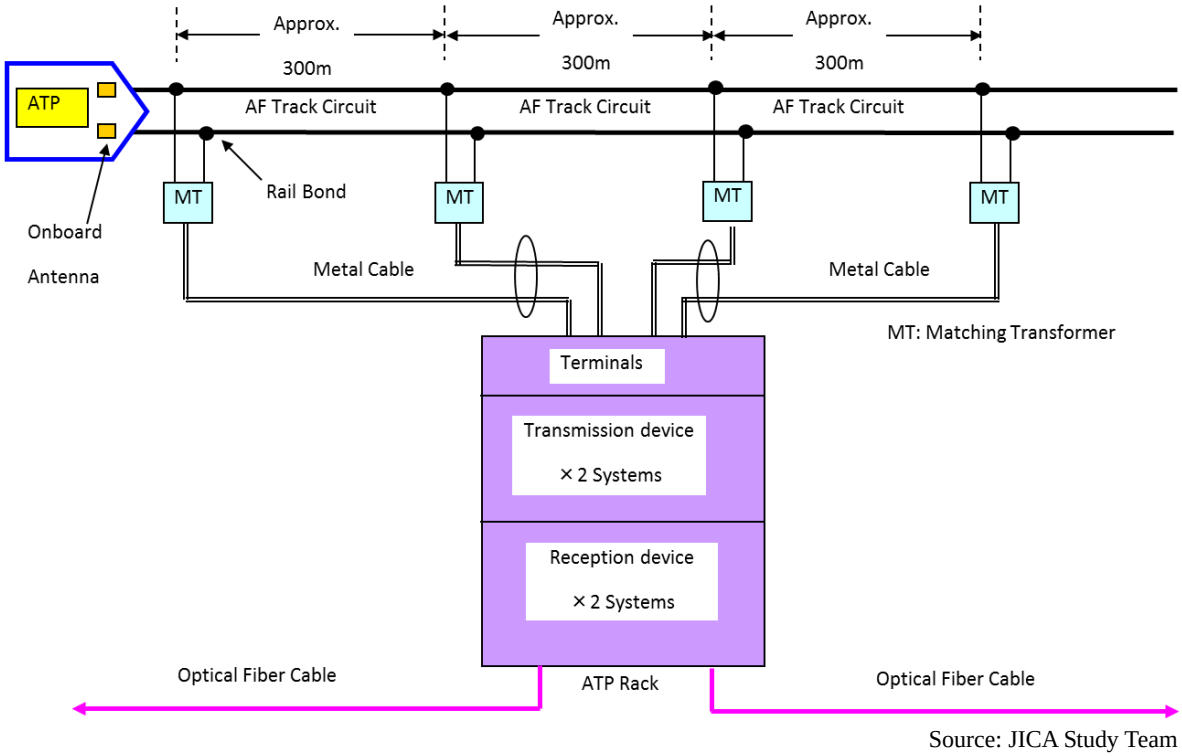
5.4 Signaling

(1) General

SAPROF-I proposed ATP/ATO using AF track circuit for train detection and signal transmission under fixed block concept. However, Communication Based Train Control (CBTC) signaling system has been applied to many urban railway projects recently. Therefore both track circuit system and CBTC system are examined and the suitable signaling system for the KCR is selected hereunder.

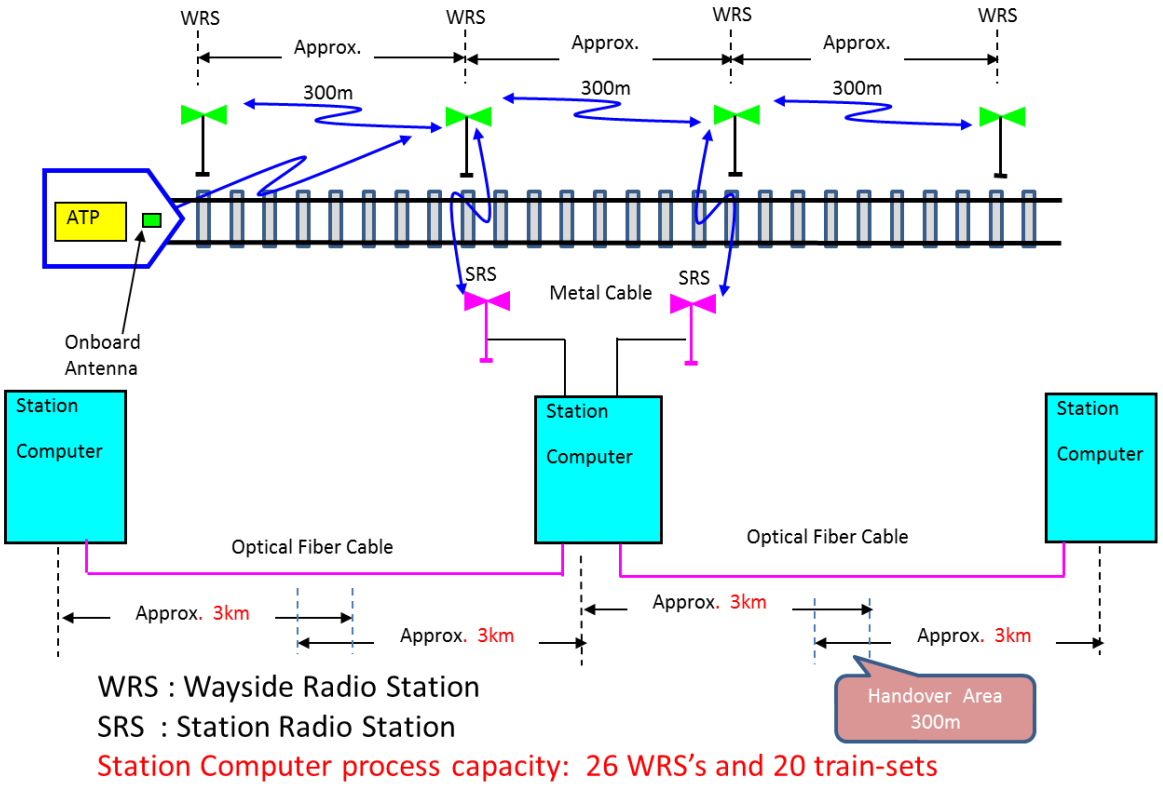
The CBTC system does not depend on facilities/equipment using track rail communication and train detection with track circuit in its train detection and inter-communication systems. Positions of all trains are detected by respective trains and the information of the position is transmitted each other by means of radio communication system. The CBTC system can easily realize moving block system as the following train can grasp the real time position of the preceding train. Owing to less facilities/equipment installed on the ground, the CBTC system requires lower cost and higher expandability. Since the CBTC system was adopted in commercial service in around 1998, the system has rapidly been spread over various urban railway projects in the world.

Typical configuration of each signaling system is presented in Figure 5.4.1 and Figure 5.4.2



Source: JICA Study Team

Figure 5.4.1 Typical Configuration of Track Circuit System

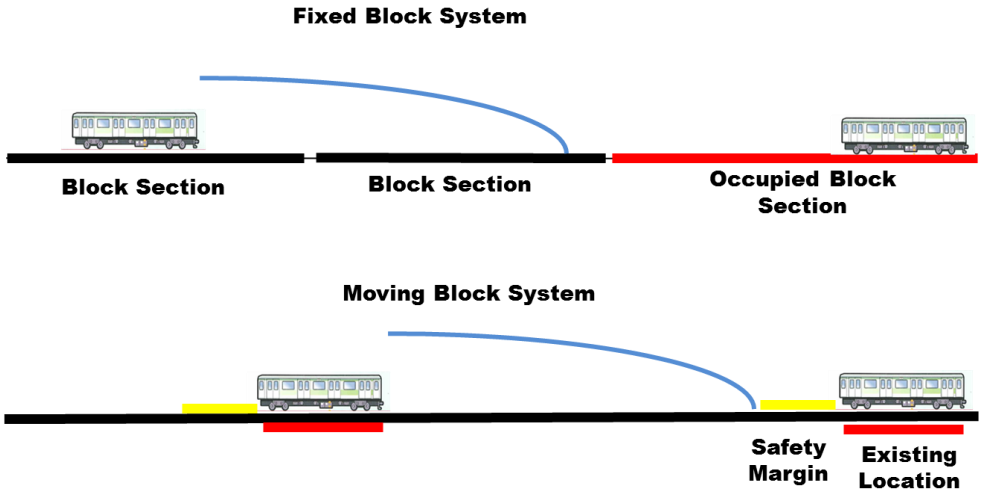


Source: JICA Study Team

Figure 5.4.2 Typical Configuration of CBTC System

(2) Advantages of CBTC System

The CBTC system utilizes on-board basis train control system with self-position detection and moving block technology, which minimizes train interval compared with conventional ground basis train control and detection system. Figure 5.4.3 shows the conceptual comparison image of interval control with respective systems.



Source: JICA Study Team

Figure 5.4.3 Interval Control with Fixed and Moving Block Systems

The CBTC system has flexible expandability in headway. When the train headway is altered in the future, ground basis train detection system requires modification works including installation of additional track circuit, impedance bond, etc. to meet the increased demand. On the other hand, the CBTC system does not require modification works with the following reasons.

- Train position is detected by itself. No track circuit is required.
- Information of the train position is transmitted with radio communication system which is installed in the initial stage without the need for additional facilities in the future.
- The signaling information between train and OCC is also made with the radio communication basis.

The number of ground system equipment for the CBTC system is fewer than that for the traditional signaling system based on conventional track circuit, which leads to less maintenance works and costs including power consumption for the CBTC system.

The initial investment cost for the CBTC system could be reduced by roughly 30% from the conventional system with AF track circuit excluding on-board cab signal equipment, the cost of which would be equivalent for both systems.

In conclusion, the CBTC system has various advantages in terms of train interval, future expandability, maintenance works and costs, and initial investment costs, without particular disadvantages against the conventional system.

(3) Standards

There are no unified international standards for the CBTC system. The following standards are applicable to specify technical requirements including safety levels:

- JIS E 3801-1 Train Control System using Radio Communication, Part1 General Requirement and Functional Requirement (Japan)
- IEEE 1474.1 Communication-Based Train Control (CBTC) Performance and Functional Requirement (USA)
- ERTMS - European Rail Traffic Management System (EU)

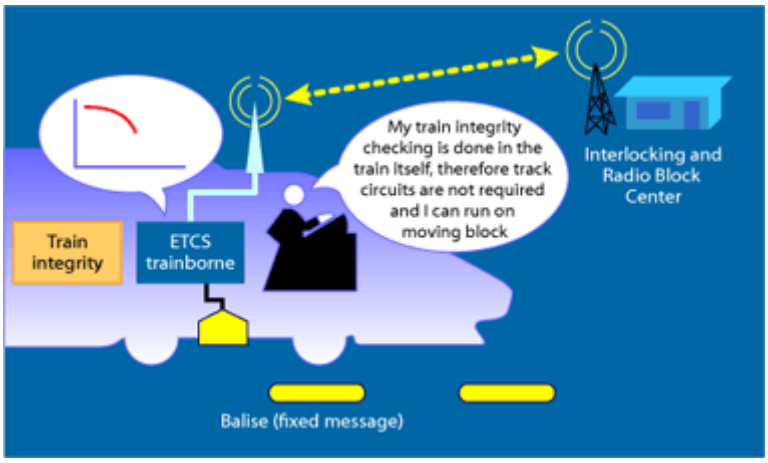
ERTMS is an initiative to enhance cross-border interoperability and the procurement of signaling equipment by creating a standard for train control and command systems in European railway system. Therefore, ETRMS is used for inter-city trains. The two main components of ERTMS are the European Train Control System (ETCS), an automatic train protection system to replace the various incompatible national safety systems, and Global System for Mobile Communications - Railway (GSM-R), an international wireless communications standard for railway communication and applications.

ERTMS defines different uses ranging from track to train communications (Level 1) to continuous communications between the train and the radio block center (Level 2), and moving block technology (Level 3) as shown in Table 5.4.1. The concept of ERTMS Level 3 which allows for the introduction of moving block system is illustrated in Figure 5.4.4.

Table 5.4.1 ERTMS Levels

ERTMS Level	Signal	Block	Train Detection	Communi-cation	Train Protection
Level 1	Wayside Signal	Fixed Block	Track Circuit	Eurobalise	Point control ATP
Level 2	Cab Signal	Fixed Block	Track Circuit	Eurobalise & GSM-R	Continuous ATP
Level 3	Cab Signal	Moving Block	On-board detection with Tachogenerator and Eurobalise	Eurobalise & GSM-R	Continuous ATP

Source: JICA Study Team



Source: www.ertms.net

Figure 5.4.4 Concept of ERTMS Level 3

(4) World Trend

The CBTC system has accumulated installation records and increasingly been adopted in recent years in the world as shown in Table 5.4.2.
The main stream of signaling system in urban railways has been shifting toward the CBTC system.

In Japan a major railway operator, JR East, introduced ATACS in Senseki Line in 2011, and announced in 2012 to invite manufacturers' proposals for the CBTC system to be installed in Joban Local Line, which is expected to be expanded to other urban lines in the future.

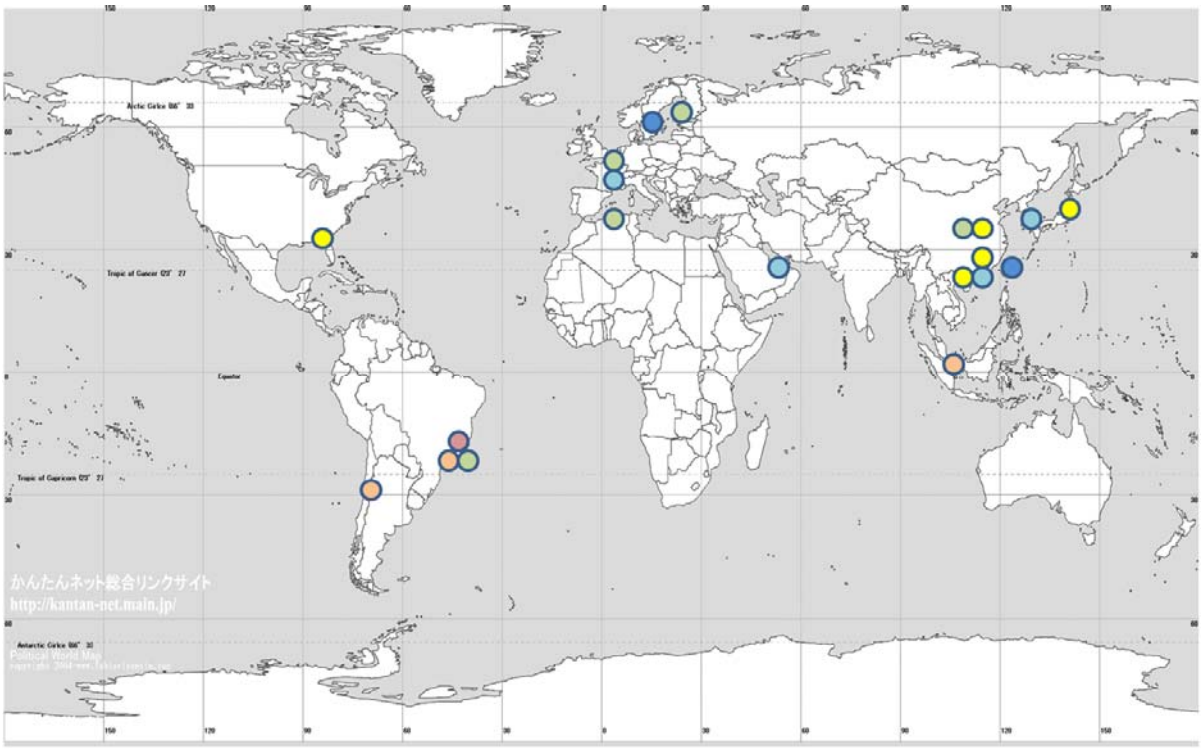
Japanese major signaling manufacturers have their own CBTC technologies: ATACS and HITAC-CBTC by Hitachi, SPARCS by Nippon Signal, and IT-ATP by Kyosan. The three manufactures will have sufficient records of installation and operation of such systems when procurement for the KCR project is made.

Table 5.4.2 Recent Records of CBTC System

Location	Line	System	Supplier	Year	Km
Yongin	Ever LineART	CITYFLO 650	Bombardier	2011	19
Shenzhen Metro		CITYFLO 650	Bombardier	2011	40
Tianjin Metro	Line 2, 3	CITYFLO 650	Bombardier	2011	52
Dubai Metro	Red Line, Green Line	SelTrac	Thales	2011	70
Seoul Metro	Bundang Line	SelTrac	Thales	2011	17
Shenyang Metro	Line 1	CBTC	Ansaldo	2011	27
JR East	Senseki Line	ATACS	Hitachi, Mitsubishi	2011	17
Chongqing Monorail	Phase 1 Phase 2	CBTC	Hitachi	2011 2011	17 39
Beijing Metro	Line15 Phase 1	SPARCS	Nippon Signal	2011	38.3
Singapore Metro	Circle	Urbalis	Alstom	2012	35
Metro Santiago	Line 1	Urbalis	Alstom	2012	20
Sao Paulo Metro	Line 1, 2, 3	Urbalis	Alstom	2012	57
Algiers Metro	Line 1	Trainguard MT CBTC	SIEMENS	2012	9
Paris Metro	Line 1	Trainguard MT CBTC	SIEMENS	2012	16
Shanghai Metro	Line 11	SelTrac RF	Thales	2012	50
Sao Paulo Commuter	Line 8, 9, 11	SIRIUS	INVENSYS	2012	107

Location	Line	System	Supplier	Year	Km
Beijing Metro	Line 15 Phase 2	SPARCS	Nippon Signal	2012	38.3
Inchen Monorail	Wolmido Eunha	SPARCS	Nippon Signal	2012	5.1
Chongqing Monorail	Phase 3	CBTC	Hitachi	2012	55
Paris Metro	Line 13	SelTracRF	Thales	2013	23
Beijing Metro	Line 8, 10	Trainguard MT CBTC	Thales	2013	49
Nanjing Metro	Line 2, 10	Trainguard MT CBTC	SIEMENS	2012	9
Helsinki Metro	Line 1	Trainguard MT CBTC	SIEMENS	2013	35
Paris Metro	Line 1	Trainguard MT CBTC	SIEMENS	2013	38
Sao Paulo Metro	Monorail Extension Line 2, 3	CITYFLO 650	Bombardier	2014	24
Incheng Metro	Line 2	SelTracRF	Thales	2014	29
Stockholm Metro	Red Line	CBTC	Ansaldo, STS	2014	41
Miami Airport	Shuttle Line	IT-ATP	Kyosan	2014	0.6
Sao Paulo Metro	Line 5	CITYFLO 650	Bombardier	2015	20
Taipei Metro	Circular	CBTC	Ansaldo	2015	15
Macao LRT		IT-ATP (K-CBTC3)	Kyosan	2015	21

Source: JICA Study Team



Source: JICA Study Team

Figure 5.4.5 Location Map of CBTC System Records

(5) Signaling System for the Project

The estimated initial investment costs of the fixed block system (AF track circuit) and the CBTC system for the project are summarized in Table 5.4.3. The use of CBTC system would reduce the initial cost by approximately 30% for main signaling system and by approximately 25% for entire signaling system.

Table 5.4.3 Cost Comparison between Fixed Block and CBTC Systems

No	Item	Fixed Block, AFTC (mil. Yen)	CBTC (mil. Yen)	Balance (mil. Yen)	Ratio of reduction
1	Main Line Signaling System	6,003	4,265	1,738	-29%
2	Depot Signaling System	1,171	784	388	-33%
3	Operation Control System	1,168	1,168	0	0%
4	Test, Commissioning and Others	1,196	890	306	-26%
5	Total	9,538	7,106	2,432	-25%

Source: JICA Study Team

In addition, the CBTC system has considerable advantages in train interval, future expandability, and maintenance works and costs. Consequently, the CBTC system is proposed for the signaling of the project.

5.5 Proposed Scope of the Project

The proposed scope of the project for Option N-A1,A2 (full development) and Option N-B1 (partial development) according to the result of the review of the preliminary design is summarized in Table 5.5.1.

Table 5.5.1 Salient Feature of the Project

Item		Option N-A1, A2	Option N-B1
Civil & Station	Route Length (total)	43.24 km	20.73 km
	On-ground	15.68 km	9.77 km
	Elevated	23.86 km	10.20 km
	Trench	2.28 km	-
	Bridge	1.42 km	0.76 km
	Number of Stations (total)	24	13
	On-ground	10	6
	Elevated	12	7
	Trench	2	-
Depot & Workshop	Total Stabling Capacity	31 trains at opening (43 trains in future)	19 trains at opening (22 trains in future)
	Wazir Mansion Depot & Workshop	19 trains at opening (23 trains in future)	15 trains at opening (18 trains in future)
	Depot-Hill Depot	4 trains at opening (10 trains in future)	4 trains at opening (4 trains in future)
	Manghopir Stabling Yard	2 trains at opening (2 trains in future)	-
	Gilani Stabling Yard	6 trains at opening (8 trains in future)	-
Track	Gauge	Standard gauge, 1435 mm	
	Rail	UIC 60 kg for main line and UIC 54 kg for depot	
	Type of Track	Ballasted track in on-ground sections Solid bed in elevated and trench sections	Ballasted track in on-ground sections Solid bed in elevated sections
Power Supply System	Grid Station (GS)	2 GS at Mauipur & KDA	1 GS at Mauipur
	Transmission Line	220 kV, Mauripur-Liyari 132 kV, KDA-Alladin Prak	220 kV, Mauripur-Liyari
	Traction Power Substation (TSS)	2 TSS at Alladin Park & Liyari	1 TSS at Liyari
	Sectioning Post (SP)	2 SP at Orangi & Karsaz	1 SSP at Karachi Cantt
	Electrification System	A/C-25kVx2 AT feeding system	
	Overhead Contact System	Simple catenary	
Signal & Telecom System	Signaling System	Automatic train operation (ATO), CBTC system	
	Telecommunication System	Fibre optic cable network, Cab radio system, CCTV system, Public addressing system, Public information display system, etc.	
Rolling Stock	Type	Electric multiple unit (EMU)	
	Train Formation	4 cars (2M2T) with 20 m long car body at opening	
	Number of Train Set	25 sets at opening	16 sets at opening
Other Facility	Fare Collection System	Automatic fare collection system	
Train Operation	Time for Train Operation	6:00 – 23:30	
	Average Speed	43 km/h	
	Headway	6-8 min. at opening	5-8 min. at opening

Source: JICA Study Team

6. REVIEW OF PROJECT SCHEDULE AND COST

6.1 Project Implementation Plan and Schedule

(1) Conditions Assumed

As an essential consideration, the completion of acquisition of land for construction is an absolute prerequisite, in advance of the commencement of the civil works. If the land take including resettlement is delayed, the overall schedule will be delayed (time overrun) as well as trigger the increase of project cost (cost overrun). In recent year, there are cases in which a road construction project was delayed, and an industrial park project was terminating due to protests by neighboring residents. The social impact arising from the implementation of mega-scale infrastructure development project such as this KCR project is substantial, and there is a high possibility that land take including resettlement issue may itself become the largest risk factor as well as the critical factor. It is advised that KUTC including all stakeholders endeavor with maximum effort for the early land take to be required for the project.

Also, interface and coordination works as following are essential role of KUTC (for KUTC execution organization, refer to Chapter 9).

a) Coordination and contribution of necessary budget by each stakeholder in timely manner.
b) Full support and contribution by Pakistan Railway (PR) for permission of land usage and prompt approval.
c) Coordinating and obtaining permissions from relevant authorities and agencies (i.e., GOS, KMC, KESC, KWSB, KPT, Custom & Tax Department, Police Department, Tax & Revenue Department, all of utility companies and so on.)
d) Social and public relation work with neighborhoods of along the KCR route.

The implementation schedule of the project has been studied based on a concept of the following works and activities being implemented in advance of the commencement of the main railway construction works:

a) Resettlement of people living inside the KCR right of way including the construction of infrastructure in the resettlement area according to the resettlement action plan and JICA guidelines.
b) Relocation of existing Pakistan Railway (PR) mainline section between Drigh Road station areas to Karachi City station areas as proposed by PR.
c) Demolition of existing KCR buildings and removal of existing railway facilities for the entire KCR route.

The delay in any of the above activities will incur the postponement of the railway construction.

(2) Critical Factors of the Resettlement Area Development Stage

The Project (For KUTC execution organization, refer to Chapter 10) aims to construct a resettlement site at Jumma Goth area near Bin Qasim industrial estate, including works involved can be generalized as:

a) Infrastructure development works (earthwork, road, foot-path, bridge, parking, paved street, ground reservoir, pump house, grid station, guard house and rivulet.)
b) Amenities construction works (primary and secondary schools, medical centre, maternity house, community centre, vocational centres, prayer places, play grounds, parks and public building)
c) Electricity (KESC) and water (KWSB) connection works
d) Electricity transmission grid installation works
e) Removal and disposal of non-hazardous solid waste and contaminated soils
f) Wastewater disposal and treatment

While the implementation of the works is desired to be completed in a short period, the JICA study team envisages that the infrastructure development works, amenities construction works and other utilities installation will be carried out in due order with a reasonable time between the commencements of each work. Since the infrastructure development works are the forerunner of the works, followed by the amenities construction works and handover to house construction by PAPs, the critical path of the whole construction schedule lies in these activities.

(3) Critical Factors for Pre-construction Stage

The KCR Project is a massive scaled project requiring a large financial investment. The Government of Pakistan is requesting the Government of Japan for Yen Loan through JICA, as self-financing and borrowing from domestic market alone are not sufficient.

The process for financing from JICA requires some time and it is mandatory to comply with their guidelines stipulating the procurement of consultants and contractors under competitive bidding procedures.

For the case of this Project, in which the application of the Special Terms for Economical Partnership (STEP) will be applied, the procurement of the consultant takes 10 months, the basic and detailed design including preparation of tender documents require the time of 24 months, and after that the total duration to complete tender for construction works, tender evaluation, negotiation with contractors, signing of contract and respective concurrences by JICA is at least 14 months.

Furthermore, the following tasks should be implemented by the Pakistan side budget and responsibility:

a) Modified PC-1 should be reviewed and revised if necessary by the Pakistan-side according to the JICA's preparatory study.
b) Extension of the validity of the approved EIA report, submission of the revised RAP, and submission of the addendum report of the IEE for Development of Juma Goth shall be completed before appraisal to be made by JICA.
c) Additional land acquisition for transmission line, substation and sectioning posts sites shall be completed.
d) All of interface issues with PR including compensation issue shall resolved before start of each activity.
e) Demolition of existing structures and clearing of land for construction shall be completed.
f) Provide required cash compensation for PAPs in case they decided not to be relocated to Resettlement Site and live in leased house.

(4) Critical Factors of the Railway Construction Stage

The railway construction is the main works of the Project, including civil & station structure, station furnishing installation works, rolling stock depot and workshop works, track installation works, power

supply system installation works, signaling and telecommunication installation works, procurement of rolling stocks, various testing, and trial operation.

The critical path of the works involved can be generalized as:

Civil works of elevated structures and stations
↓
Installation of track
↓
Installation and site testing of signaling facilities
↓
Integrated testing and commissioning
↓
Trial operation

While the implementation of the works is desired to be completed in a short period, the JICA study team envisages that the civil works, track works and signalling installation will be carried out in due order with a reasonable time between the commencements of each work. Since the civil works are the forerunner of the works, followed by the track works and signalling installation, the critical path of the whole construction schedule lies in these activities.

The length of elevated section is approx. 24.4 km, and the elevated section as well as stations is assumed to be completed effectively within 24 months with reasonable input of resources and number of work sites to be deployed along the route.

With regard to track works, the procurement of track material such as ballast, sleepers, and rail is the largest critical factor, which might affect the schedule. The project around 11,500 tons of rail, 180,000 m^3 of ballast and 150,000 pieces of PC sleepers are required to be procured.

Another main path of the construction will be:

Civil and building works of rolling stock depot and workshop
↓
Installation of depot and workshop facilities
↓
Site assembly and testing of rolling stock
↓
Integrated testing and commissioning
↓
Trial operation

Rolling stock is assumed to be procured based on ready-made design by Japanese manufacturers without substantial changes, which lead to reduce the time by the omission of manufacturing prototype cars and test running at site before mass production of rolling stock.

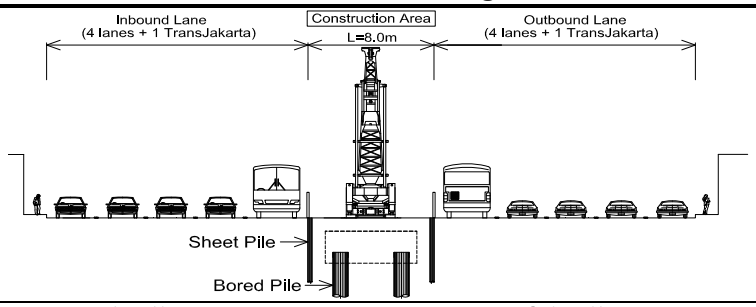
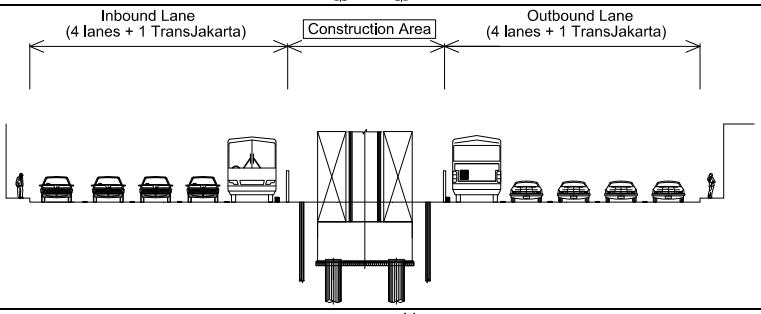
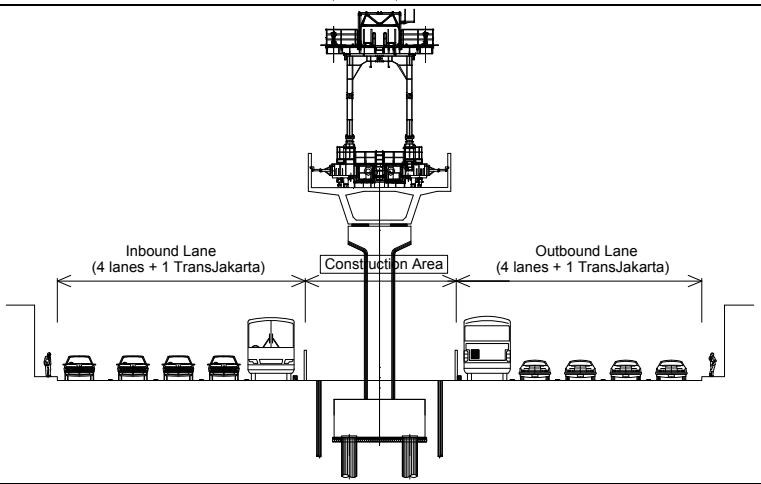
Before the delivery of rolling stock to the site, depot and workshop including necessary equipment and building must substantially be completed to assemble, test and adjust the rolling stock.

The critical path and work sequences are detailed in Figure 6.1.4.

(5) Typical Construction Method for Elevated Section

Following is a sample construction method of elevated structures (girder viaduct) including associate works. Note that the structure type and construction method introduced herein may be changed in the next basic design stage according to the detailed engineering examinations.

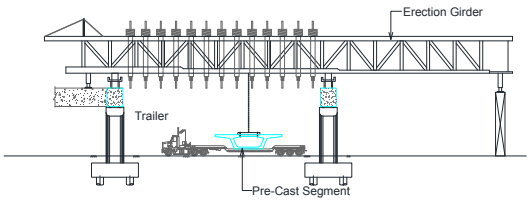
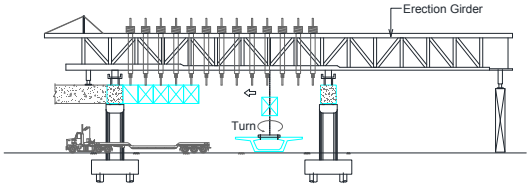
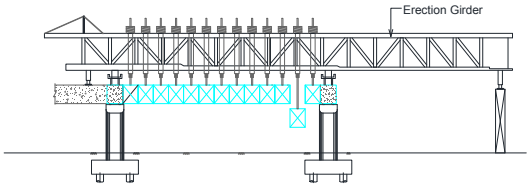
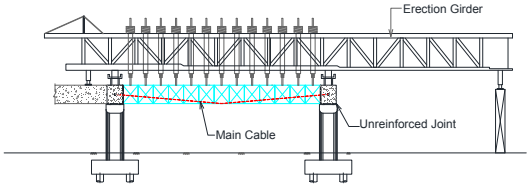
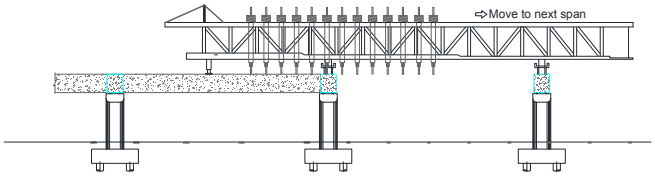
The following figure shows general steps for the construction of foundation and substructure of the viaduct, together with a traffic diversion plan. The substructure of the viaduct is a common civil structure and needs no special construction method. However, depending on the ROW of existing roads, either temporary road deck installation or reduction of working area during the daytime will be necessary to maintain the number of traffic lanes, since piling machine occupies wide space on existing road when bored pile construction is adopted.

Step	Cross Sectional Image	Description
1		1. Utility relocation 2. Traffic diversion 3. Sheet piling 4. Bored piling
2		1. Traffic diversion 2. Excavation 3. Foundation concrete work 4. Column concrete work 5. Backfill
3		1. Superstructure (Precast box girder installation)

Source: JICA Study Team

Figure 6.1.1 Viaduct Construction Steps

For the superstructure of viaduct, the span-by-span method is expected to be applied for similar reasons as that for substructure, i.e., to maintain the number of current traffic lane and minimize the impact along the proposed alignment. Precast segments manufactured span by span at the factory or at site will be hung and installed using erection girder, and tensioned and unified using PC steel bars. It is recommended that the precast segments be transported at night time when traffic is less to avoid negative impact to the road traffic. The steps for carrying out girder construction are shown in Figure 6.1.2.

STEP 1 <Transportation>		-Transport Pre-cast segment to the site from stock yard.
STEP 2 <Installation>		-Install the pre-cast segments temporarily by hanging them with erection girder.
STEP 3 <Jointing>		-Unite all the segments tight together using steel bars after applying adhesion bond.
STEP 4 <Tensioning>		-Cast concrete to unreinforced joint between spans. -Install main cables and compress all the segments by tensioning the steel cables.
STEP 5 <Equipment Transfer>		-Move and install the erection girder to the next span.

Remark: I- beams may be used instead of segmental girders where sufficient work area is available for erection works.

Source: JICA Study Team

Figure 6.1.2 Girder Construction Steps

(6) Preliminary Schedule for Implementation of the Project

Taking into account the above mentioned issues, the assumed implementation schedule for the proposed project scope Option N-A1 is prepared as shown in Figure 6.1.3 as well as the detailed implementation schedule is presented in Figure 6.1.4.

The total duration to implement the Backup Option N-B1 will be similar to Option N-A1.

(7) Phased Implementation Plan

Concerning the potential risks of implement for mega size project like the KCR project, it shall be taking account of alternative plan of phased development instead of entire project. The following risks are conceivable:

a) Huge amount of initial investment funding will be involved.
b) Lack of experience in operation of urban railway.
c) Passenger demand forecast risk.
d) Safe and security operation risk.
e) KESC's power demand forecast and supply capacity risk.

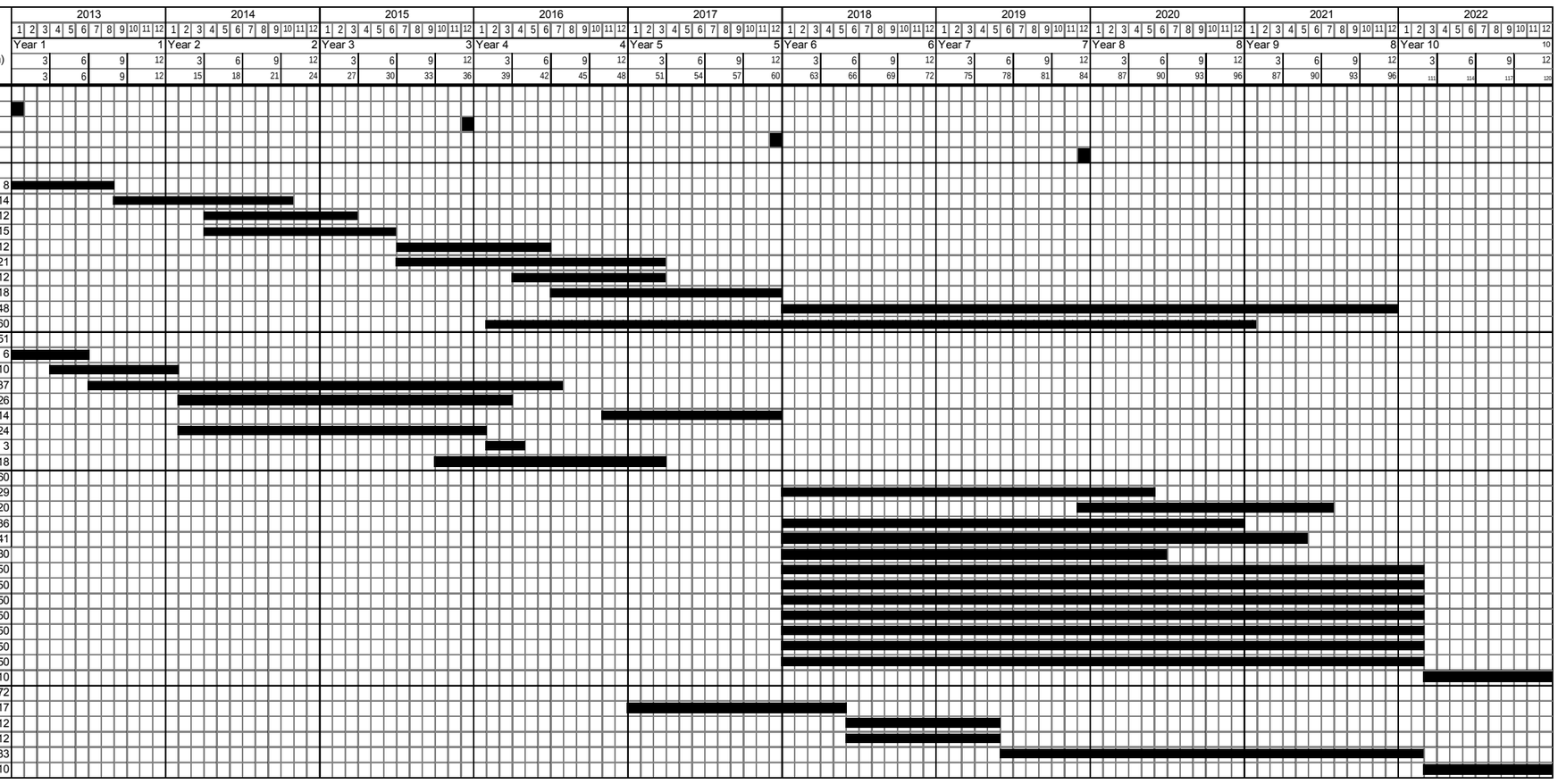
Taking the above into account, the following phased implementation plan is recommendable to reduce these risks to the acceptable and practical level:

1. Based on the results of recent demand forecast study, first development phase will be Drigh Road station to Shah Abdul Latif station. (Option N-B1)
2. Implementation schedule of Option N-B1 will be same as Option N-A1 which will be start of operation in end of year 2022.
3. Second phase, remaining circular section will implement after confirmation of improvement of operation & maintenance skills and sustainable passenger demands. It will be probably takes five years after start of operation.

KCR IMPLEMENTATION SCHEDULE

Note: Calender year and month are subject to the timing of appraisal, which is yet to be scheduled.

No.	Activity	Duration (month)
Loan Agreement		
	1st L/A Resettlement Consultant, Resettlement Site, GC, Preparatory Work	
	2nd L/A Railway Construction #1	
	3rd L/A Railway Construction #2	
	4th L/A Railway Construction #3	
01	**Resettlement**	
0101	Selection of Design, Project Management and Monitoring Consultants	8
0102	Detailed Designing of Resettlement Areas	14
0103	Pre-Contsruction Phase	12
0104	Selection of the Contractor	15
0105	Construction of Boundary Wall and Amenities	12
0106	Construction of the Infrastructure for Resettlement Area	21
0107	Construction of Houses	12
0108	Resettlement Operation	18
0109	Livelihood Rehabilitation	48
0110	Monitoring and Grievance Redressal	60
02	**Pre-construction Stage**	51
0201	Institutional Development	6
0202	Selection of General Consultant	10
0203	Land Preparation / Acquisition / Transfer	37
0204	Shifting of PR lines	26
0205	Demolition of Existing Structures and Construction of protectin walls	14
0206	Basic and Detailed Engineering Design	24
0207	Approval of Drawings	3
0208	Employment of Contractors	18
03	**Construction Stage**	60
0301	Structure and Station Civil Work	29
0302	Station Architectural and E&M Work	20
0303	Rolling Stock Depot and Workshop Civil & Buiding Work	36
0304	Track Work	41
0305	Transmission Line	30
0306	Power Supply System	50
0307	Overhead Catenary System	50
0308	Signalling System	50
0309	Telecommunication System	50
0310	Depot and Workshop Equipment	50
0311	Automatic Fare Collection	50
0312	Rolling Stock	50
0313	Testing and Commissioning	10
04	**Operation and Maintenance Stage**	72
0401	Studies on O&M Preparation	17
0402	Establishment of O&M company	12
0403	Setting up KUTC operational organization	12
0404	Setting up O&M company and staff training	33
0405	Training in Operation	10



Remarks: The above schedules of resettlement site development and resettlement implementation are tentative and may be changed according to the ongoing study on resettlement site development.

Source: ICA Study Team

Figure 6.1.3 Summarized Project Implementation Schedule for Option N-A1

KCR IMPLEMENTATION SCHEDULE

Note: Calender year and month are subject to the timing of appraisal, which is yet to be scheduled.

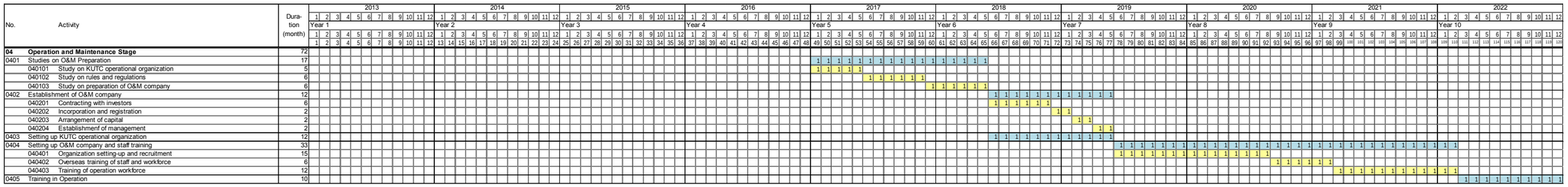
No.	Activity	Duration (month)
Loan Agreement		
	1st L/A	Resettlement Consultant, Resettlement Site, GC, Preparatory Work
	2nd L/A	Railway Construction #1
	3rd L/A	Railway Construction #2
	4th L/A	Railway Construction #3
01	**Resettlement**	
0101	Selection of Design, Project Management and Monitoring Consultants	8
	010101	Expression of interest
	010102	Submission of proposal
	010103	Evaluation of the consultants
	010104	Contract negotiation and signing of the contract
0102	Detailed Designing of Resettlement Areas	14
	010201	Additional surveys
	010202	Layout of resettlement plots
	010203	Detailed design of houses
	010204	Designing of water supply/ sewage system / wastewater treatment plant
	010205	Designing of electricity supply system
	010206	Designing of telephone and gas system
	010207	Designing of amenity spaces
	010208	Detailed design of road and storm water drainage
0103	Pre-Contsruction Phase	12
	010301	Disposal of ponded water
	010302	Disposal of industrial non-hazardous waste
	010303	Removal of contaminated top soil including municipal solid waste
0104	Selection of the Contractor	15
	010401	Preparation of contract documents
	010402	Expression of interest
	010403	Submission of tender
	010404	Evaluation of tender submission
	010405	Contract negotiation and signing of the contract
	010406	Contractor mobilization
0105	Construction of Boundary Wall and Amenities	12
	010501	Construction of boundary wall
	010502	Construction of educational facilities
	010503	Construction of public buildings
	010504	Construction of open / recreational spaces and parking facilities
0106	Construction of the Infrastructure for Resettlement Area	21
	010601	Infrastructure, electricty, gas, water supply for sector 08-1
	010602	Infrastructure, electricty, gas, water supply for sector 08-2
	010603	Infrastructure, electricty, gas, water supply for sector 08-3
	010604	Infrastructure, electricty, gas, water supply for sector 08-4
	010605	Infrastructure, electricty, gas, water supply for sector 08-5
	010606	Infrastructure, electricty, gas, water supply for sector 08-6
	010607	Infrastructure, electricty, gas, water supply for sector 08-7
	010608	Infrastructure, electricty, gas, water supply for sector 08-8
	010609	Infrastructure, electricty, gas, water supply for commercial sector 1
	010610	Infrastructure, electricty, gas, water supply for commercial sector 2
	010611	Construction of solid waste management system
	010612	Construction of drainage system
	010613	Construction & commisioning of wastewater treatment plant
0107	Construction of Houses	12
	010701	Housing Complex for Sector 08-1 and 2
	010702	Housing Complex for Sector 08-3 and 4
	010703	Housing Complex for Sector 08-5
	010704	Housing Complex for Sector 08-6
	010705	Housing Complex for Sector 08-7
	010706	Housing Complex for Sector 08-8
0108	Resettlement Operation	18
	010801	Public consultation
	010802	Confirmation of the Inventory of PAPs through census survey
	010803	Issue ID cards
	010804	Disbursement of compensation payment
	010805	Resettlement operation for Sector 08-1
	010806	Resettlement operation for Sector 08-2
	010807	Resettlement operation for Sector 08-3
	010808	Resettlement operation for Sector 08-4
	010809	Resettlement operation for Sector 08-5
	010810	Resettlement operation for Sector 08-6
	010811	Resettlement operation for Sector 08-7
	010812	Resettlement operation for Sector 08-8
0109	Livelihood Rehabilitation	48
	010901	Hiring and establishment of livelihood rehabilitation team
	010902	Assessment of current economic patterns and need
	010903	Planning of livelihood rehabilitation program
	010904	Livelihood consultation for PAPs
	010905	Preparation of eligibility criteria of NGOs
	010906	Meeting with officials of NGOs
	010907	Application by NGOs (letter of intent)
	010908	Field visit
	010909	Selection of NGOs
	010910	Signing of final agreement with NGOs
0110	Monitoring and Grievance Redressal	60
	011001	Hiring and establishment of monitoring team
	011002	Preparation of mitigation plans
	011003	Approval of mitigation plans
	011004	Implementation of mitigation measures

No.	Activity	Duration (month)
02	**Pre-construction Stage**	51
0201	Institutional Development	6
	020101 Prepare/Approved Institutional Development and Organization Plan(s)	0
	020102 Release of funds for running PMO	
	020103 Establish Project Management Office and Mobilize	2
	020104 Hiring and Mobilization of PMO Team	5
0202	Selection of General Consultant	10
	020201 Preparation of RFP document	2
	020202 JICA Review and Concurrence for RFP document	1
	020203 Preparation of short list	1
	020204 JICA Review and Concurrence for short list of consultant	0.5
	020205 Submission of proposals	2
	020206 Technical evaluation	1
	020207 JICA Review and Concurrence for technical evaluation	1
	020208 Financial evaluation	1
	020209 JICA Review and Concurrence for final evaluation	0.5
	020210 Negotiation and signing of contract	1
	020211 JICA Review and Concurrence for contract	0.5
	020212 Issuance of Letter of Intent / Notice to Proceed	0
0203	Land Preparation / Acquisition / Transfer	37
	020301 Transfer / leasing of PR-owned land	0
	020302 Identify and secure land for temporary storage	0
	020303 Land acquisition for Alladin Park Power Service Station	12
	020304 Land acquisition for Lyari Power Service Station	12
	020305 Land acquisition for Karsaz Power Sectioning Post from KW&SB	12
	020306 Land acquisition for power T/L between KESC-GSs and KCR-TSSs	24
0204	Shifting of PR lines	26
	020401 Survey	1
	020402 Design, consruction planning, scheduling and costing	3
	020403 Approval of design	2
	020404 Prequalification Documents	2
	020405 JICA Review and Concurrence	1
	020406 Prequalification	2
	020407 JICA Review and Concurrence	1
	020408 Tender Documents	2
	020409 JICA Review and Concurrence	1
	020410 Tender	2
	020411 Technical evaluation	2
	020412 JICA Review and Concurrence	1
	020413 Financial evaluation	1
	020414 JICA Review and Concurrence	0.5
	020415 Negotiation and contracting	1
	020416 JICA Review and Concurrence	0.5
	020417 Civil work (earth work, bridge, track work, etc.)	8
	020418 Provision of signaling systems	6
	020419 Provision of telecommunication systems	6
	020420 Test runs	3
	020421 Slewing and connecting with new track	1
0205	Demolition of Existing Structures and Construction of protectin walls	14
	020501 Survey	1
	020502 Design, consruction planning, scheduling and costing	1
	020503 Approval of design	1
	020504 Prequalification Documents	0
	020505 JICA Review and Concurrence	0
	020506 Prequalification	1
	020507 JICA Review and Concurrence	1
	020508 Tender Documents	1
	020509 JICA Review and Concurrence	0
	020510 Tender	1
	020511 Technical evaluation	1
	020512 JICA Review and Concurrence	1
	020513 Financial evaluation	0.5
	020514 JICA Review and Concurrence	1
	020515 Negotiation and contracting	1
	020516 JICA Review and Concurrence	0.5
	020517 Clearing of land for commencement of civil work	6
0206	Basic and Detailed Engineering Design	24
	020601 Additional survey	6
	020602 Design criteria	2
	020603 Preliminary design and approval	5
	020604 Basic design of civil and building work	9
	020605 Detailed design of civil and building work	9
	020606 Basic design of railway system	9
	020607 Construction planning and scheduling	6
	020608 Construction cost estimate	9
	020609 Prequalification documents	3
	020610 Tender documents	9
0207	Approval of Drawings	3
0208	Employment of Contractors	18
	020801 JICA Review and Concurrence of prequalification documents	1
	020802 Prequalification announcement and application	2
	020803 Prequalification evaluation and approval	1
	020804 JICA Review and Concurrence of prequalification evaluation	1
	020805 JICA Review and Concurrence of tender documents	1
	020806 Invitation for Tender	1
	020807 Pre-bid Meeting and Q&A	4
	020808 Submission of tender	6
	020809 Technical evaluation	2
	020810 JICA Review and Concurrence for technical evaluation	1
	020811 Financial evaluation	1
	020812 JICA Review and Concurrence for final evaluation	1
	020813 Negotiation and signing of contract	1
	020814 JICA Review and Concurrence for contract	1

Assuming done by signing L/A

Assuming the package is less than 1 billion yen

No.	Activity	Duration (month)
03	**Construction Stage**	60
0301	Structure and Station Civil Work	29
	030101 Mobilisation and temporary works	6
	030102 Clearing and relocation of existing structures	6
	030103 At-grade structure (14 km)	12
	030104 Elevated structure (21 km)	24
	030105 Trench structure (3 km)	24
	030106 Station structure (24 stations)	24
0302	Station Architectural and E&M Work	20
	030201 Detailed specifications of materials & equipment	4
	030202 Review and approval of detailed specifications	2
	030203 Architectural work	10
	030204 E&M work	10
	030205 Site testing	4
0303	Rolling Stock Depot and Workshop Civil & Buiding Work	36
	030301 Mobilisation and temporary works	6
	030302 Clearing and relocation of existing structures	6
	030303 Earth work	3
	030304 Foundation work	3
	030305 Structures	7
	030306 Building architectural work	10
	030307 Building E&M work	8
0304	Track Work	41
	030401 Preliminary design	3
	030402 Review and approval of preliminary design	2
	030403 Detailed technical design	12
	030404 Review and approval of detailed design	4
	030405 Manufacturing	21
	030406 Shipping and delivery	12
	030407 Installation of track for at-grade and elevated sections	13
	030408 Installation of track for trench section	5
	030409 Installation of track for depot and workshop	8
	030410 Site testing	13
0305	Transmission Line	30
	030501 Preliminary design	3
	030502 Review and approval of preliminary design	2
	030503 Detailed technical design	9
	030504 Review and approval of detailed design	4
	030505 Manufacturing	10
	030506 Shipping and delivery	5
	030507 Installation of facility for transmission line	12
	030508 Site testing	5
0306	Power Supply System	50
	030601 Preliminary design	4
	030602 Review and approval of preliminary design	2
	030603 Detailed technical design	12
	030604 Review and approval of detailed design	4
	030605 Manufacturing	18
	030606 Shipping and delivery	18
	030607 Installation of facility for substations	6
	030608 Installation of main circuit facilities and control cable	6
	030609 Installation of SCADA	12
	030610 Installation of lightening and earthing	11
	030611 Site testing	10
0307	Overhead Catenary System	50
	030701 Preliminary design	3
	030702 Review and approval of preliminary design	2
	030703 Detailed technical design	9
	030704 Review and approval of detailed design	4
	030705 Manufacturing	15
	030706 Shipping and delivery	8
	030707 Installation of supporting structure	12
	030708 Installation of feeder cable and other facilities	6
	030709 Site testing	6
0308	Signalling System	50
	030801 Preliminary design	3
	030802 Review and approval of preliminary design	2
	030803 Detailed technical design	13
	030804 Review and approval of detailed design	7
	030805 Signalling facilities	21
	030806 Main facilities at electric room	21
	030807 Site testing	14
0309	Telecommunication System	50
	030901 Preliminary design	3
	030902 Review and approval of preliminary design	2
	030903 Detailed technical design	13
	030904 Review and approval of detailed design	7
	030905 Telecommunication cable and LCX	16
	030906 Main facilities at electric room	18
	030907 Site testing	5
0310	Depot and Workshop Equipment	50
	031001 Preliminary design	5
	031002 Review and approval of preliminary design	2
	031003 Detailed technical specifications	14
	031004 Review and approval of specifications	3
	031005 All facilities in yard and CTC	28
	031006 Site testing	14
0311	Automatic Fare Collection	50
	031101 Preliminary design	3
	031102 Review and approval of preliminary design	2
	031103 Detailed technical design	12
	031104 Review and approval of detailed design	2
	031105 Manufacturing	23
	031106 Shipping and delivery	2
	031107 Installation	4
	031108 Site testing	2
0312	Rolling Stock	50
	031201 Preliminary design	3
	031202 Review and approval of preliminary design	2
	031203 Detailed technical design	13
	031204 Review and approval of detailed design	2
	031205 Manufacturing train sets No. 1 to 4	16
	031206 Manufacturing train sets No. 5 to 8	16
	031207 Manufacturing train sets No. 9 to 12	16
	031208 Manufacturing train sets No. 13 to 16	16
	031209 Manufacturing train sets No. 17 to 20	16
	031210 Manufacturing train sets No. 21 to 25	16
	031211 Shipping and delivery	12
	031212 Site testing	12
0313	Testing and Commissioning	10
	031301 Integrated testing and commissioning	4
	031302 Trial operation	6



Remarks: The above schedules of resettlement site development and resettlement implementation are tentative and may be changed according to the ongoing study on resettlement site development.

Source: ICA Study Team

Figure 6.1.4 Detailed Project Implementation Schedule for Option N-A1

6.2 Project Cost

To ensure fairness of procurement process as well as project implementation, information should not be disclosed for a fixed period.

6.3 Additional Investment due to Demand Increase and Replacement of Facilities

To ensure fairness of procurement process as well as project implementation, information should not be disclosed for a fixed period.

6.4 Contract Packages

To ensure fairness of procurement process as well as project implementation, information should not be disclosed for a fixed period.

6.5 Japanese ODA Loan

6.5.1 Introduction of JICA STEP Loan

Based on discussion with the executing agency (KUTC), it is essential to apply the Japanese ODA loan for this project other than the another international funding agencies, such as World Bank and or Asian Development Bank. Thus, the KCR project will be executed on the assumption of provision of JICA STEP Loan. The explanation of JICA STEP Loan is published on the web site of Ministry of Economy, Trade and Industry (hereinafter refer to as METI) and summarized below.

Terms and Conditions of STEP

- Interest rate : 0.2 % (0.01 % for consulting service)
- Repayment period : 40 years (including 10 year grace period)

Procurement Conditions

- A prime contractor is tied to Japanese firms.
- A joint venture (JV) with firms of a recipient country is also admitted on conditions that a Japanese firm is a leading company.
- Sub-contractors are untied and opened to all countries.

Country of Origin of Goods and Services procured under STEP

- Total cost of goods and services procured from Japan shall be not less than 30% of the total amount of contract(s) (excluding consulting services) financed by a STEP Loan.
- Total project cost can be fully covered by a STEP Loan (taxes, duties, cost of land acquisition and compensation for resettlement, administration cost cannot be covered.)
- To secure fair procurement process, procurements shall be audited by a special third party after a bid process is completed, by utilizing Japanese ODA Loan or JICA special assistance facility.

Calculation of Procurement Ratio

- Either (a) “Goods and Services” or (b) “Goods only” terms shall be determined before the pledge, according to the following.
- In case of projects which advanced technologies and/or know-how of Japanese firms can be identified in services (e.g. construction methods), not only goods but also services must be included in the ratio mentioned.
- In case of projects which consist of mainly the installation of goods or plants, and their core technologies can be identified in goods or plants, only goods shall be included in the ratio mentioned.

Commitment Charge

- As Japanese ODA loans are made possible by using the public funds in Japan, to promote the early realization of the project effects and to increase the incentive of implementing the project within the set date, commitment charge will be accrued from 120 days after the signing of the Loan Agreement (L/A). If L/A is not effectuated within 120 days from the signing date, the commitment charge accrued up until the date the L/A comes into effect should be retroactively paid on the date when first repayment under the L/A should be made. However, the charge for disbursement (0.1%) which automatically charged for every Japanese ODA loan project previously was abolished.
- The amount of the charge to be paid should be calculated on the pro rata daily basis in accordance with the following formula:
- "0.1% x the amount of unused balance (loan commitment amount in the Loan Agreement minus already disbursed amount) x actual date / 365".

6.5.2 Recommendable Items for STEP Component

To ensure fairness of procurement process as well as project implementation, information should not be disclosed for a fixed period.

7. REVIEW OF O&M PLAN

In the Special Assistance for Project Formulation for the Karachi Circular Railway Project or hereinafter referred to as SAPROF-(I), three O&M schemes were evaluated in consideration of KUTC's administrative capacity, cost impact of O&M works, and introduction of modern urban railway system.

As a result, a hybrid scheme was suggested for KCR, which consists of the franchise contract under KUTC control and the concession contract with O&M companies such as the Singapore Mass Rapid Transit (SMRT) 2nd stage (since 1998 April) and the Dockland Light Railway in London (DLR). The suggestion was accepted by KUTC and expected to be adopted for the KCR Project.

The Dubai Roads and Transport Authority (RTA)signed an agreement with Serco Group plc, which is the private operator of DLR, to operate and maintain the first two lines of the Dubai Metro which covered 76 km in 2008 with contract valued at about £500 million. It was found out that the cost of outsourcing O&M railway works on concession basis is higher than expected based on the information obtained from the O&M of the Dubai Metro.

Thus, an O&M scheme should be considered taking into consideration the cost of O&M works and O&M level required for KCR. The O&M framework, and a revenue and expenditure plan for KCR were considered in the study based on the result of Asian cities' urban railways survey, which was conducted to survey the existing conditions of mass rapid transit (MRT) O&M in Asian cities.

7.1 Survey on Urban Railways in Asian Cities

(1) Subjects of the Asian Urban Railways Survey

The Singapore Metro and the Delhi Metro were selected as the subject of Asian cities' urban railway survey because they maintain a favorable financial standing and are considered to be preferable for reference of the O&M framework of KCR. The O&M survey methodology conducted for the Singapore Metro and the Delhi Metro were the form of an interview and questionnaire. Moreover, the O&M survey conducted for the Tsukuba Express (TX) which is operated in Japan as reference to carry out a more in-depth study. The survey target railways, methods, and other items are outlined below.

Table 7.1.1 Summary of Surveyed Urban Railways

Name of City	Singapore		Delhi	Tokyo
Construction	LTA (Land Transport Authority)		DMRC (Delhi Metro Rail Co. Ltd.)	TX (Tsukuba Express, Metropolitan Intercity Railway Co.)
O&M Company	SMRT (Singapore Mass Rapid Transit Co. Ltd)	SBS (SBS Transit Ltd)		
Starting Year of Operation	1987	2003	2002	2005
Number of Lines and Stations	3 lines, 70 stations	1 line, 16 stations	6 lines, 146 stations	1 line, 20 stations
Total Length	110 km	20 km	167 km	58 km
Number of Passengers /Year	604 million	138 million	611 million	103 million

Source: Annual Report of Each MRT Company, 2011

(2) Survey Method

The survey was conducted through an interview and questionnaire prepared based on the O&M condition of the target railways to collect O&M data and information.

(3) Survey Items

In the O&M survey, the following information and data in relation to the O&M of urban railways were collected:

(a) Organizational structure,
(b) Key operating data, (e.g., total passenger/km, total car/km operated, ridership, power consumption of railcar/km, price of electrical power/kilowatt-hour, and so on),
(c) Demand forecast and actual records of passenger,
(d) Cost-sharing arrangement on the construction,
(e) O&M cost
(f) Revenue and expenditure,
(g) Non-rail business and land acquisition related to non-rail business,
(h) Outsourcing,
(i) O&M scheme, and
(j) Government grants.

7.1.1 Singapore

The information contains information of particular firms/institutions; information should not be disclosed for a fixed period.

7.1.2 India (Delhi)

The information contains information of particular firms/institutions; information should not be disclosed for a fixed period.

7.1.3 Tsukuba Express (TX)

The information contains information of particular firms/institutions; information should not be disclosed for a fixed period.

7.1.4 Applying Asian Urban Railway Survey Results to KCR

JICA Study Team conducted urban railway survey in Asian cities, Singapore, Delhi, and Tokyo. The results of survey could not apply to KCR directly. However, KCR could refer to some aspects as O&M scheme, safety operation policy and risk management. The detail discussions describe in Section 7.2, 7.2.2, 7.6.2 and 7.6.3.

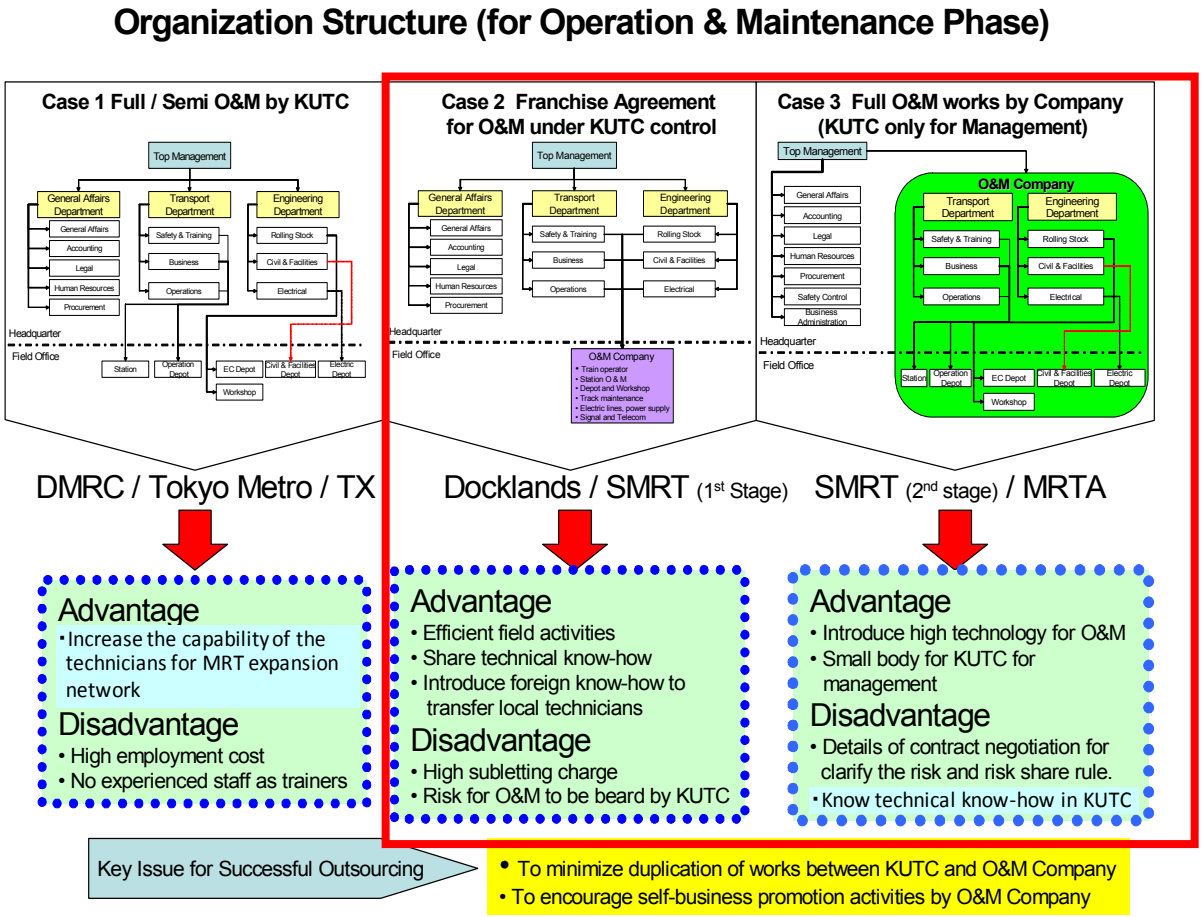
7.2 O&M Scheme and Organization of KCR

7.2.1 Proposed O&M Scheme

JICA Study Team proposed the O&M scheme for KCR comparing with the one in the former study, SAPROF (I). In the SAPROF (I), a hybrid scheme between franchise contract and concessionaire contract was proposed. However, it has some risks for KUTC to implement O&M of KCR. The O&M scheme proposed in this study is based on a consignment contract between KUTC and O&M company. It deals with the risks and enables KUTC to conduct O&M of KCR sustainably.

(1) Risks of Hybrid Scheme proposed in the SAPROF (I)

SAPROF (I) suggested the hybrid scheme consisting of Case-2 (franchise contract) and Case-3 (concessionaire contract) in consideration of the uncertainty of KCR operation in the initial stage as the figure below indicates. It was recommended that franchise contract for the KCR operation should be made 2 to 3 years from the start of the KCR opening. Moreover, it was suggested that KUTC should change the initial contract from franchise to a concessionaire with a foreign railway operator. Case-2 and Case-3 are shown below.



Source: SAPROF for KCR Project in the Islamic Republic of Pakistan (SAPROF(I))

Figure 7.2.1 O&M Scheme Alternatives where Case-2 and Case-3 are Proposed in SAPROF (I)

However, the demand forecast reviewed in this study was smaller than the one estimated in the SAPROF (I). According to this issue, the following risks would appear in case KUTC adopts the hybrid scheme between franchise contract and concessionaire contract.

Risk ①: It would be difficult for KUTC to make a concession contract with a foreign railway O&M company because there is a risk of fluctuation in demand due to demand forecast accuracy.

Currently, it has not been reported there are railway O&M companies in developed countries who intended to conduct the O&M of KCR. Any concession contracts have not been made recently unless an implementation body takes the ridership risk and implements countermeasures in accordance with the risks of O&M for a sustainable operation as a public transportation.

Risk ②: It will need enormous expenses to make a concession contract between KUTC and a foreign railway O&M company of developed countries due to a demand risk. For example, Dubai Metro spends about US$ 49 million only for personnel costs in its O&M.

Risk ③: Railway O&M companies in emerging countries would be interested in the O&M of KCR despite the risk of demand. However, they may withdraw from the O&M of KCR as the risk factors become apparent. If such withdrawal occurs, accumulation of any know-how and knowledge of O&M will be stopped in KUTC rendering the possibility of KCR not to operate sustainably.

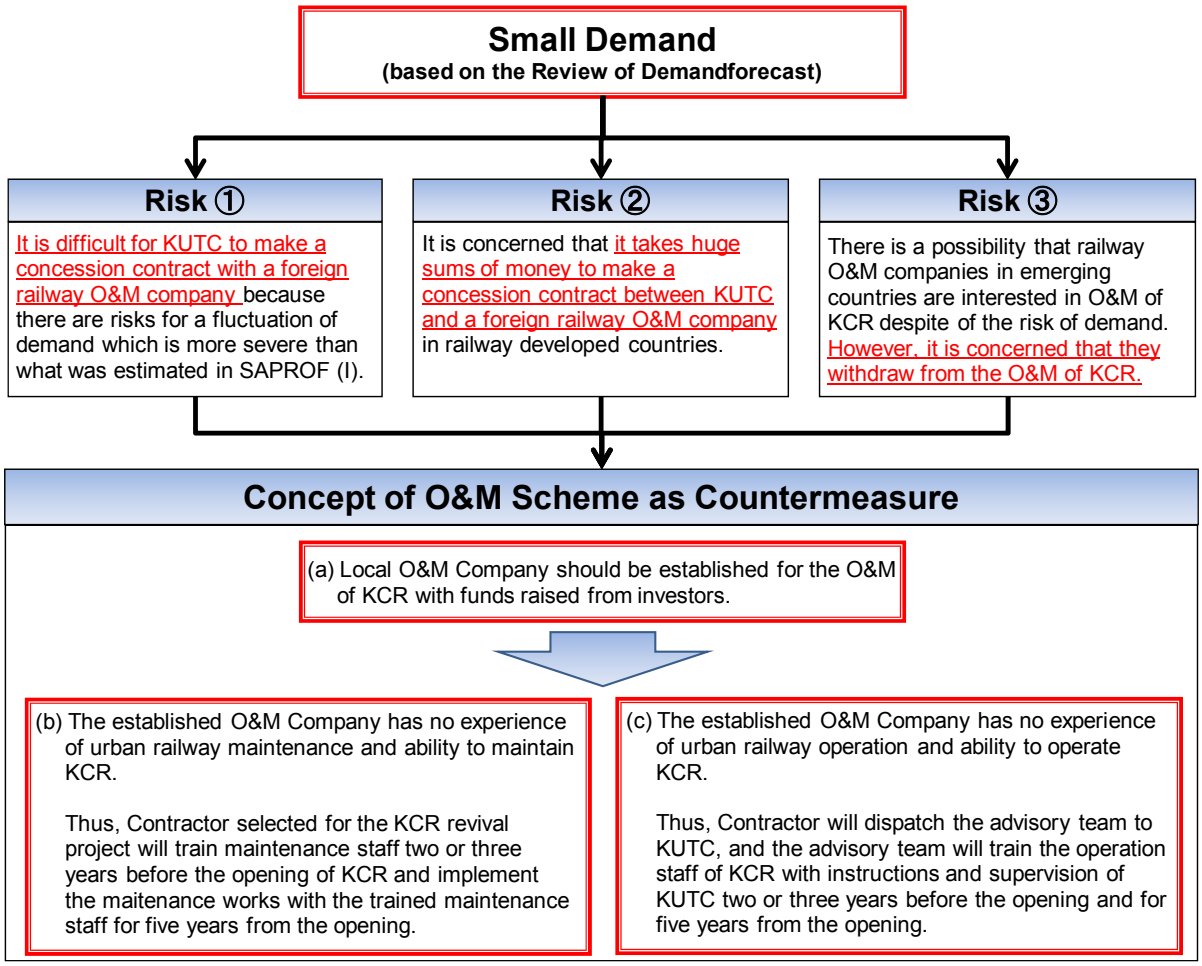
Therefore, the concept of O&M scheme was taken into account for the risks mentioned above as follows;

(a) A local private O&M company should be established for the O&M of KCR and employ O&M staff under a support of contractor.

(b) Since the O&M company has no experience in urban railway O&M, their operation staff will be trained under the assistance of Advisory Team which the contractor will organize for the KCR revival project. The training will be conducted for three years and provide maintenance manuals/textbooks prior the opening of KCR. The Advisory Team will and assist in the operation works based on their know-how and knowledge for five years after the opening. The tasks of the Advisory Team mentioned above will be conducted under the contractor's contract

(c) As to the maintenance of KCR, the contractor will train maintenance staff for three years and prepare maintenance manuals/textbooks prior the opening. The contractor will supervise maintenance works for five years from the opening. The tasks of the contractor mentioned above will be conducted under the contractor's contract.

The concept of O&M scheme based on the risks for O&M of KCR is illustrated as follows.



Source: JICA Study Team

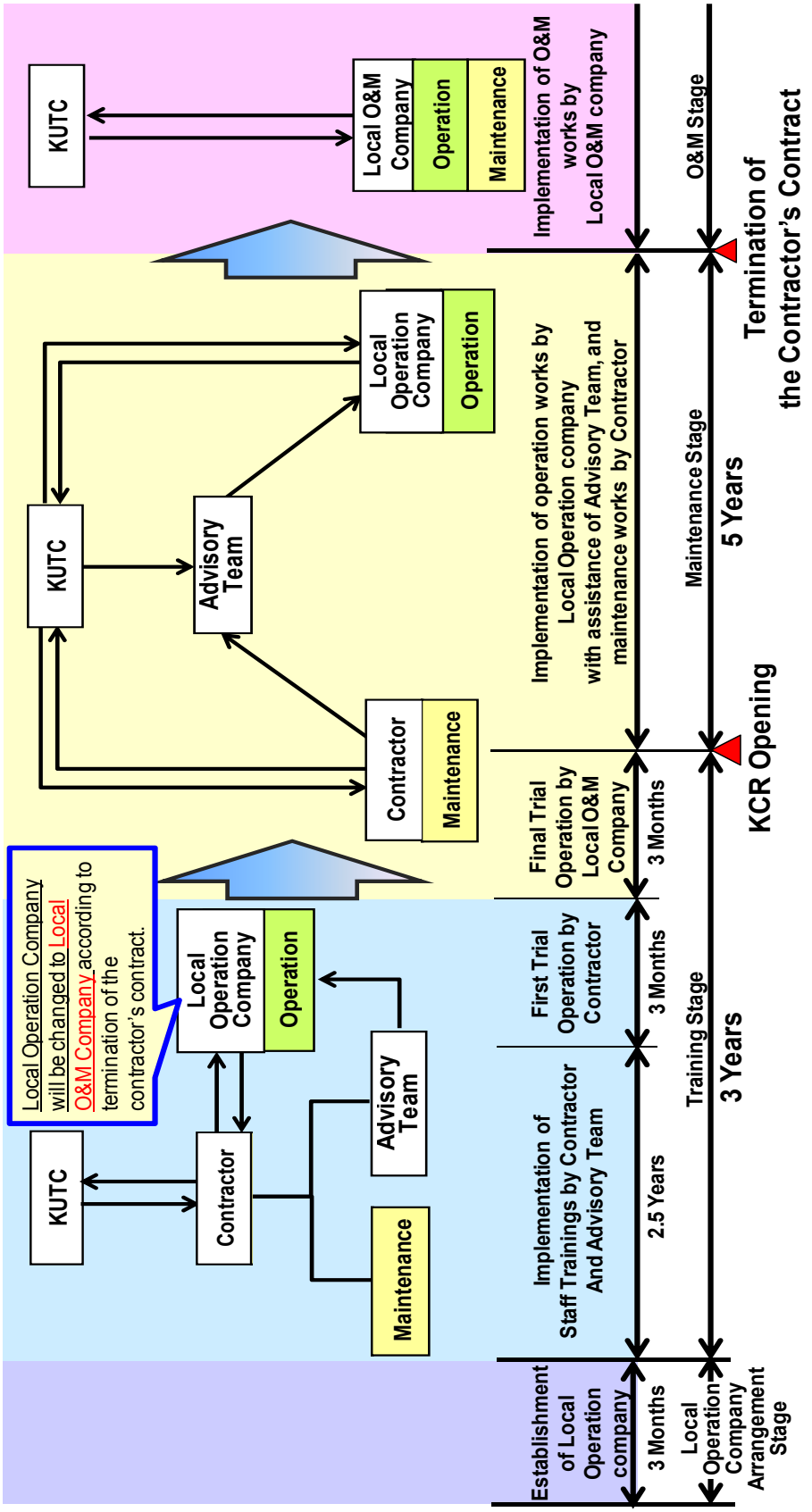
Figure 7.2.2 Concept of O&M Scheme Based on the Risks for O&M of KCR

In addition, the members of the Advisory Team will be expected to come from railway operators and be ex-engineers from railway operators. The Advisory Team is expected to be familiar with the practical railway O&M and can transfer their expertise and knowledge efficiently.

(2) Proposed O&M Scheme for the KCR Revival Project

JICA Study Team proposed O&M scheme for dealing with the risks of the Hybrid Scheme. It is a consignment contract between KUTC and O&M company based on the O&M scheme concept. In addition, the proposed O&M scheme will be changed gradually in accordance with the project implementation stages, more than 3 months prior to the KCR opening, 3 months prior to the opening and 5 years after the opening, and more than 5 years after the opening.

The proposed O&M scheme including operation company (O&M company) establishment stage can be shown in the figure below.



Source: JICA Study Team

Figure 7.2.3 Outline of the Proposed O&M Scheme

Each stage shown in the above figure can be explained below.

1) Local Operation Company Arrangement Stage

The Contractor will arrange to establish a local operation company. The Contractor consists of a trading company, construction company and manufactures. They have extensive experiences and know-how in establishing new companies for their business field. The contractor will contact Pakistani business leaders in advance to collect information about the company's profile, business policies, track records and their willingness to participate in railway O&M business. Based on their experiences and collected information, the Contractor will arrange to establish the local operation company.

2) Training Stage

The Contractor will employ maintenance staff and train them at this stage. All costs for the training and employment of maintenance staff will be included in the JICA Yen Loan. The Contractor will implement the following tasks for the training.

- Prepare maintenance manuals & textbooks,
- Educate the employed maintenance staff based on the manuals & textbooks, and
- Transfer know-how of urban railway maintenance works to the staff.

In addition, the Contractor will make a contract for operation staff training with the local operation company. The Contractor will organize the Advisory Team for training and supervising operation staff employed by the local operation company. The Advisory Team will conduct the following tasks under the Contractor's supervision.

- Prepare operation manuals & textbooks,
- Educate the employed operation staff based on the manuals & textbooks, and
- Transfer know-how of urban railway operation works to the staff.

The contractor will finish the maintenance and operation staff training by 6 months before the KCR opening and conduct first trial operation during 3 months. The first trial operation test will evaluate their performance. According to the result of the test, the Contractor will educate them in the term of final trial operation test (3 months) with the assistance of the Advisory Team. They will complete preparations for operation and maintenance of KCR. The JICA Yen Loan will finance all costs for the operation staff training, the preparation of training materials, the organization and employment of the Advisory Team.

In the training stage, KUTC and the local operation company will conducts tasks respectively. KUTC will supervise the Contractor, the Advisory Team and the local operation company, set up the fare system and prepare the operation policy. The local operation company will employ the operation staff and prepare operation plan based on the operation policy prepared by KUTC with assistance of the Advisory Team.

3) Maintenance Stage

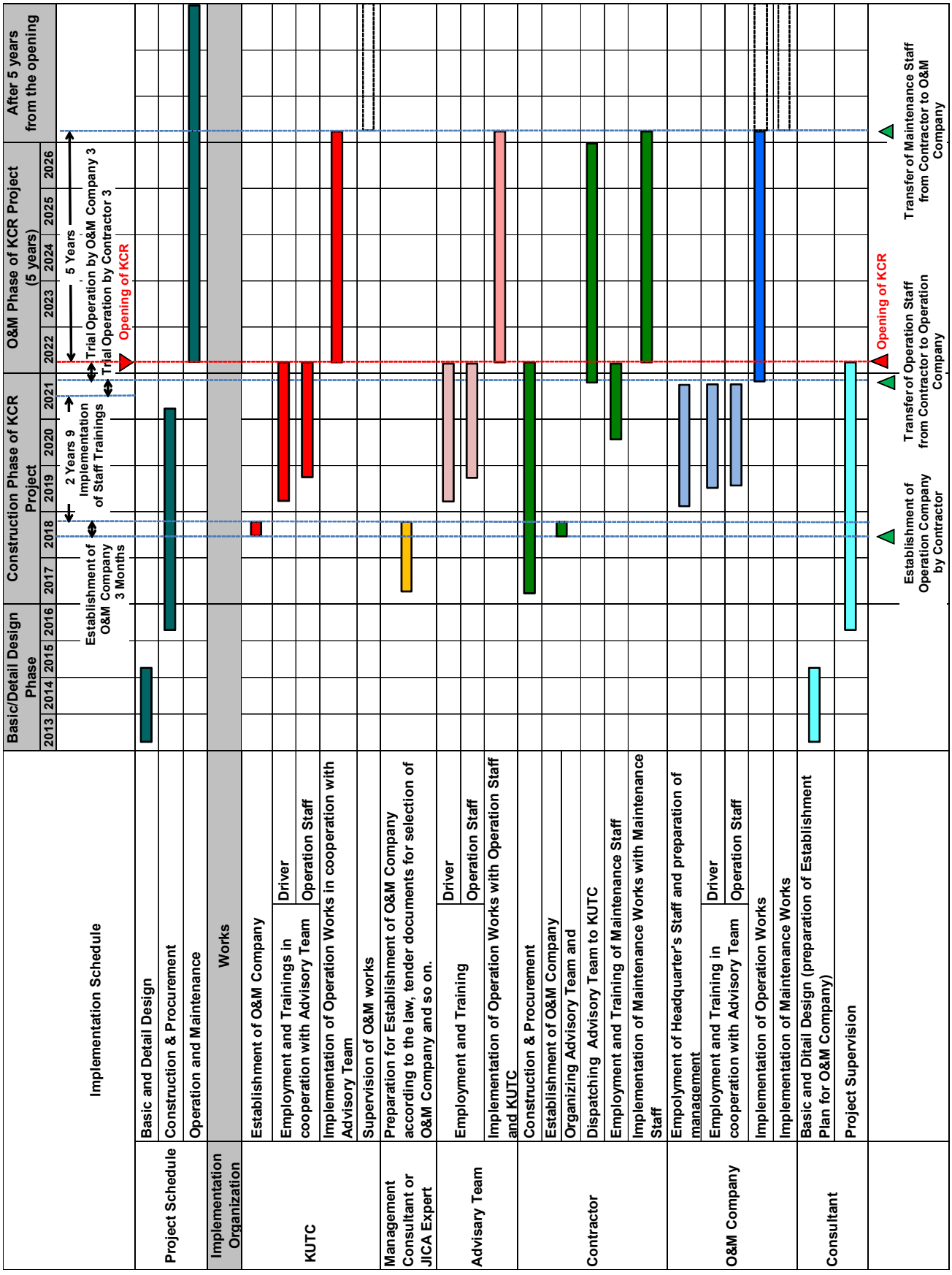
The Contractor will provide maintenance service during 5 years after the KCR opening. The maintenance staff will implement maintenance works under the supervision of the Contractor. The maintenance service will be included in the Contractor's contract of the KCR revival project. All costs for the maintenance service and the employment of maintenance staff will be financed by the JICA Yen Loan.

In addition, the local operation company will make a consignment contract with KUTC for operation works. The local operation company will conduct operation works with the assistance of the Advisory Team under the contract. KUTC will receive all fare revenues based on the contact

4) O&M Stage

In O&M stage, the contractor's contract for the KCR project will be terminated. In accordance with it, the local operation company will receive the maintenance staff from the Contractor and be changed to local O&M company. KUTC will make a consignment contract with the local O&M company. The local O&M company will implement O&M works under the contract.

The implementation schedule of the KCR O&M is shown in the table below. The schedule includes a detail study for establishing the operation company (O&M company). JICA Study Team proposes to conduct the study before the commencement of the KCR revival project. It will provide an operation performance standard, procedure and detail schedule of establishing the local operation company, and suggest Pakistani business leaders as candidates for the local operation company.



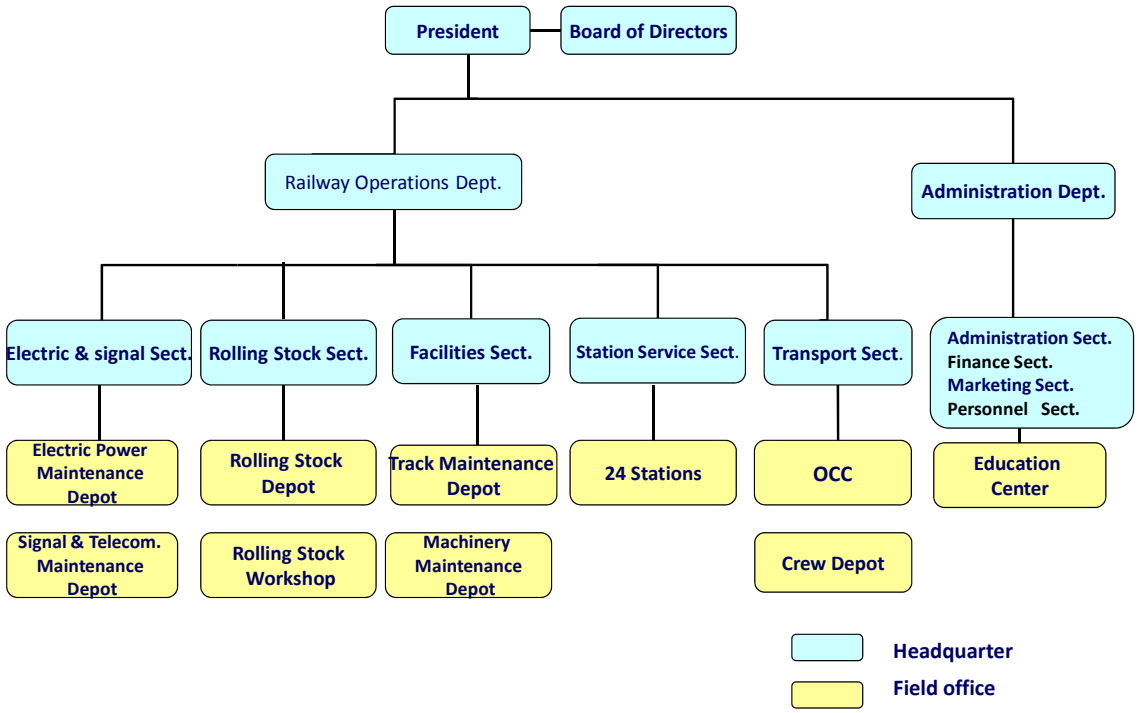
Source: JICA Study Team

Figure 7.2.4 Implementation Schedule in Relation to the O&M of KCR

7.2.2 Organizational Structure and Personnel Plan of O&M Company

(1) Organization of O&M Company

The organization of the O&M Company is proposed as shown in Figure 7.2.5. The organization is composed of a headquarter office and field office.



Source: JICA Study Team

Figure 7.2.5 O&M Company Organizational Structure

(2) Major Roles of Field Office

The field office which implements O&M works directly comprises many sections. The sections and major roles of the field offices are mentioned in Table 7.2.1.

Table 7.2.1 Major Roles of Office for Operation

Sections	Major Roles
Education Center	・ Driver's training for the issuance of license ・ New employee's training ・ Maintenance crew training
OCC	・ Traffic dispatcher ・ Rolling stock and depot dispatcher ・ Electric power dispatcher ・ Signal and telecommunication dispatcher ・ Passenger service dispatcher
Station	・ Management of station ・ Passenger guidance ・ Selling ticket ・ Observation of platform and train
Crew Depot	・ Management of driver ・ Driver assignment ・ Driver training

Source: JICA Study Team

Table 7.2.2 Major Roles of Office for Maintenance

Sections	Major Roles
Rolling Stock Depot and Workshop	・ Management of rolling stock ・ Inspection of rolling stock ・ Cleaning of rolling stock ・ Overhaul of rolling stock ・ Remodeling of rolling stock
Track Maintenance Depot and Civil Structure Depot	・ Management of track ・ Maintenance of track ・ Management of civil structure ・ Maintenance of civil structure
Machinery Depot	・ Management of machinery ・ Maintenance of machinery ・ (Machinery: escalator, elevator, ventilator, A/C, AFC)
Electric Power Maintenance Depot	・ Management of electric power ・ Maintenance of electric power ・ (Electric power: contact line, substation, distribution line)
Signal and Telecommunication Maintenance Depot	・ Management of signal and telecommunication ・ Maintenance of signal and telecommunication ・ (Signal and telecommunication: signal, switch machine, interlocking device, train protection device, train radio, telephone, disaster prevention device)

Source: JICA Study Team

(3) Working Conditions

Working conditions in the railway O&M Company is different from other companies depending on the railway operation. An example of working pattern is shown in Figure 7.2.6.

Shift I

Schedule		1st Day			2nd Day			3rd Day			4th Day			5th Day			6th Day		
Time Table		8H	8H	8H	8H	8H	8H	8H	8H	8H	8H	8H	8H	8H	8H	8H	8H	8H	8H
Group	A		8	8	8								8	8	8				
	B					8	8	8								8	8	8	
	C	8							8	8	8	8							8

*Three (3) shifts system will be applied. One group works for 8 hours a day.

Shift II

Schedule		1st Day				2nd Day				3rd Day				4th Day				5th Day			
Time Table		6H	6H	6H	6H	6H	6H	6H	6H	6H	6H	6H	6H	6H	6H	6H	6H	6H	6H	6H	6H
Group	A		6					6					6	Stay	6						
	B			6					6	Stay	6								6		
	C				6	Stay	6								6					6	
	D	Stay	6								6					6					6
	E						6					6					6	Stay	6		

*Three (3) shifts system will be applied. One group works for 6 hours a day.

Source: JICA Study Team

Figure 7.2.6 Working Pattern (Sample)

The upper figure shows a working pattern applied to dispatchers and maintenance staff. The lower figure shows a working pattern of drivers and station staff where a late shift, early shift, and overnight shift are combined. In the overnight shift, drivers and station staff can take a rest for 6 hours. The number of the required staff is estimated as shown in Table 7.2.3. As to the result of the estimation, the total number of working days is 237 days and the reserve rate, which shows whether or not the deployment of staff is suitable for the works, is calculated to be 1.54.

Table 7.2.3 Number of Working Days

Item	Number of Days
A) Total Number of Days	365 days
B) Number of Sundays and Saturdays	104 days
C) Number of National Holidays	14 days
D) Number of Annual Paid Leaves	10 days
Number of Working Day (=A-B-C-D)	237 days

Source: JICA Study Team

(4) Number of Staff

1) OCC Staff

The number of OCC dispatchers is estimated as a sample in Table 7.2.4 below. OCC dispatchers are required to work in three-shift and 24-hour working system except for the Chief OCC dispatcher. In consideration of the work volume, the traffic dispatcher is divided into two positions, planning and operating. The facility dispatcher concurrently holds the position of the signal and telecom dispatcher.

N-A1 and N-A2 are development cases in the KCR project. The required number of staff per day in OCC is estimated to be 9, and 3 staff is added for overnight shift. Thus, the total number of staff in the OCC is estimated to be 18 by multiplying the required staff per day by the reserve rate (1.54) as mentioned in above item (3), Working Conditions.

Table 7.2.4 Number of OCC Staff in N-A1 and N-A2 Cases

Dispatchers	Working Condition	①Required Staff per Day (Overnight)	Total Number of Staff (①×1.54)
Chief of OCC	Day work	1	1
Traffic (Planning / Operating)	Shift I	2 (1)	5
Rolling Stock Depot	Shift I	2 (1)	5
Electric Power Facility / Signal and Telecom.	Shift I	2 (1)	5
Passenger Service	Day work	2	2
Total		9 (3)	18

*Reserve rate (1.54) should be multiplied by the required staff per day under the "shift" condition because staff under the shift system are required to take turns continuously.

Source: JICA Study Team

Similarly, the required number of staff per day in OCC is estimated for case N-B1 as follows.

Table 7.2.5 Number of OCC Staff in Case N-B1

Dispatchers	Working Condition	①Required Staff per Day (overnight)	Total Number of Staff (①×1.54)
Chief of OCC	Day work	1	1
Traffic (Planning / Operating)	Shift I	2 (1)	2
Rolling Stock Depot	Shift I	1 (1)	4
Electric Power Facility / Signal and Telecom.	Shift I	1 (1)	4
Passenger Service	Day work	2	2
Total		7 (3)	13

*Reserve rate (1.54) should be multiplied by the required staff per day under the "shift" condition because staff under the shift system are required to take turns continuously.

Source: JICA Study Team

2) Drivers

The required number of drivers is calculated based on the following conditions:

- Annual Working Days :237 days
- Reserve Rate : 365/237=1.54
- Number of Daily Train Operation : 159 (Clockwise)
  : 147 (Counter-clockwise)
- Operation Time for One-way Trip : 60 minutes
- Total Operation Time: Approximately 335 hours
- Operation Time per Driver : Approximately 5.0 hours

  * The operation time per driver includes preparation time for driving and time required for going in and out of the depot.

Consequently, the required number of drivers per day in case of N-A1 is calculated as follows;

335 / 5.0 = 67, 67 x 1.54 = 103.4, therefore, 104 drivers required

Similarly, the required number of drivers in case N-A1, N-A2 and N-B1 were calculated in accordance with each condition as shown in Table 7.2.6.

Table 7.2.6 Number of Drivers According to Each Development Case of KCR

【From 2022 to 2029】

Item	N-A1	N-A2	N-B1
Number of Daily Train Operation	335	328	368
Operation Time for One-way Trip (minutes)	60	60	31
Total Operation Time (hours)	335	328	187
Required Number of Drivers	104	102	58

【After 2030】

Item	N-A1	N-A2	N-B1
Number of Daily Train Operation	414	349	471
Operation Time for One-way Trip (minutes)	60	60	31
Total Operation Time (hours)	414	349	239
Required Number of Drivers	128	108	74

Source: JICA Study Team

To meet the requirements mentioned above, a work shift is proposed as shown in Table 7.2.7. For drivers, accommodations should be provided in the crew stations.

Table 7.2.7 Number of Drivers per Day (N-A1 and N-A2 Cases from 2022 to 2029)

Time		0-6	6-7	7-11	11-13	13-15	15-16	16-21	21-22	22-23	23-24
Number of Working Train (no/hour)		-	15	20	18	15	18	20	18	15	-
Number of Drivers per Group	Group A			8:00-24:00 (16 hours) 22 Drivers							
	Group B	Non-working day									
	Group C	0:00-8:00 (8 hours) 22 Drivers									

*This table is prepared in accordance with "Shift I" mentioned in Figure 7.2.6 Working Pattern (sample).

Source: JICA Study Team

Consequently, the total number of staff per crew station is estimated as shown in Table 7.2.8. The trainer shown in the table below has the responsibility not only as an advising driver but also as a reserve driver for special trains during unexpected conditions. Also, the trainer will serve as a reliever in cases where the duty driver on the day cannot work for any reasons.

Table 7.2.8 Number of Drivers at the Crew Station (from 2020 to 2029)

【Case N-A1,N-A2】

Post	Working Condition	Total Number of Staffs
Chief	Day work	1
Assistant Chief	Shift I	5
Clerk	Day work	2
Trainer	Day work	2
Driver	shift I	104 [102]
Total		114 [112]

*[ ] : Case N-A2

*Reserve rate (1.54) should be multiplied by the required staff per day under the "shift" condition because staff under the shift system are required to take turns continuously.

【Case N-B1】

Post	Working Condition	Total Number of Staffs
Chief	Day work	1
Assistant Chief	Shift I	5
Clerk	Day work	2
Trainer	Day work	2
Driver	shift I	58
Total		68

*Reserve rate (1.54) should be multiplied by the required staff per day under the "shift" condition because staff under the shift system are required to take turns continuously. Source: JICA Study Team

3) Rolling Stock Depot and Workshop

The required number of rolling stocks is estimated to be 100 cars both for N-A1 and N-A2 from 2022 to 2029. Similarly, it is estimated to be 64 cars in case of N-B1 from 2022 to 2029.

The number of staff in rolling stock depot and workshop is calculated in accordance with the number of rolling stocks as follows:

Table 7.2.9 Number of Staff in Rolling Stock Depot and Workshop (from 2022 to 2029)

【Case N-A1, N-A2】

		Working Condition	Required Staff per Day (overnight)	Total Number of Staff (A+B×1.54)
[Depot]				
Chief		Day work (A)	1	1
Assistant Chief	Inspection	Day work (A)	1	1
	Crew Management	Day work (A)	1	1
Clerk		Day work (A)	2	2
Planning	Inspection	Day work (A)	3	3
Inspector	Daily Inspection	Shift I (B)	6(3)	9(5)
	Monthly Inspection	Day work (B)	5	8
	Wheel Turning	Day work (B)	4	7
Shunting Driver		Shift II (B)	2(1)	3(2)
Subtotal			25(4)	35(7)
[Workshop]				
Assistant Chief		Day work (A)	1	1
Clerk		Day work (A)	1	1
Planning	Inspection	Day work (B)	3	5
Inspector	General Inspection	Day work (B)	20	31
Subtotal			25	38
Total			50(4)	80

*Reserve rate (1.54) should be multiplied by the required staff per day under the "shift" condition because staff under the shift system are required to take turns continuously.

【Case N-B1】

		Working Condition	Required Staff per Day (Overnight)	Total Number of Staff (A+B×1.54)
[Depot]				
Chief		Day work (A)	1	1
Assistant Chief		Day work (A)	1	1
Clerk		Day work (A)	2	2
Planning	Inspection	Day work (A)	2	2
Inspector	Daily Inspection	Shift I (B)	4(2)	10
	Monthly Inspection	Day work (B)	3	5
	Wheel Turning	Day work (B)	2	3
Shunting Driver		Shift II (B)	2(1)	5
Subtotal			17(3)	29
[Workshop]				
Assistant Chief		Day work (A)	1	1
Clerk		Day work (A)	1	1
Planning	Inspection	Day work (A)	1	1
Inspector	General Inspection	Day work (B)	10	16
Subtotal			13	19
Total			30(3)	48

*Reserve rate (1.54) should be multiplied by the required staff per day under the "shift" condition because staff under the shift system are required to take turns continuously. Source: JICA Study Team

4) Facilities Maintenance Staff

The commercial route length in N-A1 and N-A2 are 43.2 km and 20.7 km, respectively. The number of facility maintenance staff is estimated in consideration of the commercial length shown in Table 7.2.10.

Table 7.2.10 Number of Maintenance Staff of Each Field Office (from 2022 to 2029)

【Case N-A1, N-A2】

	Working Condition	Track and Civil	Machinery	Electric Power	Signal & Telecom.
Chief	Day work (A)	1	1	1	1
Assistant Chief	Day work (A)	3	1	3	3
Clerk	Day work (A)	2	1	2	2
Planning	Day work (A)	6	2	6	6
Maintenance Staff	Shift I (B)	14 (7)	2 (1)	14 (7)	14 (7)
Required Staff per day (overnight)		26 (7)	7 (1)	26 (7)	26 (7)
Total Number of Staff (A+B×1.54)		45	10	45	45

*Reserve rate (1.54) should be multiplied by the required staff per day under the "shift" condition because staff under the shift system are required to take turns continuously.

【Case N-B1】

	Working Condition	Track & Civil	Machinery	Electric Power	Signal and Telecom.
Chief	Day work (A)	1	1	1	1
Assistant Chief	Day work (A)	1	0	1	1
Clerk	Day work (A)	1	1	1	1
Planning	Day work (A)	2	1	2	3
Maintenance Staff	Shift I (B)	12 (6)	2 (1)	12 (6)	12 (6)
Required Staff per day (overnight)		17 (6)	5 (1)	17 (6)	18 (6)
Total number of staff (A+B×1.54)		33	8	33	34

*Reserve rate (1.54) should be multiplied by the required staff per day under the "shift" condition because staff under the shift system are required to take turns continuously.

Source: JICA Study Team

5) Station Staff

In the stations, aside from the chief and assistant chief, it is necessary to deploy staff for passenger guidance, selling tickets, ticket gate and security guard. Their working condition is classified into three types. The number of staff in a station is calculated as shown in Table 7.2.11.

Table 7.2.11 Number of Station Staff

	Working Condition	Type		
		A	B	C
Chief	Day work (A)	1	1	1
Assistant Chief	Shift (B)	1	0	0
Observation of Platform	Shift I (B)	2(1)	0	0
Selling ticket	Shift I (B)	2(1)	2(1)	2(1)
Ticket Gate	Shift I (B)	4(2)	4(2)	2(1)
Security Guard	Shift I (B)	4(2)	4(2)	4(2)
Attendance per day (overnight)		14(6)	11(5)	9(4)
Total number of staff (A+B×1.54)	-	32	26	21

Source: JICA Study Team

In accordance with the number of passengers at each station, the number of station staff is estimated as shown in Table 7.2.12.

Table 7.2.12 Number of Station Staff (from 2022 to 2029)

【Case N-A1, N-A2】

Station	Type	Number of Staff	Station	Type	Number of Staff
Drigh Road	A	32	Shah Abdul Latif	C	21
Johar	C	21	Baldia	A	32
Alladin Park	C	21	Liyari	B	26
NIPA	C	21	Wazir Mansion	C	21
Gilani	B	26	Tower	C	21
Yasinabad	C	21	Karachi City	B	26
Liaquatabad	B	26	DCOS	B	26
North-Nazimabad	B	26	Karachi Cantt	C	21
Orangi	C	21	Naval	B	26
HBL	C	21	Chanesar	C	21
Manghopir	C	21	Shaheed-e-Millat	C	21
S.I.T.E.	C	21	Karsaz Halt	C	21
Subtotal		278	Subtotal		283
			Total		561

【Case N-B1】

Station	Type	Number of Staff	Station	Type	Number of Staff
Shah Abdul Latif	C	21	Karachi Cantt	C	21
Baldia	C	21	Naval	B	26
Liyari	B	26	Chanesar	C	21
Wazir Mansion	C	21	Shaheed-e-Millat	C	21
Tower	C	21	Karsaz Halt	C	21
Karachi City	B	26	Drigh Road	A	32
DCOS	C	21	-		
Subtotal	-	157	Subtotal	-	142
			Total		299

Source: JICA Study Team

6) Total Number of Staff

Table 7.2.13 shows the number of staff at the headquarter and each field office from 2022 to 2029, in accordance with the development case of KCR.

Table 7.2.13 Total Number of Staff (from 2022 to 2029)

Location	Workplace	Total Number of Staff		
		N-A1	N-A2	N-B1
Head office	Headquarter	40	40	26
Field office	Education Center	15	15	9
	OCC	18	18	13
	Crew Depot	114	112	68
	Rolling Stock Depot and Workshop	80	80	48
	Track and Civil Structure Maintenance Depot	45	45	33
	Machinery Maintenance Depot	10	10	8
	Electric Power Maintenance Depot	45	45	33
	Signal and Telecom. Maintenance Depot	45	45	34
Station	Station	561	561	299
Total		973	971	571

Source: JICA Study Team

The required number of staff in accordance with N-A1, N-A2, and N-B1 cases is calculated as shown in Table 7.2.14.

Table 7.2.14 Total Number of Staff (N-A1, N-A2, and N-B1 Cases)

Case N-A1				
Year	Headquarter	Field Office	Station	Total
2022	40	372	561	973
2030	48	472	598	1,118
2040	48	487	614	1,149
2050	48	574	642	1,264

Case N-A2				
Year	Headquarter	Field Office	Station	Total
2022	40	370	561	971
2030	48	439	593	1,080
2040	48	457	599	1,104
2050	48	498	621	1,167

Case N-B1				
Year	Headquarter	Field Office	Station	Total
2022	26	246	299	571
2030	26	317	341	684
2040	29	332	357	718
2050	32	397	380	809

Source: JICA Study Team

7.3 Machines and Equipment for Maintenance and Equipment for O&M Training

7.3.1 Machines and Equipment for Maintenance

Maintenance of urban railways requires modern machines and equipment as shown in Table 7.3.1. These machines are also required for related construction works. Therefore, for purposes of economics, JICA Study Team recommends that KUTC purchase the machines and equipment for construction works, which will also be used after completion of said works.

Table 7.3.1 Primary Machines and Equipment for Maintenance Works

Description		Name	Objective	Quantity
Track, Civil and Machinery	Vehicles for transport	Track motor car(15 ton)	Transport of equipments and materials	1
		Track motor car(20 ton, with crane)		1
		Rail-carrying wagon		5
		Pickup truck		1
	Vehicles for maintenance	Tamping machines	Tamping of ballast tracks	1
		Rail grinding car	Grinding of rail	1
	Measuring or testing equipments	track inspection car	Inspection of track irregularity	1
		Structure gauging train	Inspection of construction gauge	1
		Rail flaw detector	Inspection of rail defects	1
Signal, telecommunication and electric power	Vehicles for transport	Track motor car (5ton)	Transport of equipments and materials	1
		Trolley		2
	Tools for maintenance	Track work vehicle with engine and work platform	Inspection of overhead equipment	1
		Catenary renewal vehicle with engine	Maintenance for overhead equipment	1
		Aerial ladder truck		1
	Measuring of testing equipments	Electric inspection car	Inspection of overhead content line, signal and telecommunication	1
Depot and workshop	Equipment instrument	Self-propelled dust collection device		1
		High-temperature and high-pressure water washing machine		1
		Derail restoration device		1
		Trolley washing machine		1
		Compressor		2
		Cleaning and washing machine		1
		Forklift		4
	Measuring or testing equipments	Wheel set inspection and repair device		1
		Trolley gas-leakage testing machine		1
		Unit cooler testing device		1
		ATP, ATO testing machine		1
		VVVF testing device		1
		Train radio testing device		1
		Break transmitter testing device		1

Source: JICA Study Team

7.3.2 Equipment for O&M Training

The education and training for O&M also need modern equipment such as a train operation simulator and a rail signaling simulator. Table 7.3.2 shows a list of O&M equipment. Such equipment is required to be installed before commencement of the training.

Table 7.3.2 Main Equipment for O&M Training

Name of Facilities and Equipments	Target Staff	Objective
Train Operation Simulator	Drivers and Dispatchers of OCC	Training of Basic Operation and Handling Car Troubles
Train Signal Simulator	Staff of Signal and Telecommunication	Mastering of Interlocking & Programmed Route Control Device and Operation Skill
Point Machine for Training	Staff of Signal	Inspection, Testing and Adjustment of Point Machine
Overhead Contact Line for Training	Staff of Electric Power	Training of Repair and Emergency Restoration of Overhead Contact

Source: JICA Study Team

7.4 Revenue and Expenditure Plan of KCR

7.4.1 Features of Revenue and Expenditure found through O&M Survey in Third World Countries

The information contains information of particular firms/institutions; information should not be disclosed for a fixed period.

7.4.2 Basic Concept of Revenue and Expenditure Plan

A revenue and expenditure plan is basically required to maximize revenue and minimize expenditures. One main factor that could maximize revenue is to increase farebox income. It is important to gain a stable income by setting a suitable fare which stimulates passengers to use KCR. Furthermore, it is important to consider the implementation of enhanced non-rail business as DMRC has conducted to maximize revenue.

One main factor that could minimize expenditures is to reduce the share of depreciation in expenditures. If the government owns non-operating assets and leases the assets to the O&M Company like the O&M framework of SMRT, the O&M Company could help minimize depreciation. Moreover, it is expected to minimize expenditures by automation of railway facilities which can save labor force and become efficient like SMRT and TX. If O&M works to be outsourced are identified and outsourced properly, operational efficiency could be improved, that could result in the reduction of expenditures. In consideration of the aforementioned, the basic concept of the revenue and expenditure plan is summarized as follows:

- An optimal fare structure for passenger and train operation will increase the number of passenger and contribute to increasing profits consequently;
- Maximize profit by enhancing non-rail business revenues;
- Minimize the costs by using automated facilities to reduce labor force; and
- Minimize the costs by properly outsourcing O&M works which will improve operation efficiency.

Meanwhile, reduction of depreciation is not included in the basic concept at present because it needs to be discussed whether the government can possess all non-operating assets and adopt the same O&M framework as that of SMRT, and how KUTC covers depreciation for non-operating assets can be reduced.

7.4.3 Revenue and Expenditure Plan Reflecting the Basic Concept

The outline of revenue and expenditure plan in consideration of the basic concept is mentioned below.

Revenue Plan of KCR

- Setting of optimal fare structure;
- Introduction of stored fare IC card in which a value is added in accordance with a charged fare;
- Implementation of promos to increase passengers, e.g., implementation of event in accordance with season, region, holiday, and so on;
- Advertisement in trains and stations;
- Lease of spaces in stations, e.g., lease for "kiosk", convenience store, ATM (automated teller machine), and so on;
- Development of park-and-ride facility around stations; and
- Development of shopping mall/office around stations.

One day ticket system which allows unlimited number of trips within a day could cause illicit trades as one person sells the used ticket to another person. Hence, the system is not desirable at this introduction stage of KCR.

Expenditure Plan of KCR

- Automation of railway facilities which is more efficient and can help provide high quality railway service;
- Simplification of an organizational structure for O&M and elimination of redundancy in the roles of staff between KUTC and the O&M company; and
- Outsourcing of utility works in trains and stations to enhance efficiency.

7.4.4 Estimation of O&M Costs

To ensure fairness of procurement process as well as project implementation, information should not be disclosed for a fixed period.

7.4.5 Railway Fare Revenue

(1) Fare System of KCR

In SAPROF (I), the fare system of KCR was proposed based on the current public transport conditions and the result of the demand forecast as follows:

15.0 + 0.5 x (d-5.0) Unit; PRs, where "d" is trip distance (km)

Currently, the fare level of public transport sector in Karachi is suppressed. Users of air conditioned coach pay up to 35PRs. In addition, DMRC fare is from 17 to 37 PRs by distance.

KCR fare system is proposed as shown in Table 7.4.1. considering DMRC and air conditioned coach fare levels. The proposed KCR fare is lower than one of DMRC.

17.0 + 1.0 x (d-3.0) Unit; PRs, where "d" is trip distance (km)

Table 7.4.1 Proposed Fare Matrix of KCR

Distance (km)		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
KCR proposed fare (PRs)		17	17	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Bus (PRs)		13	13	13	13	13	15	15	15	15	15	16	16	16	16	16	-	-	-	-	-	-	-
Mini Bus (PRs)		14	14	14	14	14	16	16	16	16	16	17	17	17	17	17	-	-	-	-	-	-	-
Coach (No A/C; PRs)		19	19	19	19	19	19	19	19	19	20	20	20	20	20	20	20	20	20	20	20	20	20
Coach (with A/C; PRs)		2	3	5	6	8	10	11	13	14	16	18	19	21	22	24	26	27	29	30	32	34	35
DMRC	(INR	8	10	10	12	12	15	15	15	15	15	15	16	16	16	18	18	18	18	18	21	-	-)
	PRs*	14	18	18	21	21	26	26	26	26	26	26	28	28	28	32	32	32	32	32	37	-	-

*1 INR=1.75356 PKR

Source: JICA Study Team

(2) Estimated Fare Revenue of KCR

On the basis of the concept of fare matrix mentioned above, the total fare revenue in Case N-A1, N-A2, and N-B1 were estimated as shown in Table 7.4.2.

Table 7.4.2 Railway Fare Revenue

(Unit; Rs in thousands)

	2022		2030		2040		2050	
	Pax./day	Revenue (PRs)	Pax./day	Revenue (PRs)	Pax./day	Revenue (PRs)	Pax./day	Revenue (PRs)
Case N-A1	578,362	14,115	1,223,006	27,888	1,436,499	32,756	1,721,611	39,258
Case N-A2	526,738	12,849	1,174,107	26,597	1,382,386	31,315	1,660,829	37,622
Case N-B1	306,236	7,348	828,018	19,268	998,125	23,227	1,203,178	28,003

*Pax: passengers Source: JICA Study Team

7.4.6 Non-rail Business Revenues

The information contains information of particular firms/institutions; information should not be disclosed for a fixed period.

7.5 Revenue and Expenditure of KCR

The previous section explained the estimated O&M costs, fare revenue and non-rail business income. This section summarizes them as the revenue and expenditure of KCR case wise, N-A1, N-A2 and N-B1.

(1) Revenue of KCR

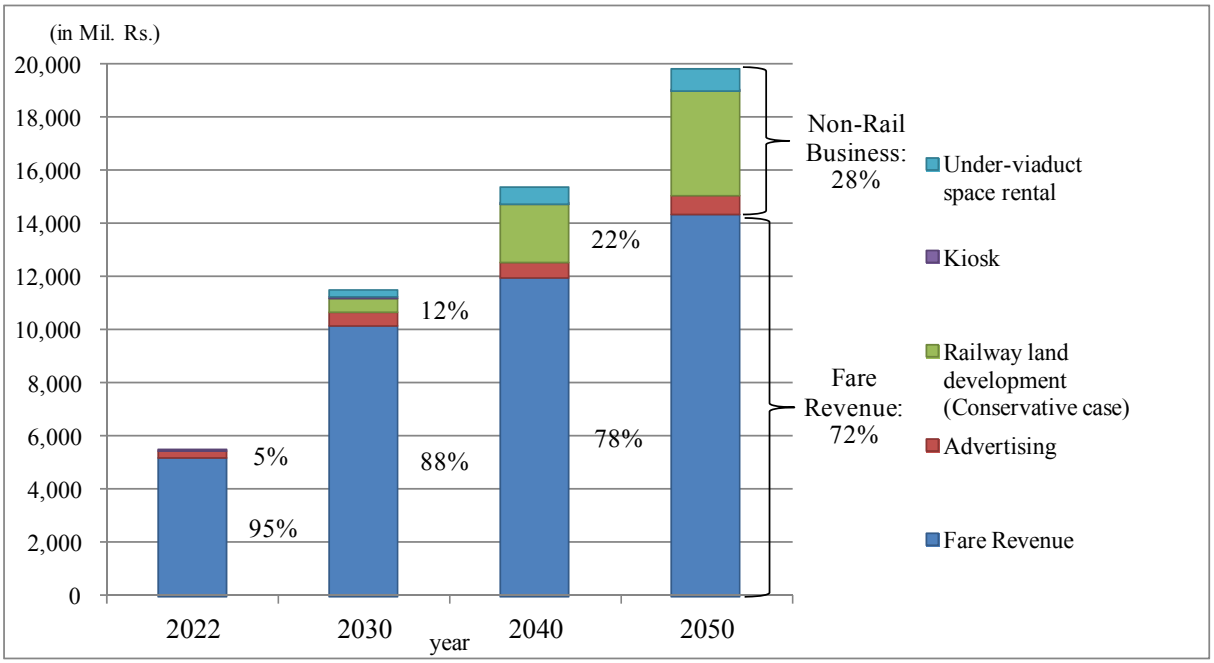
The following table shows the estimated KCR's annual revenue in each case. The annual revenue consist of fare revenue, advertising income, railway land development income, Kiosk income and under-viaduct space rental income.

Table 7.5.1 Annual Revenue of KCR (Case N-A1)

【Case N-A1】 PKR million at 2011 constant price

Year	Fare Revenue	Advertising	Railway land development	Kiosk	Under-viaduct space rental	Total
2022	5,152.5	257.6	0.0	6.0	0.0	5,416.1
2023	5,252.2	262.6	59.0	9.0	0.0	5,582.8
2024	5,352.1	267.6	132.8	10.0	73.2	5,835.6
2025	5,451.8	272.6	144.2	10.0	103.2	5,981.7
2026	5,551.5	277.6	157.1	10.0	128.0	6,124.1
2027	5,651.3	282.6	171.2	10.0	140.2	6,255.2
2028	5,751.0	287.6	286.7	10.0	171.4	6,506.7
2029	5,850.8	292.5	482.7	10.0	184.8	6,820.8
2030	10,179.3	509.0	523.8	10.0	294.0	11,516.1
2031	10,365.3	518.3	569.5	10.0	317.0	11,780.1
2032	10,554.6	527.7	638.9	10.0	380.0	12,111.2
2033	10,747.5	537.4	693.7	10.0	408.2	12,396.8
2034	10,943.9	547.2	1,063.2	10.0	424.4	12,988.7
2035	11,143.8	557.2	1,494.1	10.0	554.4	13,759.4
2036	11,347.3	567.4	1,642.3	10.0	573.3	14,140.3
2037	11,554.7	577.7	1,848.9	10.0	590.4	14,581.7
2038	11,765.8	588.3	1,994.9	10.0	608.0	14,967.0
2039	11,980.8	599.0	2,133.9	10.0	626.2	15,349.9
2040	11,955.7	597.8	2,192.6	10.0	644.8	15,400.9
2041	12,174.1	608.7	2,251.5	10.0	664.1	15,708.3
2042	12,396.5	619.8	2,522.3	10.0	683.9	16,232.5
2043	12,623.0	631.1	2,833.7	10.0	704.3	16,802.0
2044	12,853.6	642.7	2,942.8	10.0	725.3	17,174.3
2045	13,088.4	654.4	3,110.6	10.0	746.9	17,610.3
2046	13,327.6	666.4	3,502.9	10.0	769.2	18,276.0
2047	13,571.1	678.6	3,636.5	10.0	792.1	18,688.2
2048	13,819.0	691.0	3,794.3	10.0	815.7	19,129.9
2049	14,071.4	703.6	3,844.8	10.0	840.1	19,469.9
2050	14,328.6	716.4	3,933.8	10.0	865.1	19,853.9
2051	14,590.3	729.5	3,954.7	10.0	891.0	20,175.5

Source: JICA Study Team



Source: JICA Study Team

Figure 7.5.1 Composition of KCR's Annual Revenue (Case N-A1)

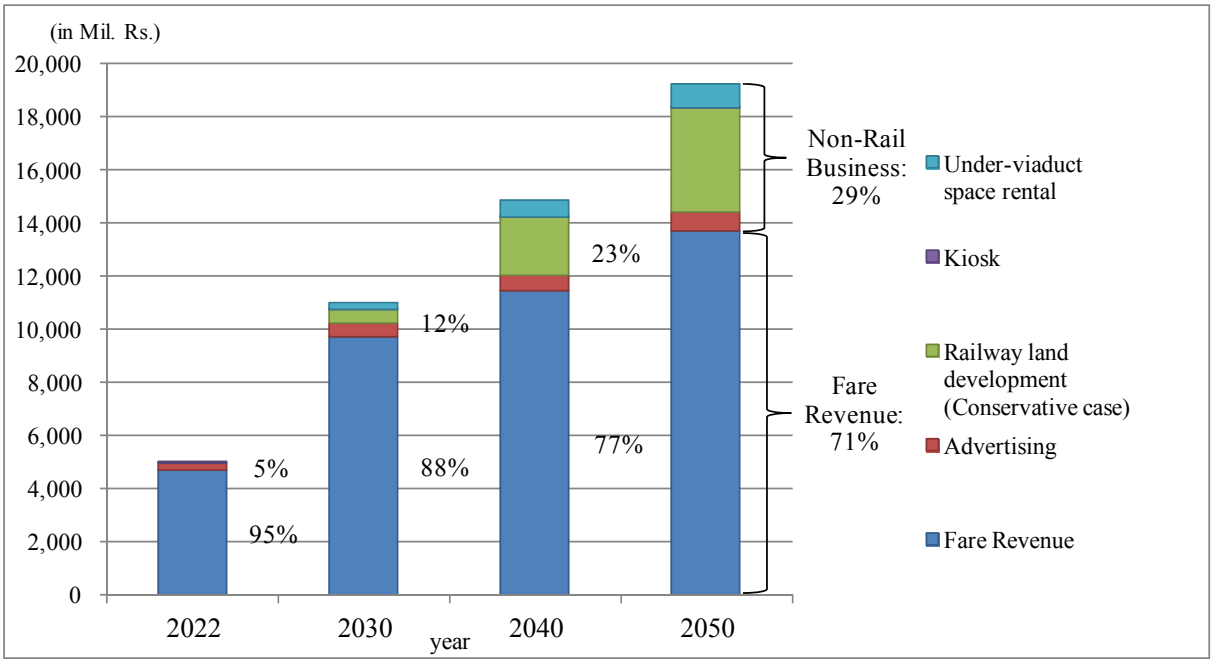
Table 7.5.2 Annual Revenue of KCR (Case N-A2)

【Case N-A2】 PKR million at 2011 constant price

Year	Fare Revenue	Advertising	Railway land development	Kiosk	Under-viaduct space rental	Total
2022	4,690.2	234.5	0.0	6.0	0.0	4,930.7
2023	4,782.3	239.1	59.0	9.0	0.0	5,089.5
2024	4,874.5	243.7	132.8	10.0	73.2	5,334.1
2025	4,966.7	248.3	144.2	10.0	103.2	5,472.4
2026	5,058.7	252.9	157.1	10.0	128.0	5,606.7
2027	5,150.8	257.5	171.2	10.0	140.2	5,729.7
2028	5,243.0	262.2	286.7	10.0	171.4	5,973.3
2029	5,335.0	266.8	482.7	10.0	184.8	6,279.3
2030	9,708.0	485.4	523.8	10.0	294.0	11,021.3
2031	9,887.7	494.4	569.5	10.0	317.0	11,278.7
2032	10,070.9	503.5	638.9	10.0	380.0	11,603.3
2033	10,257.4	512.9	693.7	10.0	408.2	11,882.2
2034	10,447.4	522.4	1,063.2	10.0	424.4	12,467.4
2035	10,640.9	532.0	1,494.1	10.0	554.4	13,231.4
2036	10,837.9	541.9	1,642.3	10.0	573.3	13,605.4
2037	11,038.7	551.9	1,848.9	10.0	590.4	14,040.0
2038	11,243.1	562.2	1,994.9	10.0	608.0	14,418.2
2039	11,451.3	572.6	2,133.9	10.0	626.2	14,793.9
2040	11,430.1	571.5	2,192.6	10.0	644.8	14,849.1
2041	11,641.9	582.1	2,251.5	10.0	664.1	15,149.5
2042	11,857.4	592.9	2,522.3	10.0	683.9	15,666.4
2043	12,077.1	603.9	2,833.7	10.0	704.3	16,228.8

【Case N-A2】 PKR million at 2011 constant price

Year	Fare Revenue	Advertising	Railway land development	Kiosk	Under-viaduct space rental	Total
2044	12,300.7	615.0	2,942.8	10.0	725.3	16,593.7
2045	12,528.5	626.4	3,110.6	10.0	746.9	17,022.4
2046	12,760.6	638.0	3,502.9	10.0	769.2	17,680.6
2047	12,996.9	649.8	3,636.5	10.0	792.1	18,085.3
2048	13,237.5	661.9	3,794.3	10.0	815.7	18,519.4
2049	13,482.8	674.1	3,844.8	10.0	840.1	18,851.8
2050	13,732.4	686.6	3,933.8	10.0	865.1	19,227.9
2051	13,986.7	699.3	3,954.7	10.0	891.0	19,541.6



Source: JICA Study Team

Figure 7.5.2 Composition of KCR's Annual Revenue (Case N-A2)

Table 7.5.3 Annual Revenue of KCR (N-B1)

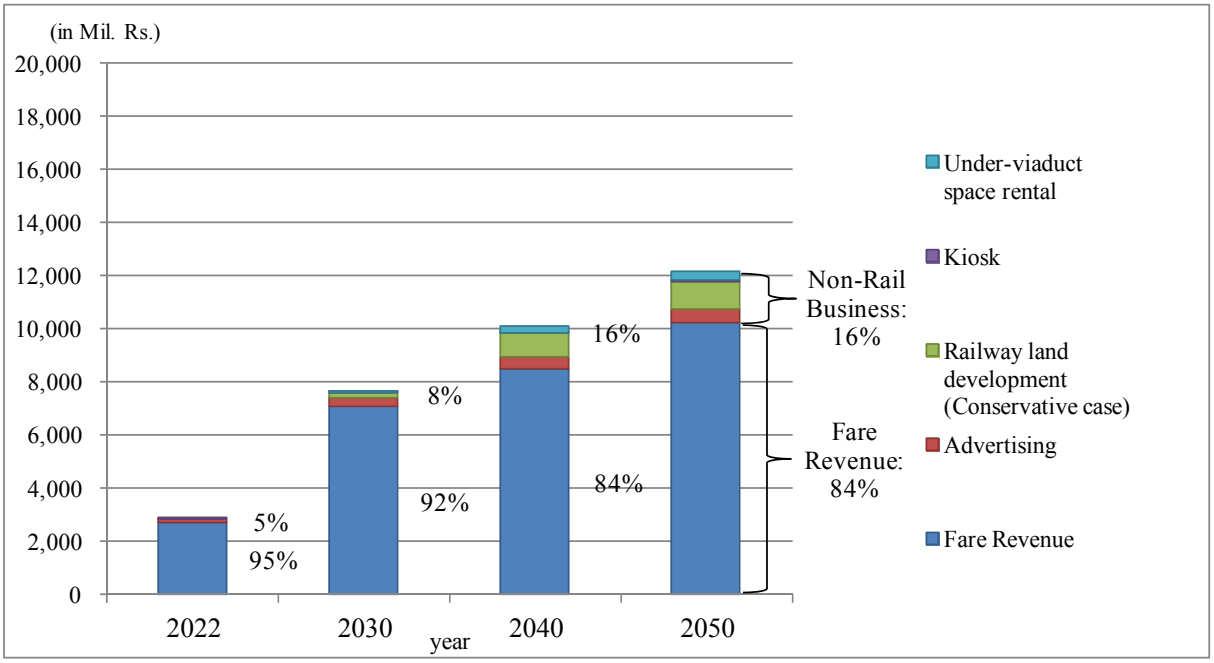
【Case N-B1】 PKR million at 2011 constant price

Year	Fare Revenue	Advertising	Railway land development	Kiosk	Under-viaduct space rental	Total
2022	2,681.9	134.1	0.0	3.2	0.0	2,819.1
2023	2,735.4	136.8	59.0	4.8	0.0	2,936.0
2024	2,788.9	139.4	90.8	5.3	16.5	3,040.9
2025	2,842.5	142.1	98.6	5.3	32.6	3,121.2
2026	2,896.0	144.8	107.2	5.3	48.8	3,202.1
2027	2,949.5	147.5	116.7	5.3	54.1	3,273.1
2028	3,003.0	150.2	143.6	5.3	78.0	3,380.0
2029	3,056.5	152.8	165.6	5.3	83.3	3,463.6
2030	7,033.7	351.7	179.5	5.3	88.6	7,658.8
2031	7,166.3	358.3	195.1	5.3	94.4	7,819.5
2032	7,301.5	365.1	212.2	5.3	131.5	8,015.6
2033	7,439.2	372.0	230.4	5.3	150.4	8,197.3

【Case N-B1】 PKR million at 2011 constant price

Year	Fare Revenue	Advertising	Railway land development	Kiosk	Under-viaduct space rental	Total
2034	7,579.5	379.0	527.6	5.3	157.1	8,648.5
2035	7,722.5	386.1	547.1	5.3	224.1	8,885.2
2036	7,868.2	393.4	566.2	5.3	232.2	9,065.2
2037	8,016.5	400.8	727.4	5.3	239.1	9,389.2
2038	8,167.8	408.4	827.2	5.3	246.3	9,655.0
2039	8,321.8	416.1	917.4	5.3	253.7	9,914.3
2040	8,478.7	423.9	924.4	5.3	261.3	10,093.7
2041	8,638.6	431.9	929.1	5.3	269.1	10,274.1
2042	8,801.5	440.1	933.9	5.3	277.2	10,458.1
2043	8,967.6	448.4	938.9	5.3	285.5	10,645.7
2044	9,136.8	456.8	944.0	5.3	294.1	10,837.0
2045	9,309.1	465.5	949.3	5.3	302.9	11,032.0
2046	9,484.5	474.2	954.7	5.3	312.0	11,230.8
2047	9,663.5	483.2	960.3	5.3	321.4	11,433.7
2048	9,845.8	492.3	966.1	5.3	331.0	11,640.4
2049	10,031.4	501.6	996.9	5.3	340.9	11,876.1
2050	10,220.5	511.0	1,065.6	5.3	351.2	12,153.7
2051	10,413.3	520.7	1,065.6	5.3	361.7	12,366.6

Source: JICA Study Team



Source: JICA Study Team

Figure 7.5.3 Composition Ratio of Revenue (Case N-B1)

(2) Expenditure of KCR

The following table shows the estimated KCR's annual expenditure in each case. The annual expenditure consists of staff training of O&M company, O&M cost, overhead cost by consignment contract between KUTC and local O&M company and land lease cost.

Table 7.5.4 Annual Expenses for O&M of KCR (N-A1)

Source: JICA Study Team

【Case N-A1】 PKR million at 2011 constant price

Year	Staff Training of O&M Company	O&M Cost	Overhead cost by contract	Land Lease	Total
2019	3.2	-	-	-	3.2
2020	23.9	-	-	-	23.9
2021	162.3	-	-	-	162.3
2022	-	2,311.4	462.3	3.1	2,776.8
2023	-	2,322.9	464.6	3.1	2,790.5
2024	-	2,334.4	466.9	3.1	2,804.4
2025	-	2,346.0	469.2	3.1	2,818.3
2026	-	2,357.7	471.5	3.1	2,832.4
2027	-	2,369.5	473.9	3.1	2,846.5
2028	-	2,381.3	476.3	3.1	2,860.7
2029	-	2,393.2	478.6	3.1	2,875.0
2030	-	3,230.9	646.2	3.1	3,880.2
2031	-	3,246.5	649.3	3.1	3,898.9
2032	-	3,262.2	652.4	3.1	3,917.7
2033	-	3,278.0	655.6	3.1	3,936.7
2034	-	3,294.0	658.8	3.1	3,955.8
2035	-	3,310.1	662.0	3.1	3,975.2
2036	-	3,326.3	665.3	3.1	3,994.7
2037	-	3,342.7	668.5	3.1	4,014.4
2038	-	3,359.3	671.9	3.1	4,034.3
2039	-	3,391.0	678.2	3.1	4,072.2
2040	-	3,389.0	677.8	3.1	4,069.9
2041	-	3,413.3	682.7	3.1	4,099.1
2042	-	3,430.3	686.1	3.1	4,119.5
2043	-	3,447.6	689.5	3.1	4,140.2
2044	-	3,518.9	703.8	3.1	4,225.8
2045	-	3,536.5	707.3	3.1	4,246.9
2046	-	3,554.2	710.8	3.1	4,268.1
2047	-	3,572.1	714.4	3.1	4,289.6
2048	-	3,590.2	718.0	3.1	4,311.4
2049	-	3,743.4	748.7	3.1	4,495.2
2050	-	3,833.6	766.7	3.1	4,603.4
2051	-	3,863.0	772.6	3.1	4,638.7

Table 7.5.5 Annual Expenses for O&M of KCR (N-A2)

【Case N-A2】 PKR million at 2011 constant price

Year	Staff Training of O&M Company	O&M Cost	Overhead cost by contract	Land Lease	Total
2019	3.2	-	-	-	3.2
2020	23.9	-	-	-	23.9
2021	162.3	-	-	-	162.3
2022	-	2,244.7	448.9	3.1	2,696.8
2023	-	2,256.0	451.2	3.1	2,710.3
2024	-	2,267.4	453.5	3.1	2,724.0
2025	-	2,278.9	455.8	3.1	2,737.7
2026	-	2,290.4	458.1	3.1	2,751.5
2027	-	2,301.9	460.4	3.1	2,765.4
2028	-	2,313.6	462.7	3.1	2,779.4
2029	-	2,325.3	465.1	3.1	2,793.4
2030	-	3,135.0	627.0	3.1	3,765.1
2031	-	3,150.5	630.1	3.1	3,783.7
2032	-	3,166.1	633.2	3.1	3,802.4
2033	-	3,181.8	636.4	3.1	3,821.2
2034	-	3,197.6	639.5	3.1	3,840.3
2035	-	3,213.6	642.7	3.1	3,859.5
2036	-	3,229.8	646.0	3.1	3,878.8
2037	-	3,246.1	649.2	3.1	3,898.4
2038	-	3,262.6	652.5	3.1	3,918.2
2039	-	3,322.4	664.5	3.1	3,990.0
2040	-	3,320.7	664.1	3.1	3,987.9
2041	-	3,405.4	681.1	3.1	4,089.6
2042	-	3,422.4	684.5	3.1	4,109.9
2043	-	3,439.5	687.9	3.1	4,130.4
2044	-	3,490.6	698.1	3.1	4,191.8
2045	-	3,508.0	701.6	3.1	4,212.7
2046	-	3,525.6	705.1	3.1	4,233.8
2047	-	3,543.4	708.7	3.1	4,255.2
2048	-	3,565.9	713.2	3.1	4,282.2
2049	-	3,655.8	731.2	3.1	4,390.1
2050	-	3,679.5	735.9	3.1	4,418.5
2051	-	3,836.4	767.3	3.1	4,606.8

Source: JICA Study Team

Table 7.5.6 Annual Expenses for O&M of KCR (N-B1)

【Case N-B1】 PKR million at 2011 constant price

Year	Staff Training of O&M Company	O&M Cost	Overhead cost by contract	Land Lease	Total
2019	2.4	-	-	-	2.4
2020	14.7	-	-	-	14.7
2021	112.6	-	-	-	112.6
2022	-	1,205.8	241.2	3.1	1,450.1
2023	-	1,212.2	242.4	3.1	1,457.7
2024	-	1,218.6	243.7	3.1	1,465.4
2025	-	1,225.0	245.0	3.1	1,473.2
2026	-	1,231.5	246.3	3.1	1,480.9
2027	-	1,238.1	247.6	3.1	1,488.8
2028	-	1,244.6	248.9	3.1	1,496.7
2029	-	1,251.3	250.3	3.1	1,504.6
2030	-	2,091.0	418.2	3.1	2,512.3
2031	-	2,100.8	420.2	3.1	2,524.0
2032	-	2,110.6	422.1	3.1	2,535.8
2033	-	2,120.6	424.1	3.1	2,547.8
2034	-	2,130.6	426.1	3.1	2,559.9
2035	-	2,140.8	428.2	3.1	2,572.1
2036	-	2,151.1	430.2	3.1	2,584.4
2037	-	2,161.5	432.3	3.1	2,596.9
2038	-	2,172.0	434.4	3.1	2,609.5
2039	-	2,182.6	436.5	3.1	2,622.3
2040	-	2,193.4	438.7	3.1	2,635.2
2041	-	2,204.2	440.8	3.1	2,648.2
2042	-	2,215.2	443.0	3.1	2,661.4
2043	-	2,280.5	456.1	3.1	2,739.7
2044	-	2,291.7	458.3	3.1	2,753.2
2045	-	2,303.1	460.6	3.1	2,766.8
2046	-	2,314.6	462.9	3.1	2,780.6
2047	-	2,467.4	493.5	3.1	2,964.0
2048	-	2,479.2	495.8	3.1	2,978.1
2049	-	2,491.1	498.2	3.1	2,992.4
2050	-	2,503.1	500.6	3.1	3,006.9
2051	-	2,531.9	506.4	3.1	3,041.3

Source: JICA Study Team

7.6 Financial Plan for O&M of KCR

The information contains information of particular firms/institutions; information should not be disclosed for a fixed period.

7.7 Risks and Risk Management in O&M

7.7.1 Risks in O&M

Usually, there are many risks in the O&M of urban railway; especially financial deficits that adversely affect the management of railway operation companies. In consideration of sustainable railway operations, measures should be taken to mitigate financial risks. In this section, causes of the financial risks in the O&M of KCR are analyzed for the sustainability of KCR. The following causes of risks (deficits) are conceivable:

1) Overestimation of the number of passengers in demand forecast

Due to overestimation in the number of passengers in demand forecast, a gap between the projected and recorded number of passengers exists, and hence, the fare revenue after the opening tends to be lower than the estimated value.

2) Time lag occurs before the number of passengers achieves the estimated number

Since it would take a long time for the users to become aware of the advantages of KCR such as convenience and rapid transportation, the estimated number of passengers will not be achieved eventually by the target year.

3) Low fare level

Fare level should be decided in consideration of balance between expenses for O&M and fare revenues. However, if low fare level is applied from the point of operation strategy of KCR, public financial support from the government is required for KCR.

4) Underestimation of O&M cost

Underestimating the O&M cost and depreciation will cause deficits.

5) Overestimation of non-rail business

Overestimation of revenue from non-rail business may cause deficits.

7.7.2 Risk Management in O&M

Measures to avoid deficits in the O&M of KCR in terms of the above mentioned risks are proposed as follows:

1) Mitigation of the interest burden of the construction costs of KCR

To avoid deficits in the O&M of KCR, the interest burden of the construction costs of KCR to the operating company should be mitigated. JICA Study Team proposed a scheme where the interest burden is not directly borne by the local operating company.

2) Implementation of public financial support to promote public transportation

To promote the utilization of public transportation to eliminate traffic congestion and prevent air pollution, public financial support should be provided by the government.

3) Operation planning in accordance with demand

Based on actual demand, the operation plan of KCR should be revised to be able to secure a suitable service level for users in consideration of headway, congestion rate, etc.

4) Approach to stimulate traffic demand

As approaches to stimulate traffic demand, discount tickets and transit discounts with other transportation, should be introduced to KCR.

5) Increase of passengers with improved user-friendly facilities

Park-and-ride or transit facilities should be provided to improve the user-friendliness and accessibility of the facilities and for the convenience of the passengers.

6) Optimization of O&M organization by automation and outsourcing

To minimize costs of the O&M, the O&M organization should be optimized and simplified by automation and outsourcing.

7) Enhancement of non-rail business

To maximize profits received from KCR, non-rail business should be strongly implemented and enhanced gradually.

7.7.3 Individual Cases of Risk Management in O&M taken by Singapore Metro, Delhi Metro, and TX

The information contains information of particular firms/institutions; information should not be disclosed for a fixed period.

7.8 Legislative System for Railway

Since railway has a great social impact as a public transport, a government shall approve railway business, construction of railway facility, manufacturing of rolling stock based on laws, and technical standards are also provided by laws for safe and efficient railways. Moreover, matters for safe transports and continuous operations of railway after opening should be legislated.

7.8.1 Legislative System in Japan

Two acts, which are railway business act and railway operation act, are representative laws in Japanese regulative systems for railway.

(1) Railway Business Act

This act is established in 1986 to prescribe regulatory standards for railway business such as on government approvals of business, construction, fare, and operation plan and accident report. It is applied for all rail systems of high speed railway, conventional railway of JR, railway owned by private sectors, monorail, AGT, APM and cable car except for LRT constructed on road. Based on this act, the following regulatory standards are provided.

- Inspection regulatory standards on railway facility: standards for inspection by government at opening and so on
- Report regulatory standards on railway accident: report standards from a railway operator to government when accidents occur
- Accounting regulatory standards for railway business
- Audit regulatory standards on railway facility: standards for audit that government exercises to railway operators

(2) Railway Operation Act

This act is established in 1900 to prescribe conditions for facility, transport, staff, passenger, the public of railway comprised of 3 chapters and 45 articles for safety of passengers and freights and smooth operations. Based on this act, the following ministerial ordinances are provided.

- Ministerial ordinance to provide the technical standard on railway: technical standards for railway facilities and rolling stock
- Ministerial ordinance on driver's license
- Driving regulatory standards (ministerial ordinance): details on handling train and rail
- Transport regulatory standards (ministerial ordinance): basic matters on passenger and freight transport
- Personnel management standards (ministerial ordinance): duties of station master, station staff, driver, conductor, traffic controller, staffs for track maintenance, repair, power transform, electrical circuit, signal, communication, electric power dispatch, car inspection and repair, and so on.

7.8.2 Legislative System Required for Railway Business

Laws required for opening, plan and design, inspection and O&M for railway business are sorted and summarized as follows.

The legislative system is expected to be established before the design start for facility and rolling stock. However, if it is difficult to compile technical standards and coordinate with related agencies in short time, the legislation prepared in parallel with the project implementation would be a more realistic measure.

(1) Scope, permission and commission for railway business

In case to commence railway business or to subcontract the business, conditions and procedures for government approval shall be legislated.

(2) Technical specification of railway facility and rolling stock, government approval and matters allowed by law

For safe and efficient transport of passengers and freight, matters on government approval and permission shall be legislated as well as technical standards. The approvals and permissions include matters on design content and construction.

(3) Inspection before railway opening

At opening, government or certification authority is required to inspect if approvals or permissions of design and construction are properly entrusted by government, and to check if the design performance and operation ensure safety. These matters should be legislated.

(4) Required Law for O&M

Ministerial ordinances for safe transport and continuous operation are required specifically for fare system, government approval or permission on fare, audit and order to railway operators, responsible person and system for O&M, accounting method, and technical standards for inspection required for facility and rolling stock maintenance.

8. VERIFICATION OF PROJECT EFFECTS

8.1 Economic and Financial Evaluation

8.1.1 Prerequisite Conditions

This section presents the results of economic and financial evaluation works. The evaluations were done by taking an authentic way of the cost-benefit analysis based on the cost estimate shown in Chapter 6.2 and demand forecast stated in Chapter 3. As explained in the demand forecast part, the socio-economic framework of the future Karachi Metropolitan Area developed in the JICA Transport Master Plan Study (KTIP) was used as the basis of demand forecast in this study. Mainly because the framework assumes a significant decentralization of future population to the outskirts of the City, the demand for the KCR dropped from the results of a precedent JICA Study on the KCR project carried out in 2009 (SAPROF-I). By this, both of the economic and financial viability of the KCR project became somewhat fragile comparing with SAPROF-I.

Here, evaluation focuses on KCR planning option N-A1, N-A2 and N-B1. All of them are planned to open in 2022 and after that, 30 years of 2012 to 2051 are the period for evaluation.

In the master plan of KTIP, the population growth rate and GRDP growth rate are assumed at 4% and 8% per annum, respectively as shown in Table 8.1.1. The growth rate of the time value to be applied to KCR economic analysis is assumed as the same as that of GRDP. In demand forecast, future car ownership was forecast based on the economic growth.

Table 8.1.1 Population Growth and Economic Growth in Karachi

Year	Population (million)	GRDP (PKR million)	GRDP per capita (PKR at 2011 price)
2010	18.53	10324.0	557.2
2020	27.55	22288.7	809.0
Annual Growth (%)	4.0	8.0	3.8

Source: Interim Report of KTIP, 2011

8.1.2 Economic Analysis

To ensure fairness of procurement process as well as project implementation, information should not be disclosed for a fixed period.

8.1.3 Financial Analysis

To ensure fairness of procurement process as well as project implementation, information should not be disclosed for a fixed period.

8.2 Project Effect Indicators

In JICA ODA loan project, operation and effect indicators are proposed to quantitatively measure the project's operational performance and effects in accordance with its objectives. These indicators, including target figures, are adopted by the mutual consent and are subject to continuous follow-up at the time of various stages of the project cycle according to Operational Guidance of Loan Project.

Operation and effect indicators are usually set up for urban railway project, and similar indicators are generally introduced in the different railway operators for comparison of each railway operation and management efficiency.

(1) Proposed Typical Operation and Effect Indicator

Typical operation & effect indicators generally used for urban railway project are shown in Table 8.2.1.

Table 8.2.1 Operation and Effect Indicators

Type	Indicator	Typical Dimension of Indicator	Means of Verification
Operation	Transportation Volume	Passenger / Year Passenger – km / Year	Passenger Records
	Number of Trains	Trains / day	Train Operation Records
	Car Operation Rate	% / year	Train Operation Records
	Running Distance	Car-km / Year	Train Operation Records
	Train Delay Time	Minutes/train/year	Train Operation Records
Effect	Transportation Volume	Passenger / Year Passenger – km / Year	Passenger Records
	Travelling Time Reduction	Travelling Time Difference between Bus and Train : Minutes / Particular Section	Bus Travelling Time Records (Survey Results on Bus Transportation)
	Mitigation of Congestion	Scheduled Speed Difference of Bus Before and After Project Completion: Minutes / Particular Section	Bus Scheduled Speed Records (Survey Results on Bus Transportation)

Source: JICA Study Team

(2) Timing of First Evaluation

Two years after the project completion is normally adopted in JICA project evaluations.

(3) Basic Approach to adopt Operation and Project Effect Indicators

- To select the proper indicators taking into consideration easiness and practicability of data collection and monitoring.
- To propose the target values at the proper time after commencement of KCR operation taking into account revised projected demand.
- In the case that baseline surveys are needed for setting the target values, to examine and propose the methods and timing of baseline surveys concerned.

(4) Proposed Operation & Effect Indicators and Target Value Based on Demand Forecast

Table 8.2.2 for Option N-A1 and Table 8.2.3 for Option N-B1 below are showing proposed operation & effect indicators and target value of 2024 (Two years after project completion) based on revised demand forecast.

In terms of operation indicators, data for transportation volume, number of trains, car-km can be obtained from passenger records and train operation records of target year. Car operation rate can also be obtained from train operation records and inspection & maintenance records. Train delay time can be obtained by daily train operation records from OCC after the commencement of train operation. Taking into consideration practicability of data collection and monitoring, these indicators are applicable to operation indicators. These operation indicators need to be further reviewed with KUTC.

In terms of effect indicators, transportation volume, travelling time reduction and mitigation of congestion are proposed as indicators.

Data for transportation volume can be obtained from passenger records same as operation indicators. Data for travelling time reduction comes from travelling time difference between bus and KCR train operation in particular section. For Option N-A1, in order to get travelling time difference, two bus routes such as North Nazimabad–Karachi Cantt and Nipa–Baldia are proposed as typical transportation routes which run from North to South and from East to West within the KCR service area. For N-B1, one bus route of Drigh Road–Baldia is proposed as typical transportation route which runs from East to West. Data survey on bus travelling time for the particular section above will be conducted every year starting in 2021, one year before the commencement of KCR operation.

Data for mitigation of congestion comes from bus scheduled speed difference of particular bus route between before and after the commencement of KCR operation. The same two bus routes applied to travelling time reduction, which go through congested area of Karachi city, are proposed as bus routes for measuring mitigation effect of congestion. Data survey on bus scheduled speed for the particular bus routes above will be conducted every year starting in 2021, one year before the commencement of KCR operation.

The target values of transportation volume of effect indicators in 2024 (2 years after project completion) are described in Table 8.2.2 and Table 8.2.3. However the target value of travelling time reduction and mitigation of congestion in 2024 will be determined after the first data is obtained in 2021.

Table 8.2.2 Operation & Effect Indicator and Target Value（Option N-A1）

Type	Indicator	Dimension of Indicator		Target Value of 2024 (2 years after project completion)
Operation	Transportation Volume	Passengers/Year		218,886,000
		Passengers /Station/Year		Each Station Value
		Passenger-km/Year		2,385,500,000
	Number of Trains	Number of Trains/Day		358
	Car Operation Rate %/Year	Procured Cars X (365 – Average Non-Operation Day due to inspection) / Accumulative Procured Cars ×Operation Day per Year		90
	Car-km	Car-km		21,537,000
	Train Delay Time	Average Delay Time /Train/Year		1 Minute
Effect	Transportation Volume	Passenger/Year		218,886,000
		Passenger /Station/Year		Each Station Value
		Passenger-km/Year		2,385,500,000
	Travelling Time Reduction	Travelling Time Difference between Bus and KCR	North Nazimabad - Karachi Cantt	*Bus: Data Survey
				KCR:28min.20sec
			NIPA - Baldia	*Bus: Data Survey
				KCR:23min.20sec
	Mitigation of Congestion	Scheduled Speed Difference of Bus Before and After Project Completion	North Nazimabad - Karachi Cantt	**Bus: Data Survey
			NIPA - Baldia	**Bus: Data Survey

Note: The values in the columns of the above table will be reviewed in case the train operations plan is changed.

Source: JICA Study Team

Table 8.2.3 Operation and Effect Indicators and Target Value (Option N-B1)

Type	Indicator	Dimension of Indicator		Target Value of 2024 (2 years after project completion)
Operation	Transportation Volume	Passengers/Year		116,032,000
		Passengers /Station/Year		Each Station Value
		Passenger-km/Year		1,103,486,000
	Number of Trains	Number of Trains/Day		389
	Car Operation Rate %/Year	Procured Cars X (365 – Average Non-Operation Day due to inspection) / Accumulative Procured Cars ×Operation Day per Year		90
	Car-km	Car-km		11,107,000
	Train Delay Time	Average Delay Time /Train/Year		1 Minute
Effect	Transportation Volume	Passenger/Year		116,032,000
		Passenger /Station/Year		Each Station Value
		Passenger-km/Year		1,103,486,000
		Travelling Time Difference between Bus and KCR	Drigh Road-Baldia	*Bus: Data Survey
				KCR:27min.50sec
	Mitigation of Congestion	Scheduled Speed Difference of Bus Before and After Project Completion	Drigh Road - Baldia	**Bus: Data Survey

Note: The values in the columns of the above table will be reviewed in case the train operations plan is changed.

Source: JICA Study Team

The survey on current bus travelling time in typical bus routes above was conducted during peak hour both in the morning and evening for three days. Survey results are shown in Table 8.2.4 below.

Average bus travelling time between Karachi Cantt to North Nazimabad in 2012 is Day1-64 minutes, Day2-50minutes and Day3-56minutes. Expected travelling time of KCR is 28minutes in 2022.

While the average bus travelling time between Nipa to Baldia in 2012 is Day1-61minutes, Day2-64minutes and Day3-57minutes. Expected travelling time of KCR is 23minutes in 2022.

It is difficult to compare bus travelling time in 2012 with KCR travelling time in 2022 because traffic condition probably might be getting worse. However in 2022 it can be predicted that bus travelling time will be much bigger than KCR and bus travelling time is not constant because of heavily depending on traffic condition. Therefore KCR project will be expected to play important role for travelling time reduction and mitigation of congestion.

Table 8.2.4 Bus Travelling Time in 2012 between Karachi Cantt to North Nazimabad and Nipa to Baldia

	Route	Day	Round	Survey date	Period	Time (at Karachi Cann. St.)	Trip hour (Minutes)	Time (at North Nazim. St)
North Nazimabad Stn./ Karachi Cantt Stn.	Karachi Cantt To North Nazim.	Day 1	Round1	2012/7/27	Morning	7:45	55	8:40
	North Nazim. To Karachi Cantt				Morning	10:00	65	8:55
	Karachi Cantt To North Nazim.		Round2	2012/7/27	Evening	4:10	65	5:15
	North Nazim. To Karachi Cantt				Evening	6:45	70	5:35
	Karachi Cantt To North Nazim.	Day 2	Round1	2012/7/28	Morning	7:25	45	8:10
	North Nazim. To Karachi Cantt				Morning	9:25	50	8:35
	Karachi Cantt To North Nazim.		Round2	2012/7/28	Evening	3:45	50	4:35
	North Nazim. To Karachi Cantt				Evening	5:50	55	4:55
	Karachi Cantt To North Nazim.	Day 3	Round1	2012/7/30	Morning	7:40	52	8:32
	North Nazim. To Karachi Cantt				Morning	9:42	56	8:46
	Karachi Cantt To North Nazim.		Round2	2012/7/30	Evening	4:11	59	5:12
	North Nazim. To Karachi Cantt				Evening	6:38	55	5:43

	Route	Day	Round	Survey date	Period	Time(at NIPA)	Trip hour (Minutes)	Time (at BaldiaStn)
NIPA Stn / Baldia Stn	NIPA Stn. to Baldia Stn.	Day 1	Round1	2012/8/1	Morning	8:12	54	9:06
	Baldia Stn. To NIPA Stn.				Morning	10:22	58	9:24
	NIPA Stn. to Baldia Stn.		Round2	2012/8/1	Evening	3:43	63	4:48
	Baldia Stn. To NIPA Stn.				Evening	6:14	68	5:06
	NIPA Stn. to Baldia Stn.	Day 2	Round1	2012/8/2	Morning	7:14	57	8:11
	Baldia Stn. To NIPA Stn.				Morning	9:26	64	8:22
	NIPA Stn. to Baldia Stn.		Round2	2012/8/2	Evening	4:13	65	5:18
	Baldia Stn. To NIPA Stn.				Evening	6:41	69	5:32
	NIPA Stn. to Baldia Stn.	Day 3	Round1	2012/8/3	Morning	7:35	57	8:32
	Baldia Stn. To NIPA Stn.				Morning	9:47	53	8:54
	NIPA Stn. to Baldia Stn.		Round2	2012/8/3	Evening	4:42	56	5:38
	Baldia Stn. To NIPA Stn.				Evening	6:57	63	5:54

Source: JICA Study Team

8.3 Climate Change Mitigation Effects

Climate change is currently one of the most important issues in international society, and it is expected to adapt/mitigate its effect properly and urgently. To combat with it, Kyoto Protocol was invented in 1997 and has come into force since 2008. Clean Development Mechanism (CDM) is an activity under Kyoto Protocol which mitigate the greenhouse gas (GHG) with the cooperation of developed and developing countries. By implementing the CDM, the project cannot only contribute to GHG emission reduction but also improve its financial status with CDM credit. GOP is taking a positive attitude toward implementing the CDM projects. Taking the above into consideration, it is expected that CDM can be applied to the KCR Project.

In this section, CDM applicability on urban transport system was considered from the view point of modal shift effect and regenerative energy effect.

8.3.1 Modal Shift Effect

Recently, modal shift effect has come under spotlight in urban railway project contributing to GHG emission reduction. To consider this point, approved consolidated methodology No. 16 (ACM0016[1]) was developed and authorized by the CDM executive board (CDM-EB[2]) under UNFCCC[3], which is intended for Mass Rapid Transit System (MRTS). Outline of the said methodology is shown below.

Table 8.3.1 Outline of the ACM0016

Methodology No.	ACM0016
Title	Methodology for mass rapid transit system (MRTS)
Applicability (except in the case of Bus Rapid Transit : BRT)	- A new rail-based infrastructure (new rail lines). Not applicable for operational improvements of an already existing and operating rail-based MRTS. - Applicable for passenger transport only. - The project system partially replaces a traditional public transport system in a city. The methodology cannot be used in areas where currently no public transport is available. - The methodology is applicable for urban or suburban trips. It is not applicable for inter-urban transport.
Project boundary	From origin to destination for all passengers using the project system.
Baseline emission	Baseline emissions include the emissions that would have happened due to the transportation of the passengers who use the project activity, had the project activity not been implemented.
Project emission	Project emissions are based on the electricity consumed by the MRTS (direct project emissions) plus emissions caused by project passengers from their trip origin to the entry station of the project and from the exit station of the project to their final destination (indirect project emissions).
Leakage	- Emissions due to changes of the load factor of taxis and buses of the baseline transport system due to the project; and - Emissions due to reduced congestion on affected roads, provoking higher average vehicle speed, plus a rebound effect.

Source: JICA Study Team

To apply ACM0016 on the Project, the following points were considered.

[1] http://cdm.unfccc.int/methodologies/DB/8PBZENI1PK0QIJW8RJ5LEDXV6WX60O
[2] CDM EB supervises the Kyoto Protocol's clean development mechanism under the authority and guidance of the Conference of the Parties serving as the Meeting of the Parties to the Kyoto Protocol (COP/MOP).
[3] United Nations Framework Convention on Climate Change (http://unfccc.int/2860.php)

(1) Applicability

In case of applying ACM0016, the following applicability conditions are taken into account at the beginning (see the table below).

Table 8.3.2 Applicability of the ACM0016 and Project Activity

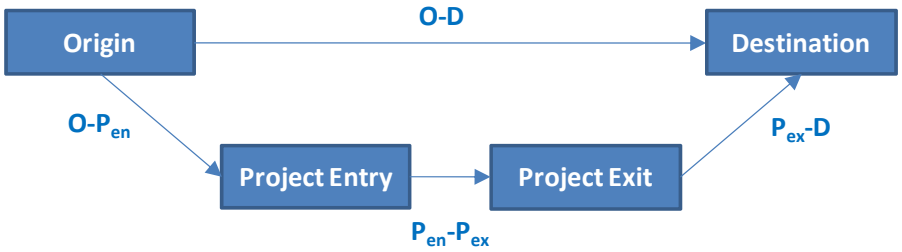
Applicability under ACM0016	Project Activity
The methodology is applicable for a new rail-based infrastructure (new rail line) or segregated bus lane. The methodology is not applicable for operational improvements of an already existing and operating bus lane or rail based rail line.	There is no electric railway in Karachi, and the project is a new rail line according to the PMU of the Karachi Circular Railway system (the System). Therefore the project activity satisfies the applicability condition.
The methodology is only for urban and/or suburban trips and passenger transport not applicable for water and air based transport system.	The project is an urban passenger transport project. Therefore the project activity satisfies the applicability condition.
The project system partially replaces a traditional public transport system in a given city. The methodology cannot be used in areas where currently no public transport is available.	In the preliminary design, the passenger transition from traditional public transport, such as taxi or public bus, is estimated. The project system partially replaces the traditional public transport system and the methodology can be used for the project. Therefore the project activity satisfies with the applicability condition.

Source: JICA Study Team

(2) Baseline scenario and project boundary

The spatial extent of the project boundary encompasses the urban area in which the Project takes place. It is based on the origins and destinations of passengers using the project system. As the Project cannot control the trip origins or destinations of passengers the spatial area of the Project is the entire city or metropolitan/urban area in which the project operates. The Project only includes emission reductions from the MRTS lanes. If any MRTS lane would in a later stage be extended beyond the originally planned route, then emission reductions can only be claimed for the original lane. In case of using electricity from an interconnected grid or power plant for the propulsion of rolling stocks, the project boundary also includes the power plant connected physically to the electricity system that supply electricity to the Project, and/or the power plant with reference to the tool to calculate baseline, project and leakage emissions from electricity consumption.

The baseline scenario seems to be a continuation of traditional modes of transport including buses, taxis, private cars, motor cycles and bikes. The boundary area for baseline and project emissions is the target passengers along/inside the system, who will change from the existing transportation to the system. To calculate the baseline emission from existing transportation situation as baseline scenario, the data to be used include the number of passengers who desire to shift to the system from the current one, and distances between each station and after the commencement of the system. The origin of the passenger to be considered will be within the project boundary.



Source: JICA Study Team

Figure 8.3.1 Schematic Figure of Baseline and Project Emissions

Transportation route from the origin to destination will be changed according to the introduction of the new system or implementation of the Project. In that case, new GHG emission will occur from the transportation (a) between origin to project entry ($O\text{-}P_{en}$) and (b) between project exit and destination ($P_{ex}\text{-}D$). However, there is currently no baseline emission data in the project area. Therefore, this is estimated as the emission from [P_{en}–P_{ex}], with the assumption that this is lower than the distance [O–D], based on the ACM0016.

8.3.2 Regenerative Energy Effect

Since a railway project normally consumes a large amount of electricity, it is preferable to apply to energy saving or energy efficiency system. In addition to the modal shift effect, effect of energy efficiency in the train operation can be a good candidate for CDM application. In CDM scheme, the regenerate energy system using braking devices has been already approved by CDM-EB. For instance, such system has already been applied in Delhi Metro project in India funded by Japan International Cooperation Agency (JICA).

Delhi Metro Railway Project

The Delhi Metro Rail Project was the first one to be registered for CDM in 2007 for the regenerative braking system installed in 2004. The purpose of the project is to install low GHG emitting rolling stocks having regenerative breaking system in Delhi Metro Rail Corporation. Before the project implementation, Kolkata metro is the only one using the conventional rheostat braking technology, with regenerative breaking technology fitted rolling stocks. The regenerated electrical energy is used by other rolling stocks on the line operating in power mode. The regenerated electrical energy reduces the consumption of equivalent grid electricity required by the power trains. By the project implementation, the GHG emissions are mitigated 41,160 [tCO2/year].

In the Delhi metro project, small scale approved methodology type III.C (AMS-III.C[4]) was applied. Outline of the said methodology is shown below.

Table 8.3.3 Outline of the AMS-III.C

Methodology No.	AMS-III.C
Title	Emission reductions by low GHG emitting vehicles
Applicability	Measures are limited to those that result in emission reductions of less than or equal to 60,000 [tCO2/year].
Project boundary	The project boundary is the low GHG emitting vehicles that are part of the project activity.

[4] http://cdm.unfccc.int/methodologies/DB/7DYUF4TWIPX6BHOM3EHMM8B8LIKF1M

Methodology No.	AMS-III.C
Baseline emission	The baseline is the energy use per unit of service for the vehicle that would otherwise have been used times the average annual units of service per vehicle times the number of vehicles affected times the emission coefficient for the fuel used by vehicle that would otherwise have been used.
Project emission	For electric vehicles, the emissions from the production of electricity used will constitute the project emissions.
Leakage	No leakage calculation is required because of small scale methodology

Source: JICA Study Team

AMS-III.C is a methodology for introducing new electric and/or hybrid vehicles that displace the use of fossil fuel vehicles in passenger and freight transportation. It can be useful on regenerative breaking system. To apply the AMS-III.C on the Project, the following points were considered.

(1) Baseline scenario

The baseline for the project activity has been arrived at using the methodology specified in the applicable project category for small scale CDM project. Indicative simplified baseline and monitoring methodologies for AMS-III.C categories defines below.

The baseline is the energy use per unit of service for the vehicle that would otherwise have been used times the average annual units of service per vehicle times the number of vehicles affected times the emission coefficient for the fuel used by vehicle that would otherwise have been used. If electricity is used by the vehicles, the associated emissions shall be estimated in accordance with paragraphs of category I.D.

In the baseline scenario for the project activity, rolling stocks without regenerative braking system would have been used and total electricity consumption of rolling stocks would have been consumed from the national grid or power plant. For the project activity, the baseline and project emissions are from the total electrical energy (kWh) consumed in running the rolling stock during the project activity.

(2) Additionality

CDM project shall be demonstrated "additionality" that the project participants (project developer) have to write explanation of how and why this project activity is additional and therefore not the baseline scenario in accordance with the selected baseline methodology. As for small scale CDM project, the project participants shall provide an explanation that the project activity would not have occurred anyway at least one of the following barriers, in accordance with the following CDM guideline[5] below.

(a) Investment barrier: a financially more viable alternative to the project activity would have led to higher emissions;
(b) Technological barrier: a less technologically advanced alternative to the project activity involves lower risks due to the performance uncertainty or low market share of the new technology adopted for the project activity and so would have led to higher emissions;
(c) Barrier due to prevailing practice: prevailing practice or existing regulatory or policy requirements would have led to implementation of a technology with higher emissions;
(d) Other barriers: without the project activity, for another specific reason identified by the project participant, such as institutional barriers or limited information, managerial resources, organizational capacity, financial resources, or capacity to absorb new technologies, emissions would have been higher.

The Project is the first urban train system utilizing the said regenerative breaking system in Pakistan. Therefore, the barrier due to prevailing practice cannot be explained. And, installation of the

[5] http://cdm.unfccc.int/Reference/Guidclarif/meth/methSSC_guid05.pdf

regenerative braking system is more costly than that of conventional braking system in its installation. In addition, since the Project is the first electrified urban train system in Pakistan, installation of the regenerative braking system is more technically challenging than that of conventional braking system in its installation, operation and maintenance. Accordingly, conventional braking system would not be installed in the absence of the CDM project activity. Thus, installation of the regenerative braking system can be considered as additional.

8.3.3 Practicability as CDM Project

Railway project involves many factors to contribute to GHG emission reduction. Its effect is not limited, but the following three (3) options were considered in application of CDM methodologies: 1) ACM0016 only, 2) AMS-III.C only, and 3) combination of ACM0016 and AMS-III.C, in order to apply to CDM scheme. Advantage and disadvantage of the said options are shown as follows.

[ACM0016 only]

Advantage	- Large amount of GHG emission reduction is expected by CDM application of modal shift. - CDM application is an effective tool to appeal to the public on necessity of the modal shift with railway transport system by showing GHG emission reduction as a part of environmental effect.
Disadvantage	- Enormous data is required to collect in the monitoring. And, monitoring cost is required for years of monitoring activity.

Source: JICA Study Team

[AMS-III.C only]

Advantage	- CDM application procedure is easier than normal scale (large scale) CDM in case that the Project is categorized as small scale. - Monitoring activity is easy, since electrical energy used and regenerated by the train is automatically recorded in the information system with accurate measurement. And, almost no cost is required for the monitoring activity, since the traffic information system (TIS) is conventional equipment and not additional in the case of CDM.
Disadvantage	- Although electrical energy generated by the regenerative braking system has to be used by other train which accelerates at the same time, rate of regenerated electricity actually used by other rolling stock may not so high as expected, especially in the beginning of operation period. - Though higher GHG emission reduction may be expected in the case where the rate of regenerated electricity actually used by other rolling stock be increased due to increase of operation frequency of the trains including extension of the Project in future and consequently the emission reduction may become more than 60,000 tCO2/year, surplus of the emission reduction will not be counted as credit due to the prerequisite of small scale methodology.

Source: JICA Study Team

[Combination of AMS-III.C and ACM0016]

Advantage	- More carbon credit may be obtained, compared to the case where single methodology is applied. And, advantages of both methodologies would be expected.
Disadvantage	- It seems to have a difficulty on project boundaries would be overlapped between both methodologies. - A scenario for project activity, which considers electrical energy used by rolling stock, common to both methodologies is used. On the other hand, while baseline scenario for the AMS-III.C considers installation of rolling stock with conventional rheostat braking system, baseline scenario for ACM0016 considers previous transport mode. It may be pointed out that two (2) baselines exist in one (1) project activity.

Source: JICA Study Team

Taking the above descriptions into consideration, it is preferable that the Project has advantages as many as possible. Accordingly, the following items will be clarified before the preparation of "prior consideration" and "Project Design Document (PDD[6])", in order to apply the CDM scheme.

(1) Modal shift effect

(i) Data collection

To consider modal shift effect in the Project, ACM0016 requires comprehensive monitoring activity through direct interview survey to the passengers, and the corresponding data processing and analysis. The following data are required in application of ACM0016.

Table 8.3.4 Necessary Data in Application of ACM0016

Data not monitored	
1	Average trip distance of passengers using the electricity-based vehicle category i prior to project start (km)
2	Average occupation rate of vehicle category i prior to project start. (passenger)
3	Passengers transported by baseline buses (passenger per day or year)
4	Average trip distance of passengers using buses prior to project start (km)
5	Total distance driven by buses of various sub-categories prior to project start. (km)
6	Average annual distance driven by baseline buses (km/bus)
7	Specific fuel consumption of vehicle category i using fuel type x prior to project start (grams of fuel/km)
8	Number of vehicles of category i prior to project start (vehicle)
9	Average annual distance driven by taxis (km/taxi)
10	Number of vehicles of vehicle category i using the affected roads per annum in the baseline. (number of vehicles)
11	Average total speed and average speed under circulation is measured (km/h)
12	Emission factor for the grid (kgCO2/kWh)
Data monitored	
1	Baseline trip distance of the cluster p of surveyed passengers using mode i in the year y (km)
2	Total fuel of type x consumed by the project transport units (mass or volume units of fuel)
3	Net calorific value of fuel type x (J/mass or volume units of fuel in year y)
4	CO2 emission factor for fuel type x in year y (gCO2/J)
5	Specific fuel consumption of vehicle category i using fuel x in the year y (mass or volume units of fuel/km)
6	Distance driven by project units using fuel type x in year y (km)

[6] Project Design Document (PDD) is the key document involved in the validation and registration of a CDM project activity.

7	Direct project emissions in year y if the project activity transport system involves electricity based transport units (tCO2)
8	Indirect project trip distance of the surveyed passenger using mode i in the year y (km)
9	Average occupation rate of vehicle category i in year y (passenger)
10	Average distance driven by taxis and cars on affected roads in year y (km)
11	Number of vehicles of vehicle category i using affected roads (number of vehicles)
12	Total passengers transported by the project activity transport system (passenger)
13	Net share of passengers using the MRTS which would have used mode i in the year y (%)
14	Number of vehicles of vehicle category i circulating in the city (number of vehicles)
15	Average speed of cars and taxis on affected roads in year y and total average speed and average moving speed (km/h)
16	Total passengers transported by baseline rail-system in the year y (passenger)
17	Total emissions from the electricity-based rail system in the year y (tCO2)

Source: Approved consolidated baseline and monitoring methodology ACM0016

(ii) Monitoring

To identify the modal shift effect, the project participant shall conduct "interview survey using questionnaire sheet". The information will be obtained through the face-to-face application on a random base To plan interview survey, the following points shall take account of: Survey objective; Target population; Sample frame; Sample design; Relative error level; Geographical coverage; Sample frequency; Sample size; Size and result of the pilot test; Selection method of the sample; Methodology for information collection and estimation of the parameters; Data verification and validation including QA and QC; Survey realization; Calculation of a trip distance in the survey; Default questionnaire.

(2) Regenerative energy effect

(i) Data collection

To consider the regenerative energy effect in the Project, AMS-III.C requires monitoring activity and data analysis. To satisfy with the requirement of AMS-III.C, the following data are required.

Table 8.3.5 Necessary Data in Application of the AMS-III.C

Data monitored	
1	Annual average distance driven by project vehicle i in year y (km/year)
2	Average technical transmission and distribution losses for providing electricity in the year y
3	Consumption of specific electricity/fossil fuel consumption per km per project vehicle category i in year y (g/km and kWh/km)
4	Net calorific value of fuel i (J/g)
5	CO2 emission factor of fuel used by vehicles category i (gCO2/J)
6	CO2 emission factor of electricity used by project vehicle (kgCO2/kWh)

Source: Approved small scale baseline and monitoring methodology AMS-III.C

(ii) Monitoring

Project activity includes installation of low GHG emitting rolling stock having regenerative braking technology instead of conventional electro-dynamic rheostat braking system. Total amount of the emission reduction depends on the number of rolling stock and annual units of service provided by rolling stock units in the System. The monitoring of all the data relating to electrical energy required for the estimation of baseline and project emissions for the activity is through state of the art electric equipments such as the information system, which is an electronic device with high accuracy used for measuring and recording train's

energy consumption. The Project represents all the electrical energy data that is monitored through information system during the project activity.

(3) Common items

In the CDM document (PDD), common items shall be checked/mentioned properly from the viewpoint of environmental/social aspects.

(i) Environmental impact assessment

To apply CDM, environmental impact shall be considered with the proper environmental impact assessment (EIA) guideline or standard in the host country (Pakistan). The EIA on the Project has been implemented and its assessment focuses on during construction and operation phases according to the characteristics and feature of the environmental components, based on the Pakistan regulation on EIA. The summary of the impact assessment are described as follows.

a) Construction phase

During construction phase, it seems that major impacts are air pollution by dust, noise generated at construction site, vibration at construction site and water pollution by the discharged waste water and so on. In case of having such impacts, the following measures are considered.

Table 8.3.6 Mitigation Measures to Reduce the Environmental Impacts during Construction Phase

Items	Issues	Mitigation measures
Noise and vibration	Noise and vibration caused by construction activity, machinery and vehicle movement in and around the site will affect the local residents.	Advance railway construction techniques provide adequate measures to control noise and vibration limiting its nuisance effects.
Air quality	Impact on air quality will be caused by exhaust gases of vehicles and construction equipment. Especially dust emissions due to construction activity will have impacts on the environment, especially dry season.	Dust protection wall should be prepared and water should be sprayed with appropriate manner.
Surface water pollution	Construction activities in proximity to water body sources and run off may cause impact on water quality	Construction methods and techniques and disposal of used water need to be designed for proper drainage and control of discharge.
Solid waste and soil contaminati on	Disposal of excavated soil, construction debris and other waste including domestic waste which can cause soil contamination and other health and safety issues	Proper solid waste management program to be designed and executed for the both construction and operation phases of the project.

Source : SAPROF report for Karachi Circular Railway Project, May 2009

b) Operation phase

During operation stage, major impacts seem to be noise and vibration, solid waste and waste water from stations and so on. In case of having such impacts, the following measures are considered.

Table 8.3.7 Mitigation Measures to Reduce the Environmental Impacts during Operation Phase

Items	Issues	Mitigation measures
Noise and Vibration during operation	Noise will occur due to train movement though the maximum noise level is lower than electrical type locomotive. Special design consideration in braking system and turning speed and radius/traction.	The utilization of low noise equipment or provision of temporary sound barrier wall will be done to control noise and vibration limiting its nuisance effects. Sound barrier wall is to be erected all along the track which will also act as safety wall. For vibration control special dampeners are provided in the sleepers and control with ballast.
Surface water pollution	Wastewater discharges	Wastewater treatment at depots will be installed to mitigate the impact.
Solid waste and soil contamination	Domestic waste will be generated in each station.	The solid waste collection system in the station will be provided.
	Special waste generated at depots requiring proper, handling, storage, collection, treatment and disposal.	Hazardous waste treatment system such as Incineration or landfilling will be required according to the nature of solid waste.

Source : SAPROF report for Karachi Circular Railway Project, May 2009

(ii) Stakeholders' comments

CDM regulations request to confirm stakeholder's opinion properly by the workshop or official meeting. The Project has not implemented stakeholder's consultation so far, with topic of CDM application. It is therefore recommended that the public consultation should be held by the commencement of validation conducted by designated operational entity (DOE).

(4) Tentative GHG emission reduction calculation

Effect of modal shift was already considered in the Sub-section 8.1 above. In this section, tentative GHG emission reduction on regenerative energy effect was calculated using the design value by the Study Team.

Conditions

1) Operation time : From 7:00 to 9:00 (two hours /day) for N-A1 and N-A2
From 7:00 to 8:00 (one hour /day) for N-B1
2) No. of rolling stocks : Four

Calculation of power consumption

There are two sub-stations to be operated in the N-A1 and N-A2. Power consumption in two stations can be estimated below.

Table 8.3.8 Effect of regenerative system on N-A1 and N-A2

Item \ Substation		Alladin SS			
		Regenerative brake		Difference	Efficiency [%]
		Off	on		
Teaser feeding bus	Max effective power [kW]	9,105.9	8,847.0	258.9	-
	Max reactive power [kVar]	1,925.6	2,436.5	-510.9	-
	Electric power consumption [kWh]	8,783.2	5,853.8	2,929.4	33.4
	Average power factor	0.98	0.93	0.0	-
Main feeding bus	Max effective power [kW]	10,258.9	7,329.7	2,929.2	-
	Max reactive power [kVar]	2,146.4	2,643.3	-496.9	-
	Electric power consumption [kWh]	8,967.8	5,403.6	3,564.2	39.7
	Average power factor	0.98	0.91	0.1	-
T+M	Max effective power [kW]	19,364.8	1,6176.7	3,188.1	-
	Electric power consumption [kWh]	17,751.0	11,257.4	**6,493.6**	36.6
Item \ Substation		Liyari SS			
		Regenerative brake		Difference	Efficiency [%]
		off	on		
Teaser feeding bus	Max effective power [kW]	2,2383	21,582.7	800.3	-
	Max reactive power [kVar]	5,084.5	6,267.3	-1,182.8	-
	Electric power consumption [kWh]	26,423.5	1,5302	11,121.5	42.1
	Average power factor	0.98	0.9	0.1	-
Main feeding bus	Max effective power [kW]	6,569.8	5,820.6	749.2	-
	Max reactive power [kVar]	1,357.8	2,094.0	-736.2	-
	Electric power consumption [kWh]	7,591.7	4,258.5	3,333.2	43.9
	Average power factor	0.98	0.9	0.1	-
T+M	Max effective power [kW]	28,952.8	27,403.3	1,549.5	-
	Electric power consumption [kWh]	34,015.2	19,560.5	**1,4454.7**	42.5

Source: JICA Study Team

Total effects of regenerative system = (Alladin SS) + (Liyari SS)

= 6,493.6 + 1,4454.7 = **20,948.3 [kWh/two hours] → 10,474.2 [kWh/hours]**

Also, power consumption in N-B1 is estimated below.

Table 8.3.9 Effect of regenerative system on N-B1

Item \ Substation		Liyari SS			
		Regenerative brake		Difference	Efficiency [%]
		off	on		
Teaser feeding bus	Max effective power [kW]	26,236.6	26,236.6	0.0	-
	Max reactive power [kVar]	6016.5	7758	-1741.5	-
	Electric power consumption [kWh]	15,704.6	8,989.3	6715.3	42.8
	Average power factor	0.98	0.9	0.1	-
Main feeding bus	Max effective power [kW]	9736	9736	0.0	-
	Max reactive power [kVar]	2,017.4	2,075.9	-58.5	-
	Electric power consumption [kWh]	2,280.6	2,053.3	227.3	10.0
	Average power factor	0.98	0.96	0.0	-
T+M	Max effective power [kW]	35,972.6	35,972.6	0.0	-
	Electric power consumption [kWh]	17,985.2	11,042.6	**6,942.6**	38.6

Source: JICA Study Team

Total effects of regenerative system = (Liyari SS) = **6,942.6 [kWh/hour]**

Travel distance

According to the design conditions, travel distance of the KCR on N-A1,A2 and N-B1 are 7,479 [Car-km] and 4,997 [Car-km] respectively.

Effect of regenerative system

Effects of regenerative system each condition is presented below.

Conditions	Calculation	Power consumption per Car-km
N-A1 and N-A2	10,474.2 kWh/7,479Car-km	1.400 [kWh/Car-km]
N-B1	6,942.6 kWh/4,997Car-km	1.390 [kWh/Car-km]

Source: JICA Study Team

Baseline information

In absence of the KCR (installation of regenerative breaking), equivalent amount of electricity would have been consumed by rolling stocks, from the grid. Thus, the project activity displaces equivalent amount of electricity that would have been generated in the fossil fuel based power plant connected to the regional grid. As for the emission factor of the Pakistan national grid, it is not opened publicly. Therefore values of 408 [gCO2/kWh] were adapted (see below). According to the CO2 emissions from Fuel Combustion Highlights 2009 Edition issued by International Energy Agency (IEA), the emission factors of the grid are referred to below.

Year	Emission factor [gCO2/kWh]
2005	380
2006	413
2007	432
Average 2005-2007	408

Source: JICA Study Team

Tentative GHG emission reduction calculation by the Project

According to the above information and the options, tentative GHG emission reduction by the KCR was calculated with the following conditions.

Conditions

1) Operating days : 365 days/year
2) CO2 emission factor : 408 [gCO2/kWh]
3) Generating effect : N-A1 and N-A2 : 1.400 [kWh/Car-km]
N-B1 : 1.390 [kWh/Car-km]
4) Crediting period: 10 years from year 2022, tentatively
5) Travel distance : Based on the options that the Project has been considered, such as N-A1, N-A2 and N-B1, travel distance was estimated below.

[Unit : Car-km/day]

Year		N-A1	N-A2	N-B1
1	2022	59,007	57,541	30,430
2	2023	59,007	57,541	30,430
3	2024	59,007	57,541	30,430
4	2025	59,007	57,541	30,430
5	2026	59,007	57,541	30,430
6	2027	59,007	57,541	30,430
7	2028	59,007	57,541	30,430
8	2029	59,007	57,541	30,430
9	2030	59,007	57,541	30,430
10	2031	84,347	73,959	63,605

Source: JICA Study Team

With the above information, GHG emission reductions were calculated using the following formula.

GHG emission reduction = [Regenerative effect (kWh/car-km)]

* [travel distance (car-km/day)] * 365[days] * [Emission factor (tCO2/kWh)]

Based on the options, GHG emission reductions of the Project are estimated below.

[Unit : tCO2/year]

Year		N-A1	N-A2	N-B1
1	2022	12,302	11,997	6,299
2	2023	12,302	11,997	6,299
3	2024	12,302	11,997	6,299
4	2025	12,302	11,997	6,299
5	2026	12,302	11,997	6,299
6	2027	12,302	11,997	6,299
7	2028	12,302	11,997	6,299
8	2029	12,302	11,997	6,299
9	2030	12,302	11,997	6,299
10	2031	17,585	15,420	13,166
Total/10y		**128,306**	**123,389**	**69,857**

Source: JICA Study Team

When implementing the Options N-A1, N-A2 and N-B1, the Project can acquire the following GHG emission reduction in 10 years.

Option N-A1 : 128,306 [tCO2/10 years]

Option N-A2 : 123,389 [tCO2/10 years]

Option N-B1 : 69,857 [tCO2/10 years]

8.3.4 Issues and Further Actions

The following actions should be considered in order to apply the Project to CDM, before preparation of the PDD or in the further stage of the Project.

Table 8.3.10 Issues and Further Actions to be Taken

Common issues and further actions	
Prior consideration of the CDM form	"The Prior consideration of the CDM Form[7]" shall be submitted to the Pakistan DNA (Ministry of Environment) and UNFCCC within six (6) month from the beginning of the construction period.
Selection of crediting period (10 years for single application or 7 years)	Further examinations on advantage and disadvantage of the crediting periods are necessary based on conditions, such as continuous funding by Japanese ODA, financial status of the Project etc.
Use of the latest electricity's grid emission factor in Pakistan	According to the official website of Pakistan DNA[8], there is no emission factor of the Pakistan national grid announced officially. Therefore, proper data shall be confirmed with the available data by preparation of the PDD.
Acquisition of stakeholders' comments	It is required to implement stakeholder's consultation to acquire their comments. Especially, explanation of CDM application seems to be necessary to conduct by the project developer (Karachi Urban Transport Corporation : KUTC).
Usage of the latest CDM forms to prepare the PDD	Every time the project developer applies to CDM, they shall prepare the CDM application document (PDD) using the latest form and the latest methodology approved. In case of that KCR applies to CDM using regenerative energy effect, AMS-III.S. is an appropriate approved methodology from the viewpoint of project scale and project characteristics. As of Oct 31, 2012, the latest version of AMS-III.S. "Introduction of low-emission vehicles/technologies to commercial vehicle fleets: Version 3.0[9]".
Issues and further actions on regenerative braking system	
Comparison of costs for installation of the regenerative braking and conventional braking system	Costs for installation of the regenerative braking and conventional braking systems are not available at this moment. The data are therefore required to conduct the simple investment analysis. In the case where it is determined that explanation on technological barrier is not enough for clarification of the additionality in the process of validation by DOE, it is noted that the project developer (KUTC) has to examine to supplementary clarify the additionality from viewpoints of the investment barrier and barrier to the prevailing practice.
Project scale due to amount of regenerated electricity	Total amount of electricity saving will be calculated based on the estimated amount of regenerated electricity by the Project during operation phase. CDM scale, i.e., whether its size is large or small, will be decided with amount of the said energy saving (GHG emission reduction). Accordingly, it is necessary to confirm frequency of the regenerated electricity and energy saving by preparation of the PDD.
Issues and further actions on modal shift system	
Planning interview survey	According to the ACM0016, it is required to collect baseline emission data which caused by the passenger transportation with vehicle, motor cycle etc. in absence of the Project. Data are collected through interview survey during operation phase. It is necessary to consider efficient planning of interview survey.
Identification of baseline scenario	Identification of baseline scenario is one of the main studies in the CDM consultation. As for modal shift project, there are some traffic modes that are supposed to replace into KCR. It is therefore necessary to identify them in the Section B "Application of a baseline and monitoring methodology" of PDD.
Collection of traffic information/data	In addition to the interview survey, there is some more necessary data/information to be collected in the application of modal shift CDM, such as fuel consumption of baseline traffic mode etc.

Source: JICA Study Team

[7] EB66 : Annex 64 CLEAN DEVELOPMENT MECHANISM PROJECT CYCLE PROCEDURE (Version 02.0), CDM-EB website

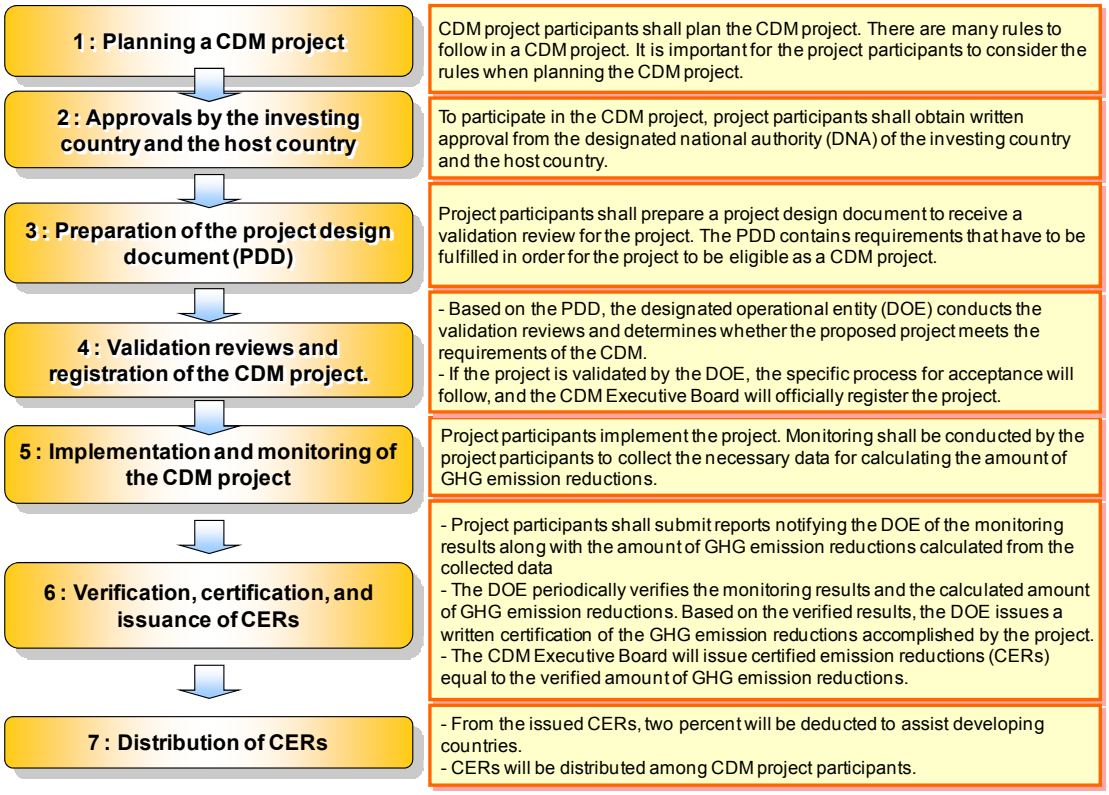
[8] According to the official information of UNFCCC, Pakistan DNA is National Energy Conservation Center (ENERCON).

[9] http://cdm.unfccc.int/methodologies/SSCmethodologies/approved

8.3.5 Implementation Schedule on CDM Application

To register the Project as CDM, the following procedure is required to be taken in parallel with the normal Project implementation.

(1) Overall schedule on CDM application



Source: JICA Study Team

Figure 8.3.2 CDM Flow

Normally step 1 to 3 above are conducted during the study and/or design stage, and draft PDD is prepared as one of the CDM outputs up to step 3. Then, from step 4, the project developer (KUTC) will normally take care of by themselves with the support of DOE etc.

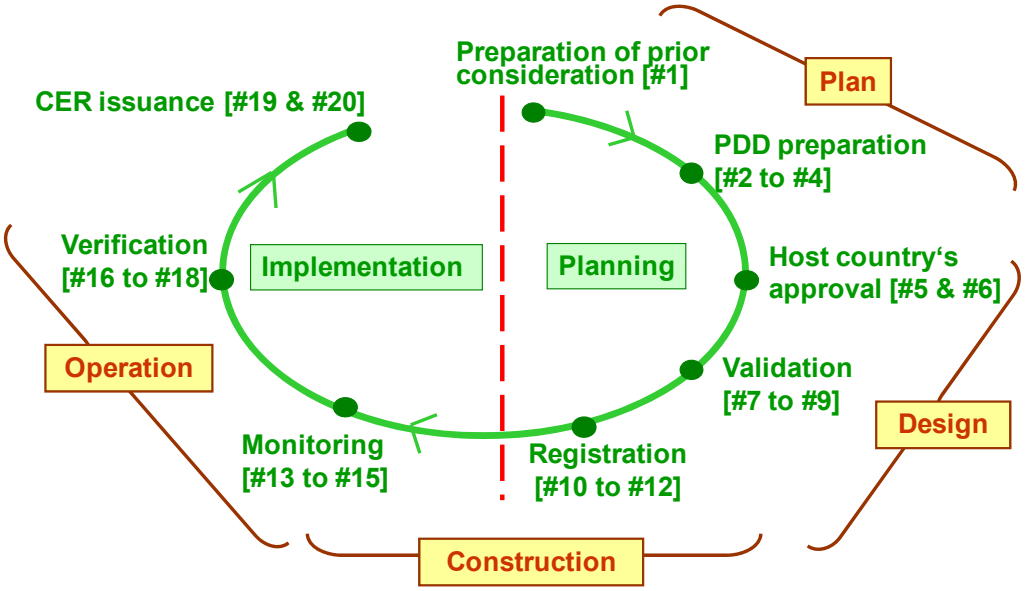
Taking the above into consideration, the following actions shall be implemented properly by the project developer (KUTC).

Table 8.3.11 Project Benchmark of CDM Activities

#	Benchmarks
1	Submission of letter of prior consideration to CDM-EB
2	Preparation of PDD
3	Implementation of stakeholders' consultation, if possible
4	Completion of PDD preparation
5	Preparation of application doc. for Pakistan approval
6	Acquisition of Pakistan approval
7	Selection of DOE for PDD validation
8	Implementation of validation by DOE
9	Preparation of validation report by DOE
10	Submission of validation report by DOE
11	Justification of validation report by CDM-EB
12	Completion of CDM registration
13	Commencement of operation of KCR Project
14	Implementation of monitoring during KCR operation
15	Preparation of monitoring report by project developer
16	Selection of DOE for verification
17	Implementation of verification by DOE
18	Preparation of verification report by DOE
19	Confirmation of verification report by CDM-EB
20	Issuance of CER by CDM-EB

Source: JICA Study Team

To apply CDM on KCR, the detailed schedule with the above benchmarks will be considered properly. It is recommended that PDD preparation will be done before pre-construction stage, at least conclusion of contract of main civil works.



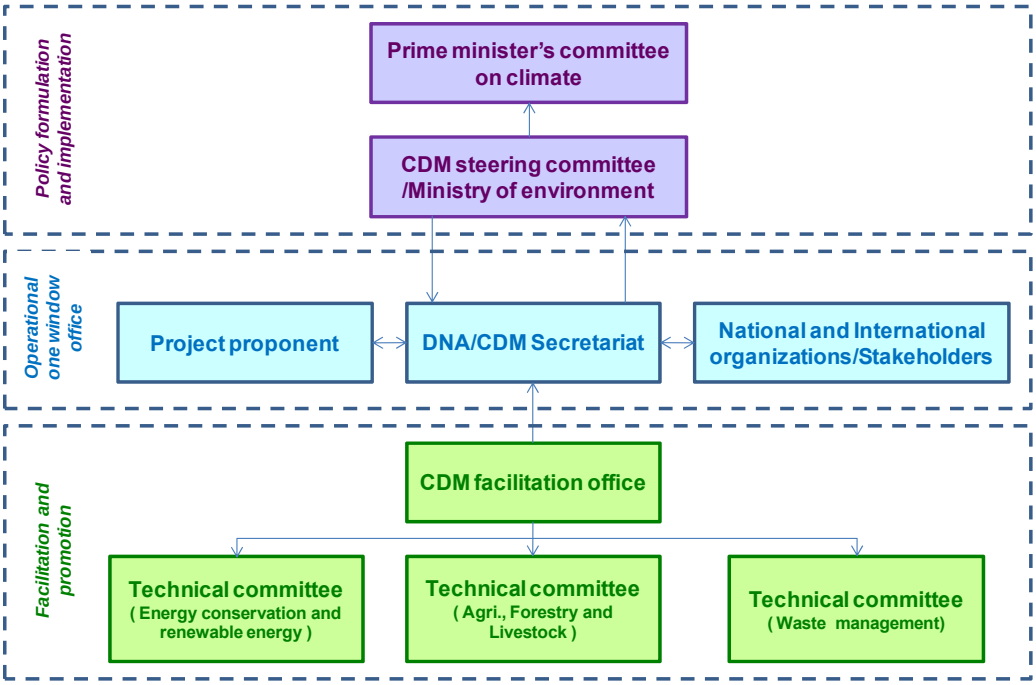
Source: CDM National Operational Strategy, Government of Pakistan
Note : Outside items written in brown are normal project cycle and inside items written in green are CDM actions.

Figure 8.3.3 CDM Project Cycle with Project Cycle

(2) Procedure of host country's approval

The Project shall acquire approval not only from CDM-EB but also from host country where the Project is physically located. According to the CDM-EB website, the official nomination as DNA in

Pakistan is National Energy Conservation Center (ENERCON)[10]. The project developer shall acquire the approval from ENECON. Instruction of host country's approval in Pakistan has been downloaded[11] in the DNA Pakistan website. Organization of national CDM authority in Pakistan is presented below.



Source: CDM national strategy, Government of the Pakistan

Figure 8.3.4 Organization Chart of CDM Authority in Pakistan

As for procedure of host country's approval in Pakistan, CDM secretariat requests to submit ten (10) copies of (i) the complete PDD and (ii) Environment Impact Assessment (EIA) report (if required). Then, CDM secretariat undertakes primary screening of PDD whether the prospective project supports sustainable development and satisfies with the following criteria or not. Criteria for CDM projects in Pakistan are summarized below.

1. General Criteria

The project should:

(i) be consistent with the national laws and sustainable development policies, strategies and plans including Pakistan Environmental Protection Act-1997, National Conservation Strategy, National Environment Policy, National Forestry Policy, National Renewable Energy Policy, Medium-term Development Framework and other relevant policies and plans of the Government; and

(ii) not result in any obligation towards the investor country other than Certified Emission Reduction (CER) authorization.

2. Environmental Criteria

The project should:

(i) result in significant reduction in the emissions of Greenhouse Gases; and

(ii) result in conservation of local resources and improvement of the local environment;

3. Social Criteria

The project should:

(i) result in poverty alleviation;

(ii) result in creation of new jobs;

(iii) result in creation of new economic activities;

[10] http://www.enercon.gov.pk/

[11] http://www.cdmpakistan.gov.pk/cdm_stat.html

(iv) have positive impacts on local communities;
(v) improve equity; and
(vi) take gender concerns into consideration.

4. Economic Criteria

The project should:
(i) result in positive impact on balance of payment;
(ii) not result in net increase in external debt burden; and
(iii) be cost effective.

5. Technological Criteria

The project should:
(i) result in technology and know-how transfer; and
(ii) not result in import of obsolete technology.

According to the national operational strategy in Pakistan[12], the CDM secretariat shall inform a project developer in case the proposed project meets CDM criteria or otherwise within 15 days of receipt of PDD. And, the project not complying with the CDM criteria will be returned for revision or modification along with a brief screening report. When the PDD conforms to the criteria, the secretariat shall issue a Letter of Approval within 30 days of receipt of the PDD.

(3) Consideration of CDM Potential in Transport Sector and Pakistan

CDM was invented to utilize market dynamics and gains an additional benefit from private sector. Especially, ODA project can get additional income from private sector through the CDM application. To improve a financial status of ODA project, it seems that CDM is one of the useful tools to solve it. Accordingly, CDM can contribute to ODA project from the viewpoint of not only environmental aspect but financial aspect.

Kyoto Protocol has come into effect since 2008 and introduced CDM as a part of Kyoto Mechanism. After launching the Kyoto Protocol, there are some countries recognized that countries become prevalent CDM or not, and there are some sectors easy to adopt CDM or not. As a conclusion of this climate change effect, CDM potential was examined in sector-wise and country-wise, and further actions for CDM application were considered.

(i) Sectoral potential

Transport sector is one of the bottleneck sectors in CDM so far, due to several difficulties, such as scattered monitoring objectives (private automobiles, motorcycles etc.), induced traffic, broad project boundary etc. Nevertheless, this sector is major GHG emission sources that shares approximate 15% of total GHG emissions in the world. According to the CDM statistic data, share of transport sector is only 0.4% (23 projects registered)[13], in spite of big GHG emission reduction potential. It can be therefore said that this sector is one of the green field ones among the CDM classification.

Table 8.3.12 List of Registered CDM Projects in Transport Sector

Registered date	Title	Host Parties	Methodology	Reductions [tCO2/y]
07 Dec 06	BRT Bogotá, Colombia: TransMilenio Phase II to IV	Colombia	AM0031	246,563
29 Dec 07	Installation of low GHG emitting rolling stock cars in metro system	India	AMS-III.C.ver.10	41,160
26 Apr 10	Cable Cars Metro Medellín, Colombia	Colombia	AMS-III.U.	17,290
19 Oct 10	BRT Chongqing Lines 1-4, China	China	AM0031 ver. 3	218,067

[12] http://www.environment.gov.pk/NEP/PakCDM-NatOpelStrgy.pdf
[13] Number of CDM projects registered is 5,511, as of Oct 29, 2012.

17 Dec 10	Plant-Oil Production for Usage in Vehicles, Paraguay	Paraguay	AMS-III.T.	17,188
04 Feb 11	Modal Shift from Road to Train for transportation of cars	India	AMS-III.C.ver. 11	23,001
30 May 11	BRT Lines 1-5 EDOMEX, Mexico	Mexico	ACM0016	145,863
07 Jun 11	BRT Zhengzhou, China	China	AM0031 ver. 3	204,715
30 Jun 11	Metro Delhi, India	India	ACM0016	529,043
10 Aug 11	BRT Metrobus Insurgentes, Mexico	Mexico	ACM0016 ver. 2	46,544
04 Oct 11	Mumbai Metro One, India	India	ACM0016 ver. 2	195,547
16 Dec 11	BRT Transmetro Barranquilla, Colombia	Colombia	AM0031 ver. 3	55,828
10 Feb 12	BRT Macrobus Guadalajara, Mexico	Mexico	AM0031 ver. 3	54,365
12 Mar 12	MIO Cali, Colombia	Colombia	AM0031 ver. 3	242,187
13 Mar 12	BRT Metroplus Medellin, Columbia	Colombia	AM0031 ver. 3	123,479
Review Requested	Metro Line 12, Mexico City	Mexico	ACM0016 ver. 2	136,983
03 Jul 12	BRT in Guatemala City	Guatemala	AM0031 ver. 3	536,148
Request Regi	Lanzhou BRT Project	China	AM0031 ver. 3	12,621
Review Request	Busan Metro Line 1 Dadae	Korea	ACM0016 ver. 2	10,619
Review Request	Daegu Metro 3th Urban Railroad	Korea	ACM0016 ver. 2	60,350
Review Request	Incheon Metro Line 2	Korea	ACM0016 ver. 2	48,064
Review Request	Mode-shift of passengers from private vehicles to MRTS for Gurgaon metro	India	ACM0016 ver. 2	105,863
Request Regi	MEGABUS, Pereira, Colombia	Colombia	AM0031 ver. 3	33,956

Source: JICA Study Team

Note : Total number of registered CDM projects in transport sector is 23. Among these projects, 10 projects painted in yellow are BRT projects, 10 projects painted in red are modal shift projects and 3 projects painted in blue are other projects in transport sector.

Delhi metro project is famous CDM example so far, other railway projects have applied already to CDM using modal shift effect and so on. According to the above table, modal shift project has been registered prominently since year 2011. It is assumed to be due to development of CDM methodology on modal shift project at the end of 2009. Most mass transit projects such as railway project is implemented by central/regional governmental agency with public fund in the developing countries. As for Japanese ODA project on railway sector, there are two opportunities to apply CDM by regenerative energy and modal shift systems using Japanese state-of-the-art technologies.

(ii) Country potential

Since 2008, more than 5,500 CDM projects registered so far. Especially big two countries, China and India, occupies approximate 60% of the registered projects[14]. Current situation of other Asian countries except China and India is presented table below.

[14] Number of registered CDM projects in China and India are 2,363 and 908 respectively.

Table 8.3.13 List of Registered CDM Projects in Asian countries

Host country	At validation				Registered			
	Number	%	1,000 tCO2	%	Number	%	1,000 tCO2	%
Bangladesh	1	0.2	42	0.1	3	0.5	224	0.4
Bhutan	1	0.2	4,160	7.4	2	0.3	500	0.9
Cambodia	4	0.8	1,812	3.2	6	1.0	209	0.4
Fiji	1	0.2	51	0.1	2	0.3	47	0.1
Indonesia	87	17.1	13,788	24.6	81	13.5	10,170	17.9
Lao PDR	6	1.2	578	1.0	4	0.7	866	1.5
Malaysia	55	10.8	3,533	6.3	110	18.3	6,266	11.0
Mongolia	0	0.0	0	0.0	4	0.7	251	0.4
Myanmar	1	0.2	678	1.2	0	0.0	0	0.0
Nepal	4	0.8	2,060	3.7	6	1.0	268	0.5
North Korea	2	0.4	69	0.1	2	0.3	44	0.1
Pakistan	**40**	**7.9**	**4,669**	**8.3**	**15**	**2.5**	**2,372**	**4.2**
PNG	5	1.0	255	0.5	6	1.0	570	1.0
Philippines	34	6.7	3,237	5.8	58	9.7	2,264	4.0
Singapore	6	1.2	1,843	3.3	2	0.3	117	0.2
South Korea	29	5.7	641	1.1	70	11.7	19,487	34.3
Sri Lanka	21	4.1	675	1.2	7	1.2	210	0.4
Thailand	110	21.7	6,061	10.8	73	12.2	3,688	6.5
Vietnam	101	19.9	12,005	21.4	149	24.8	9,187	16.2
Asia & Pacific	**508**	**100.0**	**56,157**	**100.0**	**600**	**100.0**	**56,740**	**100.0**

Source : UNEP CDM pipeline

According to the above table, Pakistan has only 5% share of Asian registered projects so far. At validation stage, Pakistan has 8.3% of the projects. It means that CDM situation in Pakistan becomes widespread gradually, and it is expected that they will be registered in a couple of years. So far the following projects were registered in Pakistan. Most of projects belong to "power generation" and "energy efficiency" sectors, for reference.

Table 8.3.14 List of Registered CDM Projects in Pakistan

Registered date	Title	Annex I parties	Meth.	Reductions [tCO2]
05 Nov 06	Catalytic N2O Abatement Project in the Tail Gas of the Nitric Acid Plant of the Pakarab Fertilizer Ltd (PVT) in Multan, Pakistan	Japan	AM0028	1,050,000
31 Jan 09	The 84 MW New Bong Escape Hydropower Project, Azad Jammu and Kashmir (AJK), Pakistan		ACM0002 ver. 6	218,988
01 May 09	Construction of additional cooling tower cells at AES Lal Pir (Pvt.) Limited. Muzaffar Garh, Pakistan.	Netherlands	AMS-II.B . ver. 9	11,179
29 Oct 09	Community-Based Renewable Energy Development in the Northern Areas and Chitral (NAC), Pakistan	Canada, Italy, Japan etc.	AMS-I.A. ver. 12	87,477
21 Dec 09	Pakarab Fertiliser Co-generation Power Project	Germany	AM0014 ver. 4	119,481
05 Apr 10	Composting of Organic Content of Municipal Solid Waste in Lahore	Denmark	AM0025 ver. 11	108,686
03 Jun 10	ICI Polyester Co-generation Project	Switzerland	AMS-II.D . ver. 11	21,486

Registered date	Title	Annex I parties	Meth.	Reductions [tCO2]
14 Jul 10	Almoiz Bagasse Cogeneration Project	UK, Ireland etc.	ACM0006 ver. 8	23,319
28 Aug 10	Waste Heat Recovery based 15 MW Power Generation Project at Bestway Cement Limited, Chakwal, Pakistan	Japan	AMS-III. Q. ver. 2	48,060
09 Nov 10	Gul Ahmed Combined Cycle Gas Turbine Project	UK, Ireland etc.	AMS-II.D . ver. 11	35,656
02 Dec 10	"Biogas-based Cogeneration Project at Shakarganj Mills Ltd., Jhang, Pakistan"	Switzerland, UK, Ireland etc.	AMS-I.C. ver. 14	18,703
19 Apr 11	DHCL Gas Turbine based Cogeneration Project	Switzerland	AMS-II.D . ver. 12	31,552
09 Nov 11	DGKCC Waste Heat Recovery and Utilization for 10.4 MW Power Generation at Dera Ghazi Khan Plant	Switzerland	AMS-III. Q. ver. 3	33,845
01 Apr 12	Fatima N2O Abatement Project	UK, Northern Ireland	ACM0019	458,114
30 Jul 12	Compost from Municipal Solid Waste in Peshawar, Pakistan	Not confirmed	AM0025 ver. 12	105,334

Source : UNFCCC CDM-EB website

Number of CDM registration in Pakistan is not many at this moment. The government has promoted enhanced measures below.

(3) Preferential treatment on project finance

There is no income tax or duty will be levied on transfer/sale of CDM emissions credits, i.e. CERs, in Pakistan. Similarly, credits will be awarded fully to the project sponsors/investors. Banks and other financial institutions can also be encouraged to provide special incentives to the sponsors/investors.

(4) Well opened CDM information and reasonable screening period

CDM secretariat in Pakistan undertakes primary screening of the PDD to see whether it supports sustainable development and to ensure that the participation in CDM is voluntary and otherwise meets the criteria for Pakistan requirement. The secretariat also informs the project participants (project developer) in case the project meets the CDM criteria or otherwise within 15 days of receipt of PDD. The projects not complying with its criteria will be returned for reformulation along with a brief screening report. In case the PDD conforms to the CDM criteria, the secretariat will issue a Letter of Approval within 30 days of receipt of the PDD.

According to the open information, required times of Pakistan projects from application commencement to official registration by CDM-EB were calculated below.

Table 8.3.15 List of Registered CDM Projects in Pakistan

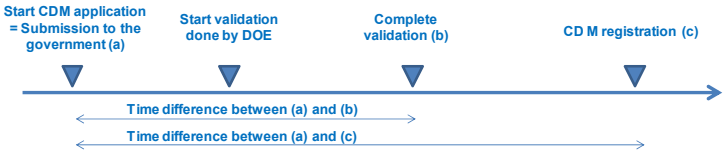
#	Title	Submission to the govn't (a)	Completion of validation (b)	Registration (c)	Time (a) to (b) [months]	Time (a) to (c) [months]
1	Catalytic N2O Abatement Project in the Tail Gas of the Nitric Acid Plant of the Pakarab Fertilizer Ltd (PVT)	24 Mar 06	27 Apr 06	05 Nov 06	**1**	**7**
2	The 84 MW New Bong Escape Hydropower Project, Azad Jammu and Kashmir (AJK), Pakistan	03 Apr 07	03 May 07	31 Jan 09	**1**	**21**
3	Construction of additional cooling tower cells at AES Lal Pir (Pvt.) Limited. Muzaffar Garh, Pakistan.	16 Mar08	10 May 08	01 May 09	**2**	**13**
4	Community-Based Renewable Energy Development in the NAC, Pakistan	14 Sep 07	30 Jul 08	29 Oct 09	**10**	**25**
5	Pakarab Fertiliser Co-generation Power Project	20 Jul 07	28 Jan 08	21 Dec 09	**6**	**29**
6	Composting of Organic Content of Municipal Solid Waste in Lahore	07 Jul 08	Jan 16 09	05 Apr 10	**6**	**21**
7	ICI Polyester Co-generation Project	02 Apr 09	10 Jun 09	03 Jun 10	**2**	**14**
8	Almoiz Bagasse Cogeneration Project	15 Mar 08	19 May 08	14 Jul 10	**4**	**28**
9	Waste Heat Recovery based 15 MW Power Generation Project at Bestway Cement Limited, Chakwal	28 Apr 09	10 Jun 09	28 Aug 10	**1**	**16**
10	Gul Ahmed Combined Cycle Gas Turbine Project	24 Jul 08	29 Dec 08	09 Nov 10	**6**	**28**
11	"Biogas-based Cogeneration Project at Shakarganj Mills Ltd., Jhang, Pakistan"	23 May 08	24 Nov 10	02 Dec 10	**30**	**30**
12	DHCL Gas Turbine based Cogeneration Project	N/A	N/A	19 Apr 11	**N/A**	**N/A**
13	DGKCC Waste Heat Recovery and Utilization for 10.4 MW Power Generation	28 Mar 09	08 Nov 11	09 Nov 11	**31**	**31**
14	Fatima N2O Abatement Project	N/A	N/A	01 Apr 12	**N/A**	**N/A**
15	Compost from Municipal Solid Waste in Peshawar, Pakistan	25 May 10	21 Sep 10	30 Jul 12	**4**	**26**
				Average	**7.9**	**22.2**

Source : UNFCCC CDM-EB website

Note 1: (a) indicates a date that the project developer submits their CDM document to Pakistan government agencies. (b) indicates a date that DOE finishes CDM validation and submit their report to CDM-EB. (c) indicates a date that the project developer could register their project as CDM.

Note 2: Time (a) to (b) indicates a required time consisting of host country's approval and validation. And, time (a) to (c) indicates a required time consisting of host country's approval, validation and CDM registration.

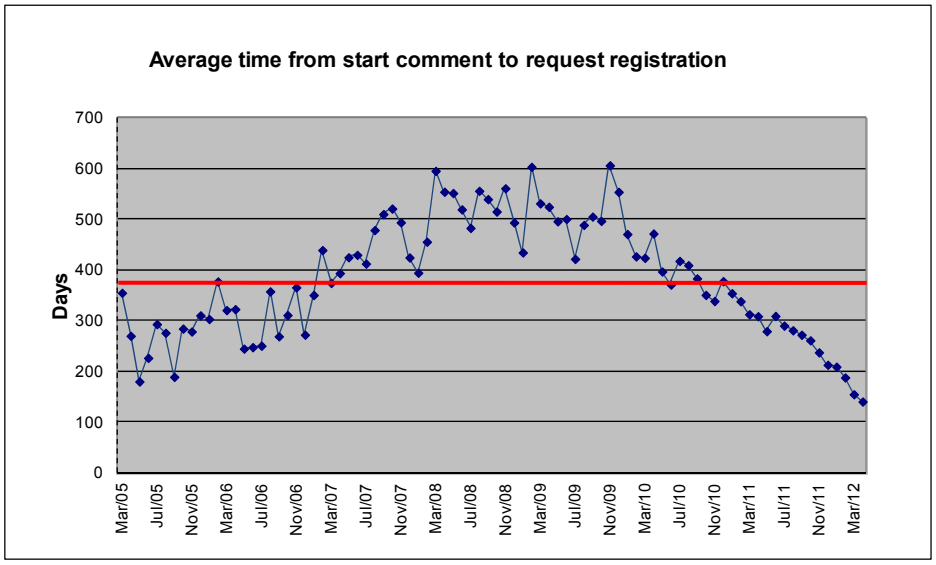
Note3 : Image of time difference is presented below.



According to the above table, process (b) to (c) is slightly time-consuming. It means that the candidate CDM projects were required to justify its status by additional documents from CDM-EB. It is necessary to check carefully for previous inspection such as host country's approval and/or validation.

By way of comparison, average required time in all registered CDM is presented below. To register the project from validation stage, it takes 388 days on average (approximate 13 months). On the other hand, it takes 22.2 months to register Pakistan projects as CDM. It

seems that Pakistan project takes time to register CDM than average ones.



Note : Average time required is 388 days (approximate 13 months).

Source : UNEP CDM pipeline

Figure 8.3.5 Average Required Time from Validation to Registration

(iii) Future potential of CDM application in Pakistan railway sector

According to the result of study on climate change effect, it is slightly difficult for Pakistan transport projects to apply to CDM by domestic developer alone. Pakistan CDM structure is however well-established comparing with other developing countries in Asian region. Also, candidate projects are increasing in energy generation and energy efficiency sectors. This tendency is similar to other Asian countries which have more CDM experience than Pakistan, such as Thailand, Vietnam etc. Therefore, Pakistan can also be experienced CDM country. Addition, railway project is one of the prominent national projects in the developing country, it is good opportunity to enhance climate change promotion using ODA scheme to domestically/internationally. As a conclusion of this study, it is recommended to implement CDM application on KCR, and it is also expected that KCR will be supported CDM application in the further study/project stage, such as preparation/capacity development of PDD.

9. ADVICES FOR PROJECT IMPLEMENTATION ORGANIZATION

9.1 Implementation Procedures and Roles of Stakeholders

Large scale infrastructure projects with a foreign loan agency such as JICA, World Bank or ADB are generally implemented under a typical framework involving the executing agency, consultants, contractors and the loan agency. Organization structures of main stakeholders are illustrated for four principal project implementation stages, procurement of consultant, basic and detailed design, procurement of contractors, and construction, in Figure 9.1.1.

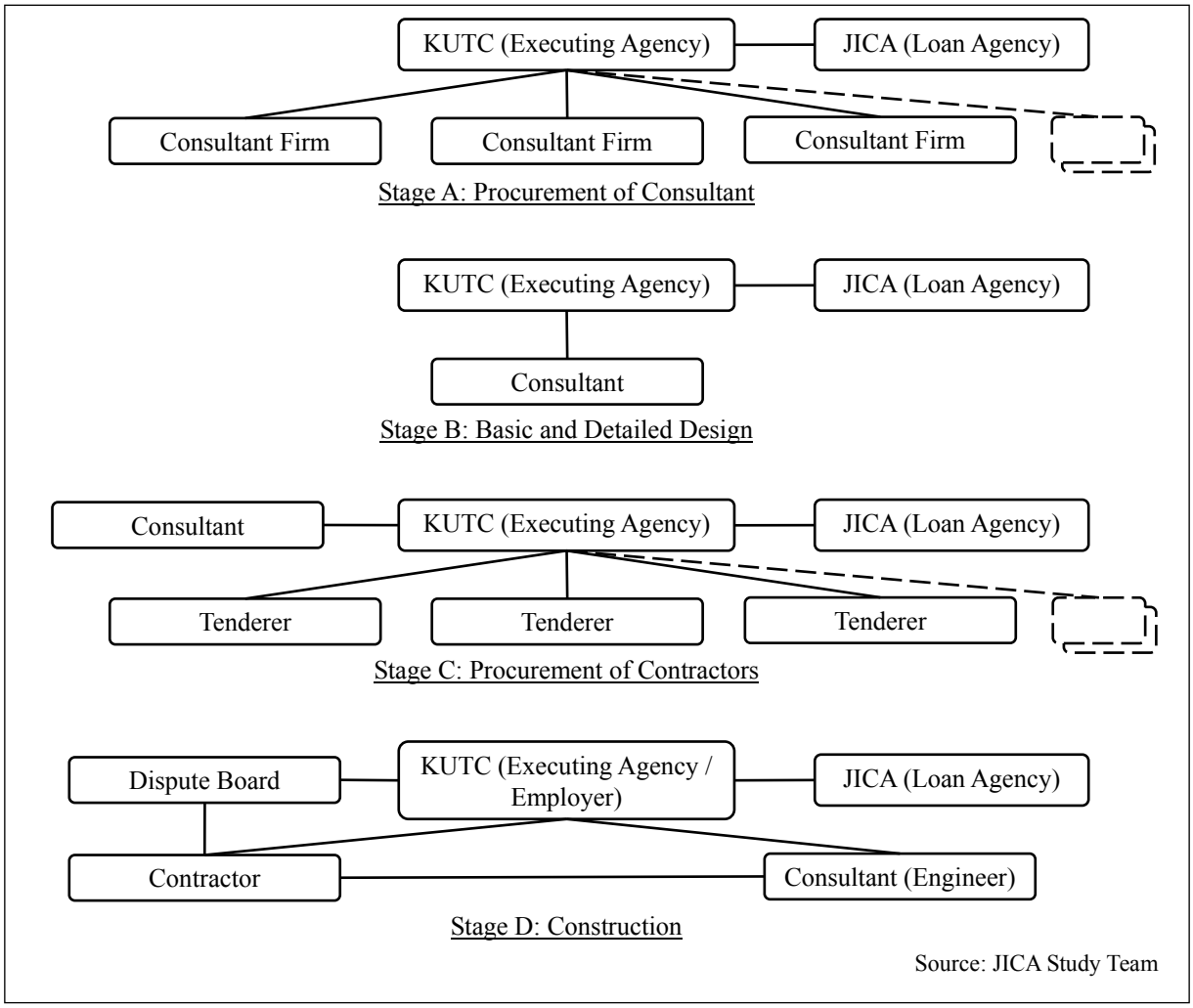


Figure 9.1.1 Organization Structures for Each Implementation Stage

Table 9.1.1 lists main and important procedures and activities needed in each implementation stage and defines the proposed role of respective stakeholders. This clarifies what tasks are required in KUTC as the executing agency and the Employer within construction contracts. It is recommended to minimize multiple approval processes other than KUTC in the GOP to achieve quick decision making with one-window responsibility. KUTC should entrust the consultant with technical, engineering and contract management according to a consultancy service agreement for efficient project implementation and management.

Table 9.1.1 Role of Stakeholders for Procedures/Activities during Implementation

Implementation Stage	Procedure/Activity	KUTC	Consultant	Contractor	JICA	Other
A. Procurement of Consultant	A01 TOR and shortlist	Prepare			Approve	
	A02 Proposals		Prepare			
	A03 Technical evaluation	Conduct			Approve	
	A04 Financial evaluation	Conduct			Approve	
	A05 Negotiation	Negotiate	Negotiate			
	A06 Contracting	Prepare	Prepare		Approve	
B. Basic and Detailed Design	B01 Additional survey plan	Review	Prepare			
	B02 Additional survey subcontract	Approve	Conduct			
	B03 Design criteria	Review	Prepare			
	B04 Preliminary design of civil & building	Approve	Prepare		Distributed	Review by MOR
	B05 Preliminary design of railway systems	Approve	Prepare		Distributed	Review by MOR
	B06 Basic design of civil & building	Review	Prepare			
	B07 Basic design of railway systems	Review	Prepare			
	B08 Detailed design of civil & building	Review	Prepare			
	B09 Approval of design drawings	Approve				
	B10 Construction planning and scheduling	Review	Prepare			
	B11 Construction cost estimate	Approve	Prepare			
	B12 Prequalification documents	Review	Prepare		Approve	
	B13 Tender documents	Review	Prepare		Approve	
	B14 Payment to consultant	Check/pay	Claim		Disburse	
C. Procurement of Contractors	C01 Prequalification (PQ) announcement	Issue	Assist		Informed	
	C02 PQ application			Prepare		
	C03 Answer to queries in PQ documents	Issue	Prepare			

Implementation Stage	Procedure/Activity	KUTC	Consultant	Contractor	JICA	Other
	C04 PQ evaluation	Approve	Conduct		Approve	
	C05 Invitation for tender	Issue	Assist		Distributed	
	C06 Pre-tender meeting	Conduct	Assist	Participate		
	C07 Answer to queries in tender documents	Issue	Prepare			
	C08 Tender preparation			Prepare		
	C09 Tender opening	Conduct	Assist	Participate		
	C10 Tender evaluation	Approve	Conduct		Approve	
	C11 Contract discussion	Conduct	Assist	Participate		
	C12 Contract award	Issue	Assist		Distributed	
	C13 Contracting	Prepare	Assist	Prepare	Approve	
D. Construction (mainly for civil work)	D01 Giving right to access to the site	Responsible	Advise			
	D02 Permits and licenses	Assist	Advise	Obtain		
	D03 Commencement order	Advise	Issue		Informed	
	D04 Construction drawings	Distributed	Prepare/issue			
	D05 Drawings by Contractor	Distributed	Approve	Prepare		
	D06 Program and construction method	Distributed	Review	Prepare		
	D07 Monthly progress reports	Distributed	Review	Prepare		
	D08 Quality management plan	Distributed	Review	Prepare		
	D09 Progress control		Approve	Responsible		
	D10 Quality control/testing		Approve	Responsible		
	D11 Inspection		Conduct	Assist		
	D12 Instruction	Distributed	Issue	Execute		
	D13 Reference points for setting out	Responsible	Advise	Check/rectify		
	D14 Safety control		Approve	Responsible		

Implementation Stage	Procedure/Activity	KUTC	Consultant	Contractor	JICA	Other
	D15 Cost control	Conduct	Assist	Conduct		
	D16 Environmental management	Informed	Approve	Responsible	Informed	
	D17 Measurement for payment		Conduct	Assist		
	D18 Variation	Informed	Initiate	Execute		
	D19 Value engineering	Informed	Approve	Propose		
	D20 Advance payment	Pay	Check/certify	Claim	Disburse	
	D21 Interim payment	Pay	Check/certify	Apply	Disburse	
	D22 Tests on completion	Informed	Review	Conduct		
	D23 Taking over	Advise	Check/certify	Apply	Informed	
	D24 Statement at completion	Distributed	Check/certify	Submit		
	D25 Final payment	Pay	Check/certify	Apply	Disburse	
	D26 Remedying defects	Notice	Instruct	Execute		
	D27 Performance certificate	Distributed	Issue		Informed	
	D28 Contractor's claims	Informed and consulted	Reject, agree, or determine	Submit and consulted		
	D29 Dispute board (DB)	Appoint and contract	Assist	Appoint and contract	Informed	
	D30 Disputes	Refer to DB	Assist	Refer to DB		Decision by DB
	D31 Arbitration	Participate	Participate	Participate		Judgment by arbitration institution
	D32 Contract amendment	Check/sign	Prepare	Check/sign	Approve	

Note: The wording used in the roles is not always strictly in accordance with the Conditions of Contract to be applied to construction contracts.

Source: JICA Study Team

9.2 Organization of KUTC Engineering Units

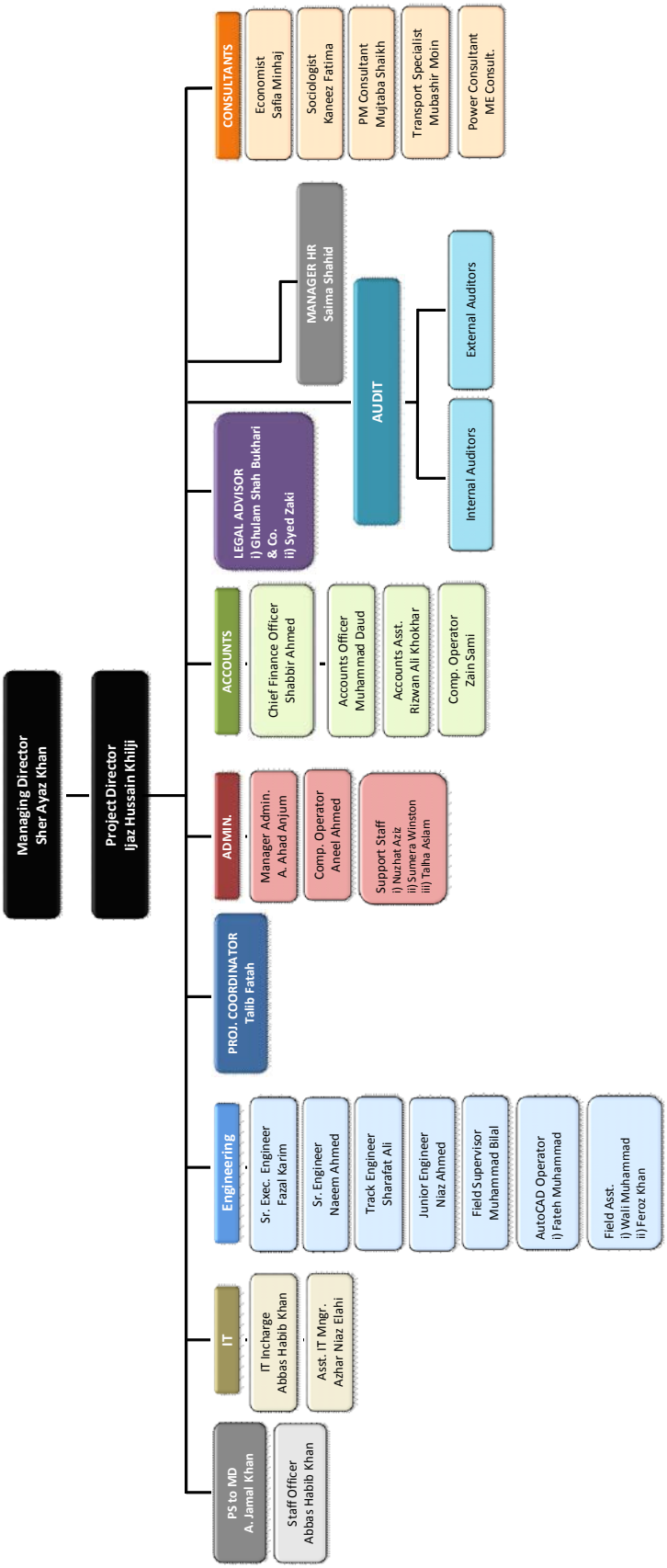
The section-wise existing staff list and the organization chart of KUTC as of November 2011 are shown in Table 9.2.1 and Figure 9.2.1 respectively, where some changes notified thereafter are reflected.

Table 9.2.1 KUTC Staff List

Name of Employee	Designation
Sher Ayaz Khan	Managing Director
Ijaz Hussain Khilji	Project Director
Administration	
Shaikh Talib Fateh	Coordinator JICA
Abdul Ahad Anjum	Manager
Azhar Niaz Elahi	IT Manager
A. Jamal Khan	Private Secretary
Abbas Habib Khan	Staff Officer
Aneel Ahmed	Computer Operator
Nuzhat Aziz	Computer Operator
Sumaira Winston	Receptionist
Wali Muhammad	Field Assistant
Shafique Sheraz	Field Assistant
Talha Aslam	Computer Operator
Muhammad Raees	Driver
Muhammad Irshad - PR	Driver (Deputation)
Muhammad Ejaz	Electrician
Islamuddin	Cook
Muhammad Faizan	Naib Qasid
Shahid Jawed	Naib Qasid
Ahmed Mehmood	Naib Qasid
Mrs. Guddi	Sweeper
Human Resources (HR)	
Saima Shahid	HR Manager
Accounts & Finance	
Shabbir Ahmed	Chief Finance Officer
Muhammad Daud	Accounts Officer
Rizwan Ali Khokhar	Accounts Assistant
Noman Khalil	Accounts Assistant
Muhamamd Zain Sami	Computer Operator
Mohammad Sawood Siddiqui	Accounts Trainee (Internship)
Sajjad Khan	Naib Qasid
Engineering (Drawing)	
Fazal Karim	Sr. Executive Engineer
Naeem Ahmed Qureshi - PR	Senior Engineer
Muhamamd Bilal	Field Superintendent
Fateh Muhammad - PR	Head Draftsman

Name of Employee	Designation
Niaz Ahmed - PR	Junior Engineer
Mehmood Hussain	AutoCAD Operator
Feroz Khan	Surveyor
Consultants & Legal Advisors	
Safia Minhaj	Economist (Part Time)
Kaneez Fatima	Sociologist (Part Time)
Ghulam Shah Bukhari	Legal Advisor (Retainership)
Syed Zaki Muhammad & Co.	Legal Advisors (Contract Basis)
Saad Usmani	HR Advisor / Consultant
Mujtaba Shaikh	Project Management Consultant (hourly basis)
Mr. Sharafat	Track Engineer
Mr. Mubashir Moin	Traffic Engineer

Source: KUTC, modified by JICA Study Team



Source: KUTC, modified by JICA Study Team

Figure 9.2.1 Organization of KUTC

To play the roles proposed in Table 9.1.1 for satisfactory project implementation, KUTC should organize three divisions excluding corporate functions. Each division will be composed of various technical/functional groups. Figure 9.2.2 shows the proposed organization of KUTC engineering units.

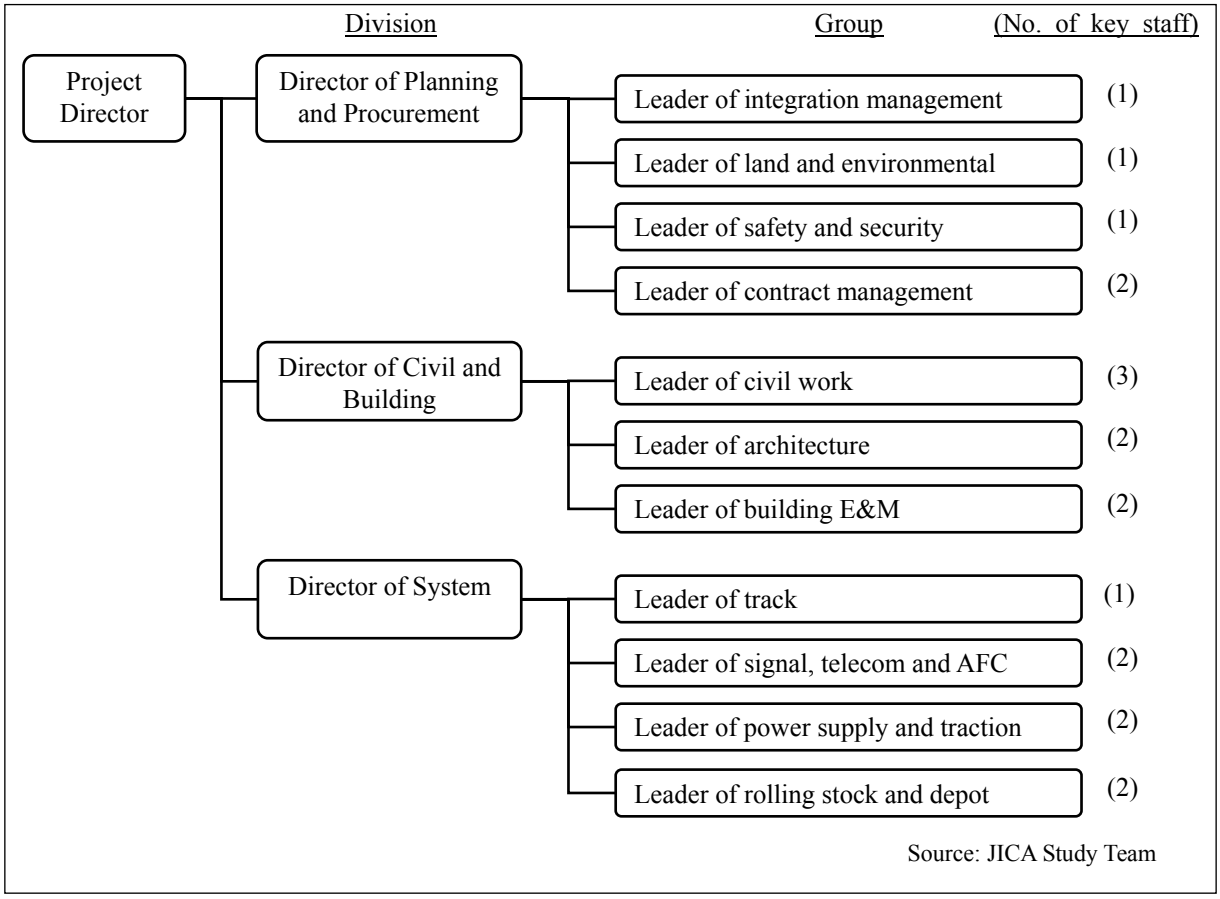


Figure 9.2.2 Proposed Organization of KUTC Engineering Units

Each divisions will be headed a director who is responsible for all the functions of the division and coordination with other divisions to deal with interface issues. The directors should have main tasks and satisfy qualifications shown in Table 9.2.2. Authorities to decide engineering matters should be given to the respective directors.

Table 9.2.2 Main Tasks and Qualifications for Division Directors

Position	Main Tasks	Qualifications
Director of Planning and Procurement	・ Overall in charge of project planning, scheduling, costing and monitoring ・ Overall in charge of land acquisition, environmental management and safety ・ Overall in charge of procurement and contract management ・ Principal in charge of liaison with GOP, PR and JICA ・ Interface issues	・ Experience in division leader of large scale project or technical organization ・ Rich experience in project management and monitoring ・ Experience in procurement and contract management ・ Basic knowledge of railway engineering ・ High integrity in business ethics and morality ・ Bachelor's degree or higher education ・ Work record of 15-25 years

Position	Main Tasks	Qualifications
Director of Civil and Building	・ Overall in charge of design and construction of civil work and structures ・ Overall in charge of design and construction of building work ・ Interface issues	・ Experience in division leader of large scale project or technical organization ・ Rich experience in civil and structure design and construction ・ Basic knowledge of building work ・ Basic knowledge of railway engineering ・ High integrity in business ethics and morality ・ Bachelor's degree of civil engineering or higher education ・ Work record of 15-25 years
Director of System	・ Overall in charge of design, installation and testing of track ・ Overall in charge of design, installation and testing of signal and telecom ・ Overall in charge of design, installation and testing of power supply and traction ・ Overall in charge of design, manufacturing and testing of rolling stock and depot equipment ・ Interface issues	・ Experience in division leader of large scale project or technical organization ・ Rich experience in mechanical or electrical design, installation, testing and commissioning ・ Basic knowledge of railway systems ・ High integrity in business ethics and morality ・ Bachelor's degree of mechanical or electrical engineering or higher education ・ Work record of 15-25 years

Source: JICA Study Team

The leaders of respective groups should be professionals with specialized technical knowledge and experience, of which tasks and qualifications are suggested in Table 9.2.3. Common requirements for these leaders that are not shown in the table will be integrity and leadership potential.

The technical leaders should be comparatively young and competent, which will lead to developing future KUTC key managers after starting the KCR operation through capacity building during design and construction stages.

Table 9.2.3 Main Tasks and Qualifications for Technical Leaders

Position	Main Tasks	Qualifications
Leader of integration management	・ Railway planning ・ Train operation ・ O&M planning	・ Experience in railway planning or operation ・ Civil engineering background ・ Work record of 7-15 years
Leader of land and environmental	・ Land acquisition and compensation ・ Environmental monitoring and management	・ Experience in social and environmental management ・ Environmental engineering or social science background ・ Work record of 7-15 years
Leader of safety and security	・ Safety management and accident prevention ・ Security management	・ Experience in safety management or accident prevention activities ・ Preferably civil or mechanical engineering background ・ Work record of 7-15 years

Position	Main Tasks	Qualifications
Leader of contract management	・ Procurement of consultant ・ Procurement of contractors ・ Project scheduling and monitoring ・ Project costing and monitoring ・ Contract administration	・ Experience in project management or contract management ・ Preferably civil engineering background ・ Work record of 7-15 years
Leader of civil work	・ Design management of civil work and structures ・ Construction management of civil work and structures	・ Experience in civil work design and/or construction ・ Civil engineering background ・ Work record of 7-15 years
Leader of architecture	・ Design management of architecture for stations and other buildings ・ Construction management of architecture for stations and other buildings	・ Experience in architecture design and/or construction ・ Architectural background ・ Work record of 7-15 years
Leader of building E&M	・ Design management of electrical and mechanical work for stations and other buildings ・ Installation and testing management of electrical and mechanical work for stations and other buildings	・ Experience in electrical or mechanical design and/or installation ・ Electrical or mechanical engineering background ・ Work record of 7-15 years
Leader of track	・ Design management of track ・ Installation and testing management of track	・ Experience in track design and/or installation ・ Civil engineering background ・ Work record of 7-15 years
Leader of signal, telecom and AFC	・ Design management of signaling, telecommunication and AFC ・ Installation and testing management of signaling, telecommunication and AFC	・ Preferably experience in signaling or telecommunication design and/or installation ・ Electronics or communication engineering background ・ Work record of 7-15 years
Leader of power supply and traction	・ Design management of transmission line, substations, catenary and power distribution ・ Installation and testing management of transmission line, substations, catenary and power distribution	・ Experience in power supply system design and/or installation ・ Electrical engineering background ・ Work record of 7-15 years
Leader of rolling stock and depot	・ Design management of rolling stock and depot/workshop facilities ・ Manufacturing and testing management of rolling stock and depot/workshop equipment	・ Preferably experience in rolling stock design and/or manufacturing ・ Electrical or mechanical engineering background ・ Work record of 7-15 years

Source: JICA Study Team

For recruitment of directors and leaders, adopting the following policies is recommended:

a) Avoid influential contacts.
b) Prioritize future potential and competence rather than past experience records.
c) Attract talented people with reasonable compensation scheme.

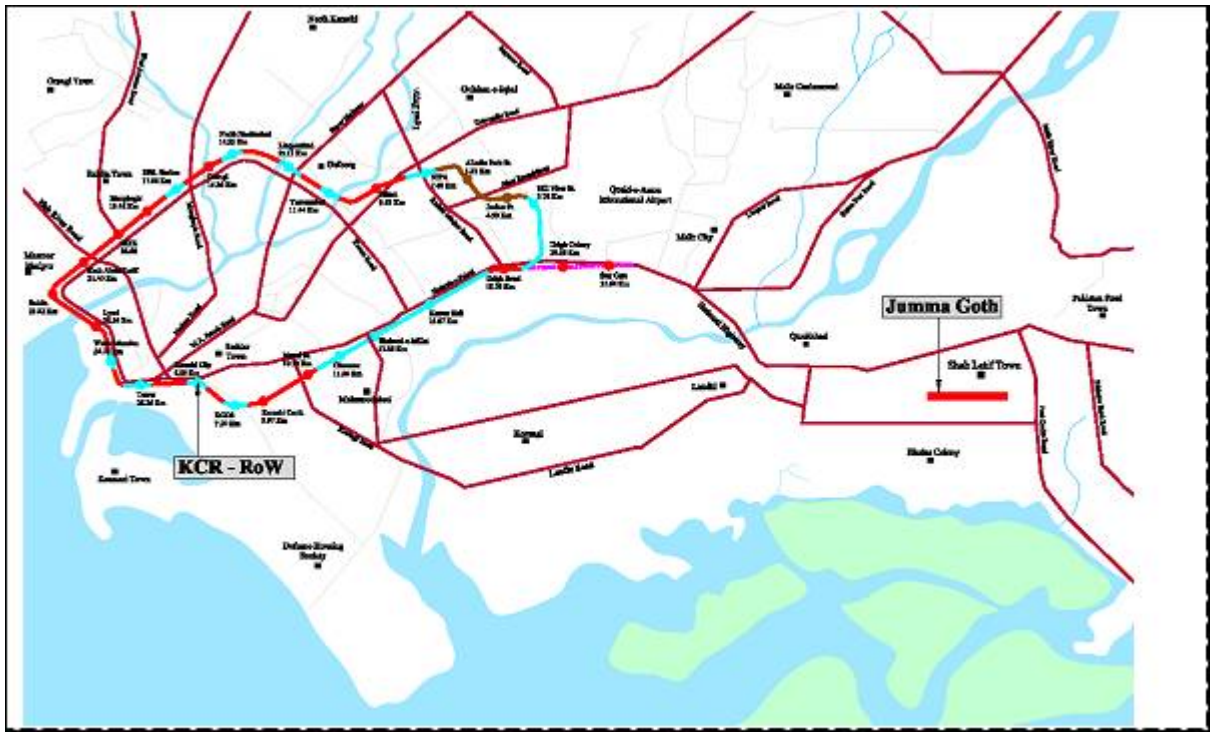
10. ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

10.1 EIA System in Pakistan

10.1.1 Introduction of KCR Project

The Karachi Circular Railway (KCR) will be revived as a modern commuter system to meet the essential transportation need of the citizens of Karachi. The total route length of the dual tracks on the KCR is 47.04 km; Karachi City Station to Drigh Road along the Loop Line (28.26 km) and Drigh Road to Karachi City Station along Main Lline (18.78 km) with 25 stations.

As both Loop and Main Lines pass through populated areas those have encroached by illegal residents, the Project is anticipated to cause the significant adverse impacts due to an involuntary resettlement. And socio-economic survey was undertaken to gather social and economic baseline information on the affected inhabitants along KCR-Right of Way (ROW). This survey was carried out from early July, 2009 to end of October 2010. As a result of the survey 4,653 households are defined as Project Affected Households (PAHs) those must be resettled. All of them are non-land-titled holders those to be allocated plots of land with title. To cope with this, 276.9 acres of land will be allocated by KUTC at Juma Goth which locates 25 km away to the east of Karachi City center as presented in Figure 10.1.1.



Source: JICA Study Team

Figure 10.1.1 Karachi Circular Railway and Resettlement Site

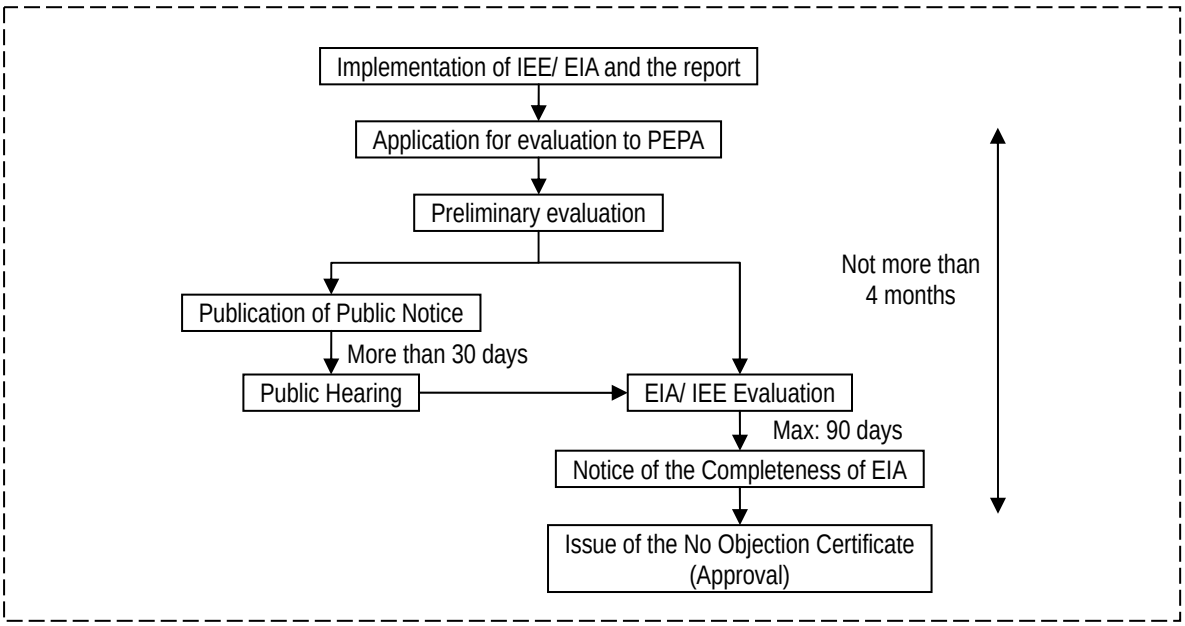
10.1.2 EIA System in Pakistan

Pakistan Environmental Protection Agency (PEPA) under the powers conferred upon it by the Pakistan Environmental Protection Act prepared "The Pakistan Environmental Assessment Procedures" in 1997. "The PEPA review of IEE and EIA regulations, 2000" provide the necessary details on the preparation, submission and review of the IEE and the EIA as the guidelines. The regulation classifies projects on the basis of expected degree of adverse environmental impacts and lists them in two separate schedules. Schedule-I lists projects that may not have significant environmental impacts and therefore require an IEE. Schedule-II lists projects of potentially significant environmental impacts requiring

preparation of an EIA. The package of regulations prepared by PEPA with relevance to an IEE or EIA includes:

- Policy and Procedures for Filing, Review and Approval of Environmental Assessments;
- Guidelines for the Preparation and Review of Environmental Reports;
- Guidelines for Public Consultation

The proposed "Karachi Circular Railway (KCR) Revival Project" is included in the Schedule-II as transport railway works. It requires proponents to prepare terms of reference for the environmental assessment reports. The proposed "Development of Juma Goth for the Resettlement of Project Affected Persons" falls in the Schedule I as urban development project. The process from submission of the application to approval of the result of EIA/ IEE study is schematized in Figure 10.1.2.



Source: Review of IEE and EIA Regulations 2000 etc.

Figure 10.1.2 Flow of EIA and IEE Process

10.2 Environmental Characteristics of the Project Site

10.2.1 Overall KCR Line

A continuous built up area is formed from Karachi Port towards northern part. Low-income households are generally located in the Trans-Lyari sections of Golimar, Liaquatabad, Federal Area, North Karachi, Baldia, Orangi, Sindh Industrial Estate, and eastward to Drigh Colony, Malia Colony, Landhi Colony & Landhi Industrial Estate, Korangi Colony and Korangi Industrial Area. They are clustered in the area along KCR railway because economic growth sequential to industrial and commercial activities attracted them to accommodate there. Extremely low-income households are encroaching on railway property of unoccupied plots as well as amenity plot. They are called as "Squatters" throughout the Karachi City.

There are no protected areas and forests applied to by the "Forest Act" in and around the project site.

10.2.2 Resettlement Site (Juma Goth)

The resettlement site comprises of 276.9 acres of land that is the old site of marshaling yard of PR. It locates 25 km away from city center and approached by the cattle colony road on the west and Port Qasim Road on the east. Shah Latif Town is located adjacent to the proposed site and Landhi Industrial area is located approximately 1.6 km in south.

The resettlement area is flat and the ground level is 9 meters high above sea level. The gentle slope of 0.6% across the width of settlement site (North-South) and slope of 0.5% across the length (West-East),

respectively.
It is an open barren land at present, parts of which are under cultivation by unauthorized vegetable growers while another section of the land is the dumping ground for solid waste as well as residential units in the surroundings. A "*nallah*" (natural stream) enters the site from the National Highway with accompanying several channels those bring waste water into "*narllah*". The vegetable growers have a few channels those bring waste water from the cattle colony.
There are no protected areas and forests applied to by the "Forest Act" in and around the resettlement site.
With regard to the land use, most of the project area (about 60%) is under illegal cultivation and some area is being used for dumping cow dung and domestic waste. About 35% of the area holds vegetation of wild grass plants and shrubs mainly. The following plant species have been reported in "Feasibility Study of Resettlement Site of the Revival of Karachi Circular Railway". These plans are common species in Karachi.

Table 10.2.1 Flora of Resettlement Site

Plant Species	Vernacular Name	Local Name	Habit
Abutilon indicum	Jangli Panir		Small shrub
Acacia nilotica	Kikar/Babool	Kiker	Tree
Achyranthes aspera	Puthkanda	-	Herb
Aerva javanica	-	Boi	Shrub
Amaranthus viridis	Chulai	lulur	Herb
Atriplex sp.	-	-	Shrub
Calotropis procera	Aak	Ak	Shrub
Capparis aphylla	Karir	Karril	Tall shrub
Cenchrus ciliaris	Dhaman	barshok	Grass
Chaenopodium album	Bathu	-	Herb
Cynodon dactylon	Khabal	Khaber	Grass
Dactyloctenium aegyptium	Gandeel	-	Grass
Datura alba	Datura	Datura	Shrub
Desmostachya bipinnata	Dub	-	Grass
Dicanthium annulatum	-	-	Grass
Euphorbia caudicifolia	Pit papra	-	Herb
Paspalum distichum	-	-	Grass
Prosopis glandulosa	Pahari Kikar	Babur	Tall shrub
Prosopis juliflora	Pahari Kikar	Babur	Tree
Ricinus communis	Casteroil	Castriale	Tall shrub
Salvadora persica	Pelu	Khabar	Tree
Senna holosericea	Jangli Sana	-	Shrub
Suaeda fruticosa	Lana	Lani	Herb
Typha sp.	Dib	Dib	Tall grass
Ziziphus nummularia	Jangli Beri	Malah	Shrub
Zygophyllum coccineum			Shrub

Source: Feasibility Study of Resettlement Site of the Revival of Karachi Circular Railway, Appendix X- Environmental and Social Profile

10.3 Review of Initial Environmental Examination on Resettlement Site

10.3.1 Outline

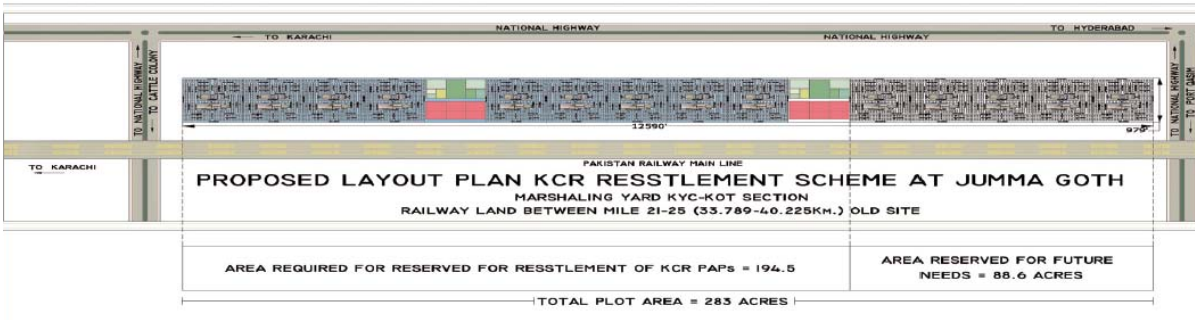
"Initial Environmental Examination (IEE) for Development of Juma Goth for the Resettlement of Project Affected Persons (PAPs)" was prepared in May 2010 and approved by Environmental

Protection Agency in Government of Sindh on 26th, May, 2010. The IEE study was conducted by Environmental Management Consultants that has conducted the EIA study for KCR project. This IEE Study has taken cognizance of the Guidelines of Government of Pakistan notification on Environmental Impact Assessment requirement for environmental classification of the Project into "Category B". Because of IEE level study, the baseline data were utilized published and publicly available relevant information and general site surveys. The IEE report has not been available on the website of KUTC.

"Supplemental Study on Resettlement of Karachi Circular Railway" to complement the IEE was conducted by Exponent Engineers (Pvt.) Limited and Environmental Management Consultants from July to October, 2012.

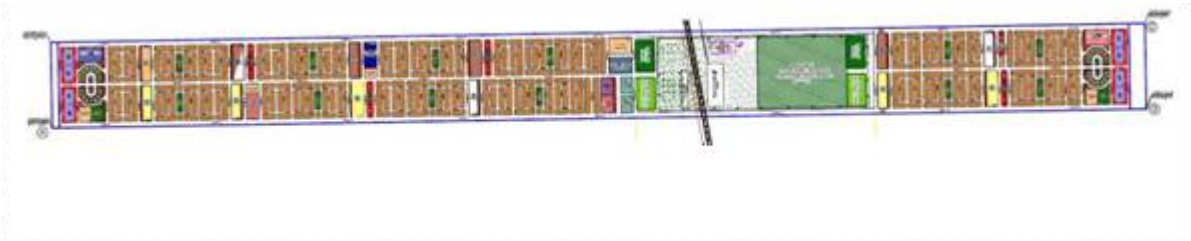
10.3.2 Project Description

Because of the conceptual planning stage, the design concept of the development area is not described at the time. The preliminary layout plan (Figure 10.3.1) was presented in the IEE. However, this layout plan is quite different from the layout plan (Figure 10.3.2) prepared by "Feasibility Study of Resettlement Site of the Revival of Karachi Circular Railway (March 2012).



Source: IEE for Development of Juma Goth for the Resettlement of Project Affected Persons

Figure 10.3.1 Preliminary Layout Plan Proposed in IEE



Source: Feasibility Study of Resettlement Site of the Revival of Karachi Circular Railway

Figure 10.3.2 Layout Plan in F/S

10.3.3 Description of Environment

Several descriptions of the project site mentioned in the IEE differ from the present status. The description in the IEE is "Two large sections of land area are at present under cultivation. One of the cultivators has been active here for more than four years while the other has moved in recently. They have their investment at stake. They have promised to vacate the land as and when required without any demand. Vacation of Land will be resolved with the inception of activities at the site". However, according to the Feasibility Study, there are at least 14 illegal cultivated areas and 50 farmers in the project site. Moreover 7 residents and abandoned row houses occupied by illegal immigrants exist in the site.

With regard to hygienic condition, the description in the IEE is "Nallah (natural stream) and several channels passing through the project site are carriers of sewage and effluent discharged from industries and a cattle colony. In view of shortage of water, the farm owners and share croppers of the area have

diverted the wastewater into their fields. There are large heaps of solid wastes dumped in the past and continuing to pile up in the middle of the project site". However, the IEE have concluded that the proposed location at Juma Goth is deemed suitable for the housing colony for resettlement of KCR-PAPs. Because the qualities of the water, soil and bottom sediment of ponds in the project site have not been analyzed yet, the project site may have hygienic problems. According to "Sectoral Guidelines for Environmental Reports-Housing Estates & New Town Development", proper chemical test is important to assess the severity of impact in case of new housing development in past waste disposal site.

10.3.4 Screening of Potential Environmental Impact

A checklist was used for the screening of potential environmental impact on 29 different components for siting of the land for Resettlement of KCR-PAPs. All potential impacts on the 29 components including solid waste, water resource problems, resettlement and social conflicts were assessed as "no impact" in the result. This result is not adequate in terms of the project characteristic and the present status of the project site.

10.3.5 Alternatives

"No action" and "Site selection" were analyzed in the IEE report. The Juma Goth site owned by Pakistan Railways was consequently reconfirmed as the only and preferred alternative in terms of the need and availability. The result of the alternative analysis is summarized in Table 10.3.1.

Table 10.3.1 Result of Alternative Analysis

Alternatives	No action (Only monetary compensation)	Other resettlement site	Juma Goth site
Environmental and social aspect	- Because the PAPs are almost low-income groups and the compensation cost is limited, it will be difficult for the PAPs to buy new residence in the urban area formally. - Illegal encroachments will continue to other places.	- Resettlement of PAPs close to their current areas of residence could not be considered because of non-availability of land in the respective areas. - Except for Juma Goth site, land for housing about 4500 affected families is not available anywhere within the urban and suburban areas.	- Pakistan Railways (PR), as the major stakeholder of the KCR project and holder of major stakes KUTC, is rightful owner of the proposed Juma Goth site and can made the land available for resettlement of KCR PAPs. - The proposed site is adjacent to Shah Latif Township, a well-developed urbanized area.

Source: JICA Study Team

Because the content of the alternative analysis is shallow and insufficient in the consideration, the alternative analysis should be revised to ensure the requirement of "2. Appendix Illustrative Environmental Impact Assessment Report for Category A Projects" in "JBIC GUIDELINES FOR CONFIRMATION OF ENVIRONMENTAL AND SOCIAL CONSIDERATIONS, APRIL 2002".

The discretion is as follows:

> Analysis of alternatives: systematically compares feasible alternatives to the proposed project site, technology, design and operation including the "without project" situation in terms of their potential environmental impacts; the feasibility of mitigating these impacts; their capital and recurrent costs; their suitability under local conditions; and their institutional, training and monitoring requirements. For each of the alternatives, quantifies the environmental impacts to the extent possible, and attaches economic values where feasible. States the basis for selecting

the particular project design proposed and offers justification for recommended emission levels and approaches to pollution prevention and abatement.

10.3.6 Environmental Management Plan

The Environmental Management Plan (EMP) in the IEE report provides an overall approach for managing and monitoring environment-related issues and describes the institutional framework. Because the outline of project components was not determined at the time, the EMP is initial level.

The environmental survey in the resettlement site, updated environmental monitoring plan and institutional framework to implement the EMP are mentioned in "Updated Environmental Management Plan" section in this report.

10.3.7 Public Consultation

Number of focus group discussions (20 Minor PCMs) and large gatherings (8 Major PCMs) were held with all of the communities along KCR-ROW. During the public consultation multiple groups of stakeholders were invited. Stakeholders were those who have an interest in the project development, and who will be involved in further consultative process. The major stakeholders were:

1. Project Affected Persons (PAPs)
2. Local Leaders of PAPs
3. Community Based Organizations (CBOs)
4. Non-Government Organizations (NGOs)
5. Officials of Revenue Department
6. Officials of City District Government Karachi (CDGK)
7. Environmental Protection Agency
8. Print and Electronic Media

10.3.8 Revised Environmental and Social Impact

The potential environmental and social impact was revised on the basis of the latest information on the project site and "Feasibility Study of Resettlement Site of the Revival of Karachi Circular Railway, March 2012". The result of the impact assessment is shown in Table 10.3.2.

Table 10.3.2 Result of Revised Environmental and Social Impact

Category	No.	Impact Item	Assessment		Reason / Remarks
			Pre-Construction Phase Construction Phase	Operation Phase	
Pollution	1	Air pollution	B-	D	**Construction Phase:** Generation of dust and exhaust gas caused by excavating works or operation of construction equipment **Operation Phase:** No considerable impact on air quality
	2	Water pollution	C-	D	**Construction Phase:** Impact on water resources of turbid water caused by construction works will not occur normally. However, several channels carrying domestic wastewater and effluent from a cattle colony flow into the project site. Because the water, soil and bottom sediment of ponds have not been analyzed yet, the project site may have hygienic problems. **Operation Phase:** A sewerage system will be installed in the developed site. No considerable impact on water quality
	3	Waste	B-	D	**Construction Phase:** Generation of construction waste caused by construction works and general waste from construction office There are large heaps of dumped solid waste in the project site. Because the water and soil have not been analyzed yet, the project site may have hygienic problems. **Operation Phase:** The solid waste management is considered in the project. No considerable impact on waste
	4	Soil pollution	C-	D	**Construction Phase:** Soil pollution caused by construction works will not occur normally. However, there are several channels including domestic wastewater, heaps of dumped solid waste and illegal cultivated areas in the project site. Because the soil and bottom sediment of ponds have not been analyzed yet, the project site may have hygienic problems. **Operation Phase:** No considerable impact on soil quality
	5	Noise and vibration	B-	D	**Construction Phase:** Increase in noise and vibration level caused by construction works **Operation Phase:** No considerable generation of noise and vibration
	6	Ground subsidence	D	D	No considerable impact on ground subsidence

Category	No.	Impact Item	Assessment		Reason / Remarks
			Pre-Construction Phase Construction Phase	Operation Phase	
	7	Offensive odors	C-	D	**Construction Phase:** In case of operation of ill-serviced construction equipment, generation of exhaust gas with offensive odors **Operation Phase:** No considerable generation of offensive odors
	8	Bottom sediment	C-	D	**Construction Phase:** Bottom sediment pollution caused by construction works will not occur normally. However, several channels carrying domestic wastewater and effluent from a cattle colony flow into the project site. Because the water and bottom sediment of ponds have not been analyzed yet, the project site may have hygienic problems. **Operation Phase:** No considerable impact on bottom sediment
Natural Environment	9	Protected areas	D	D	No protected area in and around project site
	10	Ecosystem	B-	D	**Pre-Construction Phase:** Loss of the existing vegetation **Operation Phase:** No considerable impact on ecosystem, but necessity of recovery of vegetation
	11	Hydrology	D	D	A sewerage system will be installed in the project site. No considerable impact on hydrology
	12	Geographical features	D	D	No considerable impact on geographical features
Social Environment	13	Resettlement/ Land Acquisition	B-	D	**Pre-Construction Phase:** There are 7 residents, at least 14 cultivated areas and abandoned row houses occupied by illegal immigrants in the project site. The resettlement of these persons will be required. **Operation Phase:** Because of no important facilities in the project site, no impact on the adjacent land.
	14	Poor people	B±	A+	**Construction Phase:** There are at least 14 illegal cultivated areas and 50 farmers in the project site. These farmers and their employees will lose an income source. Job creation as unskilled labor for poor people **Operation Phase:** Housing colony for resettlement of KCR-PAPs will be secured.
	15	Ethnic minorities and indigenous peoples	D	D	No residential area of ethnic minorities or indigenous peoples in and around the project site

Category	No.	Impact Item	Assessment		Reason / Remarks
			Pre-Construction Phase Construction Phase	Operation Phase	
	16	Local economies, such as employment, livelihood, etc.	B±	B+	**Construction Phase:** There are at least 14 illegal cultivated areas and 50 farmers in the project site. These farmers and their employees will lose an income source. Job creation as unskilled labor for local people **Operation Phase:** The newly created housing colony will contribute to local economies.
	17	Land use and utilization of local resources	B-	D	**Construction Phase:** Loss of the existing illegal cultivated areas and dumping sites **Operation Phase:** No considerable impact on land use and utilization of local resources
	18	Water usage	D	D	Water supply systems will be installed in the developed site. No considerable impact on water usage
	19	Existing social infrastructures and services	D	D	Because of no important infrastructures in the project site, no impact on social infrastructure.
	20	Social institutions such as social infrastructure and local decision-making institutions	D	B-	**Construction Phase:** No considerable impact on social institutions **Operation Phase:** Confects between host community and resettled community without proper coordination
	21	Misdistribution of benefits and damages	D	B-	**Construction Phase:** No considerable impact on misdistribution of benefits **Operation Phase:** Misdistribution of benefits among KCR-PAPs without proper allotment and coordination
	22	Local conflicts of interest	D	B	**Construction Phase:** No considerable impact on local conflicts **Operation Phase:** Confects between host community and resettled community without proper coordination
	23	Cultural heritage	D	D	No cultural heritage in and around project site
	24	Landscape	D	B+	**Construction Phase:** No considerable impact on landscape **Operation Phase:** Landscape will be improved by housing colony including park and green zones.
	25	Gender	D	D	No considerable impact on gender
	26	Children's rights	D	B+	**Construction Phase:** No considerable impact on children's rights **Operation Phase:** Schools will be established in the developed site.

Category	No.	Impact Item	Assessment		Reason / Remarks
			Pre-Construction Phase Construction Phase	Operation Phase	
	27	Infectious diseases such as HIV/AIDS	D	D	Because the project site is located in urban area, new considerable influx of infected persons as construction worker will not occur.
	28	Working conditions (including occupational safety)	B-	D	**Construction Phase:** Impact on sanitary conditions around the construction site of waste from construction workers Labor accident including tumble accident **Operation Phase:** No considerable impact on working condition
	29	Accidents	B-	D	**Construction Phase:** Labor accidents **Operation Phase:** No considerable impact on accidents
Other	30	Trans-boundary impacts or climate change	D	D	No trans-boundary impacts such as climate change

A+/-: Significant positive/negative impact is expected.
B+/-: Positive/negative impact is expected to some extent.
C+/-: Extent of positive/negative impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses)
D: No impact is expected

Source: JICA Study Team

10.3.9 Mitigation Measures

The mitigation measures on the environmental impacts identified in this survey are summarized in Table 10.3.3. Other migration measures described in the IEE report should be also referred to.

Table 10.3.3 Mitigation Measures

Item of Impact	Magnitude of adverse impact	Mitigation Measures
Pre-Construction Stage		
Water, soil and bottom sediment pollution	C	- To identify the pollution status, the environmental surveys and analysis should be conducted. - If considerable pollution is identified, the survey result should be reflected in the EMP and detail design.
Resettlement/ Land Acquisition	B-	- In the detail design stage, to minimize the resettlement and land acquisition, the consultants should analyze the alternative layout plan. - The land acquisition plan and resettlement plan should be prepared for the implementation without troubles.
Poor people/ Local economies/ Land use	B-	- To minimize impact on present agricultural activities, the construction schedule should be disclosed to the PAPs at the earliest possible stage. - The proper compensation should be given to the PAPs.
Construction Stage		
Air pollution	B-	- The contractor should keep their construction equipment proper condition to avoid the imperfect combustion. - The proper work schedules should be considered not to concentrate the construction equipment at a certain point for long time. - To reduce the dust, periodical water spray should be taken. - If the residents and pedestrians complain about the dust and gas, the consultant of the supervision and contractors should reconsider the construction technique.
Waste	B-	- The contractor should consider the proper reuse and disposal plan, and manage the construction wastes. - Because the surplus soil may cause negative impact on environment surrounding disposal sites, the proper disposal sites should be selected at the next stage. - The consultant of supervision should monitor the waste disposal.
Noise and vibrations	B-	- The proper work schedules should be considered not to concentrate the construction equipment at a certain point for long time. - The contractor should keep their construction equipment in proper condition. - Construction activities with high noise generation should be scheduled during daytime only. - If the local people complain about noise and vibration, the consultant of the supervision and the contractors should reconsider the construction technique.
Ecosystem	B-	- Compensatory planting and green area including parks should be considered.
Working conditions/ Accidents	B-	- The construction personnel should be provided with the necessary safety gears such as protective hard hat. - First-aid kits should be prepared within the construction site office. - Common people should be restricted to enter the construction site strictly.

Source: JICA Study Team

10.3.10 Basic Outline of JICA Environmental and Social Consideration Document

According to Japanese EIA law, the scale (112 ha) of the development site falls under the category A that requires a EIA study. For the environmental review of the this project, the following confirming items should be considered in the revised IEE (EIA level) besides the approved IEE and supplemental environmental study in the resettlement site.

1. Alternative analysis of resettlement site development including zero option
2. Description of Environment
   2.1. Description of land use and vegetation including the approximate areas in the resettlement site
   2.2. Exact description of the resident and illegal farmers in the in the resettlement site
   2.3. Result of the supplemental environmental study in the resettlement site (Condition of waste, factories in the catchment area, water quality and soil quality)
3. Screening of potential Environmental Impacts and Mitigation Measures
   3.1 Because of the screening level impact assessment, more concrete descriptions of the expected impact and mitigation measures on the effected items, especially
      a. Basic policy on the estimation and disposal of the solid waste illegally dumped, and the cost in the pre-construction phase
      b. Treatment methods of the domestic wastewater, the treated wastewater quality and quantity, and the cost in the pre-construction phase
      c. Basic policy on the quantitative estimation and disposal of the solid waste, and the cost in the operation phase
      c. Basic policy on the quantitative estimation of the domestic wastewater, impact of the waste water on the downstream areas, mitigation measures and the cost in the operation phase
4. Environmental Management Plan in accord with the above mentioned impact assessment and the result of SAPROF-II
   4.1. Description of the implementation of EMP and supervision plan in consideration of the project characteristics and expected environmental and social impact
   4. 2. Description of more concrete EMP in consideration of the expected environmental and social impact

Conclusion:

The following items should be considered in the revised version of the approved IEE report as the environmental and social considerations required for the environmental review.

1. Suggestion in SAPROF-II
2. Related section in Feasibility Study of Resettlement Site prepared by KUTC
3. Related section in Supplemental Study on Resettlement of KCR prepared by JICA

The document combined the revised IEE and "EIA for Revival of Karachi Circular Railway" shall be the environmental and social consideration document for the JICA appraisal. It is possible to edit the components on the resettlement site development as an addendum to combine with "EIA for Revival of Karachi Circular Railway". However, it is important that the description on the resettlement site development should be consistent with the EIA.

10.4 Review of Environmental Impact Assessment for KCR Line

10.4.1 Outline

“Environmental Impact Assessment (EIA) 1st Edition for Revival of Karachi Circular Railway” was prepared in January 2009 and approved by Environmental Protection Agency in Government of Sindh on 4th, July, 2009. The EIA study was conducted by Pakistani Environmental Management

Consultants Co. Ltd. The EIA report was partially revised on the basis of the conditions attracted the approval and the latest information of KCR project and finalized in July 2011. The full text EIA report written by English and summary report written by Urdu language are released to the public at the local government offices and on the website of KUTC.

Because the term of official request to JICA is on December in 2008, JBIC's "Guidelines for Confirmation of Environmental and Social Consideration (2002)", which has been considered as official guidelines for environmental and social considerations in JICA, will be applied for this project. This project is classified into "Category A". JBIC guidelines request the following items in EIA report for category A projects.

- EXECUTIVE SUMMARY
- POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK
- PROJECT DESCRIPTION
- BASELINE DATA
- ENVIRONMENTAL IMPACTS
- ANALYSIS OF ALTERNATIVES
- ENVIRONMENTAL MANAGEMENT PLAN (EMP)
- CONSULTATION

All items requested by JIBC Guidelines are described in the EIA reports. However the analysis of alternatives is not sufficient as a category A project.

10.4.2 Alternatives

"Without Project", "Revival of KCR", "Alignment" and "Power Supply System" were considered in analysis of alternative section in the EIA report.

As for "Without Project" and "Revival of KCR", the existing transportation system without the role KCR is not acceptable from the point of view of the increasing traffic demand in Karachi. Utilization of the existing railway line by KCR is one of urban mass transit system options. Revival of KCR as an effective mass transit system in resolving the transportation problems in Karachi would be the preferred alternative. Revival of KCR was consequently selected as only alternative in the EIA report.

Horizontal alignment of KCR cannot be changed because the ROW of KCR land is fixed along the existing KCR and Main Railway track. Therefore the horizontal alignment analysis was not considered. As for the vertical alignment, the use of viaduct, embankment, ground level and Culvert was considered. The result is summarized in Table 10.4.1. Only noise and community segregation were assessed in the environmental aspect.

Table 10.4.1 Environmental and Financial Aspect of Vertical Alignment

Item	Viaduct	Embankment	Ground level	Culvert
Environmental Aspect	Low level noise Community segregation	Low level noise Community segregation	High level noise	Low level noise
Financial Aspect	High	Slightly high	Low	Slightly high

Source: Environmental Impact Assessment for Revival of Karachi Circular Railway

According to the conceptual design prepared by JICA Study Team, rates of the elevated (viaduct) section, at grade (ground level) section and culvert section are 59%, 34% and 7% respectively.

As for the power supply system, three alternatives were considered. The result is summarized in Table 10.4.2.

Table 10.4.2 Comparison of Power Supply System

Item	Direct Current 1,500 V	Alternate Current 25 kV	Alternate Current 2 x 25 kV
Environmental Aspect	Electric corrosion	High level inductive communication interference	Low level inductive communication interference
Financial Aspect	Cost comparison depends on the passenger demand		

Source: Environmental Impact Assessment for Revival of Karachi Circular Railway

According to the conceptual design prepared by JICA Study Team, AC 2 x 25 kV was selected as the optimum system.

Involuntary resettlement of people encroaching on the ROW is the most serious impact of KCR project. However, alternatives to minimize the PAPs including typical cross-section arrangement and railway arrangement in the southern section where PR's rail exists along the proposed KCR line were not considered.

10.4.3 Approval and Attached Conditions

The EIA report (1st Edition) was approved by Environmental Protection Agency in Government of Sindh on 4th, July, 2009. The approval attached 14 conditions as the prerequisites. These conditions and implementation plan mentioned in the EIA report (July 2011 Edition) are shown in Table 10.4.3.

Table 10.4.3 Implementation Plan for Compliance of EIA Approval Conditions

Condition in Approval	Implementation Plan
Resettlement Action Plan based on National and International guidelines will be prepared and implemented by Karachi Urban Transport Corporation to address the concerns of affectees and residents who are to be displaced due to acquiring of ROW of KCR. All resettlement issues will be resolved in consultation with local people. Selection of resettlement area will be finalized after getting consent of community leaders/representatives. The proponent will also undertake to adopt all the possible alternatives to minimize resettlement.	- RAP has been prepared which is in line with JICA/WB/ADB guidelines. - The plan has been prepared in consultation with Project Affected Persons (PAPs). - Selection of resettlement area has been finalized after getting consent of community leaders/representatives. - Alternatives to minimize involuntary resettlement have been considered.
The proponent will constitute a committee comprising of representatives of EPA, Revenue Department, Local Government, CDGK, Local Communities and Sheri-CBE (Sheri-Citizens for a Better Environment) to oversight the matters pertaining to resettlement.	- The BoD has representatives of all the departments of GoS, MoR & CDGK. - Committee has been constituted of all the departments, NGOs and CBOs to oversee the implementation of RAP.
The ROW required for the construction activities will be informed to the local people in Public Consultation meetings. In case any piece of land has been leased or sold or notified as Katchi Abadi. It will not be disturbed by the proponent until agreed by the owner(s).	- ROW has been informed to local people/PAPs in PCMs. - No land which is termed as Katchi Abadi has been found on our ROW of KCR. All the land belongs to PR dedicated to KCR project.
All Resettlement issues will be resolved at the preconstruction stage of the project.	- Proponent shall follow it once the construction & operational stages proceeds.
The recommendation of the EIA reports including the monitoring plan and environmental management plan should be adopted by the proponent.	- Proponent shall follow it once the construction & operational stages proceeds.
An Independent Environmental Monitoring Consultant shall be engaged to monitor the implementation of EMP during construction and operation phase of the project and proponent shall submit report to EPA Sindh on quarterly basis.	- KUTC shall hire an independent monitoring consultant who shall monitor the implementation of EMP during construction and operation of KCR.
During the construction phase exposed soil surface will be regularly sprinkled with water or covered with plastic sheet especially during windy conditions to avoid soil erosion and to reduce particulate matter in the surrounding air quality;	- Once reach to operational phase this clause will be followed in letter & spirit.
Advance railway techniques should be adopted to provide adequate measures to control noise and vibration.	- The Japanese system shall be adopted which takes care of such issues. - Wherever necessary, mitigation measures shall be adopted.
During construction and operation phase, proper solid waste management programme to be designed and the solid waste collection system at the stations will be provided.	- For construction & operational phase separate waste management procedures shall be utilized as mentioned in EMP of KCR EIA.
During construction phase, proper routing and movement plan will be developed for unhindered flow of traffic in and around the construction work being carried out.	- KUTC shall prepare this plan once the appraisal of the project takes place.
A complete code of Health, Safety and Environment (HSE) shall be developed, which should include efficient parameters at specific work place. For this purpose HSE setup should be established and supervised by a designated HSE officer at the senior level with sufficient administrative and technical authority to perform the designated functions. Proponent will make sure that the operating instructions and emergency actions are made available to every worker/ labor/ commuters /citizens / passersby at the site.	- KUTC is committed to have HSE officer dedicated for this task who shall make sure that HSE compliance is completely met while construction as well as operational stage. - Trainings & awareness sessions shall be done on frequent basis covering all the stakeholders.

Condition in Approval	Implementation Plan
All conflicting issues must be settled before commencing the construction of the project. The proponent shall adhere to the replies/ clarifications submitted in response to the concerns of various stakeholders. Those shall be incorporated in the Environmental Management Plan.	- RAP of the project reveals that no such places are coming in the ROW of the KCR but if there shall be any later then it will be made sure not to disturb any such area.
The proponent shall ensure that no protected heritage site(s)/place(s)/religious place(s)/ graveyard(s) will be disturbed as well as people visiting those places during the construction of the project.	- RAP of the project reveals that no such places are coming in the ROW of the KCR but if there shall be any later then it will be made sure not to disturb any such area.
The proponent shall constantly coordinate and consult with the construction plan and schedule with all the relevant civic agencies i.e. KW&SB, KESC, PTCL, SSGC, CDGK and Cantonment Board(s) for relocation of their facilities/network to minimize the difficulties of the commuters and the citizens.	- All the civic agencies shall be taken on board before starting any relocation activity.

Source: Environmental Impact Assessment for Revival of Karachi Circular Railway

10.4.4 Environmental Management Plan and Cost Estimation

The Environmental Management Plan (EMP) provides an approach for managing and monitoring environment related issues and describes the institutional framework for environmental management and resource allocations to be carried out by Karachi KUTC for mitigating the negative impacts during pre-construction, construction and operation phases. The unit cost to implement the mitigation measures and environmental monitoring works was estimated. However, because the actual quantity of each item could not be counted at the time of the conceptual plan stage, the total costs are not described in the EMP.

The updated environmental monitoring plan and institutional framework to implement the EMP are mentioned in "Updated Environmental Management Plan" section in this report.

10.4.5 Public Consultation

The public consultation of group discussions was initially carried out at different locations of the project area (KCR-ROW) during the preparation of the EIA with a view to minimize adverse impact of the project through creating awareness among the communities on potential benefits of the project. Public Hearing on EIA report was conducted by Sindh Environmental Protection Agency in May, 2009, which is a regulatory requirement under the provisions of Pakistan Environmental Protection Act, 1997 and rules and regulations framed there under. To have adequate participation of the communities and stakeholders at Public Hearing on the EIA, a public notice was also given in newspapers for wide coverage and invitation letters were distributed through EPA to major stakeholders including NGOs, relevant Government, Departments and Institutions.

10.5 Review of Feasibility Study on Resettlement Site

10.5.1 Application of Environmental Considerations in F/S on Resettlement Site

KUTC appointed MM Pakistan (Pvt.) Ltd. in 2011 to carry out "Feasibility Study of Resettlement Site of the Revival of Karachi Circular Railway (March, 2012)" pertaining to social, environmental and engineering aspects. Moreover, JICA called for "Supplemental Study on Resettlement of KCR" after MM Pakistan's F/S. The purpose of the supplemental study was to provide further information and validation of the research work carried out in the F/S. Exponent Engineers (Pvt.) Ltd., Environmental Management Consultants and Environ Envision was appointed to undertake this assignment.

Application of the mitigation measures and environmental considerations mentioned in the IEE, IEE

approval conditions issued by EPA and JBIC Guidelines to the F/S and supplemental study is summarized in Table 10.5.1. Most of the required actions should be considered by KUTC, the design consultant, supervision consultant and contractor or in the construction stage. The action items that should be considered during the planning stage are applied to the F/S in principle.

Table 10.5.1 Application of Environmental Considerations to F/S (1)

Mitigation measures proposed in "IEE for Development of Juma Goth for the Resettlement of PAPs"		
Potential Hazards & Environmental Impacts	Proposed Mitigation Measures	Availability in F/S and Supplemental Study or (Responsible Organizations)
1. Baseline Survey		
Seismic Activity	Incorporate standards and guidelines	The standards and guideline have been considered in F/S and Supplemental Study
Hydrology, including Drainage pattern & surface	Geotechnical survey to verify	The surveys have been conducted in F/S and Supplemental Study
Hydrology, including Drainage pattern & surface	Topographic surveys to verify Water flow pattern	The surveys have been conducted in F/S and Supplemental Study
2. Design Phase		
Water Supply & Drinking Water	Provision of Safe Drinking water by Installation of on-site mini-treatment plants	Conceptual plan is proposed in F/S and Supplemental Study
Wastewater	Sewerage system for conveyance of wastewater to septic tanks and for sludge disposal	Conceptual plan is proposed in F/S and Supplemental Study
Solid waste	Solid waste will be segregated and not mixed with hospital waste and will not be disposed of indiscriminately or burnt. Segregation at source and provision of colored drums for conveyance and disposal	Conceptual plan is proposed in Supplemental Study
3. Pre-Construction Phase		
Awareness on Environmental Aspects related to use of equipment and associated environmental and occupational health hazards	Creation of awareness on procedures of safety health environment Provision of protective devices for safety Provision of protective measures for workers	(Design Consultant, Supervision Consultant and Contractor)
Awareness on Aspects related to use of equipment and associated environmental and occupational health hazards	Provision of protective devices for safety Provision of protective measures for workers	(Design Consultant, Supervision Consultant and Contractor)
Awareness on Environmental Aspects of environmental & occupational health	Provision of jobs for PAPs Provision of protective devices for safety Provision of protective measures for workers	(Design Consultant, Supervision Consultant and Contractor)
4. Construction Phase		
Damages done by land clearance	Take cognizance of land use changes due to long neglect of site and its use for cultivation of crops and dumping of solid wastes Debris removal and sustainable disposal	(Design Consultant, Supervision Consultant and Contractor)

Mitigation measures proposed in "IEE for Development of Juma Goth for the Resettlement of PAPs"		
Potential Hazards & Environmental Impacts	Proposed Mitigation Measures	Availability in F/S and Supplemental Study or (Responsible Organizations)
Traffic, Noise, Fugitive dust emission Gaseous emission from construction equipment Accidents	Safe Working Procedures; Environmentally Sound Standard Operating Procedures Emergency Response Plan	(Design Consultant, Supervision Consultant and Contractor)
Dust emission during debris removal	Dust emissions at construction sites to be minimized by implementing good housekeeping and environmentally sound standard management practices	(Design Consultant, Supervision Consultant and Contractor)
Damages done by land clearance, removal of vegetation & trees	Trees, shrubs and vegetation at the site will be removed for land clearance. Trees lost, if any, will be compensated for by replantation	Vegetation recovery program is included in F/S
Drainage system and likely impact during construction	Take cognizance of existing nallah and drainage system at site Avoid location of access roads near sensitive sites Maintenance of vehicles and other equipment will be allowed only in designated areas underlain with concrete slabs and a system to catch runoff Washing of vehicles will be restricted.	(Design Consultant, Supervision Consultant and Contractor)
Adverse impact of sitting construction camp sites	Camps, access roads, and other project related sites will avoid cultural and community owned assets and will be established beyond 500 meters of the living area No campsite will be established in the vicinity of cultural sites and community owned assets.	(Design Consultant, Supervision Consultant and Contractor)

Table 10.5.2 Application of Environmental Considerations to F/S (2)

Compliance of IEE Approval Conditions issued by Environmental Protection Agency on 26th May, 2010	
Condition laid down in approval	Availability in F/S and Supplemental Study or (Responsible Organizations)
1. The recommendations of the IEE report including the monitoring plan and environmental management plan will be strictly adhered by the proponent.	(KUTC)
2. The proponent shall fulfill their commitment for improving the quality of life of Project Affected Persons (PAPs) in good faith.	(KUTC)
3. The infrastructure development works shall be completed before the evacuation of PAPs from RoW of KCR. The evacuation of PAPs shall be restricted to the required RoW only.	(KUTC, Design Consultant, and Supervision Consultant)
4. The Provisions of Pakistan Environmental Protection Act (PEPA) 1997, JICA Guidelines, World Bank (WB) Guidelines and Asian Development (ADB) Guideline's for confirmation of Environmental & Social Considerations will be strictly followed in connection to the proposed project activities.	(KUTC)
5. During the construction works of the project, Project Affected Persons (PAPs) will be given priority for all skilled and unskilled jobs. For this a Human Resource Centre shall be established at KUTC as committed.	(KUTC, Design Consultant, Supervision Consultant and Contractor)

Compliance of IEE Approval Conditions issued by Environmental Protection Agency on 26th May, 2010	
Condition laid down in approval	Availability in F/S and Supplemental Study or (Responsible Organizations)
6. The seismic risk factor will be taken into account during the designing of structural facilities.	The seismic risk factor has been considered in F/S and Supplemental Study
7. The project's construction activities will be completed in the minimum possible time strictly as per schedule which shall be submitted to this office at the start of construction/ development activity. Similarly, the procedure of PAPs transfer from RoW to Juma Goth shall also be submitted to EPA.	(KUTC and Supervision Consultant)
8. KUTC shall facilitate EPA Officer(s)/Official(s) as and when required for inspection of compliance status against the provisions of Pakistan Environmental Protection Act, 1997 and rules and regulations framed there under and the conditions laid down in this approval.	(KUTC)
9. Karachi Urban Transport Corporation (KUTC), hereinafter referred as proponent will hire an Independent Monitoring Consultant (IMC) having expertise in carrying out Environmental & Social Impact monitoring. The IMC will monitor the implementation of the proposed activities against the commitments made in IEE report. The report of the same will be submitted to SEPA on monthly basis during the period of implementation of project including the transfer of PAPs from existing RoW of KCR to the resettlement site (Juma Goth).	(KUTC and Independent Monitoring Consultant)
10. The proponent will strictly adhere to mitigation measures proposed in the IEE report. Institutional arrangements for implementation of environmental management plan will be finalized well before the start of construction, so that proposed mechanism of environmental protection would work at the time of mobilization of project activities.	(KUTC)
11. Solid waste generated during construction will be sent to designated landfill sites. A comprehensive waste disposal plan would be developed to effectively manage all wastes.	(Supervision Consultant and Contractor) Initial level plan is proposed in F/S.
12. During construction the impact of noise and vibration would be controlled and monitored through best available practices. For this purpose generators would be placed in the canopies or inside the civil structure. World Bank standards for noise levels will be complied during construction.	(Supervision Consultant and Contractor)
13. The proponent will constantly coordinate and consult the construction plan and schedule with all the relevant civic agencies i.e. KW&SB, KESC, PTCL SSGCL, Bin Qasim Town and Traffic Police for relocation of their facilities/network to minimize the difficulties of the commuters and the affected persons. The project will be constructed in the minimum possible time and will not be left abandoned or unattended at any stage from the commencing day till the completion day.	(Supervision Consultant and Contractor)
JBIC Guidelines for Confirmation of Environmental and Social Considerations	
Environmental Review Item	Availability in F/S and Supplemental Study or (Responsible Organizations)
1. Measures necessary to prevent, minimize, mitigate or compensate for potential negative impact, and measures to promote positive impact	The mitigation measures have been considered in IEE and Supplemental Study.

Compliance of IEE Approval Conditions issued by Environmental Protection Agency on 26th May, 2010	
Condition laid down in approval	Availability in F/S and Supplemental Study or (Responsible Organizations)
2. Submission of Environmental Impact Assessment reports	The IEE report has been submitted to EPA by KUTC.
3. Submission of basic resettlement plans	Present condition survey only
4. Preparation of environmental monitoring plan	The environmental monitoring plan has been proposed in IEE.
5. Information provided by concerned organizations and stakeholders at an early stage	The disclosure of information has been conducted by KUTC.

Source: JICA Study Team

10.6 Socio-Economic Survey on KCR Line

To ensure fairness of procurement process as well as project implementation, information should not be disclosed for a fixed period.

10.7 Stakeholder Meeting

To ensure fairness of procurement process as well as project implementation, information should not be disclosed for a fixed period.

10.8 Review of Resettlement Action Plan

To ensure fairness of procurement process as well as project implementation, information should not be disclosed for a fixed period.

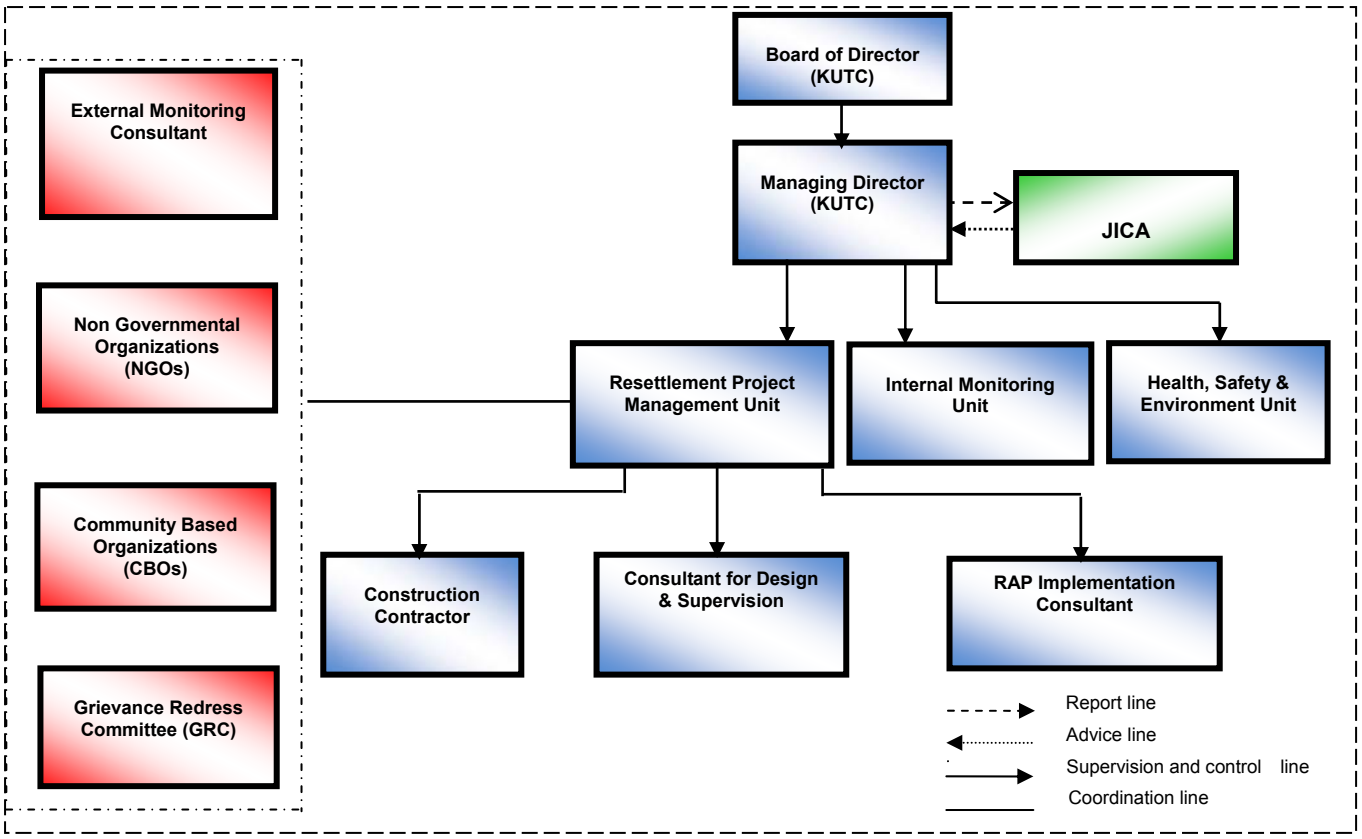
10.9 Rap Implementation Arrangement

KUTC was incorporated on 8th May 2008 in Securities Exchange Commission of Pakistan (SECP: is the financed regulatory agency whose objective is to develop a modern and efficient corporate sector and capital market) as Public Limited with nine Directors on Board, four from Pakistan Railways, Two from Government of Sindh, two from City District Government of Karachi and one Director from private sector.

KUTC will be the vehicle for the implementation of KCR Revival Project. On completion of the Project an international operators of repute will be appointed for operation and maintenance of KCR on the pattern of Successful role model of Singapore Mass Rail Transit, Deli Metro etc. KUTC will oversee the management of KCR.

10.9.1 Organization

KUTC as the sole responsibility executing agency bears the entire responsibility for KCR Resettlement Project. The overview on RAP implementation is presented in Figure 10.9.1.



Source: JICA Study Team

Figure 10.9.1 Overview on RAP Implementation Organization

(a) Board of Directors of KUTC

Board of Directors (BOD) has been constituted under the chairmanship of the Chief Secretary to Government of the Sindh to have the patronage of highest administrative authority and control through effective policy making.

(b) Managing Director KUTC

The Managing Director KUTC is also a member of BOD. KUTC as an independent functionary body does not rely on BOD's directives for day to day functions. Procurement and financial powers are vested in the executive committee of the KUTC. These have been delegated to the Managing Director KUTC who reports to the BOD of KUTC.

(c) Resettlement Project Management Unit (RPMU)

The RPMU will be created in KUTC to oversee the planning and implementation and monitoring of Resettlement and Rehabilitation component of the Project. The RPMU is also responsible for overall coordination with all stakeholders.

The RPMU is the most functionary unit and has three sub-division; i) Core Team which functions as Works & Engineering and Resettlement Processing Unit, ii) Internal Monitoring Unit and iii) Health, Safety and Environmental Unit.

The RPMU will be headed by the Project Manager who shall be responsible for executing the resettlement and rehabilitation. The Project Manager shall be directly answerable to the Managing Director of BOD. The RPMU shall liaise as independent supervisory body with External Monitoring Consultant, Non-Governmental Organizations (NGOs), Community Based Organizations (CBOs) and Grievance Redress Committee (GRC).

And the RPMU will manage Construction Contractor, Consultant for Design & Supervision and RAP Implementation Consultant as presented in Table 10.9.1, and their position, number

of persons, months of assignment and cost is presented in Table 10.9.1.

Table 10.9.1 Personnel Organization, Man-Months and Cost for RPMU

Position	No. of Persons	Months	Salary (Rs.)	Cost (Rs.)
Core Team				
Project Manager	1	60	350,000	21,000,000
Deputy Project Manager	1	60	250,000	15,000,000
Project Coordinator	1	60	175,000	10,500,000
Media Coordinator	1	60	50,000	3,000,000
Human Relation Specialist	1	60	125,000	7,500,000
Auto CAD/Computer Operator	1	60	175,000	10,500,000
			Total	67,500,000
Internal Monitoring Unit				
Senior Sociologist	1	25	150,000	3,750,000
Junior Sociologist	1	25	100,000	2,500,000
Senior Economist	1	25	150,000	3,750,000
Junior Economist	1	25	100,000	2,500,000
			Total	12,500,000
Health, Safety and Environmental Unit				
Health, Safety and Environmental Manager	1	105	175,000	18,375,000
Environment Control Officer	1	105	100,000	10,500,000
Safety Officer	1	105	100,000	10,500,000
			Total	39,375,000

Source: JICA Study Team

(d) External Monitoring Consultant (EMC)

The RPMU will hire an External Monitoring Consultant to conduct external monitoring with respect to resettlement activities of KCR Project. The purpose of the external monitoring activity is to assess whether PAPs will be to restore their incomes, living conditions and livelihood equal to their pre-project level or not, if not, to propose solutions to support them. The Consultant will conduct socio-economic survey with PAPs consequent four years after the compensation, assistance and resettlement activities have been completed. The TOR is attached in Appendix10.2 , and their position, number of persons, months of assignment and cost is presented in Table 10.9.2.

Table 10.9.2 Personnel Organization, Man-Months and Cost of EMC

Position	No. of Persons	Months	Salary (Rs.)	Cost (Rs.)
Resettlement Monitoring Specialist 1 (Team Leader)	1	48	350,000	16,800,000
Resettlement Monitoring Specialist 2 (Deputy Team Leader)	1	48	250,000	12,000,000
Gender Specialist	1	48	175,000	8,400,000
Human Relation Specialist	1	48	175,000	8,400,000
Economist	1	48	150,000	7,200,000
Urban Planner	1	48	75,000	3,600,000
			Total	56,400,000

Source: JICA Study Team

(e) Non-Governmental Organization

In the past, NGOs had avoided sectors those considered the domain of the Government

because the huge infrastructure development were needed. These include water and sanitation, urban development, environmental issues and roads. However, there is a trend to involve NGOs in these sectors. The Orangi Pilot Project and Aga Khan Rural Support Program led the way in this trend. One of the key factors in the success of the Orangi Pilot Project was its linkages with both Government and private sector. This implies that when NGOs begin to operate in sectors requiring huge investment in infrastructure, a network linkage other sectors of civil society is necessary because NGOs do not have the capacity to do it alone.

There are five laws under which NGOs in Pakistan operate. The Society Regulation Act of 1860 pertains to professional, cultural and educational bodies. The Trust Act of 1882 provides legal cover for private acts of public charity. Many NGOs are registered under the Corporative Societies Act of 1952. The Voluntary Social Welfare Agencies (Registration and Control) Ordinance was promulgated in 1961 to regulate and assist the development of NGOs undertaking welfare activities. The Companies Ordinance of 1984 allows NGOs to set themselves up as nonprofit companies.

(f) RAP Implementation Consultant

The RPMU will hire the RAP Implementation Consultant to entrust them the planning, implementation and monitoring on Resettlement and Livelihood Restoration component on KCR Project. The comprehensive scope of work for the Consultant includes;

(1) Information Dissemination and Feedback;
(2) Assisting PAPs in Resettlement Process;
(3) Grievances Redress Procedure;
(4) Assistance to PAPs during Relocation;
(5) Assistance to KUTC in Payment of Resettlement Benefits to PAPs;
(6) Information Management;
(7) Progress Reports; and
(8) Implementation Arrangements

The TOR is attached in Appendix10.3, and their position, number of persons, months of assignment and cost is presented in Table 10.9.3.

Table 10.9.3 Personnel Organization, Man-Months and Cost of RAP Implementation Consultant

Position	No. of Persons	Months	Salary (Rs.)	Cost (Rs.)
Team Leader	1	39	300,000	11,700,000
Deputy Team Leader	1	39	200,000	7,800,000
Area Manager/Liaison Officer	1	39	200,000	7,800,000
Management Information System Specialist	1	12	100,000	1,200,000
In-page Expert	1	12	40,000	480,000
Data Entry Personnel	2	24	40,000	1,920,000
Team 1				
Senior Sociologist	1	21	150,000	3,150,000
Enumerator	2	21	30,000	1,260,000
Junior Sociologist for Field Survey	2	21	55,000	2,310,000
Staff for preparing & issuing ID Cards & issuing payment	2	21	55,000	2,310,000
Team 2				
Senior Sociologist	1	21	150,000	3,150,000
Enumerator	2	21	30,000	1,260,000
Junior Sociologist for Field Survey	2	21	55,000	2,310,000
Staff for preparing & issuing ID Cards & issuing payment	2	21	55,000	2,310,000

Position	No. of Persons	Months	Salary (Rs.)	Cost (Rs.)
Team 3				
Senior Sociologist	1	21	150,000	3,150,000
Enumerator	2	21	30,000	1,260,000
Junior Sociologist for Field Survey	2	21	55,000	2,310,000
Staff for preparing & issuing ID Cards & issuing payment	2	21	55,000	2,310,000
			Total	57,990,000

Source: JICA Study Team

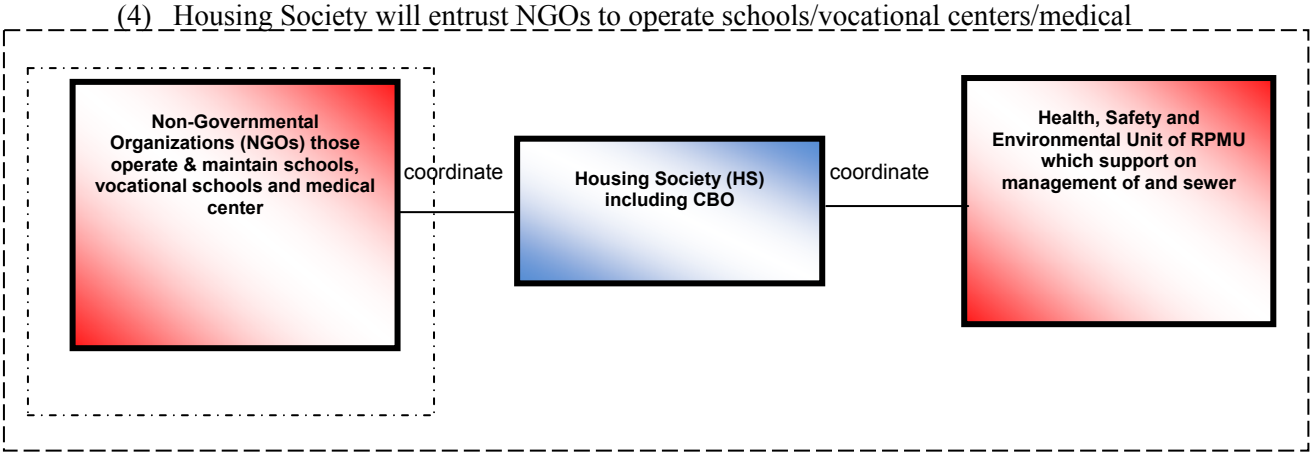
(g) Community Based Organization (CBO)

After a consultation with PAPs it is realizes that the involvement of PAPs beneficial and sustainable when they are involved in the development activities on the resettlement site. CBO will play perform in collaboration with KCR at different stages of development. The conflicts resolution among the KCR-PAPs and host communities, if any will be dully addressed by the GRC and CBOs.

(h) Housing Society (HS)

When operation stage comes KUTC will transform the RPMU into Housing Society to oversee the operations of the society. All PAHs who will be allocated residential/commercial plots will become the members of Housing Society (HS). The overview of HS is presented in Figure 10.9.2, and the key principles for establishing the Housing Society will be;

(1) Management of the Society will remain in the hands of resettled PAHs.
(2) At least 33% of the Management Committee of the Society will be women.
(3) The Housing Society will operate with a minimum staff without any financial liability for O&M of the services/utilities.
(4) Housing Society will entrust NGOs to operate schools/vocational centers/medical



Source: JICA Study Team

Figure 10.9.2 Overview on Housing Society in Operation Stage

10.9.2 Grievance Redress Committee (GRC)

Grievance Redress Committee (GRC) will be established in parallel with the RPMU for any grievances involving resettlement benefits, relocation, and other assistance. A gazette notification on the formation and scope of the GRCs will be required from the KUTC. The GRC will be comprised of the followings:

(1) Representative of MRT Line 6-convener,
(2) Representative of Administrative Body-member;
(3) One representative of male PAPs-who will be selected among PAPs in affected community-member.

(4) One representative of female PAPs, who will be selected among in affected community-member;
(5) Legal Advisor as Observer to extend legal support to the GRC to be deployed by RPMU;
(6) Representative RAP Implementation Consultant; and
(7) Representative of RPMU- member secretary.

No grievance should take more than one month for resolving from the GRC side, and before the GRC meetings, the aggrieve person(s) must be informed to remain present in the concerned GRC meeting. And procedure to settle the grievance from PAPs is as follows:

(1) STEP 1: Submission/Receipt of Grievance
PAPs will file a grievance or complaint, query to GRC and any grievances, complaints and conflicts shall be taken care by GRC with free of charge.
(2) STEP 2: Recording of Grievance/Complain
(a) Grievance Application Form (GAF) includes basic information about the resettled PAP and details of complain. Assistance in filling of the form should be provided to the illiterate persons.
(b) Full description of complaint shall be recorded and basis of claim must be asked and submitted along with GAF.
(c) All GAF data shall be filed and entered into a database system.
(d) GRC will scrutinize the entire database and categorize it according to the nature of complaint.
(3) STEP 3: Fact Finding and Investigation
(a) GRC will appoint Grievance Investigation Group (GIG) to undertake facts and investigation and through interviews, site visits, collection of evidences, pictures/documents etc. will be collected.
(b) A time-frame is given to GIG for the investigation and submission its report.
(c) GIG will present the result of fact finding and investigation to GRC and GRC will prepare either consideration of redress or no action required.
(4) STEP 4: Resolution and Appeal
There are two possible outcomes of the complaint launch and the subsequent procedure followed through the Grievance Redress System; one is that the grievance is resolved and another is complainant does not satisfy with the outcome and launches an appeal.
Appeal: A complainant may appeal the outcome to the Court of Law, the decision of which shall be final. Though the decision will be is final but the complainant still does not satisfy with the decision, he/she can seek relief from High Court Sindh under special performance act 9.
On the other hand, the Provincial Mohtasb (Ombudsman) Sindh is an independent institution, established by statute, to provide speedy relief to ant citizen or legal resident of Pakistan, especially those residing in Sindh who may have suffered from any "maladministration" at the hand of any agencies of Sindh. And, their position, number of persons, months of assignment and cost is presented in Table 10.9.4.

Table 10.9.4 Personnel Organization, Man-Months and Cost of GRC

Position	No. of Persons	Months	Salary (Rs.)	Cost (Rs.)
Legal Advisor	1	25	175,000	4,375,000
Senior Sociologist	1	25	150,000	3,750,000
Junior Sociologist	1	25	100,000	2,500,000
Senior Economist	1	25	150,000	3,750,000
Junior Economist	1	25	100,000	2,500,000
Grievance Investigation Personnel	5	25	35,000	4,375,000
			Total	21,250,000

Source: JICA Study Team

10.9.3 Implementation Schedule

(a) Implementation Schedule on Activity and Unit Basis

Synchronizing the construction schedule on resettlement site and KCR, an implementation schedule for the RAP implementation is prepared attached in Appendix10.4 on activity basis and Appendix10.5 on unit basis, respectively.

(b) Cost for RAP Implementation Management

The cost for RAP Implementation Management which includes from Table 10.9.1 to Table 10.9.4 is summarizes in Table 10.9.5.

Table 10.9.5 Summary of Cost for RAP Implementation Management

Unit	Amount (Rs.)
RPMU	
・ Core Team	67,500,000
・ Internal Monitoring Unit	12,500,000
・ Health, Safety and Environment Unit	39,375,000
RAP Implementation Consultant	57,990,000
External Monitoring Consultant	56,400,000
Grievance Redress Committee	21,250,000
Total	255,015,000

Source: JICA Study Team

10.9.4 Harmonization with Host Community

(a) Result of Focus Group Discussion with Host Communities

A total of 12 focus group discussions were conducted in 8 sectors of Shah Latif Town, 6 of which with male and 6 with female, respectively. The summary of key findings those emerged from the discussions is presented in a concise form below.

(1) Amenities: The main issues highlighted through these discussions are a serious lack of basic facilities and civic in the various sector of Shah Latif Town. There is an absence of electricity, gas, water, non-construction of street and choked sewerage line. No educational facility and then no health facility and no graveyard are provided. Lack of such facilities causes much hindrance in running small business and also results in lacking opportunities for employment.

(2) Vocational opportunities: The residents feel that if vocational training facilities exist in the area that would boost opportunities of livelihood. Since the area is in proximity to an industrial area, the feel trade like civil, mechanical, electrical, welding, air-conditioning for men and sewing tailoring, embroidery for women would be beneficial.

(3) Reaction to Resettlement: The residents on becoming aware about the Resettlement Program would be welcomed. They feel if amenities and health/education/transport services come into the Resettlement site, the host population and areas also will also benefit from them.

(b) Measures to Enhance the Harmonization

Generally, the host residents seem to be taken keen about the PAPs and they are looking forward to the new settlement. Most of them are hoping that this new development would provide opportunities and growth in their communities as well, especially in terms of addressing key issues such as lack of basic infrastructures.

However, if the host resident in not made part of the whole development process in this area, friction between host communities and new settlers cannot be ruled out. One way to deal with this situation would be to allow them that they are also in easy access to provided facilities

such as educational/medical/vocational facilities. Most of them (81%) are expecting better facilities on account of resettlement.

Care also is taken to address the concern of the host about the ethnic mix of the resettlement population. Although this area has very rarely residents have any unrest in this regard, the host resident in concerned that the re-settlers may have different attitudes and develop differences with host resident.

It is recommended that the consultation plan between host residents and PAPs must be provided to cope with above anticipated issues.

10.10 Livelihood Restoration Arrangement

The RAP recognizes the time needed for social absorption of PAPs in the new social and economic setting at resettlement site. Restoration of livelihood efforts must be undertaken in form of both short-term support and long-term support.

The program is prepared with reference to the practice which large scale of involuntary resettlement has taken place in domestic and neighbor country.

10.10.1 Resettlement and Restoration of Livelihood Program

(a) Short-term Livelihood Restoration Measures for KCR Project

PAPs those will lose their income and livelihood resources or places of generating income as a result of the resettlement will be supported with short-term income and livelihood restoration assistance for subsistence during the transitional period. These short-term measures will include the followings:

(1) Compensation for lost assets is paid in full prior to relocation: This would be paid prior to the relocation by PAPs will start.
The Supplemental Study has re-assessed the unit cost of structure presented in RAP (July 2011 version), and introduce the new unit cost based on market rate. The RAP has to be revised in accordance with the latest study results. The additional amount of full replacement cost is estimated as 567.5 million Rs., and KUTC have to bear the aforesaid cost.
(2) Another assistance for loss of business and vulnerable people is proposed in Supplemental Study report. KUTC have to develop and combine the entitlement matrix from which PAPs may not suffered due to revision.
(3) The construction of houses at the resettlement site will create the job opportunity to PAPs. A large number of people will be expected to be employed as skilled and un-skilled labor. RPMU have to encourage PAPs with introducing these job fields.

(b) Long-term Livelihood Restoration Plan for KCR Project

This is post relocation assistance for sustainable livelihood program.

(1) Appoint the local NGO who will run the vocational centers. It is recommended that the appointed NGO will be given an opportunity to join the detailed design on buildings and facility.
(2) Resettlement site is surrounded by many industrial clusters. RPMU have to help PAPs to find jobs in the surrounding factories.
(3) KUTC should provide reasonable commuter service to PAPs from resettlement site to city center or to suitable near present working area after consultation with PAPs.
(4) Set up Sunday bazaar or similar activities in the resettlement site. Weekly bazaars/small shopping centers are popular in Karachi as middle/low income family visit them. This will generate the job opportunity of PAPs and their incomes.

10.10.2 Support Measures for Housing Construction

There are four main categories on structure which employed for the KCR-ROW as presented follows.

(1) Kucha: Shabby house (wall with block and roof with nonspecific material);
(2) Pucca: Masonry block wall and pre-cast concrete slabs supported by concrete or steel girder;
(3) Kucha/Pucca: Hybrid of Kucha and Pucca;
(4) RCC: Beam-column-slab monolithic system reinforced concrete construction.

Most of the surveyed structures are categorized as Pucca or Kucha/Pucca. Major materials for those are mortar blocks which consist of cement, sand and water. Small business to manufacture the blocks is very common in Karachi. In Taiser resettlement site, some non-roof factories are engaged to fabricate the blocks.

The condition of soil foundation for residence seems fine at resettlement site and no pile work will be employed. Procurement of labors such as skilled or non-skilled common worker, form worker, masonry worker and plasterer are available in a city or its vicinity.

The plot will be provided to PAHs with cost of free, thus major issue might be highlighted how the PAHs prepare cash to build their houses. And recommended support measures are summarized as follows:

(1) Compensation to the structure by full replacement cost is prerequisite to ensure the budget for affected household;
(2) Assistance for utility connection charges at new household level;
(3) SSGC for gas connection- Rs. 2,500
(4) KW & SB water connection- Rs. 1,000
(5) KESE for electricity connection- Rs. 6,000
(6) Employ the local micro finance credit system; Rs 50,000-500,000 interest at 19.0% (approximately)
(7) Enhance PAHs to commence the fabrication of block business at resettlement site.

Source: JICA Study Team

Figure 10.10.1 Typical Pucca House at LERP

"Supplemental Study on Resettlement of KCR" has carried out to develop a RAP from July 2012 to October 2012 and it presents in terms of full replacement cost as;

(1) The cost calculated by KUTC does not take into consideration the true concept of replacement cost as it does not consider the market cost of materials to built a replacement structure with an area and quality similar to or better than those of the affected structure, and
(2) The average cost of the structure is based on the field observation and placement of the structure in the above four categories those do not fulfill the condition stated

And the Supplemental Study recommends that: KUTC should pay full replacement cost and may engage UN-Habitat to support/facilitate low cost structure construction for PAPs.

10.10.3 O & M for Public Facilities at Resettlement Site

According to the field visit to LERP, thirty five public schools had provided at initial stage, however, due to the lack of budget none of them is in service at present. And it is operated by NGO actively under the fund donated from individual, private enterprise and NGO.

In KCR Project, twelve schools, two vocational training centers and one medical center will be provided at resettlement site as presented herein under:

Table 10.10.1 Overview of Public Facilities

Name of Amenity	Quantity	Area in Acre
Schools (6 primary and 6 secondary)	12	13.46
Medical unit	1	0.67
Vocational centers	2	1.19

Source: Feasibility Study of Resettlement Site of the Revival of Karachi Circular Railway

(a) Schools

The result of census survey shows that the age group 5-9 years occupies 15 % and 10-14 years occupies 13 % of total population, respectively. Twelve schools those consist of six primaries and six secondary have been planned. All the schools will be operated in two shifts. Every school will accommodate 300-500 pupils. Thus, twelve schools those consist of six for girls and six for boys will accommodate 3,600-6,000 pupils in one shift. Two shifts in schools will accommodate 7,200-12,000 pupils who constitute 31-52 % of the total population, and it is expected to satisfy the enrollment for children in age-group of 5-15 years.

Source: JICA Study Team

Figure 10.10.2 Typical School Operated by NGOs

Number of 200-250 pupils will study by morning and afternoon shifts at 6 schools. This will make available that total of 2,400-3,000 children can go to primary school and secondary school respectively. The required running cost will be Rs.1,000/pupil/month in accordance with the interview result with NGOs.

(b) Medical Center

A comparable 24 hours open medical unit with 50 beds is planned. This size will be adequate for 5,000 households in accordance with the interview result. It is common that one patient will be charge Rs.100 per visit which is applied at outpatient department of private sector hospital in Karachi.

The medical unit will also be entrusted to NGO for its operation and management. And the NGO will have to balance its budget from outside sources/donations.

Source: JICA Study Team

Figure 10.10.3 Typical Medical Unit Operated by NGO

(c) Vocational Centers

Two vocational training centers those consist of one for girls and another for boys have been planned. The two vocational centers will accommodate 240 boys and 300 girls.

When JICA Study Team has visited one of the vocational center there were 5 courses (General Electrician, General Fitter & Fabricator, Plumber & Pipe Fitter, Welder, Refrigeration & Air Conditioning Mechanic) for boys in one-year course and they are trained by morning or afternoon shift. The age limit on trainee is 16-28, and trainees should bear the Rs.5,000 for tuition. For sustainability Rs.1,000 is charged per month from every trainee and remaining Rs.6,000 will be interest free loan amount and to be paid during the period of employment.

These centers are generally run by NGO. The selected NGO for managing the above centers would be required to collect grants and donations to meet deficits.

Source: JICA Study Team

Figure 10.10.4 Typical Vocational Training Unit Operated by NGOs

(d) Pertinent Firms to Engage in O & M

Community Based Organization (CBO)

CBO is a membership organization made up from affected communities those have joined together for their own interests. CBO can play a vital role to encourage PAPs for effective implementation and management of community activity, and harmonization with neighborhood communes. However, they have not experience, and then experts or knowhow

on how to maintain and operate the provided amenities. Furthermore, it is envisaged that they will need assistance and time until they can perform a unified organization.

Non-Governmental Organization (NGO)

NGOs in Karachi are active in the social sectors such as emergency support, rehabilitation, health and education fields. Other fields include income generation, poverty reduction, vocational training, nutrition and food security, maternal & child health & planning

NGOs are operated through the investment of endowment funds from individuals, private companies, government and governmental institutes.

(e) Sustainability on the Usage of NGOs

As discussed prescribed 10.10.3 (d), it is envisaged that the usage of appropriate NGOs will be applicable for engaging the O&M purpose on condition that they should prepare the sustainable fund by themselves. According to the interview, most of the NGOs expressed that when buildings and equipment are provided by KUTC, then the required budget will be running cost only. The required fund will be secured through grant donations or endowment because of the Islamic customs called "Zakats", by visiting well-wishers or looking for new donors through media broadly.

The experience of each NOG is presented in the following Table 10.10.2.

Table 10.10.2 Experience of each NGO

Name of NGO	Experience
The Citizens Foundation (TFC)	TCF is a professionally managed, non-profit organization set up in 1995 by a group of citizens concerned with the dismal state of education in Pakistan. It is now one of Pakistan's leading organizations in the field of formal education. As of 2011, TCF has established 730 purpose-built school units nationwide with an enrollment of 102,000 students. TCF encourages female enrollment and strives to maintain a 50% female ratio in most of its campuses. TCF has a full female faculty of 5,400 members. TCF also has a dedicated Teacher Training Center in Karachi and Mansehra for the ongoing training of its faculty and provides logistical support to all its teachers. About 8,000 jobs have been created in communities in which TCF operates.
Sindh Education Foundation (SEF)	Sindh Education Foundation (SEF) was established in 1992 as a semi-autonomous organization to undertake educational initiatives in the disadvantaged areas of Sindh. The Foundation's initial activities began with the provision of grants and loans to educational institutes and organizations. With the collaborative efforts of the partner NGOs/CBOs, communities and Village Education Committees (VECs), 100 Home Schools presently cater to more than 4000 girls in the far-flung villages of districts Umerkot, MirpurKhas, Badin, Tando Muhammad Khan, Sanghar, Nawabshah, Jamshoro, Dadu, Larkana, Qamber-ShahdadKot, Jacobabad and several towns of Karachi.
Dawood Khursheed Memorial Foundation (DKMF)	D.K. FOUNDATION, established in the year 1987, by the Late Shaikh Dawood, has a long history of dedication to the high ideals of service to humanity. It got an opportunity to contribute its bit during the Azad Kashmir earthquake October, 2005. At present it is actively involved in social work in the province of Sindh. The Foundation provides school fees, uniforms, books and other expenses for poor and deserving children of different areas of the city. The Foundation has a policy of approaching schools in the areas of residence of these children, to arrange for their admissions etc. The Foundation has a panel of doctors who hold weekly clinics in poor areas where they conduct proper medical check-ups and provide free medicines to the poor and needy. The Foundation arranges events like collective marriages of poor girls whose parents are poor and not in a position to meet their wedding expenses.

Name of NGO	Experience
	The Foundation was a partner of the UNICEF in the following projects Child Protection & Empowerment of Adolescents, Sindh. Awareness through availability of laws in local languages for all stakeholders. Training programmers for juvenile offenders on prevention of HIV/AIDS. All these projects have since been completed.
Health Oriented Preventive Education (HOPE)	Health Oriented Preventive Education (HOPE) has been providing humanitarian assistance in Pakistan through its interventions in health, education, and emergency relief for over a decade. One of HOPE's core activities is providing healthcare for vulnerable communities--particularly women and children. Currently, HOPE runs two hospitals, two Basic Health Units and maternal child care centers. To achieve improvement in the health and nutritional status of the poor and disadvantaged groups, HOPE takes an integrated approach by combining preventive, curative, and promotional health services with health education in the underserved areas. The education component includes three formal schools as well as 200 informal "Home Schools". In addition, HOPE runs vocational centers to promote income generating and skill building activities. HOPE has also played a major role in emergency relief during times of natural disasters by providing medical care, ration and safe drinking water. Effectively address the medical needs of the area by making crucial l healthcare services accessible and affordable at nominal charges for the poor. ・ Two charitable hospitals in Karachi and Thatta, 20 bedded each, fully equipped OT, labor room, NICU, 50,000 patients treated annually. ・ Basic Health Unit in HUB, Out Patient services, ultrasounds, maternal and child care facilities ・ 200 Informal Home Schools nationwide, 9,000 children. ・ Three Formal Schools in Karachi, Thatta, Muzzafargarh up to metric ・ Five Vocational Centers in Karachi, Thatta, Muzzafarabad, computer facilities, sewing/cutting. ・ Support a Marriage Campaign. ・ Crisis Center for violence against women ・ 52 health facilities monitored in earthquake affected areas in AJK. ・ Flood Relief 2010-2011 nationwide, 35,000 patients treated, 12,250 people distributed food and shelter ration, 40,000 families given access to safe drinking water, 119,000 households reached out to. ・ Nutrition Support Program in Karachi, Thatta, Dadu, ShahdadKot, ・ Reconstruction of 77 houses in flood affected areas in Sindh.
The Hunar Foundation (THF)	・ Level I – 6 months – C&G (City & Guilds London) Certification ・ Level II – 6 months – C&G (City & Guilds London) Certification ・ G-III Level (1 year) – STTB (Sindh Technical Training Board) Certificate ・ Two shifts – Morning and Afternoon ・ Skill enhancement Program for those who are already employed but need training for capacity building - – Evening Program - @ 1800-2100 hrs & 3 days in a week International certification by City & Guild's ・ Ratio of success: 60% students gain internship & 40% acquire Jobs in different i.e. all 100% pass out students have been inducted in industries
Health and Nutrition Development Society (HANDS)	Health & Nutrition project started working in 1979 under the guidance of Professor and 1st Primary Health Care center established in a village 40 kilometers away from the teaching hospital of Professor. The interns of professor follow the footsteps of professor with commitment and develop the vision of "Healthy Educated Prosperous Pakistan". The vision started taking shape by 1993 and gradually project transform in to the organization called Health And Nutrition development Society (HANDS). HANDS has evolved now in to one of the largest Non-Profit Organization of

Name of NGO	Experience
	the country and show case an excellent integrated development model comprised of key programs on Health, Education, Poverty Alleviation Disaster Management, Gender & Development, Monitoring, Evaluation and Research, Human Resource & Institution Development, Infrastructure water & Energy, Social Marketing and Information & Communication Resources have developed. The HANDS has reach in December, 2011 to more than 13 million populations of 19182 villages in 24 districts of Pakistan. HANDS conducted 46 trainings for public sectors and trained 2514 participants of district governments. HANDS offered trainings to other Public / Private organizations working in Sindh. In this year different NGOs availed the HANDS training services in the field of Health. HANDS offered TBAs trainings and conducted 37 trainings wherein 616 participants were trained.

Source: Summary of NGOs' Assistance in Resettlement of KCR PAPs prepared by KUTC

And most of the NGOs committed that they welcome to join the design of buildings because they might be given the opportunity to reflect their advice from their physical experience.

KUTC has started the selection of NGO in accordance with "Selection Process of NGOs" on educational, medical, vocational school and support of CBO field. Presently, seven NGOs have submitted "Letter of Interest" among the short listed firms. The selection process of NGOs is undertaken by following six major phases and evaluation on NGOs' capability is ongoing. And the "Summary of NGOs Assistance in Resettlement of KCR PAPs" is attached in Appendix10.6

The selection process of NGOs is undertaken by following six major phases:

(1) Preparation of eligibility criteria of NGOs;
(2) Orientation phase –Meeting with officials of NGOs;
(3) Application phase – interested NGOs give the "letter of interest";
(4) Field visit phase – visit NGOs to assess the organization and their work;
(5) Final selection – select NGOs as partners;
(6) Agreement of Collaboration.

The awarded NGOs are under the obligation to submit their financial reports and commitment on operating the facility to KUTC as a part of the necessary contract documents.

10.11 Environmental Management Plan

10.11.1 Environmental Survey in Resettlement Site

The resettlement site may have hygienic problems caused by the influent wasted water and heaps of wastes. However, the environmental condition including water and soil quality in the resettlement site have not surveyed yet. Therefore, the environmental surveys and analysis to identify the potential pollution are required in the planning phase. The survey result should be finalized in a report as the addendum of the approved IEE report. The EMP should be reconsidered in the detail design phase on the basis of the survey result.

(a) Survey Method

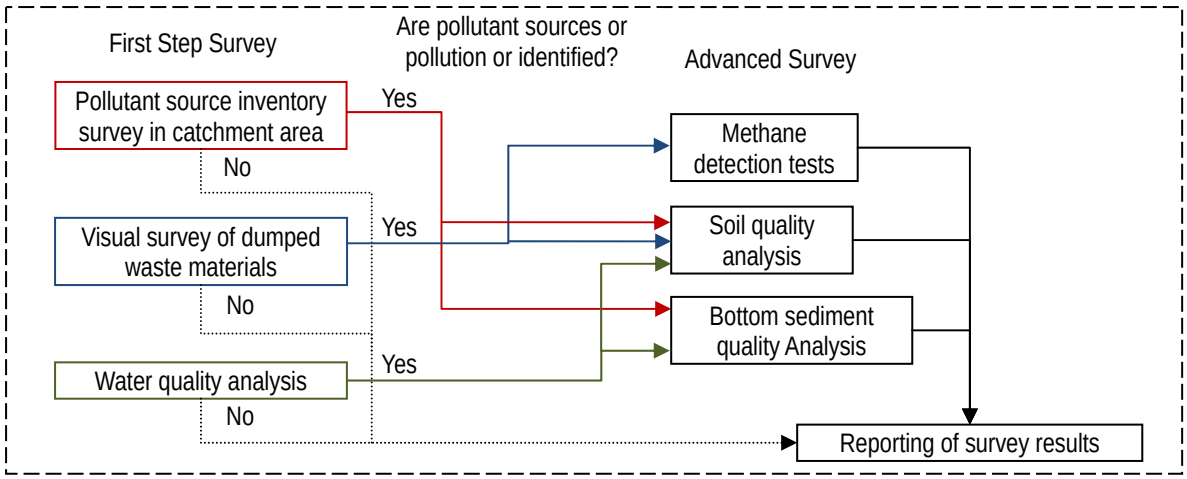
The proposed environmental survey in the resettlement site is shown in Table 10.11.1.

Table 10.11.1 Environmental Survey in Resettlement Site

Survey Item	Parameter	Location and Quantity
First Step Survey		
1 Pollutant source inventory survey in catchment area	Industrial pollutant source	Catchment area of inflow drainages
2 Visual survey of dumped waste materials	Considerable industrial or hazardous waste	All dumping areas in project site
3 Water quality analysis	pH, DO, BOD, COD TSS, Iron, Cooper, Cadmium, Chromium (hexavalent), Cyanide, Mercury, Selenium, Lead, Arsenic, Sulphide, Chloride, Phenol, Oil & Grease, Pesticides, Total Coliform Bacteria	10 drainages in and around project site 3 ponds in project site 2 wells around project site
Advanced Survey		
4 Methane detection tests (If needed)	Methane	5 points in dumping areas likely to be polluted in project site
5 Soil quality analysis (If needed)	Cadmium, Chromium (hexavalent), Cyanide, Mercury, Selenium, Lead, Arsenic, Pesticides	10 samples of dumping or agricultural areas likely to be polluted in project site
6 Bottom sediment quality analysis (If needed)	Cadmium, Chromium (hexavalent), Cyanide, Mercury, Selenium, Lead, Arsenic, Pesticides	5 samples of ponds in project site

Source: JICA Study Team

The survey flowchart of the proposed environmental survey in the resettlement site is shown in Figure 10.11.1. The pollutant sources and water quality should be surveyed at the first step. If the considerable pollution or pollutant sources are identified, advanced surveys including soil and bottom sediment analysis should be conducted.



Source: JICA Study Team

Figure 10.11.1 Survey Flowchart of Environmental Survey in Resettlement Site

(b) Judgmental Standard

The proposed judgmental standard of the results in the first step survey is shown in Table 10.11.2.

Table 10.11.2 Proposed Judgmental Standard

Survey Item	Proposed Judgmental Standard	Required Advanced Survey Item
1 Pollutant source inventory survey in catchment area	Do factories that discharge untreated wastewater containing harmful substances exist in the catchment area or not? If yes, advanced survey should be required.	- Soil quality analysis - Bottom sediment quality analysis
2 Visual survey of dumped waste materials	Do considerable industrial or hazardous wastes exist in the resettlement site or not? If yes, advanced survey should be required. If yes, advanced survey should be required.	- Methane detection tests - Soil quality analysis
3 Water quality analysis	Do the heavy metal levels and cyanide of the water samples exceed 10% levels of "Into Sewage Treatment Standard" in "National Environmental Standards for Municipal and Liquid Industrial Effluents (NEQS)" respectively or not? If yes, advanced survey should be required. (Reason: Environmental standards on water quality have not prepared in Pakistan and organic parameter levels of many rivers located in Karachi urban area exceed NEQS effluent levels, 10% levels of NEQS regarding only heaver metals are utilized as temporary environmental standards on water quality.)	- Soil quality analysis - Bottom sediment quality analysis

Source: JICA Study Team

(c) Basic Disposal Policy

The disposal plans on the polluted soil and solid waste should be considered on the basis of the following three treating methods depending on the different pollution level.

1. Treating method for unpolluted soil and solid waste
   If the considerable pollution is not identified by a series of the surveys, the soil in the site is defined as unpolluted soil. Any treatment method for unpolluted soil is not required. However, the solid wastes in the site should be disposed by landfill into proper refuse

dumps. Without impacts on the residential zone newly constructed by the development, the hollows in the site may be filled up with the solid wastes.

2. Treating method for moderately polluted soil and solid waste
   If the moderate pollution spots are identified by the advanced surveys, the soil around the spots is defined as polluted soil. Treatment methods for polluted soil to prevent spreading are required. The polluted soil, bottom sediment and solid wastes of the pollutant source should be removed, disposed and covered in proper refuse dumps, or strictly covered with concrete or asphalt in the site.

3. Treating method for severely polluted soil and solid waste
   If the severe pollution spots are identified by the advanced surveys, the soil is defined as hazardous substance. Specific treatment methods for hazardous substance are required. The severely polluted soil, bottom sediment and solid wastes of the pollutant source should be removed and disposed in proper waste treatment facilities.

Because environmental standards on soil quality have not prepared in Pakistan, Japanese environmental standards on soil quality is shown in Table 10.11.3 as a reference.

Table 10.11.3 Japanese Environmental Standards on Soil Quality

Parameter	Designated Standard by leachate test * (for moderately polluted soil) (mg/l)	Second Standard by leachate test * (for severely polluted soil) (mg/l)
Cadmium	0.01	0.3
Chromium (hexavalent)	0.05	1.5
Cyanide	Not Detectable	1
Mercury	0.0005	0.005
Selenium	0.01	0.3
Lead	0.01	0.3
Arsenic	0.01	0.3
Organic Phosphorus	Not Detectable	Not Detectable

* Leachate test: Sample (Dried soil) (g) : Solvent (Water+HCl, pH 5.8~6.3) (mL) = 1 : 10
Shaking condition 200/min, 4~5 cm range, 6 hours

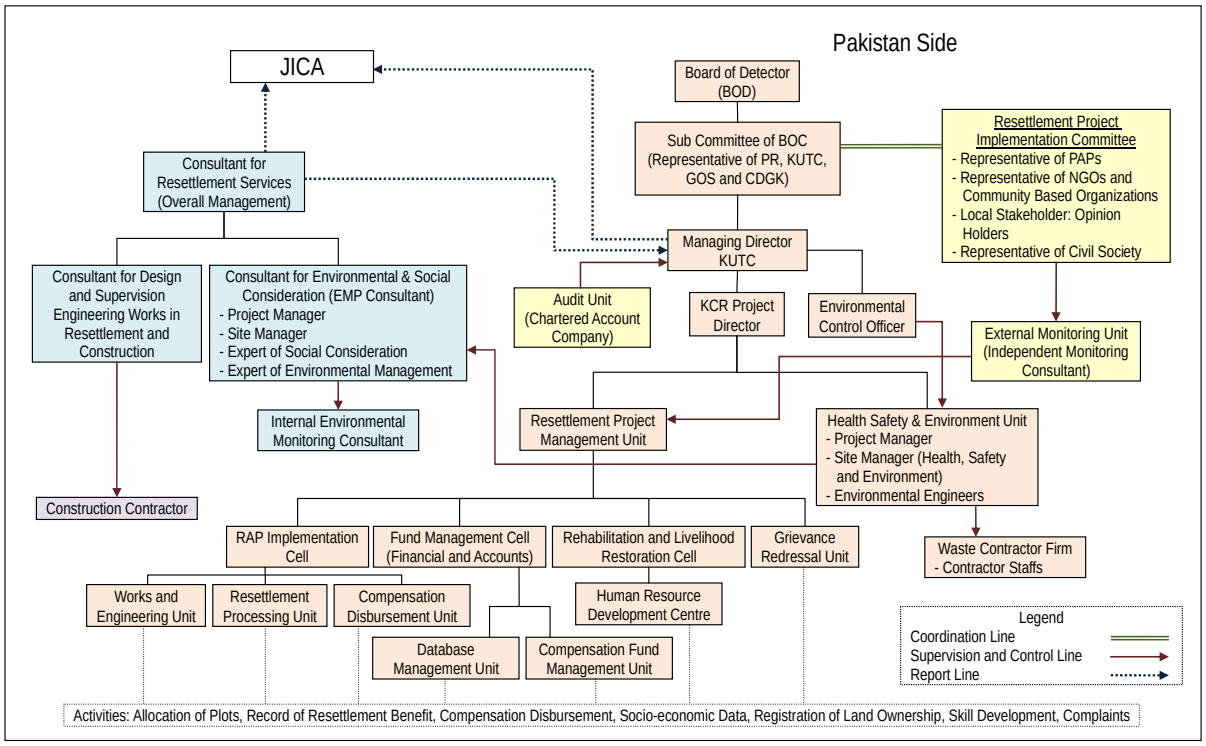
Source: Ministry of the Environment, Japan

10.11.2 Updated Environmental Management Plan

The organizational structure and monitoring plan was updated on the basis of the latest information in this survey.

(a) Organization for EMP

The each different organizational structure to implement the EMP is presented in "IEE for Development of Juma Goth for the Resettlement of PAPs" and "EIA for Revival of KCR". However, because KCR project is closely related to the RAP and resettlement site development project, a comprehensive organizational structure on the basis of the EIA and IEE should be formulated. The proposed draft organization chart in the pre-construction (resettlement site development phase) and construction phase is shown in Figure 10.11.2. The functions and responsibilities of each person or body are summarized in Table 10.11.4.



Source: JICA Study Team

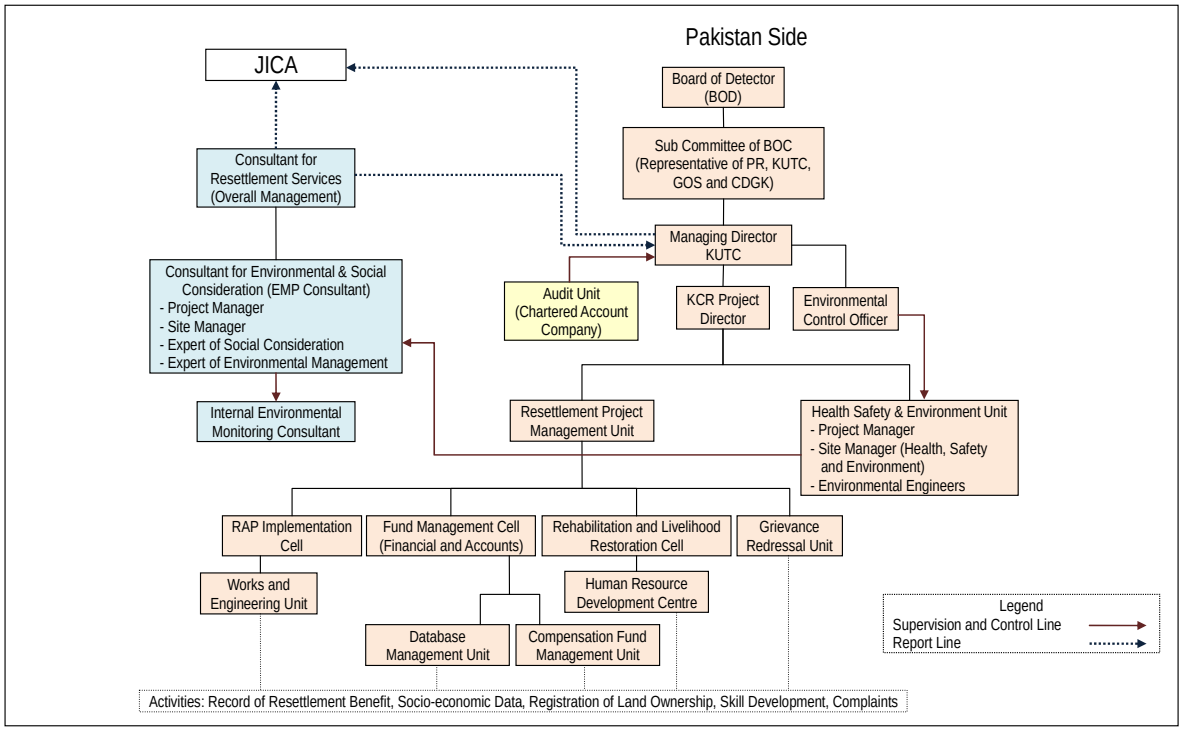
Figure 10.11.2 Proposed Organization Chart for EMP for Pre-Construction and Construction Phase

Table 10.11.4 Functions and Responsibilities of Each Person or Body

Person or Body	Task and Function
Managing Director, KUTC	- Overall management of project
KCR Project Director	- Supervision and coordination of project
Environmental Control Officer, KUTC	- Supervision and coordination of EMP
Resettlement Project Management Unit	- Implementation of RAP - Coordination between other related organizations on resettlement activity - Supervision of Consultant for Design and Supervision Engineering Works
Health Safety & Environment Unit	- Supervision of EMP Consultant - Supervision of Waste Contractor Firm
Consultant for Resettlement Services	- Overall management of design, RAP, construction works and EMP
Consultant for Design and Supervision Engineering Works in Resettlement and Construction	- Engineering works of design - Supervision of construction works - Supervision and coordination of resettlement activity
EMP Consultant	- Implementation of EMP - Supervision of Internal Environmental Monitoring Consultant
Internal Environmental Monitoring Consultant	- Implementation of environmental monitoring
Resettlement Project Implementation Committee	- Evaluation and coordination of resettlement project - Supervision of External Monitoring Unit
External Monitoring Unit	- Evaluation and supervision of Resettlement Project Management Unit

Source: JICA Study Team

The proposed draft organization chart to implement the environmental monitoring, data collection on PAPs and coordination in the resettlement site in the operation phase is shown in Figure 10.11.3.



Source: JICA Study Team

Figure 10.11.3 Proposed Organization Chart for EMP for Operation Phase

(b) Environmental Monitoring Plan for Resettlement Site Development

The proposed environmental monitoring plan in the EMP is shown in Table 10.11.5.

Table 10.11.5 Environmental Observation/Monitoring for Resettlement Site Development (1)

Construction Phase

Monitoring Item	Method / Parameter	Location, Quantity and Frequency
1 Noise Monitoring	Leq (dBA) 16 hours / day Measuring 3 times per hour	1 point of construction site 1 time / month (Total 19 times in 19 month)
2 Vibration Monitoring	La (dB), Acceleration (m/s2) 16 hours / day Measuring 3 times per hour	1 point of construction site 1 time / month (Total 19 times in 19 month)
3 Air quality monitoring	CO, CO2, SO2, NOx, O3 and SPM or PM10, PM2.5	1 point of construction site 1 time / month (Total 19 times in 19 month)
4.1 Water quality monitoring (drinking)	TSS, TDS, pH, Temperature, Oil & Grease, Anionic Detergents	1 sample of construction site 10 times in 19 months

Monitoring Item	Method / Parameter	Location, Quantity and Frequency
4.2 Water quality monitoring (effluent and surface water)	TSS, TDS, pH, Temperature, BOD, COD, Iron, Cooper, Cadmium, Lead, Arsenic, Chromium, Sulphates, Carbonates, Oil and Grease, Anionic Detergents	1 sample of construction site 2 samples of drainage or stream in project site 1 sample pond in project site 10 times in 19 months
5 Land Contamination monitoring	Alkalinity, Salinity, pH, Electrical Conductivity	1 set (2 samples 1 set) of constriction site 1 set of landfill site 3 sets of surface soil in project site 5 times in 19 Months
6 Site Restoration	Restoring the sites to finished project sites without unnecessary delays	280 acres of project site As required
7 Social Aspects	Opinion or complaint of residents near the construction sites	Shah Latif Township 1 time / month (Total 19 times in 19 month)
8 Occupational Health Monitoring	Opinion or complaint of construction worker	Construction site 4 sessions in 19 Months

Source: JICA Study Team

Reference:

Pakistan National Environmental Quality Standards

1. Noise

	Day Time (AM 6:00~PM 10:00)	Night Time (PM 10:00~AM 6:00)
Residential Area (dB ALeq)	55	45
Commercial Area (dB ALeq)	65	55
Industrial Area (dB ALeq)	75	65
Silence Zone (dB ALeq)	50	45

2. Ambient Air Quality

SO2 (ug/m3)	Annual average	80	SPM (ug/m3)	Annual average	360
	24 hours	120		24 hours	500
NOx (ug/m3)	Annual average	40	PM 10 (ug/m3)	Annual average	120
	24 hours	40		24 hours	150
NO2 (ug/m3)	Annual average	40	PM 2.5 (ug/m3)	Annual average	15
	24 hours	80		24 hours	35
O3 (ug/m3)	1 hour	130	Pb (ug/m3)	Annual average	1
CO (ug/m3)	8 hours	5		24 hours	1.5
	1 hour	10			

3 Drinking water quality (major parameters)

Colour	less or equal 15TCU
Turbidity	less 5 NTU
Total hardness	less 500 mg/l
TDS	less 1000 mg/l
pH	6.5~8.5
Cooper	less 2 mg/l
Cadmium	less 0.01 mg/l
Lead	less or equal 0.05 mg/l
Arsenic	less or equal 0.05 mg/l
Chromium	less or equal 0.05 mg/l
Coliform	Must not be detectable in any 100ml sample

Source: S.R.O.1062(I)/2010 National Environmental Quality Standards Air-Water-Noise

Table 10.11.6 Environmental Observation/Monitoring for Resettlement Site Development (2)

Operation and Maintenance Phase

Monitoring Item	Method / Parameter	Location, Quantity and Frequency
1 Air quality monitoring	CO, CO2, SO2, NOx, O3 and SPM or PM10, PM2.5	1 Point of project site 2 times / year (Total 4 times in 2 years)
2.1 Water quality monitoring (drinking)	TSS, TDS, pH, Temperature, Oil & Grease, Anionic Detergents	2 samples of project site 4 times / year (Total 8 times in 2 years)
2.2 Water quality monitoring (effluent and surface water)	TSS, TDS, pH, Temperature, BOD, COD, Iron, Cooper, Cadmium, Lead, Arsenic, Chromium, Sulphates, Carbonates, Oil and Grease, Anionic Detergents	5 samples of project site 4 times / year (Total 8 times in 2 years)
3 Land Contamination monitoring	Alkalinity, Salinity, pH, Electrical Conductivity	4 sets (2 samples 1 set) of project site 1 set of landfill site 1 time / year (Total 2 times in 2 years)
4 Social Aspects	Opinion or complaint of residents near the project site	2 locations in Shah Latif Township 1 session / year (Total 2 sessions in 2 years)

Source: JICA Study Team

(c) Environmental Monitoring Plan for KCR Project

The proposed environmental monitoring plan in the EMP is shown in Table 10.11.7, Table 10.11.8 and Figure 10.11.4.

Table 10.11.7 Environmental Observation/Monitoring for KCR Project (1)

Construction Phase

Monitoring Item	Method / Parameter	Location, Quantity and Frequency
1 Noise Monitoring	Leq (dBA) 24 hours (Day time 6:00 AM ~ 10:00 PM, Night time 10:00 PM ~ 6:00 AM) Measuring 3 times per hour	2 points of construction site 2 times / month (Total 96 times in 4 years)
2 Vibration Monitoring	La (dB), Acceleration (m/s2) 16 hours / day Measuring 3 times per hour	2 points of construction site 2 times / month (Total 96 times in 4 years)
3 Air quality monitoring	CO, CO2, SO2, NOx, O3 and SPM or PM10, PM2.5	2 points of construction site 1 time / month (Total 48 times in 4 years) 4 air quality monitoring points 6 times / year (Total 24 times in 4 year)
4.1 Water quality monitoring (drinking)	TSS, TDS, pH, Temperature, Oil & Grease, Anionic Detergents	2 samples of construction site 1 time / month (Total 48 times in 4 years)
4.2 Water quality monitoring (effluent and surface water)	TSS, TDS, pH, Temperature, BOD, COD, Iron, Cooper, Cadmium, Lead, Arsenic, Chromium, Sulphates, Carbonates, Oil and Grease, Anionic Detergents	2 samples of construction site 1 time / month (Total 48 times in 4 years) 5 samples of water quality monitoring points 6 times / year (Total 24 times in 4 year)
5 Land Contamination monitoring	Alkalinity, Salinity, pH, Electrical Conductivity	5 sets (2 samples 1 set) of constriction site 1 set of landfill site 4 times / year (Total 16 times in 4 years)
6 Site Restoration	Restoring the sites to finished project sites without unnecessary delays	Project site As required
7 Social Aspects	Opinion or complaint of residents near the construction sites	Project site As required
8 Occupational Health Monitoring	Opinion or complaint of construction worker	Construction site 4 sessions / year (Total 16 sessions in 4 year)

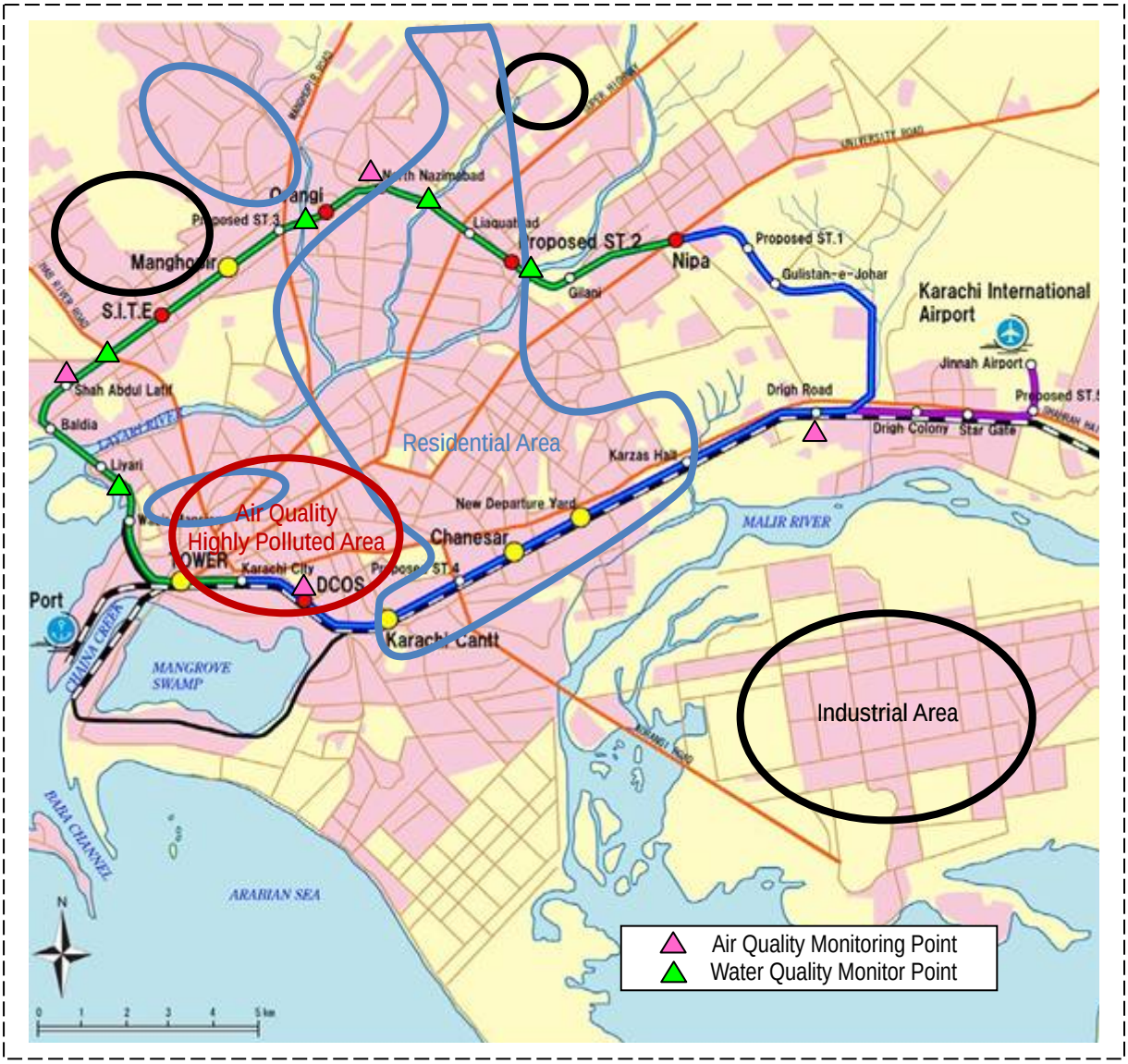
Source: JICA Study Team

Table 10.11.8 Environmental Observation/Monitoring for KCR Project (2)

Operation and Maintenance Phase

Monitoring Item	Method / Parameter	Location, Quantity and Frequency
1 Noise Monitoring	Leq (dBA) 24 hours (Day time 6:00 AM ~ 10:00 PM, Night time 10:00 PM ~ 6:00 AM) Measuring 3 times per hour	4 points along KCR line of elevated section 4 points along KCR line of at grade section 2 points along KCR kine of culvert section 5 point around station and depot 1 time / year (Total 24 times in 2 years)
2 Vibration Monitoring	La (dB), Acceleration (m/s2) 16 hours / day Measuring 3 times per hour	4 points along KCR line of elevated section 4 points along KCR line of at grade section 2 points along KCR kine of culvert section 1 time / year (Total 24 times in 2 years)
3 Air quality monitoring	CO, CO2, SO2, NOx, O3 and SPM or PM10, PM2.5	4 air quality monitoring points 6 times / year (Total 12 times in 2 years)
4.1 Water quality monitoring (drinking)	TSS, TDS, pH, Temperature, Oil & Grease, Anionic Detergents	24 samples in stations and depot 4 times / year (Total 8 times in 2 year)
4.2 Water quality monitoring (effluent and surface water)	TSS, TDS, pH, Temperature, BOD, COD, Iron, Cooper, Cadmium, Lead, Arsenic, Chromium, Sulphates, Carbonates, Oil and Grease, Anionic Detergents	24 samples in and around stations and depot 4 times / year (Total 8 times in 2 year)
5 Land Contamination monitoring	Alkalinity, Salinity, pH, Electrical Conductivity	3 sets (2 samples 1 set) of project site 2 sets of landfill site 2 times / year (Total 4 times in 2 years)
6 Social Aspects	Opinion or complaint of residents near the project site	24 stations and depot 1 session / year (Total 2 sessions in 2 year)
7 Sunshade monitoring	Impact of sunshade	Area along KCR line
8 Inductive communication monitoring	Impact of inductive communication monitoring	Area along KCR line
9 Interview survey with user and general citizen	Opinion or complaint of user and general citizen	Area along KCR line and stations
10 Occupational Health Monitoring	Opinion or complaint of employee	24 stations and depot 4 sessions / year (Total 8 sessions in 2 year)

Source: JICA Study Team



Source of area zoning: Comprehensive Environmental Monitoring Report by Pak-EPA and Sindh-EPA

Figure 10.11.4 Proposed Air and Water Quality Monitoring Point

(d) Mitigation Measures for KCR Project

Noise Control in Operation Phase

Concrete walls (maximum height of 3 meters) are proposed to reduce the noise level in this report (see Figure 5.2.10, Figure 5.2.11 and Figure 5.2.12).

Wastewater Treatment in Operation Phase

Wastewater from the stations and depots will be discharged to a public sewerage system directly. In areas without a sewerage system, the wastewater will be treated by a domestic treatment plant and discharged to a river or drainage.

10.11.3 TOR for EMP Consultant for Development of Resettlement Site

Objectives of the Consultant

The main objectives of the Consultant appointed for carrying out the EMP mentioned in the IEE report and relevant JICA reports would be:

- To select the suitable methodology as per environmental survey and monitoring plans proposed by the PEPA and JICA.
- To identify the environmental pollution in the resettlement site in the planning phase.
- To suggest the proper disposal plans on polluted soil and solid waste in the resettlement site, in case of the serious pollution.
- To carry out the environmental & social monitoring during the construction and operation phase as per the PEPA and JICA guidelines for environmental and social compliance.
- To assist the supervision consultant and HSE unit of KUTC on all matters related to construction activities and environmental management in the project.

Tasks of the Consultant

Task 1 Environmental Survey in Resettlement Site in Planning Phase

1-1 The consultant shall conduct the environmental surveys to identify the present environmental pollution in the resettlement site. (Refer to "Updated Environmental Management Plan" section in this report for the basic methodology.)
1-2 The consultant shall suggest the proper disposal plans on polluted soil and solid waste in the resettlement site to KUTC and the detail design consultant, in case of the serious pollution. (Refer to "Updated Environmental Management Plan" section in this report for the basic disposal policy.)
1-3 The consultant shall prepare the report of the survey results as the addendum of the approved IEE report.

Task 2 Implementation of EMP in Construction Phase

2-1 The consultant shall organize and conduct periodic environmental training programs and workshops for the contractors' staff and site workers with KUTC.
2-2 The consultant shall supervise the status of the implementation of the environmental mitigation measures described in the IEE report.
2-3 The consultant shall conduct the environmental monitoring. (Refer to "Updated Environmental Management Plan" section in this report for the basic methodology.)
2-4 The consultant shall prepare the required reports including the monthly report.

Task 3 Implementation of EMP in Operation Phase

3-1 The consultant shall conduct the environmental monitoring. (Refer to "Updated Environmental Management Plan" section in this report for the basic methodology.)
3-2 The consultant shall prepare the required reports including the monthly report.

10.11.4 Cost Estimation on Environmental Survey in Resettlement Site

This cost estimation includes the environmental survey cost and consultant fee. The total cost including the advanced environmental survey in the resettlement site is estimated at 5.75 million Rs..

Table 10.11.9 Estimated Cost for Environmental Survey

1. Environmental Survey in Resettlement Site in Planning Phase

Monitoring Item	Tentative Unit Cost (PKR)	Unit	Quantity	Methodology	Tentative Cost (PKR million)
First Step Survey					
1 Pollutant source inventory survey in catchment area	100,000	L/S	1	Catchment area of inflow drainages	0.10
2 Visual survey of dumped waste materials	250,000	L/S	1	All dumping areas in project site	0.25
3 Detail water quality analysis	120,000	sample	15	7 drainages in and around project site + 3 ponds in project site	1.80

Environmental Pollution Specialist	450,000	MM	1	1 person x 1 month	0.45
Field Assistant	100,000	MM	2	2 persons x 1 month	0.20
				Sub-Total 1	2.80
Advanced Survey					
4 Methane detection tests (If needed)	50,000	sample	5	5 points in dumping area of project site	0.25
5 Soil quality analysis (If needed)	100,000	sample	10	5 samples of dumping area of project site	1.00
6 Bottom sediment quality Analysis (If needed)	120,000	sample	5	5 samples of ponds in project site	0.60
Environmental Pollution Specialist	450,000	MM	1	1 person x 1 month	0.45
Soil Pollution and Test Specialist	450,000	MM	1	1 person x 1 month	0.45
Field Assistant	100,000	MM	1	2 persons x 1 month	0.20
				Sub-Total 2	2.95
				Sub-Total	5.75

Source: JICA Study Team

10.11.5 Cost Estimation on EMP for Development of Resettlement Site

The mitigation costs related the construction works and facilities are included in the construction cost, which were estimated in "Feasibility Study of Resettlement Site of the Revival of Karachi Circular Railway (March, 2012)" and "Supplemental Study on Resettlement of KCR".

This cost estimation includes the training fee in health and safety, environmental monitoring fee and consultant fee. Contents of the environmental monitoring during the construction and operation period include environmental impacts associated with water, air, noise, land contamination, solid waste generation, electromagnetic radiation and social aspect. The total cost including the advanced environmental survey in the resettlement site is estimated at 51.75 million Rs.

Table 10.11.10 Estimated Cost for Implementation of EMP

1. Environmental Mitigation Measures in Construction Phase

Monitoring Item	Tentative Unit Cost (PKR)	Unit	Quantity	Methodology	Cost (PKR million)
Basic training of personnel in health and safety and responding to emergencies	150,000	training	8	(60 workers / 30) sessions x 4 times in 19 months	1.20
				Sub-Total	1.2

2. Environmental Observation / Monitoring

2.1 Construction Phase

Monitoring Item	Tentative Unit Cost (PKR)	Unit	Quantity	Methodology	Cost (PKR million)
1 Noise Monitoring	40,000	location	19	1 time x 19 months x 1 locations (construction site)	0.76
2 Vibration Monitoring	40,000	location	19	1 time x 19 months x 1 locations (construction site)	0.76

Monitoring Item	Tentative Unit Cost (PKR)	Unit	Quantity	Methodology	Cost (PKR million)
3 Air quality monitoring	110,000	location	19	1 time x 19 months x 1 locations (construction site)	2.09
4.1 Water quality monitoring (drinking)	35,000	location	10	10 time in 19 months x 1 locations (construction site)	0.35
4.2 Water quality monitoring (effluent and surface water)	65,000	location	40	10 times in 19 months x 4 locations (1 construction site + 3 surface water samples)	2.60
5 Land Contamination monitoring	30,000	location	50	5 times in 19 Months x 2 samples x 5 locations (1 constriction site + 1 landfill site + 3 surface soil samples)	1.50
6 Site Restoration	1,000	acer	280	280 acres	0.28
7 Social Aspects	5,000	location	1	1 time x 19 months x 1 locations (Shah Latif Township)	0.01
8 Occupational Health Monitoring	75,000	session	4	4 sessions in 19 Months	0.30
				Sub-Total	8.65

2.2 Operation and Maintenance Phase

Monitoring Item	Tentative Unit Cost (PKR)	Unit	Quantity	Methodology	Cost (PKR million)
1 Air quality monitoring	110,000	location	4	2 times a year x 2 years x 1 locations	0.44
2.1 Water quality monitoring (drinking)	35,000	location	16	4 times a year x 2 years x 2 locations	0.56
2.2 Water quality monitoring (effluent and surface water)	65,000	location	40	4 times a year x 2 years x 5 locations	2.60
3 Land Contamination monitoring	30,000	location	20	1 times a year x 2 years x 2 samples x 5 locations (4 project sites + 1 landfill site)	0.60
4 Social Aspects	75,000	session	4	2 sessions x 2 locations	0.30
				Sub-Total	4.50

3. Environmental Consultant

3.1 Construction Phase

Position	No. of Persons	Tentative Unit Cost (PKR)	Unit	Quantity	Methodology	Cost (PKR million)
Project Manager	1	450,000	MM	19	19 months	8.55
Site Manager / Expert	3	250,000	MM	19	19 months	14.25
Site Surveyor	2	100,000	MM	19	19 months	3.80
					Sub-Total	26.60

3.2 Operation and Maintenance Phase

Position	No. of Persons	Tentative Unit Cost (PKR)	Unit	Quantity	Methodology	Cost (PKR million)
Site Manager / Expert	1	250,000	MM	24	12 months x 2 years	6.00
Site Surveyor	2	100,000	MM	24	12 months x 2 years	4.80
					Sub-Total	10.80

Total	51.75

Source: JICA Study Team

10.11.6 Cost Estimation on EMP for KCR Project

The mitigation costs related the construction works and facilities such as sound wall and wastewater treatment system are included in the construction cost, which are estimated and mentioned in cost sheets in this report.

This cost estimation includes the training fee in health and safety, environmental monitoring fee and consultant fee. Contents of the environmental monitoring during the construction and operation period include environmental impacts associated with water, air, noise, land contamination, solid waste generation, electromagnetic radiation and social aspect. The total cost is estimated at 275.31 million Rs..

Table 10.11.11 Estimated Cost for Implementation of EMP

1. Environmental Mitigation Measures

1.1 Construction Phase

Monitoring Item	Tentative Unit Cost (PKR)	Unit	Quantity 1	Methodology	Cost (PKR million)
Basic training of personnel in health and safety and responding to emergencies	150,000	training	140	(600 workers / 30) sessions x 7 times in 4 years	21.00
				Sub-Total	21.00

1.2 Operation and Maintenance Phase

Monitoring Item	Tentative Unit Cost (PKR)	Unit	Quantity 1	Methodology	Cost (PKR million)
Basic training of employees in health and safety and responding to emergencies.	150,000	training	128	(963 employees/ 30) sessions x 4 times in 2 years	19.26
				Sub-Total	19.26

2. Environmental Observation / Monitoring

2.1 Construction Phase

Monitoring Item	Tentative Unit Cost (PKR)	Unit	Quantity	Methodology	Cost (PKR mil.)
1 Noise Monitoring	40,000	location	192	2 times x 48 months x 2 locations (construction site)	7.68
2 Vibration Monitoring	40,000	location	192	2 times x 48 months x 2 locations (construction site)	7.68

Monitoring Item	Tentative Unit Cost (PKR)	Unit	Quantity	Methodology	Cost (PKR mil.)
3 Air quality monitoring	110,000	location	192	1 time x 48 months x 2 locations (construction site) + 6 times a year x 4 years x 4 locations (mentoring points)	21.12
4.1 Water quality monitoring (drinking)	35,000	location	96	1 time x 48 months x 2 locations (construction site)	3.36
4.2 Water quality monitoring (effluent and surface water)	65,000	location	216	1 time x 48 months x 2 locations (construction site) + 6 times a year x 4 year x 5 locations (monitoring point)	14.04
5 Land Contamination monitoring	30,000	location	192	4 times a year x 4 years x 2 samples x 6 locations (5 constriction sites + 1 landfill site)	5.76
6 Site Restoration	5,000	100m	431	43120 m / 100	2.16
7 Social Aspects	5,000	100m	431	43120 m / 100	2.16
8 Occupational Health Monitoring	75,000	session	16	4 sessions a year x 4 years	1.20
				Sub-Total	65.15

2.2 Operation and Maintenance Phase

Monitoring Item	Tentative Unit Cost (PKR)	Unit	Quantity	Methodology	Cost (PKR million)
1 Noise Monitoring	40,000	location	360	1 time x 24 months x 15 locations (10 along railway + 5 around station)	14.40
2 Vibration Monitoring	40,000	location	240	1 time x 24 months x 10 locations (along railway)	9.60
3 Air quality monitoring	110,000	location	48	6 times a year x 2 years x 4 locations	5.28
4.1 Water quality monitoring (drinking)	35,000	location	200	4 times a year x 2 years x 25 locations (24 stations + 1 depot)	7.00
4.2 Water quality monitoring (effluent and surface water)	65,000	location	200	4 time a year x 2 years x 25 locations (24 stations + 1 depot)	13.00
5 Land Contamination monitoring	30,000	location	20	2 time a year x 2 years x 5 locations (3 project sites + 2 landfill sites)	0.60
6 Social Aspects	75,000	session	50	2 sessions x (24 stations + 1 depot)	3.75
7 Sunshade monitoring	5,000	100m	431	43120 m / 100	2.16
8 Inductive communication monitoring	5,000	100m	431	43120 m / 100	2.16

Monitoring Item	Tentative Unit Cost (PKR)	Unit	Quantity	Methodology	Cost (PKR million)
9 Interview survey with rail side population	5,000	100m	431	43120 m / 100	2.16
10 Occupational Health Monitoring	75,000	session	200	8 sessions x (24 stations + 1 depot)	15.00
				Sub-Total	75.10

3. Environmental Consultant

3.1 Construction Phase

Position	No. of Persons	Tentative Unit Cost (PKR)	Unit	Quantity	Methodology	Cost (PKR million)
Project Manager	1	450,000	MM	48	12 months x 4 years	21.60
Site Manager / Expert	3	250,000	MM	48	12 months x 4 years	36.00
Site Surveyor	2	100,000	MM	48	12 months x 4 years	9.60
					Sub-Total	67.20

3.2 Operation and Maintenance Phase

Position	No. of Persons	Tentative Unit Cost (PKR)	Unit	Quantity	Methodology	Cost (PKR million)
Project Manager	1	450,000	MM	24	12 months x 2 years	10.80
Site Manager / Expert	2	250,000	MM	24	12 months x 2 years	12.00
Site Surveyor	2	100,000	MM	24	12 months x 2 years	4.80
					Sub-Total	27.60

Total	275.31

Source: JICA Study Team

10.12 Suggestion on Required Additional Survey

To ensure fairness of procurement process as well as project implementation, information should not be disclosed for a fixed period.

10.13 Recommendation

10.13.1 Environmental Management Plan

(a) Solid Waste Disposal

Waste contractor firms employed by KUTC will be responsible for the disposal of the solid waste from demolished houses and facilities in the ROW. The firms should consider the recycle and reuse plans in advance of the demolition works. The contractors should be in charge of all type of the construction waste. The operating agency of KCR should conceder a proper disposal plan on solid waste from the stations and depot in advance of the operation.

(b) Noise Control in Operation Phase

Noise levels estimated in the EIA is shown in the following table. Because the proposed train

is a low noise type and design, serious noise nuisances will not occur. However, the generated noise levels may exceed the Pakistan environmental standards (Day time 65 dB, Night time 50 dB in residential area) in some residential areas. To reduce the noise level, boundary or soundproof walls over one meter high should be installed in residential areas of the ground section. The noise along the KCR line should be periodically monitored. If the noise level reaches a significant level such as far exceeding the environmental standard, the mitigation measures on noise control should be conducted.

Table 10.13.1 Estimated Noise Level in Operation Phase

Height of soundproof wall (m)	0	1.0	2.0	3.0
Noise level in elevated section (Leq dB)	61.7	59.6	57.1	56.5
Noise level in ground section (Leq dB)	70.9	65.6	61.4	59.1

Source: Environmental Impact Assessment for Revival of Karachi Circular Railway

(c) Wastewater Treatment in Operation Phase

The wastewater from the stations and depot will include organic substances and microorganisms causing environmental contamination and hygiene issues. The wastewater should be treated up to the levels to meet the effluent standards at each site. The design and construction of treatment system should be planned as per guidelines set in "Karachi Building and Town Planning Regulations 2002".

10.13.2 Resettlement Action Plan

To ensure fairness of procurement process as well as project implementation, information should not be disclosed for a fixed period.

10.13.3 Resettlement Site Development

To ensure fairness of procurement process as well as project implementation, information should not be disclosed for a fixed period.

11. CONCLUSIONS AND RECOMMENDATIONS

11.1 Conclusions

The site conditions were surveyed in detail on topography, geology and foundations, hydrology and drainage, including stagnant water section, and power supply. No particular problems that may seriously incur the technical feasibility of the project were identified. Necessary measures recognized through the surveys were incorporated in the preliminary design and cost estimate.

The passenger demands in the cases of the full scale and partial KCR operation (Shah Abdul Latif - Karachi Cantt - Drigh Road), with and without the assumed expansion of feeder bus routes from the stations, are respectively forecasted where options are set, as follows:

- Option N-A1: Full operation with assumed expansion of feeder bus routes
- Option N-A2: Full operation without assumed expansion of feeder bus routes
- Option N-B1: Partial operation with assumed expansion of feeder bus routes
- Option N-B2: Partial operation without assumed expansion of feeder bus routes

The demand forecast study revealed that Options N-A2 and N-B2 would have less demands than Options N-A1 and N-B1 by about 9% and 23%, respectively. The train operation planning, cost estimates, and economic and financial analyses were conducted for Options N-A1, N-A2, and N-B1. JICA Study Team concludes that the three options are technically feasible, economically viable, and financially and environmentally acceptable.

The major public transportation in Karachi are minibus networks, which are run by private bus operators. The bus operators will adjust their service routes so that the buses can go to destinations through selected KCR stations to avoid loss in profits. The feeder bus routes will likely be formulated after the commencement of KCR operation. Studies on Option N-A2, assuming no feeder bus route expansion, were conducted to examine the project feasibility on a worse-case scenario.

Therefore, comparisons were made between Options N-A1 and N-B1 from the various viewpoints as discussed below.

(1) Projected Demands and Revenues at the Opening Year

The evaluation results of the projected demand of Options N-A1 and N-B1 are shown in Table 11.1.1. The projected demand of N-B1 is smaller than that of N-A1 due to its shorter route length. However, both the projected demand and revenue per km of N-B1 are slightly higher than those of N-A1. Naturally, the required number of train sets of N-B1 is smaller than that of N-A1. Therefore, from the viewpoint of projected demand and revenue per km, N-B1 is slightly better than N-A1.

Table 11.1.1 Evaluation of Projected Demand Between N-A1 and N-B1

Item	N-A1	N-B1
Route Length	43.24	20.73
Projected Demand (x1000 passengers)	578	306
Passengers/km (1000pas/km)	13.4	14.8
Fare Revenue (mil Rp/day)	14.1	7.3
Fare Revenue/km (1000Rp/day)	326	352
Required Train Sets	25	16
Evaluation	Fair	Slightly Good

Source: JICA Study Team

(2) Service Level of KCR as an Urban Railway

The most important aspect in terms of service level is the frequency of train operation during peak hour. Table 11.1.2 shows the frequency of train operations by option at opening of KCR.

Table 11.1.2 Frequency of Train Operations by Option

Item		N-A1	N-B1
Headways	Peak hour 7:00-11:00 16:00-21:00	6 min	5 min
	Semi-peak hour 11:00-13:00 15:00-16:00 21:00-22:00	6 min 40 sec	6 min 40 sec
	Off-peak hour 6:00-7:00 13:00-15:00 22:00-23:30	8 min	8 min
Evaluation on Performance as Urban Railway		Good	Excellent

Source: JICA Study Team

Headways of not more than 5 minutes are generally considered appropriate for urban railways. Apparently, the service level of N-B1, which can realize 5 minutes of headways is better than that of N-A1.

(3) Initial Investment and Cost Effectiveness

The initial investments for Options N-A1 and N-B1 are compared as shown in Table 11.1.3.

Table 11.1.3 Initial Investment by Option

Item	N-A1	N-B1	Remark
Route Length (km)	43.24	20.73	
Projected Demand	578	306	
Initial Cost (billion Yen)	223.8	149.8	with tax case
Cost per km (billion Yen)	5.2	7.2	N-B1 is more costly by 40% than N-A1.
Cost per 1000 pas (mill Yen)	387	490	N-B1 is more costly by 26% than N-A1.
Scale of Initial Investment	Large	Compact	Initial investment scale of N-B1 is 67% of that of N-A1.
Evaluation on Initial Investment	Good	Slightly good	The burden of investment for common facilities such as OCC and workshop is significantly heavy in case of a railway project.

Source: JICA Study Team

The initial investment per km of N-A1 is better than that of N-B1 because the investment for common facilities such as OCC and workshop is significantly heavy for N-B1 due to its shorter route length. Therefore, the initial investment efficiency of Option N-B1 is lower than that of N-A1.

On the other hand, the initial investment amount of N-B1 is only 67% of that of N-A1. Taking into account the risk of the first modern urban railway in Pakistan, it would be better to implement the KCR project with smaller initial investment. From the viewpoint of investment scale, N-B1 is better than N-A1.

Judging from the advantages and disadvantages on the abovementioned aspects, JICA Study Team evaluated N-A1 as good and N-B1 as slightly good.

(4) Economic and Financial Evaluations

The results of the economic and financial evaluations are shown in Table 11.1.4. Both Option N-A1 and N-B1 generally shows similar economic and financial indices.

The EIRR values for N-A1 and N-B1 are not less than 12%, which is deemed as the required minimum level for an infrastructure project. Therefore, both options are evaluated to be economically feasible.

As for the FIRR (real-term), Option N-B1 indicates a positive value while Option N-A1 indicates negative value with tax. The FIRR values for both options, however, are marginal due to low KCR fare level compared with that in other countries for maintaining an affordable price level in Karachi. The project should not be discarded due to its low FIRR.

Table 11.1.4 Results of Economical and Financial Evaluations

Item	N-A1		N-B1	
	With Tax	Without Tax	With Tax	Without Tax
EIRR	13.8%		12.3%	
Real-term FIRR	-0.01%	0.87%	0.07%	0.92%
FIRR on Nominal Base	5.31%	6.16%	5.40%	6.23%
Equity FIRR	9.45%	19.30%	9.22%	17.88%
Evaluation	Insufficient	Fair	Insufficient	Fair

Source: JICA Study Team

(5) Ease of O&M

The KCR Project will be the first modern urban railway in Pakistan and the people concerned, including PR's staff, have no experiences and know-how in the operation and maintenance (O&M) of urban railways. GOP and KUTC once intended to consign the O&M to a reputable foreign railway operator with rich experience and knowledge on urban railway O&M. This scheme, however, turned out to be unworkable due to the very high cost for a reputable foreign company and low fare revenues. Consequently, JICA Study Team recommended the employment of a new local O&M company, which will be established exclusively for the KCR O&M.

Taking the lack of experience of the new local O&M company into account, easy and simple O&M will be an essential factor for the success of the KCR Project. It is obvious that a smaller number of required staff and workers and shorter railway route length will lead to a simpler KCR O&M as well as an easier set-up of the O&M company. Table 11.1.5 shows the evaluation of the options from the viewpoint of factors concerned with O&M set-up.

Table 11.1.5 Evaluation on KCR O&M Set-up

Item	N-A1	N-B1	Remark
Route Length (km)	43.24	20.73	The shorter route length is, the easier its O&M becomes.
Number of Station	24	13	The smaller number of stations is, the easier its O&M becomes.
Train Operation	Round Operation	Simple Shuttle Operation	Round operation requires difficult tasks to smoothly change the train headways
Modern urban railway O&M Records up to now	No O&M records	No O&M records	KCR is the first modern urban railway in Pakistan.
Required number of personnel in charge of O&M	973	571	The smaller number of employees is, the easier its O&M set-up becomes.
Evaluation of Easiness on Establishment of O&M Set-up	Significantly tough	Rather easier than N-A1	-

Source: JICA Study Team

Apparently, Option N-B1 is more advantageous than Option N-A1 in terms of easiness in O&M

set-up.

(6) Overall Evaluation between Two Options

To select one option for recommendation, the overall integrated evaluation is made for the said two options in accordance with the criteria as shown in Table 11.1.6.

Table 11.1.6 Scoring Criteria for Evaluation

Evaluation	Excellent	Good	Slightly Good (Rather easier)	Fair	Insufficient	Unacceptable
Score	5	3	2	1	-1	-5

Source: JICA Study Team

The results of the overall evaluation on N-A1 and N-B1 are shown in Table 11.1.7. Option N-B1 is slightly better than Option N-A1.

Table 11.1.7 Overall Evaluations of N-A1 and N-B1

Evaluation Item	**N-A1**	**N-B1**
Projected Demand	1	2
Quality of train operation service level	3	5
Efficiency of Intial Cost	3	1
Economic and Financial Evaluations	1	1
Easiness of O&M set-up	1	3
Total	**9**	**12**

Source: JICA Study Team

In this evaluation, the scoring is made based on a flat allotment method without weights, but O&M is a crucial matter to realize a high quality urban train service to Karachi people. At the moment, no private railway O&M companies exist in Pakistan, and the establishment of a local private company and raising the technical competence of its staff and employees are very tedious. If a weighted allotment scoring method is used for the evaluation taking into account the difficulty of O&M works, the difference of total mark between the two options will be larger.

Consequently, JICA Study Team would like to recommend the implementation of Option N-B1 as the first stage of KCR Project. This is on the condition that the planned resettlement of the entire KCR route should be completed at the same time with its implementation, to serve as preparation works so that the second stage implementation for the remaining loop section will be easier.

11.2 Recommendations

The KCR will be the first modern commuter railway in Pakistan, of which success will be significantly important as a pioneer public urban railway transportation model. SAPROF-II recommends the following points for the successful implementation and operation of the project.

(1) Role of KUTC for Smooth Implementation of the Project

The role sharing of the three parties, namely KUTC, consultants and contractors, is very important to smoothly implement the KCR Project. Most of the technical issues should be entrusted to the selected consultants who will examine the issues, prepare the solutions and report to KUTC, where the consultants will make interactions with KUTC for enhancing the capacity of KUTC.

KUTC is then expected to promptly take the necessary actions to facilitate the project implementation based on advice from, and discussions with, the consultants at the design and tendering stage. At the construction stage, KUTC should also provide prompt approvals or other actions to the documents submitted by contractors through the consultants with their comments and suggestions.

KUTC is the dedicated authority in Pakistan for the implementation and administration of the KCR Project. Therefore, KUTC is expected to contact key persons in any government organization concerned for the necessary arrangement and approval procedures for smooth implementation of the project. These procedures also involve legislative and institutional issues including tax exemption.

It is recommended that KUTC should recognize the above important roles and should make every effort to enhance its capability.

(2) Shifting of the Pakistan Railway (PR) Main Lines Before KCR Project Construction

The shifting works of tracks and facilities of the PR main and siding lines are required to provide spaces available for the railway facilities of KCR, which are composed of the following two items:

A) The shifting works to create spaces for KCR double tracks including station facilities in the section between DCOS and Drigh Road.
B) The shifting works to create spaces for KCR station facilities at Tower, Karachi City and Karachi Cantt.

PR has estimated the required cost for Item A), while the detailed technical examination on the shifting method of the PR main lines under operation may not be conducted.

As for Item B), KUTC understood its necessity, and the required ranges of shifting of PR facilities explained by JICA Study Team.

These shifting works will be implemented under the operations of PR in such a way that the works may not disturb PR operations including switching works of PR decrepit signaling facilities. Also, such works must be completed before commencement of the KCR construction works for smooth implementation of the Project.

It is recommended for KUTC to discuss the abovementioned issues with PR so that the latter can examine the necessary arrangements to properly implement the shifting works.

(3) Early KCR Centerline and Land Border Setting

The actual borders of the KCR land should be clearly informed to the habitants who live in close proximity and have businesses within the vicinity. The identified habitants will be resettled accordingly. Also, topographic maps based on satellite images have a maximum tolerance of 70 cm. Considering these matters, the early setting-out of the KCR centerline and land borders is recommended.

(4) Importance of O&M and Establishment of High Quality Local O&M Company

Poor O&M would spoil the high quality urban train service to the Karachi citizens even though modern railway facilities will be introduced. The demand forecast is just an estimate based on a lot of assumptions, but the actual ridership highly depends on the O&M quality. Recently, there have been numerous successful railways which have gained larger demands than forecasted, in which frequent and stable train services are sustained due to easy O&M systems using ATO and proper incentive mechanism given to private O&M companies.

The KCR Project is planned to include the ATO and many other automatic systems, and will be operated by a new local O&M company. To establish a conscientious high quality O&M company, the following points are recommended:

A) To introduce a reasonable and fair incentive mechanism in the contract with the O&M company, where better service results in more profit, so that good investors will be willing to participate in the new company.
B) To examine the personality of the owner of the candidate company in the selection process in terms of integrity, sense of generating profits, business policy and philosophy on public service, especially focusing on high quality public transportation service.
C) To arrange the capacity building, education and training for the key personnel of the selected O&M company, including overseas on-the-job training, since modern commuter trains have never been operated in Pakistan.

(5) Fare Level

The fare system of KCR should normally be set at the proper level to cover all the necessary investment and O&M costs for sustainable high quality urban railway service to the citizens of Karachi.

However, the starting fare of KCR is proposed at Rs17 taking into account the the minimum minibus fare due to the high sensitivity of fare level to demand according to the demand forecast. Added values created by the KCR's high service level such as air-conditioning, safety and significant time saving are not reasonably reflected into the proposed fare system. It is noted that the demand forecast of SAPROF-II is based on the preference survey conducted three years ago at SAPROF-I, and the currency value has declined almost half due to inflation since the time of the survey.

As a result the financial viability of the Project is evaluated to be marginal even including advertising and kiosk revenues which implies that the fare revenue of KCR may not be sufficient to cover the required costs and the sustainability of KCR operation would be precarious.

Therefore, the following recommendations are proposed:

A) Not to depend excessively on non-rail business revenues in order to cover the expenses of the KCR railway business. The railway business should be managed within its fare revenue and the sound non-rail revenues from advertising and kiosk.
B) To review the preference survey and confirm the demand forecast of SAPROF-II. If the reviewed scale of demand is larger than that of SAPROF-II, the proposed fare level should be adjusted to control the demand to an appropriate scale.
C) To promptly readjust the fare level if a flood of passengers into KCR trains take place compared with the projected demand, as such situation would incur difficulties in the safe train operation.

The actual number of passengers depends on the quality of urban railway services including punctuality, frequency and air-conditioning as mentioned in above (4), and therefore, KUTC should always take care of provision of sustainable high-quality urban railway service to the citizens of Karachi.

(6) Railway Land Development and Under-Viaduct Space Development Businesses

As a result of investigations on the actual situations of land development businesses in Karachi, it turned out the businesses involve the following high risks:

A) The tenant occupancy rate of upper floors generally low because of long time required to go up and down with limited number of lifts, risk of unsafe emergency evacuation, and higher price than lower floors. The private land developers tend to neglect customer-oriented designs and pricing.
B) The right to use land owned by the initial developer is often resold to other developer, which lead to unintended extinction of effectiveness of the land leasing contract between the initial land developer and the land owner after the resale. Since private investors in Pakistan tend to seek immediate profit, possibility of the resale troubles would be high when the development scheme involves private investors.
C) Many tenants continue to stay on without paying rent.

The following points are therefore recommended:

A) To set up a non-rail business division in KUTC with various excellent experts in charge of planning, implementation, risk analysis, financing, marketing, contract management and business operation of non-rail businesses.
B) To manage non-rail businesses based on sound, careful, and rather conservative development policies so that huge failures and losses that imperil the KCR core railway business will not occur in non-rail businesses.

(7) Rolling Stock for KCR

The road network connected with residential areas is basically composed of radial main roads, along where bus routes are connected to CBD. The KCR route is shaped as an ellipse and passengers who intend to go to CBD from a certain station in the KCR loop section have to take 1.6 times longer route than the direct distance. To promote the use of KCR, the average speed of KCR should be kept at a level where the required time to the destination by KCR including transfer time can be shorter than the total travel time by using minibuses.

Commuter railways generally use rolling stock under the maximum operational speed of 80-90 km/h (maximum rolling stock performance speed: 90+20=110 km/h). As for the KCR rolling stock, it is planned to be operated at the maximum operational speed of 110 km/h (maximum rolling stock performance speed: 110+20=130 km/h) based on the assumed rolling stock type of TX-2000. Consequently, the standard train operation time for one round trip of KCR train can be 60 minutes with an average speed of 43 km/h, which is supposed to increase the passengers by 20% or more.

The use of rolling stock that has a lower performance than TX-2000 would seriously incur a decrease in ridership. It is essentially recommended to procure the TX-2000-based rolling stock or equivalent.

(8) Suggestion of Bus Rapid Transit (BRT) in case of Partial Operation (Option N-B1)

The JICA appraisal and discussions between JICA and GOP may determine to implement the KCR Project with partial operation (Option N-B1), where KCR will be constructed in the section between Shah Abdul Ratif and Drigh Road. Since most of the land along the loop section will be left unused for a long time, the land may be occupied again by informal settlers. Preventing the occupation of vacant public land by informal settlers seems difficult in terms of basic human rights. This will lead to the loss of opportunity to complete the KCR Project in the second stage implementation.

The KCR circular rail operation, which includes the important intersections at North Nazimabad, Liaquatbad and Nipa with radial main roads, has an essential function in view of urban development. The KCR Project will contribute in transforming Karachi City from a single pole city structure to a multi-polar city structure by dispersion of trips from radial directions along main roads to circular directions along KCR. This transformation can promote efficient city activities, well-balanced economic growth, and improved social life level.

To solve the above-mentioned problem with small investment, BRT operation by use of the land for future KCR loop section should be examined.

The following recommendations are therefore proposed:

A) The resettlement for the entire KCR land should be implemented according to the latest RAP, even if the partial operation option will be selected.
B) BRT operation along the missing KCR route is proposed to conserve the land in good condition for the future KCR loop section, if the second stage development would not be implemented soon after the completion of the project. At the same time, BRT connecting services with both terminal stations of KCR should be provided to increase KCR passengers and facilitate the formation of a multipolar city structure.

(9) Financial and Taxation Support from GOP and GOS

The FIRR of each option shows that the value is much lower than 1%. Furthermore, in Option N-B1, which shows the best FIRR among the three options, the cash flow from 2030 to 2033 was calculated to be negative due to repayment of JICA loan and additional investments and KUTC needs short-term borrowing. However, the cumulative cash flow from 2021 to 2029 and after 2034 shows positive values.

Judging from the above-mentioned status of FIRR and cash flow, the financial support of GOP and GOS to KUTC will be required to provide stable and high quality urban train services to the citizens of Karachi. The following financial and taxation support is recommended:

A) GOP and GOS should provide financial support so that the viaduct under-space and railway land developments can be implemented without the participation of private investors to ensure that the profits will be provided to KUTC.
B) GOP and GOS should set a special KCR support fund for KUTC to conduct stable fund operations for maintaining surplus in the cash flow and short-term borrowing with lower interests without risk.
C) GOP and GOS should arrange the exemption of GST, import duties and income taxes to improve the financial conditions and cash flow.

(10) Mobilization of a JICA Expert

To smoothly implement the KCR project, a competent railway specialist with sufficient experience in project implementation and railway O&M will be required to assist the key personnel of the Ministry of Railways, KUTC, Japanese Embassy, and JICA in solving the various issues in the course of the project. The specialist should be posted at the Ministry of Railways so as to have a certain authority from the central government.

It is recommended to dispatch the competent railway specialist as a JICA expert to the Ministry of Railways.