

Karachi Metropolitan Corporation
The Islamic Republic of Pakistan

**THE STUDY
FOR
KARACHI TRANSPORTATION IMPROVEMENT
PROJECT
IN
THE ISLAMIC REPUBLIC OF PAKISTAN**

**FINAL REPORT
VOLUME-1
(MASTER PLAN)**

DECEMBER 2012

JAPAN INTERNATIONAL COOPERATION AGENCY

**NIPPON KOEI CO., LTD.
YACHIYO ENGINEERING CO., LTD.
ORIENTAL CONSULTANTS CO., LTD.**

EID
JR (先)
12-150

Karachi Metropolitan Corporation
The Islamic Republic of Pakistan

**THE STUDY
FOR
KARACHI TRANSPORTATION IMPROVEMENT
PROJECT
IN
THE ISLAMIC REPUBLIC OF PAKISTAN**

**FINAL REPORT
VOLUME-1
(MASTER PLAN)**

DECEMBER 2012

JAPAN INTERNATIONAL COOPERATION AGENCY

**NIPPON KOEI CO., LTD.
YACHIYO ENGINEERING CO., LTD.
ORIENTAL CONSULTANTS CO., LTD.**

Exchange Rate

1 Pakistan Rupee (Rs.)	= 0.871 Japanese Yen (Yen)
1 Yen	= 1.148 Rs.
1 US dollar (US\$)	= 77.82 Yen
1 US\$	= 89.34 Rs.

Table of Contents

Executive Summary

Introduction

Chapter 1	Review of Policies, Development Plans, and Studies	1-1
1.1	Review of Urban Development Policies, Plans, Related Laws and Regulations	1-1
1.1.1	Previous Development Master Plans	1-1
1.1.2	Karachi Strategic Development Plan 2020	1-3
1.1.3	Urban Development Projects	1-6
1.1.4	Laws and Regulations on Urban Development	1-7
1.1.5	Laws and Regulations on Environmental Considerations	1-8
1.2	Review of Policies and Development Programs in Transport Sector	1-20
1.2.1	History of Transport Master Plan	1-20
1.2.2	Karachi Mass Transit Corridors	1-22
1.2.3	Policies in Transport Sector	1-28
1.2.4	Karachi Mega City Sustainable Development Project (ADB)	1-32
1.2.5	CNG Green Bus Project by TCD	1-33
1.2.6	Shaheed Benazir Bhutto CNG Bus Project	1-33
1.2.7	Karachi Circular Railway (KCR)	1-34
1.3	Review of Previous Transport Sector Studies	1-35
1.3.1	Private-Public partnership based environmental friendly public transport system for Karachi (2006)	1-35
1.3.2	Green Route Confirmatory Study for Karachi (2008)	1-36
1.3.3	Feasibility Study & Development of Transportation Control Plan of Karachi Metropolis (2007)	1-37
1.3.4	Pak-USAID Karachi Metropolitan ITS Project	1-37
1.3.5	Traffic Studies/ Surveys in Karachi by TCD	1-37
1.3.6	Person Trip Survey for Karachi City (2005)	1-39
1.3.7	The Study on Future Traffic Demand Forecast of Karachi City (2008)	1-39
1.4	Issues from the Review	1-39
1.4.1	Duplication of Mass Transit Corridors	1-39
1.4.2	Changes in Urban Condition along the Corridors	1-40
1.4.3	Failures Repeated for Priority Corridors	1-40
1.4.4	Disorganized Transport Strategy and Policy	1-40
1.4.5	Lack of Successful Transport Project	1-40
Chapter 2	Traffic Surveys	2-1
2.1	Traffic Surveys conducted in KTIP	2-1
2.2	Traffic Volume	2-2
2.2.1	Mid Block Traffic Count Survey	2-2
2.2.2	Cordon Line Survey	2-3
2.2.3	Screen Line Survey	2-4
2.3	Estimation of the Present OD matrix	2-6
2.3.1	Methodology	2-6
2.3.2	Expansion Factor	2-6
2.3.3	Visitors' Trips	2-7
2.3.4	Adjustment of OD matrix	2-8
2.4	Analysis of Survey Results	2-9
2.4.1	Socio-economic Characteristics	2-9
2.4.2	Trip Characteristics	2-11
2.4.3	Trip Distribution	2-16
2.4.4	Preference of LRT	2-18
Chapter 3	Analysis of Current Situation	3-1
3.1	Socio-economic Analysis	3-1

3.1.1	Population.....	3-1
3.1.2	Economic Situation.....	3-6
3.1.3	Car Ownership.....	3-8
3.1.4	Electric Power	3-10
3.2	Land Use.....	3-11
3.2.1	Land Use Survey	3-11
3.2.2	Current Situation of Land Use (2010)	3-13
3.2.3	Urbanization situation.....	3-22
3.3	Urban Transport Facilities	3-24
3.3.1	Roads	3-24
3.3.2	Public Transport	3-33
3.3.3	Inter-modal Transfer Facility.....	3-41
3.4	Institution, Organization, and Legal Analysis	3-42
3.4.1	Introduction	3-42
3.4.2	Existing Institutional, Governance and Legal Framework	3-42
3.4.3	Urban Transport and Mass Transit	3-47
3.4.4	Institutional Structures Proposed by the Previous Studies on Karachi Mass Transit Systems	3-49
3.4.5	Implementation of Mass Transit Development	3-51
3.4.6	Findings and Recommendations.....	3-53
3.5	Environmental Situation	3-57
3.6	Problem Identification of the Transport System in Karachi	3-58
3.6.1	Low Capacity of Bus Service	3-58
3.6.2	Improper Bus Route.....	3-58
3.6.3	Poor Road Network	3-58
3.6.4	Traffic Congestion.....	3-58
3.6.5	Demand-Supply Gap of Parking Space	3-58
3.6.6	Lack of Proper Traffic Enforcement.....	3-59
3.6.7	Complex Institutional and Organizational Structure	3-59
3.6.8	Absence of Proper Authority of Mass Transit System	3-59
3.6.9	Low Capacity of Power Supply	3-59
3.6.10	Structure of Problems	3-59
Chapter 4	Planning Frameworks	4-1
4.1	Introduction	4-1
4.1.1	Socio-economic frameworks	4-1
4.1.2	Future land use	4-1
4.1.3	Financial framework.....	4-1
4.2	Socio-economic Framework.....	4-2
4.2.1	Total Population in Karachi.....	4-2
4.2.2	Economically Active Population	4-4
4.2.3	Growth of GRDP in Karachi	4-8
4.2.4	Car Ownership.....	4-9
4.2.5	Number of Students	4-11
4.3	Land Use Plan.....	4-13
4.3.1	Basic Concept for Future Land Use	4-13
4.3.2	Future Land Use Planning	4-14
4.3.3	Land Use Plan in 2030.....	4-17
4.3.4	Distribution of Future Population.....	4-19
4.4	Financial Framework.....	4-24
4.4.1	Government Budget.....	4-24
4.4.2	Investment for Transport Sector in Karachi	4-31
4.4.3	Motor Vehicle Tax and Fee	4-33
4.4.4	Loan from International Aid Agencies	4-35
4.4.5	Available Budget Estimation.....	4-36
Chapter 5	Traffic Demand Forecast	5-1

5.1	Development of Models	5-1
5.1.1	General	5-1
5.1.2	Network Development.....	5-6
5.1.3	Model Description	5-9
5.1.4	Calibration of Models.....	5-13
5.2	Future Transport Demand Forecast	5-17
5.2.1	Future Zonal Attribute	5-17
5.2.2	Future Transport Network	5-19
5.2.3	Demand Forecast	5-20
Chapter 6	Urban Transport Development Policy.....	6-1
6.1	Mass Transit Development Scenario	6-1
6.1.1	“Do-Nothing” Scenario	6-1
6.1.2	“Road Development” Scenario.....	6-1
6.1.3	“Road Development + KCR” Scenario	6-3
6.1.4	“Do-Existing Plan” Scenario	6-3
6.1.5	Scenario by Network Type	6-4
6.1.6	Scenario by Marketing Segment.....	6-7
6.1.7	Conclusion of Scenario Analysis.....	6-8
6.2	Development Policies and Guidelines	6-9
6.2.1	Development Goals	6-9
6.2.2	Road Network Policies	6-12
6.2.3	Guideline of Road Development	6-13
6.2.4	Public Transport Policies.....	6-16
6.2.5	Guideline of Rail Base Transit	6-20
6.2.6	Guideline of Bus Rapid Transit (BRT).....	6-27
6.2.7	Traffic Management	6-29
6.2.8	Freight Transport Policies	6-30
6.3	Road Network.....	6-31
6.3.1	The 29 corridors	6-31
6.3.2	Ring Roads	6-32
6.3.3	Missing Links	6-32
6.3.4	Access roads to New Cities	6-32
6.3.5	Access Road to Pakistan Deep Water Container Port	6-32
6.3.6	Arterial Road Network in 2030	6-35
6.3.7	New Cities Roads Development.....	6-37
6.3.8	Access Roads Development to the Public Transport Stations.....	6-37
6.3.9	Access Ramp Development, Intersection Improvement and Overpass.....	6-37
6.4	Public Transport Network	6-39
6.4.1	Approach	6-39
6.4.2	Test Network	6-40
6.4.3	Full Network.....	6-46
6.4.4	Master Plan Network.....	6-50
6.4.5	Intermodal Facilities	6-55
Chapter 7	Urban Transport Master Plan.....	7-1
7.1	Project Identification	7-1
7.1.1	Road and Traffic Management	7-1
7.1.2	Public Transportation and Intermodal Facilities.....	7-2
7.2	Preliminary Cost Estimation.....	7-2
	To ensure fairness of procurement process as well as project implementation, information should not be disclosed for a fixed period.	
7.3	Project Prioritization.....	7-2
7.3.1	Intermediate Target Years	7-2
7.3.2	Road and Traffic Management	7-3
7.3.3	Public Transport System.....	7-4
	To ensure fairness of procurement process as well as project implementation, information	

	should not be disclosed for a fixed period.	
7.4	Implementation Plan of Short Term Project.....	7-5
7.4.1	Road and Traffic Management	7-5
7.4.2	Public Transport and Intermodal Facilities.....	7-12
Chapter 8	Implementation Framework for Mass Transit Development.....	8-1
8.1	Implementation Schemes of Operation & Maintenance.....	8-1
8.1.1	Alternative Operation & Maintenance (O&M) Schemes	8-1
8.1.2	Evaluation of O&M Schemes.....	8-6
8.1.3	Proposed O&M Scheme	8-9
8.2	Legal and Institutional Framework.....	8-12
8.2.1	Overview	8-12
8.2.2	Issues and Problems.....	8-13
8.2.3	Institutional Arrangements	8-14
8.2.4	Institutional requirements	8-14
8.2.5	Institutional Development Plan	8-15
8.2.6	Institutional Arrangements for the Implementation of Mass Transit System.....	8-19
8.2.7	Alternatives of Institutional Arrangement	8-20
Chapter 9	Priority Mass Transit Project.....	9-1
9.1	Selection of Priority Mass Transit Project.....	9-1
9.2	Economic and Financial Evaluation	9-1
	To ensure fairness of procurement process as well as project implementation, information should not be disclosed for a fixed period.	
9.3	Environmental and Social Considerations.....	9-1
9.3.1	Strategic Environmental Assessment (SEA)	9-1
9.3.2	Options of Corridors subject to SEA	9-2
9.3.3	Identification of Evaluation Parameters	9-2
9.3.4	Scoring System for Evaluation	9-3
9.3.5	Result of SEA	9-4
9.4	Selection of Feasibility Study Project	9-16
Chapter 10	Project List for Possible JICA Assistance	10-1
10.1	Type of Possible JICA Assistance for KUTMP 2030	10-1
10.1.1	Type of JICA Assistance	10-1
10.1.2	JICA Assistance in Pakistan	10-1
10.1.3	Proposed type of JICA Assistance for KUTMP 2030	10-1
10.2	Proposed List of JICA Assistance	10-2
10.2.1	ODA Loan	10-2
10.2.2	Technical Cooperation.....	10-2
10.2.3	Training	10-2
Appendix-1	Meetings	
Appendix-2	Capacity Building	
Appendix-3	UC Boundary Map	
Appendix-4	Traffic Survey	
Appendix-5	Environmental Considerations	
Appendix-6	Economical and Financial Cash Flow	
	To ensure fairness of procurement process as well as project implementation, information should not be disclosed for a fixed period.	

List of Tables

Table 1-1-1	Outline of Karachi Master Plans' History	1-2
Table 1-2-1	Main Condition in the past study	1-23
Table 1-2-2	History of BOT for Corridor-I.....	1-27
Table 1-3-1	Types of Surveys in Traffic Studies/ Surveys in Karachi	1-37

Table 2-1-1	List of Traffic Surveys (Person Trip Survey)	2-1
Table 2-1-2	List of Traffic Surveys (Supplementary Surveys)	2-1
Table 2-2-1	No. of Vehicles and Passengers Crossing Liary River per Day	2-4
Table 2-3-1	No. of Visitors (Both Directions)	2-7
Table 2-3-2	Modal Share of Feeder Transport at Station	2-7
Table 2-3-3	Modal Share of Feeder Transport at Airport.....	2-7
Table 2-4-1	Working Status by Gender.....	2-11
Table 2-4-2	Estimation of Driving License	2-11
Table 2-4-3	Trip Rate by Working Status	2-13
Table 2-4-4	Travel Mode by Working Status.....	2-14
Table 2-4-5	Percentage of Trip Purpose by Travel Mode (%)	2-15
Table 2-4-6	Percentage of Trip Purpose by Working Status (%)	2-15
Table 2-4-7	Logit Model of Motorcycle and Car against LRT	2-18
Table 3-1-1	Estimation of Population in Karachi City	3-1
Table 3-1-2	Projected Population in 2010 by UC	3-3
Table 3-1-3	Power Plants of KESC.....	3-10
Table 3-1-4	Power Sales by Demand Category (KESC: 2009-10)	3-10
Table 3-2-1	Land Use Categories.....	3-12
Table 3-2-2	Land Use by Categories (Class 1), 2010.....	3-13
Table 3-2-3	Land Use by Categories (Class 2) , 2010.....	3-13
Table 3-2-4	Major Land marks	3-21
Table 3-2-5	Urban sprawl area from 2005 to 2010	3-22
Table 3-3-1	Road Length by Road Category and Town.....	3-25
Table 3-3-2	Arterial Road Lengths.....	3-26
Table 3-3-3	Administrative Agency	3-29
Table 3-3-4	Multi Level Parking Facilities	3-31
Table 3-3-5	Off Street Parking	3-31
Table 3-3-6	Passenger Fare of PR in within Karachi (Unit: Rs.)	3-33
Table 3-3-7	Classified Routes and Number of Permits	3-34
Table 3-3-8	Average Travel Speed of Buses	3-35
Table 3-3-9	Fare Structure of Buses in Karachi	3-37
Table 3-3-10	No. of permits issued by DRTA, Karachi.....	3-37
Table 3-5-1	Vehicular Emission Monitoring & Awareness Activity in Karachi	3-57
Table 4-2-1	Annual Average Growth Rate (AAGR).....	4-3
Table 4-2-2	Projection of Economically Active Population in Karachi	4-7
Table 4-2-3	Comparison between KMP2020 and JICA Study Team.....	4-7
Table 4-2-4	Trends of GDP Growth(%), Pakistan	4-8
Table 4-2-5	Future Car / Motorcycle Ownership	4-9
Table 4-2-6	Number of School and Enrollment by SEMIS (2009-10).....	4-11
Table 4-2-7	Private Educational Institutions and Enrollment (2000).....	4-11
Table 4-2-8	Number of Students in Karachi	4-11
Table 4-2-9	Estimation of Enrollments in 2010	4-12
Table 4-2-10	Estimation of Enrollments in 2030	4-12
Table 4-3-1	Necessary Urbanization Area	4-15
Table 4-3-2	Standards of Population Density by Land Use Category.....	4-20
Table 4-3-3	Future Population by Town / Cantonment.....	4-21
Table 4-4-1	CDGK Budget at Glance 2010-11 (Receipts).....	4-24
Table 4-4-2	Summary of CDGK Budget (2010-2011).....	4-25
Table 4-4-3	CDGK Budget at Glance 2010-11 (Expenditure).....	4-25
Table 4-4-4	GOS Budget.....	4-26
Table 4-4-5	Federal Government Budget 2010-2011 Receipts	4-28
Table 4-4-6	Federal Government Budget 2010-11 Expenditure	4-29
Table 4-4-7	Work Completed (2004-09) by Work and Services Group, CDGK	4-31
Table 4-4-8	CDGK Sector-wise Progress of Development.....	4-31
Table 4-4-9	CDGK proposal works (2010-13).....	4-31
Table 4-4-10	Government of Sindh Transport Budget 2010-2011.....	4-32
Table 4-4-11	Release Position of T&C Sector Schemes pertaining to CDGK.....	4-32
Table 4-4-12	Federal Government Transport sector expenditure.....	4-32
Table 4-4-13	Details of Funds released for Karachi Package for the last FY	4-33
Table 4-4-14	Motor Vehicle Tax and Fee	4-34

Table 4-4-15	With-holding Tax for Vehicles	4-34
Table 4-4-16	Estimation of Available Budget for Mass Transit Development in Karachi	4-37
Table 5-1-1	Structure of Road Network Database	5-6
Table 5-1-2	QV Functioned by Type of Road.....	5-7
Table 5-1-3	Trip Rate by Trip Purpose	5-9
Table 5-1-4	Trip Production and Attraction Model.....	5-10
Table 5-1-5	Intra-zonal Distribution Model	5-10
Table 5-1-6	Inter-zonal Distribution Model	5-11
Table 5-1-7	Parameters for Modal Split Model - 1	5-12
Table 5-1-8	Parameters for Modal Split Model - 2	5-12
Table 5-1-9	Parameters for Modal Split Model - 3	5-13
Table 5-2-1	Socio-economic Indicators for Future Demand Forecast.....	5-17
Table 5-2-2	Estimated Trip Generation.....	5-20
Table 5-2-3	Number of Trips by Mode	5-25
Table 5-2-4	Difference of Modal Share between Networks in 2030.....	5-28
Table 5-2-5	Evaluation of Network Performance	5-29
Table 6-1-1	Comparison of Scenarios.....	6-5
Table 6-1-2	Comparison of Market Segment of Mass Transit	6-7
Table 6-2-1	Major Roads by Road Type	6-14
Table 6-2-2	Typical Condition of Each Road Item by Road Classification	6-14
Table 6-2-3	Comparison of Mass Transit Systems.....	6-18
Table 6-2-4	Design criteria concerning alignment	6-20
Table 6-2-5	Main station facilities	6-21
Table 6-2-6	Train Capacity	6-25
Table 6-2-7	Hourly Capacity of Railway	6-25
Table 6-2-8	Defining levels of BRT.....	6-27
Table 6-2-9	Measures of Traffic Management.....	6-29
Table 6-3-1	List of 29 Corridors	6-31
Table 6-3-2	Newly Defined Major Roads by Road Type.....	6-35
Table 6-3-3	Proposed Roads in the New Cities.....	6-37
Table 6-4-1	List of routes in Test Network	6-40
Table 6-4-2	Scoring Result.....	6-51
Table 6-4-3	List of Mass Transit Route in Master Plan	6-51
Table 6-4-4	Passenger Volume of Mass Transit in 2030	6-52
Table 6-4-5	Estimation of Power Consumption by MRT (2020).....	6-54
Table 7-4-1	Summary of Cost Estimation for Road Related Projects.....	7-5
Table 7-4-2(a)	Implementation Schedule	7-6
Table 7-4-2(b)	Implementation Schedule.....	7-7
Table 7-4-3(a)	Breakdown of Cost Estimation for Road Related Projects.....	7-8
Table 7-4-3(b)	Breakdown of Cost Estimation for Road Related Projects	7-9
Table 7-4-3(c)	Breakdown of Cost Estimation for Road Related Projects.....	7-10
Table 7-4-4	Measures for O&M Cost Estimations.....	7-11
Table 7-4-5	O&M Cost Estimation	7-11
Table 8-1-1	KMTA Tasks and Duties	8-1
Table 8-1-2	Type of Contract.....	8-3
Table 9-3-1	Basic Data of Evaluation Parameters for Project Impact.....	9-4
Table 9-3-2	Evaluation of Issues on SEA during Construction.....	9-5
Table 9-3-3	Evaluation of Issues on SEA During Construction.....	9-6
Table 9-3-4	Result of Interview Survey: Distribution of Respondents	9-7
Table 9-3-5	Result of Interview Survey: Use of Mass Transit System - Green Line	9-8
Table 9-3-6	Result of Interview Survey: Use of Mass Transit System - Brown Line	9-8
Table 9-3-7	Result of Interview Survey: Use of Mass Transit System - Red Line	9-8
Table 9-3-8	Result of Interview Survey: Use of Mass Transit System - Yellow Line	9-8
Table 9-3-9	Result of Interview Survey: Use of Mass Transit System - Blue Line	9-9
Table 9-3-10	Evaluation on the Natural and Social Environment.....	9-11
Table 9-3-11	Result of Key Informant Survey	9-12
Table 9-3-12	Preference of Transportation Mode	9-13
Table 9-3-13	Age Distribution of Participants	9-14
Table 9-3-14	Gender Distribution of Participants	9-14
Table 9-3-15	Distribution of Occupation	9-14

Table 9-3-16	Duration of Residence	9-14
Table 9-3-17	Participants' Opinion on the Development of KTIP and Their Income.....	9-15

List of Figures

Figure 1-1-1	Spatial Growth Strategy by Town	1-5
Figure 1-1-2	Proposed Land Use Plan, KSDP 2020.....	1-5
Figure 1-1-3	Location of Large-scale Urban Development Projects in Karachi	1-7
Figure 1-1-4	Land Holdings by Agency in Karachi	1-8
Figure 1-2-1	MRVP Plan, 1952.....	1-20
Figure 1-2-2	Routes of 6 corridors as per the Notification issues by Government of Pakistan in 1995.....	1-22
Figure 1-2-3	Karachi Mass Transit Corridors	1-23
Figure 1-2-4	Condition of LRT Corridor -1	1-25
Figure 1-2-5	Condition of LRT Corridor-2	1-26
Figure 1-2-6	Condition of LRT Corridor-5	1-26
Figure 1-2-7	Transit Routes in Transport Sector Report of KSDP 2020.....	1-31
Figure 1-2-8	Proposed 11 BRT Corridors in ADB Megacity Project	1-32
Figure 1-2-9	Location map of KCR	1-34
Figure 1-3-1	BRT Route Network.....	1-35
Figure 1-3-2	Traffic Volume of Public Transport Passengers.....	1-36
Figure 2-2-1	Daily Traffic at Mid Block Survey Locations	2-2
Figure 2-2-2	Composition of Vehicle Type by Survey Location	2-2
Figure 2-2-3	Hourly Traffic Volume.....	2-3
Figure 2-2-4	Traffic Volume at Cordon Line Survey Locations	2-3
Figure 2-2-5	Traffic Volume at 15 Survey Locations	2-4
Figure 2-2-6	No. of Passengers at 15 Survey Locations	2-5
Figure 2-2-7	Hourly Traffic Volume Crossing Lyari River	2-5
Figure 2-3-1	Flowchart of OD Matrix Estimation.....	2-6
Figure 2-4-1	Income distribution.....	2-10
Figure 2-4-2	Income Level by Town.....	2-10
Figure 2-4-3	Trip Rates by Gender	2-12
Figure 2-4-4	Trip Rate by Gender by Town.....	2-12
Figure 2-4-5	Trip Rate by Age Group by Gender	2-13
Figure 2-4-6	Trip Rate by Car Ownership.....	2-13
Figure 2-4-7	Modal Share	2-14
Figure 2-4-8	Average Trip Length (Right) and Time (Left) by Mode	2-16
Figure 2-4-9	Travel Time by UC.....	2-16
Figure 2-4-10	Traffic Assignment (Bus Passenger) on Capacity Unlimited Network	2-17
Figure 2-4-11	% Modal Shift of Car and Motorcycle Users to LRT.....	2-18
Figure 3-1-1	Census Population Trends of Major Five Cities in Pakistan	3-1
Figure 3-1-2	Population Distribution	3-2
Figure 3-1-3	Karachi, Historical Urbanization Trends.....	3-5
Figure 3-1-4	Growth Rate of GDP	3-6
Figure 3-1-5	Sectoral Share of GDP	3-6
Figure 3-1-6	Working Population Distribution	3-7
Figure 3-1-7	Car Ownership by UC	3-9
Figure 3-1-8	Motorcycle ownership by UC	3-9
Figure 3-2-1	Flow of the Land Use Analysis	3-11
Figure 3-2-2	Current Land Use Map (2010)	3-14
Figure 3-2-3	Residential Land Use (2010).....	3-16
Figure 3-2-4	Commercial Land Use (2010)	3-17
Figure 3-2-5	Industrial Land Use (2010).....	3-18
Figure 3-2-6	Percentage of Built up area; 2010.....	3-22

Figure 3-2-7	Spreading of Built up area; 2010.....	3-23
Figure 3-2-8	Urban sprawl area from 2005 to 2010.....	3-23
Figure 3-3-1	Trunk Road Network.....	3-24
Figure 3-3-2	Number of Lanes.....	3-27
Figure 3-3-3	Existing Traffic Signals.....	3-27
Figure 3-3-4	Existing Overpass and Underpasses.....	3-28
Figure 3-3-5	Existing Roundabouts.....	3-28
Figure 3-3-6	Tidal Flow System on the I.I Chundrigar Road.....	3-29
Figure 3-3-7	One-Way Roads in CBD.....	3-30
Figure 3-3-8	One-Way Roads in Landhi Town.....	3-30
Figure 3-3-9	Location of Off Street Parkings.....	3-32
Figure 3-3-10	Accident Black Spots.....	3-32
Figure 3-3-11	Scale Comparison between KCR and Yamanote-line, Tokyo.....	3-34
Figure 3-3-12	Brief History of Public Transport in Karachi.....	3-38
Figure 3-3-13	Bus Network in Karachi.....	3-39
Figure 3-3-14	Bus Route Type.....	3-40
Figure 3-3-15	Bus Frequency.....	3-41
Figure 3-6-1	Problem Structure of Transport Sector in Karachi.....	3-60
Figure 4-1-1	Planning Frameworks.....	4-1
Figure 4-1-2	Target Years for Planning.....	4-2
Figure 4-2-1	Estimation of Future Population after 2020.....	4-3
Figure 4-2-2	Population and Growth Ratio of Other Cities in the World.....	4-3
Figure 4-2-3	Population Pyramid of Karachi.....	4-5
Figure 4-2-4	Population by Age Groups in Pakistan.....	4-5
Figure 4-2-5	Labour Force Participation Rates (Both Sexes).....	4-6
Figure 4-2-6	Labour Force Participation Rates by Age and Sex.....	4-6
Figure 4-2-7	Car Ownership in Karachi from 1988 to 2010.....	4-9
Figure 4-2-8	Registered Number of Vehicles and Motorcycles.....	4-10
Figure 4-3-1	Schematic Urban Structures.....	4-13
Figure 4-3-2	Future Urban Structure, Karachi (2030).....	4-14
Figure 4-3-3	Urbanized Area (2010).....	4-15
Figure 4-3-4	Urbanization Area (2030).....	4-16
Figure 4-3-5	Future Land Use Plan, 2030.....	4-18
Figure 4-3-6	Spatial growth strategies from 2010 to 2030.....	4-19
Figure 4-3-7	Work flow for the estimation of population by UC.....	4-21
Figure 4-3-8	Future Population growth by Town / Cantonment (2010, 2020 2030).....	4-22
Figure 4-3-9	Population density by UC in 2010.....	4-23
Figure 4-3-10	Population density by UC in 2020.....	4-23
Figure 4-3-11	Population density by UC in 2030.....	4-23
Figure 4-4-1	CDGK Budget Receipts (Current Receipts and Capital Receipts).....	4-24
Figure 4-4-2	CDGK Budget Total Expenditure and Development Expenditure.....	4-26
Figure 4-4-3	GOS Budget Receipts (Current Receipts and Capital Receipts).....	4-27
Figure 4-4-4	CDGK Budget Total Expenditure and Development Expenditure.....	4-28
Figure 4-4-5	Federal Government Budget Revenues (Tax Revenues and Non-Tax Revenues).....	4-30
Figure 4-4-6	Federal Government Budget Total Expenditure and Development Expenditure.....	4-30
Figure 4-4-7	Collection of Motor Vehicle Tax and Registration Fee etc.....	4-35
Figure 4-4-8	Loan Disbursements of Foreign Economic Assistance for Pakistan.....	4-35
Figure 5-1-1	Model Development Approach.....	5-2
Figure 5-1-2	Traffic Analysis Zone.....	5-3
Figure 5-1-3	Existing Population Density by TAZ.....	5-4
Figure 5-1-4	Number of Workers at Resident and Working Place in 2010.....	5-5
Figure 5-1-5	Existing Road Network for Model Development.....	5-8
Figure 5-1-6	Modal Split Structure.....	5-11
Figure 5-1-7	Comparison of Travel Distribution by Motorcycle.....	5-14
Figure 5-1-8	Comparison of Travel Distribution by Car.....	5-15
Figure 5-1-9	Comparison of Travel Distribution by Bus.....	5-15
Figure 5-1-10	Calibration Result.....	5-16
Figure 5-2-1	Population Density by Traffic Analysis Zone.....	5-18
Figure 5-2-2	Full Network for Demand Forecast.....	5-19
Figure 5-2-3	Increase of Trip Production by Traffic Analysis Zone.....	5-21

Figure 5-2-4	Increase of Trip Attraction by Traffic Analysis Zone	5-22
Figure 5-2-5	Existing and Future Desired Line.....	5-24
Figure 5-2-6	Change of Modal Share	5-25
Figure 5-2-7	Trip Production by Mode and TAZ in 2030.....	5-26
Figure 5-2-8	Trip Attraction by Mode and TAZ in 2030	5-27
Figure 5-2-9	Traffic Volume Assigned for Full Network Case (2030).....	5-30
Figure 5-2-10	Traffic Volume Assigned for Highway Developed Case (2030).....	5-31
Figure 5-2-11	Traffic Volume Assigned for Do Nothing Case (2030)	5-32
Figure 5-2-12	Volume Capacity Ratio of Full Network Case (2030)	5-33
Figure 5-2-13	Volume Capacity Ratio of Highway Developed Case (2030).....	5-34
Figure 5-2-14	Volume Capacity Ratio of Do Nothing Case (2030).....	5-35
Figure 6-1-1	Do-Nothing Scenario (2030).....	6-2
Figure 6-1-2	Road Development Scenario (2030).....	6-2
Figure 6-1-3	“Road Development + KCR” Scenario (2030).....	6-3
Figure 6-1-4	Existing Mass Transit Plan.....	6-4
Figure 6-1-5	Conceptual Illustration of Mass Transit Scenario	6-5
Figure 6-1-6	Concept of Network Type	6-6
Figure 6-1-7	Willingness to pay for LRT (Bus and Rickshaw).....	6-8
Figure 6-2-1	Proposed Policy Structure for KUTMP.....	6-9
Figure 6-2-2	Population Growth by Town	6-10
Figure 6-2-3	Development Directions.....	6-11
Figure 6-2-4	Image of Road Type	6-13
Figure 6-2-5	Typical Road Item by Road Classification.....	6-15
Figure 6-2-6	Typical Road Cross-section by Road Classification.....	6-15
Figure 6-2-7	Concept of Urban Structure and Transport Corridor	6-17
Figure 6-2-8	Public Transport Corridors	6-17
Figure 6-2-9	Cross section of elevated station	6-22
Figure 6-2-10	Cross section of underground station	6-23
Figure 6-2-11	Proposed Gauge (Left: Rolling Stock Gauge, Right: Structure Gauge)	6-23
Figure 6-2-12	An example of seat arrangement for intermediate car.....	6-24
Figure 6-2-13	An example of seat arrangement for end car.....	6-24
Figure 6-2-14	An example of a train performance	6-26
Figure 6-2-15	General view of an end car.....	6-26
Figure 6-3-1	Location of 29 Corridors	6-33
Figure 6-3-2	Planned Four Ring Roads.....	6-33
Figure 6-3-3	Missing links	6-34
Figure 6-3-4	Access Roads to New Cities.....	6-34
Figure 6-3-5	Access Road to Pakistan Deep Water Container Port	6-36
Figure 6-3-6	Arterial Road Network in 2030	6-36
Figure 6-3-7	Location of Access Ramps and Intersections	6-38
Figure 6-4-1	Flowchart of Network Development	6-39
Figure 6-4-2	Test Network	6-41
Figure 6-4-3	Options of R-1 for Transfer to KCR.....	6-42
Figure 6-4-4	Alternatives of Connection with Tower – Guru Mandir.....	6-43
Figure 6-4-5	Alignment of R-4 (Shahrah-e-Faisal and KCR route).....	6-43
Figure 6-4-6	Connection of R-5 with KCR Station for CBD Access.....	6-44
Figure 6-4-7	Alignment of R-8 and R-9.....	6-45
Figure 6-4-8	Full Network	6-47
Figure 6-4-9	Route Alignment and Station Locations.....	6-49
Figure 6-4-10	Scoring for Rail System Selection.....	6-50
Figure 6-4-11	Master Plan Network.....	6-53
Figure 6-4-12	Volume to Capacity Ratio in 2030 (Master Plan)	6-53
Figure 6-4-13	Concept of Transfer Between Two Stations.....	6-55
Figure 7-3-1	Road Network in 2020	7-4
Figure 7-4-1	Annual Disbursement for Road Related Projects	7-11
Figure 7-4-2	Master Plan Schedule (Mass Transit Projects).....	7-12
Figure 7-4-3	Project Implementation Schedule – KCR.....	7-12
Figure 7-4-4	Project Implementation Schedule – Blue Line & Brown Line	7-13
Figure 7-4-5	Project Implementation Schedule –BRT	7-13
Figure 8-1-1	Maintenance Task Work Flow	8-4

Figure 8-1-2	Functional Organization Structure for O&M Maintenance Scheme	8-12
Figure 8-2-1	PPP Contractual Arrangements for Delivering Mass Transit Facilities	8-19
Figure 8-2-2	Conventional Project Financing Structure.....	8-19
Figure 8-2-3	Project Financing Structure for BRT.....	8-20
Figure 8-2-4	Project Financing Structure for Alternative-A	8-22
Figure 8-2-5	Proceeding ODA Loans.....	8-23
Figure 8-2-6	Organization of Karachi Mass Transit Corporation (KMTC)	8-23
Figure 8-2-7	Financial Structure of Alternative B.....	8-24

Abbreviations and Acronyms

AC	Alternating Current
ADB	Asian Development Bank
ADP	Annual Development Plan
BOOT	Build, Own, Operate, Transfer
BOT	Built, Operate and Transfer
BRT	Bus Rapid Transits
BTA	Bus Transit Agency
CBD.....	Central Business District
CBO(s)	Community-based organization(s)
CDGK.....	City District Government Karachi
CDWP	Central Development Working Party
CDWP	Central Development Working Party (of the Planning Commission)
CNG	Compressed Natural Gas
CL.....	Cordon Line
DC	Direct Current
DDWP	Department Development Working Party
EAD.....	Economic Assistance Division
ECNEC.....	Executive Committee of National Economic Council
EIA	Environmental Impact Assessment
EMP.....	Environmental Management Plan
EMU	Electric Multiple Unit
EPA/SEPA	Environmental Protection Agency /Sindh Environmental Protection Agency
GIS	Geographic Information System
GOP	Government of Pakistan
GOS	Government of Sindh
HIS	Household Interview Survey
IEE.....	Initial Environmental Examination
IES.....	Initial Environmental Study
IGBT.....	Insulated Gate Bipolar Transistor
JBIC.....	Japan Bank for International Cooperation
JETRO.....	Japan External Trade Organization
JICA	Japan International Cooperation Agency
JICA STRADA.....	(A software for demand forecast developed by JICA)
JV	Joint Venture
KCR.....	Karachi Circular Railway
KMT	Karachi Mass Transit
KMTA	Karachi Metropolitan Transport Authority
KMTC	Karachi Mass Transit Cell
KMTS.....	Karachi Mass Transit Study
KSDP.....	Karachi Strategic Development Plan 2020
KTC	Karachi Transport Corporation
KTIP	Karachi Transportation Improvement Project
KUTA.....	Karachi Urban Transport Authority

KUTC	Karachi Urban Transport Corporation
KUTMP	Karachi Urban Transport Master Plan
LRT	Light Rail Transit
MCA	Multiple Criteria Assessment
MOC	Ministry of Communications
MOF	Ministry of Finance
MPGO	Master Plan Group of Offices
MRG	Minimum Revenue Guarantee
MRT	Mass Rapid Transit
MRVP	MERZ RENDAL VETTON of Pakistan
NCCW	National Council for Conservation of Wildlife
NCS	The National Conservation Strategy
NEAP	National Environmental Action Plan
NEAP-SP	NEAP-Support Programme
NEQS	National Environmental Quality Standards
NGO(s)	Non-Governmental Organization(s)
NHA	National Highway Authority
NMT	Non Motorized Transport
NMTA	National Mass Transit Authority
O & M	Operation and Maintenance
OD (O/D)	Origin and Destination
PAPs	Project-Affected-Persons that appear within the framework of the Study
PAPs/APs	Project affected persons/Affected persons
PCO	Population Census Organization
PCU	Passenger Car Unit
PDWP	Provincial Development Working Party
PEAP	Pakistan Environmental Assessment Procedures
PEPA-1997	Pakistan Environmental Protection Act of 1997
PEPC	Pakistan Environmental Protection Council
PPP	Public Private Partnership
PSDP	Public Sector Development Program
RAP	Resettlement Action Plan
RFP	Request for Proposal
Rs.	Rupees
SAPROF	Special Assistance for Project Formation
SBCO	Sindh Building Control Ordinance
SC	Steering Committee
SL	Screen Line
SLGO	Sindh Local Government Ordinance
SOSE	the study on social environment carried out for the Project
STEP	Special Term for Economic Partnership
SUPARCO	Pakistan Space and Upper Atmosphere Research Commission
TC	Technical Committee
TMA	Town Municipal Administration
TOR	Terms of Reference
UC	Union Council
UNCHS	United Nations Centre for Human Settlements
UNDP	United Nations Development Programme
VOC	Vehicle Operating Cost
VGf	Viability Gap Funding
V/C	Volume to Capacity Ratio
WB	World Bank

The abbreviations, CDGK and KMC, used in this report are the name of the local governments of Karachi.
These two names were used in the reports because during the study period, the CDGK renamed to KMC, as per GOS Notification in this regard.

Acknowledgement

I would like to acknowledge the cooperation and support extended by Foreigners' Security Cell, Karachi police and Karachi Traffic Police. They continuously ensured the security of the JICA Study Team besides facilitating field works with sense of responsibility and commitment, resulting that during the study, no eventuality and untoward incident was reported for which all the law enforcement agencies deserve appreciations.

I also acknowledged the coordination and facilitation provided by all stakeholders including; Government of Pakistan, Government of Sindh, Karachi Port Trust (KPT), Port Qasim Authority (PQA), Civil Aviation Authority (CAA), Pakistan Railways, and departments of Karachi Municipal Corporation (KMC)/ City District Government of Karachi (CDGK) such as Master Plan Group of Office (MPGO), Transport and Communication (T&C), Water and Sanitation (W&S), etc. I would like to express my gratitude to the MPGO cooperation and assistance for the entire study period.

I also would like to acknowledge and appreciate all members of the Technical Committee and Joint Steering Committee, for their endeavors towards the needful suggestions and guidelines without which the study project could not be completed in the stipulated time frame. We also appreciate and recognize the efforts of KMTC Sr. Officers including his predecessors and staff who had delivered their duties with utmost dedication and commitment to ensure close association and coordination with the JICA Study Team with exemplary working relationship.

Minoru Shibuya

Team Leader, Karachi Transportation Improvement Project

INTRODUCTION

1. The Study

1.1 Background of the Project

Karachi City is the industrial and commercial hub of Pakistan. Its role in the national economy is pivotal. The current population is over 18 million growing at an annual rate of 4 % including natural growth and migration from the other provinces.

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 busway being 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 areas, 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 an 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.

Subsequently, ADB has also agreed for technical and financial assistant to implement first 3 BRT lines of 45 km under its first trench. However, this offer earlier was deferred due to some reservations regarding implementation / execution of the project. However, GOS has made another attempt to approach ADB for the deferment decision through Economic Affairs Div., GOP.

Meanwhile, Karachi Circular Railway, a rehabilitation project has also shown some progress towards its implementation. Japan International Corporation Agency (JICA) conducted a feasibility study for KCR project in 2008, and the financing by ODA loan to the project is under discussion between JICA and the GOP.

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.

1.2 JICA Preparatory Survey

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 (hereinafter referred as “the Study”) to Japan International Cooperation Agency (JICA). The Scope of Work of the Study was agreed between the Provincial Government of Sindh, City District Government of Karachi, and JICA on 7th October 2009. In this context, the Joint Venture of Nippon Koei Co., Ltd., Yachiyo Engineering Co., Ltd, and Oriental Consultants Co., Ltd. headed by Minoru Shibuya, have been selected as the Study Team of the project.

The Study has been commenced with a Preparatory Survey by Japanese ODA definition. The Joint Venture (JV) was employed by JICA, and the JV has mobilized the members from the middle of April according to the contract between the JV and JICA.

1.3 Objectives of the Study

As described in the Minutes of Discussion between GOP, GOS, CDGK, and JICA on 7th October 2009 (M/D), the objectives of the Study are:

1. Development of Karachi Urban Transport Master Plan (KUTMP) for year 2030
2. Demand based validation and screening of projects already identified by KSDP 2020 in transport sector.
3. Identification of additional projects in the light of KUTMP 2030
4. Demand based prioritization of projects identified under clauses 1 and 2 above.
5. Feasibility Study of a high priority project on mass rapid transit system based on outcomes of clause 4 above.

1.4 Structure of the Study

There are two committees constituted by the Government of Sindh for the implementation of the Study: The Joint Steering Committee and Technical Committee. The relationship among the JICA Study Team¹, Joint Steering Committee, Technical Committee, and JICA is shown in Figure 1.

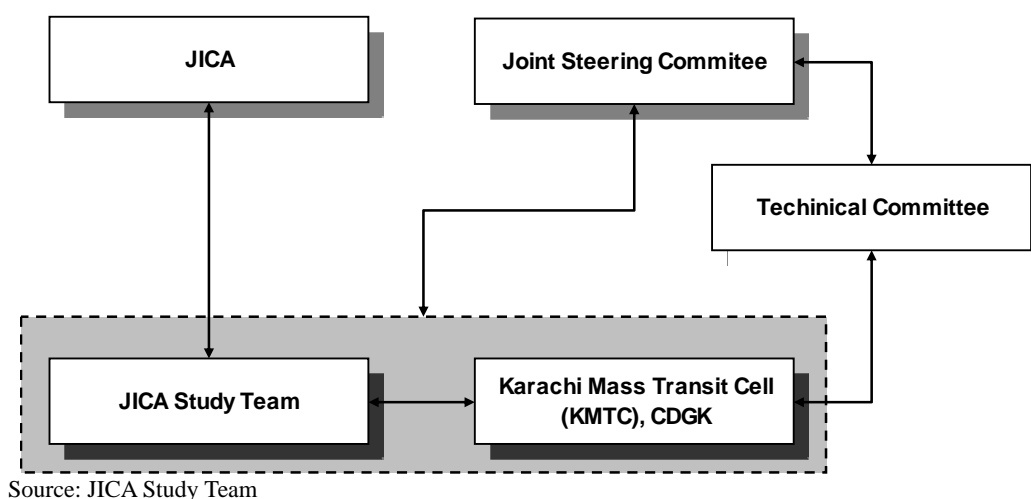


Figure 1 Study Organization

¹ the Joint Venture of Nippon Koei Co., Ltd., Yachiyo Engineering Co., Ltd, and Oriental Consultants Co., Ltd. headed by Minoru Shibuya

1.5 Scope of Works

The scope of works of the Study is described in ANNEX-2 of the M/D between GOP, GOS, CDGK, and JICA, on 7th October 2009. On the other hand, the consultant made the contract of the Study according to the Terms of References (TOR), which JICA prepared based on the said M/D. The scope of works of the Study was based on the M/D and TOR.

1.5.1 Master Plan Stage

The Scope of Works for Master Plan Stage consists of “Basic Study” and preparation of “Karachi Urban Transport Master Plan for Year 2030” as described in the M/D.

Item	Sub-Item
1 Review of policies, development plans and past studies	1.1 Review of urban development policies, plans, related laws and regulations 1.2 Review of policies and development program in transport sector 1.3 Review of previous transport sector studies 1.4 Problem identification
2 Traffic Survey	2.1 Household interview survey 2.2 Other traffic surveys 2.3 Analysis of survey result 2.4 Estimation of the present OD matrix
3 Analysis on Current Situation	3.1 Review of socio-economic and environmental situation 3.2 Review of current urban transport facilities 3.3 Analysis of current issues 3.4 Analysis of urban transport organizations 3.5 Land use survey
4 Formulation of Planning Framework	4.1 Formulation of socio-economic framework 4.2 Development of land-use plan 4.3 Formulation of financial framework
5 Traffic Demand Forecast	5.1 Modeling 5.2 Simulation
6 Urban Transport Development Policy	6.1 Urban transport scenarios 6.2 Development policies 6.3 Network alternatives 6.4 Future Network
7 Urban Transport Master Plan	7.1 Project identification 7.2 Preliminary cost estimates 7.3 Project Prioritization 7.4 Implementation plan of short-term project
8 Implementation Framework for Mass Transit Development	8.1 Financial policies for mass transit system 8.2 Legal and institutional framework
9 Priority Mass Transit Project	9.1 Selection of priority mass transit project 9.2 Economic and financial evaluation 9.3 Environmental consideration 9.4 Selection of feasibility study project
10 Project List for Possible JICA Assistance	

1.5.2 Feasibility Study Stage

The Scope of Works for Feasibility Stage consists of “Feasibility Study of Mass Transit Project, Conclusion and recommendations” as described in M/D.

Item	Sub-Item
1 Investigation of Site Situation	1.1 Collection of existing data of physical condition 1.2 Topography survey and geological survey 1.3 Utility Investigation
2 Study of design specification	2.1 Facilities required for railway system 2.2 Design specification of alignment
3 Route Plan	3.1 Comparison study of route 3.2 Location of stations 3.3 Preparation of drawings
4 Basic Plan	4.1 Transport plan 4.2 Rolling stock plan 4.3 Track bed, civil work structures and track 4.4 Stations and annex structures 4.5 Depot and workshop 4.6 Signaling, telecommunication, power supply and machinery
5 Implementation Plan	5.1 Confirming project scope 5.2 Cost estimate 5.3 Consideration of cost reduction 5.4 Preparation of implementation schedule 5.5 Procurement procedures 5.6 Study possibility of application to STEP
6 Project effects	6.1 Operation and effect indicators 6.2 Analysis of environment improvement effect 6.3 Confirmation of qualitative and quantitative effect 6.4 Implementation of economic and financial analysis
7 Environmental and Social Considerations	7.1 Overall Support for Preparation of Environment Impact Assessment(EIA)Report 7.2 Overall Support for Stakeholder Meeting 7.3 Overall Support for Preparation of Draft Resettlement Plan 7.4 Overall Support for Environmental and Social Advisory Committee
8 Establishment of Frameworks for Implementation, Operation, Maintenance and Management Organization	8.1 Clarification of implementation, operation, maintenance, and management organization 8.2 Support for legal and institutional system frameworks 8.3 Establishment of capacity development plan
9 Preparation of Finance Plan	9.1 Proposal of fund procurement plans 9.2 Estimates of costs for operation, maintenance, and management 9.3 Cash flow analysis
10 Preparation of Project Implementation Plan	10.1 Preparation of project implementation plan 10.2 Preparation of PC-I

2. Progress of the Study

2.1 Work Schedule

The Study began in the middle of April. The kick-off meeting was held on April 15, 2010 at the Committee Room of Planning & Development (P&D) Department of the Government of Sindh (GOS) and the Inception Report was handed over to Karachi Mass Transit Cell (KMTC), CDGK. The Inception Report was amended according to the discussion between the JICA Study Team and KMTC in the several meetings. The final Inception Report was submitted on May 11, 2010, and the first Technical Committee (TC) and the first Joint Steering Committee (JSC) were held on May 12 and May 31, 2010, respectively.

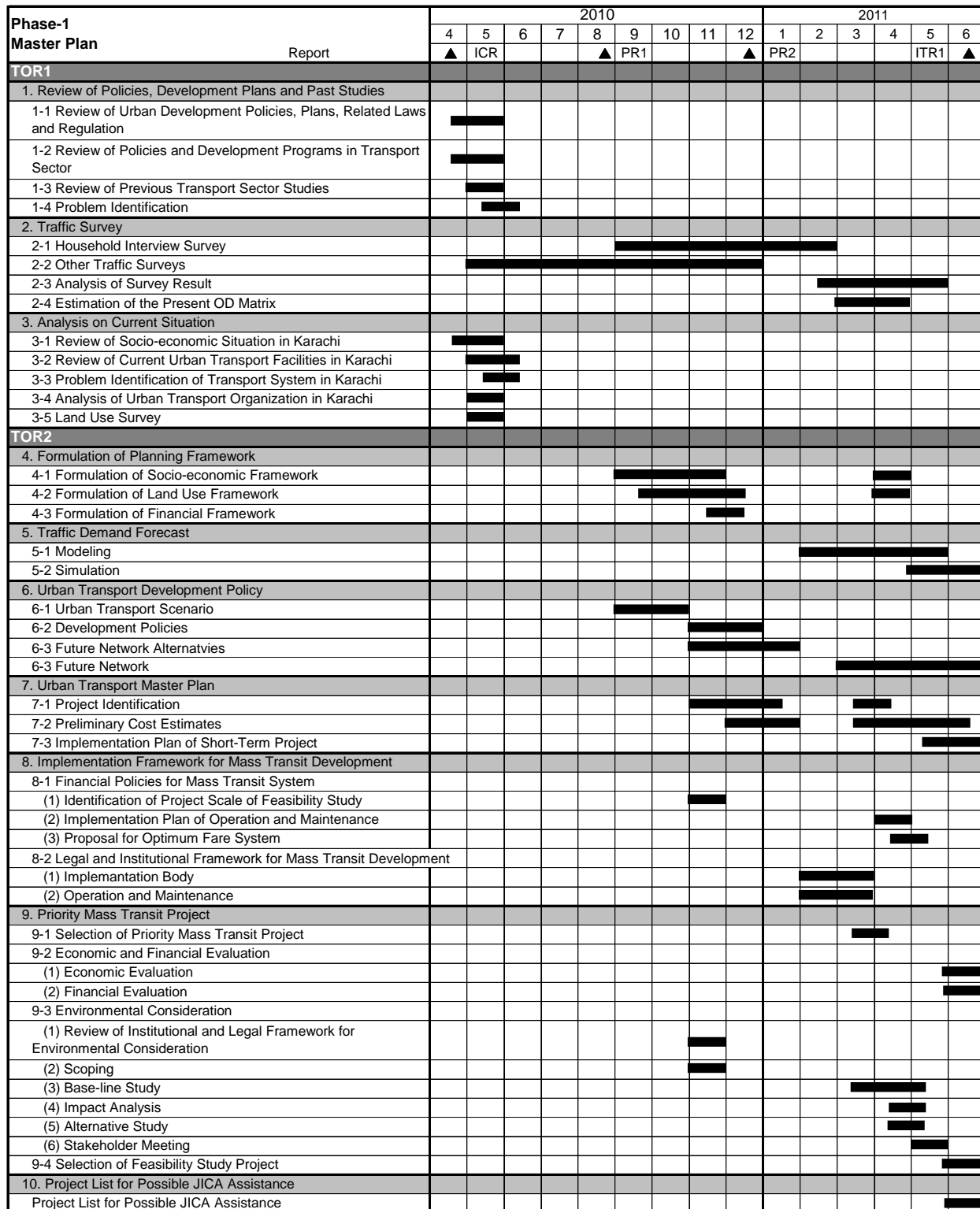
The work schedule has been revised several times from the Inception Report due to the changes of traffic survey schedule. The original schedule of the Household Interview Survey (HIS) was planned from the middle of September to the beginning of January (4 months) in the Inception Report, and all other surveys were scheduled in May 2010. There were so many interruptions of the traffic survey due to deteriorations of law and order situation. The target sample size of the household interview survey is 40,000 households, but the achievement of the sample collections is approximately 36,000 as of March 2010. The surveys in the restricted areas were not allowed, and the survey in Clifton Cantonment has been very difficult due to poor response from residents. Since summer vacation has started and Ramadan is scheduled in August, the rest of the HIS will be conducted in September 2011.

The work schedule has been delayed due to the traffic survey schedule. Considering the delay of the survey, the JICA Study Team began the demand forecast analysis with 36,000 household samples.

On the other hand, Progress Report-1 (PR-1) and Progress Report-2 (PR-2) were submitted as schedule in the middle of August 2010 and the end of December, respectively. The second TC and JSC were held to review the PR-1 on October 6 and 22, 2010, respectively, and the third committees for the PR-2 were held on February 2 and 8, 2011, respectively.

Interim Report-1 (1) was prepared based on the results of the work in the Master Plan Stage and submitted to KMTC on June 30, 2011.

Figure 2 shows the actual scheduled during the work period.



ICR: Inception Report, PR1: Progress Report-1, PR2: Progress Report-2, TIR1: Interim Report-1
 Source: JICA Study Team

Figure 2 Work Schedule

EXECUTIVE SUMMARY

This is the Final Report of the Study for Karachi Transportation Improvement Project (the Study), which was launched in the middle of April 2010 based on the agreement between the Government of Pakistan (GOP), the Government of Sindh (GOS), City District Government of Karachi (CDGK¹), and Japan International Cooperation Agency (JICA).

JICA appointed the Joint Venture of Nippon Koei Co., Ltd., Yachiyo Engineering Co., Ltd., and Oriental Consultants Co., Ltd as the JICA Study Team that was headed by Minoru Shibuya. Karachi Mass Transit Cell (KMTC), CDGK was the counterpart organization of the Study.

The Final Report consists of two volumes. Volume-1 includes the results of the efforts undertaken in the Master Plan Stage (April 2010 – June 2011) of the Study, while Volume-2 includes the work in the Feasibility Study Stage (June 2011 – April 2012).

Household Interview Survey (HIS) was one of the highlights of the Study that covers the interviews of 40,000 households in Karachi. It commenced on 5th Oct 2010, but was delayed due to deteriorating law and order situation in the city. In order to avoid critical delay of subsequence, the JICA Study Team started the analysis from April 2011 based on the data of 36,000 households, which was collected by the beginning of March 2011.

Karachi had a population of 18.9 million in 2010, and it is projected to reach 27.6 million in 2020 and 31.6 million in 2030. To accommodate the increasing population, suburban development in Gadap, Keamari, and Bin Qasim Towns has been proposed in the Study based on the Karachi Strategic Development Plan (KSDP) 2020. The growth in population and the expansion in urbanized areas will bring about a rapid increase in traffic demand in Karachi city.

Karachi Mass Transit Corridors, the existing plan notified by the GOP in 1995, will not be able to deal with the future traffic demands. The JICA Study Team has reviewed the corridors and the systems in previous plans and analyzed alternatives of corridors and systems. Along with this, the mass transit corridors for 9 major corridors and 2 circular routes were evaluated to formulate the master plan network.

The master plan network consists of Karachi Circular Railway (KCR), KCR extension to Bin Qasim, two Mass Rapid Transits (MRTs) named as Blue Line and Brown Line and seven Bus Rapid Transits (BRTs) along major corridors.

KCR is the priority project with a large scale of investment, and constructing another railway line with KCR is not practical, considering the budget constraint of the country. On the other hand, development of public transport system along corridors of radial directions is an urgent need for the urban development in Karachi. BRT corridors are proposed for radial directions in the master plan. Since the development of railway system takes time to be implemented, BRT system has been selected for the feasibility study project.

1. Review of Policies, Development Plans, and Studies

1.1 Review of Urban Development Policies, Plans, Related Laws and Regulations

KSDP 2020 is the official document of the urban development policies. To accommodate the future population, KSDP 2020 has formulated a growth strategy including the expansion of the

¹ CDGK was dissolved and replaced by Karachi Metropolitan Corporation (KMC) during the study period.

urbanized areas to a great extent. It envisaged that the city will expand beyond Northern Bypass, and new urban centers will be allocated in the suburban areas.

There are some urban development projects in the planning stage such as DHA City by DHA and Education City by GOS, although they are located approximately 40km from Central Business District (CBD).

1.2 Review of Policies and Development Programs in Transport Sector

Karachi Mass Transit Corridors (6 corridors) with KCR is the official plan notified by the GOP in 1995 as shown in Figure-1. There are some overlap sections between the corridors (3, 4, and 6) and KCR. Since KCR is now planned as a double-track urban rail, the overlap cannot be consistent anymore. The bidding for Corridor-1 (Priority Corridor) had been taken place four times, yet any of them resulted in failure. The GOS planned to carry out a feasibility study for Corridor-1 and 2 in 2010 for ADB financing, but the study was not conducted due to withdrawal of ADB from urban transport project in Karachi.

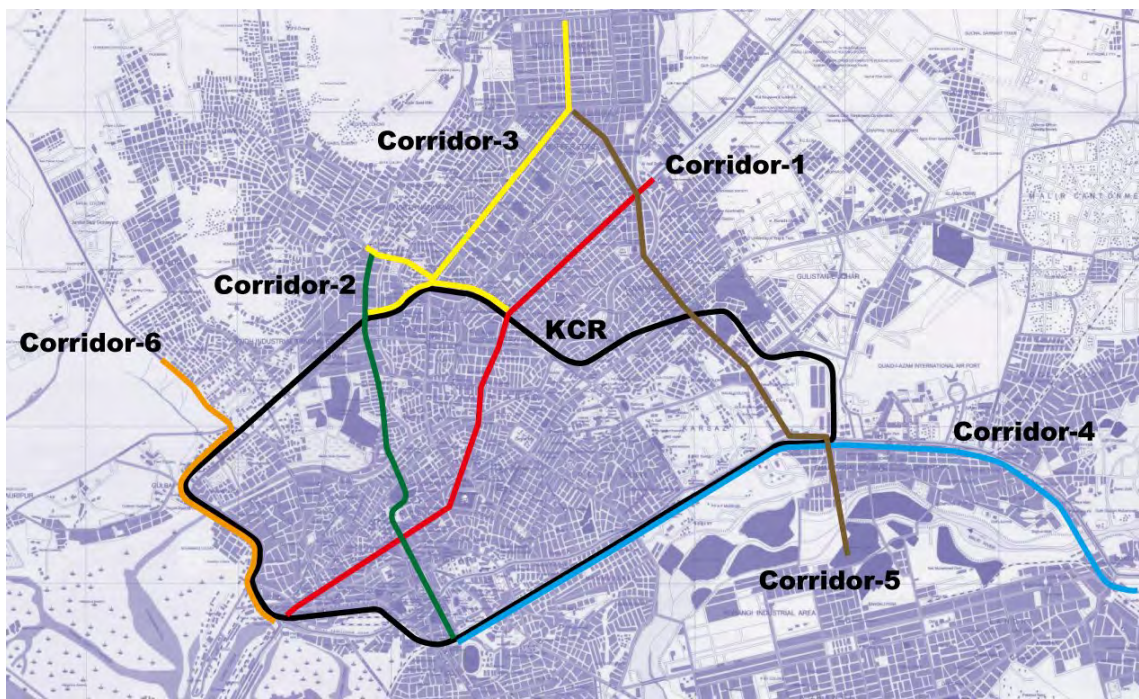


Figure-1: Mass Transit Corridors notified in 1995 (Illustration by JICA Study Team)

1.3 Review of Previous Transport Sector Studies

KMTC is engaged in the implementation of CNG Bus project based on “Private-Public Partnership based Environment Friendly Public Transport System for Karachi, 2006 (PPP Bus Study)”. The study proposed to use the right-of-way of KCR for BRT routes, while a BRT study by ADB and a CNG Bus study by CDGK were conducted in which transfer of KCR right-of-way was not proposed. The BRT project by ADB was a candidate project of the Mega city Project, but it failed due to lack of proper coordination between the GOS and CDGK.

1.4 Issues found from the Review

From the review of policies, plans, and studies, the following issues have been identified.

- Duplication of Corridors in the existing plan

- Changes in urban conditions along the Corridors
- Failures repeated for the Priority Corridor
- Lack of successful transport projects
- Rapid urban growth more than expected in studies and plans

2. Traffic Surveys

2.1 Person Trip (PT) Survey

Person Trip Survey was composed of Household Interview Survey (HIS), Screen Line Survey, and Cordon Line Survey. The target sample size of HIS was 40,000 households, and it was originally scheduled to begin in May 2010 but was rescheduled to 5th Oct 2010 to avoid summer vacation and the month of Ramadan. The survey has been interrupted frequently because of worsening law and order situation in the city. Consequently, the analysis was started with 36,000 households' data for the purpose of minimizing the delay of the entire schedule.

2.2 Key Findings of PT Survey

Some of the key findings of the PT Survey are:

1. Trip rate of female is very small.
2. The ratio of motorcycle in modal share is high.
3. The average time for a bus trip takes much time (49 minutes per one bus trip).
4. Trips in short distance are in majority (60% of trips are within the same town/ Walking accounts for 46%/ Trip distance of motorized trips is 7.7km in average).
5. The number of trips to the center of the city (Saddar), SITE industrial area, Korangi & Landhi industrial areas is very high.

2.3 Other Traffic Surveys

Other traffic surveys are composed of Mid Block Traffic Count Survey, Public Transport Survey, Travel Speed Survey, Passenger Interview Survey, and Road Inventory Survey. All those were used for the development of the traffic demand forecast model.

3. Analysis of Current Situation

3.1 Socio-economic Analysis

Population of Karachi in 2010 was estimated to be 18.9 million; while it was 11.3 million in the population census of 1998 (The annual growth rate has been 4.2%).

3.2 Land Use

The JICA Study Team conducted land use survey for year 2010 based on the land use data in 2006 that was prepared in KSDP 2020. The urbanized areas in the last five years were mainly found in Gadap Town, Bin-Qasim Town, and Clifton Cantonment.

3.3 Urban Transport Facilities

3.3.1 Road

The total road length in Karachi city is approximately 10,000 km. Local roads accounted for 93%, while the highways and arterial roads for less than 5%. There are three highways namely Super Highway (M-9), National Highway (N-5), and RCD highway (N-25), and six arterial roads: Korangi Road, Shahrah-e-Faisal Road, University Road, Shahrah-e-Pakistan Road, Chaudry Fazal Ellahi Road, and RCD Highway. Lyari Expressway was opened to traffic for north-to-south direction only.

3.3.2 Public Transport

Pakistan Railway plays an important role for inter-city transport, carrying 17,000 passengers per day with 15 trains (one round trip for each train), although most of these trains are usually not operated as scheduled. KCR was in service during 1969-1999, but currently it is not in operation. The revitalization project of KCR was approved by GOP on 3rd September 2009.

Bus (Minibus, Coach, and Large Bus) is the primary mode of public transport in Karachi, although the number of buses has been decreasing.

Rickshaw and Suzuki pickup are also popular transport modes in Karachi, which complement bus networks. Qingqi Rickshaws are mostly operated in local streets as a feeder service of the bus network and operation along main roads are restrained.

3.4 Institution, Organization, and Legal Analysis

Transport and Communication Department (TCD) and KMTC are planning and regulatory wings in CDGK, while Transport Department of the GOS is the planning and regulatory authority at the provincial level. Work & Service Department in CDGK is responsible for the construction. KMTC is responsible for planning and implementation of mass transit system, but regulation and permission are beyond its power. Regional Transport Authority (RTA) is the regulatory authority of public transport although the demarcation between Provincial RTA (PRTA) and District RTA (DRTA) is unclear.

3.5 Environmental Situation

Air pollution has worsened mainly due to transport related emission. It is considered that faulty vehicles, low-quality fuel, and traffic jam especially in CBD have contributed in increasing the pollution. Additionally, noise of vehicles cause a problem in residential areas.

3.6 Problems of Transport System

Poor public transport services, such as low capacity of bus service and improper bus routes, are the major problems of the transport system in Karachi. Traffic congestion caused by the increasing traffic demand is one of the reasons of the poor level of services, although it is also attributed to the complex institutional and organizational structure in transport sector. Lack of a proper authority of the mass transit system hinders the improvement and development of the transit system. Insufficient government's budget for transport sector underlies many problems of transport system in Karachi

4. Planning Frameworks

4.1 Socio-economic Framework

The population in Karachi has been estimated at 18.9 million in 2010 and 27.6 million in 2020. The JICA Study Team evaluated the estimation and concluded that the growth rate will gradually decrease, and the population in 2030 would reach 31.6 million.

4.2 Land Use Plan

The average population density in existing urbanized area is 238 persons/ha at present, which is relatively high as compared with other big cities in the world. In the Study, land use plan was prepared in order to meet population increase around 12.7 million within next 20 years, under the assumption that the population density will become 200 persons/ha in 2030 as a whole.

Figure-2 shows the future land use plan. Urban areas would expand from 79,567 ha at present to 158,000 ha in 2030. The population increase would be 4.5 million in Gadap Town, 2.1 million in Bin Qasim Town, and 1.5 million in Keamari Town. The allocation of urban functions has followed the KSDP 2020, locating urban sub-centers in the suburban area.

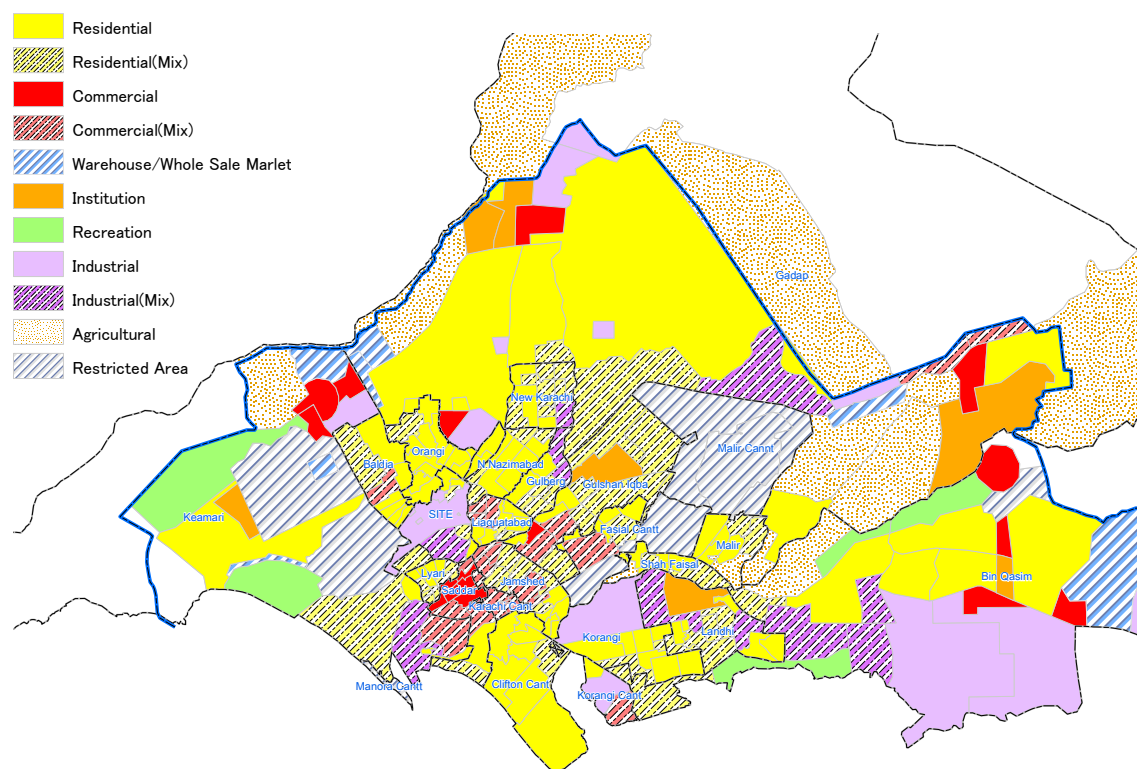


Figure-2 Future Land Use Plan 2030, (JICA Study Team)

4.3 Financial Framework

The possible amount of the investment cost on the transport sector in Karachi for the next 20 years was estimated at Rs. 310 billion, from the recent investment data of public sector.

5. Traffic Demand Forecast

5.1 Development of Models

Population data is the only available variable for the modeling of the traffic demand forecast in Karachi, although the population itself is an estimation based on old census data of 1998. The JICA Study Team estimated the number of employees at work place by UC and developed a model. The model applies the traditional four-step method. The person-base OD matrix was divided into car, motorcycle, and public mode and then the three OD matrices were assigned to the transport network to calculate traffic volume.

5.2 Result of Demand Forecast

The number of trips in 2020 and 2030 was estimated to become 1.46 and 1.67 times the present number of trips. Increase in the number of trips will be significant in Keamari Town, Bin Qasim Town, and Gadap Town and traffic on the major roads for these towns such as Hawksbay Road, Sharah-e-Faisal Road, Shahrah-e-Pakistan, Rashid Minhas would exceed the capacity.

6. Urban Transport Development Policy

6.1 Mass Transit Development Scenario

For the infrastructure development scenario, “Do-Nothing”, “Road Development”, and “Road and KCR Development” scenarios have been analyzed by the demand forecast model. The results of the analyses are summarized as:

Scenario	Evaluation
Do-Nothing	The volume to capacity ratio of most major roads would exceed the saturation level.
Road Development	This scenario would improve the traffic situation in suburban areas and some bottlenecks, while the congestion in the center of the city would still remain the same.
KCR Development	Traffic along KCR would be improved while the congestion for the radial directions would remain.

For the mass transit system scenario, “Existing plan”, “MRT (elevated and underground) only”, “LRT (elevated and surface) only”, and “BRT only” scenarios have been analyzed. The result of the evaluation is summarized as:

Scenario	Evaluation
Existing Plan	The network size is small for the present and future urbanization areas, and the capacity is not enough to deal with the future demand.
MRT (elevated & underground) only	The network density is small although it can provide high capacity service along its corridors.
LRT (elevated & surface) only	This can cover the major corridors but the cost-efficiency is very low because the capacity of surface LRT is similar to a full type BRT while the cost is much higher.
BRT only	Public transport service can be improved to a large extent, but road user will suffer from congestion because it is necessary to give road lanes to BRT system.

In conclusion, the combination of MRT (elevated & underground) and BRT was proposed for the mass transit network.

6.2 Development Policies and Guidelines

6.2.1 Transport Sector Development Policy

The followings are the transport sector development policy proposed in the Study.

- Support the urban development to formulate the future land use plan
- Enhance the corridors toward development directions
- Effective balance of between road and mass transit in the transport sector investment

6.2.2 Road Policy

The most important policy for road development is to support the urban development in the suburban areas. For this, priority is given to capacity expansion of Shakra-e-Faisal – National Highway 5, road construction between Keamari Town and the center of the city, and new road development in suburban areas.

In the urbanized area where road development is difficult, flyovers should be constructed, but the intersections along the public transport corridors should be reserved for future development of mass transit system.

6.2.3 Public Transport Policy

The future mass transit network should be formulated based on the KCR: radial direction routes will terminate at or intersect with KCR stations. Since the mass transit development for radial directions is difficult in the short-term, KCR should be fully utilized for the access to the center of the city.

The urbanized area in Karachi is expanding, and it will reach the range of 25km radius in the future. Mass transit system should be developed to the major corridors up to 15-20km, and the farther area should be covered with the feeder services.

6.2.4 Traffic Management

The stable operation of traffic signal is the basis of the proper traffic management, and uninterrupted electricity supply plays a very important role in this regard. With stable electricity supply, traffic signal system should be upgraded. Traffic management is important in Saddar area, and various measures such as relocation of illegal bus terminals, construction of parking facilities, removal of encroachments on roads, etc., are proposed in KSDP 2020. These proposed measures should be implemented in short-term period.

6.2.5 Freight Traffic

It is necessary to construct truck terminals in the suburban area and transfer a part of the warehouses and truck stands from the center of the city to the suburban area.

6.2.6 Intermodal facilities

Transfer between KCR and the radial direction corridors is important for the successful operation of KCR and reduction of congestion in the center of the city. Intermodal facilities should be well developed at Liaquatabad and North Nazimabad stations.

6.3 Future Network

6.3.1 Future Road Network

The road network in 2030 has been formulated based on the road network in 2020 that was proposed in KSDP 2020. Figure-3 shows the road network in 2030.

6.3.2 Future Public Transport Network

The future public transport network has been formulated by the following three steps: 1) preparation of a “test network” as the starting network that provides mass transit system to all corridors, 2) screening of the test network in view of engineering and social aspects to formulate the “full network” that satisfies the future demand, 3) screening of the full network considering budget constraints and priority to the “master plan” network.

Figure-4 shows the master plan network.

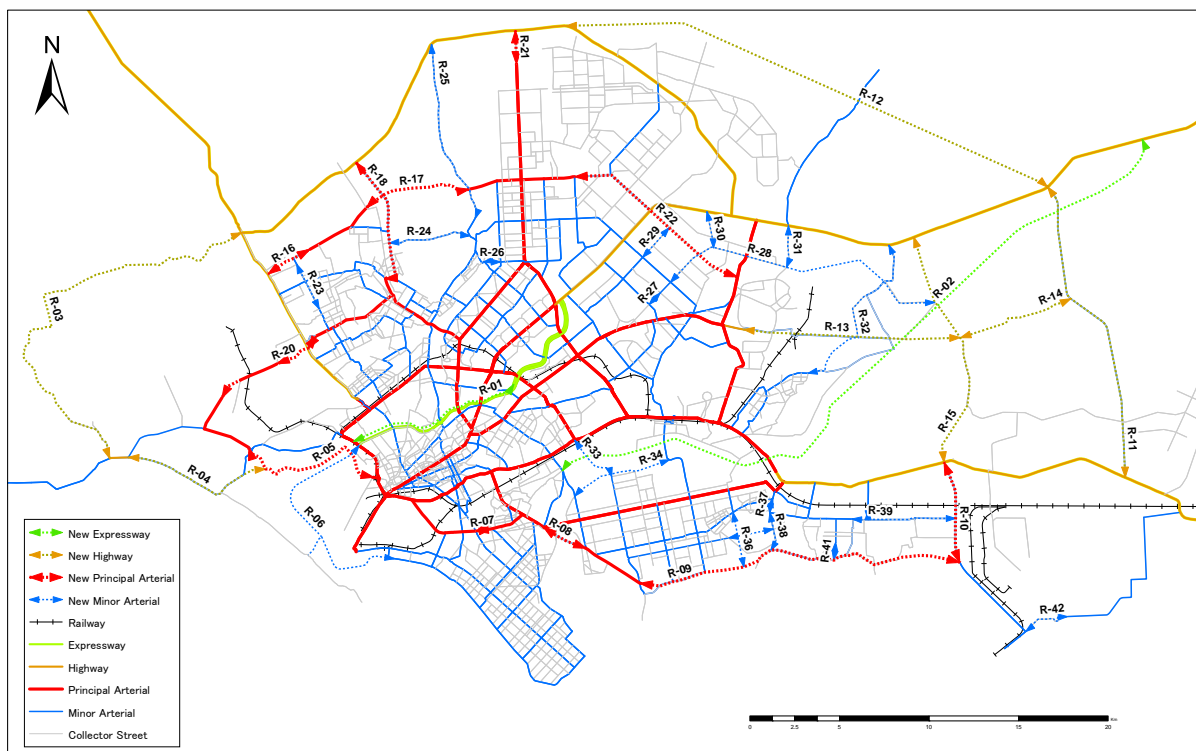


Figure-3 Future Road Network in 2030 (JICA Study Team)

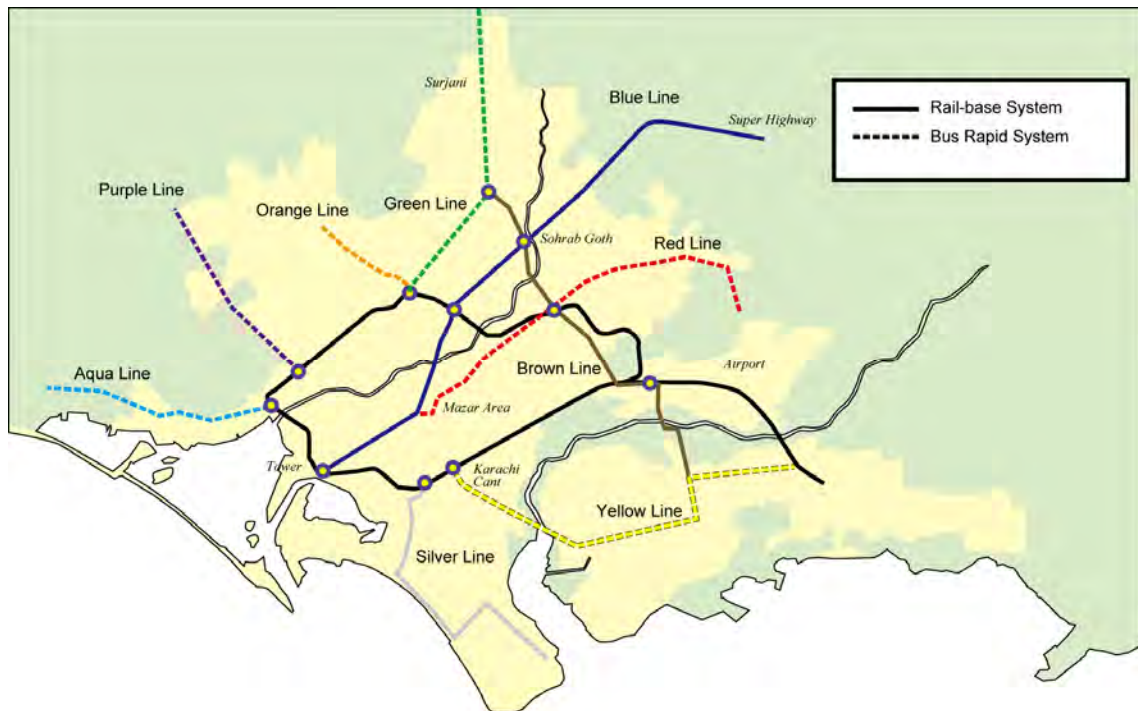


Figure-4 Master Plan Network (JICA Study Team)

7. Urban Transport Master Plan

7.1 Project Identification

For road projects, road construction of 740km consisting of expressway, highway, principal arterial road, arterial road, and major roads in the suburban areas has been identified. In addition, construction of flyovers at 53 locations, signalling at 53 locations, and construction or parking plazas (4 locations) and truck terminals (3 locations) have been also identified.

For the master plan projects of public transport, KCR, two MRTs (Blue Line and Brown Line), six BRTs, and bus modernization have also been identified.

7.2 Preliminary Cost Estimation

The cost of the master plan projects has been estimated using the unit costs collected from road projects in Karachi, MRT projects in other developing countries and the previous studies conducted in Karachi. The total cost of road projects was estimated at Rs. 171 billion in total, while that of mass transit system was estimated at Rs. 495 billion for rail-base system, and Rs. 25 billion for BRT system.

7.3 Implementation Plan of Short Term Project

Since mass transit development takes a time, “short-term” in this master plan means 10 years up to 2020. The major actions to be taken in this period are:

- Construction of KCR

- Approval of the master plan at the Provincial and the Federal level
- Establishment of the Project Management Unit in CDGK for BRT implementation
- Feasibility studies for Blue Line and Brown Line

8. Implementation Framework

8.1 Implementation Schemes of Operation & Maintenance

As far as the present situation concerned, the public sector or the government owned company cannot operate a mass transit system because of the inconsistent financial status, lack of governance and incapability for operation and maintenance of mass transit system. It is proposed to apply concession for the operation and maintenance on the net-cost basis (concessionaire will receive the fare revenue) for the mass transit system in the short term. On the other hand, gross-cost basis (concessionaire will receive the fee based on the performance) is proposed for the BRT network.

8.2 Fare Structure

The fare structure of mass transit system should be higher than that of existing minibuses in order to make the project financially stable. A fare level of Rs. 30-40 would be possible for rail-base system according to the willingness-to-pay survey conducted in the Study.

Since the fare structure is one of the key factors for the successful operation of mass transit system, political intervention should be avoided, and it should be decided in such a manner that the operator can continue the operation and maintenance smoothly.

8.3 Legal and Institutional Framework

The KCR revitalization and operation are given priority consideration while the establishment of efficient management unit in CDGK for BRT is also an immediate agenda. "Karachi Mass Transit Authority (KMTA)", should be established in order to implement the new policy objectives of CDGK and channel a long term investment of public and private agencies into Karachi mass transit project.

9. Priority Mass Transit Project

9.1 Selection of Priority Mass Transit Project

To formulate the master plan network from the full network (6.3.2), five railway routes were evaluated, and two railway routes (Blue Line and Brown Line) were selected for the master plan network. KCR has been given the highest priority because it can reach the center of the city without underground section, and the preparatory works including EIA are almost completed. Since traffic demand between the center of the city and Bin Qasim will become very high, the extension of KCR to Bin Qasim has been identified as the priority mass transit project.

9.2 Economic and Financial Evaluation

Economic Internal Rate of Return (EIRR) was calculated for the five railway projects in the full network: Green Line, Blue Line, Red Line, Brown Line, and Yellow Line. The result shows low EIRR for all routes. This means that further study is necessary for the railway development.

Green Line	Blue Line	Red Line	Brown Line	Yellow Line
11.8%	12.4%	10.9%	12.9%	10.0%

Financial viability of the railway projects is very small. This means that the railway system cannot be implemented in commercial base. The result of Financial Internal Rate of Return (FIRR) was calculated as:

Green Line	Blue Line	Red Line	Brown Line	Yellow Line
0.13%	0.73%	0.75%	2.33%	1.46%

9.3 Strategic Environmental Assessment (SEA)

SEA is one of the holistic methods for the decision making in infrastructure development, taking into account of environmental issues and stakeholders' opinion. The JICA Study Team conducted three stakeholder meetings, five interview surveys, and interview survey for 50 key informants. In addition, Initial Environmental Examination (IEE) was carried out for the five corridors.

9.4 Selection of Feasibility Study Project

BRT (Green Line and Red Line) has been selected for the feasibility study project because:

- JICA will support KCR by technical cooperation and soft loan. KCR is a large project for JICA and requires large scale resources including money and manpower. The scale of finance to two MRT projects is too large for Pakistan to implement them in parallel.
- Underground has been proposed for MRT, which increase the cost. MRT is difficult to be implemented in parallel with KCR.
- MRT (Blue Line and Brown Line) was not selected as the Short-term (2020) Mass Transit Network in the Master Plan.
- Among BRT routes in the Short-term (2020) network, Orange Line should be implemented after Green Line because it is considered as a branch line of Green Line. Regarding Yellow Line, KCR can provide the alternative service.
- From these conditions, BRT system along Green Line and Red Line was selected as the project of the Feasibility Study.

10. Project List for Possible JICA Assistance

Economic growth is one of the important aspects of the master plan. In addition to mass transit development, assistance to the road network improvement in the industrial area is proposed so that the city can attract more investment. Technical cooperation for the capacity development to establish a transit authority is also proposed for better results.

Chapter 1 Review of Policies, Development Plans, and Studies

1.1 Review of Urban Development Policies, Plans, Related Laws and Regulations

1.1.1 Previous Development Master Plans

Various master plans for urban development of Karachi were formulated since 1952 to serve as guiding documents and provided framework for the urban growth in accordance with the requirements by the local government for times to come.

Major ones are;

- 1) MRVP Plan, 1952
- 2) Greater Karachi Resettlement Plan, 1958
- 3) Karachi Development Plan 1974-85
- 4) Karachi Development Plan 2000, 1990
- 5) Karachi Strategic Development Plan 2020, 2007

An outline of the history of Karachi master plans in Karachi is summarized in Table 1-1-1. Although the appropriate master plans were established in the each stage, the master plans were not fully realized for various reasons. The following issues can be pointed out as problem areas in conclusion, despite the fact, the plans were prepared with strong analytical base.

- Difficulties in management/control of huge and continuous in migration of people into Karachi City from outer regions.
- Lack of provision of housings to cope with the demands dwelling units for various income level.
- Inadequate provision in job opportunities for the residents.
- Inability to provide necessary infrastructures and social services for rapid urban growth.
- Insufficient institutional and financial structures for management and implementation of urban development plans/projects.
- Lack of control in geographical conditions for urban sprawl.

Table 1-1-1 Outline of Karachi Master Plans' History

Year	President/Prime Minister	Population (AAGR to previous census)	Name of Master Plan	Major Topics
1941		435,887		
1951		1,068,459		
1952	Iskander Mirza	(9.4%)	MRV Plan (by Swedish firm)	<ul style="list-style-type: none"> - The First master plan for Karachi, not implemented * Federal secretariat, legislative buildings and a university around a large independence square to the north-east. * Residential flats for refugee along Lyari corridor * Railway system was proposed as mass transit
1953				
1954				
1955				
1956				
1957				
1958	Ayub Khan	Capital was shifted from Karachi to Rawalpindi	Greater Karachi Resettlement Plan (by Doxiades)	<ul style="list-style-type: none"> - Two satellite towns were planned about 25km from the center in order to resettle increasing migrants together with their job opportunities. * Landhi-Korangi to the east & New Karachi to the north * Industrialisation was too slow and housing scheme ended in failure * Programme was abandoned by 1964. * Basic urban structure of the central area was formulated in 1960's.
1959				
1960				
1961				
1962				
1963				
1964				
1965				
1966				
1967				
1968	Zulfikar Ali Bhutto		Karachi Development Plan 1974-85 (by assistance of UNDP)	<ul style="list-style-type: none"> - Plan itself is a landmark in the planning history of Karachi * Rational road network, housing, water supply, transport terminals & warehouses, land management, mass transit and ecological issues. * Only road networks were built in a substandard manner. * Housing programme for low income group over 230thousand sites were too ambitious and not systematically managed, and then failed. * Other components of the plan could not be implemented and nor could the institutional arrangements (KDA) developed for management. * Bhutto Government promoted high rise buildings with subsidy/financing system, and Karachi's skyline had changed. * During 1987-97 decade frequent institutional experiments were carried out such as KMC and KDA.
1969				
1970				
1971				
1972				
1973				
1974				
1975				
1976				
1977				
1978				
1979				
1980	Zia ul-Haq			
1981				
1982				
1983				
1984				
1986				
1987				
1988				
1989				
1990				
1991				
1992				
1993				
1994				
1995				
1996				
1997				
1998				
1999				
2000	Pervez Musharraf			
2001				
2002				
2003				
2004				
2005				
2006				
2007	Asif Ali Zardari		Karachi Strategic Development Plan - 2020 (KSDP 2020)	Details are explained in Chapter 1.1.3
2008				
2009				
2010				
		16-18million		

Source: JICA Study Team

1.1.2 Karachi Strategic Development Plan 2020

Karachi Strategic Development Plan (KSDP) 2020 was formulated in 2007 as the official development plan of the City District Government of Karachi (CDGK). This is the first ever approved development plan which has now a legal status under Section 40 of the Sindh Local Government Ordinance 2001 in contrast to the previous master plans.

The contents of KSDP 2020 consist of following 7 chapters and they are summarized as follows:

(1) Introduction/Outline

1) Coverage of the Plan

Whole City District of Karachi, consisting of 18 Towns, 6 cantonments, and Federal and provincial governments land-holding agencies; approximately 3,600 sq.km, of which 1,300 sq.km is urbanized (built-up) area.

2) Critical Issues in Land Planning and Municipal Control

The land planning and municipal control is fragmented into about twenty agencies, such as 6 Cantonment Boards, Karachi Port Trust, Port Qasim Authority, Defence Housing Authority, Pakistan Steel, Pakistan Railways, Export Processing Zone, Sindh Industrial Trading Estate, Government Sindh, City District Government Karachi, Lyari Development Authority, Malir Development Authority, cooperative housing societies and private owners, with overlapping powers/functions and utter lack of coordination. The share of CDGK is only 31% of the total area.

3) Vision for Karachi

“Transforming Karachi into a world class city, an attractive economic center with a decent life for Karachiites”

4) Plan Objectives

In order to achieve the vision, the Plan consists not only of physical renewal plans but equally invoking the spirit and commitment of both leaders and citizens to realize a more prosperous, secure and sustainable future.

- A) Finding out Karachi’s advantages/potential for future development
- B) Promoting a holistic vision towards sustainable growth
- C) Identifying and addressing key issues in social, economic, environment and urban infrastructure sectors
- D) Setting out strategic framework against the backdrop of current conditions
- E) Framing the development plans and programs
- F) Putting in place an effective, collaborative institutional arrangement with participation of all stakeholders

5) Status and Role

KSDP 2020 has a legal status under SLGO for guiding city’s growth in a planned and coordinated manner, and is mandatory for all agencies, stakeholders to follow the plan.

6) Time Span of the Plan

The operational time span for the plan extends to the year 2020 within the scope of Pakistan’s Vision 2030. The plan will be further extended to 2030 to cover the city’s region that includes part of surrounding districts of Thatta, Jamshoro and Lasbella.

(2) Summary of Land Use Plan, KSDP 2020

Major points of land use plan/strategy are:

“The spatial needs for commerce, industry, housing and infrastructure development to cope with future population growth (15.2 million in 2005 to 27.6 million in 2020; 4% of AAGR) will be provided through a set of policies and programs, as follows”

1) Spatial Growth Strategy (Basic)

- 1) Densification: Saddar, Jamshed, North Nazimabad, Gulberg, SITE and Shah Faisal Towns
- 2) Densification and Infill: Gulshan-e-Iqbal, Landhi, Korangi, New Karachi Towns, DHA and Cantonments
- 3) Infill and Expansion: Baldia, Malir, Orangi and Gadap Towns
- 4) Status Quo: Lyari and Liaquatabad Towns

This strategy is illustrated in Figure 1-1-1.

2) Various Land development policies and Strategies

In addition to the basic strategy (spatial growth), following several individual land development policies/strategies were considered and proposed in the plan.

- Regeneration of the Inner City
- Promotion of Mixed Use Development
- Permit and Guide Vertical Development and Densification
- Enable Densification and Vertical Development of Existing Residential Areas
- Development of New Urban Centers
- Policy for Urban Renewal
- Integration of Civil Areas of Cantonment and other Land-Owning Agencies
- Incorporation of Existing Goths into the Urban Fabric
- Development of Industrial Zones
- Decentralization of financial districts
- Additional site for international airport
- Special Purpose Zone along Northern bye-pass
- Development of Education city
- Additional spaces for graveyards and landfill sites for garbage

In addition to the above, some large-scale new town development schemes have been launched to be developed outside of the urbanized area of KSDP.

- DHA City, Karachi
- Zulfikarabad City Town

3) Karachi Land Use Plan 2020 (KSDP)

The following land use plan (Figure 1-1-2) is proposed as a final result of KSDP 2020, integrating various land use policies and strategies.

This is the overall land/urban development target of Karachi in future, and all the relevant urban development should follow this principle guideline.

1.1.3 Urban Development Projects

(1) DHA City Karachi (DCK)

DHA City Karachi (DCK), located on Super Highway, is a new town project with an area of as large as 11,640 acres (47.1 km²) launched by DHA¹ Karachi. The master plan of the project has been prepared recently, and construction of the new town is expected to start in 2012. The target year of full development is 2030. The new town is divided into 16 sectors in the master plan. Residential and commercial areas are major land use type for the project. DCK is planned to accommodate 600,000 residents.

The location of DCK is as far as 40-50km north-east from the city center of Karachi.

(2) Education City

The Education City is a proposed urban development project of the Government of Sindh for educational institutions, and the area of approximately 9,000 acres (36.4km²) just in the west of DHA City Karachi has been legally notified as Education City.

The location of Education City is as far as 40km from the center of Karachi.

(3) Karachi Waterfront Development

The beach of Clifton Cantonment stretches approximately 14km long along the outskirts of DHA Phase VIII, where many plots remain empty and the population is still small. The beach is divided into 7 zones from A to G in a master plan for the beach development by DHA. Commercial, residential and recreational areas are proposed in the plan.

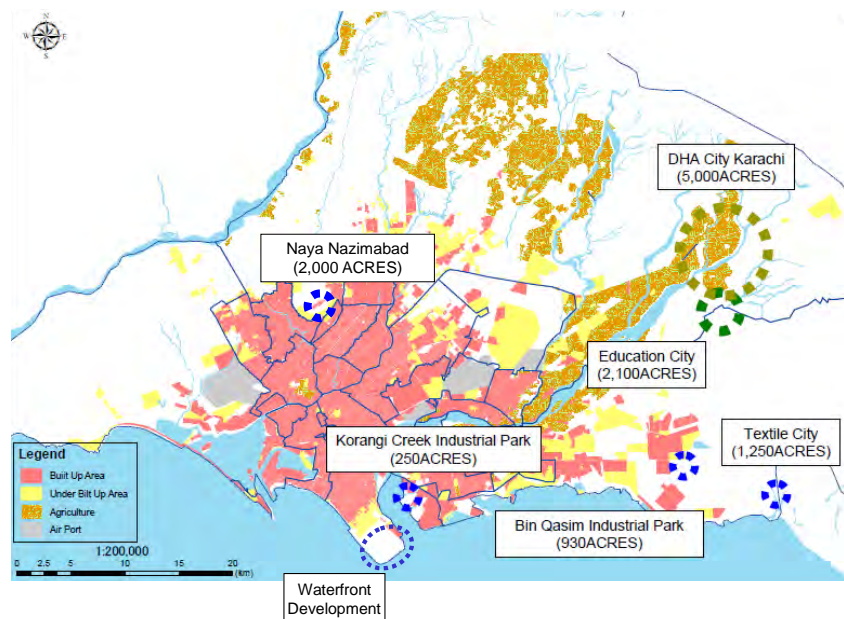
(4) Naya Nazimabad Scheme

Naya Nazimabad Scheme is a large scale housing project by a business group. The project site is located in Gadap Town near North Nazimabad and New Karachi with the total area of 2,000 acres (8.1km²). Presently, Javedan Cement plant is located in the site. The expected population is 300,000.

(5) Zulfikara bad

Government of Sindh intends to develop a new city, by the name of Zulfikarabad in coastal belt of the district Thatta. The area stretches across four Tulukas (administrative unit under district), namely Ketu Bunder, Khari Chhan, Shah Bunder and Jati. Zulfikarabad is located on approximately 150km east from Karachi. Zulfikarabad Development Authority (ZDA) has been established by GOS in 2010. ZDA has assigned the task of managing and developing the new city to Sindh Land Management & Development Company (SLM&DC). Consultants have been appointed to draw up a master plan for this new city area, consisting of 13.3 million acres, compared to Karachi's total area of 871,537 acres.

¹ Defense Housing Authority



Source: KTIP based on information from CDGK

Figure 1-1-3 Location of Large-scale Urban Development Projects in Karachi

1.1.4 Laws and Regulations on Urban Development

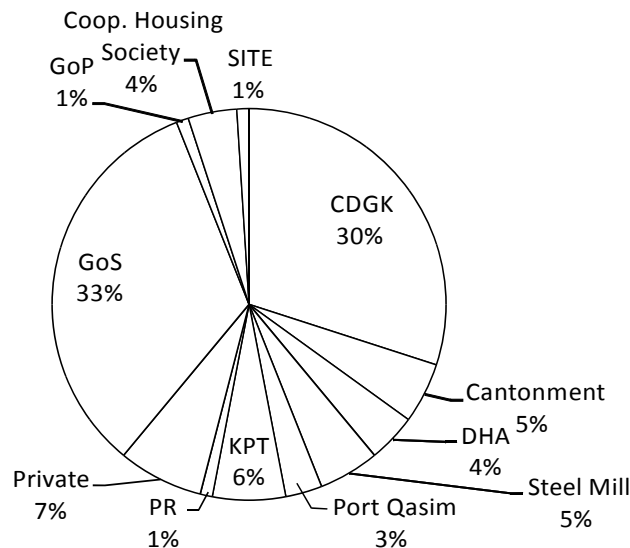
(1) Karachi Building & Town Planning Regulations 2002

This is the fundamental regulation for 'Building & Town Planning' for the whole City District of Karachi, except for the cantonment areas and the projects of National Security declared by the Federal Government, which supersedes '*Karachi Building and Town Planning Regulations-1979*'.

Eight (8) public agencies are individually designated as 'Concerned Authorities for respective areas and purposes', following City District Government Karachi (CDGK), such as:

- Cantonment Boards of the Ministry of Defense
- Karachi Port Trust (KPT)
- Pakistan Railways (PR)
- Ministry of Works, Government of Pakistan (GOP)
- Sindh Industrial Trading Estates, Karachi (SITE)
- Sindh Katchi Abadies Authority
- Board of Revenue

For reference, there are many agencies holding lands in Karachi and no dominant ones. An outline of existing condition of land holdings in Karachi is illustrated as follows.



Source: KMP 2020

Figure 1-1-4 Land Holdings by Agency in Karachi

(2) Regulations in Sindh Province

Sindh Government also has some regulations for building control:

- 1) Buildings Control Ordinance, 1979
- 2) Karachi Building Control Licensing Regulations, 1982
- 3) Sindh Regulation and Control (Use of Plots & Construction of Buildings) Ordinance, 2002

Karachi Building Control Authority is established under these ordinances, in order to implement and enforce the above regulations.

In addition, an Architects' Committee on Development of High Density Zones in Karachi was constituted in January 2009 which discussed various ideas of urban development projects. It included prominent architects and several key officials of CDGK, etc.

(3) Amendments in the Karachi Building & Town Planning Regulations, 2002

The above-mentioned regulations have been quite frequently amended as needs arose, since its commencement, especially among the detailed provisions.

1.1.5 Laws and Regulations on Environmental Considerations

(1) Environmental Framework

1) National Environmental Policy of 2005

In the Section 5.1 of the National Environmental Policy of 2005 states as follows:

- a) *Environmental concerns would be integrated into sectoral policies and plans;*
- b) *Environmental impact assessment related to the provisions of Pakistan Environment Act of 1997 would be diligently enforced for all development projects;*
- c) *Environmental Protection Agencies/Departments would be made of Provincial Departmental Working Committees;*
- d) *Strategic Environmental Assessment would be promoted as a tool for integrating environment into decision-making; and*

- e) *Environmental and natural resource accounting would be integrated in the national accounting system.*

2) National Climate Change: Strategy and Action Plan 2011-2015

In the Action Plan for Transport Sector, the following is noted:

Road transport sector has shown the highest emission growth rate of all sectors in Pakistan. To counter this, railway system needs to be developed to be fast and efficient in carrying cargo and passengers with least amount of carbon emissions.

Thus the strategy to achieve the goal of developing efficient railway system and its network, the Action Plan lists up the following strategy:

- a) *Assess the amount of cargo and passengers that have been shifted to road transport in the country during the last ten years and develop the strategy to change this trend;*
- b) *Develop a railway efficiency plan to improve the quality of service for systematic shift of cargo and passengers back from road to rail transport;*
- c) *Arrange sufficient financial resources for purchase of new train engines and cabins to make rail journey efficient and comfortable;*
- d) *Identify fuel-efficient engines for trains;*
- e) *Build infrastructure to improve the quality of train services;*
- f) *Identify new routes and build rail lines connecting areas that area not easily accessible; and*
- g) *Build railway lines parallel to roads to reduce the cargo load and emission control [on the road].*

3) Karachi Strategic Development Plan (KSDP) 2020

i. Current State of Environment

In the Section 2.15 of KSDP 2020, current state of environment is described briefly as follows:

- 1) *Karachi's environmental problems are more intense and uncontrollable in poor areas, such as katchi abadis and in low-income or high density areas;*
- 2) *Solid waste collection is also neglected in poor areas where most garbage is littered around in the streets and lanes;*
- 3) *Water quality and water pollution are important environmental concerns. Most water available in Karachi does not meet the water quality standards of WHO;*
- 4) *Air pollution is a serious environmental problem in the Karachi city. Rapid increase in the vehicular traffic have produced high pollution levels along city roads and road intersections where these far exceed the limits set by the WHO and National Environment Quality Standards of Pakistan;*
- 5) *The Lyari and Malir rivers, which have been converted into large open sewers, cause severe marine pollution along the coast and impact the harbor's marine environment; and*
- 6) *There is no close coordination between different agencies for environmental protection. This field needs to be strengthened to play its assigned role.*

ii. Environmental Framework

Thus in terms of environmental framework for urban development, KSDP 2020 states that it is particularly concerned with "Air Quality Deterioration from Transportation" and stated that the measures need to be taken for air pollution in urban areas is: i) awareness

campaign against smoke-emitting vehicles ii) creation of public awareness and education program; iii) setting up of continuous monitoring stations to record pollution levels in ambient air; iv) improvement of energy efficiency in vehicles; v) introduction of low-sulfur diesel; vi) promotion of alternative fuels such as CNG, LPG and mixed fuels; vii) review Motor Vehicle Ordinance for inspection of private vehicles; viii) restrict conversion of vehicles from gasoline to second-hand diesel engines; ix) stop import and manufacturing of 2-stroke vehicles; x) establish public/rapid transit systems; xi) give tariff preference to CNG buses.

Noise pollution from vehicles, especially in residential areas, is above recommended levels. Major contributors to the noise pollution are frequent and indiscriminate use of vehicle horns, removal of silencers on rickshaws and 2-stroke vehicles, high volumes of traffic especially heavy vehicles. The statement implies that restriction and control on the way road transportation is used is necessary in terms of the reduction of noise pollution.

(2) Review of Legal and Institutional Framework on EIA in Pakistan

1) National Environmental Policy in Pakistan

The enactment of comprehensive legislation on the environment, covering multiple areas of concern, is ongoing within Pakistan. A basic policy and legislative framework for the protection of the environment and overall biodiversity in the country is now in place. However, detailed rules, regulations and guidelines required for the implementation of the policies and the way they are enforced are still in various stages of formulation and discussion. In particular those related to protecting living environment is in its infant stage.

In 1983, Pakistan Environment Protection Ordinance (PEPO) was deemed as the first substantive policy on the environment in Pakistan. This highlighted the need to have a framework of environmental laws in Pakistan in order to address emerging national issues. PEPO had three goals for the country's environmental protection effort, which were conservation of natural resources, promotion of sustainable development, and improvement of efficiency in the use and management of resources. Fourteen program areas were targeted for priority implementation, including energy efficiency improvements, renewable resource development/ deployment, pollution prevention/reduction, urban waste management, institutional support of common resources, and integration of population and environmental programs.

National Environmental Policy 2005 provided an overarching framework for addressing the environmental issues facing Pakistan. This provided broad guidelines to the Federal Government, Provincial Government, Federally Administrated Territories and Local Government for addressing environmental concerns and ensuring effective management of their environmental resources.

The National Conservation Strategy (NCS) is the primary policy document of the Government of Pakistan (GOP) on national environmental issues. The Federal Cabinet approved the policy in March 1992. It has also attained recognition by international donor agencies, principally the World Bank. The NCS identifies 14 core areas including conservation of biodiversity, pollution prevention and abatement, soil and water conservation as well as preservation of cultural heritage. NCS therefore recommends immediate attention to these core areas in order to preserve the Pakistan's environment.

The review of NCS made in 2000 concluded that the achievements on the conservation of environment in Pakistan have been primarily awareness raising and institutional building rather than actual improvement to the natural and living environment and that NCS was not designed to achieve such specific goals. The need arose for a more specific action to be taken by National Environmental Action Plan (NEAP) requiring to bring about actual improvements in the state of the national environment with greater emphasis on poverty

reduction and economic development in addition to environmental sustainability.

The Pakistan Environmental Protection Council approved NEAP under the chairmanship of the President/Chief Executive of Pakistan in 2001. NEAP now constitutes the agenda for a policy on the development intervention in relation to the environment sustainability. Its core objective is to initiate actions that safeguards public health, promote sustainable livelihood, and enhance quality of life of the nation.

Consequently National Environmental Policy has been approved by the Federal Cabinet in its meeting held in June 2005. The Pakistan Environmental Protection Council has endorsed this policy, which contains in total 171 guidelines on sectoral and cross-sectoral issues. The objectives of the policy include assurance of sustainable development and safeguard of the natural wealth of country. The following is the approved sectoral guidelines:

- a) Air Quality and Noise
- b) Waste Management
- c) Water supply and management
- d) Biodiversity and Protected Areas
- e) Climate Change and Ozone Depletion
- f) Energy Efficiency and Renewable Energy
- g) Agriculture and Livestock
- h) Forestry
- i) Multilateral Environmental Agreements

Further the Government of Pakistan (GOP) and United Nations Development Programme (UNDP) have jointly initiated an umbrella support program called the NEAP-Support Programme (NEAP-SP) in 2001 and began implementing in 2001. The development objective of NEAP-SP is environmental sustainability and poverty reduction in the context of economic growth.

2) Pakistan Environmental Protection Act and IEE/EIA Regulations

i. Environmental Protection Act of 1997

In 1997, Pakistan Environmental Protection Act (PEPA) was enacted on 6th December 1997, repealing the PEPO of 1983. The PEPA of 1997 provides the framework for implementation of National Conservation Strategy (NCS), Establishment of Provincial Sustainable Development Funds, Protection and Conservation of Species, Conservation of Renewable Resources, Establishment of Environmental Tribunals as well as the appointment of Environmental Magistrates, and framework for Initial Environmental Examination (IEE) and Environmental Impact Assessment (EIA).

PEPA 1997 is also the basic legislative tool empowering the government to frame regulations for the protection of the environment. The PEPA 1997 is broadly applicable to air, water, soil, marine, and noise environment. Penalties have been prescribed for those contravening the provisions of the Act under the Section 17. Federal and provincial EPAs were formed at the time in order to ensure enforcement of the Act in their respective areas of power.

The two primary deliberations of PEPA 1997 are the execution of projects only after approval of environmental assessments from the relevant EPA and adherence with National Environmental Quality Standards (NEQS). Under the Section 12 of PEPA, however, no project involving construction activities or any change in the physical environment can be implemented unless an IEE or EIA as required is conducted and a report submitted to the federal or provincial EPA.

ii. Pakistan Environmental Assessment Procedures of 1997

Pakistan Environmental Protection Agency prepared the Pakistan Environmental Assessment Procedures (PEAP) in 1997. This document is based much on the existing works carried out by international donors and NGOs. The document includes:

- 1) Policy and procedures for filing, reviewing and approval of environmental assessment;
- 2) Guidelines for the preparation and review of environmental reports;
- 3) Guidelines for public consultation;
- 4) Guidelines for sensitive and critical areas; and
- 5) Sectoral guidelines for various types of projects.

The document set out best practices for the preparation of environmental assessment reports including public consultation meetings, collection of primary data and methods for prediction of impacts. The sectoral guidelines include guidelines on the development of various sectors of commerce and industry in Pakistan including description of generic environmental impacts related to the construction and operation. It also provides proposed suitable mitigation measures.

The IEE or EIA has to be submitted to provincial EPA to whom the Federal EPA has conferred powers for review and approval. Other features of the IEE-EIA Regulations, relevant to the proposed project are as follows:

- 1) IEE has to be accompanied by an application in the format prescribed in Schedule IV of the IEE-EIA Regulations, 2000;
- 2) Sindh Environmental Protection Agency (SEPA) is bound to conduct a preliminary examination and reply within 10 days of the submission of the report confirming completeness, or asking for additional information if needed, or returning the report requiring additional studies if necessary;
- 3) A fee is payable to SEPA for review of IEE Report
- 4) SEPA is required to make every effort to complete IEE review process within 45 days of the issue of confirmation of completeness;
- 5) If the SEPA accords its approval it may include subject to certain conditions:
- 6) Before commencing construction of the project, proponent is required to submit an undertaking accepting the conditions; or
- 7) Before commencing operation of the project, proponent is required to obtain from SEPA a written confirmation of compliance with the approval conditions and requirements of IEE.
- 8) It is required that an Environmental Management Plan (EMP) be submitted with the request for obtaining confirmation of compliance;
- 9) SEPA is required to issue confirmation of compliance within 15 days of the receipt of a request and complete necessary documentation;
- 10) Approval on IEE is valid for three years from the date of accord. If the project is initiated after three years from the date of approval, the proponent will have to apply for an extension in the validity period. SEPA on receiving such request may grant extension of time not exceeding 3 years at a time, or require the proponent to submit a fresh IEE if in the opinion of SEPA changes in baseline conditions of the project so warrant.

Current EIA process in Pakistan is shown in Appendix 5.

iii. The Year 2000 Regulations on IEE/EIA

The Pakistan Environmental Protection Agency review of IEE and EIA Regulations, 2000

promulgated under PEPA 1997 were enforced in June 2000. It is termed as the Year 2000 Regulations, which defines the applicability and procedures for preparation, submission and review of IEEs and EIAs. These regulations also provide legal status to the Pakistan Environmental Assessment Procedures prepared by the Federal EPA in 1997.

In The Year 2000 Regulations' Schedule-II defines projects requiring EIA study as bellow:

The Projects in schedule-II are generally major Projects and have the potential to affect a large number of people. They also include Projects in environmentally sensitive areas. The impact of such Projects may be irreversible and could lead to significant changes in land use and the social, physical and biological environment.

The Year 2000 regulations also classify projects on the basis of expected degree of adverse environmental impacts and list them in two separate schedules. Schedule I list project that may not have significant environmental impacts and therefore require an IEE only. Schedule II lists projects of potentially significant environmental impacts requiring preparation of an EIA. The regulations also require that all projects located in environmentally sensitive areas require preparation of an EIA.

The schedule I of the Year 2000 Regulations require all urban development projects including housing schemes to undertake IEE study. Schedule-II describes the requirements of EIA for railway project as one of the transport category projects.

After receiving approval from SEPA on IEE/EIA Report, the proponent will acknowledge acceptance of the condition of approval by executing and undertaking in the form prescribed in Schedule VII of the Year 2000 Regulations.

The regulation also requires proponents to obtain from SEPA, after the end of construction phase of the project, a confirmation that the requirements of IEE and the conditions of approval have been duly complied with. SEPA in granting the confirmation of compliance may impose any additional control regarding the environmental management of the project of the operation, as it deems necessary.

iv. NEAP-Support Programme

The Government of Pakistan (GOP) and United Nations Development Programme (UNDP) have jointly initiated an umbrella support program called the NEAP-Support Programme (NEAP-SP) in 2001 and began implementing in the same year. The development objective of NEAP-SP is environmental sustainability and poverty reduction in the context of economic growth.

v. Antiquities Act of 1975

Within the EIA study, The Antiquities Act of 1975 is applied. The act ensures the protection of cultural resources in Pakistan. It is designed to protect antiquities from destruction, theft, negligence, unlawful excavation, trade and export. Antiquities have been defined in the Act as ancient products of human activity, historical sites, or sites of anthropological or cultural interest, national monuments etc. The Act prohibits new construction in the proximity of a protected antiquity and empowers the Government of Pakistan to prohibit excavation in any area, which may contain articles of archaeological significance.

Guidelines for Sensitive and Critical Area, October 1997 also list up a number of areas subject to protection in terms of sensitive ecosystems and archaeological importance. In Appendix II of the Guidelines, a list of eight Archaeological Sites and Monuments, of which four of them are National Monuments, in Karachi is provided. Further, there are 203 sites declared as "Protected Heritage" within Karachi District.

3) National Environmental Quality Standards (NEQS)

NEQS promulgated under PEPA 1997 and revised in 2000 specify standards for industrial and municipal effluents, gaseous emission, vehicular emissions, and noise levels. PEPA

1997 empowers the EPA's juridical force in order to impose pollution charges in case of non-compliance to NEQS.

During the construction phase and post development phase of the project, NEQS will have to be applied to all effluents and emissions. NEQS for ambient noise, air and industrial effluent that are applicable to KTIP are provided in Appendix 5.

4) Karachi Building and Town Planning Regulations for Industrial and Public Safety

These regulations in 2002 superseded the old regulations of 1979. They are applied to the whole city district of Karachi but are not applicable to the cantonment areas of the national security. Under these regulations, not limited to but including the following should be taken into account for designing, construction, or operation and maintenance of the project in terms of the industrial and public safety:

- i. Sanitation and Solid Waste
 - a) In case pre-construction, construction, and operation and maintenance will emanate noise, pollute air, produce solid waste and sewage, the construction and operation and maintenance of the project should be complied with all requirement of NEQS;
 - b) In all public purpose projects, the central waste disposal system should be provided by the project proponent;
 - c) Where no public sewer is in existence, all sewage shall be disposed off after properly treating, through digester or septic tank and effluent shall be discharged safely into a soak pit as a temporary measure till such time as a sewer system is laid out;
 - d) Ventilating pipe should be provided in all stacks carrying wastewater or sewage in accordance with the plumbing code;
 - e) At every change of alignment, gradient or diameter of a drainage, manhole or inspection chamber should be provided. Bends and junctions in the drainage should be grouped together in manhole as far as possible;
 - f) The roofs of every building and the floor or balconies abutting on a street or constructed over a street should be so constructed or framed so as to permit effectual drainage of the rainwater wherefrom by means of a sufficient number of leaders of adequate sizes so arranged, jointed and tied as to ensure that the rainwater is carried away from the building without causing dampness in any part of the walls, foundations of the walls, of foundations of the building, or those of an adjacent building, provided the fall is not greater than 20ft.(6m) in case of spouts;
 - g) A leader should not discharge into or connect with any soil pipe of its ventilation pipe, or any waster pipe or its ventilating pipe, nor should it discharge into a sewer;
 - h) Rainwater from leader spouts should not discharge onto a public street at a height greater than 12 inch (0.3m) from that street, or onto a neighboring property.
- ii. Fire Resistance and Precautions
 - a) All buildings which are ground plus three storey or above or more than 43 ft.(13m) high shall be provided a set standpipe/pipes. Buildings over 8 storey high should be equipped with not less than 4 inch (10 cm) diameter stand pipe;
 - b) In so far as practicable, standpipes should be located with outlets within stairway enclosures but if these are not available the standpipes shall be located in a common corridor. In any case, one should be located in the main;
 - c) The standpipes should be installed in every storey and it is fed by an overhead water tank reserved solely for this purpose;
 - d) Automatic Sprinkler System should be provided in the covered car parking area(s) in building for which upper stories are designed for other uses and when such parking

area exceeds 5,000 sq.ft.(464,6 sq.m). No sprinkler system should be provided in the immediate vicinity of generators or any electrical equipment;

- e) Manual fire extinguishers and alarm shall be provided in the areas as follows:
 - a) Installation of interior fire alarm system for the building of public use;
 - b) At least one extinguisher on each floor at stairway landing and in corridor at each lift or group of lifts in residential and commercial buildings;
 - c) All office buildings more than five storey in height and with occupancy area of more than 100,000 sq.ft. (9,294 sq.m) above the ground floor;
 - d) One extinguisher in each 2,400 sq.ft. (223 sq.m) of area of public assembly building but not less than one on each floor, and not less than one in each lab, workshop or vocational room.

iii. Temporary Works for Project Implementation

- a) No part of any street shall be used in connection with the construction, repair or demolition of any building except with the written permission of the concerned authority. Any person holding such permission shall put up and maintain to the satisfaction of the concerned authority fences or barriers in order to separate the building work from such street. Where such separation is not possible he shall make arrangement for the security of public to the satisfaction of the concerned authority;
- b) Any person causing any building material or other things to be deposited, any excavation to be made, or any hoarding to be erected shall at his own expense cause sufficient and adequate red lights to be fixed upon or near the site and shall continue such lights every night from sunset to sunrise while such materials, hoarding, things or excavated materials remain on site;
- c) Any excavation is to be sufficiently fenced until it is back-filled;
- d) All material, hoarding, fences or other obstruction on any street should be kept clear of any fire hydrants if any, and other utility service installations, or alternative arrangements should be made and precautions should be taken according to the laid down procedure of the utility agencies and to the satisfaction of the concerned authority;
- e) All drains and public utility installation should be left in clean and tidy and remain serviceable conditions and divert or kept clear of obstruction of any roadside or other drain during the period of temporary works;
- f) No excavation or dewatering or earthwork or demolition of a building which is likely to effect the stability of adjacent building shall be allowed unless steps before and during the work are taken in order to prevent the collapse/damage of any adjacent building or the fall of any part of it;

5) Resettlement Action Plan

The Land Acquisition Act of 1894 has been the de facto standard of the policy on land acquisition, resettlement and compensation during the past decades. The Land Acquisition Act is the most common law for acquiring land and other properties for development projects. It has been amended from time to time while it is not specifically provided for the resettlement of people involved in the development projects. Thus Resettlement Action Plan (RAP) in Pakistan has been provided based on the National Resettlement Policy (2002).

RAP is not only cover the affected persons (APs) subject to resettlement, but also to ensure an equitable and uniform treatment of resettlement issues. This policy defines objectives of policy as follows:

- Avoid or minimize adverse social impacts in a project wherever possible and where adverse impacts cannot be avoided, the mitigation measures and resettlement activities should be conceived and executed as development programs and the affected persons be provided opportunity to share the project benefits;
- APs be provided with sufficient compensation and assistance for lost assets, that will assist them to improve or at least restore their living standards, income earning or production capacity to the pre-project level;
- Provide a development opportunity to all vulnerable groups. The vulnerable populations should receive special assistance to bring them at least to a minimum living standard at par with the pre-project level; and
- All population adversely affected by the project, should be eligible for sharing the social and economic benefits, envisaged after completion of the project.

“National Resettlement Policy (2002)” is further supplemented by “Project Implementation and Resettlement of the Affected Persons Ordinance, 2002” that has to be adopted by state and provincial governments. This ordinance provides a comprehensive and detailed procedures and definitions for land acquisition and resettlement of the APs.

Pakistan Environmental Protection Agency has further put out “Guidelines for Public Consultation” in October 1997 and it defines “Objectives of consultation” as follows:

Public involvement is a feature of environmental assessment and can lead to better and more acceptable decision-making. It can be time consuming and demanding, yet without it, proposals are seldom soundly based, and there is likely to be antagonism from affected people, Public involvement, undertaken in a positive manner and supported by a real desire to use the information gained to improve the proposal, will lead to better outcomes, and lay the basis for ongoing positive relationships between the participants. The objectives of public involvement include:

- a) *Informing the stakeholders about what is proposed;*
- b) *Providing an opportunity for those otherwise unrepresented to present their views and values, therefore allowing mere sensitive consideration of mitigation measures and trade-offs;*
- c) *Providing those involved with planning the proposal with an opportunity to ensure that the benefits of the proposal are maximized and that no major impacts have been overlooked;*
- d) *Providing an opportunity for the public to influence project design in a positive manner;*
- e) *Obtaining local and traditional knowledge (corrective and creative), before decision making;*
- f) *Increasing public confidence in the proponent, reviewers and decision-makers;*
- g) *Providing better transparency and accountability in decision making;*
- h) *Reducing conflict through the early identification of contentious issues, and working through these to find acceptable solutions;*
- i) *Increasing a sense of ownership of the proposal in the minds of the stakeholders; and*
- j) *Developing proposals which are truly sustainable.*

As above, Guidelines for Public Consultation introduces effective ways to inform contents of the project to the general public during the planning stage and that eventually consensus building toward the implementation of project is reached. Incorporating public involvement into the stages of environmental assessment, which is carried out along with project designing process is explained in the guidelines that public consultation meeting has to be carried out after the works on “developing options, and assessing and mitigating

impacts” has been carried out for public comments.

Further, there is The Sindh Katch Abadi Act, 1987 (KAA), which is one of the important laws and regulations related to resettlement. KAA covers the population of urban squatters for their rehabilitation rights by providing plots in public resettlement areas or cash payment for assistance on resettlement. The rate of cash assistance is however relatively lower than the rate APs are possibly able to restart their life in the resettlement area. Thus careful assessment is required if any Katch Abadi area is involved in the Project.

6) Institutional Framework

Two organizations, Pakistan Environmental Protection Council (PEPC) and national and provincial EPAs, are primarily responsible for administration of the environment in Pakistan. PEPC oversees the functioning of the EPAs. Its members include representatives of the government, industry, non-governmental and private sector organizations. EPAs are required to ensure project interventions are in compliance with the procedure for IEE/EIA and NEQS, monitor the established monitoring and evaluation system of the project intervention, and identify the needs of the legislation and initiating such whenever necessary.

The respective provincial governments form the provincial EPAs. A Director General who exercises powers delegated to him by the federal EPA heads the respective EPA. DG of EPA is to review and approve IEE/EIA report submitted by project proponent.

The National Council for Conservation of Wildlife (NCCW) works under the Ministry of Environment and it is headed by the Inspector General of Forests. It is responsible for formulation of national wildlife policies. It coordinates with international organizations on matters related to international treaties/conventions for protection of the environment. It also coordinates with provincial wildlife department on the implementation of these policies.

NCCW comprises of an advisory council, which is chaired by the Minister of Environment and includes representatives from all provinces, Azad Jammu and Kashmir and Northern Areas, NGOs, Civil societies, and other federal ministries.

(3) Guidelines of the International Funding Organizations

1) JICA Guidelines for Environmental and Social Considerations in 2010

JICA Guidelines for Environmental and Social Considerations of 2010 (hereinafter referred to as “JICA Guideline”) is commonly applied to JICA’s internationally funded projects for overseas economic cooperation. In order to contribute to sustainable development in developing countries, JICA confirms according to the guidelines that the project proponents are undertaking appropriate study on the environmental and social considerations through various measures so as to prevent or minimize impacts on the natural and social environment as project is implemented.

According to the JICA Guideline, “Environmental and Social Considerations Studies” means studies including socio-economic and natural environment baseline surveys, predicting and evaluating adverse impacts and likely impacts that projects are to cause on the environment and local society, and mitigation measures to avoid and minimize these impacts. The items that require investigating natural social environment are as follows:

- Natural environment in general
- Habitat of wildlife
- Resettlement
- Living and livelihood
- Heritage
- Landscape
- Ethnic minorities and indigenous people

- Working conditions (including occupational safety)

In addition, it is mandatory according to JICA Guidelines to investigate the following:

- Air quality
- Water quality
- Waste
- Soil contamination
- Noise and vibration
- Subsidence
- Odor
- Sediment
- Protected areas
- Ecosystem
- Hydrology
- Topography and geology
- Management of abandoned sites

The impacts caused by the Project on these environmental parameters should be examined and prediction should be made for before during and after the implementation of the Project on the basis of intensity, irreversibility, and cumulative effects on the existing environment.

2) World Bank Operational Policies

In conjunction with JICA Guidelines, the following World Bank guidelines are generally applied to EIA Study for the project funded by JICA:

- 1) World Bank Operational Manual BP 4.01 to BP 4.12, January 1999:
- 2) Environmental Assessment Sourcebook, Volume I: Policies, Procedures and Cross sectoral Issues, 1991; and
- 3) Environmental Health and Safety (EHS) Guidelines, IFC, 2007

The first documents provide general guidelines for the conduct of EIA as well as to address EIA practitioners and project proponents. They will have to be used in reference to JICA Guidelines where necessary. General provisions of these operational manuals are essentially the same in its philosophy as provided in JICA Guidelines. However, in the case of resettlement compensation, these operational policies are more stringent in terms of the way APs are compensated against the loss of their property and working opportunities as well as the existing life style for which they have to be recovered upon resettlement.

The Sourcebook identifies a number of areas of concern, which should be addressed during impact assessment. It sets out guidelines for the determination of impacts, provides a checklist of tools to identify possible biodiversity issues and suggests possible mitigation measures. Possible development projects on wild lands, wetlands, forests etc. are also identified and mitigation measures are suggested.

EHS Guidelines published by IFC are technical reference documents that address IFC's expectations regarding the industrial pollution management and performance of its projects. They are designed to assist managers and decision makers with relevant industry background and technical information. This information support actions aimed at avoiding, minimizing, and controlling EHS impacts during the construction, operation and maintenance and decommission phase of a project of facility.

The EHS Guidelines have become globally applied references for private sector development with their use extending well beyond World Bank operations to a diverse

external community.

3) Other Guidelines on the Environmental and Social Considerations

Other guideline essential to be referred to when environmental studies are carried out are listed up as follows:

- 1) EIA for Development Countries in Asia, ADB, December 1997;
- 2) Handbook on Resettlement: A Guide to Good Practice, ADB, 1998;
- 3) Safeguard Policy Statement, ADB, June 2009.

The above guidelines are in general the same in their philosophy as provided in the World Bank Operational Manual BP 4.01 to BP 4.12.

1.2 Review of Policies and Development Programs in Transport Sector

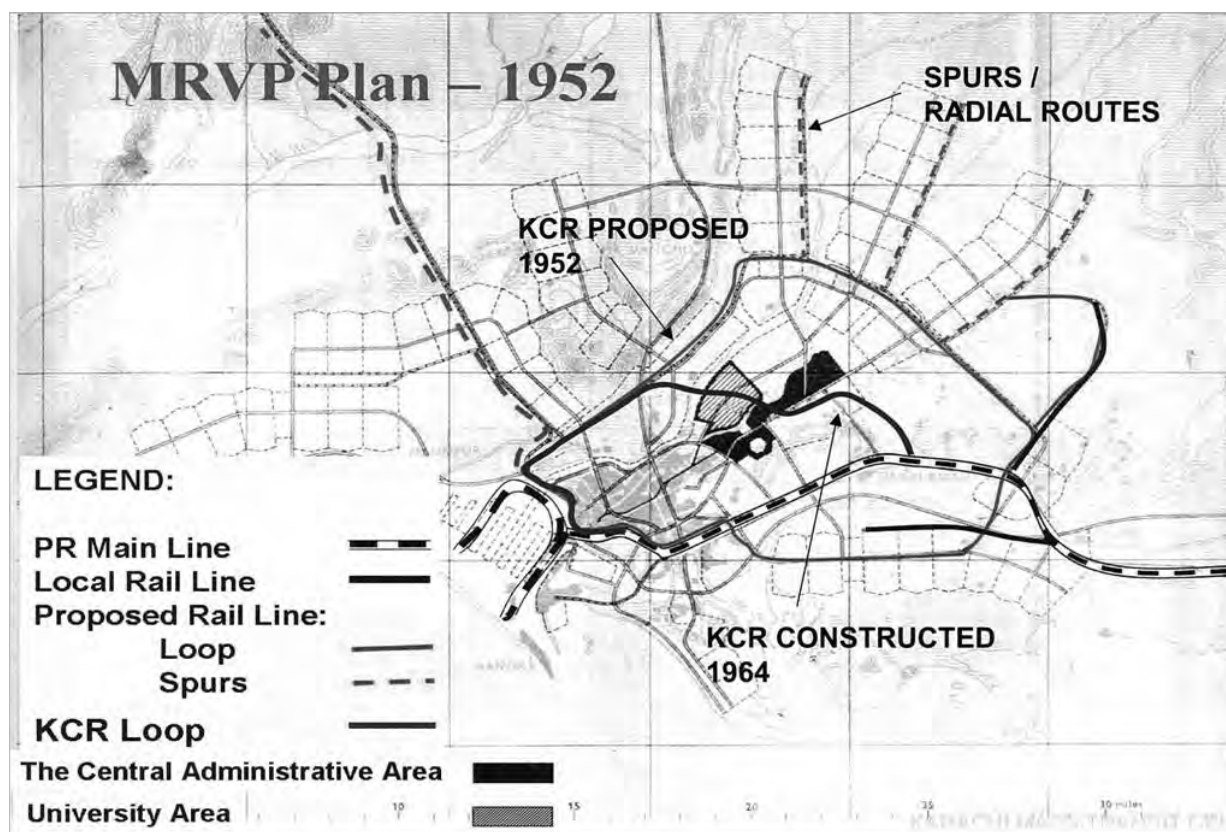
1.2.1 History of Transport Master Plan

In the past 50 years many studies have been conducted on Transport Sector of Karachi. All the reports and studies were available at different places. This study has identified all of them and copies of all the past studies have been collected and utilized for its review. Most of the past studies have been done around major funded projects, while some are done for academic interest. These studies cover a wide range of topics. Following is the summary of key issues that emerge from them¹.

(1) MRVP Plan (1952)

MRVP² Plan (1952), prepared by a Swedish Company (MRVP), is the first master plan which proposed mass transit system including Karachi Circular Railway (KCR) and several radial branches. The urban development after the master plan followed the urban structure as designed in the master plan. One of the most important implementation of the master plan was KCR, which was constructed in 1960s and opened in 1969, although the actual alignment of KCR was smaller than the proposed one as shown in Figure 1-2-1.

Since there were many level crossings with roads and the access to stations was not proper, KCR failed to attract commuters and the service level became poor. The service of KCR was reduced to bare minimum by 1999 to keep the track operational, until land slide in Gulshan-e-Johar area led to its complete suspension in 2007.



Source: CDGK

Figure 1-2-1 MRVP Plan, 1952

¹ Note: The major source of this section is "Karachi Master Plan 2020 – Transport Sector Report"

² MERZ RENDAL VETTON of Pakistan (Swedish Company)

(2) Karachi Development Plan 1974-1985 (1974)

This plan was prepared by Karachi Development Authority with the corporation of United Nation when the population in Karachi was approximately 4.4 million (1974)¹. Diesel powered trams were operated in Saddar when the plan was prepared. The number of car-owning households was as small as 36,000 (1971). In the urban transport program, it said:

Because Karachi's road system provides a capacity far greater than that needed today, few improvements would be needed to make it capable of absorbing the demand under the restrained conditions.

For mass transit system, three alternatives were studied in the final report: 1) improvement to existing rail, 2) existing rail with light rail and rail rapid transit, and 3) existing rail with light rail. The existing rail (KCR, main line, Malir branch, and Korangi branch) was common in the three alternatives. The light rail in the Plan 1975-1985 meant an urban railway using public street space similar to conventional tramways, while the rail rapid transit meant the railway system having the rail track which is separated from road system. The conclusion of the alternative analysis was that it was too early to introduce railway system in Karachi. In the public transport program, the report concluded:

No major new light rail facilities are recommended at this time, but the right-of-way of the existing diesel-powered trams should be upgraded, and the trams should be rebuilt with new engine.

(3) Other Studies

In 1970s, there were several studies conducted for mass transit development in Karachi. JICA conducted studies about electrification of KCR. SOFRERAIL French consultants also conducted the improvement of KCR and main line.

In addition to those studies for KCR, a subway system between Tower and Liaquatabad along M.A.Jinnha Road together with electric trolley buses was studied by the Rapid Transit Cell under the Federal Ministry of Communications.

Proposed projects in these studies were not implemented.

(4) Karachi Mass Transit Plan (1990)

This is very important plan for mass transit system in Karachi. Karachi Mass Transit Study (KMTS), supported by the World Bank, was carried out by international consultants during 1987-90. The final report of KMTS was submitted in August 1990 and approved at various levels by the Government of Pakistan (GOP), as well as the World Bank.

Transit-ways in the total length of 87km including elevated sections were proposed in the report. The proposed transit-ways were designed as bus ways that can be converted to light rail system.

This report recommended the establishment of an autonomous Karachi Metropolitan Transport Authority (KMTA) as the implementation agency of the proposed mass transit corridors.

KMTS introduced the concept of Light Rail Transit (LRT) as a railway system with lower capacity than heavy rail or metro system because of the smaller composition of trains but higher capacity than tramways because of the elevated or segregated track.

(5) Karachi Development Plan 2000 (1991)

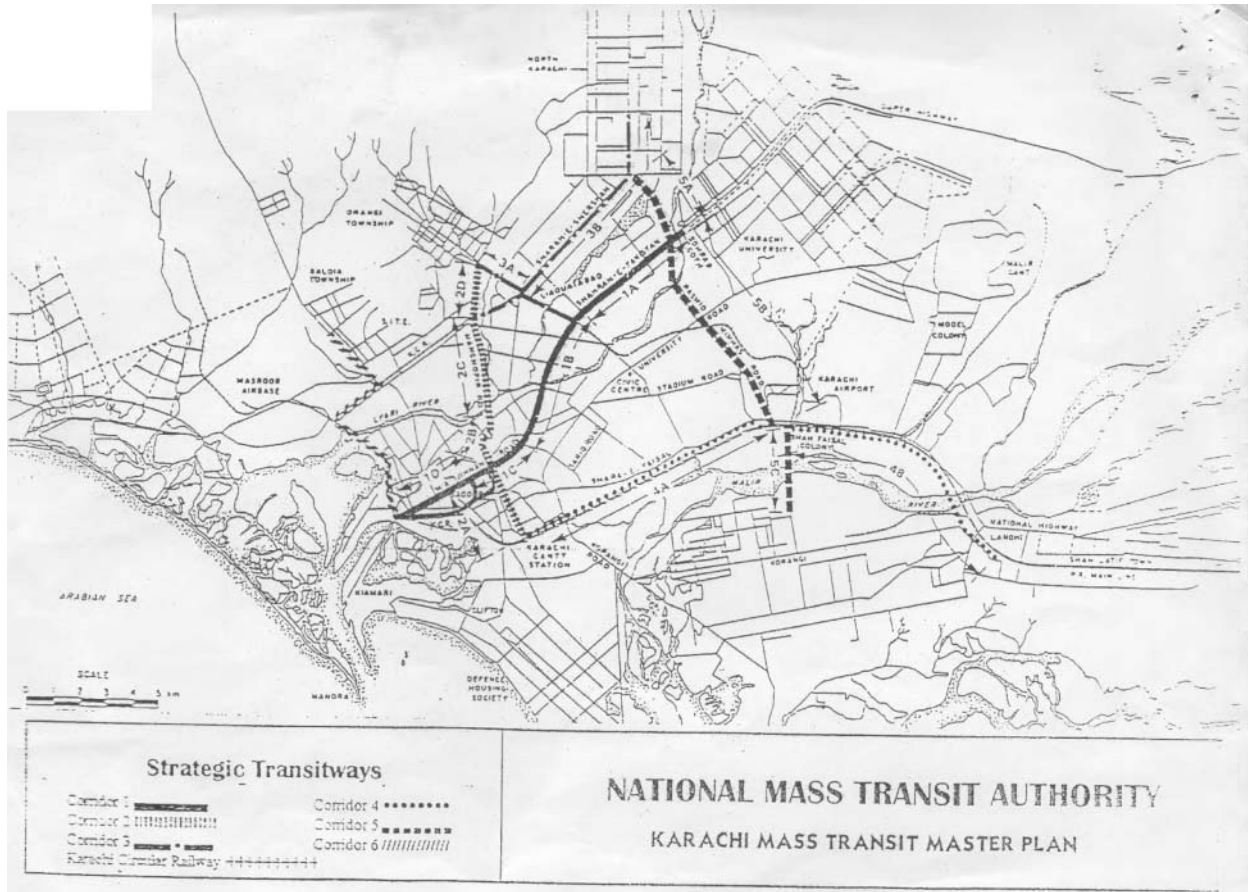
The report of Karachi Development Plan 2000 was prepared in June 1991, one year later than the submission of the final report of Karachi Mass Transit Study (KMTS), August 1990. The report just reviewed and supported the mass transit plan in KMTS and there was no

¹ Projected as 4,448,000 in Karachi Development Plan 1974-1985

modification to the plan. The population of Karachi in 1990 was approximately 7.8 million¹.

(6) Notification of Mass Transit ways (1995)

Based on the final report of Karachi Mass Transit Plan (1990), the Government of Pakistan (GOP) by its notification issued in 1995 clearly mentioned the routes of six corridors as National Mass Transit ways/strategic transit ways of Karachi Metropolitan City as shown in Figure 1-2-2. KCR was notified as the seventh corridor.



Source: Karachi Mass Transit Master Plan and Description of National Mass Transit Ways/ Strategic Transit Ways, Ministry of Communications, GOP, 1st June 1995

Figure 1-2-2 Routes of 6 corridors as per the Notification issues by Government of Pakistan in 1995

1.2.2 Karachi Mass Transit Corridors

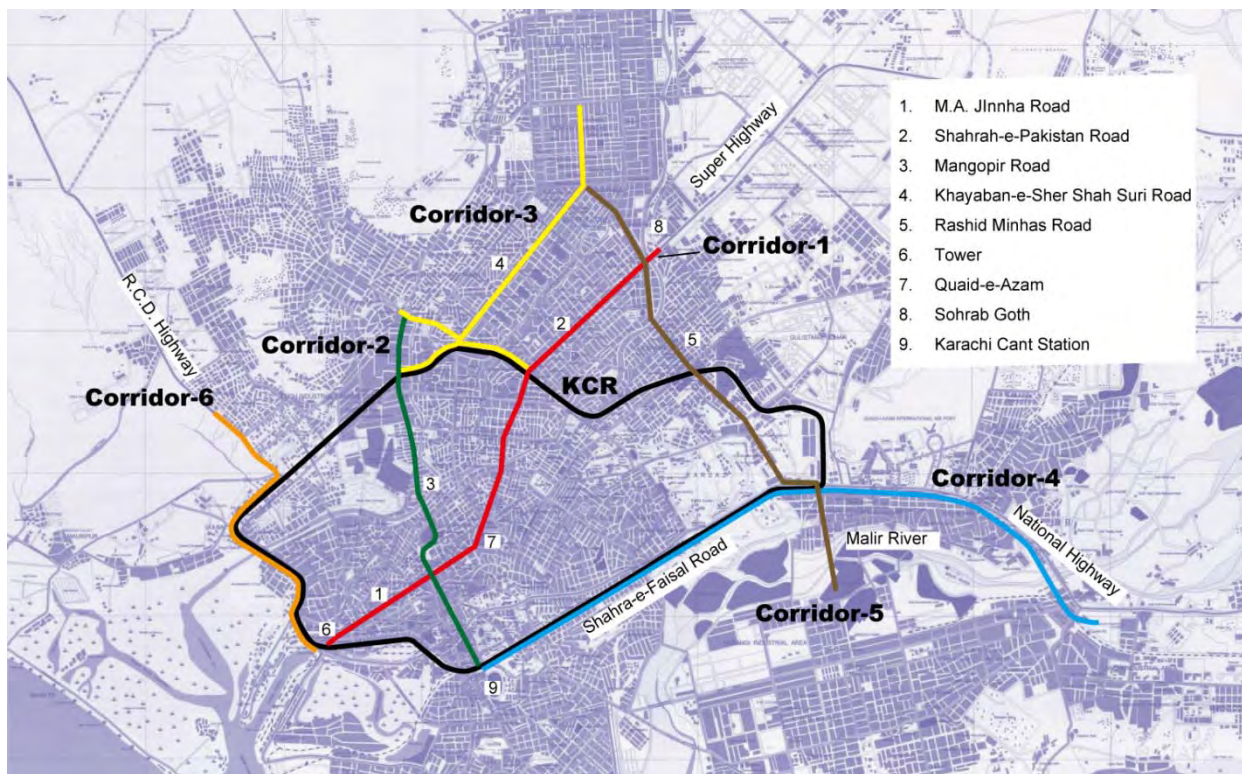
(1) Routes

Presently, the notified National Mass Transit Ways/ Strategic Transit Ways are called as Karachi Mass Transit Corridors, which comprises of the following six corridors.

- Corridor-1: Tower to Sohrab Goth (15.2km)
- Corridor-2: Cantt Station to Orangi (12.2km)
- Corridor-3: New Karachi to Board Office, Board Office to Banaras Chowk, and Liaquatnagar to Manghopir Road along KCR
- Corridor-4: Karachi Cantt to Landhi along Pakistan Railway Main Line
- Corridor-5: Nagan Chowrangi to Shahrah-e-Faisal along Rasid Minhas Road, and to Landhi
- Corridor-6: Tower to Baldia Town along KCR and RCD Highway
- Corridor-7: Karachi Circular Railway

¹ Karachi Development Plan 2000 (June 1991)

The route length from Corridor-3 to Corridor-6 was not specified in the government notification in 1995. The routes are shown in Figure 1-2-3. The routes of Corridor-3, 5, and 6 are duplicated with the KCR line partially. However, KCR was also included in the notification in 1995 as a possible circular light rail line.



Source: KMTTC (Illustration in KTIP)

Figure 1-2-3 Karachi Mass Transit Corridors

(2) Planning and Design of LRT in Past Studies

1) Design Criteria

In planning of alignment and structures for elevated LRT, minimum curve radius and maximum gradient for track alignment are, in particular, the most important factors. In addition, platform length and width are important design conditions for planning of station size and structure.

Main conditions related to design of LRT in the past studies are shown in 1-2-1.

Characteristic of past studies, in particular, is to consider a convertible transit way from bus system to LRT system.

Table 1-2-1 Main Condition in the past study

	Bus transit way	LRT transit way
Minimum curve radius	Main line: 100 m (328'4" ft) Branch line: 50 m (164'2" ft) (Exception: 30 m)	
Maximum gradient	4.0 %	
Platform width (side type)	3.35 m (11'00" ft)	5.7 m (18'9" ft)
Platform length	100 m (328'4" ft)	
Station width	20.1 m (66'.0" ft)	
Number of lane or track at station	4 lanes (include overtaking lane)	Double track
Station length	100 m (328'4" ft)	
Station spacing	About 1.0 to 1.5 km	

Source: Final Report Karachi Mass Transit Study (1990)

Minimum curve radius is one of the main factors which influences planning of plane alignment, and used in the sections required to adapt sharp curve radius to avoid land acquisition and resettlement due to topographical reasons. On the other hand, sharp curve puts a limit on train speed and consequently reduces traffic capacity.

Station facility planning has not been made clear in the past studies. Railway station needs several important facilities and rooms for railway operation. Furthermore, elevated LRT structures in the past study were considered as a convertible transit way from bus system to LRT system. In consequence, station width became larger than it was necessary for LRT system.

Rolling stock planning, transport planning, signaling and telecommunication system have not been made clear in the past studies.

2) Basic Design for Corridor 1 and Corridor 2

Studies, in particular, on Corridor 1 and Corridor 2, have been carried out into the details such as alignment of route, locations of stations, locations of bridge piers and foundations, topography and utility survey. In the basic design, Corridor-2 runs through Karachi Zoo along the boundary.

(3) Corridor Survey

Site surveys were conducted for the six corridors. Summary of review on each corridor in the past studies has been made from the viewpoint of introduction space requirements for LRT structure.

1) Corridor 1

The condition of Corridor-1 is summarized in Figure 1-2-4. M.A. Jinnah Road is too narrow to accommodate elevated structure between Tower and Cloth Market, especially in front of Cloth Market. The section of Jahangir Road between Guru Mandir and Lyari River is 4-lane road with narrow width, and it is difficult to construct elevated structure without affecting the adjoining buildings. Shahrah-e-Pakistan has an elevated section with a length of 1.9km and the east side of the section is too narrow for elevated structure while power transmission lines are running along the west side of the road.

2) Corridor 2

The condition of Corridor-2 is summarized in Figure 1-2-5. Corridor-2 runs on very narrow roads from Karachi Cant Station to Lyari River, especially Dr Daud Pota Road between Jahangir Park and Syedna Mohd Burhanuddin Road, Zaibunnisa Street between M.A. Jinnah Road and Jahangir Park, Garden Road, and Manghopir Road between Karachi Zoo and Lyari River. KMTS and the following basic design for Corridor-2 showed that the route can accommodate Light Rail (Bus way in the beginning). However, the road space would become very narrow and the negative impact on road traffic would be very high in case of the proposed system. In case of Mass Rapid Transit (MRT), the elevated structure along this corridor is impossible. Underground is also difficult because there is no place to go up to ground. Furthermore, there is no space available for depot along this corridor.

Manghopir Road has enough space for elevated structure of railway system.

3) Corridor-3

Corridor-3 consists of three parts: (i) main line along Shahrah-e-Sher Shah Suri, (ii) KCR line, and (iii) branch line to Banaras Chowk. KCR line is proposed along KCR between Manghopir Road and Shahrah-e-Pakistan, which is impossible if KCR is implemented. The branch line to Banaras Chowk is also no more possible due to the construction of Banaras Flyover.

On the other hand, Shahrah-e-Sher Shah Suri is wide enough to accommodate the elevated structure of railway system. Although power transmission line is running in the north of Nagan Chowk along Corridor-3, elevated railway can be constructed because the road is wide.

4) Corridor 4

Corridor-4 was planned in the right-of-way of Pakistan Railway along the main line between Karachi Cant Station and Landhi. Due to encroachment along the main line, this route is difficult to be implemented. If KCR is implemented, Corridor-4 will be no more possible.

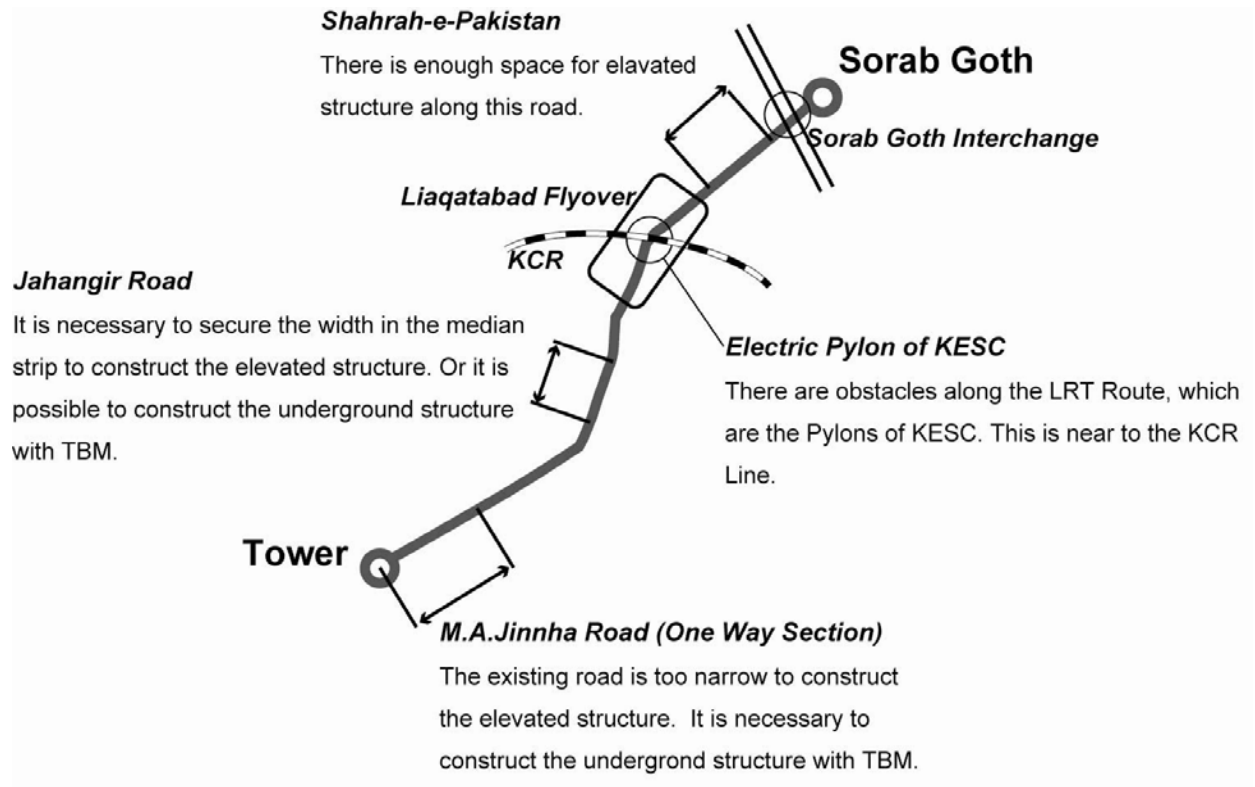
5) Corridor 5

There are several flyovers along this corridor such as Nagan Flyover, Sohrab Goth Flyover, Allama Shabbir Ahmed Usmani Flyover, NIPA Flyover, Askari Flyover, and COD Bridge. Lyari Expressway crosses this corridor. These structures did not exist when Corridor-5 was planned. However, the construction of elevated structure for railway is still possible because the road width is wide enough along the route. The problem is that the railway cannot be constructed in the median of along Shah Waliullah Road due to power transmission line.

The section in the south of Shahrah-e-Faisal goes through Nathakhan Goth, a populated area in Shah Faisal Town. This will involve a large scale of resettlement.

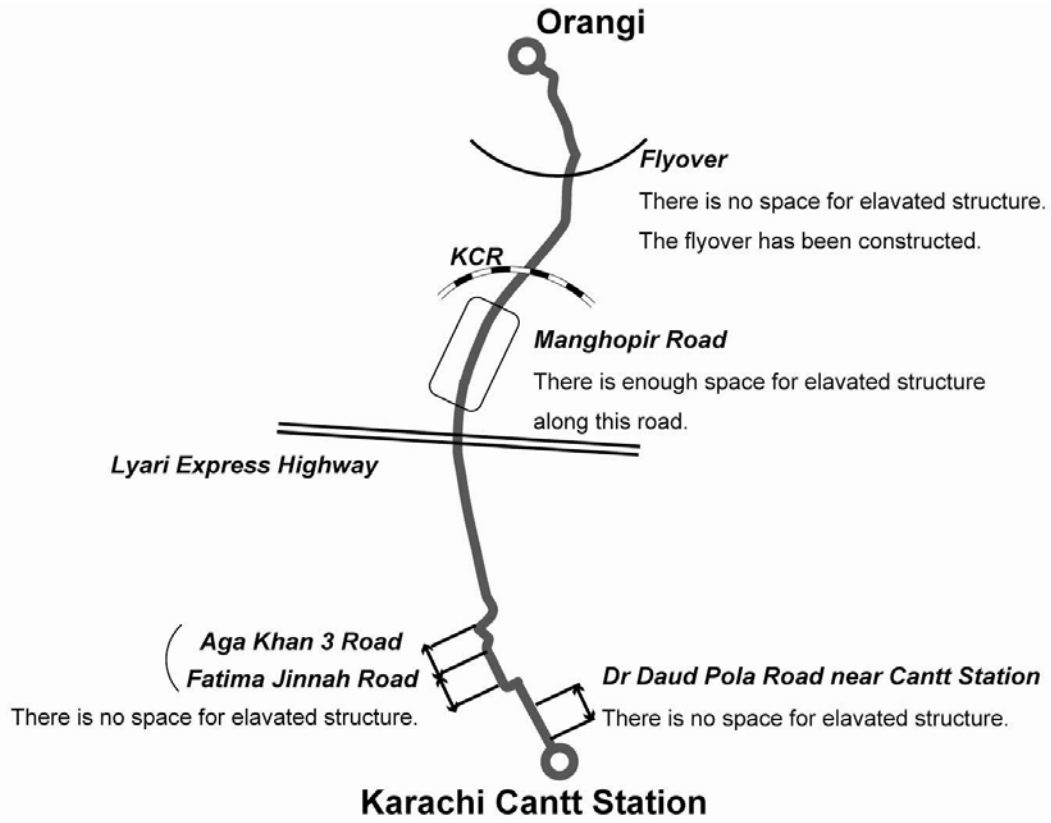
6) Corridor 6

Corridor-6 uses KCR and RCD Highway. If KCR remains as it is, Corridor-6 can be constructed along KCR from Tower to the intersection between RCD Highway and KCR. However, it can not go to RCD Highway due to Shershah Bridge. The section along RCD Highway has enough space for elevated structure as railway system, except for the road under Shershah Bridge.



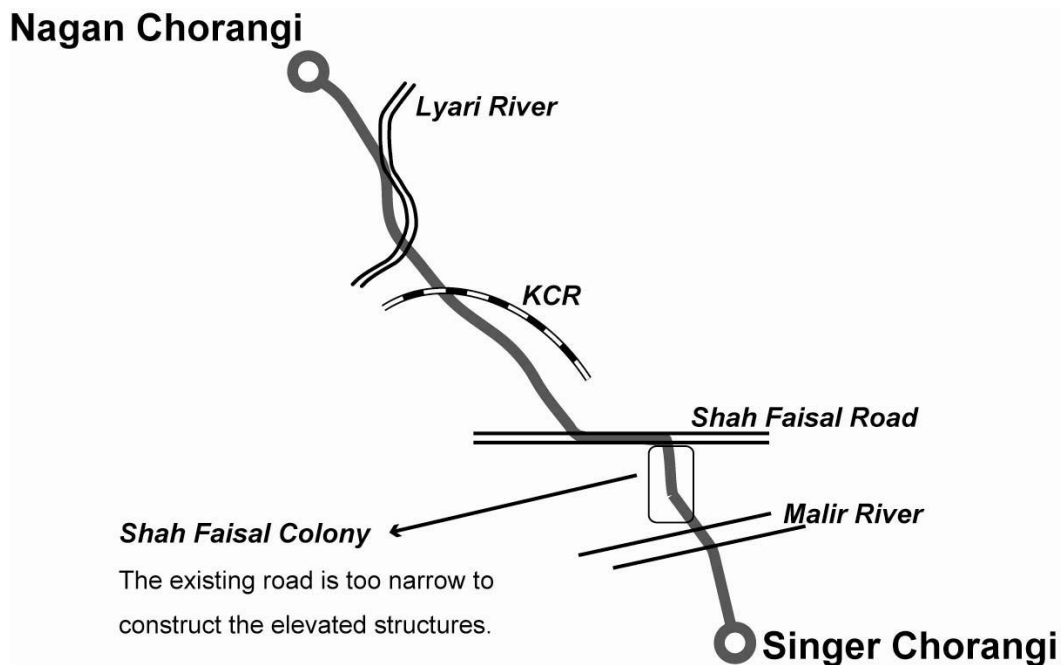
Source: JICA Study Team

Figure 1-2-4 Condition of LRT Corridor -1



Source: JICA Study Team

Figure 1-2-5 Condition of LRT Corridor-2



Source: KTIP

Figure 1-2-6 Condition of LRT Corridor-5

(4) Implementation of the Corridors

The history of implementation of the priority corridor-1 is fully described in the transport sector report of Karachi Master Plan (KMP).

There were three projects which had been pursued for implementation after the approval of the Karachi Mass Transit Plan (KMTP).

Table 1-2-2 History of BOT for Corridor-I

Period	BOT Bidding	Awarded Bidder
1996-2001	Under NMTA	IMTC (Indus Mass Transit Co.)
2003-2004	Under KMTC, CDGK	CNMEG (China Machinery and Equipment Group), only MOU was signed
2004-2006	Bidders were approached for additional comforts to participate in BOT option	ATM (American Maglev Technology Inc) & IDC (Infrastructure Development Company)
2006-2008	The bidding firms were asked to submit proposals only for LRT (Proven Technology)	Infrastructure Development Company (IDC)

Source: Karachi Master Plan-2020 Transport Sector Report, and a presentation by KMTC

The first attempt to implement the LRT project on BOT was not successful. Subsequently, significant efforts were made by KMTC, CDGK to implement the mass transit project along the corridor 1.

- Expression of interest was invited in 2003 for implementation of the project on BOT basis. 07 firms were prequalified, out of these only two firms submitted their proposals i.e. M/s American Maglev Technology (AMT), USA on BOT without Bid Bond guarantee of US\$ 1 Million and M/s China National Machinery & Equipment Group (CNMEG) for LRT on credit financing . Therefore, both the firms were declared non responsive for non-fulfillment of TOR requirements.
- CDGK, on the basis of MOU signed by CNMEG with GOS, dated September 16, 2003, for implementation of LRT Project along the Priority Corridor -2 on credit financing, made a Preliminary Implementation Agreement with CNMEG. Later on, CDGK made relentless efforts at different levels for needful support from Government of Pakistan (GOP) for sovereign guarantee which did not materialize. Government of Pakistan (GOP) did not agree with the proposal. The Government of Pakistan (GOP) directed to opt for BOT.
- Accordingly, again all 07 pre-qualified firms were contacted for additional comforts required to participate in the project implementation system. Based on these efforts/approach and certain guarantees / concessions provided by Government of Pakistan (GOP), M/s AMT and IDC jointly offered MEGLEV System on BOT basis and a Memorandum of Understandings (MOU) was signed on September 2004 between these firms and CDGK. However, the same also could not be implemented due to non-fulfillment of the commitment by the bidder.
- In 2006, LRT Project proposals were re-invited from the seven pre-qualified firms. At this time M/s Infrastructure Development Company (IDC) the consortium group of the bidders including M/s China Electronic Technology Group of Companies international (CETC), as a potential sub-contractor submitted their proposal on BOT basis. Subsequently, Letter of Intent (LOI) was signed between CDGK and M/s IDC on October, 2006. This LOI was terminated on March 17, 2008 due to no fulfillment of commitment both by BOT firms and Government of Pakistan (GOP).

- The M/s CNMEG again submitted their offer on the modified and flexible conditions besides assurance for soft Chinese credit financing. GOS approached Government of Pakistan (GOP) for reconsideration of the same but this exercise also went in vain.

Despite above stated efforts, it is evident that all the attempts to implement LRT system on BOT basis could not succeed.

1.2.3 Policies in Transport Sector

(1) Karachi Strategic Development Plan (KSDP) 2020

There are 16 objectives for the transport policy in KSDP 2020. These objectives seem to be mixture of the statements of different level, and they can be classified into two levels as:

Level-1: Goals
1. Provide safe and efficient mobility for people and goods. 8. Improve pedestrian safety and facilities. 14. Improve safety, energy efficiency and air quality.

Level-2: Policies
2. Improve public mass transportation system, targeting affordability and convenience. 4. Integration of traffic police and enforcement with city traffic planning and management through rationalization of related fundamental structure under a central transport authority. 5. Strengthen existing transportation infrastructure and services by considering various alternatives. 12. Reduce congestion in the CBD areas through a combination of rationalized parking, traffic management, pedestrianization, land use control and transit improvements. 13. Develop transport infrastructure to support planned land use changes, especially strengthening links between CBD and polycentric commercial centre nodes. 15. Seek improvements through strong private sector participation.

The following objectives are the statements about the capacity of planning itself. In total, 6 out of 16 objectives are related to planning and capacity development.

Statement about the Planning Capacity of Authorities
3. Traffic engineering improvement measures and traffic management techniques. 6. Analyze thoroughly any road building program if it would remove congestion and would not induce more traffic. 9. Development of transport related GIS data-base. 10. Development and adoption of standard and manuals for Traffic & Transportation Engineering Works & Service. 11. Evolving a comprehensive transportation plan development and modeling to address vehicular traffic, public mass transportation (bus line and rails based), parking to provide for development of roadway and public transport/mass transit infrastructure development priorities for long range. 16. Formulate strategy for management and operation of local bus terminals.

The objective no. 7 (Minimize single-occupancy vehicle use) seems to belong to another level. This is a concrete statement compared to other objectives.

For the development of public transport system in the next 20 years, the JICA Study Team recommends changing the policies of public transport in KSDP 2020.

KSDP 2020 set forth three principles for mass transit program as follows:

- It should have maximum coverage with minimum input and maximum output.
- It should be built with minimum investment and shall have a short completion period.
- It should also have maximum outreach and be compatible¹ with bus travel cost.

The first and second principles are general description. The emphasise on “short completion

¹ The meaning of “compatible” is not clear in this context. The JICA Study Team understands that the principle implies that the fare of the mass transit system should be as same as that of bus so that both modes can be integrated.

period” shows that Karachi is yearning for mass transit system, and “minimum input” and “minimum investment” show the budget limitation for mass transit in Karachi.

The third principle states that the mass transit should be competitive with bus in terms of travel cost. However, it would be difficult to provide services of mass transit system with the same fare level as that of existing buses which is as low as approximately Rs 15.

There are some recommendations by sector in KSDP 2020. The followings are those of Transit Improvement.

- Improvement in bus transport shall be effected by adopting such measures as rationalizing the bus routes, reserving high volume routes for large buses, providing bus stops, transit terminals and other physical improvements.
- Replacement of existing bus stock with environment friendly fleet shall be effected.
- Bus fare structure shall be rationalized
- Parking and garage facilities shall be provided to mini bus, taxi and rickshaw services.

The followings are recommendations about Mass Transit in KSDP 2020.

- A segregated transit system shall be built in order to facilitate travel to the CBD, industrial areas and the work centers.
- The Karachi Circular Railway shall be extended to cover sub-urban areas for maximum coverage and utility.
- Bus rapid transit shall be re-introduced on major roads.
- The feasibility of constructing light rail transit in the form of a combination of underground or elevated service on priority I and II corridors shall be examined.

(2) Karachi Master Plan 2020 – Transport Sector Report

1) Status of the Report

This is a supportive report for Karachi Strategic Development Plan-2020 (KSDP 2020) and the analysis and recommendation are reflected to the KSDP 2020.

The total cost of the proposed projects in the Transport Sector Report is approximately Rs. 222 billion, in which the cost up to 2020 accounts for approximately Rs. 213 billion.

2) Road Traffic

The Transport Sector Report proposes four ring roads development: a) Inner Ring Road (R1), b) the Second Ring Road (R2), c) the Northern Ring Road (R3), and d) the Outer Ring Road (R4). In addition to the road construction, the proposed projects include follows:

- At grade reconstruction of intersections,
- Construction of grade separations,
- Widening or reconstruction of major structures,
- Widening and reconstruction of entire roadway,
- Creation of additional through roadways in the corridor,
- Development of circumferential (ring roads) to compliment radial roadways

The report also focuses on parking and traffic management in the center of the city. In the Parking Action Plan, it is proposed to establish Parking Authorities to develop off-street parking facilities.

The road network is classified into Expressway, Principal Arterial, Minor Arterial, Collector, and Local.

3) Public Transport

Traffic management in the CBD area involves public transport system also. The report proposes Down Town Transport Terminal (DTC) in the CBD area. The idea is to develop two terminals at Saddar and Tower, connected by shuttle services. Although the Transport Sector Report supports the transition from minibuses to large buses, it also recognizes the difficulty of large bus operation in the congested CBD area where streets are narrow.

4) Mass Transit System

The future network of mass transit system is illustrated in Transport Sector Report as “Public Mass Transportation Plan (Figure 5.3.1)”. However, there is no explanation about each system. There are ambitious lines illustrated such as three circular routes in addition to KCR. Another big loop line outside the urbanized area, which connects Keamari and Bin Qasim passing through Gadap, is also illustrated. This idea is reflected as a recommendation in KSDP-2020, which mentions:

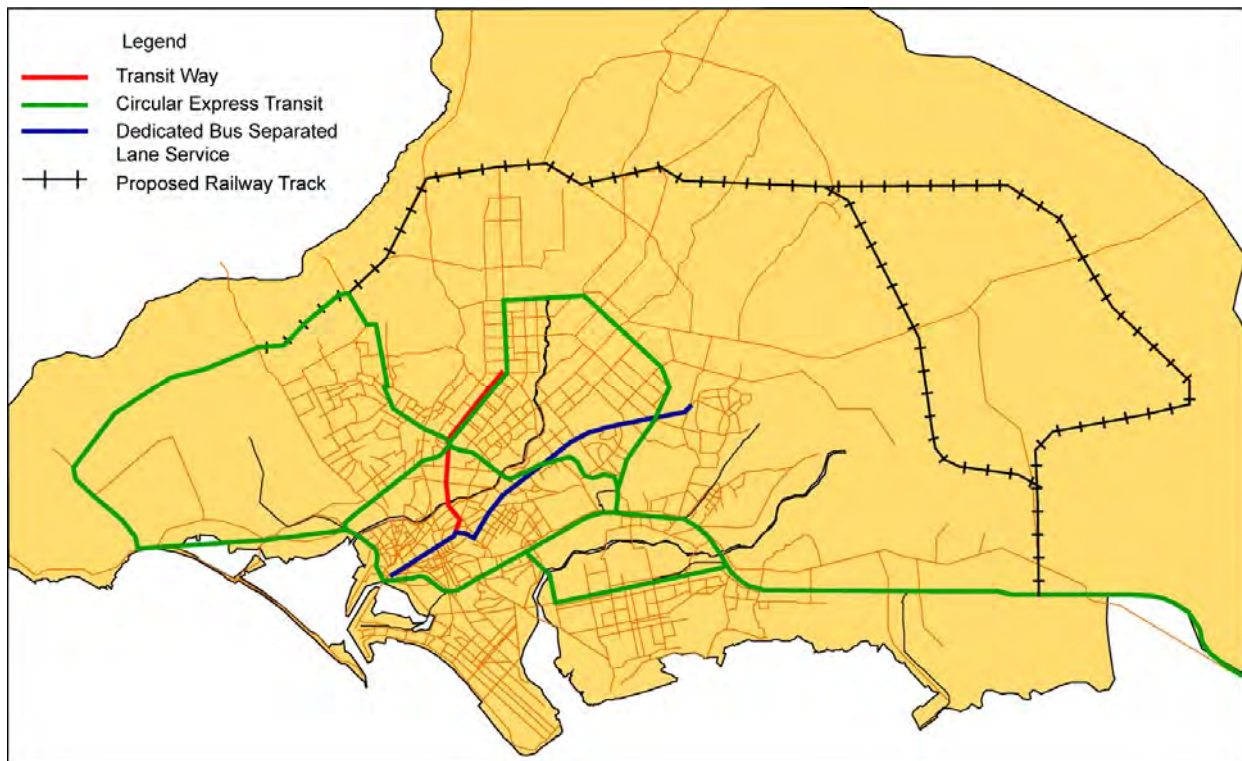
Karachi Circular Railway shall be extended to cover sub-urban areas for maximum coverage and utilities.

The priority corridor I and II in the Karachi Mass Transit Plan (KMTP) are missing in the figure, although the KSDP 2020 recommends these corridors as:

The feasibility of constructing light rail transit in the form of underground or elevated service on priority I and II corridors shall be examined.

It may be understood that the idea of the circular railways in the suburban area came from the master plan policy to develop the suburban area. However, the circular railways other than KCR should be considered as long-term projects beyond 2020 because such projects are not included in the project list for cost estimates as shown below.

1. Establishment of Bus Terminals at Proposed Locations,
2. Construct Model Bus-way on one Principal Artery of Karachi in accordance with Karachi Mass Transit Plan (proposed on Nawab Siddique Ali Khan Rd from Nagan to Mazar-e-Quaid),
3. Introduction and Operation of CNG based Bus System in Stages in accordance with approved plan,
4. Undertake construction and development of Priority-II Corridor Light Rail Line in accordance with Karachi Mass Transit Plan,
5. Introduce Bus Priority Scheme on a selected Arterial (Korangi Road),
6. Institute the Park & Ride philosophy in one of the Sub-Urban Areas of Karachi,
7. Operation of Express Park ‘n’ Ride Bus Service from Sohrab Goth to Tower via Lyari Expressway,
8. Construction of dedicated transit way for buses along University Road from Safoora Goth to Guru Mandir,
9. Revitalization of Karachi Circular Railway, and
10. Feasibility of Trams Service in Shah Faisal Town



Source: Illustrated in KTIP based on Figure 5.3.1 in Transport Sector Report of KSDP 2020

Figure 1-2-7 Transit Routes in Transport Sector Report of KSDP 2020

(3) Proposed Policy for 10th Five Year People's Plan 2010-15

KMTC has submitted a draft for 10th Five Year People's Plan 2010-15 (Karachi Urban Transport Sector), in which urban transport policy is described as:

Urban Transport Policy

- giving priority to the development of a comprehensive public transport system for Karachi and establishing a performance target such as maintaining public transport mode share at current levels.
- recognizing the need to be proactive in allocating road space to public transport to provide the necessary priority and level of service required to maximize use and deliver transit efficiency.
- addressing the growth of motor vehicles and the need to institute policy to manage growth and the implications this will have on the health and wellbeing of the populace
- establish an effective basis for the identification of a comprehensive road hierarchy
- developing a parking policy to manage parking on roads in CBDs.

The first item proposes to establish a target to keep the share of public transport mode at current level. Considering the rapid increase in the number of private cars in Karachi, the target to keep the present share in public transport seems to be realistic compared to the target of increasing the share. However, it is necessary to take into account of the present trip characteristics in Karachi for the target. Currently, there are so many jobless people who do not make any trip. When the economy improves, these people will begin to use public transport and the impact on the traffic demand in Karachi might be larger than car increase.

The second item implies introduction of exclusive bus lanes, BRT, or elevated structure using the present ROW of road.

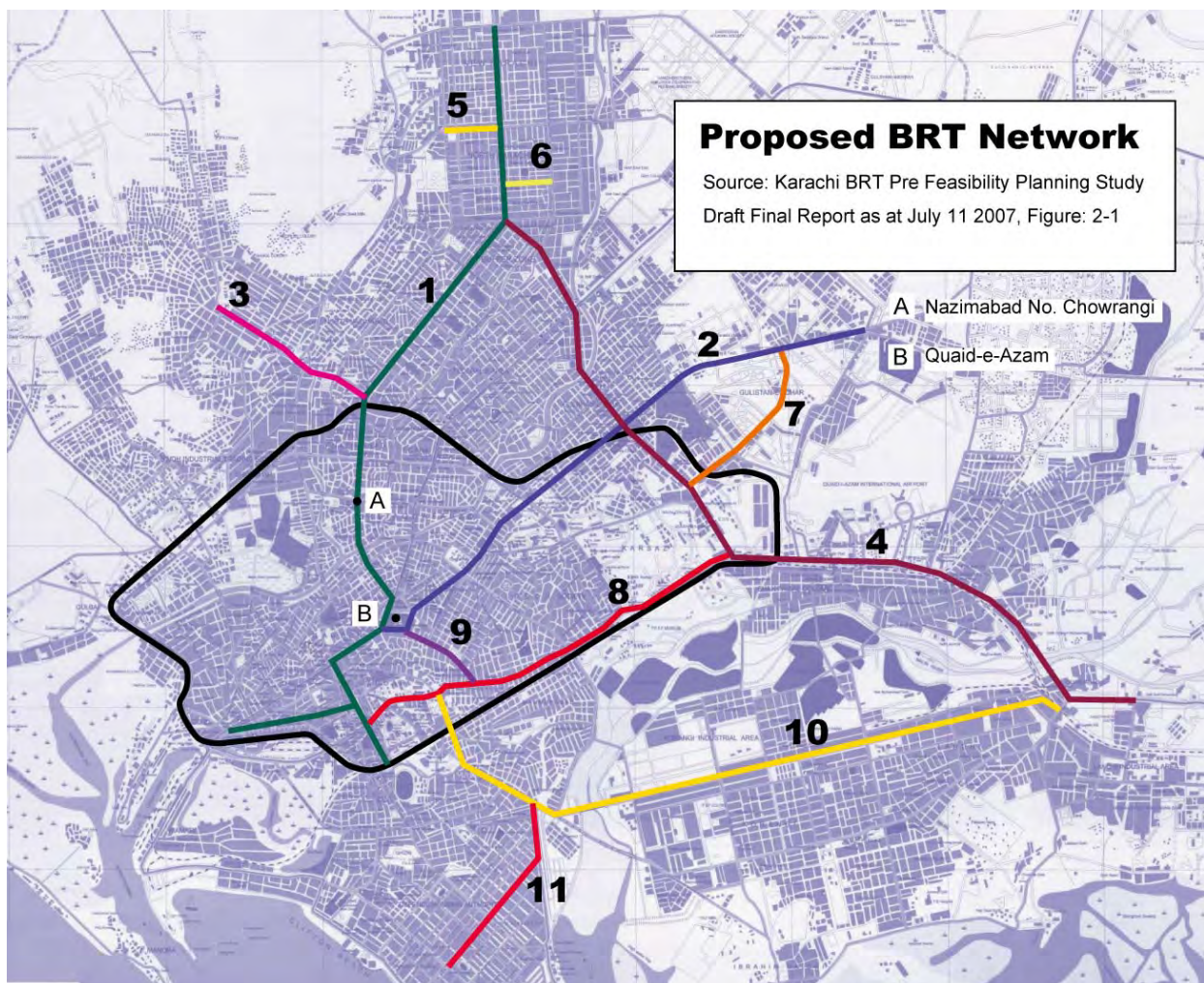
1.2.4 Karachi Mega City Sustainable Development Project (ADB)

BRT corridors were proposed in the detailed study entitled “Private Public Partnership Environment Friendly Public Transport System for Karachi”, sponsored by Government of Pakistan (GOP) in 2006. Based on the study, ADB prepared a transport sector roadmap in which 11 BRT lines were identified as shown in Figure 1-2-8. Among the 11 BRT lines, the following three lines were recommended as an initial project program (Tranche 1) in Karachi Mega City Sustainable Development Project (US\$ 200 million) and a pre-feasibility study was conducted for these lines¹.

BRT Line-1: Surjani to Quaid-e-Azam Mausoleum (25 km)

BRT Line-2: Safoora Goth to Quaid-e- Azam Mausoleum/CBD via University road (15.5km)

BRT Line-3: Orangi Town to Board Office N.Nazimabad (4 km)



Source: Karachi BRT Pre Feasibility Planning Study (Illustration in KTIP)

Figure 1-2-8 Proposed 11 BRT Corridors in ADB Megacity Project

ADB consultants in association with KMTTC completed pre-feasibility report and TOR for consulting services. However, due to certain reservations from GOS, ADB deferred the project. Subsequently, the Chief Secretary Sindh has requested vide D.O letter No. PS/CS/2009/58 dated 5.11.2009 to Economic Affairs Division, Government of Pakistan (GOP) to approach ADB for reconsideration of their deferment decision as ADB concerns had been addressed with reference to the issue of project execution by KMTTC, CDGK.

¹ BRT Line-2 was identified as Tranche 2 project in the pre-feasibility study

Although the BRT projects were not selected for the Mega City Sustainable Project, the plan of BRT line 1, 2, and 3 remains in CDGK.

The pre-feasibility study¹ proposed elevated sections along BRT-1 between Nazimabad No.1 Chowrangi and Quaid-e-Azam's Mazar. There is a roadside market along the elevated section and it was found difficult to reduce lane width of this road. Since the road is not wide enough to accommodate piers of an elevated road without reducing road side parking space, the elevated plan needs to be reviewed.

The study report concluded that BRT would not be feasible in Saddar Area and feeder routes are therefore proposed.

The location of depot for BRT buses was not identified in the report.

1.2.5 CNG Green Bus Project by TCD

This is a pilot project financed by CDGK for the operation of CNG buses in Karachi. The project was initiated in 2009 with 50 CNG buses purchased by CDGK for two routes from Surjani to Korangi and Merewether Tower. The bus fleet is modern and clean compared to other buses in Karachi, and it became very popular. Advertisements are printed on the sides of the CNG buses.

The basic scheme was that CDGK purchased CNG buses, developed a bus terminal, and then gave a concession for the operation to two private operators each. Operators received concession fee from CDGK while CDGK received revenue from passengers. In the beginning, e-ticketing system was introduced and the concession for e-ticketing was given to a company. The fare was lower than minibuses. Higher quality of bus service with lower fare level caused financial problem. CDGK had suffered continuous deficit from this project.

There was an interruption of the service due to lack of financial obligation of CDGK when replacement of tyre became necessary, and the project scheme was changed in July 2010. Under the new scheme, private operators can receive revenue from passengers but they are responsible for the maintenance expenditure and need to pay fee for using the CNG buses to CDGK. The additional 25 buses were purchased and the third route was open this year between Orangi and Clifton.

1.2.6 Shaheed Benazir Bhutto CNG Bus Project

A project, Shaheed Benazir Bhutto CNG Bus Project, Karachi is being initiated by CDGK in close coordination with Planning and Development department, GOS, IPDF, Ministry of Finance, Government of Pakistan (GOP) and Ministry of Environment, Government of Pakistan (GOP). This project is under the head of Environment Friendly Public Transport System on Public Private Partnership funding option. This project was conceived and initiated by the Planning Commission, Government of Pakistan (GOP) in 2005.

As part of the development of the project for Karachi, all the preparatory work including a detailed study, project PC1, Concession Agreement, Minimum Standard City Bus Specifications and other relevant Bidding Documents have been prepared by CDGK for its implementation in association with IPDF, Government of Pakistan (GOP).

The notification has been issued for 14 bus suppliers/manufacturers regarding minimum standard city bus specification. Expressions of interest were invited from potential investors, out of that 7 investors /operators have been pre-qualified and 6 have been submitted their financial and technical proposals. These proposals have been evaluated by a Committee consisting of representatives of Government of Pakistan (GOP), GOS and CDGK and same were submitted to NBP for necessary due diligence for 80 % loan financing. It may be mentioned that 80% of the bus cost would be provided by commercial bank as loan financing

¹ Draft Final Report as at July 11, 2007

under the umbrella of SBP. Government of Pakistan (GOP) subsidy would be provided through SBP for which necessary funding from Government of Pakistan (GOP) has been ensured. The private investors/ operators will bring at least a fleet of 25 buses and provide 20% equity. The Government of Pakistan (GOP) will input Rs. 677,181 per bus (as up front grant Rs. 300,000 per bus and remaining Rs. 377,181 as interest subsidy payable in 60 installments).

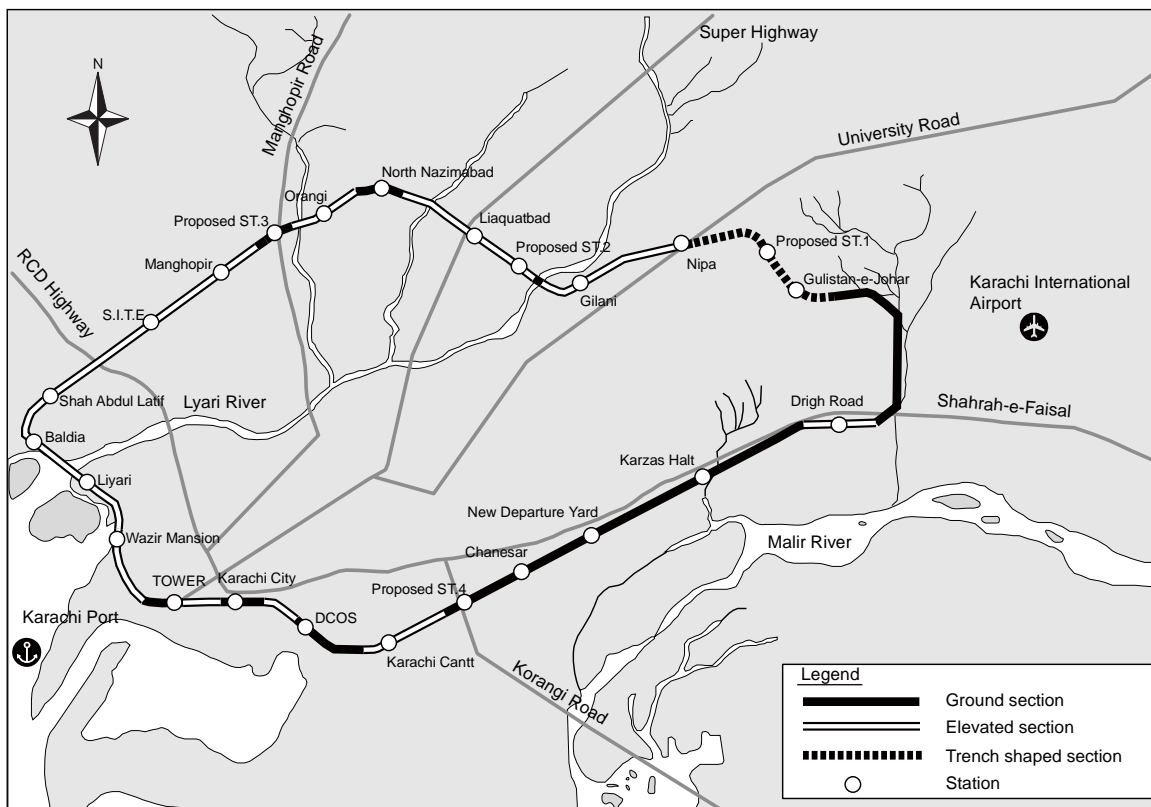
The second bidding of the project was held on April 2011, but it failed because none of the private companies submitted the bidding document.

Under the 18th amendment in the constitution of Pakistan passed by Parliament, the project has been devolved to planning development Department of GOS. The CDGK requested GOS for providing bridge financing for 80 % loan of 200 buses from Annual Development Plan (ADP) (2011-12). Besides, CDGK has already provided bridge loan financing for 50 buses in its District ADP. With the availability of funding, 250 buses will be on ground shortly.

1.2.7 Karachi Circular Railway (KCR)

The latest plan of KCR is shown below, which was obtained from the study of Special Assistance for Project Formation (SAPROF) for Karachi Circular Railway Project, JICA, May 2009. The technical studies were conducted by JETRO F/S in 2005 and Revalidation Study by SWR in 2008. Both the studies were thoroughly reviewed by SAPROF team and a proposal was made for the revised technical profile of KCR.

Location map is shown in Figure 1-2-9.



Source: Special Assistance for Project Formulation (SAPROF) for Karachi Circular Railway Project, May 2009, JICA

Figure 1-2-9 Location map of KCR

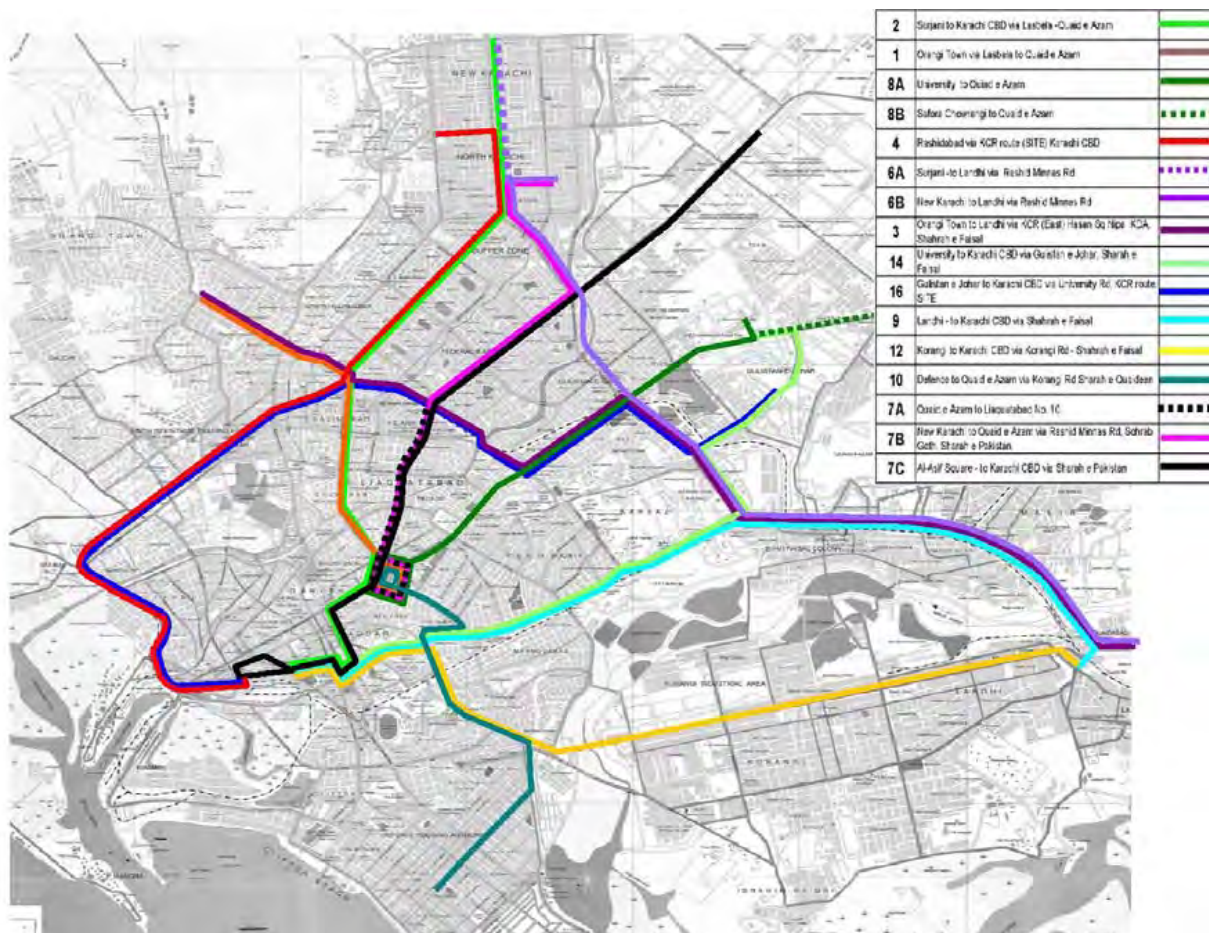
1.3 Review of Previous Transport Sector Studies

1.3.1 Private-Public partnership based environmental friendly public transport system for Karachi (2006)

This study analyzed the public transport problems in Karachi in detail and proposed bus development and reforms including the establishment of Karachi Urban Transit Authority (KUTA) and introduction of BRT. The proposed BRT system is based on the global experiences. This means that the dedicated bus lanes are provided for large capacity buses within the ROW of roads, instead of introducing elevated structures which can be converted to LRT in the later stage.

The final report has provided very useful information for BRT planning in KTIP Study.

This study proposed to convert KCR to BRT routes, and it plays an important part of the future BRT network as shown in Figure 1-3-1. On the other hand, KCR was also under consideration as on-going project. This implies that there was no coordination with KCR in this study and the proposed network should not be considered as the official plan.



Source: Public /Private Partnership based Environmentally-friendly Public Transport System for Karachi

Figure 1-3-1 BRT Route Network

1.3.2 Green Route Confirmatory Study for Karachi (2008)

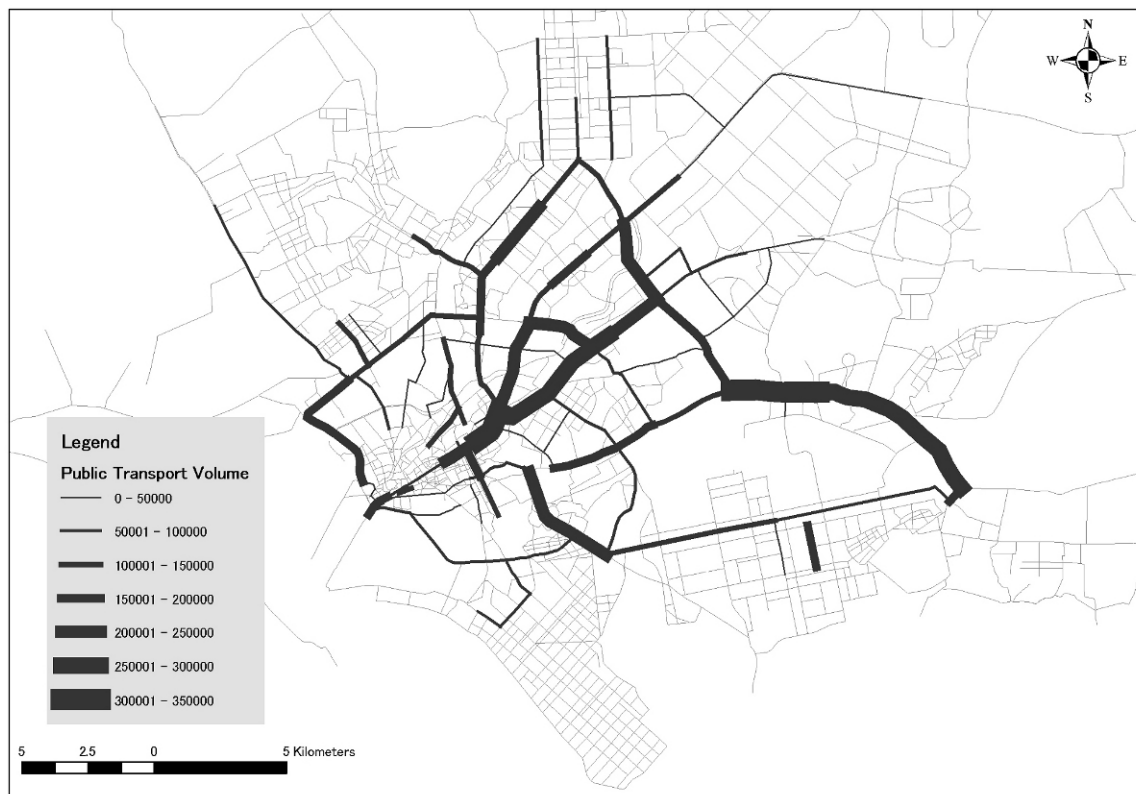
This is a detailed study for 40 CNG Green Routes identified by KMTC as notified by DRTA. The network of 40 Green Routes covers most of the major arterial roads in Karachi. The study includes:

- Mid block traffic volume count (97 locations),
- Public transport modes / routes identification and occupancy surveys,
- On-board passenger surveys /travel time study,
- Passengers interviews at the bus stops, and
- Route condition survey

The results of the study have provided very useful information in planning stage of KTIP. The result of the occupancy survey shows that Shahrah-e-Faisal Road between COD Bridge and Landhi Flyover is a very high demand corridor as well as other radial routes such as Tower – New Karachi, Tower – Super Highway, and University Road. It also shows that Rashid Minhas Road, which is not in radial direction, is also a high demand corridor.

The study provides information about the 19 parameters which are being used for development of financial model to ensure routes operation viability. Besides, this would facilitate potential bus operator to prepare their Technical and Financial proposals for onwards evaluation of CDGK.

The survey was conducted by Exponent Engineering (Pvt.) Limited. The work had been completed in March 2010 and CDGK had approved the final report. However, IPDF has not paid the contract fee to the consultant.



Source: CNG Green Route Confirmatory Study for Karachi, 2008 (Elaborated in KTIP)

Figure 1-3-2 Traffic Volume of Public Transport Passengers

1.3.3 Feasibility Study & Development of Transportation Control Plan of Karachi Metropolis (2007)

This study was conducted by Pakistan Space & Upper Atmosphere Research Commission (SUPARCO) under Transport & Communication Department (TCD), CDGK. The objective of the study was assessment of the impact of operation of vehicular traffic on physical, living and social environment of Karachi. Air quality and noise level were measured at 28 locations along five major corridors during the year 2005-2006. The monitored air pollutants were CO, CO₂, SO₂, NO_x, PM₁₀, O₃, and Toluene. Samples of soil and street sweeping were also collected at 26 points to analyze water and soil pollution.

Exhaust emissions from 468 vehicles were collected and analyzed.

The report estimated fuel consumption by vehicle type. The sources of fuel consumption obtained from the Oil Companies Advisory Committee and the average running distance by vehicle type.

1.3.4 Pak-USAID Karachi Metropolitan ITS Project

There is an on-going project of urban transport – “Development of an Intelligent Transportation System (ITS)-based traffic management model for metropolitan areas of Pakistan with Karachi as a pilot study”, in which the urban transportation policy is recommended. This is a joint research project of the University of Mississippi, USA and NED University of Engineering & Technology (NED), Pakistan, under “US-Pakistan Science and Technology Cooperative Program”. Its recommendation of urban transportation policy for Pakistani Cities covers the following issues.

- Mixed Landuse, Pedestrian, Women, and Green Space Considerations
- Road User Safety, Congestion, and Vehicle Emissions
- Public Investment for Transit, Multimodal Strategies, and Freight Infrastructures
- Traffic Management and road Network Infrastructure Asset Management
- Institutional Barriers and Infrastructure Investment Issues

This study will be finalized in March 2012.

1.3.5 Traffic Studies/ Surveys in Karachi by TCD

“Traffic Studies/ Surveys in Karachi” is a project conducted by Transport and Communication Department (TCD), CDGK. The project was started in 2004 and completed recently. The JICA Study Team was furnished the full report of the project by TCD in the beginning of July. The following surveys were conducted in the project.

Table 1-3-1 Types of Surveys in Traffic Studies/ Surveys in Karachi

No.	Name of Survey	Volume	Period
1.	Turning Movement Survey	73 intersections	2005 - 2009
2.	Mid Block Classified Counts	25 sections	2005 – 2006
3.	CBD Cordon Counts	40 locations	2005
4.	Traffic Counts at Special Generation Points	50 points	2005 – 2009
5.	Travel Time and Delay Studies	28 routes	2007 – 2009
6.	Parking Surveys	54 points	2006 – 2007
7.	Public Transport Survey	18 terminals	2007
8.	Goods Transport Survey	3 truck terminals	2005 - 2006
9.	Origin-Destination Survey	4 sections	

Source: TCD, CDGK

(1) Turning Movement Survey

A turning movement survey is a classified traffic count survey by direction at an intersection. The surveys were conducted at 70 intersections in Karachi on a weekday for 16 hours. The survey date varies by location from 2005 to 2009. Vehicle classification in the survey was: 1) Motorcycle, 2) Auto Rickshaws, 3) Cars/jeeps/vans, 4) Pickups, 5) Minibuses/Coaches, 6) Buses, and 7) Trucks+ Trailers. Traffic volume was recorded hourly.

(2) Mid Block Classified Counts

A mid block classified count survey is a classified traffic count survey of a section for both directions. The surveys were conducted at 25 sections in Karachi on a weekday for 16 hours. The survey date varies by location during 2005 and 2006. The same vehicle classification as the Turning Movement Survey was applied.

(3) CBD Cordon Counts

This survey counts traffic volume entering to the CBD area and outgoing from the CBD area at 40 points along the cordon line which surrounds the CBD area. Traffic count period was 16 hours from 7 am to 11 pm. The same vehicle classification as the Turning Movement Survey was applied. OD interview survey was also conducted as sample base. The information on origin and destination was classified into 20 zones (Town level).

(4) Traffic Counts at Special Generation Points

Traffic volume was counted at 50 points where a large scale trip generation occurs. Vehicle classification and survey period depended on the characteristics of the survey point. OD interview survey was also conducted based on 20-zones system.

(5) Travel Time and Delay Studies

These studies were conducted from 2007 to 2009 along 28 routes. Travel time was recorded in peak and off-peak hours by a test car. The driver followed the average travel speed on the traffic flow by his own judgment. The number of round trips were three.

(6) Parking Surveys

The number plates of parked vehicles were recorded every hour along the parking space for the survey. The survey period was 12 hours and vehicle classification was the same as other surveys.

(7) Public Transport Survey

The bus-occupancy, boarding/alighting and roadside interviews were conducted for 15 hours (0700 to 2200 hours) time period. The roadside interviews included origin-destination, trip purpose, and opinion about the public transport problems.

(8) Goods Transport Survey

This survey, consisting of traffic count at gates and interview with drivers, was conducted at three major truck terminals: KPT, Sabzi Mandi, and new truck terminal (Mauripur Road,). Vehicle classification was: 1) Suzuki Pickup, 2) Freight Pickup, 3) Truck 2-Axle, 4) Truck 3-Axle, 5) Truck 4-axle, and 6) Truck 5-Axle and more.

(9) Origin-Destination Survey

The Origin-Destination Survey was conducted at four locations: Super Highway (Toll Plaza), National Highway, RCD Highway, and Coastal Road. These are the points where traffic to and from Karachi can be properly obtained, except for Coastal Road. Traffic volume was counted for 24 hours for three days (two weekdays and a Saturday) in 2008. The applied

vehicle classification was: 1) Motor Cycle/Scooter, 2) Auto Rickshaw, 3) Cars/Jeeps Pickup and other small vehicle, 4) Wagons/Mini Buses, 5) Buses, 6) Trucks 2-XL & 3-XL, and 7) Trucks & Trailers 4-XL, 5-XL & 6-XL. Interview survey for origin and destination was also conducted at a sampling rate of 10-20%. The zoning system was as same as other surveys in the project.

1.3.6 Person Trip Survey for Karachi City (2005)

This survey was conducted by JICA in close coordination with KMTTC, CDGK, using a local company in 2005. The period of the field work was three months from September to November. The sample size was as large as 26,300 households but the number of persons interviewed was 58,258. This means that only 2.22 members were interviewed per household in spite of the enough number of samples of the households.

The classification of trip modes was: 1) Walk, 2) Cycle, 3) Motor Cycle, 4) Tanga, 5) Taxi, 6) Rickshaw, 7) Car/Jeep, 8) Van/Pickup, 9) Company Owned Bus, 10) Suzuki, 11) Minibus/Wagon, 12) Rail Car, 13) Others, 14) Water launch, and 15) Truck.

There are some islands where water transport is required. Water transport is also used for the trip to Manora peninsula.

The trip purpose was classified into: 1) Job/Business, 2) School, 3) Home, 4) Shopping/ market, 5) Social, 6) Hoteling, 7) For going to mosque/ church, 8) No particular place, 9) Any other, and 10) Don't know. In a person trip survey, it is better to separate commuter trip and business trip. Commuter trips can be answered by other family members or guessed by interviewer, while only the person who made the business trip can answer the trip.

The person trip survey did not include a screen line survey and cordon line survey, which are important survey to adjust the error in the household interview survey.

1.3.7 The Study on Future Traffic Demand Forecast of Karachi City (2008)

To supplement the person trip survey in 2005, a set of traffic surveys was conducted by JICA in 2008. The study conducted the following surveys:

- Screen Line Survey at 34 bridges along Lyari River,
- Cordon Line Survey (Highway) at 3 points of Karachi boundary,
- Cordon Line Survey at Airport,
- Cordon Line Survey at Karachi Cant. Station,
- Mid Block Traffic Count Survey at 34 locations, and
- Road Inventory Survey

O/D matrices were produced from the person trip survey in 2005 and the study in 2008. In addition, traffic network model was developed in the study. JICA-STRADA was used for the network building and traffic assignment.

1.4 Issues from the Review

1.4.1 Duplication of Mass Transit Corridors

The Corridor-4 runs in parallel with KCR along Shahrah-e-Faisal Road. The Corridor-6 also runs in parallel with KCR between Tower and the crossing point of KCR and RCD Highway. Since the term "Mass Transit" usually means transit system with high capacity, these parallel routes are obviously duplication. It would be rational if the Corridor-4 and Corridor-6 are branch lines of KCR and use the same route along the parallel section. In addition to the Corridors, BRT routes are proposed along KCR in the BRT study in 2006.

It is necessary to re-arrange the network to avoid the duplication and ensure the coordination between CDGK and Pakistan Railways.

1.4.2 Changes in Urban Condition along the Corridors

After the notification of the Mass Transit Master Plan by Government of Pakistan (GOP) (1995), elevated structure of the Corridors became more difficult and costly due to the construction of flyovers. Corridor-6 became impossible due to the construction of flyover at the end of RCD highway. In addition, construction of buildings and encroachment are observed along the corridors.

1.4.3 Failures Repeated for Priority Corridors

Every attempt to materialize the priority corridor I & II had been failed. There are individual reasons of the failure in each project, which seem to be rational. However, it is necessary to review the principal aspects of the project scheme such as BOT and PPP. Since there are few examples of mass transit system which is financially sustainable without financial support from public sector in the world, more attractive schemes for private sector should be considered instead of posing too much demand on investors.

1.4.4 Disorganized Transport Strategy and Policy

In an urban transport plan, its projects and programs should be well organized under a clear structure of public statements such as strategy, object, policy, and so on. The typical structure in a transport plan is such as goals – objectives – policies. In some cases, the word of “vision” and “strategy” are used. This kind of planning structure is not clear in the transport sector in KSDP 2020. There are 16 objectives, three principles, and some recommendations, but they are only a mixture of public statements of various level. It is necessary to establish the policy structure for the transport plan in Karachi.

1.4.5 Lack of Successful Transport Project

Karachi has introduced several bus projects to improve public transport. The Metro Bus was very successful in the beginning. However, the modern and clean bus fleet has become out of date and its customer oriented services have become as same as other bus services. The Urban Transport Scheme (UTS) was introduced in the early 2000’s but resulted in failure due to lack of support by the Government and changes in CDGK. The pilot project of CNG Green Bus is very new but it faces financial problem. If the history of project failure is repeated, people will take it for granted that any project initiated by the government will fail. It is necessary to implement a public transport project in successful manner.

Chapter 2 Traffic Surveys

2.1 Traffic Surveys conducted in KTIP

The traffic surveys in this study are grouped into 1) Person Trip Survey and 2) Supplementary Surveys. The major purpose of the Person Trip Survey is to develop Origin-Destination (OD) matrices for transport planning. Household Interview Survey is the core of the survey, while Cordon Line Survey (Highway, Airport, and Railway Station) and Screen Line Survey are used to calibrate the developed OD matrices. Supplementary Surveys are basically used to analyze the present traffic condition and are expected to give supportive information to the development of the master plan.

Table 2-1-1 List of Traffic Surveys (Person Trip Survey)

Survey	Contents	Method	Survey Volume
Household Interview Survey (HIS)	Trip information of sampled household	Interview by visiting sampled household	40,000 households
Cordon Line Survey (Highway)	Trip information of passengers crossing the boundary of Karachi City	Manual traffic count and roadside OD interview	3 locations Sample Rate: 20%
Cordon Line Survey (Airport)	Trip information of flight passengers at the airport	Interview in the departure lounge (assuming the arrival movement is the same)	No. of samples: 400
Cordon Line Survey (Station)	Trip information of railway passengers who cross the boundary of Karachi City	Interview inside railway and counting the number of passengers	No. of samples: 400
Screen Line Survey	Traffic volume which cross the screen line (Lyari River)	Manual traffic count and passenger occupancy by observation	15 locations for traffic count (14 locations in 2008 survey) 3 locations for passenger occupancy survey

Source: JICA Study Team

Table 2-1-2 List of Traffic Surveys (Supplementary Surveys)

Survey	Contents	Method	Survey Volume
Mid Block Traffic Survey	Traffic volume of major roads	Manual classified traffic count	4 times at 5 locations
Cargo Movement Survey	Cargo OD in Karachi City	Interview survey at gates of KPT and two truck terminals	3 locations (14 gates)
Roadside Interview Survey	Traffic opinion of public transport users	Interview to public transport users at terminal and roadside	No. of samples: 400 * 5
Public Transport Survey	Frequency and route of buses	Manual count at major bus terminals	15 routes
Travel Speed Survey	Travel speed of cars in peak and off-peak hours along the major corridors	Speed record by a test vehicle	10 routes

Source: JICA Study Team

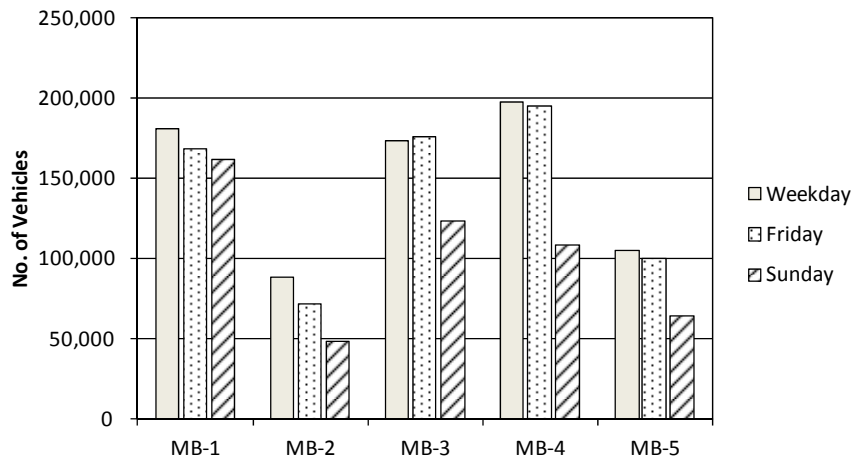
The details of the Traffic Surveys are described in Appendix-3.

The analysis in the Interim Report-1 is based on the results of Household Interview Survey in the middle of March 2011 with the sample size of 37,644 households instead of the target samples of 40,000.

2.2 Traffic Volume

2.2.1 Mid Block Traffic Count Survey

Mid Block Traffic Count Survey was conducted at 5 locations for 24 hours on a weekday, Friday, and Sunday in 2010. Figure 2-2-1 shows the daily traffic volume of the locations. Traffic volume on Friday was smaller than that of the weekday a little except for M.A. Jinnha Road. The Sunday traffic was only 55% of the weekday traffic along Estate Avenue (MB-2) and Shahrah-e-Faisal (MB-4), while it was 60% and 70% at Khayaban-e-Iqbal and M.A. Jinnah Road, respectively. On the other hand, the Sunday traffic was only 10% less than the weekday traffic along Shahrah-e-Sher Shah Suri (MB-1).

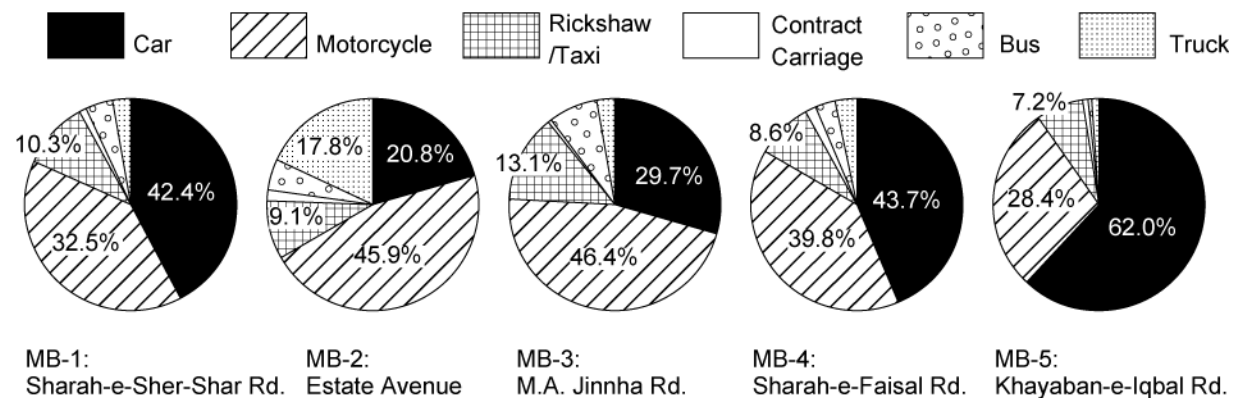


Source: JICA Study Team (Mid Block Traffic Count Survey, 2010)

Figure 2-2-1 Daily Traffic at Mid Block Survey Locations

Figure 2-2-2 shows the traffic composition at the five different roads on the weekdays. MB-1 and MB-4 represent typical radial direction corridors, where passenger cars account for more than 40%, followed by motorcycles accounting for 30–40%. Rickshaws and taxis account for 10% along these corridors. MB-2 represents a typical road inside an industrial area. The percentage of cars is as small as 20% compared to other roads, but motorcycles account for 46% of the traffic. The characteristic of this road is a high percentage of truck volume accounting for 18%. In Clifton Cantonment, car is the major transport mode accounting for 60% of road traffic as shown in the pie chart of MB-5.

Buses are very minor traffic mode in terms of the number of vehicles in these roads. This shows poor public transport service in terms of quantity.

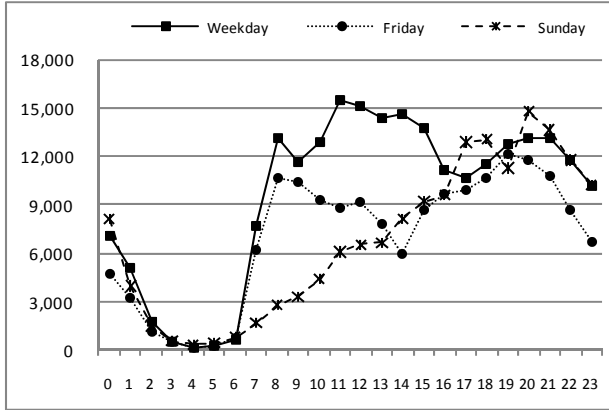


Source: Mid Block Traffic Survey in KTIP

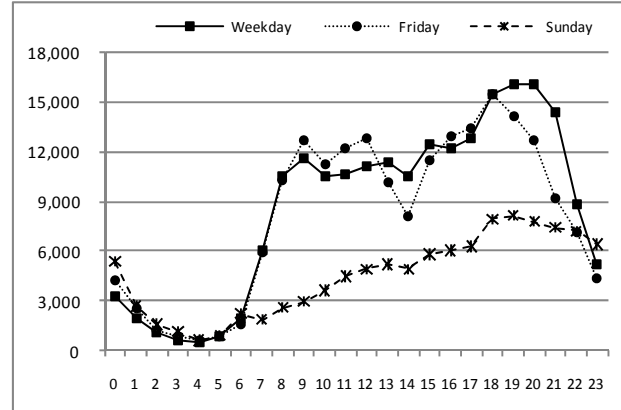
Figure 2-2-2 Composition of Vehicle Type by Survey Location

In general, typical roads have the peak in the morning time due to commuter trips and the second peak in the afternoon due to trips of going back home, and the traffic between the two peaks is small compared to the peak traffic. However, traffic of roads in Karachi shows different peak characteristics as illustrated in Figure 2-2-3. There is a continuous traffic during day time between morning and afternoon peaks.

MB-1: Sharah-e-Sher-Shah Rd.



MB-4: Sharah-e-Faisal Rd.

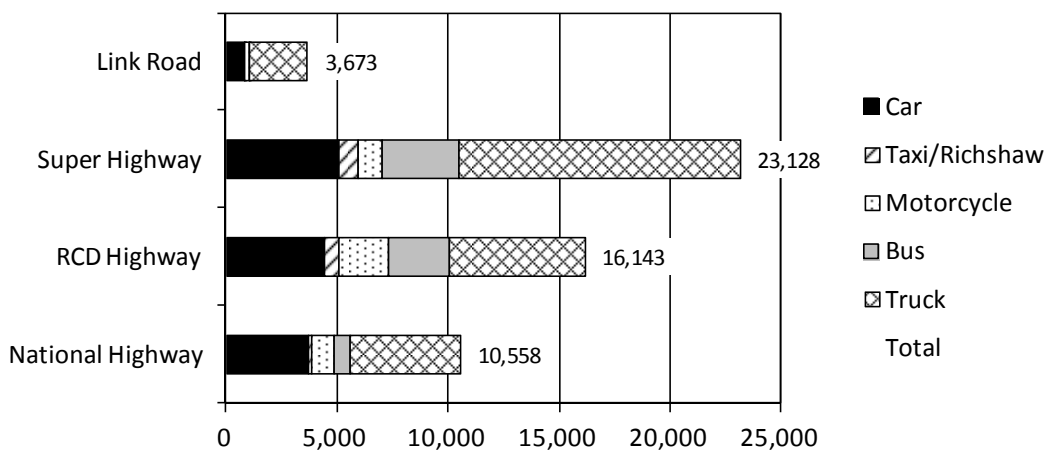


Note: Charts of MB-2, MB-3, and MB-5 are shown in Appendix-4.
Source: JICA Study Team (Mid Block Traffic Survey, 2010)

Figure 2-2-3 Hourly Traffic Volume

2.2.2 Cordon Line Survey

Cordon Line Survey was conducted at 4 locations along Super Highway, National Highway, RCD Highway, and Link Road near the Karachi boundary to count the number of traffic that enter to and exit from Karachi. Figure 2-4-4 shows the chart of traffic volume at the survey locations. The characteristics of vehicle composition near the boundary were quite different from those of urban roads. Truck was the major vehicles at these locations, accounting for 55% on Super Highway, 71% on Link Road, 47% on National Highway, and 38% on RCD Highway. The number of motorcycles was small, while buses accounted for 17% on RCD Highway and 15% on Super Highway.



Source: JICA Study Team (Cordon Line Survey, 2010)

Figure 2-2-4 Traffic Volume at Cordon Line Survey Locations

2.2.3 Screen Line Survey

Traffic count surveys and passenger occupancy surveys were conducted at 15 bridges along Lyari River in the Screen Line Survey. Table 2-2-1 shows the summary of the result. The number of vehicles that cross Lyari River was counted as 1.08 million per day for both directions, in which motorcycles accounted for 46.8% followed by passenger cars at 27.1%. The number of passengers was estimated as 3.32 million in which bus passengers accounted for 53.1%, followed by passenger car users and motorcycle users at 19.1%.

Table 2-2-1 No. of Vehicles and Passengers Crossing Liary River per Day

		Car	Taxi/Rick	Motorcycle	Bus	Truck	Total
Vehicle	No.	293,446	146,125	506,806	61,363	76,190	1,083,930
	%	27.1	13.5	46.8	5.7	7.0	100
Passenger	No.	633,334	190,178	635,233	1,762,286	99,915	3,320,947
	%	19.1	5.7	19.1	53.1	3.0	100

Source: JICA Study Team (Screen Line Survey, 2010)

Figure 2-2-5 shows the number of vehicles by survey location. In the figure, SL-01 – SL-15 are the code of the survey locations. Sir Shah Suleman Road (SL-09) has the largest traffic volume with 176,000 vehicles per day. This is a part of Inner Ring Road. S.M. Toufeeq Road (SL-07), which connects the center of the city and Super Highway for the radial direction, is the second with 168,000 vehicles. Rashid Minhas Road (SL-11) connects the north part and east part of the city for circular direction with 150,000 vehicles. Las Bela Bridge (SL-06), having 131 vehicles per day, connects the center of the city and the north of Karachi for radial direction.

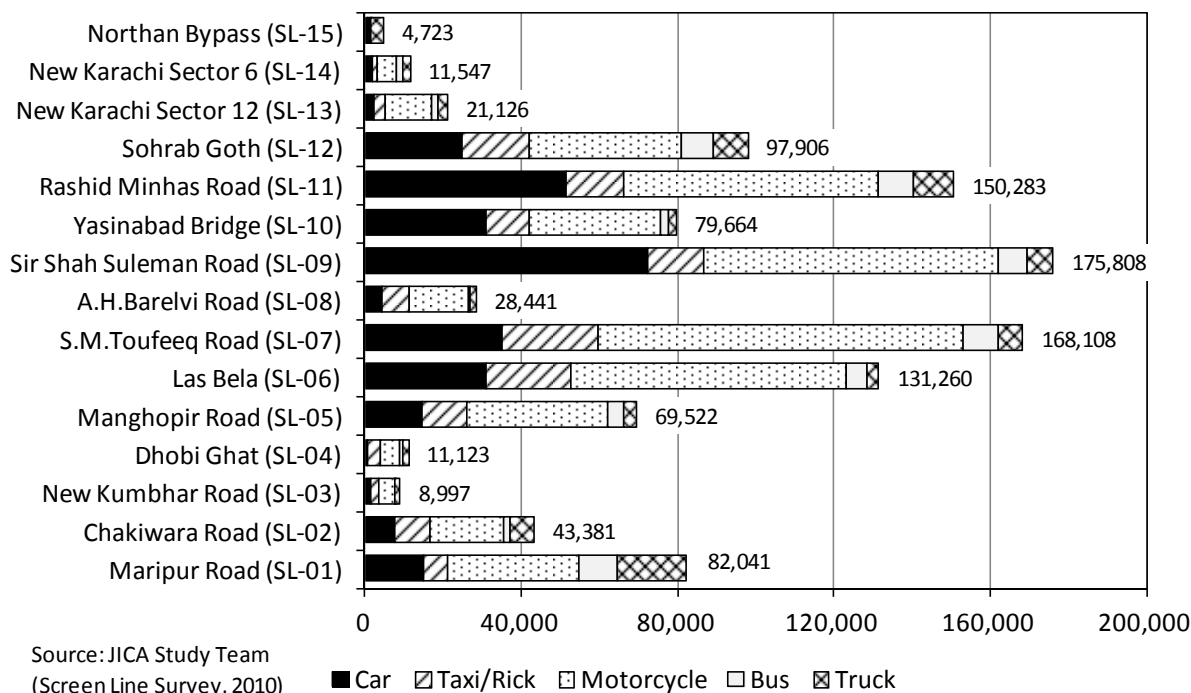


Figure 2-2-5 Traffic Volume at 15 Survey Locations

Figure 2-2-6 shows the estimated number of passengers by survey location. The passenger volume was largest at SL-07 (S.M. Toufeeq Road) with 0.56 million. The second (SL-09) and the third (SL-11) are circular routes of the road network with passenger volume of as large as 0.47 and 0.45 million, respectively.

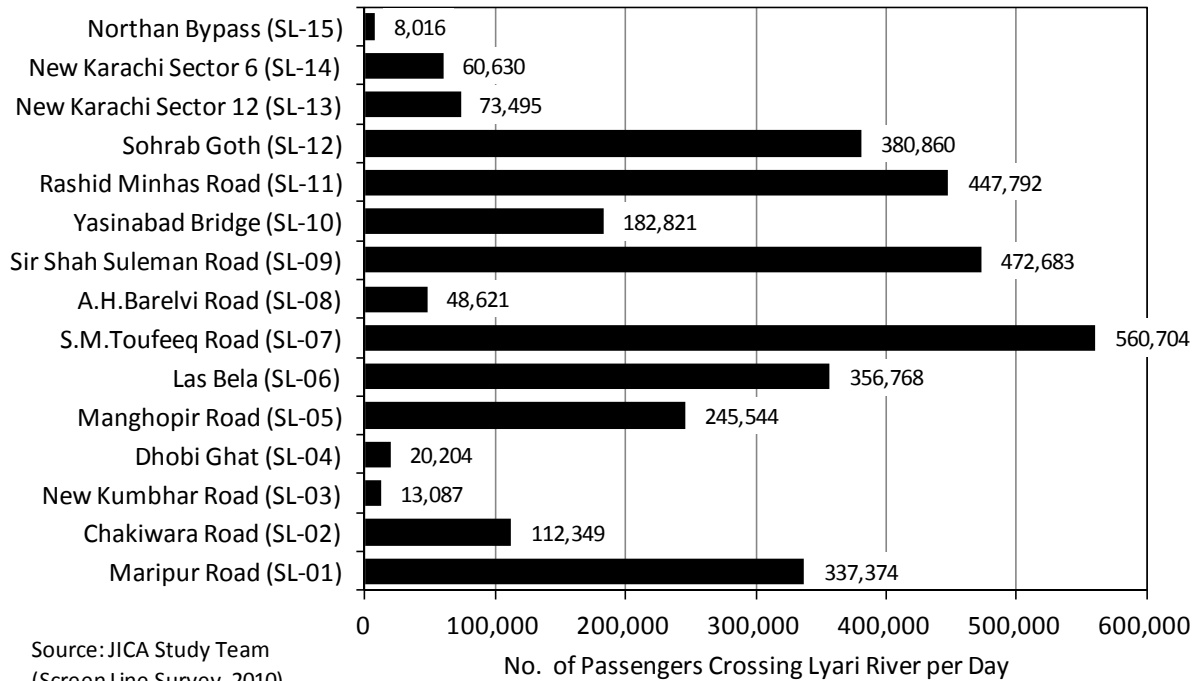


Figure 2-2-6 No. of Passengers at 15 Survey Locations

Figure 2-2-7 shows hourly traffic volume crossing Lyari River by vehicle type. Traffic volume rapidly increases from 6 to 9 A.M. and high traffic volume continues during daytime. The peak hour is observed in the evening around 7 P.M.

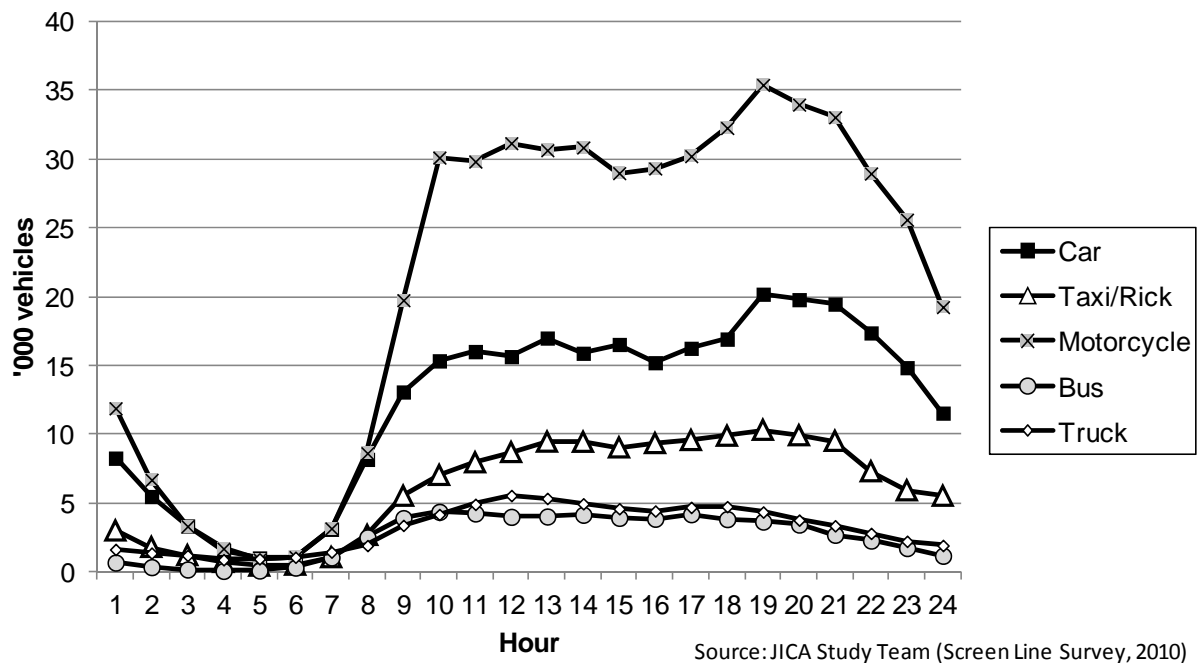
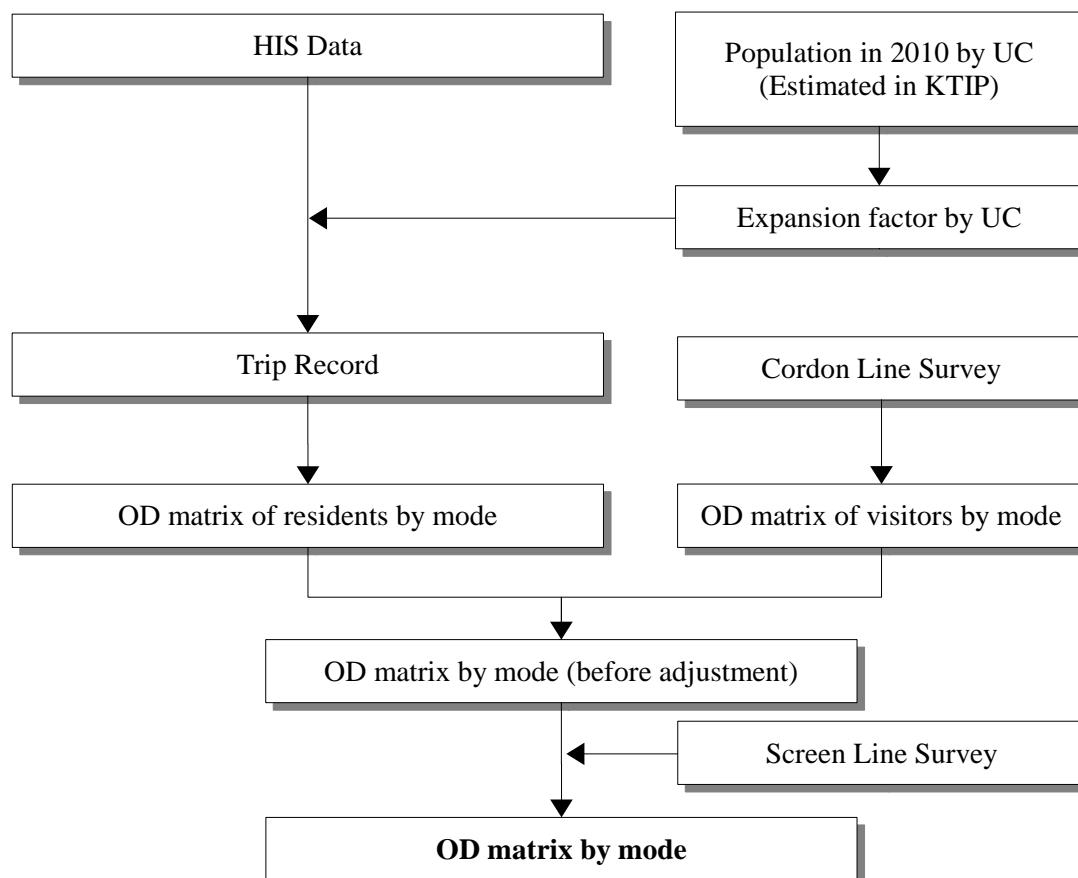


Figure 2-2-7 Hourly Traffic Volume Crossing Lyari River

2.3 Estimation of the Present OD matrix

2.3.1 Methodology

The present OD matrix was estimated from the Household Interview Survey (HIS), Screen Line Survey, and Cordon Line Survey (CLS). The OD matrix consists of residents' trip and visitors' trip. From HIS, trip records are prepared, including i) origin, ii) destination, iii) travel mode, iv) trip purpose, and v) expansion factor. The OD matrix of residents is computed from the records by summing up the expansion factor by origin by destination (and by mode, by purpose, if necessary). The OD matrix of visitors is estimated from the CLS at three highway cordons, a railway cordon, and an airport cordon. The OD matrix is adjusted by the SLS. Figure 2-3-1 shows the flowchart of the OD matrix making.



Source: KTIP

Figure 2-3-1 Flowchart of OD Matrix Estimation

Note that the OD matrix estimated in this report is the result of the HIS as of March 2011 when the total sample size was 37,644 households against the target sample size of 40,000.

2.3.2 Expansion Factor

The numbers of trips are estimated from trip samples by applying expansion factors that are calculated from the corresponding sampling rates. The sampling rates are calculated from the number of persons interviewed and the population. They were calculated UC-wise.

The number of members interviewed is 151,300 while the population age five years and more in 2010 is estimated as 17.1 million and the average expansion factor is calculated as 113. The results of expansion factors are around 90 – 120. This means that one trip obtained in the interview survey will be calculated as 90 – 120 trips in the OD matrix.

There are 196,443 sample trips in the HIS. From this, the number of trips was calculated as 21.9 million. This is the number before the necessary adjustment.

2.3.3 Visitors' Trips

The samples in HIS only cover the trips of residents in Karachi. Visitors' trips were estimated from the Cordon Line Surveys at three highways, the airport, and the railway station. The total number of visitors was estimated as 98,700 per day for both inbound and outbound. This accounts for 0.5% of the total number of trips in Karachi.

(1) Visitors by Road

The number of visitors by road was estimated as 87,390 per day (both inbound and outbound) as shown in Table 2-3-1. It was estimated as 90,000 in the JICA 2008 Study. The most bus passengers transfer the mode at three terminals (Lee Market, City Terminal, and Sohrab Goth).

Table 2-3-1 No. of Visitors (Both Directions)

Code	Road Name	Car	Rickshaw	Motorcycle	Bus	Total
CLH-1	National Highway	3,010	280	1,210	13,600	15,570
CLH-2	RCD Highway	5,910	530	1,430	16,900	20,720
CLH-3	Super Highway	4,530	1,180	1,010	37,800	41,480
Total		13,450	1,990	3,650	68,300	87,390

Source: CLH in KTIP

(2) Visitors by Train

The number of visitors by train was estimated as 10,900 per day (inbound and outbound), which was 15,000 in the JICA 2008 Study. The number of trains decreased from 18 trains per day in 2008 to 15 in 2011. The modal share of the feeder transport from/to the station was estimated as shown in Table 2-3-2.

Table 2-3-2 Modal Share of Feeder Transport at Station

Walk	Motorcycle	Car	Rickshaw/ Taxi	Bus
7%	2%	13%	45%	32%

Source: CLH in KTIP

(3) Visitors by Air

The number of visitors by air was estimated as 10,500 per day (inbound and outbound), which was 9,700 in the JICA 2008 Study. Bus accounts for only 5% of the feeder transport modes while cars do 55% as shown in Table 2-3-3.

Table 2-3-3 Modal Share of Feeder Transport at Airport

Walk	Motorcycle	Car	Rickshaw/ Taxi	Bus
N.A.	2%	55%	38%	5%

Source: CLH in KTIP

2.3.4 Adjustment of OD matrix

(1) Necessity of Adjustment

The OD matrix needs adjustment because of the following reasons.

Estimation of Population

Population size is essential information because the HIS is a sampling survey which provides only proportion of data of the population. The population by UC in 2010 was estimated by JICA Study Team because there was only 1998 Census for the population data.

Lack of Trip Information of Special Area

The household interview survey was not conducted in the military area of Malir Cantonment. The sample size in sensitive areas is smaller than other areas.

Sampling Bias

The sample houses were selected based on the allocated number of samples to each survey zone. The sample size was allocated manually considering the balance of the sample size among survey zones. Although this was done to disperse samples to entire UC area, the proportion of samples to population is different by survey zone. This might have caused over sampling of a socio-economic group and under sampling of another group.

The survey was conducted in the evening time to collect information of all members. This means that families which were out of their house in the evening time and whose head of the house is night shift worker were not selected.

Interview Bias

In most cases, the interview to each member was conducted in the presence of the head of household. It was observed that information of women was not obtained properly. Sometimes, the head of the house did not allow the interview to their wife and children and answer the question about the trip information of their family.

The interview items of trips are complex both for interviewers and interviewees. Interviewees needed to remember trips of the day before the interview date and tended to keep the trip secret when it was troublesome.

It was observed that some interviewees could not answer the location of their trip destination.

Non-resident Trips

Non-resident people such as tourists, business men, and foreigners, were not interviewed.

Driver's Trips

Trips of taxi, rickshaw, public buses, and contract carriage drivers by their vehicle were not obtained in the interview because it was not practical to ask all the trip information of these vehicles in the limited time of the interview.

(2) Comparison of OD Matrix before Adjustment with Other Data

1) Screen Line

The number of trips which cross Lyari River was counted in the Screen Line Survey. It was estimated that the number of passengers crossing the screen line was 3.2 million passengers per day for both directions, while the number of trips from the HIS was estimated as 2.2 million.

This means that the number of trips obtained in the HIS might be less than the actual trips. However, it is difficult to identify the reason because there are many variables, like UC wise population, which were estimated under limited information for the trip estimations.

The OD matrix was adjusted from the ratio of the screen line trips to HIS trips by mode.

2) CBD Cordon Count Study (2005)

The number of arrival trips to CBD was calculated from HIS and compared with the result of “CBD Cordon Count Study (2005, TCD, CDGK)”. The CBD Cordon Count Study estimated the number of trips entering the CBD area as 575,720. On the other hand, the number of trips to CBD was estimated as 454,530 in the HIS, which was 79% of the previous study.

3) Female Trips by Bus

Women account for 25% of bus passengers, according to the result of “CNG Green Bus Confirmatory Study”. On the other hand, it is estimated as 15% in the HIS. This implies that the number of female trips in the HIS is smaller than the actual number of trips.

4) Registered Vehicles

The number of the registered motorcycles in Karachi is 1.1 million in September 2010, while it was estimated as 1.79 million in the HIS. This implies the over sampling from households having motorcycles. However, the reason is under investigation. On the other hand, the number of registered cars in Karachi is 0.9 million while that in the HIS was 0.71 million. This might be due to the small sampling rates in Clifton Cantonment where the car ownership is very high.

(3) OD Matrix after Adjustment

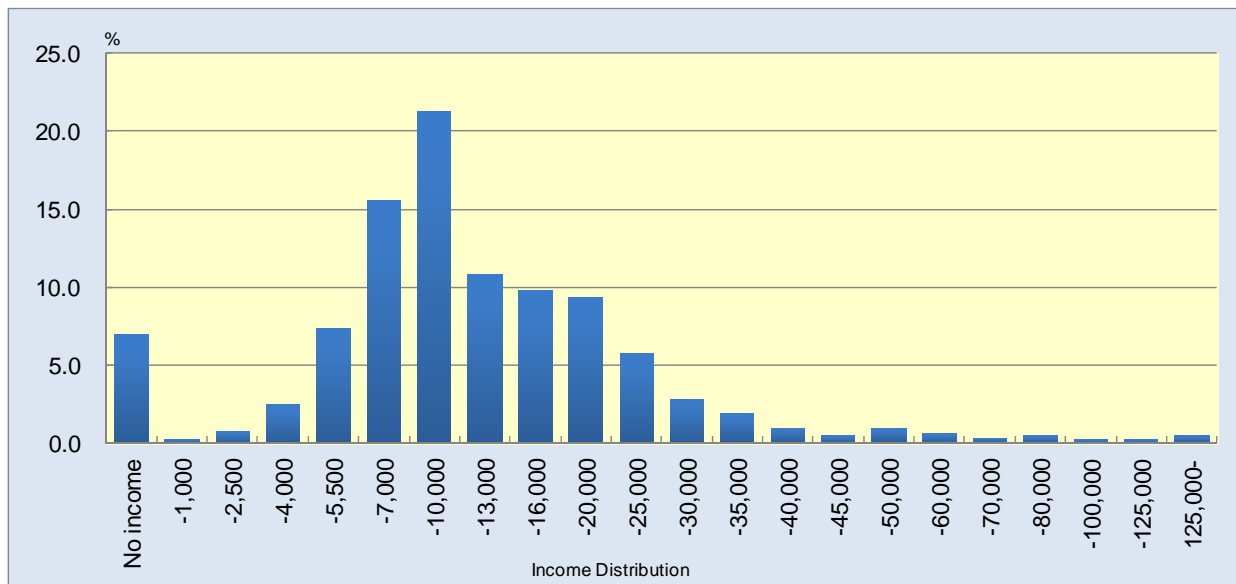
In the beginning, adjustment factors for households having motorcycles and cars have been applied to the original expansion factors so that the estimated number of registered vehicle becomes as same as the official statistics. To adjust the OD matrix to the traffic volume crossing Lyari River, adjustment factors by trip mode have been applied.

2.4 Analysis of Survey Results

2.4.1 Socio-economic Characteristics

(1) Household Income Level

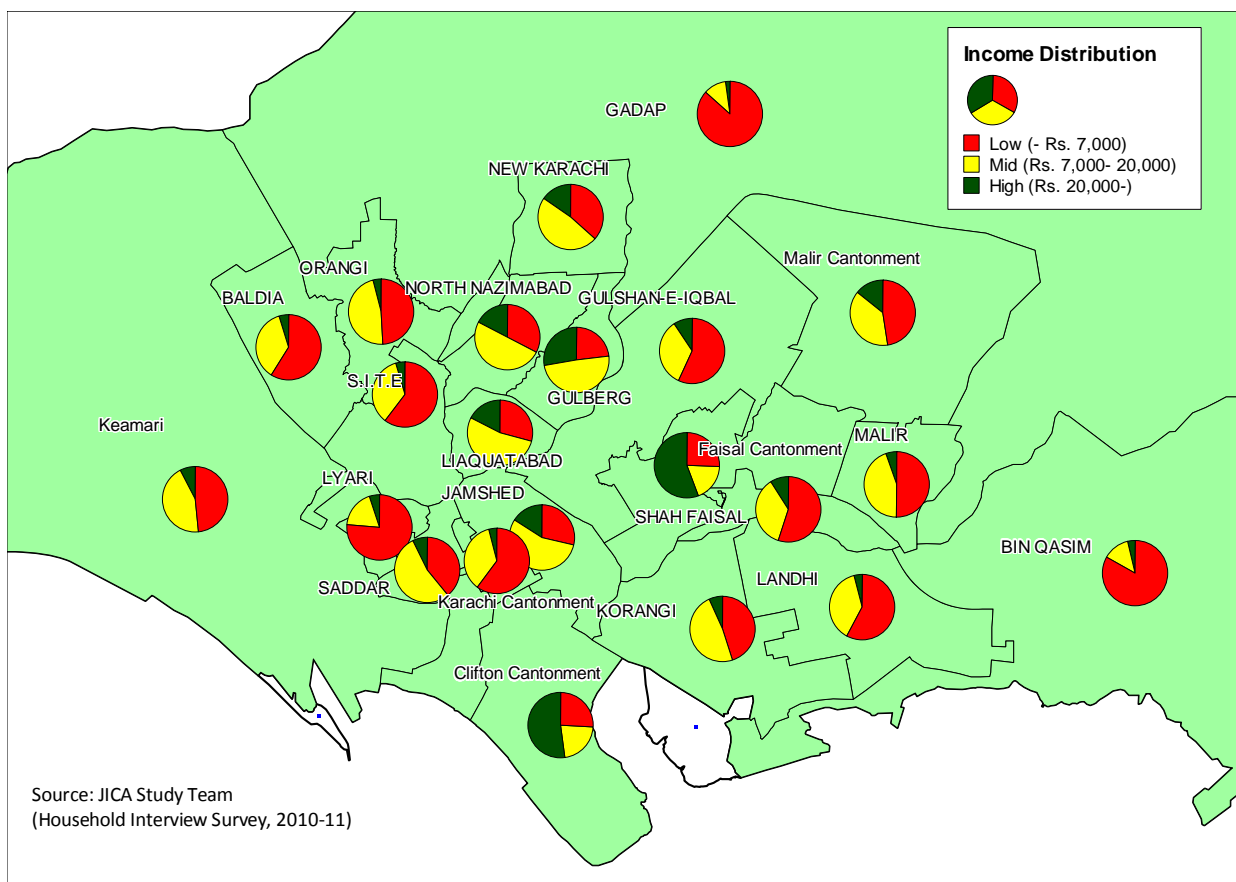
Only 9% of households answered the question about income level, which resulted in 8,000 samples against the total sample of 37,644. The chart in Figure 2-4-1 shows the income distribution from the valid data. The peak is the income group of Rs. 7,000 – 10,000. In the Person Trip Study by JICA in 2005, the peak was the income group of Rs. 5,000 – 7,000. Note that this data set is biased because it is known that higher income people are not willing to give information about their income.



Source: JICA Study Team (Household Interview Survey)

Figure 2-4-1 Income distribution

Figure 2-4-2 shows income level distribution by Town. Households are classified into three income levels – Low (less than Rs. 7,000 per month) in red color, Middle (Rs. 7,000 – 20,000) in yellow, and High (Rs. 20,000 and more) in green. As can be seen, Clifton and Faisal Cantonments are high income area, while Gadap and Bin Qasim Towns are low income area. Towns of the north-south direction such as New Karachi, North Nazimabad, Gulberg, Liaquatabad, and Jamshed are the middle income areas with approximately 50% Middle Level and 10-15% High Level.



Source: JICA Study Team (Household Interview Survey, 2010-11)

Figure 2-4-2 Income Level by Town

(2) Working Status

Table 2-4-1 shows the estimation of the population by working status by gender. There are 5.6 million workers, 5.7 million household women (or men), and 4.1 million students. Jobless people account for 5% of the total population above 5 years old.

Table 2-4-1 Working Status by Gender

Unit: '000

	Male	%	Female	%	Total	%
Worker	5,300	59.4	292	3.7	5,592	33.5
Jobless	794	8.9	39	0.5	833	5.0
Retired	340	3.8	8	0.1	348	2.1
Housewife	6	0.1	5,667	72.8	5,672	33.9
Students	2,380	26.7	1,721	22.1	4,101	24.5
Others	110	1.2	56	0.7	166	1.0
Total	8,930	100	7,784	100	16,714	100

Source: JICA Study Team (Household Interview Survey)

(3) Driving License

Driving license holders in Karachi account for very small portion to the population as shown in Table 2-4-2. The number of driving license for motorcycle is highest at 846,000 while that of car is 306,000.

Table 2-4-2 Estimation of Driving License

	Motorcycle	Rickshaw	Taxi	Car	Delivery Van	LTV	HTV
No. in samples	7,468	222	87	2,171	160	1,893	258
% samples	5.0%	0.1%	0.1%	1.4%	0.1%	1.3%	0.2%
Estimated No. of license holders	846,132	25,034	10,141	306,261	20,849	226,060	28,304
% population	5.1%	0.1%	0.1%	1.8%	0.1%	1.4%	0.2%

Source: JICA Study Team (Household Interview Survey)

2.4.2 Trip Characteristics

(1) Trip Rate

A trip rate is the number of trips per person per day. In other words, a trip rate represents how many times a person moves from one place to another for a particular purpose per day in average. A net trip rate means the trip rate of those who made trips, while a gross trip rate means the average trip rate which is calculated from the total number of trips divided by population. Since the household survey was conducted for people whose age was five years and more, the population of five years and more should be used for the calculation. A gross trip rate using the population of all ages is used in some contexts.

The trip rate in Karachi was estimated as low as 1.36 (gross: all residents), 1.51 (gross: five years and more), and 2.17 (net), as shown in Figure 2-4-3. The trip rate of females is very low at 0.71 (gross: all) while that of male is 1.92 (gross: all).

For reference, the trip rate in Tokyo is 2.54 (gross: all) in 2008, which is 1.9 times higher than that of Karachi.

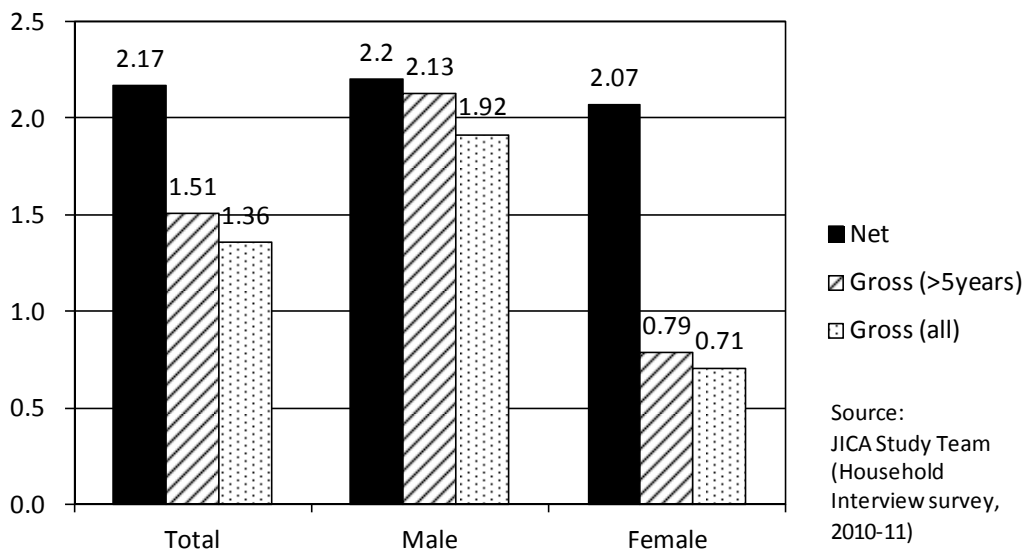
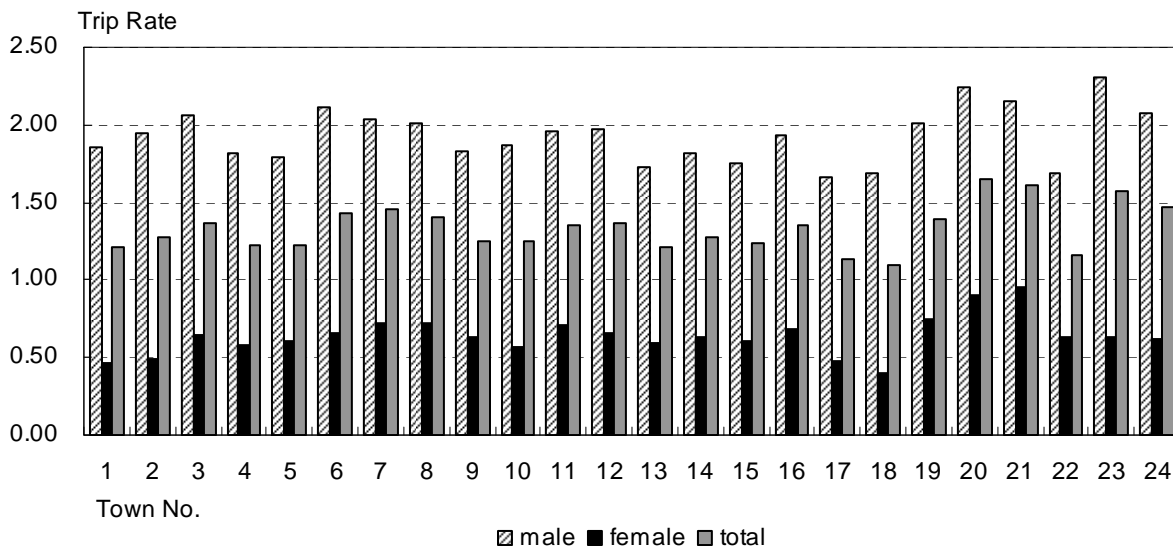


Figure 2-4-3 Trip Rates by Gender

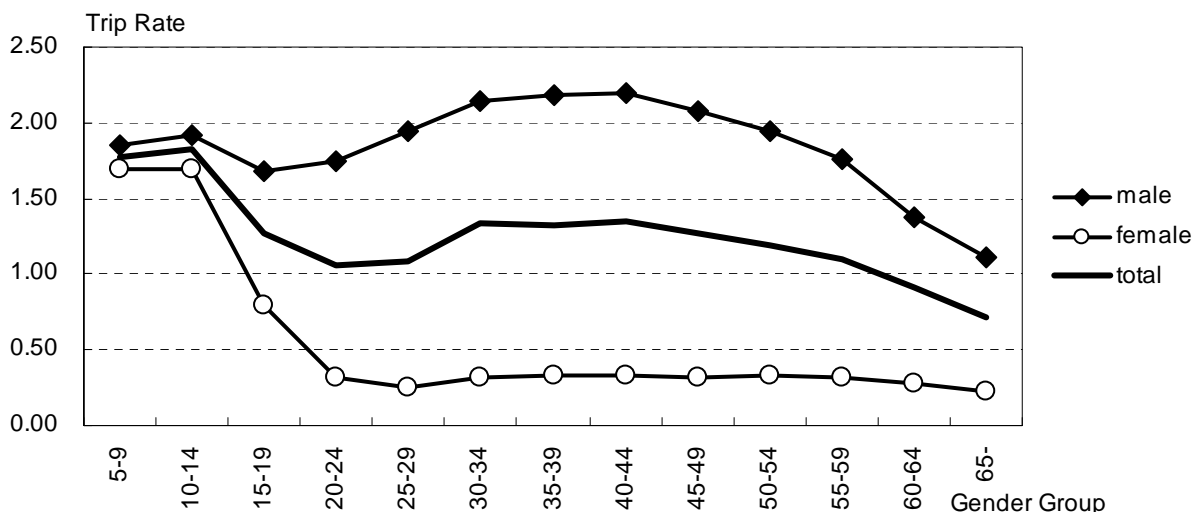
Figure 2-4-4 shows the trip rate by Town by gender. Trip rate is low in Bin Qasim (17) and Gadap (18) while that of cantonments (19 – 24) is high except for Manora Cantonment.



Source: JICA Study Team (Household Interview Survey)

Figure 2-4-4 Trip Rate by Gender by Town

Figure 2-4-5 shows the trip rate by age group by gender. A drop of the trip rate in the age group of 15 – 24 implies the lack of job opportunity for young people after compulsory education.



Source: HIS in KTIP

Figure 2-4-5 Trip Rate by Age Group by Gender

The trip rate is different by car ownership: 1.28 for households without a car, and 1.45 for households owing one or more cars (cars, jeep, van, Suzuki Carry, etc). The trip rate of households without any motorized vehicle including motorcycle was 1.24, while that of households owing one or more motorcycle was 1.37.

The trip rate by working status is shown in Table 2-4-3. Workers made the most trips at the trip rate of 2.52. The trip rate of housewife was as small as 0.28. Although the survey asked interviewees about the trip information on a weekday, the trip rate of students was only 2.06.

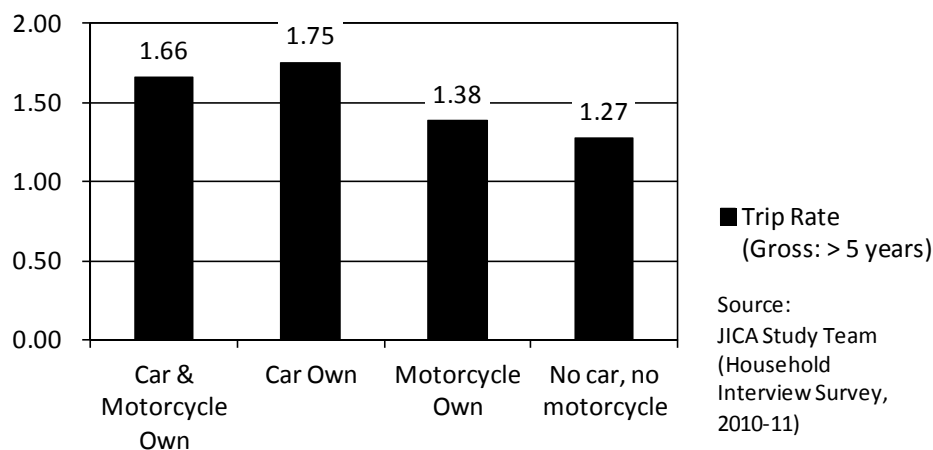
Table 2-4-3 Trip Rate by Working Status

Unit: No. of trips per day per person

Worker	Jobless	Retired	Housewife	Student	Others	Average
2.52	0.61	0.93	0.28	2.06	1.79	1.51

Source: HIS in KTIP

Figure 2-4-6 shows the trip rate by car ownership (Gross: > 5 years). People of car-own households make more trip than those of non car-own households. The trip rate of car-own household members was 1.75 while that of “no car and no motorcycle” household members was 1.27. The result shows that people of households having both car (s) and motorcycle (s) made fewer trips at the trip rate of 1.66 than those of car-own households.



Source: JICA Study Team (Household Interview Survey, 2010-11)

Figure 2-4-6 Trip Rate by Car Ownership

(2) **Travel Mode**

Figure 2-4-7 shows the modal share. The left chart shows the modal share excluding walking trips (including bicycles) while the right one shows that including walking trips. As can be seen, the half of trips in Karachi is made by no-motorized mode. Buses accounted for 22.2% of the trips while motorcycles accounted for 10.9%. The modal share of private cars was only 10.7%. If walking trips are excluded, buses account for 40.9%, motorcycles for 20.2%, and private cars for 19.8%.

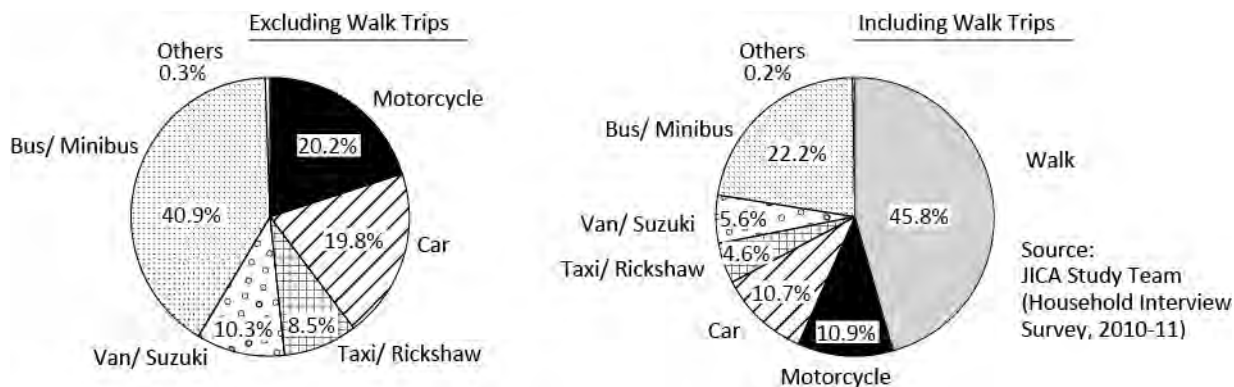


Figure 2-4-7 Modal Share

Table 2-4-4 shows the modal share by working status. As can be seen, walking was the major mode of all groups, although the share of walking was relatively small for workers and housewives at 33%. For students, walking accounted for 64%. Buses are the important motorized mode for most groups. For workers and housewives, it accounted for 27%. The share of cars by housewives was relatively high at 17% although most of them did not drive by themselves.

Table 2-4-4 Travel Mode by Working Status

Mode	Worker	Jobless	Retired	Housewife	Students	Others	Average
Walk	33.1	52.5	45.5	33.2	63.5	41.4	44.0
Motorcycle	16.0	11.6	7.7	5.7	3.7	12.2	10.9
Car	13.1	4.8	20.6	17.3	5.6	4.2	10.7
Para-transit	8.1	5.3	9.2	15.7	13.0	14.0	10.2
Bus	27.4	25.3	15.6	27.1	12.7	25.0	22.2
Others	2.3	0.5	1.4	0.9	1.5	3.2	1.9

Note: "Para-transit" consists of Rickshaw, Taxi, Van, and Suzuki Pickup
 Source: JICA Study Team (Household Interview Survey, 2010-11)

(3) **Trip Purpose**

The major purposes of the trips are "go to work", "go to school", and "go home". These trips account for 87.5% of the total trips. Table 2-4-5 shows the proportion of trip purpose by travel mode. The percentage of private purpose by car was higher than other modes. "To Work" was the major purpose of motorcycles and buses. The composition of trip purposes was similar between Walking trips and Para transit trips.

Table 2-4-5 Percentage of Trip Purpose by Travel Mode (%)

	Walk	Motorcycle	Car	Para Transit	Bus	Others	Total
To Home	49.3	47.3	45.5	49.6	49.1	46.0	48.6
To Work	18.6	34.7	24.7	19.4	32.4	40.0	24.2
To School	20.8	4.9	5.7	20.0	8.7	3.1	14.6
Business	0.8	2.5	5.2	1.2	1.3	4.0	1.6
Private	10.5	10.6	19.0	9.7	8.5	6.9	10.9
Total	100	100	100	100	100	100	100

Source: JICA Study Team (Household Interview Survey, 2010-11)

Table 2-4-6 shows the composition of trip purposes by working status. For workers and students, commuter trips accounted for more than 90% of the trips.

Table 2-4-6 Percentage of Trip Purpose by Working Status (%)

	Worker	Jobless	Retired	Housewife	Students	Others	Total
To Home	47.9	49.1	48.7	49.1	49.7	49.5	48.6
To Work	43.1	0.0	0.0	0.0	0.2	17.2	24.2
To School	0.4	0.0	0.0	0.0	42.4	20.9	14.6
Business	1.9	5.6	3.0	0.7	1.1	1.5	1.6
Private	6.7	45.3	48.3	50.2	6.7	10.9	10.9
Total	100	100	100	100	100	100	100

Source: JICA Study Team (Household Interview Survey, 2010-11)

(4) Home based Trip

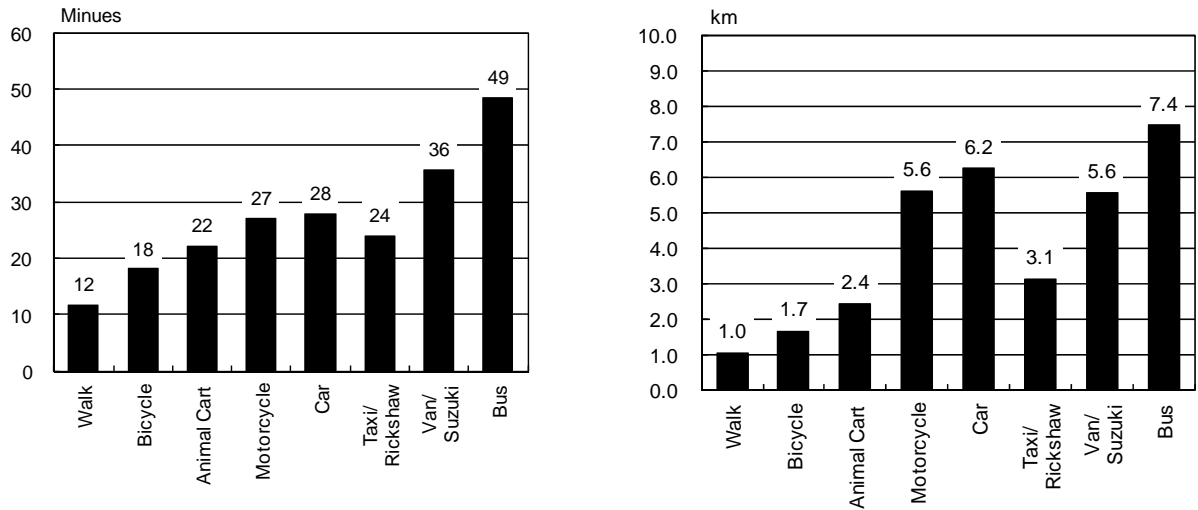
When home is the origin of a trip, 60% of the destination is within the same town of the home address, and other 40% trips go to other towns.

(5) Trip Length (travel distance)

Figure 2-4-8 shows the average trip length and time by travel mode.

The average trip length of all modes was 3.9km per trip while that of motorized trip was 6.3 km. Bus passengers traveled longest distance with the average trip length of 7.4 km while car and motorcycle users traveled with that of 6.2 and 5.6km. Since this was calculated from the distance between the center of origin zone and destination zone, the actual trip length along the roads of travel would be longer than the above estimation.

The average trip time was calculated as 25 minutes for all modes and 37 minutes for motorized trips. In case of bus passenger, the average trip time was calculated as 49 minutes while that of private cars was 28 minutes as shown in Figure 2-4-8. The average commuter trip time was 27 minutes for all modes.



Note: Trip length was calculated as the straight distance between the centres of zones
 Source: HIS in KTIP

Figure 2-4-8 Average Trip Length (Right) and Time (Left) by Mode

Figure 2-4-9 shows the average travel time of residents by their home address (UC). The farther the distance from the center, the longer the travel time.

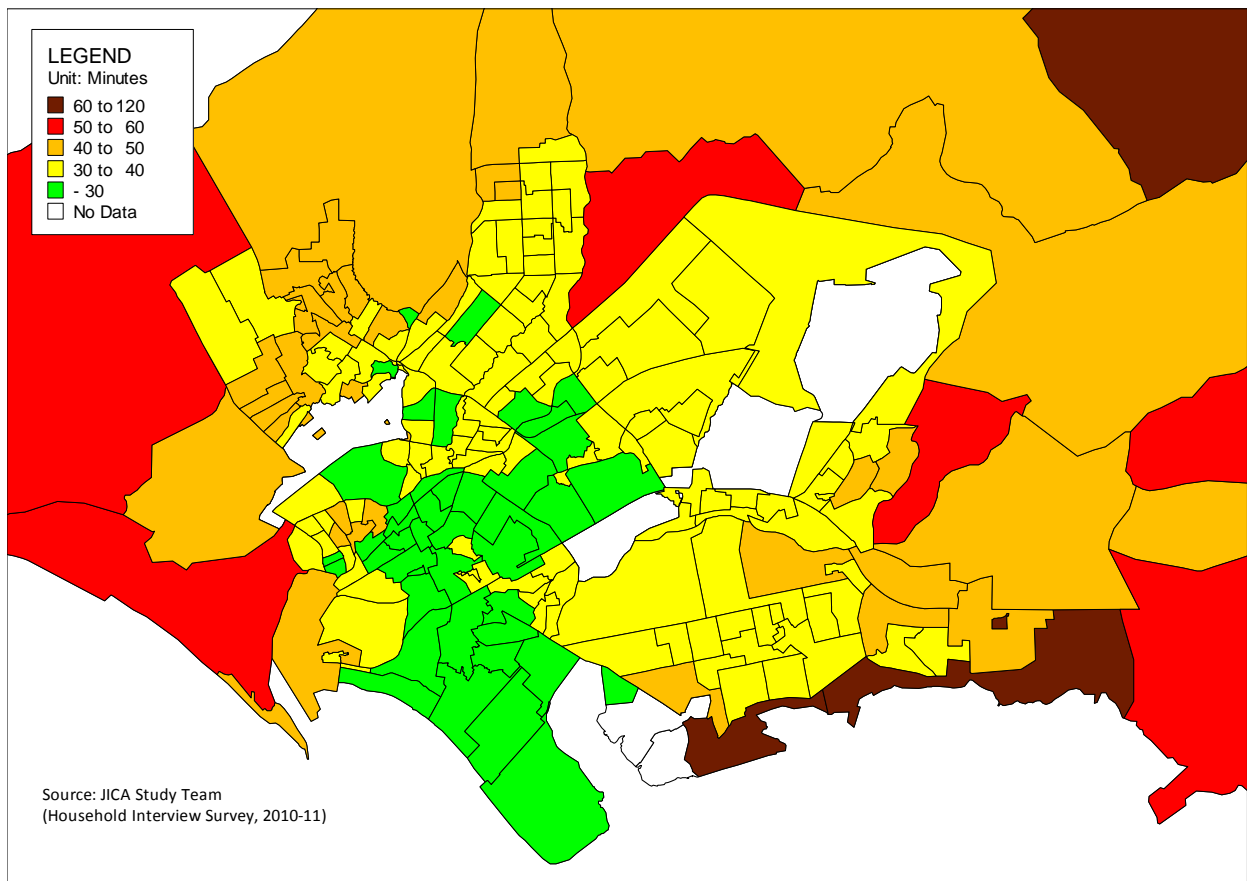
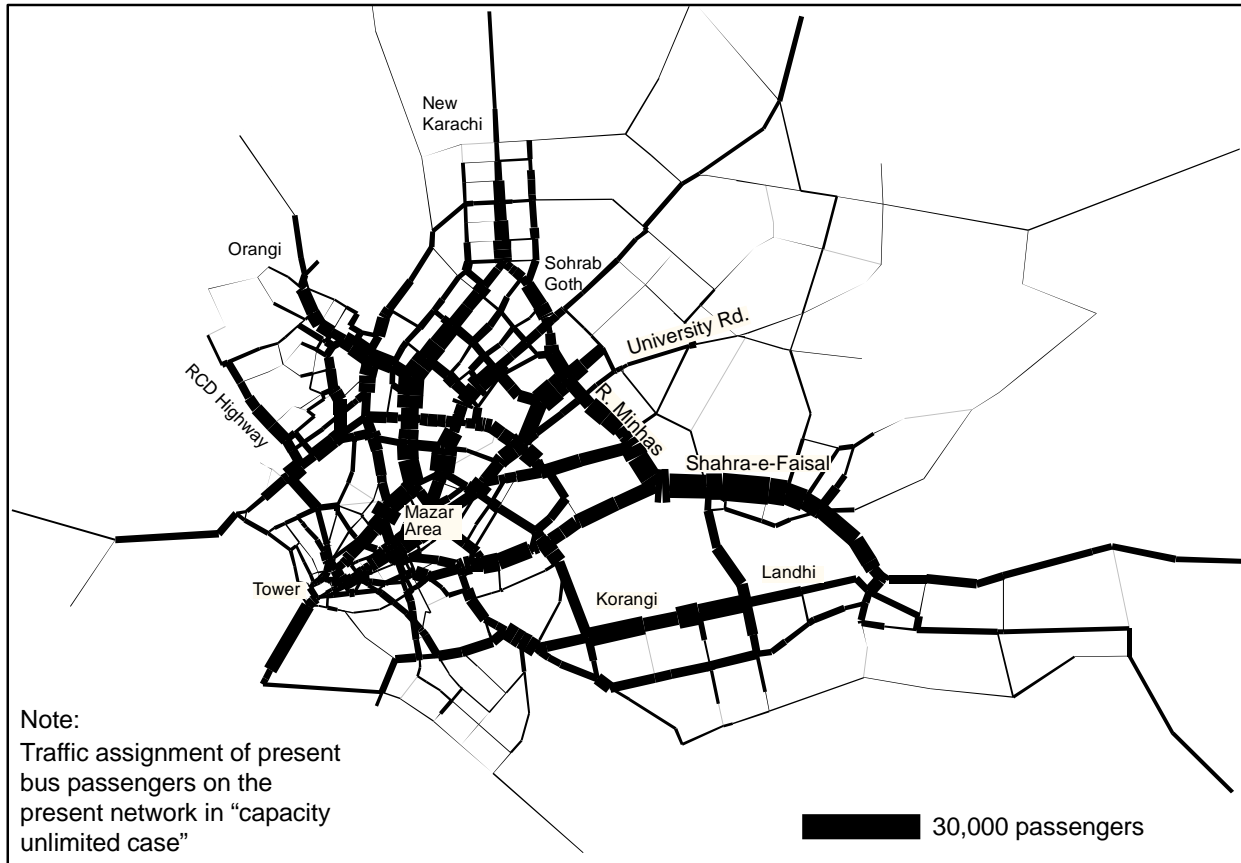


Figure 2-4-9 Travel Time by UC

2.4.3 Trip Distribution

A traffic assignment was done to see “desired routes” for trips of Karachi people using the

present network assuming “no-congestion” of all the existing roads. Figure 2-4-10 shows the result of bus passengers. As can be seen, passenger demand is very high along Shahrah-e-Faisal Road. In addition, high passenger demand is observed along the major radial directions from Tower – Mazar Area to New Karachi, Sohrab Goth, and University Rd. These three directions are important corridors in Karachi. There are other corridors with high passenger demand such as Orangi direction, RCD Highway, and Korangi – Landi. In addition to the radial directions, some circular roads have high passenger demand. Especially, Rashid Minhas Road has a large traffic demand.



Source: KTIP

Figure 2-4-10 Traffic Assignment (Bus Passenger) on Capacity Unlimited Network

2.4.4 Preference of LRT

In the Passenger Interview Survey (PIS), preference of Light Rail Transit (LRT) under various conditions was interviewed in order to develop a choice model. The sample data were analyzed and two choice models for car users and motorcycle users were worked out as shown in Table 2-4-7.

Table 2-4-7 Logit Model of Motorcycle and Car against LRT

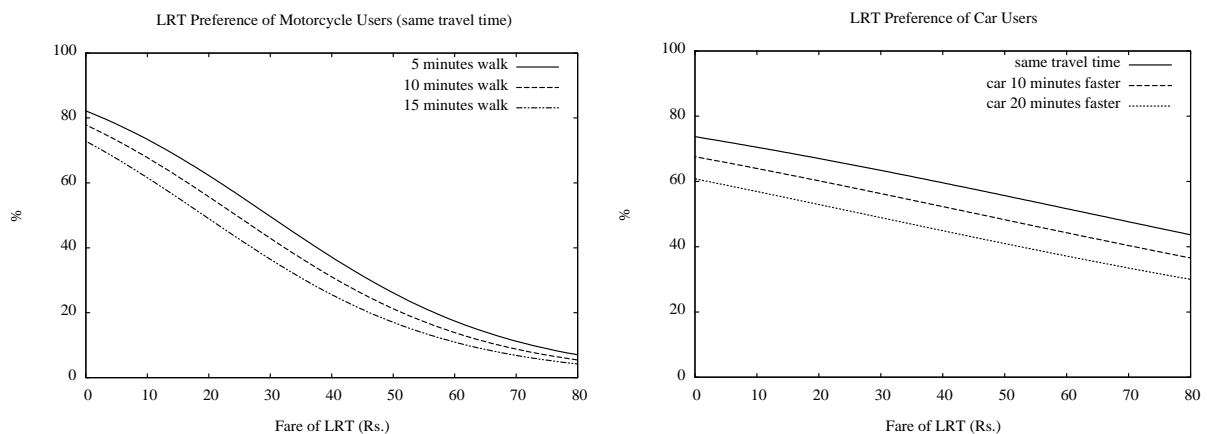
Variable	Motorcycle – LRT	Car – LRT
On-Board Time (minutes)	-0.03027 (t = 10.9)	-0.02962 (t = 13.2)
Walking Time (minutes)	-0.08448 (t = 9.64)	-
Fare of LRT (Rs.)	-0.05137 (t = 23.9)	-0.01609 (t = 9.53)
With feeder (need to use minibus = 1, no need to use minibus = 0)	-0.8522 (t = 9.57)	-0.09017 (t = 1.22) *1
Constant (LRT = 1, the other =0)	1.799 (t = 16.9)	1.032 (t = 14.4)
No. of data	3,600	4,465
Goodness-of-fit	69.0%	68.6%
Chi-square	802.3	866.5
Rho-square	0.16	0.14

Note: t = absolute of Student’s T Value;

*1: Since t-value is small, “with feeder” is ignored in Car-LRT model

Source: PIS in KTIP

Figure 2-4-11 illustrates the percentage of passengers who will use LRT instead of their usual mode such as car (right) and motorcycle (left). From this, approximately 60% of motorcycle users will shift to LRT with the fare of Rs. 20, 40-50% with Rs. 30, and 30-40% with Rs. 40 if the travel time is the same. On the other hand, the percentage of car users that will shift to LRT will be approximately 70% with the fare of Rs. 20. In case of car users, the sensitivity by fare level is very small and approximately 60% of car users will shift to LRT even if the fare is Rs. 40.



Note: Travel time of LRT and motorcycle is the same.

Note: Travel time of car is as same as LRT, 10 minutes faster, or 20 minutes faster than that of LRT.

Source: JICA Study Team (Passenger Interview Survey, 2010-11)

Figure 2-4-11 % Modal Shift of Car and Motorcycle Users to LRT