

Appendix - 3

**THE STUDY
FOR
KARACHI TRANSPORTATION
IMPROVEMENT PROJECT

BUSINESS PLAN (DRAFT)**

December, 2012

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Chapter 1 Introduction

1-1 Background of the Project

The plan of Karachi Mass Transit Corridors is the official mass transit master plan notified by the Government of Pakistan in 1995. The plan was based on Karachi Mass Transit Study in 1990 in which elevated and at-grade bus corridors were proposed. Bus corridors were designed so that they can be converted to Light Rail Transit System.

There had been several attempts to implement the plan but these corridors were not implemented. The original concept of busway was changed to the railway system and the concession on Corridor-1 as BOT basis was given private investors, but all projects have failed.

Meanwhile, Bus Rapid Transit (BRT) system was proposed in “Private-Public based environmental friendly public transport system for Karachi (2006)”. This study has introduced the modern style BRT system to Karachi and BRT became popular among transport authorities and planners in Karachi. The proposed system consisted of 16 BRT corridors, 21 secondary routes, and feeder routes.

Asian Development Bank (ADB) took over the BRT projects as a part of Megacity Project and identified 3 priority corridors. However, ADB withdrew the BRT project in 2007.

Karachi Transportation Improvement Project (KTIP) was conducted by Japan International Cooperation Agency (JICA) in collaboration with Karachi Mass Transit Cell (KMTCC), CDGK from April 2010 to June 2012. KTIP consisted of the master plan stage and feasibility study stage. In the master plan study, the JICA Study Team proposed KCR, 2 railway systems, and 6 BRT corridors. Each corridor has been given a name of color so that the corridors can be easily understood. After the master plan stage, JICA selected 2 BRT corridors, namely Green Line and Red Line for the projects of the feasibility study.

The feasibility study on Green Line and Red Line was conducted from July 2011 to June 2012. It was proposed to construct dedicated bus lanes in the median of road along Green Line (M.A. Jinnah Road – Gurmandir – Lasbela – A.O. Clock – Surjani) and Red Line (Regal Chowk – People’s Roundabout – University Road – Model Colony) with 57 stations.

1-2 Present Situation of Public Transport in Karachi

Presently, public transport system in Karachi is very poor. The number of bus passengers is approximately 5.6 million per day, accounting for 40% of motorized travel modes. Since the number of registered buses and minibuses is approximately 21,800, a bus carries 257 passengers per day. The average speed of buses is as slow as 17km/h. Since buses are operated by individual operators who want to maximize the fare revenue, overloading including roof top seating, waiting for passengers at a bus stop for a long time, non-stop at bus stops where the number of passengers is small, and low frequency in off-peak hours are commonly observed in Karachi.

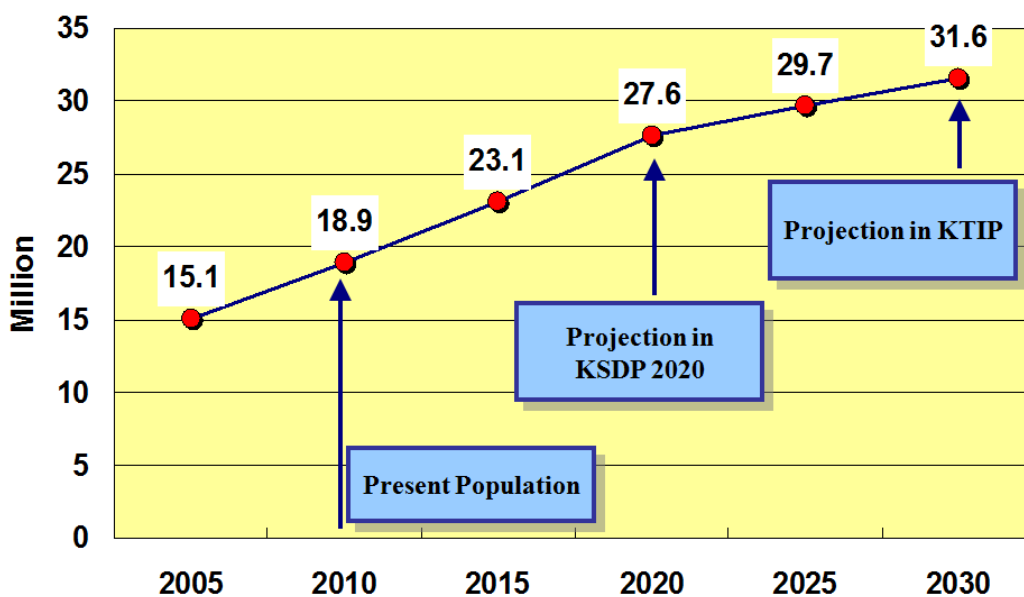
Bus services are unpredictable, unstable and uncomfortable. People who can use other transport modes prefer motorcycle, rickshaw and taxi rather than using buses.



Photo: The Study for KTIP

1-3 Future Urban Growth in Karachi

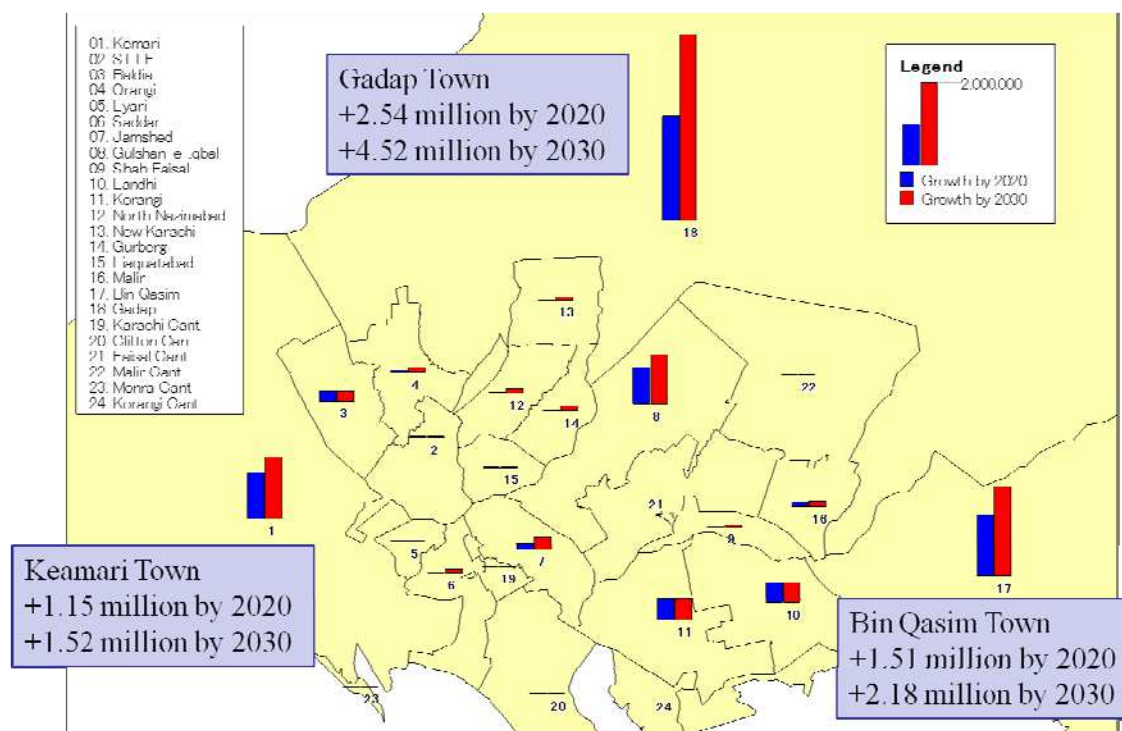
It was estimated that Karachi had a population of 18.9 million in 2010. The present population would be approximately 20 million considering the population growth. The population will increase to 27.6 million in 2020 and 31.6 million in 2030. This means that more than 10 million people will be added to Karachi city in next 20 years.



Source: The Study for KTIP

Figure 1-1 Future Population

The basic concept of the future land use plan is to expand the city in the suburban area such as Gadap, Keamari, and Bin Qasim. In Gadap Town, it is estimated that the increase in the population would be 2.54 million by 2020 and 4.52 million by 2030. Increase in the population in Bin Qasim is also as large as 1.51 million by 2020 and 2.18 million by 2030.



Source: The Study for KTIP

Figure 1-2 Population Increase by Town

1-4 Necessity of the Project

For the public transport system in Karachi, BRT system does not necessarily the best solution because of its disadvantages such as lower capacity than railway system and consumption of existing road space. However, investment cost on a railway system is too expensive to realize in Karachi, and only Karachi Circular Railway (KCR) shows a progress with the financial support of JICA. The growing city cannot wait mass transit system until the economic level of the city is high enough to introduce expensive system. To improve the public transport system in Karachi, BRT is the best system on the project corridors considering the cost-efficiency and available resources.

1-5 Vision

The vision of the Karachi BRT Project is:

Moving in Karachi will be no more stressful activity because of the reliable, comfortable, and sustainable public transport system.

1-6 Mission

Missions are:

- To introduce a Bus Rapid Transit (BRT) system
- To provide frequent, fast, reasonable, and comfortable bus services
- To ensure financial stability for continuous service

Chapter 2 Bus Rapid Transit (BRT) Scenario in Karachi

2-1 What is BRT?

2-1-1 World Trend

Bus Rapid Transit (BRT) is a high quality bus system providing high speed, reliable, and comfortable services compared to traditional bus services. The concept of BRT is based on the railway system – running along exclusive way, high speed, accurate travel time, and high capacity.

Curitiba (Brazil) introduced a high quality bus service system in 1974, which is now recognized as the first successful case of BRT in the world although some advanced bus transit services such as busway and bus exclusive lanes had been introduced in some cities. In 2000, Bogota (Columbia) opened innovative BRT system (TransMillenio) which made a significant impact on transit planners and decision makers in the world, showing that the BRT can achieve high capacity transport service similar to railway systems.



Curitiba
Photo: Toshiyuki Okamura



Bogota
Photo: Toshiyuki Okamura

In the 2000s, a number of capital cities in the world introduced BRT. These cities are: Taipei (2001), Seoul (2004), Jakarta (2004), Beijing (2005), New Delhi (2008), Istanbul (2008), Lima (2010), and Bangkok (2010).

BRT has been recognized as a cost-efficient mass transit system which can solve urban transport problem in not only developing countries but also developed countries.

2-1-2 Major Feature of BRT

There are many variations of BRT systems in the world. Articulated buses are popular but standard type larger buses are also used in many cities. The major characteristics of successful BRT systems are:

- Dedicated bus lanes in the middle of the road (at-grade)
- Stations with the platform for convenient boarding and alighting
- Frequent and rapid operation
- Pre-boarding fare collection (segregation of paid and unpaid areas in a station)
- Low cost compared to other mass transit systems



Photo: Nippon Koei Co., Ltd.

2-1-3 BRT Capacity

The Bogota BRT (TransMillenio) shows that BRT system can provide transport capacity as high as railway system, by achieving the capacity of 43,000 passengers per hour per direction. From this, BRT has been proposed in many cities as an alternative of rail-base mass transit system.

However, TransMillenio is the exceptional case, and no other BRT has achieved such a high traffic throughput. The success of TransMillenio brought about misunderstanding of BRT capacity as if BRT can be an alternative of the railway system in terms of capacity.

The maximum capacity of a standard BRT is approximately 13,000 passengers per hour per direction.

BRT capacity depends on the service frequency and vehicle capacity as same as railway system. The service frequency depends on dwell time and clearance time. In case that dwell time and clearance time are 20 and 20 seconds, respectively, the frequency is calculated at 1.5 buses per minutes (60/(20+20)), meaning 90 buses per hour (1.5*60). If articulated buses having the capacity of 150 passengers are used, the capacity is calculated at 13,500. This is the case when the stopping bay is fully used by vehicles all the times. The percentage of time that a stopping bay is used by vehicles (saturation level) affects the vehicle speed. It is recommend that saturation level is less than 0.4 to ensure the proper operating speed¹. If the saturation level of 40% is applied, the above calculated capacity becomes 5,400 passengers per hour per direction.

Additional stopping bays can increase the capacity. The following is the formula to calculate the system capacity of BRT.

$$Ca[\text{pax/hour}] = \sum_{i=1}^{Nsp} X_i \times \frac{3600[\text{sec/hour}]}{Tsb[\text{sec/bus}] \times (1 - Dir_i) + To[\text{sec/bus}]} \times Cp[\text{Pax/bus}]$$

Where,

¹ Bus Rapid Transit Planning Guide, June 2007

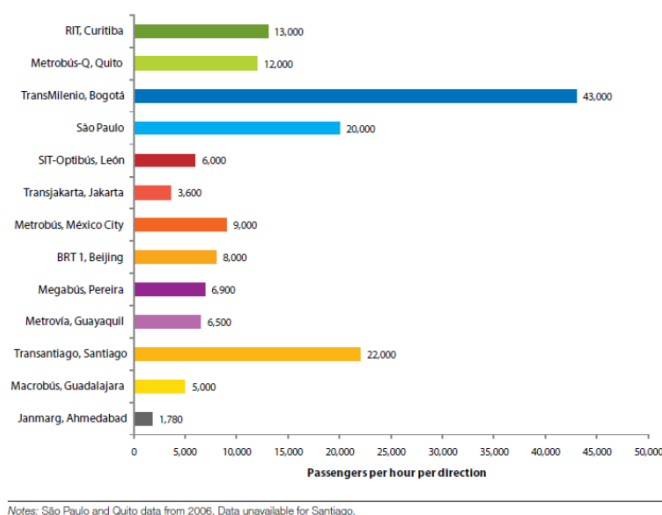
Ca [pax/hour]	System capacity (Passengers per hour per direction)
Nsp	Number of stopping bays
Tsb [sec/bus]	Passenger boarding and alighting time per bus (Dwell time)
To [sec/bus]	Minimum interval between buses (Clearance time)
Diri	Ratio of passing buses
Cp [pax/bus]	Bus capacity (passengers capacity per bus)
Xi	Saturation level

Source: EMBARQ (translated from the original in Spanish)

If a station has three stopping bays, the above calculated capacity (5,400) increases to 16,200. The ratio of passing buses (express operation) is also an important factor to increase the transport capacity.

Note that the addition of stopping bays requires passing lane at station.

Figure below shows examples of passenger volume per hour per direction in the world. Only Bogota's BRT achieves the capacity of 43,000, followed by Sao Paulo and Santiago at the capacity of approximately 20,000. The throughput of Curitiba and Quito is approximately 12,000 – 13,000. Other cities show the passenger volume of 3,600 – 9,000.



Source: EMBARQ

Figure 2-1 Comparison of Hourly Passenger Volume per Direction

The capacity of BRT is similar to Light Rail Transit (LRT) of at-grade type.

2-1-4 Speed

The world experiences show that BRT is not necessarily high speed system. The average commercial speed of a standard BRT is approximately 20km/h, ranging from 15 to 25km/h, while Transmilenio achieves approximately 30km/h. It is expected that a standard BRT can achieve a commercial speed of 25-30km/h. The commercial speed depends on the distance between stations, the density of intersections to be crossed, and necessary time at stations. Due to the delay at intersections, the maximum speed of a BRT without stopping at stations would be approximately 30-40km/h depending on the signaling phasing given to BRT lanes. With the stopping at stations, the speed would reduce to 20-30km/h.

Since the average speed of existing minibuses in Karachi is approximately 17km/h, the speed of 20km/h will produce very small benefit from travel time saving. Therefore, it is necessary to achieve higher commercial speed than minibuses.

2-1-5 Why BRT System is proposed for Karachi

BRT System has been proposed as a mass transit system for Karachi in past studies because it is cost effective system compared to railway systems. BRT System is proposed on two corridors because of:

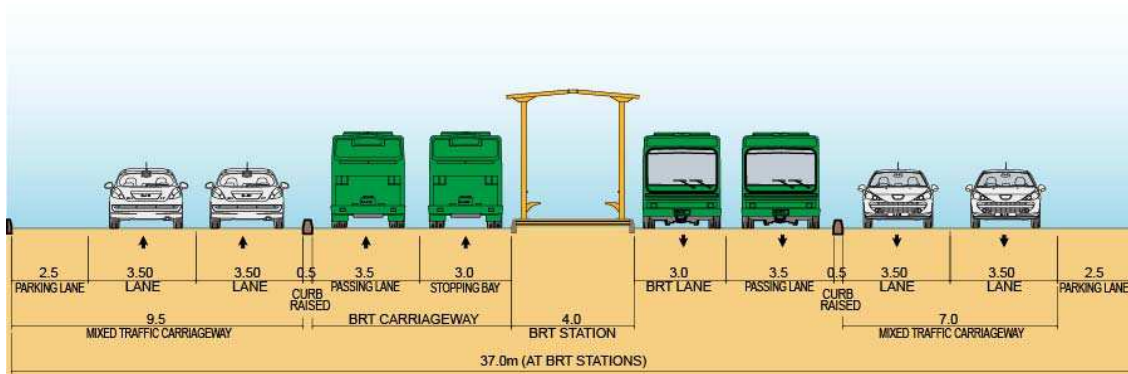
- Predictable travel time
- Faster than buses
- Constant interval
- Visual message of priority on public transit
- Lower investment cost
- Local technology

2-2 Challenges for BRT Introduction to Karachi Road System

2-2-1 Road Space

(1) Required Road Width for Full Scale BRT

A full scale BRT needs passing lanes at a station to achieve high capacity. In case of 2-lanes with a parking lane is provided for mixed traffic, the width of 37m road is necessary.



Source: The Study for KTIP

Figure 2-2 Necessary width of Road at BRT Stations

(2) Road Width of the Corridors

There are narrow sections whose width is less than 37m along the corridor. Most sections of Red Line have road width less than 37m. The road width of the south sections of North Nazimabad along Green Line is mostly less than 37m. Therefore, construction of stations with passing lanes will not be possible.

2-2-2 Bottleneck

There are three bottleneck sections along the corridor.

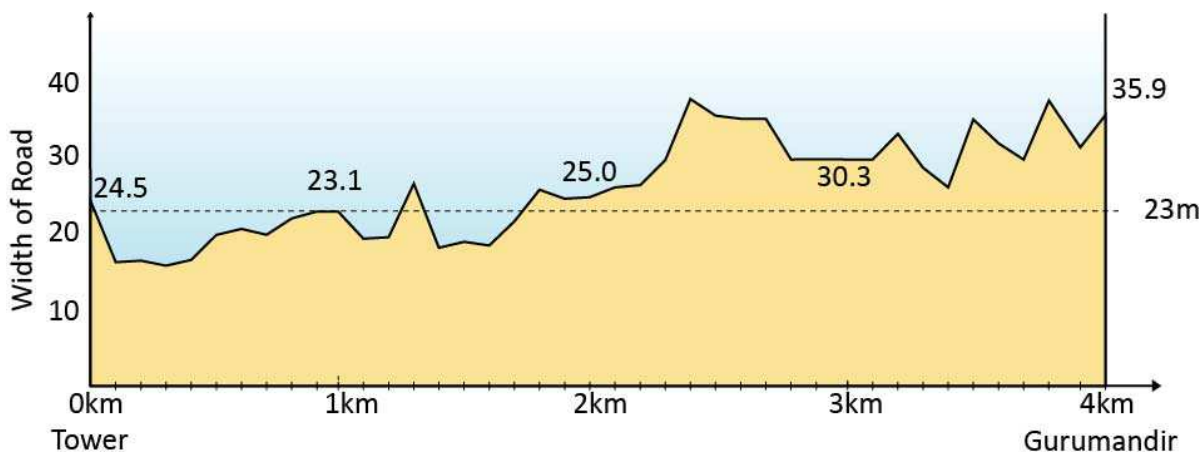
- Nawab Sadiq Ali Khan Rd (Sanitary Market), Green Line
- Business Recorder Road (Rickshaw Market), Green Line
- New M.A. Jinnah Road (Car dealer Market), Red Line

Construction of dedicated lanes along these bottleneck sections is not possible unless illegal parking and encroachment are cleared from the roadsides.

2-2-3 CBD

(1) M.A. Jinnah Road

In view of public transport network, mass transit system should be introduced along M.A. Jinnah Road between Tower and Gurumandir. However, the section between Tower and Cloth Market is too narrow to accommodate a BRT system. In addition, roadside parking along M.A. Jinnah Road cannot be prohibited because of the high commercial activity along this corridor.



Source: The Study for KTIP

Figure 2-3 Road Width along M.A. Jinnah Road

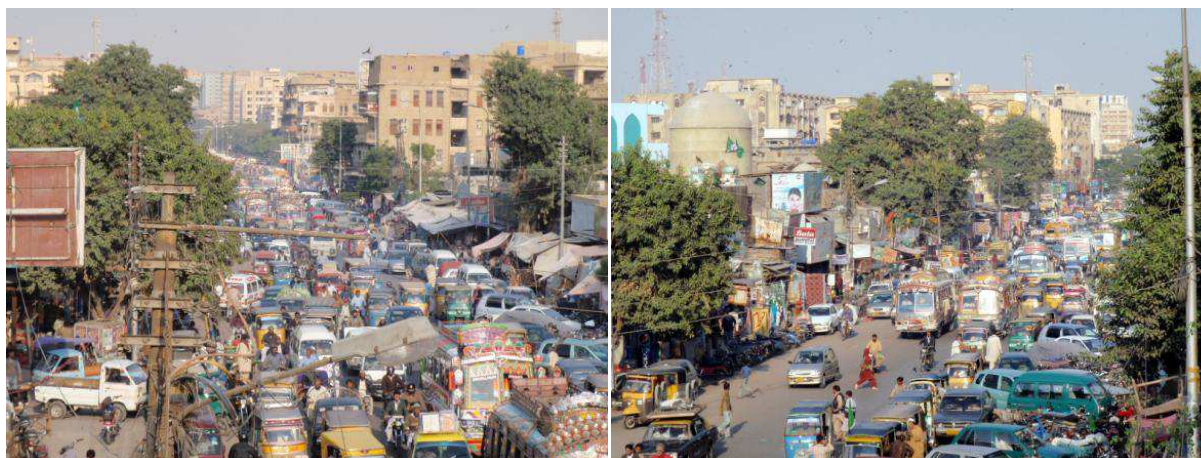


Photo: The Study for KTIP

(2) Saddar Area

Although traffic demand is very high, introduction of BRT system is very difficult in Saddar Area.

2-2-4 Demand

The present bus traffic is not high enough to justify the BRT system. On the other hand, the increase in traffic demand along the corridor is very high. According to the demand forecast in Karachi Transportation Improvement Project, the necessary capacity of a mass transit system along the corridor will be more than 10,000 passengers per hour per direction.

2-2-5 Traffic

(1) Signal Free Corridor and BRT

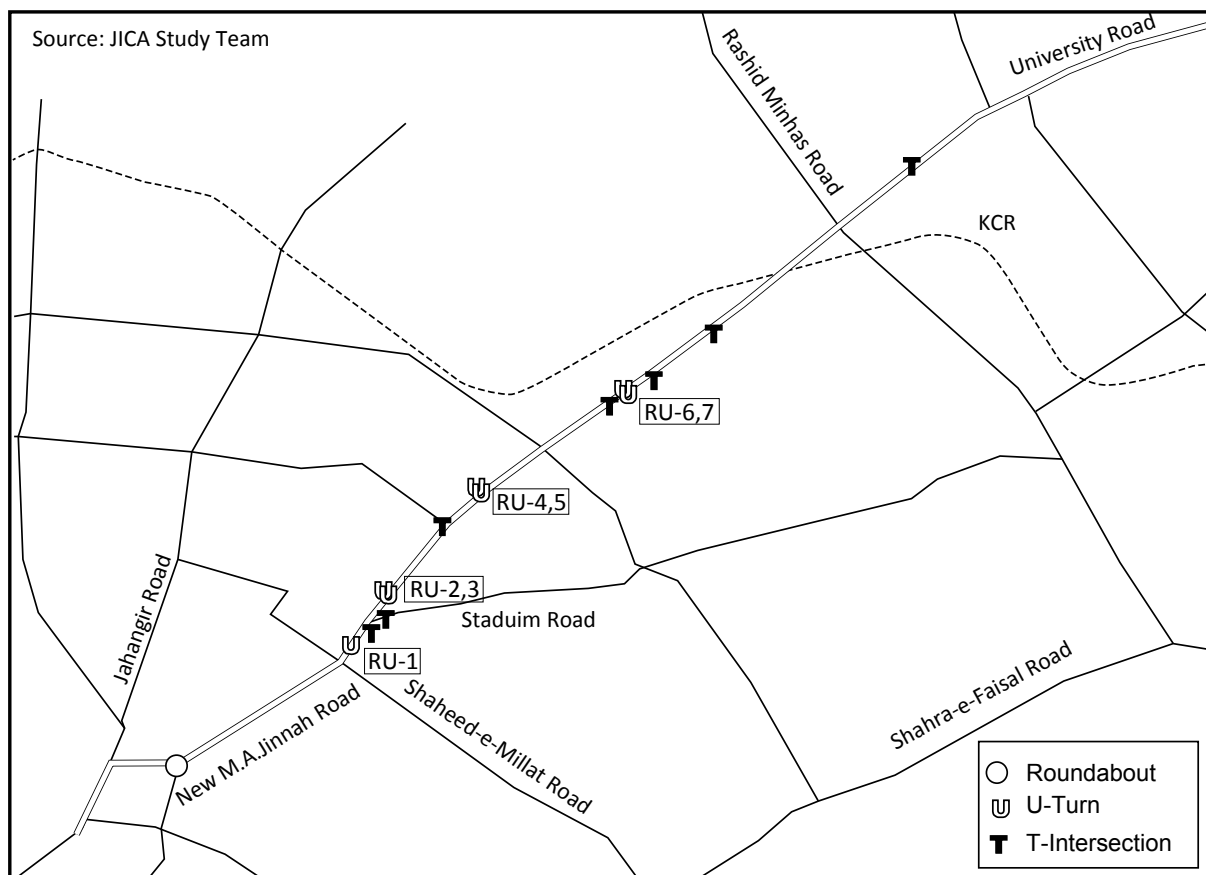
The Signal Free Corridor project is implemented by CDGK. A signal free corridor is a highway corridor where traffic is not interrupted by traffic signal with flyovers, underpasses, U-turns, and pedestrian bridges. Signals are removed from Signal Free Corridors. In October 2009, CDGK approved 29 Corridors (Notification NO.DCO/CDGK/PS/373/09). So far, Signal Free Corridors 1, 2, and 3 have been completed. Corridor-3 corresponds to Red Line.

There is a collision between Signal Free Corridors and BRT corridors.

Median breaks for U-turn traffic are the essential parts of a signal free corridor to provide a way for right turn traffic without signals. Since BRT lanes will be provided in the center of roads, U-turn traffic will conflict with BRT traffic. In order to avoid the conflict, intersections along BRT corridors should be signalized, which is incompatible with the policy of Signal Free Corridor.

(2) U-Turn Traffic (Red Line)

Figure 2-4 shows the locations of U-turns along University Road. There are four median breaks for U-turn traffic between Shaheed-e-Millat Road and Rashid Minhas Road.



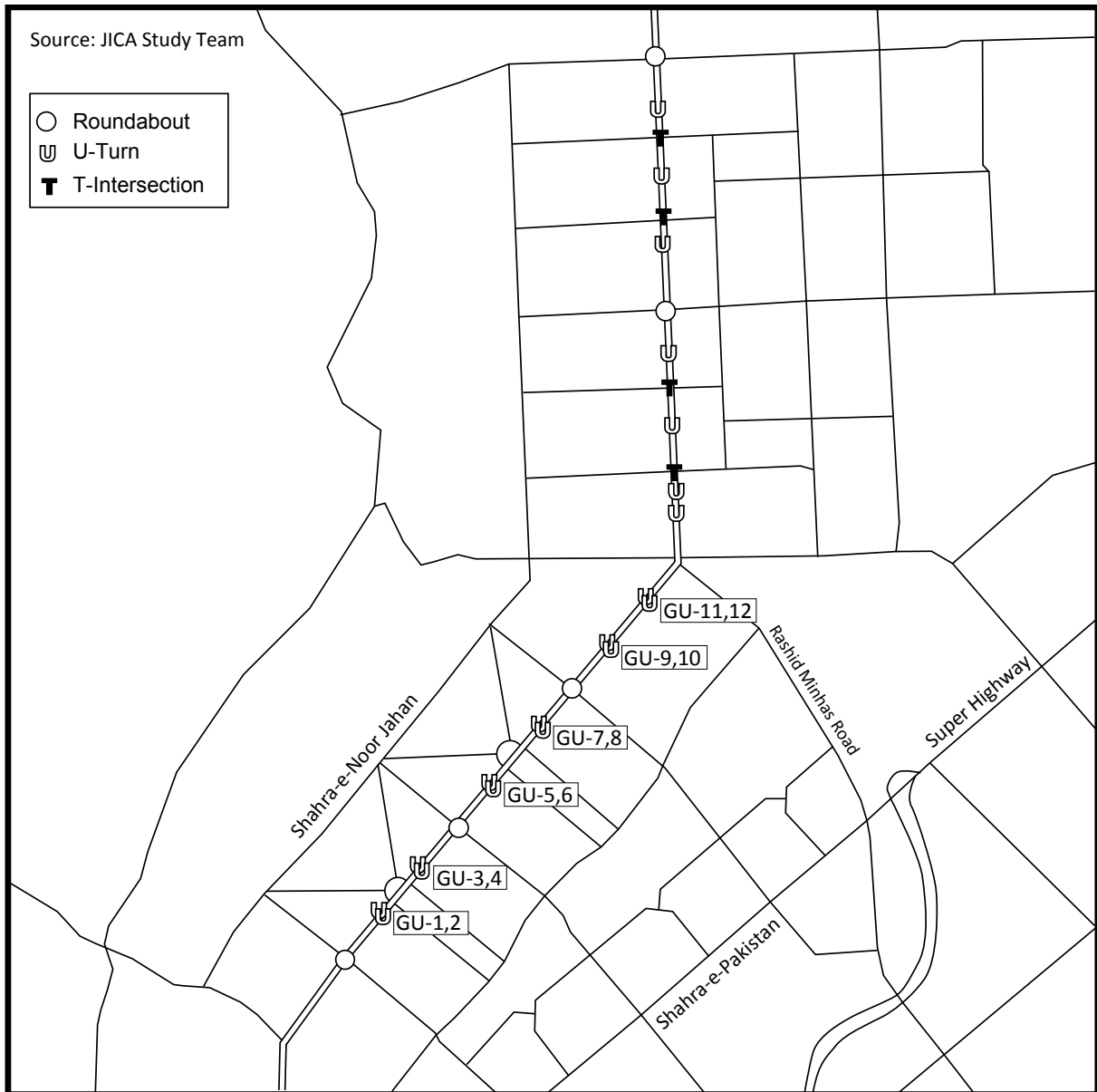
Source: The Study for KTIP

Figure 2-4 U-Turn Locations along Red Line

(3) U-Turn Traffic (Green Line)

Figure 2-5 shows U-turn locations along Green Line. There are six median breaks for U-turn traffic in North Nazimabad and seven U-turns in New Karachi. If intersections are signalized, U-turns can be closed in New Karachi because the U-turns are provided for right-turn traffic at intersections in New Karachi.

On the other hand, it will be difficult to close U-turns in North Nazimabad because signalization of intersection is not proper along the corridor in North Nazimabad.



Source: The Study for KTIP

Figure 2-5 U-Turn Locations along Green Line



U-turn: Red Line
Source: The Study for KTIP



U-turn: Green Line

(4) Roundabout Traffic

A roundabout is one of the difficult road elements for a BRT operation. There are roundabouts without traffic signals along Green Line. There are some examples of BRT systems in the world that are operated along roads having roundabouts. For example, there are roundabouts along the major route of TransJakarta (Jakarta). BRT systems in Quito (Equador) and Cali (Colombia) also have roundabout intersections. In case that a roundabout is heavily congested, the roundabout should be signalized so that BRT buses are not delayed by the congestion. So far, roundabouts in North Nazimabad and New Karachi are not so saturated that the delay of BRT buses at roundabouts would not be a problem.

2-3 Proposed BRT System for Karachi

2-3-1 Routes and Stations

(1) Green Line Route

The terminal points of Green Line are Municipal Park (Aurangzeb Park) in the center side and Surjani Town Sector 7. Since the section between Tower and Cloth Market is too narrow and busy to introduce a BRT system, a small park is used for the terminal point of the route. Vehicles make U-turn at the point. The other end point is the BRT depot.

The route is: M.A. Jinnah Road – Jahangir Road – Business Recorder Road – Nawab Sadiq Ali Khan Road – Khayaban-e-Sher Shah Suri – Shahrah-e-Usman – Chaudry Fazal Ellahi Road – Rd 5000. The total length is 21.1 km.

(2) Red Line Route

The terminal points of Red Line are Regal Chowk in the center side and Model Colony Graveyard. The terminal point of Regal Chowk is elevated because the road is too narrow to accommodate bus lanes. The other terminal point is also U-turn point at the intersection of Jinnah Avenue and Airport Road.

The route is: Pready Street – New M.A. Jinnah Road – University Road – Malir Cantonment Road – Jinnah Avenue. The total length is 24.4 km.

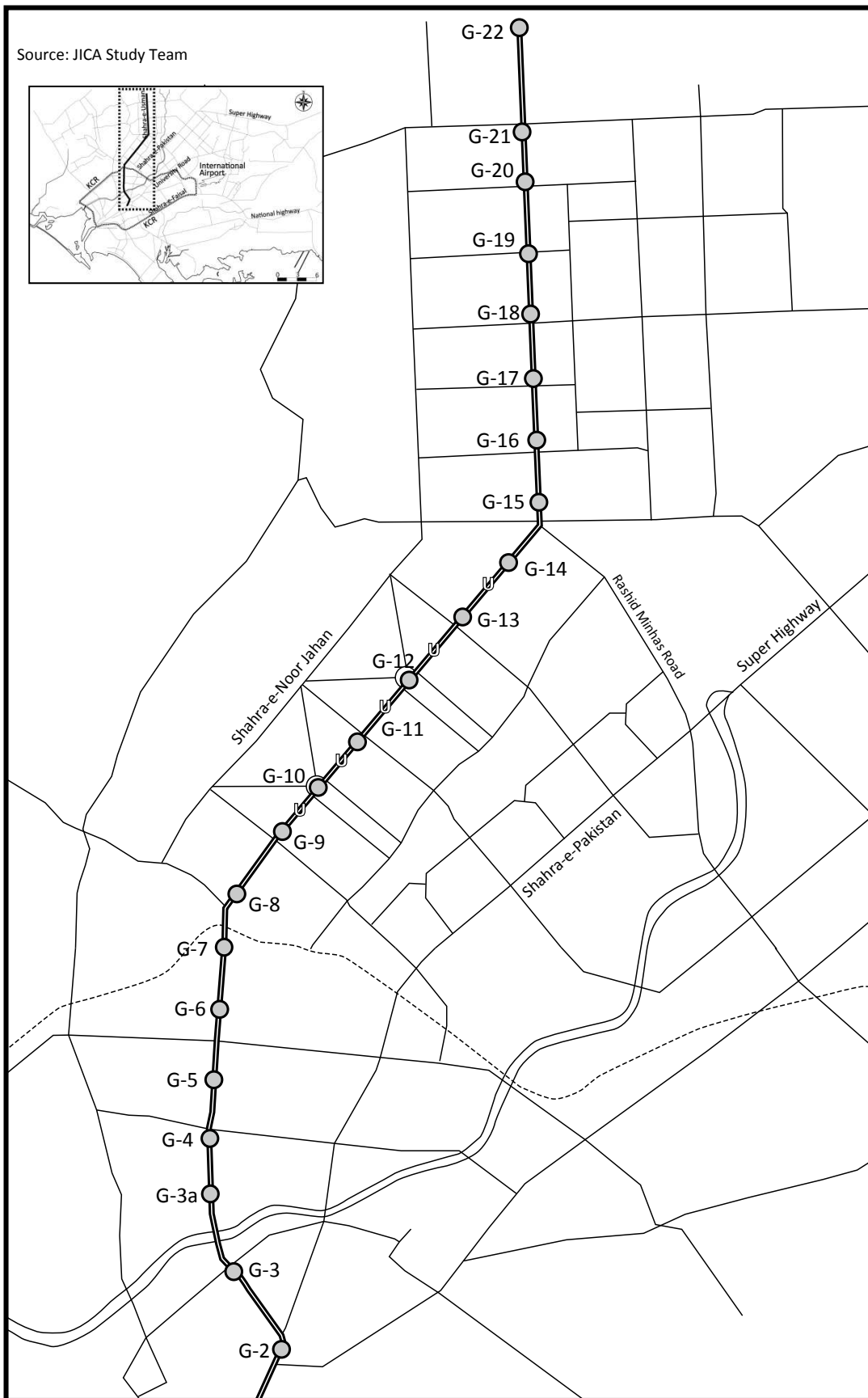
(3) Station Location (Green Line)

There are 29 stations along Green Line as shown in Table 2-1. The location map is shown in Figure 2-5 and Figure 2-8.

Table 2-1 Station Location of Green Line

No.	Location	Chainage	Distance between station	Remark	Possible Station Type
M1	Municipal Park	00+050		Start point (or end point) of Green Line/ Without passing lanes/ Access by pedestrian	Island, Both-sided
M2	Radio Pakistan	00+614	564	A transfer terminal is proposed in the vacant area near Garden Square/ Without passing	Island, Both-sided
M3	Garden Square	01+036	422	Without passing lanes/ Access by pedestrian crossing	Island, Both-sided
M4	Taj Medical Complex	01+760	724	Without passing lanes/ Access by pedestrian bridge	Island, Both-sided
M5	KGA ground	02+241	481		Island, Both-sided
G01	West of Quaid-e-Azam	02+682	441	The same station as Red Line/ Access by Pedestrian Bridge	Island, Both-sided
G02	Gurmandir	03+192	510	Between Gurmandir and G01	Island, Both-sided
G03	Lasbela Chowk	04+309	1117	North side of Lasbela Chowk	Island, Both-sided
G03a	sanitary market	05+316	1007		Island, Both-sided
G04	No. 1 Chowrangi	05+937	621	South side of No.1 Chowrangi	Island, Both-sided
G05	Model Park	06+506	569	Additional proposal in KTIP	Island, Both-sided
G06	Baqai Hospital	07+533	1027	Access by a pedestrian bridge	Island, Both-sided
G07	Public Park near Bridge	08+047	514	At Nazimabad No. 7 intersection	Island, Both-sided
G08	Board Office	08+840	793	Access by a pedestrian bridge	split type
G09	KAD Chowrangi	09+720	880	Additional proposal in KTIP	split type
G10	Hydri Market	10+394	674	Access by a pedestrian bridge	split type
G11	Five Star Chowrangi	10+948	554	Both sides of the intersection	split type
G12	Jummah Bazaar	11+967	1019	Access by a pedestrian bridge	split type
G13	Sakhi Hassan Chowrangi	12+935	968	Both sides of the roundabout	Island, Both-sided
G14	Erum Shopping Emporium	13+800	865	Between Nagan Chowrangi and Sakhi Hassan Chowrangi	Island, Both-sided
G15	Nagan Chowrangi	14+524	724	Between the first and second pylon in front of Haji Qadir Pakwan Sheermal House	Landscape
G16	U.P. Mohr intersection	15+260	736	South of roundabout	Landscape
G17	Rd 2400	15+992	732	Signalizing T-intersection	Landscape
G18	Power House Chowrangi	16+767	775	South of the roundabout	Landscape
G19	Rd 4200	17+446	679	Signalizing T-intersection	Landscape
G20	2 minutes Chowrangi	18+186	740	North of the pylon outside Sultan Plaza Complex	Landscape
G21	Surujani Chowrangi	18+790	604	The north of the roundabout	Landscape
G22	KDA Chowrangi Surjani Town	20+322	1532	Outside CDGK site office on the southern side of 5000 Road	Landscape
G23	KESC Power House	22+180	1858	Terminal station (depot)	

Source: The Study for KTIP



Source: The Study for KTIP

Figure 2-6 Station Locations along Green Line

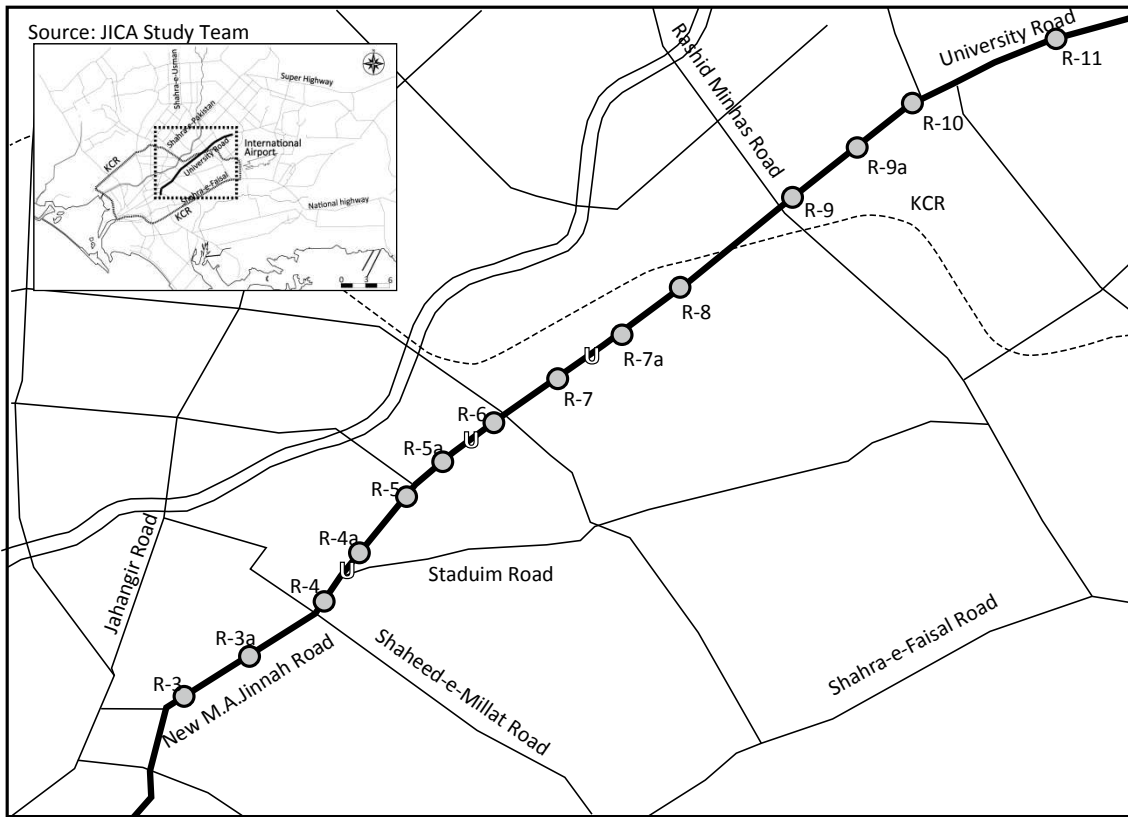
(4) Station Location (Red Line)

There are 28 stations along Green Line as shown in Table 2-2. The location map is shown in Figure 2-6 – 2-8.

Table 2-2 Station List of Green Line

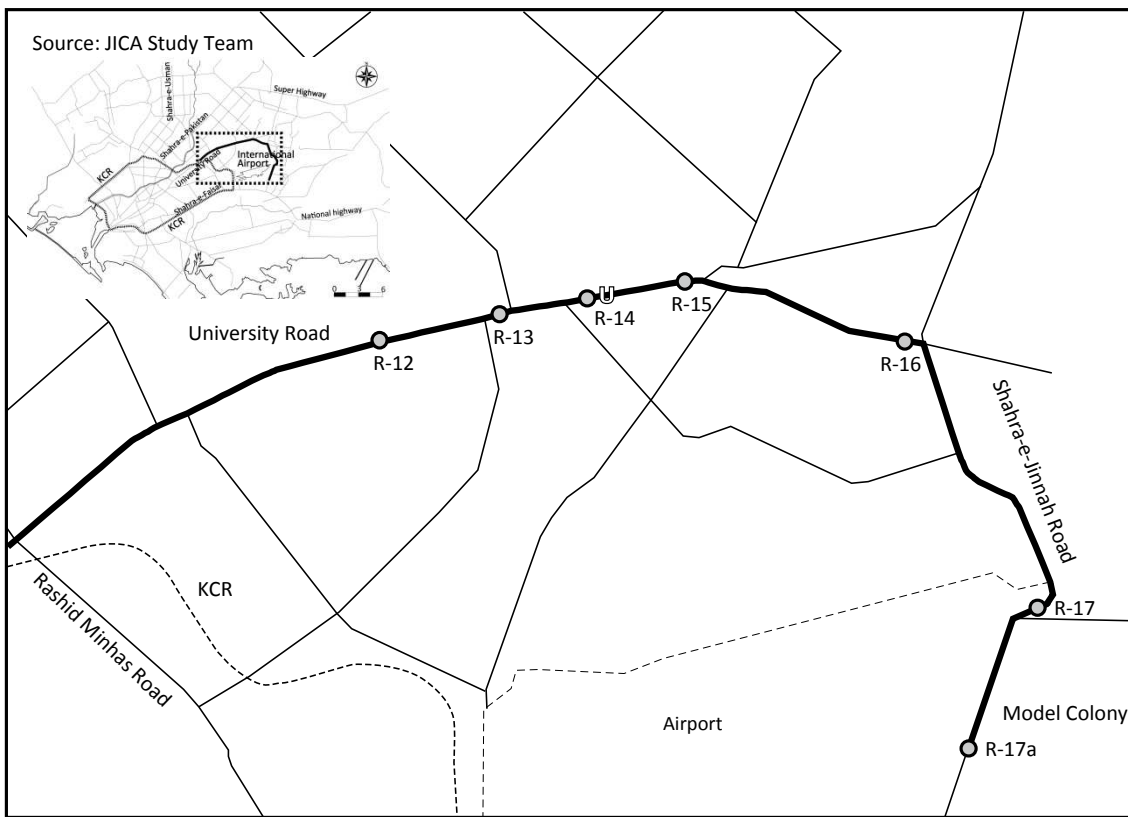
No.	Location	Chainage	Distance between station	Remark	Possible Station Type
P1	Regal Chowk	00+120		Elevated Station (U-turn point)	Elevated, Single Sided (Long)
P1a	Empress Market	00+610	490	Elevated	Elevated, Both Sided
			472		
P2	CDGK Parking Plaza	01+082	718	Transfer terminal proposed	Island Both-sided
P3	Shah Ahmad Noorani Chowrangi	01+800	480	Reservation for future development	Island Both-sided
P3a	Near numaish underpass	02+280	860	Same station as Green Line	-
			-		
R01	West of Quaid-e-Azam	-	-	Middle of intersections	-
R02	North of Quaid-e-Azam	-	-	Between roundabout and Jail road	Island Both-sided
R03	People's Roundabout	00+790	720		Island Both-sided
			743		
R03a	Car dealer shop	01+510			Island Both-sided
R04	Center Jail	02+253	489	Near flyover	Island Both-sided
			613		
R04a	u-turn stadium road	02+742			Island Both-sided
R05	Askari Park	03+355	537	Both sides of T-intersection	Island Both-sided
			570		
R05a	Near u-turn Gulsan Iqbal	03+892			Island Both-sided
R06	Civic Center	04+462	596	Between Askari Park and Flyover	Island Both-sided
			667		
R07	PIA Planetarium	05+058		Transfer to Jilani KCR Station	Island Both-sided
R07a	Hakeem Sayeed Family Ground	05+725	729		Island Both-sided
			1321		
R08	Urudu University	06+454		Before flyover	Island Both-sided
R09	National Institute Management (N.I.M)	07+775	735	After flyover	Island Both-sided
			645		
R09a	near elevated u-turn	08+510			Island Both-sided
R10	Safari Park	09+155	993	Near interchange	Island Both-sided
			1429		
R11	NED	10+148		After flyover	Island Both-sided
R12	University of Karachi	11+577	869	Near Shaikh-Zaid Islamic Center	Island Both-sided
			896		
R13	City Towers	12+446		Before T-intersection at Rabia Villas	Island Both-sided
R14	Near blue mt CNG station	13+342	712	Near Ranger Office (proposed depot)	Island Both-sided
			2193		
R15	Safura Circle	14+054		Before Safura Circle	Island Both-sided
R16	Malir Cant Check Post	16+247	2953	Near PSO Petrol Pump	Island Both-sided
			1260		
R17	Kazimabad	19+200		Jinnah Ave. Intersection	Island Both-sided
R17a	Model Colony	20+460		near end point	Island Both-sided

Source: The Study for KTIP



Source: The Study for KTIP

Figure 2-7 Station Locations along Red Line (1)



Source: The Study for KTIP

Figure 2-8 Station Locations along Red Line (2)

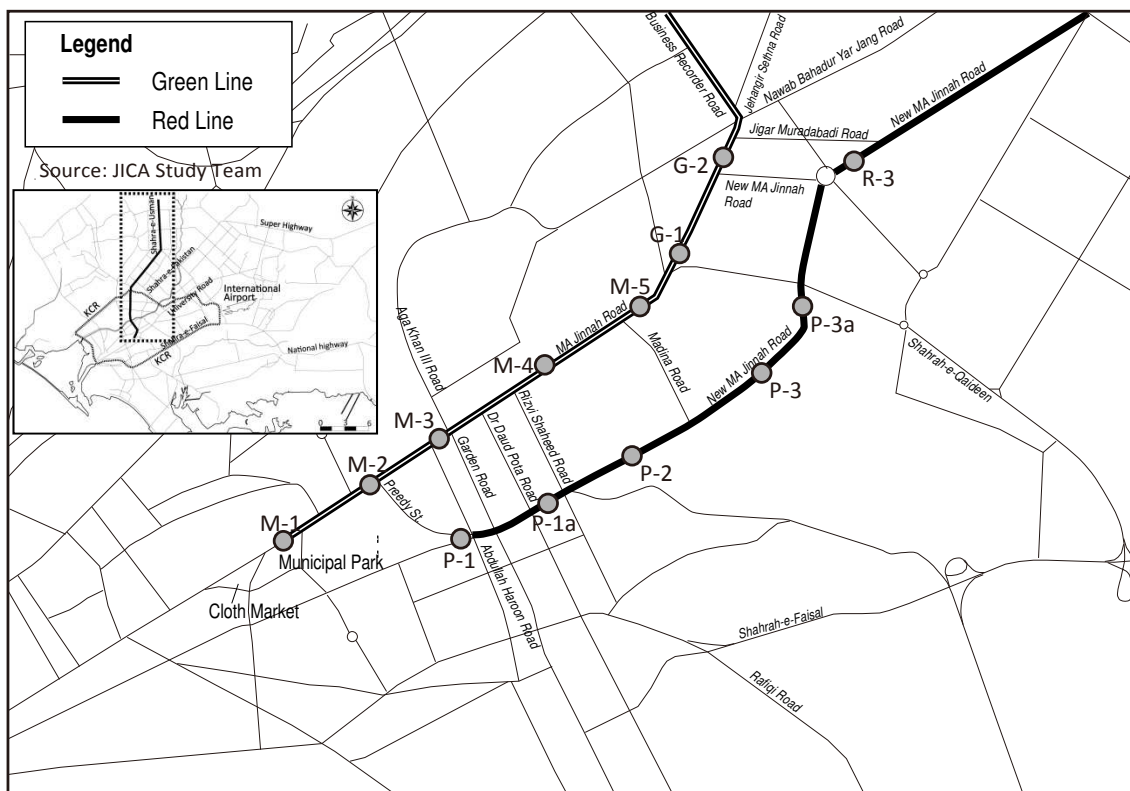


Figure 2-9 Station Locations along Red Line and Green Line in CBD

2-3-2 Fare Collection

In the Karachi BRT system, passenger fare will be collected before the boarding to buses. There are two reasons. Since the space at stations is very limited as described in the previous section, reduction in boarding and alighting time is a very important matter. Passing lanes cannot be provided, and the length of platforms cannot be long. Under this condition, payment inside buses will cause serious decrease in the capacity. The pre boarding fare collection can increase the capacity by reducing the stopping time at stations.

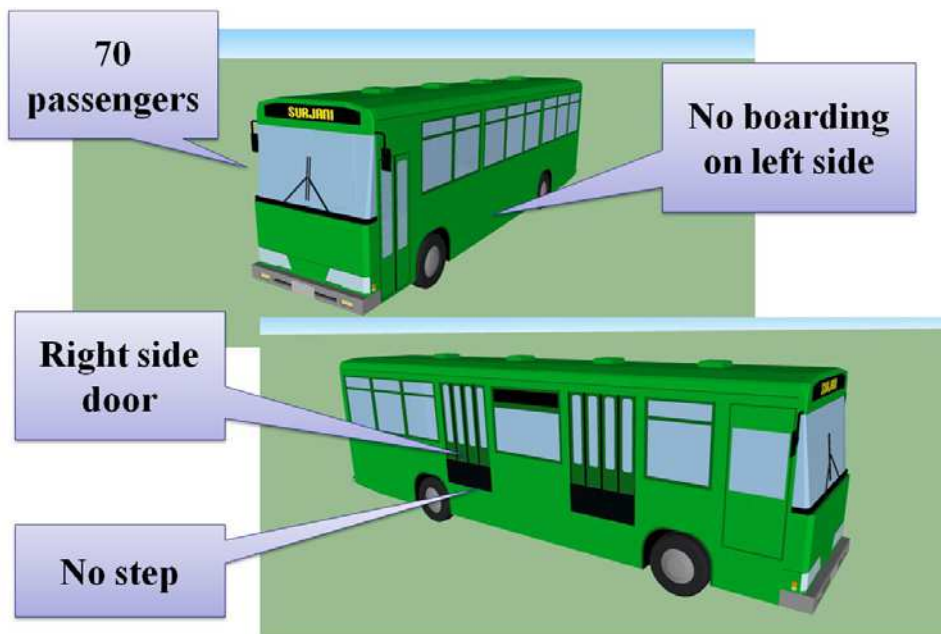
The other reason is that transparency of fare collection and the application of a popular business model in many cities where BRT system is successfully introduced. In the business model, passenger fare will be collected by a fare collection company, and operators will be paid based on the performance. Operators concentrate on providing the transport service that is guided by the project implementation agency.

2-3-3 Vehicle

Due to the limited U-turn space at terminal points and cost efficiency of vehicle type, 12m long standard buses are selected as the BRT buses. The turning radius of modern articulated buses is as same as the standard buses, but they require larger space than standard buses. The major characteristics of the BRT bus are:

- Right side door (opposite side of normal buses)
- No step (direct access to platform)
- Bridge equipment to connect bus floor and station platform
- Separation of male seats and female seats
- Capacity of 70 passengers
- Local production

The BRT buses cannot be operated in mixed traffic lane because of the location of doors.

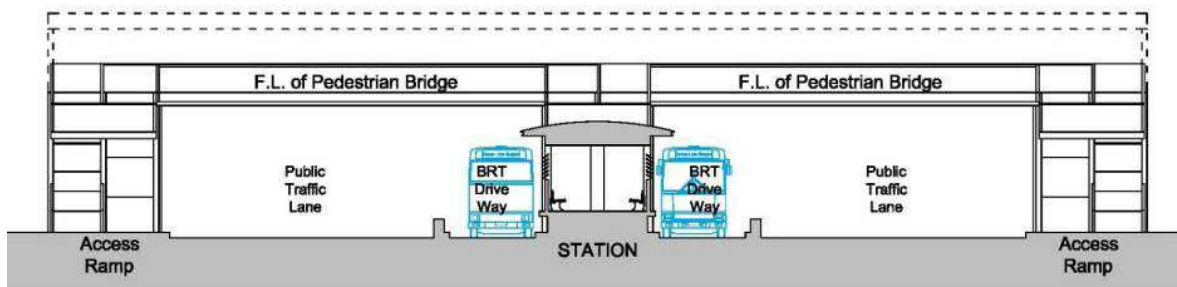


Source: The Study for KTIP

Figure 2-10 Image of BRT vehicle

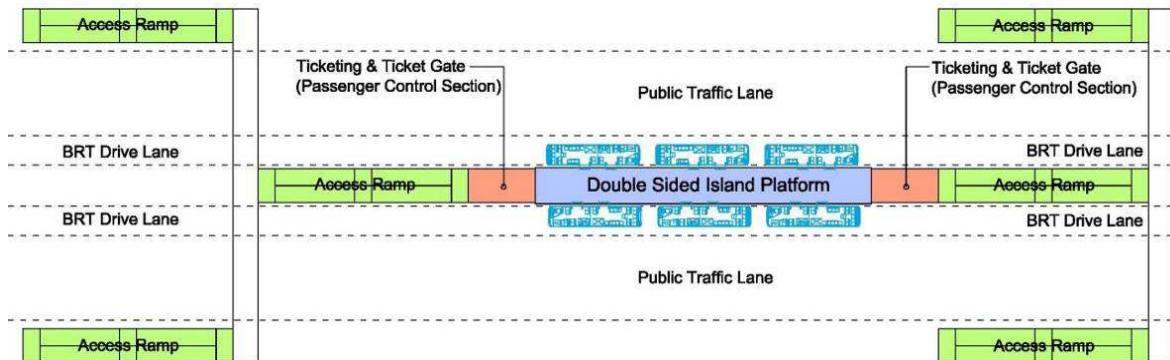
2-3-4 Station Facility

Stations are located in the median of the corridors. Due to limited road space, passing lanes are not provided. The typical width of a station platform is 4m. This is enough for most stations because of high frequency operation. The height of the platform is as same as the level of bus floor. There are three bus stopping areas in row. The length of a station is approximately 70m.



Source: The Study for KTIP

Figure 2-11 Cross Section at Stations

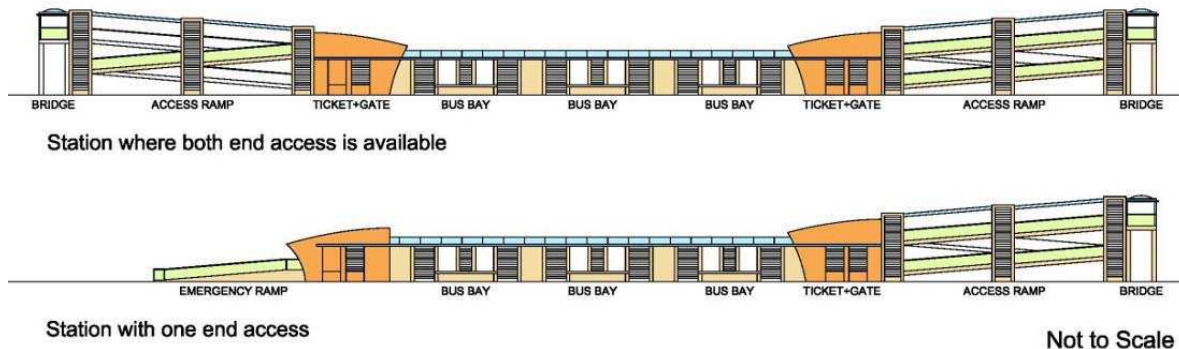


Source: The Study for KTIP

Figure 2-12 Plan of Station

A station on the platform consists of paid area and unpaid area. Ticketing area is located on the platform level in the unpaid area.

Pedestrian bridges provide access to the station platform. Access ramp with 1:12 slope enables the access by wheelchair. The access ramp need 4m width in the walkway.



Source: The Study for KTIP

Figure 2-13 Elevation of Station



Source: The Study for KTIP

Figure 2-14 Access to Station (Image)

2-4 Target Year

According to the transportation master plan in Karachi prepared by JICA, Green and Red Lines will have been completed by 2020. Although the traffic demand in New Karachi is low at present, it will increase rapidly up to 2020 due to the expected urban development in the north New Karachi up to Northern Bypass. Therefore, Green Line should be developed by 2020, but there is enough time. The condition of Red Line is the same.

Chapter 3 Demand Forecast and Revenue

3-1-1 Present Traffic

The number of passengers along major corridors was estimated in detail in “Confirmatory Green Routes Study for Karachi, March 2010”. Table 3-1 shows the passenger volume per direction per hour along Green Line, Red Line, and M.A. Jinnah Road taken from the result of the estimation in the study.

Table 3-1 Present Passenger Volume in a Peak Hour

Corridor	Code	Motorcycle	Bus	Total	Period
Green Line	MB-C39	3,743	4,337	12,913	19:00-20:00
	MB-C70	5,343	9,076	20,156	19:00-20:00
	MB-28	6,720	7,616	24,194	18:00-19:00
	MB-C27	8,174	10,277	23,827	09:00-10:00
	MB-56	4,319	7,011	19,865	08:00-09:00
Red Line	MB-77	429	1,976	2,823	12:00-13:00
	MB-79	2,231	5,021	13,524	18:00-19:00
	MB-80	3,479	15,042	32,262	08:00-09:00
	MB-C78	2,780	14,573	23,376	21:00-22:00
M.A. Jinnah Road	MB-10	7,542	21,340	34,171	19:00-20:00
	MB-C8	4,040	8,445	17,802	18:00-19:00
	MB-C2	1,563	3,599	6,686	18:00-19:00
	MB-C7	1,985	10,982	17,287	09:00-10:00

Source: Confirmatory Green Routes Study for Karachi, March 2010

Bus passenger volume in the peak hour is approximately 10,000 passengers per hour per direction (PHPDT) along Green Line, while the volume is as low as 4,337 in New Karachi (MB-C39). Total passenger volume (the sum of all mode traffic) is approximately 24,000 PHPDT along Green Line. This means that a standard BRT is enough along Green Line at present.

Bus passenger volume along University Road is as large as 15,000 PHPDT between Rashid Minhas Road and Shaheed-e-Millat Road. However, the volume decreases to 5,000 PHPDT near NED and drops to 2,000 PHPDT after universities. Bus passenger demand slightly exceeds the capacity of a standard BRT. If motorcycle demand is added to public transport, the passenger volume becomes 18,000, which is nearly the capacity of a saturated BRT. Total passenger volume is approximately 32,000 PHPDT at peak section along Red Line. If public transport needs to satisfy traffic demand of all modes along Red Line, a standard BRT is not enough although this case needs not to be considered.

Bus passenger volume is as large as 21,000 PHPDT along M.A.Jinnah Road in front of Quaid-e-Azam, which exceed the capacity of most BRT systems except for TransMillenio in Bogota. However, boarding and alighting demand is not so high at this point, and the passenger volume is the sum of traffics toward Surujani, Super Highway, and University Road. In other words, passing demand is the majority of these passengers and a standard BRT will be capable of this demand.

On the other hand, bus passenger demand drops to 8,500 PHPDT near Garden Square and 3,600 near Cloth Market. This is not the result of the demand. Rather, this is the result of constraints from the heavy congestion along M.A. Jinnah Road. Bus passenger volume is 11,000 in the one-way section of M.A. Jinnah Road between Tower and City Park.

Not all bus passengers will shift to BRT. Some passengers will remain in mixed traffic using feeder services. From this, a standard BRT system is enough for public transport under the present traffic demand.

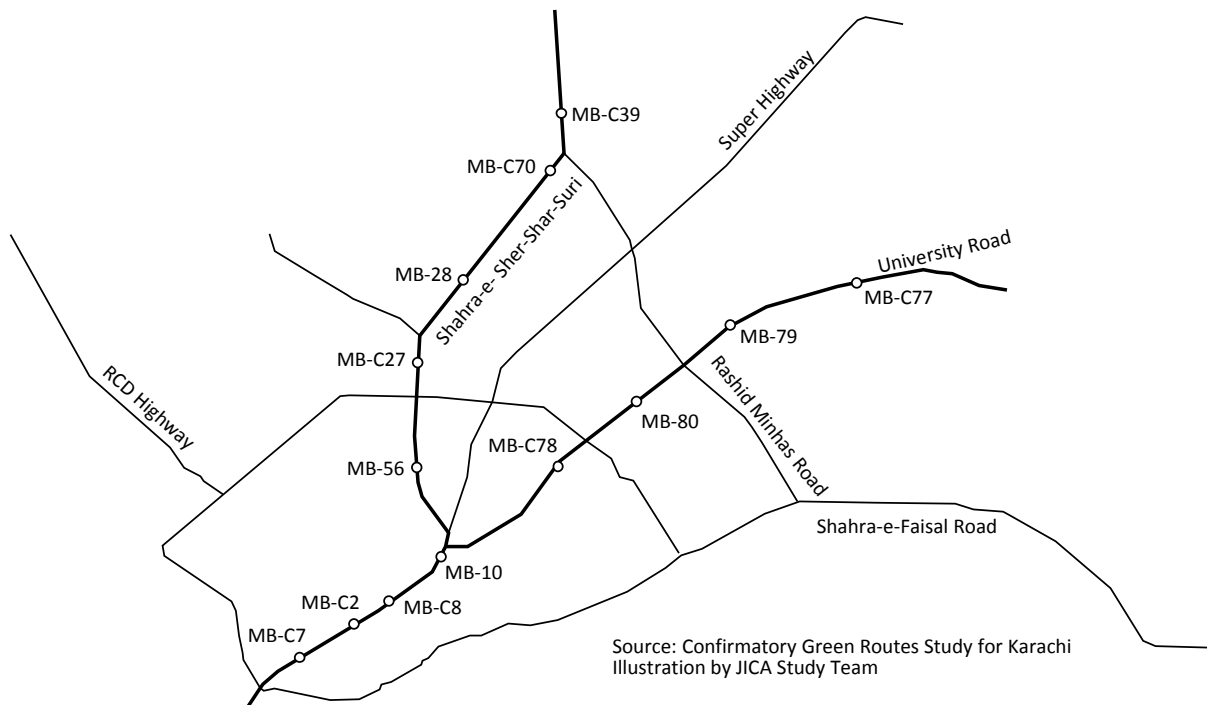


Figure 3-1 Survey Locations in Confirmatory Green Routes Study for Karachi

3-1-2 Demand Forecast Method

(1) Urban Growth

As described in Chapter 1, Karachi will have a population of additional 10 million in the next 20 years, and the population will be more than 30 million in 2030. Gadap, Keamari, and Bin Qasim Town are expected to accept the large part of the population growth.

(2) OD Matrix

The traditional four-step method was applied for the demand forecast. Karachi was divided into 216 traffic zones. The future OD matrix was developed in Karachi Transportation Improvement Project.

(3) Traffic Assignment

Transport network data were prepared for different scenarios. A network data consists of links, nodes, and zone centroids. A zone centroid represents the center of each traffic zone. The OD matrix was assigned to the transport network to estimate the traffic volume. It was assumed that motorcycle and car users would not use feeder buses but use BRT only if origin and destination were connected to the zone centroids. The fare of BRT was set as Rs. 20 while that of existing buses was Rs. 15. The capacity of BRT was limited to 12,000 passengers per hour per direction.

(4) Network Scenario

The traffic assignment network was prepared for five network scenarios.

- (A) Green & Red Lines on the present road network (2010)
- (B) Master Plan (M/P) network (2020).
- (C) M/P network (2020) without KCR
- (D) M/P network (2030)
- (E) Green & Red Lines + KCR on the 2030 road network

Road network is assumed to be developed as proposed in the M/P as shown in Table 3-2. Road capacity was reduced from the M/P along BRT routes assuming that two lanes (one lane each) are removed.

Table 3-2 Arterial Road Length in Master Plan

Year	Expressway	Highway	Principal Highway	Minor Arterial	Total
2010	25.6	173.2	157.2	527.9	884
2020	35.8	173.2	199.8	547.7	956.5
2030	76.9	257.2	229.1	609.2	1,172.4

Source: The Study for KTIP

In the M/P network, KCR is included in 2020 network while Blue Line and Brown Line are included in 2030 network as railway system. For the network in 2020, “Without KCR” scenario was prepared (C). This is the case when only Green & Red Line are developed as mass transit system by 2020. The scenario (E) is the case when no mass transit system is implemented after Green & Red Lines and KCR by 2030.

(5) Without Green Line and Red Line

Figure 3-2 shows the projected number of bus passengers of the corridor of Green Line in 2020 without the BRT project, while Figure 3-3 shows that of the corridor of Red Line in the same conditions.

The figure illustrates the number of bus passengers per hour per direction in the peak hour. The demand exceeds the capacity of standard BRT systems (10,000 PHPDT) at some links along Green Line.

Bus passenger demand exceeds 15,000 PHPDT in most sections along University Road. The demand characteristics along Red Line is quite different from the present situation in which traffic demand rapidly becomes low in the east of universities. In 2020, the demand becomes high in the east of the corridor near Model Colony.

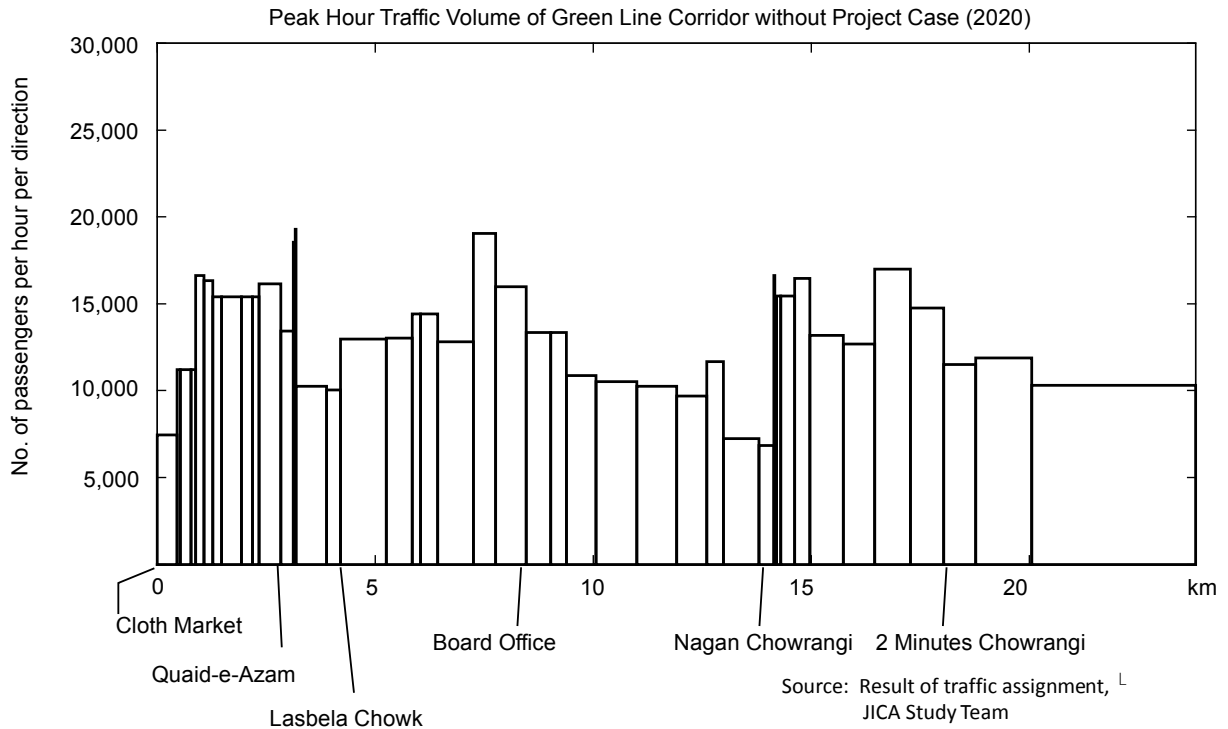


Figure 3-2 Bus Passenger Demand along Green Line (2020), without Project Case

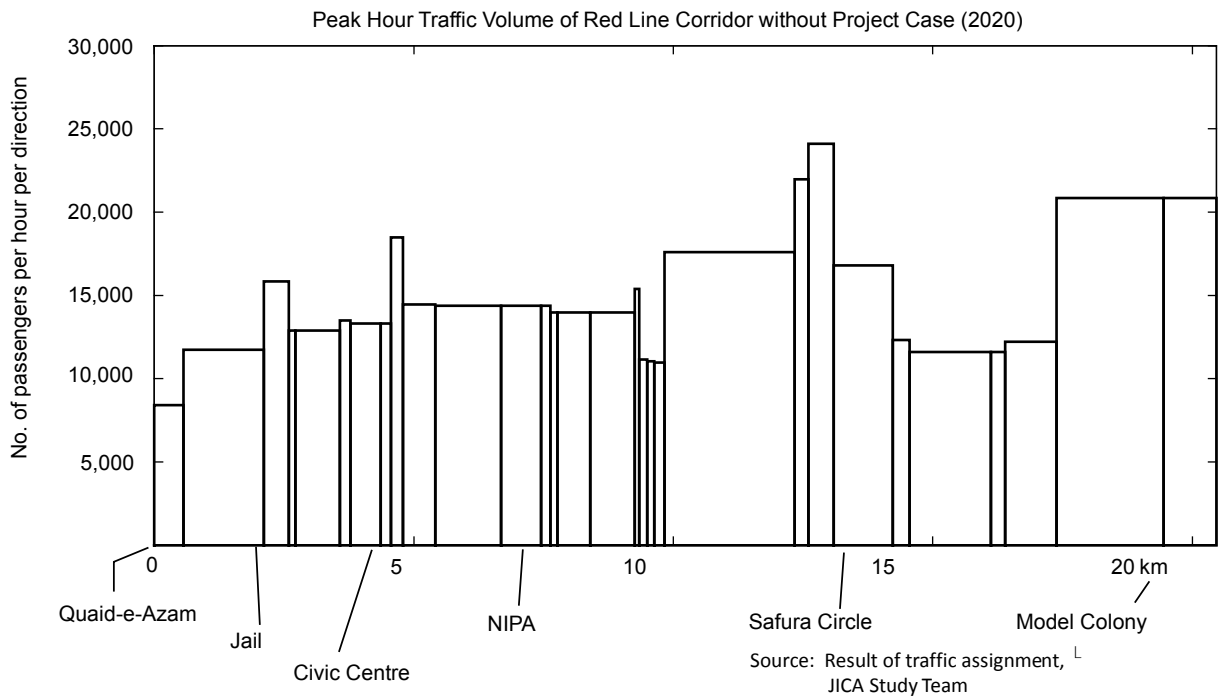


Figure 3-3 Bus Passenger Demand along Red Line (2020), without Project Case

(6) Traffic Volume Data of the Demand Forecast

Table 3-3 shows the result of the demand forecast of the daily passenger volume (both directions) of Green Line and Red Line for the five scenarios. This is computed by traffic assignment using daily OD matrices. The codes in the section column represent station codes.

Table 3-4 shows the peak hour passenger volume per direction. This was calculated from the daily traffic volume assuming the peak hour rate of 7.5% per direction.

Table 3-5 shows the result of the demand forecast of the number of passenger boarding at stations. The total number of passenger boarding is 370,000 in 2010, 733,000 in 2020, and 1.26 million in 2030. The number of daily passenger boarding was used for revenue calculation.

Table 3-6 shows the passenger boarding and alighting at stations in peak hour. The peak hour rate of 7.5% was used to calculate the volume.

Table 3-3 Daily Passenger Volume (Both Directions)

Section	2010	2020		2030		
	Green&Red	Green&Red +KCR	Green&Red only	M/P Network	Green&Red +KCR	
Green Line						
M1 - M2	27,331	108,576	111,176	68,591	137,886	
M2 - M3	50,652	163,869	159,635	98,152	181,132	
M3 - M4	60,626	219,570	213,086	116,576	216,460	
M4 - M5	64,356	227,498	219,097	127,526	223,614	
M5 - G01	64,356	227,498	219,097	324,218	224,376	
G01 - G02	99,988	351,322	329,634	341,679	331,913	
G02 - G03	92,630	351,803	329,187	332,852	330,689	
G03 - G04	105,650	349,676	328,967	329,743	331,430	
G04 - G05	107,604	342,338	332,130	322,007	326,906	
G05 - G06	111,780	337,996	331,825	319,421	329,414	
G06 - G07	116,056	331,097	329,879	323,692	326,072	
G07 - G08	113,491	325,385	331,569	314,107	323,818	
G08 - G09	118,665	321,376	269,543	274,452	333,970	
G09 - G10	119,608	317,880	262,673	269,905	331,772	
G10 - G11	117,519	307,462	255,031	262,488	322,763	
G11 - G12	112,723	300,958	250,234	259,553	323,357	
G12 - G13	112,371	294,944	246,776	257,933	323,765	
G13 - G14	98,061	280,266	234,292	249,359	318,555	
G14 - G15	96,659	273,816	233,175	311,136	317,481	
G15 - G16	92,053	255,923	221,088	302,777	308,643	
G16 - G17	89,519	243,757	212,219	293,032	298,653	
G17 - G18	79,153	218,931	193,416	279,485	276,881	
G18 - G19	64,177	202,752	180,420	265,497	261,234	
G19 - G20	43,622	183,059	163,954	227,668	242,607	
G20 - G21	24,514	142,839	130,044	193,148	199,210	
G21 - G22	15,966	125,190	116,540	165,327	181,014	
Red Line						
P1 - P2	16,383	73,929	76,406	131,002	126,860	
P2 - P3	35,335	144,188	152,647	170,098	183,761	
P3 - R02	39,290	156,145	161,530	180,026	198,487	
R01 - R02	91,495	305,943	312,655	186,971	285,196	
R02 - R03	88,770	319,558	343,745	259,949	326,565	
R03 - R04	94,971	330,721	354,953	272,817	334,848	
R04 - R05	94,941	332,169	360,123	272,954	332,411	
R05 - R06	91,392	334,209	363,184	278,360	333,044	
R06 - R07	90,064	339,391	387,292	286,537	338,479	
R07 - R08	85,549	338,727	382,556	280,030	334,805	
R08 - R09	78,424	333,843	373,503	268,320	327,285	
R09 - R10	66,424	335,472	380,595	261,901	323,547	
R10 - R11	61,339	336,729	378,565	259,313	321,120	
R11 - R12	61,339	336,546	378,184	259,125	320,938	
R12 - R13	26,327	315,611	359,950	236,960	305,918	
R13 - R14	26,193	317,730	357,840	235,219	303,462	
R14 - R15	15,629	311,832	351,940	225,203	295,250	
R15 - R16	11,716	267,839	308,345	174,579	248,537	
R16 - R17	11,412	221,604	267,932	53,359	98,408	
R17 - R18	11,412	221,604	267,932	53,359	98,408	

Source: The Study for KTIP

Table 3-4 Peak Hour Passenger Volume per Direction

Section	2010	2020		2030		
	Green&Red	Green&Red +KCR	Green&Red only	M/P Network	Green&Red +KCR	
Green Line						
M1 - M2	1,025	4,072	4,169	2,572	5,171	
M2 - M3	1,899	6,145	5,986	3,681	6,792	
M3 - M4	2,273	8,234	7,991	4,372	8,117	
M4 - M5	2,413	8,531	8,216	4,782	8,386	
M5 - G01	2,413	8,531	8,216	12,158	8,414	
G01 - G02	3,750	13,175	12,361	12,813	12,447	
G02 - G03	3,474	13,193	12,345	12,482	12,401	
G03 - G04	3,962	13,113	12,336	12,365	12,429	
G04 - G05	4,035	12,838	12,455	12,075	12,259	
G05 - G06	4,192	12,675	12,443	11,978	12,353	
G06 - G07	4,352	12,416	12,370	12,138	12,228	
G07 - G08	4,256	12,202	12,434	11,779	12,143	
G08 - G09	4,450	12,052	10,108	10,292	12,524	
G09 - G10	4,485	11,921	9,850	10,121	12,441	
G10 - G11	4,407	11,530	9,564	9,843	12,104	
G11 - G12	4,227	11,286	9,384	9,733	12,126	
G12 - G13	4,214	11,060	9,254	9,672	12,141	
G13 - G14	3,677	10,510	8,786	9,351	11,946	
G14 - G15	3,625	10,268	8,744	11,668	11,906	
G15 - G16	3,452	9,597	8,291	11,354	11,574	
G16 - G17	3,357	9,141	7,958	10,989	11,199	
G17 - G18	2,968	8,210	7,253	10,481	10,383	
G18 - G19	2,407	7,603	6,766	9,956	9,796	
G19 - G20	1,636	6,865	6,148	8,538	9,098	
G20 - G21	919	5,356	4,877	7,243	7,470	
G21 - G22	599	4,695	4,370	6,200	6,788	
Red Line						
P1 - P2	614	2,772	2,865	4,913	4,757	
P2 - P3	1,325	5,407	5,724	6,379	6,891	
P3 - R02	1,473	5,855	6,057	6,751	7,443	
R01 - R02	3,431	11,473	11,725	7,011	10,695	
R02 - R03	3,329	11,983	12,890	9,748	12,246	
R03 - R04	3,561	12,402	13,311	10,231	12,557	
R04 - R05	3,560	12,456	13,505	10,236	12,465	
R05 - R06	3,427	12,533	13,619	10,439	12,489	
R06 - R07	3,377	12,727	14,523	10,745	12,693	
R07 - R08	3,208	12,702	14,346	10,501	12,555	
R08 - R09	2,941	12,519	14,006	10,062	12,273	
R09 - R10	2,491	12,580	14,272	9,821	12,133	
R10 - R11	2,300	12,627	14,196	9,724	12,042	
R11 - R12	2,300	12,620	14,182	9,717	12,035	
R12 - R13	987	11,835	13,498	8,886	11,472	
R13 - R14	982	11,915	13,419	8,821	11,380	
R14 - R15	586	11,694	13,198	8,445	11,072	
R15 - R16	439	10,044	11,563	6,547	9,320	
R16 - R17	428	8,310	10,047	2,001	3,690	
R17 - R18	428	8,310	10,047	2,001	3,690	

Source: The Study for KTIP

Table 3-5 Daily Passenger Volume of Boarding Only

Code	Station	2010	2020		2030	
		Green&Red	Green&Red +KCR	Green&Red only	M/P Network	Green&Red +KCR
Green Line						
R0-01	M1	19,518	32,934	36,436	27,105	68,943
R0-02	M2	17,288	27,648	24,232	28,256	21,624
R0-03	M3	11,225	27,857	26,731	14,415	17,664
R0-05	M4	4,781	3,988	3,030	9,248	4,062
R1-01	G01	10,212	9,470	10,778	25,049	10,974
R1-02	G02	15,400	11,098	7,850	21,324	11,353
R1-03	G03	33,583	19,667	15,069	45,422	23,611
R1-04	G04	14,861	7,137	26,770	22,964	8,549
R1-05	G05	18,129	8,791	10,108	21,829	12,745
R1-06	G06	19,185	11,136	9,318	30,406	13,665
R1-07	G07	13,369	4,709	6,133	13,559	4,893
R1-08	G08	17,284	17,982	35,071	17,350	17,556
R1-09	G09	24,927	3,452	4,910	10,126	4,397
R1-10	G10	9,850	6,504	5,117	17,438	6,944
R1-11	G11	13,940	4,195	3,551	8,611	6,920
R1-12	G12	7,967	4,184	2,911	8,351	5,749
R1-13	G13	15,879	8,642	7,710	13,224	13,926
R1-14	G14	9,354	5,127	5,550	6,600	7,394
R1-15	G15	14,374	10,062	7,159	15,460	12,737
R1-16	G16	11,802	6,677	5,029	16,444	6,831
R1-17	G17	12,275	14,225	11,047	16,989	15,903
R1-18	G18	16,610	8,659	7,068	22,876	9,951
R1-19	G19	25,273	10,845	9,231	39,806	14,408
R1-20	G20	21,126	21,434	18,651	31,897	25,033
R1-21	G21	10,630	9,136	7,646	28,116	11,278
R1-22	G22	15,870	62,595	58,270	127,903	90,507
Red Line						
RZ-00	P1	16,057	36,965	38,203	157,630	63,430
RZ-01	P2	22,301	35,289	29,498	31,978	28,670
RZ-02	P3	9,021	6,091	4,570	12,488	7,586
R3-02	R02	5,241	3,005	2,688	4	4,147
R3-03	R03	13,611	10,731	9,441	21,573	12,614
R3-04	R04	78	4,524	6,094	1,498	5,262
R3-05	R05	39,307	14,635	10,603	32,719	16,485
R3-06	R06	11,611	14,244	20,865	34,585	16,998
R3-07	R07	34,874	17,318	16,146	48,042	18,207
R3-08	R08	29,869	12,282	12,126	31,727	13,484
R3-09	R09	15,248	11,909	12,128	17,647	10,652
R3-10	R10	6,489	5,274	5,240	5,659	2,454
R3-11	R11	0	91	190	96	91
R3-12	R12	35,171	22,938	18,046	61,360	28,961
R3-13	R13	139	5,366	2,551	988	2,981
R3-14	R14	10,004	6,511	5,454	17,328	6,372
R3-15	R15	3,913	31,412	40,990	26,914	26,187
R3-16	R16	304	25,663	23,005	60,636	88,494
R3-17	R17	0	0	0	0	0
R3-18	R18	11,373	110,802	133,966	59,347	49,204

Source: The Study for KTIP

Table 3-6 Peak Hour Boarding and Alighting

Code	Station	2010	2020		2030	
		Green&Red	Green&Red +KCR	Green&Red only	M/P Network	Green&Red +KCR
Green Line						
R0-01	M1	2,928	4,940	5,465	4,066	10,341
R0-02	M2	2,593	4,147	3,635	4,238	3,244
R0-03	M3	1,684	4,178	4,010	2,162	2,650
R0-05	M4	717	598	455	1,387	609
R1-01	G01	1,532	1,420	1,617	3,757	1,646
R1-02	G02	2,310	1,665	1,177	3,199	1,703
R1-03	G03	5,037	2,950	2,260	6,813	3,542
R1-04	G04	2,229	1,071	4,016	3,445	1,282
R1-05	G05	2,719	1,319	1,516	3,274	1,912
R1-06	G06	2,878	1,670	1,398	4,561	2,050
R1-07	G07	2,005	706	920	2,034	734
R1-08	G08	2,593	2,697	5,261	2,602	2,633
R1-09	G09	3,739	518	736	1,519	659
R1-10	G10	1,478	976	767	2,616	1,042
R1-11	G11	2,091	629	533	1,292	1,038
R1-12	G12	1,195	628	437	1,253	862
R1-13	G13	2,382	1,296	1,157	1,984	2,089
R1-14	G14	1,403	769	832	990	1,109
R1-15	G15	2,156	1,509	1,074	2,319	1,911
R1-16	G16	1,770	1,002	754	2,467	1,025
R1-17	G17	1,841	2,134	1,657	2,548	2,385
R1-18	G18	2,491	1,299	1,060	3,431	1,493
R1-19	G19	3,791	1,627	1,385	5,971	2,161
R1-20	G20	3,169	3,215	2,798	4,784	3,755
R1-21	G21	1,594	1,370	1,147	4,217	1,692
Red Line						
RZ-00	P1	2,409	5,545	5,730	23,645	9,515
RZ-01	P2	3,345	5,293	4,425	4,797	4,301
RZ-02	P3	1,353	914	686	1,873	1,138
R3-02	R02	786	451	403	1	622
R3-03	R03	2,042	1,610	1,416	3,236	1,892
R3-04	R04	12	679	914	225	789
R3-05	R05	5,896	2,195	1,590	4,908	2,473
R3-06	R06	1,742	2,137	3,130	5,188	2,550
R3-07	R07	5,231	2,598	2,422	7,206	2,731
R3-08	R08	4,480	1,842	1,819	4,759	2,023
R3-09	R09	2,287	1,786	1,819	2,647	1,598
R3-10	R10	973	791	786	849	368
R3-11	R11	0	14	29	14	14
R3-13	R13	21	805	383	148	447
R3-14	R14	1,501	977	818	2,599	956
R3-15	R15	587	4,712	6,149	4,037	3,928
R3-16	R16	46	3,849	3,451	9,095	13,274
R3-17	R17	0	0	0	0	0
R3-18	R18	1,706	16,620	20,095	8,902	7,381

Source: The Study for KTIP

Chapter 4 Capital Costs

4-1 Construction Cost

4-1-1 Scope of Cost Estimation

Construction cost was estimated based on the following scope,

- The BRT infrastructure cost to be estimated in this paragraph is defined as an initial capital cost covering all the necessary costs for constructing a complete infrastructural facility of BRT system, excepting procurement costs of the bus fleet with spare parts.
- The cost estimation does not include any contingency reserves for project management cost, transaction tax, price escalation, and consulting service fee.

4-1-2 Estimation Methodology

(1) Infrastructural costs

Most of infrastructural cost data were collected from the CDGK's past projects, and such projects included road rehabilitation, overpass and underpass construction, intersection improvement, pedestrian bridge installation, and bus-stop installation.

Unit costs were estimated from the collected cost data. Price escalations were applied to the unit costs to estimate the unit costs as of December 2011. The price escalation rates were calculated from the Wholesale Price Index (WPI) as shown in Table 4-1.

Finally, various unit costs acquired through the above process were combined into more aggregated cost units, such as BRT runway per kilometer, station per number by types, land acquisition per square meter.

Table 4-1 Whole Sales Price Index (WPI)

Year	Whole Sales Price Index (WPI)
2007-08	100.00
2008-09	118.96
2009-10	135.40
2010-11	164.16
2011-12	176.01

Source: Cost Escalation Rate Monthly Review on Price Indices, October and December, 2011 (Base 2007-08) Government of Pakistan, Statistic Division, Federal Bureau of Statistics

(2) Fare system and ITS costs

The following systems were proposed for cost estimation:

- Magnetic strip vending machines and coin & token system per station, and
- Bus operation control system with GPS technology.

Since the systems proposed above have not been planned in detail, the costs thereof were estimated in a lump sum referring to the sample costs suggested in the BRT Planning Guide 2007.

4-1-3 Estimation Result

(1) Unit Cost

The estimated unit prices are shown in the Table 4-2.

Table 4-2 Estimated Unit Costs

Cost Data No.	Base Cost (PKR)	Quantity per Km or per				Cost per Km or per Station		Specification Assumed	Data Source
		Length (m)	Width (m)	Nos	Quantity	Amount (PKR)	Unit		
Busway Infrastructure									
Runway and Station Construction									
1	At-Grade Runway	4,100 /sq.m	1,000	8.75	1	8,750	35,880,000 /km	Concrete pavement 30 cm	CDGK
2	Elevated Runway Viaduct	79,000 /sq.m	1,000	8.25	1	8,250	651,750,000 /km	Concrete bridge with precast	CDGK
3	Elevated Runway Viaduct (U-turn lane ; Single lane)	79,000 /sq.m	1,000	6.80	1	6,800	537,200,000 /km	Concrete bridge with precast girders	CDGK
4	Elevated Runway Viaduct (Platform)	79,000 /sq.m	1,000	7.40	1	7,400	584,600,000 /km	Concrete bridge with precast	CDGK
5	Ramp (Elevated to At-grade : Retaining Wall)	27,000 /sq.m	1,000	8.25	1	8,250	222,750,000 /km	Retaining Wall Structure	CDGK
6	Elevated Station Platform	55,000 /sq.m	56	6.10	1	340	18,700,000 /station	Platform Length 56 x 6.1m, 70% of Elevated runway	CDGK
7	Elevated Station Platform (Terminal)	55,000 /sq.m	100	8.00	1	800	44,000,000 /station	Platform Length 100 x 8.0m, 70% of Elevated runway	CDGK
8	Asphalt Pavement on Existing Bridge Deck	1,300 /sq.m	1,000	8.75	1	8,750	11,380,000 /km		NHA
9	Asphalt Pavement on Elevated Runway	1,300 /sq.m	1,000	8.25	1	8,250	10,730,000 /km		NHA
Lane Separators and Markings									
10	Separator Bars	1,610 /m	1,000		1	1,000	1,610,000 /km	Single both on at-grade and elevated runways	CDGK
11	Separator Blocks	830 /m	1,000		2	2,000	1,660,000 /km	Double on at-grade runway	CDGK
12	Lane Marking	740 /sq.m	1,000	0.20	4	800	590,000 /km	2 lines per BRT lane	CDGK
Median Tree Planting									
13	High-quality (1tree/10m + sculptures)	4,500,000 /km					4,500,000 /km		BRT Guide
Runway Lighting									
14	Electrical Lighting	208,600 /no.					6,950,000 /km	Lighting pole	CDGK
Station Facilities									
Station Platform with Architecture									
15	Split Platform	27,910 /sq.m	56	4.00	2	450	12,560,000 /station		StudyTeam
16	Double Platform	27,910 /sq.m	56	4.00	1	220	6,140,000 /station		StudyTeam
17	Landscape Platform	27,910 /sq.m	56	10.30	1	580	16,190,000 /station		StudyTeam
18	Elevated Double Platform	27,910 /sq.m	56	4.00	1	220	6,140,000 /station		StudyTeam
Other Station Facilities									
19	Sliding Doors at Boarding Interface	3,600,000 /station				1	3,600,000 /station		BRT Guide
20	Station Identification-Sign Post and Information Board	340,000 /station				1	340,000 /station		BRT Guide
21	Information Kiosks	2,700,000 /station				1	2,700,000 /station		BRT Guide
22	Emergency Callbox	140,000 /station				1	140,000 /station		BRT Guide
23	Security Cameras CCTV	396,552 /station				2	790,000 /station		CDGK
Integration Infrastructure									
Pedestrian Access to Station									
24	At-Grade Crosswalk with Signal	1,800,000 /station				1	1,800,000 /station	4 m wide zebra crossing	BRT Guide
25	Pedestrian Bridge Deck	62,234 /sq.m	1	1.00	1	1	60,000 /sq.m	3 m wide 46 m long	StudyTeam
26	Ramp (At-grade station)	9,273,707 /nos	1	1.00	1	1	9,270,000 /nos		StudyTeam
27	Ramp (Elevated station)	12,070,690 /nos	1	1.00	1	1	12,070,000 /nos		StudyTeam
28	Stair Case	48,000 /sq.m	16	2.00	1	32	1,540,000 /nos		StudyTeam
Existing Road Interface									
29	Road Shift in the section with Pylon	4,200 /sq.m	1,000	7.00	1	7,000	29,400,000 /km		CDGK
30	Major Intersection Improvement with Signal	4,200 /sq.m	100	50.00	1	5,000	28,200,000 /intersection	Change intersection traffic	CDGK
31	Medium Intersection Improvement with Signal	4,200 /sq.m	40	40.00	1	1,600	13,920,000 /intersection	Change intersection traffic	CDGK
32	Minor Intersection Improvement with Signal	4,200 /sq.m	40	10.00	1	400	5,280,000 /intersection	Maintain intersection traffic	CDGK
33	Median Strip for Elevated Runway Columns	3,100 /sq.m	1,000	3.00	1	3,000	9,300,000 /km	3 m wide median strip for viaduct columns	CDGK
Fare and ITS									
34	Magnetic Strip System (4 readers/station)	630,000 /station				1	630,000 /station		BRT Guide
35	Rotating Turnstile (4 No./station)	630,000 /No.				1	630,000 /station		BRT Guide
36	Magnetic Strip System	900,000 /machine				1	900,000 /station		BRT Guide
37	Magnetic Strip Cards	5 /card			500,000	500,000	2,500,000 /station		BRT Guide
38	Magnetic System	27,000,000 /software				1	27,000,000 /Project		BRT Guide
39	Green Light Phase Extension for BRT	1,800,000 /No.				1	1,800,000 /intersection		BRT Guide
40	Real-Time Information Displays	675,000 /station				1	680,000 /station		BRT Guide
Other Infrastructure Cost Items									
Control Centre (incl. software)									
63	Control centre physical construction	30,000 /sq.m	30	30.00	1	900	27,000,000 /Project		Hearing
65	GPS system (equipment and software)	90,000,000 /No.				1	90,000,000 /Project		BRT Guide
Terminals and Depots									
67	Depot	55,900,000 /No.				1	56,000,000 /Corridor	280x200 m	CDGK
68	Accessway to Depot	4,800 /sq.m	1,000	8.75	1	8,750	42,000,000 /km	Concrete Pavement 30 cm	CDGK

Source: The Study for KTIP

(2) Construction Cost Estimation Result

The result of cost estimation of BRT infrastructures is summarized in Table 4-3 with unit prices and the quantities.

Table 4-3 Estimated Construction Cost

Item	Amount LC (PKR)	Amount FC (JPY)	Unit	Green Line		Red Line	
				Quantity	Amount LC (PKR)	Quantity	Amount LC (PKR)
Runway Infrastructure							
AT-Grade Runway	39,740	-	/km	21.0	835,000	22.6	900,000
AT-Grade Runway on Existing Flyover/Bridge	13,580	-	/km	1.1	15,000	0.2	3,000
Elevated Runway Viaduct	673,980	-	/km	0.0	0	0.7	499,000
Elevated Runway Viaduct (U-turn: Single Lane)	550,130	-	/km	0.0	0	0.4	204,000
Elevated Runway Viaduct (Platform)	597,530	-	/km	0.0	0	0.2	90,000
Ramp (Embankment)	235,680	-	/km	0.0	0	0.1	19,000
Station Infrastructure							
AT-Grade Station Split Type	12,560	-	/station	5.0	63,000	0.0	0
AT-Grade Station Double Face	6,140	-	/station	14.0	86,000	24.0	147,000
AT-Grade Station Landscape	16,190	-	/station	8.0	130,000	0.0	0
Elevated Station Platform	24,840	-	/station	0.0	0	2.0	50,000
Electrical Lighting	6,950	-	/km	21.1	147,000	24.4	170,000
Integration Infrastructure							
At-Grade Crosswalk with Signal	1,800	-	/station	0.0	0	2.0	4,000
Pedestrian Bridge	60	-	/sqm	5,844	351,000	3,807	228,000
Access Ramp (At-grade)	9,270	-	/ No.	87.0	806,000	63.0	584,000
Access Ramp (Elevated)	12,070	-	/ No.	0.0	0	6.0	72,000
Staircase	1,540	-	/ No.	6.0	9,000	15.0	23,000
Road Shift along the section with Pylon	31,060	-	/km	7.2	224,000	2.2	68,000
Major Intersection Improvement with Signal	28,200	-	/ No.	1.0	28,000	0.0	0
Medium Intersection Improvement with Signal	13,920	-	/ No.	3.0	42,000	1.0	14,000
Minor Intersection Improvement with Signal	5,280	-	/ No.	5.0	26,000	4.0	21,000
Landscaping	4,500	-	/km	21.1	95,000	24.4	110,000
Fare and ITS							
Fare and ITS	1,068	6,000	/station	27.0	219,000	26.0	211,000
Green Light Phase Extension for BRT	1,800	-	/ No.	9.0	16,200	5.0	9,000
Other Infrastructure							
Depot Facility	56,000	-	/No.	1.0	56,000	1.0	56,000
Depot Civil Works	4	-	/sqm	49,400	203,000	27,600	113,000
Accessway to Depot	45,860	-	/km	0.9	39,000	0.9	41,000
GPS system (control center, equipment and software)	11,700	134,000	/Line	1.0	166,000	1.0	166,000

Source: The Study for KTIP

4-2 Procurement Cost

4-2-1 Unit Price of BRT bus

The cost of a BRT bus is estimated as Rs. 12 million including General Sales Tax (GST). This is the catalog price of a standard 12m bus plus special equipments for BRT.

4-2-2 Vehicle Maintenance Equipment

In order to perform safe and reliable BRT operation, enforcement of the periodic inspection which prevents vehicle's failure is proposed. When a workshop is established in each one depot of Green and Red lines, each workshop shall have the

maintenance capacity of approximately 200 buses. The major equipment which is needed to carry out the periodic inspection (e.g. monthly, every 3 month and every 6 month) and the unscheduled inspection for 200 buses in each workshop is estimated as shown in the following table. All equipment would be imported.

Table 4-4 Major Equipment for Vehicle Maintenance

Item	Equipment	Remarks	Q'ty per workshop
Equipment for inspection	Movable frame lift	Capacity 10 tons	4
	Transmission gear jack	Capacity 800kg	1
	Wheel dolly		1
	Drum pump	Manually and rotatory type	1
	Mechanical tool set	General tool for large-sized vehicle	5 sets
	Pneumatic-hydraulic garage jack	Capacity 15 tons, 250~430mm	3
	Service creeper	420mm x 840mm	4
	Deferential gear jack	Capacity 300kg, 200~800mm	1
	Brake fluid bleeder	18 littler	1
	Engine compression gauge set		1
Wheel/Tire/Brake maintenance	Automatic tire inflator	Floor type, 10 -700 kPa	2
Engine/Transmission maintenance	Air valve lapper	0.58MPa	1
	Engine stand	Capacity 550kg	2
Car washing equipment	Heated water high pressure washer	Capacity 1,500 litter/hour	2
Electric tool	Air impact wrench and sockets	1/2 sq.in, 3/4 sq.in, 1 sq.in. drive	3 sets
	Torque amplifier	Capacity 1,500 Nm	1
	Port-power set	Capacity 10 tons	1
Hand tool	Socket wrench set	3/8 sq.in, 1/2 sq.in 1 sq.in.	3 sets
	Chain block	Capacity 1.5 tons	1
Measurement device	Torque wrench set	3/8 sq.in, 1/2 sq.in, 3/4 sq.in, 1 sq.in.	4 sets
	Digital multi tester	DC/AC, Power current and voltage	1
	Combination socket for impact wrench	1 sq.in. 41 x 21 mm	2
Battery maintenance	Quick battery charger	12-24V/100A	1
Air compressor	Air compressor	Capacity 15 kW, 0.93MPa, Receiver tank 340 litter	1
Welding	Semi-automatic CO2 welding machine	200A	1
	Plasma-arc welding machine	35 A (3-phase)	1
	Spot welding machine	8,500A	1
Electric component maintenance	Circuit tester	Analog	1
	Clamp tester	1,000A (DC/AC)	1
Hoisting device	Sling chain	Capacity 2 tons, single hook	2
	Sling chain	Capacity 2tons, double hook	8
	Movable floor crane	Capacity 1 ton	2

Source: The Study for KTIP

4-2-3 Procurement Cost Estimation

The necessary number of buses is estimated at 425 (See 5-1-3). The procurement cost of a bus and the maintenance equipment is estimated as follow.

Table 4-5 Estimated Cost of Bus and Maintenance Equipment (Rs. 000)

	Bus per vehicle	Maintenance equipment for 2 workshops
L/C	3,100	0
F/C	7,245	130,200
(Note)	(Import duty is exempted)	(Import duty of 5% is included)
Sub total	10,345	130,200
GST	16%	16%
Total	12,000 (Rs. 5.1 billion in total)	151,032

Source: The Study for KTIP

4-3 Engineering Services

4-3-1 Package for Consulting Services

The engineering services that consultants will provide involve the following items (tasks of each service is also described together);

- Basic Design
Alignment, Location of stations, Outline specification of infrastructure and buses,
- Detail Design
Structural design for civil works and station architect works etc, detailed specification of infrastructure and buses,
- Tender Document Preparations
Preparation of tender documents including all drawings and specifications etc,
- Tender Assistance
Assistance for tender process including PQ (Pre-qualification), tender evaluation and negotiation etc,
- Construction Supervision
Supervision of contractor's construction works in all aspects,

It is proposed that engineering services for the project be conducted in two stages, where basic design, detail design, tender document preparation and tender assistance are packaged together. The engineering services for construction supervision will be one independent package.

4-3-2 Cost of Engineering Services

The cost of engineering services consists of direct employment cost and indirect cost. The direct employment cost is estimated based on the numbers of experts required in each of the project stage. Indirect cost such as transportation fee, survey cost and other expenses are also estimated individually.

The billing rates of consultants and support staff are listed in Table 4-6.

Table 4-6 Billing Rate of Consultants

	Foreign Currency (JPY)	Local Currency (Rp.)
Pro-A (International Consultant)	2,591,000	-
Pro-B (Local Consultant)	-	500,000
Supporting Staff	-	100,000

Source: The Study for KTIP

The positions and manpower required for the engineering services are tabulated in the following table.

Table 4-7 Required Positions and Manpower for Engineering Service

Type	No	Position	Total(MM)
Pro-A	1	Project Manager	17
	2	Structural Engineer	5
	3	Road Design Engineer	5
	4	Traffic Management Engineer	5
	5	Alignment Engineer	2
	6	Geotechnical Engineer	2
	7	Hydrologist	5
	8	Road Facility Engineer	4
	9	Architect	5
	10	Cost Estimator/ Construction Planner	3
	11	Environmental Specialist	3
	12	Operation and Maintenance Expert	3
	13	Contract Expert	3
	14	Vehicle Expert	3
	15	Resident Engineer	36
[Total of A]			101
Pro-B	1	Deputy Project Manager	32
	2	Structural Engineer	23
	3	Road Design Engineer (1)	23
	4	Road Design Engineer (2)	23
	5	Traffic Management Engineer (1)	23
	6	Traffic Management Engineer (2)	23
	7	Alignment Engineer (1)	23
	8	Alignment Engineer (2)	23
	9	Geotechnical Specialist	23
	10	Hydrologist	23
	11	Facility Engineer	19
	12	Architect	19
	13	Cost Estimator	15
	14	Construction Planner	15
	15	Environmental Specialist	23
	16	Document Contoller	59
	17	Contract Expert	15
	18	Inspector (Structure)	30
	19	Inspector (Road) 1	36
	20	Inspector (Road) 2	36
	21	Inspector (Architect) 1	24
	22	Inspector (Architect) 2	24
[Total of B]			554
Supporting Staff	1	Secretary	104
	2	CAD Operator	162
	3	Quantity Surveyor	108
	4	Office Boy	108
	5	Accountant	108
	6	Driver	248
	7	Sweeper	122
	8	Gurdman	122
[Total of Supporting Staff]			1,082

(Note: Type A means international professionals, while type B means local professionals.)

Source: The Study for KTIP

Chapter 5 Operation and Maintenance Costs

5-1 Operation Plan

5-1-1 BRT Routes

(1) Cross Operation

It is proposed that both Green and Red Lines go to Cloth Market along M.A. Jinnah Road and Regal Chowk along New M. A. Jinnah Road to avoid transfer between two lines near the center of the city. The demand between Green and Red Lines cannot be ignored, but it is not proposed to connect Green and Red Lines directly because such demand will be covered with other transit lines such as KCR and Brown Line in the future.

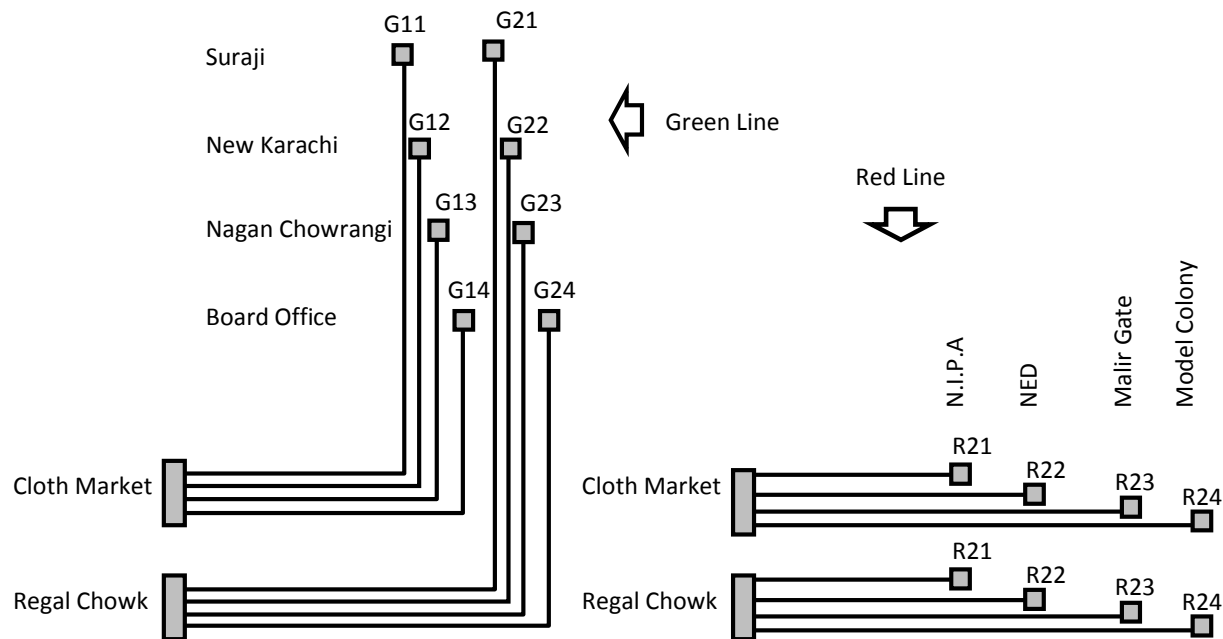
(2) Round Trip

The required number of buses is different by section. In the early stage of the operation, it is not necessary to provide the target capacity along the section which is far from the center. From the results of the demand forecast, it is proposed to provide eight routes for Green Line and four routes for Red Line as shown in Table 5-1 and Figure 5-1.

Table 5-1 Proposed Routes of Green and Red Line

Line	Round Route	Center	U-turn point
Green Line	G11	Cloth Market	Board Office
	G12	Cloth Market	Nagan Chowrangi
	G13	Cloth Market	New Karachi
	G14	Cloth Market	Surjani
	G21	Regal Chowk	Board Office
	G22	Regal Chowk	Nagan Chowrangi
	G23	Regal Chowk	New Karachi
	G24	Regal Chowk	Surjani
Red Line	R11	Cloth Market	N.I.P.A
	R12	Cloth Market	NED
	R13	Cloth Market	Malir Gate
	R14	Cloth Market	Model Colony
	R21	Regal Chowk	N.I.P.A
	R22	Regal Chowk	NED
	R23	Regal Chowk	Malir Gate
	R24	Regal Chowk	Model Colony

Source: The Study for KTIP



Source: The Study for KTIP

Figure 5-1 Diagram of BRT Routes of Green and Red Lines

5-1-2 Peak Hour Operation

The target capacity in peak hours is 12,000 passengers per hour per direction. Since the capacity of a BRT bus is planned as 80 passengers, the necessary frequency is calculated as 150 per hour (2.5 per minute). In this case, buses should arrive at station in 24 seconds interval. From this high frequency, the time table of bus arriving will not be necessary for passengers. However, BRT should be operated based on a time table for efficient operation.

(1) Time at Station

Short boarding and alighting time at stations will increase the capacity. However, it is proposed to fix the boarding and alighting time at stations at 20 seconds to enable the scheduled operation of buses. The time of 20 seconds at a station for boarding and alighting is a popular time of BRT operations in the world.

In addition to the boarding and alighting time, deceleration and acceleration time will be necessary at stations. For comfortable riding, rapid deceleration and acceleration should be avoided. The time is approximately 10-20 seconds. In total, 40 seconds will be necessary for a bus at a station.

(2) Speed

If speed is not matter, the capacity can be increased. For example, if 12m buses with the capacity of 72 passengers per bus are moving continuously like a long train at a waking speed (4km/hour), it can carry 24,000 passengers per hour (= 72/12 * 4,000). However, it is necessary to keep the BRT speed even in peak hours otherwise the benefit of BRT will become small. The target speed is 25km/h.

(3) Convoy system operation

A boarding and alighting slot can deal with only 1.5 buses per minute (60/40). To achieve 2.5 buses per minute, two slots with a passing lane is necessary. However,

due to the limitation of available road space, it was decided that passing lanes would not be provided to BRT stations. Instead, three slots for boarding and alighting were proposed to apply a convoy operation. In this case, two or more buses are operated in a group which arrive and departure at the same time. If two buses arrive at a 48 seconds interval, the capacity of 12,000 passengers per hour is possible.

(4) Peak Hours

Peak hours along Green and Red Lines differ by section. In morning, approximately two hours from 7:00- 9:00 is peak hour time, while evening peak continue approximately three hours from 18:00-21:00. In total, the peak hour operation should be applied for 5 hours in a day.

(5) Off-peak Hour Operation

The frequency should be reduced according to passenger demand. However, it is necessary to maintain the minimum frequency.

5-1-3 The number of buses

The number of buses needed for the operation (N) was calculated by the following formula.

$$N = T \text{ (minutes)} / \text{Peak hour interval (seconds)} * 60$$

Where, T is the smaller one between the round trip time and the peak hour time. Since the round trip time is less than 2 hours both for Green and Red lines, while the peak hours continue more than 2 hours, round trip times were used for the calculation. In addition to the buses calculated above, spare buses will be necessary. The number of additional buses was assumed at 5% of the total number of buses needed for the peak operation. Table 5-2 shows the estimation of the number of buses. In total, 425 buses would be needed for the BRT system.

Table 5-2 Calculation of No. of Buses Needed for BRT System

Green Line							
Section	Distance (km)	No. of buses per hour	No. of buses to be added	Interval sec	Speed km/h	Round time Hour	No. of buses
Cloth Market Surjani	21.0	80	80	45	25	1.68	135
Mazar Area Power House	14.8	100	20	180	25	1.18	24
Mazar Area Nagan Chowrangi	11.0	138	38	95	25	0.88	34
Mazar Area Board Office	7.2	150	12	300	25	0.58	7
Total							200

Red Line							
Section	Distance (km)	No. of buses per hour	No. of buses to be added	Interval sec	Speed km/h	Round time Hour	No. of buses
CBD Model Colony	23.3	70	70	51	25	1.86	131
Mazar Area Malir Gate	17.0	100	30	120	25	1.36	41
Mazar Area NED	11.5	120	20	180	25	0.92	19
Mazar Area NIPA Station	8.3	140	20	180	25	0.66	14
Total							205

Source: JICA Study Team

Total	405
Spare	20
Grand Total	425

5-1-4 Vehicle-kilometers

The vehicle-kilometer, a unit which represents the total of the travel distance of buses, is one of the most important indicators of BRT systems. The vehicle-kilometers in peak hours can be calculated from the peak operation plan in the previous section. The off-peak operation was prepared based on the assumption of hourly distribution of passenger traffic.

(1) Hourly Distribution of Passenger Traffic

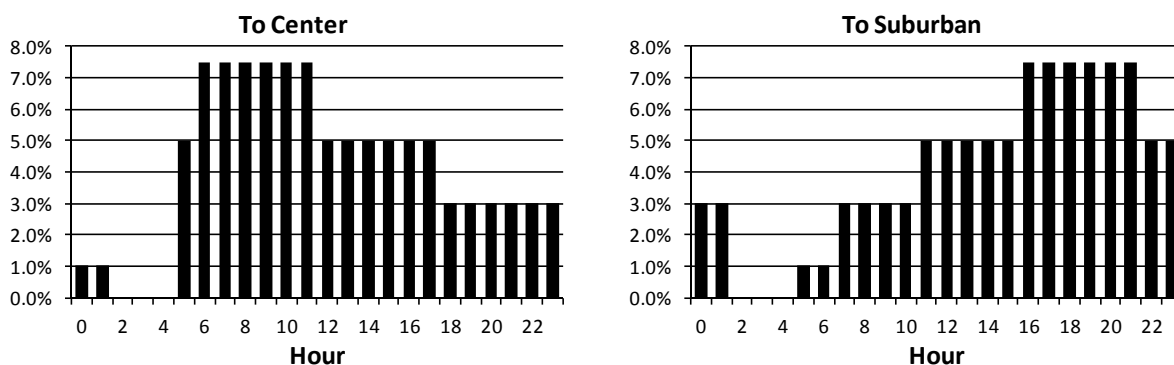
Off-peak operation plans were prepared for the following four traffic groups: 1) 7.5% of daily traffic, 2) 5%, 3) 3%, and 4) 1%. Table 5-3 shows the hourly frequency and the number of buses needed by the traffic group.

Table 5-3 Hourly Traffic Volume by Traffic Group

Line	Section		Traffic Group				No. of Required Buses			
			1	2	3	4	1	2	3	4
			7.5%	5.0%	3.0%	1.0%	0.5%	7.5%	5.0%	3.0%
Green Line	Cloth Market	Surjani	80	54	22	3	80	54	22	3
	Mazar Area	Power House	100	67	27	4	20	13	5	1
	Mazar Area	Nagan Chowrangi	138	92	37	5	38	25	10	1
	Mazar Area	Board Office	150	100	40	6	12	8	3	1
Red Line	CBD	Model Colony	70	47	19	3	70	47	19	3
	Mazar Area	Malir Gate	100	67	27	4	30	20	8	1
	Mazar Area	NED	120	80	32	5	20	13	5	1
	Mazar Area	NIPA Station	140	94	38	6	20	14	6	1

Source: The Study for KTIP

Peak characteristics are quite different by directions. The morning peak is observed toward the center direction while the evening peak is observed from the center to suburb. Passenger traffic distribution was assumed as shown in Figure 5-2 for both directions.



Source: The Study for KTIP

Figure 5-2 % Distribution by Hour by Direction

The number of hours by traffic group was prepared by combining the two charts (the average of % of each hour). The result is 12 hours (7.5%), 7 hours (5.0%), and 2 hours (3.0%). This means that peak hour operation should be applied for 12 hours a day. The number of services was calculated by adding up the product of the number of hours and the number of required buses of each traffic group. Vehicle-kilometers of the BRT system was calculated at 173,000 per day by adding up the product of the number of services and the length of each section.

Table 5-4 Calculation of Vehicle-kilometers

Line	Section	No. of Services	Bus-km
Green Line	Cloth Market Surjani	1,382	58,044
	Mazar Area Power House	341	10,094
	Mazar Area Nagan Chowrangi	651	14,322
	Mazar Area Board Office	206	2,966
	subtotal	2,580	85,426
Red Line	CBD Model Colony	1,207	56,246
	Mazar Area Malir Gate	516	17,544
	Mazar Area NED	341	7,843
	Mazar Area NIPA Station	350	5,810
	subtotal	2,414	87,443
Total		4,994	172,869

Source: The Study for KTIP

5-2 Personnel Plan

5-2-1 Required Staff

Efficient staffing is one of the important issues of a public transport operation. On the other hand, the BRT project will succeed only when the customer service is satisfactory for passengers. Good staffing is the fundamental part of the customer service. The staff members of the BRT system should be highly trained and skilled for their designation, which contributes to high quality customer services. From this viewpoint, the necessary staff was identified as shown in Table 5-5.

Table 5-5 Roles and Duties of Expected Staffs

Occupation	Roles and Duties
President	Represents a company and responsible for the management.
Director	Manages section(s) to assist the president.
Administrative Staff	Works for the administration of the company to assist the management.
Drivers	Drive the BRT vehicles safely and efficiently.
Mechanics	Keep the BRT vehicles in good condition for the safe operation.
Station staff	Works for safety of passengers and assist for safe operation of the BRT.
Security staffs	Keep the BRT area be secured from any dangers from criminals and terrorists.
Ticketing staff	Ticket sales and controlling the automatic entrance gate.

Source: The Study for KTIP

Numbers of drivers and mechanics were estimated by assuming 2.0 and 0.5 persons per one vehicle respectively. In addition to these, a conversion factor of 1.34 was applied, which represents working days per year and spare ratio (10 %) of the staffs. The calculations were based on the following formulas.

$$\text{No. of drivers} = 2.0 (\text{per vehicle}) * 386 (\text{operating vehicles}) * (365/300) * 1.1$$

$$\text{No. of mechanics} = 0.5 (\text{per vehicle}) * 425 (\text{total vehicles}) * (365/300) * 1.1$$

Majority of the fare collection company is deemed as the ticketing staffs. Total number of the company staffs was estimated as 456.

As the BRT system is expected to be operated every day all through the year, the number of staffs at the site such as drivers, station staffs, mechanics and ticket sales staffs are increased by assuming 300 working days and 10% spare staffs to the total in the same manner as the drivers and the mechanics.

5-2-2 Personnel Cost

Table 5-6 shows assumed personnel cost of the BRT system. As is described in Chapter 6, Karachi Bus Rapid Transit Corporation (KBRTC) plays a role as a PPP corporation, which is to be established by the public sector and the private sector, to manage the system by contracting out necessary works to private companies. There will be two operators: one is responsible for Green Line and the other is responsible for Red Line. A fare collecting company is responsible for the fare collection.

Monthly personnel cost by occupation was estimated based on the current prevailing rates in the transport sector in Karachi.

Table 5-6 Monthly Personnel Cost of BRT System

Occupation Category Company		KBRTC		Operation Companies (2)		Fare Collection Company	
Occupation	Monthly Personnel Cost (Rs)	Number of Staffs	Monthly Personnel Cost (Rs)	Number of Staffs	Monthly Personnel Cost (Rs)	Number of Staffs	Monthly Personnel Cost (Rs)
President	300,000	1	300,000	2	600,000	1	300,000
Director	100,000	2	200,000	8	800,000	2	200,000
Administrative Staff	12,000	10	120,000	130	1,560,183	27	328,282
Drivers	14,000	0	0	1,033	14,464,707	0	0
Mechanic	25,000	0	0	284	7,109,896	0	0
Station staff	10,000	0	0	426	4,255,900	0	0
Security staff	10,000	0	0	284	2,837,267		
Ticketing staff	10,000	0	0	0	0	426	4,255,900
Total	-	13	620,000	2,167	31,627,952	456	5,084,182

Source: The Study for KTIP

5-3 O&M Costs

5-3-1 Vehicle operation cost

The vehicle operation cost is a representative “variable” cost of the BRT system, which varies in proportion to operated distances of the BRT vehicles. The vehicle operation cost includes fuel, lubricant, tyre and filter costs in this study. The vehicle operation cost was estimated based on future total annual BRT vehicle-km by assuming specification of the BRT vehicle such as fuel type (CNG), daily service hours, operating speed and so on. Fuel consumption rate, useful life, of tyre and others are assumed properly in this calculation. The cost was estimated at the constant price of December 2011. Table 5-7 shows the vehicle operating cost per one vehicle-km.

Table 5-7 Estimated Vehicle Operation Cost per vehicle-km (Rp)

Category	Cost
Fuel	25.24
Lubricant	0.98
Filters	1.26
Tyre	1.53
Total	29.01

Source: The Study for KTIP based on Hinopak Motors Limited.

Annual vehicle operating cost was estimated as much as Rp 1,556.0 million.

5-3-2 Vehicle maintenance cost

Vehicle maintenance cost of the BRT system was estimated based on maintenance scheme, which stipulates timing of change and overhaul by part in terms of operated distance and/or period of operation. The maintenance cost of BRT vehicle is estimated as Rs 1,756,529 for a 500,000km operation according to Hinopak Motors Limited. Therefore, unit maintenance cost per vehicle-km was estimated to be Rs.3.51. Annual vehicle maintenance cost total was calculated as Rp 188.2 million.

5-3-3 Vehicle Insurance Cost

The vehicle insurance cost was estimated with due consideration to the current insurance payment by the KMC for the CNG bus project and Wright (2007). The insurance cost was finally assumed as 2 % of vehicle purchasing cost per annum. Annual insurance payment was calculated to be Rp 102.0 million.

5-3-4 Other administrative cost

It would be practical and conservative to admit the “unpredictable cost” for the implementation of future projects. The Study Team assumed the unpredictable cost as “other administrative cost” and appropriated Rp 91.0 million per year, which is 4 % of the sum of personnel cost, vehicle operation cost, vehicle maintenance cost and vehicle insurance cost. The “4%” was derived from experience of KMC as well as foreign experiences mentioned in Wright et al (2007).

The other administrative cost is considered to include office expenditures, telephone charges, utility costs, repair costs and contingency.

5-3-5 Maintenance Cost for Infrastructure

The BRT system infrastructure cost consists of carriageway/station infrastructure, integration infrastructure with the inclusion of pedestrian bridges and intersection improvement, fare collection and ITS systems, other infrastructure and property acquisition as explained earlier. The annual maintenance cost for the infrastructure was assumed as 5 % of total investment cost, based on experiences of the Study Team.

Table 5-8 shows a summary table of the O& M cost of the BRT system.

Table 5-8 Summary of O & M Cost

O & M Cost	Rs million per year
1. Personnel Cost	448.0
2. Vehicle Operation Cost	1,556.0
3. Vehicle Maintenance Cost	188.2
4. Vehicle Insurance Cost	102.0
5. Other Administrative Cost	91.8
6. Maintenance Cost of Infrastructure	400.7
Total	2,786.7

Source: The Study for KTIP

Chapter 6 Business Model

6-1 Introduction

The popular business model applied by successful BRT systems in the world is “competition for the market but monopoly in the market”. The major future of the popular business model is:

- A public entity is responsible for the implementation of the project.
- Infrastructure, including busway, stations, depot, and pedestrian bridges, is developed by public sector using public budget.
- The system is operated by private sector under the contract between the operator and the public entity.
- The private operators are selected by competitive bidding.
- Passenger fare is collected by another private company than the operator. The public entity receives the passenger revenue.
- The operators receive a contract amount from the revenue based on the vehicle-kilometers (not the number of passengers).
- The private operators are responsible for purchase and maintenance of vehicles as well as operating costs such as fuel and drives.

The basic structure of the Karachi BRT project is as same as the business model mentioned above – the public entity gives an exclusive concession to a few operators and pays the contract amount to them based on performance. The exception is vehicle ownership. In the Karachi BRT, it is proposed that the public sector owns the necessary vehicles.

6-2 Contract Type

6-2-1 Net cost model and gross cost model

There are two types of contract in terms of revenue risk: net-cost contracts and gross-cost contracts. In a net-cost contract, private operators receive the passenger revenue, while the payment from public sector based on the performance such as vehicle-kilometers travelled is the revenue for private operators in a gross-cost contract. In other words, private sector takes revenue risk in a net-cost contract while public sector takes the risk in a gross-cost contract.

The Karachi BRT project will employ the gross-cost contract because it can ensure the quality of the bus services. In case of net-cost contract, the major incentive of bus operators is to collect as many passengers as possible. This will cause overstay at a station, overloading, low frequency in off-peak hours, and non-stop at stations of few passengers, which are the same situation as the present minibus services.

6-2-2 Vehicle Ownership

In popular BRT systems in the world, vehicles are purchased and owned by private operators under the condition that the vehicles should satisfy the specification set by the implementation agency. The Karachi BRT project will require 425 buses and the total cost is estimated as Rs. 5.1 billion. Table 6-1 shows FIRR calculation with its sensitivity analysis for operators under the conditions that they need to purchase

vehicles and can receive the revenue after O&M cost of the fare collecting company and the implementation agency is deducted. The result shows that FIRR is higher than the market interest rate of approximately 14%. However the sensitivity analysis shows that the FIRR will become 10.3% in case of 10% increase in O&M cost and 10% decrease in revenue. The profitability is not attractive for private sector considering the interest payment for the vehicle investment of Rs. 5.1 billion.

Table 6-1 FIRR Analysis for Operators (Vehicle Own Case)

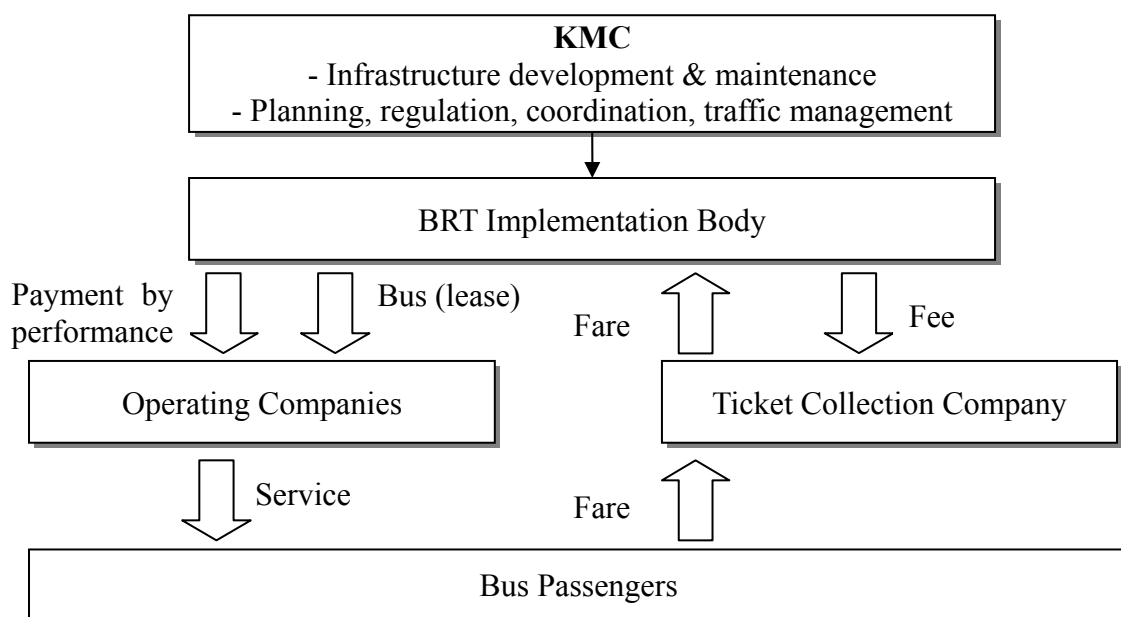
	Base Case	Case-1	Case-2	Case-3
O&M	0%	+10%	0%	+10%
Revenue	0%	0%	-10%	-10%
FIRR	20.4%	17.3%	14.0%	10.3%

Source: The Study for KTIP

Since public sector can receive long-term loans with low interest rate and grace period, the implementation body will purchase all vehicles and lease them to private operators.

6-2-3 Contract Structure

The contract structure is shown in Figure 6-1. BRT implementation body will take the revenue risk while operating companies will take operation cost risk such as fuel price increase. KMC is responsible infrastructure development and maintenance, while BRT implementation body is responsible for system and rolling stock. Traffic control at signalized intersections is done by KMC.



Source: The Study for KTIP

Figure 6-1 Contract Structure

6-2-4 Implementation Body

(1) Establishment of the Implementation Body

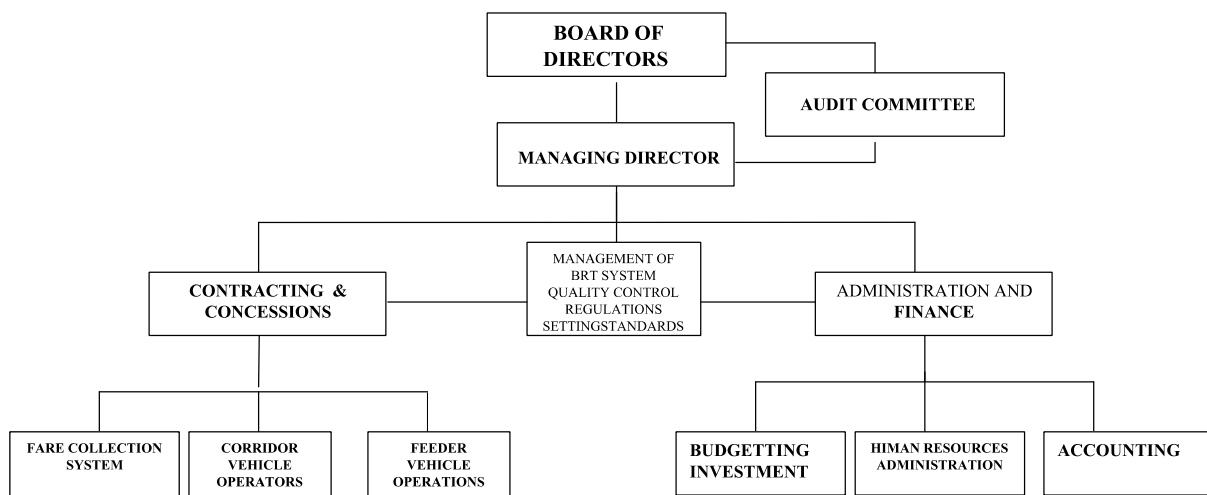
After the careful analysis of institutional set up of mass transit administration in Karachi and in consultation with various public and private organizations including, Karachi Mass Transit Cell (KMTC), Transport and Communication Department (TCD), Works and Services Department of CDGK and Public-Private Partnerships (PPP), a unit of Finance Department, GOS, a concept for the new institution was developed.

The new institution shall be a public corporation and its stakeholders will be public sector (51%), and private sector (49%). The new institution will be tentatively called as the “Karachi Bus Rapid Transit Corporation (KBRTC)”. In order to create a new institution for a mass transit system from scratch it is the first thing to make it sure that there is a political will and financial and human resources to set up and operate the institution. Operations of public transportation system either by public or private sector or both are usually running in deficit requiring government subsidies in a large scale. The BRT system’s sustainability is likely depend as much on the system’s “software” (the regulatory, and business structure) as it is on the: hardware” (vehicles, stations, terminus, and other infrastructure). The new institution must operate as a commercial and business entity. It is designed to secure long-term investments from public and private sector and leverage local, provincial, central government funds as well as private funds, maximize the level of private sector investment over the long terms in Karachi BRT system. The KBRTC’s initial institutional structure is a public company but it is a dynamic form of “corporatization” which is a final form of institution in the privatization process. KBRTC is designed to be 100% private within next several years. Meanwhile, the new institution must create an environment to utilize the efficiencies, innovativeness, flexibility and speed of the private sector to provide better infrastructure and service at an optimal cost. In other words, attempting to plan an institutional structure it is necessary to maximize private sector participation in the BRT operations and infrastructure development within a Public-Private Partnerships framework (e.g. private sector finances vehicles and fare collection equipment).

As mentioned earlier there are other institutional options available including: a transportation authority and SPC (special purpose company- a ppp company), etc. A transportation authority is usually an organization with wide oversight on all public transport activities. A state or city owned monopoly is low cost-effective due to confused corporate objectives (services or profits?), low, sporadic or inappropriate investment resulting in poor services and large subsidy requirement. What is needed for the implementation and management of Karachi BRT is a focused business-oriented organization that is able to perform a balancing act of corporate objectives. The SPC is a PPP company created to engage in the financing, development, operation and maintenance of BRT system under a concession agreement. Under the current domestic and international market conditions it is unlikely that a private company or consortium is capable to implement and manage the BRT system alone.

(2) Organization of KBRTC

Based on the institutional, regulatory and business principles KBRTC will be established as an overall lead body invested with the legal powers for establishing and implementing BRT policy. It will be the implementation agency for Karachi BRT system. KBRTC will be a public company, registered with Securities Exchange Commission of Pakistan (SECP) with the following shareholders: CDGK (41%), Government of Sindh (10%) and Private Sector (49%). It will serve as a regulatory authority for the planning, implementing and managing BRT system of Karachi. The company’s Board of Directors has the following structure: Administrator/Mayor (Nazim) Karachi, Chairman, Secretary of Finance, GOS(Member) and two members from CDGK viz EDO Transport & Communications and Director General, Karachi Mass Transit Cell (KMTC). The Board will also have two (2) members from the public traffic and transport control agencies, three (3) members from NGO and Managing Director, KBRTC as Secretary to the Board. KBRTC reports to the Chairman through its board of directors. The management of KBRTC is consisting of Managing Director who is supported by three (3) Deputies.



Source: The Study for KTIP

Figure 6-2 Organizational Structure of KBRTC

6-2-5 Transit Authority

Presently, Karachi Mass Transit Cell (KMTC), Karachi Municipal Corporation (KMC) is responsible for planning and regulation of mass transit development in Karachi. However, the present organization does not have enough power, human resources, and budget. Since the Karachi BRT is only a part of corridors, it is necessary to strengthen the organizational structure. For this, Establishment of Karachi Mass Transit Authority is proposed as well as a new law namely, Mass Transit Authority Act. Laws and regulations relating to mass transit development will be compiled into the act and legal power and responsibilities will be given to the new authority. The authority will have the power to establish public corporations for public transport services such as BRT and MRT.

Chapter 7 Financial Analysis

7-1 Funding Sources

7-1-1 Private Sector Involvement

There seem little cases that huge investment to the transport sector by the private sector in Pakistan, currently. As a recent example, one case could be mentioned that the M/S Four Brothers invested Rs. 225 million to the high speed railway service (Pak Business Express). However, the BRT system needs Rs 5.1 billion including VAT only for vehicle acquisition. The necessary investment is more than 20 times bigger than the high speed railway service business.

The BRT system is also a completely new system to Karachi and no one knows whether it would be successful or not. Therefore, it seems unrealistic that the private sector would be confident to invest huge amount of capital for the BRT system in Karachi.

It will be realistic to develop the whole BRT system by the public sector in terms of investment and that the private sector operates and maintain the BRT system through concession contract.

It should be noted that private sector involvement should be open to foreign private companies, too, because local private companies have no experience of the new BRT system. If an experienced foreign private operator or a joint venture with local companies is awarded the bidding, some amount of the investment cost would be saved in some extent.

7-1-2 Equity

In the case of Karachi Circular Railway development, the equity investment was planned as only 3.7% of the total investment cost according to JICA 2009. Most portion of the project was planned to be covered by the foreign loan. The total cost of the project was estimated as huge as Rs 160 billion. The equity investment was planned as Rs 5.9 billion only, the ratio to the total investment was as small as 3.7%.

The total investment cost of the BRT system was estimated as Rs 17.2 billion. The Study Team considers that the equity investment could be Rs 3.4 billion, which is equivalent to 20% of the total investment. The KBRTC owns all assets of the BRT system in this case.

There would be another option that the public sector would ask to private sector to share the KBRTC equity investment for some portion. The public sector would be able to reduce financial expenditure if the private sector would respond to the invitation. Potential equity share of the private sector would be less than 50% of the total equity.

7-1-3 Loans

Two types of loans were considered. One is the JICA loan, which is very soft loan for the project, for the long term loan, the other is a short term loan available in the domestic market to cope with potential cash shortage. The conditions of the loans are summarized below.

JICA Loan

Interest Rate: 1.4% per annum
(0.01% per annum for consulting service)
Repayment period: 30 years (including grace period of 10 years)

Short Term Loan

Interest Rate: 14.0% per annum
Repayment period: 1 year

The condition of the short term loan was derived from the prevailing interest rate in Pakistan.

It should be mentioned that the JICA loan would not be applied to land acquisition, administration cost of the local government and tax payment. Applicable JICA loan amounts to 80% of the total investment cost. Therefore, 20% of equity investment to the total project cost is considered reasonable.

Interest during construction

Interest during construction was included in the JICA loan and was repaid together with the loan under the condition of the loan. Therefore, no interest payment was appropriated during the construction period in the cash flow.

Commitment Charge

Commitment charge was included in the JICA loan and repaid as same as the interest during construction.

7-2 Financial Calculation**7-2-1 Assumptions****(1) Pricing date**

The pricing date of the financial planning was assumed as of December 2011.

(2) Foreign exchange rate

Foreign exchange rates in Dec. 2011(average monthly rate) were adopted as below based on “Statistical Bulletin – February 2012” by the State Bank of Pakistan.

US\$1.00 = Rs89.340

JPY1.00 = Rs1.148

(3) Project life

Thirty (30) years of the project life after the opening of the BRT system to the public was adopted for the evaluation. The project life was determined according to the repayment period of the expected foreign loan.

(4) Construction period and the opening year

As mentioned in the Chapter 5, the project is assumed to start in 2014. After detail design/ tendering process and three-year construction period, the BRT system will be completed in the end of 2019. Since the BRT system is a completely new system to

Karachi and highly trained staffs are crucial to operate the system safely, the opening time of the system was assumed as in the middle of 2020, which is after six month training period of the completion to secure reliable and safe operation of the system.

(5) Ridership

Ridership of the BRT system was estimated as 70,000 per day by the Study Team. Although the number is a bit bigger than the system transport capacity, the Study Team considered the number as realistic. The ridership is assumed to stay same level during the project life period.

7-2-2 Capital Cost

(1) Initial investment cost

The total initial investment cost is estimated as Rs 17,234 million, which includes the training cost (Rs 80 million: refer to 10.6 Capacity Development Programme) for the staffs of the BRT companies. Pure project cost is estimated as Rs 17,154 million as summarized in Table 7-1. The cost is shown in 2011 constant price.

Table 7-1 Initial Investment Cost of the BRT System

(Unit: Rs million in 2011 constant price)

Item		FC	LC	Total
<u>A. ELIGIBLE PORTION</u>				
I	Procurement / Construction	4,120	8,911	13,031
	Civil Works	0	6,531	6,531
	Facilities	373	82	455
	Depot & Workshop	472	556	1,028
	Vehicle	3,079	1,318	4,397
	Physical contingency	196	424	621
II	Consulting services	369	500	869
	Base cost	351	476	827
	Physical contingency	17	24	41
Total (I + II)		4,489	9,410	13,900
<u>B. NON ELIGIBLE PORTION</u>				
a	Administration cost	0	695	695
b	VAT	0	2,335	2,335
c	Import Tax	0	224	224
Total (a+b+c)		0	3,255	3,255
<u>TOTAL (A+B)</u>		4,489	12,665	17,154

Source: The Study for KTIP

(2) Additional investment cost

No additional investment cost was appropriated, because number of passengers is estimated same as the opening year during the project life period.

(3) Re-investment cost

Table 7-2 shows the useful lives of the invested assets for the BRT project.

Table 7-2 Useful Life by Asset

Depreciable Asset	Years
Carriageway (at grade)	50
Carriageway (viaduct)	50
Pedestrian Bridge (concrete/steel)	50
Station and Station Building	50
Office Building	50
Machinery (workshop machinery)	15
Bus Vehicle	10

Source: The Study for KTIP

Invested assets, which have less useful life than 30 years of the project life, should be re-invested before the useful life is expired. Machinery and BRT bus vehicles are re-invested as shown in Table 7-3. The costs in the table are converted by 1.38261 against the original investment cost to include physical contingency, consulting services, VAT, administration and import tax to the re-investment cost.

Table 7-3 Re-investment Cost by Year

(Unit: Rs million)

Asset	Re-investment 2029			Re-investment 2034			Re-investment 2039		
	FC	LC	Total	FC	LC	Total	FC	LC	Total
Facilities	-	-	-	515.7	113.1	628.8	-	-	-
Equipment at Depot	-	-	-	652.6	221.5	874.1	-	-	-
BRT Vehicle	4,257.2	1,821.6	6,078.8	-	-	-	4,257.2	1,821.6	6,078.8
Total	4,257.2	1,821.6	6,078.8	1,168.3	334.6	1,502.9	4,257.2	1,821.6	6,078.8

Source: The Study for KTIP

(4) Residual value

Thirty year period of the project life is defined only for the financial analysis. The BRT system lasts even after the period. Therefore, the remained value of the invested assets, which have longer useful lives than the project life, is appropriated as residual value at the last year of the project life. The residual value of the project is calculated as Rs 3,831.0 million, which is the sum of assets with 50 years useful life in Table 7-2.

7-2-3 Depreciation

Depreciation cost was appropriated according to the useful life table in Table 7-2. The cost is shown in Table 7-4 by asset.

Table 7-4 Depreciation Cost by Asset

Asset	Rs million per year
1. Civil Works	180.6
2. Facilities	41.9
3. Depot & Workshop	
Equipment	58.3
Civil Works	11.0
4. Vehicle	607.9
Total	899.6

Source: The Study for KTIP

7-3 Financial Statements

The calculation sheets are shown in Table 7-5 – 7-8. Price escalation was considered for the analysis. The conditions of the calculation and the major indices are shown below.

Case:	Price Escalation	Pricing Year	2011		
Construction Cost Change	1.00	Government Subsidy (%)		Long Term Loan	
Revenue Change	1.00	Inflation (%)		Interest Rate (%) for the Loan	1.4
Equity	0.20	Foreign	1.6	for Consultant Fee	0.01
Other Revenue	0.05	Local	4.4	Total Period (years)	30
		Corporate Tax (%)	35.0	Grace Period (years)	10
Net Present Value (Rp.million)	-	ROE(%)	38.4	Short Term Loan	
Hurdle Rate (%)	14.0			Interest Rate (%)	14.0
FIRR (%)	14.3			Period (year)	1

(1) Financial Internal Rate of Return (FIRR)

The FIRR of the project was calculated as 14.3%. The calculated rate exceeded the hurdle rate of 14.0%.

(2) Profit and Loss

Regarding the profit and loss, the project shows a very good performance. The BRT system appropriates operating profit from the next year of the commercial operation, except for the first year of year 9, when the training program takes place for 6 month and the revenue operation is assumed only six months as same as the Base Case. The operating profit increases year by year because the fare revenue increases every year by the assumed inflation rate.

(3) Cash Flow & Net Cash Flow

The cash flow also shows a stable situation, although some negative values are seen for the years when re-investments are required as same as the Base Case.

The net cash flow, which shows the actual cash reserve of the project, exhibits good performance as well, except for the year of year 9 when the training scheme takes place. The project needs some extra cash of Rs 194.4 million through the domestic monetary market at a very high interest rate. However, as the accumulated net cash flow shows, cash reserve of the project is affordable to pay for the huge re-investments in future years. The future cash reserve is considered sufficient.

(4) Other Indicators

The Debt Service Coverage Ratio (DSCR) indicates affordability of interest payment and repayment of the principal. The indicator shows high enough value through the project life, except for the years of the re-investment. Affordability of the project seems high enough. The indicator showed better values than the Base Case.

The operating ratio indicates profitability of the project, by calculating ratio of sum of O & M cost and depreciation cost against the operating revenue. If the value is less than 100, the project is considered profitable.

Table 7-5 Proforma Cash Flow Statement (1)

Item \ Year	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Profit & Loss																
Operating Revenue							3,062.4	6,394.3	6,675.7	6,969.4	7,276.1	7,596.2	7,930.4	8,279.4	8,643.7	9,024.0
Operation & Maintenance							3,451.7	3,948.1	3,647.9	3,751.2	3,858.1	3,968.7	4,083.3	4,202.0	4,324.9	4,452.2
Depreciation							1,130.7	1,130.7	1,130.7	1,130.7	1,130.7	1,130.7	1,130.7	1,130.7	1,130.7	1,326.6
Operating Profit							-1,520.0	1,715.5	1,897.1	2,087.5	2,287.3	2,496.8	2,716.4	2,946.7	3,188.1	3,245.1
Other Revenue							153.1	319.7	333.8	348.5	363.8	379.8	396.5	414.0	432.2	451.2
Government Subsidy																
Interest Expense							230.7	258.0	230.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Short Term Loan							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Long Term Loan							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Net Profit							-1,597.6	1,777.3	2,000.1	2,436.0	2,651.1	2,876.6	3,112.9	3,360.7	3,620.3	3,696.3
Corporate Tax							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Profit After Tax							-1,597.6	1,777.3	2,000.1	2,436.0	2,651.1	2,876.6	3,112.9	3,360.7	3,620.3	3,696.3
Accumulated Profit							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Financial Cash Flow																
Cash In																
Operating Profit							-236.2	3,165.9	3,361.5	3,566.7	3,781.8	4,007.3	4,243.6	4,491.3	4,750.9	5,022.9
Other Revenue							-1,520.0	1,715.5	1,897.1	2,087.5	2,287.3	2,496.8	2,716.4	2,946.7	3,188.1	3,245.1
Depreciation							153.1	319.7	333.8	348.5	363.8	379.8	396.5	414.0	432.2	451.2
Cash Out							144.0	6,399.0	7,005.0	7,408.8	7,408.8	7,408.8	7,408.8	7,408.8	7,408.8	7,408.8
Investment							144.0	6,399.0	7,005.0	7,408.8	7,408.8	7,408.8	7,408.8	7,408.8	7,408.8	7,408.8
Initial Investment							144.0	6,399.0	7,005.0	7,408.8	7,408.8	7,408.8	7,408.8	7,408.8	7,408.8	7,408.8
Re-investment																
Additional Investment																
Residual Value																
Cash Flow (FIRR: ROE)							-50.0	-28.8	-1,279.8	-1,401.0	-1,481.8	-236.2	3,165.9	3,566.7	3,781.8	4,007.3
Cash Flow (FIRR: ROD)							-250.0	-144.0	-6,399.0	-7,005.0	-7,408.8	-236.2	3,165.9	3,566.7	3,781.8	4,007.3
Financial Program																
Source																
Long Term Loan							252.0	148.8	6,489.8	7,116.0	7,467.8	-236.2	3,165.9	3,566.7	3,781.8	4,007.3
Operating Profit							202.0	313.0	5,210.0	5,715.0	5,986.0	1,715.5	1,897.1	2,087.5	2,287.3	2,496.8
Depreciation							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other Revenue							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Government Subsidy							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Equity							50.0	77.0	28.8	1,279.8	1,401.0	1,481.8	0.0	0.0	0.0	0.0
Use							250.0	385.0	144.0	6,399.0	7,005.0	7,408.8	230.7	1,074.4	930.8	1,832.2
Investment							250.0	385.0	144.0	6,399.0	7,005.0	7,408.8	230.7	1,074.4	930.8	1,832.2
Principal Repayment							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Long Term							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Short Term							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Interest Expense							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Long Term							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Short Term							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Corporate Tax							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Net Cash Flow							2.0	5.0	4.8	90.8	111.0	58.9	-466.9	2,091.5	2,430.8	2,824.3
Accumulated Net Cash Flow																
Short Term Loan							2.0	7.0	11.8	102.6	213.6	272.5	-194.4	1,897.1	4,327.9	6,062.4
Cash Flow in Present Value							-113.9	-153.9	-50.5	-1,967.7	-1,889.6	-1,753.1	-49.0	576.4	536.9	499.7
DSCR																
Operating Ratio																
Note: Year 1 denotes the current year of 2012.																

Source: The Study for KTIP

Chapter 8 Economic Analysis

8-1 Economic Benefits of the Project

8-1-1 Quantitative Impact

(1) Travel Time Reduction of Bus Passengers

Presently, the average speed of a minibus is approximately 17km/h in Karachi². It is expected that the BRT system will be operated at an average speed of 25 km/h. This will reduce the travel time of bus passengers. The benefit from the travel time reduction is estimated at Rs. 2.69 billion per year.

(2) Reduction in Vehicle Operating Cost (VOC)

Introduction of large buses for the BRT system will reduce the number of buses, which will save fuel consumption and vehicle operating costs. The total VOC saving is estimated at Rs. 3.49 billion per year.

(3) Traffic Impact

There will be negative impacts on road traffic by reducing the number of lanes and the signalization of U-turn.

(4) Job Creation

Construction will create employments of approximately 203,000 person-days.

8-1-2 Qualitative Impact

The following impacts are expected by the BRT project, although measuring the impacts in numeric units are difficult.

(1) Improvement of City's Image

Megacities in the world have introduced mass transit system including BRT systems in recent years, which have impressed the world that the cities are economically growing. Mass transit system in these cities became a symbol of the steady growth of the city. BRT system with modern type vehicles will improve the image of Karachi.

(2) Increase in Women's Trip

Presently, the trip rate of women in Karachi is very low because of the social and cultural background. However, poor transport system is also one of the reason. BRT system will provide safer transport system than existing minibuses. The project will encourage women to make more trips to participate social activities.

(3) Crime Reduction

BRT system will ensure transparent fare collection by installing ticket gates and monitoring cameras to avoid free riders. Cameras will be also installed at major

² Confirmatory Green Routes Study for Karachi, 2010, Exponent Engineers

intersections to monitor the operation of BRT buses. The presence of security cameras can reduce crime in the city. Lighting at stations will also contribute to reduce crime in night time.

(4) Pedestrian Safety

Pedestrian bridges will be constructed to access BRT stations. People can use the pedestrian bridges even if they do not use BRT. The new pedestrian bridges will increase the number of crossing points along the corridors, which encourage people to use the bridges instead of crossing roads of heavy traffic. It is expected that traffic accident on road involving crossing pedestrian and cars will decrease.

(5) City Development

Development in Gadap Town is one of the important land use development. Since the BRT corridor connect the north of New Karachi to the center of the city, urban development in the north area will be promoted.

8-2 Cost-Benefit Analysis

8-2-1 Assumptions

The cost-benefit analysis was done by “with-without” approach. In this case, all economic benefits are calculated as the amount of reduction in economic costs.

The assumptions for the cost-benefit analysis are described in the following sub sections.

(1) Passenger shift from other modes

Passenger shift from existing buses, motorcycles and cars in terms of passenger-km are assumed as shown in Table 8-1 based on the demand forecast.

Table 8-1 Passenger Shift in Passenger-km on BRT ('000 per day)

From Bus	From Motorcycle	From Car
11,356	601	662

Source: The Study for KTIP

(2) Capital costs and O&M costs

Capital costs and O&M costs are assumed as shown in Table 8-2 by deducting VAT, import tax, and other transfer costs which are not counted as economic costs.

Table 8-2 Passenger Shift in Passenger-km on BRT ('000 per day)

	With	Without
Capital Cost	Rs. 14,986 million	Included in VOC
O&M	Rs. 919.9 million	Rs. 265.8 million ^{*1}

*1: Infrastructure cost only. O&M of vehicles is included in VOC of each vehicle.

Source: The Study for KTIP

(3) VOC and Value of Time

Vehicle operating cost (VOC) per kilometer and value of time by vehicle type are assumed as shown in Table 8-3.

Table 8-3 VOC and value of time

	Unit	BRT ^{*1}	Bus ^{*2}	Motorcycle	Car
Occupancy Rate	Passengers/veh	60	35	1.2	3.4
VOC per veh-km	Rs. per km	28.0	41.9	3.46	8.8
Value of time	Rs. per hour	--	49.65	49.65	110

*1: Vehicle costs are excluded because they are included in the capital investment cost

*1: Drivers costs are excluded because they are included in the O&M cost

*2: including drivers cost

Source: The Study for KTIP

(4) Traffic Impact

It is assumed that travel speed along the corridors will reduce from 33km/h to 29.7km/h. For the impact of signalization of U-turn traffic, the delay at a U-turn signal is assumed as 40 seconds per vehicle.

8-2-2 Benefit and Cost Flow

Table 8-4 shows the flow of benefit and cost. Economic Internal Rate of Return (EIRR) was calculated as 26.6%. Net present value (NPV) at 12% discount rate was calculated as Rs. 9.0 billion. The result shows that this project would be economically feasible.

Table 8-4 Benefit and Cost Flow of Economic Evaluation

Unit: Rs. Million

Year	Investment Cost (a)	O&M (b)	Travel Time			VOC Saving (f)	Benefit (g)=(e)+(f)	Benefit - Cost (g)-(c)-(d)
			Bus (c)	M/C & Car (d)	Total (e)=(c)+(d)			
2012								0
2013	0							0
2014	200							-200
2015	305							-305
2016	112							-112
2017	4,624							-4,624
2018	4,866							-4,866
2019	4,880							-4,880
2020		654	3,290	-599	2,691	3,490	6,181	5,527
2021		654	3,290	-599	2,691	3,490	6,181	5,527
2022		654	3,290	-599	2,691	3,490	6,181	5,527
2023		654	3,290	-599	2,691	3,490	6,181	5,527
2024		654	3,290	-599	2,691	3,490	6,181	5,527
2025		654	3,290	-599	2,691	3,490	6,181	5,527
2026		654	3,290	-599	2,691	3,490	6,181	5,527
2027		654	3,290	-599	2,691	3,490	6,181	5,527
2028		654	3,290	-599	2,691	3,490	6,181	5,527
2029	5,024	654	3,290	-599	2,691	3,490	6,181	503
2030		654	3,290	-599	2,691	3,490	6,181	5,527
2031		654	3,290	-599	2,691	3,490	6,181	5,527
2032		654	3,290	-599	2,691	3,490	6,181	5,527
2033		654	3,290	-599	2,691	3,490	6,181	5,527
2034		654	3,290	-599	2,691	3,490	6,181	5,527
2035		654	3,290	-599	2,691	3,490	6,181	5,527
2036		654	3,290	-599	2,691	3,490	6,181	5,527
2037		654	3,290	-599	2,691	3,490	6,181	5,527
2038		654	3,290	-599	2,691	3,490	6,181	5,527
2039		654	3,290	-599	2,691	3,490	6,181	5,527
2040	-1,700							1,700

Source: The Study for KTIP

8-2-3 Sensitivity Analysis

To evaluate the calculated EIRR in view of uncertainty of benefit and cost, a sensitivity analysis was conducted by changing input values such as cost and benefit. Table 8-5 shows the result. The result shows that the project will be economically feasible even if the cost is high by 20% or the benefit is low by 20%.

Even in the case that the cost is 20% high and benefit is 20% low, EIRR will be still high at 17.4%. This means that the project feasibility would be stable enough against cost and benefit risks.

Table 8-5 Sensitivity Analysis of EIRR

Base case	+20% in Cost	-20% in Benefit	+20% in Cost & -20% in Benefit
26.6%	22.3%	21.3%	17.4%

Source: The Study for KTIP

Chapter 9 Implementation Schedule

9-1 Environmental Impact Assessment (EIA)

The EIA of this project was conducted by the JICA Study Team for Karachi Transportation Improvement Project from January 2012 to May 2012 including 4 stakeholder meetings. The draft EIA report was submitted to KMTC in the end of May 2012. The draft EIA report will be finalized by KMTC for the submission to Environment Protection Agency (EPA). The report will be disclosed to public for 30 days and public hearing meetings will be held. EPA will approve the EIA report and issue Non Objection Certificate (NOC).

9-2 PC-I Approval

The draft PC-I was prepared by the JICA Study Team based on the Draft Final Report of the project. The draft PC-I document will be reviewed by local consultants and key staff in KMTC for the approval by the administrator of Karachi Municipal Corporation.

The PC-I document will be submitted to Planning Commission.

9-3 Institutional Setup

Karachi Mass Transit Authority (KMTA) will be established by creating a new law, Mass Transit Authority Act. KMTA will finalize the business model and coordinate related organizations. KMTA will be the responsible agency which receive soft loan from international organizations.

KMTC will establish Karachi BRT Corporation (KBRTC), the public corporation to deal with the project as a “business”.

9-4 Financial Arrangement

The financial model of this project is based on the condition of using the soft loan by JICA. KMTA will keep close relation with JICA and discuss the financial arrangement. So far JICA shows an interest on this project.

9-5 Schedule

The schedule is planned as follows at present.

Year	Activities
2012-13	PC-I & EIA Approval
2013-14	Loan Agreement and E/S Consultant Selection
2014-15	Engineering Services & T/A
2016	S/V Consultant & Contractor Selection
2017-19	Construction
2020	Operation

Appendix -4

PC-I (Draft)
for
The Construction Project
of
Bus Rapid Transit in Karachi City

August, 2012

**Nippon Koei Co., Ltd.
Yachiyo Engineering Co., Ltd.
Oriental Consultants Co., Ltd.**

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Appendix

Appendix-1:	Daily Traffic Volume by Vehicle Type
Appendix-2:	Year-wise/ component-wise Financial Requirement
Appendix-3:	Daily and Hourly Passenger Volume per Direction
Appendix-4:	Daily Passenger Boarding
Appendix-5:	Financial Statement
Appendix-6:	Benefit and Cash Flow

1. Name of the Project	The Construction Project of Bus Rapid Transit in Karachi City (Construction of Green Line and Red Line)
2. Location	<p>Karachi, Sindh</p> <ul style="list-style-type: none"> • Green Line from Municipal chowk to Surjani town, through M.A Jinnah Rd, Gurumandir, A.O clock tower and Nagan Chowrangi. • Red Line from Regal chowk to Model Colony, along New M.A Jinnah Rd, University Rd up to
3. Authority Responsible for	
a) Sponsoring	Local Government, Government of Sindh
b) Execution	Karachi Mass Transit Cell(KMTC), Karachi Metropolitan Corporation
c) Operation and Maintenance	Karachi Mass Transit Cell(KMTC), Karachi Metropolitan Corporation
d) Concerned Ministry	Ministry of Communication, Government of Pakistan
4a. Plan Provision	
i) If the Project is included in the Current Five Year Plan	No
ii) If not included, what warrants its inclusion and how is it now proposed to be accommodated ?	The project is proposed in the master plan study by JICA (Karachi Transportation Improvement Project, 2010-2012). It was also proposed by ADB study in 2007. The project will be incorporated into Karachi Strategic Development Plan.
iii) If the project is proposed to be financed out of block provision, indicate:	Not applicable
4b. Provision in the current year PSDP/ ADP	Not applicable

5. Project Objectives

The objectives of the sector/subsector as indicated in the medium term/five year plan. Indicate objectives of the project and a linkage between the proposed project and sectoral objective

There are 16 objectives described for transport sector in Karachi Strategic Development Plan 2020, among which the followings are linked with the Project.

- Provide safe and efficient mobility for people and goods
- Improve safety, energy efficiency and air quality
- Improve public mass transportation system, targeting affordability and convenience
- Strengthen existing transportation infrastructure and services by considering various alternatives
- Develop transport infrastructure to support planned land use changes, especially strengthening links between CBD and polycentric commercial centre node

The Study for Karachi Transportation Improvement Project, 2010-2012, JICA, proposed a transport sector master plan up to 2030, in which the public transport polices focuses on mass transit system such as:

- Mass transit system should provide higher services than existing buses in order to satisfy the need of such transit system and promote modal shift from private mode to public one.
- Bus Rapid Transit (BRT) should be introduced on major roads.

In case of revised Projects, indicate objectives of the project if different from original PC-I.

Not applicable

6. Description and Justification

- (1) Describe the project and indicate existing facilities in the area and justify the establishment of the Project

(a) Project Background

Karachi Transport Study was conducted during the period 1987-91. The Study recommended building of 87.4 kilometers network of transit ways in the major traffic corridors of Karachi and its suburbs for exclusive use of mass transit vehicles. These transit ways were to be designed and built as a bus ways convertible to Light Rail Transit Ways network. The transit way network was translated into mass transit Master Plan comprising of 6 priority corridors. Despite, all possible efforts, there had been no progress towards implementation of the same.

On the other hand, the recent economic growth in Karachi is significant with rapid population increase and active land development in suburban area, and the city has expanded vertically and horizontally very rapidly. Those changes have caused motor-vehicle traffic increase and resulted in heavy

traffic congestion due to lack of mass transit system.

As immediate measure to minimize traffic congestion, City District Government of Karachi (CDGK) initiated road improvement projects including construction of flyovers / underpasses and road widening program. As a result, a lot of flyovers have been constructed at intersections in the city. Now, the routes of BRT and LRT based on previous studies have significantly been changed due to these new urban structures.

The Government of Pakistan (GOP) has recently funded for a detailed study on environment friendly public transport system for Karachi based on public – private partnership. This study was conducted by Karachi Mass Transit Cell (KMTC), CDGK in consultation with a private consultant which recommended a Bus Rapid Transit network of 140 km of exclusive BRT lines.

Further, in line with the recommendation of the above study report, the GOP has agreed to provide 2.5 billion subsidies for induction of 4,000 CNG dedicated buses during next 5 years. The first phase of this project was to be kicked off with 500 buses by 2009 under the public- private partnership funding arrangement. However, the project could not be implemented due to the lack of responsibility of bank for 80% loan finance, according to KMTC.

Karachi Strategic Development Plan-2020 (KSDP 2020), approved by CDGK in 2007, proposes development of public transport system that is convenient and reasonable. Light Rail Transit (LRT) and Bus Rapid Transit (BRT) are proposed in KSDP 2020 for the transport system.

The Government of Islamic Republic of Pakistan, in light of above mentioned background, requested the Study to formulate an urban transportation improvement project with high priority for Karachi Transportation Improvement Project to Japan International Cooperation Agency (JICA).

Based on the result of HIS survey conducted by the JICA Study Team, targeting 40,000 households in Karachi, Karachi Urban Transportation Master Plan (KUTMP) 2030 was formulated. The KUTMP proposes two BRT corridors as high-cost-benefit priority projects, and feasibility study on these two BRT lines has been completed in June, 2012. The corridors were named as Green Line and Red Line, as used in code names in the JICA Study.

Green Line:

Proposed route for Green Line starts from Municipal chowk, where a rotary U-turn lane is proposed for buses to turn back. The plane alignment extends along M.A Jinnah Road toward

northeast up to Gurumandir, and after Gurumandir the alignment runs northward along Business Recorder Road, Nawab Siddique Ali Khan Road, Sharah-E-Sher Shah Suri and Sharah-e-Usman, passing by some of major landmarks such as A.O Clock Tower and Nagan chowrangi.

Red Line

Red Line links the city centre of Karachi, where the line starts from, with eastern section of Jinnah International airport, through New M.A Jinnah Road, University Road etc. The Major landmarks along Red Line are Empress Market, Jail chowrangi, Civic Center, Nipa chowrangi, NED, Safoora Chowk etc.

(b) Project Description

This project will construct a busway (dedicated for BRT vehicles) in the median of the roads along the two corridors with station in the center of the median, and will provide high speed (25km/h), high capacity (12,000 passengers per hour per direction), high frequency (2.5 buses per minute), and comfortable BRT system using 425 buses.

(c) Existing Public Transport System

There is no mass transit system in Karachi. Bus is the major public transport mode. The number of bus passengers is approximately 5.6 million per day, accounting for 40% of motorized travel modes. Since the number of registered buses and minibuses is approximately 21,800, a bus carries 257 passengers per day. The average speed of buses is as slow as 17km/h. Since buses are operated by individual operators who want to maximize the fare revenue, overloading including roof top seating, waiting for passengers at a bus stop for a long time, non-stop at bus stop where the number of passengers is small, and low frequency in off-peak hours are commonly observed in Karachi.

Bus services are unpredictable, unstable and uncomfortable. People who can use other transport modes prefer motorcycle, rickshaw and taxi rather than using buses.

(d) Project Justification

The project can increase the travel speed of public transport along the corridors from 17 to 25 km/h, which will benefit 700,000 passengers per day in 2020. In addition to the speed, the project will provide more accurate and comfortable services than the present poor public transport modes.

Green Line connects the center of the city and the north of New Karachi, which will contribute to the development in the north area. Since the development in the north area is one of the

important plans in KSDP 2020, Green Line should be developed by 2020.

Red Line runs along University Road where many colleges and universities are located. The safety and punctual public transport will enhance the educational opportunity in Karachi.

The investment cost of a railway system is so high that it would not be possible to construct many railway systems when KCR has not been implemented yet. BRT is the financially feasible system for the corridors.

- (2) Provide technical parameters i.e. input and output of the project. Also discuss technological aspect of the project.

a) Design Specification

Item	
Route length	Green Line; 22.1 km at grade Red line; 24.2 km 23.2 km at grade 1.0 km elevated
Design maximum speed	Mainline 70 km/h CBD areas 60 km/h
Minimum curve radius	Main line 120 m (absolute minimum 80 m) Ramps and access 45 m Turning radius at intersection absolute 12 m
Maximum gradient	Main line 5% Ramps and access 6% Depot Level
Stations	Green line At grade; 28 Red line At grade; 24 Elevated; 2

b) Dedicate lane structure

Item	
Lane width	BRT busway lane 3.5 m
Pavement	Rigid pavement or Flexible pavement
Platform length	40 m without passing lane

c) Vehicle specification

Item	
Dimension	Length; 11.0-12.0m Width; Maximum 2.5m
Vehicle capacity	More than 80 passengers
Floor height	1000mm- 1100mm
Fuel type	CNG
Door arrangement	2 doorway with width 1100mm
Air conditioner	Not equipped

- (3) Provide details of

Civil works for the BRT construction project will not require

civil works, equipment, machinery and other physical facilities required for the project.

special technologies since it is just a simple road/ flyover construction project. Items of civil works to be executed are enumerated as follows,

Elevated Structure (1.0km)

- Piling works
- Substructure (including excavation works, cofferdam, concrete works for foundation and pier etc)
- Superstructure (including concrete works for slab and beams etc.)

Road Construction (45.3km)

- Excavation
- Backfilling, base course, compaction
- Concrete pavement works, curb stone installation and lane marking.

Station/Pedestrian Bridge

- Station construction (including finishing works, station facility installations).
- Pedestrian bridge installation

It should be noted that the diversion of existing road traffic will be necessary since the present traffic capacity should be kept during the construction period.

(4) Indicate governance issues of the sector relevant to the project and strategy to resolve them

There is no legal issue for the project but there remains a risk for converting 2 lanes of public road to dedicated lanes for exclusive use by bus operators. In addition, the present organization on public transport (KMTC) has not been empowered enough to carry out the project. The strategy is strengthening the organization by to establishing Karachi Transport Authority.

(5) Provide technical parameters i.e. selected design features and capacity of the proposed facilities alongwith alternates available.

Type of BRT

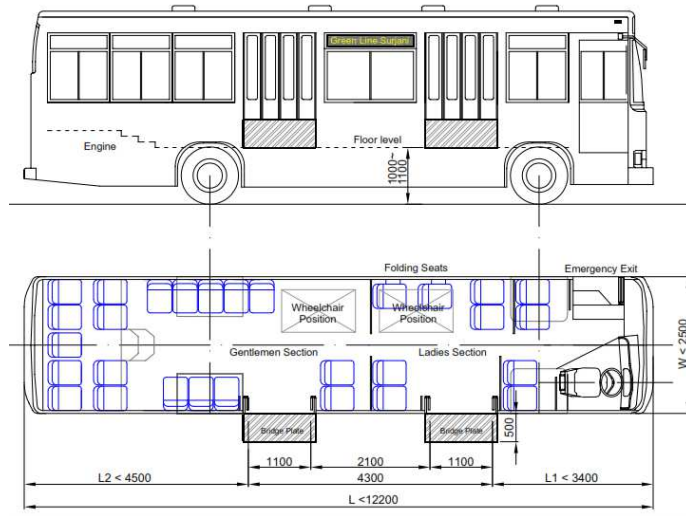
The BRT system will provide dedicated bus way for each direction. No mixed traffic is expected.

Location of Busway

It is proposed that the bus ways be developed in the center of road to ensure the speed.

Vehicle

Proposed vehicle type is the standard bus of 12m length, platform-level boarding type high-floor bus with floor height of 1,000-1,100mm. Two doorways which have 1,100mm width and bridge plate are place on the right hand side. Propulsion system is CNG engine. Car interior of bus is divided to the ladies section in front side, and gentlemen section in rear side, separated by a transparent partition, and the seats, a doorway and the wheelchair position are allocated in each section.

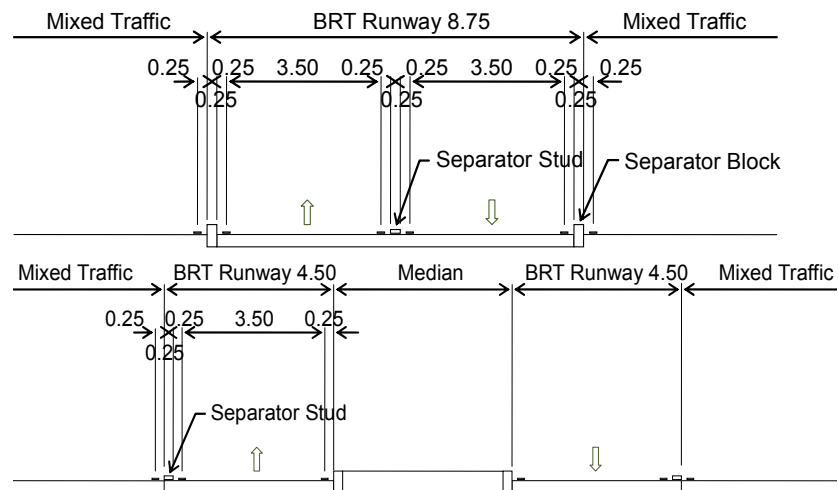


Station

- Stations for BRT will be located in the center of road in conformity with the dedicated bus way location. The passengers' access to the BRT station will be through pedestrian bridges in order to avoid traffic accidents.
- Fare collection should be made when passengers come into the station in order to maintain operation speed and time as well as uniform revenue management.
- Due to limitation of ROW, it is not realistic to provide passing lanes. Instead, three slots for boarding and alighting are proposed to be installed to apply convoy operation, so that two or more buses can be operated in a group which arrive and departure at the same time.

- (6) For roads, provide information regarding land width, geometric and pavement design including formation width, pavement width

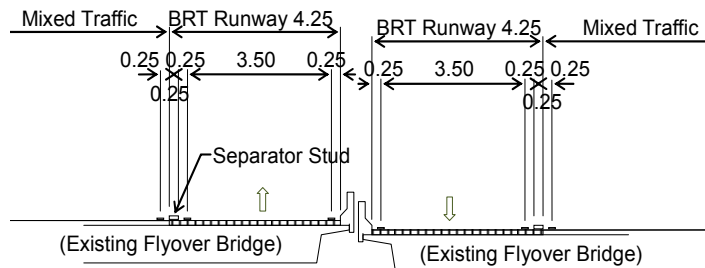
A lane width of 3.5m per direction is recommended with an offset clearance of 0.25m on either side, considering the bus size of 2.5m in width. Typical section of runway with centre median section and without-median section are shown in the figure below.



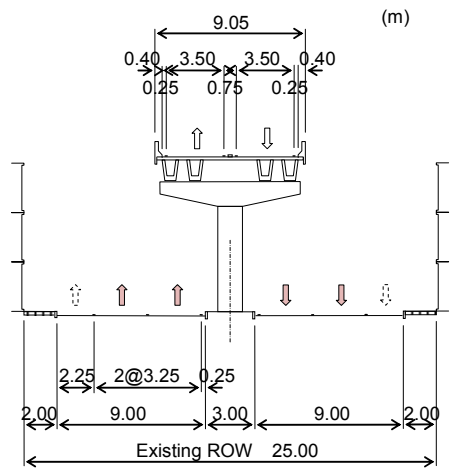
Concrete pavement is proposed for the at-grade runway, since it is considered to be more economically-efficient as it provides low life cycle cost and less maintenance runways. The thickness of concrete pavement is supposed to be 30cm, with steel reinforcement bars inside.

(7) Land classification for bridges and culverts Not applicable

(8) Thickness/width of road way on bridges and culverts There are some sections where existing flyovers run along the corridors. It is proposed that the BRT runway will pass through on these flyover bridges by occupying their centre sides, utilizing existing asphalt pavement as it is. Typical section of runway on existing flyover is as shown in the figure below.



It is proposed that elevated structure be newly constructed in the starting point of Red line – Regal chowk, because ROW for BRT is narrow. The thickness of asphalt pavement is supposed to be 10cm. Typical section of newly constructed elevated busway is shown in the figure below.



- | | |
|--|--|
| (9) Designed speed, traffic capacity of road in terms of passenger car units per day | The design speed of the BRT lanes is 60 km/h. The designed capacity of the BRT system is 12,000 passengers per hour per direction in peak hour. The daily capacity is approximately 320,000 passengers for both directions. |
| (10) Saving in distance for diverted traffic. Average daily traffic of motor vehicles by category as well as the car units be provided. | Saving in distance is not applicable because the project does not aim to provide a short cut route.

The daily traffic volume by vehicle type along the corridors is shown in Appendix-01. |
| (11) In case of improvement within the urban areas, separate traffic counts within that area should be given. Brief information regarding traffic and pavement width etc. in adjoining sections should also given. | The project is already in the urban area of Karachi. Separate studies not required. |
| (12) For bridges provide location, total length of bridge, number of spans with length of each span, width roadway and footpath, type of sub and superstructure and load classification. | Not applicable |
| 7. Capital Cost Estimate | (a) (in PKR) Rs.21.47 billion <ul style="list-style-type: none"> • Foreign component Rs.5.40 billion • Local component Rs.16.07 billion (b) (in JPY) JPY 18.70 billion <ul style="list-style-type: none"> • Foreign component JPY 4.71 billion • Local component JPY 13.99 |
| (1) Date of estimation | As of December 2011 |
| (2) Basis of determining the capital cost be provided. It includes market survey, schedule rates, | i) The base year is set in 2011.
ii) Physical Contingency is set 5% of construction cost and consulting service cost.
iii) Price escalation for foreign currency (Japanese yen) is |

estimation on the basis of previous work done etc.

- 1.6 % and local currency 4.4%, per year.
- iv) 5% of construction cost and consulting service cost, including contingency and price escalation, is presumed.
 - v) Interest rate for yen loan is applied.
 - Construction cost : 1.4%
 - Consulting service: 0.01%
 - vi) General sales tax (GST)
 - 16 % of general sales tax (GST) is levied on goods and services for the project.
 - vii) Import tax
 - 5% of import tax is presumed to be applied for products to be imported.
 - viii) Commitment charge is 0.1% of construction & procurement cost and consulting service cost per year.

- (3) Provide year-wise estimation of physical activities

The construction period is 3 years. Physical activities during the construction are summarized as follows.

Items	Unit	Year-1	Year-2	Year-3
Busway	km	15.5	15.5	15.5
Station	No.	18	18	18
Bus Procurement	No.	140	140	140

- (4) Phasing of capital cost be worked out on the basis of each item of work as stated above and provide.

Year-wise/ component-wise financial phasing is shown in Appendix-02.

- (5) In case of revised project, ...

Not applicable

8. Annual Operating Cost

- (1) Item-wise annual operating cost based on proposed capacity utilization be worked out for 5 years and sources of its financing

The annual operation and maintenance cost is estimated at Rs. 2,786.7 million as shown in the table below.

O & M Cost	Rs million per year
1. Personnel Cost	448.0
2. Vehicle Operation Cost	1,556.0
3. Vehicle Maintenance Cost	188.2
4. Vehicle Insurance Cost	102.0
5. Other Administrative Cost	91.8
6. Maintenance Cost of Infrastructure	400.7
Total	2,786.7

9. Demand and Supply Analysis

- (1) Existing capacity of services and its supply/ demand

Presently, approximately 200 buses are operated for the peak direction in a peak hour along the corridors. Full loading capacity of a minibus/coach is 48 while that of a large bus is 70. From this, the corridors have the capacity of approximately 10,000 passengers per hour per direction. Bus stops are provided along the corridors with the necessary length depending on traffic demand. Some bus stops have off-line loading area which is located out of traffic lane. However, buses do not properly stop in the loading area due to lack of proper rules. Buses often stop in the second lane from the curb side lane which forces passengers to cross the curb side lane.

The present bus passenger demand reflects the limit of the capacity, and then the supply of bus seems to meet the demand. However, roof top riding shows that the demand exceeds the bus capacity. Since full loading capacity of a minibus is 48 while the number of passengers in case of roof top riding is about 55, it can be said that the demand is higher than the supply by 15%. In addition, a part of motorcycle and rickshaw users are potential passengers using good public transport system.

- (2) Projected demand for 10 years

(a) Demand Forecast Method

Urban Growth

As described in Chapter 1, Karachi will have population of additional 10 million in the next 20 years and the population will be more than 30 million in 2030. Gadap, Keamari, and Bin Qasim Town are expected to accept the large part of the population growth.

OD Matrix

The traditional four-step method was applied for the demand forecast. Karachi was divided into 216 traffic zones. The future OD matrix was developed in Karachi Transportation Improvement Project.

Traffic Assignment

Transport network data were prepared for different scenarios. A network data consists of links, nodes, and zone centroids. A zone centroid represents the center of each traffic zone. The OD matrix was assigned to the transport network to estimate the traffic volume. It was assumed that motorcycle and car users would not use feeder buses but use BRT only if origin and destination were connected to the zone centroids. The fare of BRT was set as Rs. 20 while that of existing buses was Rs. 15. The capacity of BRT was limited to 12,000 passengers per hour per direction.

Network Scenario

The traffic assignment network was prepared for five network scenarios.

- (A) Green & Red Lines on the present road network (2010)
- (B) Master Plan (M/P) network (2020).
- (C) M/P network (2020) without KCR
- (D) M/P network (2030)
- (E) Green & Red Lines + KCR on the 2030 road network

Road network is assumed to be developed as proposed in the M/P as shown in table below. Road capacity was reduced from the M/P along BRT routes assuming that two lanes (one lane each) are removed.

Arterial Road Length in Master Plan (Unit km)

Year	Expressway	Highway	Principal Highway	Minor Arterial	Total
2010	25.6	173.2	157.2	527.9	884
2020	35.8	173.2	199.8	547.7	956.5
2030	76.9	257.2	229.1	609.2	1,172.4

(b) Result

The number of passenger boarding per day is estimated as shown in the table below.

No. of passengers boarding per day (Unit: passengers)

	2010	2020		2030	
	Green & Red	Green & Red +KCR	Green&Red only	M/P Network	Green & Red +KCR
Green	404,706	358,148	365,369	640,763	447,611
Red	264,609	375,045	391,801	622,215	402,274
Total	669,315	733,192	757,170	1,262,978	849,885

Daily and hourly passenger volume per direction is shown in Appendix-3, while daily passenger boarding is shown in Appendix-4.

- (3) Capacity of the projects being implemented in public/private sector

Public sector will provide busway, stations, and depot while private sector will provide vehicles and operation services.

- (4) Supply-Demand Gap

Supply and demand gap will still exist even if the project is implemented because the capacity of BRT. A rail-base mass transit system should be constructed between Tower and Super Highway so that passengers from New Karachi can transfer railway at Nagan Chowrangi which can decrease passenger demand along Green Line and KCR extension should be also constructed to divert passenger demand from Model Colony along Red Line.

- (5) Designed capacity and output of the proposed project The designed capacity is 12,000 passengers per hour per direction in peak hours.

10. Financial Plan The Project is to be financed by Soft Term Loan from Government of Japan. Japan International Cooperation Agency (JICA) has shown its interest to arrange the funding.

10a. Equity Equity accounts for 20% of the Capital Cost

10b. Debt JICA Loan (80% of the Capital Cost)
Interest Rate: 1.4% per annum
Grace Period: 10 years
Repayment Period: 30 years (including the grace period)

10c. Grants along with sources Not applicable

10d. Weighted cost of capital Not applicable

11. Benefit of the project and analysis

- i) Financial analysis (a) Revenue

Fare revenue

Flat fare system will be applied. The expected fare is Rs.20 per ride. As the number of passengers is estimated 700,000 passengers /day, the fare revenue is expected to be Rs. 4,340 million per year.

Other revenue

Revenue from advertisement is expected to 5% of fare revenue.

- (b) Depreciation

Depreciation cost by asset is summarized in the table below.

Depreciation Cost per Year	
Asset	Rs million per year
1. Civil Works	180.6
2. Facilities	41.9
3. Depot & Workshop	
Equipment	58.3
Civil Works	11.0
4. Vehicle	607.9
Total	899.6

(c) Re-investment cost

The project life is 30 years. The invested assets, which have less than useful life time of 30 years, shall be re-invested. Such assets are machinery and bus vehicles, and the re-investment cost is summarized in the table below.

Asset	2029	2034	2039
Facilities	-	628.8	-
Equipment at Depot	-	874.1	-
BRT Vehicle	6,078.8	-	6,078.8
Total	6,078.8	1,502.9	6,078.8

(d) Residual Value

The remained value of the invest asset which have longer useful lives than 30 years, is appropriated as residual value at the last year of the project life. Such cost is calculated as Rs. 3,819 million.

(e) Financial Indicators

Financial Internal Rate of Return (FIRR) is 5.5%. Other indicators are:

Break Even Point (BEP) = Rs. 3,289 million per year (75.8%)

Return on Equity (ROE) = 25.1%

Financial statements are shown in Appendix-5.

ii) Economic analysis

Economic benefits of the project are

- (i) saving in travel time and
- (ii) saving in vehicle operating cost for BRT passengers.

Economic Internal Rate of Return (EIRR) is calculated as 26.6% by a “with-without” analysis under the following major assumptions.

Passenger-km on BRT ('000 per day)

From Bus	From Motorcycle	From Car
11,356	601	662

Comparison of Bus and BRT

Item	Buses	BRT
Travel speed	17km/h	25km/h
Vehicle occupancy rate (passengers per vehicle)	35	60
Fuel consumption rate	2.63km/L	2.9km/L

VOC and value of time

	Bus*	Motorcycle	Car
VOC per veh-km	Rs. 41.9/km	Rs. 3.46/km	Rs. 8.8/km
Value of time	Rs. 49.65/hr	Rs. 49.65/hr	Rs. 110/hr

* including drivers cost

Time cost by lane reduction: 33km/h → 29.7km/h

Delay at intersections: 40 seconds per vehicle

The benefit and cost flow is shown in Appendix-6.

iii) Employment analysis

Construction Stage

In the planning and construction stage, the number of professionals employed by consulting service are, a) 100 M/M for foreign professionals, b) 550 M/M for local professionals and c) 1000 M/M for supporting staff.

The number of personnel and workers directly employed by contractor(s) is roughly calculated as mentioned below,

- 5 persons/ km/ day x 45km x 25 days/month x 36 months
=202,500 persons in total.

Operation Stage

The number of personnel required during operation and maintenance stage is summarized in the table below.

Occupation Category Company	KBRTC	Operation Companies (2)	Fare Collection Company
	Number of Staffs	Number of Staffs	Number of Staffs
President	1	4	1
Director	2	16	2
Administrative Staff	10	113	27
Drivers	0	1,033	0
Mechanic	0	284	0
Station staff	0	426	0
Ticketing staff	0	0	426
Total	13	1,876	456

iv) Sensitivity analysis

Financial Analysis

Financial viability is very sensitive to the changes in passenger demand. Decrease in passenger demand by 20% will cause serious problem to financial situation of the project.

Economic Analysis

Sensitivity analysis shows that economical feasibility is still

stable in case of decrease in the benefit by 20% or increase in the initial investment cost by 20%. Even if both cases happen in the same time, EIRR is still higher than the opportunity cost in Pakistan.

v) Social analysis Population near stations (500m radius) of both corridors is 1.2 million. They are direct beneficiary of the project.

vi) Environmental Impact

(a) Environmental scenario without BRT

- Most of the roads in Karachi will suffer from traffic saturation since road volume exceeds the capacity.
- The lack of public transport services and the recent enormous increase in private vehicle ownerships will worsen traffic jams, make road users relatively uncomfortable and inconvenient.
- Cause serious environmental impacts such as deterioration of air quality, dust and nitrogen oxide, noise level, and risk increment of traffic accidents.
- GHG will also be increased due to congestion.

(b) Future scenario with BRT

Positive Impact

- Substantial reduction in traffic load/congestion in the city
- Smooth flow of road traffic cut down idling time.
- CNG bus selected as BRT vehicle is good for environment.
- Improvement of environmental pollution is expected as follow in respect of the modal shifting of transportation from passenger cars/ buses to the BRT system;

NOx volume of exhaust gas is reduced approximately 26%;
 Noise level is reduced approximately 0.1% to 2.1 % and;
 Total emission factor for CO₂ is reduced approximately 12 %

BRT	Forecast of CO ₂ volume along the BRT line (g/day)		Reduction rate (%)
	With the BRT Project Road Traffic (KCR + Green Line + Red Line)	Without the BRT Project Road Traffic (Only KCR)	
	GHG _w	GHG _{wo}	(GHG _{wo} -GHG _w)/GHG _{wo}
Green Line	689,120	802,531	14.10%
Red Line	270,251	292,469	7.60%
Total	959,370	1,095,000	12.40%

Negative Impact

- During the construction phase, impacts mainly arise from generation of dust, emission of air pollution, noise and traffic congestion by the construction work.
- There are approximately 13,000 affected trees on the median.
- There is no-large scale excavation/filling and construction

activities are within the existing trunk road. The potential negative impacts are temporary during the construction and could be mitigated with appropriated mitigation measures such as regular sprinkling, heavy vehicle maintenance and re-plant.

The overall conclusion is that providing the appropriate mitigation measures are implemented in full, there should be no significant adverse environmental impacts.

12. Implementation Schedule

Since the project will be funded by Japanese yen loan, the procurement scheme for the project shall follow international standard. Before construction works commence, consulting services will be conducted in two stages, i) Engineering design (Basic/Detail Design, Tender Document Preparation and Tender Assistance), ii) Construction supervision.

- (1) Starting and completion date of the project

The construction period is supposed to be 36 months.

- (2) Item-wise/year-wise implementation schedule in line chart correlated with the phasing of physical activities

Refer Appendix-2.

13. Management Structure & Manpower Requirements

- (1) Administrative arrangements for implementation of project

The power of public transport authority should be strengthen. For this, Karachi Mass Transit Authority (KMTA) will be established by enacting "Mass Transit Authority Act". KMTA will prepare necessary arrangement of the implementation of the project. One of the important tasks of KMTA is to establish Karachi Bus Rapid Transit Corporation (KBRTC).

- (2) The manpower requirements by skills during execution and operation of the project be provided

The following is the manpower requirements for execution.

Type/No	Position	Total(MM)
A 1	Project Manager	17
A 2	Structural Engineer	5
A 3	Road Design Engineer	5
A 4	Traffic Management Engineer	5
A 5	Alignment Engineer	2
A 6	Geotechnical Engineer	2
A 7	Hydrologist	5
A 8	Road Facility Engineer	4
A 9	Architect	5
A 10	Cost Estimator/ Construction Planner	3
A 11	Environmental Specialist	3
A 12	Operation and Maintenance Expert	3

A	13	Contract Expert	3
A	14	Vehicle Expert	3
A	15	Resident Engineer	36
		[Total of A]	101

Type/No	Position	Total(MM)	
B 1	Deputy Project Manager	32	
B 2	Structural Engineer	23	
B 3	Road Design Engineer (1)	23	
B 4	Road Design Engineer (2)	23	
B 5	Traffic Management Engineer (1)	23	
B 6	Traffic Management Engineer (2)	23	
B 7	Alignment Engineer (1)	23	
B 8	Alignment Engineer (2)	23	
B 9	Geotechnical Specialist	23	
B 10	Hydrologist	23	
B 11	Facility Engineer	19	
B 12	Architect	19	
B 13	Cost Estimator	15	
B 14	Construction Planner	15	
B 15	Environmental Specialist	23	
B 16	Document Contoller	59	
B 17	Contract Expert	15	
B 18	Inspector (Structure)	30	
B 19	Inspector (Road) 1	36	
B 20	Inspector (Road) 2	36	
B 21	Inspector (Architect) 1	24	
B 22	Inspector (Architect) 2	24	
		[Total of B]	554

(Note: Type A means international professionals, while type B means local professionals.)

The following is the manpower requirements for operation.

Occupation Category Company	KBRTC	Operation Companies (4)	Fare Collection Company
	Number of Staffs	Number of Staffs	Number of Staffs
President	1	4	1
Director	2	16	2
Administrative Staff	10	113	27
Drivers	0	1,033	0
Mechanic	0	284	0
Station staff	0	426	0
Ticketing staff	0	0	426
Total	13	1,876	456

- (3) The job description, qualification, experience, age and salary of each post be provided

As mentioned above.

14. Additional projects/ decisions required

The project requires the following actions.

- 1) Relocation of Rickshaw Market along Business Recorder Road or prohibit illegal parking along the road
- 2) Relocation of car dealer market along New M.A. Jinnah Road or prohibit illegal parking along the road

- 3) Prohibit illegal parking along Nawab Sadiq Ali Khan Road
- 4) Loan arrangement

15. Certificate

The name, designation and Phone # of the officer responsible for preparation and checking be provided. It may also be confirmed that PC-I has been prepared as per guidelines issued by the Planning Commission for the preparation of PC-I for Infrastructure Sector projects.

Prepared by : _____

(The draft PC-I was prepared by the JICA Study Team for Karachi Transportation Improvement Project. However, the Team was dissolved in the end of June 2012. The Final PC-I should be prepared by the local consultant company.)

Checked by : _____

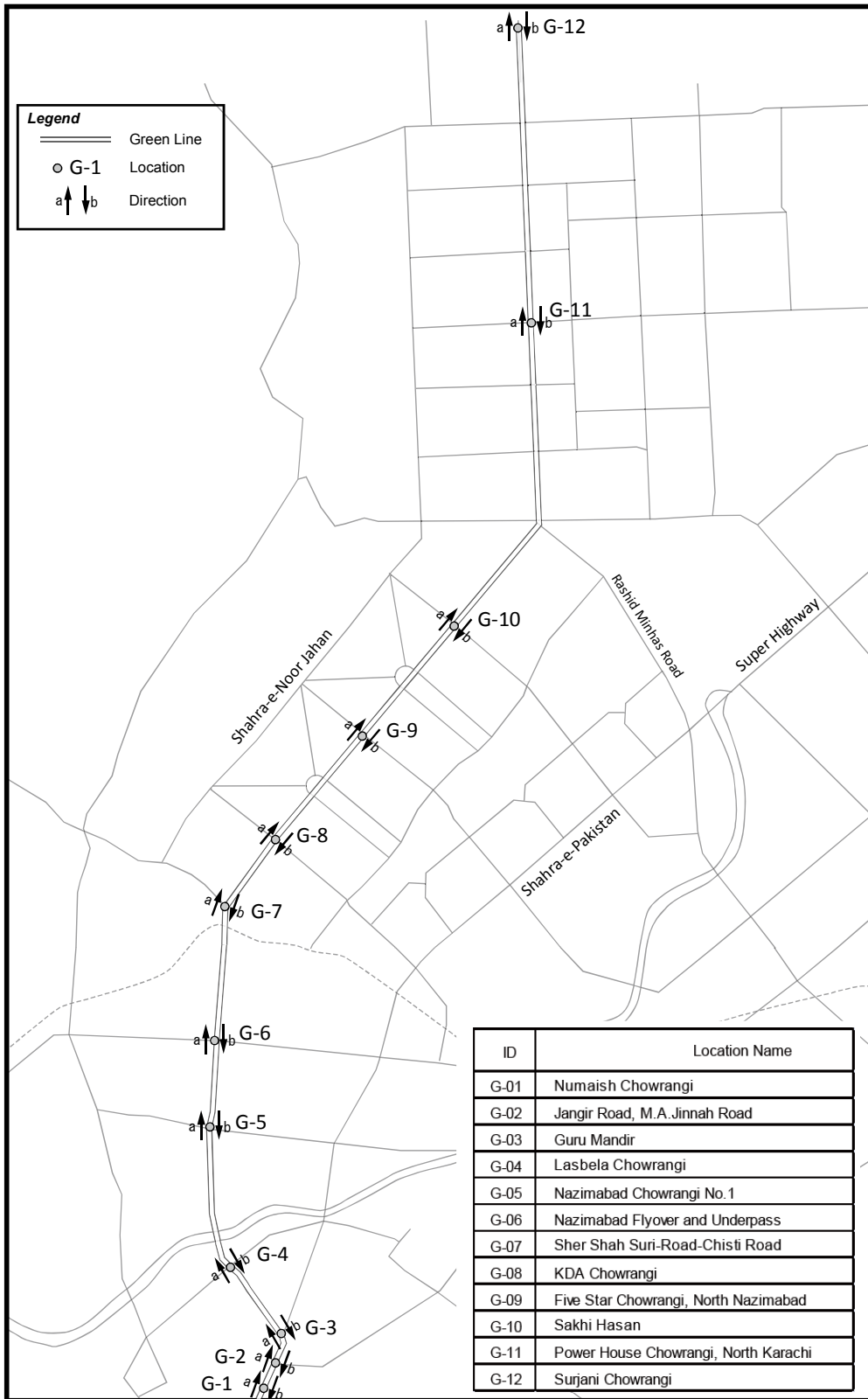
Recommend by _____

The PC-I alongwith certificate must be signed by the Principal Accounting Officer to ensure its ownership.

Approved by _____
District Coordinate Officer

Appendix 1

Daily Traffic Volume by Vehicle Type



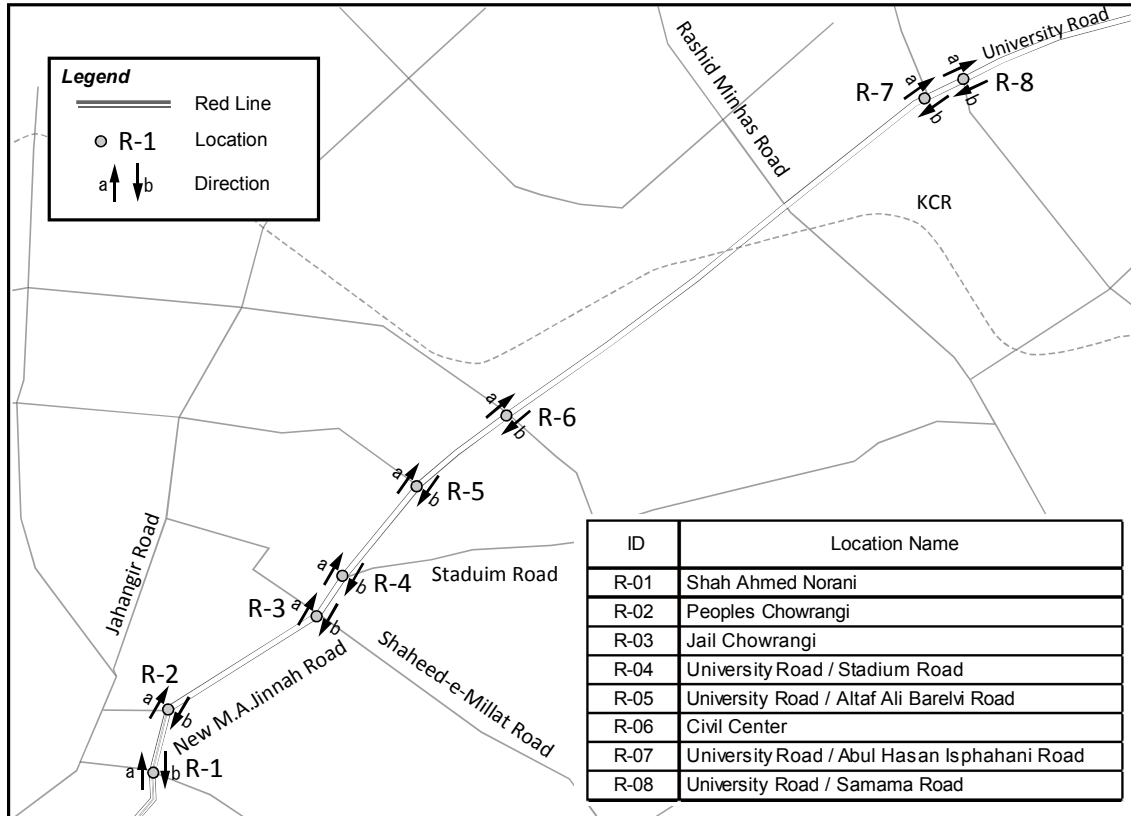
Source: Karachi Transportation Improvement Project

Location of Daily Traffic Volume along Green Line

Daily Traffic Volume along Green Line

Location	Direction	Car+Pickup	Rickshaw + Motorcycles	Bus+Minibus	Truck/Trailer	Total (PCU)
G-01	a	24,633	61,860	3,089	158	24,633
	b	29,686	42,682	4,296	226	29,686
G-02	a	15,807	47,553	2,794	125	15,807
	b	16,678	36,122	3,380	151	16,678
G-03	a	12,886	42,088	1,057	254	12,886
	b	12,583	34,329	2,566	195	12,583
G-04	a	15,430	31,972	1,438	141	15,430
	b	15,343	34,668	1,042	191	15,343
G-05	a	26,609	70,327	1,494	358	26,609
	b	23,428	44,204	1,521	160	23,428
G-06	a	27,895	70,644	2,063	1,079	27,895
	b	24,516	45,428	1,472	431	24,516
G-07	a	27,842	78,440	3,298	381	27,842
	b	28,497	67,645	1,817	1,216	28,497
G-08	a	60,322	86,216	4,592	560	60,322
	b	55,468	103,038	5,392	1,416	55,468
G-09	a	32,690	73,021	2,225	534	32,690
	b	35,242	56,404	2,548	1,223	35,242
G-10	a	38,252	112,098	4,358	2,016	38,252
	b	59,286	91,714	4,956	1,764	59,286
G-11	a	10,439	26,605	1,978	476	10,439
	b	9,214	23,679	1,540	421	9,214
G-12	a	9,466	45,620	2,740	524	9,466
	b	12,642	41,386	3,114	1,454	12,642

Source: Karachi Transportation Improvement Project



Source: Karachi Transportation Improvement Project
Location of Daily Traffic Volume along Red Line

Daily Traffic Volume along Red Line

Location	Direction	Car+Pickup	Rickshaw+ Motorcycles	Bus+Minibus	Truck/Trailer	Total (PCU)
R-01	a	13,377	23,742	139	31	13,377
	b	9,585	25,797	121	43	9,585
R-02	a	42,558	47,548	1,284	210	42,558
	b	23,206	48,876	364	120	23,206
R-03	a	31,797	48,274	2,213	340	31,797
	b	17,962	22,243	679	96	17,962
R-04	a	51,493	53,029	4,480	125	51,493
	b	17,267	19,160	1,753	174	17,267
R-05	a	27,908	39,556	2,071	361	27,908
	b	18,622	53,488	2,513	264	18,622
R-06	a	32,826	34,233	3,431	645	32,826
	b	41,772	48,568	4,077	848	41,772
R-07	1	1,259	1,946	1	4	1,259
	2	26,731	24,091	1,252	387	26,731
R-08	1	14,970	13,138	1,136	63	14,970
	2	26,981	23,212	1,269	291	26,981

Source: Karachi Transportation Improvement Project

Appendix 2

Year-wise/ component-wise Financial Requirement

Appendix 3

Daily and Hourly Passenger Volume per Direction

Daily Passenger Volume (Both Directions)

Section	2010	2020		2030		
	Green&Red	Green&Red +KCR	Green&Red only	M/P Network	Green&Red +KCR	
Green Line						
M1 - M2	27,331	108,576	111,176	68,591	137,886	
M2 - M3	50,652	163,869	159,635	98,152	181,132	
M3 - M4	60,626	219,570	213,086	116,576	216,460	
M4 - M5	64,356	227,498	219,097	127,526	223,614	
M5 - G01	64,356	227,498	219,097	324,218	224,376	
G01 - G02	99,988	351,322	329,634	341,679	331,913	
G02 - G03	92,630	351,803	329,187	332,852	330,689	
G03 - G04	105,650	349,676	328,967	329,743	331,430	
G04 - G05	107,604	342,338	332,130	322,007	326,906	
G05 - G06	111,780	337,996	331,825	319,421	329,414	
G06 - G07	116,056	331,097	329,879	323,692	326,072	
G07 - G08	113,491	325,385	331,569	314,107	323,818	
G08 - G09	118,665	321,376	269,543	274,452	333,970	
G09 - G10	119,608	317,880	262,673	269,905	331,772	
G10 - G11	117,519	307,462	255,031	262,488	322,763	
G11 - G12	112,723	300,958	250,234	259,553	323,357	
G12 - G13	112,371	294,944	246,776	257,933	323,765	
G13 - G14	98,061	280,266	234,292	249,359	318,555	
G14 - G15	96,659	273,816	233,175	311,136	317,481	
G15 - G16	92,053	255,923	221,088	302,777	308,643	
G16 - G17	89,519	243,757	212,219	293,032	298,653	
G17 - G18	79,153	218,931	193,416	279,485	276,881	
G18 - G19	64,177	202,752	180,420	265,497	261,234	
G19 - G20	43,622	183,059	163,954	227,668	242,607	
G20 - G21	24,514	142,839	130,044	193,148	199,210	
G21 - G22	15,966	125,190	116,540	165,327	181,014	
Red Line						
P1 - P2	16,383	73,929	76,406	131,002	126,860	
P2 - P3	35,335	144,188	152,647	170,098	183,761	
P3 - R02	39,290	156,145	161,530	180,026	198,487	
R01 - R02	91,495	305,943	312,655	186,971	285,196	
R02 - R03	88,770	319,558	343,745	259,949	326,565	
R03 - R04	94,971	330,721	354,953	272,817	334,848	
R04 - R05	94,941	332,169	360,123	272,954	332,411	
R05 - R06	91,392	334,209	363,184	278,360	333,044	
R06 - R07	90,064	339,391	387,292	286,537	338,479	
R07 - R08	85,549	338,727	382,556	280,030	334,805	
R08 - R09	78,424	333,843	373,503	268,320	327,285	
R09 - R10	66,424	335,472	380,595	261,901	323,547	
R10 - R11	61,339	336,729	378,565	259,313	321,120	
R11 - R12	61,339	336,546	378,184	259,125	320,938	
R12 - R13	26,327	315,611	359,950	236,960	305,918	
R13 - R14	26,193	317,730	357,840	235,219	303,462	
R14 - R15	15,629	311,832	351,940	225,203	295,250	
R15 - R16	11,716	267,839	308,345	174,579	248,537	
R16 - R17	11,412	221,604	267,932	53,359	98,408	
R17 - R18	11,412	221,604	267,932	53,359	98,408	

Source: The Study for KTIP

Peak Hour Passenger Volume per Direction

Section	2010	2020		2030		
	Green&Red	Green&Red +KCR	Green&Red only	M/P Network	Green&Red +KCR	
Green Line						
M1 - M2	1,025	4,072	4,169	2,572	5,171	
M2 - M3	1,899	6,145	5,986	3,681	6,792	
M3 - M4	2,273	8,234	7,991	4,372	8,117	
M4 - M5	2,413	8,531	8,216	4,782	8,386	
M5 - G01	2,413	8,531	8,216	12,158	8,414	
G01 - G02	3,750	13,175	12,361	12,813	12,447	
G02 - G03	3,474	13,193	12,345	12,482	12,401	
G03 - G04	3,962	13,113	12,336	12,365	12,429	
G04 - G05	4,035	12,838	12,455	12,075	12,259	
G05 - G06	4,192	12,675	12,443	11,978	12,353	
G06 - G07	4,352	12,416	12,370	12,138	12,228	
G07 - G08	4,256	12,202	12,434	11,779	12,143	
G08 - G09	4,450	12,052	10,108	10,292	12,524	
G09 - G10	4,485	11,921	9,850	10,121	12,441	
G10 - G11	4,407	11,530	9,564	9,843	12,104	
G11 - G12	4,227	11,286	9,384	9,733	12,126	
G12 - G13	4,214	11,060	9,254	9,672	12,141	
G13 - G14	3,677	10,510	8,786	9,351	11,946	
G14 - G15	3,625	10,268	8,744	11,668	11,906	
G15 - G16	3,452	9,597	8,291	11,354	11,574	
G16 - G17	3,357	9,141	7,958	10,989	11,199	
G17 - G18	2,968	8,210	7,253	10,481	10,383	
G18 - G19	2,407	7,603	6,766	9,956	9,796	
G19 - G20	1,636	6,865	6,148	8,538	9,098	
G20 - G21	919	5,356	4,877	7,243	7,470	
G21 - G22	599	4,695	4,370	6,200	6,788	
Red Line						
P1 - P2	614	2,772	2,865	4,913	4,757	
P2 - P3	1,325	5,407	5,724	6,379	6,891	
P3 - R02	1,473	5,855	6,057	6,751	7,443	
R01 - R02	3,431	11,473	11,725	7,011	10,695	
R02 - R03	3,329	11,983	12,890	9,748	12,246	
R03 - R04	3,561	12,402	13,311	10,231	12,557	
R04 - R05	3,560	12,456	13,505	10,236	12,465	
R05 - R06	3,427	12,533	13,619	10,439	12,489	
R06 - R07	3,377	12,727	14,523	10,745	12,693	
R07 - R08	3,208	12,702	14,346	10,501	12,555	
R08 - R09	2,941	12,519	14,006	10,062	12,273	
R09 - R10	2,491	12,580	14,272	9,821	12,133	
R10 - R11	2,300	12,627	14,196	9,724	12,042	
R11 - R12	2,300	12,620	14,182	9,717	12,035	
R12 - R13	987	11,835	13,498	8,886	11,472	
R13 - R14	982	11,915	13,419	8,821	11,380	
R14 - R15	586	11,694	13,198	8,445	11,072	
R15 - R16	439	10,044	11,563	6,547	9,320	
R16 - R17	428	8,310	10,047	2,001	3,690	
R17 - R18	428	8,310	10,047	2,001	3,690	

Source: The Study for KTIP

Appendix 4

Daily Passenger Boarding

Daily Passenger Volume of Boarding Only

Code	Station	2010	2020		2030	
		Green&Red	Green&Red +KCR	Green&Red only	M/P Network	Green&Red +KCR
Green Line						
R0-01	M1	19,518	32,934	36,436	27,105	68,943
R0-02	M2	17,288	27,648	24,232	28,256	21,624
R0-03	M3	11,225	27,857	26,731	14,415	17,664
R0-05	M4	4,781	3,988	3,030	9,248	4,062
R1-01	G01	10,212	9,470	10,778	25,049	10,974
R1-02	G02	15,400	11,098	7,850	21,324	11,353
R1-03	G03	33,583	19,667	15,069	45,422	23,611
R1-04	G04	14,861	7,137	26,770	22,964	8,549
R1-05	G05	18,129	8,791	10,108	21,829	12,745
R1-06	G06	19,185	11,136	9,318	30,406	13,665
R1-07	G07	13,369	4,709	6,133	13,559	4,893
R1-08	G08	17,284	17,982	35,071	17,350	17,556
R1-09	G09	24,927	3,452	4,910	10,126	4,397
R1-10	G10	9,850	6,504	5,117	17,438	6,944
R1-11	G11	13,940	4,195	3,551	8,611	6,920
R1-12	G12	7,967	4,184	2,911	8,351	5,749
R1-13	G13	15,879	8,642	7,710	13,224	13,926
R1-14	G14	9,354	5,127	5,550	6,600	7,394
R1-15	G15	14,374	10,062	7,159	15,460	12,737
R1-16	G16	11,802	6,677	5,029	16,444	6,831
R1-17	G17	12,275	14,225	11,047	16,989	15,903
R1-18	G18	16,610	8,659	7,068	22,876	9,951
R1-19	G19	25,273	10,845	9,231	39,806	14,408
R1-20	G20	21,126	21,434	18,651	31,897	25,033
R1-21	G21	10,630	9,136	7,646	28,116	11,278
R1-22	G22	15,870	62,595	58,270	127,903	90,507
Red Line						
RZ-00	P1	16,057	36,965	38,203	157,630	63,430
RZ-01	P2	22,301	35,289	29,498	31,978	28,670
RZ-02	P3	9,021	6,091	4,570	12,488	7,586
R3-02	R02	5,241	3,005	2,688	4	4,147
R3-03	R03	13,611	10,731	9,441	21,573	12,614
R3-04	R04	78	4,524	6,094	1,498	5,262
R3-05	R05	39,307	14,635	10,603	32,719	16,485
R3-06	R06	11,611	14,244	20,865	34,585	16,998
R3-07	R07	34,874	17,318	16,146	48,042	18,207
R3-08	R08	29,869	12,282	12,126	31,727	13,484
R3-09	R09	15,248	11,909	12,128	17,647	10,652
R3-10	R10	6,489	5,274	5,240	5,659	2,454
R3-11	R11	0	91	190	96	91
R3-12	R12	35,171	22,938	18,046	61,360	28,961
R3-13	R13	139	5,366	2,551	988	2,981
R3-14	R14	10,004	6,511	5,454	17,328	6,372
R3-15	R15	3,913	31,412	40,990	26,914	26,187
R3-16	R16	304	25,663	23,005	60,636	88,494
R3-17	R17	0	0	0	0	0
R3-18	R18	11,373	110,802	133,966	59,347	49,204

Source: The Study for KTIP

Peak Hour Boarding and Alighting

Code	Station	2010		2020		2030	
		Green&Red	Green&Red +KCR	Green&Red only	M/P Network	Green&Red +KCR	
Green Line							
R0-01	M1	2,928	4,940	5,465	4,066	10,341	
R0-02	M2	2,593	4,147	3,635	4,238	3,244	
R0-03	M3	1,684	4,178	4,010	2,162	2,650	
R0-05	M4	717	598	455	1,387	609	
R1-01	G01	1,532	1,420	1,617	3,757	1,646	
R1-02	G02	2,310	1,665	1,177	3,199	1,703	
R1-03	G03	5,037	2,950	2,260	6,813	3,542	
R1-04	G04	2,229	1,071	4,016	3,445	1,282	
R1-05	G05	2,719	1,319	1,516	3,274	1,912	
R1-06	G06	2,878	1,670	1,398	4,561	2,050	
R1-07	G07	2,005	706	920	2,034	734	
R1-08	G08	2,593	2,697	5,261	2,602	2,633	
R1-09	G09	3,739	518	736	1,519	659	
R1-10	G10	1,478	976	767	2,616	1,042	
R1-11	G11	2,091	629	533	1,292	1,038	
R1-12	G12	1,195	628	437	1,253	862	
R1-13	G13	2,382	1,296	1,157	1,984	2,089	
R1-14	G14	1,403	769	832	990	1,109	
R1-15	G15	2,156	1,509	1,074	2,319	1,911	
R1-16	G16	1,770	1,002	754	2,467	1,025	
R1-17	G17	1,841	2,134	1,657	2,548	2,385	
R1-18	G18	2,491	1,299	1,060	3,431	1,493	
R1-19	G19	3,791	1,627	1,385	5,971	2,161	
R1-20	G20	3,169	3,215	2,798	4,784	3,755	
R1-21	G21	1,594	1,370	1,147	4,217	1,692	
Red Line							
RZ-00	P1	2,409	5,545	5,730	23,645	9,515	
RZ-01	P2	3,345	5,293	4,425	4,797	4,301	
RZ-02	P3	1,353	914	686	1,873	1,138	
R3-02	R02	786	451	403	1	622	
R3-03	R03	2,042	1,610	1,416	3,236	1,892	
R3-04	R04	12	679	914	225	789	
R3-05	R05	5,896	2,195	1,590	4,908	2,473	
R3-06	R06	1,742	2,137	3,130	5,188	2,550	
R3-07	R07	5,231	2,598	2,422	7,206	2,731	
R3-08	R08	4,480	1,842	1,819	4,759	2,023	
R3-09	R09	2,287	1,786	1,819	2,647	1,598	
R3-10	R10	973	791	786	849	368	
R3-11	R11	0	14	29	14	14	
R3-13	R13	21	805	383	148	447	
R3-14	R14	1,501	977	818	2,599	956	
R3-15	R15	587	4,712	6,149	4,037	3,928	
R3-16	R16	46	3,849	3,451	9,095	13,274	
R3-17	R17	0	0	0	0	0	
R3-18	R18	1,706	16,620	20,095	8,902	7,381	

Source: The Study for KTIP

Appendix 5

Financial Statement

Financial Cash Flow Statement (1)

Item \ Year	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Profit & Loss																		
Operating Revenue				3,062.4	6,394.3	6,675.7	6,969.4	7,276.1	7,596.2	7,930.4	8,279.4	8,643.7	9,024.0	8,643.7	9,024.0	9,421.0	9,835.6	
Operation & Maintenance				3,451.7	3,548.1	3,647.9	3,751.2	3,858.1	3,968.7	4,083.3	4,202.0	4,324.9	4,452.2	4,584.2	4,720.9	4,854.2	4,991.8	
Depreciation				1,130.7	1,130.7	1,130.7	1,130.7	1,130.7	1,130.7	1,130.7	1,130.7	1,130.7	1,130.7	1,130.7	1,130.7	1,130.7	1,130.7	
Operating Profit				-1,520.0	1,715.5	1,897.1	2,087.5	2,287.3	2,496.8	2,716.4	2,946.7	3,188.1	3,441.1	3,700.1	3,965.8	4,236.1	4,511.1	
Other Revenue				153.1	319.7	333.8	348.5	363.8	379.8	396.5	414.0	432.2	451.2	471.1	491.8			
Government Subsidy																		
Interest Expense				230.7	258.0	230.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Short Term Loan				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Long Term Loan				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Net Profit				-1,597.6	1,777.3	2,000.1	2,436.0	2,651.1	2,876.6	3,112.9	3,360.7	3,620.3	3,896.3	4,183.3	4,472.9	4,764.9	5,059.9	
Corporate Tax				0.0	0.0	0.0	852.0	700.0	852.0	1,008.8	1,176.2	1,353.7	1,542.9	1,738.6	1,939.5	2,142.9	2,352.9	
Profit After Tax				-1,597.6	1,777.3	2,000.1	1,583.4	1,583.4	1,583.4	2,023.4	2,184.4	2,266.6	2,341.1	2,427.3	2,519.4	2,616.5	2,714.6	
Accumulated Profit				-1,597.6	-442.4	857.7	2,441.1	4,164.3	6,034.1	8,057.5	10,242.0	12,595.1	14,997.8	17,585.6	20,367.5			
Financial Cash Flow																		
Cash In				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Operating Profit				-236.2	3,165.9	3,361.5	3,566.7	3,781.8	4,007.3	4,243.6	4,491.3	4,750.9	5,022.9	5,307.9	5,606.5			
Other Revenue				-1,520.0	1,715.5	1,897.1	2,087.5	2,287.3	2,496.8	2,716.4	2,946.7	3,188.1	3,441.1	3,700.1	3,965.8			
Depreciation				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Cash Out				144.0	6,399.0	7,005.0	7,408.8	7,812.6	8,221.8	8,636.8	9,056.7	9,481.6	9,906.5	10,331.4	10,756.3	11,181.2	11,606.1	
Investment				144.0	6,399.0	7,005.0	7,408.8	7,812.6	8,221.8	8,636.8	9,056.7	9,481.6	9,906.5	10,331.4	10,756.3	11,181.2	11,606.1	
Initial Investment				144.0	6,399.0	7,005.0	7,408.8	7,812.6	8,221.8	8,636.8	9,056.7	9,481.6	9,906.5	10,331.4	10,756.3	11,181.2	11,606.1	
Re-investment				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Additional Investment				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Residual Value				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Cash Flow (FIRR: ROI)				-50.0	-28.8	-1,279.8	-1,401.0	-1,481.8	-236.2	3,165.9	3,566.7	3,781.8	4,007.3	4,243.6	4,491.3	4,750.9	5,022.9	5,307.9
Cash Flow (FIRR: ROI)				-250.0	-144.0	-6,399.0	-7,005.0	-7,408.8	-236.2	3,165.9	3,566.7	3,781.8	4,007.3	4,243.6	4,491.3	4,750.9	5,022.9	5,307.9
Financial Program																		
Source																		
Long Term Loan				148.8	6,489.8	7,116.0	7,467.8	7,818.8	8,174.4	8,534.4	8,894.4	9,254.4	9,614.4	9,974.4	10,334.4	10,694.4	11,054.4	11,414.4
Operating Profit				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Depreciation				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Other Revenue				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Government Subsidy				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Equity				500	77.0	28.8	1,401.0	1,481.8	1,562.6	1,643.4	1,724.2	1,805.0	1,885.8	1,966.6	2,047.4	2,128.2	2,209.0	2,289.8
Use																		
Investment				250.0	385.0	440.0	6,399.0	7,005.0	7,408.8	7,812.6	8,216.4	8,620.2	9,024.0	9,427.8	9,831.6	10,235.4	10,639.2	11,043.0
Principal Repayment				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Long Term				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Short Term				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Interest Expense				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Long Term				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Short Term				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Corporate Tax				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Net Cash Flow				2.0	4.8	90.8	111.0	58.9	-466.9	2,091.5	2,430.8	2,770.1	3,109.4	3,448.7	3,788.0	4,127.3	4,466.6	4,805.9
Accumulated Net Cash Flow				2.0	7.0	111.8	213.6	272.5	-194.4	1,897.1	4,327.9	6,064.4	8,503.8	11,382.5	14,610.3	17,737.6	20,764.5	23,691.4
Short Term Loan				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Cash Flow in Present Value				-113.9	-153.9	-50.5	-1,967.7	-1,889.6	-49.0	576.4	499.7	464.7	432.0	401.3	372.5	345.7	-277.0	297.2
DSCR				-1.02	7.00	14.57	3.64	3.86	4.09	4.33	4.58	4.85	5.12	5.40	5.67	5.94	6.21	6.48
Operating Ratio				149.6	73.2	71.6	70.0	68.6	67.1	65.7	64.4	63.1	61.8	60.5	59.2	57.9	56.6	55.3

Note: Year 1 denotes the current year of 2012

Source: JICA Study Team

Financial Cash Flow Statement (2)

Item \ Year	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38
Profit & Loss																		
Operating Revenue	10,268.3	10,720.1	11,191.8	11,684.3	12,198.4	12,735.1	13,295.4	13,880.4	14,491.2	15,128.8	15,794.5	16,489.4	17,214.9	17,972.4	18,763.2	19,588.8	20,450.7	21,350.5
Operating & Maintenance	4,862.6	5,009.4	5,161.7	5,319.6	5,483.3	5,653.0	5,829.1	6,011.8	6,201.4	6,398.1	6,602.2	6,814.0	7,034.0	7,262.3	7,499.4	7,745.6	8,001.2	8,266.8
Depreciation	1,326.6	1,326.6	1,374.6	1,374.6	1,374.6	1,374.6	1,374.6	1,374.6	1,674.4	1,674.4	1,674.4	1,674.4	1,674.4	1,674.4	1,674.4	1,674.4	1,674.4	1,674.4
Operating Profit	4,079.2	4,384.1	4,655.5	4,990.1	5,340.5	5,707.4	6,091.7	6,194.2	6,615.4	7,056.3	7,517.9	8,001.0	8,506.6	9,035.7	9,589.4	10,168.8	10,775.0	11,409.3
Other Revenue	513.4	536.0	559.6	584.2	609.9	636.8	664.8	694.0	724.6	756.4	789.7	824.5	860.7	898.6	938.2	979.4	1,022.5	1,067.5
Government Subsidy	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Investment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Initial Investment	0.0	0.0	2,519.4	0.0	0.0	0.0	0.0	12,361.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Re-investment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Additional Investment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Residual Value	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cash Flow (FIRR: ROE)	5,919.2	6,246.7	4,070.3	6,948.9	7,325.0	7,718.8	8,131.1	8,131.1	9,014.4	9,487.2	9,982.0	10,499.8	11,041.7	11,608.7	12,202.0	12,822.7	13,472.0	14,151.2
Cash Flow (FIRR: ROI)	5,919.2	6,246.7	4,070.3	6,948.9	7,325.0	7,718.8	8,131.1	8,131.1	9,014.4	9,487.2	9,982.0	10,499.8	11,041.7	11,608.7	12,202.0	12,822.7	13,472.0	14,151.2
Financial Program																		
Source	5,919.2	6,246.7	6,589.7	6,948.9	7,325.0	7,718.8	8,131.1	8,562.6	9,014.4	9,487.2	9,982.0	10,499.8	11,041.7	11,608.7	12,202.0	12,822.7	13,472.0	14,151.2
Long Term Loan	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Operating Profit	4,079.2	4,384.1	4,655.5	4,990.1	5,340.5	5,707.4	6,091.7	6,194.2	6,615.4	7,056.3	7,517.9	8,001.0	8,506.6	9,035.7	9,589.4	10,168.8	10,775.0	11,409.3
Depreciation	1,326.6	1,326.6	1,374.6	1,374.6	1,374.6	1,374.6	1,374.6	1,374.6	1,674.4	1,674.4	1,674.4	1,674.4	1,674.4	1,674.4	1,674.4	1,674.4	1,674.4	1,674.4
Other Revenue	513.4	536.0	559.6	584.2	609.9	636.8	664.8	694.0	724.6	756.4	789.7	824.5	860.7	898.6	938.2	979.4	1,022.5	1,067.5
Government Subsidy	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Equity	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Use	2,587.0	2,701.6	5,324.3	2,930.6	3,062.2	3,200.0	3,344.3	3,486.8	3,548.6	3,714.0	3,887.2	3,578.7	3,278.6	3,477.0	3,684.7	3,901.9	4,129.2	4,366.9
Investment	0.0	0.0	2,519.4	0.0	0.0	0.0	0.0	12,361.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Principal Repayment	979.6	979.6	979.6	979.6	979.6	979.6	979.6	979.6	979.6	979.6	979.6	979.6	979.6	979.6	979.6	979.6	979.6	979.6
Long Term	979.6	979.6	979.6	979.6	979.6	979.6	979.6	979.6	979.6	979.6	979.6	979.6	979.6	979.6	979.6	979.6	979.6	979.6
Short Term	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Interest Expense	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Long Term	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Short Term	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Corporate Tax	1,607.4	1,722.0	1,825.3	1,951.0	2,082.6	2,220.5	2,364.8	2,410.9	2,569.0	2,734.5	2,907.7	3,088.9	3,278.6	3,477.0	3,684.7	3,901.9	4,129.2	4,366.9
Net Cash Flow	3,332.2	3,545.1	1,265.4	4,018.3	4,262.8	4,518.8	4,786.8	-7,188.9	5,465.8	5,773.1	6,094.8	6,921.2	7,763.2	8,131.7	8,517.3	8,920.8	9,342.8	9,784.3
Accumulated Net Cash Flow	19,754.0	23,299.1	24,564.5	28,582.9	32,845.7	37,364.5	42,151.3	34,962.4	40,428.2	46,201.3	52,296.1	59,217.2	66,980.4	75,112.1	83,629.4	92,550.2	101,893.0	111,677.3
Short Term Loan	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cash Flow in Present Value	255.0	236.1	1,349.2	202.1	186.8	172.7	159.6	-65.4	136.1	125.7	116.0	107.0	98.7	91.1	84.0	77.4	71.3	83.5
DSCR	6.04	6.38	4.16	7.09	7.48	7.88	8.30	-3.88	9.20	9.69	10.19	21.44	-	-	-	-	-	-
Operating Ratio	60.3	59.1	58.4	57.3	56.2	55.2	54.2	55.4	54.3	53.4	52.4	51.5	50.6	49.7	48.9	48.1	47.3	46.6

Note: Year 1 denotes the current year of 2012

Source: JICA Study Team

Appendix 6

Benefit and Cost Cash Flow

Economic Evaluation - Cash Flow Analysis

Unit: Rs. Million

Year	Construction (a)	Rolling stock (b)	Capital Cost (c) =(a)+(b)	O&M (d)	Revenue Fare (e)	Non-fare (f)	Total (g)	Cash Flow (g)-(c)-(d)
2012								
2013								0
2014	218	0	218					-218
2015	335	0	335					-335
2016	125	0	125					-125
2017	3,547	2,026	5,573					-5,573
2018	4,075	2,026	6,102					-6,102
2019	4,349	2,026	6,375					-6,375
2020	0	0	0	2,766	4,340	116	4,456	1,690
2021				2,766	4,340	116	4,456	1,690
2022				2,766	4,340	116	4,456	1,690
2023				2,766	4,340	116	4,456	1,690
2024				2,766	4,340	116	4,456	1,690
2025				2,766	4,340	116	4,456	1,690
2026				2,766	4,340	116	4,456	1,690
2027				2,766	4,340	116	4,456	1,690
2028				2,766	4,340	116	4,456	1,690
2029		6,079	6,079	2,766	4,340	116	4,456	-4,389
2030				2,766	4,340	116	4,456	1,690
2031				2,766	4,340	116	4,456	1,690
2032				2,766	4,340	116	4,456	1,690
2033				2,766	4,340	116	4,456	1,690
2034	1,503		1,503	2,766	4,340	116	4,456	187
2035				2,766	4,340	116	4,456	1,690
2036				2,766	4,340	116	4,456	1,690
2037				2,766	4,340	116	4,456	1,690
2038				2,766	4,340	116	4,456	1,690
2039				2,766	4,340	116	4,456	1,690
2040	-1,053		-1,053					1,053

Source: JICA Study Team

APPENDIX-5

(DRAFT) KARACHI METROPOLITAN TRANSPORT AUTHORITY ACT, 2012

Preamble

As suggested by World Bank Study 1990 and Japan International Cooperation Agency (JICA) Study on Karachi Transportation Improvement Project 2012 including Karachi Urban Transport Master Plan (2030 vision) to create a lead body as Karachi Metropolitan Transport Authority to have due legal powers to frame transport policies and programs besides ensuring their implementation. Therefore, an act to provide for the establishment of Karachi Metropolitan Transport Authority with a view to ensure safe, comfortable, efficient, affordable and sustainable transport system based on a comprehensive, modern and integrated mass transit program to ease the travel of city's commuters and to make provisions for matters connected therewith or incidental thereto.

Chapter-1: Preliminary

1- Short Title extent and commencement:-

1. Short Title extent and commencement:-

- (1) This act may be called Karachi Metropolitan Transport Authority Act, 2012.
- (2) It extends to the territorial limits of Karachi Division or as directed by the Provincial Government.
- (3) It shall come into force at once.

2- Overriding effect:

2. Overriding effect:

This act shall have effect notwithstanding anything contained in any other law for the time being in force.

3- Definitions

3. Definitions

- (i) In this act, unless there is anything repugnant in the subject or context;
 - (a) "Authority" means the Karachi Metropolitan Transport Authority
 - (b) "BRTS" means Bus Rapid Transit System wherein dedicated lanes on main roads are used for specialized buses.

- (c) “BRTS Corridors/lines” means the roads and the routes approved by the Authority for the purpose of plying BRT buses.
- (d) “BRT lanes” means the dedicated portion of a BRTS Corridor/line to be exclusively used by BRT buses.
- (e) “Chairman” means the chairman of the governing body.
- (f) “constituent body” means any one of the following namely:-
- (i) The Karachi Metropolitan Corporation;
 - (ii) The Karachi Port Trust
 - (iii) The Ministry of Defence;
 - (iv) The Cantonment Boards;
 - (v) Pakistan Railway;
 - (vi) Civil Aviation Authority
 - (vii) The Sindh Industrial and Trading Estate
 - (viii) The Sind and Landhi Industrial Trading Estates, and
 - (ix) Any such local authority or Department of Government as the Central Government may, by notification in the Official Gazette, declare to be a constituent body, and constituent bodies shall be construed accordingly;
- (g) “Concessional rights” means rights of various revenue, returns and benefits expected to be accrued from a project given to a contractor against the investment made by the contractor and for the risks taken by him for the project.
- (h) “Contract” means any kind of agreement, undertaking written, expressed or implied for the development, construction, operations and maintenance of transportation including mass-transit schemes and the facilities thereon for the supply of materials or for the performance of any service in connection therewith.
- (i) “Contractor” means a person, syndicate, consortium or a firm responsible for carrying out a contract.
- (j) “Corporation” means Karachi Metropolitan Corporation
- (k) “Developer” means the contractor to whom the contract is awarded by the Authority for the development of mass-transit scheme.
- (l) “Fares” means the amount prescribed or agreed for a journey(s) of a mode of transport through mandatory ticketing system or e-ticketing system.
- (m) “Feeder Services” means transport service through various modes integrated with the mass transit systems to enhance the ridership besides facilitating the commuters.
- (n) “Fund” means Karachi Metropolitan Transport Authority Fund.
- (o) “Government” means Government of Sindh.
- (p) “Governing Body” means governing body of the Authority
- (q) “Internal Controls” mean systems & procedures to control or mitigate the risks associated with an activity.
- (r) “KCR” means Karachi Circular Railway operating under special purpose company i.e. Karachi Urban Transport Corporation (KUTC).
- (s) “KMTC” means the Karachi Mass Transit Cell presently working under the Corporation.
- (t) “KSDP 2020” means Karachi Strategic Development Plan 2020.
- (u) “KTIP 2030” means Karachi Transport Improvement Plan 2030.
- (v) “LRT” means Light Rail Transit System.
- (w) “Managing Director” means the Chief Executive Officer of the Authority appointed under this act.

- (x) “Mass Transit” means all types of mass transit including rail and road-based mass transit facilities i.e. circular railway, BRT, LRT, MRT, monorail, other bus service including shuttle service and various para-transit modes.
- (y) “Member” means member of the governing body.
- (z) “Mono rail” means
- (aa) “MRT” means Mass Rapid Transit.....
- (bb) “Operator” means the private party or parties entrusted with the function of operations of the mass-transit scheme including ticketing, maintenance, janitorial services and/or other facilities.
- (cc) “Parking” means keeping a vehicle stationary for any reason other than the need to avoid interference with another road user or collision with and obstruction or to comply with traffic laws, or for picking up or setting down persons or goods;
- (dd) “Performance based contracts” means contracts wherein the price to be paid to the contractor is based upon the agreed level of performance.
- (ee) “Prescribed” means prescribed by rules or regulations made under this act.
- (ff) “Project” means construction, development, implementation, operation and maintenance of a mass transit project.
- (gg) “Public-Private-Partnership Projects (PPPP)” means the projects as defined under Sindh Public Procurement Act, 2009, Sindh Public Procurement Rules, 2010 and Sindh Public Private Partnership Act, 2010
- (hh) “Secretary” means the Secretary of the Authority.
- (ii) “Regulations” means regulations made under this act
- (jj) “Right of way” means the land already reserved for road, transit-way or the land acquired for the purpose of construction of transit-way or any other road or any mass transit scheme of the Authority.
- (kk) “Road” means a road including land within the right-of-way and all works such as carriage-ways, cart-ways, footpaths, berms, side-drains, culverts, bridges, tunnels and works of every description built on, under or across any road which has been constructed or are maintained by the Government or any local Authority and are designated and intended for, or used by general public for the passage of vehicles and pedestrians.
- (ll) “road markings” means a marking which point out restrictions with reference to traffic on a road, and the lines of tracks, points and stones drawn on the surface of a road.
- (mm) “Rules” means rules made under this act.
- (nn) “Scheme” means mass transit scheme.
- (oo) “Secretary” means secretary of the governing body
- (pp) “sustainable development” means development that meets the needs of the present generation without compromising the ability of future generations to meet their needs.
- (qq) “transit-way” means and include right-of-way, a road, a grade separated structure or land to be used for development of mass transit system;
- (rr) “vehicle” means any wheeled conveyance drawn, propelled or driven by any kind of power, including human and animal power.

Chapter- 2: Establishment and management of Authority

4- Establishment of Authority:

4. Establishment of Authority:

- (1) As soon as may be after the commencement of this act, the Government shall, by notification in the official Gazette, establish an authority to be known as the Karachi Metropolitan Transport Authority for carrying out the purposes of this act.
- (2) The Authority shall be a body corporate having perpetual succession and a common seal with power to acquire, hold, use and dispose of properties and may by its name sue and be sued.
- (3) The headquarters of the Authority shall be at Karachi.
- (4) The Authority shall frame its own rules of procedure and regulations.
- (5) The Authority shall hold meetings as and when necessary but not less than one meeting in a quarter shall be held.
- (6) The Authority may constitute one or more committees for performing such functions as may be assigned to them under this act. The recommendations of the committees shall be submitted to the Board for its approval.
- (7) The Authority or any of its committees may invite any technical expert from private sector or representative of any Government Agency or non-governmental organization or other person possessing specialized knowledge of any subject for assistance in performance of its functions.

5- Purposes and objectives of the Authority:

5. Purposes and objectives of the Authority: The purposes and objectives of the Authority shall be to formulate and implement a sound transport policy and to plan, promote, organize and implement schemes and programs for construction, development, operation, repairs and maintenance of an integrated, dynamic and comprehensive Karachi transport system and other allied works.

6- Authority to be local authority

6. Authority to be local authority:

The Authority shall be deemed to be a local authority having powers of a local authority as defined under the Sind Local Government Ordinance, 1979.

7- Transfer of rights, assets and liabilities

7. Transfer of rights, assets and liabilities:

- (1) As from the commencement of this Act all assets and liabilities and all rights and obligations of the Karachi Mass Transit Cell (KMTC) shall stand transferred to the Authority.
- (2) All contracts made by the Karachi Mass Transit Cell shall be deemed to be contracts made by the Authority.
- (3) All employees working under Karachi Mass Transit Cell will stand transferred to the Authority.
- (4) The office space being currently used by Karachi Mass Transit Cell will be used by the Authority and can be moved later on.

8- Management of affairs of the Authority:

8. Management of affairs of the Authority:

- (1) The general direction and administration of the Authority and its affairs shall vest with the governing body which may exercise all powers and do all acts and things which may be exercised, performed or done by the Authority.
- (2) The governing body in discharging its functions shall act on sound principles to achieve objectives of this Act and shall be guided by the best practices related to various functions.
- (3) If any question arises as to the interpretation of anything contained in this act the decision of the Government shall be final.

9- Constitution of the Governing Body of the Authority:

9. Constitution of the Governing Body of the Authority:

- (1) The Governing Body shall consist of:
 - (a) The Secretary Local Government, Government of Sindh - Chairman
 - (b) The Secretary Finance Government of Sindh- Member
 - (c) The Secretary Law- Government of Sindh- Member
 - (d) The Secretary Transport Department Government of Sindh- Member
 - (e) The Special Secretary (Technical) Planning & Development Department Government of Sindh- Member
 - (f) The Administrator KMC – Member
 - (g) The Commissioner, Karachi- Member
 - (h) The Managing Director of the Authority- Member
 - (i) The Deputy Inspector General of Police- (Traffic & Highway)- Sindh- Member
 - (j) The Director Military Lands & Cantonment- Member
 - (k) A Representative of Civil Aviation Authority
 - (l) A Representative of Core Commander- Karachi
 - (m) A Representative of Defence Housing Authority
 - (n) A Representative of Sindh Building Control Authority- Member
 - (o) A Representative of Ministry of Railways- Member
 - (p) A Representative of Karachi Port Trust- Member

- (q) A Representative of Port Qasim Authority
 - (r) A Representative of Karachi Chamber of Commerce & Industry
 - (s) A Representative of Sindh Environmental Protection Agency- Member
 - (t) A Representative of citizens of Karachi (nominated by the Government)- Member
 - (u) A Representative of Citizen Police Liaison Committee (CPLC)- Member
 - (v) A Representative of Chartered Institute of Transport and Logistics (CILT), Pakistan.- Member
 - (w) Two representatives of private transporters' association.
- (2) A non-official member unless he resigns or is removed earlier, shall hold office for a period of three years from the date of appointment.
 - (3) Any person appointed in casual vacancy of a non-official member, shall hold office for unexpired portion of the term of such vacancy.
 - (4) The Governing Body may co-opt any person as its member for a particular purpose in specified period i.e. in matters requiring specialized skills and knowledge, but such member shall have no right of voting.
 - (5) No act or proceedings of the governing body shall be invalid merely on the grounds of existence of a vacancy or any defect in the constitution thereof.

10-Secretary of the Authority

10. Secretary of the Authority:-

- (1) Soon after formation of the Governing Body a Secretary of the Authority will be appointed by the Governing Body as Secretary of the Authority.
- (2) The functions and duties of the Secretary will be to:
 - (i) Issue notices for meeting
 - (ii) Taking minutes
 - (iii) Matters relating to annual returns and reporting
 - (iv) Any other matter as directed by the Governing Body.

11-Meeting of the Governing Body:

11. Meeting of the Governing Body:

- (1) The meeting of the governing body shall be held at such time and place and in such manner as may be prescribed by regulations.

Provided that until regulations are made the meeting shall be held as and when convened by the Secretary at the headquarters of the Authority under the advice of the Chairman or in his absence the nominee of the Chairman but at least once in a month.

- (2) At least 7 days agenda will be circulated to the members before the meeting.
- (3) An urgent meeting may be called if the requirement of notice is waived by the members.

- (4) Due record of the minutes and resolutions passed by the Governing Body in its meeting will be maintained.
- (5) The decisions of the Governing Body will be duly communicated to all concerned by the Secretary of the Authority.

12-Powers and Functions of the Authority:

12. Powers and Functions of the Authority:

- (1) Subject to the general directions and control of government, the Authority shall take such measures and discharge such powers as may be necessary for carrying out the purposes of this Act.
- (2) Without prejudice to the generality of the provisions under sub-section (1) the Authority shall;
 - (i) Advise government on matters relating to transport policy, transit scheme and transit-ways etc.
 - (ii) Examine the conceptual plans for all projects (primarily related to infrastructure but not limited to) initiated by any department or authority as to ensure their suitability and sustainability by issuing NOC for the same in accordance with KSDP 2020 and KTIP 2030.
 - (iii) Work out details including updating the design, configuration and cost of the transport master-plan and take all necessary measures for its effective and economical implementation.
 - (iv) Cause studies, surveys, experiments and technical researches to be made or contribute towards the cost of such studies, surveys, experiments or technical researches made by any other agency.
 - (v) Plan, amend and implement various transport routes, structures/ alignments and may take such steps as may be necessary or useful in the construction and reconstruction, repair, maintenance and operation of the transport or transit system.
 - (vi) Help the concerned agencies to ensure traffic disciplines for all the vehicles as it may consider necessary.
 - (vii) Coordinate between various means of transport.
 - (viii) Rationalize the existing routes of public transport and connectivity through feeder routes.
 - (ix) Devise and implement policies aimed at ensuring that vehicle used for public and other transport systems meet the safety standards.
 - (x) Seek and obtain advice and assistance from government or any agencies within or outside the province for the preparation and execution of any plan, program or project, connected with its function and purposes.
 - (xi) frame and implement schemes for all or any of the following matters, namely;
 - (a) construction, expansion, operation and development of the transport network including the mass transit systems, feeder services and allied / ancillary works;
 - (b) research and development in the field of transportation;
 - (c) training of the Authority's employees and other related personnel;

- (d) general awareness of the public;
- (xii) Enter into and perform all such contracts including agreements with any public or private utility communication system or transport system for the joint use of their respective facilities and installation and properties.
 - (xiii) Exercise power to award negotiated contracts for projects connected with its function and purposes to be undertaken through private sector financing program including build operate transfer, build own operate transfer scheme or execute such projects in collaboration with any public or private agency.
 - (xiv) Coordinate, manage, control and develop transport/ mass transit system.
 - (xv) Procure plants, machinery, instruments, equipments, and material required for its use.
 - (xvi) Determine a building line along with the roads and transit ways, between which it shall not be lawful without the consent of the Authority to construct or maintain any structure or make any excavation.
 - (xvii) License facilities on transit ways right of way or roads under its control on such terms it deems fit.
 - (xviii) Make security arrangements through private security or through its own agency to protect the property of the Authority and control and maintain security discipline on the transit ways network in such manner and on such condition as may be prescribed by such regulations.
 - (xix) Ask government to depute Police including Traffic Police to maintain traffic on mass-transit corridors.
 - (xx) Acquire, hold, lease, dedicate a portion thereof or dispose of any movable and immovable property or interest therein.
 - (xxi) Acquire any land in accordance with legal procedure and obtain and dispose of moveable and immovable property of interests therein
 - (xxii) Levy, collect or cause to be collected charge, relevant to its functions.
 - (xxiii) Regulate the fare structures and enhance or reduce fares wherever and whenever required.
 - (xxiv) Raise funds within or outside the province with the approval of government through borrowing, floating of bonds, sharing or leasing of assets or any other means.
 - (xxv) To approve the annual budget.
 - (xxvi) Incur any expenditure for carrying out the purposes of this act.
 - (xxvii) Carrying out any other work assigned to it by government in consonance with the functions of the Authority.
 - (xxviii) Provide adequate transport facilities for all segments of the population.
 - (xxix) Perform any other functions, supplemental, incidental or consequential concerning the Authority.
- (3) The advice given or recommendations made by the Authority in respect of any matter specified in sub-section(2) shall as far as possible be acted upon or implemented by the concerned agency;
- (4) If any advice or recommendation of the Authority is disputed the concerned agency may require the Authority to reconsider the advice or recommendations and if on reconsideration, difference still persists, the matter shall be referred to the Government for decision, which shall be final and binding;

13-Think Tank

13. Think Tank:

- (1) A Think Tank shall be established by the Governing Body.
- (2) The role of Think Tank will be to facilitate the Governing Body in various technical matters as and when required besides it would support and guide various departments of the Authority.
- (3) The Think Tank will be advisory only and will not take any executive decisions.
- (4) The Think Tank will comprise of 5 to 10 members. The members would be selected by the Governing Body ensuring level-playing field, transparency and merit.
- (5) The Governing Body as and when required will instruct the Secretary to call a meeting of the Think Tank.
- (6) The Secretary of the Authority will also be the secretary of the Think Tank.
- (7) The Secretary of the Authority will prepare minutes and comments of the Think Tank.
- (8) The Think Tank will submit its minutes within 7 days of its meeting.
- (9) The Governing Body will decide honorarium of the members of the Think Tank as appropriate.

Chapter-3: Development, Operations & Maintenance of the Projects

14-Schemes to be deemed to be for public purpose

14. Schemes to be deemed to be for public purpose: - All mass transit schemes framed under this Act and operated by the Authority or by an organization sponsored by the Authority shall be deemed to be schemes for a public purpose.

15-Matters to be provided for by improvement schemes:

15. Matters to be provided for by improvement schemes: - A scheme may provide for all or any of the following matters, namely:-

- (1) the development of land for transport/mass-transit schemes
- (2) the clearance or improvement of congested areas;
- (3) nature and location of scheme or schemes
- (4) total estimated cost
- (5) sources of finances
- (6) date of commencement
- (7) date of completion
- (8) manner of execution

- (9) benefits, tangible or intangible to accrue
- (10) the acquisition by purchase, exchange or otherwise of any property or interest therein necessary for on affected by the execution of the scheme:
- (11) the sale, lease, exchange, or disposal in any other manner of any property vested in or acquired by the Authority;
- (12) the construction and alteration of streets (including bridges, causeways and culverts) and back lanes, and the provision of footpaths and sidewalks;
- (13) the leveling, paving, metalling, flagging, channeling, sewerage, and draining of the streets so constructed or altered, and the provision therein for lighting and sanitary facilities;
- (14) means of access and communication;
- (15) the raising, lowering, leveling or reclamation of any land comprised in the scheme;
- (16) the recovery of a betterment fee from owners of properties improved by the scheme;
- (17) any other matter for which, in the opinion of the Authority, it is expedient to make provision with a view to the improvement of any area comprised in the scheme or of any adjoining area for the general efficiency of the scheme.

16-Determination of the Project

16. Determination of the Project:-

- (1) Under the Scheme prepared and duly approved by the Authority for mass-transit projects specific projects will be identified for development and implementation as decided by the Authority.
- (2) The concept paper and the proposed plan for the project will be submitted to the Governing Body for its deliberation and approval.
- (3) After approval of the specific project Request for Proposals will be invited from the interested parties.
- (4) The Request for Proposals will be submitted to the Governing Body for its deliberation and determination of the terms of Tender.
- (5) After approval of the terms of Tender, tenders will be called from the pre-qualified contractors as per the procedure given in Sindh Public Procurement Act, 2009, Sindh Public Procurement Rules, 2010 and Sindh Public Private Partnership Act, 2010.

17-Public Notice

17. Public notice- Before awarding of the contract a public notice will be given under this Act or the rules or regulations made there under shall be in writing and shall be made known to the locality to be affected thereby in the following three ways:-

- (1) by affixing copies thereof conspicuously in public places within the said locality.

- (2) By advertisement in newspapers having circulation in the locality and
- (3) by any other means, if the Chairman thinks fit.

18-Award of contracts:-

18. Award of contracts:-

- (1) The contracts by the Authority for carrying out any research, development, operations and maintenance of the project will be awarded through competitive bidding following the principles enumerated in Sindh Public Procurement Act, 2009 and Sindh Public Procurement Rules, 2010 with respect to procurement of works, services, supply of goods etc.
- (2) The following fundamental principles are laid down for the guidance of the Authority to enter into contracts or agreements:
 - (i) The terms of a contract must be precise and definite and there must be no room for ambiguity or misconstruction therein.
 - (ii) As far as possible contracts in standardized forms prescribed by the Authority shall be drawn up.
 - (iii) Contracts shall, where possible, be executed on one or other of the standard forms but they may be modified to suit the requirement of any particular case.
 - (iv) Provisions must be made in contracts for safeguarding the Authority's fund and the property entrusted to a contractor.
 - (v) Provision shall be made in every contract to enable the Authority to cancel it with due notice and without excessive cost.
 - (vi) Estimate for works shall not be split up to avoid the necessity for obtaining the sanction of higher authority.

19-Land acquisition

19. Land acquisition

The acquisition of any land or any interest in land for the Authority or for any project under this Act shall be deemed to be acquisition for a public purpose within the meaning of the Land Acquisition Act, 1894 and the provisions thereof shall apply accordingly.

20-Transfer to the Authority for purposes of improvement scheme of building or land vested in the Corporation or any other authority, etc.

20. Transfer to the Authority for purposes of improvement scheme of building or land vested in the Corporation or any other corporation or authority, etc. –

- (1) Whenever any building, or any street, open space, or other land, or any part thereof, which is situated along a mass-transit corridor is vested in a constituent body, the Corporation, the Karachi Port Trust, the Karachi Cantonment Board, or any other local authority is within the area of any improvement scheme and is required for the purposes of such scheme, the Authority shall give notice accordingly to the Chief Officer of the constituent body, the Corporation, the Chairman of the Port Trust or the President of the Cantonment Board or local Authority as the case may be, and such building, street, open space, other land or part thereof shall thereupon vest in the Authority.
- (2) Whereas any land situated along a mass-transit corridor vests in the Authority under clause (1) and the Authority makes a declaration that such land shall be restrained by the Authority only until it re-vests in the constituent body, the Corporation, Port Trust, Cantonment Board or other local authority as part of a street or an open space, no compensation shall be payable by the Authority to the constituent body, the Corporation Port Trust or Cantonment Board in respect of that land.
- (3) Where any land or building vests in the Authority under clause (1) and no declaration is made under clause (2) in respect of the land, the Authority shall pay to the constituent body, the Corporation, Port Trust, Cantonment Board or local authority, as the case may be, as compensation a sum equal to the market value of such land or building on the date of the transfer, and where any building situated on land in respect of which a declaration is made by the Authority under clause (2) is vested in the Authority under clause (1), like compensation shall be payable in respect of such building by the Authority.
- (4) If the Authority, having made a declaration in respect of any land under clause (2), retains or disposes of the land under clause (2), retains or disposes of the land contrary to the terms of the declaration so that the land does not vest in the constituent body, the Corporation, Port Trust or Cantonment Board, or local Authority, the Authority shall pay to the Corporation, Port Trust, Cantonment Board or local authority compensation in respect of such land in accordance with the provisions of clause (3).
- (5) If any question of dispute arises-
 - (a) whether compensation is payable under clause (3) or clause (4), or
 - (b) as to the amount of the compensation paid or proposed to be paid under clause (3) or clause (4), or
 - (c) whether any building or street, or open space or other land, or any part thereof is required for the purposes of the scheme, the matter shall be referred to the Government whose decision shall be final.

21-Transfer of private street or open space to the Authority for purpose of improvement scheme

20. Transfer of private street or open space to the Authority for purpose of improvement scheme –

- (1) Whenever any street or open space or part thereof which is not vested in the Authority or in the constituent body, the Corporation, Port Trust, Cantonment

Board or local authority is needed for executing any improvement scheme, the Authority shall cause to be affixed in a conspicuous place in or near such street, open space or part a notice signed by the Chairman or someone authorized by him and –

(a) stating the purpose for which the street, open space or part is needed, and
 (b) declaring that the Authority will, on or after a date to be specified in the notice, take over charge of such street, open space or part from the owner thereof, and shall simultaneously send a copy of such notice to the owner at his last known address.

(2) After considering any objection received in writing before the date specified under sub-clause (b) of clause (1), the property may thereupon vest in the Authority.

(3) When the Authority alters or closes any street or open space or part thereof which has vested in it under clause (2), it shall pay reasonable compensation to the owner for the loss of his rights therein as per law.

(4) If the alteration or closing of any street, open space or part causes damage or substantial inconvenience to anyone having property right therein the Authority-

(i) shall forthwith provide some other reasonable means of access for the use of such persons, and

(ii) if the, provision of such means of access does not sufficiently compensate him for such damage or inconvenience, shall also pay him reasonable compensation in money.

22-Power to enter

22. Power to enter

Subject to any regulations made in this behalf any person generally or specially authorized by the Authority in this behalf may, whenever it is necessary so to do for any of the purposes of this Act and at all reasonable times enter upon land or premises and –

- (1) make any inspection survey, measurement, valuation or inquiry.
- (2) take levels;
- (3) dig or bore into subsoil;
- (4) set out boundaries and intended lines of work.

23. Power to eject unauthorized occupants

23. Power to eject unauthorized occupants:-

- (1) The Authority shall subject to rules have the powers to summarily eject unauthorized occupants of the transit-way, roads or any other property vesting in the Authority and demolish and remove any structure thereon and to use

such force including police force as may be necessary for the purpose and to recover the cost thereof from the person responsible for such occupation.

- (2) If approved by the Governing Body appropriate compensation may be given to the persons ejected as determined by the Governing Body including relocation of the dispossessed persons.

24. General power of the Authority to pay compensation.-

24. General power of the Authority to pay compensation.- In any case not otherwise expressly provided for in this Order the Authority may pay reasonable compensations to any person who sustains damage by reason of any exercise of the powers vested by or under the Order in the Authority or the Chairman, or any officer or servant of the Authority.

Chapter-4: Control And Regulation Of Traffic And Transport Facilities

25. Transfer of control of any road:

- 25 Transfer of control of any road: The Government may, by notification, transfer control of any road or portion of a road from itself, constituent body, the Corporation, the Karachi Port Trust, the Karachi Cantonment Board, or any other local authority or from any other agency to the Authority in regard to such matters dealt with by this Act and on such conditions, as may be specified in the notification.

26 Levy of fee:

26. Levy of fee:

- (1) The developer or operator concerned with the construction and maintenance of or having control over a mass-transit scheme may with the advice of the Authority and having due regard to the safety and convenience of the traffic on a road and subject to such conditions as the Authority may impose, permit any person on payment of such fees as it may deem appropriate:
 - (a) to place a movable structure on any mass-transit scheme in front of any building;
 - (b) to make a movable structure over hanging a mass-transit scheme;
 - (c) to deposit or cause to be deposited building materials, goods for sale or other article on any a mass-transit scheme; and
 - (d) to set up a stall or scaffolding on any a mass-transit scheme.

- (2) Any person who does any of the acts enumerated in sub-section (1) or set up any fence or hedge without the written permission of the Authority shall be punished with fine as defined by rules and the Authority may, after giving reasonable notice to the offender requiring him to remove the offending structure, fence, hedge, deposit, goods, articles, stall or scaffolding, and upon his failure to comply with such notice, may remove the same at the cost of the offender;
- (3) The offending material referred to in sub-section (2) shall be disposed of in such manner as may be prescribed by rules.

27 Permission for various works:

27. Permission for various works:

- (1) Notwithstanding anything contained in any other law for the time being in force, no person or agency shall, without the consent of the Authority do any of the following acts, namely;
 - (a) open or break up the surface of mass-transit scheme; or
 - (b) construct or carry repair or alter any cable, wire, pipe, drain, sewer or channel of any kind, through across, under or over such mass-transit scheme; or
- (2) In giving its consent under sub-section (1) the Authority may impose such conditions as it may deem necessary.
- (3) If without the consent of the Authority any person does any act enumerated in sub-section (2), he shall be punished with fine as may be prescribed by Rules.

28 Notice of closure for work

28. Notice of closure for work:

- (1) The concerned agency, developer or operator intending to permanently close a road or any portion of a road for the purposes of mass-transit scheme shall obtain approval of the Authority and give notice through one or more newspapers to general public of its intentions.
- (2) The notice shall invite objections to the proposed closure within a period of not less than a fortnight from the date of publication.

29 Restricted usage of the roads:

29. Restricted usage of the roads: The concerned agency may in consultation with the Authority prohibit or restrict either permanently or temporarily, the taking of any class of vehicles or animals or the movement of pedestrians over a road or any part thereof, if such prohibition or restriction is, in its opinion necessary for the public safety or convenience, or for any other sufficient reasons.

30 Penalty/ damages to be paid by offenders for damage caused by them.**30. Penalty/ Damages to be paid by offenders for damage caused by them:-**

- (1) If, on account of any act or omission any person has been convicted of any offence against this Act or any rule or regulation made thereunder has been caused to any property of the Authority, compensation shall be paid by the said persons for the said damage notwithstanding any punishment to which he may have been sentenced for the said offence.
- (2) Any dispute as to be amount of such compensation shall be determined by a Magistrate of the First Class.
- (3) If the amount of any compensation payable under this Article be not paid, the same shall be recovered under a warrant issued by a Magistrate, of the First Class as if it were to a fine imposed by him on the said person.

Chapter- 5: Organizational Set-up**31 Appointment of Managing Director:****31. Appointment of Managing Director:**

- (1) The Governing Body shall appoint a person as Managing Director from private sector who shall possess such qualifications on such terms and conditions (including disciplinary proceedings) as may be determined by it.
- (2) The Managing Director shall be the Chief Executive of the Authority and shall exercise effective control over and make all decisions necessary for the smooth functioning of the day-to-day affairs of the Authority under the general supervision of the Governing Body.
- (3) In particular and without prejudice to the generality of the foregoing powers, the Managing Director shall:
 - (i) be responsible for and have the authority necessary for overseeing and implementing in an expeditious and efficient manner, the decisions taken or schemes approved by the Authority;
 - (ii) have the power to exercise administrative control over the personnel of the Authority, and exercise such administrative and financial powers as may be entrusted by Governing Body;
 - (iii) submit the annual financial and capital budget proposal to the Governing Body for approval;
 - (iv) submit the manpower budget including hiring of advisers, consultants etc. to the Governing Body for approval.
 - (v) prepare annual report of the Authority for submission to the Government;
 - (vi) exercise such powers of the Governing Body as it may delegate to him;
 - (vii) act on behalf of the Authority in any emergency, subject to the obligation to report, such action to the Governing Body at its next meeting and to seek its ratification of any action so taken.

32 Establishment of Departments:-

32. Establishment of Departments:- The Authority shall establish various departments in order to achieve the objectives of this Act and in line with the Organization Structure.

33 Appointment of officers and servants etc.

33. Appointment of officers and servants etc.:-

- (1) The Authority may, from time to time, employ such officers including the Deputy Managing Directors, Secretary and such experts, technical, ministerial, or secretarial qualifications and experience on such terms and conditions as may be prescribed by regulations which shall also make provision for disciplinary proceedings against such officers and staff;
- (2) Notwithstanding anything contained in any law, contract or the conditions of service every person serving in any capacity in the Traffic Engineering Bureau and Karachi Mass Transit Cell immediately before the coming into force of this Act, including a person on deputation to any Government Department or Agency or any other Organization but not being a person on deputation to the Traffic Engineering Bureau or Karachi Mass Transit Cell shall be transferred to the Authority on such terms and conditions as may be determined by it:

Provided that such terms and conditions shall not be less favorable than those admissible to such persons immediately before their transfer to the Authority.

- (3) Any authority or organization responsible for payment of salary, pension and gratuity in respect of the Traffic Engineering Bureau or Karachi Mass Transit Cell immediately before the coming into force of this Act shall pay to the Authority salary, pension, charges and gratuity (if admissible) in such manner and to such extent as Government may determine and transfer provident fund accumulations, if any, of such persons.
- (4) The services rendered by such persons in the Traffic Engineering Bureau or Karachi Mass Transit Cell shall be deemed to be the service rendered in the Authority.
- (5) Every person holding a post under the Authority not being a person who is on deputation to the Authority shall be deemed to be a civil servant for the purposes of the Sindh Service Tribunals Act, 1973.

34 Delegation of powers to chairman etc.

34. Delegation of powers to chairman etc.:-

The Authority may, by general or special orders and subject to such conditions as it may impose, delegate to the Chairman, Managing Director, Member or any other officer of the Authority, such of its powers and functions as it may consider appropriate.

Chapter 6: Finance

35 Fund

35. Fund:

- (1) There shall be constituted a fund vesting in the Authority known as the Karachi Metropolitan Transport Authority Fund.
- (2) The fund shall consist of -
 - (a) Grants/contribution made by the Federal Government, the Provincial Government, Corporation, any local authority, associations, trusts, constituent bodies or organization;
 - (b) Share from the increased revenue in the shape of various fees or charges due to increase in land utilization as per the formula decided by the Government.
 - (c) Betterment fee from the residents of the areas due to increase or change in land utilization including commercialization and increase in property value due to the implementation of mass transit scheme.
 - (d) Loans obtained from the Federal Government, the Provincial Government, a bank or any other body;
 - (e) Foreign aid and loans obtained by the Authority with the sanction of and on such terms and conditions as may be approved by Government;
 - (f) Proceeds of all charges, advertisement including display of advertisement on various modes of transport along with charges for right-of-way, income from sale of its assets, floating of bonds, all other avenues including property, development, service charges and recovery made under this Act; and
 - (g) Share from motor vehicle tax as determined by the Government.
 - (h) Contribution by the private sector organizations under Corporate Social Responsibility (CSR) in the greater interest of the city and the public.
 - (i) All other sums as may be received by the Authority.
- (3) The Corporation or any other body, Authority or Organization shall contribute to the Authority every year such amount by such date as may be prescribed by the Government.
- (4) The funds shall be administered by the Authority and shall be utilized for meeting expenses necessary for carrying out the purposes of this Act including the payment of:
 - (a) Charges in connection with the survey, research or lay out construction, reconstruction or repair of roads or execution of a scheme prepared under this Act.

- (b) Loan and interest thereon;
 - (c) Salaries and other remuneration to the members of staff, officers, Director General, Deputy Managing Director, including the experts, technical advisers, consultants, firms employed for any work under this Act and other employees of the Authority.
- (5) All money credited in the fund shall be deposited with a Scheduled Bank approved by Government.
- (6) The Authority may invest its surplus fund in any one of the Government approved securities or in the fixed deposit with the Government approved bank.

36 Budget:

36. Budget:

- (1) Every year the Budget of the Authority shall be prepared using zero-base budgeting approach by taking input from various quarters.
- (2) In the month of May every year, the Authority shall submit to government for approval a statement of the estimated receipts and expenditure in respect of the next financial year.
- (3) Government shall within thirty days of the receipt of the statement approve it with or without modification and if the approval is not conveyed within 30 days the statement shall be deemed to have been approved without any modification.

37- Valuation of financial state of affairs of the Authority

37. Valuation of financial state of affairs of the Authority

The Authority shall arrange actuarial valuation of its financial state of affairs after every five years.

38- Forecasts and Revisions:-

38. Forecasts and Revisions:-

- (1) The budgets will be reviewed on quarterly basis and revised based upon the forecast considering the changing circumstances.
- (2) The revised forecast will be submitted by the Authority to the Government for its approval.

39- Cash Flow Projections:-

39. Cash Flow Projections:-

- (1) Besides the budgets and forecast the Authority will also prepare the annual cash flow projections along with the budget to identify the funding requirement for the projects.
- (2) The Cash Flow projection to be reviewed on a quarterly basis along with the forecast.

40- Powers to borrow money –

40. Powers to borrow money:-

The Authority may, from time to time, with the previous sanction of the Government, and on such terms and conditions as may be approved by the Government, borrow moneys necessary for the purpose of defraying any cost, charges or expenses, incurred or to be incurred-

- (1) for the execution of any work authorized by or under this Act, or
- (2) for the payment of compensation for any land acquired for the purposes of this Act, or
- (3) for the repayment of a loan raised under this Act, or
- (4) for any other purpose within the intendment of this Act.

41- Justification for borrowing:-

41. Justification for borrowing:- Before borrowing an amount the Authority shall prepare detailed cash flow projections to identify the cost-benefit analysis resulting from borrowing in order to ensure that the borrowing cost including the interest-rate risk are duly hedged from either from the increased revenues or reduction in cost as well as to ensure repayment of the amount borrowed.

42- Accounts of the Authority

42. Accounts of the Authority

- (1) The Authority shall maintain complete and accurate accounts and other related records in such form and in such manner as may be prescribed by rules in consultation with the Auditor General of Pakistan.
- (2) The accounts of the Authority shall be audited every year by the Auditor appointed by Government in consultation with the Auditor General of Pakistan on payment of such remuneration as may be determined by the Authority.

- (3) As soon as may be after the receipt of audit report, the Authority shall submit the same alongwith its comments to the Government and the Authority shall comply with any directive issued by the Government for rectification of an audit objection.

43- Submission of yearly reports, returns etc.

43. Submission of yearly reports, returns etc.:

- (1) The Authority shall submit to Government as soon as possible after the end of every financial year, a report on the conduct of its affairs for that year.
- (2) Government may require the Authority to furnish to it returns statements, estimates, statistics or other information regarding any matter of any subject with which the Authority.

Chapter-7: Internal Controls

44- Internal Controls:

44. Internal Controls:-

- (1) The Authority shall ensure establishment of proper system of Internal controls comprising of the policies and procedures adopted by the Authority to assist in achieving objectives of this Act of ensuring, as far as practicable, the orderly and efficient conduct of its activities, including adherence to the policies, the safeguarding of assets, the prevention and detection of fraud and error, the accuracy and completeness of the accounting records, and the timely preparation of reliable financial information.
- (2) It shall also be a mandatory requirement to establish adequate and appropriate systems of internal controls by the Operators also in order to timely identify the risks and to take appropriate measures in development, implementation, operations and maintenance of mass-transit schemes.

45- Accounting, Information and Communication System:

45. Accounting, Information and Communication System:

- (1) The Authority shall establish adequate and appropriate Accounting system in order to main audit trail of all the decisions, actions taken, transactions, activities etc.

- (2) The Authority shall establish an adequate and appropriate Information system so that the required information pertaining to the mass-transit schemes is timely received by the Authority.
- (3) The Authority shall establish an adequate and appropriate Communication System within the organization so that there are no bottlenecks in communication from top to down and vice versa.
- (4) The Authority shall ensure that appropriate and adequate Accounting, Information and Communication systems are also established in the mass-transit projects.

46- Organization Structure:

46. Organization Structure:

- (1) An effective and appropriate Organization Chart of the Authority will be developed clearly defining lines of responsibilities and accountabilities.
- (2) The Organization Chart to be reviewed on an yearly basis to improve the same by merging or splitting various divisions and departments in order to create synergy and efficiency without compromising upon the risks by following principles of internal controls i.e. coverage to all activities, segregation of duties at various levels, clearly defined authorization and approval powers, periodic review and reconciliation, existence of physical controls and continuous training and supervision of staff.

47- Functional Setup

47. Functional Set-up: The Authority shall have its Head Office at Karachi. There are eight Wings/Sections namely Planning Wing, Operation Wing, Finance Wing, Administration Wing, Secretary Section, Public Relation Section, Internal Audit Section and Vigilance Section.

48- Decision Making:-

48. Decision Making:- All significant issues shall be placed for the information, consideration and decision of the Authority i.e. the Authority is required to consider the following matters:
- (1) establishment of efficient and effective internal control system across the organization.
 - (2) justification for establishment of a department/section by defining its objective.
 - (3) annual business plans, cash flow projections, forecasts and long term plans
 - (4) budgets including capital, manpower and overhead budgets, along with variance analysis

- (5) quarterly operating results as a whole and in terms of its operating divisions or business segments
- (6) internal audit reports, including cases of fraud or irregularities of a material nature
- (7) details of joint venture or collaboration agreements or agreements with distributors, agents etc.
- (8) promulgation or amendment of a law, rule or regulation, enforcement of an accounting standard and such other matters as may affect the listed company
- (9) status and implications of any law suit or proceedings of material nature, filed by or against the listed company
- (10) any show cause, demand or prosecution notice received from revenue or regulatory authorities, which may be material
- (11) default in payment of principal and/or interest, including penalties on late payments and other dues, to a creditor, bank or financial institution or default in payment of deposit
- (12) failure to recover material amounts of loans, advances and deposits, including trade debts and inter-corporate finances
- (13) any significant accidents, dangerous occurrences and instances of pollution and environmental problems

49- Job descriptions:

49. Job descriptions:-

The Authority shall define Job Descriptions of staffs at different levels to ensure that all the objectives of the Act have been duly cascaded down the work station to align the whole organization with the provisions of this Act.

50- Guidelines:

50. Guidelines:-

The Authority as deem appropriate from time to time will issue guidelines for elaboration of various matters.

51- Training & capacity building:

51. Training & capacity building:-

- (1) The Authority shall ensure appropriate training for its staff as well as the staff of the developer or operator for the proper communication of the expectations at various levels.
- (2) The developer and operator will pay the fee for such training to the Authority as may be appropriately prescribed by the Authority.

52- Use of Information Technology

52. Use of Information Technology:-

- (1) The Authority as well as any Special Purpose Company established to carry out the development, operations and maintenance of a mass transit project shall use support of Information Technology (I.T) to carry out its activities efficiently and effectively.
- (2) The I.T Applications will be integrated having a common data pool.
- (3) The I.T Applications will be developed by an independent professional software house.
- (4) Global Positioning System (GPS) will be used to track the movement of the vehicles.

53- Management Information System (M.I.S):

53. Management Information System (M.I.S):-

- (1) The Authority shall establish an efficient and effective M.I.S to monitor the activities, for timely identification of red flags keeping in view the Key-Risk-Indicators (KRIs) and Key-Performance-Indicators (KPIs), to assist in decision making as well as to take appropriate measures timely.
- (2) Efforts will be made to establish EDP based M.I.S.

54- Internal Audit:-

54. Internal Audit Department:-

- (1) The Authority shall establish an Internal Audit Department (IAD) to assist in establishment and improvement of effective and efficient internal control systems and procedures.
- (2) All departmental or functional heads shall be responsible for the design, development, implementation, monitoring and supervision of an effective internal controls within their areas.
- (3) The IAD's function will be of review and guidance to review that the departmental internal controls are in cohesion with the overall objectives of the organization.
- (4) The function of the Internal Audit shall be post-facto i.e. review of transactions, activities etc. in line with the provisions of this Act, rules and regulations and IAD will not involve in execution of the transaction.

- (5) The Internal Audit will focus upon improvement of systems and procedures by giving suggestions for the same.
- (6) The IAD shall submit a quarterly report on internal controls along with the observations and recommendations for improvement of the systems and procedures to mitigate the risks to the Governing Body.
- (7) The Head of IAD shall be appointed by the Governing Body as well as his pay, perks, allowances, leave and other facilities and will directly report to the chairman of the Governing Body.

Chapter-8: Complaints and appeals

55- Complaints:

55. Complaints:

- (1) Any person aggrieved from a mass transit project can file a complaint to the Authority addressed to the Secretary along with all supporting documents and evidences through courier or by hand deliver.
- (2) The Authority will call for comments from the concerned officers to the complaint lodged.
- (3) The Authority will form a committee comprising of for hearing of the Complaint.
- (4) The Authority shall make every effort to dispose of a complaint or other proceedings within 30 days of its filing. Provided that a decision of the Authority shall not be rendered invalid by reason of any delay in its delivery.
- (5) The decision of the Authority shall be given after providing opportunity of hearing to the aggrieved party and after taking into account the contentions of the respective officers.

56- Appeal:

56. Appeal: A person aggrieved from the decision of the Authority can file appeal with the High Court of Sindh within 30 days of the decision made by the Authority.

57- Notice of suit against the Authority, etc.

57. Notice of suit against the Authority, etc. –

- (1) No suit shall be instituted against the Authority or any member or any person associated with the Authority or against any servant of the Authority or against any person or persons acting under the direction or authority of the Chairman or of any officer or servant of the Authority, in respect of any Act purporting to be done under this Order or the rules or regulations made thereunder until the expiration of one month from the delivery of a written notice at the Authority office or the place of adobe of such member, officer, servant or person, stating the cause of action, the name and place of the intending plaintiff, and the nature of the relief sought.
- (2) In every such suit the complaint shall contain a statement that such notice has been delivered.
- (3) Notwithstanding anything in the Limitation Act, 1908 (IX of 1908), no such suit as is described in clause (1) shall, unless it is a suit for the recovery of immovable property or for a declaration of a title thereto, be commenced otherwise than within six months next after the accrual of the cause of action.

Chapter-9: Miscellaneous

58- Cooperation

58. Cooperation:-

- (1) All constituent bodies as well as all government departments, ministries, offices will extend full cooperation to the Authority for the development and implementation of transport/mass-transit schemes by giving due No-objection-certificates, approvals, permissions, reply etc.
- (2) For any planning and development projects coming in the alignment of the proposed transport plan of the Authority an N.O.C is required to be obtained from the Authority by any department, authority or any person.
- (3) The existing Transport Authorities will follow the instructions given by the Authority.
- (4) In case of any dispute or objection raised by any constituent body or any government office the decision of the Government will be final and binding.

59- Recoveries of dues

59. Recoveries of dues:-

Any sum due to the Authority shall be recoverable as arrears of land revenue.

60- Authentication of orders and other instruments of the Authority

60. Authentication of orders and other instruments of the Authority:

All orders, decisions and other instruments of the Authority shall be authenticated by the signature of the Chairman and any other Member or any officer of the Authority authorized by it in this behalf.

61- Liabilities of members

61. Liabilities of members:

No member shall be personally liable for any contract made or expenditure incurred by or on behalf of the Authority.

62- Officers to be public servants

62. Officers to be public servants:

The Chairman, Managing Director, Members, Secretary, Officers and Members of Staff of the Authority shall, when acting or purporting to act under this Act, be deemed to be public servants within the meaning of section 21 of the Pakistan Penal Code.

63- Power to make rules

63. Power to make Rules:

- (1) The Authority subject to the approval by the Government may, by notification in the official Gazette, make rules for carrying out the purpose of this Act.
- (2) The Authority shall develop adequate and appropriate rules in light of the provisions of this Act i.e. how an activity will be carried out, so that risk/reward trade-off may be created.
- (3) Following rules shall be developed by the Authority for its internal management. These rules are also required to be developed by the Special Purpose Company for the development, operations and maintenance of the project.
 - (i) Development and Implementation of a mass-transit scheme
 - (ii) Procurement of goods & services
 - (iii) Risk Management
 - (iv) Human Resource Management including preparation of a succession plan
 - (v) Determination of terms of credits
 - (vi) Write-off of bad/doubtful debts, advances and receivables

- (vii) Investments
- (viii) Acquisition/ disposal of fixed assets
- (ix) Borrowing of money and the amount in excess of which borrowings shall be sanctioned/ ratified by a general meeting of shareholders
- (x) Determination & delegation of financial powers
- (xi) Health, safety and environment
- (xii) Terms of Reference of consultants, advisers, think-tank members etc.
- (xiii) For any other function as entrusted to the Authority under this Act.

64- Power to make Regulations

64. Power to make Regulations:

- (1) The Authority may make regulations, not inconsistent with the rules, for carrying out the purposes of this Act by notification in the official gazette with respect to the powers and functions of the Authority.
- (2) In particular and without prejudice to the generality of the foregoing power, such regulations may provide for:-
 - (b) preparation of plan, budget and scheme for a mass transit project.
 - (c) development, operations and maintenance of a mass transit project.
 - (d) Appointment of officers, advisers, experts, consultants and employees
 - (e) Awarding of contracts with respect to the projects.
 - (f) Levy of fees, rates and charges in respect of services rendered, actions taken and schemes implemented.
 - (g) Categorization of the mass projects.
 - (h) Providing procedures for managing traffic operations on mass transit corridors.
 - (i) Procurement of I.T software.
 - (j) Installation of devices, equipments etc. on mass transit corridors, stops, parking spaces etc.

65- Removal of difficulties

65. Removal of difficulties:

If any difficulty arises in giving effect to any of the provisions of this Act, Government may make such order, not inconsistent with the provision of this Act, as may appear to it to be necessary for the purpose of removing the difficulty.

Provided that no such order shall be made after the expiry of one year from the commencement of this Act.

66- Indemnity**66. Indemnity:**

No suit, prosecution or other legal proceedings shall lie against the Authority, Chairman, Managing Director or any officer, member of Staff or other persons appointed by the Authority in respect of anything done or intended to be done in good faith under this Act.

67- Repeal, savings and succession:-**67. Repeal, savings and succession:-**

- (1) The Karachi Metropolitan Transport Authority Ordinance, 1999 (..... Of 1999) is hereby repealed.
- (2) On the establishment of the Authority under this Act, all properties, assets and liabilities pertaining to Karachi Mass Transit Cell shall vest in and be the properties, assets and liabilities, as the case may be, of the Authority established under this Act.

APPENDIX-6 COMMENTS ON DRAFT FINAL REPORT BY KMTC

Comments on Volume I

S No.	Para / Page/ Tab / Fig	Comment	Answer
1	fig 2-4-8 Pg 2-16	[Avg. Trip Length] Same figure is pasted twice despite of new figures	Left figure and right figure are different charts. Right chart was replaced because some numbers referred in the corresponding sentence are not the same in the numbers in the figure.
2	3.4.6 pg # 3-53	[Finding & Recommendation] Very Important matter should be addressed in Executive summary	The summary of the contents of was added in Executive Summary.
3	Table 5-2-3 Pg 5-25	[No. of Trips by Mode] Which scenario is considered for future Modal Split? If do nothing or Highway, share of Motor bikes decreasing in total Trips is unrealistic	The same modal split was used for all scenarios due to the method of 4-step demand forecast model. Although the percentage of motorcycle was estimated to decrease, the number was estimated to increase.
4	Table 5-2-4 Pg 5-28	[Result of Traffic Assignment] Only 3 scenarios are analyzed, further more scenarios for different combination of projects should also be analyzed, The Existing condition case should also be analyzed, Different Individual MRT projects with KCR should be analyzed for point Rating in Project selection, Only Highway Improvement shows avg. V/C = 0.82 which is nearly acceptable LOS for compact Urban Transport Design, However in reality Traffic always remain Congested without proper Public transport i.e. v/c > 1 for mega cities like Karachi	Chapter 5 focuses on the demand forecast modeling. Several scenarios are analyzed in Chapter 6. The urbanized area of Karachi will expand in Gadap, Bin Qasim, and Keamari. High improvement by road network development is the result of the divergence of traffic demand in suburban area. Since mass transit network cannot cover such large area with limited budget, it was concluded that highway construction is more important. Mass transit is proposed only along the major corridors.
5	6.2.7 Pg 6-29	[Traffic Management] Karachi has widest roads in the world & if proper Traffic Management techniques applied many Traffic problems will be solved. This one page is not enough for Traffic Management, CDGK expect much from JST to propose in this regard from JST like proposing ITS technologies, Signal Coordination, etc	Roads in Karachi are wide, but they are narrow in the central area. ITS technology itself is not a traffic management technique; it is just a tool for various types of traffic management. There are many traffic management measures as summarized in Table 6-2-9. However, applicable measures are limited. JST considered that the measures proposed in KSDP 2020 was proper, and similar measures were proposed in the report. Signal coordination would be necessary for BRT operation, so it was added in Chapter 6, Volume I.
6	fig 6.3.7 Pg 6-38	[Location of Access Ramps & Intersections] This Drawing is not clear, Submit this drawing with Satellite image on A0 size paper to KMTC for review	The figure with satellite image was submitted. It is recommended to use the submitted GIS data to browse the exact locations in which Figure 6-3-7 is included. The file in ArcGIS format is under /GIS/Highway folder (Fig6-3-7_Location of Access Ramps and Intersections .mxd).
7	Pg # 6-50	[(3) Proposed Network & Fig#6-4-6 M/P Network] The Network in figure 6-4-6 is different from transit network used in Transit Assignment Scenario 3. If this is the case, Ridership Estimation for Green/ Yellow line are changed & Ridership for Aqua, Purple & Orange line are not included in the Scenario 3. Wether these Riderships are assumed because no detail about Transit Assignment of these lines are given in the report	The demand forecast in Chapter 5 shows the evaluation of three different scenarios. In Chapter 6, the transit network was reviewed from various aspects, and there are some differences between the final network in Chapter 6 and the scenario network in Chapter 5.
8	General comments	People of New karachi Town and North Nazimabad Town have to interchange Twice wether going towards Shara-e-Faisal or M.A.	Trip distribution from the HIS shows the strong connection between New Karachi and Shara-e-Faisal along M. Rashid Road, where a

		Jinnah Road, which is not a good practice to shift people from Private vehicle towards Public Transport.	MRT is proposed. Direct connection to M.A. Jinnah Road is also important. However, the corridor from M.A.Jinnah Road to Super Highway is more important, and the direct connection is proposed along this corridor instead of the direction of North Nazimabad and New Karachi. Although Master Plan does not give detail about the connection, the proposed BRT line will provide direct connection between New Karachi and M.A. Jinnah Road.
9	General comments	Signal Free Corridor 1, Shaheed Millat Road & Shara-e-Quaideen are very important roads, There should be some sort of transport system proposed on these Roads .	BRT lines are proposed in the report, although the proposal is not emphasized. A Signal Free Corridor is a kind of freeways. Exclusive lanes are not possible along such corridor.
10	General comments	There are no Feeder routes in the Master plan, Some Feeder Routes wer prposed in the Progress report 2, the issue on these routes was raised by ex D.G. KMTC after 2nd JSC meeting and but JST didn't discuss about these routes and omit these routes from the Master Plan	The feeder routes proposed in the Progress Report 2 was disagreed by KMTC. JST reviewed the public transport network and modified it based on the demand forecast analysis. Feeder routes are shown in Chapter 6 as the secondary network system.
11	General comments	The Brown line which is third Rail based line in KTIP and suggested to be implented in MidTerm Plan has Significant Land Acquisition in Shah Faisal Colony area, Wether this Land Acquisition possibility is Analysed in SOSE?, The buildings which have to be Demolished should be identified and discussed with CDGK and concerned Department before approval of this corridor	The land acquisition possibility in Shah Faisal Colony area was identified on an approximate alignment of the master plan study stage only, by using satellite images. And the result of Brown line was described as corridor-2 in SOSE.
12	pg # 6-55	[Noth Naz. Station] Direction is towards Golimar/ Nazimabad not Sohrab goth, Dedicated flyover from Nazimabad side is not understandable if BRT has to end at KCR, If the length for vertical clearance is not achieveable then why BRT flyover on existing KCR is proposed	This comment is based on the 1 st Draft Final Report, and we have received the same comment from KMTC in May, 2012. The plan that is mentioned in the comment does not exist in the 2 nd Draft Final Report.
13	9.2.1(4) Pg 9-2	[Economic Saving Benefits] For Benefits, value of Time Taken Bus and Motor Cycle Passangers is Rs. 50/hr which is quite high nad the reason is avg. monthly working time is taken as 150 hours which is normally around 250 hours per month reulting in over estimation of benefits. Same case is for car users	Applying the working hours of 250 hours per month means very low labour productivity. KCR study also used 150 hours per month. The passenger interview survey to motorcycle users also shows the similar value (Rs. 44/hr).
14	9.2.2(5) Pg 9-4	[Revenue] Whether Fare of BRT & MRT are integrated with KCR, This condition is not described in the master plan because with and w/o integration fare of Mass Transit with KCR will heavily effect the viability of both	The fare of BRT should be integrated with KCR and MRT network as is described in Chapter 6.
15	Page 9-4	[Selection of Project for Feasibility Study] Any BRT (line or Network) without entering CBD or connected with KCR will not attract the passengers resulting in Failure due to no revenue as well as reducing road capacity but not reducing road Traffic Volume	Introduction of transit system in CBD will reduce traffic capacity unless it is constructed as underground type. Karachi's roads are narrow in CBD while they are wide in suburban area. During F/S, JST and KMTC discussed this issue many times and concluded that the BRT line should be extended to the park near Cloth Market.
16	Page 9-4	According to the Report, the CBD portion of Blue line is staged in Long Term Plan i.e. operation start in 2030, Which means that all the KTIP depend upon the KCR and if KCR delayed or fail to implement due to any reason, common people depending on Public Transport would have nothing from this project before 2030. There are many sensitive issues in KCR (Land	Development of KCR Line is precondition in this project because PC-1 of KCR has already been approved by GOP. The conclusion through meetings with KMTC was to select BRT route of Green line and Red line as highest priority projects in feasibility study based on the policy about Japanese ODA to Pakistan in consultation with JICA.

		Acquisition, Availability of Depot. Land)	JST cannot propose another plan in which KCR is not implemented under the present status.
17	Page 9-4 General comments	What Mechanism JST suggest for the stability of urban Traffic pattern on these proposed Corridors? Eg: previous LRT-2 loses its significance and priority as no significant Transport Facility was provided on the corridors. For maintaining smooth Traffic Flow CDGK has to Construct few more Flyovers on the proposed corridors so there will be no more space for MRT after 10-15 years.	The previous drawing of LRT-2 shows that the line needs to go through Karachi Zoo. The corridor is too narrow, and construction of an elevated system is not possible. Underground type is also difficult because there is no room for the transition section between underground to elevated section.
18	Page 5-19	[Future Transport Network] The traffic assignment for year 2030 has been performed assuming that Layari Expressway & Its Extensions, Malir Expressway, Northern Bypass's westwards extension, Northern Bypass eastern extension and 6 Public transport transport corridors proposed by JST would be built. however this seems a lot ambitious and JST must also perform analysis on various permutations if any of these projects are not being implemented.	This is the estimation of the full development case of the master plan. Since the number of projects is large, the number of combinations of scenarios in case some of them exist and others doesn't. It is not practical to carry out these combinations.
19	Table 5-2-3 Pg 5-25	[Number of Trip Modes] It is assumed that modal share of Bus & Cars would increase from 2010 - 2030 however the percent modal share of Walk & Motorcycle would reduce in the same period. What is the basis of estimation for future modal share is not being discussed in the report.	The figure in the table is the modal share projection in case of mass transit development (full network case). The modal share of motorcycle & walk in 2030 is small due to increase in the share of public (Bus) transport. The remarks were added to the table.
20	Table 5-2-5 Pg 5-29	[Evaluation of network Performance] The Table analyses 3 cases. For each case the average V/C ratio is above 1. Referring to the statement in Para 3.6.3 page 3-58 the statement that road capacity is not a problem in the city becomes null and void.	Para 3.6.3 describes the present condition while this chapter show the analysis in the future.
21	Page 6-3	[Road Development + KCR Scenario] The statement that "KCR is a committed Project" is a big statement from JST. Does this ensure loan guarantee from Japanese Government?	The following statement is "by the government of Pakistan". This statement does not mention anything about the loan from JICA.
22	Table 6-1-2 Pg 6-7	[Comparison of Market Segment of Mass transit] The Table highlights income groups & tries to perform analysis for mass transit market Analysis based on this. The table should clearly show value ranges of Income groups considered by JST based on results of HIS Survey or other credible dataset. Otherwise the table seems to be generic and not focused on situation in Karachi.	This is an analysis of target passengers for mass transit system from the general view point. It is difficult to show the range of income group as salary per month from HIS or other sources because the classification is general and mode choice depends on various factors.
23	Table 6-1-2 Pg 6-7	[Comparison of Market Segment of Mass transit] The table considers Private Car users in High Income Group Only? Is this also revealed by HIS Dataset also?	As mentioned above, this is a general classification. Middle income group also use private cars if adequate transit service does not exist.
24	Table 6-1-2 Pg 6-7	[Comparison of Market Segment of Mass transit] In identifying Risk the table shows Low Income Group to be resisting Mass Transit, High Income Group to have small demand & the Mid income group to have a vague demand? If this is so, where actually is the potential riders? The outcome of the table is not very clear.	This table is one of the materials to set the policy of mass transit development. The conclusion is summarized in 6.1.7.

Comments on Volume II

No	Report	Comments from KMTC	Reply from JICA Study Team (JST)
1	Fig 1-1-1 Pg 1-3	[Work Schedule] To be updated as current status	The work schedule is the original plan. We replaced it with the new one.
2	Table 3-2-1 & 3-2-2 Pg 3-4 & 3-8	[List of BRT Stations] Provide additional column for distance between the station.	Distance column was added. Distances between stations of both routes were described in Table 6-3-1, 6-3-2.
3	4.1(1) U-turn(N.Naz imabad) Pg 4-1	[U-Turn Traffic] closing of median is possible also. Since BRT is high frequency Fig. 4-1-1 is quite unsafe and not seems to be possible for example 4-1-2, signal case exclusive U-turn lane with solid divider of appropriate length will be required or Dog leg u-turn may be provided.	JST emphasizes that BRT traffic as public transportation should take precedence of mixed traffic. In addition JST proposes that adoption of traffic signal at u-turn location is essential countermeasure.
4	U-turn Red Line Pg 4-1	[U-Turn Traffic] for red line u-turn under Jail Flyover will be closed, old sabzi mandi u-turn will be replaced by signal at new town police station. Similarly shahzob hotel u-turn will be replaced by signal for BRT.	Signalization of intersections is essential for BRT introduction. The impact of closure of U-turn is considered as a negative impact in the economic analysis. From this reason, stakeholder consultation is necessary for the implementation of the BRT project.
5	4.2.4 Existing Bus Service Pg 4-10	[Reorganization of Bus Network] since BRT will not be affordable to poor people therefore CDGK will not cancel the permit of any existing route and also to avoid any social or political conflict unless an operator himself requests to change his route. The existing buses parallel to BRT will automatically reduce their frequency due to reduction in demand.	Many routes overlap the BRT corridor. This chapter just point out which routes are duplicated with the BRT corridor and only recommends discontinuing these routes. Discontinue of these routes might be done by regulation, or by market mechanism. JST do not insist to stop these routes by government power.
6	Table 5.3.3 Page 5-7	[Cost of Bus] The mentioned cost of buses i.e. 12 million seems to be on a higher side, as Hino Pak has submitted a proposal to KMTC with the cost of 9 million per bus. Further it can be estimated that this cost would be dropped down through negotiations / bargaining based on bulk quantity order placement.	The cost can be reduced by international competition. However, it is not possible to estimate the final price after the bidding.
7	Page 6-9 6.3.2 (8)	[Multi Model Transit Integrated Plan] Detailed analysis of Intermodal Transit Integration Program is expected from JST, rather than a 3.5 lines paragraph. Green & Red Line bisects KCR and Red Line bisects Brown Line at NIPA, how passengers shifting can be facilitated and how ticketing can be integrated at these locations?	JICA Study Team has already described the facility planning between KCR and BRT in fine detail on Chap 6.6.2 "Transferred from BRT to KCR" of Draft Final Report. According to this section, the outlines of them are explained as follows. 1. Connection with KCR and Green Line JICA Study Team has proposed that the dedicated walkway from BRT to KCR will be installed through use of the open space along the railway pier. In addition, the commercial deployment under the open space of railway pier would be taken in terms of creation the life of the street. This enables the passenger not to feel the distance between BRT and KCR. 2. Connection with KCR and Red Line JICA Study Team has proposed that the entrance/exit of pedestrian deck will be installed in the near distance between KCR and station and this facility. It is desired that the pedestrian deck is directly joined to KCR Station. Otherwise, there is no space to construct this intermodal transfer facility. 3. Ticketing The system of flat fee or discount fare is adopted when the passenger changes at BRT station of Red line for Brown Line. In this case, it is possible to use the shared ticketing way, which is for example direct connection with both lines. The case example of BRT Operation in JAKARTA city is described on our report.

			There are different fare structure between KCR and BRT. This showed that it is difficult to adopt the shared ticketing system between KCR and BRT Operation.
8	Page 6-34	[U-Turn along Shara-e-Usman road] If all U-turns along Shakra-e-Usman would be closed for BRTS operations, how vehicles would be able to cross roads? Has the u-turn traffic in this section being analyzed? Only saying that 'these u-turns would be closed' doesn't sound rational. Instead can be reduce no. of u-turns and install vehicle actuated signals?	There are two main characteristics along Shakra-e-Usman Road, existing power pylon tower in the median and intermediate T-type intersection. Due to construction of BRT dedicate lane and above mentioned characteristics, u-turn facility would be forced to close. Instead of closing median along the route, JST recommended that intermediate T-intersections should be converted to 4-leg signalized intersection to provide access to both sides of the road each other.
9	General comments	Preliminary design of storage capacity on these u-turns should be provided because there is heavy traffic flowing on this road.	Traffic capacity of u-turn facility should be studied in the detailed design stage, considering not only BRT operation plan but also signaling plan based on analysis of traffic volume including turning movement traffic survey at u-turn location.
10	Page 6-40 Figure 6.5-5	[Depot General Building Layout] It is always better to provide angular parking especially for large vehicles for easy maneuverability. Although it requires some extra space but parking / unparking mechanism becomes much easier.	In terms of economic efficiency, safety/smooth operation in the Depot area and difficulty of site acquisition, JICA Study Team has re-proposed that the tandemly-arranged parking space is installed inside the Depot area. 1) Economic efficiency If the angle-parking is adopted, it is necessary to take an additional acquisition of land for depot space. The extra expenses for land acquisition will be occurred, and it is not efficient for project implementation. 2) Safety/Smooth Operation in the Depot Area It is necessary for the driver of BRT to look behind check before back up. This enhances the probability of having a collision against another bus, and wasting time in totally parking. It is not good in terms of safety and Smooth Operation in the Depot Area. 3) Difficulty of site acquisition The planned depot area on this project will be installed in the urban area. There is the limitation of depot area. In case of Red Line, it is impossible to expand more area. The other, Green Line, is that it is possible to expand the Depot area. Otherwise, in future operation of Brown Line, there is possibilities to use as shared depot operation between Green Line and Brown Line. From this, it needs to keep the extra space of this land.
11	8.4.5 (1) Pg 8-9	[Value of Time] As it has already been communicated that value of time i.e. Rs. 50 is on a higher side.	This is the same comment in Master Plan (No. 13).
12	Table 9.1.1 Page 9-1	[Monthly personal cost of BRT system] No. of drivers and mechanics associated for bus operations is on a very higher side. It is said that for 353 buses, 945 drivers and 260 mechanics would be required. This reveals that there would be 2.7 drivers and almost 1 mechanic per bus be allocated.	No. of drivers and no. of mechanics were estimated by assuming 2.0 and 0.5 per one vehicle basically. In addition to these, a conversion factor of 1.34 was applied, which represents working days per year and spare ratio of the staffs to secure 365-day operation and preparing for unscheduled absence of drivers. The calculations were based on the following formulas. No. of drivers = 2.0 (per vehicle) * 386 (operating vehicles) * (365/300) * 1.1 No. of mechanics = 0.5 (per vehicle) * 425 (total vehicles) * (365/300) * 1.1 Number of drivers of and mechanics per vehicles

			are 2.20 and 0.48 in case of CDGK. Therefore, the estimated numbers of drivers and mechanics in this Study are considered within a range of reasonable numbers.
13	Table 9.1.2 Page 9-2	[Roles and duties of Staff] Vehicle Operating Cost seems to be on a lower side. Please attach reference document of HinoPak Motors.	The document cannot be disclosed. We have already submitted the reference document during the study period.
14	9.1.4 Page 9-3	[Summary of O&M Cost] Details of cost over run reasons should be mentioned in the report. Also measures that would be required to minimize the cost over runs should be mentioned in order to make the project remain financially viable.	The objective of the sensitivity analysis is to clarify potential effects to the financial situations to the entity by future uncertainty. Major causes of the cost overrun are considered as delayed construction schedule and inadequate Scope of Work in the construction stage. The key to avoid such causes is considered to contract with reliable supervision consultants. In the operation stage, traffic accidents cost and inappropriate loss of BRT vehicles are considered the major causes of the cost overrun. Traffic accidents could be prevented through safe BRT operation by drivers with well-maintained vehicles. Maintenance staffs are also important to reduce broken vehicles and loss of vehicles. Education to drivers and maintenance mechanics, in particular, is considered very effective to avoid the causes of the cost overrun. Reliable operation is expected to keep the BRT passengers at the expected level, which is the indispensable factor of the BRT operation.
15	Appendix 1-5 & 1-6 Fig A1-3-4 & A1-3-6	On Appendix 1-5 & 1-6 JST has proposed that the Blue Line (Super Highway - Tower) can be operational on the edges of the corridor. This seems to be rather difficult as there are many streets connecting to Shakra-e-Pakistan which cannot be closed. And if signals would be provided on all connecting roads than the rest of the traffic would be badly hurt and if signals will not be provided then the BRT will not be able to serve it purpose.	The purpose of this study for tentative BRT operation of Blue line was to prepare alternative plan before construction commencement of LRT Blue line. JST presumed early adoption of public transportation along Blue Line route will be essential for countermeasure against heavy traffic congestion taking into account the growth in population and rapidly motorization in Karachi, even if Blue Line will be constructed according to schedule. In case of necessity for urgent plan JST recommended temporary BRT operation along Blue Line route considering priority of public transportation.

General Comments

No	General Comments	JST Comment
1	Chingqui (three wheelers motorcycle Rickshaw) operations have been increased drastically in the last one year in the city of Karachi. Almost 50,000 Chingquis have been added into the city's network on about 67 locations, but the effects of them have not been incorporated in this study which may be a major sat back for the planning process in the years to come. As this service is progressing into leaps and bounds so some mitigation measures to deal with them shall be provided in the report such as: Chingqui service should be registered under motor vehicle registration department and route permit should be given to the operators by regional transport authority in order to bring them into the tax net. As right now they are not paying any sort of tax to the ex-chequer and they are operating illegally. Since this report targets the master plan for the year 2030, so till then this service would be a mess for the entire city. In order to channelize the service step wise methodology shall be provided in the report.	Qingqi rickshaw was very minor in the beginning of this study, but it has increased rapidly in the last one - two years. This mode provides short distance service. In developed countries, people use their bicycles for such short distance trip, but movement by private bicycle in Karachi is still risky. It is better to accept this local service because people need this kind of system.

2	Population projections that have been carried out in the study seem to be unrealistic in case of Karachi. The reason being a latest report published by 'National Sustainable Development Strategy' on the topic of 'Pathway to a sustainable Pakistan – May 2012' suggests that almost 60% of the population of Pakistan is below 30 years. This leads to the fact that all these people would get married in near future and would give birth to a new generation and hence the population would be significantly increased. Now comparing the trend of population increase in Karachi with Japan is unrealistic as the major chunk of population of Japan is above 60% and hence there are more chances of the fact that the increase would get stagnant by the year 2030, however in case of Karachi this approach could be unrealistic.	This issue has been discussed between JST and KMTC many times during the study period. JST explained the method of the population projection which was worked out by our experts from Yachiyo Engineering Co., LTD. Since the present population is also the estimation based on the last Census conducted in 1998, discussion on more accurate estimation of the future population will not contribute the planning. It is recommended that the future population should be reviewed after the new Census. We will insert the KMTC's comment into the report as a special remark.
3	Potential Non-fare revenue resources in the transport sector especially in the mass transit networks have also not been incorporated in the study which contributes majorly in the revenue generation of mass transit systems. Dubai Metro Rail claims that almost 40% of their revenues are being generated through non-fare revenues.	Non fare revenue (revenue from advertisement) was considered in the financial analysis in F/S. Non fare revenue cannot be the major revenue source of mass transit systems unless the transit development is done by a private company for the purpose of its real estate business.
	Following recommendations should be incorporated in the final report:	
1	Karachi Metropolitan Transport Authority (KMTA) should be implemented at the earliest to take care of the projects that are in consideration in the city of Karachi in totality. An Act has already been prepared by JICA legal experts in collaboration with Karachi Mass Transit Cell (KMTC). This exercise should be reflected in the report so that further progress in this direction would be streamlined.	The draft law was added as an appendix.
2	It is very important to mention that the Karachi Mass Transit Implementation Program should be executed within the next 5 years in order to achieve the real benefits of the study and to provide facilitations to the city commuters to meet their high travel demand. If the implementation would be delayed the study would lose its essence, and hence would be shelved as many previous studies.	It can be said that the implementation of KCR is one of the outcomes of the study. Although the master plan also includes some road projects, the most important project is the mass transit development. However, the JST estimated the necessary period for the project implementation at more than five years because of the financial arrangement and the necessity of establishment of proper institutional system. The Origin-destination matrix is useful information which is expected to be utilized in the transport planning in Karachi for next 10 years.
3	JICA funding for the implementation of 2 Mass Transit BRT Corridors should be geared up.	JST finalized the schedule considering the necessary actions for the loan arrangement. Although the investment cost of BRT is smaller than that of railway systems, the necessary time for the loan arrangement to a BRT project is as same as other projects.
4	A documented ticketing system in the existing buses should be developed in order to bring them into the tax net so that the government could earn some revenues from it which can be used for the investment purposes in transport sector.	This issue has not been raised during the study period. It is not practical to issue tickets to passengers in crowded minibuses. Description about the document ticketing system was added in Chapter 3, Volume I.