CHAPTER 5 PRIORITY ROAD NETWORK DEVELOPMENT PROJECTS

5.1 Road Network Development Project by KMC

5.1.1 Outline of Projects

The Study Team collected the project documents such as PC-1 and connectional paper for feasibility study (F/S) or detail design (D/D) regarding the road development projects from the Karachi Municipal Corporation (KMC). These projects may be categorized as follows:

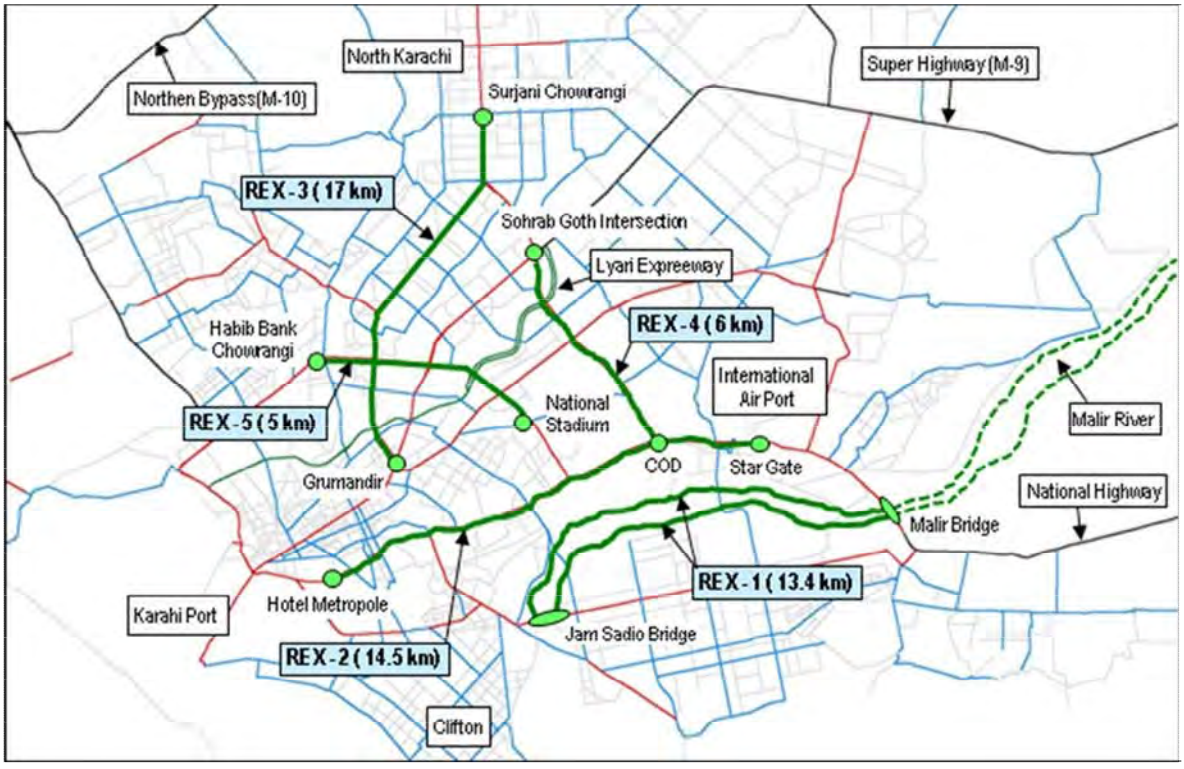
i) Expressway construction;

ii) Improving accessibility between CBD area and Super Highway; and

iii) Improving connectivity to Korangi/Landhi Industrial Area and Port Qasim.

(1) Expressway Projects

The KMC has the expressway construction plans of the Malir River Bund Road and four other elevated expressways on principal arterial roads as shown in **Figure 5.1.1**.



Source: JICA Study Team

Figure 5.1.1 Location of the Expressway Development Projects

1) Malir River Bund Road Project

The major objective of the construction of the Malir River Bund Road is to have connection with Education City and DHA City Karachi, which will be developed in the near future. According to the route plan to be provided by KMC, the carriageway of the expressway will be separated on the left and right bunds of the river, and the expressway will be extended up to Malir Bridge in the initial construction phase.

The KMC considers implementing the Malir River Bund Road Project through public-private-partnership (PPP) scheme; however, KMC has not yet conducted the financial study to engage the private sector in the project. **Table 5.1.1** shows the outline of the Malir River Bund Road Project.

Table 5.1.1 Outline of the Malir River Bund Road Project

Project ID No.	REX-1
Project Name	Malir River Bund Road Construction Project
Location	Bunds of Malir River between Jam Sadio and Malir Bridges
Project Feature	- Construction of the new 13.4 km six-lane expressway along the existing bunds of Malir River. - F/S was conducted on 2009 funded by ADB. - KMC considers providing separate lanes on the left bund and right bund of the river. - The Malir River Bund Road will connect the Education City with Super Highway (M-9) in the Phase-II Project.
Estimated Cost	Rs60,479 million (2009 market price)
Work Period	Unknown
Executed Agency	Karachi Metropolitan Cooperation
Status	PC-1 has not been prepared yet and source of finance is still to be identified.
Other	KMC considers implementing the PPP scheme.

Source: JICA Study Team

2) Elevated Expressway Projects

Among the four routes, the elevated expressway projects of Shahrah-e-Faisal on BOT scheme has been awarded to a Malaysian company, and the feasibility study has commenced immediately. However, the said projects have been cancelled due to financial problems. The KMC has been contacting possible financial sources for the F/S. **Table 5.1.2** shows the outline of the elevated expressway project on Shahrah-e-Faisal.

Table 5.1.2 Outline of the Elevated Expressways Project

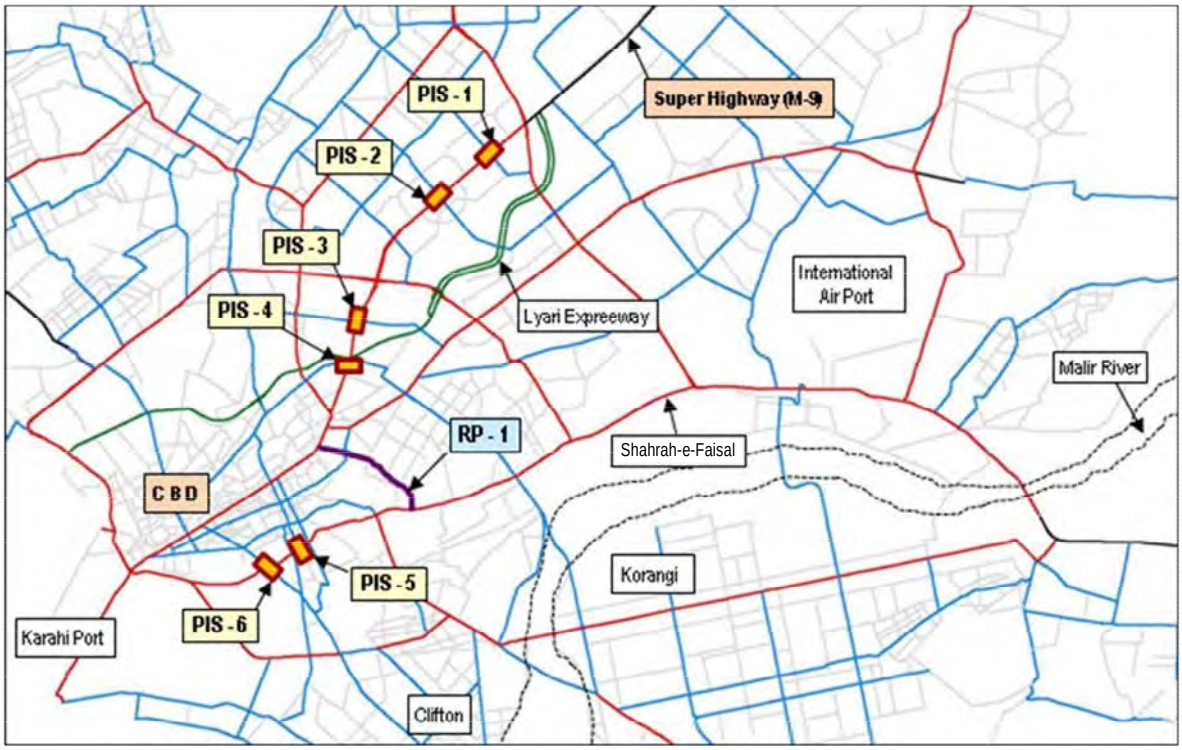
Project ID No.	REX-2 to 5 (in **Figure 5.1.1**)
Project Name	Construction of the Elevated Expressways
Location	Karachi City
Outline	- Construction of the four routes of four-lane elevated expressways on the principal arterial roads; REX-2: Shahrah-e-Faisal from Star Gate to Hotel Metropole (14.5 km) REX-3: Surjani Chowrangi to Grumandir (17 km) REX-4: Rashid Mihas Road from COD to Sohrab Goth Intersection (6 km) REX-5: Sir Shah Suleman Road from National Stadium to Habib Bank Chowrangi, Site Area (5 km) - BOT scheme is intended to be adopted for the construction and operation of the four routes.
Estimated Cost	Rs17,000 million (2005 market price) REX-2: Rs5944 million Rs., REX-2: Rs6.964 million, REX-3: Rs2.449 million, and REX-5: Rs2.041 million.
Work Period	Unknown
Executed Agency	Karachi Metropolitan Cooperation
Status	- Conceptual plan requesting for financial source for the F/S was submitted in 2005.

Project ID No.	REX-2 to 5 (in **Figure 5.1.1**)
	- Source of finance is still to be identified.
Other	A Malaysian BOT investor conducted feasibility study on the elevated expressway on Shahrah-e-Faisal, but the project was cancelled.

Source: JICA Study Team

(2) Projects for improving accessibility between CBD area and Super Highway

The improvement of accessibility to Super Highway from CBD and the inside of CBD has emphasized on Shahrah-e-Pakistan and Shahrah-e-Faisal, as shown in **Figure 5.1.2**. Both roads were addressed as signal-free corridors in accordance with the Karachi Strategic Development Plan for 2020 (KSDP-2020).



Source: JICA Study Team

Figure 5.1.2 Location of the Road Projects in CBD Area and the Access to Super Highway (M-9)

1) Separate-grade improvement on Shahrah-e-Pakistan Road

With the purpose of improving accessibility to Super Highway, four flyover construction projects at intersections with minor arterial roads on Shahrah-e-Pakistan are to be implemented, as described in **Table 5.1.3**.

Table 5.1.3 Outline of Road Improvemet Projects for Easy Access to Super Highway

Project ID No.	PIS-1
Project Name	Construction of a Two-way Flyover at Dakkhana on S.M. Toueeq Road
Location	Fakkhana Chowrangi on S.M. Taufeeq Road at Gulberg Town
Project Feature	- Construction of a four-lane flyover bridge with 23 m width (two directions). - Bridge length is 85 m and ramp lengths equal to 250 m.
Estimated Cost	Rs476.8 million
Work Period	Eight months
Executed Agency	Karachi Metropolitan Cooperation
Status	PC-1 was submitted in January 2012 and is under bidding process.

Project ID No.	PIS-2
Project Name	Construction of a Flyover at Water Pump on Shahrah-e-Pakistan
Location	Water Pump Chowrangi on Shahrah-e-Pakistan at Gulberg Town
Project Feature	- Construction of a four-lane flyover bridge with 23 m width (two directions). - Bridge length is 94.6 m and ramp lengths equal to 244 m.
Estimated Cost	Rs497.3 million
Work Period	Eight months
Executed Agency	Karachi Metropolitan Cooperation
Status	PC-1 was submitted in March 2012 and is under bidding process.

Project ID No.	PIS-3
Project Name	Construction of a Flyover at Ayesha Manzil on Shahrah-e-Pakistan
Location	Ayesha Manzil Intersection on Shahrah-e-Pakistan in Liauatabad Town
Project Feature	- Construction of a four-lane flyover bridge with 23 m width (two directions). - Bridge length is 94.6 m and ramp lengths equal to 244 m.
Estimated Cost	Rs497.3 million
Work Period	Eight months
Executed Agency	Karachi Metropolitan Cooperation
Status	PC-1 was submitted in February 2012 and is under bidding process.

Project ID No.	PIS-4
Project Name	Construction of a Single-lane Two-way Flyover at Teen Hatti
Location	Near Teen Hatti on Martin Road (intersection with Jehangir Sethana Road) at Jamshed Town
Project Feature	- Construction of a two-lane flyover bridge with 8.5 m width (two directions). - Bridge length is 207.7 m and ramp lengths equal to 245 m.
Estimated Cost	Rs290.2 million
Work Period	Eight months
Executed Agency	Karachi Metropolitan Cooperation
Status	PC-1 was submitted on March 2012 and is under bidding process.

Project ID No.	RP-1
Project Name	Rehabilitation/Improvement of Shahrah-e-Quaideen from Shahrah-e-Faisal to Khudadad Choweangi
Location	Shahrah-e-Quideen Road on Jamshed Town
Project Feature	- Improvement of six- to eight-lane carriageways (total length of approximately 3.5 km). - Providing 9 m wide service road on both sides.
Estimated Cost	Rs421.0 million
Work Period	Unknown
Executed Agency	Karachi Metropolitan Cooperation
Status	Under Construction

Source: JICA Study Team

2) Separate-grade improvement on Shahrah-e-Fasial Road in CBD

Two separate-grade improvement on flyover and underpass will be implemented on Shahrah-e-Faisal as described in **Table 5.1.4**.

Table 5.1.4 Outline of Road Improvement Projects for Smooth Traffic Flow in CBD

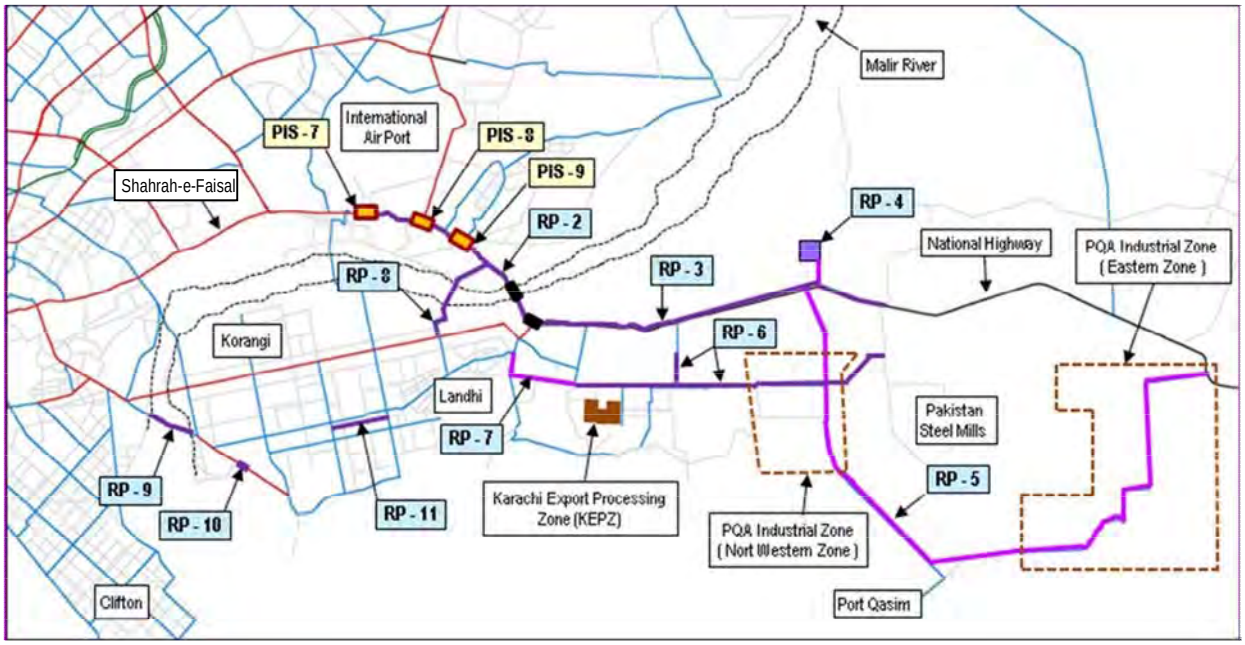
Project ID No.	PIS-5
Project Name	Construction of a Two-lane Flyover along Dr. Ziauddin Ahmed Road at PIDC Intersection
Location	PIDC Intersection on Dr Ziauddin Ahmed Road at Saddar Town
Project Feature	- Construction of a two-lane flyover bridge with 8.5 m width (two directions). - Bridge length is 150 m and total ramp length is 240 m.
Estimated Cost	Rs263.9 million
Work Period	Four months
Executed Agency	Karachi Metropolitan Cooperation
Status	PC-1 was submitted in January 2010 and the contract is being processed.

Project ID No.	PIS-6
Project Name	Construction of Madar-e-Jamhuriat Nusrat Bhutto Underpass at Mehran Hotel
Location	Dr. Daud Potta Road and Shahrah-e-Faisal Road crossing at Mehran Hotel
Project Feature	Construction of an underpass with two-lane carriageway (total length of 355 m).
Estimated Cost	Rs468.8 million
Work Period	Eight months
Executed Agency	Karachi Metropolitan Cooperation
Status	PC-1 was submitted in October 2011 and contract is being processed.

Source: JICA Study Team

(3) Projects for Improving Accessibility to Korangi/Landhi Industrial Area and Port Qasim

Figure 5.1.3 shows the location of road rehabilitation and improvement and flyover projects related to improving the accessibility to Korangi Industrial Area, Landhi Industrial Area, and Port Qasim area. The Port Qasim Authority (PQA) will be responsible for the project implementation within the boundary of Port Qasim.



Source: JICA Study Team

Figure 5.1.3 Improving Accessibility to Korangi/Landhi Industrial Area and Port Qasim

1) Improving the traffic flow on Shahrah-e-Faisal and National Highway

The KMC is planning to improve three intersections to construct a flyover between the International Airport and Malir River Bridge. Among the three flyover projects, the construction work at the International Airport has commenced while the other two projects are still waiting for the approval of budget allocation. Shahrah-e-Faisal and the National Highway between the International Airport and Pakistan Still Mills Road are being planned to be improved to six lanes from the current four-lane road. However, the budget for the F/S and D/D has not been approved.

The construction works on the parking facility, which will accommodate more than 2000 oil tanker, are ongoing. This facility aims to mitigate the issue of traffic disturbances caused by oil tankers and trailers stopping and parking on the road shoulders of the National Highway. **Table 5.1.5** shows the outline of the road improvement projects on Shahrah-e-Faisal and the National Highway.

Table 5.1.5 Outline of Road Improvement Projects on Shahrah-e-Faisal and the National Highway

Project ID No.	RP-2 and RP-3
Project Name	Improvement and Rehabilitation of Shahrah-e-Faisal
Location	Shahrah-e-Faisal to National Highway at the section of the International Airport to Quaidabad. and the section of Quaidabad to Still Mills
Project Feature	- Improvement to a six-lane carriageway. - The project will be divided into two phases: • Phase-1: Airport and Quaidabad before Malir Bridge (length of 5.88 km) • Phase-2: Quaidabad after Malir Bridge and Still Mills (length of 12.2 km)
Estimated Cost	Phase-1: Rs788 million, Phase-2: Rs899 million (2008 market price)
Work Period	Unknown
Executed Agency	Karachi Metropolitan Cooperation
Status	The conceptual plan requesting for PC-2 finance was submitted in February and May 2009 but the financial source is still to be identified.

Project ID No.	RP-4
Project Name	Development of Oil Tankers' Parking Terminal at Zulfikarabad
Location	The towns of Still Mills and Port Qasim, which are still opposing
Project Feature	Construction of a 150 ac parking space (1 ac=0.4046 ha) for 2375 oil tankers.
Estimated Cost	Rs308 million
Work Period	Six months
Executed Agency	Karachi Metropolitan Cooperation
Status	PC-1 was submitted in November 2011 and under construction.
Other	Oil Marketing Companies have financed 20 % of the project cost.

Project ID No.	PIS-7
Project Name	Construction of a Three-Lane Flyover at Jinnah Terminal Signal on Shahrah-e-Faisal
Location	Entrance to International Airport on Shahrah-e-Faisal at Shah Faisal Town
Project Feature	- Construction of a three-lane flyover bridge with 10.95 m width (one direction). - Bridge length is 200 m and ramp lengths equal to 275 m.
Estimated Cost	Rs299.8 million
Work Period	Four months
Executed Agency	Karachi Metropolitan Cooperation
Status	PC-1 was submitted in July 2009 and the project is under construction.

Project ID No.	PIS-8
Project Name	Construction of a Three-Lane Flyover at Malir Halt on Shahrah-e-Faisal
Location	Shahrah-e-Faisal Road connecting Model Colony Road on Malir Town
Project Feature	- Construction of a three-lane flyover bridge with 10.95 m width (one direction). - Bridge length is 405 m and the total ramp length is 230 m.
Estimated Cost	Rs414.9 million (price in year 2009)
Work Period	Six months
Executed Agency	Karachi Metropolitan Cooperation
Status	PC-1 has been submitted on November 2009 and waiting for finance approval.

Project ID No.	PIS-9
Project Name	Construction of a Three-Lane Flyover at Malir No. 15 on Shahrah-e-Faisal
Location	Malir No.15 on Shahrah-e-Faisal Road at Malir Town
Project Feature	- Construction of a three-leg flyover bridge from the direction of Hotel Metropole to Stell Mills and going to Azimpura Area across the railway line. - Total bridge length is approximately 560 m and ramp lengths equal to 600 m.
Estimated Cost	Rs499.8 million (price in year 2009)
Work Period	Eight months
Executed Agency	Karachi Metropolitan Cooperation
Status	PC-1 has been submitted on September 2009 and waiting for finance approval

Source: JICA Study Team

2) Improving the internal roads in Landhi and Port Qasim

The KMC is implementing the Mehran Highway Project (RP-6) with a total length of 11.8 km. At present, only 3.4 km of the section has been completed, and the accessibility between the

National Highway and KEPZ has been improved. After completion of the Mehran Highway (RP-6 and RP-7) and Port Qasim Access Road (RP-7) projects, the accessibility between Landhi area and Port Qasim will remarkably improve. Heavy industrial vehicles may pass the route of 8000 Feet Road of Mehran Highway–Port Qasim Access Road without using the National Highway.

It is recommended that the improve the connectivity within the Landhi Industrial Area and the National Highway to mitigate the heavy transportation impacts on the National Highway in the next phase, after establishing the said industrial vehicle transportation route. **Table 5.1.6** shows the outline of the road projects to be implemented in Landhi and Port Qasim.

Table 5.1.6 Outline of Road Improvement Projects for Smooth Traffic Flow in Landhi and Port Qasim

Project ID No.	RP-5
Project Name	Rehabilitation, Upgrade, and Dualization of the PQA Main Access Road
Location	Port Qasim Industrial Zone
Project Feature	- Construction of the 26 km long dual carriageway from the National Highway T-junction passing through PQA commercial areas (Western and Eastern Industrial Zones) ending at Sassui Bridge Ghaghar Railway crossing. - Upgrade of the main access road and construction of two flyovers. - The project will be implemented on a BOT scheme.
Estimated Cost	Rs6000 million
Work Period	Two years
Executed Agency	Port Qasim Authority
Status	The selection of concessionaire is under bidding process.

Project ID No.	RP-6
Project Name	Construction of the Mehran Highway
Location	Landhi Industrial Area to Pakistan Still Mills
Project Feature	- Construction of the dual carriageway and storm drainage facility (length=10.8 km). - Project has been divided into three phases: Phase-1: Hospital Chowrangi to Sta. 2+365 (2.4 km, Part-1) PMTF to Road Mehran Highway to Railway Crossing (1.0 km, Part-2) Sta. 2+365 to PMTF Uncovered Area (1.9 km, Part-3) Phase-2: PMFT to Port Qasim Road (4.2 km) Phase-3: Port Qasim Road to Pakistan Steel Millls Road (2.3 km)
Estimated Cost	Rs1.009 million Phase-1: Rs142 million (Part-1), Rs46 million (Part-2), and Rs129.3 million (Part-3) Phase-2: Rs450 million, Phase-3: Rs248 million
Work Period	Phase-1 (Part-3): 12 months, Phase-2: 10 months, and Phase-3: 6 months
Executed Agency	Phase-1 and Phase-2 by Karachi Metropolitan Cooperation; Phase-3 by Port Qasim Authority
Status	- Phase-1 (Part-1 and Part-2): completed - Phase-1 (Part-3) and Phase-2: PC-1 was submitted in February 2012 and is under process for approval. - Phase-3: PC-1 is under preparation for execution by PQA
Other	Japanese Counter Value Fund is utilized and to be adopted on Phase-1 (Part-3), Phase-2, and Phase-3.

Project ID No.	RP-7
Project Name	Rehabilitation/Reconstruction of the Mehran Highway from Rice Godown to RCC Drains in Landhi
Location	Majeed Colony in Landhi Industrial Zone
Project Feature	Improvement to a four-lane carriageway (3.25 km) with storm drainage facility and foot path (1.5 m width).
Estimated Cost	Rs123.3 million
Work Period	Twelve months
Executed Agency	Karachi Metropolitan Cooperation
Status	PC-1 was submitted in December 2011 and is currently under construction.

Project ID No.	RP-8
Project Name	Balance Work on the Construction of Shahrah–e-Altaf Hussain (Road 15,000) from Murtaza Chowrangi to TPO Office Malir River Boud at Landhi and Shah Faisal Towns.
Location	Between Landhi town and Shah Fisal town
Project Feature	- Rehabilitation of the two-lane carriageway (10 m width) with foot path (1.5 m width) with a total length of 3.65 km. - This project was approved as Revised PC-1 with a cost of Rs102.65 million. In 2006–2007, however, the contractor could not complete the construction works. The works of Rs3.63 million amount (52 % of the works) has been carried out.
Estimated Cost	Rs71.4 million
Work Period	Nine months
Executed Agency	Karachi Metropolitan Cooperation
Status	PC-1 was submitted in September 2008 and waiting for finance approval.

Source: JICA Study Team

3) Improving accessibility to Korangi Industrial Area

The Korangi Road will be part of the future Outer Ring Road (R-4), however, KMC have not formulated any implementation plan to construct the coastal road to be connected with Port Qasim Access Road. **Table 5.1.7** shows the outline of projects for improving the traffic flow in Korangi Area.

Table 5.1.7 Outline of Road Improvement Projects for Smooth Traffic Flow in Korangi Area

Project ID No.	RP-9
Project Name	Widening of the Main Korangi Road including causeway from KPT Flyover to Korangi Crossing
Location	Korangi Road on Malir River
Project Feature	Expansion of the causeway road to a four-lane carriageway (from the 8 m existing width to 15.2 m width) with a total length of 1.25 km.
Estimated Cost	Rs142 million
Work Period	Eight months
Executed Agency	Karachi Metropolitan Cooperation
Status	PC-1 was submitted in March 2011 and waiting for finance approval.

Project ID No.	PR-10
Project Name	Construction of the Box Culverts along Korangi Road near CBM
Location	Korangi Town
Project Feature	Provision of box culverts (23 cell) across storm water drains from Korangi Area with a length of 80.9 m and a width of 16.8 m (four-lane).
Estimated Cost	Rs81.7 million
Work Period	Six months
Executed Agency	Karachi Metropolitan Cooperation
Status	PC-1 was submitted in December 2011 and is currently under construction.

Project ID No.	RP-11
Project Name	Rehabilitation of Road 14,000 (Both Tracks) from Road 9000 to Road 13,000 at Korangi Town
Location	Korangi Town
Project Feature	Improvement to a four-lane carriageway (total length=2.39 km)
Estimated Cost	Rs106 million
Work Period	Twelve months
Executed Agency	Karachi Metropolitan Cooperation
Status	PC-1 was submitted in September 2011 and waiting for finance approval.

Source: JICA Study Team

5.1.2 Environmental Status of the Projects

(1) IEE/EIA Regulation

The different projects were reviewed particularly those executed by KMC and the projects approved by the Sindh Environmental Protectio Agency (SEPA). Majority of the projects executed by KMC were approved without any environmental assessment. It is further clarified that contrary to the international practice of categorizing projects as A, B, or C at the time of the review of environmental assessment documents, a different procedure is adopted in Pakistan. In the light of Pak-EPA IEE/EIA Regulation 2000, each project proponent is required to prepare an initial environmental examination (IEE) or an environmental impact assessment (EIA) in view of the nature and location of the project. Table 5.1.8 describes the Schedule-I and Schedule-II of the said regulation.

Table 5.1.8 Schedule-I and Schedule-II of the Regulation

Schedule	Sub-Category	Conditions
Schedule-I : List of Projects requiring an IEE	Transportation	• Federal or provincial highways with a total cost of less than Rs50 million
	Urban Development & Tourism	• Urban development projects • Public facilities with significant off-site impacts
Schedule-I I: List of Projects requiring an EIA	Transportation	• Federal or provincial highways or major roads with a total cost of Rs50 million and above
	Environmental Sensitive Areas	• All projects situated in environmentally sensitive areas

Source: Pak–EPA IEE/EIA Regulation 2000

The EIA requires more detailed investigation and assessment of the project-related environmental and social aspects than IEE. Moreover, an IEE does not require the holding of a public hearing during its review process, whereas an EIA does. However, based on the review of both the documents, EIA or IEE, EPAs do not categorize them (such as A, B, or C) for the implementation of the environmental management plan (EMP) and compliance monitoring during construction or operation phases of the project.

Sometimes due to the urgency of work and other reasons, public sector projects are commenced without environmental assessments, though the Planning and Development Department requires submission of environmental assessment documents along with the PC-1 for approval. However, the donor-driven or bank-funded projects comply with the prevailing legal requirements of environmental assessment.

(2) Status of the land acquisition of the KMC Project

The major transport sector-related projects planned and executed in Karachi in the last few years are summarized in **Table 5.1.9,** along with their environmental assessment and land acquisition status. Administratively, Karachi is looked after by several organizations and authorities which are responsible for the planning and implementation of the infrastructure development projects and schemes within their respective jurisdictions. However, KMC and other development authorities and agencies neither prepare nor submit to SEPA any environmental assessment document for projects related with road surface improvement. This is basically due the fact that the Pak-EPA IEE/EPA Regulation 2000 does not identify the road improvement schemes under any of the two listed categories (Schedule-I and Schedule-II) for the preparation of environmental assessment document. Moreover, it is also argued by the development authorities that since road improvement projects are urgent, the environmental assessment and approval processes would cause unnecessary delays in their implementation (source: discussion with SEPA). However, for the projects where land acquisition is perceived by SEPA, while reviewing and granting conditional approval of environmental assessment document, the preparation of a resettlement action plan (RAP) is explicitly mentioned as a mandatory requirement for commencing the project by the implementing agency.

While planning road development/improvement schemes that require land beyond the available right of way, the Engineering Department of KMC sends their requirement to the revenue department (source: discussion with TCD, KMC). At present, major road development projects under planning at KMC includes an expressway along the left bund of the Malir River linking with the Super highway from DHA Phase-9 to Qayyumabad Intersection. Recently, KMC has called in the expression of interest (EoI) for its planning, construction, and operation on public-private-partnership basis from local and international firms. Meanwhile, the Engineering Department has proposed an initial alignment and its corresponding right-of-way for this project and has been forwarded to the Revenue Department with respect to land acquisition (source: meeting with DG-Technical Services, ED-KMC).

Due to continuous changes in the administrative setup and lack of pertinent data, the boundaries of some authorities are not well-defined and ambiguities exist over jurisdictions. For instance, KMC understands that their jurisdiction over Shahrah-e-Faisal starts from Star Gate (old airport entrance) and the section beyond this limit (towards Port Qasim and onwards) is the National Highway, which is under the National Highway Authority (NHA). However, NHA understands that their jurisdiction over Shahrah-e-Faisal begins after Malir and Port Qasim area (source: meeting with the Director, Master Plan, and KMC). The KMC, previously the City District Government Karachi (CDGK), had developed a master plan for the city, called KSDP-2020. Though not totally approved by the provincial government, however, KDSP-2020 could be referred for land use and zoning clarification with respect to land acquisition. The master plan section of KMC also refers to the KSDP2-020 for planning.

Details of the projects are mentioned in **Table 5.1.9**, which were reviewed to find out the current status. **Table 5.1.9** below has the following details:

- Projects which have submitted the EIA/IEE and in operation;
- Projects which have not submitted EIA/IEE but constructed and in operation;
- Projects which have submitted the EIA/IEE and not in operation/shelved;
- Projects which have submitted the EIA/IEE and are in the planning phase.

Table 5.1.9 Environmental Approval Status of Related Road Projects for the Study

S. No	Project Name	Environmental Approval Status	Implementation Status	Project Owner/ Funding agency
01	Malir River Bund Road Construction Project	No EIA conducted	In planning phase	Karachi Metropolitan Corporation
02	Construction of Elevated Expressways	EIA conducted	Project shelved	IJM Corporation (Malaysia) & Karachi Metropolitan Corporation
03	Construction of a Two-way Flyover at Dakkhana on S.M. Toueeqr Road	No EIA conducted	In planning phase	Karachi Metropolitan Corporation
04	Construction of a Flyover at Water Pump on Shahrah-e-Pakistan	No EIA conducted	In planning phase	Karachi Metropolitan Corporation
05	Construction of a Flyover at Ayesha Manzil on Shahrah-e-Pakistan	No EIA conducted	In planning phase	Karachi Metropolitan Corporation
06	Construction of Single-lane, Two-way Flyover at Teen Hatti	No EIA conducted	In planning phase	Karachi Metropolitan Corporation
07	Rehabilitation/Improvement of Shahrah-e-Quaideen from Shahrah-e-Faisal to Khudadad Chowrangi	No EIA conducted	In construction phase	Karachi Metropolitan Corporation
08	Construction of a Two-lane Flyover along Dr. Ziauddin Ahmed Road at PIDC Intersection	EIA conducted in Corridor IV project	In planning phase	Karachi Metropolitan Corporation
09	Construction of Madar-e-Jamhuriat Nusrat Bhutto Underpass at Mehran Hotel	EIA conducted in Corridor IV project	In planning phase	Karachi Metropolitan Corporation
10	Improvement and Rehabilitation of Shahrah-e-Faisal	No EIA conducted	In planning phase	Karachi Metropolitan Corporation
11	Construction of a Three-lane Flyover at Jinnah Terminal Signal on Shahrah-e-Faisal	EIA conducted in Corridor IV project	In construction phase	Karachi Metropolitan Corporation
12	Construction of a Three-lane Flyover at Malir Halt on Shahrah-e-Faisal	EIA conducted in Corridor IV project	In planning phase	Karachi Metropolitan Cooperation
13	Construction of a Three-lane Flyover at Malir No. 15 on Shahrah-e-Faisal	EIA conducted in Corridor IV project	In planning phase	Karachi Metropolitan Cooperation

Source: JICA Study Team

Table 5.1.10 Environmental Approval Status of Other Major Projects by KMC

S. No	Project Name	Environmental Approval Status	Implementation Status	Project Owner/ Funding agency
01	Rehabilitation/Upgrading/ Dualization of the PQA Main Access Road	No EIA conducted	In construction phase	Port Passim Authority
02	Construction of the Mehran Highway Phase 1-2 & 3	No EIA conducted	In operation	Phase-1 and Phase-2: Karachi Metropolitan Corporation; Phase-3: Port Qasim Authority
03	Widening of the Main Korangi Road including Causeway from KPT Flyover to Korangi Crossing	No EIA conducted	In operation	Karachi Metropolitan Corporation
04	Rehabilitation of Road 14,000 (Both Track) from Road 9000 to Road 13,000 at Korangi Town	No EIA conducted	……	Karachi Metropolitan Corporation
05	Improvement of HUB Road From Paracha Chowk to Karachi Northern Bypass (Phase-1)	No EIA conducted	……	Karachi Metropolitan Corporation
06	Rehabilitation of Road-13000 From Road 8000 (Singer Chowrengi) to Road-12000 (Korangi-5) in Landhi Town Karachi	No EIA conducted	……	Karachi Metropolitan Corporation
07	Banaras Flyover/Interchange	No EIA conducted	……	Karachi Metropolitan Corporation
08	Revival of Karachi Circular Railway	EIA conducted	In planning phase	Karachi Urban Tran Corporation
09	Development of Infrastructure and Construction of Facilities/ Amenities for the Affected Personnel of the Project	IEE conducted	In planning phase	Karachi Urban Transport Corporation
10	Extension of the Two-lane and Construction of Karachi-Hyderabad Super Highway Road	EIA Submitted to EPA Sindh. Project is in evaluation process with EPA	In planning phase	Bina Puri (Pvt) Limited
11	Construction of the Gizri Flyover	EIA conducted	In operation	Defense Housing Authority (DHA)

Source: JICA Study Team

5.2 Formulation of Alternative Routes

5.2.1 Setting Alternative Projects

The Study Team selected three alternative routes of the road network development project between the central Karachi including Clifton area and the industrial area of eastern Karachi to contribute to the improvement of investment. The major considerations in the selection of alternative routes were; i) accessibility and connectivity to Port Qasim; ii) order of priority in the road network development plan; and iii) project implementation status by KMC. The selected alternative routes were as follows:

Route-1: Construction and rehabilitation of Coastal Road (L=26.3 km)

- This route may connect with Port Qasim directly and will operate as an alternative route of Shahrah-e-Faisal/National Highway and 8000 feet Road of Korangi/Landhi Town.
- Coastal Road will be part of the Outer Ring Road in accordance with the KSDP-2020.

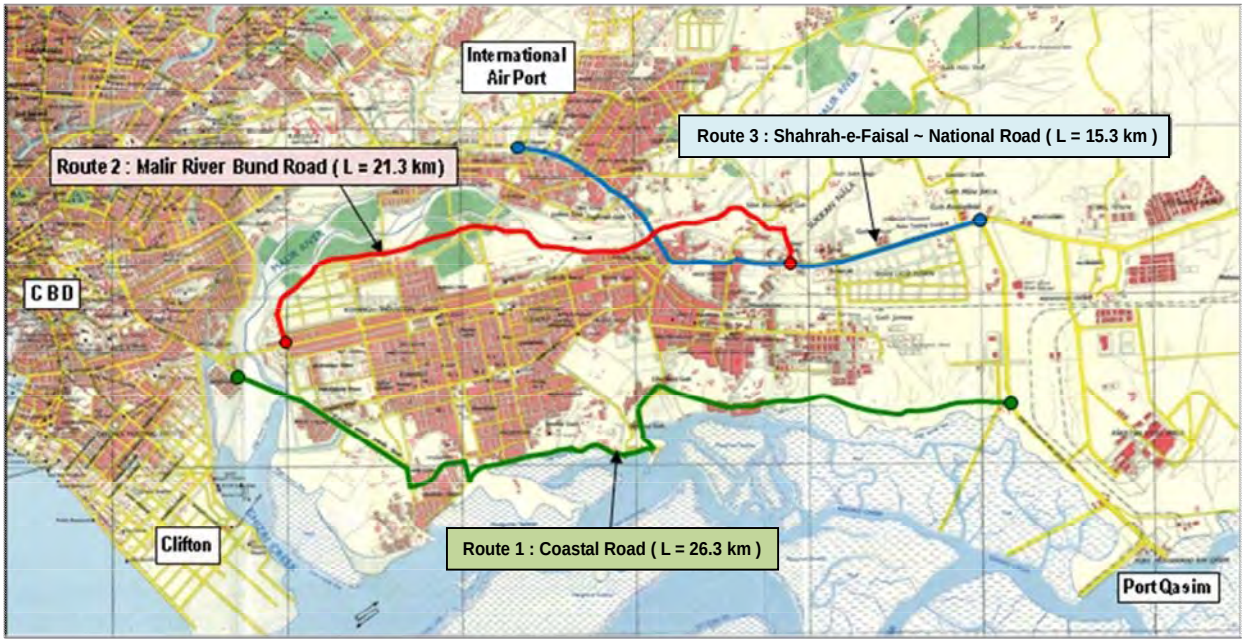
Route-2: Construction of the Malir River Bund Road (L=21.3 km)

- Being a tolled expressway, smooth traffic will be expected without traffic congestion at the intersection.
- The project is given higher priority in the KSDP-2020.
- Preliminary design has been conducted though the ADB Technical Assistance Program (2009); however, PC-1 has not been prepared.

Route-3: Improvement of Shahrah-e-Faisal/National Highway between International Airport and Port Qasim (L=15.3 km)

- Existing main access route to Port Qasim will be improved.
- JICA Study for the Karachi Transportation Improvement Project (KTIP) recommends implementing the flyover construction as a short-term (2020) target.
- The KMC has submitted PC-1 of the three flyover construction projects, and one project is under construction. The source of funds for the road improvement to a six-lane carriageway has been requested by KMC.

The location of the three alternative routes is shown in **Figure 5.2.1**, while the project features and justifications of the selection for each alternative route are summarized in **Table 5.2.1**.



Source: JICA Study Team

Figure 5.2.1 Location of the Selected Priority Alternative Routes

Table 5.2.1 Project Features of the Alternative Routes

Alternative Route 1 Project Name :	Construction and Rehabilitation of Coastal Road
Objective Length	L=26.3 km Beginning: Intersection with Creek Avenue on Korangi Road End: Port Qasim Access Road
Road Classification	Principal arterial road
Relevance to the Development Plan	- To formulate a part of the Outer Ring Road (R-4) as per KSDP-2020. - To be listed as a middle-term (up to 2025) target as per JICA Study of KTIP.
Description of the Project	- To construct a four-lane carriageway road. - To construct a 2.2 km long bridge at the Malir River crossing in order to ensure the function of the principal arterial road.
Status of the Project	- Preliminary design has not been conducted by KMC. - The KMC has submitted PC-1 of Malir River causeway improvement (four-lane) and box culvert construction near CBM, but only the box culverts are under construction.
Initial Evaluation on Environmental Issue	- To examine the bypass route at the residential area to minimize resettlement issues. - To provide sufficient sidewalk space at the road section of the residential area. - To consider the future development of tourism resource along the road.
Executed Agency	KMC

Alternative Route 2 Project Name	Construction of the Malir River Bund Road
Objective Length	L=21.3 km Beginning: Intersection with 3000 feet Road on 8000 feet Road End: National Highway at Goth Juman
Road Classification	Expressway (17.1 km) and minor arterial road (4.2 km)
Relevance to Development Plan	- The KMC highly prioritizes the road network development plan to relate with the Education City and DHA City Karachi projects. - To be listed as a long-term (up to 2030) target as per JICA Study of KTIP.
Description of Project	- To construct the controlled-access four-lane expressway up to Goth Jam Kand which is about 17.1 km long. - Due to the serious impact of resettlement issue on the right side bund, the six-lane carriage road will be constructed on the left side bund. - To construct a minor arterial road of 4.2 km long after the expressway on the bund of Malir River to connect with the National Highway.
Status of Project	- A preliminary design using the left side bund has been conducted through the ADB Techinal Assistance Program in 2009 (project cost: Rs60.48 billion). - At present, KMC has a different alignment plan to use the left and right side bund but preliminary design has not yet been prepared. - PC-1 has not yet been prepared by KMC.
Initial Evaluation on Environmental Issue	- To minimize the negative impact on resettlement at Future Colony of Landhi Town due to the expressway construction. - To find optimum routes between the end of expressway and the National Highway to minimize the issues on land acquisition and resettlement. - To minimize negative impacts on flood flow in Malir River by the construction of expressway along the river.
Executed Agency	KMC

Alternative Route 3 Project Name	Improvement of the Shahrah-e-Faisal/National Road
Objective Length	L=15.3 km Beginning: Entrance Road to the International Airport End: Intersection with Port Qasim Access Road
Road Classification	Principal Arterial Road
Relevance to Development Plan	- The KMC has submitted three flyover construction projects on Shahrah-e-Faisal. The flyover construction at the International Airport is on-going, and KMC plans to improve it to a six-lane carriageway. - The flyover construction projects on Shahrah-e-Faisal are listed as a short-term (2020) target as per JICA Study of KTIP.
Description of Project	- To improve the existing four-lane carriageway to a six-lane road. - To provide a service road in order to separate community access transporting activities from the main traffic flow. - To improve major intersections by constructing a flyover bridge.
Status of Project	- The three flyover construction projects Shahrah-e-Faisal (total cost: Rs1214.5 million) have been submitted. The flyover at the International Airport is under construction. - Regarding the road improvement to a six-lane carriageway, the project concept paper to request approval of the project implementation has been prepared by KMC. However, F/S or D/D has not commenced yet.
Initial Evaluation on Environmental Issue	- Land acquisition and resettlement issues for road widening and flyover construction.
Executed Agency	KMC

Source: JICA Study Team

5.2.2 Major Controlled Points for Road Alignment Planning

(1) Route 1: Construction and Rehabilitation of the Coastal Road

The Coastal Road will be constructed to improve and rehabilitate the existing road alignment. Out of the total 26.3 km length, the road sections of Umar Goth section (L=0.8 km) and Landhi Fishing Colony (L=1.1 km) will cause resettlement issues due to road widening (refer to **Figure 5.2.2**). In order to mitigate the negative social impacts, a bypass route for the said sections should be planned carefully.

Source: JICA Study Team

Figure 5.2.2 Location of Resettlement Issues Caused by Road Widening on Coastal Road

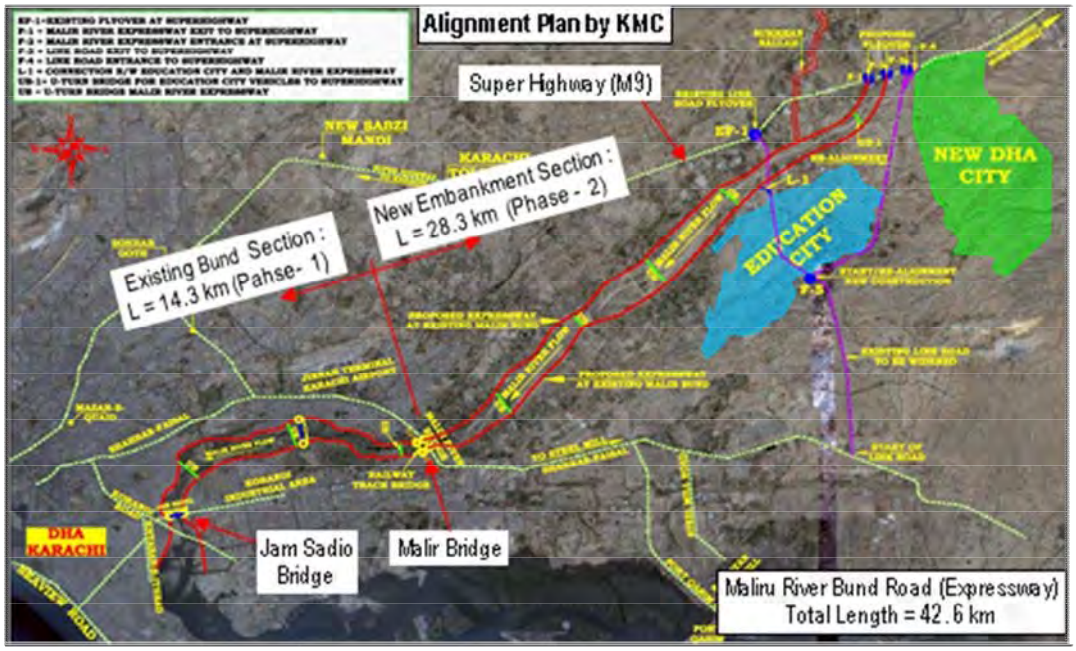
(2) Route 2 : Construction of the Malir River Bund Road

1) Review of alignment plan by KMC

According to a concept paper of Malir River Bund Road as expressway provided by KMC, the expressway alignment is planned as follows:

i) The construction of expressway will be divided into two project phases as follows (refer to **Figure 5.2.3)**:

- Phase-1: Jam Sadio Bridge–Malir Bridge (14.3 km)
- Phase-2: Malir Bridge–Super Highway (28.3 km)



Source: Karachi Metropolitan Cooperation

Figure 5.2.3 Alignment Plan of Malir River Bund Road by KMC

ii) The carriageways of each direction will be constructed separately on the right and left bunds, just like the Lyari Expressway.

iii) For the Phase-1 section, the beginning point of Ja Sadio Bridge as well as the end point of Malir River Bridge will be connected at the bridge section to be provided with access ramps as shown in **Figure 5.2.4**.

Beginning Point : Jam Sadio Bridge

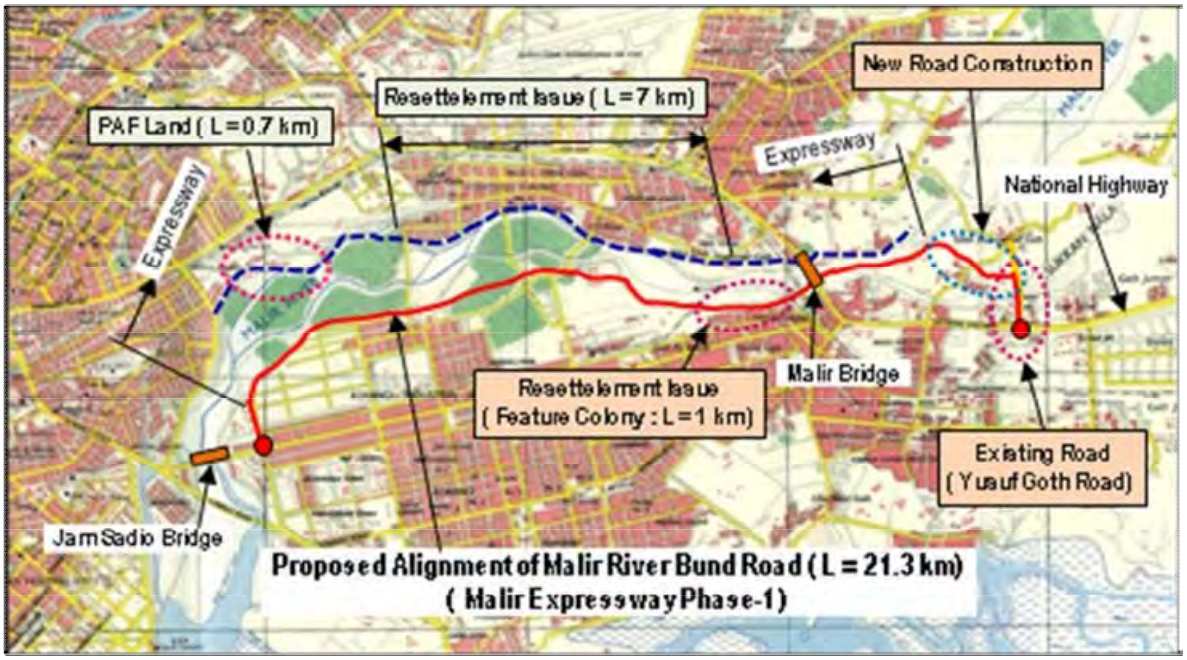
End Point : Malir Bridge

Source: Karachi Metropolitan Cooperation

Figure 5.2.4 Beginning and End Points of the Malir River Bund Road by KMC

2) Proposed alignment by the Study Team

Figure 5.2.5 shows a proposed alignment plan of Malir River Bund Road made by the Study Team. The major differences between the plan of KMC and that of the Study Team are explained as follows:



Source: JICA Study Team

Figure 5.2.5 Proposed Alignment of Malir River Bund Road

a. Carriageway construction on river bund

The carriageway should not be separated on the left and right bunds for the Phase-1 section of Malir River Bund Road. As illustrated in **Figure 5.2.5**, the road alignment proposed by the Study Team runs on the left bund of Malir River due the following reasons:

i) Residential houses are continuously built so close to the right bund at Shah Faisal Town with a length of approximately 7 km, so that the serious resettlement issues shall be raised for the alignment plan on the right bund.

ii) Approximately 0.7 km section of the right bund is located within the controlled area of Faisal Airbase by Pakistan Air Force (PAF). The discussion and negotiation to use the bund for the road constructions will not be easy and might take awhile to settle the land handover.

b. Beginning point

The Brookes Chowrangi (intersection with Main S.M Farooq Road and 3000 Feet Road) is proposed as the beginning point of the project. The Malir River Bund Road will be connected with 3000 Feet Road/EBM Causeway to be provided with an interchange.

i) Based on KCM's plan, the access ramps of Malir River Bund Road are connected on Jam Sadio Bridge. Since the carriageway of Jam Sadio Bridge as well as the flyover bridge to access Jam Sadio Bridge at Qayyam Abad has two lanes per direction, traffic problems such as congestion and accidents might occur at the connecting points.

ii) It should be recommended that the connection with Malir River Bund Road from CBD area and Clifton area be finalized through the traffic study and the road network development study in the said areas.

c. End point

The proposed alignment extends to 3.7 km of the Malir River Bund Road to upstream side, compared with KMC's plan, with the following reasons:

i) The major objective of the proposed alignment is to improve the accessibility between Port Qasim and Clifton areas.

ii) In the case where Malir River Bund Road ends at Malir Bridge on Shahrah-e-Faisal, serious traffic congestion and traffic accidents might occur at the section between the connecting points of Malir Bridge and Quaid Abad Flyover.

3) Major controlled points of road alignment

a. Resettlement issue

At the 1 km long section at Feature Colony in Landhi Town, residental houses were standing too close to the left bund of Malir River (refer to **Figure 5.2.5**). A graveyard was also located adjoining the bund in the said section. The road alignment at this section should be considered to mitigate the impact on resettlement issue.

b. Connection with the National Highway (existing road at Yusuf Goth)

Extending Malir River Bund Road from Malir Bridge aims to avoid traffic congestion between the bridge and Quaid Abad Flyover along the National Highway. In order to link with the existing road at Yusuf Goth (refer to **Figure 5.2.5**), a new road, approximately 2.5 km long, will be constructed to connect both roads.

The road section between Malir River Bund Road and the National Highway should be recommended to be categorized as a minor arterial road, while the route of the new construction section should be surveyed to minimize the social negative impacts.

c. Providing interchange along Malir River Bund Road

The Study Team proposes to provide three interchanges along the Malir River Bund Road as shown in **Figure 5.2.6**. The traffic access to the expressway section will be controlled only at the

interchanges.

Source: JICA Study Team

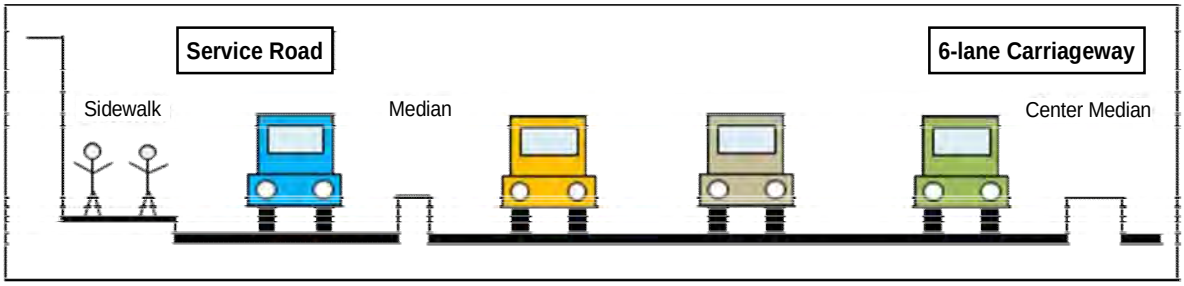
Figure 5.2.6 Proposed Location of the Interchanges on Malir River Bund Road Section

(3) Route 3: Improvement of Shahrah-e-Faisal and the National Road

The current traffic condition on the section between the International Airport intersection along Shahrah-e-Faisal and Port Qasim access road intersection along the National Highway has reached the traffic capacity. The said section must be improved to a six-lane carriageway from the existing four-lane road with the following aspects:

i) Malir Bridge and Quaidabad Flyover are also required to be improved to a six-lane carriageway in order to avoid the gap of traffic capacity.

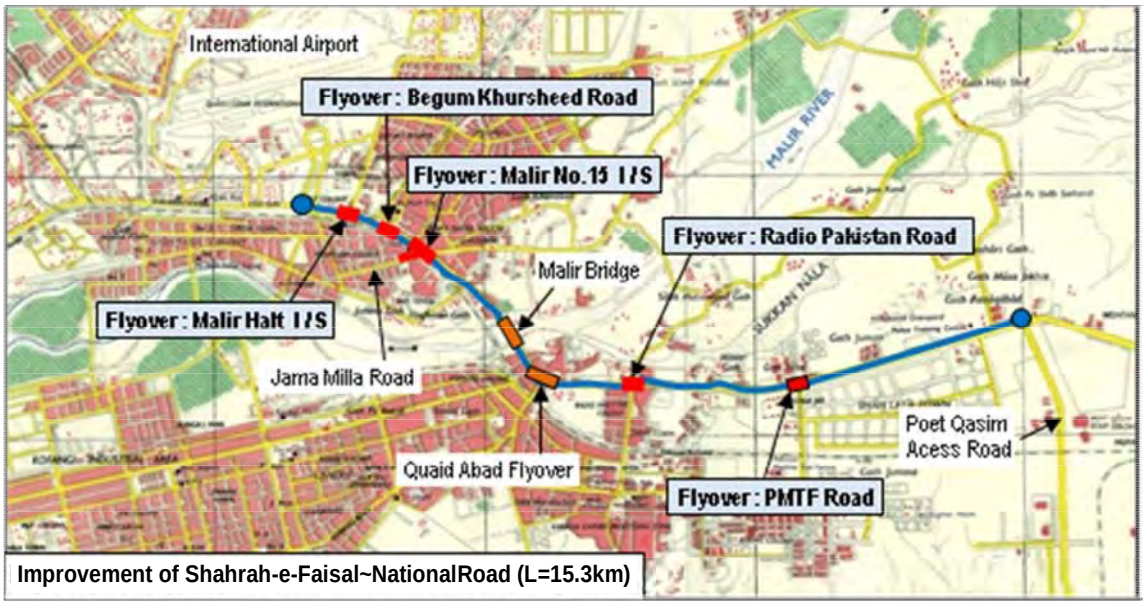
ii) A service road must be provided at the residential, commercial, and industrial areas to separate the community transportation from the main carriageway traffic as illustrated in **Figure 5.2.7**.



Source: JICA Study Team

Figure 5.2.7 Image of a Six-lane Carriageway with Service Road

iii) Five flyovers will be constructed to solve the congestion at major intersections. **Figure 5.2.8** shows the locations of flyover constructions, while **Table 5.2.2** describes the features of each flyover.



Source: JICA Study Team

Figure 5.2.8 Proposed Location of Flyover Bridge of Shahrah-e-Faisal-National Road

Table 5.2.2 Number of Carriageway for Proposed Flyover

Location	Number of Carriageway
Malir Halt Intersection Flyover	Three lanes on one direction (Airport to Port Qasim)
Begum Khursheed Road Intersection Flyover	Three lanes on one direction (Airport to Port Qasim)
Malir No.15 Intersection Flyover	Three lanes on one direction (Airport to Port Qasim) with railway flyover from Jama Milla Road
Radio Pakistan Road Intersection Flyover	Six lanes on both directions
RMTF Road Intersection Flyover	Three lanes on one direction (Airport to Port Qasim)

Source: JICA Study Team

5.3 Traffic Demand Forecast for Alternative Route

5.3.1 Method of Traffic Demand Forecast

(1) General Forecast Flow

The general procedure for calculating the future traffic demand forecast is shown in **Figure 5.3.1**. The procedure is divided into the three major tasks, as follows:

Task 1: Preparation of the present Origin-Destination (OD) tables

In order to establish the present OD tables, traffic surveys are being conducted and zoning systems are being adopted.

Task 2: Preparation of the traffic demand forecast

Various models were developed based on the present OD tables and the socio-economic indicators.

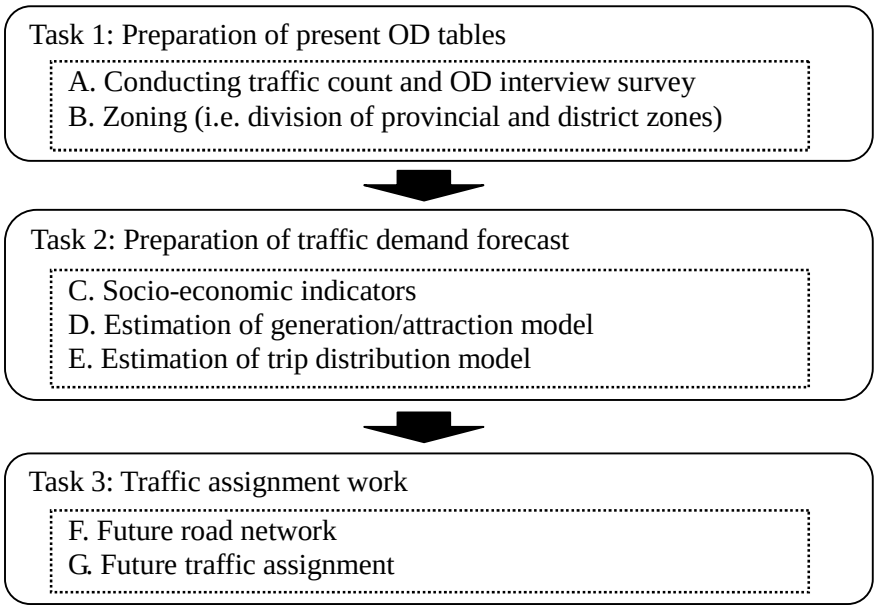
- Generation/Attraction model to predict the volume of generated and attracted vehicles based on the socio-economic indicators for each zone;
- Trip distribution model, which is the process of distributing the generated/attracted trips in

each zone into individual trips between each OD pair and providing a full matrix of trips between all zones.

Task 3: Traffic assignment work

The OD traffic tables are assigned to the road network to obtain the volume of traffic on each link of the network.

This project has used the result of the JICA Study for KTIP as a reference and the forecast flow of KTIP was almost the same as the flow mentioned above. Therefore, the data from KTIP (OD and road network) was utilized in this project.



Source: JICA Study Team

Figure 5.3.1 Procedure for Future Traffic Demand Forecast

(2) OD, Zone and Networks

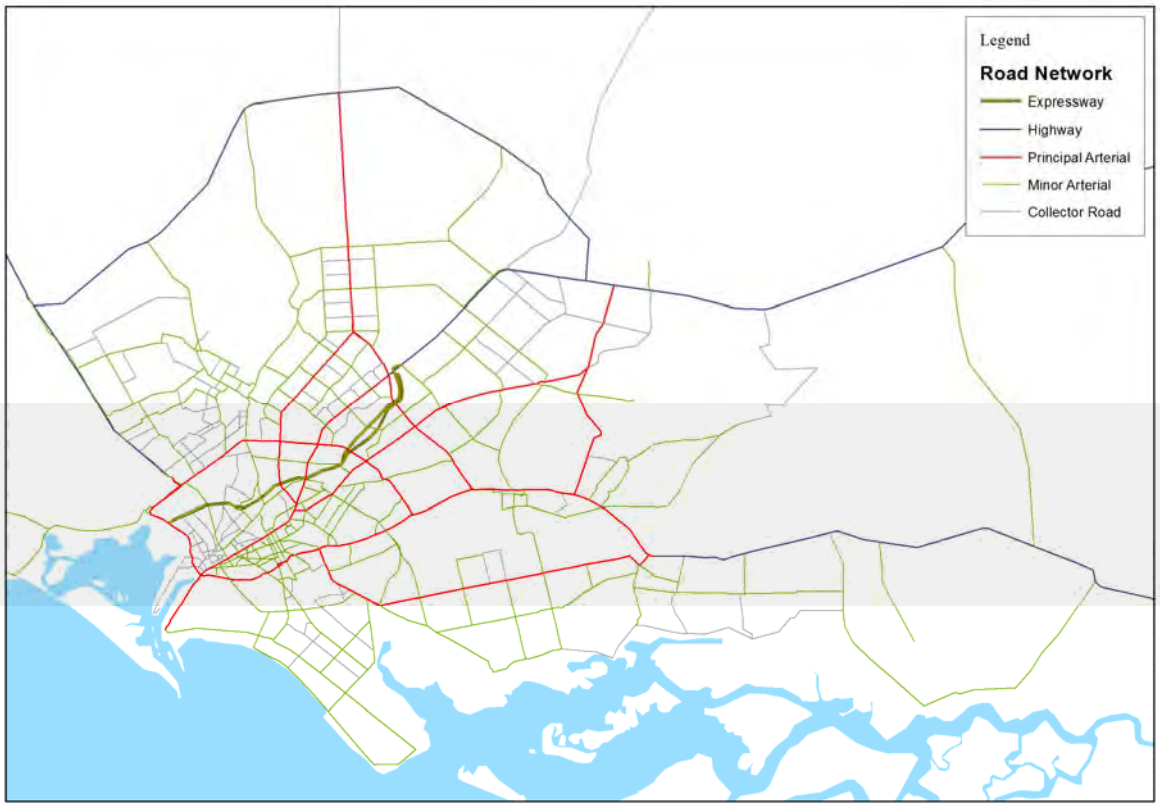
In conducting the traffic demand forecast in this study, OD tables, zoning and road network data calculated in KTIP were utilized. **Figure 5.3.2** shows the present road network.

According to KTIP, the growth of the population and employer from 2010 to 2030 changes in an annual rate of approximately around 3%.

Table 5.2.2 The Growth of Population and Employment

No.	City/Cantonment	Population (1,000)			Employment (1,000)		
		2010	2020	2030	2010	2020	2030
1	Keamari	761.7	1,913.8	2,290.0	800.2	1,304.3	1,708.2
2	S.I.T.E	853.7	894.5	894.5	620.7	565.9	560.9
3	Baldia	864.4	1,110.1	1,110.1	256.4	285.5	308.7
4	Orangi	1,337.7	1,428.9	1,522.5	182.0	186.6	195.3
5	Lyari	938.6	969.3	969.3	81.2	84.9	89.5
6	Saddar	1,104.3	1,122.7	1,233.0	702.8	861.8	989.4
7	Jamshed	1,397.3	1,559.9	1,713.2	262.2	401.1	508.7
8	Gulshan-E-Iqbal	1,458.3	2,373.4	2,684.4	537.6	686.4	802.9
9	Shah Faisal	601.9	611.9	646.9	73.4	80.9	86.5
10	Landhi	1,353.4	1,822.3	1,822.3	348.8	388.6	430.5
11	Korangi	1,285.5	1,825.6	1,825.6	446.1	390.8	379.7
12	North Nazimabad	917.1	979.5	1,043.6	118.3	129.3	138.8
13	New Karachi	1,226.2	1,246.6	1,328.3	279.7	291.9	307.8
14	Gulberg	838.1	895.2	953.8	144.5	143.3	147.9
15	Liaquatabad	1,002.0	1,034.9	1,034.9	96.5	163.3	215.0
16	Malir	780.7	907.1	936.9	149.3	165.9	177.9
17	Bin Qasim	517.8	2,031.7	2,697.3	1,098.1	2,591.1	3,293.4
18	Gadap	538.2	3,077.7	5,059.2	556.7	1,577.4	2,029.7
19	Karachi Cantonment	88.4	90.2	96.1	96.6	165.1	220.9
20	Clifton Cantonment	559.0	770.6	821.1	304.9	350.9	386.1
21	Faisal Cantonment	247.5	352.1	362.6	67.1	219.7	335.4
22	Malir Cantt Civil	205.8	400.3	414.4	74.2	69.0	68.9
23	Manora Cantonment	10.0	10.0	10.0	40.3	32.5	30.2
24	Korangi Cantonment	47.5	121.8	129.8	80.6	193.8	276.8
Total		18,935.1	27,550.2	31,600.0	7,418.0	11,330.0	13,689.0

Source: KTIP



Source: JICA Study Team

Figure 5.3.2 Present Road Network

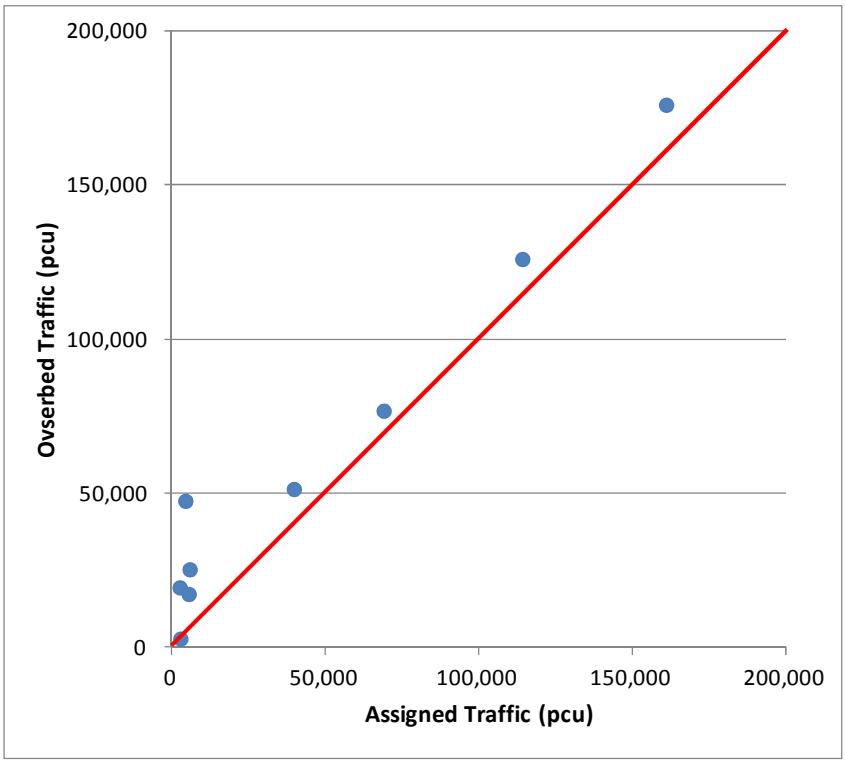
5.3.2 Present Traffic Demand Analysis

(1) Calibration of Present Traffic Demand

To check how accurate the developed models represent the existing transport situation, the output from the models and the existing transport characteristic surveyed were compared. JICA STRADA, a forecasting tool, was used for the present traffic demand analysis. Link volumes that can be estimated as an assignment result on the base year road network were compared with the traffic volumes that were observed by the traffic survey conducted by the JICA Study Team in this Study.

Figure 5.3.3 shows the result of comparison. In the graph, the horizontal line indicates the link volume of traffic assignment in terms of passenger car unit (pcu) and the vertical line indicates observed traffic volumes. The result, which is an equation of y = x, is plotted next to the straight line for a more accurate representation of the models. The correlation coefficient was calculated at 0.97 and this figure indicates that the models are tolerable.

In addition, according to KTIP, the logistics OD of the Qasim Port was not considered in the the existing OD. Therefore, a supplementary survey of the logistics around the port must be conducted to correct OD in the future.

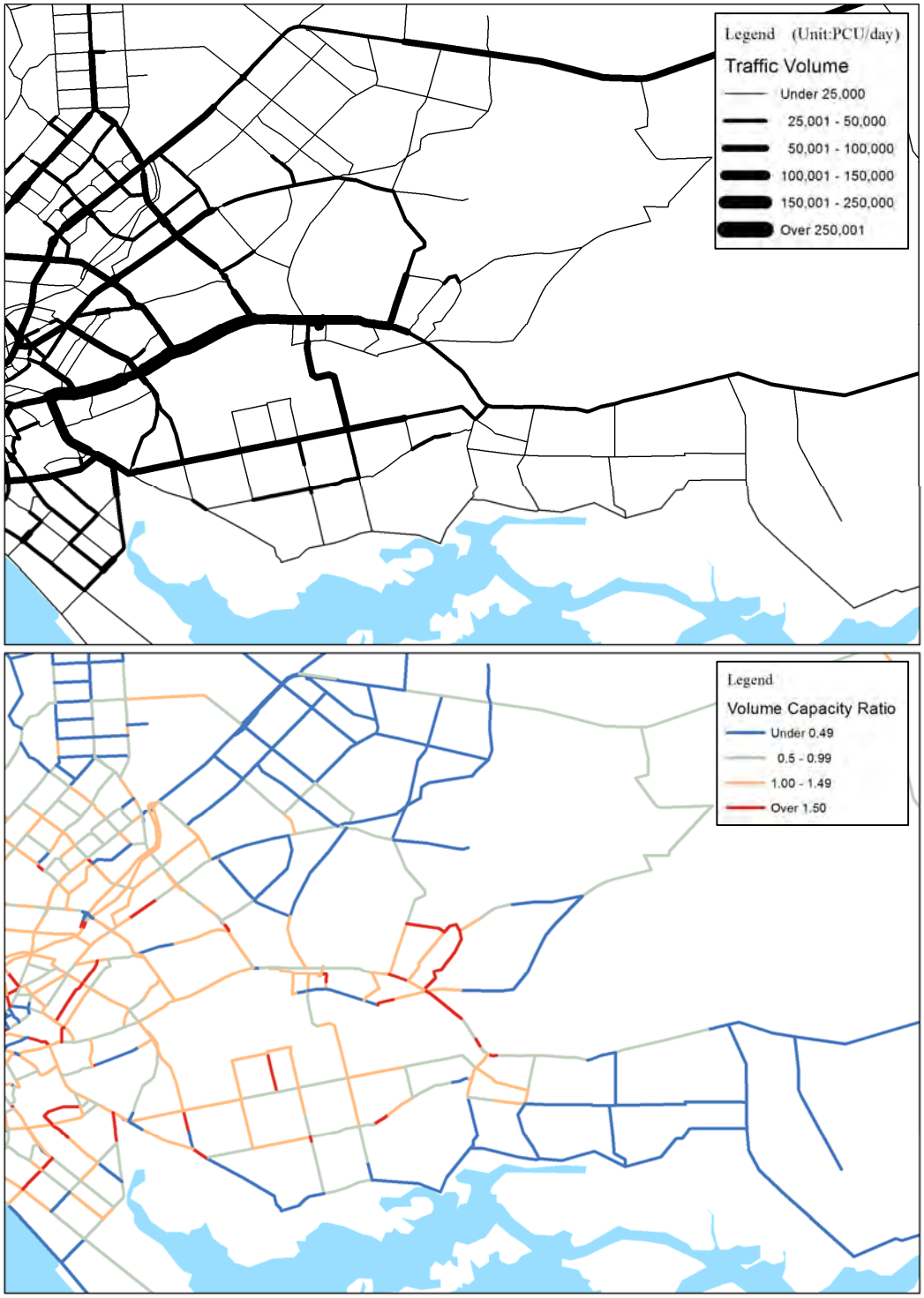


Source: JICA Study Team

Figure 5.3.3 Calibration Result of the Model

(2) Present Traffic Flow Pattern at the Study Area

Figure 5.3.4 shows result of the present traffic demand analysis. The OD and road network data utilized were acquired in 2010 . The main traffic flow was found at the east-west direction. There were many traffic volumes on Shahrah-e-Faisal Road and Kolangi Road, but the volume capacity ratio (VC) is higher.



Source: JICA Study Team

Figure 5.3.4 Present Traffic Demand and Volume Capacity Ratio (2010)

5.3.3 Estimation of Future Traffic Demand

(1) Demand Forecast Scenario

In order to evaluate future traffic demand and road network performance with or without the priority project, the traffic demand forecast was conducted. As shown in **Table 5.3.1**, there are 8 scenarios for the demand forecast. The estimated traffic volumes for 2020 and 2030 were assigned to the road network. Case 1 and Case 2 include the future road network plan without

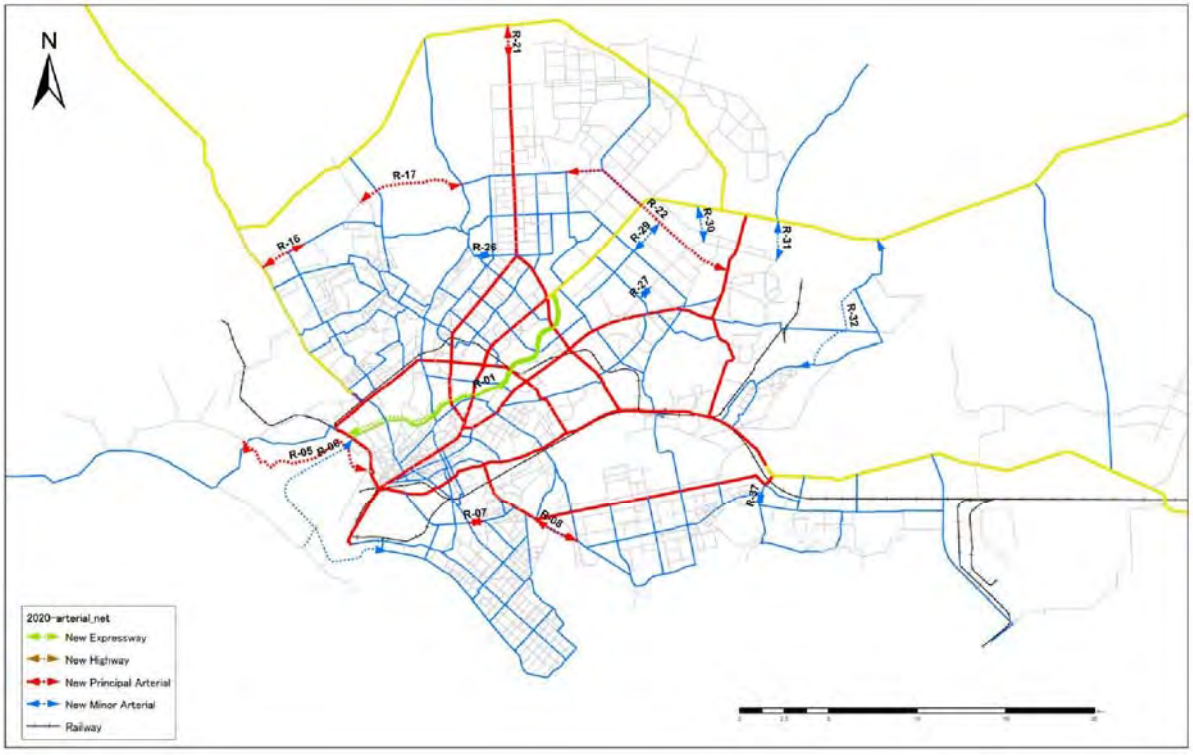
priority project called the "Without" case. Case 3 to Case 8 are "With" cases with priority projects.

Table 5.3.1 Analysis Case and Road Network Composition

Case No.	Case	Year	Malir River Bund Road	Improvement Shahrah-e-Faisal Road	Coastal Road	Future Road network
1	Without	2020				○
2	Without	2030				○
3	With A	2020	○			○
4	With A	2030	○			○
5	With B	2020		○		○
6	With B	2030		○		○
7	With C	2020			○	○
8	With C	2030			○	○

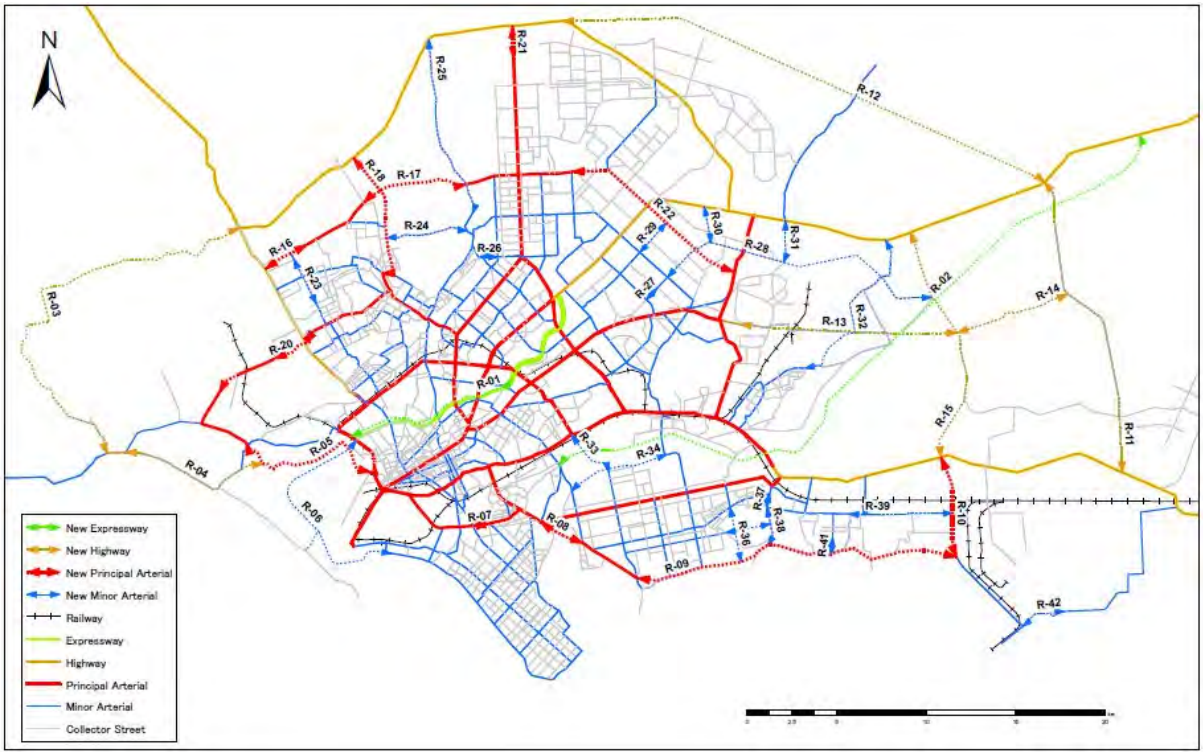
※Note; A: Malir River Bund Road, B: Improvement Shahrah-e-Faisal Road, C: Coastal Road

Source: JICA Study Team



Source: KTIP

Figure 5.3.4 Future Road Network (2020)



Source: KTIP

Figure 5.3.4 Future Road Network (2030)

(2) Results of Future Traffic Demand Forecast

Table 5.3.2 shows the results of traffic demand forecast. This metrics show the level of improvement of the traffic condition. Those marked with a double circle (◎) has the highest effect while that with a triangle (△) has the lowest. All three priority projects will improve the traffic condition in Karachi City. However, the Malir River Bund Road has the highest effect in improving the average volume capacity (VC) ratio, average travel speed, and traffic performance. From the results, the Malir River Bund Road is the most effective among the projects.

Table 5.3.2 Results of Traffic Demand Forecast (Improvement Factor)

Project	VC ratio	Travel Speed	Network Performance	Comprehensive Evaluation
Malir River Bund Road	◎	◎	○	◎
Shahrah-e-Faisal Road	○	○	◎	○
Coastal Road	△	△	△	△

※Network performance: Total Travel Distance and total Travel Time
Source: JICA Study Team

Table 5.3.3 shows the detailed result of road network performance and as prime examples, **Figures 5.3.5** and **5.3.6** show the results of Case 10 and Case 12. The other cases are shown in the **Appendix**.

Table 5.3.3 Detailed Results of the Road Network Performance

Case No	Case	Year	Average Volume Capacity Ratio	Average Travel Speed (km/h)	Total Travel Distance (PCU･km)	Total Travel Time (PCU･h)
1	Without	2020	1.16	36.8	78,341,211	2,127,338
2	Without	2030	1.22	42.5	90,277,466	2,123,120
3	with A	2020	1.04	40.7	76,218,608	1,871,696
4	with A	2030	1.11	43.7	88,728,471	2,030,494
5	with B	2020	1.10	39.4	75,844,337	1,926,954
6	with B	2030	1.17	42.7	88,570,781	2,073,115
7	with C	2020	1.11	38.0	76,494,018	2,015,207
8	with C	2030	1.17	42.9	88,655,554	2,067,231

※Note; A: Malir River Bund Road, B: Improvement Shahrah-e-Faisal Road, C: Coastal Road
Source: JICA Study Team

The summary of the results of future traffic demand forecast is shown below;

1) Without case (Case 1 and Case 2)

Because of constructing future road network, the VC ratio and average travel speed will improve, and it is anticipated that the congestion in Karachi city will decrease.

2) With Malir River Bund Road including future road network case (Case 3 and Case 4)

Similar to “With A” case, in the case of constructing the Malir River Bund Road, the VC ratio greatly decreases in comparison with “Without” case. Some roads will have a decrease in VC ratio by construction of future road in 2030.

3) With Shahrah-e-Faisal Road including future road network case (Case 5 and Case 6)

The VC ratio and average travel speed are almost same in comparison with “Without” case, but these slightly bring improvement compared with “Cases 9 and 10 with C”. Some roads will decrease VC ratio by the construction of future road in 2030, but VC ratio of Shahrah-e-Faisal Road remains over 1.00.

4) With Coastal Road including future road network case (Case 7 and Case 8)

The VC ratio and average travel speed are almost the same in comparison with “Without” case. Although traffic volume on some routes of the Coastal Road in 2030 will decrease in comparison with 2020, it is believed that the trip route will change by the construction of future road network in 2030.

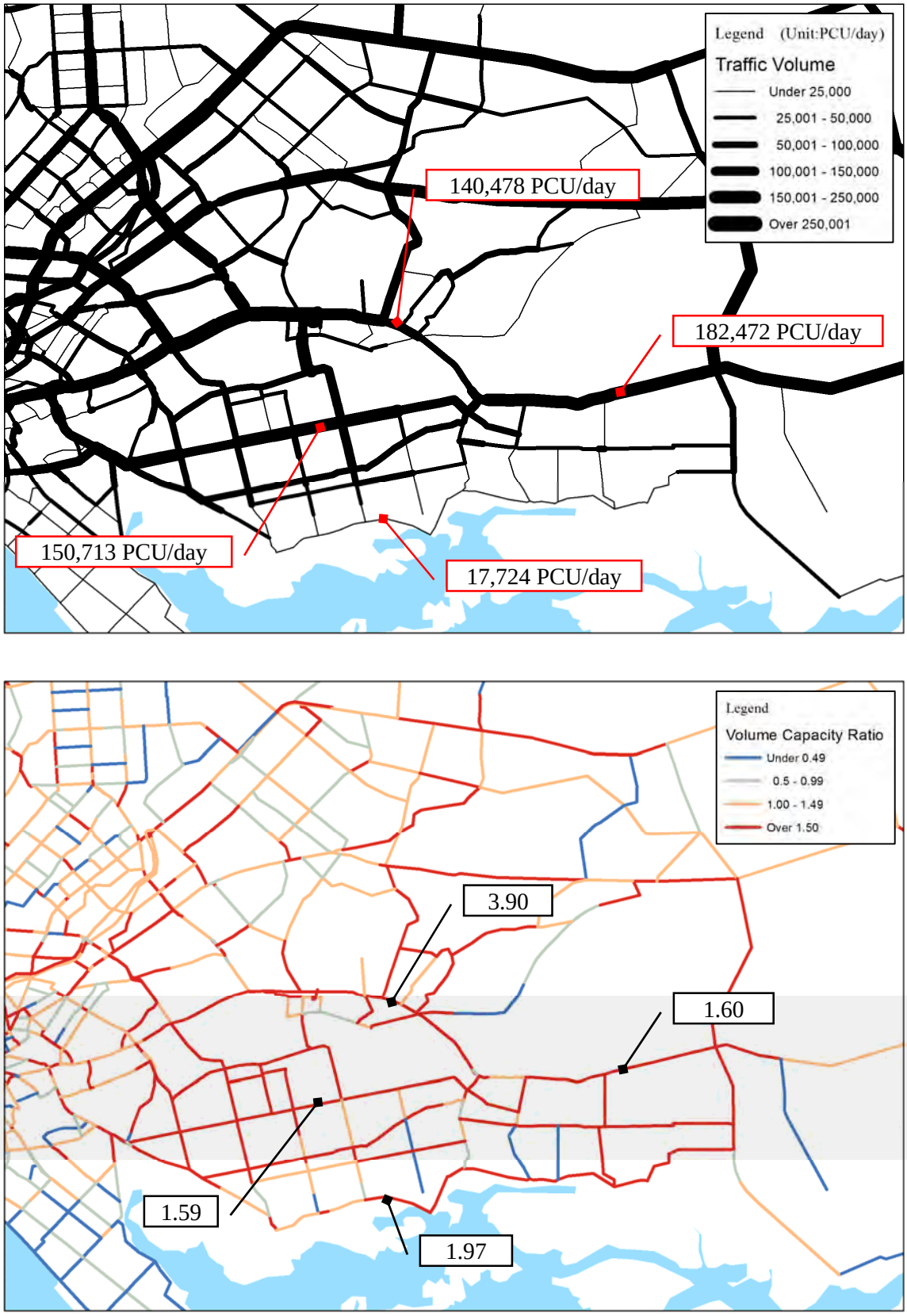
(3) Evaluation of Future Traffic Demand

Table 5.3.4 shows the evaluation of future traffic in 2030 for each priority project. The items shown are traffic demand to change the route, average VC ratio, and average travel time. The Malir River Bund Road Project is the most effective because it will have low VC ratio, high travel speed, and high many traffic demand to change in the route.

Table 5.3.4 Evaluation of the Three Priority Projects

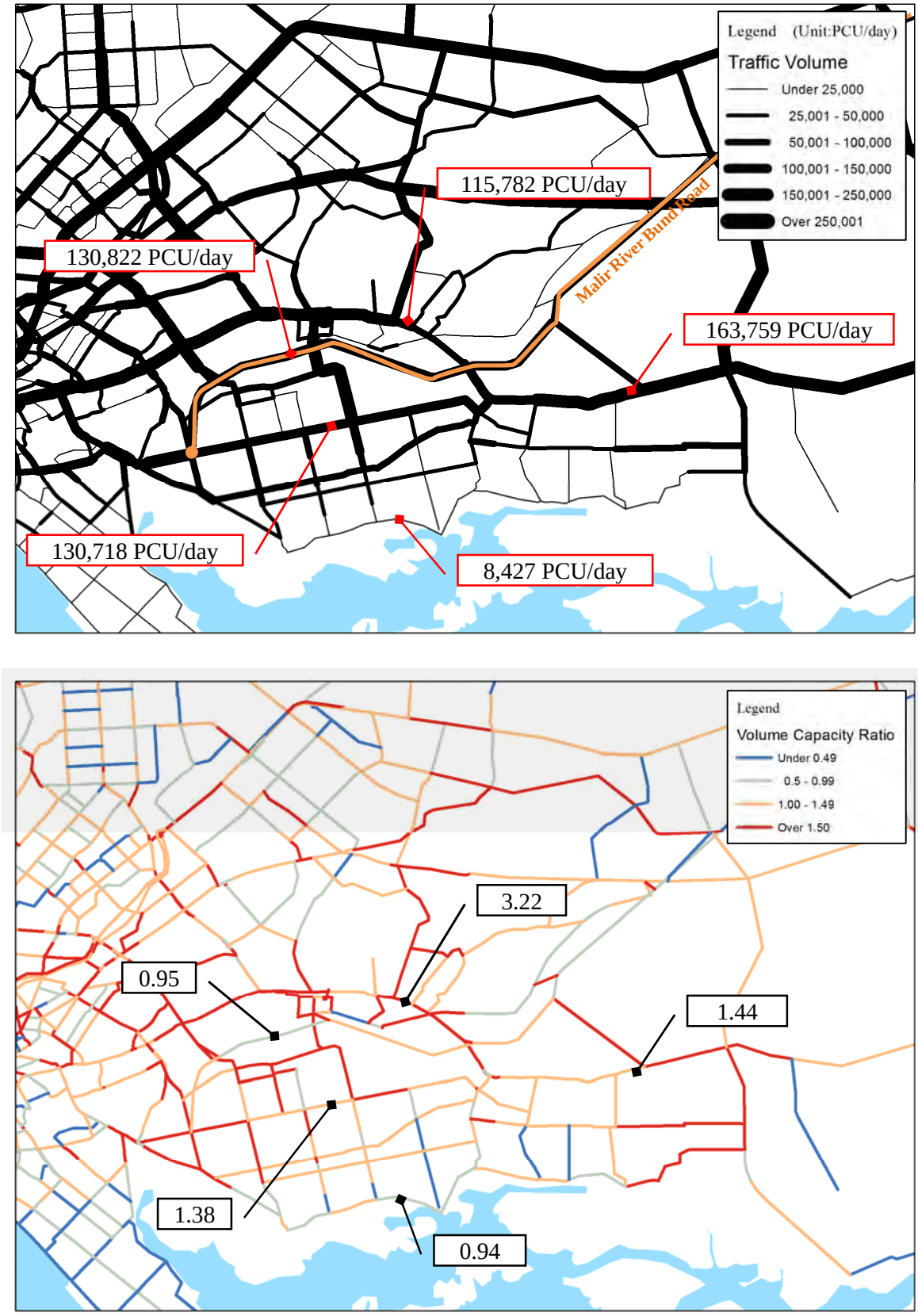
Case No	Priority Project	Traffic Demand to change the route (PCU)	Reference	
			Average Volume Capacity Ratio	Average Travel Speed (km/h)
A	Malir River Bund Road	132,820	0.79	67.1
B	Improvement of Shahrah-e-Faisal / National Highway	94,310	1.39	63.9
C	Coastal Road	53,204	1.34	45.8

Source: JICA Study Team



Source: JICA Study Team

Figure 5.3.5 Future Traffic Demand and Volume Capacity Ratio (Case 2 Without Priority Project, 2030)



Source: JICA Study Team

Figure 5.3.6 Future Traffic Demand and Volume Capacity Ratio
(Case 4 Future Road Network with Malir River Bund Road, 2030)

5.4 Environmental and Social Conditions and ROW Status on Alternative Routes

5.4.1 Route-1: Construction and Rehabilitation of Coastal Road

(1) Regional Socio-economic Baseline along Route

The Coastal Road is the first proposed route among the three priority road development projects to improve accessibility to Port Qasim. Route-1 starts at the intersection of Creek Avenue and Korangi Road, and ends at Port Qasim Access Road. The alignment passes through the towns of Korangi and Bin Qasim.

1) Korangi Town

a. General condition

Korangi Town is bordered by Faisal Cantonment and Shah Faisal Town to the north, Bin Qasim and Landhi to the south and east, Korangi Cantonment to the southwest and Jamshed Town to the west across the Malir River. The population of the Korangi Town was 829,800 in 2005 and 1161,700 in 2010.

b. Livelihood

The people in this area are very hard working and practical. Moreover, the youth plays a major role as counterpart in carrying out household and field activities. Both male and female are mainly responsible for earning money for the family. Generally, the women normally remain very busy looking after all the household tasks such as cooking breakfast, cleaning the house, washing of the pots, and looking after the kids. Most women are also involved in income generating jobs and activities e.g. factory worker, beautician, maids, teachers, sewing of clothes, and knitting of nets. The women in this area are mostly educated and have the authority to interfere with domestic decisions in the morning to carry out routine activities.

Over one forth (27.5%) of Korangi people are gainfully employed. Another point of interest is that the portion of employed people in Korangi is less than in Karachi.

The percentage of those unemployement in Korangi is 13.9%. Of all the occupational groups, the craftsmen and productive workers are predominant at 52%. This is followed by the salesmen and servicemen in the case of Korangi at 19% and 13%, respectively.

c. Economic status

The major industries include textile processing and other industrial units including jute, wool, leather, pharmaceuticals, cosmetics, sanitary, chemicals, engineering, rubber products, paint, oil refineries, food and automobiles industry. Forty percent of Pakistan's leather exports are routed from Korangi town. Similarly, there are 372 textile mills in operation contributing to 7% of Pakistan's total textile exports. As huge as 78% of the crude oil used all over Pakistan is produced by two refineries in Korangi.

2) Bin Qasim Town

a. General condition

Bin Qasim Town is located in the southeastern part of Karachi along the Arabian Sea and the Indus River delta. The town and the adjacent Port Qasim were named after Muhammad bin Qasim who conquered major parts of Pakistan in the eighth century. Bin Qasim is bordered by Gadap Town to the north, Thatta District and the Indus River to the east, the Arabian Sea to the

south, and the Malir River and the towns of Landhi, Malir, and Korangi Cantonment to the west. The local government system was introduced in 2001. The effect of the new system in Karachi was the dissolution of the former Karachi Division and the merger of its five districts to form the new Karachi City District, with 18 autonomous constituent towns including Bin Qasim Town.

d. Livelihood

Most inhabitants in PQA are unprivileged and depend on fishing for their livelihood. The fishermen normally go fishing in various creeks. The main source of their income is generated through fishing, while few inhabitants are engaged in labor, self-employment, and various other services. Nearly 70% of the population is engaged in fishing, 20% in labor, 5% in self-employment, and the remaining 5% in various services. Ibrahim Hyderi is the major fishing harbor area and Kadhero, Mir, and Hajamro creeks are also used for fishing. The fishing community consists of three categories:

i) The first category is comprised of fishermen engaged on large-scale fishing business. They are usually into deep-sea fishing. This category is the least worried about the upcoming project. It comprises nearly 3-5% of the total population of the affected inhabitants. The people that belong in this category are mostly from other areas of the Sindh Province.

ii) The second category of the community is into middle-level fishery and is more concerned with the implementation of the proposed project.

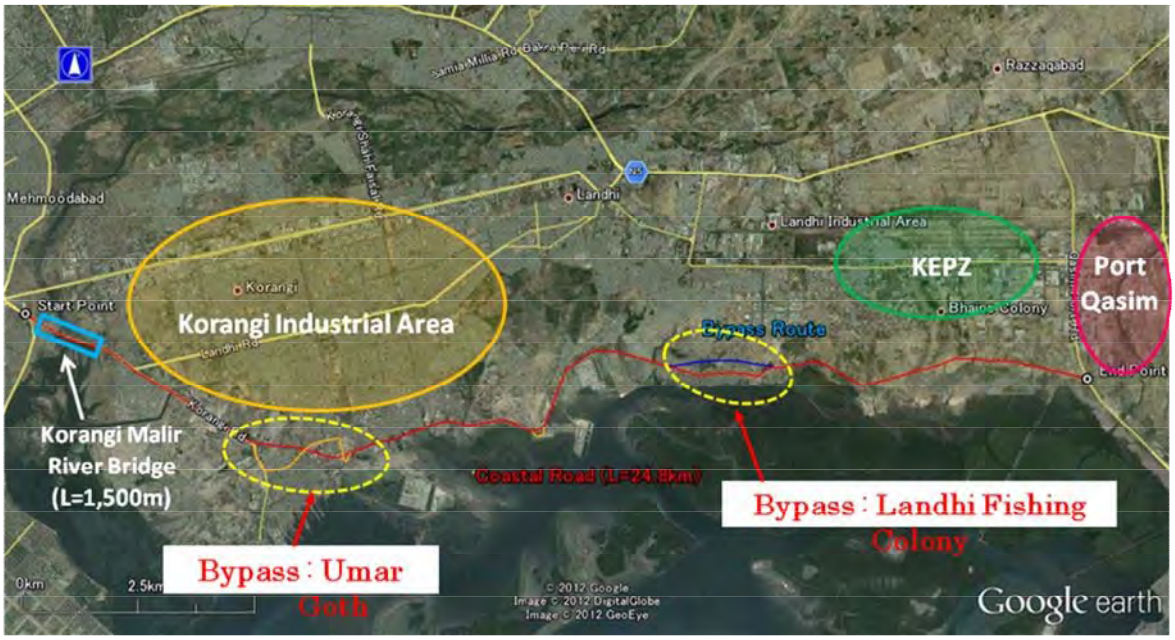
iii) The third category of the community comprises of the unprivileged. The members of this class survive on daily labor work and some consist of the impoverished people. The population in this category is found out to be most concerned with the project.

e. Economic status

The Landhi Industrial Area (LIA), Korangi Association of Trade and Industry (KATI), North Western Industrial Zone of Port Qasim, and Export Processing Zone, besides the steel mills, machine tool factory and other steel mills in the making, are all located in Bin Qasim Town. Both organized and unorganized sector industries are operating in these areas. The major textile processing and other industrial units include Husain Textile Mills, Gul Ahmed, Al-Karam, Yunus Textile Mills, Nakshbandi Industries, Indus Motors, Engro Asahi Polymer & Chemicals, Raja Motors, International Industries, BASF Pakistan, Salfi Textiles, and Olympia Textiles. The Landhi Industrial Area and the Industrial Zone of Port Qasim are special industrial zones. Infrastructure development has gone hand-in-hand with industrial development, which function as the hub of economic development in the region.

(2) Route Alternatives

The existing road passes through two residential areas at Umar Goth and Landhi Fishing Colony, where the houses are standing along the narrow road. In order to avoid removal of a large number of structures which may create social problems among the local population, the route has been suggested with two alternatives. The Study Team proposes to provide the bypass road at two areas as shown in **Figure 5.4.1**.



Source: JICA Study Team

Figure 5.4.1 Proposed Bypass Plan at Residential Area along the Coastal Road

(3) ROW Status

Based on the Road ROW maps of the Revised Master Plan of Roads (1964) provided by the Master Plan Department, the length of the existing road from the beginning to the section of Pak-Arab Limited (PARCO) Oil Tank Terminal before Umar Goth is 300 ft. However, the legal document, which states ROW for the remaining section, could not been found during the Study period. The legal status of ROW for the said section should be clarified at the further stage of the project, F/S stage, or D/D.

(4) Environmental and Social Conditions

a. Affected scale by road construction

It was observed that a large number of natural and manmade features are present along the proposed route that must be removed during project execution. These include RCC structures, temporary structures, kiosks, mosques, utility lines, and trees bushes. The removal of these will likely create a lot of environmental and social problems. It is also worth mentioning that there is a strong political influence in the area which will probably be exploited during the project execution stage. **Table 5.4.1** below gives a preliminary account of the various encroachment as viewed from Google Earth. Furthermore, a detailed survey is required to be carried out before the execution of the project.

Table 5.4.1 Brief Summary of Affected Scale by the Coastal Road Construction

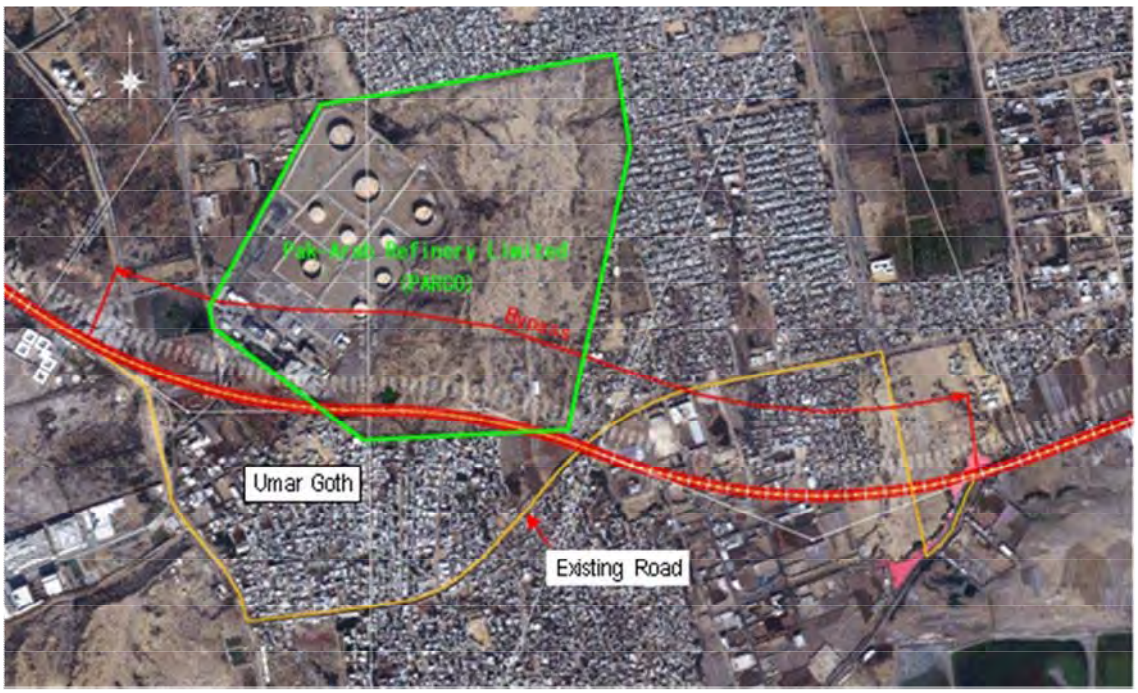
Station No. (km)	Type of Structure House/Shop			Electric Pole	Industry	Cultivated Land	Other	
	Permanent	Encroached	Hut				Tree/Bush	Open Plot
0.0 – 2.0	-	-	-	-	-	-	Yes	Mosque
2.0 – 4.0	-	5	-	-	-	-	Yes	6

Station No. (km)	Type of Structure House/Shop			Electric Pole	Industry	Cultivated Land	Other	
	Permanent	Encroached	Hut				Tree/Bush	Open Plot
4.0 – 6.0	8	10	-	-	-	-	Yes	-
6.0 – 8.0	-	200	-	-	7	-	Yes	-
8.0 – 10.0	-	4	-	-	2	-	Yes	-
10.0 – 12.0	-	6	-	-	-	-	Yes	-
12.0 +14.0	-	10	-	-	7	-	Yes	-
14.0 - 16.0	-	100	-	-	-	-	Yes	-
16.0 – 18.0	-	-	-	-	-	-	Yes	-
18.0 - 20.0	-	-	-	-	-	-	Yes	-
20.0 – 22.0	-	-	-	-	-	-	Yes	-
22.0 – 22.7	-	-	-	-	-	-	Yes	-

Source: JICA Study Team

b. Option of counter measure for resettlement issue

The road alignment at sections of Umar Goth and Landhi Fishing Colony were proposed to provide the bypass road in order to mitigate the impacts of resettlement. However, the bypass route at Umar Goth must pass through the the property of PARCO due to the limited open area, as shown in **Figure 5.4.2**.



Source: JICA Study Team

Figure 5.4.2 Proposed Bypass Plan at Umar Goth Section

5.4.2 Route-2: Construction of the Malir River Bund Road

(1) Regional Socio-economic Baseline along Route

The Malir River Bund Road starts at the intersection of main Korangi Industrial road and Korangi Industrial Area (300) road, and ends on the National Highway at Goth Juman, which passes through Korangi, Landhi, and Bin Qasim Towns. The socio-economic baseline of Landhi Town is described below.

a. General condition

Landhi Town is a large industrial town in the eastern part of Karachi, Sindh, Pakistan. It is bordered by the Faisal Cantonment and Shah Faisal Town to the north across the Malir River, Bin Qasim Town to the east and south, and Korangi Town to the west. The population of Landhi Town was estimated to be over 660,000 in the 1998 census, of which 99% are Muslim. Muhajirs and Pashtuns constitute an overwhelming majority of the population. There are 12 union councils in Landhi Town which includes Awami Colony, Bhutto Nagar, Burmee Colony, Dawood Chowrangi, Khawaja Ajmeer Colony, Korangi, Landhi, Moinabad, Muslimabad, Muzafarabad, Sharafi Goth, and Sherabad.

The town of Landhi is a middle-class area. The municipal administration office is at Landhi 5. This includes the neighborhoods of Dawood Chowrangi, Quaidabad, Malir, Moinabad, Muslimabad, and Muzafarabad, which form a cluster in the east of the town. The neighborhood of Sharafi Goth in the north of the town along the Malir River is the least densely populated neighborhood. Baber Market at Landhi 3 is the biggest market of the town. The town was initially built for Mohajirs who came to Pakistan from India. It was generally a planned area but due to the inefficiency of the local government and corruption at grass roots and upper levels, it has made the town a *katchi abadi* (ramshackle neighborhood). There were several forced take-overs of government parks and lands. Also, encroachments of government land in front of residential houses and commercial areas has completely re-shaped the Landhi Town.

b. Livelihood

Landhi Town is an industrial and commercial area having multi-occupations. A major portion of the population consists of the labor class including skilled and unskilled laborers. Most of the teenagers and women work in factories to help their families. A portion of the population have different occupations including government and private services.

c. Industrial condition

Landhi Industrial Area is one of the pioneer industrial states in Pakistan and was established in 1949. The jurisdiction of this estate begins from Farooqe Textile Mill located at 8000 Feet Road to Port Qasim including Karachi Export Processing Zone and all industries located at the National Highway to Khagar Phtak. It encompasses about 11,000 acres (45 km^2) of land. The Landhi Industrial Area houses medium and large size industries.

The industrial area houses many industries including textile, steel, pharmaceutics, automobile, chemical, engineering, and flour mills. The industrial lots in the Landhi Industrial Area are approximately 1200 in total, of which the average size is 10 acres (40,000 m^2). The industrial estate benefits from the proximity of Port Qasim and Jinnah International Airport as well as rail and road links to the rest of Pakistan.

(2) Route Alternates

The Study Team has studied connecting the National Highway with Malir River Bund Road.

Three alternative routes as shown in **Figure 5.4.3** are established, and the Alternative Route-2 is selected for the following reasons;

i) The Alternative Route-1 has land acquisition and resettlement issuess at Quaid Abad area where it is connected with the National Highway.

ii) The Alternative Route-3 is to use the existing road, which is directly connected with the Port Qasim Access Road. However, this route has longer distance from Port Qasim Intersection on National Highway to Malir River.

iii) The Alternative Route-2 has utilized the existing road at Goth Juman. Between the end point of Malir River Bund Road and the said existing road, a new 2.55 km road will be constructed. The length of the new road is shorter than that of the Alternative Route-3.

Source: JICA Study Team

Figure 5.4.3 Proposed Alignment and Route Alternative for Malir River Bund Road

(3) ROW Status

The existing ROW for the Malir River Bund up to Shahrah-e-Faisal is 110 ft (33.5 m) from centre of the river bund. The source for this ROW was taken from the decision given by the Honorable High Court of Sindh, which was issued on October 21, 2010.

However, the legal document on the ROW after Shahrah-e-Faisal section has not been found during the Study period. The legal status of ROW for the said section should be clarified at the further project stage.

(4) Environmental and Social Conditions

a. Affected scale by road construction

During the field survey of the route, it was observed that a large number of encroachments were present on the road. The major portion of these comprised of encroached houses in clusters. In addition, a portion of few industries and a graveyard also lie along the ROW. A large portion has also been encroached with cultivated land. **Table 5.4.2** gives a preliminary account of the various encroachments as viewed from Google Earth view. Furthermore, a detailed survey is required to be carried out before the execution of the project.

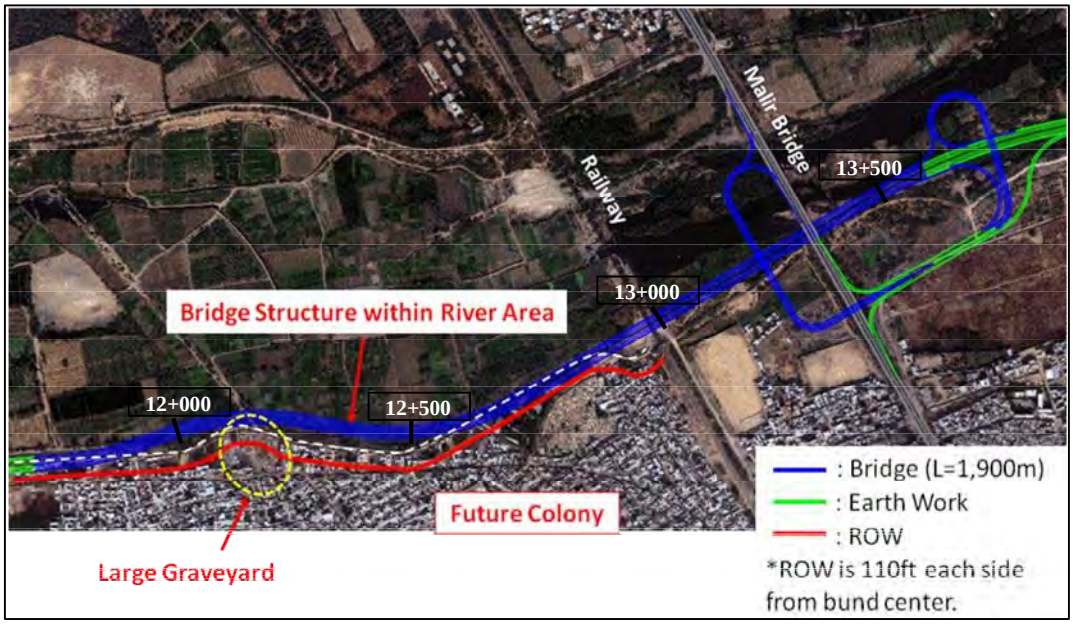
Table 5.4.2 Brief Summary of Affected Scale by the Malir River Bund Road Construction

Station No. (km)	Type of Structure House/Shop			Electric Pole	Industry	Cultivated Land	Other	
	Permanent	Encroached	Hut				Tree/ Bush	Open Plot
0 .0 – 2.0	3	43	-	4 H	1	-	-	-
2.0 – 4.0	-	70	-	-	5	-	-	3
4.0 – 6.0	-	56	-	-	1	-	-	6
6.0 – 8.0	-	70	-	-	-	3	-	-
8.0 – 10.0	2	12	-	-	-	7	Yes	-
10.0 – 12.0	-	60	4	-	-	14	-	6
12.0 - 14.0	-	110	5	-	4	8	Yes	2 Graveyard
14.0 - 16.0	-	1	-	-	-	18	Yes	-
16.0 - 18.0	-	10	-	-	-	5	Yes	-
18.0 – 20.0	-	-	-	-	-	-	Yes	-
20.0 – 22.0	-	-	-	-	-	-	Yes	-
22.0 – 24.0	-	-	-	-	-	-	-	-
24.0 – 26.0	-	-	-	-	-	-	-	-

Source: JICA Study Team

b. Option of counter measure for resettlement issue

At Future Colony on the proposed route of Malir River Bund Road, the residential houses are standing within the ROW (110 ft from the center of bund) and a large portion a graveyard is also located, as shown in **Figure 5.4.4**. The final expressway alignment shall be determined through EIA and RAP studies. In order to minimize the impacts of resettlement, the construction of the bridge structure of the expressway within the river area should be considered as a mitigation measure option in the next stage of EIA and RAP studies.



Source: JICA Study Team

Figure 5.4.4 Mitigation Measures for Resettlement at Future Colony

5.4.3 Improvement of the Shahrah-e-Faisal–National Road

(1) Regional Socio-economic Baseline along Route

The improvement of Shahrah-e-Faisal/National Highway Road starts at the intersection of Shahrah-e-Faisal and Jinnah Terminal road, and ends at the intersection with Port Qasim road, which passes through the towns of Malir and Bin Qasim. The socio-economic baseline of Malir Town is described below:

a. General condition

Malir Town is bordered by Jinnah International Airport, Malir Cantonment to the west and north, the Malir River and Shah Faisal Town to the South and Gadap Town to the East across the Thado Nallo stream. The entire town is comprised of developed areas and the physical features have defined it in such a way that it is feasible to maintain it despite the estimated population being around 400,000 in 1998. There are seven union councils in Malir Town which are Model Colony Uc-01, Kala Board Uc-02, Saudabad Uc-03, Khokarapar Uc-04, Jafar-E-Tayyar Uc-05, Gharibabad Uc-06, and Ghazi Brohi Goth Uc-07.

b. Livelihood

Malir is an industrial and commercial town having multi-occupations. The main occupation of the people is in business and trade. The other major portion of the population consists of the labor class including skilled and unskilled laborers. The remaining small portion of the population has different occupations including government and private services as well as agriculture. The women also assist their men in the economic activity in different fields of business, service, education, and other institutions. Women mostly serve in schools, colleges, and hospitals.

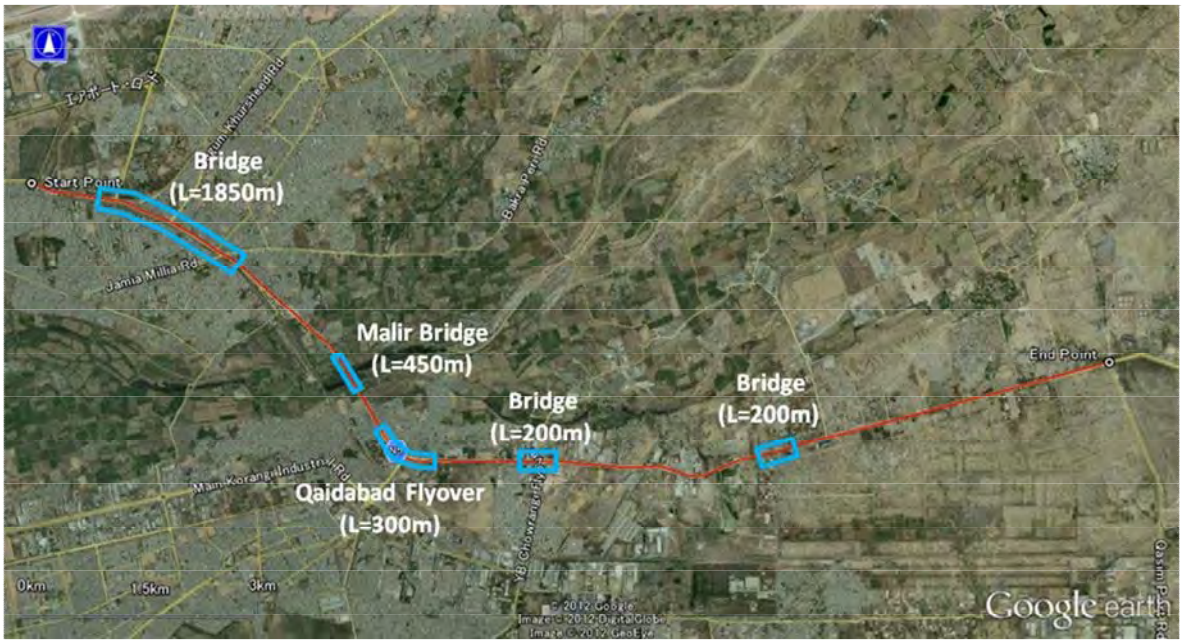
c. Economic Status

Pakistan Steel Mills, located in Malir Town, is the country's largest industrial unit having a production capacity of 1.1 million tons of steel. The foundation of this vital and gigantic project was laid by the then Prime Minister (Mr. Zulfikar Ali Bhutto) in December 30, 1973. It was built with a cost of Rs14 billion including Rs7 billion of foreign exchange. The mill is spread over an area of 18,660 acres including 10,390 acres for the main plant, and 8070 acres for 110-MG water reservoir. The mill provides employment to more than 21,000 persons on regular basis whereas about 3000 daily wageworkers, Retainers are engaged on piece job basis including capital repair and emergency work.

Karachi Airport is the gateway situated in Malir Town to the east. It was built in 1924 when aviation was in its early years. In 1928, it became the port of entry into India for the Imperial Airways. At the time of independence, this was the only airport in good shape and it met the national and international requirements. During the last 26 years, it has a fully equipped flight information center, area control center, radar approach control, and air traffic control tower providing services for the operation of aircrafts.

(2) Route Alternates

The section of Shahrah-e-Faisal/National Road between International Airport and Port of Qasim access road will be improved to a six-lane carriageway provided with a service road. Five locations for bridge construction as shown in **Figure 5.4.5** will be included in the project component. The existing Malir Bridge and Quad Abad flyover will also be expanded to a six-lane carriageway.



Source: JICA Study Team

Figure 5.4.5 Location of Bridge Construction on Shahrah-e-Faisal – National Road Improvement

(3) ROW Status

It has been learned from KMC that the existing ROW is 75 ft on each side from center of the existing road between International Airport and Quaid Abad flyover. However, the legal document stating the ROW after Quaid Abad flyover toward Port Qasim section has not been found during the study period. The legal status of ROW for the said section should be clarified at the further project stage. Based on the location condition of the existing industry building at the said section, the ROW is approximately 100 ft from the existing road center.

(4) Environmental and Social Conditions

Preliminary survey of the route indicates the presence of RCC structures in the form of shops and temporary kiosks of various types. In addition, a large number of fruit and vegetable vendors on pushcarts also encroach the ROW. Two mosques and a large number of trees are also present. Table 5.4.3 gives a preliminary account of the various encroachments seen viewed from Google Earth. Furthermore, a detailed survey is required to be carried out before the execution of project.

Table 5.4.3 Brief Summary of Affected Scale by Project Improvement

Station No.	Type of Structure House/Shop			Electric Pole	Industry	Cultivated Land	Other	
	Permanent	Encroached	Hut				Tree/ Bush	Open Plot
0.0–2.0	15	-	-	-	-	-	Yes	-
2.0-4.0	185	-	-	-	-	-	Yes	Mosque
4.0–6.0	90	6	-	-	-	-	Yes	-
6.0–8.0	120	-	-	-	2	-	Yes	Mosque
8.0–10.0	40	-	-	-	-	-	Yes	-
10.0–12.0	55	-	-	-	-	-	Yes	6

Station No.	Type of Structure House/Shop			Electric Pole	Industry	Cultivated Land	Other	
	Permanent	Encroached	Hut				Tree/ Bush	Open Plot
12.0–14.0	-	-	-	-	-	8	Yes	-
14.0–16.0	-	-	-	-	-	-	-	-

Source: JICA Study Team

5.5 Preliminary Engineering Study for Alternative Road Projects

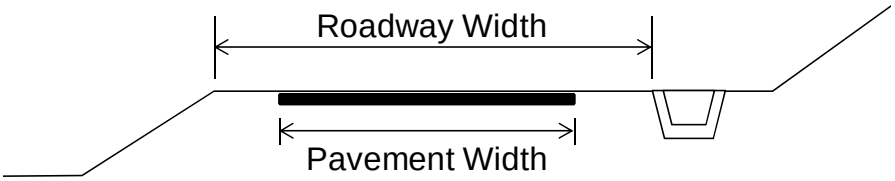
5.5.1 Route-1: Construction and Rehabilitation of Coastal Road

(1) Existing Road Inventory/ Utility Conditions

The objective of the road inventory survey is to grasp the present road conditions and public utilities. The results of survey are shown below.

1) Road width

Pavement, roadway, shoulder, median, and sidewalk width were surveyed at the point where the width may change visually. Pavement and roadway width are defined in **Figure 5.5.1**. In addition, number of lanes and presence or absence of service road, and median were confirmed at site. **Table 5.5.1** shows the results of the road width survey conducted for Route-1.



Source: JICA Study Team

Figure 5.5.1 Definition of Pavement and Roadway Width

Table 5.5.1 Road Survey Results of Route-1 (Road Width)

	Pavement Width (m)	Number of Lanes	Median	Others
Korangi Road	14.6	4	0.6	There is 1.7 m wide sidewalk on both sides (Sta.2+700 to 5+000).
Creek Road and Coast Road	6 ~7	2	-	

Source: JICA Study Team

2) Pavement

The type of pavement was grouped under asphalt, gravel, and earthen; and the pavement condition was classified into three categories (good, fair or bad) by visual checking. **Table 5.5.2** shows the results of the road pavement survey conducted for Route-1.

Table 5.5.2 Road Survey Results of Route-1 (Pavement)

Type		Asphalt
Condition	Good	12 %
	Fair	33 %
	Bad	54 %
Others	Potholes	Sta.3+300, 6+200, 6+700, 7+200, 7+400, 7+500, 7+700, 8+200, 8+700, 9+100, 9+600, 9+700, 10+000, 12+350, 12+850, 13+050, 18+900, 19+000, 19+430
	Cracks	Sta.5+500, 12+250, 13+950, 14+000, 14+200, 14+350, 15+000, 15+500, 15;750, 15+950, 17+560, 18+500, 19+530, 19+600

Source: JICA Study Team

3) Drainage

The location and type of drainage (box or pipe) were confirmed at site, and structure size was measured. **Table 5.5.3** shows the results of the road drainage survey conducted for Route-1.

Table 5.5.3 Road Survey Results of Route-1 (Drainage)

Station	Structure Type (Box or pipe)	Structure Size (m)	Remarks
2+200	Box Drain	1.7	
2+700	Box Drain	1.7	
3+800	Box Drain	1.7	
4+600	Box Drain	1.7	
5+000	Box Drain	1.7	
8+700 (L/S)	Open Drain	0.7	5.5 m from left side road edge
18+225	Box Drain	1.5	

Source: JICA Study Team

4) Bridge and culvert

The location and type of bridge and culvert were confirmed at site, and length and width were measured. **Table 5.5.4** shows the results of the road bridge and culvert survey conducted for Route-1.

Table 5.5.4 Road Survey Results of Route-1 (Bridge and Culvert)

Station	Type	Length (m)	Width (m)
0+700~1+500	Bridge (Korangi Malir River Bridge)	800	17.3
1+530	Box Culvert	12.2	14.1
3+300	Slab Bridge	6.9	100
7+400	Pipe Culvert	7	4
7+500	Slab Culvert	7	4
8+700	Slab Culvert	8	4.5
9+100	Slab Culvert	7.5	4.2
9+700	Pipe Culvert	7	2.5
10+000	Pipe Culvert	7	2.5
10+450	Pipe Culvert	7	2.5
11+125	Pipe Culvert	7	3
11+175	Pipe Culvert	7	4

Station	Type	Length (m)	Width (m)
12+350	Slab Culvert	7	3
12+850	Slab Culvert	7	3
13+050	Slab Culvert	7	3
13+950	Slab Culvert	7	3
14+000	Slab Culvert	7	3
15+500	Pipe Culvert	4.9	4
15+750	Slab Culvert	7.3	4
15+950	Slab Culvert	10.3	2.1
16+600	Slab Culvert	10.3	2.1
17+560	Slab Culvert	9.3	5.5
19+000	Pipe Culvert	7.5	4
19+430	Pipe Culvert	7.5	4
19+530	Pipe Culvert	7.5	4
19+600	Pipe Culvert	7.5	4
19+720	Pipe Culvert	8	7
19+830	Pipe Culvert	8	7
19+960	Pipe Culvert	8	7
20+030	Pipe Culvert	10.3	5
20+260	Pipe Culvert	10.3	5
20+360	Pipe Culvert	10.3	5
20+560	Pipe Culvert	10.3	9
20+740	Pipe Culvert	10.3	5
20+950	Pipe Culvert	10.3	5

Source: JICA Study Team

5) Condition of land use along road

Land use was classified into commercial area, residential area, industrial area, etc., based on visual observation. **Table 5.5.5** shows the results of the land use survey conducted for Route-1.

Table 5.5.5 Road Survey Results of Route1 (Condition of Land Use Along Road)

Station	Land Type	Land Use
2+000~2+700	Commercial/Residential	Shops and Houses
5+900~7+700	Commercial/Residential	Shops, Houses, and Factory
11+000	Commercial	Poultry Farm
13+050 (L/S)	Commercial	Fish Factory
13+950~14+200	Residential	Houses
14+350	Commercial	Petrol Pump
15+500 (R/S)	Commercial	Houses and Factory

Source: JICA Study Team

6) Public utilities

The existing public utilities along Route-1 were surveyed for both underground and overhead, and the information on the detailed location was identified. The underground utilities were surveyed by site observation and were based from collected relevant documents (e.g., maps of existing pipe for water, sewer, gas, etc.,) from the concerned agencies. **Table 5.5.6** shows the results of the public utilities survey conducted for Route-1.

Table 5.5.6 Road Survey Results of Route-1 (Public Utilities)

Item	Unit	Value	Remarks
High-Tension Pylon	no.	29	
Cable (Telephone and Electric)	km	41.8	
Telephone Pole	no.	42	
Electric Pole	no.	238	
Underground Electric Cable	m	8,828	11 kVA, 220 kVA
Gas Pipe	m	7,375	Diameters of 1", 2", 4", 6", 20", and 24"
Manhole	no.	136	

Source: JICA Study Team

The Study Team considered the present conditions of the existing road and conducted the preliminary design.

(2) Proposed Project Components

1) Widening and rehabilitation of the existing road

The Study Team conducted the preliminary design for the six-lane widening with a total length of 24.8 km.

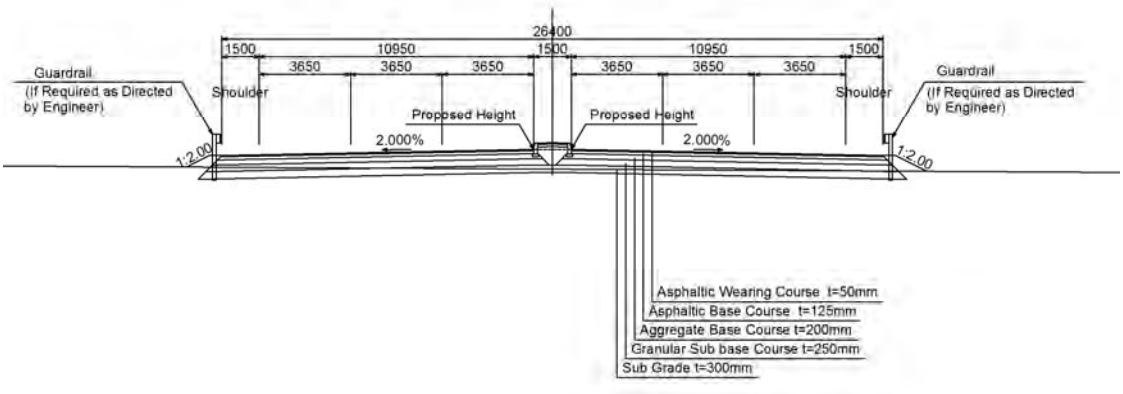
The outline and typical cross section of Route-1 are detailed in **Table 5.5.7** and illustrated in **Figure 5.5.2**.

Plan and typical cross section of Route-1 are attached in Volume III-Drawings.

Table 5.5.7 Outline of Route-1

Start Point	The Intersection with Creek Avenue on Korangi Road
End Point	Port Qasim access road
Design Speed	80 km/h
Length	24.8 km
Number of Lane	6 lanes on both directions
Width of Carriageway	3.65 m
Bridge	One (1) bridge (Length: 1500 m)

Source: JICA Study Team



Source: JICA Study Team

Figure 5.5.2 Typical Cross Section (Route-1)

(3) Rough Cost Estimation

Construction and rehabilitation of Coastal Road: US$95,180,000 (Rs8,614,000,000)
Rate: US$1.00 = Rs90.498

The composition of the project costs is shown in **Table 5.5.8**, while the detailed breakdown of quantities and costs are attached in **Appendix 3**.

Table 5.5.8 Total Project Cost of Route-1

Work Category	Cost (US$)	Cost (Rs)
Construction Cost	67,250,000	6,087,000,000
Resettlement Cost	6,370,000	576,000,000
Land Acquisition Cost	700,000	63,000,000
Relocation Cost	20,860,000	1,888,000,000
Total Project Cost	95,180,000	8,614,000,000

Source: JICA Study Team

5.5.2 Route-2: Construction of Malir River Bund Road

(1) Existing Road Inventory/ Utility Conditions

See sub-section 5.5.1 (1) for the specification of road inventory survey. The road inventory survey of Route-2 was carried out in the same way as Route-1.

1) Road width

Table 5.5.9 shows the results of the road width survey conducted for Route-2.

Table 5.5.9 Road Survey Result of Route-2 (Road Width)

	Pavement Width (m)	Number of Lanes	Median
Korangi Industrial Area (3000) Road	14.6	4	7.08
Malir River Bund	5	-	-

Source: JICA Study Team

2) Pavement

Table 5.5.10 shows the results of the road pavement survey conducted for Route-2.

Table 5.5.10 Road Survey Result of Route-2 (Pavement)

Type		Asphalt
Condition of Korangi Industrial Road	Good	0 %
	Fair	100 %
	Bad	0 %
Malir River Bund		Unsurfaced road
Others	Potholes	-
	Cracks	-

Source: JICA Study Team

3) Condition of land use along road

Table 5.5.11 shows the results of the land use survey conducted for Route-2.

Table 5.5.11 Road Survey Results of Route-2 (Condition of Land Use along Road)

Station	Land Type	Land Use
0+000~1+000	Commercial	Petrol Pump, Cotton Godown, OCS Office and Shops
1+500~2+500 (R/S)	Residential	Houses
7+500 (R/S)	Residential	Houses
11+500~13+000	Residential	Houses
24+200~24+800 (L/S)	Residential	Houses
26+100~26+400	Residential	Houses

Source: JICA Study Team

4) Public utilities

Table 5.5.12 shows the results of the public utilities survey conducted for Route-2.

Table 5.5.12 Road Survey Results of Route-2 (Public Utilities)

Item	Unit	Value	Remarks
High-Tension Pylon	no.	2	
Cable (Telephone & Electric)	km	3.0	
Telephone Pole	no.	19	
Electric Pole	no.	60	
Water Line	m	1,134	Diameters of 8” and 15”
Sewerage Line	m	1,082	Diameters of 24” and 48”
Underground Electric Cable	m	865	11 kVA
Gas Pipe	m	4,545	Diameters of 1”, 2”, 4”, 6”, and 8”

Source: JICA Study Team

The Study Team considered the present condition of the existing road (plan, profile, and public utilities), and conducted the preliminary design accordingly.

(2) Proposed Project Components

1) Widening of existing road

The Study Team conducted the preliminary design, for the widening of the Korangi Industrial Area (3000 Feet) Road to six lanes (1.3 km).

2) Construction of the Malir River Bund Road

The Study Team conducted the preliminary design for six lanes with length of 12.2 km on the left side of bund, and also for the six lanes with a length of 7.4 km connecting with the National Highway .

For details, see Chapter 6 (Pre-Feasibility Study of Recommended Road Development Project).

(3) Rough Cost Estimation

Construction of Malir River Bund Road: US$238,910,000 (Rs 21,621,000,000)
Rate: US$1.00= Rs 90.498

For details, see Chapter 6 (Pre-Feasibility Study of Recommended Road Development Project).

The breakdown of quantities and costs are attached in **Appendix 3**.

5.5.3 Route-3: Improvement of Shahrah-e-Faisal-National Road

(1) Existing Road Inventory/ Utility Conditions

See sub-section 5.5.1 (1) for the specification of road inventory survey. The road inventory survey of Route-3 was carried out in the same way as Route-1.

1) Road width

Table 5.5.13 shows the results of the road width survey conducted for Route-3.

Table 5.5.13 Road Survey Results of Route-3 (Road Width)

Pavement Width (m)	Number of Lanes	Median
14 to 20	4	1.5

Source: JICA Study Team

2) Service road

Table 5.5.14 shows the results of the service road survey conducted for Route-3.

Table 5.5.14 Road Survey Results of Route-3 (Service Road)

Station	Side	Width (m)	Number of lanes
1+400 to 2+000	Left	6.7	2
2+500	Left	4.5	1
0+000	Right	5.9	2

Source: JICA Study Team

3) Pavement

Table 5.5.15 shows the results of the road pavement survey conducted for Route-3.

Table 5.5.15 Road Survey Results of Route-3 (Pavement)

Left Side		
Type		Asphalt
Condition	Good	3 %
	Fair	25 %
	Bad	72 %
Others	Cracks	0+400, 0+500, 1+200, 1+300, 1+400, 1+500, 1+800, 2+000, 2+500, 2+700, 3+000, 3+500, 4+000, 5+500,6+800, 7+500, 7+700, 7+775, 7+900, 8+500, 9+000, 9+500, 9+700, 10+000, 10+100, 10+500, 11+000, 11+500, 12+000, 12+500, 13+000, 13+400, 13+500, 14+000,

		14+500, 15+000, 15+277
	Patching	0+400, 0+500, 1+500, 1+800, 2+000, 2+500, 3+500, 4+000, 5+500,7+775, 7+900, 8+500, 10+500, 11+500, 12+000, 12+500, 13+000
	Bleeding	1+000, 8+500
	Bumping	1+200, 1+300
	Rutting	2+700
	Pot Holes	3+000, 7+700, 7+775, 7+900, 10+100, 10+500
	Joint Failure	4+200 to 5+400
Right Side		
Type		Asphalt
Condition	Good	27 %
	Fair	70 %
	Bad	3 %
Others	Cracks	1+800, 4+000, 5+600, 6+500, 10+000, 12+775, 13+275, 13+775, 14+275, 14+775
	Pot Holes	0+800, 2+500

Source: JICA Study Team

4) Drainage

Table 5.5.16 shows the results of the road drainage survey conducted for Route-3.

Table 5.5.16 Road Survey Results of Route-3 (Drainage)

Station	Structure Type (Box or pipe)	Structure Size (m)
2+000 (L/S)	Box Drain	7.3 x 6.4

Source: JICA Study Team

5) Bridge and culvert

Table 5.5.17 shows the results of the bridge and culvert survey conducted for Route-3.

Table 5.5.17 Road Survey Results of Route-3 (Bridge and Culvert)

Station	Type	Length (m)	Width (m)
4+200~5+400	Bridge (Malir River Bridge)	1,200	17.5
5+600~6+500	Flyover (Qaidabad Flyover)	900	18.2
1+200 (L/S)	Box/Slab	27.9	5.9
1+300 (L/S)	Box/Slab	27.9	5.9
7+500 (L/S)	Box 3 Cell	19.9	15.3
9+700 (L/S)	Box	19.9	4.8
10+000 (L/S)	Box	21.1	4.84
13+100 (L/S)	Box 2 Cell	21	4

Source: JICA Study Team

6) Condition of land use along road

Table 5.5.18 shows the results of the land use survey conducted for Route-3.

Table 5.5.18 Road Survey Results of Route-3 (Condition of Land Use Along Road)

Station	Land Type	Land Use
0+400~1+000 (L/S)	Commercial	PTCL Office, Shops
1+400~1+800 (L/S)	Commercial / Residential	Houses, Shops, School, Petrol Pump and Hospital
2+500~4+000 (L/S)	Commercial	Shops, Petrol Pump
6+800~7+700 (L/S)	Industrial	Factory
7+775~7+900 (L/S)	Commercial	Petrol Pump
8+500 (L/S)	Industrial	Factory
9+000 (L/S)	Residential	Houses
9+500~10+100 (L/S)	Industrial	Factory
14+050~15+000 (L/S)	Commercial / Residential	Shops, Houses
0+800, 1+800 (R/S)	Commercial	Nursery
2+900~4+000 (R/S)	Commercial	KESC Office
7+500 (R/S)	Commercial	Shops
8+000~10+000 (R/S)	Industrial	Factory, Mill
11+100 (R/S)	Commercial	Petrol Pump
Commercial	Commercial	Truck Stand

Source: JICA Study Team

7) Public utilities

Table 5.5.19 shows the results of the public utilities survey conducted for Route-3.

Table 5.5.19 Road Survey Results of Route-3 (Public Utilities)

Item	Unit	Value	Remarks
Cable (Telephone & Electric)	km	55.6	
Telephone Pole	no.	116	
Electric Pole	no.	213	
Water Line	m	12,787	Dia (33”)
Sewerage Line	m	2,916	Dis (18”, 21”, 30”)
Underground Electric Cable	m	26,881	11KVA
Gas Pipe	m	34,117	Dia (1”, 2”, 4”, 6”, 8”, 12”, 20”)
Manhole	no.	378	

Source: JICA Study Team

The Study Team considered the present condition of existing road (plan and profile, public utilities), and conducted the preliminary design.

(2) Proposed Project Components

1) Widening of existing road

For the six-lane widening with a service road, the preliminary design was conducted by the Study Team. Total length is 15.3 km.

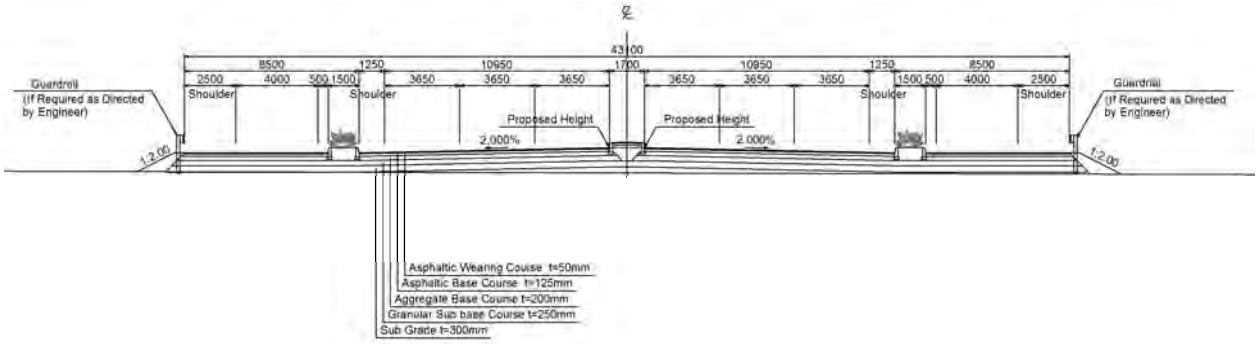
The outline and typical cross section of Route-3 are shown in **Table 5.5.20** and illustrated **Figure 5.5.3**.

Plan and typical cross section of Route-3 are attached in Volume III-Drawings.

Table 5.5.20 Outline of Route-3

Start Point	The Intersection Shahrah-e-Faisal Road and Jinnah Terminal Road (to Airport)
End Point	Port Qasim Road
Design Speed	80 km/h
Length	15.3 km
Number of Lane	6 lanes on both directions
Width of Carriage way	3.65 m
Bridge	Five (5) bridges (Length: 3000 m)

Source: JICA Study Team



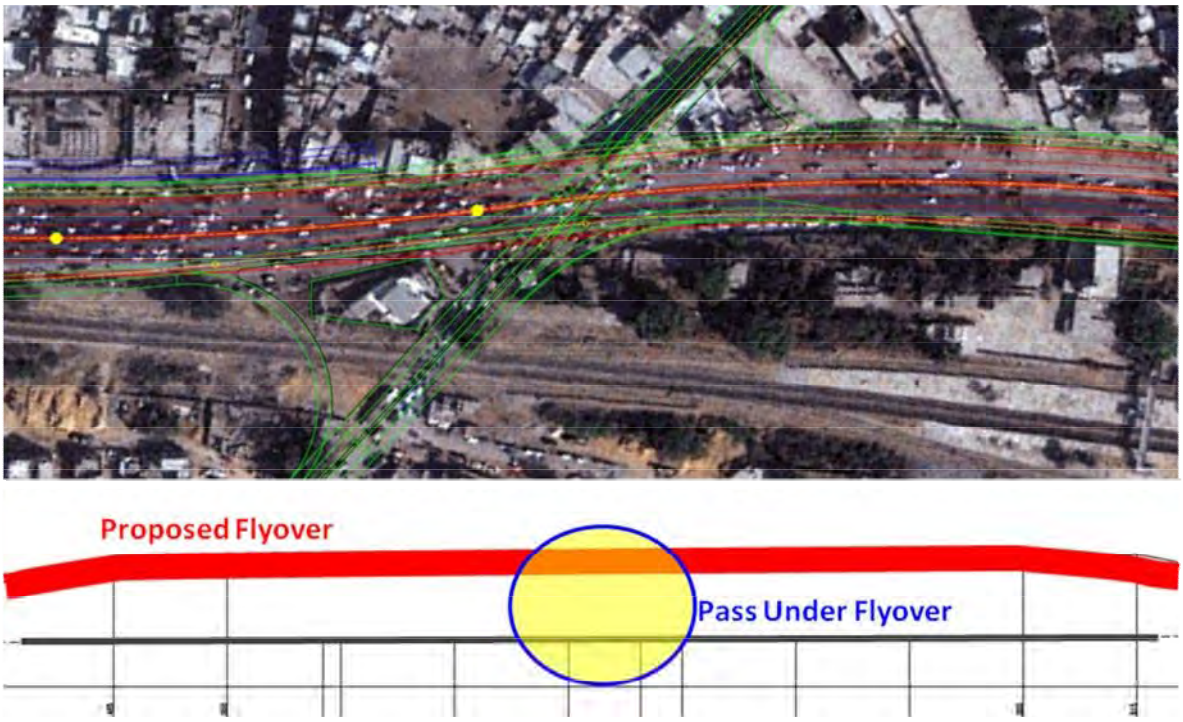
Source: JICA Study Team

Figure 5.5.3 Typical Cross Section (Route-3)

2) Grade separation design

The Study Team conducted the grade separation design for the bridge section.

The image of grade separation is shown in **Figure 5.5.4**.



Source: JICA Study Team

Figure 5.5.4 Grade Separation

(3) Rough Cost Estimation

Improvement of Shahrah-e-Faisal ~ National Highway: US$175,420,000 (Rs15,875,000,000)
Rate: US$1.00= Rs90.498

The composition of the project costs is shown in **Table 5.5.8**, while the detailed breakdown of quantities and costs are attached in **Appendix 3**.

Bridge 1 is located in Malir Halt Intersection, Begum Khursheed Road Intersection and Malir No.15 Intersection, and its length is 1850m.

Bridge 2 is located in Radio Pakistan Road Intersection, and its length is 200m.

Bridge 3 is located in RMTF Road Intersection, and its length is 200m.

Table 5.5.21 Total Project Cost of Route-3

Work Category	Cost (US$)	Cost (Rs)
Construction Cost		
Bridge 1	62,780,000	5,682,000,000
Bridge 2	9,120,000	826,000,000
Bridge 3	9,110,000	825,000,000
6 Lanes Improvement	42,940,000	3,886,000,000
Total Construction Cost	122,800,000	11,113,000,000
Resettlement Cost	18,730,000	1,695,000,000
Land Acquisition Cost	3,530,000	320,000,000
Relocation Cost	30,360,000	2,747,000,000
Total Project Cost	175,420,000	15,875,000,000

Source: JICA Study Team

5.6 Project Evaluation and Selection of Priority Project

5.6.1 Initial Economic Evaluation for Alternative Projects

(1) Introduction

The three recommended alternative projects are expected to significantly improve the investment climate in Karachi by providing safety and better access roads for the industrial zones in the Study Area.

Although the candidate projects are necessary to support and promote socio-economic activities not only in the Study Area but also in the whole area of Karachi, each project requires a huge investment from the government budget which is limited. Under this situation, it is necessary to examine whether the implementation of each project is justified or not from the viewpoint of the national economy through the comparison of the project costs with economic benefits.

(2) Evaluated Projects

The road projects evaluated in this section are the following three proposed alternatives, which are evaluated separately from each other.

- Route-1: Construction and Rehabilitation of Coastal Road
- Route-2: Construction of Malir River Bund Road
- Route-3: Improvement of Shahrah-e-Faisal~National Road

(3) Economic Costs

1) Economic investment costs

The project investment costs consist of construction and civil works, land acquisition and compensation, consulting services, physical contingency costs, and other related costs. The economic costs were obtained by deducting the transfer costs such as import duties and taxes from financial costs at market prices. In this evaluation, a factor of 0.90 was applied to convert financial costs to economic costs only for civil work related costs, referring to other road projects in Pakistan*.

[Note *Asian Development Bank, "Balochistan Road Development Sector Project", October 2003. At the same time, the Standard Conversion Factor (SCF) by the Little and Mirlees formula was calculated at 0.93 for 2000-2004. Some other studies applied 0.85. In this evaluation, a conservative value 0.90 was used.

2) Economic operation and maintenance costs

The maintenance costs consist of the annual routine and periodic maintenance costs at five-year intervals commencing after construction and opening to traffic. These costs were also converted into economic costs.

(4) Quantification of Economic Benefits (Direct Benefits)

1) Methodology for benefit estimation

In this evaluation, following are two kinds of direct benefits estimated quantitatively:

- Savings in vehicle operating costs (VOC benefit)
- Savings in passenger travel time Cost (TTC benefit)

The accident reduction benefit was not estimated due to lack of necessary information on the cost and number of accidents per vehicle/km per accident type, such as fatality, injury, and damage to properties.

■"With and Without Project Comparison Method"

The economic benefits were estimated based on the so-called "with and without project comparison method". The "with project" situation means that one of the proposed projects is implemented, while the "without project" is where none of the three projects not implemented. The assumed future road networks were based on the "Highway Developed case (for 2020 and 2030)" by the KTIP by JICA).

2) Vehicle operating costs (VOC)

(A) Basic data and sources

An extensive study on the vehicle operating costs in Pakistan was carried out in the "Pakistan Transport Plan Study" (PTPS) by JICA in 2005. PTPS basically adopted the same assumptions and physical parameters estimated by the National Transport Research Centre (NTRC) and updated to 2005 prices. And then, some adjustments were added to be consistent with the results of HDM-VOC version 4.0 such as fuel and oil consumption rates at different speed.

In this initial economic evaluation, all data cost by the above PTPS including fuel (petrol and diesel), lubricant oil, tire cost, vehicle costs, maintenance costs, and wages of crews for commercial vehicles were newly collected and updated to June 2012 prices.

(B) VOC components and vehicle classification

VOC consists of the following components:

i) Fuel cost;
ii) Lubricant oil cost;
iii) Tire cost;
iv) Maintenance (spare parts);
v) Maintenance (labor cost);
vi) Depreciation cost
vii) Interest cost;
viii) Crew cost of commercial vehicles (wages of drivers and assistants); and
ix) Overhead cost (commercial vehicles).

Unit VOCs (Rs/km) were calculated originally for the nine types as shown in **Table 5.6.1**.

Table 5.6.1 Vehicle Classification of VOC

1.	Motorcycle	4.	Wagon	7.	Truck (two-axle)
2.	Car	5.	Mini Bus	8.	Truck (multi-axle)
3.	Pickup	6.	Large Bus	9.	Trailer

Source: JICA Study Team

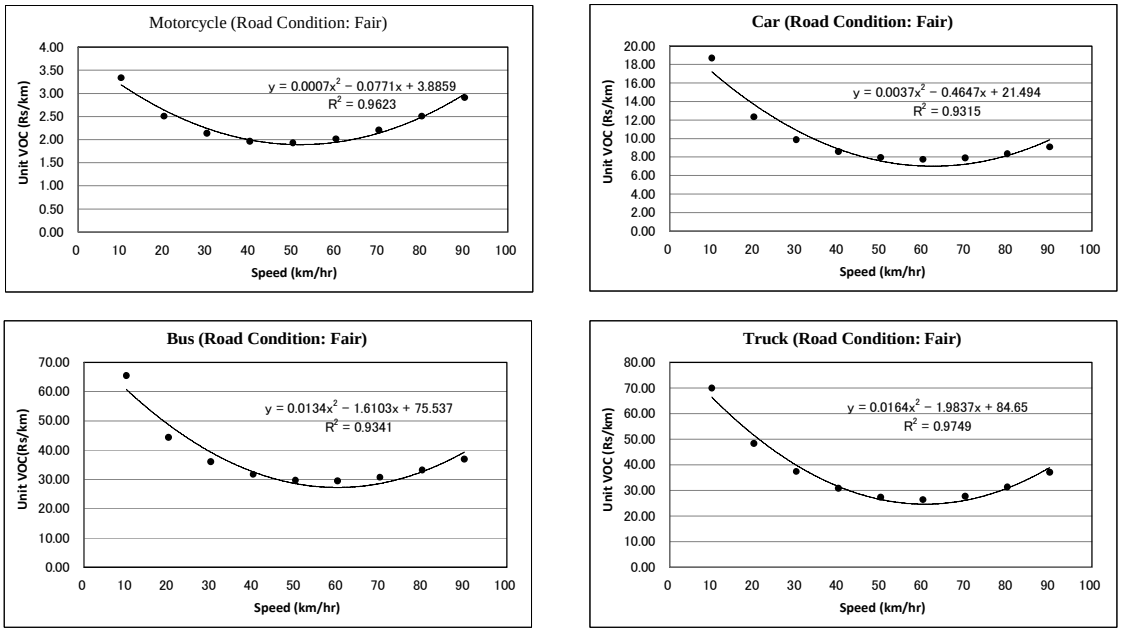
However, the traffic demand forecast by KTIP combined group vehicle types into four types. Therefore, the VOC data was selected from the above nine types representing the four vehicle types of KTIP as shown in **Table 5.6.2**.

Table 5.6.2 Vehicle Types (Demand Forecast & VOC Data)

KTIP Demand Forecast	VOC data
Motorcycle	Motorcycle
Car	Car
Bus	Large Bus
Truck	Truck (two-axle)

Source: JICA Study Team

All cost components of VOC were aggregated and the relationships between travel speed and unit VOC were estimated as shown in **Figure 5.6.1**.



Source: JICA Study Team

Figure 5.6.1 Travel Speed and Unit VOC in 2012 prices

3) Travel Time Cost (TTC)

The savings in passenger's travel time cost is another an important component of economic benefit in road projects. KTIP estimated the values of time of motorcycle and bus passengers at **Rs49.65/hour/person for work trip**, and **Rs110/hour/person for work trip** for car passengers (2011 prices). These values were derived and updated from the average monthly income in 2005 presented in "Karachi Master Plan 2020" and "Socio-economic Survey Report–2005 Karachi City Profile".

Based on the above time values and estimating the percentage of work trips and average occupancy by vehicle type (average number of passengers per vehicle), the time values per vehicle in 2011 are calculated as shown in **Table 5.6.3**.

Future time values up to 2030 were raised with the same growth rate of real per capita GDP.

Table5.6.3 Time Values of Passenger by Vehicle Type (2011/12)

Vehicle Type	Travel Time Value (2011) (Rs/ hour/ person)		Trip Purpose Composition (*)		Weighted Average Value Rs/ hour/ person)	Average No. of passengers (*)	Time Value by Vehicle Type (Rs/ hr/ vehicle)	Future Time Value (Rs./hr/vehicle)	
	Work (*)	Non-work	Work	Non-work			2011	2020	2030
M/C	49.65	0.0	37.2%	62.8%	18.47	1.2	22.16	26.27	31.39
Car	110.00	0.0	29.9%	70.1%	32.89	3.4	111.83	132.52	158.40
Bus	49.65	0.0	33.7%	66.3%	16.73	38.8	649.20	769.37	919.58

Source: KTIP

4) Formulas for benefit estimation

The economic benefits (VOC savings and TTC savings) were estimated by applying the above unit VOCs and value of time to the results of traffic demand forecasts (traffic assignment simulations). The formulas for benefit calculation are shown below:

$$VOC(B) = \sum_{n} \sum_{m} [(Q_{w/o})_{n.m} * (L^{m}) * (UVOC_{n})] - \sum_{n} \sum_{m} [(Q_{with})_{n.m} * (L^{m}) * (UVOC_{n})]$$

$$Time(B) = \sum_{n} \sum_{m} [(Q_{w/o})_{n.m} * TIM(W/O)_{m} * TV_{n}] - \sum_{n} \sum_{m} [(Q_{with})_{n.m} * TIM(WITH)_{m} * TV_{n}]$$

Where:
- VOC (B) : Total VOC saving benefit
- $(Q_{w/o})_{n.m}$: Traffic volume of vehicle type (n), on Link(m) in "Without" project case
- L^{m} : Length of link (m)
- $UVOC_{n}$: Unit VOC of vehicle type (n)
- $(Q_{with})_{n.m}$: Traffic volume of vehicle type (n), on Link (m) in "With" project case
- Time (B) : Total time saving benefit
- $TIM(W/O)_{m}$: Travel time on Link (m) in "without" project case
- $TIM(WITH)_{m}$: Travel time on Link (m) in "with" project case
- TV_{n} : Travel time value of vehicle type (n)

5) Estimated economic benefits

The estimated economic benefits are presented in **Table 5.6.4**.

It is noted that the benefits in 2030 of all three projects are lower than those in 2020. Since 2030 is a target year of KTIP, all recommended/proposed road projects by KTIP are included in the "Highway Developed Network 2030", and the road network better than in 2020 is planned in 2030. Therefore, the impacts of individual alternative project in 2030 are lower than in 2020 even though the traffic growth from 2020 to 2030 is taken into account.

Table 5.6.4 Estimated Benefits,

(unit: Rs million/year)

Year	VOC & TTC	Without Project (Exclude an Alternative Project from Highway Developed Network) (A)	With Project (Include an Alternative Project) (B)	Benefit (A) –(B)
Route-1: Coastal Road				
2020	VOC	265,339	259,526	5,812
	TTC	127,272	119,854	7,418
	Total	392,611	379,380	13,231
2030	VOC	307,822	302,256	5,565
	TTC	151,882	147,747	4,135
	Total	459,704	450,003	9,701
Route-2: Malir River Bund Road**				
2020	VOC	265,339	258,249	7,089
	TTC	127,272	111,405	15,867
	Total	392,611	369,654	22,956
2030	VOC	307,822	302,558	5,264
	TTC	151,882	145,317	6,565
	Total	459,704	447,875	11,829
Route-3: Shahrah-e-Faisal – National Road				
2020	VOC	265,339	257,389	7,950
	TTC	127,272	114,391	12,881
	Total	392,611	371,780	20,831
2030	VOC	307,822	302,009	5,813
	TTC	151,882	148,106	3,776
	Total	459,704	450,115	9,589

Source: JICA Study Team
Note: **Toll Free Case

The Malir River Bund Road Project shows the highest benefit in 2020 and 2030 among the three alternative routes.

(5) Preliminary Economic Evaluation

1) Pre-Conditions for economic cost and benefit analysis

Cost-benefit cash flow analyses were carried out under the following pre-conditions:

1) Price Level : 2012 prices
2) Opening Year : 2018
3) Evaluation Period : 20 years after opening
4) Residual Values : No residual values were counted
5) Opportunity Cost of Capital : 12%

Regarding the time saving benefit, as all portions of saved time are not necessarily used on productive activities and some portions may be wasted. Under the situation, it is more realistic to assume the utilization factor or percentage of undertaking productive activities for saved time. In this evaluation, a factor of 25% was applied***.

[Note ***As an example, refer to "The Urgent Development Study on Rehabilitation and Reconstruction in Muzaffarabad City (Urgent Rehabilitation Project: West Bank Bypass Design)" 2007, JICA

2) Evaluation results

The results of the economic evaluation are summarized below:

Route-1: Coastal Road
- Economic Internal Rate of Return (EIRR) = 51.9%
- Benefit/Cost Ratio (B/C) = 5.90
- Net Present Value (NPV) = Rs25,664 million

Route-2: Malir River Bund Road
- Economic Internal Rate of Return (EIRR) = 31.7%
- Benefit/Cost Ratio (B/C) = 2.58
- Net Present Value (NPV) = Rs24,927 million

Route-3: Shahrah-e-Faisal – National Road
- Economic Internal Rate of Return (EIRR) = 47.2%
- Benefit/Cost Ratio (B/C) = 4.84
- Net Present Value (NPV) = Rs32,340 million

The above results indicate that all the three alternative projects are economically feasible with EIRR higher than the opportunity cost of capital (>12%), B/C higher than unity (>1.0) and positive values of NPV (> 0).

Although the Malir River Bund Road will generate the highest total benefit among the three alternatives, its project cost is also the highest. On the other hand, the project cost of the Coastal Road is only less than 1/3 of the Malir River Bund Road, and the cost of the Shahrah-e-Faisal–National Road is about 1/2 only. These cost factors are the main reasons why the two alternatives other than the Malir River Bund Road show high values of EIRR (about 50%)

The Cost-Benefit Streams are shown in **Table 5.6.5** to **Table 5.6.7**.

Table5.6.5 Cost-Benefit Stream (Route-1: Coastal Road)

(unit: Rs million/year)

	Year	Investment Cost (Rs.Mill.)						Maintenance Cost		Total Cost	Benefit (Rs.Milli)		Total Benefit	B-C
		Construction Cost	Physical Contingency	Administration Cost	Environmental Management	Land Acquisition & Relocation	Engineering Services	Routine	Periodic		VOC	TTC		
	2012													
	2013			24			97			121			0	-121
	2014			24	5	1,009	97			1,135			0	-1,135
	2015	1,826	137	24	5		97			2,089			0	-2,089
	2016	1,826	137	24	5		97			2,089			0	-2,089
	2017	1,826	137	24	5		97			2,089			0	-2,089
1	2018							27		27	5,862	2,019	7,881	7,853
2	2019							27		27	5,837	1,937	7,774	7,746
3	2020							41		41	**5,812**	**1,855**	**7,667**	**7,626**
4	2021							41		41	5,788	1,772	7,560	7,519
5	2022								110	110	5,763	1,690	7,453	7,344
6	2023							27		27	5,738	1,608	7,347	7,319
7	2024							27		27	5,714	1,526	7,240	7,213
8	2025							41		41	5,689	1,444	7,133	7,092
9	2026							41		41	5,664	1,362	7,026	6,985
10	2027								164	164	5,640	1,280	6,920	6,755
11	2028							27		27	5,615	1,198	6,813	6,785
12	2029							27		27	5,590	1,116	6,706	6,679
13	2030							41		41	**5,565**	**1,034**	**6,599**	**6,558**
14	2031							41		41	5,565	1,034	6,599	6,558
15	2032								219	219	5,565	1,034	6,599	6,380
16	2033							27		27	5,565	1,034	6,599	6,572
17	2034							27		27	5,565	1,034	6,599	6,572
18	2035							41		41	5,565	1,034	6,599	6,558
19	2036							41		41	5,565	1,034	6,599	6,558
20	2037								274	274	5,565	1,034	6,599	6,325
	Total	5,479	411	121	21	1,009	484	548	767	8,839	113,235	27,078	140,314	131,474

EIRR	51.92%
NPV (Rs.Milli)*	25,664
B/C*	5.90

Discount Rate = 12%

Source: JICA Study Team

Table 5.6.6 Cost-Benefit Stream (Route-2: Malir River Bund Road)

(unit: Rs million/year)

	Year	Investment Cost (Rs.Mill.)						Maintenance Cost		Total Cost	Benefit (Rs.Milli.)		Total Benefit	B-C
		Construction Cost	Physical Contingency	Administration Cost	Environmental Management	Land Acquisition & Relocation	Engineering Services	Routine	Periodic		VOC	TTC		
	2012													
	2013			74			313			387			0	-387
	2014			74	16	1,050	313			1,453			0	-1,453
	2015	6,171	463	74	16		313			7,037			0	-7,037
	2016	6,171	463	74	16		313			7,037			0	-7,037
	2017	6,171	463	74	16		313			7,037			0	-7,037
1	2018							93		93	7,455	4,432	11,886	11,794
2	2019							93		93	7,272	4,199	11,471	11,379
3	2020							139		139	**7,089**	**3,967**	**11,056**	**10,917**
4	2021							139		139	6,907	3,734	10,641	10,502
5	2022								370	370	6,724	3,502	10,226	9,856
6	2023							93		93	6,542	3,269	9,811	9,718
7	2024							93		93	6,359	3,037	9,396	9,303
8	2025							139		139	6,177	2,804	8,980	8,842
9	2026							139		139	5,994	2,571	8,565	8,427
10	2027								555	555	5,811	2,339	8,150	7,595
11	2028							93		93	5,629	2,106	7,735	7,643
12	2029							93		93	5,446	1,874	7,320	7,227
13	2030							139		139	**5,264**	**1,641**	**6,905**	**6,766**
14	2031							139		139	5,264	1,641	6,905	6,766
15	2032								741	741	5,264	1,641	6,905	6,164
16	2033							93		93	5,264	1,641	6,905	6,812
17	2034							93		93	5,264	1,641	6,905	6,812
18	2035							139		139	5,264	1,641	6,905	6,766
19	2036							139		139	5,264	1,641	6,905	6,766
20	2037								926	926	5,264	1,641	6,905	5,979
	Total	18,514	1,389	372	65	1,050	1,563	1,851	2,592	27,395	119,513	50,963	170,477	143,082

EIRR	31.69%
NPV Rs.(Milli)*	24,927
B/C*	2.58

Discount Rate = 12%

Source: JICA Study Team

Table 5.6.7 Cost-Benefit Stream (Route-3: Shahrah-e-Faisal Road, N5)

(unit: Rs million/year)

	Year	Investment Cost (Rs.Mill.)						Maintenance Cost		Total Cost	Benefit (Rs.Milli.)		Total Benefit	B-C
		Construction Cost	Physical Contingency	Administration Cost	Environmental Management	Land Acquisition & Relocation	Engineering Services	Routine	Periodic		VOC	TTC		
	2013			42			158			200			0	-200
	2014			42	9	2,444	158			2,653			0	-2,653
	2015	2,622	197	42	9		158			3,028			0	-3,028
	2016	2,622	197	42	9		158			3,028			0	-3,028
	2017	2,622	197	42	9		158			3,028			0	-3,028
1	2018							39		39	8,377	3,675	12,052	12,013
2	2019							39		39	8,163	3,448	11,611	11,572
3	2020							59		59	**7,950**	**3,220**	**11,170**	**11,111**
4	2021							59		59	7,736	2,993	10,729	10,670
5	2022								157	157	7,522	2,765	10,287	10,130
6	2023							39		39	7,309	2,537	9,846	9,807
7	2024							39		39	7,095	2,310	9,405	9,365
8	2025							59		59	6,881	2,082	8,963	8,904
9	2026							59		59	6,668	1,854	8,522	8,463
10	2027								236	236	6,454	1,627	8,081	7,845
11	2028							39		39	6,240	1,399	7,639	7,600
12	2029							39		39	6,027	1,172	7,198	7,159
13	2030							59		59	**5,813**	**944**	**6,757**	**6,698**
14	2031							59		59	5,813	944	6,757	6,698
15	2032								315	315	5,813	944	6,757	6,442
16	2033							39		39	5,813	944	6,757	6,717
17	2034							39		39	5,813	944	6,757	6,717
18	2035							59		59	5,813	944	6,757	6,698
19	2036							59		59	5,813	944	6,757	6,698
20	2037								393	393	5,813	944	6,757	6,364
	Total	7,866	590	210	38	2,444	790	787	1,101	13,825	132,924	36,635	169,558	155,733

EIRR	47.20%
NPV (Rs.Milli)*	32,340
B/C*	4.84

Discount Rate = 12%

Source: JICA Study Team

(6) Conclusions of the Initial Economic Evaluation

The conclusions derived from the initial economic evaluation are summarized as follows:

i) All three alternative projects are economically feasible;

ii) The Malir River Bund Road has the highest economic benefit among the three alternatives (total benefit, not NPV);

iii) From the aspect of investment climate improvement, it is necessary to take into account not only the direct economic benefits (VOC and TTC savings) as calculated in the above analysis, but also other factors such as safety commuting measure with non-stop driving and direct connection to/from the industrial zones in the study area; and

iv) At the same time, the top priority project should be selected so as to contribute to the future development of the whole Karachi City to be consistent with future land use plan.

5.6.2 Selection of Priority Project

Table 5.6.8 shows the evaluation result from various factors. The Malir River Bund Road construction may be selected for the high priority project from the following reasons:

i) The project cost of Malir River Bund Road Construction is highest among the three projects, however, the economical indicators (EIRR=31.7%, B/C=2.58) show higher level in economic evaluation.

ii) The traffic demand that will be converted to Malir River Bund Road is highest among the alternative routes. This means that the future traffic impact to the neighbor road network will be mitigated by the construction of Malir River Bund Road.

iii) From the aspect of resettlement and land acquisition implementation, the required project component of the Malir River Bund Road has the most realistic condition.

Table5.6.8 Evaluation Results for Alternative Routes

Evaluation Item		**Alternative Route-1: Coastal Road**	**Alternative Route-2: Malir River Bund Road**	**Alternative Route-3: Shahrah-e-Faisal / National Highway**
Economical Aspect	Project Cost	US$95.2 million	US$238.9 million	US$175.4 million
	EIRR	51.9%	31.7%	47.2%
	B/C	5.90	2.58	4.84
Traffic Demand to Change Route		53,200 pcu	132,820 pcu	94,310 pcu
Environmental Aspect	Impact by the Project	- Passing residential area at two locations (2 km).	- Almost road alignment will be within ROW. - Passing residential area at one location (700 m)	- Houses and shops are standing in 6.5 km length.
	Mitigation Measure	- Bypass road will mitigate the impacts. - Land acquisition will be difficult at Umar Goth due to PALCO Oil Terminal.	- Construction of bridge structure carriageway in river area will mitigate the impacts of resettlement issue.	- There will be no effective mitigation measure. - Resettlement and land acquisition will be very difficult to implement.
Evaluation		△	◎	X

Source: JICA Study Team

CHAPTER 6 PRE-FEASIBILITY STUDY OF RECOMMENDED ROAD DEVELOPMENT PROJECT

A pre-feasibility study (Pre-F/S) will be conducted to the Malir River Bund Road as mentioned in **Section 5.6.2 Selection of Priority Project**.

Road design in Pakistan is based on the American Association of State Highway and Transportation Official 2004 (AASHTO 2004) guidelines. Therefore in this Study, the Study Team will use design standards based on the AASHTO and Japan Highway Standards.

6.1 Preliminary Design

6.1.1 Road Design

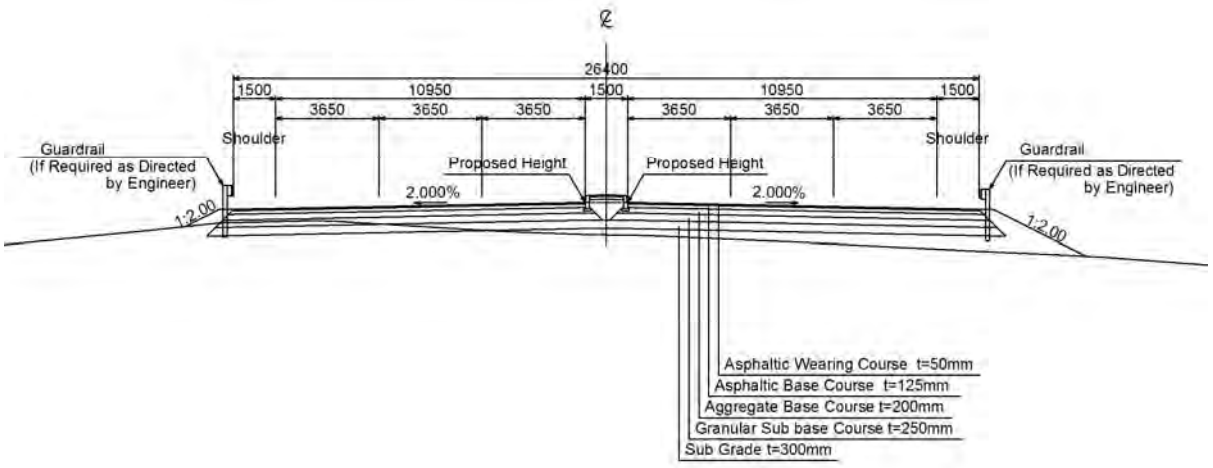
(1) Design standard

The design standard is shown in **Table 6.1.1**.

Table 6.1.1 Design Standards

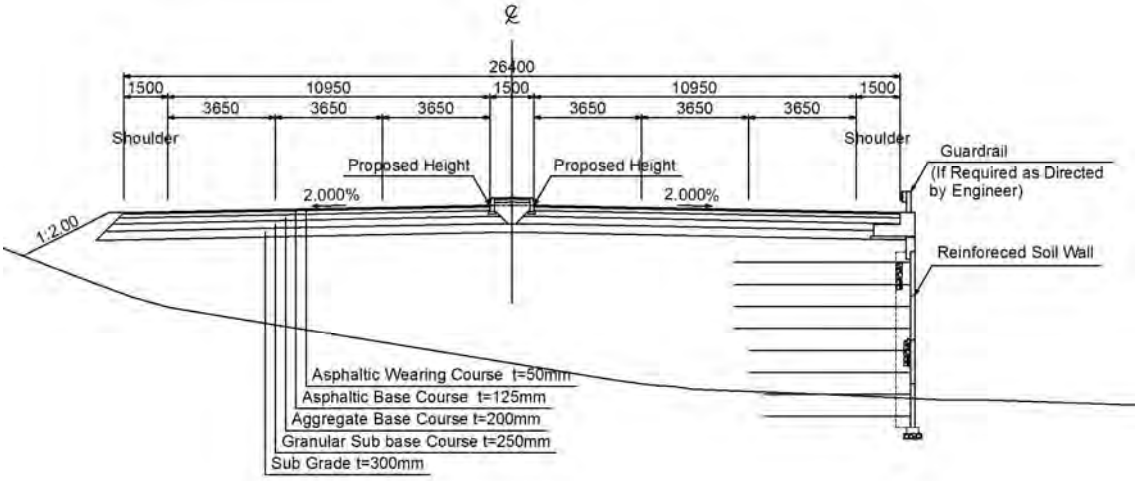
Parameters	Unit		Design Standard/Page No.
Design Speed	km/h	80	
Cross Section Elements:			
Lane Width	m	3.65	
Number of Lane (Both direction)	-	6	
Outer Shoulder	m	1.5	AASHTO 2004 / 312
Median	m	1.5	AASHTO 2004 / 337
Maximum Superelevation	%	4.0	AASHTO 2004 / 310
Crossfall of Shoulder	%	2.0	AASHTO 2004 / 316
Vertical Clearance	m	4.3	AASHTO 2004 / 385
Typical Cross Section	-	**Figure 6.1.1 ~ 4**	
Minimum Stopping Sight Distance	m	130	AASHTO 2004 / 112
Horizontal Alignment			
Minimum Radius	m	280	AASHTO 2004 / 146
Minimum Curve Length	m	140	Japan Highway Standard / 321
Maximum Radius for Use of a Spiral Curve Transition	m	379	AASHTO 2004 / 185
Minimum Length of Spiral Curve Transition	m	44	AASHTO 2004 / 189
Sharpest Curve without Superelevation	m	1,490	AASHTO 2004 / 166
Vertical Alignment			
Maximum Grade	%	4.0	AASHTO 2004 / 232
Minimum Crest Vertical Curve (Rate of Vertical Curvature K)	-	26	AASHTO 2004 / 272
Minimum Sag Vertical Curve (Rate of Vertical Curvature K)	-	30	AASHTO 2004 / 277

Source: JICA Study Team



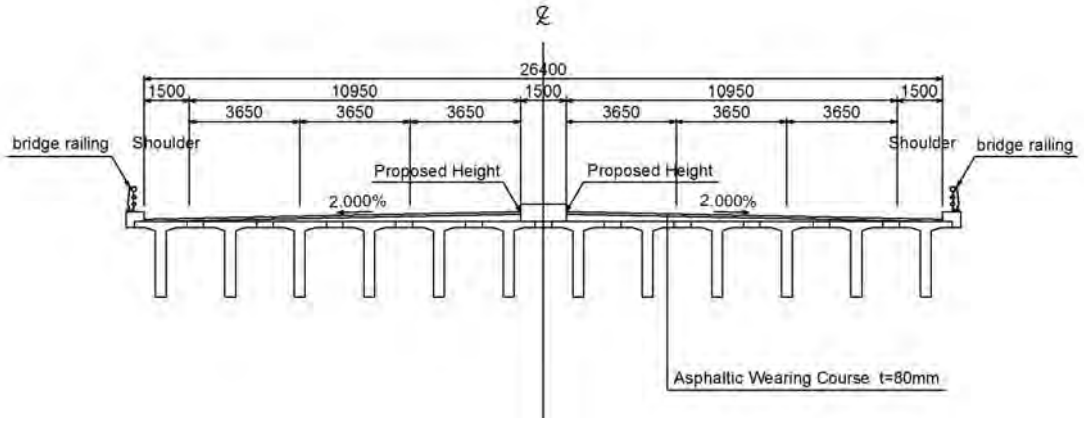
Source: JICA Study Team

Figure 6.1.1 Typical Cross Section (Earth Work)



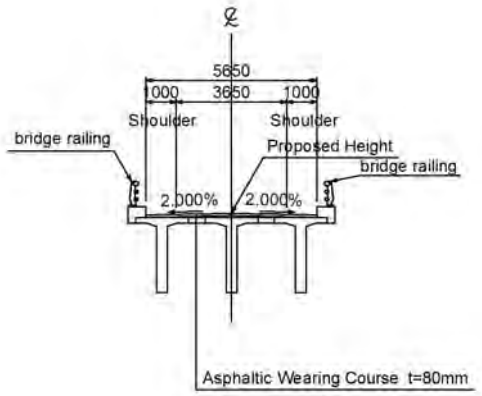
Source: JICA Study Team

Figure 6.1.2 Typical Cross Section (Retaining Wall)



Source: JICA Study Team

Figure 6.1.3 Typical Cross Section (Bridge)



Source: JICA Study Team

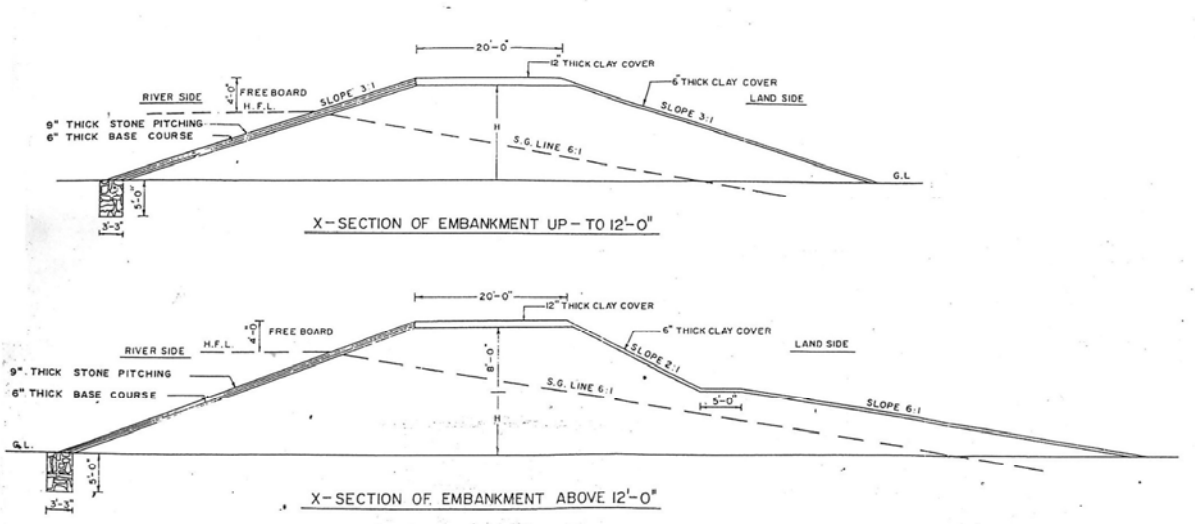
Figure 6.1.4 Typical Cross Section (Ramp)

(2) Control point in designing road

1) Top of existing bund

The height of the Malir River Bund was determined based on high-flood level (HFL) of the Malir River. As presented in **Figure 6.1.5**, the height of the bund was estimated at about 4 ft (1.2 m) above HFL.

In this Study, the final road level (FRL) was designed on top of the existing bund.



Source: Pakistan WAPDA PBI/HEP Organization

Figure 6.1.5 Typical Cross Section of Embankment (Malir River)

2) Vertical clearance of grade separation

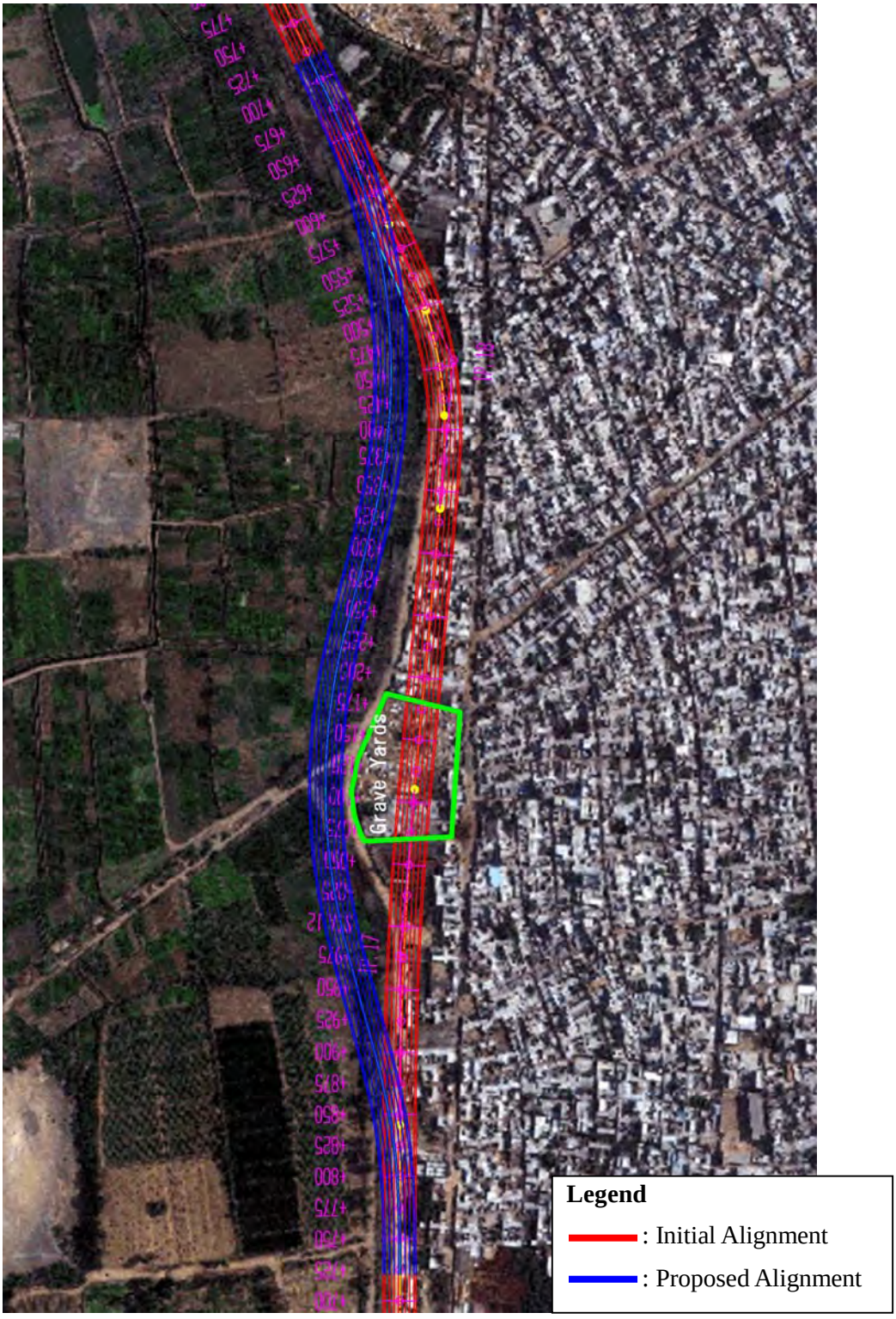
In grade separation, vertical clearance for an underpass is secured at 5.0 m, with an allowance for future resurfacing.

3) Graveyards

From Sta.12+000 to Sta.12+200, graveyards are located. Therefore, the Study Team has planned the alignment to secure the graveyards (refer to **Figure 6.1.6**).

4) Profile to Avoid High-Tension Lines at Sta.6+300

Observing the existing conditions in Sta.6+300, high-tension lines are crossing the existing bund and therefore, the Study Team has followed the same profile.



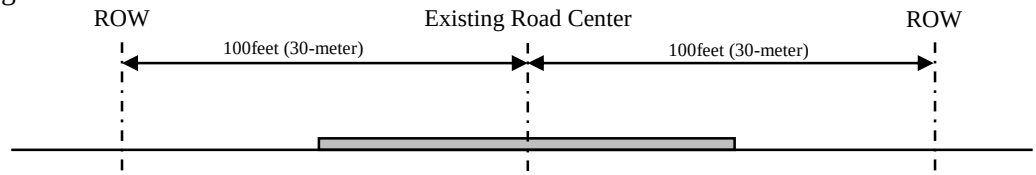
Source: JICA Study Team

Figure 6.1.6 Alignment to Secure the Graveyard

(3) Right-of-way (ROW)

1) Korangi Industrial Area (3000) Road (Sta.0+000 to Sta.1+300)

The Karachi Development Authority is setting the ROW in the Korangi Industrial Area (3000) Road. The ROW will have a width of 200 ft (60 m), at 100 ft (30 m) offset from the center of the existing road.

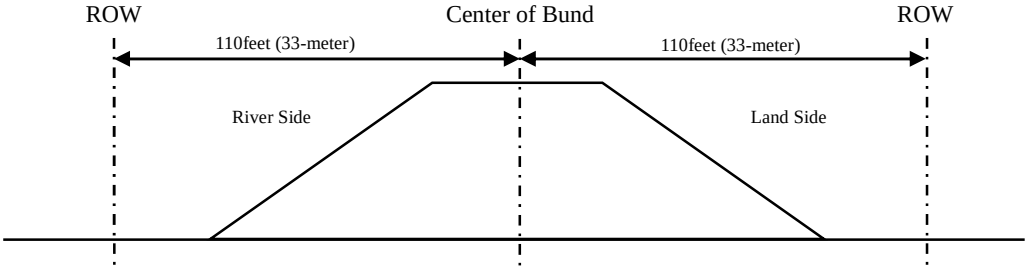


Source: JICA Study Team

Figure 6.1.7 ROW of Korangi Industrial Area (3000) Road

2) Malir River Bund (Sta.1+300 to Sta.13+000)

The Karachi Development Authority is setting the ROW in the Malir River Bund. The ROW will have a width of 220 ft (66 m), at 110 ft (33 m) offset from the bund center which will serve as clearance for the maintenance of the bund on both sides.



Source: JICA Study Team

Figure 6.1.8 ROW of Malir River Bund

3) Malir River Bund (Sta.13+000 to Sta.20+925)

This land is owned by the government; therefore, ROW was not established.

6.1.2 Structure Design

(1) Bridge design

The design condition used for the bridge is shown in **Table 6.1.2**.

Table 6.1.2 Design Condition of the Bridge

Parameters	Unit	Condition Value
Design Speed	km/h	80
Structure Type		Post tensioning system T-beam bridge
Bridge Length	m	100~1900
Max Span	m	40
Girder Height	m	2.5

Parameters	Unit	Condition Value
Bridge Width	m	26.4
Wheel Guard Width	m	0.6

Source: JICA Study Team

The span length was assumed at approximately 40 m. Also, a generally economical T-beam bridge was adopted.

The typical cross section of the bridge section is shown in **Figure 6.1.3**.

(2) Retaining wall design

The design condition of the retaining wall is shown in **Table 6.1.3**.

Table 6.1.3 Design Condition of the Retaining Wall

Parameters	Unit	Condition Value
Structure type		Reinforced soil wall
Height	m	4~11

Source: JICA Study Team

Reinforced soil wall was adopted due to its workability and economical-use.

The height was 4 m to 11m.

Typical cross section of the retaining wall section is shown in **Figure 6.1.4**.

6.1.3 Interchange

(1) Design standard

The design standard of the interchange is shown in **Table 6.1.4**.

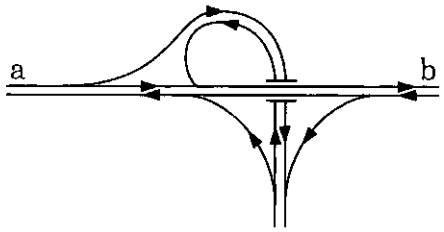
Table 6.1.4 Design Standard of the Interchange

Parameters	Unit	Standard Value	Design Standard /Page No.
Design Speed	km/h	40	AASHTO 2004/825
Minimum Radius	m	50	AASHTO 2004/825
Maximum Grade	%	6.0 (5.0 to 7.0)	AASHTO 2004/829
Lane Width	m	3.65	Japan Highway Standard /539
Median	m	2.0	Japan Highway Standard /539
Deceleration Lane Length	m	100	AASHTO 2004/851
Acceleration Lane Length	m	145	AASHTO 2004/847

Source: JICA Study Team

(2) Typical form of interchange

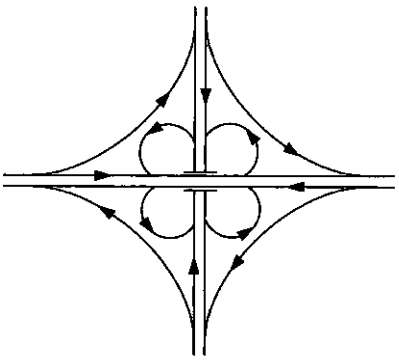
1) Trumpet-type interchange: It is the most popular three-leg intersections road type.



Source: Japan Highway Standard/522

Figure 6.1.9 Trumpet-type Interchange

2) Full cloverleaf interchange: It is the most popular four-leg intersection road type.



Source: Japan Highway Standard / 524

Figure 6.1.10 Full Cloverleaf Interchange

In this Study, the above forms of interchanges were selected.

(3) Form of Interchange

There are three interchanges in Malir River Bund Road.

i) Ramp 1 (Around Sta.1+400): Trumpet-type Interchange

Ramp 1 is a three-leg intersection.

ii) Ramp 2 (Around Sta.6+900): Double Trumpet-type Interchange

A double trumpet-type interchange was selected as a result of the comparison between it and a full cloverleaf interchange.

Construction of a full cloverleaf interchange has a much greater impact on the Malir River as compared to the double trumpet-type interchange.

Moreover, the double trumpet-type interchange can group tollgates together in one place.

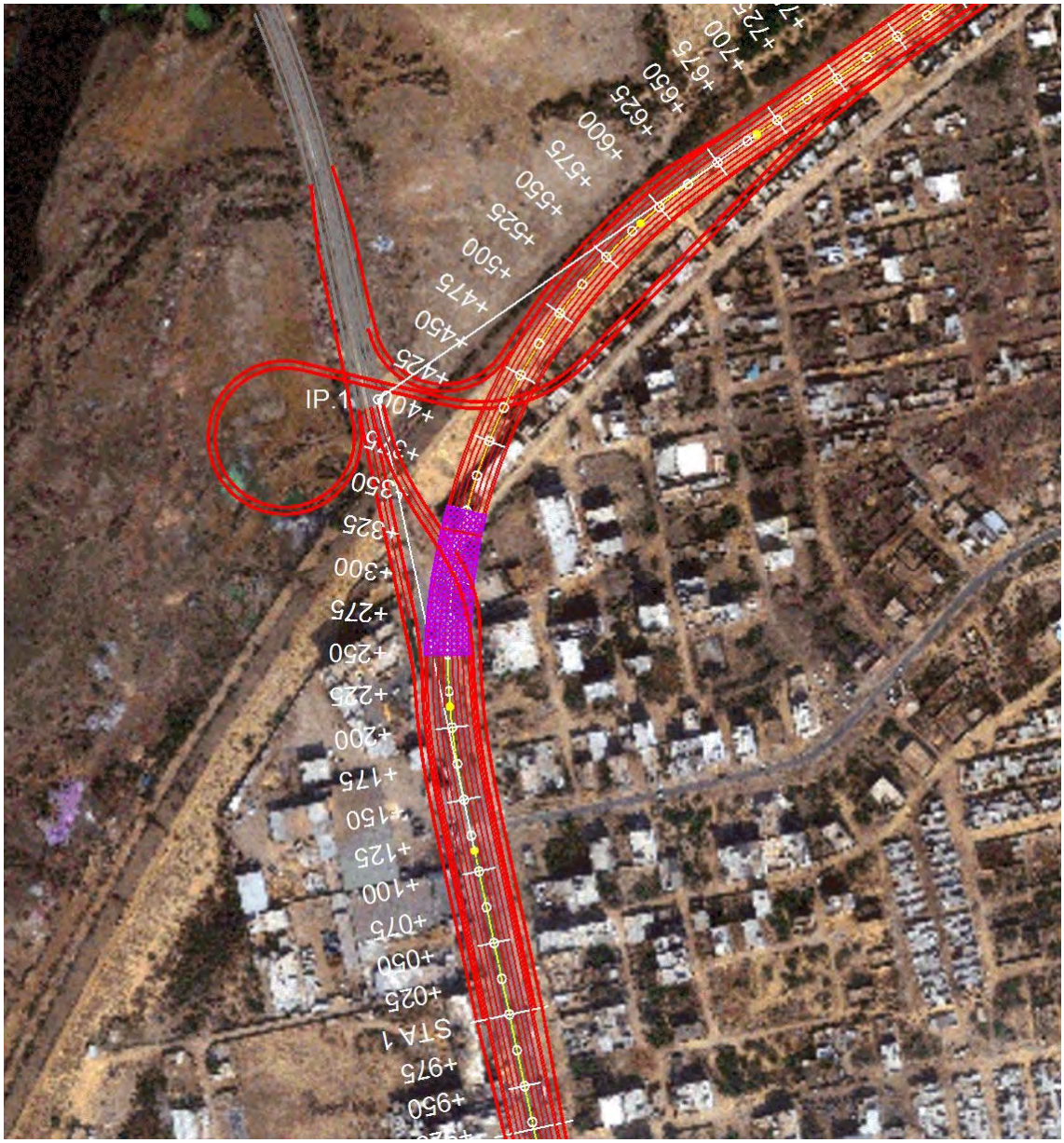
iii) Ramp 3 (Around Sta.13+700): Double Trumpet-type Interchange

A double trumpet-type interchange was selected as a result of the comparison between it and a full cloverleaf interchange.

Construction of a full cloverleaf interchange has a much greater impact on the Malir River as compared to double trumpet-type tnterchange.

Moreover, the double trumpet-type interchange can group tollgates together in one place.

The following figures (refer to Figures 6.1.11-6.1.15) are the proposed interchanges at Ramp 1 to Ramp 3.

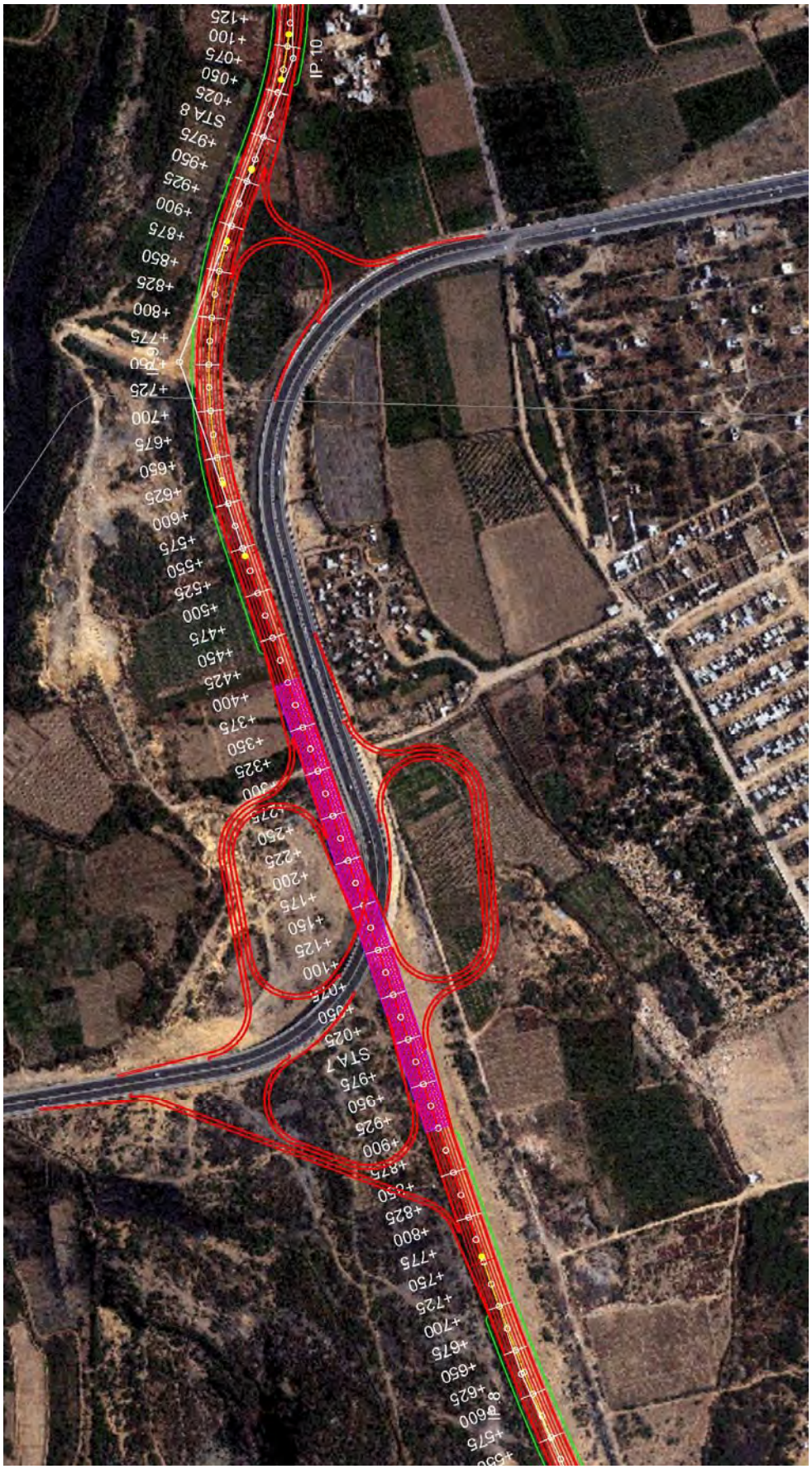


Source: JICA Study Team

Figure 6.1.11 Ramp 1: Trumpet-type Interchange

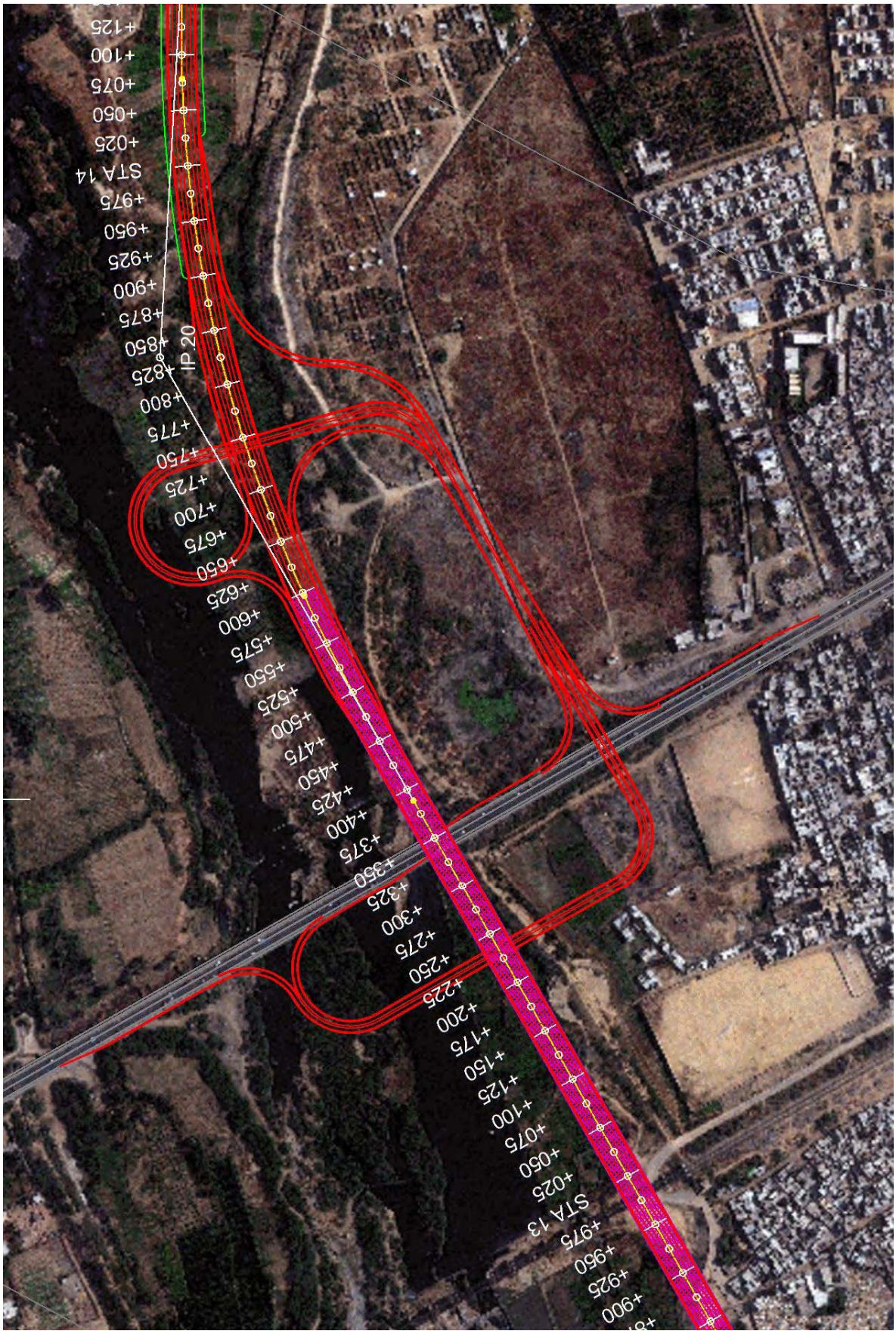
Source: JICA Study Team

Figure 6.1.12 Ramp 2: Double Trumpet-type Interchange (Proposed Type)



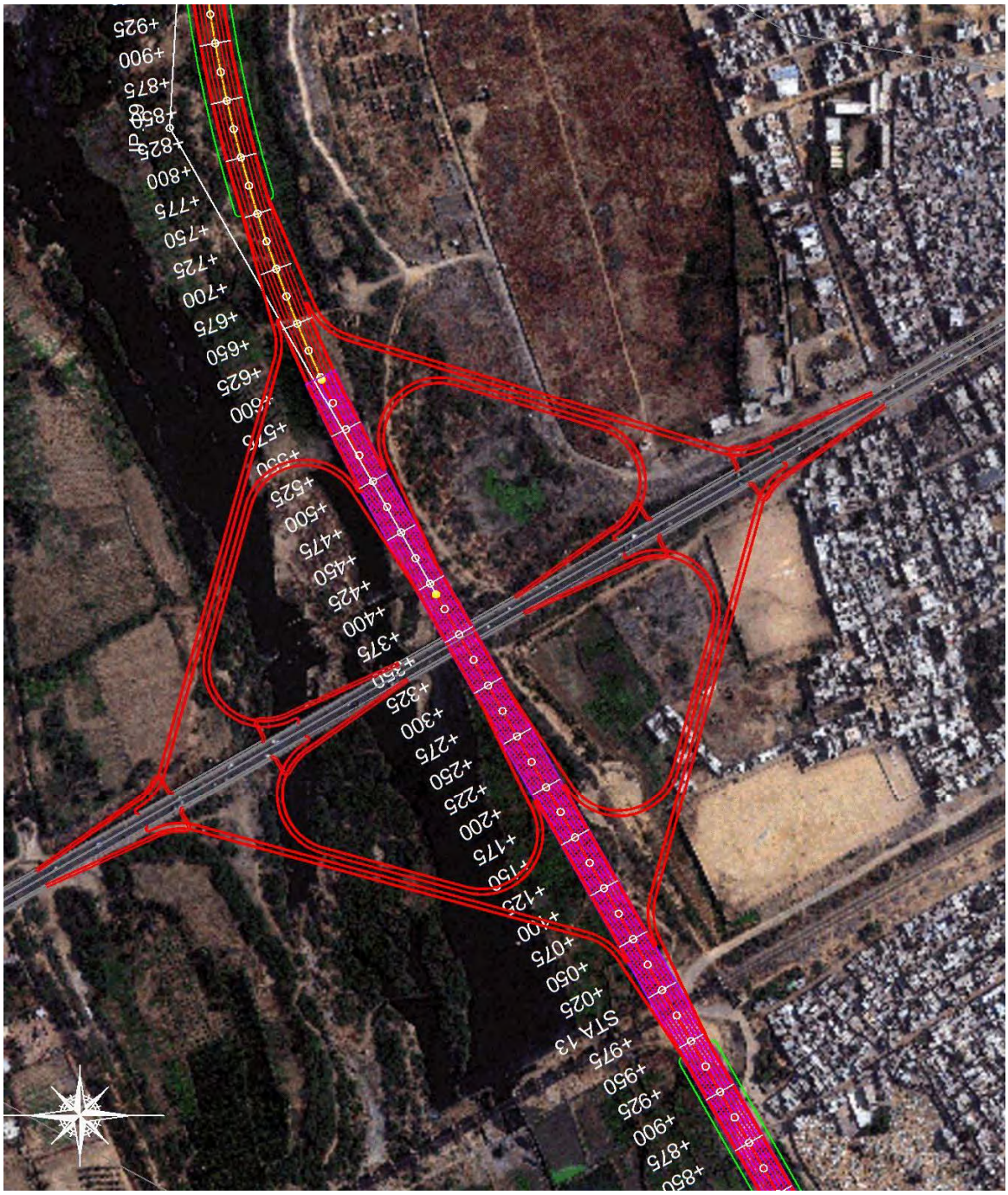
Source: JICA Study Team

Figure 6.1.13 Ramp 2: Full Cloverleaf Interchange



Source: JICA Study Team

Figure 6.1.14 Ramp3: Double Trumpet-type Interchange (Proposed Type)



Source: JICA Study Team

Figure 6.1.15 Ramp 3: Full Cloverleaf Interchange

6.2 Initial Environmental Examination (IEE)

6.2.1 Screening of Environmental Items

(1) Methodology of the IEE

The following methodology was adopted to evaluate the environmental aspects of the proposed project on road improvement:

- Review of available secondary data/information;

- Identification of the regulatory requirements that applies to the project activities in the proposed area, in the context of environmental protection, health, and safety;
- Reconnaissance survey;
- Field survey;
- Meetings with relevant government officials/departments; and
- Focused group discussions (FGD) with stakeholders.

(2) Regulations and guidelines

The following regulations and guidelines are referred in the conduct of an IEE Study;

- Pakistan Environmental Protection Act 1997.
- Pak EPA (Review of IEE and EIA) Regulation 2000.
- JICA Guidelines for Environmental and Social Considerations.
- World Bank Guidelines on Environment.
- Environmental Guidelines of Pak EPA (Guidelines for Public Consultation).
- Land Acquisition Act of 1894.
- National Resettlement Policy.
- Guidelines for Planning and Implementation of Resettlement.

(3) Social Environment Impact Examination

The alignment of an expressway along the Malir River Bund is to be designed within the legal ROW (110 ft from the center of bund) in the preliminary engineering design. However, many houses are encroached within the ROW of the project site. The Study Team attempted to estimate the number of households and population to be affected by the project using open source satellite images as mentioned in Section 5.4 “Environmental/Social Condition and ROW Status on Alternative Routes” of this report. Approximately 390 buildings were confirmed to be within the construction area. Assuming that the average number of people living in each building is five, which is the average number of persons in an Indian household, it is estimated that a total of 2000 persons would be affected or resettled. In addition, a large graveyard is located in the ROW section of the future colony.

In the preliminary engineering design, the carriageway of expressway is designed by the construction of a viaduct bridge structure in the river area to mitigate such negative impact.

In both basic designs presented in the full-scale feasibility study stage and detailed design stage, linear planning is essential to minimize the number of resettled communities and social impacts, which may lead to measures like community severance. Moreover, at present, only open source satellite system estimated the number of people concerned. Thus, further investigation will be conducted to clarify the number of households and population to be resettled during the EIA survey. The efficient plan will compose of a large scale resettlement. The results of the preliminary examination of social impacts are shown in **Table 6.2.1**. After the approval of the project, a detailed study on social environment will be conducted and measured to minimize social impacts such as regional severance.

Table 6.2.1 Expected Social Impacts for Preliminary Examination

No.	Likely Impacts	Explanation on Potential Impacts (Project-related activity is shown in the parenthesis.)	Rating
1	Involuntary resettlement	Planning phase: <Resettlement> Approximately 390 buildings are standing within the legal ROW. For the construction, consultations with residents will be required to discuss demolition/removal and compensation. <Land acquisition> Land acquisition will be required at the curve section and interchange/on-off ramp section. Measures to minimize impact of involuntary resettlement should be examined. Further investigation will be conducted to clarify the number of households and population under resettlement of the EIA survey. Adequate resettlement and rehabilitation plan should be prepared if the project involves large scale resettlement. Adequate compensation scheme should also be established. Operation phase: Inadequate compensation may cause conflict between project affected persons (PAPs) and the implementation body. Appropriate monitoring should be conducted during the operation phase.	A-
2	Local economy such as employment and livelihood, etc.	Construction phase & operation phase : <Road construction, operation of expressway> Positive impacts such as increase in employment opportunities and improvement of livelihood condition in the surrounding area are expected.	B+
3	Land use (Surrounding)	Planning phase, construction phase & operation phase: <Land acquisition> The project will be associated with industrial parks development and thus, land use in the area will be changed accordingly.	B+
		Planning phase, construction phase & operation phase: <Land acquisition> Inadequate land use planning and regulation would cause the acceleration of unplanned development along the expressway and around new interchanges due to unexpected increase of land price.	B-
4	Transportation	Construction phase : <Road construction > Construction activities at the connecting points along the existing roads may cause traffic jam if adequate countermeasures such as preparation of detour roads are not adopted.	B-
		Operation phase: <Expressway operation > The expressway is expected to reduce travel time between city center and the national highway.	B+
5	Existing social infrastructures and services	Operation phase: <Expressway operation > The expressway may improve accessibility of rural population to public facilities in big cities. At an early stage, meeting with local residents will be conducted to get them to familiarize with the project and discuss the policies to avoid community severance such means as setting up facilities to cross roads. In addition, the expressway is expected to reduce traffic impact on the major existing road networks.	B+
6	Regional severance	Construction phase and operation phase: <Expressway construction> The expressway will split some communities and agricultural lands. <Expressway operation> The expressway will restrict pedestrians to move cross-directionally.	B-

No.	Likely Impacts	Explanation on Potential Impacts (Project-related activity is shown in the parenthesis.)	Rating
		Adequate road crossing facilities will be necessary.	
7	Socially vulnerable groups such as the poor, indigenous, and ethnic people	Planning phase: <Alignment fixing and land acquisition > No particular issue was found at the moment. A detailed survey should be implemented to identify impacts of the project on socially vulnerable groups as well as mitigation measures.	C-
8	Historical and cultural heritage	Planning phase: <Alignment fixing and land acquisition > No particular issue was found at the moment. It should be studied during route survey in the next stage.	C-
9	Religious matters	Planning phase: <Alignment fixing and land acquisition > A large scale of graveyard may be affected by the expressway at Future Colony. As sensitive receptors, these locations should be surveyed in the next stage under the environmental and social study such as EIA.	A-
10	Water usage or water rights and rights of common	Planning phase & construction phase: <Establishment of construction detail plan > For usage of surface water or groundwater for construction work, the amount of water required should be estimated and water right should be confirmed The project proponent should report to and discuss with state authorities concerned regarding the use of water.	B-
11	Sanitation	Construction phase: <Road construction > Appropriate measures should be taken to avoid negative effects caused by solid waste and waste water from the work camps for construction workers. Operation phase: <Service area management > Solid waste and wastewater from service area of the expressway may cause pollution and should be treated adequately.	C-
12	Hazardous (risk) and infectious diseases such as HIV/AIDS	Construction phase & operation phase: <Road construction > Risks of infectious diseases would increase due to the increasing movement of people.	B-
13	Invasion of privacy	No particular issue was found at the moment as the expressway principally passes through an agricultural land.	-
14	Accident	Operation phase: <Expressway operation > The expressway may reduce risk of accidents along the existing roads by diverting some vehicle traffic from the existing roads to the expressway.	B+
		Construction phase and operation phase: Adequate separation of traffic between the expressway and the existing roads may contribute to minimize pedestrian accidents.	B-

<Rating>

A- : Serious impact is expected, if any measure is not implemented to the impact.

B- : Some impact is expected, if any measure is not implemented to the impact.

C- : Extent of impact is unknown (Examination is needed. Impact may become clear as study progresses.)

"-" : No impact is expected. Therefore, EIA is not required.

A+ : Remarkable effect is expected due to the project implementation itself and environmental improvement caused by the project.

B+: Some effect is expected due to the project implementation itself and environmental improvement caused by the project.

Source: The Study Team

(4) Natural Environment Impact Examination

In this IEE Study, significant negative impacts on natural environment were not found. The results of preliminary examination on natural impacts made by the Study Team are shown in **Table 6.2.2**.

Table 6.2.2 Expected Natural Environment Impacts for Preliminary Examination

No.	Likely Impacts	Explanation on Potential Impacts (Project-related activity is shown in the parenthesis.)	Rating
1	Topography and geographical features	No particular impact is expected.	-
2	Soil erosion	Construction phase: High embankment associated with road construction may cause soil erosion if no adequate measures for soil surface protection are adopted.	C-
3	Groundwater	Construction phase: Excessive use of groundwater for construction may affect groundwater level around the area.	C-
4	Hydrological situation	Planning phase and construction phase: Impact of road construction due to design for flood water flow of the Malir River should be examined in the next stage.	B-
5	Coastal zone	The expressway will not pass through the coastal zone.	-
6	Flora, fauna, and biodiversity	No particular impact is expected.	-
7	Meteorology	No particular impact is expected.	-
8	Landscape	No particular impact is expected.	-
9	Global warming	No particular impact is expected.	-

<Rating : same as **Table 6.2.1**>

Source: The Study Team

(5) Pollution Impact Examination

The project involves the construction of a new highway in an area where no road network currently exists. The construction work should implement and follow the environmental standards set by the Sindh Environment Protect Agency in order to minimize the impacts. The results of preliminary examination of natural impacts are shown in **Table 6.2.3**.

Table 6.2.3 Expected Pollution Impacts for Preliminary Examination

No.	Likely Impacts	Explanation on Potential Impacts (Project-related activity is shown in the parenthesis.)	Rating
1	Air pollution	Operation phase: <Vehicle movement on the Expressway > As a positive impact, it is expected that there would be a reduction of air pollutant emission due to the reduction of road congestion in the city area.	B+
		Construction phase and operation phase: <Movement of vehicle during construction and operation> The expressway will increase traffic in rural areas which may cause an increase of emission from vehicles. Monitoring data should be collected further. Environmental and social studies such as EIA, and adequate monitoring plans should also be examined.	B-

No.	Likely Impacts	Explanation on Potential Impacts (Project-related activity is shown in the parenthesis.)	Rating
2	Water pollution	Construction phase: <New bridge construction> Bridge construction may affect water flow and water quality of the relevant rivers, such as increase in turbidity. Before commencement of the construction work, existing conditions should be confirmed. (Besides, almost all of the rivers are temporal/seasonal.)	B-
3	Soil contamination	Construction phase: <Road construction > Discharge of solid waste and wastewater from work camps and workshops will cause soil contamination around the project site. An adequate treatment may have to be implemented.	C-
4	Waste	Construction phase: <Road construction> Discharge from work camps and workshops of heavy machinery may cause soil contamination in the area. Adequate treatment for these waste materials should be considered. Operation phase: <Service area management> Solid waste from service areas along the expressway should be treated adequately.	B-
5	Noise and vibration	Construction phase and operation phase: <Movement of vehicle during construction and operation > Noise and vibration levels in rural areas associated with the construction of the expressway may increase. In addition, traffic flow during operation phase, noise and vibration levels along the expressway will increase. A detailed study should be conducted to predict noise and vibration levels during the operation phase. Measures to reduce noise and vibration levels at the residential areas and sensitive receptors should be studied and proposed, if necessary.	B-
6	Ground subsidence	Construction phase: <Road construction> Water use should be monitored adequately when groundwater will be used for construction work.	B-
7	Offensive odor	No particular issues were found at this stage.	-
8	Bottom sediment	No particular issues were found at this stage.	-
9	Disaster	No particular issues were found at this stage.	-

<Rating : Same as **Table 6.2.1**>

Source: The Study Team

6.2.2 Recommendations and Conclusions from IEE Study

The following are some basic recommendations and conclusions with respect to the environmental aspects of the proposed project:

- A detailed EIA needs to be carried out immediately after the finalization of the alignment and ROW so that environmental and social aspects may be addressed appropriately in the planning stage of the project.
- Consent of key stakeholders including EPA, should be included during the preparation of

the scope of work for the EIA.

- Land acquisition and resettlement action plan framework may be developed for the finalized route. This is to identify any legal requirements, relevant organizations, departmental procedures and documentation etc., with respect to the identification of PAPs and compensation to be made for clearing ROW.
- Procedures for the preparation of entitlement matrix should be developed as early as possible during the planning stage to avoid any political or other influences and to commence compensation process as early as possible to avoid unforeseen events leading to any adverse social impact with respect to development.
- Preparation of documents for the Environmental and Social Assessment Study and Land Acquisition and Resettlement Action Plan are very important and essential in preparation for the proposed project. These documents are considered mandatory requirements under the national legislation as well as JICA guidelines.
- Development of the timeline for preparation of these documents and its integration with the project's overall schedule is a very important aspect. The documents must be prepared during initial planning stage of the project so as to ensure the integration of mitigation measures in the project design.
- Allocation of requisite funds should be ensured to make compensation timely for land acquisition, removal of structures, agriculture crops, and eviction of encroachers from the land.

6.2.3 Recommended Scopes of EIA Study and RAP Study in the Next Phase

(1) EIA Study

1) Study area

The EIA study area will cover an area of about 21 km along the Malir River Bund Road from the intersection of 3000 Feet Road on the 8000 Feet Road at Korangi Town, to the National Highway at Goth Juma of Bin Qaim Town.

2) Method

a. Collection of existing data and site reconnaissance

The present social and natural environment will be analyzed through data collection and site reconnaissance. Information regarding the Pakistan EIA system and environment license will also be collected.

b. Project activities

The Project covers the following five activities;

i) Widening of roads from two-lane to four-lane including road structures,

ii) Construction of bypass,

iii) Improvement of cross drainage,

iv) Improvement of traffic safety facilities, and

v) Related construction works such as borrow pit, quarry, and access road.

c. Field survey

Based on the scoping results in this Study, field surveys will be conducted to obtain data on the

present situation, as shown in **Table 6.2.4**.

Table 6.2.4 Summary of Main Survey Items

Survey Items	Impact Evaluation Based on Scoping	Survey Points	Contents
Air quality	B-	Three points	- Sulfur oxide (SOx), Nitrogen oxide (NOx), Carbon monoxide (CO), Suspended particulate matter (SPM) - Three days continuous monitoring in each location, which accounts for nine days in total
Water quality	B-	Three points	- The parameters to be monitored are: salinity, TSS, and fecal Coliforms.
Noise and vibration	B-	Three points	- Average noise (Leq dB(A)) and vibration level (L10 dB) per ten minutes with traffic volume for ten minutes - three days of continuous monitoring in each location.

Source: JICA Study Team

d. Environmental impact

Impacts will be assessed at the construction and operation phases.

e. Mitigation measures and environmental monitoring plan

All mitigation measures introduced to reduce impact on each environmental item will be confirmed and arranged into the environmental management plan (EMP).

During construction and operation, all mitigation measures have to be recorded and monitored to evaluate the impact in comparison to criteria and/or environmental standards. Mitigation measures and monitoring plans will include approximate cost and capacity development. This will be done by taking into account past projects and also through consultation with authorities.

f. Public consultation

The EIA report includes the date, time, place, number of participants, and transcripts of questions and answers from public consultations.

g. Assistance for EIA Report

This report is made in accordance with Pakistan's environmental regulations and the environmental guidelines of donor such as JICA Guidelines. The table of contents is proposed as follows:

0. Executive Summary
1. Policy, Legal, and Administrative Framework
2. Project Description
3. Scoping and TOR for EIA Study
4. Baseline Data
5. Environmental Impacts
6. Analysis of Alternatives
7. EMP
8. Consultation
9. Resettlement and Land Acquisition

10. Appendices
    - List of Contributors in Preparing the EIA Document (institutions, individuals)
    - List of References

(2) RAP Study

The Resettlement Action Plan (RAP) Study will include, but not limited to, extent and nature of impacts, socio-economic information of the affected households, entitlement matrix, institution, consultation mechanism, implementation schedule, and estimated costs.

The RAP report to be prepared is recommended to follow the World Bank Operational Policies OP 4.01-Annex B (January 1999) and involuntary resettlement processes shall confirm to the World Bank Operational Policies OP 4.12-Annex A (revised February 2011). RAP should also include the necessary contents shown in **Table 6.2.5**.

Table 6.2.5 Recommended Table of Contents for RAP

Executive Summary	
1) Introduction	2) Project Impacts
1) Compensation and Entitlement	4) Implementation Schedule
1. Introduction	**6. Implementation**
1.1 Main Objective of RAP	6.1 Implementation Schedule
1.2 Methodology	6.2 Organization of Resettlement Implementation Organization
1.3 Description of the Project	6.3 Process and Schedule of Payment
2. Impacts and Mitigation Measures	**7. Monitoring and Evaluation**
2.1 Type of Impacts	7.1 Monitoring and Supervision of RAP Implementation
2.2 Avoidance/Preventive Measures to Minimize the Impacts	7.2 Role and Responsibility
3. Policy on Eligibility for the Compensation and Other Entitlement	**Annex-A: Project Affected Family**
3.1 Criteria for Eligibility of Compensation	**Annex-B: Provisionally Expected Project Affected Family**
3.2 Indicators for Severity of Impacts	**Annex-C: Public Consultation Proceedings**
3.3 Compensation per Category of Assets Affected	**Annex-D: Detailed Comments by the Donor Agent**
3.4 Entitlements	**Annex-E: Memorandum of Understanding**
3.5 Detailed Compensation Entitlement	**Annex-F: Location of Project Affected Field**
3.6 Resettlement Costs and Budget	**Annex-G: Less Cost of Material**
4. Summary of Impacts and Estimated Resettlement Cost	
5. Discloser and Grievance Process	

Source: JICA Study Team

6.3 Project Cost Estimation

(1) Unit Cost of Major Construction Items

The unit cost of major construction items are estimated based on NHA CSR 2011 by the Study Team. In recent years, the economic condition of Pakistan has been unstable. Higher inflation exceeded 10% of the annual average rate as indicated in **Table 6.3.1**. The IMF (International Monetary Fund) forecasted that inflation of Pakistan in 2012 will be at 12.00%. The Study Team estimated the unit cost of construction work by referring to the forecasted inflation rate of the IMF. The unit costs are shown in **Table 6.3.2**, which include tax portion in the unit cost.

Table 6.3.1 Annual Average Inflation in Pakistan for Past Five Years

Year	2007	2008	2009	2010	2011	2012 (Forecast)
Annual Average Inflation (%)	7.83	10.78	17.63	10.10	13.66	12.00

Source: IMF World Economic Outlook Database (2012 April)

Table 6.3.2 Unit Cost of Major Construction Items

Work Category	CSR No.	Description	Unit	Unit Cost (Rs)	
				NHA CSR 2011	2012 Estimation
Earth Work	101	Clearing and Grubbing	m^2	21.03	23.76
	104	Compaction of natural Ground	m^2	22.74	25.70
	106	Cutting	m^3	264.14	298.48
	108	Filling	m^3	355.42	401.62
Sub Base and Base	201	Granular Sub Base	m^3	1,028.24	1,161.91
	202	Aggregate Base Course	m^3	1,176.43	1,329.37
	203	Asphaltic Base Course	m^3	14,316.67	16,177.84
	209a	Breaking of Existing Road Pavement Structure	m^3	491.14	554.99
	209b	Scarification / Grooving of Existing Road Pavement	m^2	55.02	62.17
Surfacing	302	Prime Coat	m^2	88.57	100.08
	303	Tack Coat	m^2	35.47	40.08
	305	Asphaltic Wearing Course	m^3	15,427.14	17,432.67
Construction Unit Cost		Concrete Bridge Structure	m^2	101,026.00	114,159.38
		Concrete Retaining Wall	m^2	27,147.00	30,676.11

Source: JICA Study Team

(2) Estimated Construction Cost

Table 6.3.3 shows the estimated construction cost.

Table 6.3.3 Estimated Construction Cost

Work Category	Cost (US$)	Cost (Rs)
Earth Work	4,450,000	403,000,000
Sub Base and Base	13,620,000	1,233,000,000
Surfacing	6,530,000	591,000,000
Footpath/Island/Median	460,000	42,000,000
Drainage	8,100,000	733,000,000
Structure	130,410,000	11,802,000,000
Others	63,740,000	5,768,000,000
Construction Cost Total	227,310,000	20,572,000,000

Rate: US$1.00= Rs90.498
Source: JICA Study Team

(3) Project Cost

Table 6.3.4 shows the estimated total project cost. The breakdown of quantities and costs is attached in Appendix 3.

Table 6.3.4 Estimated Total Project Cost

Work Category	Cost (US$)	Cost (Rs)
Construction Cost	227,310,000	20,572,000,000
Resettlement Cost	6,160,000	557,000,000
Land Acquisition Cost	2,510,000	227,000,000
Relocation Cost	2,930,000	265,000,000
Total Project Cost	238,910,000	21,621,000,000

Rate: US$1.00= Rs90.498
Source: JICA Study Team

6.4 Project Implementation Plan

For the economic evaluation purpose of the Project, the project implementation plan is supposed as follows:

(1) Project implementation agent

The Karachi Metropolitan Corporation (KMC) will manage the entire project during its implementation. KMC will also manage the operation and maintenance (O&M) of the Malir River Bund Road after completion of construction work.

(2) Implementation schedule

Table 6.4.1 shows the project implementation schedule. This schedule is formulated with the following conditions;

i) After the completion of the JICA Study on the "Preparatory Survey on JICA Cooperation Program for Industry Development (Investment Climate Improvement in Karachi)", the full-scale feasibility study (12 months) will commence as follows;

- To implement the resettlement and land acquisition, ROW will be determined in the feasibility study.
- Based on the said ROW, EIA Report and Resettlement Action Plan (RAP) will be finalized.
- PC-1 document will be prepared from the outcome of the feasibility study, and KMC will get an approval of the project implementation from the authorities.

ii) After procurement of the consultant, preparation of tender document for the detailed engineering design will be completed within nine months. Utilities relocation plan will be formulated in this detailed engineering design.

iii) Duration of tendering stage including PQ and bidding processes is estimated to take nine months.

iv) Resettlement, land acquisition, and utilities relocation will be completed before commencement of construction works.

v) The construction period is estimated at 30 months.

Table 6.4.1 Supposed Project Implementation Schedule

Item	Year						
	2012	2013	2014	2015	2016	2017	2018
1. JICA Preparatory Survey (Pre-F/S)							
2. Full-Scale F/S							
1) Determination of ROW							
2) EIA Report Submission							
3) RAP Report Submission							
4) PC-1 Submission							
3. Detailed Engineering Design							
1) PQ Document Submission							
2) Tender Document Submission							
4. Resettlement / Land Acquisition							
5. Utility Relocation							
6. Tendering							
1) Prequalification (PQ)							
2) Biding							
7. Construction Work							
8. Road Operation							

Source: JICA Study Team

6.5 Economic Evaluation

6.5.1 Evaluation for Toll Expressway

In the initial economic evaluation of the previous section, the Malir River Bund Road was evaluated as a toll free (non-tolled) highway. However, the project road is planned as a six-lane motorway with complete access control and with a design speed at 80 km/h. This kind of high standard road will provide better service level than general roads. Therefore, an option to consider it as a tolled expressway is more realistic rather than a non-tolled highway. In this section, an economic evaluation will be carried out in case that the Malir River Bund Road will be treated as a tolled expressway.

Due to levying of toll charge, traffic demand on the project road as well as the economic benefit will be affected.

(1) Toll rate setting

The toll rates (toll structure and toll policy) of the expressways should be decided, taking into account the factors such as users benefits (Willingness to Pay: WTP), affordability, construction costs including operation and maintenance costs, and general price level.

In general, toll rates are controlled by the government (central or local/city government) even if expressways are constructed and operated by the private sector.

In this evaluation, a rate of Rs30 per trip for light vehicles was tentatively applied as this is the existing rate on the Lyari Expressway.

(2) Economic costs

The project economic costs (as well as financial costs) of the Malir River Bund Road are the

same as presented in the initial economic evaluation.

However, since this is a pre-feasibility study, it will be necessary to cover/supplement the project costs in the next stage of the full-scale feasibility study so as to include the construction cost of toll gates and toll collection costs, and if possible, the intelligent transportation system (ITS) cost.

6.5.2 Economic Benefits of Toll Expressway

(1) Estimated economic benefits

The methodology for benefit calculation is the same as applied in the initial evaluation. Traffic demand of the tolled Malir River Bund Road was forecasted reflecting the toll charge. The estimated economic benefits are presented in **Table 6.5.1**.

Table 6.5.1 Estimated Benefits (Toll Expressway), Rs million/year

Year	VOC and TTC	Without Project (Exclude Malir River Bund Road from Highway Developed Network of KTIP) (A)	With Project (Include Malir River Bund Road) (B)	Benefit (A) – (B)
2020	VOC	265,339	262,720	2,618
	TTC	127,272	114,460	12,812
	Total	392,611	377,180	15,431
2030	VOC	307,822	303,348	4,474
	TTC	151,882	147,043	4,840
	Total	459,704	450,390	9,314

Source: JICA Study Team

6.5.3 Economic Evaluation

(1) Pre-conditions for economic cost and benefit analysis

Cost-benefit cash flow analyses were carried out under the following pre-conditions:

1) Price level : 2012 prices
2) Opening year : 2018
3) Evaluation period : 20 years after opening
4) Residual values : No residual values were counted
5) Opportunity cost of capital : 12%

(2) Evaluation results

The results of economic evaluation are shown below:

- Economic internal rate of return (EIRR) = 19.1%
- Benefit/cost ratio (B/C) = 1.56
- Net present value (NPV) = Rs8,734 million

The above results indicated that the Malir River Bund Road Project is economically feasible with an EIRR higher than the opportunity cost of capital (>12%), B/C ratio is higher than unity (>1.0) and with positive NPV (>0).

The cost-benefit streams are shown in **Table 6.5.2**.

Table 6.5.2 Cost-Benefit Stream, Malir River Bund Road (Tolled Case) Rs millions

	Year	Investment Cost (Rs.Mill.)						Maintenance Cost		Total Cost	Benefit (Rs.Milli.)		Total Benefit	B-C
		Construction Cost	Physical Contingency	Administration Cost	Environmental Management	Land Acquisition & Relocation	Engineering Services	Routine	Periodic		VOC	TTC		
	2012													
	2013			74			313			387			0	-387
	2014			74	16	1,050	313			1,453			0	-1,453
	2015	6,171	463	74	16		313			7,037			0	-7,037
	2016	6,171	463	74	16		313			7,037			0	-7,037
	2017	6,171	463	74	16		313			7,037			0	-7,037
1	2018							93		93	2,247	3,602	5,849	5,756
2	2019							93		93	2,433	3,402	5,835	5,743
3	2020							139		139	**2,618**	**3,203**	**5,822**	**5,683**
4	2021							139		139	2,804	3,004	5,808	5,669
5	2022								370	370	2,990	2,804	5,794	5,424
6	2023							93		93	3,175	2,605	5,780	5,688
7	2024							93		93	3,361	2,406	5,767	5,674
8	2025							139		139	3,546	2,206	5,753	5,614
9	2026							139		139	3,732	2,007	5,739	5,600
10	2027								555	555	3,917	1,808	5,725	5,170
11	2028							93		93	4,103	1,609	5,712	5,619
12	2029							93		93	4,289	1,409	5,698	5,605
13	2030							139		139	**4,474**	**1,210**	**5,684**	**5,545**
14	2031							139		139	4,474	1,210	5,684	5,545
15	2032								741	741	4,474	1,210	5,684	4,943
16	2033							93		93	4,474	1,210	5,684	5,591
17	2034							93		93	4,474	1,210	5,684	5,591
18	2035							139		139	4,474	1,210	5,684	5,545
19	2036							139		139	4,474	1,210	5,684	5,545
20	2037								926	926	4,474	1,210	5,684	4,758
	Total	18,514	1,389	372	65	1,050	1,563	1,851	2,592	27,395	75,009	39,744	114,753	87,358

EIRR	19.06%
NPV Rs.(Milli)*	8,734
B/C*	1.56

Discount Rate = 12%

Source: JICA Study Team

(3) Sensitivity Analysis of the Economic Evaluation

In order to check the robustness of Malir River Bund Road Project economic feasibility and sensitivity analysis were carried out using different cost and benefit values within a probable range against the base case. The prepared cases for the sensitivity analysis were as follows:

- Project costs go up by: +10%, +15% and +20%
- Project benefits go down by: -10%, -15% and -20%
- Different combinations of the above changes in costs and benefits

Summarized results of the sensitivity analysis are shown in **Table 6.5.3**.

Table 6.5.3 Results of Sensitivity Analysis (EIRR)

Benefit / Cost	Base Case	-10%	-15%	-20%
Base Case	19.1%	17.2%	16.3%	15.1%
+10%	17.4%	15.7%	14.8%	13.8%
+15%	16.7%	15.0%	14.1%	13.2%
+20%	16.0%	14.3%	13.4%	12.5%

Source: JICA Study Team

The results of the sensitivity analysis showed the robustness of the project's economic feasibility. Even if the project costs went up by 20% and economic benefits went down by 20% simultaneously, the project will maintain values of EIRR higher than the opportunity cost of capital (> 12%).

(4) Preliminary financial evaluation (FIRR) – provisional result

A provisional financial analysis was carried out for reference purpose only, it was done by calculating the value of the financial internal rate of return (FIRR). A calculated value of 3.6% FIRR is too low to attract the participation of the private sector investment. However, annual

O&M costs may be sufficiently covered with the annual toll revenue.

Further studies are necessary in the next stage of full scale feasibility study for more detailed financial analysis including optimum toll rates, toll collection system, and possibility of private sector participation.

6.5.4 Project Effects on Investment Climate Improvement

Although the economic feasibility of the Malir River Bund Road was confirmed in the above analyses, the most important impact other than the direct benefits of the investment climate improvement, is the provision of a more reliable and safe transport measure for daily commuting in the daily economic activities of people in the Karachi Metropolitan area, particularly to/from the industrial zones in the study area.

According to the results of the travel speed survey conducted by the JICA Study Team in June 2012, an average travel speed during afternoon peak hours (after 17:00) was around 30 km/hour to/from FTC (Finance and Trade Center: a gate from the central area of Karachi to the Study Area) from/to the Port Bin Qasim/Export Processing Zone (EPZ). In addition, the total delay time (stopping time) due to traffic congestion was around 10 to 20 minutes (about 20-30% of total travel time).

Under such situation, non-stop and safety direct access to industrial zones by the project expressway is one of the necessary conditions and also one of the basic infrastructures to promote/attract local and foreign direct investments (FDIs).

In the case of tolled expressway, it is recommended to introduce some toll policies to reduce the burden of toll charges for daily/permanent users by issuing discounted monthly/yearly coupons, for example. This matter should be considered in the detailed financial analysis in the full-scale feasibility study to be carried out in the next stage.

CHAPTER 7 RECOMMENDATION FOR IMPLEMENTATION OF ROAD DEVELOPMENT PROJECT

7.1 GOP's Action for Strengthening Existing Road Network

The Study Team recommends the construction of the Malir River Bund Road as a priority project that will contribute to the improvement of accessibility between the Clifton area and Port Qasim area in the aspect of investment climate improvement. Due to the limiting traffic capacity of the existing road network, road network strengthening is required to compensate for the yearly increase in traffic, even if the Malir River Bund Road will be constructed. In addition, as it takes time to complete the construction works, the Study Team espoused that Malir River Bund Road may commence operation in 2018.

The participation of the Government of Pakistan (GOP) is necessary for the preparation of the Malir River Bund Road Construction Project. On the other hand, it is recommended for the meantime that the GOP takes the following actions in road network strengthening;

1) Increasing Traffic Capacity of Shahrah-e-Faisal and National Highway

i) KMC has prepared and submitted the PC-1 for three locations of the flyover construction project in Shahrah-e-Faisal, these will be located at the International Airport, at Malir Halt Intersection and at Malir 5 intersection. The construction work of the flyover at the international airport has commenced. However, the remaining two flyover constructions should be taken the necessary procedures for budget approval and construction works should be commenced as soon as possible.

ii) KMC has a project plan on the Shahrah-e-Faisal and the national highway for a six-lane carriageway improvement. However, the status of the project is only up to the preparation of its concept paper due to opposition in budget requests to procure survey and design consultants. Since the current traffic volume on Shahrah-e-Faisal and the national highway (between the international airport and Port Qasim) reached the traffic capacity of the existing four-lane carriageway, it is recommended for KMC to accelerate the internal process of project implementation.

iii) On-road parking issue causes the decrease in traffic capacity of carriageways. An oil tanker parking terminal with the capacity of more than 2000 tankers is under construction behind the Pakistan State Oil Terminal. On-road parking by large number of oil tankers is one of the major issues in the national highway section between Quad Abad Flyover and Port Qasim. Therefore, this oil tanker parking terminal construction might be able to mitigate the on-road parking issue. To achieve the effect of a parking terminal, the following soft measures are necessary to commence;

- Formulate the dissemination framework as well as enforcement framework to corroborate with the concerned agencies.
- Many small scale private automobile workshops are making business along the national highway. It is believed that the oil tanker parking terminal will create business opportunities to the said private workshops.
- Therefore, the concerned agencies should take care of the social negative impact, for example, business space will be provided for the impacted private workshops.

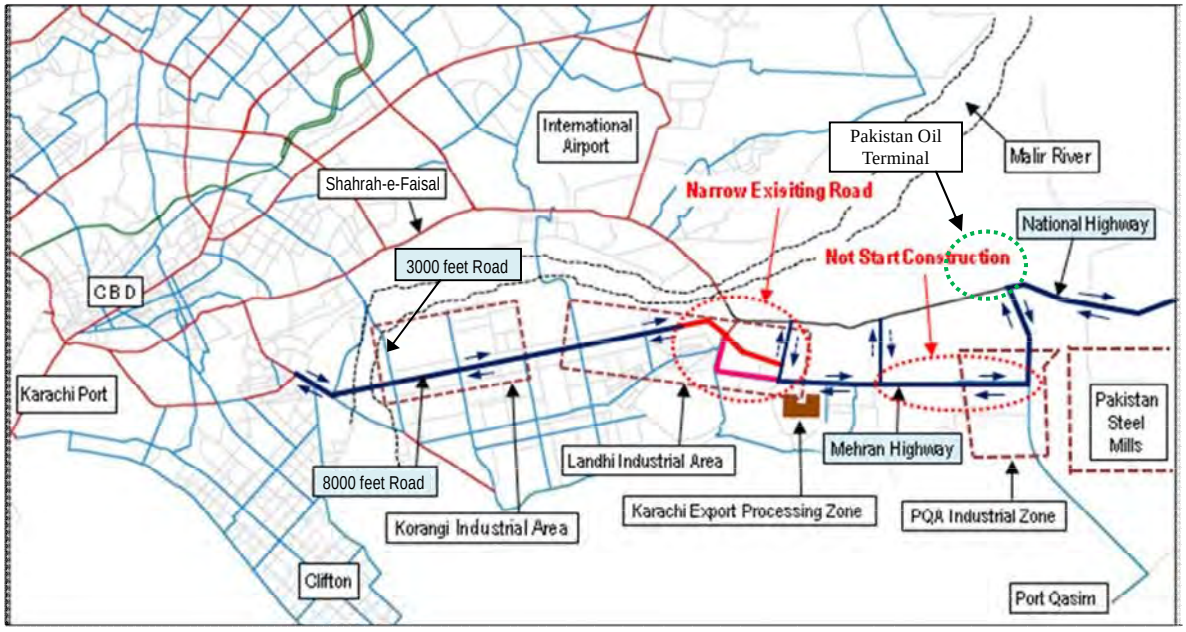
2) Reducing heavy traffic impact on the National Highway

Due to traffic regulation of Shahrah-e-Faisal, heavy industrial vehicles pass through the 8000 Feet Road at Korangi Town and Landhi Town. At present, industrial vehicles are passing through the national highway since Meharan Highway has not been completed. This also cause traffic congestion

issues at the national highway. In order to mitigate traffic impact by the industrial vehicles at the national highway, the following measures are recommended;

i) The construction of Meharan Highway should be accelerated. After completion of the Meharan Highway, heavy industrial vehicles will be controlled in passing through the 8000 Feet Road–Meharan Highway as shown in **Figure 7.1.1**.

ii) Existing conditions of the 3000 Feet Road at Future Colony and section between Rice Godown and Hospital Chowrangi of the Mehran Highway are narrow and poor. Therefore, road improvement projects should be enhanced in order to ensure good transportation conditions for industrial vehicle passing the area.



Source: JICA Study Team

Figure 7.1.1 Recommended Transportation Route of Heavy Industrial Vehicles

7.2 Next Stage of Malir River Bund Road Implementation

In the project implementation of the Malir River Bund Road construction, solving the issue of resettlement/land acquisition should be an important factor. The Study Team conducted a pre-feasibility study in the Study, and full-scale feasibility study to include RAP study should be recommended to carry out promptly the following scope of works;

1) RAP study in the feasibility study

The usual practice in Pakistan for acquiring ROW is determined at the detailed design stage. The RAP study will commence after the completion of the detailed design. Such process causes delay of resettlement and land acquisition. Consequently, project implementation is delayed. ROW should be determined in the feasibility study by raising the precision of engineering study. Finally the RAP study is conducted as a scope of the feasibility study.

i) Topographic survey with accuracy of detailed design is carried out, ROW drawings are then prepared on the topographic map.

ii) Geotechnical investigation for bridge foundation design and hydrological survey/study to confirm the flood elevation are conducted, and then, the plan and profile drawings with detailed design level are produced.

2) Financial study of expressway tolling

KMC intends that the Malir River Bund Road be developed as a tolling road. However, the preliminary engineering design of the Phase-2 section (Shahrah-e-Faisal to super highway) has not been prepared yet, therefore, the financial study for the entire Malir River Bund Road has not been conducted. To perform the proper financial study, the following studies should be conducted in the feasibility study;

i) To conduct supplemental traffic survey and demand forecast with focus on the toll road.

ii) To examine the engineering option of expressway extension to connect Clifton DHA area or Karachi Port, and to conduct traffic demand forecast.

iii) To prepare preliminary engineering design and cost estimation of Phase-2 section and the above expressway extension, including location plan of interchange or on/off ramp of expressway.

iv) To examine the traffic management plan for heavy industrial vehicle users. In the pre-F/S, passing of industrial vehicle is not taken into consideration in the traffic demand forecast.

3) Review for the engineering design of pre-F/S

i) Three locations of interchange at EBM Causeway, Malir River Bridge, and Shahrah-e-Faisal are planned in the pre-F/S. In accordance with the preliminary design of Phase-2 section and extension to Clifton DHA or Karachi Port, the interchange design should be reviewed.

ii) According to the traffic management plan of heavy industrial vehicles, the road geometric design conditions should be reviewed. Preliminary design of the pre-F/S did not consider passing of heavy vehicles on the expressway.