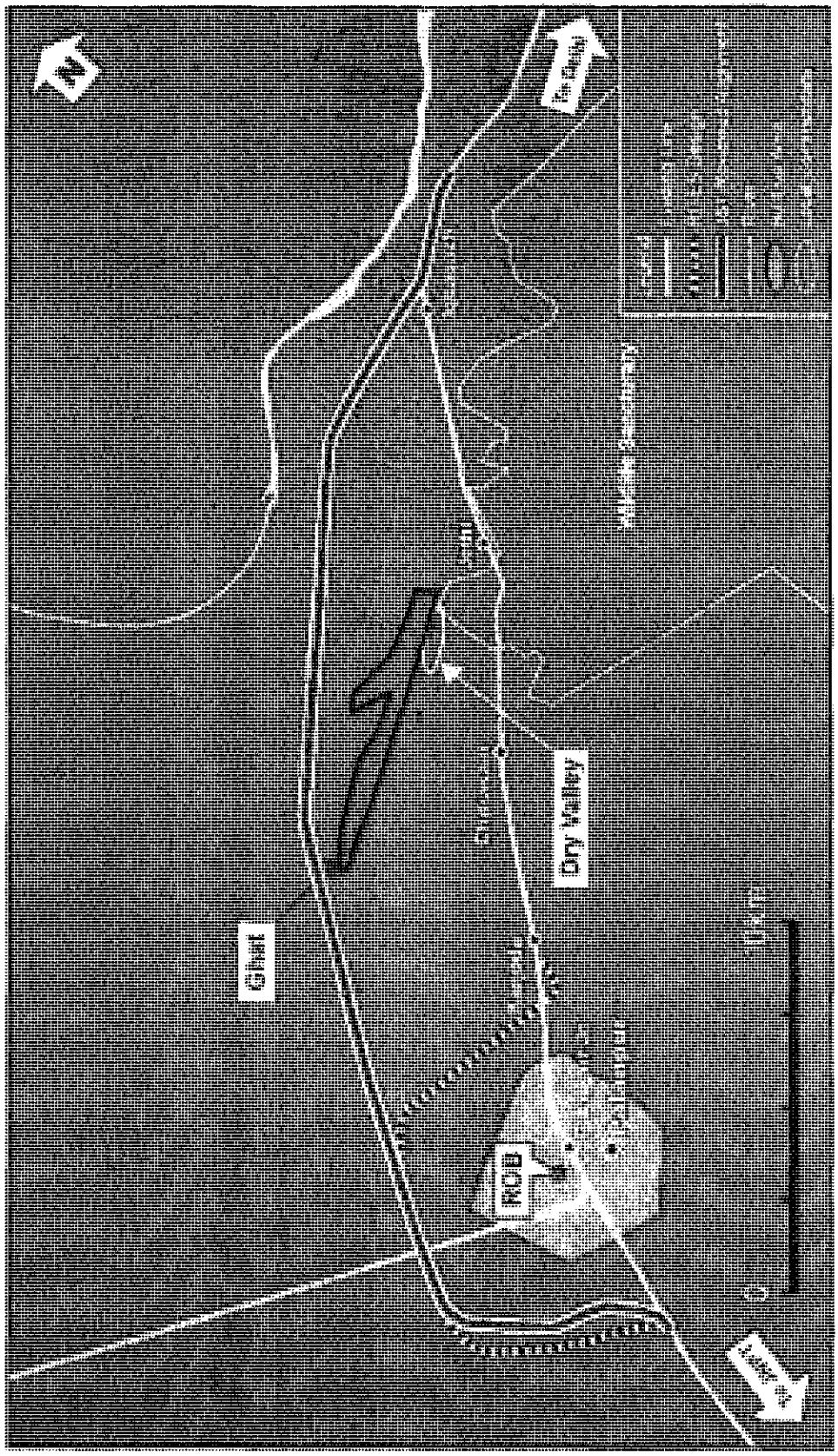
Source: Figure contained in the JICA Feasibility Study Report redrawn by the SAPROF Study Team

Figure 2-21 Vadodara-Ahmedabad Detour (South) of JICA GLD



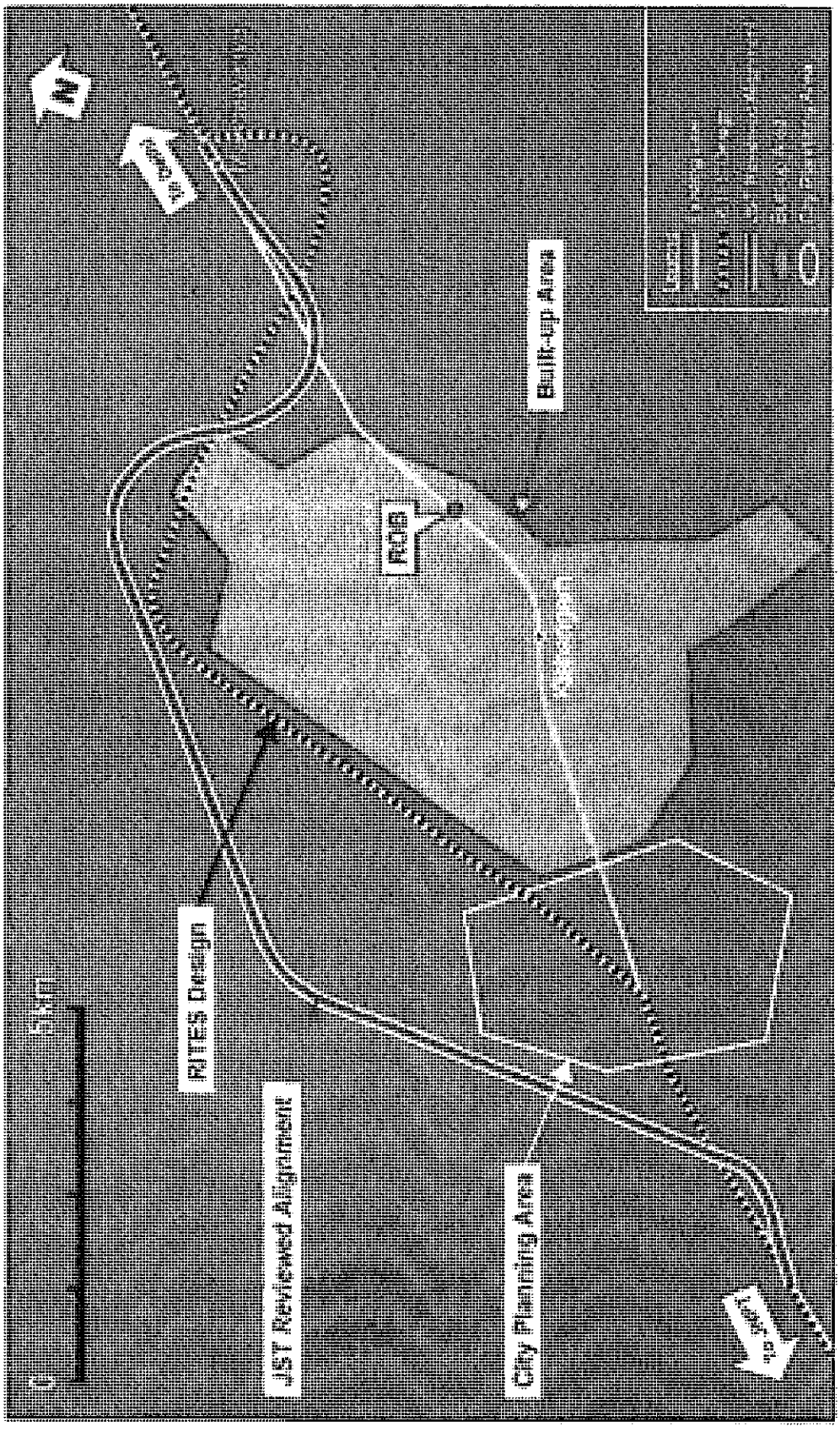
Source: Figure contained in the JICA Feasibility Study Report redrawn by the SAPROF Study Team

Figure 2-22 Vadodara-Ahmedabad Detour (North) of JICA GLD



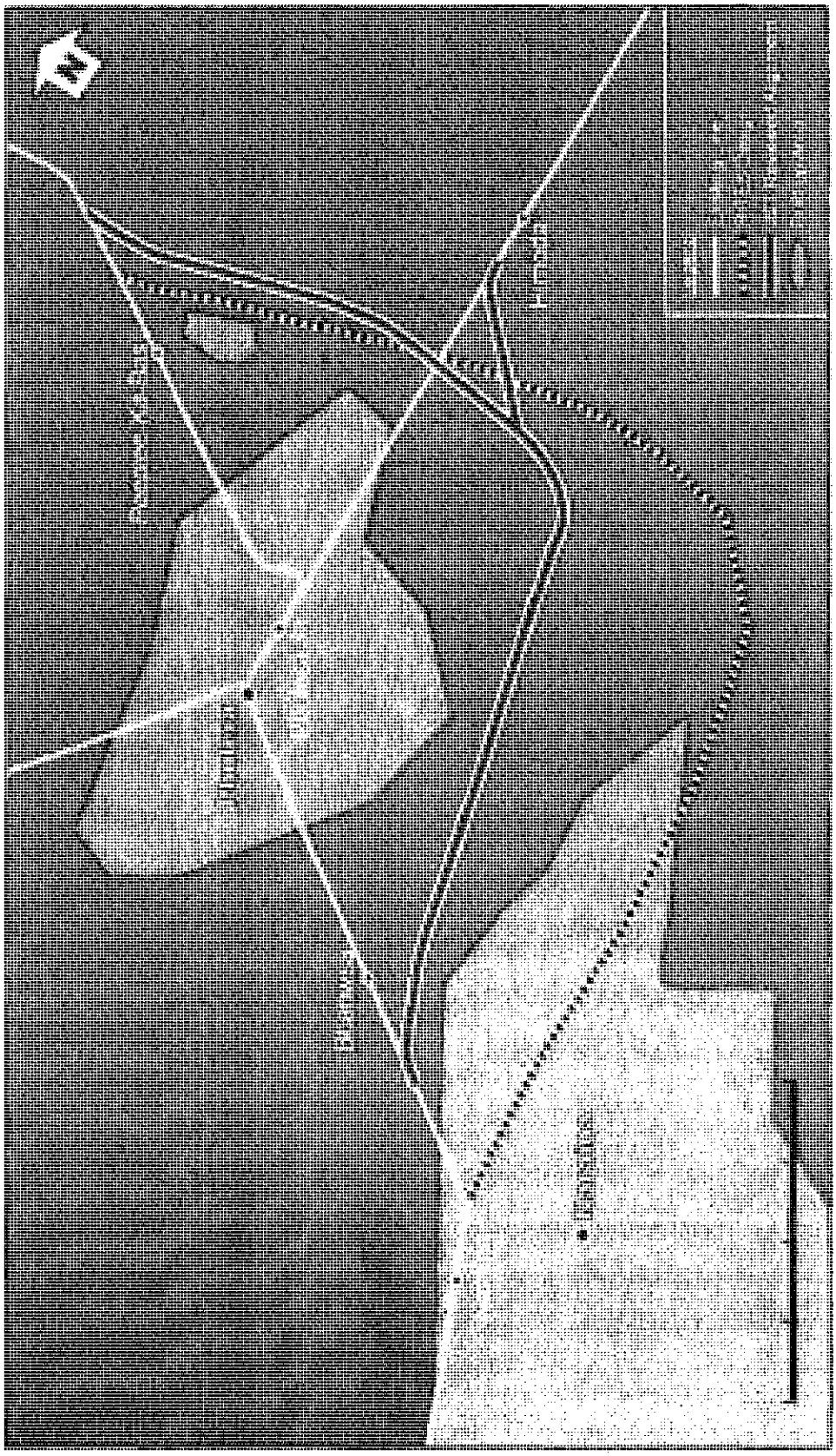
Source: Figure contained in the JICA Feasibility Study Report redrawn by the SAPROF Study Team

Figure 2-23 Palanpur Detour of JICA GLD



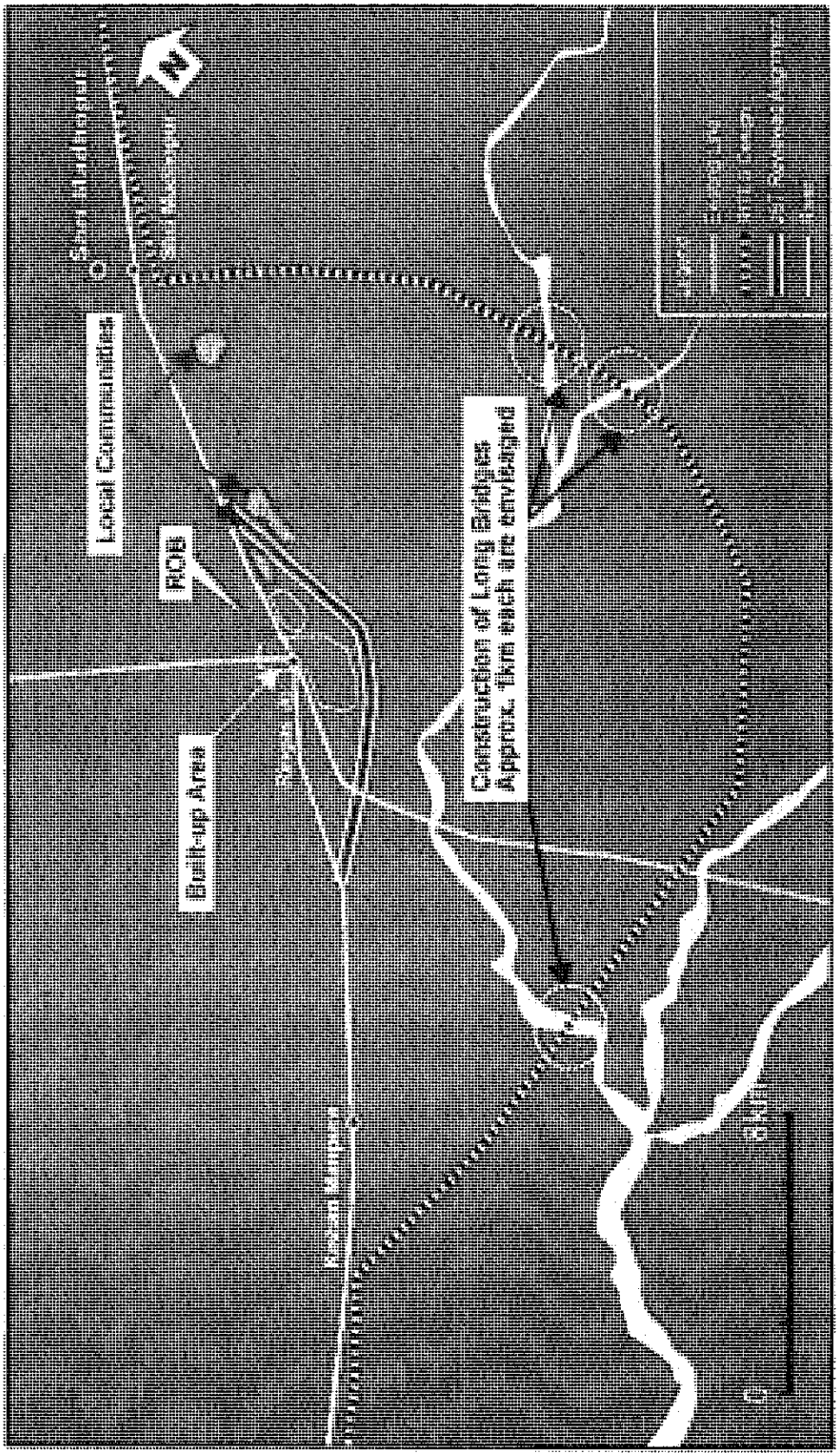
Source: Figure contained in the JICA Feasibility Study Report redrawn by the SAPROF Study Team

Figure 2-24 Kishangarh Detour of JICA GLD



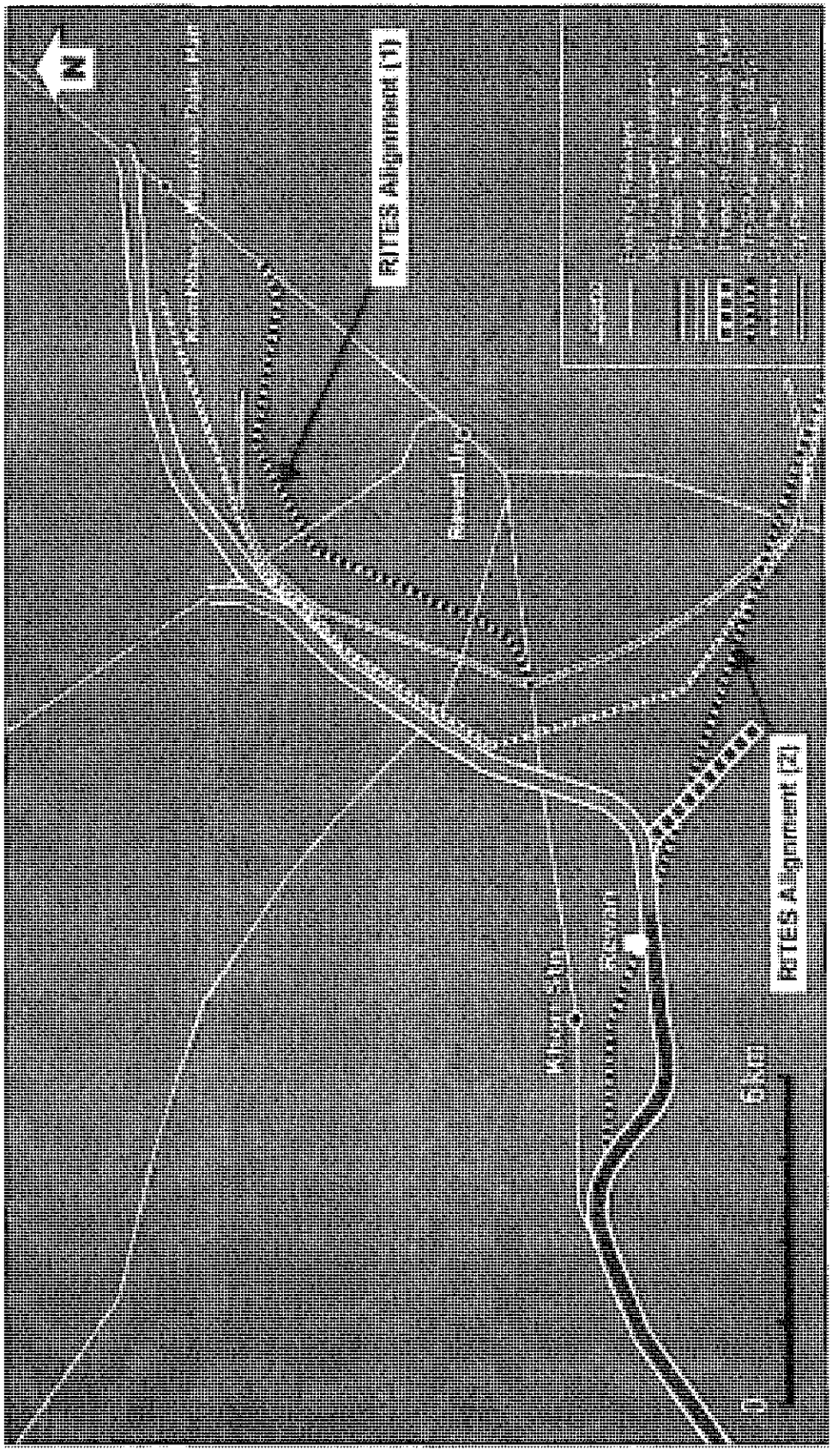
Source: Figure contained in the JICA Feasibility Study Report redrawn by the SAPROF Study Team

Figure 2-25 Phulera Detour of JICA GLD



Source: Figure contained in the JICA Feasibility Study Report redrawn by the SAPROF Study Team

Figure 2-26 Ringas Detour of JICA GLD



Source: Figure contained in the JICA Feasibility Study Report redrawn by the SAPROF Study Team

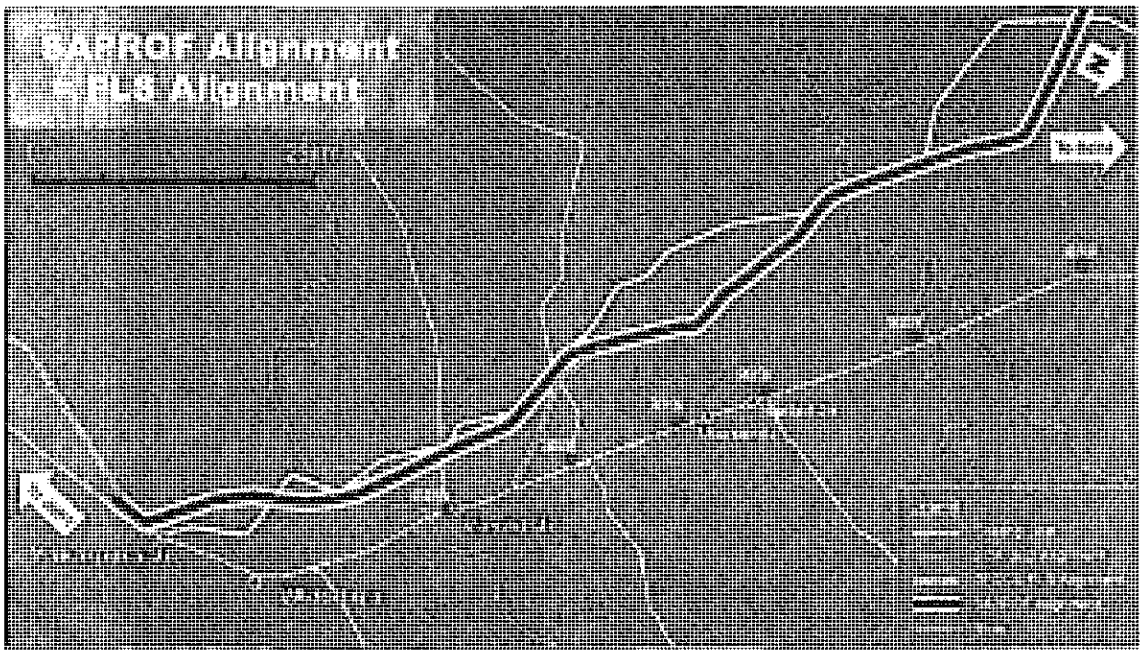
Figure 2-27 Rewari Alignment of JICA GLD

2.5.3 Agreed Alignment between DFCCIL and Study Team in SAPROF Study

The SAPROF Study Team identified the following deviations of the FLS alignment against the JICA GLD and summarises it in Table 2-9.

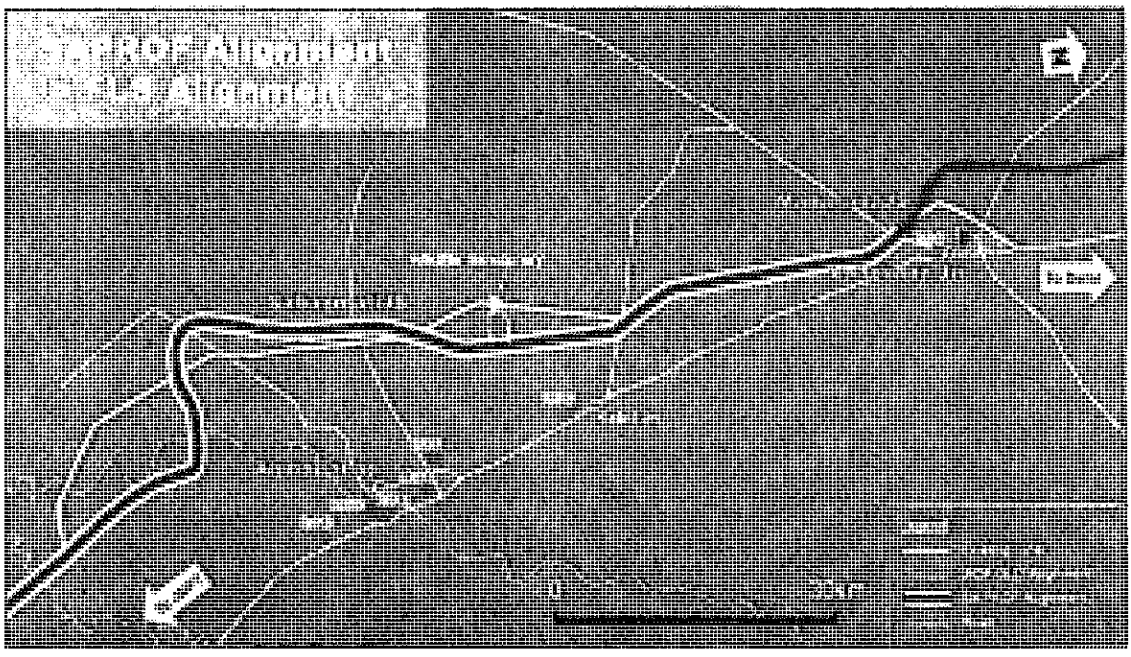
Table 2-9 Deviations Identified in the FLS and Alignment Determined

Sec.	Chainage (km)		Character of Alignment	Final Alignment	Remarks
	FLS	GLD			
5-9	-	Ex. 420 - 675	-	-	Vadodara – Iqbal Gadh (Perspective)
5-6	-	420 – 520	Extensive Detour	FLS	Figure 2.5-7 Vadodara-Mahesana (1/2)
6-7	-	515 – 615	Extensive Detour	FLS	Figure 2.5-7 Vadodara- Mahesana (2/2)
8	-	590 – 675	Extensive Detour	Pre-FLS	Figure 2.5-8 Mahesana-Palanpur
9	-	595 – 675	Extensive Detour	GLD	Figure 2.5-9 Palanpur-Iqbal Gadh
9	40.2 - 42.4	712 – 714	Small Detour	FLS	Figure 2.5-10 Near Maval St.
9	45.9 - 47.7	717 – 720	Small Detour	FLS	Figure 2.5-11 Near Abu Road St.
9	50.6 - 53.5	722 – 725	Small Detour	FLS	Figure 2.5-12 Near Morthala St.
9	58.0 - 59.5	730 – 732	Small Detour	FLS	Figure 2.5-13 Near Kivarli St.
9	78.8 - 83.0	750 – 755	Parallel	GLD	Figure 2.5-14 Banas St.
10	0.20- 14.6	762 – 775	Parallel	GLD	Figure 2.5-15 Sirohi Rd. & Keshavganj St.
10	38.4 - 41.1	798 – 802	Small Detour	FLS	Figure 2.5-16 Jawai Bandh St.
11	17.0 - 25.5	879 – 888	Parallel	GLD	Figure 2.5-17 Marwar Stn.
12	10.4-14.4	976 – 980	Parallel	FLS	Figure 2.5-18 Bangurgram Stn.
12	-	1041 – 1056		Parallel	Figure 2.5-19 Kishangarh Stn.
12	39.4 - 40.9	1005 – 1007	Parallel	FLS	Figure 2.5-20 Near Makrera Stn.
12	61.7 - 65.0	1027 – 1030	Parallel	FLS	Figure 2.5-21 Madar Stn.
13	32.8 - 40.0	1097 – 1104	Detour	FLS	Phulera JS
14	6.9 - 8.8	1156 – 1158	Parallel	FLS	Kishan Manpura Stn.
14	12.6 - 18.0	1161 – 1173	Parallel	Parallel	Figure 2.5-22 Ringas Stn.
15	-	-	Parallel	FLS	Rewari JS



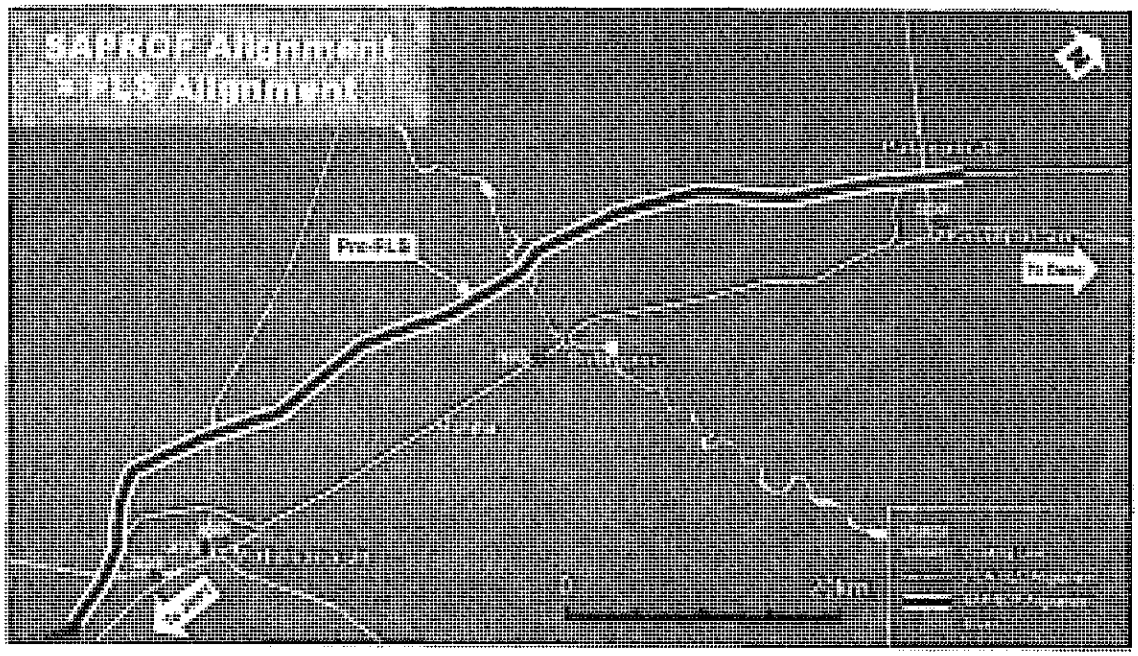
Source: SAPROF Study Team

Figure 2-28 Vadodara-Mahesana Extensive Detour (1/2)



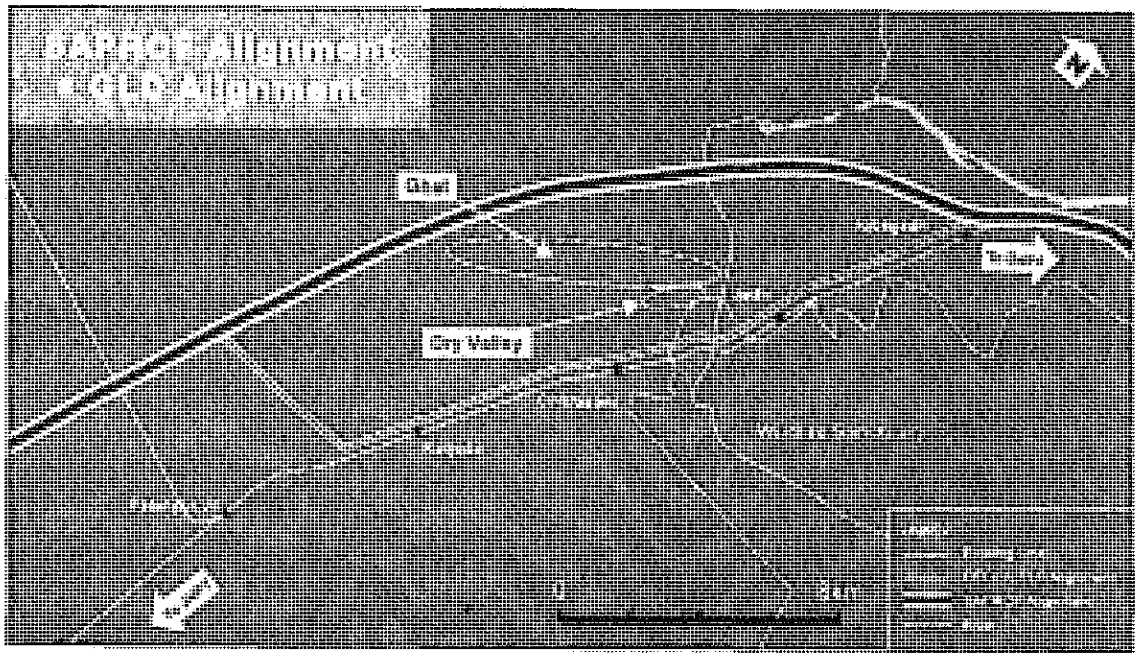
Source: SAPROF Study Team

Figure 2-29 Vadodara-Mahesana Extensive Detour (2/2)



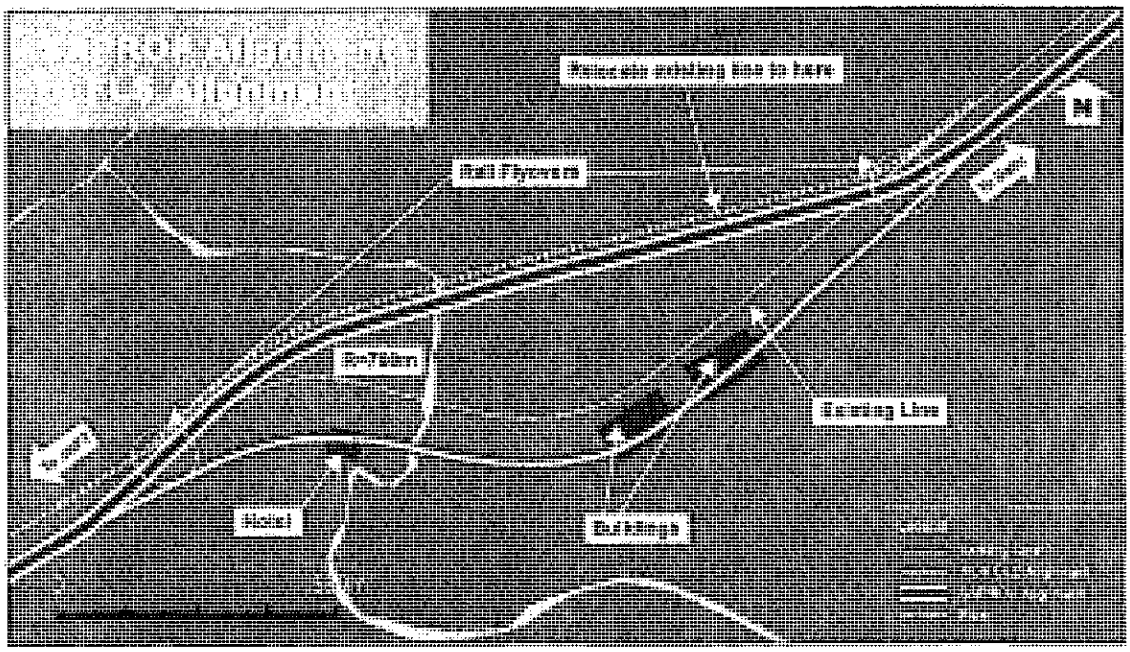
Source: SAPROF Study Team

Figure 2-30 Mahesana-Palanpur Detour



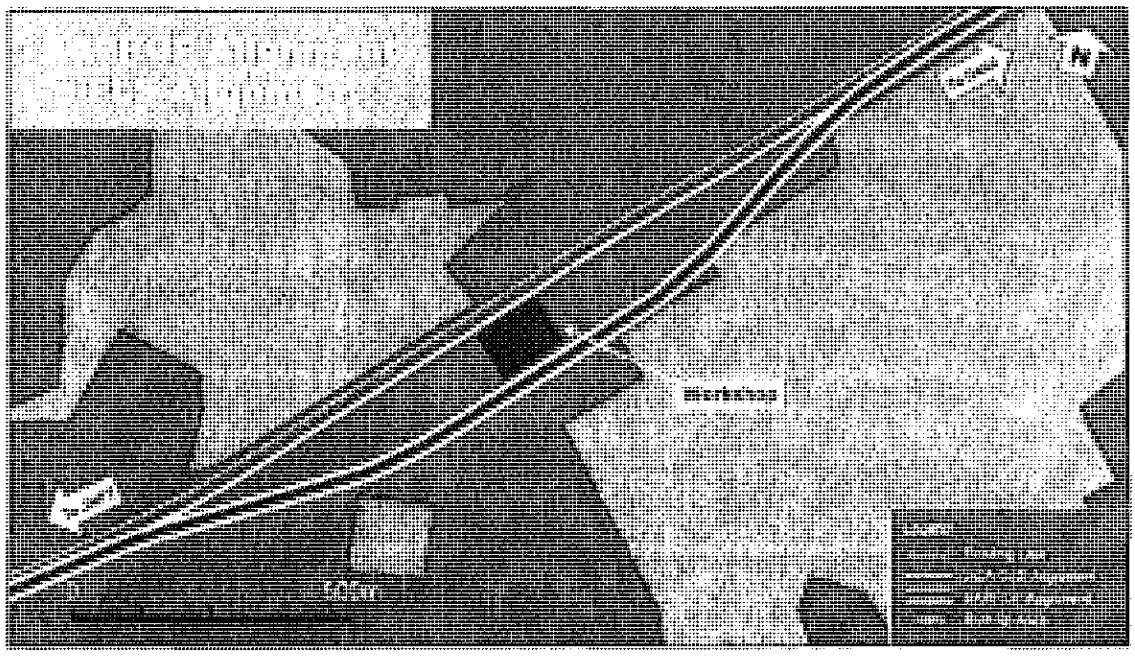
Source: SAPROF Study Team

Figure 2-31 Palanpur-Iqbal Gadh Detour



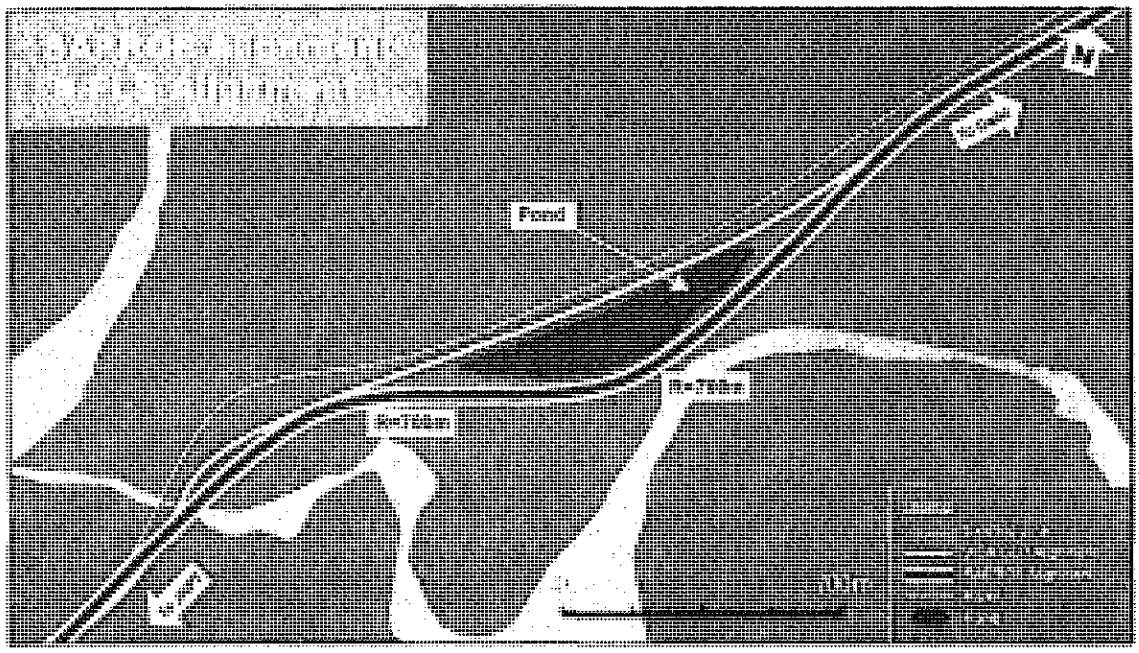
Source: SAPROF Study Team

Figure 2-32 Maval Stn. Small Detour



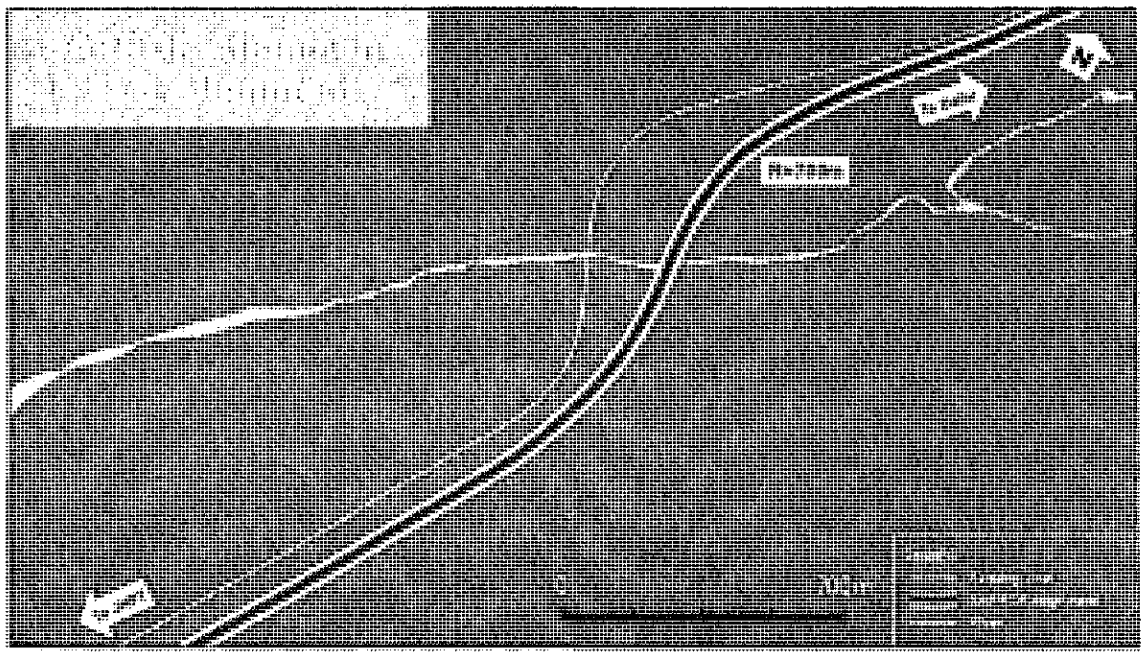
Source: SAPROF Study Team

Figure 2-33 Abu Road Stn. Small Detour



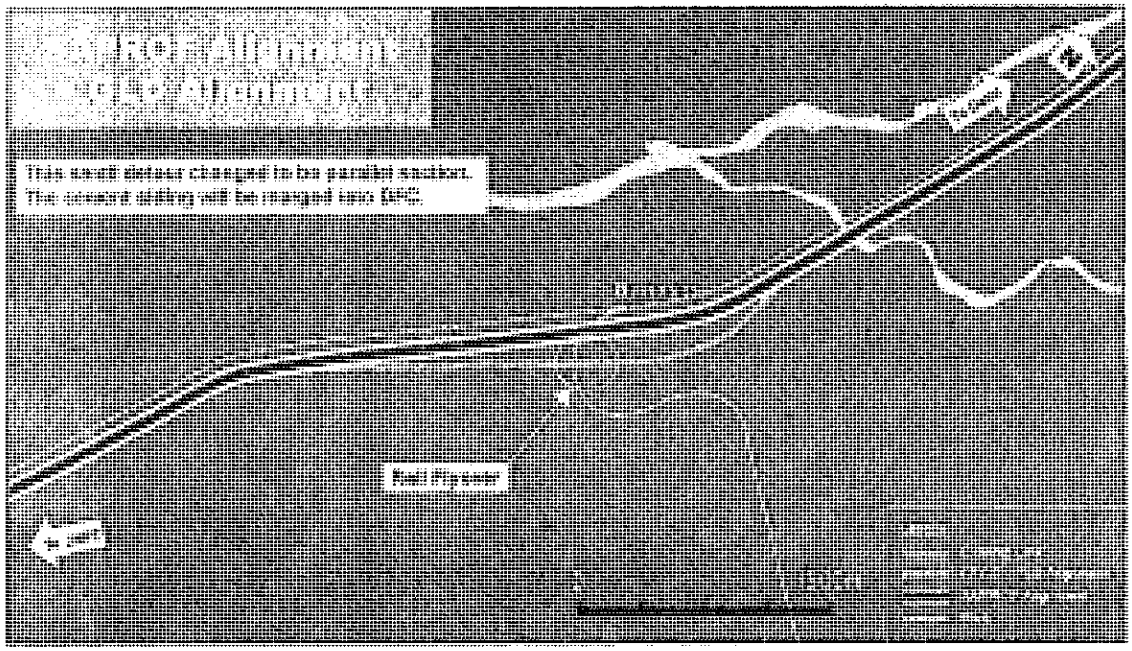
Source: SAPROF Study Team

Figure 2-34 Morthala Stn. Small Detour



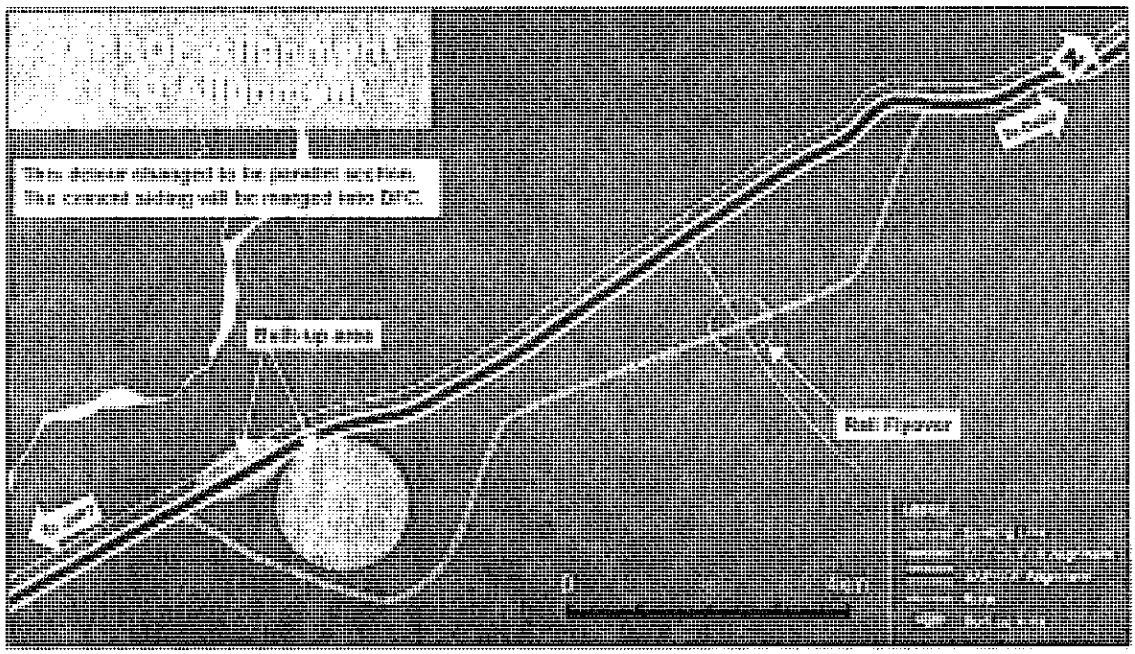
Source: SAPROF Study Team

Figure 2-35 Kivarli Stn. Small Detour



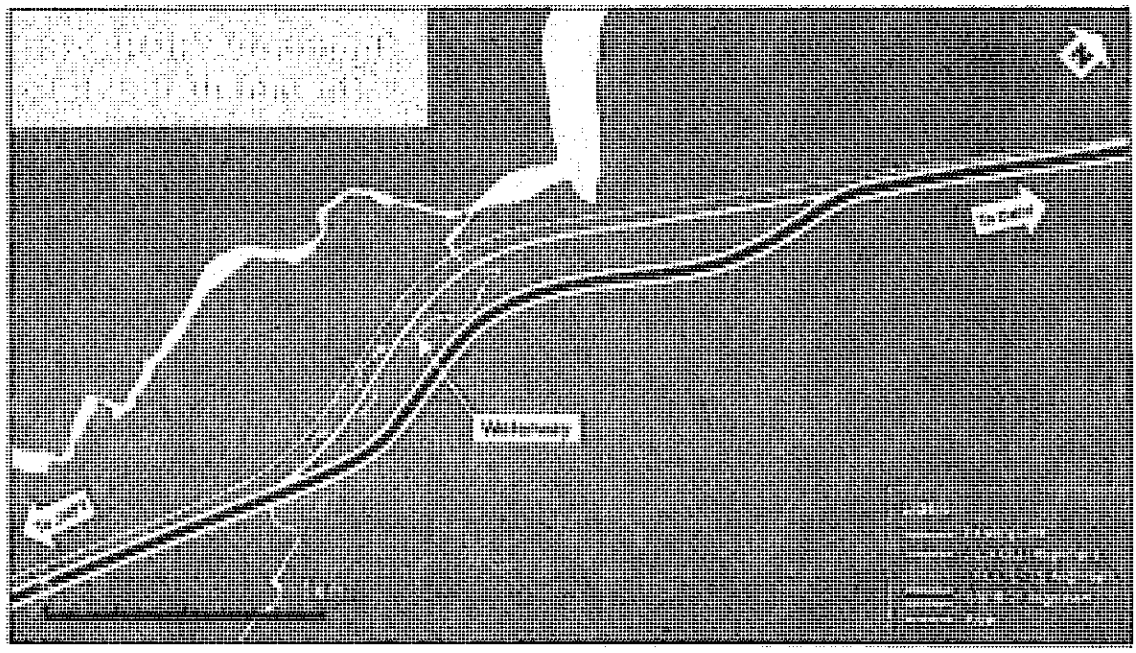
Source: SAPROF Study Team

Figure 2-36 Banas Stn. Small Detour



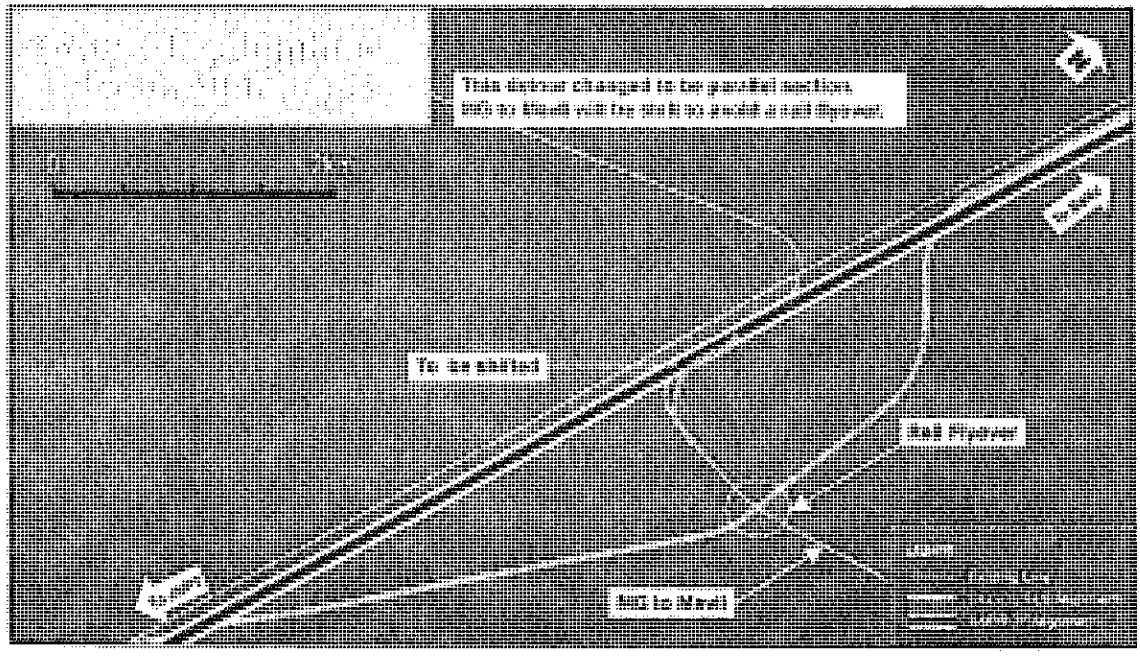
Source: SAPROF Study Team

Figure 2-37 Sirohi Road Stn. Detour



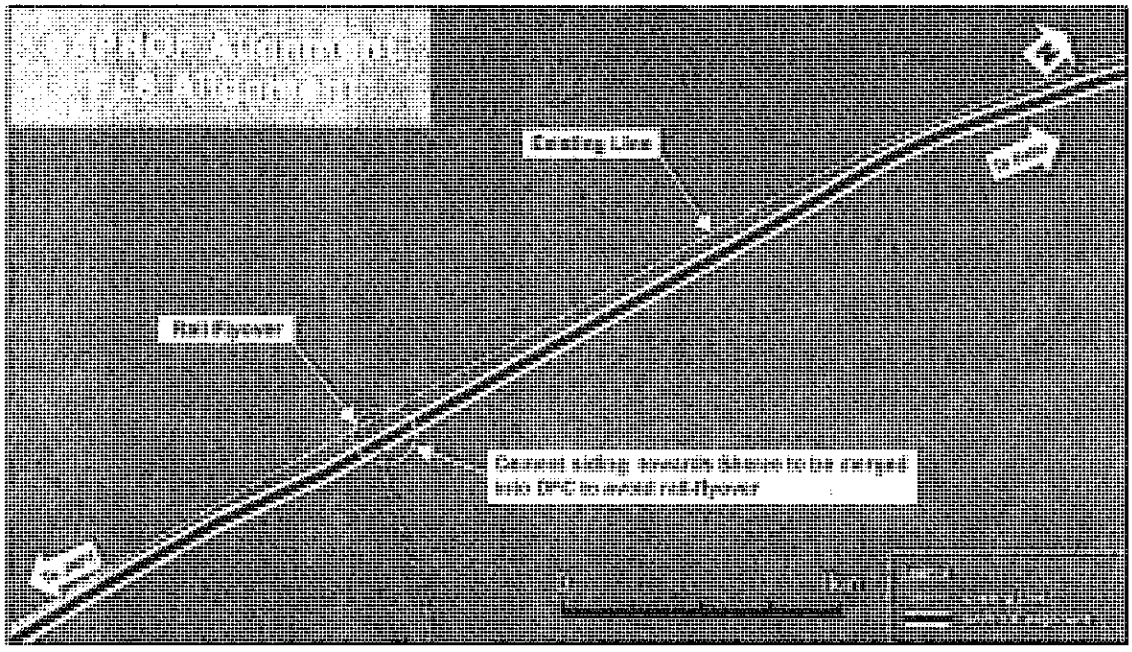
Source: SAPROF Study Team

Figure 2-38 Jawai Bandh Stn. Small Detour



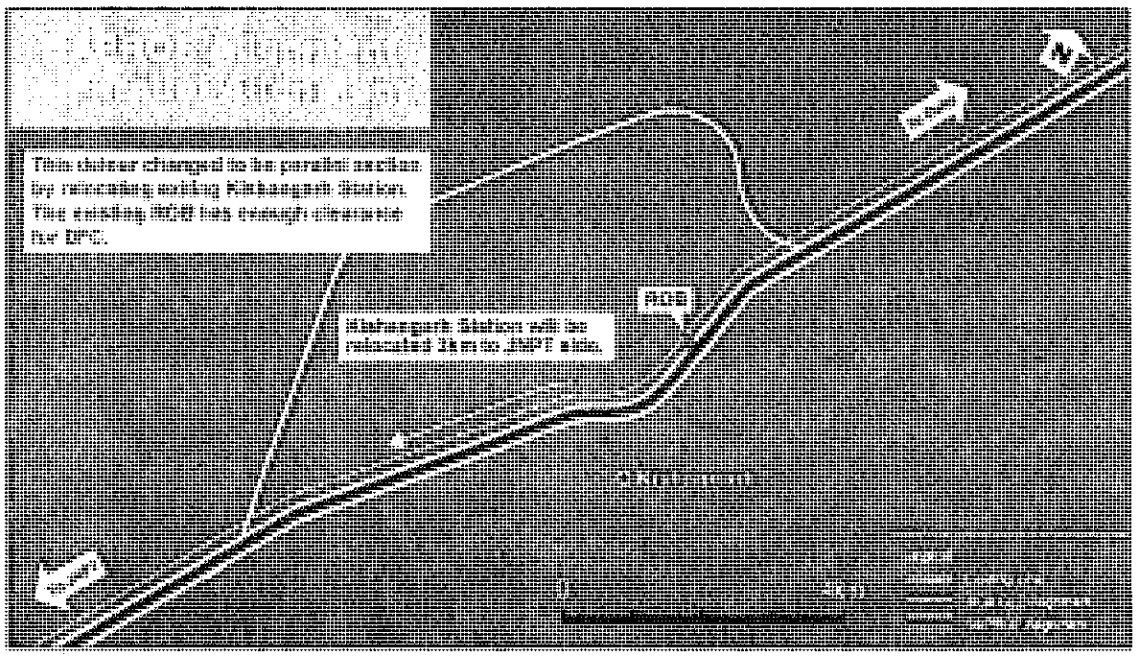
Source: SAPROF Study Team

Figure 2-39 Marwar Stn.



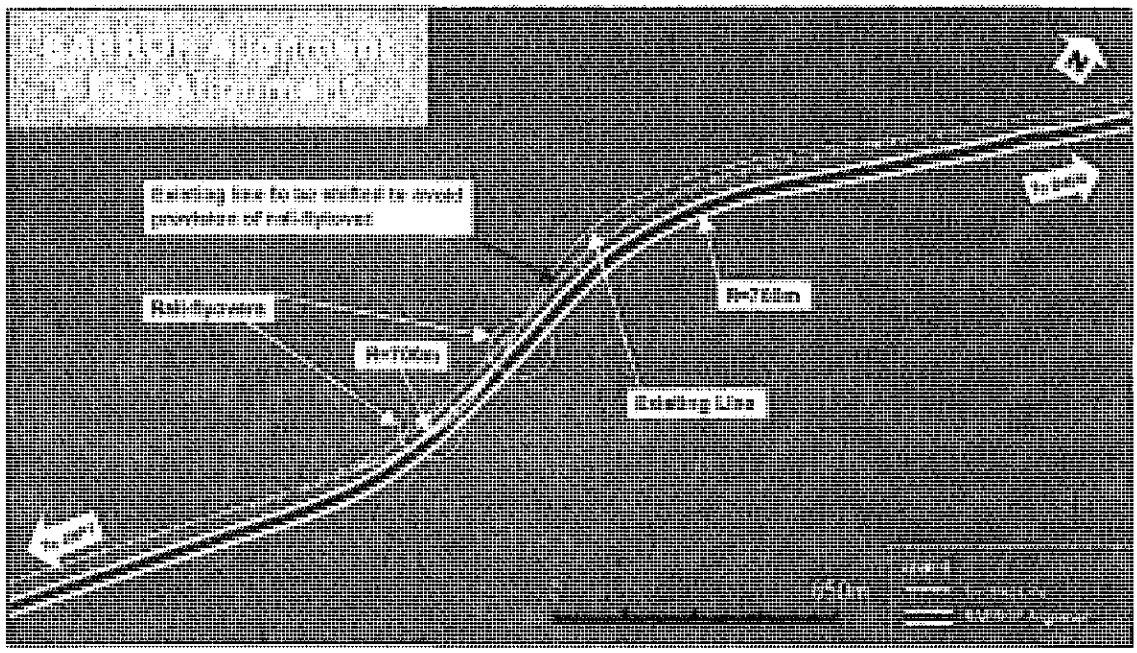
Source: SAPROF Study Team

Figure 2-40 Bangurgram Stn.



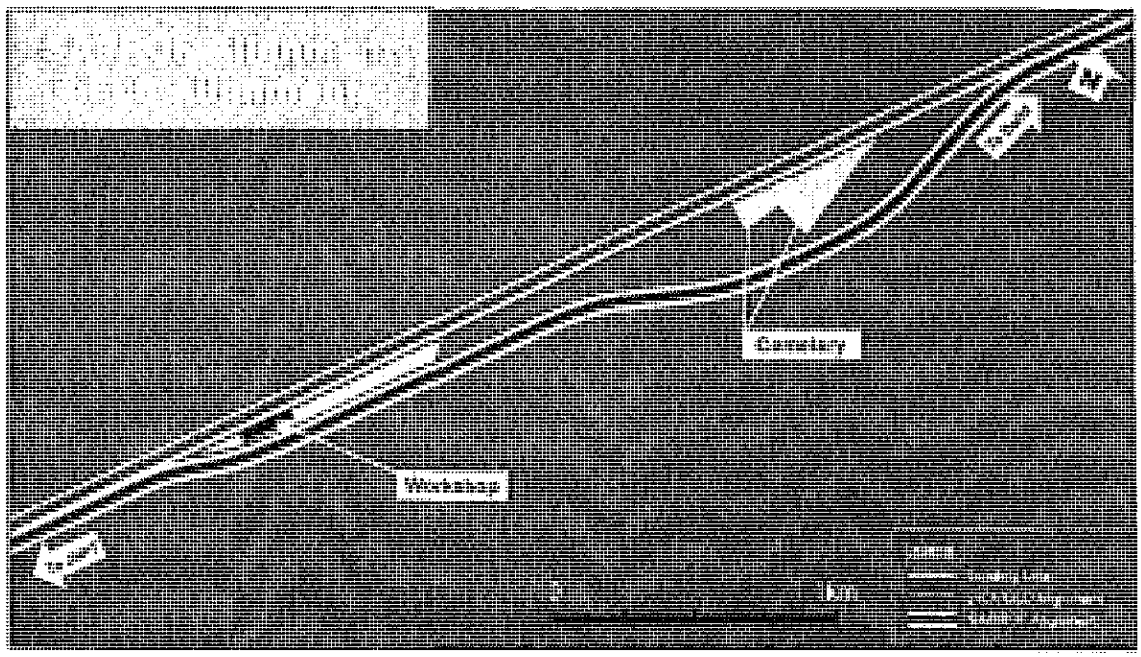
Source: SAPROF Study Team

Figure 2-41 Kishangarh Stn. Detour



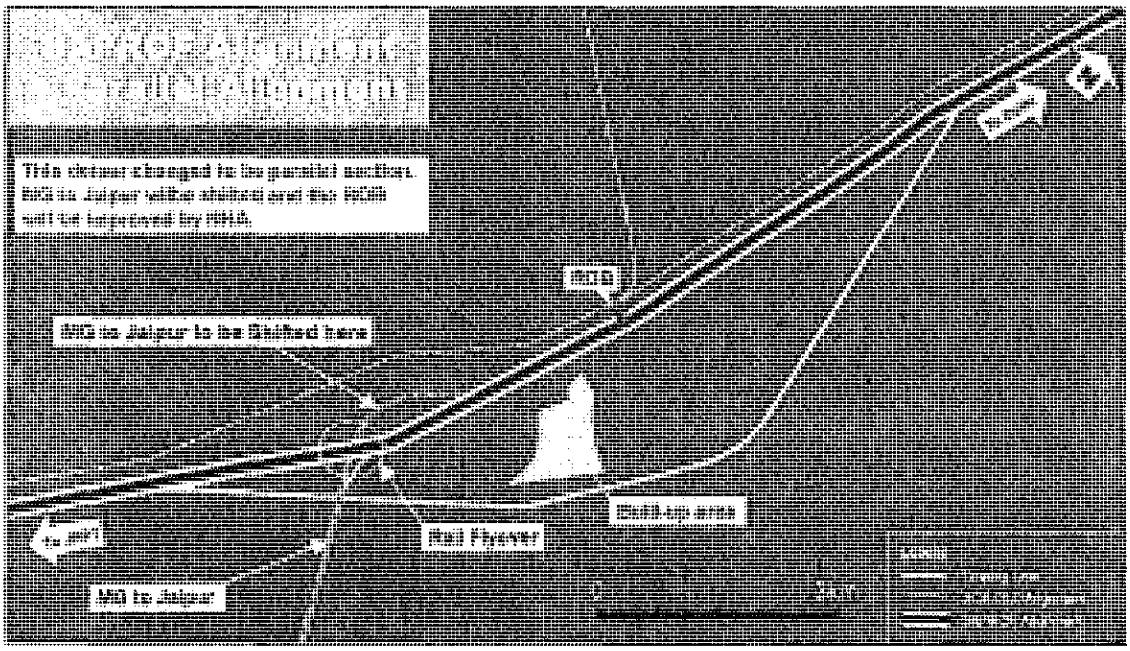
Source: SAPROF Study Team

Figure 2-42 Near Makrera Stn.



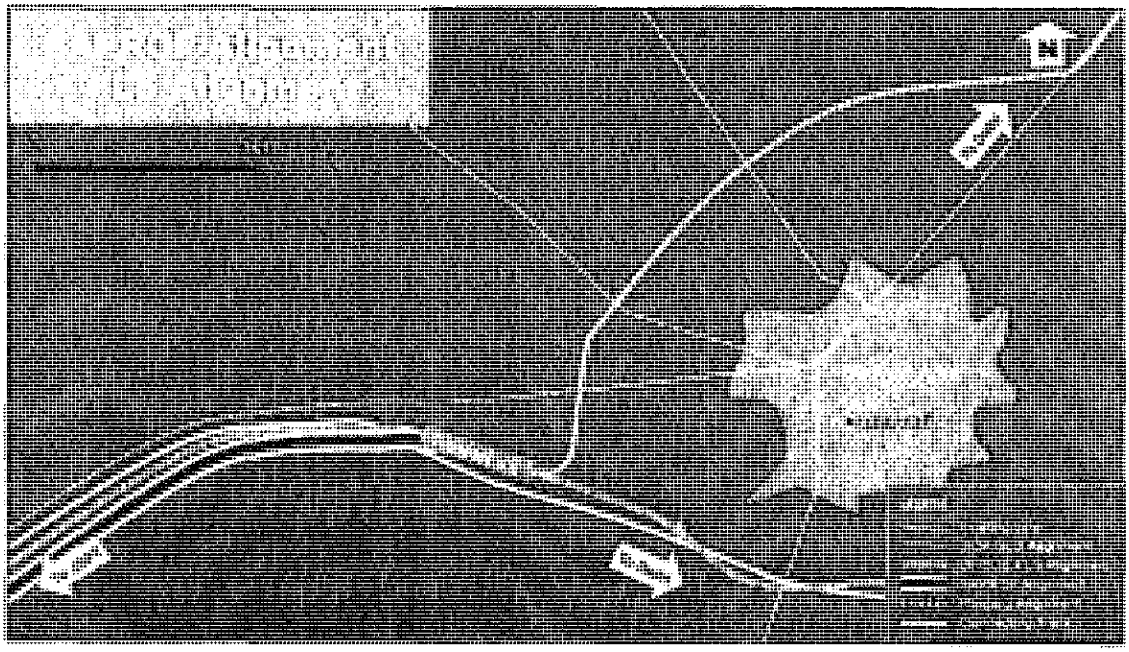
Source: SAPROF Study Team

Figure 2-43 Madar Stn. Small Detour



Source: SAPROF Study Team

Figure 2-44 Ringas Stn.



Source: SAPROF Study Team

Figure 2-45 Rewari JS

2.5.4 Reviewing of critical affected structure area

Near Existing Kishangarh sta. is one of critical affected structure area. SAPROF Study Team reviewed the alignment including shifting of Existing Line to reduce affected structure.

DFCCIL is being study, therefore ESIMMS is following the review result of SAPROF for near Kishangarh station.

CHAPTER I-3 OVERVIEW OF PRESENT CONDITIONS OF THE PROJECT AREA

3.1 PHYSICAL CONDITIONS

The DFC alignment at the section from Makarpura Junction Station in Vadodara, Gujarat to Rewari Junction station in Rewari, Haryana in the Western Corridor is the target section of S-ESIMMS. The area contains the flat lowland near the coastal zone in Vadodara District, transitional area from the low land to hilly area and rocky mountainous areas near the border with Rajasthan such as Banaskantha District. Almost entire detour section passes through the flat low land area mainly used for agriculture land.

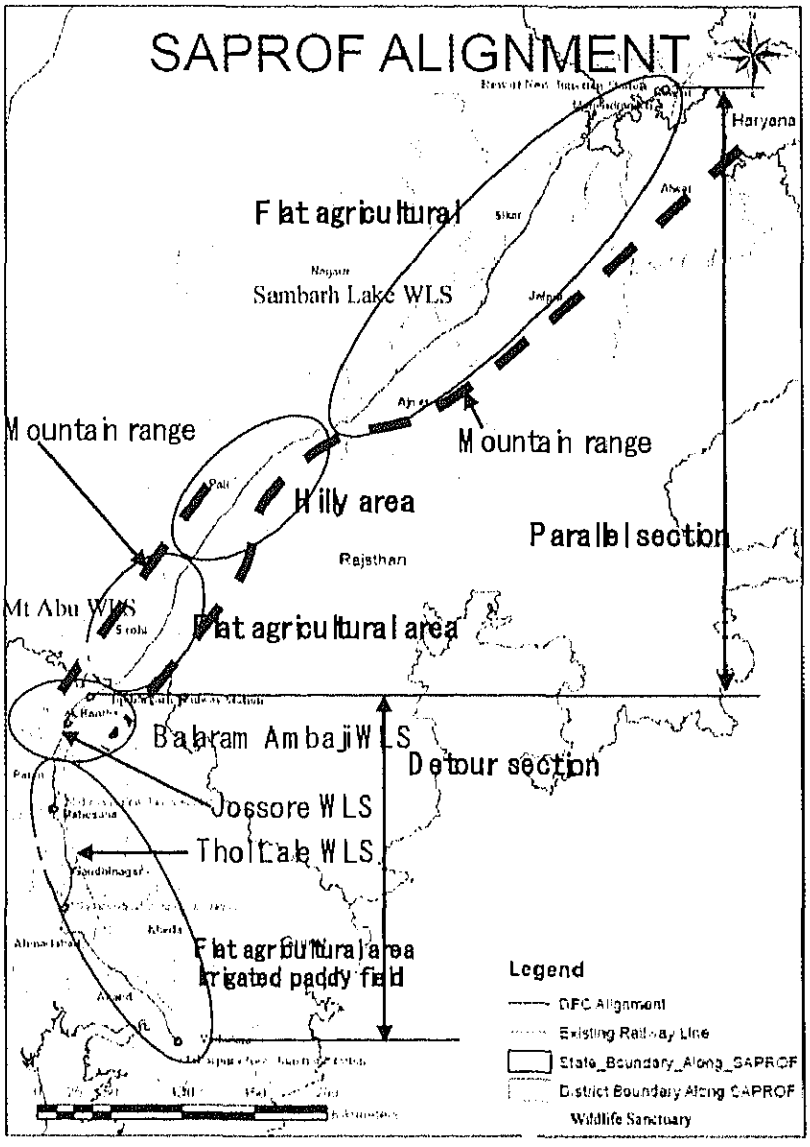


Figure 3-1 Natural Environmental Feature along DFC

At the border between Gujarat and Rajasthan, the DFC alignment runs through the western foot of Aravalli Range which is categorised one of the oldest mountains originated in the

Pre-Cambrian era and located from Gujarat to Delhi lying south west to north east in northern part of India. The DFC runs through its main part of the Western Corridor from Gujarat to Rajasthan in this western foot of Aravalli up to Rewari District in Haryana state. The districts to be passed by the DFC alignment are 8 districts in Gujarat, 7 districts in Rajasthan and 2 districts in Haryana.

The existing track of North Western Railway to which the DFC will be constructed in parallel was established more than 100 years ago during the time of British reign. The railway is located in topographically flat or gently sloped area passing the highest elevation of approximately 500 m Above Sea Level (ASL) in the middle of Rajasthan (Madar in Ajmer district). The elevation of the study area is 20 m ASL near the coastal area, approximately 200 m ASL at the end point of the western railway in Delhi. The distinguished topographic feature associated with geology in Aravalli can be observed only in the part of entire stretch near Ajmer where the railway crosses the Aravalli Range. In Ajmer, there is an old mining site of hard rocks such as metamorphic schists, quartzites, marbles and gneisses of the Pre-Cambrian age with associated acid and basic intrusive rocks according to Water Resource Department of Rajasthan. From existing Haripur Railway Station, in Pali District, the alignment passes through the rocky hilly area of Aravalli hill. At the Section between Haripur and Amarpura, the existing railway crosses a part of the aravalli hill.

The climate in the section in Western Corridor varies from the comparatively high rainfall in Vadodara district in Gujarat, approximately 900 mm to the semi-arid area in Rajasthan, approximately 500 mm, including partly arid area of extremely low rainfall area with less than 400 mm of annual rainfall. Also, the temperature at the section in the Western Corridor slightly varies from the Vadorata to Rewari where the seasonal temperature decline in the monthly mean temperature is less than 10 degree. The mean annual rainfall between 1995 and 2004 in the Western Corridor is 872 mm in Ahmedabad in Gujarat, 593 mm in Jaipur in Rajasthan and 624 mm in South Haryana and Delhi. The entire area belongs to monsoon climate and has most annual rainfall within August and September of the monsoon season (June to September). Rest of the months in the year, December, January, February are the coldest months namely winter, March, April and May are the hottest months namely summer and October and November are called post-monsoon as moderate season.

Table 3-1 Natural Environment Features along the DFC Alignment in Western Corridor

State	*Geomorphological Feature*	*Area along the DFC*
Gujarat	Gujarat is located in the north western part of India bordering Pakistan and having 196,000 km^{2}of land area. The state has the longest coastal line among all states in India and its length is 1,596 km. The entire area is topographically flat. There are many big rivers such as Tapi River and Narmada River flows into the Arabian sea.	The area mainly consists flat agricultural area, undulated river banks, low land area at the southern part and also some patchy forest spreading along the southern end of Aravalli Range in northern part. DFC alignment passes through 8 districts. From the Vadodara district at the southern end of DFC to the Banaskantha District at the border with Rajasthan, the elevation is increasing gradually.
Rajasthan	Rajasthan is located in the north west of Indian sub-continent having 342,239 km^{2}of land area. Aravalli range lies covering Mount Abu (1,722 m ASL) at south western border to Khetri at north eastern border in the state. Also, the Thar Desert is located in the area of the western to north western part of Rajasthan.	The DFC is planed to pass through 7 districts at the western foot of Aravalli Range which originated in Pre-Cambrian Era. Rocky hilly area in dry climate. The alignment passes the highest place (approx.500m) in the entire corridor.
Haryana	Haryana is located in the northern part of India having the smallest land area of 44,210 km^2 among all Indian states. Most of area is covered by alluvial plain and Shivalik Hills at the north	DFC alignment in the Western Corridor crosses a part of Aravalli Range near the border between Rewari and Mahendragarh districts in Haryana state. Entire stretch of the section runs

State	Geomorphological Feature	Area along the DFC
	western part of the state. The altitude of the plain is approximately 210-270 m and there is an international river flowing thorough Nepal and Bangladesh, Yamuna River at the east part of the state.	in parallel to the existing track of North Western Railway currently implementing the construction for converting double broad gauge. Rest of the area where the DFC alignment passes through is used for agriculture due to flat conditions.

3.2 NATURAL CONDITONS

Although most of the area is already developed as agricultural land, entire stretch of the Western corridor between Vadodara in Gujarat and Rewari in Haryana, is originally dominated by the thorny deciduous forest.

The area covered is widely developed as agricultural land in the South Western Gujarat, especially at the section from Vadodara to Mahesana District. This corresponds to the number of river flowing in the region. As shown in the DFC bridge plan, most of the main rivers in the Gujarat are located in this area and have comparatively large flood area due to very close distance to the river mouth at Arabian Sea. Surrounding area of the rivers, some aquatic ecosystems are found. The carnivorous reptiles can be the top animal of the food chain as consumer at higher level and those highly related to the human habitat of the Hindu religious living style in the area. In the area, people of Hindu religion have a practice of throwing ashes in the river after cremation and they often have a cremation ground at the river bank. As a result some carnivorous reptiles, soft shell turtles work as scavenger of the river.

In North Gujarat, from the Mahesana District to the Banaskantha, the alignment passes through agricultural land and partly through degraded reserved forest (corresponds to the drawing of FLS section 7 and 8). At the Kadi District the alignment passes through area at a distance of approximately 0.7-1.5 km to the boundary of the Thol Lake Wildlife Sanctuary. The artificial man made lake has many species of avifauna migrant bird visiting seasonally. More detailed situation of the sanctuary is described in the other chapter. The alignment also passes through the area of the two (2) wildlife sanctuaries, namely Balaram Ambaji WLS and Jessore WLS. About 30 km of DFC alignment will be between the two sanctuaries. Although critical animal migrant habitats are not found, some occasional animal movement in the privately cultivated dry land agricultural area may be affected. Adequate measures shall he considered at the design stage with the consultation of the sanctuaries administration body. Three reserved forest and one seasonal river connecting two wildlife sanctuaries, Balaram River is passed thorough by DFC alignment.

From the Gujarat border the DFC alignment in Rajasthan passes through agricultural plains on the banks of the rivers Banas and Luni and the several streams that join them. The water bodies are mainly seasonal with hardly any water during the summer months. Although the land use pattern along the alignment is predominantly agricultural, farming is mainly rain-dependent, the farms left fallow in the dry season. During the dry season, some animal such as blue bull may move around the area occasionally.

The Mt Abu Wild life sanctuary, a biodiversity rich area in the Aravalli mountain system, is located approximately 4.5 km west of the existing railway. In the area between the alignment and sanctuary, the major river of Banas, National Highway (NH-14) and human settlement areas are located (seasonal features of the sanctuary is discussed later).

In the middle of the state the alignment passes through barren lands comprised of rocky hills, between north of the existing Haripur railway station (RS) to west of existing Beawar RS. In

the area, only limited seasonal growth of the herbal plants and scattered grass growth can be seen in the rainy season, while they dry out in the dry season.

In North Rajasthan, the area between Ajmer and Sikar at the border of Haryana, the DFC passes through Agricultural land in the west foot of the Aravalli range. The alignment passes parallel to the existing railway. Also, one of the Wildlife sanctuary, Sambarh Lake Wildlife sanctuary is located at west side of the existing railway at north of the Phurela Junction Station. The distance is approximately 5km between railway and boundary of the buffer area of the sanctuary. Even it may have enough distance to the sanctuary, a river bridge will be constructed crossing one of the seasonal river which flow into the lake. It is required to minimize the release of muddy water by avoiding rainy season construction.

In Haryana, the alignment passes through dry agricultural land in parallel to the existing railway of north western railway. Ninety two (92) % of the area along the DFC is covered by agricultural area and approximately 8 % (rest of the area) is covered by residential area. The xerophytic type (drought tolerant) of flora originally dominates the study area in most cases it may construct thorny deciduous forest. The thorny leguminous species of *Acacia* spp. and other species such as *Ailanthus excelsa*, *Albizia lebbek*, *Azadirachta indica*, *Ficus bengalensis* and some other introduced exotic species such *Eucalyptus* spp., *Leucaena leucocephala* and *Prosopis juliflora* are commonly found in the area. These species are observed through out the year. Seasonal variation of tree species is not prominent along the track.

The rapid increase in human population and presence of large number of cattle has caused the destruction of vegetative cover which has led to disappearance of wild animals to a large extent. At present mainly Common Langur (Seinnopithecus entellus), Blue Bull (Boselaphus tragocamelus) antelopes and common birds are found in the area. However, Blue Bulls are present in large number and causes damage to agriculture crops and young plants.

3.3 SOCIO-ECONOMIC CONDITIONS

3.3.1 Socio-economic Conditions of the Overall Project Area

As shown in Table 3-2, the project area includes 17 districts in total; 8 districts in Gujarat, 7 districts in Rajasthan, and 2 districts in Haryana.

Table 3-2 Number of Villages Directly Affected By Projects

State	District	No. of Villages Potentially Affected by the Project
Gujarat	Vadodara	16
	Anand	29
	Kheda	18
	Ahmedabad	20
	Gandhinagar	16
	Mahesana	43
	Patan	13
	Banaskantha	34
	Sub-Total	189
Rajasthan	Sirohi	27
	Pali	73
	Ajmer	42
	Jaipur	39
	Nagaur	2
	Sikar	35
	Alwar	2
	Sub Total	220
Haryana	Mahendergarh	34
	Rewari	27
	Sub Total	61
	Total	470

Table 3-3 shows that the population of these seventeen (17) districts covered by DFC Project is estimated to be about 44.6 million. The population of the district varies from 0.9 million for the district in Haryana to more than 6 million for that in Rajasthan and Gujarat.

The affected area varies depending on the district location. The DFC Project passes through approximately 195 km in Pali District where the DFC alignment is located across the district from northeast to southwest in Rajasthan. On the other hand, there is only 2.5 km of stretch passing through Alwar in Rajasthan or 3.3 km of stretch through Nagaur. Although the overall population size of these districts is relatively small, the urban population of these districts, which is approximately 15 - 21% of the total population, is concentrated mostly along the railway.

Ajmer is the only district where the DFC alignment passes through the middle of the district. In Ajmer, the urban population is accounted for 40% of the total population, which shows higher population concentration in urban area. On the other hand, Ahmedabad City in Gujarat, the former capital city, and Gandhinagar City, the current capital city, are avoided by DFC alignment by detour. In addition, for other highly populated districts such as Vadodara, Patan, Mahesana and Kheda detours are designed for DFC alignment to avoid passing through the middle of these districts.

On average, it is estimated that DFC alignment passes through districts where the population is approximately 1.2 – 6.5 millions with the urban population ratio of 20 - 81%. Overall, DFC alignment goes through the districts where the average urban population ratio varies 12 - 81%.

Table 3-3 Demographic Features of Districts covered by DFC Project (Rewari-Vadodara)

District	Area and Population			Average annual growth in Population: 1991-2001 (%)			Proportion of SCs & STs in the total population: 2001 (%)		Sex ratio (females per 1000 males): 2001		
	Area (km^2)	Population	Urban Population (%)	Rural	Urban	Total	Ratio of SCs to the total population	Ratio of STs to the total population	Total	SC	ST
Vadodara	7,550	3,988,646	46	1.5	2.2	1.8	5.6	26.6	919	918	950
Anand	2,941	1,975,197	29	0.9	2.1	1.2	5.3	1.2	910	894	900
Kheda	4,219	2,151,572	20	1.3	0.9	1.2	5.2	1.6	923	918	912
Ahmadabad	8,087	6,555,762	81	1.1	2.7	2.4	10.7	1.0	892	891	883
Gandhinagar	2,163	1,493,301	38	1.3	3.9	2.1	8.7	1.3	912	909	847
Mahesana	4,383	1,947,540	23	1.0	1.7	1.1	8.1	0.5	927	912	838
Patan	5,730	1,263,414	20	1.3	1.4	1.3	9.9	1.1	932	915	880
Banaskantha	10,757	2,814,450	12	2.2	3.4	2.3	10.8	8.2	930	925	946
Sub-total/ Average	45,830	22,189,882	34	1.3	2.3	1.7	8.0	5.2	918	910	895
Sirohi	5,136	969,718	17	2.8	1.7	2.6	19.1	24.8	943	918	953
Pali	12,387	2,017,452	21	2.1	1.9	2.0	17.8	5.8	981	944	926
Ajmer	8,481	2,450,013	40	2.4	2.2	2.3	17.7	2.4	931	943	925
Jaipur	11,143	6,117,522	51	2.3	3.8	3.0	14.8	7.9	897	906	898
Nagaur	17,718	3,153,641	18	2.4	3.3	2.6	19.6	0.2	948	937	855
Sikar	7,732	2,548,559	20	2.2	2.0	2.2	14.9	2.7	951	932	924
Alwar	8,380	3,418,055	15	2.6	3.0	2.6	18.0	8.0	886	896	879
Sub-total/ Average	70,977	20,674,960	26	2.4	2.6	2.5	17.4	7.4	934	925	909
Mahendragarh	1,859	886,283	14	1.6	2.6	1.8	16.3	0.0	918	916	-
Rewari	1,582	858,378	19	2.0	3.6	2.3	18.9	0.0	899	897	-
Sub-total/ Average	3,441	1,744,661	17	1.8	3.1	2.1	17.6	-	909	907	-
Total	120,248	44,609,503	25	1.8	2.7	2.1	14.4	-	920	914	-

Source: Census of India, 2001
India at a glance, 2006-2007

The average annual growth in population in any districts of the Dedicated Freight Corridor is approximately 2 - 3%, while other major cities such as Rewari, Jaipur, Ahmedabad, Gandhinagar, are showing a higher rate of population increase due to industrialisation.

There are relatively large number of Scheduled Castes (SCs) and Scheduled Tribes (STs) in the affected area. In Haryana and Rajasthan, the ratio of SCs to the total population is twice as much as that of in Gujarat. However, in Sirohi District of Rajasthan, 25% of the total population is accounted for STs, which is the highest amongst the districts directly affected by DFC Project in the Western Corridor.

As shown in Table 3-3, the ratio of SCs is maximum in Nagaur in Rajasthan and Rewari in Haryana while that of ST is nil in Nagaur District. It is considered that more STs live in rural areas where forests and fertile agricultural land are available, while more SCs live in the urban areas and depend on the urban economy for their living. Therefore, an increase in the SC population in industrial areas is expected in the future.

The average per capita income of the urban area is twice as much as that of in rural area except Ajmer where urban population is dominant. However, the number of workers in the rural area is 6 - 10 times as large as that in urban areas overall except highly industrialized districts, such as Ahmedabad and Vadodara as shown in Table 3-4. In Ahmedabad, there is an exceptional trend; the number of workers in the urban area is larger than that in the rural area by 3 times. It is considered that in Ahmedabad, the capacity to accommodate urban workers almost reaches the maximum level as a whole.

Table 3-4 Income and Employment of Districts covered by DFC Project (Rewari-Vadodara)

District	Per capita rural & urban income & market size: 2006			Average annual growth in employment: 1991-2001 (%)		
	Market Size (Rs Crore)	Per capita income in urban areas (Rs)	Per capita income in rural areas (Rs)	Rural	Urban	Total
Vadodara	15,218	88,854	25,457	1.8	2.8	2.2
Anand	6,348	60,031	37,386	1.1	3.4	1.6
Kheda	5,443	59,986	26,920	1.9	2.0	1.9
Ahmadabad	25,976	62,897	34,050	1.3	3.7	3.0
Gandhinagar	6,649	98,331	42,061	2.3	5.0	2.9
Mahesana	5,463	65,287	29,473	1.4	2.6	1.6
Patan	3,231	57,977	27,843	2.0	2.5	2.1
Banaskantha	5,881	47,880	24,501	3.4	4.0	3.4
Sub-total/ Average	47,200	332,372	157,928	2.1	3.5	2.6
Sirohi	1,851	50,299	23,738	3.3	2.4	3.2
Pali	5,108	60,827	32,680	2.5	2.2	2.5
Ajmer	6,002	44,644	33,776	2.2	2.4	2.3
Nagaur	16,218	60,282	26,170	3.0	4.6	3.7
Jaipur	6,134	34,178	26,754	2.8	3.4	2.9
Sikar	5,036	30,468	28,295	4.6	2.7	4.3
Alwar	7,232	56,962	27,516	4.7	4.1	4.6
Sub-total/ Average	47,581	337,660	28,418	3.3	3.1	3.3
Mahendragarh	1,943	43,902	25,880	5.3	4.4	5.2
Rewari	2,245	50,724	31,222	7.4	4.4	7.0
Sub-total/ Average	4,188	94,626	57,102	6.4	4.4	6.1
Total/ Average	98,969	764,658	243,448	3.9	3.7	4.0

Source: Census of India, 2001
India at a glance, 2006-2007

As shown in Table 3-4 and Table 3-5, the growth of employment is higher in districts Ahmedabad and Gandhinagar due to industrialization. Overall, more than 50% of the male population engages in employment while the female population engaging employment is around 30%. Comparing the population engaged in agriculture and non-agricultural services at district level, the industrialised districts such as Ahmedabad and Gandhinagar show lower work population ratio in the agricultural sector as shown in Table 3-5.

Table 3-5 Workers Indicators of Districts covered by DFC Project (Rewari-Vadodara)

District	Work Participation rate: 2001 (%)			Work Participation rate: 2001 (%)		Number of workers (2001)			Workers in agriculture & non-agriculture sector: 2001 (%)	
	Rural	Urban	Total	Male	Female	Rural	Urban	Total	Agriculture Sector	Non Agriculture Sector
Vadodara	49.5	32.2	41.7	55.9	26.3	988,459	530,386	1,518,845	53.1	46.9
Anand	45.6	33.3	42.3	55.1	28.2	615,341	169,370	784,711	56.4	43.6
Kheda	48.1	31.8	44.9	55.1	33.8	778,796	129,384	908,180	58.8	41.2
Ahmadabad	44.5	32.1	34.5	53.1	13.8	512,642	1,496,723	2,009,365	18.2	81.8
Gandhinagar	47.2	31.0	41.5	53.1	28.9	409,703	144,633	554,336	40.2	59.8
Mahesana	48.8	32.3	45.1	53.7	35.8	695,737	132,782	828,519	47.8	52.2
Patan	48.3	32.3	45.1	53.2	36.3	456,129	76,949	533,078	63.9	36.1
Banaskantha	45.4	29.1	43.6	51.2	35.5	1,012,019	80,182	1,092,201	66.4	33.6
Sub-Total/ Average	46.8	31.4	42.0	52.9	30.1	617,246	386,254	1,003,500	47.3	52.7
Sirohi	42.5	30.7	40.4	50.1	30.1	297,621	46,284	343,905	50.6	49.4
Pali	42.2	31.1	39.8	48.5	30.9	603,391	121,492	724,883	56.8	43.2
Ajmer	45.7	29.6	39.3	49.8	28.0	597,576	259,233	856,809	47.8	52.2
Nagaur	40.4	30.4	35.5	47.4	22.3	1,075,393	788,662	1,864,055	41.0	59.0
Jaipur	43.5	27.1	40.7	48.1	32.9	999,978	129,536	1,129,514	72.3	27.7
Sikar	42.1	26.0	38.8	45.8	31.5	765,109	122,806	887,915	66.0	34.0
Alwar	51.6	31.9	48.7	53.1	43.9	1,320,066	138,620	1,458,686	70.9	29.1
Sub-total/ Average	44.0	29.5	40.5	49.0	31.4	5,659,134	1,606,633	7,265,767	59.0	41.0
Mahendragarh	45.2	31.2	43.3	48.0	38.2	317,652	34,212	351,864	65.8	34.2
Rewari	46.5	30.1	43.6	49.7	36.8	292,582	41,040	333,622	57.7	42.3
Sub-total/ Average	45.9	30.7	43.5	48.9	37.5	610,234	75,252	685,486	61.8	38.3
Total/ Average	45.6	30.5	42.0	50.2	33.0	2,295,538	689,380	2,984,918	56.0	44.0

Source: Census of India, 2001
India at a glance, 2006-2007

Table 3-6 shows the number of household using banking services. The number of household using banking service in Ahmedabad is twice as compared to Jaipur, although population of two cities is almost same. Comparing the data by state wise, Rajasthan and Haryana show 40% lower rate of using banking services than Gujarat.

As shown in Table 3-6, households using LPG for cooking would be another indicator of modernisation of the local economy. The number of household using LPG in Ahmedabad is twice as compared to Jaipur, although population of two cities is almost same. Within the project area, Haryana and Rajasthan shows 40% lower rate of the use of LPG than Gujarat. The same trend is shown in electrification, and possession of capital goods, and it is concluded that Gujarat is more economically active than that of Haryana and Rajasthan.

Table 3-6 shows semi-permanent houses and temporary houses existing in the district covered by DFC Project. In Gujarat the total number of semi-permanent houses and temporary houses is five times larger than that of Haryana and Rajasthan. It indicates that there are more low income families in Gujarat than in Haryana and Rajasthan. It is considered that a large number of low-income families flow into the industrialised districts in Gujarat due to active economy.

Table 3-6 Socio-economic Indicators of Districts covered by DFC Project (Rewari-Vadodara)

District	Penetration of banking services & use of LPG as cooking fuel in households (2001)		Penetration of electricity, TV & Phone in households: 2006 (%)			Penetration of 2-wheelers & 4-wheelers in households: 2006 (%)		Number of houses by type of construction (2001)			
	Household using banking services	Household using LPG as fuel for cooking	Household having electricity	Household owning TV	Household owning phone	Household owning 2-wheelers	Household owning 4-wheelers	Permanent houses	Semi-permanent houses	Temporary houses	Unclassifiable houses
Vadodara	330,351	272,457	83	52	23	38	7	469,814	212,019	50,778	498
Anand	135,984	103,466	83	46	22	21	4	189,905	152,862	12,773	32
Kheda	123,159	68,413	77	30	15	15	2	174,967	198,387	21,504	204
Ahmadabad	540,179	627,366	97	75	28	45	9	983,928	166,901	35,582	246
Gandhinagar	111,940	91,724	96	71	35	30	5	185,068	63,633	12,353	8
Mahesana	148,544	89,961	87	45	26	21	4	270,948	76,388	15,725	92
Patan	57,039	35,840	77	30	17	10	2	145,570	66,902	16,076	35
Banaskantha	135,925	37,516	75	18	14	7	3	209,099	164,747	50,381	88
Sub-Total/ Average	1,583,121	1,326,743	84	46	22	23	4	2,629,299	1,101,839	215,172	1,203
Sirohi	57,726	21,682	67	22	12	17	4	96,533	59,819	6,887	6
Pali	108,336	36,894	74	32	21	20	3	250,430	83,788	19,707	15
Ajmer	129,770	99,215	77	51	24	31	4	304,597	32,205	40,035	40
Jaipur	268,720	284,234	83	61	27	36	7	652,876	45,896	86,191	67
Nagaur	95,933	45,937	60	26	11	11	3	360,898	22,082	47,187	101
Sikar	113,213	54,355	72	39	16	10	4	299,607	11,328	27,880	269
Alwar	160,869	60,624	73	35	14	18	2	380,555	23,793	56,722	10
Sub-Total/ Average	934,567	602,941	72	38	18	20	4	2,345,496	278,911	284,609	508
Mahendragarh	74,381	20,408	80	48	10	19	3	124,937	4,961	3,269	1
Rewari	78,578	35,103	92	65	20	23	3	122,475	5,110	3,278	1
Sub-Total/ Average	152,959	55,511	86	56	15	21	3	247,412	10,071	6,547	2
Total/ Average	2,670,647	1,985,195	81	47	18	22	4	5,222,207	1,390,821	506,328	1,713

Source: Census of India, 2001
India at a glance, 2006-2007

As shown in Table 3-7, the rate of households with water supply for Ahmedabad is 86% higher than Jaipur. The number of households without water supply system in Gujarat is 10% smaller than Haryana and Rajasthan. Although Haryana and Rajasthan are relatively dry areas with the low precipitation rate, the data shows that Gujarat is economically more active state.

Table 3-7 Socio-economic Indicators of Districts Affected by DFC Project (Rewari-Vadodara)

District	Classification of households by source of drinking water (2001)			Households with water closet/ latrine: 2001 (%)			Literacy Rate: 2001 (%)			Gender gap in literacy rate: 2001 (%)		
	Households with access to drinking water	Households with drinking water outside premises	Households with drinking water within premises	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban	Total
Vadodara	733,109	349,394	383,715	8	69	37	71	80	61	11	26	19
Anand	355,572	161,384	194,188	16	58	27	75	86	62	15	28	24
Kheda	395,062	254,272	140,790	9	52	17	72	86	57	15	33	29
Ahmadabad	1,186,657	330,876	855,781	11	73	61	80	87	71	13	31	17
Gandhinagar	261,062	94,247	166,815	21	71	39	77	88	65	14	28	23
Mahesana	363,153	137,594	225,559	21	50	28	75	86	64	14	25	23
Patan	228,583	130,450	98,133	11	56	20	60	74	46	18	30	27
Banaskantha	424,315	306,884	117,431	7	23	9	51	67	34	22	33	32
Sub-total/ Average	3,947,513	1,765,101	2,182,412	13	56	30	70	82	57	15	29	24
Sirohi	163,245	108,484	54,761	3	35	9	54	70	37	25	34	33
Pali	353,940	240,951	112,989	3	21	6	54	72	37	30	37	36
Ajmer	376,877	241,450	135,427	4	51	22	65	79	49	17	39	31
Jaipur	785,030	393,671	391,359	2	40	22	70	83	56	19	35	27
Nagaur	430,268	277,287	152,981	5	28	8	57	74	40	28	36	34
Sikar	339,084	177,418	161,666	7	33	12	71	84	56	26	29	28
Alwar	461,080	327,116	133,964	2	47	9	62	78	43	20	37	35
Sub-total/ Average	2,909,524	1,766,377	1,143,147	4	36	13	62	77	45	24	35	32
Mahendragarh	133,168	100,822	32,346	1	15	3	70	85	54	12	19	18
Rewari	130,864	83,416	47,448	2	24	6	75	88	61	17	30	28
Sub-total/ Average	264,032	184,238	79,794	2	20	4	73	87	57	14	25	23
Total/ Average	7,121,069	3,715,716	3,405,353	6	37	16	68	82	53	18	30	26

Source: Census of India, 2001
India at a glance, 2006-2007

Table 3-8 shows the rate of immunization, awareness of epidemics and there is no significant difference among the districts of the project area.

Table 3-8 Socio-economic Indicators of Districts Affected by DFC Project (Rewari-Vadodara)

District	Immunisation of children aged 12-35 months (2003-04)		Ante-natal checkups and fertility rate: 2003-04 (%)			Awareness among women about RTI/STI & HIV/AIDS: 2003-04 (%)		Awareness and use of family planning methods: 2003-04 (%)	
	Fully immunised	Not received any immunisation	No ante-natal checkup	Full ante-natal checkup	Completed fertility	RTI/ STI	HIV/ AIDS	Women with knowledge of any modern family planning method	Women reporting current use of any family planning method
Vadodara	73.5	4.6	7.5	46.5	3.2	57.0	46.0	99.5	61.5
Anand	70.7	2.8	6.6	39.2	3.1	51.6	52.2	99.9	61.1
Kheda	62.9	9.3	8.1	36.8	3.3	70.5	41.3	99.9	65.2
Ahmadabad	64.6	0.9	8.2	28.3	3.2	36.6	59.8	100.0	56.4
Gandhinagar	67.3	1.1	4.0	22.0	3.4	42.9	66.4	99.8	56.9
Mahesana	58.5	1.1	16.3	27.6	3.5	25.9	46.7	98.7	58.3
Patan	55.3	11.9	15.1	26.6	4.0	51.1	44.8	99.9	54.6
Banaskantha	28.1	15.2	26.5	8.4	4.5	18.2	34.8	96.3	41.2
Sub-total/ Average	60.1	5.9	11.5	29.4	3.5	44.2	49.0	99.3	56.9
Sirohi	18.9	20.3	31.7	9.8	4.2	29.6	30.1	99.7	33.7
Pali	35.2	26.7	27.7	5.7	5.0	52.4	36.3	100.0	42.8
Ajmer	38.0	17.0	17.5	6.5	4.5	71.0	39.5	100.0	46.0
Jaipur	32.6	25.8	15.9	12.1	4.8	92.8	48.5	99.9	62.4
Nagaur	20.8	33.1	38.1	4.4	4.8	48.3	30.3	99.8	45.7
Sikar	21.3	22.0	24.4	4.5	4.6	72.2	40.7	100.0	45.7
Alwar	24.7	22.4	31.7	5.2	5.2	93.2	29.1	100.0	50.8
Sub-total/ Average	27.4	23.9	26.7	6.9	4.7	65.6	36.3	99.9	46.7
Mahendragarh	58.7	11.4	10.2	7.1	4.1	34.0	40.3	99.6	62.4
Rewari	68.2	5.8	10.5	12.7	3.5	70.1	67.1	99.9	69.1
Sub-total/ Average	63.4	8.6	10.3	9.9	3.8	52.0	53.7	99.8	65.8
Total/ Average	50.3	12.8	16.2	15.4	4.0	54.0	46.3	99.6	56.5

Source: Census of India, 2001
India at a glance, 2006-2007

3.3.2 OVERVIEW OF IMMEDIATE PROJECT AFFECTED AREA

There are 470 villages in seventeen districts in three states, Gujarat, Rajasthan and Haryana through which the DFC alignment traverses. Demographic and socio-economic profile of the project area is based on Census Data for the years 2001. The census data has been analyzed with respect to demographic profile, occupational structure. It is important to note that the analysis below is restricted to villages likely to be affected by the DFC project, based on Village and Town Directory, Census 2001 and ground verification of the same, and it is quite possible that the DFC alignment might just touch a particular village boundary or may cut across it also. Therefore, this analysis only gives a social overview of the immediate DFC project-affected area. Details are given in Table 3-9.

(1) Demographic Profile of the Project Area as per Census Data of 2001

1) Vadodara District

There are 16 villages falling under the project area. The total population of these villages as per Census of 2001 is 54,981. The percentages of male and female population are 52% and 48%, respectively. There are about 11,200 households in the project area. The average family size is about 5 persons/family.

2) Anand District

There are 29 villages falling under the project area. The total population of these villages as per Census of 2001 is 115,457. The percentages of male and female population are 52.3% and

47.7%, respectively. There are about 23,000 households in the project area. The average family size is about 5 persons/family.

3) Kheda District

There are 18 villages falling under the project area. The total population of these villages as per Census of 2001 is 53,453. The percentages of male and female population are 52.2% and 47.8%, respectively. There are about 10,500 households in the project area. The average family size is about 5 persons/family.

4) Ahmedabad District

There are 20 villages falling under the project area. The total population of these villages as per Census of 2001 is 84,593. The percentages of male and female population are 52.6% and 47.4%, respectively. There are about 16,700 households in the project area. The average family size is about 5 persons/family.

5) Gandhinagar District

There are 16 villages falling under the project area. The total population of these villages as per Census of 2001 is 348,453. The percentages of male and female population are 52.6% and 47.4%, respectively. There are about 70,300 households in the project area. The average family size is about 5 persons/family.

6) Mahesana District

There are 43 villages falling under the project area. The total population of these villages as per Census of 2001 is 291,860. The percentages of male and female population are 52% and 48%, respectively. There are about 58,200 households in the project area. The average family size is about 5 persons/family.

7) Patan District

There are 13 villages falling under the project area. The total population of these villages as per Census of 2001 is 34,753. The percentages of male and female population are 51% and 49%, respectively. There are about 6,500 households in the project area. The average family size is about 5 persons/family.

8) Banaskantha District

There are 34 villages falling under the project area. The total population of these villages as per Census of 2001 is 581,539. The percentages of male and female population are 51.6% and 48.4%, respectively. There are about 108,200 households in the project area. The average family size is about 5 persons/family.

9) Sirohi District

There are 27 villages falling under the project area. The total population of these villages as per Census of 2001 is 105,789. The percentages of male and female population are 52.4% and 47.6%, respectively. There are about 20,200 households in the project area. The average family size is about 5 persons/family.

10) Pali District

There are 73 villages falling under the project area. The total population of these villages as per Census of 2001 is 383,350. The percentages of male and female population are 50.4% and 49.6%, respectively. There are about 72,400 households in the project area. The average family size is about 5 persons/family.

11) Ajmer District

There are 42 villages falling under the project area. The total population of these villages as per Census of 2001 is 809,658. The percentages of male and female population are 52.3% and 47.7%, respectively. There are about 142,000 households in the project area. The average family size is about 6 persons/family.

12) Jaipur District

There are 39 villages falling under the project area. The total population of these villages as per Census of 2001 is 137,710. The percentages of male and female population are 51.8% and 48.2%, respectively. There are about 20,000 households in the project area. The average family size is about 7 persons/family.

13) Nagaur District

There are 2 villages falling under the project area. The total population of these villages as per Census of 2001 is 2,092. The percentages of male and female population are 52.7% and 47.3%, respectively. There are about 307 households in the project area. The average family size is about 7 persons/family.

14) Sikar District

There are 35 villages falling under the project area. The total population of these villages as per Census of 2001 is 179,669. The percentages of male and female population are 52.2% and 47.8%, respectively. There are about 26,000 households in the project area. The average family size is about 7persons/family.

15) Alwar District

There are 2 villages falling under the project area. The total population of these villages as per Census of 2001 is 3,433. The percentages of male and female population are 51.4% and 48.6%, respectively. There are about 600 households in the project area. The average family size is about 6 persons/family.

16) Mahendergarh District

There are 34 villages falling under the project area. The total population of these villages as per Census of 2001 is 119,483. The percentages of male and female population are 52.5% and 47.5%, respectively. There are about 20,000 households in the project area. The average family size is about 6 persons/family.

17) Rewari District

There are 27 villages falling under the project area. The total population of these villages as per Census of 2001 is 48,164. The percentages of male and female population are 51.6% and 48.4%, respectively. There are about 72,400 households in the project area. The average family size is about 5 persons/family.

(2) Social Structure

The Schedule Caste (SC) population varies from 6.2% to 15.2% of the total population in Gujarat, 11.5% to 21.5% in Rajasthan, and 15.1% to 18.6% in Haryana. However, the Schedule Tribe (ST) population in districts Sirohi, Banaskantha and Gujarat are higher than SC population in that area. In Haryana, ST population is not found within the project area. The details are given in Table 3-9.

(3) Literacy

Literacy rate is one of the important indicators of the development. The literacy rate of the project affected area in Gujarat state varies from 58.3% to 75.1% of total population. In Banaskantha, literacy rate is low. Average literacy rate within the projeet affected Gujarat State is about 70%. The literacy rate for project affected area in Rajasthan varies from 55.0% to 77.4% and that in Haryana varies from 69.9% to 75.4%. Among the districts affected by DFC literacy rate is maximum in Alwar, and minimum in Pali. The details are given in Table 3-9.

(4) Socio-economic Condition of the Project Area

Work participation rate indicates the occupational structure of the population in the project area. It has been studied with reference to main workers, marginal workers in the project area. Work participation rate in project affected area of Rajasthan varies from 37.6% to 58.2%, Gujarat varies from 40.3% to 48.6% and in Haryana it varies from 43.1% to 43.8%. From this data, it is evident that average percentage of non worker in the project affected areas is substantially high about 50%.

The urban influence is evident with well off families who possess modern implements and ferry to urban centres for jobs. However, the poor and middle class groups, though maintain nuclear families, practice rural life style. For that reason, Mahesana is nearer to Ahmedabad and Alwar is nearer to Gurgaon and Delhi and good road communication allows them to go to the urban centres to earn their wages to maintain livelihood.

Since the land fertility is poor in Pali and Banaskantha Districts, availability of the agricultural labour is uncertain. Under such situation, work participation rate is low. The details of these groups are given in Table 3-9.

Table 3-9 Socio-economic Overview of Immediate Project-Affected Area

District	Total No. of Households	Total Population			SC Population (%)	ST Population (%)	Literacy Rate (%)	Work Participation Rate (%)
		Total	Male	Female				
Vadodara	11,227	54,981	28,600	26,381	7.2	12.8	71.4	41.7
Anand	23,017	115,457	60,440	55,017	6.2	1.1	73.0	45.9
Kheda	10,475	53,453	27,878	25,575	7.8	2.0	68.6	41.1
Ahmadabad	16,668	84,593	44,502	40,091	15.2	1.0	67.0	44.9
Gandhinagar	70,300	348,453	183,209	165,244	8.0	0.5	63.8	45.9
Mahesana	58,171	291,860	151,828	140,032	7.8	0.4	75.1	48.6
Patan	06,469	34,753	17,705	17,048	14.0	0.1	73.5	43.8
Banas Kantha	108,157	581,539	300,272	281,267	8.5	17.4	58.3	40.3
Sub-total/ Average	304,484	1,565,089	814,434	750,655	9.3	4.4	68.8	44.0
Sirohi	20,175	105,789	55,461	50,328	12.2	34.9	56.6	43.1
Pali	72,397	383,350	193,111	190,239	18.5	4.8	55.0	37.6
Ajmer	142,007	809,658	423,262	386,396	14.4	1.0	60.9	39.8
Nagaur	307	2,092	1,102	990	12.3	4.0	72.5	46.2
Jaipur	19,974	137,710	71,304	66,406	16.7	3.1	65.8	39.9
Sikar	25,993	179,669	93,823	85,846	11.5	4.4	71.1	38.7
Alwar	578	3,433	1,766	1,667	21.5	0.1	77.4	58.2
Sub-total/ Average	281,431	1,621,701	839,829	781,872	15.3	7.5	65.6	43.3
Mahendragarh	19,896	119,483	62,748	56,735	15.1	0.0	69.9	43.1
Rewari	8,454	48,164	24,848	23,316	18.6	0.0	75.4	43.8
Sub-total/ Average	28,350	167,647	87,596	80,051	16.8	0.0	72.6	43.5
Total	614,265	3,354,437	1,741,859	1,612,578	13.8	4.0	69.0	43.6

Source: Census of India, 2001
India at a glance, 2006-2007

Detailed socio-economic conditions of the project area are shown in Appendix I-3-1.

CHAPTER II-1 SUMMARY OF ESIMMS

1.1 OUTLINE OF ESIMMS

1.1.1 Scope of ESIMMS

The Environmental and Social Consideration Study (ESCS) was conducted from November 2006 to March 2007 mainly based on the collected secondary data as IEE level study. The major environmental and social consideration items were identified in ESCS. Then ESIMMS was conducted from May 2007 to October 2007 based on the results of ESCS as further EIA level study including a series of field surveys and measurements.

The specific objective of ESIMMS was to ensure that potential problems are foreseen and addressed at an early stage in the project's planning. Design, execution and operation of the project can be planned in the light of the findings of this ESIMMS, so that the expected benefits from the DFC project can be sustained with minimum and acceptable adverse environmental impacts. The main objectives of ESIMMS are given below:

i) Identification of the project activities likely to cause potential significant impacts on the environment,

ii) Identification of the extent of environmental impacts caused by the DFC Project activities to the environment,

iii) Prediction and analysis of intensity and nature of impacts whether they are permanent or temporary, cumulative, and/or irreversible,

iv) Consultation with the general public as well as those concerned with the DFC Project, which are ranging from the Central and Local Government Organizations to commercial and industrial sectors of the society as a whole by holding a series of stakeholder/public consultation meetings (PCMs). The broad objective of PCMs and its proper documentation is to verify opinions of the general public and other stakeholders that could be affected by the DFC Project.

The area covered by ESIMMS was the extensive area spread over 37 districts of 5 states where relevant railway facilities will be built for dedicated freight corridor (DFC) development. Therefore, the ESIMMS area was divided into 3 packages listed below, and the study of each package was conducted.

i) Package 1: Maharashtra and Gujarat (13 districts);

ii) Package 2: Rajasthan and Haryana (9 districts); and

iii) Package 3: Uttar Pradesh (15 districts)

The results of ESIMMS were explained in district wise reports, considering that the future action necessary for land acquisition would be managed by a committee in charge of resettlement and rehabilitation issues by district-wise or village-wise as proposed in the Draft National Rehabilitation and Resettlement Policy 2006 of India. Consequently, district-wise DFC Project alignment and its relevant facilities for a development stage section were discussed and district-wise outcomes of ESIMMS were elaborated. Finally, Thirty-seven (37) volumes of the district-wise ESIMMS report were prepared.

ESIMMS Reports relevant to Western Corridor of DFC from Rewari to Vadodara is summarized in this report. For details related to remaining Western Corridor and Eastern Corridor refer to district wise reports of ESIMMS.

1.1.2 Components of ESIMMS

The ESIMMS was conducted based on the results of ESCS (IEE level study) as further EIA level study. The components which were considered important for the environmental and social considerations for the DFC project are mentioned below.

(1) Pollution Control Study

i) Sensitive Receptors (SRs) along the guideline design (GLD) which is the suggested DFC alignment under JICA F/S study were identified for noise and vibration measurements. Both background and railway noise/vibration levels were measured at the selected SRs. In addition, railway noise and vibration measurements were conducted to obtain unit data.

ii) The secondary data of water quality, air quality and other components was collected. The mitigation measures were proposed based on the analysis of the collected data.

(2) Natural Environment Study

i) The secondary data collection and survey of natural reserves, such as national parks and wildlife sanctuaries along the DFC alignment was conducted.

ii) Reserved forests and protected forests along the DFC alignment were examined to assess any impacts by the project.

(3) Social Environment Study

i) Number of Project Affected Families (PAFs)[1] was identified through field survey and socio-economic questionnaire survey was conducted at 10% of total number of the identified PAFs.

ii) The social impact assessment (SIA) was conducted and the Framework of Resettlement and Rehabilitation Plan was proposed.

(4) Stakeholder/Public Consultation Meetings

i) The 2nd Stage PCM was conducted at each district to be directly affected by the DFC Project. Targeted PCM participants were representatives of Panchayats, villages and towns[2].

ii) After the 2nd Stage PCM, the participated representatives of Panchayats, villages and towns disseminated the information obtained at the PCM amongst villagers and town residents, discussed with the issues and exchange opinions with residents at a village feedback meeting.

[1] PAF is defined as Project Affected Families to be relocated; however, at the stage of ESIMMS, the number of affected residential structures was considered as PAF. The exact number of the PAF shall be identified by the detailed field survey at the next stage of the project.

[2] First Stage PCM was conducted between January and February 2007 along the whole DFC Project area.

iii) In the 3rd Stage PCM, either one representative of each Panchayats, villages or towns or one representative of potential Project Affected Persons (PAPs) presented their outcomes of the village meetings. The outcomes were discussed, and components of the suggested RRP Framework were agreed by the participants of the 3rd Stage PCM.

(5) Environmental Management Plan (EMAP) and Environmental Monitoring Plan (EMOP)

Environmental Management Plan (EMAP) and Environmental Monitoring Plan (EMOP) for the DFC Project of each district were prepared along with environmental and social impact mitigation measures.

(6) Formulation of the Resettlement and Rehabilitation Framework

i) In the village feedback meetings organised before the 3rd Stage PCM, the contents of RRP Framework were introduced to the village residents. The components of the RRP Framework were confirmed and discussed by the village residents.

ii) The contents of the RRP Framework were discussed and agreed by participants of the 3rd Stage PCM.

iii) The social environmental monitoring plan was proposed in order to use for 3-5 years after the resettlement is completed.

1.2 POLLUTION CONTROL STUDY OF ESIMMS

1.2.1 Study Methodologies

(1) Secondary Data Collection

Secondary data relevant to the environmental pollution such as noise, vibration, water quality and air quality was collected and analyzed.

(2) Primary Data Collection for Railway Noise and Vibration

The secondary data relevant to Railway noise and vibration is limited. Since the impact of noise and vibration was considered significant for the project, primary data pertaining to Railway noise and vibration was obtained through series of field measurements of both railway and background noise and vibration levels.

1) Railway Noise and Vibration Survey

The railway noise and vibration were measured at fifteen (15) locations along the existing railway tracks (plain routes and railway bridges) in order to obtain the unit railway noise and vibration levels to be used for future prediction. Among the survey points, there were 10 sites in Gujarat and 10 sites in Rajasthan and Haryana, respectively along the Western Corridor. Measurement was conducted in accordance with standardized methods prevailing in India or JIS Z 8731 for noise and JIS Z 8735 for vibration. Railway noise and vibration measurements were carried out simultaneously using noise and vibration level meters at 3 points i.e. at a distance of 12.5 m, 25 m and 50 m distance from the centre of the nearest railway track. The readings were taken simultaneously at all the three points for each passing train in one direction.

Railway traffic conditions were initially classified into 16 categories considering (i) train types (freight or passenger), (ii) traction systems (diesel or electrified), (iii) loading types for freight train (container, covered wagon or open wagon), and (iv) railway tracks (plain route or bridge). Total number of railway noise and vibration data measured for each of the passing trains was 100 of which are 30 data for freight trains and 70 data for passenger trains. The initial 16 train categories were reclassified into 8 categories and the results of measurements were summarised as shown in Table 1-1.

Table 1-1 Classification of Observed Data

Name of Category			Category No.	Specification				Number of Data	
				Train	Traction	Loading	Route		
F-1	FEP	FE1A	7	Freight Train	Electrified Traction	Container	Plain route	12	2
		FE2A	9	Freight Train	Electrified Traction	Covered Wagon	Plain route		2
		FE3A	11	Freight Train	Electrified Traction	Open wagon for bulk transportation	Plain route		8
F-2	FDP	FD1A	1	Freight Train	Diesel Traction	Container	Plain route	6	5
		FD2A	3	Freight Train	Diesel Traction	Covered Wagon	Plain route		0
		FD3A	5	Freight Train	Diesel Traction	Open wagon for bulk transportation	Plain route		1
F-3	FEB	FE1B	8	Freight Train	Electrified Traction	Container	Bridge	10	0
		FE2B	10	Freight Train	Electrified Traction	Covered Wagon	Bridge		1
		FE3B	12	Freight Train	Electrified Traction	Open wagon for bulk transportation	Bridge		9
F-4	FDB	FD1B	2	Freight Train	Diesel Traction	Container	Bridge	2	2
		FD2B	4	Freight Train	Diesel Traction	Covered Wagon	Bridge		0
		FD3B	6	Freight Train	Diesel Traction	Open wagon for bulk transportation	Bridge		0
P-1	PEP	PEA	13	Passenger Train	Electrified Traction	-	Plain route	23	23
P-2	PEB	PEB	14	Passenger Train	Electrified Traction	-	Bridge	16	16
P-3	PDA	PDA	15	Passenger Train	Diesel Traction	-	Plain route	25	25
P-4	PDB	PDB	16	Passenger Train	Diesel Traction	-	Bridge	6	6
Total								100	100

Source: ESIMMS

2) Background Noise and Vibration Survey at Sensitive Receptors (SRs)

The background noise and vibration levels were also measured at the selected 60 sensitive receptors (SRs). The SR is defined following the Indian category as the facilities which require quiet environment such as schools, hospitals, temples, historical and cultural assets and parks. For noise and vibration survey, 60 SRs were selected among the SRs identified up to 200 m of horizontal distance away from the centre of the nearest railway track as representative/typical SR sites considering (i) characteristics of railway line and structures, (ii) number of trains passing per day, (iii) land use pattern alongside railway line. Among the SRs sites, 20 sites are located each in Gujarat and Maharashtra States and 20 in combined Haryana and Rajasthan States.

The background noise levels were measured in L_{Aeq} and vibration levels were measured in L_{peak} and L_{10} at each SR site for daytime and night time hours. Together with background noise and vibration measurements, railway noise and vibration were also measured simultaneously. Measurements were conducted in accordance with standardized methods prevailing in India or JIS Z8731 for noise and JIS Z8735 for vibration.

3) Proccdure of Prediction and Evaluation of Railway Noise and Vibration

Prediction and evaluation of railway noise and vibration from the passing freight trains have been carried out for each of the selected SR sites based on the procedure of prediction and evaluation as shown below.

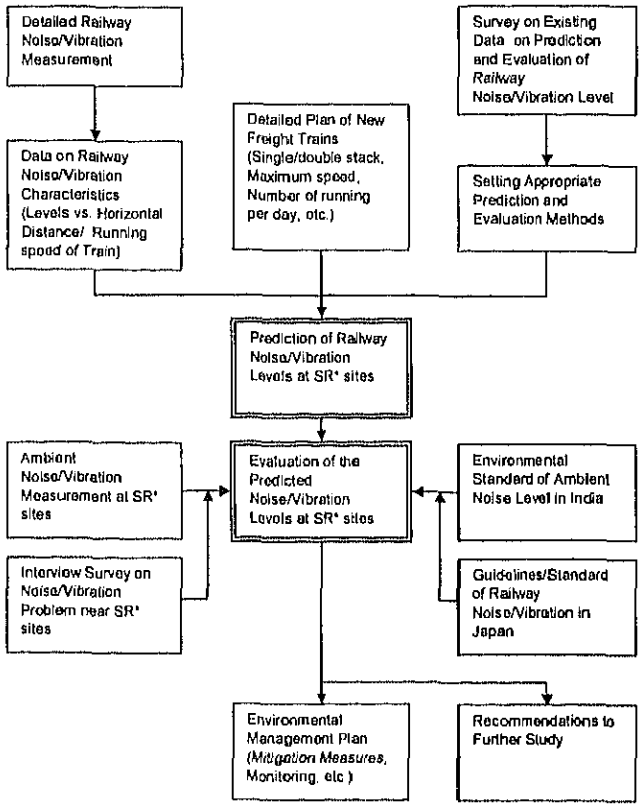


Figure 1-1 Procedure of Prediction and Evaluation of Noise and Vibration Levels Adopted in ESIMMS

For evaluation of the predicted noise and vibration levels, the following standards were taken into consideration in ESIMMS.

- Guidelines for Countermeasures for Railway Noise in Case of New Constructions and Large-scale Improvement of Existing Railways, Environmental Agency of Japan, 1995
- Guideline Value of Vibration from *Shinkansen* Superexpress Railway in Japan Environmental Agency of Japan, 1976
- The Noise Pollution (Regulation and Control) Rules, 2000

1.2.2 Major Findings and Results

(1) Air Pollution

Table-1.2 and Table-1.3 show the status of air quality in major cities within the DFC Project area in Western Corridor. Relatively higher levels of Suspended Particulate Matter (SPM) and Respirable SPM (RSPM) are observed in the air of Ahmedabad of Gujarat and Jaipur of Rajasthan. These values are higher than the permissible values prescribed in Indian Standards for the air quality.

Table1-2 Status of Air Pollution in Major Cities (Gujarat)

City	Location	Type of Area (1)	Levels of Air Pollutants			
			SO_2	NO_2	RSPM (PM_{10})	SPM
Ahmedabad	Naroda GIDC	I	L	L	H	M
	Shardaben Hospital	I	—	—	—	—
	Cadilla Bridge, Narol	R	L	L	C	C
	L. D. Engineering College	R	L	L	C	C
	R. C. High school	R	—	—	—	—
	AZL Behrampur	R	—	—	—	—
Vadodara	CETP Nandesari	I	L	L	H	M
	GPCB Office, Geri Vasahat	R	L	L	H	H
	City Dandia Bazar	R	L	M	C	C
Surat	Udhna	I	L	L	H	M
	SVR Engg. College	R	L	L	C	H
	Near Air India Office	R	L	L	C	H
Rajikot	Sardhara Industrial Corporation	I	L	L	C	M
	Regional Office	R	—	—	—	—
Ankaleshwar	Rallis India Ltd	I	L	L	H	M
	Durga Traders	R	L	L	C	H
Vapi	GEB GIDC	I	L	M	H	M
	Vapi Nagar Palika	R	L	M	C	H
Jamnagar	Fisheries Office	R	L	L	C	C

Note: Abbreviations are defined as follows:

1. Area Type: R-Residential, I-Industrial, S-Sensitive Receptors including religious places, hospitals, schools, etc.
2. Air Quality Categories:

The air quality is categories into 4 broad categories based on an Exceeding Factor EF (the ratio of annual mean concentration of a pollutant with that of a respective standard) The EF is defined as below:

EF=Observed annual mean concentration of criteria pollutant/annual standard for the respective pollutant and area class. Four air quality categories are as follow:

- Critical pollution (C): when EF is more than 1.5;
- High pollution (H): when the EF is between 1.0-1.5;
- Moderate pollution (M): when the EF between 0.5-1.0; and
- Low pollution (L): when the EF is less than 0.5.

3. "-"Not Available

Source: National Ambient Air Quality Status 2005, Central Pollution Control Board, 2007

Table1-3 Status of Air Pollution in Major Cities (Rajasthan and Haryana)

State	City	Location	Type of Area (1)	Levels of Air Pollutants			
				SO_2	NO_2	RSPM	SPM
Rajasthan	Alwar	RIICO Pump House	I	L	L	M	L
		Gaurav Solvex Ltd	I	L	L	M	L
		Regional Office	R	L	L	C	C
	Jaipur	VKIA	I	L	L	H	M
		RIICO Office, M. I. A.	I	L	L	M	M
		Office of District Education Officer, Chandpole	R	L	M	C	C
		Ajmeri Gate	R	L	M	C	C
		Rajasthan SPCB Office	R	L	L	H	H
		Regional Office (North), RSPCB, Vidaya Nagar	R	L	L	C	C
	Jodhpur	RIICO Office	I	L	L	H	M
		DIC Office	I	L	L	M	M
		Sojati Office	R	L	L	C	C
		Maha Mandir Police Thana	R	L	L	C	C
		Shastri Nagar Police Thana	R	L	L	C	C
		Office of Housing Board	R	L	L	C	C
Haryana	Faridabad	Shivalic Global Industries	I	L	L	H	H
		Regional Office	R	L	L	C	C
	Yamuna Nagar	Ballarpur Industries	I	—	—	—	—
	Hissar	Urban Estate II	R	—	—	H	H
		Guru jambeshwar Univ.	R	—	—	C	C

Note: Abbreviations are defined as follows:

1. Area Type: R-Residential, I-Industrial, S-Sensitive Receptors including religious places, hospitals, schools, etc.
2. Pollutant Levels: L-Low, M-Moderate, H-High,
   C-Critical levels of pollution based on the Exceedence Factor,
3. "-"-Not Available.

Source: National Ambient Air Quality Status 2005, Central Pollution Control Board, 2007

(2) Water Pollution

Table-1.4 shows water quality of the important rivers where important railway bridges will be constructed. Related to the 1st priority section of DFC, between Vadodara and Rewari, there are two major rivers, Mahi River and Sabarmati River. Sabarmati River runs through Ahmedabad District from east to west and flows into Arabian Sea. Sabarmati River is significantly polluted as evident from the values of BOD and DO due to direct discharge of industrial and domestic wastewater and agricultural runoff.

Table1-4 Water Quality of Important Rivers

Name of River	River Length (km)	Monitoring Point	Year	Monitoring Data							
				Water temp.(°C)	pH	Electrical conductivity (µmhos/cm)	DO (mg/l)	BOD (mg/l)	COD (mg/l)	Total coliform (MPN/100ml)	Fecal coliform (MNP/100 ml)
Sabarmati	371	8	2002	12 - 32	2.8 - 8.6	269 - 13530	0.6 - 7.9	0.8 - 475	4 to 1794	$210\text{-}28 \times 10^3$	$28\text{-}28 \times 10^3$
			2003	22 - 33	5.6 - 8.5	278 - 7270	1.2 - 9.8	0.6 - 275	4 to 803	$9\text{-}11 \times 10^6$	$4\text{-}46 \times 10^3$
			2004	20 - 35	6.6 - 8.8	286 - 4090	0.7 - 10.2	0.9 - 380	Not Done	$28\text{-}46 \times 10^4$	$20\text{-}24 \times 10^4$
Mahi	583	7	2002	19 - 34	7.1 - 9.2	175 - 5720	0.2 - 8.5	0.1 - 3.0	9 to 163	2 to 2400	3 to 75
			2003	18_34	7 - 8.8	97 - 750	2.9 - 10.1	0.5 - 3.9	7 to 38	4 to 2400	2 to 28
			2004	20 - 34	7.4 - 9.2	166 - 650	2.7 - 8.7	0.3 - 4.9	Not Done	4 to 1600	2 to 28

Source: Central Pollution Control Board, 2007

Two important rivers, Mahi and Sabarmati Rivers are crossed by the DFC alignment in the detour section. During construction, some adverse impacts are expected, such as temporarily increased turbidity of river water and impacts on aquatic organisms. The construction during the monsoon season should be avoided so as not to disturb wild animal propagation.

(3) Noise and Vibration Pollution

a) Background noise and vibration levels

The results of the field measurement of background noise and vibration levels at the selected SRs, which were conducted in ESIMMS, are summarized in Table 1-5 and Table 1-6. In general, it was difficult to find SR sites without influence of road traffic noise and vibration because the sites are mostly accompanied with access road to visit and stay.

Table 1-5 Results of Background Noise and Vibration Levels at SR Sites (Gujarat)

Serial No. (1)	Type of SR	Location of SR site	State -(District) (2)	Name of Railway	Type of Railway Line (E, P, D) (3)	Duration of measurement (hr)	Distance (m) (4)	Background Noise Level (dB)	Background Vibration Level (dB)	
								L_{Aeq}	L_{rms}	L_{10}
P1-1	Hospital	Gupta Hospital, Billimora	G-Navsari	Western Railway	E	4	65	67	108	59
P1-2	Hindu Temple	Hindu temple, Village Kartalot Near Ambica River Bridge	G-Navsari	Western Railway	E	4	95	57	47	38
P1-3	Hindu Temple	Hindu Temple, Near Ankaleshwar Crossing	G-Bharuch	Western Railway	E	4	100	71	109	57
P1-4	Mosque	Mosque, Near Bharuch RS	G-Bharuch	Western Railway	E	4	100	67	110	50
P1-5	Hindu temple	HinduTemple, Near Miyagam Karjan RS	G-Kheda	Western Railway	E	4	115	72	66	73
P1-6	Hospital	Shree Mahalaxmi Mahilaji Hospital, Near Vishvamitri RS	G-Vadodara	Western Railway	E	4	125	68	54	40
P1-7	Hospital	Darbar Shri Gopaldas Desai TB Hospital, Near Anand RS	G-Anand	Western Railway	E	4	55	73	99	65
P1-8	Farmland	Diversion, village Kashindra (Ahmedabad)	G-Ahmedabad	Western Railway	D	4	0	58	56	30
P1-9	Minaret	Shaking minaret-2, Near Ahmedabad Junction	G-Ahmedabad	Western Railway	E	4	15	72	90	45
P1-10	Hospital	Gujarat State Police Hospital, near Madhupura Crossing	G-Ahmedabad	Western Railway	E	3	15	76	110	49
P1-11	Hindu temple	Hindu Temple, near Sabarmati Railway bridge	G-Ahmedabad	Western Railway	E	2	15	75	106	50
P1-12	Hindu temple	Hindu Temple, Near Sabarmati RS	G-Ahmedabad	Western Railway	E	4	65	69	60	39
P1-13	Hindu Temple	Hindu Temple near Central Jail, (Sabarmati)	G-Ahmedabad	Western Railway	E	4	55	77	110	49
P1-14	Hospital	Kuldeep Hospital, Near Kalol RS	G-Mahesana	Western Railway	E	4	45	71	64	44
P1-15	Hospital	Hospital, Near Siddhapur RS	G-Mahesana	Western Railway	P	4	35	66	110	38
P1-16	Farmland	Diversion, village Antroli (Surat)	G-Surat	Western Railway	D	2	500	52	71	38
P1-17	Hospital	Tapi River side	G-Surat	Western Railway	P	2	40	70	68	46

Note 1: Same numbering as corresponding SR site
Note 2: Name of State, G - Gujarat
Note 3: E - Existing railway line but out of DFC alignment, P - Parallel railway line to existing one,
D - Alongside planned Detour
Note 4: Horizontal distance of measuring point from centre of the nearest track (m)

Table 1-6 Result of Background Noise and Vibration at SR Sites (Rajasthan and Haryana)

Serial No. (1)	Type of SR	Location of SR site	State -(District) (2)	Name of Railway	Type of Railway Line (E, P, D) (3)	Duration of measurement (hr)	Distance (m) (4)	Background Noise Level (dB)	Background Vibration Level (dB)	
								L_{Aeq}	L_{peak}	L_{10}
P2-SR1	School	SVN public school, between Ateli RS and Namaul RS	H-Mahendragarh	Western Railway	P	4	1500	70	61	39
P2-SR2	Govt College	Govt College, near Namaul RS	H-Mahendragarh	Western Railway	P	4	130	75	61	32
P2-SR3	Hindu	Hindu temple adjacent to RS, Nim ka Thane RS	R - Sikar	Western Railway	P	4	10	79	80	41
P2-SR4	Temple	Temple near railway crossing, Shri Madhopur	R - Sikar	Western Railway	P	4	20	71	62	37
P2-SR5	School	School near railway crossing, Ringas RS	R - Sikar	Western Railway	P	4	150	71	57	35
P2-SR6	Hospital near railway crossing	Hospital near railway crossing, Ringas RS	R - Sikar	Western Railway	P	4	100	78	58	39
P2-SR7	Waste land	Diversion, near Harinagar Rewari	H-Rewari	Western Railway	D	4	-	44	46	38
P2-SR8	School	School, near Phulera Jn.	R - Jaipur	Western Railway	E	4	80	66	57	35
P2-SR9	Hospital	Hospital along RS, Ajmer RS	R - Ajmer	Western Railway	E	4	143	72	60	31
P2-SR10	School	School along RS, Ajmer RS	R - Ajmer	Western Railway	E	4	125	81	62	39
P2-SR11	Agricultural land	Diversion, near Madar RS	R - Ajmer	Western Railway	P	4	100	77	41	38
P2-SR12	Waste land	Diversion, near Daura RS	R - Ajmer	Western Railway	P	4	-	58	41	38
P2-SR13	Temple	Temple, Front side of Marwar RS	R - Pali	Western Railway	P	4	75	77	70	51
P2-SROP3	School	School, Front side of Marwar RS	R - Pali	Western Railway	P	4	140	76	68	50
P2-SROP5	SR site	SR site, Rewari RS	H-Rewari	Western Railway	E	4	50	69	56	36

Note 1: Same numbering as corresponding SR site
Note 2: Name of State, R-Rajasthan, H-Haryana
Note 3: E - Existing railway line but out of DFC alignment, P - Parallel railway line to existing one,
D - Alongside planned Detour
Note 4: Horizontal distance of measuring point from centre of the nearest track (m)

b) Railway noise and vibration levels

The results of railway noise and vibration measurement are shown in Table 1-7 and Table 1-8.

Table 1-7 Result of Railway Noise and Vibration Levels Measurement (Gujarat)

DR Site No.	Type of Track	Location of DR site (District, State)	Category of trains	Number of trains	Passage Time (sec)	Running Speed (km/hr)	Railway Noise Level						Railway Vibration Level		
							Lea (dB)			LEA (dB)			Leak (dB)		
							12.5m	25m	50m	12.5m	25m	50m	12.5m	25m	50m
P1-DRP-1	Plain Route	Near Biltmore Station (Navsrre, Gujarat)	PEA	21	110	72	84	79	74	97	95	92	78	65	56
			FE1A	47	40	97	86	82	77	100	98	95	78	68	54
			PEA	12	10	99	87	77	69	95	91	86	80	70	55
			FE1A	47	30	96	87	84	79	102	98	97	79	71	57
			PEA	19	22	72	84	82	77	100	97	95	78	67	55
			PEA	22	23	79	86	81	74	99	95	92	77	66	54
			PEA	23	21	91	85	83	74	48	48	47	75	67	53
P1-DRP-2	Plain Route	Malinger (Ahmedabad, Gujarat)	PEA	13	15	72	81	75	72	92	89	84	64	51	43
			PEA	19	24	83	82	78	73	96	92	87	63	52	44
			FD3A	16	17	37	80	76	80	92	89	84	64	53	44
			PDA	18	37	40	78	74	70	93	89	85	60	52	43
			PEA	12	15	66	89	84	80	101	96	92	63	54	45
			PDA	14	14	83	94	90	88	106	102	100	64	53	47
			PDA	22	35	52	78	74	70	93	90	84	63	52	44
			PEA	24	30	66	82	80	66	97	95	66	63	51	44
			PEA	22	43	42	77	72	80	94	88	94	61	51	40
P1-DRB-1	Railway Bridge	Ambica River Bridge (Navsari, Gujarat)	FE3B	60	100	23	91	88	82	102	88	83	81	76	54
			FE3B	11	18	24	90	88	83	102	87	83	74	71	53
			PEB	22	20	91	88	86	81	102	87	82	75	71	53
			PEB	17	15	94	90	88	82	101	97	90	94	69	57
			PEB	13	15	72	93	90	84	105	98	92	77	76	54
			FE2B	42	40	55	88	87	82	102	97	92	97	72	52
			PEB	24	17	116	89	87	82	101	95	89	76	74	53
P1-DRB-2	Railway Bridge	Narmada River Bridge (Bharuch, Gujarat)	PEB	23	48	40	75	59	64	70	66	71	65	52	56
			PEB	13	48	22	63	64	63	70	71	70	68	55	53
			PEB	14	40	29	65	66	65	72	73	72	65	55	53
			PEB	20	42	39	62	75	67	69	82	74	68	56	56
			PEB	19	100	16	79	68	61	86	75	68	67	56	55
P1-DRB-3	Railway Bridge	Sabarmati Bridge (Ahmedabad, Gujarat)	FD1B	41	56	61	86	81	79	105	100	98	54	58	46
			PDB	13	25	43	79	80	75	100	94	89	52	54	48
			PDB	18	25	60	87	82	78	103	97	93	56	53	53
			PDB	14	40	29	87	82	82	105	99	99	48	53	46
			FD1B	44	110	33	83	77	73	103	98	94	56	54	52
			PDB	23	65	29	81	76	72	99	94	90	51	55	52
			PDB	15	26	48	89	83	78	103	97	93	57	56	49

Note: "Category of Trains" consisting of 16 freight and passenger train types were applied.

Table 1-8 Result of Railway Noise and Vibration Levels Measurement (Rajasthan and Haryana)

DR Site No	Type of Track	Location of DR site (District, State)	Category of trains	Number of trains	Passage Time (sec)	Running Speed (km/hr)	Railway Noise Level						Railway Vibration Level		
							LAeq (dB)			LAE (dB)			Lpeak (dB)		
							12.5m	25m	50m	12.5m	25m	50m	12.5m	25m	50m
DP2-DRP-1	Plain Route	Railway crossing near Khalipur RS (H -Rewari)	FD1A	46	110	35	75	70	65	96	92	85	68	57	49
			PDA	24	54	37	73	68	62	93	90	84	69	58	49
			PDA	23	62	31	74	69	62	94	90	83	59	55	48
			PDA	46	111	34	75	70	63	85	81	76	62	55	50
			PDA	21	43	40	76	70	66	95	91	86	70	63	53
			PDA	26	49	44	76	72	66	95	90	86	66	54	49
DP2-DRP-2	Plain Route	Halfway between Bharawas and Bawal RS (H -reward)	PDA	24	25	80	89	83	79	99	99	96	74	66	62
			FD1A	43	31	28	88	85	81	105	101	99	72	69	61
			PDA	23	24	79	89	87	79	106	102	97	70	63	57
			PDA	21	15	116	91	85	85	104	100	100	73	65	63
			PDA	10	12	69	90	85	77	104	100	95	72	63	56
DP2-DRP-3	Plain Route	Ringas Railway crossing (R - Sikar)	PDA	12	23	43	81	76	73	96	94	88	66	59	48
			PDA	10	21	39	91	86	84	108	104	101	67	67	51
			PDA	13	26	41	85	82	76	102	99	93	64	59	47
			PDA	10	30	28	87	80	77	101	97	91	64	62	51
			PDA	11	17	54	95	90	86	111	107	101	66	64	51
DP2-DRP-4	Plain Route	Near Ajmer RS. (R -Ajmer)	PDA	26	30	72	80	72	71	96	91	87	63	56	50
			FD1A	51	74	57	73	73	52	91	91	71	62	56	50
			PDA	14	19	61	82	82	79	99	99	95	62	56	50
			FD1A	42	83	42	85	85	80	103	103	100	67	56	48
			PDA	13	13	45	81	81	76	97	97	91	71	59	51
DP2-DRP-5	Plain Route	Near Marwar RS. (R -Pali)	PDA	23	110	17	75	68	60	95	89	78	70	62	52
			FD1A	42	72	48	68	64	62	87	81	79	76	67	57
			PDA	12	25	40	91	87	81	109	95	90	74	66	55
			PDA	20	81	20	81	75	71	89	84	77	69	61	51
			PDA	40	70	19	83	77	71	101	95	89	71	64	53

Note: "Category of Trains" consisting of 16 freight and passenger train types were applied

c) Prediction of Railway Noise and Vibration by DFC Project

Following the procedure shown in the methodology, the prediction and evaluation of railway noise and vibration due to the passing freight trains have been carried out for each SR site.

1) Prediction of Railway Noise

The prediction was carried out applying the actual data of railway noise level (L_{AE}), running speed (V) of trains and the distance from centre of the nearest railway track (D) using empirical equation proposed by Railway Technical Research Institute of Japan (1996). Based on the obtained data of railway noise at sites, the empirical equation was developed by using a simple regression and correlation analysis. Assuming V as constant and D as only one variable, the empirical equation developed is shown below. A predicted railway noise level is shown in the following table.

$$L_{AEJ} = A_J + B_J \text{ Log10 } (D)$$
$$L_{Aeqt} = L_{AEJ} + 10 \text{ Log10 } (N/T)$$

Table 1-9 Predicted Railway Noise Level by Distance

Trains	Category	A	B	Railway Noise Level (LAE & L_{Aeq} (dB))					Noise Level
				12.5 m	25 m	50 m	100 m	200 m	
Freight Electric	FEP	110.59	-8.89	101.0	98.2	95.5	92.8	90.1	LAE
				76.1	73.3	70.6	67.9	65.2	LAeq

Note 1: Electrified Freight Train (Plain Route) Running at 100 km/h.
Note 2: LAE=A+BLog10(D), LAeq=LAE-10Log10(N/T)
Note 3: Number of Sample: 6 data, r^2=0.899

2) Prediction of Railway Vibration

The prediction was carried out applying the actual data of the railway vibration level (L_{peak}), the running speed (V) of train, and the distance from centre of the nearest railway track (D). Based on the actual data obtained through railway vibration measurement along the existing railway tracks, the equation was developed for the prediction of vibration levels. Assuming V as constant and D as only one variable, the empirical equation developed is shown below. A predicted railway vibration level is shown in the table below.

$$L_{peak2} = A_2 + B_2 \text{ Log10 } (D)$$

Table 1-10 Predicted Railway Vibration Level by Distance

Trains	Category	A	B	Railway Vibration Level (Lpeak (dB))				
				12.5 m	25 m	50 m	100 m	200 m
Freight Electric	FEP	120.86	-38.04	79.8	67.7	56.2	44.8	33.3

Note 1: Electrified Freight Train (Plain Route) Running at 100 km/h.
Note 2: Lpeak = A + B Log10(D)
Note 3: Number of Sample: 6 data, r^2=0.973

d) Overall Findings

1) Findings on SRs from Prediction and Evaluation Results

In general, the existing noise levels are already higher at SRs located along the railway lines in the urban areas. In the detour sections, although the impacts to residents would be small, the railway noise would be newly added to the residents' life and the appropriate mitigation measures should be prepared for SRs and residents along the railway line. At

the SRs where the additional impact of the noise is large, it is suggested to adopt necessary mitigation measurements such as setting up soundproof walls along the DFC alignment.

2) Implementation of Railway Noise and Vibration Mitigation Measures

At SRs in the urban and city area, the background noise and vibration levels tend to be high due to the traffic, people nearby, their own religious activities, etc. Moreover, the interview survey results show that not only railway noise but also road traffic are environmental concerns of the residents. Therefore, the railway noise and vibration mitigation measures should be adopted gradually in accordance with the rise in environmental awareness especially for noise and vibration.

3) Establishment of the Methods of Railway Noise and Vibration Monitoring

For further detailed noise and vibration monitoring, it is necessary to obtain the baseline data as well as the established methodologies of railway noise and vibration measurements since there is very limited data on noise and vibration in India.

4) Impact Study on the Noise and Vibration Measurements at Affected SRs, Houses, and Private Facilities

The SRs were selected as noise and vibration measurement sites as the representative or typical sites by considering various factors of the study such as the purpose, the survey period, availability of the measurement methodology, noise and vibration standards and environmental consultants in India. It is suggested that the noise and vibration survey should be conducted at residences along the railway lines where actual affected people live. A detailed survey on SRs along the proposed DFC railway alignment should be conducted in the Detailed Design stage to identify all affected SRs located within certain area such as 100-m strip for both sides of the railway. Impacts for the houses and privately-owned facilities should be examined and measures should be proposed, if required.

1.3 NATURAL ENVIRONMENTAL STUDY OF ESIMMS

1.3.1 Study Methodologies

Following the basic concept of the DFC Project that the new DFC railway will be constructed along the existing railway and the scoping result of the ESCS (IEE level study), the impacts to the wildlife sanctuaries and recorded forests such as protected and reserved forests directly affected by the project were identified as the main study components of this natural environmental study.

The approach of the study involved review of secondary data and primary survey of the project area. Secondary data is used to compile the regional features whereas primary data is used to describe project influence area. Natural Environment Assessment consisted of review of topography, geology, soil, groundwater, hydrology, flora and fauna of the area. Primary survey was conducted through consultation with local people to obtain the relevant information about the area such as reserved forests and wildlife sanctuaries. The field reconnaissance was also conducted for confirmation on the site situation in accordance with the information. The standard quadrate method (10m x 10m) and random sampling approach was adopted in order to characterize the vegetation of the forest areas. The density measurements reflect as to how many individuals were present, the dominance measurements

denote which species is largest in terms of its presenee and the frequency measurements indicate how widely species was distributed among the same plots.

1.3.2 Major Findings

(1) Summary of Current Natural Environment Conditions

The existing railway was established more than 100 years ago during the time of British reign. The railway was located in topographically flat or slightly sloped area passing the highest elevation of approximately 500 m Above Sea Level (ASL) in the middle of Rajasthan. The elevation of the area is 10 m ASL in the coastal area, approximately 200 m ASL at the end point of the western railway in Delhi. The distinguished topographic feature associated with geology in Aravalli can be observed only in a part of entire stretch near Ajmer where the railway crosses the Aravalli Range. In Ajmer, there is an old mining site of hard rocks such as metamorphic schists, quartzites, marbles and gneisses of the Pre-Cambrian age with associated acid and basic intrusive rocks according to Water Resouree Department in Rajasthan.

The climate in the Western Corridor varies from the comparatively abundant rainfall in the semi-arid area in Rajasthan including partly arid area of extremely low rainfall area. Also, the temperature varies from the constantly warm condition of Konkhan region to the region around Delhi where the seasonal temperature decline in the monthly mean temperature is less than 10 degree. The mean annual rainfall between 1995 and 2004 in the Western Corridor is 872 mm in Ahmedabad in Gujarat, 593 mm in Jaipur in Rajasthan and 624 mm in south Haryana. The entire area belongs to monsoon climate and has most annual rainfall within the monsoon season between August and September.

The natural environmental features along the proposed DFC alignment in Gujarat, Rajasthan and Haryana states are summarized in Table 1-11

Table 1-11 Natural Environment Features along the DFC Alignment

State	Geomorphological Feature	Area along the DFC
Gujarat	Gujarat is located in the north western part of India bordering Pakistan and having 196,000 $km^2$of land area. The state has the longest coastal line among all states in India and its length is 1,596 km. The entire area is topographically flat. There are many big rivers such as Tapi River and Narmada River which flows into the Arabian sea.	The area connects two regions, Aravalli Range and Konkan area along the western Ghat. DFC alignment passes through 12 districts. From the border with Rajasthan, the elevation is decline toward Maharashtra.
Rajasthan	Rajasthan is located in the north west of Indo sub-continent having 342,239 km^2 of land area. Aravalli range lies covering Mount Abu (1,722 m ASL) at south western border to Khetri at north eastern border in the state. Also, the Thar Desert is located in the area of the western to north western part of Rajasthan.	The DFC is planed to pass through 7 districts at the western foot of Aravalli Range which originated in Pre-Cambrian Era. Rocky hilly area in dry climate. The alignment passes the highest place (approx. 500m) in the entire corridor.
Haryana	Haryana is located in the northern part of India having the smallest land area of 44,210 km^2 among all Indian states. Most of area is covered by alluvial plain and Shivalik Hills at the north western part of the state. The altitude of the plain is approximately 210-270 m and there is an international river flowing thorough Nepal and Baangladesh, Yamuna River at the east part of the state.	DFC alignment in the Western Corridor crosses the northern part of Aravalli Range with a tunnel. DFC aligament in the Eastern Corridor passes through 2 districts in the northern part of the river bank of Ganga River.

(2) Results of Natural Environment Study

Location of wildlife sanctuaries, distribution of reserved and protected forests along the DFC Project, and number of trees to be felled by the DFC Project were identified in ESIMMS.

1) Natural Environmentally Affected Areas

a) Vadodara - Ahmedabad

- The DFC alignment passes through partly an erosive river terrace of Mahi River. There is no major impact of the project topographically, though some earth works such as cutting and embankment are planned which would cause soil erosion.
- There are no other protection areas for endangered species and/or fragile ecosystem directly affected by the project.
- There is one protected reptile species: Indian Soft-shell turtle (*Aspideretes gangeticus*), one of terrapins, around Mahi River in Vadodara and Kheda Districts. The terrapin inhabits in the Mahi River and use the river for coupling during the monsoon season. The species is protected by Indian law, as a species in Appendix-1 in Wildlife Protection Act 1972 and its trades are generally prohibited. Also, it is listed as one of vulnerable species in the Red List of International Union for Conservation of Nature and Natural Resources (IUCN). It is considered that the reason for its declined population is illegal extraction by human for edible use.
- Approximately 8,500 trees would be removed at detour section between Vadodara and Ahmedabad by assuming the width of the new construction as 43.5 m in the detour section and the mean number of trees in the agricultural land is 14.1 trees/ha.

b) Ahmedabad-Palanpur

- From the northern part of Mahesana District, the DFC alignment was planned to be constructed in parallel to the existing railway. The area is the transition area between a coastal flat area at Arabian Sea Coast and hilly area of the Aravalli Range. Thus, there is no major impact topographically.
- There are no other protection areas for endangered species and/or fragile ecosystem directly affected by the project.
- Approximately 1,700 trees will be removed in the parallel section between Suneheripura in Mahesana District and Chahapi in Banaskantha District. Planted *Acacia spp.* and *Azadirachta spp.* are likely to be removed.
- Some 4,500 trees will be removed in agricultural area at detour section between Ahmedabad and Mahesana by assuming the width of the new construction as 43.5 m for the detour section and the mean number of trees in the agricultural land is 14.1 trees/ha.
- There is a small scale wildlife sanctuary, Thol Lake Wildlife Sanctuary (Bird Sanctuary), in Kadi Sub-district, Mahesana District approximately 200 m from the DFC alignment. The detour route was designed to avoid the sanctuary. Further study on indirect impacts is required at the Detailed Design stage.
- The DFC alignment crosses 2 important rivers, Sabarmati River in the detour section and Saraswati River in the parallel section from the north of Mahesana District. The locations of the bridges were selected to ensure enough water flow after construction. During construction, some adverse impacts are expected, such as temporarily increased turbidity of river water and impacts on aquatic organisms.

c) Palanpur-Ajmer

- The DFC will be constructed mainly alongside the existing railway whieh passes through the area of the western foot of Aravalli Range. The existing railway passes through the rocky and hilly area. Associated with the ground construction work such as rock cutting, some disturbances to wildlife are anticipated in surroundings.
- Approximately 1,600 trees will be removed in the parallel section between Iqbalgarh and Amirgarh in Banaskantha District based on the sampling survey. In the area, *Acacia spp.* and *Azadirachta spp.* are mainly planted.
- Approximately 8,700 trees will be removed in the parallel section on the east side of the existing railway from the state border between Rajasthan and Gujarat up to Ajmer based on the sampling survey. Main affected species are *Acacia spp.* and *Azadirachta spp.*
- In the parallel section at Sirohi District, the DFC alignment passes through the Kivari ka Jor Protected Forest (open forest). Approximately 0.8 km of the *Acacia spp.* dominated forest will be affected by tree removal.
- In the parallel section near Bhagwanpura Station in Pali District, the DFC alignment passes through Rani Village Protected Forest (open forest). The *Acacia spp.* dominated forest for approximately 2.8 km is likely to be affected, and the trees would be removed.
- In the parallel section between Jawali Station and Somesar Station in Pali District, the DFC alignment passes thorough the Jawareaswar Protected Forest (open forest). The *Acacia spp.* dominated forest for approximately 4 km is likely to be affected, and the trees are likely to be removed.
- In Banaskantha District, the existing railway passes though the protected forest at the western side of Balaram Ambaji Wildlife Sanctuary for the length of 2.4 km. The vegetation survey and line intercept survey were conducted in the area. Only domestic animals such as cows and goats were found, and any endangered species were not found in the area. Upon request from MOR, a detour to avoid the sanctuary is under consideration. Temporarily, an alternative alignment passes though a protected forest (unclassified forest) in Bantawara Village and the approximately 1 km of the forest and 1 ha of forest land is likely to be affected (assuming the widths of land acquisition as 43.5 m). Tree inventory survey will be required at the detail design stage.
- In Banaskantha District, the new detour alignment is passing through the Jethi Reserved Forest, approximately 1.6 km of the length. *Acacia spp.* dominated forest is likely to be affected. Tree inventory survey will be required at the detail design stage.
- In Banaskantha District, the new detour alignment is passing through the Malana Reserved Forest approximately 0.4 km of the length. *Acacia spp.* dominated forest is likely to be affected. Tree inventory survey will be required at the detail design stage.

d) Ajmer - Rewari

- The DFC will be constructed mainly alongside the existing railway which passes through the area of western foot of Aravalli Range. The existing railway passes through rocky and hilly area. Associated with the ground construction work such as rock cutting, some disturbances to wildlife is anticipated in surroundings.
- Approximately 4,400 trees, mainly *Acacia spp.*, would be removed in parallel section in Ajmer, Nagaur, Jaipur, Sikar and Alwar Districts in Rajasthan based on the sampling survey.
- Approximately 3,200 trees, mainly *Acacia spp.*, would be removed in the parallel section at Mahendragarh and Rewari Districts based on the sampling survey.

- The DFC alignment passes through Madanganji Protected Forest in the detour section in Kishangarh, Rajasthan. The forest where *Prosopis cineraia*, *Acacia arabica*, and *Tecomella undulata* are dominant is likely to be affected for approximately 3.4 km, and the trees are likely to be removed.
- Approximately 1,700 trees of *Acacia spp.* grown in the agricultural land would be removed in Rewari detour section by assuming the width of the new construction as 43.5 m at detour section and the mean number of trees in the agricultural land as 12.3 trees/ha.

2) Forest Areas

In addition, areas requiring forest clearance and trees removal outside of designated forests were also identified in ESIMMS as shown in Table 1-12and Table 1-13, respectively.

Table 1-12 Areas Requiring Forest Clearance (Reserved and Protected Forests)

No	Section		District	Name of Forest where DFC railway passes through	Forest type	Major spp.	Approx length along the rly(km)	Approx affected area in ha	Remark
Protected forest									
1	Palanpur	Ajmer	Sirohi, Rajasthan	Kivarli ka Jor Open forest (Near Kivarli R.S.)	Tropical thorn forest	*Acasia* spp.	0.75	1	Parallel
2	Palanpur	Ajmer	Pali, Rajasthan	Rani village Open forest	Tropical thorn forest	*Acacia* spp	2.75	4	Parallel
3	Palanpur	Ajmer	Pali, Rajasthan	Jawaleaswar Open forest	Tropical thorn forest	*Acacia* spp.	4	5	Parallel
4	Ajmer	Rewari	Ajmer, Rajasthan	Madanganji Protected forest (Kishangar)	Tropical thorn forest	*Acacia* spp.	3.35	15	Detour
				Sub-total			10.85	24	

No	Section		District	Name of Forest where DFC railway passes through	Forest type	Major spp.	Approx length along the rly(km)	Approx affected area in ha	Remark
Protected forest									
1	Palanpur	Ajmer	Banas kanthum Gujarat	Bantawara Unclassified forest	Tropical thorn forest	*Acacia* spp.	1	4	Detour
2	Palanpur	Ajmer	Banas Kantha, Gujarat	Jethi Reserved forest	Tropical thorn forest	*Acacia* spp	1.58	2	Detour
3	Palanpur	Ajmer	Banas Kantha, Gujarat	Malana Reserved forest	Tropical thorn forest	*Acacia* spp	0.39	1	Detour
				Sub-total			2.97	7	
Reserved forest									
1	Vasai road	Vadodara	Thane, Maharashtra	Boisar Reserve forest	Tropical deciduous forest	*Carissa carandas*, *Butea monosperma*	8.5	11	Parallel
				Sub-total			8.5	11	
				G-total in Maharashtra & Gujarat			11.47		
				G-total in Western corridor			22.32	18	

Table 1-13 Trees Removal outside of Designated Forests

Section		No. of trees at detour section		No. of trees at parallel section	
From	to	Length (km)	Trees in Agricultural land[1] (No./km)	Length (km)	Trees in Agricultural land (No./km)
Rewari	Ajmer	32	1,700 trees 53 trees/km	278	7,700 trees 28 trees/km
Ajmer	Palanpur	18	600 trees 33 trees/km	352	10,300 trees 29 trees/km
Palanpur	Ah. bad	74	4,500 trees 61 trees/km	61	1,700 trees 28 trees/km
Ahmedabad	Vadodara	139	8,500 trees 61 trees/km	0	0 trees 0 trees/km
Total		263	15,300 trees	691	19,700 trees

Note : Widths of the land acquisition are assumed as 13 m in parallel section and 43.5 m in detour section.
[1] Number of trees are estimated based on the estimated land acquisition area and No. of trees per ha of arable Non-Forest Area

1.4 SOCIAL CONSIDERATION STUDY OF ESIMMS

1.4.1 Study Methodologies

(1) Socio-economic Survey for PAFs

To identify social environmental situation of PAFs due to the involuntary resettlement, the socio-economic survey was conducted. In the survey, relevant railway facilities including station quarters and control centres were excluded. Although some facilities were subject to the involuntary resettlement, it was considered that those facilities were assets of the project owner.

1) *Survey Method*

The survey method of the social environmental survey is shown below:

a) Identify potentially affected villages and structures to be resettled, record the locations and take photographs;

b) Record the longitude and latitude of the starting/end points of the detours and points connected with major roads of the detours;

c) Prepare sketches of the survey locations where structures to be resettled, sensitive receptors, stations, roads, public facilities;

d) Identify the number of potentially affected structures as PAFs in the parallel sections (12.5 m from last track) and the detour sections (43.5 m) by the field survey; and

e) Conduct the socio-economic questionnaire survey on 10% of identified PAFs in the field by using the on-site sampling method. Then process and analyse the obtained data.

2) Components of the Socio-economic Questionnaire

The questionnaire survey, consisting of the questions on current socio-economic situation of PAFs, was conducted. Specific questions for squatters and the replacement of ROBs were also included. Major questions are as follows:

a) Occupation, household members, education level, religion, social categories of the

PAF;

b) House type and land ownership of PAFs;

c) Income source, assets including livestock, agricultural equipment, household goods, savings and loans;

d) Crop types and employment type in case of farmers;

e) Current problems on livelihoods;

f) Access to public facilities, markets, farmland, and religious buildings;

g) Access to basic infrastructures; and

h) Comments on the conceivable social impacts on residents, resettlement and compensation of the DFC Project

(2) Survey on Other Social Environmental Issues

In addition to involuntary resettlement, other social environmental impacts were examined as listed below. Regarding the following subjects, impacts during pre-construction, construction and operation were examined based on the results of the social environmental survey and outcomes of the Public Consultation Meetings (PCMs) which were conducted during the JICA F/S Study.

1) Changes and disturbances in agricultural activities;

2) Social impacts caused by increased transportation to new stations in the detour sections;

3) Disturbance/improved convenience in access to public facilities and farmland; local community severance; and decrease in/or loss of cultural and economic activities;

4) Social impacts on Non-motorized Vehicles (NMV) due to re-construction of ROBs;

5) Social impacts on public safety due to a large number of new construction worker flowing into the community during construction and a current sanitation condition due to construction waste and waste water;

6) Impacts on cultural and religious activities in the parallel sections and the detour sections;

7) Impacts of tree-cutting in the parallel sections and detour sections.

8) Social impacts of solid waste from new stations and relevant facilities in operation;

9) Social impacts of resettlement on the vulnerable, such as the poor, SCs, STs and squatters; and

10) Social impacts of noise, vibration and radio disturbance caused by passing trains

1.4.2 Major Findings and Results

Results of the social impact assessment are summarized below.

(1) Vadodara-Ahmedabad

The number of PAFs including illegal occupants was identified by a visual observation method in the field survey. More accurate number of PAFs of the Study was obtained by the local consultants through the field survey of the whole study area. The original alignment of the detour route in Vadodara was changed to avoid the residential area and industrial area. Therefore, the social environmental impact was greatly minimised. In addition to connecting Vadodara and Ahmedabad detours, the alignment was shifted out to northwest. Thus, social environmental impacts were minimised comparing to the previous alignment which passed

through the residential areas and industrial areas. However, there are several areas in the consolidated detour route where local areas are affected by the project as follows:

- The Southern Part of the Detour Section: The area between Vadodara and Ahmedabad is not heavily populated, and the alignment passes near a village. There is a possibility for the village to grow or urbanized.
- Middle of the Detour Section: DFC alignment passes through an industrial area in the western Ahmedabad. There are structures to be resettled, such as factories at the point the detour and state roads or National Highway 8A are connected.
- Northern Part of the Detour Section: There are structures to be affected which are located parallel to National Highway 8 with a distance of 300 m to 500 m, such as Gujarat State power supply company, a theme park, and a water tower of residential complex.

The detour route between Vadodara and Ahmedabad was shortened by 4 km, and the required farmland was also reduced. The detour of Ahmedabad has been extended to Mahesana after PETS-II Reports. Due to the review, the required farmland is increased in Mahesana, and the number of structures to be relocated was decreased in the parallel section. The total number of houses to be resettled is estimated to be 50 units. Additionally, approximately 916 ha of farmland is required. Therefore, 490 - 530 families would lose their land, assuming approximately 2 km/farmer.

Vadodara detour has not been changed after PETS-II Report. Since the original alignment passed through residential area, commercial area from the southern Vadodara to western Vadodara and industrial area and Small Mahi River in the north-western Vadodara, the detour alignment was reviewed by considering the following issues:

- Because Makarpura Junction Station is located in the southern part of the Vadodara Detour, the location of Junction Station should be reviewed together with the detour to avoid the residential area.
- Community severance by the railway line
- Cross Small Mahi River vertically
- Avoid the industrial area where petrochemical factories are located
- Avoid replacement of existing ROBs by connecting with the Ahmedabad detour
- Connect the Vadodara and Ahmedabad detours and decrease the distance of the alignment by 4 km

By considering the above-mentioned issues, the social impact such as resettlement was minimised by connecting individual detours of Ahmedabad and Vadodara.

(2) Ahmedabad – Palanpur

1) Detour Route of Ahmedabad to Mahesana

This section is a northern part of the detour route of 207 km-long from Vadodara to Ahmedabad to Mahesana. Following social impacts were noted:

- Northern part of the Detour Route: the section is parallel to the National Highway No.8 with a distance of 300 m to 500 m. The section generally passes through agricultural area and no resettlement of local population is involved.

- The detour section between Valsad and Kalol has been extended to which it passes through western side of Mahesana in order to avoid built-up area. There is no resettlement involved in this section.

The area of land acquisition in this section is approximately 410 ha of farmland would have to be acquired; there is a possibility that more than 300 farmers would lose a half to three quarters of their land.

2) Parallel Section between Mahesana and Palanpur

There are 110 squatters in the area around Siddhpur Station and 65 general households subject to resettlement. A unit of 4 story apartment complex and a structure of bus station are subject to demolition.

3) Re-construction of ROB

In the south side of the Siddhpur Station, there is an existing ROB which is being jacked up for replacement. This would cause limited adverse social impacts such as unavailability of bypasses and inward flow of traffic to the city centre due to prohibition of traffic.

4) Detour Route in Palanpur

Previously there was a parallel section to the north of Palanpur where 2.4 km-long existing railway line passes through Balaram Ambaji Wildlife Reserve. This section was requested to detour by MOR during the 5th Steering Committee Meeting of the JICA F/S Study. However, the farmland of approximately 150 ha would be required for the 36 km detour route and more than 120 farmers are expected to lose a half to three quarters of their farming area.

5) Palanpur Junction Station

Palanpur Junction Station was planned to be constructed in the middle of the detour route alongside the existing branch of Kutch from Palanpur. The junction station is located near National Highway No.14.

The station will consist of a 100 m-wide and 2,300 m-long railway yard and a connecting line 1.5 km-long with 30 - 50 m-width of embankment. The required area is mainly farmland but no structure of the local population is subject to resettlement. There is no community that will be bisected by the DFC Project's railway line. The total required land will be 23 ha, and there would be 15 - 20 families who would lose a half to three quarters of land.

(3) Palanpur – Ajmer

The existing ROB needs to be replaced in Amarpura in order to add new railway lines for the DFC Project as it is located on the single-track railway. Social impacts would be limited to restriction of traffic during construction since it is an open area with no settlement.

(4) Ajmer – Rewari

In the parallel section between Ajmer and Kishangarh, there would be 17 houses subject to resettlement in the area around Ladpura. Detour route of Kishangarh is planned to divert from the east side to the west side of the existing railway line with a ROB at the both end of the detour section. There is no PAF observed in this section of detour route. There is no household involved in the resettlement in parallel section between Kishangarh and Phurela. The detour route and junction station in Phurela passes through a dry agricultural land. As a result of review by JICA Study Team, there is no household involved in the resettlement.

Regarding the detour route in Ringas, originally the detour route was relatively large and more than 30 households were subject to resettlement. As a result of review, it has been reduced to five households due to reduction in the length of the detour route. With the review, ROB to the north of Ringas station has been eliminated from DFC Project.

(5) Other Socio-economic Issues

In addition to involuntary resettlement, the socio-economic environment of the Western Corridor is expected be adversely affected by the DFC Project as follows:

1) Significant changes and disturbances in agricultural activities in the area where detour routes are to be constructed. It is particularly significant if the local farmers sells whole of their farming land. Upon sale of their farming area, they lose their identity and social status as farmer and it is not possible to continue to be a farmer unless otherwise they maintain their farming area as "Certificate of Farming";
2) Significant changes and disturbances of accessibility to schools and other public facilities as well as to neighbours by the construction of detour routes;
3) Disruption to cultural and economic activities in the area where detour routes are constructed;
4) Impacts on non-motorised vehicles due to the re-construction of ROB;
5) Disturbances to religious activities where the planned alignment passes near religious facilities in detour and parallel sections;
6) Adverse impacts on landscape caused by the embankment of DFC Project's railway line;
7) Disturbances to radio/TV signals caused by passing trains near the residential areas.
8) Increased risk of public safety due to the increase of workers during construction period; and
9) Adverse impacts on sanitation caused by solid waste and wastewater from construction sites.

1.5 SUMMARY OF PUBLIC CONSULTATION MEETING

1.5.1 Objectives of Public Consultation Meeting

In order to disseminate information on the planning stage of the DFC Project, public consultation meeting (PCM) was planned and that it was organized in three stages as follows:

i) First Stage: February 2007
ii) Second Stage: June to July 2007
iii) Third Stage: August to September 2007

In all stages of the meeting, basic project information was disseminated to the general public for interaction, feed-back and general consensus building.

The 1st stage PCM was organised as state level workshops with an objective to promote public awareness and information dissemination on the DFC Project to the selected audience which included government authorities, representatives of media, NGOs, private organisations, academicians and those of likely to be affected.

Objectives of the 2nd stage PCM were to disseminate the information about DFC Project to the people who would likely be affected by the project, directly or indirectly, in each district where DFC Project runs through. The meeting was also designed to seek suggestions from the people on social and environmental impacts of the project.

In the PCM, stakeholders were invited from all the villages including Gram Panchayats, representatives of development blocks and towns, which were likely to be affected in the parallel section and the detour route of the proposed DFC project. At the meeting, stakeholders expressed their views and provided valuable suggestions in respect to rehabilitation and resettlement issues and other socio-environmental concerns.

The PCMs were followed by village feedback meetings with the objeetive to spread understandings and opinions of the villagers about the proposed DFC Project. The feedback meetings were conducted in each affected village of the respective district. In the feedback meetings, the contents of draft National Rehabilitation and Resettlement Policy 2006 were discussed with Gram Panchayat and affected persons. While the local people's suggestions were taken on resettlement and rehabilitation issues, Village Rehabilitation Committee (VRC) constituted of village Panchayat members in each affected village would have to be formed.

In the 3rd stage of PCM, primary stakeholders including Panchayat members, members of Village Rehabilitation Committee, directly affected persons and other stakeholders were invited. The Gram Panchayat representatives and VRC members proposed mitigation measures for social and environment impacts and presented their views and suggestions in respect to resettlement and rehabilitation measures.

1.5.2 Target Stakeholders

In the 1st stage PCM, only the selected stakeholders were invited. As the objective of the 1st stage PCM was to disseminate general information on the project, the general public including the vulnerable groups, representatives of the people's forum, government authorities, media, opinion leaders and potential PAFs were invited using random/stratified sampling method.

The stakeholders who were invited to the 2nd stage PCM which took place in each district were the PAFs, local government officials, members of the Panchayat Raj institutions and the local legislature assemblies, local NGOs, transporters of goods, representatives of local industries, opinion leaders, academicians and the local media.

The stakeholders directly and indirectly affected by the Project with detour routes, parallel section in the highly populated areas, junction/crossing stations and ROBs in each district were encouraged to participate to the 2nd and 3rd stage meetings.

In the 3rd stage public consultation meeting the Panchayat representatives, village leaders, project-affected families, villagers, and the local NGOs were invited.

1.5.3 Methodology of PCM

(1) First Stage of PCM

A formal order by the Ministry of Railways was issued to facilitate 1st stage of the PCM. Resettlement and Rehabilitation Commissioners appointed by the State Government and State Pollution Control Boards were contacted to participate in the meetings. Other central

governmental departments, such as the Department of Environment and Forests, Department of Urban Planning, Department of Land Reform were invited to participate in the PCM for the widely possible discussions on the project planning. The 1st stage PCM was organized in nine States where the DFC has been planned.

(2) Second Stage PCM

The announcement for the PCM open to all the general public was conducted with the following procedure:

i) The announcement of the PCM at each district was made by official letters of the concerned district administration;

ii) The announcement to the Panchayats and villages in respect of PCM was made by the distribution of handout materials;

iii) The announcement to the local business enterprises and associations, NGOs, and major informants concerned with the Project was made by invitation letters issued; and

iv) Announcement to the local newspapers and TV was made a few days before the meeting.

In order to feedback the results of the Second Stage PCM to the PAFs, feedback meetings were held in each village after the Second Stage PCM. In addition to the feedback, the issues of resettlement and land acquisition were also discussed at these meetings.

(3) Third Stage PCM

The meeting was held for dissemination of the final result of DFC Project limited mainly to PAFs. Process of invitation of the participants is the same as the second stage PCM. Results of the discussions of all PCMs were recorded by the meeting facilitator for reproducing it to EIA report. Overall flow of the PCMs during the JICA F/S is shown in the Figure 1-2 below.

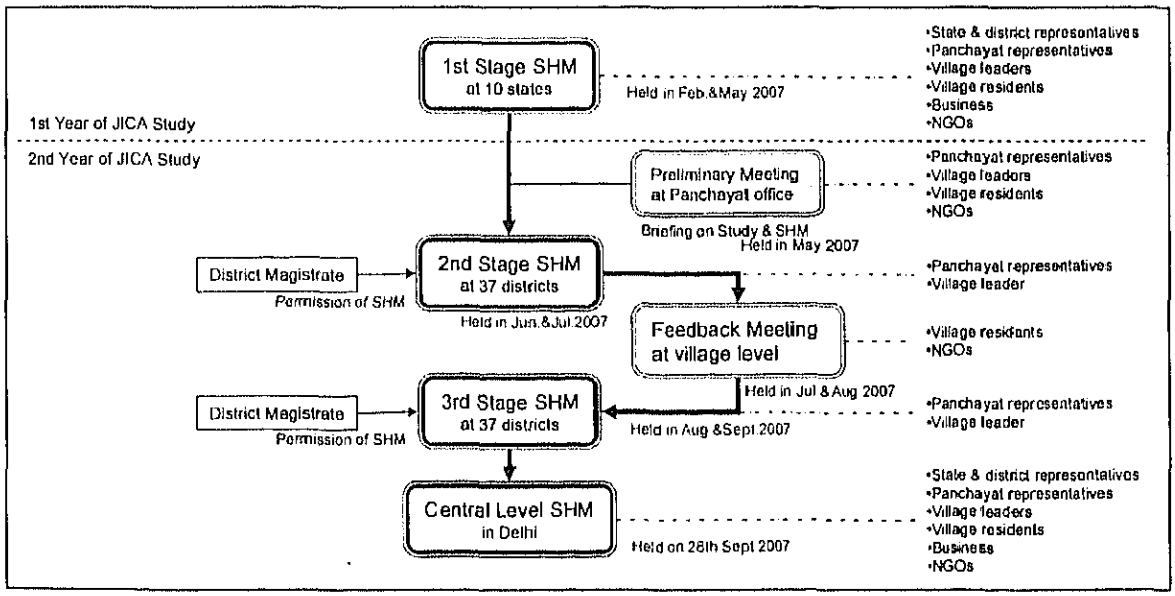


Figure 1-2 Overall flow of the PCMs during the JICA F/S Study

1.5.4 Major Issues Discussed During the First PCM

As the 1st stage PCM were introductory meetings, project details were presented to the participants followed by question-answer sessions. Participants asked several questions with regard to DFC Project. Major issues that were discussed during the first stage PCM were as follows:

- Participants raised issues of rehabilitation and resettlement of the project affected families, compensations and environment;
- The issue of economic benefit from the project was discussed on how the project will help in improving the economic status of the local population;
- Concerns were raised about the impact of the project on transport companies and their workers. Participants apprehended that the project would have adverse impact on the livelihood of the people associated with the transport industry;
- Issues on destruction of flora and fauna due to the implementation of DFC Project were raised;
- Participants wanted to know about the impact of the project on noise pollution and effect of vibration on the local communities living alongside the DFC Project;
- Majority of the participants in the meetings were in the view that the compensation package should be ready before the land acquisition. They also suggested that the appropriate compensation package should be given to the PAFs.

1.5.5 Major Issues Discussed During the Second Stage PCM

Through active participation of the local people, key issues relating to social and environmental impacts, compensation, resettlement and rehabilitation were discussed during the 2nd stage PCMs. Major issues that were discussed during the second stage PCMs are as follows:

- The most prominent issues raised and discussed by the participants during the meetings was compensation to be paid against land acquisition. Participants were keen to know on what basis the compensation would be paid;
- Compensation should be paid as per the current market value;
- Compensation in qualitative and quantitative terms i.e. agriculture land of appropriate productive capacity should be replaced by similar land acquired including appropriate irrigation facilities;
- Residential and commercial structures should be replaced with similar structures having similar facilities;
- If possible, 'land for land' as a mode of compensation for land acquisition should be considered. The major concern with regard to land for land system was location of the new site. Participants suggested that the land allotted against the land acquired should be located within 5 km from the acquired land to ensure that the given land is as productive as acquired land;
- Participants, especially in the meetings at Mahendragarh, Sikar, Anand and Vadodara wanted to know about the procedure of grievance (complaint) address mechanism;
- Loss of livelihood due to acquisition of land for the purpose of construction of DFC was the major concern raised by the participants. Provision of assistance for the small-scale farmers who would lose their land was emphasised. The issue of small-scale farmer's land was prominent in Rewari, Alwar, Nagaur, Jaipur, Ajmer, Pali, Banaskantha, Patan and Vadodara;
- Possibility of sharing a part of profit from the business generated from the DFC Project should be made. The participants felt that a portion of the profit from the

freight corridor operations should also go to the local communities living along the corridor;
- Construction of road over bridge and road under bridge for smooth passage of people, cattle and vehicles from one location to other should be provided;
- Participants in Rewari, Sirohi, Mahesana, Gandhinagar, Ahmedabad and Kheda meetings suggested for provision of job opportunity for each PAF;
- The vibration and noise pollution due to running of trains along the village was discussed;
- The safety of the people crossing the railway should be ensured;
- The container depots to be constructed under the proposed project for moving of goods and materials. The issue was prominent in Rewari, Mahendragarh, Nagur, Ajmer, Pali and Gandhinagar;
- There were apprehensions among the local communities that due to construction of detour section, the local communities will be divided as the railways line would pass through the middle of village; and
- Deterioration in water quality due to construction works emerged as a major issue, especially it is of a major concern in Gujarat.

1.5.6 Major Issues Discussed During the Third Stage PCM

Major issues that were discussed during the third stage PCMs are as follows:

- The most prominent issue that emerged in the third stage meetings was valuation of land subject to acquisition. Participants in all the districts were of the opinion that the value of each piece of land should be done individually since value of land is different from one to the other;
- Compensation should be paid on the basis of market value of each land and should not be generalised;
- There were suggestions, especially in the meetings at Patan, Gandhinagar and Anand that the land should be acquired on lease basis;
- Provision of resettlement sites for squatters and non-titleholders should be considered;
- The issue of moving small-scale retailers from the existing place should be compensated as it is their source of livelihood;
- Potential PAFs wanted to know what kind of relocation plan was offered to them in case they were asked to relocate. They were interested in knowing about the infrastructure facilities provided at the relocation sites;
- Provision of the employment opportunities for all the adult members of the family in the construction works should be made;
- Construction of ROB/RUB for the movement of goods after the implementation of DFC Project should be considered.

1.5.7 Summary of PCM

As results of PCM during JICA F/S, participants voiced their concern over their livelihood as follows:

- Proposed railway line should not pass through the middle of the village or in the congested area of the town;
- The compensation for land acquisition should be paid on the basis of market price;
- The same quality and quantity of agricultural/residential land should be provided;
- Full and final compensation should be paid before the start of any construction works;

- The resettlement sites for relocation of the PAFs should have all the necessary facilities such as education, health, electricity and drinking water to ensure quality of life for the PAFs;
- All adult members of the PAFs should be provided employment during the project construction stage. Thereafter, the provision of employment for the Indian Railways should be considered;
- Provision of skill training to create employment opportunity among the PAFs should be provided;
- Increase in noise pollution due to the implementation of DFC Project should be solved. Measures to be taken to reduce the level of noise pollution along the railway line should be taken. It is particularly true to the sensitive receptors;
- Construction of ROB and RUB at several places to reduce the risk of accidents.

1.5.8 Stakeholder Meeting at Central Level

Result of draft final report of the JICA F/S was released during the central level PCM held in Delhi on 28 September 2007. A group of PAFs in Firozabad, Agra, Hathras, Aligarh, Bulandshahar, Gautam Budh Nagar of Uttar Pradesh, Sikar, Jaipur, and Alwar of Rajasthan participated. Those of ADB, World Bank, JBIC, JICA India Office, three NGOs based in Delhi, MOR and DFCCIL also participated in the meeting. The major point of coneern that the PAFs stated are as follows:

- Proper representation of the PAFs in each village should be considered to establish appropriate compensation for the loss of land;
- Because of the lack of farming area for the farmers losing the land, resettlement colony should be constructed;
- Appropriate compensation for the loss of land and structures should be made;
- Assessment of the structures in the right of way should be properly done to ensure that all PAFs are properly compensated.

Despite the fact that participant in all the meetings 2nd and 3rd stages were apprehensive about the compensation and resettlement issues, approximately a half of the meeting participant in general accepted the DFC Project. Most common issue throughout PCM was compensation. Participants were also concerned with the social and safety issues directly related to their livelihood and made demands on clear mitigation measures.

1.6 SUMMARY OF MITIGATION MEASURES PROPOSED IN ESIMMS

1.6.1 Pollution Control

In ESIMMS, impacts of DFC Project related to pollution control were evaluated and mitigation measures were recommended. The assessed impacts and the mitigation measures at the three phases of the project, pre-construction, construction and operation phases, in concerned states, Gujarat, Rajasthan and Haryana are summarized in Table 1-14.

Table 1-14 Environmental Impacts and Mitigation Measures (Gujarat, Rajasthan and Haryana)

No.	Potential Impacts	Mitigation Measures
1	**Air Quality**	
Pre-Construction Phase		
	No Impact	
Construction Phase		
	Particulate matter would be the predominant pollutant affecting the air quality during the construction phase as it is likely to generate considerable quantities of dust, especially during dry condition even the impact on air quality will be localized, short term and reversible.	- Proper and prior planning and appropriate sequencing and scheduling of all major construction activities shall be done, and timely availability of infrastructural supports needed for construction shall be ensured to shorten the construction period vis a vis reduce pollution. - Construction materials shall be stored in covered go downs or enclosed spaces to prevent the wind blown fugitive emissions. - If the construction site adjoins a road, service lane, settlement etc., dust barricades of appropriate height and length shall be provided along the boundary of the construction area. - Truck carrying soil, sand and stone shall be duly covered to avoid spilling. - Adequate dust suppression measures such as regular water sprinkling on unpaved haul roads and vulnerable areas of the construction sites from trucks or other suitable means shall be undertaken to control fugitive dust during material handling and hauling activities particularly near habitation especially in the dry seasons.
	- Deterioration of air quality due to gaseous emissions from construction equipment and vehicular traffic.	- Stringent construction material handling/overhauling procedures shall be followed. - Low emission construction equipment, vehicles and generator sets shall be used. - It shall be ensured that all the construction equipment and vehicles are in good working condition, properly tuned and maintained to keep emissions within the permissible limits and engines turned off when not in use to reduce pollution. - Construction machinery shall be operated at least 500 m away from inhabited areas and 300 m from the approach road. - Air quality monitoring shall be conducted once in every season, except monsoon at selected locations
Operation Phase:		
	Rail is the environment friendly mode of transport. During operation phase the impact on air quality will be positive. At present, a major portion of the freight is transported by road but after DFC, it will reduce to a great extent. As the road traffic will decrease significantly, the vehicular pollution will be reduced and the air quality of the area will improve. Plantation along the DFC will also act as sink of air pollutants	No measures required.
2	**Noise and Vibration Levels**	
Pre-Construction phase		
	No Impact	

Construction phase		
	During the construction, noise and vibration will be generated due to movement of vehicles, and operation of light and heavy construction machineries including pneumatic tools (hot-mixer, dozer, tipper, loader, excavator, grader, scraper, roller, concrete mixer, generator, pump, vibrator, crane, compressor etc.) that are known to emit sounds with moderate to high decibel value. Noise generated from sources mentioned above will be intermittent and mostly during daytime.	- Construction camp and temporary labour sheds shall be located away from the immediate vicinity of the construction sites and major road traffic. - Protective gears such as ear plugs etc. shall be provided to construction personnel exposed to high noise levels as preventive measure. - Low noise construction equipment shall be used. - It shall be ensured that all the construction equipment and vehicles used are in good working condition, properly lubricated and maintained to keep noise within the permissible limits and engines turned off when not in use to reduce noise. - Stationary construction equipment shall be placed 113 m away from inhabited areas. - Stationary construction equipment shall be placed 200 m away from the sensitive receptors (SRs) i.e. school, hospital etc. - Construction activities carried out near residential area shall be scheduled to the daytime only so that minimum disturbances are caused to people. - The construction methods with lower vibration generation shall be applied. - Machines and vehicles equipped with lower vibration devices such as vibration-proofing cover shall be used. - Vibration propagation shall be prevented by keeping the distance and changing the direction and location of machines. - Near settlement and forest areas, construction activities shall be conducted only during daytime, and vibration generating activities shall be prohibited during night time. - Vibration level monitoring shall be conducted during the construction phase.
Operation Phase:		
	During operation, noise and vibration level are likely to increase due to movement of trains and related facilities such as loading and unloading. But the impacts could be insignificant.	- Vibration level monitoring shall be conducted during the construction phase. - New technologies shall be incorporated to lower vibration generation with respect to structures and rolling stocks. - Use of long welded rails without fishplate joint is suggested for reduction in vibration. - Crushed stones shall be used for ballast materials, and accumulation of crushed ballast by passing trains is to be removed through frequent ballast cleaning. - For a railway bridge girder, steel may be replaced with concrete materials such as PC and RC to minimize oscillation of the bridge girder which generates vibration in addition to noise. - If necessary, building the vibration-proof trench and underground wall may be built to prevent the vibration propagation. - Provide appropriate maintenance of locomotives, tracks and structures. - Running speed of freight trains in the urban area and the railway station shall be controlled, if required. - Fences and structures to shelter and absorb vibration in addition to noise are duly provided to the sections where houses and Sensitive Receptors are located near

		railway tracks, if required. - Monitoring of railway noise and vibration generated from dedicated freight trains shall be conducted.
3	**Water Quality**	
Pre-Construction phase		
	No Impact	
Construction phase		
	Small quantity of water will be used in the compaction of embankment during construction process. Wastewater from construction activities would mostly contain suspended impurities. Other pollutants which may find their way to it will be in insignificant concentrations and may be safely disregarded. The deterioration of water quality during construction phase is expected due to wastewater disposal from the workers camp and sullage generated from construction sites. If adequate arrangements are not made to ensure proper drainage of wastewater from the construction sites, such waters may form stagnant pools and aggravate soil erosion. Stagnant pools of water promote breeding of mosquitoes and create generally unsanitary conditions.	- Silt fencing may be provided near water bodies - Quality of construction wastewater emanating from the construction site shall be controlled through suitable drainage system with sediment traps (silting basin as water intercepting ditch) for arresting the silt/sediment load before its disposal into the main natural drainage system around the site. - Proper sanitation facilities shall be provided at the construction site to prevent health related problems due to water contamination. - All the construction and preparatory activities including construction of culverts and bridges shall be carried out dry season but working may resorted in monsoon if it does not affect the habitat of endangered species.
Operation Phase:		
	During operation phase no impact is envisaged on water quality. However, the wastewater generated from rail depot, train washing, heavy cleaning, workshops and maintenance activities shall be treated properly prior to discharge into the sewer.	After Removal of suspended solids, oil and grease, organic matter, toxie elements and neutralization of pH through waste water treatment plant, this treated water will be reused
4	**Soil Quality**	
Pre-Construction Phase		
	No Impact	
Construction Phase		
	- During construction phase soil contamination is likely to take place due to leakage of asphalt emulsifier at pavement of road. - Soil contamination may also take place during filling of oil in vehicles or leakage of oil from vehicles.	- Asphalt emulsifier must be handled with caution and any leakage detected must be immediately rectified. - Construction work should not be done during rainy season to avoid soil contamination
Operation Phase		
	During operation phase no impact is envisaged on soil quality.	
5	**Bottom Sediment**	
Pre-Construction Phase		
	No Impact	
Construction Phase		
	- The DFC alignment crosses Balaram River twice in Banaskantha District. During construction of bridge over	- Silt fencing shall be provided to restrict runoff into the water Construction of bridge shall be constructed during dry

	Balaram River, sediment pollution may occur. - During the construction of bridges over Balaram, Khari, Sabarmati, Watrak and Mahi Rivers sediment pollution may occur.	season but working may resorted in monsoon if it does not affect the habitat of endangered species
Operation Phase		
	No Impact	
6	**Offensive Odor**	
Pre-construction phase, Construction Phase, Operation phase		
	No activities causing offensive odor is envisaged however cleanliness must be maintained at construction site during construction and at ICD and Stations during operation phase to avoid any foul odor.	

1.6.2 Natural Environment

In ESIMMS, impacts of DFC project related to natural environment were evaluated and mitigation measures were recommended based on the study. The assessed impacts and the mitigation measures at the three phases of the project, pre-construction, construction and operation phases, in concerned states, Gujarat, Rajasthan and Haryana are summarized in Table 1-15.

Table 1-15 Environmental Impacts and Mitigation Measures (Gujarat, Rajasthan and Haryana)

No.	Potential Impacts	Mitigation Measures
1	**Topography and Geology**	
Pre-construction stage		
	No Impact	
Construction stage		
	Change in topography is expected due to clearing of land, felling of trees, cutting and filling of land and construction of structures. Disfiguration and change in existing profile of the land due to detour section. Disfiguration of topography due to indiscriminate digging of borrow pits. Uncontrolled digging of borrow pits resulting in water accumulation and breeding of vector disease. Disturbance on geological setting due to quarrying.	-Plantation program may be carried out to improve the aesthetic look of the construction area. -Only identified borrow pits and quarry sites shall be used to avoid any disfiguration of topography. -Opening up new borrow pits shall be in accordance with the IRC: 10-1961 specifications. Opening up of new borrow pits shall be restricted to 1 m depth followed by resurfacing of pits with top soil (15 cm). -Uncontrolled digging of borrow pits shall be avoided to prevent water accumulation in abandoned pits which results in breeding ground of vector disease. -Construction materials shall be procured from existing approved and licensed quarries only where crusher is already operating. Therefore, mitigative measure for the environmental impacts due to quarrying and rehabilitation plan of the quarries is the

		responsibility and scope of the license holder of the quarry. -Suitable seismic design of the CD structures shall be adopted to mitigate the earthquake impacts in future. On owner's choice, borrow pits shall be converted to water bodies (pond) with proper landscaping (i.e. rectangular in shape, proper sloping and plantation on the bank) which will add scenic beauty in those localities
Operation stage		
	No Impact	
2	**Soil**	
Pre-construction stage		
	No Impact	
Construction stage		
	Disruption and loss of productive top soil from agricultural fields due to creation of borrow pits and development of detour section, which may reduce crop yield. Loosening of top soil and loss of vegetative cover along detour and parallel section due to excavation and back filling which will lead to enhanced soil erosion.	-Utilization of fly ash, if technically suitable and available within 100 km distance of the DFC alignment for construction of embankment to save soil resource.. -Adequate measures like adequate drainage, embankment consolidation and slope stabilization shall be taken along the track to avoid soil erosion. -Top soils (15 cm) of the borrow pit sites shall be conserved and restored after excavation is over. Accidental spills of lubricants/oil shall be avoided by ndherence to good practices.
Operation stage		
	No Impact	
3	**Groundwater**	
Pre-construction stage		
	No Impact	
Construction stage		
	Pollution of groundwater is likely to occur due to seepage and runoff from construction site, though the impact will be negligible.	-Borrow areas may be developed into recharge ponds enhancing the ground water level. -Formation of stagnant pools may not be allowed near construction sites especially near workshop from where oil and other pollutants may seep into water.
Operation stage		
	No Impact	
4	**Hydrological Conditions**	
Pre-construction stage		
	No Impact	
Construction stage		
	Change in drainage pattern of the land around detour Increased incidence and duration of floods due to obstruction of natural drainage courses by the embankment	-Adequate drains (longitudinal and median drains) shall be provided along the track to facilitate its better maintenance. -Capacity of existing drainage works and cross drainage structures in the parallel section shall be duly augmented, wherever necessary, to accommodate high discharges to avoid flooding and formation of water pool. -Adequate new drainage works and cross drainage structures shall be provided for smooth passage of runoff to avoid flooding and formation of water pool.

	Chances of filling of existing drainage courses during earth filling.	-Filling of existing drainage courses shall be strictly avoided. -Suitable drainage at construction site and camp shall be provided to eliminate the chances of formation of stagnant water pools that leads to soil erosion and breeding of mosquitoes.
Operation stage		
	Filthy environment due to improper maintenance of drainage Local drainage is likely to be affected due to formation of railway embankment	-Longitudinal drains of sufficient capacity shall be provided on both sides of the track to accommodate increased run-off. The outfall for these drains are generally the nearby culverts/bridges on streams/rivers/drains. -Contingent actions shall be taken for speedy cleaning up of oil spills, fuel and toxic chemicals in the event of accidents
5	**Water Use**	
Pre-construction stage		
	No Impact	
Construction stage		
	Impact on the local water sources due to use of water for construction.	Minimum use of water from existing sources for construction purpose will be ensured to minimize likely impacts on other users.
Operation stage		
	No Impact	
6	**Land Use**	
Pre-construction stage		
	No Impact	
Construction stage		
	Loss of agricultural land resources due to land acquisition for the detour. Generation of solid waste in the form of construction spoils from construction sites. Changes in existing land use pattern of the ROW for construction of DFC in detour & parallel sections.	-Earth material generated from excavation shall be reused to the maximum possible extent as filling material during site development. -The small amount of construction debris and surplus excavated material shall be disposed of by mechanical transport in suitable pre-identified dumping areas in tune with the local condition to avoid land degradation and water logging due to indiscriminate dumping. -Dumping areas shall be reclaimed through top soil cover and plantation. -Construction camp shall be provided for construction personnel to avoid indiscriminate settlement of construction workers and labourers. -Regular inspection of haul roads and construction site shall be carried out to ensure regular and timely removal of construction debris to the designated dumping sites. Construction activities will be kept confined to ROW only.
Operation stage		
	Likely change of land use due to squatter/encroachment within ROW at junction station, cross station Likely change of land use due to induced railway side development outside the ROW.	Squatter development along the project shall be strictly avoided by proper regulation and vigilance. Land use control measures shall be prepared & administered to avoid occurrence of induced development as far as possible. Planning agencies and Collector/Revenue Officer/Railway Officer shall be made involved for

		controlled development and prohibiting squatter/ encroachment within ROW.
7	**Landscape**	
Pre-construction stage		
	No Impact	
Construction stage		
	The landscape within the ROW of DFC is likely to alter due to improper excavation of borrow pits, construction of temporary approach roads and labor camps.	-Landscaping Plan involving the following may be formulated for restoration, leveling and landscaping of the area after completion of construction activities. -The stockpiles may be designed such that the slope does not exceed 1:2 (vertical to horizontal) and the height of the pile is restricted to 2 m. -Stockpiled topsoil may be used to cover the disturbed areas and cut slopes. The top soil shall be utilized for redevelopment of borrows areas, landscaping along slopes, incidental spaces, etc. -Incorporation of suitable and effective contractual clauses for rehabilitation and restoration of borrow areas and other temporary works and landscaping it with surrounding area immediately after its use -Landscaping of surrounding area with plantation-ornamental plants may be planted near Stations
Operation stage		
	No Impact	
8	**Flora**	
Pre-construction stage		
	Gujarat Loss of flora due to felling of trees along the ROW and *Acacia nilotica, Prosopis juliflora, Prosopis chilensis, Acacia tortlis, Acacia catechu, Prosopis cineraria, Eucalyptus sp, Ficus benghalensis*, etc are found as major species. Rajasthan As result of clearing of site and felling of trees, the flora of the area are likely to be affect. The tree species likely to be affected are Sheesham (*Dalbergia sisoo*),Vilayti Baool (*Prosopis Spp*), Neem (*Azadirachta indica*), Desi Babool (*Acacia Spp.*), Ber (*Zizyphus mauritiana*), and Eucalyptus (*Eucalyptus hybrid*) planted outside forest area. Haryana Only trees along the railway corridor and trees in private land need to be felled. The main species along the railway track, *Acacia* species, *A.indica, Eucalyptus* and *Prosopis species* are found.	-Action plan for tree felling shall be prepared to avoid uncontrolled & indiscriminate tree felling. Appropriate compensatory plantation shall be initiated to compensate the vegetation loss due to felling of trees for site clearing. For trees to be cut, sufficient compensatory plantation, about 2 times the number of trees felled, shall be done. -For trees to be felled in private land, compensation for land & trees shall be given to the owners. Rate of trees shall be decided by the State Forest Department. Mixed plantation consisting of flowering shrubs and evergreen ornamental trees with less fruit value shall be carried out. -Under the plantation programme, more valuable tree species shall be planted in place of existing non-valuable mono crops of the project area, if any.
Construction stage		
	Deposition of fugitive dust on	Strip plantation in available open spaces on both sides

	pubescent leaves of nearby vegetation may lead to temporary reduction of photosynthesis, mainly in the initial periods of the construction phase and in the immediate vicinity of the construction area. In long term the proposed plantation will have direct positive impact on the ecological resources.	of the railway track shall not only enhance the floral cover, land use features and scenic beauty but also act as air pollutants sink dust and noise barrier. Cooking fuel shall be provided to construction workers to avoid cutting/felling of trees for fuel wood.
Operation stage		
	No impact is anticipated on flora during operation phase; however, development of green belt is suggested near stations and maintenance of plantation may be undertaken by Railway Dept. The plantation carried along alignment as compensatory afforestation is likely to enhance the ecological condition of the area.	
9	**Diversion of Forest Land**	
Pre-construction stage		
	Gujarat The alignment passes through three patches of Reserved Forest in Banaskantha district. Forest land is to be diverted for the use as ROW for construction of new track (detour). Rajasthan In Pali district, Between Jawali to Somesar Station DFC is passing Jawaleaswar open forest area and forest land is to be diverted for the use as ROW for construction of new track. Between Bhagwanpura and Balvara-near Bhagwanpura Stations DFC is passing through the open forest area and forest land is to be diverted for the use as ROW for construction of new track. Haryana An open forest area between Kori and Meli Railway Stations in Rewari, would be affected by the project.	Compensation shall be provided to the forest department towards the cost of forest land to be diverted and cost of compensatory afforestation.
Construction Stage, Operation stage		
	No Impact	
10	**Fauna**	
Pre-construction stage		
	Gujarat *Thol Wildlife (Bird) Sanctuary is* located in the west of DFC alignment (detour section) in Mahesana District, at a distanee varying between 80 m to 245 m. The project will have significant impact on the avifauna of	*Construction activity within 3 km radius of sanctuary* shall be carried out by taking special care so as to cause the least disturbance as per the provisions of the law..

	the sanctuary. Their habitat will be disturbed due to noise generated from the movement of construction machineries and vehicles. Nilgai (*Boselaphus tragocamelus*) is found in good number in the surrounding agricultural field. Due to acquisition of agricultural land for construction of detour section, they will loose part of their habitat & food.	
	Gujarat, Rajasthan, Haryana Minor temporary loss of habitat for a small number of birds due to felling of trees. Corridor of wildlife movement will be disturbed due to acquisition of Reserved Forest land in Banaskantha District.	Appropriate compensatory plantation shall be initiated to compensate the habitat loss due to felling of trees for site clearing.
Construction stage		
	Disturbance to avifauna of reserved forests due to noise generated from construction machinery. Disturbance to avifauna of the Thol Wildlife (Bird) Sanctuary and surrounding area in Mahesana District from the noise generated by construction machinery. Temporary loss of habitat of Indian Soft-shell turtle during construction of bridge over Mahi in Vadodara District	It will be ensured that all the construction equipment & vehicles used are in good working condition, properly lubricated & maintained to keep noise within the permissible limits and engines turned off when not in use to reduce noise. New DFC alignment may be considered to avoid the sanctuary. Construction of bridge shall be constructed during dry season but working may resorted in monsoon if it does not affect the habitat of endangered species Fencing shall be provided along the boundary of construction site Other precautionary measures will be adopted to minimize the impact
Operation stage		
	Effect on aquatic fauna in case of accidental oil spill & toxic chemical release find its way into the water bodies. Loss of habitat of avifauna in Mahesana District. Permanent and significant impact on Thol Lake Wildlife (Bird) Sanctuary and fauna of the surroundings. The track restricts the crossing of animals and the train movement is likely to restrict the movement of wildlife on either side of the track. Possibilities of collision of wildlife with train.	Contingent actions will be taken for speedy cleaning up of oil spills, fuel and toxic chemicals in the event of accidents. In Mahesana district no mitigation measures could be suggested other than shifting of the alignment to minimize the impact on the Bird Sanctuary Animal underpasses made for wildlife near forest areas must be camouflaged to match the surrounding environment with plantation of shrubs and trees. Fencing if feasible, may be provided along DFC in wildlife habitation concentration areas to avoid collision
15	Positive Impacts of the project	
	Reduced Green House Gas (GHG) emissions from the road sector Environment friendly & safe mode of transport Reduced travel time resulting in increased accessibility. Reduced traffic resulting in reduced congestion on roads	

	Reduced fuel consumption from the transport sector . Reduction in vehicular emission loads resulting in improved air quality of the region. Reduction in road accidents resulting in reduced death and injury during road accidents. Reduced price of commodity. Improved road conditions and extended life of the roads. Increased industrial, business and commercial activities. Increased job/employment opportunities (direct and indirect both). Reduced need for expansion of roads, flyovers, laying of new roads etc.

1.6.3 Social Considerations

(1) Land Acquisition and Compensation Package

Resettlement and Rehabilitation Policy including "RRP Frame Work" is under consideration with Government of India and will be disclosed as a separate process.

(2) Engincering Measures

As a result of a series of stakeholder/public consultation meeting throughout the alignment of DFC Project, .The following suggestions are there

- Provision of road-under-bridge (RUB) or road-over-bridge (ROB) at road crossing as per the policy and need.
- Existing road and proposed RUB/ROB/Level Crossing (LC) will cater for the movement of local people.
- Underpass or the level crossing shall be provided in the detour section as per the existing road network.
- Provision of footpath on side of the carriageway as per existing practice of the Indian Railway Code (IRC).

1.7 SUMMARY OF ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN PROPOSED IN ESIMMS

1.7.1 Environmental Management Plan Proposed in ESIMMS

An Environmental Management Plan (EMAP) was prepared in ESIMMS. The desired results from the environmental mitigation measures proposed may not be obtained without a management plan to assure its proper implementation and function. The proposed EMAP has envisaged the plans for the proper implementation of measures to mitigate the adverse impacts arising out of the project activities during pre-construction, construction and operation stage. The EMAP has addressed the issues of pollution control and monitoring, solid waste management, management / rehabilitation for quarry/borrow areas, sanitation and house keeping at the construction labour camps, procedures for storage, handling and emergency response for hazardous chemicals, etc. The EMAPs for pre-construction stage, construction stage and post-construction stage are elaborated from Table 1-16 to Table 1-18.

Table 1-16 Environmental Management Plan (Pre-construction Stage) Proposed in ESIMMS

Sl. No.	Environmental Issues	Management Measures	Responsibility	
			Planning and Execution	Supervision/ Monitoring
P1.	Land Acquisition	The acquisition of land and private properties shall be carried out in accordance with the RRP and entitlement framework for the project. Regarding forest land to be diverted to the project, full compensation towards the cost of forest land and compensatory afforestation shall be provided to Forest Department	Land Acquisition Unit, EMU, Revenue Dept., NGOs	Revenue Dept, DFCCIL
P 2.	Preservation of Trees	All efforts shall be made to preserve trees including evaluation of minor design adjustments/alternatives (as applicable) to save trees. Tree cutting is to proceed only after all the legal requirements.	EMU, Forest Department	DFCCIL
P3.	Relocation of Common Property Resources	All community utilities and properties shall be relocated before construction starts.	EMU	DFCCIL
P4.	Field verification and Modification of the Contract Documents			
P.4.1	Joint Field Verification	The Environmental Expert of EMU and the Contractor shall carry out joint field verification to ascertain the possibility to saving trees, environmental and community resources.	The Contractor & EMU	DFCCIL
P.4.2	Construction vehicles, equipment and machinery	All vehicles, equipment and machinery for construction shall confirm to the relevant Bureau of India Standard (BIS) norms and the manufacturer's specifications. The discharge standards, promulgated under the Environment Protection Act, 1986 shall be strictly adhered to. Noise limits for construction equipment to be procured such as compactors, rollers, front loaders concrete mixers, cranes (moveable) shall not exceed the value specified in the Environment (Protection) Rules, 1986.	The Contractor	Environmental Expert of EMU
P.5	Borrow Areas	Finalizing borrow areas for borrowing earth and all logistic arrangements as well as compliance to environmental requirements, as applicable, shall be the sole responsibility of the contractor.	The Contractor	Environmental Expert of SC and EMU
P.6	Quarry Areas	The quarry materials requirements may be fulfilled from the existing quarries. However, detail investigation regarding the availability and suitability of quarry materials from these locations shall be finalized. The Contractor shall obtain necessary permission for procurement of materials from Mining Department, District Administration and State Pollution Control Board and shall submit a copy of the approval and the rehabilitation plan.	The Contractor	Environmental Expert of SC and EMU
P.7	Arrangement for construction water	The Contractor shall provide a list of locations and type of sources from where water for construction shall be used. The Contractor shall need to comply with the requirements of the State Ground Water Department and seek its approval for doing so and submit copies of the permission to Environmental Expert of SC and EMU.	The Contractor	Environmental Expert of SC and EMU
P.8	Site identification for disposal of unsuitable materials	The Contractor shall identify site(s) away from the project area where unsuitable materials (debris, solid waste) generated in the course of the construction can be safely disposed off.	The Contractor	Environmental Expert of SC and EMU
P.9	Labour requirements	Local people shall be given preference for unskilled and other jobs created during construction phase of	The Contractor	EMU

Sl. No.	Environmental Issues	Management Measures	Responsibility	
			Planning and Execution	Supervision/ Monitoring
		the project.		

Source: ESIMMS

Table 1-17 Environmental Management Plan (Construction Stage) Proposed in ESIMMS

Sl. No.	Environmental Issues	Management Measures	Responsibility	
			Execution/ Civil Work	Supervision/ Monitoring
C.1 Site Clearance				
C.1.1	Clearing & Grubbing	Vegetation shall be removed from the construction zone before commencement of construction. All works shall be carried out such that the damage or disruption to flora other than those identified for cutting is minimum. Trees identified under the project shall be cut only after receiving clearance from the Forest Department.	The Contractor	Environmental Expert of SC and EMU
C.1.2	Stripping, stocking and preservation of top soil	The topsoil from all areas of cutting and all areas to be permanently covered shall be stripped to a specified depth of 150 mm and stored in stockpiles. A portion of the temporarily acquired area and/or Right of Way shall be earmarked for storing topsoil.	The Contractor	Environmental Expert of SC and EMU
C.2 Procurement of Construction Materials				
C.2.1	Earth from Borrow Areas for Construction	No borrow area shall be opened without permission of the Environmental Expert. The Contractor shall rehabilitate the borrow areas as soon as borrowing is over from a particular borrow area in accordance with the Borrow Area Rehabilitation/ Redevelopment Guidelines.	The Contractor	Environmental Expert of SC and EMU
C.2.2	Quarry operation	The Contractor shall develop a Comprehensive Quarry Redevelopment Plan as per the Mining Rules prior to opening of the quarry site. The quarry operations shall be undertaken within the rules and regulations in force.	The Contractor	Environmental Expert of SC and EMU
C.2.3	Construction water	The Contractor shall arrange adequate supply and storage of water for the whole construction period at his own costs. The Contractor shall submit a list of source/s from where water shall be used for the project to SC and EMU. The Contractor shall source the requirement of water preferentially from ground water but with prior permission from the relevant authority/ authorities, if required.	The Contractor	Environmental Expert of SC and EMU
C.3 Construction Work				
C.3.1	Drainage & Flood Control	The Contractor shall ensure that construction materials like earth, stone are disposed off so as not to block the flow of water of any watercourse and cross drainage channels.	The Contractor	Environmental Expert of SC and EMU
C.3.3	Slope Protection and Control of Soil Erosion	The Contractor shall take slope protection measures to control soil erosion and sedimentation through use of dykes, sedimentation chambers, basins, fibber mats, mulches, grasses, slope, drains and other devices.	The Contractor	Environmental Expert of SC and EMU
C.4 Pollution				
C.4.1 Water Pollution				
C.4.1.1	Water pollution from construction wastes	The Contractor shall take all precautionary measures to prevent the wastewater generated during	The Contractor	Environmental Expert of SC

Sl. No.	Environmental Issues	Management Measures	Responsibility	
			Execution/ Civil Work	Supervision/ Monitoring
		construction from entering into streams, water bodies or the irrigation system. All waste arising from the project is to be disposed off in the manner that is acceptable to the State Pollution Control Board (SPCB).		and EMU
C.4.1.2	Water pollution from fuel and lubricants	The Contractor shall ensure that all construction vehicle parking location, fuel/lubricants storage sites, vehicle, machinery and equipment maintenance sites are located at least 100 m away from any water body. The Contractor shall also ensure that spillage of fuels and lubricants do not contaminate the ground. If fuel storage and refuelling areas are located on agricultural land or areas supporting vegetation, the top soil shall be stripped, stockpiled and returned after cessation of such activities.	The Contractor	Environmental Expert of SC and EMU
C.4.2 Air Pollution				
C.4.2.1	Dust pollution	The Contractor shall take every precaution (water sprinkling etc.) to reduce the level of dust generating from construction site. All the plants shall be sited in the downwind direction from the nearest human settlement. The crushers licensed by the PCB shall be used.	The Contractor	Environmental Expert of SC and EMU
C.4.2.2	Emission from construction vehicles, equipments and machineries	The Contractor shall ensure that all vehicles, equipments and machineries used for construction are regularly maintained and confirm that pollution emission levels comply with the relevant requirements of SPCB.	The Contractor	Environmental Expert of SC and EMU
C.4.3 Noise Pollution				
	Noise from vehicles, equipments and machineries	The Contractor shall confirm that all plants and equipments used in construction shall strictly conform to the MOEF/CPCB/SPCB noise standards. At the construction sites within 150 m of the nearest habitation, noisy construction work such as crushing, concrete mixing shall be stopped during the night time between 9.00 pm to 6.00 am. No noisy construction activities shall be permitted around educational institutions/ health centres (silence zones) up to a distance of 100 m from the sensitive receptors. Monitoring shall be carried out at the construction sites as per the monitoring schedule.	The Contractor	Environmental Expert of SC and EMU
C.5 Safety				
C.5.1	Personal safety measures for labor	The Contractor shall provide: ▪ Protective footwear and protective goggles to all workers employed on mixing asphalt materials, cement, concrete etc. ▪ Protective goggles and clothing to workers engaged in stone breaking activities ▪ Earplugs to workers exposed to loud noise, and workers working in crushing, compaction, or concrete mixing operation. ▪ Adequate safety measures for workers during handling of materials at site. The Contractor shall comply with all the precautions as required for ensuring the safety of the workmen as	The Contractor	Environmental Expert of SC and EMU

Sl. No.	Environmental Issues	Management Measures	Responsibility	
			Execution/ Civil Work	Supervision/ Monitoring
		per the International Labour Organization (ILO) Convention No. 62 as far as those are applicable to this contract. The Contractor shall make sure that during the construction work all relevant provisions of the Factories Act, 1948 and the Building and other Construction Workers (regulation of Employment and Conditions of Services) Act, 1996 are adhered to. The Contractor shall not employ any person below the age of 14 years for any work and no woman will be employed on the work of painting with products containing lead in any form. The Contractor shall also ensure that no paint containing lead or lead products is used except in the form of paste or readymade paint. The Contractor will mark 'no smoking' in high risk areas and enforce non-compliance of use of PPE with zero tolerance. These will be reflected in the Construction Safety Plan to be prepared by the Contractor during mobilization.		
C.5.2	Risk from electrical equipments	The Contractor shall take all required precautions to prevent danger from electrical equipment and ensure that – ▪ No material will be so stacked or placed as to cause danger or inconvenience to any person or the public. ▪ All necessary fencing and lights is provided to protect the public in construction zones. All machines to be used in the construction will conform to the relevant Indian Standards (IS) codes, are free from patent defect, are kept in good working order, regularly inspected and properly maintained as per IS provision.	The Contractor	Environmental Expert of SC and EMU
C.5.3	First aid	The Contractor will arrange for – ▪ A readily available first aid unit including adequate supply of sterilized dressing materials and appliances as per the Factories Rules in every work zone ▪ Availability of suitable transport at all times to take injured or sick person(s) to the nearest hospital ▪ Equipment and trained nursing staff at construction camp.	The Contractor	Environmental Expert of SC and EMU
C.6	Labor Camp Management			
C.6.1	Sanitation and sewage system	The Contractor shall ensure that : ▪ The sewage system for the camp will be designed, built and operated in such a fashion that it should not pollute the ground water or nearby surface water. ▪ Separate toilets/bathrooms, will be arranged for men and women ▪ Adequate water supply is to be provided in all toilets and urinals	The Contractor	Environmental Expert of SC and EMU

Sl. No.	Environmental Issues	Management Measures	Responsibility	
			Execution/ Civil Work	Supervision/ Monitoring
		▪ All toilets in workplaces are with dry-earth system (receptacles) which are to be cleaned and kept in a strict sanitary condition ▪ Night soil (human excreta) is to be disposed off by putting layer of it at the bottom of a permanent tank prepared for the purpose and covered with 15 cm. layer of waste or refuse and then covered with a layer of earth for a fortnight.		
C.6.2	Waste disposal	The Contractor shall provide segregated garbage bins (biodegradable and non- biodegradable) in the camps and ensure that these are regularly emptied and disposed off in a hygienic manner.	The Contractor	Environmental Expert of SC and EMU
C.7 Contractor's Demobilization				
C.7.1	Clean-up operations, restoration and rehabilitation	The Contractor shall prepare site restoration plans. The clean-up and restoration operations are to be implemented by the Contractor prior to demobilization. The Contractor will clear all temporary structures; dispose all garbage, night soils, POL waste and all construction zones as per Comprehensive Waste Management Plan. All disposal pits or trenches will be filled in and effectively sealed off. Residual topsoil, if any will be distributed on adjoining/ proximate barren land or areas identified in a layer of thickness of 75 mm-150 mm.	The Contractor	Environmental Expert of SC and EMU

Source: ESIMMS

Table 1-18 Environmental Management Plan (Operation Stage) Proposed in ESIMMS

Sl. No.	Environmental Issues	Management Measures	Responsibility	
			Execution/ Civil Work	Supervision/ Monitoring
O.1	Monitoring Operation Performance	The EMU shall monitor the operational performance of the various mitigation/ enhancement measures carried out as a part of the project. The indicators selected for monitoring include the survival rate of trees; utility of enhancement provision for relocated utilities, hand pumps and other relocated structures if any; status of rehabilitation of borrow areas; and noise barriers, which are proposed at different locations.	EMU	DFCCIL
O.2	Pollution Monitoring	The periodic monitoring of background air quality, noise level, water quality, soil pollution/contamination in the selected locations as suggested in pollution monitoring plan.	Pollution Monitoring Agency, EMU	DFCCIL

Source: ESIMMS

1.7.2 Environmental Monitoring Plan Proposed in ESIMMS

An Environmental Monitoring Plan (EMOP) was also proposed in ESIMMS for the environmental and social parameters that would become significantly irreversible, cumulative or permanently changed in both construction and operation stages of the DFC Project. Its general outline is suggested to be as follows:

1) Explicit measures taken within the framework of EMAP are selectively carried out as monitoring becomes necessary;

2) Monitoring is undertaken periodically based on the laws and regulations of the Government of India. If not applicable, those of the other countries may be applied; and

3) Appropriateness of the parameters of EMAP is reviewed and alternative measures for environmental management are identified for implementation.

The detail monitoring program during construction and operation stages are presented in Table 1-19. For each of the environmental condition indicator, the monitoring program specifies:

- Parameters to be monitored
- Location of the monitoring sites
- Frequency and duration of monitoring
- Institutional responsibilities for implementation and supervision

Table 1-19 Environmental Monitoring Programme Proposed in ESIMMS

Environment Component	Project Stage	Environmental Monitoring Programme			Institutional Responsibility	
		Parameters	Location	Frequency	Implementation	Supervision
Air Quality	Construction	SPM, RSPM, SO_2, NOx	Wherever the contractor decides to locate the batch mix plant	Continuous 1 working day, once in every season except monsoon	Contractor through approved monitoring agency	EMU/ Supervision Consultants
	Operation	SPM, RSPM, SO_2, NOx	Junction stations	Continuous 1 working day, once in every season except monsoon season for once in every three years	EMU	DFCCIL
Water Quality	Construction	See Note	Surface water-Balaram River, Banas River	4 times a year (preferably in each season)	Contractor through approved monitoring agency	EMU/ Supervision Consultants
	Operation	See Note	Balaram River, Banas River;	Pre-monsoon & post-monsoon, once in every three years	EMU	DFCCIL
Noise and Vibration	Construction	Noise and vibration level	Equipment yard	4 times a year (preferably in each season)	Contractor through approved monitoring agency	EMU/ Supervision Consultants
	Operation	Noise and vibration level	Junction Stations	Once in every three years.	EMU	DFCCIL
Soil Erosion	Construction	Visual observation, and turbidity	Visual observation at high embankments & turbidity in crossing of all	Pre-monsoon and post-monsoon season	Environmental Specialist, Hydrologist, and Material Specialist of Supervision	EMU/ Supervision Consultants

Environment Component	Project Stage	Environmental Monitoring Programme			Institutional Responsibility	
		Parameters	Location	Frequency	Implementation	Supervision
			surface water bodies		Consultants	
Plantation	Construction	No. of railway side plantation	Along the side of the track	Comparison should be done for every six months	Environmental Specialist of Supervision Consultants	EMU/ Supervision Consultants
	Operation	Growth of railway side plantation	Along the side of the track	Assess growth every year for initial five years	EMU	DFCCIL
Flora & Fauna	Construction	Aquatic ecosystem	All crossings of surface water bodies	Once a month	Environmental Specialist of Supervision Consultants	EMU/ Supervision Consultants
Borrow Area Management	Construction	Borrow areas redeveloped	Identified borrow areas	Once a week	Environmental Specialist of Supervision Consultants and Contractor	EMU/ Supervision Consultants

Note: pH, BOD, COD, TDS, TSS, DO, Oil & Grease, Total hardness, Total alkalinity, Cl, SO_4, NO_3, PO_4, F, Na, K, Ca, Mg, Fe, Zn, and Heavy Metals like As, Cd, Cr, Se, Pb, and Hg.
Source: ESIMMS

1.8 SUMMARY OF FRAMEWORK OF RRP PROPOSED IN ESIMMS

Resettlement and Rehabilitation Policy including "RRP Frame Work" is under consideration with Government of India and will be disclosed as a separate process.

1.9 SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS DISCUSSED IN ESIMMS

In ESIMMS, several issues have been discussed for environmental and social impact mitigation measures. The principal organizational structure including Project Management Unit together with various sub-unites (supporting units) has been suggested. Organization of local bodies such as District Committee for Examination of DFC Project and State Resettlement and Rehabilitation Commission was also discussed. On the other hand, he following conclusion and recommendations were discussed in ESIMMS

1.9.1 Implementation of Environmental and Social Considerations under Responsibility of MOR and DFCCIL

Environmental and social considerations for the DFC Project should be conducted with initiative of Indian Government. However, comprehensive examinations on environmental and social considerations for the railway development have not so far been carried out by the Indian Government from the planning stage of the development since there is no provision of the Environmental Impact Assessment (EIA) for railway development under the Indian laws and regulations. Therefore, it was recommended in ESIMMS that Indian Government (MOR and DECCIL) should understand the extent of environmental and social considerations neecssary to carry out in accordance with requirements of international donors' funded project. Based on the recommendations in ESIMMS, it is expected that the MOR and DFCCIL

implement recommended actions for the DFC Project as earlier as possible with well understanding institutional framework for implementation of adequate environmental and social considerations for the DFC project.

1.9.2 Adequate Implementation of Measures on Land Acquisition and Involuntary Resettlement

Railway route for the DFC project was basically designed with detouring urban area to avoid large-scale involuntary resettlement. On the other hand, since most of the detour routes pass through the agricultural areas, acquisition of the farm land and farmers' relocation will be occurred. In addition, relocation of illegal occupants or squatters who presently resides in and around the railway stations may be subject to the relocation due to improvement of the stations under the DFC Project. Since some affected farmers may face difficulty to purchase alternative farm land nearby their farm land due to lack of available land, it was recommended in ESIMMS that the DFC Project should support for such farmers to find alternative farm land, not only provide farm land compensation at replacement cost in cash, from viewpoint of livelihood recovery for the affected people.

1.9.3 Implementation of Mitigation Measure and Environmental/Social Monitoring

In ESIMMS, implementation of environmental management activities in the both pre-construction and construction phases based on the Environmental Management Plan (EMAP) proposed with implementing bodies and methods has been emphasized for adequate environmental and social considerations. It was also emphasized that, in the operation phase of the DFC Project, effects of the measures including status of livelihood recovery of the PAPs due to land acquisition and involuntary resettlement has to be monitored based on the Environmental Monitoring Plan (EMOP) proposed as well as establishing implementing body to implement necessary feedback actions based on the monitoring results.

1.9.4 Continuous Implementation of Public Consultation Process

Stakeholders/Public Consultation Meetings (PCMs) were held during the Study. First Stage SHM was conducted between January and February 2007 at 10 states along the whole DFC project area. Seeond and Third Stage PCMs were held between June and July 2007 and between August and September 2007, respectively, at 37 districts along the priority DFC project area. In addition, village-level meetings were held between the Second and Third Stage PCMs. A central level stakeholder/public consultation meeting was held on 28th September to disseminate the results of ESIMMS to the stakeholders and the public. In ESIMMS, importanee of continuous public consultation process including information disclosure of ESIMMS itself has been discussed. It was also recommended that MOR/DFCCIL should make their efforts to obtain consensus to the Projcct from the stakeholders including PAPs.

CHAPTER II-2 REVIEW OF ESIMMS

2.1 REQUIREMENTS FOR ENVIRONMENTAL AND SOCIAL CONSIDERATIONS FOR THE PROJECT

2.1.1 Law and Regulations in India regarding Environmental and Social Considerations for the Project

(1) Legal Framework

Following acts, laws, rules and guidelines are applicable for this S-ESIMMS:

1) Environment (Protection) Act, 1986
2) Air (Prevention & Control of Pollution) Act, 1981
3) Water (Prevention & Control of Pollution) Act, 1974
4) Forest (Conservation) Act, 1980 and its amendments
5) Forest (Conservation) Rules, 2003 and its amendments
6) Land Acquisition Act, 1894
7) Railways (Amendment) Act, 2008

The Environment (Protection) Act, 1986, is the most comprehensive law on the subject. The law grants power to the Central Government to take all measures necessary to protect and improve the quality of environment and to prevent pollution of the environment. The following rules, notifications and standards under the Environment (Protection) Act, 1986 are particularly relevant in this case:

1) Environment (Protection) Rules, 1986 and its amendments
2) Noise Pollution (Regulation & Control) Rules, 2003 and its amendments
3) EIA Notification, 14th September 2006
4) Ash Utilisation Notification, 1999 and its amendments
5) National Ambient Air Quality Standards and its amendments

(2) Clearance of Environmental Impact Assessment

As per EIA Notification, 14th September 2006, under the Environment (Protection) Act 1986, Prior Environmental Clearance is required for projects listed in the Schedule of the Notification. Since the railway development project is not included in the Schedule, Environmental Clearance is not required for the DFC Project.

(3) Highlights of Major Applicable Laws and Regulations

1) Forest (Conservation) Rules, 2003

According to the Forest (Conservation) Rules, 2003 as amended up to February 2004, the project requires forestry clearance if forest land acquisition is involved. In case of forest land acquisition is less than 40 ha (other than mining project), decision will be taken by RCCF, if acquisition is more than 40 ha, the proposal will be sent to Ministry of Environment and Forests for their approval.

In Banaskantha District of Gujarat, the DFC alignment is passing through Reserved Forest at three locations – Jethi, Malana and Bantawada. It is estimated that, approximately 21.4 ha of forest land is to be diverted for the use as ROW for construction of new tracks in Banaskantha District. Therefore, Forest Clearance from the Gujarat State Forest Department will be required. The project proponent shall make its proposal in the relevant Form 'A' appended the Rule, to the Chief Conservator of Forest of the concerned Regional Office of the Ministry of Environment and Forests, Government of India and a copy to the DCF Banaskantha along with the following documents:

- Village map showing the alignment
- Alignment on Toposheet (1:50,000 scale)
- Area (to be diverted)
- Project Note
- Index Map
- Details of trees to be felled within the forest land
- Undertaking to pay Net Present Value

In Pali and Sirohi Districts of Rajasthan, the DFC alignment is passing through Reserved Forest and Un-classed forest at four locations. It is estimated that, approximately 5.3 ha of forest land is to be diverted (4.5 ha in Pali District and 0.8 ha in Sirohi District) for the use as ROW for construction of DFC in Rajasthan. Therefore, Forest Clearance from the Rajasthan State Forest Department will be required. The project proponent shall make its proposal in the relevant Form 'A' appended the Rule, to the Divisional Forest Officer of Pali & Sirohi Districts and a copy to the Chief Conservator of Forest of the concerned Regional Office of the Ministry of Environment and Forests, Government of India with the following documents:

- Village map showing the alignment
- Alignment on Toposheet (1:50,000 scale)
- Area (to be diverted)
- Project Note
- Index Map
- Details of trees to be felled within the forest land
- Undertaking to pay Net Present Value

In Haryana, the DFC alignment does not pass through any Reserved Forest or Protected Forest or Un-classed Forest. Therefore, Forest Clearance from the Haryana State Forest Department is not required. However, tree felling permission from Haryana State Forest Department will be required.

The following is extracted from the Forest (Conservation) Rules, 2003 as amended up to February 2004 relevant to the DFC project.

"6. Submission of proposals seeking approval of the Central Government under section 2 of the Act

(1) Every User Agency who want to use any forest land for non-forestry purposes, shall make its proposal in the relevant Form appended to these rules, i.e. Form 'A' for proposals seeking first time approval under the Act, ... to the Nodal Officer of the concerned State Government or the Union territory Administration, as the case may be, along with requisite information and documents, complete in all respects.

(2) The User Agency shall endorse a copy of the proposal, along with a copy of the receipt obtained from the office of the Nodal Officer, to the concerned Divisional Forest Officer or the Conservator of Forests, Regional Office, as well as the Monitoring Cell of the Forest Conservation Division of the Ministry of Environment and Forests,

Paryavaran Bhawan, CGO Complex, New Delhi - 110003.

(4) The proposal referred to in clause (e) (ii) of sub-rule (3), involving forest land up to forty hectares shall be forwarded by the concerned State Government or as the case may be, the Union territory Administration, along with its recommendations, to the Chief Conservator of Forests or the Conservator of Forests of the concerned Regional Office of the Ministry of Environment and Forests, Government of India, who shall, within a period of forty five days of the receipt of the proposal from the concerned State Government or the Union territory Administration, as the case may be (a) decide the diversion proposal up to five hectares other than the proposal relating to mining and encroachments, and (b) process, scrutinise and forward diversion proposal of more than five hectares and up to forty hectares including all proposals relating to mining and encroachments up to forty hectares, along with the recommendations, if any, to the Ministry of Environment and Forests, Paryavaran Bhawan, CGO Complex, New Delhi – 110003, for obtaining the decision of the Central Government and inform the State Government or the Union territory Administration, as the case may be, and the User Agency concerned.

(5) The Regional Empowered Committee shall decide the proposal involving diversion of forest land up to forty hectares other than the proposal relating to mining and encroachments, within forty-five days of the receipt of such proposal from the State Government or the Union territory Administration, as the case may be:

Provided that the Central Government may, if consider it necessary, enhance or reduce the limit of the area of the forest land.

(6) The proposal referred to in clause (e) (ii) of sub-rule (3), involving forest land of more than forty hectares shall be forwarded by the concerned State Government or as the case may be, the Union territory Administration, along with its recommendations, to the Ministry of Environment and Forests, Paryavaran Bhawan, CGO Complex, New Delhi - 110003."

2) Saurashtra Felling of Trees (Infliction of Punishment) Act, 1951

In Gujarat, felling and removal of Limbo, Desi baval, Khijdo, Kanji, Amli and Ambo trees have been governed by the Saurashtra Felling of Trees Act (1951). Therefore, during construction of DFC in Gujarat, tree felling permission will be required from Gujarat State Forest Department.

"Whereas in the state, provisions under the Saurashtra Felling of Trees (Infliction of Punishment) Act, 1951 have been broadly successful in protecting trees

And

Whereas Social Forestry is very successful in certain areas of the state " .....

In exercise of powers conferred by clause (C) of section 2 of the Saurashtra Felling of Trees (Infliction of Punishment) Act, 1951 (Saurashtra Act, XVII of 1951) the Government hereby notifies that:

(1) Permission for felling of trees of Limdo, Baval, Kanji, Khijdo, Ambo and Amli under Saurashtra Felling of Trees (Infliction of Punishment) Act, 1951 shall be required in the following areas only.

A. Mangrove covered area

B. Notified urban areas and Notified eco sensitive areas

C. Within 5 km of the boundary of Reserved Forest, Sanctuaries, National Parks, Sea

coast and desert

D. Areas above 500 metres MSL

E. Within the distance of 200 metres from the edge of the National Highways, State Highways and District Roads.

F. Kaprada, Dharampur, Dangs, Vansda, Vyara, Uchchhal, Songadh, Umarpada, Mandvi, Valod, Tilakwada, Dediapada, Sagbara, Nizar, Kawant, Pavijetpur, Chhotaudepur, Naswadi, Sankheda, Jambughoda, Dhanpur, Devgadh baria, Garbada, Limkheda, Dahod, Jhalod, Fatepura, Morva (Hadaf), Halol, Ghoghamba, Kalol, Godhra, Shehera, Lunavada, Santrampur, Kadana, Khanpur, Virpur, Bayad, Malpur, Dhansura, Modasa, Meghraj, Bhiloda, Vijaynagar, Khedbrahma, Danbta, Mendarda, Malia, Talala, Una, Khambha, Dhari, Visavadar, Junagadh & Vanthali Talukas

(2) For areas other than those specifically mentioned hereinabove in para (1), the relaxation from above permission shall be on following conditions.

(a) Minimum age / girth criterion for felling of trees will be as under:

Species	*Minimum Age of trees in years*	*Minimum girth (GHB) in cm*
Limdo	*15*	*90*
Desi baval	*10*	*60*
Khijdo	*25*	*75*
Kanji	*20*	*90*
Amli	*30*	*150*
Ambo	*30*	*150*

(b) It is desirable that an equal number of trees will be planted and cared by the farmer a year or more in advance before felling of trees. Such trees planted are normally recorded in revenue records. Talati / Sarpanch will be empowered to issue a certificate describing number of tree so planted.

(3) Above relaxation is admissible to the above trees found / grown on private lands only. A local self government body shall not fell found / planted on the area / lands administered and owned by them without the permission under Saurashtra Felling of Trees (Infliction of Punishment) Act, 1951."

3) Fly Ash Notification

As per the provisions of the Fly Ash Notification, 14th September 1999 as amended up to 17th August 2003, under the Environment (Protection) Act, 1986, it is clear that: Its mandatory that every agency, person or organisation shall utilise fly ash for construction of roads or flyovers embankments from the thermal power plants (TPPs) located within a radius of 100 kilometers of the construction site.

In Gujarat, the nearest thermal power plants producing fly ash within 100 km from the DFC alignment are at Ahmedabad (Sabarmati Thermal Power Station, Torrent Power AEC Ltd.) and Gandhi Nagar (Gandhi Nagar Thermal Power Station, Gujarat State Electricity Corporation Ltd.). The fly ash from these two thermal power stations could be utilized for embankment construction.

In Rajasthan and Haryana, no thermal power plant is located within 100 km from the DFC alignment.

As per the provisions of the Fly Ash Notification, 14th September 1999 as amended upto 17th August 2003:

"Where as it is necessary to protect the environment, conserve top soil and prevent the dumping and disposal of fly ash discharged from coal or lignite based thermal power plants on land;

And, whereas, there is a need for restricting the excavation of top soil for manufacture of bricks and promoting the utilisation of fly ash in the manufacture of building materials and in construction activity within a specified radius of one hundred kilometres from coal or lignite based thermal power plants; "

"1. Use of fly ash, bottom ash or pond ash in the manufacture of bricks and other construction activities.

(5) No agency, person or organization shall, within a radius of 100 kilometres of a thermal power plant undertake construction or approve design for construction of roads or flyover embankments in contravention of the guidelines/ specifications issued by the Indian Road Congress (IRC) as contained in IRC specification No. SP: 58 of 2001. Any deviation from this direction can only be agreed to on technical reasons if the same is approved by Chief Engineer (Design) or Engineer-in-Chief of the concerned agency or organization or on production of a certificate of "Pond ash not available" from the thermal power plant(s) (TPPs) located within 100 kilometres of the site of construction. This certificate shall be provided by the TPP within two working days from the date of making a request for ash.

(6) Soil required for top or side covers of embankments of roads or flyovers shall be excavated from the embankment site and if it is not possible to do so, only the minimum quantity of soil required for the purpose shall be excavated from soil borrow area. In either case, the topsoil should be kept or stored separately. Voids created due to soil borrow area shall be filled up with ash with proper compaction and covered with topsoil kept separately as above. This would be done as an integral part of embankment project within the time schedule of the project. "

"3. Specifications for use of ash-based products.

(2B) All agencies undertaking construction of roads or fly over bridges including Ministry of Road Transport and Highways (MORTH), National Highways Authority of India (NHAI), Central Public Works Department (CPWD), State Public Works Departments and other State Government Agencies, shall, within three months from the 1st day of September, 2003 -

(a) make provisions in their tender documents, schedules of approved materials and rates as well as technical documents, including those relating to soil borrow area or pit as per sub-paragraph (7) of paragraph 1; and

(b) make necessary specifications/guidelines for road or fly over embankments that are not covered by the specifications laid down by the Indian Road Congress (IRC).

(3) All local authorities shall specify in their respective building bye-laws and regulations the use of ash and ash-based products and construction techniques in building materials, roads, embankments or for any other use within a period of four months from the date of publication of this notification."

4) Railways (Amendment) Act 2008

The Railways Act, 1989, an Act to consolidate and amend the law relating to Railways was amended in 2008. This Act is may be called the Railways (Amendment) Act, 2008. The amendments include insertion of following clauses:

- 7A (competent authority) - means any person authorized by the central Government by notification, to perform the functions of the competent authority for such area as may be specified in the notification;
- 29A (person interested) – (i) all persons claiming an interest in compensation to be made on account of the acquisition of land under this Act; (ii) tribals and other traditional forest dwellers, who have lost any traditional rights recognized under the Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006; (iii) a person interested in an easement affecting the land; and (iv) persons having tenancy rights under the relevant State laws;
- 37A (special railway project) – means a project, notified as such by the Central Government from time to time, for providing national infrastructure for a public purpose in a specified time-frame, covering one or more States or the Union territories;
- Chapter IVA – Land Acquisition for a Special Railway Project.

The main elements of Chapter IVA are shown below:

Section		Description
20A	Power to acquire land, etc	Declaration of intention to acquire land required for execution of a special railway project. This is the first notification and empowers the competent authority to cause the substance of the notification.
20D	Hearing of objections, etc	Objections must be made by interested persons within 30 days from the date of publication of the notification under sub-section (1) of section 20A.
20E	Declaration of acquisition	On publication of the declaration under sub-section (1), the land shall vest absolutely in the Central Government.
20F	Determination of amount payable as compensation	Amount to be paid as compensation shall be determined by an order of the competent authority. The competent authority shall make an award under this section within a period of one year from the date of publication of the declaration.
20G	Criterion for determination of market value of land	
20I	Power to take possession	To surrender or deliver possession thereof to the competent authority or any person duly authorized by it in this behalf within a period of 60 days of the service of the notice.
20N	Land Acquisition Act 1 of 1894 not to apply	Nothing in the LA Act, 1894 shall apply to an acquisition under this Act.
20O	Application of the National Rehabilitation and Resettlement Policy (NRRP), 2007 to persons affected due to land acquisition	The Provisions Of The NRRP, 2007 For The Project Affected Families, Notified By The Government of India In The Ministry Of Rural Development vide number F.26011/4/2007-LRD, dated the 31st October, 2007, shall apply in respect of acquisition of land by the Central Government under this Act.

5) National Rehabilitation and Resettlement Policy, 2007

The National Rehabilitation & Resettlement Policy, 2007 for Project Affected Families (PAFs) have been prepared by the Department of Land Resources, Ministry of Rural Development, and Government of India. The policy stipulates the minimum benefits to be ensured for persons displaced due to acquisition of land for public purposes. The objectives of the Policy are shown below;

a) to minimize displacement and to identify the non-displacing or least-displacing alternatives;

b) to plan the Resettlement and Rehabilitation of project affected families (PAFs), or project affected households (PAHs), including tribal and vulnerable households;

c) to provide improved standard of living to PAFs or PAHs; and

d) to facilitate a harmonious relationship between the requiring body and PAFs.

The Policy is applicable to projects displacing 400 or more families *enmasse* in plain areas, or 200 or more families *enmasse* in tribal or hilly areas, Desert Development Programme (DDP) blocks, areas mentioned in Schedule V and Schedule VI of the Constitution of India. However, the basic principles of policy can be applied to rehabilitation and resettlement of PAFs regardless of the number of PAFs. The policy provides specific measures for vulnerable and poor groups. As of now there is no law on rehabilitation and resettlement in the country. The Rehabilitation and Resettlement Bill 2007 (Bill No. 98 of 2007)[1] has been introduced in Lok Sabha.

2.1.2 JBIC Guidelines for Confirmation of Environmental and Social Considerations

JBIC established "Japan Bank for International Cooperation Guidelines for Confirmation of Environmental and Social Considerations" on April 1, 2002, as unified guidelines of two environmental guidelines applied to International Financial Operations and Overseas Economic Cooperation Operations respectively. The Guidelines has been implemented from October 1, 2003.

JBIC Guidelines give guiding principles related to environmental consideration by JBIC in its appraisal of a project. They also give the environmental matters to be considered and environmental measures to be prepared by the recipient country in the planning and preparation stages of a project. Projects have been categorized into three basic categories A, B and C depending upon extent of involvement of significant environmental and social issues similar to other funding agencies such as World Bank and ADB.

As per JBIC guideline, projects must, in principle, be undertaken outside protected areas that are specifically designated by laws or ordinances of the government for the conservation of nature or cultural heritage (exeluding projects whose primary objectives are to promote the protection or restoration of such designated areas). Projects are also not to impose significant adverse impact on designated conservation areas.

JBIC guidelines focus on participation by stakeholders as local community inhabitants who will be affected by the project. They require the project executor to solicit stakeholders' participation from the projeet planning stage. The eheeklist to be confirmed by JBIC now includes social considerations pertaining to resettlement, indigenous people and women. Also more strengthened than in the previous guidelines is a provision on information disclosure.

[1] A bill is the draft of a legislative proposal, which, when passed by both the houses of Parliament and assented to by the President of India, becomes an Act of Parliament.

JBIC is required to make public such items as the category classification of the project prior to loan approval.

Projects must be adequately coordinated so that they are accepted in a manner that is socially appropriate to the country and locality in which the project is planned. For projects with a potentially large environmental impact, sufficient consultations with stakeholders, such as local residents, must be conducted via disclosure of information from an early stage where alternative proposals for the project plans may be examined. The outcome of such consultations must be incorporated into the contents of the project plan; □Appropriate consideration must be given to vulnerable social groups, such as women, children, the elderly, the poor and ethnic minorities, all of whom are susceptible to environmental and social impact and who may have little access to the decision-making process within society.

Involuntary resettlement and loss of means of livelihood are to be avoided where feasible, exploring all viable alternatives. When, after such examination, it is proved unfeasible, effective measures to minimize impact and to compensate for losses must be agreed upon with the people who will be affected;

People to be resettled involuntarily and people whose means of livelihood will be hindered or lost must be sufficiently compensated and supported by the project proponents, etc. in timely manner. The project proponents, etc. must make efforts to enable the people affected by the project, to improve their standard of living, income opportunities and production levels, or at least to restore them to pre-project levels.

Appropriate participation by the people affected and their communities must be promoted in planning, implementation and monitoring of involuntary resettlement plans and against the loss of their means of livelihood.

2.1.3 Other Donors' Guidelines for Environmental and Social Considerations

In addition to JICA, other international donors such as the World Bank (WB) and Asian Development Bank (ADB) are planning to finance the DFC Project for the other sections in the eastern corridor. While each donor apply their own environmental policy for the project, environmental and social considerations should be well harmonized in adequate matter not to cause deviation among railway sections under the same project on the environmental and social considerations.

Major safeguard policies and environmental guidelines for those donors are shown below.

1) WB

- Operational Policy 4.01 and Bank Procedure 4.01 (OP/BP 4.01): Environmental Assessment, 1999
- OP/BP 4.04: Natural Habitats, 2001
- OP/BP 4.36: Forests, 2002
- OP/BP 4.11: Physical Cultural Resources, 2006
- OP/BP 4.12: Involuntary Resettlement, December 2001
- OP/BP 4.10: Indigenous Peoples, July 2005
- Environmental Assessment Sourcebook, 1991 (updated chapter by chapter)

2) ADB

- The Bank's Policy on Environment, November 2002
- The Bank's Policy on Involuntary Resettlement, August 1995
- The Bank's Policy on Indigenous Peoples, April 1998

- Operations Manual on BP: Environment Considerations, September 2006
- Operations Manual on BP: Involuntary Resettlement, September 2006
- Operations Manual on BP: Indigenous Peoples, September 2006
- ADB Environmental Assessment Guidelines, 2003
- Handbook on Resettlement: A Guide to Good Practice, 1998

2.1.4 Comments from JICA Advisory Council of Environmental and Social Considerations Review

Since scale of the Project is large and large-scale involuntary resettlement is expected to occur, the DFC project was classified by JICA as "Category A" under the environmental categorization of the former JICA Environmental Guidelines in the preparatory study of the JICA F/S for the DFC project. Due to the Category A, the EIA level study including the ESIMMS conducted in the JICA F/S was reviewed by the JICA Advisory Council of Environmental and Social Considerations Review, which was composed of some members from various fields and organizations such as university and NGO.

During the JICA F/S for the DFC project, review meetings of the Advisory Council were conducted several times to review the EIA level study for the DFC project under the JICA F/S. In the end of the JICA F/S, the Advisory Council issued final official comments on 31st May, 2008. The comments were opened to the public through the web site of the JICA. Among the comments, some comments pointed out at shortage of the EIA level study conducted in the JICA F/S and requirements in further stage of the project. Considering the comments, scope of the S-ESIMMS was examined to cover such comments as much as possible with other items to be conducted in the current stage of the project. Main comments of the Advisory Council related to the S-ESIMMS are shown below.

Table 2-1 Main Comments of the Advisory Council Related to the S-ESIMMS

Comments of the Advisory Council
(1) Sufficiency of the Study
1) Accuracy of counting PAFs number Accurate number of the Project-Affected Families (PAFs) including the illegal occupants is required, but only estimation by visual observation in the field has been conducted.
2) Identification of PAPs and socio-economic survey Project Affected People (PAPs) need to be relocated should be identified and socio-economic surveys for such PAPs should be conducted.
(2) Natural environment study
1) Seasonal information Seasonal information has not been collected satisfactorily under the limited study period.
2) Corridor for migratory animals Corridor should be examined for the migratory animals due to construction of embankment structure for the DFC project.
(3) Pollution control 1) Land use Current land use should be surveyed to be utilized for further impact analysis of the noise and vibration.
2) Number of measurement sites for noise and vibration and coverage of impact analysis Although the impact analysis on noise and vibration has been conducted only for the sensitive receptors by conducting noise and vibration measurements for only 60 sites, impacts for house and other structure should also be examined.
3) Target level on noise and vibration In evaluating impacts of the nose and vibration, quantitative target levels on noise and vibration should be examined.
4) Water quality measurement The water quality measurement related to the bridge construction should be conducted in further stage of the project.
5) Mitigation measures with local conditions Mitigation measures should be proposed further by considering regional conditions.
(4) Environmental management plan
1) More detailed EMP Environmental management plan should be more concrete as well as monitoring plan in further stage of the project.
2) Role of NGOs in implementation of the resettlement plan Concrete proposal on employing the NGO should be required in implementing the resettlement plan.
(5) Project implementation plan
1) Further deliberations of implementation schedule for land acquisition and resettlement Detailed implementation schedule on land acquisition and resettlement should be prepared with more detailed information on process and surveys.

Note: The above comments are unofficial translation from the official comments written in Japanese issued by JICA on 31st March, 2008.

2.2 LIMITATIONS OF ESIMMS

2.2.1 Availability of Engineering Drawings and Topographic Sheets

Although RITES-II Report was finalised, necessary information for the ESIMMS, such as engineering drawings and topographic sheets were not available. Before the ESIMMS was started the JICA Study Team faced difficulties to implement the ESIMMS including the Stakeholder Meetings due to the lack of basic information on the DFC Project. Limitations of ESIMMS caused by the lack of essential information are as follows.

The three (3) major difficulties caused by limited availability of the project information are mentioned below.

1) Basic engineering drawings showing the relevant structure locations on a map with a scale of 1 to 50,000 have not been prepared by RITES when the ESIMMS was started. The plain figure and longitudinal profile only between Ajmer and Palanpur in the Western Corridor have been finalised as of August 2007.

2) It was not recognized by MOR that basic design drawings showing exact locations of the railway facilities should be provided for the Stakeholder Meetings because no EIA was conducted as a feasibility study of the railway development project in the past in India. After finalisation of the PETS-II Report, basic engineering design was revised several times. Therefore, in several districts, the Stakeholder Meetings were held without introducing the basic engineering drawings.

3) Due to limitation under Indian laws, topographic sheets of "Restricted Area", especially the southern part of the Western Corridor, were not procured. To obtain geographic information from alternative sources, satellite images were purchased and the extensive field survey was conducted. Thus, the DFC alignment was introduced with Google Earth™ in the Stakeholder Meetings. In addition, provisional locations of the DFC alignment within affected villages were identified by the longitude and latitude with Google Earth™.

Due to above mentioned reasons, there was a possibility that the basic engineering design would be changed in several districts after the feasibility study. Therefore, it was suggested to establish the mechanism to check the revised design compared to the result of the ESIMMS in the further stage of the project.

2.2.2 Material and Information Used

As mentioned previously, enough information for ESIMMS including engineering drawings showing all the relevant railway facilities in the study area was not available. To fill up the information gap, maps, satellite images and longitude and latitude data listed below were utilised to conduct ESIMMS, and the data was provided to local consultants for the Stakeholder Meetings, natural environmental study and social environmental study. In Table 2-2 to Table 2-4, availability of information on DFC Project in the preparation of ESIMMS is summarised.

1) Parallel Sections

Field work was carried out with standard cross-section drawings.

2) Detour Seetions

DFC alignment proposed by RITES with a scale of 1 to 50,000 was traced by the JICA Study Team together with satellite images and saved as a shape file by Geographic Information System (GIS). Based on the shape file, the longitude and latitude data of the DFC alignment was obtained with Google Earth™ as well as in the field, the survey locations were recorded by Geographic Positioning System (GPS) device.

3) Existing ROBs to be Replaced

The field work was carried out without drawings to be prepared by Indian side. Considering replacement method of ROB proposed by the JICA Study Team, likely impacts to social and natural environment were examined.

4) Level Crossings to be Replaced with ROBs

The field work was carried out without drawings to be prepared by Indian side. By

considering construction method of ROB proposed by the JICA Study Team, likely impacts to social and natural environment were examined.

Table 2-2 Available Data for ESIMMS (Western Corridor) (1/3)

State/District	Parallell Section	Detour Routes	Junction Station	Crossing Station	ROB(Re-construction)	Important Bridge	Available Drawings/Plan [3]	Action Taken for ESIMMS
1 Maharashtra								
1) Thane	Vasai Rd	-	-	-	-	-	Feasibility Report's 1:50,000 maps for the parallel section are available	Field work is possible to carry out without detailed topographic sheets
		-	-	-	Vasai Rd	-	Details of the reconstruction of ROB is not available	Explanation of the extent of impacts to PAFs is not possible but field work is possible to carry out
		-	-	-	Saphale	-	Details of the reconstruction of ROB is not available	Explanation of the extent of impacts to PAFs is not possible but field work is possible to carry out
		-	-	-	Kelve Rd	-	Details of the reconstruction of ROB is not available	Explanation of the extent of impacts to PAFs is not possible but field work is possible to carry out
		-	-	-	Umroli	-	Details of the reconst ruction of ROB is not available	Explanation of the extent of impacts to PAFs is not possible but field work is possible to carry out
		-	-	-	Dahanu Rd	-	Details of the reconst ruction of ROB is not available	Explanation of the extent of impacts to PAFs is not possible but field work is possible to carry out
		-	-	-	Boisar	-	Details of the reconst ruction of ROB is not available	Explanation of the extent of impacts to PAFs is not possible but field work is possible to carry out
		-	-	-	-	N Vaitharna	Details of the bridge are not available	It is in the parallel section and field work is possible to carried out
		-	-	-	-	S. Vaitharna	Details of the bridge are not available	It is in the parallel section and field work is possible to carried out
		-	-	Palghar	-	-	Details of crossing station are not available	Explanation to PAFs is not possible but approximate location is explained using "Google Earth TM" satellite images
		-	-	Navasari	-	-	Details of crossing station are not available	Explanation to PAFs is not possible but approximate location is explained using "Google Earth TM" satellite images
		-	-	Gholbad	-	-	Details of crossing station are not available	Explanation to PAFs is not possible but approximate location is explained using "Google Earth TM" satellite images
2 Gujarat								
1) Valsad		-	-	-	Valsad	-	Details of the reconst ruction of ROB is not available	Explanation of the extent of impacts to PAFs is not possible but field work is possible to carry out
		-	-	-	-	Daman Ganga	Details of the bridge are not available	It is in the parallel section and field work is possible to carried out
		-	-	-	-	Par	Details of the bridge are not available	It is in the parallel section and field work is possible to carried out
2) Navasari		-	-	-	-	Auranga	Details of the bridge are not available	It is in the parallel section and field work is possible to carried out
		-	-	-	-	S Kaveri	Details of the bridge are not available	It is in the parallel section and field work is possible to carried out
		-	-	-	-	N Kaveri	Details of the bridge are not available	It is in the parallel section and field work is possible to carried out
		-	-	-	-	Ambika	Details of the bridge are not available	It is in the parallel section and field work is possible to carried out
		-	-	-	-	N Poorna	Details of the bridge are not available	It is in the parallel section and field work is possible to carried out
		-	-	-	-	Mindhola	Details of the bridge are not available	It is in the parallel section and field work is possible to carried out
3) Surat		-	-	Vapi	-	-	Details of crossing station are not available	Explanation to PAFs is not possible but approximate location is explained using "Google Earth TM" satellite images
	Udhna Jn	-	-	Jorawasan	-	-	Details of crossing station are not available	Explanation to PAFs is not possible but approximate location is explained using "Google Earth TM" satellite images
		Surat	-	-	-	-	Not available but filed work is possible to carry out	Explicit field work is not possible and explanation to PAFs is not possible
		-	-	-	-	Tapi	Details of the bridge are not available	It is in the detour section and explicit field work is not possible and explanation to PAFs is not possible
4) Bharuch	Utran	-	Godhangam	-	-	-	Feasibility Report's 1:50,000 maps for the parallel section are available	Explanation to PAFs is not possible but approximate location is explained using "Google Earth TM" satellite images
		-	-	Sanjali	-	-	Details of crossing station are not available	Explanation to PAFs is not possible but approximate location is explained using "Google Earth TM" satellite images
	Ankleshwar	-	-	-	Vapi	-	Details of the reconst ruction of ROB is not available	Explanation of the extent of impacts to PAFs is not possible but field work is possible to carry out
		Bharuch	-	-	-	-	N/A	Explanation to PAFs was made using Google Earth TM satellite images
		-	-	-	-	Narmada	Details of the bridge are not available	The bridge is in the detour section and explicit field work is not possible and explanation to PAFs is not possible
	Nabipur	-	-	Varediya	-		Details of crossing station are not available	Explanation to PAFs is not possible but approximate location is explained using "Google Earth TM" satellite images
5) Vadodara	Makarpura	-	Makarpura	-	-	-	Feasibility Report's 1:50,000 maps for the parallel section are available	Explanation to PAFs is not possible but approximate location is explained using "Google Earth TM" satellite images
		Vadodara	-	-	-	-	-	Explanation of detour to PAFs was made using Google Earth TM satellite images
			-	-	-	Mahi	Details of the bridge are not available	The bridge is in the detour section and explicit field work is not possible and explanation to PAFs is not possible.Sample EIA is carried out

Table 2-3 Available Data for ESIMMS (Western Corridor) (2/3)

State/District	Parallell Section [1]	Detour Routes	Junction Station	Crossing Station	ROB/Re-construction)	Important Bridge	Available Drawings/Plan [2]	Action Taken for ESIMMS
I Maharashtra								
6) Anand		Vasad	-	-	-	-	N/A	Explanation to PAFs is not possible
			-	Vasad	-	-	Details of crossing station are not available	Explanation to PAFs is not possible but approximate location is explained using "Google Earth TM" satellite images
			-	-	Vasad	-	Details of the reconstruction of ROB is not available	ROB is deleted by new detour route suggested by JICA Study Team
			-	Changa	-	-	Details of crossing station are not available	Explanation to PAFs is not possible but approximate location is explained using "Google Earth TM" satellite images
7) Kheda			-	-	-	-	N/A	Explanation of parallel section to PAFs is possible and filed work is carried out
8) Ahmedabad		Ahmedabad	-	-	-	Sirl	Details of the bridge are not available	The bridge is in the detour section and explicit field work is not possible and explanation to PAFs is not possible/Sample EIA is carried out
			Sabarmati	-	-	-	Details of junction station are not available	Location and arrangement of junction station for explaining to PAFs is not possible but approximate location is explained using "Google Earth TM" satellite images
			-	-	-	Sabarmati	Details of the bridge are not available	The bridge is in the detour section and explicit field work is not possible and explanation to PAFs is not possible/Sample EIA is carried out
9) Ghandinagar			-	-	-	-	Details of detour routes are not available	Explanation of parallel section to PAFs is possible and filed work is carried out
10) Mahesana		Mahesana	-	-	-	-	Details of detour routes are not available	Explicit field work is not possible and exact extent of resettlement for explaining to PAFs is not possible
11) Patan	Bhandu Motidan	-	-	-	-	-	Feasibility Reports 1:50 000 maps for the parallel section are available	Explanation to PAFs is possible
12) Banaskantha		-	-	Siddhpur	-	-	Details of crossing station are not available/*Feasibility Reports* 1:50 000 maps for the parallel section are available	Explanation to PAFs is not possible but approximate location is explained using "Google Earth TM" satellite images
	Umardashi	-	-	-	Siddhpur	-	Details of the reconstruction of ROB is not available	Explanation of the extent of impacts to PAFs is not possible but field work is possible to carry out
		Palanpur	-	-	-	-	Details of detour routes are not available	Explicit field work is not possible and exact extent of resettlement for explaining to PAFs is not possible
	Kanjoda	-	Palanpur	-	-	-	Feasibility Reports 1:50 000 maps for the parallel section are available	Explanation to PAFs is not possible but approximate location is explained using "Google Earth TM" satellite images
	Shri Amirgadh	-	-	-	-	Saraswati	Feasibility Reports 1:50 000 maps for the parallel section are available but not the details of the bridge	It is in the parallel section and field work is carried out

Note 1) Nearest station name
2) Relevance to topographic feature that are comprehensive to the local residents

Table 2-4 Available Data for ESIMMS (Western Corridor) (3/3)

State/District	Parallel Section	Detour Routes	Junction Station	Crossing Station	ROB (Re-construction)	Important Bridge	Available Drawings/Plan [2]	Action Taken for ESIMMS
3 Rajasthan								
1) Sirohi	Amirgarh	-	-	-	-	-	Feasibility Report's 1:50,000 maps for the parallel section are available	Filed work is possible to carry out
2) Pali		-	-	Shri Amirgadh	-	-	Details of crossing station are not available	Explanation to PAFs is not possible but approximate location is explained using "Google Earth TM" satellite images
		-	-	Bhimana	-	-	Details of crossing station are not available	Explanation to PAFs is not possible but approximate location is explained using "Google Earth TM" satellite images
		-	-	Keshavganj	-	-	Details of crossing station are not available	Explanation to PAFs is not possible but approximate location is explained using "Google Earth TM" satellite images
		-	-	Bireliya	Bar	-	Details of crossing station are not available	Explanation to PAFs on the details of crossing station is not possible but approximate location is explained using "Google Earth TM" satellite images
		-	-	Jawali	-	-	Details of crossing station are not available	Explanation to PAFs is not possible but approximate location is explained using "Google Earth TM" satellite images
		-	Marwar	-	-	-	Details of junction station are not available	Explanation to PAFs is not possible but approximate location is explained using "Google Earth TM" satellite images
3) Ajmer		-	-	Chandawal	-	-	Details of crossing station is not available	Explanation to PAFs is not possible but approximate location is explained using "Google Earth TM" satellite images
		-	-	New Bar	-	-	Details of crossing station is not available	Explanation to PAFs is not possible but approximate location is explained using "Google Earth TM" satellite images
		-	-	Pipla	-	-	Details of crossing station is not available	Explanation to PAFs is not possible but approximate location is explained using "Google Earth TM" satellite images
	Gegal Akhli	-	-	Saradhna	-	-	Details of crossing station is not available	Explanation to PAFs is not possible but approximate location is explained using "Google Earth TM" satellite images
		-	-	Kishangarh	-	-	Details of crossing station is not available	Explanation to PAFs is not possible but approximate location is explained using "Google Earth TM" satellite images
	Kishangarh	-	-	-	-	-	Details of detour route is not available	Explicit field work is not possible and exact extent of resettlement for explaining to PAFs is not possible
	Mandawariya	-	-	Phulera	-	-	Details of crossing station is not available	Explanation to PAFs is not possible but approximate location is explained using "Google Earth TM" satellite images
		-	-	-	-	-	Feasibility Report's 1:50,000 maps for the parallel section are available	Filed work is possible to carry out
4) Jaipur		-	-	-	-	-	Feasibility Report's 1:50,000 maps for the parallel section are available	Filed work is possible to carry out
	Narsira	-	-	-	-	-	Feasibility Report's 1:50,000 maps for the parallel section are available	Filed work is possible to carry out
	Phulera	Phulera	Phulera	-	-	-	Details of detour route/junction station are not available	Explicit field work is not possible and exact extent of resettlement for explaining to PAFs on the detour routes and junction station are not possible
	Khandel	-	-	-	-	-	Feasibility Report's 1:50,000 maps for the parallel section are available	Filed work is possible to carry out
5) Sikar	Kishan Manpura	-	-	Malikapura	-	-	Details of crossing station are not available	Explanation to PAFs is not possible but approximate location is explained using "Google Earth TM" satellite images
	Ringas	-	-	-	-	-	Details of detour route are not available	Explicit field work is not possible and exact extent of resettlement for explaining to PAFs is not possible
	Sri Madhopur	-	-	Shrimadhopur	-	-	Details of crossing station are not available	Explanation to PAFs is not possible but approximate location is explained using "Google Earth TM" satellite images
		-	-	-	-	-	Feasibility Report's 1:50,000 maps for the parallel section are available	Filed work is possible to carry out
6) Nagaur		-	-	Bhageoa	-	-	Details of crossing station are not available	Explanation to PAFs is not possible but approximate location is explained using "Google Earth TM" satellite images
		-	-	Dabla	-	-	Details of crossing station are not available	Explanation to PAFs is not possible but approximate location is explained using "Google Earth TM" satellite images
		-	-	Ateli	-	-	Details of crossing station are not available	Explanation to PAFs is not possible but approximate location is explained using "Google Earth TM" satellite images
7) Alwar		-	-	-	-	-	Feasibility Report's 1:50,000 maps for the parallel section are available	Filed work is possible to carry out
2 Haryana								
1) Mahendar	Kholi						Feasibility Report's 1:50,000 maps for the parallel section are available	Filed work is possible to carry out
		(Rewari)	Rewari	-	-	-	No details of junction station is available	Explanation to PAFs is not possible but
2) Rewari	-	New	-	-	-	-	No details of junction station is available	approximate location is explained using

2.3 CHANGE OF CONDITIONS FOR ENVIRONMENTAL AND SOCIAL CONSIDERATIONS FOR THE PROJECT

2.3.1 Deviation between Guide Line Design and Finalized Project Planning to be Considered

In this S-ESIMMS, verification of the environmental condition of newly affected areas by the change in alignments associated with the facility design is required. Basic concept is to design alignment in such a way that settlements could be avoided so that relocation of settlements is minimized. Due to change in the alignments, 204 villages will be newly affected instead of 162 villages will be avoided among 470 total villages (428 affected villages at JICA F/S).

The field study related to ESIMMS such as boundary confirmation, land use, structure survey, sensitive receptor survey and natural environmental situation on the alignment should be conducted for the entire stretch of the detour section where alignment is changed because at the time of conducting ESIMMS no pillar was identified as the alignment of GLD on the ground. The study was conducted based on the GPS information using satellite images. The spatial deviation on the DFC alignment is described below.

(1) Alignment

The study of ESIMMS was conducted within the JICA F/S based on the primary alignment survey (PETS-2) at the stage of planning while the MOR was in the process of finalizing detail alignment based on field survey (FLS). The total lengths of study contained approximately 1,262 km from Vasai-Road in Maharashtra to Rewari in Haryana in Western Corridor and 756 km from Mughal Sarai to Dadri via Khurja in Uttar Pradesh in Eastern Corridor. As mentioned in the JICA study scope, the study did not cover fully finalized alignment, and FLS was expected to be complete in the year 2008, therefore this SAPROF study was conducted to verify the environmental items on the finalized alignment for the 1st priority section between Vadodara and Rewari in the electrified Western DFC.

In the GLD, the section between Vadodara and Rewari principally contained the new railway construction for detouring the heavy populated area or other important structures, etc. Those are 1) Vadodara - Ahmedabad Detour, 2) Palanpur Detour, 3) Kishangarh Detour, Phulera Detour, Ringas Detour and Rewari Alignment. Total lengths of the detour section are 293 km (Gujarat: 246 km and Rajasthan: 47km). In other words approximately 30% of the 920 km of present priority section at GLD is covered by the detour section. The rest of the location was planed to be constructed in parallel to the existing railway, jointly adding embankment to expand total width of existing railway. For the parallel section DFC principally joins at the eastern side of existing railway, although most of detour section is passing through the west side of the existing railway. The detour alignment is proposed to join to the existing railways with the flyover at each site. So each detour section is associated with the construction of the flyover. The associated cost of flyover and social consideration of the site are to be considered.

As a result of the SAPROF study, the deviations between the alignment proposed in Guideline Design (GLD) and the alignment finalized in Final Location Survey (FLS) were observed. The locations, where change in alignment was observed, are mentioned below in Table 2-5.

Total length was changed to approximately 940 km including connection line at the Rewari Junction Station. The plan contains approximately 302 km of Ahmedabad detour, 7.2 km of Phulera detour and 21.6 km of Rewari detour (including Connecting line).

The major changes of the detour section are;

1) Ahmedabad Detour route in the Gujarat was changed to avoid the built up area and

communities. The alignment of this section between Vadodara and Mahesana has been changed accordingly. In the GLD the alignment connecting Vadodara District to Mahesana District was planed detouring the heavily populated area in the Gujarat such as Anand, Nadiad, Ahmedabad, Kalol, and Mahesana. Total lengths of the detour section are 302 km and approximately 30% of the present priority section is covered by the detour section of Ahmedabad.

Also, the detour route was extended up to the area covering entire Mahesana District and connecting Palanpur Detour route proposed in GLD by JICA F/S at the west side of the Palanpur railway station ending at the south of existing Iqbalgarh railway station in Banaskantha District. Accordingly, the Palanpur Detour was partly modified to connect with the Ahmedabad Detour instead of diverting from the existing railway at the south.

2) Kishangarh Detour route was changed to be parallel using the area of the existing railway at the location.

3) Phulera Detour route was changed in its shape shortening the distance from the one proposed in GLD. Hence total length is approximately 7.2 km.

4) Ringas Detour route was changed to be parallel partly using existing ROW.

5) Rewari connecting line was changed slightly. The principle design at the Rewari Junction Station (the terminal station of the 1st priority section) ended approximately 1 km south west of the existing Khori Railway Station in the North Western Railway between Rewari and Phulera. The connecting line, a part of the facilities in the Junction Railway Station was not included in the ESIMMS due to the delay on the station design. The total length of detour is approximately 21.6 km including connecting line

Table 2-5 Deviations between GLD and Finalized Alignment

Section	Reason of Detour, Deviation
Section.5 to 9: Vadodara – Mahesana (1/2)	Avoided built-up areas & communities, etc in the Ahmedabad Detour.
Section 5 to 6: Vadodara-Mahesana (2/2)	Avoided built-up areas & communities, etc in the Ahmedabad Detour.
Section 6 to 7: Palanpur-Iqbal Gadh	Avoided build-up area, communities at existing railway and to join the Palanpur Detour section with Ahmedabad Detour section.
Section 8: Near Ext. Maval St.	The alignment was shifted with existing railway toward west to avoid hotel and housing structure.
Section 9: Near Ext. Abu Road St.	Small detour was made avoid existing workshop.
Section 9: Near Ext. Morthala St.	Small detour was made to void running through on a large pond with minimum 700 m curvatures.
Section 9: Near Ext. Kivarli St.	Small detour was made to adopt of minimum radius of 700 m.
Section 10: Near Ext. Jawai Bandh St.	Avoided body of water with minimum radius of 700 m.
Section 12: Bangurgram Stn.	DFCCIL plans to merging the existing cement siding into DFC.
Section 12: Kishangarh	Avoided built-up area and marble factories.
Section 12: Near Makrera Stn.	The alignment was slightly changed partly using the ROW of existing railway to adopt minimum radius of 700 m.
Section 12: Madar Stn.	Small detour was made to avoid the workshop next to Madar Stn. and grave yard area.
Section 13: Phulera JS.	Shape of the Phulera Detour was changed to avoid built-up areas by a shorter route than GLD.
Section 14: Kishan Manpura Stn.	Small detour was made to avoid Kishan Manpura Stn. building and platform by relocation of some railway quarters in the premises. SAPROF team suggested shifting the existing line to the west side and utilising the vacant space for DFC.
Section 14: Ringas Stn.	Detour route was changed to be parallel covering the smaller area than the GLD with the plan of ROB to be reconstructed by NHAI
Sections 15 to 16: Rewari JS Stn.	Rewari Terminal JS needs a large area plus consideration of eastward extension and connection with the existing lines.

As minor changes were also found at the parallel section which the alignment was slightly shifted in parallel from the GLD. Abu Road railway station and Sirohi railway station are examples having minor changes to avoid some large scale structures, workshop, cement siding and housings as showing in Table 2-5.

(2) Change in the structures and facilities

1) Right of Way

The Right of Way (ROW) of DFC was changed from that used in ESIMMS. The ROW is assumed as 70 m and 50 m for detour section and parallel section respectively. ROW was earlier at the time of ESIMMS was assumed as 43.5 m and 12.5 m for detour sections and parallel sections respectively.

2) Junction Station and Crossing Station

In accordance with the alignment change, the location of seven (7) Junction Stations with the connecting line considering the connectivity on the site was determined as shown below. Also, seventeen crossing stations were identified on the FLS drawings. Thus, for junction station the location and connectivity to existing lines was planned by SAPROF Study Team.

Table 2-6 Deviations in Design of Junction Station

Junction Station	FLS Section No.	JICA GLD Chainage (Km)	Deviations identified
Makarpura	5	420.0	- North side route is shifted toward south - Enclosed area - South side route is changed to detour.
Sabarmati	6&7	560.0	- Route is shifted towards west. - Clover-type layout encloses a wide area of land. - Decision of providing connecting line from JNPT to Viramgam is subject to future traffic demand.
Mahesana	7&8	611.0	- Function of JS is impaired by connecting method at "waiting track" and "at-grade crossing"
Palanpur	8	673.0	- Function of JS is who impaired by connecting method at "waiting track" - Southbound connection route is missing.
Marwar	11	881.0	- Route is shifted toward existing station plaza to built-up area bringing social environment problem.
Phurela	13	1,100.0	- Route and location is not reflected GLD of detour route. - Layout can improve to avoid enclosing broad area.
Rewari	15&16	1,310.0	- Plan is entirely changed. - Huge logistic park (4.6 km * 1.3 km) is planned with Junction station. - Much rearrangement of existing Rewari Yard is required. - Near existing Rewari JS, extensive land acquisition in built-up area is neecssary, and is likely to bring social & environment problem.

3) ROB subject to reconstruction

The number and location of the ROB subject to reconstruction in the section was changed to be one in the Amarpura Village in Pali District, Rajasthan instead of the two (2) proposed in the GLD. The other ROB is currently located at the south of existing Sidhpur Railway Station in Gujarat and the section which includes the ROB was changed to be detour route. The

following two existing bridges between Vadodara and Rewari were identified in the JICA F/S to be reconstructed in the Project.

Location (Chainage of existing line)	Station in Proximity	Section
km364+000	Amarpura	Bar - Sendra
km148+000	Ringas JS	Ringas JS - Shri Madhopur

Source: JICA Feasibility Study Report

DFCCIL has confirmed that they have discussed with NHAI regarding the reconstruction of the existing ROB at Ringas JS capable of accommodating the DFC double stack containers. Thus only one ROB which is located near Amarpura need to be reconstructed in the DFC Project under Japanese finance.

4) Important/Major Bridges

The issues related to the design of important/major bridges are still being finalized at the time of the SAPROF study. For some important bridges such as one at Sabarmati River, hydrological modelling study is being carried out. Design of bridges will be prepared taking into consideration the result of such study. The other issue is the presence of endangered species in the river. During ESIMMS endangered species of reptile was found in Mahi River. Additional field surveys on the existence of fauna will be carried out at the location where bridge is proposed to be constructed.

Following rivers are located in the area of the detour section and the crossing points were changed.

a) The alignment passes the Vishwamitri River at the Khalipur Village, Vadodara Sub-district, Vadodara. (GLD at Alamgir Village, Vadodara)

b) Mini River, Anagadh Village, Vadodara Sub-district, Vadodara

c) Mahi River, Kotna Village, Vadodara

d) Vatrak River, Vasna Bujarg Village, Kheda Sub-district, Kheda

e) Sabarmati River, Miroli Daskroi Sub-district, Ahmedabad

f) Saraswati River, Dethli Village, Sidhpur Sub-district, Patan

2.4 VALIDITY OF ESIMMS AND NECESSARY FURTHER STUDIES

2.4.1 Validity of ESIMMS and Necessary of Supplementary Studies

The ESIMMS has been conducted under the limited period with limited information on both engineering and environmental & social aspects of the Project in the JICA F/S. In addition to limitations in the ESIMMS, new project-affected area were identified due to the changes of the alignment of DFC Project after the JICA F/S. Considering the former JBIC Environmental Guidelines as well as WB and ADB guidelines, and major comments of the JICA Advisory Council of Environmental and Social Considerations Review, the following were considered to be required in the S-ESIMMS to complement the EIA level study in addition to the ESIMMS.

1) Pollution Control

a) Improvement of precision of noise and vibration unit levels;

b) Identification of the sensitive receptor (SR) along the alignment for all sections for noise and vibration;

c) Collection of land use data;

d) Based on the above unit levels and relevant data, more accurate prediction of noise and vibration levels and impacts

2) Natural Environment

a) Supplementary data collection, especially related to the seasonal change and precious fauna species;

b) Collection of water quality at the proposed bridge construction sites in the major rivers

3) Social Considerations

a) Identification of the project-affected structures to be relocated within ROW as well as identification of number of PAPs residing in the structure;

b) Further socio-economic data collection for the PAPs though the socio-economic survey with 20% samples of total PAPs;

c) Update framework of rehabilitation and resettlement plan, considering change of alignment, results of above surveys, policy and act to be newly applied for the Project such as Railways (Amendment) Act, 2008 and National Rehabilitation and Resettlement Policy 2007, etc.

4) Overall

a) Update of the environmental mitigation measures and Environmental Management and Monitoring Plan by incorporating the above supplementary data

2.4.2 Necessary Further Public Consultation Meeting

A series of the public consultation meetings (PCMs) have been conducted for the project-affected peoples in the preparation process of ESIMMS during the JICA F/S. The PCMs conducted during the JICA F/S were considered to meet requirements in preparation process of the EIA under both former JICA and former JBIC Environmental Guidelines. However, new project-affected areas were identified due to the changes of the alignment of DFC Project after the JICA F/S. Therefore, supplementary PCMs in such newly identified villages have to be conducted to complement the public consultation process in preparation process of the EIA.

CHAPTER II-3 SCOPE OF SUPPLEMENTAL ESIMMS

3.1 POLLUTION CONTROL

3.1.1 Introduction

The study of pollution control in this S-ESIMMS aims to obtain the adequate baseline data on the potential impacts by the DFC Project such as water quality at the proposed bridge sites and noise and vibration in the areas affected by the DFC Project.

Due to the limited available data of the faster freight train which correspond to the DFC, the impacts on the noise and vibration were anticipated through obtaining filed measurement of 1) noise and vibration levels at similar cases of the DFC, and 2) background noise and vibration level at the existing railway in the Western Corridor.

Unit level for noise and vibration were obtained through field measurement of the noise and vibration generated by freight train under the similar operational condition to the DFC, at the west of existing Khurja Junction Station in Aligarh-Dadri section of Northern Central Railway (NCR). The similar operational cases were determined through field observation and interview of the local railway officers to identify suitable location for noise and vibration measurement. The selected locations for noise and vibration were; 1) Mathura-Kosi section of NCR-DRM/Agra (Northern Central Railway) and 2) Aligarh-Dadri section of NCR.

Background noise and vibration levels were measured at densely populated and potentially affected areas in the Western Corridor of DFC Project.

Based on the obtained data on the noise and vibration, the impacts by the DFC were predicted and adequate mitigation measures were proposed.

3.1.2 Noise and Vibration

(1) Objectives

1) To obtain unit levels of noise and vibration of freight trains to use for the prediction of the impacts along the alignments of the Dedicated Multimodal High Axle Load Freight Corridor (DFC);
2) To grasp current noise and vibration levels at the existing tracks to use for the prediction of the impacts along the parallel sections of the DFC
3) To assess impact of noise and vibration generated by the DFC to establish adequate mitigation measure for the impacts.

(2) Scope of Noise and Vibration Study

Japanese standard of noise measurement, JIS Z 8731 (Method of Measurement of Noise Level), was used for noise measurements which is same as the ISO standard. Since there is no particular standard method for measuring railway noise in India, noise measurements are generally conducted following the ISO. Similarly, Japanese vibration measurement standard, JIS Z 8735 (Method of Measurement of Vibration Level) was used for vibration measurement. However, X, Y, Z-axis measurement that complies with ISO was used as common method in India instead of the Japanese general method mainly measuring only the Z-axis.

1) Measurement Sites

The adequate number of locations were selected for measurements of unit level of noise and vibration based on the recommendations of MOR. Field reconnaissance was also conducted to find the appropriate location. The selected locations are; 1) Mathura-Kosi section of NCR-DRM/Agra (Northern Central Railway), 2) Aligarh-Dadri section of NCR, 3) Orissa.

Noise and vibration due to the existing railway were measured to predict DFC impact in parallel section. In parallel section, besides newly establish DFC railway, noise and vibration from the existing railway should be considered to minimize the impact at the operation period. The measurements were mainly conducted at the densely populated area in the Western Corridor. The selected areas are located in Narnaul, Kishangarh, Ajmer, Marwar and Abu Road as shown in the Figure 3-1 and Table 3-1.

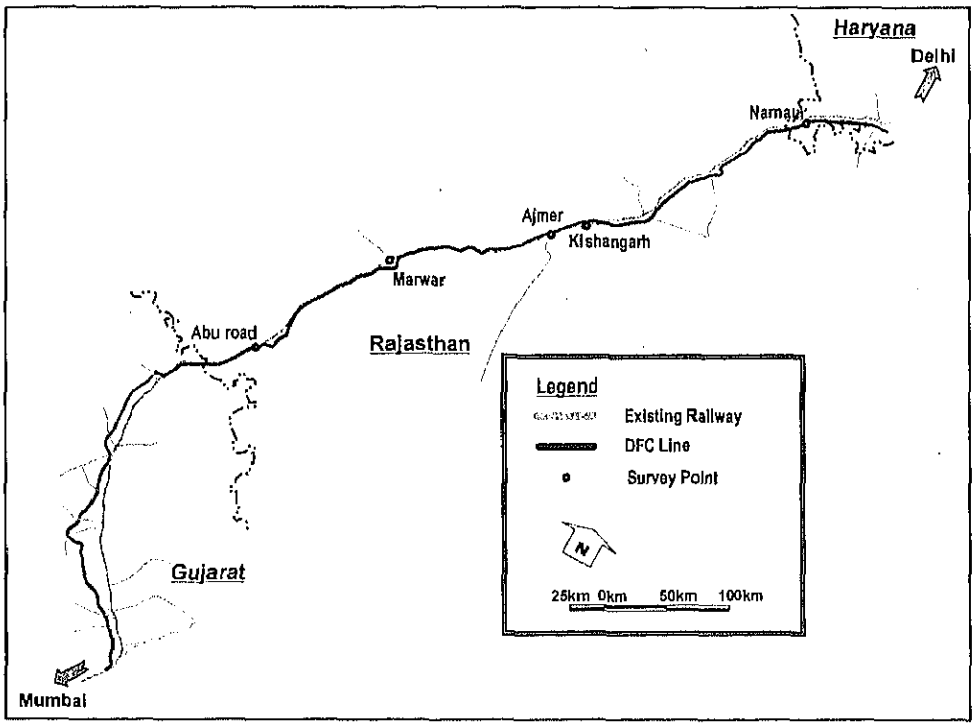


Figure 3-1 Noise and Vibration Measurement Site

Table 3-1 Noise and Vibration Measurement Site

Survey Point	No.	Location		Numbers of measurement point	Reasons
		Latitude	Longitude		
Abu Road	1	24°29'20.34"N	72°47'34.60"E	2 (13.0m,26.0m)	Residential area
	2	24°28'39.42"N	72°46'56.64"E	1 (10.0m)	Residential area
Marwar	1	25°43'39.87"N	73°36'59.36"E	2 (18.0m,32.0m)	Residential area
	2	25°43'31.48"N	73°36'51.37"E	1 (15m)	Near temple
Ajmer	1	26°27'22.20"N	74°40'44.28"E	1 (12.5m)	Residential area
	2	26°25'38.22"N	74°39'10.08"E	2 (3.5m,14.1m)	Residential area
Kishangarh	1	26°35'31.70"N	74°51'45.85"E	2 (15.0m,30.0m)	Near house
	2	26°35'18.31"N	74°51'06.00"E	1 (16.8m)	Residential area, near temple
	3	26°35'17.19"N	74°51'02.97"E	2 (15.0m, 22.0m)	Residential area, near temple
Narnaul	1	28°02'19.36"N	76°06'34.54"E	1(--)	Residential area

Survey Point	No.	Location		Numbers of measurement point	Reasons
		Latitude	Longitude		
	2	28°02'17.58"N	76°06'26.75"E	1 (—)	Residential area
	3	28°02'06.06"N	76°05'54.60"E	1 (—)	Near school and temple

Note1: Only background noise measurement was conducted. Currently no train runs in Narnaul because of construction of existing railway.
Note2: ( ) indicates the distance from center of existing railway line.

2) Survey for Unit Levels of Noise and Vibration

Noise and vibration levels of the freight trains have been measured in the existing tracks where the trains run with relatively high speed, heavy load and without the interference of background noise and vibration. Measurement has been conducted in accordance with the guidelines prepared by the SAPROF Study Team. The specifications of noise and vibration unit level measurement are presented in Table 3-2.

Table 3-2 Specifications of Noise & Vibration Unit Level Measurement

Item	Specifications
Noise	
Noise Level Meter	Noise Level Meter which complies with "JIS C 1509-1: 2005 Electroacoustites-Sound Level Meters- Part1: Specifications"
Measurement Points	*Total five points from the centre of the outer railway track*
Measurement Parameter	LAeq (equivalent continuous A-weighted sound pressure level) Lp (peak level)
Frequency Weighting	A
Time Weighting/Response	Slow
Other Data to be Recorded	Date & time, location, train load (container/bulk), number of train cars, train length, passage time, train speed, pictures, information on surrounding environment, etc.
Additional Measurement	Frequency Analysis is conducted. Necessary data are recorded.
Vibration	
Equipment	Vibration Level Meter which complies with "JIS C 1510:1995 Vibration Level Meters"
Measurement Points	Total five points from the centre of the outer railway track
Measurement Parameter	Lp (peak level)
Vibration Directions	*X, Y and Z directions*
Time Weighting/Response	Slow
Data to be recorded	Date & time, location, train load (container/bulk), number of train cars, train length, passage time, train speed, pictures, information on surrounding environment, etc.
Additional Measurement	Frequency Analysis to identify the predominant frequency is conducted. Necessary data are recorded.

3) Background Noise and Vibration Measurement

Survey for current noise and vibration levels along the parallel sections of the DFC was conducted. The location of existing noise & vibration survey has been identified by the SAPROF Study Team. Measurement has been conducted in accordance with the guidelines prepared by the SAPROF Study Team. The specifications of noise & vibration measurement of existing railways are presented in Table 3-3.

Two (2) to three (3) sites were selected in each area for the railway noise and vibration measurement. Similarly, background noise and vibration measurement was conducted at the

same sites during the time when trains did not pass through. However, at the Narnaul station, only background noise was measured due to no train operation caused by the ongoing construction of the railway.

Table 3-3 Specifications of Noise and Vibration Measurement of Existing Railways

Item	Specifications
Noise	
Noise Level Meter	Noise Level Meter which complies with "JIS C 1509-1: 2005 Electroacoustitcs-Sound Level Meters- Partl: Specifications"
Measurement Points	Total five points from the centre of the outer railway track
Measurement Parameter	LAeq (equivalent continuous A-weighted sound pressure level) Lp (peak level)
Frequency Weighting	A
Time Weighting/Response	Slow
No. of Measured Trains	50 trains in the single track + 50 trains in the double tracks = 100
Other Data to be Recorded	Date and time, location, train types (freight/passenger) & load (container/bulk), number of train cars, train length, passage time, train speed, pictures, information on surrounding environment, etc.
Additional Measurement	Frequency analysis is conducted. Necessary data are recorded.
Vibration	
Equipment	Vibration Level Meter which complies with "JIS C 1510:1995 Vibration Level Meters"
Measurement Points	Total five points from the centre of the outer railway track
Measurement Parameter	Lp (peak level)
Vibration Directions	X, Y and Z directions
Time Weighting/Response	Slow
No. of Measured Trains	50 trains in the single track + 50 trains in the double tracks = 100
Data to be recorded	Date and time, location, train load (container/bulk), number of train cars, passage time, train speed, pictures, information on surrounding environment, etc.
Additional Measurement	Frequency analysis to identify the predominant frequency is conducted. Necessary data are recorded.

4) Impact prediction and evaluation

Obtaining the Sound Power Level (PWL) in noise and Standard Vibration Level (SLV) in vibration, distance attenuation of noise and vibration were derived using the empirical formulae proposed by Railway Technical Research Institute of Japan in 1996. Based on the attenuation trends of the noise and vibration as following conditions, the impacts were predicted and evaluated to establish adequate mitigation measure and monitoring plan. Overview of the prediction and evaluation on the noise and vibration are summarized in the Figure 3-2.

a) Target of Prediction

Target of prediction is railway noise (L_{Aeq}) after DFC would be placed in service.

b) Term of Prediction

As the term of prediction, the time when the railway would be operated steadily after

placed in service has been targeted.

c) Prediction location

Twelve (12) prediction locations were selected in parallel section and five (5) locations in detour section, in where there are residential area and commercial area alongside the railway alignment. Here, the impact assessment was not limited only to Sensitive Receptors, but also to the residents of commercial and residential area. In JICA F/S report prediction of the impacts were limited to Sensitive receptors only.

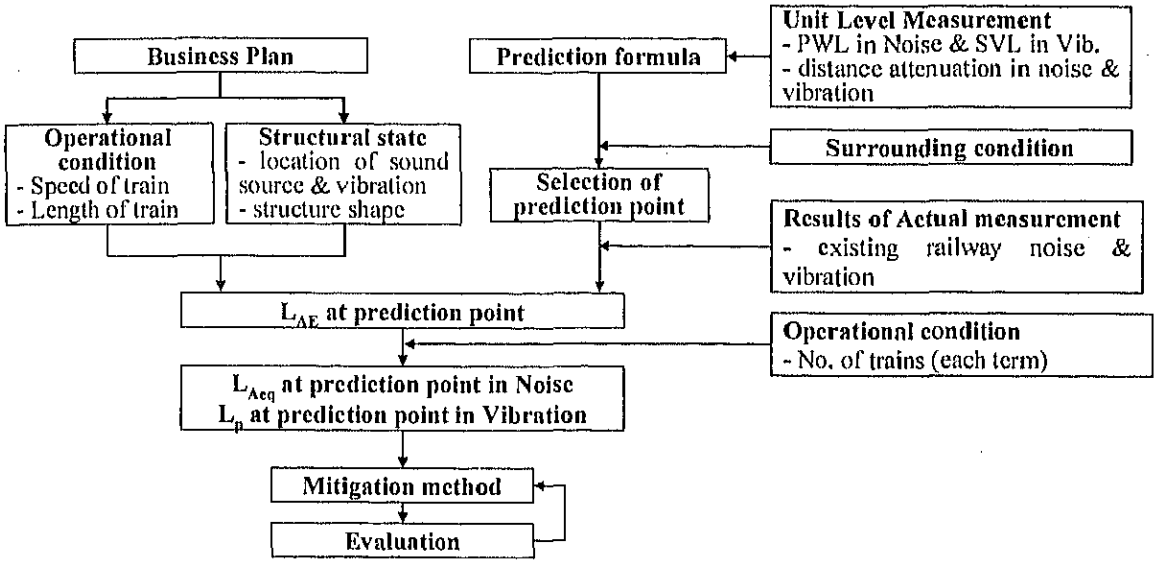


Figure 3-2 Procedure for Prediction of Noise Level and Vibration Level

3.1.3 Water Quality

(1) Objectives

To assess the impact and to establish monitoring procedure, water quality of major rivers flowing within the study area is analyzed. Secondary data on river water quality and flow rate are collected from the State Pollution Control Board (SPCB). Based on the analysis of primary and secondary data, the water quality of major rivers in the study area will be determined. The samples for water quality are collected from the proposed location of bridges, as well as from upstream and downstream.

The DFC alignment crosses some important rivers (Sabarmati River, Mahi River, Balaram River, Vishwamitri River, Vatrak River, etc.) and canals (Narmada Canal) at different locations in Gujarat. Surface water has been found as an important source for catering to the local needs of water consumption for various purposes, mainly irrigation, domestic as well as drinking. Therefore, any kind of deterioration owing to the developmental activities in the quality of surface water will pose some threat to the population and attention needs to be paid towards maintaining the quality of water using all possible tools such as monitoring with spontaneous remedial suggestions, if required.

(2) Scope of Water Quality Study

Keeping in view the importance of surface water to the local people and drawing up the baseline data, 30 representative surface water quality monitoring stations are selected for the monitoring and assessment of surface water quality.

Water samples (grab samples) were collected in the month of August 2008 from all these stations. Prior to departure to the field, all sample containers were initially leached and washed thoroughly with tap water and then with Double-Distilled water and dried. All the basic precautions and care were taken during the sampling to avoid contamination.

The samples were analyzed for relevant physical and chemical parameters for drawing up the baseline data. Parameters such as pH, water temperature and Dissolved Oxygen (DO) were measured in situ. While characterizing water samples, analytical methods for various parameters have been adopted from 'Standard Methods for the Examination of Water and Wastewater APHA AWWA WEF 19th edition (1995)' and standard methods and procedures prescribed by the Central Pollution Control Board (CPCB), e.g. relevant IS Codes (IS:2488 (Part-1 to 5) "Methods for Sampling and Testing of Industrial Effluents".

3.2 NATURAL ENVIRONMENT

3.2.1 Introduction

The supplemental study is conducted from the beginning of July 2008. The study mainly focus on revealing the impact on newly affected area due to change in alignment, protected species present in the major river environment, flora and faunal situation in the area closely passing through the Wildlife Sanctuary and impact to flora such as vegetation and forest. Considering the time scheme of the study, the comprehensive authentic information is explored about the locations of the protected species by conducting field survey by the expert on the relevant species. Base line survey of the river water quality is collected from the government source and those are confirmed by actual sampling from the rivers in the rainy season.

3.2.2 Flora

(1) Objectives

1) To verify impacts on the natural environment by the development of the Dedicated Freight Corridor between Vadodara, Gujarat and Rewari, Haryana (DFC) and the relevant facilities by collecting supplementary secondary data and conducting the supplemental field surveys, and

2) To update Environmental Management Plan and Environmental Monitoring Plan of the Environmental and Social Impacts Mitigation Measures Survey (ESIMMS) reports including the environmental mitigation measures.

(2) Scope of S-ESIMMS Regarding Flora

The scope of survey on regarding flora in this S-ESIMMS is summarized below:

1) Geological location of the forest area, Reserved Forest/ Protected Forest/ Un-classed Forest, directly affected by DFC is verified. The literature related to natural environment available with local government like district wise Working Plan of the Forest Division, Management Plan of Wildlife Sanctuary, are collected as supplemental secondary data for ESIMMS.

2) The species of flora along the final alignment and the boundaries of the relevant facilities are

verified by conducting reconnaissance survey in association with Range Officer/ Forest Guards of the State Forest Department. The exact location of the forests and their status are confirmed through interview with the officials and seasonal variation is studied.

3) The trees getting directly affected by the railway construction are identified by visual counting method (walk through the railway track). The number of trees to be felled for construction of DFC is counted. Trees having more than 30 cm girth size (diameter) and 1.5 m of height existing within 50m from the centerline of the last track on the eastern side are counted.

4) The vegetation of Wildlife Sanctuary/ Reserved Forest areas is characterized by adopting standard quadrate method and random sampling approach. The quadrate technique is easy to use in communities with a profile low enough that a frame can be placed over the area to be sampled and also appropriate for forest communities that are open enough to allow plot boundaries to be marked easily and accurately with a tape measure. Quadrate survey and random sampling are conducted in those places where no data was collected during the ESIMMS.

5) The species of flora, fauna; location of Reserved Forest/ Protected Forest/ Un-classed Forest, Wildlife Sanctuary are identified along the finalized alignment of DFC and the boundaries of the relevant facilities by conducting reconnaissance survey in association with Range Officer/ Forest Guards of the State Forest Department

6) Supplemental secondary data in terms of district-wise Working Plan of the Forest Division, Management Plan of Thol Bird Sanctuary; Management Plan of Balaram Ambaji Wildlife Sanctuary are obtained.

7) The vegetation of Wildlife Sanctuary/ Reserved Forest area is characterized adopting standard quadrate method and random sampling approach.

3.2.3 Fauna

(1) Objectives

1) To verify impacts on the natural environment by the development of the Dedicated Freight Corridor between Vadodara, Gujarat and Rewari, Haryana (DFC) and the relevant facilities by collecting supplementary secondary data and conducting the supplemental field surveys

2) To update Environmental Management Plan and Environmental Monitoring Plan of the Environmental and Social Impacts Mitigation Measures Survey (ESIMMS) reports including the environmental mitigation measures.

3) To identify potentially affected fauna by the newly determined DFC alignment based on the governmental information and result of interview survey to the academicians, governmental officials and local residents.

4) To cover the seasonal difference of the Fauna in DFC alignment affected area particularly those areas which are close to the Wildlife sanctuaries.

5) To identify the habitats of important species such as Indian Soft-shell Turtles. Field survey with secondary information collection is conducted to study the habitats/distribution of Indian Soft-shell Turtles in the stretches where bridges have been proposed over Mahi River, Viswamitri River, Vatrak River and Sabarmati River. Field survey is conducted covering an area of 10 km stretch of river (5 km upstream & 5 km downstream from the bridge location).

(2) Scope of S-ESIMMS Regarding Fauna

1) Supplemental study on fauna

a) Supplemental secondary data on fauna including hearings from local people, research institutes, universities, NGOs and jurisdictional administration offices in the each district and state is collected along the finalized alignment of DFC and WLSs.

b) The WLSs to be surveyed are specified below:

- Mt. Abu WLS in Sirohi, Rajasthan,
- Balaram Ambaji WLS, Banas Kantha, Gujarat,
- Jossore, Banaskantha, Gujarat, and
- Thol Lake WLS (bird sanctuary), Kadi sub-district, Mahesana, Gujarat
- Sambarh Lake WLS

The data collection is made mainly from the view points of seasonal changes on the habitats of plant and wildlife including invertebrate and migrating activities.

c) Supplementary field reconnaissance on the flora, fauna and ecosystem in and around the above-mentioned WLSs is conducted near the finalized alignments and relevant facilities. The field reconnaissance is made by academic experts such as research institutes and/or universities of the relevant scientific fields.

d) The results of the secondary data collection, hearings and the field reconnaissance are summarized.

e) Impacts on fauna, flora and ecosystem of the WLS near the finalized alignments and relevant facilities are verified in depth by analyzing the results of this supplementary survey and reviewing the previous findings in the ESIMMS.

f) Environmental mitigation measures on the natural environment together with updated Environmental Management Plan and Environmental Monitoring Plan are proposed.

2) Supplementary Field Survey on the protected faunal species, Habitats of Indian Soft-shell Turtles and other reptile species in the major rivers.

a) The secondary data on habitats of Indian Soft-shell Turtles (*Aspideretes gangeticus*) and other important species in and around the sections where the planned bridges crosses Mahi River are collected.

b) Hearings from academic experts in Indian softshell turtles are conducted.

c) The field survey on habitats of Indian Soft-shell Turtles (*Aspideretes gangeticus*) in and around the sections where the planned bridges crosses Mahi River is conducted together with the academic expert in Indian Soft-shell Turtles. The survey areas include the area in/along the Mahi River starting from 5 km downstream to 5 km upstream from the planned bridge.

d) A series of maps showing habitats of Indian Soft-shell Turtles are prepared along with the record of the information of the field survey such as day & time, locations (longitude and latitude), weather and pictures.

e) The results of the secondary data collection and the field survey are summarized.

f) Environmental mitigation measures on the natural environment together with updated Environmental Management Plan and Environmental Monitoring Plan are

proposed.

3.3 SOCIAL CONSIDERATIONS

(1) Project-Affected Structure Identification Survey

A Project-Affected Structure Survey is conducted to identify all the Project Affected Structures and Families (PAFs) in the Right of Way (ROW) of the finalized alignments of the DFC between Rewari in Haryana State and Vadodara in Gujarat State and in the boundaries of the relevant facilities.

In the parallel section, field survey is conducted to identify all the Project Affected Structures (PASs) coming within 50 m from the centre of the outer railway track on the side of widening along the finalized alignments of the DFC and the boundaries of the relevant facilities. In the detour section, field survey is conducted to identify all the Project Affected Structures (PASs) coming within the proposed ROW with 70-m width through out the finalized alignments of the DFC and the boundaries of the relevant facilities. During the survey, the number of families in the PAS as Project Affected Families (PAFs)[1] is also counted. Other information on family properties and socio-economic aspects is also collected using a questionnaire. A data base of Project Affected Structures (PASs) is prepared including the serial number, structure types, picture and other relevant data.

(2) Socio-economic Survey

In order to examine possible socio-economic impacts by the Project and assist the counterparts to prepare the Rehabilitation and Resettlement Plan (RRP), the Socio-economic Survey of 20% of the PAFs is conducted through out the streteh including 25 PAFs in each district whose agricultural lands are going to be affected by the project. The survey is conducted through questionnaire. The results of the questionnaire survey are analyzed and summarized.

In addition, the results of the SR and Land Use Surveys for the noise and vibration aspects are also utilized in examination of the soeial impacts.

(3) Preparation of Up-dated Framework of Rehabilitation and Resettlement Plan

An up-dated framework of Rehabilitation and Resettlement Plan is prepared taking account of latest information related to the Project and Rehabilitation and Resettlement Plan. Major details to be incorporated for the updates are shown as follows;

a) Latest railway alignment;
b) Railways (Amendment) Act, 2008;
c) National Rehabilitation and Resettlement Policy, 2007;
d) Project-Affected Structure Identification Survey under the S-ESIMMS;
e) Socio-economic Survey under the S-ESIMMS;
f) JICA (Ex-JBIC) Guidelines for Confirmation of Environmental and Social Considerations, 2002

[1] "Project Affected Families (PAFs)" mean families to be relocated or to be affected by the Project in accordance with the National Rehabilitation and Resettlement Policy 2007.

3.4 PUBLIC CONSULTATION MEETING

In the preparation stage of the EIA, the first and second stage of public consultation meetings (PCMs) at district level under the Environmental and Social Impact Mitigation Measures Study (ESIMMS) were held under the JICA F/S between February and July 2007. In addition, during PCMs, feedback meeting at village level was also conducted to secure the information dissemination and opinion collection at the PAP level.

Due to change in the alignment of the DFC Project after the JICA F/S, the PCM has to be conducted for the villages which are newly recognized as the Project-Affected Area. New villages where PCM need to be conducted are spread in 13 districts of three states. About 119 villages in Gujarat, 56 villages in Rajasthan, and 29 villages in Haryana require PCM. Lists of the project-affected village are shown in Appendix II-3-1.

CHAPTER III-1 POLLUTION CONTROL STUDY

1.1 NOISE

1.1.1 Study Methodologies

(1) Survey on Regulations of Railway Noise

The published literature and governmental documents, existing regulations related to the noise pollution in India and those in Japan were reviewed to grasp potential impacts and to consider mitigation measures.

(2) Field Measurements

1) Railway and Background Noise Measurement along the Parallel Section

a) Measurement Sites

Railway and background noise levels along the existing railway are measured to predict DFC impact in parallel section. In parallel section, besides newly establish DFC railway, noise from the existing railway should also be considered to understand the actual impact at the operation period. The measurements are mainly conducted at the relatively densely populated areas, i.e. Narnaul, Kishangarh, Ajmer, Marwar and Abu Road as shown in Figure 1-1 and Table 1-1.

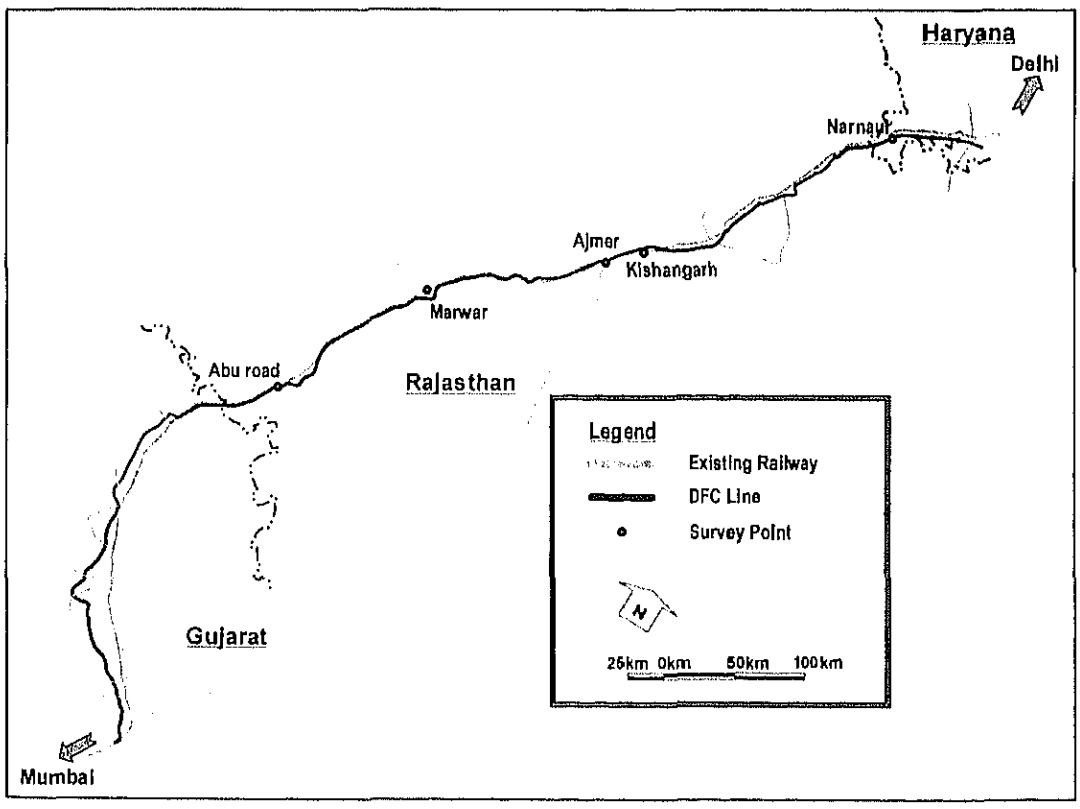


Figure 1-1 Location of Noise Measurement Sites

Table 1-1 Details of Noise Measurement Sites

Target Area	No.	Location		Numbers of Measurement Sites	Reason
		Latitude	Longitude		
Abu Road	1	24°29'20.34"N	72°47'34.60"E	2 (13.0m,26.0m)	Residential area
	2	24°28'39.42"N	72°46'56.64"E	1(10.0m)	Residential area
Mar war	1	25°43'39.87"N	73°36'59.36"E	2 (18.0m,32.0m)	Residential area
	2	25°43'31.48"N	73°36'51.37"E	1 (15m)	Near temple
Ajmer	1	26°27'22.20"N	74°40'44.28"E	2 (12.5m,21.5m)	Residential area
	2	26°25'38.22"N	74°39'10.08"E	1 (14.1m)	Residential area
Kishangarh	1	26°35'31.70"N	74°51'45.85"E	2 (15.0m,30.0m)	Near house
	2	26°35'18.31"N	74°51'06.00"E	2 (16.8m,31.0m)	Residential area, near temple
	3	26°35'17.19"N	74°51'02.97"E	2 (15.0m,22.0m)	Residential area, near temple
Narnaul	1	28°02'19.36"N	76°06'34.54"E	1 (—)	Residential area
	2	28°02'17.58"N	76°06'26.75"E	1 (—)	Residential area
	3	28°02'06.06"N	76°05'54.60"E	1 (—)	Near school and temple

Note1: Only background noise measurement was conducted. Currently no train runs in Narnaul because of on-going construction for gauge conversion of existing railway.
Note2: ( ) indicates the distance from center of existing railway line.

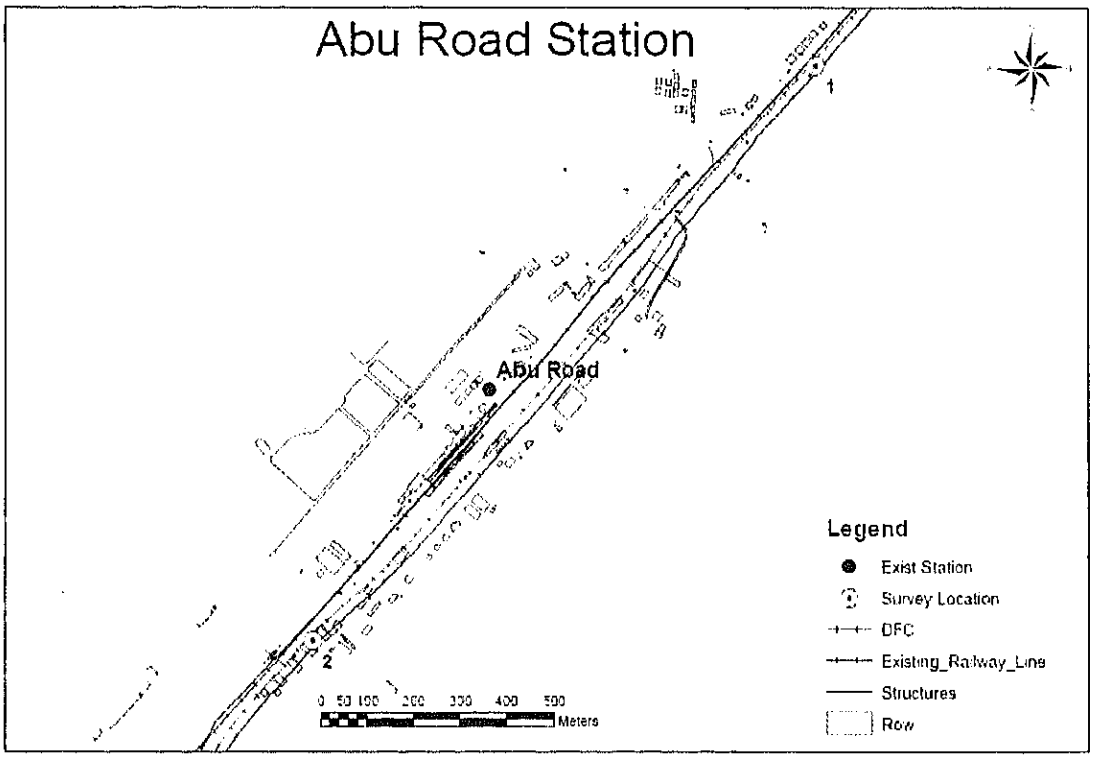


Figure 1-2 Location of Noise Measurement Sites in Abu Road

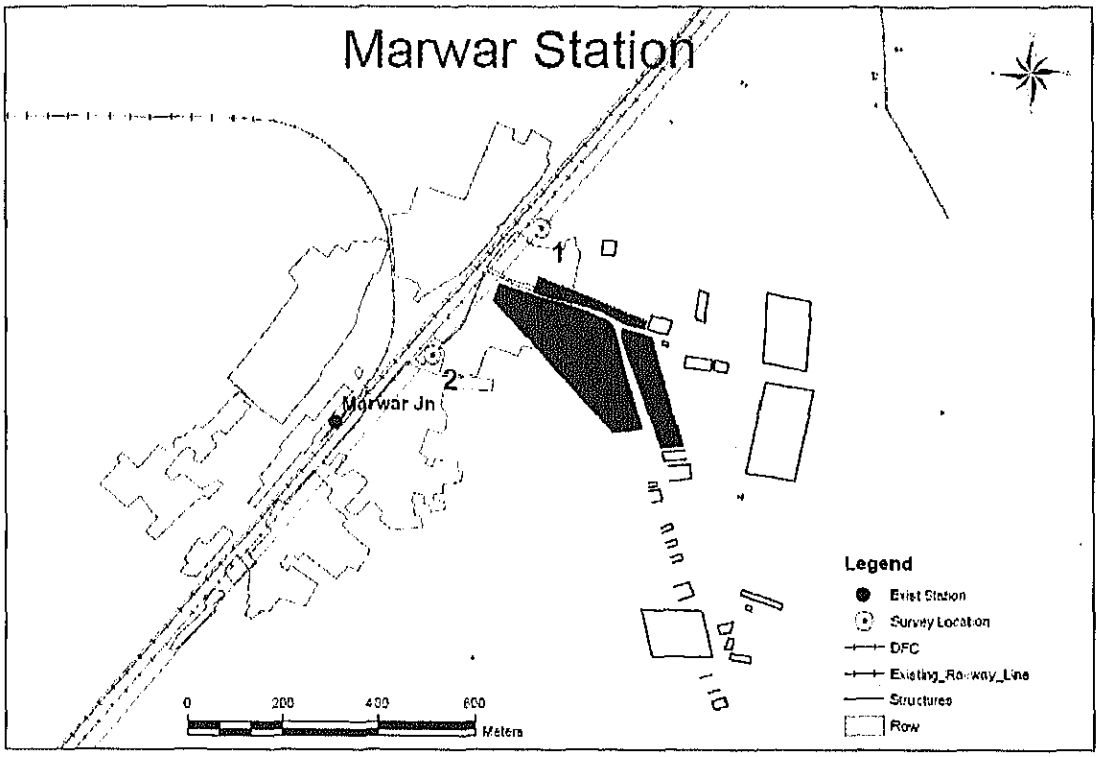


Figure 1-3 Location of Noise Measurement Sites in Marwar

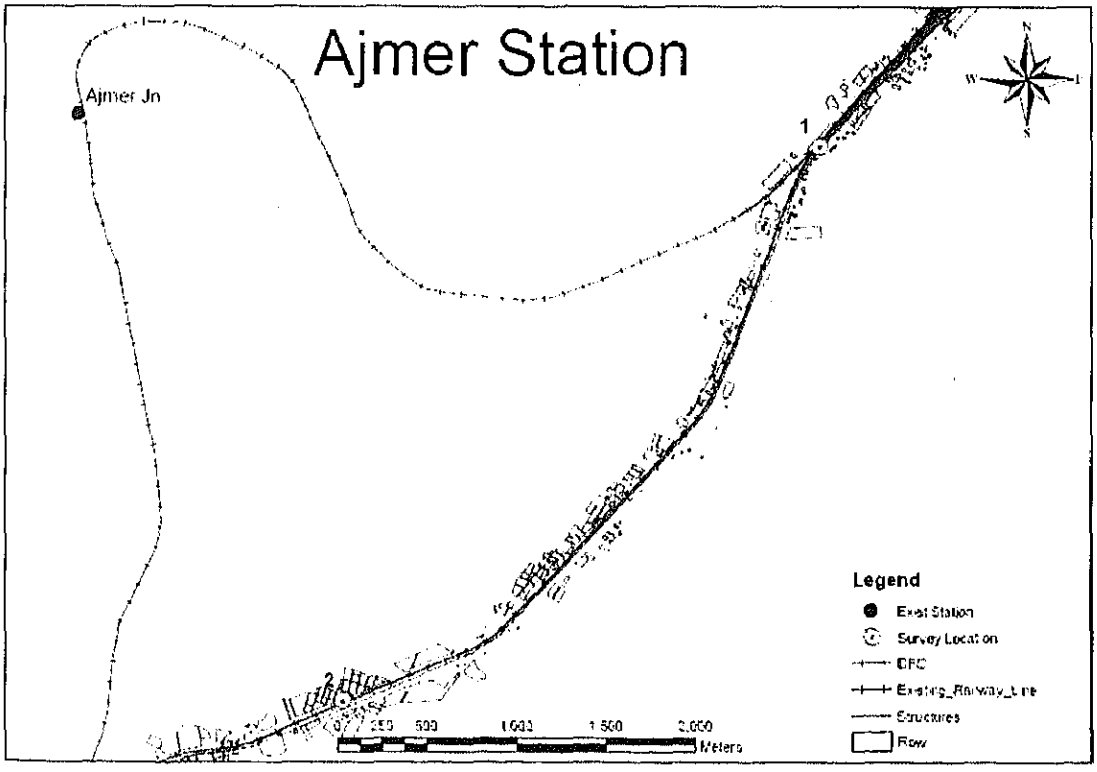


Figure 1-4 Location of Noise Measurement Sites in Ajmer

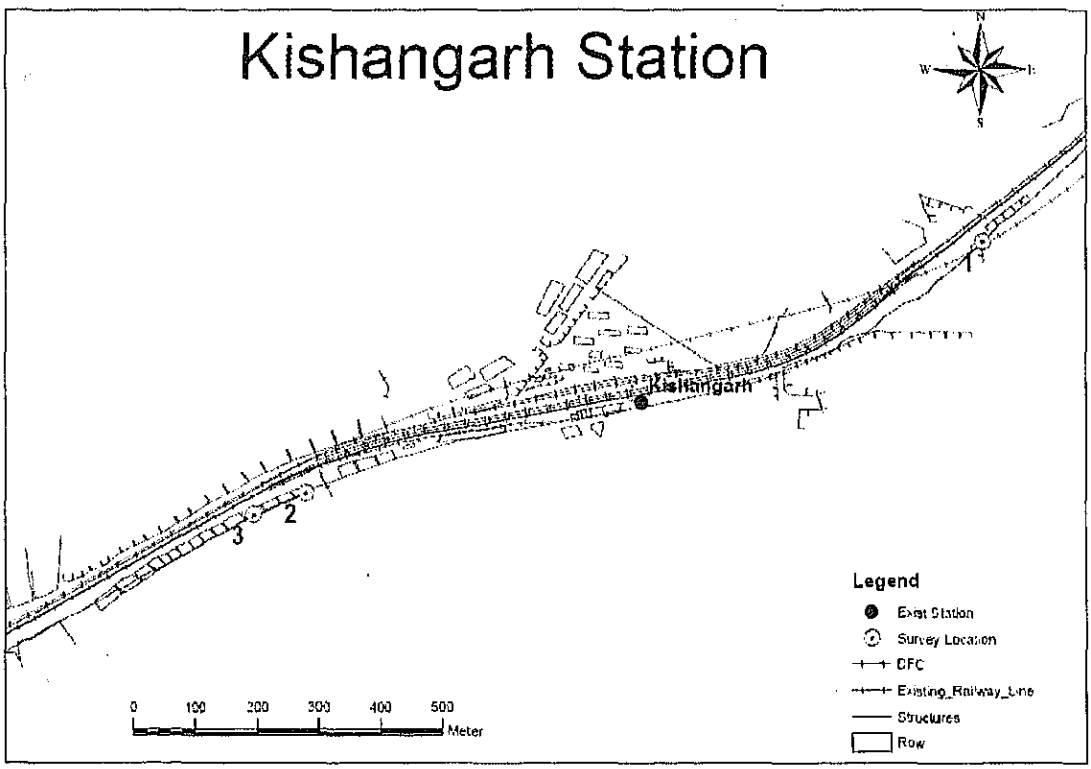


Figure 1-5 Locations of Noise Measurement Sites in Kishangarh

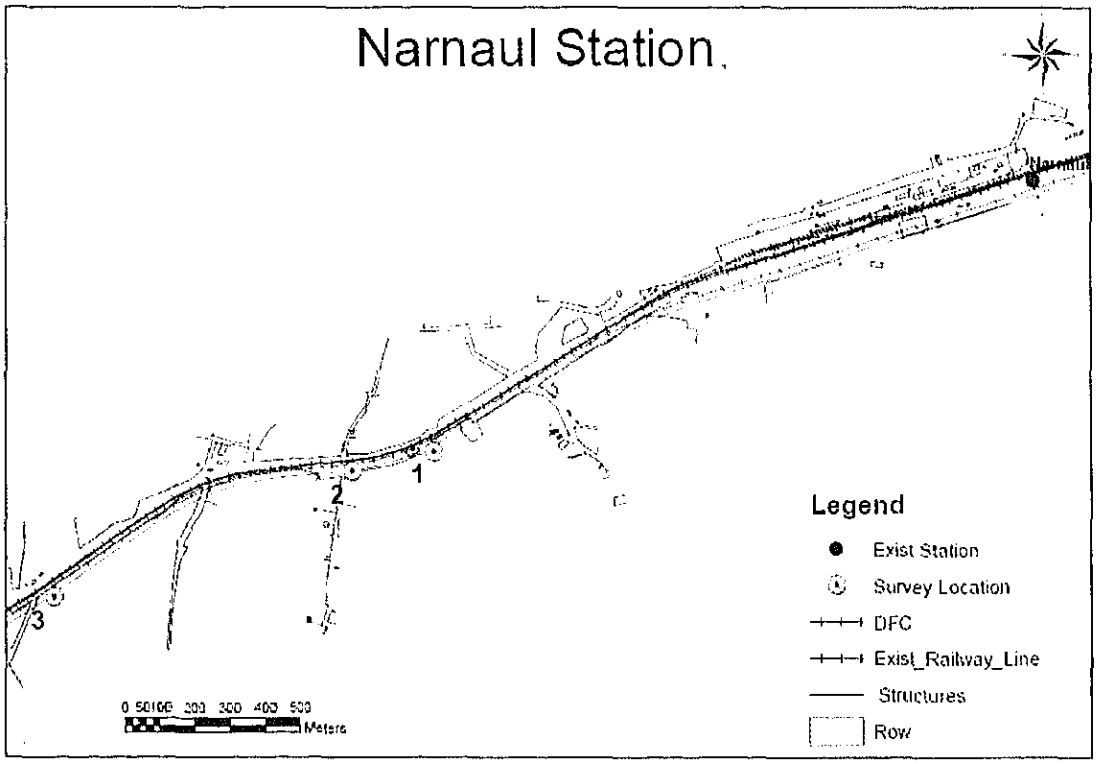


Figure 1-6 Location of Noise Measurement Sites in Narnaul

b) Method of Railway Noise and Background Noise Measurement

Japanese standard of noise measurement, JIS Z 8731 (Method of Measurement of Noise Vibration Level) is used for noise measurement which is accepted by the International Organization for Standardization (ISO). Since there is no relevant standard method for measuring railway noise in India, noise measurements are generally conducted following the International Standards.

Railway noise and background noise measurement method in parallel section is explained in Table1-2. Two (2) to three (3) sites were selected in each target area for the railway noise measurement. Background noise is also measured at the same sites during the time when trains did not pass through. However, at the Narnaul station, only background noise was measured as the existing railway track was under construction for the gauge conversion.

Table 1-2 Measurement Method of Railway and Background Noise Levels in Parallel Section

Item	Specifications
Noise Level Meter	Noise Level Meter which complies with "JIS C 1509-1: 2005 Electroacoustites-Sound Level Meters- Part1: Specifications"
Measurement Points	One or two points within the range of tens of m from the centre of the outer railway track in each site.
Measurement Items	・Railway noise L_{AE} (sound exposure level), L_{Amax} (maximum sound level), 1/3octave frequency analysis (1/3octave band center frequency : 20～8000Hz) ・Background noise L_{Aeq} (equivalent continuous A-weighted sound pressure level)
Frequency Weighting Characteristics	A
Time Weighting Characteristics	Slow
Measurement Time	Railway noise : 10:00-18:00 Background noise : 10 minutes within each term (10:00-12:00, 12:00-14:00, 14:00-16:00, 16:00-18:00)
Other Data	Date and time, location, train types (freight/passenger) and load (container/bulk), number of train cars, train length, passage time, train speed, pictures, information on surrounding environment, etc.

Measurement instruments are installed as shown in Figure 1-7.

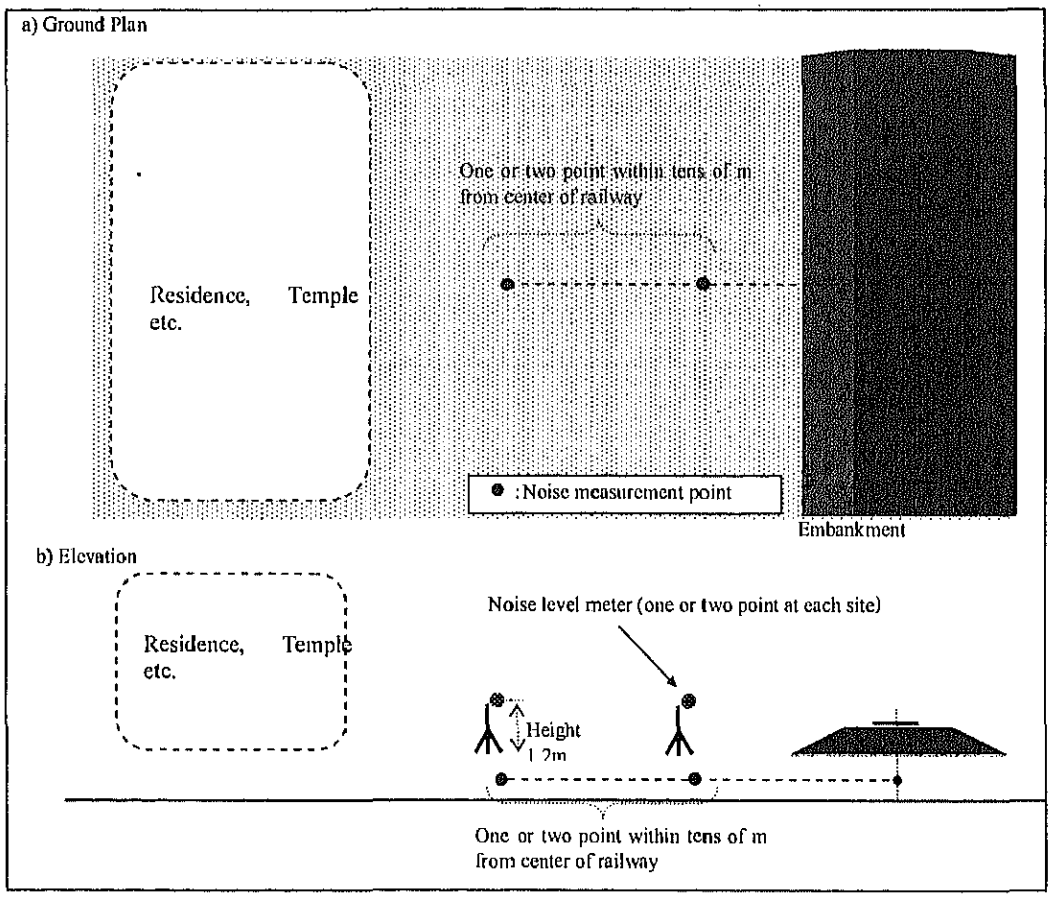


Figure 1-7 Schematic Plan of Railway and Background Noise Levels Measurement in Parallel Section

2) Unit Level of Railway Noise

a) Measurement Sites

Since DFC will be the first faster heavy loaded freight train in India, sound power level (PWL) of the freight train of DFC is not yet available. Thus, in order to predict noise levels from the DFC operation, railway noise by freight trains were measured at Khurja in electrified Aligarh-Dadri section in North Central Railway, where freight trains with relatively high speed and heavy load were operated with little obstruction by the other noises. Measurement site is shown in Figure 1-8.

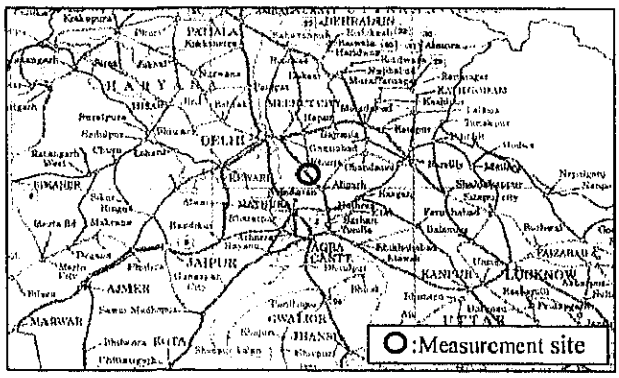


Figure 1-8 Measurement Site of Railway Noise Unit Level

b) Methodology

Japanese noise and vibration measurement standard, JIS Z 8731 (Method of Measurement of Noise Vibration Level) was used for noise measurement because there is no particular method of railway noise measurement in India. The method adopted for the measurement is summarized in Table 1-3.

Table 1-3 Measurement Method of Unit Level of Train

Item	Specifications
Noise Level Meter	Noise Level Meter which complies with "JIS C 1509-1: 2005 Electroacoustites-Sound Level Meters- Part1: Specifications"
Measurement Points	12.5 m, 25 m, 37.5m 50 m, and 62.5 m from the centre of the outer railway track (total 5 points)
Measurement Items	L_{AE} (Sound exposure level) L_{Amax} (Maximum sound level), 1/3 octave frequency analysis (center frequency : 0.4-80,00Hz)
Frequency Weighting Characteristics	A
Time Weighting Characteristics	Slow
No. of Trains	Freight train : 30 Passenger train : 24
Other Data	Date and time, location, train load (container/bulk), number of train cars, train length, passage time, train speed, pictures, information on surrounding environment, etc.

Measurement instruments were installed as shown in Figure 1-9.

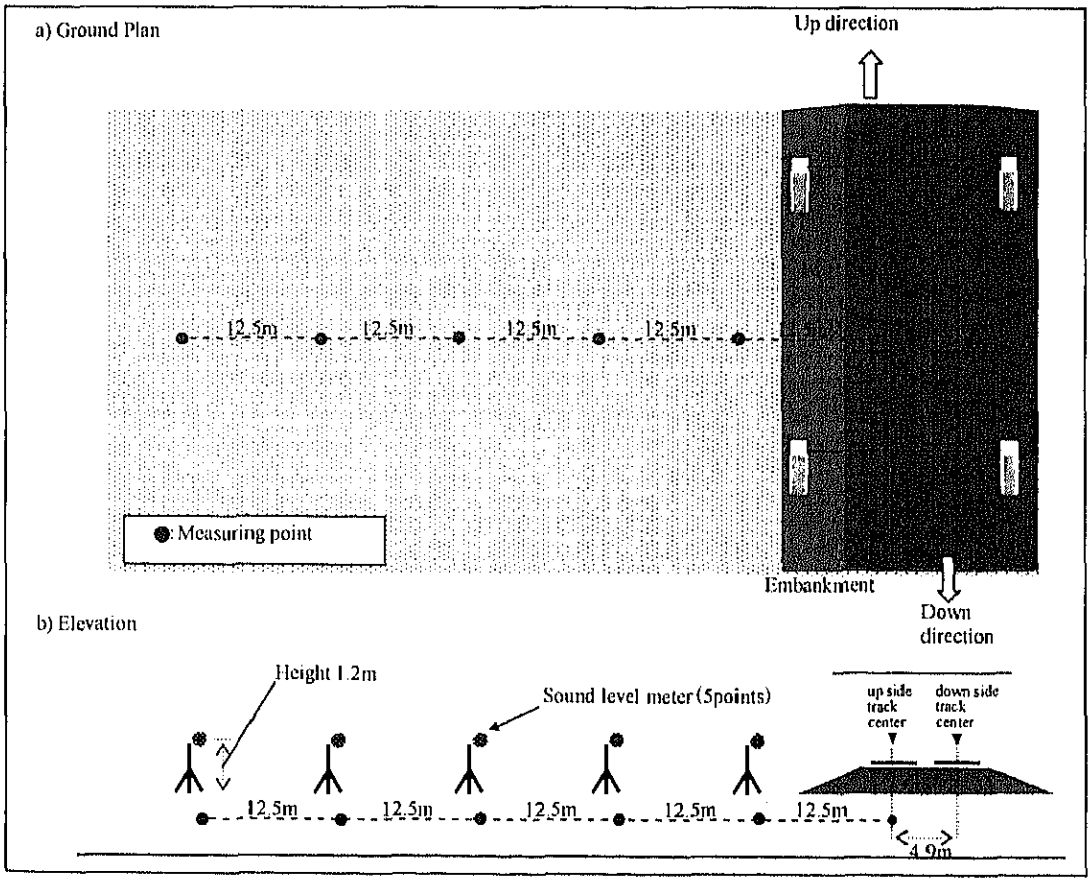


Figure 1-9 Schematic Plan of Railway Noise Unit Level Measurement

3) Inventory Survey of Sensitive Receptor

Sensitive Receptors (SRs) which are particularly vulnerable to the impacts of noise are defined in Ambient Noise Standards in India. These are school, hospital, and temple which require silent circumstances. The area within 100 m from those facilities is defined as Silence Zone as well where strict limits of noise level (Daytime: 50 dB, Night: 40 dB) are applied as the standards.

In order to evaluate future railway noise levels, an inventory of SRs along the DFC alignment was developed through the field surveys. The inventory was developed by identifying distribution of SRs by types within 100 m distance from the center of outside track of DFC (DFC side) and also within 100 m distance from the center of outside track of the existing railway (Existing railway side). The reason why the inventory area are limited as shown above is that the areas to be influenced by railway noise can be considered to be limited mainly within 100 m from the center of the outside track in general, according to past railway noise surveys in Japan, as shown discussed below:

- The areas affected by railway noise are considered to be within 100 m of horizontal distance from the centre of the nearest railway track.
- With the distance from the railway track, the railway noise measurement without influence from the other source becomes difficult in most cases due to increase of ratio of the other noise (background noise) such as traffic noises.

1.1.2 Results of Survey

(1) Noise Regulations and Standards

1) Regulation and Standards of Railway Noise in India

The ambient noise standards in India which are defined in the Noise Pollution (Regulation and Control) Rules, 2000 are shown in Table 1-4. Since there are no such regulations, standards or guidelines for railway noise in India, the standards of ambient noise have been applied for the individual cases.

Table 1-4 Ambient Noise Level Standards in India

Area Code	Category of Area Zone	Limits in dB(L_{Aeq})	
		Daytime (6:00 – 22:00)	Night (22:00 - 6:00)
(A)	Industrial Area	75	70
(B)	Commercial Area	65	55
(C)	Residential Area	55	45
(D)	Silence Zone	50	40

Note: Silence zone is defined as an area comprising not less than 100 meters around hospitals, educational institutions and courts. The silence zones are zones which are declared as such by the competent authority.
Source: The Noise Pollution (Regulation and Control) Rules, 2000

2) Railway Noise Regulations and Standards in Japan

In Japan, standards for railway noise levels are established for Shinkansen, a super express railway (or called as "bullet train"). For Shinkansen, in accordance with the land use categories (Zone I: residential area, Zone II: industrial areas), different noise level standards are defined as shown in Table 1-5.

Table 1-5 Ambient Noise Level Standards of Shinkansen Super Express Railway in Japan

Category of Area (Zone)	Standard value (dB)
I	70 or less
II	75 or less

Note: Zone I: residential area, Zone II industrial area
Source: Environmental Agency of Japan, July.1975

For the conventional railways, recommended standard level of railway noise are proposed in the Guidelines for Countermeasures for Railway Noise in Case of New Constructions and Large-scale Improvement of Existing Railways, Environmental Agency of Japan, December 1995 as shown in Table 1-6.

Table 1-6 Recommended Standard Level of Railway Noise in Japan

Case	Recommended Standard Noise Level
New Construction of Railway	Daytime (7:00 - 22:00): 60 dB (L_{Aeq}) or less Night time (22:00 - 7:00): 55 dB (L_{Aeq}) or less
	Minimize the railway noise in the residential areas as much as possible
Large-Scale Improvement of Existing Railway	Improve the railway noise level less before the construction

Note: Railway other than Shinkansen Express Railway (bullet train)
Source: Guidelines for Countermeasures for Railway Noise in Case of New Constructions and Large-scale Improvement of Existing Railways, Environmental Agency of Japan, Dec.1995

(2) Results of Field Survey on Noise

1) Background Noise Level

Measurement results of background noise (L_{Aeq}) at each site are shown in Table 1-7. The background noise is measured once in each five different time of a day, namely 10:00-12:00, 12:00-14:00, 14:00-16:00, 16:00-18:00 when trains did not pass through. The results show that background noise at these locations in daytime ranged from 43 dB to 60 dB. The noise level at all the sites is within the limits of daytime ambient standard of residential area in India.

Table 1-7 Results of Background Noise Measurement

Station	Date	No.	Background Noise Level LAeq [dB(A)]				
			10:00~12:00	12:00~14:00	14:00~16:00	16:00~18:00	Overall 10:00~18:00
Abu Road	5-Sep	1	50	53	43	52	50
	5-Sep	2	51	49	55	53	53
Marwar	3-Sep	1	45	45	49	52	49
	3-Sep	2	47	55	46	43	52
Ajmer	1-Sep	1	53	50	49	50	50
	1-Sep	2	50	54	53	53	53
Kishangarh	30-Aug	1	47	48	51	52	49
	31-Aug	2	56	55	51	51	54
	31-Aug	3	51	52	60	45	55
Narnaul	28-Aug	1	51	49	52	51	51
	28-Aug	2	54	53	54	54	54
	28-Aug	3	49	49	47	47	48

Note: Day time of Indian Ambient Noise Quality standards: 6:00-22:00
Night time of Indian Ambient Noise Quality standards: 22:00-6:00

2) Railway Noise from the Existing Railway

a) L_{AE} and L_{Amax} of Railway Noise

The results of railway noise measurements mean values of L_{AE} and L_{Amax} at each site are summarized in Table 1-8. The results also show L_{AE} and L_{Amax} of different train type and direction of the trains, e.g., up and down directions. Since most of the measurement sites are located near railway stations, average train speed was not high in the range 20-40 km/h. In addition to the mechanical railway noise, sounds of train whistle were frequently measured and the noise level was high with L_{AE} of 80-90dB and L_{Amax} of 100dB at that time.

Table 1-8 Rusults of Railway Noise Measurement in Parallel Section

Station	NO.	date	Number of trains	train type	train direction	Average train speed [km/hr]	Average train length [m]	measurement distance from railway center [m]		Average Noise level [dB]				Average Vibration Level [dB]					
										LAE		LAmax		Lp_X		Lp_Y		Lp_Z	
								point 1	point 2	point 1	point 2	point 1	point 2	point 1	point 2	point 1	point 2	point 1	point 2
Abu Road	1	5-Sep	2	passenger	up	27	460	13	26	95	92	89	85	48	43	49	43	58	50
			5		down	26	411			97	93	90	83	49	42	49	43	56	49
			3	freight	up	21	657			98	92	89	83	47	41	48	42	57	48
			4		down	19	598			100	95	92	85	47	40	46	41	56	47
	2	5-Sep	3	passenger	up	15	416	10		100		92		43		45		55	
			5		down	20	425			94		85		44		48		55	
			5	freight	up	13	646			105		94		52		56		61	
			4		down	14	603			101		91		57		59		64	
Marwar	1	3-Sep	3	passenger	up	21	389	18	32	104	102	96	94	45	36	46	38	54	44
			4		down	30	459			101	100	93	90	44	35	45	38	53	43
			2	freight	up	46	720			105	103	96	94	40	38	49	40	58	46
			3		down	25	623			99	98	89	86	44	36	44	36	53	43
	2	3-Sep	3	passenger	up	20	389	16		98		92		54		58		65	
			4		down	20	459			99		89		51		56		63	
			3	freight	up	29	672			99		89		55		60		66	
			2		down	20	588			100		91		53		56		63	
Ajmer	1	1-Sep	5	passenger	up	66	433	12.5	21.5	96	95	87	85	51		51		60	
			2		down	52	437			97	96	88	87	50		54		59	
			3	freight	up	30	597			94	97	83	85	52		56		60	
			4		down	19	624			101	100	88	87	52		58		60	
	2	1-Sep	2	freight	up	43	595	14.1		103		97		59	54	74	55	73	65
			4		down	37	573			101		92		59	51	72	52	72	64
Kishangarh	1	30-Aug	2	passenger	up	27	569	15	30	93	89	81	78	53	40	52	39	56	39
			2		down	73	339			93	92	83	82	57	42	57	43	59	45
			4	freight	up	31	625			100	96	93	87	54	39	54	39	57	41
			4		down	32	538			96	94	86	83	51	40	51	38	56	40
	2	31-Aug	2	passenger	up	38	569	16.8	31	99	94	88	84	53		56		64	
			2		down	41	383			109	103	103	97	53		57		64	
			3	freight	up	39	522			106	101	97	91	53		56		60	
			3		down	31	458			105	101	95	90	50		55		57	
	3	31-Aug	3	passenger	up	38	481	15	22	108	106	100	98	47	37	49	40	56	46
			2		down	42	344			95	94	86	86	49	39	52	42	58	48
			4	freight	up	45	492			103	100	95	90	49	40	52	42	59	48
			4		down	31	458			107	105	101	98	46	38	50	40	56	47

Note: Shaded area indicates non-measurement point
Only freight trains pass through at Ajmer No.2

b) Noise Frequency Band Analysis

In order to grasp frequency characteristics of the noise generated by freight trains, one-third (1/3) octave band analysis is conducted for the observed noise frequency spectra. The results of frequency band analysis revealed that the noise by freight trains is mainly caused by traction, structures and machines equipped to the trains according to the predominant frequency observed of 400 to 2,000Hz of frequency band. In general, the predominant frequency of railway noise is around 250 to 2,000Hz according to the past surveys in Japan.

3) Unit Noise Level of Freight Train

a) L_{AE} and L_{Amax} of Freight Train

The results of freight train noise level measurement in Khurja are summarized in Table 1-9. Measurement data include 11 events of trains going up direction and 19 events of trains going down direction.

Table 1-9 Results of Unit Noise Level Measuremnt of Freight Train

No.	date	time	cargo type	train speed [km/hr] V	train passage time [s]	train length [m]	train direction	Noise level(dB)										PWL [dB(A)]
								LAE					LAmax					
								12.5m	25.0m	37.5m	50.0m	62.5m	12.5m	25.0m	37.5m	50.0m	62.5m	
1	21-Aug	15:20	container	46.0	49.94	638	up	95.7	90.1	88.9	85.7	85.0	81.3	75.2	73.7	70.2	69.8	92.7
2	21-Aug	18:35	open	43.1	55.65	666	up	94.5	89.5	87.7	85.8	84.8	83.9	77.7	75.1	72.5	69.7	91.1
3	22-Aug	14:51	open	66.4	35.67	656	up	98.4	94.0	92.2	90.1	89.5	85.8	80.9	78.0	75.3	74.4	96.0
4	23-Aug	9:26	open	57.4	41.14	656	up	96.1	91.3	90.9	87.5	87.3	81.7	76.7	75.2	74.3	72.8	94.0
5	23-Aug	10:23	container	46.1	50.49	646	up	94.6	89.7	89.3	86.3	86.1	83.5	77.3	77.2	72.9	73.7	91.6
6	23-Aug	12:14	open	55.5	41.88	646	up	96.7	92.0	90.8	88.8	87.8	85.8	80.1	78.8	78.0	76.3	94.5
7	23-Aug	13:27	container	56.2	41.35	646	up	96.6	93.3	92.7	89.9	87.3	82.7	79.2	78.2	75.4	75.2	94.4
8	23-Aug	14:13	open	67.4	35.08	656	up	100.0	95.5	94.4	91.6	91.4	90.5	84.9	82.9	80.2	79.2	98.6
9	23-Aug	15:28	container	50.5	47.51	666	up	93.8	88.7	88.3	85.1	84.4	77.4	73.7	73.9	71.3	70.9	91.0
10	23-Aug	16:55	container	84.4	27.54	646	up	94.3	89.6	88.7	86.1	84.5	82.1	76.7	75.7	73.4	71.7	93.0
11	24-Aug	11:38	open	41.6	46.15	533	up	91.8	87.4	86.9	85.6	86.1	78.5	73.8	74.8	72.2	77.4	89.2

No.	date	time	cargo type	train speed [km/hr] V	train passage time [s]	train length [m]	train direction	Noise level(dB)										PWL [dB(A)]
								LAE					LAmax					
								17.4m	29.9m	42.4m	54.9m	67.4m	17.4m	29.9m	42.4m	54.9m	67.4m	
1	21-Aug	15:40	open	43.3	44.86	540	down	95.7	92.1	91.0	88.6	87.5	81.3	77.0	74.8	72.5	71.3	94.6
2	21-Aug	17:14	covered	56.6	36.20	569	down	93.0	88.9	87.5	85.4	84.2	78.9	74.5	72.7	70.5	69.5	92.9
3	21-Aug	17:26	open	64.0	30.96	550	down	97.4	93.8	92.9	90.6	89.3	83.0	79.4	78.6	76.0	74.8	97.0
4	21-Aug	17:35	open	81.5	28.52	646	down	98.8	94.7	93.2	90.9	89.9	85.7	81.5	79.8	77.1	75.7	99.7
5	21-Aug	17:52	open	71.5	32.51	646	down	97.6	93.3	92.0	89.7	88.9	83.8	79.2	77.8	75.3	74.3	97.9
6	21-Aug	18:02	open	74.4	31.23	646	down	98.2	93.8	92.4	90.0	88.9	85.7	81.1	79.3	76.4	75.2	98.7
7	22-Aug	13:36	open	55.8	30.69	476	down	95.3	92.4	91.2	89.3	91.1	82.2	78.9	77.2	74.7	75.7	95.9
8	22-Aug	13:59	open	74.2	31.85	656	down	97.0	93.6	92.2	89.6	89.6	83.7	80.1	78.4	75.1	75.6	97.4
9	22-Aug	15:21	open	47.3	43.52	572	down	96.0	94.0	92.8	91.0	90.2	82.3	78.9	77.0	74.9	74.1	96.0
10	23-Aug	7:54	open	80.6	29.30	656	down	98.8	94.9	93.7	91.3	90.8	86.0	81.4	80.1	77.1	76.4	99.6
11	23-Aug	9:22	open	78.1	30.26	656	down	98.1	94.4	93.5	90.8	90.4	84.9	80.9	79.8	77.2	76.4	98.7
12	23-Aug	9:31	open	72.9	32.42	656	down	96.5	93.0	92.2	90.0	89.9	81.9	78.3	77.3	75.0	74.8	96.8
13	23-Aug	9:46	open	67.2	26.21	489	down	95.5	91.8	90.9	88.4	88.0	82.2	78.1	77.1	74.5	74.2	96.8
14	23-Aug	10:17	container	72.7	32.65	660	down	94.4	90.7	90.2	88.1	87.2	81.4	77.1	75.6	73.2	72.2	94.7
15	23-Aug	11:58	open	63.9	36.96	656	down	95.9	92.3	91.4	89.0	88.4	82.9	78.7	76.9	74.4	73.6	95.7
16	23-Aug	12:10	open	62.9	34.22	598	down	96.7	92.9	91.8	89.1	88.9	86.9	82.1	80.0	76.5	75.5	96.8
17	23-Aug	14:22	open	72.2	32.74	656	down	98.3	94.7	94.0	91.1	90.3	84.8	81.1	80.1	77.0	76.2	98.6
18	24-Aug	9:57	covered	72.7	23.57	476	down	98.3	94.3	94.2	91.3	91.0	87.0	82.5	85.5	79.0	78.0	100.0
19	24-Aug	10:34	covered	69.2	31.85	612	down	94.9	91.0	91.0	89.2	89.8	83.2	78.9	82.1	81.3	78.0	95.8

b) Sound Power Level (PWL) of Freight Train

i) Determination of Sound PWL of Freight Train

In India, some railway projects conducted railway noise prediction in their environmental study reports such as IEE report of Bangalore Metro and EIA report of Delhi Metro. However, the noise levels of the sound source (power level) were not clearly defined and it is difficult to adopt these results to the other projects. In ESIMMS, the noise level was predicted using a simple regression model based on the actual freight train measurement. However, due to the limited sample numbers of freight train at the expected speed, the prediction has not covered the factors such as lengths and power levels of the freight trains. Therefore, in this study, the railway noise levels during the operation of DFC are predicted based on sound power level (PWL) of freight train which can be recognized as similar one of DFC. The sound PWL is calculated based on the results of unit noise level measurement by using modified railway noise prediction formula which is generally applied in Japan. Some factors of the formula are modified in order to improve prediction accuracy as close as possible to DFC. For this, noise levels of comparatively higher speed and heavy lorded freight trains are measured and the actual sound PWL and train lengths are considered in a simple regression model. Good relation between train speeds and PWLs calculated with is also confirmed.

For calculation of PWL, a formula proposed by Railway Technical Research Institute (RTRI) of Japan in 1996 is used. In this formula, sound generated by train is assumed to be a line sound source, and relation between generated noise level and PWL is derived when train passing at certain speed and at certain distance. The formula proposed by RTRI (Relational expression of Measured L_{AE} and PWL) is given below:

$$L_{AE} = PWL - 5 + 10\log_{10}(\pi s/2v) - 10\log_{10}d$$

where;

L_{AE} :Exposure sound level measured at the nearest point from the railway

track [dB]
PWL :Power level [dB]
D :Distance between measurement point and the center of the track [m]
S :Length of train [m]
V :Speed of train [m/s]
Source: Railway Technical Research Institute of Japan in 1996

ii) Calculation of Sound PWL of Freight Train

L_{AE}, train length, train speed, and distance are substituted to the above formula, and then PWL of railway noise is calculated. The results of L_{AE} measurement of freight trains are summarized in Table 1-9. By using the above formula, PWL of freight train is calculated. In this case, in order to reduce influence of extra attenuation as much as possible, the L_{AE} measured at the nearest point from the track are used. The results of calculation of PWL of freight train are also given in Table 1-9.

iii) Speed Dependence of PWL of Freight Train

Correlation between measured train-speeds and calculated PWLs are confirmed. In general, positive correlation between logarithm of train speed and PWL of train can be obtained. Calculated approximation and correlation coefficient are as follows:

<up and down> $PWL = 24.2 \times \log V + 52.4$ ($n=30$, $R^2=0.5996$)

<up> $PWL = 21.4 \times \log V + 56.2$ ($n=11$, $R^2=0.5489$)

<down> $PWL = 17.4 \times \log V + 65.3$ ($n=19$, $R^2=0.5996$)

where:

PWL : Power level per unit length [dB]
V : Speed of train[km/hr]
n : Number of sample
R : Correlation coefficient

It has been revealed in the previous surveys that main causes of railway noise of conventional trains (local trains, express trains) are ones from traction movements, structures and machines equipped to the trains, and all of them is dependent upon of the train speed. It has been also reported that noise from traction movement is generated from almost all of cars, and strong correlation between noise from traction movement and logarithm of train-speed can be found because noise from traction movement exceeds among the three main sources.

In this survey, since freight trains running on the earth embankment are measured and noise from particular structures such as bridge and culvert could be avoided. Thus, as indicated above, positive correlation between logarithm of train speed and PWL is confirmed. An example of correlation chart of PWL in both up and down directions and train speed from the sound source obtained is shown in Figure 1-10.

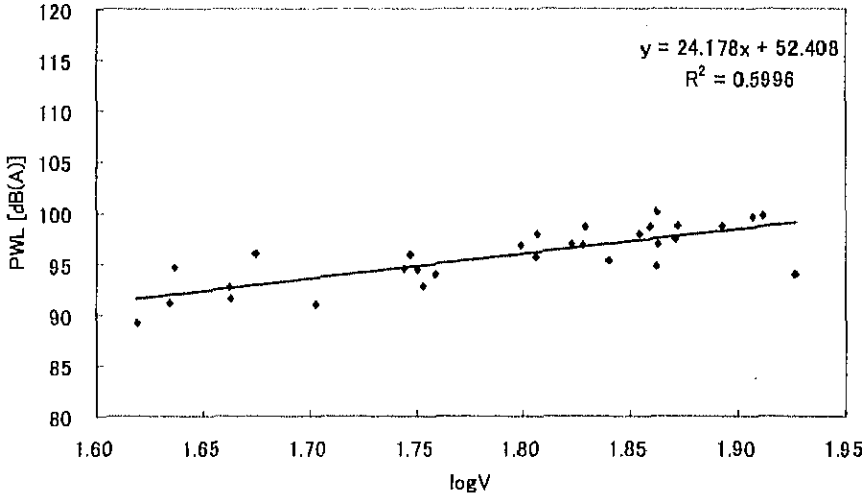


Figure 1-10 Correlation between Freight Train Speed and PWL

c) Distance Attenuation of Freight Train

In order to confirm distance attenuation of railway noise generated by freight train, relation between LAmax and logarithm of the distance are confirmed. In general, negative correlation between noise level and distanee from source of noise is known as distance attenuation. Average LAmax at each measurement point of each direction (up, down, and both up and down) and logarithm of distance from eenter of the railway tack is graphed , respectively. As a result, distance attenuation coefficient for each direction is calculated as follows:

<up>	-14.3log(d) (n=10)
<down>	-15.2log(d) (n=18)
<up and down>	-14.9log(d) (n=28)

d) Distance from Center of the Railway Track [m]

According to the coefficient obtained, distance coefficient of average both up and down directions indicates that noise level decreased approximately 4.5dB when the distance is doubled. In case of freight train measurements in Japan, within the range of 40m from the center of the railway track, when the distance is doubled, noise level decreases approximately 5dB. Therefore, result of distance attenuation in this study can be considered to be similar to the cases in Japan. An example of distance attenuation of the freight train going up direction is shown in Figure 1-11.

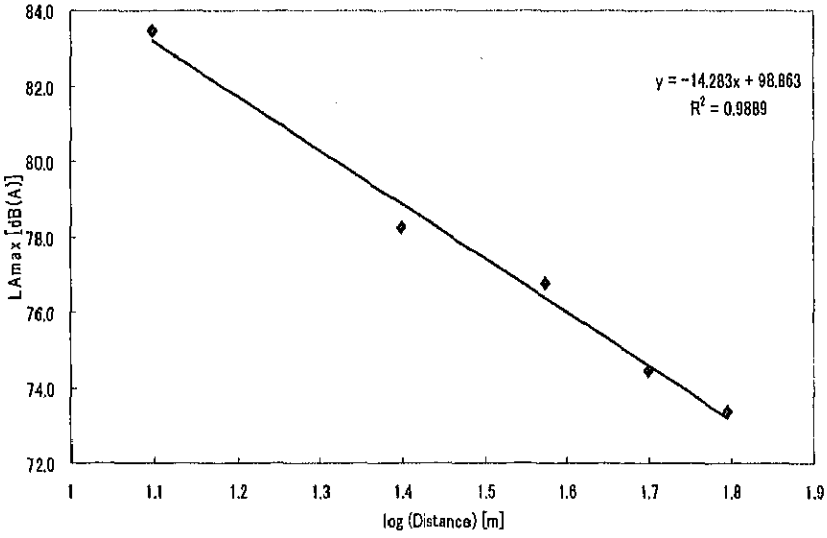


Figure 1-11 Average Distance Attenuation of Freight Train (n=10)

e) Noise Frequency Band Analysis of Freight Train

To find the frequency characteristic of the noise generated by the freight train, one-third (1/3) octave band is analysed for the obtained noise frequency spectra of freight trains. The results indicated that frequency range excelled between 250 to 2,000Hz compared to other ranges. In Japan, predominant frequency from each noise is known often within a range from 250 to 2,000Hz and the main noise of train includes traction, structures and machines equipped to the train. Result of predominant frequency is similar to the case in Japan, and this is considered to be suitable value for the prediction.

4) Unit Noise Level of Passenger Train

a) L_{AE} and L_{Amax} of Passenger Train

The results of passenger train noise level measurements at Khurja are summarized in Table 1-10. Measurement data included 10 events of trains going up direction and 14 events of trains going down direction.

Table 1-10 Results of Passenger Train Noise Level Measuremnt and PWL at Khurja

No.	date	time	train speed [km/hr] V	train passage time [s]	train length [m]	train direction	Noise level(dB) LAmax 12.5m	25.0m	37.5m	50.0m	62.5m	LAE [dB(A)]	PWL [dB(A)]
1	22-Aug	12:52	106	17	504	up	90	85	85	82	80	102	104
2	22-Aug	13:39	128	12	416	up	96	91	89	86	86	106	110
3	22-Aug	14:20	111	16	504	up	88	82	81	78	77	100	102
4	23-Aug	9:35	67	22	416	up	80	74	74	73	70	93	94
5	23-Aug	9:56	90	17	416	up	94	88	86	83	82	106	108
6	23-Aug	11:11	107	19	548	up	90	86	84	80	79	103	104
7	23-Aug	12:54	105	17	504	up	88	82	81	78	77	100	102
8	23-Aug	15:06	77	24	504	up	83	78	76	72	71	97	97
9	24-Aug	10:15	109	18	548	up	88	82	80	77	77	101	102
10	24-Aug	11:19	73	26	526	up	88	82	80	78	76	102	102
No.	date	time	train speed [km/hr] V	train passage time [s]	train length [m]	train direction	Noise level(dB) LAmax 17.4m	20.9m	42.4m	54.9m	67.4m	LAE [dB(A)]	PWL [dB(A)]
1	21-Aug	15:33	93	11	284	down	79	74	73	71	69	90	95
2	21-Aug	16:12	107	18	526	down	86	81	79	75	75	98	101
3	21-Aug	16:19	112	16	482	down	83	78	78	75	74	95	99
4	22-Aug	7:42	125	11	394	down	95	91	89	87	86	106	111
5	22-Aug	14:28	83	23	520	down	83	79	77	74	73	97	98
6	23-Aug	8:23	108	18	548	down	85	81	80	83	77	98	101
7	23-Aug	9:12	89	22	548	down	84	80	79	76	76	98	100
8	23-Aug	15:30	118	13	416	down	89	86	84	81	80	100	104
9	23-Aug	15:58	87	12	284	down	78	75	74	71	70	89	94
10	23-Aug	16:23	125	16	570	down	86	82	81	78	78	98	102
11	23-Aug	17:03	107	19	548	down	85	80	79	77	76	97	100
12	23-Aug	17:19	81	22	482	down	80	76	75	72	72	93	96
13	23-Aug	17:34	109	17	526	down	87	82	81	78	77	99	102
14	23-Aug	17:50	118	13	416	down	92	87	86	84	83	103	107

b) Sound PWL of Passenger Train

Same as the case of freight train, sound PWL of passenger train is calculated by using the formula proposed by RTRI. However, since the noise generated by passenger train sometime includes sound of whistle, it was difficult to measure L_{AE} of passenger trains. Therefore, by using the relation formula between L_{Amax} and L_{AE}, L_{AE} of passenger train is calculated from obtained L_{Amax}. Calculated sound PWL of passenger train are summarized in Table 1-10. In order to reduce influence of extra attenuation as much as possible, L_{Amax}s measured at the nearest point from railway are used.

Correlations between measured train-speeds and calculated PWLs are also confirmed for each direction. Calculated approximation and correlation coefficient are as follows:

<up and down> $PWL = 38.8 \times \log V + 23.7$ ($n=24$, $R^2=0.4291$)

<up> $PWL = 35.4 \times \log V + 32.4$ ($n=10$, $R^2=0.4990$)

<down> $PWL = 54.8 \times \log V - 9.8$ ($n=14$, $R^2=0.6046$)

where;

PWL :Power level per unit length [dB]
V :Speed of train [km/hr]
n :Number of sample
R :Correlation coefficient

From the above results, positive correlation is confirmed. Compared with the case of freight train, stronger correlation is obtained. This is maybe because the noise included both of traction movements and machines equipped to the train and speed of passenger trains is faster than freight trains. An example of correlation of both up and down data is given in Figure 1-12.

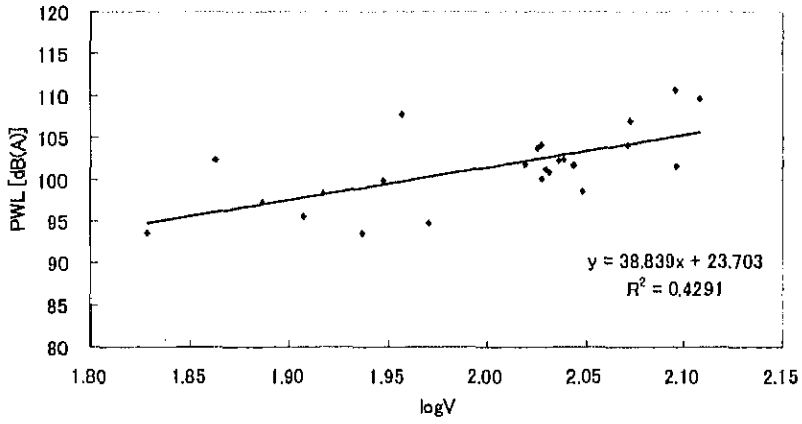


Figure 1-12 Correlation between Passenger Train Speed and PWL

c) Distance Attenuation of Passenger Train

Similar to freight train, distance attenuation of passenger train is also confirmed. As a result, distance attenuation coefficient for each direction is calculated as follows.

<up> -16.1log(d) (n=9)

<down> -15.4log(d) (n=13)

<up and down> -15.7log(d) (n=28)

d : Distance from center of the railway [m]

The obtained coefficients between noise and distance in passenger train are almost same values as freight train. An example of distance attenuation of the passenger train going up and down directions is given in Figure 1-13.

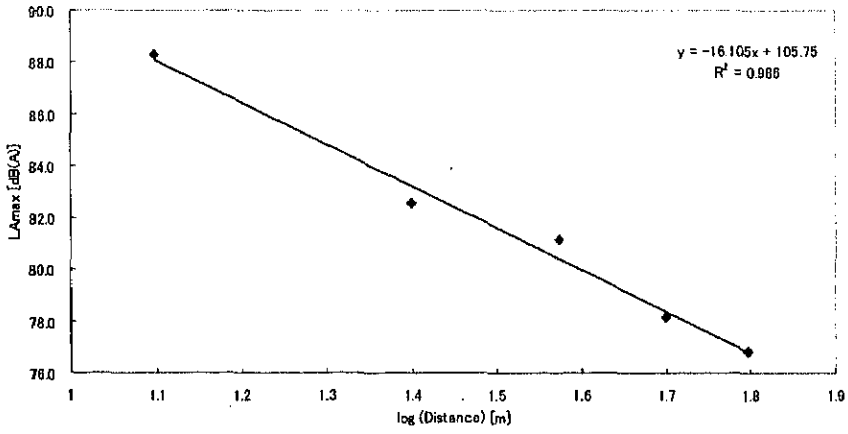


Figure 1-13 Average Distance Attenuation of Passenger Train (n=9)

d) Noise Frequency Band Analysis of Passenger Train

To find the frequency characteristics of noise generated by passenger train, one-third (1/3) octave band is analysed for the obtained noise frequency spectra in passenger trains. The results indicated that frequency is ranging from 800 to 2,000Hz.

(3) Results of Field Survey on Sensitive Receptor and Land Use

1) Sensitive Receptor Survey

SRs located within approximately 100m from the center of outer track were identified in August and September 2008 because approximately 100 m is a distance in which potential noise impact by trains should be considered according to the past studies[1]. The SRs identified in each state are summarized in Table 1-11 to Table 1-13. However, since the ROW was assumed to be 50 m in the parallel section except for Kishangarh section where it is 30 m, while 70 m in the detour section (35 m on both sides of the center of alignment), number of potentially affected SRs are picked up as follows:

- 50-100 m for east side (DFC side) for the parallel section
- 0-100 m for west side (existing railway side) for the parallel section
- 35-100 m (both sides) in the detour section

In Haryana state, total 11 SRs have been identified in the Narnaul area among twenty (20). In Rajasthan state, total 87 SRs have been identified in the five Districts. In Gujarat, four SRs have been identified within potentially noise affected area among total seven SRs.

Table 1-11 Distribution of Sensitive Receptors in Haryana State

District	Villages	East (DFC) side (0-50 m)	East (DFC) side (50-100 m)	West side (0-50 m)	West side (50-100 m)	Total	No. of potentially affected SR
Rewari	Kakoria	1	0	0	0	1	0
	Ateli	1	0	0	0	1	0
	Uninda	0	1	0	0	1	1
	Ateli Mandi	5	2	0	0	7	2
	Tobra, Ateli Mandi	0	2	0	0	2	2
	Gothra	0	1	0	0	1	1
	Khori	2	0	0	0	2	0
	Kund	0	1	0	0	1	1
Sub-total		9	7	0	0	16	7
Mahendr agarh	Patikera	1	0	1	0	2	1
	Narnaul	3	1	5	5	14	11
	Jorashi	0	0	1	0	1	1
Sub-total		4	1	7	5	17	13
Grand total		13	8	7	5	33	20

Note: 0-50 m: SRs located between 0 and 50 m from the centre of outer track, 50-100 m: SRs located between 50 m and 100 m the centre of outer track.
No. of at potentially affected area means sum of the No. of SRs in East side (50-100 m), and West side (0-50 m) and (50-100 m).
Source: S-ESIMMS

[1] The Manual for Environmental Social Considerations in Transportation Technical Assistance (Railway), Japan Transportation Cooperation Association (JTCA) and Japan Railway Technical Service (JARTS), 1996.

Table 1-12 Distribution of Sensitive Receptors in Rajasthan State

District	Village/ Town	East (DFC) side (0-50m)	East (DFC) side (50-100m)	West side (0-50m)	West side (50-100m)	Total	No. of potentially affected SR
Sikar	Dabla	2	0	0	0	2	0
	Makri	1	0	0	0	1	0
	Godwas	0	0	1	1	2	2
	Nim Ka Thana	9	0	0	0	9	0
	Bhagega	0	1	0	0	1	1
	Rajputon ki Dhani	1	1	0	0	2	1
	Madho ka was	1	1	0	0	2	1
	Sri Madhopur	3	1	4	6	14	11
	Jugalpura	0	1	0	0	1	1
	Ringas	3	0	2	2	7	4
	Sub-total	20	5	7	9	41	21
Jaipur	kishanmanpura	1	0	0	0	1	0
	Badhal	2	0	0	0	2	0
	Renwal	3	0	4	0	7	4
	Narena	0	0	1	0	1	1
	Sub-total	6	0	5	0	11	5
Ajmer	Kishangarh	7	2	4	0	13	6
	Ladpura	0	1	0	0	1	1
	Ajmer	10	1	0	0	11	1
	Ajmer (Sunder Nagar)	3	0	6	3	12	9
	Tabeej	1	0	0	0	1	0
	Saradhana	6	0	1	1	8	2
	Beawar	7	1	1	2	11	4
	Kalali ka Badai	1	0	0	0	1	0
	Mangliyawas	0	2	0	0	2	2
	Daulat Khera	1	0	0	0	1	0
	Piplaj	1	0	0	0	1	0
	Sub-total	37	7	12	6	62	25
Pali	Sabalpura	0	3	1	0	4	4
	Dholiya	2	0	0	0	2	0
	Sandra	0	0	1	0	1	1
	Dodiya	0	0	0	1	1	1
	Dipawas	0	0	1	0	1	1
	Guriya	0	0	1	0	1	1
	Aasan	0	1	0	0	1	1
	Udeshi Kuan	0	0	0	1	1	1
	Udika	0	0	1	0	1	1
	Chandawal	0	0	4	0	4	4
	Bagri Nagar	0	0	0	1	1	1
	Sojat Road	0	0	2	1	3	3
	Marwar Jn	5	0	0	1	6	1
	Somesar	0	0	1	0	1	1
	Jawali	0	0	1	0	1	1
	Rani	0	1	1	0	2	2
	Falna	3	0	2	0	5	2
	Chamundari	0	0	2	0	2	2
	Jawai Bandh	1	1	0	1	3	2
	Sub-total	11	6	18	6	41	30
Sirohi	Biroliya	0	1	0	0	1	1
	Bhimana	0	1	0	0	1	1
	Swarup Ganj	0	0	1	0	1	1
	Bujhela	0	0	0	3	3	3
	Maval	1	0	0	0	1	0
	Sub-total	1	2	1	3	7	6
	G-total	75	20	43	24	162	87

Note: 0-50 m: SRs located between 0 and 50 m from the centre of outer track, 50-100 m: SRs located between 50 m and 100 m the centre of outer track.
No. of at potentially affected area means sum of the No. of SRs in East side (50-100 m), and West side (0-50 m) and (50-100 m).

Table 1-13 Distribution of Sensitive Receptors in Gujarat State

District	Villages	East (DFC) side (0-35 m)	East (DFC) side (35-100 m)	West side (0-35 m)	West side (35-100 m)	Total	No. at potentially affected SR
Banas Kantha	Amirgarh	0	2	0	0	2	2
Patan	Vadhana	0	0	1	0	1	0
Mahesana	Linch	0	0	0	1	1	1
Gandhinagar	Moti Bhoyan	0	1	0	0	1	1
Anand	Kusumbad	1	0	0	0	1	0
	Bhagvanpura	0	0	1	0	1	0
Total		1	3	2	1	7	4

Note: 0-50 m: SRs located between 0 and 35m from the centre of outer track, 35-100 m: SRs located between 35 m and 100 m the centre of outer track.
No. of at potentially affected area means sum of the No. of SRs in East side (35-100 m), and West side (0-35 m) and (35-100 m).

2) Land Use Survey

In order to grasp potential scale of the areas where mitigation measures are required, distribution of the settlement areas along the DFC alignment is summarized in Tables 1-14 and 1-15 based on the land use pattern survey which was conducted in August and September 2008. The length of DFC alignment which passes through the settlement areas approximately 12 km in Haryana, 103.6 km in Rajasthan, and 1.1 km in Gujarat.

Table 1-14 Distribution of Residential Area along the DFC Alignment in Parallel Section

State	Total length in the settlement area at Western side of DFC (km)	Total length in the settlement area at Eastern side of DFC (km)	Total (km)
Haryana	6.2	5.8	12.0
Rajasthan	51.4	52.4	103.6
Total	57.6	58.2	115.6

Table 1-15 Distribution of Residential Area along the DFC Alignment in Detour Section

State	Total length in the settlement areas (km)
Gujarat	1.1

1.1.3 Impact Assessment

(1) Noise Prediction

Railway noise (L_{Aeq}) generated by the operation of DFC is predicted. The locations for noise prediction are selected as shown in Figure 1-10 and Table 1-12. Twelve (12) prediction locations are selected in the parallel section, while five (5) locations in the detour section. The locations where residential and commercial areas exist alongside the railway alignment are selected.

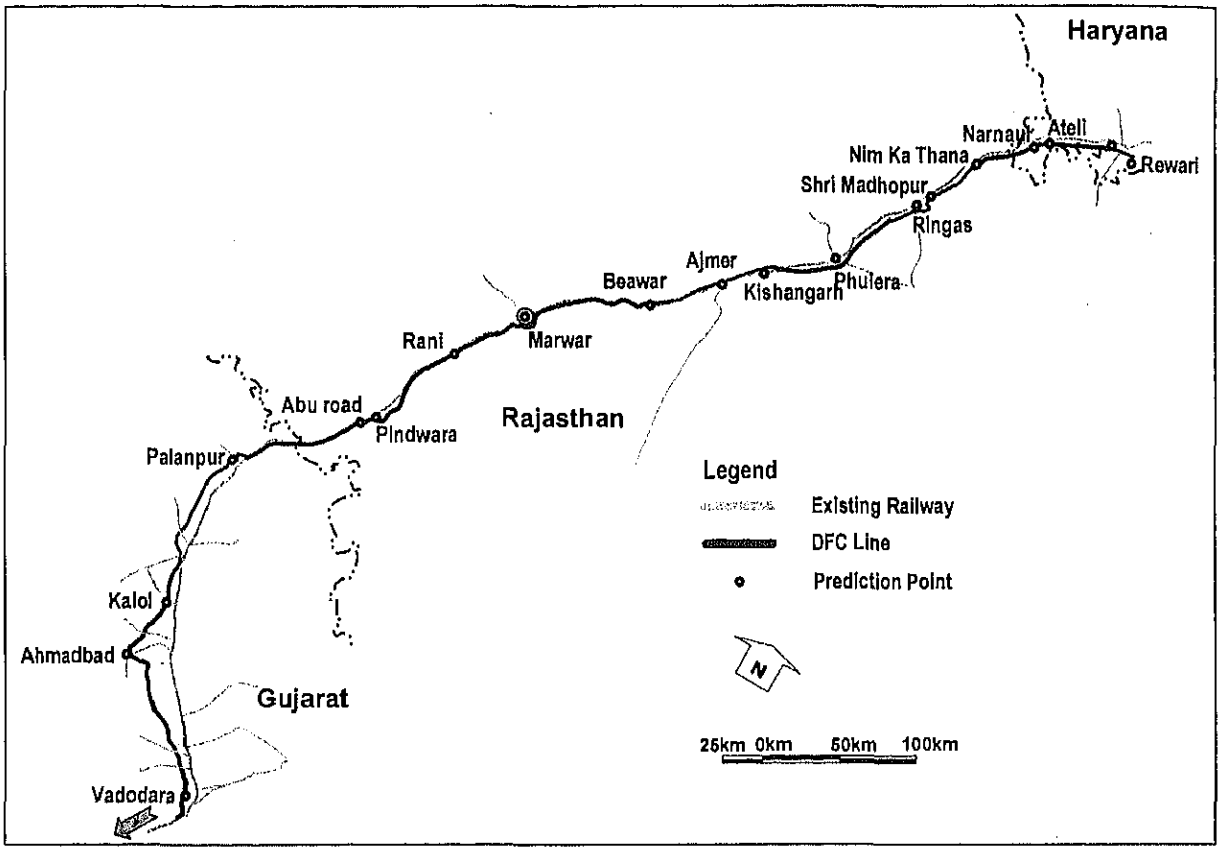


Figure 1-14 Location of Noise Level Prediction

Table 1-16 Prediction Location

Section	Name of Prediction Location	State
Parallel section	Abu road	Rajasthan
	Pindwara	Rajasthan
	Rani	Rajasthan
	Marwar	Rajasthan
	Beawar	Rajasthan
	Ajmer	Rajasthan
	Kishangarh	Rajasthan
	Ringas	Rajasthan
	Shri Madhopur	Rajasthan
	Nim ka thana	Rajasthan
	Narnaul	Haryana
	Ateli	Haryana
Detour section	Vadodara	Gujarat
	Ahmedabad	Gujarat
	Kalol	Gujarat
	Phulera	Rajasthan
	Rewari	Haryana

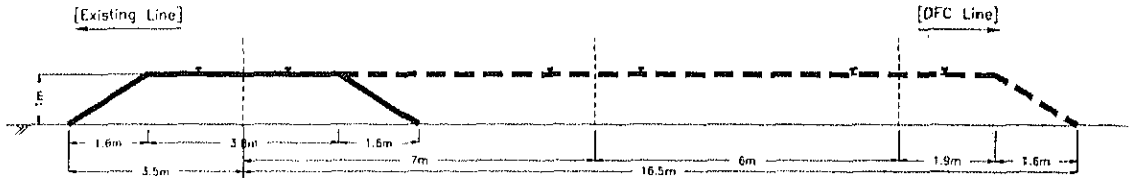
Although influence distance of noise from railway track is considered to be about 100 m, the noise is predicted with the range of 200 m from center of the outer railway track. The height of

prediction is 1.2 m above the ground. The cross-section drawings at each prediction location are given below.

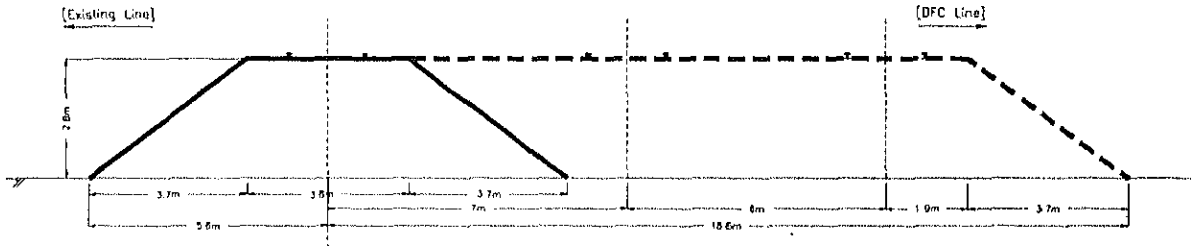
In Narnaul, Kishangarh, Ajmer, Marwar and Abu road, cross-section drawings for the prediction are determined based on actual widths measured at each site. For other sites, standard cross-section drawings are used for the prediction as shown in Figure 1-15.

a) Parallel Section

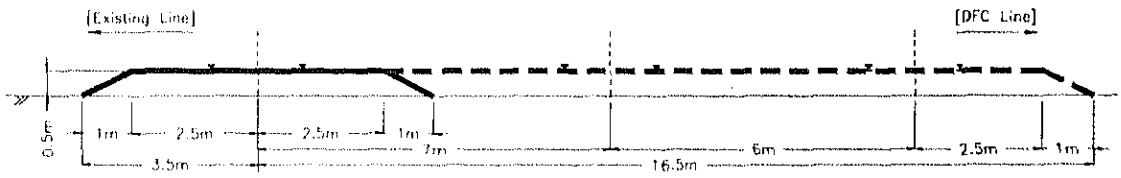
・Abu Road



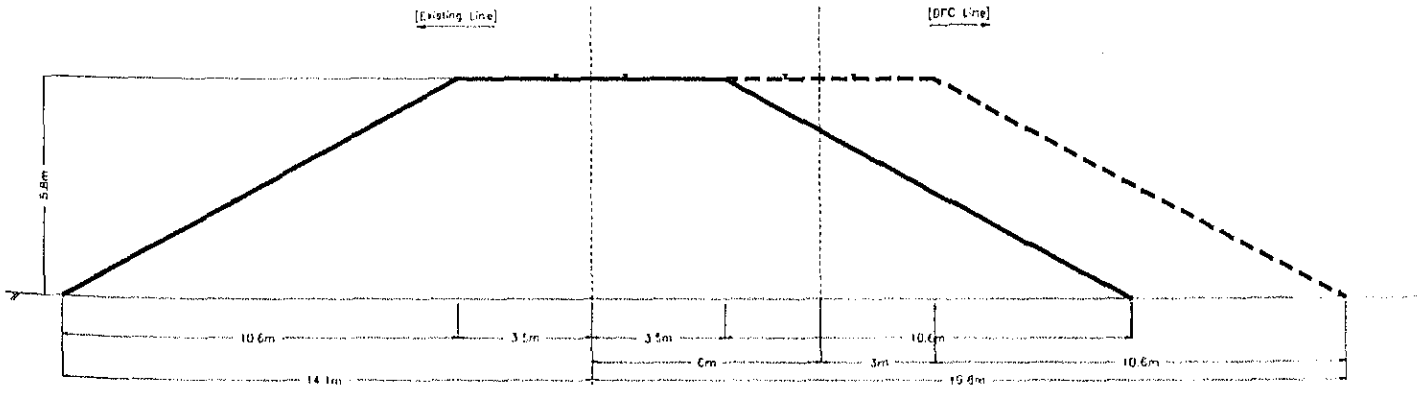
・Marwar



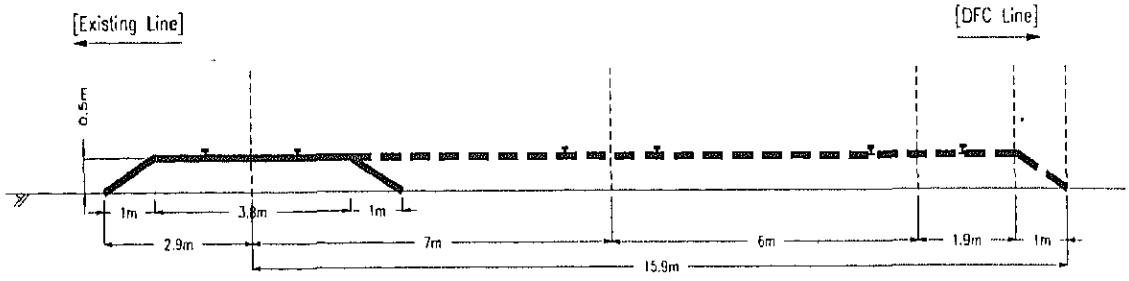
・Ajmer (St.1・Parallel Section)



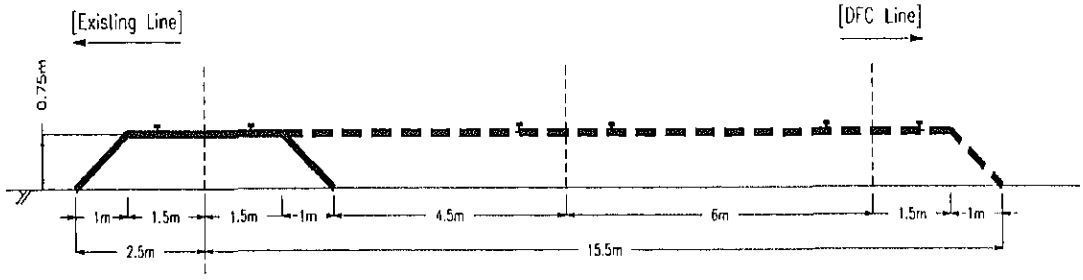
・Ajmer (St.2・DFC Section)



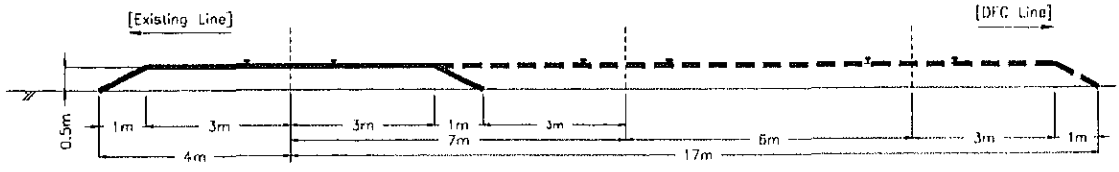
・Kishangarh



・Naunaul



・Other Point



b) Detour Section

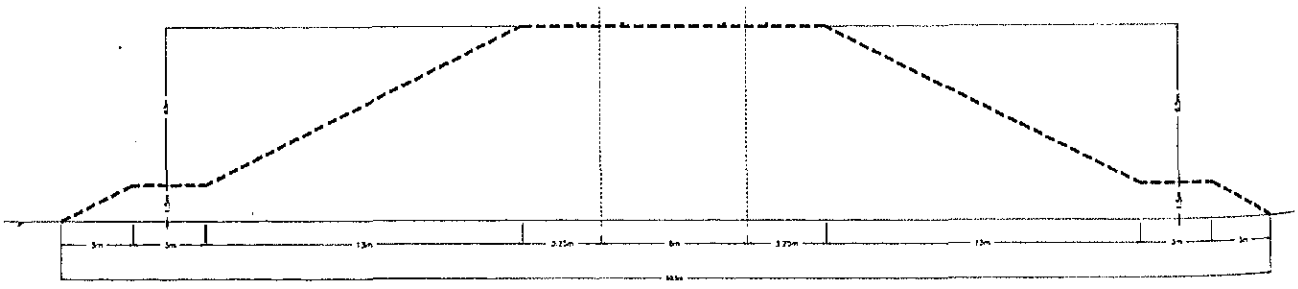


Figure 1-15 Cross Sections of Noise Level Prediction

(2) Method of Prediction

1) Procedure of Prediction

Procedure of prediction is given in Figure 1-16. At actual measurement sites, measured L_{AE} values are used for the prediction and at the other sites, measured L_{AE} values at the nearest sites are used. The L_{AE} and ambient values used for prediction at each site are shown in Table 1-17.

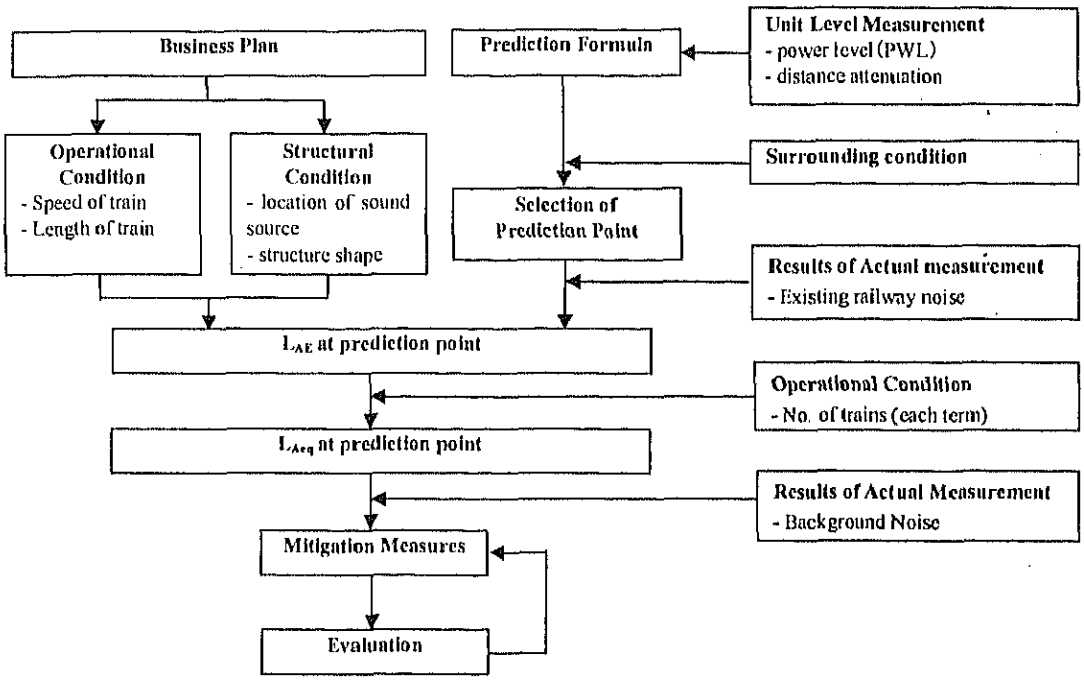


Figure 1-16 Procedure for Prediction of Noise Level

Table 1-17 Setting of Result of Actual Measurement

Prediction Point		Background Noise Levels used	Result of Existing Railway Noise Measurement (L_{AE}, No. of Freight Train)
Parallel Section	Abu road	Abu road	Abu road
	Pindwara	Abu road	Abu road
	Rani	Marwar	Marwar
	Marwar	Marwar	Marwar
	Beawar	Ajmer	Ajmer
	Ajmer	Ajmer	Ajmer
	Kishangarh	Kishangarh	Kishangarh
	Ringas	Kishangarh	Kishangarh
	Shri Madhopur	Kishangarh	Kishangarh
	Nim ka thana	Kishangarh	Kishangarh
	Narnaul	Narnaul	Kishangarh
	Ateli	Narnaul	Kishangarh
Detour Section	Vadodara	Abu road	—
	Ahmadabad	Abu road	—
	Kalol	Abu road	—
	Phulera	Kishangarh	—
	Rewari	Narnaul	—

2) Prediction Formulae

a) Noise Level of DFC

The noise level (L_{AE}) of DFC operation is predicted using modified empirical formula which was used in ESIMMS. The noise level is estimated by using total amount of unit PWL obtained at the results of actual measurement and multiplied amount of distance attenuation coefficient and logarithms of the distance from the center of the source of sound (track center). The formula adopted is shown below:

$$L_{AE} = PWL + B \log_{10}(D)$$

$$L_{Aeq} = L_{AE} + 10 \log_{10}(N/T)$$

where:

PWL :Power level ($PWL = 24.2 \cdot \log_{10}(V) + 52.4$)
D :Distance(m)
B :Distance attenuation coefficient (B = 14.9)
N :Number of trains
T :Target time [s]
Day time (7:00-22:00) T=54,000[s], Night time (22:00-7:00):T=32,400[s]

Source: Guidelines for Existing Railway in Japan

b) Noise Level of Existing Railway

An empirical formula derived from L_{AE} and distance attenuation coefficient based on the results of existing railway noise measurements in the parallel section is applied for the prediction. In addition, in order to calculate L_{Aeq}, a formula indicated by the guideline for existing railway in Japan is applied. The empirical formula is shown below. For the locations, where actual existing railway noises are not measured, the values measured at the nearest measurement location are applied.

<Freight train>

$$L_{AE}(D_2) = L_{AE}(D_1) - 14.9 * \log_{10}(D_2/D_1)$$

$$L_{Aeq}(D_2) = L_{AE}(D_2) + 10 * \log_{10}(N/T)$$

<Passenger train>

$$L_{AE}(D_2) = L_{AE}(D_1) - 15.7 * \log_{10}(D_2/D_1)$$

$$L_{Aeq}(D_2) = L_{AE}(D_2) + 10 * \log_{10}(N/T)$$

where:

D_1 : Distance from center of existing railway to the nearest measurement point [m]
D_2 : Distance from center of existing railway to prediction point [m]
B : Distance attenuation coefficient
(Freight train :B = 14.9, Passenger train :B = 14.9)
N : Number of trains
T : Target time [s]
Day time (7:00-22:00) T=54,000 [s], Night time (22:00-7:00): T=32,400 [s]

3) Condition of Prediction

a) Plan of DFC Operation

The following conditions of the DFC operation are assumed in this study.

- Type of traction: electrified traction

- Maximum train length: 686 [m]
- Running operation: 140 trains/direction/day with the same time interval (approximately one train for every five minutes, day time 96 trains/direction/day, night time 46 trains/direction/day) *day time 7:00-22:00, night time 22:00-7:00

b) Number of Existing Freight Train

In existing freight train in the parallel section, conditions of running operation are assumed in status quo. Based on the actual measurement in the parallel section, numbers of freight trains are set as shown in Table 1-18.

Table 1-18 Setting of Number of Freight Train

Time	Day time		Night time	
Prediction location	up	down	up	down
Abu road	10	8	5	4
Pindwara	10	8	5	4
Rani	6	6	3	3
Marwar	6	6	3	3
Beawar	8	12	4	6
Ajmer	8	12	4	6
Kishangarh	8	12	4	6
Ringas	8	12	4	6
Shri Madhopur	8	12	4	6
Nim ka thana	8	12	4	6
Narnaul	8	12	4	6
Ateli	8	12	4	6

Note: Day time (7:00-22:00), Night time (22:00-7:00)

c) Number of Existing Passenger Train

As for the existing passenger trains in the parallel section, based on the current time table (as of July, 2008), number of passenger trains are decided for the prediction as shown in Table 1-19. The number of passenger trains may increase in the future due to decrease in number of existing freight trains. Therefore, passenger trains presently operated at the frequency from one (1) to six (6) /week were assumed once a day. As well, as for location No.2 in Ajmer (Ajmer No.2), passenger trains are planned to operate on the existing main line of the railway and no passenger trains were considered there.

Table 1-19 Setting of Passenger Trains

Time	Day time		Night time	
Prediction location	up	down	up	down
Abu road	11	14	14	11
Pindwara	12	13	12	11
Rani	13	17	11	7
Marwar	15	15	9	9
Beawar	10	9	6	8
Ajmer	16	16	9	9
Kishangarh	15	10	5	9
Ringas	5	5	2	2
Shri Madhopur	5	5	2	2
Nim ka thana	5	5	2	2
Narnaul	5	5	2	2
Ateli	5	5	2	2

Note: Passing trains are included in above number.
Day time (7:00-2:;00), Night time (22:00-7:00)

(3) Results of Prediction

1) Parallel Section

The predicted future noise levels (L_{Aeq}) at 30 m and 50 m distances from the centre of existing railway track in the parallel section are ranging from 54-70 dB and 53-66 dB , respectively and they are summarized in Table 1-20.

Table 1-20 Result of Prediction (L_{Aeq}) in Parallel Section (Unit: dB)

Prediction location		Time	Guideline value	(1)Background Noise	(2)Existing railway		(3)DFC railway		(2)+(3)	
					30 m	50 m	30 m	50 m	30 m	50 m
Abu road	East	daytime	60	50	61	58	68	63	69	64
		nighttime	55	43	62	59	67	62	68	64
	West	daytime	60	50	61	58	63	61	65	63
		nighttime	55	43	62	59	62	60	65	62
Pindwara	East	daytime	60	50	61	58	68	63	69	64
		nighttime	55	43	62	58	67	62	68	64
	West	daytime	60	50	61	58	63	61	65	63
		nighttime	55	43	62	58	62	60	65	62
Rani	East	daytime	60	49	66	63	68	63	70	66
		nighttime	55	45	66	63	67	62	70	66
	West	daytime	60	49	66	63	63	61	68	65
		nighttime	55	45	66	63	62	60	68	64
Marwar	East	daytime	60	49	62	60	63	60	65	63
		nighttime	55	45	62	60	62	59	65	62
	West	daytime	60	49	65	62	58	57	66	63
		nighttime	55	45	65	62	57	56	65	63
Beawar	East	daytime	60	50	61	58	68	63	69	64
		nighttime	55	49	61	58	67	62	68	64
	West	daytime	60	50	61	58	63	61	65	63
		nighttime	55	49	61	58	62	60	65	62
Ajmer (St.1)	East	daytime	60	50	62	59	68	63	69	65
		nighttime	55	49	61	58	67	62	68	64
	West	daytime	60	50	62	59	63	61	66	63
		nighttime	55	49	61	58	62	60	65	62
Ajmer (St.2)	East	daytime	60	53	—	—	58	56	58	56
		nighttime	55	50	—	—	57	56	57	56
	West	daytime	60	53	—	—	55	53	55	53
		nighttime	55	50	—	—	54	53	54	53
Kishangarh	East	daytime	60	53	65	62	68	63	70	66
		nighttime	55	50	64	61	67	62	69	65
	West	daytime	60	53	65	62	63	61	67	64
		nighttime	55	50	64	61	62	60	66	63
Ringas	East	daytime	60	53	60	60	63	63	65	65
		nighttime	55	50	59	59	62	62	64	64
	West	daytime	60	53	65	62	63	61	67	64
		nighttime	55	50	65	62	62	60	67	64
Shri Madhopur	East	daytime	60	53	60	60	63	63	65	65
		nighttime	55	50	59	59	62	62	64	64
	West	daytime	60	53	65	62	63	61	67	64
		nighttime	55	50	65	62	62	60	67	64
Nim ka thana	East	daytime	60	53	60	60	63	63	65	65
		nighttime	55	50	59	59	62	62	64	64
	West	daytime	60	53	65	62	63	61	67	64
		nighttime	55	50	65	62	62	60	67	64
Narnaul	East	daytime	60	54	64	60	68	63	69	65
		nighttime	55	53	63	59	67	62	68	64
	West	daytime	60	54	64	60	63	61	66	63
		nighttime	55	53	63	59	62	60	65	63
Ateli	East	daytime	60	54	64	60	68	63	69	65
		nighttime	55	53	63	59	67	62	68	64

Prediction location		Time	Guideline value	(1)Background Noise	(2)Existing railway		(3)DFC railway		(2)+(3)	
					30 m	50 m	30 m	50 m	30 m	50 m
	West	daytime	60	54	65	62	63	61	67	64
		nighttime	55	53	65	62	62	60	67	64

Note: daytime (7:00-22:00), nighttime (22:00-7:00)
Shaded sections indicate that the noise levels exceed the recommended standard level of railway noise which is proposed in the Guidelines for Countermeasures for Railway Noise in Case of New Constructions and Large-scale Improvement of Existing Railways, Environmental Agency of Japan, December 1995

2) Detour Section

The predicted noise level (L_{Aeq}) at 35 m and 50 m from the centre of DFC alignment are ranging from 55-56 dB and 54-55 dB, respectively and are summarized in Table 1-21.

Table 1-21 Result of Prediction in Detour Section (Unit: dB)

Prediction location		Time	Guideline value	Background noise	DFC	
					35m	50m
Vadodara	East	daytime	60	50	56	55
		nighttime	55	43	55	54
	West	daytime	60	50	56	55
		nighttime	55	43	55	54
Ahmadabad	East	daytime	60	50	56	55
		nighttime	55	43	55	54
	West	daytime	60	50	56	55
		nighttime	55	43	55	54
Kalol	East	daytime	60	50	56	55
		nighttime	55	43	55	54
	West	daytime	60	50	56	55
		nighttime	55	43	55	54
Phulera	East	daytime	60	53	56	55
		nighttime	55	50	55	54
	West	daytime	60	53	56	55
		nighttime	55	50	55	54
Rewari	East	daytime	60	54	56	55
		nighttime	55	53	55	54
	West	daytime	60	54	56	55
		nighttime	55	53	55	54

Note) daytime (7:00-22:00), nighttime (22:00-7:00)

(4) Evaluation

1) Comparison with the Recommended Standard Level of Railway Noise

Among the available standards and regulations on railway noise which can be referred as the criteria, the recommended standard level of railway noise which is proposed in "the Guidelines for Countermeasures for Railway Noise in Case of New Constructions and Large-scale Improvement of Existing Railways, Environmental Agency of Japan, December 1995" was adopted for the evaluation because the operational conditions of DFC are relatively similar to this case. The following recommended standard which is applied to new construction of railway is adopted.

- Daytime (7:00 - 22:00): 60 dB (L_{Aeq}) or less
- Night time (22:00 - 7:00): 55 dB (L_{Aeq}) or less

Along the parallel section, the predicted noise levels (L_{Aeq}) which are sums of railway noise from DFC and existing railway track, at 30 m and 50 m distances from the center of DFC alignment exceed the above recommended standard level of railway noise at both day and night times, except for Ajmer No.2. In fact, the results also show that only railway noise levels

from the existing railway track already exceed the recommended standard level for the most sites. Therefore, some mitigation measures are recommended to be taken especially along the residential areas and near the SRs.

On the other hand, along the detour section, it is predicted that the railway noise levels from the DFC operation dose not exceed the recommended standards levels even at 30 m distance from the center of DFC alignment. In addition, since the DFC alignments of the detour section have been drawn already so as not to disturb the settlement areas as much as possible, limited mitigation measures can be considered except for the near SRs.

2) Consideration of Environmental Mitigation Measures

a) Case Studies on Establishment of Soundproof Wall

Among conceivable environmental mitigation measures for the railway noise, establishment of soundproof wall along the track is one of effective measures to lowering noise levels. In order to grasp necessary height of the soundproof wall at different locations, case studies have been conducted at the prediction locations along the parallel section.

The results of case studies of establishment of soundproof wall are summarized in Table 1-22, while location of the wall is shown in Figure 1-17. If ROW is set at 30 m from center of railway track, 0.5 m to 4.0 m height soundproof wall may be required, while if the ROW is set at 50 m from center of railway track (e.g. by securing wider buffer area), 0.5 m to 2.5 m height soundproof wall may be required. Actually, necessity of soundproof walls and its' required heights and locations should be examined based on the availability of buffer area as well as distribution of SRs and residential areas along the alignment.

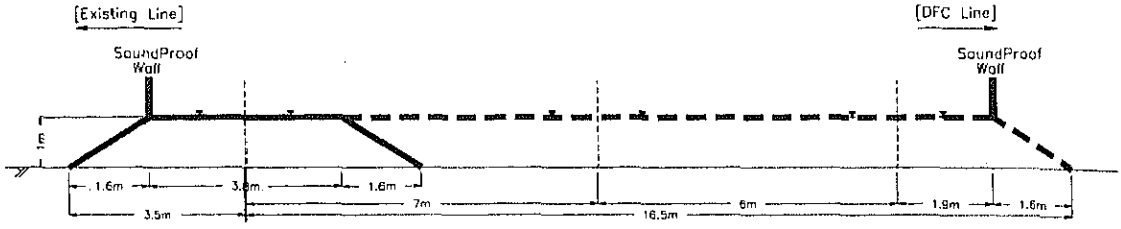
Table 1-22 Results of Case Studies on Soundproof Wall Mitigation Measure (Unit:dB)

Prediction location		Time	Recommended Standard Level	Without measure		Height of soundproof		With measure	
				30 m	50 m	30 m	50 m	30 m	50 m
Abu road	East	daytime	60	69	64	3.0 m	1.5 m	55	55
		nighttime	55	68	64			54	54
	West	daytime	60	65	63	1.5 m	1.0 m	56	55
		nighttime	55	65	62			55	54
Pindwara	East	daytime	60	69	64	3.0 m	1.5 m	55	55
		nighttime	55	68	64			55	55
	West	daytime	60	65	63	2.0 m	1.0 m	55	55
		nighttime	55	65	62			54	55
Rani	East	daytime	60	70	66	4.0 m	2.5 m	55	55
		nighttime	55	70	66			55	55
	West	daytime	60	68	65	2.5 m	1.5 m	55	55
		nighttime	55	68	64			55	55
Marwar	East	daytime	60	65	63	3.5 m	2.5 m	56	55
		nighttime	55	65	62			55	55
	West	daytime	60	66	63	2.5 m	1.5 m	55	55
		nighttime	55	65	63			55	53
Beawar	East	daytime	60	69	64	3.0 m	1.5 m	54	55
		nighttime	55	68	64			55	55
	West	daytime	60	65	63	2.0 m	1.0 m	55	55
		nighttime	55	65	62			54	55
Ajmer (St.1)	East	daytime	60	69	65	3.0 m	1.5 m	56	56
		nighttime	55	68	64			55	55
	West	daytime	60	66	63	2.0 m	1.0 m	56	56
		nighttime	55	65	62			55	55
Ajmer (St.2)	East	daytime	60	58	56	0.5 m	0.5 m	56	54
		nighttime	55	57	56			55	53
	West	daytime	60	55	53	—	—	—	—
		nighttime	55	54	53			—	—
Kishangarh	East	daytime	60	70	66	3.5 m	2.5 m	56	55
		nighttime	55	69	65			55	54
	West	daytime	60	67	64	2.0 m	1.0 m	56	56
		nighttime	55	66	63			55	55
Ringas	East	daytime	60	65	65	3.0 m	1.5 m	56	56
		nighttime	55	64	64			55	55
	West	daytime	60	67	64	2.5 m	1.5 m	55	55
		nighttime	55	67	64			54	54
Shri Madhopur	East	daytime	60	65	65	3.0 m	1.5 m	56	56
		nighttime	55	64	64			55	55
	West	daytime	60	67	64	2.5 m	1.5 m	55	55
		nighttime	55	67	64			54	54
Nim ka thana	East	daytime	60	65	65	3.0 m	1.5 m	56	56
		nighttime	55	64	64			55	55
	West	daytime	60	67	64	2.5 m	1.5 m	55	55
		nighttime	55	67	64			54	54
Narnaul	East	daytime	60	69	65	3.0 m	1.5 m	56	56
		nighttime	55	68	64			55	55
	West	daytime	60	66	63	2.0 m	1.0 m	55	55
		nighttime	55	65	63			54	55
Ateli	East	daytime	60	69	65	3.0 m	1.5 m	57	56
		nighttime	55	68	64			55	55
	West	daytime	60	67	64	2.5 m	1.5 m	55	55
		nighttime	55	67	64			54	54

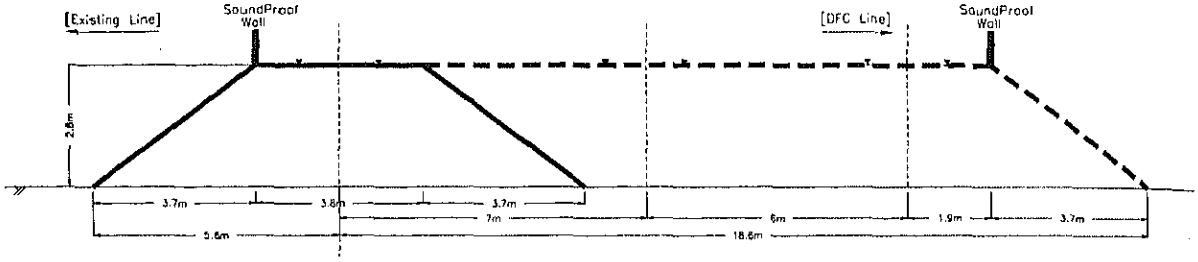
Note: daytime (7:00-22;00), nighttime (22:00-7:00)

i) Parallel Section

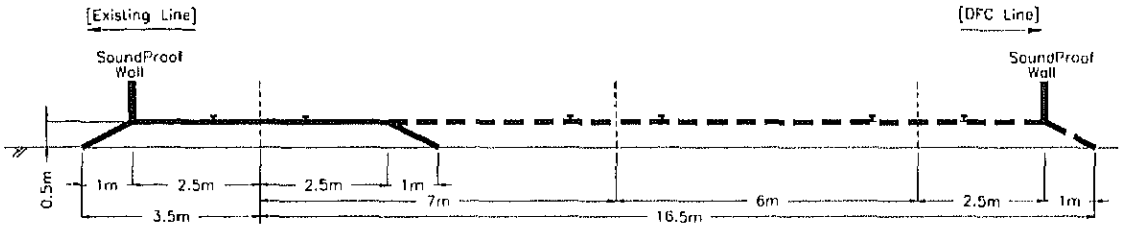
・Abu Road



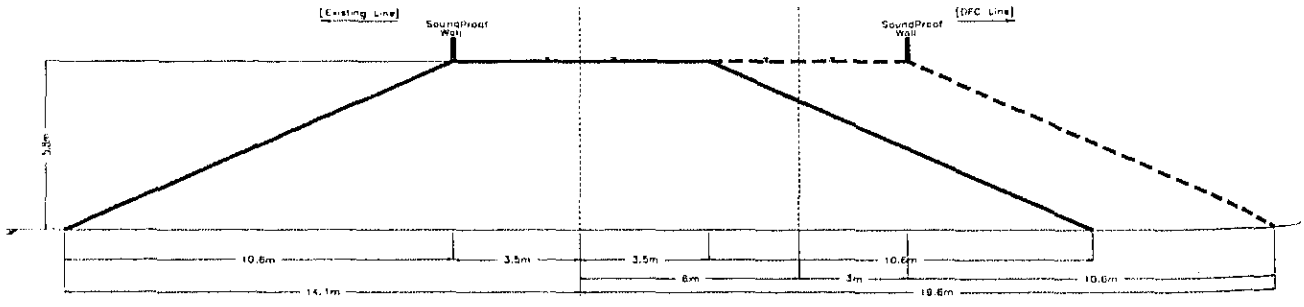
・Marwar



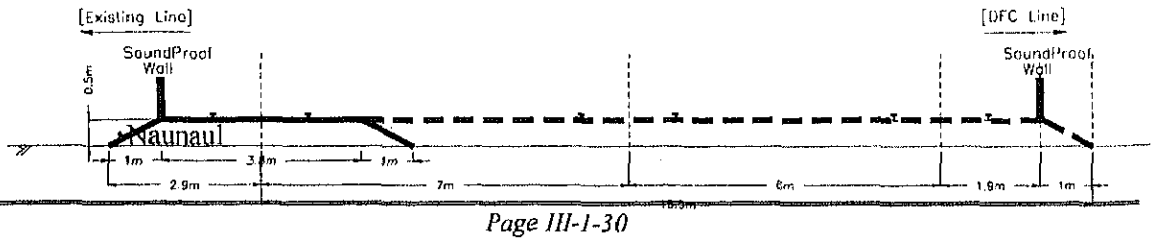
・Ajmer (St.1・Parallel Section)

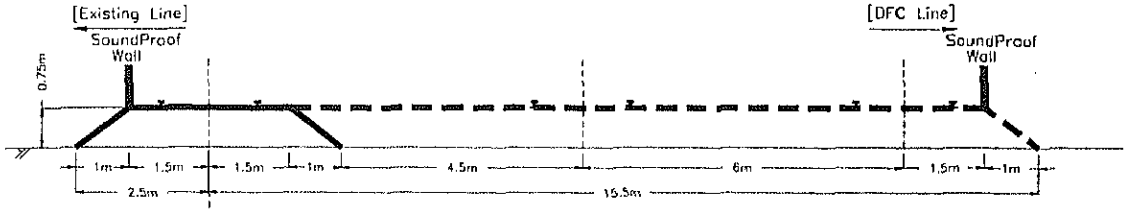


・Ajmer (St.2・DFC Section)

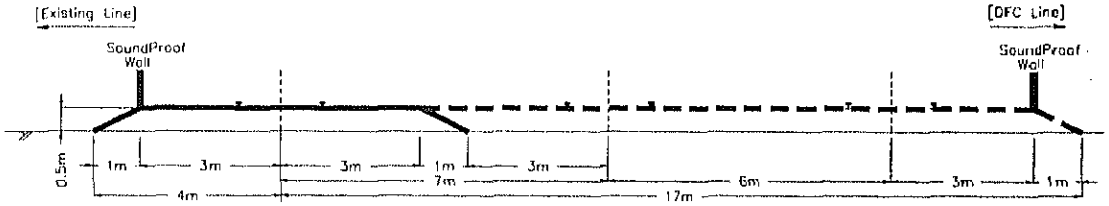


・Kishangarh





・Other point



ii) Detour Section

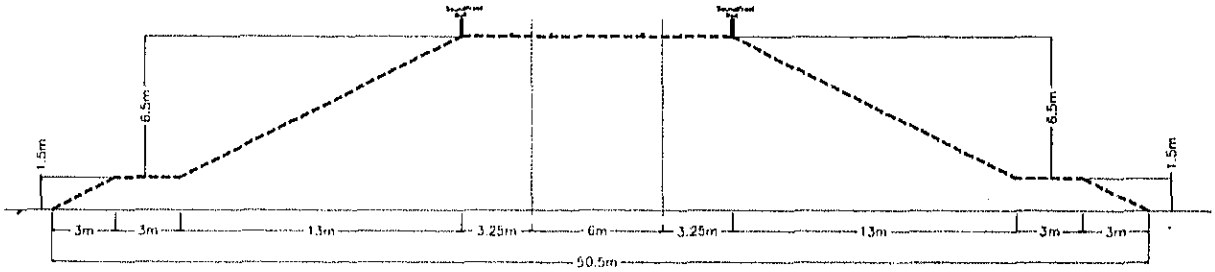


Figure 1-17 Case Studies on Soundproof Wall Mitigation Measure (Location and Height of the Wall)

b) Case Studies on Shifting Train Operation Number from Night to Day Times

The condition of Ajmer No.2 where no passenger train passes through is different from the other locations where the noise levels exceed the recommended standard levels. Since the predicted noise level at Ajmer No.2 exceed the recommended standard levels at night time only, one of conccivable mitigation measures here is to shifting the number of train operation from night to day times. The results of case studied are summarized in Table 1-23. Same as the case of soundproof wall, detail examinations should be conducted based on the availability of buffer area as well as distribution of SRs and residential areas along the alignment.

Table 1-23 Results of Case Studies on Shifting Train Operation Number (Unit: dB)

Prediction location		Time	Recommended Standard Level	Current Plan		Without Measure		Limitation Plan		With Measure	
				Up	Down	30 m	50 m	Up	Down	30 m	50 m
Ajmer (St.2)	East	daytime	60	94	94	58	56	110	110	59	57
		nighttime	55	46	46	57	56	30	30	55	54
		daytime	60	94	94	58	56	95	95	58	56
		nighttime	55	46	46	57	56	45	45	57	55

Note: daytime (7:00-22:00), nighttime (22:00-7:00)
Shaded section indicates that the noise levels exceed the recommended standard level.

1.2 VIBRATION

1.2.1 Study Methodologies

(1) Survey on Regulations of Vibration Pollution

The published literature and governmental documents, the existing regulations related to vibration pollution in India and those in Japan are reviewed to understand potential impacts and to consider mitigation measures.

(2) Survey of Existing Circumstance

1) Railway and Background Vibration Measurements in Parallel Section

a) Measurement Sites

Railway and background vibration levels at the existing railway are measured which is to be used for prediction of DFC impact in the parallel section. In the parallel section, besides newly establish DFC railway, vibration from the existing railway should be considered to understand the actual impact at the operation period. The measurements are mainly conducted at the densely populated areas. Narnaul, Kishangarh, Ajmer, Marwar, and Abu Road which are same location as that of measurement of noise.

b) Methodology of Railway and Background Vibration Measurement

Japanese standard for railway vibration measurement, JIS Z 8735 (Method of Measurement of Vibration Level) was used for vibration measurement which is accepted by ISO. Since there is no relevant standard method for measuring railway vibration in India, vibration measurements are generally conducted following ISO. However, taking into consideration the Indian general ways, X, Y, Z-axis measurement is adopted for railway vibration and background vibration measurements, although only Z-axis (vertical vibration) vibration is generally measured in Japan. The method in the parallel section is summarized in Table 1-24. One (1) or two (2) sites are selected in each area for the measurement. Similarly, background vibration is measured at the same sites during the time when trains did not pass through. However, at the Narnaul station, only background vibration is measured as the existing railway track was under construction for the gauge conversion.

Table 1-24 Measurement Method of Railway and Background Vibration in Parallel Section

Item	Specifications
Vibration Level Meter	Vibration Level Meter which complies with "JIS C 1510-1: 1995"
Measurement Points	One or two points within the range of 50 m from the centre of the outer railway track in each site.
Measurement Items	・Railway Vibration Lp (peak level), 1/3octave frequency analysis (1/3octave band center frequency: 1-80Hz) ・Background Vibration Lp (peak level)
Vibration Axis	X, Y, Z
Time Weighting Characteristics	630 ms
Measurement Time	Railway vibration : 10:00-18:00 Background vibration : 10 minutes within each term (10:00-12:00, 12:00-14:00, 14:00-16:00, 16:00～18:00
Other Data	Date and time, location, train types (freight/passenger) and load (container/bulk), number of train cars, train length, passage time, train speed, pictures, information on surrounding environment, etc.

Measurement instruments are installed as shown in Figure 1-18.

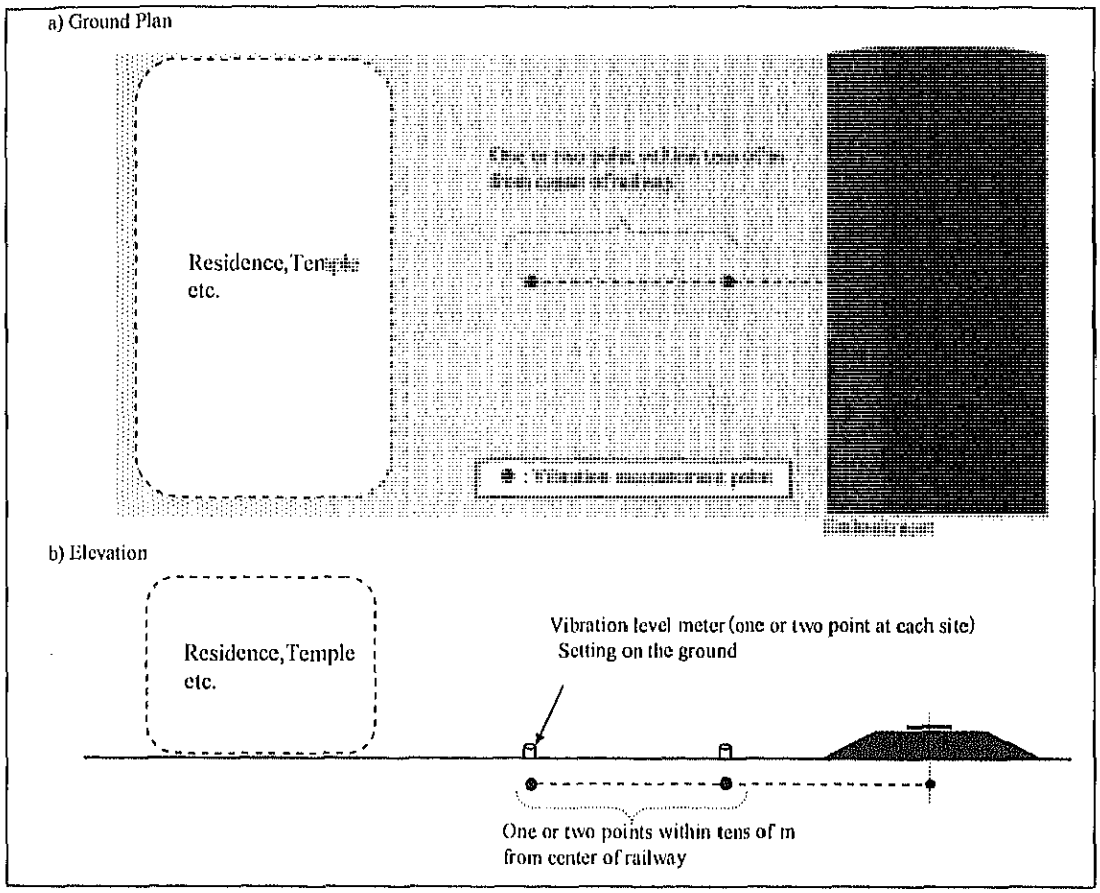


Figure 1-18 Schematic Plan of Railway and Background Vibration Measurements in Parallel Section

2) Unit Level of Railway Vibration

a) Measurement Sites

For predicting impacts of vibration at the DFC operation, railway vibration by freight trains are measured at the same sites of the noise measurements at Khurja.

b) Methodology

Japanese vibration measurement standard, JIS Z8735 (Method of Measurement of Noise Vibration Level) is used for vibration measurement. Measurement Method is explained in Table 1-25. The method commonly applied to vibration measurement in India is overall the same as that in Japan and there is no particular method of railway vibration measurement in India. However, X, Y, Z-axis measurement that complies with ISO is used as common method in India instead of the Japanese general method mainly measuring only the Z-axis.

Table 1-25 Measurement Method of Unit Level of Train

Item	Specifications
Vibration Level Meter	Vibration Level Meter which complies with "JIS C 1510-1: 1995"
Measurement Points	12.5m,25m,and 50m from center of railway
Measurement Items	Lp (peak level), 1/3octave frequency analysis (center frequency: 0.4-80Hz)
Vibration Axis	X, Y, Z
Time Weighting Characteristics	630ms
Number of Measurement	Freight train: 40 trains Passenger train: 34 trains
Other Data	Date and time, location, train types (freight/passenger) and load (container/bulk), number of train cars, train length, passage time, train speed, pictures, information on surrounding environment, etc.

Measurement instruments are installed in each site as shown in Figure 1-19.

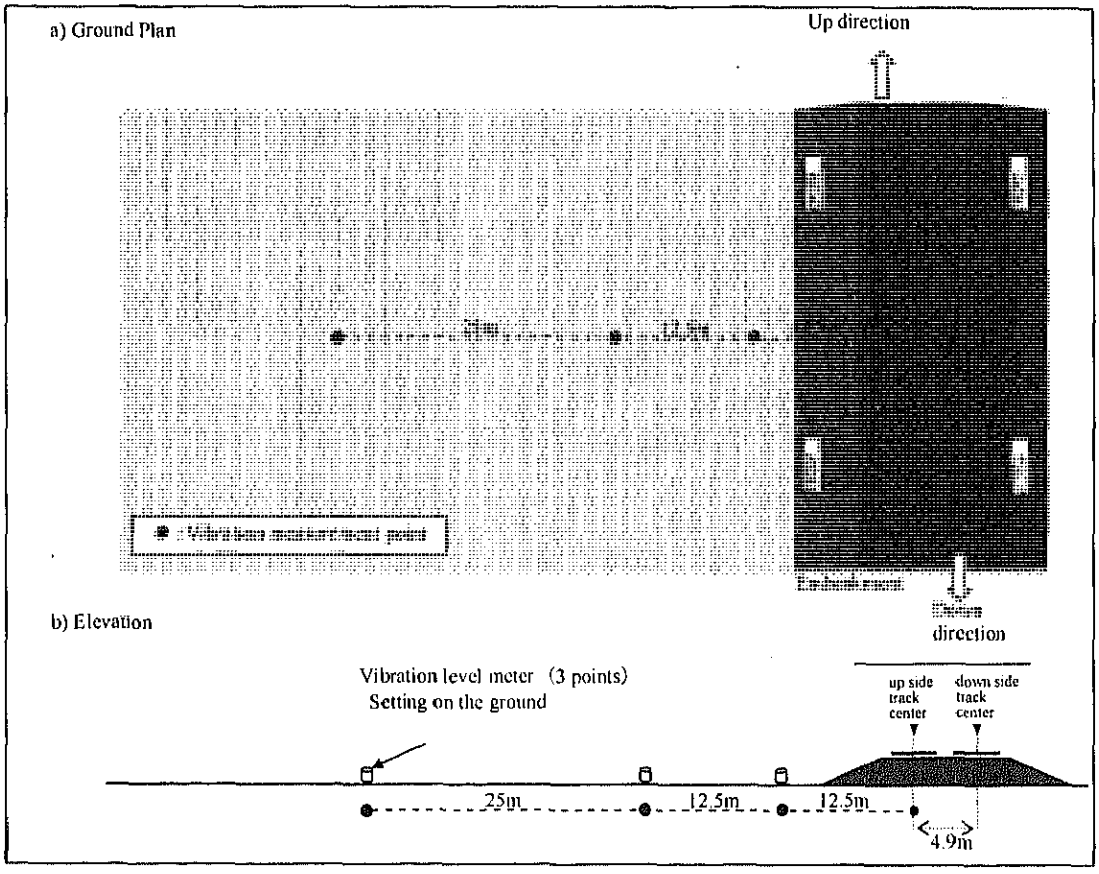


Figure 1-19 Schematic Plan of Unit Vibration Level Measurement

1.2.2 Results of Survey

(1) Survey of Regulation and Standards

There are no particular regulations, standards or guidelines for railway vibration and the standards or regulations of background vibration to be applied in India.

On the other hand, the guideline values for railway vibration are set for Shinkansen super-express railway (or called as "bullet train") in Japan as shown in Table 1-26, while there is no other national guideline value or recommend standard level on railway vibration.

However, vibration speed (0.5 mm/sec) or less (corresponding to vibration level of 65 dB (Lp) or less) for the railway is recommended by Pollution Control Committee of Yokohama City (1974). This value has been applied as the standard value of the railway vibration in EIA procedure.

Table 1-26 Guideline Value of Vibration from Shinkansen Super Express Railway in Japan

Corrected Acceleration Level	dB (Lp)
	70 or less

Source: Environmental Agency of Japan, 1976

(2) Results of Field Survey

1) Background Vibration

The results of background vibration (Lp) in each site are shown in Table 1-27. Measurement value is represented of each different time period (10:00-12:00, 12:00-14:00, 14:00-16:00, 16:00-18:00) when trains did not pass through. At all measurement sites, the results of vibration value indicated almost 30dB or less, and below 55dB which is the perceivable limit value.

Table 1-27 Results of Background Vibration Measurement

Station	No.	Ambient vibration level Lp [dB]														
		10:00~12:00			12:00~14:00			14:00~10:00			16:00~18:00			Overall 10:00~18:00		
		X	Y	Z	X	Y	Z	X	Y	Z	X	Y	Z	X	Y	Z
Abu Road	1	<30	<30	<25	<30	<30	26	<30	<30	<25	<30	<30	<25	<30	<30	26
	2	<30	<30	<25	<30	<30	<25	32	31	<25	<30	<30	<25	32	31	<25
Marwar	1	<30	<30	<25	<30	<30	<25	33	<30	<25	<30	<30	<25	33	<30	<25
	2	<30	<30	<25	30	31	33	<30	<30	<25	<30	<30	<25	30	31	33
Ajmer	1	31	<30	29	<30	<30	<25	33	<30	<25	<30	<30	<25	33	<30	29
	2	30	<30	31	32	31	31	<30	<30	28	<30	<30	31	32	31	31
Kishangarh	1	34	32	27	35	33	28	<30	<30	<25	<30	<30	<25	35	33	28
	2	<30	<30	28	<30	<30	27	<30	<30	<25	<30	<30	25	<30	<30	28
	3	<30	<30	<25	<30	<30	26	<30	<30	<25	<30	<30	23	<30	<30	26
Narnaul	1	<30	<30	33	34	31	33	34	32	35	<30	<30	34	34	32	35
	2	36	33	38	38	34	38	34	31	35	<30	<30	36	38	34	38
	3	32	32	29	32	33	29	32	<30	25	<30	<30	29	32	33	29

Note) Since measurement lower limit of vibration level meter is 30dB for X and Y-direction, 25dB for Z-direction, measurement value under these limit indicates with [<].

2) Railway Vibration

a) Peak Level (Lp) of Railway Vibration

The results of railway vibration (Lp) at each site are summarized in Table 1-28. In Japan, correlation between appeal rate of damages of buildings and vibration level has been studied and 70 dB of vibration level is said to be the limitation so as not to damage the buildings. During the survey it is found that at each survey point located at a distance of 10-20 m from the center of railway track, vibration measured was below 70 dB. Hence, under the present situation no serious damages of building due to railway vibration are expected.

Table 1-28 Results of Railway Vibration Measurement in Pallarel Section

Station	NO.	date	Number of trains	train type	train direction	Average train speed [km/hr]	Average train length [m]	measurement distance from railway-center [m]		Average Vibration Level [dB]					
										$Lp_{,x}$		$Lp_{,y}$		Lp_{z}	
								point 1	point 2	point 1	point 2	point 1	point 2	point 1	point 2
Abu Road	1	5-Sep	2	passenger	up	27	460	13	26	48	43	49	43	58	50
			5		down	26	411			49	42	49	43	58	49
			4	freight	up	21	657			47	41	48	42	57	48
			4		down	19	598			47	40	46	41	56	47
	2	5-Sep	8	passenger	up	16	416	10		43		45		55	
			5		down	20	425			44		48		55	
			5	freight	up	13	646			52		56		61	
			4		down	14	603			57		59		64	
Marwar	1	3-Sep	3	passenger	up	21	489	18	32	45	36	46	38	64	44
			4		down	30	459			44	35	46	38	53	43
			2	freight	up	46	720			46	38	49	40	58	46
			3		down	25	623			44	36	44	36	53	43
	2	3-Sep	3	passenger	up	20	489	15		54		58		65	
			4		down	20	469			51		56		63	
			3	freight	up	29	672			55		60		66	
			2		down	20	588			53		56		63	
Ajmer	1	1-Sep	5	passenger	up	66	433	12.5		51		54		60	
			2		down	52	487			50		54		59	
			3	freight	up	30	597			52		56		60	
			4		down	19	624			52		58		60	
	2	1-Sep	2	freight	up	43	595	3.5	14.1	59	54	74	56	73	65
			4		down	37	573			59	51	72	52	72	64
Kishagarh	1	30-Aug	2	passenger	up	27	569	15	30	53	40	52	39	56	39
			2		down	73	339			57	42	57	43	59	45
			4	freight	up	31	625			54	39	54	39	57	41
			4		down	32	538			51	40	51	38	56	40
	2	31-Aug	2	passenger	up	38	569	16.8		53		56		64	
			2		down	41	383			53		57		64	
			3	freight	up	39	522			53		56		60	
			3		down	31	468			50		55		57	
	3	31-Aug	3	passenger	up	38	481	15	22	47	37	49	40	56	46
			2		down	42	344			49	39	52	42	58	48
			4	freight	up	45	492			49	40	52	42	59	48
			4		down	31	468			48	38	50	40	56	47

Note) Shaded area indicates non-measurement point
Only freight trains pass through at Ajmer No.2

b) Vibration Frequency Band Analysis

To find the frequency characteristics of the vibration generated by freight trains, one-third (1/3) octave band is analysed for the obtained vibration frequency spectra of passenger trains. The results show that frequency of the vibration excelled in a range of 20 to 50Hz compared to other ranges. This tendency is different from that of Japan and also difference between passenger train and freight train is not confirmed.

In Japan, predominant frequency of vibration is reported as 20 Hz, 10-40 Hz and 60 Hz in bullet trains, conventional railway and underground railway (subway) , respectively. In addition, it is said that the difference in predominant frequency is caused by type of train, structure of rail and ground condition which vibration diffuses. The results of this study indicate that difference between Japanese examples and this study may be due to different railway track situation between Japan and India.

3) Unit Level of Freight Train Vibration

a) Peak Level (Lp) of Freight Train

The results of freight train vibration level measurement at Khurja are summarized in Table 1-29. The measurements included 19 events of trains going up direction and 17 events of trains going down direction.

Table 1-29 Results of Freight Train Vibration Level Measurement and SVL at Khurja

No.	date	time	cargo type	train speed [km/hr]	train passage time [s]	train length [m]	train direction	Vibration Level(dB) L_{pX}			SVL_x	Vibration Level(dB) L_{pY}			SVL_y	Vibration Level(dB) L_{pZ}			SVL_z
								12.5m	25.0m	50.0m		12.5m	25.0m	50.0m		12.5m	25.0m	50.0m	
1	21-Aug	15:20	container	46	50	638	up	49	45	42	70	52	46	45	73	61	55	50	82
2	21-Aug	18:09	open	56	42	646	up	53	50	49	74	53	49	50	74	62	57	54	83
3	21-Aug	18:35	open	43	56	666	up	50	47	46	70	52	48	48	73	61	57	52	82
4	22-Aug	14:51	open	66	36	656	up	52		48	72	53		48	74	62		55	83
5	23-Aug	9:26	open	57	41	656	up	54	51	49	75	56	52	51	77	65	58	55	86
6	23-Aug	10:12	open	74	32	656	up	53	50	46	74	55	50	46	76	64	57	54	84
7	23-Aug	10:23	container	46	50	646	up	50	46		71	52	48		72	61	54		81
8	23-Aug	12:01	container	76	31	646	up	52	49	47	73	54	50	46	74	62	56	55	83
9	23-Aug	12:14	open	56	42	646	up	51	49	46	72	55	50	48	75	64	57	53	84
10	23-Aug	13:27	container	56	41	646	up	51	49	46	72	52	50	47	73	62	58	54	83
11	23-Aug	13:46	open	51	46	646	up	53	49	48	73	55	48	48	76	64	57	51	85
12	23-Aug	13:56	open	42	45	630	up	51	47	45	71	56	48	46	77	66	58	51	86
13	23-Aug	14:13	open	67	35	656	up	53	48	46	73	57	53	52	78	67	61	58	88
14	23-Aug	14:30	open	50	47	656	up	54	48	45	74	52	47	47	73	62	55	51	83
15	23-Aug	15:28	container	56	48	666	up	57	54	53	78	52	47	46	73	62	56	51	83
16	23-Aug	16:22	open	60	40	656	up	51	48	46	72	56	50	50	76	65	57	56	86
17	23-Aug	16:38	container	62	38	646	up	51	46	42	71	53	50	44	74	63	56	54	83
18	23-Aug	16:55	container	84	28	646	up	54	50	49	75	57	52	46	78	65	59	57	86
19	24-Aug	10:56	open	53	45	656	up	49	47	44	70	54	49	49	75	63	56	53	84
20	24-Aug	11:06	container	61	39	648	up	53	50	47	73	55	51	46	75	63	56	55	83
21	24-Aug	11:38	open	42	46	633	up	51	49	46	72	52	49	47	73	62	56	52	82

No.	date	time	cargo type	train speed [km/hr]	train passage time [s]	train length [m]	train direction	Vibration Level(dB) L_{pX}			SVL_x	Vibration Level(dB) L_{pY}			SVL_y	Vibration Level(dB) L_{pZ}			SVL_z
								17.4m	29.9m	54.9m		17.4m	29.9m	54.9m		17.4m	29.9m	54.9m	
1	21-Aug	15:49	open	43	45	540	down	48	45	44	72	52	47	46	76	62	53	51	85
2	21-Aug	17:14	covered	57	36	569	down	50	47	44	73	53	46	47	76	62	55	52	86
3	21-Aug	17:26	open	64	31	550	down	52	49	47	75	55	49	47	79	63	57	54	87
4	21-Aug	17:35	open	82	29	646	down	52	52	48	76	57	52	51	81	66	60	56	89
5	21-Aug	17:52	open	72	33	646	down	51	49	45	75	56	50	49	80	67	59	53	90
6	21-Aug	18:02	open	74	31	646	down	52	50	46	75	58	51	49	81	66	59	54	90
7	22-Aug	13:36	open	56	31	476	down	50	47	46	74	56	48	48	80	63	56	53	87
8	22-Aug	13:59	open	74	32	656	down	52	51	46	76	57	51	48	81	66	59	55	90
9	22-Aug	15:21	open	47	44	572	down	49		44	72	53		48	76	62		51	86
10	23-Aug	7:54	open	81	29	656	down	51	49	47	74	57	51	50	80	65	59	56	89
11	23-Aug	9:22	open	78	30	656	down	53	52	46	77	58	51	50	81	66	60	55	89
12	23-Aug	9:31	open	73	32	656	down	52	50	45	75	56	50	48	80	66	59	53	90
13	23-Aug	9:46	open	67	26	489	down	51	48	45	74	56	51	49	80	66	59	54	89
14	23-Aug	10:17	container	73	33	660	down	51	48	48	75	56	51	47	79	64	57	55	87
15	23-Aug	11:58	open	64	37	656	down	52	50	46	75	57	51	48	80	66	57	53	90
16	23-Aug	12:10	open	63	34	598	down	54	49	45	77	58	53	50	82	68	60	54	91
17	23-Aug	14:22	open	72	33	656	down	52	50	45	76	57	51	48	81	67	59	54	90
18	24-Aug	9:57	covered	73	24	476	down	52	50		75	57	51		80	66	60		90
19	24-Aug	10:34	covered	69	32	612	down	52	48	45	75	56	49	48	80	64	58	54	88

Note) Shaded portions indicate missing data.

b) Standard Vibration Level of Freight Train

i) Determination of Standard Vibration Level of Freight Train

In Japan as well as in India, the methodology of railway vibration prediction is not fully established compared to that of railway noise. Based on the data on the running speed of trains, track types, structures and the distance from the centre of the nearest railway track, a few empirical formulae as shown below are proposed by Tokyo Metropolitan Government.

Flat railway :$VL = 86 - 19\log(r)$ ($\sigma = 3.1$dB)

where:

VL :vibration level [dB]

R :distance from center of the nearest railway [m] (5-40m)

However, as being pointed out in ESIMMS, it is not practieal to apply direetly the equations developed in Japan to prediet railway vibration levels of freight trains in India. One of the reasons would be that the propagation pattern of vibration changes depending upon conditions

of railway tracks, foundations, structures, surface materials of the ground (soil types, concrete or asphalt), etc. These conditions in India may be different from that in Japan. Therefore, prediction is carried out applying in the similar manner using the actual data of the railway vibration level (Lp), the running speed (V) of train, and the distance from centre of the nearest railway track (D). Based on the actual data obtained through railway vibration measurements at Khurja, the equation is developed for the prediction of vibration levels of vertical direction (Z-axis) and horizontal direction (X and Y-axis), which was not considered in ESIMMS.

In addition, based on the actual data obtained through railway vibration measurements at Khurja, standard vibration level (which is defined as vibration level on center of railway track, hereafter abbreviated as "SVL") is calculated. Since, there is no standardized method for calculating SVL, this was calculated with distance attenuation coefficient (n=19) using empirical equation applied in Tokyo Metropolitan Area as shown below:

$$SVL = Lp + 19\log(d)$$

SVL : Vibration level at center of railway (d=0) [dB]

Lp : Actual Lp value obtained at the nearest point from railway through measurement [dB]

D : Distance from center of the nearest railway track [m]

Although empirical equation in Tokyo was obtained based on actual vibration level values at only vertical axis, this distance attenuation coefficient is also used for horizontal axis too because there is no suitable value.

ii) Result of SVL Calculation

The results of Lp measurement of freight trains are summarized in Table 1-29 and standard vibration levels of freight train are calculated using the above mentioned formula. In order to reduce influence of extra attenuation as much as possible, Lp measured at the nearest point from railway track is used. The results of SVL of freight trains are given in Table 1-29.

iii) Speed Dependence of SVL of Freight Train

Calculated approximation and correlation coefficient are shown in Table 1-30. In general, positive correlation between logarithm of train speed and Lp of train is known. Obtained train-speeds and calculated SVLs are checked for the correlation.

Table 1-30 Speed Dependence of SVL of Freight Train

Vibration Direction / Running Direction	X-axis	Y-axis	Z-axis
Both direction (n=40)	SVLx=13.7logV+49.3 (R^2=0.3722)	SVLy=23.3logV+35.5 (R^2=0.4653)	SVLz=21.2logV+48.2 (R^2=0.4007)
Up (n=21)	SVLx=7.9logV+58.9 (R^2=0.1246)	SVLy=10.6logV+56.1 (R^2=0.2678)	SVLz=7.8logV+70.2 (R^2=0.1628)
Down (n=19)	SVLx=13.6logV+50.0 (R^2=0.5714)	SVLy=18.1logV+46.6 (R^2=0.6481)	SVLxz=16.8logV+58.0 (R^2=0.5132)

c) Distance Attenuation of Freight Train

As the result, distance attenuation coefficient for each direction is calculated as shown in Table 1-31. As an example, graph of train going up direction for z-axis is shown in Figure-1-20.

As a result, when each axis is compared, attenuation effect of Z axis is the largest among the three axes. Also, attenuation effect of all axes of up direction is smaller than that of down direction when effect in each train direction is compared. The reason of smaller attenuation effect in up direction might be due to difference of weight of cargo in the two directions. In Aligarh-Dadri section, almost all trains going up direction carried comparatively heavier materials such as coal, steel, and cement etc. On the other hand, almost all trains going down direction carried lighter materials such as wheat and foods etc.

The result shows that the vibration generated by the heavier axle load has the less trend of distanee attenuation in that vibration. In comparison to axle load of train toward down direction, axle load of train toward up direction is considered to be closer to that of DFC. Therefore, in this study, attenuation coefficient of train going up direction is used for empirical equation to determine the DFC impact.

Table 1-31 Distance Attenuation Coefficient of Vibration for Freight train

Vibration Direction / Running Direction	X-axis	Y-axis	Z-axis
Average both direction (n=40)	-10.3log(d)	-13.8 log(d)	-19.5 log(d)
Up (n=21)	-9.4 log(d)	-11.4 log(d)	-15.9 log(d)
Down (n=19)	-11.1 log(d)	-16.1 log(d)	-23.2 log(d)

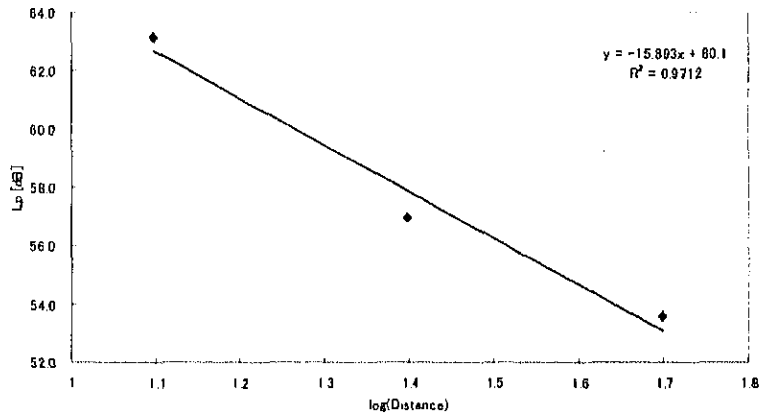


Figure 1-20 Distance Attenuation of Vibration for Freight Train (up side average at Z axis (n=21))

d) Vibration Frequency Band Analysis of Freight Train

For the vibration levels generated by the freight train at the measurement, one-third (1/3) octave band analysis is conducted. The result indicated that frequency of the vibration excelled in the range from 31.5 to 40 Hz at all axes compared to other ranges.

4) Unit Level of Passenger Train Vibration

a) Peak Level (Lp) of Passenger Train

The results of measurements of passenger train vibration level at Khurja are summarized in Table 1-32. Measurement data included 17 events of trains going up direction and 17 events of trains going down direction.

Table 1-32 Results of Passenger Train Vibration Level Measurement and SVL at Khurja

No.	date	time	train speed [km/hr]	train passage time [s]	train length [m]	train direction	Vibration Level(dB) Lp,x			SVL$_x$	Vibration Level(dB) Lp,y			SVL$_y$	Vibration Level(dB) Lp,z			SVL$_z$
							12.5m	25.0m	50.0m		12.5m	25.0m	50.0m		12.5m	25.0m	50.0m	
1	21-Aug	16:27	118	11	360	up	61	48	44	72	66	49	46	76	64	57	51	85
2	22-Aug	12:52	106	17	504	up	64	51	49	75	69	53	52	79	66	60	56	86
3	22-Aug	13:39	128	12	416	up	65	53	52	75	62	60	57	83	68	63	61	89
4	22-Aug	14:20	141	16	504	up	64	48	44	74	67	49	48	78	65	61	62	86
5	23-Aug	7:45	96	11	284	up	60	46	43	71	62	47	47	73	60	56	48	81
6	23-Aug	7:55	101	19	526	up	63	49	45	74	67	51	50	77	63	59	54	84
7	23-Aug	8:44	118	13	416	up	65	49	45	76	66	51	46	77	66	59	54	87
8	23-Aug	9:35	67	22	416	up	60	43	38	70	63	46	40	73	61	54	49	82
9	23-Aug	9:56	90	17	416	up	62	47	42	73	64	48	44	75	62	57	51	83
10	23-Aug	11:11	107	19	548	up	63	49	46	74	68	53	51	78	64	59	54	86
11	23-Aug	12:40	106	18	526	up	63	49	46	74	66	51	51	77	63	60	54	84
12	23-Aug	12:54	105	17	504	up	63	49	42	74	65	48	46	75	62	59	51	83
13	23-Aug	13:00	98	9	240	up	63	48	43	73	65	49	47	76	62	57	52	83
14	23-Aug	13:08	77	17	372	up	61	46	40	72	63	47	43	74	63	56	48	83
15	23-Aug	15:06	77	24	504	up	60	47	43	71	65	50	48	76	62	57	53	83
16	24-Aug	10:15	109	18	548	up	65	50	45	76	67	51	52	78	65	60	54	86
17	24-Aug	11:19	73	26	526	up	63	47	43	74	64	48	43	75	63	56	51	84
No.	date	time	train speed [km/hr]	train passage time [s]	train length [m]	train direction	Vibration Level(dB) Lp,x			SVL$_x$	Vibration Level(dB) Lp,y			SVL$_y$	Vibration Level(dB) Lp,z			SVL$_z$
							17.4m	29.9m	54.9m		17.4m	29.9m	54.9m		17.4m	29.9m	54.9m	
1	21-Aug	16:33	93	11	284	down	60	45	46	71	64	49	49	75	62	59	53	83
2	21-Aug	16:12	107	18	526	down	63	50	48	73	67	53	53	78	64	62	55	86
3	21-Aug	16:19	112	16	482	down	63	50	47	74	66	53	52	79	66	63	55	86
4	22-Aug	7:42	125	11	394	down	65	52	50	75	61	54	51	82	66	63	56	87
5	22-Aug	14:28	83	23	526	down	60	46	41	71	63	46	46	74	60	56	49	81
6	23-Aug	8:19	110	19	570	down	64	51	47	75	68	53	54	79	64	62	55	86
7	23-Aug	8:23	108	18	548	down	63	50	47	74	67	53	52	78	64	62	56	85
8	23-Aug	9:12	89	22	548	down	62	48	42	73	66	50	48	77	63	58	52	84
9	23-Aug	15:30	118	13	416	down	63	50	47	74	68	54	51	78	64	63	58	86
10	23-Aug	15:58	87	12	284	down	47	44	42	68	53	46	46	73	61	55	51	82
11	23-Aug	16:23	126	16	570	down	64	51	49	75	69	55	53	80	65	63	57	86
12	23-Aug	16:42	95	17	460	down	60	46	42	70	66	50	50	77	63	60	53	84
13	23-Aug	16:49	106	19	548	down	62	49	46	73	68	52	53	79	65	61	55	86
14	23-Aug	17:03	107	19	548	down	64	52	47	76	69	52	53	79	65	63	57	86
15	23-Aug	17:19	81	22	482	down	61	46	43	71	65	47	46	75	62	56	51	83
16	23-Aug	17:34	109	17	526	down	63	49	47	73	69	53	52	79	65	62	54	86
17	23-Aug	17:50	118	13	416	down	64	51	51	74	69	53	51	80	65	63	57	86

b) Standard Vibration Level of Passenger Train

SVLs are calculated by the same method as that of freight train. Based on the obtained Lp in the measurement of passenger trains as shown in Table 1-32, SVLs of freight train are calculated using the formula mentioned above. In order to reduce influence of extra attenuation as much as possible, Lp measured at the nearest point from railway is used. The results of SVL of freight train are given in Table 1-32.

Speed dependence of SVLs is calculated by the same method as that of freight trains. Calculated approximation and correlation coefficient are shown in Table 1-33.

Table 1-33 Speed Dependence of SVL of Passenger Train

Vibration Direction / Running Direction	X-axis	Y-axis	Z-axis
Both direction (n=40)	SVLx=21.7logV+31.1 (R^2=0.4981)	SVLy=30.6logV+17.2 (R^2=0.48)	SVLz=23.6logV+38.6 (R^2=0.4816)
Up (n=21)	SVLx=14.9logV+43.8 (R^2=0.4756)	SVLy=21.9logV+33.0 (R^2=0.05135)	SVLz=17.2logV+50.0 (R^2=0.4979)
Down (n=19)	SVLx=27.5logV+20.4 (R^2=0.6716)	SVLy=33.9logV+12.3 (R^2=0.08144)	SVLxz=25.9logV+35.2 (R^2=0.7628)

c) Distance Attenuation of Passenger Train

Average Lp of each axis at each measurement point for each direction (up, down, and both) and logarithm of distance between the measuring point and center of the railway is graphed. As a result, distance attenuation coefficient for each direction is calculated as shown in Table 1-34. As an example, graph of train going up direction for z-axis is shown in Figure-1-21.

The result shows that attenuation effect of X axis is the largest among the three axes and attenuation effect of all axes in both directions is almost same. In this study, attenuation coefficient obtained from the result of train going up-direction is used for empirical formula.

Table 1-34 Distance Attenuation Coefficient of Vibration for Passenger Train

Vibration Direction / Running Direction	X-axis	Y-axis	Z-axis
Average both direction (n=34)	-15.7log(d)	-13.4 log(d)	-13.8 log(d)
Up (n=17)	-16.1 log(d)	-14.1 log(d)	-13.9 log(d)
down (n=17)	-15.4 log(d)	-12.7 log(d)	-13.6 log(d)

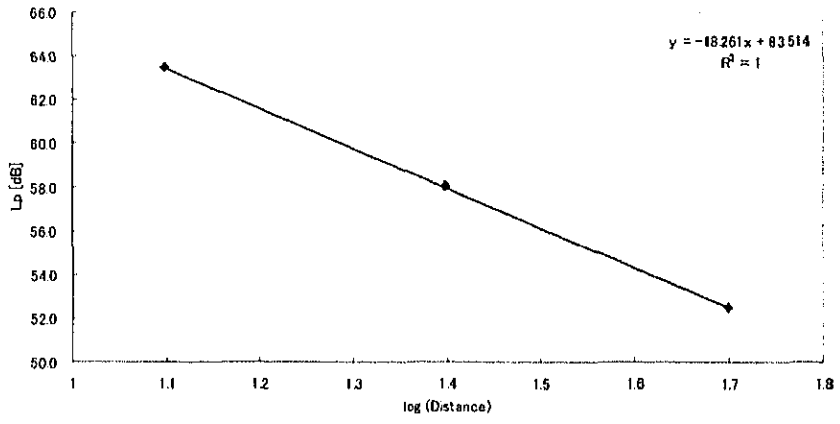


Figure 1-21 Distance Attenuation of Vibration for Passenger Train (up side average at Z axis (n=21))

d) Vibration Frequency Band Analysis of Passenger Train

For the vibration levels generated by the freight train at the measurement, one-third (1/3) octave band analysis is conducted. The result indicates that vibration frequency excelled in the range 16-40 Hz, 10/12.5-40/50 Hz and 12.5-40 Hz in X axis, Y axis and Z axis, respectively. The result of the frequency analysis in passenger train is different from that of freight train and this might be due to difference in ground conditions and railway operating conditions.

1.2.3 Impact Assessment

(1) Vibration Prediction

Railway vibration (Lp) generated by the DFC operation is predicted at the selected twelve (12) prediction locations in the parallel section and five (5) in the detour section which are same as the railway noise prediction locations. Considering influence range of vibration generated by railway, a range of 200 m from center of existing railway is targeted. The height of prediction is ground level. The cross-section drawing of the prediction location are same as the ones of the railway noise prediction.

(2) Method of Prediction

1) Procedure of Prediction

Procedure of prediction is given in Figure 1-22. At actual measurement site, actually measured Lp is used for prediction, and at other sites, Lp measured at the nearest site is used for the prediction. Peak vibration values (Lp) and background values which are used for prediction at each site are shown in Table 1-35.

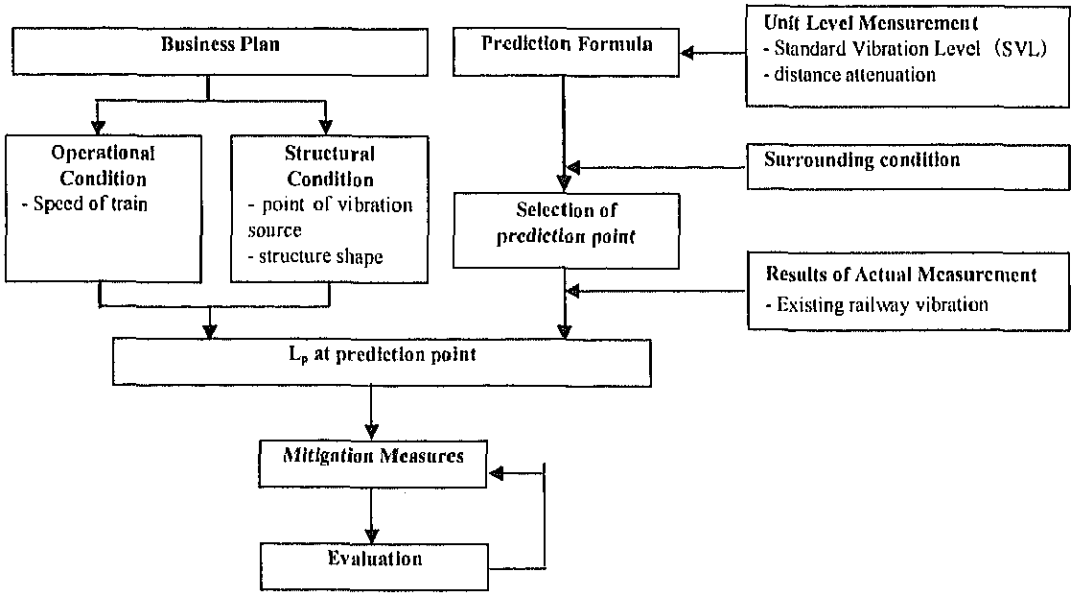


Figure 1-22 Procedure for Prediction of Vibration Level

2) Prediction formula

a) Vibration Level of DFC railway

Using the same prediction method as that of ESIMMS, an empirical formula consisting of standard vibration level (SVL) and distance attenuation coefficient based on the results of unit level measurement is applied for the prediction. The empirical formula is shown below:

L_{AE}=SVL+B・LOG_{10}(D)

where;

SVL : Standard vibration level (For X axis, SVL = 7.9 ・ LOG_{10}(V) + 58.9
For Y axis SVL = 10.6 ・ LOG_{10}(V) + 58.9
For Z axis SVL = 7.8 ・ LOG_{10}(V) + 70.2)

D :Distance [m]

B :Distance attenuation coefficient
(X axis B = 9.4, Y axis B = 11.4, Z axis B = 15.9)

b) Vibration Level of Existing Railway

An empirical formula which consists of Lp and distance attenuation coefficient based on results of actual existing railway vibration measurement in the parallel section is adopted for the prediction as shown below. The prediction locations where actual existing railway vibration measurement was not conducted, the value measured at the nearest measurement location is adopted.

<Freight Train>

X axis $L_{Peak}(D_2) = L_{Peak}(D_1)$-9.4* $LOG_{10}(D_2/D_1)$

Y axis $L_{Peak}(D_2) = L_{Peak}(D_1)$-11.4* $LOG_{10}(D_2/D_1)$

Z axis $L_{Peak}(D_2) = L_{Peak}(D_1)$-15.9* $LOG_{10}(D_2/D_1)$

<Passenger Train>

X axis $L_{Peak}(D_2) = L_{Peak}(D_1)$-14.1* $LOG_{10}(D_2/D_1)$

Y axis $L_{Peak}(D_2) = L_{Peak}(D_1)$-13.9* $LOG_{10}(D_2/D_1)$

Z axis $L_{Peak}(D_2) = L_{Peak}(D_1)$-18.3* $LOG_{10}(D_2/D_1)$

D_1 :Distance from center of the existing railway track to the nearest measurement point [m]

D_2 :Distance from center of the existing railway to prediction point [m]

Table 1-35 Setting of Result of Actual Measurement

Prediction Location		Background Vibration	Result of Existing Railway Vibration Measurement
Parallel Section	Abu road	Abu road	Abu road
	Pindwara	Abu road	Abu road
	Rani	Marwar	Marwar
	Marwar	Marwar	Marwar
	Beawar	Ajmer	Ajmer
	Ajmer	Ajmer	Ajmer
	Kishangarh	Kishangarh	Kishangarh
	Ringas	Kishangarh	Kishangarh
	Shri Madhopur	Kishangarh	Kishangarh
	Nim ka thana	Kishangarh	Kishangarh
	Narnaul	Narnaul	Kishangarh
	Ateli	Narnaul	Kishangarh
Detour Section	Vadodara	Abu road	—
	Ahmadabad	Abu road	—
	Kalol	Abu road	—
	Phulera	Kishangarh	—
	Rewari	Narnaul	—

(3) Result of Prediction

1) Parallel Section

The predicted vibration levels at 30 m and 50 m from centre of existing railway track in the parallel section are summarized in Table 1-36.

Table 1-36 Result of Predicted Vibration Level (Lp) in Parallel Section (Unit : dB)

Prediction Location			Guideline Value	①Background Level	②Existing Railway		③DFC Railway	
					30m	50m	30m	50m
Abu road	X	East	—	30	43	41	63	60
		West	—		43	41	60	58
	Y	East	—	30	44	41	63	59
		West	—		44	41	59	57
	Z	East	70	26	51	47	66	61
		West	70		51	47	61	58
Pindwara	X	East	—	30	43	41	63	60
		West	—		43	41	60	58
	Y	East	—	30	44	41	63	59
		West	—		44	41	59	57
	Z	East	70	26	51	47	66	61
		West	70		51	47	61	58
Rani	X	East	—	33	44	42	63	60
		West	—		44	42	60	58
	Y	East	—	30	47	44	63	59
		West	—		47	44	59	57
	Z	East	70	25	54	51	66	61
		West	70		54	51	61	58
Marwar	X	East	—	33	44	42	63	60
		West	—		44	42	60	58
	Y	East	—	30	47	44	63	59
		West	—		47	44	59	57
	Z	East	70	25	54	51	66	61
		West	70		54	51	61	58
Beawar	X	East	—	33	48	46	63	60
		West	—		48	46	60	58
	Y	East	—	30	53	51	63	59
		West	—		53	51	59	57
	Z	East	70	29	54	51	66	61
		West	70		54	51	61	58
Ajmer (St.1)	X	East	—	33	48	46	63	60
		West	—		48	46	60	58
	Y	East	—	30	53	51	63	59
		West	—		53	51	59	57
	Z	East	70	29	54	51	66	61
		West	70		54	51	61	58
Ajmer (St.2)	X	East	—	32	—	—	62	59
		West	—		—	—	61	59
	Y	East	—	31	—	—	62	59
		West	—		—	—	60	58
	Z	East	70	31	—	—	64	60
		West	70		—	—	62	59
Kishangarh	X	East	—	31	49	47	63	60
		West	—		49	47	60	58
	Y	East	—	27	50	47	63	59
		West	—		50	47	59	57
	Z	East	70	33	53	50	66	61
		West	70		53	50	61	58
Ringas	X	East	—	33	49	47	63	60
		West	—		49	47	60	58
	Y	East	—	31	50	47	63	59
		West	—		50	47	59	57
	Z	East	70	27	53	50	66	61

Prediction Location			Guideline Value	①Background Level	②Existing Railway		③DFC Railway	
					30m	50m	30m	50m
		West	70		53	50	61	58
Shri Madhopur	X	East	—	33	49	47	63	60
		West	—		49	47	60	58
	Y	East	—	31	50	47	63	59
		West	—		50	47	59	57
	Z	East	70	27	53	50	66	61
		West	70		53	50	61	58
Nim ka thana	X	East	—	33	49	47	63	60
		West	—		49	47	60	58
	Y	East	—	31	50	47	63	59
		West	—		50	47	59	57
	Z	East	70	27	53	50	66	61
		West	70		53	50	61	58
Narnaul	X	East	—	40	49	47	63	60
		West	—		49	47	60	58
	Y	East	—	54	50	47	63	59
		West	—		50	47	59	57
	Z	East	70	51	53	50	66	61
		West	70		53	50	61	58
Ateli	X	East	—	40	49	47	63	60
		West	—		49	47	60	58
	Y	East	—	54	50	47	63	59
		West	—		50	47	59	57
	Z	East	70	51	53	50	66	61
		West	70		53	50	61	58

2) Detour Section

The predicted vibration level at 35 m and 50 m from the centre of existing railway in the detour section are summarized in Table 1-37.

Table 1-37 Result of Predicted Vibration Level (Lp) in Detour Section (Unit: dB)

Prediction Location			Guideline Value	Background Level	DFC Railway	
					35 m	50 m
Vadodara	X	East	—	30	61	59
		West	—		61	59
	Y	East	—	30	60	58
		West	—		60	58
	Z	East	70	26	62	59
		West	70		62	59
Ahmedabad	X	East	—	30	61	59
		West	—		61	59
	Y	East	—	30	60	58
		West	—		60	58
	Z	East	70	26	62	59
		West	70		62	59
Kalol	X	East	—	30	61	59
		West	—		61	59
	Y	East	—	30	60	58
		West	—		60	58
	Z	East	70	26	62	59
		West	70		62	59
Phulera	X	East	—	33	61	59
		West	—		61	59
	Y	East	—	31	60	58
		West	—		60	58
	Z	East	70	27	62	59
		West	70		62	59
Rewari	X	East	—	33	61	59
		West	—		61	59
	Y	East	—	31	60	58

Prediction Location			Guideline Value	Background Level	DFC Railway	
					35 m	50 m
		West	--		60	58
	Z	East	70	27	62	59
		West	70		62	59

(4) Evaluatiou

Along the parallel section, the predicted vibration level (Lp) including vibrations from DFC railway and the existing railway at 30m and 50m from center of DFC alignment is less than the guideline value (70 dB). As for detour section, the predicted vibration level (Lp) which means only DFC railway vibration is also less than the guideline value (70 dB). However, the impacts of vibration should be considered together with how wide buffer area can be secured (where actually ROW will be set) and some SRs are located in the vicinity of the alignment and some of their structure may be weak to vibration. Therefore, careful attentions should be paid on SRs if any and necessary mitigation measures should be taken such as introduction of longer type of rail for the tacks, securing buffer areas as much as possible and establishment of ditches between the embankment of the SRs.

1.3 WATER POLLUTION

1.3.1 Study Methodologies

The DFC alignment crosses some important rivers (Sabarmati River, Mahi River, Balaram River, Vishwamitri River, Vatrak River etc.) and canals (Narmada Canal) at different locations in Gujarat. Surface water has been found as an important source for catering to the local needs of water consumption for various purposes, mainly irrigation, domestic as well as drinking. Therefore, any kind of deterioration owing to the developmental activities in the quality of surface water will pose some threat to the population and attention needs to be paid towards maintaining the quality of water using all possible tools such as monitoring with spontaneous remedial suggestions, if required.

(1). Selection of Monitoring Locations

Keeping in view the importance of surface water to the local population and drawing up the baseline scenario in the study corridor, 30 representative surface water quality monitoring stations (SW1 to SW30) in the study corridor are identified for the monitoring and assessment of surface water quality.

Vishwamitri River (Sample Code SW1 to SW3): This is a seasonal river which flows east to west between the Mahi and Narmada rivers in Gujarat. It originates in the hills of Pavagadh. The Vishwamitri flows west through the city of Vadodara and joins with the Dhadhar River and Khanpur River and empties into the Gulf of Khambhat, near Khanpur Village. This river system includes the Sayaji Sarovar on the Vishwamitri River near Ajwa and the Dev Dam on the Dhadhar Branch. As it flows through Vadodara, the Vishwamitri River receives drainage of the city's sewage and effluents from nearby industries. DFC alignment crosses the Vishwamitri River in Vadodara District. Three samples are collected from Vishwamitri River and sampling locations are shown in Figure 1-23.

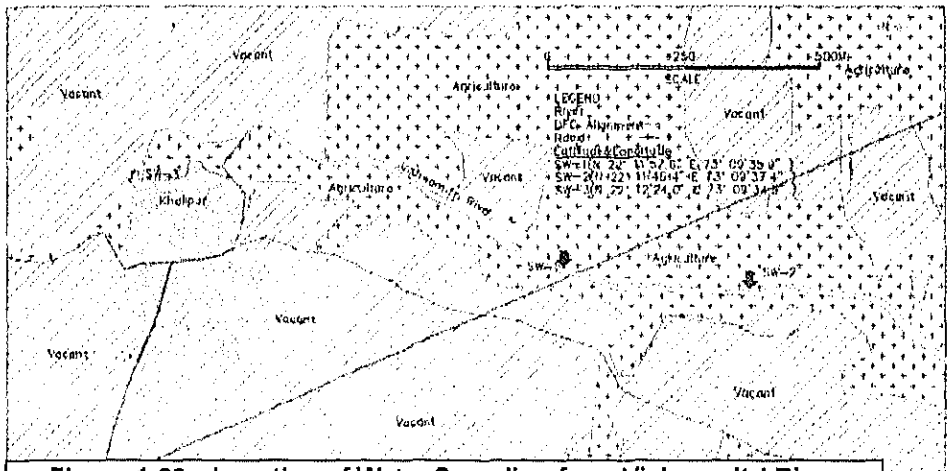


Figure 1-23 Location of Water Sampling from Vishwamitri River

Pond at Samiyala (Sample Code SW4): This pond is located on the eastern side of DFC alignment at a distance of around 250 m and has local importance as a source of drinking water for cattle. One sample is collected from this pond as shown in Figure 1-24.

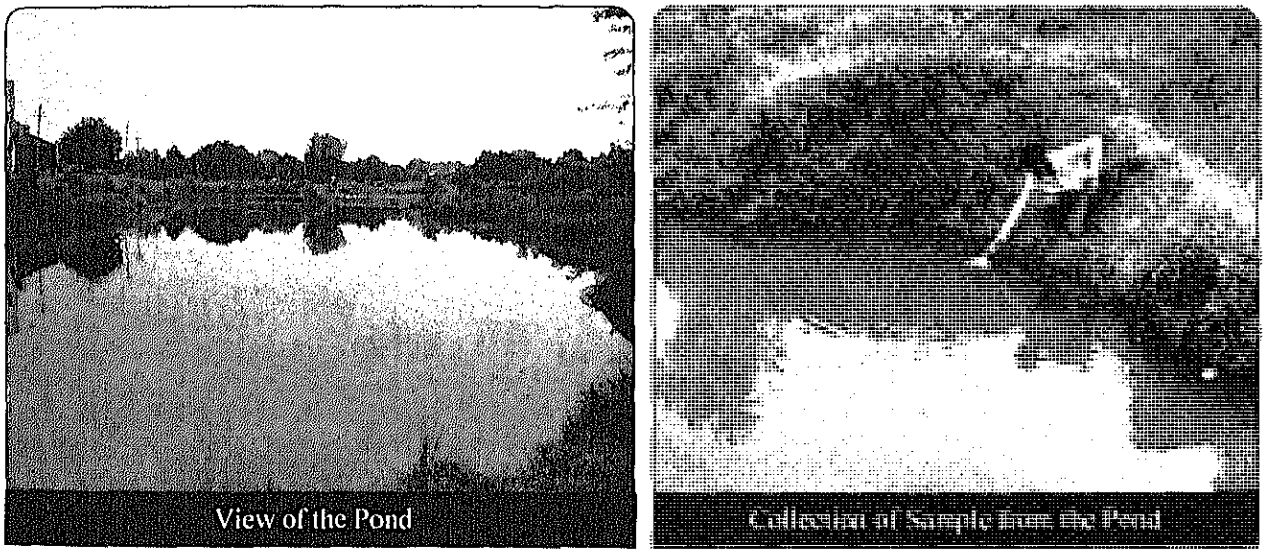


Figure 1-24 Water collection site of water pond

Sabarmati River (Sample Code SW5 to SW9): The Sabarmati River is one of the most important river and it's basin covers areas of Gujarat and Rajasthan. The total length of the river is 371 km. It originates from Aravalli hill range in west Udaipur District on the border of south Rajasthan as Wakal River and flows southwards to Gujarat, finally ending in the Gulf of Khambhat at Golana-Vadgam, Anand District. The river Sabarmati and its tributaries are all rain-fed.

Ahmedabad and Gandhinagar are located on the bank of the river. This is one of the beautiful scenic rivers with potable clean water. But its beauty remains up to Gandhinagar City only, after which the river enters Ahmedabad City and transforms into a large polluted sewage river. DFC alignment crosses the Sabarmati River in Ahmedabad District. Five samples are collected from Sabarmati River and sampling locations are shown in Figure 1-25.

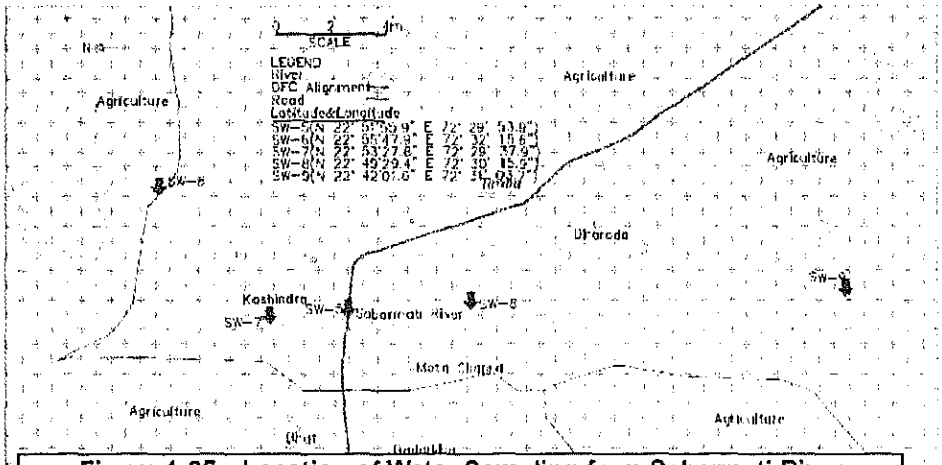


Figure 1-25 Location of Water Sampling from Sabarmati River

Balaram River (Sample Code SW10 to SW14): The Balaram is the chief tributary of Banas River, which joins the Banas near Karaj in Palanpur taluka. DFC alignment crosses the Balaram River between the village Jethi and Bantwada of Banaskantha District. It also passes through two wildlife sanctuaries of North Gujarat namely Balaram-Ambaji wildlife sanctuary and Jessore wildlife sanctuary. Five samples are collected from Balaram River and sampling locations are shown in Figure 1-26.

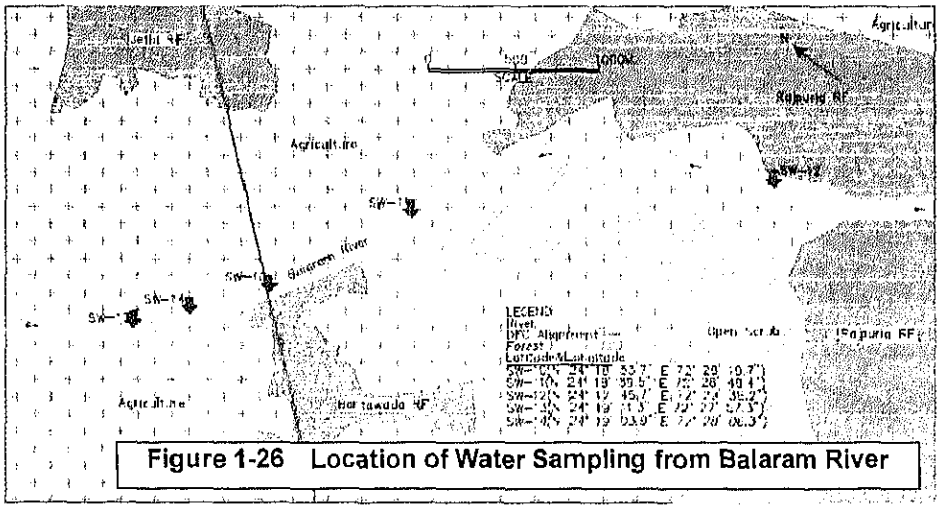


Figure 1-26 Location of Water Sampling from Balaram River

Vatrak River (Sample code SW15 to SW19): It is a comparatively small river about 300 km long, a non perennial tributary of Sabarmati River. It originates from Dungerpur District, Rajasthan. By nature it is non perennial, but waters of the downstream river continuously flows as excess water from Mahi and Narmada Irrigation Canal system is being released in the river. Originating in south Rajasthan, it flows from south-east to west-south through Sabarkantha and Kheda Districts and finally merges with river Sabarmati at Palla- Vautha Villages (Vautha Village is on right bank). DFC alignment crosses the Vatrak River in Vadodara District. Five samples are collected from Vatrak River and sampling locations are shown in Figure 1-27.

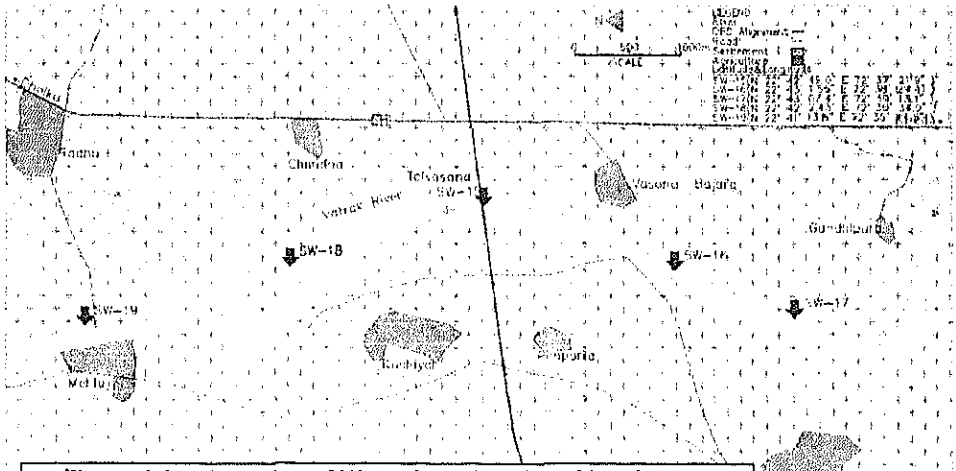


Figure 1-27 Location of Water Sampling from Vatrak River

Mahi River (Sample Code SW20 to SW24): The interstate river Mahi is 583 km long, originating in Madhya Pradesh, passing through Rajasthan and Gujarat and draining into the Gulf of Khambhat. The Mahi flows northwards initially entering into Banswara District and then turning southward flowing through Udaipur and Dungarpur Districts before entering into Gujarat. In Gujarat, it flows through Panchmahal, Kheda, Anand, Vadodara and Bharuch Districts before draining into the Gulf. The principal tributaries of the river are the Som from the right and the Anas and the Panam from the left. DFC alignment crosses the Mahi River in the border of Anand and Vadodara Districts. Five samples are collected from Mahi River and sampling locations are shown in Figure 1-28.

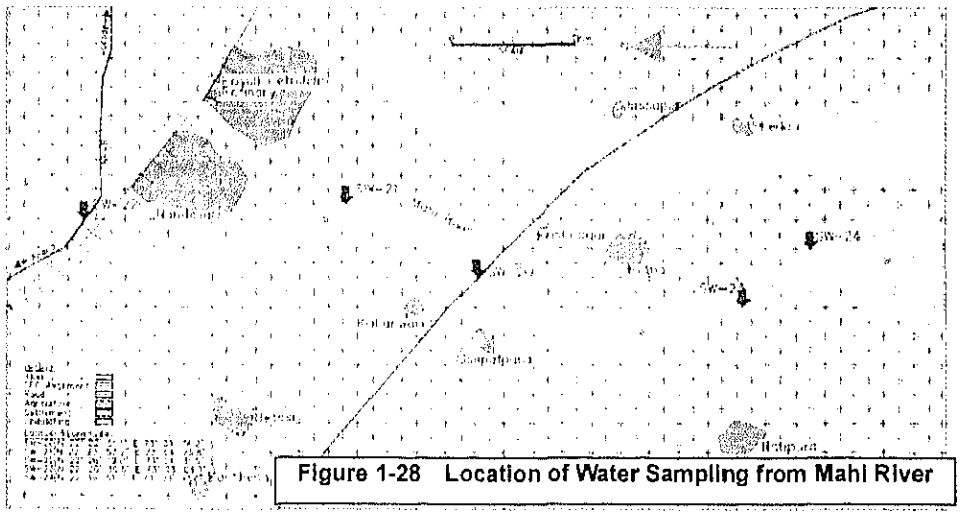


Figure 1-28 Location of Water Sampling from Mahi River

Mini River (Sample Code SW25 and SW26): It is a small seasonal 55 km long river and a tributary of Mahi River. This small river originate some where in south-east Planes of Savali areas and further flows left side parallel to Mahi, east to west-south and finally merges with Mahi in the west of Sindhrot Village. This is another polluted river in Vadodara District of Gujarat. DFC alignment crosses the Mini River in Vadodara District. Two samples are collected from Mini River and sampling locations are shown in Figure 1-29.

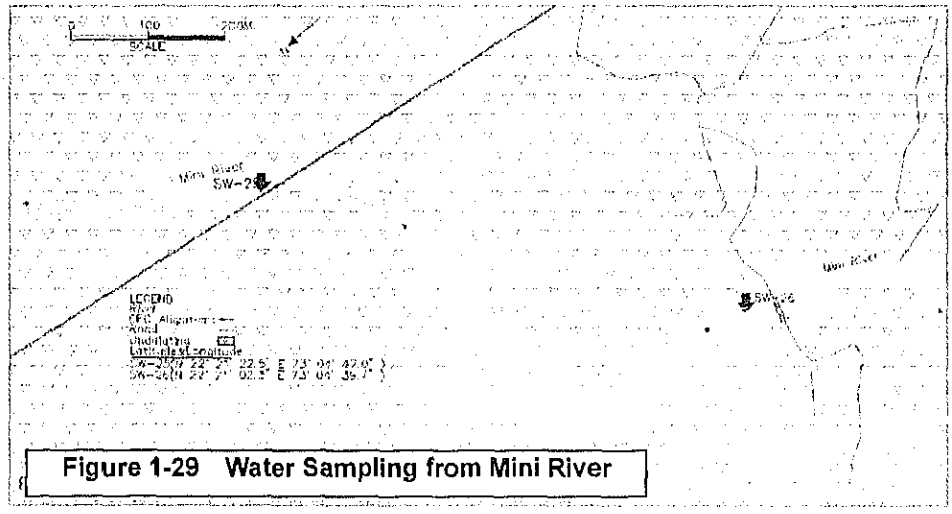


Figure 1-29 Water Sampling from Mini River

Banas River (Sample Code SW27 and SW28): Banas River rises in the Dhebar Lake among the Udepur hills in the Rajasthan State and flows westwards in the Banaskantha District. The chief tributary of the Banas is the Balaram, which joins the Banas near Karaj in Palanpur taluka. Banas river is the only river which almost parallel to the alignment for a considerable stretch; at times it comes very close to the alignment. Numerous drainage channels that form the drainage pattern of the Sirohi and Banaskantha Districts join the Banas River. It is therefore, obvious that any extraneous pollution load in these channels (which are being crossed by proposed DFC alignment) will eventually get reflected in the water quality of Banas River. In addition to this, Banas River passes in between the Balaram Ambaji WLS and Jessore WLS. The alignment in Jetty village of Banaskantha District is about 500-600 m from the river. Two samples are collected from Banas River and sampling locations are shown in Figure 1-30.

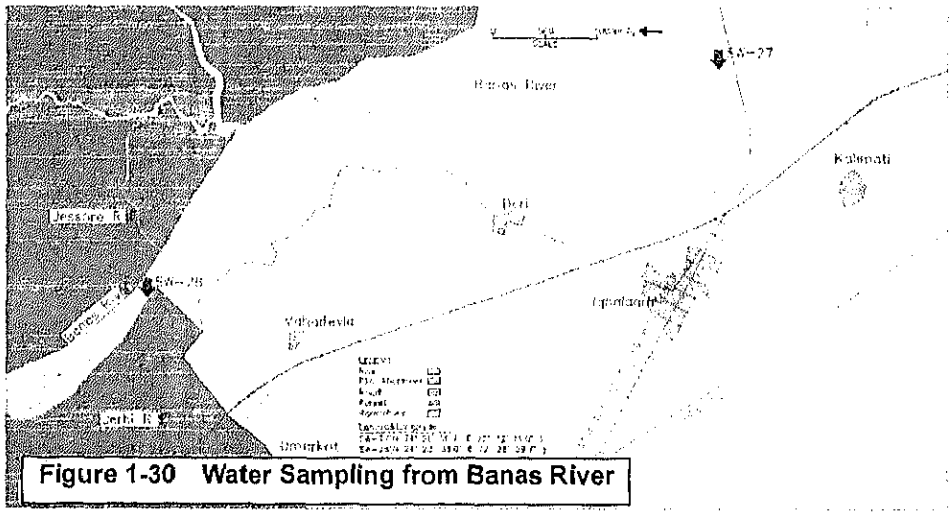


Figure 1-30 Water Sampling from Banas River

Narmada Canal (Sample Code SW29 and SW30): Narmada Canal starts from Sardar Sarovar Dam located in Gujarat and after traversing 458 km in Gujarat enters Rajasthan near Silu Village in Sanchore Tehsil of Jalore District. The total length of the main canal in Rajasthan is 74 km. There are 9 major distributaries, and the total length of the main canal, distributaries and secondary canal system totals 1,477 km. This is the biggest canal crossed by DFC in Gandhinagar of Gujarat and always has good water flow. The water is used both for

irrigation and drinking purpose (after local treatment). Two samples are collected from Narmada Canal.

Saraswati River: The Saraswati is another important river, which originates from the mountain near Koteshwar in Banaskantha District and disappears in the Rann of Kachhchha. The river does not meet the sea. The river is considered extremely sacred. The DFC alignment crosses Saraswati River in Patan District. However, the study team explored all the important locations within the study area but most of them are found to be dry in Saraswati River.

Name, location and latitude and longitude of water quality monitoring stations are presented in Table 1-38.

Table 1-38 Surface Water Sampling Locations

Sample Code	Name	Location	Village / District	Latitude and Longitude
SW1	Vishwamitri River	Bridge location	Khalipur, Vadodara	N 22° 11' 57.6" E 73° 09' 35.9"
SW2	Vishwamitri River	Downstream	Khalipur, Vadodara	N 22° 11' 46.4" E 73° 09' 37.4"
SW3	Vishwamitri River	Upstream	Khalipur, Vadodara	N 22° 12' 24.0" E 73° 09' 34.5"
SW4	Pond	Samiyala	Samiyala, Vadodara	N 22° 15' 51.4" E 73° 07' 14.6"
SW5	Sabarmati River	Bridge location	Miroli, Ahmedabad	N 22° 51' 55.9" E 72° 29' 53.9"
SW6	Sabarmati River	Upstream	Kamod, Ahmedabad	N 22° 55' 47.9" E 72° 32' 15.6"
SW7	Sabarmati River	Upstream	Kashindra, Ahmedabad	N 22° 53' 27.8" E 72° 29' 37.9"
SW8	Sabarmati River	Downstream	Saroda, Ahmedabad	N 22° 49' 29.4" E 72° 30' 15.9"
SW9	Sabarmati River	Downstream	Rasikpura, Ahmedabad	N 22° 42' 01.6" E 72° 31' 03.7"
SW10	Balaram River	Bridge location	Bantwada,Banaskantha	N 24° 18' 53.7" E 72° 28' 19.7"
SW11	Balaram River	Upstream	Bantwada,Banaskantha	N 24° 18' 39.5" E 72° 28' 49.4"
SW12	Balaram River	Upstream	Bantwada, Banaskantha	N 24° 17' 45.7" E 72° 29' 38.2"
SW13	Balaram River	Downstream	Bantwada, Banaskantha	N 24° 19' 11.3" E 72° 27' 57.3"
SW14	Balaram River	Downstream	Bantwada, Banaskantha	N 24° 19' 03.9" E 72° 28' 06.3"
SW15	Vatrak River	Bridge location	Tolvasana, Kheda	N 22° 42' 49.0" E 72° 37' 21.9"
SW16	Vatrak River	Upstream	VasanaBajarg, Kheda	N 22° 43' 1.55" E 72° 38' 29.4"
SW17	Vatrak River	Upstream	Gandhipura, Kheda	N 22° 43' 07.4" E 72° 39' 13.1"
SW18	Vatrak River	Downstream	Chandna, Kheda	N 22° 42' 2.45" E 72° 36' 34.9"
SW19	Vatrak River	Downstream	Radhu, Kheda	N 22° 41' 13.8" E 72° 35' 44.5"
SW20	Mahi River	Bridge location	Kahanwari, Anand	N 22° 22' 51.1" E 73° 03' 36.2"
SW21	Mahi River	Upstream	Anagadh, Vododara	N 22° 23' 57.2" E 73° 04' 25.8"
SW22	Mahi River	Upstream	Vasad, Anand	N 22° 26' 19.0" E 73° 04' 31.5"
SW23	Mahi River	Downstream	Hatipura, Anand	N 22° 20' 30.6" E 73° 03' 04.9"
SW24	Mahi River	Downstream	Sindhrot, Anand	N 22° 19' 51.1" E 73° 03' 33.5"
SW25	Mini River	Bridge location	Jasapura, Vadodara	N 22° 21' 22.5" E 73° 04' 47.0"
SW26	Mini River	Downstream	Jasapura, Vadodara	N 22° 21' 02.3" E 73° 04' 39.7"
SW27	Banas River	Near Iqbalgarh	Iqbalgarh,Banaskantha	N 24° 21' 56.7" E 72° 32' 11.0"
SW28	Banas River	Near Jethi	Jethi, Banaskantha	N 24° 20' 38.0" E 72° 28' 59.7"
SW29	Narmada Canal	Near Kalol	Kalol, Gandhinagar	N 23° 14' 5.54" E 72° 26' 14.9"
SW30	Narmada Canal	Near Kalol	Kalol, Gandhinagar	N 23° 13' 42.7" E 72° 26' 41.3"

(2) Methodology of Water Quality Monitoring

Water samples (grab samples) are collected once in the month of August 2008 from all these stations during the study period. Prior to departure to the field, all sample containers are initially soaked in 6 N HNO_3 for 24 hrs and washed thoroughly with tap water and then rinsed

with Double-Distilled water and kept air dry condition. All the basic precautions and care are taken during the sampling to avoid contamination.

The samples are analysed for physical and chemical parameters for drawing up the baseline data. Parameters such as pH, Temperature and Dissolved Oxygen are estimated onsite. While analyzing water samples, analytical methods for various parameters have been adopted from 'Standard Methods for the Examination of Water and Wastewater APHA AWWA WEF 19th edition (1995)' and standard methods and procedures prescribed by the Central Pollution Control Board (CPCB), e.g. relevant IS Codes (IS:2488 (Part-1 to 5) "Methods for Sampling and Testing of Industrial Effluents".

Analysis is carried out by "ECO CHEM Sales and Services", which is a Gujarat State Pollution Control Board certified laboratory.

In Gujarat, River Flow Measurement (RFM) has been carried out in August 2008 in 3 rivers, Vatrak, Balaram and Banas. The measurement site was selected by considering ease of approach to the measurement site, continuous stretch of the river where flow is uniform and less turbulent, accessibility of the both banks of the river and proximity of the DFC alignment.

Area-velocity method is adopted for measurement of river flow. Two (2) suitable locations are selected in the month of August 2008 for each of the 3 rivers. At each of the location, cross section of the river is taken to assess the width of the channel. Then, the entire width of the channel is divided into a few subsections depending on the homogeneity of the flow. Finally, velocity of the water is measured by floats in each of the homogeneous sections for a number of times.

Total discharge (Q) of the river is calculated using the following formula:

$Q = A \times V$ where A = area in square meters and V = velocity of the water in meter/second

Cross section of the Banas, Balaram and Vatrak Rivers at the flow measurement stations have been provided in Figure 1-35, Figure 1-36 and Figure 1-37. The calculated discharge is provided in Table 1-40.

1.3.2 Major Findings

Major findings related to the surface water quality and pollution load in the important rivers along the DFC alignment has come mainly from two sources: 1) Secondary source i.e. publications already in existence and 2) primary source i.e., field survey conducted for the present study.

(1) Water Quality Status based on Secondary Data

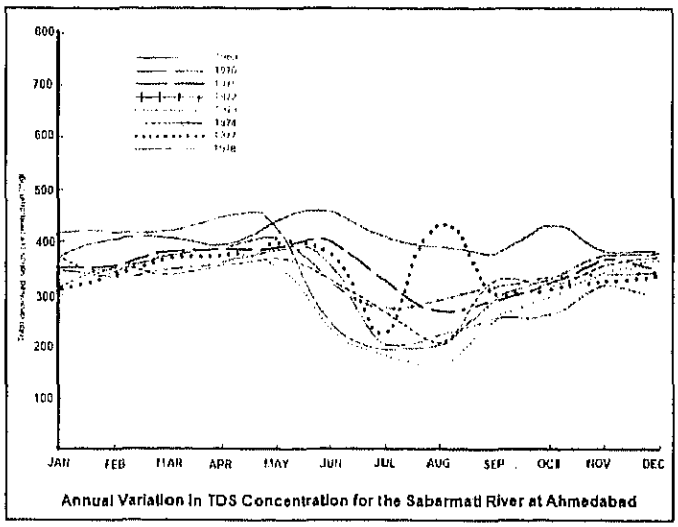
1) *Seasonal Changes:*

Published literature on seasonal changes of the dissolved chemical constituents in the rivers along the DFC alignment and trend analysis of its quality is lacking. DFC alignment crosses several rivers in Gujarat, out of which secondary information on seasonal changes is available in Datta (1983) for Sabarmati River. The mean values of ten stations in eight (8) years were presented on the seasonal variation/ changes of the water quality along the courses of Sabarmati River. Electrical conductivity (EC), pH, total dissolved solids (TDS) and major anions and cations were studied. It was observed that between December and April there is deterioration in quality from north to south (upper stream to down stream), with significant increase in electrical conductivity downstream of Ahmedabad. No remarkable seasonal variation in quality is observed in the area upstream of Ahmedabad. The water becomes highly

saline in the period from December to April in winter (Figure 1-31). Effluent discharge from Ahmedabad city could be the reason behind such increase in salinity. Data on water table fluctuations indicate the possibility of groundwater inflow into the river from both banks in the upstream of Ahmedabad (Figure 1-32).

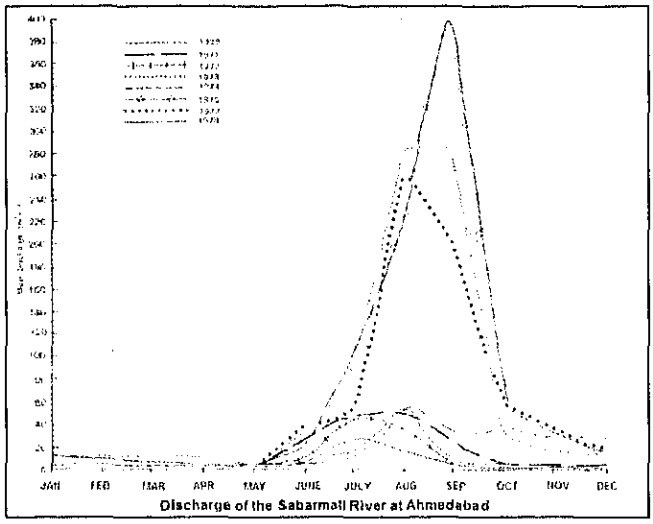
The trend may associate with the rainfall pattern in the watershed of the Sabarmati River, the concentration of the water changes higher in the Summer season, March, April and May and lower in the monsoon season, June, July and August. Although the scale of the value differ from year to year, almost same trends of the seasonal change are found. As discussed in latter the field survey result also shows possibility of abundant organic material contents in the rivers with higher value of BOD in the river water. Seasonal difference of the biological contamination such as BOD, DO is expected.

The year 2008 is reported as almost normal year in its rainfall status comparing the past 15 years record (2008, India Meteorological Department, South west monsoon 2008 end of season report). The slight delay on the monsoon rainfall, June and July and it is compensated in different time period of August and September, withdrawing the monsoon in September. In this study water sampling is conducted in the rainfall season and the result of values might be considered to be shifted towards better side due to attenuation by seasonal rain water (Figure 1-33).



Source: Trend analysis of water quality in the Sabarmati River at Ahmedabad for a decade- P.S.Datta

Figure 1-31 Annual Variation in TDS Concentration for the Sabarmati River at Ahmedabad



Source: Trend analysis of water quality in the Sabarmati River at Ahmedabad for a decade- P.S.Datta

Figure 1-32 Discharge of Sabarmati River at Ahmedabad

Maximum flow is observed during the monsoon (rainy) season in all the rivers (Tables 1-39 and 1-40, Figure 1-34). No flow has been reported in Rupen and Saraswati Rivers during the other season while the perennial rivers like Mahi, Sabarmati and Vatrak have reported reduced flow, which have been confirmed by the locals during field survey and investigation. However, no secondary data is available on lean season flow of these rivers.

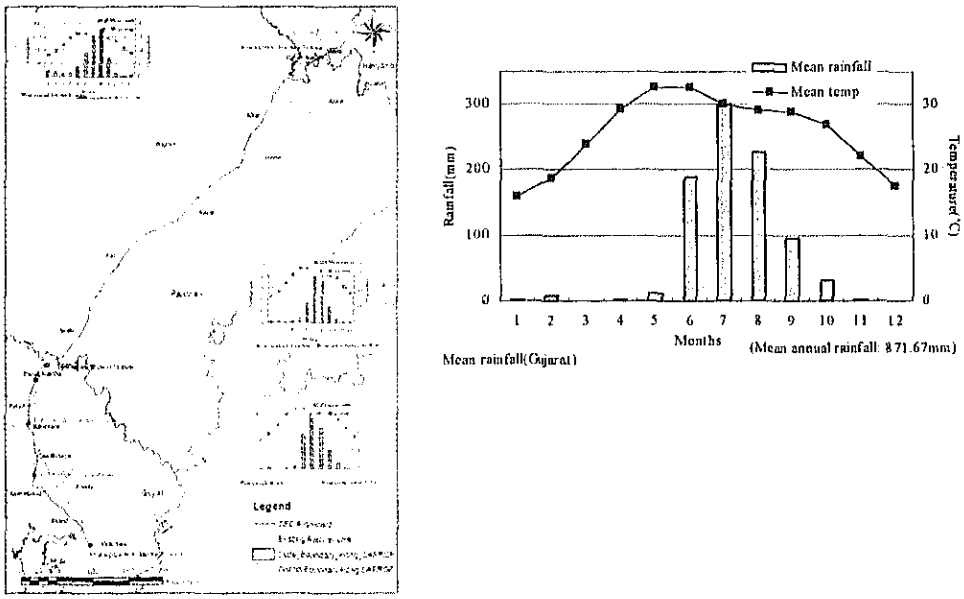


Figure 1-33 Rainfall pattern in the area along DFC

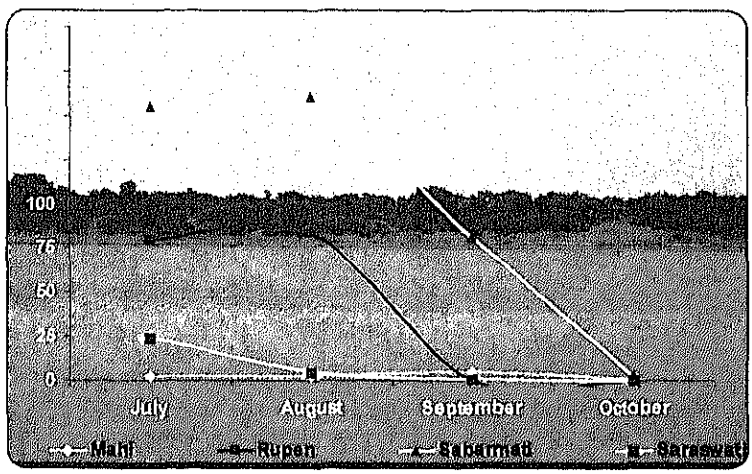
Table 1-39 River Flow Monitoring Locations

River	Station Name	District	Taluk	Latitude	Longitude
Banas	Deesa	Banaskantha	Deesa	24°15'0"	72°10'20"
Saraswati	Sidhpur	Patan	Sidhpur	23°54'35"	72°21'30"
Rupen	Delwada	Mahesana	Becharaji	23°32'40"	72°06'30"
Sabarmati	Gandhinagar	Gandhinagar	Gandhinagar	23°13'00"	72°42'00"
Vatrak	Mahmadabad	Kheda	Mahmedabad	22°49'30"	72°45'30"
Mahi	Pilol	Vadodara	Savli	22°24'39"	73°13'23"

Source: State Water Data Centre, Gandhinagar, Gujarat

Table 1-40 Average Monthly Flow based on available secondary data

River	July	August	September	October	Total
Mahi	2.7	2.6	5.1	1.0	3.2
Rupen	79.0	83.8	0.0	0.0	80.6
Sabarrmati	154.3	160.0	81.0	2.3	115.5
Saraswati	24.4	5.0	1.1	0.0	9.1
Vatrak	195.1	45.0	17.6	3.9	72.8
Grand Total	**100.8**	**70.8**	**37.1**	**2.2**	**61.9**



Source: State Water Data Centre, Gandhinagar, Gujarat

Figure 1-34 Water flow at the measured river

The result of this study, although empirical and site specific, indicate that in trend analysis there is a need to consider the effects of intermixing between river and groundwater, the relationship of dissolved constituents to discharge and the influence of channel routing.

2) Surface Water Quality:

The Gujarat State Pollution Control Board has the system to monitor the water quality (pH, DO, BOD, COD, Coliform etc.) of the important rivers and their tributaries in Gujarat. The water quality analysis results of river Mahi, Vishwamitri and Sabarmati with respect to pH, DO, BOD, COD, Coliform etc. are presented in Table 1-41, Table 1-42 and Table 1-43.

Mahi River: pH value varies between 7.66 and 8.39, which is within the tolerance limit of 6.5-8.5. Level of dissolved oxygen is varying between 8.0 and 9.3 mg/l which is above the permissible limit of 4 mg/l for fish. Natural regeneration/reoxygenation could be the main reason of such levels of DO and pH. BOD varies between 1.6-4.0 mg/l indicating no organic

contamination at the monitoring points. The overall water of the river is in healthy and clean state at the monitored section.

Table 1-41 Water Quality Data of the Mahi River

Location	pH	TDS (mg/L)	DO (mg/L)	BOD (mg/L)	COD (mg/L)	TKN (mg/L)	NO_2-N (mg/L)	NO_3-N (mg/L)	TC MPN/ 100 ml	FC MPN/ 100 ml
Anandpuri	8.27	-	9.0	2.3	7.0	-	-	-	-	-
Kadana Dam	8.05	-	8.2	2.1	10.0	-	-	-	-	-
Virpur	7.66	-	8.4	2.2	7.0	-	-	-	-	-
Sevalia	8.18	-	9.1	2.6	3.0	-	-	-	-	-
Vasad	8.26	-	8.4	2.5	10.0	-	-	-	-	-
Mujpur	8.10	-	9.3	4.0	17.0	-	-	-	-	-
Umeta	7.75	-	8.0	3.0	7.0	-	-	-	-	-
Vasad, Vadodara	8.22	286	8.6	2.2	7.0	1.12	0.01	0.05	9	2
Sevalia, Kheda	8.39	250	9.3	-	3.0	0.83	0.01	0.05	15	2
Virpur	7.74	226	9.3	1.6	6.0	1.40	0.01	0.05	7	2

Source: Annual Report of Gujarat Pollution Control Board (2006-2007)

Vishwamitri River: pH values vary between 7.46 and 7.90 which is within the tolerance limit of 6.5-8.5. Level of dissolved oxygen is varying between 0.0 and 5.9 mg/l which is below the permissible limit of 4 mg/l for fish in most of the monitoring points. (At this part of the river, water quality is contaminated slightly at Vadosar bridge showing low DO and high BOD). Values of TDS are varying between 574 and 816. It can be concluded that, high TDS reduces sunlight penetration, lowers the rate of photosynthesis of phytoplanktons and thus lowers the rate of oxygen production in the water column. This is the reason behind such low level of DO. BOD varied between 3.4 and 23 mg/l and maximum probable number of total coliform is varying 15-28/100ml. The overall water of the river is not in healthy and clean state in the monitored section.

Table 1-42 Water Quality Data of the Vishwamitri River

Location	pH	TDS (mg/L)	DO (mg/L)	BOD (mg/L)	COD (mg/L)	TKN (mg/L)	NO_2-N (mg/L)	NO_3-N (mg/L)	TC MPN/ 100 ml	FC MPN/ 100 ml
Sayajibaug, Vadodara	7.71	574	5.9	5.4	10	5.04	0.01	1.61	21	4
Fatehgunj, Vadodara	7.90	730	3.4	12	47	5.6	0.01	1.61	28	2
Vadsar bridge, Vadodara	7.46	816	0.0	23	90	12.6	1.75	1.84	15	4
Munjmahuda, Vadodara	7.50	690	4.2	3.4	16	1.68	0.01	0.14	15	2

Source: Annual Report of Gujarat Pollution Control Board (2006-2007)

Sabarmati River: pH value varies between 7.4 and 8.3 which is within the tolerance limit of 6.5-8.5. Dissolved oxygen varies between 0.7-8.1 mg/l. In upper stream of the river in the Ahmedabad District and the area near the river mouth, the level of DO is under the permissible limit level whereas DO level in Vasna – Narol Bridge, Vautha and Miroli Village is extremely low 0.7 to 2.3 mg/L. BOD is also high at Vasna – Narol Bridge, Vautha and Miroli Village indicating discharge of organic loads at these points. Besides these three locations, water of the river is in healthy and clean state in the monitored section.

Table 1-43 Water Quality Data of the Sabarmati River

Location	pH	TDS (mg/L)	DO (mg/L)	BOD (mg/L)	COD (mg/L)	TKN (mg/L)	NO_2-N (mg/L)	NO_3-N (mg/L)	TC MPN/ 100 ml	FC MPN/ 100 ml
Kheroj bridge	8.2	-	7.2	2.5	8	-			-	-
Hansol bridge	8.12	-	7.3	3.4	18	-			-	-
Railway bridge, Ahmadabad	7.95	-	6.0	4.3	27	-			-	-
Vasna – Narol Bridge	7.42	-	2.3	84	205	-			-	-
Vautha Village	7.63	-	1.1	43	128	-			-	-
Miroli	7.52	-	0.7	65	150	-			-	-
Kheroj bridge	8.27	294	8.1	3	8	0.56	0.04	1.38	20	4
Railway bridge, Ahmadabad	7.75	222	7.4	5.4	16	1.68	0.11	0.46	460	-

Source: Annual Report of Gujarat Pollution Control Board (2006-2007)

(2) Water Quality Status based on Primary Data

1) Water Quality Status of Vishwamitri River

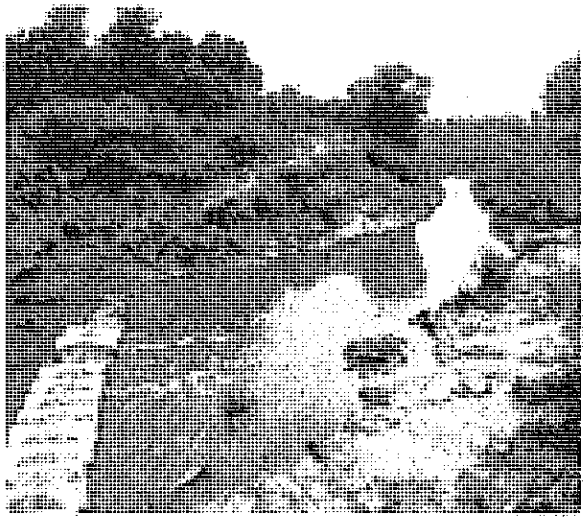
The water quality monitoring results of the Vishwamitri River are presented in Table 1-44.

Table 1-44 Water Quality Monitoring Results of Vishwamitri River

Sl. No.	Parameters and Unit	Sample Code			Permissible Limit*
		SW1	SW2	SW3	
1.	Temperature (°C)	29.8	29.0	29.6	-
2.	Turbidity (NTU)	20	17	19	-
3.	pH	7.3	7.4	7.4	8.5
4.	DO (mg/L)	4.1	4.1	3.9	4
5.	BOD (mg/L)	4.0	3.0	4.0	3
6.	Total Dissolved Solids (mg/L)	840	860	790	1500
7.	Total Suspended Solids (mg/L)	79	96	82	-
8.	Oil and Grease (mg/L)	N.D	N.D	N.D	0.1
9.	Free Ammonia as N (mg/L)	1.02	1.12	0.98	-
10.	Total Hardness as $CaCO_3$ (mg/L)	296	300	312	-
11.	Chloride as Cl (mg/L)	151.7	144.6	133.3	600
12.	Sulphate asSO^4 (mg/L)	116	160	157	400
13.	Nitrate as NO_3 (mg/L)	1.83	2.10	1.77	50
14.	Fluoride as F (mg/L)	0.70	0.76	0.68	1.5
15.	Calcium as Ca (mg/L)	60.55	63.91	62.23	-
16.	Magnesium as Mg (mg/L)	45.39	17.49	38.05	-
17.	Copper as Cu (mg/L)	N.D	N.D	N.D	-
18.	Iron as Fe (mg/L)	0.009	0.014	0.011	50
19.	Manganese as Mn (mg/L)	N.D	N.D	N.D	
20.	Zinc as Zn (mg/L)	N.D	N.D	N.D	15

Note: Based on On-site Water Quality Monitoring during August 2008
*Permissible limits (maximum) stipulated for Inland Surface Waters (Class C) i.e. drinking water source with conventional treatment followed by disinfection (IS:2296); N.D- Not Detected
Source: S-ESIMMS

Temperature varies between 29.0-29.8°C. pH values are generally below the neutral mark (7.3-7.4) and were within the tolerance limit of 6.5-8.5. TDS varies between 790-860 mg/l and TSS varies between 79-96 mg/l, while turbidity ranged between 17-19 NTU. High values of turbidity and TSS indicates medium to high sediment load in the river and implying soil erosion in the river bed and catchments area during the monitoring period.



Satisfactory levels of dissolved oxygen are observed in all the samples, levels varying between 3.9-4.1 mg/l which are slightly above the permissible limit of 4 mg/l for fish. BOD varied between 3.0-4.0 mg/l indicating the absence of organic contamination. Oil and grease is undetected in all the samples.

Total hardness values are observed to vary in the range of 296-312 mg/l. Chloride and sulphate contents are 133.3-151.7 mg/l and 116-160 mg/l, respectively. Levels of calcium and magnesium are 60.55-63.91 mg/l and 17.49-45.39 mg/l, respectively. Among heavy metals and trace elements while iron is detected with the maximum level of 0.014 mg/l, others like copper, manganese and zinc are below their respective detection limits.

The water of the river studied is in a pretty healthy and clean state in the monitored section and is not significantly affected by extraneous pollution as evidenced from the observed value of pH , DO, BOD and oil and grease (below detection limit). Such consistent levels of pH, DO, BOD, nitrogen and oil and grease clearly show the absence of any significant pollution. The overall water of the river is in healthy and clean state in the monitored section.

2) Water Quality Status of Pond (Samiyala Village)

The water quality monitoring results of pond is presented in Table 1-45.

Table 1-45 Water Quality Monitoring Results of Pond (Samiyala Village)

Sl. No.	Parameters and Unit	Sample Code SW4	Limit*
1.	Temperature (°C)	30	-
2.	Turbidity (NTU)	6	-
3.	pH	8.8	8.5
4.	DO (mg/l)	5.2	4
5.	BOD (mg/l)	2.0	3
6.	Total Dissolved Solids (mg/l)	120	1500
7.	Total Suspended Solids (mg/l)	26	-
8.	Oil and Grease (mg/l)	BDL	0.1
9.	Free Ammonia as N (mg/l)	0.82	-
10.	Total Hardness as $CaCO^3$ (mg/l)	56	-
11.	Chloride as Cl - (mg/l)	28.36	600
12.	Sulphate asSO^{4--} (mg/l)	13.5	400
13.	Nitrate as NO^3 (mg/l)	1.55	50
14.	Fluoride as F (mg/l)	0.64	1.5
15.	Calcium as Ca (mg/l)	13.45	-
16.	Magnesium as Mg (mg/l)	5.44	-
17.	Copper as Cu (mg/l)	BDL	-
18.	Iron as Fe (mg/l)	0.009	50
19.	Manganese as Mn (mg/l)	BDL	-
20.	Zinc as Zn (mg/l)	BDL	15

Note: Based on On-site Water Quality Monitoring during August 2008
*Permissible limits (maximum) stipulated for Inland Surface Waters (Class C) i.e. drinking water source with conventional treatment followed by disinfection (IS:2296); BDL- Below Detection Limit
Source: S-ESIMMS

pH value is above the neutral mark (8.8) and is above the tolerance limit of 6.5-8.5. TDS and TSS are 120 mg/l and 26 mg/l , respectively, while turbidity is 6 NTU. The low TSS (26 mg/l) and turbidity (6 NTU) values of the sample indicates that the pond did not receive any domestic discharge or silt laden surface runoff from the adjoining area during the monitoring period.

Level of dissolved oxygen is observed 5.2 mg/l which is slightly above the permissible limit of 4 mg/l for fish. BOD is 2.0 mg/l indicating no organic contamination.

Total hardness value is 56 mg/l. Chloride and sulphate contents are 28.36 mg/l and 13.5 mg/l, , respectively. Levels of calcium and magnesium are 13.45 mg/l and 5.44 mg/l, , respectively. Among heavy metals and trace elements while iron was detected with the maximum level of 0.009 mg/l, others like copper, manganese and zinc are below their respective detection limits.

The water of the pond studied is found to be of good quality and suitable for domestic use as evidenced from the high value of DO (5.2 mg/l) and low value of BOD (2.0 mg/l), oil and grease (BDL). Such levels of DO, BOD and oil and grease clearly show the absence of organic contamination in the ponds.

3) Water Quality Status of Sabarmati River

The water quality monitoring results of the Sabarmati River are presented in Table 1-46

Table 1-46 Water Quality Monitoring Results of Sabarmati River

Sl. No.	Parameters and Unit	Sample Code					Limit*
		SW5	SW6	SW7	SW8	SW9	
1.	Temperature (°C)	30.8	29.9	30.2	30.5	30.1	-
2.	Turbidity (NTU)	23	22	20	27	15	-
3.	pH	7.3	7.4	7.4	7.4	7.5	8.5
4.	DO (mg/l)	2.9	2.4	3.2	1.8	4.7	4
5.	BOD (mg/l)	21	25	19	28	20	3
6.	Total Dissolved Solids (mg/l)	1370	1436	1556	1722	426	1500
7.	Total Suspended Solids (mg/l)	89	91	85	96	49	-
8.	Oil and Grease (mg/l)	2.4	2.9	3.0	3.2	2.8	0.1
9.	Free Ammonia as N (mg/l)	5.3	6.4	6.2	7.1	5.9	-
10.	Total Hardness as $CaCO^3$ (mg/l)	248	252	289	248	136	-
11.	Chloride as Cl - (mg/l)	323	340	446.2	439.8	384	600
12.	Sulphate asSO^4-- (mg/l)	407	469	389.5	514	423.5	400
13.	Nitrate as NO^3 (mg/l)	8.6	8.9	7.6	9.4	9.2	50
14.	Fluoride as F (mg/l)	1.1	0.58	0.65	0.59	0.66	1.5
15.	Calcium as Ca (mg/l)	65	57	72	62	58	-
16.	Magnesium as Mg (mg/l)	20	26	19	22	15	-
17.	Copper as Cu (mg/l)	0.06	0.05	0.03	0.05	BDL	-
18.	Iron as Fe (mg/l)	0.29	0.3	0.26	0.35	0.29	50
19.	Manganese as Mn (mg/l)	BDL	BDL	BDL	BDL	BDL	-
20.	Zinc as Zn (mg/l)	BDL	BDL	BDL	BDL	BDL	15

Note: Based on On-site Water Quality Monitoring during August 2008

*Permissible limits (maximum) stipulated for Inland Surface Waters (Class C) i.e. drinking water source with conventional treatment followed by disinfection (IS:2296); BDL- Below Detection Limit

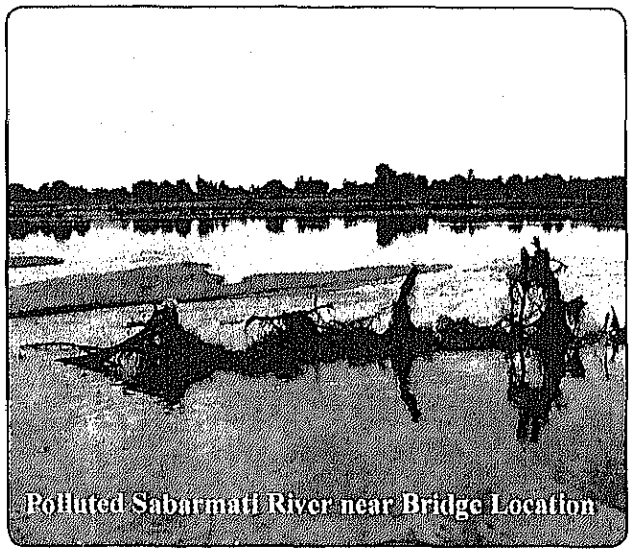
Source: S-ESIMMS

Temperature varies between 29.9-30.8°C. pH values are generally below the neutral mark (7.3-7.5) and are within the tolerance limit of 6.5-8.5. TDS varied between 426-1722 mg/l and

TSS varied between 49-96 mg/l, while turbidity ranged between 15-27 NTU. High values of turbidity and TSS indicates high sediment load in the river and implying soil erosion in the river bed and catchment area during the monitoring period.

Levels of dissolved oxygen are varying between 1.8-4.7 mg/l which are below the permissible limit of 4 mg/l for fish. BOD varies between 19-28 mg/l indicating the organic contamination. Oil and grease varies between 2.4-3.2 mg/l, which indicate the discharge of industrial effluent into the river water.

Total hardness values are observed to vary in the range of 136-289 mg/l. Chloride and sulphate contents are 323-446.2 mg/l and 389.5-514 mg/l, respectively. Levels of calcium and magnesium are 57-72 mg/l and 15-26 mg/l, respectively. Among heavy metals and trace elements while iron and copper are detected with their maximum levels of 0.35 mg/l and 0.06 mg/l, others like manganese and zinc are below their respective detection limits.


Polluted Sabarmati River near Bridge Location

The water of the river studied is polluted in the monitored section and is significantly affected by extraneous pollution as evidenced from the observed value of pH , DO, BOD and oil and grease (much higher than the permissible limit). The most polluted stretch of Sabarmati River is from Gandhinagar to Vautha (total length 80 km). Chemical industries illegally discharge industrial effluents into storm water drains – meant to carry only rain water. The Sabarmati River, which caters drinking water needs of over 3.5 million people in Ahmedabad and Gandhinagar and nearby villages, has innumerable illegal drainage connections, installed either by industries situated in its periphery or even by the local municipalities. However, the most important thing is that Ahmedabad Municipal Corporation (AMC) itself discharges some amount of the untreated domestic sewage coming from the Pirana Sewage Treatment Plant through storm water drains. At least one-third of the untreated domestic-waste water is directly flushed into Sabarmati (GANDHI'S RIVER IS NOW A SEWER by Himanshu Kaushik). The entire river system is dead and water contains various amounts of toxicants, either industrial effluents or released from urban sewages (Ballabh and Singh 1997; Anon 2001).

4) Water Quality Status of Balaram River

The water quality monitoring results of the Balaram River are presented in Table 1-47

Table 1-47 Water Quality Monitoring Results of Balaram River

Sl. No.	Parameters and Unit	Sample Code					Limit*
		SW10	SW11	SW12	SW13	SW14	
1.	Temperature (°C)	30.2	30.0	30.2	30.5	29.9	-
2.	Turbidity (NTU)	10	8	11	10	9	-
3.	pH	8.2	8.3	8.2	8.4	8.4	8.5
4.	DO (mg/l)	4.3	4.1	4.5	4.6	3.9	4
5.	BOD (mg/l)	3.0	2.0	2.0	2.0	4.0	3
6.	Total Dissolved Solids (mg/l)	390	378	394	386	336	1500
7.	Total Suspended Solids (mg/l)	36	28	31	30	27	-
8.	Oil and Grease (mg/l)	BDL	BDL	BDL	BDL	BDL	0.1
9.	Free Ammonia as N (mg/l)	0.67	0.69	0.66	0.65	0.78	-
10.	Total Hardness as $CaCO^3$ (mg/l)	216	220	216	192	250	-
11.	Chloride as Cl - (mg/l)	69.5	75.0	70.0	76.5	79.5	600
12.	Sulphate asSO^4-- (mg/l)	18.6	16.4	29.4	32.8	30.9	400
13.	Nitrate as NO^3 (mg/l)	1.65	1.66	1.67	1.64	1.59	50
14.	Fluoride as F (mg/l)	0.56	0.62	0.60	0.61	0.57	1.5
15.	Calcium as Ca (mg/l)	43	47	45	42	49	-
16.	Magnesium as Mg (mg/l)	26	24	25	21	30	-
17.	Copper as Cu (mg/l)	BDL	BDL	BDL	BDL	BDL	-
18.	Iron as Fe (mg/l)	0.026	0.025	0.025	0.024	0.03	50
19.	Manganese as Mn (mg/l)	BDL	BDL	BDL	BDL	BDL	-
20.	Zinc as Zn (mg/l)	BDL	BDL	BDL	BDL	BDL	15

Note: Based on On-site Water Quality Monitoring during August 2008
* - Permissible limits (maximum) stipulated for Inland Surface Waters (Class C) i.e. drinking water source with conventional treatment followed by disinfection (IS:2296); BDL- Below Detection Limit
Source: S-ESIMMS

Temperature varies between 29.9-30.5°C. pH values are generally above the neutral mark (8.2-8.4) and are within the tolerance limit of 6.5-8.5. Water is slightly alkaline. TDS varies between 336-394 mg/l and TSS varies between 27-36 mg/l, while turbidity ranges between 8 and 11 NTU. The values of turbidity and TSS indicates medium sediment load in the river and implies soil erosion in the river bed and catchment area during the monitoring period.

Satisfactory levels of dissolved oxygen are observed in all the samples, levels varying between 3.9 and 4.6 mg/l which are slightly above the permissible limit of 4 mg/l for fish. BOD varies between 2.0 and 4.0 mg/l indicating the absence organic contamination. Oil and grease are undetected in all the samples.

Total hardness values are observed to vary in the range of 192-250 mg/l. Chloride and sulphate contents are 69.5-79.5 mg/l and 16.4-32.8 mg/l, respectively. Levels of calcium and magnesium are 42-49 mg/l and 21-30 mg/l, respectively. Among heavy metals and trace elements while iron is detected with the maximum level of 0.03 mg/l, others like copper, manganese and zinc are below their respective detection limits.

The water of the river studied is in a pretty healthy and clean state in the monitored section and is not significantly affected by extraneous pollution as evidenced from the observed value of pH , DO, BOD and oil and grease (below detection limit). Such consistent levels of pH, DO, BOD, nitrogen and oil and grease clearly show the absence of any significant pollution. The overall water of the river is in healthy and clean state at the monitored section.

Water flow at the study site is 0.42 m^3/s (Table 1-48).

Table 1-48 River Flow Measurement Results

Segment	Area (m^2)	Measurement Distance (m)	Passing Time (Sec)	Average Velocity (m/s)	Discharge (m^3/s)
Balaram river – Location A (DRG NO. 2008079.S-ESIMMS/002)					
	1.95	35	163	0.21	0.42
				Total discharge (Q)	**0.42**
Balaram river – Location B (DRG NO. 2008079.S-ESIMMS/002)					
	1.24	50	147	0.34	0.42
				Total discharge (Q)	**0.42**

Average velocity (n=4) each location.

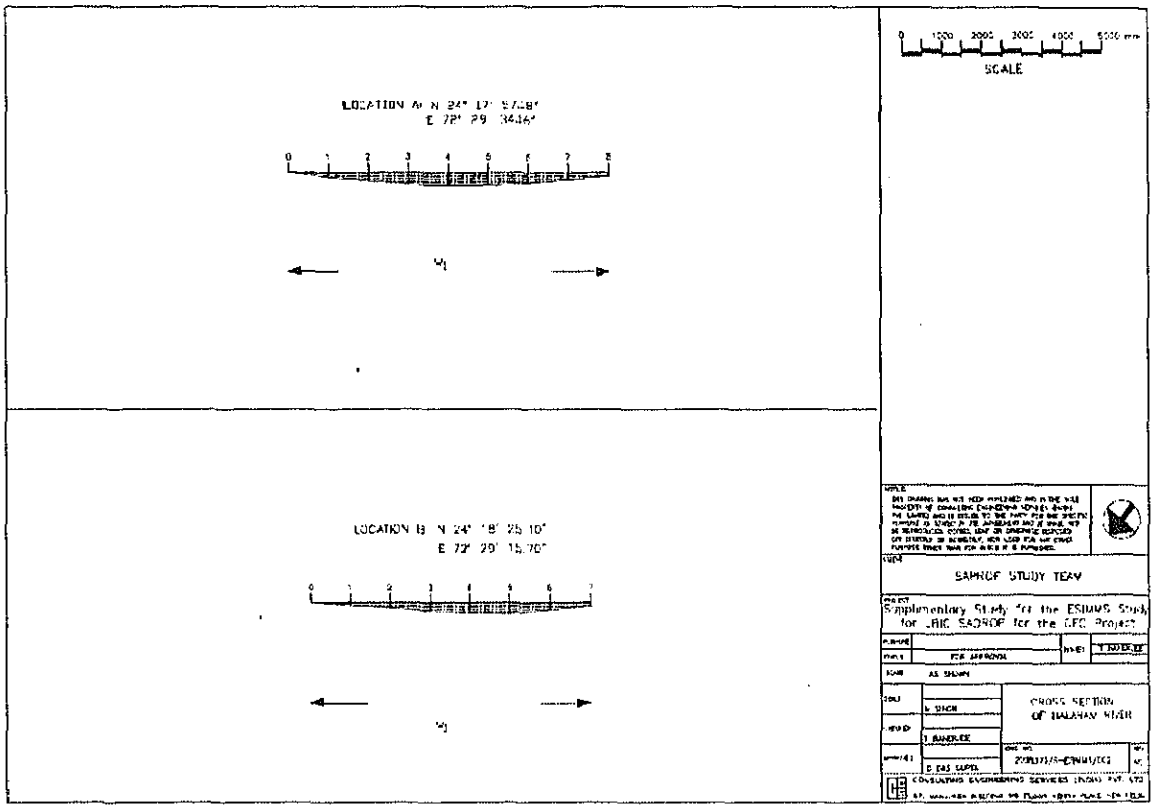


Figure 1-35 Cross section of the Water flow Measurement site (Balaram rover)

5) Water Quality Status of Vatrak River

The water quality monitoring results of the Vatrak River are presented in Table 1-49.

Table 1-49 Water Quality Monitoring Results of Vatrak River

Sl. No.	Parameters and Unit	Sample Code					Limit*
		SW15	SW16	SW17	SW18	SW19	
1.	Temperature (°C)	29.5	30.0	30.0	29.9	30.5	-
2.	Turbidity (NTU)	8	6	9	10	7	-
3.	pH	8.4	8.3	8.4	8.5	8.5	8.5
4.	DO (mg/l)	4.8	4.9	4.7	4.7	5.0	4
5.	BOD (mg/l)	3.0	2.5	3.0	2.5	2.6	3
6.	Total Dissolved Solids (mg/l)	428	424	420	426	326	1500
7.	Total Suspended Solids (mg/l)	31	28	24	27	22	-
8.	Oil and Grease (mg/l)	BDL	BDL	BDL	BDL	BDL	0.1
9.	Free Ammonia as N (mg/l)	0.7	0.5	0.57	0.6	0.4	-
10.	Total Hardness as $CaCO^3$ (mg/l)	144	126	134	140	136	-
11.	Chloride as Cl - (mg/l)	86	79	80	83	58	600
12.	Sulphate asSO^4-- (mg/l)	24.3	26.2	23.2	18.9	23.7	400
13.	Nitrate as NO^3 (mg/l)	2.3	2.0	1.9	1.6	0.9	50
14.	Fluoride as F (mg/l)	0.6	0.8	0.65	0.7	0.5	1.5
15.	Calcium as Ca (mg/l)	30	38	28	27	30	-
16.	Magnesium as Mg (mg/l)	16	20	17	15	19	-
17.	Copper as Cu (mg/l)	BDL	BDL	BDL	BDL	BDL	-
18.	Iron as Fe (mg/l)	BDL	0.02	0.03	0.025	0.018	50
19.	Manganese as Mn (mg/l)	BDL	BDL	BDL	BDL	BDL	-
20.	Zinc as Zn (mg/l)	BDL	BDL	BDL	BDL	BDL	15

Note: Based on On-site Water Quality Monitoring during August 2008
* - Permissible limits (maximum) stipulated for Inland Surface Waters (Class C) i.e. drinking water source with conventional treatment followed by disinfection (IS:2296); BDL- Below Detection Limit
Source: S-ESIMMS

Temperature varies between 29.5-30.5°C. pH values are generally above the neutral mark (8.3-8.5) and are within the tolerance limit of 6.5-8.5. Water is slightly alkaline. TDS varies between 326 and 428 mg/l and TSS varies between 22 and 31 mg/l, while turbidity ranges between 6 and 10 NTU. The values of turbidity and TSS indicates medium sediment load in the river and implies soil erosion in the river bed and catchment area during the monitoring period.

Satisfactory levels of dissolved oxygen are observed in all the samples, levels varying between 4.7 and 5.0 mg/l which are slightly above the permissible limit of 4 mg/l for fish. BOD varies between 2.5 and 3.0 mg/l indicating no organic contamination. Oil and grease is undetected in all the samples.

Total hardness values are observed to vary in the range of 126-144 mg/l. Chloride and sulphate contents are 58-86 mg/l and 18.9-26.2 mg/l, respectively. Levels of calcium and magnesium are 27-38 mg/l and 15-20 mg/l, respectively. Among heavy metals and trace elements while iron is detected with the maximum level of 0.03 mg/l, others like copper, manganese and zinc are below their respective detection limits.

The water of the river studied is in a pretty healthy and clean state at the monitored section and is not significantly affected by extraneous pollution as evidenced from the observed value of pH , DO, BOD and oil and grease (below detection limit). Such consistent levels of pH, DO, BOD, nitrogen and oil and grease clearly show the absence of any significant pollution. The overall water of the river is in healthy and clean state in the monitored section.

Water flow at the Vatrak River is 17.2 m^3s at the measurement. The water flow rate of the river is measured at the site meantime to the water quality sampling (Table 1-50).

Table 1-50 River Flow Measurement Results in Vatrak River

Segment	Area (m^2)	Measurement Distance (m)	Passing Time (Sec)	Average Velocity (m/s)	Discharge (m^3/s)
Vatrak river – Location B (DRG NO. 2008079.S-ESIMMS/003)					
W_1	4.3	100	212	0.47	2.00
				Average segmental discharge (W_1)	***2.00***
W_2	21.3	100	210	0.475	10.13
				Average segmental discharge (W_2)	***10.13***
W_3	7.6	100	209	0.477	3.63
				Average segmental discharge (W_3)	***3.63***
W_4	3.1	100	211	0.47	1.47
				Average segmental discharge (W_4)	***1.47***
				Total discharge (Q)	**17.23**

Average velocity (n=4) each location.

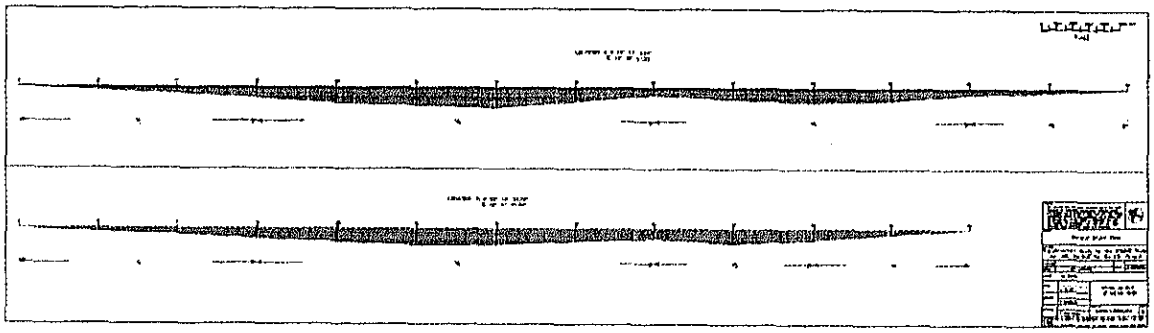


Figure 1-36 Cross section of the water flow measurement site(Vatrak River)

6) Water Quality Status of Mahi River

The water quality monitoring results of the Mahi River are presented in Table 1-51.

Temperature varies between 30.5-31.0°C. pH values are generally above the neutral mark (8.3-8.7) and are within the tolerance limit of 6.5-8.5 in most of the samples except SW20 where it is slightly above (8.7). Water is slightly alkaline. TDS varies between 194 and 349 mg/l and TSS varies between 12 and 22 mg/l, while turbidity ranges between 4 and 10 NTU. The values of turbidity and TSS indicates low sediment load in the river and implies negligible soil erosion in the river bed and catchment area during the monitoring period.

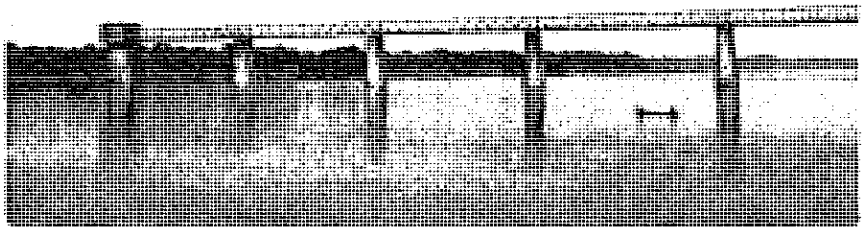
Table 1-51 Water Quality Monitoring Results of Mahi River

Sl. No.	Parameters and Unit	Sample Code					Limit*
		SW20	SW21	SW22	SW23	SW24	
1.	Temperature (°C)	30.5	31.0	30.9	30.5	30.7	-
2.	Turbidity (NTU)	8	6	10	4	6	-
3.	pH	8.7	8.3	8.3	8.4	8.4	8.5
4.	DO. (mg/l)	4.9	4.2	4.5	6.2	6.0	4
5.	BOD. (mg/l)	2.5	3.0	2.9	3.0	2.0	3
6.	Total Dissolved Solids (mg/l)	324	326	349	194	205	1,500
7.	Total Suspended Solids (mg/l)	16	19	22	12	13	-
8.	Oil and Grease (mg/l)	BDL	BDL	BDL	BDL	BDL	0.1
9.	Free Ammonia as N (mg/l)	0.5	0.4	0.48	0.8	0.58	-
10.	Total Hardness as $CaCO^3$ (mg/l)	136	136	147	112	120	-
11.	Chloride as Cl - (mg/l)	59.0	47.5	44.6	29.7	28.36	600
12.	Sulphate asSO^4-- (mg/l)	23.7	21.5	19.6	12.9	13.5	400
13.	Nitrate as NO^3 (mg/l)	0.85	0.9	1.43	1.68	1.64	50
14.	Fluoride as F (mg/l)	0.55	0.5	0.62	0.66	0.68	1.5
15.	Calcium as Ca (mg/l)	27.0	26.0	28.8	30.27	26.91	-
16.	Magnesium as Mg (mg/l)	16.0	17.0	13.0	8.84	12.83	-
17.	Copper as Cu (mg/l)	BDL	BDL	BDL	BDL	BDL	-
18.	Iron as Fe (mg/l)	0.02	0.02	0.03	0.01	0.009	50
19.	Manganese as Mn (mg/l)	BDL	BDL	BDL	BDL	BDL	-
20.	Zinc as Zn (mg/l)	BDL	BDL	BDL	BDL	BDL	15

Note: Based on On-site Water Quality Monitoring during August 2008
* - Permissible limits (maximum) stipulated for Inland Surface Waters (Class C) i.e. drinking water source with conventional treatment followed by disinfection (IS:2296); BDL- Below detection limit
Source: S-ESIMMS

Satisfactory levels of dissolved oxygen are observed in all the samples, levels varying between 4.2 and 6.2 mg/l which are slightly above the permissible limit of 4 mg/l for fish. BOD varies between 2.0 and 3.0 mg/l indicating no organic pollution. Oil and grease is undetected in all the samples.

Total hardness values are observed to vary in the range of 112-147 mg/l. Chloride and sulphate contents are 28.36-59.0 mg/l and 12.9-23.7 mg/l, respectively. Levels of calcium and magnesium are 26.0-30.27 mg/l and 8.84-17.0 mg/l, respectively. Among heavy metals and trace elements while iron is detected with the maximum level of 0.03 mg/l, others like copper, manganese and zinc are below their respective detection limits.



The water of the river studied is in healthy and clean state at the monitored section and is not polluted as evidenced from the observed value of pH , DO, BOD and oil and grease (below

detection limit). Such consistent levels of pH, DO, BOD, nitrogen and oil and grease clearly show the absence of any significant pollution. The overall water of the river is in healthy and clean state at the monitored section.

7) Water Quality Status of Mini River

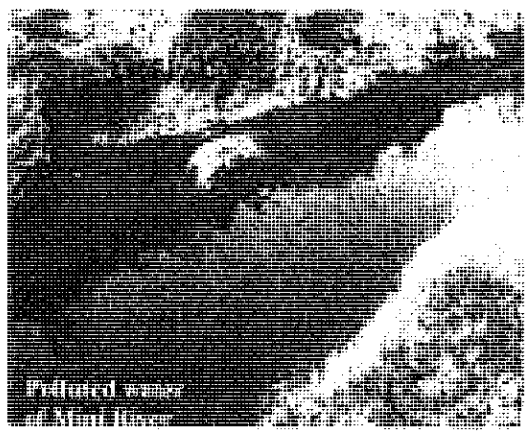
The water quality monitoring results of the Mini River are presented in Table 1-52.

Table 1-52 Water Quality Monitoring Results of Mini River

Sl. No.	Parameters and Unit	Sample Code		Limit*
		SW25	SW26	
1.	Temperature (°C)	30.0	29.5	-
2.	Turbidity (NTU)	19	24	-
3.	pH	7.7	8.2	8.5
4.	DO. (mg/l)	3.0	2.9	4
5.	BOD. (mg/l)	28	25	3
6.	Total Dissolved Solids (mg/l)	1280	1264	1500
7.	Total Suspended Solids (mg/l)	88	97	-
8.	Oil and Grease (mg/l)	2.4	2.7	0.1
9.	Free Ammonia as N (mg/l)	9.78	1.50	-
10.	Total Hardness as $CaCO^3$ (mg/l)	240	352	-
11.	Chloride as Cl - (mg/l)	259.9	359.8	600
12.	Sulphate asSO^4-- (mg/l)	628.6	279.7	400
13.	Nitrate as NO^3 (mg/l)	1.8	1.6	50
14.	Fluoride as F (mg/l)	0.8	0.7	1.5
15.	Calcium as Ca (mg/l)	62.3	80.7	-
16.	Magnesium as Mg (mg/l)	20.6	36.5	-
17.	Copper as Cu (mg/l)	BDL	BDL	-
18.	Iron as Fe (mg/l)	0.31	0.013	50
19.	Manganese as Mn (mg/l)	BDL	BDL	-
20.	Zinc as Zn (mg/l)	BDL	BDL	15

Note: Based on On-site Water Quality Monitoring during August 2008
* - Permissible limits (maximum) stipulated for Inland Surface Waters (Class C) i.e. drinking water source with conventional treatment followed by disinfection (IS:2296); BDL- Below Detection Limit.
Source: S-ESIMMS

Temperature varies between 29.5-30.0°C. pH values are generally above the neutral mark (7.7-8.2) and are within the tolerance limit of 6.5-8.5. TDS varies between 1,264 and 1,280 mg/l and TSS varies between 88 and 97 mg/l, while turbidity ranges between 19 and 24 NTU. High values of turbidity and TSS indicates high sediment load in the river and implies soil erosion in the river bed and catchment area during the monitoring period.



Levels of dissolved oxygen are varying between 2.9 and 3.0 mg/l which are below the permissible limit of 4 mg/l for fish. BOD varies between 25 and 28 mg/l indicating the presence of organic contamination. Oil and grease varies between 2.4 and 2.7 mg/l, which indicate the discharge of industrial and domestic effluent into the river water.

Total hardness values are observed to vary in the range of 240-352 mg/l. Chloride and sulphate contents are 259.9-359.8 mg/l and 279.7-628.6 mg/l, respectively. Levels of calcium and magnesium are 62.3-80.7 mg/l and 20.6-36.5 mg/l, respectively. Among heavy metals and trace elements while iron is detected with their maximum levels of 0.31 mg/l, others like copper, manganese and zinc are below their respective detection limits.

The water of the river studied is highly polluted in the monitored section and is significantly affected by extraneous pollution as evidenced from the observed value of pH, DO, BOD and oil and grease (much higher than the permissible limit). The Mini River has innumerable illegal drainage connections through which the Chemical industries of Ahmedabad illegally discharge industrial effluents into the river directly. Due to the discharge of untreated domestic and industrial effluent fish kills occur. None of the aquatic animals are sighted during the survey which indicates that the water of the river is highly polluted.

8) Water Quality Status of River Banas River

The water quality monitoring results of the Banas River are presented in Table 1-53.

Table 1-53 Water Quality Monitoring Results of Banas River

Sl. No.	Parameters and Unit	Sample Code		Limit*
		SW27	SW28	
1.	Temperature (°C)	30.3	29.9	-
2.	Turbidity (NTU)	8	10	-
3.	pH	8.28	8.33	8.5
4.	DO. (mg/l)	4.3	4.1	4
5.	BOD. (mg/l)	03	03	3
6.	Total Dissolved Solids (mg/l)	398	394	1500
7.	Total Suspended Solids (mg/l)	15	19	-
8.	Oil and Grease (mg/l)	BDL	BDL	0.1
9.	Free Ammonia as N (mg/l)	0.60	0.62	-
10.	Total Hardness as $CaCO^3$ (mg/l)	183	196	-
11.	Chloride as Cl - (mg/l)	96.3	88	600
12.	Sulphate asSO^4-- (mg/l)	28.3	27.9	400
13.	Nitrate as NO^3 (mg/l)	1.7	1.62	50
14.	Fluoride as F (mg/l)	0.6	0.58	1.5
15.	Calcium as Ca (mg/l)	40	45	-
16.	Magnesium as Mg (mg/l)	23	20	-
17.	Copper as Cu (mg/l)	BDL	BDL	-
18.	Iron as Fe (mg/l)	0.025	0.027	50
19.	Manganese as Mn (mg/l)	BDL	BDL	-
20.	Zinc as Zn (mg/l)	BDL	BDL	15

Note: Based on On-site Water Quality Monitoring during August 2008
*Permissible limits (maximum) stipulated for Inland Surface Waters (Class C) i.e. drinking water source with conventional treatment followed by disinfection (IS:2296); BDL- Below Detection Limit.
Source: S-ESIMMS

Temperature varies between 29.9 and 30.3°C. pH values are generally above the neutral mark (8.28-8.33) and are within the tolerance limit of 6.5-8.5. Water is slightly alkaline. TDS varies between 394 and 398 mg/l and TSS varies between 15 and 19 mg/l, while turbidity ranges between 8-10 NTU. The values of turbidity and TSS indicates medium sediment load in the river and implies soil erosion in the river bed and catchment area during the monitoring period.

Satisfactory levels of dissolved oxygen are observed in both the samples, levels varying between 4.1 and 4.3 mg/l which are slightly above the permissible limit of 4 mg/l for fish.

BOD in both the samples is 3.0 mg/l indicating low concentration of organic pollutants. Oil and grease is undetected in all the samples.

Total hardness values are observed to vary in the range of 183-196 mg/l. Chloride and sulphate contents are 88-96.3 mg/l and 27.9-28.3 mg/l, respectively. Levels of calcium and magnesium are 40-45 mg/l and 20-23 mg/l, respectively. Among heavy metals and trace elements while iron is detected with the maximum level of 0.027 mg/l, others like copper, manganese and zinc are below their respective detection limits.

The water of the river studied is in a pretty healthy and clean state at the monitored section and is not significantly affected by extraneous pollution as evidenced from the observed value of pH, DO, BOD and oil and grease (below detection limit). Such consistent levels of pH, DO, BOD, nitrogen and oil and grease clearly show the absence of any significant pollution. The overall water of the river is in healthy and clean state at the monitored section.

Water flow at the Banas river is **1.82 m^3s (Table 1-54).** Supplementary water flow rate is measured at two (2) locations meantime with the water quality sampling.

Table 1-54 River Flow Measurement Results

Segment	Area (m^2)	Measurement Distance (m)	Passing Time (Sec)	Average Velocity (m/s)	Discharge (m^3/s)
Banas river – Location A				**(DRG NO. 2008079.S-ESIMMS/001)**	
W_1	0.48	100	170	0.59	0.28
				Average segmental discharge (W_1)	***0.28***
W_2	1.64	100	153	0.65	1.07
				Average segmental discharge (W_2)	***1.07***
W_3	0.94	100	200	0.50	0.47
				Average segmental discharge (W_3)	***0.47***
				Total discharge (Q)	**1.82**
Banas river – Location B				**(DRG NO. 2008079.S-ESIMMS/001)**	
W_1	0.56	80	300	0.27	0.15
				Average segmental discharge (W_1)	***0.15***
W_2	1.4	80	262	0.31	0.44
				Average segmental discharge (W_2)	***0.44***
W_3	2.01	80	271	0.30	0.59
				Average segmental discharge (W_3)	***0.59***
W_4	2.24	80	282	0.28	0.64
				Average segmental discharge (W_4)	***0.64***
				Total discharge (Q)	**1.82**

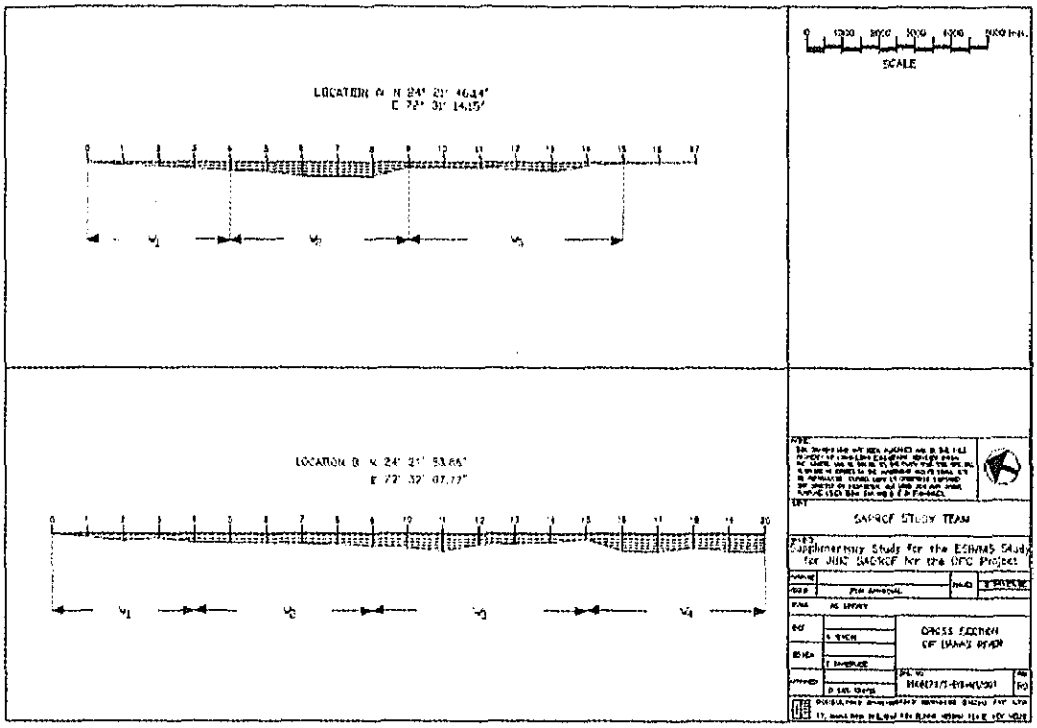


Figure 1-37 Cross section of the Water flow measurement site(Banas River)

9) Water Quality Status of Narmada Canal

The water quality monitoring results of the Narmada Canal are presented in Table 1-55.

Table 1-55 Water Quality Monitoring Results of Narmada Canal

Sl. No.	Parameters and Unit	Sample Code		Limit*
		SW29	SW30	
1.	Temperature (°C)	30.5	31.0	-
2.	Turbidity (NTU)	8	6	-
3.	pH	8.5	8.4	8.5
4.	DO. (mg/l)	7.3	7.6	4
5.	BOD. (mg/l)	2	3	3
6.	Total Dissolved Solids (mg/l)	457	366	1500
7.	Total Suspended Solids (mg/l)	44	28	-
8.	Oil and Grease (mg/l)	BDL	BDL	0.1
9.	Free Ammonia as N (mg/l)	BDL	0.5	-
10.	Total Hardness as $CaCO^3$ (mg/l)	260	200	-
11.	Chloride as Cl - (mg/l)	72	60	600
12.	Sulphate asSO^4-- (mg/l)	18	20	400
13.	Nitrate as NO^3 (mg/l)	0.7	2.1	50
14.	Fluoride as F (mg/l)	0.8	1.1	1.5
15.	Calcium as Ca (mg/l)	60.1	44.1	-
16.	Magnesium as Mg (mg/l)	26.7	21.8	-
17.	Copper as Cu (mg/l)	BDL	BDL	-
18.	Iron as Fe (mg/l)	0.25	0.41	50
19.	Manganese as Mn (mg/l)	BDL	BDL	-
20.	Zinc as Zn (mg/l)	BDL	BDL	15

Note: Based on On-site Water Quality Monitoring during August 2008

* - Permissible limits (maximum) stipulated for Inland Surface Waters (Class C) i.e. drinking water source with conventional treatment followed by disinfection (IS:2296); BDL- Below detection limit

Source: S-ESIMMS

Temperature varies between 30.5-31.0°C. pH values are generally above the neutral mark (8.4-8.5) and are within the tolerance limit of 6.5-8.5. Water is slightly alkaline. TDS varies between 366-457 mg/l and TSS varies between 28-44 mg/l, while turbidity ranges between 6-8 NTU. The values of turbidity and TSS indicates medium sediment load in the canal and implies soil erosion in the canal bed during the monitoring period.

Satisfactory levels of dissolved oxygen are observed in both the samples, levels varying between 7.3-7.6 mg/l. BOD levels are varying between 2.0-3.0 mg/l indicating the absence of organic pollutants. Oil and grease is undetected in all the samples.

Total hardness values are observed to vary in the range of 200-260 mg/l. Chloride and sulphate contents are 60-72 mg/l and 18-20 mg/l, respectively. Levels of calcium and magnesium are 44.1-60.1 mg/l and 26.7-21.8 mg/l, respectively. Among heavy metals and trace elements while iron is detected with the maximum level of 0.41 mg/l, others like copper, manganese and zinc are below their respective detection limits.

The water of the canal studied is in a pretty healthy and clean state in the monitored section and is not at all affected by extraneous pollution as evidenced from the observed value of pH , DO, BOD and oil and grease (below detection limit). Such consistent levels of pH, DO, BOD, nitrogen and oil and grease clearly show the absence of any significant pollution. The overall water of the canal is in healthy and clean state at the monitored section.

1.3.3 Impact Assessment

(1) Preconstruction Phase

During preconstruction phase no impact is envisaged on river water quality.

(2) Construction Phase

A number of land based activities are associated with the construction of bridges over the rivers which could have potential impact on surface water quality. The activities include:

- Site clearance
- Earthwork including construction of embankment and cutting
- Demolition activities
- Construction of approach road, footpath and associated facilities and services
- Construction materials handling; storage and use of fuels and oils and other potentially polluting construction materials
- Spillage and uncontrolled release of construction materials such as cement, concrete, diesel, hydraulic fluid, paint etc.

Silty water can arise from earthworks, exposed ground, water collecting in excavations, stockpiled materials and site roads etc. Soil compaction can occur as a result of construction vehicles and plant passing over previously undeveloped land. Soil compaction causes a reduction in the volume of water permeating into the ground therefore increasing run-off. The run-off would normally contain suspended silt as the compacted ground would be susceptible to erosion in the absence of vegetation cover. The areas at particular risk from compaction would include those identified as construction compounds for plant and materials, temporary access routes for construction traffic and related activities.

The deterioration of water quality during construction phase is also expected due to wastewater disposal from the workers camp and sludge generated from construction sites. If

adequate arrangements are not made to ensure proper drainage of wastewater from the construction sites, such waters may form stagnant pools and aggravate soil erosion. Stagnant pools of water promote breeding of mosquitoes and create generally unsanitary conditions.

Impacts:

- Slight change in water quality for a temporary period during works affecting the channels and bank of the rivers/ water bodies.
- Increase of sediment load in the run off from construction sites and increase in turbidity in receiving streams/water bodies
- Change in water quality due to spillage and uncontrolled release of construction materials such as cement, concrete, diesel, hydraulic fluid, paint etc.
- Slight change in hydrology and geomorphology of the stretch of water course directly affected by the temporary works at the site of new crossing
- Water pollution due to discharge of sewage from construction camps

Mitigation Measures:

At the time of detailed design, civil works required during construction phase shall be designed to minimize disruption of flows and disturbance to the bed, channels and banks of the rivers

All untreated contaminated drainage from construction site and construction camps shall be prevented from entering the rivers and other water bodies located nearby. Provision shall be made to collect and treat the drainage from all construction sites and camps and to remove any sediment and other contaminants before discharging the clean water under an appropriate consent from State Pollution Control Board.

A floating oil boom shall be placed on the water surface near construction site to prevent discharge of any trace of oil and fuel that may have entered the drainage system. This would serve as a contingency measures: the adoption of good site practice for the prevention of pollution should prevent any fuel or oil entering the drainage system.

In order to prevent materials leaking from static plant, such as pumps and generators, contaminating the ground and being washed into the drainage system; static plant shall be placed on drip trays. Construction site run-off from plant and machinery can cause serious pollution if appropriate management systems from controlling discharges are not adequately followed.

Facilities of washing plant and equipment contaminated with concrete and other chemicals shall be provided.

Chemicals shall be stored in secure designated storage areas and in accordance with the appropriate regulatory requirements. Hazardous chemicals shall be handled as per Hazardous Waste (Management and Handling) Amendment Rules, 2003.

Stockpile of dry materials shall be stored at least 200m away from the banks of the rivers.

Onsite batching facilities shall be operated under the conditions of the appropriate authorization i.e., No Objection Certificate from State Pollution Control Board.

Silt fencing may be provided near water bodies

Proper sanitation facilities shall be provided at the construction site to prevent health related problems due to water contamination.

All the construction and preparatory activities including construction of culverts and bridges shall be carried out during dry seasons only.

Effective storm water drainage system shall be provided in every bridge to eliminate / reduce the chance of discharge of untreated storm water directly to the river.

(3) Operation Phase:

Impacts:

During operation phase no significant impact is envisaged on surface water quality. However, some operational effects on the surface water environment would occur as a result of the following:

- Increase in the volume of surface water run-off caused by an increase in impermeable surface associated with the new bridge/crossing.
- Impacts associated with maintenance and repair of bridge which may include sediment aggravation and works on the watercourse banks

Mitigation Measures:

- To minimize the increase volume of surface runoff from new areas, permeable hard surfacing materials may be utilized.
- The discharge of polluted surface water run-off into receiving water body shall be mitigated by minimizing the number of discharge points along the DFC alignment and using existing surface water drainage wherever possible.
- At the detailed design stage a flood risk assessment shall be undertaken. The risk assessment would establish the required mitigation in detail. A flood risk assessment would enable more accurate predictions of the likelihood of inundation near the bridge locations.
- Adequate pollution control measures shall be incorporated into the drainage system in order to prevent deterioration of the quality of surface water and shall include the installation of oil/ petrol interceptors where necessary.

CHAPTER III-2 NATURAL ENVIRONMENT

2.1 GUJARAT

2.1.1 General

Gujarat is located in the western part of the Indian subcontinent. It is one of the important maritime State of India with the longest shoreline of about 1,650 km. On the basis of geographical position and drainage characteristics, the State of Gujarat can be divided into three broad regions viz. south Gujarat, north and central Gujarat (main land) and Saurashtra and Kutch. The proposed DFC alignment is passing through North and Central Gujarat. The state has an area of about 195,984 km^2.

In Gujarat, the DFC alignment passes through eight districts as detour alignment and its length is approximately 319.3 km The surrounding areas of the DFC alignment in the state is mainly agricultural land (93%), followed by barren land, forest area, river bed etc. The soil types along the DFC alignment vary from district to district. The soils of Vadodara District are clayey (containing 45% clay and 20% sand), deep black, fertile and suitable for cotton, jawar (sorghum), rice, wheat and other garden crops. The soils of the Anand District are very deep, well drained, calcareous, fine to coarse and loamy soil on gently sloping flood plain and are very rich and fertile. The soils in the Kheda District are known as "pieces of gold" as they respond very well to manuring and irrigation. There are mainly three types of soils in the district. The soils of alluvial plains consist of very deep, well-drained, calcareous, fine to coarse loam, occupying the major part of the district. The DFC alignment in Ahmedabad and Gandhinagar Districts is passing through alluvial plain. The soils in the districts are fine to coarse, loamy, and mixed and is one of the most fertile parts of the state and agrieulturally much advanced. The Soils of Banaskantha District is poorest from agriculture point of view as the soil is deficient in organic matter and nitrogen. The soil type of the corridor is mixed, calcareous, coarse, and loamy soil with slight to moderate salinity.

Two main seasonal crops, namely Rabi crop in winter season and Kharif crop in summer and rainy seasons are cultivated in Gujarat. The major crops grown in the District through which the DFC alignment is passing is given in Table 2-1.

Table 2-1 Main crop species in the area along DFC

Name of the Crop	Scientific Name	Remarks
Paddy	*Oryza sativa*	Kharif crop
Bajri	*Pennisetum typhoidem*	Kharif crop
Tobacco	*Nicotiana tobacum*	Kharif crop
Isabgul	*Plantago ovata*	Kharif crop
Wheat	*Triticum vulgare*	Rabi crop
Jowar	*Andropogau sorghum*	Rabi crop
Cotton	*Gossypium herbaccum*	
Name of the Pulses		
Tur	*Cajanus indicus*	Kharif crop
Gram	*Cicer arietinum*	Kharif crop
Mag	*Phaseolus radiatus*	Kharif crop
Math	*Phaseolus acontifolius*	Kharif crop
Udid	*Phaseolus mungo*	Kharif crop
Val	*Lablab niger*	Kharif crop

Source: Field Survey during August and September 2008 in S-ESIMMS

The important vegetables of the rainy season are *Abelmoschus esculentus*, *Capsicum annuum*, Lablab purpureus, *Solanun melongena*, and *Cyamopsis tetragonoloba*.

The climate of the area is moderate and tropical characterized by a hot summer from March to June, a humid monsoon or rainy season stretching from July to September, a short pleasant post-monsoon in October and November, and short winter spanning between December and January. The rainfall is of monsoonic type and about 70-80% of the total annual rainfall is received during the monsoon period where as during remaining period the light showers are received. Past meteorological data of the nearest IMD observatory located at Vadodara, Ahmedabad, Idar, Radhanpur and Deesa, which deemed representative of the study area, has been summarized in Table 2-2.

Table 2-2 Summary of Climatological Data of the Study Corridor

Parameter	IST	Monthly Range	Annual Mean/Total
Vadodara			
Mean daily maximum temperature (°C)		30.3 (Jan) – 40.9 (May)	34.8
Mean daily minimum temperature (°C)		12.0 (Jan) – 27.0 (Jun)	20.6
Relative humidity (%)	0830	53 (Mar) – 90 (Aug)	70
	1730	20 (Mar) – 74 (Aug)	43
Total rainfall (mm)		0.6 (Feb) – 297.6 (Jul)	922.7
Wind speed (km/h)		3.0 (Oct) – 10.0 (Jul)	5.5
Ahmedabad			
Mean daily maximum temperature (°C)		28.4 (Jan) – 41.8 (May)	34.4
Mean daily minimum temperature (°C)		11.7 (Jan) – 27.0 (Jun)	20.5
Relative humidity (%)	0830	46 (Mar) – 88 (Aug)	64
	1730	18 (Mar) – 70 (Aug)	38
Total rainfall (mm)		0.9 (Apr) – 265.3 (July)	803.4
Wind speed (km/h)		4.3 (Oct) – 10.1 (June)	6.7
Idar			
Mean daily maximum temperature (°C)		27.5 (Jan) – 40.5 (May)	33.4
Mean daily minimum temperature (°C)		14.5 (Jan) – 25.5 (Jun)	21.0
Relative humidity (%)	0830	34 (Mar) – 90 (Aug)	55
	1730	15 (Apr) – 72 (Aug)	36
Total rainfall (mm)		0.9 (Feb) – 308.7 (Jul)	847.7
Wind speed (km/h)		4.9 (Oct) – 10.3 (June)	7.0
Radhanpur			
Mean daily maximum temperature (°C)		27.2 (Jan) – 41.6 (May)	34.4
Mean daily minimum temperature (°C)		10.0 (Jan) – 26.6 (Jun)	19.5
Relative humidity (%)	0830	58 (Mar) – 86 (Aug)	69
	1730	28 (Mar) – 65 (Aug)	42
Total rainfall (mm)		0.1 (Apr) – 152.0 (Jul)	418.9
Wind speed (km/h)		5.0 (Oct) – 15.3 (June)	8.5
Deesa			
Mean daily maximum temperature (°C)		27.3 (Jan) – 41.0 (May)	34.1
Mean daily minimum temperature (°C)		9.8 (Jan) – 26.7 (Jun)	19.4
Relative humidity (%)	0830	48 (Mar) – 87 (Aug)	64
	1730	20 (Apr) – 67 (Aug)	36
Total rainfall (mm)		0.1 (Apr) – 215.7 (Jul)	578.8
Wind speed (km/h)		5.8 (Oct) – 14.3 (June)	8.5

Note: Based on Records of IMD, 1951-80

Along the project corridor, January is coldest month with the mean daily minimum temperature of 9.8-14.5°C and maximum of 27.2-30.3°C. March onwards the temperature

begins to rise rapidly and May and June are the hottest months. Thereafter, the advent of monsoon brings down the temperature. Monsoon withdraws in October but the temperature continues to fall gradually up to January in the middle of winter.

The air along the project corridor is humid through the major part of the year and the mean relative humidity rises to above 75% during the monsoon months, particularly July to September. The highest mean relative humidity is recorded in August (86-90% in the morning and 65-74% in the evening), a wet monsoon month and the lowest mean relative humidity is recorded in March (34-58% in the morning and 15-28% in the evening). As usual, the humidity in the morning (0830 IST) is more than that in the evening (1730 IST) during all the months. The total annual rainfall received along the project corridor is about 418.9-922.7 mm. The annual mean wind speed along the project corridor is around 5.5-8.5 km/h.

Gujarat is a forest poor state but rich in biodiversity. Forest constitutes only 9.6% of the total geographical area of the state, which is much less than the national average of 23.4%. Forests in Gujarat are mainly found in southern and eastern belts of the state. In southern Gujarat, there are some areas having moist deciduous forests, whereas the rest of the areas of the state have dry deciduous and dry scrub forests. The forests are highly fragmented, scarred with interspersed habitation and cultivation. In Gujarat, there are a lot of wetlands and natural lakes. A study conducted by Space Applications Centre (SAC), Ahmedabad in 1998 estimated wetlands area in the country about 75,819 km^2, out of which Gujarat's contribution is about 27,175 km^2 (36%).

Gujarat has divergent climatic and geomorphological conditions and because of its uniqueness, the state can further be divided into six distinctly identifiable regions; i) South Gujarat, ii) Central Gujarat Plateau, iii) Aravallis and adjoining track, iv) Kathiavad Peninsula, v) Kutch peninsula with the Rann and vi) Coastal Track.

The DFC alignment is mainly passing through Central Gujarat and the area in the Aravalli and adjoining track. In Central Gujarat, there is no natural forest and the area is dominated by agricultural land. Vishwamitri, Mahi, Watrak (Vatrak) and Sabarmati Rivers are flowing through this region. Paddy fields ponds and lakes in the central region constituted a very good habitat for birds. This area is also important for breeding of resident birds including sarus crane and other waterfowl. Nalsarovar and Thol Lake Bird Sanctuaries are located in this part of the state, which are prime wintering grounds for migratory birds. Aravalli and the adjoining track is the barrier against progressing desert. This part has dry deciduous and thorn forests, which have moderating effect on climate of northern Gujarat. Banas and Sabarmati Rivers, flowing from this area, irrigate fields of the northern Gujarat. The ecosystem types of the districts through which the DFC alignment is passing in Gujarat is summarized below.

Table 2-3 Ecosystem type at Gujarat

District/ Area	Ecosystem type
Banaskantha	Dry teak, dry deciduous mixed, *Boswellia* forests, riverine forests, *Anogeissus* forests, *Butea* forests, dry bamboo brakes, dry deciduous scrub, *Aegle* forests, *Zizyphus* scrub, Khair (*Accacia catechu*) forests, *Butea monosperma* forests, rocky hills and seasonal rivers
Mahesana, Patan, Gandhinagar, Ahmedabad and part of Banaskantha	Agriculture lands (dominant), wasteland, wetlands (ponds, and lakes), dry rivers, ravine forests, rocky hills
Kheda, Anand and plains in Vadodara	Wetlands (lakes and ponds), dry deciduous scrub, *Acacia nilotica* forests, seasonal perennial rivers, paddy fields, canal system and agricultural lands (dominant)

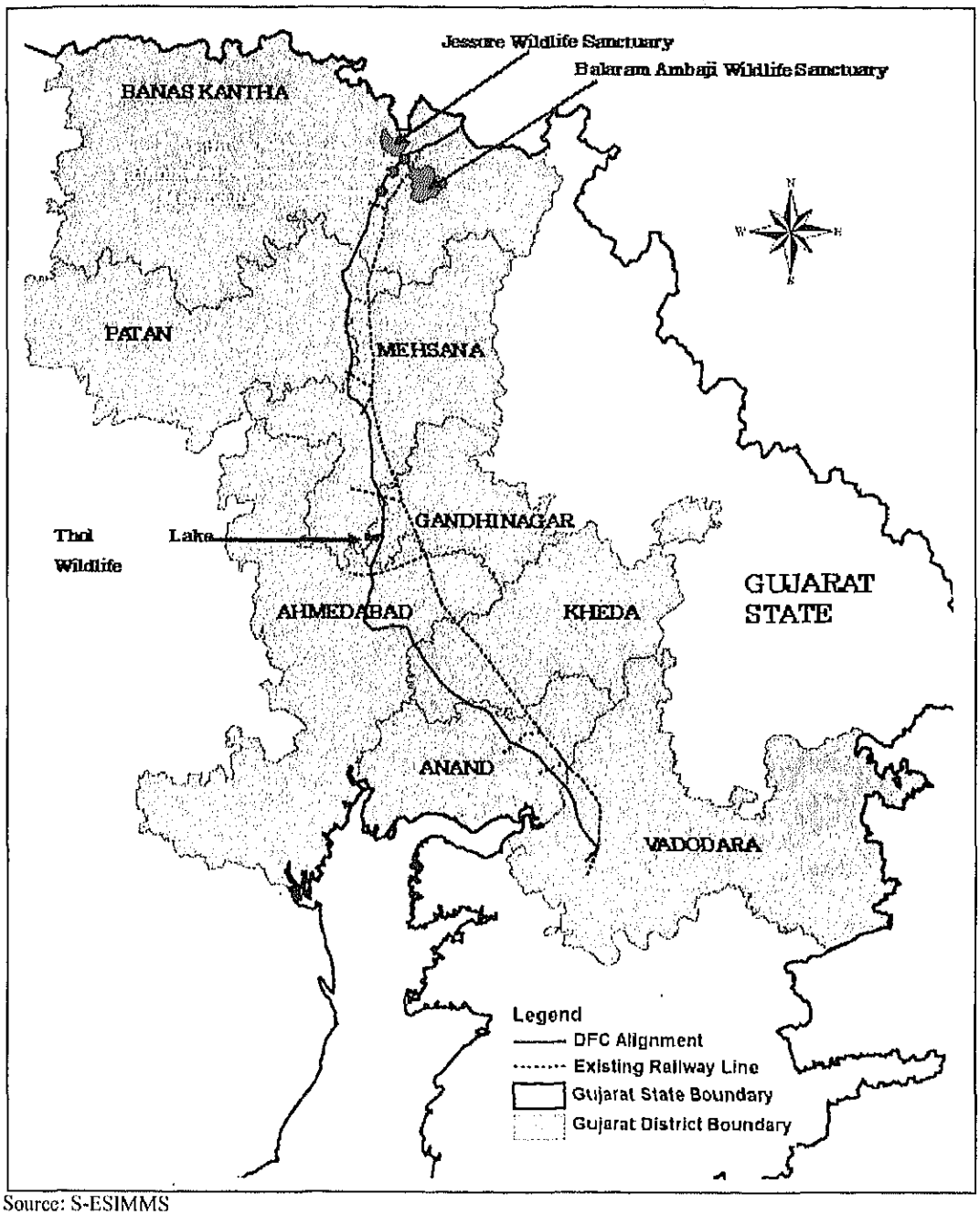
Source: GEER Foundation, 2001

The DFC alignment will cross several rivers and canals in Gujarat, out of which Mahi, Sabarmati, Vishwamitri, Mini and Vatrak Rivers are the important rivers where faunal diversity was identified during ESIMMS study in the year 2007. Supplementary study has been conducted to assess the potential impacts on the habitat of wildlife due to construction of bridge over two major rivers along the DFC alignment.

The entire stretch of DFC in Gujarat is detour except few portions (from Iqbalgarh to Maval) and the alignment is mainly passing through agricultural land. There is no plantation raised by the Forest Department along the detour alignment except private trees. The major tree species exist along the DFC alignment are Arjun (*Terminalia arjuna*), Bilayti Babul (*Prosopis juliflora*), Deshi baval (*Acacia nilotica*), Izarail baval (*Acacia tortlis*), Jambu (*Syzygium cumini*), Khair (*Acacia catechu*), Limdo/Neem (*Azadirachta indica*), Mahuda (*Madhuca indica*), Nilgiri (*Eucalyptus sp*), Sag (*Tectona grandis*), Sisham (*Dalbergia sisoo*). The DFC alignment crosses two Reserved Forest namely Jethi RF and Malana RF and one Un-classed Forest i.e. Bantawada in Banaskantha District of Gujarat.

In Gujarat, there are three protected areas which are located close to the DFC alignment. These are Balaram Ambaji Wildlife Sanctuary, Jessore Wildlife Sanctuary and Thol Lake Wildlife (Bird) Sanctuary. Balaram Ambaji and Jessore Wildlife Sanctuaries are in Banaskantha District of Gujarat where as Thol Lake Wildlife (Bird) Sanctuary is in Mahesana District. Balaram Ambaji Wildlife Sanctuary is located on the Easterrn side of DFC alignment and the distance between DFC alignment and the Sanctuary is varying from 1.2 to 3.1 km. Jessore Wildlife Sanctuary is located in Westernside of the alignment and the distance between DFC alignment and the Sanctuary is varying from 1.2 km to 2.9 km. Thol Sanctuary is located in the Western side of DFC alignment and the distance between Thol Sanctuary and DFC alignment is varying from 0.9 km to 1.5 km. Location of forests, protected areas along the DFC alignment in Gujarat is shown in Figure 2-1.

The natural environmental study in the S-ESIMMS mainly focussed on the directly affected natural environment, namely, the forest areas located along the alignment and also the wildlife sanctuaries in the vicinity of the alignment though it's course is at a relatively safe distance from the sanctuaries, on the assumption that some movement of the animals occur from and to the sanctuaries.



Source: S-ESIMMS

Figure 2-1 Location of Forests and Protected Areas along the DFC Alignment in Gujarat

2.1.2 Flora

(1) Study Methodology

The objectives of the survey are to verify impacts on the flora by the development of the Dedicated Freight Corridor and the relevant facilities by collecting supplementary secondary data and conducting the supplemental field surveys.

- To identify the species of flora along the final alignment and the boundaries of the relevant facilities, location of Reserved Forest/ Protected Forest/ Un-classed Forest along the final alignment, reconnaissance survey was conducted in association with Range Officer/Forest Guards of the State Forest Department. The exact location of forest along the final alignment was confirmed through interview of forest officials.

  - To identify the directly affected trees by the railway construction, visual counting method (walk through the proposed alignment) has been adopted to count the number of trees to be felled for construction of DFC. Trees has more than 30 cm girth size (diameter) and 1.5 m of height exist within the proposed ROW (70 m) were counted. The survey was carried out from 25th August to 25th September, 2008.
  - Supplemental secondary data like district wise Working Plan of the Forest Division, Management Plan of Wildlife Sanctuary, literature etc. were collected to verify the survey results and to gather information about the seasonal changes along the track.
  - To characterize the vegetation of Wildlife Sanctuary/Reserved Forest area, standard quadrate method and random sampling approach has been adopted to update the ESIMMS study. The quadrate technique is easy to use in communities with a profile low enough that a frame can be placed over the area to be sampled and also appropriate for forest communities that are open enough to allow plot boundaries to be marked easily and accurately with a tape measure. Quadrate survey and random sampling were conducted in those places where no data was collected during the ESIMMS. The detailed methodology is given below:

In summarizing quadrate data, density, dominance, and frequency values weree determined for each species.

Frequency refers how widely species is distributed among the same plot. This is indicative of the dispersion of a particular species in a community.

Density refers to the number of individuals of a particular species in a unit area. This is the primary character of a community.

Dominance refers which species is largest in terms of its presence. This is a measure of the relative importance of a species in the particular community.

For a particular species, these values may be expressed as ***relative frequency, relative density*** and ***relative dominance,*** which show the percentage of the individual species' value with respect to the total for all species. Relative values for frequency, density and dominance can be combined into a single ***importance value index,*** which combines these three somewhat different measures of the importance of the species in the community. These values are calculated by the following equations:

Quadrate Size = 10 m x 10 m = 100 m^2 **Scale** = Per m^2.

Frequency (F) = $\frac{\text{Total no. of quadrates in which the species occur X 100}}{\text{Total No of quadrate studied}}$

Relative Frequency of a species (RF) = $\frac{\text{Frequency of the species in stand x 100}}{\text{Sum of the frequencies for all species in stand}}$

Density of a species per unit area (D) = $\frac{\text{Total No of individuals of species in all the sample plot}}{\text{Total No of sample plots studied}}$

Relative density of a species (RD) = $\frac{\text{Total no of individuals of a species x 100}}{\text{Total No of individual of all species}}$

Abundance of a species (AB) = $\frac{\text{Total no of individuals of the species in all Quadrates}}{\text{Total No of Quadrates in which the species occured}}$

Relative Dominance of the species (RDO) = $\frac{\text{Total Basal area of a species in all the quadrates x 100}}{\text{Total Basal area of all the species in all the quadrates}}$

Index of Similarity = $\frac{\text{2 x No. of common species x 100}}{\text{Total number of species in both associations}}$

Importance value Index = Relative Frequency + Relative Density + Relative Dominance

(2) Major Findings

1) Vegetation along the DFC

The DFC alignment starts near Makarpura Railway Station in Vadodara District of Gujarat as detour alignment on the western side of the existing track. The detour alignment passes through Vadodara, Anand, Kheda, Ahmedabad, Gandhinagar, Mahesana, Patan and Banaskantha Districts of Gujarat and crosses the existing Mumbai-Delhi Railway track at about 1 km north of Iqbalgarh Railway Station (located at north of Palanpur). Thereafter, the alignment becomes parallel to the existing track on the eastern side before entering Rajasthan.

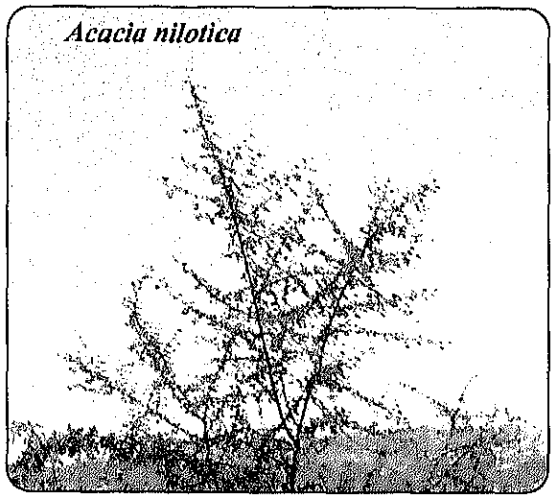
The entire stretch of DFC in Gujarat is detour except few portions (from Iqbalgarh to Maval) and the alignment is mainly passing through agricultural land. In Gujarat, there is no plantation raised by the Forest Department along the detour alignment except private trees. The major tree species, shrubs and grasses exist within the proposed ROW of DFC alignment in Gujarat are listed in Table 2-4.

Table 2-4 List of Trees Species in the Proposed ROW in Gujarat

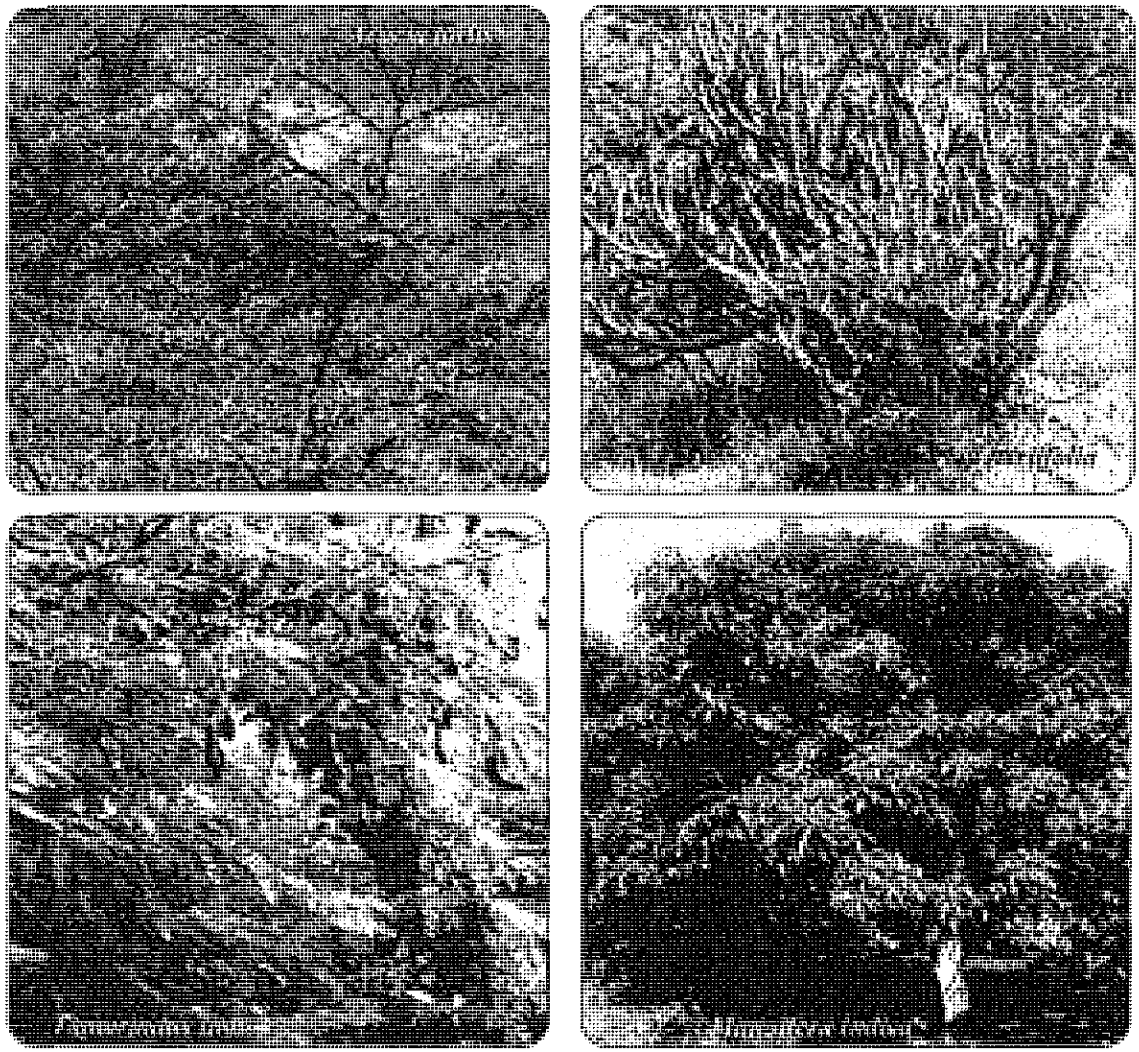
Sl. No.	Local Name	Scientific Name
1	Ain	*Terminalia alata*
2	Amla	*Emblica officinalis*
3	Ambo	*Mangifera indica*
4	Amli / Ambli	*Tamarindus indica*
5	Arjun	*Terminalia arjuna*
6	Bilayti Babul	*Prosopis juliflora*
7	Ber	*Zizyphus mauritiana*
8	Deshi baval	*Acacia nilotica*
9	Dholo Sirisi	*Albizia odoratissima*
10	Dudhi	*Wrightia tinctoria*
11	Gando Baval	*Prosopis chilensis*
12	Goras amli	*Pithecellobium dulce*
13	Izarail baval	*Acacia tortlis*

Sl. No.	Local Name	Scientific Name
14	Jambu	*Syzygium cumini*
15	Jhariber	*Ziziphus nummularia*
16	Kaju	*Anacardium occidentale*
17	Kanaji	*Holoptelea integrifolia*
18	Karanj	*Derris indica*
19	Khair	*Acacia catechu*
20	Khijado	*Prosopis cineraria*
21	Limbu	*Citrus limon*
22	Limdo/ Neem	*Azadirachta indica*
23	Mahuda	*Madhuca indica*
24	Moyna	*Lannea grandis*
25	Nilgiri	*Eucalyptus sp*
26	Pipal	*Ficus religiosa*
27	Rayan	*Manilkara hexandra*
28	Sag	*Tectona grandis*
29	Shiras	*Albizia lebbeck*
30	Sisham	*Dalbergia sisoo*
31	Timru	*Diospyros melanoxylon*
32	Umberdo	*Ficus racemosa*
33	Vad	*Ficus benghalensis*

Source: Field Survey with Forest Officials in S-ESIMMS



Source: Field Survey during September 2008 in S-ESIMMS



Source: Field Survey during September 2008 in S-ESIMMS

Table 2-5 List of Shrubs Species in the Proposed ROW in Gujarat

Sl. No.	Local Name	Scientific Name
1	Adusa/ Ardusi	*Adhatoda vasica*
2	Ankol	*Alangium salvifolium*
3	Aval	*Cassia auriculata*
4	Dano	*Lantana camara*
5	Dhatura	*Datura inoxia*
6	Ghatbor	*Zizyphus xylopyrus*
7	Gurab	*Helectaris isora*
8	Kalikanthar	*Capparis sepiaria*
9	Kanthar	*Capparis sepiaria*
10	Moto Ankado	*Calotropis gigantia*
11	Nagod	*Vitex negundo*
12	Parijat	*Nytanthus arbortristis*
13	Ratanjot	*Jatropha curcas*
14	Tal Baval	*Acacia farnesiana*
15	Thor	*Euphorbia neriifolia*
16	Zil	*Indigofera oblongifolia*

Source: Field Survey with Forest Officials in S-ESIMMS

Table 2-6 List of Grass Species found within the Proposed ROW in Gujarat

Sl. No.	Local Name	Scientific Name	Family
1	Baru	*Sorghum halepense*	Gramineae
2	Bhathdu	*Themada triandra*	Gramineae
3	Bhatadi	*Themada quardrivalvis*	Gramineae
4	Daro or Dub	*Cynodon dactylon*	Gramineae
5	Dhaman	*Cenchrus ciliaris*	Gramineae
6	Dhudu or Dhundu	*Arundinella pumila*	Gramineae
7	Gandharu	*Cymbopogon jwarancusa*	Gramineae
8	Jinjavo	*Dichanthium annulatum*	Gramineae
9	Kakudu, Katusla	*Saccharum spontaneum*	Gramineae
10	Khariu	*Dinebra retroflexa*	Gramineae
11	Katas bamboo	*Bambusa arundinacea*	Gramineae
12	Lapdu	*Aristida adscensionis*	Gramineae
13	Mosi	*Lseilema laxum*	Gramineae
14	Pusha	*Cymbopogon citrates*	Gramineae
15	Bhatdu	*Themeda cymbaria*	Gramineae
16	Rosha	*Cymbopogon martini*	Gramineae
17	Shukli	*Heteropogon contortus*	Gramineae
18	Zinzvo	*Dichanthium annulatum*	Gramineae

Source: Working Plan of Forest Division and field verification

Tree counting within the proposed ROW (70 m) has been conducted to assess the extent of trees to be cut down. District wise list of existing tree to be felled for construction of DFC in Gujarat is given in Table 2-7. In Gujarat, about 6,938 numbers of trees exist within the proposed ROW, out of which 5,612 no. of trees are in private land and 1,326 no. of trees are in forest land (556 no. of trees in Malana RF and 770 no. of trees in Bantawada Un-classed Forest). The predominant tree species include *Mangifera indica, Ziziphus mauritiana, Eucalyptus sp, Dalbergia sisoo, Ficus benghalensis, Madhuca indica, Syzygium cumini, Acacia tortlis, Acacia nilotica, Acacia catechu*, etc.

Table 2-7 District-wise Approximate Number of Trees to be felled in Gujarat

District	Village Name	No. of trees	Major Species
Vadodara	Itola to Shamiyala	275	*Azadirachta indica , Terminalia arjuna, Acacia catechu, Mangifera indica,*
	Shamiyala to Kotna	315	*Eucalyptus sp, Ficus benghalensis, Acacia nilotica, Acacia catechu, Tectona grandis, Emblica officinalis*
	Sub-total	590	
Anand	Kotna to Laxmi Pura	136	*Azadirachta indica , Terminalia alata, Tectona grandis, Derris indica, Ficus religiosa,*
	Laxmi Pura to Gana	265	*Mangifera indica, Ziziphus mauritiana, Eucalyptus sp, Dalbergia sisoo, , Ficus benghalensis, Madhuca indica, Syzyghum cumini*
	Gana to Vishnoli	155	*Terminalia arjuna, Acacia tortlis, Acacia nilotica, Acacia catechu, Mangifera indica*
	Vishnoli to Changa	120	*Azadirachta indica , Mangifera indica, Terminalia alata, Ficus religiosa*
	Changa to Deva Vanta	138	*Eucalyptus sp, Acacia tortlis, Acacia nilotica, Acacia catechu, Madhuca indica, Syzygium cumini*
	Sub-total	814	
Kheda	Deva Vanta to Traj	189	*Dalbergia sisoo , Mangifera indica, Tectona grandis, Derris indica, Ficus religiosa, Acacia nilotica, Acacia catechu*
	Traj to Vasna Bujarg	150	*Azadirachta indica , Terminalia arjuna,*

District	Village Name	No. of trees	Major Species
			Acacia nilotica, Acacia catechu, Terminalia alata,
	Vasna Bujarg to Chalindra	115	*Mangifera indica, Acacia catechu, Ziziphus mauritiana, Azadirachta indica, Syzygium cumini*
	Chalindra to Adasar	99	*Terminalia arjuna, Acacia nilotica, Acacia catechu, Tectona grandis, Citrus limon, Ficus religiosa*
	Sub-total	553	
Ahmedabad	Adasar to Miroli	105	*Azadirachta indica , Terminalia alata, Terminalia arjuna, Dalbergia sisoo*
	Miroli to Kavitha	86	*Eucalyptus sp, Acacia tortlis, Acacia nilotica, Acacia catechu,*
	Kavitha to Sanand	345	*Azadirachta indica , Mangifera indica, Tectona grandis, Derris indica, Ficus religiosa, Madhuca indica,*
	Sanand to Garodiya	108	*Eucalyptus sp, Acacia tortlis, Acacia nilotica, Acacia catechu, Azadirachta indica*
	Sub-total	644	
Gandhinagar	Garodiya to Dabla	129	*Acacia tortlis, Acacia nilotica, Acacia catechu, Ziziphus mauritiana, Tectona grandis, Ficus benghalensis*
	Dabla to Khatraj	135	*Azadirachta indica , Mangifera indica, Terminalia arjuna,*
	Khatraj to Ramnagar	98	*Tectona grandis, Acacia catechu, Ziziphus mauritiana,*
	Ramnagar to Dhanot	146	*Azadirachta indica , Acacia tortlis, Acacia nilotica, Acacia catechu, Terminalia arjuna,*
	Sub-total	508	
Mahesana	Dhanot to Rajpur	110	*Dalbergia sisoo, Acacia nilotica, Acacia catechu, Mangifera indica,*
	Rajpur to Ganesgpura	169	*Azadirachta indica , Eucalyptus sp, Acacia catechu, Ziziphus mauritiana,*
	Ganesgpura to Linch	150	*Terminalia alata, Acacia nilotica, Acacia catechu, Ziziphus mauritiana,*
	Linch to Gilosan	198	*Acacia tortlis, Eucalyptus sp, Tectona grandis, Emblica officinalis, Syzygium cumini*
	Gilosan to Veerta	205	*Dalbergia sisoo. Acacia catechu, Mangifera indica, Derris indica, Dalbergia sisoo*
	Veerta to Lindi	393	*Azadirachta indica , Eucalyptus sp, Acacia catechu, Ficus religiosa, Mangifera indica, Ziziphus mauritiana, Dalbergia sisoo, , Ficus benghalensis, Madhuca indica, Syzygium cumini*
	Sub-total	1,225	
Patan	Lindi to Dhelol	395	*Terminalia arjuna , Acacia nilotica, Acacia catechu, Ziziphus mauritiana,*
Banas Kantha	Dhelol to Changa	75	*Terminalia arjuna, Acacia catechu, Mangifera indica, Terminalia alata, Derris indica*
	Changa to Chodotar	173	*Acacia tortlis, Acacia nilotica, Acacia catechu, Tectona grandis, Mangifera indica, Terminalia alata, Derris indica*
	Chodotar to Antroli	166	*Acacia tortlis, Acacia nilotica, Acacia catechu, Ziziphus mauritiana, Ficus religiosa*
	Antroli to Bantwada	835	*Acacia tortlis, Acacia nilotica, Acacia catechu, Ziziphus mauritiana, Ziziphus nummularia*
	Bantwada to Iqbalgarh	700	*Acacia tortlis, Acacia nilotica, Acacia catechu, Ziziphus mauritiana, Ziziphus nummularia*
	Iqbalgarh to awal Gomti	260	*Acacia tortlis, Acacia nilotica, Acacia*

District	Village Name	No. of trees	Major Species
			catechu, Ziziphus mauritiana, Ziziphus nummularia, Dalbergia sisoo
	Sub-total	2,209	
Total		6,938	

Source: Field Survey during September 2008 in S-ESIMMS

Scheduled Trees: Six tree species have been notified as Scheduled trees by the Government of Gujarat under Saurashtra Felling of Trees (Infliction of Punishment) Act, 1951. List of Scheduled Trees are listed in Table 2-8.

Table 2-8 List of Scheduled Trees in Gujarat

Sl. No.	Local Name	Scientific Name
1	Ambo	*Mangifera indica*
2	Amli / Ambli	*Tamarindus indica*
3	Deshi baval	*Acacia nilotica*
4	Limdo/ Neem	*Azadirachta indica*
5	Khijado	*Prosopis cineraria*
6	Kanaji	*Holoptelea integrifolia*

Source: Gujarat Forest Department

Flora in Agricultural Land: The agricultural land along the DFC alignment cultivates paddy, wheat, tobacco, cotton and pulses predominantly. List of major crops grown is provided in Table 2-9.

Table 2-9 List of Major Crops Grown in Gujarat within the Proposed ROW

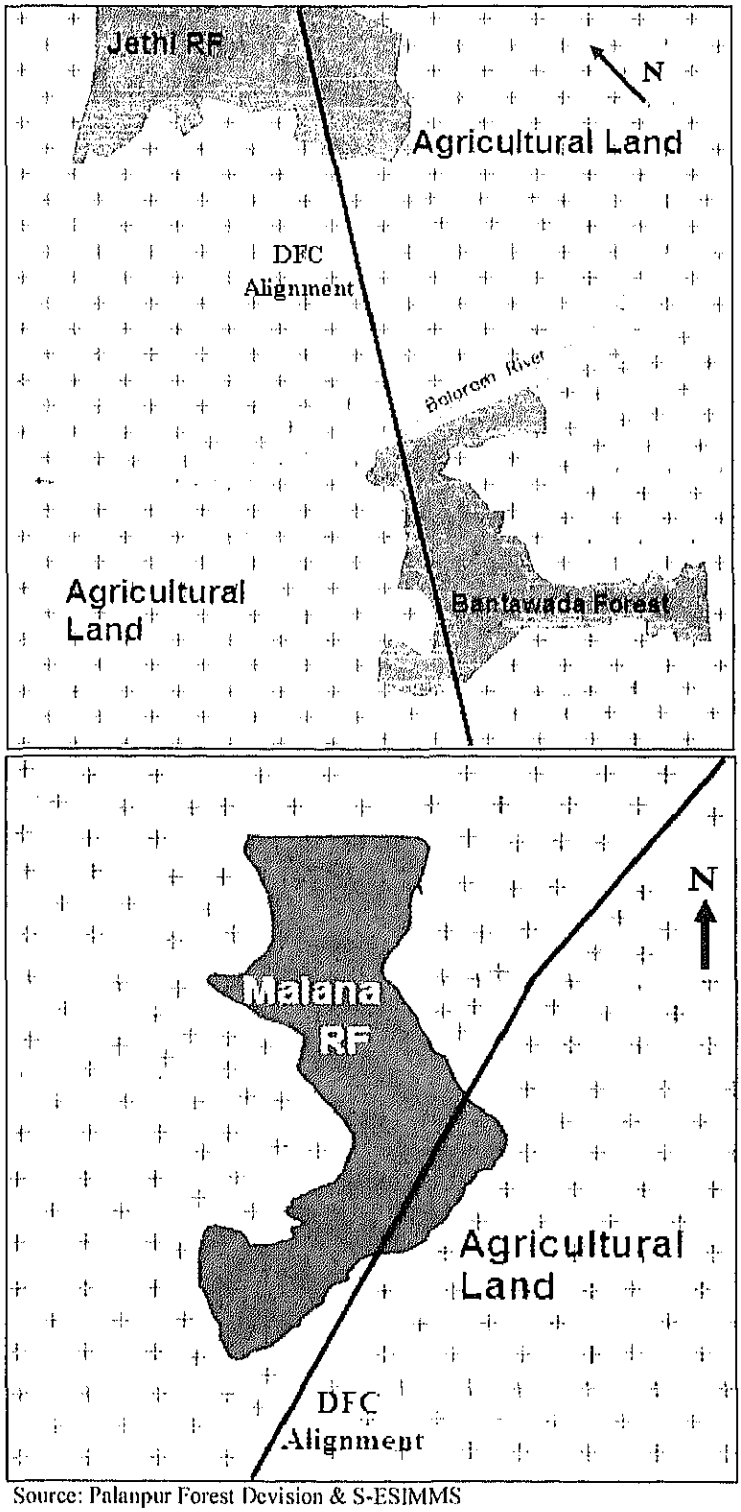
Name of the Crop	Scientific Name	Remarks
Wheat	*Triticum vulgare*	Rabi crop
Jowar	*Andropogau sorghum*	Rabi crop
Cotton	*Gossypium herbaccum*	
Paddy	*Oryza sativa*	Kharif crop
Bajri	*Pennisetum typhoidem*	Kharif crop
Isabgul	*Plantago ovata*	Kharif crop
Maize	*Zea mays*	Kharif crop
Tobacco	*Nicotiana tobacum*	Kharif crop
Pulses		
Tur	*Cajanus indicus*	Kharif crop
Gram	*Cicer arietinum*	Kharif crop
Mag	*Phaseolus radiatus*	Kharif crop
Math	*Phaseolus acontifolius*	Kharif crop
Udid	*Phaseolus mungo*	Kharif crop
Val	*Lablab niger*	Kharif crop

Source: Field Survey during August and September 2008 in S-ESIMMS

Source: Field Survey during September 2008 in S-ESIMMS

2) Forest Area

DFC alignment crosses two Reserved Forest namely Jethi RF and Malana RF and one Un-classed Forest i.e. Bantawada in Banaskantha District of Gujarat. Location of forest along DFC alignment is shown in Figure 2-2. Details of the forest, impacted area, floral diversity and land use of the surrounding area are discussed below.

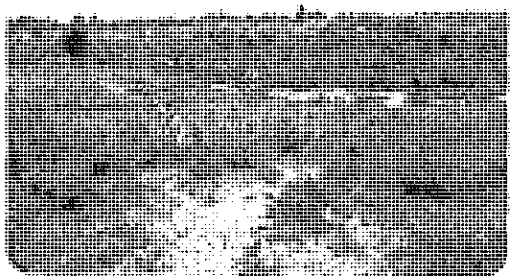


Source: Palanpur Forest Devision & S-ESIMMS

Figure 2-2 Location of Forests along DFC Alignment in Gujarat

a) Jethi Reserved Forest

Date of Survey	1st September 2008
Time	11-00 a.m. to 02-00 p.m.
Location	Jethi RF is located on the western side of Karja Village of Amirgadh sub-district and in-between Balaram-Ambaji and Jessore WLS;
District	Banaskantha
Total Area	726.5 ha
Length of DFC inside the RF	1.6 km
Forest land to be acquired	11.1 ha
Latitude and Longitude of start point (from Vadodara side)	N 24° 19' 20.98" ,E 72° 28' 47.45"
Latitude and Longitude of end point (from Vadodara side)	N 24° 19' 57.13" ,E 72° 29' 24.33"
Land use of the surrounding area	Banas River is located on the northern side of the RF while Karja Village is located on the eastern side, remaining area of the forest is surrounded by agricultural land.



Source: Field Survey during September 2008 in S-ESIMMS

View of the Jethi RF from where DFC Alignment will Passes

Floral Diversity

A site visit of the Jethi Reserved Forest area was conducted to assess the potential impact of the proposed development on the Reserved Forest. In the Jethi RF, from where the proposed DFC alignment is passing, there are no tree species found except shrubs. It has been reported by the forest department that there are no rare or endangered tree species in Jethi RF. The forest of Jethi is more or less stunted and natural regeneration is nil. The shrubs species identified during the survey and reported by the forest officials are presented in Table 2-10.

Table 2-10 List of Shrubs Species found in Jethi RF

Sl. No.	Local Name	Scientific Name
1	Aval	*Cassia auriculata*
2	Dano	*Lantana camara*
3	Dhatura	*Datura inoxia*
4	Gundi	*Cordia dichotoma*
5	Gurab	*Helectaris isora*
6	Kanthar	*Capparis sepiaria*
7	Parijat	*Nytanthus arbortristis*
8	Ratanjot	*Jatropha curcas*
9	Tal Baval	*Acacia farnesiana*
10	Thor	*Euphorbia neriifolia*
11	Zil	*Indigofera oblongifolia*

Source: Field Survey during September 2008 in S-ESIMMS

Source: Field Survey during September 2008 in S-ESIMMS

Field Survey at Jethi Reserved Forest

b) Bantawada Forest (Un-classed)

Date of Survey	3rd September 2008
Time	11-00 a.m. to 03-30 p.m.
Location	Bantawada forest is located on the south bank of Balaram River nd in-between Balaram-Ambaji and Jessore WLS
District	Banaskantha
Total Area	53.5 ha
Length of DFC inside the forest	1.1 km
Forest land to be acquired	7.5 ha
Latitude and Longitude of start point (from Vadodara side)	N 24° 18' 26.82" E 72° 27' 52.88"
Latitude and Longitude of end point (from Vadodara side)	N 24° 18' 52.68" E 72° 28' 18.64"
Land use of the surrounding area	Balaram River is located on the north-eastern side of the forest and remaining area of the forest is surrounded by agricultural land.

View of Bantawada Forest

View of Agricultural Field beside Bantawada Forest

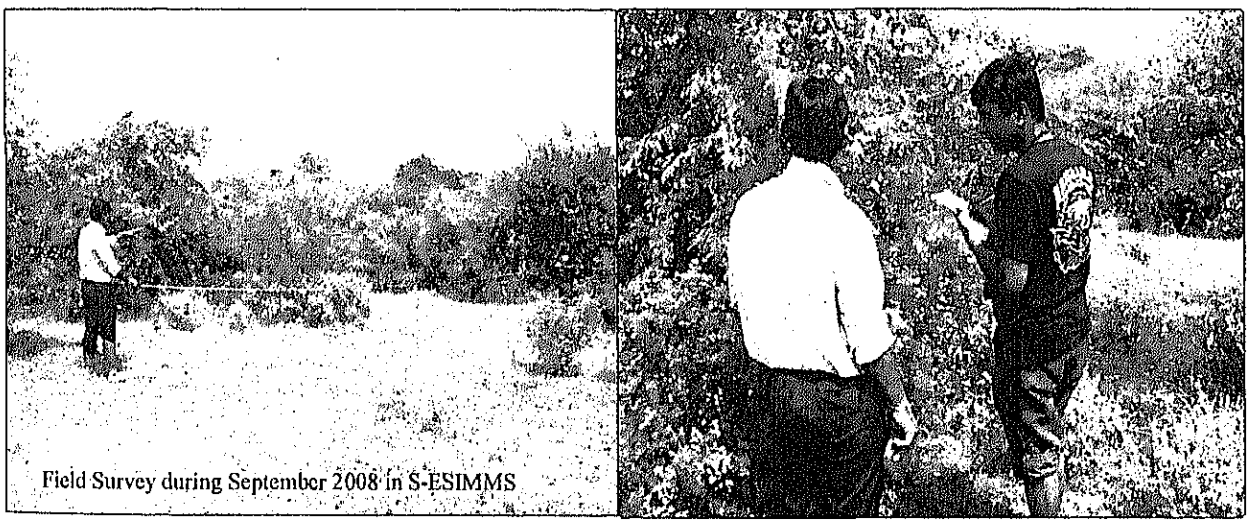
Floral Diversity: A site visit of the Bantawada Forest area was conducted to assess the potential impact of the proposed development on the Forest. Tree species found in Bantawada, from where the proposed DFC alignment is passing, are mainly Izarail baval (*Acacia tortlis)*, Deshi baval (*Acacia nilotica*), Khair (*Acacia catechu*), Ber (Ziziphus mauritiana) and Jhariber (*Ziziphus nummularia*) and shrubs like Aval (*Cassia auriculata*), Thor (*Euphorbia neriifolia*), Dhatura (*Datura inoxia*) etc.

In Bantawada forest, quadrate survey was carried out in 3rd September 2008 at 30 m x 30 m plots in twenty sampling locations. Girth size of the species in all sample plots were varied between 20 cm to 90 cm and height varied between 3 m and 9.5 m. Five types of species were observed during the survey, out of which deshi baval was the predominant species. Species wise total number of trees in different sample plots is presented in Table 2-11 and data collected during the survey is given in **Table-A.3.1.1** of **Annex-3.1**. Species wise frequency, relative frequency, density, relative density, abundance, relative abundance and Important Value Index are presented in Table 2-12.

Table 2-11 Species-wise Total Number of Trees in Different Sample Plots

Sample Plot No.	Tree Species					Grand Total
	Israili Baval	Deshi Baval	Khair	Ber	Jhariber	
1	4	3		1		8
2		8	1			9
3	1	5	2		3	11
4	4	5	1	3	1	14
5		2	1		4	7
6	7		2		1	10
7			6	1	2	9
8		5	2			7
9		2		5		7
10	1	8			2	11
11	4	1	3	1		9
12		5		2		7
13	1	3	2		1	7
14				6	3	9
15	6		1			7
16			3	8		11
17		5	2	3		10
18	5	2	2			9
19	4				7	11
20	2	3		2	5	12
Total	39	57	28	32	29	185
%	21	31	15	17	16	100

Source: Field Survey during September 2008



Field Survey at Bantawada Forest

Table 2-12 Results of Transect Analysis

Species (SP)	Frequency (%) (F)	Relative frequency (RF)	Density (D)	Relative Density (RD)	Abundance (AB)	Relative Dominance (RDO)	Importance Value Index
Israili baval	55	18.97	1.95	21.08	3.55	21.44	61.49
Deshi baval	70	24.14	2.85	30.81	4.07	34.60	89.55
Khair	65	22.41	1.4	15.14	2.15	20.67	55.21
Ber	50	17.24	1.6	17.30	3.2	12.88	50.43
Jhar Ber	50	17.24	1.45	15.68	2.9	10.38	43.3

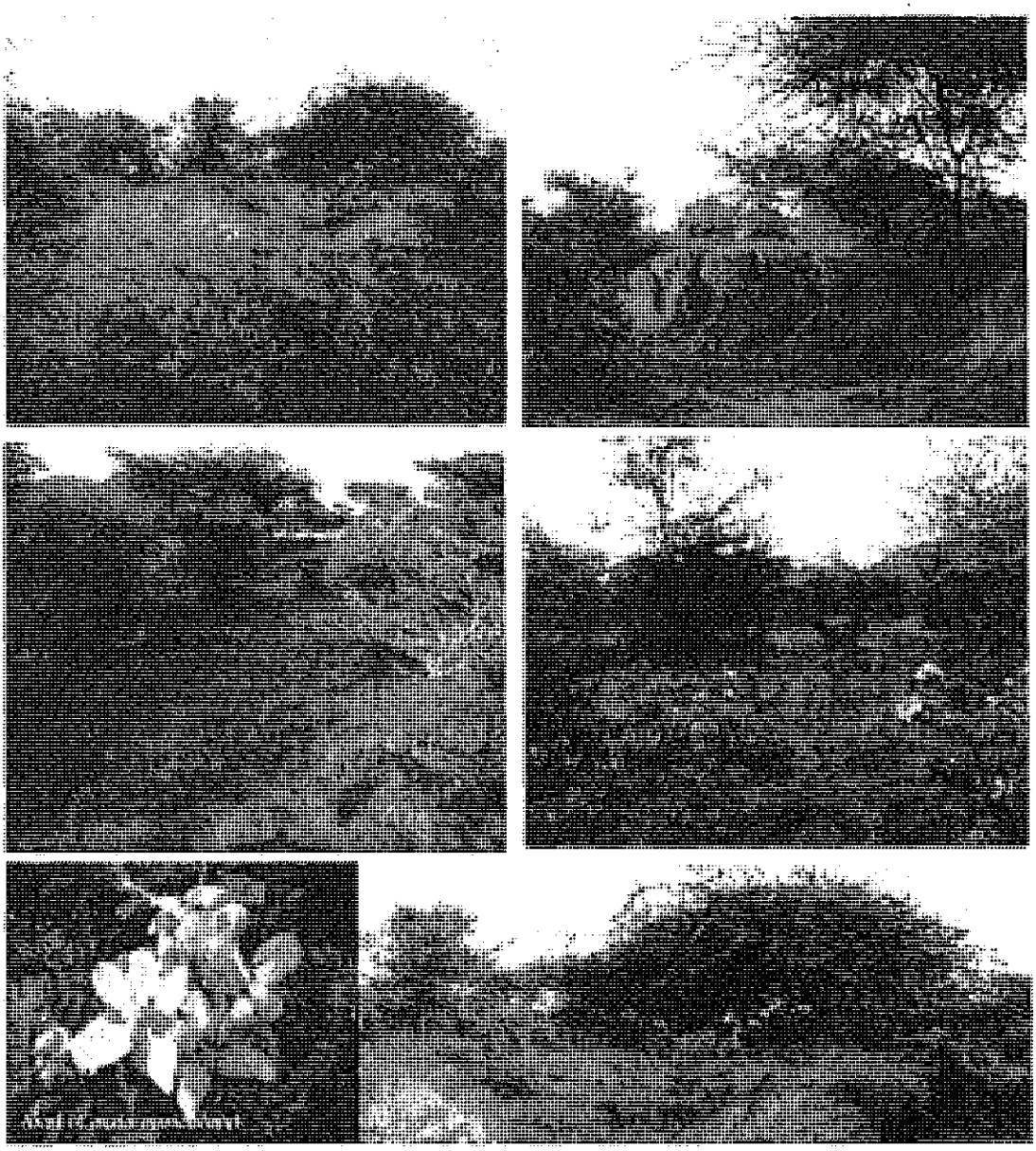
Total surveyed area = {20 x (30 x 30)} = 18,000 m^2 = 1.8 ha
Total area of forest land to be diverted = 7.5 ha
Therefore, approximate number of trees to be felled = 770

c) Malana Reserved Forest

Date of Survey	4th September 2008
Time	10-30 a.m. to 03-30 p.m.
Location	Malana Reserved Forest is located approximately 5.5 km south-west of Bantawada forest and 2 km north-west of Malana Village.
District	Banaskantha
Total Area	278.7 ha
Length of DFC inside the RF	0.4 km
Forest land to be acquired	2.7 ha
Latitude and Longitude of start point (from Vadodara side)	N 24° 15' 59.10" E 72° 25' 37.85"
Latitude and Longitude of end point (from Vadodara side)	N 24° 16' .10.70" E 72° 25' 43.65"
Land use of the surrounding area	Malana reserved forest is surrounded by agricultural land and open scrub.

Floral Diversity: A site visit of the Malana Reserved Forest area was conducted to assess the potential impact of the proposed development on the Reserved Forest. Tree species found in Malana, from where the proposed DFC alignment is passing, are mainly Izarail baval (*Acacia tortlis),* Deshi baval (*Acacia nilotica*), Khair (*Acacia catechu*) and Bilayti Baval (*Prosopis juliflora*) and shrubs like Aval (*Cassia auriculata*), Thor (*Euphorbia neriifolia*), Dhatura (*Datura inoxia*) etc.

In Malana RF, quadrate survey was carried out in 4th September 2008 at 30m x 30m plots in fifteen sampling locations. Girth size of the species in all sample plots were varied between 30 cm to 90 cm and height varied between 2 m to 10 m. Five types of species were observed during the survey, out of which bilayti baval was the predominant species. Species wise total number of trees in different sample plots is presented in Table 2-13 and data collected during the survey is given in **Table-A.3.1.2** of **Annex-3.1**. Species wise frequency, relative frequency, density, relative density, abundance, relative abundance and Important Value Index are presented in Table 2-14.



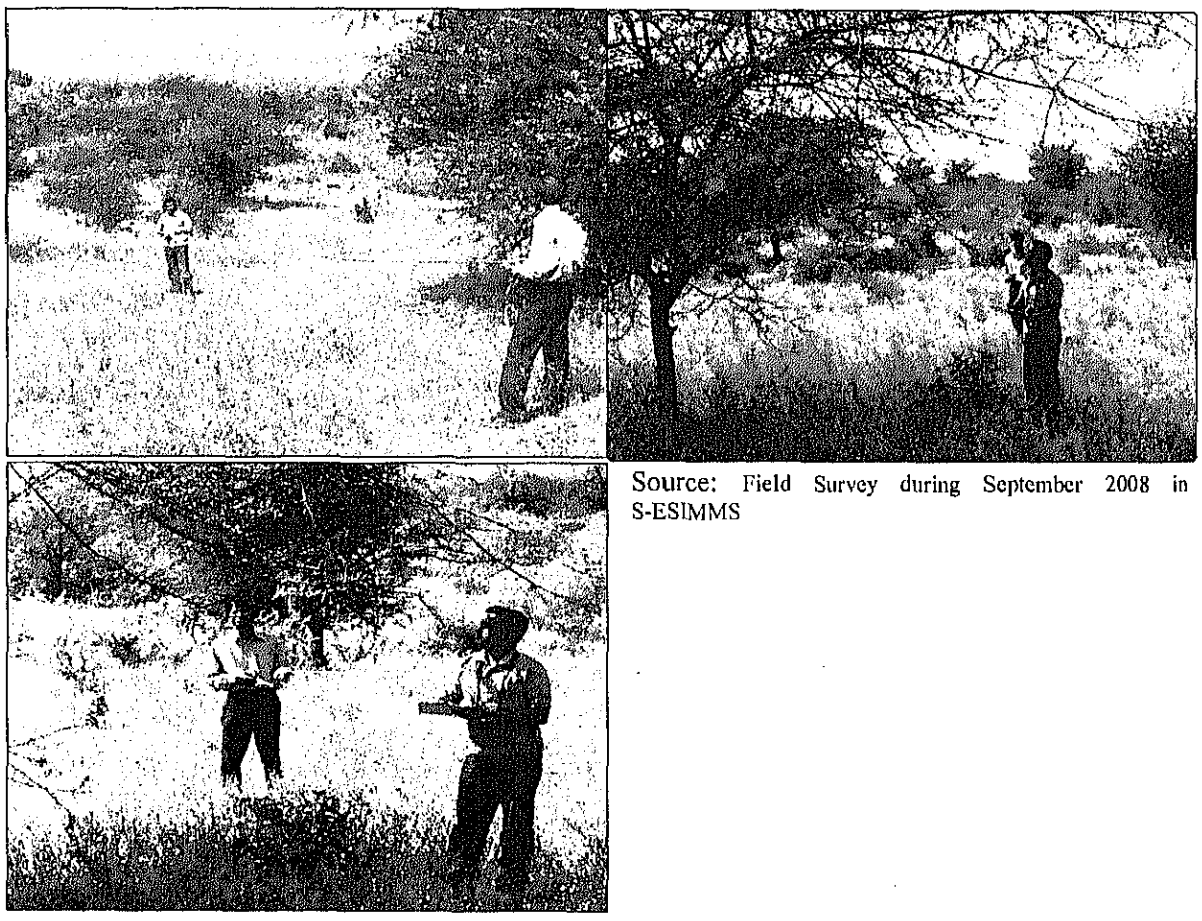
Source: Field Survey during September 2008 in S-ESIMMS

View of Malana Reserved Forest from different locations

Table 2-13 Species wise Total Number of Trees in different Sample Plots

Sample Plot No.	Tree Species				
	Israili Baval	Khair	Bilayti Baval	Deshi Baval	Grand Total
1	5	7	3	4	19
2	4	2	10	4	20
3	3	8	3	5	19
4	6	2	4	7	19
5	1	2	8	4	15
6	8	2	5	3	18
7	2	6	3	2	13
8	4	2	7	8	21
9	4	2	2	12	20
10	1	8	6	4	19
11	5	1	3	1	10
12	2	5	9	2	18
13	6	3	4	3	16
14	10	3	5	5	23
15	7	8	2	8	25
Total	68	61	74	72	275
%	25	22	27	26	100

Source: Field Survey during September 2008 in S-ESIMMS



Source: Field Survey during September 2008 in S-ESIMMS

Field Survey at Malana Reserved Forest

Table 2-14 Results of Transect Analysis

Species (SP)	Frequency (%) (F)	Relative frequency (RF)	Density (D)	Relative Density (RD)	Abundance (AB)	Relative Dominance (RDO)	Importance Value Index
Israili baval	100	25.0	4.5	24.7	1.0	24.6	74.3
Khair	100	25.0	4.1	22.2	1.0	22.0	69.2
Bilayti baval	100	25.0	4.9	26.9	1.0	29.8	82.0
Deshi baval	100	25.0	4.8	26.2	1.0	23.7	75.0

Total surveyed area = {15 x (30 x 30)} = 13,500 m^2 = 1.4 ha

Total area of forest land to be diverted = 2.7 ha

Therefore, approximate number of trees to be felled = 556

(3) Impact Assessment

1) Vegetation along the DFC

Impacts:

- Loss of flora due to felling of private trees within the proposed ROW. Approximately **5,612** no of private trees have to be felled. The predominant tree species include *Mangifera indica, Ziziphus mauritiana, Eucalyptus sp, Dalbergia sisoo, Ficus benghalensis, Madhuca indica, Syzygium cumini, Acacia tortlis, Acacia nilotica, Acacia catechu* etc.
- No endangered or rare plant species is reported within the proposed ROW.

Mitigation Measures:

- To avoid uncontrolled and indiscriminate tree felling, all trees are to be numbered before felling. Joint field visit is to be conducted with the officials of Forest Department to finalize the list of trees to be felled. A sample format is given below, which is to be filled up during the visit:

Tree No.	Common Name	Height (m)	Girth Size (cm)						
			< 30	30-60	60-90	90-120	120-180	>180	Total
1.									
2.									
3.									
4.									

- Tree cutting is to proceed only after all the legal requirements including Formal Clearances from the Gujarat State Forest Department are completed and subsequently a written order is issued to the Project Proponent/Contractor.
- Appropriate compensatory plantation will be initiated to compensate the vegetation loss due to felling of trees for site clearing. For trees to be cut, sufficient compensatory plantation, about 2 times of the number of trees felled, will be done along the DFC alignment.
- For trees to be felled in private land, compensation for land and trees will be given to the owners. Rate of trees will be decided by the State Forest Department.
- Preferential mixed plantation consisting of flowering shrubs and evergreen ornamental trees with less timber and fruit value will be carried out.
- Under the plantation programme, more valuable tree species will be planted in place of existing non-valuable mono crops of the project area, if any.

2) Forest

Impacts:

- ***Diversion of Forest Land:*** It is estimated that 21.3 ha of forest land is to be diverted in Banaskantha District for the use as ROW for construction of DFC in Gujarat. The details breakup of the forest land to be acquired is given below:

Name of the Forest	District	Land to be acquired (ha)
Jethi Reserved Forest	Banaskantha	11.1
Bantwada Un-classed Forest	Banaskantha	7.5
Malana Reserved Forest	Banaskantha	2.7
	Total	21.3

Source: Field survey in S-ESIMMS

- ***Felling of Trees:*** Approximately 1,326 no. of trees exist in the forest area which have to be felled along with diversion of forest land. There are no endangered or rare plant species exist in the forest area.

Name of the Forest	District	No. of trees to be felled
Jethi Reserved Forest	Banaskantha	0
Bantwada Un-classed Forest	Banaskantha	770
Malana Reserved Forest	Banaskantha	556
	Total	1,326

Source: Field survey in S-ESIMMS

Mitigation Measures:

- Monetary compensation should be provided to Forest Dept. towards the cost of forest land to be diverted and cost of compensatory afforestation.
- Before start any activity within the Forest area, Forest Clearance must be obtained as per Forest Conservation Act, 1980 and it's amendments from the State Forest Department.
- Action plan for tree felling should be prepared to avoid uncontrolled and indiscriminate tree felling.
- Appropriate compensatory plantation should be initiated to compensate the vegetation loss due to felling of trees for site clearing. For trees to be cut, sufficient compensatory plantation, about 2 times of the number of trees felled, will be done.
- Preferential mixed plantation consisting of flowering shrubs and evergreen ornamental trees with less timber and fruit value will be carried out.
- Under the plantation programme, more valuable tree species will be planted in place of existing non-valuable mono crops of the project area, if any.

2.1.3 Fauna

(1) Limno Fauna at Mejor Rivers

1) Methodology

The DFC alignment will cross several rivers in between Rewari to Vadodara, out of which Mahi, Sabarmati, Vishwamitri, Mini and Vatrak Rivers are the important rivers where faunal diversity was identified during ESIMMS in the year 2007. Supplementary study has been conducted to assess the potential impacts on the habitat of wildlife due to construction of bridge over two major rivers (Mahi and Sabarmati Rivers) and three minor rivers (Vishwamitri, Mini and Vatrak Rivers) along the DFC alignment. These five bridge locations

are situated in four districts of Gujarat State. Proposed bridge locations are presented in Table 2-15.

Table 2-15 Proposed Bridge Locations

Sl. No.	Name	Latitude and Longitude	Location Description (Village and District)
1	Vishwamitri River	N 22° 11' 57.6" E 73° 09' 35.9"	Between halipur and Maretha/Maneja Villages (Vadodara District)
2	Mini River	N 22° 21' 22.5" E 73° 04' 47.0"	Between Sherkhi and Angadh Village (Vadodara District)
3	Mahi River	N 22° 22' 51.1" E 73° 03' 36.2"	Between Kotna Village (Vadodara District) and Amrol Village (Anand District)
4	Vatrak River	N 22° 42' 51.3" E 72° 37' 21.3"	Between Pipariya/Koshiyal Villages and Vasanha Buzarg Village (Kheda District)
5	Sabarmati River	N 22° 51' 55.9" E 72° 29' 53.9"	Between Miroli and Koshindra Villages (Ahemdabad District)

Source: Field survey in S-ESIMMS

a) Objective of the Study

The study area is assessed with the consideration of the following important aspects.

- Collection of secondary data on inhabiting wildlife, in and around the selected segments of the river stretches.
- Listing of wildlife population to determine the impacts of this project on the inhabiting wildlife in future, especially for the wildlife in and around the river and river stretch, at the exact locations where the bridge would be constructed
- Conduct field survey of habitats and wildlife: starting from 5 km downstream up to 5 km upstream from the proposed bridge site (from the aliment point of DFC).
- Information of the field survey such as day and time, location (latitude and longitude), photographs etc.
- Suggestions for mitigation measures to minimize the impacts.

b) Applied Method for Field Survey

Physical relocation of all five suggested and demarcated locations of proposed bridges over two major rivers (Mahi and Sabarmati) and other three minor rivers (Vishwamitri, Mini and Vatrak), on the aerial map of Gujarat State with a GPS device, by visiting river basin areas was carried out. All provided geographic co-ordinates of proposed bridges were matched with the ground locations considered as the Study Area Location (SAL), on the rivers. Here each SAL is considered as a range of 10 km (five km of upstream and five km of downstream river stretch from the bridge location) long river stretch on both the banks of the five rivers maximizing the possible impact area. Therefore each SAL has been considered as Potential Impact Area of Wildlife (PIAW).

The PIAW is over a size of 20 km^2 habitat block on river bank stretch, excluding the river width. Each PIAW was rapidly surveyed on the rivers of Vishwamitri, Mini Nadi, Mahi, Vatrak and Sabarmati and all important and necessary data were recorded in the **'Data Card-A and B' (Annex-3.1)** with respect to objectives. It was decided to collect information in the following manner.

- Relevant published literature survey

- Field surveys:
  - → Visual encounter survey (as per animal groups)
  - → Transact survey (only at few locations)
  - → Recording the species through indirect evidences like foot prints, shell, skin, moult, burrows, droppings and sounds
- Additionally, secondary information was gathered from the local people of surrounding villages, fisher men, forest personnel and wildlife enthusiasts about different species of wild animals, by interviewing and showing colour pictures of species to them.

The taxonomy and nomenclatures mentioned in this document are adopted from those of Ali and Ripley (1983) and Girmmett and Inskipp (2003) for birds; Nameer (2008) and Wilson and Reeder (2005) for Mammals and for reptiles Das (1994 and 2003) has been referred.

Mugger Survey: The crocodile survey method follows visual day counts and night count. The survey methods used were direct visual day counts and rapid habitat assessment, along with gathering the information on animal conflicts in the area. For night count, the torchlight (high-power beam) was used. Most of the muggers were recorded under reflection; their fiery glowing eyes marked their presence in the water body (this method used only in Vishwamitri River).

Turtle Survey: The turtle fauna was surveyed by slowly walking along the edge of the river dusk and dawn to find out most potential habitats of the animals in confirmation to the information given by locals and fisherman. These selected patches and river pockets are frequently visited during early mornings and late evenings, waiting to watch the animals' activity through binoculars from some elevated points.

- The density formula of the mugger crocodile and turtle species used here:

DSP= SiI/km RL
(DSP =Density of the species; SiI= sighting of individuals; km RL= per 1 km river stretch length)

Bird Survey: The bird fauna was explored and listed in the study area by observing slowly from the edge of the river during early mornings and evenings. Use of binoculars (8 x 40) for the close view of bird and the identification of the species has been done.

c) Study Constraints

While the S-ESIMMS is designed to optimize the information collection and output generation, there were few major limitations in the study.

i) This study generates information relevant only to one month of monsoon. Many river banks areas are not approachable in this particular period.

ii) The population ecology and behavior of many species, especially aquatic reptilians is highly active but less visible due to rainy-muddy water, which makes it difficult to determine the exact status and underestimated results are obtained.

iii) Present study period is monsoonal, other two seasons: Winter and Summer observations are uncovered in this study.

iv) Many migratory birds being the winter visitors use such stretches of the river. But this data remains uncovered in the study.

d) Data Analysis

Present findings of the investigation of the habitat and inhabitant wildlife, includes limno-fauna, especially species of turtles and crocodile. During the study, relevant published information has been analyzed for most probable impacts of bridge construction.

e) Study Period and Assessment

The suggested five locations on two major and three minor river stretches were rapidly assessed and a detailed survey was carried out to list the inhabiting wildlife and its status. Possible threats can be envisaged during the study itself.

Total over a month have been the spent behind yielding this study report, which includes 18 field days for generating new data. The five locations were assessed during 22nd August and 25th September 2008, keeping in consideration the above mentioned objectives.

f) Profile and Features of the Rivers

The topography of the area and some salient features, and other relevant details of all the five rivers are shown as follows. (Here the profile and features of the rivers are mentioned in order as per sequence from south to north).

i) **Vishwamitri River:** Vishwamitri River is one of the seasonal rivers of Gujarat State and it flows from east to west in between two large perennial rivers of Mahi and Narmada. Vishwamitri River originates from Pavagadh hills, Panchmahal District, flows westwards through Vadodara City and further merges with two other small tributaries (meets the Jambuva tributary at Khalipur Village, and Dhadhar branch near Kothawada Village) and finally reaches the Gulf of Khambhat near Khanpur Village, Bharuch District. Two water reservoirs are constructed on the river system, Sayaji Sarovar near Ajwa Village on Vishwamitri River and Dev Dam on its Dhadhar branch, for consumption and irrigation purposes.

Vishwamitri River flows through Vadodara City and so sewage of the entire city and near by industries (Kalali and Makarpura) are drained into the river which adds immense amount of pollutants in the river. This polluted river holds a few numbers of wildlife including a small population of mugger crocodiles (*Crocodylus palusris*).

ii) **Mini River:** Mini River is a small seasonal 55 km-long rivulet tributary of Mahi River. This small river originates somewhere in south-east planes of Savali areas and further flows left side parallel to Mahi, east to west-south and finally merges with Mahi in the west of Sindhrot Village, Vadodara District.

This small river flows through a few industrial areas of Vadodara District. These industries (Nadesari GIDC, Ranoli Industrial Estate and Indian Refinery) release huge amount of toxic effluents in the river, making it a highly polluted river in Vadodara District.

iii) **Mahi River:** Mahi River (= Mahi Sagar) is a perennial 576 km-long river and flows through three states of Rajasthan, Madhya Pradesh and Gujarat. It originates from Gomanpura, Malwa Plateau of Vindhya hills, north-west Madhya Pradesh and flows west-south towards Gujarat and finally reaches the Gulf of Khambhat at Kavi-Degam, Bharuch District. The Goma, Mesari, Panam, Karad, Haran and Machundri are the main tributaries of the river and all meet on left bank of the river. There are a number of small-big dams (Mahi Bajaj Sagar, Kadana and Wanakbori, first one in Rajasthan and the later two dams in Gujarat) constructed on the various tributaries of the river, which irrigate large areas of the state. This large river harbors important wildlife.

iv) Vatrak River: Vatrak River is a small river about 300-km long, a non perennial tributary of Sabarmati River. It originates from Dungarpur District, Rajasthan. By nature it is non perennial, but waters of the downstream river continuously flow. This is due to the excess water from Mahi and Narmada Irrigation Canal systems being released in the river. Originating in southern Rajasthan, it flows from south-east to west-south through Sabarkantha and Kheda Districts and finally merges with Sabarmati River at Palla and Vautha Villages (Vautha Village is on right bank). The Meshwa, Majam, Shedhi and Mohar are the main tributaries of Vatrak.

v) Sabarmati River: Sabarmati River is a large perennial 371 km-long river of the state. It originates from Aravalli Hill Range in western Udaipur District on the border of southern Rajasthan as Wakal River and flows southwards to Gujarat, finally ending in the Gulf of Khambhat at Golana-Vadgam, Anand District. There are over a dozen tributaries, which are Wankal, Harnav, Hathmati, Khari, Meshwa, Majam, Vatrak, Shedhi and Mohar flowing from Sabarkantha and Kheda Districts, finally all meeting in it on its left bank, except Bhogava River, the only tributary which joins it at its right bank.

This is one of the beautiful scenic rivers with potable clean water. But its beauty remains up to Gandhinagar City only, after which the river enters Ahemadabad City and transforms into a large polluted sewage river. At Golana-Vadgam near Gulf of Khambhat, it turns into almost a blackish red colored river.

2) Major Findings

Findings of the survey cover the aquatic fauna (especially turtle species and mugger) and other associated fauna, (including various species of birds, reptiles and mammals: **Table-A.3.1.1, A.3.1.2 and A.3.1.3** of **Annex-3.1**). Anthropogenic activities and utility of river water and river stretch areas of individual SAL for bridge also have been studied.

a) SAL of Vishwamitri River

This SAL is surrounded by 6 villages of Vadodara, 4 villages are on left bank (Maneja, Maretha, Jambuva and Juni Karali) and 2 villages are on right banks (Chapad and Khalipur) of the river.

Anthropogenic Use and Utility: All the 6 villages use the river water for various purposes, including agricultural, cattle cleaning and other domestic purposes, like cloths, utensils and bathing use (Following photo and Table 2-16). The water quality is much polluted. Villagers of all six villages abstain the use of water for drinking purposes.

Use of Vishwamitri River Water for Cattle Cleaning and Other

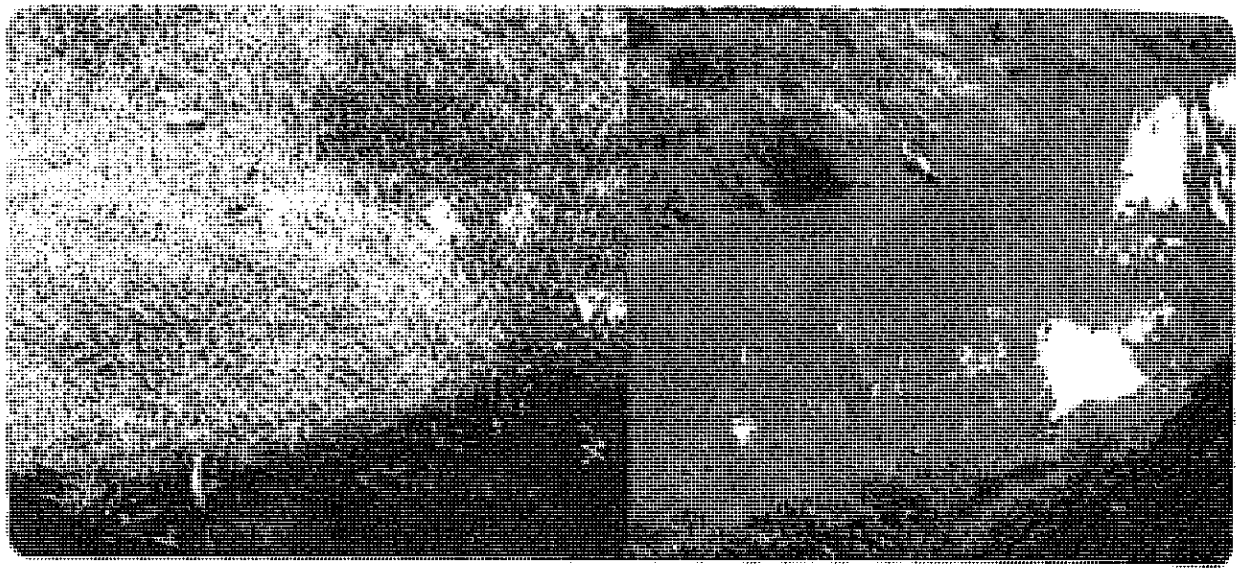
Table 2-16 List of Surrounding Villages at SAL of Vishwamitri and Usage of River Water

Name of Village/ Boundary	Use of River Water	Use of River Banks and Types of Agricultural Crops
Left Bank Area		
Maneja	CC, W, I	Co, COS, Mi
Maretha	CC, W, I	Co, COS, Mi
Jambuva	CC, W, I	Co, COS, Mi
Juni Karali	CC, W, I	Co, COS, Mi
Right Bank Area		
Chapad	CC, W, I	C, COS, Mi, CS, BF
Khalipur	CC, W, I	C, CO, Mi, CS, BF, FI,

Note: CC=Cattle Cleaning, W= Washing, I= Irrigation; Co=Cotton, Mi=Millets, FL=Flowering, CS= Cane Sugar
Source: Field Survey during September 2008 in S-ESIMMS

Aquatic Animals: During the study on aquatic reptiles, one species of turtle and a species of erocodile was observed. Total six mugger crocodiles (*Crocodylus palustris*) are sighted in study area, including three crocodiles sighted at the confluence of Vishwamitri and Jambuwa Rivers, near Khalipur. Two adults were found between Jambuva and Juni Karali Villages and a sub-adult mugger in small puddles at entrance of Juni Kareli. Only, one species of fresh water turtle (Indian Flap-shell Turtle: *Lissemys punctata*) was present in the study area in a small number near the Vishwamitri- Jambuwa confluence area.

The mugger density was observed 0.5/km in the study area, whereas the turtle status was not determined. It has been observed that some of the animals have migrated from village ponds to river ditches attaining to the nature of the species.



A Mugger Crocodiles (*Crocodylus palustris*) in Vishwamitri River

Associated Wildlife: During the study period the survey team have recorded numbers of wildlife, including 54 species of birds belonging to 31 families, five species of mammals belonging to five families and 10 species of reptiles belonging to eight families (Table 2-17).

Table 2-17 List of Wildlife Recorded at SAL of Vishwamitri River

Wildlife	Sighted		Reported		Total Sighted and Reported	
	Species	Family	Species	Family	Species	Family
Birds	54	31	0	0	54	31
Reptiles	9	7	1	1	10	8
Mammals	5	5	0	0	5	5

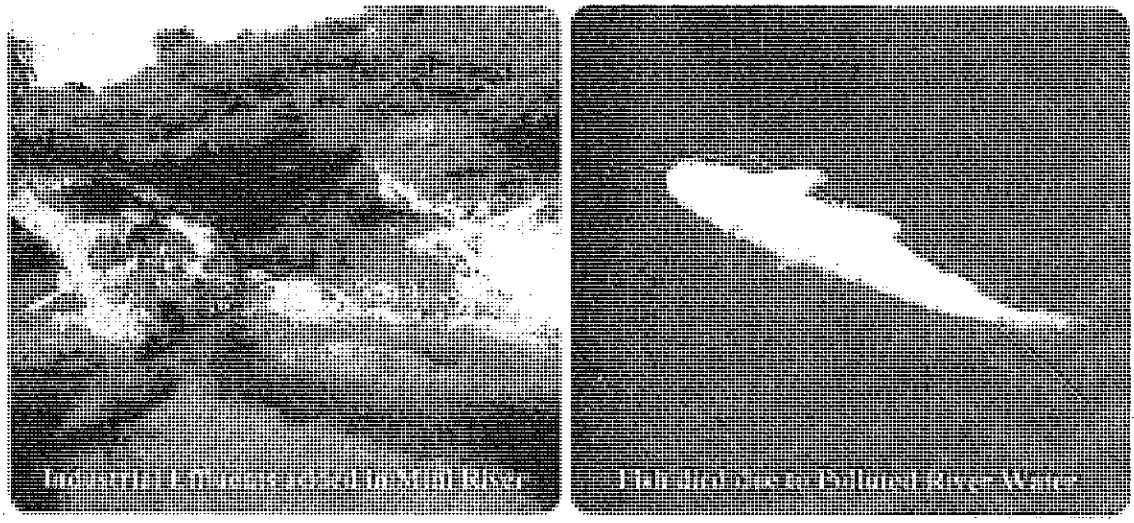
Source: Field Survey during September 2008 in S-ESIMMS

b) SAL of Mini River

This SAL is surrounded by 7 villages of Vadodara, 4 villages are on left bank (Ranoli, Koyali, Rampura-Jaspura and Sherkhi) and 3 villages are on right banks (Namdesari, Anagadh and Bhilapura) of the river.

Anthropogenic Use and Utility: The entire study area of Mini Nadi is topographically high with terrains and ravines. The entire study area is a thorny scrub forest with few farming lands. Very few numbers of agricultural fields are found on both the banks. The villagers of Jasapara and Sherkhi use the water for irrigation purposes. The river bank sands and earthen soils are used in very small scale constructions and road leveling by locals.

Aquatic Animals: None of the aquatic animals (**neither turtles nor crocodiles**) were sighted during the study. A small number of fishes were found floating dead and some in an awkward up-down position suffering from severe breathing problems in the downstream of river, near Sherkhi Village. The fishes are dead due to the poor water quality. The river water is brown colored and very much polluted.



Views of Mini River

Associated Wildlife: During the study time, 60 species of birds belonging to 34 families, 11 species of mammals belonging to 10 families, 5 species of reptiles belonging to 3 families has been recorded (Table 2-18).

Table 2-18 List of Wildlife Recorded at SAL of Mini River

Wildlife	Reported		Sighted		Total Sighted and Reported	
	Species	Family	Species	Family	Species	Family
Birds	60	34	0	0	60	34
Reptiles	5	3	0	0	5	3
Mammals	8	8	3	3	11	10

Source: Field Survey during September 2008 in S-ESIMMS

c) SAL of Mahi River

This SAL is surrounded by 11 villages of Vadodara and Kheda Districts, five are on left bank (Fajalpur, Nandesari, Anagadh, Kotana and Sindharot) and 6 villages are on right banks (Bhanpur-Bhetasi, Kanahawadi, Amarol, Rampura, Asarma and Umeta) of the river.

Anthropogenic Use and Utility: All the 11 villages use the river water for various purposes, including drinking agricultural, fishing, cattle cleaning and other domestic purposes, like washing cloths-utensils and bathing use (Table 2-19). The quality of river water is good and drinkable, therefore there are 6 water pumping stations on the upper stream on the left bank of the river owned by the Vadodara Maha-nagar Seva Sadan (Vadodara City), Refinery Township (IOC), Gujarat State Fertilizer Company (GSFC) and Indian Petro Chemicals Limited (IPCL=now Reliance Petro Chemicals). But all pumping stations are not excluded from the demarcated SAL, except an IOC potable water pumping station located in the upper stream area of SAL.

Small scale fishing activities are observed in the entire SAL, where the local fishermen and some of the migratory 'Bihari Fishermen' fish in the river with traditional methods. Also, small scale sand mining industries are operated on the right bank at Kanhawadi Village and on the entire left bank of the river.

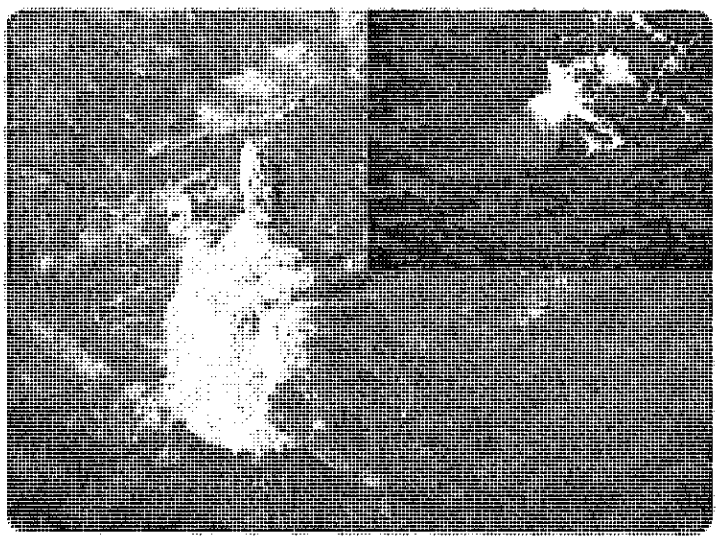
Table 2-19 List of Surrounding Villages at SAL of Mahi and Usage of River Water

Name of Village/ Boundary	Use of River Water	Use of River Banks and Types of Agricultural Crops
Left Bank Area		
Fajalpur	D, B, CC, F, I	Co, Mi, Ma, Ve, CS, BF, SM
Nandesari	D, B, CC, F, I	Co, Mi, Ma, Ve, CS, BF, SM
Anagadh	D, B, CC, F, I	Co, Mi, Ma, Ve, CS, BF, P, SM
Kotana	D, B, CC, F, I	Co, Mi, Ma, Ve, CS, BF, CF, SM
Sindharot	D, B, CC, F, I,	Co, Mi, Ma, Ve, CS, BF, P, SM
Right Bank Area		
Bhanpur-Bhetasi	D, B, CC, F, I,	Co, Mi, Ma, CS, BF, SM
Kanhawadi	D, B, CC, F, I,	Co, Mi, Ma, Ve, CS, BF, SM
Amarol	D, B, CC, F, I,	Co, Mi, Ma, Ve, CS, BF,
Ram Pura	D, B, CC, F, I,	Co, Mi, Ma, Ve, CS, BF,
Asarma	D, B, CC, F, I,	Co, Mi, Ma, Ve, CS, BF,
Umeta-Bridge	D, B, CC, F, I,	Co, Mi, Ma, Ve, CS, BF,

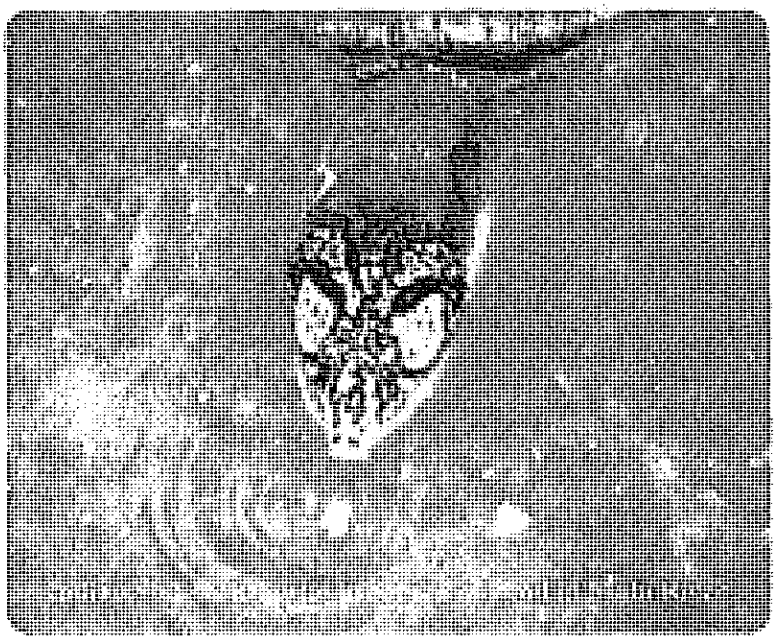
Note: D=Drinking B= Bathing; CB=Cattle Cleaning, F= Fishing; I= Irrigations; RB=Boating-Recreational; Co=Cotton, Mi=Millets, Ma=Maize, Ve=Vegetables, CS=Cane Sugar, P=Paddy BF=Banana Farming, CF=Cattle Fodder, SM= Sand mining

Source: Field Survey during September 2008 in S-ESIMMS

Aquatic Animals: During the study on aquatic reptiles, two species of turtles; Indian Soft-shell Turtle (*Nilssonia gangeticus*) and Indian Flap-shell Turtle (*Lissemys punctata*) in a good number were recorded from the entire study area. The distribution and population of Indian Soft-shell Turtle is fairly intermediate. The distribution of Indian Flap-shell Turtle is restricted to some areas where the river flow is slow and growth of aquatic vegetations is found.

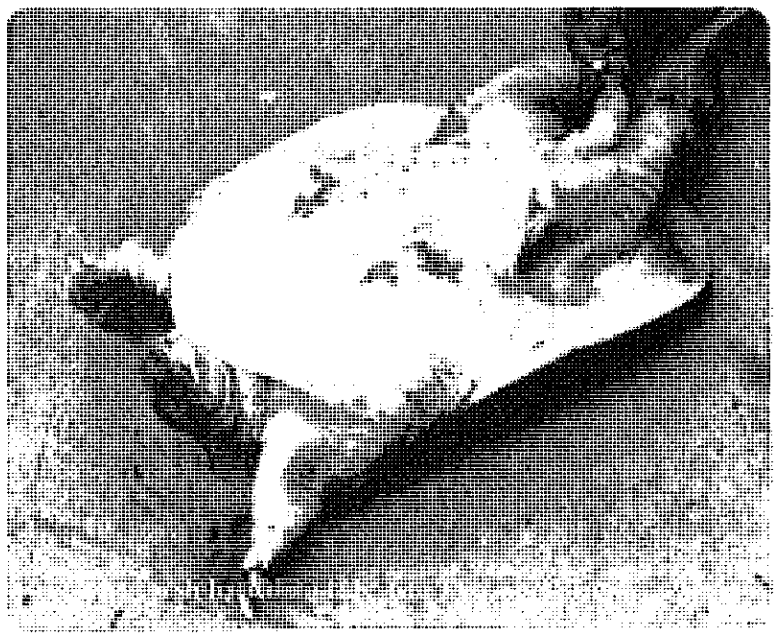


A large Indian Soft-shell Turtle in Mahi River



Soft-Shell Turtle in Mahi river2

The species density of Indian Soft-shell Turtle observed is high in and around the deep pools of river and near the village crematorium. Any turtle nest or any nesting activities of animals have not been observed in study area.



Indian Flap-shell Turtle

The Indian Soft-shell Turtle (*Nilssonia gangeticus*) density is observed 4.0/km in the study areas whereas the Indian Flap-shell Turtle (*Lissemys punctata*) status is not determined. Due to the habitat and habit of the species, it is difficult to assess the status of the species. It was observed that some of the animals have migrated from the village ponds to the river ditches attaining to the nature of the species.

Associated Wildlife: During the study, 73 species of birds belonging to 36 families, 12 species of mammals belonging to ten families and nine species of reptiles belonging to six families were reported (Table 2-20).

Table 2-20 List of Wildlife Recorded at SAL of Mahi River

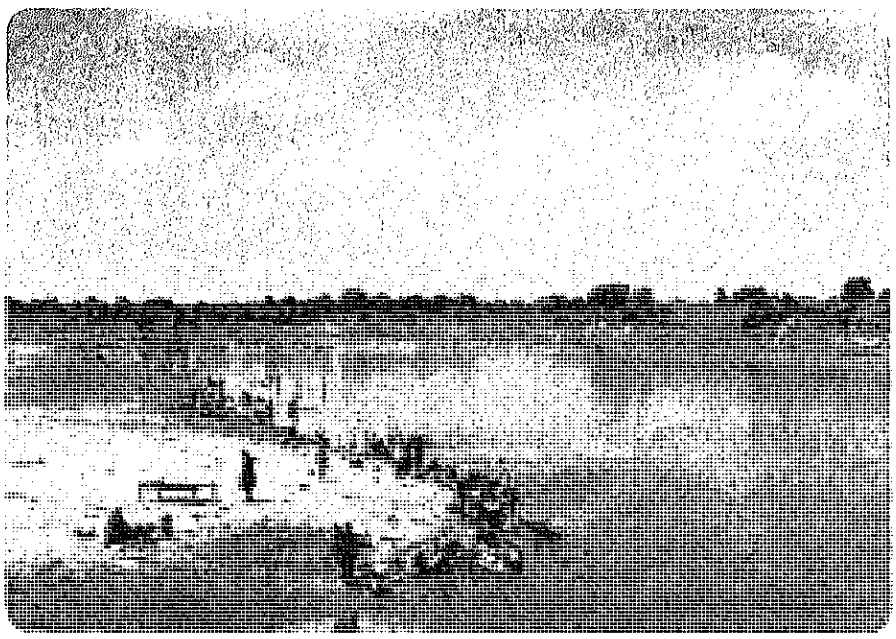
Wildlife	Reported		Sighted		Total Sighted and Reported	
	Species	Family	Species	Family	Species	Family
Birds	73	36	0	0	73	36
Reptiles	9	6	0	0	9	6
Mammals	9	9	3	2	12	10

Source: Field Survey during September 2008 in S-ESIMMS

d) SAL of Vatrak River

This SAL is surrounded by 8 villages of Kheda District, 4 are on left bank (Matar, Pipariya, Koshiyal and Mahelaj) and 4 are on right banks (Hariyala, Vasana-Bujarg, Chandana and Radhu) of the river.

Anthropogenic Use and Utility: All 7 villages use the river water for various purposes, including agriculture, fishing, cattle cleaning and other domestic purposes. The condition of the river water is good and very less polluted in comparison to SAL of Sabarmati. However, it was informed by the villagers that the river water is not consumable. The villagers from these 7 villages do not use the water for drinking purposes.



Use of Vatrak River Water for Domestic Purposes

During the study, a number of water pumps fitted on both banks for pumping of water for individual irrigation of agricultural lands was observed. The agricultural practices are found on various types of crops, including Paddy, Cotton, Millet, Juvar, Castor oil seeds, fodders (sundhiu grass and rajko) and various types of fruits and vegetables.

The fishing practice observed is very traditional and limited. Fishermen used two types of nets for fishing, throw net and drag net. According to the fishermen of Vasana-Bujarg "Mr.

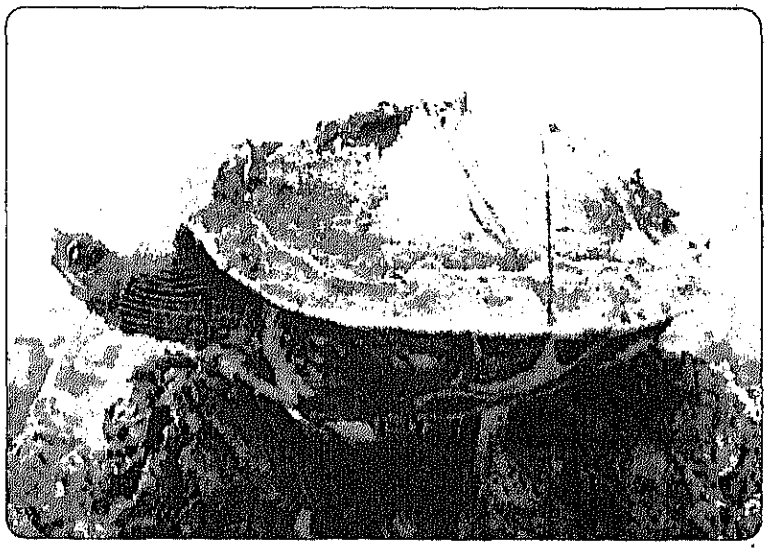
Manubhai Talabada, numbers of the fishes caught are very low, and after long hours of hard work only small fishes are caught". The most of the villagers of Mahelaj are of Muslim community and they regularly practice fishing in the river. They used 'throw net' and 'sit and fix net' for fishing.

Table 2-21 List of surrounding Villages at SAL of Vatrak and Usage of River Water

Name of Village/ Boundary	Use of River Water	Use of River Banks and Types of Agricultural Crops
Left Bank Area		
Matar	B, CC, F, I,	Co, Mi, Ma, Ve, CF, COS
Pimpariya	B, CC, F, I,	Co, Mi, Ma, Ve, CF, COS, SM
Koshiyal	B, CC, F, I,	Co, Mi, Ma, Ve, CF, COS
Mahelaj	B, CC, F, I,	Co, Mi, Ma, Ve, CF, COS
Right Bank Area		
Hariyala	B, CC, F, I,	Co, Mi, Ma, Ve, CF, COS
Vasana-Bujarg	B, CC, F, I,	Co, Mi, Ma, Ve, CF, COS
Chandana	B, CC, F, I,	Co, Mi, Ma, Ve, CF, COS
Radhu	B, CC, F, I,	Co, Mi, Ma, Ve, CF, COS

Note: B= Bathing; CB=Cattle Cleaning, F= Fishing; I= Irrigations; Co=Cotton, Mi=Millets, Ma=Maize, Ve=Vegetables, CF=Cattle Fodder, COS=Castor Oil Seeds, SM= Sand mining
Source: Field Survey during September 2008 in S-ESIMMS

Aquatic Animals: During the study three species of turtles was observed: Indian Soft-shell Turtle (*Nilssonia gangeticus)*; Indian Flap-shell Turtle (*Lissemys punctata)*; Indian Roofed Turtle (*Pangshura tecta*) and marsh crocodile existing in such particular river stretches (Table 2-22).



A Male Indian Roofed Turtle observed at SAL of Vatrak River

Indian Roofed Turtle basking on Wooden Log at Vatrak River

Table 2-22 Details of the Aquatic Animals Recorded in SAL at Vatrak River

Common Name and Scientific Name	Location (RB; LB)	No. of Animals Sightings	Remarks
Mugger Crocodile (*Crocodylus palustris*)	Mahelaj Vasana	1 (1 m) 1 (2 m)	Reported by fisherman
Indian Soft-shell Turtle (*Nilssonia gangeticus*)	Nr. Mahelaj	1	Reported by fisherman
Indian Flap-shell Turtle (*Lissemys punctata*)	Mahelaj (RB) Koshiyal (RB) Vasana (RB) Matar (LB)	6 4 8 2	Common in area
Indian Roofed Turtle (*Pangshura tecta*)	Mahelaj (LF) Matar (LB) Vasana (RB) Radhu (RB)	4 11+4=15 10+3=13 12+6=18	Common in area

Note: RB = Right Bank, LB = Left Bank
Source: Field Survey during September 2008 in S-ESIMMS

According to Mr. Kasam Mohmad (Mahelaj), they caught a small sized crocodile along with the fishes in the last year monsoon (2007). The crocodile was about one meter long and a healthy one; he immediately released it in the same area of river belt. Also, Mr. Manubhai (fisherman of Vasana) reported that a large two meter crocodile was sighted in 2006 during the time of floods in the river and disappeared from the area after two days. It might have come from the village pond of Tranj, where a small crocodile population is flourishing well.

The Indian Roofed Turtle (*Pangshura tecta*) density is observed at 5.0/km in the study area whereas density of Indian Flap-shell Turtle is recorded at 2.0/km and both the species are status wise common in the area.

Associated Wildlife: During the study period, following numbers of wildlife was recorded, including 68 species of birds belonging to 35 families, 8 species of mammals belonging to 8 families and 12 species of reptiles belonging to 9 families (Table 2-23).

This study area is interesting from the view point of bird fauna. During the visit 4 to 5 pairs of Saras Crane (*Grus antigone*) roosting (*roosting is not related with breeding but species may stay/settle for rest during the day time or night time*) in river beds, between the area of 3 villages, Matar, Pipariya and Vasana was observed. The Sarus Crane is one of the important bird species. The species density is high in the area, same as in Kheda and Anand Districts in comparison to other parts of the state.

Table 2-23 List of Wildlife Recorded at SAL of Vatrak River

Wildlife	Reported		Sighted		Total Sighted and Reported	
	Species	Family	Species	Family	Species	Family
Bird	68	35	0	0	68	35
Reptiles	8	7	4	3	12	9
Mammals	6	6	2	2	8	8

Source: Field Survey during September 2008 in S-ESIMMS

Source: Field Survey during September 2008 in S-ESIMMS

Sarus Crane at Vatrak River

e) SAL of Sabarmati River

This SAL is surrounded by 8 villages of Ahmedabad District, 4 are on left bank (Paldi-kankaj, Miroli, Kasindra and Mahijada) and 4 are on right banks (Vanzar, Bakro-Bandarwada, Kasindra and Saroda) of the river.

Anthropogenic Use and Utility: All the 8 villages use the river water for agricultural and cattle bathing purpose. The agricultural practices are observed on various types of crops, including paddy, cotton, castor oil seeds, fruits and vegetables (Table 2-24). There is irrigation co-operative society, which operates pumping station on left bank near the RBL location, near Miroli Village. The Miroli Irrigation Co-operative Society is pumping large amounts of water from the river. There are six water pumps working regularly day and night, pumping huge amounts of water from the river and through the canal system, irrigating agricultural fields of Navapura, Miroli, Timba and Paladi Villages.

The entire river stretch has become highly polluted and surrounding habitat has also degraded, no life form (vertebrates) found in the water, except some of the pollution resistant macro and microscopic animals from the lover phyla are present, which includes insects and bacteria. On both the banks few water-birds were sighted during the study. Large scaled sand mine is operated on left bank at Miroli (closed to RBL) for sand collection for the construction purpose, also. Two large Jack Cum Bulldozers (JCB) machines work to collect sand for construction.

Table 2-24 List of Surrounding Villages at SAL of Sabarmati and Usage of River Water

Name of Village/ Boundary	Use of River Water	Use of River Banks and Types of Agricultural Crops
Left Bank Area		
Paldi-Kankaj	CC, I	Co, Mi, P, Ve, CF, COS
Miroli	CC, I	Co, Mi, P, Ve, CF, COS, Large scale SM and Cooperative Irrigation Pumping Station
Kasindra	CC, I	Co, Mi, P, Ve, CF, COS
Mahijada	CC, I	Co, Mi, P, Ve, CF, COS
Right Bank Area		
Vanzar	CC, I	Co, Mi, P, Ve, CF, COS
Bakro-badrawada	CC, I	Co, Mi, P, Ve, CF, COS
Kasindra	CC, I	Co, Mi, P, Ve, CF, COS
Saroda	CC, I	Co, Mi, P, Ve, CF, COS

Note: B= Bathing; CB=Cattle Cleaning, I= Irrigations; Co=Cotton, Mi=Millets, Ma=Maize, Ve=Vegetables, CS=Cane Sugar, P=Paddy, CF=Cattle Fodder, COS=Castor Oil Seeds, SM= Sand mining
Source: Field Survey during September 2008 in S-ESIMMS

Aquatic Animals: During the study, the team has not found any turtle or crocodile nor any report about existence of these species in such particular river stretches. It might be due to the deteriorated condition of the river water. The condition of river water was highly polluted.

Associated Wildlife: During the study, few numbers of wildlife, including 64 species of birds belonging to 33 families, three species of mammals belonging to three families and eight species of reptiles belonging to six families was reported (Table 2-25).

Table 2-25 List of Wildlife Recorded at SAL of Sabarmati River

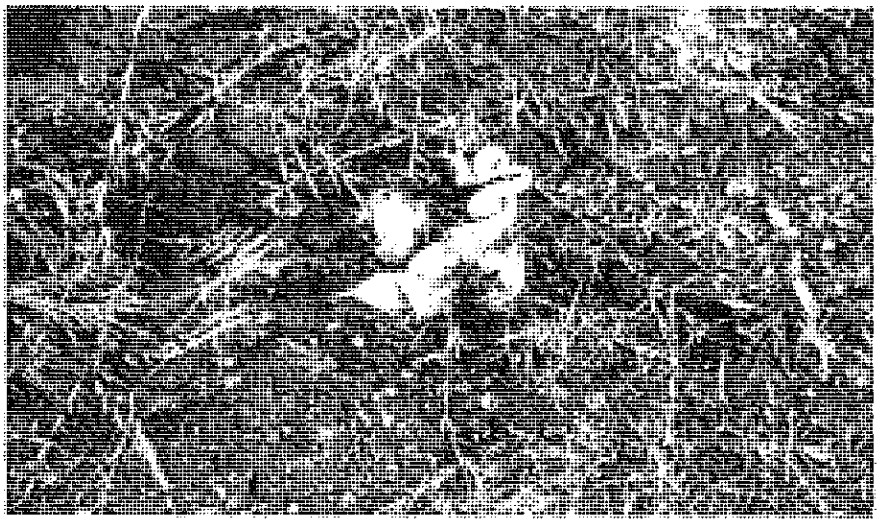
Wildlife	Reported		Sighted		Total Sighted and Reported	
	Species	Family	Species	Family	Species	Family
Bird	64	33	0	0	64	33
Reptiles	5	3	3	3	8	6
Mammals	3	3	0	0	0	3

Source: Field Survey during September 2008 in S-ESIMMS

f) Important Wildlife Species

From the view of conservation value and protected species under wildlife law, few most important species of wildlife, including five species of reptiles, one species of bird and two species of mammals are recorded in the SALs (Table 2-26). They are namely; Mugger (*Crocodylus palustris*), Indian Roofed Turtle (*Pangshura tecta*), Indian Soft-shell Turtle (*Nilssonia gangeticus*), Indian Flap-shell Turtle (*Lissemys punctata*) and Common monitor lizard (*Varanus bengalensis*), Saras Crane (*Grus antigone*), Striped Hyena (*Hyaena hyaena*) and Leopard (*Panthera pardus*).

The Striped Hyena in SAL of Mahi River is recorded by indirect evidences (droppings and footprints). The record of Striped Hyena mentioned in the SAL of Mini River is by the reports of villagers of Angadh and Sherkhi. The leopard has not been sighted in the present study but it is included on the basis of past records of species inhabitation in SAL of Mini and Mahi Rivers. There is a probability of some stray animal to have somehow entered into the area and have again disappeared. It might have come through the terrains and ravines of the river in search of prey.



Source: Field Survey during September 2008 in S-ESIMMS

Indirect Evidences of Stripped Hyena (*Hyaena hyaena*) in SAL of Mahi River

Table 2-26 Most Important Wildlife Recorded in Different Study Area Location

Sl. No.	Species Name	SAL of Vishwamitri	SAL of Mini	SAL of Mahi	SAL of Vatrak	SAL of Sabarmati	Status IWPA-Schedule
1	*Crocodylus palustris*	P	A	A	R	A	I
2	*Pangshura tecta*	A	A	A	P	A	I
3	*Nilssonia gangeticus*	A	A	P	R	A	I
4	*Lissemys punctata*	P	A	P	P	A	I
5	*Varanus bengalensis*	P	P	P	R	P	I
6	*Grus antigone*	A	A	A	P	A	IV
7	*Hyaena hyaena*	A	R	P	A	A	I
8	*Panthera pardus*	A	R	R	A	A	I

Note: A=absent; P=present; and R= reported; IWPA= Indian Wildlife Protection Act-1972
Source: Field Survey during September 2008 in S-ESIMMS

One or two lonely animal sightings of Common Monitor Lizard (*Varanus bengalensis*) in four SAL and report from SAL of Sabarmati are interesting and it might have visited river banks for foraging only.

The sighting of few pairs of Sarus Crane (*Grus antigone*) in the SAL of Vatrak is noticeable. The bird species is a wetland species and is found in surrounding wetlands and marshy areas like paddy fields commonly. The presence of birds in Vatrak River stretch may be a time being roosting population of few pairs of Sarus.

Table 2-27 Status of the Important Limno-fauna Species in the Area

Common name	Scientific name	Status IUCN	India
Indian Soft-shell Turtle	*Aspideretes gangeticus*	Threatened species, Vulnerable	Wildlife Protection Act 1972 Schedule-I
Mugger Crocodile	*Crocodylus palustris*	Threatened species, Vulnerable	Wildlife Protection Act 1972 Schedule-I
Indian Flap-shell Turtle	*Lissemys punctata*	Lower risk, Least concernded	Wildlife Protection Act 1972 Schedule-I
Indian Roofed Turtle	*Kachuga tecta*	Lower risk, Least concernded	-

Source: IUCN, Wildlife Protection Act 1972

g) Habitat of Important Species

Indian Soft-shell Turtle: The Indian Soft-shell Turtle is one of the important fresh water turtles found in all big rivers of the northern and western India, Nepal, Pakistan and Bangladesh. The species is legally protected under Indian Wildlife (Protection) Act, 1972 as Schedule I species, In CITES, the species is not listed, IUCN criteria: vulnerable A1d + 2d species.

The species is prominent in most of all big rivers, reservoirs, temple tanks, lakes and natural ponds. Females nest in monsoon, from August to December, lay 15-30 eggs and hatchlings emerge in the next monsoon after 10–12 months of incubation period.

Some individuals grow up to 94 cm and weigh 60-70 kg, hatchling size observed is 3.0-4.0 cm with a weight of 12 to 15 gm. By nature, omnivorous animals but known to grab small birds to large animals, even attacks on Blue Bull have been known. Hatchlings take insects and rotten food, and by nature cannibalistic. (Vyas 1989a, 1989b 1995; Vyas and Patel 1990 and 1992; Das 1991, 2002; Mouler and Walker 1993)

Mugger Crocodile: The mugger crocodile, a kind of soft water crocodile, is widely distributed throughout Asia such as Bangladesh, Iran, India, Nepal, Pakistan, and Sri Lanka. In India, the species is distributed in the India in Gujarat and approximately 1,200 - 1,500 animals were reported (Vijay Kumar 1997). They generally reach maturity between 1.7 and 2.6 m between the ages of six years to ten years (Whitaker and Whitaker, 1989). While juveniles eat insects, crustaceans and small fish, adults primarily eat reptiles, amphibians, fish, birds, and small mammals, such as monkeys (Britton, 1995).

The species has high adaptability, occupying a variety of habitats including hill streams, large manmade reservoirs, seasonal tanks, large rivers and small pools in the wilderness and also irrigation channels, digging burrows and nest in holes (V Vijaya Kumar, Raju Vyas and BC Choudhury http://www.wii.gov.in/envis/crocodile/gujrat.htm). Females generally lay on average of twenty five to thirty eggs once a year.

Indian Flap-shelled Turtle: The species is widely distributed and commonly found in South Asia. The flap-shelled turtle was placed in Appendix I of CITES in 1975 and also it protected in India under Wildlife Protection Act 1972 Schedule-I. The turtle lives in the shallow, quiet, often stagnant waters of rivers, streams, marshes, ponds, lakes and irrigation canals, and tanks. Waters with sand or mud bottoms are preferred. Nesting occurs from September to November (Das, 1991; Sarker and Husain, 1996); Vyas (1996) reported the period June-October for western India. 2 to 16 eggs are laid at a time, and a female may lay a total of 34-40 eggs in 2-3 clutches each year.

Indian Roofed Turtle: One of the most beautiful turtles and commonly found in western and northern Indian rivers, reservoirs and pounds. Usually this species prefers stagnant water or

slow running water. The species is legally protected under Indian Wildlife (Protection) Act, 1972 as Schedule 1 species, In CITES appendix I animals, IUCN criteria: low risk, near threatened species.

Males are smaller and possess a comparatively longer tail that is thicker at the base. Males possess white bands on the top of the tail, while females possess yellow bands. In addition, male carapaces are darker and the irises are red as opposite to the paler carapaces and pink irises of the females.

The species is found in most of all big rivers of the state. Females are nesting in February and March, laying 5-10 eggs and hatchlings emerge in April and May after 70–75 days of incubation period. By nature, herbivorous animals but some times take insects and rotten food. (Vyas and Patel 1990; Vyas 1993; Vyas 1997; Das 1991, 2002; Mouler and Walker 1993)

h) Conclusion

The survey on the fresh water turtles and crocodiles, wildlife and habitat, anthropologic activities and utility of river stretches, indicates richness in diversity and water quality of each SAL (Table 2-28).

The survey results of river water utility and anthropogenic activities by surrounding villages of river stretches undoubtedly indicate (without any chemical or lab tests) that the water of Vishwamitri, Mini Nadi and Sabarmati Rivers are non consumable and heavily polluted. The river water of Vatrak is less polluted in comparison of waters of the first three rivers, and therefore still traditional fishing activities are observed. Water of Mahi River is non polluted and consumable too.

Overall, health of a river and its condition is measured with the following aspects: population of limno-fauna (turtles and crocodile), reptiles, birds and mammalian species, along with the usage of river water by surrounding villages and anthropogenic activities on that particular river stretch, and with past published data. Most degraded river stretches visualized are of SAL of Sabarmati and Mini Rivers; SAL of Vishwamitri and Vatrak River is comparatively healthier and the healthiest river belt is Mahi River.

Table 2-28 Summary of Wildlife Diversity, Anthropogenic Use and Utility of River Banks and Proposals for Future Development in All five SAL for RBL proposed for DFC

Wildlife	River Vishwamitri	River Mini	River Mahi	River Vatrak	River Sabarmati
Birds Species	54	60	73	68	64
Reptiles Species	10	5	9	12	8
Mammals Species	5	11	12	8	0
Total Species	69	76	94	88	72
Important Species	*C. palustris* *L. punctata*		*N. gangeticus* *L. punctata*	*C. palustris*® *N. gangeticu*® *L. punctata* *P. tecta*	
Use of River Water	Cattle-Cleaning, Washing, Irrigation,	- -	Drinking, Fishing, Bathing Cattle-Cleaning Washing Irrigation	Fishing, Bathing Cattle-Cleaning, Washing, Irrigation	Cattle-Cleaning, Irrigation
Use of River Bank		Industrials effluent canal	Sand Mining, Water Pumping Station	Sand Mining	Sand Mining, Sewage Pumping Station

Note: VUDA=Vadodara Urban Development Authority; ®= Reported Species; SND= Status Not Determined; NF= Not Found
Source: Field Survey during September 2008 in S-ESIMMS

Usually, degraded and polluted river stretches do not support much diversified limno-fauna and the same is observed at SAL of rivers of Vishwamitri, Mini nadi and Sabarmati. The water quality of Vatrak and Mahi is clean and non-polluted and both the river stretches support diversified fauna (in comparison of other three SALs), supporting 88 and 94 species of wildlife, respectively. These numbers indicate that the RBL of Vatrak and Mahi are more significant areas in comparison to other three RBL of Vishwamitri, Mini nadi and Sabarmati.

During the study period, breeding and nesting activities of any species of turtles/crocodiles was not found, especially in such river stretches. This might be due to low density of the species and less potential riverine habitat structures (for such activities) in comparison to other parts of upper river streams. Also, higher number of anthropogenic activities in the segment of the rivers may be a probable reason.

Present study indicate that these five SALs are of little importance in the view of wildlife habitat and environmentally. However, if any impacts would occur in those areas due to the development and the construction of railway bridge, adequate mitigation measures have been suggested to minimize those impacts as discussed in the following section.

i) Supplementary Field Survey on Wildlife in the Dry Season (winter)

The study confirmed the field condition of the bridge location in the winter season having the short survey trek approximately 1-2km in February 2009 within 10 km of the previous S-ESIMMS study trek in each bridge location at August 2008.

Through the field reconnaissance, the result of the S-ESIMMS was confirmed at the site where the important limno-fauna were found in bridge location of major rivers in detour section. Even in the different season, some individuals and field signs of limno-fauna were observed at the time of winter in this additional field study in three rivers although it may not be affected seriously by the DFC project.

Water levels of the three rivers were very low compare to the previous study period in the monsoon period in 2008 although the Mahi River was still keeping abundant water. Especially, in Vishramitri River, water quality itself became deteriorated having blackish brown water color associated with sulfur odor and appearance of bubbling from the bottom.

In Vishwamitri River, there was a possible mugger crocodile (*Crocodylus palustris*) nest in winter, a hole on the bank (appeared by lowering water level) was found but no any observed individual. Some migrant bird species seeming to be winter visitors were identified during study. In Vatrack River, some reptile species which found at the previous field survey were observed. Those are Indian flap-shell turtle (*Lissemys punctata*) and Indian roofed turtle (*Pangshura (=Kachuga) tecta*). Also, some winter visitors of bird species were observed in the river/ river bed. Although water level in the river was declined compare to the other season, the water quality was not so deteriorated in visual observation having clear appearance. In Mahi River, as well as the other 2 rivers, some migrant bird species and cascara of the jackal (*Canis aureus*) were observed.

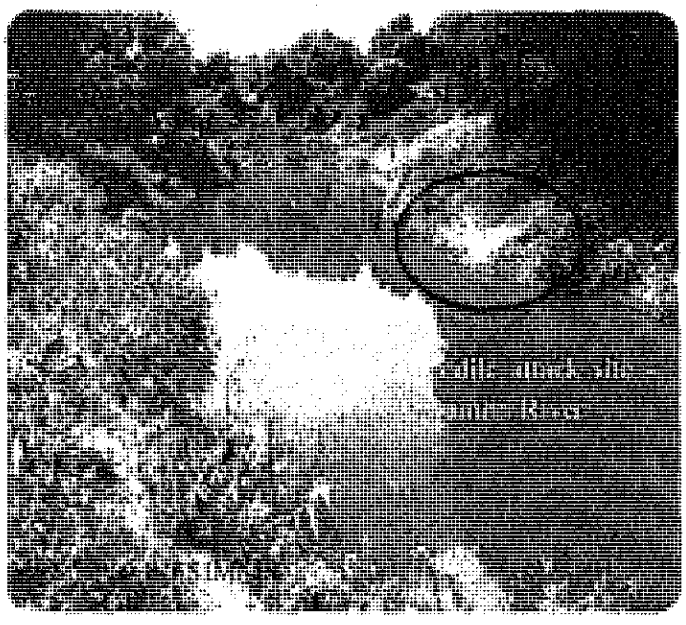
As the result of the study, no critical difference was found on the wildlife in two season, not observing new endangered mammal species and reptile species. Some winter visiting bird were found as migrant bird. All newly found bird species at the site were already listed in the report in the S-ESIMMS (refer at the Thol Lake Wildlife Sanctuary in the part-III) and not categorized as endangered species at the moment. Thus, the study confirmed the S-ESIMMS would not require the particular modification of the report at the time due to the result.

3) Impacts Assessment

a) SAL Vishwamitri River

The SAL of Vishwamitri is the one of the crocodile conflicts area. It is noticed that every year two to three human beings are preyed by mugger crocodile in and around the SAL from past two years. This small population of mugger found in such polluted river stretch is very interesting.

Generally, mugger crocodiles are not known to attack humans (Denial 1983). Despite the fact that there are several reservoirs and ponds in Gujarat where crocodiles and humans come in close proximity, there have been almost no untoward incidents. But unfortunately it is observed that muggers of Vishwamitri attack humans, may be due to less availability of food in river and human interference in crocodile habitat especially during the breeding season. The mugger crocodiles are very possessives during the breeding seasons, especially when there is nesting and hatchling in the area.



Total fourteen attacks of mugger were noted from Vishwamitri-Dhadhar River Valley during last thirteen years (1995 to 2007), which victimized 4 young boys (9-16 years), 4 females (30–45 years) and 6 males (21-45 years) by attack, including six fatal attacks with male

victims (Vyas, 2005 and in press). Most recent two crocodiles attacks were recorded (2007 and 2008) at Talsat Village, which is situated about 15 km from upper stream from SAL of Vishwamitri.

Recent two incidences of crocodile attacks are recorded in monsoon season, when river was crossed by victim and water level was high. Also monsoon is the breeding season of the species. In these remote areas there is no high level bridge on the river particular section of the river. One bridge is situated on the up stream near Vadasar, and the other one on the downstream at Juni Karali Village, separated by a distance of about 30 km. Therefore the proposed bridge might prove helpful in reducing the conflicts between crocodile and man and lessen the unwanted impacts on the species and its habitat too.

Also, the mugger density of 0.5/km at the study area is very low in comparison to other parts of the river. The mugger density in and around Vadodara City is higher. In upper stream area mugger density 2.8/km has been recorded during the year 2001 (Vyas and Vyas 2002). Therefore, no significant impact is envisaged on wildlife due to the construction of bridge over Vishwamitri River.

b) SAL Mini River

None of the aquatic animals (turtles and crocodile) were sighted during the survey indicating that the water quality of Mini River being totally polluted and complete limno-fauna is dead in the entire river stretch, except the most upper parts of the river (area above Nadesari and Ranoli Village) (Anon 2001).

Also, it has been observed that most of the chemical industries of Nandesari and Ranoli release toxic industrial effluents in the river (Vyas, 1989), these effluents are not treated or detoxicated when diluted with water and released in the river. A huge amount of effluents are released through a large canal by three big corporate companies in the down stream at the end of study area.

Therefore there is no chance of any aquatic fauna to survive or further development of any kind of the river area. So there arises no chance of any further negative impact on the environment of the SAL of Mini River.

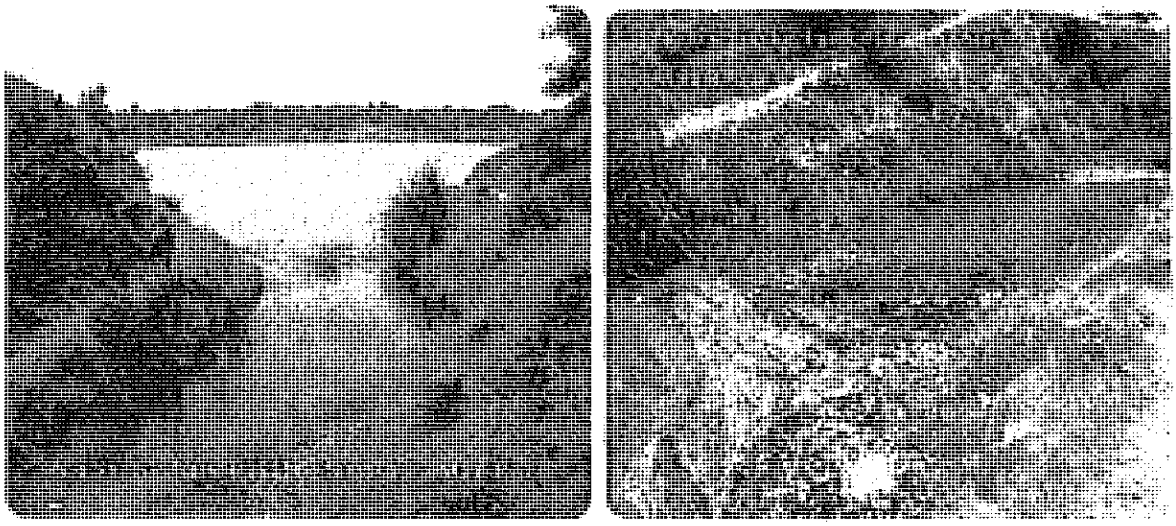
c) SAL of Mahi River

The Mahi River is the most important river along the alignment of DFC. This study is indicating that the river is quite healthy and the water of the river supports many forms of life, including two species of turtles. A small population of Indian Soft-shell Turtle and Indian Flap-shell Turtle inhabit in that particular river stretch. Therefore any type of development might affect such turtle population. However, in view of urban development there are few resorts and farm-houses already under development on the left banks of river by various tourist industries. According to Vadodara Urban Development Authority (VUDA), the area between Vadodara City and Mahi River would be urbanized within next two decades. The authority made second revised proposal (draft) for 'Land Use 2031 AD' and it is yet pending for the approval and finalization by the State Government.

There is already a good turtle population flourished in and outside the study area (Vyas, 1989; Vyas and Patel 1990). Also, both turtle species are found commonly in many parts of India and in the state.

Therefore, construction of bridge over Mahi River in between Kotana and Amrol Villages may not have any noteworthy impact on such turtle population and on wildlife. Impacts would be minor and time-being lasting only up to the construction period.

Also, when Umeta-Sindhrot Bridge was constructed, (1987-1988) Indian Soft-shell Turtles disappeared from the bridge construction site but today it is a noticeable healthy population of the turtle species on the same site. It indicates that impacts on the species are negligible and short-term up to the construction period.



Source: Field Survey during September 2008 in S-ESIMMS

d) SAL of Vatrak River

The SAL of Vatrak River is the second most important river along the DFC alignment. Vatrak River is one of the tributaries of Sabarmati River and is still healthy at some points due to good numbers of wildlife existing in the river stretches. Also the present populations of both turtle species are found in and outside the study area. There is a high and dense population of *Pangshura tecta* found in upper river stream of Sabarmati, Panam (one of the Mahi tributaries) and Vatrak Rivers (Vyas and Patel 1990).

The proposed bridge planned by the state government is in progress, located on the higher study area at Vasana-Bujarg Village in memory of the historical "Dandi Marching Path". Construction of bridge on the river at Pipariya and Koshiyal Villages would have meager time-being impact on the river environment and surrounding areas.

e) SAL of Sabarmati

The study area of Sabarmati is down stream of the river after the mega city of Ahemdabad. The entire river system is dead and water contains various amounts of toxicants, either industrial effluents or released from urban sewages (Ballabh and Singh 1997; Anon 2001). The river's natural support systems are totally perished and surrounding environment is to be lost very soon due to the contaminated water of the river used for irrigation purpose. An anon report (2002) of Agricultural University of Anand, emphasizes such contaminated (heavy metal and pesticides) water affecting on surrounding agricultural fields adversely.

Polluted Water of Sabarmati River

Notes: *The proposed 'bridge of Vishwamitri, Mini and Mahi river areas come under the boundary of VUDA and various types of urban planning are in progress few are mentioned by the authority in the future plans of 'The Land Use 2031 AD' surrounding the Vadodara City. Therefore present planning of rail line bridge construction and development of "Dedicate Fright Corridor" should be taken under consideration after encircling these aspects too.*

4) Mitigation Measure

The present study of 5 different locations for DFC on bridge locations on rivers namely, Vishwamitri, Mini, Mahi, Vatrak and Sabarmati Rivers indicates that the river stretch areas are less important in the comparison to upper stream areas of these rivers from the environment point of view.

The biodiversity found in and around the bridge locations is significant but the same diversity and numbers of species are found in higher numbers in the other parts of river stretches, especially the Upper River areas of all five rivers. However, following mitigation measures have been suggested to minimize the impacts:

a) At the time of detailed design, civil works in construction phase should be designed to minimize disruption of flows and disturbance to the bed, channels and banks of the rivers

b) The river banks area should be least disturbed during the construction periods.

c) A floating oil boom should be placed on the water surface near construction site to prevent discharge of any trace of oil and fuel that may have entered the drainage system. This would serve as a contingency measures: the adoption of good site practice for the prevention of pollution should prevent any fuel or oil entering the drainage system.

d) Construction activities during peak breeding periods of inhabitant turtles and other aquatics species should be avoided.

e) Usage of hazardous materials or chemicals in such designs should be avoided at the site as possible. These hazards refer to chemicals which can develop contamination in the water, especially where there are good numbers of biodiversity recorded during the study.

f) The 'RLB' should be designed with 'foot-path', which local villagers can use to access right from left banks or vice versa reducing risk on conflict between villagers and animals, especially crocodile.

g) During the construction period of the bridge, if some environmental or wildlife consequence develops at any such site or location, especially some important wildlife species needs a special help or rescue, the site in-charge of the project engineer should immediately contact

'Deputy Conservator of Forest' and local NGOs for help, who work for the same, and the problem should be solved. Therefore the 'In-charge of Project Engineer' should be aware enough to know about such emergency contacts; addresses, phone numbers etc. Addresses of few NGOs, who are working on wildlife animal rescuing under the guidance of State Forest Department at Vododara District of Gujarat are given below.

- Staff of Fire Brigade, Vadodara Seva Sadan, Vadodara
- Gujarat Sate Narmada valley Fertilizer Company, Bharuch (GNFC)
- Gujarat Society for the Prevention of Cruelty to the Animals (GSPCA), 54- Kunj Society, Alkapuri, Vadodara
- Vadodara Society for the Prevention of Cruelty to the Animals (VSPCA)
- Crocodile Group, Raopura, Vadodara
- State Forest Department, Vadodara Division, Kothi Kacheri, Kothi, Gujarat

(2) Study on Protected Areas near the DFC

In Gujarat, as showing in Figure 2-1, there are three protected areas which are located close to the DFC alignment. These are:

a) Balaram Ambaji Wildlife Sanctuary

b) Jessore Wildlife Sanctuary

c) Thol Lake Wildlife (Bird) Sanctuary

The impacts of the DFC alignment to those wildlife sanctuaries are discussed based on the secondary information obtained from each wildlife sanctuary management authority namely District Forest Office as below.

1) Area of the Balaram Ambaji and Jessore Wildlife Sanctuary

a) Major findings

In Banaskantha District in Gujarat, DFC alignment avoids entering the area of Balaram Ambaji Wildlife Sanctuary and passes through the area between the Balaram Ambaji and Jossore Wildlife Sanctuary.

i) Balaram Ambaji Wildlife Sanctuaries

Undulating hills of Aravali, supporting the dry deciduous forests of northern Gujarat, provide an unimaginable beautiful ambience to Balaram-Ambaji Wildlife Sanctuary. The sanctuary derives its name from two historical temples- Balaram and Ambaji, situated at the opposite corners of the sanctuary. This picturesque area was constituted as a Wildlife Sanctuary by Government of Gujarat on 7th August' 1989 for the purpose of protection, propagation and development of wildlife and its environment. The total area of the Sanctuary is 542.08 sq. km. The entire area of the sanctuary falls completely within Banaskantha District comprising the forests of 95 villages of Danta, Amirgadh, Palanpur and Vadgam talukas.

View of Balaram Ambaji WLS

Balaram Ambaji Wildlife Sanctuary is located on the western side of DFC alignment. The alignment does not pass through the Sanctuary. The distance between DFC alignment and the Sanctuary vary from 1.2 to 3.1 km.

ii) Jessore Wildlife Sanctuary

Jessore is an important hill of the Aravalli series. It is a historic site of the district, situated on the Gujarat-Rajasthan border. The total area of the sanctuary is 180.7 km^2, covering the forest area of 18 villages of Dhanera and Palanpur talukas of Banaskantha District. Hill forests in the sanctuary act as barrier against desertification and provide ecological security. The sanctuary provides environmental stability and security to the watershed in the region. The area is considered as an important habitat for sloth bear, a threatened species in the region.

Jessore Wildlife Sanctuary is located on the eastern side of the DFC alignment. The alignment does not pass through the Jessore Wildlife Sanctuary. The distance between DFC alignment and the Sanctuary is varying from 1.2 km to 2.9 km.

Once the Banaskantha Forests in Balaram and Ambaji as well as Jessore areas were quite rich in good number of big and small game animal. However, due to loss of forests, hunting, poaching and mining, wildlife has been disappeared from the track. What are left now are panthers and sloth bears found in Jessore as well as Balaram and Ambaji sanctuary areas. Seasonal birds have also found in big water reservoir in the forest area, as these sites have become their feeding ground. (Working Plan for the Forests of Banaskantha Forest Division (Page-74))

Rock, Soil and Terrain: The rocks of this area are mainly quartzite, granite, limestone, marble, schist and vollastonite. The soil is sandy loam with poor moisture retention capacity in plain. In the hills, the moisture retention capacity of the soil is fairly good and covered with vegetation.

The forest track of the sanctuaries are highly undulating with broken ranges of hills of height ranging from 170 to 923 m above mean sea level. The hilly tracks are highly sloppy. The topography of the area consists of hills, piedment zones and the plains.

Type of Forests: The forest of the area can be divided into two types –Forest on Hills and Forest on Plains. The flora of the plains, due to locality factors, resembles more to that of Xerophytic type. The floral constituents of the Banaskantha Forest can be classified as Tropical Dry Deciduous Forests and Tropical Thorn Forests as per the revised classification of Forests Types by Champion and Seth (1966).

In the Jessore Sloth Bear Sanctuary, these two types are quite distinctly separated in the Eastern and Western regions. The mixed deciduous type of forests are observed in the Eastern and most of the southern parts and thorn forests are predominant in Western parts adjoining the Thar Desert.

Forest on Hills: This type of forest occurs on hills where the hilltops are conspicuous by their outcrop and shallow poor soil. The following species are found in the hills:

Table 2-29 Species in Jessore Wildlife Sanctuary

Sl. No.	Common/ Local Name	Scientific Name
	Top Canopy	
1	Amla	*Emblica officinalis*
2	Amli	*Tamarindus indica*
3	Baheda	*Terminalia bellirica*
4	Bili	*Aegle marmelos*
5	Dhaman	*Grewia tiliaefolia*
6	Golada	*Lannae grandis*
7	Golia Dhav	*Anogeissue latifolia*
8	Humb	*Saccopatalum tomentosum*
9	Jambu	*Syzygium cumini*
10	Kala Dhav	*Anogeissus pendula*
11	Kalam	*Mitragyna parvifolia*
12	Kalasiris	*Albizia odoratissima*
13	Khair	*Acacia catechu*
14	Salada	*Boswellia serrata*
15	Simla	*Salmalia malabarica*
16	Sissum	*Dalbergia latifolia*
17	Timru	*Diospyros melanoxylon*
18	Umardi	*Ficus glomerata*
19	Umbro	*Ficus racemosa*
	Middle Canopy	
20	Amla	*Emblica officinalis*
21	Bor	*Zizyphus jujuba*
22	Dudhi	*Wrightia tinctoria*
23	Garmala	*Cassia fistula*
24	Hinger	*Balanites roxburghii*
25	Kala Dhav	*Anogeissus pendula*
26	Khakhara	*Betea monosperma*
27	Manvel Bamboo	*Dendrocalamus strictus*
28	Tatakiyo Bawal	*Acacia eburnea*
29	Timru	*Diospyros melanoxylon*
	Lower Canopy	
30	Ankol	*Alangium salvifolium*
31	Ghatbor	*Zizyphus xylopyrus*
32	Gurab	*Helectaris isora*
33	Kanthar	*Capparis sepiaria*
34	Kuvadiu	*Cassia tora*
35	Marda Sing	*Helicteres isora*
36	Parijatak	*Nyctanthes arbortistis*
37	Rato Baval	*Acacia jacquemontii*
38	Tal Baval	*Acacia farnesiana*
39	Vankal	*Gymnosporia Montana*
	Ground Cover (Grass)	
40	Baru	*Sorghum halepense*
41	Bhatadi	*Themada quardrivalvis*
42	Daro or Dub	*Cynodon dactylon*
43	Dhaman	*Cenchrus ciliaris*
44	Dhrammu	*Cenchrus setigerus*
45	Jinjavo	*Dichanthium annulatum*
46	Karedi	*Apluda mutica*
47	Lampado	*Aristida funicalata*
48	Mang	*Saccharum munga*
49	Shukli/ sabhli	*Heteropogon contortus*

Source: Working Plan for the Forest of Banaskantha Forest Division

Forest on Plain: The forests on the plains are stunted and the trees are unsound and inferior species. The density of the crop is 0.3 to 4.0 in the thickest part. In the plain, natural generation is poor or nil. The ground cover is predominated by Parijatak (*Nyctanthes arbor-tristis*) and some grasses. The following species are found in the plains:

Table 2-30 Main Species in the Jessore WLS

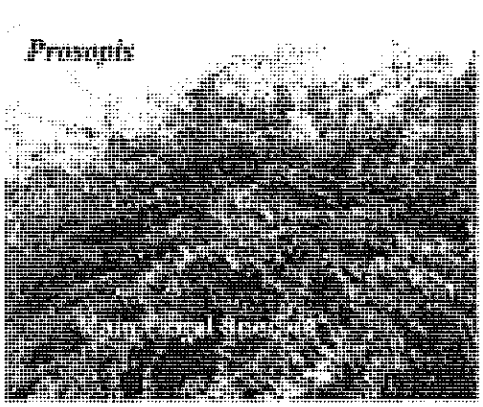
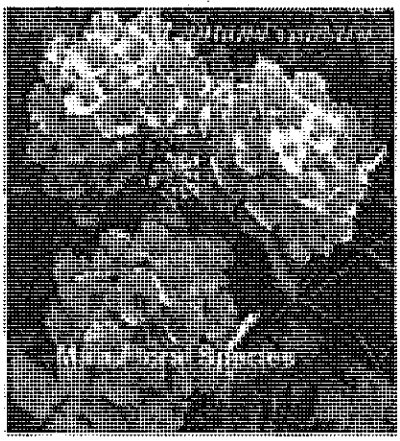
Sl. No.	Common/ Local Name	Scientific Name
	Top Canopy	
1	Aniyar	*Acacia leucophloea* Wild
2	Baval	*Acacia arabica* Wild
3	Bili	*Aegle marme*
4	Dudhi	*Wrightia tinctora*
5	Indrajav or Kudo	*Holarrhena antidysenterica*
6	Kakad	*Garuga pinnata*
7	Kalasiris	*Albizia odoratissima*
8	Khair	*Acacia catechu*
9	Moyna	*Lannea grandis*
10	Rayan	*Soymida febrifuga*
11	Timru	*Diospyros melanoxylon*
	Middle and Lower Canopy	
12	Ankol	*Alangium salvifolium*
13	Bor	*Zizyphus jujuba*
14	Indrajav or Kudo	*Holarrhena antidysenterica*
15	Hinger	*Balanites roxbughii*
16	Kanthar	*Capparis sepiaria*
17	Kardo	*Capparis aphylla*
18	Kargol	*Trema orientalis*
19	Khakhara	*Betea monosperma*
20	Marda Sing	*Helicateres isora*

Source: Working Plan for the Forest of Banaskantha Forest Division

Species of Conservation Importance:

The excessive biotic pressure in the sanctuary area has resulted in reduced regenerative capacity of various floral species leading to loss of boidiversity. Further, introduction of exotics for fencing and in plantations, the floral diversity in the plain and foothills has suffered the most. Bilayti Babul (*Prosopis juliflora*) is one such exotic which is very hardy and resistant to all types of biotic pressures. Introduction and dissemination of this species has been detrimental for the natural flora and habitat health of the area. *Lantana camara* is another exotic which has also started colonizing in the forest areas. Bilayti Babul (*Prosopis juliflora*) is prevalent in Chitrasani, Jethi, Dhandha and other south-western parts.

As per the IUCN classification, several species of global importance are found in the sanctuary which needs immediate actions to protect them against the threats of extinction. A list of such species and their IUCN category is given in Table 2-31.

Source: Field Survey during September 2008 in S-ESIMMS

Table 2-31 List of Tree Species and IUCN Category

Sl. No	Scientific Name	IUCN Category	Distribution Area (Villages)
1	*Sterculia urens*	Threatened	Hathidra, Zanzarva, Ghoda and Koteshwar to Hadad.
2	*Dendrocalamus strictus*	Rare	Hathidra, Dharmata, Kansa, Karmadi, Kengora.
3	*Tecomella undulata*	Rare	Rupvas
4	*Commiphora wightii*	Intermediate	Dharmata, Gavra.
5	*Phoenix sylvestris*	Threatened	Sembalpani, Karmadi, Bedapani, Guda, Virampur.
6	*Anogeissus sericea*	Intermediate	Dharmata.
7	*Ceropegia odorata*	Endangered	Rupvas, Danta.
8	*Chlorophytum borivilianum*	Rare	Rupvas, Danta.
9	*Pavonia arabica*	Rare	Rupvas.
10	*Solanum indicum*	Rare	Godh.
11	*Gloriosa superba*	Intermediate	Hathidra, Rupvas.

Source: Management Plan of Balaram Ambaji Wildlife Sanctuary

Quadrate Survey:

In Balaram Wildlife Sanctuary, quadrate survey was carried out in July 2007 at 10 m x 10 m plots in twenty sampling locations. Average girth size of the species in all sample plots were 56.5 cm and average height were 7.4 m. Average tree density was 0.03/m^2. Average girth size and height of all species is summarized in Table 2-32. Six types of species were observed during the survey, out of which deshi baval was the predominant species. Species wise total number of trees in different sample plots is presented in Table 2-33. Species wise frequency, relative frequency, density, relative density, abundance, relative abundance and Important Value Index are presented in

Table 2-34.

Field Survey at Balaram-Ambaji Wildlife Sanctuary

Table 2-32 Summary of Average Girth Size and Height in all Sample Plots

Local Name	Data	Girth Class					
		A	B	C	D	E	F
Akar	Average of Height (m)	-	-	-	-	25.0	-
	Average of Girth (cm)	-	-	-	-	137.5	-
Deshi Baval	Average of Height (m)	1.4	7.6	9.3	12.4	-	3.0
	Average of Girth (cm)	13.2	42.3	69.6	98.6	-	200.0
Israili Baval	Average of Height (m)	2.5	6.0	8.5	6.7	-	-
	Average of Girth (cm)	14.1	40.7	68.3	93.3	-	-
Karanj	Average of Height (m)	2.7	8.0	-	-	30.0	-
	Average of Girth (cm)	13.3	43.3	-	-	160.0	-
Neem	Average of Height (m)	-	-	-	3.5	20.0	40.0
	Average of Girth (cm)	-	-	-	95.0	140.0	250.0
Palas	Average of Height (m)	0.5	5.1	7.5	11.3	13.8	-
	Average of Girth (cm)	10.0	40.7	70.0	95.0	136.3	-

Note: Girth Class: A: <30 cm, B: 30-60 cm; C: 60-90 cm; D: 90-120 cm E: 120-180 cm F: >180 cm
Source: Field Survey during September 2008 in S-ESIMMS

Table 2-33 Species-wise Total Number of Trees in Different Sample Plots

Sample Plot No.	Species						Grand Total
	Akar	Deshi Baval	Israili babul	Karanj	Neem	Palas	
1		3	2				5
2		8					8
3		10	1			2	13
4		5	4				9
5		4				3	7
6			9				9
7				1		6	7
8		5				2	7
9		2		4			6
10		8				2	10
11		1	4	1		3	9
12			6			2	8
13		3	1		1	2	7

Sample Plot No.	Species						Grand Total
	Akar	Deshi Baval	Israili babul	Karanj	Neem	Palas	
14		4			1		5
15	2		4				6
16			5			3	8
17		5		1		2	8
18		2	5			2	9
19			4			4	8
20		4	2		2	2	10
Total	2	64	47	7	4	35	159

Souce: Field Survey during September 2008 in S-ESIMMS

Table 2-34 Results of Transect Analysis

Species (SP)	Frequency (%) (F)	Relative frequency (RF)	Density (D)	Relative Density (RD)	Abundance (AB)	Relative Dominance (RDO)	Importance Value Index
Akar	5	2.1	0.1	1.3	2.0	5.1	8.5
Deshi Baval	70	29.8	3.2	40.3	4.6	37.1	107.1
Israili Baval	60	25.5	2.4	29.6	3.9	12.6	67.7
Karanj	20	8.5	0.4	4.4	1.8	4.3	17.2
Neem	15	6.4	0.2	2.5	1.3	13.6	22.5
Palas	65	27.7	1.8	22.0	2.7	27.3	77.0

Source: S-ESIMMS

Fauna:

Sloth Bear (*Melursus ursinus*) is the flagship species of the Balaram-Ambaji and Jessore Wildlife Sanctuaries. The adult male weighs 80-145 kg while the adult female weighs 55-95 kg. Their height at shoulder varies from 65 cm to 85 cm and average length is 140-170 cm. It is mostly nocturnal and lives where there is sufficient food available.

Panther (*Panthera pardus*) is the top carnivore and inhabiting in these sanctuaries. In the absence of perfect food chain in often moves to agricultural fields and habitations in search of food. Other major vertebrate species of the area include the striped hyaena, jungle cat, jackal, Indian fox, common langur, neelgai, palm striped squirrel, rats, hedgehog, Indian pangolin, bats, porcupine etc.

Table 2-35 Population of Wild Animal Identified in the Balaram-Ambaji WLS

Species	Number
Leopard	42
Bear	35
Striped Hyaena	50
Wild Boar	69
Fox	66
Cat	70
Blue bull	57
Porcupine	7
Wolf	5

Source: Management Plan of Balaram-Ambaji Wildlife Sanctuary

Wild Boars observed in WLS

Table 2-36 List of Major Fauna of the Sanctuaries

Sl. No.	Common Name	Scientific Name	Conservation status
1	Sloth Bear	*Melursus ursinus*	Vulnerable
2	Leopard	*Panthera pardus*	Lower Risk
3	Rhesus macaque	*Macaca mulatta*	Near threatened
4	Indian hyena	*Hyaena hyaena*	Standard
5	Wild Boar	*Sus criatatus*	Standard
6	Wolf	*Canis lupus*	Threatened
7	Indian Civet	*Viverra zibetha*	Near threatened
8	Jackal	*Canis anrens*	Standard
9	Langur	*Seinnopithecus entellus*	Standard
10	Hare	*Lepus nigricollis*	Standard
11	Porcupine	*Hystrix lencura*	Standard
12	Blue Bull	*Boselaphus tragocamelus*	Standard
13	Monitor Lizard	*Varanus monitor*	Standard
14	Pangolin	*Manis crassicaudata*	Standard

Source: Working Plan for the Forest of Banaskantha Forest Division

Avi Fauna: The variety of birds inhabiting the sanctuary ranges from land birds to water birds. The multi storeyed forests in several parts of the sanctuary and the scrubs in other parts provide a suitable habitat for various avifaunal species. Variety of fruit species, grasses and varied microenvironments inhabiting insects etc. form suitable habitat conditions for various frugivorous and insectivorous birds. Khapa, Gangasagar and Guda waterbodies and some almost perennial nallahas inhabit a variety of water birds. At least 11 bird species found in the sanctuary are listed in the IUCN Red List and at least 4 bird species are included in the ZSI Red Databook, are given in the Table 2-37 and Table 2-38.

Table 2-37 Birds of Balaram -Ambaji Sanctuary Included in the ZSI Red Databook

Sl. No.	English Name	Scientific Names	Category
1	Adjutant stork	*Leptoptiilos*	Threatened
2	Spoonbill	*Platelia leucorodia*	Threatened
3	Osprey	*Pandion haliaeatus*	Threatened
4	Common peafowl	*Pavo cristatus*	Threatened

Source: Management Plan of Balaram-Ambaji Wildlife Sanctuary

Table 2-38 Birds of Balaram -Ambaji Sanctuary Included in the IUCN Red Data List

Sl. No.	English Name	Scientific Names	Category
1	Red spurfowl	*Galloperdix spadicea*	Endangered
2	Grey junglefowl	*Gallus sonneratii*	Near threatened
3	Whitebelied minivet	*Pericrocotus rythropygus*	Near threatened
4	Indian black ibis	*Pseudibis papillosa*	Near threatened
5	Painted stork	*Mycturia leucocephala*	Vulnerable
6	Whitewinged black tit	*Parus nuchalis*	Vulnerable
7	Asian openbill	*Anastomus oscitans*	Vulnerable
8	Asian whitebacked vulture	*Gyps bengalensis*	Vulnerable
9	Long-billed griffon	*Gyps indicus*	Vulnerable
10	Indian black vulture	*Sarcogyps calvus*	Vulnerable
11	Rednecked falcon	*Falco chicquera*	Vulnerable

Source: Management Plan of Balaram-Ambaji Wildlife Sanctuary

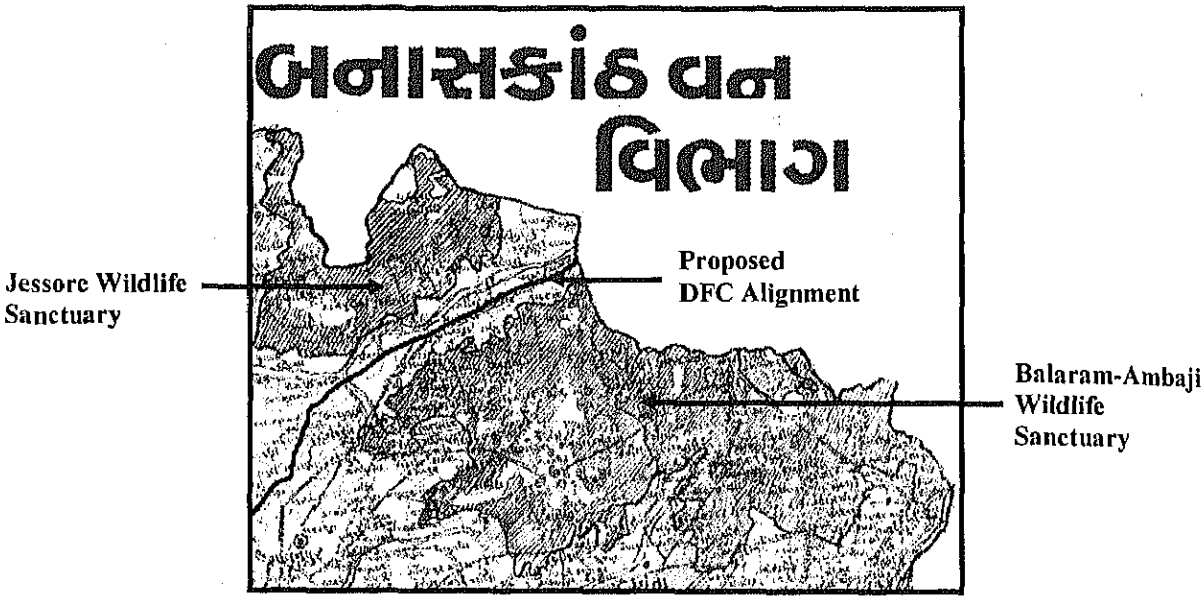
Reptiles and Amphibians: The reptiles include the snakes, tortoises and lizards of various types. Among the non-poisonous snakes, Indian Python is the rarest snake and like to inhabit damp places. Its presence is confirmed near Balaram area. Other non-poisonous snakes include the Rat Snake and John's Sand Boa. The poisonous snakes include the Cobra, Common Krait and Russell's Viper. Bamboo Pit Viper is the rarest of the poisonous snakes of the area. Lizards including monitor lizard, Indian Chamaeleon, Chandan Gho etc. are also found in the sanctuary area. Amphibians of the sanctuary include frog, toad, flapshell turtle and star tortoise etc.

b) Impact Assessment

i) Movement of Wild Animal between Balaram-Ambaji and Jessore Wildlife Sanctuary

Balaram-Ambaji and Jessore Wildlife Sanctuaries are two sanctuaries of northern Gujarat with similar wild fauna and habitat conditions. The migration of wild animals in-between these two protected areas is quiet natural for protection against the possible ill-effects of in-breading among a particular species. "The Jessore Wildlife Sanctuary which has a weak but still existing connectivity with Balaram-Ambaji Wildlife Sanctuary is supporting the western most population of sloth bear in India. The latter sanctuary has larger area and several potential corridors for movement of Sloth Bears towards adjacent areas in Rajasthan and north-eastern Gujarat that have similar landscape features. Other than Sloth Bears, the entire landscape expanding over the two sanctuaries supports mammals like Leopards, Striped Hyaena, Indian Civet, Jackal, Jungle Cat, Sambar, Chinkara, Indian Pangolin and Nilgai as well as reptiles like Indian Crocodile, Indian Python, Star Tortoise, Indian Monitor Lizards etc." (Singh, 2000). The proposed DFC alignment is passing in-between these two Wildlife Sanctuaries.

To assess the impact of the proposed development on the connectivity between Balaram-Ambaji Wildlife Sanctuary and Jessore Wildlife Sanctuaries, a site visit was conducted during the month of September 2008. The objective of the survey was to identify the corridor used by wild animal for movement, to assess the presence of wild animal, to assess the impact of proposed development on wildlife movement and how to maintain the smooth migration of wild animals between the two sanctuaries.



Source: Palanpur Forest Devision

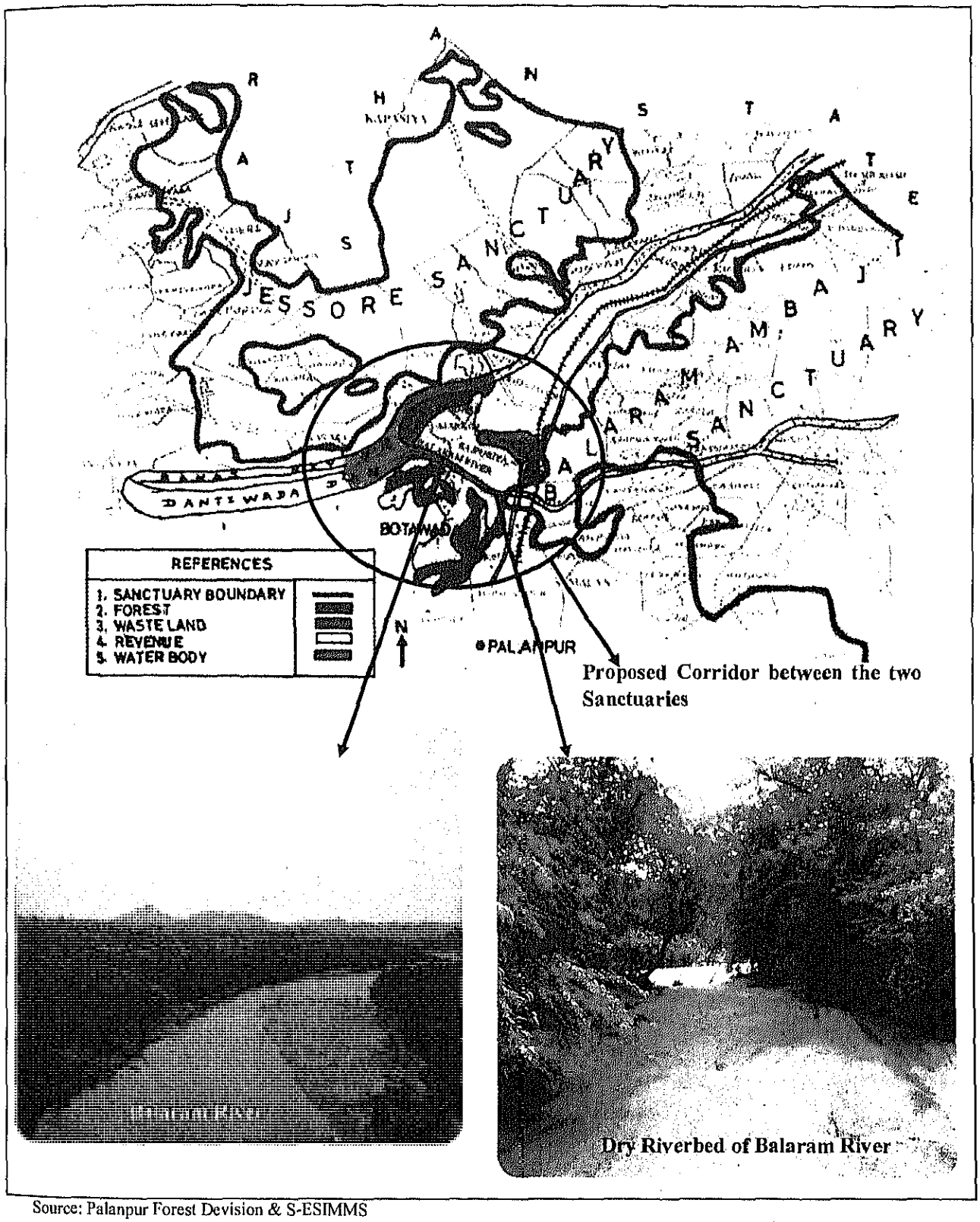
Figure 2-3 Area between Balaram-Ambaji and Jessore WLSs

ii) Consultation with Forest Officials

During the survey, the team members met with the forest officials at Palanpur, since it was considered to be the most authentic source of information regarding the wildlife movement. During the consultation, forest officials informed that one such migratory route has already been identified between the two sanctuaries which need to be developed as a corridor (Source: Palanpur Forest Devision

Figure 2-3 and Source: Palanpur Forest Devision & S-ESIMMS

Figure 2-4). The proposed corridor is along the Balaram River which passes under the railway and national highway bridges. A significant portion of this area is comprised of forest and riverbed. The two bridges are quite high and surrounded by adjoining forest areas of Chitrasani and Rajpuriya Villages. It joins with Banas River and finally entering into the forest areas of Jessore Wildlife Sanctuary.



Source: Palanpur Forest Devision & S-ESIMMS

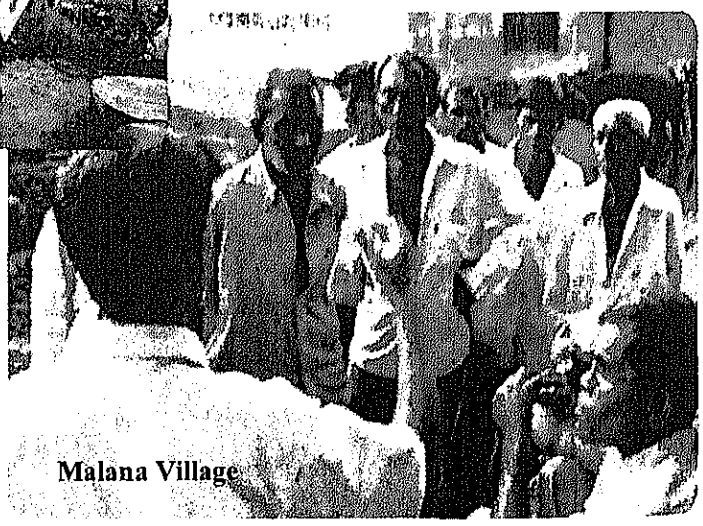
Figure 2-4 Area between Balaram-Ambaji and Jessore WLSs

iii) Consultation with Local People

Jethi and Bantawada Villages are located in-between Balaram-Ambaji and Jessore Wildlife Sanctuaries. During the field survey, the people of Jethi, Bantawada and Malana Villages was consulted to gather the information regarding the movement of wild animal and most frequently used path by carnivores such as leopards and omnivores such as Sloth Bears. It has been confirmed by the local villagers that the area supports wild animals like Leopards, Striped Hyaena, Sloth Bear, Jackal, Jungle Cat, Nilgai etc. and they used to migrate through the riverbed of Balaram River, which connects these two sanctuaries and agricultural field of the surrounding area. Villagers also informed that the area supports a number of small mammals like mongoose, rodents along with some reptiles like snakes and lizards.

Source: S-ESIMMS

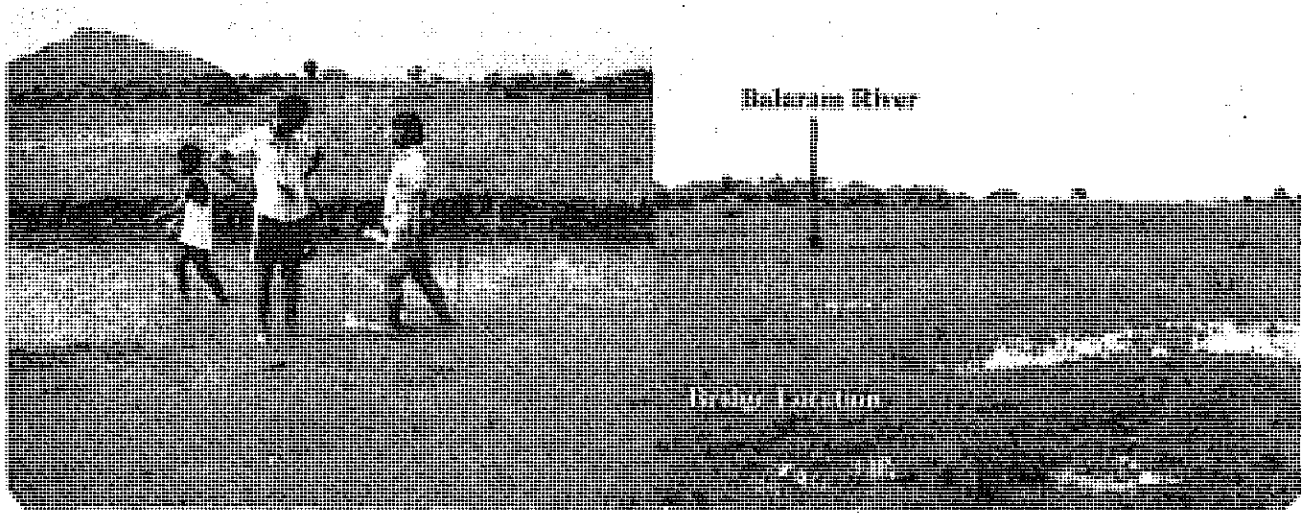
Informal Consultation with local People



Interview Survey to Villagers

iv) Site Visit

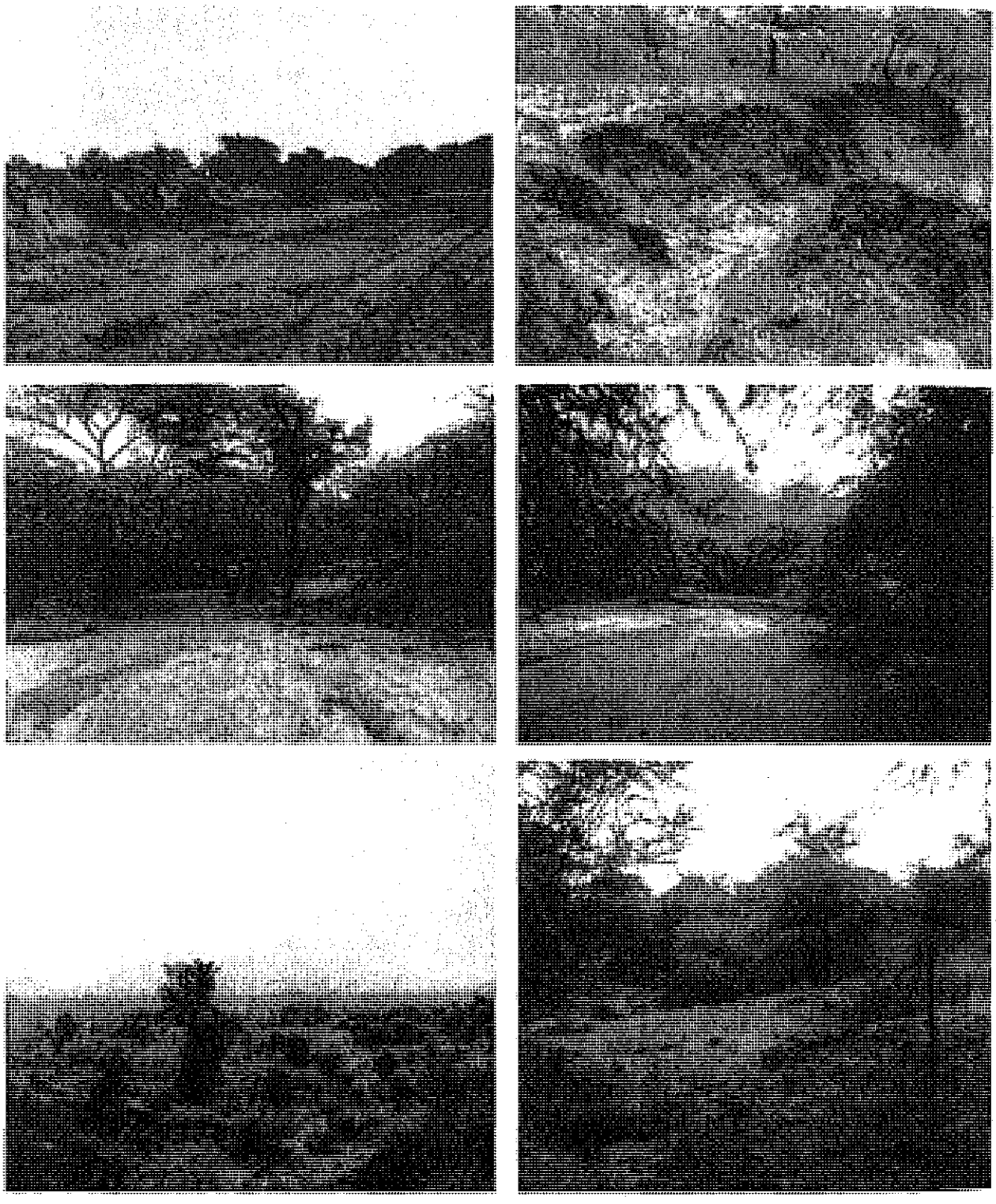
Survey was conducted along the bank of Balaram River in-between these two sanctuaries and the proposed bridge location over Balaram River to obtain information on the faunal presence through indirect evidence. Team members also surveyed the surrounding agricultural fields and natural drainage areas. However, due to heavy rainfall during those days indirect evidence of wildlife such as pugmarks, digging sign, scrap mark, scats were not found in the field. On the other, the movement of wildlife was confirmed from the Forest Department and local villagers.



Agricultural land beside Balaram River

Source: S-ESIMMS

Field Survey at the Area between Balaram-Ambaji and Jessore WLSs



Source: S-ESIMMS

Existing Path Used by the Wild Animal for Movement near Balaram River and Surroundings

v) Interview of Academic Expert

Interview of academic expert was carried out during the month of September 2008 to understand their view about the proposed development; in their opinion what could be the potential impact on natural environment and wildlife corridor due to the construction of DFC in between Balaram-Ambaji and Jessore Wildlife Sanctuaries and mitigation measure. The summary of interview survey is presented in Table 2-39.

Table 2-39 Summary of Interview Survey of Academic Expert in Gujarat

Sl. No.	Name of Academic Expert	Remarks
1.	Dr. Nishith Dharaiya Asst. Professor (*Environmental Science*) and Wildlife Expert Department of Life Sciences, North Gujarat University, Patan, Gujarat	• It was observed that many large animals like, Sloth Bear, Leopard, Blubull and small animals like Hyena, Wolf, Jackal, Fox, etc are frequently moving in between Balaram Ambaji and Jessore Wildlife Sanctuary. Such kind of movement is very important for population and genetic exchange among the wild animals. • In Jessore WLS, Sloth Bear population is around 60-100 and in Balaram WLS it is around 30-50. For breeding purpose they move from Jessore to Balaram as the area of Balaram is much bigger than Jessore. • The Forest Department is planning to join these two Sanctuaries for development of conservation corridor. The DFC will be a permanent barrier and will create a big threat of fragmentation • There are occurrences of death or injury of human and livestock due to the movement of wild animal. • For conservation of the corridor, alignment may be diverted outside the boundary of the sanctuaries. • Providing underpass after every 2 km may not be effective as wild animal have their own route to move from one place to another. • There is an urgent need to study (covering four seasons) and identify the actual route and provide underpass on that location so that we can prevent the future developments in these particular areas. • Conservation of such corridors will also enhance both wildlife habitats and development activities in the region. • 27 species of small mammals have been reported in this region. Out of these 27, 13 species are very rare, 2 species are rare, 7 species are common and 5 species are abundant. • A variety of birds inhabiting in the Sanctuary, out of which 11 bird species are listed in the IUCN Red List. • No systematic report or documents are available on the seasonal change of flora and fauna of this region. • There will be no impact on Thol Lake Bird Sanctuary and migratory route of the birds due to the DFC project.
2.	Dr. Ranjitsing V. Devkar Lecturer in Zoology (*Wildlife Expert*) Department of Zoology, Faculty of Science, The M.S. University Vadodara, Gujarat	• The Jessore and Balaram Ambaji Wildlife Sanctuaries possess 483 species of plants which includes trees, herbs, shrubs, climbers, grasses and lower plants. • Sloth Bear is an omnivorous animal and for the food they move from Jessore to Balaram and vise versa. Construction of DFC will disturb their movement and will also increase number of death of wild animal. • One-year study is required to be conducted to identify the actual route where underpass should be provided.

Sl. No.	Name of Academic Expert	Remarks
		• Bridge over the major rivers should be constructed during summer which will minimize the impact on water quality
3.	Dr. Geeta S. Padate Lecturer in Zoology (*Avian Scientist)* Department of Zoology, Faculty of Science, M.S. University, Vadodara, Gujarat	• Sloth Bear population is good in both the sanctuaries. Therefore, in this section line should be elevated and underpass should be provided after every 1 km. • Where Forest Land will be diverted for construction of DFC, the same amount of land should be acquired in the neighboring area for plantation. It should not be far away from the area. • During construction period, there will be short-term insignificant impact on turtles and they will automatically shift to some other place. • Water flow of the rivers should not be disturbed
4.	Mr. B. M. Parasharya Research Scientist, Bio. Control Research Laboratory, Agricultural University, Anand, Gujarat	• In Gujarat, land is fertile and has the facility of irrigation through Narmada Canal. Paddy, bajra, wheat, and tobacco are the major crops grown in this region. • Due to the acquisition of agricultural land for construction of DFC in Gujarat, there will be loss of agricultural productivity. • DFC should be constructed along the existing track to minimize the impact on agricultural land. • Most of the rivers became dry during summer and bridge should be constructed during this period.
5.	Dr. K P Patel Sr. Research Scientist, Micro-Nutrient Projects, Agricultural University, Anand, Gujarat	• Proper access facility should be provided for village population and cattle movement. • Due to construction of embankment there will be drainage problem and it will increase the flood intensity • DFC should be constructed along the existing track to minimize the impact on agricultural land • Impact on Avifauna is not envisaged due to construction of DFC.
6.	Dr. Raju Vysa Herpetologist, Urban Planning Department, Municipal Corporation, Vadodara, Gujarat	• Natural drainage slope of Gujarat is from east-west and in Sabarmati basin and the slope is from north to south. DFC alignment will obstruct the natural drainage system which in turn increase flood intensity in this region. Therefore, cross drainage structures should be provided in sufficient numbers to minimize the impact. • The proposed bridge locations are very remote and became water logged during rainy season. Therefore, facility of footpath should be provided on either side of the carriageway in rach RUBs otherwise village people will use the railway track for river crossing which in turn will increase number of accidents. • Present study period is monsoonal, other two seasons: Winter and Summer observations are uncovered in this study. Many migratory birds being the winter visitors use such stretches of the river. But this data remains uncovered in the study.

c) Mitigation Measures

Length of DFC in-between the proposed corridor developed by the Forest Department is 3 km. To minimise the impact on the wildlife movement, sufficient number of underpass should be provided. Box culverts (H x W x L=3.0 m x 3.0 m x over 14.5 m dimension) should be provided after every 500 m. Ground surface of the culverts should be kept natural. Additional culverts (pipe culverts) for crossing of reptiles and small mammals should be provided in consultation with Gujarat State Forest Department.

The design of culverts and location should be approved by the State Forest Department before construction.

Metal beam crash barrier/ chain link fencing on both sides at the edge of ROW should be provided except around culverts'.

No underpass for local villagers should be provided in the corridor stretch.

Setting up of construction yard or construction camp should be prohibited within 1 km from the boundary of the sanctuary.

Adequate number of sign boards of high-intensity grade should be provided as per approved design of forest department.

Environmental monitoring should be carried out during construction and operation periods as per the monitoring plan prepared for the project.

An Environmental Management Plan should be prepared to ensure that environment is not degraded during construction and operation phases.

2) Thol Lake Bird Sanctuary

a) Major Findings

The DFC alignment, in Mahesana District, passes through the vicinity of the Thol Lake Bird Sanctuary, 700 m at its closest. This course of the alignment has been developed by considering potential environmental impact on the earlier proposal in which the alignment was to pass very close to the sanctuary. The sanctuary is profiled here due to its presence in the vicinity of the alignment, possible impacts and mitigation measures are discussed at the end of this section.

i) Location and origin

The sanctuary is located in the predominantly agricultural taluka of Kadi in Mahesana District, 25 km north-west of Ahmedabad. It was built as an irrigation tank in 1912 which subsequently became an important habitat for waterbirds, especially migrant birds, and was declared as a sanctuary under the Wildlife (Protection) Act in November 1988. The map of the sanctuary and the proposed DFC alignment is given in Figure 2-1.

ii) Salient features

Thol Sanctuary has total area of 7.0 km^2, with a perimeter of 5.6 km and is spread on a west to east line[1]. The catchment area of the waterbody is located to its north and north-east, with 6 feeder canals flowing into it. The upper level of water in the sanctuary is regulated through a weir which is used to divert excess water into a canal that runs along the eastern boundary of

[1] Gujarat Forest Dept (2002). Management Plan of Thol Bird Sanctuary 2002-2011

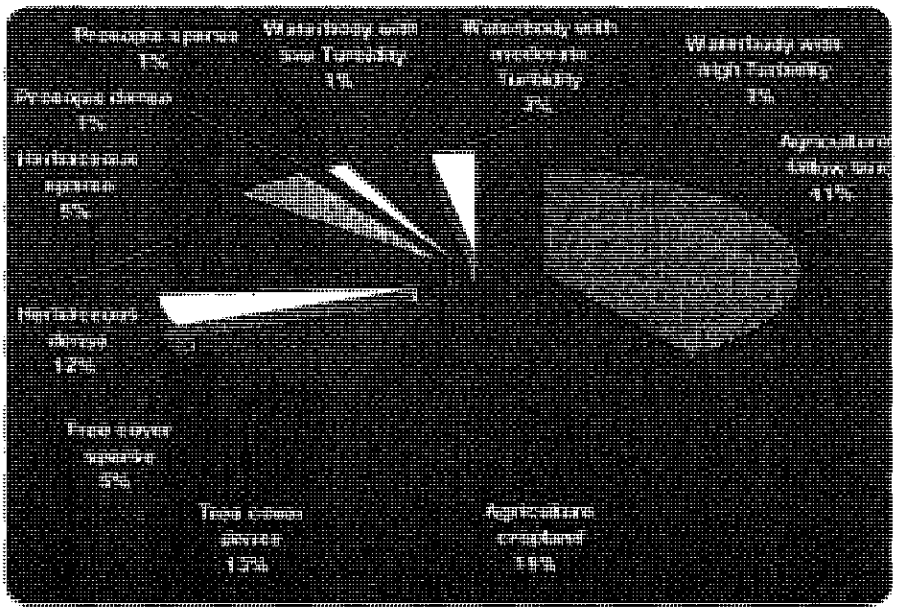
the sanctuary. Water for irrigation purpose is released through 7 canals with a total length of 20.0 km that serve the villages of Thol, Jhaloda, Adhana and Vayana. The salient hydrological features of the sanctuary are as follows[1]:

- Full Supply Level (FSL)	:	163 ft.
- High Flood Level (HFL)	:	167 ft.
- Top of the bank	:	172 ft.
- Catchment Area	:	155.3 km^2
- Storage Capacity	:	312 Million Cubic ft.
- Total Command Area	:	3,670 acres
- Irrigation Command Area	:	1,835 acres
- Area of the tank	:	1,728 acres
- Area under Submergence at FSL	:	1,780 acres

94 ha of the area has dense tree cover while it is sparse in 33 ha. The north-east part of the wetland has sparse growth of *Acacia* sp., herbaceous cover is found in the southern part of the sanctuary. The land use pattern of the sanctuary is given in Figure 2-5.

iii) Jurisdiction

Thol Lake Bird Sanctuary is managed by the Wildlife Wing of the Gujarat Forest Department as per the provisions of the Wildlife (Protection) Act. However, the Irrigation Department has an overlapping jurisdiction in regulating the water levels in the tank and this leads to conflict between the two agencies, especially when the priorities of conservation and irrigation needs tend to become divergent[2].



Source: GEER Foundation (2002): Ecological Study of Thol Lake Wildlife (Bird) Sanctuary

Figure 2-5 Land Cover Pattern of Thol Lake Bird Sanctuary

[1] GEER Foundation (2002), *Ecological Study of Thol Lake Wildlife (Bird) Sanctuary*
[2] Gujarat Forest Department (2005). *Gujarat State Biodiversity Strategy and Action Plan.*

iv) Biodiversity

Birds are the most critical component of the biodiversity of Thol Lake. Apart from hosting its own breeding birds, this wetland also provides wintering ground for a large number of migratory waterfowl. Thol Lake has also been identified as an Important Bird Area in the country[1]. The various components of the biodiversity of the site are presented below.

v) Flora

The flora of the sanctuary consists of aquatic and terrestrial plants totaling about 100 species. The aquatic plants include:

- Submerged rooted vegetation: *Ceratophyllum demersum* and *Hydrilla veorticillata.*
- Free floating vegetation: Algae of different species like *Coscinodiscus marginatus, Coscinodiscus rheliatus, Rhizosolenia stolterfothii, Gyrosigma balticum, Navicula hennedyii.*
- Rooted floating vegetation: *Ipomoea aquatica, Neptunia oleracea*

Terrestrial vegetation of the sanctuary is of scrub type dominated by *Acacia nilotica.* The surrouonding landscape has species such as *Acacia nilotica, Prosopis chilensis, Prosopis cineraria, Salvadora oleoides, Salvadora persica* and *Zizyphus* sp. etc. A list of the terrestrial and aquatic plants recorded in the sanctuary is given in Table 2-40.

Table 2-40 List of Terrestrial and Aquatic Flora Recorded in Thol Lake Bird Sanctuary

Sl. No.	Scientific Name	Local Name	Habit	Status
1	*Balanites aegyptiaca*	Ingorio	Tree	Common
2	*Azadirachta indica*	Limdo	Tree	Cultivated
3	*Mangifera indica*	Ambo	Tree	Cultivated
4	*Butae monosperma*	Khakharo	Tree	Uncommon
5	*Derris indica*	Karanj	Tree	Cultivated
6	*Bauhinia racemosa*	Asotri	Tree	Uncommon
7	*Cassia fistula*	Garmalo	Tree	Cultivated
8	*Cassia roxburghii*	-	Tree	Cultivated
9	*Cassia siamea*	-	Tree	Cultivated
10	*Tamarindus indica*	Amli	Tree	Uncommon
11	*Acacia nilotica*	Desi Baval	Tree	Common
12	*Acacia* sp.	-	Tree	Cultivated
13	*Albizia odoratissima*	Dholo Sirisi	Tree	Cultivated
14	*Prosopis cineraria*	Khijado	Tree	Common
15	*Prosopis chilensis*	Gando Baval	Tree	Common
16	*Madhuca indica*	Mahudo	Tree	Uncommon
17	*Manilkara hexandra*	Rayan	Tree	Uncommon
18	*Salvadora oleoides*	Mithi Pilu	Tree	Common
19	*Salvadora persica*	Khari Pilu	Tree	Common
20	*Cordia gharaf*	Nani Gundi	Tree	Uncommon
21	*Holoptelea integrifolia*	Kanjo	Tree	Common
22	*Ficus religiosa*	Piplo	Tree	Cultivated
23	*Ficus virens*	Papal	Tree	Cultivated
24	*Capparis decidua*	Kerdo	Shrub	Common
25	*Capparis sepiaria*	Kanther	Shrub	Common
26	*Corchorus olitorius*	-	Shrubs	Uncommon
27	*Maytenus emarginata*	Viklo	Shrubs	Uncommon
28	*Zizyphus nummularia*	Chain Bor	Shrubs	Uncommon
29	*Alhagi pseudalhagi*	-	Shrubs	Uncommon
30	*Crotalaria burhia*	Kharshan	Shrubs	Uncommon
31	*Indigofera oblongifolia*	Ziladi	Shrubs	Uncommon

[1] Islam, M Z and Rahmani, A. (2004). *Important Bird Areas in India: Priority sites for conservation.* Bombay Natural History Society and Birdlife International

Sl. No.	Scientific Name	Local Name	Habit	Status
32	*Cassia auriculata*	Aval	Shrubs	Common
33	*Calotropis procera*	Nano akdo	Shrubs	Common
34	*Calotropis gigantea*	Akdo	Shrubs	Common
35	*Ipomoea fistulosa*	Naffat Val	Shrubs	Common
36	*Clerodendrum multiflorum*	Arani	Shrubs	Common
37	*Euphorbia nivulia*	Thor	Shrubs	Common
38	*Cocculus hirsutus*	Vevdi	Herbs	Common
39	*Cleome viscose*	Pili Talavani	Herbs	Common
40	*Bergia ammannioides*	-	Herbs	Common
41	*Bergia suffruticosa*	Ropatri	Herbs	Common
42	*Suaeda* sp.	-	Herbs	Uncommon
43	*Corchorus aestuans*	Chunch	Herbs	Common
44	*Corchorus fascicularis*	-	Herbs	Uncommon
45	*Corchorus* sp.	-	Herbs	Uncommon
46	*Tribulus terrestris*	Bethu Gokhru	Herbs	Common
47	*Alysicarpus* sp.	-	Herbs	Common
48	*Indigofera linnaei*	Fatakiya	Herbs	Common
49	*Melilotus alba*	jungli Methi	Herbs	Common
50	*Melilotus indica*	-	Herbs	Common
51	*Tephrosia purpurea*	Sarpankho	Herbs	Common
52	*Trigonella occulta*	-	Herbs	Common
53	*Cassia italica*	Mindhi aval	Herbs	Uncommon
54	*Cassia occidentalis*	Kasundri	Herbs	Common
55	*Cassia tora*	Kuvandio	Herbs	Common
56	*Neptunia oleracea*	Lajalu	Herbs	Common
57	*Glinus lotoides*	Mitho Okharad	Herbs	Common
58	*Oldenlandia sp.*	-	Herbs	Common
59	*Amberboa ramosa*	Bada Vard	Herbs	Uncommon
60	*Eclipta prostrata*	Bhangro	Herbs	Common
61	*Grangea maderaspatana*	Zinki Mundi	Herbs	Common
62	*Launaea procumbens*	Moti Bhonpatri	Herbs	Common
63	*Sphaeranthus indicus*	Gorakh Mundi	Herbs	Common
64	*Tridex procumbens*	Pardesi Bhangro	Herbs	Common
65	*Vernonia cineraria*	Sahadevi	Herbs	Common
66	*Xanthium strumarium*	Gadariyu	Herbs	Common
67	*Enicostema hyssopifolium*	Mamejevo	Herbs	Common
68	*Coldenia procumbens*	Basario Okharad	Herbs	Common
69	*Heliotropium indicum*	Hathisundho	Herbs	Common
70	*Convolvulus microphyllus*	Shankhavali	Herbs	Common
71	*Cressa cretica*	Khariyu	Herbs	Uncommon
72	*Evolvulus alsinoides*	Kali Shankhavali	Herbs	Common
73	*Ipomoea aquatica*	Nada ni Vel	Herbs	Common
74	*Datura metal*	Dholo Dhantura	Herbs	Common
75	*Solanum indicum*	Ubhi Ringani	Herbs	Uncommon
76	*Solanum sarattense*	Bhoy Ringani	Herbs	Common
77	*Martynia annua*	Vinchhudo	Herbs	Common
78	*Justicia simplex*	-	Herbs	Common
79	*Lapidogathis trinervis*	Haran Charo	Herbs	Common
80	*Peristrophe bicalyculata*	Kali Anghedi	Herbs	Common
81	*Ocimum basilicum*	Damro	Herbs	Common
82	*Ocimum canum*	Ran Tulsi	Herbs	Common
83	*Boerhavia diffusa*	Satodi	Herbs	Common
84	*Boerhavia verticillata*	Satado	Herbs	Common
85	*Achyranthes aspera*	Andhedo	Herbs	Common
86	*Pupalia lappacea*	Lampadi	Herbs	Common
87	*Chenopodium album*	Chil Bhaji	Herbs	Common
88	*Polygonum plebeium*	-	Herbs	Common
89	*Euphorbia hirta*	Dudheli	Herbs	Common
90	*Euphorbia orbiculata*	-	Herbs	Common
91	*Cyperus* sp.	-	Herbs	Common
92	*Cynodon dactylon*	Darba	Herbs	Common
93	*Eragrostis* sp.	-	Herbs	Common

Sl. No.	Scientific Name	Local Name	Habit	Status
94	*Cardiospermum halicacabum*	Kagdoliyo	Climber	Common
95	*Coccinia grandis*	Ghiloda	Climber	Common
96	*Mukia maderaspatana*	Chanak chibhdi	Climber	Common
97	*Trichosanthes cucumerina*	Jangli parval	Climber	Common
98	*Rivea hypocrateriformis*	Fang	Climber	Common

Source: GEER Foundation (2002): Ecological Study of Thol Lake Bird Sanctuary

vii) Fauna

Fishes: The fish species found in Thol Lake are *Ophiocephalus punctatus*,*Heteropneustes fossilis*, *Chela bacaila*,and *Barbus stigma.*

Amphibians and Reptiles: The GEER Foundation study has reported the following species from the area. Amphibians: Bull Frog (*Haplobatrachus tigerinus*), Marbled Toad (*Bufo stomaticus*)

Reptiles: Rat Snake (*Ptyas mucosus*), Cobra (*Naja naja*), Checkered Keelback (*Xenochropis piscator*), Garden Lizard (*Calotes versicolor*), Fan-throated Lizard (*Sitana pondiceriana*), Skink (*Mabuya* sp.), Bengal Monitor (*Varanus bengalensis*), Indian Flapshell Turtle (*Lissemys punctata*)

Mammals: Common Langur (*Presbytis entellus*) is the key mammalian species found in the area. The study team of GEER Foundation has reported Jungle Cat (*Felis chaus*), Common Mongoose (*Herpestes edwardsii*), Jackal (*Canis anrens),* Pale Hedgehog (*Paraechinus micropus*), Grey Musk Shrew (*Suncus murinus*), Indian Flying Fox (*Pteropus giganteus*), Indian Pipistrelle (*Pipistrellus coromandra*), Indian Hare (*Lepus nigricollis)*, Blue Bull (*Boselaphus tragocamelus*) and Feral Pig (*Sus scrofa*).

Faunal Species in Thol Lake Bird Sanctuary

Birds: The sanctuary has 150 species of birds of which 92 species are waterfowl belonging to 24 families as reported by the GEER Foundation study conducted during 1999- 2001. Of the total 92 species of waterfowl reported, 24 are residents, 38 are migrants with resident population and 30 are exclusively migrants. A list of the waterbirds recorded from Thol Lake is given in Table 2-41. A list of the globally threatened waterbird species found in the sanctuary is provided in Table 2-42.

Table 2-41 Checklist of Waterfowl seen at Thol Lake Bird Sanctuary

Sl. No.	English Name	Scientific Name	Migratory Sstatus
I.	Family: DENDROCYGNIDAE		
1.	Whistling -Duck	*Dendrocygna javanica*	Resident
II.	Family: ANATIDAE		
2.	Greylag Goose	*Anser anser*	Migratory
3.	Bar-Headed Goose	*Anser indicus*	Resident- Migratory
4.	Ruddy Shelduck	*Tadorna ferrugina*	Resident- Migratory
5.	Comb Duck	*Carina scutulata*	Resident
6.	Eurasian Wigeon	*Anas Penelope*	Migratory
7.	Mallard	*Anas platyrhynchos*	Resident- Migratory
8.	Spot-Billed Duck	*Anas poecilorhynca*	Resident- Migratory
9.	Northern Shoveler	*Anas clypeata*	Migratory
10.	Nortern Pintail	*Anas acuta*	Migratory
11.	Common Teal	*Anas crecca*	Migratory
12.	Common Pochard	*Aythya ferina*	Migratory
13.	Ferruginous Pochard	*Aythya nyroca*	Resident- Migratory
14.	Tufted Duck	*Aythya fuligula*	Migratory
III.	Family: ALCEDINIDAE		
15.	Common Kingfisher	*Alcedo atthis*	Resident- Migratory
IV.	Family: HALCYONIDAE		
16.	White-Throated Kingfisher	*Halcyon smyrnensis*	Resident
V.	Family: CERYLIDAE		
17.	Pied Kingfisher	*Ceryle rudis*	Resident
VI.	Family: STRIGIDAE		
18.	Brown Fish Owl	*Ketupa zeylonensis*	Resident
VII.	Family: GRUDAE		
19.	Sarus Crane	*Grus antigone*	Resident
20.	Demoiselle Crane	*Grus virgo*	Migratory
21.	Common Crane	*Grus grus*	Migratory
VIII.	Family: RALLIDAE		
22.	White-Breasted Waterhen	*Amourornis phoenicurus*	Resident
23.	Common Moorhen	*Gallinula chloropus*	Resident- Migratory
24.	Common Coot	*Fulica atra*	Resident- Migratory
IX.	Family: SCOLOPACIDAE		
25.	Black-tailed Godwit	*Limosa limosa*	Migratory
26.	Eurasian Curlew	*Numenitus arquata*	Migratory
27.	Spotted Redshank	*Tringa erythropus*	Migratory
28.	Common Redshank	*Tringa totanus*	Migratory
29.	Marsh Sandpiper	*Tringa stagnatilis*	Migratory
30.	Common Greenshank	*Tringa nebularia*	Migratory
31.	Green Sandpiper	*Tringa ochropus*	Resident- Migratory
32.	Wood Sandpiper	*Tringa glareola*	Migratory
33.	Common Sandpiper	*Actitis hypoleucos*	Resident- Migratory
34.	Little Stint	*Calidris minuta*	Migratory
35.	Temminck's Stint	*Calidris temmickii*	Migratory
36.	Ruff	*Philomachus pugnax*	Migratory
X.	Family: JACANIDAE		
37.	Pheasant-Tailed Jacana	*Hydrophasianus chirurgus*	Resident- Migratory
38.	Bronze-Winged Jacana	*Metopidus indicus*	Resident
XI.	Family: BURHINIDAE		
39.	Great-Thick Knee	*Esacus recurvirostris*	Resident
XII.	Family: CHARADRIIDAE		
40.	Black-Winged Stilt	*Himantopus himantopus*	Resident- Migratory
41.	Pied Avocet	*Recurvirostra avosetta*	Resident- Migratory
42.	Pacific Golden Plover	*Pluvialis fulva*	Migratory
43.	Little Ringed Plover	*Charadrius dubius*	Resident- Migratory

Sl. No.	English Name	Scientific Name	Migratory Sstatus
44.	Kentish Plover	*Charadrius alexandrinus*	Resident- Migratory
45.	Lesser Sand Plover	*Charadrius mongolus*	Resident- Migratory
46.	Red-wattled Lapwing	*Vanellus indicus*	Resident
47.	Sociable Lapwing	*Vanellus gregarius*	Migratory
48.	White-Tailed Lapwing	*Vanellus leucurus*	Migratory
XIII.	Family: GLAREOLIDAE		
49.	Small Pratincole	*Glareola lacteal*	Resident
XIV.	Family: LARIDAE		
50.	Brown-Headed Gull	*Larus brunnicephalus*	Resident- Migratory
51.	Gull-Billed Tern	*Gelochelidon nilotica*	Resident- Migratory
52.	River Tern	*Sterna aurantia*	Resident
53.	Black-Bellied Tern	*Chelidonicus hybridus*	Resident- Migratory
54.	Whiskered Tern	*Chelidonicus aeruginosus*	Migratory
XV.	Family: ACCIPITRIDAE		
55.	Eurasian Marsh Harrier	*Circus aeruginosus*	Migratory
XVI.	Family: PODICIPEDIDAE		
56.	Little Grebe	*Tachybaptus ruficollis*	Resident- Migratory
XVII.	Family: PHALCROCORACIDAE		
57.	Little Cormorant	*Phalacrocorax niger*	Resident- Migratory
XVIII.	Family: ANHINGIDAE		
58.	Darter	*Anhinga melanogaster*	Resident- Migratory
XIX.	Family: ARDEIDAE		
59.	Little Eagret	*Egretta garzetta*	Resident
60.	Western Reef Heron	*Egretta gularis*	Resident- Migratory
61.	Grey Heron	*Ardea cinerea*	Resident- Migratory
62.	Purple Heron	*Ardea purpurea*	Resident- Migratory
63.	Great Eagret	*Casmerodius albus*	Resident- Migratory
64.	Intermediate Eagret	*Mesophoyx intermedia*	Resident- Migratory
65.	Cattle Eagret	*Bubulcus ibis*	Resident- Migratory
66.	Indian Pond Heron	*Ardeola grayii*	Resident
67.	Little Heron	*Butorides striatus*	Resident
68.	Black-crowned Night Heron	*Nycticorax nycticorax*	Resident
XX.	Family: PHOENICOPTERIDAE		
69.	Greater Flamingo	*Phoenicopterus rubber*	Resident- Migratory
XXI.	Family: THRESKIORNITHIDAE		
70.	Glossy Ibis	*Plegadis falcinellus*	Resident- Migratory
71.	Black-Headed Ibis	*Threskiornis melanocephalus*	Resident
72.	Black Ibis	*Pseudibis papillosa*	Resident
73.	Eurasian Spoonbill	*Platalea leucorodia*	Resident- Migratory
XXII.	Family: PELECANIDAE		
74.	Great White Pelican	*Pelecanus onocrotalus*	Resident- Migratory
XXIII.	Family: CICONIIDAE		
75.	Painted Stork	*Mycteria leucocephala*	Resident
76.	Asian Openbill	*Anastomus oscitans*	Resident
77.	Woolly-Necked Stork	*Ciconia episcopus*	Resident
78.	White Stork	*Ciconia ciconia*	Migratory
XXIV.	Family: PASSERIDAE		
79.	White Wagtail	*Motacilla alba*	Resident- Migratory
80.	Yellow Wagtail	*Motacilla flava*	Resident- Migratory
81.	Cotton Pygmy-Goose	*Nettapus coromandelianus*	Resident
82.	Garganey	*Anas quequedula*	Migratory
83.	Gadwall	*Anas strepera*	Migratory
84.	Purple Swamphen	*Porphyrio porphyrio*	Resident
85.	Red-necked Phalarope	*Phalaropus lobatus*	Migratory
86.	Oriental Pratincole	*Glariola maldivarum*	Resident
87.	Little Tern	*Sterna albifrons*	Resident- Migratory

Sl. No.	English Name	Scientific Name	Migratory Sstatus
88.	Yellow-legged/Huglin's Gull	*Larus cachinnans/huglinii*	Migratory
89.	Great Cormorant	*Phalocrocorax carbo*	Resident- Migratory
90.	Dalatian Pelican	*Pelecanus crispus*	Migratory
91.	Greater Spotted Eagle	*Aquila clanga*	Resident- Migratory
92.	Osprey	*Pandion halatus*	Resident- Migratory

Source: GEER Foundation (2002): Ecological Study of Thol Lake Wildlife (Bird) Sanctuary

Table 2-42 Globally Threatened Waterfowl Species Recorded at Thol Lake Bird Sanctuary as per Red List of Birdlife International (2001)

Sl. No.	Waterfowl Species	Status of threat
1.	Sarus Crane (*Grus antigone*)	Vulnerable
2.	Sociable Lapwing (*Vanellus gregarious)*	Vulnerable
3.	Black-Bellied Tern (*Chelidonicus hybridus)*	Near Threatened
4.	Oriental Darter (*Anhinga melanogaster*)	Near Threatened
5.	Black-Headed Ibis (*Threskiornis melanocephalus)*	Near Threatened
6.	Painted Stork (*Mycteria leucocephala)*	Near Threatened
7.	Greater Spotted Eagle (*Aquila clanga)*	Vulnerable
8.	Ferruginous Pochard (*Aythya nyroca)*	Near Threatened
9.	Dalatian Pelican (*Pelecanus crispus)*	Conservation Dependent

Source: GEER Foundation (2002): Ecological Study of Thol Lake Bird Sanctuary

Seasonal variation in avifauna

There is considerable seasonal variation in species richness in Thol Lake, corresponding to the migratory dynamics and the changing level of water in the lake also has a role in the changing species richness. The GEER Foundation study has found that the highest number of species is found in October and November while the lowest number of species in February and March. The monthly composition of resident, resident-migrant and migrant waterfowl species between September 1999 and March 2000 is given in Table 2-43, the same features between August 2000 and February 2001 are given in Table 2-44.

Table 2-43 Monthly Composition of Resident (R), Resident-Migrant (RM) and Migrant (M) Waterfowl Species in Thol Lake Bird Sanctuary during 1999 – 2000

Month	Total	Number of Species			Percentage		
		R	RM	M	R	RM	M
September 1999	28	05	13	10	18.9	46.4	35.7
October 1999	38	12	15	11	31.6	39.5	28.9
November 1999	38	11	15	12	28.9	39.5	31.6
December 1999	37	08	15	14	21.6	40.6	37.8
January 2000	33	08	12	13	24.2	36.4	39.4
February 2000	24	03	11	10	12.5	45.8	41.7
March 2000	13	03	05	05	23.0	38.5	38.5

Source: GEER Foundation (2002): Ecological Study of Thol Lake Bird Sanctuary

Table 2-44 Monthly Composition of Resident (R), Resident-Migrant (RM) and Migrant (M) Waterfowl Species in Thol Lake Bird Sanctuary during 2000 – 2001

Month	Total	Number of Species			Percentage		
		R	RM	M	R	RM	M
August 2000	33	26	2	5	79	15	6
September 2000	42	21	6	15	50	36	14
October 2000	45	19	10	16	42	36	22
November 2000	38	12	9	17	32	44	24
December 2000	39	9	9	21	23	54	23
January 2001	32	9	9	14	28	44	28
February 2001	12	2	3	7	17	58	25

Source: GEER Foundation (2002): Ecological Study of Thol Lake Bird Sanctuary

Relative abundance of species:

Scolopacidae (waders) and *Anatidae* (ducks and geese) are the dominant families found in Thol. The *Anatidae* family is represented by over 16 species and the period between September and November is peak in the population of these birds. The maximum number of 11 species of ducks observed between 2000 and 2001 is given in Table 2-45. The abundance of some common waterfowl species between 1999 and 2000 is presented in Table 2-46. It has been observed that with the influx of migrants, the resident birds tend move afar from the sanctuary.

Table 2-45 Abundance of Ducks in Thol Lake Bird Sanctuary between August 2000 and February 2001

Sl. No.	English Name	Scientific Name	R/ RM/ M	Highest Number	Month
1	Northern Shoveler	*Anas clypeata*	M	1,300	October
2	Common Teal	*Anas crecca*	M	550	October
3	Greylag Goose	*Anser anser*	M	410	December
4	Nortern Pintail	*Anas acuta*	M	400	October
5	Comb Duck	*Carina scutulata*	R	258	September
6	Eurasian Wigeon	*Anas Penelope*	M	100	November
7	Ruddy Shelduck	*Tadorna ferrugina*	RM	53	November
8	Spot-Billed Duck	*Anas poecilorhynca*	RM	50	September
9	Common Pochard	*Aythya ferina*	M	4	November
10	Ferruginous Pochard	*Aythya nyroca*	RM	3	January
11	Tufted Duck	*Aythya fuligula*	M	1	December

Source: GEER Foundation (2002): Ecological Study of Thol Lake Wildlife (Bird) Sanctuary

Table 2-46 Highest number of some common waterfowl species during September 1999 - March 2000

Sl. No.	English Name	Scientific Name	R/ RM/ M	Highest Number	Month
1	Ruff	*Philomachus pugnax*	M	60,000	December
2	Common Crane	*Grus grus*	M	1,570	December
3	Greater Flamingo	*Phoenicopterus rubber*	RM	1,000	September
4	River Tern	*Sterna aurantia*	R	550	September
5	Greylag Goose	*Anser anser*	M	400	December
6	Eurasian Spoonbill	*Platalea leucorodia*	RM	240	October
7	Glossy Ibis	*Plegadis falcinellus*	RM	215	September
8	Black-tailed Godwit	*Limosa limosa*	M	210	December
9	Painted Stork	*Mycteria leucocephala*	R	160	September
10	Black-Headed Ibis	*Threskiornis melanocephalus*	R	140	October
11	Ruddy Shelduck	*Tadorna ferrugina*	RM	100	December
12	Black-Winged Stilt	*Himantopus himantopus*	RM	90	October
13	Pied Avocet	*Recurvirostra avosetta*	RM	83	January

Source: GEER Foundation (2002): Ecological Study of Thol Lake Wildlife (Bird) Sanctuary

Key Bird species:

Ruff (*Philomachus pugnax*): Ruff is the most abundant bird in the wetland in the winter months. The bird prefers there due to the presence of paddy fields in its environs which serve as feeding grounds for this migrant from the northern latitudes.

Thol Lake Bird Sanctuary is widely regarded as an important site for the bird.

Common Crane (*Grus grus*): This winter migrant peaks in population in November with over 1,500 birds and by March when the lake almost dries up the bird's population thins out. The Common Crane uses the sanctuary mainly for roosting, while the forage in the nearby paddy fields.

Sarus Crane (*Grus antigone*): This tallest flying bird of the world is resident in Thol Sanctuary, and has at least five breeding pairs there. It is regarded as a vulnerable species by BirdLife International. The bird is also seen in the farmlands in other parts of the State and the people by and large protect the species and its nesting sites.

Greater Flamingo (*Phoenicopterus rubber*): Greater Flammingo that has the largest breeding colony in Rann of Kutch of Gujarat is seen here in small but significant numbers. A flock of 12 birds was seen in the month of July in the field reconnaissance of S-ESIMMS. This bird has both resident and migrant populations in the state.

Great White Pelican (*Pelecanus onocrotalus*): This gregarious, fish eating waterfowl has both resident and wintering populations in Gujarat. More than 1000 individuals were seen at Thol Lake Bird Sanctuary. The bird needs a large daily intake of fish and therefore the health of the aquatic ecosystem is critical for its survival. Great White Pelican was observed in some of the waterbodies near Thol Lake Bird Sanctuary in the S-ESIMMS

The Thol Lake Bird Sanctuary is thus an important wetland site in Gujarat, harbouring resident waterfowl and hosting long distance migrants in the winter. However, the sanctuary also faces a number of threats to its ecological integrity. The withdrawl of water for irrigation depleting the water level remains a serious problem. Residues of chemical fertilisers and pesticides reach the water body from the catchment area and this eventually gets into the food chain. There are seven oil wells located in the sanctuary area which pump crude oil. Some of the ditches in the area contain spilled oil, besides there are potential for oil spill into the major mass of the waterbody. The livestock using the wetland also are a source of disturbance to the birds.

b) Impacts assesment

- Thol Lake Bird Sanctuary is located in the east of the DFC alignment. The distance between Thol Lake Bird Sanctuary and DFC alignment varies from 0.7 km to 1.5 km. Placed at this distance, the alignment is not likely to have any significant impact on the bird sanctuary. Academics at M. S. Baroda University, Vadodara and North Gujarat University, Patan also concur with this conclusion. However, the habitat of migratory waterfowl will be disturbed due to noise generated from construction machinery and vehicle during construction period.
- There is a likelihood of electrocution, rarely though, of some large waterbirds which might use the electrical poles of the DFC line for perching/roosting.
- Nilgai (*Boselaphus tragocamelus*) is found in the surrounding agricultural fields. It is widely

regarded as a pest species in most parts of Gujarat. Due to acquisition of agricultural land for construction of DFC, there is likely to be impact on their habitat and food source, though the impact will be limited to the tract of land taken up for the ROW. However, being a versatile feeder, they are likely to disperse to surrounding villages. Besides, the rail tack cannot restrict their movement and they will cross over to the other side of the village for feeding.

c) Mitigation Measures

- As per the field survey, interview of academic experts, and interaction with Forest Department and review of secondary data, it is confirmed that migratory waterfowls are found at Thol from October to March. As the construction activities are likely to disturb the birds, construction work in this stretch of DFC should be avoided during these months, and should be limited the months of April to August. This will minimise the impact on the migratory waterfowl as well as resident birds.
- Setting up of construction yard or construction camp should be prohibited within 3 km from the boundary of the sanctuary.
- For movement of cattle underpass should be provided after every 2 km
- Additional culverts (box/pipe) should be provided after every 1 km (in-between the two underpasses) for crossing of reptiles and small mammals like common langur, jungle cat, jackal etc. in this stretch.
- Metal beam crash barrier should be provided along both sides of the corridor in this stretch to minimise the chances of accident.
- During the operation phase, the train speed should be restricted in this stretch and adequate sign boards of high-intensity grade should be provided here to this effect.
- The electrical design in this stretch of DFC should include measures to make the line bird-proof, by providing the provision of spikes on poles, insulation of wires where possible, etc. In doing so reference may be made to the document Caution Electrocution: Suggested Practices for Bird Protection on Power Lines published by NABU- German Society for Nature Conservation in 2006.
- Adequate number of sign boards of high-intensity grade should be provided with warning sing in this stretch for restriction of speed.

2.2 RAJASTHAN

2.2.1 General

Rajasthan is located in the northwestern part of the subcontinent. It is bounded on the west and northwest by Pakistan, on the north and northeast by the states of Punjab, Haryana, and Uttar Pradesh, on the east and southeast by the states of Uttar Pradesh and Madhya Pradesh, and on the southwest by the state of Gujarat. The state has an area of 342,239 km^2.

In Rajasthan, the entire stretch of the DFC alignment passes in parallel to the existing railway track, on the eastern side, and its length is approximately 537 km in total (SAPROF chainnage: 319.3 km-853.4 km, 899.7 km-902.3 km). The surrounding areas of the DFC alignment in the state is mainly agricultural land (60%), and 10 % of the area having settlement while 27 % of the surrounding area is regarded as barren land. It also passes, in short lengths, through scrub forests. The rocky hills along the alignment are barely utilised by human beings. Only limited plant species can grow in the area mainly due to the paucity of rainfall.

From the Gujarat border the DFC alignment in Rajasthan passes through agricultural plains on the banks of the Banas and Luni Rivers and the several streams that join them. The water bodies are mainly seasonal with hardly any water during the summer months. Although the land use pattern along the alignment is predominantly agricultural, farming is mainly rain-dependent, the farms left fallow in the dry season.

Three main seasonal crops, namely Rabi crop during winter season, Zayad crop during summer season and Kharif crop during rainy season are cultivated. The food crops of the winter season include the cereals, mainly *Triticum aestivum*, *Hordeum vulagare* and few pulses such as *Cicer arientium* and *Pisum sativum*. During summers, a few cucurbitaceous plants are cultivated for fruits like the species of *Citrullus*, *Cucumis*, *Cucurbita*, *Lageneria*, *Luffa*, and *Momordica*. The food crops of the rainy season include cereals such as *Echinochloa frumentacea*, *Oryza sativa*, *Pennisetum typhoides*, *Setaria italica*, *Sorghum saccharatum*, and *Zea mays*. and pulses. The important vegetables of the rainy season are *Abelmoschus esculentus*, *Capsicum annuum*, *Lablab purpureus*, *Solanum melongena*, and *Cyamopsis tetragonoloba*.

The climate of the area is moderate and tropical characterized by a hot summer from March to Mid June, a humid monsoon or rainy season stretching from Mid June to September, a short pleasant post-monsoon during October and November, and a cool winter spanning between December and February. The rainfall is of monsoonic type and about 70-80% of the total annual rainfall is received during the monsoon period where as during remaining period the light showers are received. Past meteorological data of the nearest IMD observatory located at Alwar, Sikar, Jaipur, Ajmer, Jawai Bandh and Abu, which deemed representative of the study area, has been summarized in Table 2-47.

Along the project corridor, January is coldest month with the mean daily minimum temperature of 5.1-8.2°C and maximum of 22.0-26.1°C (Table 2-47). March onwards the temperature begins to rise rapidly and May and June are the hottest months. Thereafter, the advent of monsoon brings down the temperature. Monsoon withdraws in October but the temperature continues to fall gradually up to January in the middle of winter.

Table 2-47 Summary of Climatological Data of the Study Corridor

(Based on Records of IMD, 1951-80)

Parameter	IST	Monthly Range	Annual Mean/Total
Alwar			
Mean daily maximum temperature (°C)		22.0 (Jan) – 40.6 (May)	32.2
Mean daily minimum temperature (°C)		7.3 (Jan) – 29.5 (Jun)	19.2
Relative humidity (%)	0830	44 (May) - 81 (Dec)	67
	1730	32 (May) – 65 (Jul)	48
Total rainfall (mm)		6.2 (Apr) – 257.5 (Aug)	774.6
Wind speed (km/h)		1.7 (Dec) – 6.8 (June)	3.6
Sikar			
Mean daily maximum temperature (°C)		22.5 (Jan) – 39.2 (May)	32.0
Mean daily minimum temperature (°C)		5.1 (Jan) – 26.7 (Jun)	16.7
Relative humidity (%)	0830	45 (Apr) – 80 (Aug)	61
	1730	28 (Apr) – 64 (Aug)	42
Total rainfall (mm)		3.4 (Dec) – 202.2 (July)	507.8
Wind speed (km/h)		3.7 (Nov) – 8.7 (June)	5.9
Jaipur			
Mean daily maximum temperature (°C)		22.5 (Jan) – 40.3 (May)	31.9
Mean daily minimum temperature (°C)		7.8 (Jan) – 27.2 (Jun)	18.5

Parameter	IST	Monthly Range	Annual Mean/Total
Relative humidity (%)	0830	30 (Apr) – 82 (Aug)	55
	1730	16 (Apr) – 70 (Aug)	36
Total rainfall (mm)		3.2 (Nov) – 231.2 (Aug)	673.9
Wind speed (km/h)		3.9 (Nov) – 12.6 (May)	7.8
Ajmer			
Mean daily maximum temperature (°C)		23.1 (Jan) – 39.9 (May)	31.8
Mean daily minimum temperature (°C)		6.7 (Jan) – 26.9 (Jun)	18.2
Relative humidity (%)	0830	34 (Apr) – 81 (Aug)	59
	1730	21 (Apr) – 67 (Aug)	37
Total rainfall (mm)		1.6 (Dec) – 236.7 (Jul)	650.0
Wind speed (km/h)		3.4 (Dec) – 12.4 (May)	7.7
Jawai Bandh			
Mean daily maximum temperature (°C)		26.0 (Jan) – 40.3 (May)	33.1
Mean daily minimum temperature (°C)		8.2 (Jan) – 26.5 (Jun)	19.1
Relative humidity (%)	0830	51 (Apr) – 83 (Aug)	68
	1730	36 (Apr) – 71 (Aug)	49
Total rainfall (mm)		0.7 (Dec) – 199.9 (Jul)	627.5
Wind speed (km/h)		2.7 (Dec) – 10.0 (June)	5.7
Abu			
Mean daily maximum temperature (°C)		19.8 (Jan) – 31.8 (May)	25.4
Mean daily minimum temperature (°C)		7.8 (Jan) – 21.1 (May)	15.5
Relative humidity (%)	0830	30 (Apr) – 95 (Aug)	57
	1730	21 (Apr) – 88 (Aug)	46
Total rainfall (mm)		1.7 (Feb) – 592.7 (Jul)	1675.0
Wind speed (km/h)		3.3 (Dec) – 11.4 (Jul)	7.2

Note: Based on Records of IMD, 1951-80

The air along the project corridor is fairly humid through the major part of the year and the mean relative humidity rises to above 75% during the monsoon months, particularly July to September. The highest mean relative humidity is recorded in August (80-95% in the morning and 64-88% in the evening), a wet monsoon month and the lowest mean relative humidity is recorded in April and May (30-51% in the morning and 16-36% in the evening). As usual, the humidity in the morning (0830 IST) is more than that in the evening (1730 IST) during all the months. The total annual rainfall received along the project corridor is about 507.8-1675.0 mm. The annual mean wind speed along the project corridor is around 3.6-7.8 km/h.

Three physiographic regions may be recognized in Rajasthan based on floral composition and seasonal changes, namely – The Western Sandy Desert, Aravalli Range and The Area in the East of Aravalli. The DFC alignment is mainly passing through the area in the east of Aravalli Region.

The eastern part of Sirohi District falls under Bhorat Plateau. The average elevation of this plateau is 1,225 m. The vegetation on the hills is of mixed deciduous type, showing three altitudinal zones with the higher elevations dominated by *Boswellia serrata*, associated with *Anogeissus latifolia, Lannea coromandelica,* and *Sterculia urens*. In the middle zone *Anogeissus pendula* is dominant and it is associated with *Albizia odoratissima, Diospyros melanoxylon, Holoptelea integrifolia,* and *Wrightia tinctoria*. The lower elevations are dominated by *Cassia auriculata*, in association with *Annona squamosa, Butea monosperma, Dichrostachys cinerea*, and *Diospyros cordifolia*. Shrubs and under-shrubs are usually not affected by elevation, the common ones being *Capparis sepiaria, Dyerophytum indicum, Grewia flavescens, Justicia adhatoda, Spermadictyon suaveloens*, and *Woodfordia fruticosa*.

The western Ajmer, southern part of Alwar District constitutes 'Banas Basin'. The maximum height of hills is about 582 m near Deogarh. The forests located here are of with *Acacia senegal, Bauhinia racemosa, Boswellia serrata, Capparis sepiaria, Cassia fistula, Dichrostachys cinerea, Diospyros melanoxylon, Lannea coromandelica,* and *Wrightia tinctoria.* There is no significant elevational effect on the vegetation of Banas basin except that *Boswellia serrata* becomes more abundant at the summit of the hills and *Butea monosperma* and *Cassia auriculata* on the outskirts.

North-eastern hilly region (Alwar District) is traversed in the north and northeast to south and southeast by a number of parallel outliers of Aravallis rising up to 800 m. The hill slopes are excessively stony and the vegetation shows three distinct elevation zones. The higher zone is dominated by *Boswellia serrata*, the middle zone is dominated by *Anogeissus pendula* and in the basal zone *Acacia niotica, Dichrostachys cinerea, Butea monosperma, Tecomella undulata* etc. grow almost in equal proportions. The vegetation in such habitats is very sparse, stunted and bushy with plants like spiny Euphorbias and Acacias, Diospyros cordifolia, and D. montana.

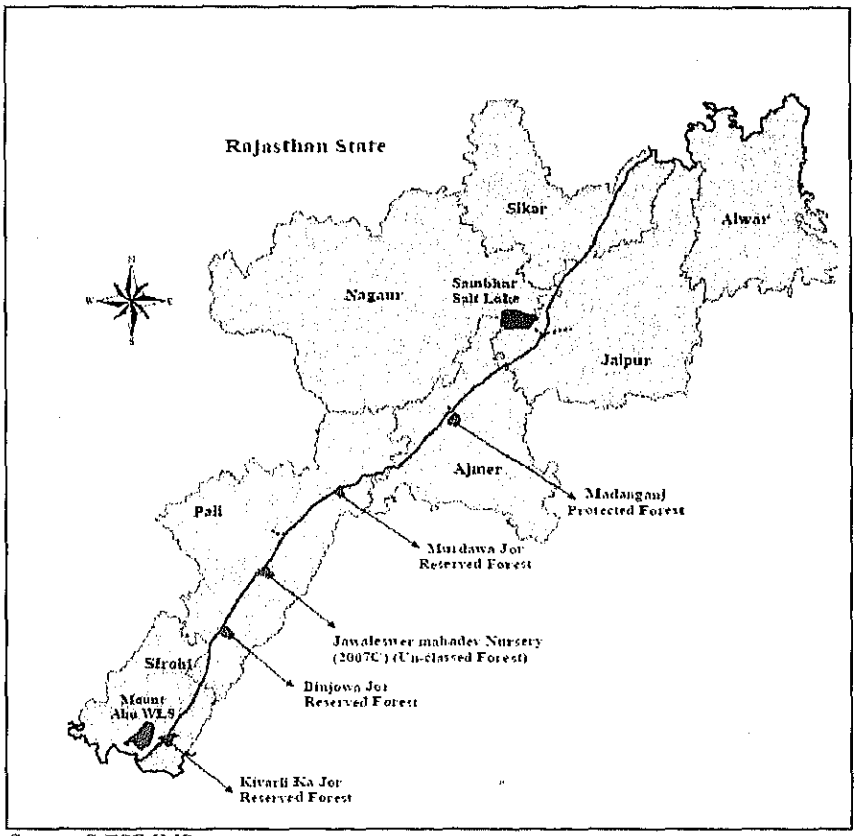
During the rainy season, the area presents a glorious appearance of a green carpet of semi-xerophytic and meadow herbs which help in increasing the humus content of the soil. The rainy season herbs are dominated by leguminous plants like species of Alysicarpus, Cassia, Crotalaria, Indigofea, Psoralea, Tephrosia, Vigna etc. The common associates of the above are: *Aristolochia bracteolate, Borreria articularis, Cleome gynandra, C. viscose, Convolvulus prostrates, Evolvulus alsinoides, Glossocardia bosvallea, Merremia tridentate, Polygala erioptera, Tridax procumbens* and several grasses among which Aristida, Cenchrus, Chloris, Eragrostis, Tragus, and Urochloa are more common.

In Rajasthan, DFC alignment passes through three Reserved Forest and one Un-classed Forest. The Mt. Abu Wildlife Sanctuary, which is a biodiversity rich area in the Aravalli mountain system, is located approximately 4.5 km west of the existing railway. In the area between the alignment and sanctuary, the major river of Banas, National Highway No.14 and human settlement areas are located (seasonal features of the sanctuary is discussed later).

In the middle of the state, the alignment passes through barren lands comprised of rocky hills, between north of the existing Haripur Railway Station to west of existing Beawar Railway Station. In the area, only limited seasonal growth of the herbal plants and scattered grass growth can be seen in the rainy season, while they dry out in the dry season.

In the northern part of Rajasthan, the DFC alignment passes through the settlement areas and agricultural areas. Approximately 5.5 km west of the existing railway is located the nearest boundary of the Sambarh Lake Ramsar site, which is an important site for wintering waterbirds. The possible impact of the project on the lake is discussed later based on secondary information from long term studies. Location of forests, protected areas along the DFC alignment in Rajasthan is shown in Figure 2-6.

The natural environmental study in the S-ESIMMS mainly focussed on the directly affected natural environment, namely, the forest areas located close to the existing railway track and also the wildlife sanctuaries in the vicinity of the alignment though its course is at a relatively safe distance from the sanctuaries, on the assumption that some movement of the animals occur from and to the sanctuaries.



Source: S-ESIMMS

Figure 2-6 Location of Forests and Protected Areas along the DFC Alignment in Rajasthan

2.2.2 Flora

(1) Study Methodology

The objective of the survey is to verify impacts on the flora by the development of the Dedicated Freight Corridor and the relevant facilities by collecting supplementary secondary data and conducting the supplemental field surveys.

- To identify the species of flora along the final alignment and the boundaries of the relevant facilities, location of Reserved Forest/ Protected Forest/ Un-classed Forest along the final alignment, reconnaissance survey has been conducted in association with Range Officer/ Forest Guards of the State Forest Department. The exact location of forest along the final alignment was confirmed through interview of forest officials.
- To identify the directly affected trees by the railway construction, visual counting method (walk through the railway track) has been adopted to count the number of trees to be felled for construction of DFC. Trees has more than 30 cm girth size (diameter) and 1.5m of height exist within 50 m from the from the centerline of the last track on the eastern side were counted. The survey was carried out from 20th August to 15th September, 2008.
- Supplemental secondary data like district wise Working Plan of the Forest Division, Management Plan of Wildlife Sanctuary, literature etc. have also been collected to verify the survey results and to gather information about the seasonal changes along the track.
- To characterize the vegetation of Wildlife Sanctuary/ Reserved Forest area, standard quadrate method and random sampling approach has been adopted to update the ESIMMS. The quadrate technique is easy to use in communities with a profile low enough that a frame

can be placed over the area to be sampled and also appropriate for forest communities that are open enough to allow plot boundaries to be marked easily and accurately with a tape measure. Quadrate survey and random sampling have been conducted in those places where no data was collected during the ESIMMS. The detailed methodology is given below:

In summarizing quadrate data, density, dominance, and frequency values can be determined for each species.

Frequency refers how widely species is distributed among the same plot. This is indicative of the dispersion of a particular species in a community.

Density refers to the number of individuals of a particular species in a unit area. This is the primary character of a community.

Dominance refers which species is the largest in terms of its presence. This is a measure of the relative importance of a species in the particular community.

For a particular species, these values may be expressed as ***relative frequency, relative density*** and ***relative dominance,*** which show the percentage of the individual species' value with respect to the total for all species. Relative values for frequency, density and dominance can be combined into a single ***importance value index,*** which combines these three somewhat different measures of the importance of the species in the community. These values are calculated by the following equations:

Quadrate Size = 10 x 10 m = 100 m^2 **Scale** = Per m^2

$$\textbf{Frequency (F)} = \frac{\text{Total no. of quadrates in which the species occur x 100}}{\text{Total No of quadrate studied}}$$

$$\textbf{Relative Frequency of a species (RF)} = \frac{\text{Frequency of the species in stand x 100}}{\text{Sum of the frequencies for all species in stand}}$$

$$\textbf{Density of a species per unit area (D)} = \frac{\text{Total no. of individuals of species in all the sample plot}}{\text{Total No of sample plots studied}}$$

$$\textbf{Relative density of a species (RD)} = \frac{\text{Total no of individuals of a species x 100}}{\text{Total No of individual of all species}}$$

$$\textbf{Abundance of a species (AB)} = \frac{\text{Total no of individuals of the species in all Quadrates}}{\text{Total No of Quadrates in which the species occured}}$$

$$\textbf{Relative Dominauce of the species (RDO)} = \frac{\text{Total Basal area of a species in all the quadrates x 100}}{\text{Total Basal area of all the species in all the quadrates}}$$

$$\textbf{Index of Similarity} = \frac{\text{2 X No. of common species x 100}}{\text{Total number of species in both associations}}$$

Importance value Index = Relative Frequency + Relative Density + Relative Dominance

(2) Major Findings

1) Vegetation along the DFC

In Rajasthan, along the existing railway track, there are private trees, government trees and plantation raised by the Forest Department on railway land. Tree species and shrubs exist within the proposed ROW is presented in Table 2-48. No endangered or rare tree species is reported within the proposed ROW by the Forest Department. For construction of DFC, approximate number of trees to be felled in Rajasthan is 14,447. Station-wise number of trees to be felled is presented inTable 2-49.

Table 2-48 List of Flora Exist within the Proposed ROW in Rajasthan

S. No	Local Name	Botanical Name
	TREES	
1	Aal	*Morinda tinctoria*
2	Aam	*Mangifera indica*
3	Anjeer	*Ficus palmata*
4	Ankol	*Alangium salvifolium*
5	Anola	*Emblica officinalis*
6	Arjun	*Terminalia arjun*
7	Aritha	*Sapindus emarginatus*
8	Ashok	*Polyalthia jongifolia*
9	Babul	*Acacia Arabica Wild*
10	Bad	*Ficus bengalensis*
11	Bahera	*Terminalia belerica*
12	Bakain	*Melia azedarach*
13	Barna	*Crataeva religiosa*
14	Bija	*Pterocarpus marsupium*
15	Bilayti Babul	*Prosopis juliflora*
16	Ber	*Zizyphus mauratiana*
17	Chhoti Jamun	*Syzygium heyneana*
18	Deshi babul	*Acacia nilotica*
19	Eucalyptus	*Eucalyptus sp.*
20	Gharvolia	*Gharvolia robusta*
21	Ghatbor	*Zizyphus glaberrium*
22	Gular	*Ficus glomerata*
23	Hingotia	*Balanites aegyptica*
24	Imli	*Tamarindus indica*
25	Izarail babul	*Acacia tortlis*
26	Jal (Pilu)	*Salvadora oleoides*
27	Jamun	*Syzygium cuminii*
28	Jangal jalebi	*Pithecolobium dulce*
29	Jhariber	*Ziziphus nummularia*
30	Kachnar	*Bauhinia variegata*
31	Kadam	*Anthocephalus indicus*
32	Kakon	*Flacourtia ramontchi*
33	Kanti	*Flacourtia indica*
34	Karanji	*Pongamia pinnata*
35	Karmala	*Cassia fistula*
36	Khajur	*Phoenix sylvestris*
37	Khair	*Acacia catechu*
38	Khejri	*Prosopis sp.*
39	Kumtha	*Acacia Senegal Wild*
40	Kupela	*Mallotus philippensis*
41	Mahua	*Madhuca indica*
42	Neem	*Azadirachta indica*
43	Nem chameli	*Millingtonia hortensis*
44	Nimboo	*Citrus madica*
45	Padar	*Stereospermum suveolens*
46	Pakar	*Ficus lacor*
47	Papal	*Ficus rilegiusa*

S. No	Local Name	Botanical Name
48	Rohan	*Soymida febrifuga*
49	Shahtoot	*Morus alba*
50	Shisham	*Dalbergia sissoo*
51	Shisham kala	*Dalbergia latifolia*
52	Siris kala	*Albizzia lebbek*
53	Siris Safed	*Albizzia odoratissima*
54	Tamboli	*Ehretia laevis*
55	Vilayti khejra	*Prosopis juliflora*
	SHRUBS	
56	Arni	*Clerodendron viscosum*
57	Bekari	*Indigofera astragalina*
58	Dhatura	*Datura stramonium*
59	Dhatura	*Datura inoxia*
60	Jal	*Hiptage benghalensis*
61	Jhandberi	*Zizyphus nummularia*
62	Lantana	*Lantana camara*
63	Nagphani	*Opuntia dillenii*
64	Thor	*Euphorbia ligularia*
65	Thor	*Euphorbia neriifolia*

Source: Field Survey during the month of August 2008

Table 2-49 Approximate Number of Trees to be Felled in Rajasthan

District	Station Name	No. of trees	Major Species
Sikar	Dabla to Neem Ka Thana	315	*Azadirachta indica, Acacia nilotica, Acacia tortlis, Eucalyptus sp., Dalbergia sissoo*
	Neem ka Thana to Kanwat	225	*Azadirachta indica, Acacia nilotica, Acacia tortlis, Zizyphus mauratiana, Tamarindus indica*
	Kanwat to Srimadhopur	156	*Acacia nilotica, Acacia tortlis, Acacia catechu*
	Srimadhopur to Reengus	145	*Prosopis sp., Prosopis juliflora Acacia nilotica, Acacia tortlis, Morinda tinctoria, Zizyphus mauratiana*
	Sub-total	841	
Jaipur	Reengus to Kishanmanpura	61	*Azadirachta indica, Acacia nilotica, Acacia tortlis, Morinda tinctoria, Tamarindus indica*
	Kishanmanpura to Badhal	80	*Azadirachta indica, Acacia nilotica, Acacia tortlis, Morinda tinctoria*
	Badhal to Renwal	150	*Azadirachta indica, Acacia nilotica, Acacia tortlis, Prosopis sp.*
	Renwal to Phulera	210	*Azadirachta indica, Acacia nilotica, Acacia tortlis, Zizyphus mauratiana*
	Phulera to Naraina	300	*Azadirachta indica, Acacia nilotica, Acacia tortlis, Prosopis sp.*
	Naraina to Dantara	480	*Azadirachta indica, Acacia nilotica, Acacia tortlis, Terminalia' arjun, Madhuca indica, Acacia catechu, Prosopis juliflora, Soymida febrifuga*
	Dantara to Sakhun	350	*Azadirachta indica, Acacia nilotica, Acacia tortlis, Prosopis sp., Zizyphus mauratiana, Acacia catechu*
	Sakhun to Sali	550	*Azadirachta indica, Acacia nilotica, Acacia tortlis, Madhuca indica, Prosopis juliflora, Soymida febrifuga*
	Sali to Gahlota	545	*Azadirachta indica, Acacia nilotica, Acacia tortlis, Prosopis juliflora, Soymida febrifuga*

District	Station Name	No. of trees	Major Species
	Sub-total	2,726	
Ajmer	Gahlota to Tiloniya	390	*Azadirachta indica, Acacia nilotica, Acacia tortlis, Ficus rilegiusa, Ficus bengalensis, Zizyphus mauratiana*
	Tiloniya to Mandawariya	350	*Acacia nilotica, Acacia tortlis, Prosopis sp., Prosopis juliflora, Soymida febrifuga*
	Mandawariya to Kishangarh	450	*Acacia nilotica, Acacia tortlis, Terminalia arjun, Prosopis juliflora*
	Kishangarh to Gegal Akhri	154	*Acacia nilotica, Acacia tortlis, Ficus bengalensis*
	Gegal Akhri to Ladpura	90	*Azadirachta indica, Acacia nilotica, Acacia tortlis, Prosopis sp.*
	Ladpura to Madar	115	*Azadirachta indica, Acacia nilotica, Acacia tortlis, Eucalyptus sp.*
	Madar to Dauria	89	*Acacia nilotica, Acacia tortlis, Ficus bengalensis*
	Daurai to Makrera	440	*Azadirachta indica, Acacia nilotica, Acacia tortlis, Zizyphus mauratiana, Acacia catechu, Prosopis juliflora, Soymida febrifuga*
	Makrera to Lamana	411	*Prosopis sp., Azadirachta indica, Acacia nilotica, Acacia tortlis, Madhuca indica Ficus bengalensis, Prosopis juliflora*
	Lamana to Kharwa	163	*Azadirachta indica, Acacia nilotica, Acacia tortlis, Ficus bengalensis, Acacia catechu*
	Kharwa to Piplaj	95	*Azadirachta indica, Acacia nilotica, Acacia tortlis,*
	Piplaj to Beawar	276	*Azadirachta indica, Acacia nilotica, Acacia tortlis, Prosopis sp. Tamarindus indica, Soymida febrifuga*
	Sub-total	3,023	
Pali	Beawar to Amarpura	280	*Azadirachta indica, Acacia nilotica, Acacia tortlis, Ficus bengalensis, Tamarindus indica*
	Amarpura to Sendra	450	*Ficus rilegiusa Azadirachta indica, Acacia nilotica, Acacia tortlis, Acacia catechu, Prosopis juliflora*
	Sendra to Bar	80	*Azadirachta indica, Acacia nilotica, Acacia tortlis, Eucalyptus sp., Zizyphus mauratiana*
	Bar to Haripur	250	*Ficus rilegiusa, Azadirachta indica, Acacia nilotica, Acacia tortlis,*
	Haripur to Guriya	60	*Azadirachta indica, Acacia nilotica, Acacia tortlis, Ficus bengalensis*
	Guriya to Chandawal	240	*Azadirachta indica, Acacia nilotica, Acacia tortlis, Acacia catechu*
	Chandawal to Bagri Sajjanpur	163	*Azadirachta indica, Acacia nilotica, Acacia tortlis, Tamarindus indica*
	Bagri Sajjanpur to Bagri Nagar	175	*Prosopis sp., Azadirachta indica, Acacia nilotica, Acacia tortlis,*
	Bagri Nagar to Sojat Road	163	*Azadirachta indica, Acacia nilotica, Acacia tortlis, Ficus bengalensis, Ficus rilegiusa*
	Sojat Road to Bhesana	75	*Azadirachta indica, Acacia nilotica, Acacia tortlis, Prosopis sp., Albizzia*

District	Station Name	No. of trees	Major Species
			lebbek
	Bhesana to Marwar Jn.	474	*Zizyphus mauratiana, Prosopis sp., Azadirachta indica, Acacia nilotica, Acacia tortlis, Acacia catechu, Prosopis juliflora, Tamarindus indica, Soymida febrifuga*
	Marwar Jn to Auwa	185	*Azadirachta indica, Acacia nilotica, Acacia tortlis,*
	Auwa to Banta Raghunathgarh	211	*Azadirachta indica, Acacia nilotica, Acacia tortlis, Morinda tinctoria*
	Banta Raghunathgarh to Bhinwaliya	216	*Zizyphus mauratiana, Azadirachta indica, Acacia nilotica, Acacia tortlis,*
	Bhinwaliya to Someswer	150	*Azadirachta indica, Acacia nilotica, Acacia tortlis, Morinda tinctoria*
	Someswer to Jawali	250	*Prosopis sp., Azadirachta indica, Acacia nilotica, Acacia tortlis,*
	Jawali to Bhagwanpura	245	*Azadirachta indica, Acacia nilotica, Acacia tortlis, Morinda tinctoria*
	Bhagwanpura to Rani	317	*Zizyphus mauratiana, Azadirachta indica, Acacia nilotica, Acacia tortlis, Acacia catechu, Prosopis juliflora, Tamarindus indica*
	Rani to Khimel	307	*Azadirachta indica, Acacia nilotica, Acacia tortlis,, Prosopis sp., Soymida febrifuga*
	Khimel to Falana	396	*Azadirachta indica, Albizzia odoratissima, Ficus bengalensis*
	Falana to Biroliya	368	*Albizzia lebbek, Azadirachta indica, Acacia nilotica, Acacia tortlis, Morinda tinctoria*
	Biroliya to Jawai Bandh	510	*Albizzia lebbek, Azadirachta indica, Acacia nilotica, Acacia tortlis,, Madhuca indica, Prosopis sp., Tamarindus indica, Soymida febrifuga*
	Jawai Bandh to Mori bera	320	*Ficus bengalensis, Azadirachta indica, Acacia nilotica, Acacia tortlis, Prosopis sp.*
	Mori bera to Kothar	113	*Albizzia odoratissima, Azadirachta indica, Acacia nilotica, Acacia tortlis, Morinda tinctoria*
	Kothar to Nana	336	*Zizyphus mauratiana, Acacia nilotica, Acacia tortlis, Prosopis sp., Soymida febrifuga*
	Sub-total	6,334	
Sirohi	Nana to Keshavganj	229	*Azadirachta indica, Acacia nilotica, Acacia tortlis, Terminalia arjun, Prosopis sp.*
	Keshavganj to Sirohi Road	191	*Acacia catechu, Azadirachta indica, Acacia nilotica, Acacia tortlis, Prosopis juliflora*
	Sirohi Road to Banas	211	*Azadirachta indica, Acacia nilotica, Acacia tortlis,, Prosopis sp.*
	Banas to Swarupganj	157	*Acacia catechu, Azadirachta indica, Acacia nilotica, Acacia tortlis, Eucalyptus sp.*
	Swarupganj to Bhimana	103	*Azadirachta indica, Acacia nilotica, Acacia tortlis, Tamarindus indica*
	Bhimana to Kivarli	179	*Azadirachta indica, Acacia nilotica,*

District	Station Name	No. of trees	Major Species
			Acacia tortlis, Albizzia lebbek, Soymida febrifuga
	Kivarli to Abu Road	256	*Zizyphus mauratiana, Acacia nilotica, Acacia tortlis, Prosopis juliflora*
	Abu Road to Maval	197	*Acacia catechu, Acacia nilotica, Acacia tortlis, Terminalia arjun, Prosopis juliflora, Tamarindus indica*
	Sub-total	1,523	
Total		14,447	

Source: Field Survey during the month of August 2008

2) Forest Area

In Rajasthan, DFC alignment passes through 3 Reserved Forest and one Un-classed Forest (Table 2-50). There is one more Protected Forest at Kishangarh, which is located very close to the alignment. Details of the forest, impacted area, floral diversity and forest land to be diverted are discussed below.

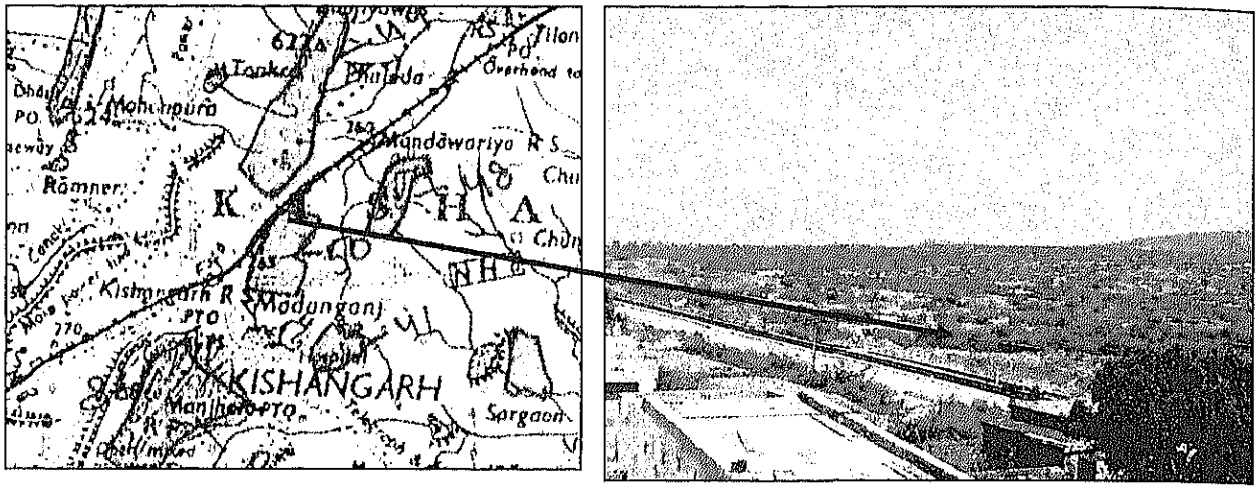
Table 2-50 Location of Forests along DFC alignment in Rajasthan

Sl. No.	Name of the Forest	Location	District	Status
A.	Madanganj Protected Forest	Kishangarh	Ajmer	Not affected
B.	Murdawa Jor Reserved Forest	Opposite Chandawal railway station	Pali	Affected
C.	Binjowa Jor Reserved Forest	Opposite Bhagwanpura railway station	Pali	Affected
D.	Jawaleswer mahadev Nursery (2007C) (Un-classed Forest)	Jawali railway station	Pali	Affected
E.	Kivarli Ka Jor Reserved Forest	Near Kivarli Railway Crossing	Sirohi	Affected

Source: Field Survey during the month of August 2008

A) Madanganj Protected Forest

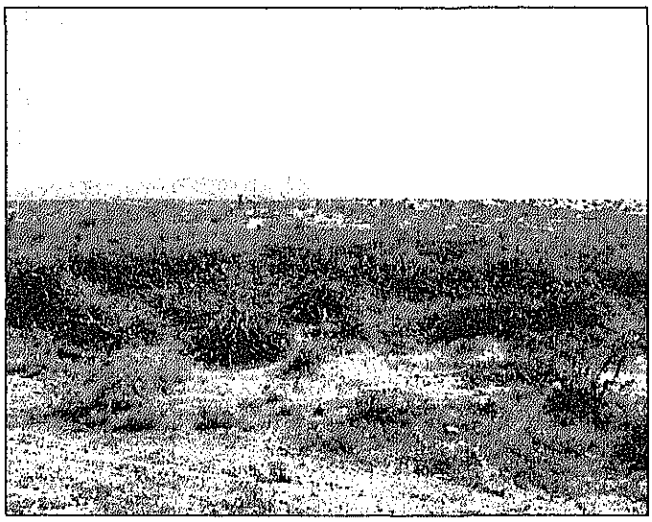
- **Date of Survey** : 18th September 2008
- **Time** : 11-00 a.m. to 02-00 p.m.
- **Location** : Kishangarh, Dist.: Ajmer
- **Total Areaof the Forest** : 440 ha
- **Latitude and Longitude of Nearest Point** : N 26°36'21.34" E 74°52'24.32"
- **Latitude and Longitude of Farthest Point** : N 26°36'12.29" E 74°52'20.83"
- **Distance from centerline of last track** : varies between 68 m to 130 m
- **Status** : Not Affected



Source: Forest Department & S-ESIMMS

Figure 2-7 Location of Madanganj Protected Forest

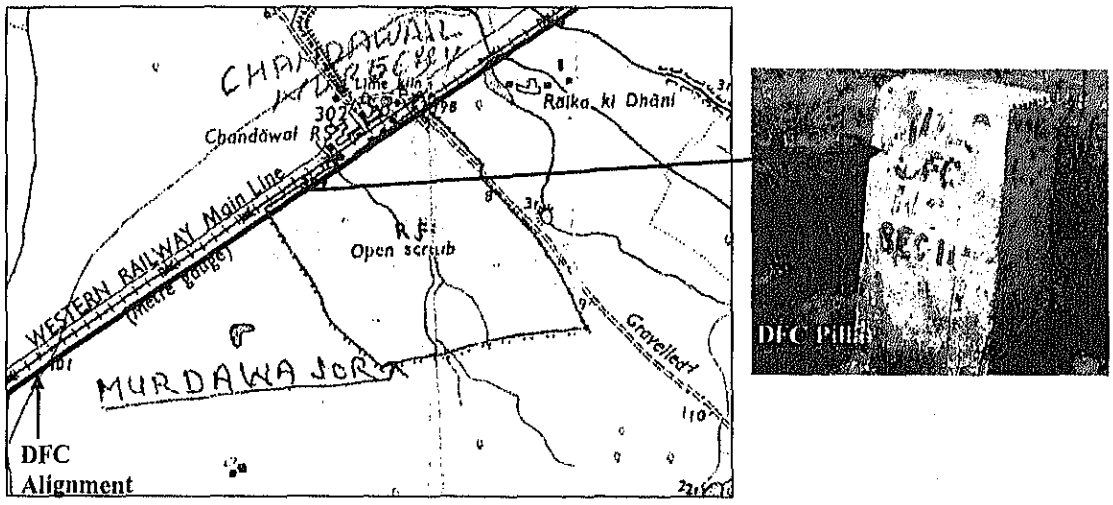
Floral Diversity: A site visit of the Madanganj Protected Forest area was conducted to assess the potential impact of the proposed development on the Forest. The forest is a middle growth open forest (less than 40% canopy cover). The main species of the forest were Izarail babul (*Acacia tortlis),* Deshi babul (*Acacia nilotica*), Neem (*Azadirachta indica*), Aval (*Cassia auriculata*), Thor (*Euphorbia neriifolia*), and Ber (*Ziziphus mauritiana*). Girth size of the species was varied between 30 cm to 50 cm and height varied between 1.5 m to 2.5 m. It has been reported by the Forest Department that there are no wild animal, migratory birds and rare and endangered species of flora and fauna



View of Madanganj Protected Forest

B) Murdawa Jor Reserved Forest

▪ **Date of Survey**	:	19th September 2008
▪ **Time**	:	10-30 a.m. to 03-30 p.m.
▪ **Location**	:	Opposite Chandawal Railway Station
▪ **Dist.**	:	Pali
▪ **Total Area of the Forest**	:	226.4 ha
▪ **Latitude and Longitude of Nearest Point**	:	N 25°56'39.4" E 73°51'59.24"
▪ **Latitude and Longitude of Farthest Point**	:	N 25°56'50.7" E 73°52'18.5"
▪ **Distance from centerline of last track**	:	varies between 20m to 55m
▪ **Total Length parallel to the track**	:	1.1 km
▪ **Affected length of the Forest**	:	560 m
▪ **Forest land to be diverted**	:	560 m x 30 m = 1.7 ha
▪ **Status**	:	Affected



Source: Forest Department & S-ESIMMS

Figure 2-8 Location of Murdawa Jor Reserved Forest

Floral Diversity: A site visit of the Murdawa Jor Reserved Forest area was conducted to assess the potential impact of the proposed development on the Forest. The forest is a middle growth open forest (less than 50% canopy cover). The main species of the forest were Bilayti Babul (*Prosopis juliflora*), Deshi babul (*Acacia nilotica*), Kumtha (*Acacia Senegal Wild*), Khejra (*Prosopis spicigera*), Ber (Ziziphus mauritiana), and Jhariber (*Ziziphus nummularia*). It has been reported by the Forest Department that there are no wild animal, migratory birds and rare and endangered species of flora and fauna.

In Murdawa Jor RF, quadrate survey was carried out in September 2008 at 10 m x 10 m plots in 15 sampling locations. Girth size of the species was varied between 30 cm to 90 cm and height varied between 1.5 m and 4.5 m. 6 types of species were observed during the survey, out of which *Prosopis juliflora* was the predominant species. Density of trees close to the railway track was very low in comparison to the density inside the forest. Species wise total number of trees in different sample plots is presented in Table 2-51. Species wise frequency, relative frequency, density, relative density, abundance, relative abundance and Important Value Index are presented in Table 2-52.

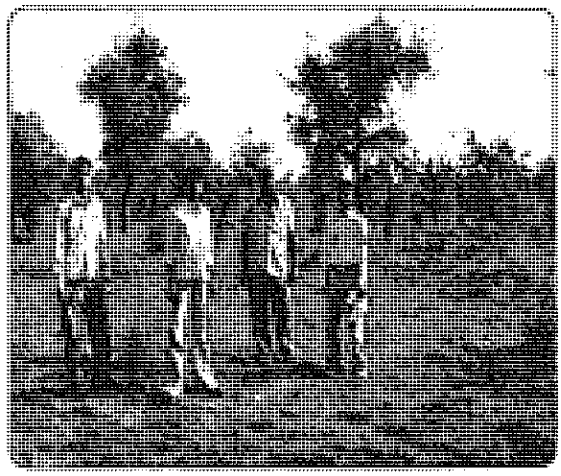
Table 2-51 Species wise Total Number of Trees in different Sample Plots

Sample Plot No.	Tree Species						Grand Total
	Bilayti babul	Deshi babul	Kumtha	Khejri	Ber	Jhariber	
1	2	1				2	5
2	1		2				3
3					3	1	4
4	2						2
5	4						4
6		1		1		1	3
7			2	1			3
8	5						5
9	1	3					4
10			3		1		4
11	1			3		1	5
12	4						4
13		3				2	5
14			1		2		3
15	1		1		2		4
Total	21	8	9	5	8	7	58
%	36	14	15	9	14	12	100

Source: Field Survey during September 2008

Total surveyed area = {15 x (10 x 10)} = 1,500 m^2 = 0.15 ha
Total area of forest land to be diverted = 1.7 ha
Therefore, approximate number of trees to be felled = 650

Survey at Murdawa Jor Reserved Forest



Field Visit with Forest Officials

Table 2-52 Results of Transect Analysis

Species (SP)	Frequency (%) (F)	Relative frequency (RF)	Density (D)	Relative Density (RD)	Abundance (AB)	Relative Dominance (RDO)	Importance Value Index
P. juliflora	60	30	1.4	36.2	2.3	19.8	86.0
A. nilotica	27	13.5	0.5	13.8	2.0	28.3	55.6
A. Senegal	33	16.5	0.6	15.5	1.8	34.0	66.0
P. spicigera	20	10	0.3	8.6	1.7	3.3	21.9
Z. mauritiana	27	13.5	0.5	13.8	2.0	7.6	34.9
Z. nummularia	33	16.5	0.5	12.1	1.4	6.6	35.2
	200	100	3.9	100	11.2	100.0	300.0

Source: Field Survey during September 2008 in S-ESIMMS

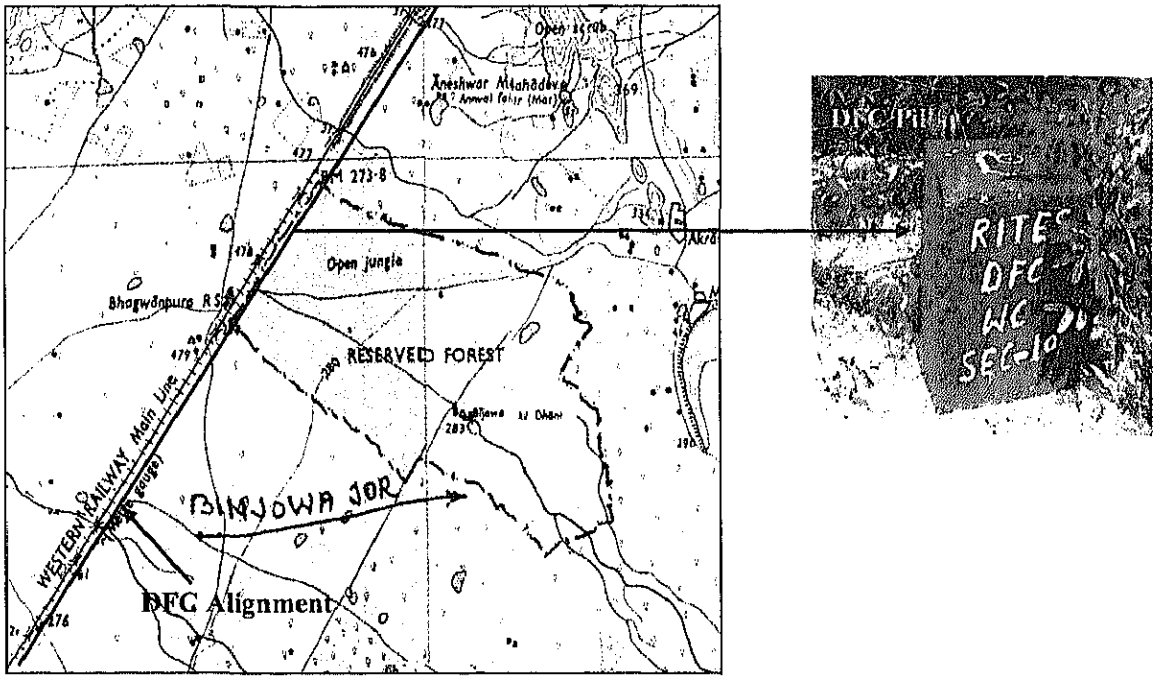
C) Binjowa Jor Reserved Forest

▪ **Date of Survey**	:	20th September 2008
▪ **Time**	:	10-30 a.m. to 01-00 p.m.
▪ **Location**	:	Opposite Bhagwanpura railway station
▪ **Dist.**	:	Pali
▪ **Total Area of the Forest**	:	554.1 ha
▪ **Latitude and Longitude of Nearest Point**	:	N 25°24'18.2" E 73°21'09.9"
▪ **Latitude and Longitude of Farthest Point**	:	N 25°24'54.4" E 73°21'38.0"
▪ **Distance from centerline of last track**	:	varies between 25m to 34.5m
▪ **Total Length parallel to the track**	:	1.4 km
▪ **Affected length of the Forest**	:	1.4 km
▪ **Forest land to be diverted**	:	2.7 ha
▪ **Status**	:	Affected

Floral Diversity: A site visit of the Binjowa Jor Reserved Forest area was conducted to assess the potential impact of the proposed development on the Forest. The forest is a middle growth open forest (less than 40% canopy cover). The main species of the forest were Babul (*Acacia Arabica*), Deshi babul (*Acacia nilotica*), Kumtha (*Acacia Senegal Wild*), Khejri (*Prosopis cineraria*), Arjun (*Terminalia arjun*), Shisham (*Dalbergia sissoo*), Siris Safed (*Albizzia odoratissima*), and Neem (*Azadirachta indica*). It has been reported by the Forest Department that there are no wild animal, migratory birds and rare or endangered species of flora and fauna

Density of tree species was very low within the affected area. High density was observed around 100 to 150m away from the railway track. There were two tree species i.e. Babul (*Acacia Arabica*) and Khejri (*Prosopis cineraria*); shrubs mainly Aval (*Cassia auriculata*) and grasses within the affected area. Out of the two species, Khejri (*Prosopis cineraria*) was the predominant species. It was observed during the survey that around 7 trees were exist in 0.01 ha (10m x 10m) area. Girth size of the species was varied between 30 cm and 60 cm and height varied between 1 m and 4 m.

▪ **Approximate number of trees to be felled: 1,904** (7 trees/0.01 ha)



Source: Forest Department & S-ESIMMS

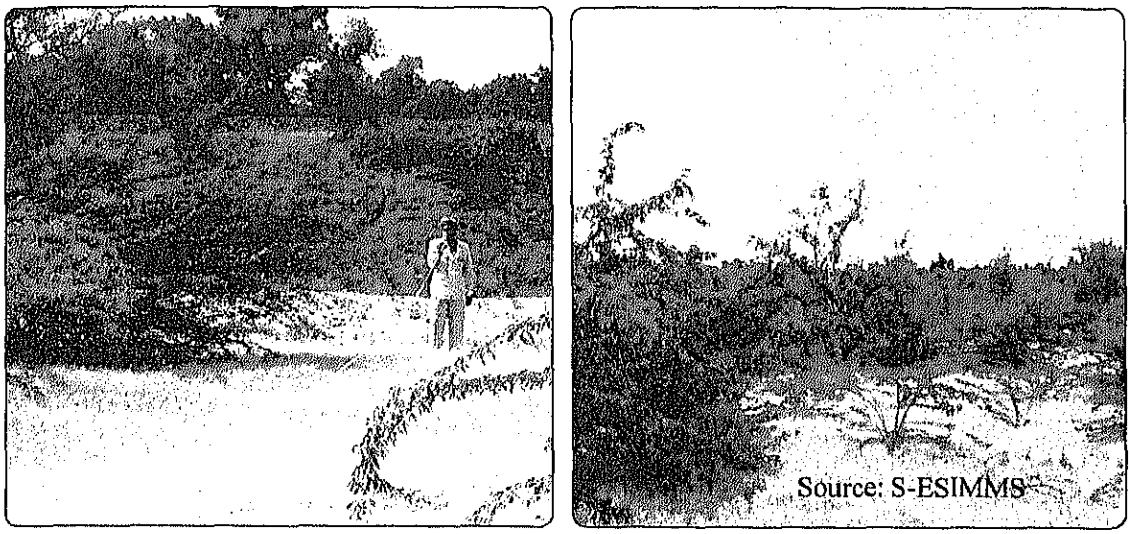
Figure 2-9 Location of Binjowa Jor Reserved Forest

View of Binjowa Jor Reserved Forest

D) Jawaleswer Mahadev Nursery (2007C) (Un-classed Forest)

- **Date of Survey** : 20th September 2008
- **Time** : 3-00 p.m. to 5-30 p.m.
- **Location** : Near Jawali railway station
- **Dist.** : Pali
- **Total Area of the Forest** : 20 ha
- **Latitude and Longitude of Nearest Point** : N 25°28'37.2" E 73°24'26.6"
- **Latitude and Longitude of Farthest Point** : N 25°29'02.5" E 73°24'40.3"
- **Distance from centerline of last track** : varies between 42 m to 80 m
- **Total Length parallel to the track** : 900 m

- **Affected length of the Forest** : 140 m
- **Forest land to be diverted** : 0.11 ha
- **Status** : Affected



View of Jawaleswer Mahadev Nursery (2007C) (Un-classed Forest)

Floral Diversity: Jawaleswer Mahadev Nursery is a nursery, which is under control of Jawali Gram Panchayat. A site visit of the forest area was conducted to assess the potential impact of the proposed development on the Forest. Due to the proposed development 0.11 ha land is to be diverted. There was no species diversity and the main species of the forest were Babul (*Acacia Arabica*), Bilayti Babul (*Prosopis juliflora*), Khejri (*Prosopis cineraria*), Shisham (*Dalbergia sissoo*), and Neem (*Azadirachta indica*). It has been reported by the Forest Department that there are no wild animal, migratory birds and rare or endangered species of flora and fauna

Density of tree species was very low within the affected area. There were two tree species i.e. Bilayti Babul (*Prosopis juliflora*) and Khejri (*Prosopis cineraria*); shrubs mainly Aval (*Cassia auriculata*) and grasses within the affected area. Out of the two species, Bilayti Babul (*Prosopis juliflora*) was the predominant species. It was observed during the survey that around 8 trees were exist in 0.01 ha (10m x 10m) area. Girth size of the species was varied between 30 cm to 75 cm and height varied between 2.5m and 4.5m.

- **Approximate number of trees to be felled: 99** (8 trees/0.01 ha)

E) **Kivarli Ka Jor Reserved Forest**

- **Date of Survey** : 22nd September 2008
- **Time** : 11-00 p.m. to 3-30 p.m.
- **Location** : Near Kivarli railway station
- **Dist.** : Sirohi
- **Total Area of the Forest** : 50 ha
- **Latitude and Longitude of Start Point** : N 24°32'58.17" E 72°50'55.24"
- **Latitude and Longitude of End Point** : N 24°33'01.56" E 72°50'55.66"
- **Length through the forest** : 110 m
- **Forest land to be diverted** : 0.8 ha
- **Status** : Affected

Survey at Kivarli Ka Jor Reserved Forest with Forest Officials

Floral Diversity: A site visit of the Reserved Forest area was conducted with the forest officials to assess the potential impact of the proposed development on the Forest. Due to the proposed development 0.77 ha land is to be diverted. There was no spccies diversity at all in the forest and the main species of the forest were Babul (*Acacia Arabica*), Bilayti Babul (*Prosopis juliflora*), Khejri (*Prosopis cineraria*), Aval (*Cassia auriculata*) and grasses. It has been reported by the Forest Department that there are no wild animal, migratory birds and rare or endangered species of flora and fauna.

Density of tree species was medium within the affected area. There were only Bilayti Babul (*Prosopis juliflora*); shrubs mainly Aval (*Cassia auriculata*) and grasses within the affected area. It was observed during the survey that around 11 trees were exist in 0.01 ha (10m x 10m) area. Girth size of the species was varied between 25 cm to 45 cm and height varied between 1.5 m and 3 m.

- **Approximate number of trees to be felled: 850** (11 trees/0.01 ha)

(3) Impact Assessment

1) Vegetation along the DFC

Impacts:

- Loss of flora due to felling of private and government trees within the proposed ROW
- Approximately 14,447 no. of trees have to be felled. The predominant tree species is *Acacia* sp. No endangered or rare plant species is reported within the proposed ROW.

Mitigation Measures:

- To avoid uncontrolled and indiscriminate tree felling, all trees are to be numbered before felling. Joint field visit is to be conducted with the officials of Forest Department to finalize the list of trees to be felled. A sample format is given below, which is to be filled up during the visit:

Tree No.	Common Name	Height (m)	Girth Size (cm)						
				30-60	60-90	90-120	120-180	>180	Total
1.									
2.									
3.									
4.									

- Tree cutting is to proceed only after all the legal requirements including Formal Clearances from the Haryana State Forest Department are completed and subsequently a written order is issued to the Project Proponent/ Contractor.
- Appropriate compensatory plantation should be initiated to compensate the vegetation loss due to felling of trees for site clearing. For trees to be cut, sufficient compensatory plantation, about 2 times the number of trees felled, will be done. If adequate space for compensatory plantation is not available along DFC corridor, plantation may be carried out along State Highway (SH), Major District Road (MDR), and Other District Road (ODR) or in degraded forest land.
- For trees to be felled in private land, compensation for land and trees will be given to the owners. Rate of trees will be decided by the State Forest Department.
- Preferential mixed plantation consisting of flowering shrubs and evergreen ornamental trees with less timber and fruit value will be carried out.
- Under the plantation programme, more valuable tree species will be planted in place of existing non-valuable mono crops of the project area, if any.

2) Forest

Impacts:

- ***Diversion of Forest Land:*** It is estimated that, 5.3 hectares of forest land is to be diverted (4.5 ha in Pali District and 0.8 ha in Sirohi District) for the use as ROW for construction of DFC in Rajasthan. The details breakup of the forest land to be acquired is given below:

Table 2-53 Acquired area for DFC in Forest area

Name of the Forest	District	Land to be acquired (ha)
Murdawa Jor Reserved Forest	Pali	1.68
Binjowa Jor Reserved Forest	Pali	2.72
Jawaleswer Mahadev Un-classed Forest)	Pali	0.11
Kivarli Ka Jor Reserved Forest	Sirohi	0.77
	Total	**5.28**

Source: Field survey in S-ESIMMS

- ***Felling of Trees:*** Approximately 3,503 no. of trees exist in the forest area which have to be felled along with diversion of forest land. There are no endangered or rare plant species exist in the forest area.

Table 2-54 Number of Tree Damaged by DFC in Forest Area

Name of the Forest	District	No. of trees to be felled
Murdawa Jor Reserved Forest	Pali	650
Binjowa Jor Reserved Forest	Pali	1,904
Jawaleswer Mahadev Un-classed Forest)	Pali	99
Kivarli Ka Jor Reserved Forest	Sirohi	850
Total		3,503

Source: Field survey in S-ESIMMS

Mitigation Measures:

- Monetary compensation should be provided to Forest Dept. towards the cost of forest land to be diverted and cost of compensatory afforestation.
- Before start any activity within the Forest area, Forest Clearance must be obtained as per Forest Conservation Act, 1,980 and it's amendments from the State Forest Department.
- Action plan for tree felling should be prepared to avoid uncontrolled and indiscriminate tree felling.
- Appropriate compensatory plantation should be initiated to compensate the vegetation loss due to felling of trees for site clearing. For trees to be cut, sufficient compensatory plantation, about 2 times the number of trees felled, will be done.
- Preferential mixed plantation consisting of flowering shrubs and evergreen ornamental trees with less timber and fruit value should be carried out.
- Under the plantation programme, more valuable tree species should be planted in place of existing non-valuable mono crops of the project area, if any.

2.2.3 Fauna

(1) Study Methodology

The objectives of the survey are to verify impacts on the fauna by the development of the Dedicated Freight Corridor and the relevant facilities by collecting supplementary secondary data and conducting the supplemental field surveys if required.

- To identify the species of fauna within the study area, consultation with Forest Department, local population and academic expert have been conducted.
- Supplemental secondary data like district wise Working Plan of the Forest Division, Management Plan of Wildlife Sanctuary, literature etc. have been collected.

(2) Major Findings

1) Possible Fauna at the area

Due to rapid increase of human population, industrialization along the existing railway track and presence of large number of cattle has caused the destruction of vegetative cover, which has reduced faunal diversity of the area. Faunal species found within the study area is presented in Table 2-55. No endangered or rare species of mammals/ reptiles/birds is reported within the study area by the Forest Department and academic experts.

Table 2-55 List of Fauna Reported within the Study Area in Rajasthan

Sl. No.	English Name	Scientific Name
MAMMALS		
1	Blue Bull/ Nilgai	*Boselaphus tragocamelus*
2	Common Langur	*Presbytis entellus*
3	Common Fox	*Valpus bangalensis*
4	Desert Cat	*Felis libyca*
5	Five stripped squirrel	*Funambulees pennanti*
6	Hyaena	*Hyaena hyaena*
7	Hare Indian	*Lepus nigricollis*
8	Indian Wolf	*Canislupus pallipes*
9	Indian Porcupine	*Hystrixe indica*
10	Jackal	*Canis aureus*
11	Jungle Cat	*Felis chaus*
12	Mongoose	*Herpestes edwardsi*
13	Monkey	*Macaca mulatta*
14	Pangolin/ Indian anteaters	*Manis crassicaudata*
15	Wild Boar	*Susscrofa cristatus*
AVI FAUNA		
16	Black Headed Yellow Bulbul	*Pycnonotus lelanicterus*
17	Blue Rock Pigeon	*Columba livia*
18	Comb Duck	*Sarkidiornis melanotos*
19	Common Sand grouse	*Peterocles exustus*
20	Common Green Pigeon	*Treron phoenicoptera*
21	Common Quail	*Coturnix Coturnix*
22	Common Swallow	*Hirundo rustica*
23	Common Myna	*Acridotheres tristes*
24	Gray Duck	*Anas poecilorhyncha*
25	Gray Heron	*Ardae cinerea*
26	Grey Partridge	*Francolinus pondicerianus*
27	Green Munia	*Estrilda formosa*
28	House Crow	*Corvus splendens*
29	House Sparrow	*Passer domesticus*
30	House Swift	*Apus affinis*
31	Jungle Crow	*Corvus macrorhynchos*
32	Jungle-fowl	*Gallus gallus*
33	Koel	*Eudynamys scolopacae*
34	King Vulture	*Targos calvus*
35	Little Egret	*Egretta garzotta*
36	Night Heron	*Nycticorax nycticorax*
37	Pond Heron	*Ardeola grahii*
38	Snake Bird	*Anhinga rufa*
39	Spoon Bill	*Platalea leucoredia*
40	Spotted Dove	*Streptopelia chinensis*
41	White Backed Vulture	*Gyps bangalensis*

Source: State Forest Department, Government of Rajasthan

2) Protected Areas

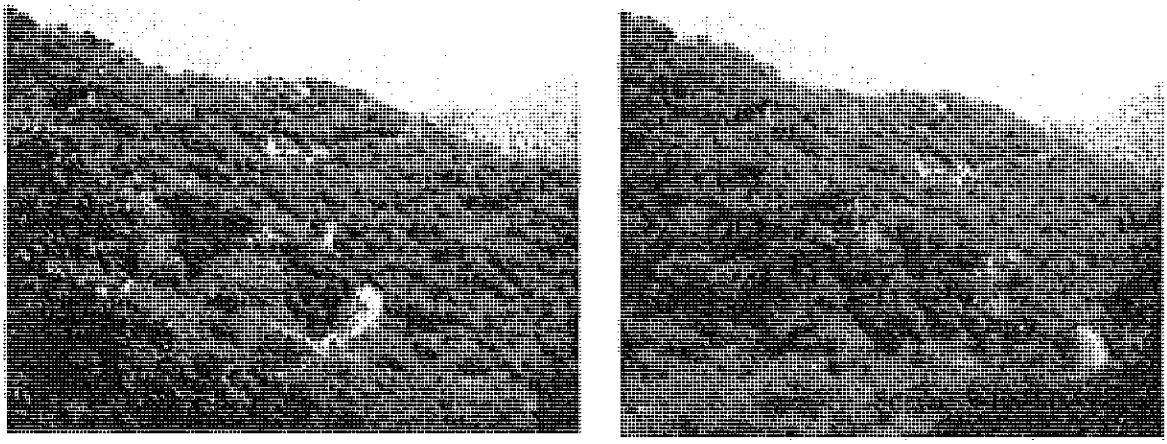
In Rajastha, there are two protected areas which are located within 10 km from the DFC alignment. These are:

A) Mount Abu Wildlife Sanctuary
B) Sambhar Salt Lake

A) Mount Abu Wildlife Sanctuary

Mount Abu Wildlife Sanctuary in Sirohi District of Rajastan is located in the southern part of the Aravali, one of the the oldest mountain ranges. It is situated between 24°30′ and 24°43′ North and 72°38′ and 72°53′ East. The DFC alignment is located 4.5 km away from the sanctuary and hence it is profiled here.

Mount Abu was declared as a Wildlife Sanctuary in 1960 and comes under the jurisdiction of the Wildlife Circle of Jodhpur within the Rajastan Forest Department. The sanctuary covers a total area of 326.1 km^2 and has a high diversity of fauna and flora owing to its high altitude and better precipitation. Gurushikhar, measured at 1,722 ft, is the highest peak in the sanctuary. The water drains into two major watershed feeding two rivers located outside the sanctuary, namely, Sip and West Banas Rivers. There are 17 villages situated inside the sanctuary boundary and 44 villages situated on the periphery of the sanctuary.



View of Mount Abu Wildlife Sacntuary

Geology and Soil: The Aravali system of which the sanctuary is a part is considered to be a 3500 million year old rock formation. Caves, Caverns and large holes are common in Mt Abu and these serve as home to Leopard and Sloth Bear and the cliffs provide nesting places for vultures. The soil is reddish brown to grayish brown in colour, light textured and fairly drained in the upper slopes while in the lower region the soil is reddish to yellowish red in colour and varies from light to rich alluvium of varying depths. The mean annual rainfall is 1,500 mm and the temperature varies from -2°C in January to 35°C in May-June.

Forest Type: The forests of Mount Abu Wildlife Sanctuary are termed as dry tropical forests as per Champion and Seth's revised classification of forest types of India. It varies from semi arid on the foothills to semi evergreen at higher slopes. The differential distribution has a bearing on the pattern of vegetation.

Flora: The sanctuary has a rich diversity of flora which consists of 112 plant families with 449 genera and 820 species[1]. Of these, 663 species are dicotyledons and remaining 157 are monocotyledons. The key species found in the sanctuary are Kalia Dhav (*Anogeissus pendula*), Bakla (*Anogeissus latifolia*), *Anogeissus sericea*, Salar (*Boswllia serrata*), Golar (*Lannea coromondelica*), Palas (*Butea monosperma*), Lal kachnar (*Bauhinia purpurea*), Pangra (*Erythrina suberosa*), Silver oak (*Grevillea robusta*), Bargad (*Ficus benghalensis*), Gular (*Ficus glomerata*), Gulu (*Sterculia urens*) and Bamboo (*Dindrocalamus strictus*). Fruit bearing trees such as Mango (*Mangifera indica*), Jamun (*Syzygium cuminii*), *Ficus* sp and

[1] Govt of Rajastan (2003). Management Plan of Mt Abu Wildlife Sanctuary 2003-08.

Zizyphus sp are found in good numbers. Serveral species of ferns and fern-allies are also found in Mt. Abu Wildlife Sanctuary.

The rare plant species recorded from the sanctuary include Dicliptera abuensis, Carvia colossus, Ischaemum kingii, Convolvolus blatteri, Ceropegia odorata, Rosa involucrate and Hydrila poly-sperma. Species like Anogeissus sericea, Tricoarpa begonia, Crotalaria filipe, Indigofera constrata are included in the threatened plant list of IUCN.

Mt. Abu Wildlife Sanctuary is the only area where orchids are found in Rajasthan. Orchid species such as *Aerides crispum, Aerides multiflorum, Utopia ochreata* and *Habenaria longicaniculata* are found in moist localities. Grass species found in the sanctuary include Bhangli (*Apluda mutica*), Karar (*Dichanthium annulatum*) and Lampra (*Aristida hystrix*). Most of the forest patches have been infested by Lantana *camera* and *Parthenium hysterophorus* weeds.

Wild Fauna: Leopard Sloth Bear, Sambhar, Blue Bull, Hyaena and wolf are among the large mammals found in the sanctuary. One tiger was spoted here during an animal census conducted by the Forest Department in 1999. However, Ranthambore and Sariska Protected Areas are important Tiger habitats elsewhere in the state. Leopard and Sloth bear are distributed through out the sanctuary. Wild boars are also common on higher hills.

Small mammal species such as Fox, Jungle cat, Jackal, Porcupine, and Hanuman Langur and reptiles like lizards, snakes are common through out the sanctuary area. Year wise census of wildlife conducted by the Forest Department is presented in Table 2-56.

Table 2-56 Census of Wild Animals of Mount Abu Wildlife Sanctuary

English Name	Scientific Name	1996	1997	1999	2001	2002	2003
Panthers	*Panthera pardus*	21	36	38	40	40	36
Sloth Bear	*Melursus ursinus*	62	90	95	108	117	107
Sambhar	*Rosa unicoler*	17	30	32	22	14	12
Blue Bull	*Boselaphus tragocamelus*	284	233	242	215	319	258
Hyaena	*Hyaena hyaena*	66	68	57	46	72	59
Hanuman Langur	*Semnopithecus entellus*	781	880	826	1064	1246	1314
Jackal	*Canis anrens*	113	135	142	185	187	145
Grey Jungle Fowl	*Gallus sonnerati*	315	456	468	243	306	285
Wild Boar	*Sus cristatus*	Nil	Nil	35	85	147	136
Tiger	*Panthera tigris*	Nil	Nil	1	Nil	Nil	Nil
Porcupine	*Hystrix lencura*	Nil	74	77	44	63	61
Hare	*Lepus nigricollis*	Nil	28	52	155	175	171
Wolf	*Canis lupus*	Nil	Nil	5	2	12	25
Mongoose	*Herpestes edwardsii*	Nil	46	57	124	160	112
Jungle Cat	*Felis chaus*	Nil	31	32	63	57	51
Monitor Lizard	*Varanus monitor*	Nil	Nil	Nil	44	46	52
Peacock	*Pavo cristatus*	Nil	511	524	393	476	482
Civet	*Civettictis civetta*	Nil	Nil	Nil	33	38	51
Crocodile	*Crocodiles palustris*	Nil	Nil	Nil	7	14	18
Pangolin	*Manis crassicaudata*	Nil	Nil	Nil	Nil	Nil	1

Source: Management Plan of Mount Abu Wild Life Sanctuary, Government of Rajasthan, 2003-2008

The sanctuary has a rich and varied avifauna represented by 121 species. A list of the key bird species found in the sanctuary is given in Table 2-57.

Black Headed Ibis (*Threskiornis aethiopica*), Shoveller (*Anas clypeata*), White Necked Stork (*Ciconia episcopus*), Eurasian Wigeon (*Anas penelope*), etc that visit the water bodies in the sanctuary are the key winter migrants. By about March they leave Mt. Abu Wildlife Sanctuary for the breeding grounds in the Eurasian and European regions.

Table 2-57 Key Bird Species Found in Mount Abu Wildlife Sanctuary

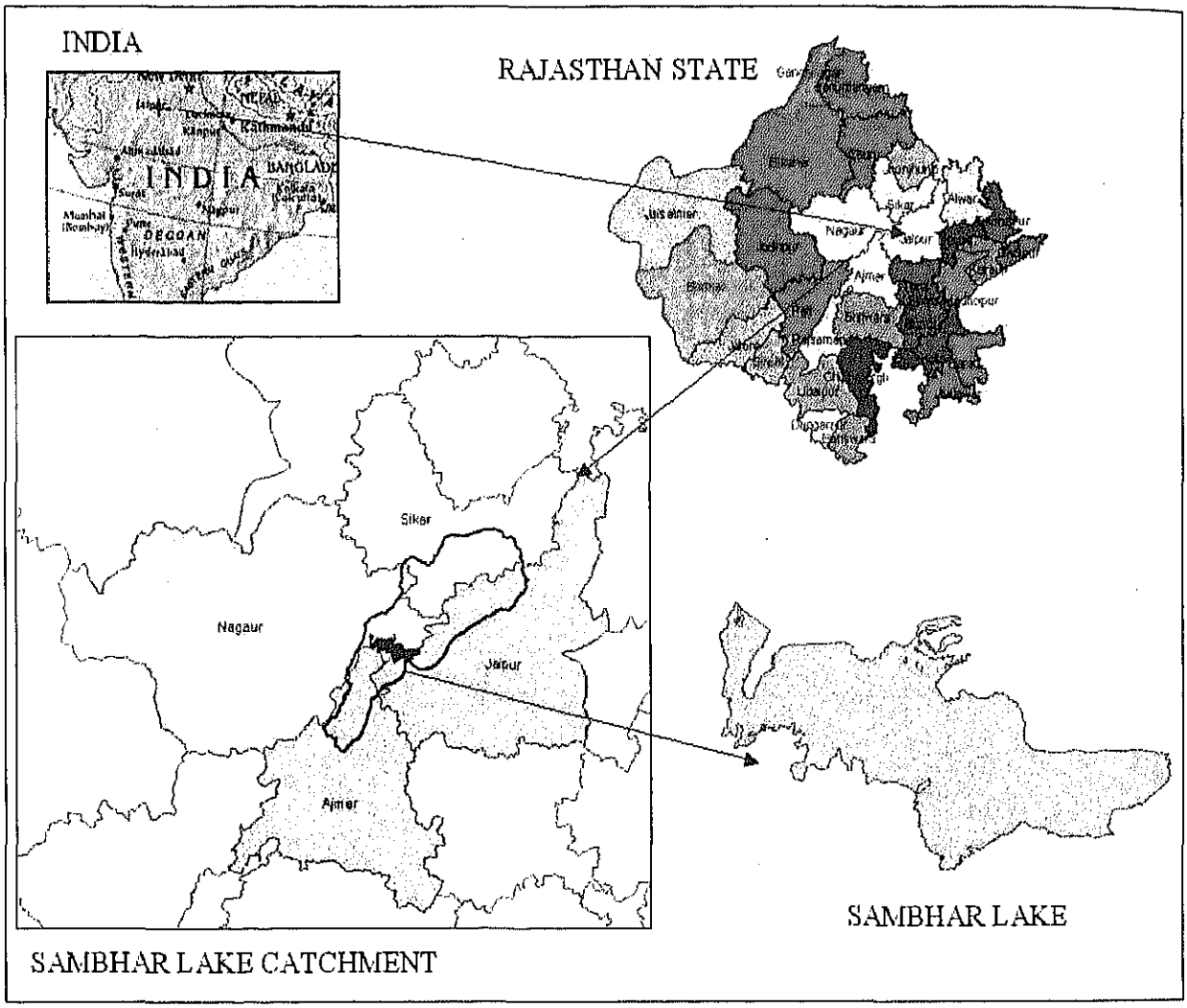
Sl. No.	Family Name	English Name	Scientific Name
1	Muscicapidae	Common Babbler	*Turdoides caudatus*
2	Muscicapidae	White Cheeked Barbet	*Magalaima haemacephala*
3	Meropldae	Blue tailed bee eater	*Merops philippinus*
4	Meropldae	Little green blue eater	*Merops orientalis*
5	Phalacrocoracidae	Large Cormorant	*Phalacarocorax carbo*
6	Phalacrocoracidae	Little Cormorant	*Phalacarocorax niger*
7	Gruidae	Sarus Crane	*Grus antigone*
8	Cuculidae	Cuckoo	*Euchynamis scolopacea*
9	Columbidae	Laughing Dove	*Streptopelia senegalensis*
10	Columbidae	Red Collared Dove	*Streptopelis tranquebarica*
11	Columbidae	Eurasian Collared Dove	*Streptopelia decaocto*
12	Columbidae	Spotted Dove	*Streptopelia chinensis*
13	Dicruridae	Black Drongo or King Crow	*Discrurus macrocercus*
14	Accipitridae	Hawk Eagle	*Spizaetus cirrhatus*
15	Ardeidae	Cattle Egret	*Bubulcus ibis*
16	Ardeidae	Little Egret	*Egretta garzetta*
17	Ardeidae	Median Egret	*Egretta intermedia*
18	Muscicapidae	Grey-headed Fly Catcher	*Culicicapa ceylonensis*

Sl. No.	Family Name	English Name	Scientific Name
19	Dicaeidae	Thick billed flower pecker	*Dicaeum agile*
20	Ardidae	Indian Reef Heron	*Egretta gularis*
21	Ardidae	Black crowned Night-Heron	*Nycticorax nycticorax*
22	Threskiornithidae	Black headed ibis	*Threskiornis aethiopica*
23	Phasianidae	Red Spur Jungle Fowl	*Galloperdix spadicea*
24	Phasianidae	Grey Jungle Fowl	*Gallus sonneratii*
25	Alcedinidae	Little Blue King Fisher	*Alcedo atthis*
26	Alcedinidae	Pied King Fisher	*Ceryle rudis*
27	Alcedinidae	White Throated King Fisher	*Haleyon smyrnesis*
28	Charadriidae	Red Wattled Lapwing	*Venellus indicus*
29	Campephagidae	Scarlet Minivet	*Pericrocotus flammeus*
30	Campephagidae	Small Minivet	*Pericrocotus cinnamomeus*
31	Ploceidae	Spotted Munia	*Lonchura punctulata*
32	Sturnidae	Common Myna	*Acridotherus tristis*
33	Sturnidae	Hill Myna	*Gracula religiosa*
34	Caprimulgidae	Indian Night Jar	*Caprimulgus asiaticus*
35	Phasianidae	Grey Francolin	*Francolinus pondicerianus*
36	Phasianidae	Painted Francolin	*Francolinus pictus*
37	Phasianidae	Indian Peafowl	*Pavo cristatus*
38	Columbidae	Mountain Imperial Pigeon	*Ducula badia*
39	Muscicapidae	Indian Robin	*Saxecoloides fulicate*
40	Ploceidae	Yellow throated Sparrow	*Petronia xanthocollis*
41	Nectariniidae	Crimson Sun bird	*Aethopyga siparaja*
42	Hirundinidae	Barn Swallow	*Hirundo rustica*
43	Hirundinidae	Wiretailed Swallow	*Hirundo smithii*
44	Accipitridae	White rumped Vulture	*Gyps bengalensis*
45	Accipitridae	Egyptian Vulture	*Neophron percnopterus*
46	Accipitridae	Eagle Spotted	*Aquila clanga*
47	Muscicapidae	Red-breasted Fly Catcher	*Muscicapa parva*
48	Bucerotidae	Indian Grey Hornbill	*Tockus birostris*

Source: Management Plan of Mount Abu Wild Life Sanctuary, Government of Rajasthan, 2003-2008

B) Sambhar Salt Lake

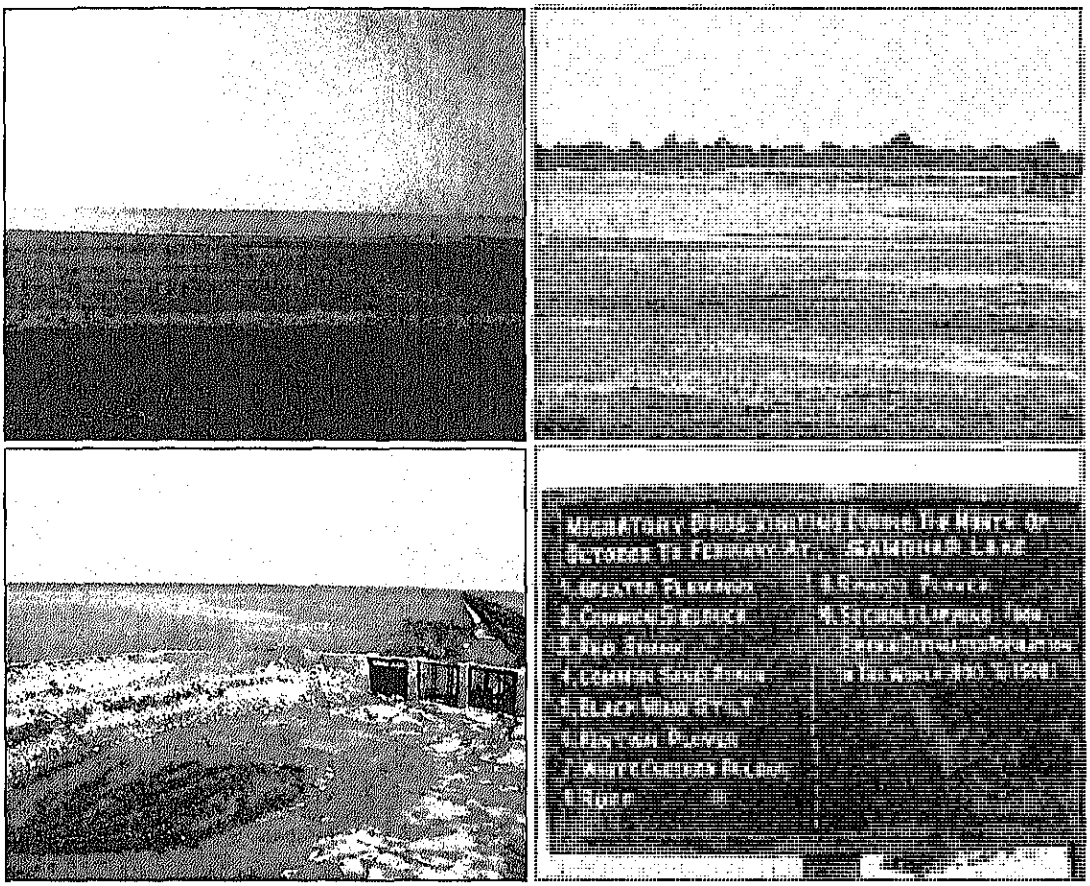
The Sambhar Lake is an extensive saline wetland, with water depths fluctuating from 60 cm to 3 m. The lake lies within the latitude 26°52' to 27°02' North and 74°54' to 75°14' East. It occupies an area of 190 to 230 km^2, based on the season. It is an elliptically shaped lake 35.5 km long with a breadth varying between 3 km and 11 km. The lake is located in Nagaur and Jaipur Districts and it also borders of the Ajmer District. The circumference of the lake is 96 km, surrounded on all sides by the Aravali hiils. The whole catchment is spreads over the four districts i.e., Jaipur, Ajmer, Sikar and Nagaur of the Rajasthan state.



Source: Conservation Planning of Sambhar Lake, Rajasthan using Satellite Remote sensing and GIS by A. K. Jain, K. K. Das and A. K. Goyal

Figure 2-10 Location of the Sambhar Lake and its Catchment

The Sambhar lake basin is divided by a 5.1 km-long dam made of sand stone. After salt water reaches a certain concentration, it will be released from the west side to the eastern side by lifting dam gates. To the east of the dam are salt evaporation ponds where salt has been farmed for a thousand years. This eastern area is 80 km² and comprises salt reservoirs, canals and salt pans separated by narrow widths. To the east of the dam is a railroad, built by the British (before India's independence) to provide access from Sambhar Lake City to the salt works.



View of Sambhar Lake

It is India's largest saline lake and produces 196,000 tonnes of clean Salt every year, which equals 8.7% of India's Salt production. Its salt production is done by evaporation process of brine and is mainly managed by Shambar Salts Ltd. (SSL), a joint venture of the Hindustan Salts Ltd. and the State Government. SSL owns 3% of the eastern lake.

Ecological Importance:

Sambhar has been designated as a Ramsar Site (recognized wetland of international importance) in 1990 because of its biological and biotic importance and the wetland is a key wintering area for tens of thousands of flamingos and other birds that migrate from northern Asia. The specialized algae and bacteria growing in the lake provide striking water colours and support the lake ecology that, in turn, sustains the migrating waterfowl.

Flora in the Catchment Area

The natural vegetation in the catchment area is Northern Tropical Dry Mixed Deciduous Forests and Thorn Forest. Most of the areas have typical nature of vegetation of arid and semi arid nature. The hilly areas consist of mainly degraded Dhok (*Anogeissus pendula*) Salar (*Boswellia serrata*), *Capparis* sp. with some bushy vegetation. The plain area is dominated by *Acacia nilotica*, *Acacia senegal*, *Salvadora persica* etc. The nearby by area of rivers and streams having the sandy nature with good amount of moisture, the *Dalbergia sissoo* is the common tree. Other important species is the *Azadirachta indica*, *Prosopis cineraria* and *Prosopis juliflora*.

Faunal Diversity:

The catchment of Sambhar Lake has a variety of ecosystems, which includes:

Mammals: Due to salinity of the area only Nilgai (*Boselaphus tragocamelus*) is commonly observed near the water sources.

Avifauna: About 40-50 species of aquatic birds (flamingos, duck, geese) are reported from the lake and its surrounding in the recent years where as the number was 244 in past (Adam, 1873). After the 1977, it was noticed that the flamingoes became permanent residents of the Sambhar Lake (Alam, 1981). Out of the six world flamingo species, Lesser *Phoenicopternus minor* and greater *Phoenicopternus ruber* regularly visits the Sambhar Lake (Sangha, 1999). The visit of flamingoes to the lake was recorded since 1873 (Adam, 1873). The waterfowl census (Srishti-AWB, 1993) as given below clearly shows the importance of the Lake from point of view of avifauna. In the year of 1999 the reported waterbirds in the Sambhar Lake was 920, having 21 species (AWC, 1997-2001).

Table 2-58 Waterfowl Census of Sambhar Lake in 1993

Common Name	Scientific Name	Number
Grey heron	*Ardea cinerea*	7
Grater flamingo	*Phoenicopterus ruber*	390
Lesser flamingo	*Phoeniconaias minor*	6400
Common teal	*Anas crecca*	53
Northern shoveler	*Anas clypeata*	415
Common coot	*Fulica atra*	319
Black winged stilt	*Himantopus himanopus*	47
Little ringed plover	*Charadrius dubius*	15
Kentish plover	*Charadrius alexandrinus*	107
Little stint	*Calidris minuta*	160
Temminck's stint	*Calidris temminckii*	107
Herring gull	*Larus argentatus*	35
Great Black headed gull	*Larus ichthyaetus*	360

Source: Srishti-AWB, 1993

(3) Impact Assessment

There will be no significant impact on fauna due to the proposed development.

DFC alignment passes 4.5 km east of the sanctuary, and on the eastern side of the existing railway line and this is also after the existing highway (NH-47). Therefore, no significant direct impact on the Sanctuary is anticipated due to the proposed development.

However, the occasional animal movement across the existing railway line is likely to be impacted. It has been suggested by the Forest Department (Wildlife Division) that underpass should be provided after every 1 km in this stretch. Location of underpasses should be corresponding to the existing underpasses on the NH-14.

DFC alignment passes 5.5 km east of the Sambhar Lake. Therefore, no significant direct impact on the lake is anticipated due to the proposed development. However, the alignment passes the one of the seasonal territory flowing the lake and adequate bridge design should be taken to keep enough flow area not to disturb water flow. In addition, construction method should consider not increasing turbidity of the lake through avoiding rainy season construction or preventing muddy water release to the water.

Impacts:

- Loss of habitat of avian fauna due to felling of trees, which is a short-term impact. During construction period they will be shifted to some other place.

Mitigation Measures:

- Appropriate compensatory plantation should be initiated to compensate the habitat loss due to felling of trees for site clearing. Due to the plantation along the alignment, habitat of avifauna will be restored within 1-2 years.

2.3 HARYANA

2.3.1 General

In Haryana, the entire stretch of final alignment passes in parallel to the existing railway track on the eastern side and its length is approximately 83 km in total (SAPROF chainage: 853.4 km – 899.0 km, 902.3 km – 939.0 km). The surrounding area of the final alignment in the state is mainly agricultural (92 – 93%) and settlement (7 – 8%). The area fall under indo-gangetic plain marked with vast stretch of almost flat land. The soil depth and texture vary from place to place. The soil texture of the area varies from sandy loam to clayey loam and depth varies from 5-15 cm. The soils are deficient in nitrogen and organic matter.

The climate of the area is hot tropical to sub-tropical characterized by high temperature and moisture deficiency for the greater part of the year. There is prolonged hot period entending from March to June. Hot dust-laden winds, which is locally known as "LOO" blow from April onwards. The highest incident of dust storm and thunder storms occurs between April and June. December and January are the coldest months. The rainfall is of monsoonic type and starts in the last week of June and lasts up to 15th of September. About 70-80% of the total annual rainfall is received during the monsoon period where as during remaining period the light showers are received. Past meteorological data of the nearest IMD observatory located at Gurgaon and Narnaul, which deemed representative of the study area has been summarized in Table 2-59.

Table 2-59 Summary of Climatological Data of the Study Corridor (Based on Records of IMD, 1951-80)

Parameter	IST	Monthly Range	Annual Mean/Total
Gurgaon			
Mean daily maximum temperature (°C)		21.5 (Jan) – 40.5 (May)	31.8
Mean daily minimum temperature (°C)		5.0 (Jan) – 26.9 (Jun)	16.8
Relative humidity (%)	0830	38 (May) - 81 (Aug)	62
	1730	23 (May) – 70 (Aug)	42
Total rainfall (mm)		3.5 (Dec) – 255.7 (July)	743.4
Wind speed (km/h)		3.3 (Dec) – 8.4 (June)	5.4
Narnaul			
Mean daily maximum temperature (°C)		22.4 (Jan) – 40.3 (May)	32.2
Mean daily minimum temperature (°C)		4.7 (Jan) – 27.0 (Jun)	17.3
Relative humidity (%)	0830	38 (May) – 78 (Aug)	59
	1730	22 (May) – 61 (Aug)	40
Total rainfall (mm)		2.6 (Nov) – 222.2 (July)	625.1
Wind speed (km/h)		3.3 (Dec) – 6.8 (May)	4.7

Note: Based on Records of IMD, 1951-80

There is no perennial river in Rewari and Mahendragarh Districts. The seasonal river in Rewari District is Sahibi, which rises in the Jaipur District of Rajasthan and passes through

Rewari District. The bed is about 1 km wide. Now it dried up. The seasonal rivers in Mahendergarh District like Krishnawati and Dohan run parallel to each other from South-West to North-East and pass through middle of Mahendergarh District. The course of Krishnawati River is well defined up to Narnaul City, after that it is not visible and water flows through depression and ultimately falls into drain no. 8 near Ratanthal Village of Rewari District. Similarly the course of Dohan River is well defined up to Akoda Village of Mahendergarh Tehsil and down below, the water flows through the depression in the cultivated fields and ultimately during rainy season water flows into Drain No. 8 or spreads up to Palri Village in Bhivani District. Except monsoon no water is found in those rivers. The final alignment does not crosse any river in Haryana.

The xerophytic type of flora dominates the study area. The district is inadequately wooded and some parts are practically bare of trees. Tree species found are *Acacia nilotica*, *Acacia senegal*, *Acacia tortlis*, *Ailanthus excelsa*, *Albizia lebbek*, *Azadirachta indica*, *Ficus bengalensis*, *Eucalyptus* sp., *Leucaena leucocephala*, *Melia azedarach*, *Prosopis cineraria*, *Prosopis juliflora*, *Tamarindus indica*,*Terminalia arjuna*, and *Zizyphus mauritiana*. Shisham (*Dalbergia sissoo Roxb.*) is the only local species which provides goood quality timber. Its timber is used for construction of houses and for making good quality furniture. Shrubs found in the area are *Acacia jacquemontii*, *Adhatoda vasica*, *Balanites aegyptica*, *Calotropis procera*, *Euphorbia royalaena*, and *Eichhornia crassipes*. These species are observed through out the year. Seasonal variation of tree species is not prominent along the track.

Economy of the rural population of the study area is based on agriculture and animal husbandry. About 93% portion of the final alignment is passing through agricultural land. Most of the area is irrigated by tube well. Crops grown can be divided into two main categories viz. *Kharif* (harvest during summer season) and *Rabi* (harvest during winter season). The major *Kharif* crops harvested in the area are bajra, cotton, jowar, soyabean. moong, maize, arhar and vegetables such as brinjal, tomato, onion, ladies figure, and chillies. The major *Rabi* crops are wheat, gram, mustard and vegetables like carrot, cauliflower, potato, tomato, cabbage etc. People keep domestic animals such as cow, buffalo, sheep, and goats mainly for milk production, agriculture, and transportation. Buffalo is the main milk yielding domestic animal.

The natural environmental study in the S-ESIMMS mainly focused on the directly affected natural environment, namely the forest areas located close to the existing railway track and also the wildlife sanctuaries in the vicinity of the alignment.

2.3.2 Flora

(1) Study Methodology

The objective of the survey is to verify impacts on the flora by the development of the Dedicated Freight Corridor and the relevant facilities by collecting supplementary secondary data and conducting the supplemental field surveys.

- To identify the species of flora along the final alignment and the boundaries of the relevant facilities, location of Reserved Forest/ Protected Forest/ Un-classed Forest along the final alignment, reconnaissance survey has been conducted in association with Range Officer/ Forest Guards of the State Forest Department. The exact location of forest along the final alignment was confirmed through interview of forest officials.
- To identify the directly affected trees by the railway construction, visual counting method (walk through the railway track) has been adopted to count the number of trees to be felled for construction of DFC. Trees has more than 30 cm girth size (diameter) and

1.5 m of height exist within 50m from the from the centerline of the last track on the eastern side were counted. The survey was carried out from 13th August to 24th August, 2008.

- Supplemental secondary data like district wise Working Plan of the Forest Division, Management Plan of Wildlife Sanctuary, literature etc. have also been collected to verify the survey results and to gather information about the seasonal changes along the track.
- To characterize the vegetation of Wildlife Sanctuary/ Reserved Forest area, standard quadrate method and random sampling approach has been adopted to update the ESIMMS. The quadrate technique is easy to use in communities with a profile low enough that a frame can be placed over the area to be sampled and also appropriate for forest communities that are open enough to allow plot boundaries to be marked easily and accurately with a tape measure. Quadrate survey and random sampling have been conducted in those places where no data was collected during the ESIMMS. The detailed methodology is given below:

In summarizing quadrate data, density, dominance, and frequency values can be determined for each species.

Frequency refers how widely species is distributed among the same plot. This is indicative of the dispersion of a particular species in a community.

Density refers to the number of individuals of a particular species in a unit area. This is the primary character of a community.

Dominance refers which species is largest in terms of its presence. This is a measure of the relative importance of a species in the particular community.

For a particular species, these values may be expressed as ***relative frequency, relative density*** and ***relative dominance,*** which show the percentage of the individual species' value with respect to the total for all species. Relative values for frequency, density and dominance can be combined into a single ***importance value index,*** which combines these three somewhat different measures of the importance of the species in the community. These values are calculated by the following equations:

Quadrate Size = 10 m x 10 m = 100 m^2 **Scale** = Per m^2

$$\textbf{Frequency (F)} = \frac{\text{Total no. of quadrates in which the species occur x 100}}{\text{Total No of quadrate studied}}$$

$$\textbf{Relative Frequency of a species (RF)} = \frac{\text{Frequency of the species in stand x 100}}{\text{Sum of the frequencies for all species in stand}}$$

$$\textbf{Density of a species per unit area (D)} = \frac{\text{Total no of individuals of species in all the sample plot}}{\text{Total No of sample plots studied}}$$

$$\textbf{Relative density of a species (RD)} = \frac{\text{Total no of individuals of a species x 100}}{\text{Total No of individual of all species}}$$

$$\textbf{Abundance of a species (AB)} = \frac{\text{Total no of individuals of the species in all Quadrates}}{\text{Total No of Quadrates in which the species occured}}$$

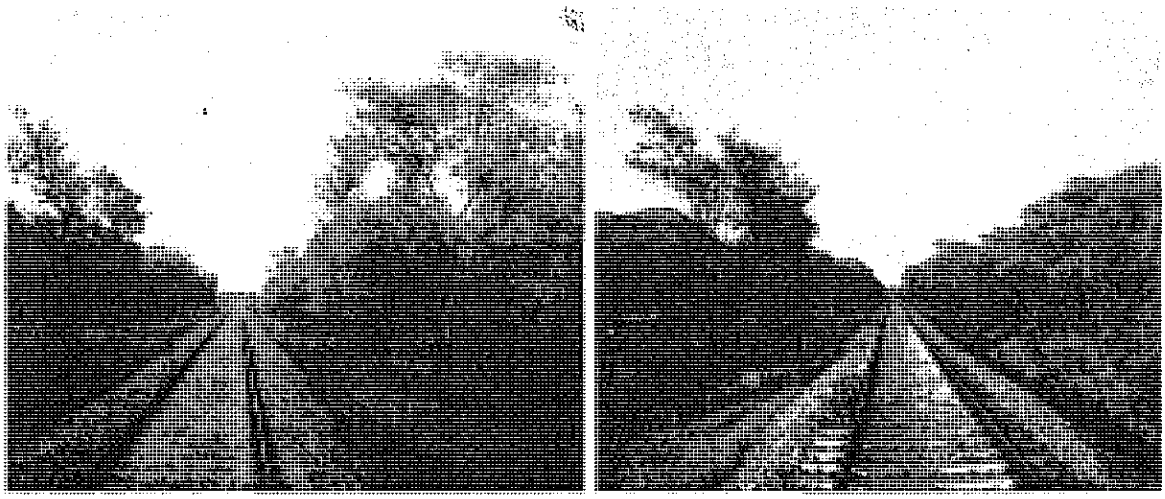
$$\textbf{Relative Dominance of the species (RDO)} = \frac{\text{Total Basal area of a species in all the quadrates x 100}}{\text{Total Basal area of all the species in all the quadrates}}$$

$$\textbf{Index of Similarity} = \frac{2 \times \text{No. of common species} \times 100}{\text{Total number of species in both associations}}$$

Importance value Index = Relative Frequency + Relative Density + Relative Dominance

(2) Major Findings

In Haryana, along the existing track, plantation has been raised by the Haryana Forest Department and major species found within the proposed ROW in Haryana are Kikar (*Acacia nilotica*), Khairi (*Acacia senegal*), Israeli kikar (*Acacia tortlis*), Ulloo neem (*Ailanthus excelsa*), Siris (*Albizia lebbek*), Neem (*Azadirachta indica*), Safeda (*Eucalyptus* sp.), Su-babul (*Leucaena leucocephala*), Bakain (*Melia azedarach*), Jand (*Prosopis cineraria*), Vilayati kikar (*Prosopis juliflora*), Arjun (*Terminalia arjuna*), and Beri (*Zizyphus mauritiana*). It has been reported by the Forest Department that there are no rare and endangered tree species along the proposed final alignment in Haryana. These species are observed through out the year. It has been reported by the Forest Department that seasonal variation of tree species is not prominent along the track and no authentic information is available regarding the seasonal changes of vegetation within the study area.



Railway Side Plantation between Khori and Kund

Along the DFC alignment, dense plantation is observed between Khori to Kund with length of 1.8 km. To assess the number of trees to be felled for construction of DFC, quadrate survey was carried out on 13th August 2008 at 30 m x 30 m plots in ten sampling plots. Girth size of the species in all sample plots were varied between 30 cm and 90 cm and height varied between 3 m and 10 m. Four types of species were observed during the survey, out of which Kikar (*Acacia nilotica*) was the predominant species. Based on the survey, total number of trees to be felled has been calculated for this stretch. Species wise total number of trees in different sample plots is presented in Table 2-60 and data collected during the survey is given in **Annex-2.1**.

Quadrate Survey between Khori and Kund along the Existing Railway Track in Haryana

Table 2-60 Species-wise Total Number of Trees in different Sample Plots

Sample Plot No.	Tree Species				Grand Total
	Kikar	Israeli kikar	Ulloo neem	Vilayati kikar	
1	8	2	1	3	14
2		5		10	15
3			19		19
4	13	3		1	17
5	8	5	4	2	19
6	7	1	3	2	13
7	6	7		4	17
8	1		15	2	18
9	20				20
10	7	2	3	5	17
Total	70	25	45	29	169
%	41%	15%	27%	17%	100%

Source: Field Survey in S-ESIMMS

- **Date of Survey** : 13th August 2008
- **Time** : 11-30 a.m. to 03-00 p.m.
- **Total surveyed area** : {10 x (30 x 30)} = 9,000 m^2 = 0.9 ha
- **Total number of trees counted** : 169
- **Latitude and Longitude of start point** : N 28° 10' 30.95" E 76° 26' 54.01"

(from Narnaul side)

- **Latitude and Longitude of end point (from Narnaul side)** : N 28° 11' 13.41" E 76° 28' 25.66"
- **Length of Plantation** : 1.8 km
- **Width of Plantation** : 30 m
- **Total area of land under plantation** : 5.3 ha
- **Therefore, approximate number of Trees to be felled** : 986

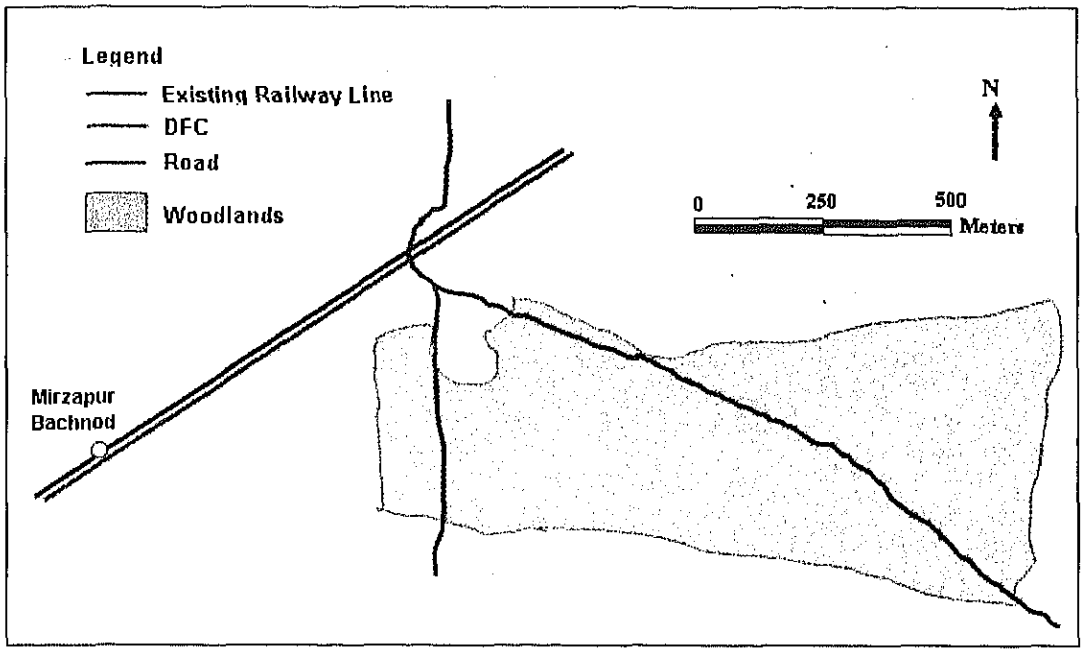
In remaining locations, visual counting has been done to assess the number of trees to be felled. For construction of DFC, approximate 6,590 trees are to be felled in Haryana as presented in Table 2-61.

Table 2-61 Approximate Number of Trees to be Felled in Haryana

District	Location	Number of Trees	Major species
Rewari	Rewari station to Khori	175	*Acacia nilotica, Acacia tortlis, Ailanthus excelsa, Eucalyptus sp.*
	Khori to Kund	1,259	*Acacia nilotica, Acacia tortlis, Ailanthus excelsa, Prosopis juliflora*
	Kund to Padla	500	*Acacia nilotica, Acacia tortlis, Ailanthus excelsa, Prosopis juliflora, Azadirachta indica, Zizyphus mauritiana*
	Sub-total	1,934	
Mahendragarh	Sujapur to Uninda	800	*Acacia nilotica, Acacia tortlis, Ailanthus excelsa, Prosopis juliflora, Azadirachta indica, Zizyphus mauritiana*
	Uninda to Ateli	195	*Acacia nilotica, Acacia tortlis, Ailanthus excelsa, Terminalia arjuna, Leucaena leucocephala*
	Ateli to Mirzapur Bachod	2,100	*Acacia nilotica, Acacia senegal, Acacia tortlis, Ailanthus excelsa, Albizia lebbek, Azadirachta indica, Eucalyptus* sp., *Leucaena leucocephala, Melia azedarach, Prosopis cineraria, Prosopis juliflora, Terminalia arjuna, Zizyphus mauritiana.*
	Mirzapur Bachod to Narnaul	825	*Acacia nilotica, Acacia tortlis, Ailanthus excelsa, Terminalia arjuna, Leucaena leucocephala*
	Narnaul to Amarpur Jorasi	456	*Acacia nilotica, Acacia tortlis, Prosopis juliflora, Prosopis cineraria*
	Amarpur Jorasi to Azmabad Mokhuta	280	*Acacia nilotica, Acacia tortlis, Prosopis juliflora, Prosopis cineraria*
	Sub-total	4,656	
Total		6,590	

Source: Field Survey during September 2008 in S-ESIMMS

Mirzapur woodlands: this lies near Mirzapur Bachnod railway station, on the eastern side of the proposed alignment. The DFC alignment does not pass through the woodland and located at a distance of 100m. It comes under the Narnaul Forest Range, scrubby vegetation in ravenous landscape, with scattered *A.nilotica* trees. Location of the woodland along with DFC alignment is shown in Figure 2-11. In Haryana, DFC alignment does not pass through any Reserved or Protected or Un-classed Forest.



Source: S-ESIMMS

Figure 2-11 Map Showing Mirzapur Woodlands and Proposed DFC alignment

(3) Impact Assessment

Impacts:

- ***Felling of Trees:*** In Haryana approximately 6,590 no. of trees have to be felled. The predominant tree species is Kikar (*Acacia nilotica*). No endangered or rare plant species is reported within the proposed ROW.

Mitigation Measures:

- To avoid uncontrolled and indiscriminate tree felling, all trees are to be numbered before felling. Joint field visit is to be conducted with the officials of Forest Department to finalize the list of trees to be felled. A sample format is given below, which is to be filled up during the visit:

Tree No.	Common Name	Height (m)	Girth Size (cm)						
				30-60	60-90	90-120	120-180	>180	Total
1.									
2.									
3.									
4.									

- Tree cutting is to proceed only after all the legal requirements including Formal Clearances from the Haryana State Forest Department are completed and subsequently a written order is issued to the Project Proponent/ Contractor.
- Appropriate compensatory plantation should be initiated to compensate the vegetation loss due to felling of trees for site clearing. For trees to be cut, sufficient compensatory plantation, about 2 times the number of trees felled, will be done. If adequate space for compensatory plantation is not available along DFC corridor, plantation may be carried out along State Highway (SH), Major District Road (MDR), and Other District Road (ODR) or in degraded forest land.

- For trees to be felled in private land, compensation for land and trees should be given to the owners. Rate of trees will be decided by the State Forest Department.
- Preferential mixed plantation consisting of flowering shrubs and evergreen ornamental trees with less timber and fruit value should be carried out.
- Under the plantation programme, more valuable tree species should be planted in place of existing non-valuable mono crops of the project area, if any.
- There will be no impact on forest due to the proposed development.

2.3.3 Fauna

(1) Study Methodology

The objective of the survey is to verify impacts on the fauna by the development of the Dedicated Freight Corridor and the relevant facilities by collecting supplementary secondary data and conducting the supplemental field surveys if required.

- To identify the species of fauna within the study area, consultation with Forest Department, local population and academic expert have been conducted.
- Supplemental secondary data such as district wise Working Plan of the Forest Division and literature have been collected.

(2) Major Findings

Due to rapid increase in human population and presence of large number of cattle, has caused the destruction of vegetative cover which has led to disappearance of wild animals to a large extent. At present mainly Common Langur (*Seinnopithecus entellus*), Blue Bull (*Boselaphus tragocamelus*) antelopes and common birds are found in the area. However, Blue Bulls are present in large number and causes damage to agriculture crops and young plants. Faunal species found within the study area is presented in Table 2-62. No endangered or rare species of mammals/ birds is reported within the study area by the Forest Department.

Table 2-62 List of Fauna Reported within the Study Area in Haryana

Sl. No.	English Name	Scientific Name
MAMMALS		
1	Blue Bull/ Nilgai	*Boselaphus tragocamelus*
2	Common Langur	*Presbytis entellus*
3	Common Fox	*Valpus bangalensis*
4	Jungle Cat	*Felis chaus*
5	Mongoose	*Herpestes edwardsi*
6	Monkey	*Macaca mulatta*
7	Pangolin/ Indian anteaters	*Manis crassicaudata*
AVI FAUNA		
8	Blue Rock Pigeon	*Columba livia*
9	Common Green Pigeon	*Treron phoenicoptera*
10	Common Swallow	*Hirundo rustica*
11	Common Myna	*Acridotheres tristes*
12	Gray Duck	*Anas poecilorhyncha*
13	House Crow	*Corvus splendens*
14	House Sparrow	*Passer domesticus*
15	House Swift	*Apus affinis*
16	Jungle Crow	*Corvus macrorhynchos*
17	Jungle-fowl	*Gallus gallus*
18	Koel	*Eudynamys scolopacae*
19	Snake Bird	*Anhinga rufa*

Source: Field survey and Consultation with Forest Department and local people

(3) Impact Assessment

There will be no significant impact on fauna due to the proposed development.

Impacts:

Loss of habitat of avian fauna due to felling of trees, which is a short-term impact: During construction period they will be shifted to some other place.

Mitigation Measures:

Appropriate compensatory plantation should be initiated to compensate the habitat loss due to felling of trees for site clearing. Due to the plantation along the alignment, habitat of avifauna will be restored within 1-2 years.

CHAPTER III-3 SOCIAL CONSIDERATIONS

3.1 SCOPE OF LAND ACQUISITION AND RESETTLEMENT

3.1.1 Land Acquisition

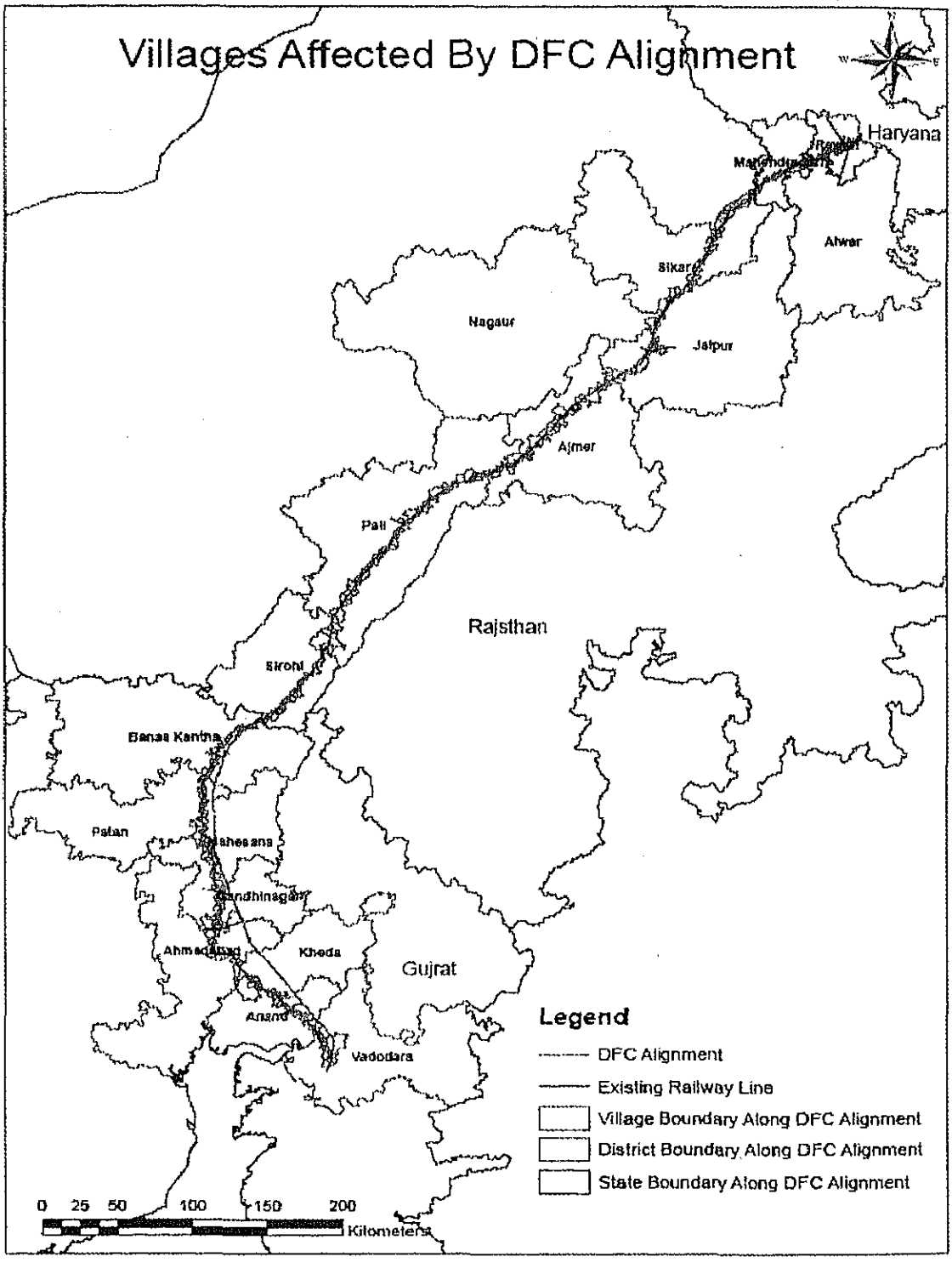
Alignment for the Western Corridor of DFC Project between Vadodara and Rewari passes through 470 villages of 17 districts in 3 states. The land acquisition is required for construction of the Project in full stretch of length which is approximately 940 km. Broadly, two kinds of land will be required for this project, one within ROW and two, in detour area. Detailed Land Acquisition Plan for this area is under preparation. Therefore, total land area to be required for the Project is calculated based on approximate boundaries of ROW based on the available FLS drawing overlaying on the GIS. Total land required for the Project is around 4,880 ha. Since the total land area calculated includes both private and public lands, total land to be acquired for the Project which is mainly private land will be less land area than that of total land area to be required. The land area to be acquired for the Project will be known, when the detailed Land Acquisition Plans become available. District-wise land acquisition details are given in Table 3-1 and villages affected by the Project are shown in Figure 3-1.

Table 3-1 District-wise Land Details for the Project

	Villages DFC alignment passes through	Length of the Parallel Section (km)	Length of the Detour Section (km)	Total Length (km)	Total Land Area (ha) *
Gujarat					
Vadodara	16	0.0	28.3	28.3	190
Anand	29	0.0	45.5	45.5	277
Kheda	18	0.0	26.4	26.4	135
Ahmedabad	20	0.0	43.7	43.7	221
Gandhinagar	16	0.0	27.0	27.0	116
Mahesana	43	0.0	54.5	54.5	374
Patan	13	0.0	34.1	34.1	244
Banaskantha	34	16.0	44.0	60.0	379
Sub-total	189	16.0	303.5	319.5	1,936
Rajasthan					
Sirohi	27	65.5	0.0	65.5	305
Pali	73	195.8	0.0	195.8	954
Ajmer	42	95.3	3.9	99.2	380
Jaipur	39	86.8	4.7	91.5	468
Nagaur	2	3.3	0.0	3.3	10
Sikar	35	78.9	0.0	78.9	461
Alwar	2	2.5	0.0	2.5	9
Sub-total	220	528.1	8.6	536.7	2,587
Haryana					
Mahendragarh	34	46.4	0.0	46.4	175
Rewari	27	17.6	19.5	37.1	180
Sub-total	61	64.0	19.5	83.5	355
Total	470	608.1	331.6	939.7	4,877

Note: * - within ROW

** - It includes existing Ministry of Railway's Land within ROW.



Source: JBIC SAPROF Study, 2008

Figure 3-1 Villages Affected By DFC Alignment

3.1.2 Project-Affected Structure Survey

A Project-Affected Structure Survey was carried out between July and September 2008 to identify structures to be relocated as well as identify the Project-Affected Families to be resettled in the land acquisition for the Project, based on design of the alignment prepared by DFCCIL. A structured questionnaire as shown in Attachment III-3-1 was used to collect basic information on project-affected structure and families for adequate understanding of impacts in order to develop mitigation measures and basic resettlement action plan for the PAPs. The objective of the survey is to generate an inventory of project-affected structures and families with basic socio-economic information such as type of affected structure, type of ownership, market value of land and/or structure, social profile of the affected people, and poverty status. The major findings and magnitude of impacts are shown below.

(1) Survey Method

The survey method of the Project-Affected Structure Survey is explained below.

1) Identification of Administrative Units

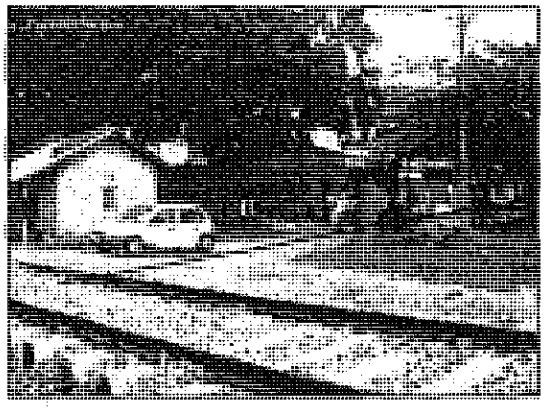
As a first step, all administrate units such as districts, sub-districts and villages through which proposed alignment of the DFC project traverses are identified.

2) Identification of Structures

During the survey, some sections of the DFC alignment are still under examination and boundaries of the right-of way (ROW) have not been fixed. Therefore, the following rule was applied to identify the project affected structures.

a) Parallel Section

Broadly, sections between Khori Station in Haryana (Section 15) and Iqbalgarh in Gujarat (Section 9) are parallel section. In these sections, land will be acquired on eastern side of the existing track. Therefore, in the parallel sections, all structures which are located on the 50 m-width stretch from centreline of existing last track to eastern side are identified as project-affected structures.



b) Detour Section

In detour sections, width of ROW is considered at 70 m for survey with 35 m-width from centre to both sides of the alignment.

3.1.3 Categories of Properties Affected within ROW

Based on results of the survey, number of residential and commercial structures as well as affected community and religious properties and squatters structures built within the ROW of FLS drawing for both parallel and detour sections are identified as more actual project-affected structures. On the other, in some sections where the FLS drawings are not available as Section 15 (910 km to 939.4 km) and Section 9 (278.2 km to 302.2 km) and

Section 8 (230.2 km to 278.2 km), 70 m for the detour section and 50 m for parallel section are applied for width of the ROW.

District-wise details of properties getting impacted under various categories are shown in Table 3-2.

Table 3-2 Number of Project-Affected Structures to be Relocated

	Residential	Commercial	Residential -cum- commercial	Community	Religious	Government	Others	Total
Gujarat								
Vadodara	0	0	0	0	0	0	1	1
Anand	23	0	1	0	2	0	4	30
Kheda	8	1	0	0	0	0	0	9
Ahmedabad	0	0	0	0	0	0	0	0
Gandhinagar	2	1	0	0	0	0	1	4
Mahesana	3	0	0	0	0	0	0	3
Patan	0	0	0	0	0	0	0	0
Banaskantha	52	0	1	0	2	0	1	56
Sub-total	88	2	2	0	4	0	7	103
Rajasthan								
Sirohi	9	0	0	0	2	24	6	41
Pali	92	18	4	1	23	114	30	282
Ajmer	252	51	17	7	24	58	41	450
Jaipur	55	33	16	2	9	7	23	145
Nagaur	0	0	0	0	0	0	0	0
Sikar	113	56	30	5	22	15	32	273
Alwar	7	0	0	0	0	0	0	7
Sub-total	528	158	67	15	80	218	132	1,198
Haryana								
Mahendragarh	178	69	19	12	14	22	26	340
Rewari	16	22	8	5	3	3	4	61
Sub-total	194	91	27	17	17	25	30	401
Total	**810**	**251**	**96**	**32**	**101**	**243**	**169**	**1,702**

Note: The above figures are related to both fully and partially affected structures.
Source: Project-Affected Structure Survey, 2008

Various types of structures are being affected due to the DFC project. Out of total 1,702 structures, 810 (47.6%) are of residential type followed by 251 (14.7%) are commercial type such as shops, kiosks, and hotels and 96 (5.6%) are of residential cum commercial structures. Some people have their residential structures close to the road and use the front part for business purpose. Other than these, 32 community property resources and 101 religious structures will be affected.

Project Affected Families (PAFs) are calculated from the residential, commercial and residential cum commercial structures which are getting affected by the project. In Gujarat, the proportion of structures getting affected based on their present use as residential, commercial, and residential cum commercial is 95.6%, 2.2%, and 2.2%, respectively. For Rajasthan the proportion is 70.2%, 20.9%, and 8.9%, and in Haryana is 62.2%, 29.2%, and 8.6%, respectively.

3.1.4 Percentage of Type of Affected Residential Structures and Construction Type

Due to the implementation of Project, the residential structures getting affected are comprised of 97.2 % houses and 2.8% huts. State-wise distribution shows that in Gujarat 96.6 % affected residential structures are houses and 3.4 % are huts. In Rajasthan, 96.9 % affected residential structures are houses and 3.1% are huts. In Haryana, 98.3 % affected residential structures are houses and 1.7 % is huts.

Similarly, due to the Project, permanent at 84.5% and semi-permanent structures at 15.5% will be affected. Likewise, 35.2% and 64.8%, respectively in Gujarat, 90.7% and 9.3%, respectively in Rajasthan, and 90.9% and 9.1%, respectively in Haryana.

District-wise house types to be affected are given in Table 3-3.

Table 3-3 District-wise House Type to be Affected

	House Appearance (%)		Construction Type (%)	
	House	Hut	Permanent	Semi-permanent
Gujarat				
Vadodara	0.0	0.0	0.0	0.0
Anand	26.1	0.0	6.8	19.3
Kheda	9.1	0.0	0.0	9.1
Ahmedabad	0.0	0.0	0.0	0.0
Gandhinagar	2.3	0.0	0.0	2.3
Mahesana	0.0	3.4	0.0	3.4
Patan	0.0	0.0	0.0	0.0
Banaskantha	59.1	0.0	28.4	30.7
Sub-total	96.6	3.4	35.2	64.8
Rajasthan				
Sirohi	1.7	0.0	0.8	1.0
Pali	17.2	0.2	14.8	2.9
Ajmer	47.4	0.4	45.8	2.5
Jaipur	8.2	1.9	8.2	1.0
Nagaur	0.0	0.0	0.0	0.0
Sikar	21.4	0.2	20.6	1.2
Alwar	1.0	0.4	0.6	0.8
Sub-total	96.9	3.1	90.7	9.3
Haryana				
Mahendragarh	89.2	1.7	84.1	6.8
Rewari	9.1	0.0	6.8	2.3
Sub-total	98.3	1.7	90.9	9.1
Total	97.2	2.8	84.5	15.5

Note: The above figures are related to both fully and partially affected structures.
Source: Project-Affected Structure Survey, 2008

3.1.5 Number of Affected Family

Due to the land acquisition of the Project, 1,296 families with 8,487 persons are likely to be relocated, out of which 4,458 (52.5%) are male and 4,029 (47.5%) are female. The average household size is 6 persons / household. The details of project-affected persons are summarized in the Table 3-4 and Table 3-5.

In Gujarat, 102 families with 646 persons are likely to be affected, out of which 339 (52.5%) are male and 307 (47.4%) are female. The average household size is 6 persons / household. In Vadodara and Ahmedabad Districts, no structures will be affected. In Gujarat, 624 residential, 9 commercial and 13 residential-cum-commercial PAPs will be affected.

In Rajasthan, 780 families with 5,439 persons are likely to be affected, out of which 2,878 (53%) are male and 2,561(47%) are female. The average household size is 7 persons / household. In Nagaur District, no structures will be affected. In Rajasthan, 3,774 residential, 997 commercial and 668 residential-cum-commercial PAPs will be affected.

In Haryana, 414 families and 2,402 persons are likely to be affected, out of which 1,241 (52%) are male and 1,161 (48%) are female. The average household size is 6 persons / household. In Haryana, 1,436 residential, 744 commercial, and 222 residential-cum-commercial structures will be affected.

Table 3-4 Number of Project-Affected Families

	PAF			Total
	Residential (1)	Commercial (2)	Residential -cum- Commercial (3)	
Gujarat				
Vadodara	0	0	0	0
Anand	28	0	1	29
Kheda	8	1	0	9
Ahmedabad	0	0	0	0
Gandhinagar	2	1	0	3
Mahesana	3	0	0	3
Patan	0	0	0	0
Banaskantha	56	0	2	58
Sub-total	97	2	3	102
Rajasthan				
Sirohi	9	0	0	9
Pali	94	18	4	116
Ajmer	254	51	18	323
Jaipur	56	33	16	105
Nagaur	0	0	0	0
Sikar	121	61	38	220
Alwar	7	0	0	7
Sub-total	541	163	76	780
Haryana				
Mahendragarh	262	73	28	363
Rewari	16	27	8	51
Sub-total	278	100	36	414
Total	**916**	**265**	**115**	**1296**

Note: The above figures are related to both fully and partially affected structures.
Source: Project-Affected Structure Survey, 2008

Table 3-5 Number of Project-Affected Persons

	PAP				Male				Female			
	Residential (1)	Commercial (2)	Residential -cum- Commercial (3)	Total	(1)	(2)	(3)	Total	(1)	(2)	(3)	Total
Gujarat												
Vadodara	0	0	0	0	0	0	0	0	0	0	0	0
Anand	153	0	6	159	74	0	3	77	79	0	3	82
Kheda	43	5	0	48	26	3	0	29	17	2	0	19
Ahmedabad	0	0	0	0	0	0	0	0	0	0	0	0
Gandhinagar	11	4	0	15	8	2	0	10	3	2	0	5
Mahesana	15	0	0	15	8	0	0	8	7	0	0	7
Patan	0	0	0	0	0	0	0	0	0	0	0	0
Banaskantha	402	0	7	409	211	0	4	215	191	0	3	194
Sub-total	624	9	13	646	327	5	7	339	297	4	6	307
Rajasthan												
Sirohi	69	0	0	69	39	0	0	39	30	0	0	30
Pali	615	112	26	753	342	62	12	416	273	50	14	337
Ajmer	1522	248	103	1873	798	129	50	977	724	119	53	896
Jaipur	525	255	197	977	288	118	109	515	237	137	88	462
Nagaur	0	0	0	0	0	0	0	0	0	0	0	0
Sikar	999	382	342	1723	526	212	169	907	473	170	173	816
Alwar	44	0	0	44	24	0	0	24	20	0	0	20
Sub-total	3774	997	668	5439	2017	521	340	2878	1757	476	328	2561
Haryana												
Mahendragarh	1332	567	169	2068	704	281	86	1071	628	286	83	997
Rewari	104	177	53	334	54	89	27	170	50	88	26	164
Sub-total	1436	744	222	2402	758	370	113	1241	678	374	109	1161
Total	**5834**	**1750**	**903**	**8487**	**3102**	**896**	**460**	**4458**	**2732**	**854**	**443**	**4029**

Note: The above figures are related to both fully and partially affected structures.
Source: Project-Affected Structure Survey, 2008

3.1.6 Number of Affected Squatters

Due to the land acquisition for the Project, 10 squatters will be affected in Haryana; 8 in Mahendragarh District and 2 in Rewari District. By profession, they are mainly Kiosks having semi permanent structures. In Gujarat and Rajasthan, there is no squatter to be affected. No residential squatters will be affected in these three concerned states.

3.1.7 Additional Social Survey in Ajmer and Patan Districts

Due to change in the alignment in near Madar Junction in Ajmer and Patan District, additional social survey was carried out in the month of March 2009. The survey results are shown in Appendix III_3.3.

3.2 SOCIO-ECONOMIC FEATURES OF THE PROJECT-AFFECTED PEOPLE

3.2.1 Socio-Economic Survey of PAPs

In addition to the demographic and social data collected through structure identification survey additional socio-economic information is collected from PAFs through a structured socioeconomic questionnaire. This socio-economic questionnaire as shown in Attachment III-3-2 is administered in the project area covering 20% of the Project Affected Families (PAFs). This chapter presents the socio-economic profile of PAFs in two separate sections based on two different surveys, i.e. Project-Affected Structure Identification Survey and Socio-economic Survey.

(1) Components of the Socio-economic Questionnaire

Major questions of questionnaire in the Socio-economic Survey are as follows:

1) Occupation, household members, education level, religion, social categories of the PAF;
2) House type and land ownership of PAFs;
3) Income source, assets including livestock, agricultural equipment, household goods, savings and loans;
4) Employment type if farmers;
5) Problems on livelihoods;
6) Access to public facilities, markets, farmland, and religious buildings;
7) Access to basic infrastructures; and
8) Comments on the expected social impacts on residents, resettlement and compensation of the DFC Project

3.2.2 Social Profile of PAFs

Based on findings of the Project-Affected Structure Identification Survey, the social profile of the affected persons such as religion, social stratification and socio-economic characteristics etc. are presented in the following sections.

(1) Social Category of PAFs

The social stratification of the whole project area shows that the dominance of other backward caste (OBC) family with 43.2%. The second stratum of the social grouping in the area is of General Caste family (32.4%) followed by Scheduled Caste (18.8%). The presence of

Schedule Tribe (ST) family in the project area is 5.4% as there are 63 household from the ST community is enumerated by the Survey. The detail of social grouping in the project area is presented in the Table 3-6.

In Rajasthan and Haryana, percentages of OBC are predominant which are 41.4% and 54.6%, respectively. In Haryana, there is no ST population which will be affected.

Table 3-6 Social Features of Project-Affected Families

	Social Category			
	General	SC	ST	OBC
GUJARAT				
Vadodara	0	0	0	0
Anand	10	14	0	0
Kheda	0	0	0	9
Ahmedabad	0	0	0	0
Gandhinagar	1	0	0	2
Mahesana	0	0	0	3
Patan	0	0	0	0
Banaskantha	33	1	13	6
Sub-total	44	15	13	20
RAJASTHAN				
Sirohi	2	0	5	2
Pali	39	25	8	42
Ajmer	114	67	26	113
Jaipur	20	28	7	49
Nagaur	0	0	0	0
Sikar	68	23	4	104
Alwar	5	0	0	2
Sub-total	248	143	50	312
HARYANA				
Mahendragarh	79	59	0	127
Rewari	3	0	0	43
Sub-total	82	59	0	170
Total	374	217	63	502
	1156			

Note: The above figures are related to both fully and partially affected structures
Source: Project-Affected Structure Survey, 2008

(2) Religious Categories of the PAFS

The project area is dominated by Hindu community as they form 94.5% (1,092) of the PAFs. Among others, 3.5% (41) are Muslim community. The religious categories of PAFs are presented in the Table 3-7.

Table 3-7 Religious Categories of the PAFS

	Hindu	Muslim	Christian	Jain	Sikh	Buddhist
GUJARAT						
Vadodara	0	0	0	0	0	0
Anand	18	6	0	0	0	0
Kheda	9	0	0	0	0	0
Ahmedabad	0	0	0	0	0	0
Gandhinagar	3	0	0	0	0	0
Mahesana	3	0	0	0	0	0
Patan	0	0	0	0	0	0
Banaskantha	48	5	0	0	0	0
Sub-total	81	11	0	0	0	0
RAJASTHAN						
Sirohi	7	2	0	0	0	0
Pali	89	19	0	6	0	0
Ajmer	295	8	8	7	2	0
Jaipur	103	1	0	0	0	0
Nagaur	0	0	0	0	0	0
Sikar	199	0	0	0	0	0
Alwar	7	0	0	0	0	0
Sub-total	700	30	8	13	2	0
HARYANA						
Mahendragarh	265	0	0	0	0	0
Rewari	46	0	0	0	0	0
Sub-total	311	0	0	0	0	0
Total	1092	41	8	13	2	0
	1156					

Note: The above figures are related to both fully and partially affected structures.
Source: Project-Affected Structure Survey, 2008

(3) Vulnerable Families

In the project area there are many families falling below poverty line (BPL).

Woman headed families and disabled families are also considered vulnerable. Some of the women headed families and disabled families belong to the Scheduled Castes (SC) and therefore either way they are vulnerable

According to the Project-Affected Structure Identification Survey, a total of 46 families have been identified as socially and economically vulnerable in Gujarat. In vulnerable category, there are 89.1% such families falling under BPL category and vulnerable group. There are 8.7% women headed families and 2.2% families headed by physically handicapped people being affected.

In Rajasthan, 25% of the total affected families have been identified as socially and economically vulnerable. 92.1% of the total vulnerable families belong to BPL family. It is observed that most of BPL families are found in Ajmer District. Among BPL families, SC constitutes the highest followed by economically poor families and women headed families.

In Haryana, vulnerable families likely to be affected have been identified 31.9% of the total affected families. According to the latest BPL Survey in 2007 under the Government of Haryana, BPL families comprise 25.5% and 26.6% of the total rural families in Rewari and Mahendragarh Districts, respectively. It is observed that about 57% of the affected BPL

families are in Mahendragarh District. Woman-headed household at 12.9% has been observed during time of survey.

(4) Distribution of Family Income

In Gujarat, 77% of the families are having income level less than or equal to Rs. 5,000/month and most of the families whose monthly income are less than equal to Rs. 5,000/month are concentrated at Banaskantha and Mahesana District. 7.5% of total families surveyed are having income level at Rs. 10,000/month.

In Rajasthan, 70.6% of the families are found whose income level is less than and equal to Rs. 5,000/month and 12.4% of the total families surveyed whose income level is Rs. 10,000/month. Most of the families whose monthly income are less than and equal to Rs. 5,000/month are concentrated at Ajmer, Pali and Sikar Districts.

In Haryana, 59% of the families are having income level less than and equal to Rs. 5,000/month and 16% of the total families surveyed whose income level is Rs. 10,000/month.

3.2.3 Socio-Economic Findings Based on Sample Survey

In addition to the social profile of PAFs based on the findings of the Project-Affected Structure Identification Survey, the socioeconomic profile of the PAFs is presented based on the Socio-economic Survey with 20% sample of the total PAFs in the following sections.

(1) Occupation of Surveyed PAPs

In the overall project area, the percentage of business people, daily wage labour, is dominant.

In Gujarat, Major income source is agriculture and daily wage labour. 65.2% people directly or indirectly depends upon agriculture and daily wage labour.

In Rajasthan, major income source is private service and wage employee. 17.2% people do business. Other than this 19% people directly or indirectly depends upon agriculture, daily wage labour and other occupations.

In Mahendragarh District of Haryana, business is the dominant occupation. In Rewari, since the total number of structures surveyed is only 16, no dominant occupation type is visible.

Table 3-8 Occupational Status of Surveyed PAPs

	Occupation (20% of PAFs)*							
	Agriculture	Business	Daily Wage Labour	Govt. Service	Others	Pvt. Service	Wage Employee	Total
GUJARAT								
Vadodara	0	0	0	0	0	0	0	0
Anand	6	0	7	0	0	1	0	14
Kheda	0	0	1	1	0	0	0	2
Ahmedabad	0	0	0	0	0	0	0	0
Gandhinagar	0	0	0	0	0	0	0	0
Mahesana	6	0	3	5	1	0	0	15
Patan	2	0		0	0	0	1	3
Banaskantha	1	1	4	2	0	4	0	12
Sub Total	15	1	15	8	1	5	1	46
Percentage	32.6%	2.2%	32.6%	17.3%	2.2%	10.9%	2.2%	100%
RAJASTHAN								
Sirohi	0	0	0	0	0	0	3	3
Pali	0	4	1	0	1	16	14	36
Ajmer	9	12	4	4	10	41	23	103
Jaipur	6	3	1	0	3	11	4	28
Nagaur	0	0	0	0	0	0	0	0
Sikar	4	19	2	3	0	16	11	55
Alwar	1	1	0	0	0	0	0	2
Sub-total	20	39	8	7	14	84	55	227
Percentage	8.8%	17.2%	3.5%	3.1%	6.2%	37.0%	24.2%	100%
HARYANA								
Mahendragarh	5	28	12	7	8	5	6	71
Rewari	3	5	3		4	0	1	16
Sub-total	8	33	15	7	12	5	7	87
Percentage	9.2%	37.9%	17.2%	8.0%	13.8%	5.7%	8.0%	100%
Average	16.9%	19.1%	17.8%	9.5%	7.4%	17.9%	11.5%	100.0%

Source: Socio-economic Survey of PAFs, 2008

(2) Educational Status of PAPS

Education level of Project affected districts are presented in Table 3-9.

In Gujarat, only 6.5% people are illiterate. Most of the people are literate among them 10.9% people are graduate. In Rajasthan, only 5.7% people are illiterate. Most of the people are literate among them 34.4% people are graduated.

In Mahendragarh of Haryana, maximum people surveyed are high school standard/completed education up to 12th standard, meaning moderately educated. About 30% of the people surveyed are illiterate. This indicates that in case these people are affected, they would need appropriate training for their restoration of livelihood as most of them are either illiterate or education level is low.

Table 3-9 Educational Status of PAPs

	Educational Status (20%)							
	Can Read	Can Write	Graduate	High School (12th Std)	Illiterate	ITI	Primary (5th Std)	Total
GUJARAT								
Vadodara	0	0	0	0	0	0	0	0
Anand	0	10	1	1	2	0	0	14
Kheda	0	0	1	0	0	0	1	2
Ahmedabad	0	0	0	0	0	0	0	0
Gandhinagar	0	0	0	0	0	0	0	0
Mahesana	0	4	1	7	1	1	1	15
Patan	1	2	0	0	0	0	0	3
Banaskantha	0	3	2	6	0	1	0	12
Sub Total	1	19	5	14	3	2	2	46
Percentage	2.2%	41.3%	10.9%	30.5%	6.5%	4.3%	4.3%	100%
RAJASTHAN								
Sirohi	0	2	0	0	0	0	1	3
Pali	0	21	15	0	0	0	0	36
Ajmer	6	49	31	7	5	0	5	103
Jaipur	0	9	11	4	4	0	0	28
Nagaur	0	0	0	0	0	0	0	0
Sikar	3	10	21	12	4	0	5	55
Alwar	0	0	0	2	0	0	0	2
Sub-total	9	91	78	25	13	0	11	227
Percentage	4.0%	40.1%	34.4%	11.0%	5.7%	0%	4.8%	100%
HARYANA								
Mahendragarh	1	3	10	29	17	0	11	71
Rewari	0	2	0	5	9	0	0	16
Sub-total	1	5	10	34	26	0	11	87
Percentage	1.1%	5.7%	11.5%	39.1%	29.9%	0%	12.6%	100%
Average	2.4%	29.0%	18.9%	26.9%	14.0%	1.4%	7.2%	100.0%

Source: Socio-economic Survey of PAFs, 2008

(3) Distribution of Assets

Distribution of assets is presented in Table 3-10. Assets are indicators of the socio-economic conditions of people. Livestock are mostly cow, buffalo, sheep, ox, goat etc. Agricultural equipments are mainly tractor, power trailer, thresher, harvester, Consumer durables are TV, fridge, mixer etc.

In Gujarat, Banaskantha District the number of livestock and number of two wheelers are maximum which indicate the better economic condition of majority of families likely to be affected by the project. In Rajasthan, Ajmer District the number of livestock and consumer durables are maximum which indicate the better economic condition of majority of families likely to be affected by the project. In Haryana, consumer durables and livestock are proportionately more in Mahendragarh than that in Rewari.

Table 3-10 Distribution of Assets

	Distribution of Assets				
	Livestock	Agricultural Equipments	Consumer durables	2 Wheelers	4 wheelers
GUJARAT					
Vadodara	0	0	0	0	0
Anand	41	1	4	47	1
Kheda	3	0	0	7	0
Ahmedabad	0	0	0	0	0
Gandhinagar	0	0	0	0	0
Mahesana	14	2	0	51	0
Patan	14	0	2	8	0
Banaskantha	51	0	3	52	0
Sub-total	123	3	9	165	1
RAJASTHAN					
Sirohi	0	0	8	0	0
Pali	4	0	134	11	0
Ajmer	116	4	358	28	4
Jaipur	54	10	127	8	1
Nagaur	0	0	0	0	0
Sikar	53	12	295	27	11
Alwar	6	12	9	1	0
Sub-total	233	38	931	75	16
HARYANA					
Mahendragarh	131	8	349	65	13
Rewari	35	7	62	19	0
Sub-total	166	15	411	84	13
Total	522	56	1351	324	30

Source: Socio-economic Survey of PAFs, 2008

(4) Drinking Water Source

Drinking water source are presented in Table 3-11. Most of the population in overall area depends on private pump well for drinking water source. In Gujarat, most of the population depends on public supply for drinking water source. In Rajasthan, most of the families have their private pump well. 48.5% of populations depend on private pump well. In Haryana, private pumps dominate in Mahendragarh while in Rewari dug wells too are important with private pumps.

Table 3-11 Drinking Water Source of the Area

	Drinking Water Source					
	Common Dig well	Common Pump well	Private Dig well	Private Pump well	Public Supply	Total
GUJARAT						
Vadodara	0	0	0	0	0	0
Anand	2	3	6	2	1	14
Kheda	0	0	0	1	1	2
Ahmedabad	0	0	0	0	0	0
Gandhinagar	0	0	0	0	0	0
Mahesana	0	0	0	1	14	15
Patan	0	0	0	2	1	3
Banaskantha	4	2	0	2	4	12
Sub Total	6	5	6	8	21	46
Percentage	13.0%	10.9%	13.0%	17.4%	45.7%	100%
RAJASTHAN						
Sirohi	0	2	0	1	0	3
Pali	2	21	0	5	8	36
Ajmer	3	11	4	57	28	103
Jaipur	0	5	0	21	2	28
Nagaur	0	0	0	0	0	0
Sikar	4	18	1	24	8	55
Alwar	0	0	0	2	0	2
Sub-total	9	57	5	110	46	227
Percentage	4.0%	25.1%	2.2%	48.5%	20.3%	100%
HARYANA						
Mahendragarh	1	6	3	57	4	71
Rewari	0	0	5	9	2	16
Sub-total	1	6	8	66	6	87
Percentage	1.1%	6.9%	9.2%	75.9%	6.9%	100%
Total	16	68	19	184	73	360

Source: Socio-economic Survey of PAFs, 2008

(5) Toilet Facility

Toilet facilities are presented in Table 3-12. Maximum PAFs have their own toilet facilities at their own house. In Gujarat, 82% of the PAFs have their own toilet facilities at their own house. There are some few villages where there is no toilet facility. In Rajasthan, maximum PAFs have their toilet facilities at their own house (76%). In Haryana, 50.6% of PAFs don't have toilet facilities at their own house and 43.7% of the families have toilet facilities.

Table 3-12 Toilet Facility of the Project Area

	Toilet Facilities				
	Indoor	Pvt Outdoor	Common Outdoor	Not Available	Total
GUJARAT					
Vadodara	0	0	0	0	0
Anand	10	0	1	3	14
Kheda	1	0	0	1	2
Ahmedabad	0	0	0	0	0
Gandhinagar	0	0	0	0	0
Mahesana	13	0	0	2	15
Patan	3	0	0	0	3
Banaskantha	11	1	0	0	12
Sub-total	38	1	1	6	46
Percentage	82.6%	2.2%	2.2%	13.0%	100%
RAJASTHAN					
Sirohi	2	0	0	1	3
Pali	27	2	5	2	36
Ajmer	80	2	18	3	103
Jaipur	25	1	1	1	28
Nagaur	0	0	0	0	0
Sikar	38	0	12	5	55
Alwar	1	0	0	1	2
Sub-total	173	5	36	13	227
Percentage	76.0%	2.0%	16.0%	6.0%	100%
HARYANA					
Mahendragarh	31	5	0	35	75
Rewari	7	0	0	9	18
Sub-total	38	5	0	44	93
Percentage	43.7%	5.7%	0.0%	50.6%	100%
Total	249	11	37	63	360

Source: Socio-economic Survey of PAFs, 2008

(6) Power Supply

Power supply facilities are presented in Table 3-13. In Gujarat, 96% villages have electric connections. Some people have their private generator set. In Rajasthan, 96.5% project affected villages have electric connections. Only 3.5% of the respondents reported that power supply is not available. Considering power supply, toilet facilities and access to drinking water as development index, the villages in Rajasthan may be considered as moderately developed. In Haryana, 86.2% of villagers have electric connections.

Table 3-13 Power Supply of Project Area

	Power Supply			
	Not available	Power line	Pvt Generator	Total
GUJARAT				
Vadodara	0	0	0	0
Anand	1	12	1	14
Kheda	0	2	0	2
Ahmedabad	0	0	0	0
Gandhinagar	0	0	0	0
Mahesana	0	15	0	15
Patan	0	3	0	3
Banaskantha	0	12	0	12
Sub-total	1	44	1	46
Percentage	2.2%	95.6%	2.2%	100%
RAJASTHAN				
Sirohi	0	3	0	3
Pali	1	35	0	36
Ajmer	0	103	0	103
Jaipur	0	28	0	28
Nagaur	0	0	0	0
Sikar	7	48	0	55
Alwar	0	2	0	2
Sub-total	8	219	0	227
Percentage	3.5%	96.5%	0.0%	100%
HARYANA				
Mahendragarh	8	63	0	71
Rewari	4	12	0	16
Sub-total	12	75	0	87
Percentage	13.8%	86.2%	0.0%	100%
Total	21	338	1	360

Source: Socio-economic Survey of PAFs, 2008

(7) Women in Economic Activities

Women members of the affected household in the project area are engaged in various economic and non-economic (household) activities. As result of the Socio economic Survey, it shows that the numbers of female member engaged in economic activities in Banaskantha District of Gujarat are more than that in the others project affected districts. In Rajasthan, the numbers of female member engaged in economic activities in Sikar District are more than that in the others project affected districts. Ajmer takes second position in this matter. In Haryana, the number of female member engaged in economic activities in Rewari District are more than that in the others project affected districts.

(8) Awareness and Envisaged Benefits about DFC project

The awareness of DFC Project is presented in Table 3-14. People are conscious about the DFC Project at 98% in Gujarat, 73.6% in Rajasthan, and 97.7% in Haryana. People have got the basic information about the Project mainly from newspaper and TV. Most of the people of the project area at 91.3% are conscious about the Project and they agree that this project will bring the economic benefit in their areas. People at Mahendragarh District accept that this project will bring business opportunity while people at Rewari agreed with industry development.

Table 3-14 Awareness about DFC Project

	Awareness about DFC Project		
	Yes	No	Total
GUJARAT			
Vadodara	0	0	0
Anand	14	0	14
Kheda	2	0	2
Ahmedabad	0	0	0
Gandhinagar	0	0	0
Mahesana	14	1	15
Patan	3	0	3
Banaskantha	12	0	12
Sub Total	45	1	46
Percentage	97.8%	0.02%	100%
RAJASTHAN			
Sirohi	2	1	3
Pali	29	7	36
Ajmer	71	32	103
Jaipur	22	6	28
Nagaur	0	0	0
Sikar	41	14	55
ALWAR	2	0	2
Sub Total	167	60	227
Percentage	73.6%	26.4%	100%
HARYANA			
Mahendragarh	70	1	71
Rewari	15	1	16
Sub Total	85	2	87
Percentage	97.7%	2.3%	100%
Total	297	63	360

Source: Socio-economic Survey of PAFs, 2008

(9) Choice of Place for Relocation and Resettlement

While asked about relocation options if required, it is noted that majority of the people preferred to be relocated in the same village.

Table 3-15 Choice of Place for Relocation and Resettlement

	Compensation	Doesn't matter	Same State	Same District	Same sub-district	Same village	No answer	Total
GUJARAT								
Vadodara	0	0	0	0	0	0	0	0
Anand	1	0	0	0	2	9	0	14
Kheda	0	0	0	0	1	1	0	2
Ahmedabad	0	0	0	0	0	0	0	0
Gandhinagar	0	0	0	0	0	0	0	0
Mahesana	0	0	0	0	0	15	0	15
Patan	0	0	0	0	0	2	0	3
Banaskantha	0	0	0	2	1	9	0	12
Sub Total	1	0	0	2	4	36	0	46
Percentage	2.2%	0.0%	0.0%	4.3%	8.7%	78.3%	0.0%	100%
RAJASTHAN								
Sirohi	0	0	0	0	1	2	0	3
Pali	0	0	0	0	1	35	0	36
Ajmer	0	6	1	0	5	91	0	103
Jaipur	0	0	0	0	1	27	0	28
Nagaur	0	0	0	0	0	0	0	0
Sikar	0	0	0	0	7	48	0	55
ALWAR	0	0	0	0	0	2	0	2
Sub Total	0	6	1	0	15	205	0	227
Percentage	0.0%	2.6%	0.4%	0.0%	6.6%	90.3%	0.0%	100%
HARYANA								
Mahendragarh	0	3	0	1	0	62	5	71
Rewari	0	1	0	1	0	14	0	16
Sub Total	0	4	0	2	0	76	5	87
Percentage	0.0%	4.6%	0.0%	2.3%	0.0%	87.4%	5.7%	100%

Source: Socio-economic Survey of PAFs, 2008

(10) Anticipated Loss of Income

Anticipation of difficulty during resettlement is presented in Table 3-16. Most of the respondents have anticipated the major difficulty in finding a new house and finding new income source.

Table 3-16 Anticipated Loss of Income

	Acclimatization	Finding Income Source	Finding new farmland	Finding new house	Security issues	Finding New School	Total
GUJARAT							
Vadodara	0	0	0	0	0	0	0
Anand	0	6	2	6	0	0	14
Kheda	0	0	1	1	0	0	2
Ahmedabad	0	0	0	0	0	0	0
Gandhinagar	0	0	0	0	0	0	0
Mahesana	0	8	0	7	0	0	15
Patan	0	0	2	1	0	0	3
Banaskantha	2	3	1	5	1	0	12
Sub-total	2	17	6	20	1	0	46
Percentage	4.3%	37.0%	13.0%	43.5%	2.2%	0.0%	100%
RAJASTHAN							
Sirohi	0	0	0	3	0	0	3
Pali	0	10	0	26	0	0	36
Ajmer	2	7	0	94	0	0	103
Jaipur	1	4	0	23	0	0	28
Nagaur	0	0	0	0	0	0	0
Sikar	1	23	1	29	0	1	55
Alwar	0	0	0	2	0	0	2
Sub-total	4	44	1	177	0	1	227
Percentage	1.8%	19.4%	0.4%	78.0%	0.0%	0.4%	100%
HARYANA							
Mahendragarh	2	14	0	52	3	0	71
Rewari		4	1	10	1	0	16
Sub-total	2	18	1	62	4	0	87
Percentage	2.3%	20.7%	1.1%	71.3%	4.6%	0.0%	100%

Source: Socio-economic Survey of PAFs, 2008

(11) Preference for Type of R and R Assistance

In Gujarat, 54.3% of the respondents have requested for newly constructed house. 17.4% of the respondents have requested for self relocation. In Rajasthan, 17.6% of the respondents has requested for newly constructed house. While 63% of the respondents agreed for self relocation. Only a few respondents have requested for replaceable value of their structures. In Haryana, 49.4% of the respondents has requested for newly constructed house. Only a few respondents have requested for replaceable value of their structures.

(12) Requesting to Implementing Authority about R and R

About 97% and 51.1% of respondents have requested for provision and disbursement of proper compensation by the project proponent in Gujarat and Rajasthan State respectively. In Haryana, 51.4% of the respondents have requested for compensation and R and R.

3.2.4 Analysis of Socio-Economic Survey Results of Agricultural PAFs

To identify socio-economic situation of Agricultural PAFs (Agri-PAFs) whose agricultural land are likely to be affected by the land acquisition for the Project, the socio-economic survey of 25 Agri-PAFs of each district has been conducted throughout 17 districts of 3 states. The survey results of each district are presented below.

(1) Possession of Legal Documents

It is observed in Table 3-17 that the surveyed Agri-PAFs have legal documents at 96.5% in Gujarat, 64.8% in Rajasthan, and 84% in Haryana. In Rajasthan, it is found that a large number of PAFs are traditional owners of the land; however, have either not obtained the legal papers from the government or lost those papers over the years. The legal documents mainly comprises of registration certificates (Pattas) issued by local government. Other legal documents include the sale deed, lease agreements, etc.

Table 3-17 Possession of Legal Documents

	Yes	No	Total
GUJARAT			
Vadodara	24	1	25
Anand	22	3	25
Kheda	25	0	25
Ahmedabad	22	3	25
Gandhinagar	25	0	25
Mahesana	25	0	25
Patan	25	0	25
Banaskantha	25	0	25
Sub-total	193	7	200
Percentage	96.5%	3.5%	100%
RAJASTHAN			
Sirohi	25	0	25
Pali	28	7	35
Ajmer	38	2	40
Jaipur	10	21	31
Nagaur	0	13	13
Sikar	11	19	30
Alwar	2	0	2
Sub-total	114	62	176
Percentage	64.8%	35.2%	100%
HARYANA			
Mahendragarh	19	6	25
Rewari	23	2	25
Sub-total	42	8	50
Percentage	84.0	16.0	100
Average Percentage	81.8%	18.2%	100%

Source: Socio-economic Survey of Agri-PAFs, 2008

(2) Religion-wise Distribution of Agri-PAFs

Religious distribution of Agri-PAFs of project affected districts is presented in Table 3-18. It shows that overall area dominant religion is Hinduism. In Gujarat, majority of the population (91%) are Hindu. Maximum number of PAPs from religious minority community is reported from Patan, Banaskantha, Mahesana, and Vadodara Districts.

In Rajasthan, 97.7% of Agri-PAFs are Hindu. Only 3 PAFs in Ajmer District belong to Muslim community, while 1 PAF in Pali District practices Jainism.

In Haryana, majority of the Agri-PAFs (98.0%) are Hindu. About 2 % of the Agri-PAFs surveyed practices Jainism.

Table 3-18 Religion-wise Distribution of PAFs

	Hindu	Muslim	Christian	Boudh	Jain	Total
GUJARAT						
Vadodara	23	2	0	0	0	25
Anand	24	1	0	0	0	25
Kheda	22	3	0	0	0	25
Ahmedabad	25	0	0	0	0	25
Gandhinagar	25	0	0	0	0	25
Mahesana	21	4	0	0	0	25
Patan	21	4	0	0	0	25
Banaskantha	21	4	0	0	0	25
Sub Total	182	18	0	0	0	200
Percentage	91.0	9.0%	0.0%	0.0%	0.0%	100%
RAJASTHAN						
Sirohi	25	0	0	0	0	25
Pali	34	0	0	0	1	35
Ajmer	37	3	0	0	0	40
Jaipur	31	0	0	0	0	31
Nagaur	13	0	0	0	0	13
Sikar	30	0	0	0	0	30
Alwar	2	0	0	0	0	2
Sub Total	172	3	0	0	1	176
Percentage	97.7%	1.7%	0.0%	0.0%	0.6%	100%
HARYANA						
Mahendragarh	24	0	0	0	1	25
Rewari	25	0	0	0	0	25
Sub Total	49	0	0	0	1	50
Percentage	98.0%	0.0%	0.0%	0.0%	2.0%	100%
Average Percentage	95.6%	3.6%	0.0%	0.0%	0.9%	100%

Source: Socio-economic Survey of Agri-PAFs, 2008

(3) Social Category

In Gujarat, 56.5% of the Agri-PAFs belong to General Castes while 13.5% and 29.0% belong to the Scheduled Caste (SC) and Scheduled Tribe (ST), respectively. Mehasana has maximum number of Agri-PAFs belonging to ST, while Ahmedabad has maximum PAFs from SC Community.

In Rajasthan, 65.3% of the Agri-PAFs belong to OBC, while 18.8% belong to ST. Population of Scheduled Tribes among the surveyed agricultural PAPs is found to be very low. In Haryana, 60% of the Agri-PAFs belongs to OBC, while remaining 40% belongs to General Category.

Table 3-19 Social Category distribution of Agri PAFs

	General	OBC	SC	ST	Total
GUJARAT					
Vadodara	21	0	1	3	25
Anand	23	0	1	1	25
Kheda	13	0	3	9	25
Ahmedabad	2	0	20	3	25
Gandhinagar	11	0	0	14	25
Mahesana	7	0	0	18	25
Patan	15	1	2	7	25
Banaskantha	21	1	0	3	25
Sub-total	113	2	27	58	200
Percentage	56.5%	1.0%	13.5%	29%	100%
RAJASTHAN					
Sirohi	1	14	7	3	25
Pali	6	14	14	1	35
Ajmer	4	30	6	0	40
Jaipur	1	27	1	2	31
Nagaur	0	13	0	0	13
Sikar	9	16	5	0	30
Alwar	1	1	0	0	2
Sub-total	22	115	33	6	176
Percentage	12.5%	65.3%	18.8%	3.4%	100%
HARYANA					
Mahendragarh	8	17	0	0	25
Rewari	12	13	0	0	25
Sub-total	20	30	0	0	50
Percentage	40.0%	60.0%	0.0%	0.0%	100%
Average Percentage	36.3%	42.1%	10.8%	10.8%	100%

Source: Socio-economic Survey of Agri-PAFs, 2008

(4) Distribution of Assets

Assets are indicators of the socio-economic conditions of people. Livestock are mostly cow, buffalo, sheep, ox, goat etc. Agricultural equipments are mainly tractor, thresher, harvester. Consumer durables are TV, fridge, mixer etc.

In Banaskantha District, the number of livestock and consumer durables are maximum which indicate the better economic condition of majority of families likely to be affected by the Project.

Table 3-20 shows that Agri-PAFs belonging to all the districts of Rajasthan have a good number of livestock and consumer durables but have less numbers of vehicles. In Haryana, both Rewari and Mahendragarh Districts have a number of livestock and consumer durables which indicate the better economic condition of majority of families likely to be affected by the Project.

Table 3-20 Distribution of Assets

	Livestock	Agri Equipments	Consumer Durables	2-Wheelers	4-Wheelers
GUJARAT					
Vadodara	98	21	97	19	0
Anand	69	14	105	6	2
Kheda	144	7	71	5	0
Ahmedabad	72	53	135	7	0
Gandhinagar	154	12	65	13	1
Mahesana	110	48	128	8	1
Patan	81	19	92	11	0
Banaskantha	174	62	164	17	5
Sub-total	902	236	857	86	9
RAJASTHAN					
Sirohi	114	20	50	6	0
Pali	132	30	164	15	2
Ajmer	235	14	105	10	7
Jaipur	354	17	87	10	2
Nagaur	78	12	28	8	0
Sikar	191	24	88	11	2
Alwar	9	0	6	0	0
Sub-total	1,113	117	528	60	13
HARYANA					
Mahendragarh	73	17	115	10	2
Rewari	58	47	127	22	6
Sub-total	131	64	242	32	8
Grand Total	2,146	417	1627	178	30

Source: Socio-economic Survey of Agri-PAFs, 2008

(5) Average Landholding Size

Table 3-21 shows that average land holding capacity is maximum in Ahmedabad and minimum in Sirohi. In Gujarat, the average land holding size is maximum at 4.6 ha in Ahmedabad District, while in Anand it is only 1.0 ha. In Rajasthan, the average land holding size is maximum in Pali District at 5.1 ha while in Sirohi District it is only 0.9 ha. In Haryana, the average land holding size is maximum at 3.5 ha in Mahendragarh District, while it is 3.3 ha in Rewari.

Table 3-21 Average Size of Landholding

	Average of Land holding (ha)
GUJARAT	
Vadodara	1.3
Anand	1
Kheda	1.9
Ahmedabad	4.6
Gandhinagar	2.8
Mahesana	2.1
Patan	1.2
Banaskantha	1.9
RAJASTHAN	
Sirohi	0.9
Pali	5.1
Ajmer	2.7
Jaipur	1.6
Nagaur	1.9
Sikar	1.4
Alwar	2.6
HARYANA	
Mahendragarh	3.5
Rewari	3.3

Source: Socio-economic Survey of Agri-PAFs, 2008

(6) Requirement of Accessibility Envisaged

It may be noted that all of the Agri-PAFs of three states have demand for a provision of RUB to ensure easy accessibility to their agricultural fields because in parallel section land may get bifurcated due to the proposed alignment. In Rajasthan, 2.3% of PAFs have demanded for service road also.

(7) Drinking Water Sources

Table 3-22 shows that PAFs all over project area depend upon public water supply.

In Gujarat, only 40% of the Agri-PAFs depend on public water supply for drinking water. Almost equal number of people depends on their own pump well for water while 18% depends on common pump well.

In Rajasthan, only 32.4% of the Agri-PAFs depend on public water supply for drinking water. About 19.3% have their own pump well for water while another 22.2% of Agri-PAFs own dig well. About 24.4% depend on common pump well for drinking water.

In Haryana, only 62% of the Agri-PAFs depend on public water supply for drinking water. About 24% depend on their own pump well for water while 10% depends on common pump well.

Table 3-22 Drinking Water Sources

	Brought from Water Vendors	Dig Well (Common)	Dig Well (Private)	Public Water Supply	Pump Well (Common)	Pump Well (Private)	Total
GUJARAT							
Vadodara	0	2	2	6	10	5	25
Anand	0	0	0	8	15	2	25
Kheda	0	0	1	11	8	5	25
Ahmedabad	0	0	0	19	1	5	25
Gandhinagar	0	0	0	9	2	14	25
Mahesana	0	0	0	9	0	16	25
Patan	0	0	0	13	0	12	25
Banaskantha	0	0	0	5	0	20	25
Sub-total	0	2	3	80	36	79	200
Percentage	0.0%	1.0%	1.5%	40.0%	18.0%	39.5%	100%
RAJASTHAN							
Sirohi	0	0	3	7	11	4	25
Pali	3	0	11	9	6	6	35
Ajmer	0	0	15	16	9	0	40
Jaipur	0	0	2	2	11	16	31
Nagaur	0	0	0	4	3	6	13
Sikar	0	0	8	17	3	2	30
Alwar	0	0	0	2	0	0	2
Sub-total	3	0	39	57	43	34	176
Percentage	1.7%	0.0%	22.2%	32.4%	24.4%	19.3%	100%
HARYANA							
Mahendragarh	0	0	1	19	2	3	25
Rewari	1	0	0	12	3	9	25
Sub-total	1	0	1	31	5	12	50
Percentage	2.0%	0.0%	2.0%	62.0%	10.0%	24.0%	100%
Average Percentage	1.9%	0.3%	8.6%	44.8%	17.5%	27.6%	100%

Source: Socio-economic Survey of Agri-PAFs, 2008

(8) Toilet Facility

Table 3-23 shows that, 76.5% of Agri-PAFs have indoor facilities for toilet in Gujarat, while 22.5% of them have toilets outside of their house. It is common practice throughout rural India

that people construct toilets separately from their residential building but within their own courtyard. In Rajasthan, majority of the Agri-PAFs at 89.2% have their own toilet as indoor facility, while 4% have outdoor toilets. Only 1.1% of them do not have any toilets. In Haryana, 62% of Agri-PAFs have no toilet facility. Only 36% of them have toilets inside their house.

Table 3-23 Toilet Facility of Agri-PAFs

	In-door Toilet	Out-door Toilet(Common)	Out-door Toilet (Private)	Not Available	Total
GUJARAT					
Vadodara	9	1	15	0	25
Anand	25	0	0	0	25
Kheda	11	0	14	0	25
Ahmedabad	25	0	0	0	25
Gandhinagar	20	0	5	0	25
Mahesana	20	0	5	0	25
Patan	21	0	4	0	25
Banaskantha	22	1	2	0	25
Sub-total	153	2	45	0	200
Percentage	76.5%	1.0%	22.5%	0.0%	100%
RAJASTHAN					
Sirohi	22	0	2	1	25
Pali	30	4	1	0	35
Ajmer	38	1	1	0	40
Jaipur	28	1	2	0	31
Nagaur	11	2	0	0	13
Sikar	27	2	1	0	30
Alwar	1	0	0	1	2
Sub-total	157	10	7	2	176
Percentage	89.2%	5.7%	4.0%	1.1%	100%
HARYANA					
Mahendragarh	9	0	1	15	25
Rewari	9	0	0	16	25
Sub-total	18	0	1	31	50
Percentage	36.0%	0.0%	2.0%	62.0%	100%
Average Percentage	67.2%	2.2%	9.5%	21.0%	100%

Source: Socio-economic Survey of Agri-PAFs, 2008

(9) Power Supply

In Gujarat about 99.9%, Rajasthan about 94.3% and Haryana about 98% of Agri-PAFs surveyed have power supply.

(10) Women Involved in Economic Activity

The Agri-PAFs families who have women economically active are about 4.5%, 30.1%, and 2% in Gujarat, Rajasthan and Haryana respectively. About 6 families in Anand District Gujarat, 24 families in Jaipur District, Rajasthan and 1 family in Rewari District, Haryana have reported that women members are engaged in economic activities.

(11) Awareness about DFC Project

About 94 % of Agri-PAFs in Gujarat, 90.3 % of Agri-PAFs in Rajasthan and 92 % of Agri-PAFs are conscious about the DFC project. People have got the basic information about the Project mainly from newspaper and TV. In Rajasthan, majority of the Agri-PAFs (who are aware about DFC) acknowledged Television as the prime source of information. 29.6% of the respondents have obtained the information from newspapers while only 3.8% of PAFs learnt about the Project by word of mouth.

(12) Intension to Change of Occupation

Table 3-24 shows that overall 40% of Agri-PAFs want to change their occupation. In Gujarat, only 12.5% of Agri-PAFs wished to change their occupation while 87.5% wanted to remain farmers. In Rajasthan, 86.4% of the Agri-PAFs expressed their desire to continue farming in future. Only 13.6% of the Agri-PAFs wished to change their present occupation to business. In Haryana, Only 6% of Agri-PAFs wished to change their occupation, while 94% wanted to remain farmers.

Table 3-24 Intension to Change of Occupation

	Change of occupation	Work as farmer
GUJARAT		
Vadodara	1	24
Anand	4	21
Kheda	3	22
Ahmedabad	1	24
Gandhinagar	3	22
Mahesana	2	23
Patan	6	19
Banaskantha	5	20
Sub-total	25	175
Percentage	12.5%	87.5%
RAJASTHAN		
Sirohi	11	14
Pali	8	27
Ajmer	1	39
Jaipur	1	30
Nagaur	0	13
Sikar	3	27
Alwar	0	2
Sub-total	24	152
Percentage	13.6%	86.4%
HARYANA		
Mahendragarh	24	1
Rewari	23	2
Sub-total	47	3
Percentage	94.0%	6.0%
Average Percentage	40.0%	60.0%

Source: Socio-economic Survey of Agri-PAFs, 2008

(13) Preferences for Future Occupation

Table 3-25 shows preferences for future occupations of PAFs in the project area. About 39.4% Agri-PAFs have preferences of rice cultivation followed by vegetable production which is 29.2%.

In Gujarat, rice is the most favoured crop of the farmers who wanted to continue the farming occupation i.e (48%). In Rajasthan, 42.1% of the surveyed PAFs, who wished to retain their status as farmers chose to cultivate vegetables, while 34.2% preferred rice cultivation. Higher rate of return of the investment amount in case of vegetable farming have influenced the choice of the people. In Haryana, 36% Agri-PAFs wants to continue the rice cultivation farming occupation. About 20% and 12% of the Agri-PAFs are interested in vegetable and livestock raising farming respectively. Almost all over project area, the agricultural PAFs did not express any choice for alternative farming land.

Table 3-25 Preferences for Future Occupation

	Livestock raising	Orchard	Rice cultivation	Vegetable	No Answer	Total
GUJARAT						
Vadodara	2	2	15	5	1	25
Anand	3	1	10	7	4	25
Kheda	3	0	13	6	3	25
Ahmedabad	0	1	17	6	1	25
Gandhinagar	1	0	16	5	3	25
MAHESANA	0	3	12	8	2	25
Patan	3	1	4	11	6	25
Banaskantha	8	0	9	3	5	25
Sub-total	20	8	96	51	25	200
Percentage	10.0%	4.0%	48.0%	25.5%	12.5%	100%
RAJASTHAN						
Sirohi	2	0	6	6	0	14
Pali	6	0	12	9	0	27
Ajmer	8	0	14	17	0	39
Jaipur	6	0	11	13	0	30
Nagaur	6	0	1	6	0	13
Sikar	8	0	8	11	0	27
Alwar	0	0	0	2	0	2
Sub-total	36	0	52	64	0	152
Percentage	23.7%	0.0%	34.2%	42.1%	0.0%	100%
HARYANA						
Mahendragarh	2	3	13	2	5	25
Rewari	4	0	5	8	8	25
Sub-total	6	3	18	10	13	50
Percentage	12.0%	6.0%	36.0%	20.0%	26.0%	100%
Average Percentage	15.2%	3.3%	39.4%	29.2%	12.8%	100%

Source: Socio-economic Survey of Agri-PAFs, 2008

(14) Request to Implementing Authority about R and R

Table 3-26 shows that all of the Agri-PAFs want proper distribution of compensation against acquisition of their agricultural land in Gujarat. In Rajasthan, almost all of the Agri-PAFs request for disbursement of compensation (at market price of their land). Only 1 person in Alwar District has requested for both compensation and assistance in R and R. In Haryana, all of the PAPs wants proper distribution of compensation and assistance for R and R against acquisition of their agricultural land.

Table 3-26 Request to Implementing Authority about R and R

	Both compensation and assistance for R and R	Compensation	Total
GUJARAT			
Vadodara	-	25	25
Anand	-	25	25
Kheda	-	25	25
Ahmedabad	-	25	25
Gandhinagar	-	25	25
Mahesana	-	25	25
Patan	-	25	25
Banaskantha	-	25	25
Sub-total	-	200	200
Percentage	-	100%	100%
RAJASTHAN			
Sirohi	0	25	25
Pali	0	35	35
Ajmer	0	40	40
Jaipur	0	31	31
Nagaur	0	13	13
Sikar	0	30	30
Alwar	1	1	2
Sub-total	1	175	176
Percentage	0.6%	99.4%	100%
HARYANA			
Mahendragarh	21	4	25
Rewari	24	1	25
Sub Total	45	5	50
Percentage	90.0%	10.0%	100%

Source: Socio-economic Survey of Agri-PAFs, 2008

3.3 OTHER SOCIAL IMPACTS

As results of the above surveys and field reconnaissance throughout the project area during the S-ESIMMS, there is no specific social impact to be noted in addition to the social impacts identified in the ESIMMS as summarized in Section 1.4 of Chapter II-1 in Part II.

CHAPTER III-4 PUBLIC CONSULTATION MEETING

4.1 APPROACHES AND METHODOLOGIES

4.1.1 Approach of Public Consultation Meeting

Well planned public consultation meeting can lead to reduced financial risks of time and cost over-run, legal disputes, and negative publicity, direct cost savings, increased market share through good public image, and enhanced social benefits to the affected local communities. Public consultation meeting (PCM) should provide an opportunity for the general public, private and community bodies to obtain contents of the final form of the environmental and social impacts as a result of project implementation. Thus, the meeting is held open to all general public who are concerned with the project during the initial stage of planning of the DFC Project. This has been done during JICA F/S period in general. In addition, supplemental information dissemination is necessary for those who are newly identified to be directly affected by the DFC Project during the Supplementary ESIMMS (S-ESIMMS).

Major purpose of the environment and social consideration under the S-ESIMMS is to identify the level of project acceptance by the PAPs. Thus toward the final stage of the planning of DFC Project focus group is the PAPs that have to be encouraged to participate in the public consultation meeting in order to reach general agreement on the policy of land acquisition as well as the resettlement and rehabilitation plan of the DFC Project.

4.1.2 Methodology

(1) Initial Information Dissemination

i) All of the head of districts and gram panchayats, which are directly affected by the DFC Project, in respect of holding PCM are informed.

ii) Leaflets informing the main alignment and other structures of the DFC Project are prepared and distributed to the head of districts, gram panchayats, and head of villages as well as other key informants such as the head of schools, local organizations of commerce and industries, local NGOs and social groups/organizations, local farmers and residents that are concerned with DFC Project.

iii) List of invitees is elaborated one so as the participants of the PCM shall assume that they are appropriately representing inter alia all the local population directly affected by the DFC Project.

iv) No person is prevented from entering and/or leaving the PCM as he/she shall so desire.

(2) Contents of Disclosed Information

Topics of presentation at the PCM are the result of the EIA Study: projected extent, intensity and cumulative effect of the degree of the changes of the natural environment and social environment as a result of the implementation of DFC Project.

(3) Discussions, Questions and Answers

A session for question and answer is prepared after completion of the major information dissemination on the Project. A session for discussion of taking questions from the participants and answering to the questions where correct information is available is appropriately held in order to disseminate full information of the Project at the time of holding the PCM.

(4) Record of the Meeting

i) Record the Participants:

Name, gender, occupation, age, name of the village the participants belong to and other appropriate features is recorded at the entrance of PCM and reproduced in the report.

ii) Record of the Contents of Meeting

The contents of the discussion of the PCM are recorded by electronically recordable device and reproduced by transcribing the contents in the report.

iii) Questionnaire Survey

Elaborate questionnaire survey is prepared but not limited to the questionnaire as follows in order to illustrate representation of the participants of each meeting. The results are analyzed statistically and reproduced in the report.

A questionnaire is less than a sheet of A4 size paper with major points of concern as follows:

- Origin of the participant (native/not native to the state, majority/minority of native tribe);
- Name of the village;
- Age:
- Occupation;
- Level of education;
- Whether the participant is directly affected by the Project as a result of project implementation;
- Opinion on the Project (good or bad for the village/local economy);
- Willingness to resettlement (yes/no/conditional);
- Request to the Project Owner in terms of engineering, social and environmental concerns.

4.1.3 Schedule of Public Consultation Meeting

The PCM under the S-ESIMMS is planned based on the following concept and arrangement:

i) Dissemination of the Final Contents of Environment and Social Considerations

- Any information on the result of environmental and social considerations study for the DFC Project is disseminated by DFCCIL to the general public;
- Any information on the changes of DFC Project since the JICA F/S is disseminated by DFCCIL to the general public;
- Information on what is considered as final in terms of the environmental and social impacts caused by the DFC Project is disseminated by DFCCIL to the general public;
- Environmental management/monitoring plan and impact mitigation measures on the DFC Project is disclosed by DFCCIL to the general public;
- Policy on the resettlement and rehabilitation plan is disseminated by DFCCIL to the general public and that DFCCIL is making firm commitment to implement it; and
- Comments and suggestions on the environmental management and monitoring plan as well as land acquisition and resettlement and rehabilitation plan are obtained from the general public, stakeholder and PAPs.

ii) Correction of the Area Affected by the DFC Project

The following correction of the area affected by the DFC Project is carried out:

- There have been a number of villages that are covered by the JICA F/S while some of them are necessary to exclude as a result of the changes of alignment;
- Because of the changes of alignment of DFC Project after the JICA F/S and upon finalization of it within the framework of the S-ESIMMS, there have been a number of villages that are newly identified as affected villages;
- It is therefore necessary to make correction of the affected area based on the result of latest alignment of the DFC Project.

iii) Target Area of the Public Consultation Meeting

The supplementary PCM within the framework of S-ESIMMS is organised as follows:

- Villages newly identified as affected area are invited for the PCM;
- Public consultation meeting is held once in each district that contains newly identified affected villages during the S-ESIMMS;
- Stakeholders of each district subject to hold public consultation meeting are invited; and
- Despite the fact that there are new village names listed in Appendix II-3-1, there is no change of alignment made in the districts of Mahendragarh in Haryana, Nagaur, Sikar and Alwar in Rajasthan. Thus these village names listed in the JICA F/S report are considered falsely listed i.e. no public consultation meeting is held in these districts.

iv) Schedule of the First Round of Public Consultation Meeting

Schedule of the first round of public consultation meeting is shown in Table 4-1 as follows:

Table 4-1 Schedule of PCM

No.	Date	Venue of Meeting	District	State
1	15th October, 2008	Punjabi Dharamsala, Rewari	Rewari	Haryana
2	16th October, 2008	Rotary Club, Kalol	Gandhinagar	Gujarat
3	16th October, 2008	Saurashtra Sthanakvasi Jain Vadi Hall, Sanand	Ahmedabad	Gujarat
4	18th October, 2008	Agricultural Produce Marketing Committee's Hall	Kheda	Gujarat
5	18th October, 2008	Surya Temple Complex, Borsad	Anand	Gujarat
6	21st October, 2008	Sanskruti Party Plot, Bill	Vadodara	Gujarat
7	22nd October, 2008	Parot Mata Temple, Unja	Mahesana	Gujarat
8	22nd October, 2008	APMC Hall, Sidhpur	Patan	Gujarat
9	24th October, 2008	Thakkar Baba Hall, Palanpur	Banaskantha	Gujarat
10	10th February, 2009	Hotel Ganges Garden, Shahpura Road, Neem Ka Thana	Sikar	Rajasthan
11	12th February, 2009	Singhaniya Dharmsala, Gandhi Chowk, Phulera town	Phulera	Rajasthan
12	15th February, 2009	Government Senior Secondary School, Marwar Junction	Pali	Rajasthan
13	17th February, 2009	Shri Agarawal Vishnu Dharamshala, Abu Road	Sirohi	Rajasthan

Because of the socio-political conditions after the PCM held in Vadodara have become not favourable to the DFC Project, the PCMs for Rajasthan have been suspended until February, 2009.

v) Presentation Materials

Presentation materials used during the PCM contains the following information:

a) Project Information

- Objectives of the Project
- Overall service area of the Project
- Cost estimation for implementation of the Project
- Villages and districts directly affected by the Project
- Schedule of Project implementation

b) Environmental Impact Assessment

- Environment and social impacts caused by the Project
- Area of land acquisition and DFCCIL's policy on the compensation

Hand out distributed in the PCM is shown as per Appendix III-4-1.

4.2 RESULTS OF THE PUBLIC CONSULTATION MEETINGS

The following are the major points of concern of the participants of PCM:

1) As long as the compensation for land is appropriately assessed and paid in order to replace the current land and/or livelihood, there is no objection to the Project. Thus no circular rate is acceptable as a basis of land acquisition and resettlement and rehabilitation;
2) It is not quite clear if the compensation package deals with particulars of the individual needs upon land acquisition and resettlement;
3) Permanent crops are never appropriately compensated in the past. Compensation made for their life time yield should be considered;
4) There are a number of indirectly affected persons whose livelihood is endangered as a result of the implementation of Project. Land acquisition of dairy farming area indirectly affects the milking cows, which are the major source of income for the dairy farmers. Thus compensation should be made for them;
5) Past promises of the local and central government are not kept. Thus it is skeptical if the government will keep what promised to do for the DFC Project;
6) There are a large number of flood incidents in Kheda, Anand and Vadodara and the railway construction would worsen the situation. What has been done with engineering design has never been solved to date;
7) DFC Project is an industrial and commercial development with no agricultural development in mind i.e. the small scale farmers are not taken care of their livelihood;
8) DFC Project's alignment should be made in parallel to the existing railway line in order to minimize land acquisition;
9) Alignment is within the boundary of Vadodara's urban development area. Thus re-alignment should be considered with the consultation of Vadodara Urban Development Corporation; and
10) Because of the past experiences that the government never appropriately compensated to PAPs, unless compensation package is ensured appropriate, PAPs will protest against the Project.

Result of the PCM is attached in Appendix III-4-2.

4.3 COMMENTS FROM THE PUBLIC ON DRAFT EIA REPORT

As an information disclosure process in the preparation of the EIA report, set of the EIA report for the project, which consists of the ESIMMS reports for three states and S-ESIMMS report, was disclosed to the public in the area along the proposed DFC alignment with its summary between the middle of March and middle of April. After the disclosure, comments on the draft EIA report were collected in the certain period. Details are shown in Appendix III-4-3.

CHAPTER III-5 UP-DATED ENVIRONMENTAL MITIGATION MEASURES

5.1 POLLUTION CONTROL

5.1.1 Noise

Impact on noise pollution is envisaged during construction and operation phases as follows.

(1) Construction phase

1) Impact

During the construction phase, noise and vibration will be generated due to movement of vehicles, and operation of light and heavy construction machineries including pneumatic tools (hot-mixer, dozer, tipper, loader, excavator, grader, scraper, roller, concrete mixer, generator, pump, vibrator, crane, compressor etc.) that are known to emit sounds with moderate to high decibel value. Noise generated from sources mentioned above will be intermittent and mostly during daytime.

2) Mitigation measure

a) Construction camp and temporary labour sheds will be located away from the immediate vicinity of the construction sites and major road traffic.

b) Protective gears such as ear plugs etc. will be provided to construction personnel exposed to high noise levels as preventive measure.

c) Low noise construction equipment will be used.

d) It will be ensured that all the construction equipment and vehicles used are in good working condition, properly lubricated and maintained to keep noise within the permissible limits and engines turned off when not in use to reduce noise.

e) Stationary construction equipment will be placed 113 m away from inhabited areas[1].

f) Stationary construction equipment will be placed 200 m away from the sensitive receptors (SRs) i.e. school, hospital etc.

g) Construction activities carried out near residential area will be scheduled preferably in daytime so that minimum disturbances are caused to people.

[1] The required distance was calculated in the ESIMMS as follows:
Operation of construction machinery will lead to rise in noise level to the range between 80-95 dB(A). The magnitude of impact from noise will depend upon types of equipment to be used, construction methods and also on work scheduling. The noise level generated from a source will decrease with distance as per the following empirical formula (inverse square law).

$SPL2 = SPL1 - 20\text{Log}10(r_2/r_1)$

where, SPL1 and SPL2 are the sound pressure levels at distance r_1 and r_2 respectively.
Considering the stationary construction equipment as a point source generating 90 dB(A) at a reference distance of 2 m, computed minimum distance required from the stationery source to meet the permissible noise limits during day time for different land use categories are given in the following table.

Table Minimum Distance Required from Stationary Noise Source

Category	Permissible Limits in Day Time (CPCB)	Distance Required (m)
Silence Zone	50 dB(A)	200
Residential Zone	55 dB(A)	113
Commercial Zone	65 dB(A)	36
Industrial Zone	75 dB(A)	11

(2) Operation phase

1) Impact

During operation phase noise level are likely to increase due to movement of trains and related facilities such as loading and unloading. As a result of the prediction based on the directly measurement of noise level at similar freight train and present background noise, in almost all five locations, predicted noise level (LAeq) plus existing railway noise level exceeded guideline value, 60 dB of daytime and 55 dB of night time, in parallel section. However, for the detour section, predicted noise level (LAeq) is within the guideline value at both day time and night time.

2) Mitigation measure

a) Monitoring of railway noise and vibration generated from dedicated freight trains shall be conducted.

b) Establishing Soundproof

Result of consideration of establishing soundproof is shown in Table 5-1. When ROW is located at 30 m from centre of railway, soundproof with the height of 0.5 m to 4.0 m is required. When the ROW is located at 50 m, soundproof with the height of 0.5 m to 2.5 m is required. The settlement area approximately 12 km in Haryana, 103.6 km in Rajasthan and 1.1 km in Gujarat.

c) Limitation of Operation at Night Time

The condition at Ajmer No.2 where no passenger train passes through is different from the other locations where the noise level exceeds guideline value. Limiting the number of trains at night time is one of the mitigation measure and results are shown in Table 5-1.

Table 5-1 Result of Consideration of Environmental Preservation Measure

(Unit: dB)

Prediction location		Time	Guideline Value	Current plan		No measures		Limitation Plan		After Limitation	
				Up	Down	30 m	50 m	Up	Down	30 m	50 m
Ajmer (St.2)	East	daytime	60	94	94	58	56	110	110	59	57
		nighttime	55	46	46	57	56	30	30	55	54
		daytime	60	94	94	58	56	95	95	58	56
		nighttime	55	46	46	57	56	45	45	57	55

Note: daytime (7:00~22:00), nighttime (22:00~7:00)
Shaded region indicates that the value exceeds guideline value.
Source: S-ESIMMS

5.1.2 Vibration

Impact on vibration is envisaged during construction and operation phases as follows.

(1) Construction phase

1) Impact

During the construction phase, vibration will be generated due to movement of vehicles, and operation of light and heavy construction machineries including pneumatic tools (hot-mixer, dozer, tipper, loader, excavator, grader, scraper, roller, concrete mixer, generator, pump, vibrator, crane, compressor etc.) that are known to emit sounds with moderate to high decibel value. Noise generated from sources mentioned above will be intermittent and mostly during

daytime. As a result of the prediction based on the directly measurement of vibration level at similar freight train and present background, in all 12 locations in parallel section and 5 locations , predicted vibration levels for Z axis were under guideline value (70 dB) which tentatively applied.

2) Mitigation

a) It will be ensured that all the construction equipment and vehicles used are in good working condition, properly lubricated and maintained to keep noise within the permissible limits and engines turned off when not in use to reduce noise.

b) Stationary construction equipment will be placed 113 m away from inhabited areas.

c) Stationary construction equipment will be placed 200 m away from the sensitive receptors (SRs) i.e. school, hospital etc.

d) Construction activities carried out near residential area will be scheduled preferably in daytime so that minimum disturbances are caused to people.

e) The construction methods with lower vibration generation shall be applied.

f) Machines and vehicles equipped with lower vibration devices such as vibration-proofing cover shall be used.

g) Vibration propagation shall be prevented by keeping the distance and changing the direction and location of machines.

h) Near settlement and forest areas, construction activities shall be conducted preferably in daytime, and vibration generating activities shall be prohibited during night time.

i) Vibration level monitoring shall be conducted during the construction phase.

(2) Operation phase

1) Impact

During operation phase vibration level are likely to increase due to movement of trains and related facilities such as loading and unloading.

The result shows that, predicted vibration level for Z axis meets guideline value (70 dB) at all locations.

5.1.3 Water Pollution

(1) Pre-construction phase

During pre-construction phase no impact is envisaged on water quality.

(2) Construction phase

1) Impacts

a) A number of land based activities are associated with the construction of bridges over the rivers which could have potential impact on surface water quality. The activities include:

- Site clearance
- Earthwork including construction of embankment and cutting
- Demolition activities
- Construction of approach road, footpath and associated facilities and services

- Construction materials handling; storage and use of fuels and oils and other potentially polluting construction materials
- Spillage and uncontrolled release of construction materials such as cement, concrete, diesel, hydraulic fluid, paint etc.

b) Silty water can arise from earthworks, exposed ground, water collecting in excavations, stockpiled materials and site roads etc. Soil compaction can occur as a result of construction vehicles and plant passing over previously undeveloped land. Soil compaction causes a reduction in the volume of water permeating into the ground therefore increasing run-off. The run-off would normally contain suspended silt as the compacted ground would be susceptible to erosion in the absence of vegetation cover. The areas at particular risk from compaction would include those identified as construction compounds for plant and materials, temporary access routes for construction traffic and related activities.

c) The deterioration of water quality during construction phase is also expected duc to wastewater disposal from the workers camp and sludge generated from construction sites. If adequate arrangements are not made to ensure proper drainage of wastewater from the construction sites, such waters may form stagnant pools and aggravate soil erosion. Stagnant pools of water promote breeding of mosquitoes and create generally unsanitary conditions.

d) Slight change in water quality for a temporary period during works affecting the channels and bank of the rivers/ water bodies.

e) Increase of sediment load in the run off from construction sites and increase in turbidity in receiving streams/water bodies

f) Change in water quality due to spillage and uncontrolled release of construction materials such as cement, concrete, diesel, hydraulic fluid, paint etc.

g) Slight change in hydrology and geomorphology of the stretch of water course directly affected by the temporary works at the site of new crossing

h) Water pollution due to discharge of sewage from construction camps

2) Mitigation Measures

a) At the time of detailed design, civil works required during construction phase would be designed to minimize disruption of flows and disturbance to the bed, channels and banks of the rivers

b) All untreated contaminated drainage from construction site and construction camps would be prevented from entering the rivers and other water bodies located nearby. Provision would be made to collect and treat the drainage from all construction sites and camps and to remove any sediment and other contaminants before discharging the clean water under an appropriate consent from State Pollution Control Board.

c) A floating oil boom would be placed on the water surface near construction site to prevent discharge of any trace of oil and fuel that may have entered the drainage system. This would serve as a contingency measures: the adoption of good site practice for the prevention of pollution should prevent any fuel or oil entering the drainage system.

d) In order to prevent materials leaking from static plant, such as pumps and generators, contaminating the ground and being washed into the drainage system; statie plant would be places on drip trays. Construction site run-off from plant and machinery can cause serious pollution if appropriate management systems from eontrolling discharges are not adequately followed.

e) Facilities of washing plant and equipment contaminated with concrete and other

chemicals would be provided.

f) Chemicals would be stored in secure designated storage areas and in accordance with the appropriate regulatory requirements. Hazardous chemicals would be handled as per Hazardous Waste (Management and Handling) Amendment Rules, 2003.

g) Stockpile of dry materials would be stored at least 200m away from the banks of the rivers.

h) Onsite batching facilities would be operated under the conditions of the appropriate authorization i.e., No Objection Certificate from State Pollution Control Board.

i) Silt fencing may be provided near water bodies.

j) Proper sanitation facilities will be provided at the construction site to prevent health related problems due water contamination such as oil trap to segregate the oil mixed in water to be discharged into the soil or city drain.

k) All the construction and preparatory activities including construction of culverts and bridges would be carried out during dry seasons but working may resorted in monsoon if it does not affect the quality to achieve the target.

l) Effective storm water drainage system should be provided in every bridge to eliminate / reduce the chance of discharge of untreated storm water directly to the river.

(3) Operation Phase

During operation phase no significant impact is envisaged on surface water quality. However, some operational effects on the surface water environment would occur as a result of the following:

5.2 NATURAL ENVIRONMENT

The proposed project will have impacts on the natural environment in two distinct phases. During the construction phase which may be regarded as temporary or short-term; the other during the operation stage which will have long term effects. Impacts on natural environment have been discussed separately for the construction phase and the operation phase.

Identification of impacts is followed by recommendations of appropriate cost effective mitigation measures. These impacts along with the preventive, compensatory and enhancement measures to be taken up during construction and operation phases have been discussed in the following sections.

5.2.1 Topography and Geology

(1) Pre-construction phase

During pre-construction phase no impact is envisaged on topography and geology.

(2) Construction phase

The impacts on existing topographical setting originate primarily from embankment preparation and opening up borrow pits to fulfil the requirement of huge quantity of earth material. Disfiguration of land may result from unplanned opening up of borrow pits/quarry sites. In Gujarat, the DFC alignment passes through plain, rolling and hilly terrain, there would be significant impact on the overall relief of the region.

The DFC alignment in Gujarat and Rajasthan is in Zone-III (having moderate seismic intensity) and Zone-IV (having severe seismic intensity) and similarly in Haryana is in Zone-IV of the seismic map of India (as per IS:1893, Part-1, 2002), and therefore it will have a moderate to severe risk of potential damage due to earthquake.

No significant impact on geology is anticipated from DFC construction activities except requirement of construction materials, which would be supplied from approved quarry sites located nearby.

1) *Impacts*

   a) Disfiguration and change in existing profile of the land.

   b) Disfiguration of topography due to indiscriminate digging of borrow pits.

   c) Uncontrolled digging of borrow pits resulting in water accumulation and breeding of vector disease.

   d) Disturbance on geological setting due to quarrying.

2) Mitigation Measures

   a) Only identified borrow pits and quarry sites will be used to avoid any disfiguration of topography.

   b) Opening up new borrow pits will be in accordance with the IRC: 10-1961 specifications. Opening up of new borrow pits will be restricted to 1 m depth followed by resurfacing of pits with top soil (15 cm).

   c) Uncontrolled digging of borrow pits will be avoided to prevent water accumulation in abandoned pits which results in breeding ground of vector disease.

   d) Construction materials will be procured from existing approved and licensed quarries only where crusher is already operating. Therefore, mitigative measure for the environmental impacts due to quarrying and rehabilitation plan of the quarries is the responsibility and seope of the licence holder of the quarry.

   e) Suitable seismic design of the drainage structures will be adopted to mitigate the earthquake impacts in future.

   f) On owner's choice, borrow pits will be converted to water bodies (pond) with proper landscaping (i.e. rectangular in shape, proper sloping and plantation on the bank) which will add scenic beauty in those localities.

(3) Operation phase

During operation phase no impact is envisaged on topography and geology.

5.2.2 Soil

(1) *Pre construction phase*

During pre-construction phase no impact is envisaged on soil.

(2) Construction phase

Placing of loose soil for embankment preparation would cause significant soil erosion in case appropriate compaction and stabilization measures are not adopted promptly. The erosion at construction stretches will result in increased sediment load in recipient streams. Loss of productive soil may result from uncontrolled opening up of borrow pits. Any leakage of lubricants in equipment yard and spills at batch mix plant sites will cause soil contamination.

1) Impacts

   a) Disruption and loss of productive top soil from agricultural fields due to creation of borrow pits and development of detour section, which may reduce crop yield.

   b) Loosening of top soil and loss of vegetative cover along detour and parallel section due to excavation and back filling which will lead to enhanced soil erosion.

2) Mitigation Measures

   a) Utilization of fly ash, if technically suitable and available within 100 km distance of the DFC alignment for construction of embankment to save soil resource.

   b) Adequate measures like adequate drainage, embankment consolidation and slope stabilization will be taken along the track to avoid soil erosion.

   c) Top soils (15 cm) of the borrow pit sites will be conserved and restored after excavation is over.

   d) Accidental spills of lubricants/oil will be avoided by adherence to good practices.

5.2.3 Land Use

(1) Pre construction phase

During pre-construction phase no impact is envisaged on land use.

(2) Construction

Proposed development will lead to change in land use pattern of areas that comes under the proposed ROW. The entire alignment is mainly passes through agricultural land; 94.2% in Gujarat, 71.4% in Rajasthan, and 93.2% in Haryana. Therefore, construction of DFC in Gujarat will change the land use pattern of the corridor.

Preparatory activities like clearing of ROW, construction of temporary construction camps and godowns, storage of construction materials etc. will be confined within the camp and ROW. This will not hamper the land use aspects outside ROW. However, indirectly there may be some change in the land use pattern of the proximate area due to influx of construction work-force and supplier who are likely to construct temporary tents in the vicinity. The on-site land use will more or less have a temporary impact in terms of fugitive emission from handling of construction material.

1) Impacts

   a) Loss of agricultural land resources due to land acquisition.

   b) Generation of solid waste in the form of construction spoils from construction sites.

   c) Changes in existing land use pattern of the ROW for construction of DFC.

2) Mitigation measures

   a) Earth material generated from excavation will be reused to the maximum possible extent as filling material during site development.

   b) The small amount of construction debris and surplus excavated material will be disposed of by mechanical transport in suitable pre-identified (jointly by project proponent and local administration) dumping areas in tune with the local condition to avoid land degradation and water logging due to indiscriminate dumping.

   c) Dumping areas will be reclaimed through top soil cover and plantation.

   d) Construction camp will be provided for construction personnel to avoid indiscriminate

settlement of construction workers and labourers.

e) Regular inspection of haul roads and construction site will be carried out to ensure regular and timely removal of construction debris to the designated dumping sites.

f) Construction activities will be kept confined to ROW only.

(3) Operation phase

1) Impacts

a) Land use due to squatter/encroachment within ROW at junction station, cross station likely change.

b) Land use due to induced railway side development outside the ROW likely change.

2) Mitigation Measures

a) Squatter development along the project shall be strictly avoided by proper regulation and vigilance.

b) Land use control measures will be prepared and administered to avoid occurrence of induced development as far as possible.

c) Planning agencies and Collector/Revenue Officer/Railway Officer will be made involved for controlled development and prohibiting squatter/ encroachment within ROW.

5.2.4 Drainage

(1) Pre construction phase

During pre-construction phase no impact is envisaged on drainage.

(2) Construction phase

1) Impacts

a) Change in drainage pattern of the land around detour.

b) Increased incidence and duration of floods due to obstruction of natural drainage courses by the embankment.

c) Chances of filling of existing drainage courses during earth filling.

2) Mitigation Measures

a) Adequate drains (longitudinal and median drains) will be provided along the track to facilitate its better maintenance. This will also help in avoiding soil erosion and land degradation due to water stagnation on tbe either side of the track.

b) Capacity of existing drainage works and cross drainage (CD) structures in the parallel section will be duly augmented, wherever necessary, to accommodate high discharges to avoid flooding and formation of water pool.

c) Adequate new drainage works will be provided for smooth passage of runoff to avoid flooding and formation of water pool.

d) Filling of existing drainage courses will be strictly avoided.

e) Suitable drainage at construction site and camp will be provided to eliminate the chances of formation of stagnant water pools that leads to soil erosion and breeding of mosquitoes.

(3) Operation phase

1) Impacts

a) Filthy environment due to improper maintenance of drainage.

b) Local drainage is likely to be affected due to formation of Railway Embankment.

2) Mitigation Measures

a) Longitudinal drains of sufficient capacity will be provided on both sides of the track to accommodate increased run-off. The out of all for these drains are generally the nearby culverts/bridges on nallas (canals)/rivers/drains.

b) Contingent actions will be taken for speedy cleaning up of oil spills, fuel and toxic chemicals in the event of accidents.

5.2.5 Water Use

(1) Pre construction phase

During pre-construction phase no impact is envisaged on water use.

(2) Construction phase

In Gujarat, during construction period water is required for compaction of embankment, dust suppression, concrete making and domestic use in construction camp. The water demand for construction will be met from the existing sources like rivers and nallas (canals) close to the alignment after taking permission from concerned authority (State Water Resources Department/State Irrigation Department) and water for domestic use and drinking purpose will be purchased by the contractor from local municipality. However the quantity being very small it is not likely to have significant impacts on other users.

Similarly to the Gujarat, in Rajasthan and Haryana also water is required for construction work and domestic use. DFC project area in Haryana and Rajasthan is semi-arid condition and there is no perennial river in the area of Haryana. Deficiency of moisture prevails over greater part of the year. Water scarcity became maximum during the months of May and June. Therefore, during construction period, it will be the responsibility of the contractor to arrange water from municipal source. Ground water extraction should not be allowed in both states. Otherwise it will have severe impact on local water requirement.

(3) Operation phase

During operation phase no impact is envisaged on water use.

5.2.6 Flora

(1) Pre construction phase

During pre-construction phase no impact is envisaged on flora. However, associated with the land survey, minor disturbance on the flora may happen although it negligible.

(2) Construction phase

1) Impacts

a) Felling of Private Trees along detour Section: Loss of flora due to felling of private

trees within the proposed ROW.

b) Felling of Trees along parallel section: In parallel section (Iqbalgarh in Gujarat to Rewari in Haryana), approximately 2,306 of trees in Gujarat, approximately 14,447 of trees in Rajasthan and approximately 6,590 of trees in Haryana have to be felled. The predominant tree species is *Acacia* sp. No endangered or rare plant species is reported within the proposed ROW because all of them were artificially planted.

c) Diversion of Forest Land: It is estimated that, 21.3 ha of forest land in Gujarat and 5.3 ha (4.5 ha in Pali District and 0.8 in Sirohi District) in Rajasthan are to be diverted for the use as ROW for construction of DFC in Gujarat. The details of the forest land to be acquired are given below.

Table 5-2 Forest Land to be Diverted by DFC in Gujarat.

Name of the Forest	District	Land to be acquired (ha)
Jethi Reserved Forest	Banaskantha	11.1
Bantwada Un-classed Forest	Banaskantha	7.5
Malana Reserved Forest	Banaskantha	2.7
Total		21.3

Source: Field survey in S-ESIMMS

Table 5-3 Forest Land to be Diverted by DFC in Rajasthan.

Name of the Forest	District	Land to be acquired (ha)
Murdawa Jor Reserved Forest	Pali	1.7
Binjowa Jor Reserved Forest	Pali	2.7
Jawaleswer Mahadev Un-classed Forest)	Pali	0.1
Kivarli Ka Jor Reserved Forest	Sirohi	0.8
Total		5.3

Source: Field survey in S-ESIMMS

2) Mitigation Measures

a) Compensation shall be provided to the forest department towards the cost of forest land to be diverted and cost of compensatory afforestation.

b) Before start any activity within the Reserved Forest area, Forest Clearance must be obtained as per Forest Conservation Act, 1980 and it's amendments from the State Forest Department.

c) Action plan for tree felling will be prepared to avoid uncontrolled and indiscriminate tree felling. All trees are to be numbered before felling. Joint field visit is to be conducted with the officials of Forest Department in concerned state to finalize the list of trees to be felled. A sample format is given below, which is to be filled up during the visit:

Tree No.	Common Name	Height (m)	Girth Size (cm)						
			<30	30-60	60-90	90-120	120-180	>180	Total
1.									
2.									
3.									
4.									

d) Appropriate compensatory plantation will be initiated to compensate the vegetation loss due to felling of trees for site clearing. For trees to be cut, sufficient compensatory plantation, about 2 times the number of trees felled, will be done. If adequate space for compensatory plantation is not available along DFC corridor, plantation may be carried

out along State Highway (SH), Major District Road (MDR), and Other District Road (ODR) or in degraded forest land.

e) For trees to be felled in private land, compensation for land and trees will be given to the owners. Rate of trees will be decided by the State Forest Department.

f) Preferential mixed plantation consisting of flowering shrubs and evergreen ornamental trees with less timber and fruit value will be carried out.

g) Under the plantation programme, more valuable tree species will be planted in place of existing non-valuable mono crops of the project area, if any.

(3) Operation phase

1) Impact

Illegal felling of railway side plantation is envisaged.

2) Mitigation measure

a) Plantation along the ROW will be maintained properly.

b) Plantation along the ROW will be protected from illegal felling.

5.2.7 Fauna

(1) Pre construction phase

During pre-construction phase no impact is envisaged on Fauna. However, associated with the land survey, minor disturbance on the fauna may happen although it is negligible.

(2) Construction phase

1) Impact

a) Fauna in major rivers

Habitat of the protected reptile species will be disturbed temporary, at the major river around Vadodara namely Vishwamitri, Mahi, Vatrak. Those are Mugger (*Crocodylus palustris*), Indian Roofed Turtle (*Pangshura tecta*), Indian Soft-shell Turtle (*Nilssonia gangeticus*) and Indian Flap-shell Turtle (*Lissemys punctata*) based on the field study. Some movements of animals were found at the river banks and those will be disturbed temporally by bridge construction, although the impact assessment on the species indicates less critical. The biodiversity found in and around the bridge locations is significant but the same diversity and numbers of species are found in higher numbers in the other parts of river stretches, especially the Upper River areas of all five rivers.

b) Balaram Ambaji Wildlife Sanctuary and Jessore Wildlife Sanctuary

Balaram-Ambaji and Jessore Wildlife Sanctuaries are two sanctuaries of North Gujarat having similar wild fauna and environment conditions.

- No direct damages on the sanctuaries are envisaged.
- Disturbance of the occasional animal movements of major species in two sanctuaries such as Nilgai, Sloth bear including some domestic animals is envisaged in the area, although the area is outside of the both sanctuaries.

c) Thol Lake Wildlife Sanctuary

Thol Lake Wildlife Sanctuary is located in the west of the DFC alignment. The distance between Thol Sanctuary and DFC alignment varies between 0.7 km and 1.5 km. Placed at this distance, the alignment is not likely to have any significant impact on the bird sanctuary. Academics at M. S. Baroda University, Vadodara and North Gujarat University, Patan also concur with this conclusion. However, the habitat of migratory waterfowl will be disturbed due to noise generated from construction machinery and vehicle during construction period.

- There is a likelihood of electrocution, rarely though, of some large water birds which might use the electrical poles of the DFC line for perching/roosting.
- Nilgai (*Boselaphus tragocamelus*) is found in the surrounding agricultural fields .It is widely regarded as a pest species in most parts of Gujarat. Due to acquisition of agricultural land for construction of DFC, there is likely to be impact on their habitat and food source, though the impact will be limited to the tract of land taken up for the ROW. However, being a versatile feeder, they are likely to disperse to surrounding villages. Besides, the rail tack cannot restrict their movement and they will cross over to the other side of the village for feeding.

2) Mitigation measure

a) Fauna in major rivers:

- Fencing will be provided and also, it mentioned in the water avoid the animals to enter the construction area.
- With adequate method closing water area bypassing the water flow.
- At the time of detailed design, civil works required during construction phase would be designed to minimize disruption of flows and disturbance to the bed, channels and banks of the rivers
- The river banks area should be least disturbed during the construction periods.
- A floating oil boom would be placed on the water surface near construction site to prevent discharge of any trace of oil and fuel that may have entered the drainage system. This would serve as a contingency measures: the adoption of good site practice for the prevention of pollution should prevent any fuel or oil entering the drainage system.
- Avoid construction activities during peak breeding periods of inhabitant turtles and other aquatics species.
- Usage of hazardous materials or chemicals in such designs can be avoided at the site. These hazards refer to chemicals which can develop contamination in the water, especially where there are good numbers of biodiversity recorded, during the study.
- The 'RLB' should be designed with 'foot-path', which local villagers can use to access right from left banks or vice versa reducing risk on conflict between villagers and animals, especially crocodile.
- During the construction period of the bridge, if some environmental or wildlife consequence develops at any such site or location, especially some important wildlife species needs a special help or rescue, the site in-charge of the project engineer should immediately contact 'Deputy Conservator of Forest' and local NGOs for help, who work for the same, and the problem should be solved. Therefore the 'In-charge of Project Engineer' should be aware enough to know about such emergency contacts; addresses, phone numbers etc. Addresses of few NGOs, who are working on wildlife animal rescuing under the guidance of State Forest Department at Vadodara District of Gujarat, are given below:
  - Staff of Fire Brigade, Vadodara Seva Sadan, Vadodara
  - Gujarat Sate Narmada valley Fertilizer Company, Bharuch (GNFC)

- Gujarat Society for the Prevention of Cruelty to the Animals (GSPCA), 54- Kunj Society, Alkapuri, Vadodara
- Vadodara Society for the Prevention of Cruelty to the Animals (VSPCA)
- Crocodile Group, Raopura, Vadodara
- State Forest Department, Vadodara Division, Kothi Kacheri, Kothi, Gujarat

b) Balaram Ambaji Wildlife Sanctuary and Jossore Wildlife Sanctuary

- Length of DFC in-between the proposed corridor developed by the Forest Department is 3 km. To minimise the impact on the wildlife movement, sufficient number of underpass should be provided. Box culverts (3.0 m x 3.0 m x over 14.5 m dimension) should be provided after every 500 m. Ground surface of the culverts should be kept natural. Additional culverts (pipe culverts) for crossing of reptiles and small mammals should be provided in consultation with Gujarat State Forest Department.
- The design of culverts and location should be approved by the State Forest Department before construction.
- Metal beam crash barrier/ chain link fencing on both side at the edge of ROW should be provided except around culverts'
- No underpass for local villagers should be provided in the corridor stretch
- Setting up of construction yard or construction camp should be prohibited within 1 km from the boundary the sanctuary.
- Adequate number of sign boards of high-intensity grade should be provided as per approved design of forest department.
- Environmental monitoring should be carried out during construction and operation period as per the monitoring plan prepared for the project.
- An Environmental Management Plan is prepared to ensure that environment is not degraded during construction and operation phase.

c) Thol Lake Wildlife Sanctuary

- From field survey, interview of academic experts, interaction with Forest Department and review of secondary data, it is confirmed that migratory waterfowls are found at Thol Lake Wildlife Sanctuary from October to March. As the construction activities are likely to disturb the birds, construction work in this stretch of DFC should be avoided during these months, and should be limited the months of April to August. This will minimise the impact on the migratory waterfowl as well as resident birds.
- Construction activity within 3 km radius of sanctuary shall be carried out by taking special care so as to cause the least disturbance as per the provisions of the law.
- For movement of cattle underpass should be provided after every 2 km
- Additional culverts (box/pipe) should be provided after every 1 km (in-between the two underpasses) for crossing of reptiles and small mammals like common langur, jungle cat, jackal etc. in this stretch.
- Metal beam crash barrier should be provided along both sides of the corridor in this stretch to minimise the chances of accident.
- During the operation phase, the train speed should be restricted in this stretch and adequate sign boards of high-intensity grade should be provided here to this effect.
- The electrical design in this stretch of DFC should include measures to make the line bird-proof, by providing the provision of spikes on poles, insulation of wires where possible, etc. In doing so reference may be made to the document Caution

Electrocution: Suggested Practices for Bird Protection on Power Lines published by NABU- German Society for Nature Conservation in 2006.

(3) Operation phase

1) Impacts

Effect on aquatic fauna in case of accidental oil spill and toxic chemical release find its way into the water bodies.

2) Mitigation Measures

a) Plantation along the ROW will be maintained properly

b) Plantation along the ROW will be protected from illegal felling

c) Contingent actions will be taken for speedy cleaning up of oil spills, fuel and toxic chemicals in the event of accidents.

5.3 SOCIAL CONSIDERATIONS

5.3.1 Accessibility

Impact on accessibility is envisaged during operation phase as follows.

(1) Operation phase

1) Impacts:

a) Accessibility on the other side of bisected land will be severely impaired for all detour routes due to lack of access roads and road-rail crossings

2) Mitigation Measures:

a) Provision of road-under-bridge (RUB) or road-over-bridge (ROB) at road crossing as per the policy and need.

b) Existing road and proposed RUB/ROB/Level Crossing (LC) will cater for the movement of local people.

c) Underpass or the level crossing shall be provided in the detour section as per the existing road network.

d) Provision of footpath on side of the carriageway as per existing practice of the Indian Railway Code (IRC)

5.3.2 Land Acquisition and Resettlement

Various social impacts on livelihood are envisaged related to the land acquisition and resettlement as follows.

1) Impacts

The table below summarizes the impact on structures based on structure identification survey. Since the impact would be quite considerable as the figures state, several mitigation measures to address them have been provided in this subsection.

Table 5-4 Number of Project-Affected Structures to be Relocated

	Residential	Commercial	Residential -cum- commercial	Community	Religious	Government	Others	Total
Gujarat								
Vadodara	0	0	0	0	0	0	1	1
Anand	23	0	1	0	2	0	4	30
Kheda	8	1	0	0	0	0	0	9
Ahmedabad	0	0	0	0	0	0	0	0
Gandhinagar	2	1	0	0	0	0	1	4
Mahesana	3	0	0	0	0	0	0	3
Patan	0	0	0	0	0	0	0	0
Banaskantha	52	0	1	0	2	0	1	56
Sub-total	88	2	2	0	4	0	7	103
Rajasthan								
Sirohi	9	0	0	0	2	24	6	41
Pali	92	18	4	1	23	114	30	282
Ajmer	252	51	17	7	24	58	41	450
Jaipur	55	33	16	2	9	7	23	145
Nagaur	0	0	0	0	0	0	0	0
Sikar	113	56	30	5	22	15	32	273
Alwar	7	0	0	0	0	0	0	7
Sub-total	528	158	67	15	80	218	132	1,198
Haryana								
Mahendragarh	178	69	19	12	14	22	26	340
Rewari	16	22	8	5	3	3	4	61
Sub-total	194	91	27	17	17	25	30	401
Total	**810**	**251**	**96**	**32**	**101**	**243**	**169**	**1,702**

Note: The above figures are related to both fully and partially affected structures.
Source: Project-Affected Structure Survey, 2008

2) Mitigation Measures

Compensation and assistance package will be planned in the Rehabilitation and Resettlement Plan (RRP), separately from the EIA.

[Note: - Mitigation measures identified in this EIA report are not mandatory and only recommendatory in nature. These mitigation measures shall be examined in detail by the Engineering Services Consultant based on practicability and feasibility aspects and the final measures shall be appropriately included in the pre-construction and during construction activities].

In particularly, there would be difficulties in implementing the following suggested noise mitigation measures:

1. Control of running speed of freight trains in urban areas
2. Shifting of train operations from night to day time
3. Provision of sound proof wall along the DFC near residential and sensitive receptor locations
4. Stationary construction equipment to be 200m away from sensitive receptor locations like school, hospital etc.

However, other alternative mitigation measures as listed below may be suitably considered to mitigate the noise levels

1. Use of low noise construction equipment
2. Use of long welded rails
3. Adopting new technologies to lower noise and vibration generation with respect to structures and rolling stocks

4. Appropriate maintenance of locomotives, tracks and structures
5. Tree plantation to mitigate the noise levels

CHAPTER III-6 UP-DATED ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN

6.1 INTRODUCTION

Environmental Management Plan (EMP) is the key to ensure a safe and clean environment. The expected results from the environmental mitigation measures proposed in the project may not be obtained without a management plan to assure its proper implementation and function. The EMP envisages the plans for the proper implementation of mitigation measures to reduce the adverse impacts arising out of the project activities during pre-construction, construction and operation stages.

(1) Pre-construction Stage

During the pre-construction stage, management measures required will include land acquisition, the clearance of the ROW, borrow area and quarry area identification, arrangement of construction water, measures for relocation of sensitive receptor such as temple, mosque etc. and other utilities likely to be impacted etc.

(2) Construction Stage

Construction stage is the most crucial and active stage of the EMP. The construction of freight corridor includes civil work including construction of cross stations, junction stations, RUB/ROB, cross drainage structures, other ancillary structures etc. The construction activities shall increase pollution load in the atmosphere as well as there shall be some other impacts. Therefore, in addition to the monitoring of construction activity to ensure that the environment is not impacted beyond permissible limits, safety of the workers, labour camp management, disposal of construction waste and risks associated with construction activities such as accidental spillages and consequent damage to the surrounding environment in terms of loss of flora, fauna, agricultural crops or loss of fertile land shall be monitored simultaneously.

(3) Operation Stage

The operation stage shall essentially entail monitoring activity along the corridor. The monitoring for pollutants specified in the monitoring plan will serve two purposes. In addition to checking the efficacy of the protection/mitigation/enhancement measures implemented, this will help verify or refute the predictions made as a part of impact assessment. Thus, it will complete a very important feedback loop for DFCCIL.

The EMP is prepared addressing the issues as follows.

1) Details of Management Plan
   a) Greenbelt Development Plan
   b) Solid Waste Management Plan
   c) Management / Rehabilitation Plan for Quarry/Borrow Areas
   d) Guidelines for Sanitation and House Keeping at the Construction Labour Camps
   e) Procedures for Storage, Handling and Emergency Response for Hazardous Chemical
   f) Land Acquisitions and Resettlement
2) Stage wise Environmental Management Measures and Responsibilities
3) Expenditures for environmental protection measures and budget for implementation of the EMP.

6.2 DETAILS OF MANAGEMENT PLANS

6.2.1 Greenbelt Development Plan

The detail Greenbelt Development Plan provided here contains:

- Objective and General Guidelines
- Species suggested for plantation
- Technical specification for plantation
- Precautionary and protection measures
- Cost of plantation

(1) Objective and General Guidelines

Green areas not only improve the floral status, land use and the aesthetic look of an area, but also serve the dual purpose of filtering any fugitive dust from open areas, help to abate noise effects through dampening, and replenish oxygen and ameliorate the surrounding temperature. Therefore, development of green belt is nowadays imperative as a part of development projects.

The main objectives of plantation along the railway track (parallel section) and along the road (detour section) are:

- To reduce impact of noise caused due to movement of train
- To reduce impacts of dust pollution
- To arrest soil erosion at embankment slopes
- Beautification of the project corridor by planting selective ornamental trees and shrubs
- To compensate for trees to be felled during construction

Considering the inadequacy or limitation of space, a nominal green belt is considered along the corridor, in junction station and cross station. The following general guidelines and measures are adopted:

- Destruction of existing trees shall be minimized.
- The plantation of trees shall be completed in the construction stage so that substantial growth is achieved when the project is completed.
- The plantation programme is drawn to conform to natural climatic conditions and adaptability of the species.
- The plantations would consist of a mixture of carefully chosen locally available indigenous, fast growing and sturdy species of trees having ornamental value.
- Preferential plantation of flowering trees with less timber and fruit value shall be carried out. Fruit bearing trees shall not be planted to avoid accident
- Proper drainage system and proper plantation techniques shall be adopted.
- Plantation in the initial stage of 3 years shall be properly maintained and protected by fencing from grazing and felling.
- Within 500 m from the signal, no tree shall be planted

(2) Species Suggested for Plantation

The plant species are selected based on criteria such as:

- Indigenous, fast growing, sturdy and perennial having ornamental values, preferably evergreen
- Growth and morphological characteristics (height, crown and flowering)

- Other factors like availability of local species, resistance to pollutants and adverse environmental conditions
- Adaptability to local climatic conditions and water availability

The list of indigenous plant species suggested for plantation along the corridor is presented in Table 6-1.

Table 6-1 Species Suggested for Plantation

SN	Common Name	Scientific Name	Characteristics
1	Lal Kachnar	*Bauhinea purpurea*	Medium size ornamental tree, conspicuous pink flowers
2	White Kachnar	*Bauhinea variegata*	Medium size ornamental tree, conspicuous white flowers
3	Bottle brush	*Callistemon viminalis*	Medium size ornamental tree, conspicuous red flowers
4	Amaltas	*Cassia fistula*	Medium size tree, conspicuous yellow flowers
5	Gulmohar	*Delonix regia*	Medium size ornamental tree, consp. scarlet flowers
6	Lagerstroemia	*Lagerstroemia thorelli*	Ornamental tree bearing pink flowers.
7	Mahua	*Madhuca indica*	Shady tree with large canopy
8	Neem	*Azadirachta indica*	Shady tree with large canopy
9	Jamun	*Syzygium cumini*	Shady tree with large canopy
10	Sisham	*Dalbergia sisoo*	Shady tree with large canopy
11	Devdaru	*Polyalthia longifolia*	Conical shaped tree
12	Arjun	*Terminalia arjuna*	Shady tree with large canopy
13	Ain	*Terminalia alata*	Shady tree with large canopy
14	Siris	*Albizzia lebbek*	Shady tree with large canopy
15	Khair	*Acacia catechu*	Shady tree with large canopy
16	Teak/Sag	*Tectona grandis*	Shady tree with large canopy

(3) Technical Specification for Plantation

Distance from the last track	:	4 m
Spacing between the plants	:	3 m
Size of the pits	:	60 x 60 x 60 cm
Species recommended	:	List of species provided in Table 6-1
No of plants per km	:	330 (Approximately 1 tree/3 m)
Height of the plant	:	Not less than 2 m
Age of the plant	:	Not less than 3 years

(4) Precautionary Measures

- Plantation shall be made in the monsoon months
- The height of the plants should not be less than 1 ft and should be in polythene bags and are not to be removed till the time of planting
- All plants supplied must be planted within three days of removal from the nursery
- The contractor shall be required to water the area in case of insufficient rains after planting
- 2 kg of compost /manure are suggested for each pit before plantation

(5) Turfing with grasses

Grass lines are used to provide a strong surface cover at the slope but it also needs a well-prepared surface in which to be planted. For a well spread grass cover, the surface should

not be disturbed in the initial stages of turfing. The grass species recommended for turfing is presented in Table 6-2.

Table 6-2 Grass Species Suggested for Turfing

SN	Local Name	Scientific Name	Family
1	Baru	*Sorghum halepense*	Gramineae
2	Bhathdu	*Themada triandra*	Gramineae
3	Bhatadi	*Themada quardrivalvis*	Gramineae
4	Daro or Dub	*Cynodon dactylon*	Gramineae
5	Dhaman	*Cenchrus ciliaris*	Gramineae
6	Dhudu or Dhundu	*Arundinella pumila*	Gramineae
7	Gandharu	*Cymbopogon jwarancusa*	Gramineae
8	Jinjavo	*Dichanthium annulatum*	Gramineae
9	Kakudu, Katusla	*Saccharum spontaneum*	Gramineae
10	Khariu	*Dinebra retroflexa*	Gramineae
11	Katas bamboo	*Bambusa arundinacea*	Gramineae
12	Lapdu	*Aristida adscensionis*	Gramineae
13	Mosi	*Lseilema laxum*	Gramineae
14	Pusha	*Cymbopogon citrates*	Gramineae
15	Bhatdu	*Themeda cymbaria*	Gramineae
16	Rosha	*Cymbopogon martini*	Gramineae
17	Shukli	*Heteropogon contortus*	Gramineae
18	Zinzvo	*Dichanthium annulatum*	Gramineae

All these species are locally available in the surrounding area. Contractor shall ensure that the condition of the site is good enough for successful establishment of grasses. They will also supervise all field operations like preparation of surface, sowing of grasses and quality of grass seeds used.

6.2.2 Solid Waste Management Plan

Solid waste from the project during construction will be mainly domestic scraps and wastes from the construction camp and construction spoils from construction sites.

- The construction debris shall be disposed of in suitable pre-identified dumping areas in tune with the local condition to avoid land degradation and water logging due to indiscriminate dumping.
- Dumping areas shall be reclaimed through top soil cover and plantation.
- Construction debris can also be disposed of in the existing municipal dumping area, if located near the alignment.
- Spoil and domestic refuse can be use as refill material for the sub-grade.
- Small amount of domestic refuse from construction camp shall be collected and disposed of in the nearest landfill site.
- Regular inspection of haul roads, construction site and camp shall be carried out to ensure regular and timely removal of construction debris to the dumping sites.
- During operation phase, solid waste management system shall be framed.
- Biodegradable and non-biodegradable waste shall be collected separately.
- Regular cleaning shall be conducted at ICD and at Stations.

6.2.3 Management / Rehabilitation Plan for Quarry/Borrow Areas

The contractor is required to take quarry material only from licensed quarries. In the case of existing quarries the contractor through the Engineer's representative will have to ensure that

all actions in these quarries are in accordance with the environmentally sound and acceptable manner.

In case the contractor establishes additional quarries and dedicated crusher plants, the contractor has to ensure that all actions are in accordance with the environmental requirements.

In the case of borrow areas, Contractor need to specify a detailed arrangement including the agreement with the owner of the land. The Contractor must comply with provisions of taxes, levies, royalties etc. of the State.

(1) Plan Required for Borrow/Quarry Areas

The contractor needs to develop a Borrow and Quarry area management plan providing at least the following details:

- Name, location and ownership of the borrow or quarry area;
- Existing land use of the area including the access road to be developed or not
- Approximate quantity of the material available;
- The number of trees and the species of the trees to be removed;
- Total area involved;
- Arrangement with the owner;
- Whether purchased or leased;
- A statement from the owner saying the actual arrangement (not in terms of exact monitory compensation) with him is agreeable for him;
- The exact restoration plan indicating the number of trees that shall be planted;
- The action plan for levelling and landscaping in order to bring the area in conformity to the neighbouring land uses; and
- The access roads rehabilitation.
- Compliance certificate of tax, levy, royalty etc. provisions.

The objective of the rehabilitation programme is to reinstate the quarry /borrow pit sites to a safe and secure area, which the general public should be able to safely enter and enjoy. Securing borrow pits /quarry sites in a stable condition should be a fundamental requirement of the rehabilitation proccss. This could be achieved by filling the quarry/ borrow pit with suitable materials to approximately the access road level.

Quarries and borrow pits may be backfilled with rejected construction wastes and shall be given a vegetative cover. If this is not possible, then excavation slopes shall be smoothed and depression shall be filled in such a way that it looks more or less like the original ground surface.

During works execution, the contractor shall ensure preservation of trees during piling of materials; spreading of stripping material to facilitate water percolation and allow natural vegetation growth; re-establishment of previous natural drainage flows; improvement of site appearance; digging of ditches to collect runoff; and maintenance of roadways where a pit or quarry is declared useable water source for livestock or people nearby. Once the works are completed, the contractor shall restore the environment at his own expense around the work site to its original splits.

6.2.4 Guidelines for Sanitation and House Keeping at the Construction Labour Camps

(1) Site Selection

- The construction camps shall be located at least 500 m away from habitations at identified sites. The living accommodation and ancillary facilities for labour shall be erected and maintained to standards and scales approved by the resident engineer.
- All sites used for camps must be adequately drained. They must not be subject to periodic flooding, nor located within 200 feet of swamps, pools, sink holes or other surface collections of water unless such water surface can be subjected to mosquito control measures.
- The camps must be located such that the drainage from and through the camps shall not endanger any domestic or public water supply.
- All sites must be graded, ditched and rendered free from depressions such that water may get stagnant and become a nuisance.

(2) Water Supply

- An adequate and convenient water supply, approved by the appropriate health authority, must be provided in each camp for drinking, cooking, bathing and laundry purposes.
- Potable water supply systems for labour camps occupants shall be as per the design approved by the Local Public Health Engineering Department and meet the water quality standards as prescribed by the State Pollution Control Board. In addition, the design of water system facilities shall be based on the suppliers Engineer's estimates of water demands.
- The drinking water system must be monitored in accordance with the water quality parameters as prescribed by the State Pollution Control Board. The water supply system used for cooking purposes that is drained seasonally must be cleaned, flushed, and disinfected prior to use. Furthermore, a water sample of satisfactory bacteriologic quality, i.e. a sample showing not more than one coliform bacteria per 100 ml sample must be obtained before being placed into service.
- At all construction camps and other workplace, good and sufficient water supply shall be maintained to eliminate chances of waterborne/water-related/water-based diseases to ensure the health and hygiene of the workers.

(3) Toilet Facilities and Hygiene

- There shall be adequate supply of water, close to latrines and urinals.
- Within the precincts of every workplace, latrines and urinals shall be provided in an accessible place, and the accommodation, separately for each of these, as per standards set by the Building and other Construction Workers (regulation of Employment and Conditions of Service) Act, 1996. Except in workplaces provided with water-flushed latrines connected with a water borne sewage system, all latrines shall be provided with dry-earth system (receptacles) which shall be cleaned at least four times daily and at least twice during working hours and kept in a strict sanitary condition. Receptacles shall be tarred inside and outside at least once a year.
- Toilet facilities adequate for the capacity of the camp must be provided. Each toilet room must be located so as to be accessible, without any individual passing through any sleeping room.

- A toilet room must be located within 200 feet of the door of each sleeping room. No toilet may be closer than 100 feet to any sleeping room, lunch area or kitchen.
- Where the toilet rooms are shared, such as in multifamily shelters and in barracks type facilities; separate toilet rooms must be provided for male and female. These rooms must be distinctly marked "for men" and "for women" by signs printed in the native language of the persons occupying the camp, or marked with easily understood pictures or symbols. If the facilities for each sex are in the same building, they must be separated by solid walls or partitions; extending from the floor to the roof or ceiling.
- Urinals must be provided on the basis of one unit or 2 linear feet of urinal trough for each 25 men. The floor from the wall and for a distance not less than 15 inches measured from the outward edge of the urinals must be constructed of materials impervious to moisture. Where water under pressure is available, urinals must be provided with an adequate water flush. Urinals troughs in privies must drain freely into the pit or vault, and the construction of this drain must be such as to exclude flies and rodents from the pit.

(4) Waste Disposal

- The sewage system for the camp must be designed, built and operated to the satisfaction of the concerned local State Govt. Department so that no health hazard occurs and no pollution to the air, ground or adjacent watercourse takes place. Compliance with the relevant legislation must be strictly adhered to.
- Garbage bins must be provided in the camps and regularly emptied and the garbage disposed off in a hygienic manner to the satisfaction of relevant norms.
- Unless otherwise arranged for by the local sanitary authority, arrangement for disposal of excreta by incineration at the workplace shall be made by means of a suitable incinerator approved by the local medical health or municipal authorities. Alternatively, excreta may be disposed off by putting a layer of night soils at the bottom of permanent tank prepared for the purpose and covering it with 15 cm layer of waste or refuse and then covering it with a layer of earth for a fortnight (by then it shall turn into manure).
- On completion of the works, all such temporary structures shall be cleared away, all rubbish burnt, excreta tank and other disposal pits or trenches filled in and effectively sealed off and the outline site left clean and tidy, at the Contractor's expense, to the entire satisfaction of the engineer.

(5) First Aid

- Injuries might occur during the construction period. It is therefore pertinent to provide first aid facilities for all the construction workers. At construction camps and at all workplaces first aid equipment and nursing staff must be provided. Since many of the workplaces may be far away from regular hospitals, an indoor health unit having one bed facility every 250 workers needs to be provided.
- Adequate transport facilities for moving the injured persons to the nearest hospital must also be provided in ready to move condition.
- The first-aid units, apart from an adequate supply of sterilized dressing material should contain other necessary appliances as per the factory rules of the State.

(6) Maintenance

- All buildings, rooms and equipment and the grounds surrounding them shall be maintained in a clean and operable condition and be protected from rubbish accumulation.
- All necessary means shall be employed to eliminate and control any infestations of insects and rodents within all parts of any labour camp. This shall include approved screening or other control of outside openings in structures intended for occupancy or food service facilities.
- Each structure made available for occupancy shall be of sound construction, shall assure adequate protection against weather, and shall include essential facilities to permit maintenance in a clean and operable condition. Comfort and safety of occupants shall be provided by adequate heating, lighting, ventilation or insulation when necessary, to reduce excessive heat.
- Each structure made available for occupancy shall comply with the requirements of the Uniform Building Code. This shall not apply to tent camps.

6.2.5 Procedures for Storage, Handling and Emergency Response for Hazardous Chemical

(1) Refueling/Maintenance Procedure

- Truck or suitable containers shall bring in all fuel and fluids. There shall be no storage of fuel, oil or fluids within 100m of any surface water body.
- Prior to re-fuelling or maintenance, drip pans and containment pans shall be placed under the equipment. Absorbent blankets may also be required to be placed under the equipment and hoses where there is a possibility of spillage to occur.
- All used oils or fluids shall be properly contained and transported to appropriately licensed (authorized) disposal sites.

(2) Spill Procedure (inside the stream, river or pond /opeu surface)

In the case of an accidental spill, overflow or release of fluid occurs into the stream, river, pond /open surface; the following steps will be followed:

a) Stop the follow

- Stop the release into the stream waterway
- Shut down the equipment
- Close valves and pumps
- Plug hoses

b) Remove Ignition Sources

- Shut down the vehicles and other engines
- Do not allow tiger torches, vehicles, smoking or other sources of ignition near the area. Keep a fire extinguisher on hand but keep it a safe distance away from the potential ignition source (if a fire starts, the extinguisher must be easily accessible)

c) Contact the Environmental Officer and initiate emergency response

- Notify the site supervisor and the Contractor's Environmental Officer as soon as possible
- The Environmental Officer will review the situation and decide if Emergency Services (like Fire Brigade) are required or not.

- Appropriate parties to be informed:
- The Contractor's Project Manager
- The Site Engineer of SC through his designated Environmental Officer
- The Client
- Regulatory Agencies like Pollution Control Board, Municipal Authorities, as applicable
- Site Safety Officer

d) Cleanup and Disposal

- Emergency Services will be engaged for the cleanup and disposal of contaminants released into the environment.

e) Reporting

- The Contractor's Environmental Officer will document the event and submit the reports to the Client and appropriate regulatory agencies like the State Pollution Control Board etc.

f) Procedure Review

- The Site Engineer of SC will review the report, determine if changes are required to the procedures and will recommend the required changes.

6.2.6 Management Plan for Land Acquisition and Resettlement

Compensation and assistance package will be planned in the Rehabilitation and Resettlement Plan (RRP), separately from the EIA.

6.3 STAGE-WISE ENVIRONMENTAL MANAGEMENT MEASURES

6.3.1 Pre-construction Stage

Table 6-3 Environmental Management Measures and Responsibilities (Pre-construction Stage)

Sl. No.	Environmental Issues	Management Measures	Responsibility	
			Planning and Execution	Supervision/ Monitoring
P1.	Land Acquisition	The acquisition of land and private properties shall be carried out in accordance with the RRP and entitlement framework for the project approved by DFCCIL. Environmental Management Unit (EMU) has to ascertain that any additional environmental impacts resulting from acquisition of land shall be addressed and integrated into the EMP and other relevant documents.	Land Acquisition Unit, EMU, Revenue Dept., NGOs	Revenue Dept, DFCCIL
P2.	Diversion of Reserved Forest land – 21.3 ha of forest land is to be diverted in Banaskantha District of Gujarat (break up: Jethi RF: 11.1 ha; Bantawada Un-class Forest: 7.5 ha Malana RF; 2.7 ha)	EMU shall prepare and submit the documents to DFC Banaskantha at Palanpur and a copy to CCF of Concerned Regional Office of MoEF for Forest Clearance in the case of Gujarat. EMU shall prepare and submit the documents to Divisional Forest Office of Pali and Sirohi District for Forest Clearance in the case of Rajasthan. The documents shall contain: • Filled up Application Form • Village map showing the alignment	State Forest Department, EMU	DFCCIL

Sl. No.	Environmental Issues	Management Measures	Responsibility	
			Planning and Execution	Supervision/ Monitoring
	5.3 ha of forest land is to be diverted in Pali and Sirohi Districts of Rajasthan (break up: 4.5 ha in Pali District and 0.8 ha in Sirohi district)	• Alignment on Toposheet (1:50,000 scale) • Area (to be diverted • Project Note • Index Map • Details of trees to be felled within the forest land • Undertaking to pay Net Present Value Tree counting shall be done by the Forest Department. Environmental Expert of EMU shall assist Forest Officials during tree counting. Compensation shall be provided to the forest department towards the cost of forest land to be diverted and cost of compensatory afforestation. Before start any activity within the Reserved Forest area, Forest clearance must be obtained.		
P 3.	Preservation of Trees	All efforts shall be made to preserve trees *including evaluation of minor design adjustments* / alternatives (as applicable) to save trees. Specific attention shall be given for protecting giant trees and green tunnels. Tree cutting is to proceed only after all the legal requirements including attaining of In-principle and Formal Clearances from the State Forest Department are completed and subsequently a written order is issued to the Contractor. Stacking, transport and storage of the wood shall be done as per the relevant norms. Systematic corridor level documentation for the trees cut and those saved shall be maintained by the EMU.	EMU, State Forest Department	DFCCIL
P4.	**Field verification and Modification of the Contract Documents**			
P.4.1	Joint Field Verification	The Environmental Expert of EMU and the Contractor shall carry out joint field verification to ascertain the possibility of saving trees, environmental and community resources. The verification exercise should assess the need for addition or changes in design/scale/nature of protection measures including the efficacy of enhancement measures suggested in the EMP. Proper documentation and justifications/reasons shall be maintained in all such cases where deviation from the original EMP is proposed.	Contractor and EMU	DFCCIL
P.4.2	Construction vehicles, equipment and machinery	All vehicles, equipment and machinery to be procured and brought to site for construction shall confirm to the relevant Bureau of India Standard (BIS) norms and the manufacturer's specifications. The discharge standards promulgated under the Environment Protection Act, 1986 shall be strictly adhered to.	Contractor	Environmental Expert of EMU

Sl. No.	Environmental Issues	Management Measures	Responsibility	
			Planning and Execution	Supervision/ Monitoring
		Noise limits for construction equipment to be procured such as compactors, rollers, front loaders concrete mixers, cranes (moveable) shall not exceed the value specified in the Environment (Protection) Rules, 1986. The equipment proposed to be used for bridge and culvert construction and installed close to waterway/streams, must be checked and certified fit, especially with respect to the potential leakage of oil and grease. The inspection should verify that: ▪ Equipment is clean (free of mud, dirt and oil) ▪ Equipment is in good working order. ▪ A drip pan is available for equipment that shall be stored on site. ▪ Contractor has a spill kit ▪ Operator is trained on the refuelling, maintenance and emergency spill procedures. ▪ A log book shall be maintained documenting all fuelling and maintenance events (date, time, location, condition of site, weather conditions, amount of fuel on maintenance event, issues). ▪ Adequate inspections shall be conducted during the construction period.		
P.5	Borrow Areas	Finalizing borrow areas for borrowing earth and all logistic arrangements as well as compliance to environmental requirements, as applicable, shall be the sole responsibility of the contractor. The Contractor shall not start borrowing earth from select borrow area until the formal agreement is signed between the land owner and the Contractor and a copy is submitted to the Supervision Consultant (SC) and EMU . Locations finalized by the Contractor shall be reported to the Environmental Expert of SC and who shall in turn report to EMU. Format for reporting shall be as per the Reporting Format for Borrow Area (**Form P.1 of Appendix III-6-1**) and shall include a referenee map. In addition to testing for the quality of borrow materials by the SC, the environmental experts of the SC shall be required to inspect every borrow area location prior to approval.	Contractor	Environmental Expert of SC and EMU
P.6	Quarry Areas	The quarry materials requirement of the project may be fulfilled from the existing quarries. However, detail investigation regarding the availability and suitability of quarry materials from these locations shall be finalized by the DPR Consultant. In case the Contractor decides to use quarries	Contractor	Environmental Expert of SC and EMU

Sl. No.	Environmental Issues	Management Measures	Responsibility	
			Planning and Execution	Supervision/ Monitoring
		other than recommended by DPR consultants, then it shall be selected based on the suitability of the materials. The Contractor shall obtain necessary permission for procurement of materials from Mining Department, District Administration and State Pollution Control Board and shall submit a copy of the approval and the rehabilitation plan to the EMU and Environmental Expert of SC.		
P.7	Site identification for disposal of unsuitable materials	The Contractor shall identify site (s) away from the project area where unsuitable materials (debris, solid waste) generated in the course of the construction can be safely disposed off. Such locations shall be inspected by the Environmental Expert of Supervision Consultant and approved in consultation with the EMU before construction work starts	Contractor	Environmental Expert of SC and EMU
P.8	Labour requirements	Local people shall be given preference for unskilled and other jobs created during construction phase of the project. The contractor would notify requirement of unskilled labours in nearby/surrounding villages. In case local labours are not interested/available then a certificate/letter shall be issued by the Panchayat officials to the Contractors in this regard.	Contractor	EMU
P.9	Construction camp – location, design and layout	Sitting of the construction camps shall be as per the guidelines below: Locations identified by the Contractor shall be reported as per format given. Construction camps shall not be proposed within 500 m from the nearest settlements to avoid conflicts and stress over the infrastructure facilities with the local community. Location for stockyards for construction materials shall be identified at least 1000 m from water sources. The waste disposal and sewage system for the camp shall be designed, built and operated such that no odour is generated. Unless otherwise arranged by the local sanitary authority, arrangements for night soils (human excreta) disposal approved by the local medical health or municipal authorities or as directed by Environmental Expert shall have to be provided by the contractor.	Contractor	EMU
P.10	Arrangements for temporary land	The Contractor as per prevalent rules shall carry out negotiations with the landowners for obtaining their consent for temporary use of lands for workers camp, construction sites etc. The Environmental Expert shall ensure that the clearing up of the site prior to handling over to the owner (after construction or completion of the activity) is duly carried out by the Contractor.	Contractor	Environmental Expert of SC and EMU

Sl. No.	Environmental Issues	Management Measures	Responsibility	
			Planning and Execution	**Supervision/ Monitoring**
		From P.2 and **From P.3** (given in **Appendix III-6-1**) shall be used for reporting status of temporarily acquired land to Environmental Expert		
P.11	Orientation of Implementing Agency and the Contractors	The EMU of DFCCIL shall organize orientation sessions and regular training sessions during all stages of the project. This shall include on-site training (general as well as in the specific context of a sub-project). These sessions shall involve all staff of Environmental Cells, field level implementation staff of EMU, Environmental Experts of Supervision Consultant and the Contractors.	EMU	EMU

6.3.2 Construction Stage

Table 6-4 Environmental Management Measures and Responsibilities (Construction Stage)

Sl. No.	Environmental Issues	Management Measures	Responsibility	
			Execution/ Civil Work	Supervision/ Monitoring
Activities to be carried out by the Contractor				
C.1	Site Clearance			
C.1.1	Clearing and grubbing	Vegetation shall be removed from the construction zone before commencement of construction. All works shall be carried out such that the damage or disruption to flora other than those identified for cutting is minimum. Only ground cover/shrubs that impinge directly on the permanent works or necessary temporary works shall be removed with prior approval from the Environmental Expert. The Contractor, under any circumstances shall not cut or damage trees. Trees identified under the project shall be cut only after receiving clearance from the State Forest Department of and after the receipt of written permission from EMU. **Form C.1** (given in **Appendix III-6-1**) shall be used as target sheet for tree cutting	Contractor	Environmental Expert of SC and EMU
C.1.2	Stripping, stocking and preservation of top soil	The topsoil from all areas of cutting and all areas to be permanently covered shall be stripped to a specified depth of 150 mm and stored in stockpiles. A portion of the temporarily acquired area and/or Right of Way shall be earmarked for storing topsoil. The locations for stock piling shall be pre-identified in consultation and with approval of Environmental Expert. The following precautionary measures shall be taken to preserve them till they are used: (a) Stockpile shall be designed such that the slope does not exceed 1:2 (vertical to horizontal), and height of the pile is restricted to 2 m. To retain soil and to allow percolation of water, the edges of the pile shall be protected by silt fencing	Contractor	Environmental Expert of SC and EMU

Sl. No.	Environmental Issues	Management Measures	Responsibility	
			Execution/ Civil Work	Supervision/ Monitoring
		(b) Stockpiles shall not be surcharged or otherwise loaded and multiple handling shall be kept to a minimum to ensure that no compaction shall occur. Such stockpiled topsoil shall be utilized for - • covering all disturbed areas including borrow areas (not those in barren areas) • top dressing of the embankment and fill slopes • in the agricultural fields of farmers, acquired temporarily. Residual topsoil, if there is any shall be utilized for the plantation.		
C.2	Procurement of Construction Material			
C.2.1	Earth from borrow areas for construction	No borrow area shall be opened without permission of the Environmental Expert. The location, shape and size of the designated borrow areas shall be as approved by the Environmental Expert of SC. The Contractor shall rehabilitate the borrow areas as soon as borrowing is over from a particular borrow area in accordance with the Borrow Area Rehabilitation/ Redevelopment Guidelines or as instructed by the Environmental Expert.	Contractor	Environmental Expert of SC and EMU
C.2.2	Quarry operation	The Contractor shall develop a Comprehensive *Quarry Redevelopment Plan as per the Mining* Rules of the State and submit a copy to EMU and SC prior to opening of the quarry site. The quarry operations shall be undertaken within the rules and regulations in force.	Contractor	Environmental Expert of SC and EMU
C.2.3	Construction water	The Contractor shall arrange adequate supply and storage of water for the whole construction period at his own costs. The Contractor shall submit a list of source/s from where water shall be used for the project to SC and EMU. The Contractor shall source the requirement of water preferentially from existing municipal supply. If ground water extraction is required, prior permission should be taken from the concerned authority/ authorities. A copy of the permission shall be submitted to SC and EMU prior to initiation of construction. The Contractor shall take all precaution to minimize the wastage of water in the construction process/ operation. **Form C.2** (given in **Annex-6.1**) shall be used for reporting.	Contractor	Environmental Expert of SC and EMU
C.2.4	Rain water harvesting	To minimize stress on groundwater, recharging through water harvesting structures along the project corridor shall be considered. As a long-term benefit of the project, water harvesting structures like check dams, and Underground tanks are recommended. Location shall be decided in consultation with Central/State Ground Water Authority.	Contractor	Environmental Expert of SC and EMU

Sl. No.	Environmental Issues	Management Measures	Responsibility	
			Execution/ Civil Work	Supervision/ Monitoring
C.3	Construction Work			
C.3.1	Drainage and Flood Control	The Contractor shall ensure that construction materials like earth, stone are disposed off so as not to block the flow of water of any watercourse and cross drainage channels. The Contractor shall take all necessary measures to prevent the blockage of water flow. In addition to the design requirements, the Contractor shall take all required measures as directed by the Environmental Expert of SC to prevent temporary or permanent flooding of the site or any adjacent area, if any.	Contractor	Environmental Expert of SC and EMU
C.3.2	Siltation of Water Bodies and Degradation of Water Quality	The Contractor shall not excavate beds of any river/ stream/ any other water body for borrowing earth for embankment construction. The Contractor shall construct silt fencing at the base of the embankment construction for the entire perimeter of any water body adjacent to the ROW and around the stockpiles at the construction sites close to water bodies. The fencing shall be provided prior to commencement of earthwork and continue till the stabilization of the embankment slopes, on the particular sub-section of the road. Equipment and plants shall be located at least 100 m away from any water body. The Contractor shall ensure that construction materials containing fine particles are stored in an enclosure such that sediment-laden water does not drain into nearby water body.	Contractor	Environmental Expert of SC and EMU
C.3.3	Slope protection and control of soil erosion	The Contractor shall take slope protection measures as per design, or as directed by the Environmental Expert of SC to control soil erosion and sedimentation through use of dykes, sedimentation chambers, basins, fibber mats, mulches, grasses, slope, drains and other devices. All temporary sedimentation, pollution control works and maintenance thereof shall be deemed as incidental to the earth work or other items of work and as such as no separate payment shall be made for them. The Contractor shall ensure the following safeguards: • During construction activities on embankment, the side slopes of all cut and fill areas shall be graded and covered with stone pitching, grass and shrub. • Turfing works shall be taken up as soon as possible provided the season is favourable for the establishment of grass sods. Other measures of slope stabilization shall include mulching, netting and seeding of batters and drains immediately on completion of earthworks. • In borrow pits, the depth shall be so regulated that the sides of the excavation shall have a slope not steeper than 1 vertical to 2	Contractor	Environmental Expert of SC and EMU

Sl. No.	Environmental Issues	Management Measures	Responsibility	
			Execution/ Civil Work	Supervision/ Monitoring
		horizontal, from the edge of the final section of the bank.		
C.4	Pollution			
C.4.1 Water Pollution				
C.4.1.1	Water pollution from construction wastes	The Contractor shall take all precautionary measures to prevent the wastewater generated during construction from entering into streams, water bodies or the irrigation system. He shall avoid construction works close to streams or water bodies during monsoon. Silt fencing may be provided near water bodies to avoid spillage of construction material. All waste arising from the project is to be disposed off in the manner that is acceptable to the State Pollution Control Board or as directed by Environmental Expert. Construction activities near the river/water bodies shall be prohibited during the rainy season.	Contractor	Environmental Expert of SC and EMU
C.4.1.2	Water pollution from fuel and lubricants	The Contractor shall ensure that all construction vehicle parking location, fuel/lubricants storage sites, vehicle, machinery and equipment maintenance sites are located at least 100 m away from any water body. The Contractor shall also ensure that spillage of fuels and lubricants do not contaminate the ground. If fuel storage and refuelling areas are located on agricultural land or areas supporting vegetation, the top soil shall be stripped, stockpiled and returned after cessation of such activities. All location and lay-out plans of such sites shall be submitted by the Contractor prior to their establishment and shall be approved by the Environmental Expert and EMU. The Contractor shall arrange for collection, storing and disposal of oily wastes to the pre-identified disposal sites (list to be submitted to SC and EMU) and approved by the Environmental Expert. All spills and collected petroleum products shall be disposed off in accordance with MoEF and state PCB guidelines.	Contractor	Environmental Expert of SC and EMU
C.4.2	Air Pollution			
C.4.2.1	Dust pollution	The Contractor shall take every precaution (water sprinkling etc.) to reduce the level of dust generating from construction site. All the plants shall be sited at least 1 km in the downwind direction from the nearest human settlement. The Contractor shall provide necessary certificates to confirm that all crushers used in construction conform to relevant dust emission control legislation. Alternatively, only crushers licensed by the SPCB shall be used. The Contractor in such a case shall submit required certificates and consents. Hot mix plant shall be fitted with dust extraction units.	Contractor	Environmental Expert of SC and EMU

Sl. No.	Environmental Issues	Management Measures	Responsibility	
			Execution/ Civil Work	Supervision/ Monitoring
		Form C.3 (given in **Appendix III-6-1**) shall be used for reporting to SC.		
C.4.2.2	Emission from construction vehicles, equipments and machineries	The Contractor shall ensure that all vehicles, equipments and machineries used for construction are regularly maintained and confirm that pollution emission levels comply with the relevant requirements of State Pollution Control Board (SPCB). The Contractor shall submit PUC certificates for all vehicles/ equipment/ machinery used for the project and maintain a record of the same during the contract period. Monitoring results shall also be submitted to SC and EMU as per the monitoring plan.	The Contractor	Environmental Expert of SC and EMU
C.4.3 Noise Pollution				
	Noise from vehicles, equipments and machineries	The Contractor shall confirm the following: • All plants and equipments used in construction shall strictly conform to the CPCB noise standards. • All vehicles and equipment used in construction shall be fitted with exhaust silencers. • Servicing of all construction vehicles and machinery shall be done regularly and during routine servicing operations, the effectiveness of exhaust silencers shall be checked and if found defective shall be replaced. At the construction sites within 150 m of the nearest habitation, noisy construction work such as crushing, concrete mixing shall be stopped during the night time between 9.00 pm to 6.00 am if possible. No noisy construction activities shall be permitted around educational institutions/ health centres (silence zones) up to a distance of 100 m from the sensitive receptors. Monitoring shall be carried out at the construction sites as per the monitoring schedule and results shall be submitted to SC and EMU. Environmental Expert shall be required to inspect regularly to ensure the compliance of EMP. **Form C.4** (given in **Appendix III-6-1**) shall be used for pollution monitoring during construction.	The Contractor	Environmental Expert of SC and EMU
C.5	Safety			
C.5.1	Personal safety measures for labour	The Contractor shall provide: • Protective footwear and protective goggles to all workers employed on mixing asphalt materials, cement, concrete etc. • Protective goggles and clothing to workers engaged in stone breaking activities • Earplugs to workers exposed to loud noise, and workers working in crushing, compaction,	Contractor	Environmental Expert of SC and EMU

Sl. No.	Environmental Issues	Management Measures	Responsibility	
			Execution/ Civil Work	Supervision/ Monitoring
		or concrete mixing operation. • Adequate safety measures for workers during handling of materials at site. The Contractor shall comply with all the precautions as required for ensuring the safety of the workmen as per the International Labour Organization (ILO) Convention No. 62 as far as those are applicable to this contract. The Contractor shall make sure that during the construction work all relevant provisions of the Factories Act, 1948 and the Building and other Construction Workers (regulation of Employment and Conditions of Services) Act, 1996 are adhered to. The Contractor shall not employ any person below the age of 14 years for any work and no woman shall be employed on the work of painting with products containing lead in any form. The Contractor shall also ensure that no paint containing lead or lead products is used except in the form of paste or readymade paint. He shall provide facemasks for use to the workers when paint is applied in the form of spray or a surface having lead paint is rubbed and scraped. The Contractor shall mark 'no smoking' in high risk areas and enforce non-compliance of use of PPE (Personal Protective Equipment) with zero tolerance. These shall be reflected in the Construction Safety Plan to be prepared by the Contractor during mobilization and shall be approved by SC and EMU.		
C.5.2	Risk from electrical equipments	The Contractor shall take all required precautions to prevent danger from electrical equipment and ensure that – • No material shall is so stacked or placed as to cause danger or inconvenience to any person or the public. • All necessary fencing and lights is provided to protect the public in construction zones. All machines to be used in the construction shall conform to the relevant Indian Standards (IS) codes, are free from patent defect, are kept in good working order, regularly inspected and properly maintained as per IS provision and to the satisfaction of the Environmental Expert.	Contractor	Environmental Expert of SC and EMU
C.5.3	First aid	The Contractor shall arrange for the following. • A readily available first aid unit including adequate supply of sterilized dressing materials and appliances as per the Factories Rules in every work zone. • Availability of suitable transport at all times to take injured or sick person(s) to the nearest hospital.	Contractor	Environmental Expert of SC and EMU

Sl. No.	Environmental Issues	Management Measures	Responsibility	
			Execution/ Civil Work	Supervision/ Monitoring
		• Equipment and trained nursing staff at construction camp.		
C.6	Labour Camp Management			
C.6.1	Accommodation	The Contractor shall follow all relevant provisions of the Factories Act, 1948 and the Building and the other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 for construction and maintenance of labour camp.	Contractor	Environmental Expert of SC and EMU
C.6.2	Potable water	The Contractor shall also guarantee the following: a) Supply of sufficient quantity of potable water (as per IS) in every workplace/labour camp at suitable and easily accessible places and regular maintenance of such facilities. b) If any water storage tank is provided, the bottom of the tank shall be kept at least 1 m from the surrounding ground level. c) If water is drawn from any existing well, which is within 30 m proximity of any toilet, drain or other source of pollution, the well shall be disinfected before water is used for drinking. d) All such wells shall be entirely covered and provided with a trap door, which shall be dust proof and waterproof. e) A reliable pump shall be fitted to each covered well. The trap door shall be kept locked and opened only for cleaning or inspection, which shall be done at least once in a month. f) Testing of water shall be done every month as per parameters prescribed in IS 10500:1991. Environmental Expert shall be required to inspect the labour camp once in a week to ensure the compliance of the EMP.	Contractor	Environmental Expert of SC and EMU
C.6.3	Sanitation and sewage system	The Contractor shall ensure that - a) The sewage system for the camp shall be designed, built and operated in such a fashion that it should not pollute the ground water or nearby surface water. b) Separate toilets/bathrooms, shall be arranged for men and women. c) Adequate water supply is to be provided in all toilets and urinals. d) All toilets in workplaces are with dry-earth system (receptacles) which are to be cleaned and kept in a strict sanitary condition e) Night soil (human excreta) is to be disposed off by putting layer of it at the bottom of a permanent tank prepared for the purpose and covered with 15 cm. layer of waste or refuse and then covered with a layer of earth for a fortnight.	The Contractor	Environmental Expert of SC and EMU
C.6.4	Waste disposal	The Contractor shall provide segregated garbage bins (biodegradable and non- biodegradable) in the camps and ensure that these are regularly emptied and disposed off in a hygienic manner as	Contractor	Environmental Expert of SC and EMU

Sl. No.	Environmental Issues	Management Measures	Responsibility	
			Execution/ Civil Work	Supervision/ Monitoring
		per the Comprehensive Solid Waste Management Plan approved by the Environmental Expert of SC. Unless otherwise arranged by local municipal authority, arrangements for disposal of night soils (human excreta) suitably approved by the local municipal authority or as directed by Environmental Expert, shall be arranged by the Contractor. **Form C.5** (given in **Appendix III-6-1**) shall be used for hygiene reporting of construction/labour camps.		
C.7	Contractor's Demobilization			
C.7.1	Clean-up operations, restoration and rehabilitation	The Contractor shall prepare site restoration plans, which shall be approved by the Environmental Expert of SC and PIU. The clean-up and restoration operations are to be implemented by the Contractor prior to demobilization. The Contractor shall clear all temporary structures; dispose all garbage, night soils, POL waste and all construction zones as per Comprehensive Waste Management Plan and as approved by SC. All disposal pits or trenches shall be filled in and effectively sealed off. Residual topsoil, if any shall be distributed on adjoining/ proximate barren land or areas identified by Environmental Expert in a layer of thickness of 75 mm-150 mm. **Form C.6** (given in **Appendix III-6-1**) shall be used for reporting to SC.	Contractor	Environmental Expert of SC and EMU

6.3.3 Operation Stage

Table 6-5 Environmental Management Measures and Responsibilities (Operation Stage)

Sl. No.	Environmental Issues	Management Measures	Responsibility	
			Execution/ Civil Work	Supervision/ Monitoring
O.1	Monitoring Operation Performance	The EMU shall monitor the operational performance of the various mitigation/ enhancement measures carried out as a part of the project. The indicators selected for monitoring include the survival rate of trees; utility of enhancement provision for relocated utilities, hand pumps and other relocated structures if any; status of rehabilitation of borrow areas; and noise barriers, which are proposed at different locations.	EMU	DFCCIL
O.2	Pollution Monitoring	The periodic monitoring of the ambient air quality, noise level, water (both ground and surface water) quality, soil pollution/contamination in the selected locations as suggested in pollution monitoring plan shall be the responsibility of EMU. EMU shall appoint SPCB approved pollution monitoring agency for this purpose. **Form O.1**	Pollution Monitoring Agency, EMU	DFCCIL

Sl. No.	Environmental Issues	Management Measures	Responsibility	
			Execution/ Civil Work	Supervision/ Monitoring
		(given in **Appendix III-6-1**) shall be used for pollution monitoring.		

6.4 UP-DATED ENVIRONMENTAL MONITORING PLAN

6.4.1 Introduction

The purpose of the environmental monitoring plan is to ensure that the envisaged purpose of the project is achieved and results in desired benefits to the target population. To ensure the effective implementation of the EMP, it is essential that an effective monitoring plan be designed and carried out. The broad objectives are:

- To evaluate the performance of mitigation measures proposed in the EMP
- To suggest improvements in management plan, if required
- To enhance environmental quality
- To satisfy the legal and community obligations

The environmental monitoring plan contains:

- Performance indicators
- Environmental monitoring programme
- Reporting formats

6.4.2 Performance Indicators

The environmental and social components identified to be particularly significant in affecting the environment at critical locations are suggested as Performance Indicators (PIs). The Performance Indicators shall be evaluated as follows:

a) Environmental condition indicators to determine efficiency of environmental management measures in control of air, noise, water and soil pollution

b) Environmental and social management indicators to determine compliance with the suggested environmental management measures

c) Operational performance indicators that have been devised to determine efficiency and utility of the proposed mitigation measures

The Performance Indicators and monitoring plans prepared are presented in Table 6-6.

Table 6-6 Performance Indicators

S.N.	Indicators	Details	Responsibility
A.	Pre-Construction Stage: Environmental & Social Management Indicators and Monitoring Plan		
1	Land Acquisition	Land acquisition to be carried out in accordance with the RRP and entitlement framework for the project approved by DFCCIL.	Land Acquisition Unit, EMU, Contractor
2	Dumping locations	Locations for dumping of wastes have to be identified and parameters indicative of environment in the area has to be reported	Contractor
3	Construction camps	Location of construction camps have to be identified and parameters indicative of environment in the area has to be reported	Contractor

S.N.	Indicators	Details	Responsibility
4	Borrow areas	Location of borrow areas have to be finalized from identified lists and parameters indicative of environment in the area has to be reported	Contractor
5	Site clearing	Progress of tree removal marked for cutting is to be reported	Contractor
B.	Construction Stage: Environmental & Social Condition Indicators and Monitoring Plan		
1	Air quality	The parameters to be monitored as per frequency, duration & locations of monitoring specified in the Environmental Monitoring Programme prepared (Refer Table 6-7).	Contractor through approved monitoring agency
	Noise & vibration level		Contractor through approved monitoring agency
	Water quality		Contractor through approved monitoring agency
	Sediment quality		Contractor through approved monitoring agency
2	Tree plantation	Progress of measures suggested as part of the strategy is to be reported	Contractor through approved monitoring agency
3	Top soil	Contractor shall report implementation of the measures suggested for topsoil preservation to environmental expert, supervision consultant.	Contractor
4	Construction workers	The Contractor shall provide: • A readily available first aid unit, suitable transport facility, equipment and trained nursing staff at construction camp • Supply of sufficient quantity of potable water • Proper sanitation & sewage system in the camp • Separate toilets/bathrooms for men and women Waste disposal facility	Contractor
C.	Operation Stage: Management & Operational Performance Indicators		
1	Survival rates of trees	The number of trees surviving during each visit shall be compared with the number of saplings planted.	Environmental Expert of Supervision Consultants up to construction period, and then EMU of DFCCIL over a period of 5 years
2	Rehabilitation of borrow areas	The Environmental Specialist of Supervision Consultants and EMU shall undertake site visit to determine how many borrow areas have been rehabilitated in line with the landowners request and to their full satisfaction	Environmental Expert of Supervision Consultants up to construction period, and then EMU of DFCCIL over a period of 5 years
3	Utility of noise barriers for sensitive receptors	The EMU shall visit sensitive locations along with the environmental monitoring agency (responsible for monitoring of noise & vibration levels during operation stage) to check the efficiency of the noise barriers	Environmental Expert of Supervision Consultants up to construction period, and then EMU of DFCCIL over a period of 5 years

6.4.3 Environmental Monitoring Programme

The detail monitoring programmer during construction and operation stages are presented in Table 6-7. For each of the environmental condition indicator, the monitoring programme specifies:

- Parameters to be monitored
- Location of the monitoring sites
- Frequency and duration of monitoring
- Institutional responsibilities for implementation and supervision

Table 6-7 Environmental Monitoring Programme

Environment	Project	Environmental Monitoring Programme			Institutional Responsibility	
Component	Stage	Parameters	Location	Frequency	Implementation	Supervision
Air Quality	Construction	SPM, RSPM,	Wherever the	Continuous 1	Contractor through	EMU/

Environment	Project	Environmental Monitoring Programme			Institutional Responsibility	
Component	Stage	Parameters	Location	Frequency	Implementation	Supervision
		SO_2, NOx	contractor decides to locate the batch mix plant & other machinery	working day, at least once in every season (once in 6 months) except monsoon and preferably once in 3 months for areas of construction sites in proximity of inhabited areas	approved monitoring agency	Supervision Consultants
		SPM, RSPM, SO_2, NOx	All major settlement areas located near the DFC alignment. However, final decision shall be taken in consultation with SPCB	Continuous 1 working day, at least once in every season (once in 6 months) except monsoon and preferably once in 3 months for areas of construction sites in proximity of inhabited areas	Contractor through approved monitoring agency	EMU/ Supervision Consultants
	Operation	SPM, RSPM, SO_2, NOx	Shall be decided by SPCB	Continuous 1 working day, once in every season except monsoon season for once in every three years	EMU	DFCCIL
Water Quality	Construction	See Note	Surface water- at 8 locations: Balaram, Banas, Mahi, Sabarmati, Mini, Vishwamitri, Vatrak River, & Narmada Canal Ground water: location shall be decided by SPCB	4 times a year (preferably in each season)	Contractor through approved monitoring agency	EMU/ Supervision Consultants
	Operation	See Note	Shall be decided by SPCB	Pre-monsoon & post-monsoon, once in every three years	EMU	DFCCIL
Noise & vibration Level	Construction	Noise level & vibration in dB (A)	At equipment yard	4 times a year (preferably in each season)	Contractor through approved monitoring agency	EMU/ Supervision Consultants
		Noise level in dB (A)	All major settlement areas located near the DFC alignment. However, final decision shall be taken in consultation with SPCB	4 times a year (preferably in each season)	Contractor through approved monitoring agency	EMU/ Supervision Consultants
	Operation	Noise & vibration level in dB (A)	Shall be decided by SPCB	Once in every three years.	EMU	DFCCIL
Sediment	Construction	pH, Conductivity, Texture, Total OM, Total N, Na SAR, K, and Oil content	No. of location: 7 Balaram, Banas, Mahi, Sabarmati, Vishwamitri, Vatrak River, and Narmada Canal	Once in a year	Contractor through approved monitoring agency	EMU/ Supervision Consultants
Soil Erosion	Construction	Visual observation & turbidity	Visual observation at high embankments & turbidity in crossing of all surface water bodies	Pre-monsoon and post-monsoon season	Environmental Specialist, Hydrologist, and Material Specialist of Supervision	EMU/ Supervision Consultants

Environment	Project	Environmental Monitoring Programme			Institutional Responsibility	
Component	Stage	Parameters	Location	Frequency	Implementation	Supervision
					Consultants	
Haul Road	Construction	Maintenance of haul roads	Haul roads & hauling mode	At least twice a day i.e. midday and evening	Environmental Specialist of Supervision Consultants and Contractor	EMU/ Supervision Consultants
Plantation	Construction	No. of railway side plantation	Along the side of the track	Comparison should be done for every six months	Environmental Specialist of Supervision Consultants	EMU/ Supervision Consultants
	Operation	Growth of railway side plantation	Along the side of the track	Assess growth every year for initial five years	EMU	DFCCIL
Flora & Fauna	Construction	Aquatic ecosystem	All crossings of surface water bodies	Once a month during construction period	Environmental Specialist of Supervision Consultants	EMU/ Supervision Consultants
Borrow Area Management	Construction	Borrow areas redevelopment.	Identified borrow areas	Once a week during	Environmental Specialist of Supervision Consultants and Contractor	EMU/ Supervision Consultants

Note: pH, BOD, COD, TDS, TSS, DO, Oil and Grease, Total hardness, Total alkalinity, Cl, SO_4, NO_3, PO_4, F, Na, K, Ca, Mg, Fe, Zn, and Heavy Metals such as, Cd, Cr, Se, Pband Hg

6.4.4 Key Players in the Implementation of EMP

The responsibility for implementation and supervision of EMP's is vested with four agencies, namely Contractors, Environmental Monitoring Unit (EMU), DFCCIL and Engineers. The "Contractors" herein mean the agency hired for execution of the construction works for the respective packages. DFCCIL would be the implementation agency at two levels, one at the centre referred to as "DFCCIL" and the other at project level named as "EMU" in the EMP. The term engineer refers to the "Supervision Consultant".

6.4.5 Institutional Framework

The DFCCIL is responsible for implementation of all the mitigation and management measures suggested in EMP and RRP. To effectively oversee the project preparation and to ensure the timely implementation of the EMP, an Environmental Management Unit (EMU) is proposed under the DFCCIL. The implementation of the EMP and RRP would be the responsibility of the EMU. The Environmental Engineer of EMU will assist the Project Director and will interact with State Pollution Control Board (SPCB), Forest Dept. and NGO for addressal of environmental issues, and with Revenue Dept., NGO and various Committees for RandR issues. The Environmental Expert of the Supervision Consultants and the Contractor will assist the EMU for successful implementation of the EMP. The institutional/implementation arrangements have been shown in Figure 6-1.

6.4.6 Progress Monitoring and Reporting Arrangements

The monitoring and evaluation of the management measures envisaged are critical activities in implementation of the Project. Monitoring involves periodic checking to ascertain whether activities are going according to the plans. It provides the necessary feedback for project management to keep the program on schedule. The rational for a reporting system is based on accountability to ensure that the measures proposed as part of the EMP get implemented in the project. The reporting system shall operate linearly with the contractor who is at the lowest rank of the implementation system reporting to the Supervision Consultant, who in turn shall

report to the EMU. All subsequent reporting by the contractor shall be monitored as per the targets set by the EMU before the contractors move on to the site. The reporting by the Contractor shall be monthly report like report of progress on construction and will form the basis for monitoring by the EMU, either by its own Manager (Environment) or the Environmental Specialist hired by the Supervision Consultant.

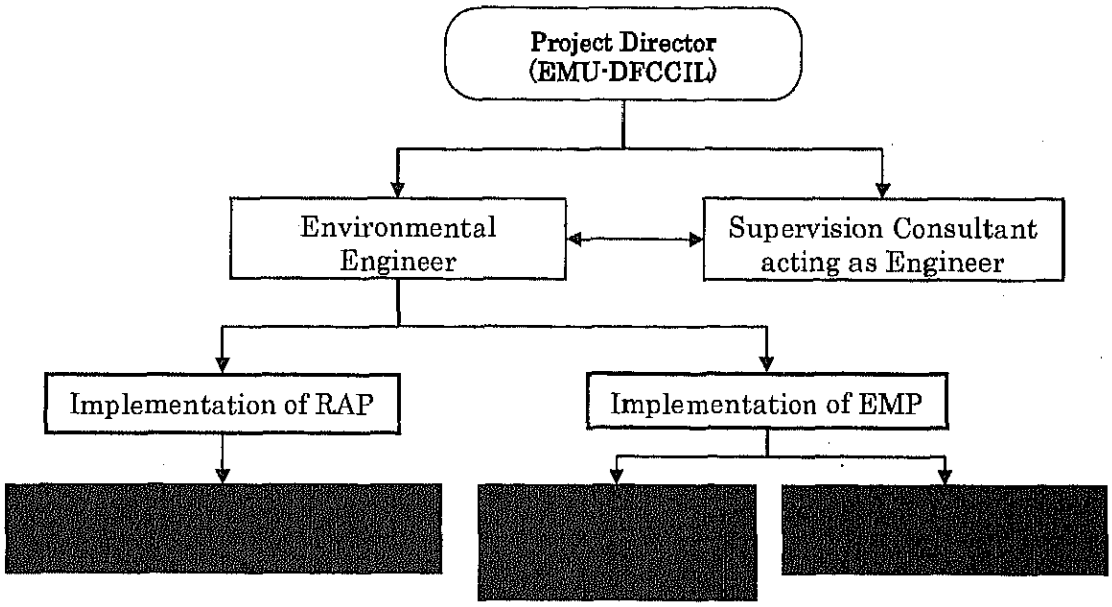


Figure 6-1 Implementation Arrangement

6.4.7 Training

(1) Training Need

Environmental training should be provided to the relevant staff of DFCCIL, the contractors and their appropriate personnel and the staff of the Supervision Consultant with a view to help them gain a full understanding of the relevant environmental regulations and their application to the project as well as the technical issues involved in implementing the EMP. While all of the EMU/DFCCIL staff should get training, other staff members involved in planning and implementation wherein their work has a bearing on the EMP should also be given environmental training. Since it is the first time environmental measures are seriously applied in a long distance rail corridor in the country, it is critical to provide training and skill upgradation to those involved in the implementation of the project.

(2) Training Components

The broad areas of environmental training shall include the following:

- Environmental regulations and their application to the project,
- Environmental impact of the project and the mitigation measures as given in the EMP and their implementation,
- Duties and responsibilities of the Contractors, Supervision Consultants and staff of DFCCIL involved in the project,
- Public/community consultation and its role during the implementation of the project,

- Procedures for obtaining various clearances, reporting requirements and liaison with the relevant departments and agencies (such as Forest Dept and SPCB, etc.),
- Supervision of the implementation of the EMP and environmental issues during construction and operation. Resolution of environmental and social issues and their reporting,
- Monitoring during construction and operation, and
- Weekly, monthly and quarterly report preparations and submission

Training Programme: DFCCIL should facilitate a training need assessment so that exact areas of training, number of persons to be trained within its organisation and the project implementation partners, and the timings of the training programs would become clear. Each training program would be addressed to a specific target group. Looking into the potential requirements of each of the target groups involved, a few training modules are suggested in Table 6-8. The training programs can be held by EMU, by drawing on experts from leading organisations in environmental management as well as individual experts; it can also commission such organisations to conduct training programs on certain topics.

Table 6-8 Training Modules for Environmental Management

Sl. No.	Training Recipients	Mode of Training	Environmental aspects to be covered in training modules	Training Conducting Agency
Module-I	EMU and other relevant staff of DFCCIL involved in the project, staff of construction supervision consultant, contractors and their relevant personnel	Lecture Sessions, Workshops and Presentation	Environmental overview and environmental regulations and acts	External environmental specialists
Module-II	EMU and other relevant staff of DFCCIL involved in the project, staff of construction supervision consultant and contractor	Lecture Sessions, Workshops and Presentation	Environmental Impact Assessment: DFC and environmental issues, and introduction to the physical/natural environment of the project area	External environmental specialists
Module-III	EMU and other relevant staff of DFCCIL involved in the project, staff of construction supervision consultant and contractors and their relevant personnel	Lecture Sessions, Workshops and Presentation	Issues involved in the implementation of the EMP	External environmental specialists
Module-IV	EMU staff of DFCCIL	Workshop	Procedures for obtaining the required environmental clearances	External environmental specialists
Module-V	Relevant staff of DFCCIL involved in the project, staff of construction supervision consultant, contractors and their relevant personnel, and collaborating Government agencies	Lectures; Group Discussions	Environmental reporting requirements as per the EMP	EMU
Module-VI	EMU and other relevant staff of DFCCIL involved in the project, staff of construction supervision consultant and relevant personnel of contractors	Lectures; Demonstration sessions; Group Discussions	Environmentally Sound Construction Management	External environmental specialists
Module-VII	EMU and other relevant staff of DFCCIL involved in the project	Lectures; Group Discussions	Planning for Environmentally Sustainable Operation of DFC	External environmental specialists
Module-VIII	EMU and other relevant staff of DFCCIL involved in the project	Lectures; Demonstration sessions; Group Discussions	Long Term Environmental Issues in DFC Management	External environmental specialists
Module IX	EMU and other relevant DFCCIL staff involved in the project	Workshop	Provision of biodiversity protection measures in DFC (underpasses, bird proofing of power lines, rail side plantation, etc)	External environmental specialists

Table 6-9 List of Organisations for Environmental Training Support

Name of agency	Area of specialisation
Statutory bodies	
CPCB	Pollution related issues
SPCBs	Do
Central Groundwater Board	Groundwater issues
Govt Departments	
MoEF	Forest and wildlife related issues, laws and regulations
State Forest Departments	Do
Other organisations	
Wildlife Institute of India, Dehra Dhun	Wildlife management interventions, impact mitigation measures
Bombay Natural History Society, Mumbai	Wildlife related issues, birds in particular
National Environmental Engineering Research Institute, Nagpur	Technological issues related to environmental management
Centre for Science and Environment, Delhi	Pollution issues
World Wildlife Fund, Delhi	Wildlife management interventions

CHAPTER IV-1 CONCLUSION AND RECOMMENDATION

1.1 POLLUTION CONTROL

The impact of the DFC Project to the present condition of noise was envisaged to require mitigation measure. The actual impact to the DFC operation was predicted based on measurement on the existing railway noise. Unit noise level was derived from the actual measurement in the high speed and heavy lorded electrified freight train under the less influence of the other noise. The result shows that aggregate noise levels of predicted noise level (LAeq) and existing railway noise level exceed guideline value (60 dB in daytime and 55 dB in night time) in almost all locations requiring some counter measures. However, as mentioned in the Note under Chapter III-5 (Page-III-5-15), the mitigation measures are not mandatory and only recommendatory in nature. The measures would need to be further examined by the Engineering Services consultant and the final measures along with the suitable alternative mitigation measures, included in the pre-construction and construction stages. Considering distribution of sensitive receptors and land use of the area, adequate scale of mitigation measure may be adopted.

The impact of the DFC Project to the present condition of vibration was envisaged not high to be required mitigation measure at the moment. Applying the Japanese guideline, vibration levels of the freight trains was measured in the existing tracks where the trains with relatively high speed; heavy load and without the background vibration. Calculating the Power level value, the trend of distance attenuation was examined. The result shows that predicted vibration level for Z axis meets guideline value (70 dB) at predicted all 12 locations in parallel section and five (5) locations in detour section.

The impact of the DFC Project to present condition of the water bodies is envisaged as negligible as long as adequate design and construction works will be conducted. To establish adequate environmental mitigation and monitoring plan, water quality of the water bodies at the detour section in Gujarat were examined based on the secondary information and primary survey result. Water quality of the rivers in presently developing State of Gujarat were deteriorated. Amongst thirty (30) water samplings, the general trends of sampled water showed high turbidity, while low Dissolved Oxygen (DO). Most of the samples from the rivers show low DO except sample from down stream of Mahi River. The values are ranged up to 5.0mg/l usually recognized as lower limit of environment for fish what those can survive. Also, water from Sabarmati River and Mini River highly contain oils and high sulphate at 10 times higher than the values in the other rivers exceeding the Indian standard for the water quality (389.5 - 514 mg/L in Sabarmati River and 279.7 - 628.6 mg/L in Mini river). The minimum, maximum and mean values of each parameter in 30 samples are shown below and the detail results are shown in the Section III-1.

The study was conducted in the monsoon season which comparatively abundant water levels in the water bodies are expected in the year. The water flow of the important rivers are also studied the seasonal change on the quality is a dependant on the water flow level in the rivers which increase in the monsoon season from June to September after the hottest season of summer, March to May. Several mitigation measures were recommended mainly for reducing the discharge of the mad water at the construction sites. It is recommended that the construction work in monsoon season should be avoided.

1.2 NATURAL ENVIRONMENT

The impact of the DFC Project to present condition of the natural environment is envisaged as not critical. The area of DFC alignment between Makarpura Railway Station in Vadodara District of Gujarat to Rewari Junction Station in Rewari District in Haryana was mostly

covered by flat agricultural area and approximately 93% in Gujarat, 60% in Rajasthan and 93% in Haryana States , respectively.The climate of the area of DFC is comparatively moderate and tropical characterized by a hot summer from March to June, a humid monsoon or rainy season stretching from July to September, a short pleasant post-monsoon during October and November, and short winter spanning between December and January. The rainfall is of monsoonic type and about 70-80% of the total annual rainfall is received during the monsoon period where as during remaining period the light showers are received.

As directly affected flora, the study shows that no any highly natural forest such as primeval forest is found along the corridor and no any disturbance on the critically important flora leading irreversible damage are not anticipated at the time. As mentioned above, after long time of human habitation most area has been developed even in forest land. Almost all species are planted forestry purpose to be protect the land. On the DFC alignment, three recorded forests are affected in Gujarat at detour section and 4 recorded forests are affected in Rajasthan at parallel section. Detail survey based on the quadrate, the thorny leguminous species were classified as predominance. According to interview to the literature, academician and local villagers, the seasonal change was a little on the higher plant. Also, among the lower plants, there are no particularly endangered plant species were not found. With other private and railway side plantation trees felling, adequate compensatory activities including Forest Clearance are required following the governmental procedure.

The DFC alignment will cross several rivers and canals in Gujarat, out of which River Mahi, Sabarmati, Vishwamitri, Mini and Vatrak Rivers are the important rivers where faunal diversity was identified during ESIMMS study in the year 2007. Supplementary study has been conducted to assess the potential impacts on the habitat of wildlife due to construction of bridge over major rivers along the DFC alignment. The impact assessments indicate that such 'Bridge' construction would be have negligible and time-being impacts on some of important wildlife and surrounding environment. However, the mitigation measures required during construction and operation stage to minimize the disturbance to the water body.

Three protected areas in Gujarat and two protected area in Rajasthan are located closely to the DFC alignment. Those are Balaram Ambaji Wildlife Sanctuary, Jessore Wildlife Sanctuary and Thol Lake Wildlife (Bird) Sanctuary in Gujarat and Mount Abu Wildlife Sanctuary and Sambarh Lake in Rajasthan. Balaram Ambaji and Jessore Wildlife Sanctuaries are in Banaskantha District of Gujarat, while as Thol Lake Wildlife (Bird) Sanctuary is in Mahesana District. Balaram Ambaji Wildlife Sanctuary is located on the western side of DFC alignment and the distance between DFC alignment and the Sanctuary is varying from 1.2 to 3.1 km. Jessore Wildlife Sanctuary is located in eastern side of the alignment and the distance between DFC alignment and the Sanctuary is varying from 1.2 km to 2.9 km. Thol Sanctuary is located in the eastern side of DFC alignment and the distance between Thol Sanctuary and DFC alignment is varying from 0.7 km to 1.5 km. The other two areas at parallel section in Rajasthan are less critical having approximately 5 km from the railway. Although the surrounding areas of the DFC are outside of the sanctuaries, some animal movement were confirmed in the areas in Gujarat through interview and mitigation measures are recommended.

Thus, the impact of the DFC to the natural environment in terms of the flora and fauna were mainly studied in supplemental study. Although most of areas have already been developed as agricultural land, occasional animal movements are still found at the area. Some mitigation measures to reducing further conflict between human being and wildlife such as underpass for animal on the embankment to allow the animal movement and foot pass for human being at the bridge to reduce human disturbance.

1.3 SOCIAL ENVIRONMENT

In subsequent stage of the Project, further activities and arrangements have to be done based on the draft RRP, especially preparation of the RRP by conducting detailed survey for all the PAPs, which is called as Census under the NRRP 2007, as basis for the compensation and assistance for the compensation and resettlement of land acquisition for the Project.

As per the NRRP 2007, a Rehabilitation and Resettlement Plan (RRP) has to be prepared after the project-affected area is declared by the notification, which means that the timing after the notification under the Section 20A of the Railways (Amendment) Act, 2008 was issued as declaration of intention on the land acquisition for the Project. The RRP should be prepared based on the draft RRP. In the preparation of the RRP, a Social Impact Assessment (SIA) has to be conducted as per the NRRP 2007.

Social Impact Assessment (SIA) will be carried out by the Project Authority for the entire stretch in both parallel and detour sections of the project based on the technical design. SIA will determine the extent of impact on general as well as vulnerable categories, estimate of prospective losses, and ascertain costs of resettlement and preparation of resettlement plan for implementation. The SIA surveys will comprise the Census and Baseline Socio-economic Survey. Regarding the Baseline Socio-economic Survey, the survey has already been conducted in the preparation of draft RRP as shown in Chapter 4 of the draft RRP. Regarding the Census, the purpose of census is to prepare the list of likely PAPs within the proposed ROW and also make an inventory of properties and other assets affected. It will cover all (100%) of PAPs.

The census and socio-economic survey will be conducted using questionnaire by the consultant appointed by the Project Authority. Broad information to be collected would include demography of family members, religion, caste, sources of income, occupation, land holdings, ownership and type of structures, other property and assets owned, livestock size, details of losses of assets to the project, etc. The extent of impact on Common Property Resources shall also be covered during census. In addition, individuals and group consultations would be carried out to understand the needs and concerns of PAPs with regard to various issues such as alternatives, compensation, assistance, resettlement options, etc. Based on results of the census, PAPs should be suitably categorized as titleholders, encroachers, squatters, tenants, vulnerable, etc. The disclosure of RRP should be done by the NGO to be appointed by the Project Authority for the implementation of RRP.

APPENDIX I-3-1 SOCIO-ECONOMIC CONDITION OF THE PROJECT AREA

1.1 GUJARAT

There are eight districts in Gujarat – Vadodara, Anand, Kheda, Ahmedabad, Gandhinagar, Mahesana, Patan and Banaskantha through which the DFC alignment traverses. The DFC corridor is mostly detour in Gujarat State except a small parallel section between Iqbalgarh and Gujarat/Rajasthan State Border in Banaskantha District. Railway route has been selected as detour to avoid large scale involuntary resettlements in urban areas. This project area comprises of all the eight mentioned districts. Village wise details of project affected villages are discussed in following sections.

1.1.1 Vadodara District

Vadodara District is surrounded by Narmada District in the South and Bharuch District in the South and South-West. It shares its boundary with the State of Madhya Pradesh on the East and with Dahod, Panchmahal and Anand Districts of Gujarat in the North. The district has a total geographic area of 7,794 m^2 and a population density of 467 persons per square kilometer. Vadodara City is the administrative headquarter of the district.

Table 1-1 provides salient information about the villages likely to be affected by the DFC project in Vadodara District.

There are only three villages (Gokalpura, Khalipur and Karali) having population of less than 1,000 while 6 villages have population in the range of 1,000-4,999. There are four villages (Anagadh, Sherkhi,Bhayali,Samiyala) having a total population of more than 5,000. Anagadh Village has highest population at 13,531 persons. The number of households varies in different villages ranging from a minimum of 172 (Karali) to a maximum of 2,560 (Anagadh).

The number of households in these villages sums up to 11,227 containing 54,981 persons. The average size of the household in the affected villages in the district works out to be 4.9. The percentage of male population (52.0%) is slightly more than the female population (48.0%). The Schedule Caste population constitutes 7.2% while Schedule Tribe population constitutes 12.8% of the total population.

Literacy rate is one of the important indicators of the development. Maximum literacy rate in Samiyala (80.3%) is reported to be highest whereas the minimum literacy rate is 56.5% in Khalipur Village. The average literacy rate in affected villages is 71.4% which is greater than the average district literacy rate (70.8%). The villages close to the Vadodara City are observed to have higher literacy rate than other villages.

The work participation rate varies substantially ranging from 31.3 % to 53.4%. The highest work participation rate is in Gokalpura Village (53.4%). There are 2 villages in Vadodara District where work participation rate is 50% or more. The work participation rate of Vadodara District is 41.7%. There are 6 villages in which the work participation rate is less than the district average whereas in 7 villages it exceeds the district average.

Table 1-1 Village-Wise Details of Vadodara District

Sub-District	Affected Villages	Total No. of Households	Total Population			SC Population (%)	ST Population (%)	Literacy Rate (%)	Work Participation Rate (%)
			Person	Male	Female				
District Total		**739,276**	**3,641,802**	**1,897,368**	**1,744,434**	**5.6**	**26.6**	**70.8**	**41.7**
Vadodara	Anagadh	2,560	13,531	6,931	6,600	3.3	0.4	69.4	35.7
	Kotna	379	2,051	1,062	989	0.9	0.0	69.1	39.7
	Sherkhi	1,627	8,425	4,425	4,000	3.4	0.7	71.6	44.5
	Mahapura	242	1,335	710	625	3.1	5.4	70.4	50.2
	Bhayli	1,553	7,096	3,682	3,414	14.4	9.8	79.8	42.1
	Gokalpura	176	904	466	438	16.4	7.1	66.2	53.4
	Samiyala	1,286	6,073	3,191	2,882	6.1	2.3	80.3	31.8
	Bil	966	4,471	2,339	2,132	9.1	17.5	76.9	45.5
	Chapad	496	2,280	1,200	1,080	10.7	16.6	69.8	49.6
	Khalipur	200	937	486	451	3.5	32.3	56.5	45.1
	Karali	172	937	497	440	0.9	23.8	66.9	31.8
	Itola	861	3,826	1,971	1,855	10.4	27.3	71.7	41.2
	Vadsala	709	3,115	1,640	1,475	12.1	23.4	79.7	31.3
Affected Villages Total		**11,227**	**54,981**	**28,600**	**26,381**	**7.2**	**12.8**	**71.4**	**41.7**

Source: Census of India, 2001

1.1.2 Anand District

Anand District is surrounded by Vadodara and Bharuch Districts in the South and East, across the river Mahi. It shares its northern boundary with Kheda District while Ahmedabad District is located in the North West. The district has a total geographic area of 2,942 km^2 and a population density of 631 persons per square kilometer. Anand City is the administrative headquarter of the district.

Table 1-2 provides salient information about the villages likely to be affected by the DFC project in Anand District.

It is observed that there are 16 villages having a population in the range of 1,000-4,999. There are 10 villages which population is greater than 5,000. There are two villages (Napad Vanto and Mahelav) whose population is more than 11,000. It may be noted that all of the affected villages have population more than 1,000.

The number of households varies in different villages ranging from a minimum of 257 (Bhetashi-Talpad) to a maximum of 2,338 (Mahelav) in rural areas. The number of households in these villages sums up to 23,017 accommodating 115,457 persons. The average size of the household works out to be 5. The percentage of male population (52.3%) is more than the female population (47.7%). The Schedule Castes and Schedule Tribe constitute 6.2% and 1.1% of the total population in the affected villages.

Literacy rate is one of the important indicators of the development. Maximum literacy rate is in Meghva Gana Village (85.2%) whereas the minimum literacy rate is in Haldari (62.6%). Literacy rate is more than 80% in 5 out of 26 villages. The average literacy rate in affected villages in Anand District is about 73% which is slightly less than the district average literacy rate (74.5%).

The work participation rate varies substantially ranging from 33.6% to 59.8%. The highest work participation rate is in Kasumbad Village (59.8%). There are 6 villages where work participation rate is 50% or more. The work participation rate of Anand District is 45.9%. There are 12 villages where the work participation rate is less than the district average.

Table 1-2 Village-Wise Details of Anand District

Sub-District	Affected Villages	Total No. of Households	Total Population			SC Population (%)	ST Population (%)	Literacy Rate (%)	Work Participation Rate (%)
			Person	Male	Female				
District Total		**360,808**	**1,856,872**	**972,000**	**884,872**	**5.3**	**1.2**	**74.5**	**42.3**
Anklav	Khadol	1,530	7,216	3,873	3,343	2.3	0.1	65.2	53.8
	Haldari	508	2,249	1,155	1,094	1.7	0.0	62.6	53.8
	Bhetasi (Talpad)	257	1,218	656	562	17.5	0.0	76.7	44.2
	Ambali	839	4,027	2,086	1,941	3.2	0.1	68.7	54.1
	Kanvadi	1,110	5,816	3,055	2,761	2.2	0.0	68.5	47.9
	Lalpura	319	1,531	812	719	13.7	0.0	78.8	47.4
	Asodar	1,697	8,811	4,580	4,231	5.6	1.8	74.2	46.4
Anand	Sandesar	1,015	5,091	2,698	2,393	4.6	1.6	76.4	40.1
	Meghva Gana	331	1,584	828	756	7.6	0.0	85.2	48.0
	Gana	764	3,569	1,900	1,669	14.5	2.3	84.5	33.6
	Vans Khiliya	520	2,589	1,375	1,214	1.2	0.0	67.1	35.3
	Khandhali	361	1,664	862	802	5.5	2.3	80.1	52.5
	Napad Vanto	2,119	11,300	5,832	5,468	0.7	4.2	69.2	43.4
Borsad	Napa Vanto	971	5,436	2,838	2,598	0.9	0.0	71.9	48.7
	Kasumbad	557	2,488	1,265	1,223	4.5	0.0	70.8	59.8
Petlad	Demol	616	2,955	1,553	1,402	9.2	6.9	78.8	41.6
	Changa	1,334	6,828	3,587	3,241	6.2	0.0	81.7	34.8
	Padgol	1,075	5,371	2,789	2,582	1.7	0.0	71.0	43.3
	Mahelav	2,338	11,398	6,021	5,377	5.6	0.4	69.6	46.6
	Bandhni	1,667	8,221	4,274	3,947	4.6	0.5	69.6	42.6
	Ravipura	282	1,365	698	667	0.0	2.2	66.7	55.0
	Morad	792	3,936	2,108	1,828	3.7	1.4	65.4	49.9
	Vishnoli	551	2,913	1,540	1,373	3.3	0.0	70.4	41.6
	Boriya	758	3,852	2,010	1,842	15.9	0.0	77.6	37.9
Sojitra	Deva Vanta	425	2,464	1,301	1,163	7.4	0.0	81.4	46.9
	Run	281	1,565	744	821	17.6	3.6	66.2	45.1
Affected Villages Total		**23,017**	**115,457**	**60,440**	**55,017**	**6.2**	**1.1**	**73.0**	**45.9**

Source: Census of India, 2001

1.1.3 Kheda District

Kheda District shares its southern boundary with Anand District. Ahmedabad District is located on the North-West while Sabarkantha and Gandhinagar Districts are located in the north of the district. The district has a total geographic area of 4,215 km^2 and a population density of 480 persons per square kilometer. Nadiad Town is the administrative headquarter of the district.

Literacy rate is one of the important indicators of the development. Village Khandli has the most literates (80.50%) whereas the minimum literacy rate is found in Setra (55.10%) village. Literacy rate is more than 60% in 14 out of 16 villages. The average literacy rate in affected villages in Kheda District is 68.6% which is slightly less than the average district literacy rate (71.96%).

The work participation rate varies substantially ranging from 32.6% to 54.5%. The highest work participation rate is in village Vasna Bujarg (54.5%). There are 3 villages where work participation rate is 50% or more. The work participation rate of Kheda District is 44.9%. Out of the 16 affected villages, 12 villages have work participation rate is less than the district average.

Table 1-3 provides salient information about the villages likely to be affected by the DFC Project in Kheda District.

It may be observed that there are 13 villages having population in the range of 1,000-4,999. Only two villages (Matar & Naika) have more than 50,000 population; among them Matar Village being the most populous (13,421 persons). Pipariya is the least populous village having population of less than 1,000.

The number of households varies in different villages ranging from a minimum of 140 (Pipariya) to a maximum of 2,542 (Matar). The number of households in these villages sums up to 10475 accommodating 53,453 persons. The average size of the household works out to be 5.1. The percentage of male population (52.2%) is more than the female population (47.8%). The Schedule Caste and Schedule Tribe population constitutes 7.8% and 2.0% of the total population in the district.

Literacy rate is one of the important indicators of the development. Village Khandli has the most literates (80.50%) whereas the minimum literacy rate is found in Setra (55.10%) village. Literacy rate is more than 60% in 14 out of 16 villages. The average literacy rate in affected villages in Kheda District is 68.6% which is slightly less than the average district literacy rate (71.96%).

The work participation rate varies substantially ranging from 32.6% to 54.5%. The highest work participation rate is in village Vasna Bujarg (54.5%). There are 3 villages where work participation rate is 50% or more. The work participation rate of Kheda District is 44.9%. Out of the 16 affected villages, 12 villages have work participation rate is less than the district average.

Table 1-3 Village-Wise Details of Kheda District

Sub-District	Affected Villages	Total No. of Households	Total Population			SC Population (%)	ST Population (%)	Literacy Rate (%)	Work Participation Rate (%)
			Person	Male	Female				
District Total		**395,493**	**2,024,216**	**1,052,823**	**971,393**	**5.2**	**1.6**	**72.0**	**44.9**
Matar	Pipariya	140	722	390	332	6.4	0.4	59.5	34.8
	Koshiyal	503	2,528	1,343	1,185	2.5	0.0	61.8	34.6
	Matar	2,542	13,421	6,953	6,468	5.8	1.9	72.0	36.8
	Garmala	328	1,841	972	869	7.2	0.5	65.7	37.1
	Traj	792	4,206	2,176	2,030	9.3	0.1	74.2	43.8
	Machhiel	553	2,858	1,490	1,368	1.4	0.0	61.8	49.8
	Heranj	364	1,862	971	891	7.1	0.0	73.8	32.6
	Maliyataj	685	3,331	1,737	1,594	2.7	0.0	73.4	50.9
	Laval	299	1,464	756	708	7.6	0.9	79.3	37.4
	Khandhli	625	3,029	1,620	1,409	8.9	0.3	80.5	38.7
Kheda	Kathwada	404	2,254	1,157	1,097	11.2	0.0	60.0	35.0
	Navagam	896	4,311	2,281	2,030	20.0	6.6	79.4	37.6
	Chalindra	196	1,066	554	512	14.0	6.1	61.8	42.5
	Naika	1,293	6,257	3,252	3,005	6.4	8.3	71.4	38.9
	Shetra	236	1,133	575	558	6.9	1.2	55.1	52.4
	Vasna Bujarg	619	3,170	1,651	1,519	7.8	6.1	67.9	54.5
Affected Villages Total		**10,475**	**53,453**	**27,878**	**25,575**	**7.8**	**2.0**	**68.6**	**41.0**

Source: Census of India, 2001

1.1.4 Ahmedabad District

Ahmedabad District is surrounded by Anand and Kheda Districts in the South and South-East, Surendranagar District in the West and Gandhinagar & Mahesana Districts in the North. The district has a total geographic area of 8,707 km^2 and a population density of 668 persons per square kilometer. Ahmedabad City is the administrative headquarter of the district.

Table 1-4 provides salient information about the villages likely to be affected by the DFC project in Ahmedabad District.

It may be observed that there are 17 villages having a population in the range of 1,000-4,999. There are 3 villages which number of population are more than 5,000; Sanand being the most populous (32,417 persons). It may be noted that all of the affected villages have population more than 1,000.

The number of households varies in different villages ranging from a minimum of 269 (Timba) to a maximum of 6,420 (Sanand) in rural areas. The number of households in these villages sums up to 16,668 accommodating 84,593 persons. The average size of the household works out to be 5.1. The percentage of male population (52.6%) is more than the female population (47.4%). The Schedule Caste population constitutes 15.2% of the total population and Schedule Tribe population constitutes 1% in the district.

Literacy rate is one of the important indicators of the development. Maximum literacy rate is in Sanand (81.7%) whereas the minimum literacy rate is in Soyla (53.4%). Literacy rate is more than 60% in 16 out of 20 villages. The average literacy rate in affected villages in Ahmedabad District is 72.5% which is slightly less than the literacy rate (79.5%) of Ahmedabad District.

The work participation rate varies substantially ranging from 28.5% to 62.1%. The highest work participation rate is in Palwada Village (62.1%). There are 6 villages where work participation rate is 50% or more. The work participation rate of Ahmedabad District is 34.5%. There are 3 villages where the work participation rate is less than the work participation rate of the district.

Table 1-4 Village-Wise Details of Ahmedabad District

Sub-District	Affected Villages	Total No. of Households	Total Population			SC Population (%)	ST Population (%)	Literacy Rate (%)	Work Participation Rate (%)
			Person	Male	Female				
District Total		**1,150,588**	**5,816,519**	**3,074,556**	**2,741,963**	**10.7**	**1.00**	**79.5**	**34.5**
Daskroi	Miroli	624	3,012	1,606	1,406	23.0	4.0	59.5	50.9
	Bhat	987	5,111	2,638	2,473	21.4	0.1	63.1	36.5
	Timba	269	1,290	664	626	12.6	7.5	68.7	52.3
	Mahijda	546	2,535	1,317	1,218	19.6	0.0	66.6	55.8
Bavla	Rajoda	697	3,392	1,797	1,595	25.4	3.0	75.0	43.2
	Kavitha	1,300	6,539	3,452	3,087	21.7	0.0	66.6	44.9
	Madosar	506	2,700	1,425	1,275	13.4	0.2	54.1	48.5
Sanand	Godhavi	717	3,632	1,936	1,696	13.1	0.0	79.6	30.2
	Soyla	317	1,793	913	880	6.7	0.1	53.4	48.9
	Moti Devti	425	2,316	1,185	1,131	7.1	0.0	65.1	45.5
	Pipan	584	3,077	1,602	1,475	10.5	0.0	64.5	37.6
	Nani Devti	381	1,987	1,058	929	33.1	0.0	69.1	53.4
	Matoda	341	1,856	969	887	3.7	0.3	53.8	46.7
	Sari	318	1,732	876	856	13.8	1.5	66.4	61.8
	Palwada	296	1,668	847	821	11.6	0.0	63.8	62.1
	Vasna Chacharavadi	485	2,238	1,177	1,061	32.5	1.2	74.0	43.2
	Sanand (M)	6,420	32,417	17,178	15,239	13.3	0.2	81.7	33.0
	Garodiya	339	1,628	849	779	0.3	0.0	66.4	28.5
	Kaneti	336	1,759	930	829	10.5	0.0	75.6	38.6
	Nidhrad	780	3,911	2,083	1,828	10.7	1.7	72.7	36.8
Affected Villages Total		**16,668**	**84,593**	**44,502**	**40,091**	**15.2**	**1.0**	**67.0**	**44.9**

Source: Census of India, 2001

1.1.5 Gandhinagar District

Gandhinagar District is surrounded by Ahmedabad District in the South and Kheda District in the South-East. It shares its Northern and Western boundary with Mahesana District while Sabarkantha District is located in the East. The district has a total geographic area of 649 km^2 and a population density of 2,056 persons per square kilometer. Gandhinagar City, the capital of Gujarat is the administrative headquarter of the district.

Literacy rate is one of the important indicators of the development. Maximum literacy rate is in Ramnagar village (80.8%) whereas the minimum literacy rate is in Vansajada Dhedia (43.8%). Literacy rate is more than 60% in 10 out of 15 villages. The average literacy rate in affected villages is 62.9% which is less than the district average (76.6%).

The work participation rate varies substantially ranging from 30.3% to 62.4%. The highest work participation rate is in village Karoli (62.4%). There are 6 villages where work participation rate is 50% or more. The work participation rate of Gandhinagar District is 41.5%. There are 5 villages where the work participation rate is lower than the district average.

Table 1-5 provides salient information about the villages likely to be affected by the DFC project in Gandhinagar District.

It is observed that there are 11 villages having a population in the range of 1,000-4,999. There are two villages (Bhoyan Moti and Chhatral) where population is more than 5000. Only one village (Sanavad) has population of less than 1,000.

The number of households varies in different villages ranging from a minimum of 127 (Sanavad) to a maximum of 2,111 (Chhatral). The number of households sums up to 7,919 accommodating 38,372 persons. The average size of the household works out to be 4.8. The percentage of male population (53.1%) is more than the female population (46.9%). The Schedule Castes and the Schedule Tribes constitutes 7.9% and 0.5% of the total population.

Literacy rate is one of the important indicators of the development. Maximum literacy rate is in Ramnagar village (80.8%) whereas the minimum literacy rate is in Vansajada Dhedia (43.8%). Literacy rate is more than 60% in 10 out of 15 villages. The average literacy rate in affected villages is 62.9% which is less than the district average (76.6%).

The work participation rate varies substantially ranging from 30.3% to 62.4%. The highest work participation rate is in village Karoli (62.4%). There are 6 villages where work participation rate is 50% or more. The work participation rate of Gandhinagar District is 41.5%. There are 5 villages where the work participation rate is lower than the district average.

Table 1-5 Village-Wise Details of Gandhinagar District

Sub-District	Affected Villages	Total No. of Households	Total Population			SC Population (%)	ST Population (%)	Literacy Rate (%)	Work Participation Rate (%)
			Person	Male	Female				
District Total		**269,440**	**1,334,455**	**697,999**	**636,456**	**8.7**	**1.3**	**76.6**	**41.5**
Kalol	Ramnagar	372	1,965	1,024	941	6.9	0.0	80.8	48.8
	Vansajada	456	2,356	1,194	1,162	2.4	0.0	60.3	55.9
	Bhoyan Moti	1,039	5,141	2,643	2,498	2.0	0.1	55.1	61.8
	Karoli	400	1,410	775	635	7.3	1.2	72.9	62.4
	Jethlaj	484	2,618	1,383	1,235	5.4	0.0	58.1	58.7
	Khatraj	447	1,868	1,063	805	2.1	2.0	65.1	54.6
	Sanavad	127	709	342	367	8.5	0.0	63.1	43.3
	Nasmed	486	2,355	1,207	1,148	10.1	1.7	55.0	40.1
	Rancharada	571	2,770	1,432	1,338	8.2	0.9	66.6	30.6
	Piyaj	718	3,766	1,955	1,811	10.8	0.0	61.7	50.9
	Chhatral	2,111	9,744	5,451	4,293	7.7	1.6	74.5	41.6
	Dhanot	239	1,224	677	547	8.3	0.0	63.7	34.6
	Vansajada Dhedia	234	1,187	601	586	25.7	0.0	43.8	33.6
	Unali (Boriyavi)	235	1,259	617	642	4.8	0.0	60.0	30.3
Affected Villages Total		**7,919**	**38,372**	**20,364**	**18,008**	**7.9**	**0.5**	**62.9**	**46.2**

Source: Census of India, 2001

1.1.6 Mahesana District

Mahesana District is surrounded by Ahmedabad and Gandhinagar Districts in the South, Sabarkantha District in the East, Banaskantha and Patan Districts in the North and Patan District in the West. The district has a total geographic area of 4,386 km^2 and a population density of 419 persons per square kilometer. Mahesana Town is the administrative headquarter of the district.

Table 1-6 provides salient information about the villages likely to be affected by the DFC Project in Mahesana District.

It is observed that there are 28 villages having a population in the range of 1,000-4,999. There are 6 villages where populations are more than 5000, Unjha village being the largest (174,303 persons). Further, there are five villages having population of less than 1,000.

The number of households varies in different villages ranging from a minimum of 61 (Naranpura) to a maximum of 35,064 (Unjha). The number of households in these villages sums up to 58,171 accommodating 291,860 persons. The average size of the household works out to be 5.0. The percentage of male population (52.0%) is more than the female population (48.0%). The Schedule Caste and Schedule Tribe constitute 7.8% and 0.4% of the total population respectively.

Literacy rate is one of the important indicators of the development. Maximum literacy rate is in Karshanpura Village (90.8%) whereas the minimum literacy rate is in Irana (53.8%). Literacy rate is more than 60% in 37 out of 39 villages. The average literacy rate in affected villages in Mahesana District is 75.1% which is almost same as the district average.

The work participation rate varies substantially ranging from 29.3% to 64.2%. The highest work participation rate is in Hardesan Village (64.2%). There are 18 villages where work participation rate is 50% or more. The work participation rate of Mahesana District is 45.1%. There are 13 villages where the work participation rate is less than the work participation rate of the district.

Table 1-6 Village-Wise Details of Mahesana District

Sub-District	Affected Villages	Total No. of Households	Total Population			SC Population (%)	ST Population (%)	Literacy Rate (%)	Work Participation Rate (%)
			Person	Male	Female				
District Total		**364,447**	**1,837,892**	**953,842**	**884,050**	**8.09**	**0.49**	**75.2**	**45.1**
Kadi	Ganeshpura	297	1,494	753	741	10.0	0.0	71.2	29.3
	Nandasan	1,884	10,222	5,344	4,878	11.4	0.2	80.2	42.2
	Mathasur	493	2,490	1,253	1,237	16.7	0.2	77.6	39.4
	Kherpur	312	1,546	778	768	15.3	0.0	77.6	37.9
	Lakshmipura (Nandasan)	315	1,542	788	754	0.0	0.0	89.6	44.2
	Rajpur	1,707	8,253	4,390	3,863	7.4	0.1	66.3	43.9
	Naranpura	61	247	124	123	0.0	0.0	82.1	51.4
	Irana	535	2,970	1,514	1,456	13.3	0.0	53.8	45.2
	Indrad	878	4,289	2,282	2,007	6.4	0.0	67.6	43.0
	Ankhol	331	1,584	855	729	1.3	0.3	57.1	44.6
	Vamaj	846	4,357	2,448	1,909	8.2	0.1	83.3	56.2
Mehsana	Virta	470	2,129	1,096	1,033	8.3	0.0	79.2	43.5
	Gorad	640	3,080	1,573	1,507	5.4	0.0	82.6	47.6
	Chhathiyarda	1,013	5,549	2,917	2,632	8.3	1.1	64.5	47.1
	Aloda	351	1,835	956	879	13.0	0.0	77.8	51.7
	Hardesan	142	754	406	348	2.8	0.0	74.6	64.2
	Gilosan	132	740	374	366	0.0	0.0	81.5	55.1
	Bodla	228	1,145	588	557	5.3	2.3	81.5	58.3
	Nugar	597	2,938	1,553	1,385	5.1	0.0	69.7	54.3
	Heduva Hanumat	316	1,480	782	698	14.5	1.0	64.0	48.7
	Heduva-Rajgar	232	1,260	660	600	2.3	0.5	77.9	46.2
	Karshanpura	128	729	379	350	0.0	0.0	90.8	53.0
	Sametra	554	2,729	1,438	1,291	11.3	0.0	78.3	55.7
	Mareda	461	2,514	1,290	1,224	6.6	0.0	77.9	52.1
	Vadosan	518	2,813	1,425	1,388	4.8	0.0	62.4	44.5
	Boriavi	987	5,496	2,844	2,652	7.3	0.0	75.6	41.0
	Linch	1,889	9,444	4,900	4,544	4.9	0.2	67.0	41.2
	Ambasan	1,001	4,807	2,452	2,355	11.2	0.0	79.0	46.9
	Baliyasan	897	4,410	2,647	1,763	17.2	7.5	69.0	51.0
	Bhasariya	499	2,586	1,361	1,225	5.3	0.0	77.3	50.8
	Tundali	444	2,375	1,228	1,147	4.0	0.0	70.9	48.3
Maguna	Unjha	35,064	174,303	90,235	84,068	7.6	0.2	80.8	44.6
	Sunak	699	3,274	1,636	1,638	17.4	0.0	87.2	55.2
	Dabhi	971	4,971	2,560	2,411	3.5	0.0	57.3	51.9
	Surpura	393	2,367	1,243	1,124	3.6	0.0	77.8	56.7
	Pali	381	1,860	962	898	14.1	0.0	77.4	51.7
	Kanthravi	955	4,710	2,473	2,237	6.7	0.0	82.1	49.0
	Lindi	75	342	171	171	12.9	0.0	87.3	55.6
	Amudh	475	2,226	1,150	1,076	9.9	1.3	71.8	51.7
Affected Villages Total		**58,171**	**291,860**	**151,828**	**140,032**	**7.8**	**0.4**	**75.1**	**48.6**

Source: Census of India, 2001

1.1.7 Patan District

Patan District is surrounded by Surendranagar District in the South, Mahesana District in the East, Banaskantha District in the North and Kachchh District in the West. The district has a total geographic area of 5,738 km^2 and a population density of 206 persons/km^2. Patan Town is the administrative headquarter of the district.

Table 1-7 provides salient information about the villages likely to be affected by the DFC project in Patan District.

It is observed that there are 9 villages having a population in the range of 1,000-4,999. There is only one village (Kakoshi) where population size is more than 8,000 (8,456 persons). There are only two villages which have population of less than 1,000. The number of households varies in different villages ranging from a minimum of 120 (Karan) to a maximum of 1508 (Kakoshi) in rural areas. The number of households in these villages sums up to 6469 accommodating 34,753 persons. The average size of the household works out to be 5.4. The percentage of male population (50.9%) is slightly more than the female population (49.1%). The Schedule Caste and Schedule Tribe constitute 14% and 0.1% of the total population respectively.

Literacy rate is one of the important indicators of the development. Maximum literacy rate is in Manund Village (89.9%) whereas the minimum literacy rate is in Metrana (63.3%). Literacy rate is more than 60% in 4 out of 12 villages. The average literacy rate in affected villages in Patan District is 73.5% which is less than the literacy rate (60.4%) of Patan District.

The work participation rate varies substantially ranging from 24.9% to 58.6%. The highest work participation rate is in Karan Village (58.6%). There are 5 villages where work participation rate is 50% or more. The work participation rate of Patan District is 45.1%. There are 6 villages where the work participation rate is less than the average work participation rate of the district.

Table 1-7 Village-Wise Details of Patan District

Sub-District	Affected Villages	Total No. of Households	Total Population			SC Population (%)	ST Population (%)	Literacy Rate (%)	Work Participation Rate (%)
			Person	Male	Female				
District Total		**222,630**	**1,182,709**	**612,100**	**570,609**	**9.9**	**1.1**	**60.4**	**45.1**
Patan	Kani	354	1,871	951	920	14.4	0.0	81.2	50.0
	Visal-Vasna	245	1,160	601	559	6.1	0.0	79.8	50.1
	Manund	934	3,994	2,012	1,982	17.7	0.0	89.9	49.4
	Derasana	147	777	401	376	4.0	0.0	64.2	56.6
Sidhpur	Kakoshi	1,508	8,456	4,359	4,097	15.1	0.9	76.9	24.9
	Metrana	584	3,262	1,689	1,573	12.0	0.3	63.3	39.5
	Rasulpur	452	2,410	1,185	1,225	10.8	0.0	80.2	26.9
	Thakrasan	318	1,686	817	869	5.6	0.0	73.2	52.6
	Dethli	636	3,546	1,832	1,714	22.0	0.0	69.3	40.0
	Karan	120	614	302	312	24.6	0.0	65.3	58.6
	Nedra	589	3,700	1,867	1,833	27.2	0.0	74.1	37.9
	Vaghana	582	3,277	1,689	1,588	8.2	0.0	64.9	38.7
Affected Villages Total		**6,469**	**34,753**	**17,705**	**17,048**	**14.0**	**0.1**	**73.5**	**43.7**

Source: Census of India, 2001

1.1.8 Banaskantha District

Banaskantha District is surrounded by Patan and Mahesana Districts in the South, Sabarkantha District in the East, Sirohi District of Rajasthan State in the North and Kachchh District in the West. The district has a total geographic area of 12,703 km^2 and a population density of 197 persons per square kilometer. Palanpur town is the administrative headquarter of the district. Banaskantha is the largest district among the project affected eight districts in Gujarat and also has the lowest population density.

Literacy rate is one of the important indicators of the development. Maximum literacy rate is in Badarpura Village (85.5%) whereas the minimum literacy rate is in Dhanpura (13.8%). Literacy rate is more than 60% in 18 out of 33 villages. The average literacy rate in affected

villages in Banaskantha District is 57.7% which is greater than the literacy rate (51%) of Banaskantha District.

The work participation rate varies substantially ranging from 23.6% to 54.6%. The highest work participation rate is in Village Dungarpura (54.6%). There are 6 villages where work participation rate is 50% or more. The work participation rate of Banaskantha District is 43.6%. There are 20 villages where the work participation rate is less than the district work participation rate of the district.

Table 1-8 provides salient information about the villages likely to be affected by the DFC project in Banaskantha District.

It is observed that there are 22 villages having a population in the range of 1,000-4,999. There are two villages with more than 8,000 population. The most populated village is Amirgarh (101,133). There are only six villages having population of less than 1,000.

The number of households varies in different villages ranging from a minimum of 90 (Pakhanwa) to a maximum of 1,811 (Basu) in rural areas. The number of households in these villages sums up to 18,366 containing 99,699 persons. The average size of the household works out to be 5.43. The percentage of male population (51.4%) is slightly more than the female population (48.6%). The Schedule Caste and Schedule Tribe constitute 8.5% and 18% of the total population respectively.

Literacy rate is one of the important indicators of the development. Maximum literacy rate is in Badarpura Village (85.5%) whereas the minimum literacy rate is in Dhanpura (13.8%). Literacy rate is more than 60% in 18 out of 33 villages. The average literacy rate in affected villages in Banaskantha District is 57.7% which is greater than the literacy rate (51%) of Banaskantha District.

The work participation rate varies substantially ranging from 23.6% to 54.6%. The highest work participation rate is in Village Dungarpura (54.6%). There are 6 villages where work participation rate is 50% or more. The work participation rate of Banaskantha District is 43.6%. There are 20 villages where the work participation rate is less than the district work participation rate of the district.

Table 1-8 Village-Wise Details of Banaskantha District

Sub-District	Affected Villages	Total No. of Households	Total Population			SC Population (%)	ST Population (%)	Literacy Rate (%)	Work Participation Rate (%)
			Person	Male	Female				
District Total		**426,781**	**2,504,244**	**1,297,404**	**1,206,840**	**10.8**	**8.2**	**51.0**	**43.6**
Vadgam	Changwada	759	4,096	2,117	1,979	11.5	4.1	73.9	43.5
	Changa	711	3,771	1,867	1,904	15.3	0.2	71.5	31.8
	Basu	1,811	10,537	5,306	5,231	6.0	2.4	79.6	29.6
	Meta	1,194	5,858	2,865	2,993	16.6	2.8	80.0	33.6
Palanpur	Sangla	163	817	431	386	27.4	15.5	56.6	39.9
	Antroli	495	2,607	1,341	1,266	2.4	0.0	40.9	28.9
	Pirojpura(Tankani)	176	904	488	416	4.9	7.2	57.9	42.4
	Malana	738	3,775	1,931	1,844	15.7	8.9	57.4	40.7
	Pakhanwa	90	526	277	249	0.0	37.8	34.6	52.3
	Moriya	289	1,396	695	701	14.6	0.9	63.8	46.0
	Lunwa	276	1,420	746	674	29.9	0.0	65.8	33.8
	Parpada	273	1,357	719	638	1.8	0.0	69.4	43.7
	Khodla	671	3,429	1,759	1,670	7.7	0.6	62.5	48.2
	Akesan	254	1,350	711	639	19.8	0.0	67.9	37.3
	Chadotar	1,212	6,326	3,238	3,088	5.7	0.4	68.4	36.6
	Gathaman	731	4,162	2,127	2,035	6.8	0.0	70.1	26.7
	Sagrosana	474	2,507	1,288	1,219	5.2	0.2	78.0	52.5
	Bhagal (Jagana)	835	4,599	2,305	2,294	11.1	0.0	83.9	37.6
	Vasna (Jagana)	434	2,241	1,143	1,098	13.3	2.4	70.4	48.9
	Badarpura (Kalusana)	437	2,510	1,279	1,231	13.9	1.2	85.5	36.4
	Amirgadh	17,026	101,133	52,148	48,985	3.2	53.2	34.9	39.7
	Awal	464	2,552	1,296	1,256	6.4	19.0	46.5	51.5
	Karaza	564	3,264	1,721	1,543	8.8	0.0	45.7	23.6
	Umarkot	291	1,653	871	782	1.4	39.5	50.2	45.4
	Deri	235	1,194	632	562	1.7	65.4	43.3	50.3
	Kali Mati	157	790	409	381	0.8	80.1	43.5	27.2
	Kidotar	514	2,875	1,487	1,388	8.3	12.9	36.3	39.4
Amirgadh	Dungarpura	119	634	325	309	0.0	23.3	54.9	54.6
	Dholia	431	3,041	1,538	1,503	0.2	92.3	19.0	46.4
	Iqbalgadh	983	5,211	2,751	2,460	3.6	4.5	66.2	38.7
	Jethi	714	3,669	1,935	1,734	8.9	33.8	50.3	52.3
	Bantawada	130	562	308	254	6.8	5.5	60.3	45.4
	Dhanpura	596	3,957	2,001	1,956	0.0	81.2	13.8	42.3
Affected Villages Total		**34,247**	**194,723**	**100,055**	**94,668**	**8.5**	**18.0**	**57.7**	**40.8**

Source: Census of India, 2001

1.2 RAJASTHAN

There are seven districts in Rajasthan –Sirohi, Pali, Ajmer, Jaipur, Nagaur, Sikar and Alwar through which the DFC alignment traverses. The DFC corridor passes mostly to the parallel section and partly detour section in Rajasthan state. This study area starts from Sirohi District which is located in the southern part of the State and accordingly it covers the above mentioned districts. Total 220 villages of 7 districts in Rajasthan come under affected villages. Village wise details of project affected villages are discussed in following sections.

1.2.1 Sirohi District

Table 1-9 indicates that 25 villages and 1 town having a population at 105,789. There are only 6 villages which are small in size having population of less than 1,000. It may be observed that there are 17 villages of medium size having a population in the range of 1,000-4,999. This is followed by villages having population in the range of greater than 5,000 (large size). The only Bhavri Village whose total population is more than 5,000 (12,440). The least number of populations at the Ghodiyawa Village only 12. The number of households varies in different villages ranging from a minimum of 2 (Ghodiyawa) to a maximum of 2,229 (Bhavri).

The number of households in these villages and town sums upto 20,175 containing 105,789 persons. The average size of the household works out to be 5.2. The percentage of male population (52.4%) is slightly more than the female population (47.6%). The Schedule Caste population constitutes 18.3% of the total population and Schedule Tribe population constitutes 18.8% in the district.

Literacy rate is one of the important indicators of the development. Maximum literacy rate is 100% (Ghodiyawa) whereas the minimum literacy rate is 26% (Sangna). The average literacy rate in affected villages in Sirohi District is 67.6%.

The work participation rate varies substantially ranging from 26.9% to 100%. The highest work participation rate is in Ghodiyawa Village (100%). There are 4 villages in Sirohi District where work participation rate is 50% or more. The work participation rate of Sirohi District is 40.4%.

Table 1-9 Village-Wise Details of Sirohi District

District/ Taluka/ Village	Name	Total No. of Households	Total Population			SC Population (%)	ST Population (%)	Literacy Rate (%)	Work Participation Rate (%)
			Person	Male	Female				
District	**Sirohi**	**159,307**	**851,107**	**437,949**	**413,158**	19.2	24.8	53.9	40.4
Taluka	Abu Road	33,895	184,610	97,455	87,155				
Village	Wasda	413	2,346	1,217	1,129	9.3	11.3	44.3	48.3
	Maval	485	2,593	1,390	1,203	18.2	13.1	51.2	39.0
	Khara	191	1,153	604	549	0.2	97.1	36.3	54.7
	Amba	103	534	286	248	0.0	99.4	28.5	55.1
	Chandrawati	334	1,649	919	730	2.4	20.1	74.6	41.6
Town	Abu Road	9,305	47,640	25,376	22,264	24.2	8.2	80.3	30.0
Village	Kui	254	1,587	774	813	0.2	95.7	33.0	48.9
	Sangna	292	1,689	872	817	0.0	95.2	26.0	59.0
	Khadat	266	1,448	745	703	14.5	46.2	45.0	29.2
	Derna	233	1,200	631	569	8.3	49.4	40.5	47.7
	Or	505	2,599	1,289	1,310	11.7	39.0	55.9	34.4
	Kiwarli	634	3,078	1,554	1,524	15.8	9.0	60.8	26.9
Tehsil	Pindwara	38,091	205,568	105,541	100,027				
Village	Wara	134	751	364	387	15.9	30.4	52.6	28.6
	Bharja	827	4,231	2,124	2,107	14.5	17.4	52.8	46.8
	Bhimana	358	1,774	926	848	20.3	12.3	54.4	46.0
	Udvariya	168	1,036	548	488	35.4	23.3	58.4	37.3
	Vatera	858	4,607	2,274	2,333	8.3	31.0	47.1	38.5
	Bhavri	2,229	12,440	6,537	5,903	18.0	7.7	68.0	32.3
	Kodarla	222	1,222	663	559	11.3	33.6	74.0	43.8
	Peshua	499	2,530	1,252	1,278	30.6	18.0	58.3	35.1
	Banas	103	425	257	168	28.9	26.1	82.9	37.2
	Ghodiyawa	2	12	11	1	0.0	0.0	100.0	100.0
	Chawarli	187	994	538	456	9.5	26.6	62.0	38.1
	Ajari	1,029	5,691	2,937	2,754	12.5	32.4	54.1	34.8
	Pindwara (Rural)	438	2,041	1,132	909	1.3	30.1	73.4	45.5
	Sadalwa	106	519	241	278	6.6	33.7	57.0	41.2
Affected Villages Total		**20,175**	**105,789**	**55,461**	**50,328**	**18.3**	**18.8**	**67.6**	**34.8**

Source: Census of India, 2001

1.2.2 Pali District

Table 1-10 provides salient information about the villages likely to be affected by the DFC Project in Pali District. It indicates that 73 villages having a population 218,741. It may be observed that there are 36 villages of medium size having a population in the range of 1,000-4,999. This is followed by villages having population in the range of greater than 5,000 (large size).There are 10 large size villages which population are greater than 5,000. There are 27 small size villages whose population is less than 1,000. The number of households varies in different villages ranging from a minimum of 19 (Shergarh) to a maximum of 33,763 (Raipur). The number of households in these villages sums upto 41,693 containing 218,741 persons. The average size of the household works out to be 5.3. The percentage of male population (50.4%) is slightly more than the female population (49.6%). The Schedule Caste population constitutes 18.7% of the total population and Schedule Tribe population constitutes 5.4% in the district.

Literacy rate is one of the important indicators of the development. Maximum literacy rate is in Somesar (76.6%) whereas the minimum literacy rate is in Jor Dudor (15.6%). Literacy rate is more than 60% in 22 out of 73 villages. The average literacy rate in affected villages in Pali District is 60.3% which is greater than the literacy rate (54.4%) of Pali District.

The work participation rate varies substantially ranging from 18.96% to 59.8%. The highest work participation rate is in Surya Nagar (59.8%). There are six villages where work participation rate is 50% or more. The work participation rate of Pali District is 39.8%.

Table 1-10 Village-Wise Details of Pali District

District/ Taluka/ Village	Name	Total No. of Households	Total Population			SC Population (%)	ST Population (%)	Literacy Rate (%)	Work Participation Rate (%)
			Person	Male	Female				
District	Pali	339,660	1,820,251	918,856	901,395	17.8	5.8	54.4	39.8
Tehsil	Bali	42,011	223,027	111,572	111,455				
Village	Malnoo	452	2,317	1,201	1,116	14.9	65.9	46.1	59.1
	Nana	1,904	10,298	5,215	5,083	14.2	27.1	51.6	46.3
	Bhandar	942	4,723	2,331	2,392	10.5	30.7	52.6	38.9
	Kothar	510	2,328	1,132	1,196	17.7	28.4	41.5	43.3
	Mori	189	982	458	524	3.7	4.9	44.8	53.0
	Doodni	456	2,342	1,212	1,130	16.5	1.4	55.1	55.4
	Chamunderi Rana Watan	1,267	6,543	3,248	3,295	17.4	6.3	59.4	39.3
	Rughnathpura	286	1,371	716	655	10.9	39.5	43.0	45.5
	Beesalpur	1,041	5,507	2,842	2,665	29.7	7.6	66.2	29.9
	Beeroliya	158	909	456	453	18.6	2.2	62.4	23.9
	Beral	224	1,182	574	608	16.5	0.0	45.4	31.6
	Jadri	137	776	419	357	32.9	2.7	56.1	40.9
Town	Falna (M)	4,007	21,024	10,961	10,063	23.4	4.6	70.8	31.6
Village	Phalna (Rural)	539	2,872	1,479	1,393	24.6	0.7	58.6	29.9
	Kheemel	807	4,421	1,851	2,570	17.7	2.9	61.7	31.8
	Mokhampura	422	2,193	1,077	1,116	17.1	0.0	57.0	32.9
	Sarkhejra	24	113	53	60	6.2	12.4	55.4	27.4
Tehsil	Sumerpur	34,799	185,290	93,729	91,561				
Village	Balwana	842	4,473	2,340	2,133	30.7	7.8	65.5	30.3
	Koliwara	531	2,917	1,518	1,399	21.8	4.4	52.3	36.1
Tehsil	Desuri	42,056	215,722	105,978	109,744				
Town	Rani (M)	2,292	12,392	6,383	6,009	12.8	5.6	73.6	30.0
Village	Beejowa	1,050	5,360	2,623	2,737	17.6	1.4	53.3	44.4
	Bhagwanpura	34	154	77	77	0.0	6.5	53.2	22.1

District/ Taluka/ Village	Name	Total No. of Households	Total Population			SC Population (%)	ST Population (%)	Literacy Rate (%)	Work Participation Rate (%)
			Person	Male	Female				
	Station								
	Ajaneshwar	59	289	150	139	0.0	4.2	55.2	38.8
	Satariya	269	1,289	624	665	19.2	19.9	42.5	40.3
	Jawali	755	3,483	1,671	1,812	20.7	0.6	51.6	31.5
	Dhariya	288	1,380	651	729	15.9	0.1	47.7	34.6
	Somesar	181	967	518	449	37.1	9.4	76.6	32.2
	Bhadarlau	272	1,339	679	660	23.4	0.0	57.8	30.3
	Indarwara	243	1,441	726	715	19.6	2.6	61.6	39.1
Tehsil	Marwar Junction	37,516	191,981	95,693	96,288				
	Bhimaliya	404	1,946	962	984	14.5	4.4	52.5	44.3
	Banta	898	4,650	2,330	2,320	16.1	0.2	53.2	41.5
	Dhamli	608	2,747	1,319	1,428	25.0	3.9	47.4	38.8
	Kapari	329	1,476	737	739	24.1	0.5	50.7	43.9
Village	Bhagwanpura	178	848	396	452	15.2	4.0	38.5	50.7
	Barsa	371	1,729	830	899	35.0	0.2	41.3	48.5
	Bithora Khurd	106	562	271	291	21.0	0.0	51.1	45.7
	Surya Nagar	112	602	296	306	15.6	0.0	58.5	59.8
	Auwa	851	4,202	2,104	2,098	24.8	1.5	58.3	27.9
Town	Marwar Junction (CT)	2,011	10,536	5,464	5,072	22.5	4.8	76.5	28.5
	Hemliyawas Khurd (Rural)	90	466	235	231	17.4	0.0	71.1	39.9
	Hemliyawas Kalan (Rural)	117	579	285	294	9.5	0.0	60.8	33.5
	Dudor	689	3,259	1,569	1,690	16.8	1.0	48.9	38.4
Village	Jor Dudor	72	401	208	193	100.0	0.0	15.2	37.9
	Reesaniya	131	737	340	397	38.4	0.0	46.2	51.4
	Sawrad	832	4,513	2,232	2,281	21.0	0.0	47.1	43.6
	Dhundhala	665	3,550	1,801	1,749	26.1	0.0	67.6	41.3
	Dadiya	158	881	446	435	11.2	1.1	62.5	43.7
Tehsil	Sojat	39,022	205,950	103,596	102,354				
Village	Bagri	2,216	11,420	5,716	5,704	12.2	0.3	62.0	41.5
Town	Sojat Road (CT)	2,068	11,178	5,746	5,432	15.4	0.4	76.3	30.4
	Pachunda Kalan	309	1,761	915	846	37.0	0.6	50.7	42.3
	Murdawa	242	1,186	574	612	38.2	0.0	49.8	39.1
	Chandawal	1,279	6,810	3,420	3,390	24.6	0.0	64.6	38.9
	Chandawal Station	59	246	118	128	19.1	0.0	70.5	41.1
Village	Udeshi Kua	226	1,238	591	647	29.8	0.0	46.4	46.2
	Karmawas	422	2,053	997	1,056	19.8	0.0	46.2	41.2
	Raipur	33,763	182,004	91,683	90,321				
	Guriya	266	1,340	668	672	17.6	0.0	58.8	38.7
	Jhoontha	919	4,774	2,388	2,386	24.7	1.1	50.1	43.8
Tehsil	Raipur	2,472	14,136	7,198	6,938	13.3	0.6	60.7	38.1
Village	Deepawas	286	1,556	787	769	17.1	0.0	42.8	45.3
	Makarwali	70	395	188	207	0.0	0.0	74.1	25.6
	Malni	140	824	433	391	0.0	0.0	37.4	41.1
	Fata Khera	*125*	*595*	*306*	289	*0.0*	*0.0*	*34.5*	26.7
	Kaya Bheela	242	1,297	650	647	0.8	0.0	32.9	32.5
	Asan Tiloriya	86	577	305	272	7.3	0.0	48.2	25.1
	Jhala Ki Chauki	151	860	458	402	9.8	0.0	51.2	20.5
	Dholiya	183	1,084	556	528	2.1	0.0	69.7	23.8
	Sendara	408	2,328	1,193	1,135	13.1	0.5	72.1	32.4
	Kurantiya	47	275	144	131	0.0	0.0	75.1	32.7
	Sabalpura	87	480	265	215	3.3	0.0	60.0	19.0

District/ Taluka/ Village	Name	Total No. of Households	Total Population			SC Population (%)	ST Population (%)	Literacy Rate (%)	Work Participation Rate (%)
			Person	Male	Female				
	Manpura	153	813	413	400	0.0	0.0	68.6	37.4
	Shergarh	19	83	44	39	0.0	0.0	58.0	36.1
	Saradhana	137	699	377	322	6.2	0.0	55.5	42.6
	Amarpura	114	650	353	297	7.2	0.0	41.9	38.3
	Baripol	164	1,014	489	525	2.4	0.0	53.4	28.2
Affected Villages Total		**41,693**	**218,741**	**110302**	**108,439**	**18.7**	**5.4**	**60.3**	**36.9**

Source: Census of India, 2001

1.2.3 Ajmer District

Table 1-11 provides salient information about the villages likely to be affected by the DFC Project in Ajmer District. It may be observed that there are 23 villages of medium size having a population in the range of 1,000-4,999. This is followed by villages having population in the range of greater than 5,000 (large size). 6 villages whose total population is more than 5,000. The population of Ajmer town is 485575. There are only 12 villages which are small in size having population of less than 1,000. The number of households varies in different villages ranging from a minimum of 2 (Shivpura) to a maximum of 1302 (Saradhana) in rural areas. The number of households at Kishangarh town is 20,272 and the population are 116,222. The number of households in these villages and towns sums upto 142,007 containing 809,658 persons. The average size of the household works out to be 5.70. The percentage of male population (50.4%) is more than the female population (49.6%). The Schedule Caste population constitutes 20.1% of the total population and Schedule Tribe population constitutes 1.3% in the district.

Literacy rate is one of the important indicators of the development. Maximum literacy rate is in Ajmer Town (83.7%) whereas the minimum literacy rate is in Kakniyawas (38.4%). Literacy rate is more than 60% in 24 out of 42 villages. The average literacy rate in affected villages in Ajmer District is 79.7% which is greater than the literacy rate (64.65%) of Ajmer District.

The work participation rate varies substantially ranging from 24.5% to 58.5%. The highest work participation rate is in Mandawariya Village (56.7%). There are 8 villages where work participation rate is 50% or more. The work participation rate of Ajmer District is 39.3% and at Ajmer town is 28.4%.

Table 1-11 Village-Wise Details of Ajmer

District/ Taluka/ Village	Name	Total No. of Households	Total Population			SC Population (%)	ST Population (%)	Literacy Rate (%)	Work Participation Rate (%)
			Person	Male	Female				
District	Ajmer	376,731	2,181,670	1,129,920	1,051,750	17.7	2.4	64.7	39.3
Tehsil	Beawar	50,422	283,882	145,206	138,676				
Village	Badiya Gena	79	424	211	213	36.3	0.0	81.1	44.1
	Ratanpura Sardara	197	1,212	625	587	1.4	0.0	70.0	45.5
	Beawar (M Cl)	21,082	123,759	64,417	59,342	19.1	0.3	82.2	31.2
	Mediya (Naya Nagar)	190	1,030	551	479	6.8	0.0	66.9	27.1
	Rampura Mewatiyan (Rural)	67	330	169	161	18.5	0.0	55.1	37.9
	Sarmaliya	212	1,233	608	625	17.5	0.7	66.8	57.2
	Theekrana Goojran	64	390	215	175	13.3	0.0	78.6	54.6
Tehsil	Masuda	33,782	187,295	96,125	91,170				
Village	Renpura	63	318	158	160	9.1	0.0	43.2	58.5
	Peeplai	602	3,394	1,770	1,624	7.2	0.0	73.5	51.6
	Kharwa	1,050	6,265	3,210	3,055	16.1	4.2	55.8	38.8
	Rani Sagar	93	535	268	267	7.3	1.3	50.5	55.0
Tehsil	Peesangan	19,067	108,890	55,834	53,056				
Village	Daulat Khera	121	734	393	341	27.5	0.0	62.8	52.2
	Lamana	337	1,856	940	916	13.9	3.5	51.6	41.6
	Mangaliyawas	350	2,057	1,026	1,031	25.9	4.0	65.2	36.6
	Arjunpura Khalsa	103	621	321	300	24.5	9.0	61.4	33.8
	Makrera	398	2,063	1,059	1,004	19.7	1.7	58.0	37.8
	Kesharpura	587	3,453	1,766	1,687	14.0	0.0	57.2	38.6
	Jethana	963	5,643	2,890	2,753	21.5	2.0	69.6	38.5
	Shivpura	2	17	9	8	0.0	0.0	57.1	52.9
Tehsil	Ajmer	120,659	689,976	360,716	329,260				
Village	Jatli	143	1,030	545	485	5.6	0.0	41.7	44.6
	Akhri	226	1,342	706	636	11.9	0.0	54.0	24.5
	Gegal	388	2,307	1,288	1,019	3.3	0.5	49.9	40.2
	Muhami (Mohami)	383	2,330	1,224	1,106	5.7	0.0	54.6	47.6
	Gudha	224	1,271	668	603	5.3	0.0	40.9	31.2
	Bhoodol	524	3,375	1,747	1,628	18.6	0.0	66.5	29.3
	Ladpura	315	2,002	1,013	989	8.7	1.1	68.7	36.2
	Somalpur	1003	6,203	3,260	2,943	5.0	0.3	49.6	29.0
	Madarpura	277	1,758	906	852	4.2	0.2	81.4	28.0
	Guwardi	158	934	482	452	22.2	2.8	63.5	44.1
	Nareli	462	2,970	1,625	1,345	20.7	0.3	44.4	37.7
	Daurai (Rural)	806	4,739	2,461	2,278	26.9	0.9	61.8	29.8
	Doomara	453	2,705	1,431	1,274	5.0	0.0	53.2	39.8
	Saradhana	1302	7,590	3,858	3,732	19.9	0.0	61.9	41.9
	Tabeeji (Rural)	629	3,830	1,984	1,846	15.7	0.3	63.0	25.0
Town	Ajmer (M Cl)	86,576	485,575	254,164	231,411	22.1	1.7	83.7	28.4
Tehsil	Kishangarh	54,659	334,984	173,796	161,188				
Village	Buharoo	256	1,572	822	750	32.7	5.3	69.1	30.9
	Bhojiyawas	157	900	456	444	8.6	0.0	44.6	47.9
	Mandawariya	107	630	336	294	0.0	0.2	45.1	56.7
	Phaloda	115	729	395	334	10.2	0.0	77.2	43.8
	Tiloniya	505	3,225	1,636	1,589	21.9	0.2	66.8	29.9
	Kakniyawas	166	1,085	574	511	13.6	0.0	38.4	43.0
Town	Kishangarh (M)	20,272	116,222	61,075	55,147	16.2	1.0	73.0	29.0
Affected Villages Total		**142,007**	**809,658**	**423,262**	**386,396**	**20.1**	**1.3**	**79.7**	**29.8**

Source: Census of India, 2001

1.2.4 Jaipur District

Table 1-12 provides salient information about the villages likely to be affected by the DFC Project in Jaipur District. It may be observed that there are 21 villages of medium size having a population in the range of 1,000-4,999. This is followed by villages having population in the range of more than 5000 (large size). There are 4 large size villages which number of

population are more than 5000. The number of population at Phulera and Kishangarh Renwal are 21,643 and 27,565 respectively. 12 villages which are small in size having population of less than 1,000. least number of population is at Charanwas Village (110). There are only 16 households at this village which is the lowest also. The number of households varies in different villages ranging from a minimum of 16 to a maximum of 2,078 (Narayana) in rural areas. In the urban areas like Renwal and Phulera the households are like 3,803 and 3,767 respectively. The number of households in these villages suns upto 19,974 containing 137,710 persons. The average size of the household works out to be 6.9. The percentage of male population (51.8%) is more than the female population (48.2%). The Schedule Caste population constitutes 18.5% of the total population and Schedule Tribe population constitutes 2.2% in the district.

Literacy rate is one of the important indicators of the development. Maximum literacy rate is in Phulera (83.7%) whereas the minimum literacy rate is in Beegolao (37.2%). Literacy rate is more than 60% in 31 out of 39 villages. The average literacy rate of male (62.7%) is more than female (37.3%).The average literacy rate in affected villages in Jaipur District is 70.2% which is slightly more than the literacy rate (69.9%) of Jaipur District.

The work participation rate varies substantially ranging from 24.9% to 68.1%. The highest work participation rate is in Bokarawas Village (68.1%). There are 3 villages where work participation rate is 50% or more. The work participation rate of Jaipur District is 32.5%. Work participation rate at Phulera town is 25.9%. There are 8 villages where the work participation rate is less than the work participation rate of the district.

Table 1-12 Village-Wise Details of Jaipur District

District/ Taluka/ Village	Name	Total No. of Households	Total Population			SC Population (%)	ST Population (%)	Literacy Rate (%)	Work Participation Rate (%)
			Person	Male	Female				
District	**Jaipur**	**815,766**	**5,251,071**	**2,768,203**	**2,482,868**	14.8	7.9	69.9	35.5
Tehsil	Dudu (Hq. Mauzamabad)	25,928	174,672	90,554	84,118				
Village	Gahlota	246	1,811	917	894	8.8	1.8	45.6	45.2
	Sali	439	2,794	1,416	1,378	19.6	0.5	47.6	49.6
	Jhakolar	49	329	171	158	13.1	0.0	42.0	48.3
	Beegolao	84	645	334	311	8.8	0.0	37.2	52.3
	Bokarawas	77	577	308	269	14.6	15.1	65.0	68.1
	Deopura	96	753	382	371	4.4	0.0	46.7	47.1
Tehsil	Phulera (Hq.Sambhar)	55,148	389,372	201,852	187,520				
Village	Kishanpura @ Nathi Ka Bas	272	1,928	1,025	903	26.1	0.3	74.8	31.9
	Malikpura	361	2,624	1,358	1,266	13.3	3.5	71.1	43.8
	Bajiyon Ka Bas	69	548	292	256	0.0	5.5	79.5	49.8
	Charanwas	16	110	55	55	10.0	0.0	64.7	45.5
	Badhal	1,110	8,240	4,299	3,941	16.6	1.4	66.9	35.5
	Kabron Ka Bas	223	1,752	896	856	20.8	0.0	78.2	45.0
	Itawa	529	3,984	2,047	1,937	30.8	1.1	73.1	36.3
	Kanwarpura	153	1,185	580	605	3.9	5.2	67.7	37.2
	Meendi	88	614	300	314	12.9	8.1	66.7	41.0
	Paharpura	120	828	438	390	3.9	4.7	72.7	48.4
	Bhainslana	459	3,109	1,559	1,550	40.6	1.8	74.4	25.5
	Bhookhron Ki Dhani	179	1,307	687	620	6.1	0.0	63.0	40.4
	Sinodiya	298	2,291	1,213	1,078	20.4	5.8	59.7	42.2
	Dodwadiyon Ka Bas	153	1,072	547	525	16.2	0.3	60.9	42.1
	Khatwari Khurd	88	656	342	314	11.9	2.0	68.8	49.9
	Khandel	248	1,967	982	985	22.0	2.3	74.5	39.2
	Prithvipura	109	779	384	395	18.7	18.9	69.9	41.9
	Jaitpura	291	2,110	1,077	1,033	12.2	8.4	82.3	31.3
	Peepli Ka Bas	172	1,124	590	534	15.0	4.4	63.9	37.2
	Itawa	144	1,353	693	660	14.2	0.0	57.0	30.3
	Kanchroda	1,171	7,383	3,867	3,516	21.5	2.1	81.1	26.6
	Samalpura	186	1,595	800	795	11.0	0.0	55.8	37.0
	Haripura	105	855	428	427	16.4	0.0	62.8	27.1
	Kothera	20	151	80	71	68.9	0.0	75.6	53.0
	Narayana	2,078	13,472	7,045	6,427	13.3	0.8	60.7	30.0
	Rojri	596	3,994	2,039	1,955	14.7	2.1	64.5	30.9
	Hirnoda	733	5,270	2,731	2,539	11.4	1.2	61.0	37.7
Town	Kishangarh Renwal (M)	3,803	27,565	14,244	13,321	18.2	1.3	70.6	27.3
Town	Phulera (M)	3,767	21,643	11,289	10,354	26.0	3.0	83.7	25.9
Tehsil	Chomu	42,756	326,488	170,339	156,149				
Village	Bagri	161	1,315	692	623	20.8	10.7	71.2	44.1
	Nangal Govind	212	1,839	969	870	17.4	3.5	69.9	45.5
	Kishanpura	594	4,388	2,327	2,061	20.6	3.2	72.4	24.9
	Asti Kalan	475	3,750	1,901	1,849	6.1	4.0	64.8	41.2
	Affected Villages Total	**19,974**	**137,710**	**71,304**	**66,406**	**18.5**	**2.2**	**70.2**	**32.5**

Source: Census of India, 2001

1.2.5 Nagaur District

Table 1-13 provides salient information about the villages likely to be affected by the DFC Project in Nagaur District. It may be observed that there are 2 villages (Thikariya Khurd and Bheevpura) one is small size and another semi medium having a population in the range of less than 1,000 and slightly more than 1,000. The numbers of households in these villages are 237 and 70 respectively. The average size of the household works out to be 6.8. The percentage of male population (52.7%) is more than the female population (47.3%). The Schedule Caste population constitutes 12.2% of the total population and Schedule Tribe population constitutes 5.8 % in the district.

Literacy rate is one of the important indicators of the development. Maximum literacy rate is in Bheevpura Village (73.7%). Literacy rate is more than 60% both the villages. The average literacy rate in affected villages in Nagaur District is 72.0%.

Average of work participation rate in this district is 44.3%.

Table 1-13 Village-Wise Details of Nagaur District

District/ Taluka/ Village	Name	Total No.of Households	Total Population			SC Population (%)	ST Population (%)	Literacy Rate (%)	Work Participation Rate (%)
			Person	Male	Female				
District	Nagaur	421,118	2,775,058	1,424,967	1,350,091	19.7	0.2	57.3	40.7
Tehsil	Nawa	48,962	336,963	174,530	162,433				
Village	Thikariya Khurd	237	1,527	808	719	12.2	8.0	71.3	42.0
	Bheevpura	70	565	294	271	12.4	0.0	73.7	50.3
Affected Villages Total		307	2,092	1,102	990	12.2	5.8	72..0	44.3

Source: Census of India, 2001

1.2.6 Sikar District

Table 1-14 provides salient information about the villages likely to be affected by the DFC Project in Sikar District. It may be observed that there are 23 villages of medium size having a population in the range of 1,000-4,999. This is followed by villages having population in the range of more than 5,000 (large size). There are 6 big size villages where populations are more than 5,000. The population of Sri Madhopur and Reengus are 28,492 and 22,932, respectively. Both these are towns. There are only 3 villages which are small in size having population of less than 1,000. Less number of population is in the Chak Jaswantpura Village (36) accordingly the number of households are also less in this village; only 5. This is the least number of households in Sikar District. The number of households varies in different villages ranging from a minimum of 5 to a maximum of 1,477 (Sirohi) in rural areas. Maximum number of households is in Neem-Ka- Thana town (4,353). The number of households in these villages sums upto 25,993 containing 179,669 persons. The average size of the household works out to be 6.91. The percentage of male population (52.2%) is more than the female population (47.8%). The Schedule Caste population constitutes.13.6% of the total population and Schedule Tribe population constitutes 4.02% in the district.

Literacy rate is one of the important indicators of the development. Maximum literacy rate is in Makri Village (84.1%) whereas the minimum literacy rate is in Kunwar @ Ramnagar (54.8%). Literacy rate is more than 60% in almost all villages. The male literacy rate (61.5%) is much higher than the female literacy rate (38.5%). The average literacy rate in affected villages in Sikar District is 74.1% which is more than the literacy rate (70.5%) of Sikar District.

The work participation rate varies substantially ranging from 25.3% to 56.1%. The highest work participation rate is in Jassi Ka Bass Village (56.1%). Most of the villages work participation rate is less than 50%. The work participation rate of Sikar District is 33.7%.

Table 1-14 Village-Wise Details of Sikar District

District/ Taluka/ Village	Name	Total No. of Households	Total Population			SC Population (%)	ST Population (%)	Literacy Rate (%)	Work Participation Rate (%)
			Person	Male	Female				
District	Sikar	333,300	2,287,788	1,172,753	1,115,035	14.9	2.7	70.5	38.8
Tehsil	Sri Madhopur	71,724	506,979	260,134	246,845				
Village	Jugalpura	505	3,485	1,831	1,654	23.1	4.7	69.4	33.9
	Madho Ka Bas	96	735	388	347	4.2	1.0	70.7	44.8
	Jorawar Nagar	423	2,685	1,293	1,392	8.9	7.4	73.8	37.5
	Kancharra @ Kanchanpur	577	3,876	1,956	1,920	13.7	12.9	73.8	33.6
	Jaswantpura	188	1,330	653	677	1.6	3.4	67.8	42.7
	Chak Jaswantpura	5	36	19	17	0.0	0.0	64.7	47.2
	Derawalidhani	153	1,352	699	653	0.0	0.0	68.0	37.2
	Gurha	226	1,381	681	700	25.2	0.7	73.3	25.3
	Mahroli	1,411	10,766	5,562	5,204	13.1	1.6	78.0	30.7
	Bharni	464	3,454	1,759	1,695	12.3	0.0	76.9	43.6
	Srimadhopur (Rural)	259	2,078	1,071	1,007	4.9	3.0	66.7	37.1
	Hanspur	602	4,131	2,080	2,051	12.9	6.0	70.2	29.9
	Nalot	255	1,910	979	931	16.3	5.7	59.4	34.1
Town	Sri Madhopur (M)	4,250	28,492	15,000	13,492	16.9	2.8	78.0	28.0
Town	Reengus (M)	3,424	22,932	12,307	10,625	12.6	2.2	73.8	34.2
Tehsil	Neem-Ka-Thana	49,286	346,597	180,474	166,123				
Village	Jassi Ka Bas	212	1,582	798	784	8.3	3.7	64.7	49.4
	Govindpura	533	3,654	1,878	1,776	14.5	6.5	65.0	37.2
	Sirohi	1,477	11,018	5,706	5,312	11.0	2.4	67.4	36.7
	Ranasar	231	1,784	958	826	14.6	14.0	67.8	45.6
	Mandoli	224	1,523	774	749	18.3	21.7	72.3	41.7
	Makri	285	1,847	946	901	5.4	2.1	84.1	40.8
	Shyama Wali	146	1,088	539	549	24.7	3.3	78.3	56.1
	Mawanda Khurd	797	5,078	2,597	2,481	13.3	0.3	76.2	32.6
	Nawanda Railway Station	272	2,173	1,157	1,016	0.3	0.0	78.1	48.7
	Jatala	276	1,997	1,070	927	1.1	0.0	80.5	27.1
	Kunwara @ Ramnagar	60	376	207	169	9.8	0.0	54.8	45.5
	Jeelo	826	5,465	2,814	2,651	11.6	12.8	64.9	31.4
	Bihari Pur	437	3,028	1,627	1,401	18.5	6.9	79.5	39.0
	Dabla	831	5,487	2,763	2,724	10.4	11.5	74.2	29.0
	Kanwar Ki Nagal	286	1,882	921	961	18.0	2.3	64.6	49.4
	Bihar	262	1,702	899	803	15.2	4.5	66.9	42.5
	Godawas	483	3,439	1,780	1,659	6.0	2.7	71.8	38.9
	Neem Ka Thana(Rural)	718	5,256	2,771	2,485	14.2	0.2	67.8	46.3
	Agawari	446	3,099	1,637	1,462	4.5	4.1	65.9	48.7
Town	Neem-Ka-Thana (M)	4,353	29,548	15,703	13,845	16.7	4.4	79.4	27.6
Affected Villages Total		25,993	179,669	93,823	85,846	13.6	4.0	74.1	33.7

Source: Census of India, 2001

1.2.7 Alwar District

Table 1-15 provides salient information about the villages likely to be affected by the DFC Project in Alwar District. It may be observed that there are 2 villages both of medium size having a population in the range of 1,000-4,999. There are no small or large size villages having population less than 1,000 or more than 5,000. The number of households in these villages sums upto 578 containing 3,433 persons. The average size of the household works out to be 5.9. The percentage of male population (51.4%) is slightly more than the female population (48.6%). The Schedule Caste population constitutes 21.1% of the total population and Schedule Tribe population constitutes 0.1% in the district.

Literacy rate is one of the important indicators of the development. Literacy rate of affected villages in Alwar district is 77.5%. The percentage of male literature (51.4%) is more than female literature (48.6%).

The work participation rate of Alwar District is 48.7%. Among the two villages the work participation rate is higher at Hudiya Khurd Village (59.0%) which is more than the total percentage of the district.

Table 1-15 Demographic Profile of Alwar District

District/ Taluka/ Village	Name	Total No. of Households	Total Population			SC Population (%)	ST Population (%)	Literacy Rate (%)	Work Participation Rate (%)
			Person	Male	Female				
District	Alwar	461,973	2,992,592	1,586,752	1,405,840	18.0	8.0	61.7	48.7
Tehsil	Behror	49,455	305,688	159,502	146,186				
Village	Hudiya Khurd	327	1,810	931	879	14.3	0.1	78.9	59.0
	Kathoowas	251	1,623	835	788	28.7	0.1	76.0	57.3
Affected Villages Total		578	3,433	1,766	1,667	21.1	0.1	77.5	58.2

Source: Census of India, 2001

1.3 HARYANA

There are two districts in Haryana - Rewari and Mahendragarh through which the DFC alignment traverses. Over view of the two districts are as under following sections:

1.3.1 Mahendergarh District

Mahendragarh District is located in the southern part of the State bordering Rewari on the west. It is bounded on the north by Bhiwani and Rohtak Districts, on the east by Rewari District and Alwar District of Rajasthan, on the south by Alwar, Jaipur and Sikar Districts of Rajasthan, and on the west by Sikar and Jhunjhunu Districts of Rajasthan. The district lies between 270 47' north latitude and 760 51' east longitudes. The district has an area of 1,899 km^2 with a population density of 428 persons per sq km. According to 2001 census the total population of the district is 812,521 (423,578 males and 388,943 females) which include 86.51% of rural and 13.49% of urban population. The sex ratios in the district are 855.4, 770.48 and 298 respectively for total, rural and urban population. The literacy rate of the district (excluding children in the age group of 0 to 6) is 58.9% of which 62.5% are male and 37.5% are female. The Schedule Caste population constitutes 16.3% of the total population and there is no Schedule Tribe population in the district.

Table 1-16 provides salient information about the villages likely to be affected by the DFC project in Mahendragarh District. It may be observed that there are 18 villages of medium size having a population in the range of 500-1,999. This is followed by villages having population in the range of 2,000-4,999 (large size). There are only four villages which are small in size having population of less than 500. The number of households varies in different villages ranging from a minimum of 9 (Sheonathpura) to a maximum of 684 (Patikara) in rural areas. The number of households in these villages sums upto 9,308 containing 57,406 persons. The total population including the Narnaul town is 119,483. The average size of the household (rural as well as urban combined together) works out to be 6. The percentage of male population (52.5%) is more than the female population (48.5%). There is no SC population in four small villages. Percentage of SC population in only one village (Azmabad Mukhuta) is more than one third of the total population of the village. This is a large size village having a population of more than 2,000. In majority of villages (21), percentage of SC population is less than 20% of the total population. There is no ST population in the Haryana.

Literacy rate is one of the important indicators of the development. Maximum literacy rate is in Tobra Village (82.1%) whereas the minimum literacy rate is in Gokalpur (47.3%). In Narnaul town, the literacy rate is 78.6% next to Tobra Village. Literacy rate is more than 60% in 29 out of 33 villages. The average literacy rate in affected villages and Narnaul town in Mahendragarh District is 78.6% which is higher than the literacy rate (69.9%) of Mahendrgarh District and equal to literacy rate (69.9%) of Haryana State.

The work participation rate varies substantially ranging from 21.2% to 59.3%. The highest work participation rate is in Fatehpur Village (59.3%). There are ten villages where work participation rate is 50% or more. The work participation rate of Mahendragarh District is 43.3%. There are 17 villages where the work participation rate is less than the work participation rate of the district. The work participation rate in Narnaul town is also 30.8% which is substantially less than the work participation rate of district.

Table 1-16 Village-Wise Details of Mahendergarh District

Sub-District	Village/Town	Total No. of House-holds	Total Population			SC Population (%)	ST Population (%)	Literacy Rate (%)	Work Participation Rate (%)
			Person	Male	Female				
District	**Mahendragarh**	135,218	812,521	423,578	388,943	16.3	0.0	69.9	43.3
Village	Sujapur(25/2)	192	1,135	585	550	6.1	0.0	70.6	58.1
	Hasanpur(28)	204	1,280	677	603	32.8	0.0	70.5	40.2
	Gokalpur(26)	22	115	54	61	0.0	0.0	47.3	48.7
	Beghpur(22)	248	1,575	810	765	15.9	0.0	75.4	53.8
	Uninda (Part)(4)	262	1,665	854	811	32.1	0.0	75.6	38.2
	Dhanunda(3)	207	1,359	723	636	13.5	0.0	73.3	21.2
	Ateli (Rural)(21)	285	1,754	893	861	19.6	0.0	72.1	38.7
	Khor (Part)(2)	483	2,850	1,434	1,416	15.0	0.0	70.5	29.4
	Tobra (Part)(8)	133	801	419	382	22.1	0.0	82.1	41.6
	Fatehpur(9)	201	1,239	656	583	21.0	0.0	70.	59.3
	Tajpur(10)	389	2,261	1,181	1,080	32.1	0.0	69.5	48.4
	Bhilwara(11)	221	1,442	736	706	11.9	0.0	73.1	50.0
	Bachhod(178)	522	2,907	1,489	1,418	11.6	0.0	74.5	46.8
	Sarai Bahadur Nagar(181)	223	1,290	659	631	4.6	0.0	74.4	40.1
	Sheonathpura(184)	9	67	45	22	0.0	0.0	62.3	53.7
	Bhushan Khurd(188)	131	879	442	437	19.2	0.0	69.9	46.2
	Shahpur Doyam(189)	53	370	192	178	0.0	0.0	76.8	52.4
	Patikara(186)	684	4,110	2,120	1,990	23.8	0.0	76.1	36.2
	Faizaltpur(187)	201	1,113	547	566	11.6	0.0	76.1	36.7
	Narnaul (MCl)	**10,588**	**62,077**	**33,050**	**29,027**	**12.8**	**0.0**	**78.6**	**30.8**
	Narnaul (Rural)(159)	674	4,562	2,423	2,139	3.3	0.0	67.2	36.8
	Nuniawal(161)	607	3,160	1,665	1,495	12.7	0.0	78.5	29.2
	Mukandpura(215)	430	2,747	1,442	1,305	17.7	0.0	50.6	50.4
	Tajpur(213)	17	92	60	32	0.0	0.0	60.5	55.4
	Amarpur Jorasi(280)	246	1,721	866	855	18.1	0.0	78.1	28.5
	Kaloli(279)	206	1,808	911	897	10.8	0.0	57.8	34.2
	Bashirpur(281)	286	1,822	923	899	12.6	0.0	72.9	49.0
	Ghataser(284)	342	2,320	1,196	1,124	21.7	0.0	69.0	51.6
	Pawera(286)	366	2,140	1,091	1,049	16.2	0.0	69.0	50.0
	Chhilro(283)	374	2,124	1,063	1,061	19.6	0.0	70.3	43.5
	Napla(287)	128	880	468	412	22.5	0.0	69.1	48.6
	Bamanwas Nau(275)	273	1,611	830	781	6.2	0.0	70.2	37.0
	Narheri(289)	200	1,292	691	601	11.3	0.0	56.3	39.9
	Azmabad Mokhuta(274)	489	2,915	1,553	1,362	33.9	0.0	68.3	40.0
Affected Villages and Town Total		19,896	119,483	62,748	56,735	15.1	0.0	69.9	43.1

Source: Census of India, 2001

1.3.2 Rewari District

District of Rewari is located in the southern part of the State. It is surrounded by the district of Rohtak in the north, Mahendragarh District in its west and district of Gurgaon in its east and north-east directions. District Alwar of Rajasthan touches Rewari in the south-east. It lies between 280 12' north latitude and 760 04' east longitudes. The district is has an area of 1,583 sq. km with a population of density of 483 persons per sq km. According to 2001 census the total population of the district is 764,727 (403,034 males and 362,317 females) which include 82.2% of rural and 17.8% of urban population. The sex ratios in the district are 900.5, 911.6 and 443.7 respectively for total, rural and urban population. The literacy rate of the district (excluding children in the age group of 0 to 6) is 64.44% of which 61.3% are male and 38.7% are female. The Schedule Caste population constitutes 18.9% of the total population and there is no Schedule Tribe population in the district.

The DFC Project would traverse through the boundary of 27 villages[1] in Rewari District. Table 1-17 indicates that 15 villages of medium size having a population in the range of 500-1,999. This is followed by villages having population in the range of 2,000-4,999 (large size). There are only two villages which are small in size having population of less than 500. The number of households varies in different villages ranging from a minimum of 59 (Gobind Puri) to a maximum of 845 (Manethi). The number of households in these villages sums upto 8,454 containing 48,164 persons. The average size of the household works out to be 5.7. The percentage of male population (51.6%) is slightly more than the female population (48.4%). There is no SC population in Gobind Puri Village. Percentage of SC population in four villages is quite high, more than one third of the total population of the village. Three of these four villages are medium sized villages. However, in majority of the villages (17), percentage of SC population is less than 20% of the total population. There is no ST population in the Haryana.

Literacy rate is one of the important indicators of the development. Maximum literacy rate is 81.6% whereas the minimum literacy rate is 68.3%. Overall literacy rate is higher in those villages in which percentage of SC population is comparatively less barring a few exceptions. The average literacy rate in affected villages in Rewari District is 75.4% which is similar to literacy rate (75.2%) of Rewari District and higher by 8% points of literacy rate (69.9%) of Haryana State.

The work participation rate varies substantially ranging from 28.8% to 69.7%. The highest work participation rate is in Mailawas Village (69.7%). There are eight villages in Rewari District where work participation rate is 50% or more. The work participation rate of Rewari District is 43.6%. Thus there are 12 villages in which the work participation rate is less than the district average whereas in 15 villages it is more than the district average.

Table 1-17 Village Wise Details of Rewari

Sub-District	Village	Total No. of House-holds	Total Population			SC Population (%)	ST Population (%)	Literacy Rate (%)	Work Participation Rate (%)
			Person	Male	Female				
District Total		135,560	765,351	403,034	362,317	18.9	0.0	75.3	43.6
Rewari	Chillar(259)	476	2,720	1,405	1,315	27.9	0.0	74.1	51.9
	Bhurthal Thethar(215)	67	421	202	219	37.5	0.0	80.7	50.8
	Bhurthal Jatt(216)	246	1,672	821	851	22.7	0.0	75.9	40.1
	Gangayacha Ahir(222)	488	2,693	1,405	1,288	6.7	0.0	77.5	32.1
	Shekhpur Shikarpur(224)	268	1,587	835	752	2.0	0.0	80.2	44.1
	Rajpura Khalsa(111)	203	1,054	527	527	3.1	0.0	74.8	57.3
	Gindo Khar(113)	284	1,618	825	793	11.2	0.0	77.7	51.7
	Lakhnor(115)	176	1,005	498	507	20.2	0.0	76.2	45.2
	Jadara(87)	594	3,092	1,656	1,436	15.6	0.0	69.3	45.9
	Maha Kharia(68)	90	515	264	251	44.5	0.0	68.3	37.9
	Dhamlawas(136)	253	1,382	741	641	10.9	0.0	81.6	53.7
	Sundrodh(66)	193	1,159	613	546	21.1	0.0	70.6	34.8
	Mailawas(61)	146	788	411	377	36.6	0.0	697	69.7
	Dhani Sundrod(62)	108	604	298	306	15.4	0.0	75.2	38.3
	Pitherawas(60)	198	1,228	661	567	4.5	0.0	77.6	45.6
	Gumina(42)	153	831	439	392	44.4	0.0	74.0	28.8
	Rajpura Istamrar(64)	259	1,434	714	720	15.4	0.0	76.4	39.1
	Khori(70)	481	2,990	1,588	1,402	31.4	0.0	74.6	31.9
	Tint(41)	392	2,254	1,170	1,084	8.5	0.0	74.1	44.8
	Gobind Puri(71)	59	339	184	155	0.0	0.0	75.6	44.8
	Mamaria Thethar(72)	134	788	388	400	15.4	0.0	79.5	28.8
	Gothara Tappa Khori(39)	479	2,434	1,225	1,209	13.1	0.0	74.9	47.0
	Pali(38)	644	3,511	1,762	1,749	10.6	0.0	74.8	56.6
	Majra Mutsal Bhalaki(36)	569	3,321	1704	1,617	14.7	0.0	74.5	40.9
	Bhalaki(35)	257	1,621	867	754	9.1	0.0	78.3	5.0
	Manethi(28)	845	4,665	2,385	2,280	19.3	0.0	77.5	37.2
	Padla(27)	392	2,438	1,260	1,178	21.9	0.0	72.2	35.3
Affected Villages Total		**8,454**	**48,164**	**24,848**	**23,316**	**18.6**	**0.0**	**75.4**	**43.8**

Source: Census of India, 2001

Appendix II-3-1
List of Villages Identified in S-ESIMMS

List of Villages Identified as a Result of S-ESIMMS Study: Haryana

District	Sub-district	No.	Name of Villages Considered in ESIMMS	No.	SAPROF Villages	No.	New Villages	No.	Excluded villages
Rewari	Rewari	1	Padla	1	Chillar	1	Chillar	1	Dhani Santo
		2	Majra Mustal Bhalaki	2	Bhutal Tetihar	2	Bhutal Tetihar	2	Balawaskahri
		3	Bhalaki	3	Bhutal Jat	3	Bhutal Jat	3	Kharagwas
		4	Pali	4	Gangaachariya ahir	4	Gangaachariya ahir	4	Saharanwas
		5	Gothera Tapa Khori	5	Sekhpur sikar Pur	5	Sekhpur sikar Pur	5	Thothwalka
		6	Govindpuri	6	Rajpur Khalsa	6	Rajpur Khalsa	6	Narainpur
		7	Tini	7	Kindokhar	7	Kindokhar	7	Qutub Pur mola
		8	Gumina	8	Lakhnor	8	Lakhnor	8	Kan Majra
		9	Dhani Santo	9	Jadora	9	Mahakharia	9	Chanduwas
		10	Dhani Sundrodh	10	Mahakharia	10	Sundrod	10	Kaluwas
		11	Dhamlawas	11	Dhantawas	11	Maitawas	11	Gokulgarh
		12	Jadara	12	Sundrod	12	Pitherawas	12	Dohaki
		13	Balawaskahri	13	Maitawas	13	Rajpura Istamrar	13	Bhagwanpur
		14	Kharagwas	14	Dhanisundrod	14	Khori		
		15	Saharanwas	15	Pitherawas	15	Mamariatethar		
		16	Thothwalka	16	Gumina	16	Manethi		
		17	Narainpur	17	Rajpura Istamrar				
		18	Qutub Pur mola	18	Khori				
		19	Kan Majra	19	Teent				
		20	Chanduwas	20	Govind Puri				
		21	Kaluwas	21	Mamariatethar				
		22	Gokulgarh	22	Gothara Thappa Khori				
		23	Dohaki	23	Pali				
		24	Bhagwanpur	24	Majra Mutsal Bhalaki				
				25	Bhalaki				
				26	Manethi				
				27	Padla				
	Total : Sub-district	24		27		16		13	
Total: District		24		27		16		13	
Mahendragarh	Namaul	1	Bhushan Khurd	1	Sujapur	1	Hasanpur	1	Nangal
		2	Sheonathpura	2	Hasanpur	2	Beghpur	2	Ganiyar
		3	Sarai Bhadur Nagar	3	Gokal Pur	3	Ateli	3	Bajar
		4	Bachhod	4	Beghpur	4	Khor Part		
		5	Bhilwara	5	Uninda	5	Tobra		
		6	Tajpur	6	Dhanunda	6	Narnaul Rural		
		7	Fatehpur	7	Ateli	7	Nuni Awal		
		8	Nangal	8	Khor Part	8	Mukand Pur		
		9	Uninda	9	Tobra	9	Amarpur Jorasi		
		10	Dhanunda	10	Fathepur	10	Kaloli		
		11	Gokalpur	11	Tajpur	11	Chhilro		
		12	Sujapur	12	Bhilwara	12	Narehri		
		13	Ganiyar	13	Bachhod	13	Faizlipur		
		14	Bajar	14	Sarai Bahadurnangar				
		15	Azmabad Mookhuta	15	Sheonath Pura				
		16	Bamanwas Nau	16	Bhusan Khurd				
		17	Napla	17	Shah Pur Doyam				
		18	Pavera	18	Patikara				
		19	Ghatasar	19	Faizlipur				
		20	Bashirpur	20	Namaul Urban				
		21	Tajpur	21	Namaul Rural				
		22	Narnaul	22	Nuni Awal				
		23	Patikara	23	Mukand Pur				
		24	Shahpur Doyam	24	Tajpur				
				25	Amarpur Jorasi				
				26	Kaloli				
				27	Bhasir pur				
				28	Ghatasar				
				29	Pavera				
				30	Chhilro ki Dhani				
				31	Napla				
				32	Bamanwasnau				
				33	Narehri				
				34	Azmabad Mokhuta				
	Total : Sub-district	24		34		13		3	
Total: District		24		34		13		3	
Total: State		48		61		29		16	

Note: (*) denotes "Not Revenue Village"
(NKB) denotes the village name at the post office
Dhetasi (Talpad) denotes the village has two names.

List of Villages Identified as a Result of S-ESIMMS Study: Rajasthan (1/4)

District	Sub-district	No.	Name of Villages Considered in ESIMMS	No.	SAPROF Villages	No.	New Villages	No.	Excluded villages
ALWAR	Behror	1	Kathoowas	1	Kathoowas	1	Hudiya Khurd		
				2	Hudiya Khurd				
	Total : Sub-district	1		2		1		0	
Total: District		1		2		1		0	
SIKAR	Sri Madhopur	1	Sargoth	1	Nalot	1	Nalot	1	Sargoth
		2	Shimarla jageer	2	Kanchrapur	2	Derawali Dhani	2	Shimarla jageer
		3	Kolwa	3	Jarawan nagar	3	Bharni	3	Kolwa
		4	Jalalpur	4	Jawswant Pura	4	Maharoli	4	Jalalpur
		5	Amiya	5	Derawali Dhani	5	Gurha	5	Amiya
		6	Mau	6	Chak Jaswant pura	6	Sirsa	6	Mau
		7	(Sri Madhopur)	7	Hanspura	7	Ringus	7	Samotaka Bas
		8	Hanspura	8	Sri Madhopur	8	Jugalpura	8	Shahpura
		9	Kuncharra	9	Bharni	9	Madhopura	9	Theekariya Raisinghpura
		10	Jaswantpura	10	Maharoli	10	Madho Ka Was	10	Malikpura
		11	Chok jaswantpura	11	Gurha			11	Baori
		12	Jorawar Nagar	12	Sirsa				
		13	Samotaka Bas	13	Ringus				
		14	Shahpura	14	Jugalpura				
		15	Theekariya Raisinghpura	15	Madhopura				
		16	Malikpura	16	Madho Ka Was				
		17	Baori						
	Total : Sub-district	17		16		10		11	
	Neem Ka Thana	1	Jassi Ka Bas	1	Kanwar Ki Nagal	1	Nawanda Railway Stati	1	Bhagega
		2	Govindpura	2	Dabla	2	Rajputon Ki Dhani	2	Charanwas
		3	Bhagega	3	Bihar			3	Natha Ki Nagal
		4	Sirohi	4	Beharipur				
		5	Ranasar	5	Jeelo				
		6	Charanwas	6	Kunwara @ Ramnagar				
		7	Agawari	7	Rajputon Ki Dhani				
		8	Neem Ka Thana	8	Mawanda				
		9	Godwas	9	Jatala				
		10	Mandoli	10	Nawanda Railway Station				
		11	Makri	11	Shyama Wali				
		12	Shyamawali	12	Makri				
		13	Mawanda Kalan	13	Mandoli				
		14	Jatala	14	Godawas				
		15	Kunwara	15	Ranasar				
		16	Jeelo	16	Neem Ka thana				
		17	Natha Ki Nagal	17	Agawari				
		18	Biharipur	18	Sirohi				
		19	Bihar	19	Govindpura				
		20	Dabala	20	Jassi Ka Bas				
		21	Kanwar Ki nagal						
	Total : Sub-district	21		20		2		3	
Total: District		38		36		12		14	
NAGAUR	Nava	1	Minda	1	Naya Bas	1	Thikariya Khurd	1	Minda
		2	Naya Bas	2	Thikariya Khurd				
	Total : Sub-district	2		2		1		1	
Total: District		2		2		1		1	
JAIPUR	Phulera and Dadu	1	Gahlota	1	Kanawar Pura	1	Renwal	1	Hatoopura
		2	Sali	2	Badhal	2	Kathowari Khurd	2	Kandeoli
		3	Deopura	3	Itawa	3	Rojri	3	Shyosinghpura
		4	Hatoopura	4	Kabron Ka Bas	4	Hironmda	4	Shardulpura
		5	Bokrawas	5	Charanwas	5	Phulera	5	Samota ka bas
		6	Begaloo	6	Bajiyon Ka Bs			6	Bajiyon ka bas
		7	Jhakolar	7	Malik Pura			7	Kishanpura
		8	Kothera	8	Kishanpura @ NKB				
		9	Narayana	9	Renwal				
		10	Haripur	10	Meendi				
		11	Kandeoli	11	Bhookhron Ki Dhani				
		12	Samalpura	12	Bhainslana				
		13	Shyosinghpura	13	Paharpura				
		14	Shardulpura	14	Kathowari Khurd				
		15	Samota ka bas	15	Sinodiya				
		16	Kanchroda	16	Dodwadiyon Ka Bas				
		17	Itawa	17	Prithvi Pura				
		18	Pipali Ka bas	18	Khandel				
		19	Jaitpura	19	Jaitpura				
		20	Prithivipura	20	Peepli Ka Bas				
		21	Khandel	21	Itawa				
		22	Dodawadiyon Ka Bas	22	Rojri				
		23	Sinodiya	23	Hironmda				
		24	Brijamiyon Ka bas	24	Kanchroda				
		25	Bhainslana	25	Phulera				
		26	Paharpura	26	Samalpura				
		27	Bhookhron ki dhani	27	Haripura				
		28	Meendi	28	Narayana				

List of Villages Identified as a Result of S-ESIMMS Study: Rajasthan (2/4)

District	Sub-district	No.	Name of Villages Considered in ESIMMS	No.	SAPROF Villages	No.	New Villages	No.	Excluded villages
JAIPUR		29	Kishanpura	29	Kothera				
		30	Kishanpura (NKB)	30	Jhakolar				
		31	Malikpura	31	Beegolao				
		32	Bajiyon ka bas	32	Bokrawas				
		33	Charanwas	33	Deopura				
		34	Kabron Ka bas	34	Sali				
		35	Badhal	35	Gahlota				
		36	Itawa						
		37	Kanwarpura						
	Total : Sub-district	37		35		5		7	
	Chomu	1	Astikalan	1	Bagri				
		2	Nagal Govind	2	Nangal Govind				
		3	Kishan Manpura	3	Kishan Manpura				
		4	Bagri	4	Asti Kalan				
	Total : Sub-district	4		4		0		0	
Total: District		41		39		5		7	
AJMER	Beawar	1	Ratanpura Sardara	1	Renpur	1	Renpur	1	Shobhapura
		2	Beawar	2	Theekrana Goojran	2	Mediya (Naya Nagar)	2	Ratanpura Sardara
		3	Rampura Mewatiyan	3	Sarmaliya	3	Kalali Ka Badai	3	Rampura Mewatiyan
		4	Shobhapura	4	Mediya (Naya Nagar)	4	Bedia Gena		
		5	Sarmaliya	5	Beawar				
		6	Theekrana goojra	6	Kalali Ka Badai				
				7	Bedia Gena				
	Total : Sub-district	6		7		4		3	
	Masuda	1	Peeplai	1	Peeplai				
		2	Kharwa	2	Kharwa				
		3	Ranisagar	3	Ranisagar				
	Total : Sub-district	3		3		0		0	
	Ajmer & Nasirabad	1	Ajmer (Town)	1	Jaili	1	Nareli	1	Rasoolpura
		2	Madar	2	Akhri	2	Doomra		
		3	Rasoolpura	3	Gegal				
		4	Guwardi	4	Muhami (Mohami)				
		5	Gudha	5	Bhoodol				
		6	Ladpura	6	Ladpura				
		7	Bhoodol	7	Gudha				
		8	Muhami	8	Guwardi				
		9	Gegal	9	Nareli				
		10	Akhri	10	Madar				
		11	Jaili	11	Ajmer				
				12	Doomra				
	Total : Sub-district	11		12		2		1	
	Kishangarh	1	Dhani Rathoran	1	Kakriyawas	1	Kishangarh City	1	Dhani Rathoran
		2	Buharoo	2	Buharoo			2	Mohanpura
		3	Mohanpura	3	Tiloniya			3	Kali Doongri
		4	Kali Doongri	4	Bhojiyawas			4	(NA)
		5	Mandawariya	5	Phaloda				
		6	(NA)	6	Mandawariya				
		7	Phaloda	7	Kishangarh city				
		8	Bhojiyawas						
		9	Tiloniya						
		10	Kakaniyawas						
	Total : Sub-district	10		7		1		4	
	Peesangan	1	Lamanna	1	Saradhana	1	Somalpur		
		2	Daulet Khera	2	Shivpura	2	Keshav pura		
		3	Mangaliyawas	3	Keshav pura				
		4	Jethana	4	Makera				
		5	Makrera	5	Arjunpura Khalsa				
		6	Arjunpura Khalsa	6	Mangaliyawas				
		7	Shivpura	7	Lamana				
		8	Sardhana	8	Daulat Khera				
		9	Tabeeji	9	Jeethana				
		10	Daurai	10	Somalpur				
				11	Daurai (Rural)				
				12	Tabeeji (Rural)				
	Total : Sub-district	10	-	12	-	2	-	0	-
Total: District		40	-	41	-	9	-	8	-
PALI	Sumerpur	1	Balwana	1	Koliwara	1	Jawali Bandh	1	Galthani
		2	Galthani	2	Balwana				
		3	Koliwara	3	Jawali Bandh				
	Total : Sub-district	3		3		1		1	
	Bali	1	Malnoo	1	Sarkhejra	1	Mokhampura	1	Sela
		2	Chamunderi Ranawatan	2	Mokhampura	2	Phalna (Rural)	2	Rughnathpura
		3	Kothar	3	Kheemal	3	Jadri	3	Chamunderi Rana Watan
		4	Doodni	4	Phalna (Rural)	4	Beral		
		5	Rughnathpura	5	Phalna Stn	5	Bhandar		
		6	Beesalpur	6	Jadri				
		7	Beeroliya	7	Beral				
		8	Sela	8	Beeroliya				
		9	Phalna	9	Beesalpur				
		10	Kheemal	10	Doodni				

List of Villages Identified as a Result of S-ESIMMS Study: Rajasthan (3/4)

District	Sub-district	No.	Name of Villages Considered in ESIMMS	No.	SAPROF Villages	No.	New Villages	No.	Excluded villages
PALI	Dali	11	Sarkhejra	11	Kothar				
				12	Bhandar				
				13	Malnoo				
	Total : Sub-district	11		13		5		3	
	Rani Station	1	Rani Kalan					1	Rani Kalan
		2	Bhagwanpura Station					2	Bhagwanpura Station
		3	Salariya					3	Salariya
		4	Jawali					4	Jawali
		5	Duthriya					5	Duthriya
		6	Somesar					6	Somesar
	Total : Sub-district	6		0		0		6	
	Marwar JN.	1	Bhimaliya	1	Dadiya	1	Hemliyawas Kalan	1	Sawarad
		2	Banta	2	Dhundhala	2	Auwa		
		3	Dhamli	3	Bhesana	3	Bhesana		
		4	Karari	4	Reesaniya				
		5	Barsa	5	Jor Dudor				
		6	Bhagwanpura	6	Dudor				
		7	Bithora Khurd	7	Hemliyawas Kalan				
		8	Surya Nagar	8	Hemliyawas Khurd (Rural)				
		9	Marwar	9	Marwar Junction				
		10	Hemliyawas Khurd	10	Auwa				
		11	Jor Dudor	11	Surya Nagar				
		12	Dudor	12	Bithora Khurd				
		13	Reesaniya	13	Borsa				
		14	Sawrad	14	Bhagwanpura				
		15	Dhundhala	15	Karari				
		16	Dadiya	16	Dhamli				
				17	Banta				
				18	Bhimadia				
	Total : Sub-district	16		18		3		1	
	Sojat Road	1	Siyat	1	Karmawas	1	Sojat Road	1	Siyat
		2	Panchunda Kalan	2	Udeshi Kua				
		3	Bagri Nagar	3	Chandawal				
		4	Murdawa	4	Murdawa				
		5	Chandawal Station	5	Pachudo Kalan				
		6	Udeshi Kuan	6	Sojat Road				
		7	Karmawas	7	Bagri Nagar				
	Total : Sub-district	7		7		1		1	
	Raipur	1	Guriya	1	Rampura Mewatiyan (Rural)	1	Haripura	1	Bar
		2	Jhoontha	2	Amarpura	2	Rampur Mewatiyan	2	Baripol
		3	Deepawas	3	Saradhana	3	Aasan		
		4	Malni	4	Shergarh	4	Laka Ji Ki Dhani		
		5	Megarda	5	Manpura	5	Dhaliya		
		6	Phata Khera	6	Sabalpura				
		7	Kaya Bheela	7	Kurantiya				
		8	Bar	8	Sendara				
		9	Jhala Ki Chauki	9	Jhala Ki Chauki				
		10	Sendara	10	Kaya Bheela				
		11	Kurantiya	11	Phata Khera				
		12	Sabalpura	12	Malni				
		13	Manpura	13	Megarda				
		14	Shergarh	14	Deepawas				
		15	Amarpura	15	Haripur				
		16	Saradhana	16	Aasan				
		17	Baripol	17	Laka Ji Ki Dhani				
				18	Dhaliya				
				19	Jhoontha				
				20	Guriya				
	Total : Sub-district	17		20		5		2	
	Desuri			1	Indarwara	1	Indarwara		
				2	Bhadarlau	2	Bhadarlau		
				3	Somesar	3	Somesar		
				4	Jawali	4	Jawali		
				5	Salariya	5	Salariya		
				6	Ajaneshwar	6	Ajaneshwar		
				7	Bhagwanpura Station	7	Bhagwanpura Station		
				8	Beejowa	8	Beejowa		
				9	Rani	9	Rani		
				10	Dhariya	10	Dharia		
	Total : Sub-district	0		10		10		0	
Total: District		60		71		25		14	
SIROHI	Abu Road	1	Wasda	1	Kiwarli	1	Sangna	1	Santpur (rural)
		2	Mawal	2	Or	2	Khara	2	Morthala
		3	Amba	3	Derna			3	Toonka
		4	Chandrawati	4	Khadat			4	Siyawa
		5	Siyawa	5	Sangna				
		6	Abu Road	6	Kui				
		7	Kui	7	Abu Road				
		8	Khadat	8	Chandrawati				

List of Villages Identified as a Result of S-ESIMMS Study: Rajasthan (4/4)

District	Sub-district	No.	Name of Villages Considered in ESIMMS	No.	SAPROF Villages	No.	New Villages	No.	Excluded villages
SIROHI	Abu Road	9	Santpur (rural)	9	Amba				
		10	Morthala	10	Khara				
		11	Or	11	Maval				
		12	Derna	12	Wasda				
		13	Toonka						
		14	Kiverli						
	Total : Sub-district	14		12		2		4	
	Pindwara	1	Wara	1	Sadalwa	1	Swaroop Gunj	1	Keshavganj
		2	Bharja	2	Pindwara Jn			2	Reechhri
		3	Bhimana	3	Ajari			3	Adarsh doorigri
		4	Udvariya	4	Chawarli				
		5	Vatera	5	Ghodiyawa				
		6	Bhavri	6	Banas				
		7	Kodarla	7	Peshua				
		8	Peshua	8	Kodarla				
		9	Banas	9	Swaroop Gunj				
		10	Adarsh doorigri	10	Bhavri				
		11	Ghodhuiyawa	11	Vatera				
		12	Reechhri	12	Udavariya				
		13	Chawarli	13	Bhimana				
		14	Ajari	14	Bharja				
		15	Pindawara	15	Wara				
		16	Sadalwa						
		17	Keshavganj						
	Total : Sub-district	17		15		1		3	
Total: District		31		27		3		7	
Total: State		213		218		56		51	

Note: (*) denotes "Not Revenue Village"
(NKB) denotes the village name at the post office
Bhetasi (Talpad) denotes the village has two names.

List of Villages Identified as a Result of S-ESIMMS Study: Gujarat (1/4)

District	Sub-district	No.	Name of Villages Considered in ESIMMS	No.	SAPROF Villages	No.	New Villages	No.	Excluded Villages
Banaskantha	Amirgadh	1	Amirgadh	1	Awal Gomti	1	Awal Gomti	1	Jorapura
		2	Dungarpura	2	Dungarpura	2	Deri	2	Juni Roh Sarothi
		3	Kirotar	3	Amirgadh	3	Mahadevia	3	Zanzarvav
		4	Jorapura	4	Kitodar	4	Kalimati	4	Jethi
		5	Dhanpura	5	Dholia	5	Umarkot		
		6	Dholia	6	Iqbalgarh	6	Karja		
		7	Juni Roh Sarothi	7	Bantawada				
		8	Zanzarvav	8	Deri				
		9	Iqbalgarh	9	Mahadevia				
		10	Jethi	10	Dhanpura				
		11	Bantawada	11	Umarkot				
				12	Karja				
				13	Kalimati				
	Total : Sub-district	11	-	13	-	6	-	4	-
	Palanpur	1	Pirojpura	1	Antroli	1	Lunwa	1	Rajpura
		2	Antroli	2	Pirjopura (Tankani)	2	Kholda	2	Jagana
		3	Malana	3	Lunawa	3	Bhagal (Jagana)	3	Jasleni
		4	Rajpura	4	Parpapada	4	Vasna (Jagana)	4	Palanpur
		5	Pakhanwa	5	Kholda	5	Badarpura (Kalusana)	5	Malana
		6	Moriya	6	Chodotar	6	Sangla		
		7	Parpada	7	Akasan	7	Uttampura		
		8	Palanpur	8	Gathaman				
		9	Chadotar	9	Bhagal (Jagana)				
		10	Akesan	10	Sagrosana				
		11	Gathaman	11	Vasna (Jagana)				
		12	Jagana	12	Badarpura (Kalusana)				
		13	Sedrasana	13	Pakhanwa				
		14	Jasleni	14	Moriya				
				15	Sangla				
				16	Uttampura				
	Total : Sub-district	14	-	16	-	7	-	5	-
	Vadgan	1	Malosana	1	Changwada	1	Changwada	1	Malosana
		2	Majadar	2	Changa	2	Changa	2	Majadar
		3	Kotadi	3	Basu	3	Basu	3	Kotadi
		4	Teniwada	4	Meta	4	Meta	4	Teniwada
		5	Manpura	5	Mumuwada	5	Mumuwada	5	Manpura
		6	Dharewada					6	Dharewada
	Total : Sub-district	6	-	5	-	5	-	6	-
Total: District		31	-	34	-	18	-	15	-
Patan	Sidhpur	1	Maloj	1	Kakoshi	1	Dehlol	1	Maloj
		2	Ganeshpura	2	Rasulpur	2	Kakoshi	2	Ganeshpura
		3	Ankvi	3	Metrana	3	Rasulpur	3	Ankvi
		4	Sidhpur	4	Vadhana	4	Metrana	4	Sidhpur
		5	Lalpur	5	Thakrasan	5	Vadhana	5	Lalpur
				6	Dethali	6	Thakrasan		
				7	Dehlol	7	Dethali		
				8	Karan	8	Karan		
				9	Nedra	9	Nedra		
	Total : Sub-district	5	-	9	-	9	-	5	-
	Patan			1	Derasana	1	Derasana		
				2	Kani	2	Kani		
				3	Visal Vasna	3	Visal Vasna		
				4	Manund	4	Manund		
	Total : Sub-district	0	-	4	-	4	-	0	-
Total: District		5	-	13	-	13	-	5	-
Mahesana	Unjha	1	Kamli	1	Lindi	1	Lindi	1	Kamli
		2	Maktupur	2	Amudh	2	Amudh	2	Maktupur
		3	Unjha	3	Sunoka	3	Sunak	3	Unjha
		4	Aithor	4	Sujerupura (Dabi)	4	Sujerupura (Dabi)	4	Aithor
				5	Chandravati	5	Chandravati		
	Total : Sub-district	4	-	5	-	5	-	4	-
	Visnagar	1	Jethalvasana					1	Jethalvasana
		2	Bhandu					2	Bhandu
	Total : Sub-district	2	-	0	-	0	-	2	-
	Mahesana	1	Motidau	1	Allora	1	Allora	1	Motidau
		2	Palodar	2	Hardesan	2	Hardesan	2	Palodar
		3	Panchot	3	Bodla	3	Bodla	3	Panchot
		4	Dediyason	4	Nugar	4	Maguna	4	Dediyason
		5	Nugar	5	Maguna	5	Karshanpura		

List of Villages Identified as a Result of S-ESIMMS Study: Gujarat (2/4)

District	Sub-district	No.	Name of Villages Considered in ESIMMS	No.	SAPROF Villages	No.	New Villages	No.	Excluded Villages
Mahesana	Mahesana	6	Sametra	6	Karshanpura	6	Matpur		
		7	Heduva- Rajgadh	7	Sametra	7	Padi		
		8	Vadosan	8	Heduva-Rajgar	8	Kanthravi		
		9	Boriavi	9	Vadosan	9	Veerta		
		10	Linch	10	Boriavi	10	Gorad		
		11	Ambasan	11	Linch	11	Chatiyarda		
		12	Baliyasan	12	Ambasan	12	Gilosan		
		13	Bhasariya	13	Baliyasan	13	Mareda		
		14	Tundali	14	Bhasariya	14	Sabkheda		
				15	Tundali	15	Surpura		
				16	Matpur	16	Revavi		
				17	Padi	17	Dabri		
				18	Kanthravi				
				19	Gorad				
				20	Gilosan				
				21	Chatiyarda				
				22	Mareda				
				23	Sabkheda				
				24	Veerta				
				25	Surpura				
				26	Revavi				
				27	Dabri				
	Total : Sub-district	14	-	27	-	17	-	4	-
	Kadi	1	Ganeshpura	1	Ganeshpura	1	Narain Pura	1	Dhanali
		2	Dhanali	2	Mathasur			2	Achrason
		3	Mathasur	3	Nandasan			3	Fuletra
		4	Nandasan	4	Kherpur			4	Vadavi
		5	Lakshmipura	5	Rajpur			5	Thol
		6	Kherpur	6	Irana				
		7	Rajpur	7	Indrad				
		8	Irana	8	Narain Pura				
		9	Indrad	9	Lakshmipura				
		10	Ankhol	10	Ankhol				
		11	Achrason	11	Vamaj				
		12	Vamaj						
		13	Fuletra						
		14	Vadavi						
		15	Thol						
	Total : Sub-district	15	-	11	-	1	-	5	-
Total: District		35	-	43	-	23	-	15	-
Gandhinagar	Kalol	1	Dhanot	1	Dhanot	1	Piyaj	1	Hajipur
		2	Chhatral	2	Chhatral	2	Ramnagar	2	Bhaimasan
		3	Hajipur	3	Piyaj	3	Vansajada	3	Adhina
		4	Bhaimasan	4	Ramnagar	4	Bhoyan Moti	4	Unali
		5	Adhina	5	Vansajeda	5	Khatraj		
		6	Nasmed	6	Bhoyan Moti	6	Sanavad		
		7	Rancharada	7	Khatraj	7	Karoli		
		8	Unali	8	Sanavad	8	Jethlaj		
				9	Nasmed	9	Dabla		
				10	Rancharada	10	Vansjeda Dhedia		
				11	Karoli	11	Boriyavi		
				12	Boriyavi	12	Vasnol		
				13	Jethlaj				
				14	Dabla				
				15	Vasnol				
				16	Vansjeda Dhedia				
	Total : Sub-district	8	-	16	-	12	-	4	-
Total: District		8	-	16	-	12	-	4	-
Ahmedabad	Sanand	1	Garodiya	1	Garodiya	1	Nidhard	1	Kolat
		2	Godhavi	2	Godhavi	2	Pipan	2	Moraiya
		3	Manipur	3	Kaneti	3	Nani Devti	3	Manipur
		4	Kanethi	4	Nidhard	4	Palwada		
		5	Sanand	5	Sanand	5	Matoda		
		6	Kolat	6	Pipan	6	Soila		
		7	Moti Devti	7	Moti Devti	7	Sari		
		8	Moraiya	8	Nani Devti				
		9	Vasna Chacharavadi	9	Palwada				
				10	Soila				
				11	Sari				

List of Villages Identified as a Result of S-ESIMMS Study: Gujarat (3/4)

District	Sub-district	No.	Name of Villages Considered in ESIMMS	No.	SAPROF Villages	No.	New Villages	No.	Excluded Villages
				12	Matoda				
				13	Vasna Chacharavadi				
	Total : Sub-district	9	-	13	-	7	-	3	-
	Bhavla	1	Kavitha	1	Rajoda	1	Rajoda		
				2	Kavitha	2	Modasar		
				3	Modasar				
	Total : Sub-district	1	-	3	-	2	-	0	-
	Dholka	1	Bawala					1	Bawala
		2	Badarkha					2	Badarkha
		3	Saroda					3	Saroda
Ahmedabad		4	Chaloda					4	Chaloda
		5	Vasna Keleya					5	Vasna Keleya
		6	Chandisar					6	Chandisar
		7	Ambaliyara					7	Ambaliyara
		8	Sathal					8	Sathal
	Total : Sub-district	8	-	0	-	0	-	8	-
	Daskroi			1	Miroli	1	Miroli		
				2	Mahijda	2	Mahijda		
				3	Rampura	3	Rampura		
				4	Timba	4	Timba		
	Total : Sub-district	0	-	4	-	4	-	0	-
Total: District		18	-	20	-	13	-	11	-
	Kheda	1	Kaloli	1	Adasar	1	Adasar	1	Kaloli
		2	Naika	2	Kathwada	2	Kathwada	2	Radhu
		3	Radhu	3	Chalindra	3	Chalindra	3	Govindpura
		4	Govindpura	4	TOI.Vasna	4	TOI Vasna	4	Kathoda
		5	Shetra	5	Naika Navi Vasad (*)	5	Naika Navi Vasad (*)		
		6	Vasna Bujarg	6	Naika Chalendra(*)	6	Naika Chalendra(*)		
				7	Navagam	7	Dharampura		
				8	Shetra	8	Navagam		
				9	Vasna Bujarg				
				10	Dharampura				
Kheda	Total : Sub-district	6	-	10	-	8	-	4	-
	Matar	1	Palla	1	Pimpara	1	Hernaj	1	Palla
		2	Matar	2	Koshiyal	2	Laval	2	Kathoda
		3	Traj	3	Matar	3	Maliataj		
		4	Garmala	4	Traj	4	Pimpara		
		5	Machhiel	5	Garmala	5	Koshiyal		
		6	Kathoda	6	Machhiel				
		7	Khandhli	7	Hernaj				
				8	Khandhli				
				9	Laval				
				10	Malhataj				
	Total : Sub-district	7	-	10	-	5	-	2	-
Total: District		13	-	20	-	13	-	6	-
	Sojitra	1	Bhadkad	1	Deva Vanta	1	Deva Vanta	1	Bhadkad
		2	Bantwa	2	Roon	2	Roon	2	Bantwa
		3	Virsadpura					3	Virsadpura
		4	Malataj					4	Malataj
		5	Kasor					5	Kasor
	Total : Sub-district	5	-	2	-	2	-	5	-
	Petlad	1	Mahelav	1	Demol	1	Demol	1	Sunav
		2	Sunav	2	Changa	2	Changa	2	Porda
		3	Bandhni	3	Mahelav	3	Ravipura	3	Ardi
		4	Porda	4	Ravipura	4	Thaladi	4	Bandhni
		5	Vishnoli	5	Morad	5	Padgol		
		6	Ardi	6	Boriya	6	Navagam		
Anand		7	Morad	7	Thaladi	7	Radupura		
		8	Voriya	8	Padgol	8	Kaisy Kua		
				9	Radupura				
				10	Kaisy Kua				
				11	Navagam				
				12	Vishnoli				
	Total : Sub-district	8	-	12	-	8	-	4	-
	Anand	1	Sandesar	1	Sandesar	1	Meghva Gana	1	Karamsad
		2	Karamsad	2	Gana	2	Napad Vanto		
		3	Gana	3	Meghva Gana				
		4	Vanas Khilya	4	Vans Khiliya				
		5	Khandhali	5	Khandhali				
				6	Napad Vanto				
	Total : Sub-district	5	-	6	-	2	-	1	-

List of Villages Identified as a Result of S-ESIMMS Study: Gujarat (4/4)

District	Sub-district	No.	Name of Villages Considered in ESIMMS	No.	SAPROF Villages	No.	New Villages	No.	Excluded Villages
Anand	Borsad	1	Napa Vanto	1	Napa Vanto			1	Dahemi
		2	Dahemi	2	Kasumbad			2	Harkhapura
		3	Kasumbad						
		4	Harkhapura						
	Total : Sub-district	4	-	2	-	0	-	2	-
	Anklav	1	*Haldari*	1	*Khadol (Haldari)*	1	*Khadol (Haldari)*	1	*Asodar*
		2	Asodar	2	Haldari	2	Bhetasi (Talpad)	2	Amrol
		3	Vhedi (Talpad)	3	Bhetasi (Talpad)	3	Laxmi Pura*	3	Vhedi (Talpad)
		4	Anklav	4	Laxmi Pura*	4	Lalpura*	4	Anklav
		5	Ambali	5	Lalpura*	5	Khanvadi*		
		6	Amrol	6	Ambali*				
				7	Khanvadi				
	Total : Sub-district	6	-	7	-	5	-	4	-
Total: District		28	-	29	-	17	-	16	-
Vadodara	Vadodara	1	Kotna	1	Bil	1	Sherkhi	1	Ampad
		2	Anagarh	2	Kotna	2	Trikanpura*	2	Raypura
		3	Sindhrat	3	Sherkhi	3	Krisna nagar*	3	Vadodara
		4	Hinglot	4	Sonarkoi	4	Mahapura	4	Talsat
		5	Ampad	5	Trikanpura*	5	Gokul Pura	5	Maretha
		6	Raypura	6	Krisna nagar*	6	Samiyala	6	Alamgir
		7	Bhayli	7	Mahapura	7	Jeevari*	7	Kashipura
		8	Bil	8	Bhayali	8	Khalipur	8	Sarar
		9	Vadodara	9	Gokul Pura	9	Karali	9	Varnama
		10	Talsat	10	Samiyala	10	Sonarkoi	10	Sindhrot
		11	Chapad	11	Jeevari*			11	Anagarh
		12	Maretha	12	Chapad			12	Hinglot
		13	Alamgir	13	Khalipur				
		14	Varnama	14	Vadasala				
		15	Vadsala	15	Karali				
		16	Itola	16	Itola				
		17	Kashipura						
		18	Sarar						
	Total : Sub-district	18	-	16	-	10	-	12	-
	Karjan	1	*Kherda*					1	*Kherda*
		2	Kandari					2	Kandari
		3	Karjan					3	Karjan
		4	Miyagam					4	Miyagam
		5	Vavava					5	Vavava
		6	Lakodara					6	Lakodara
		7	Dethan					7	Dethan
		8	Valan					8	Valan
		9	Mankhan					9	Mankhan
		10	Sansrod					10	Sansrod
		11	Haldarva					11	Haldarva
	Total : Sub-district	11	-	0	-	0	-	11	-
Total: District		29	-	16	-	10	-	23	-
Total: State		167	-	191	-	119	-	95	-

Note: (*) denotes "Not Revenue Village"
(NKB) denotes the village name at the post office
Bhetasi (Talpad) denotes the village has two names.

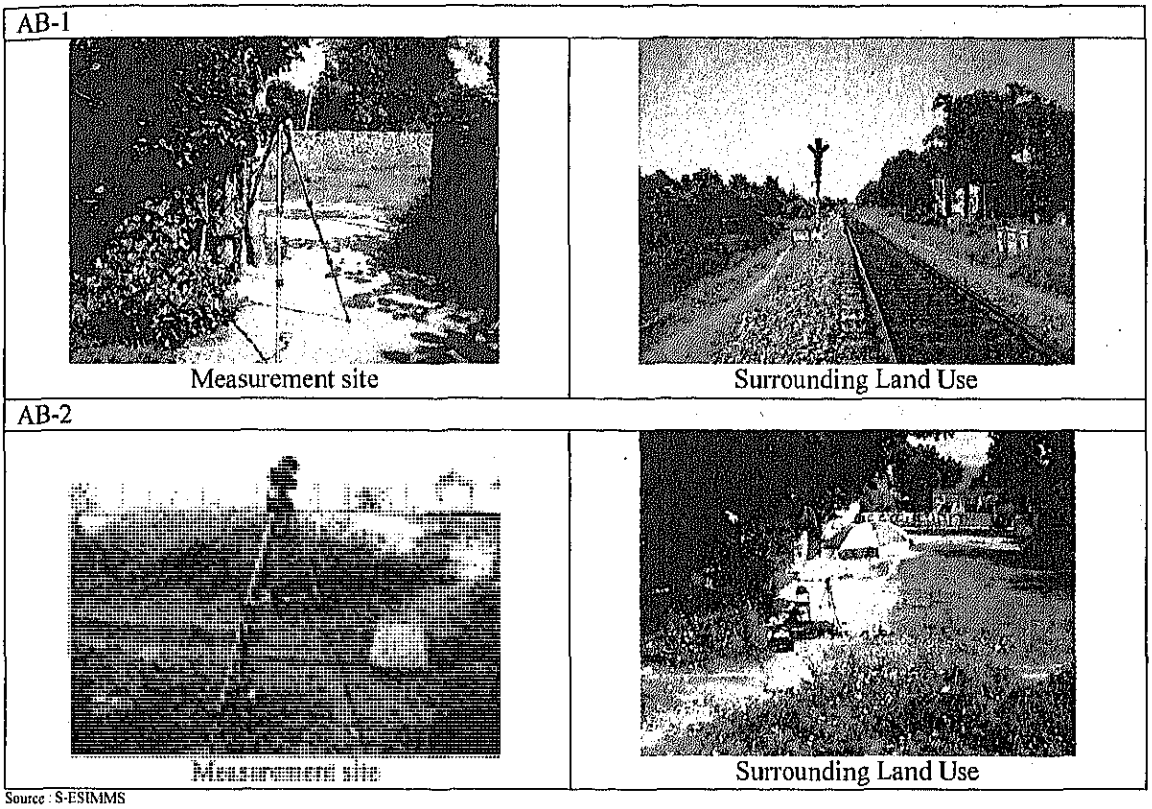
APPENDIX III-1-1 NOISE SURVEY

1. Railway and Background Noise in Parallel Section

1-1 Photographs on Measurement Sites In Parallel Section

(1) Abu Road

Photographs on each measurement site and surrounding land use in Abu Road are given in Figure 1.1-1.

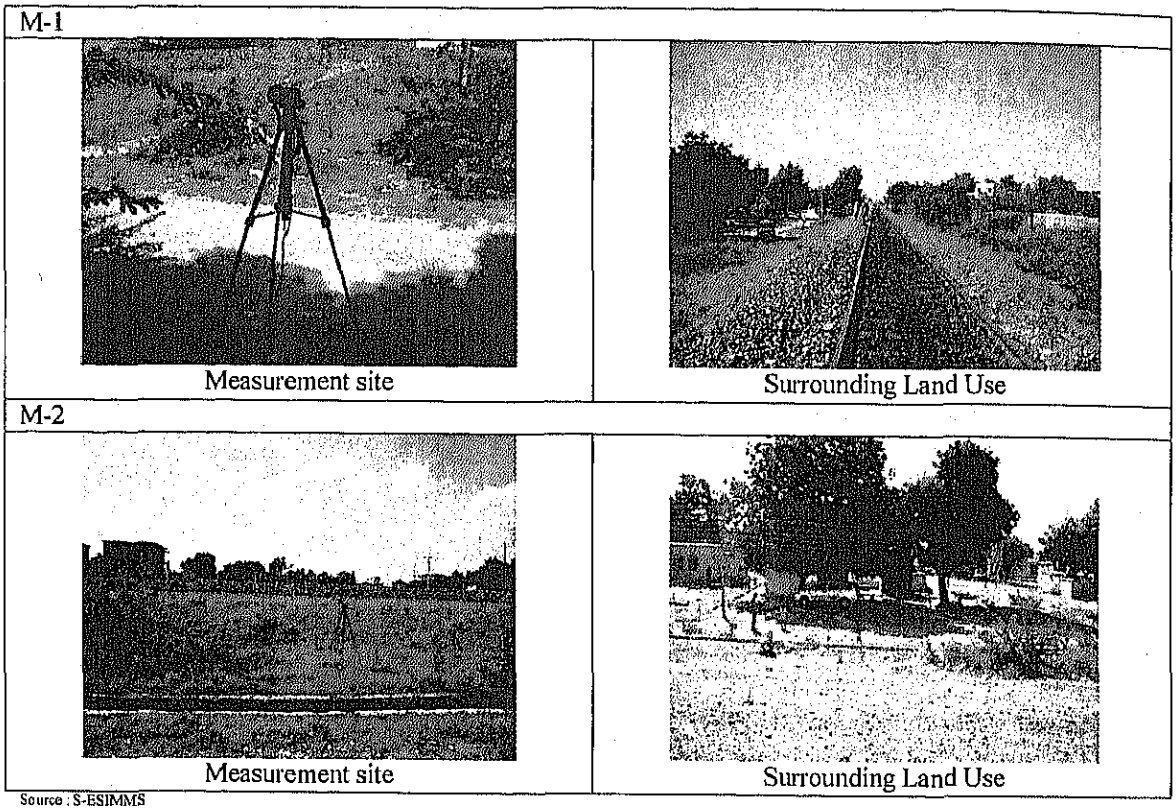


Source : S-ESIMMS

Figure 1.1-1 Measurement Sites and Surrounding Land Use In Abu Road (AB-1,AB-2)

(2) Marwar

Photographs on each measurement site and surrounding land use in Marwar are given in Figure 1.1-2.

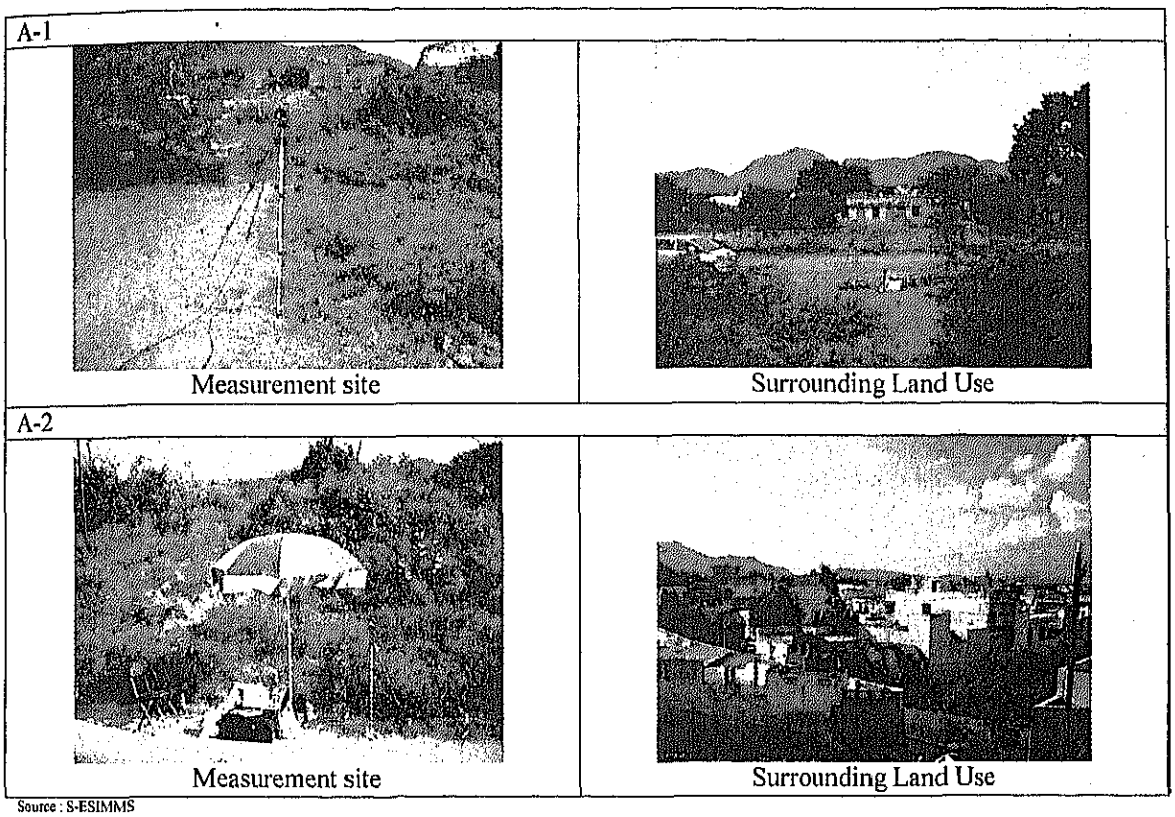


Source : S-ESIMMS

Figure 1.1-2 Measurement Sites and Surrounding Land Use In Marwar (M-1,M-2)

(3) Ajmer

Photographs on each measurement site and surrounding land use in Ajmer are given in Figure 1.1-3.

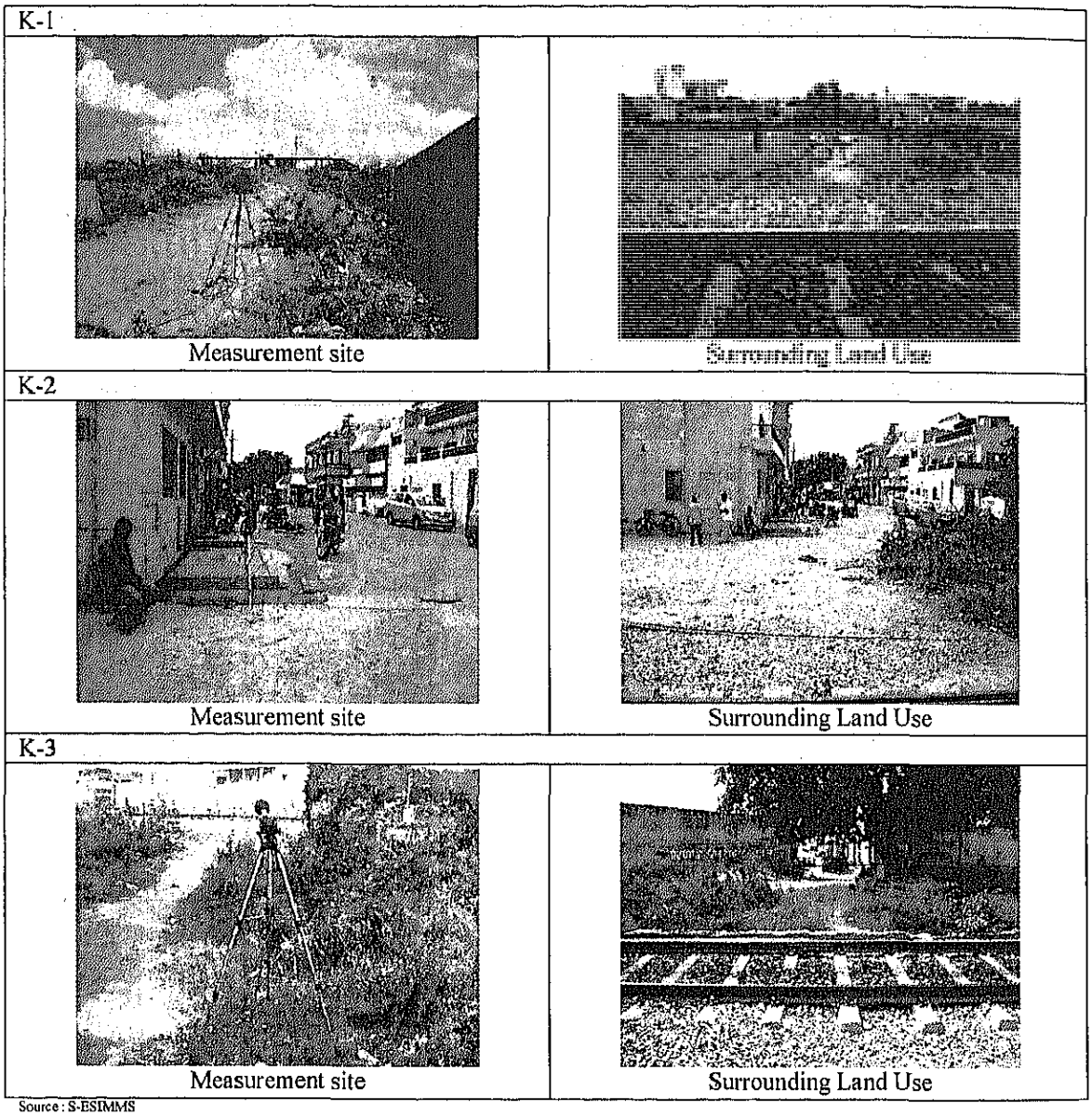


Source : S-ESIMMS

Figure 1.1-3 Measurement Sites and Surrounding Land Use In Ajmer (A-1,A-2)

(4) Kishangarh

Photographs on each measurement site and surrounding land use in Kishangarh are given in Figure 1.1-4.

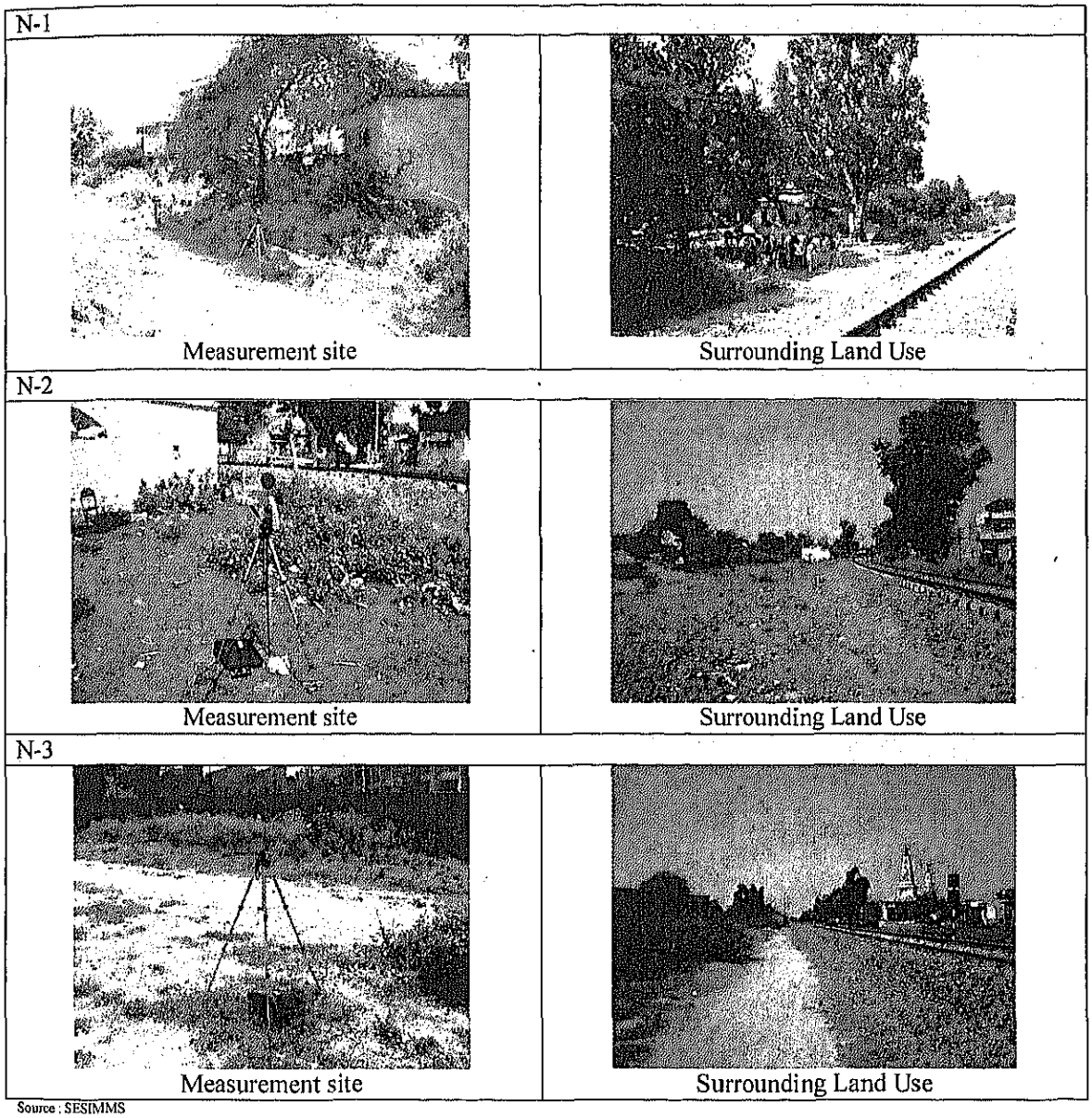


Source : S-ESIMMS

Figure 1.1-4 Measurement Sites and Surrounding Land Use In Kishangarh (K-1, K-2, K-3)

(5) Narnaul

Photographs on each measurement site and surrounding land use in Narnaul are given in Figure 1.1-5.



Source : SESIMMS

Figure 1.1-5 Measurement Sites and Surrounding Land Use in Narnaul (N-1, N-2, N-3)

1-2 Results of Railway and Background Noise in Parallel Section

Results of railway and background noise in parallel section are shown below.

(1) Abu Road

1) Cross-section View

Cross-section views of measurement site in Abu Road are given in Figure 1.2-1 and Figure 1.2-2.

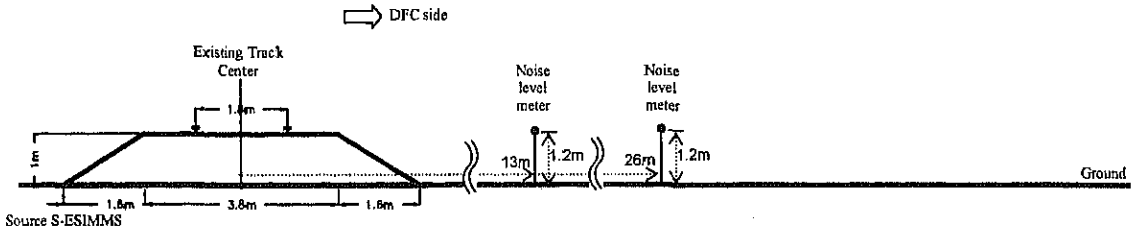


Figure 1.2-1 Cross-section view of AB-1 Measurement Site in Abu Road

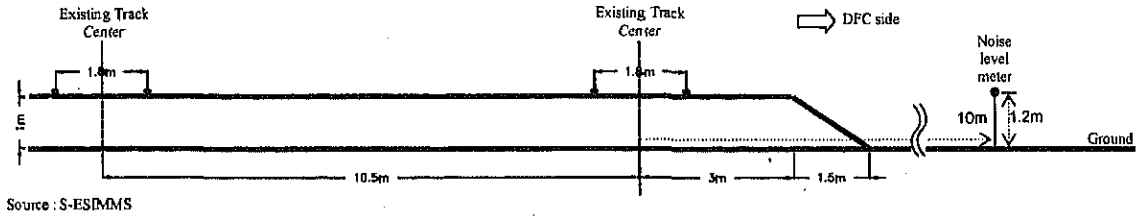


Figure 1.2-2 Cross-section view of AB-2 measurement site in Abu Road

2) Result of Background Noise

Results of background noise measurement in Abu Road is given in Table 1.2-1.

Table 1.2-1 Result of background noise measurement in Abu Road

Date	No.	Background Noise Level LAeq [dB(A)]				
		10:00~12:00	12:00~14:00	14:00~16:00	16:00~18:00	Overall 10:00~18:00
5-Sep	AB-1	50	53	43	52	50
5-Sep	AB-2	51	49	55	53	53

Source : S-ESIMMS

3) Result of Railway Noise

Results of railway noise measurement in Abu Road is given in Table 1.2-2 and Table 1.2-3.

Table 1.2-2 Result of Railway noise measurement At AB-1

No.	date	time	train type	train speed [km/hr]	train passage time [s]	measurement time [s]	train length [m]	train direction	Railway Noise level(dB)			
									LAE		LAmax	
									13.0m	26.0m	13.0m	26.0m
1	5-Sep	10:02	P	37.4	37.9	45.6	394	down	110.3	106.1	106.5	100.5
2	5-Sep	11:03	P	23.1	88.5	93.8	569	down	95.1	91.1	85.8	80.4
3	5-Sep	11:21	F	15.4	137.1	167.8	588	up	91.6	90.0	78.5	82.8
4	5-Sep	11:36	P	27.7	62.7	84.2	482	up	96.9	92.7	90.0	84.5
5	5-Sep	13:04	F	20.8	101.7	125.8	588	down	97.6	94.4	88.1	82.7
6	5-Sep	13:46	F	28.0	131.5	145.4	1024	up	99.9	98.1	91.3	89.9
7	5-Sep	13:59	F	19.8	106.7	132.6	588	down	94.5	91.7	84.6	79.6
8	5-Sep	14:22	P	26.8	61.0	91.5	438	up	93.6	92.2	87.9	84.0
9	5-Sep	14:35	P	34.7	31.8	52.2	306	down	93.7	91.2	85.6	81.6
10	5-Sep	14:49	P	29.8	53.0	67.5	438	down	90.0	86.9	81.2	77.2
11	5-Sep	15:01	F	18.1	117.2	129.8	588	down	100.2	93.5	92.1	86.6
12	5-Sep	15:38	F	23.9	64.6	88.8	430	up	113.2	102.1	107.8	96.0
13	5-Sep	16:07	P	24.0	52.2	66.5	340	down	97.5	88.0	88.7	77.4
14	5-Sep	16:26	F	15.1	139.7	152.8	588	up	87.4	77.2	74.0	62.2
15	5-Sep	16:38	F	17.3	130.9	145.1	628	down	109.1	98.6	103.1	92.5
average		Passenger (P)		26.8	61.9	87.9	460.3	up	95.3	92.5	89.0	84.7
				29.8	49.7	65.1	411.2	down	97.3	92.7	89.6	83.4
		Freight (F)		20.6	114.7	137.3	657.2	up	98.0	92.1	87.9	82.7
				19.0	118.3	133.3	597.8	down	100.4	94.6	92.0	85.1

Note) P : passenger train F : freight train
up : to Mumbai down : to Delhi
train passage time (s): time until the back of the train passes after the head of the train passes at a certain point
measurement time (s): This indicates railway noise measurement time for LAE and LAmax in time that is 10dB or more higher than background noise.
average : value calculated by the simple arithmetic average in each up side passenger train, down side passenger train, up side freight train, down side freight train
Source : S-ESIMMS

Table 1.2-3 Result of Railway noise measurement At AB-2

No.	date	time	train type	train speed [km/hr]	train passage time [s]	measurement time [s]	train length [m]	train direction	Railway Noise level(dB)	
									LAE	LAmax
									10.0m	10.0m
1	5-Sep	9:48	F	13.6	168.9	175.1	601	up	102.7	92.3
2	5-Sep	10:30	P	19.6	104.3	141.3	569	down	87.8	78.9
3	5-Sep	11:45	F	14.3	147.8	177.0	688	down	104.5	95.5
4	5-Sep	11:58	P	13.3	130.2	150.7	482	up	96.9	89.3
5	5-Sep	12:14	P	16.9	69.9	81.0	328	up	102.7	94.0
6	5-Sep	12:55	F	12.5	169.7	195.4	588	down	103.3	93.9
7	5-Sep	13:08	P	22.0	79.0	85.6	482	down	99.8	95.2
8	5-Sep	13:17	F	12.5	169.7	179.1	588	up	104.2	94.6
9	5-Sep	14:05	F	14.7	143.9	169.4	688	down	100.4	88.4
10	5-Sep	14:16	P	21.0	52.5	62.6	306	down	107.7	100.5
11	5-Sep	14:30	P	14.2	111.4	134.3	438	down	89.6	78.4
12	5-Sep	14:40	P	15.4	102.3	115.9	438	up	99.6	91.7
13	5-Sep	15:00	F	16.8	219.8	252.0	1024	up	104.7	93.0
14	5-Sep	15:50	P	13.7	86.1	103.2	328	down	82.9	71.7
15	5-Sep	16:12	F	16.0	146.1	166.7	648	down	97.7	84.6
16	5-Sep	16:20	F	12.2	127.0	153.2	430	up	118.9	111.5
17	5-Sep	16:45	F	9.4	225.8	238.9	588	up	95.1	76.8
average		Passenger (P)		15.2	98.4	115.9	416	up	99.7	91.7
				18.1	84.5	105.4	425	down	93.6	84.9
		Freight (F)		12.9	180.6	199.7	646	up	105.1	93.6
				14.4	151.1	177.1	603	down	101.5	90.6

Note) P : passenger train F : freight train
up : to Mumbai down : to Delhi
train passage time (s): time until the back of the train passes after the head of the train passes at a certain point
measurement time (s): This indicates railway noise measurement time for LAE and LAmax in time that is 10dB or more higher than background noise.
average : value calculated by the simple arithmetic average in each up side passenger train, down side passenger train, up side freight train, down side freight train
Source : S-ESIMMS

4) Result of Frequency Analysis

Results of 1/3 octave band frequency analysis are given in Table 1.2-4 and Table 1.2-5. In consideration of both results roughly, frequency of the range from 630 to 2000Hz excelled. In Japan, the main noise of train includes[1] (1) traction, (2) structures and (3) machines equipped to the train, and predominant frequency from each noise is said to be almost from 250 to 2000Hz as well. Therefore, result of predominant frequency was similar to the case in Japan, and this would be suitable value. In addition, in case of countermeasure (e.g. soundproof) for railway noise, Japanese countermeasure method might be available.

Table 1.2-4 Results of 1/3 Octave Band Frequency Analysis of Railway Noise At AB-1 In Abu Road

No.	train type	Frequency [Hz]	20	25	32	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25k	1.6k	2k	2.5k	3.15k	4k	5k	6.3k	8k	AP
1	P	Noise Level [dB(A)]	24	30	37	50	54	61	65	70	70	67	73	80	94	90	97	98	91	101	97	94	95	93	90	88	85	81	79	106
2	P		29	33	41	50	61	59	64	71	64	65	69	69	71	73	72	72	73	72	71	74	74	74	75	74	75	75	75	86
3	F		19	26	35	44	48	49	50	50	53	54	55	58	56	60	63	63	63	62	65	80	71	67	68	60	57	57	53	81
4	P		29	30	36	43	52	52	56	61	61	64	67	69	79	77	71	75	81	83	85	79	76	76	75	74	73	72	70	90
5	F		26	29	45	47	57	59	70	70	66	68	71	73	75	79	76	77	77	77	77	79	78	75	74	72	71	70	67	88
6	F		22	29	36	44	49	53	55	58	59	62	63	71	66	65	67	81	80	86	86	75	72	69	65	62	57	53	48	92
7	F		25	33	40	44	54	60	62	65	61	61	71	68	66	70	70	71	72	75	74	74	75	75	73	72	71	71	71	85
8	P		14	18	23	31	35	39	41	43	45	45	46	49	70	76	76	82	76	81	80	78	78	74	73	71	69	64	60	89
9	P		22	30	44	46	54	54	62	65	66	72	67	68	68	69	69	71	73	76	75	75	76	76	74	73	71	70	69	86
10	P		19	30	37	39	46	57	56	62	68	66	65	66	67	70	70	69	71	70	69	71	70	69	67	66	64	63	61	81
11	F		26	32	39	42	51	59	63	68	69	66	70	71	75	76	75	76	75	77	76	79	77	76	75	76	73	71	68	88
12	F		30	36	40	47	53	52	55	62	61	63	64	67	63	84	93	89	85	95	87	87	93	90	86	85	82	80	77	101
13	P		28	34	41	52	53	63	63	70	69	67	72	76	80	76	76	78	79	77	76	78	80	75	72	70	67	64	61	89
14	F		21	31	37	43	49	54	55	57	59	58	63	63	61	64	64	63	63	62	61	61	61	60	59	58	55	52	49	74
15	F		28	29	46	47	57	61	64	70	65	69	73	76	93	77	77	86	90	102	94	87	93	87	85	82	79	78	74	104

Note) each frequency indicates center frequency of 1/3 octave band.
Value enclosed in heavy line indicates maximum one of each measurement.
Source S-ESIMMS

Table 1.2-5 Results of 1/3 Octave Band Frequency Analysis of Railway Noise At AB-2 In Abu Road

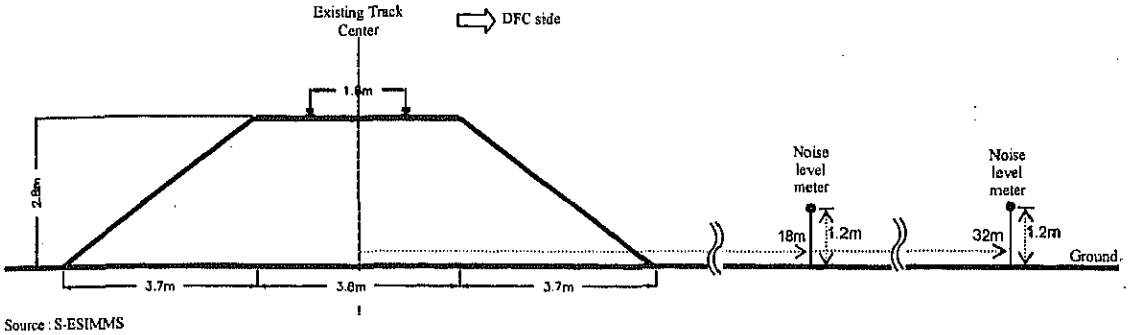
No.	train type	Frequency [Hz]	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25k	1.6k	2k	2.5k	3.15k	4k	5k	6.3k	8k	AP
1	F	Noise Level [dB(A)]	34	38	45	50	56	60	65	65	66	65	67	68	70	70	71	72	73	75	73	75	75	74	74	73	72	71	69	85
2	P		25	30	41	46	52	57	56	57	58	54	58	57	62	61	59	61	63	63	61	63	62	60	60	59	57	56	55	73
3	F		33	36	44	54	53	58	67	67	64	65	69	71	80	82	88	82	76	82	77	78	77	75	75	73	72	71	69	92
4	P		16	22	35	44	46	45	44	49	50	50	50	50	54	77	68	83	87	72	79	77	81	75	76	73	69	65	61	91
5	P		21	31	34	37	46	59	56	52	53	52	55	68	89	86	69	67	85	83	78	75	70	66	62	58	54	50	46	94
6	F		35	44	44	53	62	68	71	68	66	69	69	72	77	74	73	74	75	79	77	79	80	81	80	78	76	75	73	89
7	P		19	25	32	38	47	43	47	52	50	51	54	68	63	66	74	91	77	85	83	78	78	77	73	71	69	67	65	93
8	F		28	37	45	53	58	56	58	61	61	61	65	68	66	66	68	71	66	68	68	68	69	66	64	63	62	60	59	79
9	F		35	38	41	50	54	55	60	66	67	71	75	74	76	75	74	74	75	76	76	79	79	77	79	76	73	70	67	88
10	P		21	26	33	41	49	50	48	52	56	52	55	53	61	85	74	65	89	79	88	89	80	78	74	77	80	83	87	95
11	P		31	29	42	48	55	60	57	53	60	55	59	61	67	67	65	67	68	67	66	67	66	65	69	71	72	74	75	78
12	P		23	28	33	44	53	52	61	59	58	63	61	64	81	82	75	84	85	80	79	85	81	74	71	68	65	62	59	92
13	F		33	37	41	45	57	62	58	59	62	61	62	67	70	68	69	69	72	71	69	70	71	69	68	66	65	63	62	81
14	P		25	30	33	38	49	50	49	54	52	51	58	55	57	55	57	57	59	60	59	60	61	60	62	64	66	68	70	71
15	F		30	41	43	54	61	64	67	66	64	68	72	73	73	72	72	71	72	74	74	75	75	74	72	69	67	65	62	85
16	F		28	37	46	50	60	58	63	59	62	62	65	83	100	98	102	104	96	102	109	101	100	98	97	94	91	88	86	113
17	F		29	38	39	45	53	57	57	57	58	56	60	63	64	63	63	64	65	64	64	64	64	61	60	57	54	52	49	75

Note) each frequency indicates center frequency of 1/3 octave band.
Value enclosed in heavy line indicates maximum one of each measurement.
Source : S-ESIMMS

(2) Marwar

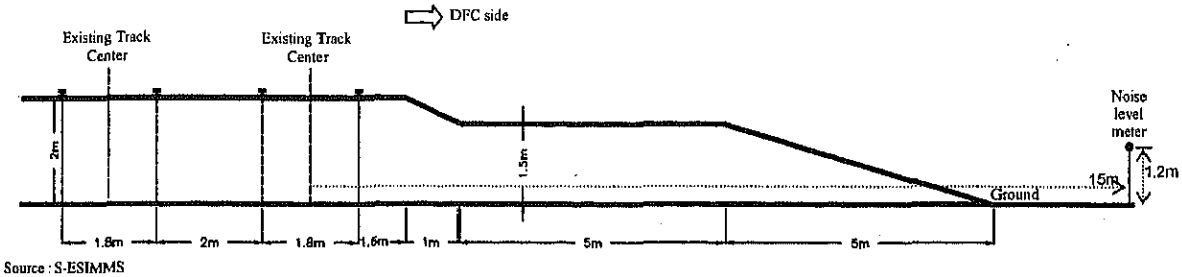
1) Cross-section view

Cross-section view of measurement site in Marwar are given in Figure 1.2-3 and Figure 1.2-4.



Source : S-ESIMMS

Figure 1.2-3 Cross-section view of M-1 Measurement Site in Marwar



Source : S-ESIMMS

Figure 1.2-4 Cross-section view of M-2 Measurement Site in Marwar

2) Result of Background Noise

Results of background noise measurement in Marwar is given in Table 1.2-6.

Table 1.2-6 Result of background noise measurement in Marwar

Date	No.	Background Noise Level LAeq [dB(A)]				
		10:00~12:00	12:00~14:00	14:00~16:00	16:00~18:00	Overall 10:00~18:00
3-Sep	M-1	45	45	49	52	49
3-Sep	M-2	47	55	46	43	52

Source : SAPROF Study Team

3) Result of Railway Noise Measurement

Results of railway noise measurement in Abu Road is given in Table 1.2-7 and Table 1.2-8.

Table 1.2-7 Result of Railway noise measurement At M-1

No.	date	time	train type	train speed [km/hr]	train passage time [s]	measurement time [s]	train length [m]	train direction	Railway Noise level(dB)			
									LAE		LAmax	
									16.0m	32.0m	16.0m	32.0m
1	3-Sep	10:51	P	19.1	86.8	105.1	460	up	105.8	104.1	96.5	94.6
2	3-Sep	11:06	P	10.1	78.5	86.8	416	down	108.6	107.0	102.3	101.0
3	3-Sep	14:04	P	25.0	82.0	103.0	569	up	108.6	107.0	100.9	99.6
4	3-Sep	14:15	F	27.7	90.1	106.4	694	down	06.9	95.1	85.6	82.2
5	3-Sep	14:40	F	47.7	44.4	53.7	588	up	101.7	100.3	94.7	92.2
6	3-Sep	15:15	P	33.6	61.0	76.9	569	down	97.6	95.9	86.9	83.6
7	3-Sep	15:37	F	43.4	70.7	84.7	852	up	107.5	105.6	97.9	96.0
8	3-Sep	15:51	F	19.1	110.9	129.4	588	down	97.7	95.7	89.3	85.8
9	3-Sep	16:17	P	18.5	84.8	101.3	437	up	97.2	06.1	91.0	88.3
10	3-Sep	16:39	P	30.4	49.3	58.8	416	down	93.3	91.9	82.7	79.1
11	3-Sep	17:05	F	27.2	77.7	91.1	588	down	103.6	102.3	93.3	90.7
12	3-Sep	17:28	P	35.5	44.3	55.8	437	down	105.4	104.1	98.7	96.8
average		Passenger (P)		20.9	84.3	103.1	489	up	103.9	102.1	96.1	94.1
				20.6	55.8	69.6	459	down	101.2	90.5	92.5	90.1
		Freight (F)		45.5	66.9	69.2	720	up	104.6	103.0	96.3	94.1
				24.7	90.9	109.0	623	down	99.4	97.7	89.4	86.2

Note) P : passenger train F : freight train
up : to Mumbai down : to Delhi
train passage time (s): time until the back of the train passes after the head of the train passes at a certain point
measurement time (s): This indicates railway noise measurement time for LAE and LAmax in time that is 10dB or more higher than background noise.
average : value calculated by the simple arithmetic average in each up side passenger train, down side passenger train, up side freight train, down side freight train
Source : S-ESIMMS

Table 1.2-8 Result of Railway noise measurement At M-2

No.	date	time	train type	train speed [km/hr]	train passage time [s]	measurement time [s]	train length [m]	train direction	Railway Noise level(dB)	
									LAE	LAmax
									15.0m	15.0m
1	3-Sep	10:51	P	19.6	84.7	107.7	460	up	106.4	100.6
2	3-Sep	11:06	P	15.8	94.9	99.7	416	down	112.6	100.9
3	3-Sep	14:04	P	17.7	116.6	136.7	669	up	102.0	96.7
4	3-Sep	14:40	F	36.4	59.9	75.1	688	up	97.7	85.6
5	3-Sep	15:15	P	19.3	106.1	121.9	569	down	92.8	80.0
6	3-Sep	15:37	F	38.4	79.9	104.4	852	up	102.2	94.6
7	3-Sep	15:51	F	16.6	127.6	166.4	588	down	98.4	88.6
8	3-Sep	16:17	P	21.4	73.4	77.4	437	up	86.9	77.7
9	3-Sep	16:39	P	24.1	62.1	86.3	416	down	92.9	84.5
10	3-Sep	17:05	F	23.3	90.7	106.3	688	down	102.3	93.3
11	3-Sep	17:28	P	19.5	80.8	104.5	437	down	97.9	90.5
12	3-Sep	17:54	F	13.4	164.6	176.0	575	up	96.9	87.9
average		Passenger (P)		19.6	89.9	107.3	489	up	98.1	91.6
				19.7	84.1	103.1	459	down	99.1	89.0
		Freight (F)		29.0	83.3	118.5	672	up	98.9	89.4
				20.0	106.0	136.4	688	down	100.4	91.0

Note) P : passenger train F : freight train
up : to Mumbai down : to Delhi
train passage time (s): time until the back of the train passes after the head of the train passes at a certain point
measurement time (s): This indicates railway noise measurement time for LAE and LAmax in time that is 10dB or more higher than background noise.
average : value calculated by the simple arithmetic average in each up side passenger train, down side passenger train, up side freight train, down side freight train
Source : S-ESIMMS

4) Result of Frequency Analysis

Results of 1/3 octave band frequency analysis are given in Table 1.2-9 and Table1.2-10. In consideration of both results roughly, frequency of the range from 400 to 2000Hz excelled. In Japan, the main noise of train includes[1] (1)traction, (2)structures and (3) machines equipped to the train, and predominant frequency from each noise is said to be almost from 250 to 2000Hz as well. Therefore, result of predominant frequency was similar to the case in Japan, and this would be suitable value. In addition, in case of countermeasure (e.g. soundproof) for railway noise, Japanese countermeasure method might be available.

Table 1.2-9 Results of 1/3 Octave Band Frequency Analysis of Railway Noise At M-1 In Marwar

No.	train type	Frequency [Hz]	20	25	32	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25k	1.6k	2k	2.5k	3.15k	4k	5k	6.3k	8k	AP
1	P	Noise Level [dB(A)]	22	32	35	51	57	60	61	58	60	61	61	63	67	85	77	91	89	79	88	81	78	74	73	74	70	66	65	95
2	P		26	31	33	45	54	54	63	59	59	63	61	70	87	90	79	91	94	97	97	90	86	87	85	83	81	77	74	103
3	P		28	32	37	46	53	54	58	60	61	63	66	69	84	85	79	92	92	92	97	91	88	87	85	82	78	73	67	101
4	F		24	34	43	52	60	61	60	68	71	70	66	68	73	74	74	73	74	74	73	75	74	72	71	72	70	70	68	85
5	F		35	39	44	49	54	53	58	60	61	67	68	69	86	92	73	82	87	76	82	74	72	70	68	66	63	60	56	95
6	P		27	35	42	45	57	62	61	70	73	69	69	72	75	76	75	75	76	76	75	75	75	74	72	71	68	66	63	66
7	F		23	28	38	44	52	58	55	59	60	64	67	72	91	90	71	88	87	91	86	84	83	80	76	75	72	68	64	98
8	F		29	33	40	46	55	60	63	65	65	66	66	70	86	73	72	80	73	79	73	76	75	73	71	68	67	66	62	89
9	P		25	31	41	47	54	60	67	57	60	65	62	64	68	69	65	66	70	69	69	72	74	71	69	68	65	65	61	81
10	P		28	37	37	46	58	61	67	64	63	65	67	64	64	66	66	68	67	70	72	75	74	73	70	68	67	65	60	83
11	F		27	32	43	52	55	60	64	70	77	72	72	76	80	84	81	82	82	83	81	83	81	80	80	79	63	76	74	93
12	P		36	36	39	43	48	52	56	60	60	62	65	77	89	83	73	87	88	95	89	88	84	80	78	77	76	76	76	99

Note) Each frequency indicates center frequency of 1/3 octave band.
Value enclosed in heavy line indicates maximum one of each measurement.
Source : S-ESIMMS

Table 1.2-10 Results of 1/3 Octave Band Frequency Analysis of Railway Noise At M-2 In Marwar

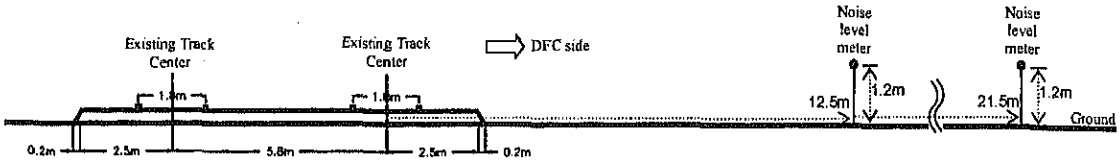
No.	train type	Frequency [Hz]	20	25	32	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25k	1.6k	2k	2.5k	3.15k	4k	5k	6.3k	8k	AP
1	P	Noise Level [dB(A)]	23	32	40	46	55	55	54	58	60	62	65	65	66	90	81	93	94	85	95	89	86	81	81	77	73	70	66	100
2	P		23	27	39	43	47	52	54	57	56	58	61	67	86	93	82	90	95	93	94	83	83	80	78	79	80	81	81	101
3	P		28	31	39	46	52	55	57	59	61	63	65	67	80	79	72	85	89	91	94	90	87	89	85	84	84	83	83	99
4	F		27	36	44	49	53	53	59	61	64	68	71	71	70	71	72	73	72	71	70	71	73	72	72	72	72	72	71	83
5	P		22	30	39	44	53	59	58	57	60	61	62	63	62	63	63	64	64	63	61	63	62	61	60	59	57	55	53	75
6	F		26	31	37	46	51	55	57	61	63	67	70	69	69	69	67	74	71	76	74	71	72	70	69	68	67	66	66	83
7	F		21	25	36	45	49	53	57	61	61	64	66	65	84	67	68	87	72	79	71	73	72	70	67	66	65	63	62	89
8	P		18	23	34	39	42	46	50	52	54	57	59	63	55	60	62	59	60	59	59	60	62	63	63	63	62	62	61	73
9	P		22	23	32	45	53	52	53	55	58	56	56	59	55	58	56	58	59	58	61	61	61	60	57	58	55	54	53	71
10	F		17	23	37	41	47	52	59	66	69	67	63	62	64	71	71	73	73	75	72	73	73	72	72	69	67	64	62	83
11	P		18	23	32	38	43	45	47	54	54	54	59	66	81	77	69	83	82	85	82	80	78	73	71	72	73	75	76	91
12	F		26	33	42	47	51	49	53	54	58	59	61	58	58	59	60	60	60	60	59	62	61	63	63	63	64	64	64	73

Note) Each frequency indicates center frequency of 1/3 octave band.
Value enclosed in heavy line indicates maximum one of each measurement.
Source : S-ESIMMS

(3) Ajmer

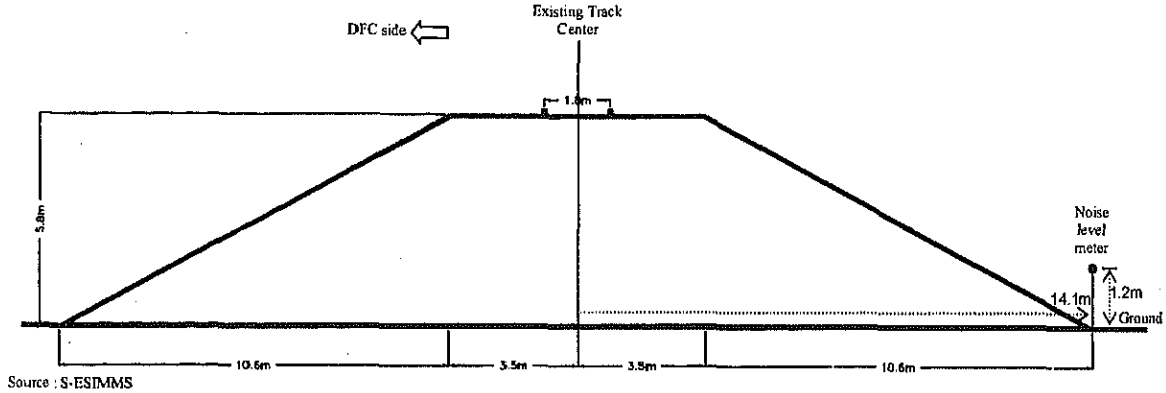
1) Cross-section View

Cross-section view of measurement site in Abu Road are given in Figure 1.2-5,Figure 1.2-6.



Source : S-ESIMMS

Figure 1.2-5 Cross-section view of A-1 Measurement Site in Ajmer



Source : S-ESIMMS

Figure1.2-6 Cross-section view of A-2 Measurement Site in Ajmer

2) Result of Background Noise

Results of background noise measurement in Ajmer is given in Table 1.2-11.

Table 1.2-11 Result of background noise measurement in Ajmer

Date	No.	Background Noise Level LAeq [dB(A)]				
		10:00~12:00	12:00~14:00	14:00~16:00	16:00~18:00	Overall 10:00~18:00
1-Sep	A-1	53	50	49	50	50
1-Sep	A-2	50	54	53	53	53

Source : S-ESIMMS

3) Result of Railway Noise Measurement

Results of railway noise measurement in Abu Road is given in Table 1.2-12, Table 1.2-13.

Table 1.2-12 Result of Railway noise measurement At A-1

No.	date	time	train type	train speed [km/hr]	train passage time [s]	measurement time [s]	train length [m]	train direction	Railway Noise level(dB)			
									LAE		LAmax	
									12.5m	21.5m	12.5m	21.5m
1	1-Sep	11:15	P	62.0	31.9	55.1	548	up	95.8	93.8	85.6	82.8
2	1-Sep	11:23	F	20.5	116.5	135.0	662	down	100.0	97.4	84.2	82.9
3	1-Sep	12:05	F	19.6	108.2	121.0	588	down	104.3	102.8	91.9	90.0
4	1-Sep	12:20	F	28.8	75.1	93.3	601	up	94.3	93.0	76.5	75.0
5	1-Sep	12:40	F	24.0	98.9	116.4	659	down	101.7	101.1	91.0	89.5
6	1-Sep	12:58	P	80.5	26.4	39.1	591	up	104.4	103.2	98.9	98.4
7	1-Sep	13:25	P	77.0	14.2	25.2	305	up	94.6	92.8	83.9	81.9
8	1-Sep	15:45	F	38.9	56.7	90.1	601	up	86.9	98.8	85.5	07.5
9	1-Sep	16:55	F	10.9	194.4	200.2	588	down	99.8	99.8	86.3	85.6
10	1-Sep	16:10	P	59.5	18.5	36.6	306	down	101.2	100.4	93.6	92.2
11	1-Sep	16:23	F	23.6	89.6	92.7	588	up	101.6	98.7	86.0	82.8
12	1-Sep	16:58	P	69.8	21.5	31.7	416	up	94.4	93.0	83.5	81.8
13	1-Sep	17:22	P	44.2	46.3	58.6	569	down	92.9	91.9	83.2	82.1
14	1-Sep	17:28	P	39.0	28.3	35.8	306	up	91.3	90.7	82.6	81.8
average		Passenger (P)		65.6	23.8	37.4	433	up	96.0	94.7	86.9	85.3
				51.8	30.4	47.6	437	down	97.1	96.2	88.4	87.2
		Freight (F)		30.4	70.6	92.0	597	up	94.3	93.8	82.7	85.1
				18.7	120.0	143.2	624	down	101.5	100.3	88.4	87.0

Note) P : passenger train F : freight train
up : to Mumbai down : to Delhi
train passage time (s): time until the back of the train passes after the head of the train passes at a certain point
measurement time (s): This indicates railway noise measurement time for LAE and LAmax in time that is 10dB or more higher than background noise.
average : value calculated by the simple arithmetic average in each up side passenger train, down side passenger train, up side freight train, down side freight train
Source : S-ESIMMS

Table 1.2-13 Result of Railway noise measurement At A-2

No.	date	time	train type	train speed [km/hr]	train passage time [s]	measurement time [s]	train length [m]	train direction	Railway Noise level(dB)	
									LAE	LAmax
									14.1m	14.1m
1	1-Sep	11:10	F	40.3	58.1	60.9	651	down	102.4	94.6
2	1-Sep	11:55	F	41.0	51.0	66.3	588	down	103.6	95.8
3	1-Sep	12:25	F	40.4	53.6	59.2	601	up	109.3	104.7
4	1-Sep	14:07	F	27.3	61.2	65.1	463	down	97.8	88.2
5	1-Sep	14:46	F	39.7	53.4	72.7	588	down	99.6	90.4
6	1-Sep	16:30	F	45.2	46.9	50.3	588	up	97.4	89.7
average		Freight (F)		42.8	50.0	54.8	595	up	103.4	97.2
				37.1	55.6	66.3	573	down	100.9	92.3

Note) P : passenger train F : freight train
up : to Mumbai down : to Delhi
train passage time (s): time until the back of the train passes after the head of the train passes at a certain point
measurement time (s): This indicates railway noise measurement time for LAE and LAmax in time that is 10dB or more higher than background noise.
average : value calculated by the simple arithmetic average in each up side passenger train, down side passenger train, up side freight train, down side freight train
Source : S-ESIMMS

4) Result of Frequency Analysis

Results of 1/3 octave band frequency analysis are given in Table1.2-14, Table1.2-15. In consideration of all results roughly frequency of the range from 630 to 2000 Hz excelled. In Japan, the main noise of train includes[1] (1) traction, (2)structures and (3) machines equipped to the train, and predominant frequency from each noise is said to be almost from 250 to 2000Hz as well. Therefore, result of predominant frequency was similar to the case in Japan, and this would be suitable value. In addition, in case of countermeasure (e.g. soundproof) for railway noise, Japanese countermeasure method might be available.

Table 1.2-14 Results of 1/3 Octave Band Frequency Analysis of Railway Noise At A-1 In Ajmer

No.	train type	Frequency [Hz]	25	32	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25k	1.6k	2k	2.5k	3.15k	4k	5k	6.3k	8k	AP
1	P	Noise Level [dB(A)]	33	40	49	52	52	56	62	59	64	67	67	62	62	66	70	70	70	70	72	73	76	75	76	77	76	75	85
2	F		48	53	58	64	59	61	64	66	66	67	67	68	69	70	71	73	73	75	77	76	75	73	72	70	68	63	85
3	F		42	53	58	60	65	69	74	78	73	75	77	79	80	81	80	82	80	80	82	81	80	78	77	77	76	73	92
4	F		36	42	48	54	57	56	58	61	61	58	58	58	59	61	62	62	62	61	64	64	64	63	63	67	58	53	75
5	F		39	44	53	62	63	65	71	75	74	70	71	75	79	79	79	78	79	79	79	80	81	79	77	80	77	75	91
6	P		40	46	54	56	64	63	71	74	72	74	73	80	77	80	85	90	94	89	89	84	85	81	80	78	76	75	98
7	P		37	39	46	48	50	54	58	59	62	62	65	64	66	69	71	73	72	69	69	70	70	69	68	65	62	58	81
8	F		38	40	49	53	60	64	69	67	67	68	71	68	73	74	73	73	73	75	77	78	77	75	73	72	72	69	86
9	F		38	46	48	54	64	62	69	69	66	69	68	69	73	73	74	74	73	75	77	77	75	74	72	71	71	69	86
10	P		37	42	52	59	67	71	67	75	74	68	70	74	78	82	83	81	82	85	85	82	82	81	80	78	77	75	93
11	F		42	49	54	61	62	61	64	65	67	66	69	71	65	67	69	71	70	69	71	71	72	71	70	70	68	63	82
12	P		43	43	45	48	57	72	59	60	69	67	65	67	69	73	73	72	71	69	70	70	68	67	66	62	59	55	82
13	P		34	37	43	48	49	53	56	58	61	60	60	71	63	66	80	71	78	68	65	66	65	63	61	58	55	52	83
14	P		42	41	49	53	61	67	66	66	67	67	64	64	68	69	70	68	69	72	75	74	72	69	69	67	64	61	82

Note) Each frequency indicates center frequency of 1/3 octave band.
Value enclosed in heavy line indicates maximum one of each measurement.
Source : S-ESIMMS

Table1.2-15 Results of 1/3 Octave Band Frequency Analysis of Railway Noise At A-2 In Ajmer

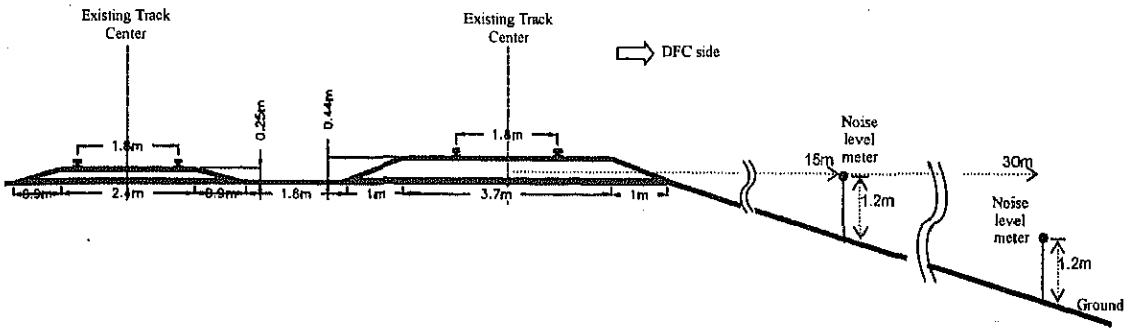
No.	train type	Frequency [Hz]	20	25	32	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25k	1.6k	2k	2.5k	3.15k	4k	5k	6.3k	8k	AP
1	F	Noise Level [dB(A)]	37	41	48	54	58	60	59	59	61	61	62	62	68	64	69	87	92	81	79	83	79	75	77	69	64	61	54	94
2	F		35	36	46	53	54	59	63	70	76	70	72	73	80	88	81	86	86	87	90	84	81	79	77	76	74	72	69	96
3	F		41	41	41	44	52	54	57	59	60	61	63	68	85	93	88	97	99	97	95	93	92	90	87	85	82	79	74	105
4	F		26	30	42	48	52	59	61	72	72	70	70	71	72	76	77	78	78	79	77	76	77	76	76	74	73	72	69	88
5	F		33	34	41	48	52	55	64	68	77	71	69	74	72	76	79	80	80	80	80	81	81	80	78	77	76	74	72	91
6	F		46	46	46	48	55	54	56	60	60	63	63	65	82	78	66	82	79	83	78	77	76	71	66	62	58	55	49	89

Note) Each frequency indicates center frequency of 1/3 octave band.
Value enclosed in heavy line indicates maximum one of each measurement.
Source : S-ESIMMS

(4) Kishangarh

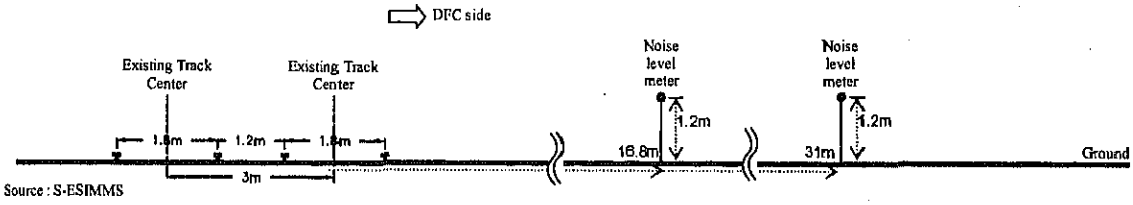
1) Cross-section View

Cross-section view of measurement site in Kishangarh are given in Figure1.2-7 and Figure1.2-8 and Figure1.2-9.



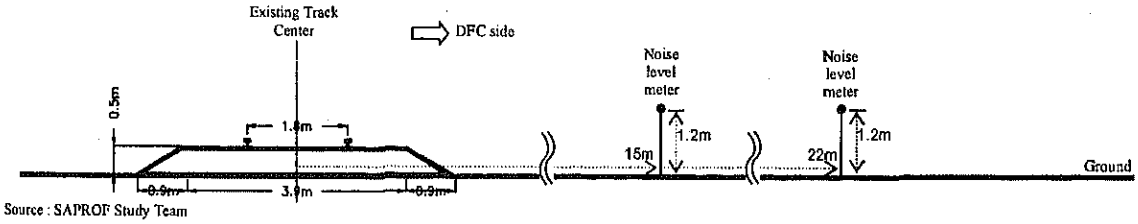
Source : S-ESIMMS

Figure1.2-7 Cross-section view of K-1 Measurement Site in Kishangarh



Source : S-ESIMMS

Figure1.2-8 Cross-section view of K-2 Measurement Site in Kishangarh



Source : SAPROF Study Team

Figure1.2-9 Cross-section view of K-3 Measurement Site in Kishangarh

2) Result of Background Noise Measurement

Results of background noise measurement in Kishangarh is given in Table1.2-16.

Table1.2-16 Result of background noise measurement in Kishangarh

Date	No.	Background Noise Level LAeq [dB(A)]				
		10:00~12:00	12:00~14:00	14:00~16:00	16:00~18:00	Overall 10:00~18:00
30-Aug	K-1	47	48	51	52	49
31-Aug	K-2	56	55	51	51	54
31-Aug	K-3	51	52	60	45	55

Source : SAPROF Study Team

3) Result of Railway Noise Measurement

Results of railway noise measurement in Kishangarh are given in Table 1.2-17 and Table 1.2-18 and Table1.2-19.

Table 1.2-17 Result of Railway noise measurement At K-1

No.	date	time	train type	train speed [km/hr]	train passage time [s]	measurement time [s]	train length [m]	train direction	Railway Noise level(dB)			
									LAE		LAmax	
									15.0m	30.0m	15.0m	30.0m
1	30-Aug	10:55	P	24.0	85.4	96.1	569	up	90.4	88.6	76.9	76.0
2	30-Aug	12:00	P	71.3	18.8	29.5	372	down	94.1	90.4	86.0	81.6
3	30-Aug	12:27	P	29.3	69.8	82.8	569	up	94.6	88.7	85.4	79.1
4	30-Aug	12:52	F	21.3	82.3	108.1	487	down	96.8	94.3	88.8	86.6
5	30-Aug	13:21	F	23.1	94.4	115.7	605	up	94.2	93.0	87.4	85.1
6	30-Aug	13:28	F	20.3	86.4	116.4	487	down	93.0	89.2	82.7	78.0
7	30-Aug	13:58	F	52.2	43.1	57.7	625	up	103.8	99.7	97.2	92.7
8	30-Aug	14:30	F	23.8	94.6	111.6	625	up	99.7	90.5	93.3	77.9
9	30-Aug	15:25	F	67.4	35.2	34.7	660	down	94.8	91.5	81.0	77.4
10	30-Aug	15:53	F	26.7	87.0	105.0	646	up	102.9	100.8	95.0	93.4
11	30-Aug	16:01	F	21.0	89.1	97.3	519	down	100.7	100.9	91.2	92.4
12	30-Aug	16:27	P	73.8	14.9	23.6	306	down	91.1	93.9	80.2	82.7
average		Passenger (P)		26.7	77.6	89.5	569	up	92.5	88.7	81.2	77.6
				72.5	16.9	26.6	339	down	92.6	92.2	83.1	82.2
		Freight (F)		31.4	79.8	97.5	625	up	100.1	96.0	93.2	87.3
				32.5	73.2	89.1	538	down	96.3	94.0	85.0	83.4

Note) P : passenger train F : freight train
up : to Mumbai down : to Delhi
train passage time (s): time until the back of the train passes after the head of the train passes at a certain point
measurement time (s): This indicates railway noise measurement time for LAE and LAmax in time that is 10dB or more higher than background noise.
average : value calculated by the simple arithmetic average in each up side passenger train, down side passenger train, up side freight train, down side freight train
Source : S-ESIMMS

Table 1.2-17 Result of Railway noise measurement At K-2

No.	date	time	train type	train speed [km/hr]	train passage time [s]	measurement time [s]	train length [m]	train direction	Railway Noise level(dB)			
									LAE		LAmax	
									15.0m	30.0m	15.0m	30.0m
1	31-Aug	10:01	F	15.7	109.2	127.3	476	down	92.1	87.7	78.5	70.4
2	31-Aug	10:08	F	29.4	57.0	69.8	466	up	96.9	93.8	82.4	79.5
3	31-Aug	10:25	F	37.9	56.1	57.6	592	up	109.2	105.0	101.2	97.8
4	31-Aug	10:48	P	48.1	47.5	70.3	569	up	101.7	97.7	92.3	89.4
5	31-Aug	11:30	F	50.8	36.0	47.1	508	up	111.3	103.2	106.1	96.5
6	31-Aug	12:26	P	38.7	60.8	96.7	569	up	96.7	91.1	84.4	78.7
7	31-Aug	13:49	F	38.5	47.8	60.2	444	down	108.3	104.9	100.1	97.7
8	31-Aug	14:46	P	37.5	54.6	85.8	569	down	105.6	100.8	97.9	93.4
9	31-Aug	15:13	F	44.0	37.3	48.0	455	down	113.6	108.9	107.8	103.3
10	31-Aug	16:23	P	45.1	15.7	30.0	197	down	112.4	105.2	107.3	99.6
average		Passenger (P)		38.4	54.1	83.6	569	up	99.2	94.4	86.4	84.1
				41.3	35.2	57.0	383	down	109.0	103.0	102.6	96.5
		Freight (F)		39.4	49.7	58.2	522	up	105.8	100.7	96.6	91.3
				31.1	64.7	78.5	468	down	104.7	100.5	95.5	90.5

Note) P : passenger train F : freight train
up : to Mumbai down : to Delhi
train passage time (s): time until the back of the train passes after the head of the train passes at a certain point
measurement time (s): This indicates railway noise measurement time for LAE and LAmax in time that is 10dB or more higher than background noise.
average : value calculated by the simple arithmetic average in each up side passenger train, down side passenger train, up side freight train, down side freight train
Source : S-ESIMMS

Table 1.2-19 Result of Railway noise measurement At K-3

No.	date	time	train type	train speed [km/hr]	train passage time [s]	measurement time [s]	train length [m]	train direction	Railway Noise level(dB)			
									LAE		LAmax	
									15.0m	30.0m	15.0m	30.0m
1	31-Aug	10:03	F	15.7	109.2	121.8	476	down	104.6	101.9	98.4	96.1
2	31-Aug	10:09	F	29.4	57.0	68.2	466	up	100.9	95.4	90.4	84.4
3	31-Aug	10:27	F	37.9	44.2	78.0	466	up	98.9	95.9	93.3	89.8
4	31-Aug	10:49	P	43.1	47.5	64.6	560	up	101.7	100.0	94.0	92.0
5	31-Aug	10:30	F	50.8	36.0	49.1	508	up	104.2	104.0	95.4	97.1
6	31-Aug	12:27	P	33.7	60.8	79.8	569	up	112.4	110.2	103.5	100.7
7	31-Aug	12:39	P	38.1	20.0	37.3	306	up	109.3	106.9	103.8	100.8
8	31-Aug	12:57	P	43.3	25.5	37.0	306	down	90.6	92.3	78.3	88.0
9	31-Aug	13:25	F	61.9	26.5	48.9	455	up	108.0	106.7	100.2	100.2
10	31-Aug	13:50	F	33.6	47.8	61.2	444	down	108.8	106.9	101.1	97.8
11	31-Aug	14:47	P	37.5	54.6	60.7	569	down	109.2	96.5	98.8	88.3
12	31-Aug	15:14	F	44.0	37.3	53.6	455	down	107.4	105.1	102.4	99.8
13	31-Aug	16:23	P	45.1	12.6	22.3	158	down	94.9	92.3	88.8	81.2
average		Passenger (P)		38.8	46.7	60.6	481	up	107.8	105.7	100.4	97.8
				42.0	30.9	40.0	344	down	96.2	93.7	85.6	85.8
		Freight (F)		44.6	42.2	60.8	492	up	102.7	100.4	94.7	92.7
				31.1	64.7	78.9	458	down	106.9	104.6	100.6	97.7

Note) P : passenger train F : freight train
up : to Mumbai down : to Delhi
train passage time (s): time until the back of the train passes after the head of the train passes at a certain point
measurement time (s): This indicates railway noise measurement time for LAE and LAmax in time that is 10dB or more higher than background noise.
average : value calculated by the simple arithmetic average in each up side passenger train, down side passenger train, up side freight train, down side freight train .
Source : SAPROF Study Team

4) Result of Frequency Analysis

Results of 1/3 octave band frequency analysis are given in Table 1.2-20, Table 1.2-21 and Table1.2-22. At K-1, frequency of the range from 500 to 2000 Hz excelled. And at K-2, frequency of the range from 630 to 2000 Hz excelled. And at K-3, frequency of the range from 800 to 2500Hz excelled. In Japan, the main noise of train includes[1] (1)traction, (2)structures and (3) machines equipped to the train, and predominant frequency from each noise is said to be almost from 250 to 2000 Hz as well. Therefore, result of predominant frequency at K-1 and K-2 was similar to the case in Japan, and this would be suitable value. In addition, in case of countermeasure (e.g. soundproof) for railway noise, Japanese countermeasure method might be available. On the contrary, at K-3, it is necessary to consider measures of the frequency of 2000 Hz or more.

Table 1.2-20 Results of 1/3 Octave Band Frequency Analysis of Railway Noise At K-1 In Kishangarh

No.	train type	Frequency [Hz]	20	25	32	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25k	1.6k	2k	2.5k	3.15k	4k	5k	6.3k	8k	AP
1	P	Noise Level [dB(A)]	23	37	45	45	51	54	58	59	60	65	69	66	67	66	66	65	64	64	62	62	63	61	60	58	56	55	51	77
2	P		28	35	45	48	55	59	62	70	65	65	68	70	72	75	76	75	76	76	74	75	75	74	72	70	68	66	63	86
3	P		23	28	32	40	46	44	50	55	57	59	57	62	59	66	62	61	82	66	74	72	63	60	59	58	55	53	50	85
4	F		14	28	31	47	47	55	57	62	71	67	63	69	74	73	73	72	75	74	73	72	71	70	70	71	88	74	68	90
5	F		19	30	35	40	48	46	48	53	55	57	61	65	81	63	62	76	71	80	83	77	69	68	66	64	60	57	53	88
6	F		17	28	36	43	46	61	58	67	67	64	62	68	70	73	74	71	72	72	71	71	69	67	67	66	67	64	61	82
7	F		24	33	35	42	50	52	61	81	59	58	61	73	82	89	76	80	89	84	91	87	86	84	81	80	77	75	72	97
8	F		24	34	38	45	52	52	55	55	56	56	55	61	73	77	66	85	89	83	80	85	90	81	82	75	79	67	63	95
9	F		25	32	36	43	49	50	56	57	60	64	67	64	66	68	67	68	88	70	68	68	69	68	67	66	64	62	59	79
10	F		24	32	37	44	48	54	59	60	61	63	63	75	77	87	74	76	87	88	91	86	81	80	80	79	76	75	73	96
11	F		17	27	34	39	52	53	58	63	61	61	61	67	82	65	68	82	76	85	87	79	77	73	71	69	66	65	62	92
12	P		22	31	34	40	51	57	54	59	59	61	62	66	66	69	69	69	72	69	67	68	67	66	63	61	60	61	58	79

Note) Each frequency indicates center frequency of 1/3 octave band.
Value enclosed in heavy line indicates maximum one of each measurement.
Source : S-ESIMMS

Table 1.2-21 Results of 1/3 Octave Band Frequency Analysis of Railway Noise At K-2 In Kishangarh

No.	train type	Frequency [Hz]	20	25	32	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25k	1.6k	2k	2.5k	3.15k	4k	5k	6.3k	8k	AP
1	F	Noise Level [dB(A)]	22	35	36	42	50	49	48	50	53	56	56	60	70	56	66	78	66	68	66	66	66	63	60	58	56	54	52	80
2	F		28	42	46	46	52	54	57	63	66	67	69	74	66	68	69	70	71	72	72	72	72	71	71	70	69	66	67	83
3	F		34	40	50	52	55	66	68	75	76	73	74	76	81	91	83	87	95	87	94	95	91	86	84	83	81	79	78	101
4	P		31	42	47	50	54	63	64	75	76	73	73	76	81	82	79	81	83	80	80	81	82	81	80	81	81	82	82	92
5	F		33	37	44	52	59	61	62	65	71	76	73	69	83	89	87	92	100	98	98	92	94	92	90	88	87	86	84	105
6	P		32	41	43	53	57	61	65	68	66	67	72	72	70	71	72	72	74	75	73	74	75	72	71	69	68	66	65	84
7	F		34	42	43	45	46	54	55	63	68	69	66	69	79	83	84	87	94	96	89	85	88	87	82	79	75	72	69	100
8	P		32	37	36	39	46	50	55	58	62	62	66	66	75	62	66	88	91	95	86	81	82	82	74	69	63	56	53	98
9	F		29	43	45	46	49	54	59	61	70	69	71	69	78	91	97	103	92	100	100	97	96	93	90	89	87	86	84	108
10	P		36	37	46	49	53	54	58	63	70	72	72	72	71	79	75	98	105	81	93	99	91	87	89	89	88	86	88	107

Note) Each frequency indicates center frequency of 1/3 octave band.
Value enclosed in heavy line indicates maximum one of each measurement.
Source : S-ESIMMS

Table 1.2-22 Results of 1/3 Octave Band Frequency Analysis of Railway Noise At K-3 In Kishangarh

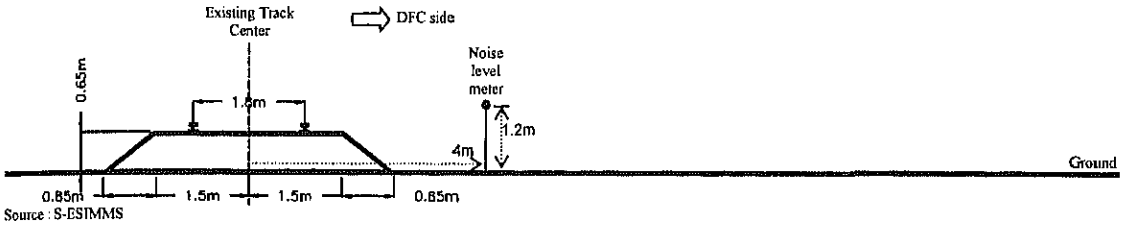
No.	train type	Frequency [Hz]	20	25	32	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25k	1.6k	2k	2.5k	3.15k	4k	5k	6.3k	8k	AP
1	F	Noise Level [dB(A)]	23	32	40	46	51	49	52	52	57	56	58	73	87	66	77	91	84	90	89	93	89	85	81	79	76	71	67	99
2	F		31	38	46	51	56	59	65	69	70	67	69	79	76	75	78	77	78	79	77	80	78	78	77	78	76	77	74	90
3	F		32	34	41	50	53	56	61	60	62	64	65	71	79	86	75	76	89	79	80	86	84	76	77	74	73	70	67	93
4	P		28	35	43	52	52	62	65	71	76	71	78	81	83	83	81	82	82	82	81	82	83	84	82	81	81	79	77	94
5	F		33	41	47	53	62	68	63	68	75	77	76	77	80	79	78	82	82	81	81	82	81	83	83	83	86	81	77	94
6	P		25	36	46	45	58	63	63	67	67	75	71	72	79	92	79	92	101	82	90	95	90	86	85	83	78	75	71	104
7	P		31	35	40	48	59	69	71	70	73	71	74	74	78	85	78	92	102	83	86	96	88	86	86	85	82	80	78	104
8	P		36	36	40	46	53	50	54	58	59	59	63	65	64	65	88	88	88	67	66	87	69	66	65	63	61	58	54	76
9	F		33	44	46	56	56	61	65	71	78	73	74	79	86	94	92	88	91	90	89	86	87	86	83	79	78	77	74	100
10	F		31	33	42	49	53	54	57	60	61	63	67	73	87	86	86	87	95	96	86	85	88	87	82	78	75	72	67	101
11	P		25	26	32	37	43	45	49	51	54	53	57	62	82	64	61	80	88	91	81	78	76	78	71	68	63	57	51	94
12	F		25	30	33	44	46	43	48	47	52	56	57	64	85	85	93	94	85	94	93	90	90	89	86	84	80	78	75	101
13	P		30	32	37	42	47	48	49	52	54	55	60	60	61	67	70	70	73	72	70	71	72	70	89	66	65	62	60	81

Note) Each frequency indicates center frequency of 1/3 octave band.
Value enclosed in heavy line indicates maximum one of each measurement.
Source : S-ESIMMS

(5) Narnaul

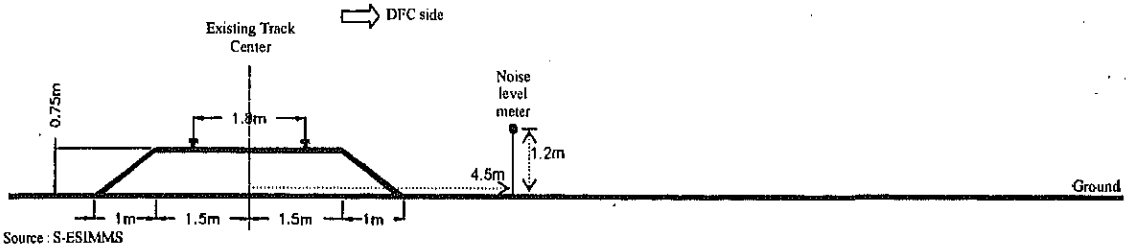
1) Cross-section View

Cross-section view of measurement site in Abu Road are given in Figure 1.2-10, Figure1.2-11 and Figure1.2-12.



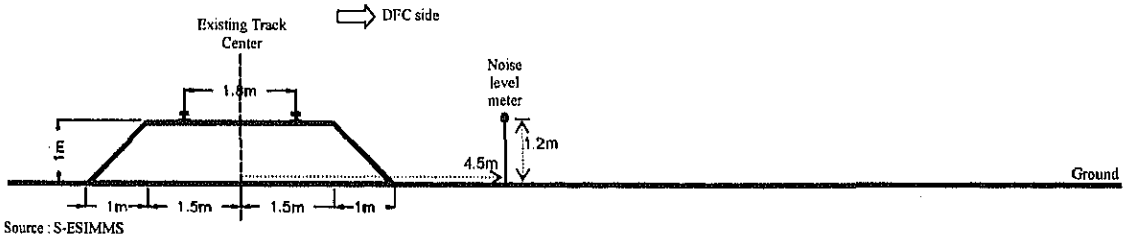
Source : S-ESIMMS

Figure1.2-10 Cross-section view of N-1 Measurement Site in Narnaul



Source : S-ESIMMS

Figure1.2-11 Cross-section view of N-2 Measurement Site in Narnaul



Source : S-ESIMMS

Figure1.2-12 Cross-section view of N-3 Measurement Site in Narnaul

2) Result of Background Noise

Results of background noise measurement in Narnaul is given in Table 1.2-23.

Table 1.2-23 Result of background noise measurement in Narnaul

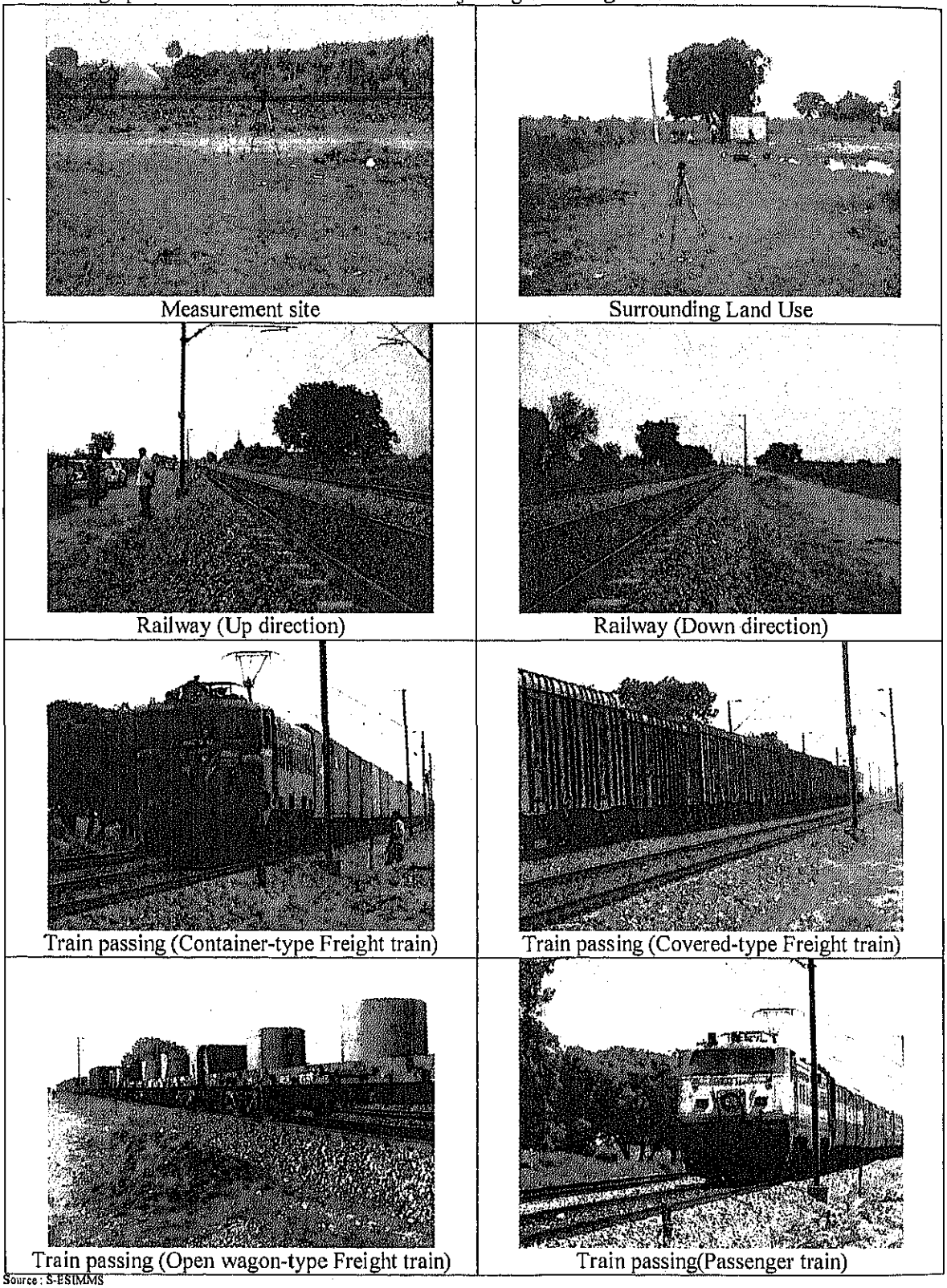
Date	No.	Background Noise Level LAeq [dB(A)]				
		10:00~12:00	12:00~14:00	14:00~16:00	16:00~18:00	Overall 10:00~18:00
28-Aug	N-1	51	49	52	51	51
28-Aug	N-2	54	53	54	54	54
28-Aug	N-3	49	49	47	47	48

Source : SAPROF Study Team

2. Unit Level Measurement

2-1 Photographs on Unit Level Measurement At Khurja

Photographs on unit level measurement at Khurja are given in Figure 2.1-1.



Source : S-ESIMMS

Figure 2.1-1 Photographs on unit level measurement At Khurja

2-2 Unit Noise Level of Freight Train

(1) Results of LAE, LAmax, PWL, Distance Attenuation of Freight Train

Results of railway noise (LAE, LAmax) of freight train are given in Table 2.2-1.
Power levels (PWL) were calculated with equation proposed by Railway Technical Research Institute of Japan in 1996. In addition, in order to reduce influence of extra attenuation as much as possible, LAEs measured at the nearest point from railway were used to calculate PWL. Equation used to calculate PWL is shown below.

●Relational expression of Measured LAE and PWL

$$LAE = PWL - 5 + 10\log_{10}(\pi s/2v) - 10\log_{10}d$$

L_{AE}: Exposure sound level of measured at the nearest point from railway [dB(A)]
PWL: Power level [dB(A)]
d: Distance between measurement point and center of the railway [m]
s: The length of train [m]
v: Speed of train [m/s]
source: Railway Technical Research Institute of Japan in 1996[2]

And, in general, negative correlation between noise level and distance from source of the noise is known as distance attenuation. As well, in this study, in order to confirm distance attenuation of railway noise generated by freight train, relation between LAmax and logarithm of the distance were confirmed by calculating distance attenuation approximation. Explanation of distance attenuation approximation is shown below. Distance attenuation coefficient and correlation coefficient of each approximation is shown below.

● Distance Attenuation Approximation of Freight Train

$$Lp = -a \times \log_{10}(d) + b \qquad R = -1 \sim 1$$

L_p: Noise level measured at the nearest point from railway [dB(A)]
(In this study, LAmax was used as L_p.)
a : Distance attenuation coefficient of approximation
b : Intercept of approximation
d : Distance between each measurement point and center of the railway [m]
R : Correlation coefficient of approximation
(A positive correlation is strong when it is near one, a negative correlation is strong when it is near minus one.)

Results of calculation of PWL and distance attenuation are given in Table 2.2-1.

Table 2.2-1 Results of Railway Noise Measurement of Freight Train At Khurja

No.	date	time	cargo type	train speed [km/hr]	train passage time [s]	train length [m]	train direction	Railway Noise Level(dB) LAE 12.5m	LAE 25.0m	LAE 37.5m	LAE 50.0m	LAE 62.5m	LAmax 12.5m	LAmax 25.0m	LAmax 37.5m	LAmax 50.0m	LAmax 62.5m	PWL [dB(A)]	distance attenuation coefficient	distance attenuation correlation
1	21-Aug	15:20	container	46	50	638	up	96	90	89	86	85	81	75	74	70	70	93	-16.7	-0.989
2	21-Aug	18:35	open	43	56	666	up	95	90	88	86	85	84	78	75	73	70	91	-19.6	-0.997
3	22-Aug	14:51	open	60	36	656	up	98	94	92	90	90	86	81	78	75	74	97	-16.7	-0.998
4	23-Aug	9:26	open	57	41	656	up	96	91	90	88	87	82	77	75	74	73	94	-12.2	-0.987
5	23-Aug	10:23	container	46	50	646	up	95	90	89	86	86	84	77	77	73	74	92	-14.6	-0.957
6	23-Aug	12:14	open	56	42	646	up	97	92	91	89	88	86	80	78	76	76	94	-12.4	-0.956
7	23-Aug	13:27	container	56	41	646	up	97	93	93	90	87	83	79	78	75	75	94	-11.0	-0.986
8	23-Aug	14:13	open	67	35	656	up	100	96	94	92	91	91	85	83	80	79	99	-16.2	-0.996
9	23-Aug	15:28	container	50	48	666	up	94	89	88	85	84	77	74	73	71	71	91	-9.2	-0.982
10	23-Aug	16:55	container	84	28	646	up	94	90	89	86	85	82	77	76	73	72	94	-14.2	-0.990
11	24-Aug	11:38	open	42	46	533	up	92	87	87	86	86	79	74	75	72	77	89	-3.8	-0.410

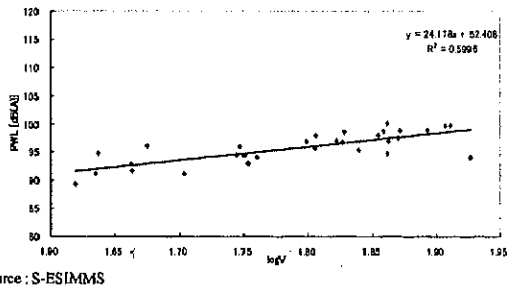
No.	date	time	cargo type	train speed [km/hr]	train passage time [s]	train length [m]	train direction	Railway Noise Level(dB) LAE 17.4m	LAE 29.9m	LAE 42.4m	LAE 54.9m	LAE 67.4m	LAmax 17.4m	LAmax 29.9m	LAmax 42.4m	LAmax 54.9m	LAmax 67.4m	PWL [dB(A)]	distance attenuation coefficient	distance attenuation correlation
1	21-Aug	16:49	open	43	45	540	down	96	92	91	89	88	81	77	75	73	71	95	-17.1	-0.999
2	21-Aug	17:14	covered	57	36	569	down	93	89	88	85	84	79	75	73	71	70	93	-16.0	-0.997
3	21-Aug	17:26	open	64	31	550	down	97	94	93	91	89	83	79	79	76	75	98	-13.6	-0.988
4	21-Aug	17:35	open	82	29	646	down	99	95	93	91	90	86	82	80	77	76	100	-16.8	-0.996
5	21-Aug	17:52	open	73	33	646	down	98	93	92	90	89	84	79	78	75	74	98	-16.0	-0.994
6	21-Aug	18:02	open	74	31	646	down	98	91	92	90	89	86	81	79	76	75	99	-17.8	-0.996
7	22-Aug	13:36	open	56	31	476	down	95	92	91	89	91	82	79	77	75	76	96	-12.3	-0.967
8	22-Aug	13:59	open	74	32	656	down	97	94	92	90	90	84	80	78	76	76	97	-15.0	-0.981
9	22-Aug	15:21	open	47	44	572	down	97	94	93	91	90	82	79	77	75	74	96	-14.2	-0.998
10	23-Aug	7:54	open	81	29	656	down	99	95	94	91	91	86	81	80	77	76	100	-16.4	-0.991
11	23-Aug	9:22	open	76	30	656	down	98	94	94	91	90	85	81	80	77	76	99	-14.4	-0.992
12	23-Aug	9:31	open	73	32	656	down	97	93	92	90	90	82	78	77	75	75	97	-12.3	-0.987
13	23-Aug	9:46	open	67	25	489	down	96	92	91	88	88	82	78	77	75	74	97	-13.8	-0.987
14	23-Aug	10:17	container	73	33	669	down	94	91	90	88	87	81	77	76	73	72	95	-15.6	-0.995
15	23-Aug	11:58	open	64	37	656	down	96	92	91	89	88	83	79	77	74	74	96	-16.0	-0.996
16	23-Aug	12:10	open	63	34	598	down	97	93	92	89	89	87	82	80	77	76	97	-19.7	-0.995
17	23-Aug	14:22	open	72	33	656	down	98	95	94	91	90	85	81	80	77	76	99	-14.7	-0.987
18	24-Aug	9:57	covered	73	21	476	down	98	94	94	91	91	87	83	86	80	79	100	-12.4	-0.832
19	24-Aug	10:34	covered	69	32	612	down	95	91	91	89	90	83	79	82	81	79	95	-4.7	-0.518
Up Side average								96	91	90	88	87	83	78	77	74	73	93	-14.3	
Down side average								97	93	92	90	89	84	79	76	75	75	97	-15.2	
Over all average																		96	-14.9	

Note) up : to Delhi down : to kolkata
average : value calculated by simple arithmetic average without measurement value the correlation of which is not good
coefficient: This value indicates a distance attenuation coefficient of approximation.
correlation: This value indicates a correlation coefficient of distance attenuation approximation. (A positive correlation is strong when it is near one, a negative correlation is strong when it is near minus one.)
Source : S-ESIMMS

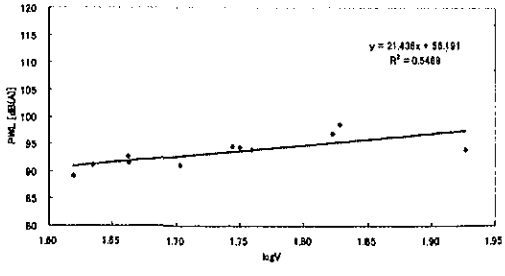
(2) Correlation Between Logarithm of Freight Train Speed and PWL

In Japan, positive correlation between logarithm of train speed and PWL of train are known. And measured train-speeds and calculated PWLs were confirmed whether there is correlation or not as well. Correlation diagram of upside, downside, and both side respectively were shown in Figure 2.2-1, Figure 2.2-2, and Figure 2.2-3.

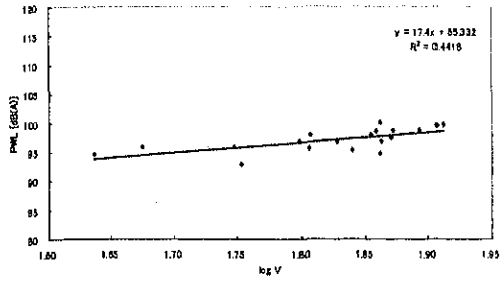
As a result, the approximation type was different respectively. As this main reason, it is thought that bias of the distribution of the speed at each direction influence. Therefore, in noise prediction of DFC, in order to reduce the influence of the distribution of the speed as much as possible, as calculation of power level of DFC, the approximation of both side (up and down side) was used.



Source : S-ESIMMS
Figure 2.2-1 Correlation Between PWL And logV Of Freight Train(up and down, n=30))



Source : S-ESIMMS
Figure 2.2-2 Correlation Between PWL And logV Of Freight Train(up, n=11))

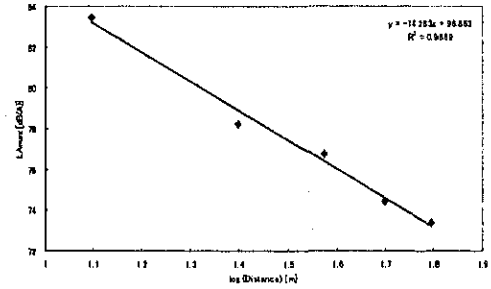


Source : S-ESIMMS

Figure 2.2-3 Correlation between PWL and logV Of Freight Train (down, n=19))

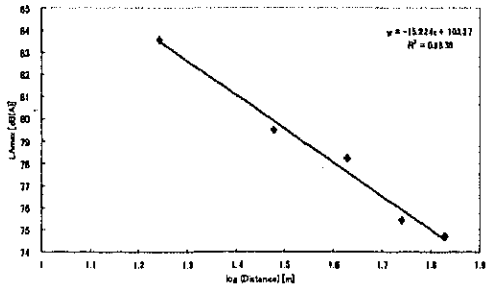
(3) Distance Attenuation for Freight Train

Correlation diagram between LAmax and logarithm of the distance of upside and downside respectively were shown in Figure 2.2-4 and Figure 2.2-5. As a result, each distance attenuation coefficient of approximation of up side and down side were almost same value. Therefore, in noise prediction of DFC, average value (=14.9) of distance attenuation coefficient of both side (up and down side) was used.



Source : S-ESIMMS

Figure 2.2-4 Correlation Between LAmax and logD Of Freight Train (up average, n=10))



Source : S-ESIMMS

Figure 2.2-5 Correlation Between LAmax and logD Of Freight Train (down average, n=18)

(4) Frequency Analysis for Freight Train

Results of 1/3 octave band frequency analysis are given in Table 2.2-2. Results indicated that frequency of about 400 to 1600Hz excelled .In Japan, the main noise of train includes[1] (1)traction, (2)structures and (3) machines equipped to the train, and predominant frequency from each noise is said to be almost from 250 to 2000Hz as well. Therefore, result of predominant frequency in this study was similar to the case in Japan, and this would be suitable value. In addition, in case of countermeasure (e.g. soundproof) for railway noise, Japanese countermeasure method might be available.

Table 2.2-2 Results of 1/3 Octave Band Frequency Analysis of Freight Train Noise At Khurja

No.	train direction	Frequency [Hz]	20	25	32	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25k	1.6k	2k	2.5k	3.15k	4k	5k	6.3k	8k	AP
1	up		20	29	38	44	47	45	47	51	56	60	64	63	64	69	71	68	66	63	61	61	62	60	59	56	57	58	56	77
2	up		20	23	35	41	43	46	48	55	57	61	63	65	67	68	66	62	60	61	63	68	65	64	61	59	57	54	52	76
3	up		20	28	38	43	49	62	65	64	65	68	68	70	71	72	70	68	67	68	66	70	72	70	68	67	65	62	59	82
4	up		21	24	32	44	55	51	53	55	59	63	66	66	68	69	67	64	63	65	68	71	70	69	68	65	66	65	61	80
5	up		36	37	40	47	49	46	47	50	57	60	62	61	61	65	67	65	63	60	59	61	62	60	59	56	54	52	49	75
6	up		37	37	37	39	47	51	55	58	60	63	66	66	68	68	66	64	64	66	65	68	68	67	65	64	62	61	59	78
7	up		21	31	39	48	54	56	61	60	62	62	61	65	69	67	67	67	69	69	67	71	70	69	68	67	66	63	59	80
8	up		19	24	33	39	51	61	57	57	62	65	67	69	71	70	69	67	68	69	72	77	74	73	73	70	72	70	67	84
9	up		21	24	33	43	45	47	46	49	56	59	63	63	64	69	72	69	67	64	64	64	67	63	63	59	59	56	53	78
10	up		20	25	36	42	47	52	56	58	58	62	67	67	67	69	71	69	68	68	69	70	71	71	70	67	67	64	62	81
11	up		35	34	36	42	45	51	56	61	62	63	63	64	65	65	64	61	60	61	60	63	62	61	60	58	55	53	50	75
1	down		19	22	28	41	47	52	59	60	64	64	66	68	68	65	63	62	62	63	65	68	68	67	68	64	64	62	67	78
2	down		17	26	30	37	47	52	55	58	60	64	61	65	66	65	61	59	60	61	62	66	66	66	65	64	62	60	59	76
3	down		18	21	32	41	51	56	61	62	65	66	70	71	72	70	67	66	67	69	69	72	71	71	70	68	67	64	63	82
4	down	Noise Level [dB(A)]	28	34	37	43	50	56	60	58	62	63	62	65	69	69	69	68	71	71	70	74	72	71	69	69	67	64	61	82
5	down		19	32	40	47	52	58	59	60	62	66	64	67	70	69	69	66	70	71	70	75	73	71	70	69	67	64	61	82
6	down		25	29	39	48	52	58	61	62	64	65	65	66	70	69	69	69	71	71	70	73	74	72	70	70	67	64	61	82
7	down		36	35	34	38	46	52	58	59	61	61	61	65	70	68	64	63	63	64	64	67	68	69	69	68	66	64	61	79
8	down		33	34	39	47	53	58	60	60	65	63	62	65	69	68	66	68	69	70	69	73	73	71	70	70	68	65	62	82
9	down		18	22	27	41	47	52	58	61	65	67	68	71	71	68	65	64	64	66	69	71	71	69	69	67	66	63	60	81
10	down		29	33	41	48	51	57	62	61	64	65	65	69	71	71	70	71	73	74	73	77	76	74	73	72	69	67	63	85
11	down		32	32	40	49	52	60	63	64	66	65	65	67	71	71	70	70	72	72	71	74	74	72	71	70	68	65	62	83
12	down		24	31	40	47	52	54	59	58	61	61	61	64	68	69	69	69	71	70	68	72	71	69	68	68	65	62	58	81
13	down		31	30	34	41	46	53	56	57	62	62	61	65	70	69	68	69	70	69	68	73	72	70	69	66	66	63	60	81
14	down		39	42	46	52	58	58	56	56	60	60	61	61	63	67	68	67	68	68	67	68	68	68	67	66	64	61	58	79
15	down		32	34	39	45	51	56	59	60	63	63	62	64	68	66	65	66	68	68	68	71	70	69	68	67	66	62	59	80
16	down		33	32	33	37	45	51	51	55	62	60	59	62	66	67	65	66	68	67	65	69	69	68	67	66	64	60	57	78
17	down		20	30	41	49	51	56	59	61	63	63	64	67	70	69	68	69	71	71	70	75	73	71	71	71	68	64	62	83
18	down		25	30	40	46	53	57	63	62	63	64	64	67	73	73	72	72	74	74	73	78	77	73	73	72	69	65	63	85
19	down		26	28	36	41	52	56	57	58	61	61	62	65	67	67	64	63	63	65	64	68	69	68	67	66	65	62	59	78

Note) Each frequency indicates center frequency of 1/3 octave band.
Value enclosed in heavy line indicates maximum one of each measurement.
Source : S-ESIMMS

2-3 Unit Noise Level of Passenger Train

(1) Results of LAE, LAmax, PWL, Distance Attenuation of Passenger Train

Results of railway noise (LAE, LAmax) of passenger train are given in Table 2.3-1.
As well as freight train, PWL of passenger was calculated by equation proposed by Railway Technical Research Institute of Japan in 1996. However, for safety noise generated by passenger train have been included whistle frequently. So it was difficult to measure LAE of passenger train due to whistle. And so by use of relation equation between LAmax and LAE , LAE of passenger train was calculated by LAmax obtained in the time when whistle wasn't honked. Relation equation between LAmax and LAE was given below.

●Relational Expression of Measured LAE and PWL

$$LAE = PWL - 5 + 10\log_{10}(\pi s/2v) - 10\log_{10}d$$

L_{AE}: Exposure sound level of measured at the nearest point from railway [dB(A)]
PWL: Power level [dB(A)]
d: Distance between measurement point and center of the railway [m]
s: The length of train [m]
v: Speed of train [m/s]
source: Railway Technical Research Institute of Japan in 1996

●Relational Expression of Measured LAE

$$LAE \fallingdotseq LAmax + 10\log(s/v)$$

L_{AE}: Exposure sound level [dB(A)]
LAmax: Maximum sound level [dB(A)]
s: Length of train [m]
v: Speed of train [m/s]
source: Railway Technical Research Institute of Japan in 1996

As well as freight train, distance attenuation coefficient and correlation coefficient of each approximation were calculated as shown in Table 2.3-1.

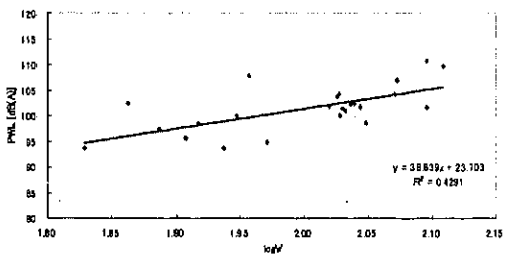
Table 2.3-1 Results of Railway Noise Measurement of Passenger Train At Khurja

No.	date	time	train speed [km/hr] V	train passage time [s]	train length [m]	train direction	Railway Noise Level(dB) LAmax 12.5m	25.0m	37.5m	50.0m	62.5m	LAE [dB(A)]	PWL [dB(A)]	distance attenuation coefficient	distance attenuation correlation
1	22-Aug	12:52	106	17	504	up	90	85	85	82	80	102	104	-13.2	-0.968
2	22-Aug	13:39	128	12	416	up	96	91	89	86	85	106	110	-16.0	-0.994
3	22-Aug	14:20	111	16	504	up	88	82	81	78	77	100	102	-16.0	-0.995
4	23-Aug	9:35	67	22	416	up	80	74	74	73	70	93	94	-12.4	-0.966
5	23-Aug	9:56	90	17	416	up	94	88	86	83	82	106	108	-17.4	-0.993
6	23-Aug	11:11	107	19	548	up	90	85	84	80	79	103	104	-16.5	-0.985
7	23-Aug	12:54	105	17	504	up	88	82	81	78	77	100	102	-16.4	-0.983
8	23-Aug	16:06	77	24	504	up	83	78	76	72	71	97	97	-17.9	-0.985
9	24-Aug	10:15	109	18	548	up	88	82	80	77	77	101	102	-16.7	-0.990
10	24-Aug	11:19	73	26	526	up	88	82	80	78	76	102	102	-17.6	-0.994
No.	date	time	train speed [km/hr] V	train passage time [s]	train length [m]	train direction	Railway Noise level(dB) LAmax 17.4m	29.9m	42.4m	54.9m	67.4m	LAE [dB(A)]	PWL [dB(A)]	distance attenuation coefficient	distance attenuation correlation
1	21-Aug	15:33	93	11	284	down	79	74	73	71	69	90	95	-16.3	-0.992
2	21-Aug	16:12	107	18	526	down	86	81	79	75	75	98	101	-19.0	-0.990
3	21-Aug	16:19	112	16	482	down	83	78	78	75	74	95	99	-15.2	-0.984
4	22-Aug	7:42	125	11	394	down	95	91	89	87	86	106	111	-14.9	-0.993
5	22-Aug	14:28	83	23	526	down	83	79	77	74	73	97	98	-17.0	-0.998
6	23-Aug	8:23	108	18	548	down	85	81	80	83	77	98	101	-10.8	-0.791
7	23-Aug	9:12	89	22	548	down	84	80	79	76	76	98	100	-15.6	-0.989
8	23-Aug	15:30	118	13	416	down	89	85	84	81	80	100	104	-14.3	-0.982
9	23-Aug	15:58	87	12	284	down	78	75	74	71	70	89	94	-13.6	-0.983
10	23-Aug	16:23	125	16	570	down	86	82	81	78	78	98	102	-13.8	-0.979
11	23-Aug	17:03	107	19	548	down	85	80	79	77	76	97	100	-14.3	-0.989
12	23-Aug	17:19	81	22	482	down	80	76	75	72	72	93	96	-14.4	-0.992
13	23-Aug	17:34	109	17	526	down	87	82	81	78	77	99	102	-17.3	-0.990
14	23-Aug	17:50	118	13	416	down	92	87	86	84	83	103	107	-14.4	-0.992
Up Side average							88.3	82.6	81.1	78.1	76.8	101.0	102.4	-16.1	
Down side average							85.1	80.8	79.6	76.9	76.0	97.2	99.4	-15.4	
Over all average												98.8	90.4	-15.7	

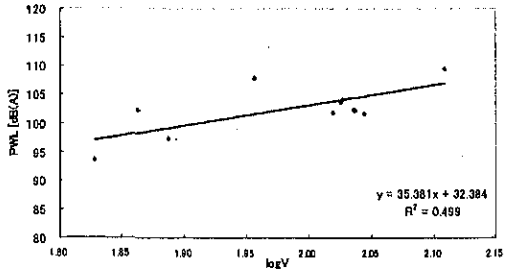
Note) up : to Delhi down : to kolkata
average : value calculated by simple arithmetic average without measurement value the correlation of which is not good
coefficient: These values indicate distance attenuation coefficients of approximation.
correlation: These values indicate correlation coefficients of distance attenuation approximation. (A positive correlation is strong when it is near one, a negative correlation is strong when it is near minus one.)
Source : S-ESIMMS

(2) Correlation Between Logarithm of Passenger Train Speed and PWL

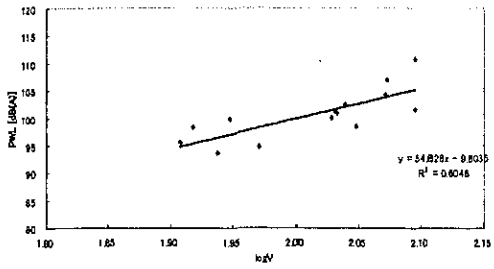
As well as Freight train, correlation diagram of upside, downside, and both side respectively were shown in Figure 2.3-1, Figure 2.3-2, and Figure 2.3-3.
As a result, the approximation type was different respectively. As this main reason, it is thought that bias of the distribution of the speed influence.



Source : SAPROF Study Team
Figure 2.3-1 Correlation Between PWL And logV Of Freight Train(up and down, n=24))



Source : S-ESIMMS
Figure 2.3-2 Correlation Between PWL And logV Of Freight Train(up, n=10))

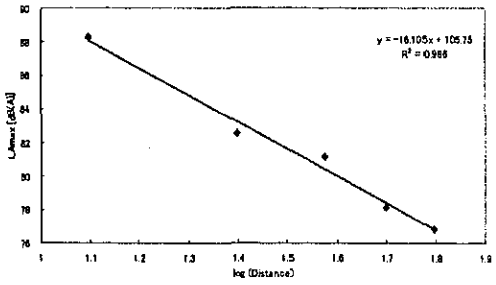


Source : S-ESIMMS

Figure 2.2-3 Correlation between PWL and logV Of Freight Train (down, n=14))

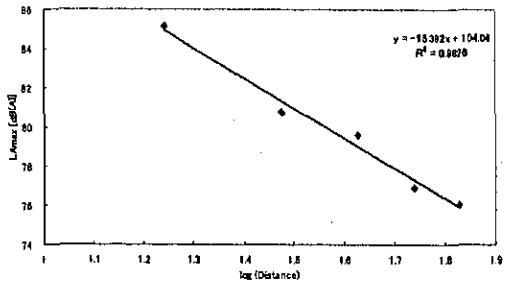
(3) Distance Attenuation for Passenger Train

As well as freight train, correlation diagram between LAmax and logarithm of the distance of up side and down side respectively were shown in Figure 2.3-4 and Figure 2.3-5. As a result, each distance attenuation coefficient of approximation of up side and down side was almost same value. Therefore, for noise prediction of existing passenger train in parallel section, average value (=15.7) of distance attenuation coefficient of both side (up and down side) was used.



Source : S-ESIMMS

Figure 2.3-4 Correlation Between LAmax and logD Of Freight Train (up average,n=10))



Source : S-ESIMMS

Figure 2.3-5 Correlation Between LAmax and logD Of Freight Train (down average, n=13)

(4) Frequency Analysis for Passenger Train

Results of 1/3 octave band frequency analysis are given Table 2.3-2. Results indicated that frequency of about 800 to 2000 Hz excelled. In Japan, the main noise of train includes[1] (1)traction, (2)structures and (3) machines equipped to the train, and predominant frequency from each noise is said to be almost from 250 to 2000Hz as well. Therefore, result of predominant frequency in this study was similar to the case in Japan, and this would be suitable value. In addition, in case of countermeasure (e.g. soundproof) for railway noise, Japanese countermeasure method might be available.

Table 2.3-2 Results of 1/3 Octave Band Frequency Analysis of Passenger Train Noise At Khurja

No.	train direction	Frequency [Hz]	20	25	32	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25k	1.6k	2k	2.5k	3.15k	4k	5k	6.3k	8k	AP
1	up	Noise Level [dB(A)]	33	33	36	44	47	50	56	60	63	69	71	71	72	75	76	78	78	78	77	77	78	77	76	73	72	70	68	88
2	up		41	40	41	41	46	51	54	56	60	64	66	71	73	75	77	80	81	82	81	84	85	85	84	83	82	80	76	94
3	up		38	37	36	37	44	44	51	51	56	58	61	61	67	69	73	75	75	75	72	72	76	74	70	68	67	63	59	84
4	up		40	39	38	39	41	44	48	48	53	60	62	62	65	66	69	69	70	69	65	65	67	65	62	60	57	54	50	78
5	up		46	45	43	43	46	47	48	52	56	60	64	68	71	77	78	77	79	79	76	78	78	76	74	72	69	65	62	88
6	up		36	35	36	41	46	51	55	58	63	67	68	72	73	76	79	79	80	79	76	79	81	78	76	74	71	68	65	89
7	up		26	27	30	37	43	46	51	54	58	64	64	68	73	74	77	79	80	78	75	76	79	75	71	70	68	64	61	88
8	up		21	30	31	38	39	48	50	54	56	59	63	63	65	68	70	71	74	69	66	71	72	74	70	68	65	65	63	82
9	up		33	33	35	41	46	49	53	57	61	65	69	71	72	76	77	78	78	79	77	78	79	76	72	70	67	65	63	88
10	up		29	29	36	43	44	45	49	53	60	65	69	73	73	77	76	75	74	74	71	70	71	68	67	65	63	61	61	84
1	down		19	24	30	36	38	47	52	55	59	57	56	62	60	64	62	65	68	64	61	66	66	66	65	64	59	58	54	76
2	down		25	27	28	35	47	49	54	59	60	60	58	65	65	66	68	68	69	69	67	70	72	70	67	66	64	60	57	80
3	down		27	30	27	35	45	43	49	53	58	58	55	63	63	65	65	67	67	69	67	71	73	69	65	65	63	59	56	79
4	down		30	30	33	40	49	55	58	61	65	66	66	70	70	73	72	74	75	78	76	83	84	84	80	76	73	70	66	90
5	down		19	21	26	36	44	49	54	56	61	62	60	66	71	71	69	70	70	71	69	70	73	70	69	68	67	63	62	82
6	down		39	38	36	40	49	51	55	60	62	62	61	67	70	70	70	71	73	73	73	76	78	75	71	70	69	64	61	84
7	down		50	49	46	47	50	55	59	61	62	64	62	70	72	73	71	70	72	72	71	73	75	73	70	70	67	63	59	84
8	down		26	29	32	36	46	55	55	59	58	60	59	65	68	70	71	73	75	77	77	80	81	79	74	74	71	66	62	87
9	down		25	25	29	33	39	46	51	52	56	55	54	59	61	62	60	62	63	64	63	69	66	65	64	63	60	57	53	76
10	down		29	30	35	38	46	53	54	59	61	62	59	64	69	70	71	72	74	74	73	76	78	75	71	71	68	64	61	85
11	down		30	30	33	39	50	50	54	57	61	59	58	66	67	71	70	69	71	71	70	73	74	72	70	69	66	63	60	82
12	down		18	23	30	37	45	50	54	54	59	60	57	65	67	69	69	68	69	68	69	71	72	68	67	66	63	59	56	80
13	down		28	29	33	38	50	52	55	59	61	60	60	65	69	72	74	75	76	78	77	78	79	76	74	73	70	67	63	87
14	down		32	34	34	43	50	58	59	62	68	68	68	71	74	76	75	77	77	78	76	83	83	81	78	76	73	69	67	90

Note) Each frequency indicates center frequency of 1/3 octave band.
Value enclosed in heavy line indicates maximum one of each measurement.
Source : S-ESIMMS

3. Impact Assessment

3-1 Time Table of Passenger Train in Parallel Section

Time Tables of Passenger Train in Parallel Section used for setting of noise prediction are shown from Figure 3.1-1 to Figure 3.1-12. These time table were made based on actual time table of each station (July /2008). In addition, time table of Keshavganj Station located near Pindwara was used for one of Pindwara Station.

For noise prediction in parallel section, in order to consider influence of railway noise from existing passenger train, number of train is set. For setting of number of train, current time table (July /2008) shown below was used.
In addition, when operation of DFC will be steady, number of existing freight train would be reduced in the future. At the same time, number of passenger train running on the existing railway might increase. Therefore, in consideration of reducing number of freight train and increase of population in India in the future , in this noise prediction, passenger trains (both stop and through) operated at the frequency from 1 to 6 per week currently were considered as ones operated everyday.
Number of passenger train for noise prediction was sum at daytime (7:00-22:00) and nighttime (22:00-7:00) respectively.

In the example of Abu Road shown in Table3.1-1, in case of up side, passenger trains which stop daily at this station are 6 trains in daytime, 3 trains in nighttime at the present day. But in the noise prediction, number of trains which aren't operated daily (5 trains in daytime, 11trains in nighttime) are included as the number of trains which are operated daily. Therefore, in case of up side ,as the number of trains 11 trains in daytime, 14 trains in nighttime are set respectively for noise prediction.

Table 3.1-1 Time Table at Abu Road Station

Time		Up															Down													
From	To	Daily		Stop per week						Through per week						Total	Daily		Stop per week						Through per week						Total
		Stop	Through	1	2	3	4	5	6	1	2	3	4	5	6	(up)	Stop	Through	1	2	3	4	5	6	1	2	3	4	5	6	(down)
0:00	1:00	0	0	0	0	2	1	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1:00	2:00	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
2:00	3:00	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
3:00	4:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:00	5:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
5:00	6:00	1	0	2	0	0	0	0	0	0	0	0	0	0	0	3	1	0	3	1	0	0	0	0	0	0	0	0	0	0	5
6:00	7:00	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:00	8:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:00	9:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9:00	10:00	0	0	2	2	0	0	0	0	0	0	0	0	0	0	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
10:00	11:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:00	12:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	2	0	0	0	0	0	0	0	0	0	0	4
12:00	13:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	2
13:00	14:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:00	15:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
15:00	16:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
16:00	17:00	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:00	18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:00	19:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19:00	20:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20:00	21:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	2	0	0	0	0	1	0	0	0	0	0	0	4
21:00	22:00	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
22:00	23:00	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23:00	0:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2	1	0	0	0	0	0	0	0	0	3
Daytime Total		6	0	2	2	1	0	0	0	0	0	0	0	0	0	11	6	0	5	2	0	0	0	1	0	0	0	0	0	0	14
Nighttime Total		3	0	0	1	2	1	0	1	0	0	0	0	0	0	14	3	0	3	1	3	1	0	0	0	0	0	0	0	0	11

Note) up : to Mumbai down : to Delhi
Stop: This indicates number of trains which stops at this station.
Through: This indicates number of trains which pass through this station.
Daytime:7:00-22:00 Nighttime:22:00-7:00
Source : S-ESIMMS

Table 3.1-2 Time Table at Pindwara Station (Keshavganj Station)

Time		Up														Down													
From	To	Daily		Stop per week						Through per week						Total	Daily		Stop per week						Through per week						Total
		Stop	Through	1	2	3	4	5	6	1	2	3	4	5	6	(up)	Stop	Through	1	2	3	4	5	6	1	2	3	4	5	6	(down)
0:00	1:00	0	0	0	0	0	0	0	0	1	0	0	1	0	0	2	0	0	0	0	0	0	0	0	0	0	2	1	0	0	3
1:00	2:00	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2:00	3:00	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
3:00	4:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
4:00	5:00	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:00	6:00	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
6:00	7:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	1	0	0	4
7:00	8:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
8:00	9:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9:00	10:00	0	0	0	0	0	0	0	0	2	2	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:00	11:00	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
11:00	12:00	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:00	13:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	4
13:00	14:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	2
14:00	15:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
15:00	16:00	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
16:00	17:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:00	18:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:00	19:00	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19:00	20:00	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20:00	21:00	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2
21:00	22:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
22:00	23:00	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
23:00	0:00	0	0	0	0	0	0	0	0	0	0	2	1	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Daytime Total		2	4	0	0	0	0	0	0	2	3	1	0	0	0	12	2	3	0	0	0	0	0	0	5	2	0	0	0	1	13
Nighttime Total		0	2	0	0	0	0	0	0	5	0	2	2	0	1	12	0	3	0	0	0	0	0	0	2	1	3	2	0	0	11

Note) up : to Mumbai down : to Delhi
Stop: This indicates number of trains which stops at this station.
Through: This indicates number of trains which pass through this station.
Daytime:7:00-22:00 Nighttime:22:00-7:00
Source : S-ESIMMS

Table3.1-3 Time Table at Rani Station

Time		Up														Down													
From	To	Daily		Stop per week						Through per week						Total	Daily		Stop per week						Through per week						Total
		Stop	Through	1	2	3	4	5	6	1	2	3	4	5	6	(up)	Stop	Through	1	2	3	4	5	6	1	2	3	4	5	6	(down)
0:00	1:00	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1:00	2:00	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
2:00	3:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	2
3:00	4:00	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
4:00	5:00	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
5:00	6:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6:00	7:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
7:00	8:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	1	0	0	4
8:00	9:00	0	0	0	0	0	0	0	0	2	2	0	0	0	0	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
9:00	10:00	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:00	11:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:00	12:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
12:00	13:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:00	14:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	2	2	0	0	0	0	4
14:00	15:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
15:00	16:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
16:00	17:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	2
17:00	18:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:00	19:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19:00	20:00	0	0	0	0	0	0	0	0	0	1	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20:00	21:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21:00	22:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	2	0	0	0	0	1	3
22:00	23:00	0	0	0	0	2	1	0	0	0	0	0	0	0	0	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
23:00	0:00	0	0	0	0	0	0	0	0	1	0	0	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Daytime Total		6	1	0	0	0	0	0	0	2	3	1	0	0	0	13	4	1	0	0	0	0	0	0	7	3	0	1	0	1	17
Nighttime Total		0	1	2	0	2	1	0	0	3	0	0	1	0	1	11	1	2	0	0	2	1	0	0	0	0	1	0	0	0	7

Note) up : to Mumbai down : to Delhi
Stop: This indicates number of trains which stops at this station.
Through: This indicates number of trains which pass through this station.
Daytime:7:00-22:00 Nighttime:22:00-7:00
Source : S-ESIMMS

Table3.1-4 Time Table at Marwar Station

Time		Up														Down													
From	To	Daily		Stop per week						Through per week						Total	Daily		Stop per week						Through per week						Total
		Stop	Through	1	2	3	4	5	6	1	2	3	4	5	6	(up)	Stop	Through	1	2	3	4	5	6	1	2	3	4	5	6	(down)
0:00	1:00	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1:00	2:00	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
2:00	3:00	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	1	1	0	0	0	0	0	0	0	0	2
3:00	4:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:00	5:00	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
5:00	6:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1
6:00	7:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:00	8:00	0	0	1	2	0	0	0	0	0	0	0	0	0	0	3	1	0	0	0	1	0	0	0	0	0	0	0	0	0	2
8:00	9:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9:00	10:00	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	2	0	0	0	0	0	0	0	0	0	0	0	3
10:00	11:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	2
11:00	12:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:00	13:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:00	14:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
14:00	15:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	2	0	0	0	0	0	0	0	0	0	0	3
15:00	16:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
16:00	17:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
17:00	18:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
18:00	19:00	0	0	0	1	0	0	0	0	0	0	1	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
19:00	20:00	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20:00	21:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21:00	22:00	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22:00	23:00	0	0	0	0	1	1	0	0	0	0	0	0	0	0	2	0	0	1	1	0	0	0	0	0	0	0	0	0	1	3
23:00	0:00	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Daytime Total		8	0	1	4	1	0	0	0	0	0	1	0	0	0	15	7	0	4	3	0	0	0	1	0	0	0	0	0	0	15
Nighttime Total		0	1	4	0	1	1	0	0	1	0	0	0	0	1	9	1	1	1	1	2	1	0	0	0	0	1	0	0	1	9

Note) up : to Mumbai down : to Delhi
Stop: This indicates number of trains which stops at this station.
Through: This indicates number of trains which pass through this station.
Daytime:7:00-22:00 Nighttime:22:00-7:00
Source : S-ESIMMS

Table 3.1-5 Time Table at Beawar Station

Time		Up															Down													
From	To	Daily		Stop per week						Through per week						Total	Daily		Stop per week						Through per week						Total
		Stop	Through	1	2	3	4	5	6	1	2	3	4	5	6	(up)	Stop	Through	1	2	3	4	5	6	1	2	3	4	5	6	(down)
0:00	1:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
1:00	2:00	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2:00	3:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
3:00	4:00	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:00	5:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	2
5:00	6:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6:00	7:00	0	0	1	1	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
7:00	8:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
8:00	9:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
9:00	10:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
10:00	11:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:00	12:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
12:00	13:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:00	14:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
14:00	15:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
15:00	16:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	2
16:00	17:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:00	18:00	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:00	19:00	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
19:00	20:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20:00	21:00	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21:00	22:00	0	0	0	0	1	1	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22:00	23:00	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23:00	0:00	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	0	0	0	1	3
Daytime Total		5	0	0	1	2	1	0	0	0	0	1	0	0	0	10	5	0	1	2	0	0	0	0	1	0	0	0	0	0	9
Nighttime Total		0	1	2	1	0	0	0	0	1	0	0	0	0	1	6	0	1	1	0	2	1	0	0	1	0	1	0	0	1	8

Note) up : to Mumbai down : to Delhi
Stop: This indicates number of trains which stops at this station.
Through: This indicates number of trains which pass through this station.
Daytime:7:00-22:00 Nighttime:22:00-7:00
Source : S-ESIMMS

Table3.1-6 Time Table at Ajmer Station

Time		Up															Down													
From	To	Daily		Stop per week						Through per week						Total	Daily		Stop per week						Through per week						Total
		Stop	Through	1	2	3	4	5	6	1	2	3	4	5	6	(up)	Stop	Through	1	2	3	4	5	6	1	2	3	4	5	6	(down)
0:00	1:00	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
1:00	2:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	3
2:00	3:00	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3:00	4:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:00	5:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
5:00	6:00	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	2
6:00	7:00	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
7:00	8:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:00	9:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
9:00	10:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
10:00	11:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	0	0	0	0	0	0	0	0	0	3
11:00	12:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:00	13:00	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
13:00	14:00	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2
14:00	15:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:00	16:00	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	2
16:00	17:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
17:00	18:00	0	0	0	1	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	3
18:00	19:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19:00	20:00	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20:00	21:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
21:00	22:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22:00	23:00	0	0	2	1	1	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23:00	0:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
Daytime Total		8	0	2	1	3	1	0	1	0	0	0	0	0	0	16	8	0	3	2	2	0	0	1	0	0	0	0	0	0	16
Nighttime Total		1	0	5	1	1	0	0	1	0	0	0	0	0	0	9	1	0	4	0	2	1	0	1	0	0	0	0	0	0	9

Note) up : to Mumbai down : to Delhi
Stop: This indicates number of trains which stops at this station.
Through: This indicates number of trains which pass through this station.
Daytime:7:00-22:00 Nighttime:22:00-7:00
Source : S-ESIMMS

Table 3.1-7 Time Table at Kishangarh Station

Time		Up															Down													
From	To	Daily		Stop per week						Through per week						Total	Daily		Stop per week						Through per week						Total
		Stop	Through	1	2	3	4	5	6	1	2	3	4	5	6	(up)	Stop	Through	1	2	3	4	5	6	1	2	3	4	5	6	(down)
0:00	1:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1:00	2:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
2:00	3:00	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	2	0	0	0	0	0	0	0	0	0	0	0	3
3:00	4:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:00	5:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
5:00	6:00	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6:00	7:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0	1	0	0	0	0	0	3
7:00	8:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:00	9:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9:00	10:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:00	11:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:00	12:00	1	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	1	0	0	0	0	1	0	1	0	0	0	3
12:00	13:00	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:00	14:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:00	15:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	2
15:00	16:00	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:00	17:00	0	1	0	1	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	1	2
17:00	18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:00	19:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
19:00	20:00	0	0	0	0	1	1	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	1	0	0	0	0	1	2
20:00	21:00	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21:00	22:00	0	0	0	0	1	0	0	0	1	1	1	0	0	0	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22:00	23:00	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23:00	0:00	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
Daytime Total		3	2	0	1	2	1	0	0	3	1	1	0	0	1	15	4	1	0	1	0	0	0	0	2	0	1	0	0	1	10
Nighttime Total		1	1	0	0	0	0	0	0	2	0	0	0	0	1	5	0	1	2	0	1	1	0	0	2	0	1	0	0	1	9

Note) up : to Mumbai down : to Delhi
Stop: This indicates number of trains which stops at this station.
Through: This indicates number of trains which pass through this station.
Daytime:7:00-22:00 Nighttime:22:00-7:00

Source : S-ESIMMS

Table 3.1-8 Time Table at Ringas Station

Time		Up																Down													
From	To	Daily		Stop per week						Through per week							Total (up)	Daily		Stop per week						Through per week						Total (down)
		Stop	Through	1	2	3	4	5	6	1	2	3	4	5	6			Stop	Through	1	2	3	4	5	6	1	2	3	4	5	6	
0:00	1:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1:00	2:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2:00	3:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3:00	4:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:00	5:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
5:00	6:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6:00	7:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:00	8:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:00	9:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9:00	10:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2
10:00	11:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:00	12:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:00	13:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
13:00	14:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:00	15:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:00	16:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:00	17:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:00	18:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
18:00	19:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19:00	20:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20:00	21:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
21:00	22:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22:00	23:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23:00	0:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Daytime Total		5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	5	0	0	0	0	0	0	0	0	0	0	0	0	0	5
Nighttime Total		2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2

Note) up : to Mumbai down : to Delhi
Stop: This indicates number of trains which stops at this station.
Through: This indicates number of trains which pass through this station.
Daytime:7:00-22:00 Nighttime:22:00-7:00
Source : S-ESIMMS

Table 3.1-9 Time Table at Shri Madhopur Station

Time		Up																Down													
From	To	Daily		Stop per week						Through per week							Total (up)	Daily		Stop per week						Through per week						Total (down)
		Stop	Through	1	2	3	4	5	6	1	2	3	4	5	6			Stop	Through	1	2	3	4	5	6	1	2	3	4	5	6	
0:00	1:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1:00	2:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
2:00	3:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3:00	4:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:00	5:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:00	6:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
6:00	7:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:00	8:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:00	9:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9:00	10:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
10:00	11:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
11:00	12:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:00	13:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
13:00	14:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:00	15:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:00	16:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:00	17:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:00	18:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:00	19:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
19:00	20:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20:00	21:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
21:00	22:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22:00	23:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23:00	0:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Daytime Total		6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	5	0	0	0	0	0	0	0	0	0	0	0	0	0	5
Nighttime Total		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2

Note) up : to Mumbai down : to Delhi
Stop: This indicates number of trains which stops at this station.
Through: This indicates number of trains which pass through this station.
Daytime:7:00-22:00 Nighttime:22:00-7:00
Source : S-ESIMMS

Table3.1-10 Time Table at Nim Ka Thana Station

Time		Up																Down													
From	To	Daily		Stop per week						Through per week							Total (up)	Daily		Stop per week						Through per week						Total (down)
		Stop	Through	1	2	3	4	5	6	1	2	3	4	5	6			Stop	Through	1	2	3	4	5	6	1	2	3	4	5	6	
0:00	1:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1:00	2:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2:00	3:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
3:00	4:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:00	5:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:00	6:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
6:00	7:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:00	8:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:00	9:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9:00	10:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:00	11:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
11:00	12:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
12:00	13:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:00	14:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
14:00	15:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:00	16:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:00	17:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:00	18:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:00	19:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19:00	20:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
20:00	21:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21:00	22:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
22:00	23:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23:00	0:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Daytime Total		6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	5	0	0	0	0	0	0	0	0	0	0	0	0	0	5
Nighttime Total		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2

Note) up : to Mumbai down : to Delhi
Stop: This indicates number of trains which stops at this station.
Through: This indicates number of trains which pass through this station.
Daytime:7:00-22:00 Nighttime:22:00-7:00
Source : S-ESIMMS

Table 3.1-11 Time Table at Narnaul Station

Time		Up															Down													
From	To	Daily		Stop per week						Through per week						Total	Daily		Stop per week						Through per week						Total
		Stop	Through	1	2	3	4	5	6	1	2	3	4	5	6	(up)	Stop	Through	1	2	3	4	5	6	1	2	3	4	5	6	(down)
0:00	1:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1:00	2:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2:00	3:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3:00	4:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
4:00	5:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:00	6:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6:00	7:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:00	8:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
8:00	9:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9:00	10:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:00	11:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:00	12:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
12:00	13:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
13:00	14:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:00	15:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
15:00	16:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:00	17:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:00	18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:00	19:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19:00	20:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20:00	21:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
21:00	22:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22:00	23:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
23:00	0:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Daytime Total		5	0	0	0	0	0	0	0	0	0	0	0	0	0	5	5	0	0	0	0	0	0	0	0	0	0	0	0	0	5
Nighttime Total		2	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2

Note) up : to Mumbai down : to Delhi
Stop: This indicates number of trains which stops at this station.
Through: This indicates number of trains which pass through this station.
Daytime:7:00-22:00 Nighttime:22:00-7:00
Source : S-ESIMMS

Table 3.1-12 Time Table at Ateli Station

Time		Up															Down													
From	To	Daily		Stop per week						Through per week						Total	Daily		Stop per week						Through per week						Total
		Stop	Through	1	2	3	4	5	6	1	2	3	4	5	6	(up)	Stop	Through	1	2	3	4	5	6	1	2	3	4	5	6	(down)
0:00	1:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1:00	2:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2:00	3:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3:00	4:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:00	5:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
5:00	6:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6:00	7:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:00	8:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
8:00	9:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9:00	10:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:00	11:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:00	12:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:00	13:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2
13:00	14:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:00	15:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
15:00	16:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:00	17:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:00	18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:00	19:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19:00	20:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20:00	21:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
21:00	22:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22:00	23:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23:00	0:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Daytime Total		5	0	0	0	0	0	0	0	0	0	0	0	0	0	5	5	0	0	0	0	0	0	0	0	0	0	0	0	0	5
Nighttime Total		2	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2

Note) up : to Mumbai down : to Delhi
Stop: This indicates number of trains which stops at this station.
Through: This indicates number of trains which pass through this station.
Daytime:7:00-22:00 Nighttime:22:00-7:00
Source : S-ESIMMS

3-2 Results of Noise Prediction

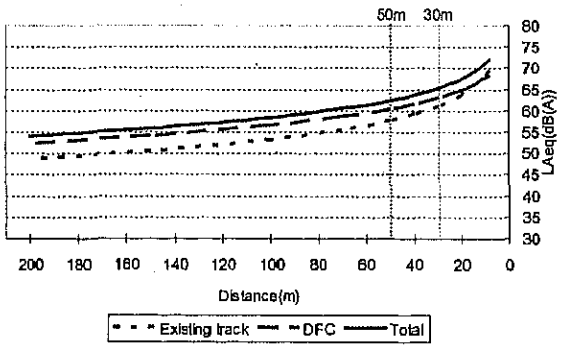
3-2-1 Parallel Section

Results of noise prediction in parallel section are given below. Range of distance from near railway to 200m is indicated on graphs. As well, results of noise prediction with countermeasure by soundproof are given below. Countermeasures1 are the methods of setting up the soundproof to meet the guideline value in 30m point from the center of the existing railway, and countermeasure2 are the methods of setting up the soundproof to meet the guideline value in 50m point from the center of the existing railway.

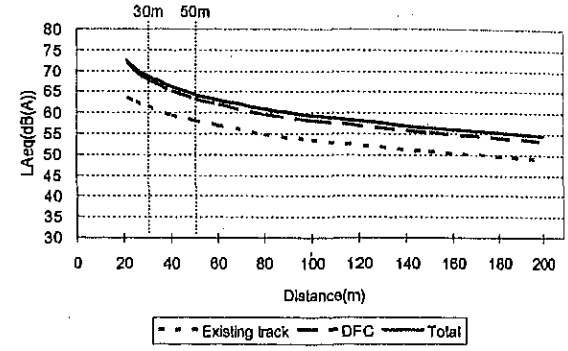
Note) Distance 0m in each graphs indicates center position of each existing track. And prediction point (30m and 50m) were put down with each graphs.

(1) Abu road
Results of noise prediction for Abu Road are given from Figure 3.2(1)-1 to Figure 3.2(1)-12.

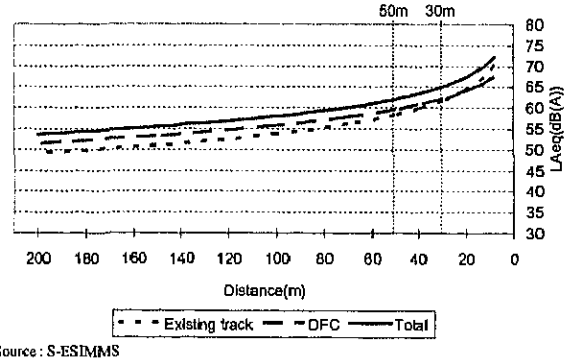
1) without countermeasure



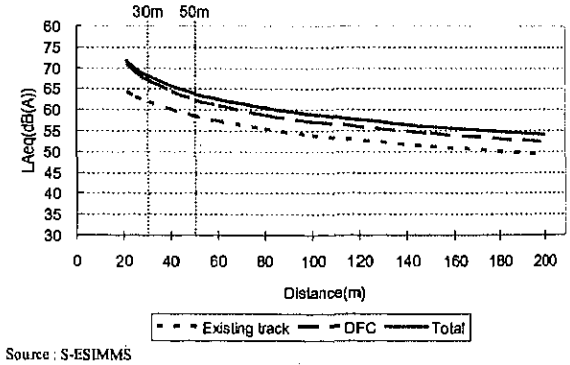
Source : S-ESIMMS
Figure 3.2(1)-1 Result of Noise Prediction Without Countermeasure on Daytime At Abu Road (Existing track side)



Source : S-ESIMMS
Figure 3.2(1)-2 Result of Noise Prediction Without Countermeasure on Daytime At Abu Road (DFC side)

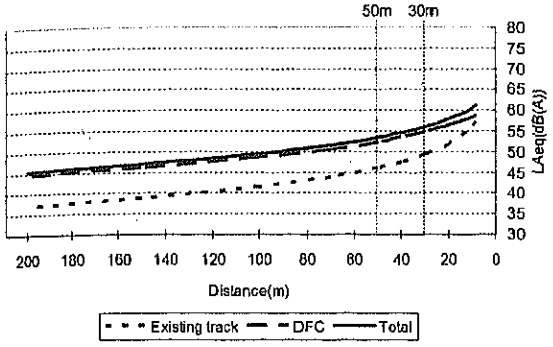


Source : S-ESIMMS
Figure 3.2(1)-3 Result of Noise Prediction Without Countermeasure on Nighttime At Abu Road (Existing track side)



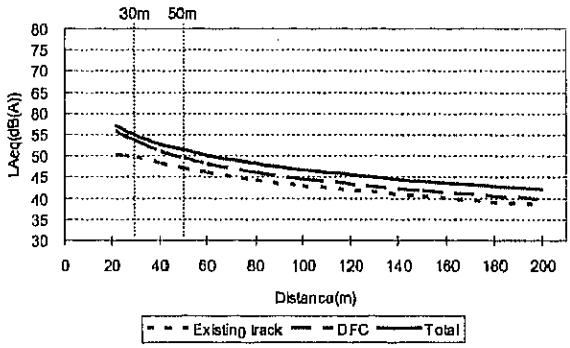
Source : S-ESIMMS
Figure 3.2(1)-4 Result of Noise Prediction Without Countermeasure on Nighttime At Abu Road (DFC side)

2) with countermeasure1 (soundproof height DFC side:3m Existing track side:1.5m)



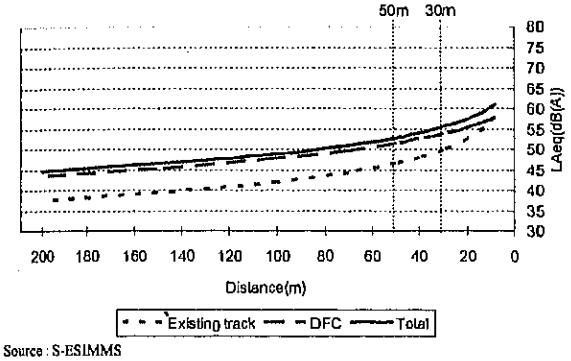
Source : S-ESIMMS

Figure 3.2(1)-5 Result of Noise Prediction With Countermeasure1 on Daytime At Abu Road (Existing track side)



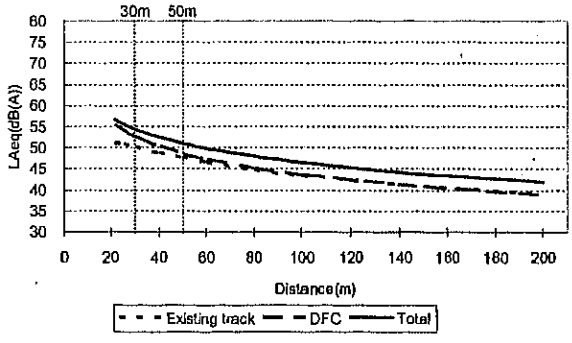
Source : S-ESIMMS

Figure 3.2(1)-6 Result of Noise Prediction With Countermeasure1 on Daytime At Abu Road (DFC side)



Source : S-ESIMMS

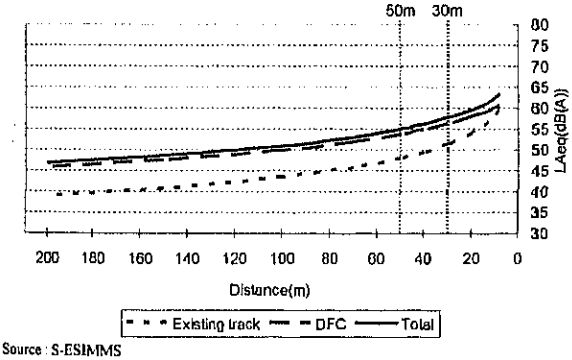
Figure 3.2(1)-7 Result of Noise Prediction With Countermeasure1 on Nighttime At Abu Road (Existing track side)



Source : S-ESIMMS

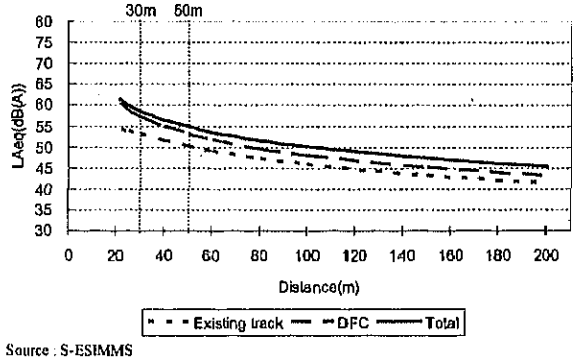
Figure 3.2(1)-8 Result of Noise Prediction With Countermeasure1 on Nighttime At Abu Road (DFC side)

3) with countermeasure2 (soundproof height DFC side:1.5m Existing track side:1m)



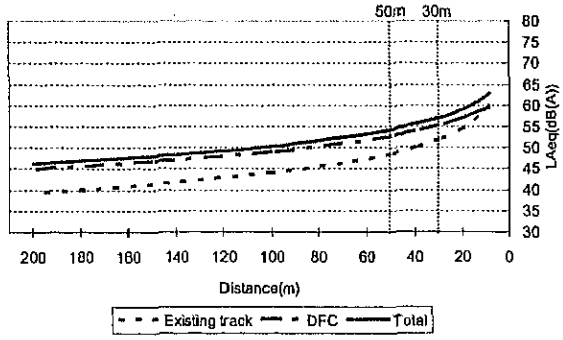
Source : S-ESIMMS

Figure 3.2(1)-9 Result of Noise Prediction With Countermeasure2 on Daytime At Abu Road (Existing track side)



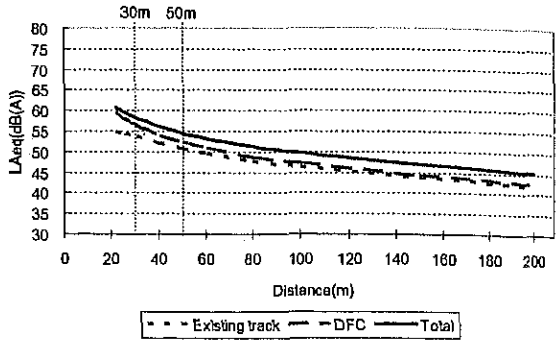
Source : S-ESIMMS

Figure 3.2(1)-10 Result of Noise Prediction With Countermeasure2 on Daytime At Abu Road (DFC side)



Source : S-ESIMMS

Figure 3.2(1)-11 Result of Noise Prediction With Countermeasure2 on Nighttime At Abu Road (Existing track side)

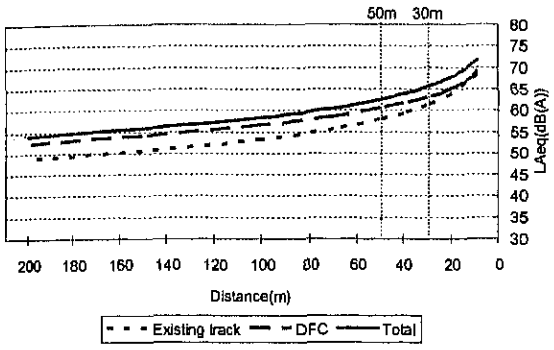


Source : S-ESIMMS

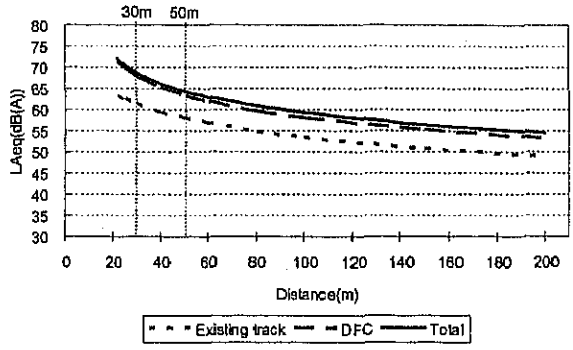
Figure 3.2(1)-12 Result of Noise Prediction With Countermeasure2 on Nighttime At Abu Road (DFC side)

(2) Pindwara
Results of noise prediction for Pindwara are given from Figure 3.2(2)-1 to Figure 3.2(2)-12.

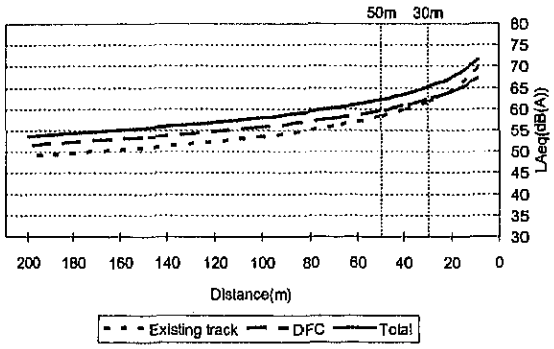
1) without countermeasure



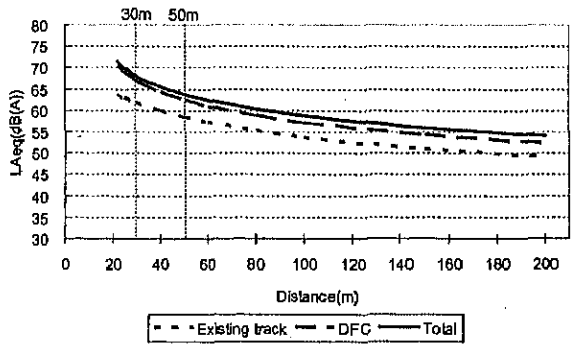
Source : S-ESIMMS
Figure 3.2(2)-1 Result of Noise Prediction Without Countermeasure on Daytime At Pindwara (Existing track side)



Source : S-ESIMMS
Figure 3.2(2)-2 Result of Noise Prediction Without Countermeasure on Daytime At Pindwara (DFC side)

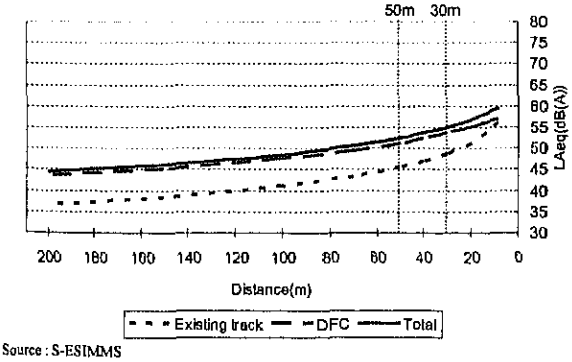


Source : S-ESIMMS
Figure 3.2(2)-3 Result of Noise Prediction Without Countermeasure on Nighttime At Pindwara (Existing track sida)

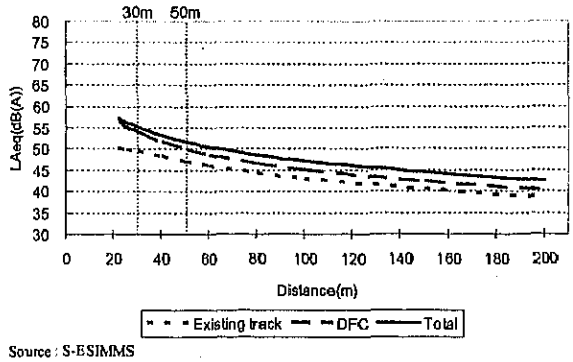


Source : S-ESIMMS
Figure 3.2(2)-4 Result of Noise Prediction Without Countermeasure on Nighttime At Pindwara (DFC side)

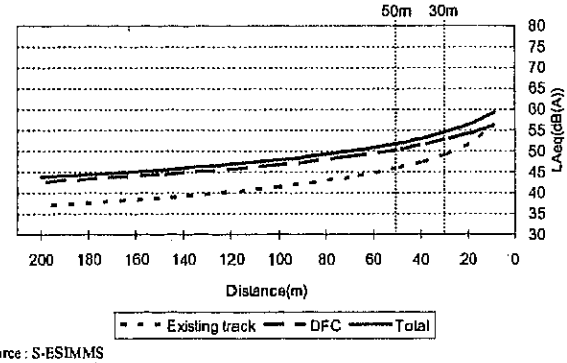
2) with countermeasure1 (soundproof height DFC side:3m Existing track side:2m)



Source : S-ESIMMS
Figure 3.2(2)-5 Result of Noise Prediction With Countermeasure1 on Daytime At Pindwara (Existing track side)

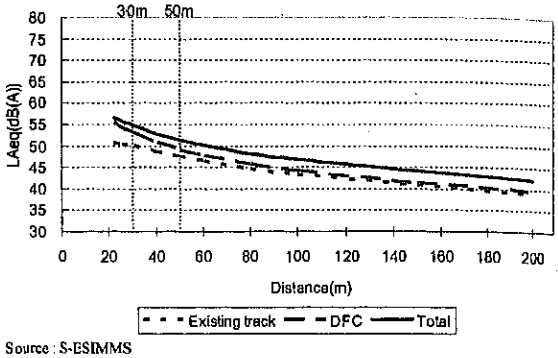


Source : S-ESIMMS
Figure 3.2(2)-6 Result of Noise Prediction With Countermeasure1 on Daytime At Pindwara (DFC side)



Source : S-ESIMMS

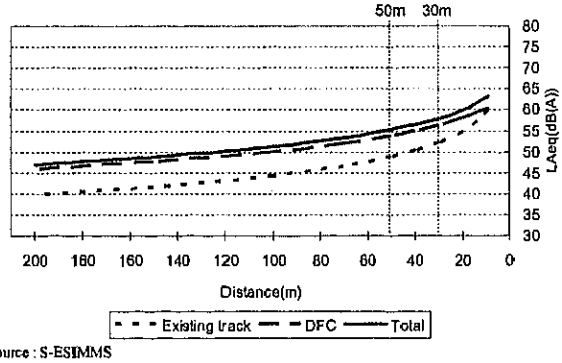
Figure3.2(2)-7 Result of Noise Prediction With Countermeasure1 on Nighttime At Pindwara (Existing track side)



Source : S-ESIMMS

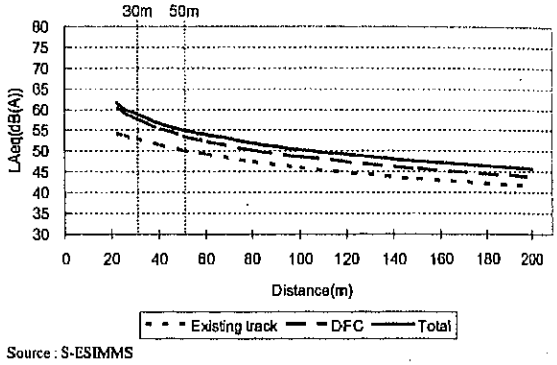
Figure3.2(2)-8 Result of Noise Prediction With Countermeasure1 on Nighttime At Pindwara (DFC side)

3) with countermeasure2 (soundproof height DFC side:1.5m Existing track side:1m)



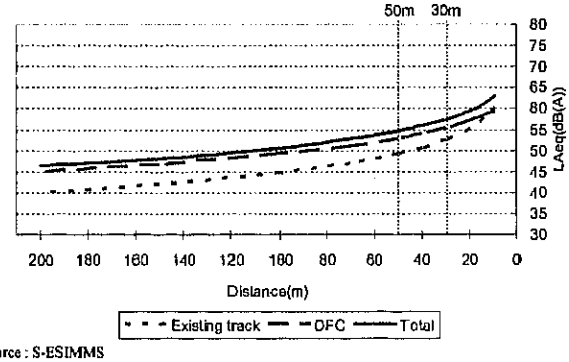
Source : S-ESIMMS

Figure 3.2(2)-9 Result of Noise Prediction With Countermeasure2 on Daytime At Pindwara (Existing track side)



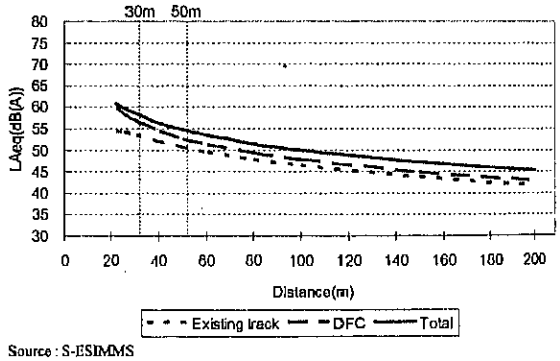
Source : S-ESIMMS

Figure 3.2(2)-10 Result of Noise Prediction With Countermeasure2 on Daytime At Pindwara (DFC side)



Source : S-ESIMMS

Figure3.2(2)-11 Result of Noise Prediction With Countermeasure2 on Nighttime At Pindwara (Existing track side)



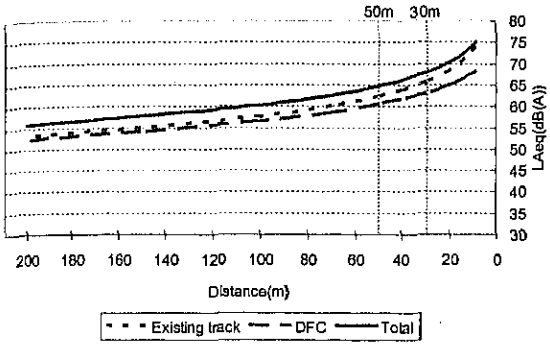
Source : S-ESIMMS

Figure 3.2(2)-12 Result of Noise Prediction With Countermeasure2 on Nighttime At Pindwara (DFC side)

(3) Rani

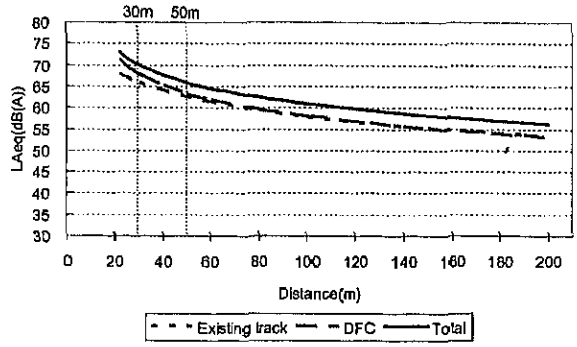
Results of noise prediction for Rani are given from Figure3.2(3)-1 to Figure3.2(3)-12.

1) without countermeasure



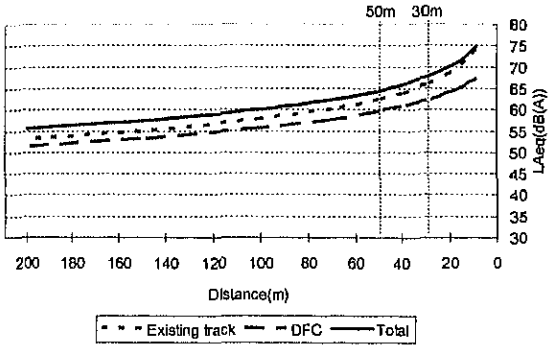
Source : S-ESIMMS

Figure 3.2(3)-1 Result of Noise Prediction Without Countermeasure on Daytime At Rani (Existing track side)



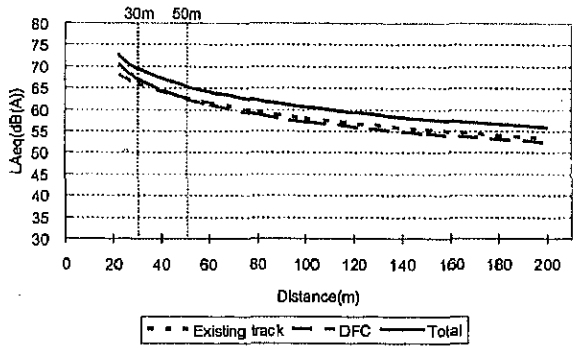
Source : S-ESIMMS

Figure 3.2(3)-2 Result of Noise Prediction Without Countermeasure on Daytime At Rani (DFC side)



Source : S-ESIMMS

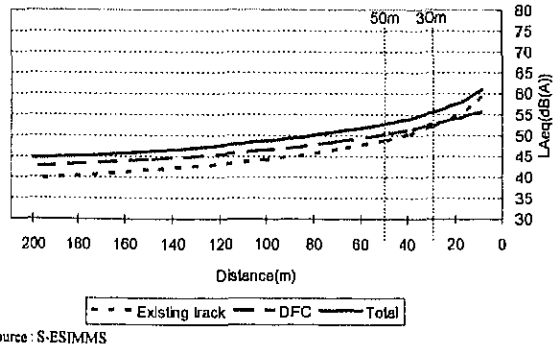
Figure 3.2(3)-3 Result of Noise Prediction Without Countermeasure on Nighttime At Rani (Existing track side)



Source : S-ESIMMS

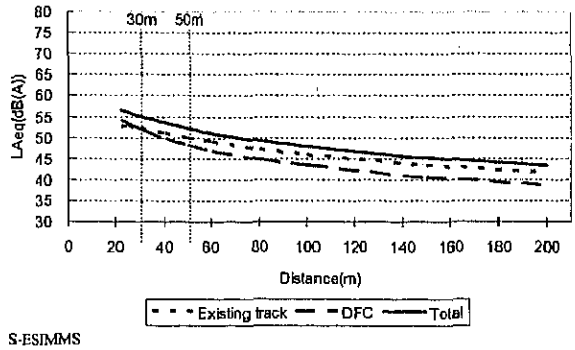
Figure 3.2(3)-4 Result of Noise Prediction Without Countermeasure on Nighttime At Rani (DFC side)

2) with countermeasure1 (soundproof height DFC side:4m Existing track side:2.5m)



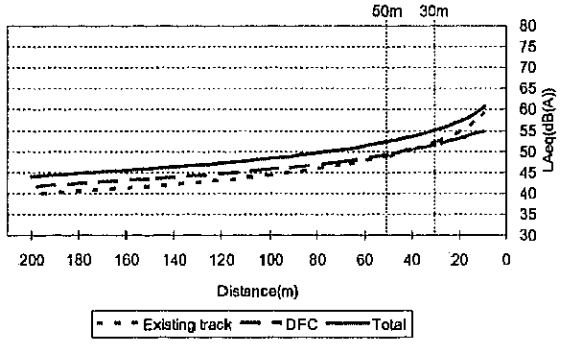
Source : S-ESIMMS

Figure 3.2(3)-5 Result of Noise Prediction With Countermeasure1 on Daytime At Rani (Existing track side)



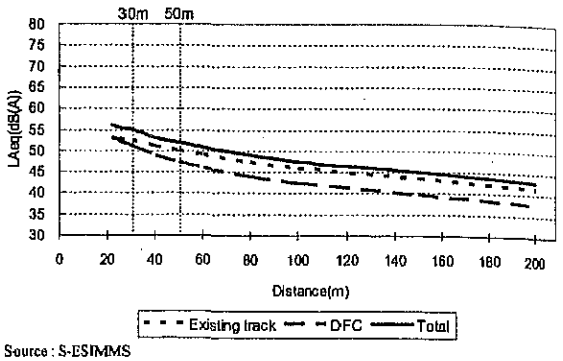
S-ESIMMS

Figure 3.2(3)-6 Result of Noise Prediction With Countermeasure1 on Daytime At Rani (DFC side)



Source : S-ESIMMS

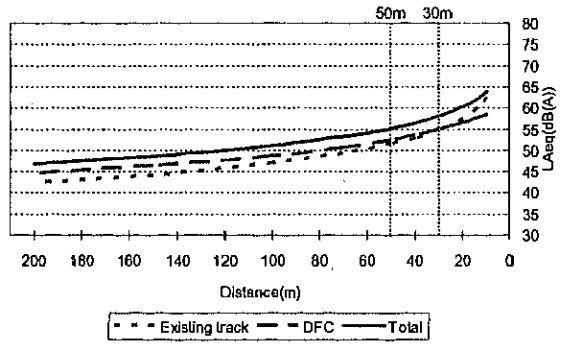
Figure 3.2(3)-7 Result of Noise Prediction With Countermeasure1 on Nighttime At Rani (Existing track side)



Source : S-ESIMMS

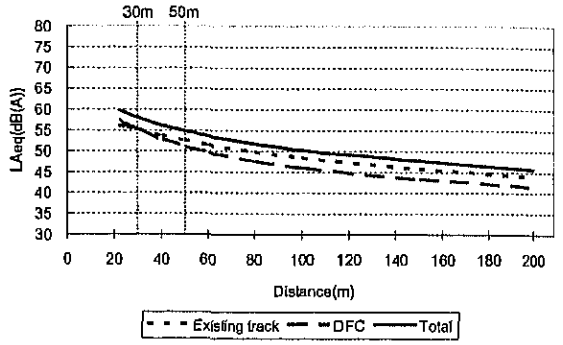
Figure 3.2(3)-8 Result of Noise Prediction With Countermeasure1 on Nighttime At Rani (DFC side)

3) with countermeasure2 (soundproof height DFC side:2.5m Existing track side:1.5m)



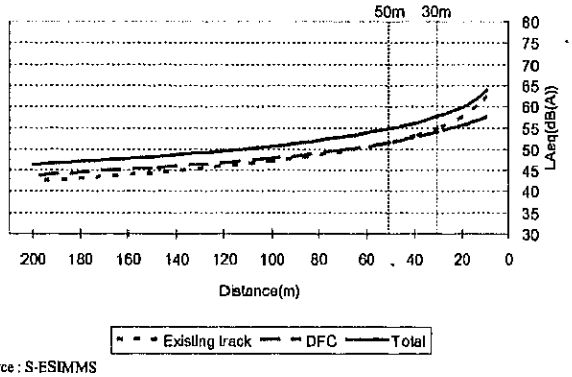
Source : S-ESIMMS

Figure 3.2(3)-9 Result of Noise Prediction With Countermeasure2 on Daytime At Rani (Existing track side)



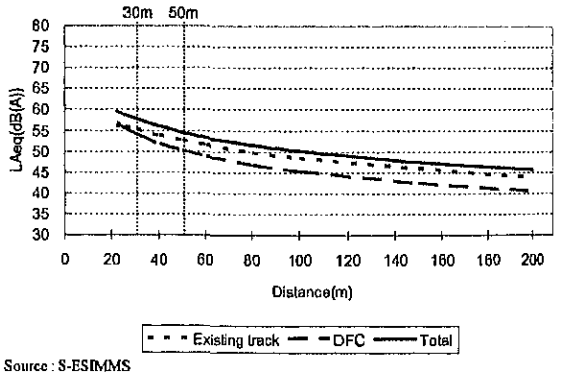
Source : S-ESIMMS

Figure 3.2(3)-10 Result of Noise Prediction With Countermeasure2 on Daytime At Rani (DFC side)



Source : S-ESIMMS

Figure 3.2(3)-11 Result of Noise Prediction With Countermeasure2 on Nighttime At Rani (Existing track side)



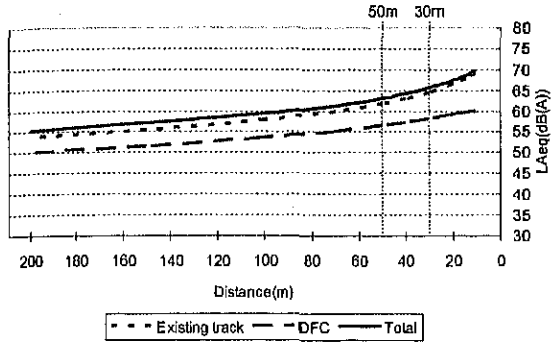
Source : S-ESIMMS

Figure 3.2(3)-12 Result of Noise Prediction With Countermeasure2 on Nighttime At Rani (DFC side)

(4) Marwar

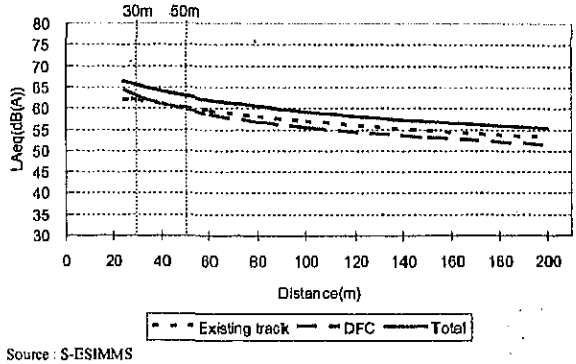
Results of noise prediction for Marwar are given from Figure 3.2(4)-1 to Figure 3.2(4)-12.

1) without countermeasure



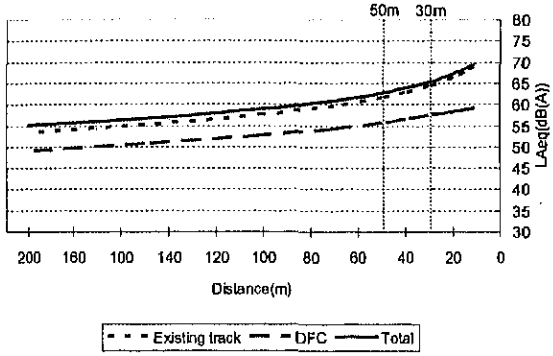
Source : S-ESIMMS

Figure 3.2(4)-1 Result of Noise Prediction Without Countermeasure on Daytime At Marwar (Existing track side)



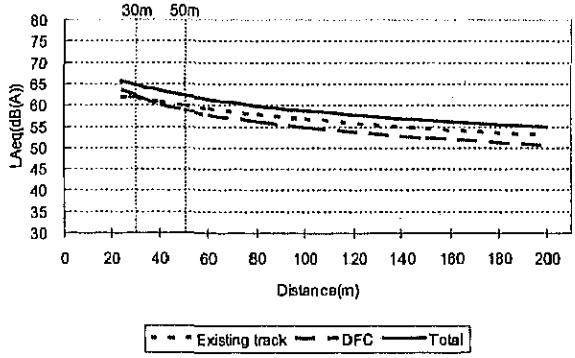
Source : S-ESIMMS

Figure 3.2(4)-2 Result of Noise Prediction Without Countermeasure on Daytime At Marwar (DFC side)



Source : S-ESIMMS

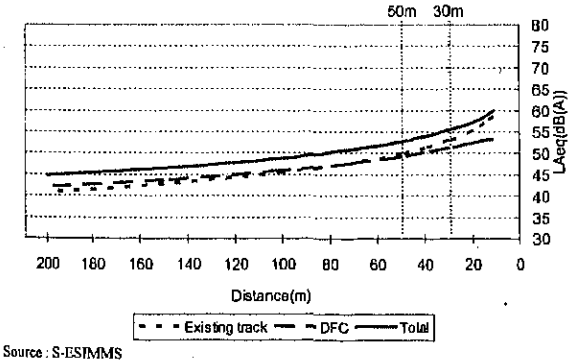
Figure3.2(4)-3 Result of Noise Prediction Without Countermeasure on Nighttime At Marwar (Existing track side)



Source : S-ESIMMS

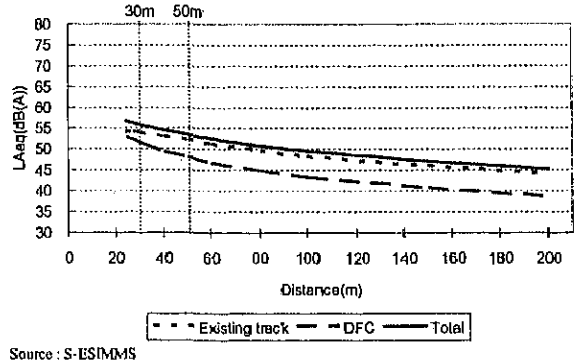
Figure3.2(4)-4 Result of Noise Prediction Without Countermeasure on Nighttime At Marwar (DFC side)

2) with countermeasure1 (soundproof height DFC side:3.5m Existing track side:2.5m)



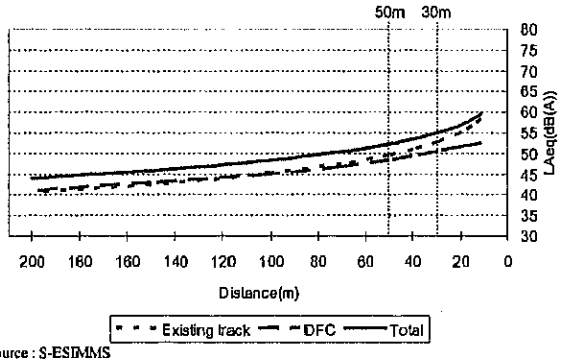
Source : S-ESIMMS

Figure 3.2(4)-5 Result of Noise Prediction With Countermeasure1 on Daytime At Marwar (Existing track side)



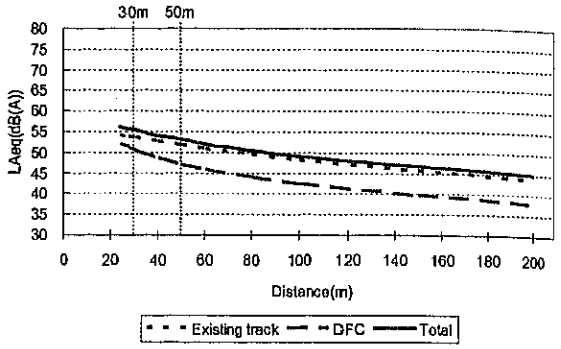
Source : S-ESIMMS

Figure 3.2(4)-6 Result of Noise Prediction With Countermeasure1 on Daytime At Marwar (DFC side)



Source : S-ESIMMS

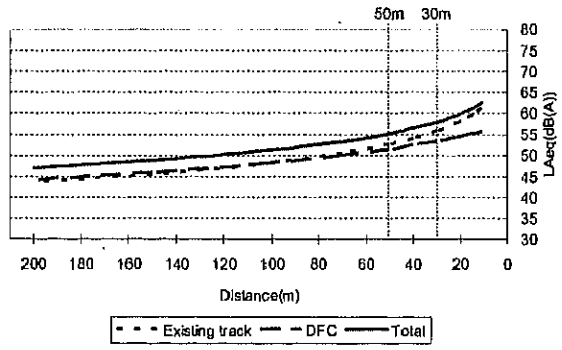
Figure 3.2(4)-7 Result of Noise Prediction With Countermeasure1 on Nighttime At Marwar (Existing track side)



Source : S-ESIMMS

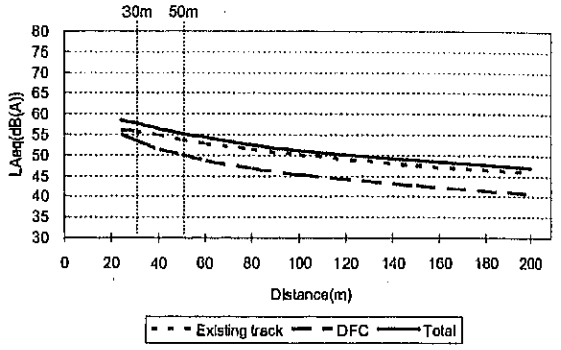
Figure 3.2(4)-8 Result of Noise Prediction With Countermeasure1 on Nighttime At Marwar (DFC side)

3) with countermeasure2 (soundproof height DFC side:2.5m Existing track side:1.5m)



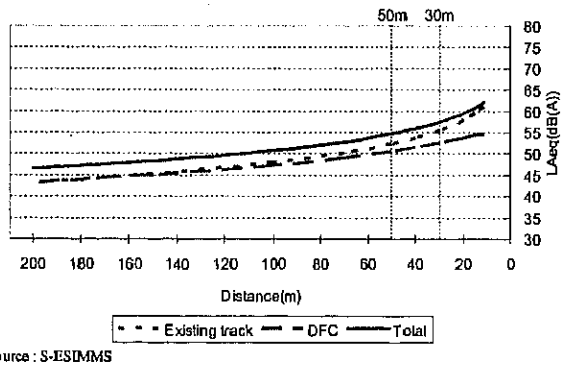
Source : S-ESIMMS

Figure 3.2(4)-9 Result of Noise Prediction With Countermeasure2 on Daytime At Marwar (Existing track side)



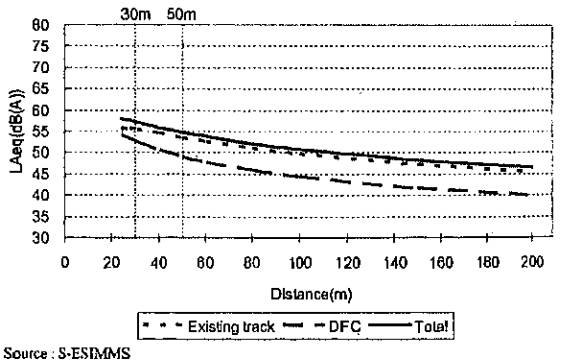
Source : S-ESIMMS

Figure 3.2(4)-10 Result of Noise Prediction With Countermeasure2 on Daytime At Marwar (DFC side)



Source : S-ESIMMS

Figure 3.2(4)-11 Result of Noise Prediction With Countermeasure2 on Nighttime At Marwar (Existing track side)



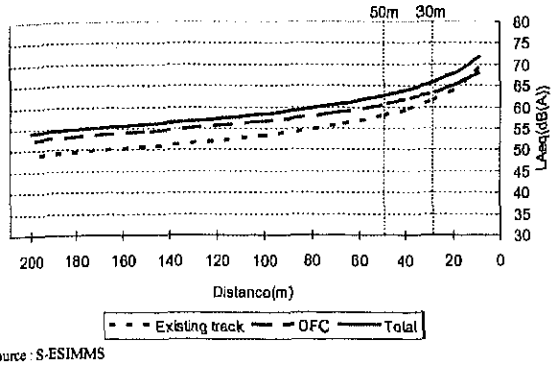
Source : S-ESIMMS

Figure 3.2(4)-12 Result of Noise Prediction With Countermeasure2 on Nighttime At Marwar (DFC side)

(5) Beawar

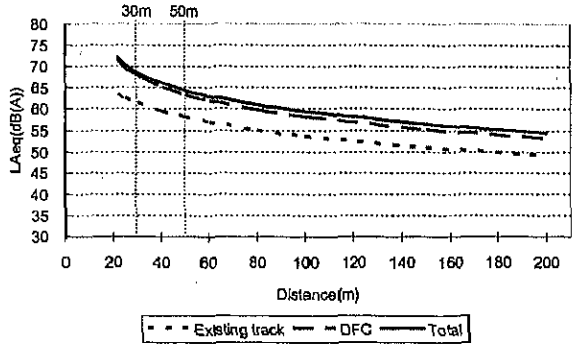
Results of noise prediction for Beawar are given from Figure 3.2(5)-1 to Figure 3.2(5)-12.

1) without countermeasure



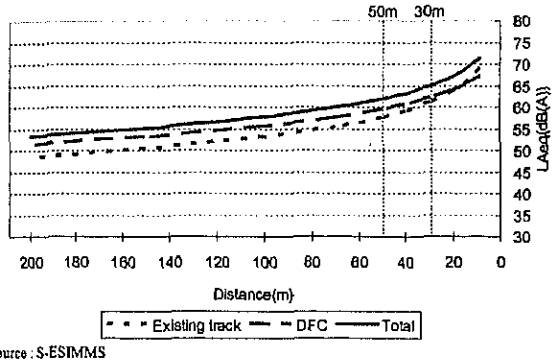
Source : S-ESIMMS

Figure 3.2(5)-1 Result of Noise Prediction Without Countermeasure on Daytime At Beawar (Existing track side)



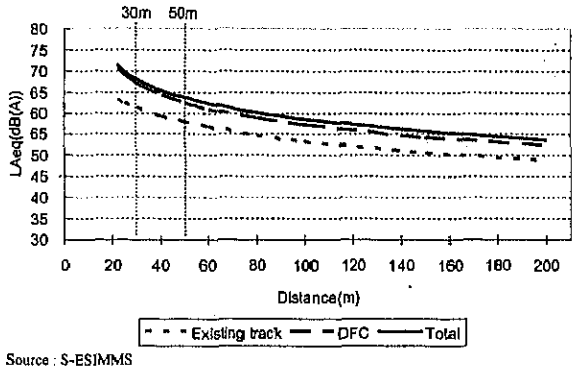
Source : S-ESIMMS

Figure 3.2(5)-2 Result of Noise Prediction Without Countermeasure on Daytime At Beawar (DFC side)



Source : S-ESIMMS

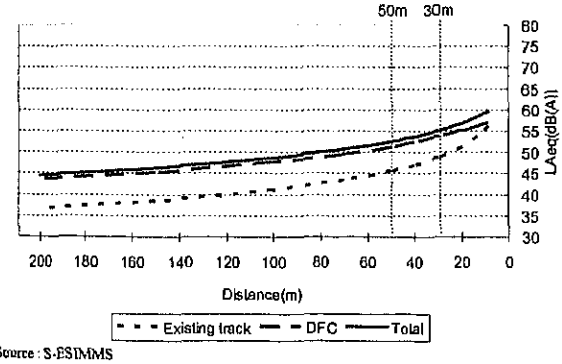
Figure 3.2(5)-3 Result of Noise Prediction Without Countermeasure on Nighttime At Beawar (Existing track side)



Source : S-ESIMMS

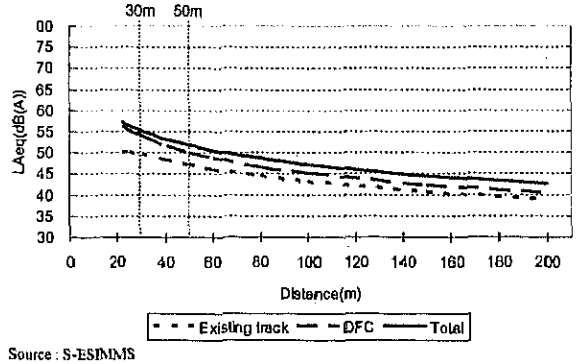
Figure 3.2(5)-4 Result of Noise Prediction Without Countermeasure on Nighttime At Beawar (DFC side)

2) with countermeasure1 (soundproof height DFC side:3m Existing track side:2m)



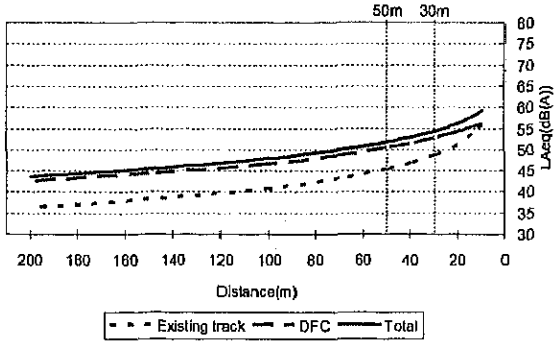
Source : S-ESIMMS

Figure3.2(5)-5 Result of Noise Prediction With Countermeasure1 on Daytime At Beawar (Existing track side)



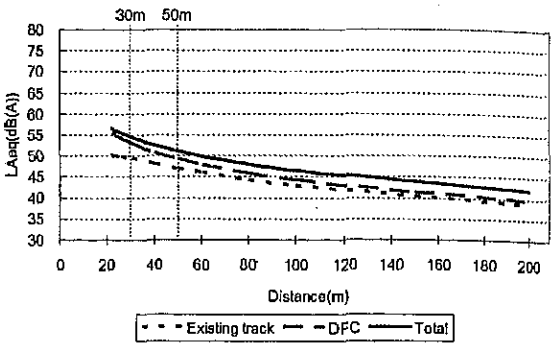
Source : S-ESIMMS

Figure3.2(5)-6 Result of Noise Prediction With Countermeasure1 on Daytime At Beawar (DFC side)



Source : S-ESIMMS

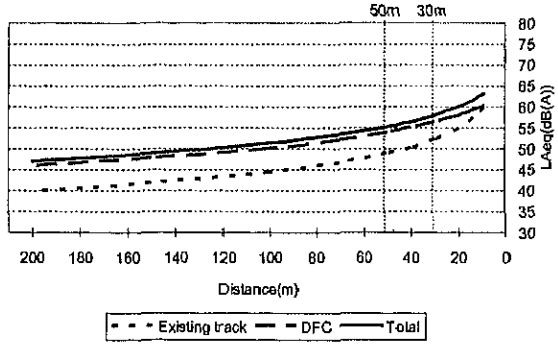
Figure 3.2(5)-7 Result of Noise Prediction With Countermeasure1 on Nighttime At Beawar (Existing track side)



Source : S-ESIMMS

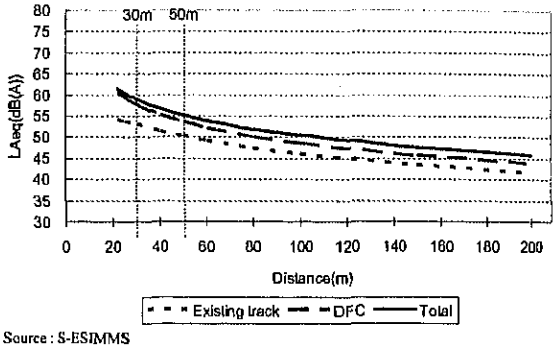
Figure 3.2(5)-8 Result of Noise Prediction With Countermeasure1 on Nighttime At Beawar (DFC side)

3) with countermeasure2 (soundproof height DFC side:1.5m Existing track side:1m)



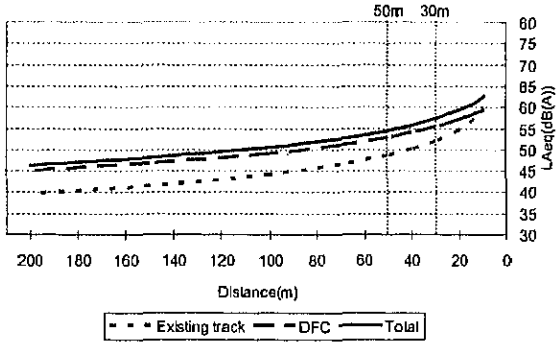
Source : S-ESIMMS

Figure 3.2(5)-9 Result of Noise Prediction With Countermeasure2 on Daytime At Beawar (Existing track side)



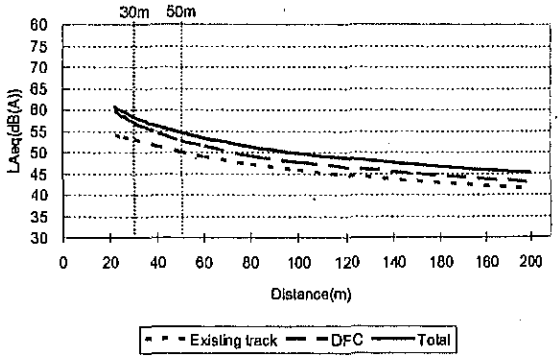
Source : S-ESIMMS

Figure 3.2(5)-10 Result of Noise Prediction With Countermeasure2 on Daytime At Beawar (DFC side)



Source : S-ESIMMS

Figure 3.2(5)-11 Result of Noise Prediction With Countermeasure2 on Nighttime At Beawar (Existing track side)



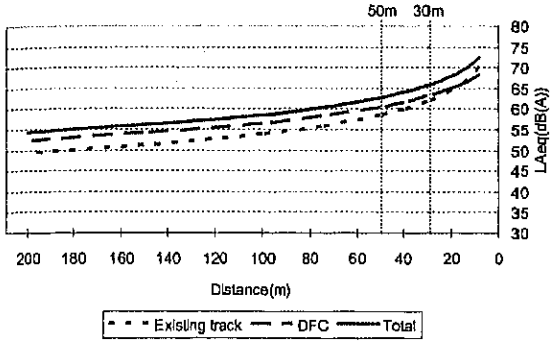
Source : S-ESIMMS

Figure 3.2(5)-12 Result of Noise Prediction With Countermeasure2 on Nighttime At Beawar (DFC side)

(6) Ajmer NO.1

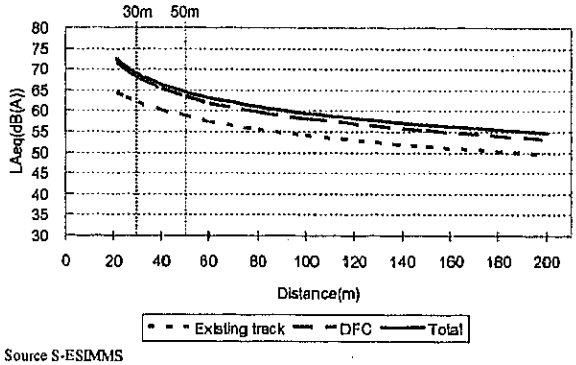
Results of noise prediction for Ajmer NO.1 are given from Figure 3.2(6)-1 to Figure 3.2(6)-12.

1) without countermeasure



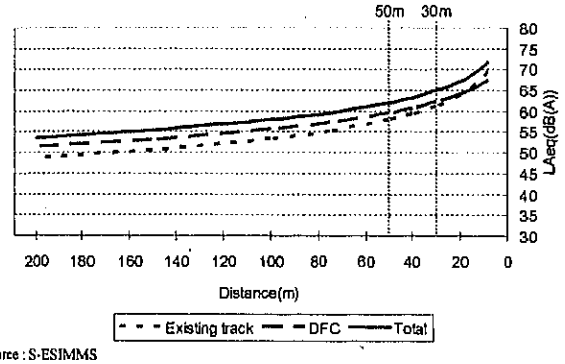
Source : S-ESIMMS

Figure 3.2(6)-1 Result of Noise Prediction Without Countermeasure on Daytime At Ajmer NO.1 (Existing track side)



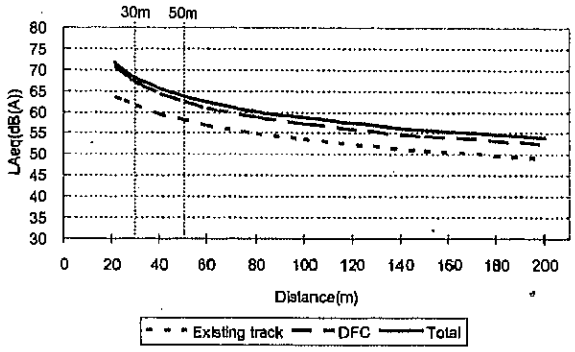
Source S-ESIMMS

Figure 3.2(6)-2 Result of Noise Prediction Without Countermeasure on Daytime At Ajmer NO.1 (DFC side)



Source : S-ESIMMS

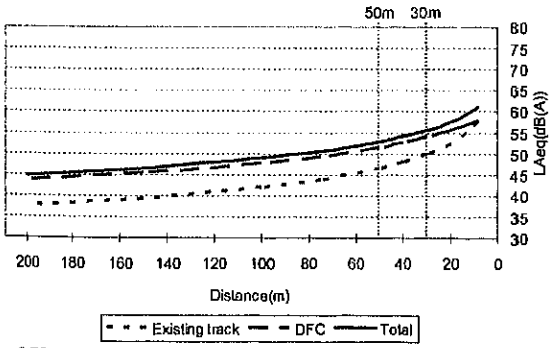
Figure 3.2(6)-3 Result of Noise Prediction Without Countermeasure on Nighttime At Ajmer NO.1 (Existing track side)



Source : S-ESIMMS

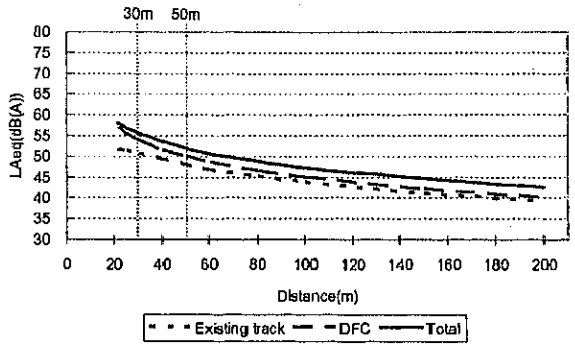
Figure 3.2(6)-4 Result of Noise Prediction Without Countermeasure on Nighttime At Ajmer NO.1 (DFC side)

2) with countermeasure1 (soundproof height DFC side:3m Existing track side:2m)



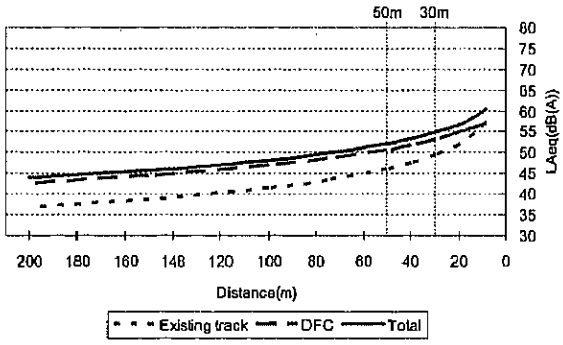
Source : S-ESIMMS

Figure3.2(6)-5 Result of Noise Prediction With Countermeasure1 on Daytime At Ajmer NO.1 (Existing track side)



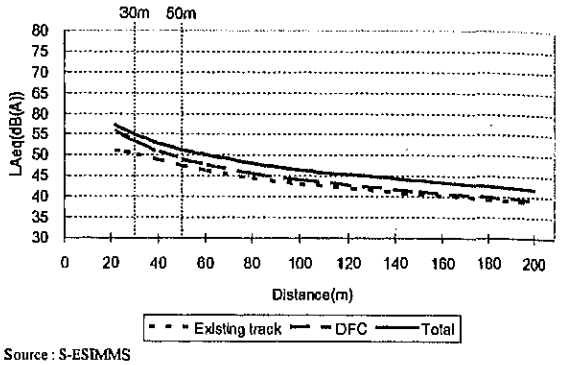
Source : S-ESIMMS

Figure3.2(6)-6 Result of Noise Prediction With Countermeasure1 on Daytime At Ajmer NO.1 (DFC side)



Source : S-ESIMMS

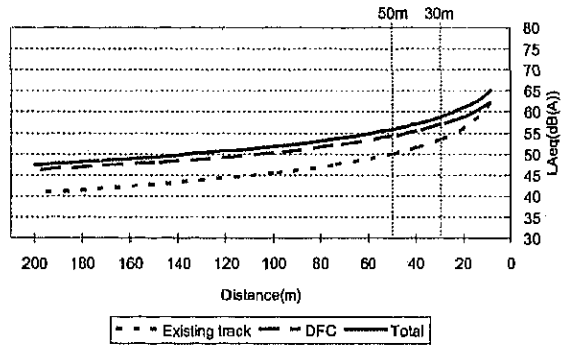
Figure 3.2(6)-7 Result of Noise Prediction With Countermeasure1 on Nighttime At Ajmer NO.1 (Existing track side)



Source : S-ESIMMS

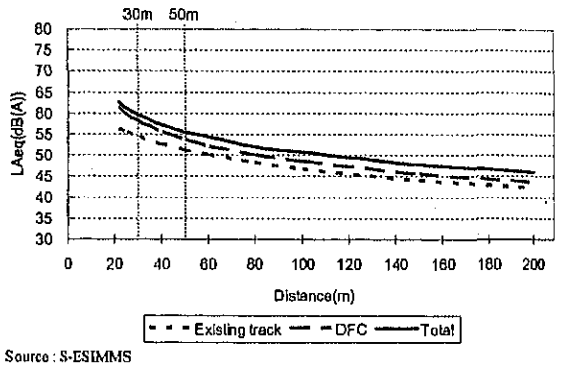
Figure 3.2(6)-8 Result of Noise Prediction With Countermeasure1 on Nighttime At Ajmer NO.1 (DFC side)

3) with countermeasure2 (soundproof height DFC side:1.5m Existing track side:1m)



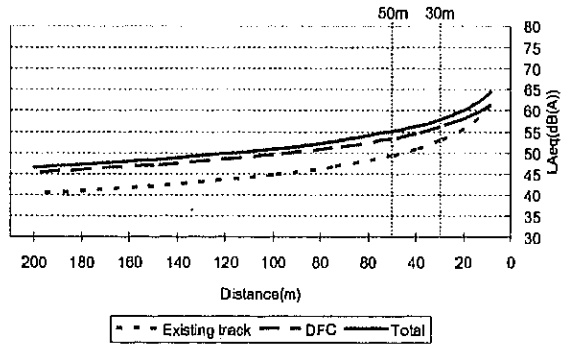
Source : S-ESIMMS

Figure 3.2(6)-9 Result of Noise Prediction With Countermeasure2 on Daytime At Ajmer NO.1 (Existing track side)



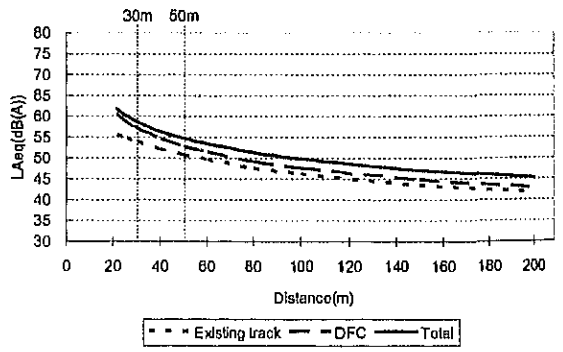
Source : S-ESIMMS

Figure 3.2(6)-10 Result of Noise Prediction With Countermeasure2 on Daytime At Ajmer NO.1 (DFC side)



Source : S-ESIMMS

Figure 3.2(6)-11 Result of Noise Prediction With Countermeasure2 on Nighttime At Ajmer NO.1 (Existing track side)



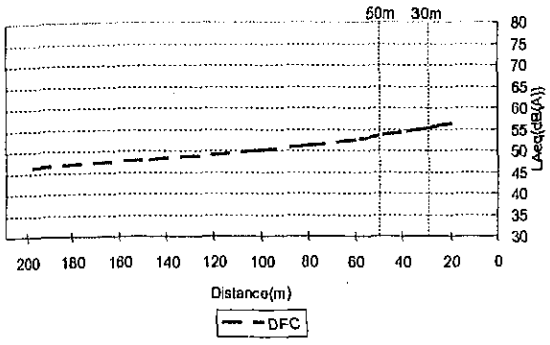
Source : S-ESIMMS

Figure 3.2(6)-12 Result of Noise Prediction With Countermeasure2 on Nighttime At Ajmer NO.1 (DFC side)

(7) Ajmer NO.2

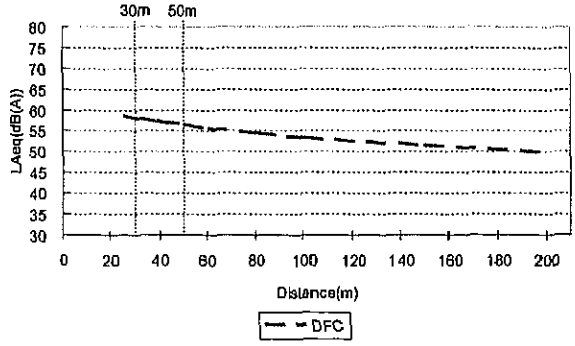
Results of noise prediction for Ajmer NO.2 are given from Figure 3.2(7)-1 to Figure 3.2(7)-10.

1) without countermeasure



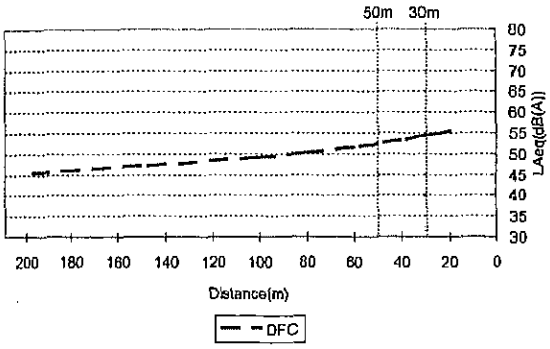
Source : S-ESIMMS

Figure 3.2(7)-1 Result of Noise Prediction Without Countermeasure on Daytime At Ajmer NO.2 (Existing track side)



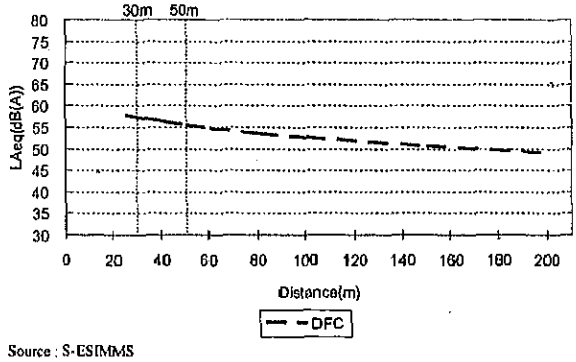
Source : S-ESIMMS

Figure 3.2(7)-2 Result of Noise Prediction Without Countermeasure on Daytime At Ajmer NO.2 (DFC side)



Source : S-ESIMMS

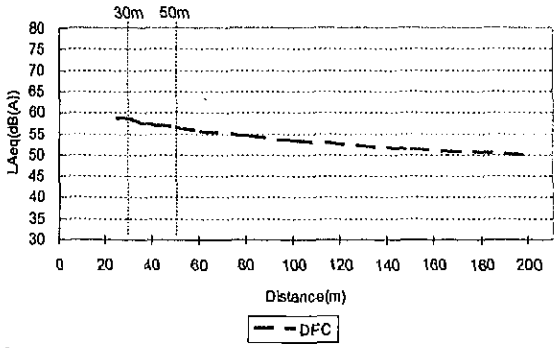
Figure 3.2(7)-3 Result of Noise Prediction Without Countermeasure on Nighttime At Ajmer NO.2 (Existing track side)



Source : S-ESIMMS

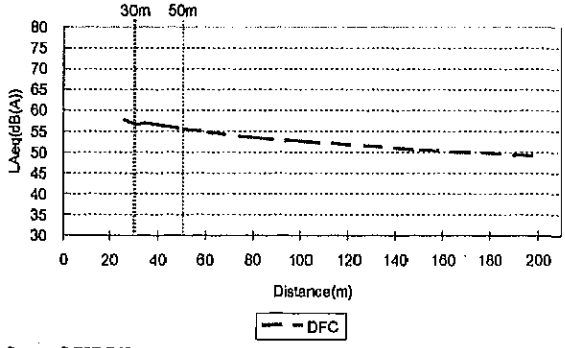
Figure 3.2(7)-4 Result of Noise Prediction Without Countermeasure on Nighttime At Ajmer NO.2 (DFC side)

2) with countermeasure1 (soundproof height DFC side:0.5m)



Source : S-ESIMMS

Figure 3.2(7)-5 Result of Noise Prediction With Countermeasure1 on Daytime At Ajmer NO.2 (DFC side)

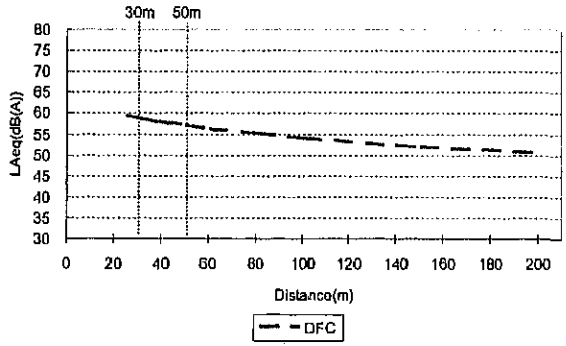


Source : S-ESIMMS

Figure 3.2(7)-6 Result of Noise Prediction With Countermeasure1 on Nighttime At Ajmer NO.2 (DFC side)

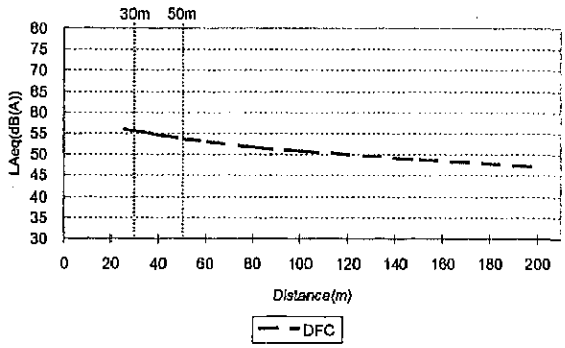
3) with countermeasure A (by limitation of operation)

Limitation plan (daytime: 94 trains →110 trains, nighttime: 46 trains → 30 trains)



Source : S-ESIMMS

Figure 3.2(7)-7 Result of Noise Prediction With Countermeasure A on Daytime At Ajmer NO.2 (DFC side)

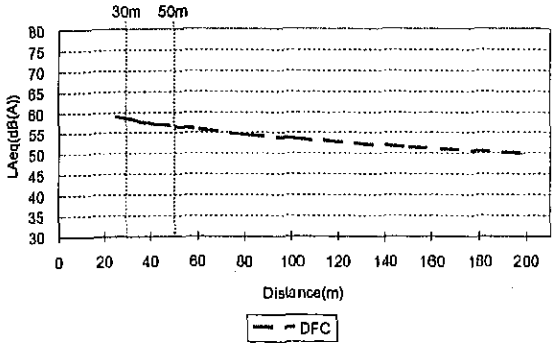


Source : S-ESIMMS

Figure 3.2(7)-8 Result of Noise Prediction With Countermeasure A on Nighttime At Ajmer NO.2 (DFC side)

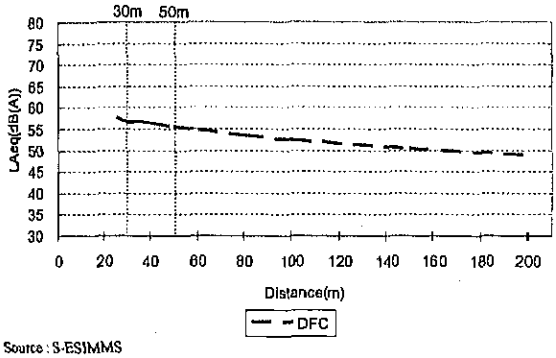
4) with countermeasure B (by limitation of operation)

Limitation plan (daytime: 94 trains →95 trains, nighttime: 46 trains → 45 trains)



Source : S-ESIMMS

Figure 3.2(7)-9 Result of Noise Prediction With Countermeasure B on Daytime At Ajmer NO.2 (DFC side)



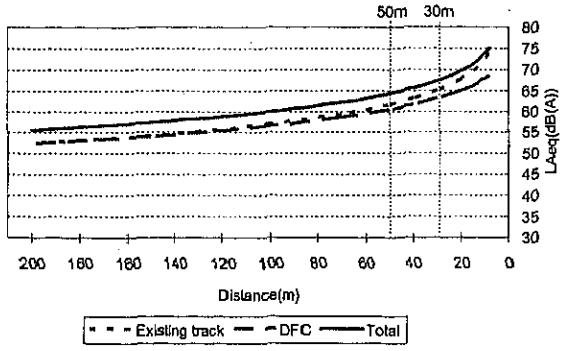
Source : S-ESIMMS

Figure 3.2(7)-10 Result of Noise Prediction With Countermeasure B on Nighttime At Ajmer NO.2 (DFC side)

(8) Kishangarh

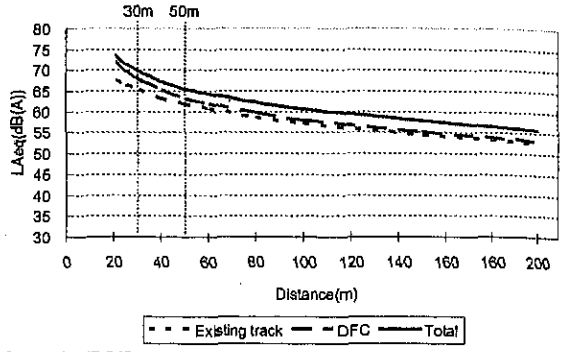
Results of noise prediction for Kishangarh are given from Figure 3.2(8)-1 to Figure 3.2(8)-12.

1) without countermeasure



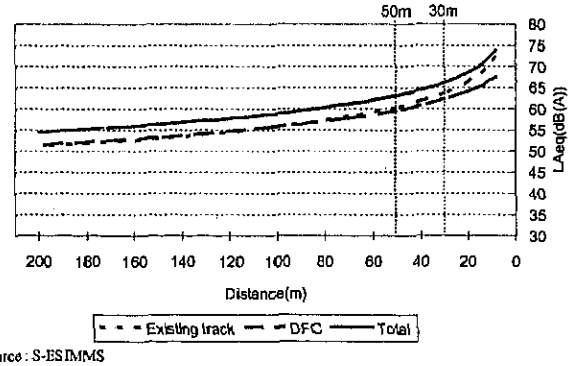
Source : S-ESIMMS

Figure 3.2(8)-1 Result of Noise Prediction Without Countermeasure on Daytime At Kishangarh (Existing track side)



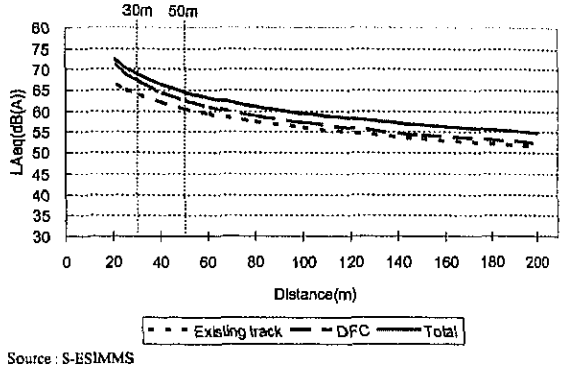
Source : S-ESIMMS

Figure 3.2(8)-2 Result of Noise Prediction Without Countermeasure on Daytime At Kishangarh (DFC side)



Source : S-ESIMMS

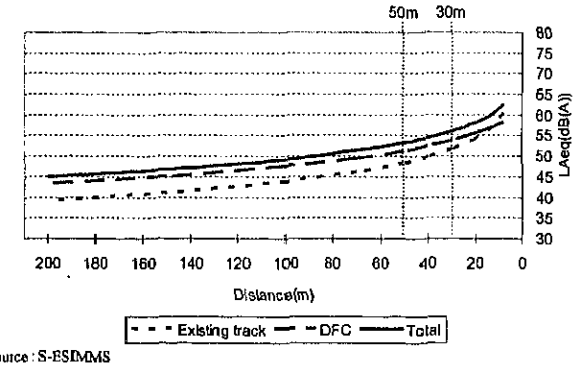
Figure 3.2(8)-3 Result of Noise Prediction Without Countermeasure on Nighttime At Kishangarh (Existing track side)



Source : S-ESIMMS

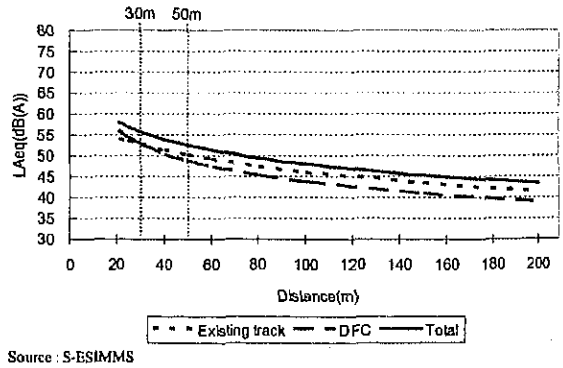
Figure 3.2(8)-4 Result of Noise Prediction Without Countermeasure on Nighttime At Kishangarh (DFC side)

2) with countermeasure1 (soundproof height DFC side:3.5m Existing track side:2m)



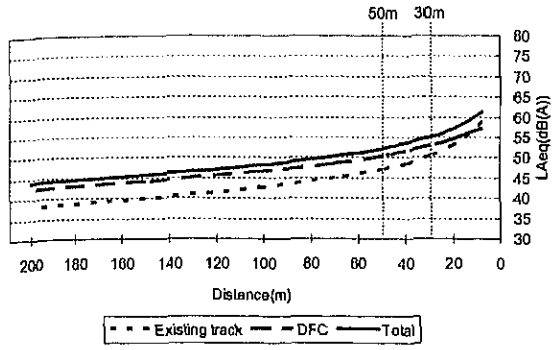
Source : S-ESIMMS

Figure 3.2(8)-5 Result of Noise Prediction With Countermeasure1 on Daytime At Kishangarh (Existing track side)



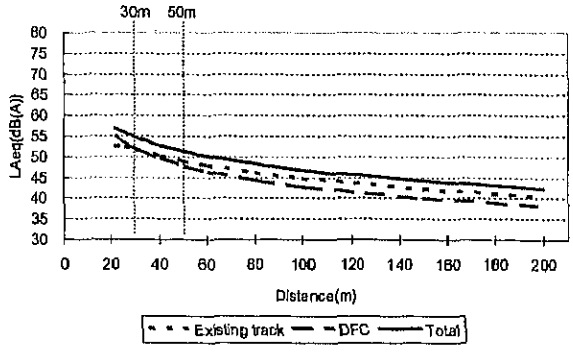
Source : S-ESIMMS

Figure 3.2(8)-6 Result of Noise Prediction With Countermeasure1 on Daytime At Kishangarh (DFC side)



Source : S-ESIMMS

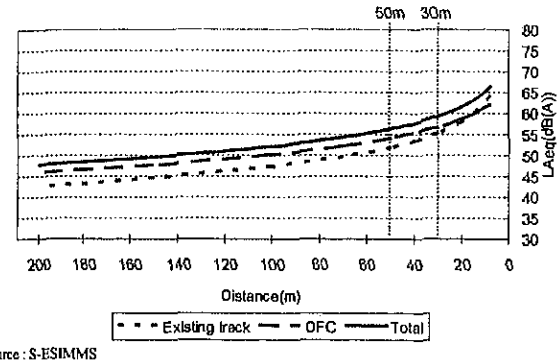
Figure 3.2(8)-7 Result of Noise Prediction With Countermeasure1 on Nighttime At Kishangarh (Existing track side)



Source : S-ESIMMS

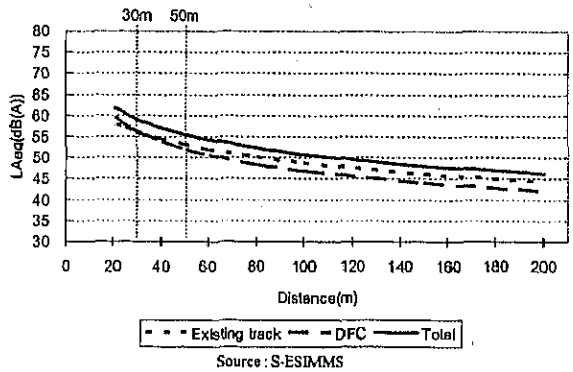
Figure 3.2(8)-8 Result of Noise Prediction With Countermeasure1 on Nighttime At Kishangarh (DFC side)

3) with countermeasure2 (soundproof height DFC side:2.5m Existing track side:1m)



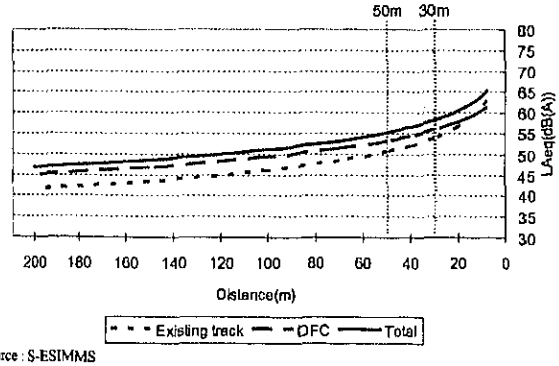
Source : S-ESIMMS

Figure 3.2(8)-9 Result of Noise Prediction With Countermeasure2 on Daytime At Kishangarh (Existing track side)



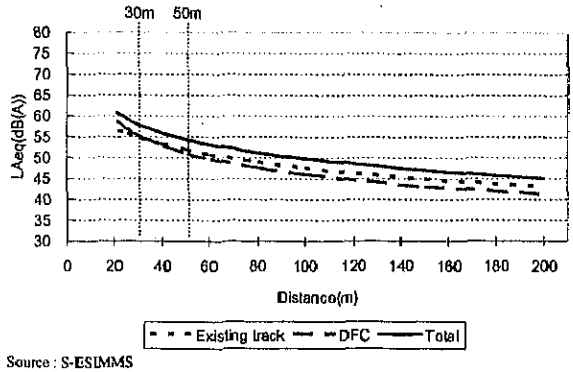
Source : S-ESIMMS

Figure 3.2(8)-10 Result of Noise Prediction With Countermeasure2 on Daytime At Kishangarh (DFC side)



Source : S-ESIMMS

Figure3.2(8)-11 Result of Noise Prediction With Countermeasure2 on Nighttime At Kishangarh (Existing track side)



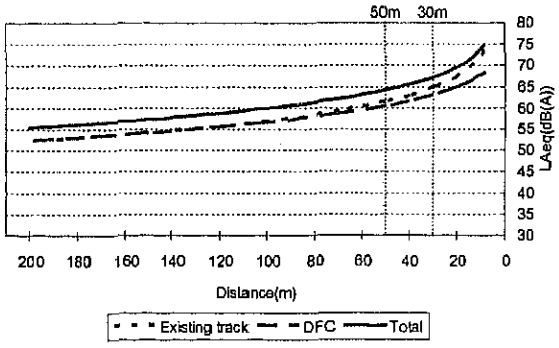
Source : S-ESIMMS

Figure3.2(8)-12 Result of Noise Prediction With Countermeasure2 on Nighttime At Kishangarh (DFC side)

(9) Ringas

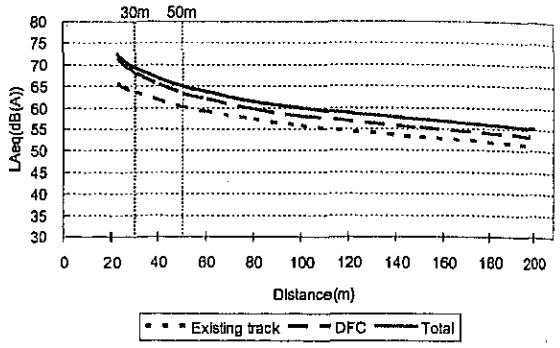
Results of noise prediction for Ringas are given from Figure 3.2(9)-1 to Figure 3.2(9)-12.

1) without countermeasure



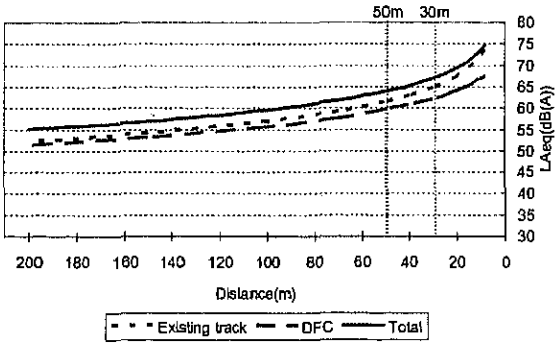
Source : S-ESIMMS

Figure 3.2(9)-1 Result of Noise Prediction Without Countermeasure on Daytime At Ringas (Existing track side)



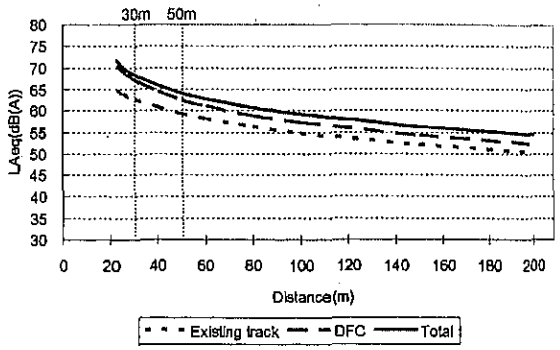
Source : S-ESIMMS

Figure 3.2(9)-2 Result of Noise Prediction Without Countermeasure on Daytime At Ringas (DFC side)



Source : S-ESIMMS

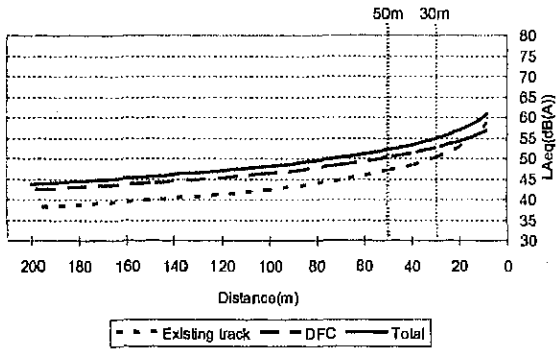
Figure 3.2(9)-3 Result of Noise Prediction Without Countermeasure on Nighttime At Ringas (Existing track side)



Source : S-ESIMMS

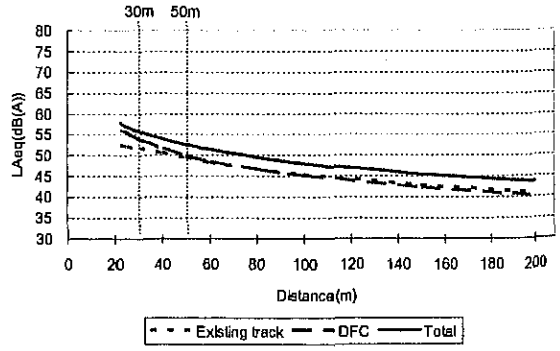
Figure 3.2(9)-4 Result of Noise Prediction Without Countermeasure on Nighttime At Ringas (DFC side)

2) with countermeasure1 (soundproof height DFC side:3m Existing track side:2.5m)



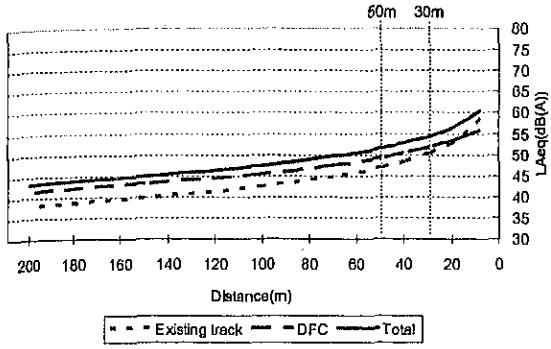
Source : S-ESIMMS

Figure 3.2(9)-5 Result of Noise Prediction With Countermeasure1 on Daytime At Ringas (Existing track side)



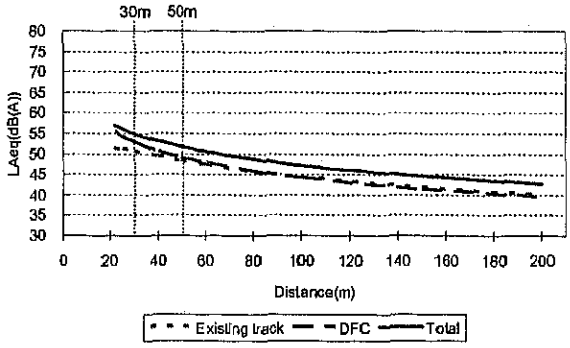
Source : S-ESIMMS

Figure 3.2(9)-6 Result of Noise Prediction With Countermeasure1 on Daytime At Ringas (DFC side)



Source : S-ESIMMS

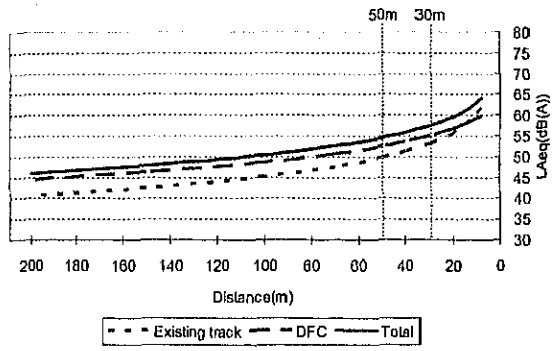
Figure 3.2(9)-7 Result of Noise Prediction With Countermeasure1 on Nighttime At Ringas (Existing track side)



Source : S-ESIMMS

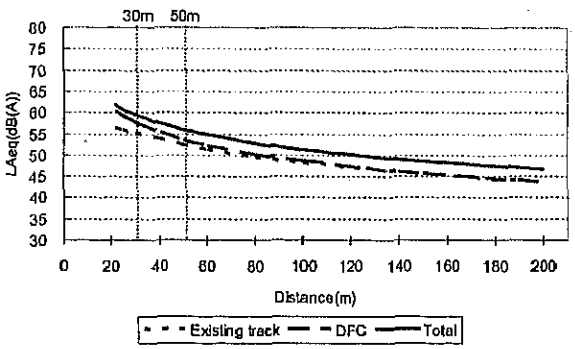
Figure 3.2(9)-8 Result of Noise Prediction With Countermeasure1 on Nighttime At Ringas (DFC side)

3) with countermeasure2 (soundproof height DFC side:1.5m Existing track side:1.5m)



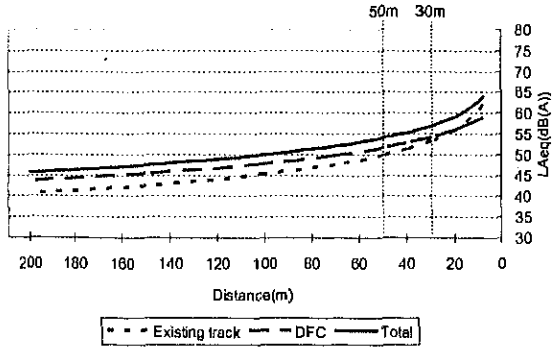
Source : S-ESIMMS

Figure 3.2(9)-9 Result of Noise Prediction With Countermeasure2 on Daytime At Ringas (Existing track side)



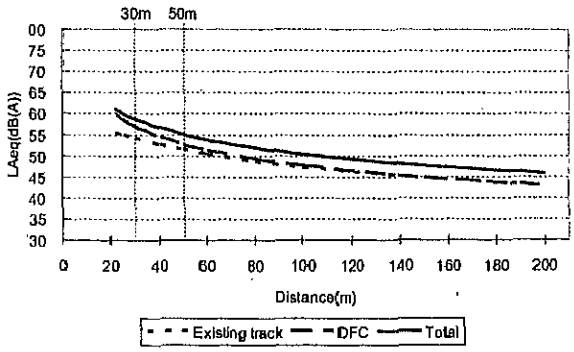
Source : S-ESIMMS

Figure3.2(9)-10 Result of Noise Prediction With Countermeasure2 on Daytime At Ringas (DFC side)



Source : S-ESIMMS

Figure3.2(9)-11 Result of Noise Prediction With Countermeasure2 on Nighttime At Ringas (Existing track side)



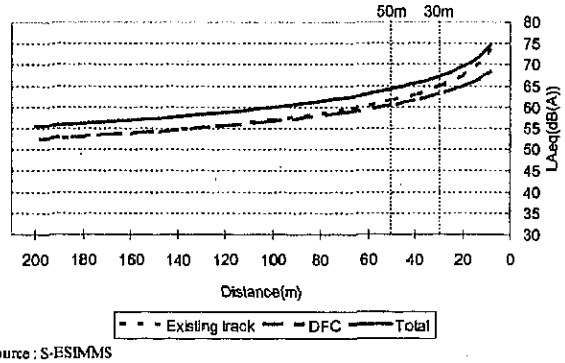
Source : S-ESIMMS

Figure3.2(9)-12 Result of Noise Prediction With Countermeasure2 on Nighttime At Ringas (DFC side)

(10) Shri Madhopur, Nim ka thana

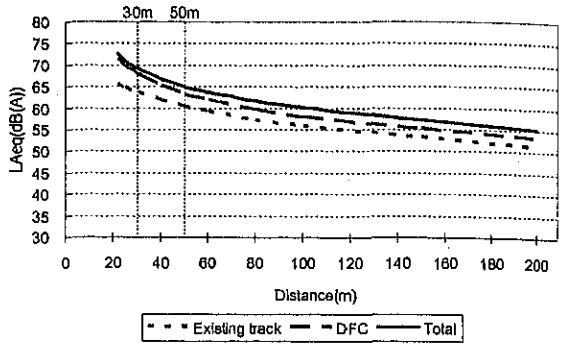
Results of noise prediction for Shri Madhopur, Nim ka thana are given from Figure 3.2(10)-1 to Figure 3.2(10)-12.

1) without countermeasure



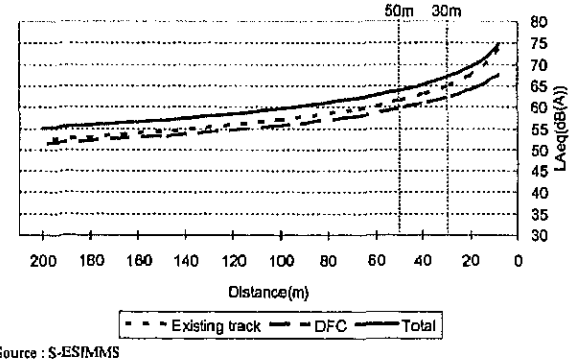
Source : S-ESIMMS

Figure 3.2(10)-1 Result of Noise Prediction Without Countermeasure on Daytime At Shri Madhopur, Nim ka thana (Existing track side)



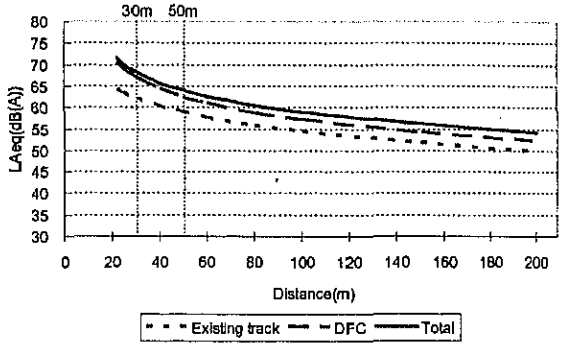
Source : S-ESIMMS

Figure 3.2(10)-2 Result of Noise Prediction Without Countermeasure on Daytime At Shri Madhopur, Nim ka thana (DFC side)



Source : S-ESIMMS

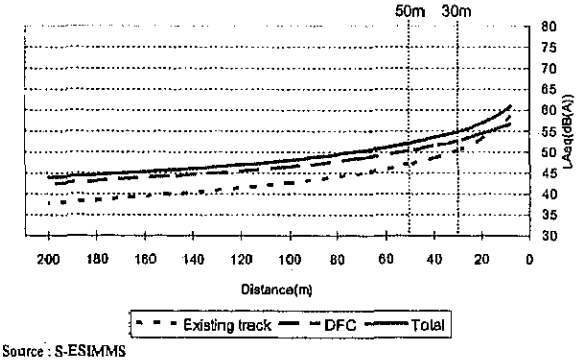
Figure3.2(10)-3 Result of Noise Prediction Without Countermeasure on Nighttime At Shri Madhopur, Nim ka thana (Existing track side)



Source : S-ESIMMS

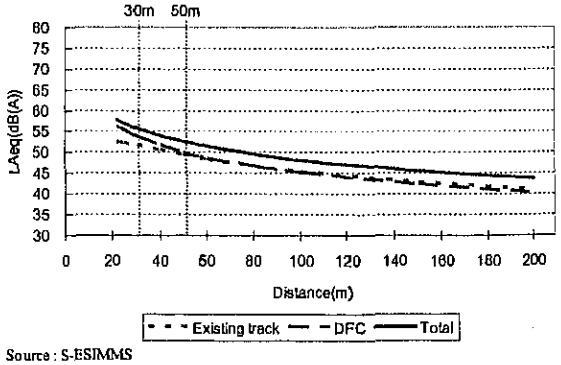
Figure3.2(10)-4 Result of Noise Prediction Without Countermeasure on Nighttime At Shri Madhopur, Nim ka thana (DFC side)

2) with countermeasure1 (soundproof height DFC side:3m Existing track side:2.5m)



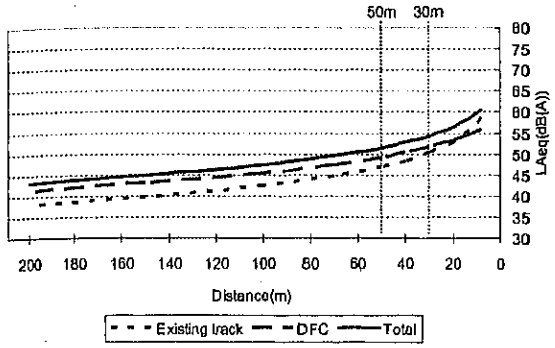
Source : S-ESIMMS

Figure 3.2(10)-5 Result of Noise Prediction With Countermeasure1 on Daytime At Shri Madhopur, Nim ka thana (Existing track side)



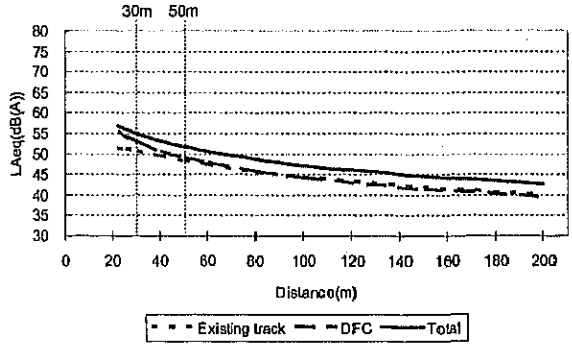
Source : S-ESIMMS

Figure 3.2(10)-6 Result of Noise Prediction With Countermeasure1 on Daytime At Shri Madhopur, Nim ka thana (DFC side)



Source : S-ESIMMS

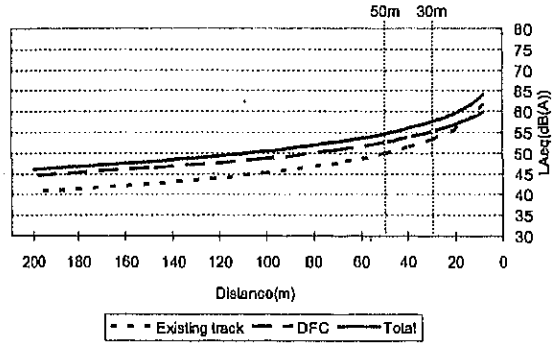
Figure 3.2(10)-7 Result of Noise Prediction With Countermeasure1 on Nighttime At Shri Madhopur, Nim ka thana (Existing track side)



Source : S-ESIMMS

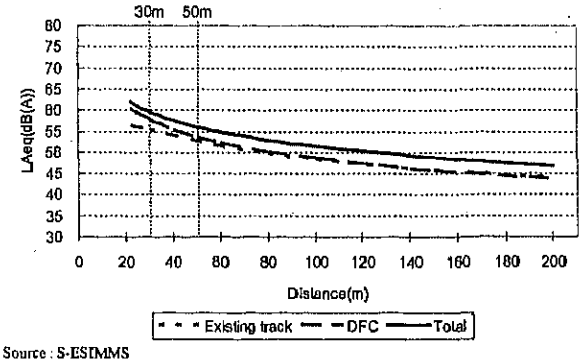
Figure 3.2(10)-8 Result of Noise Prediction With Countermeasure1 on Nighttime At Shri Madhopur, Nim ka thana (DFC side)

3) with countermeasure2 (soundproof height DFC side:1.5m Existing track side:1.5m)



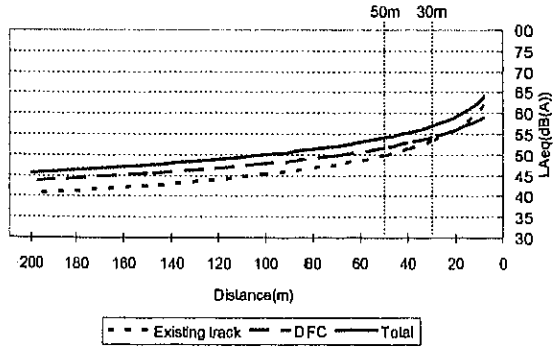
Source : S-ESIMMS

Figure 3.2(10)-9 Result of Noise Prediction With Countermeasure2 on Daytime At Shri Madhopur, Nim ka thana (Existing track side)



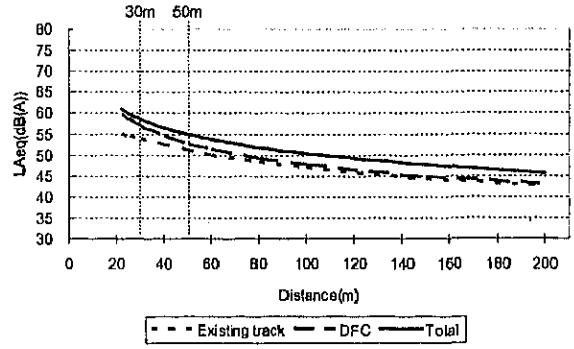
Source : S-ESIMMS

Figure 3.2(10)-10 Result of Noise Prediction With Countermeasure2 on Daytime At Shri Madhopur, Nim ka thana (DFC side)



Source : S-ESIMMS

Figure3.2(10)-11 Result of Noise Prediction With Countermeasure2 on Nighttime At Shri Madhopur, Nim ka thana (Existing track side)



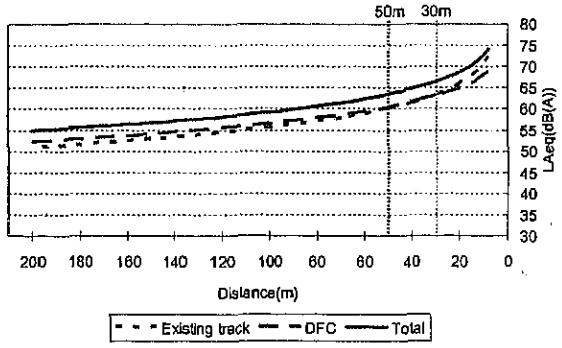
Source : S-ESIMMS

Figure3.2(10)-12 Result of Noise Prediction With Countermeasure2 on Nighttime At Shri Madhopur, Nim ka tha (DFC side)

(11) Narnaul

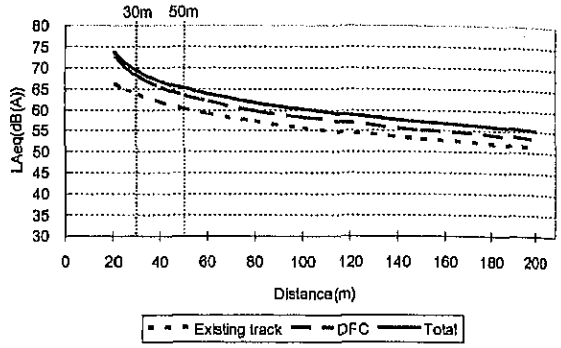
Results of noise prediction for Ringas are given from Figure 3.2(11)-1 to Figure 3.2(11)-12.

1) without countermeasure



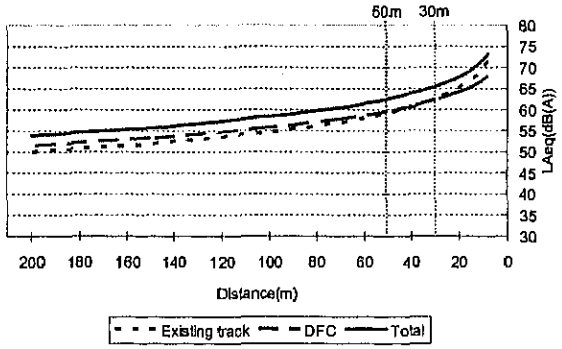
Source : S-ESIMMS

Figure 3.2(11)-1 Result of Noise Prediction Without Countermeasure on Daytime At Narnaul (Existing track side)



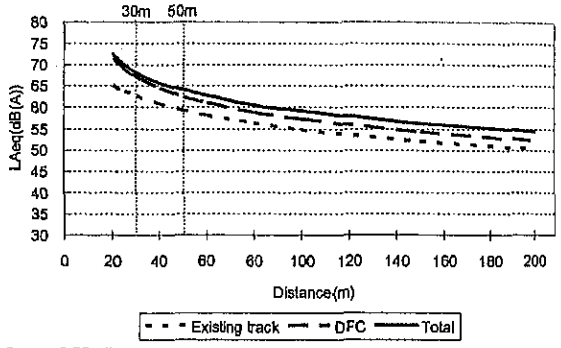
Source : S-ESIMMS

Figure 3.2(11)-2 Result of Noise Prediction Without Countermeasure on Daytime At Narnaul (DFC side)



Source : S-ESIMMS

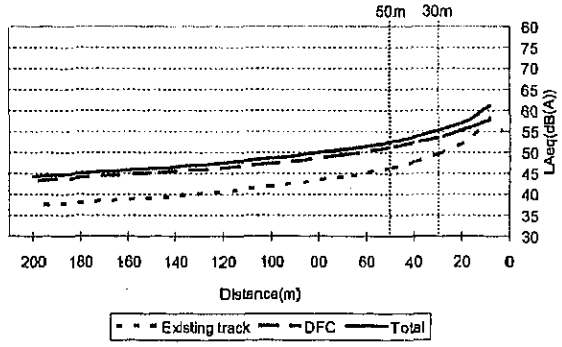
Figure 3.2(11)-3 Result of Noise Prediction Without Countermeasure on Nighttime At Narnaul (Existing track side)



Source : S-ESIMMS

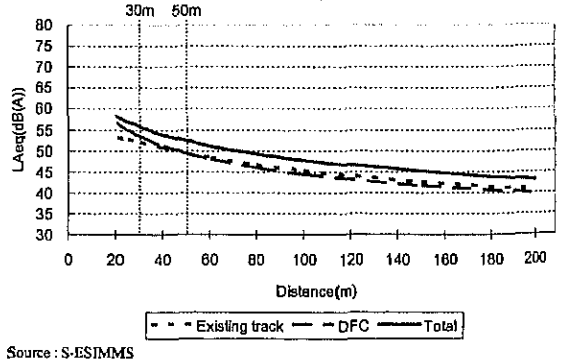
Figure 3.2(11)-4 Result of Noise Prediction Without Countermeasure on Nighttime At Narnaul (DFC side)

2) with countermeasure1 (soundproof height DFC side:3m Existing track side:2m)



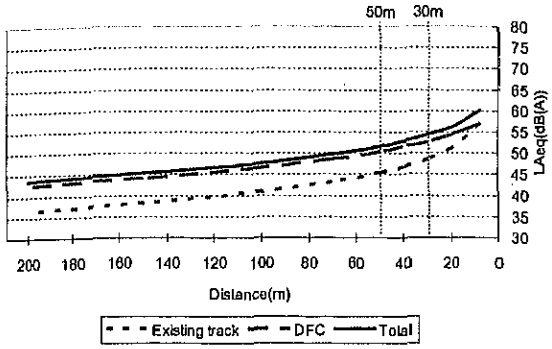
Source : S-ESIMMS

Figure 3.2(11)-5 Result of Noise Prediction With Countermeasure1 on Daytime At Narnaul (Existing track side)



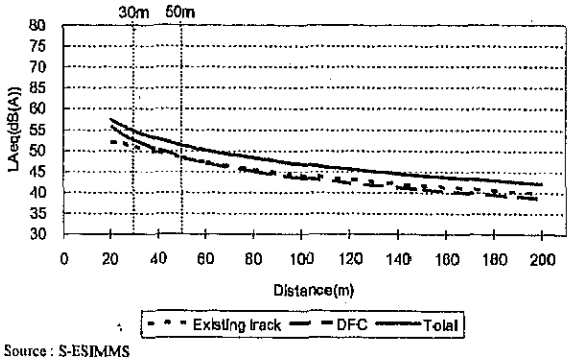
Source : S-ESIMMS

Figure 3.2(11)-6 Result of Noise Prediction With Countermeasure1 on Daytime At Narnaul (DFC side)



Source : S-ESIMMS

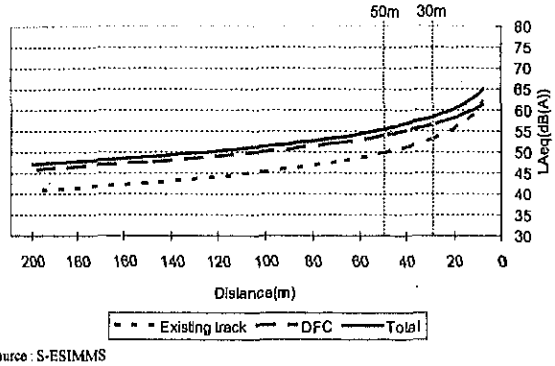
Figure 3.2(11)-7 Result of Noise Prediction With Countermeasure1 on Nighttime At Narnaul (Existing track side)



Source : S-ESIMMS

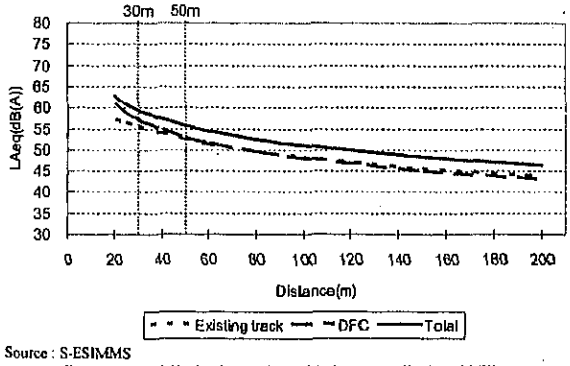
Figure 3.2(11)-8 Result of Noise Prediction With Countermeasure1 on Nighttime At Narnaul (DFC side)

3) with countermeasure2 (soundproof height DFC side:1.5m Existing track side:1m)



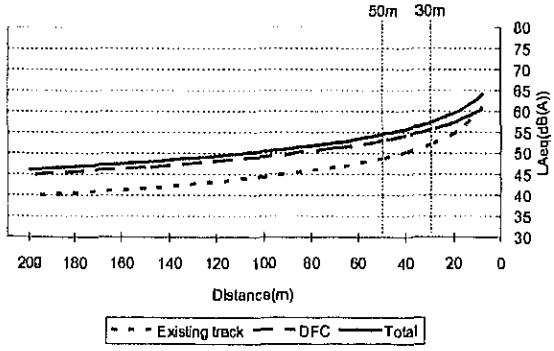
Source : S-ESIMMS

Figure 3.2(11)-9 Result of Noise Prediction With Countermeasure2 on Daytime At Narnaul (Existing track side)



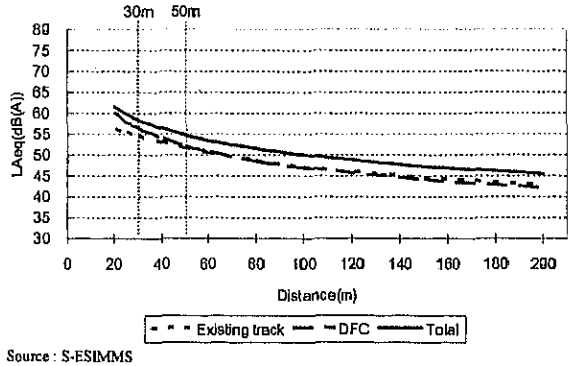
Source : S-ESIMMS

Figure 3.2(11)-10 Result of Noise Prediction With Countermeasure2 on Daytime At Narnaul (DFC side)



Source : S-ESIMMS

Figure3.2(11)-11 Result of Noise Prediction With Countermeasure2 on Nighttime At Narnaul (Existing track side)



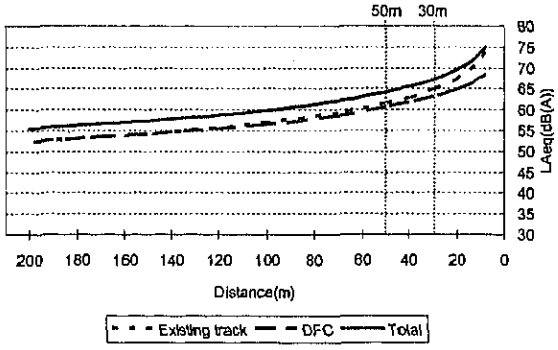
Source : S-ESIMMS

Figure3.2(11)-12 Result of Noise Prediction With Countermeasure2 on Nighttime At Narnaul (DFC side)

(12) Ateli

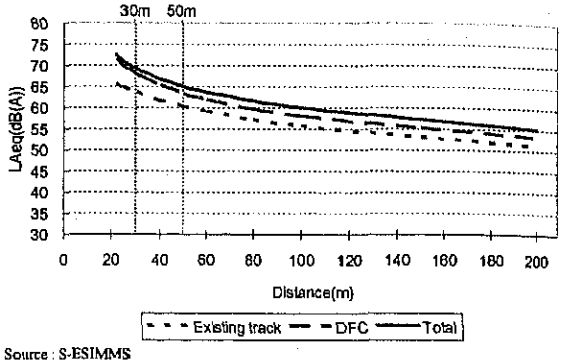
Results of noise prediction for Ringas are given from Figure 3.2(12)-1 to Figure 3.2(12)-12.

1) without countermeasure



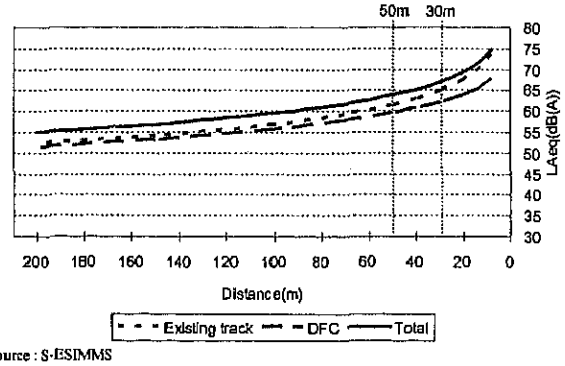
Source : S-ESIMMS

Figure 3.2(12)-1 Result of Noise Prediction Without Countermeasure on Daytime At Ateli (Existing track side)



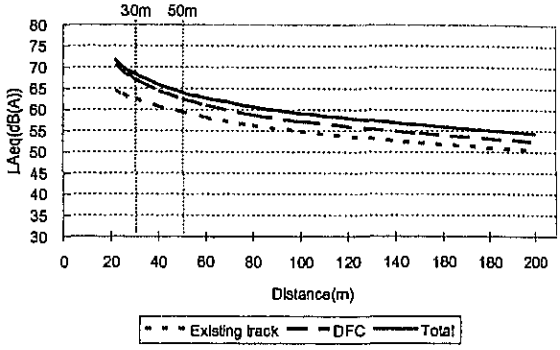
Source : S-ESIMMS

Figure 3.2(12)-2 Result of Noise Prediction Without Countermeasure on Daytime At Ateli (DFC side)



Source : S-ESIMMS

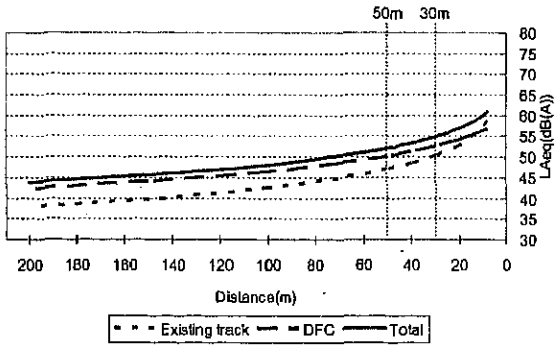
Figure3.2(12)-3 Result of Noise Prediction Without Countermeasure on Nighttime At Ateli (Existing track side)



Source : S-ESIMMS

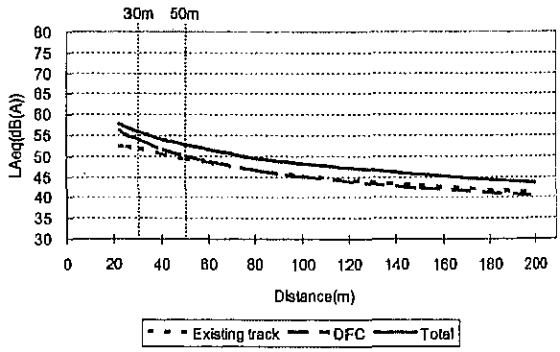
Figure3.2(12)-4 Result of Noise Prediction Without Countermeasure on Nighttime At Ateli (DFC side)

2) with countermeasure1 (soundproof height DFC side:3m Existing track side:2.5m)



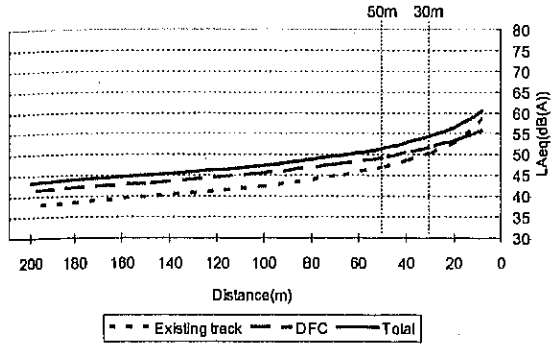
Source : S-ESIMMS

Figure3.2(12)-5 Result of Noise Prediction With Countermeasure1 on Daytime At Ateli (Existing track side)



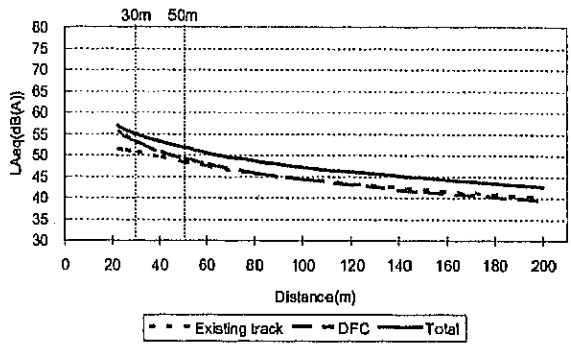
Source : S-ESIMMS

Figure3.2(12)-6 Result of Noise Prediction With Countermeasure1 on Daytime At Ateli (DFC side)



Source : S-ESIMMS

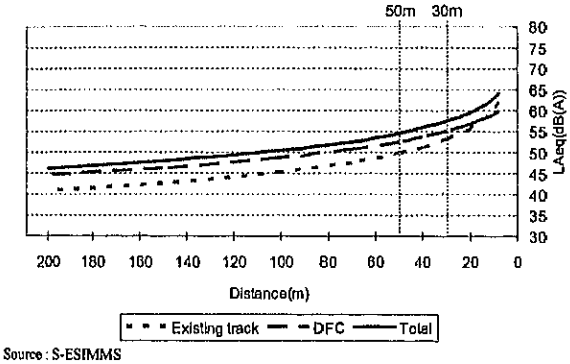
Figure 3.2(12)-7 Result of Noise Prediction With Countermeasure1 on Nighttime At Ateli (Existing track side)



Source : S-ESIMMS

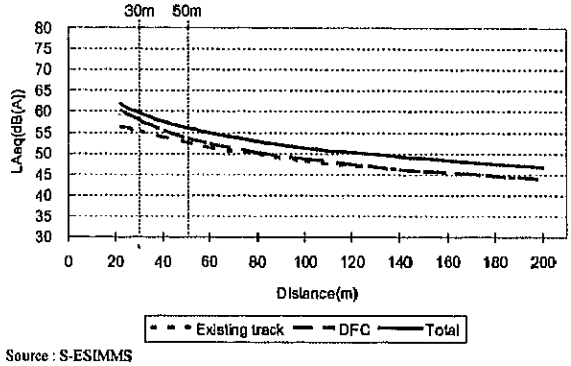
Figure 3.2(12)-8 Result of Noise Prediction With Countermeasure1 on Nighttime At Ateli (DFC side)

3) with countermeasure2 (soundproof height DFC side:1.5m Existing track side:1.5m)



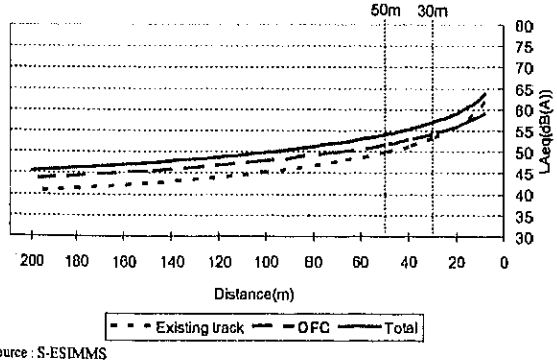
Source : S-ESIMMS

Figure 3.2(12)-9 Result of Noise Prediction With Countermeasure2 on Daytime At Ateli (Existing track side)



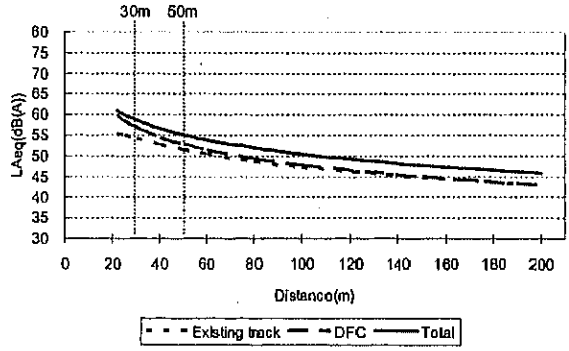
Source : S-ESIMMS

Figure 3.2(12)-10 Result of Noise Prediction With Countermeasure2 on Daytime At Ateli (DFC side)



Source : S-ESIMMS

Figure3.2(11)-11 Result of Noise Prediction With Countermeasure2 on Nighttime At Narnaul (Existing track side)



Source : S-ESIMMS

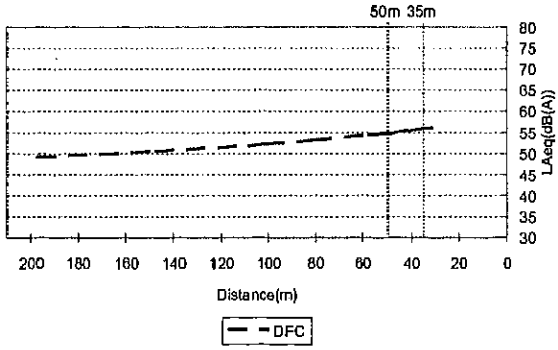
Figure3.2(11)-12 Result of Noise Prediction With Countermeasure2 on Nighttime At Narnaul (DFC side)

3-2-2 Detour Section

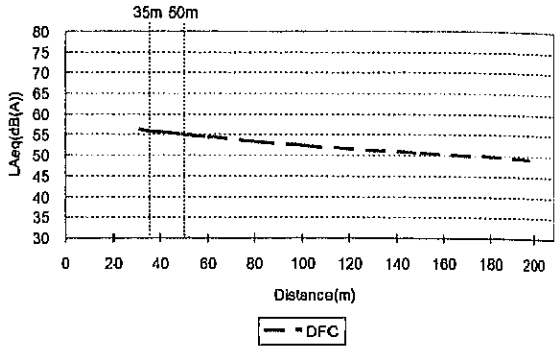
Results of noise prediction in detour section are given below. Range of distance from near railway to 200m is indicated on graphs.

(1) Vadodara, Ahmadabad, Kalol, Phulera, Rewari
Results of noise prediction for detour section (Vadodara, Ahmadabad, Kalol, Phulera, Rewari) are given from Figure 3.2(13)-1 to Figure 3.2(13)-4.

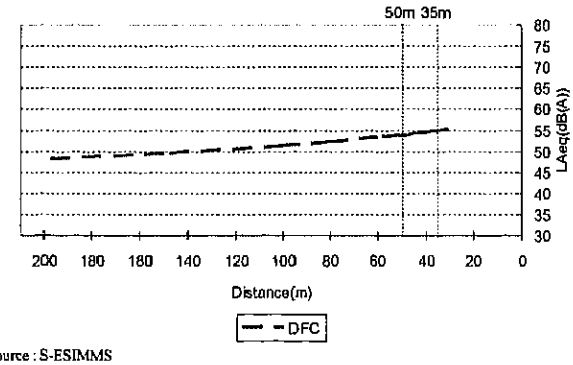
1) without countermeasure



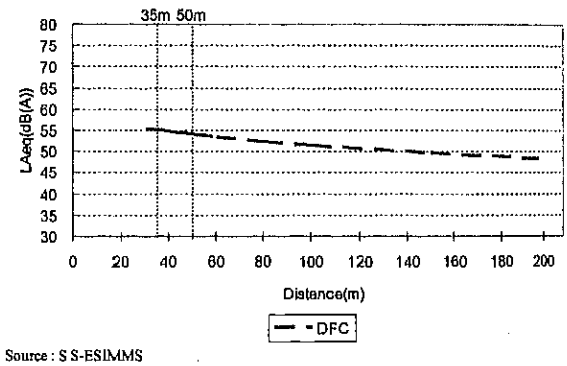
Source : S-ESIMMS
Figure 3.2(13)-1 Result of Noise Prediction Without Countermeasure on Daytime In Detour section (Existing track side)



Source : S-ESIMMS
Figure 3.2(13)-2 Result of Noise Prediction Without Countermeasure on Daytime In Detour section (DFC side)



Source : S-ESIMMS
Figure 3.2(13)-3 Result of Noise Prediction Without Countermeasure on Nighttime In Detour section (Existing track side)



Source : S S-ESIMMS
Figure 3.2(13)-4 Result of Noise Prediction Without Countermeasure on Nighttime In Detour section (DFC side)

4. Comparison with JICA F/S

4-1 Results of Background Noise Level Measurement Carried Out in JICA F/S

Results of background noise level measurement at Sensitive Receptor (SR) in the vicinity of plan route carried out in JICA F/S is given in Table 4.1-1.
As a result, background noise level (L_{Aeq}) in parallel section is range from 58 dB(A) to 79 dB(A), and there are a lot of points where especially 60dB(A) or more have been measured. Therefore, as compared to daytime limit (50 dB) of silence Zone of ambient noise standard in India, current background noise level at almost point is considered to be much higher than Indian standard.
On the other hand, background noise level (L_{Aeq}) in detour section is range from 44 dB(A) to 58 dB(A). As compared to parallel section, background noise level (L_{Aeq}) is lower.

Table 4.1-1 Results of background noise level measurement at SR in JICA F/S

Serial NO.	Type of SR	Location of SR site	State -(District)	Type of Railway Line (P, D)	Duration of measurement	Distance (m)	Ambient Noise Level (dB)
							LAeq
P1-8	Farmland	Diversion, village Kashindra (Ahmedabad)	G-Ahmedabad	D	4	0	58
P1-15	Hospital	Hospital, Near Siddhapur RS	G-Mahesana	P	4	35	66
P1-17	Hospital	Tapi River side	G-Surat	P	2	40	70
P2-SR13	Temple	Temple, Front side of Marwar RS	R - Pali	P	4	75	77
P2-SROP3	School	School , Front side of Marwar RS	R - Pali	P	4	140	76
P2-SR12	Waste land	Diversion, near Daural RS	R - Ajmer	P	4	-	58
P2-SR11	Agricultural land	Diversion, near Madar RS	R - Ajmer	P	4	100	77
P2-SR5	School	School near railway crossing, Ringas RS	R - Sikar	P	4	150	71
P2-SR6	Hospital near railway crossing	Hospital near railway crossing, Ringas RS	R - Sikar	P	4	100	78
P2-SR4	Temple	Temple near railway crossing, Shri Madhopur	R - Sikar	P	4	20	71
P2-SR3	Hindu	Hindu temple adjacent to RS, Nim ka Thane RS	R - Sikar	P	4	10	79
P2-SR2	Govt College	Govt College , near Narnaul RS	H-Mahendragarh	P	4	130	75
P2-SR7	Waste land	Diversion , near Harinagar Rewari	H-Rewari	D	4	-	44

Note) Serial NO.: serial no. named in JICA F/S
G: Gujarat state, R: Rajasthan state, H: Haryana state
P: paralleling railway line to existing one, D: alongside planned detour
Distance(m): horizontal distance of measuring point centre of the nearest track
Source: JICA F/S

4-2 Comparison Between JICA F/S And This Study Regarding Noise Prediction Method

Comparison between JICA F/S and this study regarding noise prediction method is given in Table 4.2-1. In addition, improvement and its reason against method of JICA F/S regarding noise prediction was shown in Table 4.2-1.

Table 4.2-1 Comparison of Noise Prediction Method

Item	JICA F/S	SAPROF (this study)	Improvement / Reason
Method of noise survey (DFC unit level measurement)	- Fifteen survey sites including the plain routes and the railway bridges were selected. - By use of freight train data (Electrified traction, plain route), distance attenuation, relation train speed and noise level were confirmed [Content] Point of measurement : 3 points Item of measurement : LAeq, LAE Sample data : 6	- Khurja in Aligarh-Dadri section was selected, where is electrified section, and freight trains with relatively high speed, heavy load are operated. As well, there is little obstruction noise. - By use of freight train data , distance attenuation, relation train speed and noise level were confirmed [Content] Point of measurement : 5 points Item of measurement : LAE, LAmax Sample data : 30	- Freight trains which are nearer operating condition of DFC are targeted. -In order to increase accuracy of prediction, number of sample data and measurement point was increased.
Prediction equation	- Based on results of actual measurement, prediction equation was extracted by using a simple regression and correlation analysis. [Prediction Equation] PWL(100km/h) = 110.59dB(A) LAE(100km/h)=PWL (100km)-8.89*Log10(D) D: distance(m) LAeq=LAE(100km/h)+10*Log10(N/T) N: number of trains T: targeted time (s)	- Based on results of actual measurement, PWL was calculated by use of equation proposed by Railway Technical Research Institute of Japan (1996). - By use of correlation between train speed and PWL, distance attenuation, prediction equation was extracted. [Prediction Equation] LAE=PWL-15.2*Log10(D) PWL: power level of freight train (=24.4logV + 52.1) V: train speed (km/h) D: distance LAeq=LAE+10*Log10(N/T) N: number of trains T: targeted time (s)	- In order to increase accuracy of PWL, factor of train length, relation equation between PWL and train speed was considered. - Due to increase sample data, accuracy of distance attenuation was improved.
Method of prediction	- point prediction at selected Sensitive Receptor (SR) along DFC railway.	- section prediction at main city along DFC railway	- Residences which receive actually big influence along the DFC railway was targeted - In order to conduct more practical prediction, noise of existing train was considered to condition of prediction.
Condition of prediction	[Condition of DFC] - Operation: 140 trains/direction/day - Speed : 100km/h - Type of traction: Electric locomotive - Train Length: no consideration [Existing passenger train] no consideration [Existing freight train] no consideration [Prediction Point] Selected SRs were targeted.	[Condition of DFC] - Operation: 140 trains/direction/day *(daytime:96 trains/direction/day ,nighttime:46 trains/direction/day) - Speed : 100km/h - Type of traction: Electric locomotive - Train Length: 686m Note) daytime:7:00-22:00 nighttime:22:00-7:00 [Existing passenger train] -Number of trains were set by current time table of each station -Noise level was set by use of result of actual measurement [Existing freight train] -Number of train and noise were set by use of actual measurement [Prediction Point] ROW and range from center of railway to 200m was targeted.	
Evaluation	- Results of prediction at each SR were compared with Indian standard noise level.	- Results of section prediction at main city were compared with guideline standard level of railway noise in Japan. -As well, SRs and Land use were put in consideration to evaluate.	- Influence to residences along railway and land use were taken into consideration to evaluate more practical influenee. - By use of guideline standard level of railway noise in Japan, the range of countermeasures was clarified.

Source : S-ESIMMS

5. Reference

[1] Generation of high-frequency sound in Railway Noise, KOBAYASHI INSTITUTE OF PHYSICAL RESEARCH NEWS, NO.82, 2003
[2] Proposal of a Prediction Model for Noise of Conventional Railway, Noise Control, Vol.20 NO.3, 1996
[3] Handbook of Noise and Vibration-Abatement Measure, Acoustical Materials Association Corp., p517, 1985
[4] Guidelines for Countermeasures for Railway Noise in Case of New Constructions and Large-scale Improvement of Existing Railways, Environmental Agency of Japan, Dec.1995

APPENDIX III-1-2 RESULT OF SENSITIVE RECEPTOR(SR) SURVEY

1 STUDY METHODOLOGY

The objectives of the survey are to grasp the distribution of Sensitive Receptors1 (SRs)[1] along the final alignment of the Dedicated Freight Corridor (DFC) and the finalized boundaries of the relevant facilities.

- In the parallel section, field survey has been conducted to identify all the sensitive receptors coming within 100m from the centre of the outer railway track on the both sides of the final alignment and the boundaries of the relevant facilities.
- In the detour section, field survey has been conducted to identify all the sensitive receptors coming within the proposed ROW i.e. 70m through out the final alignment of the DFC and the boundaries of the relevant facilities.
- A database has been prepared of the identified sensitive receptors with the serial number, name, distance from C/L of the existing track, latitude & longitude and their pictures.

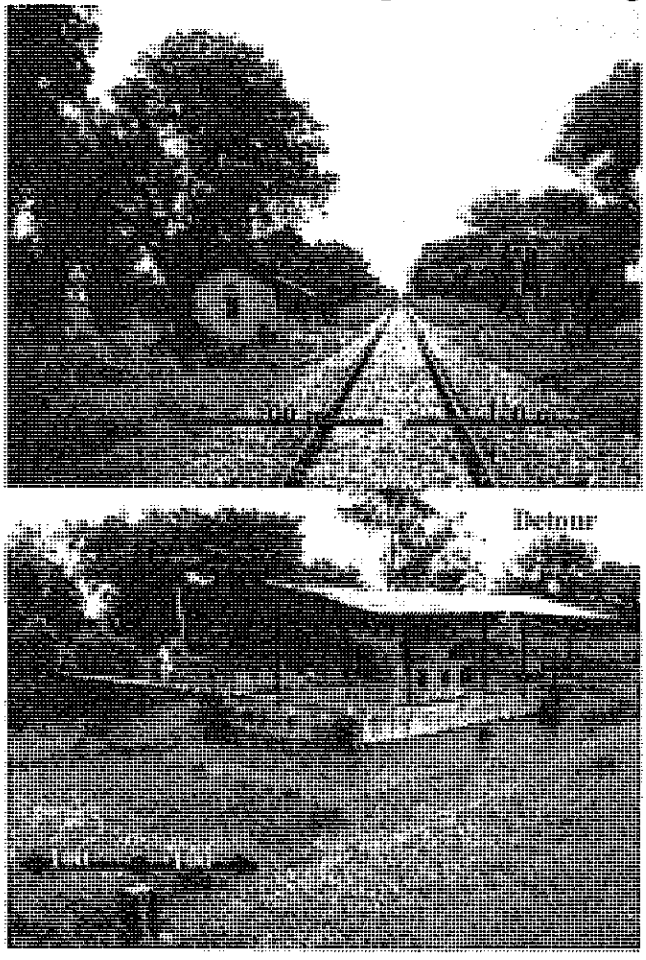


Figure 1 Survey Area for Sensitive Receptor Survey in Parallel & Detour Section

[1] "Sensitive Receptors (SRs)" are defined hospitals, schools, religious facilities and historical facilities by referring the definition of Silent Zones of "Ambient Air Quality Standards in respect of Noise" of India.

2 MAJOR FINDINGS

2.1 Sensitive Receptors in Gujarat

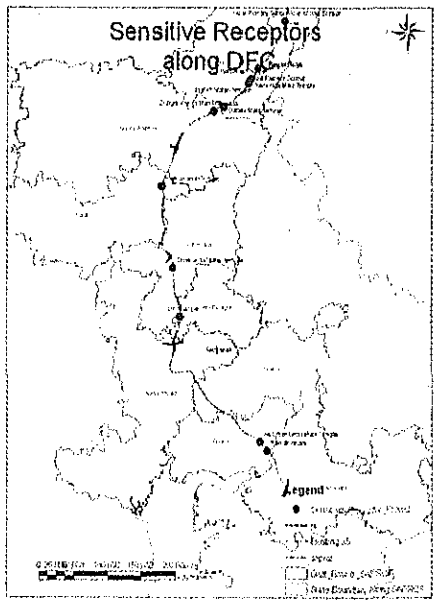


Figure 2 Distribution of Sensitive Receptors in Gujarat

In Gujarat, seven sensitive receptors are located along the alignment of DFC; out of which, four will be fully affected. Location of sensitive receptors with other details are presented in Table 1.

Table-1 List of Sensitive Receptors in Gujarat

District	Village/ Town	Sl. No.	Name of SR	Latitude & Longitude	Distance from C/L (m)	Side	Status	Picture No.
Banaskantha	Amirgadh	1..	Mosque	N 24 24 13.5 E 72 38 28.8	43	East	FA	1
		2.	Dungar Puriya Mandir	N 24 24 14.2 E 72 38 29.6	44	East	FA	2
Patan	Vadhana	1.	Kalikamandir Temple	N 23 57 09.2 E 72 17 53.4	35	West	NA	3
Mehsana	Linch	1.	Chamunda Mataji Temple	N 23 28 20.6 E72 22 54.6	80	West	NA	4
Gandhinagar	Moti Bhoyan	1.	Shiv Temple	N 23 11 11.2 E 72 26 14.1	70	East	NA	5
Anand	Kusumbad	1.	Jai Shree Leels Mata Temple	N 22 27 28.6 E 72 58 54.3	10	East	FA	6
	Bhagvanpura	2.	Ramdevdham	N 22 24 22.6 E 73 02 1.8	10	West	FA	7

Note: FA = Fully Affected; NA = Not Affected

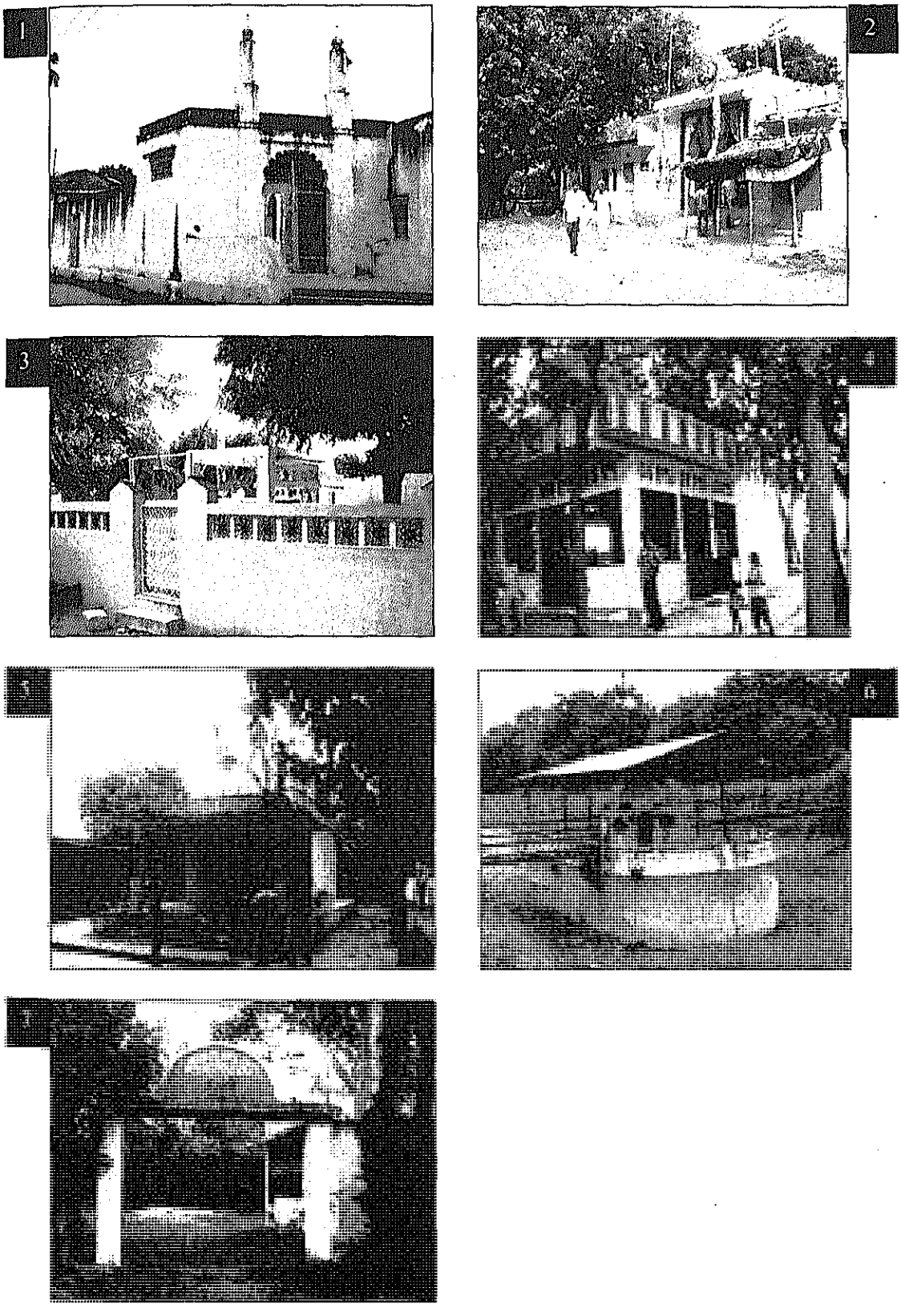


Figure 3 Sensitive Receptors in Gujarat

2.2 Sensitive Receptors in Rajasthan

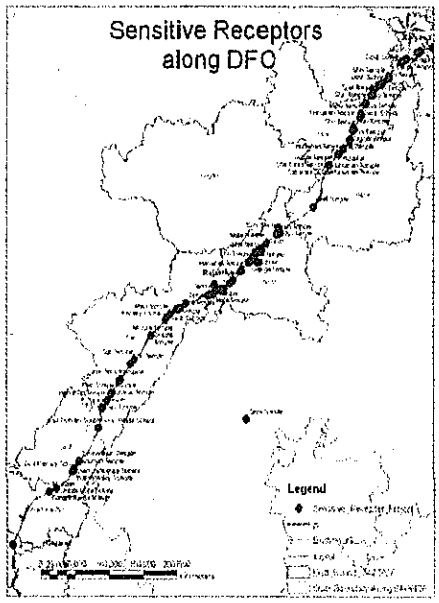


Figure 4 Distribution of Sensitive Receptors in Rajasthan

In Rajasthan, 162 sensitive receptors are located along the final alignment of DFC in eastern & western Side; out of which 55 will be fully affected, 19 will be partially affected and 85 will be not affected. Location of sensitive receptors with other details is presented in **Table 2.** Photographs of sensitive receptors are given followings.

Table-2 List of Sensitive Receptors in Rajasthan

District	Village/ Town	Sl. No.	Name of SR	Latitude & Longitude	Distance from C/L (m)	Side	Pic No.	Status
Sikar	Dabla	1..	Shiv Temple	N 27°53'23.9" E 75°56'54.7"	35.4	East	1	FA
		2.	Hunuman Temple	N 27°52'56.4" E 75°56'34.2"	44.6	East	2	FA
	Makri	1.	Hunuman Temple	N 27°47'36.8" E 75°48'05.6"	7.9	East	3	FA
	Godwas	1.	Govt. Primary School	N 27°44'50.7" E 75°46'55.6"	80.5	West	4	NA
		2.	Shiv Temple	N 27°44'38.7" E 75°46'48.8"	25	West	5	NA
	Nim Ka Thana	1.	Shiv Temple	N 27°44'33.3" E 75°46'50.2"	38.6	East	6	FA
		2.	Shiv Temple	N 27°44'26.3" E 75°46'44.6"	25	East	7	FA
		3.	Gaytri Saktipeet	N 27°44'25.0" E 75°46'45.6"	33.6	East	8	FA
		4.	Sitala Mata Temple	N 27°44'24.2" E 75°46'43.8"	41.5	East	9	PA
		5.	Goel Hospital	N 27°44'26.1"	35.4	East	10	FA

District	Village/ Town	Sl. No.	Name of SR	Latitude & Longitude	Distance from C/L (m)	Side	Pic No.	Status
				E 75°46'45.8"				
		6.	Hunuman Temple	N 27°44'22.8" E 75°46'42.5"	32.6	East	11	FA
		7.	Dr. Ashok Agrawal Nursing Home	N 27°44'20.4" E 75°46'40.6"	41.2	East	12	PA
		8.	Shiv Temple	N 27°44'16.9" E 75°46'37.5"	11.4	East	13	FA
		9.	Hunuman Temple	N 27°44'33.3" E 75°46'50.2"	38.6	East	14	FA
	Bhagega	1.	Shiv Temple	N 27°40'37.3" E 75°43'17.4"	52	East	15	NA
	Rajputon ki Dhani	1.	Govt. School	N 27°49'47.4" E 75°51'03.4"	26.2	East	16	FA
		2.	Shiv Temple	N 27°50'55.1" E 75°53'11.3"	57.3	East	17	NA
	Madho ka was		Hanuman Temple	N 27°33'25.6" E 75°40'02.8"	20.5	East	18	FA
			Govt. School	N 27°33'55.7" E 75°40'12.2"	50.2	East	19	NA
	Sri Madhopur	1.	Shiv & Hanuman Temple	N 27° 27' 89.4" E 75° 36' 04.4"	70	East	20	NA
		2.	India Public School	N 27° 27' 37.2" E 75° 36' 03.0"	35	East	21	PA
		3.	Shiv Temple	N 27° 27' 45.6" E 75° 36' 07.3"	29	East	22	FA
		4.	Shiv Temple	N 27° 27' 44.1" E 75° 36' 06.1"	32.1	East	23	FA
		5.	Bar ke Balaji Temple	N 27° 27' 10.1" E 75° 35' 38.2"	48	West	24	NA
		6.	Shiv Temple	N 27° 27' 11.9" E 75° 35' 40.2"	36	West	25	NA
		7.	Shiv Temple	N 27° 27' 25.6" E 75° 35' 48.8"	95	West	26	NA
		8.	Hanuman Temple	N 27° 27' 35.6" E 75° 35' 55.2"	84	West	27	NA
		9.	Shiv Temple	N 27° 27' 34.7" E 75° 35' 53.9"	100	West	28	NA
		10.	Ayurvedic Hospital	N 27° 27' 39.2" E 75° 36' 00.9"	25	West	29	NA
		11.	Indian Public School	N 27° 27' 39.9" E 75° 36' 01.5"	27	West	30	NA
		12.	Ganga Mata Temple	N 27° 27' 46.3" E 75° 36' 00.6"	91	West	31	NA
		13.	Shiv Temple	N 27° 27' 45.6" E 75° 36' 00.2"	92.6	West	32	NA
		14.	Govt. Primary School	N 27° 27' 45.2" E 75° 36' 00.6"	90	West	33	NA
	Jugalpura	1	Shiv Temple	N 27° 35' 15.8" E 75° 40' 36.0"	62	East	34	NA
	Reengus	1.	Hunuman Temple	N 27°22'14.7" E 75°33'46.6"	45.2	East	35	PA

District	Village/ Town	Sl. No.	Name of SR	Latitude & Longitude	Distance from C/L (m)	Side	Pic No.	Status
		2.	Shiv Temple	N 27°22'25.9" E 75°33'52.1"	20.1	East	36	FA
		3.	Balaji Temple	N 27°22'24.7" E 75°33'51.8"	18.3	East	37	FA
		4.	Hunuman Temple	N 27°22'33.6" E 75°33'50.1"	94	West	38	NA
		5.	Railway Hospital	N 27°22'22.8" E 75°33'47.1"	17	West	39	NA
		6.	Tagore School	N 27°22'13.7" E 75°33'40.7"	45	West	40	NA
		7.	Krishna Temple	N 27°22'16.1" E 75°33'41.8"	58	West	41	NA
Jaipur	Kishanman-pura	1.	Shiv & Hunuman Temple	N 27°17'57.1" E 75°30'20.0"	48.0	East	42	PA
	Badhal	1.	Shiv Temple	N 27°15'07.0" E 75°27'08.4"	27.5	East	43	FA
		2.	Hunuman Temple	N 27°15'06.5" E 75°27'08.2"	28.0	East	44	FA
	Renwal	1.	Sri Sankatmochan Hunuman Temple	N 27°09'34.9" E 75°21'47.4"	5.7	East	45	FA
		2.	Hunuman Temple	N 27°09'18.8" E 75°21'36.6"	15	East	46	FA
		3.	Hunuman Temple	N 27°09'21.6" E 75°21'32.2"	25	East	47	FA
		4.	Sati mata Temple	N 27°09'31.9" E 75°21'42.2"	41	West	48	NA
		5.	Gopalji Temple	N 27°09'30.6" E 75°21'42.4"	40	West	49	NA
		6.	Shri Salasr Temple	N 27°09'23.7" E 75°21'37.9"	15	West	50	NA
		7.	J K Hospital	N 27°09'19.8" E 75°21'34.0"	35	West	51	NA
	Narena	1.	Shiv Temple	N 26°48'33.7" E 75°12'12.7"	32	West	52	NA
Ajmer	Kishangarh	1.	Shri Krishna Temple	N 26° 35' 22.9" E 74° 51' 33.6"	56.5	East	53	NA
		2.	Hanuman Balaji Temple	N 26° 35' 20.0" E 74° 51' 11.4"	23.6	East	54	FA
		3.	Shiv Temple	N 26° 35' 17.7" E 74° 51' 05.8"	22.7	East	55	FA
		4.	Shiv Temple	N 26° 35' 11.9" E 74° 50' 33.1"	25.6	East	56	FA
		5.	Muslim Pirbaba	N 26° 38' 11.6" E 74° 50' 53.5"	28.2	East	57	FA
		6.	Shri Ram Temple	N 26° 35' 09.0" E 74° 50' 53.0"	78.3	East	58	NA
		7.	Hanuman Temple	N 26° 35' 02.6" E 74° 50' 34.0"	30.5	East	59	FA
		8.	Jain Temple	N 26° 34' 42.8" E 74° 49' 54.9"	48.5	East	60	PA

District	Village/ Town	Sl. No.	Name of SR	Latitude & Longitude	Distance from C/L (m)	Side	Pic No.	Status
		9.	Shiv & Ganesh Temple	N 26° 35' 25.7" E 74° 51' 38.6"	48.8	East	61	PA
		10.	Mansa Devi Temple	N 26° 35' 33.6" E 74° 51' 45.3"	24	West	62	NA
		11.	Sri Amarnath Mahadev Temple	N 26° 35' 27.0" E 74° 51' 33.7"	32	West	63	NA
		12.	Durga Temple	N 26° 35' 32.4" E 74° 51' 44.1"	28	West	64	NA
		13.	Jagdhamba Bal Vidiya Mandir	N 26° 35' 11.1" E 74° 50' 47.2"	25	West	65	NA
	Ladpura	1.	Mata Temple	N 26° 30' 21.4" E 74° 43' 53.0"	58	East	66	NA
	Ajmer	1.	Shiv Temple	N 27° 35' 15.8" E 75° 40' 44.3"	8.2	East	67	FA
		2.	Mother's Secondary School	N 26° 25' 32.2" E 74° 38' 42.3"	15.2	East	68	FA
		3.	Bharon Temple	N 26° 26' 57.34" E 74° 40' 32.8"	48.5	East	69	PA
		4.	Ratal Babu Temple	N 26° 25' 31.5" E 74° 38' 41.8"	13.3	East	70	FA
		5.	Temple (Plateform)	N 26° 26' 25.5" E 74° 40.1' 5.2"	56.8	East	71	NA
		6.	Ram Dev Temple	N 26° 25' 31.2" E 74° 38' 41.8"	16.9	East	72	FA
		7.	Tejaji Temple	N 26° 26' 22.2" E 74° 40' 10.4"	25.3	East	73	FA
		8.	Sarvodya Public School	N 26° 25' 29.4" E 74° 38' 30.6"	42.6	East	74	PA
		9.	Shiv Temple	N 26° 25' 6.6" E 74° 38' 8.4"	14.5	East	75	FA
		10.	Ram Dev Temple	N 26° 24' 53.5" E 74° 38' 02.3"	48.1	East	76	PA
		11.	Church	N 26° 27' 21.4" E 74° 40' 44.3"	8.2	East	77	FA
	Ajmer (Sunder Nagar)	12.	Hanuman Temple	N 26° 24' 49.3" E 74° 37' 57.6"	15.5	East	78	FA
		13.	Primary School	N 26° 24' 43.3" E 74° 37' 53.5"	12.5	East	79	FA
		14.	Mangaleshwar Mahadev Temple	N 26° 24' 15.2" E 74° 37' 33.9"	20.5	East	80	FA
		15.	Baba Ramdev Temple	N 26° 26' 33.7" E 74° 40' 19.6"	15	West	81	NA
		16.	Shiv Temple	N 26° 26' 14.0" E 74° 40' 00.5"	32	West	82	NA
		17.	Govt. School	N 26° 26' 11.6" E 74° 40' 57.9"	15	West	83	NA
		18.	Shiv Temple	N 26° 26' 10.5" E 74° 39.0' 52.8"	92	West	84	NA
		19.	Balaji Teple	N 26° 25' 39.2" E 74° 39.0' 3.0"	15	West	85	NA
		20.	Shiv Temple	N 26° 25' 40.7" E 74° 39.0' 2.4"	65	West	86	NA
		21.	Kali Mata Temple	N 26° 25' 35.1" E 74° 38.0' 49.0"	55	West	87	NA
		22.	Tejaji Temple	N 26° 25' 32.4" E 74° 38.0' 44.6"	25.3	West	88	NA

District	Village/ Town	Sl. No.	Name of SR	Latitude & Longitude	Distance from C/L (m)	Side	Pic No.	Status
		23.	Hanuman Temple	N 26° 25' 33.0" E 74° 38.0' 44.8"	25.2	West	89	NA
	Tabeeji	1.	Nursing School	N 26° 22' 17.4" E 74° 36.0' 03.3"	32.8	East	90	PA
	Saradhana	1.	Veterinary Hospital	N 26° 20' 51.0" E 74° 34' 38.7"	30	East	91	PA
		2.	Ganga Temple	N 26° 20' 31.5" E 74° 34' 10.0"	48.2	East	92	PA
		3.	Govt Girls Senior Secondary School	N 26° 20' 47.1" E 74° 34' 33.0"	7	East	93	FA
		4.	Public Health Centre	N 26° 20' 45.7" E 74° 34' 3.2"	6	East	94	FA
		5.	Govt Senior Scondary School	N 26° 20' 45.5" E 74° 34' 29.1"	6	East	95	FA
		6.	Shiv Temple	N 26° 20' 43.3" E 74° 34' 28.0"	6	East	96	FA
		7.	Shakti Mata Temple	N 26° 20' 45.5" E 74° 39' 24.6"	50	West	97	NA
		8.	Shiv Temple	N 26° 20' 26.5" E 74° 33' 58.0"	30	West	98	NA
	Beawar	1.	Hanuman Temple	N 26° 06' 00.0" E 74° 19' 32.7"	48.5	East	99	PA
		2.	Narsing Temple	N 26° 06' 59.5" E 74° 19' 31.2"	47	East	100	PA
		3.	Shiv Temple	N 26° 06' 18.4" E 74° 18' 19.4"	48.2	East	101	PA
		4.	Shury Academic Public School	N 26° 06' 18.9" E 74° 18' 15.6"	33.0	East	102	FA
		5.	Minu Clatt Public School	N 26° 06' 19.1" E 74° 18' 12.9"	31.4	East	103	FA
		6.	Government School	N 26° 11' 34.4" E 74° 24' 47.2"	54.5	East	104	NA
		7.	Ramdev Temple	N 26° 10' 10.4" E 74° 23' 04.5"	30.5	East	105	FA
		8.	Santoshi Mata Temple	N 26° 10' 10.6" E 74° 23' 04.5"	15	East	106	FA
		9.	Shiv Temple	N 26° 06' 22.3" E 74° 18' 39.7"	4	West	107	NA
		10.	School	N 26° 06' 23.3" E 74° 18' 12.4"	100	West	108	NA
		11.	Hanuman Temple	N 26° 06' 23.3" E 74° 18' 10.8"	90	West	109	NA
	Kalali ka Badai	1.	Amba Mata Temple	N 26° 06' 46.7" E 74° 16' 45.2"	35	East	110	FA
	Mangliyawas	1.	Shiv & Hanuman Temple	N 26° 16' 18.4" E 74° 29' 43.0"	50	East	111	NA
		2.	Govt School	N 26° 16' 48.4" E 74° 29' 43.0"	50	East	112	NA
	Daulat Khera	1.	Hanuman Temple	N 26° 16' 08.5" E 74° 29' 07.7"	49	East	113	FA
	Piplaj	1.	Balaji Tmple	N 26° 10' 19.2" E 74° 23' 23.7"	5.5	East	114	FA
Pali	Sabalpura	1.	Mosque	N 26° 05' 09.9" E 74° 13' 13.9"	20	West	115	NA
		2.	Ramdev Temple	N 26° 09' 22.8" E 74° 13' 29.9"	55	East	116	NA

District	Village/ Town	Sl. No.	Name of SR	Latitude & Longitude	Distance from C/L (m)	Side	Pic No.	Status
		3.	Sherawali Temple	N 26° 09' 23.1" E 74° 13' 29.6"	50	East	117	NA
		4.	Mosque	N 26° 09' 22.6" E 74° 13' 22.5"	80	East	118	NA
	Dholiya	1.	Temple	N 26° 04' 26.6" E 74° 10' 51.2"	22.4	East	119	FA
		2.	Temple	N 26° 04' 26.6" E 74° 10' 51.2"	21.8	East	120	FA
	Sandra	1.	Mata Temple	N 26° 04' 40.7" E 74° 12' 31.4"	40	West	121	NA
	Dodiya	1.	Mata Temple	N 26° 04' 28.2" E 74° 10' 48.4"	50	West	122	NA
	Dipawas	1.	Shiv Temple	N 25° 01' 34.2" E 74° 33' 8.8"	20	West	123	NA
	Guriya	1.	Temple	N 25° 59' 35.1" E 73° 56' 34.3"	25	West	124	NA
	Aasan	1.	Mahadev Temple	N 26° 03' 54.3" E 74° 09' 12.3"	55	East	125	NA
	Udeshi Kua	1.	Hanuman Temple	N 25° 57' 35.0" E 73° 53' 21.7"	60	West	126	NA
	Udika	1.	Bayshar Temple	N 25° 57' 25.2" E 73° 53' 3.6"	20	West	127	NA
	Chandawal	1.	Mata Temple	N 25° 56' 56.3" E 73° 52' 19.1"	30	West	128	NA
		2.	Govt Primary School	N 25° 56' 46.0" E 73° 52' 1.3"	35	West	129	NA
		3.	Ramdev Temple	N 25° 56' 47.7" E 73° 52' 2.9"	15	West	130	NA
		4.	Mata Temple	N 25° 56' 48.8" E 73° 52' 4.9"	30	West	131	NA
	Bagri Nagar	1.	Mata Temple	N 25° 54' 15.6" E 73° 48' 0.2"	60	West	132	NA
	Sojat Road	1.	Govt. School	N 25° 52' 34.7" E 73° 45' 57.3"	50	West	133	NA
		2.	Shiv Temple	N 25° 51' 37.8" E 73° 45' 11.2"	30	West	134	NA
		3.	Primary School	N 25° 51' 37.8" E 73° 45' 11.7"	25	West	135	NA
	Marwar Jn	1.	Durga Temple	N 25° 43' 33.2" E 73° 36' 49.7"	50	West	136	NA
		2.	Gurudwara	N 25° 43' 34.4" E 73° 36' 54.5"	40	East	137	FA
		3.	Temple	N 25° 43' 31.3" E 73° 36' 51.7"	35	East	138	FA
		4.	Temple	N 25° 43' 30.2" E 73° 36' 52.8"	36	East	139	FA
		5.	Mosque	N 25° 43' 24.8" E 73° 36' 46.0"	10.5	East	140	FA
		6.	Temple	N 25° 43' 24.4" E 73° 36' 45.5"	25.5	East	141	FA
	Somesar	1.	Shiv Temple	N 25° 31' 05.0" E 73° 26' 52.1"	30	West	142	NA
	Jawali	1.	Shiv Temple	N 25° 29' 01.7" E 73° 24' 34.2"	25	West	143	NA
	Rani	1.	Jain Temple	N 25° 21' 16.1" E 73° 18' 51.4"	45	West	144	NA

District	Village/ Town	Sl. No.	Name of SR	Latitude & Longitude	Distance from C/L (m)	Side	Pic No.	Status
		2.	Hospital	N 25° 21' 02.1" E 73° 18' 47.9"	55	East	145	NA
	Falna	1.	Navneet Public Schol	N 25° 14' 22.9" E 73° 14' 10.9"	47	West	146	NA
		2.	Ram Temple	N 25° 14' 18.9" E 73° 14' 09.4"	30	West	147	NA
		3.	Mosque	N 25° 14' 16.6" E 73° 14' 11.3"	48	East	148	PA
		4.	Bharun Temple	N 25° 13' 45.6" E 73° 13' 54.5"	41	East	149	PA
		5.	Muslim Platform	N 25° 13' 40.9" E 73° 13' 50.8"	43	East	150	PA
	Chamundari	1.	Govt Primary School	N 24° 56' 29.3" E 73° 06' 52.6"	20	West	151	NA
		2.	Govt. Middle School	N 24° 56' 28.5" E 73° 06' 48.6"	30	West	152	NA
	Jawai Bandh	1.	Temple	N 25° 06' 46.1" E 73° 08' 45.1"	50	West	153	NA
			Jain Temple	N 25° 06' 53.9" E 73° 08' 56.0"	60.2	East	154	NA
			Temple	N 25° 06' 59.0" E 73° 08' 58.0"	32.6	East	155	FA
	Biroliya	1.	Hanuman Temple	N 25° 10' 25.6" E 73° 11' 44.7"	70	East	156	NA
Sirohi	Bhimana	1.	Hanuman Temple	N 24° 35' 45.0" E 72° 53' 14.1"	60	East	157	NA
	Swarup Gunj	1.	Devnarayan Temple	N 24° 39' 46.4" E 72° 56' 03.9"	40	West	158	NA
	Bujhela	1.	Chamunda Mata Temple	N 24° 34' 17.7" E 72° 52' 01.9"	60	West	159	NA
		2.	Bujheli Mataji Temple	N 24° 34' 19.8" E 72° 52' 03.0"	65	West	160	NA
		3.	Govt Primary School	N 24° 34' 20.6" E 72° 52' 01.2"	91	West	161	NA
	Maval	1.	Shitala Mata Temple	N 24° 25' 53.5" E 72° 42' 41.0"	45.6	East	162	PA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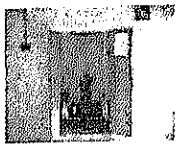
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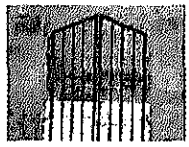
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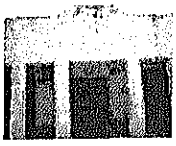
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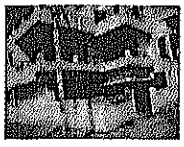
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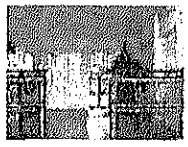
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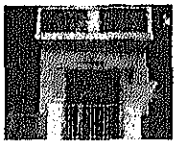
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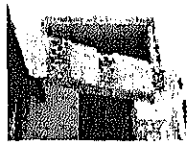
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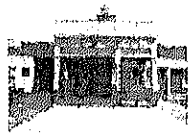
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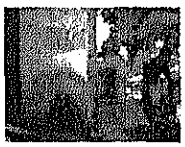
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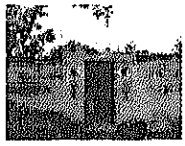
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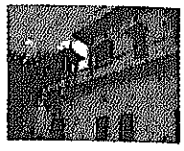
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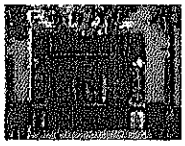
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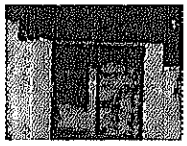
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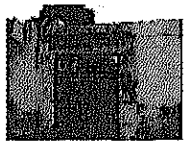
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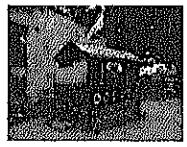
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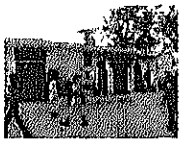
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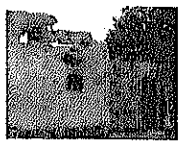
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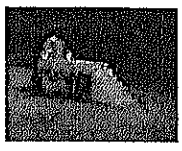
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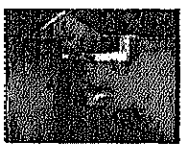
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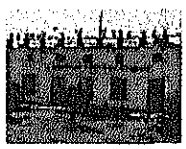
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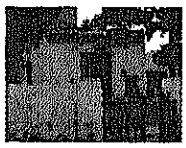
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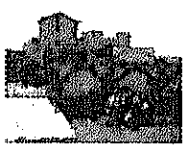
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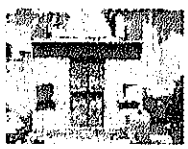
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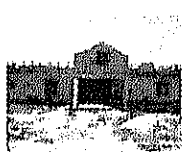
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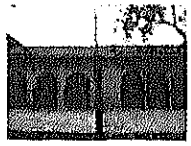
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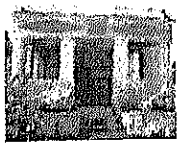
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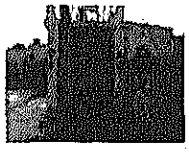
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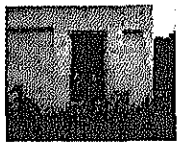
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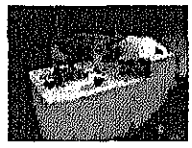
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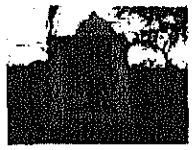
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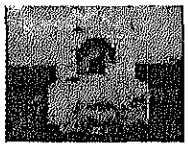
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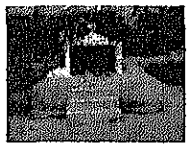
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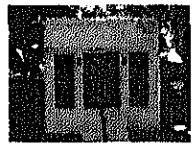
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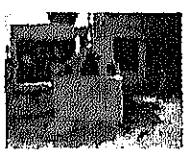
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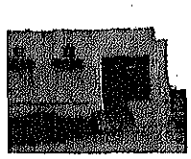
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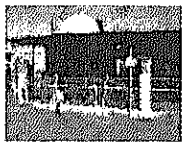
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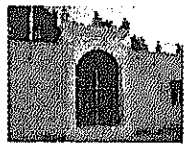
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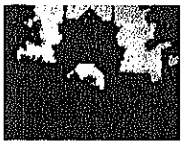
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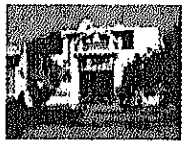
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2.3 Sensitive Receptors in Haryana

In Haryana, 33 sensitive receptors are located along the alignment of DFC; out of which, 12 are fully affected, 1 partially affected and 20 not affected. Location of sensitive receptors with other details is presented in **Table 3.**

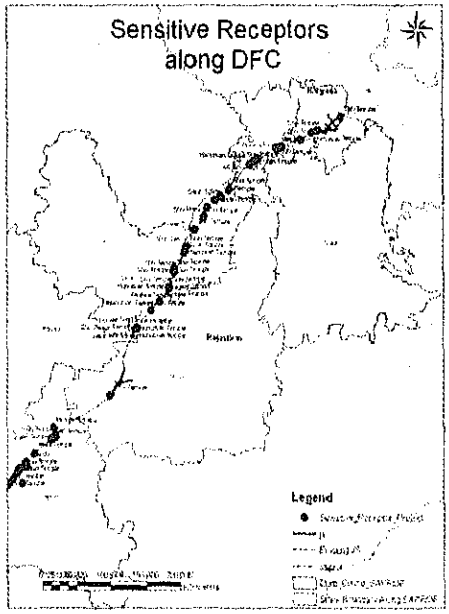
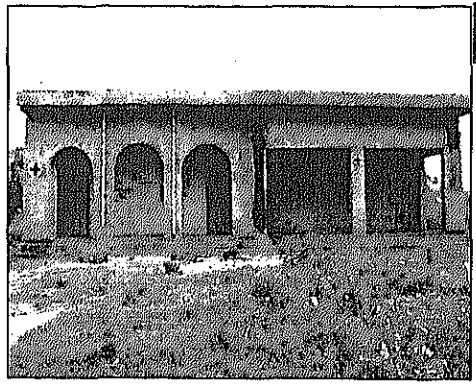


Figure 5 Distribution of Sensitive Receptors in Haryana

Table-3 List of Sensitive Receptors in Haryana

District	Village/ Town	Sl. No.	Name of SR	Latitude & Longitude	Distance from C/L (m)	Side	Status	Picture Number
Rewari	Kakoria	1.	Shiv Temple	N 28°15'22.0" E 76°38'52.9"	In detour section	-	FA	1
	Ateli	1.	Shyam Temple	N 28°06'28.0" E 76°16'42.2"	30	East	FA	2
	Uninda	1.	Shiv Temple	N 28°06'18.5" E 76°16'15.4"	65	East	NA	3
	Ateli Mandi	1.	Hunuman Temple	N 28°05'56.4" E 76°14'57.6"	17	East	FA	4
		2.	Durga Temple	N 28°05'55.8" E 76°14'58.6"	35	East	FA	5
		3.	Hunuman Temple	N 28°06'01.7" E 76°15'18.9"	37	East	FA	6
		4.	Mosque	N 28°06'01.9" E 76°15'20.5"	43	East	PA	7
		5.	Radha Krishna Temple	N 28°06'06.0" E 76°15'33.2"	30	East	FA	8
		6.	Adarsh Shishu Vatika	N 28°06'5.8" E 76°15'34.1"	70	East	NA	9
		7.	Civil Veterinary Hospital	N 28°06'6.2" E 76°15'35.6"	90	East	NA	10
	Tobra, Ateli Mandi	8.	Shiv Temple	N 28°05'46.0" E 76°14'28.5"	51	East	NA	11
		9.	Government Primary School	N 28°05'45.5" E 76°14'27.3"	63	East	NA	12

District	Village/ Town	Sl. No.	Name of SR	Latitude & Longitude	Distance from C/L (m)	Side	Status	Picture Number
	Gothra	1.	Hunuman Temple	N 28°10'52.6" E 76°27'38.9"	53.8	East	NA	13
	Khori	1.	Biswakarma Temple	N 28°11'16.7" E 76°29'50.8"	15	East	FA	14
		2.	Shiv Temple	N 28°11'15.4" E 76°30'13.5"	41.5	East	FA	15
	Kund	1.	Shiv Temple	N 28°08'36.4" E 76°23'36.2"	64	East	NA	16
Mahendragarh	Patikera	1.	Govt. Sr. Secondary School	N 28°02'48.2" E 76°07'49.7"	15	West	NA	17
		2.	Hanuman Temple	N 28°02'48.7" E 76°07'58.5"	30	East	FA	18
	Narnaul	1.	Radhakirshna Temple	N 28°02'34.6" E 76°07'13.7"	80	East	NA	19
		2.	Lakhsmi Narayan Temple	N 28°02'40.1" E 76°07'13.2"	85	West	NA	20
		3.	Govt. College	N 28°02'40.3" E 76°07'10.9"	99	West	NA	21
		4.	Agrasen Bal Mandir H. S. School	N 28°02'32.6" E 76°06'55.8"	45	West	NA	22
		5.	Durga Temple	N 28°02'33.0" E 76°06'55.2"	65	West	NA	23
		6.	General Hospital	N 28°02'33.0" E 76°06'55.2"	80	West	NA	24
		7.	T. B. Hospital	N 28°02'29.2" E 76°06'41.5"	45	West	NA	25
		8.	Sardha Nath Maharaj Temple	N 28°02'23.4" E 76°06'44.5"	20	East	FA	26
		9.	Govt. Girls College	N 28°02'27.6" E 76°06'39.4"	30	West	NA	27
		10.	Govt. Girls Sr. Secondary School	N 28°02'29.1" E 76°06'39.0"	25	West	NA	28
		11.	Govt. Sr. Secondary School	N 28°02'16.6" E 76°06'02.7"	95.8	West	NA	29
		12.	Sri Shyam Temple	N 28°02'06.8" E 76°05'54.1"	10	West	NA	30
		13.	Polytechnic College	N 28°02'05.9" E 76°05'54.4"	10	East	FA	31
		14.	Historical Monument	N 28°02'10.7" E 76°06'6.3"	16	East	FA	32
	Jorashi	1.	Hanuman Temple	N 28°01'10.8" E 76°04'17.0"	32	West	NA	33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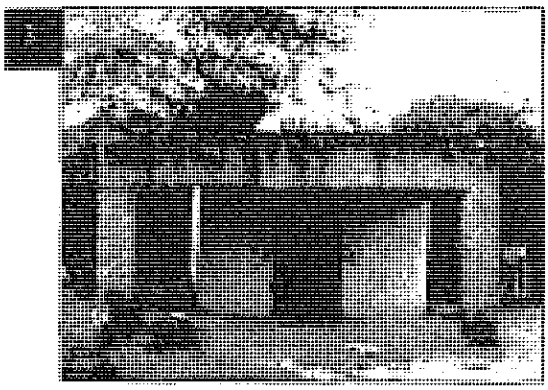

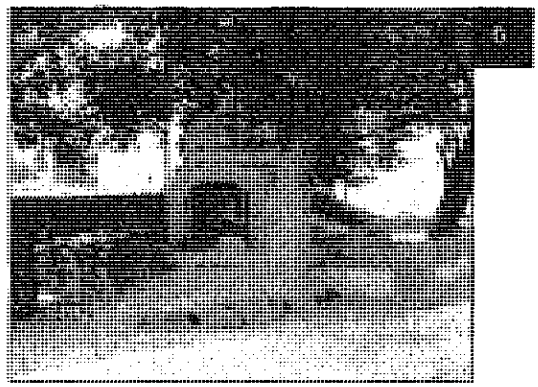

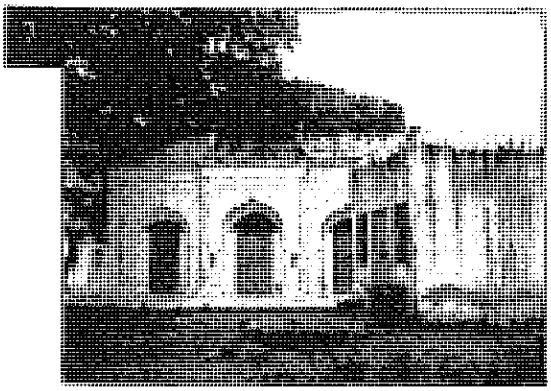

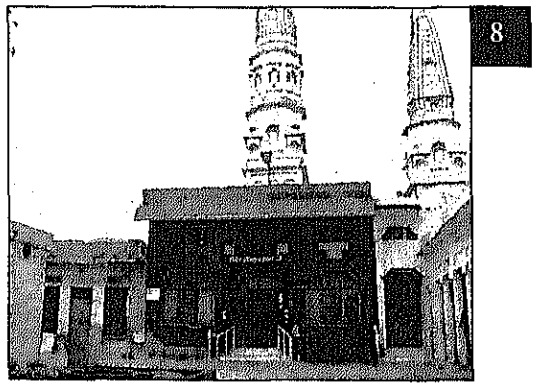
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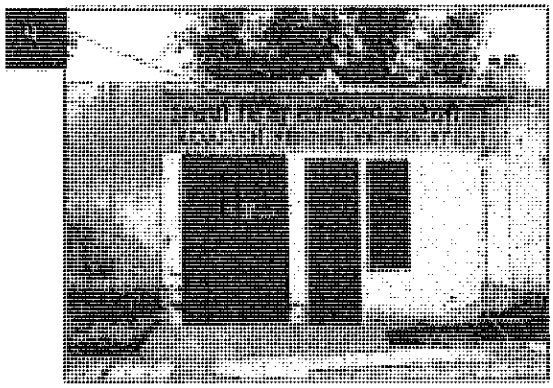

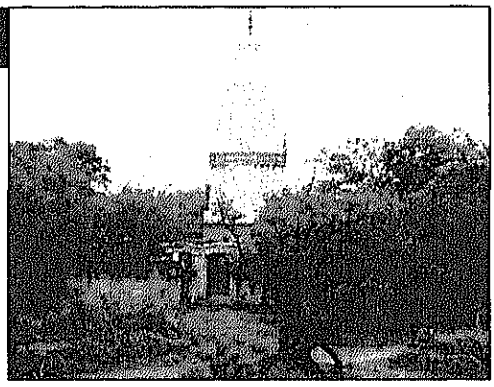

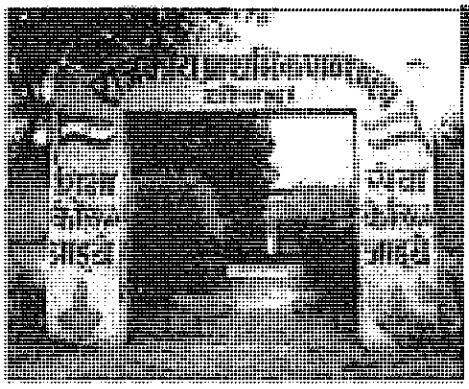

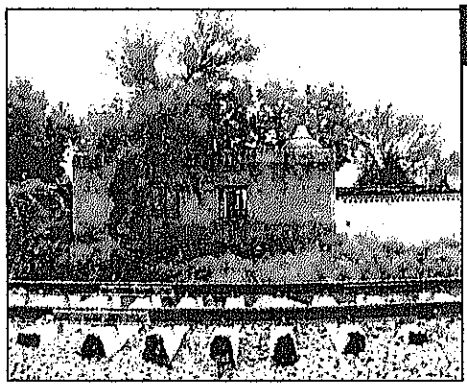

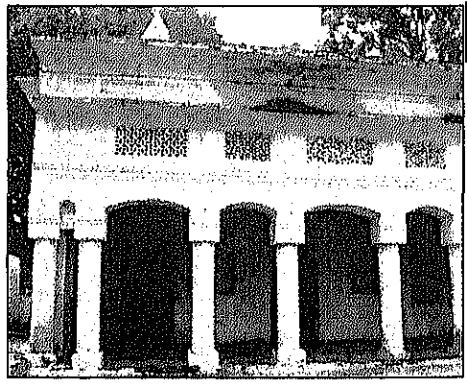

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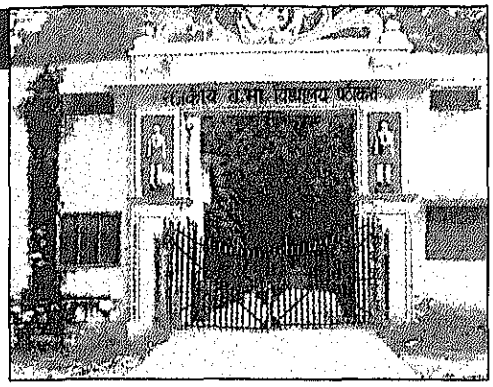

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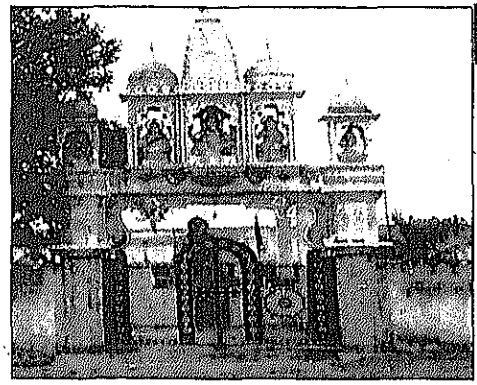

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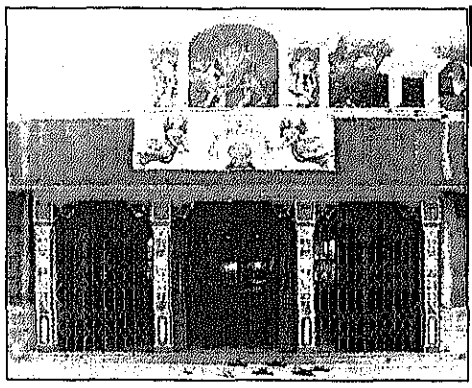

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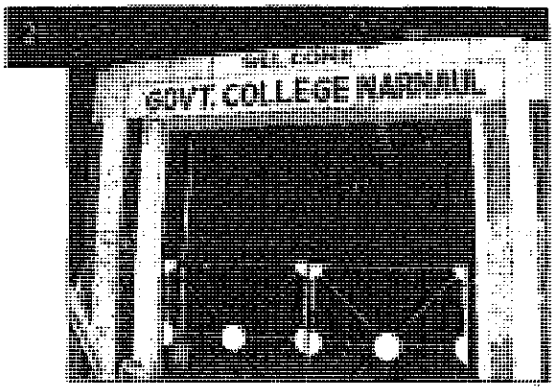

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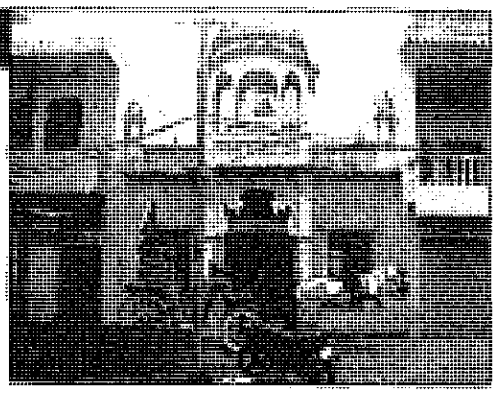

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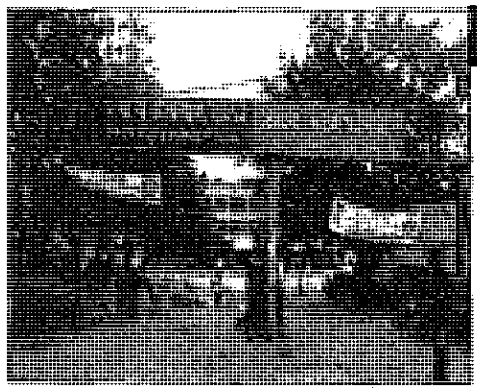

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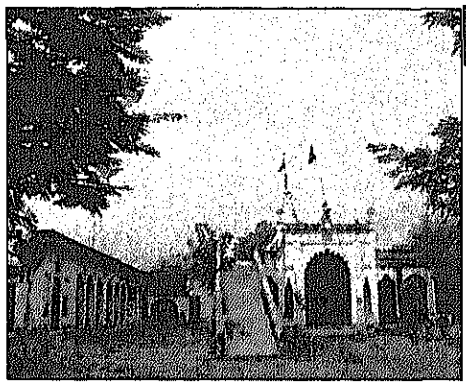

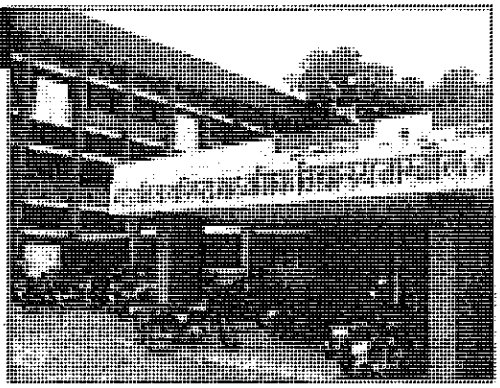

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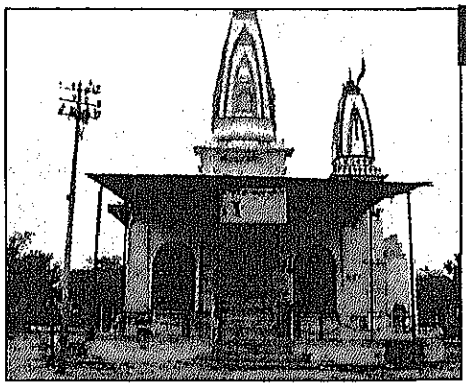

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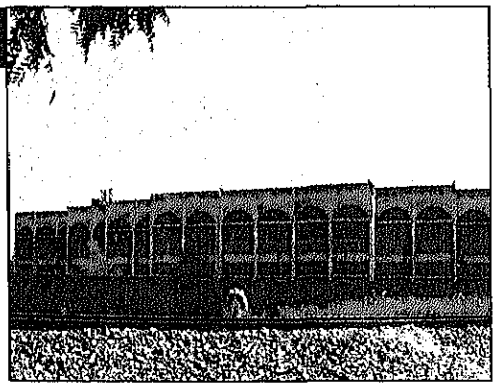

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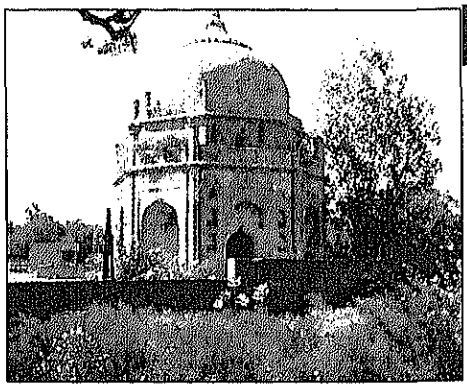

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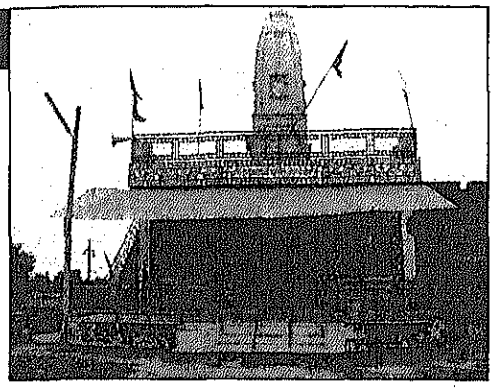


APPENDIX III-1-3 LAND USE PATTARN OF THE STUDY AREA

1 STUDY METHODOLOGY

- Field survey has been conducted to identify the current land use patterns along the final alignment and relevant facilities within 500 m from the centerline of the existing track on both sides (eastern & western sides).
- A database has been prepared covering lane use types, areas and locations along the alignment. The land use pattern of the survey area is presented graphically.

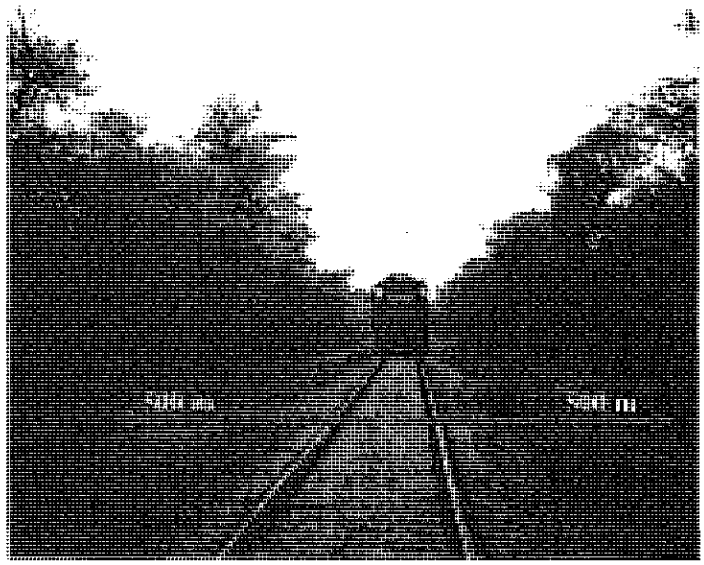


Figure 1 Survey Area for Land Use Survey

2 MAJOR FINDINGS

3.1 Land Use Pattern of the Study Area in Gujarat

The study area has mainly agricultural land with settlements & forest in very few areas. Chainage wise land use pattern is given in **Table 1** and item-wise break-up of land use pattern is summarized in **Table 2.**

Table 1 Chainage Wise Land Use Pattern of the Study Area

From (Ch. Km)	To (Ch. Km)	Land Use	Area (Ha)
0.00	4.50	Agriculture	225
4.50	5.50	Vegetation Cover	50
5.50	24.50	Agriculture	950
24.50	26.00	River Bed	75
26.00	28.20	Agriculture	110
28.20	28.80	River Bed	30
28.80	29.30	Agriculture	25
29.30	30.00	Barren Land	35
30.00	87.70	Agriculture	2885
87.70	88.10	River Bed	20
88.10	110.10	Agriculture	1100

From (Ch. Km)	To (Ch. Km)	Land Use	Area (Ha)
110.10	110.50	River Bed	20
110.50	112.10	Agriculture	80
112.10	112.50	Vegetation Cover	20
112.50	154.00	Agriculture	2075
154.00	154.80	Low Land	40
154.80	155.20	Industrial Area	20
155.20	203.00	Agriculture	2390
203.00	204.00	Barren Land	50
204.00	206.80	Agriculture	140
206.80	207.00	River Bed	10
207.00	213.10	Agriculture	305
213.10	214.00	River Bed	45
214.00	215.80	Agriculture	90
215.80	216.50	Industrial Area	35
216.50	219.70	Agriculture	160
219.70	220.20	Settlement	25
220.20	220.40	River Bed	10
220.40	243.00	Agriculture	1130
243.00	243.60	River Bed	30
243.60	249.50	Agriculture	295
249.50	250.50	River Bed	50
250.50	286.70	Agriculture	1810
286.70	288.15	Forest	72.5
288.15	288.90	Agriculture	37.5
288.90	289.00	Settlement	5
289.00	291.50	Barren Land	125
291.50	292.70	Agriculture	60
292.70	293.80	Forest	55
293.80	294.00	River Bed	10
294.00	295.00	Agriculture	50
295.00	296.50	Forest	75
296.50	311.30	Agriculture	740
311.30	311.40	River Bed	5
311.40	312.00	Agriculture	30
312.00	312.20	Agriculture	10
312.20	313.80	Agriculture	80
313.80	314.30	Settlement	25
314.30	316.10	Agriculture	90
316.10	318.50	Vegetation Cover	120
318.50	319.30	Agriculture	40

Table 2 Item Wise Detail of Land Use Pattern

Sl. No.	Class	Area (ha)	Percentage
1.	Agriculture	14,907.5	93.38
2.	Barren Land	210	1.32
3.	Forest	202.5	1.27
4.	Industrial Area	55	0.34
5.	Low Land	40	0.25
6.	River Bed	305	1.91
7.	Settlement	55	0.34
8.	Vegetation Cover	190	1.19
	Total	**15,965**	**100**

It is observed that majority (93.4%) of the land along the DFC alignment is agricultural, followed by river bed (about 1.9%), barren land (about 1.3%) and forest (1.3%). The land use pattern of the study area is graphically shown in **Figure 2.**

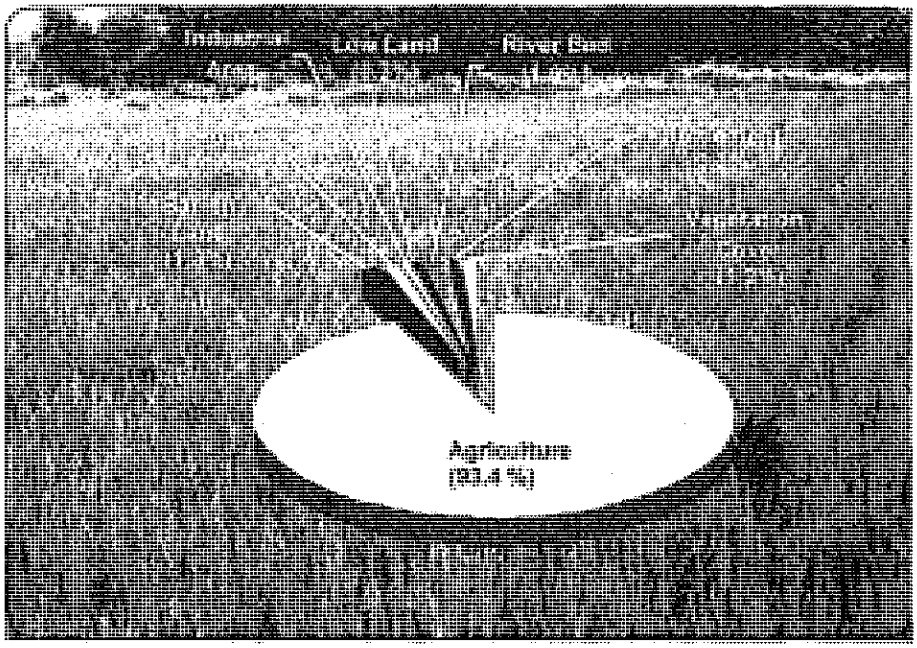


Figure 2 Land Use Pattern of the Study Area

3.2 Land Use Pattern of The Study Area in Rajasthan

The study area has mainly agricultural land with settlements & forest in very few areas. Chainage wise land use pattern of both sides (eastern & western sides) is presented in **Table 3** and **Table 4** and item-wise break-up of land use pattern is summarized in **Table 5** and **Table 6.**

Table 3 Chainage Wise Land Use Pattern of the Study Area in Rajasthan (East)

Side	From (Ch. Km)	To (Ch. Km)	Land Use	Area (Ha)
East	319.30	320.50	Agriculture	60
East	320.50	322.00	Agriculture	75
East	322.00	322.50	Settlement	25
East	322.50	323.00	Agriculture	25
East	323.00	324.50	River Bed	75
East	324.50	325.50	Agriculture	50
East	325.50	329.30	Agriculture	190
East	329.30	333.30	Settlement	200
East	333.30	334.00	Agriculture	35
East	334.00	334.40	Settlement	20
East	334.40	334.50	River Bed	5
East	334.50	335.00	Agriculture	25
East	335.00	336.00	Barren Land	50
East	336.00	340.50	Agriculture	225
East	340.50	340.80	Settlement	15
East	340.80	349.50	Agriculture	435
East	349.50	365.00	Barren Land	775

Side	From (Ch. Km)	To (Ch. Km)	Land Use	Area (Ha)
East	365.00	365.20	Settlement	10
East	365.20	375.00	Agriculture	490
East	375.00	377.50	Settlement	125
East	377.50	378.50	River Bed	50
East	378.50	413.70	Barren Land	1760
East	413.70	415.00	Settlement	65
East	415.00	429.00	Barren Land	700
East	429.00	431.00	Settlement	100
East	431.00	444.00	Barren Land	650
East	444.00	445.80	Settlement	90
East	445.80	446.10	River Bed	15
East	446.10	463.00	Barren Land	845
East	463.00	463.20	River Bed	10
East	463.20	468.70	Agriculture	275
East	468.70	468.80	Settlement	5
East	468.80	469.70	Agriculture	45
East	469.70	470.10	River Bed	20
East	470.10	480.30	Agriculture	510
East	480.30	482.70	Agriculture	120
East	482.70	482.90	River Bed	10
East	482.90	490.30	Agriculture	370
East	490.30	490.50	River Bed	10
East	490.50	496.00	Agriculture	275
East	496.00	497.80	Settlement	90
East	497.80	517.30	Agriculture	975
East	517.30	518.10	Settlement	40
East	518.10	519.50	Settlement	70
East	519.50	520.10	River Bed	30
East	520.10	538.00	Agriculture	895
East	538.00	543.50	Barren Land	275
East	543.50	543.60	River Bed	5
East	543.60	546.50	Barren Land	145
East	546.50	550.50	Agriculture	200
East	550.50	551.00	Settlement	25
East	551.00	560.00	Agriculture	450
East	560.00	582.70	Barren Land	1135
East	582.70	588.00	Settlement	265
East	588.00	598.00	Barren Land	500
East	598.00	621.50	Agriculture	1175
East	621.50	622.00	Agriculture	25
East	622.00	629.00	Agriculture	350
East	629.00	640.00	Settlement	550
East	640.00	657.00	Agriculture	850
East	657.00	664.50	Settlement	375
East	664.50	666.00	Forest	75
East	666.00	683.00	Agriculture	850
East	683.00	683.70	Settlement	35
East	683.70	694.00	Agriculture	515
East	694.00	696.80	Barren Land	140
East	696.80	698.00	Agriculture	60
East	698.00	701.00	Barren Land	150
East	701.00	702.20	Agriculture	60
East	702.20	702.70	Agriculture	25
East	702.70	705.00	Barren Land	115
East	705.00	713.90	Agriculture	445
East	713.90	714.20	Settlement	15

Side	From (Ch. Km)	To (Ch. Km)	Land Use	Area (Ha)
East	714.20	729.80	Agriculture	780
East	729.80	730.50	Settlement	35
East	730.50	744.60	Agriculture	705
East	744.60	745.40	River Bed	40
East	745.40	746.20	Agriculture	40
East	746.20	748.50	Settlement	115
East	748.50	778.80	Agriculture	1515
East	778.80	779.70	Settlement	45
East	779.70	788.50	Agriculture	440
East	788.50	791.00	Settlement	125
East	791.00	798.80	Agriculture	390
East	798.80	799.10	Settlement	15
East	799.10	822.50	Agriculture	1170
East	822.50	823.20	River Bed	35
East	823.20	825.00	Agriculture	90
East	825.00	826.40	Settlement	70
East	826.40	835.80	Agriculture	470
East	835.80	836.20	Settlement	20
East	836.20	850.50	Agriculture	715
East	850.50	851.00	Settlement	25
East	851.00	853.40	Agriculture	120
East	899.70	900.50	Settlement	40
East	900.50	902.30	Agriculture	90

Table 4 Chainage Wise Land Use Pattern of the Study Area in Rajasthan (West)

Side	From (Ch. Km)	To (Ch. Km)	Land Use	Area (Ha)
West	319.30	320.50	Agriculture	60
West	320.50	323.00	Barren Land	125
West	323.00	324.50	River Bed	75
West	324.50	325.50	Agriculture	50
West	325.50	329.30	Settlement	190
West	329.30	333.30	Settlement	200
West	333.30	334.00	Agriculture	35
West	334.00	334.40	Settlement	20
West	334.40	334.50	River Bed	5
West	334.50	335.00	Agriculture	25
West	335.00	336.00	Agriculture	50
West	336.00	340.50	Agriculture	225
West	340.50	340.80	Agriculture	15
West	340.80	349.50	Agriculture	435
West	349.50	365.00	Barren Land	775
West	365.00	365.20	Settlement	10
West	365.20	375.00	Agriculture	490
West	375.00	377.50	Settlement	125
West	377.50	378.50	River Bed	50
West	378.50	413.70	Barren Land	1760
West	413.70	415.00	Settlement	65
West	415.00	429.00	Barren Land	700
West	429.00	431.00	Settlement	100
West	431.00	444.00	Barren Land	650
West	444.00	445.80	Settlement	90
West	445.80	446.10	River Bed	15
West	446.10	463.00	Barren Land	845
West	463.00	463.20	River Bed	10

Side	From (Ch. Km)	To (Ch. Km)	Land Use	Area (Ha)
West	463.20	468.70	Agriculture	275
West	468.70	468.80	Settlement	5
West	468.80	469.70	Agriculture	45
West	469.70	470.10	River Bed	20
West	470.10	480.30	Agriculture	510
West	480.30	482.70	Agriculture	120
West	482.70	482.90	River Bed	10
West	482.90	490.30	Agriculture	370
West	490.30	490.50	River Bed	10
West	490.50	496.00	Agriculture	275
West	496.00	497.80	Settlement	90
West	497.80	517.30	Agriculture	975
West	517.30	518.10	Settlement	40
West	518.10	519.50	Agriculture	70
West	519.50	520.10	River Bed	30
West	520.10	538.00	Agriculture	895
West	538.00	543.50	Barren Land	275
West	543.50	543.60	River Bed	5
West	543.60	546.50	Barren Land	145
West	546.50	550.50	Agriculture	200
West	550.50	551.00	Agriculture	25
West	551.00	560.00	Barren Land	450
West	560.00	582.70	Barren Land	1135
West	582.70	588.00	Settlement	265
West	588.00	598.00	Barren Land	500
West	598.00	621.50	Agriculture	1175
West	621.50	622.00	Settlement	25
West	622.00	629.00	Agriculture	350
West	629.00	640.00	Settlement	550
West	640.00	657.00	Agriculture	850
West	657.00	664.50	Settlement	375
West	664.50	666.00	Agriculture	75
West	666.00	683.00	Agriculture	850
West	683.00	683.70	Agriculture	35
West	683.70	694.00	Agriculture	515
West	694.00	696.80	Barren Land	140
West	696.80	698.00	Agriculture	60
West	698.00	701.00	Barren Land	150
West	701.00	702.20	Agriculture	60
West	702.20	702.70	Settlement	25
West	702.70	705.00	Barren Land	115
West	705.00	713.90	Agriculture	445
West	713.90	714.20	Settlement	15
West	714.20	729.80	Agriculture	780
West	729.80	730.50	Settlement	35
West	730.50	744.60	Agriculture	705
West	744.60	745.40	River Bed	40
West	745.40	746.20	Agriculture	40
West	746.20	748.50	Settlement	115
West	748.50	778.80	Agriculture	1515
West	778.80	779.70	Settlement	45
West	779.70	788.50	Agriculture	440
West	788.50	789.50	Agriculture	50
West	789.50	790.50	Settlement	50
West	790.50	799.10	Agriculture	430
West	799.10	822.50	Agriculture	1170

Side	From (Ch. Km)	To (Ch. Km)	Land Use	Area (Ha)
West	822.50	823.20	River Bed	35
West	823.20	825.00	Agriculture	90
West	825.00	826.40	Settlement	70
West	826.40	835.80	Agriculture	470
West	835.80	836.20	Agriculture	20
West	836.20	850.50	Agriculture	715
West	850.50	851.00	Settlement	25
West	851.00	853.40	Agriculture	120
West	899.70	900.00	Agriculture	15
West	900.00	900.80	Settlement	40
West	900.80	902.30	Agriculture	75

Table 5 Item Wise Detail of Land Use Pattern (Eastern Side)

Sl. No.	Class	Area (ha)	Percentage
1.	Agriculture	16,605	61.88
2.	Barren Land	7,240	26.97
3.	Forest	75	0.28
4.	River Bed	305	1.14
5.	Settlement	2,610	9.73
	Total	**26,835**	**100**

It is observed that on the eastern side of the proposed alignment majority (61.9%) of the land is agricultural, followed by barren land (27%). The land use pattern of the study area is graphically shown in **Figure 3**.

Table 6 Item Wise Break-up of Land Use Pattern (Western Side)

Sl. No.	Class	Area (ha)	Percentage
1.	Agriculture	16,195	60.35
2.	Barren Land	7,765	28.93
3.	River Bed	305	1.14
4.	Settlement	2,570	9.58
		26,835	**100**

It is observed that on the western side of the proposed alignment majority (60.4%) of the land is agricultural, followed by barren land (28.9%). The land use pattern of the study area is graphically shown in **Figure 4**.

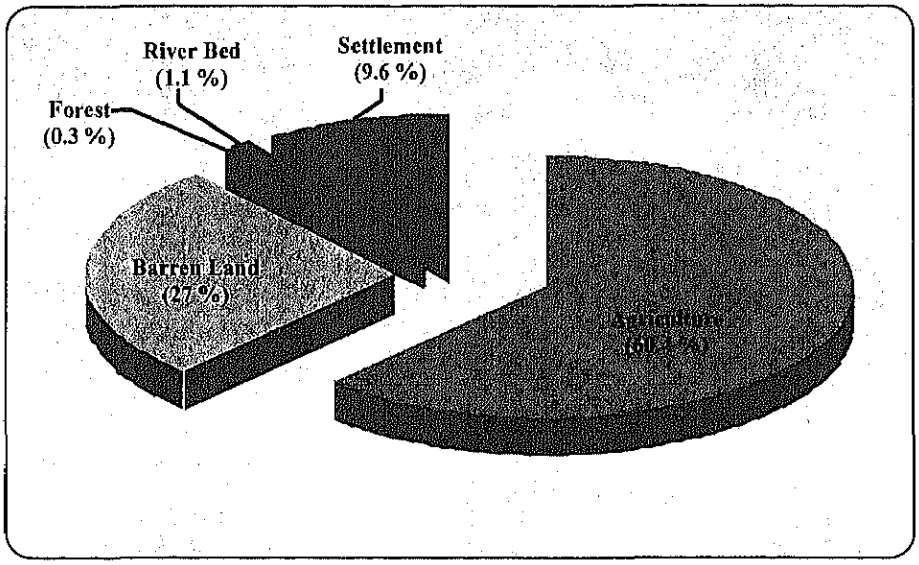


Figure 3 Land Use Pattern of the Study Area (Eastern Side)

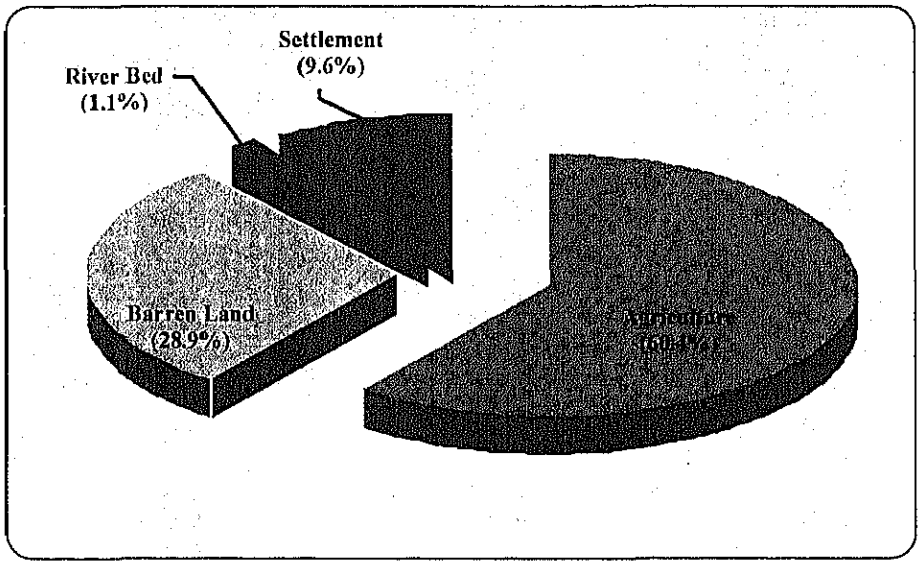


Figure 4 Land Use Pattern of the Study Area (Western Side)

3.3 Land Use Pattern of The Study Area in Haryana

The study area has mainly agricultural land with settlements & forest in very few areas. Chainage wise land use pattern of both sides (eastern & western sides) is given in **Table 7** and **Table 8.** Item-wise detail of land use pattern is summarized in **Table 9** and **Table 10.**

Table 7 Chainage Wise Land Use Pattern of the Study Area (Eastern Side)

From (Ch. Km)	To (Ch. Km)	Land Use	Area (Ha)
853.40	860.40	Agriculture	350.00
860.40	860.60	Agriculture	10.00

From (Ch. Km)	To (Ch. Km)	Land Use	Area (Ha)
860.60	861.90	Agriculture	65.00
861.90	862.10	Settlement	10.00
862.10	866.70	Agriculture	230.00
866.70	867.00	Settlement	15.00
867.00	868.90	Agriculture	95.00
868.90	869.20	Settlement	15.00
869.20	873.00	Agriculture	190.00
873.00	875.50	Settlement	125.00
875.50	877.00	Settlement	75.00
877.00	890.00	Agriculture	650.00
890.00	891.00	Settlement	50.00
891.00	899.70	Agriculture	435.00
902.30	905.00	Agriculture	135.00
905.00	905.20	Settlement	10.00
905.20	916.00	Agriculture	540.00
916.00	916.20	Settlement	10.00
916.20	939.00	Agriculture	1140.00

Source: Field Survey

Table 8 Chainage Wise Land Use Pattern of the Study Area (Western Side)

From (Ch. Km)	To (Ch. Km)	Land Use	Area (Ha)
853.40	860.40	Agriculture	350
860.40	860.60	Settlement	10
860.60	868.80	Agriculture	410
868.80	873.00	Agriculture	210
873.00	875.50	Settlement	125
875.50	888.00	Agriculture	625
888.00	888.50	Settlement	25
888.50	890.00	Agriculture	75
890.00	891.00	Settlement	50
891.00	891.90	Agriculture	45
891.90	892.10	Settlement	10
892.10	892.80	Agriculture	35
892.80	893.30	Settlement	25
893.30	899.70	Agriculture	320
902.30	904.90	Agriculture	130
904.90	905.10	Settlement	10
905.10	917.00	Agriculture	595
917.00	917.50	Settlement	25
917.50	924.80	Agriculture	365
924.80	925.00	Settlement	10
925.00	939.00	Agriculture	700

Source: Field Survey

Table 9 Item Wise Detail of Land Use Pattern (Eastern Side)

Sl. No.	Class	Area (ha)	Percentage
1.	Agriculture	3,840	92
7.	Settlement	310	8
	Total	**4,150**	**100**

Table 10 Item wise Break-up of Land Use Pattern (Western Side)

Sl. No.	Class	Area (ha)	Percentage
1.	Agriculture	3,860	93.0
7.	Settlement	290	7.0
	Total	**4,150**	**100**

It is observed that majority of the land along the final alignment is agricultural (eastern side- 92% and western side – 93%) and remaining is settlement area. The land use pattern of the study area is graphically shown in **Figure 4** and **Figure 5**.

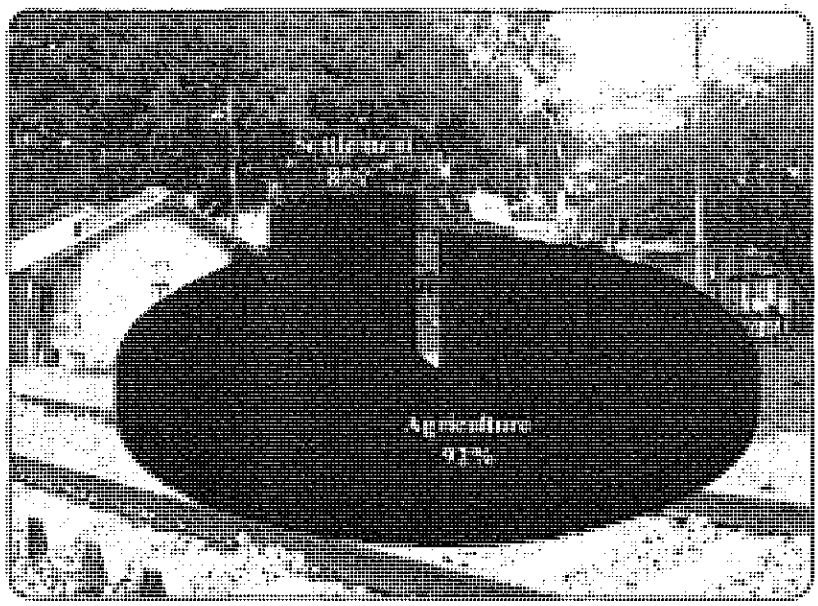


Figure 5 Land Use Pattern of the Study Area (Eastern Side)

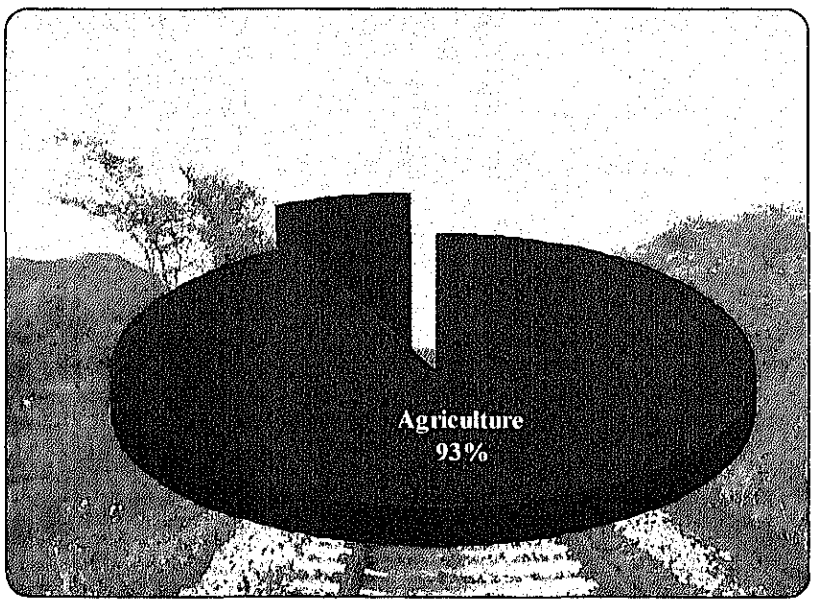


Figure 5 Land Use Pattern of the Study Area (Western Side)

3.4 Impact Assessment

Proposed development in Rajasthan will lead to change in land use pattern of areas that comes under the proposed ROW. The major portion of the alignment is passing through agricultural land.

Preparatory activities like clearing of ROW, construction of temporary construction camps and godowns, storage of construction materials etc. will be confined within the camp & ROW. This will not hamper the land use aspects outside ROW. However, indirectly there may be some change in the land use pattern of the proximate area due to influx of construction work-force and supplier who are likely to construct temporary tents in the vicinity. The on-site land use will more or less have a temporary impact in terms of fugitive emission from handling of construction material.

Impacts:

- Loss of agricultural land resources due to land acquisition
- Generation of solid waste in the form of construction spoils from construction sites
- Changes in existing land use pattern of the ROW for construction of DFC

Mitigation Measures:

- Earth material generated from excavation will be reused to the maximum possible extent as filling material during site development.
- The small amount of construction debris and surplus excavated material will be disposed of by mechanical transport in suitable pre-identified (jointly by project proponent & local administration) dumping areas in tune with the local condition to avoid land degradation & water logging due to indiscriminate dumping.
- Dumping areas will be reclaimed through top soil cover & plantation.
- Construction camp will be provided for construction personnel to avoid indiscriminate settlement of construction workers and labourers.
- Regular inspection of haul roads and construction site will be carried out to ensure regular and timely removal of construction debris to the designated dumping sites.
- Construction activities will be kept confined to ROW only.

APPENDIX III-1-4 RELEVANT INDIAN STANDARDS FOR WATER POLLUTION

Table 1 Tolerance Limits for Inland Surface Waters (as per IS:2296)

SN	Parameter and Unit	Class-A	Class-B	Class-C	Class-D	Class-E
1.	Colour (Hazen Units)	10	300	300	-	-
2.	Odour	Unobjectionable	-	-	-	-
3.	Taste	Tasteless	-	-	-	-
4.	pH (max) (min:6.5)	8.5	8.5	8.5	8.5	8.5
5.	Conductivity (25°C) (μmhos/cm)	-	-	-	1000	2250
6.	DO (mg/L)(min)	6	5	4	4	-
7.	BOD (3 days at 27°C) (mg/L)	2	3	3	-	-
8.	Total Coliforms (MPN/100 mL)	50	500	5000	-	-
9.	TDS (mg/L)	500	-	1500	-	2100
10.	Oil and Grease (mg/L)	-	-	0.1	0.1	-
11.	Mineral Oil (mg/L)	0.01	-	-	-	-
12.	Free Carbon Dioxide (mg/L CO_2)	-	-	-	6	-
13.	Free Ammonia (mg/L as N)	-	-	-	1.2	-
14.	Cyanide (mg/L as CN)	0.05	0.05	0.05	-	-
15.	Phenol (mg/L C_6H_5OH)	0.002	0.005	0.005	-	-
16.	Total Hardness (mg/L as $CaCO_3$)	300	-	-	-	-
17.	Chloride (mg/L as Cl)	250	-	600	-	600
18.	Sulphate (mg/L as SO_4)	400	-	400	-	1000
19.	Nitrate (mg/L as NO_3)	20	-	50	-	-
20.	Fluoride (mg/L as F)	1.5	1.5	1.5	-	-
21.	Calcium (mg/L as Ca)	80	-	-	-	-
22.	Magnesium (mg/L as Mg)	24.4	-	-	-	-
23.	Copper (mg/L as Cu)	1.5	-	1.5	-	-
24.	Iron (mg/L as Fe)	0.3	-	50	-	-
25.	Manganese (mg/L as Mn)	0.5	-	-	-	-
26.	Zinc (mg/L as Zn)	15	-	15	-	-
27.	Boron (mg/L as B)	-	-	-	-	2
28.	Barium (mg/L as Ba)	1	-	-	-	-
29.	Silver (mg/L as Ag)	0.05	-	-	-	-
30.	Arsenic (mg/L as As)	0.05	0.2	0.2	-	-
31.	Mercury (mg/L as Hg)	0.001	-	-	-	-
32.	Lead (mg/L as Pb)	0.1	-	0.1	-	-
33.	Cadmium (mg/L as Cd)	0.01	-	0.01	-	-
34.	Chromium (VI) (mg/L as Cr)	0.05	0.05	0.05	-	-
35.	Selenium (mg/L as Se)	0.01	-	0.05	-	-
36.	Anionic Detergents (mg/L MBAS)	0.2	1	1	-	-
37.	PAH (mg/L)	0.2	-	-	-	-
38.	Pesticides (μg/L)	Absent	-	-	-	-
39.	Insecticides (mg/L)	-	-	Absent	-	-
40.	Alpha Emitters (10^{-6}μc/mL)	0.001	0.001	0.001	0.001	0.001
41.	Beta Emitters (10^{-6}μc/mL)	0.01	0.01	0.01	0.01	0.01
42.	Percent Sodium (%)	-	-	-	-	60
43.	Sodium Absorption Ratio	-	-	-	-	26

Class-A: Drinking water source without conventional treatment but after disinfection.
Class-B: Outdoor bathing.
Class-C: Drinking water source with conventional treatment followed by disinfection.
Class-D: Fish culture and wild life propagation.
Class-E: Irrigation, industrial cooling and controlled waste disposal.

Table 2 Drinking Water Quality Standards (as per IS:10500)

Sl. No.	Parameter and Unit	Desirable Limit	Permissible Limit in Absence of Alternate Source
1.	Colour (Hazen units)	5	25
2.	Odour	Unobjectionable	-
3.	Taste	Agreeable	-
4.	Turbidity (NTU)	5	10
5.	pH	5-8.5	No relaxation
6.	Total Coliforms (MPN/100 mL)	nil	-
7.	Pathogenic Organisms or Virus	nil	-
8.	TDS (mg/L)	500	2000
9.	Mineral Oil (mg/L)	0.01	0.03
10.	Free Residual Chlorine (mg/L)	0.2	-
11.	Cyanide (mg/L as CN)	0.05	No relaxation
12.	Phenol (mg/L C_6H_5OH)	0.001	0.002
13.	Total Hardness (mg/L as $CaCO_3$)	300	600
14.	Total Alkalinity (mg/L as $CaCO_3$)	200	600
15.	Chloride (mg/L as Cl)	250	1000
16.	Sulphate (mg/L as SO_4)	200	400
17.	Nitrate (mg/L as NO_3)	45	100
18.	Fluoride (mg/L as F)	1	1.5
19.	Calcium (mg/L as Ca)	75	200
20.	Magnesium (mg/L as Mg)	30	100
21.	Copper (mg/L as Cu)	0.05	1.5
22.	Iron (mg/L as Fe)	0.3	1
23.	Manganese (mg/L as Mn)	0.1	0.3
24.	Zinc (mg/L as Zn)	5	15
25.	Boron (mg/L as B)	1	5
26.	Aluminium (mg/L as AL)	0.03	0.2
27.	Arsenic (mg/L as As)	0.05	No relaxation
28.	Mercury (mg/L as Hg)	0.001	No relaxation
29.	Lead (mg/L as Pb)	0.05	No relaxation
30.	Cadmium (mg/L as Cd)	0.01	No relaxation
31.	Chromium (VI) (mg/L as Cr)	0.05	No relaxation
32.	Selenium (mg/L as Se)	0.01	No relaxation
33.	Anionic Detergents (mg/L MBAS)	0.2	1
34.	PAH (mg/L)	nil	-
35.	Pesticides (µg/L)	Absent	0.001
36.	Alpha Emitters (10^{-6}µc/mL)	nil	0.0001
37.	Beta Emitters (10^{-6}µc/mL)	nil	0.001

Table 3 General Standards for Discharge of Effluents

[as per Environment (Protection) Rules, 1986]

Sl. No.	Parameter and Unit	Inland Surface Water	Public Sewers	Land for Irrigation	Marine Coastal Water
1	Temperature (oC)	#	-	-	#
2	Colour and Odour	$	-	$	$
3	pH	5.5-9.0	5.5-9.0	5.5-9.0	5.5-9.0
4	BOD (3 days at 27oC) (mg/L)	30	350	100	100
5	COD (mg/L)	250	-	-	250
6	Bio-assey (% 96-hrs Survival)	@	@	@	@
7	TSS (mg/L)	100	600	200	100*
8	SS Particle size(pass IS Sieve)	850	-	-	&
9	Oil and Grease (mg/L)	10	20	10	20
10	Total Residual Chlorine (mg/L)	1	-	-	1
1	Nitrate Nitrogen (mg/L as N)	10	-	-	20
12	Ammonia Nitrogen (mg/L N)	50	50	-	50
13	Kjeldahl Nitrogen (mg/L as N)	100	-	-	100
14	Free Ammonia (mg/L as N)	5	-	-	5
15	Cyanide (mg/L as CN)	0.2	2	0.2	0.2
16	Phenol (mg/L C6H5OH)	1	5	-	5
17	Fluoride (mg/L as F)	2	15	-	15
18	Sulphide (mg/L as S)	2	-	-	5
19	Dissolved Phosphate (mg/L P)	5	-	-	-
20	Copper (mg/L as Cu)	3	3	-	3
21	Iron (mg/L as Fe)	3	3	-	3
22	Manganese (mg/L as Mn)	2	2	-	2
23	Zinc (mg/L as Zn)	5	15	-	15
24	Nickel (mg/L as Ni)	3	3	-	5
25	Vanadium (mg/L as V)	0.2	0.2	-	0.2
26	Arsenic (mg/L as As)	0.2	0.2	0.2	0.2
27	Mercury (mg/L as Hg)	0.01	0.01	-	0.01
28	Lead (mg/L as Pb)	0.1	1	-	1
29	Cadmium (mg/L as Cd)	2	1	-	2
30	Chromium (VI) (mg/L as Cr)	0.1	2	-	1
31	Chromium (Total) (mg/L as Cr)	2	2	-	2
32	Selenium (mg/L as Se)	0.05	0.05	-	0.05
33	Alpha Emitters (10-6μc/mL)	0.1	0.1	0.01	0.1
34	Beta Emitters (10-6μc/mL)	1	1	0.1	1

\# Shall not exceed 5°C above the receiving water temperature.
$ All efforts should be made to remove colour and unpleasant odour as far as practicable.
@ 90% survival of fish after 96 hours in 100% effluent.
* For cooling water effluent 10% above TSS of influent.
& (a) Floatable solids 3 mm, (b) Settleable solids 850 micron.

Table 4 General Emission Standards

[as per Environment (Protection) Rules, 1986]

I. *Concentration Based Standards*

SN	Parameter	Standard (mg/Nm^3)
1.	Particulate Matter (PM)	150
2.	Total Fluoride	25
3.	Asbestos	Fibres: 4 nos/cc, Dust: 2 mg/Nm^3
4.	Mercury	0.2
5.	Chlorine	15
6.	Hydrochloric acid vapour and mist	35
7.	Sulphuric acid mist	50
8.	Carbon Monoxide	1% max (v/v)
9.	Lead	10

II. *Equipment Based Standards*

(For dispersal of sulphur dioxide, minimum stack height limit is accordingly prescribed below)

Power Generation Capacity (MW)	Steam Generation Capacity (T/h)	Coal Consumption (MT/day)	Minimum Stack Height Limit (m)
≥ 500			275
≥ 200/210 and < 500			220
< 200/210			$H = 14\ Q^{0.3}$
	< 2	< 8.5	9
	2 to 5	8.5 to 21	12
	5 to 10	21 to 42	15
	10 to 15	42 to 64	18
	15 to 20	64 to 84	21
	20 to 25	84 to 105	24
	25 to 30	105 to 126	27
	> 30	> 126	30 or using $H = 14\ Q^{0.3}$

Note: H = Physical height of the stack in metre, Q = Emission rate of SO_2 in kg/hr

Table 5 National Ambient Air Quality Standards

[as per Environment (Protection) Rules, 1986]

Pollutant	Time Weighted Average	Concentration ($\mu g/m^3$) in Ambient Air		
		Industrial Area	Residential, Rural and Other Areas	Sensitive Area
Sulphur Dioxide (SO_2)	Annual*	80	60	15
	24 Hours**	120	80	30
Oxides of Nitrogen (as NO_2)	Annual*	80	60	15
	24 Hours**	120	80	30
Suspended Particulate Matter (SPM)	Annual*	360	140	70
	24 Hours**	500	200	100
Respirable Particulate Matter (RPM) (size less than 10 μm)	Annual*	120	60	50
	24 Hours**	150	100	75
Lead (Pb)	Annual*	1	0.75	0.5
	24 Hours**	1.5	1	0.75
Ammonia	Annual*	100	100	100
	24 Hours**	400	400	400
Carbon Monoxide (CO)	8 Hours**	5000	2000	1000
	1 Hour	10000	4000	2000

* Annual arithmetic mean of minimum 104 measurements in a year taken twice a week 24-hourly at uniform interval.

** 24-hourly/8-hourly values should be met 98% of the time in a year. However, 2% of the time, it may exceed but not on two consecutive days.

Table 6 Ambient Air Quality Standards in respect of Noise

[as per Noise Pollution (Regulation and Control) Rules, 2000]

Area Code	Category of Area	Limits in dB(A) L_{eq}*	
		Day Time	Night Time
A	Industrial Area	75	70
B	Commercial Area	65	55
C	Residential Area	55	45
D	Silence Zone	50	40

Notes: 1. Day time shall mean from 6.00 a.m. to 10.00 p.m.
2. Night time shall mean from 10.00 p.m. to 6.00 a.m.
3. Silence zone is defined as an area comprising not less than 100 metres around hospitals, educational institutions and courts. The silence zones are zones which are declared as such by the competent authority.
4. Mixed categories of areas may be declared as one of the four above mentioned categories by the competent authority.
* dB(A) L_{eq} denotes the time weighted average of the level of sound in decibels on scale A which is relatable to human hearing.

Table 7 Permissible Exposure Levels of Impulse or Impact Noise for Work Zone Area

[as per Model Rules of Factories Act, 1948]

Peak Sound Pressure Level in dB	Permitted Number of Impulses or Impacts/day
140	100
135	315
130	1,000
125	3,160
120	10,000

Notes: 1. No exposure in excess of 140 dB peak sound pressure level is permitted.
2. For any peak sound pressure level falling in between any figure and the next higher or lower figure as indicated in column 1, the permitted number of impulses or impacts per day is to be determined by extrapolation on a proportionate basis.

Table 8 Permissible Exposure in Case of Continuous Noise for Work Zone Area

[as per Model Rules of Factories Act, 1948]

Total Time of Exposure (continuous or a number of short term exposures) per day, in hr	Permissible Sound Pressure Level in dB(A)
8	90
6	92
4	95
3	97
2	100
1	102
1&1/2	105
1/2	107
1/4	110
1/8	115

Notes: 1.No exposure in excess of 115 dB(A) is to be permitted.
2. For any period of exposure falling in between any figure and the next higher or lower figure as indicated in column 1, the permissible sound pressure level is to be determined by extrapolation on a proportionate basis.

APPENDIX III-2-1 QUADRATE SURVEY RESULTS IN GUJARAT

Table 1 Quadrate Survey Results of Bantawada Forest (Un-classed)

Plot No.	Date	Local Name	Scientific Name	Girth (cm)	Height (m)	Area (m^2)
1	03/09/2008	Israili Baval	*Acacia tortlis*	60	7	0.03
1	03/09/2008	Israili Baval	*Acacia tortlis*	60	8	0.03
1	03/09/2008	Israili Baval	*Acacia tortlis*	40	4	0.01
1	03/09/2008	Israili Baval	*Acacia tortlis*	65	5	0.03
1	03/09/2008	Deshi Baval	*Acacia nilotica*	90	9.5	0.06
1	03/09/2008	Deshi Baval	*Acacia nilotica*	35	4	0.01
1	03/09/2008	Deshi Baval	*Acacia nilotica*	60	5	0.03
1	03/09/2008	Ber	*Zizyphus mauritiana*	45	3	0.02
2	03/09/2008	Deshi Baval	*Acacia nilotica*	40	4	0.01
2	03/09/2008	Deshi Baval	*Acacia nilotica*	40	3.5	0.01
2	03/09/2008	Deshi Baval	*Acacia nilotica*	60	7	0.03
2	03/09/2008	Deshi Baval	*Acacia nilotica*	40	5	0.01
2	03/09/2008	Deshi Baval	*Acacia nilotica*	50	6	0.02
2	03/09/2008	Deshi Baval	*Acacia nilotica*	30	4.5	0.01
2	03/09/2008	Deshi Baval	*Acacia nilotica*	45	4	0.02
2	03/09/2008	Deshi Baval	*Acacia nilotica*	80	8	0.05
2	03/09/2008	Khair	*Acacia catechu*	30	6	0.01
3	03/09/2008	Israili Baval	*Acacia tortlis*	50	4.5	0.02
3	03/09/2008	Deshi Baval	*Acacia nilotica*	60	5.5	0.03
3	03/09/2008	Deshi Baval	*Acacia nilotica*	60	6	0.03
3	03/09/2008	Deshi Baval	*Acacia nilotica*	65	7	0.03
3	03/09/2008	Deshi Baval	*Acacia nilotica*	40	3.5	0.01
3	03/09/2008	Deshi Baval	*Acacia nilotica*	70	5	0.04
3	03/09/2008	Khair	*Acacia catechu*	75	6	0.04
3	03/09/2008	Khair	*Acacia catechu*	40	10	0.01
3	03/09/2008	Jhariber	*Ziziphus nummularia*	35	3	0.01
3	03/09/2008	Jhariber	*Ziziphus nummularia*	35	3	0.01
3	03/09/2008	Jhariber	*Ziziphus nummularia*	40	3.5	0.01
4	03/09/2008	Israili Baval	*Acacia tortlis*	70	5	0.04
4	03/09/2008	Israili Baval	*Acacia tortlis*	50	8	0.02
4	03/09/2008	Israili Baval	*Acacia tortlis*	80	6	0.05
4	03/09/2008	Israili Baval	*Acacia tortlis*	50	4.5	0.02
4	03/09/2008	Deshi Baval	*Acacia nilotica*	30	4	0.01
4	03/09/2008	Deshi Baval	*Acacia nilotica*	55	7.5	0.02
4	03/09/2008	Deshi Baval	*Acacia nilotica*	40	5	0.01
4	03/09/2008	Deshi Baval	*Acacia nilotica*	45	5	0.02
4	03/09/2008	Deshi Baval	*Acacia nilotica*	60	7	0.03
4	03/09/2008	Khair	*Acacia catechu*	85	9.5	0.06
4	03/09/2008	Ber	*Zizyphus mauritiana*	45	4	0.02
4	03/09/2008	Ber	*Zizyphus mauritiana*	45	5	0.02
4	03/09/2008	Ber	*Zizyphus mauritiana*	50	5	0.02
4	03/09/2008	Jhariber	*Ziziphus nummularia*	40	3	0.01
5	03/09/2008	Deshi Baval	*Acacia nilotica*	85	9	0.06
5	03/09/2008	Deshi Baval	*Acacia nilotica*	50	6	0.02
5	03/09/2008	Khair	*Acacia catechu*	55	5	0.02
5	03/09/2008	Jhariber	*Ziziphus nummularia*	50	3	0.02
5	03/09/2008	Jhariber	*Ziziphus nummularia*	60	3.5	0.03
5	03/09/2008	Jhariber	*Ziziphus nummularia*	55	3	0.02
5	03/09/2008	Jhariber	*Ziziphus nummularia*	35	3	0.01
6	03/09/2008	Israili Baval	*Acacia tortlis*	65	7	0.03
6	03/09/2008	Israili Baval	*Acacia tortlis*	40	4	0.01
6	03/09/2008	Israili Baval	*Acacia tortlis*	65	5.5	0.03
6	03/09/2008	Israili Baval	*Acacia tortlis*	40	6	0.01
6	03/09/2008	Israili Baval	*Acacia tortlis*	45	4	0.02
6	03/09/2008	Israili Baval	*Acacia tortlis*	50	5	0.02
6	03/09/2008	Israili Baval	*Acacia tortlis*	65	5	0.03

Plot No.	Date	Local Name	Scientific Name	Girth (cm)	Height (m)	Area (m^2)
6	03/09/2008	Khair	*Acacia catechu*	90	7	0.06
6	03/09/2008	Khair	*Acacia catechu*	85	5	0.06
6	03/09/2008	Jhariber	*Ziziphus nummularia*	35	3	0.01
7	03/09/2008	Khair	*Acacia catechu*	55	4	0.02
7	03/09/2008	Khair	*Acacia catechu*	60	4.5	0.03
7	03/09/2008	Khair	*Acacia catechu*	55	4	0.02
7	03/09/2008	Khair	*Acacia catechu*	70	6	0.04
7	03/09/2008	Khair	*Acacia catechu*	80	7.5	0.05
7	03/09/2008	Khair	*Acacia catechu*	45	5	0.02
7	03/09/2008	Ber	*Zizyphus mauritiana*	60	5.5	0.03
7	03/09/2008	Jhariber	*Ziziphus nummularia*	45	3	0.02
7	03/09/2008	Jhariber	*Ziziphus nummularia*	55	4	0.02
8	03/09/2008	Deshi Baval	*Acacia nilotica*	70	6.5	0.04
8	03/09/2008	Deshi Baval	*Acacia nilotica*	60	5.5	0.03
8	03/09/2008	Deshi Baval	*Acacia nilotica*	90	9.5	0.06
8	03/09/2008	Deshi Baval	*Acacia nilotica*	75	6.5	0.04
8	03/09/2008	Deshi Baval	*Acacia nilotica*	60	5	0.03
8	03/09/2008	Khair	*Acacia catechu*	60	5.5	0.03
8	03/09/2008	Khair	*Acacia catechu*	50	6.5	0.02
9	03/09/2008	Deshi Baval	*Acacia nilotica*	45	3	0.02
9	03/09/2008	Deshi Baval	*Acacia nilotica*	70	6	0.04
9	03/09/2008	Ber	*Zizyphus mauritiana*	40	5	0.01
9	03/09/2008	Ber	*Zizyphus mauritiana*	45	5	0.02
9	03/09/2008	Ber	*Zizyphus mauritiana*	60	7	0.03
9	03/09/2008	Ber	*Zizyphus mauritiana*	55	4	0.02
9	03/09/2008	Ber	*Zizyphus mauritiana*	45	6	0.02
10	03/09/2008	Israili Baval	*Acacia tortlis*	85	8	0.06
10	03/09/2008	Deshi Baval	*Acacia nilotica*	60	5	0.03
10	03/09/2008	Deshi Baval	*Acacia nilotica*	70	7.5	0.04
10	03/09/2008	Deshi Baval	*Acacia nilotica*	75	9	0.04
10	03/09/2008	Deshi Baval	*Acacia nilotica*	40	5	0.01
10	03/09/2008	Deshi Baval	*Acacia nilotica*	90	8	0.06
10	03/09/2008	Deshi Baval	*Acacia nilotica*	85	8	0.06
10	03/09/2008	Deshi Baval	*Acacia nilotica*	40	5	0.01
10	03/09/2008	Deshi Baval	*Acacia nilotica*	45	3	0.02
10	03/09/2008	Jhariber	*Ziziphus nummularia*	60	3.5	0.03
10	03/09/2008	Jhariber	*Ziziphus nummularia*	50	3.5	0.02
11	03/09/2008	Israili Baval	*Acacia tortlis*	50	6	0.02
11	03/09/2008	Israili Baval	*Acacia tortlis*	55	6	0.02
11	03/09/2008	Israili Baval	*Acacia tortlis*	50	5.5	0.02
11	03/09/2008	Israili Baval	*Acacia tortlis*	60	6	0.03
11	03/09/2008	Deshi Baval	*Acacia nilotica*	90	8.5	0.06
11	03/09/2008	Khair	*Acacia catechu*	70	8	0.04
11	03/09/2008	Khair	*Acacia catechu*	65	7	0.03
11	03/09/2008	Khair	*Acacia catechu*	75	6.5	0.04
11	03/09/2008	Ber	*Zizyphus mauritiana*	35	3.5	0.01
12	03/09/2008	Deshi Baval	*Acacia nilotica*	40	5	0.01
12	03/09/2008	Deshi Baval	*Acacia nilotica*	50	4	0.02
12	03/09/2008	Deshi Baval	*Acacia nilotica*	55	6	0.02
12	03/09/2008	Deshi Baval	*Acacia nilotica*	50	5.5	0.02
12	03/09/2008	Deshi Baval	*Acacia nilotica*	65	5	0.03
12	03/09/2008	Ber	*Zizyphus mauritiana*	50	5.5	0.02
12	03/09/2008	Ber	*Zizyphus mauritiana*	60	5	0.03
13	03/09/2008	Israili Baval	*Acacia tortlis*	55	6.5	0.02
13	03/09/2008	Deshi Baval	*Acacia nilotica*	60	5.5	0.03
13	03/09/2008	Deshi Baval	*Acacia nilotica*	55	6.5	0.02
13	03/09/2008	Deshi Baval	*Acacia nilotica*	70	8	0.04
13	03/09/2008	Khair	*Acacia catechu*	90	9	0.06
13	03/09/2008	Khair	*Acacia catechu*	75	7	0.04
13	03/09/2008	Jhariber	*Ziziphus nummularia*	60	4	0.03
14	03/09/2008	Ber	*Zizyphus mauritiana*	65	6	0.03

Plot No.	Date	Local Name	Scientific Name	Girth (cm)	Height (m)	Area (m^2)
14	03/09/2008	Ber	*Zizyphus mauritiana*	65	7	0.03
14	03/09/2008	Ber	*Zizyphus mauritiana*	70	6	0.04
14	03/09/2008	Ber	*Zizyphus mauritiana*	60	5.5	0.03
14	03/09/2008	Ber	*Zizyphus mauritiana*	75	5	0.04
14	03/09/2008	Ber	*Zizyphus mauritiana*	55	4	0.02
14	03/09/2008	Jhariber	*Ziziphus nummularia*	40	3	0.01
14	03/09/2008	Jhariber	*Ziziphus nummularia*	50	3	0.02
14	03/09/2008	Jhariber	*Ziziphus nummularia*	45	3	0.02
15	03/09/2008	Israili Baval	*Acacia tortlis*	70	6	0.04
15	03/09/2008	Israili Baval	*Acacia tortlis*	90	8	0.06
15	03/09/2008	Israili Baval	*Acacia tortlis*	90	9.5	0.06
15	03/09/2008	Israili Baval	*Acacia tortlis*	65	6	0.03
15	03/09/2008	Israili Baval	*Acacia tortlis*	70	7	0.04
15	03/09/2008	Israili Baval	*Acacia tortlis*	35	4	0.01
15	03/09/2008	Khair	*Acacia catechu*	65	6	0.03
16	03/09/2008	Khair	*Acacia catechu*	75	8	0.04
16	03/09/2008	Khair	*Acacia catechu*	70	6.5	0.04
16	03/09/2008	Khair	*Acacia catechu*	80	9	0.05
16	03/09/2008	Ber	*Zizyphus mauritiana*	30	3	0.01
16	03/09/2008	Ber	*Zizyphus mauritiana*	35	3	0.01
16	03/09/2008	Ber	*Zizyphus mauritiana*	45	3.5	0.02
16	03/09/2008	Ber	*Zizyphus mauritiana*	35	3	0.01
16	03/09/2008	Ber	*Zizyphus mauritiana*	50	4	0.02
16	03/09/2008	Ber	*Zizyphus mauritiana*	30	3	0.01
16	03/09/2008	Ber	*Zizyphus mauritiana*	45	3.5	0.02
16	03/09/2008	Ber	*Zizyphus mauritiana*	35	4	0.01
17	03/09/2008	Deshi Baval	*Acacia nilotica*	60	8	0.03
17	03/09/2008	Deshi Baval	*Acacia nilotica*	90	9.5	0.06
17	03/09/2008	Deshi Baval	*Acacia nilotica*	90	9	0.06
17	03/09/2008	Deshi Baval	*Acacia nilotica*	80	7	0.05
17	03/09/2008	Deshi Baval	*Acacia nilotica*	90	8	0.06
17	03/09/2008	Khair	*Acacia catechu*	85	8	0.06
17	03/09/2008	Khair	*Acacia catechu*	90	9.5	0.06
17	03/09/2008	Ber	*Zizyphus mauritiana*	70	5	0.04
17	03/09/2008	Ber	*Zizyphus mauritiana*	65	5	0.03
17	03/09/2008	Ber	*Zizyphus mauritiana*	50	4	0.02
18	03/09/2008	Israili Baval	*Acacia tortlis*	55	4	0.02
18	03/09/2008	Israili Baval	*Acacia tortlis*	50	5	0.02
18	03/09/2008	Israili Baval	*Acacia tortlis*	60	6.5	0.03
18	03/09/2008	Israili Baval	*Acacia tortlis*	90	9.5	0.06
18	03/09/2008	Israili Baval	*Acacia tortlis*	70	8	0.04
18	03/09/2008	Deshi Baval	*Acacia nilotica*	65	7	0.03
18	03/09/2008	Deshi Baval	*Acacia nilotica*	55	6	0.02
18	03/09/2008	Khair	*Acacia catechu*	80	8	0.05
18	03/09/2008	Khair	*Acacia catechu*	65	6	0.03
19	03/09/2008	Israili Baval	*Acacia tortlis*	35	4	0.01
19	03/09/2008	Israili Baval	*Acacia tortlis*	40	5	0.01
19	03/09/2008	Israili Baval	*Acacia tortlis*	50	3.5	0.02
19	03/09/2008	Israili Baval	*Acacia tortlis*	45	5	0.02
19	03/09/2008	Jhariber	*Ziziphus nummularia*	50	3.5	0.02
19	03/09/2008	Jhariber	*Ziziphus nummularia*	60	4	0.03
19	03/09/2008	Jhariber	*Ziziphus nummularia*	55	3.5	0.02
19	03/09/2008	Jhariber	*Ziziphus nummularia*	60	4	0.03
19	03/09/2008	Jhariber	*Ziziphus nummularia*	40	3	0.01
19	03/09/2008	Jhariber	*Ziziphus nummularia*	70	4	0.04
19	03/09/2008	Jhariber	*Ziziphus nummularia*	50	3.5	0.02
20	03/09/2008	Israili Baval	*Acacia tortlis*	70	6.5	0.04
20	03/09/2008	Israili Baval	*Acacia tortlis*	60	6	0.03
20	03/09/2008	Deshi Baval	*Acacia nilotica*	65	7	0.03
20	03/09/2008	Deshi Baval	*Acacia nilotica*	90	9.5	0.06
20	03/09/2008	Deshi Baval	*Acacia nilotica*	70	6.5	0.04

Plot No.	Date	Local Name	Scientific Name	Girth (cm)	Height (m)	Area (m^2)
20	03/09/2008	Ber	*Zizyphus mauritiana*	60	5.5	0.03
20	03/09/2008	Ber	*Zizyphus mauritiana*	40	3	0.01
20	03/09/2008	Jhariber	*Ziziphus nummularia*	55	3	0.02
20	03/09/2008	Jhariber	*Ziziphus nummularia*	30	3	0.01
20	03/09/2008	Jhariber	*Ziziphus nummularia*	35	3	0.01
20	03/09/2008	Jhariber	*Ziziphus nummularia*	50	3.5	0.02
20	03/09/2008	Jhariber	*Ziziphus nummularia*	45	3.5	0.02

Table 2 Quadrate Survey Results of Malana Reserved Forest

Plot No.	Date	Local Name	Scientific Name	Girth (cm)	Height (m)	Area (m^2)
1	04/09/2008	Israili Baval	*Acacia tortlis*	90	9.5	0.06
1	04/09/2008	Israili Baval	*Acacia tortlis*	40	4	0.01
1	04/09/2008	Israili Baval	*Acacia tortlis*	50	4.5	0.02
1	04/09/2008	Israili Baval	*Acacia tortlis*	40	5	0.01
1	04/09/2008	Israili Baval	*Acacia tortlis*	65	6	0.03
1	04/09/2008	Khair	*Acacia catechu*	80	6	0.05
1	04/09/2008	Khair	*Acacia catechu*	90	10	0.06
1	04/09/2008	Khair	*Acacia catechu*	65	6	0.03
1	04/09/2008	Khair	*Acacia catechu*	40	4.5	0.01
1	04/09/2008	Khair	*Acacia catechu*	65	7	0.03
1	04/09/2008	Khair	*Acacia catechu*	70	7	0.04
1	04/09/2008	Khair	*Acacia catechu*	70	6	0.04
1	04/09/2008	Bilayti Baval	*Prosopis juliflora*	75	8	0.04
1	04/09/2008	Bilayti Baval	*Prosopis juliflora*	60	8	0.03
1	04/09/2008	Bilayti Baval	*Prosopis juliflora*	85	8	0.06
1	04/09/2008	Deshi Baval	*Acacia nilotica*	70	6	0.04
1	04/09/2008	Deshi Baval	*Acacia nilotica*	30	2	0.01
1	04/09/2008	Deshi Baval	*Acacia nilotica*	90	10	0.06
1	04/09/2008	Deshi Baval	*Acacia nilotica*	90	9	0.06
2	04/09/2008	Israili Baval	*Acacia tortlis*	55	7	0.02
2	04/09/2008	Israili Baval	*Acacia tortlis*	40	3.5	0.01
2	04/09/2008	Israili Baval	*Acacia tortlis*	55	4	0.02
2	04/09/2008	Israili Baval	*Acacia tortlis*	75	6	0.04
2	04/09/2008	Khair	*Acacia catechu*	90	10	0.06
2	04/09/2008	Khair	*Acacia catechu*	80	10	0.05
2	04/09/2008	Bilayti Baval	*Prosopis juliflora*	30	4	0.01
2	04/09/2008	Bilayti Baval	*Prosopis juliflora*	30	3	0.01
2	04/09/2008	Bilayti Baval	*Prosopis juliflora*	30	3	0.01
2	04/09/2008	Bilayti Baval	*Prosopis juliflora*	90	10	0.06
2	04/09/2008	Bilayti Baval	*Prosopis juliflora*	85	10	0.06
2	04/09/2008	Bilayti Baval	*Prosopis juliflora*	90	9	0.06
2	04/09/2008	Bilayti Baval	*Prosopis juliflora*	70	10	0.04
2	04/09/2008	Bilayti Baval	*Prosopis juliflora*	55	8.5	0.02
2	04/09/2008	Bilayti Baval	*Prosopis juliflora*	90	9	0.06
2	04/09/2008	Bilayti Baval	*Prosopis juliflora*	85	10	0.06
2	04/09/2008	Deshi Baval	*Acacia nilotica*	90	10	0.06
2	04/09/2008	Deshi Baval	*Acacia nilotica*	75	9.5	0.04
2	04/09/2008	Deshi Baval	*Acacia nilotica*	90	9	0.06
2	04/09/2008	Deshi Baval	*Acacia nilotica*	85	10	0.06
3	04/09/2008	Israili Baval	*Acacia tortlis*	70	10	0.04
3	04/09/2008	Israili Baval	*Acacia tortlis*	50	8	0.02
3	04/09/2008	Israili Baval	*Acacia tortlis*	85	10	0.06
3	04/09/2008	Khair	*Acacia catechu*	90	10	0.06
3	04/09/2008	Khair	*Acacia catechu*	90	10	0.06
3	04/09/2008	Khair	*Acacia catechu*	55	7	0.02
3	04/09/2008	Khair	*Acacia catechu*	65	7	0.03
3	04/09/2008	Khair	*Acacia catechu*	90	9	0.06

Plot No.	Date	Local Name	Scientific Name	Girth (cm)	Height (m)	Area (m^2)
3	04/09/2008	Khair	*Acacia catechu*	35	5	0.01
3	04/09/2008	Khair	*Acacia catechu*	60	7	0.03
3	04/09/2008	Khair	*Acacia catechu*	70	8	0.04
3	04/09/2008	Bilayti Baval	*Prosopis juliflora*	40	3.5	0.01
3	04/09/2008	Bilayti Baval	*Prosopis juliflora*	40	3.5	0.01
3	04/09/2008	Bilayti Baval	*Prosopis juliflora*	60	7	0.03
3	04/09/2008	Deshi Baval	*Acacia nilotica*	40	5	0.01
3	04/09/2008	Deshi Baval	*Acacia nilotica*	50	5	0.02
3	04/09/2008	Deshi Baval	*Acacia nilotica*	30	3.5	0.01
3	04/09/2008	Deshi Baval	*Acacia nilotica*	45	5	0.02
3	04/09/2008	Deshi Baval	*Acacia nilotica*	80	9	0.05
4	04/09/2008	Israili Baval	*Acacia tortlis*	30	4	0.01
4	04/09/2008	Israili Baval	*Acacia tortlis*	50	4	0.02
4	04/09/2008	Israili Baval	*Acacia tortlis*	60	5.5	0.03
4	04/09/2008	Israili Baval	*Acacia tortlis*	60	6	0.03
4	04/09/2008	Israili Baval	*Acacia tortlis*	65	5	0.03
4	04/09/2008	Israili Baval	*Acacia tortlis*	40	5	0.01
4	04/09/2008	Khair	*Acacia catechu*	70	10	0.04
4	04/09/2008	Khair	*Acacia catechu*	75	9	0.04
4	04/09/2008	Bilayti Baval	*Prosopis juliflora*	40	4	0.01
4	04/09/2008	Bilayti Baval	*Prosopis juliflora*	90	10	0.06
4	04/09/2008	Bilayti Baval	*Prosopis juliflora*	85	10	0.06
4	04/09/2008	Bilayti Baval	*Prosopis juliflora*	50	6	0.02
4	04/09/2008	Deshi Baval	*Acacia nilotica*	70	6.5	0.04
4	04/09/2008	Deshi Baval	*Acacia nilotica*	50	4	0.02
4	04/09/2008	Deshi Baval	*Acacia nilotica*	80	9	0.05
4	04/09/2008	Deshi Baval	*Acacia nilotica*	50	6.5	0.02
4	04/09/2008	Deshi Baval	*Acacia nilotica*	30	2	0.01
4	04/09/2008	Deshi Baval	*Acacia nilotica*	30	2.5	0.01
4	04/09/2008	Deshi Baval	*Acacia nilotica*	40	5	0.01
5	04/09/2008	Israili Baval	*Acacia tortlis*	45	5	0.02
5	04/09/2008	Khair	*Acacia catechu*	60	7	0.03
5	04/09/2008	Khair	*Acacia catechu*	85	10	0.06
5	04/09/2008	Bilayti Baval	*Prosopis juliflora*	85	10	0.06
5	04/09/2008	Bilayti Baval	*Prosopis juliflora*	85	10	0.06
5	04/09/2008	Bilayti Baval	*Prosopis juliflora*	60	8	0.03
5	04/09/2008	Bilayti Baval	*Prosopis juliflora*	70	10	0.04
5	04/09/2008	Bilayti Baval	*Prosopis juliflora*	75	9	0.04
5	04/09/2008	Bilayti Baval	*Prosopis juliflora*	40	4	0.01
5	04/09/2008	Bilayti Baval	*Prosopis juliflora*	90	10	0.06
5	04/09/2008	Bilayti Baval	*Prosopis juliflora*	85	10	0.06
5	04/09/2008	Deshi Baval	*Acacia nilotica*	40	5	0.01
5	04/09/2008	Deshi Baval	*Acacia nilotica*	35	3	0.01
5	04/09/2008	Deshi Baval	*Acacia nilotica*	80	9	0.05
5	04/09/2008	Deshi Baval	*Acacia nilotica*	50	7	0.02
6	04/09/2008	Israili Baval	*Acacia tortlis*	50	7	0.02
6	04/09/2008	Israili Baval	*Acacia tortlis*	55	7	0.02
6	04/09/2008	Israili Baval	*Acacia tortlis*	50	5.5	0.02
6	04/09/2008	Israili Baval	*Acacia tortlis*	60	7	0.03
6	04/09/2008	Israili Baval	*Acacia tortlis*	90	8.5	0.06
6	04/09/2008	Israili Baval	*Acacia tortlis*	70	6.5	0.04
6	04/09/2008	Israili Baval	*Acacia tortlis*	65	7	0.03
6	04/09/2008	Israili Baval	*Acacia tortlis*	40	4	0.01
6	04/09/2008	Khair	*Acacia catechu*	35	2.5	0.01
6	04/09/2008	Khair	*Acacia catechu*	40	5	0.01
6	04/09/2008	Bilayti Baval	*Prosopis juliflora*	35	4	0.01
6	04/09/2008	Bilayti Baval	*Prosopis juliflora*	40	5	0.01
6	04/09/2008	Bilayti Baval	*Prosopis juliflora*	50	5	0.02
6	04/09/2008	Bilayti Baval	*Prosopis juliflora*	45	4	0.02
6	04/09/2008	Bilayti Baval	*Prosopis juliflora*	50	5.5	0.02
6	04/09/2008	Deshi Baval	*Acacia nilotica*	60	7	0.03

Plot No.	Date	Local Name	Scientific Name	Girth (cm)	Height (m)	Area (m^2)
6	04/09/2008	Deshi Baval	*Acacia nilotica*	55	6.5	0.02
6	04/09/2008	Deshi Baval	*Acacia nilotica*	60	5	0.03
7	04/09/2008	Israili Baval	*Acacia tortlis*	55	6.5	0.02
7	04/09/2008	Israili Baval	*Acacia tortlis*	70	8	0.04
7	04/09/2008	Khair	*Acacia catechu*	50	5	0.02
7	04/09/2008	Khair	*Acacia catechu*	45	3.5	0.02
7	04/09/2008	Khair	*Acacia catechu*	60	6	0.03
7	04/09/2008	Khair	*Acacia catechu*	65	6	0.03
7	04/09/2008	Khair	*Acacia catechu*	65	7	0.03
7	04/09/2008	Khair	*Acacia catechu*	70	6	0.04
7	04/09/2008	Bilayti Baval	*Prosopis juliflora*	60	6.5	0.03
7	04/09/2008	Bilayti Baval	*Prosopis juliflora*	90	10	0.06
7	04/09/2008	Bilayti Baval	*Prosopis juliflora*	75	10	0.04
7	04/09/2008	Deshi Baval	*Acacia nilotica*	60	8	0.03
7	04/09/2008	Deshi Baval	*Acacia nilotica*	60	5	0.03
8	04/09/2008	Israili Baval	*Acacia tortlis*	75	10	0.04
8	04/09/2008	Israili Baval	*Acacia tortlis*	70	6	0.04
8	04/09/2008	Israili Baval	*Acacia tortlis*	90	8	0.06
8	04/09/2008	Israili Baval	*Acacia tortlis*	90	10	0.06
8	04/09/2008	Khair	*Acacia catechu*	65	5	0.03
8	04/09/2008	Khair	*Acacia catechu*	70	7	0.04
8	04/09/2008	Bilayti Baval	*Prosopis juliflora*	35	4	0.01
8	04/09/2008	Bilayti Baval	*Prosopis juliflora*	65	5	0.03
8	04/09/2008	Bilayti Baval	*Prosopis juliflora*	75	8	0.04
8	04/09/2008	Bilayti Baval	*Prosopis juliflora*	70	9	0.04
8	04/09/2008	Bilayti Baval	*Prosopis juliflora*	80	7	0.05
8	04/09/2008	Bilayti Baval	*Prosopis juliflora*	30	5	0.01
8	04/09/2008	Bilayti Baval	*Prosopis juliflora*	35	5	0.01
8	04/09/2008	Deshi Baval	*Acacia nilotica*	30	4	0.01
8	04/09/2008	Deshi Baval	*Acacia nilotica*	35	4	0.01
8	04/09/2008	Deshi Baval	*Acacia nilotica*	50	5	0.02
8	04/09/2008	Deshi Baval	*Acacia nilotica*	30	4.5	0.01
8	04/09/2008	Deshi Baval	*Acacia nilotica*	45	5.5	0.02
8	04/09/2008	Deshi Baval	*Acacia nilotica*	35	4	0.01
8	04/09/2008	Deshi Baval	*Acacia nilotica*	60	9	0.03
8	04/09/2008	Deshi Baval	*Acacia nilotica*	60	8	0.03
9	04/09/2008	Israili Baval	*Acacia tortlis*	90	9.5	0.06
9	04/09/2008	Israili Baval	*Acacia tortlis*	90	9	0.06
9	04/09/2008	Israili Baval	*Acacia tortlis*	80	7	0.05
9	04/09/2008	Israili Baval	*Acacia tortlis*	90	8	0.06
9	04/09/2008	Khair	*Acacia catechu*	85	8	0.06
9	04/09/2008	Khair	*Acacia catechu*	90	9.5	0.06
9	04/09/2008	Bilayti Baval	*Prosopis juliflora*	70	5	0.04
9	04/09/2008	Bilayti Baval	*Prosopis juliflora*	65	5	0.03
9	04/09/2008	Deshi Baval	*Acacia nilotica*	50	4	0.02
9	04/09/2008	Deshi Baval	*Acacia nilotica*	55	4	0.02
9	04/09/2008	Deshi Baval	*Acacia nilotica*	50	5	0.02
9	04/09/2008	Deshi Baval	*Acacia nilotica*	60	6.5	0.03
9	04/09/2008	Deshi Baval	*Acacia nilotica*	90	9.5	0.06
9	04/09/2008	Deshi Baval	*Acacia nilotica*	70	8	0.04
9	04/09/2008	Deshi Baval	*Acacia nilotica*	65	7	0.03
9	04/09/2008	Deshi Baval	*Acacia nilotica*	55	6	0.02
9	04/09/2008	Deshi Baval	*Acacia nilotica*	80	8	0.05
9	04/09/2008	Deshi Baval	*Acacia nilotica*	65	6	0.03
9	04/09/2008	Deshi Baval	*Acacia nilotica*	35	4	0.01
9	04/09/2008	Deshi Baval	*Acacia nilotica*	40	5	0.01
10	04/09/2008	Israili Baval	*Acacia tortlis*	50	3.5	0.02
10	04/09/2008	Khair	*Acacia catechu*	45	5	0.02
10	04/09/2008	Khair	*Acacia catechu*	50	3.5	0.02
10	04/09/2008	Khair	*Acacia catechu*	60	4	0.03
10	04/09/2008	Khair	*Acacia catechu*	55	3.5	0.02

Plot No.	Date	Local Name	Scientific Name	Girth (cm)	Height (m)	Area (m^2)
10	04/09/2008	Khair	*Acacia catechu*	60	4	0.03
10	04/09/2008	Khair	*Acacia catechu*	40	3	0.01
10	04/09/2008	Khair	*Acacia catechu*	70	4	0.04
10	04/09/2008	Khair	*Acacia catechu*	50	3.5	0.02
10	04/09/2008	Bilayti Baval	*Prosopis juliflora*	70	6.5	0.04
10	04/09/2008	Bilayti Baval	*Prosopis juliflora*	60	6	0.03
10	04/09/2008	Bilayti Baval	*Prosopis juliflora*	65	7	0.03
10	04/09/2008	Bilayti Baval	*Prosopis juliflora*	90	9.5	0.06
10	04/09/2008	Bilayti Baval	*Prosopis juliflora*	70	6.5	0.04
10	04/09/2008	Bilayti Baval	*Prosopis juliflora*	60	5.5	0.03
10	04/09/2008	Deshi Baval	*Acacia nilotica*	40	3	0.01
10	04/09/2008	Deshi Baval	*Acacia nilotica*	55	3	0.02
10	04/09/2008	Deshi Baval	*Acacia nilotica*	30	3	0.01
10	04/09/2008	Deshi Baval	*Acacia nilotica*	35	3	0.01
11	04/09/2008	Israili Baval	*Acacia tortlis*	50	3.5	0.02
11	04/09/2008	Israili Baval	*Acacia tortlis*	45	3.5	0.02
11	04/09/2008	Israili Baval	*Acacia tortlis*	60	7	0.03
11	04/09/2008	Israili Baval	*Acacia tortlis*	60	8	0.03
11	04/09/2008	Israili Baval	*Acacia tortlis*	40	4	0.01
11	04/09/2008	Khair	*Acacia catechu*	65	5	0.03
11	04/09/2008	Bilayti Baval	*Prosopis juliflora*	90	9.5	0.06
11	04/09/2008	Bilayti Baval	*Prosopis juliflora*	35	4	0.01
11	04/09/2008	Bilayti Baval	*Prosopis juliflora*	60	5	0.03
11	04/09/2008	Deshi Baval	*Acacia nilotica*	45	3	0.02
12	04/09/2008	Israili Baval	*Acacia tortlis*	40	4	0.01
12	04/09/2008	Israili Baval	*Acacia tortlis*	40	3.5	0.01
12	04/09/2008	Khair	*Acacia catechu*	60	7	0.03
12	04/09/2008	Khair	*Acacia catechu*	40	5	0.01
12	04/09/2008	Khair	*Acacia catechu*	50	6	0.02
12	04/09/2008	Khair	*Acacia catechu*	30	4.5	0.01
12	04/09/2008	Khair	*Acacia catechu*	45	4	0.02
12	04/09/2008	Bilayti Baval	*Prosopis juliflora*	80	8	0.05
12	04/09/2008	Bilayti Baval	*Prosopis juliflora*	30	6	0.01
12	04/09/2008	Bilayti Baval	*Prosopis juliflora*	50	4.5	0.02
12	04/09/2008	Bilayti Baval	*Prosopis juliflora*	60	5.5	0.03
12	04/09/2008	Bilayti Baval	*Prosopis juliflora*	60	6	0.03
12	04/09/2008	Bilayti Baval	*Prosopis juliflora*	65	7	0.03
12	04/09/2008	Bilayti Baval	*Prosopis juliflora*	40	3.5	0.01
12	04/09/2008	Bilayti Baval	*Prosopis juliflora*	70	5	0.04
12	04/09/2008	Bilayti Baval	*Prosopis juliflora*	75	6	0.04
12	04/09/2008	Deshi Baval	*Acacia nilotica*	40	10	0.01
12	04/09/2008	Deshi Baval	*Acacia nilotica*	35	3	0.01
13	04/09/2008	Israili Baval	*Acacia tortlis*	35	3	0.01
13	04/09/2008	Israili Baval	*Acacia tortlis*	40	3.5	0.01
13	04/09/2008	Israili Baval	*Acacia tortlis*	70	5	0.04
13	04/09/2008	Israili Baval	*Acacia tortlis*	50	8	0.02
13	04/09/2008	Israili Baval	*Acacia tortlis*	80	6	0.05
13	04/09/2008	Israili Baval	*Acacia tortlis*	50	4.5	0.02
13	04/09/2008	Khair	*Acacia catechu*	30	4	0.01
13	04/09/2008	Khair	*Acacia catechu*	55	7.5	0.02
13	04/09/2008	Khair	*Acacia catechu*	40	5	0.01
13	04/09/2008	Bilayti Baval	*Prosopis juliflora*	45	5	0.02
13	04/09/2008	Bilayti Baval	*Prosopis juliflora*	60	7	0.03
13	04/09/2008	Bilayti Baval	*Prosopis juliflora*	85	9.5	0.06
13	04/09/2008	Bilayti Baval	*Prosopis juliflora*	45	4	0.02
13	04/09/2008	Deshi Baval	*Acacia nilotica*	45	5	0.02
13	04/09/2008	Deshi Baval	*Acacia nilotica*	50	5	0.02
13	04/09/2008	Deshi Baval	*Acacia nilotica*	40	3	0.01
14	04/09/2008	Israili Baval	*Acacia tortlis*	85	9	0.06
14	04/09/2008	Israili Baval	*Acacia tortlis*	50	6	0.02
14	04/09/2008	Israili Baval	*Acacia tortlis*	55	5	0.02

Plot No.	Date	Local Name	Scientific Name	Girth (cm)	Height (m)	Area (m^2)
14	04/09/2008	Israili Baval	*Acacia tortlis*	50	3	0.02
14	04/09/2008	Israili Baval	*Acacia tortlis*	60	3.5	0.03
14	04/09/2008	Israili Baval	*Acacia tortlis*	55	3	0.02
14	04/09/2008	Israili Baval	*Acacia tortlis*	35	3	0.01
14	04/09/2008	Israili Baval	*Acacia tortlis*	65	7	0.03
14	04/09/2008	Israili Baval	*Acacia tortlis*	40	4	0.01
14	04/09/2008	Israili Baval	*Acacia tortlis*	65	5.5	0.03
14	04/09/2008	Khair	*Acacia catechu*	40	6	0.01
14	04/09/2008	Khair	*Acacia catechu*	45	4	0.02
14	04/09/2008	Khair	*Acacia catechu*	50	5	0.02
14	04/09/2008	Bilayti Baval	*Prosopis juliflora*	65	5	0.03
14	04/09/2008	Bilayti Baval	*Prosopis juliflora*	90	7	0.06
14	04/09/2008	Bilayti Baval	*Prosopis juliflora*	85	5	0.06
14	04/09/2008	Bilayti Baval	*Prosopis juliflora*	35	3	0.01
14	04/09/2008	Bilayti Baval	*Prosopis juliflora*	55	4	0.02
14	04/09/2008	Deshi Baval	*Acacia nilotica*	60	4.5	0.03
14	04/09/2008	Deshi Baval	*Acacia nilotica*	55	4	0.02
14	04/09/2008	Deshi Baval	*Acacia nilotica*	70	6	0.04
14	04/09/2008	Deshi Baval	*Acacia nilotica*	80	7.5	0.05
14	04/09/2008	Deshi Baval	*Acacia nilotica*	45	5	0.02
15	04/09/2008	Israili Baval	*Acacia tortlis*	60	5.5	0.03
15	04/09/2008	Israili Baval	*Acacia tortlis*	45	3	0.02
15	04/09/2008	Israili Baval	*Acacia tortlis*	55	4	0.02
15	04/09/2008	Israili Baval	*Acacia tortlis*	70	6.5	0.04
15	04/09/2008	Israili Baval	*Acacia tortlis*	60	5.5	0.03
15	04/09/2008	Israili Baval	*Acacia tortlis*	90	9.5	0.06
15	04/09/2008	Israili Baval	*Acacia tortlis*	75	6.5	0.04
15	04/09/2008	Khair	*Acacia catechu*	60	5	0.03
15	04/09/2008	Khair	*Acacia catechu*	60	5.5	0.03
15	04/09/2008	Khair	*Acacia catechu*	50	6.5	0.02
15	04/09/2008	Khair	*Acacia catechu*	45	3	0.02
15	04/09/2008	Khair	*Acacia catechu*	70	6	0.04
15	04/09/2008	Khair	*Acacia catechu*	40	5	0.01
15	04/09/2008	Khair	*Acacia catechu*	45	5	0.02
15	04/09/2008	Khair	*Acacia catechu*	60	7	0.03
15	04/09/2008	Bilayti Baval	*Prosopis juliflora*	55	4	0.02
15	04/09/2008	Bilayti Baval	*Prosopis juliflora*	45	6	0.02
15	04/09/2008	Deshi Baval	*Acacia nilotica*	85	8	0.06
15	04/09/2008	Deshi Baval	*Acacia nilotica*	60	5	0.03
15	04/09/2008	Deshi Baval	*Acacia nilotica*	70	7.5	0.04
15	04/09/2008	Deshi Baval	*Acacia nilotica*	75	9	0.04
15	04/09/2008	Deshi Baval	*Acacia nilotica*	40	5	0.01
15	04/09/2008	Deshi Baval	*Acacia nilotica*	90	10	0.06
15	04/09/2008	Deshi Baval	*Acacia nilotica*	85	8	0.06
15	04/09/2008	Deshi Baval	*Acacia nilotica*	40	5	0.01

APPENDIX III-2-2 NATURAL ENVIRONMENT FAUNAL SURVEY

Table 1 Form for DATA CARD 'A': EIA: Proposed Rail line Bridge

Date:	Time:	
Location no.	Geographic co-ordinates	Name of River
	Lat.	
	Log.	
	Right River Bank	Left River Bank
Village Name		
Condition of banks / water	Pollute / Non Pollute	Pollute / Non Pollute

Right / Left River Banks	Terrestrial Habitat	Use of water / banks
Village Name: Muddy/Sand /Rocky / Mix	Agri. / Thorny /Scrub / Open / Other	Fishing , Mining, Other Activity
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

Table 2 DATA CARD 'B': EIA: Proposed Rail line Bridge

Date:	Time:	
Location no.	Geographic co-ordinates	Name of River
	Lat.	
	Log.	

Right / Left Banks

Name of Nr. Village	No.	Sighting of Species			Remarks
		Birds	Reptiles	Mammals	

Table 3 List of sighted and recorded Reptilian species at various railway bridges locations on the rivers, Gujarat State

No	Common Name of Species (Scientific Name)	Vishwamitri	Mini Nadi	Mahi	Vatrak	Sabarmati
	Family: Crocodildae					
1	Mugger (*Crocodylus palustris*)	P	-	-	R	-
	Family: Bataguridae					
2	Indian roofed turtle (*Pangshura (=Kachuga) tecta*)	-	-	-	P	-
	Family: Trinychidae		-			
3	Indian Soft-shell turtle (*Nilssonia (=Aspideretes) gangeticus*)	-	-	P	R	-
4	Indian flap-shell turtle (*Lissemys punctata*)	P	-	P	P	-
	Family: Agamidae					
5	Garden lizard (*Calotes versicolor*)	P	P	P	P	P
6	Fan-throated lizard (*Sitana ponticeriana*)	P	P	P	P	P
	Family: Varanidae					
7	Bengal monitor (*Varanus bengalensis*)	P	P	P	R	P
	Family: Boidae					
8	Common sand boa (*Gongylophis conica*)	R	-	P	P	R
	Family: Colubridae					
9	Indian rat snake (*Ptyas mucosus*)	P	P	P	P	P
10	Ch. Keelback water snake (*Xenochrophis piscator*)	P	P	P	P	P
	Family: Elapidae					
11	Spectacled cobra (*Naja naja*)	P	-	P	R	R
	Family: Viperidae					
12	Indian saw-scaled viper (*Echis carinata*)	P	-	-	P	R
	Total =	**9+1+10**	**5**	**9**	**8+4=12**	**5+3=8**

(P= Sighting in present study; R= reported of presence)

Table 4 List of sighted and recorded birds species at various railway bridge locations on the Rivers, Gujarat State

(P= Sighting in present study; R= report of presence)

No.	Common Name of Species (Scientific Name)	Vishwamitri	Mini Nadi	Mahi	Vatrak	Sabarmati
	Family: Phalacrocoracidae					
1	Little Cormorant (*Phalacrocorax niger*)	P	P	P	P	P
	Family: Arediae					
2	Grey Heron (*Ardea cinerea*)	-	P	P	P	P
3	Indian Pond Heron (*Ardeola grayii*)	P	P	P	P	P
4	Cattle Egret (*Bubulcus ibis*)	P	P	P	P	P
5	Large Egret (*Casmerodius albus*)	P	P	P	P	P
6	Median Egret (*Mesophoyx intermedia*)	P	P	P	P	P
7	Little Egret (*Egretta garzetta*)	P	P	P	P	P
8	Night Heron (*Nycticorax nycticorax*)	P	P	P	P	P
	Family: Ciconiidae					
9	Painted Stork (*Mycteria leucocephala*)	-	-	P	P	-
10	Asian Openbill Stork (*Anastomus*	-	-	P	P	P

No.	Common Name of Species (Scientific Name)	Vishwamitri	Mini Nadi	Mahi	Vatrak	Sabarmati
	oscitans)					
11	White necked Stork (*Ciconia episcopus*)	-	-		P	-
	Family: Threskiornithidae					
12	White Ibis (*Threskiornis melanocephalus*)	-	P	P	P	P
13	Black Ibis (*Pseudibis papillosa*)	P	P	P	P	P
14	Glossy Ibis (*Plegadis falcinellus*)	-	-	-	P	-
	Family: Anatidae					
15	Brahminy Shelduck (*Tadorna ferruginea*)	-	-	P	-	-
16	Comb Duck (*Sarkidiornis melanotos*)	-	-	P	-	-
	Family: Accipitridae					
17	Black-shoulder Kite (*Elanus caeruleus*)	P	P	P	P	P
18	Pariah Kite (*Milvus migrans*)	P	P	P	P	P
19	Brahminy Kite (*Haliastur indus*)	-	-	P	-	-
20	Shikra (*Accipiter badius*)	P	P	P	P	P
	Family: Phasianidae					
21	Grey Francolin (*Francolinus pondicerianus*)	P	P	P	P	P
22	Indian Peafowl (*Pavo cristatus*)	P	P	P	P	P
	Family: Gruidae					
23	Saras Crane (*Grus antigone*)	-	-	-	P	-
	Family: Rallidae					
24	White-breasted Waterhen (*Amauronis phoenicurus*)	P	P	P	P	P
	Family: Charadriidae					
25	Red-wattled Lapwing (*Vanellus indicus*)	P	P	P	P	P
	Family: Laridae					
26	Gull-billed Tern (*Gelochelidon nilotica*)	P	P	P	P	P
27	River Tern (*Sterna aurantia*)	P	P	P	P	P
	Family: Columbidae					
28	Yellow-legged Green Pigeon (*Treron phoenicoptera*)	P	P	P	P	P
29	Blue Rock Pigeon (*Columba livia*)	P	P	P	P	P
30	Collared Dove (*Streptopelia sp.*)	-	-	P	P	P
31	Little Brown Dove (*Streptopelia senegalensis*)	P	P	P	P	P
	Family: Psittacidae					
32	Alexandrine Parakeet (*Psittacula eupatria*)	P	P	P	-	P
33	Rose-ringed Parakeet (*Psittacula krameri*)	P	P	P	P	P
34	Plum-headed Parakeet (*Psittacula cyanocephala*)	-	P	P	P	P
	Family: Cuculidae					
35	Pied Crested Cuckoo (*Clamator jacobinus*)	P	P	P	P	P
36	Brainfever Bird (*Hierococcyx varius*)	P	-	P	P	P
37	Asian Koel (*Eudynamys scolopacea*)	P	P	P	P	-

No.	Common Name of Species (Scientific Name)	Vishwamitri	Mini Nadi	Mahi	Vatrak	Sabarmati
38	Greater Coucal (*Centropus sinensis*)	P	P	P	P	P
	Family: Tytonidae					
39	Barn Owl (*Tyto alba*)	-	P	P	-	-
	Family: Strigidae					
40	Eurasian Eagle Owl (*Bubo bubo*)	-	-	P	-	-
41	Spotted Owlet (*Athene brama*)	P	P	P	P	P
	Family: Alcedinidae					
42	Common Kingfisher (*Alcedo atthis*)	P	P	P	P	P
43	White-breasted Kingfisher (*Halcyon smyrnensis*)	P	P	P	P	P
44	Pied Kingfisher (*Ceryle rudis*)	-	-	P	P	P
	Family: Meropidae					
45	Green Bee-eater (*Merops orientalis*)	P	P	P	P	P
46	Blue-checked Bee-eater (*Merops persicus*)	-	P	P	-	-
	Family: Coraciidae					
47	Indian Roller (*Coracias benghalensis*)	P	P	P	P	P
	Family: Upupidae					
48	Common Hoopoe (*Upupa epops*)	P	P	P	P	P
	Family: Capitonidae					
49	Coppersmith Barbet (*Megalaima haemacephala*)	P	P	P	P	P
	Family: Picidae					
50	Lesser Golden-backed Woodpecker (*Dinopium benghalensis*)	-	P	P	P	P
51	Yellow-fronted Pied Woodpecker (*Dendrocopos mahrattensis*)	-	P	P	P	-
	Family: Alaudidae					
52	Lark (*Mirafra sp.*)	P	P	P	P	P
	Family: Hirundinidae					
53	Wire-tailed Swallow (*Hirundo smithii*)	P	P	P	P	P
54	Red-rumped Swallow (*Hirundo daurica*)	P	P	P	P	P
	Family: Laniidae					
55	Shrike (*Lanius sp.*)	P	P	P	P	P
	Family: Oriolidae					
56	Eurasian Golden Oriole (*Oriolus oriolus*)	P	P	P	P	P
	Family: Dicruridae					
57	Black Drongo (*Dicrurus macrocercus*)	P	P	P	P	P
	Family: Sturnidae					
58	Brahminy Starling (*Sturnus pagodarum*)	P	P	P	P	P
59	Common Myna (*Sturnus tristis*)	P	P	P	P	P
60	Bank Myna (*Acridotheres ginginianus*)	P	P	P	P	P
	Family: Corvidae					
61	Indian Tree-pie (*Dendrocitta vagabunda*)	P	P	P	P	P
62	House Crow (*Corvus splendens*)	P	P	P	P	P
63	Jungle Crow (*Corvus*	P	-	P	P	P

No.	Common Name of Species (Scientific Name)	Vishwamitri	Mini Nadi	Mahi	Vatrak	Sabarmati
	macrorhynchos)					
	Family: Pycnonotidae					
64	White-eared Bulbul (*Pycnonotus leucotis*)	-	P	P	-	P
65	Red-vented Bulbul (*Pycnonotus cafer*)	P	P	P	P	P
	Family: Timaliinae					
66	Common Babbler (*Turdoides caudatus*)	P	P	P	P	P
67	Large Grey Babbler (*Turdoides malcolmi*)	-	-	P	P	P
68	Jungle Babbler (*Turdoides striatus*)	-	P	P	P	P
	Family: Sylviinae					
69	Common Tailorbird (*Orthotomus sutorius*)	P	P	P	P	P
	Family: Turdinae					
70	Indian Robin (*Luscinia brunnea*)	P	P	P	P	P
71	Oriental Magpie Robin (*Copsychus saularis*)	P	P	P	P	P
	Family: Nectariniidae					
72	Purple Sunbird (*Nectarinia asiatica*)	P	P	P	P	P
	Family: Passerinae					
73	House Sparrow (*Passer domesticus*)	P	P	P	P	P
74	Yellow-throated Sparrow (*Petronia xanthocollis*)	P	P	P	P	P
	Family: Ploceinae					
75	Baya Weaver (*Ploceus philippinus*)	P	P	P	P	P
	Family: Estrildidiae					
76	White-throated Munia (*Lonchura malabarica*)	P	P	P	P	P
	Total =	**54**	**60**	**73**	**68**	**64**

Table 5 List of sighted and recorded Mammalian species at various railway bridges locations on the rivers, Gujarat State

(P= Sighting in present study; R= reported of presence)..

No	Common Name of Species (Scientific Name)	Vishwamitri	Mini Nadi	Mahi	Vatrak	Sabarmati
	Family: Cercopithecidae					
1	Hanuman Langur (*Semnopithecus entellus*)	P	P	P	P	P
	Family : Sciuridae					
2	Northern Palm Squirrel (*Funambulus pennantii*)	P	P	P	P	P
	Family: Hystricidae					
3	Indian Crested Porcupine (*Hystrix indica*)		P	P	R	-
	Family: Leporidae					
4	Indian Hare (*Lepus nigricollis*)	-	P	P	P	-
	Family: Felidae					
5	Jungle Cat (*Felis chaus*)	P	P	P	R	-
6	Leopard (*Panthera pardus*)	-	R	R	-	-
	Family: Viverridae					
7	Asian Palm Civet (*Paradoxurus hermaphroditus*)	-	R	R	-	-
8	Small Indian Civet (*Viverricula indica*)	-	-	R	-	-
	Family: Herpestidae					
9	Grey mongoose (*Herpestes edwardsii*)	P	P	P	P	P
	Family: Hyaenidae					
10	Striped Hyena (*Hyaena hyaena*)	-	R	P	-	-
	Family Canidae					
11	Jackal (*Canis aureus*)	P	P	P	P	-
	Family: Bovidae					
12	Nilgai (*Boselaphus tragocamelus*)	-	P	P	P	-
	Total=	**5**	**8+3=11**	**9+3=12**	**6+2=8**	**3**

APPENDIX III-2-3 MAP OF MOUNT ABU WILDLIFE SANCTUARY

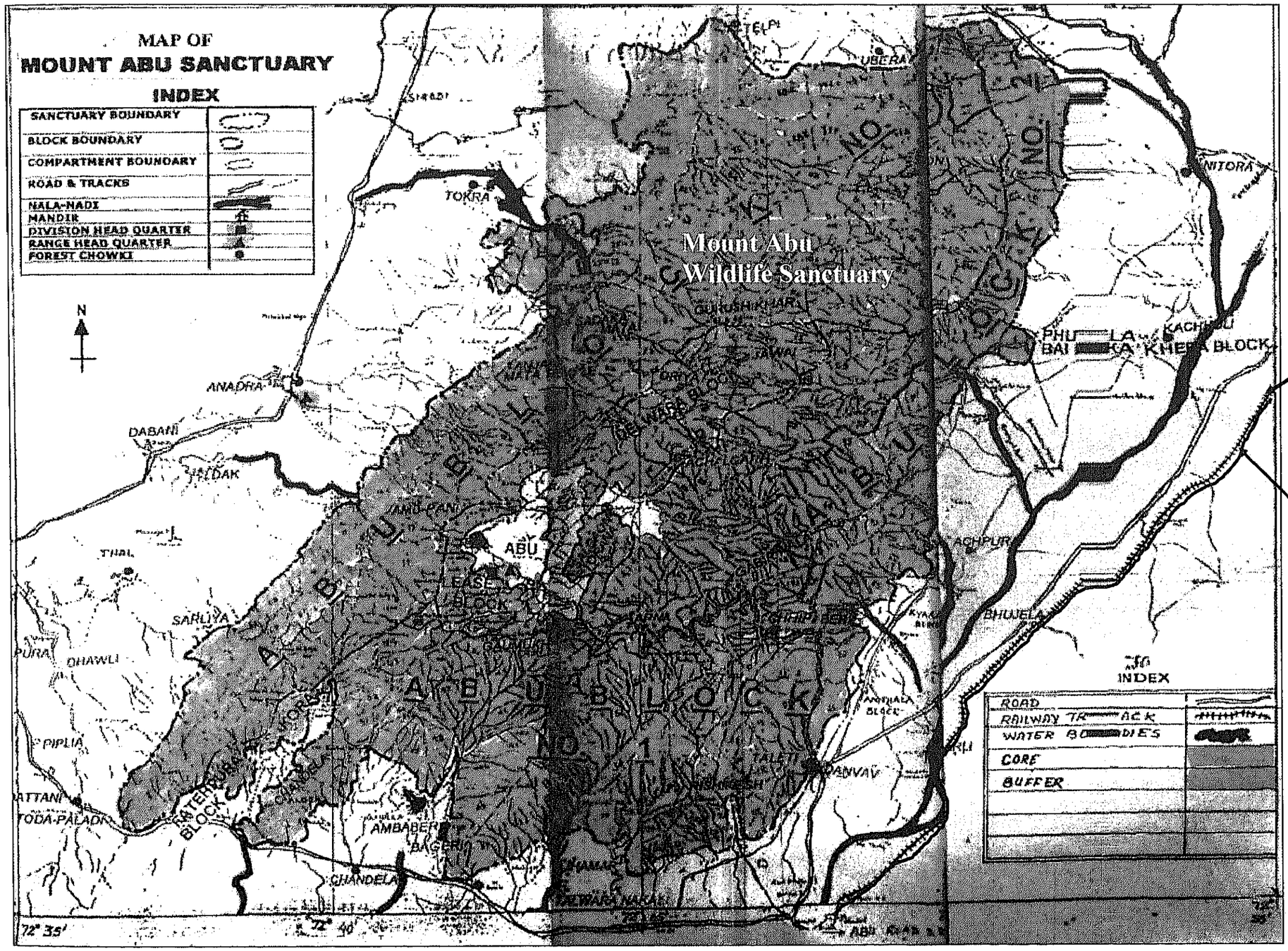


Figure 1 Map Showing Mount Abu Wildlife Sanctuary & Proposed DFC Alignment

APPENDIX III-2-4 ADDITIONAL FIELD SURVEY OF THE IMPORTANT FAUNA IN MAJOR RIVERS IN GUJARAT STATE

1. INTRODUCTION

The study aims to confirm the animal species which were found at the ecological survey in S-ESIMMS conducted through the literature review and field survey at the wet season when the animal movement was actively found. During the wet/ post-monsoon survey, which was conducted in August 2008, 6 crocodiles and 1 flap shell turtle were found in Vishwamitri River, 37 Soft-shell Turtles and 23 flap shell turtles were found in Mahi River, 1 soft shell turtle and 20 flap shell turtles and 1 Indian roofed Turtle were found and previous experience on 2 crocodiles were reported by villagers in Vatrak River (Refer the Chapter-3 in S-ESIMMS Report). Also, some protected bird species such as Sarus crane and waterfowl were found at the study area.

This supplementary survey for S-ESIMMS has been carried out during the winter / dry season in second week of February 2009 lasting for a week, for confirmation of the animal species recorded in wet / post-monsoon season at three major rivers namely Vishwamitri, Mahi and Vatrak

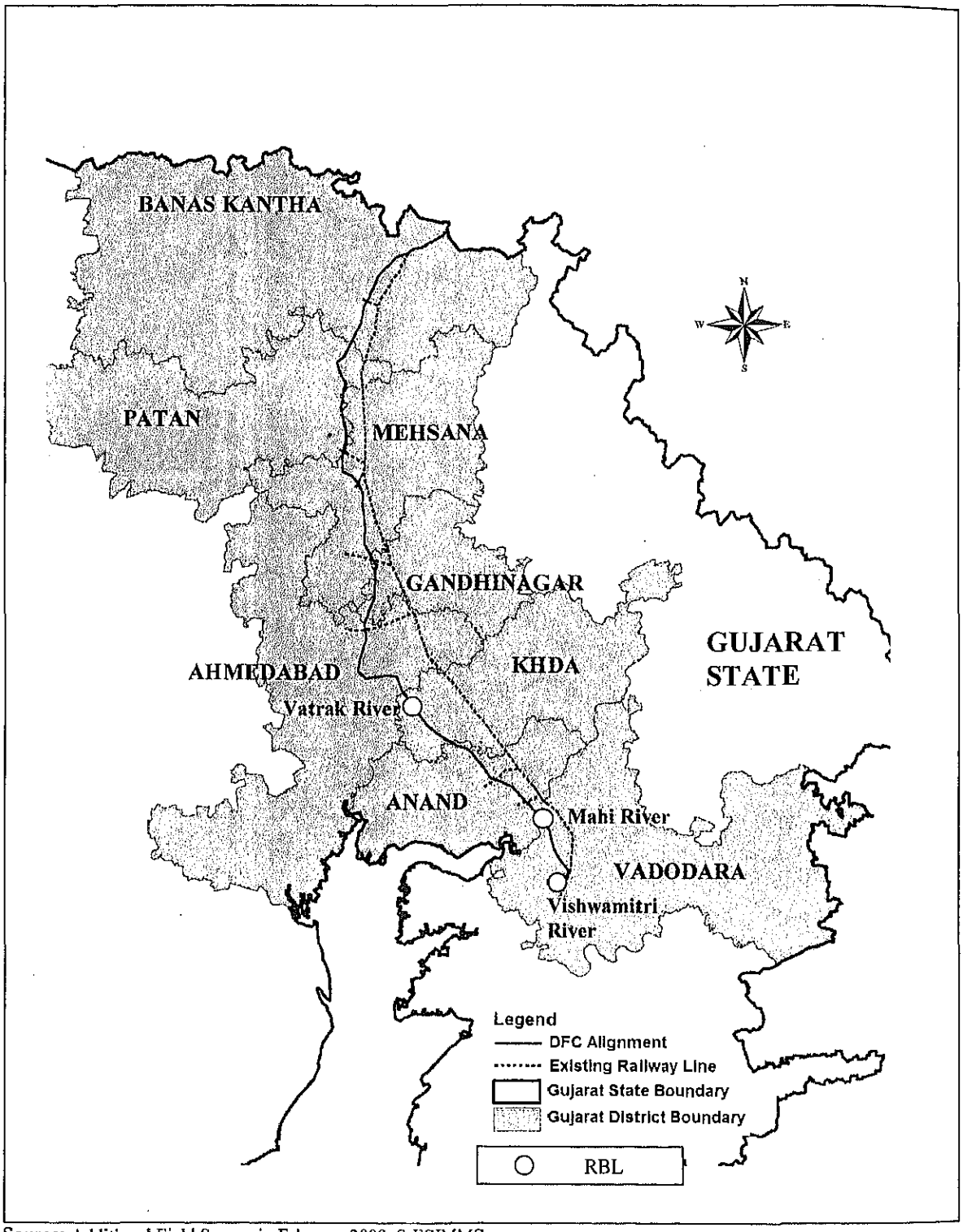
2. STUDY AREA

The location was selected to cover approximately 1-2 km length at the bridge locations in three rivers namely Vishwamitri, Mahi and Vatrak river of Gujarat State, considering the previous survey conducted approximately 10 km stretch of survey treks at the proposed bridge locations of DFC in August 2008 to enable seasonal comparison between two field surveys.

These three bridge locations are situated in four districts of the State. Two of the railway bridges would be proposed in Vadodara district, one in Kheda and one railway bridge is proposed between Vadodara and Anand districts (Figure 1).

2.1 Bridge Location on the River

Name of River	Latitude & Longitude	Description
Vatrak	N 22° 42' 49.0" E 72° 37' 21.9"	The proposed rail line is to have a bridge on Vatrak River connecting Pipariya+ Koshiyal villages and Vasana-Buzarg village (Kheda dist).
Mahi	N 22° 22' 51.1" E 73° 03' 36.2"	The proposed rail line is to have a bridge on Mahi connecting Kotna village (Vadodara dist) and Amrol village (Anand dist).
Vishwamitri	N 22° 11' 57.6" E 73° 09' 35.9"	The proposed rail line is to have a bridge on Vishwamitri River connecting Khalipur village (Vadodara dist) and Maretha/Maneja village (Vadodara dist).



Source: Additional Field Survey in February 2009, S-ESIMMS

Figure-1 Proposed bridge location over Vatrak, Mahi & Vishwamitri River along DFC alignment

3. OBJECTIVES OF THE STUDY

The study area is assessed with the consideration of the following important aspects:

- Collection of dry season data on inhabiting wildlife, in the selected segments of the river stretches, only.
- Conduct field survey of habitats & wildlife: starting from 1 km downstream up to 1 km upstream from the proposed bridge site (from the alignment point of DFC).
- Conduct the field survey on habitats of Indian Soft-shell Turtles (*Nilssonia gangeticus*), Mugger Crocodiles (*Crocodylus palstris*) and other protected reptiles in and around the section where the bridges across Vishwamitri, Mahi and Vatrak Rivers are planned, along with the academic expert of the India Soft-shell turtles. The survey location shall be basically same as that of previous survey to enable seasonal comparison.
- Prepare a map, showing habitats of India Soft-shell Turtles and record the information of the field survey such as day and time, locations (longitude and latitude), weather, and photos.
- To emphasize utility of river stretches by any wildlife in dry season, if any.
- Suggestions for mitigation measures to minimize the impacts.

4. METHODOLOGY

Field surveys: Visual encounter survey at field trekking (as per animal groups) in the morning and recording the species through indirect evidences like foot prints, shell, skin, moult, hollows, droppings and sounds(Field sign method)

The bird species is listed by use of binoculars (8 x 40) and nomenclature is followed as per the field guide 'Birds of Northern India' (Girmmett & Inskipp: 2003, Oxford University Press. 304pp).

Date of the survey, duration of survey, approximate distance covered and latitude & longitude of start & end point are presented in the following table:

Name of River	Date of visit	No. of Day	Duration of survey	Approx. Distance covered (Km)	Lat & Lon	
					From	To
Vishwamitri	12th Feb 2009	1	9:00 a.m. to 12:45 p.m. 2:00 p.m. to 4:30 p.m.	1.4	N 22° 12' 23.63" E 73° 09' 39.00"	N 22° 11' 38.94" E 73° 09' 38.45"
Vatrak	13th Feb 2009	1	9:30 a.m. to 2:00 p.m. 2:45 p.m. to 5:00 p.m.	1.7	N 22° 43' 02.0" E 72° 37' 42.2"	N 22° 42' 34.84" E 72° 36' 55.18"
Mahi	14th Feb 2009	1	9:00 a.m. to 12:45 p.m.	4.9	N 22° 21' 29.65" E 73° 03' 04.19"	N 22° 23' 51.49" E 73° 04' 32.95"
Mahi	17th Feb 2009	1	10:30 a.m. to 1:00 p.m. 2:30 p.m. to 5:00 p.m.			

5. FINDINGS OF THE SURVEY

Three species of turtles are sighted, including Indian soft-shell turtle (*Nilssonia gangeticus*), Flap-shell Turtle (*Lissemys punctata*) and Indian Roofed turtle (*Pangshura tecta*). First two species of turtles are sighted at Mahi and last two turtle species are recorded at Vatrak River. During this survey there is no any important aquatic reptilian species sighted, other than those sighted in previous wet season.

During this supplementary dry season survey, total 82 species of birds belonging to 37 families of common residential, residential-migratory and migratory birds are sighted near the RBL at river stretches of Vishwamitri, Mahi and Vatrak (Appendix-1). Out of which 18 species belonging to nine families are recorded as winter residential-migratory and migratory birds, which were not recorded in previous wet season survey.

The detailed survey results of these three rivers are mentioned individually as follows:

5.1 Viswamitri River

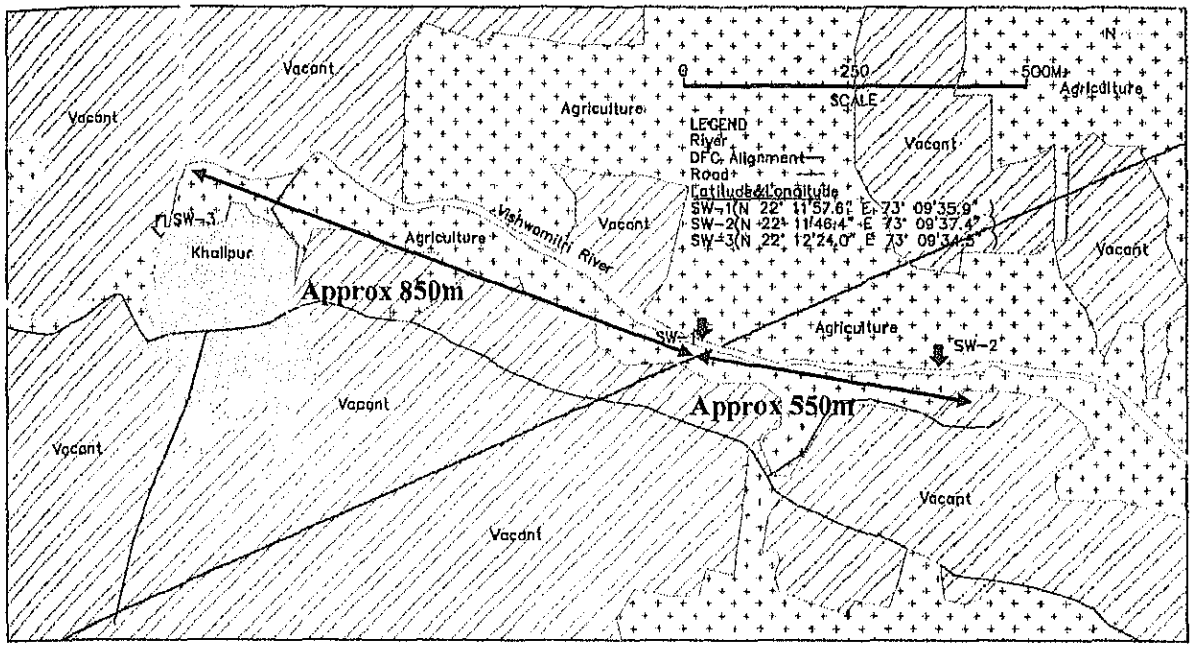
One day field survey made at the particular river stretch, approximately 1.4 km upper and down streams from the proposed bridge location of the river (Figure-2).

Survey Track was in the location between Joining point of Vishwamitri river and Jambuwa river (located approximately at N 22°12'23.63", E 73°09'39.00") and curving point (N22°11'38.94" and E73°9'38.45") were surveyed. The length was approximately 1.4 km direct distance. The survey was conducted in the morning (9:00 a.m. to 12:45 p.m.) and afternoon (2:00 p.m. to 4:30 p.m.)

The river flow and level of water had declined than that in the monsoon season. Most of rain fed drainages and small river streams were dried and waterless. Only Jambuwa tributary was still surviving with very low water levels. The visual appearance of the river water indicated that the river water is much polluted and continues putrefied odor and gas bubbles formation are noted in waters.

During the survey, we did not find any important aquatic species in the river stretch except few common bird species. A mugger crocodile burrow is found on the west bank (location of observer on opposed bank: N 22°12'09.0"; E 73°09'40.2") at water level. The burrow is surrounded with high vegetation and is on vertical slope of west bank in the upper stream area. But we didn't find any crocodile in the surrounding areas. On a close observation, the burrow size indicated that the den/tunnel was may be used by a large sized mugger crocodile, during the seasonal movement from upper to down stream visits.

During the visit, total 44 bird species belonging to 27 families were listed, including the common and residential- migratory birds on the banks of particular river stretch areas. Most of birds listed in this study are recorded in the previous season data, except Black-winged Stilt (*Himantopus himantopus*) is first time recorded (Appendix- 3).



Source: Additional Field Survey in February 2009, S-ESIMMS

Figure-2 Location of Additional Field Survey in Winter in Vishwamitri River

5.2 Mahi River

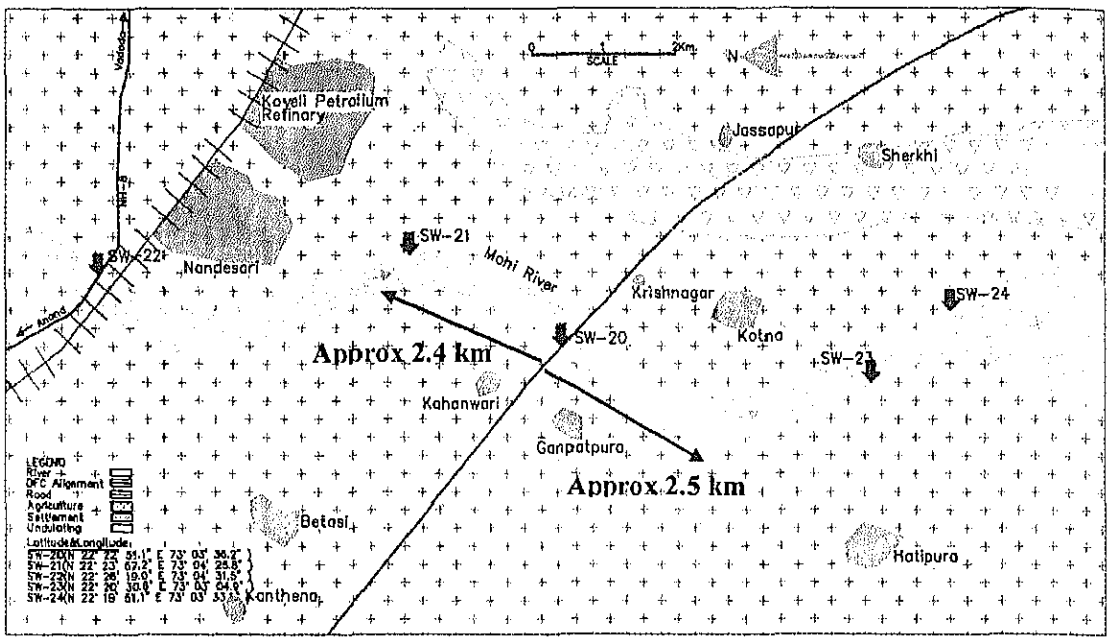
Two days field survey made at the particular river stretch, approximately 4.9 km upper and down streams from the proposed bridge location of the river (**Figure-3**). Survey Track was in the location approximately N 22° 21′ 29.65″ E 73° 03′ 04.19″ to N 22° 23′ 51.49″ E 73° 04′ 32.95″ was surveyed.

The river flow is heavy and level of water has little declination than that in the monsoon season. Some of the rain fed drainages and small river streams had dried. The water quality was clean and unpolluted it seemed by the visual appearance. The bathing, washing and fishing activities by local villagers were also noticed. A small number of fishermen were fishing in the river stretches by traditional practices. The flourished aquatic vegetation growths were found. Both river banks were covered with aquatic plants and one to two meters tall Elephant-grass (*Typha* sp.) growths.

During the survey no important aquatic reptilian species were sighted on the east bank(Mumbai side) of down stream, but three turtles were sighted from two species, on east bank of upper streams areas of the bridge location (Table-1).

Table-1 List of Turtle sighting records at RBL of Mahi River

Species	No. of Specimens	Location	Name of the village	Location (Lat. & Lon.)
Flap-shell Turtle (*Lissemys punctata*)	1	East Bank (Delhi side) Upstream	Kotana Opp. Amarol	N 22° 23′ 04.4″ E 73° 4′ 05.8″
1. Soft-shell turtle (*Nilssonia gangeticus*)	2	East Bank(Delhi side) Upstream	Anagadh village	N 22° 23′ 18.7″ E 73° 04′ 05.4″



Source: Additional Field Survey in February 2009, S-ESIMMS

Figure-3 Location of Additional Field Survey in Winter in Mahi River

In this study, Total 78 species belonging to 36 families of migratory and residential-migratory, residential birds were sighted from particular river stretch areas of Mahi (Appendix - 1). Total 16 species of birds from nine families are sighted in the survey, which were not listed in previous season data (Table-2). Also, a dead Jackal (*Canis aureus*), Checkered Keelback Water Snake (*Xenochrophis piscator*) and three Nilgai (*Boselaphus tragocamelus*) and was found on the west(Mumbai side) river bed.

Table-2 List of bird species sighted at RBL of Mahi River

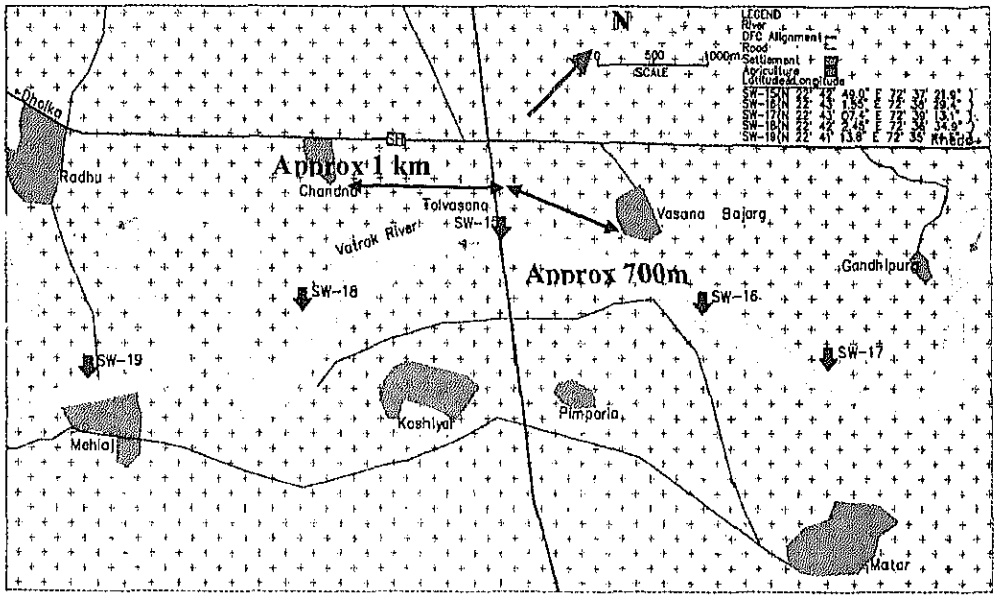
No	Common Name (Scientific Name)	Status
	Family 1: Podicipedidae	
1	Little Grebe (*Podiceps nigricollis*)	Migratory
	Family 2: Arediae	
2	Purple Heron (*Ardea purpurea*)	Residential Migratory/winter visitor
	Family 3: Anatidae	
3	Pintail Duck (*Anas acuta*)	Migratory
4	Common Teal (*Anas crecca*)	Migratory
5	Spot-billed Duck (*Anas poecilorhyncha*)	Residential Migratory/winter visitor
6	Eurasian Wigeon (*Anas Penelope*)	Migratory
7	Northern Shoveller (*Anas clypeata*)	Migratory
8	Common Pochard (*Aythya ferina*)	Migratory
	Family 4: Rallidae	
9	Common Moorhen (*Gallinula chloropus*)	Residential Migratory/winter visitor
10	Common Coot (*Fulica atra*)	Migratory
	Family 5: Jacanidae	
11	Pheasant tailed Jacana (*Hydrophasianus chirurgus*)	Residential Migratory/winter visitor
	Family 6: Scolopacidae	

No	Common Name (Scientific Name)	Status
12	Sandpiper (*Tringa sp.*)	Migratory
	Family 7: Recurvirostridae	
13	Black-winged Stilts (*Himantopus himantopus*)	Residential Migratory/winter visitor
	Family 8: Turdinae	
14	Desert Wheatear (*Oenanthe deserti*)	Migratory
	Family 9: Motacillidae	
15	Yellow Wagtail (*Motacilla flava*)	Migratory
16	Grey Wagtail (*Motacilla cinerea*)	Migratory

Source: Additional Field Survey in February 2009, S-ESIMMS

5.3 Vatrak River

One day field survey made at the particular river stretch, approximately 1.7 km upper and down streams from the proposed bridge location of the river (Figure-4).



Source: Additional Field Survey in February 2009, S-ESIMMS

Figure-4 Location of Additional Field Survey in Winter in Vatrak River

The survey track at the Vatrak River covering bridge location was from upstream (N 22° 43' 02.0"; E 72° 37' 42.2") to downstream (N 22° 42' 34.84"; E 72° 36' 55.18"). The survey was conducted in the morning (9:30 a.m. to 2:00 p.m.) and afternoon (2:45 p.m. to 4:45 p.m.).

The river flow and water level had declined and large areas of river bank were dry and waterless, in comparison to the previous survey time (monsoon seasons). Most of the rainfed drainages and small river streams were totally dried without water. Only a small river flow was continual with very low water levels. The river water flows on north (Delhi side) banks in upper streams and after the bridge location, the flow continues in down stream on the south(Mumbai side) banks. Also small to large size river pools are formed on that dry river bed. These river pools and puddles are covered with a good growth of aquatic algae and vegetation. Visually the water quality appears clean and not polluted.

During the survey, no turtle was sighted on down river stretch but five turtles belonging to two species were sighted on the north-upper river stream area, including Indian flap shell turtle and Indian roofed turtles (Table 3).

Table-3 List of Turtle sighting records at RBL of Vatrak River

No	Species	Number of Specimen	Location	Name of the village	Co-ordination
1	Flap-shell Turtle (*Lissemys punctata*)	1	Right Bank – near bridge location-Upstream	Opposite bank Village Pipariya	N 22° 42′ 23.3″ E72° 37′ 07.1″
2	Indian Roofed turtle (*Pangshura tecta*)	2	Right Bank – Upstream	Vasana Bujarg	N22° 42′ 58.8″ E72° 37′ 35.4″
3	Indian Roofed turtle (*Pangshura tecta*)	1	Right Bank – Upstream	Vasana Bujarg	N 22° 42′ 57.0″ E 72° 37′ 32.1″
4	Flap-shell Turtle (*Lissemys punctata*)	1	Right Bank Upstream	Vasana Bujarg	N 22° 42′ 54.0″ E 72° 47′ 26.2″

Source: Additional Field Survey in February 2009, S-ESIMMS

Total 60 species of residential and migratory birds belonging to 34 families were recorded from entire two kilometers river stretch (Appendix - 1). Total 14 species of birds belonging to six families were sighted in the study, which were not listed in previous season data (Table-4).

On north river bank area, three species of lizards (*Calotes versicolour*, *Sitana ponticeriana*, *Mabuya carinata*) and a cricket frog (*Fejervarya limnocharis*) were found. Also, two Indian grey Hare (*Lepus nigricollis*) were sighted in agricultural fields.

Table-4 List of bird species sighted at RBL of Vatrak River

No	Common Name (Scientific Name)	Status
	Family 1: Podicipedidae	
1	Little Grebe (*Podiceps nigricollis*)	Migratory
2	Pintail Duck (*Anas acuta*)	Migratory
3	Common Teal (*Anas crecca*)	Migratory
4	Spot-billed Duck (*Anas poecilorhyncha*)	Residential Migratory/winter visitor
5	Gadwall (*Anas stepera*)	Migratory
6	Northern Shoveller (*Anas clypeata*)	Migratory
7	Common Pochard (*Aythya ferina*)	Migratory
	Family 2: Rallidae	
8	Common Moorhen (*Gallinula chloropus*)	Residential Migratory/winter visitor
	Family 3: Scolopacidae	
9	Sandpiper (*Tringa* sp.)	Migratory
	Family 4: Recurvirostridae	
10	Black-winged Stilts (*Himantopus himantopus*)	Residential Migratory/winter visitor
	Family 5: Hirundinidae	
11	Martin (*Riparia* sp.)	Residential Migratory/winter visitor
	Family 6: Motacillidae	
12	Yellow Wagtail (*Motacilla flava*)	Migratory
13	Grey Wagtail (*Motacilla cinerea*)	Migratory
14	Paid Wagtail (*Motacilla maderaspatensis*)	Migratory

Source: Additional Field Survey in February 2009 (M= Migratory; Rm = Residential Migratory or winter visitor)

During the survey a large breeding colony of Martin (*Riparia* sp.) was located on earthen bed of left bank of Vatrak. Unfortunately, we was unable to identify which species of Martin it was, but on basis of colour and flight styles it may be Sand Martin (*Riparia riparia*) or Pale Martin (*R. diluta*) or Plain Martin (*R. paludicola*). These three martin species are hole nester and winter migratory.

6. DISCUSSION

Overall, present dry/winter season data indicates that the river segments of Vishwamitri, Mahi and Vatrak are environmentally of little importance and such river stretches are a part of habitat for a few species of wildlife only. No doubt, these three river segments were inhabited and used by a small number of various species of wildlife in comparison to present dry season.

The previous wet season data of S-ESIMMS marks the presence of a good number of reptiles, birds and mammalian species recorded in the study area, including some protected bird species too (Table-5). The low animal diversity recorded during the present survey, might be a result of usual fluctuation and ecological changes in the river habitat.

Table-5 Summery of recorded diversity at major three rivers, in wet season

Name of River	Number of Reptile Species (Family)	Number of Bird Species (Family)	Number of Mammal Species (Family)
Vishwamitri	10 (8)	54 (31)	5 (5)
Mahi	9 (6)	73 (36)	12 (10)
Vatrak	12 (9)	68 (35)	8 (8)

Source: Additional Field Survey in February 2009, S-ESIMMS

Previous wet season data indicates, that there are few important aquatic reptilian species inhabiting the study areas, including one species of crocodile and three species of turtles in the rivers - Vishwamitri, Mahi and Vatrak, at the particular river stretches around the DFC alignment areas. And in comparison to the previous wet season data, the current data indicates the same reptilian species inhabiting the same river streams area but with low density (Table-6).

Table-6 The comparison of two seasonal data of Important Aquatic Reptilian Species recorded in the study area

Name of River	No. of Mugger (Density/km)	No. of Flap Shell Turtle (Density/km)	No. of Soft Shell Turtle (Density/km)	No. of Indian Roofed Turtle (Density/km)
Wet Season	**study area 10 km length**			
Vishwamitri	6 (0.5)	1	--	--
Mahi	--	23 (snd)	50 (5.0)	--
Vatrak	2*	20 (2.0)	01*	50 (5.0)
Dry Season	**study area 2 km length**			
Vishwamitri	1 (burrow)	--	--	--
Mahi	--	1 (0.5)	2 (1.0)	--
Vatrak	--	2 (1.0)	--	3 (1.5)

* = secondary data

Source: Additional Field Survey in February 2009, S-ESIMMS

These low numbers of animal diversity and especially aquatic reptilian species and sighting of some of new bird species in the present study period may have been caused due to the following possibilities.

- The rivers in study area are non-perennial and rain-fed, except River Mahi.
- Most of reptilian species are in dormant / inactive due to low temperatures in winter.
- River's water level declines, only large and deep river pools survive in dry season and this condition forces aquatic animals to migrate further to new areas for better habitat for survival.
- Higher numbers of aquatic vegetation and growth of *typha* grasses and algae provide best hiding places to such aquatic species. This obstructs clear visibility.
- The month of February is the end of winter and a transition period, which is the pairing season for Mugger and Indian roofed turtle, therefore such species have to migrate locally in search of sex partner, also.
- The study area and low water depth provide best habitat as a foraging ground for many wet land dependant birds, especially winter visitor / migratory birds

7. CONCLUSION

Through the field reconnaissance, the result of the S-ESIMMS was confirmed at the site where the important fauna were found in bridge location of major rivers in detour section. Even in the different season, some individuals and field signs (possible nest) of protected reptiles were also observed and at the time of winter in this additional field study namely field reconnaissance in three rivers although it may not affect seriously. As described in the S-ESIMMS, the monsoon season might be much important season for those faunal species because of the breeding season.

Water levels of the three rivers were very low compare to the previous study period in the monsoon period in 2008 although the Mahi River was still keeping abundant water. Especially, in Vishramitri River, water quality itself became deteriorated having blackish brown water color associated with sulfur odor and appearance of bubbling from the bottom.

In Vishwamitri River, there was a possible mugger crocodile (*Crocodylus palustris*) nest in winter, a hole on the bank (appeared by lowering water level) was found but no any individual. Some migrant bird species seeming to be winter visitors were identified during study. In Vatrack River, some reptile species which found at the previous field survey were observed. Those are Indian flap-shell turtle (*Lissemys punctata*) and Indian roofed turtle (*Pangshura* (=*Kachuga*) *tecta*). Also, some winter visitors of bird species were observed in the river/ river bed. Although water level in the river was declined compare to the other season, the water quality was not so deteriorated in our visual observation namely clear appearance. In Mahi River, as well as the other 2 rivers, some migrant bird species were observed.

As the result of the study, there was no any big difference on the wildlife in two season, not observing new endangered mammal species and reptile species. Some winter visiting bird were found as migrant bird. All newly found bird species at the site were already listed in the report in the S-ESIMMS (refer at the Thol Lake Wildlife Sanctuary in the part-III) and not categorized as endangered species at the moment. Thus, the study confirmed the S-ESIMMS would not require the particular modification of the report at the time.

Appendix - 1
List of birds species are sighted at three railway bridge locations of Vishwamitri, Mahi and Vatrak rivers, Gujarat State

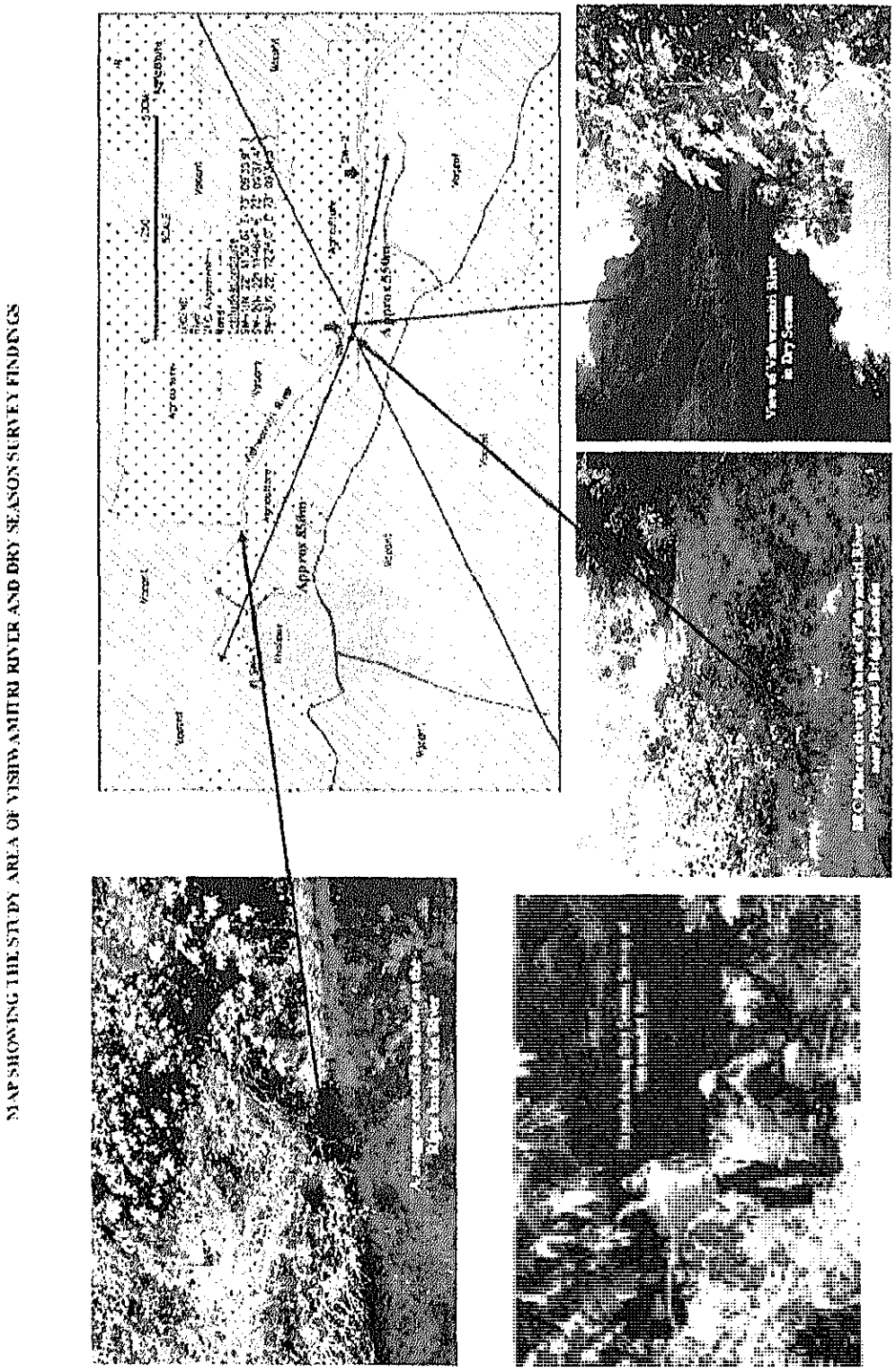
No	Common Name of Species (Scientific Name) (* first time record in this study)	Status	Vishwamitri	Mahi	Vatrak
	Family: Podicipedidae				
1	Little Grebe (*Podiceps nigricollis*)*	M	-	P	P
	Family: Phalacrocoracidae				
2	Little Cormorant (*Phalacrocorax niger*)	R	P	P	P
	Family: Arediae				
3	Grey Heron (*Ardea cinerea*)	M	-	P	P
4	Purple Heron (*Ardea purpurea*)*	Rm		P	
5	Indian Pond Heron (*Ardeola grayii*)	R	P	P	P
6	Cattle Egret (*Bubulcus ibis*)	R	P	P	P
7	Large Egret (*Casmerodius albus*)	R	P	P	P
8	Median Egret (*Mesophoyx intermedia*)	R	P	P	P
9	Little Egret (*Egretta garzetta*)	R	P	P	P
10	Night Heron (*Nycticorax nycticorax*)	R	P	-	-
	Family: Ciconiidae				
11	Painted Stork (*Mycteria leucocephala*)	R	-	P	-
12	Asian Open-bill Stork (*Anastomus oscitans*)	R	-	P	P
13	White necked Stork (*Ciconia episcopus*)	R	-	P	-
	Family: Threskiornithidae				
14	White Ibis (*Threskiornis melanocephalus*)	R	-	P	P
15	Black Ibis (*Pseudibis papillosa*)	R	P	P	P
16	Glossy Ibis (*Plegadis falcinellus*)	M	-	P	P
	Family: Anatidae				
17	Brahminy Shelduck (*Tadorna ferruginea*)	Rm	-	P	P
18	Comb Duck (*Sarkidiornis melanotos*)	Rm	-	P	-
19	Pintail Duck (*Anas acuta*)*	M	-	P	P
20	Common Teal (*Anas crecca*)*	M	-	P	P
21	Spot-billed Duck (*Anas poecilorhyncha*)*	Rm	-	P	P
22	Gadwall (*Anas stepera*)*	M	-	-	P
23	Eurasian Wigeon (*Anas Penelope*)*	M	-	P	-
24	Northern Shoveller (*Anas clypeata*)*	M	-	P	P
25	Common Pochard (*Aythya ferina*)*	M	-	P	P
	Family: Accipitridae				
26	Black-shoulder Kite (*Elanus caeruleus*)	R	-	P	-
27	Pariah Kite (*Milvus migrans*)	R	P	P	P
28	Shikra (*Accipiter badius*)	R	P	P	-
	Family: Phasianidae				
29	Grey Francolin (*Francolinus pondicerianus*)	R	P	P	P
30	Indian Peafowl (*Pavo cristatus*)	R	-	P	-
31	White-breasted Water-hen (*Amauronis phoenicurus*)	R	P	P	P
32	Common Moorhen (*Gallinula chloropus*)*	Rm	-	P	P
33	Common Coot (*Fulica atra*)*	M	-	P	-
	Family: Jacanidae				
34	Pheasant tailed Jacana (*Hydrophasianus chirurgus*)*	Rm	-	P	-
	Family: Charadriidae				
35	Red-wattled Lapwing (*Vanellus indicus*)	R	P	P	P
	Family: Laridae				
36	Gull-billed Tern (*Gelochelidon nilotica*)	M	-	P	P
37	River Tern (*Sterna aurantia*)	R	-	P	P

No	Common Name of Species (Scientific Name) (* first time record in this study)	Status	Vishwamitri	Mahi	Vatrak
	Family: Columbidae				
38	Yellow-legged Green Pigeon (*Treron phoenicoptera*)	R	-	P	-
39	Blue Rock Pigeon (*Columba livia*)	R	P	P	P
40	Collared Dove (*Streptopelia sp.*)	R	-	P	-
41	Little Brown Dove (*Streptopelia senegalensis*)	R	P	P	P
	Family: Psittacidae				
42	Alexandrine Parakeet (*Psittacula eupatria*)	R	-	P	-
43	Rose-ringed Parakeet (*Psittacula krameri*)	R	P	P	P
44	Plum-headed Parakeet (*Psittacula cyanocephala*)	R	P	P	P
	Family: Scolopacidae*				
45	Sandpiper (*Tringa* sp.)*	M	-	P	P
	Family: Recurvirostridae*				
46	Black-winged Stilts (*Himantopus himantopus*)*	Rm	P	P	P
	Family: Cuculidae				
47	Asian Koel (*Eudynamys scolopacea*)	R	P	P	-
48	Greater Coucal (*Centropus sinensis*)	R	P	P	P
	Family: Strigidae				
49	Spotted Owlet (*Athene brama*)	R	P	P	-
	Family: Alcedinidae				
50	White-breasted Kingfisher (*Halcyon smyrnensis*)	R	P	P	P
	Pied Kingfisher (*Ceryle rudis*)	R	P	P	P
	Family: Meropidae				
51	Green Bee-eater (*Merops orientalis*)	R	P	P	P
	Family: Coraciidae				
52	Indian Roller (*Coracias benghalensis*)	R	-	P	P
	Family: Upupidae				
53	Common Hoopoe (*Upupa epops*)	Rm	P	P	P
	Family: Capitonidae				
54	Coppersmith Barbet (*Megalaima haemacephala*)	R	P	P	P
	Family: Picidae				
55	Lesser Golden-backed Woodpecker (*Dinopium benghalensis*)	R	-	P	-
	Family: Hirundinidae				
56	Martin (*Riparia sp.*)	?	-	-	P
57	Wire-tailed Swallow (*Hirundo smithii*)	Rm	-	P	-
	Family: Laniidae				
58	Shrike (*Lanius sp.*)	R	P	P	P
	Family: Dicruridae				
59	Black Drongo (*Dicrurus macrocercus*)	R	P	P	P
	Family: Sturnidae				
60	Brahminy Starling (*Sturnus pagodarum*)	R	P	P	P
61	Common Myna (*Sturnus tristis*)	R	P	P	P
62	Bank Myna (*Acridotheres ginginianus*)	R	P	P	P
	Family: Corvidae				
63	Indian Tree-pie (*Dendrocitta vagabunda*)	R	P	P	P
64	House Crow (*Corvus splendens*)	R	P	P	P
65	Jungle Crow (*Corvus macrorhynchos*)	R	P	P	P
	Family: Pycnonotidae				
66	White-eared Bulbul (*Pycnonotus leucotis*)	R	-	P	-
67	Red-vented Bulbul (*Pycnonotus cafer*)	R	P	P	P
	Family: Timaliinae				
68	Common Babbler (*Turdoides caudatus*)	R	P	P	P
69	Large Grey Babbler (*Turdoides malcolmi*)	R	-	P	

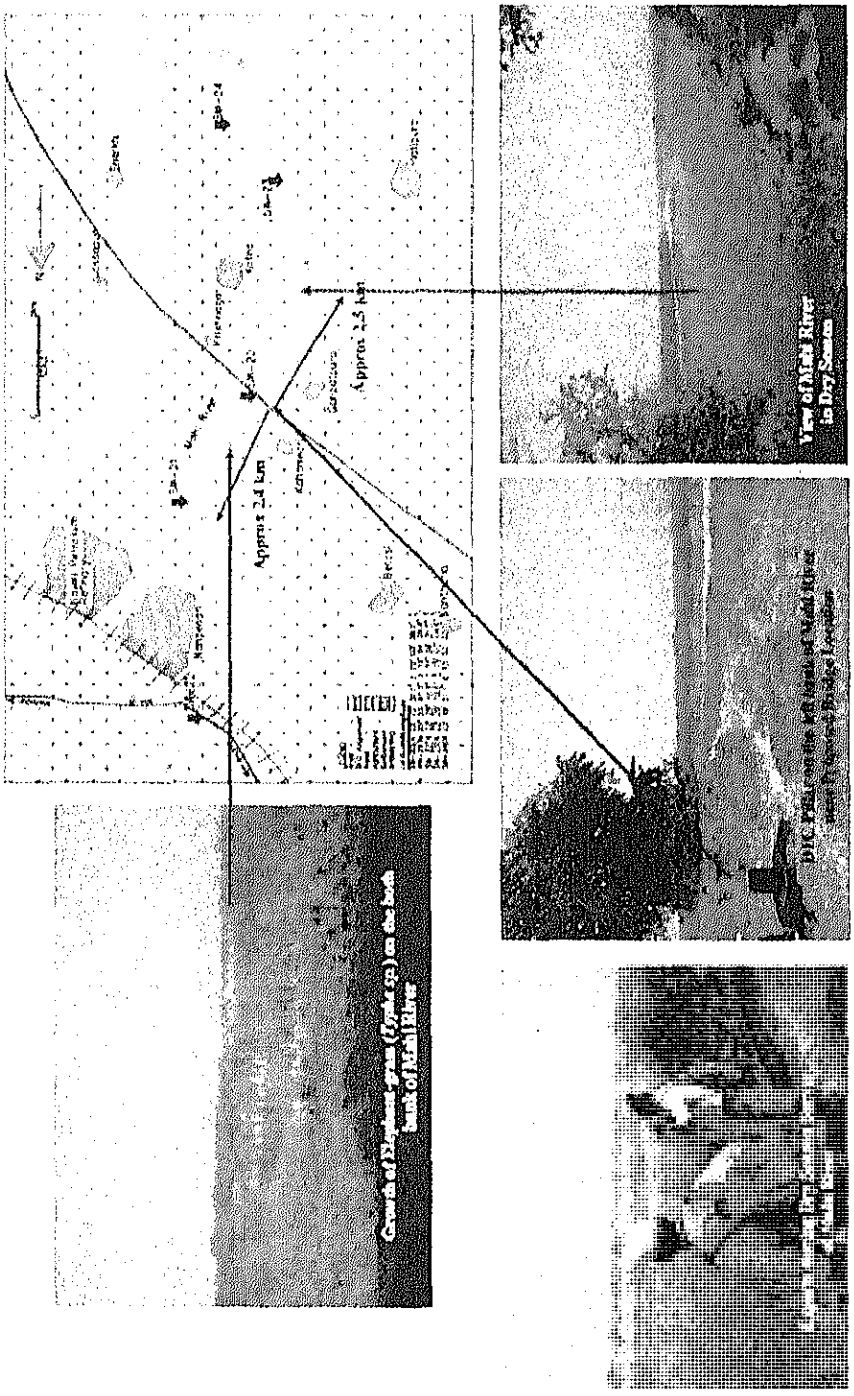
No	Common Name of Species (Scientific Name) (* first time record in this study)	Status	Vishwamitri	Mahi	Vatrak
70	Jungle Babbler (*Turdoides striatus*)	R	-	P	P
	Family: Sylviinae				
71	Common Tailorbird (*Orthotomus sutorius*)	R	P	P	P
	Family: Turdinae				
72	Desert Wheatear (*Oenanthe deserti*)*	M		P	
73	Indian Robin (*Luscinia brunnea*)	R	P	P	P
74	Oriental Magpie Robin (*Copsychus saularis*)	R	P	P	P
	Family: Motacillidae				
75	Yellow Wagtail (*Motacilla flava* sp.)*	M	P	P	P
76	Grey Wagtail (*Motacilla cinerea*)*	M	P	P	P
77	Paid Wagtail (*Motacilla maderaspatensis*)*	M	-	-	P
	Family: Nectariniidae				
78	Purple Sunbird (*Nectarinia asiatica*)	R	P	P	P
79	**Family: Passerinae**				
80	House Sparrow (*Passer domesticus*)	R	P	P	P
81	Yellow-throated Sparrow (*Petronia xanthocollis*)	R	-	P	-
	Family: Estrildidiae				
82	White-throated Munia (*Lonchura malabarica*)	R	P	P	P

Source: Additional Field Survey in February 2009, S-ESIMMS

(M= Migrant; R= Residential; Rm=Residential and Migrant; P= Sighting in the study)

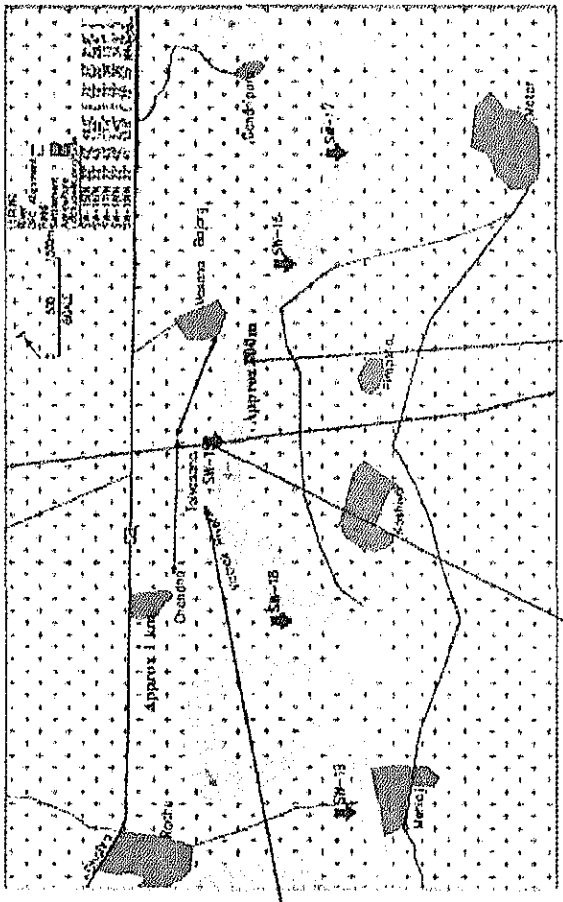


MAP SHOWING THE STUDY AREA OF VISHWAMITRI RIVER AND DRY SEASON SURVEY FINDINGS



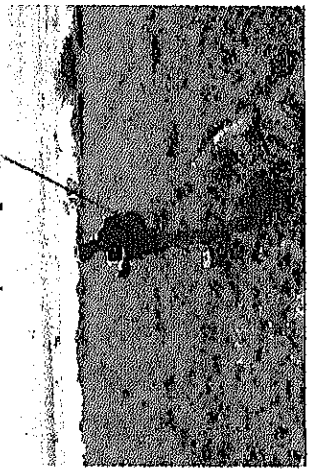
MAP SHOWING THE STUDY AREA OF MAHI RIVER AND DRY SEASON SURVEY FINDINGS

MAP SHOWING THE STUDY AREA OF VATRAK RIVER AND DRY SEASON SURVEY FINDINGS



View of Vatrak River in Dry Season

DFC Pillar on the bank of Vatrak River near Proposed Bridge Location



Expert during Dry Season Survey of Vatrak River

Attachment III-3-1
Questionnaire for Project-Affected Structure Survey

LOCATION

State: | District | Village/Town: | Panchayat / Ward No:

Section No.: | Type of the Village: A. Revenue B. Settlement C. SC Village D. ST village | Location A. Rural B. Urban C. Semi urban D. Forest

Nearest Station 1) 2) | Station Location: A. Immediate B. In between

GPS Serial No of Affected Structures					
GPS Value	N	N	N	N	N
	E	E	E	E	E

TYPE OF AFFECTED STRUCTURES

Residential Structure A. House B. Hut C. Multi storied Building (apartment) D. Other					
Commercial Structure A. Shops B. Hotel C. Restaurant D. Kiosk E. Petrol Pump F. Clinic G. STD Booth H. Work Shop I. Vendors J. Commercial complex K. Industry I. Other					
Mixed Structure (Residential cum Commercial)					
Community Structure A. Club B. Trust C. Memorial D. Grave Yard E. Crematorium F. Community Pond G. Panchayat Ghar H. Cooperative Society I. Seed/ fertilizer storage J. Health Centre K. Community centre L. School/College (Private) M. Training Institute N. Others (Specify)					
Religious Structure A. Temple B. Church C. Mosque D. Gurudwara F. Shrines G. Religious platform H. Others					
Government Structures A. Government Offices B. Hospital C. School D. College E. Railway Staff House F. Railway yard G. Post Office H. Others					
Others A. Boundary Wall B. Cattle shed C. Oil extraction field D. Historical Monuments (Specify) E. Others					

STATUS OF THE AFFECTED STRUCTURE

Type of Construction of the Structure A. Temporary B. Semi Permanent C. Permanent					
No of Floors					
Area of the affected structure (m x m) EYE ESTIMATION					
Distance of Structure (m) Category: A. From last track of parallel line (m) B. From centre of detour line (m)					
Status of the Structure A. Legal Titleholder B. Lease Holder C. Encroacher D. License from local Government E. Squatters					
People associated with the structure A. No of Tenant B. No of Employee/Wage earner					
Number of project affected family (PAF)					
Number of family members (PAPs) (Male + Female)	M F	M F	M F	M F	M F
Scale of Impact A. 25% B. 50% C. 75% D.100%					

VALUATION

Market Value of structure (In Rs) A. Government					
B. Private					
Current Land Price A. Circle rate/Government Rate (Rs)					
B. Private Rate (Rs)					

SOCIAL STATUS

Name of Owner /Father's Name					
Religion: A. Hindu B. Muslim C. Jain D. Bourdh E. Christian F. Sikh G. Other					
Social Status: A. General B. SC C. ST D. OBC					
Monthly Income of Family (in Rs.):					
Vulnerability: A. BPL Family B. Woman Headed Family C. Disabled Head of Family D. Schedule Caste E. Schedule Tribe					
Photograph number of Affected Structure					

Attachment III-3-2
Questionnaire for Socio-Economic Survey

101	**SURVEY QUESTIONNAIRE IDENTIFICATION**	
1	ROW – 1; ROB-2; Squatter-3	
102	**BASIC PROFILE OF PAP**	
2	A. Name of Interviewee (only adult members):	
	B. Address of the Interviewee (only abult members)	
3	i State:	
4	ii District :	
5	iii Panchayat :	
6	iv Village:	
7	C. Location (choose one) 1: Rural 2: Semi Urban 3: Urban	
8	D. Type of Location (chose one) 1: Parallel to railways, 2: Near Diversion, 3: Near ROB (**for ROB only**) 4: Others	
9	E. Specific Location: If parallel or diversion, specify the given section No. and GPS data If ROB, specify nearest station name(s) where ROB are located **FOR ROB ONLY** (1: Right-hand side from Mumbai, 2: Left-hand side from Mumbai)	
10	F. Relation to Head of Family 1: Myself, 2: Wife, 3. Child, 4. Parent, 5: Other (specify)	
11	G. How many years have you been living here?	
12	H. Is there any tenant in this house? If Yes, number of tenants?	
13	I. How many years has (have) the tenant(s) resided?	
14	J. What is the market value of this structure in curreht condition?	
15	K. Do you have any legal documents for structures? If yes, please mention the document is	
16	L. Do you have any legal documents? If yes , 1: ration card, 2: Voter I.D card, 3: others (specify)	
17	M. How long are you planning to live here (in years)? (**for Squatters only**)	
	Profile of Head of Family:	
18	N. Head of Family (Name)	
19	O. Sex 1: Male, 2: Female	
20	P. Age	
21	Q. Marital Status 1: Married, 2: Unmarried	
22	R. Occupation (chose all that apply) 1: Govt. Service 2 Private Service 3: Business 4.Wage Employee 5: Agriculture 6: Daily wage labour 7: Unemployed 8: Others (specify)	
23	S. Attainment Level of Education (chose one) 1: Illiterate 2: Can Read only 3: Can read and write both 4. Upto Class 5 5: Upto Class 12 6: Graduate & above 7: ITI, Diploma/Degree, CA, ICWA, MBA, etc; 8.Others (specify)	
24	T. Religion (chose one) 1: Hindu 2: Muslim 3: Christian 4: Jain 5: Sikh 6: Buddhist 7: Other (specify)	
25	U. Social Category (chose one) 1: General 2: SC 3: ST 4: OBC	
26	V. Total number of family members (including infants and children)	
103	**TYPE OF IMPACT**	
27	A. Type of Social Impact Related to the Land Acquisition under the Project (chose all that apply) 1: loss of housing 2: loss of agricultural plots 3: Losses of crops, trees, and fixed assets 4: loss of businesses or enterprises 5: loss of incomes and livelihoods 6: Loose access to facilities, services or natural resources	

104	STRUCTURES LIKELY TO BE LOST	
28	A. Type of Structure (chose all that apply) 1: Residential 2:Commercial 3: Residential + Commercial 4: Office 5: Health Facility 6:Cattle Shed 7:Farm House 8: Boundary Wall/Fencing 9: Shrine 10: Well 11: Hand Pump 12: School 13: Graveyard/Crematorium ground 14: Others (specify)	
29	F. Ownership of the structure: (chose one) 1:Self-owned 2: State-owned structure for rental 3: Private-owned house for rental or borrow 4: Group- or Community-owned 5: Uncertain ownership,6: Illegal Occupants	
	G. What is (are) the market value of the structure(s) in current condition?	
	H. If rented, how much do you pay per month?	
105	HOUSING LIKELY TO BE LOST	
30	A. What is the type of house likely to be affected? 1: Single detached one-storey 2: Single detached two-storey 3: Single detached three-storey or more 4: Apartment/Row house duplex 5: Shanties connected to each other 6: Tents or tentative simple hut	
31	B. Please write the description of the house appearance/housing. (Take photo)	
32	C. Roof (chose one) 1: G.I. sheets 2: Tiles 3: Nipa or other natural materials 4: Concrete 5: Others (specify)	
33	D. Walls (chose one) 1: All concrete 2: Concrete and wood 3: All wood 4: Nipa or other natural materials 5: Others (specify)	
34	E. Housing Ownership (chose one) 1: Self-owned 2: State-owned house for rental 3: Private-owned house for rental or borrow 4: Group- or Community-owned 5: Uncertain ownership 6: Illegal Occupants	
35	F. What is the market value of the house in current condition?	
36	G. If rented, how much do you pay per month?	
37	H. Living Area / Floor Area (m^2)	
38	I. Number of bedrooms	

39	106 HOUSEHOLD BUDGET	INCOME		
	Source of Income ↓ Avg Income (INR)→	Daily	Monthly	Yearly
	a. Agriculture			
	b. Wage Labour			
	c. Business/Trading			
	d. Service			
	e. Livestock & Animal Husbandry			
	f. Fishing & Aquaculture			
	g. Collage Craft			
	h. Forestry			
	i. Other (specify)			
	Total Income			

B. Livestock holding of the family (unit in nos.)	No.
1. Cow	
2. Ox	
3. Buffalo	
4. Sheep	
5. Goat	
6. Camel	
7. Donkey	
8. Horse	
9. Pig	
10. Chicken	
11. Duck	
12. Others livestock (specify)	

C. Agricultural implements owned by the family	No.
1. Tractor	
2. Power Trailer	
3. Thresher	
4. Harvester	
5. Genset Sprayer	
6. Pump Set	
7. Electric Pump	
8. Others (specify)	

D. Household items owned by the family	No.
1. TV	
2. Fridge	
3. Mixer	
4. Electric Cooker	
5. Geyser	
6. Electric Fan	
7. OTG	
8. Toaster	
9. Microwave	
10. Radio	
11. Others (specify)	

E. Other assets owned by the family	No.
1. Scooter/Motorcycle	
2. Jeep/Car	
3. Truck	
4. Bus	
5. Bullock/Camel Cart	
6. Others (specify:)	

F. Total Annual Saving (Rs.)		
	G. Have you taken any loan? 1: Yes, 2: No, 3: Don't Know	
	H: If **yes**, then please tell us the following:	

Name of the loan provider	Amount (in Rs.)	Re-paid (in Rs.)	Balance (in Rs.)
1. Bank			
2. Relative/Friend			
3. Mahajan			
4. Other (specify ---------)			

107	COVERAGE UNDER GOVERNMENT DEVELOPMENT SCHEMES	
40	A. Have you availed any benefit under any govt. scheme? 1: Yes, 2: No	
41	B. If **'Yes'**, please specify name of the scheme 1. National Rural Employment Guarantee scheme 2.Jawar Rojgar Yojna 3. PM Rojgar Yojna 4,Integrated Rural Development Programme 5. Indira Awas Yojana 6.Others	
42	C. If **'Yes'**, when did you receive the help?	
43	D. If **'Yes'**, please tell kind of help. 1: Loan, 2: Training, 3: Employment	
44	E. If **'1'**, kindly indicate the amount. (Rs.)	
45	F. If **'2'**, kindly indicate the type of training.	
46	G. After availing this scheme did your annual income increase? 1: Yes 2: No	
47	H. If **'Yes'**, how much? (Rs)	
48	I. If **'No'**, Why? Please specify	

108	HEALTH STATUS	
49	A. Was any member of your family affected by any illness in last one year? 1: Yes, 2: No	
50	B. If **'Yes'**, please specify type of diseases.	
51	C. If **'Yes'**, please specify treatment taken	

109	LAND HOLDING AND LIVELIHOOD				
52	A. Land Ownership 1: Self-owned 2: State-owned land for rental 3: Private-owned land for rental or borrow 4: Group- or Community-owned 5: Uncertain ownership 6: Illegal land occupation				
53	B. What is the market value of the land in current condition?				
54	C. Do you have agricultural land? 1: Yes 2: No				
55	D. If Yes, please tell us the total land owned by you (in local unit)				
	Type of Land	Sq m.	Bigha	Biswa	Hectare
	1. Agricultural land				
	2. Orchard				
	3. Others (specify ----------)				
	Total Area				
56	E. In case of farmers, list names of your 3 major products				
57	F. In case of other occupations, specify main income source?				
58	G. Select the observed type of squatters **(only for Squatters)** (chose one) 1: Illegal residents with station-related occupation 2: Shops of illegal occupancy 3: Seasonal labour (Agriculture) 4: Seasonal labour (Factory/Construction) 5: Gangmen's colony 6: Migrant Tribe				
59	I. What is the most serious problem on your livelihood at present?				

110	ACCESSIBILITIES (DFC Related Issues)	
60	A. If Land is divided in two parts, what kind of accessibilities is required? i). ROB ii) RUB iii) Road Crossings iv) Service Road v)Others	
61	B. What is distance? (in km)	
62	C. If schools, colleges, market, religious centre, hospital, office, factory, tube well is separated from your near area due to DFC project, then what kind of arrangements should be made for your transportation? Pls. specify with alternatives.	
63	D. How often do you cross ROBs? Specify the number. **(Only for ROBs)**	
64	E. How often do you cross ROBs with Non-motorized Vehicles (NMVs)? **(Only for ROBs)**	

111	ACCESS TO UTILITIES		
65	A. Potable Water	1: Dig Well (Private)	2: Dig Well (Common)
	3: Pump Well (Private)	4: Pump Well (Common)	5: Piped Public Water Supply
	6: Bought from Water Vendors	7: Other Facilities (specify)	8: Others (specify)
66	B. Toilet Facilities	1: In-door Toilet	2. Out-door Toilet (Private)
		3: Out-door Toilet (Common)	4: Not Available
67	C. Electricity	1: Power line	2: Generator (Private)
		3: Generator (Common) 4: Car Battery	5: Not Available

112	WOMEN STATUS	
68	A. No of female family members engaged in economic/ non-economic activities	
69	B. If, engaged in economic activities total income of the year: (Rs.)	
70	C. Do your female member have any say, in decision making of household matters? If 'Yes, give the details?	

113	**SURVEY FOR COMMERCIAL STRUCTURE**	
71	A. How old is the Structure?	
72	B. Is your business self owned? 1: Yes 2: No	
73	C. If no, how many partners are there?	
74	D. Usage of Structure? 1: Shop 2: Godown 3: Workshop 4: Factory 5: Office 6: Others (specify)	
75	E. What type of business you are doing? Please specify.	
76	F. Do you have license of the business?	
77	G. How many workers are there?	
78	H. What is the market value of the structure as per Govt. registration?	
114	**PERCEPTION OF THE PROJECT**	
79	A. Are you aware of the DFC Project? 1: Yes 2: No (If No, go to C.)	
80	B. If Yes, what has been your source of information for DFC Project? 1: TV 2: Radio 3: News Paper 4: Word of Mouth 5: Friend/Relative 6: Others (specify)	
81	C. Will the project bring economic benefit in the area? 1: Yes 2: No 3: No comment	
82	D. What kind of economic benefit would take place? 1: Wage employment 2: Business opportunity 3: Industry establishment 4: Others (specify)	
115	**INTENTION ON REHABILITATION AND RESETTLEMENT**	
83	A. Anticipation of loss of income source by PAPS. 1: Income source will not be lost 2: Loss of all or large part of the farmland 3: Becoming too far to commute working place after the resettlement 4: Loss of working place such as loss of market 5: Others (specify)	
84	B. Anticipation of difficulty during resettlement? 1: Find new income source 2: Find new house 3: Find new suitable farmland in the resettlement site 4: Find suitable school for child (children) 5: Acclimatizing in the resettlement site, 6: Security in the resettlement site 7: Access to utilities,8: Others (specify)	
85	C. Choice of House affected People 1: Self relocation 2: Project assisted resettlement 3: Protest displacement 4: Conditional 5: Can't say now 6: only replaceable value 7: Shifting Expenses 8: Constructed Houses 9: House site,10: In another city/town/village/ or same city/town/village 11: Others (specify)	
86	D. Where would you like to resettle? (chose one) 1: In the same village 2: In the same sub-district 3: In the same district, 4: In the same state 5: Does not matter the resettlement location	
87	E: Please specify reason of the above answer.	
88	F: If already secured resettlement place, please specify name of place.	
89	G. Which way do you prefer to resettle? 1: Resettling with village members 2: Resettling individually	
90	H. Choice of Livelihood affected People 1: Provision of new shop 2: Employment during construction 3: Training for self employment 4: Cash grant 5: Provision of land 6: Others(specify)	
91	I. Intention of future occupation of farmers 1: Wish to continue to work as a farmer 2. Wish to change the occupation	
92	J. If 2 is selected in the above answer; please specify kind of occupation (if any).	
93	K. Choice for types of farming in the future. 1:Rice cultivation 2: Vegetable 3: livestock raising 4: Orchard 5: Flower garden, 6: Others (specify)	
94	L. Choice for alternative farming land: 1: Yes 2: No	
95	M. If yes, preferred alternative land 1: Newly established farmland 2: Already established farmland 3: Wish to look for farmland by yourself	
96	N. Request to the Project Implementing Authority regarding R&R? 1: Compensation 2: Assistance for resettlement and rehabilitation 3: Both compensation & assistance for R&R 4: Other (specify)	

Appendix III-3-3
ADDITIONAL SOCIAL SURVEY

1. ADDITIONAL SOCIAL SURVEY NEAR MADAR JUNCTION IN AJMER

Due to change in the alignment near Madar Junction in Ajmer district, additional survey has been carried out in the month of March 2009 and the survey results are provided in the following subsections.

1.1 IMPACTS ON STRUCTURES

The proposed project would have impacts on private residential structures as well as land. However, at this stage the analysis is limited to adverse impacts on structures only.

Number of structures likely to be affected is presented in **Table A1.1**. Out of the total of 32 affected structures, 29 structures are residential while rests of the 3 structures are boundary walls.

Table A1.1 Type of Affected Structures

District	Residential	Commercial	Mixed	Community	Religious	Govt. Structure	Others	Total Structure	No of PAFs
Ajmer	29	0	0	0	0	0	3	32	25
%	90.6	0	0	0	0	0	9.4	100.0	

Source: Social survey

Type of residential structures is presented in **Table A.1.2**. Most of the affected residential structures are hut houses indicating the poor economic condition of majority of Project Affected Families. No multi-storey building will be affected due to the project.

Table A.1.2 Type of Residential Structures

District	House	Hut	Multistoried	Others	Total
Ajmer	10	19	0	3	32
%	31.2	59.4	0.0	9.4	100

Source: Social survey

Typology of affected structures and its area are presented in **Table A.1.3.** It may be observed that about 59.4% of the structures likely to be affected are temporary structure while 40.6% structures are permanent. Materials used for the construction of structure are indicators of the socio-economic conditions of people. Clearly a large majority of affected structures are temporary indicating the poor economic condition of majority of families. These temporary structures are made of bamboo or wood stick and polythene sheet.

Table A.1.3 Number of Structure Affected (Type of Construction)

District	Temporary	Semi-Permanent	Permanent	Grand Total
Ajmer	19	0	13	32
%	59.4	0.0	40.6	100

Source: Social survey

Legal status of the structures likely to be affected is presented in **Table A.1.4**. 59.4% of the affected structures belong to squatters while 40.6% structures belong to titleholders.

Table A.1.4 Legal Status of Structure

District	Title Holder	Lease Holder	Encroacher	Licensee	Squatter	Total
Ajmer	13	0	0	0	19	32
%	40.6	0	0	0	59.4	100.00

Source: Social survey

Distribution of families likely to be affected by religion and social categories are presented in **Table A.1.5**. All of the families likely to be affected belong to Hindu religion.

Table A.1.5 Distribution of Structure Owner Families by Religion

District	Hindu	Muslim	Jain	Budhist	Christian	Sikh	Others	Total
Ajmer	32	0	0	0	0	0	0	32
%	100.0	0	0	0	0	0	0	100

Source: Social survey

Majority of the affected families are from Scheduled Castes (91.7%) followed by other general castes (9.3%).

Table A.1.6 Distribution of Affected Families by Social Category

District	General	SC	ST	OBC	Total
Ajmer	3	29	0	0	32
%	9.3	91.7	0.0	0.0	100.0

Source: Social survey

Table A.1.7 presents income data obtained from the Structure Identification Survey. It may be seen that about 81% of the surveyed PAFs have income level of less than or equal to Rs. 5000 per month.

Table A.1.7 Distribution of Families by Income

District	0-5000	5001-10000	> 10001	No Answer	Total
Ajmer	26	2	0	4	32
%	81.3	6.2	0	12.5	100.0

Source: Social survey

Average monthly income level of surveyed PAFs is presented in **Table A.1.8**. It may be observed that the income level of PAFs belonging to General Castes is considerably higher than Scheduled Castes.

Table A.1.8 Social Category Wise Monthly Income Level (INR)

District	General	SC	ST	OBC
Ajmer	5,000	2,220	0	0

Source: Social survey

The number of vulnerable families likely to be adversely affected due to the project has been provided in **Table A.1.9**. Out of total of 32 families, 19 families have been identified as socially and economically vulnerable. However, none of these people possess BPL card issued by Government.

Table A.1.9 Affected Vulnerable Families

District	BPL	Disabled & BPL	WHH	Total
Ajmer	19	0	0	9

Note: WHH: Women Headed Household; BPL: Below Poverty Line
Source: Social survey

Number of families and persons affected as a consequence of impacts on structures is presented in **Table A.1.10**. A total of 186 persons belonging to 32 families would be affected. Overall the average number of persons per family works out to be 5.8.

Table A.1.10 Project Affected Families (PAFs) & Project Affected Persons (PAPs)

District	PAF	PAP Male	PAP Female	PAP Total
Ajmer	32	92	94	186
%	-	49.4	50.6	100

Source: Social survey

Total surface area affected by the project covering all kinds of structures is provided in **Table A.1.11**. Overall 2,834 m^2 of surface area comprising permanent and temporary structures would be affected by the project.

Table-A.1.12 Surface Area Affected by the Project (in square meters)

District	Temporary	Semi-Permanent	Permanent	Grand Total
Ajmer	220	0	2634	2834
Total	7.7	0	92.3	100

Source: Social survey

1.2 ANALYSIS OF SOCIO-ECONOMIC SURVEY RESULTS (20% PAFS)

Socio-economic survey has been carried out through pre-tested structure questionnaire among 20% of the affected structure owners has enumerated during structure identification survey. The head of the family has been interviewed for the socio-economic status of the family. The survey results have been analyzed in light of various social development indicators, which are provided in this sub-section.

Table A.1.13 Occupation of the Surveyed PAFs

District	Agriculture	Business	Daily Wage Labour	Govt. Service	Others	Pvt Service	Wage Employee	Total
Ajmer	0	0	4	1	0	1	0	6
%	0	0	66.6	16.7	2.2	16.7	0	100.0

Source: Social survey

Occupation of the surveyed Project Affected Family heads is presented in **Table A.1.13**. Majority of the surveyed PAPs are daily wage labours.

Table A.1.14 Education of the Surveyed PAFs

District	Can Read	Can Write	Graduate	High School (12th Std)	Illiterate	ITI	Primary (5th Std)	Total
Ajmer	0	2	1	1	2	0	0	6
%	0	33.3	16.7	16.7	33.3	0	0	100.0

Source: Social survey

Education levels of surveyed Project Affected Family heads are presented in **Table A.1.14.** 66.7% of the respondents are literate. 16.7% respondents have attained high school education while another 16.7% respondents have studied up to graduation level.

Table A.1.15 Roof type of the Affected Structures

District	Concrete	GI Sheets	Tiles	Others	Total
Ajmer	2	0	0	4	6
%	33.4	0	0	66.6	100

Source: Social survey

Roof type of Project affected houses are presented in **Table A.1.15**. 33% of the affected houses have concrete (RCC) roofs, while 66.6% houses have plastic sheets as roof materials.

Table A.1.16 Walls of the Affected Structures

District	Concrete	Concrete & Wood	Nipa	Wood	Total
Ajmer	2	0	0	4	6
%	33.4	0	0	66.6	100

Source: Social survey

Walls type of Project affected houses are presented in **Table A.1.16**. 33% of the affected houses have concrete & wooden walls, while 66% houses have plastic and plywood as walls.

Table A.1.17 Distribution of Assets among PAFs

District	Livestock	2 Wheelers	Agricultural Equipments	Consumer durables	4 wheelers
Ajmer	0	1	0	0	0

Source: Social survey

Assets are indicators of the socio-economic conditions of people. However, only one of respondents owns a 2 Wheeler while others have reported that they do not have any asset.

Table A.1.18 Requirement of Accessibilities Envisaged

District	No Answer	Others	Road X-ings	ROB	RUB	Service Road	Total
Ajmer	6	0	0	0	0	0	6
%	100	0	0	0	0	0	100

Source: Social survey

None of the respondents have envisaged any requirement of accessibility.

Table A.1.19 Drinking Water Source of PAFs

District	Common dig well	Common pump well	Private dig well	Private pump well	Public Supply	Total
Ajmer	0	0	0	0	6	6
%	0	0	0	0	100	100

Source: Social survey

Drinking water source of the surveyed PAFs is public supply for drinking water.

Table A.1.20 Toilet Facilities

District	Common Outdoor	Indoor	Not Available	Private Outdoor	Total
Ajmer	0	2	4	0	6
%	0	33.4	66.6	0	100

Source: Social survey

Existing toilet facilities are presented in **Table A.1.20.** 33.4% of the project affected families have toilet facilities at their own house, it is not available for 66.6% respondents.

Table A.1.21 Women in Economic Activities

District	Total
Ajmer	4
Total	4

Source: Social survey

Out of the total of 6 surveyed families, 4 families have reported that women members participate in economic activity.

Table A.1.22 Power Supply

District	Not available	Power line	Private Generator	Total
Ajmer	4	2	0	6
%	66.6	33.4	0	100.0

Source: Social survey

Power supply facilities to the affected PAFs are presented in **Table A.1.22.** About 67% PAFs do not any electric connections.

Table A.1.19, A.1.20 and A.1.22 elaborates vital development indicators related to the infrastructure development and basic amenities. It is evident from these three tables that the majority of the surveyed PAFs do not have access to the basic amenities.

Table A.1.23 Awareness about DFC project

District	No	Yes	Total
Ajmer	0	6	6
%	0	100.0	100.0

Source: Social survey

Table A.1.24 Source of Information

District	Friend/Relative	News paper	Word of Mouth	No Answer	TV	Total
Ajmer	0	0	6	0	0	6
%	0.0	0.0	100.0	0.0	0.0	100.0

Source: Social survey

Table-A.1.23 and A.1.24 show awareness level among surveyed project affected families about the DFC project and sources from where they have obtained information about the project. All of the respondents are conscious about the DFC project and they obtained the information through word of mouth.

Table A.1.25 Envisaged Benefit from DFC

District	No	Yes	Total
Ajmer	0	6	6
%	0.0	100.0	100.0

Source: Social survey

Table A.1.26 Type of Envisaged Benefit

District	Business Opportunity	Industry Development	Wage Employment	Others	Total
Ajmer	0	4	2	0	6
%	0.0	66.6	33.4	0.0	100.0

Source: Social survey

Table A.1.25 provides envisaged benefits from the project by surveyed PAFs and **Table A.1.26** provides the type of envisaged benefits. All of the respondents agreed that this project will bring the economic benefit in their areas. 33.4% respondents expected wage employment opportunity to increase whereas 66.6% respondents anticipated industrial development due to the project.

Table A.1.26 shows anticipated loss of income by the surveyed PAFs. All of the respondents have not anticipated any loss of income due to the project. **Table A.1.27** shows that all of the respondents have anticipated difficulty in finding new houses during resettlement.

Table A.1.26 Anticipated Loss of Income

District	Finding new farmland	Increased commuting time	Loss of farmland	Loss of work place	No Answer	No loss	Total
Ajmer	0	0	0	0	0	6	0
%	0	0	0	0	0	100.0	100.0

Source: Social survey

Table A.1.27 Anticipated Difficulty in R&R

District	Acclimatization	Finding Income Source	Finding new farmland	Finding new house	Security issues	Total
Ajmer	0	0	0	6	0	6
%	0	0	0	100.0	0	100.0

Source: Social survey

Table A.1.28 shows choices of PAFs on relocation of their residential buildings. 66.6% respondents preferred constructed houses for relocation over other R&R options.

Table A.1.28 Choice of House Affected People

District	Can't say now	Constructed Houses	Only replaceable value	Same district	Conditional	Total
Ajmer	0	4	0	0	2	6
%	0	66.6	0	0	33.3	100

Source: Social survey

Table A.1.29 Choice of Place for Resettlement

District	Compensation	Doesn't matter	Same district	Same sub district	Same village	Total
Ajmer	0	6	0	0	0	6
%	0	100	0	0	0	100

Source: Social survey

Table A.1.29 shows choices of surveyed PAFs over place of resettlement. All of the respondents opined that they do not have any choices for resettlement and it doesn't matter for them where they will be resettled.

Table A.1.30 Request to Implementing Authority about R&R

District	Compensation	Compensation and R&R	Total
Vadodara	6	0	6
%	100	0	100

Source: Social survey

Table A.1.30 shows the request by PAFs to the implementing authority on R&R. All of the respondents have requested project proponent for timely disbursement of proper compensation against their acquired structures.

PHOTOGRAPHS OF AFFECTED STRUCTURES

29 Aj 1

30 Aj 2

31 Aj 3

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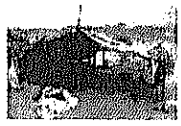
35 Aj 7



36 Aj 8

37 Aj 9

38 Aj 10

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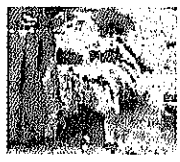

46 Aj 18

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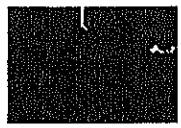

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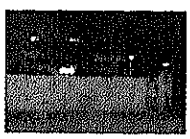
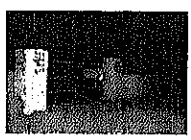


59 Aj 31



60 Aj 32

2. ADDITIONAL SOCIAL SURVEY IN PATAN

Due to change in the alignment Patan district, additional survey has been carried out in the month of March 2009 and the survey results are provided in the following subsections.

2.1 IMPACTS ON STRUCTURES

The proposed project would have impacts on private residential structures well as land. However, at this stage the analysis is limited to adverse impacts on structures only. Number of structures likely to be affected is presented in **Table A2.1.** Out of the total of 28 affected structures, 23 structures are residential while rests of the 1 structure is religious.

Table A.2.1 Type of Affected Structures

District	Residential	Commercial	Mixed	Community	Religious	Govt. Structure	Others	Total Structure	No of PAFs
Patan	23	0	0	0	1	0	4	28	24
%	90.6	0	0	0	0	0	9.4	100.0	-

Source: Social survey

Type of residential structures is presented in **Table A.2.2.** All of the affected structures are houses. No multi-storey building will be affected due to the project.

Table A.2.2 Type of Residential Structures

District	House	Hut	Multistoried	Others	Total
Patan	23	0	0	0	23
%	100.0	0.0	0.0	0.0	100.0

Source: Social survey

Typology of affected structures and its area are presented in **Table A.2.3.** It may be observed that majority (71.4%) of the affected structures are semi-permanent; while about 17.9% of the structures likely to be affected are temporary structure while 10.7% structures are permanent.

Materials used for the construction of structure are indicators of the socio-economic conditions of people. Clearly a large majority of affected structures are semi-permanent indicating the poor economic condition of majority of families.

Table A.2.3 Number of Structure Affected (Type of Construction)

District	Temporary	Semi-Permanent	Permanent	Grand Total
Patan	5	20	3	28
%	17.9	71.4	10.7	100.0

Source: Social survey

Legal status of the structures likely to be affected is presented in **Table A.2.4.** 100% of the affected families are legal titleholders.

Table A.2.4 Legal Status of Structure

District	Title Holder	Lease Holder	Encroacher	Licensee	Squatter	Total
Patan	28	0	0	0	0	28
%	100.0	0	0	0	0	100.00

Source: Social survey

Distribution of families likely to be affected by religion and social categories are presented in **Table A.2.5.** Majority of the affected families belong to Hindu religion.

Table A.2.5 Distribution of Structure Owner Families by Religion

District	Hindu	Muslim	Jain	Buddhist	Christian	Sikh	Others	Total
Patan	24	2	0	0	0	0	0	26
%	62.3	7.7	0.0	0.0	0.0	0.0	0.0	100.0

Source: Social survey

Majority of the affected families are from General Castes (92.3%) followed by Other Backward Castes (7.7%).

Table A.2.6 Distribution of Affected Families by Social Category

District	General	SC	ST	OBC	Total
Patan	24	0	0	2	26
%	92.3	0.0	0.0	7.7	100.0

Source: Social survey

Table A.2.7 presents income data obtained from the Structure Identification Survey. It may be seen that about 81% of the surveyed PAFs have income level of less than or equal to Rs. 5000 per month.

Table A.2.7 Distribution of Families by Income

District	0-5000	5001-10000	> 10001	No Answer	Total
Patan	21	5	0	0	26
%	80.7	19.3	0.0	0.0	100.0

Source: Social survey

Average monthly income level of surveyed PAFs is presented in **Table A.2.8.** It may be observed that the income level of PAFs belonging to General Castes is higher than other castes.

Table A.2.8 Social Category Wise Monthly Income Level (INR)

District	General	SC	ST	OBC
Patan	4604	0	0	3750

Source: Social survey

The number of vulnerable families likely to be adversely affected due to the project has been provided in **Table A.2.9.** A total of 4 families have been identified as socially and economically vulnerable.

Table A.2.9 Affected Vulnerable Families

District	BPL	Disabled & BPL	WHH	Total
Patan	4	0	0	4
%	100.0	0	0	100.0

Note: WHH: Women Headed Household; BPL: Below Poverty Line
Source: Social survey

Number of families and persons affected as a consequence of impacts on structures is presented in **Table A.2.10.** A total of 147 persons belonging to 23 families, including 82 male and 65 females will be affected. Overall the average number of persons per family works out to be 6.3.

Table A.2.10 Project Affected Families (PAFs) & Project Affected Persons (PAPs)

District	PAF	PAP Male	PAP Female	PAP Total
Patan	23	82	65	147
%	-	55.8	44.2	100.0

Source: Social survey

Total surface area affected by the project covering all kinds of structures is provided in **Table A.2.11**. Overall 1,857 m^2 of surface area comprising permanent, semi-permanent and temporary structures would be affected by the project of which **semi-permanent structures comprise the large majority (82.8%).**

Table A.2.11 Surface Area Affected by the Project (in square meters)

District	Temporary	Semi-Permanent	Permanent	Grand Total
Patan	200	1537	120	1857
%	10.8	82.8	6.5	100

Source: Social survey

2.2 ANALYSIS OF SOCIO-ECONOMIC SURVEY RESULTS (20% PAFS)

Socio-economic survey has been carried out though pre-tested structure questionnaire among 20% of the affected structure owners as enumerated during structure identification survey. The head of the family has been interviewed for the socio-economic status of the family. The survey results have been analyzed in light of various social development indicators, which are provided in this sub-section.

Table A.2.12 Occupation of the Surveyed PAFs

District	Agriculture	Business	Daily Wage Labour	Govt. Service	Others	Pvt Service	Wage Employee	Total
Patan	6	0	0	0	0	0	0	6
%	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0

Source: Social survey

Occupation of the surveyed Project Affected Family heads is presented in **Table A.2.12**. All of the surveyed PAPs are involved in agricultural activities.

Table A.2.13 Education of the Surveyed PAFs

District	Can Read	Can Write	Graduate	High School (12th Std)	Illiterate	Primary (5th Std)	Total
Patan	0	2	0	3	1	0	6
%	0.0	33.3	0.0	50.0	16.7	0.0	100.0

Source: Social survey

Education levels of surveyed Project Affected Family heads are presented in **Table A.2.13**. 83.3% of the respondents are literate. 50% of the respondents have attained high school education. It may be noted that the literacy rate in the rural areas of Gujarat state (Census of India, 2001)) is 62.1%. Therefore, the surveyed PAFs in affected villages have higher number of literates than the State average.

Table A.2.14 Roof type of the Affected Structures

District	Concrete	GI Sheets	Nipa	Tiles	Total
Patan	0	2	0	4	6
%	0.0	33.3	0.0	66.7	100

Source: Social survey

Roof type of Project affected houses are presented in **Table A.2.14**. 33% of the affected houses have GI sheet roofs, while 66.7% houses have tilled roofs.

Table A.2.15 Walls of the Affected Structures

District	Brick	Concrete & Wood	Nipa	Wood	Total
Patan	6	0	0	0	6
%	100.0	0.0	0.0	0.0	100

Source: Social survey

Walls type of Project affected houses are presented in **Table A.2.15**. All of the affected houses have brick walls.

Table A.2.16 Distribution of Assets among PAFs

District	Livestock	2 Wheelers	Agricultural Equipments	Consumer durables	4 wheelers
Patan	12	2	6	7	0

Source: Social survey

Distribution of assets among PAFs is presented in **Table A.2.16**. Assets are indicators of the socio-economic conditions of people. Livestock are mostly cow, buffalo, sheep, ox, goat etc. Agricultural equipments include tractors, power tillers, grain thresher and harvesters. Television, refrigerators, electric fans, coolers, geysers, electric ovens, OTGs, microwave ovens, mixer grinders etc are categorised as consumer durables.

Table A.2.17 Requirement of Accessibilities Envisaged

District	No Answer	Road X-ings	ROB	RUB	Service Road	Total
Patan	0	0	0	4	2	6
%	0.0	0.0	0.0	66.7	33.3	100

Source: Social survey

Requirement of accessibilities envisages are presented in **Table A.2.17**. Most of the people have requested for RUB (66.7%), followed by service roads (33.3%).

Table A.2.18 Drinking Water Source of PAFs

District	Common dig well	Common pump well	Private dig well	Private pump well	Public Supply	Total
Patan	0	6	0	0	0	6
%	0.0	100.0	0.0	0.0	0.0	100.0

Source: Social survey

Table A.2.18 shows that all the respondents use common pump well as drinking water source.

Table A.2.19 Toilet Facilities

District	Common Outdoor	Indoor	Not Available	Private Outdoor	Total
Patan	0	3	2	1	6
%	0.0	50.0	33.3	16.7	100

Source: Social survey

Existing toilet facilities are presented in **Table A.2.19**. Half of the affected families have their toilet facilities at their own house (50%).

Table A.2.20 Power Supply

District	Not available	Power line	Private Generator	Total
Patan	2	4	0	6
%	33.3	66.6	0.0	100.0

Source: Social survey

Power supply facilities to the affected PAFs are presented in **Table A.2.20.** About 67% PAFs have electric connections at their houses.

Table A.2.21 Women in Economic Activities

District	Total
Patan	0

Source: Social survey

None of the surveyed PAFs have reported participation of women members from their family in economic activity.

Table A.2.22 Awareness about DFC project

District	No	Yes	Total
Patan	0	6	6
%	0	100.0	100.0

Source: Social survey

Table A.2.23 Source of Information

District	Friend/Relative	News paper	Word of Mouth	No Answer	TV	Total
Patan	0	0	6	0	0	6
%	0.0	0.0	100.0	0.0	0.0	100.0

Source: Social survey

Table A.2.22 and A.2.23 show awareness level among surveyed project affected families about the DFC project and sources from where they have obtained information about the project. All of the surveyed PAPs are conscious about the DFC project and they have obtained the information through word of mouth.

Table A.2.24 Envisaged Benefit from DFC

District	No	Yes	Total
Patan	0	6	6
%	0.0	100.0	100.0

Source: Social survey

Table A.2.25 Type of Envisaged Benefit

District	Business Opportunity	Industry Development	Wage Employment	Others	Total
Patan	2	4	0	0	6
%	33.4	66.6	0.0	0.0	100.0

Source: Social survey

Table A.2.24 provides envisaged benefits from the project by surveyed PAFs and **Table A.2.25** provides the type of envisaged benefits. All of the respondents agreed that this project will bring the economic benefit in their areas. 33.4% respondents expected business opportunity to increase whereas 66.6% respondents anticipated industrial development due to the project.

Table A.2.26 shows anticipated loss of income by the surveyed PAFs. 33.4% respondents anticipated loss of work place while 66.6% PAFs have not anticipated any loss in income due to the project.

Table A.2.26 Anticipated Loss of Income

District	Finding new farmland	Increased commuting time	Loss of farmland	Loss of work place	No Answer	No loss	Total
Patan	0	0	0	2	0	4	6
%	0.0	0.0	0.0	33.4	0.0	66.6	100.0

Source: Social survey

Table A.2.27 Anticipated Difficulty in R&R

District	Acclimatization	Finding Income Source	Finding new farmland	Finding new house	Security issues	Total
Patan	0	2	0	4	0	6
%	0.0	33.4	0.0	66.6	0.0	100

Source: Social survey

Table A.2.27 shows the anticipated difficulty by surveyed PAFs during R&R. 66.6% of the respondents anticipated major difficulty in finding a new house while 33.4% PAFs anticipated difficulty in finding new income source.

Table A.2.28 Choice of House Affected People

District	Can't say now	Constructed Houses	Only replaceable value	Conditional	Self relocation	Total
Patan	0	2	0	4	0	6
%	0.0	33.4	0.0	66.6	0.0	100

Source: Social survey

Table A.2.28 shows choices of affected PAFs on relocation of their residential buildings. 33.4% respondents preferred constructed houses for relocation over other R&R options. 66.6% respondents reserved their opinion on resettlement for the time being.

Table A.2.29 Choice of Place for Resettlement

District	Compensation	Doesn't matter	Same district	Same sub district	Same village	Total
Patan	0	2	0	0	4	6
%	0.0	33.4	0.0	0.0	66.6	100

Source: Social survey

Table A.2.29 shows choices of surveyed PAFs over place of resettlement. Majority of the respondents (66.6%) preferred to be relocated within the same village. 33.4% of the surveyed PAFs are prepared to get resettled at any place decided by the project authorities.

Table A.2.30 Request to Implementing Authority about R&R

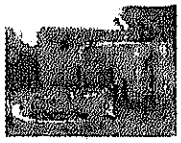
District	Compensation	Compensation and R&R	Total
Patan	6	0	6
%	100.0	0.0	100

Source: Social survey

Table A.2.30 shows the request by PAFs to the implementing authority on R&R. All of the respondents have requested project proponent for timely disbursement of proper compensation against their acquired structures.

PHOTOGRAPHS OF AFFECTED STRUCTURES

1 Vadhana R 1



2 Vadhana R 2

3 Vadhana R 3

4 Vadhana R 4

5 Vadhana R 5

6 Vadhana R 6

7 Vadhana R 7

8 Vadhana R 8

9 Vadhana R 9

10 Vadhana R 10

11 Vadhana R 11

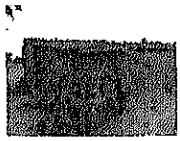
12 Vadhana R 12

13 Vadhana R 13

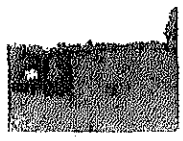
14 Vadhana R 14

15 Vadhana R 15

16 Vadhana R 16



17 Vadhana R 17



18 Vadhana R 18

19 Vadhana R 19

20 Vadhana R 20

21 Kunwara R 1

22 Kakosi R 1

23 Kakosi R 2

24 Kakosi R 3

25 Kakosi R 4

26 Maitrana R 1

27 Maitrana R 2

28 Maitrana R 3

Appendix III-4-1

Handout for the PCM

PUBLIC CONSULTATION MEETING FOR DEDICATED FREIGHT CORRIDOR (DFC) PROJECT

Objective of Public Consultation Meeting:

MOR is implementing DFC Project, which is Multiple High Axle Load Freight Corridor with Computerized Control on the Western Industrial Corridor, connecting from Rewari in Haryana to Vadodara in Gujarat. Its detailed design work is scheduled to begin in the middle of 2009 followed by the 4 -5 years of construction works which should begin by the end of 2019.

MOR is concerned with :

1) The level of understanding and acceptance of DFC Project among the general public living alongside the proposed railway line;

2) Dissemination of information on the project in respect of the likely environmental and social impacts induced by the project;

3) Public Consultation Meeting is to offer opportunities to stakeholders to voice their concern on the project during the planning stage; and

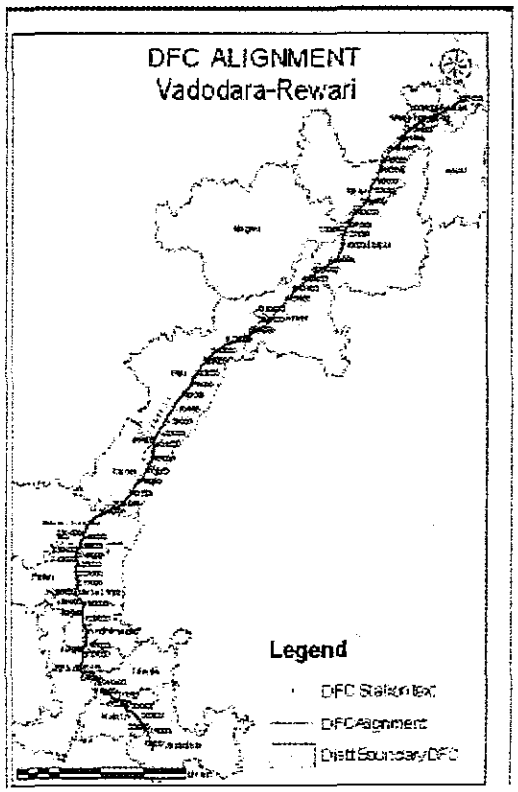
4) Opinions raised during the public consultation meeting are fed-back to the planning process of the Project.

Therefore MOR would like to hold public consultation meeting at this stage of the Project planning.

Project at a Glance:

General Features:

DFC Project in the Western Industrial Corridor runs from Rewari to JNPT, out of which Rewari (Haryana) to Vadodara (Gujarat) section is a total length of 940 km and that the final alignment of this section has been designed.
Upon completion, it runs with electric traction system, double stack containers, and computerized signal system at the maximum speed of 100km/hour.



Economic Impacts:

DFC Project aims to help boosting the present trends of growth of the economy in India. It is designed to carry a total freight of 37.7 million tones in the fiscal year 2013-2014.
At the same time it should create job opportunities and the growth of household income in general for the better interests of the public at large.

Environmental Impacts:

The laws and regulations of EIA in India do not require EIA study for the linear development of railway project. However, as an internationally funded project, all efforts need to be made in the DFC Project for minimizing environmental impacts caused.

The section between Rewari and Vadodara under the final design stage induces various levels of environmental and social impacts in the districts of: 1) Rewari, and Mehendragarh in Haryana; 2) Alwar, Ajmer, Sikar, Jaipur, Pali, Nagaur and Sirohi in Rajasthan; and 3) Banaskantha, Patan, Mahesana, Gandhingar, Ahmedabad, Kheda, Anand and Vadodara in Gujarat.

In Haryana and Rajasthan the alignment runs parallel to the present railway line while in Gujarat it takes a detour to the west of existing railway line in order to avoid major settlements which might cause negative social impacts in Gujarat. Thus considerable number of land owners and households are affected.

In the northern part of Gujarat, the alignment of DFC Project avoids Balaram Ambaji Wildlife Sanctuary and that the alignment runs in the area to the north of the sanctuary.

In the middle of Gujarat, the alignment of DFC Project also avoids Thol Wildlife Sanctuary in Mahesana District and that the alignment runs in the area to the west of the sanctuary.

Project Components:

- Main line construction works in Haryana and Rajasthan. DFC Project line is constructed generally on the eastern/ southern side of the existing railway. The width differs from 30 – 50 m depending on the topography. In Gujarat, the main line is constructed on the 70 m wide embankment so as to avoid railway crossing with the existing road.
- Seven junction and crossing stations of approximately 60 m wide and 1,600 m long each at Makarpura in Vadodara, Sabarmati in Ahmedabad, Mehsana in Mehsana, Palanpur in Banaskantha, Marwar Junction in Pali, Phulera in Jaipur, and Rewari Junction in Haryana.
- Major bridges crossing over important rivers as well as minor bridges; and
- ROB between Bar-Amarpura station in Pali District

Assistance Extended by Japan Bank of International Cooperation (JBIC)

Indian Government made a request of assistance to the Government of Japan, who has sent *SAPROF Study Team* in order to verify the planning process of DFC Project and that CES (India) Private Ltd, New Delhi as local consultants should assist MOR to facilitate the meeting as per JBIC Guidelines on the Environment and Social Considerations.

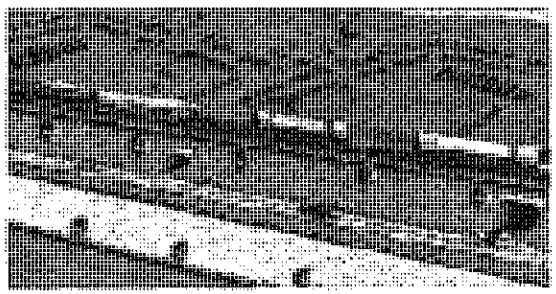
Information Disclosed at Public Consultation Meeting:

To assess and address the likely social and environmental impacts, public consultation meetings are therefore organized in 6 districts of Gujarat, 7 districts of Rajasthan and 2 districts of Haryana.

In these meetings MOR would like to disclose the final DFC alignment, major findings related to social and environmental impacts.
Because of the changes of alignment made after JICA Study Report which was completed in October 2007, there are a number of extra villages identified that are directly affected by the implementation of DFC Project.

Thus focusing on those villages, and as per the above context, we would like to call upon all the stakeholders of the newly identified villages/hamlets, NGO representatives, officials of the local government and opinion leaders having social and environmental concerns relevant to this project, to attend the public consultation meeting scheduled to be held:

Place: .....
Time: from..... to.....
Date: .....

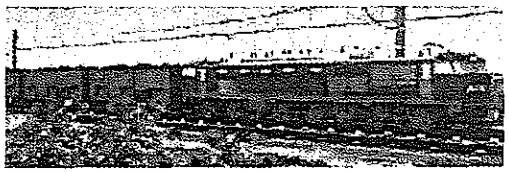


Public Consultation Meeting

For

Dedicated Freight Corridor

(DFC) Project



Ministry of Railway, Railway Bhawan,
New Delhi

Appendix III-4-2 Record of Public Consultation Meeting

Public Consultation Meeting

Rewari, Haryana

Date: 15th October, 2008
Venue: Punjabi Dharamsala, Rewari
Time: 11:00 AM – 13:00 PM

Villagers of the newly identified villages under S-ESIMMS were present. Out of the total 26 villages that are affected by the DFC Project, representatives of 19 villages participated the meeting. Of the attended, all were from new villages identified during the S-ESIMMS. A total of approximately 90 participants including 10 females were present in the meeting. The participants at the PCM were from the below mentioned villages:

1. CHILLAR
2. BHURTHAL THEIHAR
3. BHURTHAL JAT
4. GANGAYACHA AHIR
5. SHEKHPUR SHIKARPUR
6. RAJPUR KHALSA
7. GINDO KHAR/KINDO KHAR
8. LAKHNOR
9. JADARA
10. BANGARWA
11. MAHA KHARIA
12. SUNDROD
13. DHANI SANTO
14. DHANI SUNDROD
15. PITHERAWAS
16. GUMINA
17. RAJPURA ISTAMRAR
18. KHORI
19. MAMARIA THETHAR

Only Mailawas Village had no representative in the PCM.

Power point presentation of the DFC Project, covering alignment of DFC Project, summary of Social and Environment Impact Assessment including environmental management and mitigation plan and key elements of the Railways (Amendment) Act 2008 and National Rehabilitation and Resettlement Policy 2007 were discussed in vernacular (Hindi) language.

Issues Raised by Participants
Various issues raised by participants are as follows:

1. Majority of people were interested to know about the **compensation rate** and **resettlement** and **rehabilitation** measures that would be offered by the first participant. They wanted to know the specific answer with respect to these issues. Some of the participants informed that the present market rate of land in the affected area is close to Rs. 10,000,000/per acre.
2. A few participants cited the **example of Rewari-Jhajjar-Rohtak** railway line project for which land was acquired in recent past. One of the affected persons of the said project informed that Rs. 2,400,000/- per acre was paid as compensation which was more or less close to prevailing market price in the area. Compensation less than the prevailing market rate would not be acceptable as participants contended. If not, the project would face resistance and warned of taking recourse of court. Some of the participants also provided examples of Nandigram and Singur in West Bengal (Tata's Nano project)
3. A few participants raised questions on the **proposed alignment** and wanted to know why the alignment has been fixed in zig-zag manner i.e, the logic of fixing the alignment. Several participants disagreed with the explanation provided by the SAPROF representative as engineering concern. Few participants also suggested **alternate the alignment** instead of the proposed one.
4. **Severance of land acquisition** due to DFC Project is the local participants' concern. Participants were of the opinion that a plot is bisected into two parts spoils the value of land and hence some additional measures should be provided to those land owners whose land is severed due to the project.

5. **Accessibility problems** such as taking of agricultural instruments, tractor and animal etc. to other side of the railway line would become a problem. Majority of people were interested to know how the project has addressed these issues and what built-in provisions have been made in the project.
6. One of the female participants made the request that alternative arrangements for resettlement and rehabilitation should be made **before dismantling** the structure affected by the project.
7. One of the participants **from Scheduled Castes category** enquired about any special provision for **vulnerable** community.
8. Several participants demanded that there should be provision of **employment** for at least one member of the project affected families and compensation must be paid at the prevailing market rate and not the circle rate.
9. Provision of **royalty from Haryana Government** is paid to land losers for 33 years. Some of the participants enquired whether the same would apply for DFC Project section in Haryana.

Major Outcome of the Meeting

1. Majority of participants requested for a re-consideration of the alignment.
2. Participants demanded a clear answer with respect to the details on compensation for land acquisition and resettlement and rehabilitation.
3. Compensation should be based on the prevailing market rate.

Others

Upon completion of the meeting, Haryana News (TV) channel took interviews of SAPROF representatives and few participants after the public consultation meeting was over.

Public Consultation Meeting

Gandhinagar, Gujarat

Date: 16th October, 2008
Venue: Rotary Club, Kalol, Gandhinagar District, Gujarat. (GPS coordinates: 72 29 37 E, 22 14 03 N)
Time: 11:00 – 13:00

Besides the SAPROF study team members, Mr. Rankawat, GM, DFCCIL, Ahmedabad Division, along with his team members, Mr. Shrivastav and Mr. Pawan Kumar attended the meeting. Raju Bhai of Jeevan Tirth, a Gandhi Nagar based NGO made the vernacular-Gujrati presentation. A total of approximately 50 participants were present in the meeting.

Villagers from 8 newly identified villages under the S-ESIMMS were present. Village representatives from earlier village, Kasindra which is identified during the JICA F/S Study participated in the meeting. Out of the total 16 villages that are affected by the DFC Project, representatives of 9 villages participated the meeting. Of the attended, 8 villages are new villages identified during the S-ESIMMS and 1 Village- Kasindra is the old village identified during the JICA F/S Study and is excluded from the S-ESIMMS. The participants of the PCM are from the villages of:

1. CHHATRAL
2. PIYAJ
3. RAMNAGAR
4. KHATRAJ
5. SANAVAD
6. KAROLI
7. VANSJADA
8. JETHLAJ
9. BHOYAN MOTI
10. KASINDRA

Power point presentation of the DFC Project, covering alignment of DFC Project, summary of social and environment impact assessment including environmental management and mitigation plan and key elements of the Railways (Amendment) Act 2008 and National Rehabilitation and Resettlement Policy 2007 were discussed in vernacular language of Gujarati.

Issues Raised by Participants

1. DFC Project should go **along the existing railway line**. Many opposed the detour which goes through fertile agricultural land. This area is one of the most fertile patches of Gujarat, any loss of agricultural land due to project is irreplaceable.
2. Participants were of the opinion that division of a plot into two parts spoils the value of land and hence some additional measures should be provided to those land holders whose land is severed due to the project.
3. Many pointed out that **unlike road projects** where adjoining land to new or upgraded roads fetch higher market price for land, in case of railway projects, it is generally just the opposite scenario. There was premonition that the **land price would drop** in the adjoining land area as DFC Project is implemented. Mr. Rankawat of DFCCIL defended by stating that DFC Project and associated industrial development along the corridor might increase land price in future.
4. **Accessibility problems** such as taking of agricultural instruments, tractor and animal etc to other side of the railway line should occur if the land was split into two parts. Thus there must of a provision of facilities on the embankment that enable farmers moving from one side to another. Majority of people were interested to know how the project has addressed these issues and what built-in provisions have been made in the project.
   The Railway Authority replied that provision of water pipeline from one side of the railway line to other side is made. **Implementing Authority would provide such facilities free of cost only if they are intimated well before time.**
5. Whether there would be any special provision for **marginal and small farmers** who would be affected by the DFC Project should be clearly stated in the resettlement plan.

6. Several participants demanded that there should be a provision of **employment** for at least one member of the project affected family and compensation must be paid at the **prevailing market rate and not the circle rate.**
7. **Retention of "farmer's title"** by some certificate or by-law should be made so that he can buy agricultural land in future even when he ceases to have any agricultural land lost due to the DFC Project.
8. Many demanded **land for land** in case of land acquisition.
9. There was a general demand for **underpass at regular intervals** on the embankment of the railway so that farmers could cross from one side to the other without hassle.
10. Majority of people were interested to know about the **compensation rate** and **resettlement and rehabilitation** measures that would be offered. by the competent authority.
11. The most sensitive area is Khatraj, **a small industrial area where DFC Project's alignment goes through. The alignment should be changed.**
12. The presence of DFCCIL representative in the meeting lends authenticity and their explanations to the participant's queries and his formal and informal interactions with the participants made the PCM a success. They also informed that the complete report with survey numbers have been submitted to the District Collector on 15th October, 2008 for his approval and it can be expected that notification would be issued within a month's time. Participants were made aware that all leading newspapers would carry the details of the land plots to be acquired and any complaint against the project can be officially filed within a month to the competent authority.

Major Outcome of the Meeting

1. Majority of participants requested for parallel alignment and demanded are-routing of the Project.
2. Loss of agricultural land should be compensated by the same quality of land or the market rate should be the basis of compensation.
3. Contents of the Resettlement and Rehabilitation Plan is not clear except for which the embankment of the Project would provide RUB, drainage, local road along the embankment.

Media Coverage

The local news papers covered the public consultation meeting.

Public Consultation Meeting

Ahmedabad, Gujarat

Date: 16th October, 2008
Venue: Saurashtra Sthanakvasi Jain Vadi Hall, Sanand District, Gujarat.
GPS coordinates: 72 22 50.3 E, 22 59 22.8 N.
Time: 14:30 – 17:00

Besides the SAPROF study team members, Mr. Rankawat, GM, DFCCIL, Ahmedabad Division, along with his team member of Mr. Shrivastav and Mr. Pawan Kumar attended the meeting. Raju Bhai of Jeevan Tirth, a Gandhi Nagar based NGO made the Gujarati language presentation. A total of 140 participants were present in the meeting.

Villagers from 15 newly identified villages under the S-ESIMMS were present. Out of the total 16 villages that are affected by the DFC Project, representatives of mostly the new villages participated the meeting. The participants at the PCM were from the below mentioned villages:

1. GARODIYA
2. GODHAVI
3. NIDHRAD
4. KANETI
5. SANAND
6. PIPAN
7. MOTI DEVTI
8. NANI DEVLI
9. PALWADA
10. MODASAR
11. MATODA
12. RAJODA
13. KAVITHA
14. BHAT
15. BADARKHA

Power point presentation of the DFC Project, covering alignment of DFC Project, summary of social and environment impact assessment including environmental management and mitigation plan and key elements of the Railways (Amendment) Act 2008 and National Rehabilitation and Resettlement Policy 2007 were discussed in vernacular language of Gujarati.

<u>Issues Raised by Participants</u>

1. **Retention of "Farmer's Title"** by some certificate or by-law should be made so that he can buy agricultural land in future even when he ceases to have any agricultural land lost due to DFC Project.
2. Many had family sentiments attached to their **ancestral land** so no money could compensate that.
3. Many pointed out that **unlike road projects** (eg. of **ring road** around Ahmedabad-Gandhinagar) where adjoining land to new or upgraded roads fetch higher market price for land, in case of railway projects, it is generally just the opposite scenario. There was premonition that the **land price would drop** of the adjoining land plots as a result of the implementation of the DFC Project. Mr. Rankawat of DFCCIL defended by stating that DFC Project and associated industrial development along the corridor might increase land price in future.
4. There was a general concern as how to cross the DFC Railway in case their land was bisected. There was demand for **underpass at regular intervals** so that farmers could cross from one side to the other without hassle. To this Mr. Rankawat answered that the **implementing authority would provide such facilities free of cost only if they are intimated well before time.** He cited examples from his past experiences where he had undertaken such tasks.
5. Many farmers pointed out that they have already **invested a lot of money on irrigation,** (drip irrigation, lift irrigation etc,) and DFC Project affected farmers would incur huge loss due to the project. They requested the implementing authority to address this problem.

6. There was apprehension that DFC Project would trigger off **flooding** in the adjoining lowland. Mr. Rankawat answered that proper drainage along the service roads would be provided to combat such natural hazard.
7. It was emphasized that this area is one of the **most fertile area** of Gujarat where **vegetables, fruits like papaya, banana and sugarcane** are grown extensively and marketed all over North India. For 1 acre, papaya worth 2 lakh is sold by the farmer in one season. Thus lifetime loss of orchard should be compensated.
8. The **role of middlemen** in selling agricultural produce should be curtailed and any benefit due to DFC Project made out for affected persons should be **direct and transparent.**
9. Most people **objected to training** as an option for rehabilitation measure. They emphasized that they are farmers for generations and have no other skill for livelihood supplement and were not interested to take up any other livelihood.
10. Whether there would be any special provision for **marginal and small farmers** who would be affected by the DFC Project should be clearly stated in the RRP policy.
11. Several participants demanded that there should be provision of **employment** for at least one member of the project affected families.
12. Participants were of the opinion that division of a plot into two parts diminishes the value of land. In most cases, the left-over portion of land holding becomes **uneconomic and unfit** for farming and also for re-sale. The implementing authority should then consider the **entire land is acquired** and calculate compensation and assistance accordingly, even though the entire land might not be acquired.

Major Outcome of Consultations

Majority of participants requested:

1) Parallel alignment along the existing railway should be the option and the participants demanded re-routing of the alignment of the Project.
2) Compensation package is not clear at all. PAPs should be appropriately compensated for which a sustainable period of good standard of living is possible to maintain if the Project is implemented.
3) Compensation of the perennial crops should be considered for their life time.
4) Farmer's title should be retained upon sale of land in order to purchase agricultural land elsewhere and resume agriculture.
5) No job training is necessary since the local area is agricultural area. Upon resettlement agriculture as our vocation should be ensured by the laws and regulations.
6) The presence of DFCCIL representative in the meeting lends authenticity and Mr. Rankawat's explanations to the participant's queries and his formal and informal interactions with the participants made the PCM a success.

Media Coverage

The local news papers covered the public consultation meeting.

Public Consultation Meeting

Kheda, Gujarat

Date: 18th October, 2008
Venue: Agricultural Produce Marketing Committee, Kheda District, Gujarat
(GPS coordinates: 72 41 3.7" E, 22 44 56.5" N)
Time: 11:30 - 13:00

Besides the SAPROF study team members, Mr. Pawan Kumarof DFCCIL, Ahmedabad division attended the meeting. Raju Bhai of Jeevan Tirth, a Gandhi Nagar based NGO made the vernacular-Gujarati presentation. A total of approximately 50 participants were present in the meeting.

Villagers from 7 newly identified villages under the S-ESIMMS were present. Out of the total 18 villages that are affected by the DFC Project, representatives of mostly the new villages participated the meeting. The participants at the PCM were from the below mentioned villages:

1. KATHWADA
2. CHALINDRA
3. NAIKA
4. SHETRA
5. VASNA BUJARG (old)
6. MATAR
7. GARMALA
8. HARANJ

Power point presentation of the DFC Project, covering alignment of DFC Project, summary of social and environment impact assessment including environmental management and mitigation plan and key elements of the Railways (Amendment) Act 2008 and National Rehabilitation and Resettlement Policy 2007 were discussed in vernacular language of Gujarati.

Issues Raised by Participants

The attendance at the meeting was comparatively poor than Sanand and Gandhinagar. This may be because of two reasons:

a) The new villages that would be affected by the DFC Project were relatively far from the venue at Kheda Township;
b) Two villages presently identified affected during the S-ESIMMS are the old villages of Vasna Bujurg and Govindpura. The Sarpanch of Vasna Bujurg came to attend the meeting but when he was told that no survey number of affected land would be disclosed here, he left quite agitated and also compelled the Sarpanch of Govindpura to leave the meeting with him. It is assumed on this basis that they might have dissuaded many other village heads not to attend the public consultation meeting as a mark of protest against the Project.

Issues Raised by Participants

1. Whether there would be any special provision for marginal and small farmers who would be affected by the DFC Project was the first issue raised at the meeting.
2. There was a question if **70 m wide of land have been proposed for ROW.** DFC Project should manage with less land i.e. less impact.
3. There was an **objection on the embankment** of DFC Project as that might induce more flooding with associated drainage problems. Participants mentioned that **Kheda is a district with 7 rivers** and **flooding is an annual phenomenon**. Water logging is a problem for 2-3 months in a year in this part of Gujarat.
4. How the implementing authority would address the **problem of accessibility** and how to cross the railway in case the land was bisected. There was general concern as to how would the water and electricity pipeline be connected to the other side of the field in case their land was bisected by the DFC Project. **Implementing authority would provide such facilities free of cost only if they are intimated well in advance.**

5. The flood problem is a chronicle problem in Kheda because of heavy rains, low-lying basin and also poor drainage. The general opinion of the participants was that with DFC Project this problem would be further aggravated. The local people have put their petition on this problem forwarded **to the MOR.** DFCCIL staff replied that Project Authorities would solve the problem with engineering design by keeping provision of drainage canals along the corridor and also embankments on either side of bridge.
6. Villagers are ready to migrate and re-settle in other areas because of the flood problems.
7. No villagers are interested in monetary compensation. Land for land was the preferred option.
8. **Retention of "Farmer's Title"** by certificate or by-law should be made so that farmers can buy agricultural land in future even when he ceases to possess any agricultural land as a result of DFC Project implementation.
9. Villagers have stated that DFC Project would no doubt induce industrial development but no improvement for farmers and so they opposed the project. Unless there was appropriate agricultural development plan, many threatened to fast unto death.
10. A few villagers have mentioned the issue of indirect impact to farmers in respect of hindrance to accessibility to their farmland, disruption of water accessibility and drainage, etc. The question was whether they would be considered within the project affected persons.
11. The general mood of the participants was against the project and many left the meeting before it was over.

Major Outcome of consultations

Majority of participants requested:

1. Agricultural development should be associated with DFC Project, which is a part of industrial and commercial development. There must be appropriate development plan for farming communities;
2. Parallel alignment along the existing railway should be the option and the participants demanded re-routing of the alignment of the Project.
3. Compensation package is not clear at all. PAPs should be appropriately compensated for which a sustainable period of good standard of living is possible to maintain if the Project is implemented.
4. Compensation of the perennial crops should be considered for their life time.
5. Farmer's title should be retained upon sale of land in order to purchase agricultural land elsewhere and resume agriculture.
6. No job training is necessary since the local area is agricultural area. Upon resettlement agriculture as our vocation should be ensured by the laws and regulations.
7. Flood incidents in the district should worsen upon implementation of the Project. Whatever the government promises, they always make mistakes and the farmers are always victimised.

Public Consultation Meeting

Anand, Gujarat

Date: 18th October, 2008
Venue: Surya Temple Complex, Borsad, Anand (GPS coordinates: 72 54 20.2" E, 22 24 53.6" N)
Time: 14:00 – 17:00

The meeting started at 2:00 p.m. Besides the SAPROF study team members, Mr. A.S. Chaudhary and L.R. Maurya of DFCCIL's Vadodara division attended the meeting. Raju Bhai of Jeevan Tirth, a Gandhi Nagar based NGO made the vernacular-Gujarati presentation. A total of approximately 80 participants were present in the meeting.

There are 11 villages participated the meeting. Villagers from 9 newly identified villages under the S-ESIMMS were present, out of the total 30 villages that are affected by the DFC Project. The participants at the PCM were from the below mentioned villages:

1. Deva Vanta
2. Run
3. Petlli
4. Sandesar
5. Boriya
6. Meghva Gana
7. Khandhali
8. Napad Vanto
9. Betasi Ka Bagh
10. Bhaganpure
11. Ambali

Issues Raised by Participants

At the initiation of the meeting, several participants complained that many villages that would be affected by the DFC Project have not been intimated of this public consultation meeting. It was explained to them that newly identified villages that they would be affected were of priority for this time of PCM. These new villages were intimated by CES's staff visiting to each individual village head and distributed the leaflet and the letter along with it. As for the old villages identified during the JICA F/S Study, all village heads were contacted over telephone and intimated of the purpose of PCM. Project authorities would take further measures to disseminate information on the Project as notification is issued.

Various issues raised by participants are as follows:

1. Participants questioned the basis of estimated number of PAPs if it would be on the conservative side. CES replied that the number of PAPs was based on SIA information while it is still preliminary information and that it would be bound to differ when detailed survey result was released.
2. Whether there would be any special provision for **marginal and small farmers.**
3. How the project authorities would addressing the **problem of accessibility** and how to cross the DFC railway in case their land was split into two areas. There was general concern as to how would the water and electricity pipeline be connected to the other side of the field in case the land was bisected. **The Project Authority would provide such facilities free of cost only if they are intimated well in advance.**
4. Many **objected to the high embankment** of the DFC Corridor as that might induce more flooding with associated drainage problems.
5. One participant requested to establish a DFCCIL Office if another should be established in Anand.
6. Market rate for compensation, circle rate not acceptable should be the commitment of the Project Authorities. DFCCIL representative explained if any PAP could produce evidence of transaction at market rate, similar compensation package would be considered to provide.
7. Betasi ka Bagh village's representative stated that about 15 structures near the temple (all permanent) would be affected by the DFC Project. They requested for re-alignment of the Project.

8. DFCCIL representative mentioned that this kind of PCM was held for the first time to those newly identified villages for gathering public opinion. While they would take care of social and engineering concerns, the District administration would take care of compensation and related issues.

Major Outcome of consultations

The following is a major outcome of the meeting:

1. Majority of participants requested for re-alignment of the project;
2. Appropriate compensation for land acquisition based on the market rate should be made for resettlement;
3. Details of the resettlement and rehabilitation plan is not quite clear for the PAPs;
4. Flood incidents should increase upon implementation of the Project. Appropriate and explicit measures to avoid worsening flood incidents are not clear. Detailed drawing etc. should be presented.

Public Consultation Meeting

Vadodara, Gujarat

Date: 21st October, 2008
Venue: Sanskruti Party Plot, Bil village, Vadodara District (GPS coordinates: 73 07 57.1 E, 22 15 58.5 N)
Time: 11:00 – 13:30

Besides the SAPROF study team members, Mr. Pradeep K. Rai and Mr. Rajesh B. Shroff of DFCCIL, Vadodara Division, attended the meeting. Raju Bhai of Jeevan Tirth, a Gandhi Nagar based NGO made the presentation in vernacular language of Gujarati. A total of approximately 100 participants were present in the meeting.

Villagers from the area affected by the alignment of DFC Project, including the old villages that are identified during the JICA F/S Study have been invited. The following is the villages that have attended the PCM:

1. TRIKANPURA
2. JESSORE PURA
3. KRISNA NAGAR
4. SEVASI
5. MAHAPURA
6. BHAYALI
7. GOKULPURA
8. SAMIYALA
9. JEEVARI
10. BIL
11. CHAPAD
12. KHALIPUR
13. VARNAMA
14. VADASALA
15. KARALI
16. ITOLA

The villages which had no representative in the meeting are mostly located at northern part of the alignment such as Anagadh, Kotna, Sherkhi, Alamgir, and Maretha.

Power point presentation of the DFC Project, covering alignment of DFC Project, summary of social and environment impact assessment were discussed in vernacular language of Gujarati.

Issues Raised by Participants

Various issues raised by participants are summarised as follows:

1. Hasmukh Patel, District Secretary of farmers' union and advocate by profession interrupted several times and was most vocal. He voiced the opinion on behalf of most farmers. The present alignment he stated, is passing through dense residential area which would soon be engulfed by the ever-expanding area of Vadodara Urban Development Authority (VUDA). He stated that the DFC Project would become in the area within the "would-be extended city limits" in 50 years from now. Since this would be high speed train corridor, it would entail disturbance to future city dwellers in many ways.
2. He also said that here the market rate is measured in square feet and the implementing authority would not be able to give that much compensation.
3. He further stated that only farmers suffer due to such developmental projects. In reality, big industrial and business houses benefit from such projects, not the farmers.
4. Few complained that request made by GEB (Gujarat Electricity Board) to pass the electric line across the narrow gauge railway line connecting to Padra from Vadodara is not allowed. If this was the case how could GEB trust that implementing authority of DFCCIL would allow electricity line to go across the railway as DFC Project is implemented.
5. Many stated that their past experiences with such developmental projects like Narmada Dam/Canal has been bitter. Since what the government promised to do have never been kept, the farmers had no benefit from such projects. So the local farmers oppose the DFC.

6. Many suggested that alternative alignment should be proposed so as to avoid all settlements in Vadodara District. Alternative route should be laid down in the coastal region.
7. Participants are unanimously agree of the opinion that the 600 m wide land that runs up to Delhi acquired by VUDA for multiple project use approximately 18-20 years ago should be utilized since it has been kept idle to date. The area should be fruitfully utilized by the DFC Project. This fact however needs ground verification. Participants were agitated with the lack of coordination between the local and central government agencies resulting in the misery of farmers.
8. Many warned that circle rate was not acceptable for land acquisition and they would not settle for anything less than the prevailing market price of land.
9. Quite a few of the participants pointed out that agricultural land has been acquired by either the State or Central Government in the past for such developmental projects like DFC Project. Thus very little land is left with original farmers to practice cultivation. Thus the local farmers are in no mood to further sacrifice their land to DFC Project.
10. The process of acquiring land should be transparent. This is another allegation against the Ministry of Railways that it first starts acquiring a narrow strip of land and then gradually increases its need to acquire more land in the name of development.
11. Some participants raised the issue of indirect impact that would occur to many farmers due to the project by losing access to their fields, or sharing irrigation facilities etc. The implementing authority should have some provision for them.
12. Retention of "Farmer's Title" by certificate or by-law should be provided so that he can buy agricultural land in future even when he ceases to have any agricultural land due to DFC Project.
13. There was apprehension that DFC Project would trigger flooding in the adjoining lowland area. To this DFCCIL personnel answered that proper drainage along the service roads would be provided so as to combat such natural hazard.
14. There should be special provision for marginal and small farmers who would be affected by the DFC Project.
15. Several participants demanded that there should be a provision of employment for at least one member of the project affected families.
16. Severance of land acquisition due to DFC Project should be considered very important. Participants were of the opinion that division of a plot into two parts diminishes the value of land. In most cases, the left over portion of land becomes uneconomic and unfit for farming and also for re-sale. The implementing authority should therefore consider the entire land is acquired and calculate compensation and assistance accordingly, even though the entire land might not be used.
17. DFCCIL representative Mr. Pradeep Rai explained the logic behind the present alignment and why there was no scope to shift further towards the sea as suggested by several participants. He explained that since DFC Project would be a heavily loaded double-stuck container train operation and the axle load of the track would need stable and solid base soil, shifting alignment close to the sea is not technically viable. On the other hand, he agreed to take a look at the urban development map of Vadodara for further design study.

Major Outcome of the Meeting

The participants requested for:

1. The alignment of DFC Project should be re-aligned so as to avoid the urban area of Vadodara;
2. Participants opposed the Project and refused to hear major SIA and EIA findings;
3. Participants were not ready to hear anything about the land acquisition process under Railways Amendment Act 2008;
4. Participants warned JBIC to withdraw their commitment for this project as their investment would go waste since no farmer would give up their land;
5. If JBIC did not withdraw from DFC Project, they would protest the Project in a way what happened in Singur of West Bengal State.

Media Coverage

Local news papers – Dainik Bhaskar and Gujarat Samachar covered the public consultation meeting along with local TV news channel who also took interview of SAPROF team members.

PUBLIC CONSULTATION MEETING

Mahesana, Gujarat

Date: 22nd October, 2008
Venue: Baroj Mata Temple Hall, Unjha (GPS coordinates: 72 23 5.3 E, 23 48 15.8 N)
Time: 11:00 – 13:00

Besides the SAPROF study team members, Mr. Shrivastav of DFCCIL, Ahmedabad division, attended the meeting. Station Master of Mahesana could not attend the meeting but he requested the station master of Unjha, Mr. Meena to attend. Mr. Raju Bhai of Jeevan Tirth, a Gandhi Nagar based NGO made the presentation in vernacular language of Gujrati.

A total of approximately 50 participants were present in the meeting. Most of the newly identified villages were present in the meeting. The villages that had representation in the PCM are:

1. VISNOL
2. AMUDH
3. SUNAK
4. DABHI
5. ALODA
6. HARDESAN
7. NUGAR
8. KARSHANPURA

The villages which have had no representative in the meeting are, Indrad, Irana, Rajpur, Kherpur, Nandasan, Mathasur, Ganeshpura, Dhanali, Tundali, and Baliyasan.

Power point presentation of the DFC Project, covering alignment of DFC Project, summary of social and environment impact assessment as well as environmental management programme, mitigation measures and monitoring programme were discussed in vernacular language of Gujarati.

Issues Raised by Participants

Issues raised during the public consultation meeting are as follows:

1. **Tube-wells getting affected** by the DFC Project. This is a complex issue as approximately 60-70 families depend on one tube-well for mainly irrigation purposes while the farmer owning the well would be compensated i.e. tube-well users are forced to find other sources of irrigation water. Participants therefore questioned what provisions would be provided for farmers who would **not be directly affected** by DFC Project but are dependent of tube-well irrigation system.
2. There was a question whether there would be any special provision for **marginal and small farmers** who would be affected by the DFC Project.
3. **Retention of "Farmer's Title"** by certificate or by-law is requested so that he can buy agricultural land in future even when he ceases to own any agricultural land due to DFC Project.
4. People of Mahesana District practise animal husbandry. When the land is lost, they are forced to sell milk cows, which is very difficult to sell. Thus the loss of land for grazing area as well as farming area **the significant loss of livelihood** should be experienced.
5. Since **animal husbandry** is an activity which all farmers are engaged along with vegetable farming, many argued that their **loss of land would be felt double** as with land acquisition not only do they lose land for **cultivation** but also they are not able to **rear animals.** It was roughly estimated that on an average 10 animals are bred per family and average income from milking them is IRP. **20,000/ per month.** So when implementing authority estimates compensation, this should be taken into account.
6. Many pointed out that even if they are compensated, it would be a one time payment which most likely would be spent in very short period. Many questioned if any **share of DFCCIL** would be available to the affected persons just like pension to retired officials.
7. Participants demanded that **compensation** should be paid by competent authority **before any land acquisition** takes place.
8. Many questioned about **Japanese investment** for the DFC Project if it was only technical cooperation or including financial contribution. Role of JBIC was then explained by SAPROF Study team member.

9. Participants of the meeting demanded **land for land** as compensation. The participants clearly stated that no monetary compensation could suffice for the land acquired.
10. Many stated that their past experience with such developmental projects **has been bitter.** The farmers had no benefit from such projects and no promises made by the government were realized. Thus the participants opposed DFC Project.
11. Many warned that **circle rate was not acceptable** to them for compensation of land acquisition. The participants stated that they would not settle for anything less than market price of land.
12. There was general apprehension that with DFC Project **land price** of adjoining land would **decline.**

Major Outcome of Meeting

The following summarises the major outcome of the meeting:

1) Land acquisition due to DFC Project could induce greater impacts than other districts due to the loss of land because of the milk cows are forced to sell if alternative land was not readily available;
2) Provision of employment to every PAF should partially solve the problem of the loss of livelihood;
3) Compensation for land acquisition should be made based on the prevailing market rate or land to land compensation should be considered. Unless otherwise appropriate compensation is made, the local population should unanimously oppose the project;
4) Details of resettlement and rehabilitation plan are not clear. Explicit resettlement package should be presented.

Media Coverage

Local news paper of "Sandesh" covered the public consultation meeting.

Public Consultation Meeting

Patan, Gujarat

Date: 22nd October, 2008
Venue: APMC Hall, Siddhpur (GPS coordinates: 23 55 28.8 N, 72 22 4.2 E)
Time: 16:00 – 18:00

Besides the SAPROF study team members, Mr. Shrivastav of DFCCIL, Ahmedabad Division, was present in the PCM. Also the Station Master of Siddhpur, Mr. P.A. Chauhan presided over the meeting. Raju Bhai of Jeevan Tirth, a Gandhi Nagar based NGO made the presentation in vernacular language of Gujarati. A total of approximately 65 participants were present in the meeting.

Representation from all newly affected villages due to the changes of alignment was relatively high. The villages that had representation in the PCM are:

1. KAKOSI
2. METRANA
3. RASULPUR
4. THAKRASAN
5. DETHLI
6. NEDRA
7. DERASANA
8. KANI
9. VISAL VASNA
10. RUVAVI
11. MANUND
12. PALASAR

Power point presentation of the DFC Project, covering alignment of DFC Project, summary of social and environment impact assessment as well as environmental management programme, mitigation measures and monitoring programme were discussed in vernacular language of Gujarati.

<u>Issues Raised by Participants</u>

Issues raised by participants are as follows:

1. The meeting started with one participant who prepared a **hand written memo** containing several issues on problems induced by the project, expected impacts and suggestions for possible solutions. He stated that the villagers in Patan are aware of **the negative environmental impacts** due to project implementation. He explained about the various environmental mitigation measures that would have to be adopted in this project – some standard ones and some especially designed for DFC. He also raised the issue of **monitoring the social and environmental impact** due to DFC Project implementation and that he demanded that NGOs should undertake periodical monitoring to assess the impact of the project.
2. A few villagers charged of **corruption against the revenue officials** who would actually be involved in the distribution of compensation from the competent authority.
3. Others also alleged that post acquisition of land if railway authority would **sell the acquired land to private parties.**
4. Most of the participants preferred an option of **land for land compensation.** When they were cautioned that they might not get good quality land, most of them agreed that whatever available land was given to them, they would accept only after the land was developed to a standard fit for cultivation.
5. Many warned that **circle rate was not acceptable** for compensation of land. They would not settle for anything less than prevailing market price of land. Prevailing market rate was 125 % more than the circular rate.
6. Another participant suggested that there already exists an **unused metre gauge railway line connecting Kakosi to Patan.** It is almost parallel to the existing line and suggested that this should be used in order to avoid land acquisition.
7. Since this area is rich in cash crops like wheat, bajra, cotton, castor oil etc. which are mostly sent across entire India, there was a **demand for a loading station at Siddhpur.** It was estimated that annually Rs.1,000 crore worth of cash crops are traded at Siddhpur.

DFCCIL replied that a provision of **4 junction stations** - Palanpur, Mahesana, Sabarmati and Vadodara - have been planned to construct. They should cater for the local traffic of commodities. These junction stations could serve the entire Siddhpur zone in Patan District.

8. Provisions to address **vulnerable families** who would be affected by DFC should be clearly stated.
9. Suggestion for **alternative alignment** which would pass through vacant village land in **Rasulpur** Village. It is an unproductive vacant land in the southeast corner of tbe village.
10. There was a request to run **passenger trains on the DFC Project's railway** track. DFCCIL staff explained that this was a dedicated freight corridor for goods train. More passenger trains could be added to the existing railway as goods trains are reduced from the existing railway.
11. **Retention of "Farmer's Title"** by certificate or by-law should be considered so that a farmer can buy agricultural land in future even when he ceases to own any agricultural land due to DFC Project.
12. There was a general apprehension among the participants that, with DFC Project, **land price of adjoining land would decline.**

Major Outcome of the Meeting

The following is a major outcome of the meeting:

1. Participants were made aware of the various aspects of Railways (Amendment) Act, 2008 while they asserted that prevailing market rate should be the basis of compensation for land acquisition;
2. It is not quite clear, during the design work, if there was a thought that land acquisition should be minimised by using the land belongs to Indian Railway.
3. Appropriate environmental management and monitoring plan with NGOs employed for it is inevitable.
4.

Media Coverage

"The Times of India" covered the public consultation meeting.

Public Consultation Meeting

Banaskantha, Gujarat

Date: 24th October, 2008
Venue: Thakkar Bapa Hall, Palanpur, (GPS coordinates: 24 09' 57.7" N, 72 26' 9.2" E)
Time: 11:00 – 13:00

Besides the SAPROF study team members, Mr. Shrivastav of DFCCIL, Ahmedabad Division, was present in the PCM. Also the station master of Palanpur, Mr. Babulal Shrimani presided over the meeting. The District collector of Banaskantha, Mr. R. J. Patel attended the meeting and addressed the gathering at the end of the public consultation with much applause.

A total of approximately 70 participants were present in the meeting. Most of them are the representatives of newly identified villages during the S-ESIMMS. The villages that had representation in the PCM are:

1. KHUNIYA
2. GHANGHU
3. JUNI ROH SAROTRI
4. ZANZARVAV
5. JETHI
6. MALANA
7. PAKHANWA
8. LUNWA
9. PARPADA
10. CHADOTAR
11. KHODLA
12. AKASAN
13. GATHAMAN
14. BADARPURA
15. CHANGWADA
16. CHANGA
17. BASU

A few villages that are identified during the JICA F/S Study period such as Amirgadh, Dungarpura, Bantawada, Pirojpura and Meta are not present.

Power point presentation of the DFC Project, covering alignment of DFC Project, summary of social and environment impact assessment including environmental impact mitigation measures, environmental management and monitoring plan was made in vernacular language of Gujarati followed by question and answer session.

<u>Issues Raised by Participants</u>

Various issues raised by participants are summarised as follows:

1. Almost all the participants **protested the detour** alignment of DFC Project. They questioned whether the available ROW of railways is really insufficient to accommodate the DFC Project. Most participants demanded to keep the **alignment parallel** to the existing railway line. Suggestion was made to use the unused railway line from Porbander to Deesa which is lying idle.
2. Demand for employment in DFC Project was made from project affected families.
3. Most farmers preferred option of **land for land compensation.**
4. The issue of land bifurcation due to the project implementation and the provisions of measures suggested by the implementing authority in order to solve the issue were addressed.
5. The issue of tube wells serving not one but many families was addressed. What provisions should the authority provide to such families is that not only directly affected person should be compensated but also indirectly affected persons should be compensated.
6. Many warned that **circle rate was not acceptable** for compensation of land acquisition and they would not settle for anything less than market price of land.
7. Some complained that project authorities were conducting **survey without prior information** which is creating inconvenience especially to the female members of local villages.

8. Someone cited the **example of western railways** – how judiciously the several tracks are laid down in suburban Mumbai within a narrow strip of land. The DFC should follow the same example.
9. Participants demanded to know all available options of the alignment of DFC Project and the basis for selecting the present alignment.
10. There was a demand that the District Collector should speak on the occasion. Thus D C, Mr. R. J. Patel obliged and would play an important role as a perfect mediator.
    a. Mr. R. J. Patel, District Collector of Banaskantha spoke in local language of Gujarati and calmed the crowd who were very excited and in complete protesting mood. He shared his experiences of Sardar Sarovar Project and Ukai Dam projects where he had first hand experience of dealing with resettlement and rehabilitation issues.
    b. He mentioned that being from a farmer's family he understood the sentiments of farmers and would try to be fair to them.
    c. He would like to push the District of Banaskantha forward by welcoming big projects of which DFC is one of them.
    d. He appreciated DFCCIL personnel who attended the meeting and how he tried to answer the queries which the people had.
    e. He stated that public consultation meeting organized by DFCCIL was the first of its kind. Thus the villagers should appreciate the effort of the project authorities that they are try to interact with local people. The sincere attempts to bring the Project into confidence are the most important process of realization of such large scale project.
    f. He cleared some doubts which existed in the minds of the general crowd on the issues of drainage and the associated problems.

Major Outcome of consultations

There was a general demand made by the participants as follows:

1) Appropriate compensation, including the market rate for land acquisition, should be made before the project implementation begins;
2) Farmers made a demand of land to land compensation;
3) Process of the decision making on the alignment of DFC Project is not clear. Alternative alignment should be explicitly explained and that the presently available land area that belongs to India Railway should be optimally utilised;
4) For the farmers, land to land compensation should be the option for land acquisition.

Media Coverage

1) "The Times of India" covered the public consultation meeting.
2) TV news person from "Sahara Samay" tried to cover the meeting while his abusive language to the SAPROF Study Team members inflamed participants. Thus no appropriate coverage was made.

Public Consultation Meeting

Sikar, Rajasthan

Date: 10th February, 2009
Venue: Hotel Ganges Garden, Shahpura Road, Neem Ka Thana,
(GPS coordinates: 27° 44' 16.8" N, 75° 46' 45.3" E)
Time: 13:00 – 15:00

Besides the SAPROF study team members, Mr. Fateh Singh Yadav and Mr. Vijay Mittal of DFCCIL Jaipur, Mr. P L Meena, Station Master of Sri Madhopur, and Mr. Pratap Singh, Station Master of Kathuawas were present in the PCM.

A total of approximately 70 participants were present in the meeting. Most of them are the representatives of newly identified villages during the S-ESIMMS. The villages that had representation in the PCM are:

1. KATHOOWAS
2. NALOT
3. JORAWAR NAGAR
4. DERAWALI DHANI
5. SRI MADHOPUR
6. BHARNI
7. MAHAROLI
8. GURHA
9. SIRSA
10. JUGALPURA
11. KANWAT
12. KALIYAWAS
13. JAITUSAR
14. BHADWARI
15. KANWAR KI NAGAL
16. DABLA
17. RAJPUTO KI DHANI
18. MAWANDA
19. MANDOLI
20. GODAWAS
21. NEEM KA THANA
22. SIROHI
23. GOVINDPURA
24. JASSI KA BAS
25. THIKARIYA KHURD

Power point presentation on the DFC project, explaining the proposed DFC alignment, in general, and alignment in Rajasthan in particular, summary of environmental impact assessment including environmental mitigation measures and management plan (EMP), brief summary of affected villages and structures etc was made before the participants in Hindi language.

<u>Issues Raised by Participants</u>

Various issues raised by participants are summarised as follows:

1. The project related information obtained from various agencies over past 2 years has confused the villagers. In 2007, it was told that 100 m land will be acquired but later on it was reduced to 50 m. He told that the lack of clarity about various components of the proposed project has created confusion and anxiety among villagers. He wanted to have clarification on several survey teams being deputed for the survey work over this two year period.
2. A participant has requested for a provision of noise barrier at Dabla to safeguard the villagers from increased noise and vibration levels. He expressed his concern over bifurcation of his village into two parts due to development of the corridor and envisaged the problem of accessibility across the bifurcated parts.

3. A participant has requested for implementation of National R&R policy 2007 and requested for evaluation of assets like cupboards, showcase etc through survey. He wished that the evaluation survey to be supervised by IAS rank officials of state government. Mr. Banerjee replied that the PCM intends to discuss environmental impacts due to the project; the social impacts and R&R policy will be discussed in forthcoming PCM-RRP meetings in March 2009.

4. A participant has requested that the people residing in immediate vicinity of the proposed corridor to be paid monetary compensation against increased environmental hazards due to noise and vibration, dust and accidental risks. A facilitator of the PCM has explained him the increase in noise and vibration level will be of much significance and regular water sprinkling will be carried out as dust suppression measures during the construction phase.

5. A participant pointed out the local people should get employed as labours during the construction phase of the project. He commented that the recent gauge conversion project (conversion of existing meter gauge railway track to broad gauge track) has set bad precedents by hiring labours from other States, who often got engaged in confrontation with local residents. Therefore, the stakeholders find it hard to believe that they will be get employment opportunity during the construction phase of the DFC project. A facilitator of the PCM has replied that the concern will duly be forwarded to competent authorities.

6. A participant have shared the view with another participant that the local villagers were not employed during the ongoing broad gauge conversion work. A participant and several other villagers from different villages echoed the same view. He requested that the local people should be provided employment opportunity and a portion of the construction materials to be procured locally. DFCCIL representatives agreed to take up this issue to the higher authorities and informed that local people will be employed during the constriction period.

7. A participant requested to ensure the quality of work and viewed that local people, being stakeholders, are naturally motivated to carry out quality work. He requested to make qualification as the only criteria for getting employment opportunity. He also requested to provide the insurance cover for the structures in immediate vicinity of the proposed corridor for development of cracks and other damages due to railway vibration. He requested for payment of compensation to stakeholders residing close to the railway track against environmental hazards due to increased dust, noise and vibration levels. A facilitator of the PCM informed that the anticipated increase in noise and vibration level due to rail movement being marginal and insignificant, damages of the structures are not envisaged. However, he informed that the concern of the stakeholders will be forwarded to the concerned authorities.

8. Most of the participants viewed the project as beneficial and requested for timely completion of construction work. A participant viewed the project as booster of local economy and development. He requested the project authorities to provide job for at least one member of each project affected families. A facilitator of the PCM explained him the meeting intends to discuss the environmental impacts due to the project and the social issues including R&R policy will be discussed in forthcoming meetings in March 2009.

9. A participant requested DFCCIL and railway officials to consider creation of more gates across the existing railway to facilitate crossing of camel carts and bullock carts. He told that closure of many existing gates have created tremendous problem among the residents. The railway officials present in the meeting said they will take up the matter seriously and forward it to the concerned authorities.

10. A participant said the utilities (like wells, hand pumps etc) are required to be relocated. A facilitator of the PCM explained him the meeting intends to discuss the environmental impacts due to the project and the social issues including R&R policy will be discussed in forthcoming meetings in March 2009. However, he continued that there are several families who have negotiated with temple management committees for construction of houses in the surplus land belonging to temple committee. Most of these families are retired priests of the temple. These families do not have land records in their names as land belongs to be temple committee. Many of such structures will be affected and the residents are mentally upset over the issue. He requested for an amicable solution to the problem. The DFCCIL officials promised to look into the matter seriously and assured him to solve the problem.

11. A participant said that the rumour has been spread that level crossing number of 86 on the existing railway is going to be closed. He wanted clarification on the issue. A facilitator of the PCM referred the question to the railway officials who confirmed that the level crossing will remain functional and requested the participants not to pay heed to any rumour.

12. A participant welcomed the project and said the construction work should be put in fast track to avoid cost escalation. He also echoed the view of another participant that some mechanism should be

developed to provide relief to the people who have constructed house on temple land. DFCCIL and railway officials assured the stakeholders that they will look into the matter on priority basis.

13. A participant said the project affected persons whose land as well are structure will be acquired should be provided government land in the same village so that he remains in close contact with his community. He also requested that PAPs below the poverty line should be provided jobs in railway or in other government departments. A facilitator of the PCM explained him the meeting intends to discuss the environmental impacts due to the project and the social issues including R&R policy will be discussed in forthcoming meetings in March 2009.

14. A participant also requested to reopen the level crossing no 88 located close to his village. He expressed the view that railway has good amount of surplus land along its tracks and requested to remove all encroachments along the track. He welcomed the project as it will benefit the region as well as the Nation as a whole and requested railway officials to examine the possibility of running passenger train on the newly constructed track in future. DFCCIL representative replied that only goods trains are proposed to run on the newly developed track but the view of the participant will be forwarded to higher authorities.

15. A participant welcomed the project and requested the authorities to start the construction work as early as possible. He also supported the view of a participant that running of passenger train may be considered in future. He reiterated that goods trains are proposed to run on the newly developed track but the view of him will be forwarded to higher authorities.

Major Outcome of consultations

Overwhelming majority of the participants have welcomed the project as pro-development and requested to ensure timely completion. The participants are found to be more concerned on the social issues than the environmental issues due to the project. The issues raised by the participants are summarised as follows:

1) Need of clarity and uniformity in disseminated information
2) Safeguard from increased noise and vibration levels
3) Accessibility across the corridor, especially in the bifurcated settlements
4) Evaluation for fixed assets for compensation
5) Regular monetary compensation for increased environmental risks and hazards
6) Employment of local villagers during as labourer during construction phase
7) Local procurement of construction materials, wherever possible
8) Adherence to quality norms for construction and operation
9) Jobs for BPL PAPs
10) Possibility of passenger train operation in the DFC track

Media Coverage

1) Rajasthan Patrika (Hindi daily - Sikar edition)
2) Dainik Bhaswar (Hindi daily - Sikar edition)

Public Consultation Meeting

Phulera, Rajasthan

Date: 12th February, 2009
Venue: Singhaniya Dharmsala, Gandhi Chowk, Phulera town,
(GPS coordinates: 26° 52′ 28.38″ N, 75° 14′ 30.59″ E)
Time: 11:00 – 13:00

Besides the SAPROF study team members, Mr. Shailendra Jain of DFCCIL Ajmer, Mr. Vijay Kumar Mittal of DFCCIL Jaipur, Mr. R K Vijaya, SS (P) FL, Phulera Junction, Jaipur District, Mr. Rajendra Maurya, Station Manager of Makrera Station, Ajmer District, and Mr. Jagmohan Singh Chowdhury, Station Manager of Phulera Station, Jaipur District were present in the PCM.

A total of approximately 50 participants were present in the meeting. Most of them are the representatives of newly identified villages during the S-ESIMMS. The villages that had representation in the PCM are:

1. ITAWA
2. RENWAL
3. SINODIYA
4. PRITHVI PURA
5. JAITPURA
6. KANCHRODA
7. PHULERA
8. NARAYANA
9. DOODIYAN KA BAS
10. NADRI
11. PREMPURA
12. KISHAN MANPURA
13. SIRSI
14. KALALI KI BADAI
15. AJMER
16. KISHANGARH CITY
17. MADANGANJ
18. SOMALPUR

Power point presentation on the DFC project, explaining the proposed DFC alignment, in general, and alignment in Rajasthan in particular, summary of environmental impact assessment including environmental mitigation measures and management plan (EMP), brief summary of affected villages and structures etc was made before the participants in Hindi language.

Issues Raised by Participants

Various issues raised by participants are summarised as follows:

1. A participant has expressed concern over the impacts on drainage due to the project and possibility of water logging after construction of rail embankment. A facilitator of the PCM replied that provision of both longitudinal and cross drains have been considered for the project and drainage system will developed with due consideration of local requirement. Cross drainage structures will be provided at regular intervals.
2. A participant said that the all level crossings across the existing Rewari-Vadodara meter gauge line (which is being converted into broad gauge) are said to be closed after gauge conversion. Therefore, the facilities provided by the DFC authorities for unhindered access across the corridor will be of limited or no use as the passenger rail track will be located just adjacent to the DFC. A representative of DFCCIL Ajmer replied that the access facilities across the DFC will also be extended over the existing railway track. Further, the existing level crossing will also continue to be operational.
3. A participant asked the reason for varying construction width of 30-50m and the gradient of the new track. A representative of DFCCIL Ajmer replied that the construction width varies due to variation in embankment height. As the gradient of the track is kept as low as 1:200 for DFC instead of the standard

gradient of 1:100 of Indian Railways to make DFC a high speed track, longer embankments are required.

4. A participant expressed his concern over increased noise and vibration level due to the movement of high speed goods trains. He also enquired whether the noise levels will increase in hilly areas due to reflection of noise. A facilitator of the PCM replied that noise and vibration levels have been studied at 4 locations in Rajasthan. The background noise and vibration levels as well as the same during the movement of goods trains (of different types of wagons) have been recorded at varying distances (12.5m, 25m, 50m and 100m) from the railway track. Based on the measurement, noise and vibration levels have been predicted using latest modelling techniques and the anticipated increase in noise and vibration level at a distance of 30m is found be insignificant.
5. A participant asked about the length of the junction stations and A representative of DFCCIL Ajmer replied that the average length of the junction stations will be 1600 m approximately.
6. A participant expressed also his concern over increased noise and vibration levels due to movement of goods train, who was explained about the insignificant change in the noise and vibration level by a facilitator of the PCM. Theparticipant asked whether the measurement of trains were conducted in both loaded and unloaded condition. A facilitator of the PCM clarified him that measurement has been conducted in all possible conditionals for several days for different types of goods carriers.
7. A participant enquired about the competent authority for supervision work during construction phase of the project, which will be responsible for implementation of the environmental mitigations measures suggested in the EMP. He also spoke at length about the height of the speed-breakers at the both sides of the level crossing in his area, which has damaged two vehicles considerably within a week's time. He sought information about the competent authority for lodging formal complaints and claming of compensation, if possible. He was replied by the railway officials present in the meeting that he can lodge formal complain with PWD officials for inspection of site to find out whether the allegations are true. However, he could not throw much light about the compensation part. DFCCIL representatives informed the participants that the supervision of construction work will probably be monitored by independent supervision consultants appointed by DFCCIL.
8. A participant enquired about the details of land to be acquired for the project. Another participant enquired about the compensation package for acquired land and structures. A facilitator of the PCM replied that these issues will be discussed in March 08 when separate PCMs will be conducted at village level on R&R issues.
9. A participant welcomed the project and enquired for project time schedule, specially the construction phase. He envisaged that accessibility across the corridor is the most important issue among others. A facilitator of the PCM explained him the project time schedule and informed him the construction is likely to begin in 2011. Accessibility across DFC will be ensured by providing ROB/RUB at each road-rail crossing and also at regular intervals at the detour sections.

Major Outcome of consultations

Overwhelming majority of the participants have welcomed the project as pro-development and requested to ensure timely completion. The participants are found to be more concerned on the social issues than the environmental issues due to the project. The issues raised by the participants are summarised as follows:

1. Drainage and water logging
2. Accessibility across the corridor, especially in the bifurcated settlements
3. Land requirement along the corridor and junction station
4. Safeguard from increased noise and vibration levels
5. Adherence to quality norms for construction and operation

Media Coverage

1) Rajasthan Patrika (Hindi daily - Jaipur edition)

Public Consultation Meeting

Pali, Rajasthan

Date: 15th February, 2009
Venue: Government Senior Secondary School, Marwar Junction,
(GPS coordinates: 25° 43' 35.6" N, 73° 36' 42.3" E)
Time: 11:00 – 13:00

Besides the SAPROF study team members, Mr. Shailendra Jain of DFCCIL Ajmer and Mr. Hansraj Sharma, Station Master of Dhareshwar were present in the PCM.

A total of approximately 110 participants were present in the meeting. Most of them are the representatives of newly identified villages during the S-ESIMMS. The villages that had representation in the PCM are:

1. JAWALI BANDH
2. SARKHEJARA
3. MOKHAMPURA
4. RAGHUNATHPURA
5. NANA
6. DUDOR
7. HEMLIYAWAS KALAN
8. MARWAR JUNCTION
9. AUWA
10. BITHORA KHURD/KALAN
11. NARSINGHPURA
12. KARCHI
13. SOJAT ROAD
14. SABALPURA
15. LAKA JI KI DHANI
16. GURIYA
17. RANI

Power point presentation on the DFC project, explaining the proposed DFC alignment, in general, and alignment in Rajasthan in particular, summary of environmental impact assessment including environmental mitigation measures and management plan (EMP), brief summary of affected villages and structures etc was made before the participants in Hindi language.

Issues Raised by Participants

Various issues raised by participants are summarised as follows:

1. A participant has expressed the view that the project related information obtained from various agencies over past 2 years has confused the villagers. In 2007, it was told that 100 m land will be aequired but later on it was reduced to 50 m. He told that the lack of clarity about various components of the proposed project has created confusion and anxiety among villagers. He wanted to have clarification on several survey teams being deputed for the survey work over this two year period. A facilitator of the PCM has explained about various components of the DFC project. He also replied that the mega projects of this magnitude requires careful assessment and consideration of all factors before implementation. Therefore, a number of surveys have been conducted over the period of last two years. Further, the design work for the project is scheduled to begin in 2009, when further survey may be required.
2. A participant has requested for implementation of National R&R policy 2007 and requested for evaluation of assets like cupboards, showcase etc through survey. Mr. Banerjee replied that the PCM intends to discuss environmental impacts due to the project; the social impacts and R&R policy will be discussed in forthcoming PCM-RRP meetings in March 2009.
3. A participant pointed out the local people should get employed as labours during the construction phase of the project. She commented that the railways in most cases hire labours from other States, depriving the locals. Therefore, the stakeholders find it hard to believe that they will be get employment

opportunity during the construction phase of the DFC project. A facilitator of the PCM has replied that the concern will duly be forwarded to competent authorities.

4. A participant along with several other participants has shared the his view that the local villagers were not employed by railways. He requested that a portion of the construction materials should be procured locally. DFCCIL representatives agreed to take up this issue to the higher authorities and informed that local people will be employed during the constriction period.

5. A participant enquired about the details of exact alignment and significance of colours of the pillars, if any. He also said that he has sold some portion of his agricultural land at handsome amount. He anticipates that compensation from DFCCIL for his acquired land will be meagre low. He further said that he has forwarded his complain to DFCCIL Ajmer office a few months back but no response, even acknowledgement of his letter has been received yet. A facilitator of the PCM explained him the meeting intends to discuss the environmental impacts due to the project and the social issues including R&R policy will be discussed in forthcoming meetings in March 2009. A representative of DFCCIL Ajmer assured him to give reply to his letter shortly.

6. A participant said that the level crossing at the town clogged in traffic for hours together, and the project will only add to this problem unless ROBs are provided. A representative of DFCCIL Ajmer replied that ROB will be provided at each road-rail crossing and provision for ROB at Marwar Junction will be duly considered.

7. A participant said that plantation under compensatory afforestation scheme should be started early so that the trees will grow sufficiently by the time the construction activity will be over. A facilitator of the PCM replied that his view will be forwarded with due importance to the concerned authorities.

8. A participant commented that detour was proposed at Marwar Junction which was not considered in later stages of the project. He opined that the detour option is better for the town as it will avoid large scale involuntary displacement of people. A representative of DFCCIL Ajmer replied that the detour has not been considered due to techno-economical reasons and proper compensation will be distributed among the affected persons. A facilitator of the PCM explained him the meeting intends to discuss the environmental impacts due to the project and the social issues including R&R policy will be discussed in forthcoming meetings in March 2009.

9. Most of the participants viewed the project as beneficial and requested for timely completion of construction work. A participant viewed the project as booster of local economy and development. He requested the project authorities to provide job for at least one member of each project affected families. A facilitator of the PCM explained him the meeting intends to discuss the environmental impacts due to the project and the social issues including R&R policy will be discussed in forthcoming meetings in March 2009.

10. A participant requested DFCCIL and railway officials to consider creation of more gates across the existing railway to facilitate crossing of camel carts and bullock carts. He told that closure of many existing gates have created tremendous problem among the residents. The railway officials present in the meeting said they will take up the matter seriously and forward it to the concerned authorities.

11. A participant said the utilities (like wells, hand pumps etc) are required to be relocated. A facilitator of the PCM explained him the meeting intends to discuss the environmental impacts due to the project and the social issues including R&R policy will be discussed in forthcoming meetings in March 2009. However, a representative of DFCCIL Ajmer continued that there are several families who have negotiated with temple management committees for construction of houses in the surplus land belonging to temple committee. Most of these families are retired priests of the temple. These families do not have land records in their names as land belongs to be temple committee. Many of such structures will be affected and the residents are mentally upset over the issue. Mr. Singh requested for an amicable solution to the problem. The DFCCIL officials promised to look into the matter seriously and assured him to solve the problem.

12. A participant said that the rumour has been spread that level crossing number of 86 on the existing railway is going to be closed. He wanted clarification on the issue. A facilitator of the PCM referred the question to the railway officials who confirmed that the level crossing will remain functional and requested the participants not to pay heed to any rumour.

13. A participant welcomed the project and said the construction work should be put in fast track to avoid cost escalation. He also echoed other participant's view that some mechanism should be developed to

provide relief to the people who have constructed house on temple land. DFCCIL and railway officials assured the stakeholders that they will look into the matter on priority basis.

14. A participant said the project affected persons whose land as well are structure will be acquired should be provided government land in the same village so that he remains in close contact with his community. He also requested that PAPs below the poverty line should be provided jobs in railway or in other government departments. A facilitator of the PCM explained him the meeting intends to discuss the environmental impacts due to the project and the social issues including R&R policy will be discussed in forthcoming meetings in March 2009.

15. A participant also requested to reopen the level crossing no 88 located close to his village. He expressed the view that railway has good amount of surplus land along its tracks and requested to remove all encroachments along the track. He welcomed the project as it will benefit the region as well as the Nation as a whole and requested railway officials to examine the possibility of running passenger train on the newly constructed track in future. A representative of DFCCIL replied that only goods trains are proposed to run on the newly developed track but the view of him will be forwarded to higher authorities.

16. A participant welcomed the project and requested the authorities to start the construction work as early as possible. He also supported the other participant's view that running of passenger train may be considered in future. He reiterated that goods trains are proposed to run on the newly developed track but the other participant's view will be forwarded to higher authorities.

Major Outcome of consultations

Overwhelming majority of the participants have welcomed the project as pro-development and requested to ensure timely completion. The participants are found to be more concerned on the social issues than the environmental issues due to the project. The issues raised by the participants are summarised as follows:

1. Need of clarity and uniformity in disseminated information
2. Accessibility across the corridor, especially in the bifurcated settlements
3. Evaluation for fixed assets for compensation
4. Employment of local villagers during as labourer during construction phase
5. Local procurement of construction materials, wherever possible

Media Coverage

1) Rajasthan Patrika (Hindi daily - Pali edition)
2) Dainik Bhaswar (Hindi daily - Pali edition)

Public Consultation Meeting

Sirohi, Rajasthan

Date: 17th February, 2009
Venue: Shri Agarawal Vishnu Dharamshala, Abu Road,
(GPS coordinates: 24^0 29' 02.7"N 72^0 47' 01.2"E)
Time: 11:00 – 13:00

Besides the SAPROF study team members, Mr. Sanjay Gupta of DFCCIL Abu Road and Mr. Jitendra Sharma, Station Master of Bhimana were present in the PCM

A total of approximately 40 participants were present in the meeting. Most of them are the representatives of newly identified villages during the S-ESIMMS. The villages that had representation in the PCM are:

1. KIWARLI
2. OR
3. KHADAT
4. SANGNA
5. KUI
6. ABU ROAD
7. CHANDRAWATI
8. KHARA
9. MAVAL
10. AJARI
11. CHAWARLI
12. BANAS
13. SWAROOP GANJ
14. BHIMANA
15. BHARJA

Power point presentation on the DFC project, explaining the proposed DFC alignment, in general, and alignment in Rajasthan in particular, summary of environmental impact assessment including environmental mitigation measures and management plan (EMP), brief summary of affected villages and structures etc was made before the participants in Hindi language.

Issues Raised by Participants

Various issues raised by participants are summarised as follows:

1. A participant said that along with the common tree species, some valuable trees like Neem etc. would also be felled. He enquired whether there is any provision for monetary compensation against felling of private trees. Further, he also wanted to know about the compensation to be provided for acquired properties. A facilitator of the PCM explained that prior permission would be taken from forest department before felling of any tree and compensation would be given to the forest department for government owned trees as well as to individuals for private tress. Plantation will be carried out double the number of trees felled as per the provision of Indian Forest Conservation Act, 1980.

2. A participant also enquired about R&R policy. He was also eager to know about the details of land acquisition process. Mr. Hira Lal asked for specific dates for commencement of land acquisition process in Sirohi district. A facilitator of the PCM replied that the PCM intends to discuss environmental impacts due to the project; the social impacts and R&R policy will be discussed in forthcoming PCM-RRP meetings in March 2009.

3. A participant said that preference should be given to local contractors for award of petty contracts during the construction phase of the project which will eventually generate employment in the area. He also complained that the railways, in most cases, hire labours from other States, depriving the locals. He also added that a portion of the construction materials should be procured locally. A facilitator of the PCM has replied that the concern will duly be forwarded to competent authorities.

4. A participant enquired about the details of exact alignment. He told that the project related information obtained from various agencies has confused the villagers and there is a need for comprehensive

information from a single authority/source. A facilitator of the PCM explained him that the information related to the project gets changed from time to time because the project planning work is still being continued. A mega project of this magnitude requires involvement of various agencies but the flow of information to the stakeholders at grass root level are always monitored at central level by DFCCIL, who is the competent authority for implementation of the project. As the stakeholders have been taken into confidence since the beginning of the project and have been involved actively in the project formulation stages, the changes in the project information such as alignment etc are also promptly disseminated to the concerned stakeholders for their feedback.

5. A participant wanted enquired about the time provided to the stakeholders for lodging formal complaints, if any from the time he gets notice from the government about acquisition of his property. A representative of DFCCIL replied that the stakeholders can do so within 60 days from getting the land acquisition notice from SDM. He also added that the suggestions/complaints can only be lodged with SDM office of respective jurisdiction.

6. A participant said that the level crossing at the town remain clogged in traffic for hours together, and the project will only add to this problem unless ROBs are provided. A representative of DFCCIL replied that ROB will be provided at each road-rail crossing and provision for ROB at Abu Road will be duly considered.

7. A participant requested DFCCIL and railway officials to consider creation of more gates across the existing railway to facilitate crossing of camel carts and bullock carts. He told that closure of many existing gates have created tremendous problem among the residents. The railway officials present in the meeting said they will take up the matter seriously and forward it to the concerned authorities.

8. A participant welcomed the project and said the construction work should be put in fast track and requested to relocate the utilities like wells, hand pumps etc. DFCCIL and railway officials assured the stakeholders that they will look into the matter and forward their concern to the competent authority.

9. A participant said the project affected persons whose land as well structure will be acquired should be provided government land in the same village so that he remains in close contact with his community. He also requested that PAPs below the poverty line should be provided jobs in railway or in other government departments. A facilitator of the PCM explained him the meeting intends to discuss the environmental impacts due to the project and the social issues including R&R policy will be discussed in forthcoming meetings in March 2009.

10. A participant welcomed the project and requested the authorities to start the construction work as early as possible.

Major Outcome of consultations

Overwhelming majority of the participants have welcomed the project as pro-development and requested to ensure timely completion. The participants are found to be more concerned on the social issues than the environmental issues due to the project. Some of the participants raised questions on environment, the real agenda of the PCM. The issues raised by the participants are summarised as follows:

1. Need of clarity and uniformity in disseminated information
2. Accessibility across the corridor, especially in the bifurcated settlements
3. Evaluation for fixed assets for compensation
4. Employment of local villagers during as labourer during construction phase
5. Local procurement of construction materials, wherever possible

Media Coverage

1) Rajasthan Patrika (Hindi daily - Sirohi edition)

Appendix III-4-3
COMMENTS FROM THE PUBLIC ON DRAFT EIA REPORT AS AN INFORMATION DISCLOSURE PROCESS

1.1 OBJECTIVE OF INFORMATION DISCLOSURE

The objectives of disclosure are as follows:

1) Disseminate information on the environmental and social considerations of the DFC Project, including environmental and social impacts, mitigation measures, general plan on the management and monitoring of the environment in the study area.

2) Collection of comments and opinions from the public on environment and social issues on the DFC project to be reflected in final EIA report.

1.2 METHODOLOGY OF INFORMATION DISCLOSURE AND COLLECTION OF COMMENTS

The process of information disclosure was arranged in a systematic, time bound and transparent manner ensuring widest possible public participation of the project. Methodology of the process was as follows:

- The distribution of draft EIA reports including summary in vernacular languages (Hindi and Gujarati) and English as shown in Appendix III-4-4 started from 23rd March 2009 and completed by 1st April 2009.
- Draft EIA (ESIMMS and S-ESIMMS) Reports had been distributed 4 Chief Project Manager (CPM) offices of DFCCIL, 17 District Collectorate (DC) Offices and 28 Major Stations including Junction Stations along the proposed DFC alignment. Reports were available there for public viewing.
- Summary of the draft EIA reports were distributed in 569 Project Affected villages, 4 CPM offices, 17 DC Offices and 28 Major Stations including Junction Stations along the proposed DFC alignment. All Details are available in Table 1-1.
- In order to facilitate proper information dissemination of availability of draft EIA reports as well as summary and call for comments, public notice in vernacular languages (Hindi and Gujarati) and English had been put in notice board in CPM, DC and Village Offices and Major Stations. The public notices distributed in the information disclosure process are shown as per Appendix V-1-3.
- Last Date of sending comments was 15th April, 2009, considering minimum 2 weeks for review by public.
- Comments and opinions were accepted on draft EIA report only in writing through direct delivery, fax, or post and email (dfc.wc.eia@gmail.com) to the respective CPM offices.
- After collection of all comments from CPM offices, it had been sorted out and summarized.
- Collection of the draft EIA reports from Major stations and District Collectorate Offices.
- Finalization of EIA reports by reflecting comments/opinion.

Table 1-1 Distribution of Number of Draft EIA (ESIMMS +S-ESIMMS) Reports

Sl No.	Locations	No. of Set of Reports
1	DFCCIL CPM Offices (4)	5
2	District Collectorate Offices (17)	17
3	Major Railway Stations along the Corridor (28)	28
	Total	50

Note: A detailed list is shown in Appendix V-1-4
ESIMMS reports for both Haryana and Rajasthan were distributed in the CPM Office in Jaipur

Table 1-2 Distribution of Number of Summary of EIA Report

Sl No.	Location		Number of Vernacular Language		
	State	Number of Villages	Hindi	Gujarati	English
1	Haryana	67	770		360
2	Rajasthan	287	3,415		1,585
3	Gujarat	215		2,285	1,085
4	CPM Offices (4)	-	15	10	25
5	DC Offices (17)	-	45	40	85
6	Railway Stations (28)	-	90	50	140
Sub Total		569	4,335	2,385	3,280
Total		-	10,000		

Note: A detailed list is shown in Appendix V-1-4
ESIMMS reports for both Haryana and Rajasthan were distributed in the CPM Office in Jaipur

1.3 RESULTS OF COLLECTED COMMENTS

Various comments and opinions were collected through the information disclosure.

(1) Number of Collected Comments

Total 68 comments were collected. District wise numbers of comments are given in Table 1-3.

Table 1-3 District Wise Number of Comments Received Regarding Draft EIA Report

State	District	No. of Comments Received *
Haryana	Rewari	3
	Mahendergarh	9
	Sub-Total	12
Rajasthan	Alwar	1
	Sikar	1
	Jaipur	9
	Ajmer	18
	Nagaur	0
	Pali	3
	Sirohi	6
	Sub-Total	38
Gujarat	Banaskantha	2
	Patan	1
	Mahesana	1
	Ahmedabad	0
	Gandhinagar	0
	Kheda	0
	Anand	4
	Vadodara	10
	Sub-Total	18
Grand Total		68

Note: Other than this, Number 4 and 22 reports for Valuation of properties were received from Sendra and Sabalpura Villages of District Pali, respectively. It is not considered as comments.
*As of 23rd April, 2009

(2) Classification of Comments

After scrutinizing these comments, these were categorized in following category like, Natural Environment, Pollution, Sensitive Receptor, Social Environment (except for Land Acquisition and R&R issue), Land and R&R issue and others. Summary table of comments is shown in Table 1-4. Details of comments are shown in Appendix V-I-5.

Table 1-4 Classification of Comments regarding Draft EIA

State	District	No. of Comments Received	Type of Party	Classification of Comments						Proposal
				Natural	Pollution	Sensitive Receptor	Social (except Land & Resettlement Issue)	Land & Resettlement	Others	
Haryana	Rewari	3	Group Appeal Village (1), Individual (1), Member of Panchayat(1)	1	01	0	0	2	2	0
	Mahendergarh	9	Business Community (1), Municipal Committee (1), Temple Committee (1), Group Letter from SC Community (1), Ex Village Head (1), Group Appeal from Village (4)	1	6	4	4	8	5	0
	Sub-Total	12		2	6	4	4	10	7	0
Rajasthan	Alwar	1	Group Appeal from Village (1)	0	0	0	0	1	1	
	Sikar	1	Group Appeal from Village (1)	1	1	0	0	1	1	
	Jaipur	9	Group Appeal from Village (7), Individual (2)	1	3	1		8	7	0
	Ajmer	18	Individual Shop owner (7), Individual House Owner (9), Temple Committee (1), Group Appeal from Village (1)	0	17	17	17	17	1	0
	Nagaur	0		0	0	0	0	0	0	0
	Pali	3	Group Appeal from Village (2), Individual (1)	0	0	0	0	3	2	0
	Sirohi	6	Group Appeal from Village (4), Individual (1), MLA(1), Panchayat Samity (1)	0	0	0	0	3	3	3
	Sub-Total	38		2	21	18	17	33	15	3
Gujarat	Banaskantha	2	Individual (2)	0	1	0	2	2	1	0
	Patan	1	Group Appeal from Village (1),	0	0	0	0	1	1	0
	Mahesana	1	Group Appeal from Village (1),	0	0	0	0	1	1	0
	Ahmedabad	0	-	0	0	0	0	0	0	0
	Gandhinagar	0	-	0	0	0	0	0	0	0
	Kheda	0	-	0	0	0	0	0	0	0
	Anand	4	Group Appeal from Village (4),	0	1	0	1	4	4	0
	Vadodara	10	Group Appeal from Village (10),	0	0	0	0	10	10	10
	Sub-Total	18	-	1	2	0	3	18	17	10
Grand Total		68		5	29	22	24	61	39	13

Note: As of data available on 23rd April, 2009

1.4 CONCLUSION

Among these comments, there are no specific comments to be incorporated in the EIA report. These are mainly land acquisition and rehabilitation and resettlement issues. These overall issues except L&A and R&R issues are already discussed in EIA reports. However, these comments will be taken care of at the time of implementation period through mitigation measures and Environmental Management Plan. In addition, L&A and R&R issues will be taken care of at the time of preparation of Rehabilitation and Resettlement Plan.

Appendix III-4-6 Distribution List of the Draft EIA Report

1. Distribution of Full Set of the Draft EIA Report

- A set of draft EIA report (ESIMMS + draft S-ESIMMS Reports) was distributed to each of the following.

Distribution of EIA report (ESIMMS + draft S-ESIMMS Reports)

ESIMMS and draft S-ESIMMS Report	CPM Office	Major Sta.	District Office
ESIMMS (Haryana), Draft S-ESIMMS Report	1) CPM Jaipur*	1) Rewari (Jn) 2) Narnaul 3) Dabla (Jn)	1) Mahendragarh 2) Rewari
ESIMMS (Rajasthan), Draft S-ESIMMS Report	1) CPM Jaipur* 2) CPM Ajmer	1) Alwar (Jn) 2) Kund 3) Neem Ka Thana 4) Sri Madhopur 5) Ringus (Jn) 6) Jaipur (Jn) 7) Phulera (Jn) 8) Kishangarh 9) Ajmer (Jn) 10) Beawar 11) Sojat Road 12) Marwar Jn 13) Falna 14) Sirohi Road 15) Abu Road	1) Jaipur 2) Nagaur 3) Sikar 4) Alwar 5) Sirohi 6) Pali 7) Ajmer
ESIMMS (Gujarat), Draft S-ESIMMS Report	1) CPM Ahmedabad 2) CPM Vadodara	1) Palanpur (Jn) 2) Siddhapur 3) Unjha 4) Mahesana(Jn) 5) Sabarmati (Jn) 6) Ahmedabad (Jn) 7) Nadiad (Jn) 8) Anand(Jn) 9) Vasad (Jn) 10) Vadodara (Jn)	1) Vadodara 2) Anand 3) Kheda 4) Ahmedabad 5) Gandhinagar 6) Mahesana 7) Patan 8) Banaskantha

Note: ESIMMS reports for both Haryana and Rajasthan were distributed in the CPM office in Jaipur.

List of Villages where the Summary of the Draft EIA Reports were Distributed
< Haryana >

District	Sub-district	S. No	Affected Villages
Rewari	Rewari	1	Chillar
		2	Bhutal Tetihar
		3	Bhutal Jat
		4	Gangaachariya ahir
		5	Sekhpur sikar Pur
		6	Rajpur Khalsa
		7	Gindokhar
		8	Lakhnor
		9	Jadara
		10	Mahakharia
		11	Dhanlawas
		12	Sundrod
		13	Mailawas
		14	Dhanisundrod
		15	Pitherawas
		16	Gumina
		17	Rajpura Istamrar
		18	Khori
		19	Teent
		20	Govind Puri
		21	Mamariatethar
		22	Gothara Thappa Khori
		23	Pali
		24	Majra Mutsal Bhalaki
		25	Bhalaki
		26	Manethi
		27	Padla/Kund Station Area
	Sub-total	27	
Total District		27	
Mahendragarh	Narnaul	1	Sujapur
		2	Hasanpur
		3	Gokal Pur
		4	Beghpur
		5	Uninda
		6	Dhanunda
		7	Ateli
		8	Khor Part
		9	Tobra
		10	Fathepur
		11	Tajpur
		12	Bhilwara
		13	Bachhod
		14	Sarai Bahadurnangar
		15	Sheonath Pura
		16	Bhusan Khurd
		17	Shah Pur Doyam
		18	Patikara
		19	Faizlipur
		20	Narnaul Urban
		21	Narnaul Rural
		22	Nuni Awal
		23	Mukand Pur
		24	Tajpur
		25	Amarpur Jorasi
		26	Kaloli
		27	Bhasir pur
		28	Ghatasar
		29	Pavera

District	Sub-district	S. No	Affected Villages
		30	Chhilro ki Dhani
		31	Napla
		32	Bamanwasnau
		33	Bamanwas
		34	Narehri
		35	Azmabad Mokhuta
		36	Neejampur
		37	Bejhad
		38	Chandpura and Ganiyar
		39	Nangal
		40	Talot
	Sub-total	40	
Total District		40	
Total State		67	

List of Villages where the Summary of the Draft EIA Report were Distributed
< Rajasthan >

District	Sub-district	S. No	Affected Villages
Alwar	Behror	1	Kathoowas
		2	Hudiya Khurd
	Sub-total	2	
Total: District		2	
SIKAR	Sri Madhopur	1	Nalot
		2	Kanchrapur @ kanchanpur
		3	Jorawar nagar
		4	Jawswant Pura
		5	Derawali Dhani
		6	Chak Jaswant pura
		7	Hanspura
		8	Sri Madhopur
		9	Bharni
		10	Maharoli
		11	Gurha
		12	Sirsa
		13	Ringus
		14	Jugalpura
		15	Madhopura
		16	Madho Ka Was
		17	Kanwat
		18	Bhadwari
		19	Kalyanpura
		20	Patwari Ki Bass
		21	Malakali
		22	Jaitusar
		23	Kaliyawas
	Sub-total	23	
	Neem Ka Thana	1	Kanwar Ki Nagal
		2	Dabla
		3	Bihar
		4	Beharipur
		5	Jeelo
		6	Kunwara @ Ramnagar
		7	Rajputon Ki Dhani
		8	Mawanda
		9	Nawanda Railway Station
		10	Shyama Wali
		11	Makri
		12	Mandoli
		13	Godawas
		14	Ranasar

District	Sub-district	S. No	Affected Villages
		15	Neem Ka thana
		16	Agawari
		17	Sirohi
		18	Govindpura
		19	Jassi Ka Bas
		20	Harjanpura
		21	Bhagot
		22	Bhagega
		23	Kurbada
		24	Chak Charwas
		25	Shyam Nagar
		26	Natha Ka Nangal
		27	Jhalara
		28	Bagwada
		29	Simli
		30	Ratan Nagar
		31	Jatala
	Sub-total	31	
Total : District		54	
NAGAUR	Nava	1	Naya Bas
		2	Thikariya Khurd
		3	Minda
		4	Baori
	Sub-total	4	
Total: District		4	
JAIPUR	Phulera and Dadu	1	Kanawar Pura
		2	Badhal
		3	Itawa
		4	Kabron Ka Bas
		5	Charanwas
		6	Bajiyon Ka Bs
		7	Malik Pura
		8	Kishanpura @ Nathi Ka Bas
		9	Renwal
		10	Meendi
		11	Bhookhron Ki Dhani
		12	Bhainslana
		13	Paharpura
		14	Kathowari Khurd
		15	Sinodiya
		16	Dodwadiyon Ka Bas
		17	Prithvi Pura
		18	Khandel
		19	Jaitpura
		20	Peepli Ka Bas
		21	Itawa
		22	Rojri
		23	Hironmda
		24	Kanchroda(Subhash Colony)
		25	Phulera
		26	Samalpura/Sawalpura
		27	Haripura
		28	Narayana
		29	Kothera
		30	Jhakolar
		31	Beegolao
		32	Bokrawas
		33	Deopura
		34	Sali
		35	Gahlota

District	Sub-district	S. No	Affected Villages
		36	Shakun
		37	Hatupura
		38	Mandha
		39	Nadri
		40	Deva Ka Bas
		41	Prempura
		42	Kandeoli
	Sub-total	42	
	Chomu	1	Bagri
		2	Nangal Govind
		3	Kishan Manpura
		4	Asti Kalan
		5	Sirsi
		6	Ranjeet pura
	Sub-total	6	
Total: District		48	
AJMER		1	Renpur
		2	Theekrana Goojran
		3	Sarmaliya
		4	Mediya (Naya Nagar)
		5	Beawar
		6	Kalali Ka Badai
		7	Bedia Gena
	Beawar	8	Ratanpura Sardara
		9	Fatehpuria Doyam
		10	Chhawani Pared
		11	Narsinghpura
		12	Daulatgarh Singha
		13	Rampura Mevatiyan
		14	Daulatpura Balaiyan
		15	Bhawani Kheda
	Sub-total	15	
	Masuda	1	Kharwa (Rani Sagar)
		2	Peeplaj
		3	Bhawani pura
		4	Rampura
	Sub-total	4	
	Ajmer & Nasirabad	1	Jatli
		2	Akhri
		3	Gegal
		4	Muhami (Mohami)
		5	Bhoodol
		6	Ladpura
		7	Gudha
		8	Guwardi
		9	Nareli
		10	Madar
		11	Ajmer
		12	Doomra
	Sub-total	12	
	Kishangarh	1	Kakniyawas
		2	Buharoo
		3	Tiloniya
		4	Bhojiyawas
		5	Phaloda
		6	Mandawariya
		7	Kishangarh city
		8	Swantsar
		9	Madanganj
		10	Farshia

District	Sub-district	S. No	Affected Villages
	Sub-total	10	
	Peesangan	1	Saradhana
		2	Shivpura
		3	Keshav pura
		4	Makera
		5	Arjunpura Khalsa
		6	Mangaliyawas
		7	Lamana
		8	Daulat Khera
		9	Jeethana
		10	Somalpur
		11	Daurai (Rural)
		12	Tabeeji (Rural)
	Sub Total	12	
Total: District		53	
PALI	Sumerpur	1	Koliwara
		2	Balwana
		3	Jawali Bandh
	Sub-total	3	
	Bali	1	Sarkhejra
		2	Mokhampura
		3	Kheemal
		4	Phalna (Rural)
		5	Phalna Stn
		6	Jadri
		7	Beral
		8	Beeroliya
		9	Beesalpur
		10	Doodni
		11	Kothar
		12	Bhandar
		13	Malnoo
		14	Moribeda Station
		15	Nana
		16	Perva
		17	Khudala
		18	Virampur
		19	Chamunderi Ranawatan
		20	Rughnathpura
		21	Saila
	Sub-total	21	
	Pali (Sojat) Marwar JN.	1	Dadiya
		2	Dhundhala
		3	Reesaniya
		4	Jor Dudor
		5	Dudor
		6	Hemliyawas Kalan
		7	Hemliyawas Khurd (Rural)
		8	Marwar Junction
		9	Auwa
		10	Surya Nagar
		11	Bithora Khurd/Kalan
		12	Borsa
		13	Bhagwanpura
		14	Karari
		15	Dhamli
		16	Banta
		17	Bhimadia
		18	Narsingh Pura
		19	Karchi

District	Sub-district	S. No	Affected Villages
		20	Sawrad
	Sub-total	20	
	Sojat	1	Karmawas
		2	Udeshi Kua
		3	Chandawal
		4	Murdawa
		5	Pachudo Kalan
		6	Sojat Road
		7	Bagri Nagar
		8	Bhesana
		9	Guda Bachhraj
	Sub-total	9	
	Raipur / Pali (Jaitran)	1	Rampura Mewatiyan (Rural)
		2	Amarpura
		3	Saradhana
		4	Shergarh
		5	Manpura
		6	Sabalpura
		7	Kurantiya
		8	Sendara/Jharli
		9	Jhala Ki Chauki
		10	Kaya Bheela
		11	Phata Khera
		12	Malni
		13	Megarda
		14	Deepawas
		15	Haripur
		16	Aasan
		17	Laka Ji Ki Dhani
		18	Dholiya
		19	Jhoontha
		20	Guriya
		21	Gujro Ka dhani
		22	Raipur-II
		23	Lavacha
		24	Lalpura
		25	Chang
	Sub-total	25	
	Desuri	1	Indarwara
		2	Bhadarlau
		3	Somesar
		4	Jawali
		5	Salariya
		6	Ajaneshwar
		7	Bhagwanpura Station
		8	Beejowa
		9	Rani
		10	Dhuteriya
		11	Etandra Meditan
		12	Nandha Jodhan
	Sub-total	12	
Total District		90	
SIROHI	Abu Road	1	Kiwarli
		2	Or
		3	Derna
		4	Khadat
		5	Sangna
		6	Kui
		7	Abu Road
		8	Chandrawati

District	Sub-district	S. No	Affected Villages
		9	Amba
		10	Khara
		11	Maval
		12	Wasda
		13	Morthala
		14	Tartoli
		15	Sant pur
	Sub-total	15	
	Pindwara	1	Sadalwa
		2	Pindwara Jn
		3	Ajari
		4	Chawarli
		5	Ghodiyawas
		6	Banas
		7	Peshua
		8	Kodarla
		9	Swaroop Gunj
		10	Bhavri
		11	Vatera
		12	Udavariya
		13	Bhimana
		14	Bharja
		15	Wara
		16	Keshav ganj
		17	Bilar
		18	Pindwara II
		19	Golya
		20	Nai Dhaneri
	Sub-total	20	
Total District		35	
Total State		286	

List of Villages where the Summary of the Draft EIA Report were Distributed
< Gujarat >

District	Sub-district	S. No	Affected Villages
Banaskantha	Amirgadh	1	Awal Gomti
		2	Dungarpura
		3	Amirgadh
		4	Kitodar
		5	Dholia
		6	Iqbalgarh
		7	Bantawada
		8	Deri
		9	Mahadevia
		10	Dhanpura
		11	Umarkot
		12	Karja
		13	Kalimati
	Sub-total	13	
	Palanpur	1	Antroli
		2	Pirjopura (Tankani)
		3	Lunawa
		4	Parpapada
		5	Kholda
		6	Chodotar
		7	Akasan
		8	Gathaman
		9	Bhagal (Jagana)
		10	Sagrosana

District	Sub-district	S. No	Affected Villages
		11	Vasna (Jagana)
		12	Badarpura (Kalusana)
		13	Pakhanwa
		14	Moriya
		15	Sangla
		16	Uttampura
		17	Tokariya
	Sub-total	17	
	Vadgan	1	Changwada
		2	Changa
		3	Basu
		4	Meta
		5	Mumuwada
	Sub-total	5	
Total District		35	
Patan	Sidhpur	1	Kakoshi
		2	Rasulpur
		3	Metrana
		4	Vaghana
		5	Thakrasan
		6	Dethali
		7	Dindrol
		8	Karan
		9	Nedra
		10	Chandravati
		11	Chandanswar
		12	Nandotri
		13	Momvada
		14	Kunvara
	Sub-total	14	
	Patan	1	Derasana
		2	Kani
		3	Visal Vasna
		4	Manund
		5	Ruvavi
	Sub-total	5	
Total District		19	
Mahesana	Unjha	1	Lindi
		2	Amudh
		3	Sunoka
		4	Sujerupura (Dabi)
		5	Chandravati
		6	Pali
		7	Dabhi
	Sub-total	7	
	Mahesana	1	Allora
		2	Hardesan
		3	Bodla
		4	Nugar
		5	Maguna
		6	Karshanpura
		7	Sametra
		8	Heduva-Rajgar
		9	Vadosan
		10	Boriavi
		11	Linch
		12	Ambasan
		13	Baliyasan
		14	Bhasariya
		15	Tundali

District	Sub-district	S. No	Affected Villages
		16	Matpur
		17	Padi
		18	Kanthravi
		19	Gorad
		20	Gilosan
		21	Chatiyarda
		22	Mareda
		23	Sabkheda
		24	Veerta
		25	Surpura
		26	Revavi
		27	Dabri
		28	Mandali
		29	Jagudan
	Sub-total	29	
	Kadi	1	Ganeshpura
		2	Mathasur
		3	Nandasan
		4	Kherpur
		5	Rajpur
		6	Irana
		7	Indrad
		8	Narain Pura
		9	Lakshmipura
		10	Ankhol
		11	Vamaj
		12	Lunasan
	Sub-total	12	
Total District		48	
Gandhinagar	Kalol	1	Dhanot
		2	Chhatral
		3	Piyaj
		4	Ramnagar
		5	Vansajeda
		6	Bhoyan Moti
		7	Khatraj
		8	Sanavad
		9	Nasmed
		10	Rancharada
		11	Karoli
		12	Boriyavi
		13	Jethlaj
		14	Dabla
		15	Vasnol
		16	Vansjeda Dhedia
		17	Unali
		18	Hajipur
	Sub-total	18	
Total District		18	
Ahmedabad	Sanand	1	Garodiya
		2	Godhavi
		3	Kaneti
		4	Nidhard
		5	Sanand
		6	Pipan
		7	Moti Devti
		8	Nani Devti
		9	Palwada
		10	Soila
		11	Sari

District	Sub-district	S. No	Affected Villages
		12	Matoda
		13	Vasna Chacharavadi
		14	Lodariyal
	Sub-total	14	
	Bhavla	1	Rajoda
		2	Kavitha
		3	Modasar
	Sub-total	3	
	Daskroi	1	Miroli
		2	Mahijda
		3	Rampura
		4	Timba
		5	Kashindra
		6	Bhat
	Sub-total	4	
Total District		21	
Kheda	Kheda	1	Adasar
		2	Kathwada
		3	Chalindra
		4	TOI Vasna
		5	Naika Navi Vasad (Not Revenue village)
		6	Naika Chalendra(Not Revenue village)
		7	Navagam
		8	Shetra
		9	Vasna Bujarg
		10	Dharampura
		11	Govindpura
		12	Dharoda
	Sub-total	12	
	Matar	1	Pimpara
		2	Koshiyal
		3	Matar
		4	Traj
		5	Garmala
		6	Machhiel
		7	Hernaj
		8	Khandhli
		9	Laval
		10	Maliataj
	Sub-total	10	
Total District		22	
Anand	Sojitra	1	Deva Vanta
		2	Roon
	Sub-total	2	
	Petlad	1	Demol
		2	Changa
		3	Mahelav
		4	Ravipura
		5	Morad
		6	Boriya
		7	Thaladi
		8	Padgol
		9	Radupura
		10	Kaisy Kua
		11	Navagam
		12	Vishnoli
	Sub-total	12	
	Anand	1	Sandesar

District	Sub-district	S. No	Affected Villages
		2	Gana
		3	Meghva Gana
		4	Vans Khiliya
		5	Khandhali
		6	Napad Vanto
	Sub-total	6	
	Borsad	1	Napa Vanto
		2	Kasumbad
	Sub-total	2	
	Anklav	1	Khadol (Haldari)
		2	Haldari
		3	Bhetasi (Talpad)
		4	Laxmi Pura*
		5	Lalpura*
		6	Ambali*
		7	Khanvadi
	Sub-total	7	
Total District		29	
Vadodara	Vadodara	1	Bil
		2	Kotna
		3	Sherkhi
		4	Sonarkoi
		5	Trikanpura
		6	Krisna nagar
		7	Mahapura
		8	Bhayali
		9	Gokul Pura
		10	Samiyala
		11	Jeevari
		12	Chapad
		13	Khalipur
		14	Vadasala
		15	Karali
		16	Itola
		17	Maneja
		18	Sevasi
		19	Jambua (Vadodara City)
		20	Anagarh
		21	Raypura
		22	Maretha
		23	Vernama
	Sub-total	23	
Total District		23	
Total State		**215**	

Appendix III-4-7 Comments on the Draft EIA Report

SUMMARY OF THE COMMENTS

[Haryana State]

State:	Haryana	District	Rewari	Village	Gangaachariya Ahir
Category of Comments	Natural Environment; Land and R&R Issues				
Type of Comments	Community				
Abstract					

1. The only pond of the village may get affected due to the proposed DFC track, resulting adverse impact on the drinking water source of cattle as well the natural environment of the area. The railway track should be at least 1 km nway from the pond.
2. The villagers losing their land due to the project will have long term adverse economic impacts. They should be paid a compensation of 10 million INR per 0.41 ha. Further, royalty should be paid for 30 years.
3. Jobs should be provided in railway/other government departments to at least one member of the affected families. Insurance cover should be provided to every affected family.

State:	Haryana	District	Rewari	Village	Rajpur Khalsa
Category of Comments	Social except land and R&R Issues				
Type of Comments	Individual				
Abstract					

A man of Rajpur Khalsa village owns a piece of agricultural land which is not affected by the project. However, irrigation water to his land is being supplied from a tube well through 2 km long PVC pipeline, costing about 0.6 million INR. The pipeline and the tube well will get affected by the project. The man has requested to kindly save these installations.

State:	Haryana	District	Rewari	Village	Mnjra
Category of Comments	Land and R&R Issues				
Type of Comments	Individual				
Abstract					

The village head requests to pay the compensation against acquired land as per the market rate (2.5 million INR per acre) and anticipates difficulty is sustaining the life of the villagers if compensation is paid as per government rate.

State:	Haryana	District	Mahendragarh	Village	Ateli Mandi
Category of Comments	Natural Environment; Land and R&R Issues				
Type of Comments	Community				
Abstract					

The Secretary of Haryana Byapar Mandal (Haryana Traders Association), Ateli Mandi has raised the following issues:

1. The project will increase environmental pollution
2. The increased noise pollution level will disturb the students and will also increase the deafness among the residents.
3. Major chunk of the settlement is located on the south, by the railway. Therefore, the project will affect a good number of residential buildings.
4. A bypass (detour) should be considered for Ateli Mandi region.
5. The temple and crematorium ground will be affected by the project.
6. This project will affect a number of villages in the area which is located close to the railway tracks.
7. The water supply tank and rest house of Ateli Mandi will be affected due to the project.
8. The increased vibration level will damage the belongings of the residents.
9. Radha Krishna temple, a century old shrine is quite popular among the residents. This temple will be affected, which will hurt the religious sentiments of the locals.
10. Potential losses due to land acquisition are anticipated to be of high magnitude. Further, the newspapers have reported that only meager amount will be paid as compensation.
11. The level crossing is usually closed for train operation in almost half an hour interval. The proposed DFC corridor will increase the frequency of train movement and will eventually lead to traffic snarls at the crossing. This will not only increase the environmental pollution but also stall the development of the town.
12. The drainage system of the town runs parallel to the existing track for about 1.6 km and then terminates across the railway line. The proposed project will affect the drainage system causing great inconvenience to the residents. Therefore, bypass (detour) must be considered for Ateli Mandi area.

State:	Haryana	District	Mahendragarh	Village	Ateli Mandi
Category of Comments	Natural Environment; Land and R&R Issues				
Type of Comments	Community				
Abstract					

A man, Chairman, Ateli Mandi Municipal Corporation has raised the following issues:

1. The project will increase environmental pollution
2. The increased noise pollution level will disturb the students and will also increase the deafness among the residents.
3. Major chunk of the settlement is located on the south, by the railway. Therefore, the project will affect a good number of residential buildings.
4. A bypass (detour) should be considered for Ateli Mandi region.
5. The temple and crematorium ground will be affected by the project.
6. This project will affect a number of villages in the area which is located close to the railway tracks.
7. The water supply tank and rest house of Ateli Mandi will be affected due to the project.
8. The increased vibration level will damage the belongings of the residents.
9. Radha Krishna temple, a century old shrine is quite popular among the residents. This temple will be affected, which will hurt the religious sentiments of the locals.
10. Potential losses due to land acquisition are anticipated to be of high magnitude. Further, the newspapers have reported that only meager amount will be paid as compensation.

State:	Haryana	District	Mahendragarh	Village	Ateli Mandi
Category of Comments	Natural Environment; Land and R&R Issues				
Type of Comments	Community				
Abstract					

A man, Shiv Mandir Raksha Committee (Forum for saving Shiv Temple), Ateli Mandi has raised the following issues:

1. The project will increase environmental pollution
2. The increased noise pollution level will disturb the students and will also increase the deafness among the residents.
3. Major chunk of the settlement is located on the south, by the railway. Therefore, the project will affect a good number of residential buildings.
4. A bypass (detour) should be considered for Ateli Mandi region.
5. The temple and crematorium ground will be affected by the project.
6. This project will affect a number of villages in the area which is located close to the railway tracks.
7. The water supply tank and rest house of Ateli Mandi will be affected due to the project.
8. The increased vibration level will damage the belongings of the residents.
9. Radha Krishna temple, a century old shrine is quite popular among the residents. This temple will be affected, which will hurt the religious sentiments of the locals.
10. Potential losses due to land acquisition are anticipated to be of high magnitude. Further, the newspapers have reported that only meager amount will be paid as compensation.
11. The level crossing is usually closed for train operation in almost half an hour interval. The proposed DFC corridor will increase the frequency of train movement and will eventually lead to traffic snarls at the crossing. This will not only increase the environmental pollution but also stall the development of the town.
12. The drainage system of the town runs parallel to the existing track for about 1.6 km and then terminates across the railway line. The proposed project will affect the drainage system causing great inconvenience to the residents. Therefore, bypass (detour) must be considered for Ateli Mandi area.

State:	Haryana	District	Mahendragarh	Village	Bachod
Category of Comments	Natural Environment; Land and R&R Issues				
Type of Comments	Community				
Abstract					

A man, village head has requested for the following:

1. ROB at each rail-road crossings
2. Job for project affected family and compensation as per the market value of land at Gurgaon city instead of collector rate
3. Compensation against damaged/acquired utilities such as wells
4. Predicted increase in noise and vibration level, causing damage in residential structures.

State:	Haryana	District	Mahendragarh	Village	Chilro Ki Dhani
Category of Comments	Natural Environment; Land and R&R Issues				
Type of Comments	Community				
Abstract					

Residents of Chilro Ki Dhani village has raised the following issues:

Issues:

1. Every family in the village belongs to Scheduled Castes
2. Every family own their residential houses
3. The village was founded in 1963 as *"lal dora"* area (area where land deeds are not provided)
4. The villagers don't own any other plot/land except the present residential plots
5. All of villagers do not own any agricultural land and are not dependent on agrarian practices for their livelihood
6. The villagers do not have any alternative residential plots/units.

Suggestions:

1. All of the villagers belong to same community and wish to stay together.
2. Alternative land, monetary assistance for construction of houses and sufficient time for construction and shifting should be provided.
3. Primary education facilities should be provided at the resettled colony.
4. Health care facilities should be provided within a kilometer of the resettled colony.
5. Link road to the colony from the main thoroughfares should be provided
6. Drinking water facility should be ensured before setting up of the resettled colony
7. Basic commodities should be made available within 1 km of the resettled colonies.

State:	Haryana	**District**	Mahendragarh	**Village**	Fatehpur
Category of Comments	Natural Environment; Land and R&R Issues				
Type of Comments	Individual				
Abstract					

A man, Ex Sarpanch of the village informed that an old Shiv Temple may get affected due to the project. It will hurt the religious sentiments of the locals. He requested project authorities to look for some alternative arrangements so that the temple remains undisturbed.

State:	Haryana	**District**	Mahendragarh	**Village**	Fatehpur
Category of Comments	Natural Environment; Social Expect R&R Issues				
Type of Comments	Community				
Abstract					

The village head of Fatehpur welcomed the project and expected that with completion of the DFC, our railway system will be at par with other developed nations. However, he anticipated the following impacts :

1 Dust Pollution during construction period for increased vehicular movement. Water is a scarce resource in the area, so it will not be available for sprinkling.
2 The houses are not earth quake resistant, so these structures may collapse due to increased vibration level during the construction phase
3 Almost half of the village is affected by the project. The school, temples and other facilities have been built by the villagers by community contribution. Will the Government be generous to rebuild these facilities?
4 The rehabilitation of the grazing lands and two ponds will be difficult as alternative land is not available in vicinity.
5 The level crossing will remain closed due to increased rail movement, leading to disruption in traffic flow.
6 The tree felling activity will only increase the pollution load till the time green belt gets developed. The area being water scarce, the early re-development of plantation is a remote possibility.
7 Increased pollution during the operation phase due to use of old railway engines that emits huge quantum of smoke

State:	Haryana	**District**	Mahendragarh	**Village**	Narnaul
Category of Comments	Natural Environment; Land and R&R Issues				
Type of Comments	Community				
Abstract					

The people of Narnaul, Mahendragarh District raised the following issues:

a. The area is near about 150-200 years old. Their forefathers have constructed houses, shops and lots of business institutions. If the DFC corridor passes through this area then near about 5,000 people will be affected.
b. The area of land to be acquired is not clearly mentioned in the booklet as well as during the PCMs. Please provide clarification.
c. It is requested to consider a detour and provide land and monetary compensation to the affected persons.

State:	Haryana	District	Mahendragarh	Village	Tajpur
Category of Comments	Natural Environment; Land and R&R Issues				
Type of Comments	Community				
Abstract					

The Tajpur residents commented as follows:
a. The village is located on both sides of the railway track. Therefore, ROB/ RUB should be provided.
b. The compensation rate for Narnaul should be same with Rewari and Gaurgaun.
c. Proper compensation should be paid for the sensitive receptors like Temple, Gurudwara, Cremation area, Schools etc which are going to be affected for DFC project.
d. Proper compensation should be paid for the Panchayat land to be acquired for the project.
e. The increase in noise and vibration level should be taken care of.

[Rajasthan State]

State:	Rajasthan	District	Alwar	Village	Kathoowas
Category of Comments	Land and R&R Issues				
Type of Comments	Community				
Abstract					

The village is sandwiched between Rewari and Mahendragarh Districts of Haryana. The compensation for land acquisition is reported to be higher in adjoining Haryana villages than this village as the government circle rates (land rates) in Rajasthan is lower than that of Haryana. Interestingly, the land conditions in the village is exactly same as of Haryana villages.
The villagers have also requested for construction of ROB for smooth traffic flow.

State:	Rajasthan	District	Sikar	Village	Jaitusar
Category of Comments	Natural Environment; Land and R&R Issues				
Type of Comments	Community				
Abstract					

The village head has welcomed the project and expected that it will benefit the entire nation. However, he raised the following issues:
1. Greenbelt to be developed on both sides of the track
2. The railway engines/compartments should be fitted to anti-vibration/noise equipments.
3. The PAPs should be rehabilitated and at least one member of the affected family should be project a job as per his/her qualification.
4. The compensation should be paid as per the market rate after proper evaluation.

State:	Rajasthan	District	Jaipur	Village	Badhal
Category of Comments	Social except Land and R&R Issues				
Type of Comments	Community				
Abstract					

The village head has raised the following issues:
1. ROB should be provided at the rail-road crossing
2. The passenger train movement should not be hampered during the construction period.
3. Chetak Express should stop at the nearby station and a new train between Delhi and Jodhpur should be started.
4. The rest house located close to the tracks may be affected by the project. It should be re-constructed.

State:	Rajasthan	District	Jaipur	Village	Charanwas
Category of Comments	Land and R&R Issues				
Type of Comments	Community				
Abstract					

The village head has raised the following issues:
1. The existing level crossing should remain open.
2. The compensation for acquired land should be provided as per the DLC rate.

State:	Rajasthan	District	Jaipur	Village	Dewa Ka Was
Category of Comments	Land and R&R Issues				
Type of Comments	Community				
Abstract					

The village head has raised the following issues:
1. ROB should be constructed over the only connecting road between the village and Jaipur-Sikar State Highway
2. Bitumen layer should be laid over the existing road on the east of the railway track.
3. Compensation for acquired agricultural land should be provided as per the present DLC rate while compensation acquired structures should be paid as per the present BSR rate.

State:	Rajasthan	District	Jaipur	Village	Sakhun
Category of Comments	Social except Land and R&R Issues; Natural Environment				
Type of Comments	Community				
Abstract					

The village head has raised the following issues:
1. The goods train and passenger train should halt in the station
2. Either compensation should be paid as per the BSR rates for acquired irrigation wells or these should be reconstructed.
3. ROB should be constructed over gate number 11, 13, 14 and 15. The level crossing number 14 should be manned for 24 hours till the time ROB is constructed.
4. The area being water scarce, drinking water can be bought from other areas through railway. Water tank/chambers should be constructed in the station premises to facilitate the storage of water.
5. Foot over bridge should be constructed in the railway station
6. Storm water drainage canal connecting various nallas should be considered.
7. Greenbelt should be developed on both sides of the Jaipur-Ajmer section of the track.
8. Provision for new level crossing on the east of the station should be considered.
9. Provision of electricity in the platforms should be considered for passenger amenities.
10. A new railway line from Sakun to Tonk via Dudu and Malpura should be considered for future requirements.
11. A retiring room for passengers on the southern side of the railway station should be constructed.
12. Mechanism should be developed to update the village heads regularly about the development activity.

State:	Rajasthan	District	Jaipur	Village	Itawa
Category of Comments	Land and R&R Issues				
Type of Comments	Community				
Abstract					

The village head has raised the following issues:
1. Connective roads for farmers (who own lands close to the DFC tracks) up to main thoroughfares should be provided
2. Provision for ROB/RUB should be considered for providing access across the DFC track.
3. Compensation for acquired agricultural land should be provided at par with Kishan Manpura and Asthi Kalan Villages.
4. Permanent solution for impacts due to increased noise and vibration level should be devised.
5. Compensation for acquired structures as per the market rate should be provided.

State:	Rajasthan	District	Jaipur	Village	Kabro Ka Was
Category of Comments	Land and R&R Issues				
Type of Comments	Community				
Abstract					

The village head has raised the following issues:
1. Provision of ROB at the level crossing as this is the only connecting road to the village.
2. Compensation for acquired agricultural land should be provided at par with Kishan Manpura and Asthi Kalan Villages.
3. Open wells and tube wells should be compensated as per the BSR rates.
4. Bitumen road should be constructed on the east of the DFC track so that villagers can get easy access to the Ringus-Phulera Road.

State:	Rajasthan	District	Jaipur	Village	Pachar Malikpura
Category of Comments	Land and R&R Issues				
Type of Comments	Individual				
Abstract					

A lady with a man owns about 3.5 ha land with a plantation of 550 trees, which will be acquired for the purpose of the project. 14 person of her family are dependent on the land for their livelihood. She has requested the project authorities to

make full payment of the compensation amount before taking possession of the acquired land. Further, she has also suggested to develop a 4 lane road near the proposed corridor.

State:	Rajasthan	**District**	Jaipur	**Village**	Renwal
Category of Comments	Natural Environment; Land and R&R Issues				
Type of Comments	Individual				
Abstract					
A man, priest of Gumtiwale Balaji Temple at Renwal expressed the view that increased rail traffic movement due to the project will increase the noise and vibration level to the considerable extent. This will affect the peace and tranquility of the worshipers. The temple should be re-constructed at near places in government land with due diligence.					

State:	Rajasthan	**District**	Ajmer	**Village**	Madangunj-Kishangarh
Category of Comments	Natural Environment; Land and R&R Issues				
Type of Comments	Individual				
Abstract					
A man, resident of Kishangarh expressed the view that there are several residential, commercial and religious structures affected by the proposed project that will cause big economic loss to public as well railways. Some of stakeholders will loose their sources of income and the religious sentiments of different communities will be hurt due to demolition of temples and mosques. Noise and vibration level as well as environmental pollution will increase, which will affect general public badly. Therefore, detour may be considered for Kishangarh Town.					

State:	Rajasthan	**District**	Ajmer	**Village**	Madangunj-Kishangarh
Category of Comments	Natural Environment; Land and R&R Issues				
Type of Comments	Individual				
Abstract					
A man owns a shop near Balaji ki Bagiche area, expressed the view that there are several residential, commercial and religious structures affected by the proposed project that will cause big economic loss to public as well railways. Some of stakeholders will loose their sources of income and the religious sentiments of different communities will be hurt due to demolition of temples and mosques. Noise and vibration level as well as environmental pollution will increase, which will affect general public badly. Therefore, detour may be considered for Kishangarh Town.					

State:	Rajasthan	**District**	Ajmer	**Village**	Madangunj-Kishangarh
Category of Comments	Natural Environment; Land and R&R Issues				
Type of Comments	Individual				
Abstract					
A man, resident of Kishangarh expressed the view that there are several residential, commercial and religious structures affected by the proposed project that will cause big economic loss to public as well railways. Some of stakeholders will loose their sources of income and the religious sentiments of different communities will be hurt due to demolition of temples and mosques. Noise and vibration level as well as environmental pollution will increase, which will affect general public badly. Therefore, detour may be considered for Kishangarh Town.					

State:	Rajasthan	**District**	Ajmer	**Village**	Madangunj-Kishangarh
Category of Comments	Natural Environment; Land and R&R Issues				
Type of Comments	Individual				
Abstract					
A man owns a shop near Balaji ki Bagiche area, expressed the view that there are several residential, commercial and religious structures affected by the proposed project that will cause big economic loss to public as well railways. Some of stakeholders will loose their sources of income and the religious sentiments of different communities will be hurt due to demolition of temples and mosques. Noise and vibration level as well as environmental pollution will increase, which will affect general public badly. Therefore, detour may be considered for Kishangarh Town.					

State:	Rajasthan	District	Ajmer	Village	Madangunj-Kishangarh
Category of Comments	Natural Environment; Land and R&R Issues				
Type of Comments	Individual				
Abstract					
A man owns a shop near Balaji ki Bagiche area, expressed the view that there are several residential, commercial and religious structures affected by the proposed project that will cause big economic loss to public as well railways. Some of stakeholders will loose tbeir sources of income and the religious sentiments of different communities will be hurt due to demolition of temples and mosques. Noise and vibration level as well as environmental pollution will increase, which will affect general public badly. Therefore, detour may be considered for Kishangarh Town.					

State:	Rajasthan	District	Ajmer	Village	Madangunj-Kishangarh
Category of Comments	Natural Environment; Land and R&R Issues				
Type of Comments	Individual				
Abstract					
A man owns a shop near Balaji ki Bagiche area, expressed the view that there are several residential, commercial and religious structures affected by the proposed project that will cause big economic loss to public as well railways. Some of stakeholders will loose their sources of income and the religious sentiments of different communities will be hurt due to demolition of temples and mosques. Noise and vibration level as well as environmental pollution will increase, which will affect general public badly. Therefore, detour may be considered for Kishangarh Town.					

State:	Rajasthan	District	Ajmer	Village	Madangunj-Kishangarh
Category of Comments	Natural Environment; Land and R&R Issues				
Type of Comments	Individual				
Abstract					
A man, resident of Kishangarh expressed the view that there are several residential, commercial and religious structures affected by the proposed project that will cause big economic loss to public as well railways. Some of stakeholders will loose their sources of income and the religious sentiments of different communities will be hurt due to demolition of temples and mosques. Noise and vibration level as well as environmental pollution will increase, which will affect general public badly. Therefore, detour may be considered for Kishangarh Town.					

State:	Rajasthan	District	Ajmer	Village	Madangunj-Kishangarh
Category of Comments	Natural Environment; Land and R&R Issues				
Type of Comments	Individual				
Abstract					
A man owns a shop near Balaji ki Bagiche area, expressed the view that there are several residential, commercial and religious structures affected by the proposed project that will cause big economic loss to public as well railways. Some of stakeholders will loose their sources of income and the religious sentiments of different communities will be hurt due to demolition of temples and mosques. Noise and vibration level as well as environmental pollution will increase, which will affect general public badly. Therefore, detour may be considered for Kishangarh Town.					

State:	Rajasthan	District	Ajmer	Village	Madangunj-Kishangarh
Category of Comments	Natural Environment; Land and R&R Issues				
Type of Comments	Individual				
Abstract					
A man, resident of Kishangarh expressed the view that there are several residential, commercial and religious structures affected by the proposed project that will cause big economic loss to public as well railways. Some of stakeholders will loose their sources of income and the religious sentiments of different communities will be hurt due to demolition of temples and mosques. Noise and vibration level as well as environmental pollution will increase, which will affect general public badly. Therefore, detour may be considered for Kishangarh Town.					

State:	Rajasthan	District	Ajmer	Village	Madangunj-Kishangarh
Category of Comments	Natural Environment; Land and R&R Issues				
Type of Comments	Individual				
Abstract					
A man, resident of Kishangarh expressed the view that there are several residential, commercial and religious structures affected by the proposed project that will cause big economic loss to public as well railways. Some of stakeholders will					

loose their sources of income and the religious sentiments of different communities will be hurt due to demolition of temples and mosques. Noise and vibration level as well as environmental pollution will increase, which will affect general public badly. Therefore, detour may be considered for Kishangarh Town.

State:	Rajasthan	District	Ajmer	Village	Madangunj-Kishangarh
Category of Comments	Natural Environment; Land and R&R Issues				
Type of Comments	Individual				
Abstract					
A man, resident of Kishangarh expressed the view that there are several residential, commercial and religious structures affected by the proposed project that will cause hig economic loss to public as well railways. Some of stakeholders will loose their sources of income and the religious sentiments of different communities will be hurt due to demolition of temples and mosques. Noise and vibration level as well as environmental pollution will increase, which will affect general public badly. Therefore, detour may be considered for Kishangarh Town.					

State:	Rajasthan	District	Ajmer	Village	Madangunj-Kishangarh
Category of Comments	Natural Environment; Land and R&R Issues				
Type of Comments	Individual				
Abstract					
A man, resident of Kishangarh expressed the view that there are several residential, commercial and religious structures affected by the proposed project that will cause big economic loss to public as well railways. Some of stakeholders will loose their sources of income and the religious sentiments of different communities will be hurt due to demolition of temples and mosques. Noise and vibration level as well as environmental pollution will increase, which will affect general public badly. Therefore, detour may be considered for Kishangarh Town.					

State:	Rajasthan	District	Ajmer	Village	Madangunj-Kishangarh
Category of Comments	Natural Environment; Land and R&R Issues				
Type of Comments	Individual				
Abstract					
A man, priest of Sri Balaji Bagicha expressed the view that the temple complex is more than 250 years old and it also houses several other temples. Further, there are several residential, commercial and religious structures affected by the proposed project that will cause big economic loss to public as well railways. Some of stakeholders will loose their sources of income and the religious sentiments of different communities will be hurt due to demolition of temples and mosques. Noise and vibration level as well as environmental pollution will increase, which will affect general public badly. Therefore, detour may be considered for Kishangarh Town.					

State:	Rajasthan	District	Ajmer	Village	Madangunj-Kishangarh
Category of Comments	Natural Environment; Land and R&R Issues				
Type of Comments	Individual				
Abstract					
A man, resident of Kishangarh expressed the view that there are several residential, commercial and religious structures affected by the proposed project that will cause big economic loss to public as well railways. Some of stakeholders will loose their sources of income and the religious sentiments of different communities will be hurt due to demolition of temples and mosques. Noise and vibration level as well as environmental pollution will increase, which will affect general public badly. Therefore, detour may be considered for Kishangarh Town.					

State:	Rajasthan	District	Ajmer	Village	Madangunj-Kishangarh
Category of Comments	Natural Environment; Land and R&R Issues				
Type of Comments	Community				
Abstract					
The shopkeepers who own shops near Balaji ki Bagiche area, expressed the view that there are several residential, commercial and religious structures affected by the proposed project that will cause big economic loss to public as well railways. Some of stakeholders will loose their sources of income and the religious sentiments of different communities will be hurt due to demolition of temples and mosques. Noise and vibration level as well as environmental pollution will increase, which will affect general public badly. Therefore, detour may be considered for Kishangarh Town.					

State:	Rajasthan	District	Ajmer	Village	Madangunj-Kishangarh
Category of Comments	Natural Environment; Land and R&R Issues				
Type of Comments	Individual				
Abstract					

A man owns a shop near Balaji ki Bagiche area, expressed the view that there are several residential, commercial and religious structures affected by the proposed project that will cause big economic loss to public as well railways. Some of stakeholders will loose their sources of income and the religious sentiments of different communities will be hurt due to demolition of temples and mosques. Noise and vibration level as well as environmental pollution will increase, which will affect general public badly. Therefore, detour may be considered for Kishangarh Town.

[Gujarat State]

State:	Gujarat	District	Vadodara	Village	Maretha
Category of Comments	Land and R&R Issues				
Type of Comments	Community				
Abstract					

Project affected persons of Maretha Village has raised the following observations:

1. The DFC alignment affects 31 villages in the district, out of which 19 villages comes under VUDA [Vadodara Urban Development Authority] area.
2. The State government has planned to develop Vadodara as Mega City and sale/purchase of lands within the VUDA area is restricted. The alignment should either bypass the VUDA area or should be accommodated within the reversed area for road/rail development. 640 m wide corridor has been earmarked for road development, where DFC tracks can be accommodated.
3. The compensation to be provided [circle rate + 60%] is inadequate and will cause huge economic losses. The farmers want to retain their status as farmers and do not wish to take any other profession for livelihood. Further, compensation should also be paid for bore well and trees in the acquired land.
4. The project will not benefit the farmers. Moreover, the fragmented pieces of land, which will not be acquired, will be of no use for agrarian purposes. Construction of embankment will cause water logging, which will further deteriorate the productivity of neighboring land.
5. The exiting norms prohibit any construction within 60 m on both sides of the track; construction of 1 storey houses and small roads are allowed in next 20m width. Therefore, implementation of the project will dampen the development prospects of the lands.
6. The compensation amount should 500% on the circle rate or market rate, whichever is higher and government/railway jobs should be ensured for at members of affected families for a few generations.
7. The farmers in this area will be badly affected due land acquisition by various authorities viz., VUDA, DFCCIL etc for developmental purposes. Therefore, the unutilized government lands should be distributed among the farmers.
8. Accessibility across the DFC will be major problem; therefore 12 m wide access roads should be provided on both sides of the track.
9. The affected farmers have taken agriculture loans from Nationalized Banks; the project authorities should repay the balance loan amount and provide certificate from the banks.
10. The project is designed to benefit industrial houses, not ordinary citizens of our country. Therefore, this project is not a public purpose project. Therefore, 500% of the highest circle rates among the affected 31 villages should be the basis of the compensation.

State:	Gujarat	District	Vadodara	Village	Bil
Category of Comments	Land and R&R Issues				
Type of Comments	Community				
Abstract					

Project affected persons of Bil Village has raised the following observations:

1. The DFC alignment affects 31 villages in the district, out of which 19 villages comes under VUDA [Vadodara Urban Development Authority] area.
2. The State government has planned to develop Vadodara as Mega City and sale/purchase of lands within the VUDA area is restricted. The alignment should either bypass the VUDA area or should be accommodated within the reversed area for road/rail development. 640 m wide corridor has been earmarked for road development, where DFC tracks can be accommodated.
3. The compensation to be provided [circle rate + 60%] is inadequate and will cause huge economic losses. The farmers want to retain their status as farmers and do not wish to take any other profession for livelihood. Further, compensation should also be paid for bore well and trees in the acquired land.
4. The project will not benefit the farmers. Moreover, the fragmented pieces of land, which will not be acquired, will be of no use for agrarian purposes. Construction of embankment will cause water logging, which will further deteriorate the productivity of neighboring land.
5. The exiting norms prohibit any construction within 60 m on both sides of the track; construction of 1 storey houses and small roads are allowed in next 20m width. Therefore, implementation of the project will dampen the development prospects of the lands.

6. The compensation amount should 500% on the circle rate or market rate, whichever is higher and government/railway jobs should be ensured for at members of affected families for a few generations.
7. The farmers in this area will be badly affected due land acquisition by various authorities viz., VUDA, DFCCIL etc for developmental purposes. Therefore, the unutilized government lands should be distributed among the farmers.
8. Accessibility across the DFC will be major problem; therefore 12 m wide access roads should be provided on both sides of the track.
9. The affected farmers have taken agriculture loans from Nationalized Banks; the project authorities should repay the balance loan amount and provide certificate from the banks.
10. The project is designed to benefit industrial houses, not ordinary citizens of our country. Therefore, this project is not a public purpose project. Therefore, 500% of the highest circle rates among the affected 31 villages should be the basis of the compensation.

State:	Gujarat	District	Vadodara	Village	Samiyala
Category of Comments		Land and R&R Issues			
Type of Comments		Community			

Abstract

Project affected persons of Samiyala Village has raised the following observations:

1. The DFC alignment affects 31 villages in the district, out of which 19 villages comes under VUDA [Vadodara Urban Development Authority] area.
2. The State government has planned to develop Vadodara as Mega City and sale/purchase of lands within the VUDA area is restricted. The alignment should either bypass the VUDA area or should be accommodated within the reversed area for road/rail development. 640 m wide corridor has been earmarked for road development, where DFC tracks can be accommodated.
3. The compensation to be provided [circle rate + 60%] is inadequate and will cause huge economic losses. The farmers want to retain their status as farmers and do not wish to take any other profession for livelihood. Further, compensation should also be paid for bore well and trees in the acquired land.
4. The project will not benefit the farmers. Moreover, the fragmented pieces of land, which will not be acquired, will be of no use for agrarian purposes. Construction of embankment will cause water logging, which will further deteriorate the productivity of neighboring land.
5. The exiting norms prohibit any construction within 60 m on both sides of the track; construction of 1 storey houses and small roads are allowed in next 20m width. Therefore, implementation of the project will dampen the development prospects of the lands.
6. The compensation amount should 500% on the circle rate or market rate, whichever is higher and government/railway jobs should be ensured for at members of affected families for a few generations.
7. The farmers in this area will be badly affected due land acquisition by various authorities viz., VUDA, DFCCIL etc for developmental purposes. Therefore, the unutilized government lands should be distributed among the farmers.
8. Accessibility across the DFC will be major problem; therefore 12 m wide access roads should be provided on both sides of the track.
9. The affected farmers have taken agriculture loans from Nationalized Banks; the project authorities should repay the balance loan amount and provide certificate from the banks.
10. The project is designed to benefit industrial houses, not ordinary citizens of our country. Therefore, this project is not a public purpose project. Therefore, 500% of the highest circle rates among the affected 31 villages should be the basis of the compensation.

State:	Gujarat	District	Vadodara	Village	Kambola
Category of Comments		Land and R&R Issues			
Type of Comments		Community			

Abstract

Project affected persons of Kambola Village has raised the following observations:

1. The DFC alignment affects 31 villages in the district, out of which 19 villages comes under VUDA [Vadodara Urban Development Authority] area.
2. The State government has planned to develop Vadodara as Mega City and sale/purchase of lands within the VUDA area is restricted. The alignment should either bypass the VUDA area or should be accommodated within the reversed area for road/rail development. 640 m wide corridor has been earmarked for road development, where DFC tracks can be accommodated.
3. The compensation to be provided [circle rate + 60%] is inadequate and will cause huge economic losses. The farmers want to retain their status as farmers and do not wish to take any other profession for livelihood. Further, compensation should also be paid for bore well and trees in the acquired land.
4. The project will not benefit the farmers. Moreover, the fragmented pieces of land, which will not be acquired, will be of no use for agrarian purposes. Construction of embankment will cause water logging, which will further deteriorate the productivity of neighboring land.
5. The exiting norms prohibit any construction within 60 m on both sides of the track; construction of 1 storey houses and small roads are allowed in next 20m width. Therefore, implementation of the project will dampen the development prospects of the lands.
6. The compensation amount should 500% on the circle rate or market rate, whichever is higher and government/railway jobs should be ensured for at members of affected families for a few generations.

7. The farmers in this area will be badly affected due land acquisition by various authorities viz., VUDA, DFCCIL etc for developmental purposes. Therefore, the unutilized government lands should be distributed among the farmers.
8. Accessibility across the DFC will be major problem; therefore 12 m wide access roads should be provided on both sides of the track.
9. The affected farmers have taken agriculture loans from Nationalized Banks; the project authorities should repay the balance loan amount and provide certificate from the banks.
10. The project is designed to benefit industrial houses, not ordinary citizens of our country. Therefore, this project is not a public purpose project. Therefore, 500% of the highest circle rates among the affected 31 villages should be the basis of the compensation.

State:	Gujarat	District	Vadodara	Village	Chansad
Category of Comments	Land and R&R Issues				
Type of Comments	Community				
Abstract					

Project affected persons of Chansad Village has raised the following observations:

1. The DFC alignment affects 31 villages in the district, out of which 19 villages comes under VUDA [Vadodara Urban Development Authority] area.
2. The State government has planned to develop Vadodara as Mega City and sale/purchase of lands within the VUDA area is restricted. The alignment should either bypass the VUDA area or should be accommodated within the reversed area for road/rail development. 640 m wide corridor has been earmarked for road development, where DFC tracks can be accommodated.
3. The compensation to be provided [circle rate + 60%] is inadequate and will cause huge economic losses. The farmers want to retain their status as farmers and do not wish to take any other profession for livelihood. Further, compensation should also be paid for bore well and trees in the acquired land.
4. The project will not benefit the farmers. Moreover, the fragmented pieces of land, which will not be acquired, will be of no use for agrarian purposes. Construction of embankment will cause water logging, which will further deteriorate the productivity of neighboring land.
5. The exiting norms prohibit any construction within 60 m on both sides of the track; construction of 1 storey houses and small roads are allowed in next 20m width. Therefore, implementation of the project will dampen the development prospects of the lands.
6. The compensation amount should 500% on the circle rate or market rate, whichever is higher and government/railway jobs should be ensured for at members of affected families for a few generations.
7. The farmers in this area will be badly affected due land acquisition by various authorities viz., VUDA, DFCCIL etc for developmental purposes. Therefore, the unutilized government lands should be distributed among the farmers.
8. Accessibility across the DFC will be major problem; therefore 12 m wide access roads should be provided on both sides of the track.
9. The affected farmers have taken agriculture loans from Nationalized Banks; the project authorities should repay the balance loan amount and provide certificate from the banks.
10. The project is designed to benefit industrial houses, not ordinary citizens of our country. Therefore, this project is not a public purpose project. Therefore, 500% of the highest circle rates among the affected 31 villages should be the basis of the compensation.

State:	Gujarat	District	Vadodara	Village	Vernama
Category of Comments	Land and R&R Issues				
Type of Comments	Community				
Abstract					

Project affected persons of Vernama Village has raised the following observations:

1. The DFC alignment affects 31 villages in the district, out of which 19 villages comes under VUDA [Vadodara Urban Development Authority] area.
2. The State government has planned to develop Vadodara as Mega City and sale/purchase of lands within the VUDA area is restricted. The alignment should either bypass the VUDA area or should be accommodated within the reversed area for road/rail development. 640 m wide corridor has been earmarked for road development, where DFC tracks can be accommodated.
3. The compensation to be provided [circle rate + 60%] is inadequate and will cause huge economic losses. The farmers want to retain their status as farmers and do not wish to take any other profession for livelihood. Further, compensation should also be paid for bore well and trees in the acquired land.
4. The project will not benefit the farmers. Moreover, the fragmented pieces of land, which will not be acquired, will be of no use for agrarian purposes. Construction of embankment will cause water logging, which will further deteriorate the productivity of neighboring land.
5. The exiting norms prohibit any construction within 60 m on both sides of the track; construction of 1 storey houses and small roads are allowed in next 20m width. Therefore, implementation of the project will dampen the development prospects of the lands.
6. The compensation amount should 500% on the circle rate or market rate, whichever is higher and government/railway jobs should be ensured for at members of affected families for a few generations.
7. The farmers in this area will be badly affected due land acquisition by various authorities viz., VUDA, DFCCIL etc for developmental purposes. Therefore, the unutilized government lands should be distributed among the farmers.

8. Accessibility across the DFC will be major problem; therefore 12 m wide access roads should be provided on both sides of the track.
9. The affected farmers have taken agriculture loans from Nationalized Banks; the project authorities should repay the balance loan amount and provide certificate from the banks.
10. The project is designed to benefit industrial houses, not ordinary citizens of our country. Therefore, this project is not a public purpose project. Therefore, 500% of the highest circle rates among the affected 31 villages should be the basis of the compensation.

State:	Gujarat	District	Vadodara	Village	Mahapura
Category of Comments		Land and R&R Issues			
Type of Comments		Community			

Abstract

Project affected persons of Mahapura Village has raised the following observations:

1. The DFC alignment affects 31 villages in the district, out of which 19 villages comes under VUDA [Vadodara Urban Development Authority] area.
2. The State government has planned to develop Vadodara as Mega City and sale/purchase of lands within the VUDA area is restricted. The alignment should either bypass the VUDA area or should be accommodated within the reversed area for road/rail development. 640 m wide corridor has been earmarked for road development, where DFC tracks can be accommodated.
3. The compensation to be provided [circle rate + 60%] is inadequate and will cause huge economic losses. The farmers want to retain their status as farmers and do not wish to take any other profession for livelihood. Further, compensation should also be paid for bore well and trees in the acquired land.
4. The project will not benefit the farmers. Moreover, the fragmented pieces of land, which will not be acquired, will be of no use for agrarian purposes. Construction of embankment will cause water logging, which will further deteriorate the productivity of neighboring land.
5. The exiting norms prohibit any construction within 60 m on both sides of the track; construction of 1 storey houses and small roads are allowed in next 20m width. Therefore, implementation of the project will dampen the development prospects of the lands.
6. The compensation amount should 500% on the circle rate or market rate, whichever is higher and government/railway jobs should be ensured for at members of affected families for a few generations.
7. The farmers in this area will be badly affected due land acquisition by various authorities viz., VUDA, DFCCIL etc for developmental purposes. Therefore, the unutilized government lands should be distributed among the farmers.
8. Accessibility across the DFC will be major problem; therefore 12 m wide access roads should be provided on both sides of the track.
9. The affected farmers have taken agriculture loans from Nationalized Banks; the project authorities should repay the balance loan amount and provide certificate from the banks.
10. The project is designed to benefit industrial houses, not ordinary citizens of our country. Therefore, this project is not a public purpose project. Therefore, 500% of the highest circle rates among the affected 31 villages should be the basis of the compensation.

State:	Gujarat	District	Vadodara	Village	Borka
Category of Comments		Land and R&R Issues			
Type of Comments		Community			

Abstract

Project affected persons of Borka Village has raised the following observations:

1. The DFC alignment affects 31 villages in the district, out of which 19 villages comes under VUDA [Vadodara Urban Development Authority] area.
2. The State government has planned to develop Vadodara as Mega City and sale/purchase of lands within the VUDA area is restricted. The alignment should either bypass the VUDA area or should be accommodated within the reversed area for road/rail development. 640 m wide corridor has been earmarked for road development, where DFC tracks can be accommodated.
3. The compensation to be provided [circle rate + 60%] is inadequate and will cause huge economic losses. The farmers want to retain their status as farmers and do not wish to take any other profession for livelihood. Further, compensation should also be paid for bore well and trees in the acquired land.
4. The project will not benefit the farmers. Moreover, the fragmented pieces of land, which will not be acquired, will be of no use for agrarian purposes. Construction of embankment will cause water logging, which will further deteriorate the productivity of neighboring land.
5. The exiting norms prohibit any construction within 60 m on both sides of the track; construction of 1 storey houses and small roads are allowed in next 20m width. Therefore, implementation of the project will dampen the development prospects of the lands.
6. The compensation amount should 500% on the circle rate or market rate, whichever is higher and government/railway jobs should be ensured for at members of affected families for a few generations.
7. The farmers in this area will be badly affected due land acquisition by various authorities viz., VUDA, DFCCIL etc for developmental purposes. Therefore, the unutilized government lands should be distributed among the farmers.
8. Accessibility across the DFC will be major problem; therefore 12 m wide access roads should be provided on both sides of the track.

9. The affected farmers have taken agriculture loans from Nationalized Banks; the project authorities should repay the balance loan amount and provide certificate from the banks.
10. The project is designed to benefit industrial houses, not ordinary citizens of our country. Therefore, this project is not a public purpose project. Therefore, 500% of the highest circle rates among the affected 31 villages should be the basis of the compensation.

State:	Gujarat	District	Vadodara	Village	Handod
Category of Comments	Land and R&R Issues				
Type of Comments	Community				

Abstract

Project affected persons of Handod Village has raised the following observations:

1. The DFC alignment affects 31 villages in the district, out of which 19 villages comes under VUDA [Vadodara Urban Development Authority] area.
2. The State government has planned to develop Vadodara as Mega City and sale/purchase of lands within the VUDA area is restricted. The alignment should either bypass the VUDA area or should be accommodated within the reversed area for road/rail development. 640 m wide corridor has been earmarked for road development, where DFC tracks can be accommodated.
3. The compensation to be provided [circle rate + 60%] is inadequate and will cause huge economic losses. The farmers want to retain their status as farmers and do not wish to take any other profession for livelihood. Further, compensation should also be paid for bore well and trees in the acquired land.
4. The project will not benefit the farmers. Moreover, the fragmented pieces of land, which will not be acquired, will be of no use for agrarian purposes. Construction of embankment will cause water logging, which will further deteriorate the productivity of neighboring land.
5. The exiting norms prohibit any construction within 60 m on both sides of the track; construction of 1 storey houses and small roads are allowed in next 20m width. Therefore, implementation of the project will dampen the development prospects of the lands.
6. The compensation amount should 500% on the circle rate or market rate, whichever is higher and government/railway jobs should be ensured for at members of affected families for a few generations.
7. The farmers in this area will be badly affected due land acquisition by various authorities viz., VUDA, DFCCIL etc for developmental purposes. Therefore, the unutilized government lands should be distributed among the farmers.
8. Accessibility across the DFC will be major problem; therefore 12 m wide access roads should be provided on both sides of the track.
9. The affected farmers have taken agriculture loans from Nationalized Banks; the project authorities should repay the balance loan amount and provide certificate from the banks.
10. The project is designed to benefit industrial houses, not ordinary citizens of our country. Therefore, this project is not a public purpose project. Therefore, 500% of the highest circle rates among the affected 31 villages should be the basis of the compensation.

State:	Gujarat	District	Vadodara	Village	Mangrol
Category of Comments	Land and R&R Issues				
Type of Comments	Community				

Abstract

Project affected persons of Mangrol Village has raised the following observations:

1. The DFC alignment affects 31 villages in the district, out of which 19 villages comes under VUDA [Vadodara Urban Development Authority] area.
2. The State government has planned to develop Vadodara as Mega City and sale/purchase of lands within the VUDA area is restricted. The alignment should either bypass the VUDA area or should be accommodated within the reversed area for road/rail development. 640 m wide corridor has been earmarked for road development, where DFC tracks can be accommodated.
3. The compensation to be provided [circle rate + 60%] is inadequate and will cause huge economic losses. The farmers want to retain their status as farmers and do not wish to take any other profession for livelihood. Further, compensation should also be paid for bore well and trees in the acquired land.
4. The project will not benefit the farmers. Moreover, the fragmented pieces of land, which will not be acquired, will be of no use for agrarian purposes. Construction of embankment will cause water logging, which will further deteriorate the productivity of neighboring land.
5. The exiting norms prohibit any construction within 60 m on both sides of the track; construction of 1 storey houses and small roads are allowed in next 20m width. Therefore, implementation of the project will dampen the development prospects of the lands.
6. The compensation amount should 500% on the circle rate or market rate, whichever is higher and government/railway jobs should be ensured for at members of affected families for a few generations.
7. The farmers in this area will be badly affected due land acquisition by various authorities viz., VUDA, DFCCIL etc for developmental purposes. Therefore, the unutilized government lands should be distributed among the farmers.
8. Accessibility across the DFC will be major problem; therefore 12 m wide access roads should be provided on both sides of the track.
9. The affected farmers have taken agriculture loans from Nationalized Banks; the project authorities should repay the balance loan amount and provide certificate from the banks.

10. The project is designed to benefit industrial houses, not ordinary citizens of our country. Therefore, this project is not a public purpose project. Therefore, 500% of the highest circle rates among the affected 31 villages should be the basis of the compensation.

State:	Gujarat	District	Anand	Village	Bandhani
Category of Comments	Natural Environment; Land and R&R Issues				
Type of Comments	Community				
Abstract					

The villagers have raised the following issues:

1. The villagers are totally dependent on their land for their livelihood. Along with the agricultural crops, the land also provided them the fodder required for animal husbandry.
2. Land has been acquired for a number of developmental and industrial projects in the area, especially the irrigation projects has consumed a vast quantum of productive lands. Acquisition of productive agricultural land will further add to the pressure on land resources, resulting shortage of food grains which will have long term impacts on National Level.
3. The existing Vadodara-Nadiad section of the railway tracks can be upgraded and utilized for goods carriage. This will not only save productive agricultural lands but minimize the environmental impacts.

State:	Gujarat	District	Anand	Village	Mahelav
Category of Comments	Natural Environment; Land and R&R Issues				
Type of Comments	Community				
Abstract					

The villagers have raised the following issues:

1. The villagers are totally dependent on their land for their livelihood. Along with the agricultural crops, the land also provided them the fodder required for animal husbandry.
2. Land has been acquired for a number of developmental and industrial projects in the area, especially the irrigation projects has consumed a vast quantum of productive lands. Acquisition of productive agricultural land will further add to the pressure on land resources, resulting shortage of food grains which will have long term impacts on National Level.
3. The existing Vadodara-Nadiad section of the railway tracks can be upgraded and utilized for goods carriage. This will not only save productive agricultural lands but minimize the environmental impacts.

State:	Gujarat	District	Anand	Village	Khadol
Category of Comments	Natural Environment; Land and R&R Issues				
Type of Comments	Community				
Abstract					

The villagers has raised the following issues:

1. The productive land of the area coupled with adequate water supply supports good harvest and vegetation. Construction of DFC tracks will lead to destruction of vegetation, which will damage the environment considerably.
2. Acquisition of productive agricultural land will further add to the pressure on land resources, resulting shortage of food grains which will have long term impacts on National Level.
3. All of the farmers in the region belong to small time farmers, having small pieces of agricultural land. Acquisition of land will make them completely landless.
4. Many of the farmers in the area have constructed permanent/semi permanent residential houses inside their agricultural field for better monitoring of agricultural production and are staying there with there family. Therefore, acquisition of agricultural land will also make a vast population homeless and jobless, who will be forced to take up begging.
5. Survey has been carried out a number of times without disseminating proper information about the quantum and date of land acquisition. This has created severe anxiety among farmers, causing death of a few.
6. The farmers being uneducated, can not take up other professionals to sustain themselves. The situation further worsens as this area lacks small scale industries or job opportunities.
7. The area being quite populated, noise and vibration generated from movement of multi axle goods train will damage buildings as well as human health.
8. The proposed DFC track can be shifted westwards (toward Bhalbandar – Dholka), where land is not agriculturally productive. Further, westward shifting of DFC will also serve the townships of Bhavnagar and Khambat.

State:	Gujarat	District	Anand	Village	Ravipura
Category of Comments	Natural Environment; Land and R&R Issues				
Type of Comments	Community				
Abstract					

The villagers have raised the following issues:

1. The villagers are totally dependent on their land for their livelihood. Along with the agricultural crops, the land also provided them the fodder required for animal husbandry.
2. Land has been acquired for a number of developmental and industrial projects in the area, especially the irrigation projects has consumed a vast quantum of productive lands. Acquisition of productive agricultural land will further add to the pressure on land resources, resulting shortage of food grains which will have long term impacts on National Level.

3. The existing Vadodara-Nadiad section of the railway tracks can be upgraded and utilized fro goods carriage. This will not only save productive agricultural lands but minimize the environmental impacts.

State:	Gujarat	**District**	Mahesana	**Village**	Hedua Rajghar
Category of Comments	Land and R&R Issues				
Type of Comments	Community				
Abstract					

The villagers have raised the following issues:

1. The village has population 1,500 people belonging to 200 families; land has already been acquired for various projects. After land acquisition of DFC, only marginal land (250 bigha) will be left for the huge population. [Note: 6.25 bigha = 1 Acre; 2.47 Acre = 1 Hactare]
2. Many of the villagers will be completely landless after acquisition of land by various project authorities including DFC.
3. Instead of productive agricultural land of this village, unutilized grazing and vacant land of neighboring Sametra and Vadosan village that belongs of State Government should be acquired.
4. Gujarat State Petroleum Limited has acquired land in same village at a handsome compensation rate of 53 lakh (5.3 million) per bigha. Compensation should be paid at the same rate.
5. The village will be come under Mahesana Municipal Area shortly. The market rate of the land is very high in the village, while it is low at neighboring villages. Therefore, the alignment should be changed.
6. The villagers have accused that the alignment has been shifted to this village under influence of neighboring villages; in the initial phases, the alignment was far away from this village.
7. The villagers have demanded to stop the project immediately and warned the project authorities that large scale agitation and protests including self immolation will be undertaken in line of the protests made by the farmers of Singur in West Bengal State, in case their demands are not met.

State:	Gujarat	**District**	Patan	**Village**	Mamuvada
Category of Comments	Natural Environment; Land and R&R Issues				
Type of Comments	Community				
Abstract					

The villagers has raised the following issues:

1. The villagers have raised some issues regarding land acquisition during recent Siddhpur PCM, which is still unanswered. Still the project authorities have issues land acquisition notices. This is an example of bad governance.
2. The entire LA plan should be made public before action land acquisition to avoid atrocities by the contractors.
3. Drainage problems should be addressed properly to avoid water logging.
4. The compensation amount should be distributed immediately; else interest should be paid @18% per annum.
5. Compensation should be paid for standing crops.
6. Special Task Force should be formed for distribution of compensation.
7. The villagers suggest that a tree of 50 years can bring economic benefit of 250 crores; this aspect of environmental economics has not been reflected in the EIA report. Therefore, eminent environmental activists like [some ladies name] should be involved in the environmental assessment.
8. If detailed assessment and mitigation measures regarding tree felling is not made public, the villagers will write to Government of Japan directly to stop funding in this project. Further, they will also inform the World Bank and UN Bodies regarding this environmental loss.
9. The height of the embankment to be constructed has not disclosed yet. The source of earth materials to used for constriction of embankment (borrow areas) have also not been disclosed. It is very much possible that during the construction phase, the constructors will take the earth from nearby lands causing loss of top soil and water logging. Unless these issues are not addressed, we will not allow anybody to enter into our land, even for survey.
10. Industrial Corridor, SEZ etc will come up in later stages, when people may get better compensation at the cost of today's development. Therefore, circle rates should be increased.
11. The farmers should be provided with certificates so that they can retain their title.
12. Field level consultation should be carried out before finalizing the drainage planning and selection of underpasses.
13. Compensation for utilities should be provided

State:	Gujarat	**District**	Banaskantha	**Village**	Iqbalgadh
Category of Comments	Land and R&R Issues				
Type of Comments	Individual				
Abstract					

A man of Iqbalgadh has expressed concern over acquisition of his agricultural land as part of his land has already been acquired for electric substation and gas pipeline. He commented that due to this project, he will lose his source of income and will have no option expect homicide.

State:	Gujarat	**District**	Banaskantha	**Village**	Iqbalgarh
Category of Comments	Natural Environment; Land and R&R Issues				
Type of Comments	Individual				
Abstract					

A man has expected the development of the Nation due to implementation of the project. However, he requested the project authorities to pay attention to the welfare of the farmers who will get affected due to the project. He has suggested the

following remedies:

1. To provide compensation as per the market value.
2. To rehabilitate the farmers in near by areas
3. To rebuild the infrastructure
4. To compensate for the standing crops.
5. To employ in DFC project.
6. To build the ROB or RUB (Bridge) for animal and cattle passing

State	District	and &Resettlement	Others	Proposal
Haryana	Rewari	gh compensation for Land, in Railway or other Govt. nsurance for PAFs,	Construction of Railway Corridor 1 Km from existing railway line.	
			Reconstruction of Irrigation PVC Pipeline length 2 km) along Corridor.	
		isation for land according to rate to sustain life of villagers		
	Mahendergarh	nt of Compensation		By pass
		nt of Compensation		By pass
		nt of Compensation		By pass
		nd near by village, good for R&R, assure compensation lement and give time for Education for school children, th centre	Construction of link road to main road, drinking water facility and water facility for construction of houses, providing market place with in 1 km of resettled area	
		of School and Temple,	Traffic problem arises due to rail gate close, other wise welcome the project	
		regarding Rehabilitation and policy, land for land and house d employment in Railway for owner	Information regarding width of land acquisition ,	
		for Land and Assistance ust be similar to Assistance Rewari and Gurgaon district, for affected sensitive receptors, for Panchayat land,	Construction of RUB, and underpass	
		Compensation for land according ket rate of Rewari and Gurgaon, n of Open Well,	Construction of ROB	
	Sub-Tota			
Rajasthan	Alwar	for Land and Assistance ust be similar to Assistance ewari and Mahendergarh district	Construction of ROB, RUB, and culverts	
	Si k ar	in Railway , Good compensation House and others. It must be	Welcome project,	

Summary Table of Comments

State	District	No. of Comments	Number of Letter	Location	Type of Letter	Classification of Comments						Proposal
						Natural	Pollution	Sensitive Receptor	Social (except Land & Resettlement Issue)	Land &Resettlement	Others	
Haryana	Rewari	3	Letter 1	Gangachari ya Ahir	Group Appeal (Community)	Water Resource (Pond) getting affected				Demand High compensation for Land, Employment in Railway or other Govt. Offices, Life insurance for PAFs,	Construction of Railway Corridor 1 Km from existing railway line.	
			Letter 2	Rajpur Khalsa	Individual						Reconstruction of Irrigation PVC Pipeline length 2 km) along Corridor.	
			Letter 3	Majra	Member of Panchayat					High Compensation for land according to present market rate to sustain life of villagers		
	Mahendergarh	9	Letter 1	Ateli Mandi	Business Community		Increase pollution in noise and vibration , effects in water supply and pollution and drainage problem	Many Sensitive Receptors issues (like Temple, shrine, Crematorium ground)	Demolition of Affected houses, business structures, Un Employment, Transportation problem,	Type of payment of Compensation		By pass
			Letter 2	Ateli Mandi	Municipal Committee		Increase pollution in noise and vibration , effects in water supply and pollution and drainage problem	Many Sensitive Receptors issues (like Temple, shrine, Crematorium ground)	Demolition of Affected houses, business structures, Un Employment, Transportation problem,	Type of payment of Compensation		By pass
			Letter 3	Ateli Mandi	Temple Committee		Increase pollution in noise and vibration , effects in water supply and pollution and drainage problem	Many Sensitive Receptors issues (like Temple, shrine, Crematorium ground)	Demolition of Affected houses, business structures, Un Employment, Transportation problem,	Type of payment of Compensation		By pass
			Letter 4	Chhilro Ki Dhani	Group Letter from SC				Demolition of Affected houses belongs to SC,	Land for land near by village, good compensation for R&R, assure compensation before resettlement and give time for resettlement, Education for school children, providing health centre	Construction of link road to main road, drinking water facility and water facility for construction of houses, providing market place with in 1 km of resettled area	
			Letter 5	Fatehpur	Ex Village Head			Temple issue				
			Letter 6	Fatehpur	Group Appeal from Village	Tree cutting and plantation problem due to scarcity of water ,	Due to shortage of water, no sprinkling of water during construction phase, Vibration problem, Air Pollution			Establishment of School and Temple,	Traffic problem arises due to rail gate close, other wise welcome the project	
			Letter 7	Near Narnaul	Group Appeal					Information regarding Rehabilitation and Resettlement policy, land for land and house for house and employment in Railway for affected shop owner	Information regarding width of land acquisition ,	
			Letter 8	Tajpur	Group Appeal from Village		Noise pollution and vibration problem			Compensation for Land and Assistance Packages must be similar to Assistance Packages of Rewari and Gurgaon district, Compensation for affected sensitive receptors, compensation for Panchayat land,	Construction of RUB, and underpass	
			Letter 9	Bacbhod	Group Appeal from Village		Noise pollution and vibration problem			Employment, Compensation for land according to present market rate of Rewari and Gurgaon, Re construction of Open Well,	Construction of ROB	
	Sub-Total	12										
Rajasthan	Alwar	1	Letter 1	Kathoowas	Group Appeal					Compensation for Land and Assistance Packages must be siuilar to Assistance Packages of Rewari and Mahendergarh district	Construetion of ROB, RUB, and culverts	
	Sikar	1	Letter 1	Jaitsur	Group Appeal	Green Belt Development	Noise and Vibration Control			Employment in Railway , Good compensation for Land and House and others. It must be	Welcome project,	

State	District	No. of Comments	Number of Letter	Location	Type of Letter	Classification of Comments						Proposal
						Natural	Pollution	Sensitive Receptor	Social (except Land & Resettlement Issue)	Land &Resettlement	Others	
										based on present market value		
		1	Letter 1	Badhal	Group Appeal						Construction of ROB, Rest house, Smooth passenger train movement during construction and construction of new Railway station	
	Jaipur	9	Letter 2	Village Charanwas	(Group) Appeal from all Villagers					Payment for acquiring land is based on present (District Level Committee) DLC rate.	Proper functioning of existing Rail Gate,	
			Letter3	Deepawas	(Group) Appeal from all Villagers					Payment for acquiring land/ structure is based on present (District Level Committee) DLC rate	Construction of ROB between Village and Jaipur -Sikar High Way, Construction of road along the corridor,	
			Letter 4	Shakun, Jaipur	(Group) Appeal from all Villagers	Tree plantation, Construction of Canal,				Construction of Open Well, compensation will be paid as per present government rate,	Running Freight train and Express (passenger) train in same track, Construction of road and foot path along the corridor, Construct ROB above the present Rail Gates, Employment of Gate man, Construction of water Reservoir near Railway Station , Construction of Sub Way, Providing electricity in whole Platform, Construction of New Railway Line (Dudu-Malpura), Construction of Rest Room in Shakun Rail Station,	
			Letter 5	Itawah , Jaipur	(Group) Appeal from all Villagers		Control Noise and Vibration			Compensation for houses as per market rate, Good compensation for land and it should be equal to land value for adjoining villages	Construction of road along the DF corridor, Providing no fencing along the corridor, Construction of ROB/RUB	
			Letter 6	Kunuwar puara	(Group) Appeal from all Villagers		Control Noise and Vibration			Compensation for houses as per market rate, Good compensation for land and it should be equal to land value for adjoining villages	Construction of road along the DF corridor, , Construction of ROB/RUB	
			Letter 7	Kabarno ka was , Jaipur	(Group) Appeal from all Villagers					Compensation for land and it should be equal to DLC rate of adjoining villages, Compensation for open well, tube well for agriculture purpose should be as per Basic schedule Rate	Construct ROB above the present Rail Gates, Construction of road along the DF Corridor	
			Letter 8	Panchar Malikpura, Jaipur	Individual					Willing to give land with full compensation	Construction of Road along the DF Corridor	
			Letter 9	Renwal, Jaipur	Individual		Noise Pollution	Affected Temple		Construction of New Temple near by area		
	Ajmer	5	Letter 1	Kishangarh Railway Station	Individual (Shop Owner)		Noise Pollution	Affected Temple	Demolition of Affected houses, business structures, Un Employment	Economical burden may be arise for people and Railway to remove houses and business from Kishangarh station area		By Pass
			Letter 2	Kishangarh Railway Station	Individual (House Owner)		Noise Pollution	Affected Temple	Demolition of Affected houses, business structures, Un Employment	Economical burden may be arise for people and Railway to remove houses and business from Kishangarh station area		By Pass
			Letter 3	Kishangarh Railway Station	Individual (House Owner)		Noise Pollution	Affected Temple	Demolition of Affected houses, business structures, Un Employment	Economical burden may be arise for people and Railway to remove houses and business from Kishangarh station area		By Pass
			Letter 4	Kishangarh Railway Station	Individual (House Owner)		Noise Pollution	Affected Temple	Demolition of Affected houses, business structures, Un Employment	Economical burden may be arise for people and Railway to remove houses and business from Kishangarh station area		By Pass
			Letter 5	Kishangarh Railway Station	Individual (Shop Owner)		Noise Pollution	Affected Temple	Demolition of Affected houses, business structures, Un Employment	Economical burden may be arise for people and Railway to remove houses and business from Kishangarh station area		By Pass
Raja stha			Letter 6	Kishangarh Railway Station	Individual (House Owner)		Noise Pollution	Affected Temple	Demolition of Affected houses, business structures, Un Employment	Economical burden may be arise for people and Railway to remove houses and business from Kishangarh station area		By Pass

State	District	No. of Comments	Number of Letter	Location	Type of Letter	Classification of Comments						Proposal
						Natural	Pollution	Sensitive Receptor	Social (except Land & Resettlement Issue)	Land &Resettlement	Others	
			Letter 7	Kishangarh Railway Station	Individual (House Owner)		Noise Pollution	Affected Temple	Demolition of Affected houses, business structures, Un Employment	Economical burden may be arise for people and Railway to remove houses and business from Kishangarh station area		By Pass
		13	Letter 8	Kishangarh Railway Station	Individual (Shop Owner)		Noise Pollution	Affected Temple	Demolition of Affected houses, business structures, Un Employment	Economical burden may be arise for people and Railway to remove houses and business from Kishangarh station area		By Pass
			Letter 9	Kishangarh Railway Station	Individual (Shop Owner)		Noise Pollution	Affected Temple	Demolition of Affected houses, business structures, Un Employment	Economical burden may be arise for people and Railway to remove houses and business from Kishangarh station area		By Pass
			Letter 10	Kishangarh Railway Station	Individual (House Owner)		Noise Pollution	Affected Temple	Demolition of Affected houses, business structures, Un Employment	Economical burden may be arise for people and Railway to remove houses and business from Kishangarh station area		By Pass
			Letter 11	Kishangarh Railway Station	Temple Society		Noise Pollution	Affected Temple	Demolition of Affected houses, business structures, Un Employment	Economical burden may be arise for people and Railway to remove houses and business from Kishangarh station area		By Pass
			Letter 12	Kishangarh Railway Station	Individual (Shop Owner)		Noise Pollution	Affected Temple	Demolition of Affected houses, business structures, Un Employment	Economical burden may be arise for people and Railway to remove houses and business from Kishangarh station area		By Pass
			Letter 13	Kishangarh Railway Station	Individual (House Owner)		Noise Pollution	Affected Temple	Demolition of Affected houses, business structures, Un Employment	Economical burden may be arise for people and Railway to remove houses and business from Kishangarh station area		By Pass
			Letter 14	Kishangarh Railway Station	Individual (House Owner)		Noise Pollution	Affected Temple	Demolition of Affected houses, business structures, Un Employment	Economical burden may be arise for people and Railway to remove houses and business from Kishangarh station area		By Pass
			Letter 15	Kishangarh Railway Station	Individual (Shop Owner)		Noise Pollution	Affected Temple	Demolition of Affected houses, business structures, Un Employment	Economical burden may be arise for people and Railway to remove houses and business from Kishangarh station area		By Pass
			Letter 16	Kishangarh Railway Station	Individual (House Owner)		Noise Pollution	Affected Temple	Demolition of Affected houses, business structures, Un Employment	Economical burden may be arise for people and Railway to remove houses and business from Kishangarh station area		By Pass
			Letter 17	Kishangarh Railway Station	Individual (Shop Owner)		Noise Pollution	Affected Temple	Demolition of Affected houses, business structures, Un Employment	Economical burden may be arise for people and Railway to remove houses and business from Kishangarh station area		By Pass
			Letter 18	Village Faloda	(Group) Appeal from all villagers						Level crossing, construction of road along the corridor, Opening new level crossing in existing track	
Nagaur	0											
Pali	3		Letter 1	Amar pura	(Group) Appeal from all villagers					Land for land and house for house for poor villagers in near by villages (forest land available), good compensation for R&R, assure compensation before resettlement	Welcome project	
			Letter 2	Sendra	(Group) Appeal from all villagers					Land for land and house for house for poor villagers in near by villages (forest land available), good compensation for R&R, assure compensation before resettlement	Welcome project	
			Letter 3	Marwar Jn	Individual					Amount of Compensation, Time of starting construction		
Sirohi	6		Letter 1	Abu Road, Pindwara	MLA , Abu Road, Pindwara						Re opening of Ral gate no. 106	
			Letter 2	Chawrali, Pindwara	Group Appeal from Village						Construction of ROB and RUB and Re opening of Ral gate no. 106	
			Letter 3	Morthala	Group Appeal from Village				Asking information regarding type of effect with Animal and Human being	Date of receiving compensation, Land for land and house for houses in near by villages,		
			Letter 4	Khadat	Group Appeal from Village				Asking information regarding type of effect with Animal and Human being	Date of receiving compensation, Land for land and house for houses in near by villages,		
			Letter 5	Panchayat Samity ,	From Panchayat Samity						Re opening of Ral gate no. 106 and connecting with High Way 14	

State	District	No. of Comments	Number of Letter	Location	Type of Letter	Classification of Comments						Proposal
						Natural	Pollution	Sensitive Receptor	Social (except Land & Resettlement Issue)	Land &Resettlement	Others	
				Pindwara								
			Letter 6	Manpur, Abu Road	Group Appeal from Village				Asking information regarding type of effect with Animal and Human being			
	Sub-Total	38										
Gujarat	Banaskantha	2	Letter 1	Iqbalgarh	Individual		Environment pollution during construction		Minimize loss of farmers	Compensation as per present market value, Land for land near by villages, compensation for infrastructure in terms of money, compensate crop value	Construction of ROB, RUB	
			Letter 2	Iqbalgarh	Individual				Loss of income	Loss of total land		
	Patan	1	Letter 1	Mamuvada	(Group) Appeal from all villagers	Drainage Problem				Compensation for standing crops, Special arrangement for distribution of compensation, The compensation amount should he distributed immediately; else interest should be paid @18% per annum	Environmental economic should be provided for this project , Non availability of land plan	
	Mahesana	1	Letter 1	Hedua Rajghar	(Group) Appeal from all villagers					After land acquisition of DFC, only marginal land (250 bigha) will be left for the huge population. Villagers will be land less, High rate of compensation as per other project.	Suggestions for acquiring land for adjacent villages, Opposes for project	
	Ahmedabad	0										
	Gandhinagar	0										
	Kheda	0										
	Anand	4.	Letter 1	Bandhani	(Group) Appeal from all villagers					Livelihood depend upon agriculture production as well as land, Land had been already acquired for different project. Further land acquisition affects their livelihood	The existing Vadodara-Nadiad section of the railway tracks can be upgraded and utilized for goods carriage	
			Letter 2	Mahelav	(Group) Appeal from all villagers					Livelihood depend upon agriculture production as well as land, Land had been already acquired for different project. Further land acquisition affects their livelihood	The existing Vadodara-Nadiad section of the railway tracks can be upgraded and utilized for goods carriage	
			Letter 3	Khadol	(Group) Appeal from all villagers		Noise and Vibration related problem		Lack of small scale industries job opportunity is few.	Livelihood depend upon agriculture production as well as land, Land had been already acquired for different project. Further land acquisition affects their livelihood, farmers becoming land less,	Proper information dissemination required regarding land acquisition , DFC track shift towards west side of villages	
			Letter 4	Ravipura	(Group) Appeal from all villagers					Livelihood depend upon agriculture production as well as land, Land had been already acquired for different project. Further land acquisition affects their livelihood	The existing Vadodara-Nadiad section of the railway tracks can be upgraded and utilized for goods carriage	
	Vadodara	10	Letter 1	Maretha	(Group) Appeal from all villagers	Water logging				Sale and purchase of land under VUDA is restricted due to State government has planned to develop Vadodara as Mega City ,compensation for land [circle rate + 60%] is inadequate, farmers want to retain their status as farmers and do not wish to take any	19 villages out of 31 villages in the district affected by DFC alignment, comes under VUDA [Vadodara Urban Development Authority] area ,loss of land due to existing norms, road construction,	Either By pass the railway track or accommodate DFC track within designated area for rail/road

State	District	No. of Comments	Number of Letter	Location	Type of Letter	Classification of Comments						Proposal
						Natural	Pollution	Sensitive Receptor	Social (except Land & Resettlement Issue)	Land &Resettlement	Others	
										other profession for livelihood, compensation for bore well and trees, High compensation (500% above circle rate or market rate) , employment, distribution of Government land, Repayment of Agricultural loan of affected farmers from Bank,		development
			Letter 2	Bil	(Group) Appeal from all villagers	Water logging				Sale and purchase of land under VUDA is restricted due to State government has planned to develop Vadodara as Mega City ,compensation for land [circle rate + 60%] is inadequate, farmers want to retain their status as farmers and do not wish to take any other profession for livelihood, compensation for bore well and trees, High compensation (500% above circle rate or market rate) , employment, distribution of Government land, Repayment of Agricultural loan of affected farmers from Bank,	19 villages out of 31 villages in the district affected by DFC alignment, comes under VUDA [Vadodara Urban Development Authority] area ,loss of land due to existing norms , road construction ,	Either By pass the railway track or accommodate DFC track within designated area for rail/road development
			Letter 3	Samiyala	(Group) Appeal from all villagers	Water logging				Sale and purchase of land under VUDA is restricted due to State government has planned to develop Vadodara as Mega City ,compensation for land [circle rate + 60%] is inadequate, farmers want to retain their status as farmers and do not wish to take any other profession for livelihood, compensation for bore well and trees, High compensation (500% above circle rate or market rate) , employment, distribution of Government land, Repayment of Agricultural loan of affected farmers from Bank,	19 villages out of 31 villages in the district affected by DFC alignment, comes under VUDA [Vadodara Urban Development Authority] area ,loss of land due to existing norms , road construction ,	Either By pass the railway track or accommodate DFC track within designated area for rail/road development
			Letter 4	Kambola	(Group) Appeal from all villagers	Water logging				Sale and purchase of land under VUDA is restricted due to State government has planned to develop Vadodara as Mega City ,compensation for land [circle rate + 60%] is inadequate, farmers want to retain their status as farmers and do not wish to take any other profession for livelihood, compensation for bore well and trees, High compensation (500% above circle rate or market rate) , employment, distribution of Government land, Repayment of Agricultural loan of affected farmers from Bank,	19 villages out of 31 villages in the district affected by DFC alignment, comes under VUDA [Vadodara Urban Development Authority] area ,loss of land due to existing norms , road construction ,	Either By pass the railway track or accommodate DFC track within designated area for rail/road development
			Letter 5	Chansad	(Group) Appeal from all villagers	Water logging						
			Letter 6	Vernama	(Group) Appeal from all villagers	Water logging				Sale and purchase of land under VUDA is restricted due to State government has planned to develop Vadodara as Mega City ,compensation for land [circle rate + 60%] is inadequate, farmers want to retain their status as farmers and do not wish to take any other profession for livelihood, compensation for bore well and trees, High compensation (500% above circle rate or market rate) , employment, distribution of Government land, Repayment of Agricultural loan of affected farmers from Bank,	19 villages out of 31 villages in the district affected by DFC alignment, comes under VUDA [Vadodara Urban Development Authority] area ,loss of land due to existing norms , road construction ,	Either By pass the railway track or accommodate DFC track within designated area for rail/road development
			Letter 7	Mahapura	(Group) Appeal from all villagers	Water logging				Sale and purchase of land under VUDA is restricted due to State government has planned to develop Vadodara as Mega City ,compensation for land [circle rate + 60%]	19 villages out of 31 villages in the district affected by DFC alignment, comes under VUDA [Vadodara Urban Development Authority]	Either By pass the railway track or accommodate DFC track within

State	District	No. of Comments	Number of Letter	Location	Type of Letter	Classification of Comments						Proposal
						Natural	Pollution	Sensitive Receptor	Social (except Land & Resettlement Issue)	Land &Resettlement	Others	
										is inadequate, farmers want to retain their status as farmers and do not wish to take any other profession for livelihood. compensation for bore well and trees, High compensation (500% above circle rate or market rate) , employment, distribution of Government land, Repayment of Agricultural loan of affected farmers from Bank,	area ,loss of land due to existing norms , road construction ,	designated area for rail/road development
			Letter 8	Borka	(Group) Appeal from all villagers	Water logging				Sale and purchase of land under VUDA is restricted due to State government has planned to develop Vadodara as Mega City ,compensation for land [circle rate + 60%] is inadequate, farmers want to retain their status as farmers and do not wish to take any other profession for livelihood. compensation for bore well and trees, High compensation (500% above circle rate or market rate) , employment, distribution of Government land, Repayment of Agricultural loan of affected farmers from Bank,	19 villages out of 31 villages in the district affected by DFC alignment, comes under VUDA [Vadodara Urban Development Authority] area ,loss of land due to existing norms , road construction ,	Either By pass the railway track or accommodate DFC track within designated area for rail/road development
			Letter 9	Handod	(Group) Appeal from all villagers	Water logging				Sale and purchase of land under VUDA is restricted due to State government has planned to develop Vadodara as Mega City ,compensation for land [cirele rate + 60%] is inadequate, farmers want to retain their status as farmers and do not wish to take any other profession for livelihood. compensation for bore well and trees, High compensation (500% above circle rate or market rate) , employment, distribution of Government land, Repayment of Agricultural loan of affected farmers from Bank,	19 villages out of 31 villages in the district affected by DFC alignment, comes under VUDA [Vadodara Urban Development Authority] area ,loss of land due to existing norms , road construction ,	Either By pass the railway track or accommodate DFC track within designated area for rail/road development
			Letter 10	Mangrol	(Group) Appeal from all villagers					Sale and purchase of land under VUDA is restricted due to State government has planned to develop Vadodara as Mega City ,compensation for land [circle rate + 60%] is inadequate, farmers want to retain their status as farmers and do not wish to take any other profession for livelihood. compensation for bore well and trees, High compensation (500% above circle rate or market rate) , employment, distribution of Government land, Repayment of Agricultural loan of affected farmers from Bank,	19 villages out of 31 villages in the district affected by DFC alignment, comes under VUDA [Vadodara Urban Development Authority] area ,loss of land due to existing norms , road construction ,	Either By pass the railway track or accommodate DFC track within designated area for rail/road development
	Sub-Total	18										
Grand Total		**68**										

APPENDIX III-6-1 FORMS FOR ENVIRONMENTAL MANAGEMENT PLAN

FORM P.1 BORROW AREAS IDENTIFICATION

(Reporting by Contractor to Environmental Expert)

Construction Stage Report – Date ..... Month .....Year.....

Site Layout of Borrow Area and Proposed Borrow Area Redevelopment
Plan to be attached with format.

Borrow Area No.

Location of Borrow Area (km) ..... *Package*.....

S. N.	Item	Unit	Details	Remarks by SC
1	Date of borrow Area becoming operational dd/mm/yy			
2	Current Land use			
3	No of settlements within 500 m of Borrow Area	Nos.		
4	Total Capacity	Cum		
5	No. of Trees with girth more than 30 cm	Nos.		
6	Length of Haul Road	Km		
7	Width of Haul road	M		
8	Type of Haul road	Metal / dirt		
9	No. of settlements within 200m of Haul Road	Nos.		
10	Size of Borrow Area	Sq km		
11	Area of Borrow Area	Km x km		
12	Quantity Available	Cum		
13	Dist of Nearest Water Source	Type/Size/Cap-acity/Present Use/ Ownership		
14	Quantity of top soil removed	Cum		
15	Details of storage of topsoil			

Certified that the furnished information is correct and all relevant information as required is attached.

Environmental Specialist

Contractor

(Supervision Consultant)

FORM P.2 Temporary acquisition of land

(Reporting by Contractor to Environmental Expert of Supervision Consultant)
Construction stage: Quarterly Report – Date ..... Month ..... Year .....

(Site Layout of all locations to be attached with format)

Sl. No.	Item	Target date for Establishment	Location (CH)	Present Land use	Size (m×m)	Existing Trees >30 cm girth	Dist. From nearest Settlement	Dist. From nearest water source	Remarks by SC, if any
1.	Borrow Areas								
	BA 1								
	BA 2								
	BA 3								
	BA 4								
2.	Workers Camps								
	WC 1								
	WC 2								
3.	Site for Construction Equipment								
	CE 1								
	CE 2								
4.	Stock Yard								
	SY 1								
	SY 2								

Certified that the furnished information is correct and all relevant information as required is attached.

Environmental Specialist

(Supervision Consultant)

Contractor

FORM P.3 SITE IDENTIFICATION AND SETTING UP OF WORKERS CAMP AND CONSTRUCTION EQUIPMENT

(Reporting by Contractor to PIU after certification by Environmental Expert)

Construction Stage Report: Date ..... Month.....Year.....

(Site layout of Construction camp and working drawings of dwelling units with allied facilities to be attached with format)

Format to be submitted before target date (decided by PD) of establishing camps as
Camp no. WC

Location of Camp (km _____ package_____)

S. N.	Item	Unit	Details	Remarks by SC, if any
	Detail of item camp	m x m		
1	Size of Camp	Sq.m		
2	Area of Camp			
3	Distance from Nearest Settlement	Type/Size/ Capacity/Present use/Ownership		
4	Distance from nearest water source			
5	Date of camp becoming operational dd/mm/yy			
6	Present land use			
7	No other trees with girth>0.3m			
	Details of top soil stacking			
1	Quantity of top soil removed	Sq.m		
2	Detail of storage of topsoil	Describe stackling		
	Details of workforce			
1	Total no. of labourers	Nos.		
2	Total no. of Male Workers	Nos.		
3	No. of male workers below 18 years of age	Nos.		
4	Total no. of female workers	Nos.		
5	No of female workers below 18 years of age	Nos.		
6	No. of children	Nos.		
	Details of dwelling units			
1	No of dwellings	Nos.		
2	Minimum size of dwelling	m x m		
3	No of opening per dwelling	Nos.		
4	Minimum size of opening	Nos.		
5	Walls	Specifications		
6	Roofing	Specifications		
7	Flooring	Specifications		
8	Drinking water tank	Specifications		
9	Capacity of Drinking water tank	Cum		
10	Size of drinking water tank	m x m x m		
11	Total No. of WC	Nos.		
12	No. of WCs for female workers	Nos.		
13	Maximum size of WC	m x m		
14	Total no. of bathrooms for female workers	Nos.		
15	Size of septic tank for WCs/Baths	m x m x m		
16	Capacity of Water Tank for WCs/Bathrooms and general purpose			
17	Fencing around camp	Y/N		
	Details of facilities			
1	Availability of security guard 24 hrs a day	Y/N		

S. N.	Item	Unit	Details	Remarks by SC, if any
2	Details of First Aid Facility	Y/N		
3	Availability of Day Care Centre	Y/N		

Certified that the furnished information is correct the quality of work is as per good practice and all relevant information as required is attached

Environmental Specialist
(Supervision Consultant)

Contractor

FORM C.1 TARGET SHEET FOR TREE CUTTING

(Reporting by contractor to Environmental Expert)

Construction Stage Report: Date .....Month.....Year.....

S. N.	Location	Species	Girth Size (cm)	Average dist from edge of existing railway track (m)**

** In detour section this information will not be required

Environmental Specialist
(Supervision Consultant)

Contractor

FORM C.2 WATER REQUIRED FOR CONSTRUCTION

(Reporting by contractor to Environmental Expert)

Construction Stage: Monthly Report – Date..... Month.....Year

Sl. No.	Source (Name)	Location	Distance from Railway Track	Water Drawn (m3/day)	Remarks
1.	Rivers				
2.	Streams/Canal				
3.	Ponds				
4.	Tube well				
5.	Other source / tankers				
	Total Water Used				

Certified that the above information is correct

Environmental Specialist
(Supervision Consultant)

Contractor

FORM C.3 DUST SUPPRESSION AT BORROW & CRUSHER SITES AREA

(Reporting by Contractor to SC)

Construction Stage: Monthly Report – Date ..... Month ..... Year .....

Format (Reporting Format No. __) for each Borrow Area prepared during Construction stage to be submitted at the end of the month

	Item	Date																												
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Stock Yard	Frequency of sprinkling of water (times / day)																														
	Quantity of water sprinkled (litres)																														
	Quantity of water Sprinkled around site																														
Borrow Area	Frequency of sprinkling of water on Haul road (times / day)																														
	Frequency of sprinkling of water at Borrow Site (times / day)																														
	Total Quantity of water Sprinkled (litres)																														
Crusher Sites	Frequency of sprinkling of water on Haul road (times / day)																														
	Quantity of water sprinkled (liters)																														
	Quantity of Water Sprinkled on Conveyor Belt																														
	Quantity of water Sprinkled around site																														
	Quantity of water Sprinkled around Crusher site, if any																														

Certified that the above-mentioned works have been completed as specified by the Project Engineer and EMPIU

Environmental Specialist
(Supervision Consultant)

Contractor

FORM C.4 POLLUTION MONITORING

(Reporting by Contractor to Environmental Expert of SC)

Construction Stage: Report -Date_____ Month_____ Year_____

(Locations at which monitoring to be conducted as per EMP)

S. N.	Location	Details of location	Duration of monitoring	Instruments used	Target Date	Date of completion	Reason for Delay if any
Air Monitoring							
1							
2.							
3.							
4.							
5.							
Water Monitoring							
1							
2							
3							
4							
5							
Soil Monitoring							
1							
2							
3							
4							
5							
Noise Monitoring							
1							
2							
3							
4							
5							

Certified that the Pollution Monitoring has been conducted at all the locations specified in the EMP and as per the directions of the Environmental Expert SC

Environmental Expert
(Supervision Consultant)

Contractor

FORM C.5 HYGIENE REPORTING AT CONSTRUCTION CAMPS AND LABOUR CAMPS

(Reporting by Contractor to Environmental Expert of SC)

Construction Stage: Monthly Report – Date .....Month.....Year.....

S. No.	Item	Unit	Quantity	Remarks
1	Total No. of WCs			
2	No. of WCs Functioning			
3	No. of bathrooms functioning			
4	Water Tank cleaned			
5	First Aid facilities available			
6	Emergency Vehicle available & functioning			
7	Camp visit by Doctor/month	No. of times		
8	Accident occurred, if any	Details to be given		
9	Measures taken	Details to be given		
10	Security available 24 hrs daily	Yes/No		
11	Water logging if any in Camp	Yes/No		
12	If yes, measures taken			

Certified that the furnished information is correct and all relevant information as required is attached.

Environmental Expert
(Supervision Consultant)

Contractor

FORM C.6 RESTORATION OF CONSTRUCTION SITES

(Reporting by Contractor to Environmental Expert of SC)

Construction stage: Monthly Report – Date ..... Month ..... Year.

Reporting by Contractor to DFCCIL (EMU)

S. N.	Item	Location (km)	Unit (cum)	Volume of Topsoil Restored (m^3)	Remarks by SC
	Restoring top soil at diversions				
1					
2					
3					
4					
	Restoring of top soil at Workers Camp				
1					
2					
3					
4					
	Restoring of top soil at Construction yard and disposal of spoil				
1					
2					
3					
4					

Certified that the mitigation / enhancement works have been completed as specified and as per prevalent good construction practices.

Environmental Expert
(Supervision Consultant)

Contractor

FORM O.1 POLLUTION MONITORING

Operation Stage: Report -Date_____ Month_____ Year_____

(Locations at which monitoring to be conducted as per EMP)

S. N.	Location	Details of location	Duration of monitoring	Instruments used	Completion		
					Target Date	Date of completion	Reason for Delay if any
Air Monitoring							
1							
2.							
3.							
4.							
5.							
Water Monitoring							
1							
2							
3							
4							
5							
Soil Monitoring							
1							
2							
3							
4							
5							
Noise Monitoring							
1							
2							
3							
4							
5							

Certified that the Pollution Monitoring has been conducted at all the locations specified In the EMP and as per the directions of the SC

Nodal Officer
(DFCCIL)

Field Officer
(EMU)

Appendix III-4-4

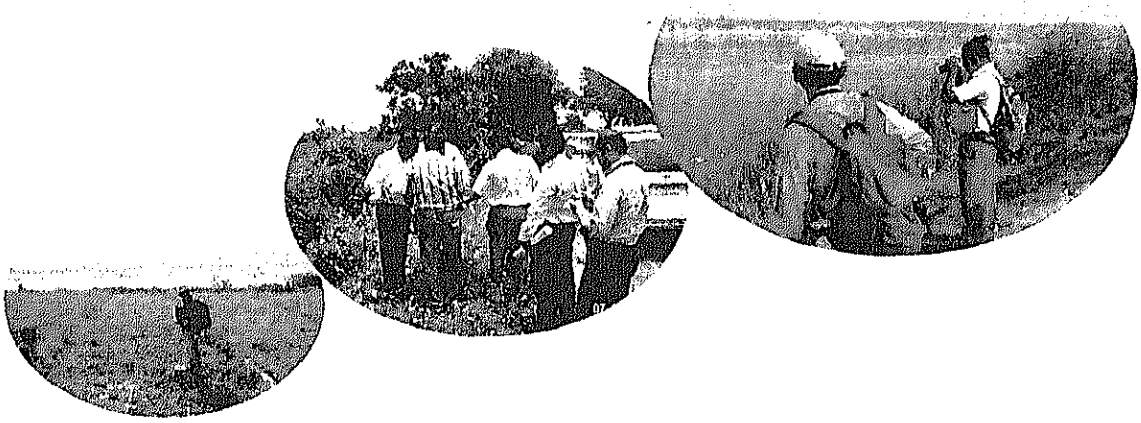
Summaries of the Draft EIA Report

MINISTRY OF RAILWAYS
DFCC of India Ltd. (DFCCIL)

Western Corridor of the DFC Project between Vadodara and Rewari

Summary of the Environmental Impact Assessment

March 2009



This summary explains outline of environmental and social considerations for Western Corridor of the Dedicated Freight Corridor (DFC) Project between Vadodara and Rewari as first priority section of the Dedicated Freight Corridor in India. This summary is distributed to the public as an information disclosure process under the project by responsible bodies; Ministry of Railway (MOR) as competent ministry and Dedicated Freight Corridor Corporation of India Limited (DFCCIL) as project executing agency. Any comments and opinions are welcome on the project from viewpoints of environmental and social considerations, and will be reflected into the Environmental Impact Assessment (EIA) report for the DFC Project with deliberations in the preparation process of finalization of the EIA report.

Outline of the Project

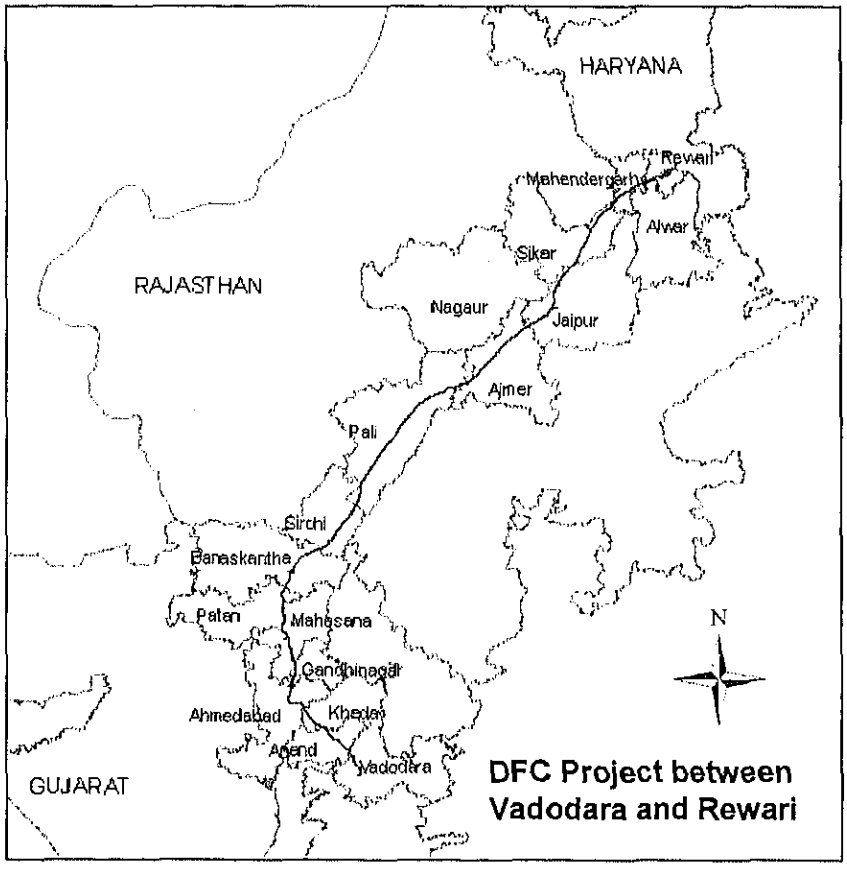
Ministry of Railway is implementing Computerized Multi Modal High Axle Load Dedicated Freight Corridor Project (DFC Project) to facilitate speedier and smooth transportation of bulk goods without any interruption between the two metropolises Delhi and Mumbai and their respective hinterlands at lesser transport cost and lesser time.

DFC Project aims to help boosting the present trends of growth of the economy in India. It is designed to carry a total freight line of 37.7 million tones in the fiscal year 2013-2014. At the same time, it is anticipated that the construction of DFC would induce economic development, generate employment and above all improve economic integration of regions in the country with improved links among major economic and trade centres.

Dedicated Freight Corridor Corporation of India Limited (DFCCIL) under Ministry of Railways, Government of India is an executing agency for the development of DFC. DFC Project in the Western Corridor between Vadodara and Rewari passes through approx. 470 villages in 17 districts of three states; Haryana, Rajasthan and Gujarat. Length of the proposed alignment is approximately 920 km.

The project is now under planning stage. Detailed design will start in the middle of 2009 till around 2011. Project implementation / construction work is scheduled after 2011 for 4-5 years.

State / District
Gujarat
Vadodara
Anand
Kheda
Ahmedabad
Gandhinagar
Mahesana
Patan
Banaskantha
Rajasthan
Sirohi
Pali
Ajmer
Jaipur
Nagaur
Sikar
Alwar
Haryana
Mahendragarh
Rewari

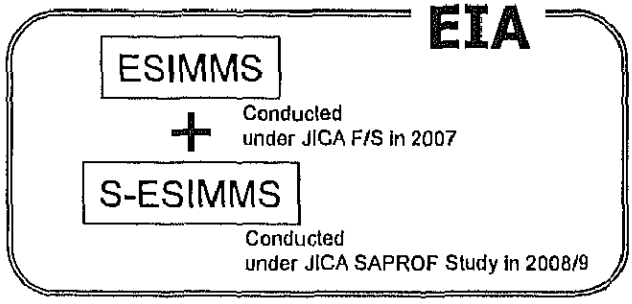


Proposed DFC Alignment and Facilities

Western Corridor of the DFC Project subject to implementation is traversing Vadodara – Ahmedabad – Palanpur – Rewari as double track. The proposed alignment passes through the states of Gujarat, Rajasthan and Haryana. In principle, the alignment for the DFC Project was designed as parallel to the existing railway within the land of Indian Railways. However, some sections where there is no enough land along the existing railway are designed as detour route to avoid resettlement as much as possible. Alignment for detour route of the DFC Project was designed, considering avoidance of local communities, wildlife sanctuary, city planning area, marble stone factories, residential area, large excavation, etc. to minimize environmental and social impacts as possible.

Environmental and Social Considerations Study for the Project

There is no provision of the Environmental Impact Assessment (EIA) for railway development under the Indian laws and regulations. However, since the DFC Project is the large-scale project which would cause large and various environmental and social impacts such as noise pollution and involuntary resettlement, comprehensive examinations on environmental and social considerations for the railway development have been carried out for the DFC Project from the planning stage of the development.



Under the situation, MOR/DFCCIL has prepared draft EIA for the Western Corridor of the DFC Project between Vadodara and Rewari under technical support by the Japan International Cooperation Agency (JICA), which are composed of ESIMMS[1] conducted under the JICA Feasibility Study in 2007 and S-ESIMMS[2] conducted under the JICA SAPROF[3] Study in 2008/9. Draft EIA report is composed of state-wise ESIMMS reports for 3 states and S-ESIMMS report covering whole project area.


Field survey on flora

Both ESIMMS and S-ESIMMS covered impacts potentially induced from nature of the project, physical and social conditions of the project sites for natural environment, pollution control, and social issues. In the S-ESIMMS, further detailed studies were conducted such

[1] ESIMMS: Environmental and Social Impact Mitigation Measures Study as EIA Level Study under the JICA Guideline for Environmental and Social Considerations, 2004
[2] S-ESIMMS: Supplementary ESIMMS
[3] SAPROF: Special Assistance for Project Formulation

as detailed prediction of the railway noise and vibration as well as sensitive receptor[4] and land use surveys, detailed survey for the protected area nearby DFC alignment and major rivers to cover data for all seasons, and survey on structures to be relocated and further socio-economic survey, in addition to supplementary surveys for area which is newly affected due to change of alignment after the JICA F/S.

Noise measurement survey
along the existing railway

Potential Impacts and Mitigation Measures

Various environmental and social impacts were identified through the series of the surveys. Mitigation measures are proposed to minimize the environmental impacts which are unavoidable after examinations. Mitigation measures for major items of the environmental and social impacts are shown below.

List of Potential Impacts and Mitigation Measures

Potential Impacts	Mitigation Measures
Air Quality	
Construction Phase	
Deterioration of air quality due to particulate matter such as dust, especially during dry condition, and gaseous emissions from construction equipment and vehicular traffic.	➢ Storage of construction materials in covered godowns or enclosed spaces ➢ Coverage of truck carrying soil, sand and stone to avoid spilling. ➢ Adequate dust suppression measures such as regular water sprinkling on unpaved haul roads and vulnerable areas of the construction sites ➢ Use of low emission construction equipment, vehicles and generator sets.
Noise and Vibration Levels	
Construction phase	
Noise and vibration due to movement of vehicles, and operation of light and heavy construction machineries	➢ Use of low noise construction equipment ➢ Place of stationary construction equipment away from inhabited areas, and 200 m away from the sensitive receptors (SRs) i.e. school, hospital ➢ Construction activities carried out near residential area preferably in daytime ➢ Provision of protective gears such as ear plugs etc. to construction personnel exposed to high noise levels
Operation Phase:	
Noise and vibration due to movement of trains and related facilities	➢ New technologies incorporated to lower noise and vibration generation with respect to structures and rolling stocks. ➢ Use of long welded rails ➢ Appropriate maintenence of locomotives, tracks and structures. ➢ Control of running speed of freight trains in the urban area ➢ Provision of soundproof wall to the sections where houses and Sensitive Receptors are located near railway tracks, if required.

[4] Sensitive facility is public facility, which is sensitive to the noise and vibration impacts, such as hospital, school, and religious facilities.

Potential Impacts	Mitigation Measures
Water Quality	
Construction phase	
• Wastewater from construction activities with suspended impurities. • Wastewater disposal from the workers camp and sludge generated from construction sites	➢ Provision of silt fencing near water bodies ➢ Control of quality of construction wastewater emanating from the construction site through suitable drainage system with sediment traps ➢ Provision of proper sanitation facilities at the construction site to prevent health related problems due to water contamination.
Operation Phase:	
Wastewater generated from rail depot, train washing, heavy cleaning, workshops and maintenance activities	➢ Reuse of treated water by removal of suspended solids, oil and grease, organic matter, toxic elements and neutralization of pH through waste water treatment plant.
Topography and Geology	
Construction stage	
• Change in topography due to clearing of land, felling of trees, cutting and filling of land and construction of structures. • Disfigurations of topography due to indiscriminate digging of borrow pits.	➢ Use of only identified borrow pits and quarry sites to avoid any disfiguration of topography. ➢ Avoidance of uncontrolled digging of borrow pits to prevent water accumulation in abandoned pits resulting in breeding ground of vector disease. ➢ Procurement of construction materials from existing approved and licensed quarries only
Soil	
Construction stage	
• Disruption and loss of productive top soil from agricultural fields due to creation of borrow pits and development of detour section • Loosening of top soil and loss of vegetative cover due to excavation and back filling • Deterioration of soil quality	➢ Utilization of fly ash, if technically suitable and available within 100 km distance of the DFC alignment for construction of embankment to save soil resource. ➢ Adequate measures like adequate drainage, embankment consolidation and slope stabilization ➢ Conservation and restoration of top soils of the borrow pit sites ➢ Avoidance of accidental spills ➢ Proper disposal of used bentonite slurry
Hydrological Conditions	
Construction stage	
• Increased incidence and duration of floods due to obstruction of natural drainage courses by the embankment	➢ Provision of adequate drains along the track ➢ Augmentation of capacity of existing drainage works ➢ Provision of adequate drainage works for smooth passage of runoff to avoid flooding and formation of water pool.
Operation stage	
Impact to local drainage due to formation of railway embankment	➢ Provision of longitudinal drains of sufficient capacity on both sides of the track to accommodate increased run-off.
Flora	
Construction stage	
Loss of flora due to felling of trees along the ROW	➢ Appropriate compensatory plantation with about 2 times the number of trees felled. ➢ Compensation for forest land and trees to be felled in forest area and private land, ➢ Mixed plantation consisting of flowering shrubs and evergreen ornamental trees
Deposition of fugitive dust on pubescent leaves of nearby vegetation	➢ Strip plantation in available open spaces on both sides of the railway track ➢ Provision of cooking fuel to construction workers to avoid cutting/felling of trees for fuel wood.
Diversion of Forest Land	
Pre-construction stage	
The alignment passes through several patches of Reserved Forest and open forest area	➢ Compensation shall be provided to the forest department towards the cost of forest land to be diverted and cost of compensatory afforestation. ➢ Before start any activity within the Reserved Forest area, Forest clearance must be obtained.
Fauna	
Pre-construction stage	
Thol Wildlife (Bird) Sanctuary in the west of DFC alignment (detour section) in Mahesana District.	➢ Construction activity within 3 km radius of sanctuary shall be carried out by taking special care so as to cause the least disturbance as per the provisions of the law.

Potential Impacts	Mitigation Measures
Construction stage	
• Disturbance to avifauna in reserved forests and Thol Wildlife (Bird) Sanctuary due to noise generated from construction machinery. • Temporary loss of habitat of Indian Soft-shell Turtle and Mugger Crocodile during bridge construction over Mahi, Vishwamitri, and Vatrak Rivers	➢ All the construction equipment and vehicles used are in good working condition, properly lubricated and maintained to keep noise within the permissible limits and engines turned off when not in use to reduce noise. ➢ Construction of bridge shall be constructed during dry season but working may resorted in monsoon if it does not affect the habitat of endangered species. ➢ Provision of fencing along the boundary of construction site as per site requirement
Operation stage	
Disturbance of corridor of wildlife movement due to acquisition of Reserved Forest land in Banaskantha District.	➢ Initiation of appropriate compensatory plantation to compensate the habitat loss due to felling of trees for site clearing.
• Effect on aquatic fauna in case of accidental oil spill and toxic chemical release into water bodies. • Restriction of the movement of wildlife on either side of the track. • Collision of wildlife with train.	➢ Contingent actions for speedy cleaning up of oil spills, fuel and toxic chemicals in the event of accidents. ➢ Provision of animal underpasses for wildlife near forest areas ➢ Provision of fencing, if feasible, along DFC in wildlife habitat concentration areas to avoid collision.
Land Acquisition and Resettlement	
Pre-construction stage	
Loss of livelihood and properties	➢ Compensation and assistance package will be planned in the Rehabilitation and Resettlement Plan (RRP), separately from the EIA.
Construction stage	
Disturbance of vehicle traffic and pedestrian (farmers) passage	➢ Provision of detour with adequate sign board and instruction
Operation stage	
Regional severance and disturbance of movement for local people and farmers due to embankment structure of the DFC	➢ Provision of road-under-bridge (RUB) or road-over-bridge (ROB) at road crossing as per the policy and need. ➢ Existing road and proposed RUB/ROB/Level Crossing (LC) will cater for the movement of local people. ➢ Underpass or the level crossing shall be provided in the detour section as per the existing road network. ➢ Provision of footpath on side of the carriageway as per existing practice of the Indian Railway Code (IRC).

Note: Major impact items and mitigation measures are shown in the table. Further impact items and mitigation measures are considered in the draft EIA report.

Environmental Management Plan

Environmental Management Plan (EMP) is the key to ensure a safe and clean environment. The expected results from the environmental mitigation measures proposed in the project may not be obtained without a management plan to assure its proper implementation and function. The EMP envisages the plans for the proper implementation of mitigation measures to reduce the adverse impacts arising out of the project activities during pre-construction, construction and operation stages. EMP is prepared addressing the issues as follows.

1) Details of Management Plan proposed are mentioned below.
   a) Greenbelt Development Plan
   b) Solid Waste Management Plan
   c) Management / Rehabilitation Plan for Quarry / Borrow Areas
   d) Guidelines for Sanitation and House Keeping at the Construction Labour Camps
   e) Procedures for Storage, Handling & Emergency Response for Hazardous Chemical
   f) Land Acquisitions and Resettlement
2) Stage wise Environmental Management Measures are proposed for the following environmental and social issues.
   a) Pre-construction stage
      - land acquisition, diversion of reserved forest land, preservation of trees, borrow area, quarry area, site identification for disposal of unsuitable materials, construction camp, arrangement for temporary yard, orientation of implementation agency and contractors
   b) Construction stage
      - Site clearance, procurement of construction materials, construction work (drainage, siltation, slope protection, etc.), water pollution, air pollution, noise, safety, labour camp management, contractor's demobilization (clean-up operation, restoration and rehabilitation)
   c) Operation stage
      - Monitoring of operation performance of various mitigation measures, pollution monitoring

Environmental Monitoring

The purpose of the environmental monitoring plan is to ensure that the envisaged purpose of the project is achieved and results in desired benefits to the target population. To ensure the effective implementation of the EMP, it is essential that an effective monitoring plan be designed and carried out. The environmental monitoring plan consists of performance indicators and environmental monitoring programme.

Performance indicators

1) Pre-construction stage: land acquisition, dumping locations, construction camps, borrow areas;

2) Construction stage: air quality, noise & vibration levels, water quality, tree plantation, top soil, construction workers;
3) Operation stage: survival rate of trees, rehabilitation of borrow areas, utility of noise barriers for sensitive receptors

Environmental monitoring programme

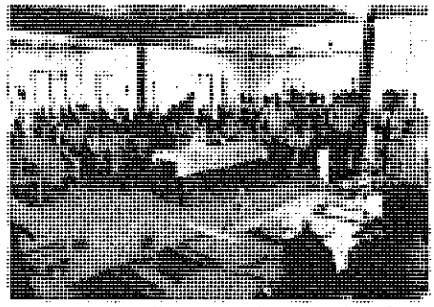
For the following items of environmental items, a) parameters to be monitored, b) location of the monitoring sites, c) frequency and duration of monitoring, and d) institutional responsibilities for implementation and supervision.

- Air quality, water quality, noise and vibration level, soil erosion, plantation, flora and fauna

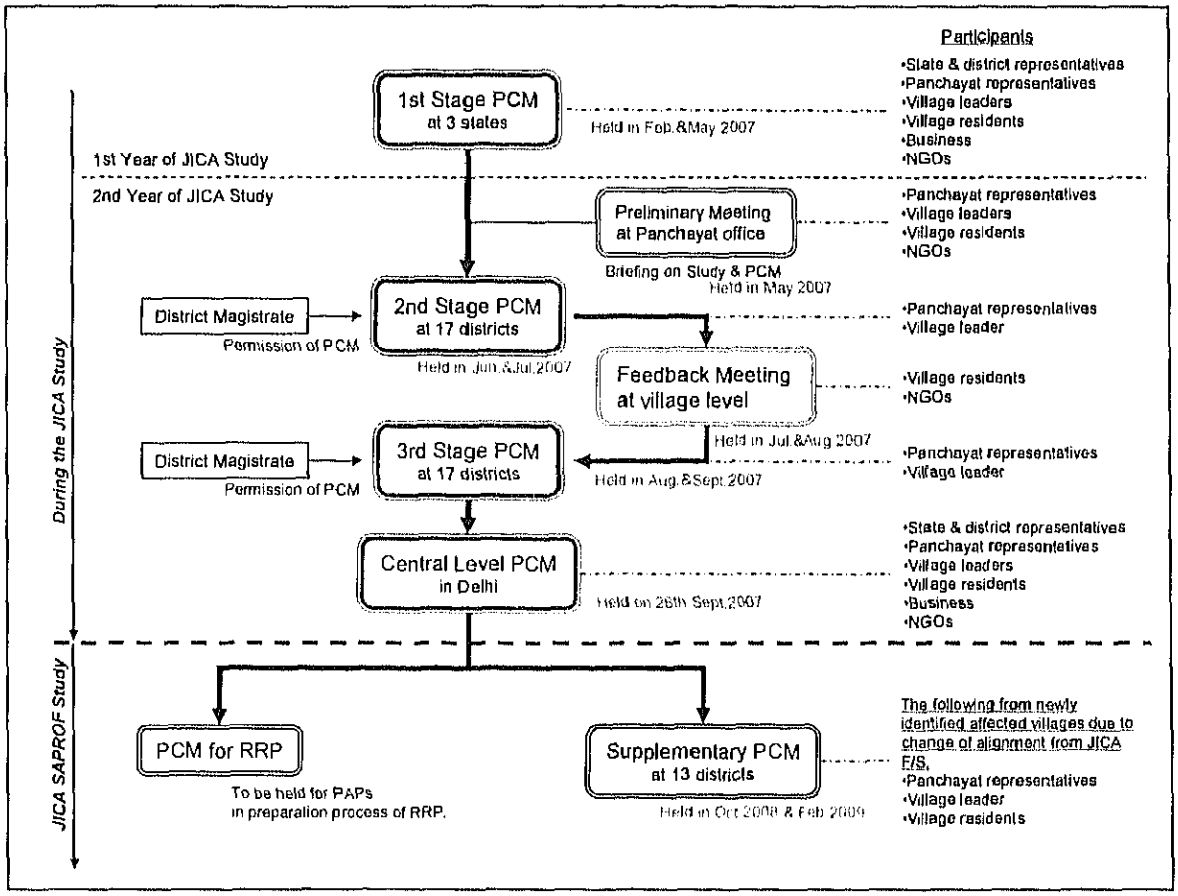
Public Consultation Meeting

Series of the Public Consultation Meetings (PCMs) were held during the ESIMMS under the JICA-funded Feasibility Study to disclose project information to as well as to get opinions and comments from the public. In addition, additional district-wise PCMs were held during the S-ESIMMS under the JICA funded SAPROF Study targeting for newly identified project-affected villages due to change of design of DFC alignment after the JICA F/S. Various comments and opinions were collected through the PCMs and incorporated into the project design such as provision of culvert to make vehicles, residents, and farmers access smoothly for both sides of the embankment section of the DFC.

On the other hand, PCM for Rehabilitation and Resettlement Plan (RRP) will be separately conducted in preparation process of the RRP to disclose to and obtain comments and opinions from project-affected peoples subject to the land acquisition and resettlement (PAPs).



Public Consultation Meeting



Further Schedule

- Finalization of the draft EIA report by reflecting the comments and opinions from the public.
- Disclosure of the finalized EIA report to the public after MOR reviews and approves the finalized EIA report.
- Full set of the finalized EIA report will be available for review by the public in the same locations where the draft EIA report was disclosed; respective Chief Project Manager (CPM) offices of DFCCIL, major stations along the proposed DFC alignment, and respective District Offices, in May 2009, as well as summary of the finalized EIA report in all of the project-affected villages.

Calling for Comments and Opinions

Please send your comments and opinions on environmental and social issues on the DFC Project only in writing with your name, address, and contact number, if any, through direct delivery, fax, or post to the respective CPM offices. Sending the comments/opinions through the e-mail is also acceptable (dfc.wc.eia@gmail.com). Full set of the draft EIA report, which is composed of the state-wise ESIMMS reports and draft S-ESIMMS report, is available for any person, who is interested in the EIA in detail, in the relevant CPM offices, major stations along the proposed stations, and respective District Offices.

Comments/opinions are kindly requested to send not later than 15th April, 2009.

Address of the CPM offices of the DFCCIL

- CPM office in Jaipur
  B-12,Hanuman Nagar, Opp. Metro Hospital, Sirsi Road, Jaipur, Tel: 0141-4028741, Fax: 0141-4028740
- CPM office in Ajmer
  Mall Road,Opp DRM Office, Ajmer-305001, Tel/Fax: 0145-2625548
- CPM office in Ahmedabad
  1st Floor, Old DRM Office Building, Kalupur,Ahmedabad-380002, Tel: 079-22175107, Fax: 079-22163101
- CPM office in Vadodara
  13-14,17-18,Panorama Complex,3rd Floor, R.C.Dutt Road,Alkapuri,Vadodara-7, Tel: 0265-2326024, Fax: 0265-2326027

Major Stations where the draft EIA report is available

- Gujarat
  Palanpur (Jn), Siddhapur, Unjha, Mahesana(Jn), Sabarmati (Jn), Ahmedabad (Jn), Nadiad (Jn), Anand(Jn) Vasad (Jn), Vadodara (Jn)
- Rajasthan
  Alwar (Jn), Kund, Neem Ka Thana, Sri Madhopur, Ringus (Jn), Jaipur (Jn), Phulera (Jn), Kishangarh, Ajmer (Jn), Beawar, Sojat Road, Marwar Jn, Falna, Sirohi Road, Abu Road
- Haryana
  Rewari (Jn), Narnaul, Dabla (Jn)

Thank you very much for your cooperation for the project.

रेल मंत्रालय
ड़ी.एफ.सी.सी.आई.एल.

वडोदरा एवं रेवाड़ी के मध्य समर्पित मालभाड़ा कारीडोर परियोजना का पश्चिमी कारीडोर पर्यावरणीय प्रभावों का मुल्याकंन का संक्षेप

मार्च 2009

यह भारत में वडोदरा एवं रेवाड़ी के मध्य समर्पित मालभाड़ा कारीडोर (ड़ी.एफ.सी.) परियोजना के पश्चिमी कारीडोर के पर्यावरणीय एवं समाजिक प्रभावों का संक्षेप है। यह संक्षेप परियोजना के सूचना प्रकटीकरण प्रक्रिया के तहत जन समुदाय में आवंटित होना हैं, जिसके लिए रेल मंत्रालय अधिकारिक मंत्रालय है एवं ड़ी.एफ.सी.सी.आई.एल. कार्यकारी संस्था है। हम इस परियोजना के लिए पर्यावरणीय एवं सामाजिक विषयों पर आपके विचारों का स्वागत करते हैं। आपके विचार डी.एफ.सी. परियोजना की अन्तिम पर्यावरणीय प्रभावों का मुल्याकंन रिर्पोट पूर्ण करने में सहायक सिद्ध होगें।

परियोजना की मुख्यताऐं

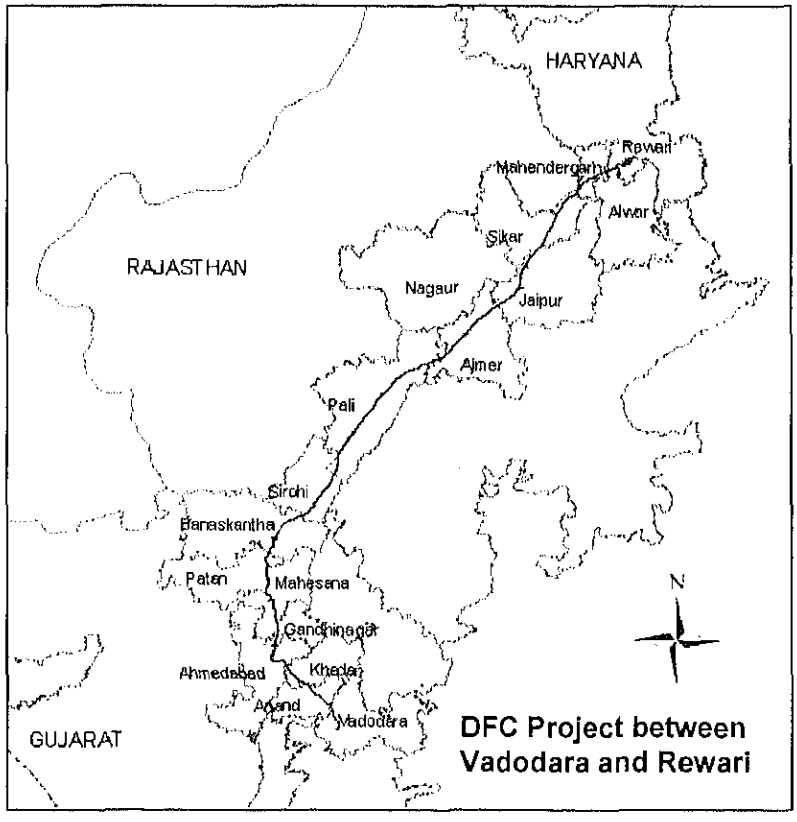
रेल मंत्रालय दिल्ली और मुम्बई महानगरों एवं इनके आसपास के स्थानों के मध्य माल के अतिशीघ्र एवं अबाधित आवागमन हेतू कम्प्यूटरिकृत समर्पित मालभाडा कारीडोर परियोजना को मूर्तरुप देने जा रहा हैं। जिससे माल बिना किसी बाधा के अपने गंतव्य स्थान तक कम समय एवं न्यूनतम परिवहन लागत में पहुँच सके।

डी.एफ.सी. परियोजना का उद्देश्य भारत की वर्तमान आर्थिक उन्नति के पथ को सुदृढ़ करना है। वर्ष 2013–2014 तक इस परियोजना द्वारा 37.7 मिलियन टन माल का परिवहन हो सकेगा। परियोजना के निर्माण से आर्थिक उन्नति एवं रोजगार के नये अवसर उत्पन्न होगें। साथ ही राष्ट्र में प्रान्तों के मध्य आर्थिक विनिमय एवं प्रमुख व्यापार केन्द्रों का परस्पर सुधार होगा।

भारत सरकार के रेल मंत्रालय के अधिनस्त डी.एफ.सी.सी.आई.एल. इस परियोजना के विकास के क्रियान्वयन संस्था है। डी.एफ.सी. परियोजना का पश्चिमी कारीडोर का वडोदरा से रेवाड़ी के मध्य का भाग हरियाणा, राजस्थान एवं गुजरात राज्य के 17 जिलों कें 470 गॉवो से होकर गुजरता है। जिसकी लम्बाई करीब 920 कि.मी. है।

परियोजना अभी प्लानिंग अवस्था मे है। वर्ष 2009 के मध्य से लगभग 2011 तक परियोजना का विस्तृत प्रारुप कार्य किया जायेगा। परियोजना का निर्माण कार्य वर्ष 2011 से आरम्भ होगा एवं 4–5 वर्ष में पूर्ण होगा।

राज्य/जिले
गुजरात
वडोदरा
आंनद
खेड़ा
अहमदाबाद
गॉधीनगर
महेसाणा
पाटन
बनासकांठा
राजस्थान
सिरोही
पाली
अजमेर
नागौर
जयपुर
सीकर
अलवर
हरियाणा
महेन्द्रगढ़
रेवाड़ी



प्रस्तावित **DFC** रेलमार्ग एवं संलग्न सुविधाऐं

समर्पित मालभाड़ा कारीडोर परियोजना का पश्चिमी कारीडोर वडोदरा–अहमदाबाद –पालनपुर–रेवाड़ी से गुजरता हुआ दो तरफा रेलमार्ग होगा। यह प्रस्तावित मार्ग गुजरात, राजस्थान एवं हरियाणा राज्य से होकर गुजरता है। परियोजना का मार्ग मुख्यतया भारतीय रेल विभाग की भूमि पर वर्तमान रेल मार्ग के समान्तर नियोजित किया गया है। जबकि कुछ स्थानों पर वर्तमान रेल लाईन के समान्तर पर्याप्त भूमि उपलब्ध न होने के कारण तथा जहाँ तक सम्भव हो पुर्नवास से बचाने हेतू बाईपास का प्रावधान रखा गया है। बाईपास मार्ग की योजना बनाते समय स्थानीय समुदाय, जीव अभ्यारण, शहरी योजना क्षेत्र, मार्बल उद्योग, आबादी क्षेत्रों, खदान आदि को बचाने का ध्यान रखा गया, ताकि प्रतिकूल पर्यावरण एवं सामाजिक प्रभावों को यथा सम्भव कम किया जा सके।

परियोजना हेतू पर्यावरण एवं सामाजिक अध्ययन

भारतीय कानून व नियमों में रेल परियोजनाओं हेतू पर्यावरणीय प्रभावों के मुल्यांकन करने का कोई प्रावधान नही है। चूंकि ड़ी.एफ.सी. परियोजना वृहत परियोजना है जिससे विपरीत पर्यावरणीय एवं सामाजिक प्रभावों की सम्भावना है। अतः परियोजना के योजना कार्यकाल से ही पर्यावरणीय एवं सामाजिक मुद्दों का विस्तृत अध्ययन किया गया है।

पर्यावरणीय प्रभावों का मुल्याकंन रिर्पोट

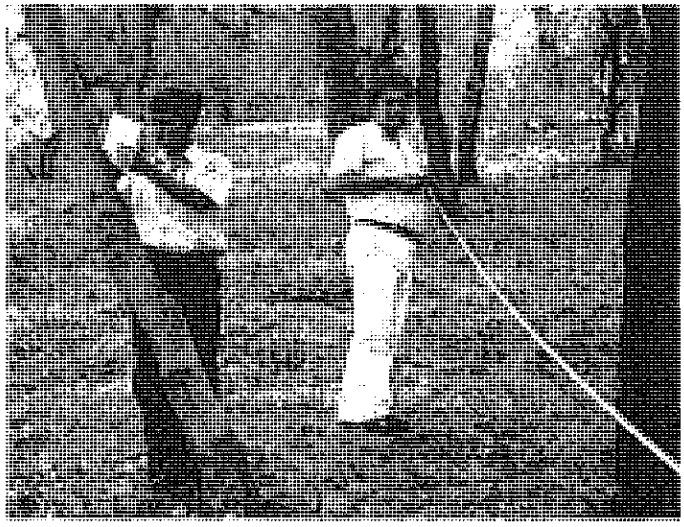
ESIMMS

\+ वर्ष 2007 में जे.आई.सी.ए. मार्गदर्शिका के अनुरुप बनायी गयी रिर्पोट

S-ESIMMS

वर्ष 2008/9 में जे.आई.सी.ए. सेप्रोफ अध्ययन के अनुरुप बनायी गयी रिर्पोट

इस संदर्भ में रेल मंत्रालय/ड़ी.एफ.सी.सी.आई.एल. ने जापान इन्टरनेशनल कार्पोरेशन ऐजन्सी (जे.आई.सी.ए.) के तकनीकी सहयोग से ड़ी.एफ.सी. परियोजना के पश्चिमी कारीडोर की ड्राफ्ट पर्यावरणीय प्रभावों का मुल्याकंन (ई.आई.ए.) रिर्पोट तैयार किया है, जो कि जे.आइ.सी.ए. (JICA) अध्ययन रिर्पोट 2007 (ESIMMS[1]) एवं जे.आइ.सी.ए.–सेप्रोफ (SAPROF[3]) अध्ययन रिर्पोट 2008–09 (S-ESIMMS[2]) का सम्मलित रुप है। ड्राफ्ट पर्यावरणीय प्रभावों का मुल्याकंन (ई.आई.ए.) रिर्पोट तीनों प्रदेशों की ESIMMS रिर्पोट एवं S-ESIMMS रिर्पोट का मिश्रित रुप है, जो पूरे परियोजना प्रभावित क्षेत्र का वर्णन करता है।



पेड़ पौधो का सर्वेक्षण

दोनों ESIMMS एवं S-ESIMMS रिर्पोट, परियोजना से उत्पन्न प्रभावों, परियोजना क्षेत्र की सामाजिक एवं भौतिक अवस्थाऐं, प्रदुषण नियंत्रण एवं सामाजिक विषयों पर आधारित है। S-ESIMMS रिर्पोट में अध्ययन किए गये प्रमुख विषयों में रेल द्वारा उत्पन्न ध्वनि एवं कम्पन का पुर्वानुमान तथा संवेदनशील अभिग्राहकों पर ध्वनि एवं कम्पन का प्रभाव, भूमि उपयोग सर्वेक्षण, प्रस्तावित रेल मार्ग के निकट संरक्षित क्षेत्रों एवं प्रमुख नदियों के प्रत्येक मौसम के आंकडों का संकलन तथा विस्तृत विश्लेषण, स्थानान्तरित होने वाले ढाचों का सर्वेक्षण एवं तदोपरान्त सामाजिक–आर्थिक सर्वेक्षण आदि विषय सम्मलित हैं। इसके अतिरिक्त जे.आइ.सी.ए. (JICA) अध्ययन के वाद स्थानान्तरित हुए रेलमार्ग से नवप्रभावित क्षेत्रों का पूरक सर्वेक्षण भी सम्मलित है।

रेल द्वारा उत्पन्न ध्वनि एवं कम्पन मापने का सर्वेक्षण

[1] ESIMMS: जे.आई.सी.ए. की 'पर्यावरणीय एवं सामाजिक निगित्त 2004 मार्गदर्शिका' के अनुसार बनाये गये पर्यावरणीय एवं सामाजिक प्रभावों का मुल्याकंन रिर्पोट

[2] S-ESIMMS: जे.आई.सी.ए. की 'पर्यावरणीय एवं सामाजिक निगित्त 2004 मार्गदर्शिका' के अनुसार बनाये गये पर्यावरणीय एवं सामाजिक प्रभावों का मुल्याकंन की पूरक रिर्पोट

[3] SAPROF स्पेशल अरिसस्टेन्स फॉर प्रोजेक्ट फॉरमेशन

संभावित प्रभाव एवं निराकरण के उपाय

सर्वेक्षणों में अनेक प्रतिकूल पर्यावरणीय एवं सामाजिक प्रभावों का पता चला है। इन विपरित प्रभावों को न्यूनतम करने के सुझाव प्रस्तावित किये गये हैं। प्रमुख पर्यावरणीय व सामाजिक प्रभावों के निराकरण के सुझाव नीचे दिऐ गये हैं।

प्रभावों एवं निराकरण के उपायों की तालिका

संभावित प्रभाव	निराकरण के उपाय
वायु गुणवत्ता	
निर्माणावधि धूल के सूक्ष्म कणों, निर्माण कार्य में प्रयुक्त उपकरणों एवं वाहनो द्वारा वायु प्रदुषण	➔ निर्माण कार्य में प्रयुक्त माल को बन्द स्थानो अथवा ढके गोदामों में रखने की व्यवस्था ➔ ढुलाई वाले वाहनो से मिट्टी, पत्थर आदि छलकने से बचाव ➔ निर्माण क्षेत्र की कच्ची सड़कों एवं अन्य स्थानो पर धूल उड़ने से बचाव के लिए पानी के छिड़काव की व्यवस्था ➔ कम धुआँ उत्पन्न करने वाले उपकरणों, जनेटरो एवं परिवहन के साधनो का प्रयोग
ध्वनि एवं कम्पन्न स्तर	
निर्माणावधि निर्माण कार्य में प्रयुक्त हल्की तथा भारी मशीनों व वाहनों द्वारा ध्वनि एवं कम्पन	➔ न्यूनतम ध्वनि उत्पन्न करने वाले उपकरणों का प्रयोग ➔ स्थिर निर्माण उपकरणों को आवासीय क्षेत्रों, शिक्षण संस्थानों एवं चिकित्सालय जैसे स्थानों से 200 मी. की दूरी पर स्थापित करना ➔ आवासीय क्षेत्रों में निर्माण कार्य दिन के समय ही करने का प्रयास होगा ➔ अतिध्वनित स्थानों पर श्रमिकों को ध्वनि बचाव उपकरण उपलब्ध कराने की व्यवस्था
संचालन अवधि ट्रेनों तथा अन्य सम्बन्धित वाहनों के अवागमन से उत्पन्न ध्वनि एवं कम्पन	➔ न्यूनतम ध्वनि एवं कम्पन पैदा करने वाली तकनीक का प्रयोग ➔ जुड़ी हुई लम्बी पटरीयों का प्रयोग ➔ रेलगाड़ी, पटरी एवं इमारतों का सही रखरखाव ➔ शहरी क्षेत्रों में मालगाड़ी की नियन्त्रित गति ➔ रेल पटरी के आस–पास स्थित मकानों एवं संवेदनशील अभिग्राहकों पर आवश्यकतानुसार ध्वनिरोधक दीवारों के निर्माण का प्रावधान
जल गुणवत्ता	
निर्माणावधि • निर्माण कार्य के दौरान घुली गंदगी युक्त दूषित जल • श्रमिक शिविरों से उत्पन्न दूषित जल एवं निर्माण क्षेत्रों से उत्पन कीचड़ इत्यादि	➔ जल क्षेत्रों के निकट गाद निरोधक आड़ का प्रावधान ➔ अवसाद अलग कर गुणवत्ता नियंत्रित करने के पश्चात निर्माण क्षेत्र से उत्पन्न दूषित जल का निकास का प्रावधान ➔ दूषित जल से होने वाली स्वास्थ्य समस्याओं की रोक थाम हेतू प्रयाप्त आरोग्यकर सुविधाओं का प्रावधान
संचालन अवधि रेल डिपो, रेलगाड़ियों की धुलाई एवं कारखाने की रखरखाव क्रियाओं द्वारा उत्पन्न दूषित जल	➔ जल शोधन संयत्र द्वारा दूषित जल से घुलनशील पदार्थ, तेल एवं चिकनाई, कार्बनिक पदार्थ एवं जहरीले तत्व दूर कर एवं अम्लता उदासीन कर उपचारित जल का पुनः उपयोग
स्थलाकृति एवं भूगर्भ विज्ञान	
निर्माणावधि • पेड़ों की कटाई, जमींन की खुदाई, जमींन का भराव एवं निर्माण कार्य द्वारा स्थलाकृति बदलाव • गर्त खुदाई से स्थलाकृति का विकृत होना	➔ स्थलाकृति के विकृत होने से बचाव के लिए प्रयोजित गर्त एवं खदान का उपयोग ➔ अनियंत्रित गर्त खुदाई से बचाव, ताकि त्यागे गये गर्तों में एकत्रित जल संक्रामक रोग कारकों के प्रजनन का स्थान ना बन सके ➔ निर्माण सामग्री का केवल स्वीकृत एवं अनुमोदित खाईयों से दोहन

संभावित प्रभाव	निराकरण के उपाय
मृदा	
निर्माणावधि • मिट्टी दोहन गर्तों एवं बाईपास अनुभाग के विकास के कारण उपरी उपजाऊ मृदा की हानि • खुदाई के कारण उपरी मृदा का ढीला होना एवं वनस्पतिय आच्छादन की हानि • मृदा गुणवत्ता की अवनति	→ तटबन्धों के निर्माण में मृदा श्रोतों को बचाने हेतू तापीय संयत्रो से निकली राख का प्रयोग (यदि तकनिकी रूप से अनूकुल एवं 100 किमी में स्थित हो) → प्रयाप्त जल निकास व्यवस्था तटबन्ध दृढीकरण एवं ढलान स्थितिकरण जैसे उपाय → मृदा दोहन गर्तों वाले स्थानों की उपरी मृदा का बचाव तथा पुनर्वीकरण → चिकनाई एवं तेल के रिसाव से बचाव का प्रावधान → निर्माण कार्य से उत्पन्न कीचड़ का प्रयाप्त निपटान
जल विज्ञान सम्बन्धि दशाऐं	
निर्माणावधि • तटबन्ध निर्माण से प्राकृतिक जल निकास में बाधा के कारण बाढ़ के संयोग एवं उसकी अवधि में वृद्धि	→ रेल मार्ग के साथ-साथ प्रयाप्त नालियों का प्रावधान → वर्तमान जल निकास नालियों की क्षमता में वृद्धि → बाढ़ एवं जल भराव से बचाव हेतू प्रयाप्त जल निकास का प्रावधान
संचालन अवधि • तटबन्ध निर्माण के कारण स्थानीय जल निकास पर प्रभाव	→ वर्धित अपवाह के समायोजन हेतू रेल मार्ग के दोनों ओर प्रयाप्त क्षमता की रेल मार्ग के समान्तर नालियों का प्रावधान
वनस्पति	
निर्माणावधि • परियोजना के लिए अधिग्रहित भूमि पर पेड़ों के कटान से वनस्पति का नुकसान • निकटस्थ वृक्षादि की पत्तियों पर धूल का जमाव	→ काटे गये पेड़ों की दुगनी संख्या में क्षतिपूरक वृक्षारोपण → वन्य भूमि एवं व्यक्तिगत भूमि स्थित काटे गये वृक्षों की क्षति पूर्ति → अधिग्रहित वन्य भूमि हेतू क्षति पूर्ति → फूल वाली झाड़ियों एवं सदाबहार वृक्षों युक्त मिश्रित पौधारोपण → प्रस्तावित रेल मार्ग के दोनों ओर उपलब्ध स्थानों पर पट्टीदार वृक्षारोपण → ईधन के लिए श्रमिकों द्वारा वृक्षों की कटाई की रोकथाम हेतू ईधन का प्रावधान
वन भूमि परिवर्तन	
पूर्व निर्माणावधि • प्रस्तावित रेल मार्ग के कुछ स्थानों पर आरक्षित वन क्षेत्रों से गुजरना	→ वन भूमि के परिवर्तन एवं काटे गये वृक्षों की वन विभाग को क्षतिपूर्ति → आरक्षित वन क्षेत्र में किसी क्रिया कलाप से पूर्व वन विभाग की अनापत्ति प्राप्त की जायेगी
जीव-जन्तु	
पूर्व निर्माणावधि • महेसाणा जिले में ड़ी.एफ.सी. रेल मार्ग (बाईपास अनुभाग) के पश्चिम में थोल वन्य जीव (पंक्षी) अभ्यारण	→ अभ्यारण की 3 कि.मी. परिधी में निर्माण कार्य विशेष सावधानी पूर्वक एवं कानून अनुसार किया जायेगा ताकि अभ्यारण में न्यूनतम विध्न हो
निर्माणावधि • निर्माण कार्य में प्रयुक्त यंत्रों से उत्पन्न ध्वनि द्वारा आरक्षित वनों एवं थोल वन्यजीव अभ्यारण के पक्षियों का प्रभावित होना • मही, विश्वामित्री एवं वत्रक नदियों पर पुल निर्माण के समय मृदुकाय कछुआ एवं मुग्गर मगरमच्छ के आवास का अल्पकालिक क्षति '	→ निर्माण कार्य में प्रयुक्त उपकरण एवं वाहनों का प्रयाप्त रखरखाव एवं व्यर्थ उपयोग से बचाव, ताकि स्वीकृत मात्रा में ही ध्वनि उत्पन्न हो → पुलों का निर्माण कार्य शुष्क मौसम में किया जाऐगा, यदि लुप्तप्राय प्रजातियों के आवास पर प्रभाव ना पड़े तो वर्षाकाल में भी कार्य किया जा सकता है → निर्माण क्षेत्र की आवश्यकता अनुसार सीमाओं पर आड़ लगाने का प्रावधान
संचालन अवधि • बनासकांठा जिले में आरक्षित वन्य भूमि के अधिग्रहण से वन्यजीवों का आवागमन प्रभावित होना	→ वृक्षों के कटान से नष्ट हुए वन्य जीव आवासों की क्षतिपूर्ति हेतू पौधारोपण

संभावित प्रभाव	निराकरण के उपाय
• जल क्षेत्रों में तेल एवं जहरीले रसायनों के रिसाव से जलीय जीवों पर प्रभाव • रेल मार्ग के आरपार वन्य जीवों के आवागमन में बाधा • वन्य जीवों की रेलगाड़ियों द्वारा दुर्घटनाग्रस्त होने की सम्भावना	➔ तेल, ईंधन एवं जहरीले तत्वों का दुर्घटना से हुऐ रिसाव के समय तत्काल सफाई की व्यवस्था ➔ वन्य क्षेत्रों के पास रेल मार्ग के नीचे से पशुओं के अवागमन की व्यवस्था का प्रावधान ➔ दुर्घटनाओं को टालने के लिए वन्यजीवों की अधिकता वाले स्थानों पर आवश्यकतानुसार आड़ लगाने का प्रावधान
भूमि अधिग्रहण एवं पुर्नस्थापन	
पूर्व निर्माणावधि सम्पत्ति एवं जीविका की हानि	➔ पर्यावरणीय प्रभावों के मुल्याकंन के अलावा पुनरोद्धार एवं पुर्नवास योजना के अर्न्तगत क्षतिपूर्ति एवं सहायता की योजना बनाई जाऐगी
निर्माणावधि पैदल यात्रियों एवं वाहन के आवागमन में बाधा	➔ बाईपास का प्रावधान एवं उपयुक्त जगहों पर सूचना एवं दिशा निर्देशक बोर्ड
संचालन अवधि डी.एफ.सी. के तटबन्ध निर्माण के कारण स्थानीय लोगों एवं किसानों के आवागमन में बाधा	➔ नीति एवं आवश्यकतानुसार रेल–सड़क क्रॉसिंग पर या तो रेल के निचे से (RUB) अथवा रेल के ऊपर (ROB) से सड़क का प्रावधान ➔ वर्तमान सड़क एवं प्रस्तावित RUB/ ROB/रेल–सड़क क्रॉसिंग स्थानीय लोगों की आवश्यकताऐं पूरी करेंगे ➔ बाईपास अनुभाग में रेलमार्ग के निचे से सड़क एवं रेल–सड़क क्रॉसिंग वर्तमान सड़क नेटवर्क के अनुसार होगा ➔ भारतीय रेल की वर्तमान कार्यप्रणाली अनुसार RUB तथा ROB में सड़क के दोनो ओर पैदलपथ (फुटपाथ) का प्रावधान

नोट : प्रमुख प्रभाव एवं निराकरण के उपाय तालिका मे दिऐ गये हैं। अन्य प्रभाव एवं उपाय पर्यावरण के प्रभावों का मुल्याकंन रिर्पोट में दिए गये है।

पर्यावरणीय प्रबन्ध योजना

पर्यावरणीय प्रबन्ध योजना स्वच्छ एवं सुरक्षित पर्यावरण की कुंजी है। पर्यावरण प्रबन्ध योजना एवं इसके प्रयाप्त क्रियान्वयन को सुनिश्चित किए बिना सुझाए गये निराकरण के उपायों का वान्छित नतीजा मिलना सम्भव नही है।

पर्यावरण प्रबन्ध योजना, निर्माण पूर्व अवस्था, निर्माण अवस्था एवं क्रियान्वयन अवस्था के समय परियोजना क्रियाकलापों द्वारा उत्पन्न विपरीत प्रभावों को कम करने के लिए सुझाऐ गये उपायों के क्रियान्वयन की योजना बताता हैं। पर्यावरण प्रबन्ध योजना निम्न बिन्दुओं पर आधारित होती है।

1) प्रस्तावित प्रबन्ध योजना इस प्रकार है –
   - क) हरित पट्टी विकास योजना
   - ख) अपशिष्ट प्रबन्ध योजना
   - ग) खाईयों एवं मृदा आपूर्ति वाले क्षेत्रों के प्रबन्ध/पुनरोद्धार योजना
   - घ) श्रमिक शिविरों की स्वच्छता एवं रखरखाव की निर्देशिका
   - ड) हानिकारक रसायनों के भण्ड़ारण, रखरखाव एवं आपातकालीन उपायों के नियम
   - च) भू–अधिग्रहण एवं पुर्नवास

2) निम्न पर्यावरण एवं सामाजिक बिन्दुओं के लिऐ आवश्यकतानुसार पर्यावरण प्रबन्ध उपाय प्रस्तावित है –
   - क) निर्माण पूर्ण अवस्था
     - भू–अधिग्रहण, वन भूमि के परिवर्तन, वृक्षों का संरक्षण, मृदा दोहन गर्तों, खाईयों का बचाव, अवान्छित सामाग्री के निपटान के लिए एवं श्रमिक शिविरों के लिए जगह का चुनाव, अल्पकालीन रेल यार्ड़ की व्यवस्था, क्रियान्वयन ऐजन्सी एवं ठेकेदारों का अभिविन्यास

ख) निर्माण अवस्था

- कार्य क्षेत्र की सफाई, निर्माण सामग्री का उपार्जन, निर्माण कार्य (जल निकास, ढलान स्थरिकरण आदि) जल प्रदूषण, वायु प्रदुषण, ध्वनि, श्रमिक शिविरों का प्रबन्धन, ठेकेदारों की कार्य समाप्ती

ग) क्रियान्वयन अवस्था

- विभिन्न निराकरण के उपायों के सम्पादन की समीक्षा, प्रदुषण समीक्षा

पर्यावरण प्रबोधन

पर्यावरण प्रबोधन का उद्देश्य यह सुनिश्चित करना है कि परियोजना के निर्धारित उद्देश्य एवं इच्छित परिणाम पा लिया गया है। पर्यावरण प्रबन्ध योजना के क्रियान्वयन को सुनिश्चित करने के लिऐ प्रभावशाली पर्यावरण प्रबोधन योजना तैयार करना जरुरी है। पर्यावरण प्रबोधन योजना दो तत्वों, कार्य सम्पादन सूचक एवं पर्यावरण प्रबोधन कार्यक्रम से मिलकर बना है।

कार्य सम्पादन सूचक

क) निर्माणपूर्व अवस्था : भूमि अधिग्रहण, निस्तारण स्थान, निर्माण शिविर, मृदा दोहन गर्त
ख) निर्माण अवस्था : वायु गुणवत्ता, ध्वनि एवं कम्पन्न स्तर, जल गुणवत्ता, पौधारोपण, उपरी मृदा, श्रमिक
ग) क्रियान्वयन अवस्था : पौधों के जीवित रहने का अनुपात, मृदा दोहन गर्तों का पुनरोद्धार, संवेदनशील स्थानों पर ध्वनिरोधकों की उपयोगिता

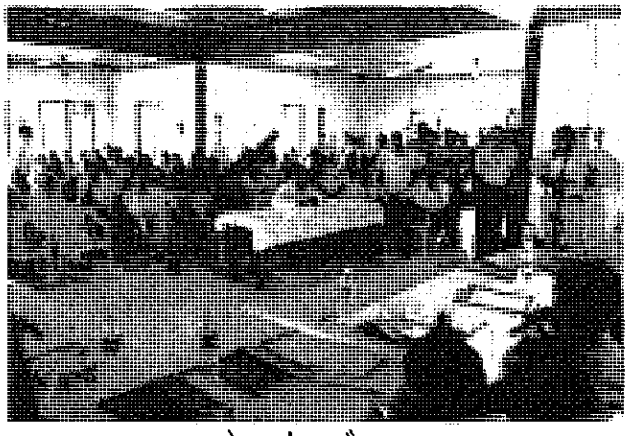
पर्यावरणीय प्रबोधन कार्यक्रम

पर्यावरणीय प्रबोधन कार्यक्रम में निम्नलिखित विषयों पर ध्यान दिया जायेगा :-
क) प्रबोधन योग्य मद
ख) प्रबोधन का स्थान
ग) प्रबोधन की अवधि एवं तीव्रता
घ) क्रियान्वयन एवं निरीक्षण की संस्थानिक जिम्मेदारी

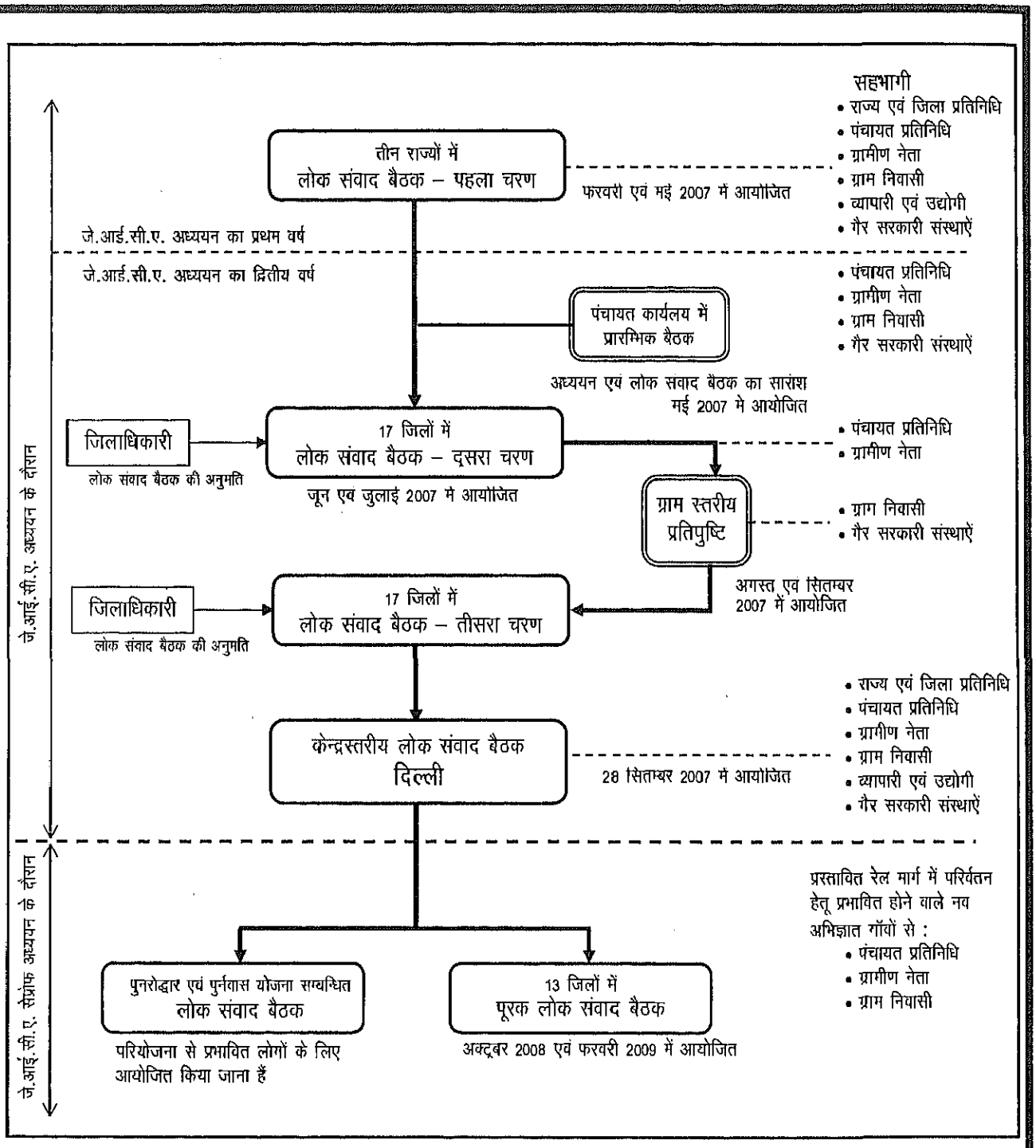
उपरोक्त विषयों के आधार पर पर्यावरणीय प्रबोधन कार्यक्रम में निम्न मदों का प्रबोधन किया जायेगा :-

क) वायु गुणवत्ता	ख) जल गुणवत्ता	ग) ध्वनि एवं कम्पन्न स्तर
घ) भूमि कटाव	ड) पौधारोपण	च) वनस्पति एवं जीवजन्तु

लोक संवाद बैठक


लोक संवाद बैठक

जन समुदाय तक परियोजना की जानकारी पहुँचाने एवं उनके विचार जानने के लिए जे.आइ.सी.ए. की आर्थिक सहायता से किए गये पर्यावरण एवं सामाजिक प्रभावों एवं उपायों के अध्ययन के समय लोक संवाद बैठक का आयोजन किया गया था। इसके अलावा जे.आइ.सी.ए. की आर्थिक सहायता से किए गये सेप्रोफ अध्ययन के समय डी.एफ.सी. रेलमार्ग में परिवर्तन के कारण नये प्रभावित गॉवों को ध्यान में रखते हुऐ जिलानुसार लोक संवाद बैठकों का आयोजन किया गया था। इन लोक संवाद बैठकों से विभिन्न सुझाव प्राप्त हुऐ जिन्हें परियोजना प्रारुप में सम्मलित किया गया है जैसे वाहनों, किसानों एवं स्थानीय लोगों के आवागमन हेतू तटवन्ध अनुभाग में पुलिया का प्रावधान। दूसरी तरफ पुनरोद्धार एवं पुर्नवास योजना का प्रकटीकरण एवं परियोजना प्रभावित लोगों के भू-अधिग्रहण एवं पुर्नवास सम्बन्धित विचार जानने के लिए अलग से लोक संवाद बैठक का आयोजन किया जायेगा।



आगला कार्यक्रम

- ड्राफ्ट पर्यावरणीय प्रभावों का मुल्याकंन रिर्पोट में जन समुदाय के विचारों को सम्मलित कर अन्तिम रुप देना।
- रेल मंत्रालय द्वारा स्वीकृत होने के पश्चात अन्तिम पर्यावरण रिर्पोट को जनसाधारण के लिऐ उपलब्ध करना।
- पूर्ण पर्यावरण रिर्पोट जन साधारण की समीक्षा के लिए उन स्थानों पर उपलब्ध होगी जहॉ पर ड्राफ्ट रिर्पोट उपलब्ध कराई गयी थी। रिर्पोट सम्बन्धित ड़ी.एफ.सी.सी.आई.एल. के मुख्य परियोजना प्रबन्धक, प्रस्तावित ड़ी एफ सी रेल मार्ग के साथ प्रमुख रेल स्टेशन एवं सम्बन्धित जिला कार्यलय में मई 2009 में उपलब्ध होगी। अन्तिम रिर्पोट का सासंश सभी परियोजना प्रभावित गॉवों में उपलब्ध होगा।

विचारों एवं सुझावों का स्वागत

कृपया डी.एफ.सी. परियोजना सम्बन्धित पर्यावरणीय एवं सामाजिक विषयों पर अपने सुझाव एवं विचार अपने नाम पतें एवं फोन नम्बर (यदि है तो) सहित लिखित में, व्यक्तिगत रूप में, डाक या फेक्स द्वारा सम्बन्धित प्रमुख परियोजना अधिकारी कार्यालय पर भेजें। आप अपने विचार ई मेल (dfc.wc.eia@gmail.com) द्वारा भी भेज सकते है। ड्राफ्ट पर्यावरणीय प्रभावों का मुल्यांकन रिर्पोट डी.एफ.सी.सी.आई.एल. के सम्बन्धित प्रमुख परियोजना अधिकारी कार्यालय, रेलमार्ग के समीप प्रमुख स्टेशनों एवं जिला कार्यालय में उपलब्ध है।

कृपया अपने विचार एवं टिप्पणीयाँ 15 अप्रेल 2009 से पहले भेजें

मुख्य परियोजना प्रबन्धक (डी.एफ.सी.सी.आई.एल.) कार्यालय का पता

- मुख्य परियोजना प्रबन्धक कार्यालय – जयपुर
  बी 12,हनुमान नगर, मेट्रो हॉस्पीटल के सामने, सिरसी रोड़ , जयपुर,
  दूरभाष : 0141–4028741 फैक्स : 0141–4028740
- मुख्य परियोजना प्रबन्धक कार्यालय – अजमेर
  माल रोड़, डी आर एम कार्यालय के सामने, अजमेर–305001
  दूरभाष : 0145–2625548 फैक्स–0145–2625548
- मुख्य परियोजना प्रबन्धक कार्यालय – अहमदाबाद
  पुरानी डी आर एम भवन, पहली मंजिल
  अहमदाबाद रेल्वे स्टेशन, अहमदाबाद –380002
  दूरभाष : 079–22175107
- मुख्य परियोजना प्रबन्धक कार्यालय – वडोदरा
  13–14, 17–18,पैनोरामा कॉम्पलेक्स, तीसरी मंजिल
  आर सी दत्त रोड़, अल्कापूरी वड़ोदरा –7
  दूरभाष : 0265–2326024, फैक्स–0265–2326027

प्रमुख स्टेशन जहाँ पर ड्राफ्ट रिर्पोट उपलब्ध हैं

- गुजरात
  पालनपुर (जंक्शन), सिद्धपुर, ऊंझा, महेसाणा (जंक्शन), साबरमती (जंक्शन), अहमदाबाद (जंक्शन), नडियाद (जंक्शन), आन्नद (जंक्शन), वासाड (जंक्शन) एवं वडोदरा (जंक्शन)
- राजस्थान
  अलवर (जंक्शन), कुण्ड़, नींम का थाना, श्री माधोपुरा, रिंगस (जंक्शन), जयपुर (जंक्शन), फुलेरा(जंक्शन), किशनगढ़, अजमेर (जंक्शन), व्यावर, सोजत रोड़, मारवाड़ (जंक्शन), फालना, सिरोही रोड़ एवं आबू रोड़
- हरियाणा
  रेवाड़ी (जंक्शन), नारनौल एवं डाबला (जंक्शन)

।। परियोजना में आपके सहयोग के लिए धन्यवाद ।।

રેલ મંત્રાલય
ડી.એફ.સી.સી.આઈ.એલ.

વડોદરા અને રેવાડી વચ્ચે સમર્પિત માલભાડા કોરિડોર પરિયોજનાનાં પશ્ચિમી કોરિડોર (વિભાગ)

પર્યાવરણિય અસરોના મુલ્યાંકનોનો સંક્ષેપ

માર્ચ ૨૦૦૯

ભારતમાં વડોદરાથી રેવાડી વચ્ચે સમર્પિત માલભાડા કોરિડોર (ડી.એફ.સી) પરિયોજનાએ પશ્ચિમી વિભાગની પર્યાવરણિય તેમજ સામાજિક અસરોનો વિભાગ છે. આ વિભાગની પરિયોજનાનાં સુચનોને જન–સમુદાય સુધી પહોંચાડવામાં આવશે. જેના માટે રેલ્વે મંત્રાલય દ્વારા અધિકારી મંત્રાલય તેમજ ડી.એફ.સી.સી.આઈ.એલ. કાર્યકારી સંસ્થા છે. અમે આ પરિયોજના માટે પર્યાવરણીય તેમજ સામાજિક વિષયો બાબત તમારા મંતવ્યોને આવકારીએ છીએ. તમારા મંતવ્યો તેમજ વિચારો ડી.એફ.સી પરિયોજનાની પર્યાવરણિય અસરોના મુલ્યાંકનનાં રિપોર્ટને પુર્ણ કરવામાં ઉપયોગી સિધ્ધ થશે.

પરિયોજના ની વિશેષતાઓ

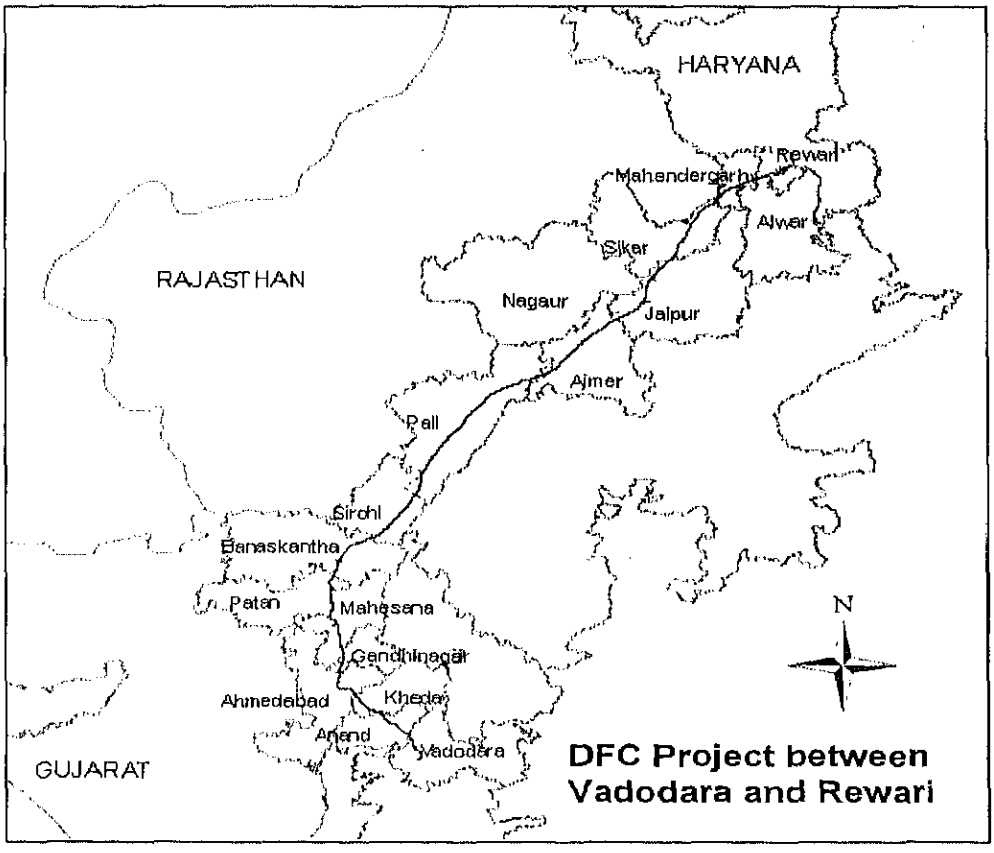
રેલ્વે મંત્રાલય દિલ્હી અને મુંબઈ મહાનગર સુધી તેમજ આસ-પાસના સ્થાનો પરથી માલ-સામાનની ઝડપી હેરફેર હેતુથી કમ્પ્યુટર સંચાલિત સમર્પિત માલવાહક પરિયોજનાનું આયોજન કરી રહેલ છે. જેના કારણે માલ-સામાનને યોગ્ય સ્થાને ઝડપી અને ઓછા ખર્ચમાં પહોંચાડી શકાય.

ડી.એફ.સી. પરિયોજનાનો મુખ્ય ઉદ્દેશ્ય ભારતના વર્તમાન વિકાસ દરને બળ પૂરુ પાડવાનો છે. વર્ષ:2013-2014 સુધી આ યોજના દ્વારા 37.7 મિલિયન ટન માલ-સામાનની હેરફેર થશે. આ યોજનાનાં નિર્માણથી આર્થિક ઉન્નતિ અને રોજગારની નવી તકો ઊભી થશે. સાથે-સાથે રાષ્ટ્રના આંતરીક પ્રાંતો વચ્ચે આર્થિક વિનિમય ઉપરાંત મુખ્ય વ્યાપાર કેન્દ્રોમાં પરસ્પર સુધારો થશે.

ભારત સરકારના રેલ્વે મંત્રાલય તરફથી ડી.એફ.સી.સી.આઈ.એલ. આ પરિયોજનાની વિકાસશીલ અને કાર્યક્ષમ સંસ્થા છે. ડી.એફ.સી. પરિયોજનાનાં 'પશ્ચિમ કોરિડોરમાં' વડોદરાથી રેવાડીનામધ્ય ભાગમાં હરિયાણા, રાજસ્થાન તેમજ ગુજરાત રાજ્યના 17 જિલ્લાઓના 470 ગામડાંઓમાંથી પસાર થાય છે. જેની લંબાઈ લગભગ 920 કી.મી. છે.

પરિયોજના અત્યારે આયોજનના તબક્કે છે, આ પરિયોજના લગભગ 2009 ના મધ્યભાગમા વિસ્તૃત રુપાંતર પામશે. પરિયોજના નું નિર્માણ કાર્ય વર્ષ 2011 થી શરુ થઈ 4 થી 5 વર્ષ માં પુરું કરવાનું લક્ષ્ય છે.

રાજ્ય/ જિલ્લા
ગુજરાત
વડોદરા
ખેડા
અમદાવાદ
ગાંધીનગર
મહેસાણા
પાટણ
બનાસકાંઠા
રાજસ્થાન
સિરોહી
પાલી
અજમેર
જયપુર
સીકર
અલવર
હરિયાણા
મહેન્દ્રગઢ
રેવાડી



પ્રસ્તાવિત ડી.એફ.સી. રેલ્વે માર્ગ અને સંલગ્ન સુવિધાઓ

સમર્પિત માલભાડા કોરિડોર પરિયોજનાનાં પશ્ચિમી વિભાગ વડોદરા, અમદાવાદ, પાલનપુર, રેવાડી દ્વિમાર્ગીય રેલ્વેમાર્ગ છે. આ પ્રસ્તાવિત માર્ગ ગુજરાત, રાજસ્થાન અને હરિયાણા રાજ્યથી પસાર થાય છે. પરિયોજનાનો મુખ્ય માર્ગ ભારતીય રેલ વિભાગની જમીન પર વર્તમાન રેલ માર્ગની સમાંતર આયોજન કરી રહેલ છે. જોકે કોઈ સ્થાનો પર વર્તમાન રેલ્વે લાઈનની સમાંતર પર્યાપ્ત જમીન ઉપલબ્ધ ન હોવાને કારણે તેમજ મોટા ભાગની વસાહતોને બચાવવા હેતુ બાઈપાસ આપવામા આવ્યો છે, બાઈપાસ આપતી વખતે જીવઅભ્યારણીય, શહેરી યોજનાક્ષેત્ર, માર્બલ ઉધોગ, આબાદી ક્ષેત્રો, વગેરેને ધ્યાનમાં રાખવામાં આવ્યા છે. જેથી પર્યાવરણ તેમજ સમાજનાં અર્થતંત્ર પર થનારી અસરોને બને તેટલી ઓછી કરી શકાય.

પરિયોજના માટે પર્યાવરણ અને સામાજિક અધ્યયન

ભારત સરકારના પર્યાવરણિય અસરોના અભ્યાસ કરવાના ધારધોરણો અને કાયદાઓ અનુસાર રેલ્વે પરિયોજનાઓ માટે પર્યાવરણીય અસરોનો અભ્યાસ કરવાની આવશ્યકતા નથી. તેમ છતાં ડી.એફ.સી.એ ઘણી મોટી પરિયોજનાં છે, જે વિપરીત પર્યાવરણીય તેમજ સામાજિક અસરોને ધ્યાનમાં રાખીને યોજના નાં કાર્ય સમયમાં પર્યાવરણિય તેમજ સામાજિક મુદ્દાઓ ઉપર વિસ્તૃત અભ્યાસ કરવામાં આવ્યો છે.

પર્યાવરણિય અસરોનાં મુલ્યાંકન રિપોર્ટ

ESIMMS

\+ વર્ષ 2007 માં જે.આઈ.સી.એ. ના માર્ગદર્શન દ્વારા બનાવવામાં આવેલ રિપોર્ટ

S-ESIMMS

વર્ષ 2008/09 માં જે.આઈ.સી.એ. ના સેપ્રોફ અધ્યયન દ્વારા બનાવવમાં આવેલ રિપોર્ટ

આસંદર્ભ માં રેલ્વે મંત્રાલય, ડી.એફ.સી.સી.આઈ.એલ. એ જાપાન ઈન્ટરનેશનલ કોર્પોરેશન એજન્સી(જે.આઈ.સી.એ.)ના ટેકનીકલ સહયોગથી ડી.એફ.સી. પરિયોજનાનાં પશ્ચિમી કોરિડોરના પર્યાવરણિય અસરો(ઈ,આઈ,એ)નો ડ્રાફ્ટ રિપોર્ટ તૈયાર કરી દેવામા આવ્યો છે, જ્યારે જે.આઈ.સી.એ. (JICA) અધ્યયન રિપોર્ટ 2007 (ESIMMS[1]) તેમજ જે.આઈ.સી.એ.–સેપ્રોફ (SAPROF[3]) અધ્યયન રિપોર્ટ 2008/2009 (S-ESIMMS[2]) નું સમ્મલિત રૂપ છે. પર્યાવરણીય અસરોનાં મુલ્યાંકન(ઈ.આઈ.એ)નાં ડ્રાફ્ટ રિપોર્ટને ત્રણ પ્રદેશોના ESIMMS રિપોર્ટ તેમજ S-ESIMMS તે રિપોર્ટનું સમંલ્લિત રુપ છે, જે પરિયોજનાથી અસર પામનાર ક્ષેત્રોનું વર્ણન કરે છે.

વૃક્ષોનોસર્વે

બન્ને ESIMMS તેમજ S-ESIMMS રિપોર્ટ પરિયોજનાથી થનારી અસરો, પરિયોજના ક્ષેત્રની સામાજિક તેમજ ભૌતિક અવસ્થાઓ, પ્રદૂષણનિયંત્રણ તેમજ સામાજિક વિષયો પર આધારિત છે. S-ESIMMS રિપોર્ટના અભ્યાસ કરવામાં આવેલ મુખ્ય વિષયોમા રેલ્વે દ્વારા ઉત્પન્ન ધ્વનિ અને કમ્પનનાં પહેલાના અનુમાન તથા સંવેદનશીલ અભિગ્રાહકો પર ધ્વનિ તેમજ કમ્પનની અસર, જમીન ઉપયોગી સર્વેક્ષણ, પ્રસ્તાવીત રેલ્વેમાર્ગની પાસેના સંરક્ષિત વિસ્તારો તેમજ મુખ્ય નદીઓના પ્રત્યેક મોસમ માં મળેલ આંકડાઓના સંકલન તથા વિસ્તૃત વિશ્લેષણ, સ્થાનાન્તરીત કરવામા આવનાર ઢાંચાઓનું સર્વેક્ષણ, તેમજ સામાજિક આર્થિક સર્વેક્ષણ, એનાથી વધારે જે.આઈ.સી.એ.(JICA) ના અભ્યાસ પછી સ્થાનાન્તરીત થયેલ રેલ્વે માર્ગથી નવા અસર પામનાર ક્ષેત્રોનાં પૂરક સર્વેક્ષણ વગેરે વિષયો સામિલ છે.

રેલ્વે દ્વારા ઉત્પન્ન ધ્વનિ તેમજ કમ્પનનું સર્વેક્ષણ

[1] ESIMMS જે.આઈ.સી.એ. ની 'પર્યાવરણ તેમજ સામાજિક નિયમો 2004 માર્ગદર્શિકા' અનુસાર બનાવવા માં આવેલ પર્યાવરણીય તેમજ સામાજિક અસરોનો મુલ્યાંક રિપોર્ટ.

[2] S-ESIMMS જે.આઈ.સી.એ. ની 'પર્યાવરણિય તેમજ સામાજિક નિયમો' 2004 માર્ગદર્શિકા' અનુસાર બનાવવાં માં આવેલ પર્યાવરણિય તેમજ સામાજિક અસરોનાં મુલ્યાંક રિપોર્ટની પહેલાનો રિપોર્ટ

[3] SAPAROF સ્પેશલ આસ્સિસ્ટેન્સ ફોર પ્રોજેક્ટ ફોરમેશન

સંભવિત અસરો તેમજ નિરાકરણના ઉપાયો

સર્વેક્ષણમાં અનેક પર્યાવરણિય તથા સામાજિક અસરો વિશે જાણવા મળેલ છે, પરિક્ષણથી જાણવા મળેલ પર્યાવરણિય અસરોને ઓછી કરવાના સુઝાવો મળ્યા છે, જેનો નીચે ઉલ્લેખ કરવામાં આવ્યો છે.

અસરો તેમજ તેના નિરાકરણ માટેની સૂચિ:

સંભવિત અસરો	નિરાકરણના ઉપાયો
વાયુની ગુણવત્તા	
નિર્માણ સમયે • નિર્માણ કરતી વખતે બાંધકામના સમય દરમિયાન વાહનો તથા મશિનરીઓની ફેરાફેરીને કારણે ધુળના સુક્ષમકણો દ્વારા વાયુ પ્રદૂષણ	• નિર્માણ કાર્યમાં ઉપયોગમાં આવનાર માલ-સામાનને ગોડાઉનમાં તેમજ ઢાંકીને રાખવાની વ્યવસ્થા • ભરેલા વાહનોથી માટી તથા પથ્થર છલકે નહીં તેની કાળજી • નિર્માણ વિસ્તારમાં કાચા રસ્તાઓ તેમજ અન્ય સ્થાનો પર ધુળને ઊડતી રોકવા માટે પાણીનો છંટકાવ કરાવવાની વ્યવસ્થા • ઓછો ધૂમાડો ઉત્પન્ન કરે તેવા સાધનો તેમેજ વાહનોનો ઉપયોગ
ધ્વનિ અને કમ્પન માત્રા	
નિર્માણ સમયે • નિર્માણ કાર્ય સમયે ઉપયોગમાં આવનાર હલકા તેમજ ભારી વાહનો દ્વારા ધ્વનિ તેમજ કમ્પન	• ઓછો અવાજ ઉત્પન્ન કરે તેવા ઉપકરણોનો પ્રયોગ • નિર્માણ કાર્યમાં સ્થાયી રહેનાર ઉપકરણોને રહેણાંક વિસ્તાર તેમજ સ્કૂલ, પ્રાથમિક આરોગ્ય કેન્દ્રો જેવા સ્થાનોથી ૨૦૦મી. દૂર સ્થાપિત કરવા જોઈએ • રહેણાંકવાળી જગ્યાએ કામ-કાજ ફક્ત દિવસેજ થવું જોઈએ. • ખુબ અવાજ ઉત્પન્ન થતો હોય તેવા કામના સ્થાનો પર કામ કરનાર વ્યક્તિઓને અવાજથી બચાવ કરે તેવા ઉપકરણોની વ્યવસ્થા કરાવવી
સંચાલન સમયે • રેલગાડી તેમજ અન્ય વાહનોના આવાગમનથી ઉત્પન્ન થતો અવાજ અને કમ્પન	• ઓછો અવાજ તથા કમ્પન ઉત્પન્ન કરે તેવી ટેકનોલોજીનો ઉપયોગ • લાંબી તેમજ જોઈન્ટ પટ્ટરીનો પ્રયોગ કરવો • રેલ્વેગાડી, પટ્ટરી, તેમજ મકાનોની સમય-સમય પર દેખરેખ • શહેરી વિસ્તારમા માલગાડીની નીચંત્રિત ગતિ • રેલ્વેપટ્ટરીની આજુ-બાજુ સ્થિત મકાનો તેમજ સંવેદનશીલ જગ્યાઓ પર જરૂરીયાત અનુસાર ધ્વનિ રોધક દિવાલોનું નિર્માણ કરવું
પાણીની ગુણવત્તા	
નિર્માણ સમયે • નિર્માણ સમય દરમિયાન ધૂળ તથા ગંદકીથી દૂષિત પાણી. • કામગારોના રહેઠાણથી ઉત્પન્ન દૂષિત પાણી તેમજ નિર્માણના વિસ્તારથી ઉત્પનીત કીચડ વગેરે	• પાણીવાળા ક્ષેત્રોથી કીચડ ન ફેલાય તેવી આડનું નિર્માણ • ઉપયોગ થયેલ પાણીને અલગ કરી તેમજ ગુણવતા નિયંત્રણ કર્યા પછી તેના નિકાસની વ્યવસ્થા • દૂષિત પાણીથી થનાર સ્વાસ્થય સમસ્યાઓને રોકવા માટે સ્વાસ્થય સુવિધાઓની પ્રાથમિકતા.
સંચાલન સમયે • રેલ્વે ગોડાઉન, રેલ ગાડીઓની ધોવાણથી તેમજ કારખાનાઓની સાફ-સફાય દ્વારા ઉત્પન્ન દૂષિત પાણી	• જળ સંશોધન ચંત્રો દ્વારા પાણીમાં દૂષિત રહેલ દૂષિત પદાર્થો, તૈલીય, ચિકણાય, કાર્બનીક પદાર્થ તેમજ ઝેરીલા તત્વોને દૂર કરી પાણી ઉપયોગમા આવે તેવા ઉપાય કરવા જોઈએ
સ્થળ આકૃતિ તેમજ ભુગર્ભ વિજ્ઞાન	
નિર્માણ સમયે • વૃક્ષો કાપવા, જમીન સાફ કરવી, માટી લેવાની જગ્યાએ થતા ખોદકામ જેવા કામોને	• સ્થળ આકૃતિઓને વિકૃત થતી બચાવવા માટે વર્તમાન ખાઈઓ તેમજ ખાડાઓનો ઉપયોગ કરવો

સંભવિત અસરો	નિરાકરણના ઉપાયો
લીધે, બાંધકામના કારણે થતાં ભુમિગત ભૌગોલિક ફેર-ફાર. • ઊન્ડા ખોદકામથી સ્થળોમાં થતા વિકૃત ફેર-ફાર.	• અનિયંત્રીત ખોદકામ ન કરવું કારણ કે પછી ખોદાયેલ ખાડાઓ તેમજ ખાઈઓમા પાણી ભરાય ન રહે તેમજ રોગ ફેલાવનારા જીવ જંતુઓનું જન્મ સ્થળ બની ન રહે. • બાંધકામ માટે ફકત સ્વિકૃતી તેમજ અનુમતી મળેલ ખાઈઓથી જ ખોદકામ કરવું.
જમીન(માટી)	
નિર્માણ સમય • બાય-પાસ વિભાગ ખેતીની ફળદ્રુપ જમીનમાંથી પસાર થશે. જેના કારણે જમીનની ઉપરી ફળદ્રુપતાનો નાશ થવો સંભવ છે • ખોદકામના કારણે ઉપરની જમીનનું ધોવણ થશે તેમજ વનસ્પતિનો નાશ • માટીની ગુણવત્તાની ચકાસણી	• એમ્બેકમેન્ટના નિર્માણમાં માટીના સ્ત્રોતને બચાવવા માટે સ્થાપીત ચંત્રોથી નીકળેલ રાખનો પ્રયોગ કરવો (ચંત્રો ૧૦૦ કિ.મી.માં સ્થાપીત હોય તો) • પાણીના નિકાલ, એમ્બેકમેન્ટની મજબુતાઈ તેમજ ઢોળાવના સ્થિતિકરણ જેવા ઉપાયો • માટી ખોદાયેલ સ્થાનોપર ઉપરના સ્તરની માટીને બચાવવા નવીનીકરણ કરવું • ચિકણાચ તેમજ તેલના બગાડથી બચાવ • નિર્માણ કામથી ઉત્પન્ન થતી કીચડ નો નિકાલ
જળ વિજ્ઞાન સંબંધીત બાબત	
નિર્માણ સમય • એમ્બેકમેન્ટના નિર્માણથી પાણી નીકાસના કુદરતી માર્ગમાં અવરોધ પેદા થશે, જેના કારણે પૂર તેમજ પૂરના પાણીમાં વધારો થશે	• રેલ્વે માર્ગની સાથે-સાથે જરૂરીયાત મુજબ નાળાઓનું નિર્માણ • વર્તમાન નાળાઓની સંખ્યામાં વધારો કરવો તેમજ તેની ક્ષમતામાં વધારો કરવો • પૂર તેમજ પાણીનાં ભરાવાથી બચવા માટે તેમજ વ્યર્થ પાણીના નિકાસ માટેના ઉપચારો
સંચાલન સમય • રેલ્વે માર્ગના એમ્બેકમેન્ટ નિર્માણથી સ્થાનીક જળ નિકાસ પર અસર.	• વરસાદ તેમજ વ્યર્થ વહી જતા પાણીના નિકાલ માટે રેલ્વે માર્ગની બન્ને બાજુ ક્ષમતાવાળી નાળીયોંનું આયોજન
વનસ્પતિ	
નિર્માણ સમય • પરિયોજના માટે સંપાદીત ભૂમિપર વૃક્ષોની કાપણીથી વનસ્પતિનો નાશ.	• કપાયેલ વૃક્ષોની ડબલ સંખ્યામાં ખામીમુકત વૃક્ષા રોપણ થવું જોઈએ • વન્ય ભૂમિ તેમજ વ્યકિતિગત ભૂમિ પરથી કપાયેલ વૃક્ષો તેમજ વન્ય ભૂમિની ક્ષતી(નુકસાની)પૂર્ણ કરવી જોઈએ. • ફૂલોવાળી ઝાડીયો તેમજ સદાબહાર વૃક્ષો યુકત મિશ્રિત વૃક્ષારોપણ થવું જોઈએ
• પરિયોજનાની આસ-પાસના વૃક્ષોની ડાળીયો તેમજ પાંદડા પર ધૂળની જમાવટ	• રેલ્વે પટ્ટરીની બન્ને બાજુ રહેલ જગ્યા પર પટ્ટીદાર વૃક્ષારોપણ કરવું • બળતણ માટે કામદારો દ્વારા વૃક્ષોની કાપાણી પર રોકથામ માટે તેઓને બળતણ પુરું પાડવુ
વનભૂમિ નું પરિવર્તન	
નર્માણ સમય પહેલા • રેલ્વે માર્ગ ઘણા બધાં અભ્યારણ્ય (રિઝર્વફોરેસ્ટ) માંથી પસાર થાય છે	• વન ભૂમિમાં પરિવર્તન તેમજ કપાયેલ વૃક્ષોની ક્ષતિપૂર્તિ વનવિભાગને કરવી • અભ્યારણ્ય ક્ષેત્રમાં કોઈપણ કાર્ય કરતા પહેલાં વનવિભાગની મંજૂરી પ્રાપ્ત કરવી

સંભવિત અસરો	નિરાકરણના ઉપાયો
જીવ-જંતુ	
નિર્માણ સમય પહેલા • ડી.એફ.સી. રેલ્વે માર્ગ (બાઈ-પાસ વિભાગ) માં મહેસાણા જિલ્લાનાં પશ્ચિમમાં થોલનું વન્યજીવ(પક્ષી) અભ્યારણ્ય	• અભ્યારણ ની ૩ કિ.મી.પરિધમા કોઈ નિર્માણ કાર્ય સાવધાનીપૂર્વક તેમજ નિયમાનુસાર કરવામા આવે જેનાથી અભ્યારણ્યમા નુકસાન ઓછુ થાય
નિર્માણ સમયે • નિર્માણ કાર્યમાં ઉપયોગી મશીનો દ્વારા ઉત્તપન્ન ધ્વનિ દ્વારા રિઝર્વ તેમજ થોલ વન્યજીવીય અભ્યારણ નાં પક્ષીઓ પર થનાર અસર • મહી, વિશ્વામિત્રી, તેમજ વાત્રક નદીઓ પર પુલોના નિર્માણ સમયે મોટીકાચબ તેમજ મગ્ગરમચ્છનાં રહેણાંક સ્થાનો થોડા સમય માટે નાશ પામશે.	• નિર્માણ કાર્યમા ઉપયોગી ઉપકરણો ઉપરાંત વાહનોની ચોકકસ દેખભાળ તેમજ ખોટા ઉપયોગથી બચાવ,જેથી સ્વિકૃતિ મુજબજ ધ્વનિ ઉત્પન્ન થાય • પુલાનું નિર્માણ કાર્ય શુષ્કમોસમમાં કરવામાં આવે, (પરંતુ જો કાર્યની ગુણવત્તામા કોઈ અસર ન પડે તો મોનસૂનમા પણ કામ કરી શકાય) • કામ-કાજના ક્ષેત્રમાં આવશ્યકતા અનુસાર આડ બનાવવામાં આવે
સંચાલન સમયે • બનાસકાંઠા જિલ્લાના વન્યજીવ અભ્યારણ્ય વિસ્તારની જમીન લેવાથી વન્યજીવોના આવાગમન પર થનારી અસર • પાણીવાળા ક્ષેત્રોં મા તૈલીય તેમજ ઝેરીલા રસાયણોનાં બહાવથી જલીય જીવ-જંતુ પર અસર • વન્ય જીવોને રેલ્વેની બીજી બાજુ જતા રોકવા નું આયોજન • વન્ય જીવોની રેલ્વેગાડીઓ દ્વારા દુર્ઘટના થવી	• વૃક્ષોની કાપણીથી નષ્ટ થયેલ વન્ય જીવોના આવાસોની ક્ષતી પૂર્ણ કરવા માટે વૃક્ષારોપણ કરવું • તેલ, ઈંધણ તેમજ ઝેરીલા તત્વોના રિસાવ સમયે તાત્કાલિક સફાયની વ્યવસ્થા કરવી • જંગલ વિસ્તારમાં રેલ્વે માર્ગ નીચેથી પશુઓની આવાગમન માટેની વ્યવસ્થા • દુર્ઘટના રોકવા માટે વન્ય જીવોની વધુ માત્રાવાળા વિસ્તારોમાં આવશ્યકતા મુજબ વાડ કરવી
જમીન સંપાદન તેમજ પુનઃ સ્થાપન	
નિર્માણ સમય પહેલા • સંપતિ તેમજ જીવન વ્યવહારની હાની	• પર્યાવરણીય અસરો ના મુલ્યાંકન પછી પુનરોદ્ધાર તેમજ પુન:વસન યોજના દ્વારા ક્ષતીપૂર્તિ તેમજ સહાયતાનુ આયોજન
નિર્માણ સમયે • પગપાળા મુસાફરો તેમજ વાહનો ની અવરજવર માં મુશ્કેલી	• બાઈપાસ વિસ્તારમાં સુચનો તેમજ નિર્દેશ બોર્ડ લગાવવામાં આવે
સંચાલન સમયે • ડી.એફ.સી. એમ્બેકમેન્ટના નિર્માણથી સ્થાનીય લોકો તેમજ કિસાનો ની અવરજવર માં મુશ્કેલી	• નિયમ તેમજ આવશ્યકતા મુજબ દરેક રેલ્વે/ રસ્તા ક્રોસિંગ પર ચાતો રેલ્વેની નીચેથી (RUB) અથવા રેલ્વેની ઉપર(ROB) થી રસ્તાનું આયોજન • હાલમા સ્થિત રસ્તા તેમજ RUB/ ROB/ રેલ્વે-રસ્તા ક્રોસિંગનું નવિનીકરણ • બાઈપાસ વિભાગમાં રેલ્વે નીચેથી તેમજ રેલ્વે-રસ્તા ક્રોસિંગ પ્લાનિગ મુજબ હોવા જોઈએ • ભારતીય રેલ્વેની વર્તમાન કાર્ય પ્રણાલી અનુસાર બાઈપાસ વિભાગમા પ્રત્યેક RUB તથા ROB માં બન્ને તરફ રસ્તાની બાજુમાં ફૂટપાથ નું આયોજન

નોંધ- મુખ્ય અસરો તેમજ નિવારવાના ઉપાયો ઉપરોકત સૂચીમા બતાવવામાં આવ્યા છે. અન્ય અસરો તેમજ ઉપયો પર્યાવરણનાં અસરો ના મુલ્યાંકનના રિપોર્ટમાં આપવામાં આવ્યા છે.

પર્યાવરણિય પ્રબંધ યોજના

પર્યાવરણીય પ્રબંધ યોજના સ્વચ્છ તેમજ સુરક્ષીત પર્યાવરણની ચાવી છે. પર્યાવરણિય પ્રબંધ યોજના તેમજ તેના કાર્યને સુનિશ્ચિત કર્યા વગર નિરાકરણના વાન્છિત કારણો મળવા સંભવ નથી.

પર્યાવરણ પ્રબંધ યોજના, નિર્માણ પહેલાની સ્થિતિ, નિર્માણ સમયની સ્થિતિ, તેમજ કામની સ્થિતિના સમયે પરિયોજનાનાં ક્રિયા કાર્યો દ્વારા ઉત્પન્ન થયેલ વિપરીત અસરોને ઓછી કરવા માટે બતાવવામા આવેલ ઉપાયોને કાર્ય કાળની યોજના બતાવવામાં આવેછે. પર્યાવરણીય પ્રબંધ યોજના નીચેનાં બિંદુઓ પર આધારિત છે.

૧) પ્રસ્તાવિત પ્રબંધ યોજના આ મુજબ છે.
   ક) હરિતપટ્ટી વિકાસ યોજના
   ખ) અવશિષ્ઠ પ્રબંધ યોજના
   ગ) ખાઈઓ તેમજ માટીની અપૂર્તિવાળા વિસ્તારોનો પ્રબંધ/ પુનરોધ્ધાર યોજના
   ઘ) કામદાર શિબિરોની સ્વચ્છતા તેમજ રખ-રખાવ માટે નિર્દેશનો
   ચ) હાનીકારક રસાયણોના ભંડારોના રખ-રખાવ માટે નિર્દેશ તેમજ સંકટ સમયના ઉપાયોના નિયમો.
   છ) જમીન સંપાદન તેમજ પુનઃવાસ

૨) નિમ્ન પર્યાવરણ તેમજ સામાજિક બિન્દુઓ માટે આવશ્યકતા અનુશાર પર્યાવરણ પ્રબંધ ઉપાય પ્રસ્તાવિત છે.
   ક) નિર્માણ પહેલાની સ્થિતિ.
   - જમીન સંપાદન, વન ભૂમિના પરિવર્તન, વૃક્ષોનુ સંરક્ષણ, જમિનની ખોદાઈ, ખાઈઓનો બચાવ, ત્યાગી દિધેલ સામગ્રીના નિકાલ તેમજ કામદાર શિબિરો માટે જગ્યાની પસંદગી, થોડા સમય માટે રેલ્વેચાર્ડની વ્યવસ્થા, નિર્માણ એજન્સિઓ તેમજ કોન્ટ્રાકટરોની પસંદગી

   ખ) નિર્માણ સમયની સ્થિતિ.
   - કાર્યના ક્ષેત્રની સફાઈ, નિર્માણ સામગ્રીના સાધનો, નિર્માણકાર્યમાં(પાણીના નિકાલ, ઢોળાવ, સ્થળીકરણ વગેરે) જલ પ્રદૂષણ, વાયુ પ્રદૂષણ, ધ્વનિ, કામદાર શિબિરોના પ્રબંધ, કોન્ટ્રાકટરોના કામની સમાપ્તી

   ગ) કાર્ય કાળની સ્થિતિ
   - દરેક પ્રકારના નિરકરણના ઉપાયોના સંપાદનની સમીક્ષા, પ્રદૂષણ સમીક્ષા

પર્યાવરણ પ્રબોધન

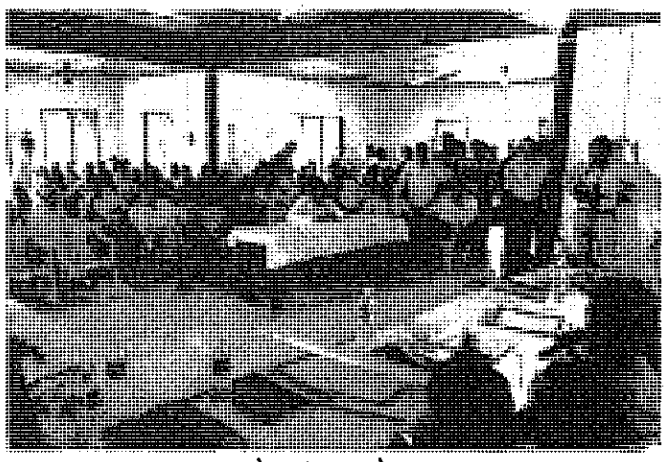
પર્યાવરણ પ્રબોધનનો ઉદેશ્ય એ સુનિશ્ચિત કરે છે કે, પરિયોજનાનાં નિર્ધારણના ઉદેશ્ય તેમજ ઈચ્છિત પરિણામ મળી ગયેલ છે. પર્યાવરણ પ્રબંધ યોજનાનાં ક્રિયાકાળને સુનિશ્ચિત કરવા માટે પ્રભાવશાળી પર્યાવરણ પ્રબંધ યોજના તૈયાર કરવાની જરૂર છે. પર્યાવરણ પ્રબંધ યોજના બે તત્વો, કાર્યસંપાદન સુચક અને પર્યાવરણ પ્રબોધન કાર્યક્રમથી મળીને બને છે.

કાર્ય સંપાદન ના સૂચન:
ક) નિર્માણ પહેલાની સ્થિતિ: જમીન સંપાદન, નિસ્તારણ સ્થાન, નિર્માણ શિબિરો, માટી ખોદવા માટેના ખાડઓ
ખ) નિર્માણ સમયની સ્થિતિ: વાયુની ગુણવત્તા, ધ્વનિ અને કમ્પન્ન સ્તર, પાણીની ગુણવત્તા, વૃક્ષારોપણ, ઉપરની માટી, કામદારો
ગ) વૃક્ષોના જીવીત રહેવાનો અનુપાત, માટી ખોદાયેલા ખાડાઓનો પુનરોધ્ધાર, સંવેદનશીલ સ્થાનો પર ધ્વનીરોધકોની ઉપયોગીતા

પર્યાવરણિય પ્રબોધન કાર્યક્રમ
પર્યાવરણિય પ્રબોધન કાર્યક્રણમાં નીચે આપવામાં આવેલ વિષયોને ધ્યાનમાં રાખવામા આવ્યા છે.
ક) પ્રબોધન યોગ્ય મદદ ખ) પ્રબોધનનું સ્થાન ગ) પ્રબોધનમાં વધારો તેમજ તિવ્રતા
ઘ) કામ-કાજ તેમજ નિરીક્ષણની સ્થાનિક જવાબદારી
ઉપરોકત વિષયો આધરે પર્યાવરણીય પ્રબોધન કાર્યક્રમમાં નીચેના મુદ્દાઓનું પ્રબોધન કરવામાં આવશે

ક) હવાની ગુણવત્તા ખ) પાણીની ગુણવત્તા ગ) ધ્વનિ તેમજ કંપન્ન સ્તર
ઘ) જમીનની ખોદાય ચ) વૃક્ષારોપણ છ) વનસ્પતિ તેમજ જીવ જન્તુ

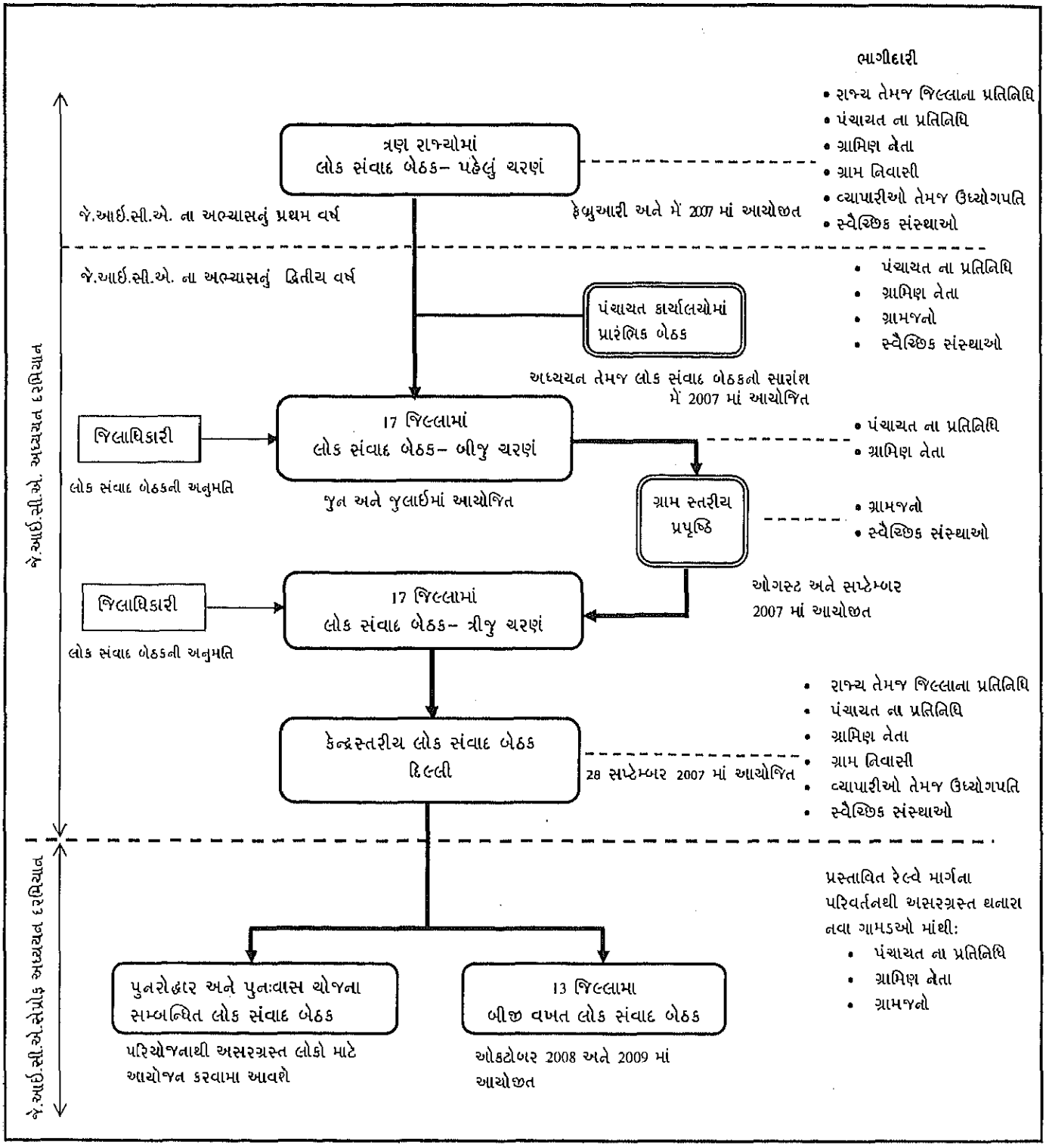
લોકસંવાદ બેઠક


લોકસંવાદ બેઠક

સામાન્ય જનતા સુધી પરિયોજનાની જાણકારી પહોંચે તેમજ તેમના વિચારોને જાણવા માટે જે.આઈ.સી.એ. ની આર્થિક સહાયથી કરવામાં આવેલ પર્યાવરણ તેમજ સમાજપર થનાર અસરો તેમજ તેના ઉપાયો માટે અભ્યાસ સમયે લોકસંવાદ બેઠકનું આયોજન કરવામાં આવ્યું હતું. તેનાથી જે.આઈ.સી.એ ની આર્થિક સહાયથી કરવામા આવેલ સેપ્રોફ અભ્યાસ સમયે ડી.એફ.સી. રેલ્વેમાર્ગમા અનેક ફેરફાર કરવામા આવ્યા છે જેના કારણે અનેક નવા ગામોને સીધી અસર થશે. આથી આ બધા ગામડાઓને ધ્યાનમાં રાખીને જિલ્લા વાર લોકસંવાદ બેઠકનું આયોજન કરવામાં આવ્યુ હતું. આ લોક સંવાદ બેઠકથી વિવિધ સુચનો (પ્રતિભાવો/સુઝાવો) જાણવા મળ્યા છે, જેને પરિયોજનામાં સામેલ કરવામા આવ્યા છે. જેવા કે, વાહનો, ખેડૂતો તેમજ સ્થાનિક લોકોની અવરજવર માટે યોગ્ય જગ્યાએ અને જરુરીયાત વાળી જગ્યાઓએ પુલોનું નિર્માણ. બીજી તરફ પુનરોધ્ધાર તેમજ પુનઃવાસ યોજનાનાં પ્રકટીકરણ તેમજ પરિયોજનાથી અસર પામેલ લોકોને જમીન આપી પુનઃવાસ સમ્બન્ધિત મંન્તવ્યો જાણવા માટે અલગથી લોકસંવાદ બેઠકનું આયોજન કરવામાં આવશે.

આગળનો કાર્યક્રમ

- પર્યાવરણિય અસરોનાં મુલ્યાંકનનાં ડ્રાફ્ટ રિપોર્ટમા લોકોના મંતવ્યોને શામીલ કરી અંતીમરુપ આપવું
- રેલ્વે મંત્રાલય દ્વારા સ્વીકૃતી મળ્યા પછી પર્યાવરણના ફાઈનલ રિપોર્ટને જન સમુદાય સુધી પહોંચાડવો
- પર્યાવરણના ફાઈનલ રિપોર્ટને જન સમુદાયની સમીક્ષા માટે એવી જગ્યાએ આપવામા આવશે કે જ્યાં ડ્રાફ્ટ રિપોર્ટ આપવામા આવ્યો હતો. રિપોર્ટ સંબંધીત માહિતી ડી.એફ.સી.સી.આઈ.એલ. નાં મુખ્ય પરિયોજના પ્રબંધક, પ્રસ્તાવિત ડી.એફ.સી. રેલ્વે માર્ગની સાથે મુખ્ય રેલ્વે સ્ટેશન તેમજ સમ્બંધિત જિલ્લા કાર્યાલયોમા મે ૨૦૦૯ માં ઉપલબ્ધ કરાવવામાં આવશે. ફાઈનલ રિપોર્ટનો સારાંશ પરિયોજના પ્રભાવિત બધાજ ગામડાંઓમાં પહોંચાડવામાં આવશે.


ભાગીદારી
• રાજ્ય તેમજ જિલ્લાના પ્રતિનિધિ
• પંચાયત ના પ્રતિનિધિ
• ગ્રામિણ નેતા
• ગ્રામ નિવાસી
• વ્યાપારીઓ તેમજ ઉધ્યોગપતિ
• સ્વૈચ્છિક સંસ્થાઓ
ત્રણ રાજ્યોમાં
લોક સંવાદ બેઠક– પહેલું ચરણં
ફેબ્રુઆરી અને મેં 2007 માં આયોજીત
જે.આઈ.સી.એ. ના અભ્યાસનું પ્રથમ વર્ષ
જે.આઈ.સી.એ. ના અભ્યાસનું દ્વિતીય વર્ષ
• પંચાયત ના પ્રતિનિધિ
• ગ્રામિણ નેતા
• ગ્રામજનો
• સ્વૈચ્છિક સંસ્થાઓ
પંચાયત કાર્યાલયોમાં
પ્રારંભિક બેઠક
અધ્યયન તેમજ લોક સંવાદ બેઠકનો સારાંશ
મેં 2007 માં આયોજીત
જિલાધિકારી
લોક સંવાદ બેઠકની અનુમતિ
17 જિલ્લામાં
લોક સંવાદ બેઠક– બીજુ ચરણં
જુન અને જુલાઈમાં આયોજીત
• પંચાયત ના પ્રતિનિધિ
• ગ્રામિણ નેતા
ગ્રામ સ્તરીય
પ્રપૃષ્ઠિ
• ગ્રામજનો
• સ્વૈચ્છિક સંસ્થાઓ
ઓગસ્ટ અને સપ્ટેમ્બર
2007 માં આયોજીત
જિલાધિકારી
લોક સંવાદ બેઠકની અનુમતિ
17 જિલ્લામાં
લોક સંવાદ બેઠક– ત્રીજુ ચરણં
• રાજ્ય તેમજ જિલ્લાના પ્રતિનિધિ
• પંચાયત ના પ્રતિનિધિ
• ગ્રામિણ નેતા
• ગ્રામ નિવાસી
• વ્યાપારીઓ તેમજ ઉધ્યોગપતિ
• સ્વૈચ્છિક સંસ્થાઓ
કેન્દ્રસ્તરીય લોક સંવાદ બેઠક
દિલ્લી
28 સપ્ટેમ્બર 2007 માં આયોજીત
પ્રસ્તાવિત રેલ્વે માર્ગના
પરિવર્તનથી અસરગ્રસ્ત થનારા
નવા ગામડાઓ માંથી:
• પંચાયત ના પ્રતિનિધિ
• ગ્રામિણ નેતા
• ગ્રામજનો
પુનરોદ્ધાર અને પુનઃવાસ યોજના
સમ્બન્ધિત લોક સંવાદ બેઠક
પરિયોજનાથી અસરગ્રસ્ત લોકો માટે
આયોજન કરવામા આવશે
13 જિલ્લામા
બીજી વખત લોક સંવાદ બેઠક
ઓકટોબર 2008 અને 2009 માં
આયોજીત
જે.આઈ.સી.એ. અધ્યયન દરમિયાન
જે.આઈ.સી.એ.સેપ્રોફ અધ્યયન દરમિયાન

મંતવ્યો તેમજ સુઝાવો આવકાર્ય

કૃપયા ડી.એફ.સી. પરિયોજના સંબધિત પર્યાવરણિય તેમજ સામજિક વિષયો બાબત મંતવ્યો તેમજ સૂઝાવ તમારા નામ, સરનામા સહિત ફોન નંબર(હોયતો) સાથે લેખીતમા પોસ્ટ તેમજ ફેકસ દ્વારા સંબંધિત મુખ્ય પરિયોજના અધિકારી કાર્યાલય પર મોકલી શકો છો. તમે તમારા સુઝાવોને ઈ-મેલ (dfc.wc.eia@gmail.com) દ્વારા મોકલી શકો છો. પર્યાવરણિય અસરોનાં મુલ્યાંકનનાં ડ્રાફ્ટ રિપોર્ટ સંબંધી માહિતી મુખ્ય પરિયોજના અધિકારી કાર્યાલય, ડી.એફ.સી. રેલ્વે માર્ગની પાસેના મુખ્ય સ્ટેશનો તેમજ જિલ્લા કાર્યાલયોમા ઉપલબ્ધ છે.

કૃપયા તમારાં વિચારો અને ટિપ્પણીઓ 27 માર્ચ 2009 પહેલા મોકલો.

મુખ્ય પરિયોજના અધિકારી(ડી.એફ.સી.સી.આઈ.એલ.) કાર્યાલયોનાં સરનામા

- મુખ્ય પરિયોજના અધિકારી કાર્યાલય- જયપુર
  બી ૧૨, હનુમાન નગર, મેટ્રો હોસ્પિટલની સામે, સિરસી રોડ, જયપુર
  ફોન નં: 0141-4028741 ફેકસ: 0141-4028740

- મુખ્ય પરિયોજના અધિકારી કાર્યાલય- અજમેર
  માલ રોડ, ડી આર એમ કાર્યાલયની સામે, અજમેર-305001
  ફોન નં: 0145-2625548 ફેકસ: 0145-2625548

- મુખ્ય પરિયોજના અધિકારી કાર્યાલય- અમદાવાદ
  જુના ડી.આર.એમ.ભવન, પહેલો માળ, અમદાવાદ રેલ્વે સ્ટેશન, અમદાવાદ-380002 ફોન નં: 079-22165107

- મુખ્ય પરિયોજના અધિકારી કાર્યાલય- વડોદરા
  13-14, 17-18, પનોરમા કોમ્પલેકસ, ત્રીજો માળ, આર સી દત્ત રોડ, અલકાપુરી વડોદરા-7
  ફોન નં: 0265-2326024 ફેકસ: 0265-2326027

મુખ્ય સ્ટેશનો કે જ્યાં ડ્રાફ્ટ રિપોર્ટ મળવા પાત્ર છે.

- ગુજરાત
  પાલનપુર(જંકશન), સિધ્ધપુર, ઉંઝા, મહેસાણા(જંકશન), સાબરમતી(જંકશન), અમદાવાદ(જંકશન), નડિયાદ(જંકશન), આણંદ(જંકશન), વાસદ(જંકશન) તેમજ વડોદરા(જંકશન)

- રાજસ્થાન
  અલવર(જંકશન), કુન્ડ(જંકશન), નીંમ કા થાના, શ્રી માધોપુરા, સિંગસ(જંકશન), જયપુર(જંકશન), ફુલેરા(જંકશન), કિશનગઢ, અજમેર(જંકશન), બ્યાવર, સોજત રોડ, મારવાડ(જંકશન), ફાલના, સિરોહિ રોડ તેમજ આબુ રોડ

- હરિયાણા
  રેવાડી(જંકશન), નારનોલ તેમજ ડાબલા(જંકશન)

॥ પરિયોજના માં આપના સહયોગ બદલ આભાર ॥

Appendix III-4-5

Public Notices on Disclosure of the Draft EIA Report

PUBLIC NOTICE

Ministry of Railway hereby inform that disclosure of draft EIA (ESIMMS + draft S-ESIMMS) reports of proposed DFC (Dedicated Freight Corridor) Project between Vadodara and Rewari will start from 23rd March 2009 and will be completed by 1st April 2009.

Summary of EIA reports in vernacular language and in English version will be distributed to all the affected village offices between Rewari and Vadodara. A full set of draft EIA reports will be available in the CPM offices of DFCCIL (Dedicated Freight Corridor Corporation of India), major stations along the proposed DFC alignment and districts offices as mentioned below.

Comments from people will be accepted only at CPM offices of DFCCIL through direct delivery, fax or post. Interested persons can also send comments at the email address (dfc.wc.eia@gmail.com).

Comments/opinions will be received up to 15th April, 2009.

Draft EIA report is available and Comments shall be received at the following CPM offices of the DFCCIL

CPM office in Jaipur
B-12, Hanuman Nagar, Opp. Metro Hospital, Sirsi Road, Jaipur,
Tel: 0141-4028741, Fax: 0141-4028740
CPM office in Ajmer
Mall Road, Opp DRM Office, Ajmer-305001, Tel/Fax: 0145-2625548
CPM office in Ahmedabad
1st Floor, Old DRM Office Building, Kalupur,Ahmedabad-380002, Tel: 079-22175107, Fax: 079-22163101
CPM office in Vadodara
13-14,17-18,Panorama Complex,3rd Floor, R.C.Dutt Road,Alkapuri,Vadodara-7,
Tel: 0265-2326024, Fax: 0265-2326027

Draft EIA report is available at the following Major Stations

Haryana
Rewari (Jn), Narnaul, Dabla (Jn)
Rajasthan
Alwar (Jn), Kund, Neem Ka Thana, Sri Madhopur, Ringus (Jn), Jaipur (Jn), Phulera (Jn), Kishangarh, Ajmer (Jn), Beawar, Sojat Road, Marwar Jn, Falna, Sirohi Road, Abu Road
Gujarat
Palanpur (Jn), Siddhapur, Unjha, Mahesana(Jn), Sabarmati (Jn), Ahmedabad (Jn), Nadiad (Jn), Anand(Jn), Vasad (Jn), Vadodara (Jn)

Draft EIA report is available at the following District Collectorate Offices

Haryana
Rewari, Mahendergarh
Rajasthan
Sikar, Alwar, Jaipur, Nagaur, Ajmer, Pali, Sirohi
Gujarat
Banaskantha,Patan,Mahesana,Gandhinagar, Ahmedabad, Kheda, Anand, Vadodara

(Jeetendra Singh)
Director/Planning (Spl.)
Room No 143
Rail Bhavan, New Delhi
Ministry of Railways

विज्ञप्ति

रेल मंत्रालय सूचित करता है कि वडोदरा एवं रेवाड़ी के मध्य समर्पित मालभाड़ा कारीडोर (डी.एफ.सी.) परियोजना के पश्चिमी कारीडोर की पर्यावरणीय एवं सामाजिक प्रभावों का मुल्याकंन (ई.आई.ए.) ड्राफ्ट रिर्पोट (ESIMMS[1] + ड्राफ्ट S-ESIMMS[2]) की प्रकटीकरण प्रक्रिया 23 मार्च 2009 से शुरू होकर 1 अप्रेल 2009 तक पूरी कर ली जाएगी।

पर्यावरणीय एवं सामाजिक प्रभावों का मुल्याकंन (ई.आई.ए.) रिर्पोट का संक्षेप स्थानीय एवं अंग्रेजी भाषा में वडोदरा एवं रेवाड़ी के मध्य सभी प्रभावित गांवो के दफ्तरों में वितरित किया जाएगा। ड्राफ्ट पर्यावरणीय प्रभावों का मुल्याकंन रिर्पोट डी.एफ.सी.सी.आई.एल. के सम्बन्धित प्रमुख परियोजना अधिकारी कार्यालय, रेलमार्ग के समीप प्रमुख स्टेशनों एवं निम्नलिखित जिला कार्यालयों में उपलब्ध होगी।

कृपया अपनी टिप्पणीयाँ व्यक्तिगत रूप से, डाक या फेक्स द्वारा डेडीकेटेड फेट कारीडोर कॉरर्पोरेशन इन्डिया लि. के सम्बन्धित प्रमुख परियोजना अधिकारी कार्यालयों पर भेजें। आप अपनी टिप्पणीयाँ ई-मेल (**dfc.wc.eia@gmail.com**) द्वारा भी भेज सकते हैं।

कृपया अपने विचार एवं टिप्पणीयाँ 15 अप्रेल 2009 से पहले भेजें।

डी.एफ.सी.सी.आई.एल. के निम्नलिखित प्रमुख परियोजना अधिकारी कार्यालयों पर ड्राफ्ट रिर्पोट उपलब्ध हैं एवं टिप्पणीयाँ भेजी जा सकती हैं

मुख्य परियोजना प्रबन्धक (डी.एफ.सी.सी.आई.एल.) कार्यालय का पता

- मुख्य परियोजना प्रबन्धक कार्यालय - **जयपुर**
  बी 12,हनुमान नगर, मेट्रो हॉस्पीटल के सामने, सिरसी रोड़, जयपुर दूरभाष : 0141-4028741 फैक्स : 0141-4028740
- मुख्य परियोजना प्रबन्धक कार्यालय - **अजमेर**
  माल रोड़, डी आर एम कार्यालय के सामने, अजमेर–305001 दूरभाष : 0145-2625548 फैक्स : 0145-2625548
- मुख्य परियोजना प्रबन्धक कार्यालय - **अहमदाबाद**
  पुरानी डी आर एम भवन, पहली मंजिल, अहमदाबाद रेल्वे स्टेशन, अहमदाबाद-380002 दूरभाष : 079–22175107 फैक्स : 079–22163101
- मुख्य परियोजना प्रबन्धक कार्यालय - **वडोदरा**
  13-14, 17-18, पैनोरामा कॉम्पलेक्स, तीसरी मंजिल, आर सी दत्त रोड़, अल्कापूरी, वडोदरा-7
  दूरभाष : 0265–2326024 फैक्स–0265–2326027

प्रमुख स्टेशन जहाँ पर ड्राफ्ट रिर्पोट उपलब्ध हैं

हरियाणा: रेवाड़ी (जंक्शन), नारनौल एवं डाबला (जंक्शन)

राजस्थान: अलवर (जंक्शन), कुण्ड, नीम का थाना, श्रीमाधोपुर, रिंगस (जंक्शन), जयपुर (जंक्शन), फुलेरा (जंक्शन), किशनगढ़, अजमेर (जंक्शन), ब्यावर, सोजत रोड, मारवाड़ (जंक्शन), फालना, सिरोही रोड एवं आबू रोड

गुजरात: पालनपुर (जंक्शन), सिद्धपुर, ऊंझा, महेसाणा (जंक्शन), साबरमती (जंक्शन), अहमदाबाद (जंक्शन), नडियाद (जंक्शन), आन्नद (जंक्शन), वासड (जंक्शन) एवं वडोदरा (जंक्शन)

जिला कार्यालय जहाँ पर ड्राफ्ट रिर्पोट उपलब्ध हैं

हरियाणा: रेवाड़ी एवं महेन्द्रगढ

राजस्थान: सीकर, अलवर, जयपुर, नागौर, अजमेर, पाली एवं सिरौही

गुजरात: बनासकांठा, पाटन, महेसाणा, गॉधीनगर, अहमदाबाद, खेड़ा, आंनद एवं वडोदरा

[1] ESIMMS: जे.आई.सी.ए. की 'पर्यावरणीय एवं सामाजिक निगिरत 2004 मार्गदर्शिका' के अनुसार बनाये गये पर्यावरणीय एवं सामाजिक प्रभावो का मुल्याकंन रिर्पोट ।

[2] S-ESIMMS: जे.आई.सी.ए. की 'पर्यावरणीय एवं सामाजिक निगिरत 2004 मार्गदर्शिका' के अनुसार बनाये गये पर्यावरणीय एवं सामाजिक प्रभावो का मुल्याकंन की पूरक रिर्पोट ।

रेल मंत्रालय

જાહેર નોટીસ

રેલ્વે મંત્રાલય દ્વારા જાહેર કરવામાં આવે છે કે વડોદરાથી રેવાડી વચ્ચે માલભાડા સમર્પિત રેલ્વે માર્ગ (ડી.એફ.સી.) પરિયોજનાનાં પશ્ચિમી વિભાગના પર્યાવરણિય તેમજ સામજિક અસરોના મુલ્યાંકન (ઈ.આઈ.એ.) ડ્રાફ્ટ રિપોર્ટ (ESIMMS[1] + ડ્રાફ્ટ S-ESIMMS[2]) ની પ્રકટીકરણ પ્રક્રિયા ૨૩ માર્ચ ૨૦૦૯ થી શરુ કરી ૧ એપ્રિલ ૨૦૦૯ સુધી પુરી કરવામાં આવશે.

પર્યાવરણિય તેમજ સામજિક અસરોના મુલ્યાંકન (ઈ.આઈ.એ.) રિપોર્ટનાસંક્ષેપ ને સ્થાનિય તેમજ અંગ્રેજી ભાષામાં વડોદરાથી રેવાડી વચ્ચેનાં બધાજ પ્રભાવિત ગામોની પંચાયત કાર્યાલયોમાં વિતરીત કરવામા આવશે. ડ્રાફ્ટ પર્યાવરણિય અસરોના મુલ્યાંકન રિપોર્ટ સંબંધીત માહિતિ મુખ્ય પરિયોજના અધિકારી કાર્યાલય ડી.એફ.સી.સી.આઈ.એલ. તેમજ રેલ્વે માર્ગની સાથે મુખ્ય સ્ટેશનો તથા સમ્બંધિત જિલ્લા કાર્યાલયમાં ઉપલબ્ધ છે.

તમે સુઝાવોને લેખિતમા વ્યક્તિગત, પત્ર દ્વારા તેમજ ફેકસ દ્વારા ડેડીકેટેડ ફ્રેટ કોરિડોર કોર્પોરેશન ઈન્ડીયા લિ ના સમ્બંધિતપરિયોજના ના મુખ્ય અધિકારી કાર્યાલય પર મોકલી શકો છો. તમે તમારા સુઝાવો અથવા મન્તવ્યો ને ઈ-મેલ (dfc.wc.eia@gmail.com) દ્વારા મોકલી શકો છો.

<u>કૃપયા તમારા વિચારો અને ટિપ્પણીઓ 15 એપ્રિલ 2009 પહેલાં મોકલો.</u>

નીચે બતાવવામાં આવેલ ડી.એફ.સી.સી.આઈ.એલ. ના મુખ્ય પરિયોજના અધિકરી કાર્યાલયો પર તમે તમારાં મંતવ્યો મોકલી શકો છો, તેમજ આ કાર્યાલયો પર ડ્રાફ્ટ રિપોર્ટ ઉપ્લબ્ધ છે.

<u>મુખ્ય પરિયોજના અધિકારી(ડી.એફ.સી.સી.આઈ.એલ.) કાર્યાલયોનાં સરનામાં</u>

- મુખ્ય પરિયોજના અધિકારી કાર્યાલય-જયપુર
  બી ૧૨, હનુમાન નગર, મેટ્રો હોસ્પિટલની સામે, સિરસી રોડ, જયપુર ફોન નં : ૦૧૪૧-૪૦૨૮૭૪૧ ફેકસ : ૦૧૪૧-૪૦૨૮૭૪૦
- મુખ્ય પરિયોજના અધિકારી કાર્યાલય-અજમેર
  માલ રોડ, ડી.આર.એમ.કાર્યાલયની સામે, અજમેર ફોન નં : ૦૧૪૫-૨૬૨૫૫૪૮ ફેકસ:૦૧૪૫-૨૬૨૫૫૪૮
- મુખ્ય પરિયોજના અધિકારી કાર્યાલય-અમદાવાદ
  જુની ડી.આર.એમ.ભવન, પહેલો માળ, અમદાવાદ રેલ્વે સ્ટેશન, અમદાવાદ-૩૮૦૦૦૨
  ફોન નં : ૦૭૯-૨૨૧૭૫૧૦૭ ફેકસ : ૦૭૯-૨૨૧૬૩૧૦૧
- મુખ્ય પરિયોજના અધિકારી કાર્યાલય-વડોદરા
  ૧૩-૧૪, ૧૭-૧૮, પનોરમા કોમ્પલેક્ષ, ત્રીજો માળ, આર.સી. દત્ત રોડ, અલકાપુરી, વડોદરા-૭
  ફોન નં : ૦૨૬૫-૨૩૨૬૦૨૪ ફેકસ : ૦૨૬૫-૨૩૨૬૦૨૭

મુખ્ય સ્ટેશનો કે જ્યાં ડ્રાફ્ટ રિપોર્ટ મળવા પાત્ર છે

હરિયાણા: રેવાડી(જંકશન), નારનોલ, અને ડાબલા(જંકશન)

રાજસ્થાન: અલવર(જંકશન), કુન્ડ(જંકશન), નીમ કા થાના, શ્રી માધોપુર, રિંગસ(જંકશન), જયપુર(જંકશન), ફુલેરા(જંકશન), કિશનગઢ, અજમેર(જંકશન), બ્યાવર, સોજત રોડ, મારવાડ(જંકશન), ફાલના, સિરોહિ રોડ અને આબુ રોડ.

ગુજરાત: પાલનપુર(જંકશન), સિધ્ધપુર, ઉંઝા, મહેસાણા(જંકશન), સાબરમતી(જંકશન), અમદાવાદ(જંકશન), નડિયાદ(જંકશન), આણંદ(જંકશન), વાસદ (જંકશન) અને વડોદરા(જંકશન).

જિલ્લા કાર્યાલય કે જ્યાં ડ્રાફ્ટ રિપોર્ટ માળવા પાત્ર છે

હરિયાણા: રેવાડી, મેન્દ્રગઢ
રાજસ્થાન: સીકર, અલવર, જયપુર, નાગૌર, અજમેર, પાલી, સિરોહી
ગુજરાત: બનાસકાંઠા, પાટણ, મહેસાણા, ગાંધીનગર, અમદાવદ, ખેડા, આણંદ, વડોદરા

[1] ESIMMS: જે.આઈ.સી.એ. ની 'પર્યાવરણ તેમજ સામાજિક નિયમો ૨૦૦૪ માર્ગદર્શિકા' અનુસાર બનાવવા માં આવેલ પર્યાવરણિય તેમજ સામાજિક અસરો નો મુલ્યાંક રિપોર્ટ

[2] S-ESIMMS જે.આઈ.સી.એ. ની 'પર્યાવરણય તેમજ સામાજિક નિયમો ૨૦૦૪ માર્ગદર્શિકા' અનુસાર બનાવવા માં આવેલ પર્યાવરણિય તેમજ સામાજિક અસરોનાં મુલ્યાંક રિપોર્ટની પહેલાનો રિપોર્ટ

રેલ્વે મંત્રાલય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