2.5 RIVER CROSSING STRUCTURE

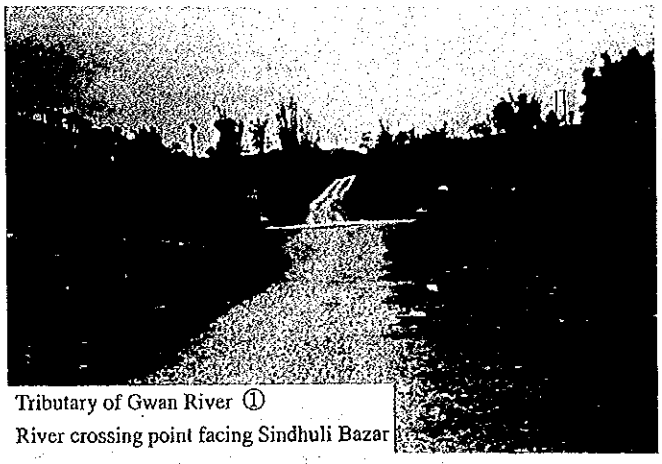
2.5.1 Site and Type of Structure

The site reconnaissance confirmed six locations where large-scale river crossing structures are necessary. The adopted structure and its respective reasons are summarized in Table 2.5.1.

Table 2.5.1 Basis for Selection of Large Scale River Crossing Structures

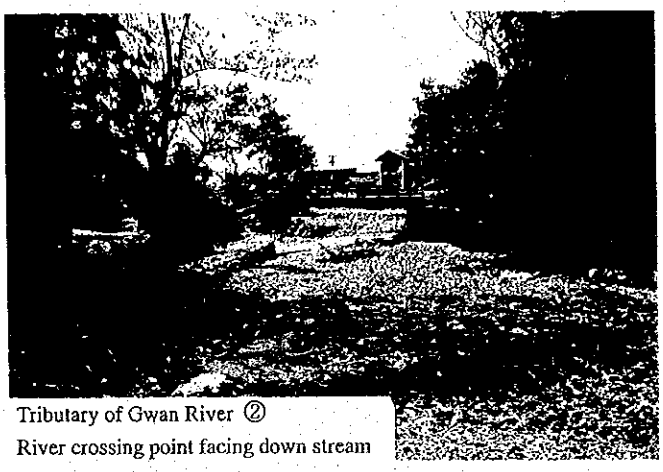
Location	Adopted River Crossing Structure	Catchment Area (m2)	Discharge (m3/sec)	Reason
Tributary of Gwang River 1)	Causeway	1,843,000	130	The low elevation road beside the existing slab-culvert was inundated during the 1993 heavy rain. The section area of the existing slab-culvert (width 5 meters) is insufficient for the discharge. Re-installation of a slab-culvert type causeway with sufficient section area is recommended.
Tributary of Gwang River 2)	Causeway	1,340,000	90	This flat area is where the water flow becomes stagnant due to the protruding ridges from both banks of the river. Since the discharge is minimal and scouring can be dismissed, a slab-culvert type causeway is considered economically viable in those water stagnant areas.
Main Stream of Gwang River	Bridge	8,760,000	431	The U-shaped valley has a height of 15m, a width of 40m. Boulder deposits on the riverbed has a maximum diameter of 2m, and rock base protrudes from the river bed. Riverbed inclination is approximately 4%. Since the location is down stream of the debris flow and considering the topographical formation of the location, a bridge type structure with no pier is recommended.
Main Stream of Andheri River	Causeway	19,182,000	692	The river width is approximately 100m and maximum diameter of the river deposit is 1m, with an average diameter of 0.3m. There is no evidence of large-scale debris flows. The river crossing location sits on the intake area of an alluvial fan and the accumulated deposit is thick and evidence of seasonal deformation of riverbed persists. The clearance underneath the bridge should take into account the deposit due to debris flow and also consider the deep foundation for the pier structure would cost a few hundred million Yen. The abutment on the right bank would sit on the steep slope, which would require extensive slope protection measures along the connecting road. On the other hand, the causeway option is prone

				to risks of damage by debris flows and would result to disruption to traffic. However, despite the circumstances, the structure is foreseen to be a simple reinforced concrete structure, thus remedial works would be possible by the Nepalese engineering while providing a temporary detour route for the traffic on the flat riverbed. There is also an advantage in reducing the size of the connecting road to the bridge. Considering the above issues and to be consistent to the policy, to adopt a realizable lowest scale of works, which was presented in the road planning of the Aftercare Study, a culvert type causeway is recommended.
Tributary of Andheri River 1)	Causeway	1,287,000	92	Site evidence shows that the riverbed is stable. The discharge is minimal and no concern over scouring is imminent. Also further to above, the concave topographical features of the site suggests that a culvert-type causeway is the recommended structure for river crossing.
Tributary of Andheri River 2)	Causeway	3,953,000	330	The location sits in the mid-section of the deposit of the debris flow. The river width is approximately 50m, maximum diameter of the deposit 1m, the average being 0.5m. A culvert type causeway, similar to the Andheri River main stream, is recommended.

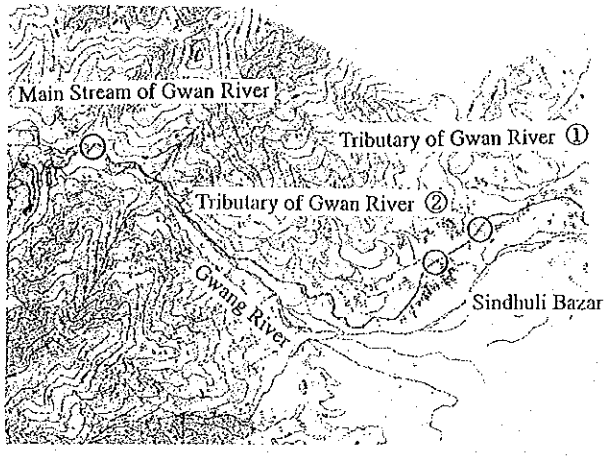


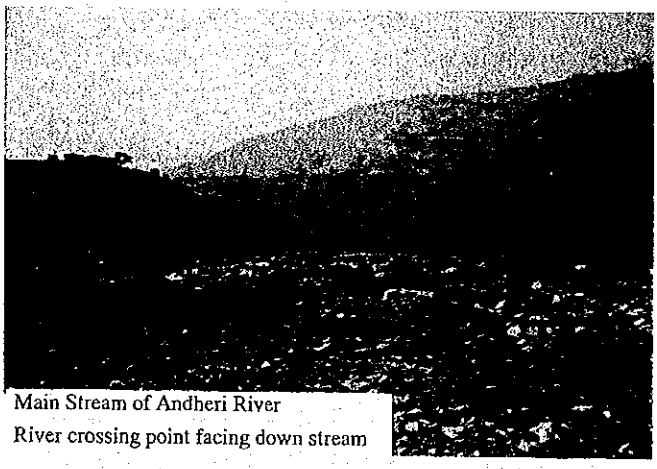
Tributary of Gwan River ①
River crossing point facing Sindhuli Bazar

Main Stream of Gwan River
River crossing point facing down stream

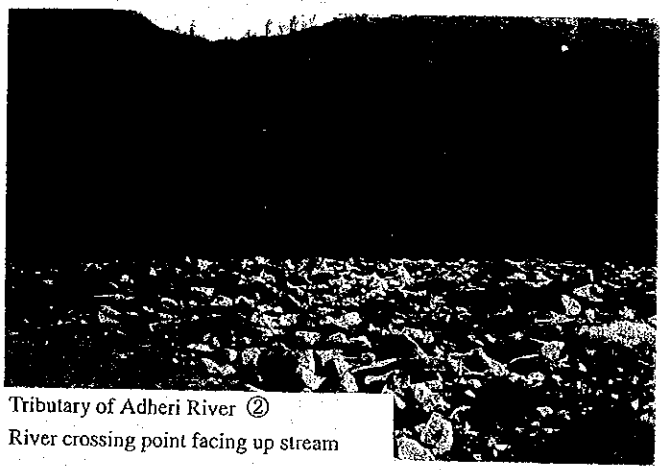


Tributary of Gwan River ②
River crossing point facing down stream

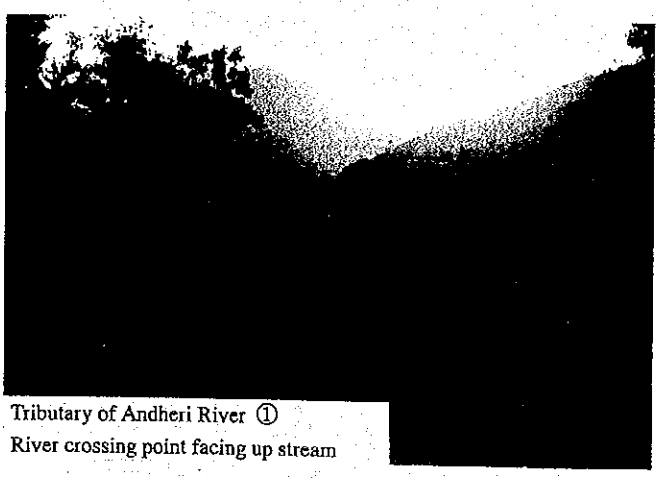




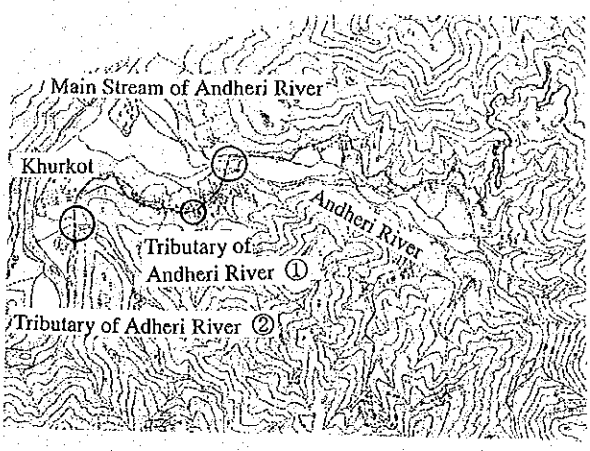
Main Stream of Andheri River
River crossing point facing down stream



Tributary of Adheri River ②
River crossing point facing up stream



Tributary of Andheri River ①
River crossing point facing up stream



Photograph 2.5.1 River Crossing Sites

2.5.2 Bridge Design (Gwang Bridge)

The bridge design standards utilized in the design for The Project Section IV will also be adopted for this project.

(1) Design condition

a) Design Standards Adopted

"Road Bridge Specifications Volume I, II, III, IV, V" Japan Road Association
"Concrete Standard Specifications" Japan Society of Civil Engineers

b) Design Loads

Live Load	A Type Live Load	
Impact Load	Steel bridge	I=20/50 + L (span)
	Concrete bridge	I=7/20 + L (span)

c) Design Seismic Coefficient

Horizontal seismic coefficient Kh=0.15 (Calculated by Design Standards of India)

d) Freeboard under the Bridge Girder

Since the bridge location is not in a deposit area, the freeboard will be the sum of maximum wave height of the debris flow, freeboard for debris flow, and the freeboard for the bridge. The maximum wave height and the freeboard for debris flow is calculated based on the formula presented in the "Research Report For Design of Roads Crossing Torrent Devastated Region" published by the Sabo/Landslide Engineering Center in 1982.

e) Allowable Stress

(Concrete)

Allowable bending compressive stress

Superstructure	68.5kgf/cm2
Substructure	80.0kgf/cm2
Allowable shearing unit stress	3.9kgf/cm2
Allowable bond unit stress	8.0kgf/cm2

(Reinforcing bar)

Superstructure (slab)	1200kgf/cm2
Substructure	1400kgf/cm2

(Steel materials)

SS400	Allowable tensile stress	1400kgf/cm2

SM490Y Allowable tensile stress 2100kgf/cm2

f) Road Width

Based on the "Classification and Design Standards for Feeder Roads (Second Revision)" 1994, Department of Roads, the effective width is fixed as 4.25m.

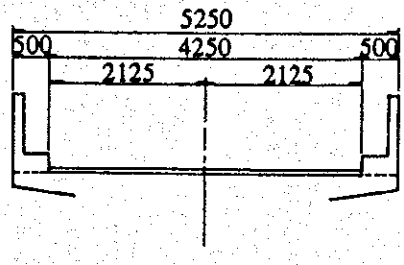


Figure 2.5.1 Composition of Bridge width

(2) Bridge length

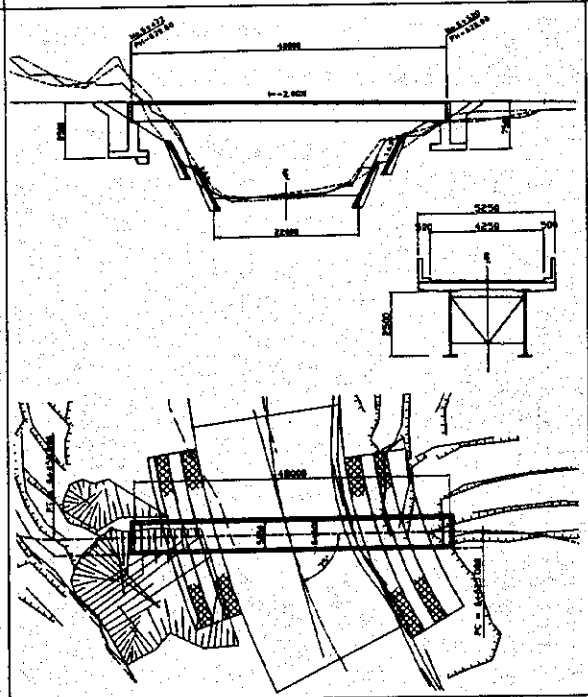
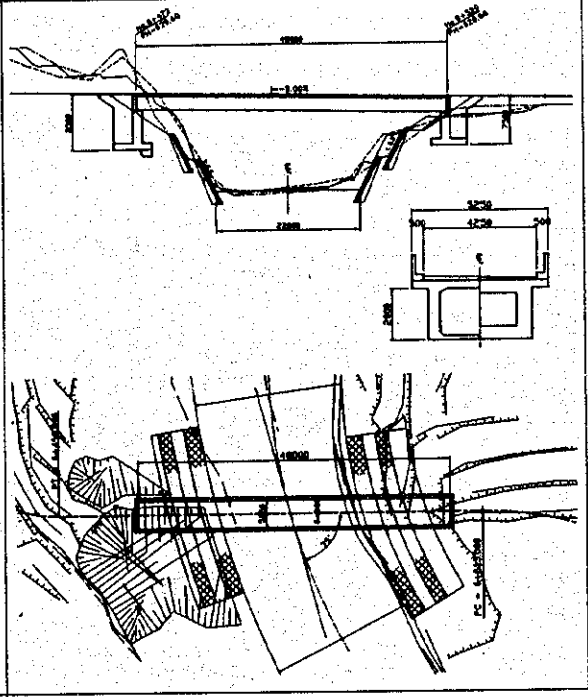
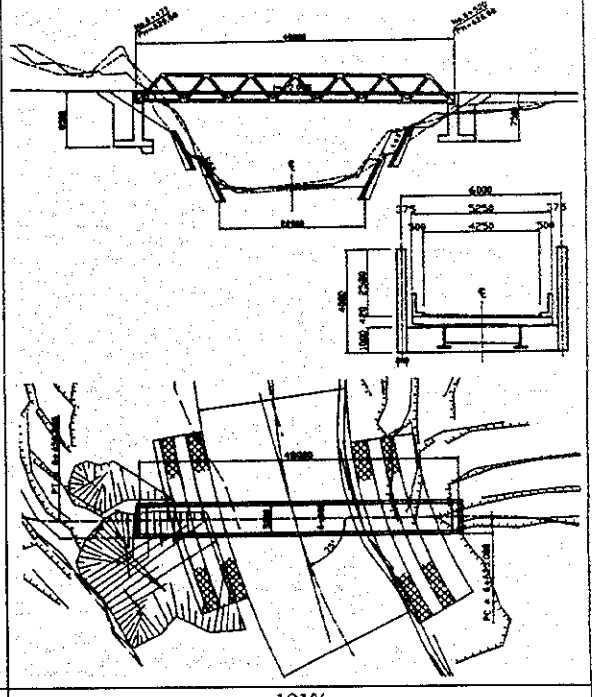
The single span bridge with 48m in length is selected by following two conditions.

- To avoid installing pier due to possible debris flow, and
- To set abutment without obstructing the sectional area of river.

(3) Selection of Bridge Structure

From the comparison of three alternative of possible bridge types for the bridge span length, Plate girder, P.C. simple box girder, and Simple truss as shown in Table 2.5.2, Plate girder type bridge which is the most economic bridge structure was selected.

Table 2.5.2 Comparison Table of Bridge Type Selection

Bridge Type	Plate Girder	PC Simple Box Girder	Simple Truss
General View			
Construction Cost	100%	106%	121%
Construction Method	The site condition is suitable for erection by the crane.	The staging for election has to be take out before rainy season. Therefore, the construction on slab has to be done between Nov. and Apr.	The site condition is suitable for erection by the crane..
Maintenance	Periodical painting	No maintenance	Periodical painting
Evaluation	Selected	Applicable	Applicable

2.5.3 Causeway Design

The type of causeways were selected as mentioned in Table 2.5.1 and length and structural details were designed as shown in Table 2.5.3. The bridge design standard will be applied for the structural design of causeways.

Table 2.5.3 Length and Structural Details of Causeways

Location	Causeway Type	Length and Structural Details
Gwang river tributary (1)	Continuation box culvert type causeway	-According to the flow width of upstream and downstream section, 60m length of causeway is planned. -Span length of 10m is selected as of maximum length of slab using 25mm diameters reinforcement bar taking into consideration of making the sectional area wider as much as possible. -Hinge type joint is applied at connection of super-structure and substructure considering the easy repair. -Movement joint type is selected at the joint of both end walls and slab to avoid the influence of the horizontal force by earth pressure to other walls.
Gwang river tributary (2)	Continuation box culvert type causeway	-The length of 50m is designed to cross the stagnant area caused by narrow downstream section. - Span length of 5m is selected from the economical view point because of the gentle river condition. -Movement joint type is selected at the joint of both end walls and slab to avoid the influence of the horizontal force by earth pressure to other walls.
Andheri river mainstream	Continuation box culvert type causeway	-The length of 130m is designed as same as present river width. -Hinge type joint is applied at connection of super-structure and substructure considering the easy repair. -Movement joint type is selected at the joint of both end walls and slab to avoid the influence of the horizontal force by earth pressure to other walls.
Andheri river tributary (1)	Continuation box culvert type causeway	-The length of 50m is designed as same as present river width. -Hinge type joint is applied at connection of super-structure and substructure considering the easy repair. -Movement joint type is selected at the joint of both end walls and slab to avoid the influence of the horizontal force by earth pressure to other walls.
Andheri river tributary (2)	Continuation box culvert type causeway	-The length of 50m is designed as same as present river width. -Hinge type joint is applied at connection of super-structure and substructure considering the easy repair. -Movement joint type is selected at the joint of both end walls and slab to avoid the influence of the horizontal force by earth pressure to other walls.

2.5.4 Clearance of River Crossing Structure

(1) Classification of River

The condition of river where crossing structures are planned are classified as below.

Name and Type of Structure	Catchment area	River Condition
No.1 Causeway	1,843,000m^2	Gentle river
No.2 Causeway	1,340,000m^2	Gentle river
Gwang Bridge	8,760,000m^2	Possible debris flow
No.3 Causeway(Andheri River)	19,182,000m^2	Possible debris flow
No.4 Causeway	1,287,000m^2	Gentle river
No.5 Causeway	3,953,000m^2	Possible debris flow

The clearance will be planned for gentle river and the river of possible debris flow respectively.

(2) Clearance for the Gentle River

The clearance for gentle rivers will be planned with additional height set on high flood water surface level according to the Structural Regulation for River Management Facilities in Japan.

a) No.1 Causeway

Catchment area: 1,843,000m2
Discharge: 130.6m3/sec (50 year return period)
Velocity of flow: 2.6m/sec
Clearance:

High water level	512.02m
Clearance for bridge (ho)	0.6m
Elevation of bottom of slab to be kept.	512.62m
Designed elevation of bottom of slab	513.86m (OK)

b) No.2 Causeway

Catchment area: 1,340,000m2
Discharge: 90.0m3/sec (50 year return period)
Velocity of flow: 1.4m/sec
Clearance:

High water level	513.18m
Clearance for bridge (ho)	0.6m
Elevation of bottom of slab to be kept.	513.78m
Designed elevation of bottom of slab	513.88m (OK)

c) No.4 Causeway

Catchment area: 1,287,000m2
Discharge: 91.6m3/sec (50 year return period)

Velocity of flow: 5.23m/sec

Clearance:

High water level	502.05m
Clearance for bridge (ho)	0.6m
Elevation of bottom of slab to be kept.	502.65m
Designed elevation of bottom of slab	503.04m (OK)

(3) Clearance for the river crossing structure across the river possible debris flow

a) Design policy

The clearance of structure across the river possible debris flow will be designed in accordance with the concept described in the study report of The Study on the Road Design Policy Passing through the Ruin Mountain Stream Area, SABO technical Center, 1976.

b) River condition and debris flow movement

The situation of debris flow will be changed according to the river gradient as below.

River gradient	Situation of debris flow
1/100 - 1/60	Flood flow section
1/60 - 1/20	Mad flow section
1/20 - 1/5	Debris flow stopping section
1/5 - 1/3	Debris flow passing section
1/3	Debris flow starting section

The river crossing structures planned in the Section II are existing at the debris flow stopping section.

c) Clearance

The clearance will be designed for bridge and causeways separately as shown below.

Bridge		Causeway
Case-1: For passing of debris flow	Case-2: For stopping of debris flow	
Maximum height of Debris flow wave (H)	Height of deposit (Hd)	No consideration for debris flow
Clearance for debris flow (Hc)	Height of flood flow (h)	Height of flood flow (h)
Clearance for bridge (ho)	Clearance for flood flow (hd)	Clearance for flood flow (hd)
	Clearance for bridge (ho)	Clearance for bridge (ho)

where :

Maximum height of Debris flow wave $H = Qsp / Bd \times Uf$ and $10m > H > 5m$

Qsp (Peak volume of debris flow) = 4.7Q

	(flood discharge) Bd: Width of Debris flow (m) Uf: Average velocity of debris flow (m/sec)
Clearance for debris flow (Hc)	Maximum particle size (m)
Height of deposit (Hd)	5m (Average of record in Japan)
Height of flood flow (h)	To be calculated
Clearance for flood flow (hd)	0.4H or 0.8m (for river gradient 3%-10%)
Clearance for bridge (ho)	0.5m

d) Clearance on each bridge and causeways

(i) Gwang river bridge

River bed gradient: 4 - 5%
Catchment area: 8,760,000m2
Flood discharge: 431.0m3/sec (5 year return period)
Clearance:

Case-1: For passing of debris flow		Case-2: For stopping of debris flow	
River bed level	618.98m	River bed level	618.98m
Maximum height of Debris flow wave (H)	8.0m	Height of deposit (Hd)	5.0m
Clearance for debris flow (Hc)	2.0m	Height of flood flow (h)	2.82m
Clearance for bridge (ho)	0.5m	Clearance for flood flow (hd)	1.13m
		Clearance for bridge (ho)	0.5m
Elevation of bottom of slab to be kept.	624.48m	Elevation of bottom of slab to be kept.	623.43m
Designed elevation of bottom of slab	625.73m(OK)	Designed elevation of bottom of slab	625.73m(OK)

(ii) No.3 Causeway (Andheri River)

River bed gradient: 4 - 5%
Catchment area: 19,180,000m2
Flood discharge: 692.0m3/sec (5 year return period)
Clearance:

For passing of flood flow	
River bed level	500.15m
Height of flood flow (h)	2.00m
Clearance for flood flow (hd)	0.8m
Clearance for bridge (ho)	0.8m
Elevation of bottom of slab to be kept.	503.75m
Designed elevation of bottom of slab	504.30m(OK)

(iii) No.5 Causeway

River bed gradient: 4 - 5%
Catchment area: 3,950,000m2
Flood discharge: 330.0m3/sec (5 year return period)
Clearance:

For passing of flood flow	
River bed level	485.00m
Height of flood flow (h)	3.5m
Clearance for flood flow (hd)	1.4m
Clearance for bridge (ho)	0.5m
Elevation of bottom of slab to be kept.	490.40m
Designed elevation of bottom of slab	491.00m(OK)

2.6 BASIC DESIGN DRAWING

The following drawings have been prepared for the cost estimation and construction planning purpose.

A-1 Location Map
A-2 Plan and Profile
A-3 Standard Cross Sections
A-4 General Plan of Gwang River Bridge
A-5 General Plan of Causeways
A-6 General Plan of Drainage
A-7 General Plan of Retaining Walls
A-8 General Plan of Slope Protections
A-9 General Plan of Associated Facilities
A-10 General Plan of Bus-stop and Passing Place

A-1 to A-10 are attached in Appendix.

CHAPTER 3

IMPLEMENTATION PLAN

CHAPTER 3 IMPLEMENTATION PLAN

3.1 IMPLEMENTATION PLAN

3.1.1 Implementation Concept

After the signing of an Exchange of Note (E/N) between both Governments, the Project Section II implementation will commence officially. For the project implementation, the contracts for the consulting services and for the construction will be concluded between the Department of Roads (DOR), Ministry of Works and Transport (MOWT), His Majesty's Government of Nepal (HMG/N) and a Japanese consultant, and a Japanese contractor respectively. These contacts will be effective after verification by the Government of Japan.

DOR is responsible for the implementation of the project. Hence, DOR shall manage for coordination, adjustment, etc. of the administrative matters on the Grant Aid and technical cooperation agreed between the two countries as well as management, supervision and maintenance of the Project.

A Japanese Consultant will be involved in the following services as the Engineer on behalf of HMG/N.

- Detailed engineering design including preparation of tender documents.
- Pre-construction activities for the pre-qualification and tendering
- Construction supervision

A Japanese contractor to be selected by open tender according to Japan's Grant Aid system shall undertake the construction in accordance with the work program and schedule of the Project Section II.

3.1.2 Implementation Conditions

(1) Construction in rainy season

The Project Section II is located heavy rainfall affected area where has above 20 rainy days in a month in rainy season. Hence, earth works will not be possible and construction of minor structures may only be possible in rainy season. Therefore, the construction schedule has to be planned on the condition that there will not be progress of earthworks in rainy season and the construction management with care due to rain like finishing unstable portions before rainy seasons are essential in order to complete the Project Section II successfully.

(2) Environmental Consideration

Special consideration to avoid and to minimize following environmental issues expected to be caused by construction activities should be made.

- Accelerating riverbank erosion by collecting the aggregate and sand in quarry.
- Blowing dust by construction vehicles running arise
- Destruction of existing vegetation below the construction sites and damaging cultivated land by mud flow caused by inadequate management of cuttings.

(3) Securing the safety during construction

The construction activities; usage of explosive, works on steep slopes, deep structural excavation and etc., which may cause accidents easily will carry out in the narrow construction site and continuously. Furthermore, since the existing main trail connecting Sindhuli bazar and Khurkot located along the alignment, villagers will access into the construction sites and walk nearby the working places easily. Therefore, special attention and care with proper safety measure such as rock falling prevention fence, safety fence for falling, access control and etc., should be done.

(4) Securing road to transport construction material in site and access

Since the construction work proceeds as one way from Sindhuli Bazar side, all construction materials including water have to be transported from Sindhuli Bazar till the completion of the Project Section II. Therefore, to open the access from Bardibas to Sindhuli Bazar and Sindhuli Bazar to the construction sites is the basic condition and the closure of the access seriously affects on the progress of the construction. Special attention have to be given in the management and operation to ensure the transportation route.

(5) Management of footpath and entrance control to site

Since the alignment planned along the main trail connecting Sindhuli Bazar and Khurkot, the construction works must obstruct the traffic. Therefore, to ensure the transportation route, temporary detour should be prepared at sections where the trail are totally obstructed. Furthermore, to manage the control of the entrance of villagers frequently, good public relations should be carried out.

(6) Removal of obstacle

Along the alignment, electric lines and telephone lines in Sindhuli Bazar area, water

supply systems along the route and high tension distribution line in Sindhuli Gadhi will seriously affect the construction works as well as work progress. These obstacles should be relocated by planned schedule and method without any disturbance for the construction works and the work progress.

3.1.3 Scope of Work

The scopes of work for which the Japanese Government and His Majesty's Government of Nepal are responsible respectively are as follows:

(1) Works and facilities to be provided by the Japanese side,

- Detailed design and preparation of tender documents,
- Construction between Sindhuli Bazar and Khurkot (about 40km) as mentioned in Chapter 2.4 and 2.5, and
- Maintenance of surface of Access road during the construction period.

(2) Works and facilities to be provided by the Nepalese side

- Demolition / removal / relocation of existing power transmission line and other obstacles before the construction,
- Management / removal of water supply systems along the alignment before the construction, and
- Maintenance of transferred road section, excepting the maintenance of surface used as access road by the construction.

3.1.4 Consultant Supervision

(1) Consulting Services Schedules

The Scopes of consulting services are divided into three stages; detailed design stage, pre-construction stage and construction supervision stage. Contents of the consulting service in each stage are as follows;

a) Detailed Design Stage

The contract for consulting service will be concluded between DOR and a Japanese consultant within the limits of the Grand Aid after the signing of an Exchange of Notes (E/N) concerning to the engineering services for detailed design between the GOJ and HMG/N.

The consultant shall carry out the centerline survey, detailed design of the road,

the bridge and the causeways, calculation of quantities and preparation of specifications and tender documents according to specifications and concepts of the basic design study. The detailed design stage completed will be officially accepted by DOR.

b) Pre-Construction Stage

After the signing of an Exchange of Notes (E/N) pertaining to the engineering service for the construction supervision and the construction between the GOJ and the HMG/N, the contract for the construction supervision will be concluded between DOR and a Japanese consultant within the limits of the Grand Aid. DOR shall initiate to select a Japanese contractor to implement the project through an open tender. The consultant shall assist DOR on Bid announcement, Pre-qualification of contractors, Pre-bid conference and site inspection, Tender and the tender evaluation and Contract negotiation

c) Construction Supervision Stage

The engineering services for construction supervision will begin, after issuance of the Notice to Proceed to the contractor by DOR.

The consultant shall periodically report to DOR about the field activities and shall issue field memo or letters to the contractor regarding various matters in terms of progress, quality, safety, and payment.

(2) Staffing and Service during Detailed Design Stage

In the preparation of the detailed design including the tender documents, Japanese staffs with the following expertise are needed as shown in Table 3.1.1.

Table 3.1.1 Staffing and Service during Detailed Design Stage

Engineer	Service
Team Leader	Total management of quality, progress and instruction
Highway Engineer 1	Detailed design of road, making drawings and calculation of quantities.
Highway Engineer 2	Detailed design of cross drainage, making drawings and calculation of quantities.
Bridge Engineer	Detail design of bridge, making drawings and calculation of quantities.
Causeway Engineer	Detail design of causeway, making drawings and calculation of quantities.
Vegetation Engineer	Design of planting work, making specification
SABO Engineer	Detail design of protection structure against disaster, making drawings and calculation of quantities.
Cost Estimator	Price research, estimation
Tender Document Specialist	Preparation of tender documents

(3) Organization and staffing during Construction Supervision

The consultant organization in the construction supervision stage is as shown in Figure 3.1.1.

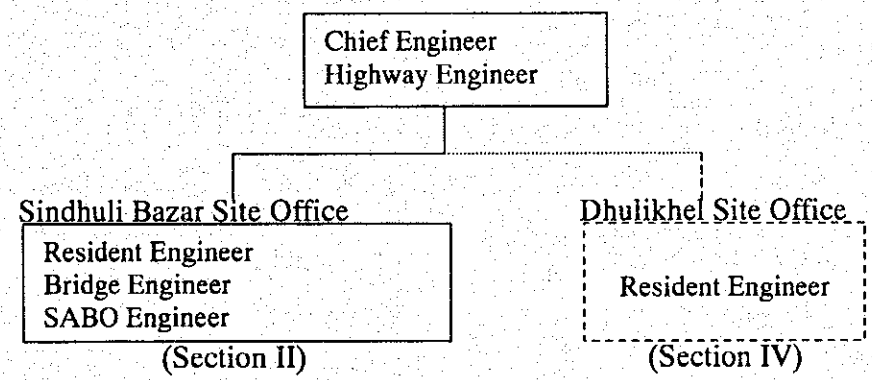


Figure 3.1.1 Organization during the Construction Supervision Stage

With reference to the major field works required for close supervision during the construction, the consulting staff as shown in Table 3.1.2 are considered during the construction supervision.

Table 3.1.2 Staff and Service during the Construction Supervision Stage

Engineer	Service
Team Leader	Instruction to resident engineers, coordination of total scope of works
Resident Engineer	Total management, control of quality, progress and safety
Bridge Engineer	Quality of the bridge and causeway construction
SABO Engineer	Quality of slope protection work
Highway Engineer	Adjustment of road design at site

3.1.5 Procurement Plan

(1) Construction Materials

According to actual procurement in the Projects Section I and IV, the sources of construction materials to be procured in the Project Section II are selected as shown in Table 3.1.3.

Table 3.1.3 Procurement of Major Construction Materials

Item	Procured in Nepal	Procured in third world Country	Procured in Japan
Cement	○	○	
Aggregate and sand for high quality concrete			○
Plywood for mould	○		
Timber	○		
Reinforcing bar	○		
Wire for Gabion	○		
Asphalt	○		
Asphalt emulsion	○		
Material for bridge			○
Material for reinforces earth			○
Shot soil materials			○
Laboratory equipment			○
Light oil	○	○	
Gasoline	○		
Oils and fats			○
Corrugated metal pipe			○
Hume pipe	○		
Figured steel, rolled steel	○		

(2) Construction Equipment

There is no lease system in Nepal. Therefore, the contractor should procure in Japan. The procurement of the construction equipment is as shown in Table 3.1.4.

Table 3.1.4 Procurement of Construction Equipment

Item	Procured in Nepal	Procured in third world Country	Procured in Japan
All construction equipment			○

3.1.6 Implementation Schedule

Total construction period of 78 months will be required for full completion of the Project Section II due to severe site conditions. The Project Section II will be implemented in section wise construction by following three phases;

Phase 1	Between STA.0+000 and STA.12+500	13.5km
Phase 2	Between STA.12+500 and STA.26+000	13.5km
Phase 3	Between STA.26+000 and STA.39+700	13.7km

The detailed design for the Phase-1 2 and 3 requires 6 months (including preparation of tender documents for the Phase-1) and 29 months for the Phase-1 construction. As for the Phase-2, two months is required for the preparation of tender documents and 41 months for the construction. As for the Phase-3, two months is required for the preparation of tender documents and 29 months for the construction. Figure 3.1.2 show in implementation schedule of Phase-1, 2 and 3.

The Project Section II shall be implemented as shown in Figure 3.1.3 taking into consideration the procedure of the Japanese Grant Aid System.

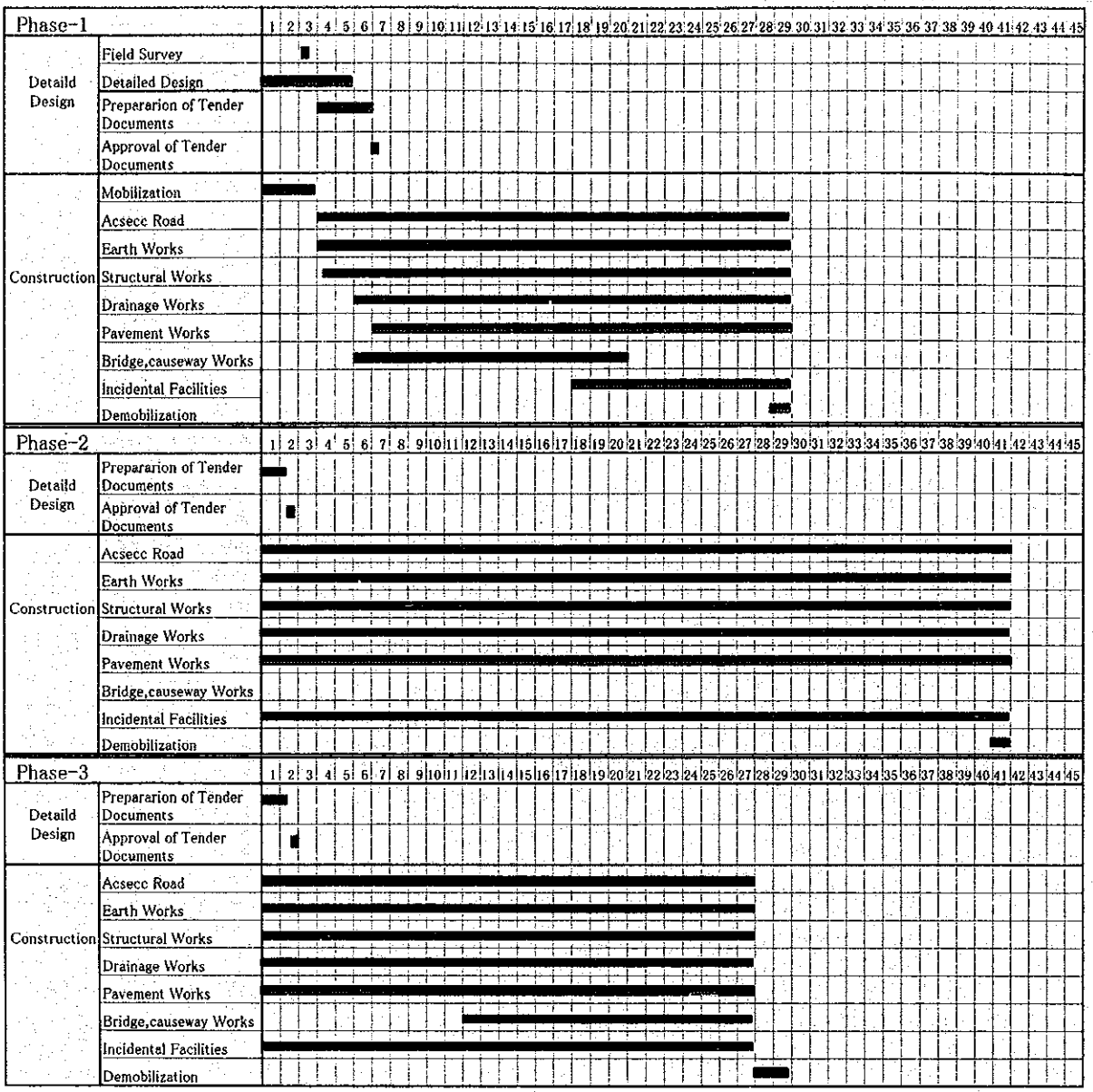
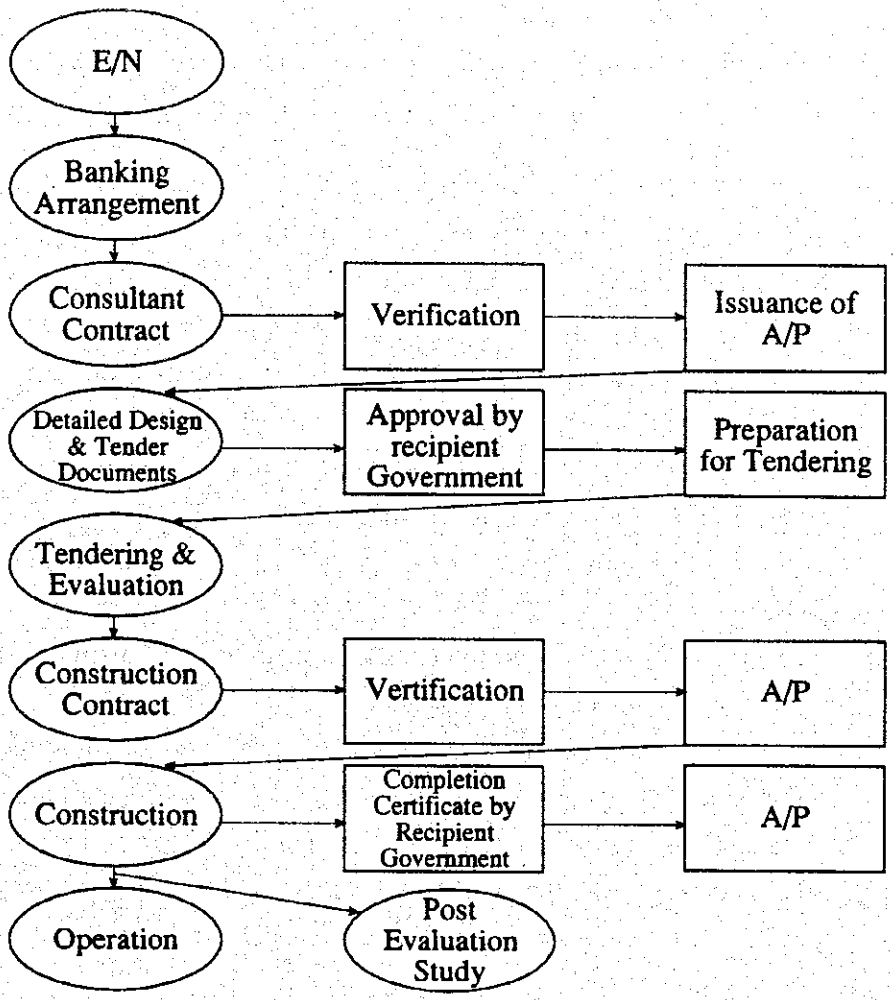


Figure 3.1.2 Overall Implementation Schedule



Note (1) E/N : Exchange of Note
(2) A/P : Authorization to Pay

Figure 3.1.3 Procedure of Japanese Grant Aid Program

3.1.7 Obligations of Recipient Country

The following necessary measures should be undertaken by HMG/N on condition that the Grant Aid by the Government of Japan is extended to the Project Section II:

- To acquire the land and compensate houses removed before the construction,
- To secure correcting river gravel, sand and boulder around Ratu River, Kamala River, Gwang River and Andheri River with no charge,
- To take necessary procedure relating to felling forest and prepare and manage the stock yards of cut trees around the Sindhuli Bazar before the construction,
- To secure lands for spoil banks before the construction,
- To demolition / remove/ relocate of the existing power transmission line and other obstacles before the construction,
- To manage / remove of water supply systems along the alignment before the construction,
- To maintain of transferred road section, excepting the maintenance of surface used as access road by the construction,
- To take necessary procedure to control entrance of villager into the site,
- To take necessary measures relating to secure public peace around the site,
- To take necessary procedure to make temporally detour of the existing trail and secure lands to make the detour, if necessary,
- To allow the contractor to use the maintenance equipment procured under the Grand Aid,
- To secure keeping the Section I road as passable condition,
- To take necessary procedure relating to Environment Impact Assessment and carry out necessary mitigation measure excluding in the scope described in this report,
- To bear commissions to a Japanese foreign exchange bank for its banking service based upon the Banking Arrangement, namely the advising commission of the "Authorization to Pay" and payment commission,
- To exempt Japanese juridical and physical nationals engaged in the Project from customs duties, internal taxes and other fiscal levies which may be imposed on the supply of the products and services under the verified contracts.
- To accord Japanese nationals whose services may be required in connection with the supply of the products and the services under the verified contract such facilities as may be necessary for their entry into Nepal and stay therein for the performance of their work, and
- To secure staff and budget to manage equipment and facility granted by the

Grand Aid effectively.

3.2 EXPENDITURES TO BE BORNE BY HMG/N

The expenditures to be borne by HMG/N in connection with the implementation of the Project Section II is estimated as shown below:

Descriptions	Amount (NRs)
Land acquisition and house compensation cost	52,157,000
Obstacles relocation cost	510,000
Administration cost	480,000
Total	53,147,000

3.3 OPERATION AND MAINTENANCE COSTS

(1) Operation and Maintenance Plan

After completion of Sindhuli Road Construction Project, Janakpur Maintenance Office will maintain the Sindhuli Road Section II. The operation and maintenance as shown in Table 3.3.1 are required to keep the structures in sound.

Table 3.3.1 The Maintenance Works for Sindhuli Road Section II

Category	Frequency	Items to be Inspected	Scope of Works
Inspection/ Maintenance for Road	Daily Maintenance	Drainage	Cleaning deposit
		Roadsurface	Repairing cracks and hole
	Periodical Maintenance	Slope	Weeding
		Pavement	Repairing
		Bridge	Repainting damages
	Emergency Maintenance	Surface	Removing / Hauling deposit
		Drainage	Cleaning deposit
		Slope	Arranging slope and replanting
		Pavement	Repairing damages
		Retain	Repairing damages

Operation and Maintenance works will be implemented by the equipment procured in the Sindhuli Road Construction Project Section I.

(2) Maintenance Cost

Based on the maintenance works mentioned above, the periodical maintenance cost required is estimated at NRs 9,560,000/every year, which is equivalent to about 6% of DOR annual budget.

CHAPTER 4

PROJECT EVALUATION AND RECOMENDATION

CAPTER 4 PROJECT EVALUATION AND RECOMENDATION

4.1 PROJECT EFFECT

The direct effect of the completion of entire sections of the Sindhuli Road is to reduce the travel distance by about 200 km in the trip between Kathmandu and Eastern Development Region. This will reduce the traffic cost and induce the round trip between Kathmandu and middle Terai area within one day. A great number of populations will receive the benefit from the road. About 1.17 million people in the districts along the rout, 5.44 million population in the Kathmandu Valley and in Eastern Region as well as the passengers of busses and trucks travelling Kathmandu and Eastern Development Region which are estimated at 30 thousands per day and totaling 10 million per year, will receive benefit.

Besides the above, the following effects will be anticipated.

- To provide alternative route of transportation of materials from Terai to Kathmandu, in parallel with now functioning Birgandi - Hetauda - Kathmandu route,
- To expand the sphere of market economy, encouraging of cash crop plantation in the areas where market accessibility is expected to be improved due to opening of the project road,
- To secure the supply of such daily materials as salt, rice and oil, which are unstably supplied at present to the hilly areas by such means as porters or animals due to luck of motorble roads,
- To enhance the welfare of rural people with the opening of hospitals and public facilities in the area where there have been no these facilities at all,
- To reduce the burden of labour of women and children in the transportation of such materials as agriculture products, fuel and grasses for domestic animals and so on, with the opening of the motorble road,
- To induce leisure and tourism development, such as rafting at Sunkosh river, in the areas where one-day trip from Kathmandu become possible with the opening of the road, and
- To enable spherical area development in the areas neighboring to the project road with the opening of access roads and bridges connecting to the former in a long term.

Due to the nature of the Sindhuli Road that traverse mountainous terrain, the Road is requested to be performed adequate maintenance works to protect slope failures and debris flows in every year. Therefore, the importance of the maintenance and strengthening of present maintenance capability of DOR including establishment of maintenance office, education of maintenance staff and procurement of maintenance equipment have been undertaking as a part of the Project as described in the Basic Design Reports on the Project Section I and the Project Section IV.

The alignment of the Section II has been planned so as to minimize negative effects on the surrounding environment including regional partition, distraction of forest, damage on the existing irrigation channels, acceleration of slope failures. The Environmental Impact Assessment was carried out by the DOR and concluded that there is no serious environmental impact.

The construction period of the Project Section II Project is six years. Therefore, in order to meet the condition of the Japanese Grant Aid Program and to realize smooth implementation, phased implementation program which consists Phase-1 (3 years), Phase-2 (4 years) and Phase-3 (3years) shall be adopted.

4.2 RECOMMENDATION

As mentioned above, the Sindhuli Road Construction Project will be produced great impacts to the nation and will enhance the basic human need to the surrounding areas. Therefore, it is recommendable that the Project Section II, which will promote the early connection of the whole of the Sindhuli Road, should be implemented under Japanese Grant Aid Program. However, in order to ensure the smooth performance of the Project Section II, it is recommended that HMG/N should undertake the following items of works: -

- To carry out a judicial procedure of land acquisition and houses compensation before the construction progress.
- To establish the efficient implementation body to ensure smooth implementation.
- To carry out appropriate mitigation measures for the negative environmental impacts.
- To ensure the security of the Project Section II site during the construction.
- To maintain the road conditions passable at the section between Bardibas and Sindhuli Bazar.

APPENDIX

MEMBER LIST OF STUDY TEAMS

SURVEY SCHEDULE

LIST OF PARTY CONCERNED IN NEPAL

MINUTES OF DISCUSSIONS

COST ESTIMATION BORNRE BY HMG/N

LAND USE AND VEGETATION

TRAFFIC COUNTING RESULT

MEMBER LIST OF STUDY TEAMS

Member List of Survey Teams

Inception Report explanation and First Field Survey Team

Assignment	Name	Position
Team Leader	Mr. Satoshi UMENAGA	Deputy Director, Third Project Management Division, Grant Aid Management Department, Japan International Cooperation Agency
Technical Advisor	Mr. Hiroyuki YOSHIMATU	SABO Technical Center
Chief Consultant/Construction Planner	Mr. Yoshihisa YAMASHITA	Kippon Koei Co., Ltd.
Road Planner	Mr. Hiroki SHINKAI	Kippon Koei Co., Ltd.
Bridge Designer	Mr. Katuhumi MATUZAWA	Kippon Koei Co., Ltd.
Geologist/Road Disaster Prevention Planner	Mr. Akichika ISHIBASHI	Kippon Koei Co., Ltd.
Hydrologist	Mr. Masayuki OGINO	Kippon Koei Co., Ltd.
Cost Estimator	Mr. Tetuto NAKANO	Kippon Koei Co., Ltd.
Road Designer	Mr. Takashi IHARA	Kippon Koei Co., Ltd.
Environmentalist	Mr. Kanzi WATANABE	Kippon Koei Co., Ltd.
Surveyor	Mr. Masashi SUZUKI	Kippon Koei Co., Ltd.

Second Field Survey Team

Assignment	Name	Position
Team Leader	Mr. Koichi YAMADA	Director, Third Project Management Division, Grant Aid Management Department, Japan International Cooperation Agency
Chief Consultant/Construction Planner	Mr. Yoshihisa YAMASHITA	Kippon Koei Co., Ltd.
Road Designer	Mr. Takashi IHARA	Kippon Koei Co., Ltd.
Environmentalist	Mr. Kanzi WATANABE	Kippon Koei Co., Ltd.

Draft Basic Design Report Explanation Team

Assignment	Name	Position
Team Leader	Mr. Atsumu IWAI	Third Project Management Division, Grant Aid Management Department, Japan International Cooperation Agency
Grant Aid	Mr. Koichi TOKUGAWA	Grant Aid Division Bureau of Economic Cooperation, Ministry of Foreign Affairs
Technical Advisor	Mr. Hiroyuki YOSHIMATU	SABO Technical Center
Chief Consultant/Construction Planner	Mr. Yoshihisa YAMASHITA	Kippon Koei Co., Ltd.
Road Planner	Mr. Hiroki SHINKAI	Kippon Koei Co., Ltd.

SURVEY SCHEDULE

Survey Schedule

Inception Report explanation and First Field Survey Team

S. No.	Date		Movement/Place/Agencies	Station	Activities/Name of Parson
1	March 20	SAT	Tokyo - Bangkok(BKK)	BKK	Messrs. Yamashita, Nakano, Suzuki
2	21	SUN	BKK - Kathmandu(KTM)	KTM	Internal meeting
3	22	MON	Department of Roads(DOR) JICA Nepal Office	KTM	Courtesy call
4	23	TUE	DOR	KTM	Submission of Inception Report Explanation of Inception report
5	24	WEN		KTM	Internal meeting
6	25	THU		KTM	Mr. Ogino arrive KTM. Internal meeting
7	26	FRI	DOR JICA Nepal Office	KTM	Mr. Umenaga arrive KTM. Courtesy call
8	27	SAT	KTM - Sinshuli Bazar - Bardibas	Bardibas	Site observation of Section 2 and 1 by Messrs. Umenaga, Yamashita, Nakano
9	28	SUN	Bardibas - KTM	KTM	Site observation
10	29	MON	Embassy of Japan Ministry of Finance Department of Roads	KTM	Courtesy call Preparation of Draft
11	30	TUE		KTM	Signing on the Minutes
12	31	WEN		Charikot	Observation of Jiri Road
13	April 1	THU		KTM	Messrs. Ihara, Watanabe arrive KTM. Internal meeting
14	2	FRI	Embassy of Japan JICA Nepal Office	KTM	Reporting the result of Minutes of Discussion Mr. Umenaga leave KTM.
15	3	SAT		KTM	Mr. Sinkai arrive KTM. Internal meeting Mr. Suzuki dispatch to Bardibas.
16	4	SUN		KTM	Topo-survey, Traffic count, Hydrological survey
17	5	MON		KTM	Topo-survey, Traffic count, Hydrological survey
18	6	TUE		KTM	Topo-survey, Traffic count, Hydrological survey
19	7	WEN		KTM	Topo-survey, Traffic count, Hydrological survey
20	8	THU		KTM	Topo-survey, Traffic count, Hydrological survey
21	9	FRI		KTM	Messrs. Matuzawa, Ishibashi arrive KTM. Internal meeting Topo-survey, Traffic count, Hydrological survey
22	10	SAT		KTM	Topo-survey, Traffic count, Hydrological survey
23	11	SUN	KTM - Bardibas	Bardibas	Traffic count 、First Field Observation by Messrs. Yamashita, Shinkai, Masuzawa, Ishibashi, Ihara, Watanabe, Nakano.
24	12	MON		Bardibas	Traffic count 、First Field Observation by Messrs.

					Yamashita, Shinkai, Masuzawa, Ishibashi, Ihara, Watanabe, Nakano.
25	13	TUE		Sindhuli	First Field Observation by Messrs. Yamashita, Shinkai, Masuzawa, Ishibashi, Ihara, Watanabe, Nakano.
26	14	WEN		Sindhuli	First Field Observation by Messrs. Yamashita, Shinkai, Masuzawa, Ishibashi, Ihara, Watanabe, Nakano.
27	15	THU		Sindhuli	First Field Observation by Messrs. Yamashita, Shinkai, Masuzawa, Ishibashi, Ihara, Watanabe, Nakano.
28	16	FRI		Khurkot	First Field Observation by Messrs. Yamashita, Shinkai, Masuzawa, Ishibashi, Ihara, Watanabe, Nakano.
29	17	SAT	Khurkot - KTM	KTM	Internal meeting. Mr. Suzuki leave KTM.
30	18	SUN		KTM	Mr. Yoshimatu arrive KTM. Internal meeting Preparation of Site observation report.
31	19	MON	KTM - Sindhuli	Sindhuli KTM	Second Field Observation by Messrs. Yoshimatu, Yamashita, Ishibashi Preparation of Site observation report.
32	20	TUE		Bardibas KTM	Second Field Observation Preparation of Site observation report.
33	21	WEN	Bardibas - KTM	KTM	Second Field Observation Preparation of Site observation report. Internal meeting
34	22	THU		KTM	Preparation of Site observation report. Internal meeting
35	23	FRI		KTM	Preparation of Site observation report. Internal meeting
36	24	SAT		KTM	Messrs. Yoshimatu, Ishibashi leave KTM. Preparation of Site observation report.
37	25	SUN		KTM	Preparation of Site observation report.
38	26	MON		KTM	Preparation of Site observation report.
39	27	TUE		KTM	Preparation of Site observation report.
40	28	WEN		KTM	Preparation of Site observation report. Traffic volume counting
41	29	THU		KTM	Basic Design of the Project road., Traffic volume counting
42	30	FRI		KTM	Basic design of the project road

43	May 1	SAT		KTM	Basic design of the project road
44	2	SUN		KTM	Basic design of the project road
45	3	MON		KTM	Basic design of the project road
46	4	TUE		KTM	Basic design of the project road
47	5	WEN		KTM	Basic design of the project road
48	6	THU		KTM	Basic design of the project road
49	7	FRI		KTM	Basic design of the project road
50	8	SAT		KTM	Basic design of the project road
51	9	SUN		KTM	Basic design of the project road
52	10	MON		KTM	Basic design of the project road
53	11	TUE	JICA Nepal Office	KTM	Report of the Survey result.
54	12	WEN	KTM - BKK	BKK	Messrs. Yamashita, Nakano leave KTM
55	13	THU	BKK - Tokyo		

Second Field Survey Team

S.No.	Date		Movement/Place/Agencies	Station	Activities/Name of Parson
1	June 27	SUN	Tokyo - BKK	BKK	Messrs. Yamashita, Ihara, Watanabe
2	28	MON	BKK - KTM	KTM	
3	29	TUE	JICA Nepal Office	KTM	Courtesy call
4	30	WEN	Department of Roads	KTM	Submission of Interim Report
5	July 1	THU		KTM	Internal meeting
6	2	FRI	Department of Roads	KTM	Discussion on the Interim report
7	3	SAT		KTM	Internal meeting
8	4	SUN	Department of Roads	KTM	Discussion on the Interim report
9	5	MON	Embassy of Japan JICA Nepal Office	KTM	Mr. Yamada arrive KTM. Courtesy call
10	6	TUE	National Planning Commission Ministry of Finance Ministry of Works and Transport Department of Roads	KTM	Courtesy call Discussions
11	7	WEN	Ministry of Population and Environment Department of Roads	KTM	Courtesy call Signing on the Minutes of Discussion.
	8	THU	Section 4 Site Embassy of Japan JICA Nepal Office	KTM	Site observation Reporting the result of the Minutes of Discussion
13	9	FRI	KTM - BKK	BKK	Messrs. Yamada, Yamashita, Ihara, Watanabe leave KTM.
14	10	SAT	BKK - Tokyo		

Draft Basic Design Report Explanation Team

S.No.	Date		Movement/Place/Agencies	Station	Activities/Name of Parson
1	Oct. 6	WEN	Tokyo - BKK	BKK	Messrs. Iwai, Yoshimatu, Yamashita, Shinkai
2	7	THU	BKK - KTM	KTM	
3	8	FRI	JICA Nepal Office Department of Roads	KTM	Mr. Tokugawa arrive KTM. Courtesy call Sibmission of Draft Report. Explanation of the Report
4	9	SAT	KTM - Sindhuli - Bardibas	Bardibas	Site observation of Section 2 and 1.
5	10	SUN	Bardibas - KTM	KTM	Site observation of Section 2 and 1.
6	11	MON	Ministry of Finance Ministry of Works and Transport KTM - Dhulikel	KTM	Courtesy call Site observation of Section 4.
7	12	TUE	Ministry of Population and Environment National Planning Commission	KTM	Courtesy call
8	13	WEN	Department of Roads	KTM	Signing on the Minutes of Discussion
9	14	THU		KTM	Mr. Tokugawa leave KTM. Internal meeting
10	15	FRI	KTM - BKK	BKK	Messrs. Iwai, Yoshimatu, Yamashita, Shinkai
11	16	SAT	BKK - Tokyo		