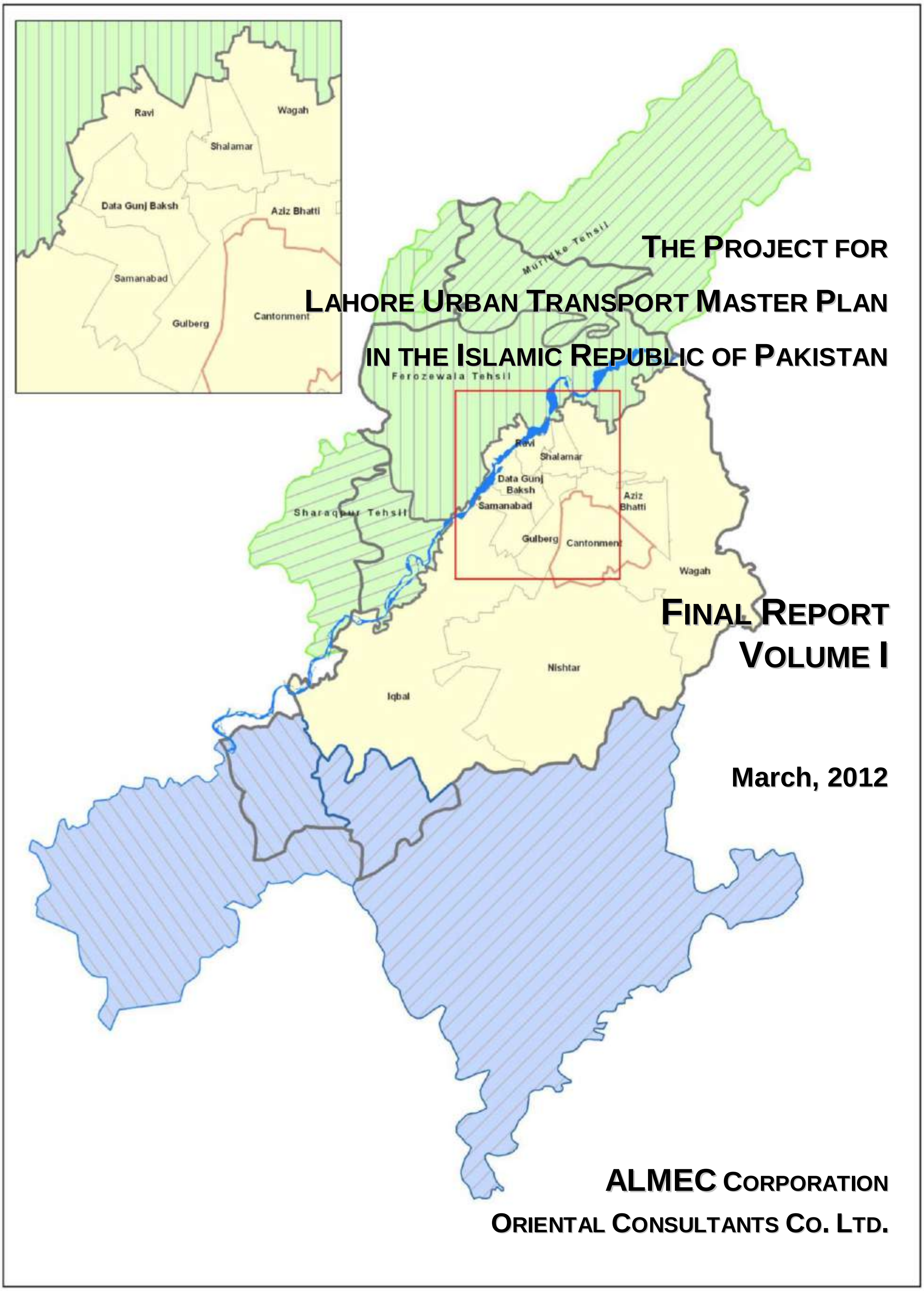
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

A GOVERNMENT OF THE PUNJAB PROJECT

TRANSPORT DEPARTMENT



THE PROJECT FOR LAHORE URBAN TRANSPORT MASTER PLAN IN THE ISLAMIC REPUBLIC OF PAKISTAN

FINAL REPORT
VOLUME I

March, 2012

ALMEC CORPORATION

ORIENTAL CONSULTANTS CO. LTD.

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PREFACE

In response to a request from the Government of the Punjab in the Islamic Republic of Pakistan, the Government of Japan decided to conduct “The Project for Lahore Urban Transport Master Plan in the Islamic Republic of Pakistan” and entrusted to the study to Japan International Cooperation Agency (JICA).

JICA selected and dispatched a study team headed by Mr. Takashi Shoyama of ALMEC Co., LTD. and consists of ALMEC Co., LTD. and Oriental Consultants Co., LTD. between April, 2010 and March, 2012.

The study team held discussions with the officials concerned of the Government of the Punjab, conducted field surveys in the study area, prepared a Lahore Urban Transport Master Plan (LUTMP) and its Action Plan, conducted a capacity development through On-the-Job-Training (OJT), and prepared this final report.

The project was composed of two phases; i) Phase I to conduct a Home Interview Survey (Person Trip Survey) and other transport/ traffic surveys and develop a transport demand analysis model, and ii) Phase II to prepare a master plan and its action plan. This report is presents the study findings of both Phases.

I hope that this report will contribute to the promotion of this project and to the enhancement of friendly relationship between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of the Punjab for their close cooperation extended to the study team.

March, 2012

KONISHI Atsufumi,
Director, Economic Infrastructure Department
Japan International Cooperation Agency

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ABBREVIATIONS & ACRONYMS

AASHTO	American Association of State Highway and Transportation Officials
AD	Assistant Director
ADB	Asian Development Bank
ADP	Annual Development Program
ALOS	Advanced Land Observation Satellite
BOT	Build Operate Transfer
C&W	Communication and Works Department
CantB	Cantonment Board
CBD	Central Business District
CDG	City District Government
CDGK	City District Government, Kasur
CDGL	City District Government, Lahore
CDGS	City District Government, Sheikhupura
CNG	Compressed Natural Gas
DCO	District Coordination Officer
DHA	Defence Housing Authority
DIG	Deputy Inspector General
DPL	Development Policy Loan
DRTA	District Regional Transport Authority
DSMD	District Support and Monitoring Department
E&T	Excise and Taxation Department
EDO	Executive District Officers
EPA	Environment Protection Agency
EPD	Environmental Protection Department
ETC	Electronic Toll Collection
F&P	Finance and Planning
FDI	Foreign Direct Investment
FMR	Farm to Market Roads
GDP	Gross Domestic Product
GIS	Geographic Information System
GoPb	Government of the Punjab
H&PP	Housing and Physical Planning Provincial Department
H&UPDD	Housing and Urban Physical Development Department
HIS	Household Interview Surveys
HOV	High Occupancy Vehicle
HP&EP	Housing Physical & Environmental Planning
HRT	Heavy Rapid Transit
HUD&PHED	Housing, Urban Development and Public Health Engineering Department
ICT	Information and Communication Technology
IFC	International Finance Corporation
IMF	International Monetary Fund
ITS	Intelligent Transport System
LCCHS	Lahore Cantonment Cooperative Housing Society
LDA	Lahore Development Authority
LDRTA	Lahore District Regional Transport Authority
LIT	Lahore Improvement Trust
LRMTS	Lahore Rapid Mass Transit System
LRR	Lahore Ring Road
LRRP	Lahore Ring Road Project
LRT	Light Rail Transit
LSE	Lahore School of Economics
LTC	Lahore Transport Company
LTD	Lahore Transport Database
LUTMP	Lahore Urban Transport Master Plan
MCC	Manual Classified Count
MD	Managing Director
MRT	Mass Rapid Transit
MS	Municipal Services

MTDF	Medium Term Development Framework
MVO	Motor Vehicles Ordinance
MVR	Motor Vehicle Rules
NEC	National Economic Council
NESPAK	National Engineering Services Pakistan
NFC	National Finance Commission
NHA	National Highway Authority
NHMP	National Highway and Motorway Police
NHSO	National Highway Safety Ordinance
NMT	Non-Motorized Transport
NTCIP	National Trade Corridor Improvement Program
NTRC	National Transport Research Centre
NWFP	North West Frontier Province
O&M	Operation and Management
OBU	On Board Unit
OD	Origin-Destination
OJP	On-the-Job Participation
OJT	On-the-Job Training
P&D	Planning and Development Department
PHA	Parks and Horticultural Authority
PHATA	Punjab Housing and Town Planning Agency
PHED	Public Health Engineering Department
PMDGP	Punjab Millennium Development Goal Program
PMU	Project Management Unit
PNR	Pakistan National Railway
PPHPD	Passenger Per Hour Per Direction
PPO	Punjab Police Office
PPP	Public Private Partnership
PPTA	Punjab Provincial Transport Authority
PRTC	Punjab Road Transport Corporation
PSP	Private Sector Participation
PTA	Provincial Transport Authority
PTPS	Pakistan Transport Plan Study
PTUIS	Public Transport User Interview Survey
PUTC	Punjab Urban Transport Corporation
R&B	Rehabilitation and Building
RCC	Roller Compacted Concrete
RIS	Road Interview Survey
RMTS	Rail-based Mass Transit System
RTAs	Regional Transport Authorities
STREAM	Sustainable Transport in East Asian Mega-cities
TD	Transport Department
TDM	Traffic Demand Management
TEPA	Traffic Engineering and Transport Planning Agency (Under LDA)
TEVTA	Technical Education and Vocational Training Authority
TEVTC	Technical Education and Vocational Training Council
TMA	Town Municipal Administrations
TPU	Transport Planning Unit
TSDI	Transport Sector Development Initiative
UA	Union Administration
UCs	Union Councils
UN	United Nations
UNESCO	United Nations Educational Scientific Cultural Organisation
UU	Urban Unit
W&S	Works and Services
WASA	Water and Sanitation Agency (Under LDA)
WB	World Bank

SUMMARY, CONCLUSION AND RECOMMENDATIONS

FINAL REPORT

SUMMARY, CONCLUSION AND RECOMMENDATIONS

1. Study Objectives

The Lahore Urban Transport Master Plan (LUTMP) was formulated with the following main objectives:

(i) To formulate an urban transport master plan for the Study Area up to the year 2030;

(ii) To formulate an action plan for the identified priority projects up to the year 2020; and

(iii) To provide assistance to strengthen the administrative capacity of the Government of the Punjab for implementing the master plan.

2. Worsening Transport Situation – Threat to Sustainability

The LUTMP study area of about 3,044 km^2, covering the whole of Lahore District, part of Kasur and Sheikhupura Districts, has been suffering from worsening traffic situation and environmental degradation in the city center and on major arterial roads.

Population of Lahore District has been growing continuously, and increased by 7.5 times since the first census in 1951. The fastest growth pace was recorded between 1972 and 1981, i.e., 4.3% per annum. Since then, the growth rate has been steadily declining. As of 2010 the population of the LUTMP study area was estimated at about 9.9million, including 0.4million of part of Kasur and 0.9million of Sheikhupura District areas. However, most of the population is concentrated in the center of Lahore, while the rest of the areas are mostly rural except for narrow strips along arterial roads, showing a ribbon development.

Table S.1 Growth of Socio-economy and Transport Demand in LUTMP Study Area

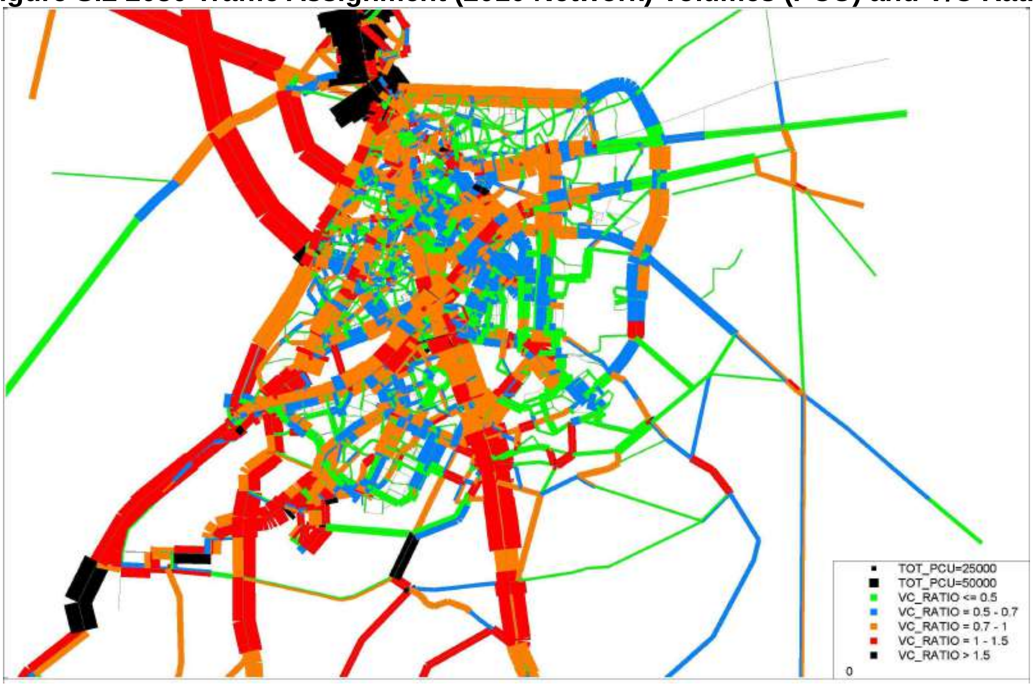
Indicator		Present (2010)	2030	Growth 2030/ 2010
Population (000)		9,928	16,429	1.65
No. of Workers (000)		2,691	4,978	1.85
No. of Students (000)		857	1,597	1.86
GDP per Capita[1] (PKR 000)		135.1	274.8	2.03
Car Ownership (% of households)		18.3	44.0	2.40
Trip Production (million/ day)		8.2	17.0	2.07
Average Volume/ Capacity Ratio (Do-Nothing Scenario)	Canal Screenline	0.28	0.66	1.74
	Railway Screenline	0.50	1.07	2.14
	Ravi River	0.71	1.95	2.75
	Study Area Cordon	0.32	0.76	2.38

Note: 1) at 2010 constant prices
Source: JICA Study Team

Figure S.1 2010 Traffic Assignment Volumes (PCU) and V/C Ratio

Source: JICA Study Team

Figure S.2 2030 Traffic Assignment (2010 Network) Volumes (PCU) and V/C Ratio



Source: JICA Study Team

While population and economy of the study area are foreseen to grow steadily in the future, the increase of transport demand will be at much faster rate. The gradual shift from poor quality public transport to private transport due to the increase of income and motorcycle/ car ownership would further exacerbate the road traffic congestion, particularly at the Railway and Ravi crossings. The forecast traffic volume will well surpass the road capacity by 2030, if no countermeasures are taken.

This trend is the most fundamental threat to the quality of Lahoris life to overcome. Under the strong pressure of this rapidly growing transport demand, the critical issues are not only how to develop transport infrastructure but how to seek a sustainable solution between urban development and transport development.

3. Constraints and Opportunities

Constraints: - Influencing transport sector development include insufficient institutional capacity of the government even to understand the problems ahead, poorly coordinated project implementation, limited funding, unclear status of “committed” projects, and so on. Particularly critical is the funding capability. The estimated budget envelope is USD 6.6-19.8 billion for the entire Master Plan period (2011 to 2030) and USD 2.3-6.9 billion for the Action Plan period (2011 to 2020). However, the percentage of the investment to Lahore’s GDP is on the high side at 2.4 % during the Action Plan period. This is about 3 times of the current level of investment in transport infrastructure. For the entire plan period, the investment is equivalent to 1.4 % of the Lahore GDP. Private sector funding such as PPP scheme would be additional to public funds.

Opportunities: - There are many to improve the situation in the LUTMP study area. These are, among others: (1) the modal share of public transport in Lahore is considerably high at 37~40 % as of 2010 (excluding walk trips, residents only) as compared to some other Asian cities (see Table S.2). This is one of the precious assets that Lahore should maintain; (2) the road infrastructure of Lahore is well developed and allows Lahoris to live on “borrowed time” for a while more; and (3) LDA’s land use rules and regulations, though in a limited coverage, offer a good opportunity not only to control urban development but to provide revenue sources from integrated development of trunk public transport system, local access roads and other urban facilities.

Table S.2 Public Transport Modal Shares in Selected Asian Cities

City (Country)	Modal Share of Public Transport (%)	Year
Shanghai (China)	22	2000
Bangkok (Thailand)	39	1989
Manila (Philippines)	70	1996
Jakarta (Indonesia)	55	2000
Hanoi (Vietnam)	7	2005
Phnom Penh (Cambodia)	18	2000
Kuala Lumpur (Malaysia)	10	1997
Delhi (India)	54	2000

Source: JICA urban transport master plans and UITP publications

4. Master Plan 2030

Key Strategies

1) For large urban areas, such as Lahore, the only way to effectively meet transport demand is to provide the city with a high-quality public transport system which must be developed in integration with the urban development. The core network will be composed of urban rail (RMTS) and Bus Rapid Transit (BRT). Secondary and feeder services will be by buses with different sizes and types of services. Experiences of successful cities clearly indicate that mass transit networks serve as the backbone of the urban transport infrastructure and are integrated with urban land use and development. Bus, including wagon, is and will remain the most important mode of public transport system in Lahore. Although urban rail is expected to play a major role in the future, the coverage will be limited and many corridors and areas would remain without direct (walk-in) access to mass transit. Bus also provides important feeder services for urban rail.

2) The travel demand analysis has presented the gap between the available road capacity and the demand. The outcome is clear that with 2+% growth rate in population, coupled with GRDP growth of about 6% the current network will not be able to sustain the future road traffic demand. The primary strategy of road network development is to fill the gaps by increasing road capacity. This has been seriously considered in the master plan particularly at the congested cross-section of the Ravi River.

3) Infrastructure is expensive and requires proper management and operation. Traffic management is hence essential not only for the efficiency of traffic but for safety, comfort and urban environment. Particularly in relation to road safety, the current worsening situation is unacceptable. As car ownership is expected to increase sharply in the future while road development is limited, managing the demand for private transport will become a more serious concern. Traffic condition/ situation in the central area of Lahore is the most serious in the study area. Most intercity and intra-city traffic concentrate there using radial arterial roads. Disorderly traffic management and insufficient road infrastructure aggravate the situation. The traffic management deficiencies need to be tackled urgently.

Investment Summary and Project List

The development of the Lahore Urban Transport Master Plan (LUTMP) has been carried out based on the analyses on current situation and future transport demand, and project prioritization by Multi Criteria Analysis (MCA). The summary of the investment planned in the Master Plan is presented in Table S.3. The estimated total investment for the entire plan period till 2030 is about USD 11.1 billion. This falls in the estimated range of budget envelope though on the high side particularly for the short- and medium-term.

Table S.3 Planned Investment Summary for the Master Plan Projects (USD million)

Period (Year)	Short Term 2012-2015	Medium Term 2016-2020	Long Term 2021-2030	Total
Public Transport	1,499	3,021	2,742	7,262
Road Sub-sector	450	570	2,139	3,159
Traffic Management	146	363	154	663
Total	**2,095**	**3,954**	**5,035**	**11,084**

Note: excluding committed projects of which cost is unknown
Source: JICA Study Team

Table S.4 summarizes the projects proposed in the Master Plan with responsible agency specified by project.

Table S.4 Master Plan Projects with Estimated Cost and Responsible Dept./ Agency

Project No.	Project Description	Project Cost (USD Million)	Assumed Year of Operation	Status 1)	Proposed by:	Responsible Agency
Public Transport Projects – Committed						
PT01	Multimodal Inter-City Bus Terminals in Lahore	-	2014	Ongoing	TD	TD
PT02	Effective and Efficient School Bus System	0.01	2014	Planned	TD	TD
PT03	Up-gradation of Bus Stands	-	2015	Planned	TD	TD
PT04	Integrated Bus Operation	80.1	2015	Planned	LTC	LTC
PT05	Establishment of Multimodal Bus Terminal at Shahdara	-	2017	Planned	TD	TD
Public Transport Projects – LUTMP 2030 Proposed						
PT06	RMTS Green Line	2,583.0	2020	Planned	TD	TD
PT07	RMTS Orange Line (Initially BRT)	2,330.0	2030	Planned	TD	TD
PT08	RMTS Blue Line (Initially BRT)	1,908.0	2030	Planned	TD	TD
PT07	BRT Orange Line	74.5	2015		LUTMP	LTC
PT08	BRT Blue Line	58.6	2020		LUTMP	LTC
PT09	BRT Purple Line	40.8	2020		LUTMP	LTC
PT10	BRT Line 1	30.7	2020		LUTMP	LTC
PT11	BRT Line 2	30.5	2020		LUTMP	LTC
PT12	BRT Line 3a	28.7	2020		LUTMP	LTC
PT13	BRT Line 3b	35.3	2020		LUTMP	LTC
Road Sub-sector Projects – Committed						
R01	Construction of LRR (Airport – Ferozepur Road)	113.0	2015	Ongoing	C&W	C&W
R02	Construction of Kalma Chowk Flyover	17.5	2015	Completed	C&W	C&W

Project No.	Project Description	Project Cost (USD Million)	Assumed Year of Operation	Status 1)	Proposed by:	Responsible Agency
R03	Construction of Canal Bank Road Flyover	17.1	2015	Ongoing	C&W	C&W
R04	Remodeling of Canal Bank Road	43.8	2015	Ongoing	TEPA	TEPA
R05	Remodeling of Barki Road (LRR – Green City)	2.0	2015	Ongoing	C&W	C&W
R06	Remodeling of Kala Khatai Road	10.8	2015	Ongoing	C&W	C&W
R07	Remodeling of Allama Iqbal Road	16.1	2015	Ongoing	C&W	C&W
R08	Remodeling of Multan Road	46.4	2015	Ongoing	C&W	C&W
R09	Remodeling of Thokar Niaz Baig Road	4.8	2015	Ongoing	C&W	C&W
R10	Remodeling of Lahore Ferozepur Road	17.5	2015	Completed	C&W	C&W
LUTMP 2030 Road Sub-sector Projects – Proposed						
R11	Barki Road (Green City – BRB Canal)	17.0	2020		LUTMP	C&W
R12	Bedian Road (DHA – LRR – Ferozepur Road)	142.0	2026		LUTMP	C&W
R13	Shabir Usmani Road (Barkat Market – Maulana Shaukat Ali Road)	6.9	2021	Planned	TEPA	TEPA
R14	Link Peco Road – Ferozepur Road	6.7	2021		LUTMP	TEPA
R15	Link Ferozepur Road - Nalay Wali Road (Completion of link between Ferozepur and Multan Road)	5.3	2021	Planned	TEPA	TEPA
R16	Old Ravi Bridge and Road **(Bridge 0.5km)**	5.3	2018	Planned	TEPA	TEPA
R17	G.T. Road (Cooper Store - Ek-Moria Pul)	6.3	2019	Planned	TEPA	TEPA
R18	College Road (Ghaus-e-Azam Road to Defence Road)	14.0	2020	Planned	TEPA	TEPA
R19	Structure Plan Road (Shahrah Nazria-e-Pakistan – Defence Road)	35.0	2018	Planned	TEPA	TEPA
R20	EXPO-Kahna Kacha Station Road (Khayban-e-Jinnah – Kahna Kacha Station)	29.9	2024	Planned	TEPA	TEPA
R21	Main Boulevard PIA Society Road (Baig Road – Ittehad Road)	4.0	2024	Planned	TEPA	TEPA
R22	Raiwind Road (Lahore Ring Road Southern Loop – Raiwind City)	52.5	2025		LUTMP	C&W

Project No.	Project Description	Project Cost (USD Million)	Assumed Year of Operation	Status 1)	Proposed by:	Responsible Agency
R23	Madrat-e-Millat Road - Defence Road	10.9	2024	Planned	TEPA	TEPA
R24	Extension of Maulana Shaukat Ali Road (Canal Bank Road – Noor-ul-Amin Road through Punjab University)	6.0	2024	Planned	TEPA	TEPA
R25	Kamahan Lidher Road (Ferozepur Road – Lahore Bedian Road)	26.4	2027	Committed	C&W	C&W
R26	Sua Asil Road (Ferozepur Road – Raiwind Road)	130.7	2030	Committed	C&W	C&W
R27	Kahna Station – Raiwind City (Kahna Kacha Approach Road – Raiwind City along Railway Line)	91.7	2027	Committed	C&W	C&W
R28	Kahna Kacha Road (Kahna Station – Ferozepur Road)	29.9	2027	Committed	C&W	C&W
R29	Sharaqpur Road (Lahore Ring Road – Saggian Wala Bypass) **(Bridge 0.7km)**	202.0	2030		LUTMP	C&W
R30	Lahore-Sheikhupura Road (Saggian Wala Bypass – G.T. Road)	20.4	2028		LUTMP	C&W
R31	Sagianwala Bypass Road (Ring Road – Sharaqpur Road) **(Bridge 0.6km)**	43.4	2028		LUTMP	C&W
R32	Lahore-Sheikhupura Road (West) (Sharaqpur Road – Lahore-Sheikhupura Road)	16.2	2028		LUTMP	C&W
R33	Link Thokar Niaz Baig Canal Bank Road – Ferozepur Road (Khyaban-e-Jinnah Road – Defence Road – Ferozepur Road)	57.6	2022		LUTMP	TEPA
R34	Manga-Raiwind Road (Multan Road – Raiwind Road)	43.5	2028		LUTMP	C&W
R35	Southern Bypass South Road (Ferozepur Road – College Road)	57.0	2022	Planned	TEPA	TEPA
R36	Southern Bypass North Road (Canal Bank Road – M-2)	19.7	2022	Planned	TEPA	TEPA
R37	Raiwind-Pattoki Road (Raiwind City – Boundary of LUTMP Study Area)	73.3	2028		LUTMP	C&W
R38	Raiwind Road (Thokar – Lahore Ring Road Southern Loop)	54.2	2028		LUTMP	C&W

Project No.	Project Description	Project Cost (USD Million)	Assumed Year of Operation	Status 1)	Proposed by:	Responsible Agency
R39	Defence Road (Multan Road – Ferozepur Road)	60.1	2022		LUTMP	C&W
R40	Thokar Niaz Baig Canal Road Extension (Defence Road – Lahore Ring Road Sothern Loop)	20.8	2028		LUTMP	C&W
R41	Construction of LRR West (Multan Road – M2)	121.9	2024	Planned	C&W	C&W
R42	Construction of LRR South (Ferozepur Road – Multan Road)	201.2	2030	Planned	C&W	C&W
R43	Secondary Roads in Dharampura Area	38.9	2018		LUTMP	TEPA
R44	Secondary Roads in Shadbagh Area	170.5	2018		LUTMP	TEPA
R45	Secondary Roads in Samanabad Area	48.0	2017		LUTMP	TEPA
R46	Lahore Bypass (G.T. Road – Kala Shah Kaku Bypass)	41.0	2022		LUTMP	NHA
R47	M-2 – Lahore-Islamabad Motorway (Lahore-Sheikhupura Road – Boundary of LUTMP Study Area) **(Bridge 0.6km)**	89.0	2022		LUTMP	NHA
R48	M-2 – Lahore-Islamabad Motorway (Bund Road – Lahore-Sheikhupura Road)	64.6	2022		LUTMP	NHA
R49	N-5- Multan Road (Lahore Ring Road Sothern Loop – Boundary of LUTMP Study Area)	109.7	2029		LUTMP	C&W
R50	Sharif Complex Road (Defence Road – Manga Raiwind Road – Bhai Pheru Kot Rada Kishan Road)	116.1	2029		LUTMP	C&W
R51	North-West Secondary Ring Road(Sharaqpur Road – Lahore-Sheikhupura Road – G.T. Road)	118.3	2031		LUTMP	C&W
R52	Sheikhupura Muridke Road (G.T. Road – M-2)	284.4	2031		LUTMP	C&W
R53	Link G.T. Road (Sharaqpur Road – Lahore-Sheikhupura Road – G.T. Road)	22.9	2027		LUTMP	C&W
R54	Link Kala Shah Kaku – Lahore-Sialkot Motorway	25.1	2022	Planned	C&W	C&W
R55	Lahore-Sialkot Motorway **(Bridge 0.8km)**	128.0	2024	Planned	C&W	C&W

Project No.	Project Description	Project Cost (USD Million)	Assumed Year of Operation	Status 1)	Proposed by:	Responsible Agency
R56	Link G.T. Road Lahore-Sialkot Motorway	2.2	2022	Planned	C&W	C&W
R57	Construction and remodeling of Secondary roads - south of LRR in the south-western quadrant between Ferozepur Road and Multan Road	The Road Projects will be executed by LDA/ TEPA in conjunction with the developer's contribution towards capital cost to be completed by 2020.				
Traffic Management Projects – Committed						
TM01	Establishment of Centralized Driver Licensing Authority	-	2016	Planned	TD	TD
TM 02	Parking Management Company	-	2018	Planned	TEPA	TEPA
TM 03	Traffic Education Center	-	2014	Planned	Traffic Police	Traffic Police
TM 04	Traffic Control Plan of City	-	2015	Planned	Traffic Police	Traffic Police
TM 05	Vehicle Inspection and Certification System (VICS)	-	2021	Ongoing	TD	TD
TM 06	Construction of New Parking Plazas	207.1	2020	Ongoing	TEPA	TEPA
TM 07	Construction of Pedestrian Bridges	1.8	2016	Ongoing	TEPA	TEPA
TM 08	Improvement of 52 Junctions	30.5	2021	Planned	TEPA	TEPA
TM 09	Ferozepur Road Pilot Project	28.3	2022	Ongoing	TEPA	TEPA
TM 10	Conversion of Two Stroke Rickshaw into CNG Fitted Four Stroke Rickshaw	12.4	2019	Planned	TD	TD
TM 11	Remodeling of Inner and Outer Circular Road	14.1	2015	Planned	TEPA	TEPA
Traffic Management Projects – Proposed by LUTMP 2030						
TM 12	A.1 Junction Design and Traffic Signal Improvement – CBD	4.0	2015		LUTMP	TEPA
TM 13	A.2 Existing Junctions Design and Network Improvement	30.0	2019		LUTMP	TEPA
TM 14	A.3 Road Function and Capacity Improvement Program	2.0	2015		LUTMP	TEPA and CDGL
TM 15	B.1 Low Occupancy Vehicles Planning for Outskirt/ Rural Areas	5.0	2017		LUTMP	LTC
TM 16	B.2 Traffic Circulation System Design and Implementation	20.0	2018		LUTMP	TEPA
TM 17	B.3 Public and Freight Transport Terminals	100.0	2021		LUTMP	TEPA and CDGL
TM 18	B.4 Linking Communities - Smart Roads	4.0	2019		LUTMP	TEPA

Project No.	Project Description	Project Cost (USD Million)	Assumed Year of Operation	Status 1)	Proposed by:	Responsible Agency
TM 19	B.5 Feasibility Study for Traffic Demand Management Measures	2.5	2018		LUTMP	TEPA
TM 20	B.6 RMTS and BRT Station Area Traffic Management	1.5	2023		LUTMP	TEPA
TM 21	C.1 Planning and Design Study for Non-Motorized Traffic	1.5	2017		LUTMP	TEPA
TM 22	C.2 Non-Motorized Traffic Facilities Implementation	6.0	2021		LUTMP	TEPA
TM 23	C.3 Pedestrian and Bicycle Path Network	5.0	2017		LUTMP	TEPA
TM 24	D.1 Comprehensive Parking System Development	2.5	2015		LUTMP	TEPA
TM 25	D.2 Parking Facilities Implementation	60.0	2024		LUTMP	TEPA
TM 26	D.3 Park and Ride Facilities Development	75.0	2030		LUTMP	TEPA
TM 27	E.1 Traffic Enforcement Strengthening Programme	3.0	2015		LUTMP	Traffic Police
TM 28	F.1 Traffic Calming	6.0	2015		LUTMP	TEPA
TM 29	F.2 Traffic Safety Education Improvement	1.0	2018		LUTMP	Traffic Police and 1122
TM 30	G.1 Intelligent Transportation System Development	38.0	2029		LUTMP	TEPA
TM 31	H.1 Local Standards and Guidelines Development	1.5	2017		LUTMP	TEPA

Note: 1) Committed: officially approved by GoPb. Planned: waiting for approval.
Source: JICA Study Team

5. LUTMP Action Plan 2020

Core Programs

A number of transport projects have been proposed in the Master Plan. Among the projects, there are many projects that need immediate action of government agencies due to urgent needs of the city. These projects are categorized as follows:

- ❑ Immediate action to commence work on trunk public transport system such as RMTS and BRT; to improve convenience, accessibility and comfort of people's travel, alleviating serious road traffic congestion foreseen in the future (***Core Program-1***).
- ❑ Traffic management in central Lahore; to improve disorderly traffic situation around the Walled City, by a combination of minor road improvement, junction re-design, parking management, pedestrian/ bicycle path development and other cost effective traffic management measures (***Core Program-2***).

These projects may be considered as the core program of LUTMP. Other cost effective projects to supplement and enhance the viability/ performance of the ***core projects*** mentioned above may be included in the core program during project planning phase.

Proposed Core Program-1

In the Action Plan period (2012-2020), one RMTS line (Green) and seven BRT lines are proposed. Later, by 2030, two BRT lines would need to be upgraded to RMTS (Orange and Blue Lines). Table S.5 shows implementation programme. Figure S.3 illustrates the broad corridors for these proposed projects for 2020.

Table S.5 RMTS and BRT Lines Proposed for 2020 and 2030

Project Code	Project Description	System	Daily Boarding			Max Line Load (Pax Per Hr Per Direction – PPHPD)		
			2020	2030	% Growth	2020	2030	% Growth
PT06	RMTS Green Line	RMTS	759,000	980,000	29	17,200	21,900	28
PT07	RMTS Orange Line	2020 BRT/ 2030 RMTS	510,000	743,000	46	9,500	20,100	102
PT08	RMTS Blue Line	2020 BRT/ 2030 RMTS	270,000	379,000	40	5,600	11,200	100
PT09	BRT Purple Line	BRT	129,000	276,000	114	1,800	3,700	137
PT10	BRT Line 1 (Red)	BRT	88,000	285,000	224	2,100	6,800	219
PT11	BRT Line 2 (Light Blue)	BRT	109,000	331,000	204	1,500	3,700	164
PT12	BRT Line 3a (Pink)	BRT	161,000	265,000	65	3,200	3,500	12
PT13	BRT Line 3b (Pink)	BRT	167,000	248,000	49	2,700	3,200	19
Totals			**2,193,000**	**3,507,000**	**60**	**n/a**		

Source: JICA Study Team

Proposed Core Program-2

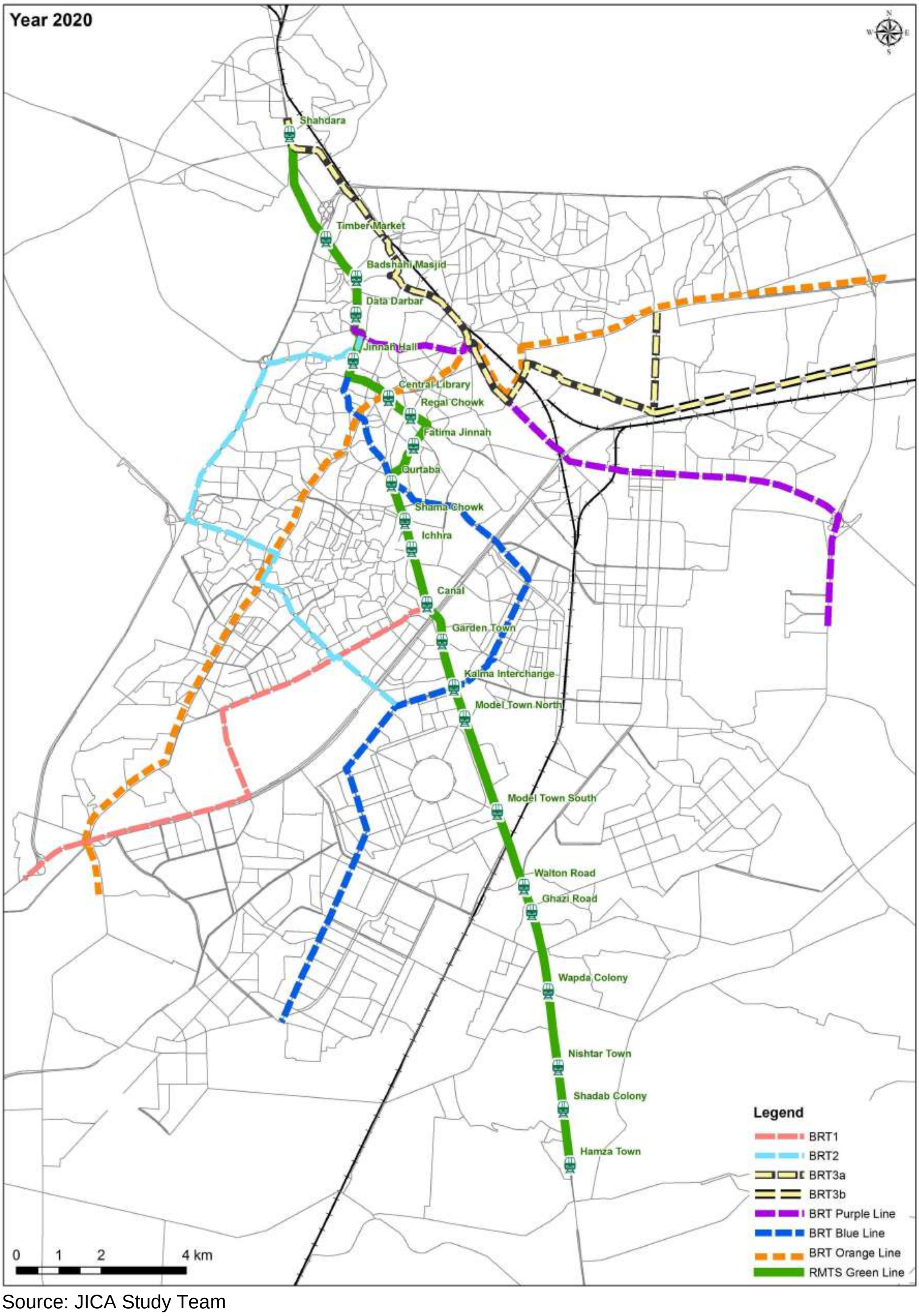
List of the projects selected for the 2020 Action Plan Core Program 2 are given in Table S.6.

Table S.6 Proposed Action Plan Traffic Management Projects (Core Program-2)

Project No.	Project Description	Implementation
TM12	A.1 Junction Design and Traffic Signal Improvement – CBD	Short Term
TM18	B.4 Linking Communities - Smart Roads	Short Term
TM23	C.3 Pedestrian and Bicycle Path Network	Short Term
TM24	D.1 Comprehensive Parking System Development	Short Term
TM31	H.1 Local Standards and Guide Lines Development	Short Term
TM16	B.2 Traffic Circulation System Design and Implementation	Medium-term
TM17	B.3 Public and Freight Transport Terminals	Medium-term
TM19	B.5 Feasibility Study for Traffic Demand Management Measures	Medium-term
R44 & R45	Shadbagh Area (Roads - R44) and Samanabad Area (Roads R45) – Secondary Road Network Development	Urgent Action
R57	Construction and Remodeling of Secondary roads - south of LRR in the south-western quadrant between Ferozepur Road and Multan Road	On-Going Developments

Source: JICA Study Team

Figure S.3 Location of RMTS/ BRT Lines for 2020



Source: JICA Study Team

Investment Summary

Table S.7 shows investment summary of LUTMP for the 2020 Action Plan period. Public transport projects share is about 75 % of the total cost, while road and traffic management share is 17 % and 8 %, respectively. The budget envelope is USD 2.3-6.9 billion for the Action Plan period (2012 to 2020). The planned investment falls in this range. However, the percentage of the investment in relation to Lahore's GDP is on the high side at 2.6 % during the action plan period. This is about 3 times the current level of investment. Private sector finance should be sought for these projects and measures to raise government revenue should also be taken.

Table S.7 Planned Investment Summary for the Action Plan (USD million)

Period (Year)	Short Term 2012-2015	Medium Term 2016-2020	Total
Public Transport	1,499	3,021	4,520
Road	450	570	1,020
Traffic Management	146	363	509
Total	**2,095**	**3,954**	**6,049**

Note: Excluding committed projects of costs of which are unknown
Source: JICA Study Team

Possible reduction of public investment has been estimated assuming PPP scheme on the proposed RMTS/ BRT projects. This was done assuming a percentage of contribution from the private sector as shown in Table S.8. The reduction was estimated at about USD 750 million equivalent to 26 % of the total investment.

Table S.8 Cost Reduction by Applying PPP Scheme to RMTS/ BRT Projects by 2020

Project No.	Project Description	EIRR (%)	FIRR (%)	Project Cost (USD million)	% Private Sector	Cost to Gov't (USD million)
PT06	RMTS Green Line	12.1	7.1	2,583.0	20	2,066.4
PT07	BRT Orange Line	18.8	21.0	74.5	100	0.0
PT08	BRT Blue Line	16.7	17.9	58.6	80	11.7
PT09	BRT Purple Line	15.5	16.1	40.8	50	20.4
PT10	BRT Line – 1	37.6	24.9	30.7	100	0.0
PT11	BRT Line – 2	43.6	26.5	30.5	100	0.0
PT12	BRT Line – 3a	20.4	16.3	28.7	50	14.4
PT13	BRT Line – 3b			35.3	50	17.7
Total				**2,882.1**	**26.1**	**2130.6**

Source: JICA Study Team

6. Recommendations

The LUTMP study team recommends for the Government of the Punjab to:

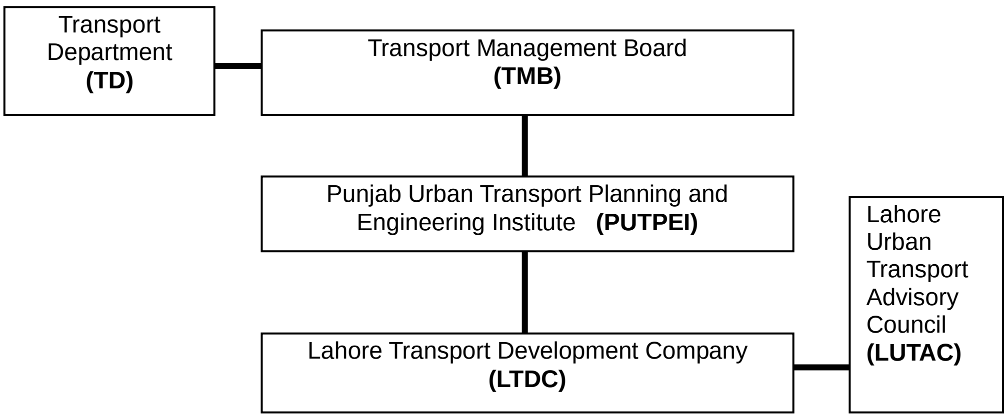
1) Authorize and get this master plan approved by Chief Minister and concerned agencies of GoPb, and disseminate its contents to all stakeholders.

2) Allocate implementation responsibilities by project clearly to government agencies. Transport Department (TD) oversees and monitors the implementation of these

projects.

3) Establish new organizational setup to make decisions on various transport projects. This proposal includes the establishment of Transport Management Board (TMB), Punjab Urban Transportation Planning and Engineering Institute (PUTPEI), Lahore Transport Development Company (LTDC) and Lahore Urban Transport Advisory Council (LUTAC) to control the urban transport sector of Lahore as presented in Figure S.4. This institutional setup is expected also to monitor and manage the progress of the proposed projects in this master plan.

Figure S.4 New Establishment for Transportation Development



Source: JICA Study Team

4) Take necessary actions to launch the Core Program 1 of the LUTMP Action Plan as shown in Table S.9.

Table S.9 Necessary Actions to Construct Trunk Public Transport System

Project Code	Route/ Line	System	Actions Needed
PT06	RMTS Green Line	RMTS	EIA, detailed design, land acquisition, utility relocation and procurement of transaction adviser are needed immediately. Tender and financial arrangement by 2015. Completion by 2019/20.
PT07	RMTS Orange Line (Initially BRT)	BRT	Reference Design is needed urgently to firm up costs for budgeting, land acquisition etc. Other actions (EIA etc) by 2015.
PT08	RMTS Blue Line (Initially BRT)	BRT	FS is needed by 2015. Other actions by 2019/20.
PT09	BRT Purple Line	BRT	All actions by 2019.
PT10	BRT Line – 1	BRT	All actions by 2019.
PT11	BRT Line – 2	BRT	All actions by 2019.
PT12	BRT Line – 3a	BRT	All actions by 2019.
PT13	BRT Line – 3b	BRT	All actions by 2019.

Source: JICA Study Team

5) Start the projects proposed in the Core Program 2 of the LUTMP Action Plan as soon as possible. GoPb has already requested Japanese Government to conduct a

technical assistance project in this regard. Particularly in relation to the encroachment of roads found everywhere at present in central Lahore, not only strengthening enforcement but rationalization of road space and pedestrian facilities use (along with improved bus system) should be seriously considered and planned coupled with improvement of traffic management such as installation of modern signal system.

6) Raise funding capability of GoPb by seeking from various additional revenue sources, and optimising current revenue sources under the institutional arrangements of the government. Some of the initiatives that could be expanded further in Lahore could include: (1) Property Assessment Taxes**,** (2) Betterment Charges and (3) Development Charges. Although application of these initiatives needs careful examination before it is implemented, the revenue potential is huge, presumably at an order of several tens of billion rupees. It is recommended for GoPb to investigate the possibility in relation to LDA’s land use rules and regulations.

Volume-I – Chapter-1

INTRODUCTION

FINAL REPORT

1. INTRODUCTION

1.1 Study Background

Lahore, the provincial capital of Punjab, is the second largest city in Pakistan with a population of about 10 million. The city's population has been growing at a growth rate of about 3 % per annum. The city's rapidly growing population coupled with increasing vehicle ownership has resulted insatiable travel demand. Development of transport infrastructure has not kept pace with this increase, and has caused transport related problems like traffic congestion, poor environment and a slew of emerging issues:

- absence of mass transit system, inefficient and dilapidated condition of public transport system;
- insufficient traffic management; poor junction design and lack of traffic control;
- encroachment of road space and public right of way, and poor public space management;
- roadside commercial activities, absence of sidewalks, bus stops, proper bus services, shelters; roadside garbage and garbage collection containers;
- illegal parking, and totally uncontrolled parking; and
- disorderly traffic: mixed of animal-drawn carts, auto rickshaws, bicycles and pedestrians.

In 1991, Japan International Cooperation Agency (JICA) conducted a comprehensive urban transport study and formulated a master plan for Lahore. The priority road projects identified in the study, included intersection improvements, underpasses and bridge construction across the Ravi River have been implemented by the World Bank and Government funds. This improved traffic situation to limited extent, and alleviated congestion in the last decade. However, guide way transit projects, including the construction of the light rail transit (LRT) could not be implemented due to lack of institutional capacity and financial constraints. Over the last twenty years city's population has more than doubled, as anticipated, but the transport infrastructure did not keep pace. Also the city's growth was not as planned; it expanded uncontrolled in all directions, as unplanned ribbon development. There was no attempt to review and update the transport master plan except limited planning for some ad-hoc transport projects.

The necessity of formulating a new urban transport master plan was highlighted under these circumstances, and this led the Government of the Punjab requesting JICA to conduct this study. Acting on the request of the Government of the Punjab (GoPb), JICA dispatched a preparatory study mission to Lahore in January 2010. The mission discussed and signed the Scope of Work and Minutes of Meeting with the Government of the Punjab. This study has been implemented based on the agreed Scope of Work.

This study was divided into two phases; Phase 1 focused on transport/ traffic surveys and Phase 2 included transport planning and master plan development. This report covers both Phase 1 and Phase 2 of "The Project for Lahore Urban Transport Master Plan in the Islamic Republic of Pakistan (LUTMP)," covering transport and traffic surveys, analyses, formulation of urban development scenarios, setting future socio-economic framework, demand forecast, preparing transport development strategies, formulation of urban transport master plan for 2030 and formulation of urban transport action plan for 2020.

Figure 1.1.1 A Typical Directionless Traffic Mix and Parking in Lahore

Source: JICA Study Team

1.2 Study Objectives

The following are the overall objectives of the study, as defined in the scope of work:

(i) To formulate an urban transport master plan for the Study Area up to the year 2030;

(ii) To formulate an action plan for the identified priority projects up to the year 2020; and

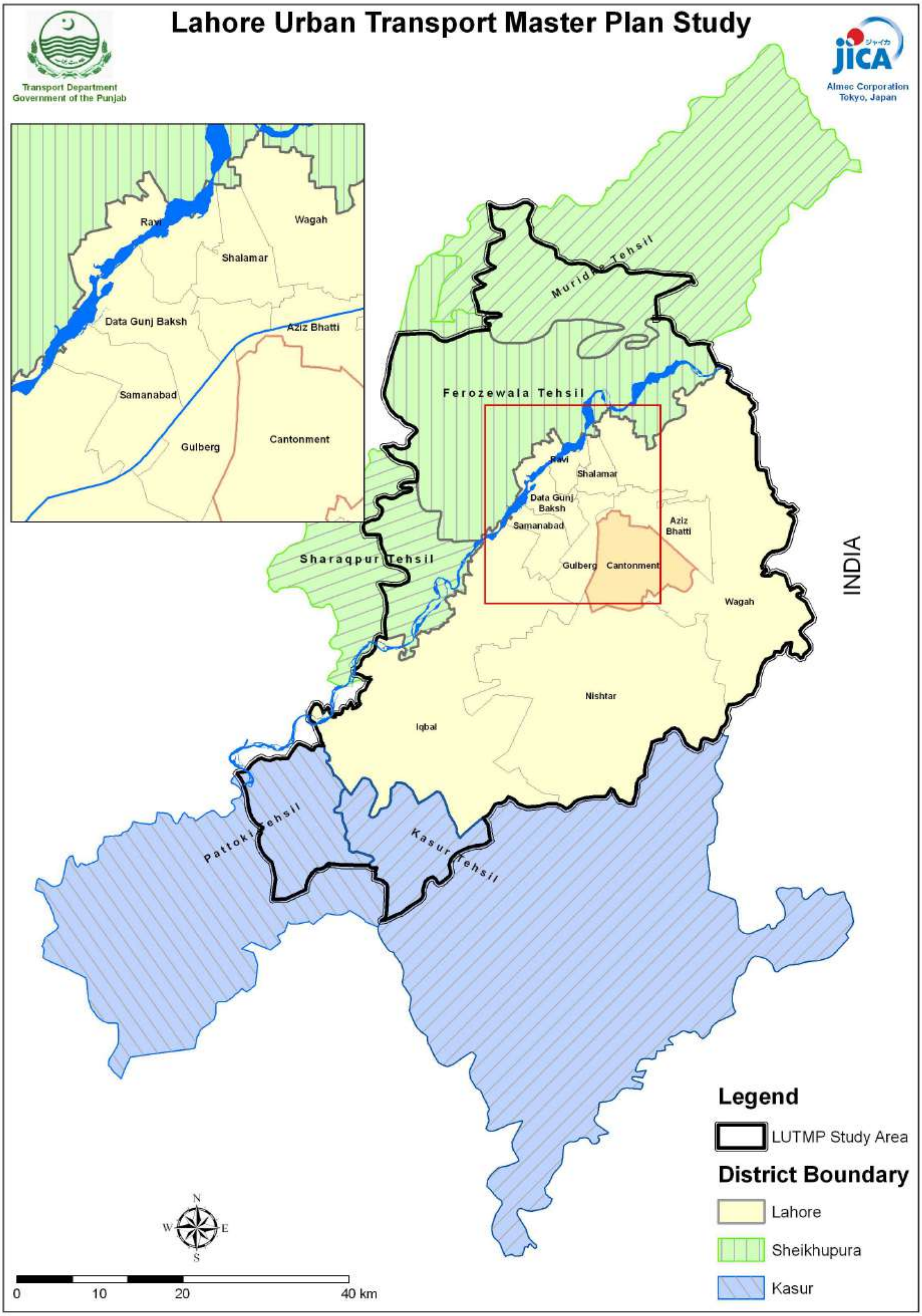
(iii) To provide assistance to strengthen the administrative capacity of the Government of the Punjab for implementing the master plan.

1.3 Study Area

The Study Area as shown in Figure 1.3.1, is about 3,044 km^2, covers the whole of Lahore District (yellow area), part of Kasur District (blue area), and part of Sheikhupura District (green area). This area is 30% larger than the LMA Area (2,306 km^2) studied by JICA in 1991 master plan and also by the LDA in 2004 master plan project.

Urbanization in Lahore has spread beyond its administrative boundaries, although the city continues to be the center of the growing metropolis. As of 2010 the population of the Study Area was estimated at about 9.9 million, including 0.4 million of Kasur; and 0.9 million of Sheikhupura District areas included in the Study Area. However, most of the population is concentrated in the center of Lahore, while the rest of the areas are mostly rural except for narrow ribbon development along arterial roads.

Figure 1.3.1 The Study Area

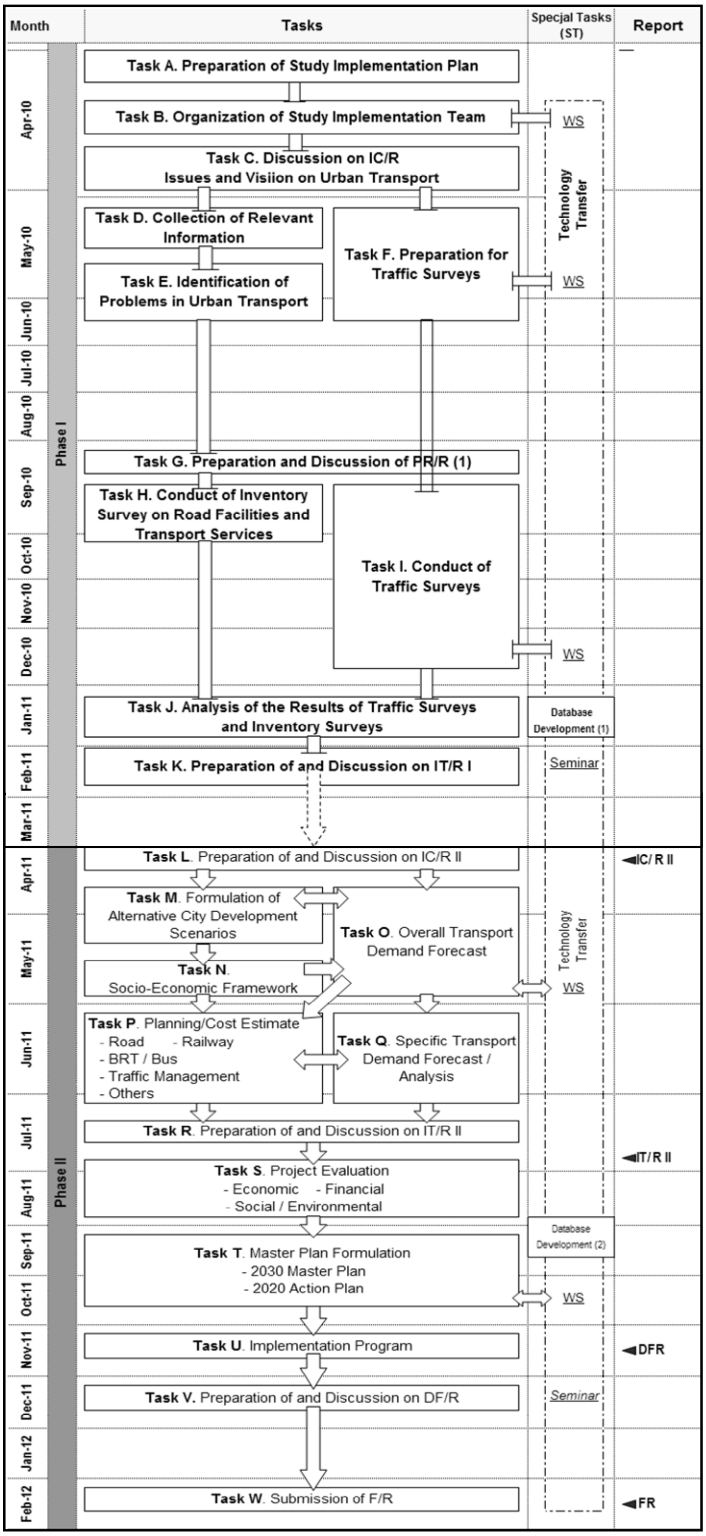


Source: JICA Study Team

1.4 Study Schedule and Framework

The study commenced in April 2010 and ended in February, 2012. The overall framework of the study is shown in Figure 1.4.1.

Figure 1.4.1 Outline Schedule of LUTMP



Source: JICA Study Team

1.5 Composition of LUTMP Reports

The LUTMP Final Report is composed of the following:

A. Main Text Vol.1: Urban Transport Master Plan for Lahore

B. Main Text Vol. 2: Surveys, Analyses, Demand Forecast and Capacity Development

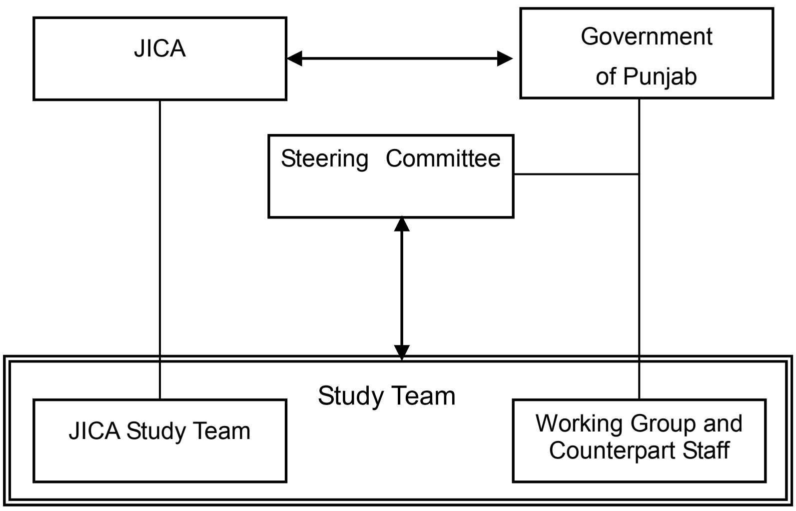
In addition to the above, urban transport database has been created in the form of DVD based on various transport /traffic surveys, demand needed and 2020 and 2030 travel demand forecasts.

1.6 Study Organization

1.6.1 Study Organization

The study organization is composed of JICA and JICA Study Team on the Japanese side and Steering Committee, Working Group, and Counterpart Staff on the Pakistani side, as shown in Figure 1.6.1.

Figure 1.6.1 Study Organization



1.6.2 Members of Study Organization

The members of the study organization are presented in Table 1.6.1 and Table 1.6.2 for the Pakistani and the Japanese side, respectively.

Table 1.6.1 Members of the Pakistani Side

Steering Committee Members

No.	Name	Position/ Status	Department/ Agency
1.	Mr. Ali Tahir,	Secretary/ (Chairman)	Planning and Development
2.	Mr. Muhammad Yousaf	Secretary	Transport
3.	Mr. Azam Suleman Khan	Secretary	Communication and Works
4.	Mr. Sajid Saleem Hotiana	Secretary	Environment Protection
5.	Dr. Muhammad Abid Bodla	Member (Infrastructure and Development)	Planning and Development Board
6.	Mr. Ahad Khan Cheema	DCO	City District Government
7.	Mr. Ahmad Mobeen	D.I.G Traffic	Traffic Police
8.	Mr. Abdul Jabbar Shaheen	Director General	Lahore Development Authority
9.	Mr. Ihsan-ul-Hq	Managing Director	Traffic Engineering and Transport Planning Agency
10.	Dr. Nasir Javaid	Project Director	The Urban Unit
11.	Khawaja Ahmad Hassan	Chairman	Lahore Transport Company

Working Group Members

No.	Name	Position/ Status	Department/ Agency
1.	Mr. Muhammad Yousaf	Secretary/ (Chairman)	Transport
2.	(Vacant)	Project Director	Transport Planning Unit
3.	Mr. Manzoor Ahmad Ch.	EDO (W/S)	City District Government
4.	Dr. Shagufta Shahjahan	Director General	Environment Protection
5.	Dr. Muhammad Shehzad	SP Traffic	Traffic Police
6.	Mr. Waseem Ahmad Khan	Chief Metropolitan	Lahore Development Authority
7.	Mr. Saif-ur-Rehman	Chief Engineer	Traffic Engineering and Transport Planning Agency
8.	Mr. Tayyab Farid	Coordinator LRMTS/ Optional Member	Transport Department
9.	Mr. Muhammad Imran	Asst. Chief, Infrastructure/ Optional Member	Planning and Development
10.	Mr. J.I. Kim	Chief Exec. Officer	Lahore Transport Company
11.	Mr. Ozair Shah	Transport Specialist	The Urban Unit
12.	Mr. Sohail Raza	Director	Lahore Ring Road Project

Table 1.6.2 Members of the Japanese Side

JICA

No.	Name	Position	Division/ Office
1	Mr. Hiroyuki HAYASHI	Director	Urban and Regional Development Div.
2	Mr. Kenji MAEKAWA	Director	Urban and Regional Development Div.
3	Mr. Yasuhisa TOMINAGA		Urban and Regional Development Div.
4	Mr. Masahiro Suzuki		Urban and Regional Development Div.
5	Mr. Nobuyuki KOBE		Urban and Regional Development Div.
6	Mr. Tomoharu OTAKE	Chief Representative	JICA Pakistan Office
7	Mr. Takatoshi NISHIKATA	Chief Representative	JICA Pakistan Office
8	Mr. Toshiya SATO	Senior Representative	JICA Pakistan Office
9	Mr. Nobuhiro KAWATANI	Representative	JICA Pakistan Office
10	Ms. Haruka SHINDO	Representative	JICA Pakistan Office
11	Ms. Naila ALMAS	Senior Program Officer	JICA Pakistan Office

JICA Study Team

No.	Name	Position/ Status	Assignment
1.	Mr. SHOYAMA Takashi	Team Leader	Comprehensive Transport Policy
2.	Mr. Mazhar IQBAL	Deputy Team Leader	Public Transport Planning
3.	Mr. KUMAZAWA Ken	Deputy Team Leader	Urban Planning, Land Use Planning
4.	Mr. SHIBA Yutaka	Member	Urban Planning, Land Use Planning
5.	Mr. David O'BRIEN	Member	Demand Forecast/ Bus and BRT Development
6.	Mr. OKAMURA Naoshi	Member	Traffic Survey and Analysis/ Demand Forecast
7.	Mr. Malik BECHAR	Member	Demand Forecast
8.	Mr. Johan GEORGET	Member	Transport Survey
9.	Mr. KOMORI Masaru	Member	Transport Survey
10.	Dr. KANAI Yoshikazu	Member	Supplemental Traffic Survey
11.	Mr. WAKUI Tetsuo	Member	Organization/ Capacity Development
12.	Mr. HORIE Tetsuo	Member	Capacity Development
13.	Mr. Joel CRUZ	Member	GIS

14.	Mr. TANAKA Masanobu	Member	Database Development
15.	Mr.TAKEDA Haruo	Member	Road Development Planning
16.	Mr. NISHIKATSU Yoshiaki	Member	Road Development Planning
17.	Mr. MATSUDA Tatsuyuki	Member	Railway Development Planning
18.	Mr. Frits OLYSLAGERS	Member	Bus and BRT Development
19.	Mr. TAKAGI Michimasa	Member	Traffic Management Planning
20.	Mr. SEKI Yosui	Member	Project Evaluation
21.	Mr. OKUZAWA Shinjiro	Member	Environmental / Social Considerations
22.	Ms. SAKAI Yuko	Member	Project Coordination

JICA Local Study Team

No.	***Name***	***Position***	***Title***
1.	Mr. Aqeel Younis Mughal	Member	Transport Planning
2.	Mr. Nisar Ahmad Shaikh	Member	Transport Planning
3.	Mr. Taimoor-ul-Haq Abbasi	Member	Transport Planning
4.	Mr. Muhammad Usman Akram	Member	Transport Planning
5.	Ms. Sara Anbreen	Member	GIS Specialist
6.	Ms. Uzma Shahzadi	Member	Project Administration
7.	Mr. Kamran Alam Khan	Member	Project Coordination

1.6.3 Meetings Held

During the course of the conduct of LUTMP, a series of meetings were held as shown in Table 1.6.3. In addition, numerous lectures were delivered for capacity development of Pakistani officials comprised mainly of Transport Planning Unit, Transport Department, GoPb, The Urban Unit, Lahore Transport Company, University of Engineering and Technology, Lahore School of Economics and JICA Local Staff, as detailed in Chapter 5, Volume 2.

Table 1.6.3 List of Meetings Held

Steering Committee

Description	*Date*	*Venue*	*Participants*
1st Meeting	3rd June, 2010	Planning and Development Department	22
2nd Meeting	27th November, 2010		19
3rd Meeting	23rd February, 2011		21
4th Meeting	18th April, 2011		23
5th Meeting	14th September, 2011		26
6th Meeting	2nd December, 2011		24
7th Meeting	22nd February, 2012		26
8th Meeting	24th February, 2012	Transport Department	18

Working Group

Description	*Date*	*Venue*	*Participants*
1st Meeting	5th August, 2010	Transport Department	18
2nd Meeting	17th September, 2010		17
3rd Meeting	1st July, 2011	Planning and Development Department	21

LUTMP Intl. Seminars

Description	*Date*	*Venue*	*Participants*
1st Seminar	25th February, 2011	Royal Palm Golf and Country Club, Lahore	152
2nd Seminar	15th September, 2011		158
3rd Seminar	17th November, 2011		45
4th Seminar	1st December, 2011		170

Volume-I – Chapter-2

CURRENT TRANSPORT SITUATION, PROBLEMS AND ISSUES

FINAL REPORT

2 CURRENT TRANSPORT SITUATION, PROBLEMS AND ISSUES

2.1 Review of Existing Information, Studies and Plans/ Projects

2.1.1 Historic Development of Lahore and Previous Studies

Lahore is a city which has its mentions in history books as far back as AD 630. Lahore City has been growing, and underwent many development eras, i.e. The Hindu Era, Mughal Period, Sikh Raj, the British Rule and then the creation of Pakistan in 1947. Since then, as the capital of Punjab Province, city has been growing in somewhat circular fashion around the walled city, and also unplanned organic growth of old population centres outside the walled city area. The major growth started around late 1960's when the population growth rate was very high. This high growth lead to the city's expansion in the south and south-west corridors of Ferozepur Road and Multan Road, again mostly unplanned suburbs, with the exception of rich areas Model Town, Gulberg and Shadman. In the east urbanisation has been limited due to proximity to the India, and was seriously affected after the 1965 war. Similarly, westward expansion has been restrained due to Ravi River.

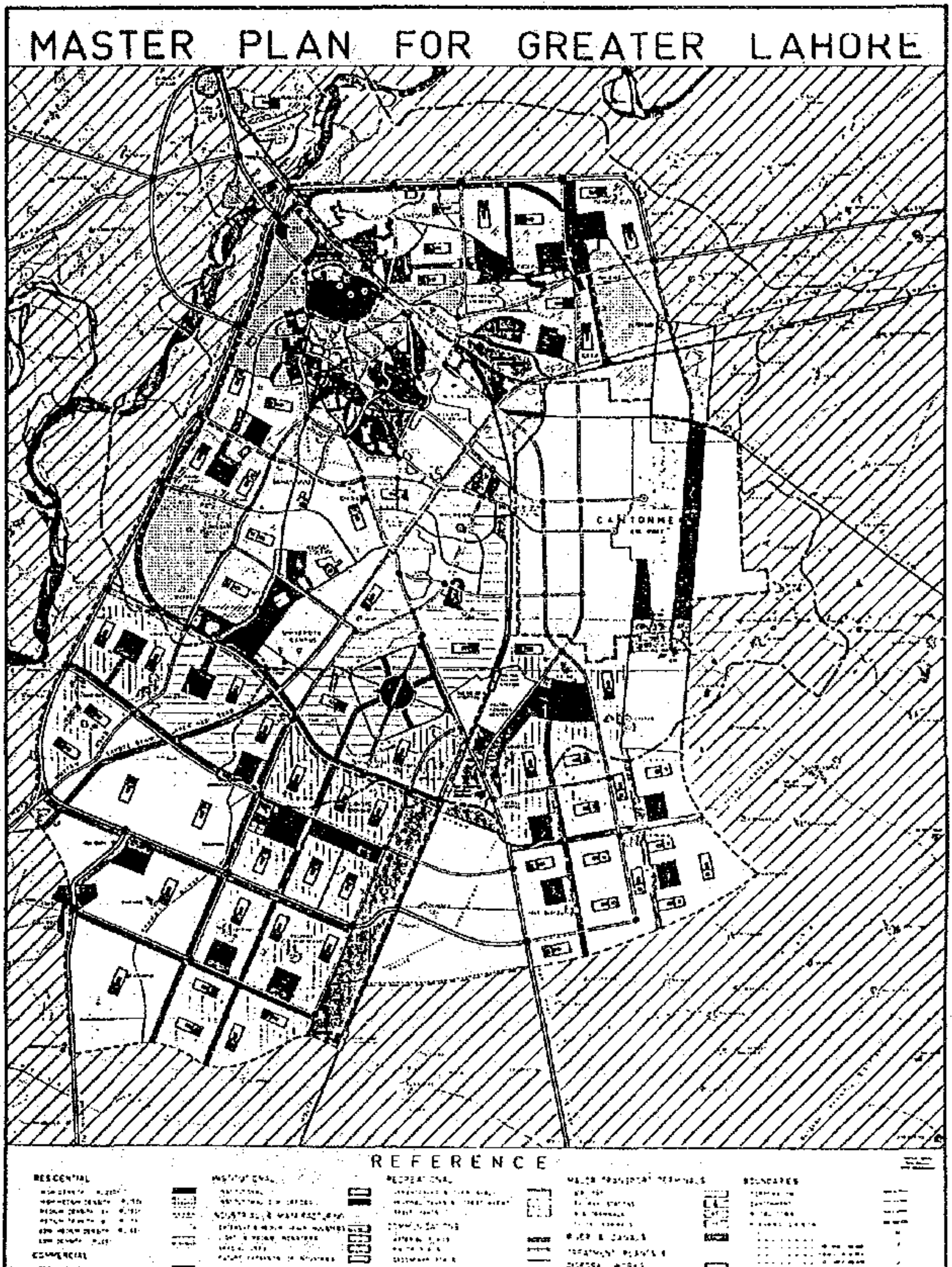
1) 1966 Greater Lahore Master Plan

Development planning of Lahore was first envisaged in the 1966 Master Plan for Greater Lahore. Similar to the prevailing town planning trends of that period, the Grater Lahore Master Plan conceived Lahore as a metropolitan area with several satellite towns around within a radius of 20~25 km. However, due to total lack of development control, no understanding of transport needs that exceed the growth in transport infrastructure, the city continued to grow linearly along radial routes, and the Greater Lahore Master Plan failed to achieve its objectives. The master plan output is depicted in Figure 2.1.1.

2) Lahore Urban Development and Traffic Study, 1980

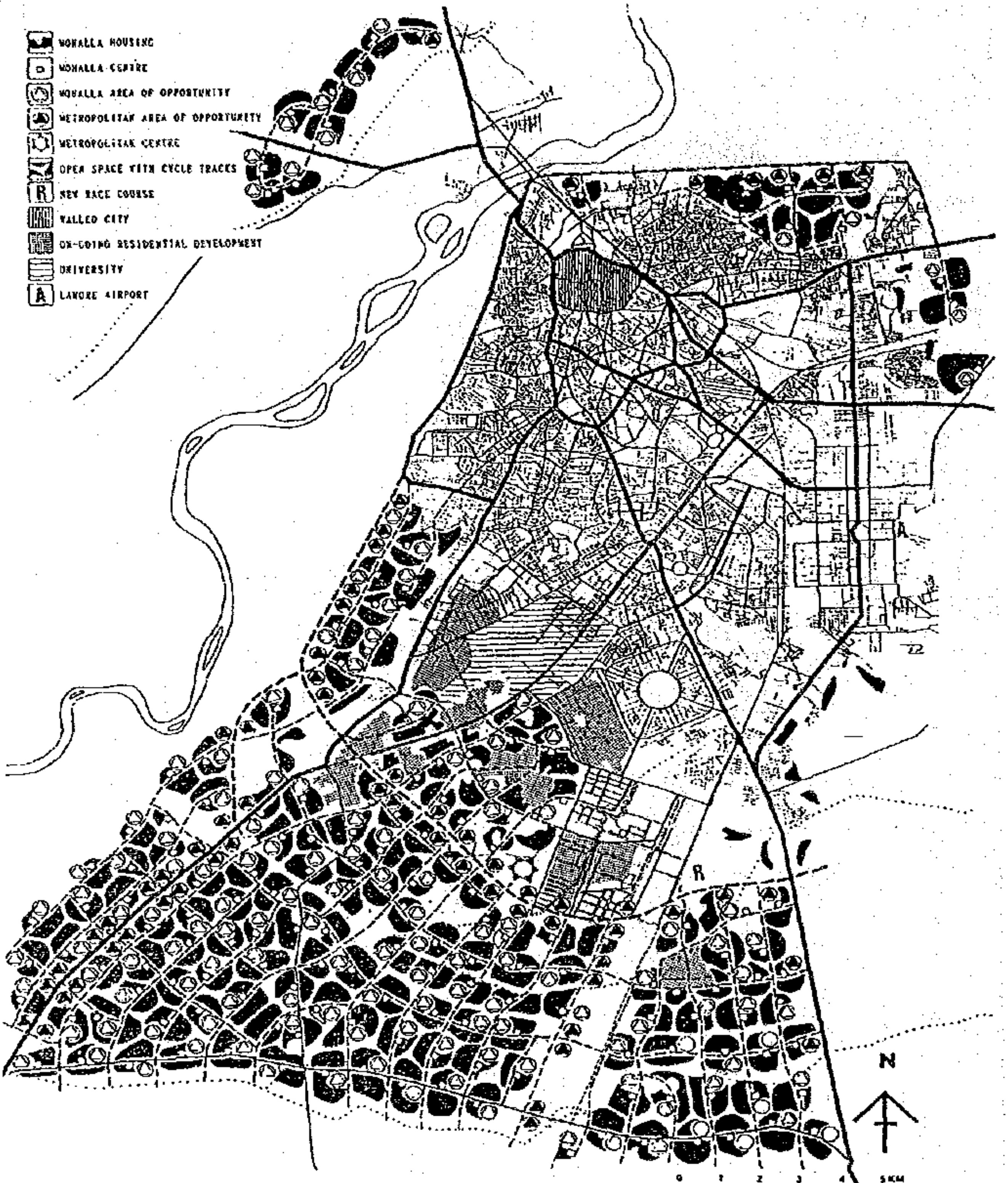
This study was conducted by Halcrow Fox UK, and it was the first attempt to plan the city growth, and prepare an integrated development and transport infrastructure plan for the year 2000. The future growth was planned towards the south and southwest axis, with additional townships and population centres with adequate transport infrastructure. Again the plan was for the development of population centres and associated transport infrastructure. The transport infrastructure comprised mostly building of new secondary and tertiary roads. No attempt was made to address the overall transport demand, including the issue of public transport, which is crucial for the mobility of its poor residents, with such low vehicle ownership. The overall development plan key features are shown in Figure 2.1.2.

Figure 2.1.1 Master Plan for Greater Lahore



Source: Grater Lahore Master Plan, 1966

Figure 2.1.2 Lahore Urban Development and Traffic Study



SOURCE: LAHORE URBAN DEVELOPMENT AND TRAFFIC STUDY
AUGUST, 1980.

3) 1991 Comprehensive Study on Transportation System in Lahore, JICA

This study was conducted in 1991 by JICA consultants with the assistance of Lahore Development Authority (LDA) and Traffic Engineering and Planning Agency (TEPA). The study objectives were:

- to formulate a transportation master plan for the Study Area for 2010, with intermediate action plans for year 2000, and
- to conduct a feasibility study of selected mass transit system and other selected transport infrastructure projects.

The study was first ever attempt to apply modern transport planning techniques for travel demand analyses, development and evaluation transport infrastructure projects to meet the travel demand of the City of Lahore (comprising of most of the contiguous urban area of Lahore District and adjoining parts of Sheikhupura District in the north and part of Kasur District in the south. The Study Area is shown below in Figure 2.1.3. The key features of the master plan were:

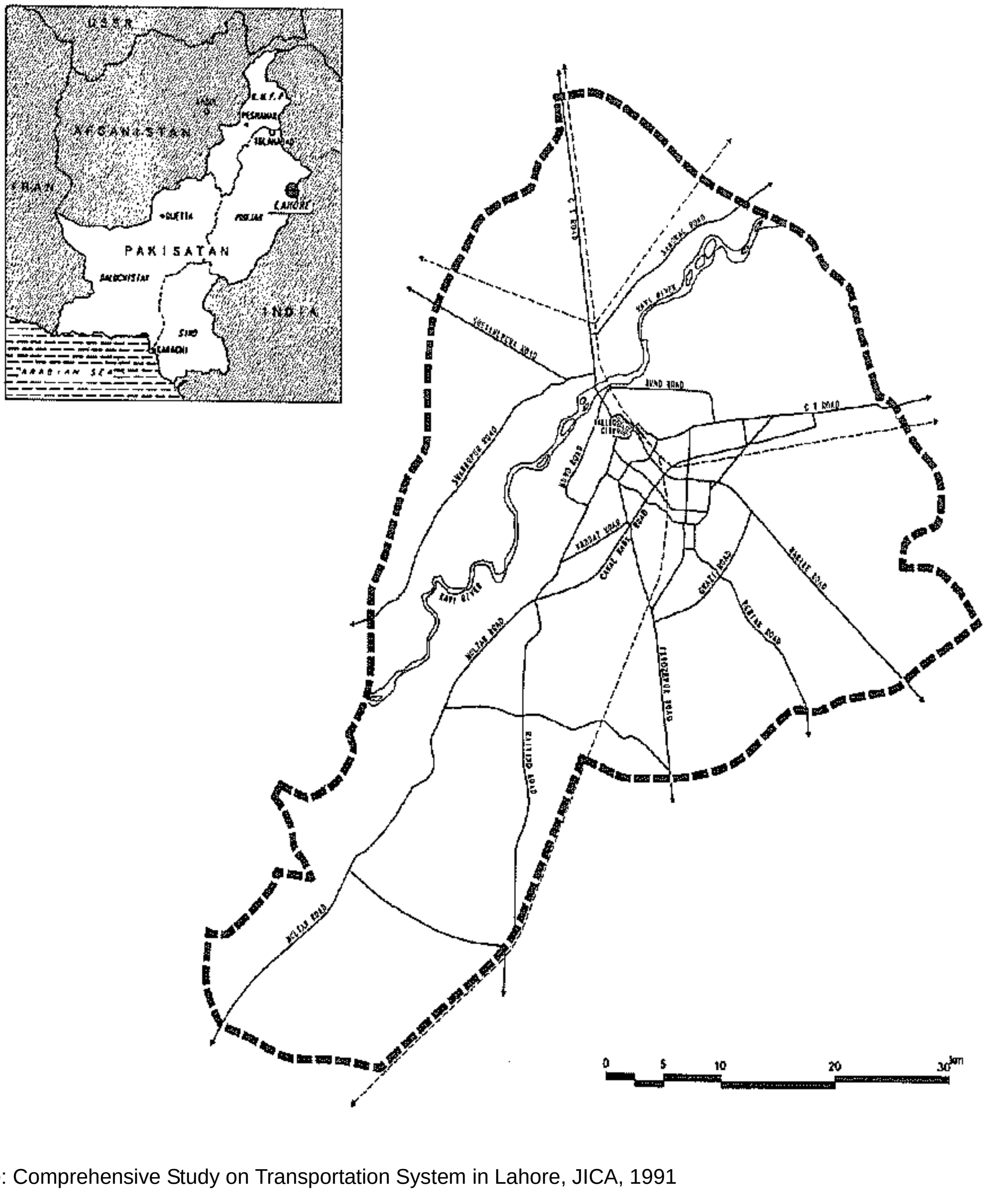
- most of the future population will be accommodated by intensification of the existing urban areas, and further urbanisation of the city in the south/ southwest quadrant;
- a series of road projects, comprising of new roads and major improvement of existing road intersections by construction of grade separated; and
- introduction of mass both road based and fix-track mass transit system;
- the implementation cost of the master plan was PKR 20 billion in 1991 prices

The master plan proposed a number of projects as shown in Figure 2.1.4. Its progress since then is:

- Improvement of existing roads – 70 km; halfway
- Construction of new roads – 200 km; Lahore Ring Road (LRR) and some feeder roads completed but no progress for circumferential roads in the south of the center of Lahore
- Improvement of 26 intersections; mostly done but needs further improvement
- New bridges over River Ravi; proposed two new bridges completed
- Introduction of bus priority lane 52 km; no progress
- Provisions of bus larger bus fleet; once tried but failed due to the lack of control
- Improvements of bus routes and schedules; being done continuously
- Revision of fares; adjustment to inflation only
- Improvement of existing railways – 40 km; none
- Ferozepur LRT system 12.5 km; Pre-FS conducted by WB in 1994 but suspended due to financial constraints
- Development of 2-multi-modal interchanges (Bus and LRT); none completed
- A new bus terminal in the south; proposed

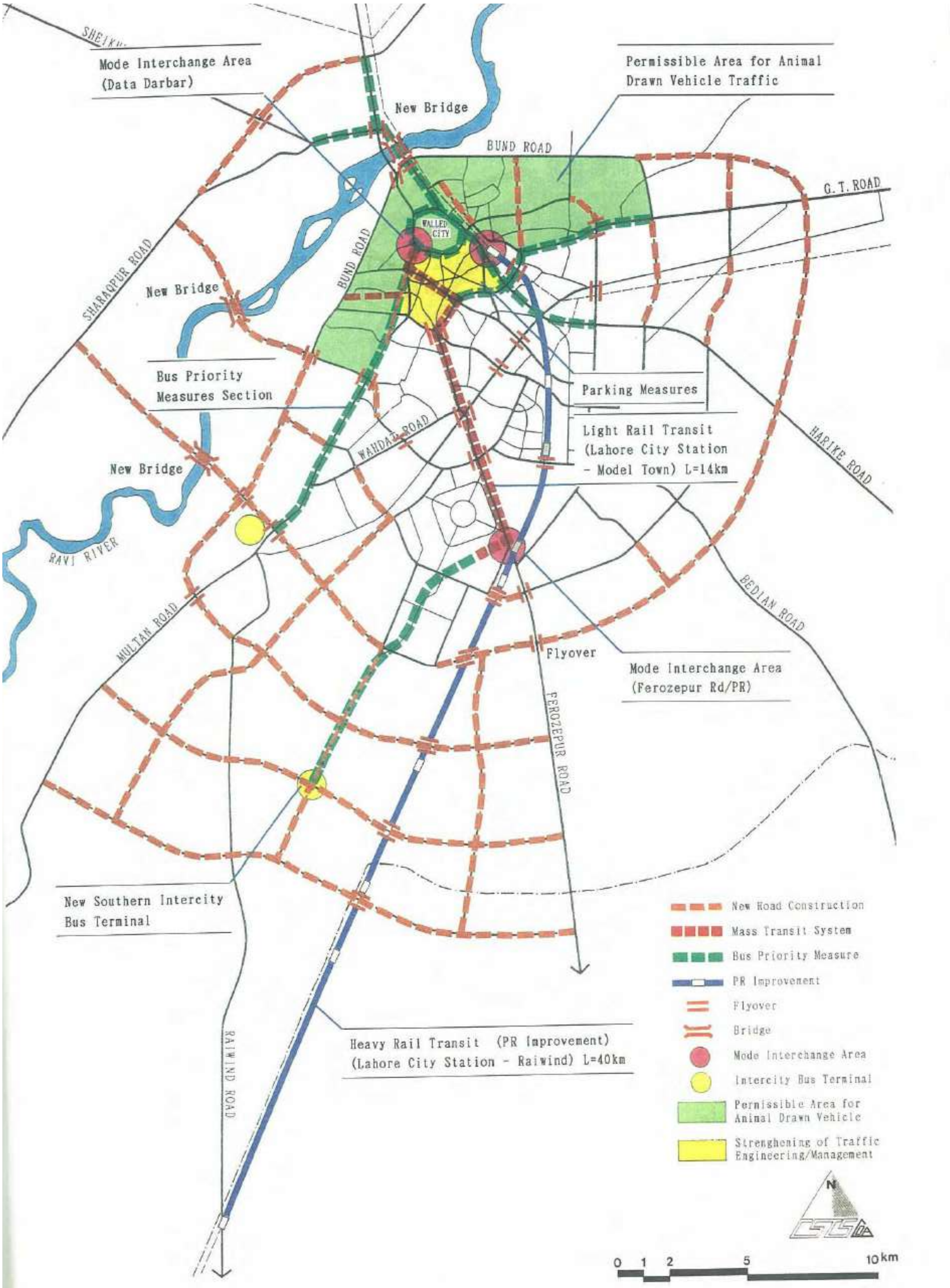
- Parking control; proposed
- Segregation of motorised and non-motorised traffic; limited control only

Figure 2.1.3 Comprehensive Study of Transportation System in Lahore – the Study Area



Source: Comprehensive Study on Transportation System in Lahore, JICA, 1991

Figure 2.1.4 Comprehensive Study of Transportation System in Lahore – Master Plan



Source: Comprehensive Study on Transportation System in Lahore, JICA, 1991

4) Integrated Master Plan for Lahore-2021 by NESPAK

This study was conducted in 2001 by National Engineering Services Pakistan (NESPAK) consultants for LDA. The study addressed the urban planning issues of Lahore and prepared a 2020 master plan. The study is comprehensive in nature as far as urban planning is concerned. The data analysis is weak, as does not provide the impact of the urban development scenarios on travel demand and corresponding requirement for transport infrastructure. Therefore the master plan is of little use as an integrated master plan for the city <u>without</u> taking account of the accessibility/ mobility issues of the residents and future travel demand requirements.

2.1.2 Plans and Projects

1) Vision 2030

Pakistan's strategic priorities are summarized in "Vision 2030" prepared by Planning Commission, Government of Pakistan, August, 2007. The Vision 2030 statement approved by National Economic Council (NEC) envisages a "developed, industrialized, just and prosperous Pakistan through rapid and sustainable development in a resource constrained economy by deploying knowledge inputs".

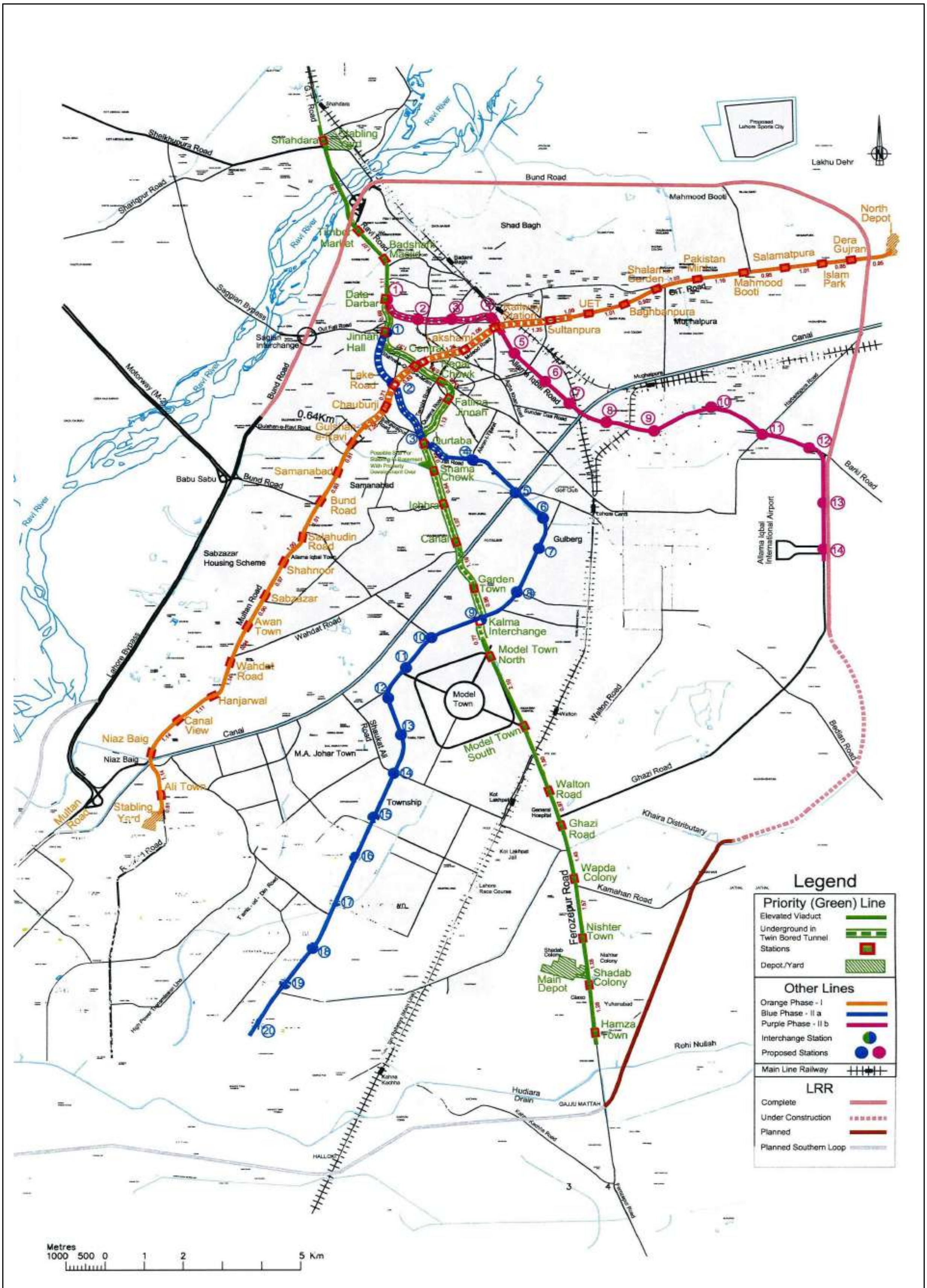
The "Vision 2030" mentioned some important comments and targets, including those for Lahore City, for example:

- "With present infrastructure, it will not be possible to expect our enterprises to become part *of,* and players *in,* the international supply chain, or to facilitate new investments in industry, agriculture and services." (p.67)
- "Reducing delays in our transport system is critical instrument for the cost of doing business, and hence increasing our competitiveness." (p.67)
- **"**Lahore, a sprawling metropolis of seven million, has fewer than 150 traffic lights, which are measures of insufficient traffic management. The result is severe traffic congestion." (p.96)
- **"**Lahore returns to being a city of intellectual activity and entertainment. Half a dozen foreign universities will have made it their first overseas campus; together with its older well known Pakistani universities, they will offer a variety of studies to people from across the world. The Mall will have a large number of theatres and restaurants, with the walled city and historical monuments becoming a haven for tourists and students. Its industrial estates, technology parks, and shopping centres will rival the best in the region. Its cultural and art festivals will attract a large numbers of domestic and international tourists." (p.99)

2) Lahore Rapid Mass Transit System (LRMTS)

Lahore Rapid Mass Transit System (LRMTS) is a project envisioned to provide mass transit facilities to Pakistan's second largest city Lahore. The project is expected to complete in 2025. In the first phase, two medium capacity rail based mass transit lines will be constructed. For the priority Green Line between Shahdara and Hamza Town (Ferozepur Road), a feasibility study was completed in 2006, and was immediately followed by its reference design, which was completed in 2008 by SYSTRA. The Green Line was likely to be completed by 2015 at a cost of USD 2.4 billion. The funding source for the construction has not been decided. The feasibility study of the second priority line (Orange Line) was completed in August 2007. No further programme has been made on the mass transit project, since June 2008.

Figure 2.1.5 Lahore Rapid Mass Transit System (LRMTS)



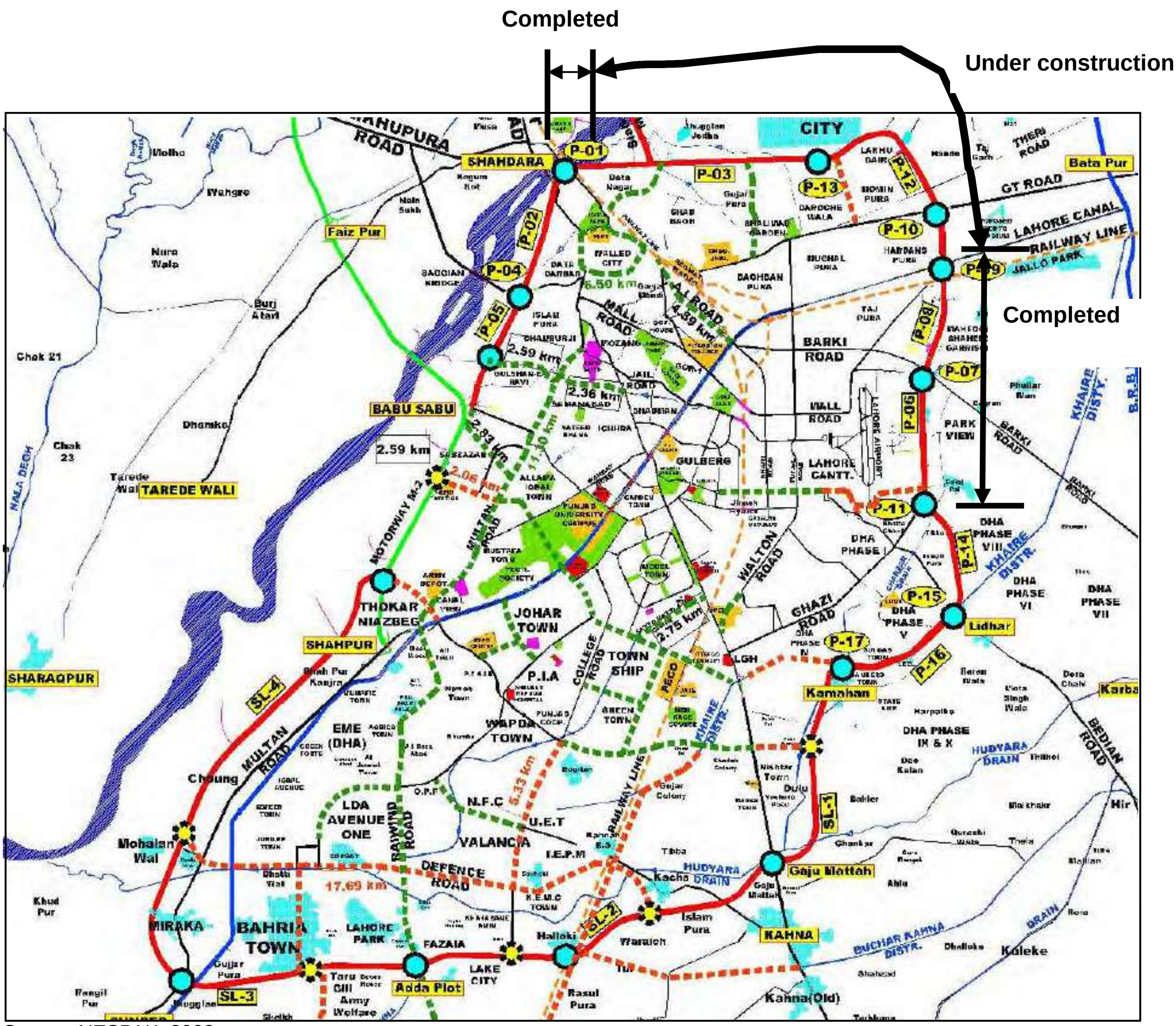
Source: LRMTS Study, 2007

3) Lahore Ring Road (LRR)

The Lahore Ring Road (LRR) Project was launched on December 22, 2004. The LRR Project is a large road project being developed by the GoPb, intended to ensure efficient and speedy movement of freight and passengers, to alleviate traffic flow problems, and to boost the city's potential for industrial development. The project includes the construction of:

- 6-lane divided highway with interchanges (access-controlled);
- RCC bridges with reinforced earth abutments and walls;
- Overhead pedestrian bridges, culverts, tunnels, underpasses, flyovers and related works; and
- Total projected cost of over PKR 20 billion.

Figure 2.1.6 Lahore Ring Road (as of May 2010) and Connecting Roads Plan



Source: NESPAK, 2008

At present (May 2010), the first phase of the north-eastern part 18 km is under construction and the part of it from west to Airport is open to operation.

Figure 2.1.7 A Completed Section of Lahore Ring Road

Source: JICA Study Team

4) Underpasses and Flyovers in Lahore

Lahore has the highest number of underpasses and flyovers in Pakistan after Karachi. One of arterial roads, Canal Bank Road, has 10 underpasses in the Study Area.

Figure 2.1.8 One of the Underpasses along Canal Bank Road

Source: JICA Study Team

Shalimar Interchange

In 2009, one of the interchanges in the Canal Bank Road, called Shalimar Interchange, was completed. It has a flyover 1 km long, in north-south direction and crossing two underpasses in east-west direction.

Figure 2.1.9 Shalimar Interchange

Source: JICA Study Team

Features of the underpass of the Shalimar Interchange are as follows (from the Design report and Drawings):

- Wall Structure: Diaphragm piled-wall (Dia. 660 mm) with retaining walls (tile- surfaced),
- Overpass part: Pre-cast roof deck slab,
- Vertical clearance: H = 3.6 m Too low by AASHTO standard
- Carriageway: Dual-3
- Carriageway grade: Max. 3 %,
- Design speed: 70 km/h

Features of the flyover part of the Shalimar Interchange are as follows (from the Design report and Drawings):

- Superstructure: Inverted Pre-stressed pre-cast concrete T-beam, span = 25 m, beam height: H=1,360 mm.
- Substructure: Single column piers with bored pile (Dia. 1,000 mm) foundations,
- Vertical clearance: 5.5 m (under the flyover)
- Carriageway: 3.3 m x 2 x two-way, total 4-lane,
- Carriageway grade: Max. 3.9 %
- Design speed: 70 km/h

5) Ferozepur Road Pilot Project

The GoPb decided to implement the project in 2006. However it has not been completed. The main components of the project are relatively minor civil works (intersections and service roads) and the installation of modern traffic signals, signs and road markings on the 11.8 km stretch of Ferozepur Road from Qartaba Chowk to Khaira distributary near Lahore General Hospital. It is treated as a pilot project to demonstrate the benefits of applying modern traffic management methods, with a view to replicating the same approach elsewhere in the city. In February 2010, the Lahore Division Commissioner directed that Ferozepur Road should be remodelled soon while imposing a ban on the entry of two-stroke rickshaws on the thoroughfare, besides removal of all kinds of encroachments and garbage containers. The project cost was estimated at PKR 600 million.

2.1.3 Data Gaps Identified

There is no single agency/ department of either GoPb or Lahore District or local authority that is responsible of maintaining transport and traffic data. There is no system in place to keep up-to-date data, be it socio-economic, vehicle ownership, driving licenses, or on traffic and transport in Lahore. There is a tendency that each agency collects its own data for its own purpose and most often for particular purpose or a study. It is sometimes the case that traffic and transport surveys are repeated on the same road within a year, but by different agencies and consultants.

The data or database received from various government departments, agencies and consultants is sometimes rudimentary. As a result LUTMP has to launch a comprehensive set of transport and traffic surveys to prepare an up-to-date and comprehensive database of travel demand and traffic situation in the Study Area. For example:

- The last census was in 1998, almost 12 years ago.
- There have been no household interview surveys since Comprehensive Study on Transportation System in Lahore conducted by JICA in 19991.

- The road inventory data was poorly collected and documented, without geographic reference. It only covered physical attributes of roads, and completely neglected to collect the adjacent land-use, and time conditions such as kerb side parking and encroachments.
- There was no data available on junction conditions.
- There was little latest and comprehensive traffic count data available from any agency. The traffic data received is mostly related to localised traffic impact studies, and lacks level of detail.

Therefore, the Study Phase1 is totally devoted to comprehensive transport and traffic surveys. The definition and scope of these surveys are detailed in the remaining sections of this report.

2.1.4 Possible Future Directions in Transport Infrastructure Development

Lahore is undergoing transport infrastructure improvement; albeit at much lower rate than one would expect for city of 10 million inhabitants and population growth rate of almost twice the national average. The developments in transport infrastructure during the last decade were also limited, but the neglect of the system has been much more pronounced over the last three to four years. Some of the key areas of transport infrastructure developments have been:

1) Lahore Ring Road (LRR)

The construction of LRR (Phase-I, the northern loop) has been on-going, albeit at slower pace. To some extent it could be attributed to the changes made to the alignment in the south-west section of Lahore. It is anticipated that the LRR remainder section from Lahore Airport to Ferozepur road would be completed by 2012.

The southern loop of the LRR was envisaged after the changes to alignment of the original LRR route, which passed through the city along Ferozepur Road. A pre-feasibility study of the southern loop was completed in 2009. This study defined the 49 km alignment and estimated the cost to be PKR 63 billion. The funding for the project is yet to be secured. Given the current austerity measures, it is unlikely that GoPb could provide funds for this project much before 2012/ 13 financial year. However, attempts are being made by the GoPb to secure private sector financing on ‘Private, Public Partnership (PPP) basis, with little success.

2) Lahore Rapid Mass Transit System Projects

The work on the project was stopped in June 2008. Since then there has been no progress on any component of the project. ADB had initially expressed interest in funding the Green Line capital cost by about USD 1.0 billion. This funding was contingent upon GoPb putting the project on PPP basis for raising the part or all of the remainder (USD 1.4

billion) of the capital cost and to secure private sector operator. As the GoPb showed no interest in funding the project through ADB loans, the proposed financing model collapsed. The GoPb alone cannot afford to fund the project capital cost. As a result the project remains suspended until some form of capital cost funding could be secured.

As alternative to building the LRMTS defined alignments, GoPb has been soliciting proposals of lesser capital costs, albeit of lesser capacity, and not necessarily '*value for money*'. These attempts are outlined next.

Monorail System for Lahore

A Malaysian group has recently submitted an unsolicited bid to build a monorail system along the Green Line alignment on BOT basis. The proposal is currently being examined by the GoPb in detail. Particularly its financial and technical aspects are under scrutiny, as some of the 'claims' regarding source of funding, its technical and financial feasibility lack level of detail required for the implementation for such large scale infrastructure project. As a result there has been no decision on adopting a 'Monorail' system for Lahore.

Bus Rapid Transit (BRT) System for Lahore

A Korean group has expressed interest in providing BRT system for Lahore along the Green and Orange lines corridors on BOT basis. The proposals are in early stages of development. GoPb has requested to group to submit detailed feasibility reports on its proposals. Feasibility report from the proponent has not been submitted yet as of November 2011.

3) Other Transport Projects

There are a number of transport improvement projects under various phases/ stages of consideration and implementation. The status of each one of these project is unclear. The list below outlines these projects:

- Widening of Canal Bank Road project – Project suspended by the Supreme Court of Pakistan on environmental grounds
- Gradual phasing out of 2-stroke rickshaws and replacement by '*cleaner*' 4-stroke engine rickshaws – project completion delayed, due to financial constraints.
- Setting up of Vehicle Inspection and Testing System – at proposal stage with Transport Department
- Development and implementation of an ITS (Intelligent Transport System) – A pilot project was studied, but never implemented. Implementation of a city-wide system under consideration with Transport Department (TD) with the support and technical help of Istanbul Municipality.

- Development of Parking Plazas – LDA recently built a parking plaza, and is trying to operate it as Park-n-Ride facility for the nearby shopping area. So far success has been limited as a parking facility. A repetition of the project in other areas of Lahore is being planned.

- Development and Setup of Transport Planning Unit (TPU) – Development and implementation of transport projects have been under the domain of TEPA. However, over the last decade or so TEPA has done little or no planning. Much of the work done by TEPA has been based on ad-hoc project development and its implementation, without any concern or priority for the overall transport needs of Lahore citizens. As a result, TD has setup TPU under the provincial government, which is now conducting Lahore Master Plan study, with the aid of JICA in TD. It is envisaged that TPU would gain the necessary technical skills from the JICA Study Team, through a comprehensive technology transfer programme, and would be capable of carrying out similar transport planning studies for the other major cities of the Punjab Province.

2.2 Current Policy and Institutional Framework

2.2.1 Policy and Institutional Framework

1) Transport-related Organizations

Historically, many transport-related organizations and agencies have been established and abolished in the Punjab Province. In addition, decentralization policy has been promoted based the Punjab Local Government Ordinance 2001, aiming at the transfer of administrative powers and obligations from the Provincial Government to the City District Government. By this, transport-related agencies have been increased and jurisdictional demarcations became complicated and ambiguous.

Table 2.2.1 shows main organization and agency, in principle, responsible for each sector. Some of them focus on the physical infrastructure such as roads and pedestrian facilities, others on public transport services, others on the management of the public space available for the movement of persons and goods, and yet others have cross-cutting responsibilities.

Table 2.2.1 Main Transport-relating Organizations

Field	Organization/ Agency	Coverage			
		Nation	Province	City District	Town/ Union
Infrastructure	EDO(W&S)/ CDGL Office(W&S)				
	Lahore Development authority (LDA)				
	Department of Communication and Works (C&W)				
	P&D Department/ Urban Unit (UU)				
	Cantonment Boards and Defence Housing Authority (DHA)				
Public Transport	Transport Department (TD)				
	District Regional Transport Authority (DRTA)				
Public Space Management	EDO(MS)/ CDGL Office (Revenue)				
	EDO(MS)/ CDGL Office (Municipal Services)				
	Parks and Horticultural Authority)				
	Traffic Police				
Cross Cutting Responsibility	Traffic Engineering and Transport Planning Agency (TEPA)				
	Town Municipal Administrations (TMAs)				
	Punjab Planning and Development Department (P&D)				

Source: Institutional Development of a Traffic Management for Ferozepur Road Pilot Project, Dec. 2007

Many of these agencies report to the Nazim of the City District Government of Lahore (CDGL). Some are agencies of the GoPb, while others maintain direct links to both the city and provincial Governments. In addition, there are two Cantonment Boards, administrating large areas with a population of more than 830 thousands in 2010. They are under National Jurisdiction and have virtually no institutional links with local and provincial agencies.

There are four mega-cities in Punjab: Lahore, Rawalpindi, Multan and Gujranwala. These city districts have three tiers: the City District Government (CDG), the Town Municipal Administration (TMA), and the Union Administration (UA). Accordingly, the CDG of Lahore includes 9 TMAs and 150 UAs.

(i) Physical Infrastructure

The CDGL office of Works and Services (W&S), under the Executive District Officers (EDO) of W&S is conceived as the main agency responsible for the management of urban street system. Most of the senior staffs were transferred from the Communication and Works Department (C&W) of the GoPb and in many ways, remain in closer coordination with the provincial agency than with those specifically created for Lahore. However, it is expected that, over time, this office will be strengthened and to assume all functions related to public works in the city.

As other organizations responsible for physical infrastructure, there are C&W, LDA, Cantonment Boards, Defence Housing Authority (DHA), National Highway Authority (NHA), Urban Unit (UU) and Planning and Development Department (P&D). Their roles are described in this chapter.

(ii) Public Transport

The Transport Department (TD) is responsible for public transport policy and planning in the Province. It is also responsible for licensing of public transport service outside the major cities through the Provincial Transport Authority (PTA) and, by statutory exemption, licensing of high-occupancy bus services in Lahore and other large cities. District Regional Transport Authority (DRTA) continues to issue route permits for minibuses (“wagons”) instead of TEPA.

(iii) Public Space Management

Most attention focuses usually on road infrastructure and transport services, neglecting the issues regarding day-by-day management of public space such as parking, encroachments and traffic safety. At present, many of these aspects are addressed by CDGL, the Parks and Horticultural Authority (PHA), the traffic police and TEPA.

(iv) Cross-cutting Responsibilities

At the provincial level, the P&D has been actively involved in shaping road and transport investments in Lahore. Most road construction and rehabilitation are financed through the Provincial Annual Development Program and assigned for execution to variety of agencies. In addition, the P&D has spear-headed studies and policy initiatives, such as the studies for a Rapid Mass Transit System in Lahore, and Ferozepur Road Pilot Project implemented by the UU.

When TEPA was created in 1987, TEPA was to perform all function and exercise all power of Authority with regard to traffic engineering and planning within the metropolitan area of Lahore. Practically, it was given 25 specific functions. As seen in the next section, however, it could not function as expected mainly due to insufficient financial and personnel capacity.

2) Allocation of Responsibilities

Table 2.2.2 was worked out in the Ferozepur Road Pilot Project conducted in 2007, showing allocation of transport-related responsibilities among organizations, both according to regulations and practice in reality. Comparing allocations by regulation and in practice, several gaps are observed. In the next steps, reliability of the table will be examined. As for functions with more than two agencies assigned, their appropriateness will be investigated as well.

Table 2.2.2 Function Allocation of Transport Administration

Functions		Regulation	In Practice
Transport Planning and Finance	Comprehensive Transport Planning	TEPA	None
	Defining priorities and requesting budget	P&D + CDGL	P&D + CDGL
	Approving budget requests	P&D + CDGL	P&D + CDGL
	Funding infrastructure investment	GoP + CDGL ?	GoP + CDGL ?
	Funding Operation and Maintenance	-	-
Road Infrastructure *(Primary and Secondary Road)*	Planning	TEPA+LDA+CantB+ P&D+C&W+NHA	as per regulation
	Design	TEPA+LDA+CantB+ P&D+C&W+NHA	as per regulation
	Construction + remodeling roads	LDA+CantB+P&D+ C&W+NHA	as per regulation + TEPA
	Landscaping	PHA	PHA
	Maintenance of road surface	W&S	W&S
	Maintenance of drains	WASA + EDO(MS)	WASA + EDO(MS)
	Maintenance of pedestrian facilities	W&S	None
	National Route N-5	NHA	NHA
Road Infrastructure *(Tertiary Roads)*		TMAs+LDA+ CantB in their areas	TMAs+LDA+ CantB in their areas
Traffic Signals	Planning + Design	TEPA	TEPA + C&W
	Installation + Maintenance	TEPA	TEPA + C&W
	Operation	TEPA	TEPA + Police
	Signals in Cantonment Board Areas	CantB	CantB
Traffic Signs and Road Markings	Design	TEPA	PHA + TEPA + C&W+W&S
	Implementation	TEPA	PHA+TEPA+C&W+ W&S+Police
Public Transport	Mass Transit Planning	TEPA	TD
	Bus Route Planning and Regulation	TEPA	TD
	Award and Issuance of Bus Route Permits	PTA	DRTA
	Award and Issuance of Wagon Route permits	DRTA	DRTA
	Monitoring and Supervision of Route Permits	DRTA	None
	Issuance of permits for yellow cabs	PTA	PTA

Functions		Regulation	In Practice
Public Transport	Issuance of permits for rickshaws and similar vehicles	DRTA	DRTA
	Design of Traffic Safety Strategy	TEPA	None
	Accident Recording (General)	Police	Police
	Accident Recording (Commercial Transport)	Police + DRTA	Police + DRTA
	Black Spot and other Accident Analysis	TEPA	None
	Physical Traffic Safety Improvement	TEPA	TEPA
	Traffic Safety Education and Campaigns	TEPA	None
	Enforcement of Traffic Rules	Police	Police
	Monitoring of Periodic Reports	TEPA	None
Public Space Management	Design Parking Policy and Regulations	TEPA	None
	Implement (enforce) parking regulations	EDO (Rev)	EDO (Rev)
	Parking Fines and Revenue Management	EDO (Rev)	EDO (Rev)
	Define Policy of Encroachment Control	-	None
	Reinstate Pavement Affected by Construction	-	None
	Implement (enforce) encroachment regulations	TEPA+TMA+EDO(MS)	as per regulation
	Encroachment Fines and Revenue Management	TEPA+TMA+EDO(MS)	as per regulation
Public Space Management	Conditions of Road Surface, Signs and Markings	TEPA	None
	Functioning of Traffic Signals	TEPA	TEPA
	Conditions of Pedestrian Facilities	TEPA	None
	Traffic Flow Conditions (volumes, speeds, orderliness)	TEPA	None
	Pedestrian Conditions	TEPA	None
	Public Transport Quality	TEPA	None
	Unwanted Use of Public Space, such as parking, encroachment, solid waste management	TEPA	None
	Consultation with Stakeholders and Neighborhood Groups	-	None
	Periodic Reports to Government Decision Makers	-	None

Source: Institutional Development of a Traffic Management for Ferozepur Road Pilot Project, MVA Asia Dec. 2007

3) Main Laws and Regulations

According to Institutional Development of a Traffic Management for Ferozepur Road Pilot Project, Dec. 2007, the transport sector in Pakistan is regulated through the federal and provincial enactments; they are:

- The Provincial Motor Vehicles Ordinance, 1965,
- The Provincial Motor Vehicle Rules, 1969 – regulates the motor vehicles throughout the four Provinces, i.e. Balochistan, K.P.K, Punjab and Sindh except the Tribal Areas,
- The Motor Vehicles Act, 1939 – extends its jurisdiction throughout Pakistan except Tribal Areas,
- The Fatal Accidents Act, 1855 – provides the methodology provisions for the payment of compensation to family for loss caused by the death of a person on account of an actionable claim.
- The National Highway Safety Ordinance, 2000 – extends to the whole of Pakistan and the Northern Areas for providing safe driving on the national highways and motorways and for matters connected therewith.

(i) The Provincial Motor Vehicles Ordinance (MVO), 1965

The Provincial Motor Vehicles Ordinance, 1965 being a Provincial law relates to the whole of the Province of Baluchistan, K.P.K., Punjab and Sindh except the Tribal Areas. It consists of 9 Chapters, 122 Sections and 14 Schedules, as shown in Table 2.2.3.

Table 2.2.3 Composition of the Provincial Motor Vehicles Ordinance, 1965

Chapter No.	Description	Sections
I	Preliminary	1-2
II	Licensing of Drivers of Motor Vehicles	3-22
III	Registration of Motor Vehicles	23-43
IV	Control of Transport Vehicles	44-69
V	Road Transport Corporation	70-72
VI	Construction, Equipment and Maintenance of Motor Vehicles	73-74
VII	Control of Traffic	95-76
VIII	Offences, Penalties and Procedure	97-118
IX	Miscellaneous	119-122

Source: Institutional Development of a Traffic Management for Ferozepur Road Pilot Project, MVA Asia Dec. 2007

The said provincial law contains the provisions for the registration, movement, control and regulations of Motor Vehicles. The term “Motor Vehicle” as defined in the MVO, 1965 means “any mechanically propelled vehicle adapted for use upon road”. The MVO, 1965 includes a motor cab, contract carriage and stage carriage. The MVO, 1965 provides for the mandatory Registration of Motor Vehicles and Licensing of drivers of Motor Vehicles whereas the Transport Vehicles are required to obtain the Fitness Certificate prior to their registration and then to ply these vehicles in accordance with the terms & conditions of the Route Permits issued by the Provincial Transport Authorities or District Regional Transport Authorities.

The MVO, 1965 is administrated by the four departments of the Provincial Government in the manner listed Table 2.2.4.

The MVO, 1965 provides the mechanism for registration, licensing and regulation of Motor Vehicles in particular and for control of traffic but it does not cover all the aspects of the Road Traffic and the Public Space Management. The MVO 1965 has provisions for the construction, equipment and maintenance of Motor Vehicles but has not been updated for a long time and there is a frequent need for its amendment.

Table 2.2.4 Allocation of Responsibility by Provincial Motor Vehicles Ordinance, 1965

No.	Name of Department	Attached Department	Statutes	Functions
1	Transport Department	Provincial Transport Authority; District Regional Transport Authorities	MVO, 1965 and MVR, 1969 except control of traffic, checking and inspection of motor vehicles	Policy making, Planning and regularization of public service vehicles

No.	Name of Department	Attached Department	Statutes	Functions
2	Home Department	Inspector General of Police, Punjab; Deputy Inspector General of Police (Traffic), Punjab	Police Order, 2001 MVO, 1965 and MVR 1969	Licensing of Drivers of Motor Vehicles Enforcement of Traffic Laws and Chapter 7 of Motor Vehicles Ordinance, 1965
3	Excise and Taxation Department	Director General (E&T)	MVO, 1965 and MVR, 1969	Registration of Motor Vehicle
4	Environment Protection Department	Provincial Environment Protection Agency	MVO, 1965 and MVR, 1969 Environment Protection Act, 1997	Monitoring and control of traffic generated air pollution

Source: Institutional Development of a Traffic Management for Ferozepur Road Pilot Project, MVA Asia Dec. 2007

(ii) The Motor Vehicle Rules (MVR), 1969

The Motor Vehicle Rules, 1969 prescribed under the provisions of Motor Vehicle Ordinance, 1965 provides the mechanism causes for carrying out of the provinces of Motor Vehicle Ordinance, 1965. The MVR, 1969 consists of 8 Chapters, 268 Rules, 6 Schedules and 3 Appendices shown in Table 2.2.5.

Table 2.2.5 Composition of the Motor Vehicle Rules, 1969

Chapter No.	Description	Sections
I	Preliminary	1-4
II	Licensing of Drivers of Motor Vehicles	5-27
III	Registration of Motor Vehicles	28-53
IV	Control of Transport Vehicles	54-125
V	Road Transport Corporation	126-149B
VI	Construction, Equipment and Maintenance of Motor Vehicles	150-215
VII	Control of Traffic	216-239A
VIII	Offences, Penalties and Procedure	240--268

Source: Institutional Development of a Traffic Management for Ferozepur Road Pilot Project, MVA Asia Dec. 2007

The MVR, 1969 expand upon the parent law i.e. MVO, 1965 and are conforming pedigree. There is a definite need to establish a Motor Accidents Claims Tribunal' Rules providing specialized, focused and fast relief in Pakistan. The MVR are exhaustive, but they lack certain issues such as passport/ visa, international driving and technical requirements of vehicles, transport of animals, dangerous goods and perishable goods. It also lacks the provisions for new technological advancements in the automobile sector such as CNG 4 stroke Motor Cab Rickshaws and Compressed Natural Gas (CNG) Buses.

(iii) The Motor Vehicle Act, 1939

The West Pakistan Motor Vehicle Ordinance, 1965 has repealed the Motor Vehicle Act, 1939 in its application to the Province of West Pakistan, except Chapter VII and VIII and Section 125; these deal with insurance of motor vehicles against third party risks. The Act provides that no person shall use a motor car vehicle in any public place without having proper insurance cover for the third party risk.

Table 2.2.6 Insurance by the Motor Vehicle Act, 1939

Chapter No.	Description	Sections
VII	Motor Vehicle Temporarily leaving or visiting Pakistan	92
VIII	Insurance of Motor Vehicles against third party risks	93-111
	Driving uninsured vehicle	125

Source: Institutional Development of a Traffic Management for Ferozepur Road Pilot Project, MVA Asia Dec. 2007

(iv) The Fatal Accidents Act, 1855

The Fatal Accidents Act, 1855 provides the provisions for the award of compensation to families for loss occasioned by the death of a person caused by actionable wrong by filing a Suit in the Court of District and Sessions Judge of the District. It consists of four Sections shown in Table 2.2.7.

Table 2.2.7 The Fatal Accidents Act, 1855

Section No.	Description
1	Suit for compensation to the family of person for loss occasioned to it by his death by actionable wrong
2	Not more than one suit to be brought. Claim for loss to estate may be added
3	Plaintiff shall deliver particulars, etc
4	Interpretation Clause

Source: Institutional Development of a Traffic Management for Ferozepur Road Pilot Project, MVA Asia Dec. 2007

(v) The National Highway Safety Ordinance, 2000

The National Highways Safety Ordinance, 2000 provides provisions for safe driving on the National Highways and for matters connected therewith or incidental thereto. It consists of 8 Chapters, 99 Sections and 11 Schedules as shown in Table 2.2.8. The Ordinance aims at safe driving on the National Highways and administration by the Federal Government.

Table 2.2.8 The National Highway Safety Ordinance, 2000

Chapter No.	Description	Sections
I	Short title, extent and commencement	1-2
II	Licensing	3-17
III	Registration of Road Vehicles	18-38
IV	Construction, Equipment and Maintenance of Motor Vehicles	39-40
V	Control of Traffic	41-64
VI	Offences, Penalties and Procedure	65-89
VII	Establishment of a Police for Motorways and National Highways	90-93
VIII	Miscellaneous	94-99

Source: Institutional Development of a Traffic Management for Ferozepur Road Pilot Project, MVA Asia Dec. 2007

4) Orientations of the Current Plans and Policies

Current urban transport policies are briefly summarized in the Punjab Urban Transport Policy 2007 prepared by the Urban Units. It listed the followings as basic transport policies which will be checked one by one from the viewpoints of their actualization in the next steps.

(i) An Integrated Urban Transport System

The GoPb shall notify an overarching legal and regulatory framework for the establishment and management of a unified, consolidated and an independent transportation institution.

(ii) Public Transport System

The GoPb shall encourage, facilitate and guide Local Governments to introduce competitive mass transit system and make it choice of the riders through long term strategic intervention to meet public transport demand such as:

- Introduce Multi-modal Transit System
- Private equitable road space for Public Transport
- Private incentives to the operators linked with service performance and passenger comfort
- Reforms for bus and para-transit operations, and
- Introduction of executive bus system for educational institutions

(iii) Urban Road Infrastructure

The expansion and up-grade of road infrastructure shall contribute substantially to transform the economy through significantly reducing journey times and cost of passengers and freight. The GoPb shall prepare an overall framework to continuous process of need identification and assessment for the expansion and up-grade of transport infrastructure. The Local Governments shall be encouraged to adopt planning process for urban transport expansion based on sound engineering, socio-economic and environmental consideration.

Adequate financing for road operation and maintenance is critical for sustainability of the existing road infrastructure. The Local Governments shall estimate systematic and secure financial arrangement for continuous operation and maintenance of the road infrastructure. The GoPb shall issue guidelines and manuals for the operation and maintenance of the transport infrastructure.

The GoPb shall promote traffic management instruments (traffic signaling system, traffic circulation design, parking management, bus priority, demand management, traffic signage etc.) for safe and efficient mobility of people and goods.

(iv) Land Use and Transport Planning Integration

The GoPb shall encourage the City Governments to develop area-wide computer based transport planning models in the framework of overall city land use planning. The Local Government shall be facilitated to prepare, approve and regularly update land use plans for all towns and cities. Land use plans shall provide a programmatic and efficient base to enable towns and cities to develop an integrated transport and traffic engineering plan and restructure the urban space.

(v) Public Private Partnership

The GoPb shall develop the necessary legal, regulatory and institutional framework for optimum use of PPP Model in activities such as:

- Construction, operation and maintenance of transport infrastructure;
- Construction, operation and maintenance of parking facilities;
- Vehicle testing and certification facilities;
- Construction and management of terminals;
- Investment on Large Buses and Rolling Stock for Mass Transit System and etc.

The Local Government shall be encouraged to adopt various options of Public Private Partnership (PPP) in design, construction, maintenance and operation of road infrastructure, public transport and services.

(vi) Urban Freight Transport

Unregulated axle weights, unplanned truck stations due to poor land use control and shop loading in the city centers resulting in deterioration of road infrastructure, environment and congestion which can be optimized through restraining freight movement in short term basis which can be addressed through zoning and land use control on long term basis.

The GoPb shall encourage Local Governments to develop freight transport planning guidelines, time limited movement strategies and regulatory framework for permissible weight limits.

(vii) Capacity Building

The GoPb shall develop capacity in the transport sector institutions by strengthening their professional and organizational capacity. In-house skill development shall be enhanced by providing scholarships for higher studies, continuous in service training programs and career development.

(viii) Road Safety

In line with the framework development by the National Road Safety Secretariat, Ministry of Communication of the Government shall formulate comprehensive road safety legislation

The Local Government will develop mandatory safety audit system as part of each transport infrastructure project to ensure road safety of the road users and frame regulations and rules under proposed road safety legislation such as:

- Rules for operation of vehicles on road
- Legislation for victim’s compensation
- Permissible traffic speeds
- Responsibilities of pedestrians on roads
- Procedures to follow in the event of accidents

(ix) Public Awareness

The Local Government shall allocate a reasonable percentage of development budget to conduct community education programs to change the driving and road use behavior. The masses shall be educated through community awareness programs, educational institutions, print and the electronic media etc. These programs shall focus upon *inter alia,*

- Driver’s training;
- Road safety;
- Women and children mobility;
- Pedestrian mobility; and
- Other transportation issues as required

(x) Environmental Protection

The GoPb shall invest in research, development, educational programs and utilization of clearer technologies in the context of indigenous knowledge to reduce vehicular tailpipe emissions and improve air quality of cities.

The Local Government shall be finalized to adopt clearer technologies to reduce externalities and concentrate on disseminating basic knowledge of transport impacts on environment and human health through media. The Local Government shall also make ensure that environmental impact assessment shall an essential component of the transport and land-use structure planning.

(xi) Standardization

The GoPb shall develop and encourage Local Government to adopt standardized uniform procedures, guideline and codes while planning, designing and implementing transport infrastructure and services projects.

(xii) Central Data Repository

Central Data Repository is essential for planning, monitoring and evaluation of infrastructure and service delivery.

(xiii) Monitoring and Evaluation

The Local Government shall adopt regulations for monitoring and evaluation of operation, maintenance and development of various transport projects. Environmental management and monitoring plan shall be prepared and adopted by the Local Government during construction operation stage of the project.

(xiv) Non-Motorized Transport

Non-motorized transport modes (NMT) *i.e.* walk and bicycle has predominant share in daily trips therefore NMT network planning must be integrated with detailed road section planning and intersection planning

2.2.2 Expenditure and Financing

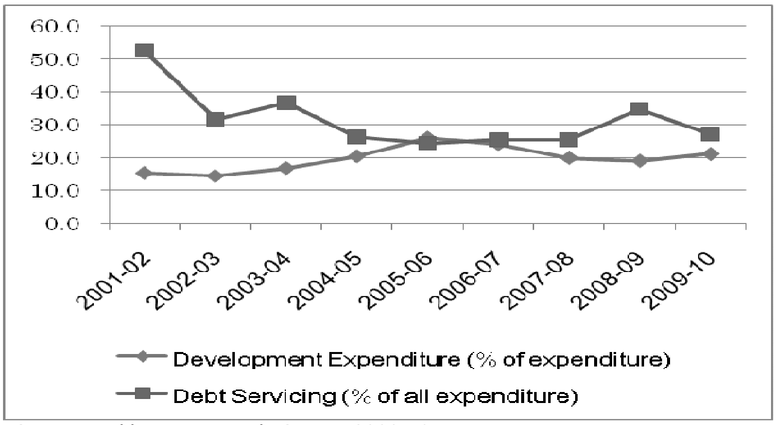
1) Federal Finance

In the Federal budget for 2009-10, a total expenditure of PKR 2,877 billion was estimated for the full year, comprising of PKR 2,261 billion of current expenditure and PKR 616.5 billion of development expenditure. Among the major expenditure heads, interest payments of PKR 647.1 billion were estimated. According to IMF in April 2010, Pakistan has considerable general government debt which is 58.1 % of the country's GDP. In the last decade, however, the Government has improved its finance structure. It is attested by reduced debt servicing ratio in the federal budget, from 52.5 % in 2001-02 to 27.1 % in 2009-10. The second largest category was defence services, requiring PKR 343 billion.

In terms of structure of budgeted expenditure, current expenditure was estimated to account for 78.9 % of total spending, with development and net lending at 21.1 % of the total. The government has made continuous efforts to increase development expenditure in the last decade, i.e., 15.3 % of the 2001-02 budget.

In the Federal budget for 2009-10, net transfer of province was estimated at PKR 697.9 billion, where Punjab Province may receive 51-52 % of the total in compliance with the 7th National Finance Commission (NFC) Award. From the Punjab Province's viewpoint, provincial finance largely depends on federal transfers. In fact, provincial own revenues accounted for only 27 % in the Punjab Province budget for 2008-09.

Figure 2.2.1 Shares of Development Expenditure and Debt Servicing in Federal Finance, 2001-02 to 2009-10



Source: Pakistan Economic Survey 2009-10

2) Provincial Finance

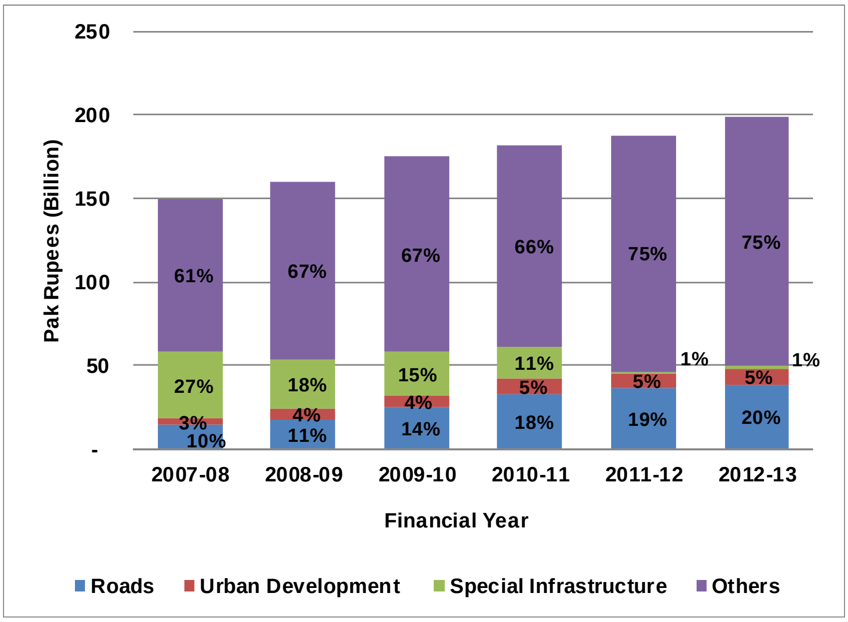
Similar to the federal finance, provincial finance of Punjab has expanded development expenditure, i.e., 24.6 % of the budget in 2005-06 to 38.5 % in 2009-10. As results, provincial development expenditure sharply increased from PKR 63 billion in 2005-06 to PKR 175 billion in 2009-10 or by 2.8 times. Even taking rupee depreciation against US dollar into account, provincial development expenditure substantially increased from USD 1,055 million equivalent to USD 2,101 million equivalent during the same period.

In the development expenditure categories, urban transport related public spending may be absorbed into "roads" especially for provincial roads or "urban development" for minor urban roads and terminal facilities or "special infrastructure".

Special infrastructure comprises two major projects, i.e., Lahore Ring Road (LRR) and Lahore Rapid Mass Transit System (LRMTS). The projects under this sector cater for major urban transportation and mass transit needs in the provincial metropolis. These projects, owing to their potential impact on economic growth, are placed as a separate sector under present Medium Term Development Framework (MTDF) in Punjab.

In the 2010-11 Development Programme, PKR 19,121 million is budgeted for the Special Infrastructure Sector including approved 23 contracts or equivalently PKR 4 billion for LRR. No specific contract is recorded in order to disburse the rest budget of over PKR 15 billion for both LRR and LRMTS. In the MTDF 2010-13, subsequent budget allocation is planned for the Special Infrastructure Sector, i.e., each PKR 20 billion for the years 2011-12 and 2012-13, respectively.

Figure 2.2.2 Composition of Development Expenditure in Punjab Province, 2007-08 to 2012-13



Note: "Others" include education, health, irrigation, agricultural production, etc.
Source: MTDF 2007-2010, MTDF 2010-13, Punjab Statistical Book 2009
Unit: PKR Billion

3) Analysis of Punjab Development Budget 2009-10

(i) Overview

According to the White Paper (Budget 2010-11) of GoPb, the overview of the Budget 2010-11 is summarized as follows:

- "Budget for financial year 2010-11 is being presented in the backdrop of difficult and challenging security situation; sluggish economic growth; persistent inflationary trends; ever increasing resource requirement for rehabilitation, improvement and up gradation of existing infrastructure; a substantial salary increase for public sector employees; a greater demand and emphasis on the development and implementation of social security net etc." (p.1)
- "Notwithstanding the constraints highlighted above, provincial government will ensure the realization of its development vision through substantial allocations for Annual Development Program." (p.1)

Table 2.2.9 Budget at a Glance (The GoPb, 1 Jul. 2010 - 30 Jun.2011)

CURRENT BUDGET (Year 2010-2011)	PKR (Million)
General Revenue Receipts	558,381.7
Revenue Expenditure	386,787.0
Net Revenue Expenditure	365,787.0
Pro-poor Subsidies	21,000.0
Net Revenue Account Deficit (-) / Surplus (+)	171,594.7
CURRENT CAPITAL BUDGET	
Current Capital Receipts	222,049.6
Current Capital Expenditure	222,378.1
Net Capital Account	-328.5
Net Public Account	-3,040.6
Net Deficit (-) / Surplus (+) in the Budget	168,225.6
Federal Grants	677.4
Foreign Project Assistance	12,597.0
Financing through privatization sale proceeds	12,000.0
Operational Shortfall	-
Total Resources for Development	193,500.0
Provincial Annual Development Programme	182,000.0
Other Development Expenditure	-
Daanish School	3,000.0
Punjab Millennium Development Goal Program (PMDGP)	6,500.0
TEVTA / TEVTC	2,000.0
Total provincial Development	193,500.0
PSDP Funded Schemes	-
Total Development	193,500.0

Source: Budget 2010-11 (White Paper), the GoPb

From the table above, the following amounts are notable and related to this Project:

- General Revenue Receipts: PKR 558 billion,
- Foreign Project Assistance: PKR 12 billion,
- Provincial Annual Development Programme: PKR 182 billion

(ii) Budget Items Related to Transport

The Budget for Annual Development Programme of Punjab of PKR 182 billion is tabulated in Table 2.2.10.

Four (4) Lahore transport related items are found in the table below:

a) Roads (in Infrastructure Development): PKR 32 billion,
b) Urban Development (in Infrastructure Development): PKR 9 billion,
c) Transport (in Services Sectors): PKR 1 billion,
d) Special Infrastructure (Special Programme/ Packages): PKR 19 billion

Table 2.2.10 Budget Allocation of Annual Development Programme Punjab, 2009-10

No.	Sector (Budget Year 2010-2011)	Allocation PKR (Million)	Percentage (%)
A.	Social Sectors (Education, Health etc.)	68,253.0	37.5
B.	Infrastructure Development	59,260	32.6
	1) Roads	32,885	18.1
	2) Irrigation	11,005	6.0
	3) Public Buildings	6,210	3.4
	4) Urban Development	9,160	5
C.	Production Sectors (Agriculture, Livestock etc.)	7,000	3.8
D.	Service Sectors	7,050	3.9
	1) Information Technology	1,960	1.1
	2) Commerce and Investment	140	0.1
	3) Labour and HR Development	85	0.0
	4) Transport	1,190	0.7
	5) Emergency Services	2,000	1.1
	6) Tourism	1,675	0.9
E.	Others (Planning and Development etc)	6,366	3.5
F.	Special Programme/ Packages	34,071	18.7
	1) District/TMA Development Programme	12,000	6.6
	2) Special Infrastructure (Lahore Ring Road and Lahore Rapid Mass Transit System)	19,121	10.5
	3) Special Packages	1,450	0.8
	4) New Imitatives/ Medical Colleges	1,500	0.8
Total Development Programme		**182,000**	**100**

Source: Annual Development Programme of the GoPb, 2009-10

In the following sections, each item is analyzed.

(iii) Budget Items for Roads

Budget for the roads takes the largest portion (18.1 %, PKR 32 billion) of the Development Programme as shown above in Table 2.2.10.

The provincial road sector has been focusing to consolidate and maintain the existing inter-district roads while catering for rehabilitation of the rural-access roads under an umbrella program. In addition to above, present development portfolio for the province entails major urban and inter-city road projects including the Lahore Ring Road (LRR) and Lahore Rapid Mass Transit System (LRMTS) projects (Both are included under Special Infrastructure section).

The road projects for Year 2010-11 in Lahore are shown in Table 2.2.11. Location of these projects is shown in Figure 2.2.3.

Table 2.2.11 Roads Projects for Lahore (2010-11 Budget)

No.	Description	Length (km)	Budget (PKR million)
1	Construction of 4 lane, Lahore Wahgha Road	16.35	203
2	Dualization of Lahore Ferozepur Road	11.50	124
3	Thokar Flyover	0.95	100
4	Improvement of Canal Bank Road	10.96	200
5	Widening of Kamahan-Lidher Road	3.10	34
6	Widening from Jallo More to River Ravi	13.95	45
7	Construction of over Head Bridge in Raiwind	-	150
8	Rehabilitation of Defense Road	6.00	22
9	Construction of Road along both side of Butcher Kahna Distributory	8.50	50
10	Widening of road from Kahna Kacha Approach Road	14.10	10
11	Widening of road from Kahna Nau to Kahna Kacha	7.35	37
12	Feasibility study for construction of new Roads	-	5
13	Construction of Dual carriageway for Tarogil road	2.00	51
14	Rehabilitation of Allama Iqbal Road	4.00	5
15	Detailed engineering design and Feasibility of Circular Road	-	5
16	Detailed engineering design and construction supervision of Multan Road	-	115
17	Improvement of existing Multan Road	-	1,000
18	-ditto-	11.20	675
19	-ditto-, Proposed sewerage, drainage and Water supply	-	1,325
20	Dualization of Barki Gawandi Road	2.77	40
21	Study and design of Kalma Chowk	-	60
22	Establishment of Project Management Unit (PMU) for Kalma Chowk	-	93
23	Widening of Sui-e-Asil to Raiwind Road	19.00	300
24	Linking of Centre Point with Ferozepur Road	-	600
25	Improvement of Centre Point Intersection	-	1,000
26	Construction of Extension Building for IWMI	-	31
27	Rehabilitation of road from Jallo More to Khaira Bridge	0.90	1
28	Rehabilitation of road from Sundar Stop to Khaneki Jhuggian village	7.60	13
1-28	Total	140.23	6249

Source: Development Programme, 2010-11, the GoPb

(iv) Budget Items for Urban Development

Urban Development Sector covers developmental projects sponsored by WASA and Development Authorities of the Large Cities (Lahore, Faisalabad, Rawalpindi, Gujranwala and Multan) and district governments of the selected Intermediate Cities (with population ranging from 0.24 to 0.54 million) of Punjab.

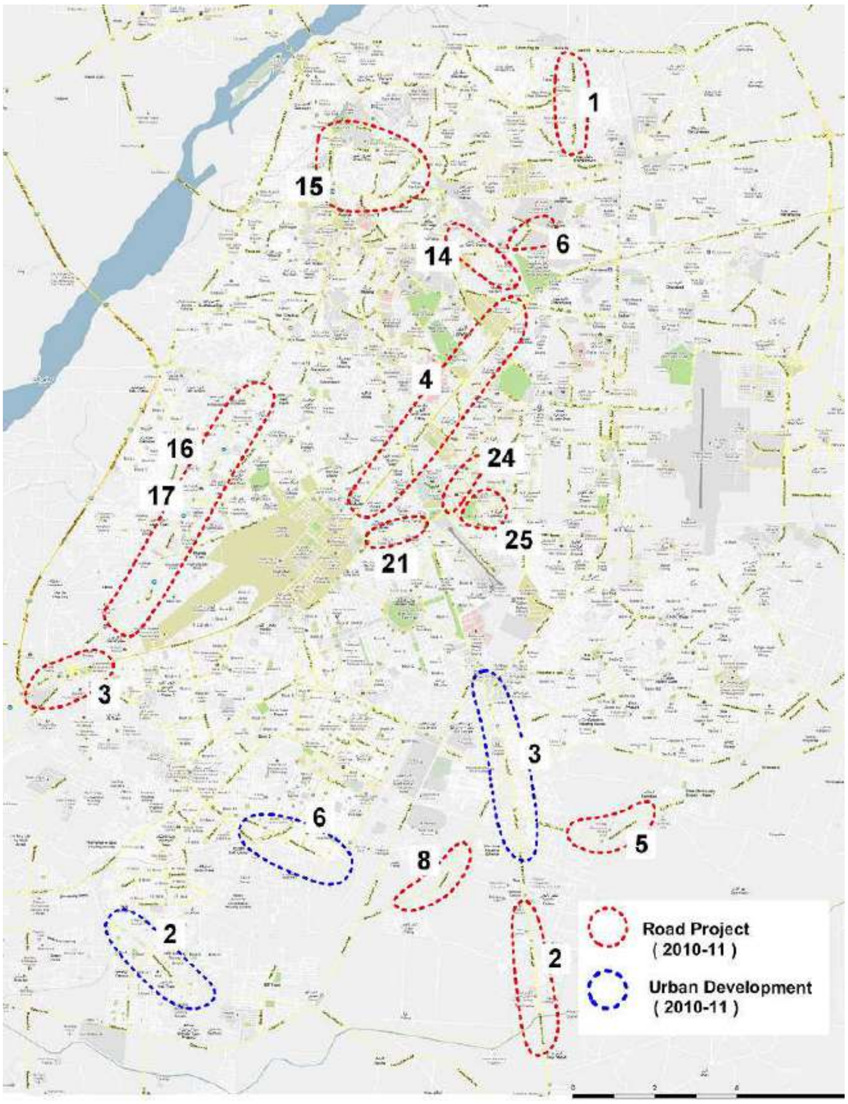
Budgets 2010-11 for urban development related to Lahore are presented in Table 2.2.12. Location of these projects is shown in Figure 2.2.3.

Table 2.2.12 Urban Development Budget 2010-11 for Lahore

No.	Description	Amount (PKR Million)
	On-going schemes, Lahore Development Authority (LDA)	
1	Improvement of 45m wide road in M.A. Johar Town	33
2	Construction of Structural Road from Khayaban-e-Jinnah to Valencia Town	163
3	Integrated Traffic Management system, Ferozepure Road	10
4	Widening of M.M. Alam Road, L=2 km	10
5	Remodeling of Canal Bank Road	50
	New Schemes, Lahore Development Authority (LDA)	
6	Construction of Southern Bypass Road from Ferozepur Road to College Road	10
7	Construction of Missing Link, Allama Iqbal Town	10

Source: Development Programme, 2010-11, the GoPb

Figure 2.2.3 Location of Road and Urban Development Projects, Budget 2010-11



Source: JICA Study Team

(v) Budget Items for Transport in Service Sectors

Transport development aims at provision of efficient, economical, comfortable safe and green transport facility to the public in Punjab. The Development Programme 2010-11 holds three new strategies:

- Introduction of environment friendly transport (CNG Buses).
- Preparation of Transport Master Plan for Lahore with the assistance of JICA.
- Preparation of Transport Master Plans for all major cities of Punjab in coming years with in-house expertise of TD developed by JICA.

Table 2.2.13 Transport Budget (Punjab, 2010-11, in Services Sectors)

No.	Scheme Information	Major Components	Amount (PKR Million)
On-going schemes			
1	Capacity building of Transport Dept.	Purchase of equipment and capacity building of officers	1.5
2	Establishment of Transport Planning Unit in Transport Dept.	Recruitment of staff, procurement of equipment	51
3	Lahore Transport Master Plan (JICA assisted)	Hiring of consultants, procurement of equipment and vehicles	92
New Schemes			
4	Conversion of 2-stroke Rickshaws into 4-stroke CNG rickshaws	Subsidy to Rickshaw owners	43
5	Subsidy for induction of CNG/ Diesel buses in Urban areas	To enable private sector to induct buses in Urban transport system	1,000

Source: Development Programme, 2010-11, the GoPb

(vi) Budget Items for Special Infrastructure

As already mentioned in the previous section, the Special Infrastructure Sector is composed of Lahore Ring Road (LRR) and Lahore Rapid Mass Transit System (LRMTS).

The Development Programme gives the following targets to LRR:

- Completion of LRR (north loop); and
- Detailed engineering design for LRR (south loop).

On the other hand, there is no specific budget item for LRMTS.

Table 2.2.14 Lahore Ring Road Budget (2010-11)

No.	Scheme Information	No. of Schemes	Amount (PKR Million)
On-going schemes			
1	Lahore Ring Road	19	2,875
New Schemes			
2	Lahore Ring Road	4	1,125
	Total	23	4,000

Source: Development Programme, 2010-11, the GoPb

2.2.3 Transport Related Organizations

As stated earlier in this report, there are a dozen of transport-related organizations in the Metropolitan Lahore and their inter-relationships are complicated and role demarcations are not very clear. Figure 2.2.4 shows such organizations by levels of nation, province, city district and municipality. In the following sections, the roles and organizations of transport-related agencies are briefly outlined. There is no special intention regarding the order of descriptions as this study has not covered yet all the responsible agencies.

1) Federal Government

Under the Ministry on Communication of the Federal Government, National Highway Authority (NHA) was established in 1991 to plan, construct and maintain national highways and specific provincial roads entrusted by the provincial Government. In the Study Area, NHA manages Lahore – Islamabad motorway and Nation Road No.5 (Multan Road and Ravi Road in Lahore).

National Highway and Motorway Police (NHMP) controls traffic on the national highways together with Punjab Highway Patrol. National Transport Research Center (NTRC) makes nation-wide transport plans and strategies as well as transport-related researches. NOTC conducted “Pakistan Transport Plan Study” in 2005-2006 with the technical cooperation by JICA.

2) Provincial Government

As of April 2010, there are 42 Departments and Boards in the GoPb and out of which the following four Departments are responsible to transportation administration and transportation infrastructure development:

A) Planning and Development Department (P&D)
B) Transport Department (TD)
C) Communication and Works Department (C&W)
D) Housing, Urban Development and Public Health Engineering Department (HUD & PHED)

The GoPb P&D is the principal planning organization at the Provincial level. It coordinates and monitors the programs prepared by the Provincial departments concerned with provincial development. The department also prepares an overall provincial Five Years Plan and the Annual Development Program. It acts as a catalyst between different departments in order to improve the pace and quality of economic development in the Province. The main objectives of the Planning and development department are:

- Assessment of the material and human resources of the province and formulation of long and short term plans.
- Recommendations concerning to prevailing economic conditions, economic policies or measures. Examination of such economic problems as maybe referred to for advice.
- Coordination of all economic activities in the Provincial Government.

Urban Unit (UU) was set up under the P&D Department in 2006 with the purpose of urban development research, improvement of urban traffic, study of solid waste treatment policy and policy making for water supply and sanitation system.

The TD is responsible mainly in public transport administration established in 1987 based on the West Pakistan Vehicle Ordinance 1965. TD issues the license for mass-transit project and bus operation in Lahore, through its subordinate organization, i.e. the Provincial Transport Authority (PTA).

The C&W Department is responsible for establishment of road and bridge design standard, planning, designing, construction, improvement and maintenance of roads, bridges and causeways, management of toll road inclusive of leasing of roadside land, inspection of roads and materials and training of civil works. Under this department, there are Project Management Unit (PMU), Lahore Ring Road Office (LRR) and District Support and Monitoring Department (DSMD).

Lahore Development Authority (LDA) was established under Housing and Urban Physical Development Department (HUPDD) based on the LDA Act 1975 and in charge of management of the comprehensive development plan of Lahore, management of the building code and regulations and development of poverty areas. LDA established the Traffic Engineering and Planning Agency (TEPA) in 1987 based on LDA Act 1975, aiming at playing all the roles concerning traffic management and transport planning.

3) City District/ Town Municipality Level

The TD established a government-owned company named Lahore Transport Company (LTC) in July 2009, aiming at improvement of public transportation, currently with about 40 staffs. LTC is responsible to evaluate and review existing bus routes, propose new routes, monitor bus operation and plan other improvement measures of public transport, excluding a rail transit.

PTA has local offices named Regional Transport Authorities (RTA), one of which is Lahore District Road Transport Authority (LDRTA). LDRTA was established in 2001, based on Provincial Motor Vehicles Ordinance 1965. LDRTA was originally responsible for management of public transport and issuing all the public transport. However, since PTA became responsible for city bus licensing by Provincial Motor Vehicle Act 2005, LDRTA has issued licenses only to mini-buses. LDRTA has 28 staff, headed by the District Coordination Officer (DCO).

Lahore City District as well as other three mega-cities has three tiers: the City District Government (CDG), the Town Municipal Administration (TMA), and the Union Administration (UA).

When setting up the City District Government and TMA, two important principles have been kept in mind (according to www.lahore.gov.pk/city-government/overview):

- Where technical factors allow, the principle of subsidiarity has to be used in determining which planning and municipal services/ functions are assigned to the CDG and which ones to the TMAs; and
- The transition process should be smooth and no disruption in services should be felt by the people.

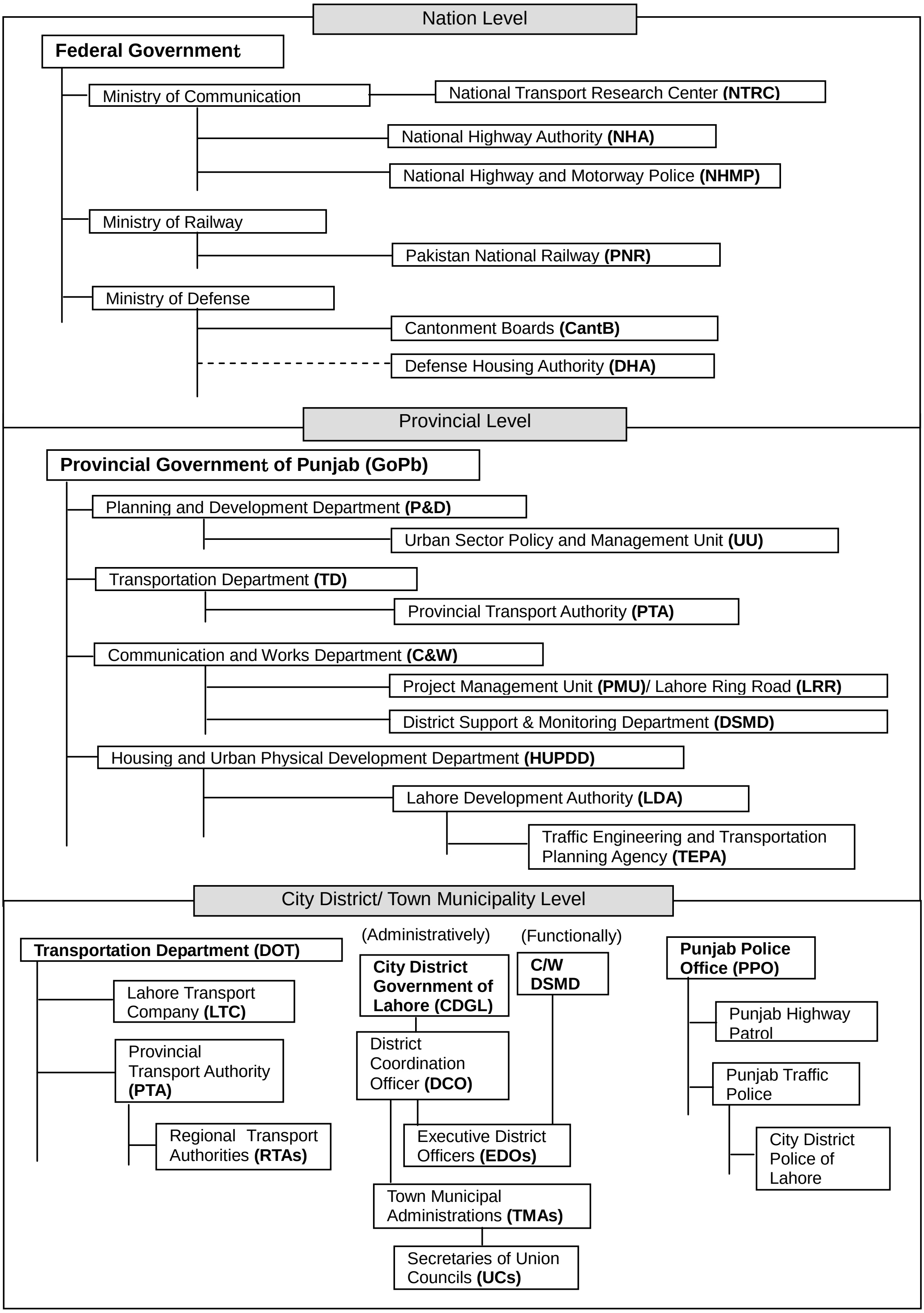
The City District Government consists of Zila Nazim and District Administration. The City District Government of Lahore (CDGL) is component to hold, acquire or transfer any property, to enter into contract and sue or be sued through the District Coordination Officer (DCO).

District Coordination Officer (DCO)

In every District, the Government appoints a DCO who is a civil servant of the Federation or the Province. He is the coordinating head of the District Administration, and his functions are to:

- ensure that the business of the District Coordination groups of officers is carried out in accordance with the law;
- coordinate the activities of the groups of officers for coherent planning and synergistic development;
- exercise general supervision over programs, projects and other activities;
- coordinate the flaw of information required by the Zila Council;
- act as principal accounting officer for the CDG;
- call for information and reports from local governments in the district;
- assist Zia Nazim in accomplishing administrative and financial discipline and efficiency

Figure 2.2.4 Transport-related Governmental Organizations



Source: Elaborated by JICA Study Team based on various information sources

- prepare a report on the implementation of development plan
- initiate the performance evaluation report of the Executive District Officers; and
- implement government policy and collect and disseminate information on behalf of the Provincial or District Government.

Executive District Officers (EDO)

The activities of any District are assigned to a number of groups and officers, each of which is headed by an EDO whose functions are:

- ensure that the business under his administrative control is carried out in accordance with the law and that the resources placed at his disposal are optimally utilized;
- supervise the activities and ensure efficient service delivery;
- supply information to the Monitoring Committee;
- take corrective actions based on the information received from the Monitoring Committee;
- enforce relevant laws and rules;
- prepare development plans and propose budgets;
- Implement approved plans and policies;
- authorize disbursement bonuses to employee;
- prepare proposals from programs, projects and other activities;
- propose relevant bye-laws on service delivery to the DCO; and
- act as Departmental Accounting Officer.

In Lahore, some agencies such as LDA, TEPA, Water and Sanitation Agency (WASA) and the LDRTA report to either the DCO or Zila Nazim. In addition, there are eleven EDOs responsible for the following subjects: Revenues, Health, Education, Agriculture, Community Development, Finance and Planning (F&P), Law, Information Technology, Literacy, Municipal Services (MS) and Works and Services (W&S).

In this chapter hereunder, outlines inclusive of roles and staffing will be shown as for the main organizations. Main information sources are:

- Institutional Development of Traffic Management Unit for Ferozepur Road Pilot Project, 2007, Urban Unit
- Assessment of Capacity and Capacity Building Institutions in the Development Policy Loan (DPL) Sectors, 2008, Urban Unit
- Home page of the GoPb.

In the next steps, the stated facts will be checked if they are still valid or correct and if there are any outdated descriptions, they are to be updated.

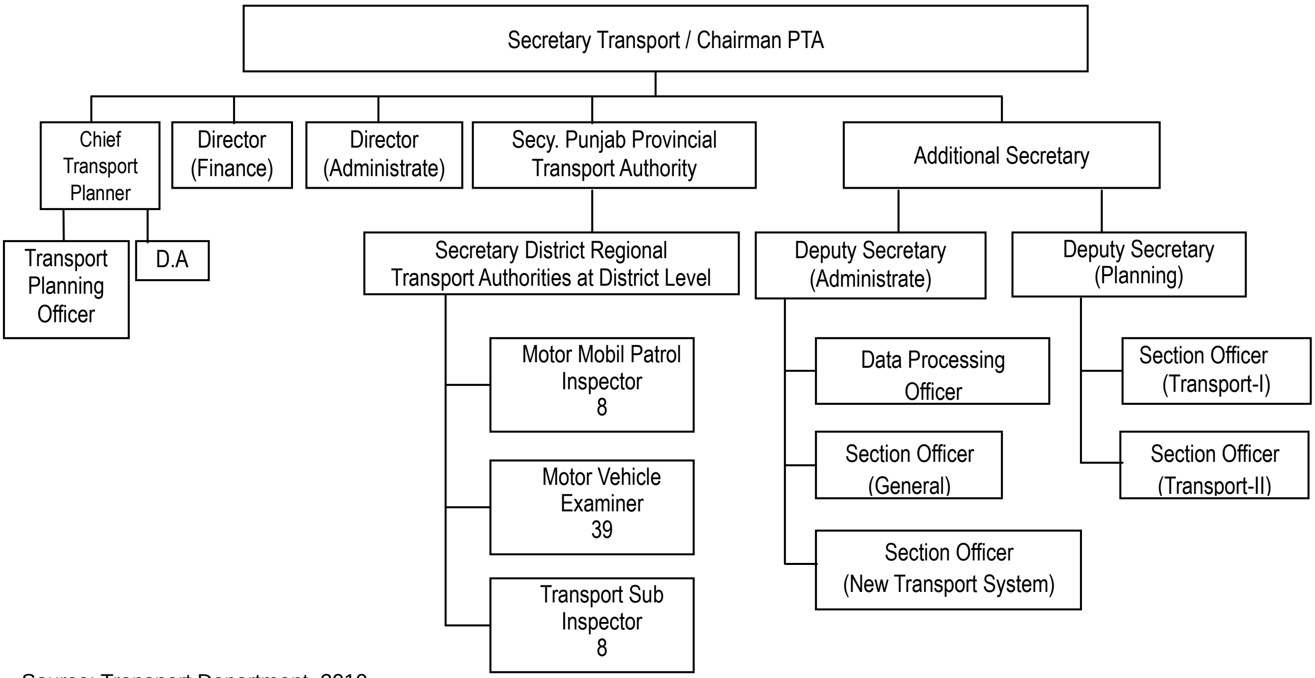
2.2.4 Transport Department (TD)

1) General

TD is headed by Secretary (BS-20) with two Deputy Secretaries (BS-18), four Under Secretaries/ Section Officers and one Data Processing Officer. It has one attached department i.e. Provincial Transport Authority and one Autonomous body, Punjab Road Transport Corporation (PRTC). The Department has District Regional Transport Authorities (DRTA) at District level. Main functions of the Transport Department are:

- Formulation of Transport Policy and planning.
- Administration of the Punjab Motor Vehicle ordinance, 1965 and the Rules framed there under except control of traffic and registration of vehicles.
- Administration of Provincial Transport Authority, DRTA and PRTC.
- Regulation of fares of public service vehicles.

Figure 2.2.5 Organizations of Transport Department (TD)



Source: Transport Department, 2010

2) Punjab Provincial Transport Authority

Secretary Transport is an ex-office Chairman of Punjab PTA under the Chairman a Secretary (BS-18) along with ancillary staff functions at provincial level.

Provincial Transport Authority consists of:

Secretary TD	Chairman ;
Secretary, C&W	Member ;
Chief (Transport) P&D	Member ;

- Deputy Inspector General (DIG) of Police (Traffic) Punjab, Lahore
  Member ; and
- Secretary, Punjab PTA Member/Secretary

3) District Regional Transport Authority (DRTA)

DRTA constituted under Section 46 of the Motor Vehicles Ordinance, 1965 in each District of the Punjab. The composition of the District Regional Transport Authority is as under:-

i) DCO of the concerned District Chairman
ii) District Police Officer of the concerned Member
iii) EDO (Works and Services) of the Member concerned District.
iv) Secretary of DRTA Member/ Secy

4) Functions

- To regulate transport within their respective jurisdiction by assessing the Traffic needs of passengers and goods transport.
- To grant issue and renew the route permits to the transport vehicles plying in the District (Region).
- To classify various routes within District (Region).
- To prepare time and fare tale of public service vehicles.
- To issue and renew licenses to the Body Building Workshops.
- Checking of traffic in their respective jurisdiction.
- To grant/renewal of licenses of A, B, C and D Class stands.
- To grant/renewal of licenses of Goods Forwarding Agencies.

5) Regional Transport Authorities

- To regulate transport within their respective jurisdiction by assigning the traffic needs of passengers and goods transport.
- To grant issue and renew the route permits to the transport vehicles plying in the divisions.
- To classify various routes within region.
- To prepare time and fare tables of public service vehicles.
- To issue and renew licences to the Body building workshops.
- Checking of traffic in their respective jurisdiction
- To grant licences for bus stands.

Note: The right of appeal against the order of the RTA lies with Chairman PTA.

6) Motor Vehicles Examiners

- Examination of motor vehicles for the purpose of issuance of fitness certificates.
- Checking of vehicles on roads.
- Detection of un-road worthy vehicles.
- Suspension of fitness certificates.
- Investigation of fatal accidents and to give technical expert opinion
- Inspection of government vehicles for repair and issue their condemnation certificates.
- Prosecution of vehicles without fitness certificates and to force such vehicles for examination.
- Acts as essential member of Driving Test Board.

2.2.5 Traffic Engineering and Planning Agency (TEPA)

1) Roles

TEPA was created in 1987 under section 6, subsection (3) sub-clause (xii) of the Lahore Development Authority Act, 1975 as a subsidiary agency of LDA.

When it was created, TEPA was to perform all function and exercise all power of the Authority with regard to traffic engineering and planning within the metropolitan area in Lahore. TEPA was given 25 specific functions, among which the followings were main ones:

- Coordinate and prepare comprehensive transportation plan for the city (item b);
- Plan, design and implement traffic engineering and traffic management programs (item c);
- Define design standards, specifications and layout plans of roads (item d)
- Monitor and undertake regular traffic on roads (item i)
- Be responsible for the collection, analysis and publication of road accident data (item j)
- Identify the needs of the pedestrians and the facilities as they may be provided (Item k)
- Plan and design the public transport system for Lahore Metropolitan Area (Item l)
- Undertake the management, design and maintenance of traffic signals, road signs and road markings (Item m)
- Design and maintain a parking policy and impose parking fee (Item n)
- Require the concerned agency or authority to remove encroachments (Item u)
- Make recommendations to Government with regard of Traffic Police (Item w)

2) Organization, Staffing and Budget

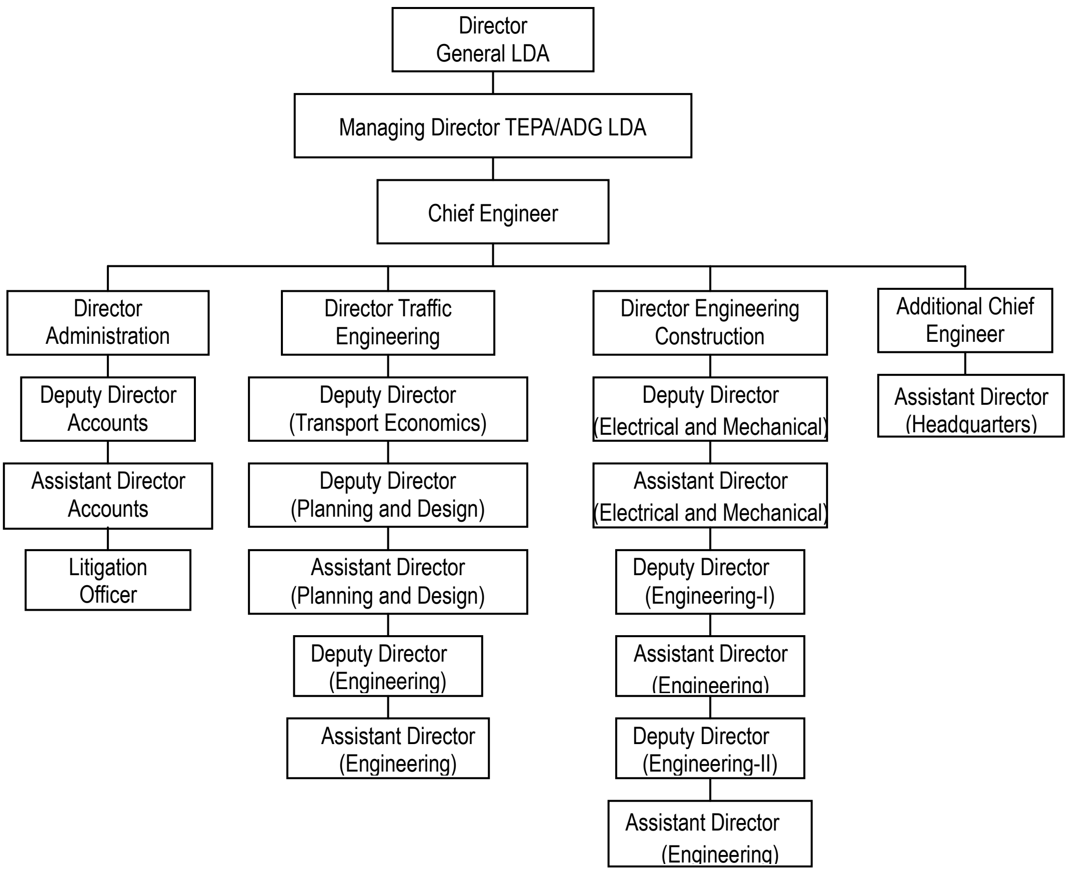
TEPA is headed by a Director General, a Managing Director and Chief Traffic Engineer who direct a staff of about 135 persons, working in four directorates: (i) Administration and

Finance, (ii) Traffic Engineering, (iii) Engineering Construction and (iv) Special Projects (Figure 2.2.6). Number of Staff of TEPA as of December 2007 is shown in Table 2.2.15.

The budget of TEPA is approved and consists of non-development expenditures (salaries, operating expenses, etc.) and development expenditures (project funded from the provincial Annual Development Program Annual Development Program (ADP) and deposit works of CDGL). The budget for development expenditures was raised from PKR 136 million in fiscal year 2005/ 2006 to PKR 315 million in 2006/ 2007 and PKR 2,146 million in 2007/ 2008 The ADP funds most (98%) of the FY 2007/ 2008 program, including the implementation of the Ferozepur Road project (PKR 593 million).

TEPA does not receive direct income from the transport sector, as original sources from roadside advertisement charges or parking fees are no longer available. Roadside advertisements have been taken over by the Parks and Horticultural Authority, and parking by CDGL and the TMAs. This leaves behind departmental charges and fines to meet the non-developmental expenses of the agency. The non-developmental expenses budgeted for FY 2007/ 2008 amount to PKR 99 million, including PKR 23 million for staffing and PKR 20 million for a new office building in Jubilee Town.

Figure 2.2.6 Organizational Chart of TEPA



Source: TEPA/ Institutional Development of Traffic Management Unit for Ferozepur Road Pilot Project,12-2007

Table 2.2.15 TEPA Staff Numbers by Grade

Designation	BPS	Status	P/S	Number of Post			
				2005/6	2006/7	2007/8	2009/10
Managing Director	20	Regular	P	1	1	1	
Chief Traffic Engineer	20	Regular	P	1	1	1	
Addl. Chie Engineer	19	Regular	P	1	1	1	
Director Traffic Engineer	19	Regular	P	1	1	1	
Director Engg. Const.	19	Regular	P	1	1	1	
Director (P&D)	19	Regular	P	-	1	1	
Director Admin. & Fin.	19	Regular	S	1	1		
Director Admin.	19	Regular	S	-	-	1	
Director Finance	19	Regular	S	-	-	1	
Director Study	19	Regular	P	-	1	1	
Dy. Director Headquater	18	Regular	S	1	1	1	
Dy. Director Engg.	18	Regular	P	2	2	2	
Dy. Director Electrical	18	Regular	P	1	1	1	
Dy. Director (P&D)	18	Regular	P	-	1	3	
Dy. Director Engg. Const.	18	Regular	P	2	2	2	
Dy. Director Account	18	Regular	S	1	1	1	
Magistrate	18	Regular	S	-	-	1	
Magistrate	17	Regular	S	1	1	-	
Transport Economist	18	Project	P	1	1	1	
A.D. to M.D.	17	Regular	S	-	1	1	
AD Admin.	17	Regular	S	-	-	1	
Litigation Officer/ Asst Dir.	17	Regular	S	-	1	1	
Asst. Director Engg.	17	Regular	P	6	6	7	
Asst. Director Account	17	Regular	S	1	1	1	
Asst. Director	17	Regular	S	-	-	2	
Assistant Architect	16	Regular	P	-	1	1	
Sub-Engineer	16	Regular	P	7	6	12	
Sr. Accountant	16	Regular	S	-	-	1	
Sub-Engineer	11	Regular	P	8	8	10	
Sub-Engineer	11	Project	P	1	1	1	
Circle Head Draft Man	16	Regular	P	-	1	2	
Sr. Accountant	16	Regular	S	-	-	1	
Stenographer	12	Regular	S	1	5	6	
Stenographer	12	Project	S	1	1	1	
Draft Man	11	Regular	P	-	1	1	
Junior Accountant	11	Regular	S	1	1	1	
D-E-O	11	Regular	S	-	-	1	
Assistant	11	Regular	S	3	3	3	
Supervisor	6	Project	P	5	5	5	
Junior Clerk	5	Regular	S	2	5	9	
Junior Clerk	5	Project	S	4	4	4	
Telephone Operator	5	Regular	S	-	1	1	
Reader/ Junior Clerk	5	Regular	S	-	1	1	
Electrician	5	Regular	S	1	1	1	
Driver	7	Regular	S	1	1	1	
Driver	5	Regular	S	2	6	9	
Driver	5	Project	S	6	6	6	
Naib Qasid	1	Regular	S	2	4	3	
Peon	1	Regular	S	-	2	5	
Peon	1	Project	S	4	4	4	

Designation	BPS	Status	P/S	Number of Post			
				2005/6	2006/7	2007/8	2009/10
Chowkidar	1	Regular	S	-	4	4	
Chowkidar	1	Project	S	2	2	2	
Dak Runner	1	Regular	S	-	1	1	
Sweeper	1	Regular	S	1	2	2	
Total Number of Posts				**74**	**104**	**135**	

Source: TEPA/ Institutional Development of Traffic Management Unit for Ferozepur Road Pilot Project,12-2007

2.2.6 Urban Unit (UU)

1) General

UU with the formal name of the Urban Sector Policy and Management Unit was established in March 2006 as a project management unit within the GoPb P&D Department. It is a professional team, staffed with highly qualified and experienced professionals in the field of urban management, including urban planning, urban transport, solid waste management, urban water and sanitation and municipal finance.

In the urban transport sector, its projects include the development of a Manual for Uniform Traffic Control Devices, an Urban Transport Study for the Province, and Ferozepur Road Pilot Projects.

2) Roles and responsibility

The UU shall be working under the overall guidance and supervision of the Chairman of Planning and Development Board. The Unit is proposed to be staffed by a core team of qualified and experienced professionals in various fields/sectors relating to urban planning and development, in particular those included in the Development Policy Loan (Urban planning, Urban transport, Solid Waste Management and municipal finance), the Private Sector Participation (PSP) initiative in municipal services (Water and sanitation, Costing and tariff) etc, development of an Integrated Traffic Management System and for the overall development of cities to turn these into engines of economic growth in-line with the vision 2020 of the GoPb.

The Unit shall act as a technical wing of the P&D in urban matters and shall have the following broad parameters of responsibility:

- Shall provide technical advice and support in matters relating to urban planning and development.
- Shall coordinate with the WB for DPL, International Finance Corporation (IFC) for PSP in WASA Lahore in matters related to project preparation, and execution.
- Shall assist the P&D in evaluation and appraisal of projects programs and schemes related to urban development, whether donor funded or ADP funded.
- Shall carry out extensive data collection, data analysis and research on all issues of urban development, especially in the five city District Governments in the Province.

- Shall act as a resource bank for all the information, data, facts and figures relating to urban sectors in the province.
- Assist the P&D Department in preparation of project proposals and documentation for donor funded projects.
- Shall assist the GoPb in developing a sound and effective regulatory framework for PSP in municipal services.
- Shall act as a technical facilitation unit for the local governments, in matters relating to urban development, service delivery, infrastructure and municipal finance.
- Shall provide technical assistance and guidance to the Local Governments in all urban matters.
- Any other work assigned by the Chairman P&D on matters related to Urban Development.

3) Staffing

- Project Director (1)
- Cultural Heritage Specialist (1)
- Urban Planner (1)
- Junior Urban Planner (1)
- Urban Economist (1)
- Local Government Finance Specialist (1)
- Water and Sanitation Specialist (1)
- Solid Waste Management Specialist (1)
- Costing and Tariff Specialist (1)
- Urban Transport Specialist (1)
- Institutional Development Specialist (1)
- Communications Specialist (1)
- GIS Expert (1)
- Internees (10)
- Supporting Staff
  a. Admin officer (1)
  b. Accountant (1)
  c. Internal Auditor (1)
  d. Stenographer (1)
  e. Receptionist (1)
  f. Office assistants (3)
  g. IT Manager (1)
  h. IT Assistant (1)
  i. Drivers (3)
  j. Naib Qasids (3)
  k. Chowkidar (2)
  l. Sanitary Worker (1)

Ten floating positions of ‘interns’ at the UU have been proposed. The interns would be recruited from the market for a period of six months to a year in three categories.

1. Research Assistant (Fresh Graduates)
2. Research Associate(one to 2 years experience)
3. Research Analyst (2+years experience)

These interns would be working as assistants to the sector specialists/ Project Director and would be selected from amongst the brilliant graduates in the fields of Engineering, Town Planning, Economics, Business Administration, Information Technology and Sociology etc.

These interns would enhance the output of the consultants; provide 'skilled mind power' for data collection, data analysis, research and studies etc, one of the key assignments of the Urban Unit. It may be mentioned that provided the guidance, this kind of activities can be performed very well by these interns and saves a lot of time of the more expensive specialists for strategic work.

Last, but not the least, the Urban Unit would be disseminating knowledge skills and expertise available in the country for dealing with urban issues, and narrowing the gap between the academics and the implementers.

2.2.7 Housing, Urban Development and Public Health Engineering Department (HUD & PHED)

HUD&PHED was created during August, 1972 by replacing West Pakistan Housing and Settlement Agency with a single attached department of "Directorate General Housing and Physical Planning" at Lahore. Later on Improvement Trust at Faisalabad, Gujranwala, Multan, Rawalpindi, Sargodha and Murree with Social Welfare and Local Government Department were placed under the administrative control of Housing and Physical Planning (H&PP) Department during 1973.

Improvement Trusts ultimately were converted into Development Authorities except Murree and Sargodha. In 1978 Public Health Engineering Department (PHED) was placed under the administrative control of Housing and Physical Planning Department.

The Department was renamed as Housing Physical and Environmental Planning (HP & EP) in 1978 and Environmental Protection Agency (EPA) was created as its attached wing. In 1996, Environmental Protection Agency was detached from Housing Physical and Environmental Planning Department and was made independent provincial Department. Finally Housing Physical and Environmental Protection Department was given the name as Housing, Urban Development and Public Health Engineering Department (HUD&PHED) in 1997 to depict Urban Development Authorities and Public Health Engineering Department.

The Directorate General H&PP Punjab has been revamped as Punjab Housing and Town

Planning Agency (PHATA) under the PHATA Ordinance, 2002. The said agency has been effectuated w-e-f 01.04.2004 with the objective of rejuvenating the housing sector in general and provision of shelter to shelter-less low income group in particular.

2.2.8 Communications and Works Department (C&W)

1) Establishment and Function

C&W Department was set up in May 1962, with attached departments, namely, Buildings, Highways and Architect departments beside the three organizations namely, Budget Directorate, Building Research Station and Road Research Laboratory. The Buildings and Highways Departments are further subdivided geographically into two zones. Each zone is headed by a Chief Engineer. The Architecture Department is headed by a Chief Architect.

The functions of C&W are defined as follows:

- To plan, design, construct, maintain, repair and improve all government buildings;
- Evaluation, fixation of rent, control, management, leases of government buildings;
- Preparation of architectural design/ drawings;
- Building, road research and material testing activities;
- Laying standards and specifications for various types of buildings, roads and bridges;
- Plan, design, construct, maintain, repair and improve roads, culverts, causeways and boat bridges
- Administration of roads, bridges and boat bridges, toll collection. Leases of land for access road for filling/ service stations ant factories
- Execution of works on behalf of other agencies/ departments as deposit works

2) Budget

The C&W Department allocates funds under two heads i.e. development and non-development. All development activities in the Rehabilitation and Building (R&B) as well as Farm to Market Roads (FMR) sectors are carried out under the development budget. Payment of establishment and maintenance activities are done under the 25-communications budget grant. The construction of government buildings both offices as well as residential are carried out through budget allocations for the respective sector. Buildings maintenance activities are done under the head 24-civil works budget grant. The maintenance allocations are made according to yard stick which is based per 10 feet width per kilometer for roads and on the basis of unit area for government buildings.

2.2.9 Lahore Transport Company (LTC)

LTC was established in July 2009, as a non-profit public association under the Transport

Department, aiming at review and assessment of present bus routes, propose of new routes, effective monitoring of bus operation and planning of other public facilities other than rail transits.

1) Legal Framework

LTC was established under Section 42 of the Company Ordinance, 1984. Prior to establishment, the Section 2 of Ordinance XIX of 1965 was amended by inserting the following definitions.

- (1-A) "Area" means such as area or areas as are notified by the Government,
- (4-A) "Company" means the urban public transport company established under 43-A
- (43-A) "Urban Public Transport" means the urban public transport vehicles operating under the regime of company with valid route permits within the area.

In addition, the following Chapter V-A was inserted in the Ordinance XIX of 1965.

- 72-(A) Company, --- (1) Government may establish a not-for-profit Urban Public Transport Company limited by shares incorporated under the Section 42 of the Companies Ordinance, 1984 in such area as the Government may determine, for the provision of urban public transport and related services consistent with the provisions of this Ordinance and the Company so established shall have perpetual succession and a common seal and shall by that name sue and be sued.

2) Activities

According to a presentation material by the Company, its nature and responsibilities are defined as follows:

- LTC shall be a corporate sector limb of the Go0vernment with the objective to plan, provide, operate, enforce and regulate urban transport in the city of Lahore
- LTC shall enter into negotiations, understandings, agreements and contracts with public and private persons/ entities
- LTC shall plan, align, classify and re-classify the routes
- LTC shall prescribe the criteria for operation of urban public transport
- LTC shall undertake and maintain such works as required for infrastructure related to public transport, i.e. Bus Stops, Bus Bays Shelters, Terminals, Bus Lanes, Fleet management systems, Control room(s), etc.
- LTC shall solicit and channelize subsidies/ concessions of the Government if any for Urban Public Transport
- LTC shall survey, collect, classify, analyze, plan, circulate, distribute the data, information, statistics relating to Urban Public Transport
- LTC shall be competent to establish and maintain contacts and relations with companies, bodies, authorities, associations, societies and institutions throughout the world for achievement of its objectives.
- LTC shall employ or engage the required services of its professionals for the achievement of its objectives
- LTC shall be competent to obtain permits and other certifications in its name under

Hire-purchase agreements for the public transport operating in its area of operations

- LTC shall survey, assess, purchase, lease and acquire under the law the immovable properties required for the purpose of public transport.
  (Omitted hereunder)

3) Associate and Members

LTC is a company, not a corporation because public corporation and authorities are more inflexible in their management style subject to government rules and regulations. LTC is on self-financing basis and therefore can have the option of working under a more flexible structure controlled by its own Board of Directors.

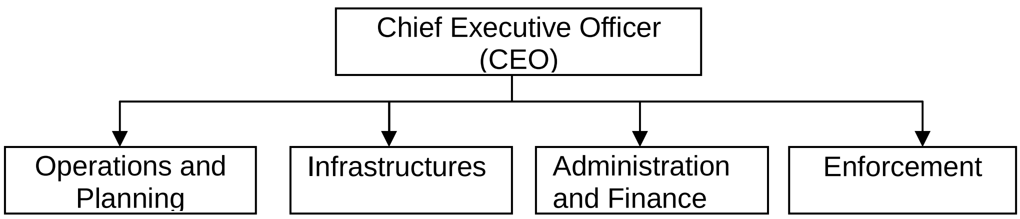
LTC was licensed as Association Not-for-Profit and registered as a Guarantee Limited Company having no share of capital. LTC is a Membership Organization which will derive income from membership fees, user fees and commercial revenue but does not distribute it amongst its directors but utilize the same for achievement of its objectives.

LTC has individual members and corporate members which are classified into four classes: Class A to D. Class A members are nine founders of LTC and constitute the Board of Directors, inclusive of Chairman, Chief Executive Officer, Secretary, Treasurer and other five members of Secretary of Transport Department, Deputy Inspector General Traffic Police of Lahore, District Coordination Officer/ Chairman DRTA of Lahore, Director General of LDA and Private Sector Nominee. Members of Class B to D are the persons fulfilling criteria of membership up to the satisfaction of the Board of Directors.

4) Organization

Figure 2.2.7 shows the organization of LTC. As of May 2010, LTC has about 40 employees out of which approximately 15 staffs are professionals of traffic surveys, data analysis, demand forecast and transport planning.

Figure 2.2.7 Organization of LTC



Source: Presentation Material of Seminar by LTC

2.3 Socio-Economic Characteristics

2.3.1 The Study Area Profile

1) Regional Setting

Lahore District lies between 310-15` and 310-43` north latitude and 740-10` and 740-39` east longitudes. The district is bounded by Sheikhupura District on the north and west mostly separated by Ravi River, on the east by the Indian district of Amritsar and in the south by Kasur District. The Study Area land elevation is depicted in Figure 2.3.1.

The summer season starts in April and continues till September. May, June and July are the hottest months. The winter season lasts from November to March. December, January and February are coldest months. Light rain fall happens during January and February. Towards the end of June, monsoon starts and continues for about two and half months. The maximum temperature touches around 50 degrees Celsius. Sometimes, minimum temperature falls below zero degrees Celsius.

The terrain conditions are flat and gently sloping towards south and south-west directions. There is no physical hindrance in the expansion of the metropolis except the Ravi River and the Indian Border.

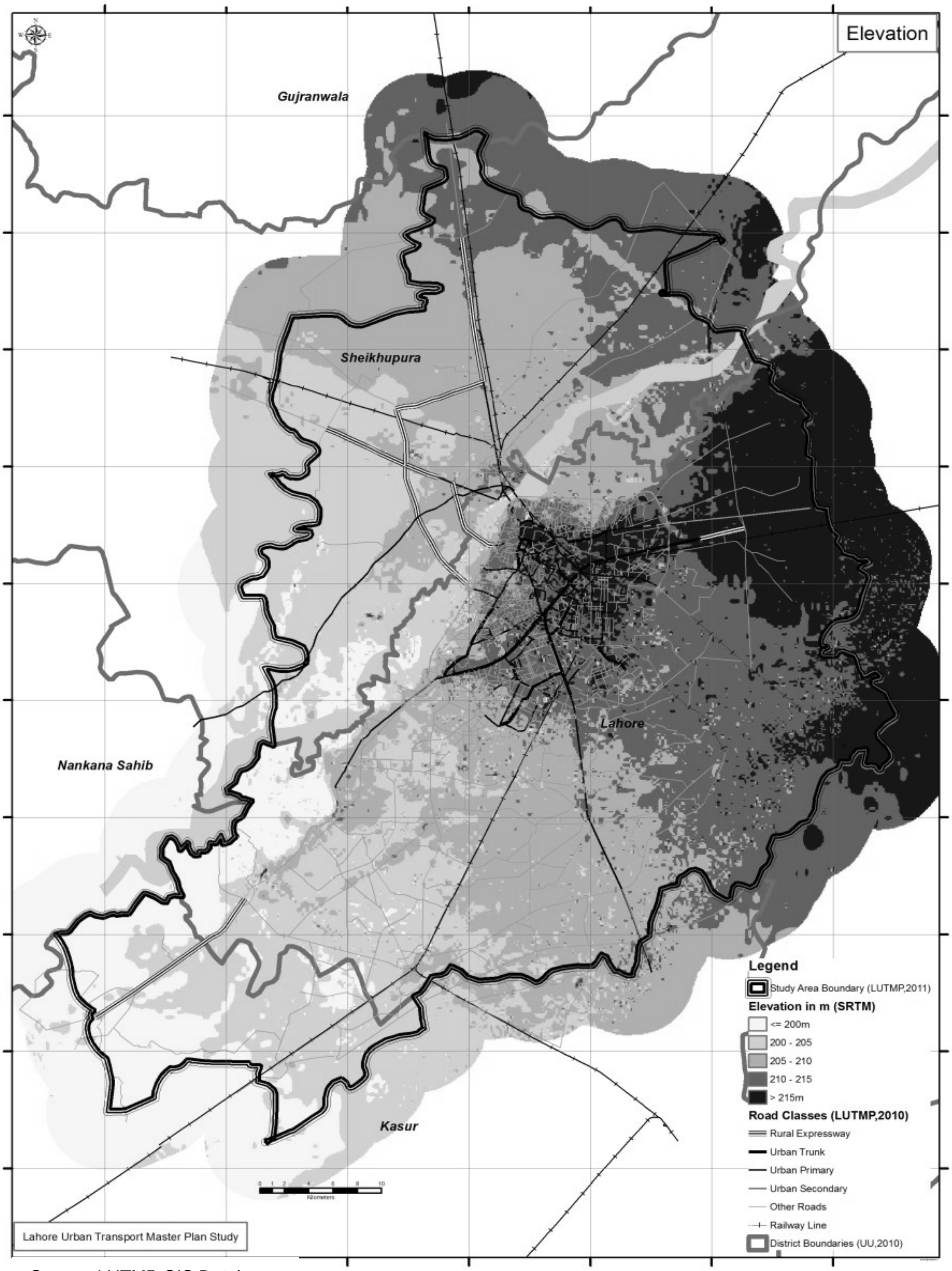
The Ravi River historically caused floods and consequently flood protection facilities were constructed, including Mahmood Booti Bund (initially constructed in 1952, 8.8 km long), Lahore Protection Bund (initially constructed in the early 1950s, 7.6 km long), Tie Bund (constructed in 1979-80) and others. The local topography shows that flat lands located at the north of the city center and across the river are very low and vulnerable against floods.

In recent years, the year 1988 flood seriously damaged Tie Bund of Lahore Protection Bund and Shahdara Distributary Flood Bund. The year 1997 flood caused damages to the Spur near Furrakhabad and Shahdara Flood Protection Bund.

The water right of Ravi River is given to India in accordance with the Indus Water Treaty. Beside natural conditions, India operates Thein Dam, at the upstream of Madhopur Barrage. It is therefore difficult for Pakistan to control river stream.

The Indian border lies at the eastern edge of district boundary. There are defense restricted areas notified by the Army authorities. There is Niaz Baig Ammunition Depot and its surrounding area with a radius of 11 km is regarded as prohibited area in development.

Figure 2.3.1 Land Elevation in the Study Area



Source: LUTMP GIS Database

2) Local Administration

The administrative structure has been changed after promulgation of Local Government Ordinance (2001). Districts, City Districts, Towns/ Tehsil and Union Council's Administrations have been created. Lahore was declared as City District and divided into six towns. In 2005, six towns were split to create nine towns in CDGL. Now, Lahore City District comprises of following nine towns which are administrated by TMA. The Lahore cantonment is separately governed by cantonment board and provision of core facilities is the responsibility of Lahore Cantonment Board.

Today, Lahore District is spread over 1,772 km^2: over 80 % of the total area is occupied by three towns of Iqbal Town, Nishtar Town and Wagha Town.

Local Government Ordinance 2001 changed local administration. Before 2001, in urban areas, local bodies which performed services[1] were metropolitan corporations, municipal corporations, municipal committees and town committees. In rural areas district and union councils were performed functions. After 2001, major local level services have been transferred to Local Governments. These include primary education, health, water supply and sanitation. Three tiers of Local Government have been developed in the form of district/city district, Town/ Tehsil and union administration.

Under the Punjab Development of Cities Act 1975, LDA was established in 1975 as a successor body of Lahore Improvement Trust (LIT) which was established in 1935 under Punjab Town Improvement Act 1922. The prime purpose of its establishment is to introduce a comprehensive system of Planning and Development in order to improve standard of living in Lahore. It is headed by a Director General (DG) and houses three sections: 1) Urban Development, 2) WASA, and 3) TEPA. LDA under its first wing i.e. the Urban Development is responsible for the planning, designing and development of various projects in accordance with the functions of the Development Authority. Area jurisdiction under LDA is over 2,000 km^2, consisting of Lahore District and parts of areas of Sheikhupura and Kasur Districts.

2.3.2 Urban Development Characteristics

1) Urban Structure

As a meaningful debate on urban structure formation, the history of Lahore started from the walled city as shown in Figure 2.3.2. During the Mughal Era, particularly 16^{th} and 17^{th} centuries, the city was walled and many gardens were constructed. To protect the city from floods, 4 miles long embankment, known as Band-e-Alamgiri was constructed.

During the British Rule period, the city was expanded by 3 times, equipped with modern urban infrastructure. Particularly for the second half of 19^{th} century, urban development was significant. Some remarkable events were recorded including the Bari Doab Canal opened in 1859, Lahore Railway Station opened in 1861 and the first piped water supply started in 1882.

[1] It included provision and maintenance of roads, bridges, public buildings, water supply, hospitals and school buildings.

As to urban structure in 1900, two built-up areas were separated between expanded city center and cantonment area. In the early 20th century, two built-up areas were further expanded and combined in a form of conurbation. The city sought for new large development lands southwards around Model Town.

Soon after the independence, Lahore experienced severe times, tackling with urban rehabilitation, redevelopment and new development. The situations were brought about from about 40 % of city's populace migrated to India and a proportionate number of refugees came to Lahore. LIT empowered under the Punjab Development of Damaged Areas Act 1952 undertook numerous urban renewal and new development projects such as Shah Almi, Gulberg, Samanabad, Upper Mall, etc.

During the period 1970s and 1980s, urban population exceeded 2 millions, forming Lahore into a metropolis. Ferozewala in Sheikhupura District was urbanized as part of the metropolis although major expansion trends remained to the south and southwest directions.

In the last two decades, urbanization has shown more dynamics and is complex. It is discussed in the next section.

Since the 1950s, urban development pace has been accelerated because of greater accumulation of population and economy. Today, Lahore experiences mass urbanization of over 1,000 hectares every year.

2) Current Urbanization Directions

Below Tehsil or Towns, there are Union Councils (UC). In Lahore District, there are 122 urban UCs and 28 rural UCs. In the Study Area, for the Household Interview Survey (HIS) zoning system, some UCs are subdivided (as they lie across natural or man-made barriers) and Cantonment is subdivided into 24 Zones, resulting in 228 Zones in the Study Area (Volume 2, Annex -1).

Figure 2.3.3 shows population density by zone and it implies urban directions in the Study Area. As we define urbanized zones over 100 inhabitants per hectare, such urban zones are concentrated in 7 towns, the northern edge of Nishtar Town and part of Ferozewala Tehsil in Sheikhupura District.

As we define the zones from 20 to 100 inhabitants per hectare are partially settled such as rural centers along inter-city roads and new housing areas adjacent to the urban zones, the latter zones are found to be in many directions from the massive urbanized areas of Lahore, i.e., to the north-west across the Ravi River, to the north beyond the Ring Road, to the east along GT Road, to the southeast beyond the airport towards Barki and Bedian Roads, DHA V, VI & VII, and Ghazi Road, to the south along Ferozepur Road and to the southwest along Multan Road.

Those urbanization trends are quite different from the Integrated Master Plan for Lahore 2021 which clearly directs urbanization towards south and southwest axis is inverted V shape as shown in Figure 2.3.4. The gap can be explained by the following reasons:

(1) Mono-centric metropolitan structure: Holding a mono-centric structure in the metropolis, travel time to the existing city center is only a decisive factor in land development and valuation;

(2) No mass transit available: The Comprehensive Study on Transportation System in Lahore (JICA, 1991) envisaged LRT on the Ferozepur corridor by 2010. However, no mass transit has been introduced. Frequent and punctual mass transit services allow people longer commuting distance. Without mass transit, actually in Lahore, people particularly who can't afford private transport means must be conscious about accessibility to their work places on severely congested roads;

(3) Cantonment development by DHA: Beforehand, Lahore Cantonment was regarded as an exclusive area for military purpose and residents were limited to active military staff families and veterans. In addition, the area beyond the cantonment area to the east was supposedly restricted in urban development due to border management. However, DHA was established in 1999 as a converted body of former Lahore Cantonment Cooperative Housing Society (LCCHS), changed the situations. DHA has actively engaged in housing development for upper middle-class clientele, i.e., 7 phases or 4,400 ha under construction, Phase VIII (1,400 ha) under planned and Phase IX / X (2,400ha) under land acquisition (see Figure 2.3.5). Today, DHA is the largest housing supplier and the east and southeast suburbs in Lahore becomes most active development areas although they were not assumed in the previous metropolitan planning documents;

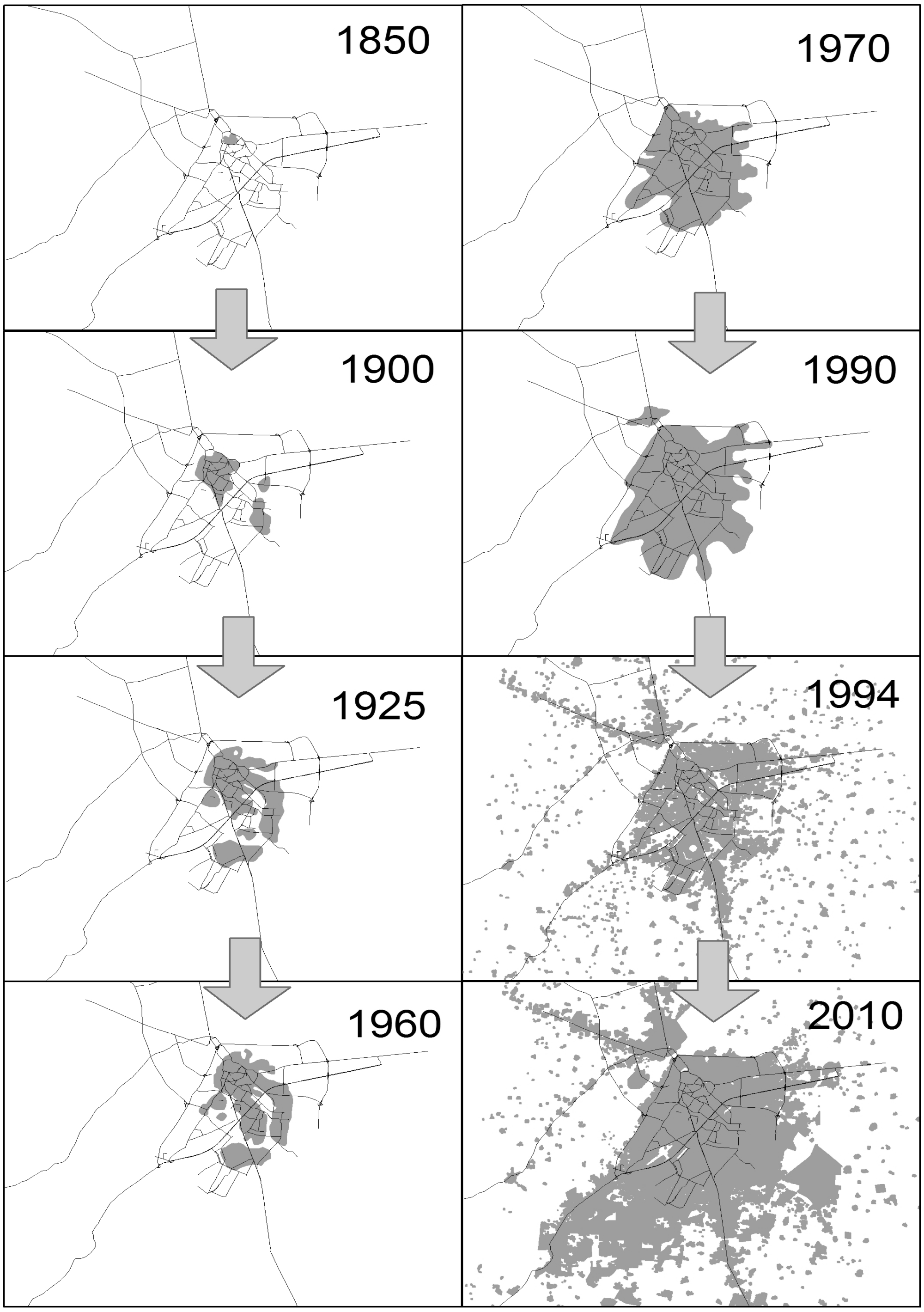
(4) Insufficient housing schemes for low to middle income class: Many small to medium-size developers are undertaking residential development along south and southwest axis. But their target is upper middle-class, competing with the current DHA market while low to middle-class residential development schemes barely appear in the suburbs. Without such schemes and transit support, those people must cling to the edge of the city center regardless of congested housing units and unfavorable urban environments.

Table 2.3.1 Historical Development of Lahore

Period	Cumulative Developed Area (km^2)	Average Growth Area Per Year (ha)
Pre-British Period	23.8	
1850 – 1900	68.7	90
1901 – 1950	71.2	48
1951 – 1965	117.2	323
1966 – 1980	175.7	390
1981 – 1990	245.6	699
1991 - 2000	326.0	804
2001 - 2006	397.8	1,196

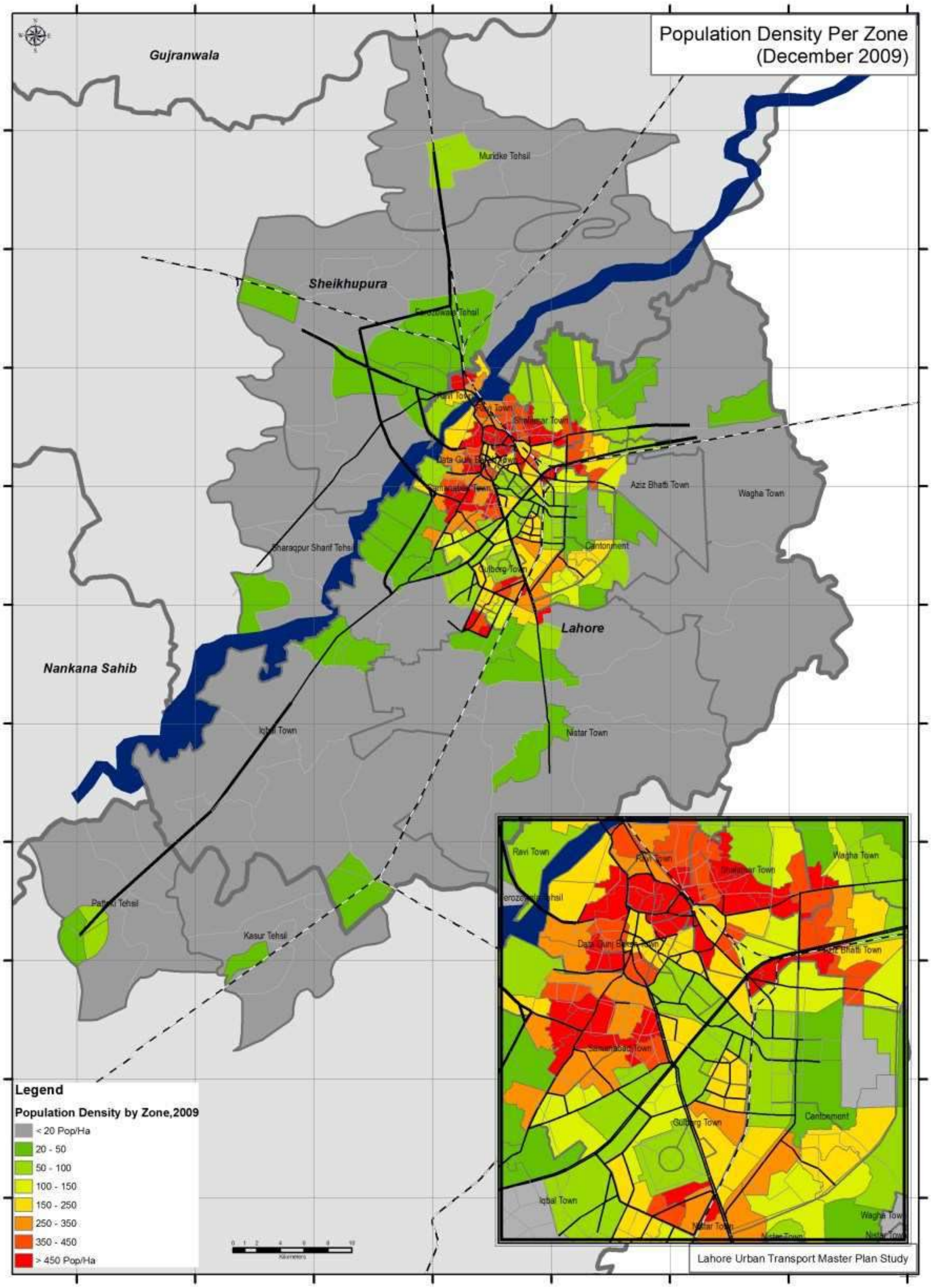
Source: Developing Comprehensive "City Boundary" for Lahore – Consultation Report, NESPAK, 2010

Figure 2.3.2 History of Urban Structure Transformation



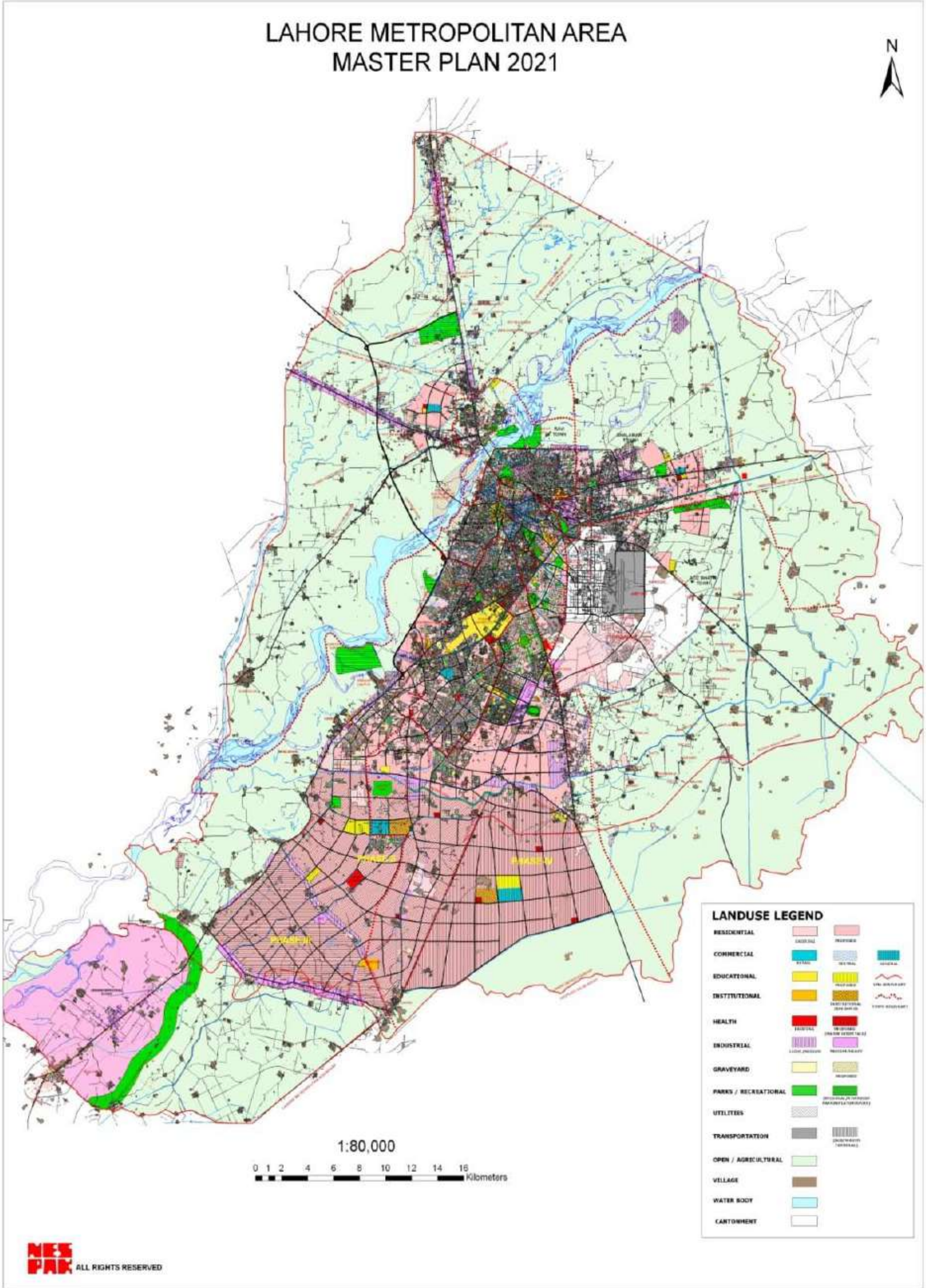
Source: Comprehensive Study on Transportation System in Lahore, JICA, 1991
Survey of Pakistan and LUTMP GIS Database

Figure 2.3.3 Population Density by LUTMP Zone (Dec 2010)



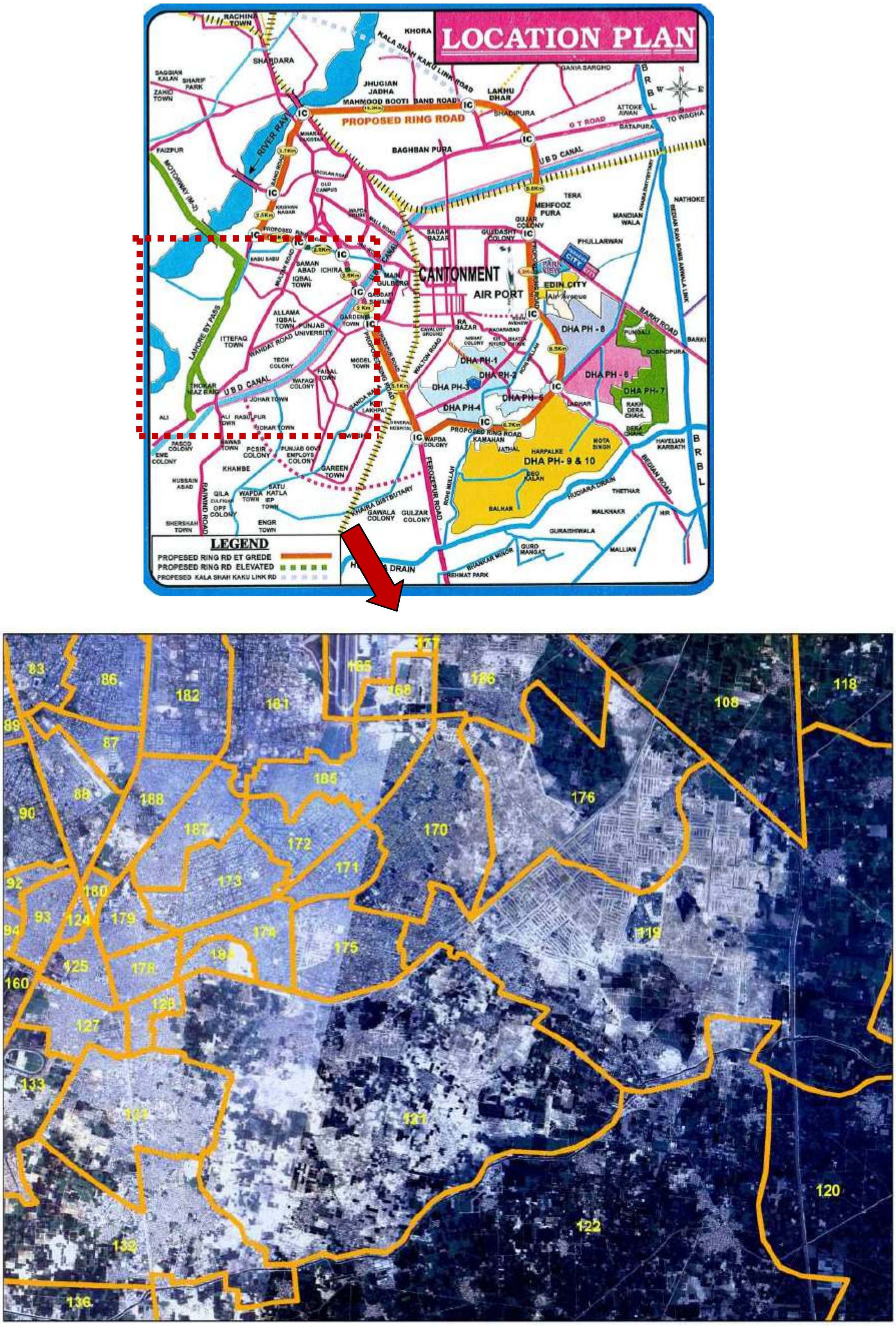
Source: JICA Study Team

Figure 2.3.4 Lahore Metropolitan Area Master Plan 2021



Source: Lahore Metropolitan Area Master Plan, NESPAK, 2021

Figure 2.3.5 Delineation and Satellite Image of DHA Phases



Source: DHA

3) Housing Condition

Lahore city is facing severe shortage of housing. Although data are limited and not new, two milestone statistics of 1980 and 1998 showed the situation. Majority of these housing units comprised two to three rooms, with 3.0 inhabitants per room on the average. During the period, the number of inhabitants per unit increased from 6.7 to 7.1 inhabitants. It is an adverse phenomenon experienced in other countries where household size becomes small as a city grows with economic development. Such household congestion is attributed to high density urban areas in Lahore.

Table 2.3.2 Housing Supply and Conditions, 1980 and 1998

Data Item	1980	1998
No. of house stock	441,721	722,721
Persons per house	6.7	7.1
Persons per room	3.0	3.0
Rooms per house	2.2	2.4

Source: City Report, Lahore, 1998

According to Population Census 1998, about 68 % of total population of Lahore owned a house, 22 % rented a house and the rest stayed free.

4) Urban Services

(i) Water Supply and Waste Disposal

The Household survey of 2007-08 indicates that 85 % people were using potable (tap) water, and the rest 10 % people were dependent of their personal hand pumps. These figures are not different from that of 1998, where 10 % population was using hand pumps for drinking water.

WASA Lahore provides its sanitation services to very large number of people, i.e., 80 % of the city population on 66 % of the city area, according to WASA Report 2005-06.

(ii) Solid Waste Management

In Lahore it is estimated that 5,000 ton waste is generated within the day and in which 70 % waste is lifted but 30 % waste leaves un-lifted. The services are labor-intensive, i.e. 7,897 to serve the vast area of Lahore city and thus the division of worker per thousand people is 1.21.

Solid waste management needs considerable improvements. The Solid Waste Management department of Lahore faces weak management, the biggest reason of its inefficiency in fulfilling the demands of growing population. Landfill sites, workshops and proper machinery are apparently short. The problem becomes more crucial when the hospital and industrial waste is dumped with household waste and disposed without treatment.

5) Development Regulation

The Building Regulations 2005 was issued by the LDA which is responsible for a coordinated process of planning and development in Lahore Metropolitan Area. Relevant regulations with urban transport development are cited in the following:

(i) Right of Way (Article 17)

The right of way for arterial, major and secondary roads prescribed as such in the Master Plan, shall be as specified below:

a)	Arterial Roads	150 feet and above
b)	Major Roads	120 feet
c)	Secondary Roads	80 feet

The minimum right of way for minor roads is less than 20 feet (6 m).

However, existing roads are accepted as established at site in existing built-up areas. It means that existing arterial, major and secondary roads designated by a statutory master plan must be widened on an individual project basis when necessary.

(ii) Parking of Vvehicles (Article 66)

In the Central Area as well as in case of converted plots in other areas, every prospective builder shall be required to provide parking space within the premises at the rate of:

a) Apartment buildings: one car space for every 1000 sft. of covered area subject to minimum one car space for every housing unit and one motor cycle/ scooter space for every housing unit.

b) Office, commercial including large stores and retail shops and hospitals: One car space for every 1000 sft. of floor area and one motor cycle/ scooter for every 500 sft. of floor area.

Vehicle parking is regulated in other building types in a similar way except residential lots.

(iii) Areas Subject to Special Control (Section 96)

In addition to general requirements, the Building Regulation 2005 specifies some areas subject to special control.

For example, a minimum building line (30 ft.) is required in case of properties abutting the following 26 roads:

(1) Main Boulevard, Gulberg, (2) Stadium Road, Gulberg-III, (3) M.M Alam Road, Gurberg-III, (4) Syed Hussain Shaheed Suhrwardi Road, (5) College Road, Gulberg, (6) Main Market Road, Gulberg-II, (7) Park Road, Gulberg, (8) Gurumangat Road, Gulberg, (9) Road from PACE to Chen One Junction, Gulberg, (10) Shabbir Ahmad Usmani Road, (11) Ferozepur Road, (12) Jail Road and Gulberg Road, (13) Multan Road, (14) Wahdat Road, (15) Raiwind Road, (16) Road behind Liberty Market to Stadium Road, (17) Tollinton Market Shadman, Shadman Road, (18) Link M.M Alam Road, (19) Link Road Main Boulevard Garden Town, (20) Link Road Main Market Gulberg-II, (21) Qazi M.Esa Road Link, (22) Road from Firdaus Market to 37 Block-J,

Gulberg-III, (23) U.B.D. Canal, (24) Campus Bridge U.B.D. Canal to Y-Junction, New Garden Town, (25) Sher Shah Road, and (26) Main Boulevard, Shadbagh.

10 Roads are also designated for general commercial areas, including all types of retail and wholesale commercial activities, offices, restaurants, showrooms, etc. These are: (1) Multan Road, (2) Lytton Road, (3) Ferozepur Road, (4) Allama Iqbal Road, (5) Shahrah-e-Quaid-e-Azam, (6) Temple Road, (7) Ravi Road, (8) G.T. Road (Baghbanpura), (9) Sheikhupura Road from Octroi to the roundabout near Ravi Bridge, and (10) Shalimar Link Road.

Due to roadside development, heavy urban traffic and substantial public transport needs are expected on the above-mentioned roads.

(iv) Rules for Private Site Development Schemes

Punjab Private Site Development Schemes (Regulation) Rules 2005, attached to the Building Regulation 2005, guide privately-led housing schemes. Planning standards other than residential lots and roads are set as below:

a. Open space/ parks – not less than 7 % of total scheme area;
b. Graveyard – not less than 2 % of total scheme area;
c. Commercial area – not more than 5 % of total scheme area;
d. Maximum size of residential plots – 1,000 sq.yds.;
e. Minimum road width – 30 feet; and
f. Public buildings – 2 to10%

2.3.3 General Socio-economic Condition

1) Demography

(i) Broad Analysis

Broad population analysis is given in the table below. 8.5 million People reside in Lahore District and 82 % of which are urban dwellers. The population growth rate of 2.5 % since 1998 Census is much faster than the national and provincial rate of 1.9 %.

The Study Area is expanded by 70% from Lahore District due to inclusion of parts of Kasur and Sheikhupura Districts. Rural populace is still dominant in these two inclusion areas and thus urban residents account for 66 % in the Study Area. The reason of inclusion of these two areas into the Study Area is simply to compare the result with the Comprehensive Study on Transportation System in Lahore conducted by JICA in 1991. The population growth rate of 2.3 % is slightly lower than Lahore District.

Table 2.3.3
Past Population Trends of Pakistan, the Punjab, Lahore Division and the Study Area

Area Description	Area (sq.-km)	Census Population ('000)					Annual Growth Rate (%)				
		1961[1]	1972[1]	1981[1]	1998[1]	2010[1]	1951-61	1961-72	1972-81	1981-98	1998-10
Pakistan	796,096	42,880	65,309	84,254	132,352	168,258	2.43	3.90	2.87	2.69	2.02
The Punjab	205,345	25,464	37,607	47,292	73,621	93,682	2.17	3.61	2.58	2.64	2.03
Lahore Division	11,729	3,560	5,431	7,183	12,016	15,784	2.36	3.91	3.16	3.07	2.30
Lahore District	1,772	1,626	2,588	3,545	6,319	8,650	3.66	4.32	3.56	3.46	2.65
Kasur District	3,995	854[2]	1,186[2]	1,528[2]	2,376	3,016	1.16	3.03	2.86	2.63	2.01
Sheikhupura District	3,242	656[3]	1,028[3]	1,338[3]	2,276[3]	2,888	1.61	4.17	2.97	3.17	2.00
The Study Area	**3,044**	**N/A**	**N/A**	**N/A**	**7,307**	**9,928**	**N/A**	**N/A**	**N/A**	**N/A**	**2.59**

Note 1: Census Year; Note 2: Lahore divided in to Lahore District and Kasur District; Note 3: Sheikhupura divided in to Sheikhupura District and Nankana Sahib District in 2005.
Source: Punjab Development Statistics, 2010

(ii) Analysis at Tehsil/ Town Level

Tehsil is lower level of administration boundary under district administration in Pakistan. The Study Area is composed of whole of Lahore District: 2 Tehsils of Lahore and Cantonment areas; Part of Sheikhupura District: parts of Tehsils of Ferozewala, Muridke, and Sharaqpur; and Part of Kasur District: Tehsils of Kasur and Pattoki adjacent to Lahore District in the South-west and south respectively.

In Lahore District, Tehsil Lahore is comprised of 9 towns, whereas Lahore Cantonment Tehsil areas are treated as single town. In Lahore district six towns (including Cantonment) are totally urbanized. Except Cantonment, other 5 towns areas are densely populated with density reaching over 200 inhabitants per hectare.

It is noted that there are Data constraints at Tehsil level. After 1998 Census, all Towns in Lahore, except Cantonment has the same population growth rates in the District, as shown in Table 2.3.4 below.

Table 2.3.4 Demographic Characteristics by Tehsil

District	Tehsil/ Lahore Tehsil Town	Area (km^2)	1998 Census Population	Current Population (Dec 2010)				Annual Growth Rate (%)
				Pop (000)	Urban Pop (000)	Density (persons/ha)	Urban Rate (%)	
Lahore	Aziz Bhatti Town	89	414	553	348	60	62.9	2.4
	Data Gunj Baksh Town	33	712	949	949	288	100.0	2.4
	Gulberg Town	32	571	761	761	238	100.0	2.4
	Iqbal Town	464	567	756	279	16	36.9	2.4
	Nishtar Town	520	734	978	526	19	53.8	2.4
	Ravi Town	62	1,163	1,550	1,550	250	100.0	2.4
	Samanabad Town	35	722	963	963	275	100.0	2.4
	Shalimar Town	15	389	519	519	346	100.0	2.4
	Wahgha Town	435	481	642	258	15	40.2	2.4
	Cantonment	87	566	791	791	90	100.0	2.8
Sheikh-upura	Ferozewala	576	428	547	149	10	27.2	2.1
	Muridke	224	420	538	180	24	33.5	2.1
	Sharaqpur	140	151	193	36	14	18.7	2.1
Kasur	Kasur	150	1,157	1,452	458	97	31.5	1.9
	Pattoki	162	634	797	144	49	18.1	1.9

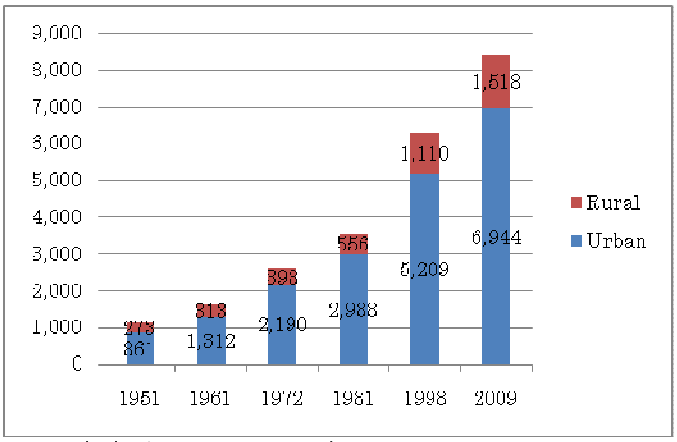
Source: Punjab Development Statistics, 2010

(iii) Historical Change

Population in Lahore District has been growing continuously, and increased by 7.5 times since the first census in 1951. The fastest growth pace was recorded between 1972 and 1981, i.e., 4.3 % per annum. Since then, the growth rate has been steadily declining. In recent years, a growth rate of 2.69% is estimated.

The share of urban population in Lahore District has always been in a narrow range between 75 % and 85 %. Inline with rapid population growth, urban areas have been expanding accordingly.

Figure 2.3.6 Historical Population Growth in Lahore District



Source: District Census Reports, Lahore
Punjab Development Statistics, 2010

(iv) Age Profile

Age profile in Lahore District is very much young like other Districts in Pakistan. The population below 14 years old account for nearly 40 %. Within possible labor force age group between 15 and 64, people less than 49 years are dominant.

The Lahore urban areas show a similar age profile where the possible labor force age group is slightly weighted due to the accumulation of higher education facilities and other reasons.

Table 2.3.5 Age Structure in Lahore District, 1998

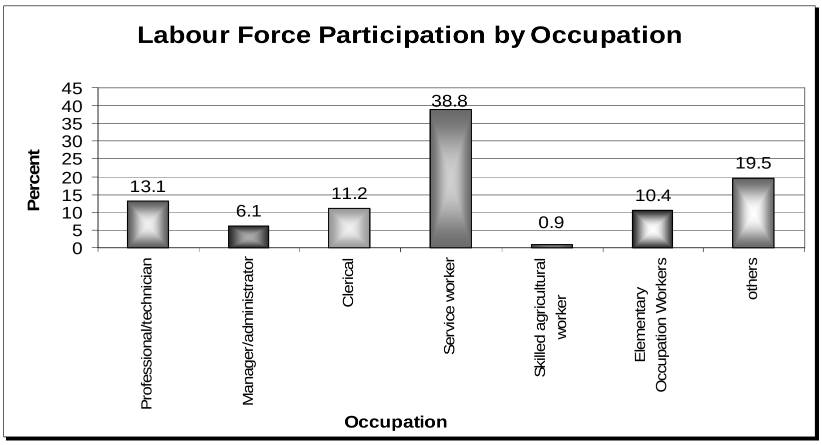
Age Group	Total	Urban
Below 14	39.2 %	38.1 %
15 – 49	50.0 %	51.1 %
15 – 64	57.5 %	58.7 %
65 and Over	3.2 %	3.2 %
Age Dependency Rate*	73.6 %	70.4 %

Note: * Age Group = (below 14 + 65 and over) / Age Group (15 – 64)
Source: District Census Report, Lahore

2) Labour Force

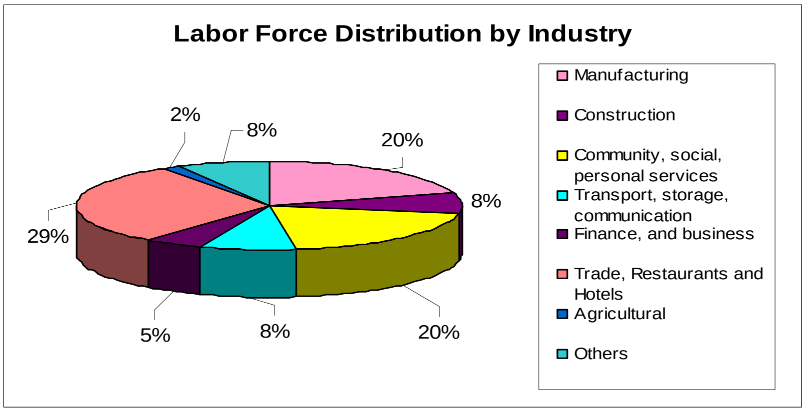
In Punjab Province, labour force ('working' plus 'looking for work') accounts for 31.8 % of the provincial population during the period 2006-07. In the urban areas, an unemployment rate of 7.5 % is rather high than that of 4.7 % in the rural areas. Recent provincial statistics do not show district-level labor force. When working population had a share of 29.4 % in the provincial population during the period 2003-04, its share was 21.8 % in Lahore District due to the mass of students and other reasons. According to the labor survey done by the Urban Unit during the period 2007-08, Lahore labor force is characterized as many service workers by occupation type and social services and trade and commercial activities by industry type as illustrated in Figure 2.3.7 and Figure 2.3.8.

Figure 2.3.7 Labour Force by Occupation in Lahore



Source: Urban Unit, Lahore, 2007-08

Figure 2.3.8 Labour Force by Industry in Lahore



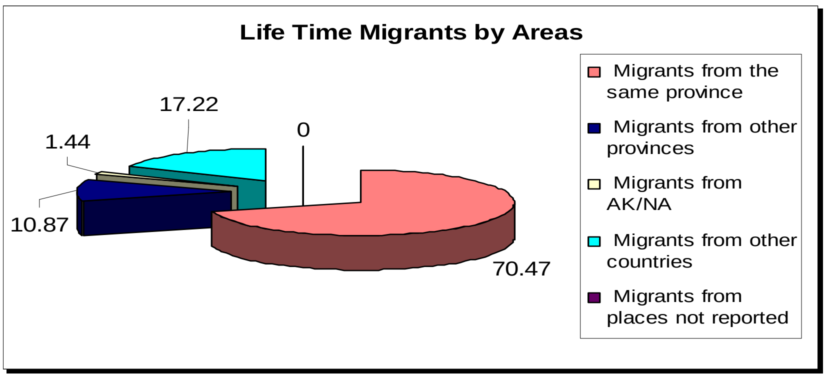
Source: Urban Unit, Lahore, 2007-08

Lahore District also shows considerable labour concentration on the manufacturing sector. In 2004, the district has 1,454 factories with 118,450 workers. The share of manufacturing workers in the province is 19.9 % which is much larger than that of population, 9.2 % in the province. Locally prevalent manufacturing types are metal, machinery, textile and food related.

3) Social Migration

According to 1998 Census, 897,129 migrants in urban Lahore were reported. It nearly constituted 17.4 % of total urban population. There are two types of migration inflow, i.e., intra-provincial migration and international migration. In the census figure, 70.5 % of intra-provincial migrants came from other districts while international migration accounted for 17.2 %. In Lahore, primary reasons of in-migration are better economic opportunities and larger high-quality educational facilities.

Figure 2.3.9 Migration Origins into Lahore



Source: 1998 Census

4) Education

Educational facilities are considered important social facilities and an indicator for human development. In Punjab Province as a whole, various enrolment rates by education stages during 2007-08 were estimated as follows:

- Primary stage education (5-9 years) – 42.2 %
- Middle stage education (10-12 years) – 29.6 %
- High stage education (13-14 years) – 20.6 %
- Intermediate stage education (15-16 years) – 11.9 %
- Degree stage education (17-18 years) – 5.4 %

The 1998 Census indicated that the literacy rate of urban dwellers in Lahore District was 69.1 % which was higher than that of provincial urban average, i.e., 64.5 %. It is thus supposed that enrolment rates of Lahore by education stages may be higher than the above-mentioned provincial averages accordingly.

Lahore is known as an educational hub in the country. High schools and higher educational facilities are concentrated in the city. The number of all types of students is estimated at approximately 883 thousand. 651 thousand of which goes to high schools or higher education facilities and they mostly need longer trips to the education places than primary and middle school students.

In Lahore, there are 24 universities. 11 universities are relatively new since they established after 1990. The largest university is University of the Punjab (30,000 students), followed by University of Engineering and Technology, Lahore (16,000 students) and the University of Lahore (11,500 students).

Table 2.3.6 Educational Facilities and Enrolment in Lahore, 2009

Education Level and Type		No. of Facilities	No. of Students
Government Schools	Primary, Mosque Schools	847	146,123
	Middle	192	86,694
	High	268	247,872
Colleges and Vocational, Intermediate Schools		231	282,656
Universities		24	Approx. 120,000
Total		**1,562**	**Approx. 883,000**

Source: Punjab Development Statistics , 2009

2.3.4 Population Distribution

The population of the Study Area in 2010 is estimated at about 9.9 million, of which 8.65 million (87 %) are resident in Lahore district, and 0.9 million (9 %) are resident in part of Sheikhupura District: partial Tehsils of Ferozewala, Muridke, and Sharaqpur. The remainder 0.37 million (4 %) are resident in Kasur District Tehsils of Kasur and Pattoki. Within Lahore District population is almost evenly distributed (around 900,000) between the seven Towns and Tehsils of Cantonment, with the exception of two peripheral towns Aziz Bhatti and Wagah where the population is just over 660,000 each. Key Study Area population statistics are summarised below in Table 2.3.7.

Table 2.3.7 The Study Area 2010 Population by Town/ Tehsil

District	Town/ Tehsil	Area (km^2)	2010 Population ('000)	Urban Population ('000)	Density (Persons/ ha)	% of Study Area
Lahore	Ravi Town	31	1,007	1,007	328	10.1
	Data Gunj Bakhsh Town	31	970	970	317	9.8
	Samanabad Town	38	984	984	262	9.9
	Shalamar Town	24	854	854	350	8.6
	Gulberg Town	44	778	778	178	7.8
	Aziz Bhatti Town	69	667	609	97	6.7
	Wagah Town	440	656	263	15	6.6
	Nishter Town	497	945	399	19	9.5
	Iqbal Town	520	960	424	18	9.7
	Cantonment	98	831	831	85	8.4
Sheikhupura	Ferozwala Tehsil	576	534	152	9	5.4
	Muridke Tehsil	224	266	143	12	2.7
	Sharaqpur Tehsil	140	101	36	7	1.0
Kasur	Kasur Tehsil	150	168	50	11	1.7
	Pattoki Tehsil	162	207	71	13	2.1
Lahore	Lahore District	1,792	8,652	7,119	48	87.1
Sheikhupura	Part of Sheikhupura	939	901	331	10	9.1
Kasur	Part of Kasur	312	375	121	12	3.8
LUTMP	**The Study Area Total**	**3,044**	**9,928**	**7,571**	**33**	**100**

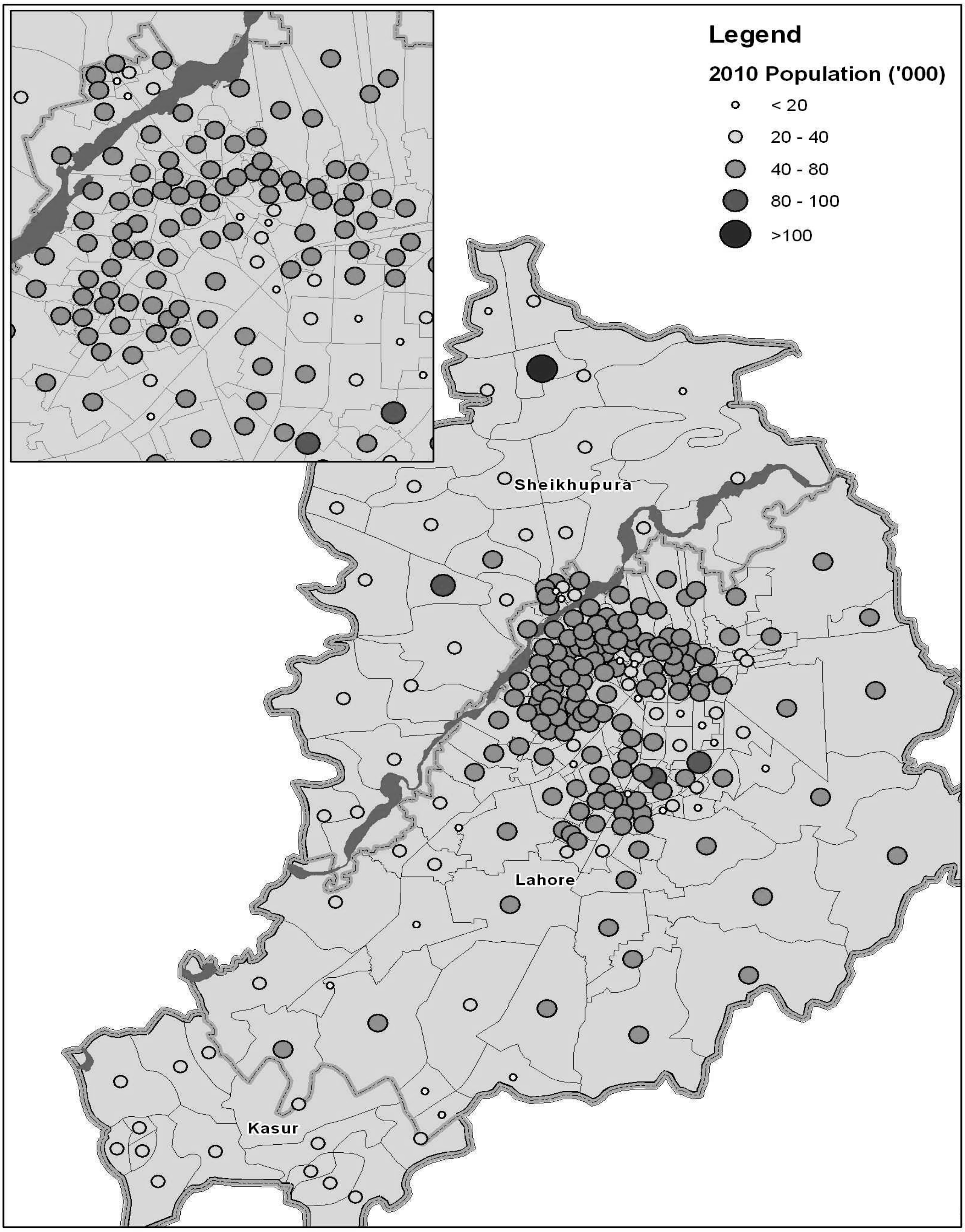
Source: Punjab Development Statistics, 2010

The zonal population is depicted in Figure 2.3.10 indicating that zonal population mostly lies around 40-80,000, with the exception of few large suburban zones, where population exceeds 80,000 and further dis-aggregation was not possible.

The gross population density (total population / total zone area) is shown in Figure 2.1.11. This reflects that highest densities are in and around the walled city area. However, some zones in south model town, Township, Ghazi road and Shahdara areas also have densities similar to the inner city areas.

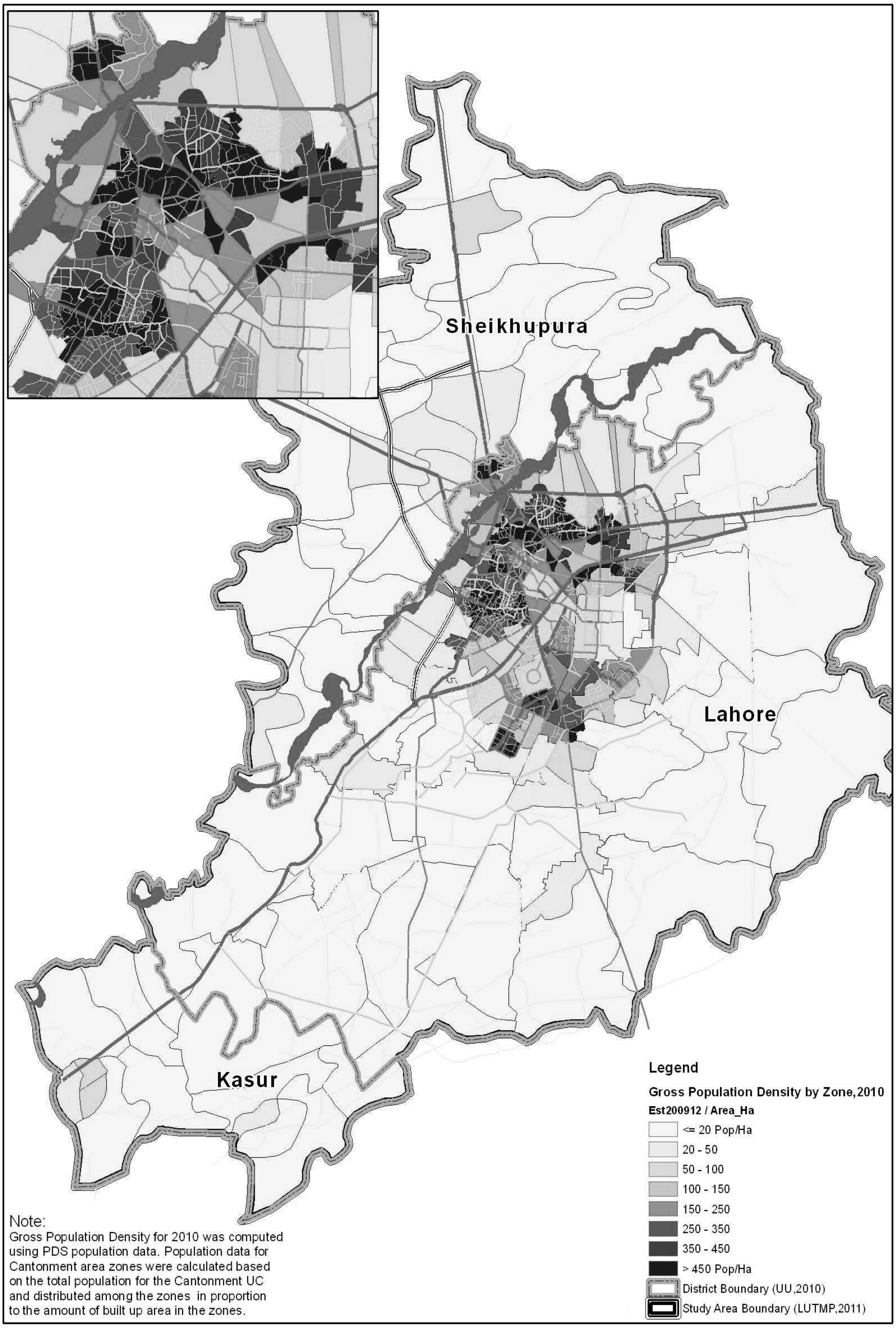
The net 2010 population density (total zonal population/ built up area of the zone) as shown in Figure 2.3.12 gives a more realistic picture of residential developments in the Study Area.

Figure 2.3.10 The Study Area 2010 Populations by Zone



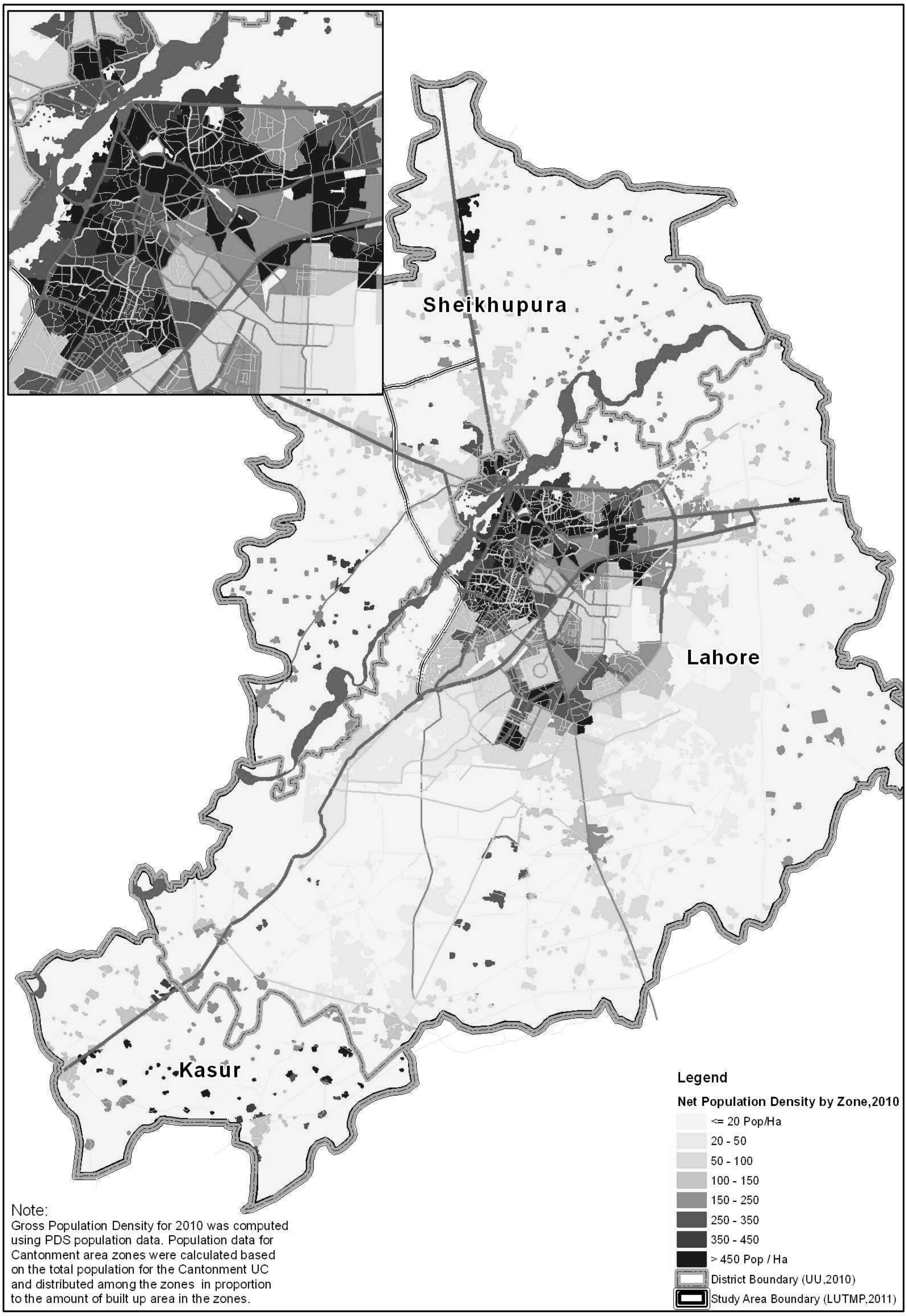
Source: Punjab Development Statistics 2010 and JICA Study Team

Figure 2.3.11 The Study Area 2010 Gross Population Density by Zone



Source: Punjab Development Statistics 2010 and JICA Study Team

Figure 2.3.12 The Study Area 2010 Net Population Density by Zone



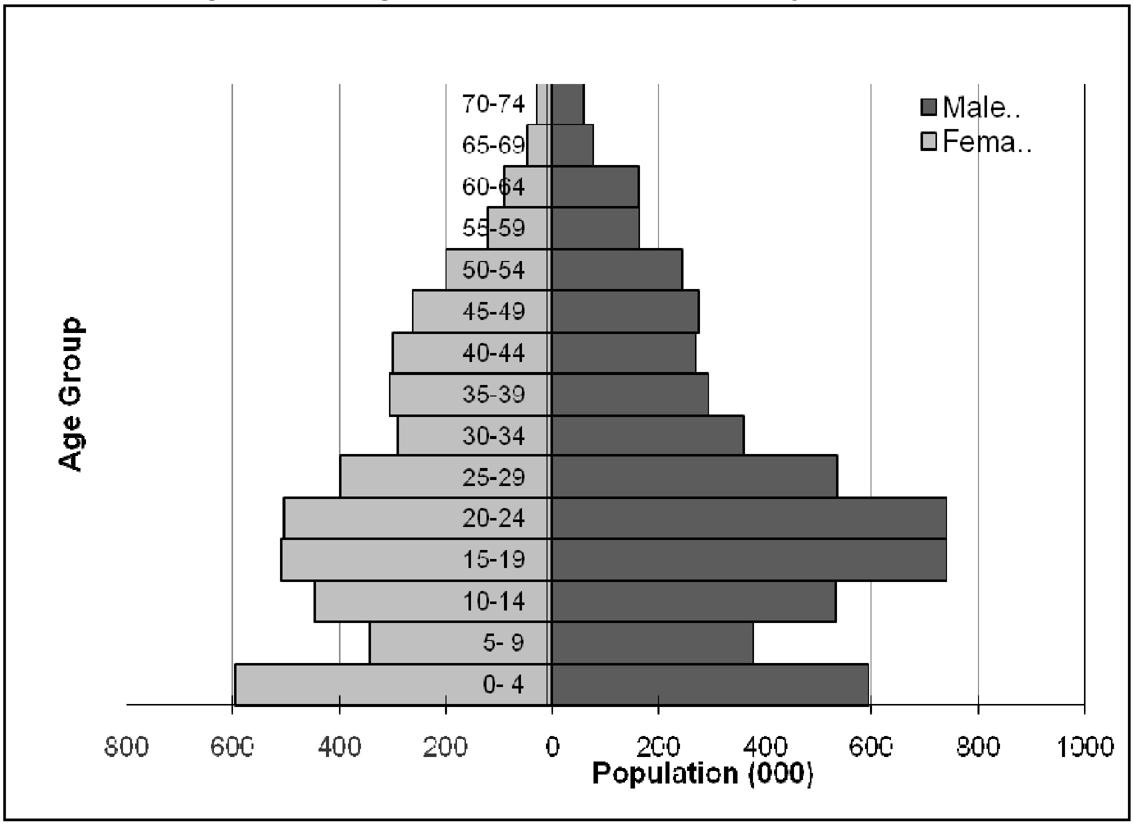
Source: Punjab Development Statistics 2010 and JICA Study Team

The net density plot clearly demonstrates that the population is mostly concentrated around the old city area in a concentric fashion, with the exception of linear developments along major arterial roads in the Study Area. The population in the mostly built up area around the city centre accounts for over 66 % of the Study Area population in approximately 10 % of the Study Area. This signifies that the population density in Lahore is still considerably lower than similar conurbation/ metropolis around the Asia region.

Figure 2.3.13 shows the age structure of the people living in the Study Area. Age groups 15-19 and 20-24 form the peak for both male and female due to the inflow of young students and workers into Lahore.

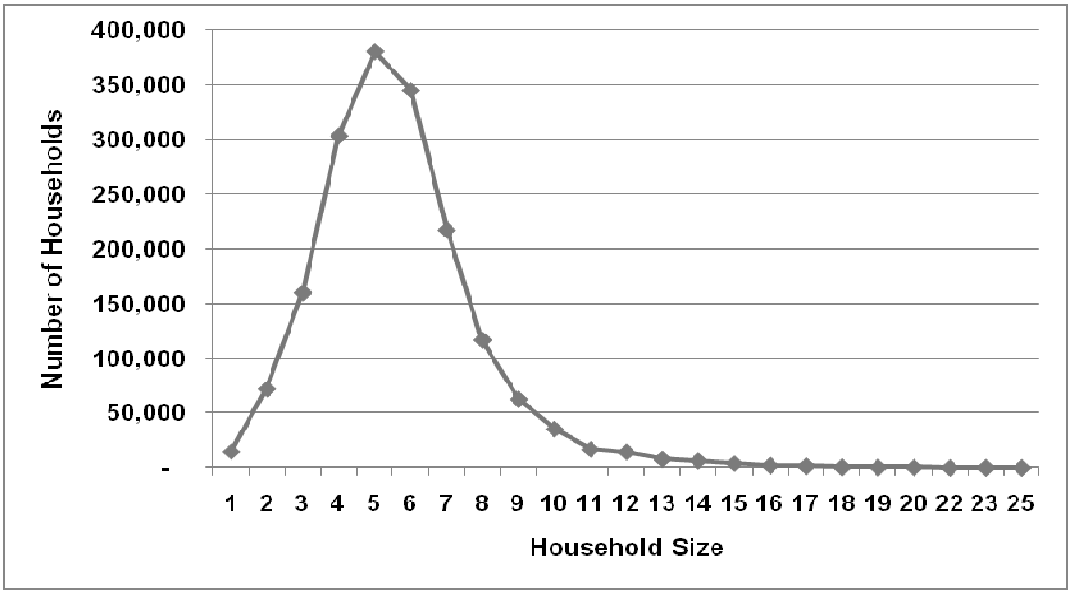
Figure 2.3.14 illustrates the distribution of household size in the Study Area. The average household size as of 2010 has been anticipated to be 5.62 persons per hundred.

Figure 2.3.13 Age Structure of Lahore 2010 Population



Source: JICA Study Team

Figure 2.3.14 Household Size Distribution of 2010 Population of Lahore



Source: JICA Study Team

2.3.5 Employment Distribution

The Punjab or city statistics do not provide data on employed residents (level of employment) in the Study Area. The analysis below is based on the Household Interview Surveys (HIS) conducted for the Study. The data relates to the residence of the employed persons. Table 2.3.8 summarises the employed residents by zone in the Study Area.

Table 2.3.8 The Study Area 2010 Employment by Zone of Residence ('000)

Town/ Tehsil		Primary	Secondary	Tertiary	Total
1	Ravi	5	40	248	293
2	Data Gunj Baksh	3	31	227	262
3	Samanabad	4	40	232	275
4	Shalamar	3	36	197	237
5	Gulberg	3	23	191	217
6	AzizB	5	24	145	174
7	Wagah	27	29	111	167
8	Nishter	27	52	171	251
9	Iqbal	19	39	194	252
10	Cantt	8	29	185	221
11	Ferozewala	27	33	86	146
12	Muridke	12	13	44	70
13	Sharaqpur	16	5	18	39
14	Kasur	8	5	26	40
15	Patoki	13	6	27	47
1-10	**Lahore District**	**103**	**343**	**1,902**	**2,348**
11-13	**LUTMP_SHK**	**54**	**51**	**149**	**254**
14-15	**LUTMP-Kasur**	**22**	**11**	**54**	**87**
1-15	**LUTMP Total**	**179**	**405**	**2,105**	**2,689**

Source: JICA Study Team

The employment participation rate (Number of employed persons/ Total population) in Lahore is estimated to be around 27 %. This figure is rather low, and the main reason being that most of the population is young, and is below the employment age group of 0 ~ 16 years. As anticipated, majority of the population is employed in tertiary sector, almost five times more than those employed in the industrial or manufacturing sector. This is significant to note that most of the Punjab provincial government offices are in Lahore, along with the banking, and other service sector employment. Distribution of employed residents by zone and employment sector is shown in Figure 2.3.15.

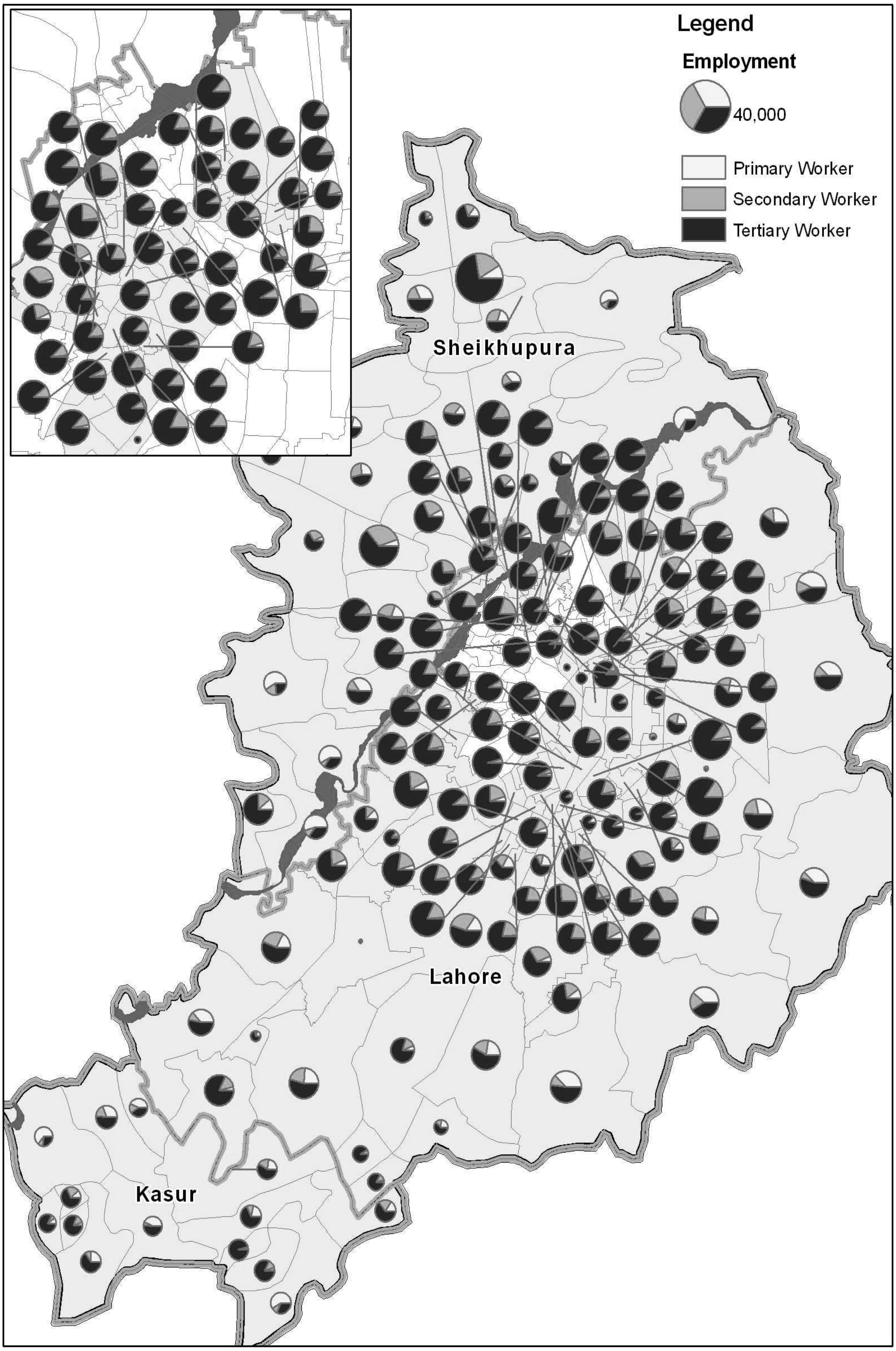
The unemployment level in the city remains very high, and exceeds those employed by about 27 %. The main conclusion to be drawn is that unemployment is almost 99 % among female residents. This is illustrated in Figure 2.3.16 for each zone in the Study Area and is summarised in Table 2.3.9.

Table 2.3.9 LUTMP 2010 Unemployed Residents by Zone of Residence (‘000)

District	Town / Tehsil	Unemployed
Lahore	Ravi Town	339.4
	Data Gunj Bakhsh Town	346.7
	Samanabad Town	353.5
	Shalamar Town	281.2
	Gulberg Town	262.4
	Aziz Bhatti Town	229.1
	Wagah Town	224.1
	Nishter Town	318.2
	Iqbal Town	328.0
	Cantonment	277.2
Sheikhupura	Ferozwala Tehsil	194.4
	Muridke Tehsil	91.0
	Sharaqpur Tehsil	27.5
Kasur	Kasur Tehsil	58.5
	Pattoki Tehsil	73.7
Lahore		2,959.8
Sheikhupura		312.9
Kasur		132.2
LUTMP	**The Study Area Total**	**3,404.9**

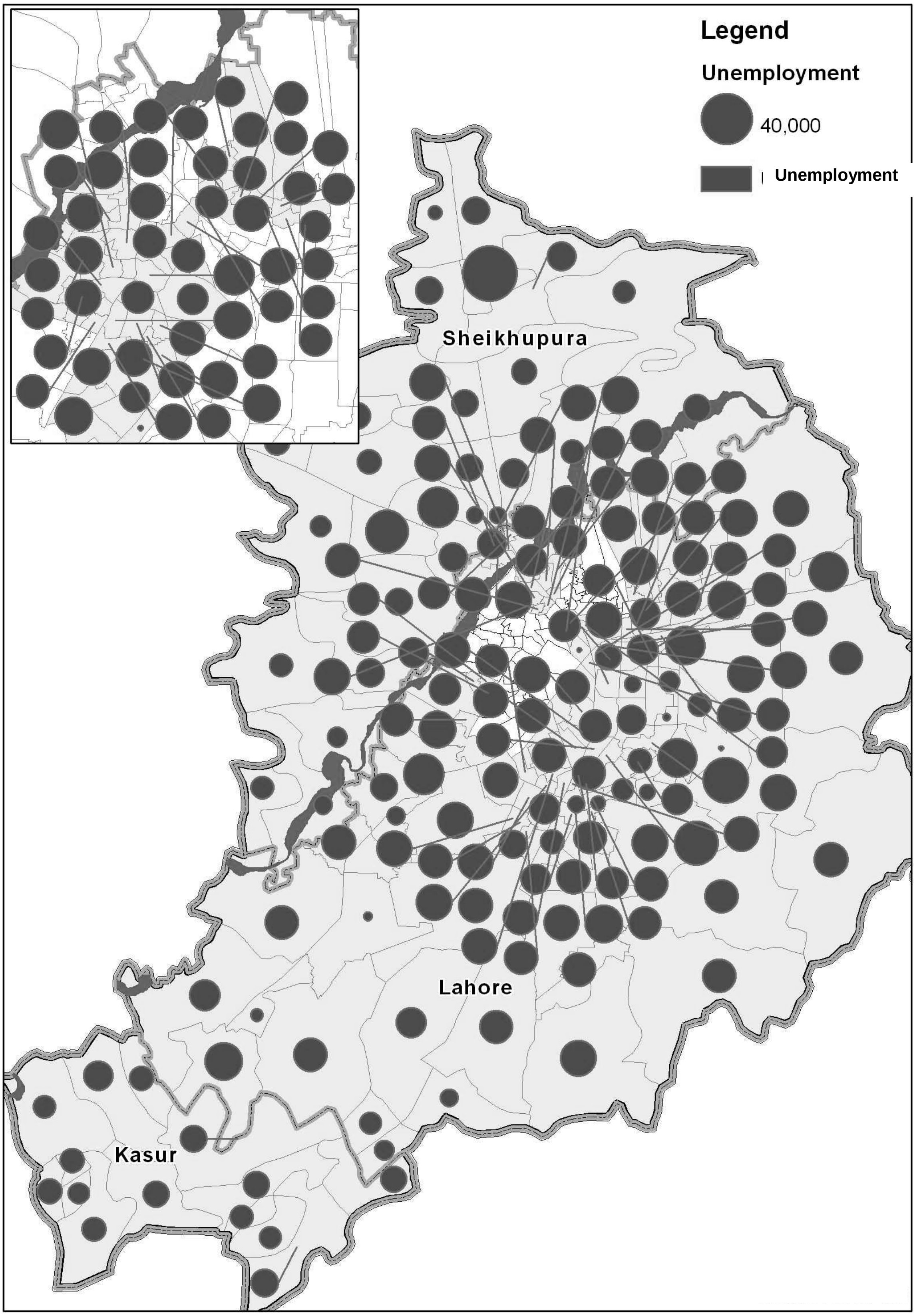
Source: JICA Study Team

Figure 2.3.15 LUTMP 2010 Zonal Employed Residents by Employment Sector



Source: JICA Study Team

Figure 2.3.16 LUTMP 2010 Zonal Un-employed Residents by Residence Zone



Source: JICA Study Team

2.3.6 2010 Vehicle Ownership in the Study Area

In the Study Area there are 1.77 million household, with an average household size of 5.62. The car ownership is highest in Cantonment (more than double of the Study Area) and stand at about 40 %. Gulberg and Iqbal towns have car ownership close to 30 % where as in the remainder of the Study Area it is lowest in the inner-city area towns, compared to larger towns on the outskirts. The car ownership in the areas of other two districts included in the Study Area is just over 10 %. The significant conclusion is that there are about 350,000 cars in the Study Area. Vehicle (cars and motorcycles) ownership in the Study Area is summarised in Table 2.3.10. The car owning households by the Study Area zones are shown in Figure 2.3.17.

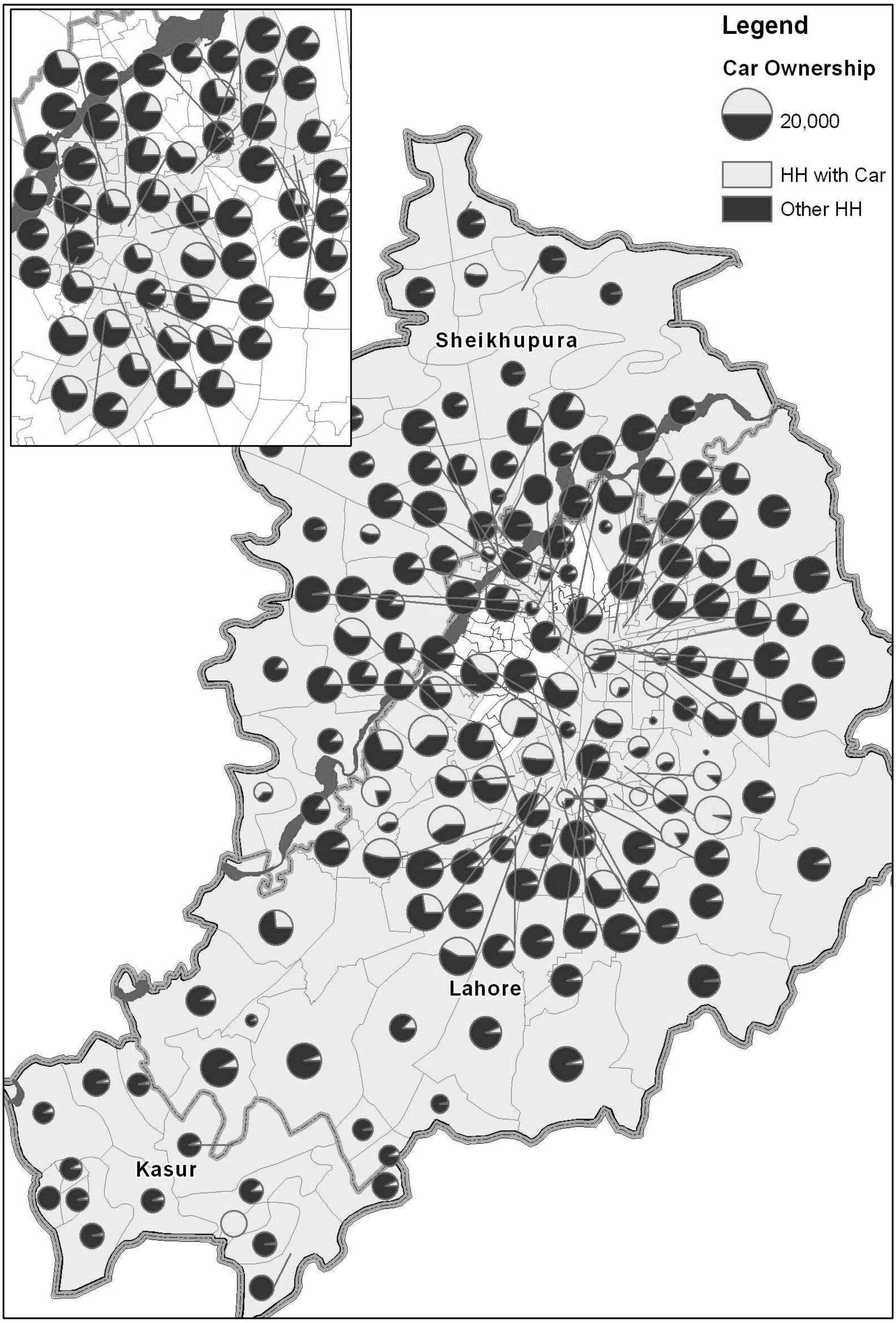
Table 2.3.10 LUTMP 2010 Vehicle (Car and Motorcycle) Owning Households

District	Town/ Tehsil	2010 Household (HH)					
		Total 2010 HH (000)	Car Owning HH (000)	% Car Owning HH	M/ Cycle Owning HH	% M/Cycle Owning HH	% Car and M/ Cycle Owning HH
Lahore	Ravi Town	172.8	13.1	7.6	80.9	46.8	54.4
	Data Gunj Bakhsh	173.4	30.9	17.8	90.1	52.0	69.8
	Samanabad Town	175.5	39.9	22.7	88.2	50.3	73.0
	Shalamar Town	144.7	18.3	12.6	75.1	51.9	64.5
	Gulberg Town	138.5	40.6	29.3	64.5	46.6	75.9
	Aziz Bhatti Town	121.6	20.2	16.6	60.5	49.8	66.4
	Wagah Town	106.8	7.4	6.9	46.2	43.3	50.2
	Nishter Town	161.9	14.4	8.9	66.2	40.9	49.8
	Iqbal Town	177.1	49.6	28.0	60.9	34.4	62.4
	Cantonment	161.3	64.2	39.8	54.4	33.7	73.5
Sheikhupura	Ferozwala Tehsil	98.4	8.8	8.9	34.7	35.3	44.2
	Muridke Tehsil	44.8	3.0	6.7	12.6	28.1	34.8
	Sharaqpur Tehsil	27.9	4.0	14.3	9.4	33.7	73.5
Kasur	Kasur Tehsil	28.1	6.4	22.8	5.8	20.6	43.4
	Pattoki Tehsil	33.2	1.8	5.4	8.2	24.7	30.1
Lahore		1,533.6	298.6	19.5	687.0	44.8	64.3
Sheikhupura		171.1	15.8	9.2	56.7	33.1	42.4
Kasur		61.3	8.2	13.4	14.0	22.8	36.2
The Study Area Total		**1,766.0**	**322.6**	**18.3**	**757.7**	**42.9**	**61.2**

Source: JICA Study Team

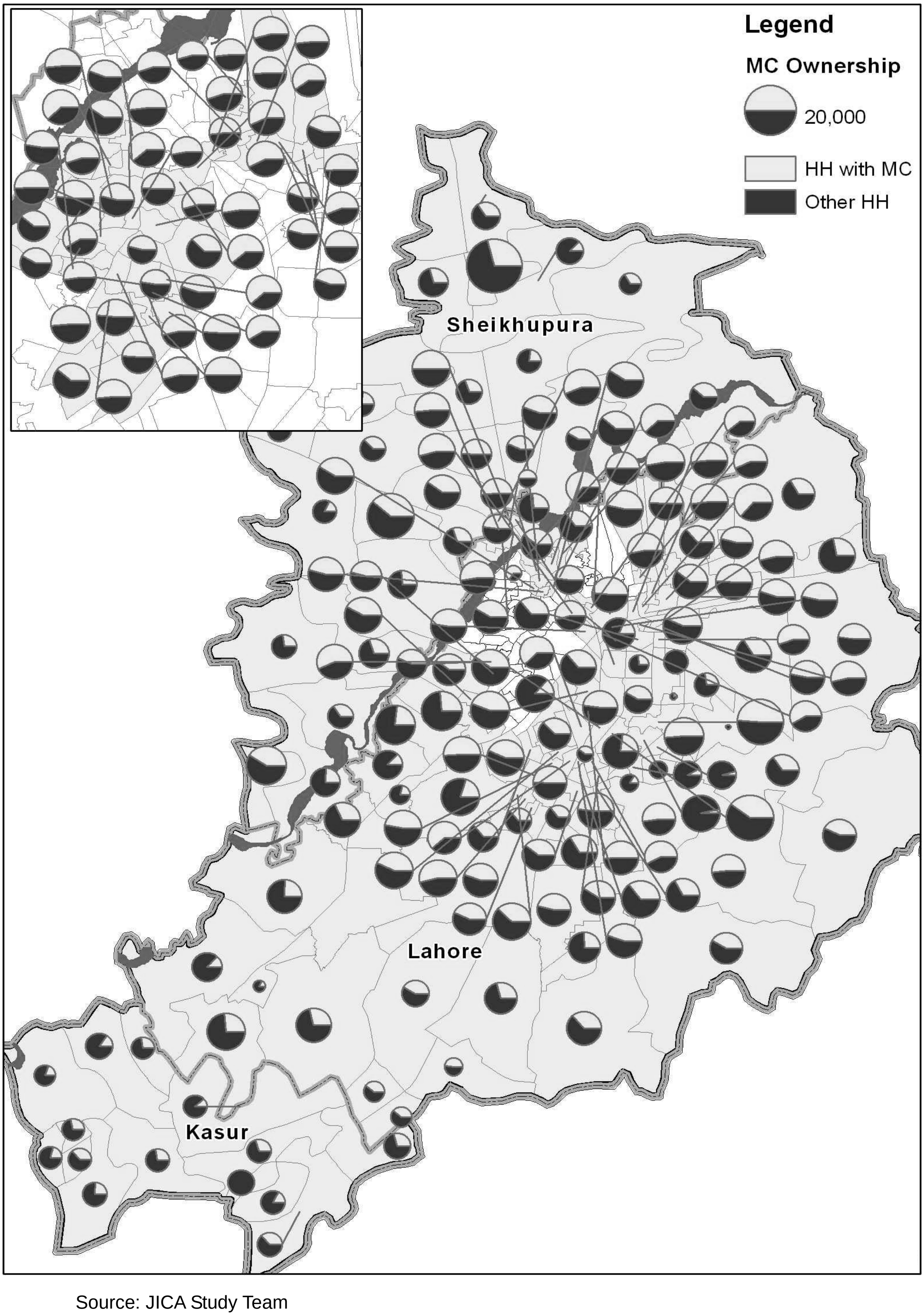
Motorcycle ownership in the Study Area exceeds 42 % of all households. The motorcycle ownership is more dominant in the inner city towns of Data Gunj Baksh, Samanabad and Shalamar towns, where it exceeds 50%. The motorcycle ownership is also dominant in the rural areas, as it is the only means of transport for the isolated villager and farmer. In Lahore around 45 % households are owning one or more motorcycles on average, and it is about 30% lower in Sheikhupura and about half in the district of Kasur. It is estimated that there are about 850,000 motorcycles in the Study Area. In total there are about 1.2 million vehicles in the Study Area. Figure 2.3.18 illustrates the motorcycle owning households by the Study Area zones.

Figure 2.3.17 LUTMP 2010 Car Owning Households by Zone



Source: JICA Study Team

Figure 2.3.18 LUTMP 2010 Motorcycle Owning Households by Zone

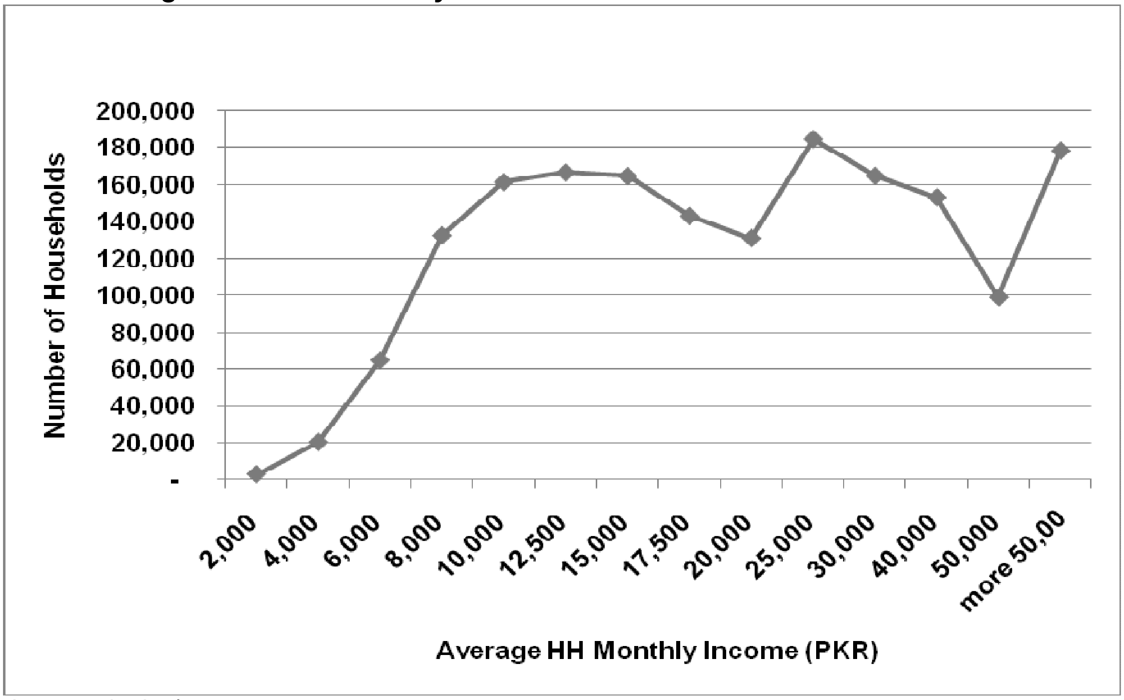


Source: JICA Study Team

2.3.7 Household Income

One of the key factors in trip making is the household income. The HIS recorded income in a number of ranges from less than PKR 2,000 per month to those earning more than PKR 50,000 per month. The income distribution of the Study Area is shown in Figure 2.3.19.

Figure 2.3.19 The Study Area 2010 Household Income Distribution



Source: JICA Study Team

Table 2.3.11 presents the household income results of HIS. The data has been aggregated into three income groups: low, medium and high. It is interesting to note that there are similar number of households in low and high income groups (381,000 ~ 22 %) and 430,000 ~ 24 %).

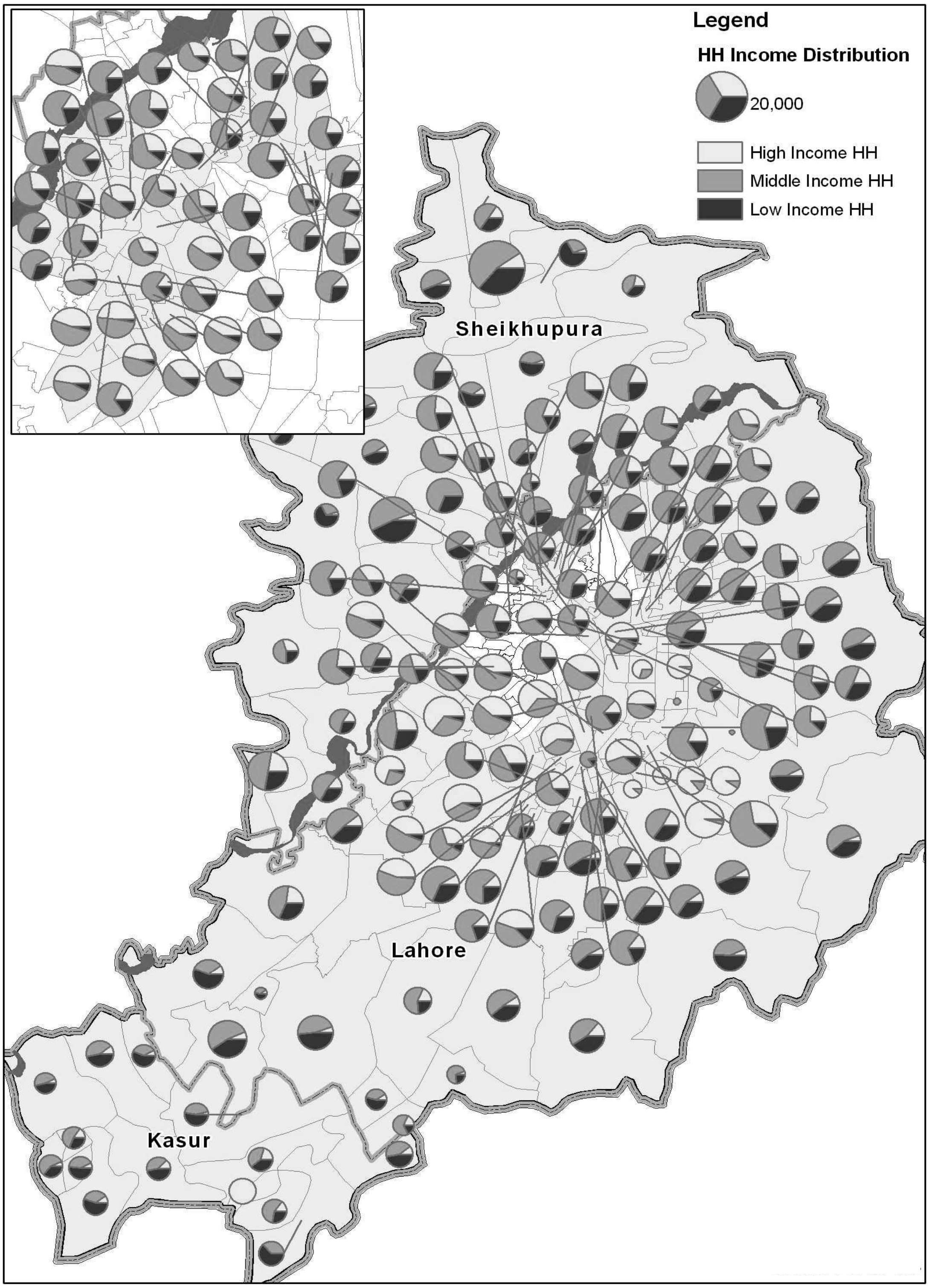
The middle income group accounts for just over 54 % of all households, with an average income of around PKR 20,000 (USD 250) per month. When converted to income per capita, it amounts to just over PKR 3,500 per month or USD 1.4 per day per person, rather low income on per capita basis by international standards. However, when compared with Pakistan GDP per capita, it shows that the survey results are quite consistent.

Household income varies considerably between areas of Lahore. Highest income group lives in Cantonment, where high income group amounts to 44 % of households. The other richer areas are Gulberg and Samanabad. As anticipated, the outskirt areas (mostly rural Wagah and Nishtar towns) have lowest proportion of high income household.

Household income in the areas of two adjoining districts is lower than those of Lahore. In both of these districts the high income group is less than 20 % of the total households, with Kasur being the poorer of the two districts.

The complete household distribution by income groups, by Towns/ Tehsils is summarised in Table 2.3.11 and illustrated by zone in Figure 2.3.20.

Figure 2.3.20 LUTMP 2010 Household Income Distribution by the Study Area Zone



Source: JICA Study Team

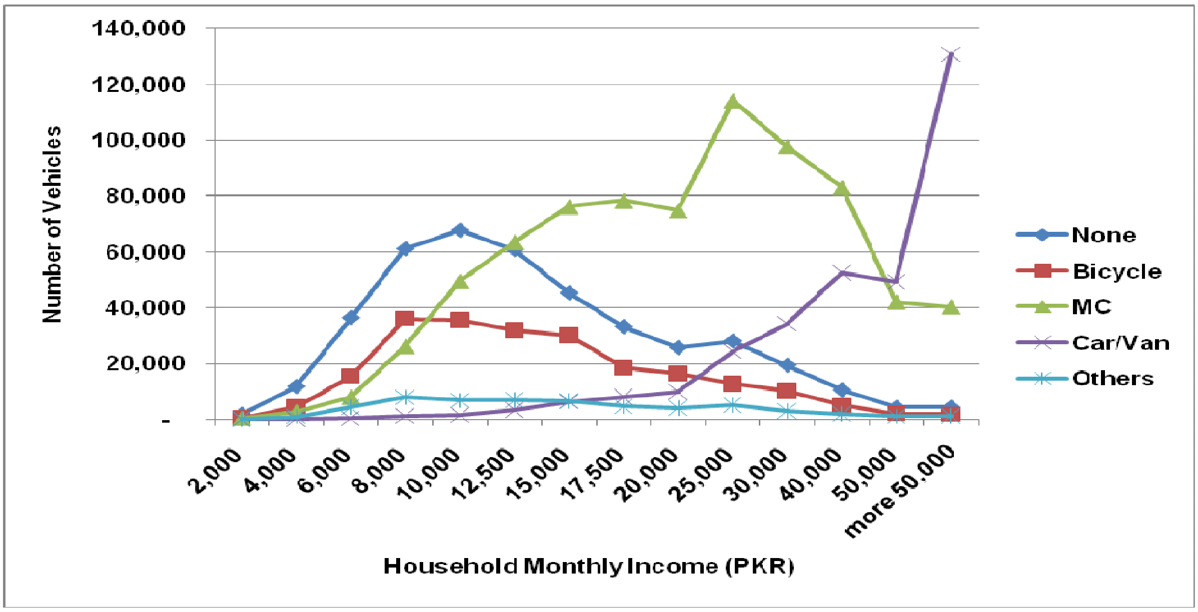
Table 2.3.11 LUTMP 2010 Household Income Distribution by Town/ Tehsil

District	Town / Tehsil	Low Income (< =PKR 10,000/m)		Middle Income (> PKR10,000 & < =30,000/m)		High Income (>PKR 30,000/m)		Total Household (000)
		HH (000)	% in Area	HH (000)	% in Area	HH (000)	% in Area	
Lahore	Ravi Town	34.4	20	106.6	62	31.8	18	172.8
	Data Gunj Bakhsh	25.1	14	105.4	61	43.0	25	173.4
	Samanabad	20.0	11	96.6	55	59.0	34	175.5
	Shalamar Town	25.6	18	87.9	61	31.3	22	144.7
	Gulberg Town	10.6	8	74.9	54	53.1	38	138.5
	Aziz Bhatti Town	29.9	25	69.0	57	22.6	19	121.6
	Wagah Town	35.4	33	58.9	55	12.5	12	106.8
	Nishter Town	50.9	31	89.5	55	21.5	13	161.9
	Iqbal Town	39.1	22	84.4	48	53.5	30	177.1
	Cantonment	18.6	12	71.8	45	70.3	44	161.3
Sheikhupura	Ferozwala Tehsil	39.3	40	48.8	50	10.3	10	98.4
	Muridke Tehsil	18.4	41	21.8	49	4.6	10	44.8
	Sharaqpur Tehsil	7.9	28	14.3	51	5.7	20	27.9
Kasur	Kasur Tehsil	10.6	38	10.1	36	7.5	27	28.1
	Pattoki Tehsil	15.5	47	14.5	44	3.3	10	33.2
Lahore		289.6	19	845.0	55	399.1	26	1,533.6
Sheikhupura		65.6	38	84.9	50	20.6	12	171.1
Kasur		26.1	43	24.6	40	10.8	18	61.3
The Study Area Total		**381.3**	**22**	**954.5**	**54**	**430.5**	**24**	**1,766.0**

Source: JICA Study Team

Household income has a strong relationship with household vehicle ownership as revealed by Figure 2.3.21. Car is owned more as income level goes up. Motorcycle seems to be suitable for middle- to high-income households with a monthly income of PKR 20 to 50 thousand.

Figure 2.3.21 Household Income Distribution by Vehicle Ownership, 2010



Source: JICA Study Team

2.3.8 Social Increase of Population by Income Level and by Zone of Destination

The assessment of population behaviour to move home was also studied through HIS, by asking household their previous address, and how long ago they moved. The analysis reported below summarises the population which moved home within the last five or ten years, by low and high income groups. This is a preliminary analysis, with respect to population movement from outside or within the Study Area to the Study Area only. The analysis from where the population moved form will be subject of further analysis, at a later date.

The low income households (those earning <= PKR 10,000 /month) who moved home within the last five or ten years to the Study Area Town/ Tehsil are summarised in Table 2.3.12. Close to one third of all low income households moved home to the Study Area over the last ten years, whereas, those who moved within the last five years is about one-fifth of all low income households. This amounts to about 4 % of total households of the Study Area. The area-wide distribution of households which moved to the Study Area is above 30 % for most areas of Lahore Towns and adjoining areas of Sheikhupura District. In case of Kasur District the low income household movement is close to half of all those who moved in the Study Area. This would illustrate that the tendency of low income household to move, is to the areas in concentric fashion around city centre, and as adjoining Tehsil areas of Pattoki and Kasur are farther away, the migration is much lower than the adjoining Tehsils of Sheikhupura District.

The low income households who moved over the last 5 or 10 years are also shown at zonal level in Figure 2.3.22 below. The five and ten year movement figures below, clearly depicts the low income household growth areas over the past five to ten years are mostly around (say within 10~20km radius) central Lahore, and very much limited to the outskirts, to the east and west/ south-west of Lahore.

By comparison, household with high income (Household’s earning > PKR 30,000 /month) have more tendency to move homes. Table 2.3.13 provides a summary of all high income households which moved home over the last five or ten years, with destination in the Study Area Towns or Tehsils. The favourite destination towns for high income group were urban area of Cantonment, and rather greener outskirt towns of Aziz Bhatti and Iqbal Towns in Lahore District. The adjoining areas of Kasur Tehsil also attracted more than 50 % of household, of high income households who moved, albeit the numbers are rather small and account for less than 0.3 % of total households of the Study Area. Overall 56 % of all high income households moved home over the last 10 year. This illustrates a considerable movement of households with changing economic and job environment.

Table 2.3.12 LUTMP 2010 Low Income Household Who Moved Home over the Last 5 or 10 Years to the Study Area

District	Town / Tehsil	Low Income HH who moved within last 5 years		Low Income HH who moved within last 10 years		Total Low Income HH (000)
		HH (000)	% of Total Low Income HH	HH (000)	% of Total Low Income HH	
Lahore	Ravi Town	6.3	18	12.4	36	34.4
	Data Gunj Bakhsh	5.3	21	7.6	30	25.1
	Samanabad Town	5.0	25	7.5	38	20.0
	Shalamar Town	4.1	16	6.3	25	25.6
	Gulberg Town	2.1	20	3.5	33	10.6
	Aziz Bhatti Town	6.5	22	10.7	36	29.9
	Wagah Town	6.5	18	11.1	31	35.4
	Nishter Town	9.8	19	16.3	32	50.9
	Iqbal Town	7.8	20	13.0	33	39.1
	Cantonment	5.1	27	6.5	35	18.6
Sheikhupura	Ferozwala Tehsil	7.6	19	12.3	31	39.9
	Muridke Tehsil	3.7	20	6.0	33	18.4
	Sharaqpur Tehsil	1.5	19	1.9	24	7.9
Kasur	Kasur Tehsil	1.0	9	1.6	15	10.6
	Pattoki Tehsil	1.5	10	2.7	17	15.5
Lahore		58.5	20	94.9	33	289.6
Sheikhupura		12.8	20	20.2	31	65.6
Kasur		2.5	10	4.3	16	26.1
The Study Area Total		**73.8**	**19**	**119.4**	**31**	**381.3**

Source: JICA Study Team

The zonal distribution of low and high income group households who moved over the last five or ten years are shown in Figures 2.3.22 and 2.3.23 respectively, for both five and ten years. The majority of the movement of high income group households have been to DHA Lahore, Cantonment and areas along the Canal (various very high-end income gated communities) and also the areas of Raiwind. Some areas of DHA and along the Canal show that all the movement is over the last ten years and the entire household who moved are from high income group. Additionally, it can also be seen that during the period of five to ten years how the movement of high income household is static in some areas, particularly to the south-west direction.

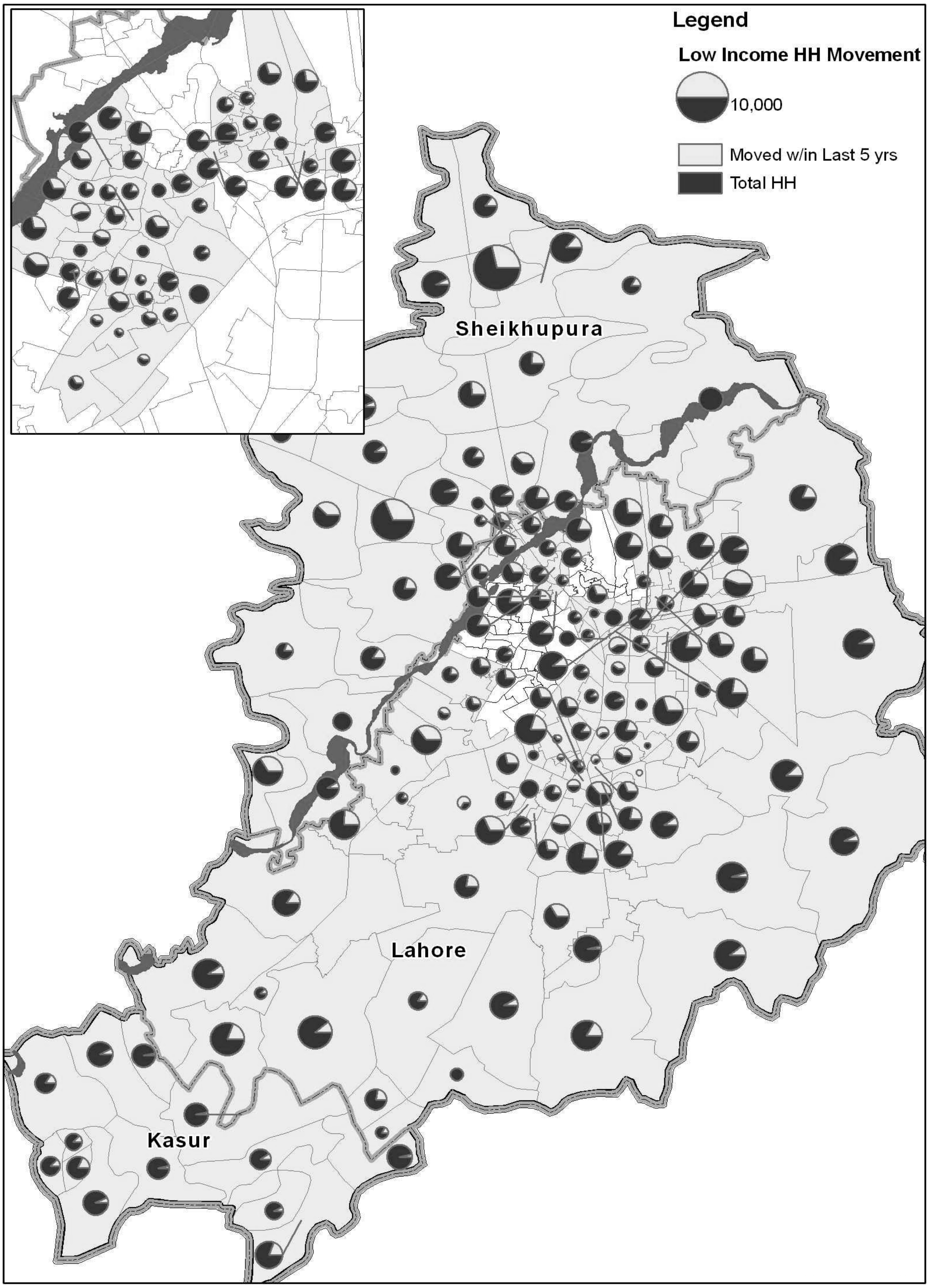
Table 2.3.13 LUTMP 2010 High Income Household Who Moved Home over the Last 5 or 10 Years to the Study Area

District	Town/ Tehsil	High Income HH who moved within last 5 years		High Income HH who moved within last 10 years		Total High Income HH (000)
		HH (000)	% of Total High Income HH	HH (000)	% of Total High Income HH	
Lahore	Ravi Town	3.5	11	6.9	22	31.8
	Data Gunj Bakhsh	5.2	12	8.4	20	43.0
	Samanabad Town	13.2	22	20.2	34	59.0
	Shalamar Town	4.2	13	8.4	27	31.3
	Gulberg Town	7.5	14	13.0	24	53.1
	Aziz Bhatti Town	6.6	29	11.5	51	22.6
	Wagah Town	2.3	18	3.7	30	12.5
	Nishter Town	3.8	18	6.7	31	21.5
	Iqbal Town	16.1	30	28.6	53	53.5
	Cantonment	23.1	33	36.1	51	70.8
Sheikhupura	Ferozwala Tehsil	1.2	12	1.7	17	10.3
	Muridke Tehsil	0.3	7	0.9	20	4.6
	Sharaqpur Tehsil	0.6	11	0.8	14	5.7
Kasur	Kasur Tehsil	4.3	57	5.0	67	7.5
	Pattoki Tehsil	0.3	9	0.5	15	3.3
Lahore		85.5	21	143.5	36	399.1
Sheikhupura		2.1	10	3.4	17	20.6
Kasur		4.6	43	5.5	51	10.8
The Study Area Total		92.2	21	152.4	35	430.5

Source: JICA Study Team

Figure 2.3.22

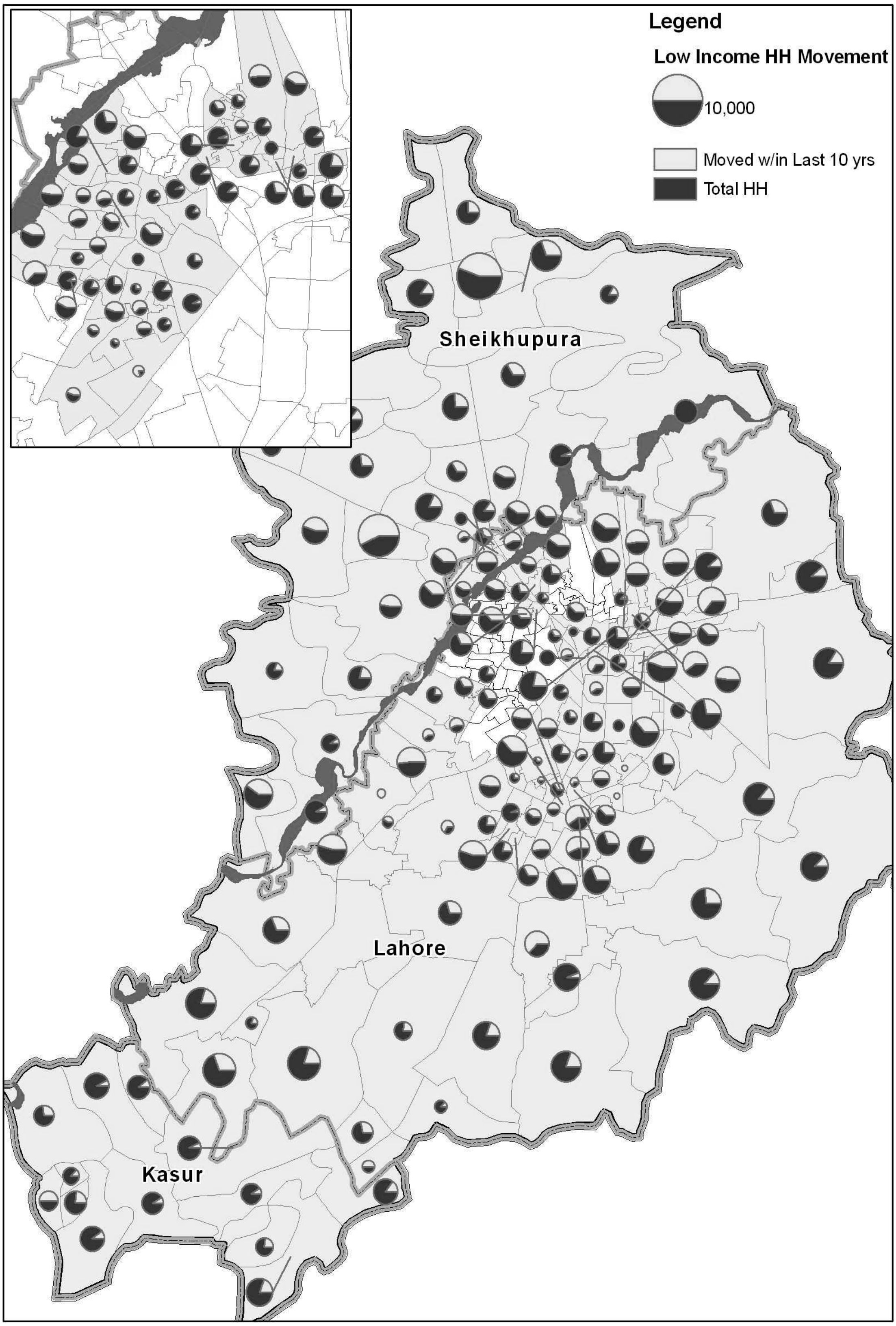
Low Income Household Movement by HIS Zone over the last 5 and 10 Years <5 years>



Source: JICA Study Team

Figure 2.3.22

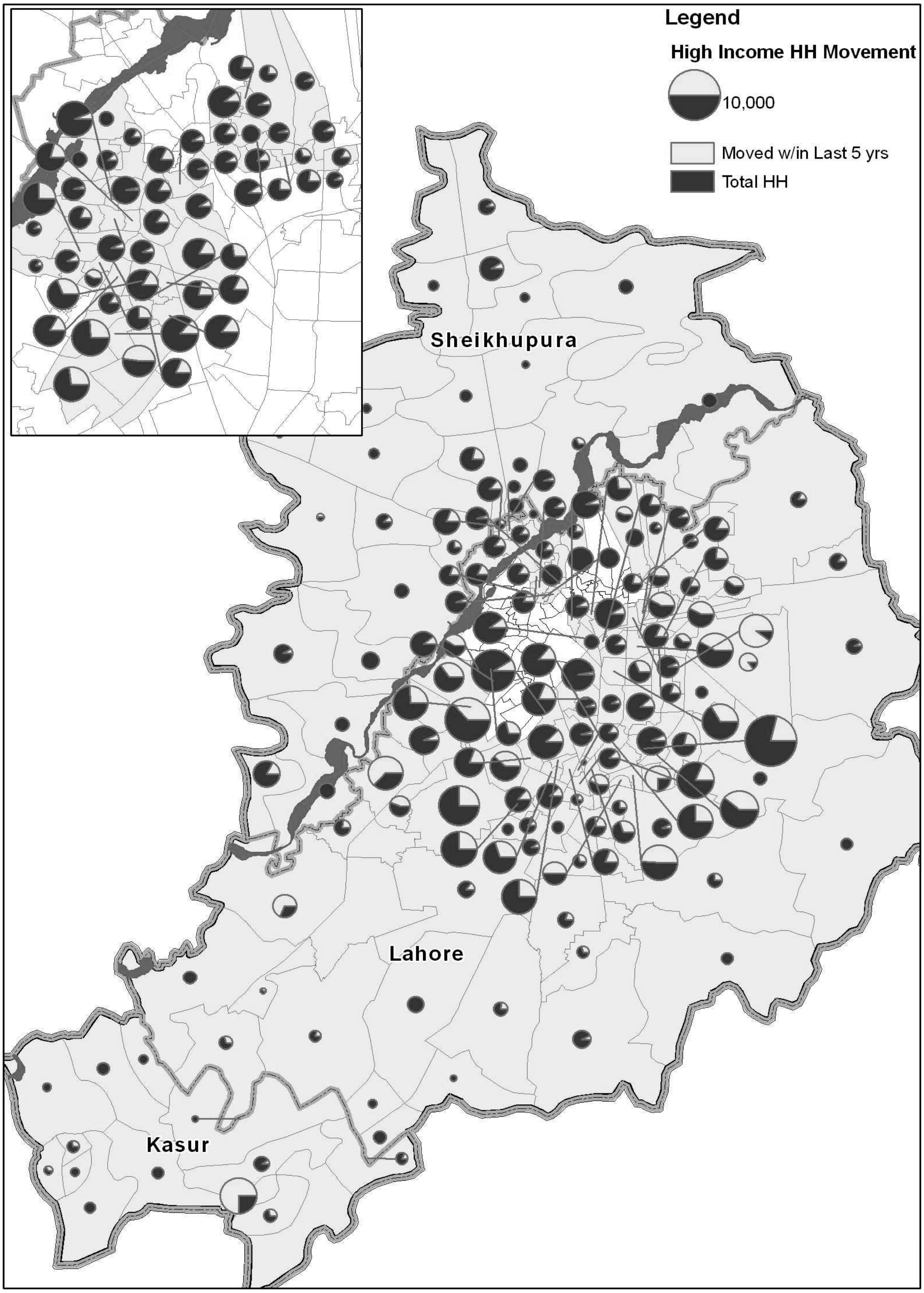
Low Income Household Movement by HIS Zone over the last 5 and 10 years <10 Years>



Source: JICA Study Team

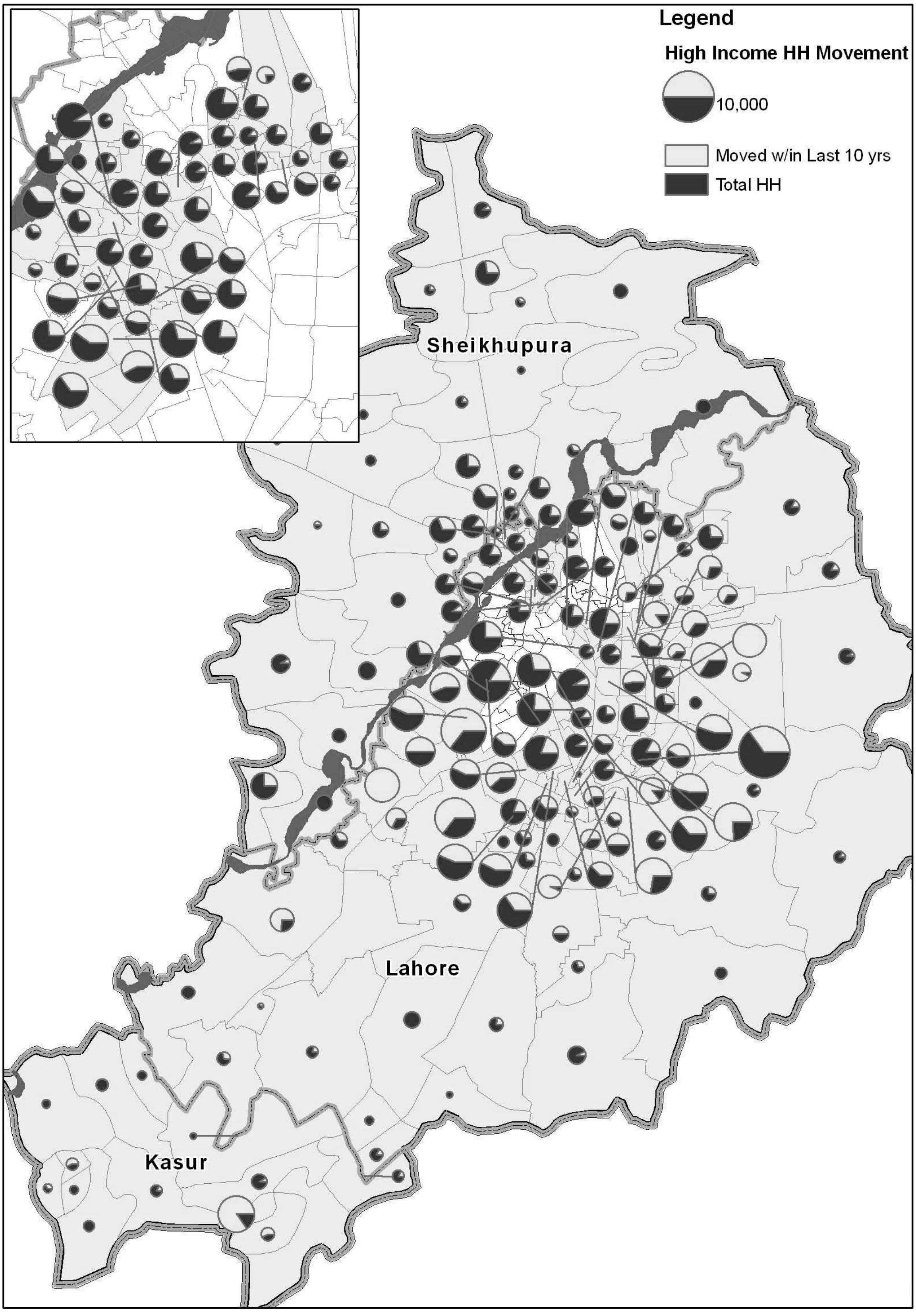
Figure 2.3.23

High Income Household Movement by HIS Zone over the last 5 and 10 years <5 years>



Source: JICA Study Team

Figure 2.3.23
High Income Household Movement by HIS Zone over the last 5 and 10 years <10 years>



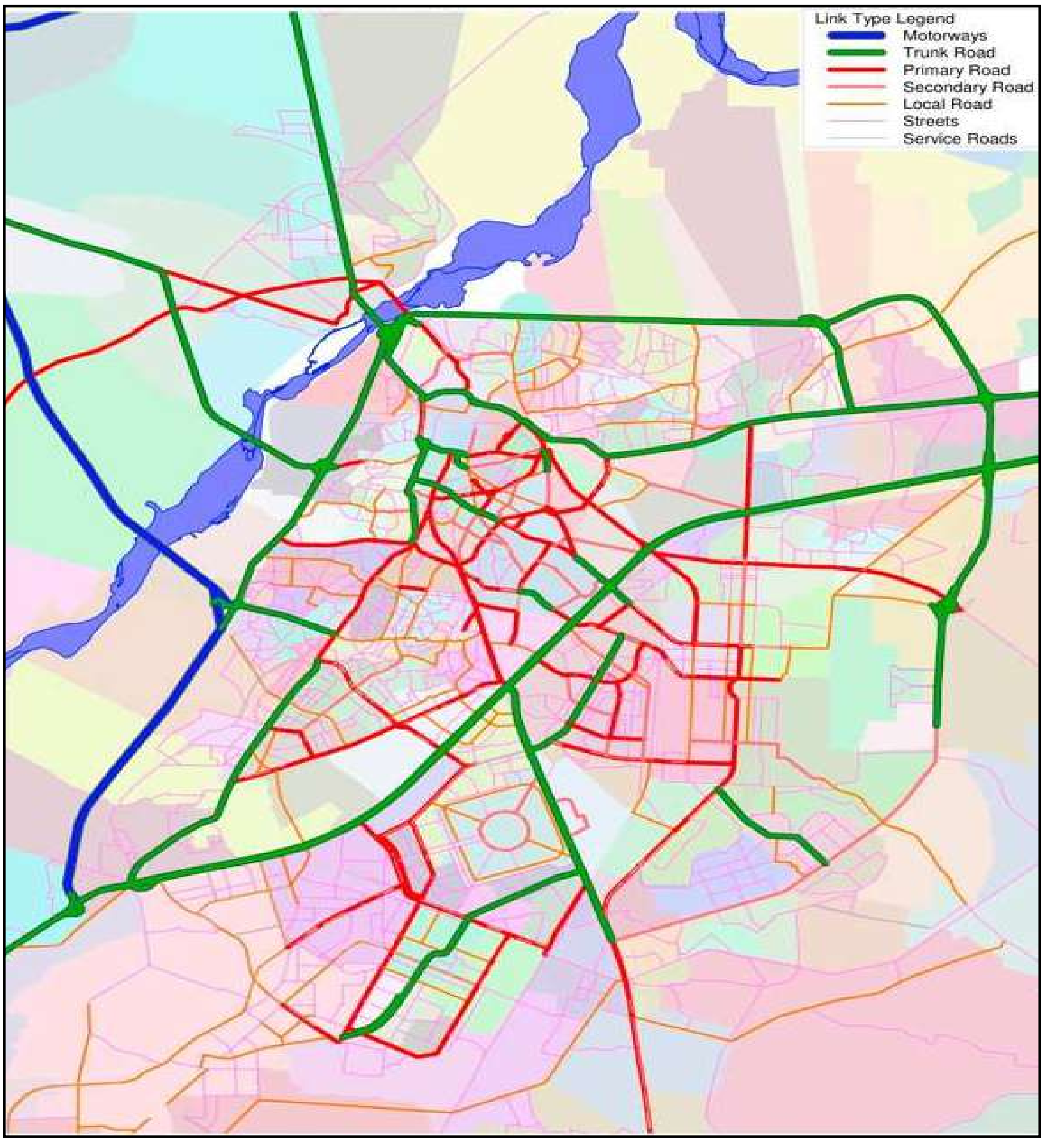
Source: JICA Study Team

2.4 Transport System of Lahore

2.4.1 Road Network

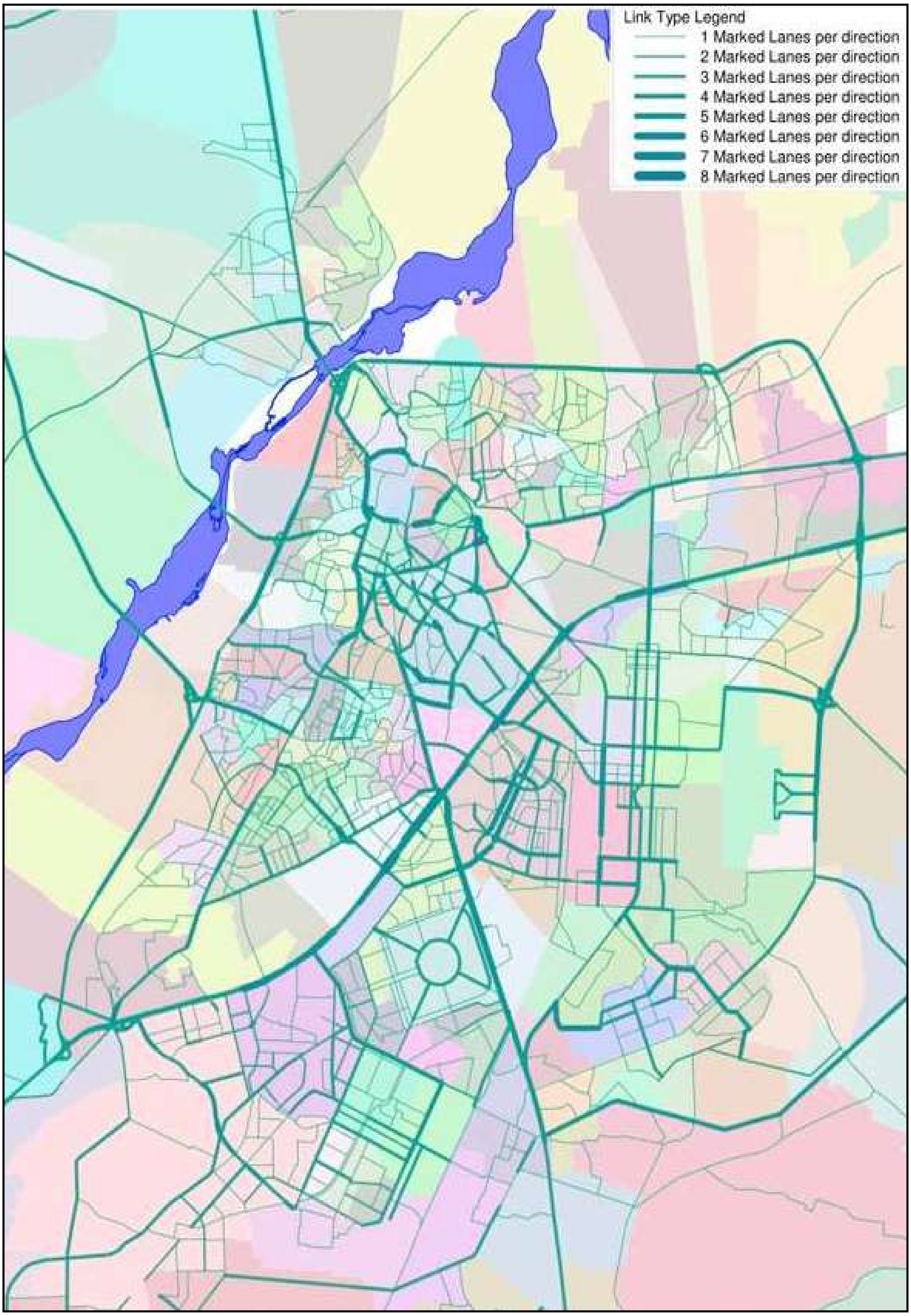
A Road Inventory Survey (RIS) was undertaken for this study and the results were used to build a complete picture of the Study Area road network. A highway network model was built and the results are shown in Figure 2.4.1, with the various road types classified by their function in the road hierarchy. Figure 2.4.2 presents the road network expressed in terms of number of lanes (by direction). The road network is relatively well developed in Lahore. At the same time, however, it is observed that road development did not take place evenly by area and a number of bottlenecks were observed.

Figure 2.4.1 Lahore Study Area Surveyed Road Network as Defined by Agencies



Source: Road Classification as By Different Agencies

Figure 2.4.2 Lahore Study Area Road Network by Number of Lanes



Source: JICA Study Team

The RIS surveyed 64km of Motorways, about 430 km of Trunk and Primary Roads and other road lengths as specified in the table below.

Table 2.4.1 Surveyed Road Lengths from RIS

Road Class	Length Surveyed (km)
Motorway	64
Trunk Road	230
Primary Road	200
Secondary Road	55
Local Road	265
Streets and Rural Roads	1,447
Service Road	386
Total	2,647

Source: JICA Study Team

2.4.2 Road Transport

(1) Road Transport Modes in Lahore

In general, Lahore has better road infrastructure than other major cities of the Punjab. The roads are wide and several underpasses and flyovers have been constructed, except for the city center and "Walled City" areas. The central areas cause major traffic jams, resulting in longer travel time for all travellers in central areas of Lahore.

In addition to private vehicles such as motor cycles, cars and trucks, the public transport modes of Lahore include:

- Public buses, large and medium size
- Mini buses (Delivery Vans), Mini-vans called 'Wagons'
- Auto Rickshaws, Qingqis (a motorcycle driven Rickshaw)
- Taxis, and
- Horse Drown carriages and hand pulled Carts

Many auto rickshaws are being changed from 2-stroke-cyle to 4-stroke-cyle engines and from petrol to Compressed Natural Gas (CNG) operation to reduce air and noise pollution in the city.

Figure 2.4.3 Traffic Congestion at Qartaba Chowk (Intersection) in the Central Lahore

Source: JICA Study Team

Figure 2.4.4 Motorcycle Rickshaw (Qingqi) at Fort Road

Source: JICA Study Team

Figure 2.4.5 Donkey Cart at an Intersection in Central Area

Source: JICA Study Team

(2) Bus Services

Several bus companies operate in Lahore. Premier Bus Services, owned by the Beacon House Group, was started in 2003. It provides premium transportation services to the general public of Lahore, with hundreds of buses running on exclusive routes. This is the largest public transport service provider in Lahore. The buses are in the process of being converted to CNG for environmental and economic reasons.

Daewoo City Buses provide intra-city and inter-city transport for the masses. Though these buses are fewer in number, they are air conditioned and provide better comfort to passengers. In addition to these two major companies, there are several other smaller companies (New Khan Metro, Niazi etc.) that provide services within Lahore. These cover only particular routes and are limited in number. The urban bus operation is regulated through LTC, setup by the GoPb.

Figure 2.4.6 Daewoo Intra-City Bus Terminal

Source: JICA Study Team

(3) Motorization

In 2008, 1.9 million motorized vehicles were registered in Lahore District. Lahore has witnessed a number of transport problems due to somewhat rapid motorization. In fact, motorization in Lahore is acute. The number of registered vehicles in Lahore District sharply increased by 294 % between 2001 and 2008, higher than the provincial motorization trend, i.e., 212 % during the same period. Among vehicle types, Lahore citizens nowadays show a strong preference for motorcycles, which increased at much faster rate, by 483 % during the same period and accounted for 136 units per 1,000 residents in 2008. This rapid growth is illustrated in Figures 2.4.7 and 2.4.8.

Table 2.4.2 below shows the number of registered vehicles with District Regional Transport Authority (DRTA), for all districts of Lahore division. Around 1,950,000 vehicles are registered within the Lahore district area, to be compared with only 34,000 and 52,000 for Kasur and Sheikhupura. Motorcycles make up for more than half (56 %) of all registered vehicles, while cars represent one third of registered vehicles in Lahore.

Due to such rapid rate of motorization, the number of motorized vehicles per 1,000 residents substantially increased from 95 vehicles in 2001 to 238 vehicles in 2008.

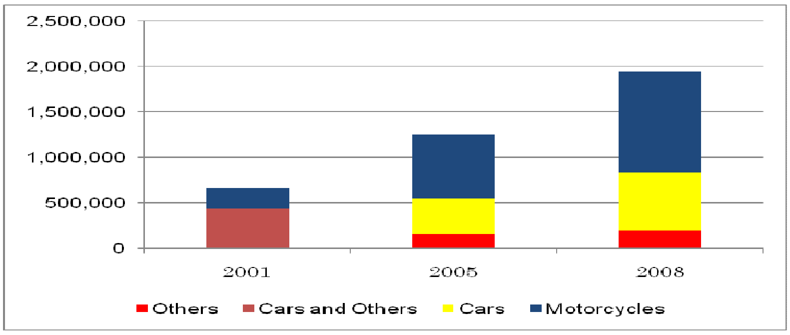
International experiences imply that such sharp trend may not continue for a long period. Compared with advanced Asian cities such as Tokyo and Seoul, vehicle ownership in Lahore has already reached the saturation range over 200 vehicles per 1,000 residents. However, Lahore differs from these cities in vehicle composition; motorcycles are dominant in Lahore with a 57 % share, while passenger cars are dominant in Tokyo and Seoul with a marginal role of two wheelers.

Table 2.4.2 Number of Motor Vehicles ('000) 'Registered' as of 30th June 2008

Registered Vehicle Type	Districts				Lahore Division Total
	Lahore	Kasur	Nankana Sahib*	Sheikhupura	
Cars, Jeeps and Wagons	638	0	0	4	642
Motorcycles	1,110	6	2	21	1,140
Trucks	16	0	0	1	17
Delivery Vans	40	0	0	0	41
Buses	33	0	0	1	34
Taxis	12	0	0	0	12
Auto-Rickshaws	66	1	0	2	70
Tractors	29	26	0	23	77
Others	1	0	0	0	2
Total	1,945	34	3	52	2,034

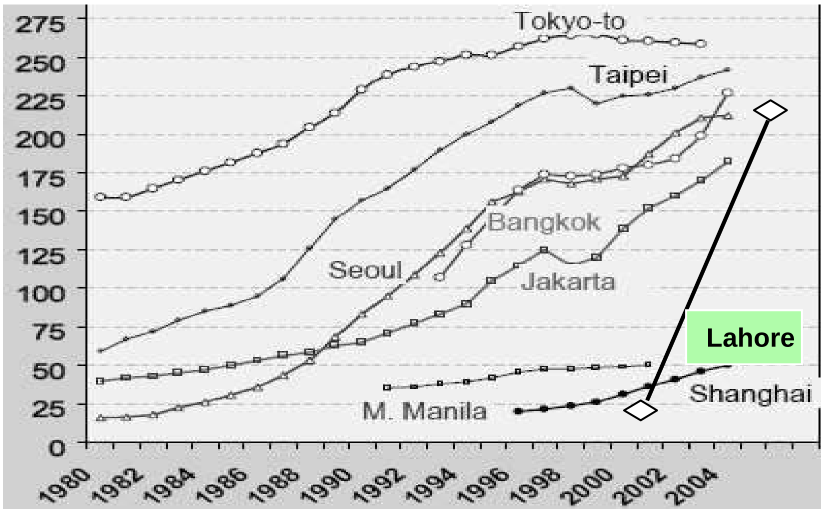
*Note: Nankana Sahib became a District in 2008
Source: Punjab Development Statistics, 2009

Figure 2.4.7 Trend in Registered Motorized Vehicles in Lahore District



Source: Punjab Development Statistics

Figure 2.4.8 Motorization Experiences in Selected Asian Cities



Note: Number of vehicles per 1,000 residents
Source: Sustainable Transport in East Asian Megacities (STREAM), 2007 except Lahore

Two-wheeler patronage may shift to public transport usage with the provision of attractive public transport services and the imposition of stricter policies to two wheelers such as a local ban on riding two wheelers within Central Business Districts (CBDs), as China did this in late 1990s. On the other hand, a shift from two wheelers to private cars may happen only when considerable income increase occurs.

(4) Traffic Management

Road safety is declining as revealed by the increase in number of fatalities per year from 100 in 1990 to over 400 nowadays. Vulnerable road users are more exposed to traffic fatalities, including 30 % pedestrian, 10 % cyclist and 8 % motorcyclists due to inadequate walkways and cycle routes[2]. Recent introduction of segregated highways within the city environment has lead to severe severance, without adequate provision for road crossing for residents, particularly in dense urban areas, resulting in such high pedestrian fatalities.

Table 2.4.3 Road Traffic Accidents and Casualties, Lahore

Year	Accidents			Casualties		
	Total	Fatal	Non-fatal	Total	Killed	Injured
2005	806	394	412	982	432	550
2007	759	443	316	1,003	455	548

Source: Punjab Development Statistics, 2007 and 2009

Intersections/ Junctions: There are four major types in Lahore city: grade separation, intersections with traffic signals, roundabouts and priority / uncontrolled junctions. Each type has pros and cons in terms of traffic management. Intersections with traffic signals can cope with heavy flows with small turning movements. In Lahore, however, traffic police is assigned at major intersections to ensure smooth traffic flows. It is reported that an area-wide traffic control system by means of synchronizing traffic signals and central signal control and management within a certain urban area has not been introduced yet.

Other Traffic Management Issues: They are restriction and rationalization of on-street parking, restricting roadside encroachment by vendors and allocating safe and comfortable pedestrian sidewalks and crossings. Those issues do not necessarily address to capital-intensive infrastructure development. Instead, institutional coordination among relevant government agencies and public involvement and awareness are keen to improve the situations for efficient and safe road space utilization.

ITS solutions: may become more attractive in the city. Possible options are Electronic Toll Collection (ETC) and vehicle On Board Unit (OBU) with wireless transaction or touch-less smartcard for ticketing to smooth traffic flow, car navigation services through OBU and message sign board, efficient transfer between public transport modes and between car

[2] Final Report, Assessment of Capacity and Capacity Building Institutions in the Development Policy Loan Sectors

parking and public transport use (park-and-ride) by smartcard, and so on.

2.4.3 Road-based Public Transport

(1) Introduction

The population of Lahore nearly doubled in 20 years and quadrupled in 40 years, from 2.6 million in 1972 to 5.4 million in 1991 and 9.7 million people today, which represents a 3 % growth per annum since 1991. In the meantime, the vehicle growth reached 17 % per annum between 2004 and 2008 in Lahore. Around 2 million vehicles are estimated to ply the roads of Lahore, majority of these being motorcycles, cars and relatively few buses, taxis and rickshaws.

(2) Historic Trends

Before Independence

As Pakistan gained independence from the British Empire in 1947, the First Five Year Plan (1955-1960) recognized that the most valuable asset of Pakistan was the railways built under the British Rule. Karachi is connected by railway since 1861, and Lahore since 1865. Around 8,100 kilometres of railways connected Pakistani cities in 1947, and rail represented the only inter-urban public transport system while the road network was comparatively underdeveloped.

The first bus service in Lahore started in the beginning of the 20th century with the introduction of the Omni Bus Company by the then British government, plying Mall Road to connect the major buildings and government offices. Model Town, built during the 1920's decade, also started a bus public transport service connecting the town to the rest of Lahore. However, as Lahore is characterized by a mixed land use of homes, work places and bazaars within a short distance, walking remained the most common mode of transport and horse-drawn carriages (tonga) were the main urban public transport mode until the late 19th century.

Urban and inter-urban public transport services have historically been owned and operated by the provincial governments in Pakistan. The Omni Bus service was a public monopoly and expanded both in organization and resources over time.

After Independence

Following the First Five Year Plan, The Second Five Year Plan (1960-1965) encouraged the development of roads and road-based public transport over railway. By pushing private companies to engage towards public transport due to high demand, it led to the development of private wagons along assigned routes. In the seventies public transport became fully deregulated, which also allowed the private sector to compete with public bus companies. However, this measure did not meet the expectations as public companies were given the priority over private ones in the allocation of routes.

The Punjab Road Transport Corporation (PRTC) was established in 1977 to provide efficient, adequate, economical, and coordinated public intercity transport services in the province while the Punjab Urban Transport Corporation (PUTC) was established to develop and maintain urban and intra-city bus services. PUTC took over the existing public-owned Omni Buses, and, following a study of Lahore bus system conducted by Volvo in 1980 which led to recommendations toward a continued mix between public and private companies, expanded its fleet with a gift of 350 Volvo buses from the Swedish government. However, even with new buses, the PUTC fleet was too small to provide adequate bus services. As PUTC lacked investment capabilities, it started a leased bus scheme in an effort to attract the private sector – invest in intra-city public transport system.

These efforts eventually proved unsuccessful as the level of bus services degraded and no buses were purchased after 1989. PUTC was disbanded by the government in 1998.

Despite the priority given to road-based public transport services over urban rail for both urban and inter-urban movements, the policies and efforts undertaken after the independence achieved little success in the improvement and quality of public transport in the centre of Punjab.

(3) Structure and Organization

The government has further encouraged the private sector in public transport operation, and the current public transport structure in Lahore is a direct heritage of the 1998 transport policy review, which revamped the structure of public transport services. The franchise scheme was introduced in 1999 by support of the government through the Transport Sector Development Initiative (TSDI), which promoted a privatization and deregulation of public transport, while government agencies regulate the services. New private operators then entered the market, increased the number of buses in operation and significantly improved the public transport situation in Lahore in 1999.

The public transport administration, policy making and planning in Punjab is coordinated by the Transport Department, which was established in 1987 under the West Pakistan Motor Vehicles Ordinance 1965. It is responsible for the licensing of 'high-occupancy' large bus services in Lahore and other large cities, and of public transport services outside the major cities of Punjab through the PTA. Minibus routes are granted by the Lahore DRTA, which was established in 2001 by the Punjab Transport Department, and reports to the CDGL and PTA.

However, in the 2000s the government's attention shifted to other projects (road projects, rail based public transport (LRMTS), and 4-stroke rickshaws), and as the bus system in Lahore received little consideration the improvements seen since 1999, failed to continue and the situation started worsen since 2006-07. The number of large buses in operation has decreased considerably since 2005 due to poor maintenance, lack of investment, and somewhat unfair competition with the other road-based modes (Wagons). Between 2005 and 2009 no operator entered the market and no additional bus had been added to the depleting fleet.

While the number of buses declined and private operators were unable to meet the overall demand, the services of public transport were provided by smaller, private vehicles such as Wagon, Rickshaw and Qingqi, which have had a significant growth in the later half of the last decade.

In an effort to improve the situation of road-based public transport, the LTC, a state-owned company, was established in December 2009, taking over the infrastructure and regulation responsibilities from the Lahore DRTA.

LTC is primarily a regulatory body and is now the sole organ responsible for custody of all transport infrastructures in Lahore and its operations through a network of private operators. Infrastructures include bus stops, shelters, bays, depots and terminals, while the regulation and operational aspects cover service routes and the buses provided by and operated through a network of private operators.

(4) Key Characteristics and Statistics

<u>Buses</u>

The bus transport service in Lahore district has over 53 planned routes, based on a 2005 survey of passengers and published in Punjab Gazette 2006, yet only 30 routes are operational. Non-operational bus routes are being served by non-permitted vans, coasters, wagons, rickshaws and Qingqis. The lower operating costs of these informal and poorly maintained service vehicles has literally driven out the bus service from these routes. All of the gazetted bus routes are shown on Figure 2.4.9.

Bus service are currently (2010) provided by a fleet of about 250 to 300 buses, almost all of which are older than 2004. However, LTC planned to introduce 2,000 buses within 2010 with the help of 20 % upfront capital cost for new and old subsidies, refurbished buses and to operate the currently non-operated routes. While LTC has law enforcement capabilities and eventually intends to withdraw illegal vehicles (wagons, motorcycle rickshaws) from official bus routes, it has raised several concerns among drivers.

The current operational bus routes are operated by 9 operators: Daewoo, Premier Bus Service, BHK Transport (Sial Express), Makks, Niazi, ABC, Monolite Star, Baloch

Transport Company and Chattha Brothers.

Minibuses and Wagons

Many public transport vehicles operate without valid license, with an estimated 25 % or more of minibuses with no valid license or documentation at all. It has also been reported that many wagons and coasters are operating without licenses, and that many do not follow the authorized route, sometime do not complete the full route journey, and also provide services to suburbs satellite towns and illegally competing with legal buses although they are not allowed to serve the designated urban high occupancy vehicle (HOV) routes.

Wagon and bus routes should normally be controlled and enforced by DRTA/ LTC, but the inefficiency of public-owned public transport has led to the multiplication of illegal operation and forcing the private vehicle ownership even higher.

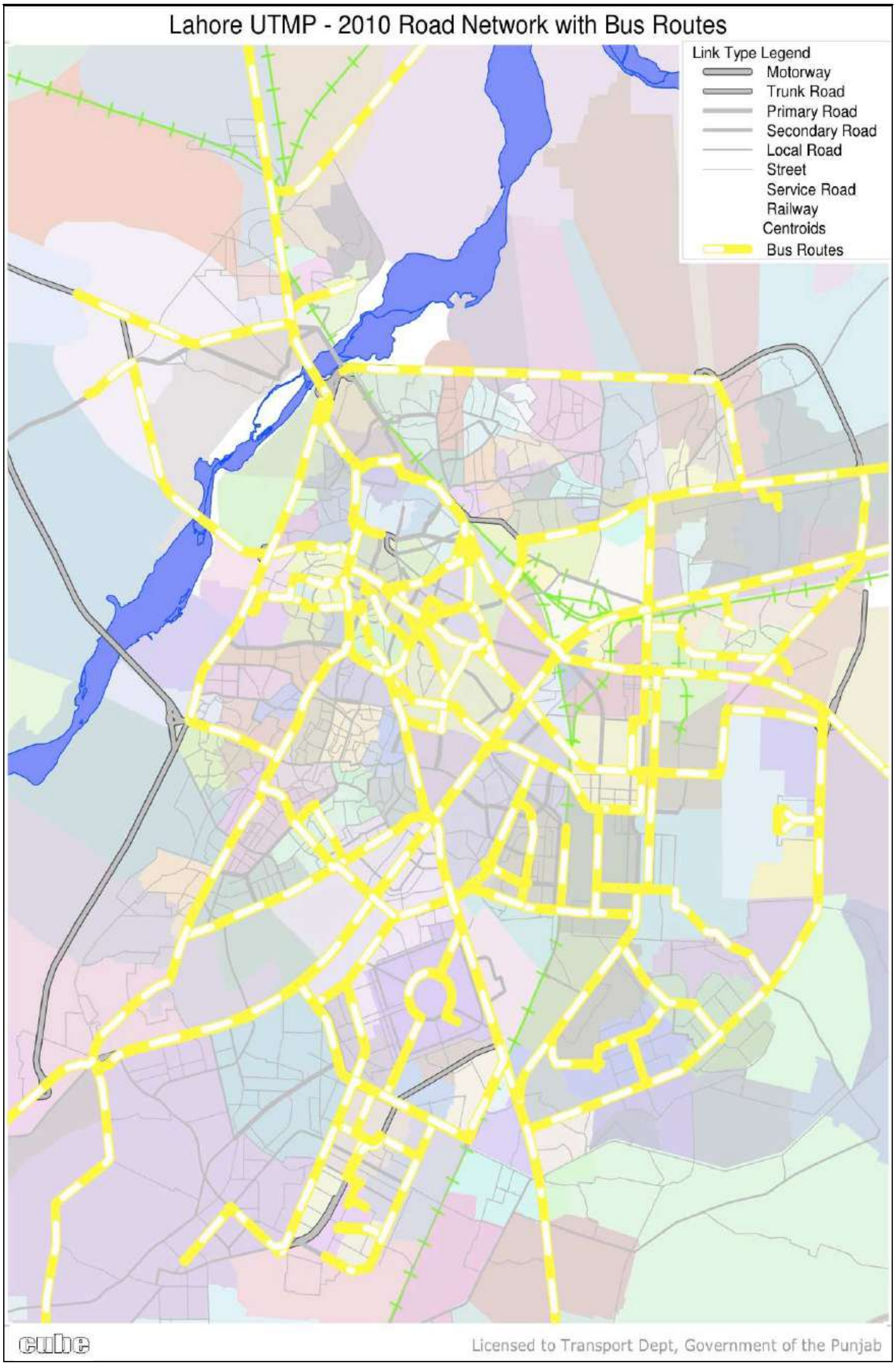
Auto-rickshaws and Qingqis

The number of rickshaws running on the roads of Lahore is about 66,000 as per registration by the Lahore District Registration Authority, but up to 80,000 may actually ply the routes of Lahore when taking into account unregistered vehicles. About 5,000 route permits have also been issued for Qingqis, but it is estimated that as many as 40,000 are currently operating ‘illegally’ in Lahore, many along primary and secondary roads which are also served by licensed bus services. While there has been no change in the design of the auto-rickshaws over the last 4 decades, the government is currently trying to ban two-stroke engines in favour of CNG fuelled four-stroke rickshaws.

Mode share

Tables below show estimated mode share and trip-making in Lahore, by TEPA for 2007 and by the JICA Study Team for 2006 and 2011. The proportion of non-motorized (mostly walk trips, and some bicycle trips) trips is high, at 45%, while the proportion of public transport trips among motorized trips is around 35% (TEPA) to 38 % (LRMTS). This puts the percentage of public transport share of motorised trips at around 51 % including trips by Rickshaws. This has been declining over the years, due degradation of the Public transport services, and the declining trend of public transport mode share has led to shift of these trips in favour of mostly motorcycle and to some extent car trips, but considering the growth of population and trip-making, the actual number of trips made by public transport services will continue to increase over the next decade.

Figure 2.4.9 Gazetted Bus Route Coverage in Lahore



Source: Lahore Transport Company (LTC)

Table 2.4.4 Estimated Daily Person Trips in Lahore, 2007

Mode		Trips (,000)	Proportion	Proportion Excluding Walk
Public Transport		3,409	19.3%	35.4%
Private Vehicles	Cars	2,894	16.4%	30.1%
	Motorcycles / Bicycles	3,314	18.8%	34.5%
Mechanised Total (Excluding Walk)		**9,617**	**54.5%**	**100%**
Walk		8,050	45.5%	-
Total		**17,667**	**100%**	**-**

Source: TEPA, 2007

Table 2.4.5 Estimated Daily Motorized Person Trips in Lahore (LRMTS)

Travel Mode	2006		2011 (Forecast)	
	Total (,000)	Proportion	Total (,000)	Proportion
Motorcycle	1,292	18.5%	1,532	18.3%
Rickshaw	1,014	14.5%	1,157	13.9%
Car/Taxi/4WD	1,991	28.5%	2,561	30.7%
Public Transport	2,699	38.6%	3,100	37.1%
Total	6,996	100.0%	8,350	100.0%

Source: LRMTS Study, 2007

Operational Details

The table below shows the distance ranges and fares for bus and wagon routes.

Table 2.4.6 Bus and Wagon Fares, June 2010

Distance (km)	Fare (PKR)
0 – 4	13
4.1 – 8	18
8.1 – 14	22
14.1 – 22	25

Source: Transport Department, 2010

Bus fares have significantly increased since the introduction of the franchised scheme, as they had started at PKR 3 for the 0-3 km distance (representing more than twice the 1999 price when taking inflation into account). The cost of free of charge ridership is high, and is estimated at 3.5 PKR/bus/km according to the Department of City and Regional Planning, with 10 to 15 % of passengers who do not pay a fare.

Table 2.4.7 Key Operational Details

Distance (km)	Distance (km)	Fare (PKR)
Specified headways (minutes)	Peak	5.7
	Off Peak	8.2
Observed headways (minutes)	Peak	9.3
	Off Peak	11.5
Average Speed (km/h)		19
Passenger trip length	<=4 km	40%
	<=8 km	66%
	<=14 km	89%
Bus kilometres (km/day/bus)		234
Operating cost (PKR/km)		29

Source: Department of City and Regional Planning, Study/policy planning of intra city routes in four major cities in Punjab, 2007

2.4.4 Railways

PR (Pakistan Railways) has only a limited role in urban transport of Lahore. It has various kinds of problems in train operation, i.e. late running problems, lack of service, old-type rolling stocks, obsolete maintenance equipment, and so on. Because almost all the trains run late, normal urban railway passengers such as workers and students do not use railway for short- to medium-distance travel.

The punctuality is the most superior point of railway, compared with other transport modes. Therefore the lack of this important feature can be seemed fatal for public usage. The current PR has been on a steady decline. PR (Pakistan Railway) has been a target of the Government of Pakistan for reform, rationalization and privatization for a long time.

2.4.5 Goods Movement

Goods vehicles can be classified in several types: pick-up trucks, delivery trucks, 2 axles, 3+ axles, tractors, construction machines and animal-drawn vehicles. Most of the goods vehicles registered today in Lahore are delivery vans, with around 41,000 registered vehicles in the Study Area, while there are around 29,000 tractors.

As the HIS, conducted in Phase-I of this study, focused on person trips in the future rather than vehicle trips, the movements of goods vehicles was not captured as precisely by this survey. However, traffic count surveys (cordon, screenline, vehicle occupancy, and traffic counts at major intersections) provided estimates of the goods vehicles flows on the network.

Larger trucks are banned from most of the roads in Lahore during daytime, and are only allowed in specific areas. Table 2.4.8 below lists the existing truck terminals in Lahore.

Table 2.4.8 Truck City Terminals in Lahore

No.	Inter-city Terminals	City Terminals	Freight Loading/ Unloading Terminals
1	Badami Bagh	Lahore Railway Station	Badami Bagh on Ravi Link Road
2	Site close to the Railway Station	Bhatti Gate	Babu Sabu on Bund Road
3	Daewoo stand on Ferozepur Road		Airport
4	Bund Road		Dry Port

Source: Integrated Master Plan for Lahore, 2021

2.4.6 Historical Comparison of Present Traffic Demand with 1990

During the period 1990-1991, JICA conducted the first full-scale urban transport study or the "Comprehensive Study on Transportation System in Lahore" with cooperation of LDA and TEPA. This on-going study intends to totally renew the year 1990 traffic database by means of various traffic surveys including HIS, cordon, screenlines surveys, public transport user interview survey and through others data collection and analysis.

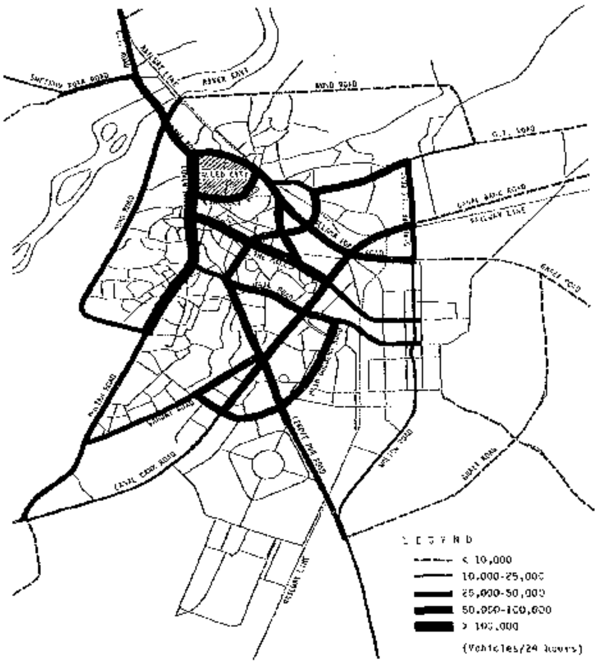
Although complete new traffic database has not been established at this stage of reporting, this section attempts to make some historical comparisons between recent other survey results and the year 1990 database. After the JICA study 1991, sporadic traffic count surveys were conducted for several road projects while a city-wide traffic survey was done in 2005 for the Lahore Rapid Mass Transit System (LRMTS) Feasibility Study. The LRMTS database is quoted for historical comparison. As results, the historical comparison shows the following characteristics; which are compared in Figure 2.4.10 and 2.4.11.

Expansion of urban transport activity area: The two transport studies illustrate existing traffic demand maps on the city's road network (see Figure 2.4.10 and 2.4.11). Although detailed demand degree settings vary from each other, the two images differ in urban transport area and it means the extension of urban transport area particularly to the east, southeast and southwest directions as the city's urban areas have considerably expanded.

Road traffic increase: We observe 4-wheeler road traffic increase at all the comparable lines and points between 1990 and 2005. However, increase rates vary from 149 % (6.2 % p.a.) at the West Canal Screen Line to 752 % (15 % p.a.) at the Inner Southeast Cordon Point. Significant traffic increase can be found at the fringe of urban areas due to acute urbanization and densification of existing urban areas during this period.

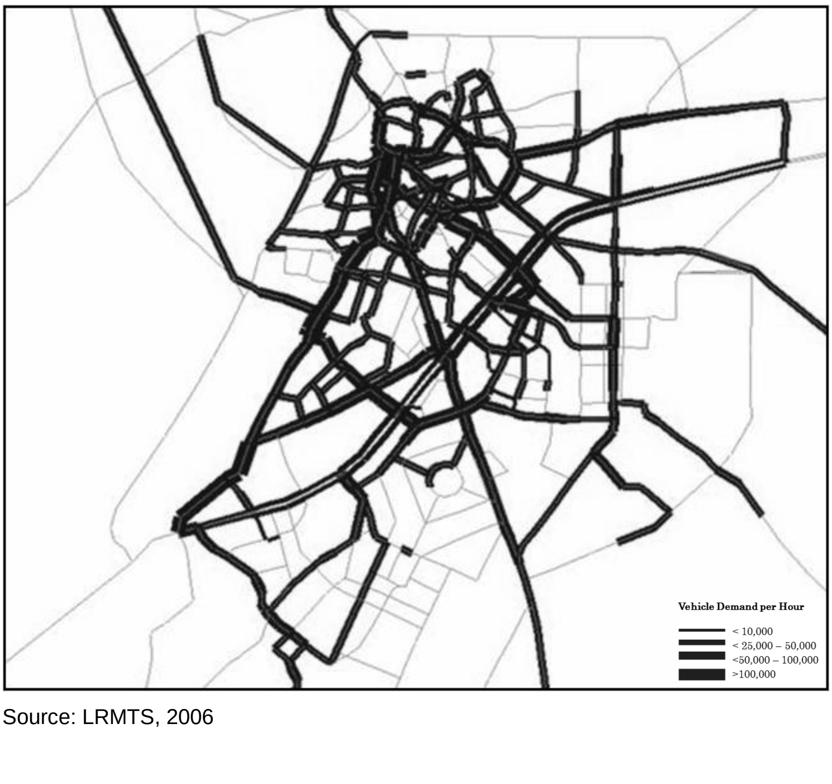
Change in modal share: In 1990, bicycle, rickshaw and horse carriages took an important role in urban transport. The 1990 HIS reported that they enjoyed a person trip share of 15 %. Due to their small passenger capacity and slow speed, such non-motorized transport means excluding walking occupied more road space than the modal share. Nowadays the role of the old non-motorised modes is marginal and all animal drawn modes have converted to rickshaws and in narrow urban streets to Qingqis.

Figure 2.4.10 Road Traffic Demand in 1990



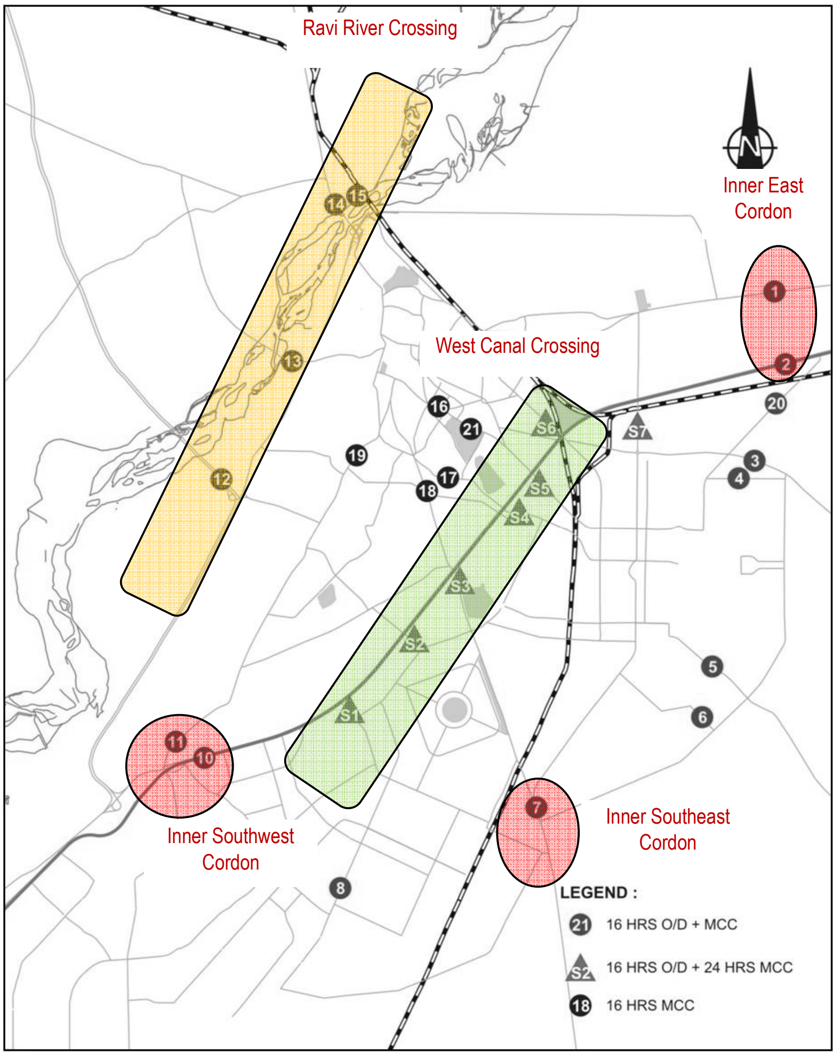
Source: Comprehensive Study on Transportation System in Lahore, JICA, 1991

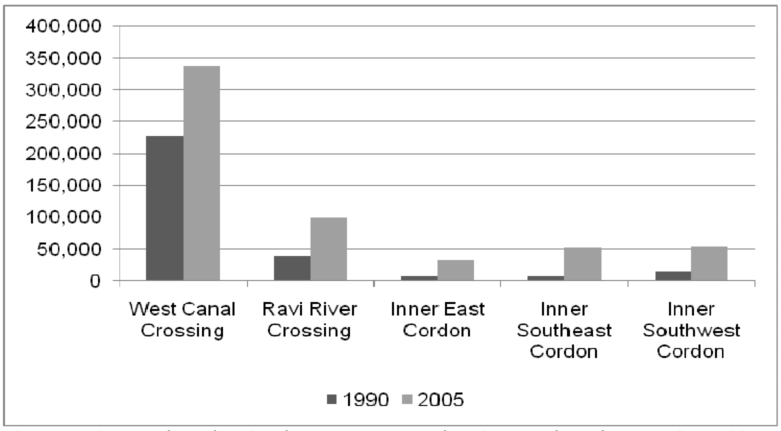
Figure 2.4.11 Road Traffic Demand in 2005



Source: LRMTS, 2006

Figure 2.4.12 Change in 4-wheeler Road Traffic, 1990 and 2005





Source: Comprehensive Study on Transportation System in Lahore, JICA, 1991 and LRMTS, 2006

2.5 Transport Demand Characteristics

2.5.1 Road Traffic Volume

Screenline surveys were undertaken based on the screenlines as shown in Figure 2.5.1. The road traffic as determined from the Screenline surveys is summarised in Table 2.5.1. Of note in Table 2.5.1 is the absence of a 1991 screenline of Ravi River. There are dramatic increases in the traffic volumes across the screenlines, most notably in the South and East. This is likely due to the development of the Cantonment area, DHA and the general development away from the Walled City.

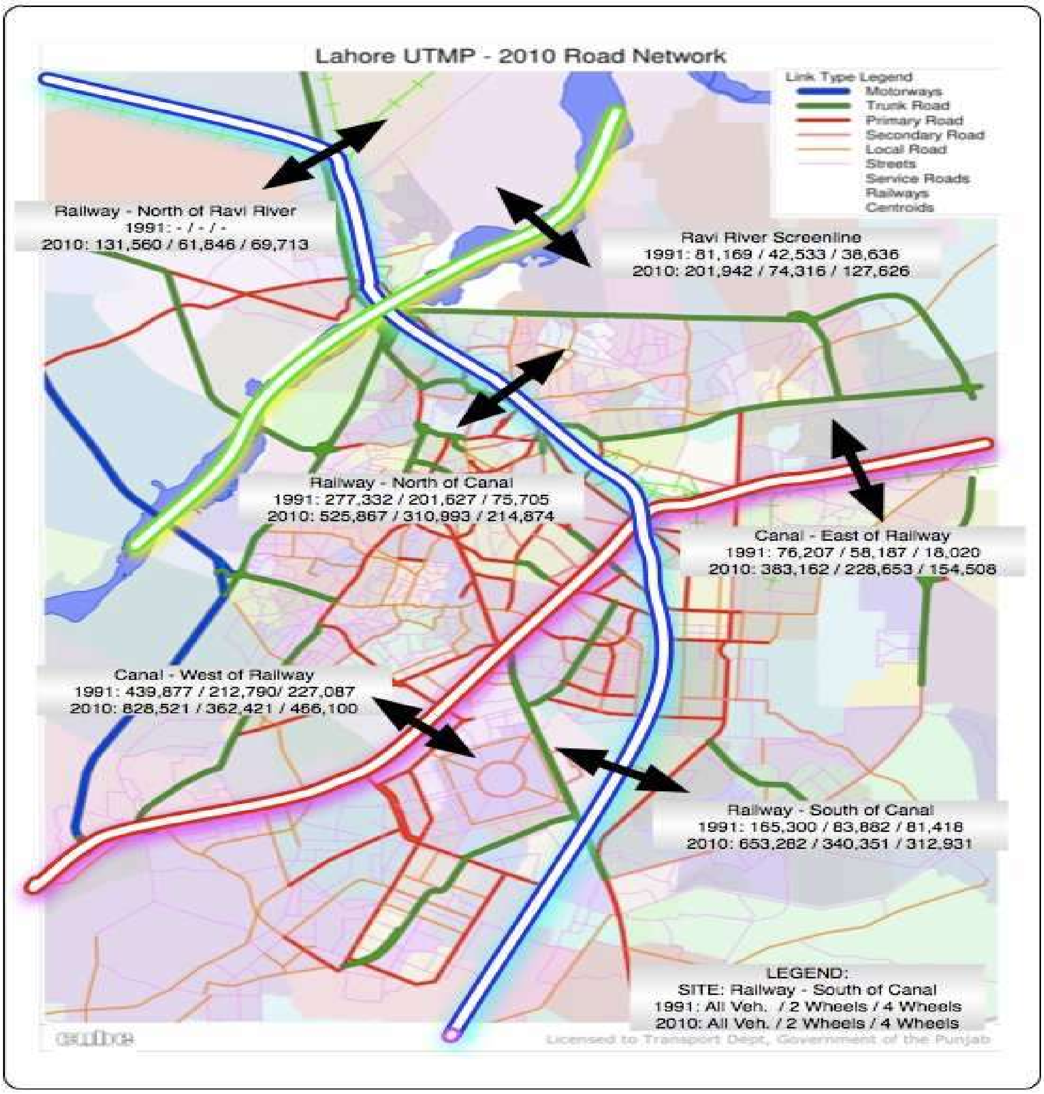
Table 2.5.1 Comparison of Screenline Crossing Flows since 1991 JICA Study

Screenline	1991 JICA Study			2011 JICA Study			Growth Per Annum (%)		
	All Vehicle	2 Wheel	4 Wheel	All Vehicle	2 Wheel	4 Wheel	All Vehicle	2 Wheel	4 Wheel
Railway: North of Ravi River	-	-	-	131,559	61,846	69,713	-	-	-
Ravi River	81,169	42,533	38,636	201,942	74,316	127,626	4.7%	2.8%	6.2%
Railway: North of Canal	277,332	201,627	75,705	525,867	310,993	214,874	3.3%	2.2%	5.4%
Railway: South of Canal	165,300	83,882	81,418	653,282	340,351	312,931	7.1%	7.3%	7.0%
Canal: West of Railway	439,877	212,790	227,087	828,521	362,421	466,100	3.2%	2.7%	3.7%
Canal: East of Railway	76,207	58,187	18,020	383,161	228,653	154,508	8.4%	7.1%	11.3%

Note: 2 Wheeled Vehicles are Bicycles, Motorcycles and Animal Drawn Carts.
4 Wheeled vehicles included cars, wagons, buses, trucks.
Source: JICA Study Team

Figure 2.5.2 to 2.5.5 show hourly variation of traffic volume on the Canal Screenline and the Railway Screenline by direction and by vehicle type. Note that the traffic volume is the total of all survey locations on the screenlines on these sections.

Figure 2.5.1 Major Screenlines in Lahore

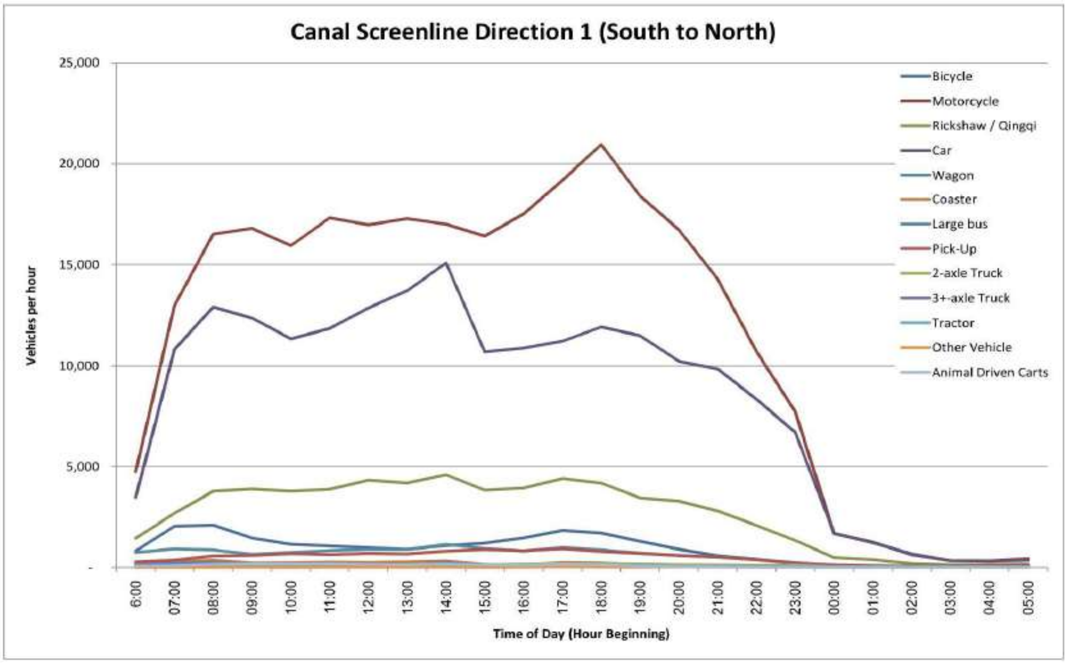


Source: JICA Study Team

On the Canal Screenline, motorcycle and car are the dominant mode although the number of motorcycle is larger than that of car. Hourly traffic volume is distributed relatively equally from morning till evening with unclear peaks in the morning and evening. For car, there is a vague peak at around 1-2 o'clock.

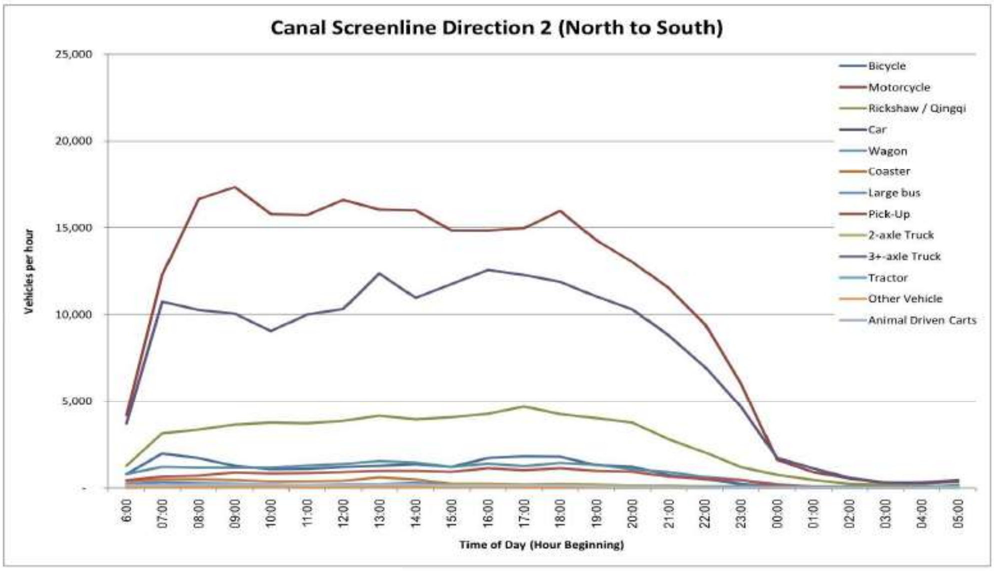
On the railway screenline, the dominant mode is motorcycle. Car traffic is less compared to the Canal screenline. Hourly traffic volume is also distributed relatively equally from morning till evening. However, motorcycle has a peak around 8-9 a.m. for east to west direction and around 18-19 p.m. for west to east direction. The traffic volume of trucks is relatively large on this screen line.

Figure 2.5.2 Hourly Variation of Traffic Volume on Canal Screenline (South to North)



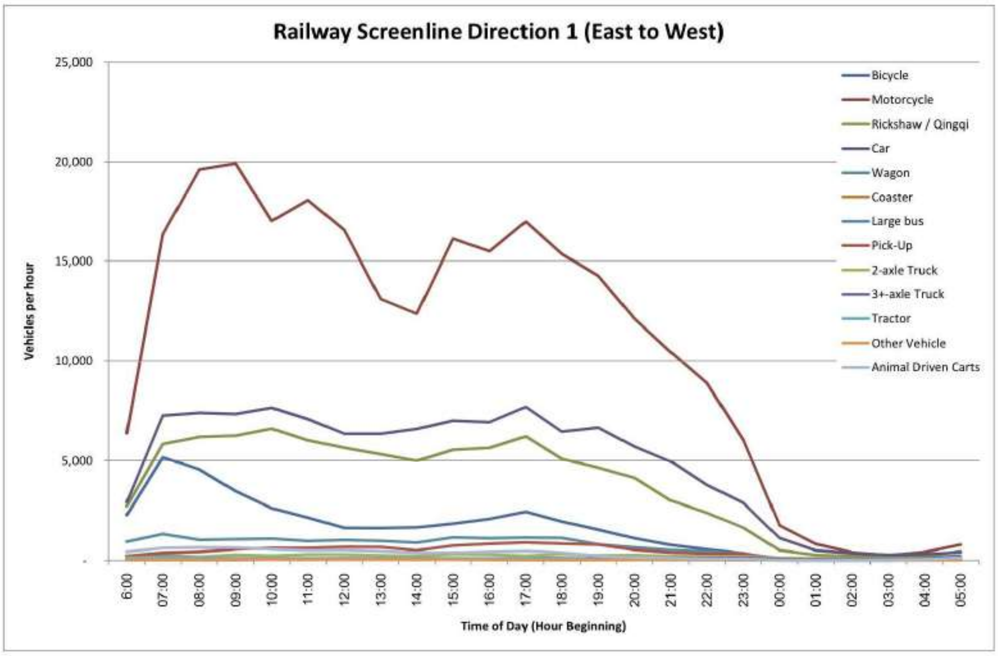
Source: JICA Study Team

Figure 2.5.3 Hourly Variation of Traffic Volume on Canal Screenline (North to South)



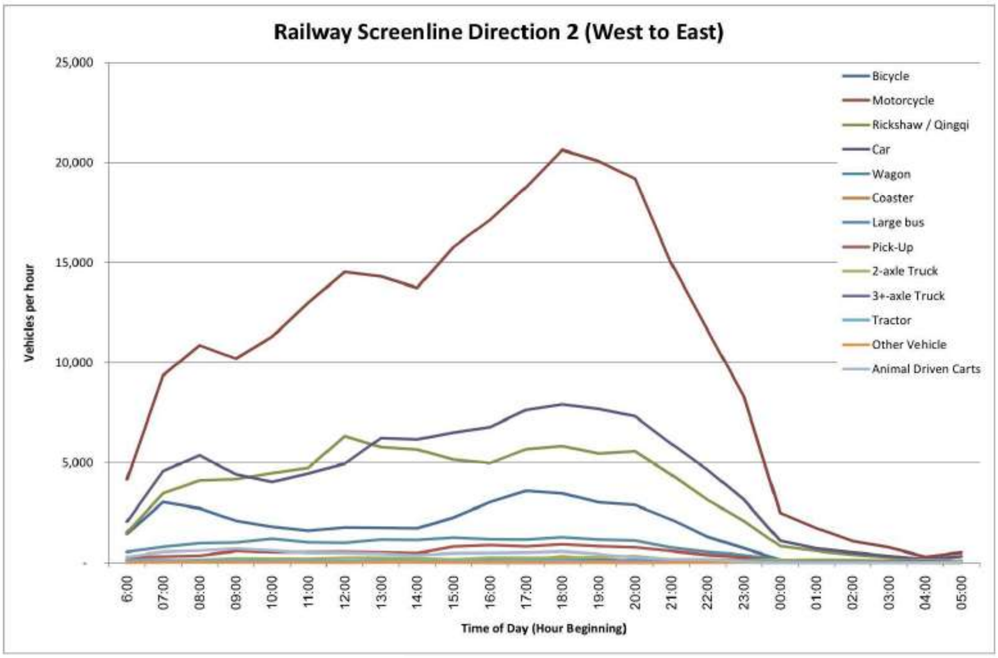
Source: JICA Study Team

Figure 2.5.4 Hourly Variation of Traffic Volume on Railway Screenline (East to West)



Source: JICA Study Team

Figure 2.5.5 Hourly Variation of Traffic Volume on Railway Screenline (West to East)



Source: JICA Study Team

2.5.2 External Traffic Volume

Cordon Surveys were undertaken along the cordon as shown in Figure 2.5.6. The External Traffic volume as determined from the Cordon surveys are summarised in Table 2.5.2.

Table 2.5.2 Outer Cordon Traffic Volumes since 1991 JICA Study

Cordon	1991 JICA Study			2010 JICA Study			Per Annum Growth		
	All Vehicle	2 Wheel	4 Wheel	All Vehicle	2 Wheel	4 Wheel	All Vehicle	2 Wheel	4 Wheel
Northern	21,780	7,334	14,446	39,424	7,378	32,047	3.0%	0.0%	4.1%
Northeastern	2,294	1,544	750	6,172	1,841	4,331	5.1%	0.9%	9.2%
Eastern	-	-	-	172	0	172	-	-	-
Southern	19,932	11,573	8,359	21,097	7,017	14,080	0.3%	-2.5%	2.6%
Southwestern	8,127	879	7,248	28,174	4,647	23,527	6.4%	8.7%	6.1%
Western	16,026	3,323	12,703	65,691	5,187	60,504	7.3%	2.3%	8.1%

Note: 2 Wheeled vehicles are Bicycles, Motorcycles and Animal Drawn Carts.
4 Wheeled vehicles included cars, wagons, buses, trucks.
Source: JICA Study Team and Comprehensive Study on Transportation System in Lahore, JICA, 1991

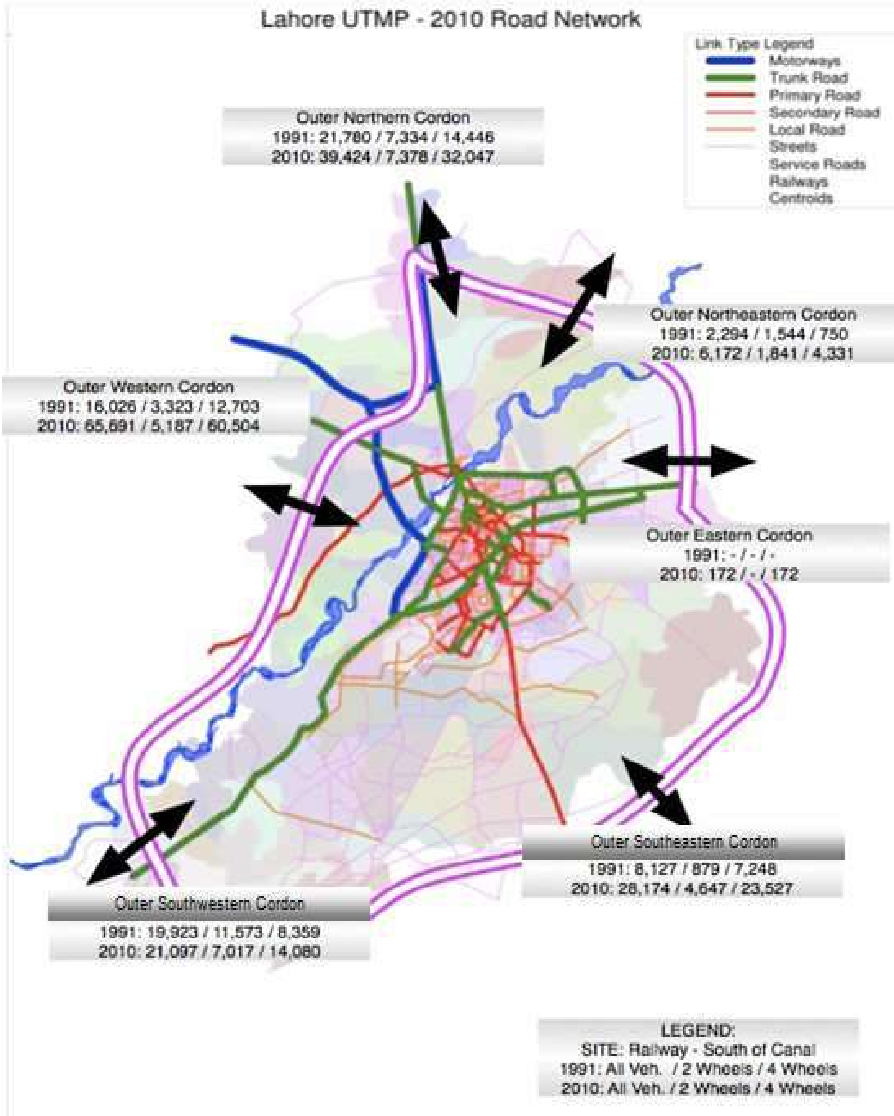
In 1991, there was no cordon survey at the Wagah Border Crossing, so there are no vehicles recorded at the Eastern Screenlines. In any case, the traffic volumes across the border are very low. It is also important to note that the cordons are in different locations between the two studies. A strict comparison is misleading, but serves as an indicator of the changes in traffic volumes over time.

The current study has not surveyed an inner cordon, so there is not basis for comparing the 1991 JICA Study inner cordon.

Figure 2.5.7 and 2.5.8 show hourly variation of traffic volume at the Cordons by direction and by vehicle type. Note that the traffic volume is the total of all survey locations at cordon.

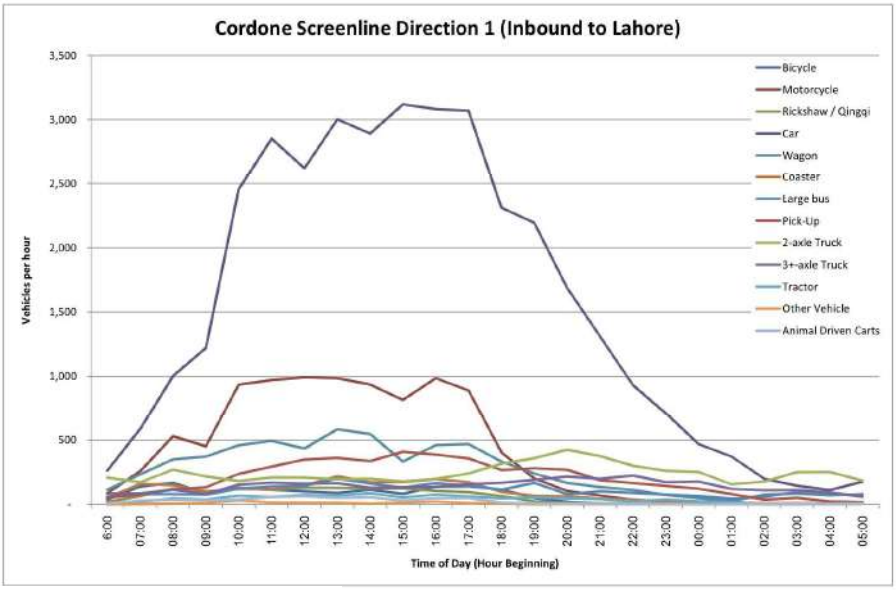
On the cordon, the dominant mode is car followed by motorcycle then wagon. Hourly traffic volume is distributed relatively equally from morning till evening. However, outbound car traffic has a peak at around 11 a.m.

Figure 2.5.6 Cordon Boundary in Lahore



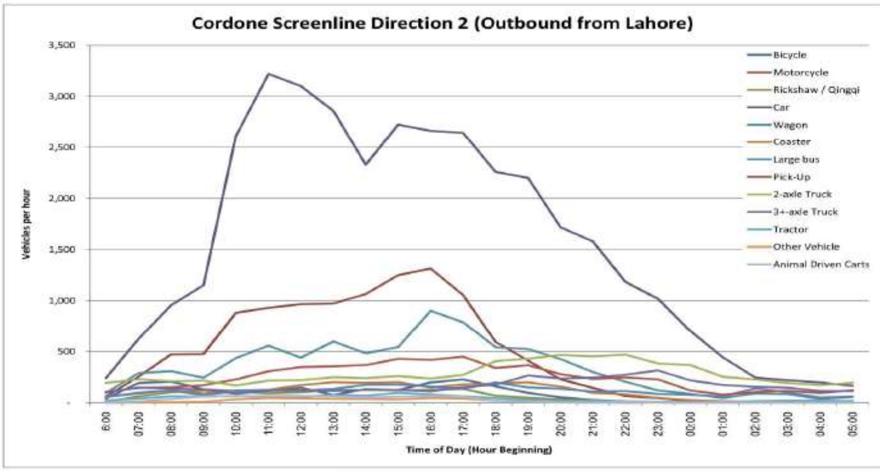
Source: JICA Study Team

Figure 2.5.7 Hourly Variation of Traffic Volume at Cordon (Inbound)



Source: JICA Study Team

Figure 2.5.8 Hourly Variation of Traffic Volume at Cordon (Outbound)



Source: JICA Study Team

2.5.3 Person Trips

In the Study Area, in 2010 about 12 million trips are made in a day as shown in Table 2.5.3. However, about 3.7 million trips or 32 % of the total trips are of short-distance walking. Excluding walking, about 8.1 million trips are made on a usual weekday.

Table 2.5.3 Number of Person Trips in the Study Area by Mode and by Trip Purpose, 2010

Travel Mode		No. of Trips by Trip Purpose ('000/day)					
		To Work	To School	Private	Business	To Home	Total
Private	Bicycle	152	72	11	5	231	472
	MC (Driver)	775	206	123	76	1,110	2,290
	MC (Passenger)	72	171	28	8	223	501
	Car	382	191	155	56	732	1,517
	Truck	2	1	1	0	4	7
	Sub-Total	1,383	640	319	145	2,300	4,786
Public	Bus/Mazda/Wagon	418	253	131	34	784	1,620
	Rail/Air	1	0	0	0	3	4
	Rickshaw	129	171	75	9	368	751
	Qinggi	170	71	53	7	311	612
	Sub-Total	718	495	259	50	1,466	2,987
Others	Taxi	1	1	1	0	3	6
	Private Bus	28	99	2	0	127	256
	Others	13	3	2	1	17	37
	Sub-total	42	103	5	1	147	299
	Walk	561	1,197	86	41	1,845	3,729
Total	(including walk)	2,705	2,436	668	236	5,756	11,801
	(excluding walk)	2,144	1,239	582	195	3,911	8,072

Source: JICA Study Team

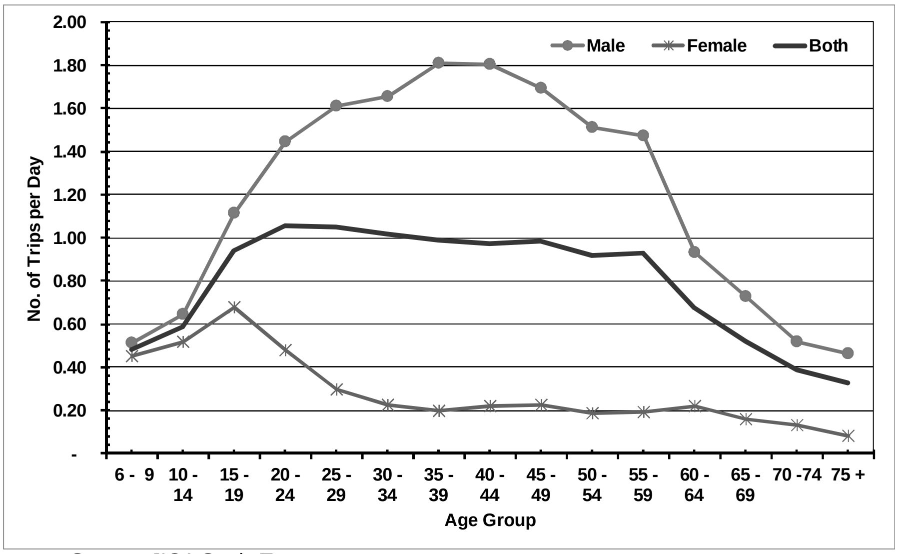
Table 2.5.4 shows the daily trip rates (No. of trips divided by population). On average, the residents in Lahore make 1.14 trips a day including walking or 0.76 trips a day excluding walking. This is very low at almost half the level compared to other mega-cities in Asia such as Manila, Ho Chi Minh and Jakarta. This may be attributed to the existence of inactive female population and the high percentage of unemployment. Figure 2.5.9 further shows the trip rate distribution by gender and by age group.

Table 2.5.4 Trip Rate of Lahore Residents, 2010

Mode	Male	Female	Total
Including walking	1.59	0.60	1.14
Excluding walking	1.12	0.32	0.76

Source: JICA Study Team

Figure 2.5.9 Trip Rate by Gender and by Age Group

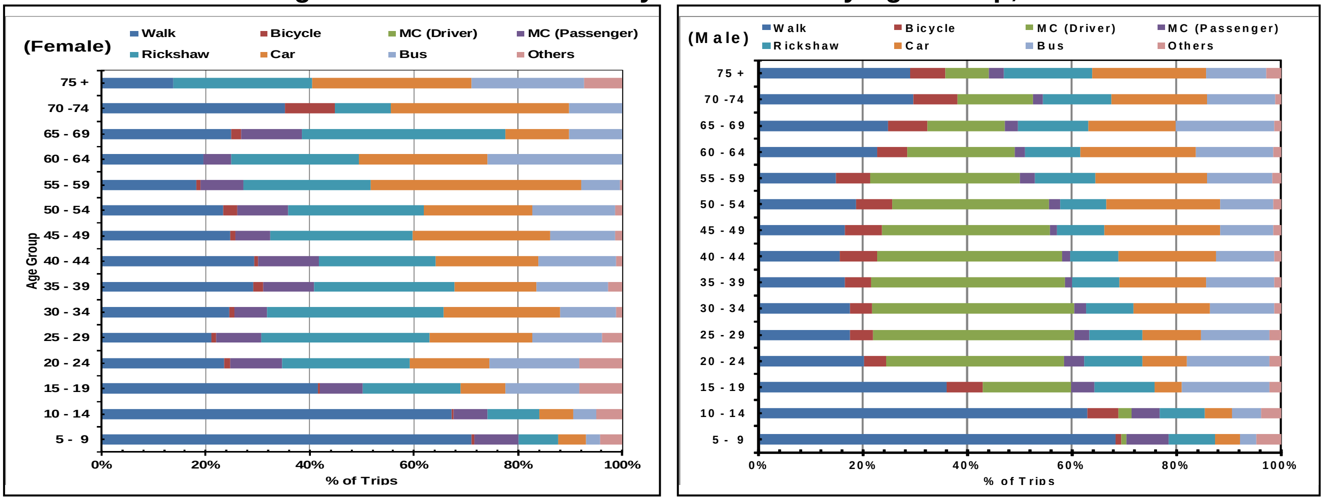


Source: JICA Study Team

2.5.4 Model Shares

Figure 2.5.10 presents model shares by gender and by age group. Female largely depend on walking and uses rickshaw relatively frequently. Male travels by motorcycles more than female. Females are usually passengers.

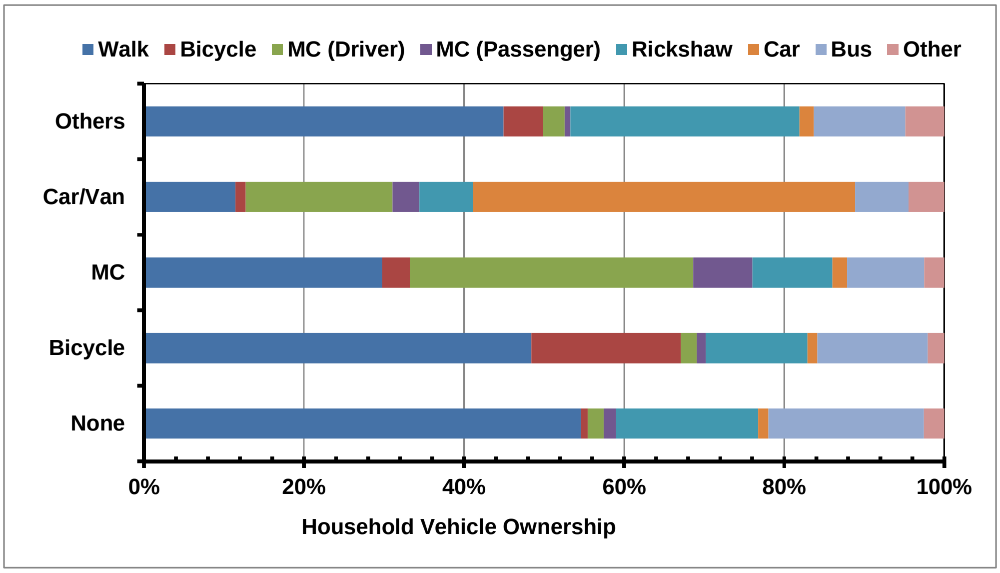
Figure 2.5.10 Model Share by Gender and by Age Group, 2010



Source: JICA Study Team

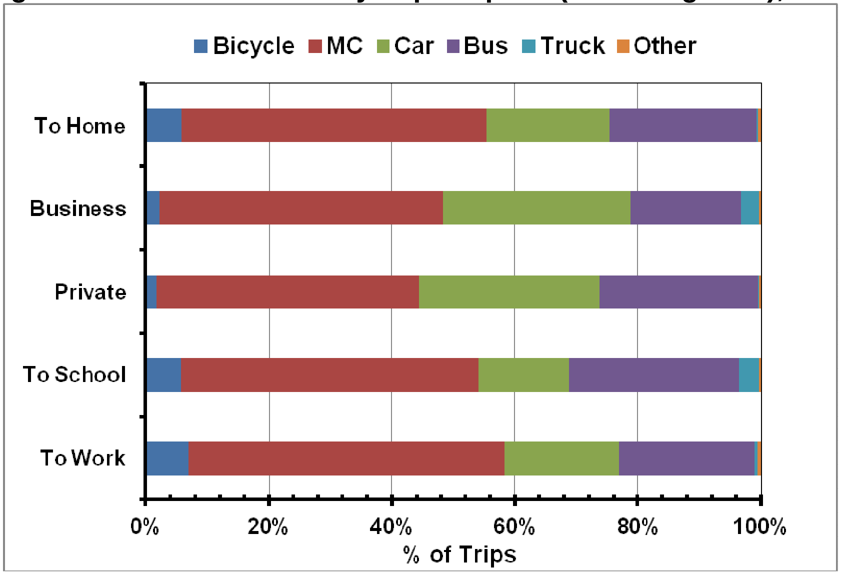
Car owning households naturally use cars more frequently, but they use motorcycles as well because they often have motorcycles too, as presented in Figure 2.5.11. Motorcycle is used mainly by motorcycle owning households and car owning households. Public transport such as bus and rickshaw is important for non-vehicle owning households. Modal shares do not change much depending on trip purpose. “To School” trips tend to use buses more than other trips due to school bus services.

Figure 2.5.11 Model Share by Household Vehicle Ownership, 2010



Source: JICA Study Team

Figure 2.5.12 Modal Share by Trip Purpose (excluding walk), 2010



Source: JICA Study Team

2.5.5 Trip Generation/ Attraction

Table 2.5.5 presents the total trip generations/ attractions by Town/ Tehsil. Data Gunj Baksh and Gulberg attract a greater number of "To Work" and "To School" trips than trips for the same purpose generated from the area. Shalamar, Samanabad, Aziz Bhatti are typical residential towns where more "To Work" trips are generated than attracted.

Table 2.5.5 Trip Generation/ Attraction by Town/Tehsil, 2010

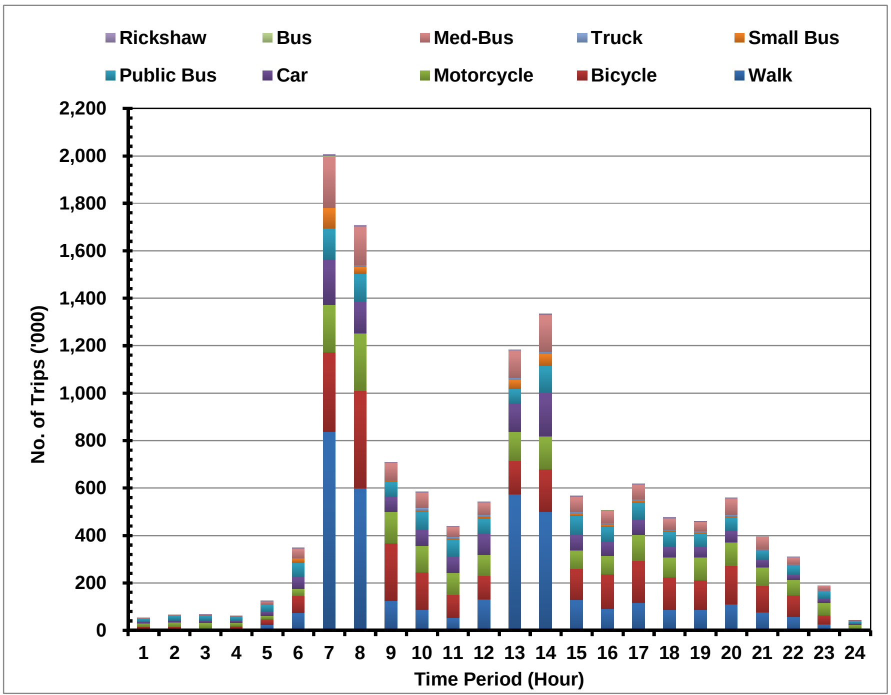
No	Town/ Tehsil	Generations ('000/day)						Attractions ('000/day)					
		To Work	To School	Private	Bus	To Home	Total	To Work	To School	Private	Bus	To Home	Total
1	Ravi	226	92	39	21	426	803	272	72	62	38	336	781
2	DataGB	161	122	52	16	771	1,121	453	248	92	34	308	1,135
3	Samanabad	218	137	85	35	405	880	170	172	66	31	422	860
4	Shalamar	295	130	44	16	208	693	102	91	25	13	470	701
5	Gulberg	214	155	71	25	713	1,177	381	238	90	32	425	1,166
6	AzizB	188	124	41	14	189	556	88	62	31	9	360	550
7	Wagah	129	81	37	6	157	410	80	48	32	5	239	405
8	Nishter	179	70	41	16	204	510	126	41	34	8	312	523
9	Iqbal	207	135	79	24	424	870	262	135	82	25	379	882
10	Cantt	182	132	49	26	369	758	194	122	63	14	374	767
11	Ferozewala	90	44	45	12	90	282	62	20	27	6	154	269
12	Muridke	47	21	27	4	62	159	62	21	28	4	80	195
13	Sharaqpur	11	9	15	1	23	59	10	8	10	0	29	57
14	Kasur	36	20	7	4	20	87	11	7	4	0	49	72
15	Patoki	40	19	13	3	43	117	29	14	17	4	82	146
	Total	2,223	1,290	644	223	4,103	8,483	2,302	1,299	665	223	4,021	8,509

Source: JICA Study Team

2.5.6 Hourly Distribution of Trips

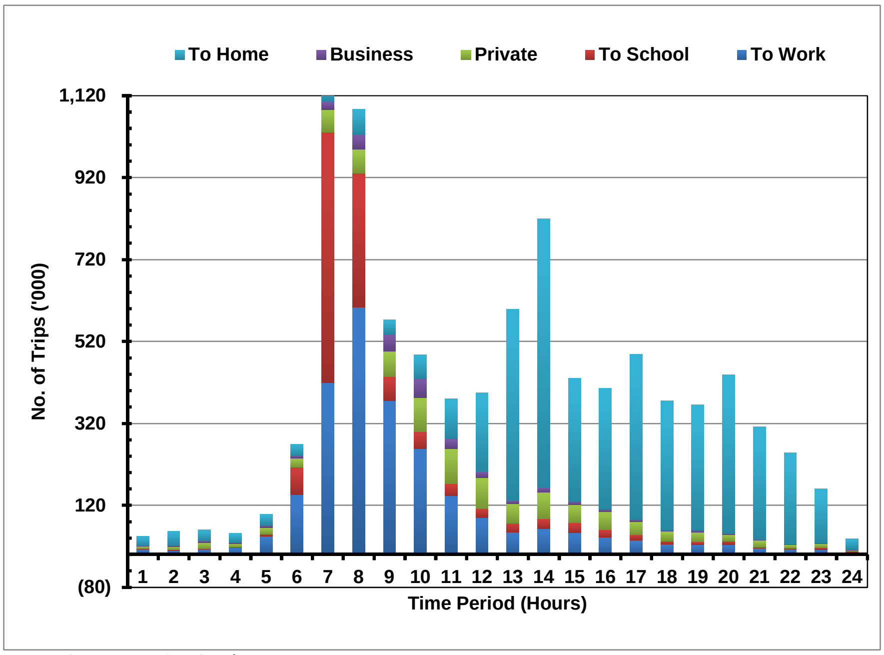
Figure 2.5.13 and 2.5.14 show hourly distribution of trips generated by time of the day, classified by mode and by trip purpose. There are two peaks around 7-8 a.m. and 1-2 p.m. The morning peak is due to "To School" and "To Work" trips and the afternoon peak is due to "To home" trips made by students/ pupils. A large number of walk trips are seen in these peak hours.

Figure 2.5.13 Hourly Distribution of Trips by Mode, 2010



Source: JICA Study Team

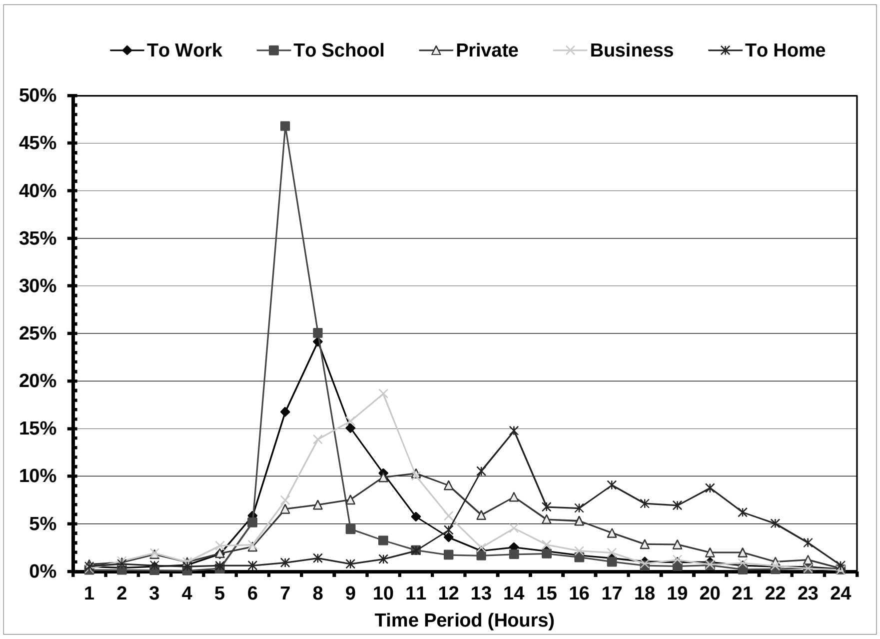
Figure 2.5.14 Hourly Distribution of Trips by Trip Purpose (excluding walk), 2010



Source: JICA Study Team

The tendency described above can be clearly seen in Figure 2.5.15. "To School" and "To Work" trips make a sharp peak around 7-8 a.m. and "Business" and "Private" trips are made mainly in the morning period. "To Home" trips are made relatively equally from 1-2 p.m.

Figure 2.5.15 Hourly Distribution of Trips by Trip Purpose in terms of Percentage (excluding walk), 2010



Source: JICA Study Team

2.5.7 Travel Time and Speed

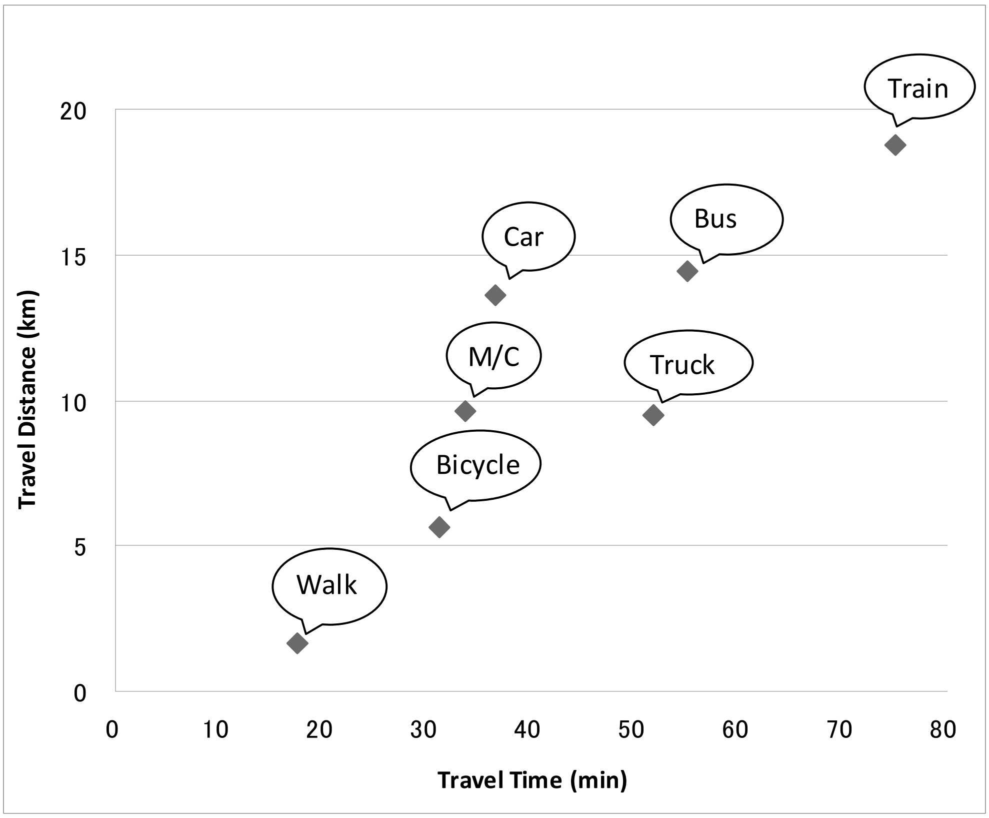
The average travel time of Lahore residents is 38.3 minutes as a whole. About 62 % trips are less than 30 minutes as shown in Table 2.5.6. However, about 9 % of the trips exceed 60 minutes. The relation between travel time and distance can be illustrated by mode schematically as presented in Figure 2.5.16.

Table 2.5.6 Number of Trips by Travel Time and Trip Purpose, 2010

Travel Time	No. of Trips by Trip Purpose (000/day)					
	To Work	To School	Private	Business	To Home	Total
- 10 min	135	148	48	20	276	628
- 20 min	364	337	91	37	693	1,522
- 30 min	659	391	117	55	1,211	2,434
- 40 min	122	64	27	9	252	475
- 50 min	210	107	40	15	360	733
- 60 min	307	107	74	19	533	1,041
- 75 min	52	20	12	4	97	185
- 90 min	69	30	23	6	114	242
- 120 min	40	18	18	1	82	159
120 min +	14	5	11	1	37	69
Total	1,975	1,227	462	168	3,655	7,487
Average (min.)	38.9	31.9	42.8	34.3	38.8	37.8

Source: JICA Study Team

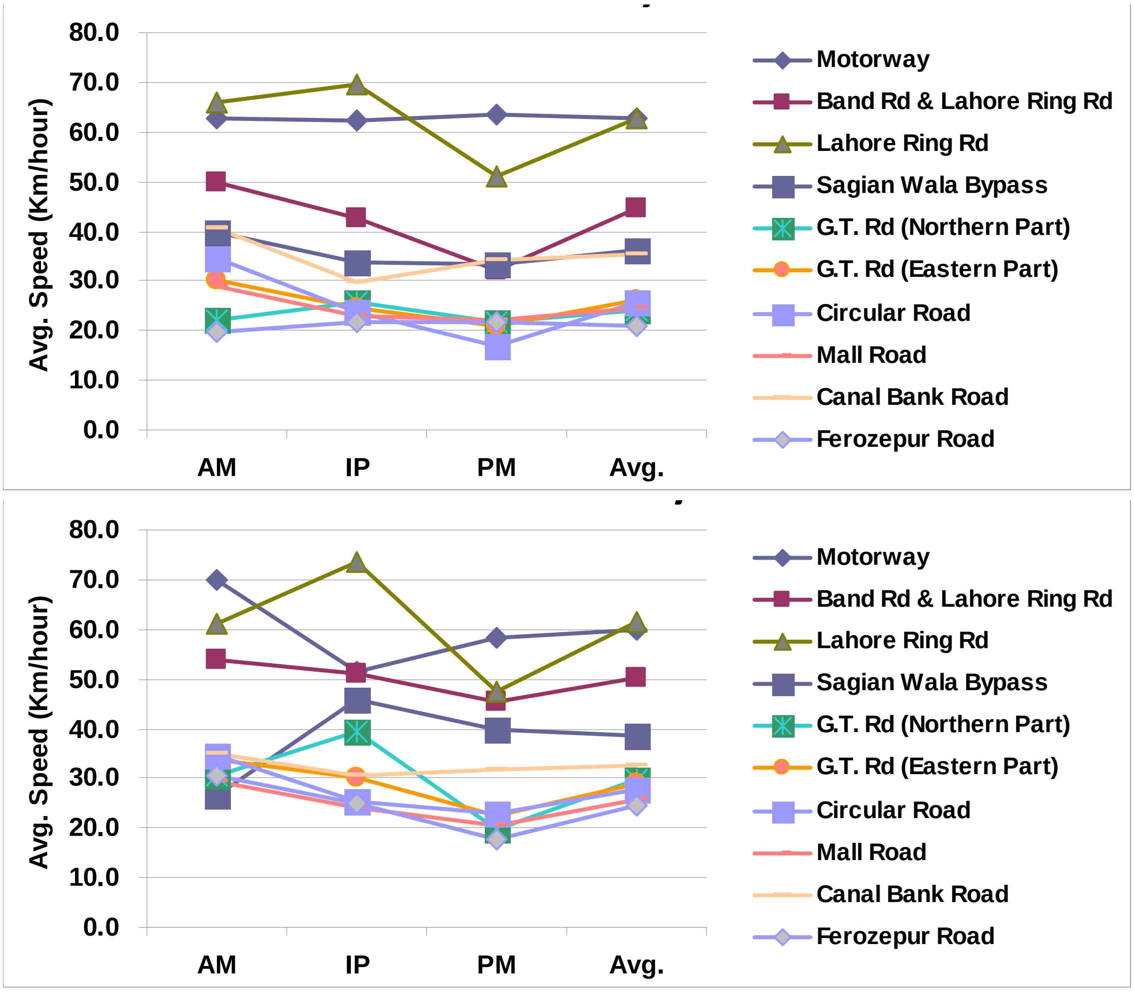
Figure 2.5.16 Average Travel Time and Distance by Travel Mode, 2010



Source: JICA Study Team

Figure 2.5.17 shows the result of LUTMP travel speed survey. Motorway and Lahore Ring Road show high travel speed of above 50 km/h throughout the day. Circular Road, Mall Road, Ferozepur Road and G.T. Road (east and north) show a relatively slow speed of 20 to 30 km/h throughout the day. This indicates the serious traffic congestion in the city centre and along the north – south radial corridor of the city.

Figure 2.5.17 Average Travel Speed on Selected Roads



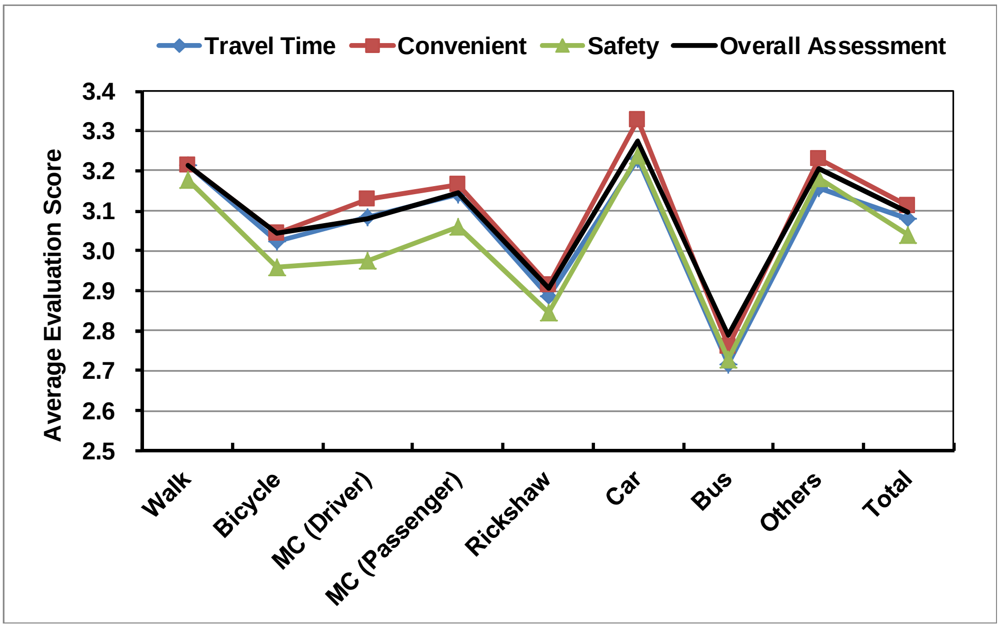
Source: JICA Study Team

2.5.8 Trip Makers' Assessment of Their Journey

In LUTMP HIS, questions were asked to interviewees on their assessment of the journey they make. Figure 2.5.18 depicts this assessment of the mode they have used. In general, their scoring is lower for public transport trips including bus and rickshaw.

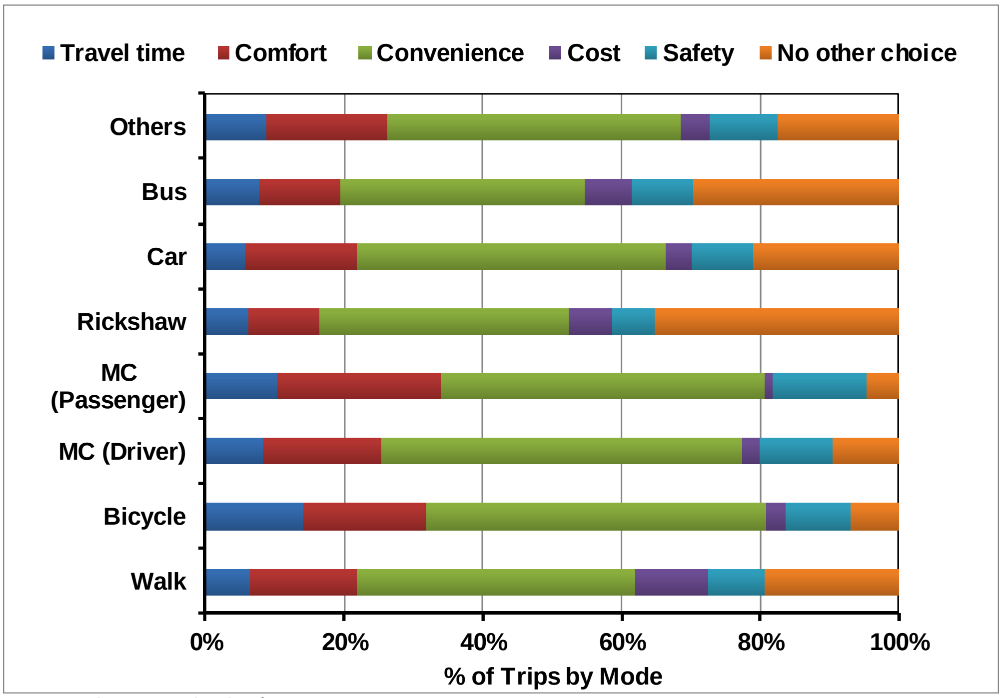
Figure 2.5.19 shows the reason of mode choice. Albeit no large difference is seen by mode, "No Other Choice" answer is significant for bus and rickshaw. For these modes, "Convenience" was least selected.

Figure 2.5.18 Average Evaluation Score by Mode, 2010



Note: 5-point evaluation – 5: very good, 4: good, 3: so-so, 2: bad and 1: very bad
Source: JICA Study Team

Figure 2.5.19 Reason of Modal Choice, 2010



Source: JICA Study Team

2.6 People's Perception of Travel Situation

The Study has conducted a large-scale HIS (Home Interview Survey) covering about 18,000 households. In the interview, a considerable number of questions were asked to the respondent households in relation to their perception and opinion of traffic/ transport situation in Lahore. Major findings from this interview are briefly described in the following:

2.6.1 General Traffic Situation and Congestion

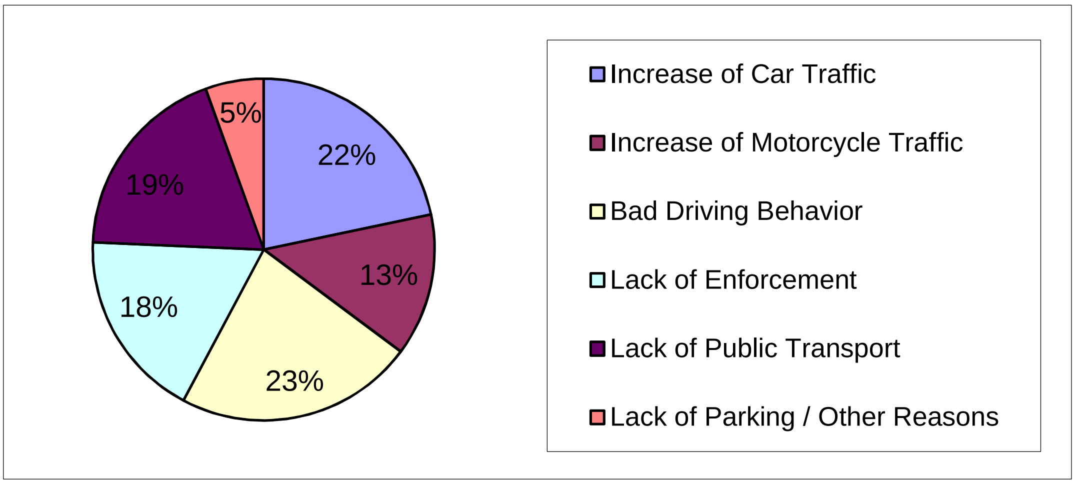
Table 2.6.1 shows the perception of Lahore citizen of the present traffic situation. It is amazing that nearly 90 % people opinion is that traffic situation is "very bad" or "bad". Figure 2.6.1 portrays the reasons why they think this situation has been brought about. There are major reasons; "Increase of Car Traffic", "Bad Driving Behaviour", "Lack of Enforcement" and "Lack of Public Transport".

Table 2.6.1 People's General Feeling on Present Traffic Situation

Opinion	Number of Samples	Percentage (%)
Very Good	24	0.1
Good	239	1.4
Average	1,865	10.5
Bad	5,489	31.0
Very Bad	10,086	57.0

Source: JICA Study Team

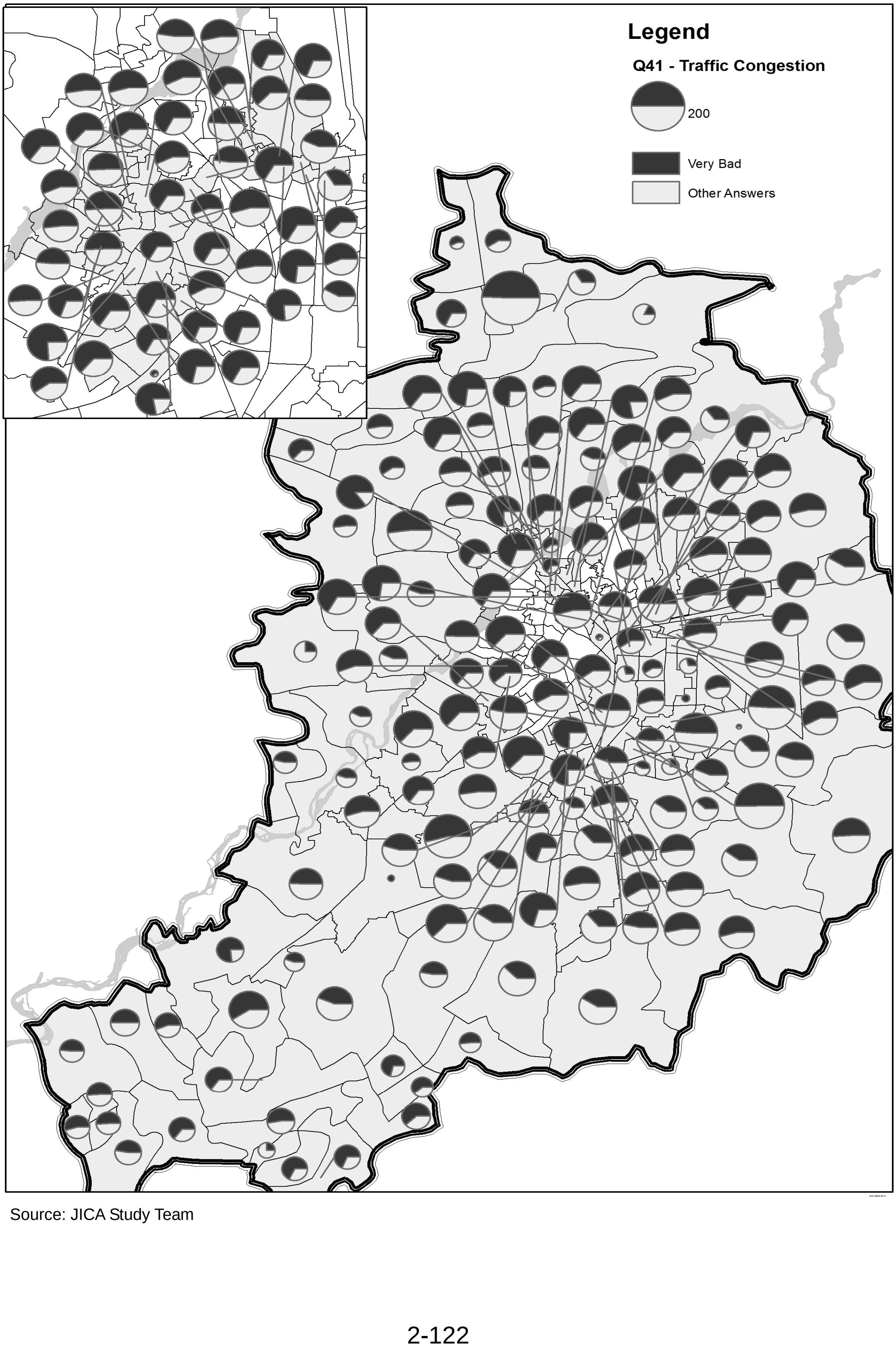
Figure 2.6.1 Stated Causes of "Very Bad" or "Bad" Traffic Situation



Source: JICA Study Team

Many people answered "Much Worse" or "Worse" of current traffic situation as compared to 5 years ago as shown in Table 2.6.2. The percentage is highest regarding congestion followed by safety. It is clear that most people are frustrated with the current traffic situation. Figure 2.6.2 illustrates the distribution of respondent households who answered "very bad regarding traffic congestion. Its percentage is high around the city center and its surrounding areas.

Figure 2.6.2 Distribution of Respondent Households who Answered “Very Bad” regarding Traffic Congestion



Source: JICA Study Team

Table 2.6.2 Percentage of People who Answered “Much Worse” or “Worse” on Current Traffic Situation as Compared to 5 Years Ago

Subject	Percentage answered “Much Worse” or “Worse”
Congestion	80.4%
Safety	76.6%
Convenience	68.6%

Source: JICA Study Team

2.6.2 Traffic Safety

In Lahore, traffic safety situation is serious. Nearly 20 % of households have experienced traffic accidents in the past 5 years as shown in Table 2.6.3.

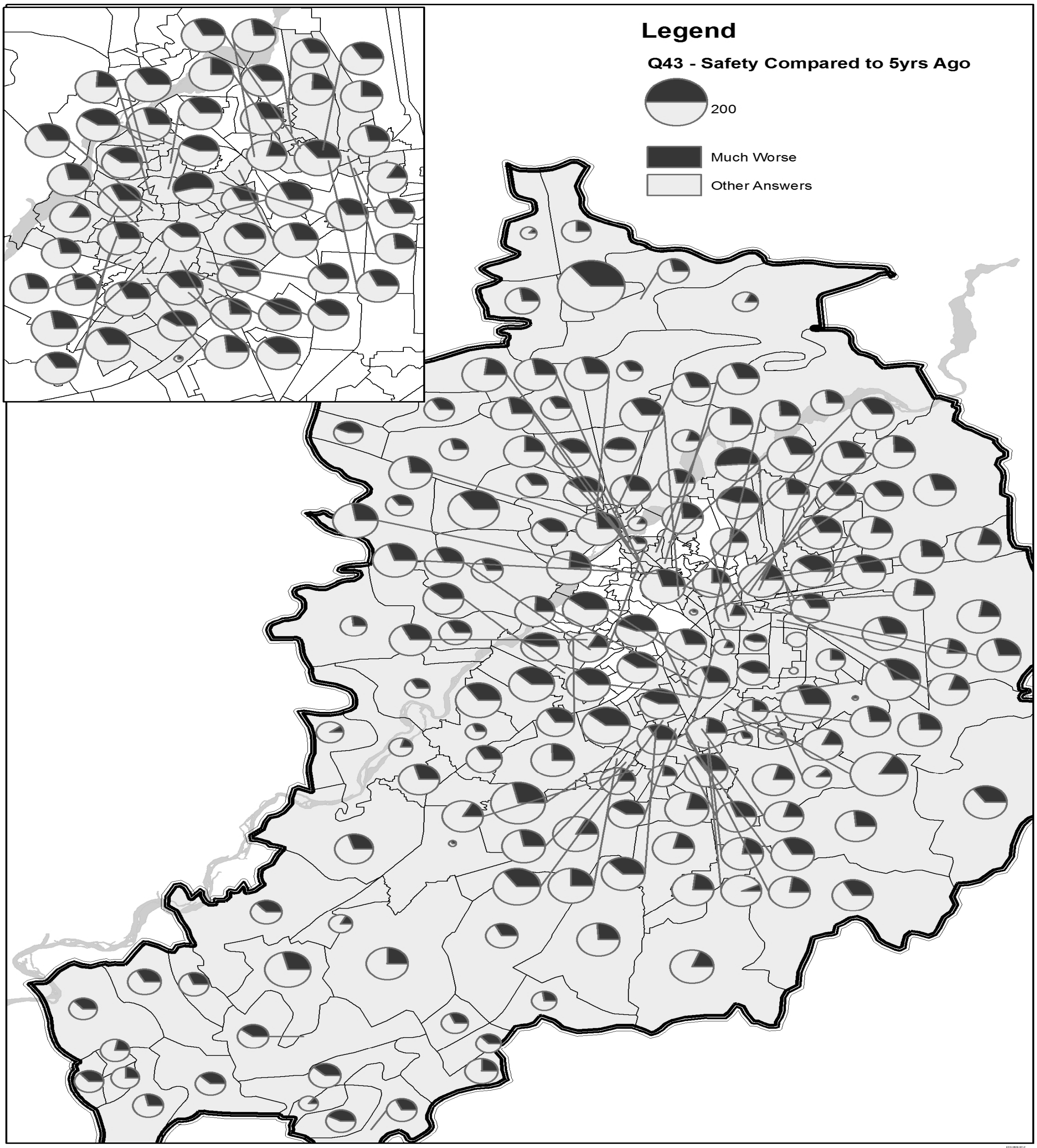
Table 2.6.3 “Have you got involved in traffic accidents in the past 5 years?”

Response	Number of Samples	Percentage
Yes	3,416	19.3%
No	14,266	80.7%
Total	**17,682**	**100.0%**

Source: JICA Study Team

Traffic safety situation in Lahore is worsening rapidly. Figure 2.6.3 shows the distribution of respondents who answered “Much Worse” of the current traffic situation as compared to 5 years ago. Its percentage tends to be higher in the city centre areas.

Figure 2.6.3 Distribution of Respondent Households who Answered Much Worse" Traffic Safety Situation as Compared to 5 Years Ago

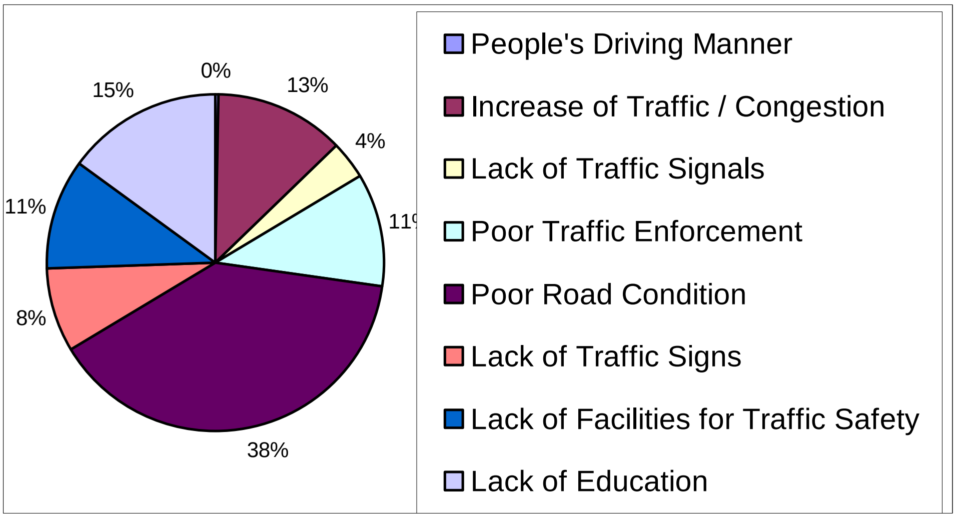


Source: JICA Study Team

Lahore citizen think that the reasons of this poor traffic safety are "Poor Road Condition", "Lack of Education", "Increase of Traffic / Congestion", "Poor Traffic Enforcement", "Lack of Facilities for Traffic Safety", and so on as presented in Figure 2.6.4. It is noted that "People's Driving Manner" is not taken seriously as traffic safety. As to the behavior of motorcyclist, people have generally negative impression such as "Very Bad" or "Bad".

Regarding traffic safety measures, majority thinks "Enhancement of People's Awareness" and "Improvement of Road" are most necessary measures, as illustrated in Figure 2.6.5

Figure 2.6.4 People's Opinion on Reasons of Poor Traffic Safety



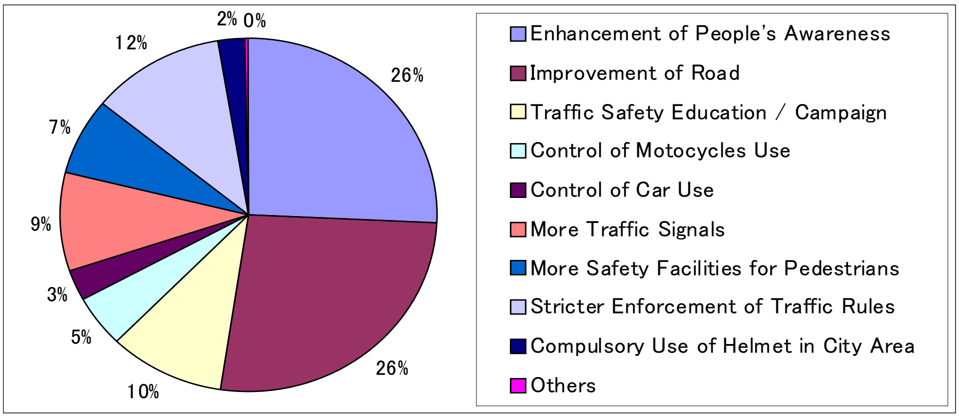
Source: JICA Study Team

Table 2.6.4 People's Feeling on the Behavior of Motorcyclists

Response	Number of Samples	Percentage
Very Good	24	0.1%
Good	358	2.0%
Ok	3,294	18.6%
Bad	5,853	33.1%
Very Bad	8,166	46.1%
Total	**17,695**	**100.0%**

Source: JICA Study Team

Figure 2.6.5 People's Opinion on Necessary Traffic Safety Measures



Source: JICA Study Team

2.6.3 Public Transport

Most of Lahore citizen are not using bus service regularly. Only about 14 % are the regular bus users as summarised in Tables 2.6.5 and 2.6.6. Among the reasons of not using buses, “Have own transport vehicles” was the reply of most respondents, followed by “Do not need to use buses” and “Not satisfied with bus services”. Based on people’s assessment on bus/ wagon service given in Table 2.6.7, majority of people are not satisfied on almost all aspects of the present bus/ wagon services.

Table 2.6.5 Frequency of Bus Use

Regularity	Number of Samples	Percentage (%)
5-7 Times a Week	2,434	13.8
2-4 Times a Week	2,318	13.2
Once a Week	2,422	13.7
Rarely	6,127	34.8
Never	4,315	24.5
Total	**17,616**	**100.0**

Source: JICA Study Team

Table 2.6.6 Reasons of Not Using Bus Service

Reason	Number of Samples	Percentage (%)
Have Own Transport Vehicle	4,015	43.2
Not Satisfied with Bus Service	1,821	19.6
Don’t need to Use Bus	1,896	20.4
No Opinion	1,568	16.9
Total	**9,300**	**100.0**

Source: JICA Study Team

Table 2.6.7 People’s Assessment on Bus/Wagon Service

Reason	Percentage Answered Very Bad or Bad
Route System	67.9
Operating Hours	69.6
Frequency/ Headway	67.7
Punctuality	73.3
Bus Speed	66.2
Bus Fare	73.0
Access to Bus Stop	59.3
Bus Stop Facilities	73.1
Waiting Condition	77.9
Number of Bus Stops	65.5
On-Board Comfort	70.9
On-Board Security	72.7
Driver/ Conductor’s Attitude	68.5
Convenience of Transfer	62.2
Others	59.0

Source: JICA Study Team

Despite adverse views on the present bus/ wagon services, people generally agree to the necessity of improving public transport as shown in Table 2.6.8. For the improvement of public transport, improvement of bus services is considered most important.

Development of air conditioned buses and rail based mass transit are also considered as a necessity by the citizens of Lahore.

Table 2.6.8 People's Opinion on the Necessity of Public Transport Improvement

Response	Number of Samples	Percentage
Yes	15,925	90.5%
No	970	5.5%
Don't Know	356	2.0%
No Opinion	349	2.0%
Total	**17,600**	**100.0%**

Source: JICA Study Team

Table 2.6.9 "What types of public transport services must be improved? (Choose two)"

Mode	Number of Samples	Percentage
Taxi/ Rickshaw	3,208	10.1
Bus Services	11,447	36.1
Aircon Buses	7,056	22.2
Underground Railway	5,084	16.0
Elevated Railway	2,344	7.4
Railway	2,596	8.2
Total	**31,735**	**100.0**

Source: JICA Study Team

2.6.4 Improvement of Transport System

Table 2.6.10, presents that possible measures for transport improvements as supported by people. More than 90 % of people support "Construction/ Improvement of Roads", "Strict Traffic Control" and "Improvement of Walking Condition". "Restricting Motorcycle" seems to be the relatively unpopular response.

Table 2.6.10 People's Attitude on Transport Improvement

Transport Improvements	Percentage Answered "Strongly Support" or "Support"
Construction / Improvements of Roads	96.5
Strict Traffic Control	93.4
Restricting Motorcycle	49.0
Installation of Traffic Signals	82.6
Strict Parking Control	88.0
More Parking Facilities	89.2
Improvements of Walking Condition	91.5
Expansion of Bus Services	88.1
Introduction of Bus Lanes	87.5
Remove of Animal-driven Carts	64.8
Others	60.0

Source: JICA Study Team

Regarding public transport improvement measures, "Control of Air Pollution", "Promotion of People's Understanding of Transport Problems and Measures", "Construction of Bus Exclusive Lane / Bus-way" and "Construction of Urban Railway" have a strong support from the citizens of Lahore. "Removal of Animal-driven Carts" and "Removal of Qingqi" also have a support to certain extent. Restrictive and economic measures on the use of private vehicles (car and motorcycle) are unpopular, as summarized in Table 2.6.11.

Table 2.6.11 People's Attitude on Public Transport Improvement Measures

Restrictive Measures	Percentage Answered "Strongly Agree" or "Agree"
Restriction of Motorcycle Use on Service Roads	48.3
Restriction of Car Use in City Area	42.2
Increase of User Charges for Car	32.5
Increase of User Charges for Motorcycle	31.1
Construction of Bus Exclusive Lane / Bus Ways	83.8
Construction of Urban Railway (Elevated)	77.4
Construction of Urban Railway (Underground)	78.2
Construction of Urban Railway (At-Grade)	76.2
Control of Air Pollution	93.2
Promotion of People's Understanding of Transport Problems and Measures	88.3
Removal of Rikshaw	51.5
Removal of Qinq Qi	61.6
Removal of Animal-driven Carts	63.8
Others	52.2

Source: JICA Study Team

2.7 Current Transport Problems and Issues

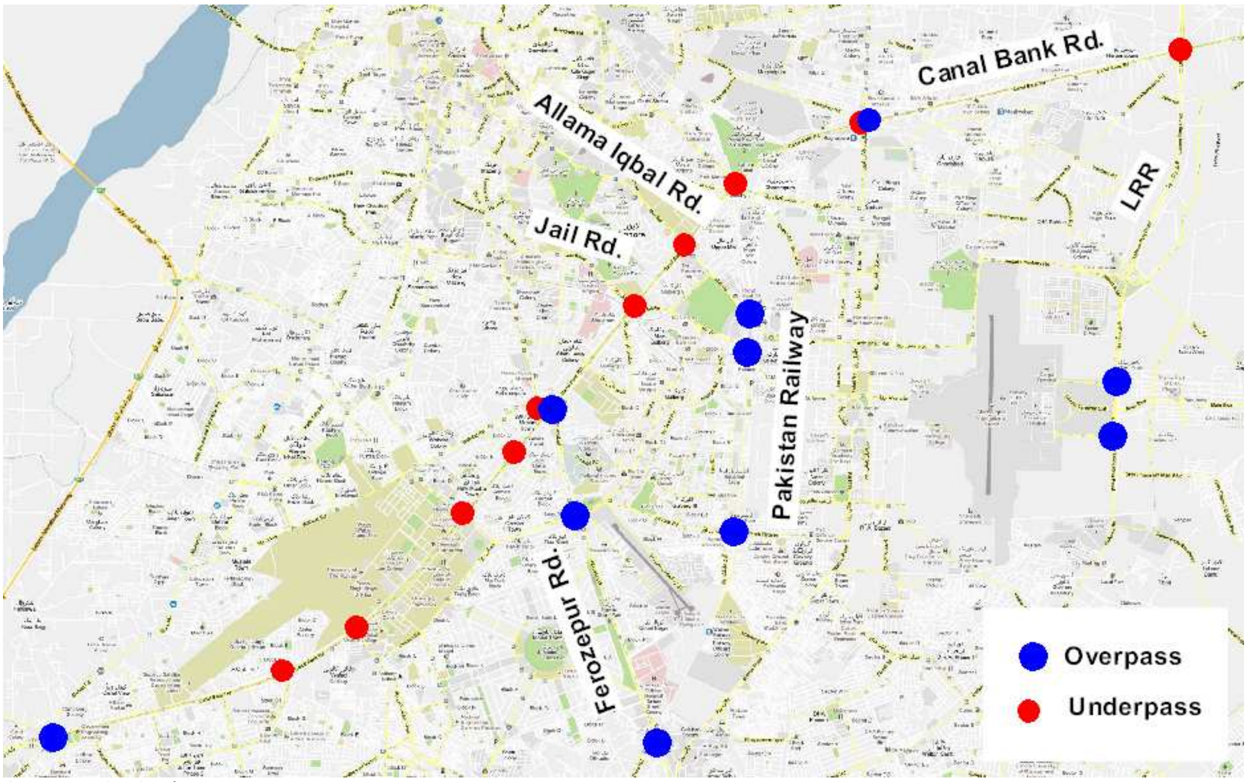
2.7.1 Road Network

Lahore is one of the most accessible cities of the Punjab Province. In addition to the historic Grand Trunk Road (G.T. Road), a motorway (M-2) was completed in 1997 from Lahore to Islamabad. The government has built underpasses to ease congestion and prevent traffic jams, and according to official figures, Lahore transportation services have improved to accommodate the growing number of visitors to the city. It is well connected by air to other countries as well as all major cities of Pakistan. Buses, trains, taxis and rickshaws are the other means of transport available in Lahore. The problems regarding road infrastructure are summarized as follows:

1) Lack of Overpasses and Underpasses

Despite these improvements, Lahore struggles for safety on its roads, which are dangerous because the number of vehicles overwhelms the road space. Massive congestion occurs every day as millions of Lahorites travel through disorganized, fast-moving traffic, and accidents are widespread. However the government is trying to improve traffic conditions by constructing flyovers, underpasses, and conducting public safety campaigns. As shown in Figure 2.7.1, the number of overpasses and underpasses are still limited, only on few roads including Canal Bank Road.

Figure 2.7.1 Location of Overpasses and Underpasses in Lahore



Source: JICA Study Team

2) Encroachment

There is no segregation between markets and roads in Lahore. All roads are market places in Lahore. LUTMP conducted RIS and recorded the extent of encroachment in terms of percentage of road area illegally occupied within the right-of-way (RoW).

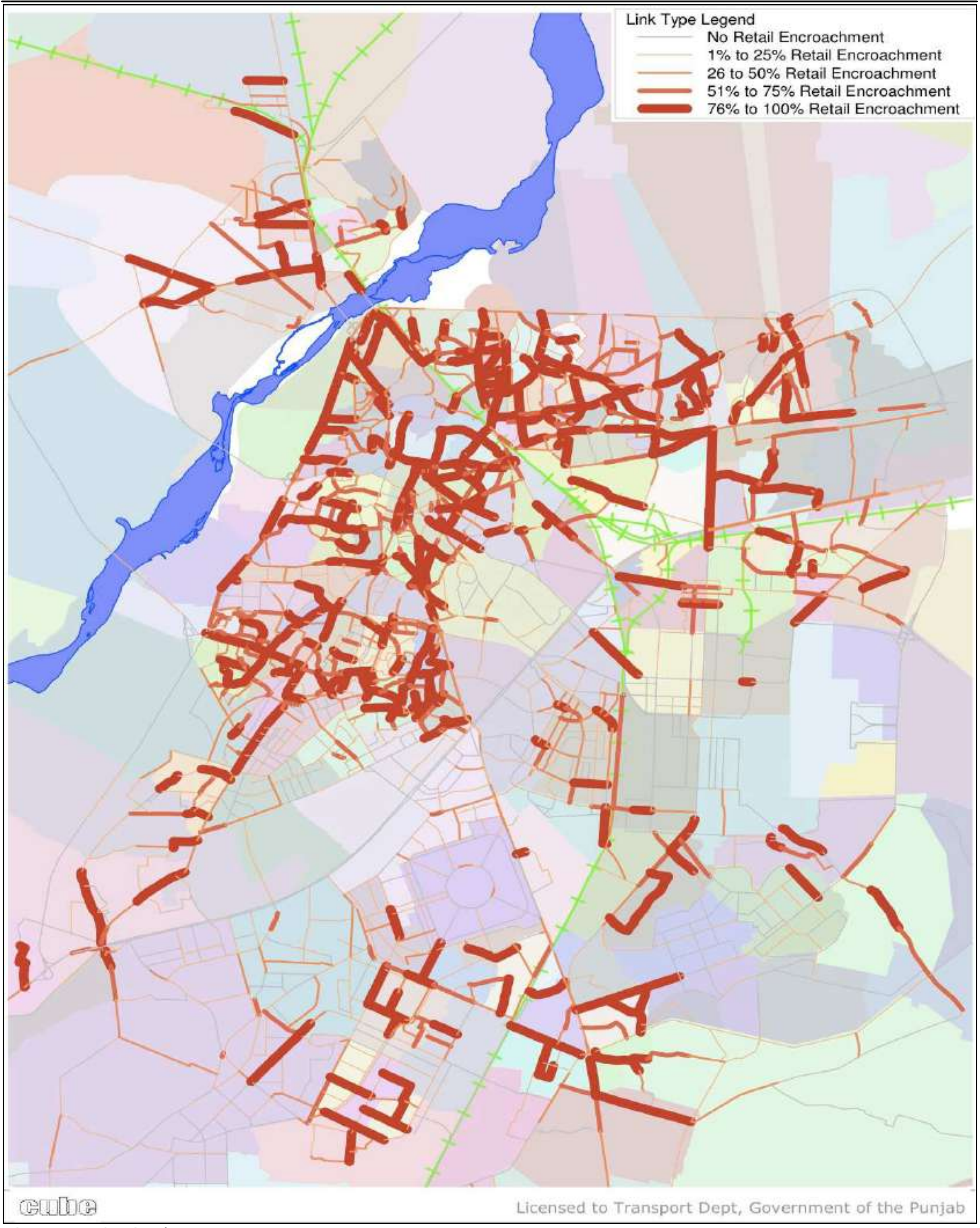
The Retail Encroachments are shown in Figure 2.7.2. The reasons will be:

- Many street vendors are working to earn their daily income.
- Parking spaces are limited or non-existent in most of commercial shops and business buildings.

Solutions to remove the encroachment will not be easy because it depends on a kind of social policy. The possible solutions will be:

- The street vendors are required to develop their economy so as to discontinue the street vending (Overall economic development is needed.).
- The shops and buildings owners have to determine to invest for their required parking spaces.

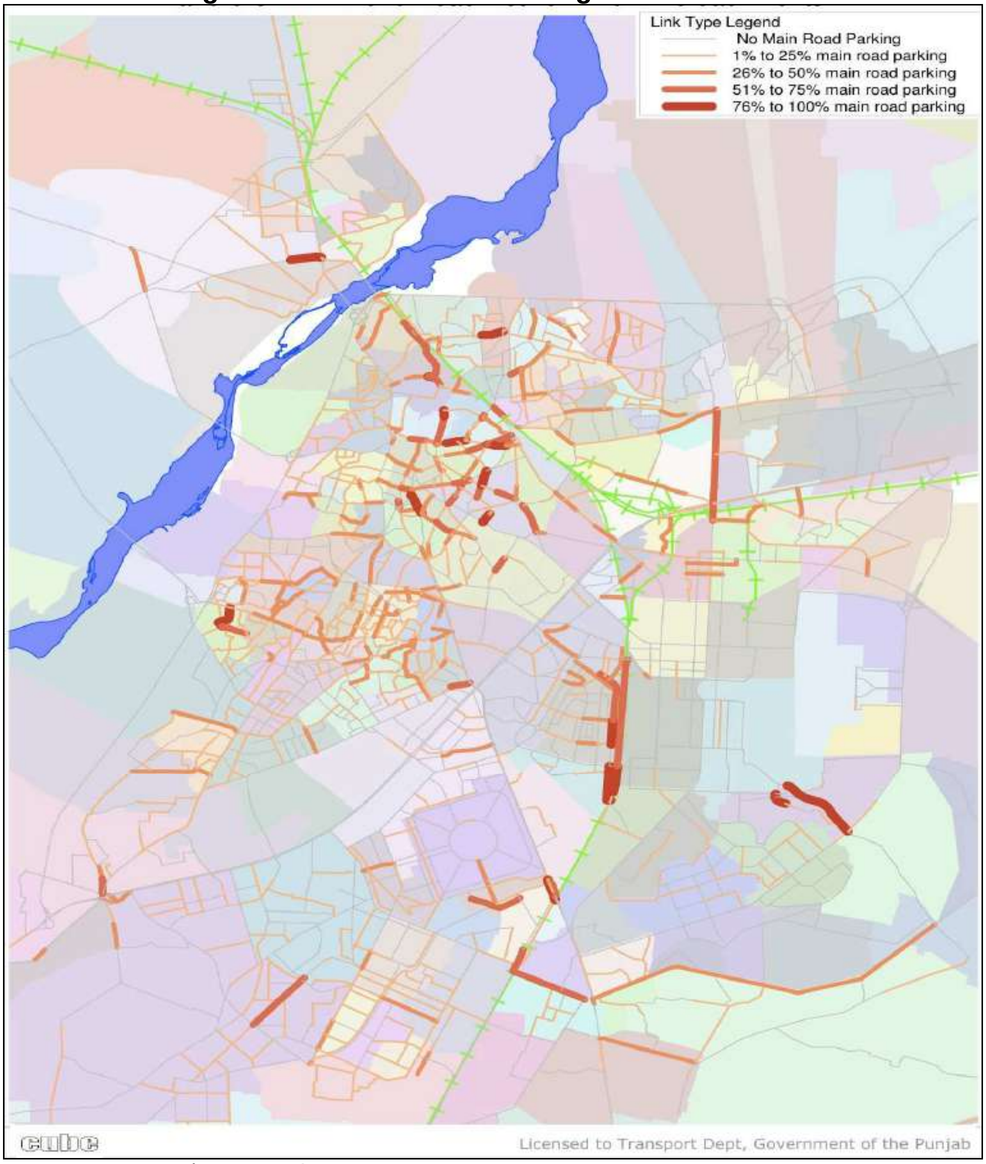
Figure 2.7.2 Retail Encroachment – Road Inventory Surveys



Source: JICA Study Team

Other forms of encroachment result from the activities outside schools, industrial facilities, hospitals and office spaces. Most of these are relatively minor, parking on main roads is significant cause of encroachments, as shown in Figure 2.7.3.

Figure 2.7.3 Main Road Parking Encroachments



Source: LUTMP Road Inventory Surveys

There is rarely parking all along the entire length of a road section. It is quite common to see parking along 25 % to 50 % of the road section, where commercial activity is prevalent.

3) Lahore Ring Road (LRR) Construction

Over quarter of the LRR is complete and eastern section is now under construction. LRR land acquisition process has been slow, however, it is anticipated that LRR Phase-I will be operational by the end of 2012. Early completion of both phases of LRR is essential to relieve the congestion in the inner city areas.

4) Lack of Ravi River Bridges

In the 1991 Master Plan prepared by Comprehensive Study on Transportation System in Lahore, JICA, three additional bridges over Ravi River were proposed. The outstanding one is from the south end of the Canal Bank Road to the north-west over the Ravi River. For the development of the city to the west of the Ravi River, additional bridges over the Ravi River would be required.

5) Development in the South-west of Lahore

Present new housing and industrial development schemes are mostly located in the south-west quadrant of the city between Multan Road and Ferozepur Road. The development of this area was initially proposed in the 1991 Master Plan prepared by JICA Study and later confound by the 2001 Master Plan prepared by LDA. Development toward east, north and even west were not considered due to fear of flooding from Ravi River proximity to the international border with India.

For the balanced development of Lahore, all directional development should be sought including road infrastructure development for smaller sub-centres, otherwise more people will tend to travel to the city centre from a single (south-west Ferozepur Road) corridor which is not sustainable.

6) Lack of Road Classification and Inventories

At present, road classification of each road is not clear, every authority has its own definition and classification is not authorized by laws. For the long term development and smooth implementation of each road, the classification should be well planned and the road inventories should be prepared for a single classification for all the relevant agencies.

7) Vertical Clearance of Underpasses

In May 2010, several pupils sitting on the roof top of a bus were hit and killed at one of the underpasses at Canal Bank Road. Existing vertical clearances of most of underpasses varies and maximum is only 4 m, sub-standard even by American Association of State Highway and Transportation Officials (AASHTO) standard (min. 4.3 m).

2.7.2 Public Transport Development

The public transport network in Lahore is currently under-developed, fragmented, inadequately managed and highly inefficient.

1) Under-Development

It is estimated that there are 3.3 million passenger trips in the Study Area using public transport (buses, wagons and other paratransit), whereas there are only 300 to 400 buses (55 ft) are operated by 13 private companies. Evidently the public transport network is under-developed and there is a great gap between the demand and provision of an efficient and environment friendly public transport system. Despite a considerable demand and several projects (Green, Orange, Blue and Purple Mass Rapid Transit lines), there is currently no Rail-based Mass Transit (RMTS) line in Lahore.

2) Fragmentation

Historically, the provincial governments in Pakistan have owned and operated intercity and urban public transport services. However, over the years, the government, according to the guidelines of the World Bank, advocated to encourage the private sector in operating public transport. The decline of state-owned public transport services created a vacuum that was filled by private operators in accordance with these guidelines. Initially, the market was opened to private operators in parallel with public-owned public transport. However, the availability of public transport has not grown at the same rate as the population. Therefore, a large number of small private operators were permitted to fulfil this gap in a fragmented way. As a result, a chaotic mass of individually-owned small vehicles (Wagon, Qingqi, Rickshaw etc.) operate in Lahore, competing for road space.

3) Inadequate Management

Public transport organizations have a long history of deficiency in professional, administrative, and financial capacity to manage public transport service planning. In the absence of human resources, coordination, research, and financial capacity of public transport institutions in Punjab, public transport has now become fully the prerogative of the private sector as described in the previous paragraph. The incomplete routes, high fares, fewer-than-needed buses, gender discrimination, and even absence of buses in some places are common in the urban areas. Whole public transport is grossly mismanaged with least objective of service provision, limited and inadequate condition of the public transport facilities (including buses, bus terminals and bus stops) and chaotic use of road space (leap frogging by Wagons) due to absence of proper government regulations and enforcement. Public transport operation should be improved by extending franchised bus operations on all major corridors and restricting small vehicles operations on feeder routes. It will require emphasis on high-capacity buses (50+ seats) rather than a multitude of small vehicles.

Transport related functions (transport planning, engineering and maintenance, and licensing, registration, regulation and operation of public transport routes) were not concentrated into one single and efficient authority: TEPA has no longer any involvement, and licenses are issued without assistance of any origin-destination data or transport planning processes. LTC is established to regulate public transport operations, it is anticipated to improve, albeit, the program has been limited over the last three years since its operation.

Actually there are currently many public transport vehicles operating without valid license and or even registration. About 25 % of mini-buses operate without any valid documents. It has also been reported that many wagons are operating without any registration, and that many do not follow the authorized route. Buses also suffer because of undue competition with paratransit; there are wagons and coasters which provide licensed services to neighbouring towns and, although they are not allowed to serve intra-urban passengers, these compete illegally with bus routes by picking-up and dropping-off passengers within Lahore district area.

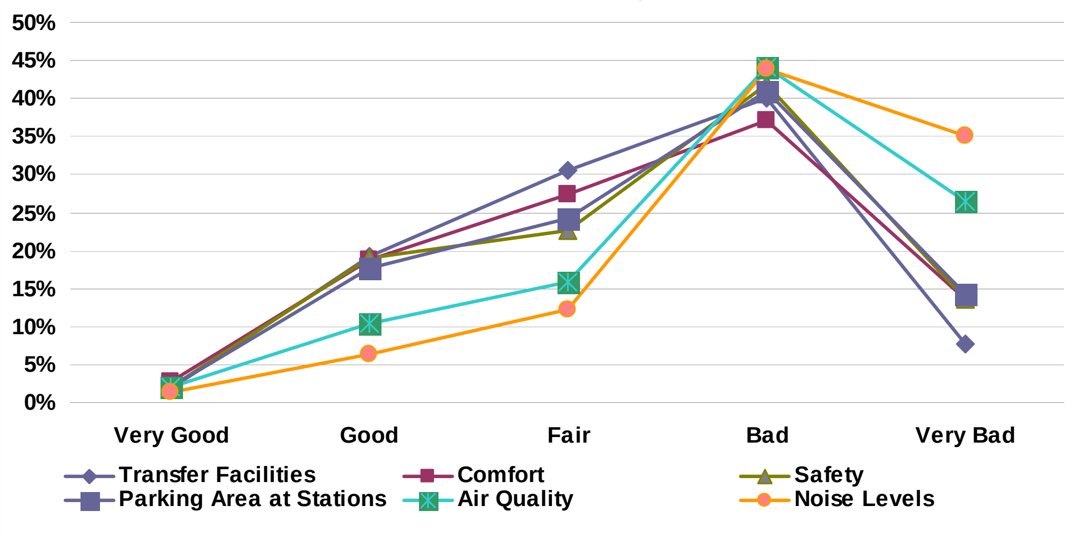
In addition to unlicensed mini-bus and wagon services, there is increasing phenomenon of Qingqis and Rickshaws. About 5,000 route permits have been issued to Qingqis, but it is estimated that as many as 40,000 are currently operating in Lahore, many along primary and secondary roads which are also served by licensed bus services. In parallel, the presence of more than 80,000 rickshaws not only causes congestion but serious threat to efficiency and service quality.

4) Performance

Due to rapid motorization increase in traffic volume over the last two decades, the road network has many congested sections along arterial roads, which increases travel delays and reduces bus travel speeds, implying a less competitive public transport network, especially in the CBD where commercial and trading activities are concentrated.

Current public transport services are suffering greatly due to irregularity. On certain routes waiting times for the passengers are too long, whereas on certain routes buses wait for the passengers to be filled. Such a situation prevails because of the fact that routing and licensing is not based on passenger demand analysis but based on convenience of operators and the regulator. Efficiency is acceptable on certain routes but reliability is poor, there being no scheduling at all. Quality of public transport services, as reported by users is illustrated in Figure 2.7.4.

Figure 2.7.4 User Assessment of Public Transport Facilities



Source: JICA Study Team

2.7.3 Traffic Management

Mainly due to institutional issues, traffic management is highly inefficient and ineffective in Lahore. Main aspects are: traffic laws, management of the public spaces, management of the physical infrastructure, traffic control, also management of the drivers, provision of pedestrian facilities and safety of all road users.

1) Traffic Laws

In general, traffic related regulations are insufficient, ineffective and obsolete; moreover, enforcement of rules is quite weak. This generally implies a chaotic and an in-disciplined traffic on roads, and therefore results in high rate of accident and even loss of life, injuries and damages to the properties. This chaotic situation is exacerbated by the diversity of the traffic in Lahore. The traffic laws are not though applied on pedestrians, cyclists, animal-drawn carts and hand-pushed carts, even though these modes make up around 70% of the total road users. The typical traffic enforcement fines are quite low and are in the range of around PKR 50 to 300. Also there are no appropriate punishments for damaging the road infrastructure; and compensation for a death in a road accident is around only PKR 10,000 with a third party insurance. Road safety is globally declining resulting in increase in number of fatalities per year.

2) Management of Public Spaces

Management of the public spaces in Lahore is poor, resulting in disorderly traffic mixed with various modes, many encroachments and illegal parking, and few facilities for pedestrians and cyclists.

As illustrated by the following Figure 2.7.5, Lahore is characterized by a disorderly traffic mix with pedestrians, animal-drawn carts, hand-pushed carts (fruit sellers, hawkers), bicycles, motorbikes, rickshaws, Qingqis, cars, vans, mini-buses, inter-city coaches, trucks etc. The animal driven vehicles and the other slow-moving non-motorized vehicles need to be eliminated from using the main road and separated from general traffic. These slow modes of traffic cause blocking back in traffic resulting in congestion, queues and even severe traffic accidents. It is observed that such animal driven/ hand carts and slow modes are frequently parked on footpaths, as a result the pedestrian walk in the main carriageway, are major problem and reasons for pedestrian accidents.

Figure 2.7.5 Disorderly Traffic Mixed in Lahore

Source: JICA Study Team

Wide spread, encroachments of roadside, both permanent and temporary, reveal a lack of parking policy in Lahore. Parking blocks sidewalks in many locations and inhibit both pedestrian and vehicular flows. For instance, large Solid Waste Containers are placed on main roads (as service roads are full with the parked vehicles). These obstruct traffic and, while this procedure eases solid waste collection, it is clearly contrary to any modern principles of traffic management. Due to encroachments, the slow modes and two wheelers have to use higher speed lane which make travelling difficult and increase the risk of accidents as well as traffic congestion. There is a strip commercial development along most of the transportation corridors without proper offsets, set-backs, on and off-street parking and access management as per the bye-laws; causing severe encroachments and traffic congestion issues. Moreover, traffic police does not have the adequate authority/ capacity or even interest to remove encroachments.

On the other hand, facilities for pedestrians and cyclists are either non-existent or inadequate. These are the most vulnerable groups and are the victims of 50% road accidents. Most sidewalks are in poor condition or encroached by parked vehicles or commercial activities, garbage and hawkers forcing pedestrian to walk on the street and therefore affecting traffic safety.

3) Management of the Physical Infrastructure

Management of the physical infrastructure particularly concerns road maintenance. The poorly developed transport network in Lahore is under-maintained. One of the key weaknesses in the system is indeed relatively low priority to the maintenance of existing infrastructure. Roads are completely dilapidated condition resulting in frequent pavement failures and require full rehabilitation. Road maintenance is generally ignored till reconstruction becomes due. Secondary and tertiary road/ drainage networks in lower income parts of the city have been neglected and become impassable in the rainy season for pedestrians and vehicles alike, as shown in Figure 2.7.6.

Figure 2.7.6 Flood in Lahore

Source: JICA Study Team

4) Traffic Control

Traffic control devices include traffic signs, signals, road marking and other devices (cameras) are used and are key elements for managing traffic flow. There is no standard practice of using uniform traffic control devices in the Punjab. The only Manual for Uniform Traffic Control Devices available is the National Transport Research Centre (NTRC) Manual for Signs, Signals ad Markings (1989), which has never been updated. Furthermore, there are many gaps and missing areas in the NTRC Manual e.g. work zone area, school children signage etc. Many of the traffic signals (only 120 in Lahore) are inoperative and signage is almost non-existent. In Lahore, traffic signals are largely being managed by TEPA as originally stipulated. There was a period in the late 1990s when the traffic signal functions were re-assigned to an agency responsible for civil works, with the result that most signals ceased functioning. In recent years, some signals have been installed and managed by other agencies, such as the GoPb, C&W, the NHA (on National Route N-5) and The Cantonment Board, about 50 signal installations in the Defence Housing Areas. Similarly, traffic signs and road markings are placed and maintained by TEPA, CDGL and Parks and Horticultural Authority (PHA), and also by other agencies and even private sector with advertisement. For the sake of efficiency, uniformity and economy, it would be desirable to concentrate these functions in a city-wide single traffic agency.

5) Management of the Drivers

The current situation in Lahore is also worsened by a weak management concerning the drivers, both private and public transports, with a considerable proportion that are lacking proper training and licensing. Commuters and transporter have generally no traffic sense resulting in a chaotic situation. A lack of operators discipline in this complex environment reduces traffic capacity further and increases safety concerns. Traffic police also suffers from inadequate strength and needs further training. There is finally a significant safety issue concerning the motorbikes use, sometimes transporting two or more passengers, often without helmet for both driver and passengers. The general situation causes a fatal failure to follow traffic rules, which in turns leads to a worsening of congestion level and contribute to road accidents.

2.7.4 Institutional Set-up

In LUTMP Phase-I, institutional issues of transport sector administration in Lahore were reviewed through perusal of past studies and interviews of relevant organizations. As a result, following was understood as the key current institutional problems. However, there are still quotations pointed out in some reports or hearsays mentioned in some interviews.

1) Many Responsible Agencies and Duplication of Roles

There are at least 17 departments or agencies of the national, provincial and city district Governments that play important role in the management of roads, public space and transport services. In addition to these, there are nine TMAs. Among these, some roles are assigned to plural organizations and as a result, such roles are prone to be neglected. The matter is now further worsened by creation of government owned public companies for public transport and waste management without clear delineation of power.

2) Insufficiently Trained Traffic Police

Traffic police is mainly responsible for traffic control and management, while capacity building of traffic police has been neglected. In the past 20 years, information technology in traffic management has been significantly advanced and training of traffic police has failed to catch up with these advances.

Along with increase of traffic volume, roles of traffic police has been widened and complicated, while training of traffic police is not adequate, this has resulted in low efficiency in traffic control and road space management. As a result, people have not respect of traffic police and their role in traffic management.

3) Shortage of Planning Expertise

The TD of the GoPb does not have any agency specialized in transport planning and as result, has no trained staff or planning expertise. By this, every action and projects tend to have a nature of a patchwork, which will impair investment efficiency. With this background, the Transport Department has decided to establish the Transport Planning Unit (TPU).

4) Outdated Transport-related Rules and Regulations

The transport sector in Pakistan is regulated through the federal and provincial enactments which are (a) The Provincial Motor Vehicle Ordinance (MVO), 1965 (b) The provincial Motor Vehicle Rules, 1969 (c) The Motor Vehicle Act, 1939 (d) The Fatal Accidents Act, 1855 and (e) The National Highway Safety Acts.

Most of these well out dated and losing their proper workability to the 21st Century transportation phenomena. These require review and amendment. For example, the MVO 1965 provides the mechanism, licensing and regulation of motor vehicles in particular and for control of traffic but it does not cover all the aspects of the Road Traffic Control, Regulation and the Public Space Management. It has provisions for the construction, equipment and maintenance of motor vehicles but has not been updated for a very long time.

The section 67 of the MVO, 1965 provides another aspect relating to accidents of motor vehicles and causalities which specify the responsibility for compensation. However, the principles relating to award of compensation in motor accident cases and the provisions relating to insurance in the MVO, 1965 are extremely vague, uncertain and complicated.

5) Incomplete Implementation of Rules and Regulations

The MVO, 1965 is a consolidated and comprehensive law with various amendments over the years. Despite the exhaustive nature of the ordinance and the matters contained therein, the issue of effective enforcement is lacking, resulting in deterioration of traffic conditions and motor vehicle affairs in general.

The criteria for granting various licenses like driving licenses, stage carriage licenses and private/ public carrier licenses are contained in the ordinance but not followed by proper enforcement. The discretion available to the traffic police officers and cumbersome penal ticketing system in case of traffic rules violations have contributed towards corrupt practices and deterioration of traffic system.

As for another example, the National Highway Safety Ordinance (NHSO), 2000 has provision for “No Fault Accident Compensation” by a registered insurance company, but the rules have not yet been framed to implement this provision. An urgent need is pointed out in Pakistan to introduce new concepts within the MVO, 1965, commensurate for the compensation for no fault liability.

Section 76 of the MVO, 1965 authorizes the Government to prescribe conditions for the issue of permits to heavy transport vehicles. In reality, however, an offender driving an over-loaded heavy vehicle is only asked to reduce the weight at the close-by storage point, which is rarely exercised, resulting in the common and widespread road surface rutting.

Volume-I – Chapter-3

URBAN DEVELOPMENT CONTEXT

FINAL REPORT

3. URBAN DEVELOPMENT CONTEXT

3.1 Alternative Urban Development Scenarios

3.1.1 Assessment of Past Urban Development in Lahore

1) Urban Area Formation in the Past

The origin of Lahore's urban development is the Walled City. During British colonial era, urban facilities including residence, parks and universities were constructed in the south of the Walled City surrounding administrative centres. At present, a number of administrative facilities such as provincial parliament, governor's official residence and government officer's residences are concentrated in this area together with the Jinnah Park, the University of Punjab, other colleges and many business/ commercial buildings. This area boasts of its beautiful urbanization with low-coverage buildings, characterized by wide streets and parks/ gardens covered by tall trees.

The Canal also has a salient influence on the formation of Lahore's urban area. The Canal Bank road runs in the east to south-west direction, and contributes largely to the special urban scenery of Lahore having the canal in the center of the road. The canal has its source in Larger BRB Canal upstream and supplies irrigation water to Lahore and agricultural areas in Lahore and the south-west green belt.

In the north-east of this built-up area, the Lahore station is located. The railway is basically for intercity long distance travel connecting Lahore with Rawalpindi and Peshawar in the north and Karachi in the south. The agglomeration of iron/ steel industries located in the north-east of the railway (about 150 ha) is considered to have been once developed due to the proximity to the railway. Although it has little relation with the railway transportation at present yet its production and sales functions still remain in the same area. The road traffic generated from these industries, coupled with intra-city bus terminal traffic on the opposite side of the railway, creates serious traffic congestion between the Walled City and the Lahore Station.

Lahore's population was about 2.5 million in 1960, which is less than third of the present. As population increased with economic growth, urbanization went southward and eastward. Eastward urbanization was led by the military as Cantonment, and southward expansion was based on road and road transport. There is no evidence that railway played any role in leading urbanization.

In the later decade of the Last Century (1980-1990), urban development pattern was gradual outward expansion of the existing built-up areas. Motorcycles and auto-rickshaws, which became popular, then, may have assisted this development. In the meantime, a huge academic town of universities and colleges of about 10km^2 was developed at the south-western end of the urban area. This academic town, however, is in the midst of residential area at present.

Urban development pattern changed in 1990's due to rapid motorization, commercial, industrial and residential development occurred along arterial roads showing ribbon development pattern along radial roads. In one word, the pattern changed from concentric-contiguous pattern to starfish pattern. This pattern, however, is changing again. The concentric-contiguous pattern is appearing again due to the following reasons:

- New road development has become difficult (except for northern half of the LRR).
- Insufficient capacity of radial arterial roads has become a restriction for large-scale urban development between radial corridors.
- Development permission system has started functioning (LDA was established in 1975 and legal system has been provided).

The concentric-contiguous pattern is seen mainly in the south and in the east. In Cantonment, well-organized residential area (DHA) was developed by the military, and the eastern section of the LRR further enforced this development. In the south, development permissions were given to vast areas such as Engineering Town and Chung. However, these areas are not necessarily built-up yet, and agricultural land and other open space still remain in the midst of residential areas.

In the north of the Ravi River, ribbon-type development is still seen particularly along the G.T. Road and Sheikhupura Road. Industrial, commercial and residential development of this area is mainly due to the improvement of access condition by the Motorway.

The population of the Study Area is 9,928 thousand (8,652 thousand for Lahore District and 7,571 thousand for built-up area of Lahore) as of 2010. Population density exceeds 1,700 /ha in some zones of the Walled City. However, it is sometimes below 50/ha in the residential areas that are not fully built-up. In the remaining vacant parts of these inefficient areas, high-rise buildings of up to 15 stories are often built. But the location is not well-planned in general. In addition, LDA promotes many housing schemes, mostly in the suburbs in the east and south.

- LDA Regular Schemes: 52
- Private Housing Schemes approved by LDA: 215

With regards to industrial estates, there are two salient industrial estates: one in the south nears the border with Kasur District (Sundar Industrial Estate) and the other in the north along Lahore-Sheikhupura Road. The former depends on a narrow 2-lane local road and the later on a 6-lane National Highway. There is also industrial ribbon belt along G.T.

Road (National Highway N-5) between Lahore and Muridke in the Study Area.

2) Assessment and Identified Problems

(i) Densely Built-up Area in the North

In the north of Lahore, there are extremely high-density built-up areas such as the Walled City. The most salient advantage of this area is that a wide variety of functions exist in proximity and the area does not generate many long-distance trips as compared to the dense accumulation of population and urban functions. The close community incubates local/ family industries and vitalizes people's life. The disadvantage of the area is obsolete residences with extreme high population density and poor sanitary condition due to dust, sewerage and uncollected garbage. The advantage and disadvantage are in a trade-off relation.

A large problem exists with the agglomeration of iron/ steel industries, which produces traffic congestion as mentioned earlier. Its production efficiency is deteriorated due to its dependency on road transport, and with limited access to main roads.

Congestion on the secondary and local roads of this area is serious due to mixed traffic of car, bus, truck, auto-rickshaw, Qingqi, and animal-drawn carts and had drawn carts mostly for movement of goods.

(ii) Government Building Area and Its Environs

This area consists of government buildings, offices, hotels, high-grade residences and so on, and its environment such as greeneries, parks, gardens, historic buildings and wide-carriageway roads needs to be inherited. This area is the actual CBD of Lahore. The coverage of most buildings is low and high-rise buildings are few (mostly 3-5 stories, 10 stories at most). The space in this area for future possible development and enhancement is sufficient because limited elevation of buildings in harmony with the existing environment may suffice for immediate future needs.

The only problem of this area is that it is located in far north of Lahore, and it creates large travel needs to/ from the southern and eastern residential areas. If urbanization proceeds further to the south without strong public transport, there is a strong possibility that the CBD functions would get paralyzed in the not too distant future.

(iii) Existing Built-up Residential Areas

This area consists mainly of residential areas constructed before 1990. With moderate population density and reasonable road network, people's life is comfortable and convenient in general. This situation, however, is changing.

First, 3-7 story buildings are constructed along arterial roads. However, the location seems to be selected randomly without any city plan. Usually, this type of building is admitted in limited areas to form urban functions in an orderly manner. Another problem is related to the fact that the construction period seems very long. Due to this inefficient investment (e.g. interest during construction), building construction does not contribute much to the urban economy as seen in other cities of the world.

Second, there are many unused land spaces that seem to be increasing recently. Large-scale disorderly development in the suburbs, results in deterioration of existing urban area, and this again increases unused land spaces. This vicious cycle should be checked early on. Such development cycle was also observed in the early redevelopment years of Japan after the World War II.

Third, conversion from residence to commercial building is often seen in high-grade residential areas. This increases convenience of the area, while this tends to aggravate the living environment. It may be necessary to restrict this conversion. In addition, GoPb has development rules established in 2009 which can deal with this situation.

In summary, this area is changing rapidly. Major effort should be made to create good urban environment in this area.

(iv) University Area

As mentioned earlier, an academic town is located in the midst of residential area in the south-west of Lahore. Its population density ranges 50-100 /ha (partially over 200 /ha) showing that many staff and students stay in residences and dormitories on campus. Travel demand to/ from outside is relatively small.

For instance, Zone 57 (Sikandar Block) is mostly university campus. This zone has incoming 5,757 trips on commuting purpose, of which 2,723 trips or 47 % are intra-zonal. Nearly half of the university staff lives on the campus. Number of "to-school" trips is 11,252, of which 4,405 or 39 % are intra-zonal. About 40 % of the students live on campus.

The problem of this area is that the area hinders the north-south traffic flow due to the lack of through road from this 4-5 km wide area. In addition to the above, there are other universities, colleges, etc in the CBD or in the suburbs. Those in the suburbs have been developed recently, such as the Institute of Technology located 10 km north of the Ravi River and two universities located in the west of Nishtar Town and recently opened Lahore School of Economics and University of South Asia on Burki Road in the east of Lahore.

(v) Expansion of Urban Area toward the East and South

The expansion of urban areas toward east and south has created a number of problems due to vast and low-density development:

- Poor community formation with weak internal relationship;
- Inconvenient access to urban facilities;
- Dependency on cars for commuting with large load on arterial roads.

The largest problem is lack of coordination between urban development projects and arterial road development that support daily traffic needs of the residents. LDA acknowledges this problem focusing on "increasing distances from city center, deficiency in social and physical infrastructure, environmental degradation".

It is essential for sound urban development to pursue maturation of urban area by filling scattered unused open space and development of trunk transport system. As for unused open space, it is recommended to classify it into the area to be urbanized or the area to be conserved as green spaces.

(vi) Ribbon Development in the North

With regard to the ribbon development along arterial roads seen in the north, some problems are identified:

- Difficulty of land use at the back of ribbon development;
- Low efficiency of the thinly developed area;
- Degraded function of the arterial road.

Due to the reasons above, UK prohibited ribbon-type development by law in 1935[1]. Owing to this restriction, many British cities including London are generally compact and efficient. In Japan, however, because ribbon-type development was admitted, suburban land use became inefficient and functions of arterial roads were degraded. Disorderly development in the suburbs damages city efficiency as a whole.

In the north, planned development should be pursued taking advantage of the following favourable condition:

- Proximity to the center of Lahore;
- High mobility due to the Motorway and wide-carriageway arterial roads;
- Vast open space usable for various projects of urban development.

Without planned development, ribbon-type development will further proceed and 'concentric-contiguous' development will become unfeasible.

[1] Restriction of Ribbon Development Act

(vii) Industrial Zones

Industrial development in Lahore has continued depending on existing arterial roads. This was favourable to strengthen the basis of Lahore’s economy.

In the south, most industries are located in the shape of ribbon developments except for some estates, and its production environment is not generally good in terms of transportation of materials/ industrial products and workers. Immediate countermeasures are required to prevent exodus of factories.

The developing industrial area in the north of Ravi River also has the problem of ribbon-type development although the function of intercity arterial roads is much stronger than in the south. Development of industrial estates is required. According to Sheikhupura Tehsil, 723 factories were established by 2000 in that Tehsil, and the reason of location was the existence of intercity roads for 307 factories or 42.5 % of the total. In addition, the factories are rice mills, iron steel re-rolling mills, tanneries, flour mills and so on. Most of the factories are small except for sugar mills, polyester processing and fertilizer production. Although no data is available after 2000, recent industrial developments can be observed in this area.

(viii) Overall Urban Structure

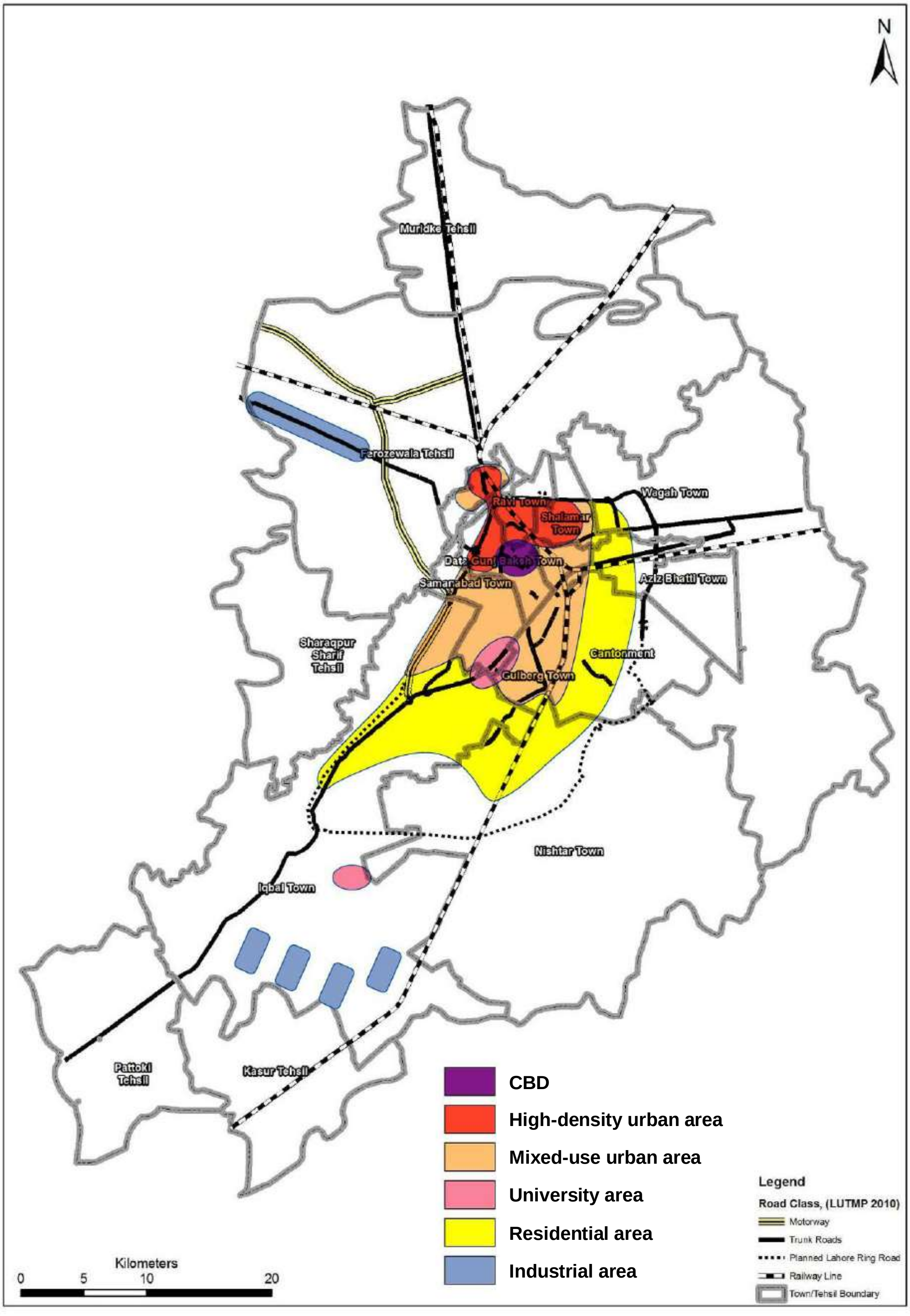
As stated earlier, the CBD of Lahore is located in the north due to historical reasons and urbanization spreads toward the south and the east. Due to poorly developed public transport depending on a small number of buses, long-distance travel becomes more and more uncomfortable, inconvenient and extremely difficult affecting economic performance of Lahore.

The residential area spreading to the south and the east seems to have been developed in a planned manner. However, developed areas are actually distributed widely like islands in the sea with numerous vacant land plots. The overall population density of these residential areas is very low. This incurs the issues of low efficiency of urban infrastructure and the difficulty of public transport development.

Outside Lahore District, there are some urban clusters in Sheikhupura and Kasur District such as Muridke, Raiwind area and Pattoki Tehsil areas. However, the interrelation of these urban clusters with urban activities of Lahore is very weak, presumably due to historical reason and the lack of high-mobility transport system.

The present urban structure is schematically illustrated in Figure 3.1.1.

Figure 3.1.1 Present Urban Structure



Source: JICA Study Team

3.1.2 Alternative Urban Development Scenarios

In order to solve the urban problems mentioned above and to promote future development, medium- to long-term urban development scenarios should be formulated. Three scenarios have been developed;

Scenario1: assumes past natural tendency will continue without any political intervention from the Government except for some ongoing projects such as LRR.

Scenario 2: assumes compact development with improvement of living environment and mobility by development/ enhancement of public transport.

Scenario 3: assumes dispersed multi-core development by fostering suburban cities and urban areas by restricting urban expansion of Lahore.

In order to determine the land use pattern for each scenario above, the result of land development suitability analysis was taken into account. The analysis are based on three factors; proximity to major roads, accessibility to city center and net population density. Natural conditions were not considered due to the similarity over the entire Study Area. This is presented in Figure 3.1.2, with its criteria shown in Table 3.1.1.

Table 3.1.1 Criteria for Land Development Suitability Analysis

Factor	Weight (%)	Grade				
		5 (Good)	4	3	2	1 (Bad)
Proximity to major roads	25	<500m from trunk roads	<500m from primary roads	500-1000m from trunk roads	500-1000m from primary roads or <500m from secondary roads	500-1000m from secondary roads
Access time to city center	25	- 15 mins.	15-30 mins.	30-45 mins	45-60 mins	60 mins. or more
Net population density	50	< 50/ ha	50-100/ ha	100-150/ ha	150-250/ ha	250/ha or more

Source: JICA Study Team

1) Scenario 1 (Zero Option – Trend)

This scenario assumes that the past tendency of urbanization will continue in the future. Although there is a risk that this Scenario will further amplify the current urban problems such as: inefficiency of urban infrastructure and worsening of traffic congestion, public investment by the Government would be limited.

(i) Densely Built-up Area in the North

Population of this area will not increase much. Actually the population of the Walled City has been stagnant already according to the “Sustainable Development of Walled City Lahore Project”. As people’s income increases, residents of this area will move out gradually looking for better living environment.

(ii) Government Building Area and Its Environs

The needs for public facility and office spaces will increase according to the population growth. Thus the floor area of this zone will increase accordingly. Although existing greenery and open space will decrease slightly, its environmental impact will be minimal considering strict land use restriction and its abundance.

(iii) Existing Built-up Residential Area

Although strong political intervention is not considered, vacant land space will be gradually filled by buildings as a natural tendency. Moderate land use control based on existing laws is assumed in this scenario.

(iv) University Area

No change is assumed in this scenario.

(v) Expansion of Urban Area toward the East and South

Population of LDA project areas and development permitted areas will reach its target by 2030 as planned. The rest of increased population is assumed to be distributed in newly developed areas to the east of LRR, in the south of Defense Road, around Ravi Town and so on. Moderate land use control based on existing laws is assumed in this scenario as well.

(vi) Ribbon Development in the North

Ribbon development will further expand along arterial roads.

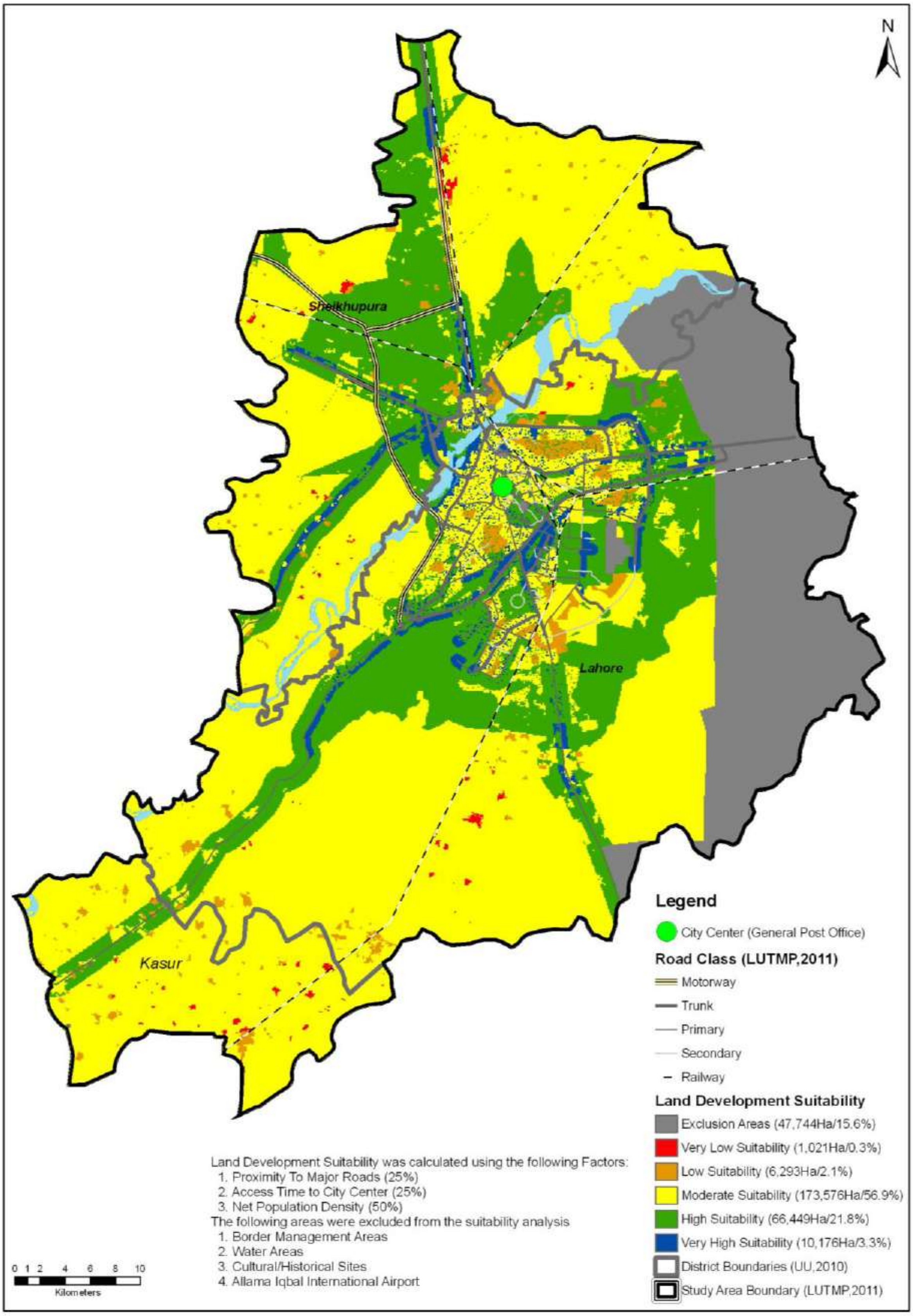
(vii) Industrial Zones

Considering the existing road network, industrial development will not precede much in the south. In the north, however, it will expand taking advantage of the favourable road condition.

(viii) Overall Urban Structure

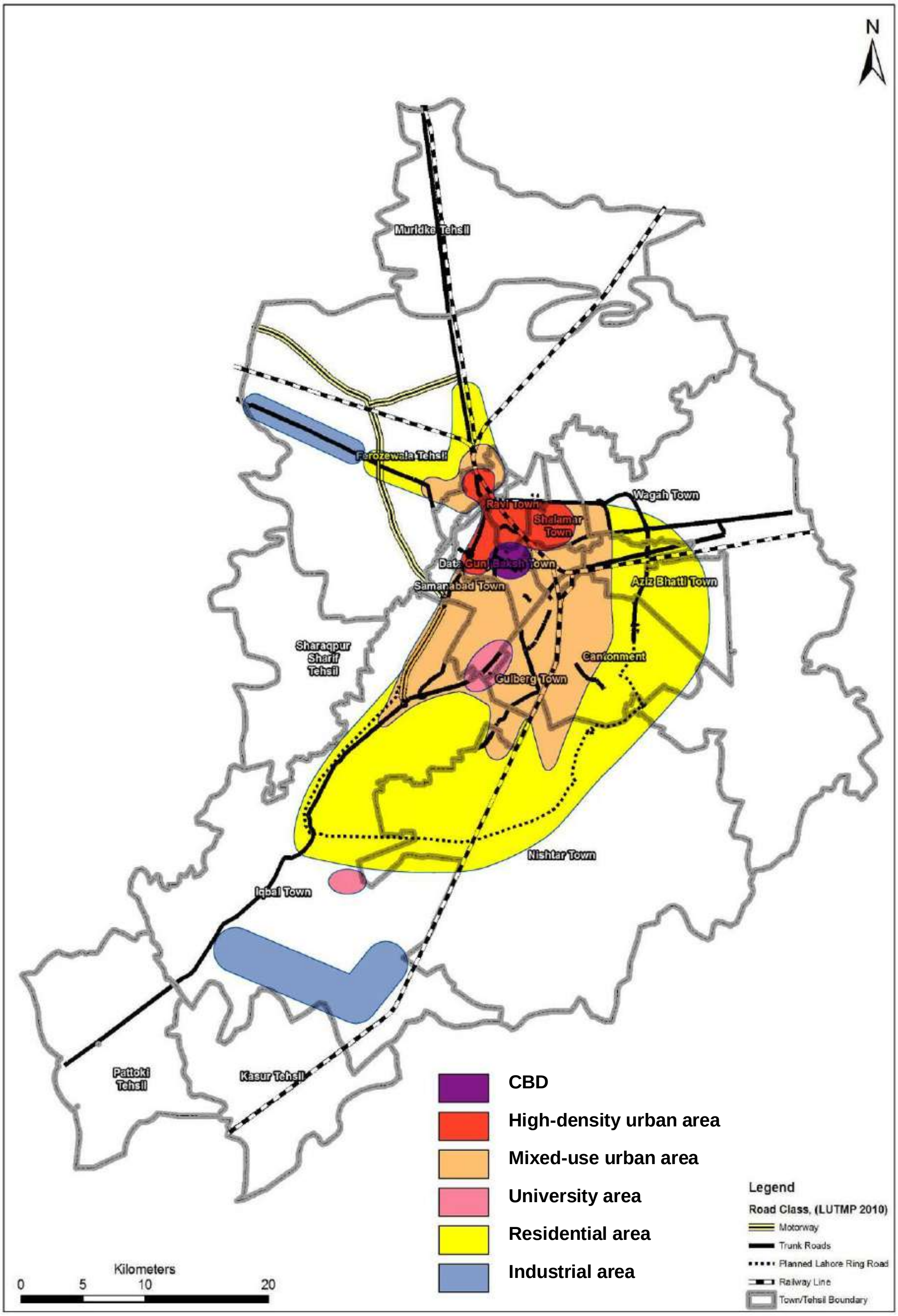
In this scenario, urban structure will be the same as at present as a whole. Urban area will expand mainly to the east and south. It is a car-oriented society. The resultant scenario (Zero Option – Trend) is depicted in Figure 3.1.3.

Figure 3.1.2 Result of Land Development Suitability Analysis



Source: JICA Study Team

Figure 3.1.3 Urban Development Scenario 1 (Zero Option – Trend)



Source: JICA Study Team

2) Scenario 2 (Compact Development)

This scenario intends a compact urbanization led by public transport development. This scenario is friendly to people's travel, living environment and natural environment. Many of the current urban problems will be alleviated although sizeable public investment and administrative capacity of the government are required.

(i) Densely Built-up Area in the North

This scenario assumes a salient urban development project. The existing agglomeration of iron/ steel industries will be relocated to suburbs and integrated development of this area including the retaining of the bus terminal and railway station will be carried out using this space. This intends to alleviate the problems of high density and traffic congestion in the area. The development is of multi-purpose mainly of residential but including business/ commercial functions. The environment of the Walled City may be improved in relation to this project. Using the impact of this key project, similar projects can be carried out one after another.

(j) Government Building Area and Its Environs

This scenario assumes integrated urban development in some obsolete areas to enhance the CBD functions. Conservation of the present scenery and environment should be pursued, too.

(k) Existing Built-up Residential Area

The three problems of this area will be tackled by designating specific areas or streets for high-rise buildings and by stringent application of LDA's land use rules to deal with unused land space remaining in the area and land use conversion. In some cases, relaxation of the rules may be necessary.

(ii) University Area

As for existing universities located in urbanized area, no action is assumed in this scenario. The new academic town planned in Ferozewala Tehsil, where the University of Engineering and Technology of Lahore has already located some of its faculties, should be expanded by inviting high-grade education facilities, research organizations and related business establishments. It is important to relate this academic town with the adjacent industrial estate mentioned later so that this academic town becomes one of the leading areas for high technology in the Punjab and Pakistan.

(iii) Expansion of Urban Area toward East and South

Population of LDA project areas and development permitted areas will reach its target by 2030 as planned. The rest of increased population is assumed to be distributed in areas to be developed near the railway stations and other public transport nodes to be proposed in this master plan.

(iv) Ribbon Development in the North

This scenario assumes concentric-contiguous development of this area consisting of industrial estates and an academic town mentioned above. Ribbon-type development should be suppressed to enhance land use efficiency of this area. The industrial estates are considered to become the relocation site of iron/ steel industries located in the north of Lahore station at present. Residential development is also done in this area to absorb the increasing of population.

(v) Industrial Zones

Development of industrial estates is assumed in this scenario in the north in connection with the proposed academic town. In the south, improvement of access and arterial roads should be carried out to strengthen the functions of the existing industries. The road improvement includes some circumferential roads and Thokar Niaz Beg Canal Road.

(vi) Overall Urban Structure

As this scenario assumes urban Rail-based Mass Transit System (RMTS) to be the trunk public transport system of Lahore, dense urbanization will occur along these RMTS routes. Urban RMTS facilitates people’s movement in the city as well as conservation of suburban greenery and agriculture. RMTS usually reduces traffic congestion on roads. The combination of industrial estates and academic town proposed in Ferozewala Tehsil has a possibility to lead high-tech industrial development of not only Punjab but entire Pakistan. As a whole, this scenario aims to vitalize various urban functions by combining them closely with each other using improved mobility and enhanced land use efficiency. The envisioned urban structure is shown in Figure 3.1.4.

3) Scenario 3 (Dispersed Multi-Core Development)

The core idea of this scenario is to increase absorptive capacity of Lahore for rapidly growing population by developing suburban cities. Thus this scenario assumes less population increase in the built-up areas of Lahore. Suburban development is proposed in this scenario at Muridke, Raiwind area, and Pattoki Tehsil areas. Each of these areas will be a sub-center of the metropolis of Lahore with its own CBD and surrounding residential areas.

(i) Densely Built-up Area in the North

Same as Scenario 2.

(ii) Government Building Area and Its Environs

Same as Scenario 2.

(iii) Existing Built-up Residential Area

Same as Scenario 2.

(iv) University Area

Same as Scenario 2.

(v) Expansion of Urban Area toward East and South

Population of LDA project areas and development permitted areas will reach its target by 2030 as planned. However, this scenario assumes no more development permitted in Lahore except for the proposed academic town located in Ferozewala Tehsil. All the rest of increased population is assumed to be accommodated in Muridke, Raiwind area and Pattoki Tehsil areas. These three areas have their own accumulation of business/ commercial facilities. Enhancement of CBD functions will be pursued coupled with residential development in the surrounding areas.

(vi) Ribbon Development in the North

Same as Scenario 2.

(vii) Industrial Zones

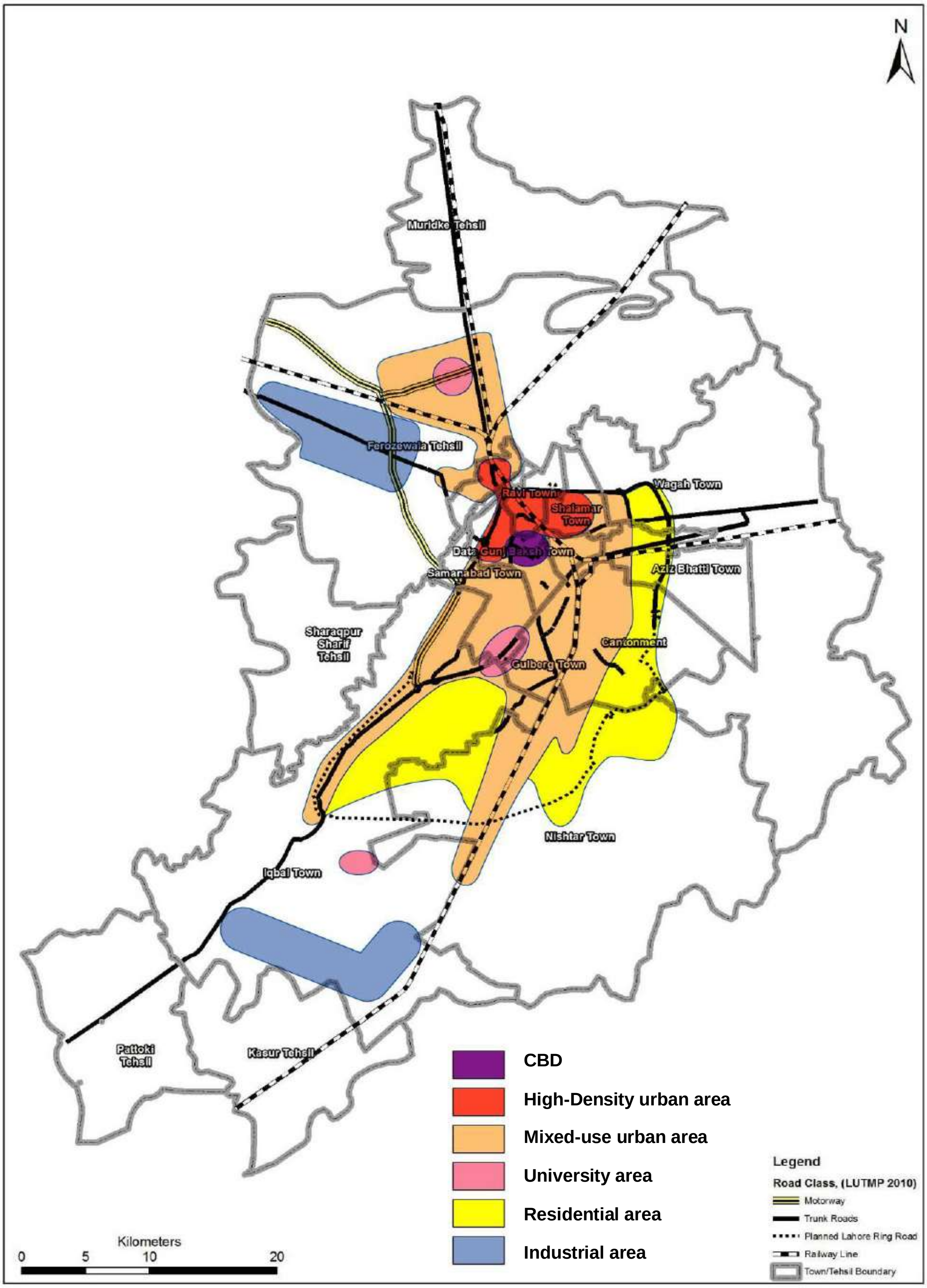
Same as Scenario 2.

(viii) Overall Urban Structure

The existing built-up areas in Lahore will mature with fewer vacant spaces/ plots, industrial estates are located in the south and north, and there will be an academic town in the north. To be more important, three cities will appear in the suburbs of Lahore with urban functions and 300-500 thousand population. In the long run, high-speed, high capacity transport system connecting Lahore and these sub-centers will be required.

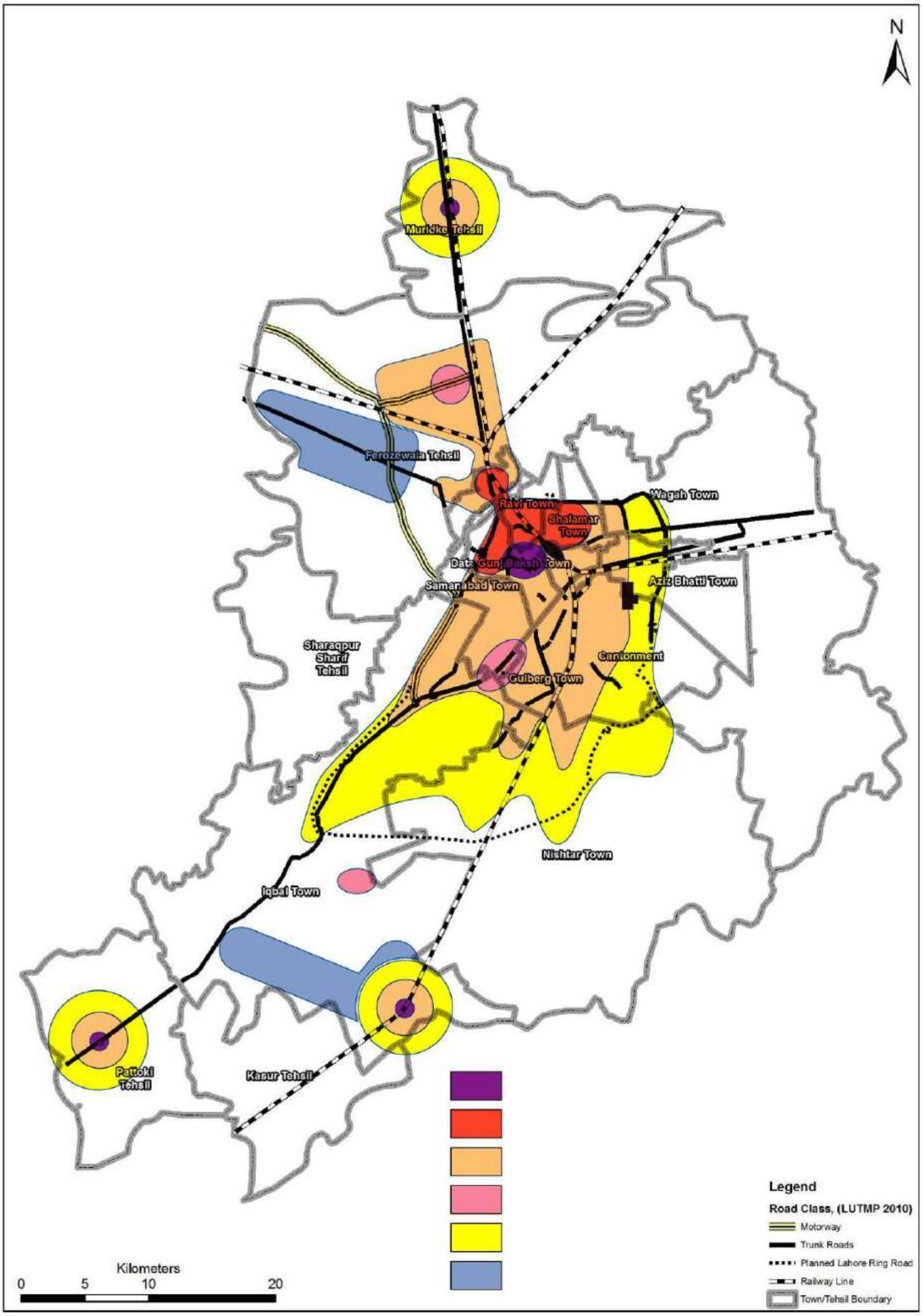
In Tokyo, Japan, there is a conceptual plan called “Core Cities Linkage Plan”. The intention of this plan is to transplant part of CBD functions of Tokyo to medium to large cities located at 30-50 km distance from Tokyo. The objective of this plan is to alleviate the negative impacts of high density and to prevent disorderly urbanization. At present these core cities perform the central functions significantly. This concept is illustrated in Figure 3.1.5.

Figure 3.1.4 Urban Development Scenario 2 (Compact Development)



Source: JICA Study Team

Figure 3.1.5 Urban Development Scenario 3 (Dispersed Multi-Core Development)



Source: JICA Study Team

3.1.3 Assessment of Alternative Scenarios

1) Assessment by Scenario

The three scenarios described above are compared and an assessment is presented in Table 3.1.2.

Table 3.1.2 Assessment of Alternative Scenarios

Component	Scenario 1 (Trend)	Scenario 2 (Compact Development)	Scenario 3 (Multi-Core Dev.)
Transport Convenience	Chronic traffic congestion near the city center will become more serious (Grid-lock) due to expansion of urbanization.	Development of public transport enhances mobility of people and reduces traffic congestion on roads	Due to increase of sub-urban traffic, development of sub-urban public transport will become necessary.
Living Environment	Difficult to provide favorable living environment for many people due to continued over-saturation of the built-up area in the north and insufficient mobility in the expanded residential area.	Gradual enhancement of living environment can be expected in the built-up area in the north and high mobility due to public transport development in expanded urban area can be expected.	Gradual enhancement of living environment can be expected in the built-up area in the north and urban expansion in the area of poor mobility will be restricted. Living environment in Lahore will be much improved as a whole and that of suburban cities could be favorable, depending on city planning.
Impact on Natural Environment	Due to lack of planning, disorderly land use will continue and conservation of greenery and agricultural land will become difficult.	Owing to planned urbanization control, conservation of greenery and agricultural land can be done in an orderly manner.	In terms of conservation of greenery and agricultural land, this scenario is the best for Lahore. However, the situation may become worse in suburban areas.
Reality	Most realistic because public investment is minimal and government intervention is also the least; only with 2009 land use rules of LDA.	Though there are difficult targets of development of competitive public transport system and planned urban development, many cities in the world have overcome these issues. It is feasible if institutional and financial problems could be resolved.	Development of suburban cities needs tremendous efforts by the government. If this is not prepared in a timely manner, the situation will become the same as Scenario 1 (Zero Option - Trend).
Others	-	-	If suburban cities are developed, high-speed rail transport system will be needed to connect these cities with Lahore.

Source: JICA Study Team

2) Conclusion

Scenario 2 and 3 are both excellent for a city with a population over 10 million in terms of mobility, living environment and conservation of greeneries and agricultural land. From the viewpoint of reality, Scenario 1 *(Zero Option - Trend)* is the easiest way. However, Scenario 2 and 3 are also realistic only if strong *'political will'* and leadership are guaranteed in planning and funding. Scenario 3, however, may be slightly weak in flexibility because the timing of project implementation must be consistent with population increase and high-speed transport system will be required in the long run to support the intended structure of the metropolis.

In contrast, Scenario 2 has a flexibility to shift from Scenario 1 to Scenario 2 depending on the timing of public transport development. In this sense it may be called Scenario 2a (between Scenario 1 and 2).

3.1.4 Existing Land Use Rules of the Punjab and Its Use

1) Existing Land Use Rules of the Punjab

The GoPb enacted new land use rules on the 10th February, 2009 based on the 1975 Lahore Development Authority Act. The Rules intend to determine land use in controlled areas according to land use classification. There are 6 land use classes, as follows:

1. Residential,
2. Commercial (including institutional),
3. Industrial,
4. Peri-urban,
5. Agricultural, and
6. Notified Areas. (e.g. specially designated development area)

For each of these classes, maximum height, coverage, floor to area ratio, etc. are determined by size of the plot. Orderly development is thus ensured in the controlled area. This specification is done by plot, and it is easy to understand for both government and private developers since subdivision of a plot is prohibited by law (Subdivision Ordinance). However, this detailed specification requires a long time for the government to prepare and the consistency of these specifications with macroscopic land use plans is not necessarily guaranteed. In addition, land use conversion from one class to the other is allowed by paying the land use conversion tax if the conversion is deemed appropriate judging from the environment nearby. LDA applies these rules mainly to the areas where land use is changing rapidly or new development is foreseen because of the huge time and cost required for land use classification of entire Lahore. In reality, built-up areas like

Walled City and rural villages are excluded from application of these rules.

Although this system has a significant effect to improve the quality of urban areas, there still remain some problems. Private developers tend to select arbitrarily development areas for their convenience, and thus these are inefficient, and in many cases the agricultural land remains in between developed areas (e.g. in the southern developing areas of Lahore). LDA recognizes this problem and is seeking for measures for solution. Another big issue is how to keep consistency between detailed land use classification and the overall urban structure of Lahore. Strong political will may be needed to realize an ideal land use for the entire metropolis.

2) Application of Present Land Use Rules toward Realization of the Scenario

As described above, GoPb has a strong power through LDA to realize planned land use. In this section, how to use the present land use rules to attain the goals of Scenario 2 is briefly discussed.

The basic assumption here is the future development of urban RMTS. Around planned RMTS stations, development areas (assuming 800 m to 1000 m radius, 200ha and fifty thousand population) should be determined first, and the mode of development (LDA direct or through private developers) should be selected depending on the land use condition such as the size of commercial area, type of public facilities to be developed, size of parks/ greeneries, and open spaces.

Next step is the implementation of the development around RMTS stations. LDA has enough capacity of these types development although their experience is based on Radial or Trunk roads (e.g. development along Thokar Niaz Baig; Canal Bank Road). In this scenario, the road is replaced by RMTS. If LDA does not implement the project directly, private developer should be selected on a competitive basis based on land use requirement and other condition. This procedure is allowed by the 2009 land use rules.

There is an important point in the RMTS-based development. While financial viability of the project is not affected by the timing of implementation in the case of road-based development, the synchronization of the timing of urban development and station development is a critical factor to determine the financial (and also economic) viability of the entire project in the case of RMTS-based development.

Korea amended the city planning law and its related rules and regulations in 2000-2003, where the right of cancellation of development permit was given to local government when private developer could not observe the planned timing of development. This system may be added to the 2009 land use rules of Lahore, and would be an essential pre-requisite for Scenario 2 and 2a.

3) Proposal for a Development Benefit Recovery System

The development around RMTS stations produces a huge benefit for urban developers. After developing a RMTS station, land price of the surrounding area naturally increases many fold due to improved mobility, and the benefit becomes huge as a whole. Theoretically, therefore, developers should pay a part of the benefit to the RMTS operator. If this system is introduced, it can be a part of the funds required for the RMTS development.

This system has been implemented in many cities of the world. For instance, subway line No.1 in Osaka, Japan was subsidized in 1930's by a new tax imposed on land owners around stations (within 800 m radius) who were potential beneficiaries of the subway. This tax was collected as a surcharge to the property tax.

3.1.5 Projects Assumed by Scenario

In order to materialize the three urban development scenarios shown above, a series of urban development projects need to be implemented. Some projects are common among the scenarios while others are unique to the scenario.

1) Proposed Urban Development Projects

Table 3.1.3 shows the proposed urban development projects needed for each scenario.

Table 3.1.3 Proposed Urban Development Projects

Project	Scenario
Utilization of open space in built-up areas	1, 2, 3
Control of expanding urban area	1, 2
Environment improvement in northern densely built-up area	2, 3
Maturing of CBD	2, 3
Development of academic town	2, 3
Development of industrial estates	2, 3
Fostering suburban cities	3

Source: JICA Study Team

2) Project Description

(i) Utilization of Open Space in Built-up Areas

This is materialized only when "carrot and stick" strategy is applied to land developers or land owners. As to "stick", the 2009 land use rules should be strictly applied in the controlled areas and need to be strengthened, for example, by imposing "non-utilization surcharge" on unused land plots in the classified area.

As to “carrot”, subdivision of land plot and high-rise buildings may be admitted under certain condition, and a part of taxes may be exempted for a certain period when land is used properly. For this purpose, the Subdivision Ordinance may be deregulated for large land plots above a certain size if environmental degradation is not incurred.

(ii) Control of Expanding Urban Area

The principle of this project is the stringent application of the 2009 land use rules. In *Scenario 1*, development will proceed along arterial roads, and development permit should be given to developers so that remaining unused land area becomes minimal. In *Scenario 2*, the most important is the political intervention to guide urban development to RMTS station areas. Plans and concepts should be informed to the public, and the role of LDA is quite significant as planner, developer and controller.

(iii) Environment Improvement in Northern Densely Built-up Area

The 150ha land produced by the relocation of the existing iron/ steel industries to the suburbs is the key element of this project. In close coordination with the adjacent bus terminal and railway station, the environment of the area will be largely improved by an integrated multi-purpose development. The image of the central redevelopment building is as follows:

- First floor – Integrated transport terminal including Pakistan Railway, city bus and feeder transport. Shopping mall, office, park and road space.
- Second floor – Artificial ground covering Lahore Station of Pakistan Railway. Business and commercial facilities. Pedestrian deck. Equipment room to support the complex building.
- Third floor and above – Residence in principle.
- The overall scale could be:
  - Developed area : 300 ha;
  - Floor area : 2,000 ha (1,500 ha residence);
  - Population : 150 thousand (with population density at 500/ha); and
  - No. of workers : 50 thousand

The residence here absorbs residents from the nearby area, and other environment improvement projects will be promoted one after another in the adjacent area.

(iv) Maturation of CBD

The present CBD takes advantage of well developed social infrastructure including roads and parks/ gardens. However, as population and economy grow, the function of this CBD needs to be upgraded. For this purpose, a large-scale development project will be necessary.

For this project, a comprehensive plan needs to be formulated including future number of workers, necessary floor space, building location, height of building, transport access, pedestrian movement and conservation of greenery/ parks. For areas of government buildings, the project should be implemented by LDA, while other areas can be developed by private developers under control of LDA.

The present CBD of Lahore consists of the four zones shown in Table 3.1.4 and the density of workers, particularly of tertiary sector (service and commercial), is quite high compared to the zones nearby.

Table 3.1.4 Workers Density in the Four Zones of CBD, 2010

Zone No.	Area Name	No. of Workers in Daytime ('000)	Area (ha)	Density (/ha)
27	Anarkali	79	206	384
30	Qila Gujjar Singh	88	243	361
32	Mozang	37	145	256
33	Jinnah Hall	41	161	252
Total		**244**	**755**	**324**

Source: JICA Study Team

As seen in the table above, the density of daytime workers is not high as a CBD. For instance, the same figure in Tokyo, Japan is 1,000-3,000 as of 2010. Although the situation of Tokyo is not necessarily favorable, the room for future development is very large in Lahore.

The present CBD of Lahore should remain as the CBD in the future too, because of the well developed infrastructure and the abundant room for future upgrading. The current workers density could be easily raised to 500/ha without any negative impact on environment. For this upgrading project, high-rise building may be allowed in some specific areas or streets.

(v) Development of Academic Town

The academic town proposed in the north of Ravi River is expected to be one of the high-tech centers of Pakistan. The proposed site has favorable conditions such as well developed road infrastructure, existence of The University of Engineering and Technology, proximity to railway and industrial estates proposed nearby.

The overall scale of this project could be:

- Development area: 1,500 – 2,000 ha;
- Campus area: 1,000 – 1,400 ha;
- No. of universities/ high-grade education organizations: 3 – 4;
- No. of research organizations: 30 – 50;
- Population: 100 – 150 thousand;
- No. of workers: 60 – 80 thousand; and
- No. of students: 60 – 80 thousand.

(vi) Development of Industrial Estates

In the south-west of the academic town mentioned above, industrial estates will be developed. The ribbon development along Lahore-Sheikhupura Road should be absorbed. This is the relocation site of the existing industries located in Lahore. Modern high-tech industries should be invited too to promote synergy with the proposed academic town. The overall scale of this project could be:

- Development area : 500 – 800 ha;
- Floor area : 400 – 600 ha;
- No. of enterprises : about 2,000; and
- No. of workers: about 50 thousand.

(vii) Fostering Suburban Cities

This project, inherent to Scenario 3 only, intends to foster, Muridke, Raiwind area, and Pattoki Tehsil areas, as suburban cities. The other aspect of this project is the stringent restriction of urban area expansion in Lahore.

In this project, the role of District Government becomes essential. The experience of LDA should be transferred to local government agencies in the field of planning, design, contract preparation, implementation, control and monitoring.

3.2 Socio-Economic Framework

3.2.1 Population

1) Past Trends in Population Growth

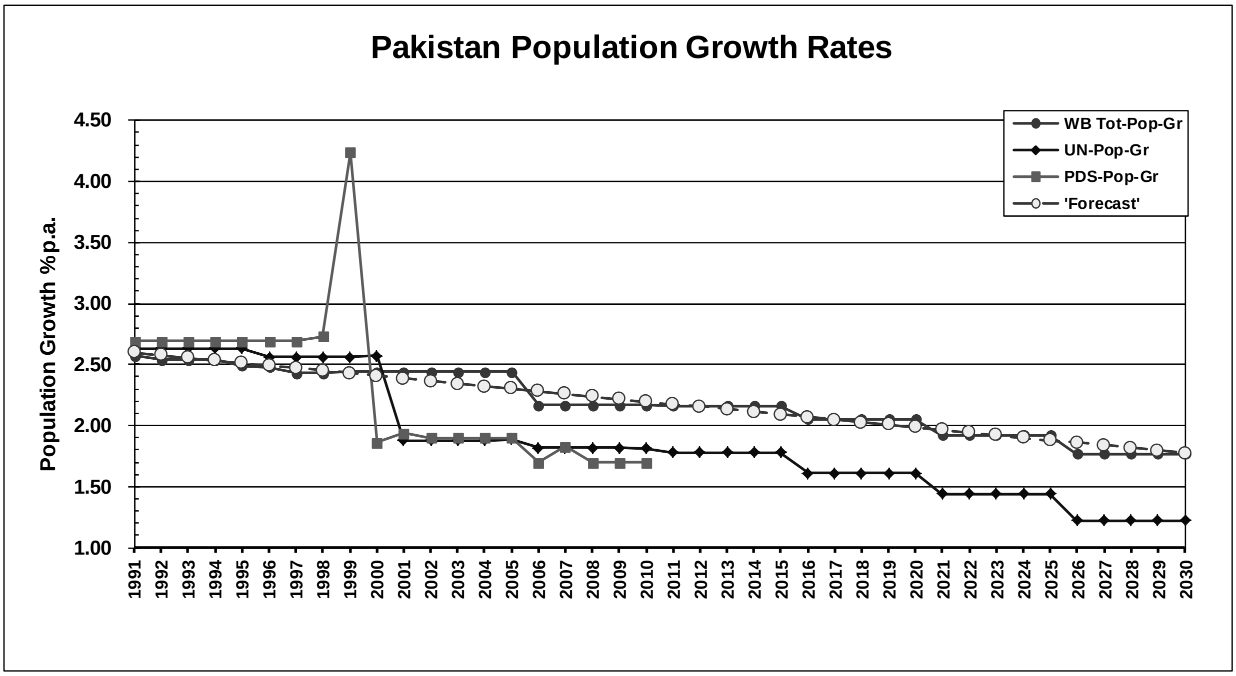
Table 3.2.1 shows the past population trends for Pakistan, the Punjab, Lahore Division and the Study Area. The latest census was conducted in 1998, and the 2010 figures have been estimated by the Study Team after consulting various government agencies. Past population trends and forecast for future years by various agencies and JICA Study Team are shown in Figure 3.2.1.

Table 3.2.1 Past Population Trends of Pakistan, the Punjab, Lahore Division and the Study Area

Area Description	Area	Census Population ('000)					Annual Growth Rate (%)				
	(km^2)	1961[1]	1972[1]	1981[1]	1998[1]	2010[1]	1951-1961	1961-1972	1972-1981	1981-1998	1998-1910
Pakistan	796,096	42,880	65,309	84,254	132,352	168,258	2.43	3.90	2.87	2.69	2.02
The Punjab	205,345	25,464	37,607	47,292	73,621	93,682	2.17	3.61	2.58	2.64	2.03
Lahore Division	11,729	3,560	5,431	7,183	12,016	15,784	2.36	3.91	3.16	3.07	2.30
Lahore District	1,772	1,626	2,588	3,545	6,319	8,650	3.66	4.32	3.56	3.46	2.65
Kasur District	3,995	854[2]	1,186[2]	1,528[2]	2,376	3,016	1.16	3.03	2.86	2.63	2.01
Sheikhupura District	3,242	656[3]	1,028[3]	1,338[3]	2,276[3]	2,888	1.61	4.17	2.97	3.17	2.00
The Study Area	**3,044**	**N/A**	**N/A**	**N/A**	**7,307**	**9,928**	**N/A**	**N/A**	**N/A**	**N/A**	**2.59**

Note 1: Census Year; Note 2: Lahore divided in to Lahore District and Kasur District; Note 3: Sheikhupura divided in to Sheikhupura District and Nankana Sahib District in 2005.
Source: Punjab Development Statistics, 2010

Figure 3.2.1 Past Population Trends of Pakistan and Future Forecast by Various Agencies



Source: WB, UN and PDS 2010

2) Population Projections

Due to lack of detailed demographic data, macroscopic approach has been taken. The procedure of projection is as follows:

Step-1: Set future population growth rates for Pakistan:

2010 – 2015: 2.13 % p.a.

2015 – 2020: 2.03 % p.a.

2020 – 2025: 1.92 % p.a.

2025 – 2030: 1.82 % p.a.

The above growth rates are the same as the projection of the United Nations (UN) Census Bureau, and also consistent with the recent Planning Commission's paper "Pakistan: Framework for Economic Growth". These rates are higher than the targets of the Mid-Term Development Framework 2005 – 10 (MTDF) which states 2010 population growth rate at 1.63 %. Pakistan Transport Plan Study (PTPS, 2006 JICA), following the MTDF approach, also used these low growth rates of 1.63 % for 2010 and 1.08 % for 2020. Considering the recent trends, however, these low growth rate projections have proven to be unrealistic.

Step-2: Set future population share of the Punjab to Pakistan, and the Study Area to the Punjab:

These shares can be calculated as shown in Table 3.2.2. The share of the Punjab has been gradually diminishing, while the share of Lahore Division and the Study Area is on the increasing trend. Note that the share of the Study Area can be calculated only for 1998 and 2010 due to the change of administrative boundaries of Districts, Tehsils and Lahore Towns. Kasur District was separated out of Lahore District in 1976 and Sheikhupura District was split in to Sheikhupura and Nankana Sahib District in 2005.

In addition, Lahore district Tehsils/ Towns have been created and merged in to number of towns. Therefore at time it is almost impossible to do a direct area based comparison.

Table 3.2.2 Relation of Population between Pakistan, the Punjab, Lahore Division and the Study Area

Description	1961	1972	1981	1998	2010
Share (%) of Punjab to Pakistan	59.4	57.6	56.1	55.6	54.0
Share (%) of Lahore Division to Punjab	14.0	14.4	15.2	16.3	16.8
Share (%) of the Study Area to Punjab	N/A	N/A	N/A	9.9	10.6

Source: Punjab Development Statistics

Assuming the same tendency between 1998 and 2010 continues in the future until 2030, these shares can be calculated as follows:

2030 Share (%) of the Punjab to Pakistan: 51.3 %

2030 Share of Lahore Division to the Punjab: 17.9 %

2030 Share of the Study Area to the Punjab: 11.7 %

Step-3: Calculate Future Population:

The results of projected population for Pakistan, Punjab and the Study Area is presented in Table 3.2.3 and annual growth rate comparison for future years forecast is shown in Figure 3.2.2.

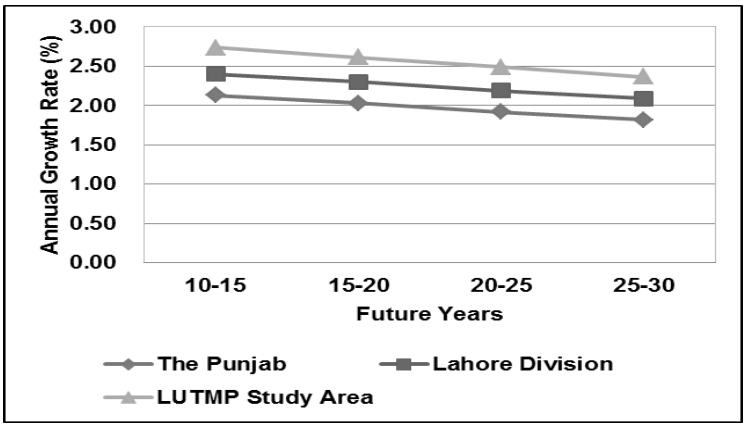
The 2030 population of Pakistan was projected at 256.4 million. This is considerably higher than the PTPS 2030 projection at 216.2 million. However, the UN Census Bureau projected 2025 population at 245.1 million is considerably on the high side. Regarding Lahore Metropolitan Area (LMA), "Integrated Master Plan for Lahore 2021" by LDA projected population at 10.5 and 14.1 million for 2011 and 2021, respectively. Although comparison cannot be made exactly due to the difference in the Study Areas, this estimate seems to be considerably higher than the current projection. In addition, the 1991 JICA, Comprehensive Study on Transportation System in Lahore projected 2010 LMA population at 10.4 to 11.0 million. This is comparable to the LDA study forecasts.

Table 3.2.3 Population Forecasts

Province / Division / District	Estimated Population ('000)					Annual Growth Rate (%)			
	2010	2015	2020	2025	2030	10-15	15-20	20-25	25-30
Pakistan	168,258	186,957	206,720	227,342	248,797	2.13	2.03	1.92	1.82
The Punjab	93,682	104,093	115,097	126,578	138,524	2.13	2.03	1.92	1.82
Lahore Division	15,784	17,772	19,913	22,191	24,609	2.40	2.30	2.19	2.09
The Study Area	**9,928**	**11,362**	**12,925**	**14,615**	**16,429**	**2.74**	**2.61**	**2.49**	**2.37**

Source: JICA Study Team

Figure 3.2.2 Annual Growth Rate Comparison for Future Year Forecast



Source: JICA Study Team

3) Population Breakdown to the Study Area Zones

(i) General

The projected 2030 population is distributed to traffic zones according to the methodology explained hereafter. After zonal breakdown, the difference is adjusted by distributing the projected total to zones in proportion to the calculated figures as a result of the zonal breakdown. 2020 population by zone was estimated by interpolation, and the values by zone were adjusted to the projected total. The zonal breakdown methodology is different by scenario.

(ii) Methodology of Population Breakdown to Study Area Zones

1. Ravi, Data Gunj Baksh, Samanabad and Shalamar Towns

The methodology is common for all scenarios. The density of these towns is extremely high and needs to be reduced by political intervention. According to the "Sustainable Development of Walled City Lahore Project", there are already some zones where population has started to decrease. It is a common phenomenon in many cities of the world that the population of high-density areas has decreased and living environment has been improved. Therefore population of these areas will certainly continue to decrease for some time to come. However, political intervention is desirable rather than wait-and-see attitude of natural change, for the betterment of the living environment.

The upper limit of population density for a low to medium height building areas population density is set at 500 /ha, and 1,000 /ha in the case of super high-rise building areas. In Lahore, super high-rise building is not admitted and excellent city scenery with open skyline has been traditionally maintained. This tradition should be observed in the future. It is assumed that population density of zones with more than 500 /ha be lowered to 500 /ha while population density of other zones remain unchanged.

2. Gulberg Town

This area boasts of its excellent environment with large residences, wide streets and parks/ greeneries. For scattered open spaces including under-used facilities of Pakistan Railway (PR), redevelopment projects should be promoted as proposed in the previous chapter.

In Scenario 2 and 3, the population of zones 77 (Railway Colony) and 79 (Daras Barey Mian) that include PR facilities is assumed to be 150 thousand. In other zones, it is assumed that population will increase by 5 % (open space 1 % and its redeveloped population density at 5 times of the present).

3. Aziz Bhatti Town

The western part of this area has been densely built-up, and the same assumption is introduced as 1 above (Ravi and other towns). For other zones, Scenario 1 assumes that urbanization spreads beyond LRR while Scenario 2 and 3 controls urbanization within LRR. Upper limit of population density is set at 100 /ha. For zones already built up, the present population is maintained.

4. Wahgah Town

Present population density of this area is about 15 /ha showing low level of urbanization. This is due to the government restriction on development for the defense reasons and lack of arterial roads to Lahore city centre.

Similarly to Aziz Bhatti Town, Scenario 1 assumes that urbanization spreads beyond LRR while Scenario 2 and 3 controls urbanization within LRR. Upper limit of population density of newly developed areas is assumed at 100 /ha in all the scenarios.

5. Nishtar Town

This area remains under-developed with a population density of 19 /ha although a part of northern area shows considerable urbanization. The area to the west of railway has been developed mainly by private developers with relatively high standards although numerous unused land plots are common. In the eastern area, Ferozepur Road has led urbanization towards the south.

Scenario 1 assumes the following:

a. Population density of densely inhabited areas of more than 1,000 /ha located in the north of this area be lowered to 500 /ha similarly to the northern densely built-up area.

b. Population density of areas with a population density of 200-500 /ha should be raised to 500 /ha.

c. Population density of areas with a population density of less than 200 /ha be raised to 200 /ha.

d. Population density of suburban areas with a population density of 10-60 /ha at present is raised to 100 /ha on average.

e. Other agricultural areas will remain as is.

Scenario 2 has the same assumption for densely inhabited area of more than 1,000 /ha located in the north of this area (as above). Along the railway, new development areas will have a population density at 200 /ha. For other areas urbanization is controlled within the planned areas at average population density of 100 /ha.

Scenario 3 has the same assumption for densely inhabited areas of more than 1,000 /ha located in the north of this area (as above). Urbanization is controlled within the planned areas at average population density at 100 /ha. Planned development along the railway is not assumed unlike Scenario 2.

6. Iqbal Town

This area has been partially urbanized along Multan Road with a population density over 600 /ha. As a whole, however, urbanization level is low with an average population density of 18 /ha. In this area, there are a number of urban development projects are planned and prepared, and it is assumed that these projects will be implemented.

Population density of over-saturated areas will be lowered to 500 /ha at the highest. This assumption is common for all scenarios.

Scenario 1 assumes conventional road-based urban development taking advantage of LRR and other roads. This scenario assumes urbanization beyond LRR. Westward development is not taken into account due to the risk of flooding of the Ravi. Assumed population density is 100 /ha.

Scenario 2 assumes planned dense development around the stations of the proposed RMTS to be developed in the long run. Planned population density is 200 /ha. Suburban development is limited within the planned/ on-going projects. Its population density is set at 100 /ha.

Scenario 3 assumes that suburban development be restricted within the planned/ ongoing projects. Its population density is set at 100 /ha.

7. Cantonment

This area is characterized by high-quality residences. In the west of the airport, the residential area is already matured while future development is foreseen in the east. Unlike Gulberg, unused land plots are limited.

Scenario 1 assumes that population density of already built up zones remain basically as it is except for immature zones with a population density of less than 200 /ha that will be raised to 200 /ha. For eastern zones, maximum population density is set at 100 /ha.

Scenarios 2 and 3 assume the same as Scenario 1. However, outside LRR, urbanization is not considered and population will remain unchanged.

8. Tehsil Ferozewala Areas

This area has a large potential for future development due to the proximity to Lahore CBD.

Scenario 1 assumes conventional ribbon development toward the north and north-west along arterial roads. Population density is assumed at 200 /ha for the area near Ravi Town and 100 /ha for other areas.

Scenario 2 and 3 assume planned development of the area taking advantage of the high potential. The key project is the development of an academic town mentioned in the previous chapter. Population density is set at 100 /ha in the academic town, 200 /ha in the surrounding residential area and 100 /ha for the high-quality residential area further outside of the academic town.

9. Muridike, Pattoki and Kasur North (Raiwind)

These areas have been conventional rural villages without salient urban development.

In Scenario 1 and 2, no major change is foreseen.

Scenario 3 intends to utilize the potential of Lahore's urbanization for developing these areas as suburban cities by providing urban functions in the built-up areas and by supplying residences in the surrounding area. The total population of this area should be 500-600 thousand with a population density of 200 /ha near the city center and 100 /ha in the adjacent area.

10. Sharaqpur

In this area, population will not change much due to the absence of urban development projects.

(iii) Results of Forecast Population Distribution

The resultant distributed forecast population by Towns and Tehsil is given in Table 3.2.4 and detailed in Figure 3.2.3 and 3.2.4. It is noted that population decrease is assumed in Ravi, Data Gunj Baksh, Samanabad and Shalamar towns while significant increases are forecast for Nishtar and Iqbal Towns, Cantonment and Ferozewala under all scenarios. Large increase in population is assumed for Muridike, Raiwind and Pattoki as assumed under Scenario 3.

The results might be considered as too drastic from practical point of view of Lahore residents. However, political intervention, if applied properly, could have strong influence. This is the reason why master planning is important. Of course there must be a strong will of residents to guide Lahore to the desirable direction they choose whether Scenario 1, 2, 3, or another scenario as combination of the proposed scenarios.

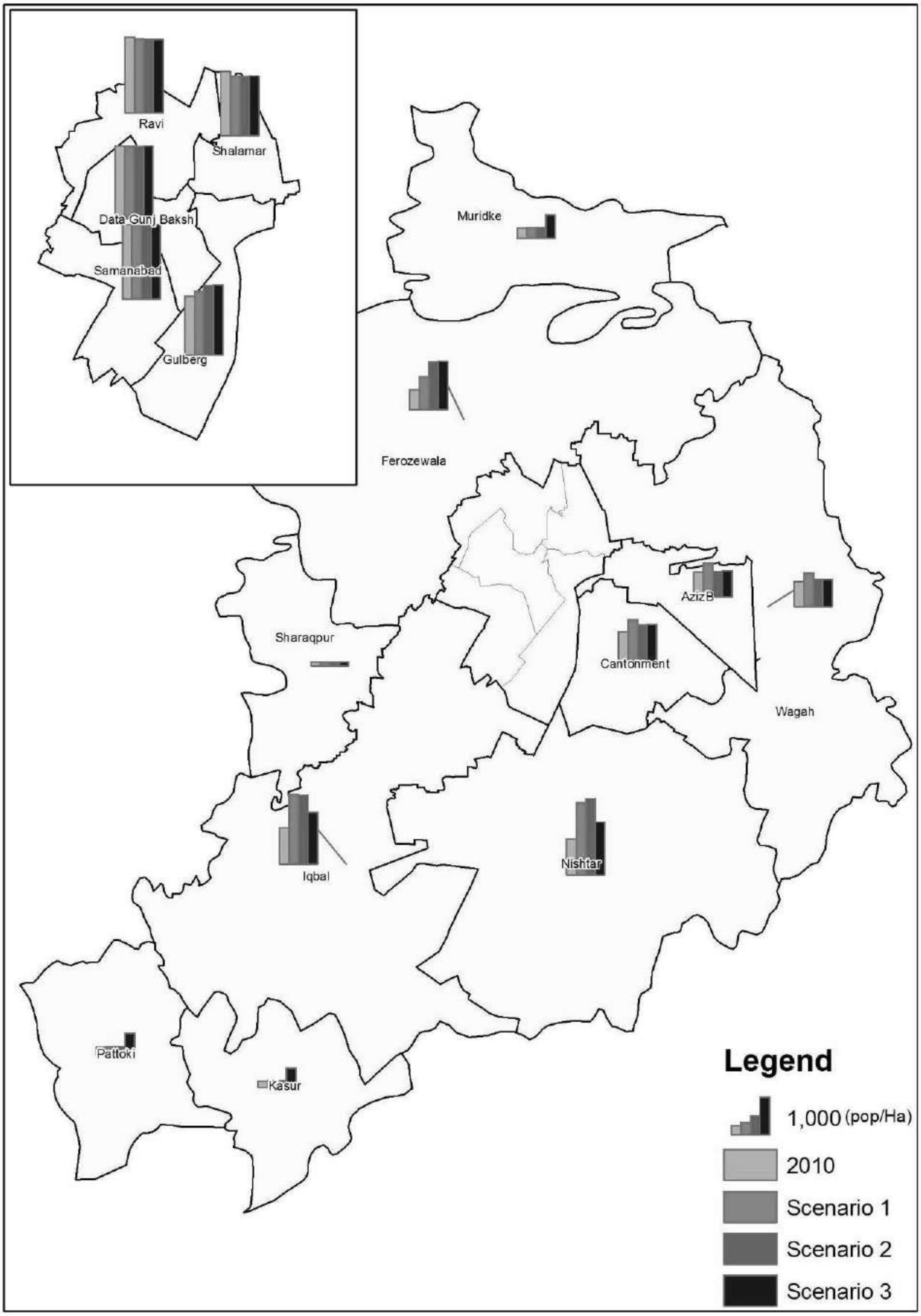
In addition, the total population of the Study Area is controlled to be the same under all three scenarios to facilitate an easy and direct comparison.

Table 3.2.4 Summary of Forecast Population ('000)

No.	Town/ Tehsil in the Study Area	2010	2020			2030		
			Scenario I	Scenario II	Scenario III	Scenario I	Scenario II	Scenario III
1	Ravi	1007	978	971	976	949	938	947
2	Data Gunj Baksh	970	968	961	966	970	958	967
3	Samanabad	984	990	983	988	1002	990	999
4	Shalamar	854	790	784	788	720	711	717
5	Gulberg	778	850	926	931	937	1102	1112
6	AzizB	667	901	686	690	1175	714	721
7	Wagah	656	881	713	717	1145	784	792
8	Nishter	945	1906	2007	1399	3017	3226	1927
9	Iqbal	960	1840	1824	1366	2857	2818	1838
10	Cantt	831	1149	1018	1024	1521	1240	1251
11	Ferozewala	534	883	1268	1275	1288	2110	2130
12	Muridke	266	284	282	609	305	302	1005
13	Sharaqpur	101	108	107	107	116	114	115
14	Kasur	168	179	177	520	192	190	927
15	Patoki	207	221	219	568	238	235	983
1-10	**Lahore**	**8653**	**11252**	**10873**	**9846**	**14291**	**13479**	**11270**
11-13	**Sheikhupura**	**901**	**1274**	**1656**	**1992**	**1708**	**2526**	**3250**
14-15	**Kasur**	**375**	**399**	**397**	**1088**	**430**	**424**	**1910**
1-15	**The Study Area**	**9928**	**12925**	**12925**	**12925**	**16429**	**16429**	**16429**

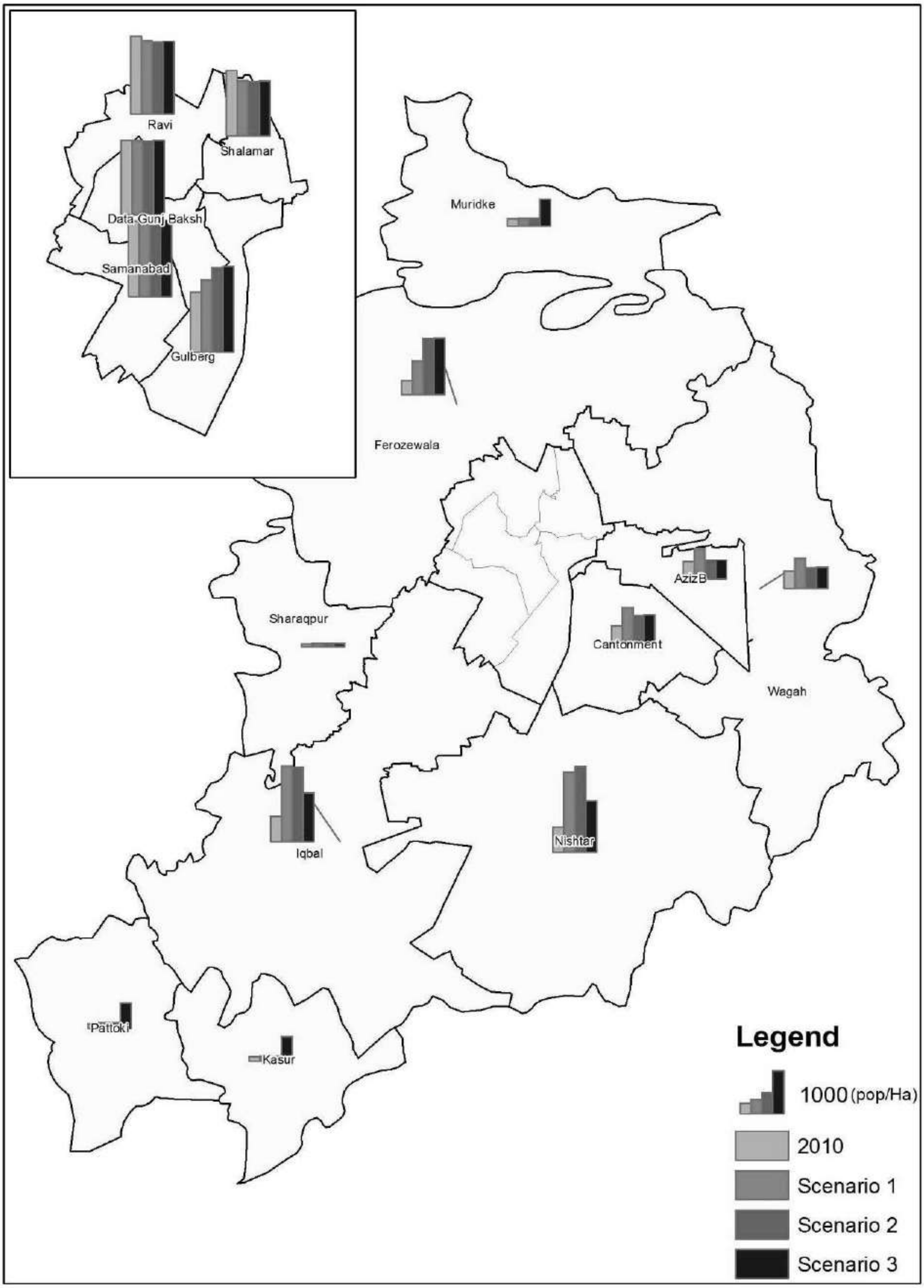
Source: JICA Study Team

Figure 3.2.3 2020 Population Forecast for Three Scenarios



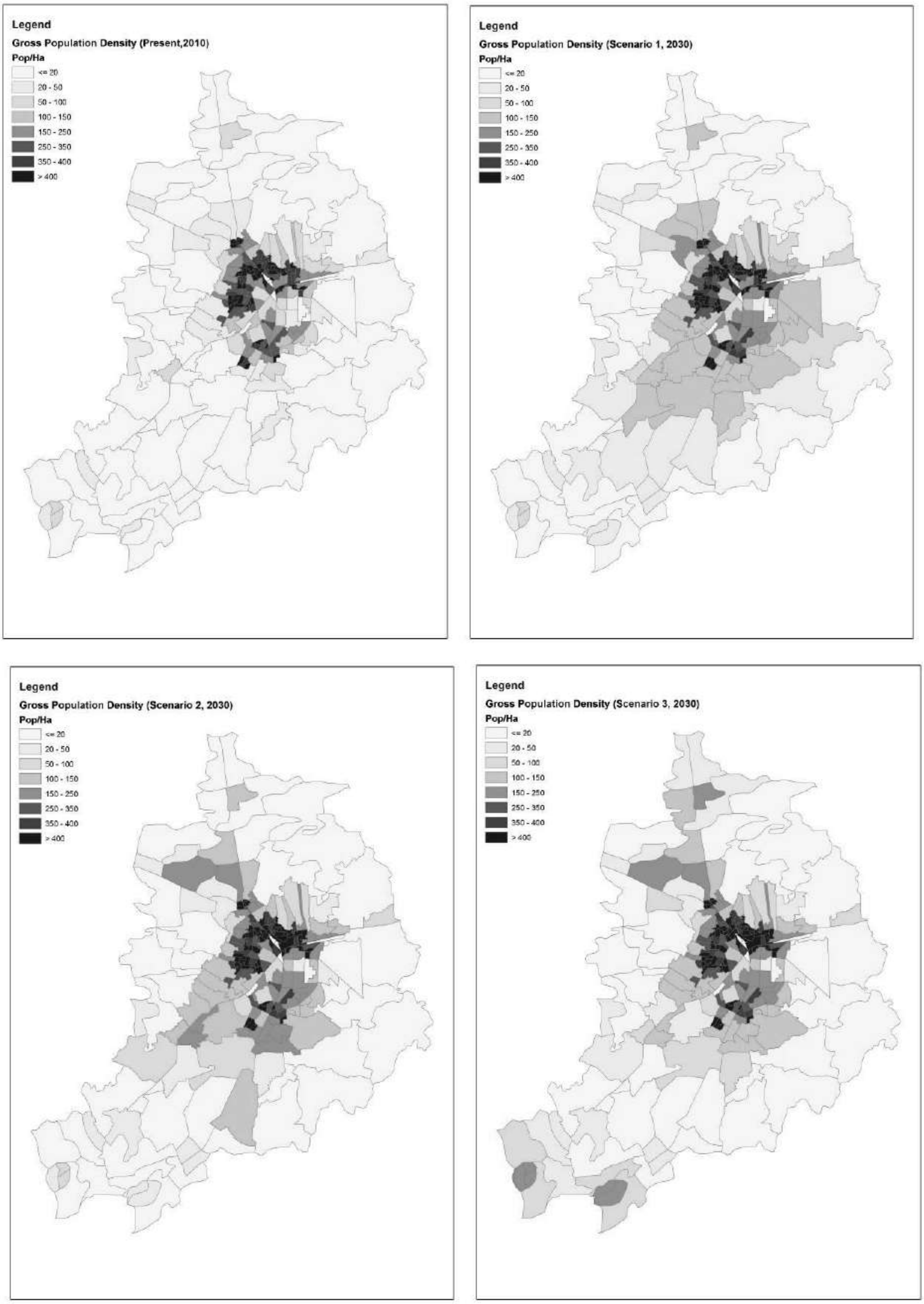
Source: JICA Study Team

Figure 3.2.4 2030 Population Forecast for Three Scenarios



Source: JICA Study Team

Figure 3.2.5 Gross Population Density, 2010 and 2030 by Scenario



Source: JICA Study Team

3.2.2 Employment

1) Ratio of Number of Workers to Population and Total Workers

According to LUTMP HIS, the ratio of Number of workers to population is 27.1 % for the Study Area. This is extremely low compared to international standard employment participation rate. This is due to the high unemployment rate and particularly the lack of female workers due to social issues. However, female employment participation rate is gradually progressing as can be seen in Table 3.2.5.

Table 3.2.5 Past Trend in Female (15 years +) Employment Participation Rate in Pakistan

1995	2000	2005	2006	2007	2008
10.7	13.5	**16.8**	**18.8**	**19.0**	**19.8**

Source: World Development Indicators 2010

Judging from this table, female labour participation rate is on an increasing trend, and it will naturally be 21 % in 2020 and 33 % in 2030 if the past trend is to continues. Although the basis is different between HIS (total population) and WDI (population age 15 years+), only growth rate of labour participation rate is used for the analysis. Meanwhile, male labour participation rate is assumed to be constant at 80 % in the future as no remarkable change has been observed in the past.

Since male and female contribution to labour participation rate is 80:20 according to World Development Indicators of WB, female labour participation rate will grow from 5.4 % (20 % of 27.1 %) in 2010 to 8.5 % (1.57 times of 5.4 %) in 2030 while male labour participation rate will remain at 21.8 % (80 % of 27.1 %). Thus the total labour participation rate will become 28.8 % in 2020 and 30.3 % in 2030.

As a result the total number of workers in 2020 and 2030 is estimated by multiplying these ratios with population for entire Study Area as whole and for each zone. These are 3.8 million in 2020 and 5.1 million in 2030 for the Study Area. In addition, the current labour participation rate by zone is almost constant at 26-29 % according to HIS.

Table 3.2.6 Forecast No. of Workers for the Study Area

Description	2010	2020	2030
Population ('000)	9,928 (100.0)	12,925 (130.2)	16,429 (165.5)
Number of Workers ('000)	2,691 (100.0)	3,722 (138.3)	4,978 (185.0)
Participation Rate (%)	27.1 %	28.8 %	30.3 %

Source: JICA Study Team

2) Employment by Sector

(i) Primary Sector Employment

In Pakistan, the share of primary sector workers has dropped from 51.5 % in 1990 to 43.6 % in 2007, while the number of primary sector workers has increased by about 4 million during the same period. In the Study Area, however, the number of primary sector workers is considered to have been and will continue decrease due to rapid urbanization.

In the period 1994 to 2000, urbanized area has increased by about 41 thousand hectare (from 21 to 62 thousand hectare). Assuming this is due to the decrease of agricultural land, and its declining rate is about 1 % per year. Assuming again that the number of agricultural workers has decreased and will decrease at the same pace, the total number of primary sector workers in the future will be as follows:

2010: 179 thousand
2020: 160 thousand
2030: 146 thousand

For zonal disaggregation of primary employment following steps were taken:

a. For 2030, no primary sector workers are assigned to zones in the CBD, High-Density Urban Area, Mixed-use Urban Area, University Area and Industrial Area.

b. For 2030, one half of primary sector workers of the present numbers are assigned to zones in the Residential Area.

c. For 2030, remaining primary sector workers are assigned to other zones in proportion to the present numbers.

d. The assigned result is adjusted to the predetermined control to total given above.

e. The 2020 numbers are estimated by interpolation using 2010 and 2030 figures. Then the assigned result is adjusted to the predetermined control to total given.

f. For primary sector workers, the number is assumed to be the same for daytime and nighttime (i.e. they live and work in the same zone).

(ii) Secondary and Tertiary Sector Employment

General

The sectoral composition of workers in the Study Area is characterized by the high percentage of the tertiary sector at 78.3 % according to 2010 LUTMP HIS. Out of this (78.3 %) 27.3 % is the contribution of wholesale/ retail commerce sector employment and this is comparable to major cities in the world. However the remaining 51 % is very high presumably due to contribution of provincial government and other public services concentration in Lahore. As a result, the share of the secondary sector is small at 15.1 % of the total employment.

Due to the estimated improvement of labour participation rate, the growth of employment is higher than population. Moreover, the number of secondary and tertiary workers will grow rapidly due to the decrease of primary sector workers.

It is essential for the economy of Lahore to absorb more workers into the secondary sector by effective political intervention. This is the reason why academic town and industrial estates are proposed under development Scenario 2 and 3.

It is assumed that the number of tertiary sector workers increases in proportion to population as seen in other major cities of the world. Once the number of tertiary sector workers is estimated, the remainder is the number of workers of the secondary sector. In addition, it is also assumed that the number of secondary and tertiary sector does not change between daytime and nighttime as a whole for the Study Area considering the present day/night ratio revealed by 2010 HIS (0.996 and 1.008 for the secondary and tertiary sector, respectively). The results are tabulated below in Table 3.2.7 and employment by sector for year 2010 is shown in Figure 3.2.6.

Table 3.2.7 Forecast No. of Workers by Employment Sector for the Study Area

Description	2010		2020		2030	
	No. ('000)	%	No. ('000)	%	No. ('000)	%
Total Workers	***2691***	***100.0***	***3722***	***100.0***	***4978***	***100.0***
Primary Sector	179	6.6%	164	4.4%	154	3.1%
Secondary Sector	406	15.1%	819	22.0%	1339	26.9%
Tertiary Sector	2107	78.3%	2740	73.6%	3485	70.0%

Source: JICA Study Team

Zonal Breakdown of Tertiary Sector Workers (night-time)

The ratio of the number of tertiary sector workers to population ranges between 0.22-0.28 for most of the urbanized zones and 0.12-0.15 in the surrounding areas. It is assumed that the number of tertiary sector workers is 25 % of population for zones already built up or to be urbanized in the future and 15 % for other zones. The values thus calculated are then adjusted to the control totals of predetermined above.

Zonal Breakdown of Tertiary Sector Workers (day-time)

First, planned number of workers is allocated to the proposed projects including redevelopment of the super high-density area, CBD redevelopment and academic town. The rest is then assigned to other zones in proportion to the present number of tertiary sector workers (day-time).

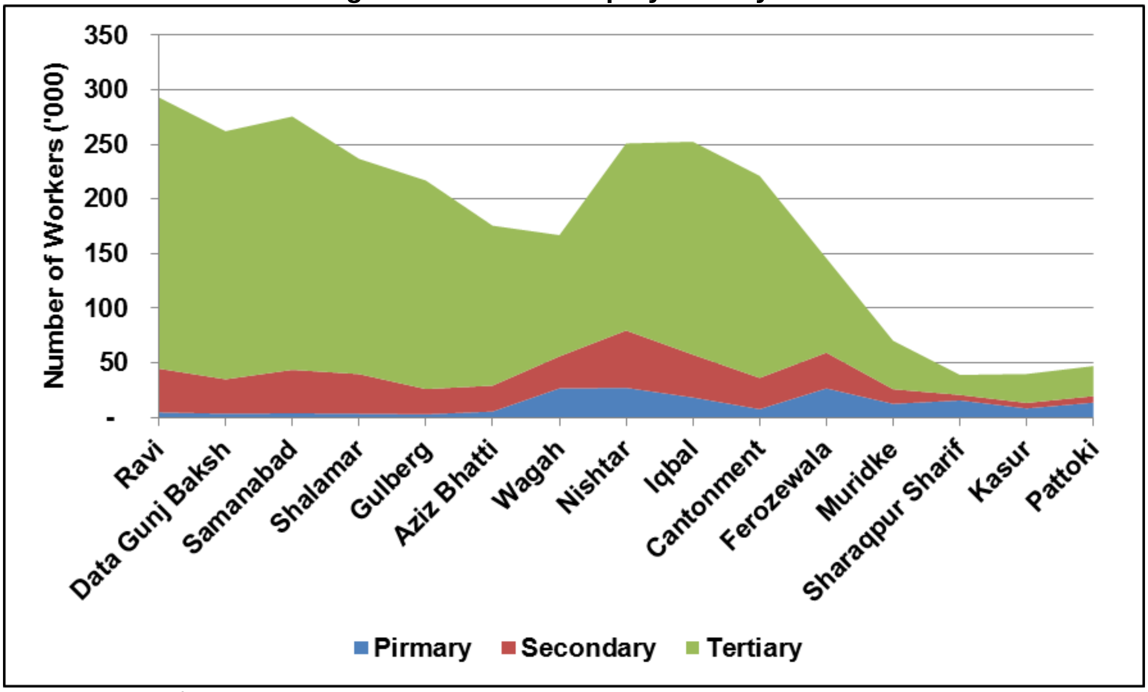
Zonal Breakdown of Secondary Sector Workers (night-time)

This is calculated simply by subtracting the number of primary and secondary sector workers from the total employment.

Zonal Breakdown of Secondary Sector Workers (day-time)

For zones of industrial estates, planned number of secondary workers is allocated, and the rest is then assigned to other zones in proportion to the present number of secondary sector workers (day-time).

Figure 3.2.6 2010 Employment by Sector



Source: JICA Study Team

(iii) Result of Zonal Breakdown

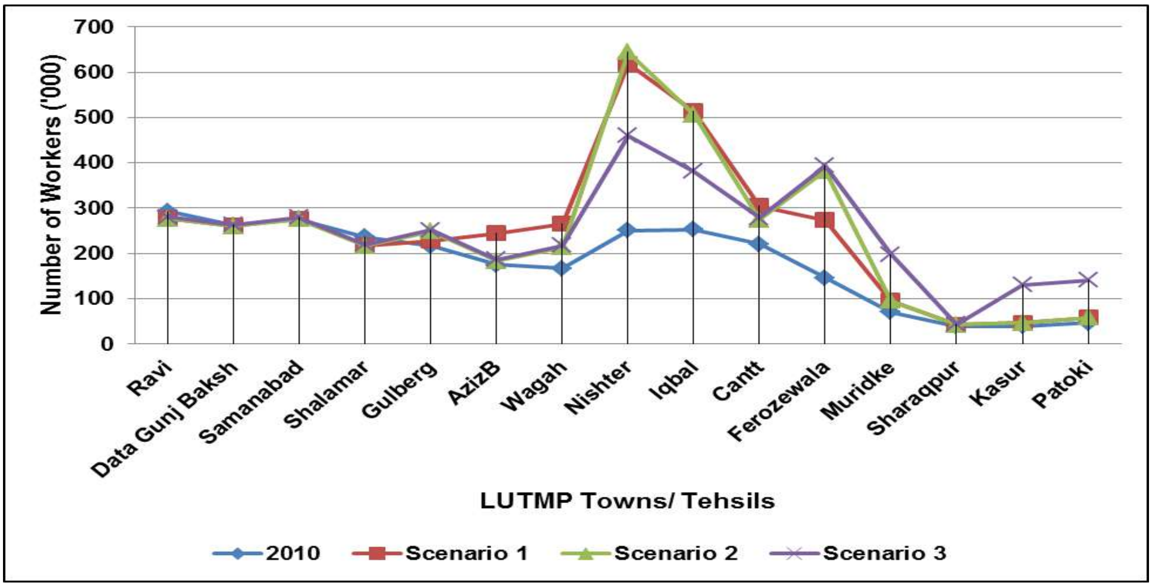
Table 3.2.8 to 3.2.14 details the result of zonal breakdown of number of workers by Town/ Tehsil for night-time and day-time population for the Study Area Towns and Tehsils. All employment sectors Night-time comparison of forecast for different scenarios are shown in Figure 3.2.7 and 3.2.8, and Day-time shown in Figure 3.2.9 and 3.2.10.

Table 3.2.8 Summary Forecast Result of Zonal Breakdown of Number of Workers (All Employment Sectors, Night-time, '000)

No.	Town/ Tehsil in the Study Area	2010	2020			2030		
			Scenario I	Scenario II	Scenario III	Scenario I	Scenario II	Scenario III
1	Ravi	293	278	277	281	273	271	279
2	Data Gunj Baksh	262	261	260	263	270	267	275
3	Samanabad	275	276	275	279	288	286	295
4	Shalamar	237	217	217	219	205	204	210
5	Gulberg	217	228	248	252	248	291	298
6	AzizB	174	244	183	186	329	201	206
7	Wagah	167	266	214	217	383	273	281
8	Nishter	251	618	645	460	1040	1096	705
9	Iqbal	252	513	506	382	812	797	535
10	Cantt	221	305	274	278	405	341	350
11	Ferozewala	146	274	382	393	422	651	675
12	Muridke	70	95	95	198	127	126	343
13	Sharaqpur	39	43	43	43	48	48	50
14	Kasur	40	47	47	131	56	56	232
15	Patoki	47	58	58	140	72	72	245
1-10	**Lahore**	**2348**	**3206**	**3099**	**2817**	**4253**	**4026**	**3434**
11-13	**Sheikhupura**	**254**	**411**	**519**	**634**	**597**	**825**	**1068**
14-15	**Kasur**	**87**	**105**	**105**	**271**	**129**	**128**	**477**
1-15	**The Study Area**	**2689**	**3722**	**3722**	**3722**	**4978**	**4978**	**4978**

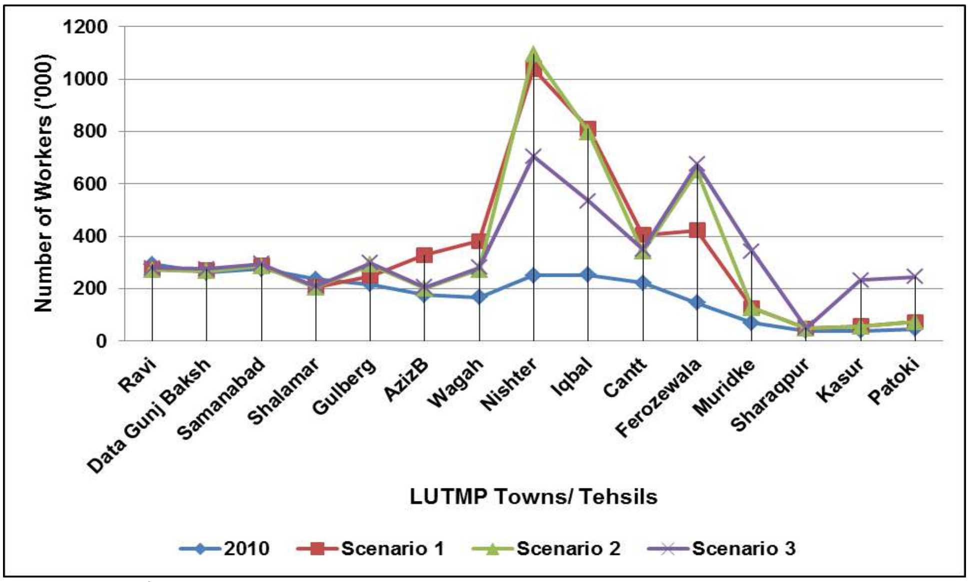
Source: JICA Study Team

Figure 3.2.7 2020 Night Time Forecast for Workers of All Employment Sectors by Scenario



Source: JICA Study Team

Figure 3.2.8 2030 Night Time Forecast for Workers of All Employment Sectors by Each Scenario



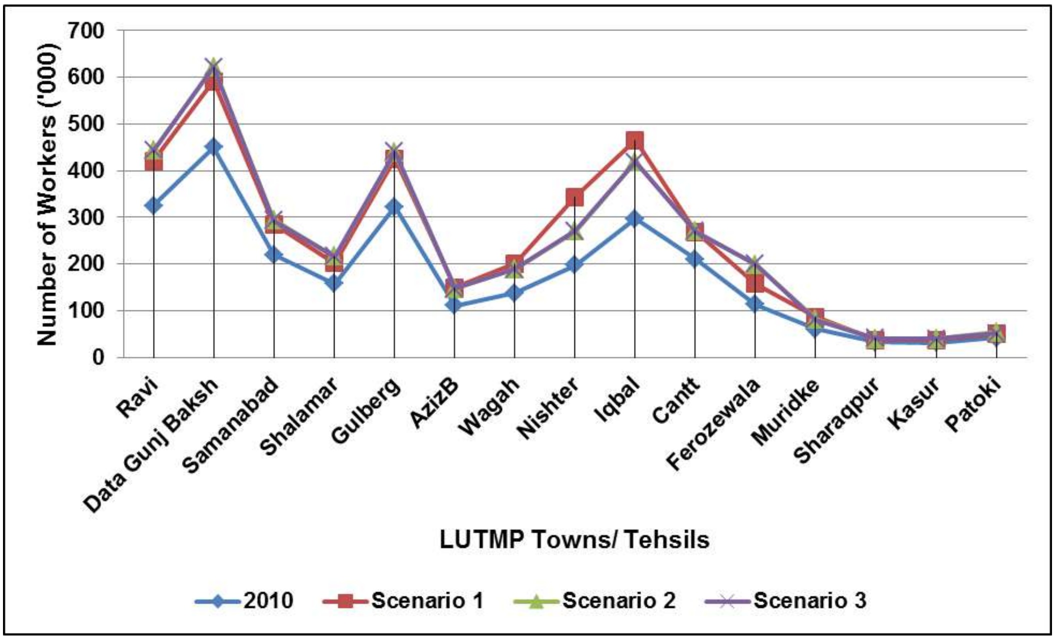
Source: JICA Study Team

Table 3.2.9 Summary Forecast Result of Zonal Breakdown of Number of Workers (All Employment Sectors, Day-time, '000)

No.	Town/ Tehsil in the Study Area	2010	2020			2030		
			Scenario I	Scenario II	Scenario III	Scenario I	Scenario II	Scenario III
1	Ravi	325	421	443	443	541	589	589
2	Data Gunj Baksh	450	592	622	622	767	831	831
3	Samanabad	219	285	295	293	366	388	386
4	Shalamar	158	202	217	216	259	289	289
5	Gulberg	323	426	439	441	553	581	585
6	AzizB	111	150	147	147	198	193	193
7	Wagah	138	202	189	189	280	253	253
8	Nishter	198	344	270	271	520	360	363
9	Iqbal	298	465	418	419	669	568	570
10	Cantt	210	269	270	270	344	347	347
11	Ferozewala	113	157	198	200	213	299	303
12	Muridke	61	87	82	80	119	109	106
13	Sharaqpur	32	37	40	40	44	49	51
14	Kasur	31	37	40	39	46	52	50
15	Patoki	42	50	54	52	60	69	65
1-10	**Lahore**	**2427**	**3354**	**3309**	**3311**	**4496**	**4400**	**4404**
11-13	**Sheikhupura**	**205**	**281**	**320**	**321**	**376**	**458**	**459**
14-15	**Kasur**	**73**	**87**	**94**	**91**	**106**	**121**	**115**
1-15	**The Study Area**	**2705**	**3722**	**3722**	**3722**	**4978**	**4978**	**4978**

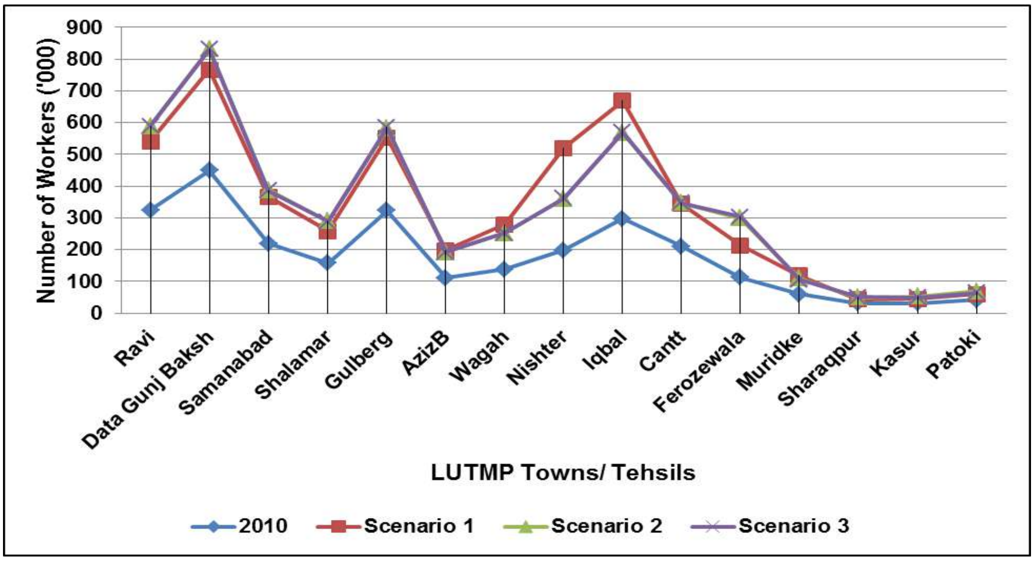
Source: JICA Study Team

Figure 3.2.9 2020 Day-Time Forecast for Workers of All Employment Sectors by Each Scenario



Source: JICA Study Team

Figure 3.2.10 2030 Day-Time Forecast for Workers of All Employment Sectors by Each Scenario



Source: JICA Study Team

Table 3.2.10 Summary Forecast Result of Zonal Breakdown of Number of Workers (Primary Sector, Night-time and Day-time, '000)

No.	Town/ Tehsil in the Study Area	2010	2020			2030		
			Scenario I	Scenario II	Scenario III	Scenario I	Scenario II	Scenario III
1	Ravi	5	3	3	3	1	1	1
2	Data Gunj Baksh	3	2	2	2	-	-	-
3	Samanabad	4	2	2	2	1	1	1
4	Shalamar	3	2	2	2	0	0	0
5	Gulberg	3	2	2	2	-	-	-
6	AzizB	5	4	4	4	2	2	3
7	Wagah	27	26	28	28	27	30	29
8	Nishter	27	24	24	25	22	22	24
9	Iqbal	18	16	16	17	14	13	15
10	Cantt	8	5	5	5	2	2	2
11	Ferozewala	27	27	26	28	29	27	31
12	Muridke	12	13	13	11	14	14	10
13	Sharaqpur	16	16	16	17	18	18	19
14	Kasur	8	9	9	8	9	9	8
15	Patoki	14	14	14	12	15	16	11
1-10	**Lahore**	**103**	**85**	**86**	**88**	**70**	**71**	**75**
11-13	**Sheikhupura**	**54**	**56**	**55**	**56**	**60**	**59**	**60**
14-15	**Kasur**	**22**	**23**	**23**	**20**	**25**	**25**	**19**
1-15	**The Study Area**	**179**	**164**	**164**	**164**	**154**	**154**	**154**

Source: JICA Study Team

Table 3.2.11 Summary Forecast Result of Zonal Breakdown of Number of Workers (Secondary Sector, Night-time, '000)

No.	Town/ Tehsil in the Study Area	2010	2020			2030		
			Scenario I	Scenario II	Scenario III	Scenario I	Scenario II	Scenario III
1	Ravi	40	52	53	56	71	71	77
2	Data Gunj Baksh	32	45	45	48	64	64	70
3	Samanabad	40	54	55	58	75	76	82
4	Shalamar	36	42	42	45	53	53	58
5	Gulberg	23	34	38	40	49	57	62
6	AzizB	24	48	33	35	78	47	51
7	Wagah	29	67	50	53	113	77	83
8	Nishter	53	200	206	152	377	390	272
9	Iqbal	39	108	106	80	193	187	130
10	Cantt	29	51	49	52	81	76	83
11	Ferozewala	33	72	98	105	121	177	193
12	Muridke	13	29	29	62	48	48	120
13	Sharaqpur	5	5	5	5	6	6	6
14	Kasur	5	5	5	15	6	6	28
15	Patoki	6	6	6	15	7	7	25
1-10	**Lahore**	**343**	**702**	**676**	**617**	**1152**	**1096**	**968**
11-13	**Sheikhupura**	**51**	**106**	**132**	**172**	**174**	**231**	**319**
14-15	**Kasur**	**11**	**11**	**11**	**30**	**13**	**13**	**53**
1-15	**The Study Area**	**405**	**819**	**819**	**819**	**1339**	**1339**	**1339**

Source: JICA Study Team

Table 3.2.12 Summary Forecast Result of Zonal Breakdown of Number of Workers (Secondary Sector, Day-time, '000)

No.	Town/ Tehsil in the Study Area	2010	2020			2030		
			Scenario I	Scenario II	Scenario III	Scenario I	Scenario II	Scenario III
1	Ravi	49	66	97	97	91	158	158
2	Data Gunj Baksh	47	72	93	93	107	151	151
3	Samanabad	28	39	56	54	56	90	88
4	Shalamar	27	36	54	54	48	88	88
5	Gulberg	35	55	67	69	81	108	112
6	AzizB	15	29	30	30	47	48	48
7	Wagah	28	67	56	56	114	91	91
8	Nishter	41	152	82	82	283	134	133
9	Iqbal	56	161	122	121	288	203	203
10	Cantt	33	56	63	63	86	100	100
11	Ferozewala	23	48	55	55	80	95	95
12	Muridke	11	26	23	23	44	37	37
13	Sharaqpur	3	3	6	6	4	10	10
14	Kasur	4	4	8	8	5	13	13
15	Patoki	5	5	10	10	6	16	16
1-10	**Lahore**	**358**	**732**	**718**	**718**	**1200**	**1170**	**1170**
11-13	**Sheikhupura**	**37**	**78**	**84**	**84**	**128**	**141**	**141**
14-15	**Kasur**	**9**	**9**	**18**	**18**	**11**	**28**	**28**
1-15	**The Study Area**	**404**	**819**	**819**	**819**	**1339**	**1339**	**1339**

Source: JICA Study Team

Table 3.2.13 Summary Forecast Result of Zonal Breakdown of Number of Workers (Tertiary Sector, Night-time, '000)

No.	Town/ Tehsil in the Study Area	2010	2020			2030		
			Scenario I	Scenario II	Scenario III	Scenario I	Scenario II	Scenario III
1	Ravi	248	223	222	223	201	199	201
2	Data Gunj Baksh	227	214	213	214	206	203	205
3	Samanabad	232	220	219	220	213	210	212
4	Shalamar	197	173	173	173	153	151	152
5	Gulberg	191	192	209	210	199	234	236
6	AzizB	147	193	146	147	249	152	153
7	Wagah	111	173	136	137	243	166	168
8	Nishter	171	394	415	283	640	684	409
9	Iqbal	195	389	385	286	606	598	390
10	Cantt	185	249	220	221	323	263	265
11	Ferozewala	87	175	258	260	273	448	452
12	Muridke	44	54	53	125	65	64	213
13	Sharaqpur	18	21	21	21	25	24	25
14	Kasur	27	33	33	108	41	40	197
15	Patoki	28	38	38	114	50	50	209
1-10	**Lahore**	**1902**	**2419**	**2337**	**2113**	**3031**	**2859**	**2390**
11-13	**Sheikhupura**	**149**	**249**	**332**	**406**	**362**	**536**	**689**
14-15	**Kasur**	**54**	**71**	**71**	**221**	**91**	**90**	**405**
1-15	**The Study Area**	**2105**	**2740**	**2740**	**2740**	**3485**	**3485**	**3485**

Source: JICA Study Team

Table 3.2.14 Summary Forecast Result of Zonal Breakdown of Number of Workers (Tertiary Sector, Day-time, '000)

No.	Town/ Tehsil in the Study Area	2010	2020			2030		
			Scenario I	Scenario II	Scenario III	Scenario I	Scenario II	Scenario III
1	Ravi	272	352	343	343	449	430	430
2	Data Gunj Baksh	400	518	527	527	661	680	680
3	Samanabad	188	243	237	237	310	297	297
4	Shalamar	127	165	161	161	211	202	202
5	Gulberg	285	370	371	371	472	473	473
6	AzizB	91	117	114	114	149	143	143
7	Wagah	84	109	106	106	139	133	133
8	Nishter	130	168	164	164	214	205	205
9	Iqbal	223	288	281	281	368	352	352
10	Cantt	169	208	203	203	255	244	244
11	Ferozewala	63	82	117	117	105	178	178
12	Muridke	37	48	47	47	61	58	58
13	Sharaqpur	14	18	17	17	23	22	22
14	Kasur	19	25	24	24	31	30	30
15	Patoki	24	31	30	30	39	38	38
1-10	**Lahore**	**1966**	**2537**	**2505**	**2505**	**3226**	**3159**	**3159**
11-13	**Sheikhupura**	**114**	**148**	**181**	**181**	**188**	**258**	**258**
14-15	**Kasur**	**43**	**55**	**54**	**54**	**70**	**68**	**68**
1-15	**The Study Area**	**2123**	**2740**	**2740**	**2740**	**3485**	**3485**	**3485**

Source: JICA Study Team

3.2.3 Number of Students

1) Ratio of Students in the Same Age Group and Number of Students

(i) Ratio of Students in the Same Age Group

Ratio of students (high school and above) in the same age group is shown in Table 3.2.15 by Town/ Tehsil. These Towns/ Tehsils were classified into three groups; A, B and C. A is a group of high income and a number of high schools, universities, etc. are located in the same Town/ Tehsil. C belongs to the area of relatively low income with insufficient number of high-grade education facilities, and B comes in between A and C. This grouping may change in the future depending on economic growth and location of high-grade education facilities.

Table 3.2.15 Ratio of Students in the Same Age Group

No.	Town/ Tehsil	Ratio of Students (%)	Group
1	Ravi	39.6	B
2	Data Gunj Baksh	48.8	A
3	Samanabad	44.7	B
4	Shalamar	51.6	A
5	Gulberg	56.6	A
6	Aziz Bhatti	47.8	A
7	Wagah	30.5	C
8	Nishtar	31.4	C
9	Iqbal	43.2	B
10	Cantonment	51.8	A
11	Ferozewala	27.3	C
12	Muridke	31.9	C
13	Sharaqpur	32.9	C

No.	Town/ Tehsil	Ratio of Students (%)	Group
14	Kasur	42.8	B
15	Pattoki	28.6	C
1-15	**The Study Area**	**43.2**	**B**

Source: JICA Study Team

In the world, this ratio is as follows[2]:

United States	57.1	(2005)
UK	52.4	(2006)
Germany	51.5	(2006)
France	56.2	(2006)
Japan	67.1	(2008)
Korea	116.7	(2007)

In Lahore, this ratio is almost comparable with developed countries reflecting the fact that a lot of academic and educational facilities are accumulated in Lahore. Actually the ratio is only 6.4 % for entire Pakistan (2008, United Nations Educational Scientific and Cultural Organization (UNESCO)). This trend/ tradition should be maintained also in the future.

(ii) Future No. of Students

It is assumed that the upper limit of the ratio of students in the same age group will become as follows by 2030:

Group A: 55 %

Group B: 44 % (80 % of Group A)

Group C: 35 % (80 % of Group B)

The population ratio of zones belonging to Group A, B and C is 5:2:3 at present and the weighted average of the Study Area is calculated at 46.8 % for 2030 and 45.0 % for 2020. Average growth rate is 1.8 % p.a. The result is given in Table 3.2.16.

Table 3.2.16 Forecast Number of Students for the Study Area

Description	2010	2020	2030
Population ('000)	9,928	12,925	16,429
Population of the Age Group ('000)	1,986	2,665	3,386
Ratio of Students in the Age Group	0.43	0.45	0.49
No. of Students ('000)	857	1,163	1,597

Source: JICA Study Team

2) Zonal Breakdown of Student Population

(i) No. of Students (Night-time)

The number of students residing in a zone is first estimated by multiplying population with the present ratio of number of students to population. Then it is adjusted to the total of the Study Area control total as predetermined above. The result is presented in Table 3.2.17.

[2] source: Ministry of Education and Science, Japan

Table 3.2.17 Forecast Number of Students ('000) by Town/ Tehsil (Night-time)

No.	Town/ Tehsil in Study Area	2010	2020			2030		
			Scenario I	Scenario II	Scenario III	Scenario I	Scenario II	Scenario III
1	Ravi	80	84	82	84	90	86	89
2	Data Gunj Baksh	95	102	99	101	111	106	110
3	Samanabad	102	112	109	112	128	122	126
4	Shalamar	82	83	81	82	84	81	83
5	Gulberg	88	106	113	115	130	148	153
6	AzizB	64	84	71	72	112	81	84
7	Wagah	40	57	46	47	81	56	58
8	Nishter	59	122	134	90	209	237	133
9	Iqbal	83	169	177	131	291	306	198
10	Cantt	86	129	114	117	190	154	160
11	Ferozewala	29	59	82	84	101	155	160
12	Muridke	17	20	19	40	24	23	73
13	Sharaqpur	7	8	8	8	9	9	9
14	Kasur	14	17	16	46	20	19	90
15	Patoki	12	14	13	37	17	16	72
1-10	**Lahore**	**778**	**1046**	**1025**	**949**	**1426**	**1376**	**1194**
11-13	**Sheikhupura**	**53**	**87**	**109**	**132**	**135**	**186**	**242**
14-15	**Kasur**	**26**	**31**	**30**	**83**	**37**	**35**	**162**
1-15	**The Study Area**	**857**	**1163**	**1163**	**1163**	**1597**	**1597**	**1597**

Source: JICA Study Team

(ii) Number of Students (day-time)

For Scenario 1, the number of students by zone was estimated by distributing the predetermined total in proportion to the present number of students (daytime).

For Scenario 2 and 3, 40 thousand students were allocated to the academic town proposed in Ferozewala. Then the rest was distributed to zones in proportion to the present numbers. The result is summarized in Table 3.2.18.

Table 3.2.18 Forecast Number of Students ('000) by Town/ Tehsil (Day-time)

No.	Town/ Tehsil in Study Area	2010	2020			2030		
			Scenario I	Scenario II	Scenario III	Scenario I	Scenario II	Scenario III
1	Ravi	54	59	59	61	65	64	68
2	Data Gunj Baksh	186	212	214	221	249	247	261
3	Samanabad	136	155	156	161	181	180	190
4	Shalamar	66	69	70	72	74	74	78
5	Gulberg	129	154	163	168	189	204	216
6	AzizB	33	44	37	38	61	42	44
7	Wagah	26	44	31	32	70	37	39
8	Nishter	38	88	94	63	157	167	96
9	Iqbal	75	160	164	114	277	280	166
10	Cantt	63	111	94	97	180	134	141
11	Ferozewala	15	29	42	44	48	121	126
12	Muridke	14	16	16	30	19	19	52
13	Sharaqpur	5	5	6	6	7	6	7
14	Kasur	6	7	7	23	8	8	47
15	Patoki	11	12	13	35	15	15	69
1-10	**Lahore**	**806**	**1094**	**1081**	**1027**	**1501**	**1428**	**1297**
11-13	**Sheikhupura**	**33**	**50**	**64**	**79**	**74**	**147**	**184**
14-15	**Kasur**	**16**	**19**	**19**	**58**	**23**	**22**	**116**
1-15	**The Study Area**	**855**	**1163**	**1163**	**1163**	**1597**	**1597**	**1597**

Source: JICA Study Team

3.2.4 GDP and Per Capita GDP

1) Past Trends

Past trends of Pakistan Gross Domestic Products (GDP) are outlined in Table 3.2.19 and GDP Growth rate past trend is shown in Figure 3.2.11.

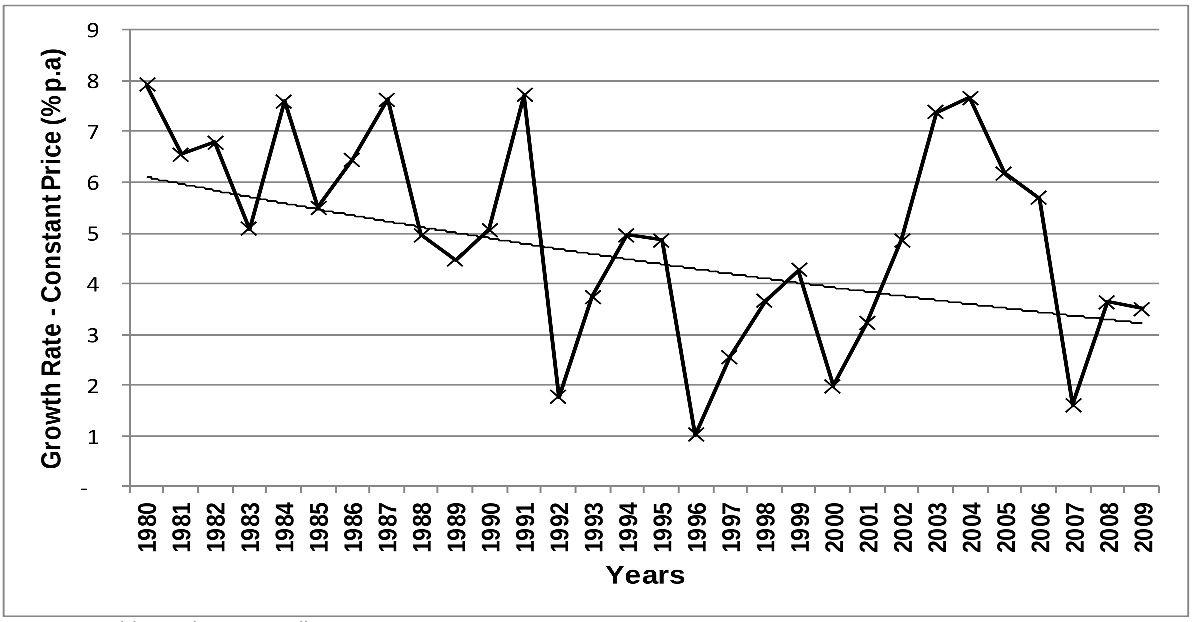
Table 3.2.19 Past Trends of Pakistan GDP and GDP per Capita

Year	Population (Million)	GDP (PKR billion)		Annual GDP Growth Rate - Constant price (% p.a.)	GDP per Capita at 2010 Constant price (PKR '000)
		Current Price	2010 Constant Price[1]		
1980	82.73	234.53	3,309.55	-	40.0
1981	85.10	278.20	3,571.69	7.92	42.0
1982	87.44	324.16	3,805.19	6.54	43.5
1983	89.83	364.39	4,063.12	6.78	45.2
1984	92.28	419.80	4,268.92	5.07	46.3
1985	94.79	472.16	4,593.03	7.59	48.4
1986	97.35	514.53	4,845.72	5.50	49.8
1987	99.95	572.48	5,158.38	6.45	51.6
1988	102.62	675.39	5,551.72	7.63	54.1
1989	105.27	769.75	5,827.07	4.96	55.4
1990	107.98	855.94	6,086.88	4.46	56.4
1991	110.75	1,016.72	6,394.97	5.06	57.7
1992	113.56	1,205.20	6,887.76	7.71	60.6
1993	116.44	1,333.04	7,008.83	1.76	60.2
1994	119.40	1,561.10	7,270.78	3.74	60.9
1995	122.37	1,865.92	7,631.60	4.96	62.4
1996	125.41	2,120.17	8,001.47	4.85	63.8
1997	128.46	2,428.31	8,082.64	1.01	62.9
1998	131.58	2,677.66	8,288.76	2.55	63.0
1999	134.79	2,938.38	8,592.14	3.66	63.7
2000	138.08	3,826.11	8,958.18	4.26	64.9
2001	141.45	4,209.87	9,135.77	1.98	64.6
2002	144.90	4,452.65	9,430.35	3.22	65.1
2003	148.44	4,875.65	9,887.37	4.85	66.6
2004	152.06	5,640.58	10,615.93	7.37	69.8
2005	155.77	6,499.78	11,429.89	7.67	73.4
2006	159.14	7,623.21	12,135.97	6.18	76.3
2007	162.59	8,673.01	12,825.67	5.68	78.9
2008	166.11	10,242.80	13,030.37	1.60	78.4
2009	169.71	12,739.34	13,503.70	3.63	79.6
2010	168.26	13,976.33	13,976.33	3.50	83.1

Note: 1) Calculation assuming a growth rate between 2009 and 2010 predicted by International Monetary Fund (IMF).
Source: World Development Indicators 2010

As seen in the table, Pakistan economy has been growing. However, the growth has not been stable and has been fluctuating year to year. Although average growth rate was 4.9% between 1972 and 2010, it has declined recently (Pakistan: Framework for Economic Growth, April 2011, Planning Commission).

Figure 3.2.11 Past Trends - Growth Rate at Constant Price (% of Per Annum)



Source: World Development Indicators, WB 2010

As for the Punjab, Lahore District as well as the Study Area, there is no GDP or GRDP statistics available. However, Price Water House Coopers of UK estimated 2008 GDP of Lahore in purchasing power parity (PPP) at USD 40 billion using population and income statistics available for Lahore and other similar cities (Economic Outlook, Nov. 2009). In this estimate, “Lahore” means urban agglomeration of Lahore based on UN definition, and this is almost comparable to the Study Area.

We estimated 2010 GDP of the Study Area at about PKR 1,341 billion or USD 17 billion at 2010 constant prices using GDP growth between 2008 and 2010 and the ratio between PPP and 2010 constant price basis estimated by IMF (2010 Economic Outlook).

2) GDP Projections

In the absence of available data and considerable fluctuation of economy in the past, it is difficult to forecast future GDP. In order to forecast GDP and GDP per Capita in the future both for Pakistan and the Study Area, the following assumption were introduced:

A. For entire Pakistan, between 2010 and 2015, the forecast of IMF’s 2010 economic outlook was referred. This assumes the following growth rates:

2010-11: 2.8 %

2011-12: 4.0 %

2012-13: 5.0 %

2013-14: 5.5 %
2014-15: 6.0 %

2.8 % of 2010-11 is the same as the Planning Commission's "Pakistan Economic Outlook, Feb. 2011". In this Study, these rates were taken and for 2016 and after, it were assumed that the growth rate would be constant at 6.0 %. Then the average growth for 2010-30 is 5.7 %. This is comparable to the forecast of Price Water House Coopers at 5.6 % for 2008-25 (Economic Outlook, Nov. 2009).

B. For Lahore or the Study Area, no reference is exists as to GDP. Thus it was assumed that the 2010 GDP of Lahore estimated above would grow in parallel to national economy with slightly higher rate due to higher population increase.

The result is presented in Table 3.2.20 below. It should be noted that this is just an approximation on most likely basis. However, this indicative estimate provides a relatively good basis for transport demand forecast.

Table 3.2.20 Projected GDP and GDP per Capita for Pakistan and the Study Area

Year	Population (million)		Assumed GDP Growth Rate (% p.a.)		GDP at 2010 Constant Price (PKR billion)		GDP per Capita at 2010 Constant Price (PKR '000)	
	Pakistan	LUTMP	Pakistan	LUTMP	Pakistan	LUTMP	Pakistan	LUTMP
2010	168.26	9.93	-	-	13,976	1,341	83.1	135.1
2011	171.84	10.20	2.8	2.81	14,368	1,387	83.6	136.0
2012	175.50	10.48	4.0	4.01	14,942	1,451	85.1	138.4
2013	179.24	10.77	5.0	5.01	15,689	1,532	87.5	142.3
2014	183.06	11.06	5.5	5.52	16,552	1,626	90.4	147.0
2015	186.96	11.36	6.0	6.02	17,546	1,734	93.8	152.6
2016	190.75	11.66	6.0	6.02	18,598	1,848	97.5	158.5
2017	194.62	11.96	6.0	6.02	19,714	1,970	101.3	164.7
2018	198.58	12.28	6.0	6.02	20,897	2,101	105.2	171.1
2019	202.61	12.60	6.0	6.02	22,151	2,239	109.3	177.8
2020	206.72	12.93	6.0	6.02	23,480	2,387	113.6	184.7
2021	210.69	13.25	6.0	6.01	24,889	2,545	118.1	192.1
2022	214.73	13.58	6.0	6.01	26,382	2,712	122.9	199.8
2023	218.86	13.91	6.0	6.01	27,965	2,891	127.8	207.8
2024	223.06	14.26	6.0	6.01	29,643	3,081	132.9	216.1
2025	227.34	14.61	6.0	6.01	31,421	3,284	138.2	224.7
2026	231.48	14.96	6.0	6.01	33,307	3,500	143.9	234.0
2027	235.69	15.31	6.0	6.01	35,305	3,730	149.8	243.6
2028	239.98	15.68	6.0	6.01	37,423	3,975	155.9	253.6
2029	244.35	16.05	6.0	6.01	39,669	4,237	162.3	264.0
2030	248.80	16.43	6.0	6.01	42,049	4,515	169.0	274.8

Source: JICA Study Team

3) Zonal Breakdown

For distributing the estimated Study Area GDP to traffic zones, the following procedure was adopted:

1. Development of regression equation to estimate average per capita GDP by zone based on sector distribution of employment. Using WDIs from 1980 to 2007 for entire Pakistan, the following equation was developed:

   $$y = c1 * p1 + c2 * p2 + c3 * p3 + c4$$

   Where,

   y: GDP per capita (PKR/person)

   p1-p3: employment composition of the Primary, Second and Tertiary sectors (%)
   c1-c4: parameters be determined by regression

   The values of these parameters were estimated by least square regression method as:

   c1: 10,233.9 (*1.216*)

   c2: 11,046.6 (*1.295*)

   c3: 12,467.9 (*1.515*)

   c4: -1,050,940.8 (*-1.257*)

   Correlation Coefficient $\boldsymbol{R^2 = 0.82}$; and

   figures in parenthesis give the (*t-statistics*); indicating that there is good correlation and all parameters are statistically significant.

2. Using worker's sectoral composition by zone, per capita GDP was calculated by the above equation for each zone. For 2010, the result of HIS was used, and for 2020 and 2030, the estimated values described in previous sections were used.

3. By multiplying population with per capita GDP is estimated as above, GDP was calculated by zone. The total of these values, however, is slightly different from the GDP estimated earlier for the Study Area.

4. To keep consistency, the total GDP of the Study Area was distributed to zones in proportion to the value by zone calculated in 3 above.

The results are presented in Tables 3.2.21, 3.2.22 and 3.2.23 for 2010, 2020 and 2030, respectively.

Table 3.2.21 2010 Estimated GDP and GDP per Capita by Town/Tehsil

No.	Town/ Tehsil in the Study Area	Population ('000)	GDP (PKR, billion)	GDP per Capita (PKR, 000)
1	Ravi	1007	148	146.7
2	Data Gunj Baksh	970	145	149.4
3	Samanabad	984	144	146.3
4	Shalamar	854	125	145.2
5	Gulberg	778	119	152.2
6	AzizB	667	96	143.3
7	Wagah	656	75	112.9
8	Nishter	945	114	120.0
9	Iqbal	960	128	133.0
10	Cantt	831	120	144.0
11	Ferozewala	534	57	105.1
12	Muridke	266	30	110.9
13	Sharaqpur	101	8	73.7
14	Kasur	168	19	110.9
15	Patoki	207	20	95.5
1-10	Lahore	8,653	1,210	139.8
11-13	Sheikhupura	901	94	103.3
14-15	Kasur	375	39	102.4
1-15	**The Study Area**	**9928**	**1341**	**135.1**

Source: JICA Study Team

Table 3.2.22 2020 Projected GDP and GDP per Capita by Town/Tehsil

No.	Town/ Tehsil in LUTMP Study Area	Population ('000)			GDP (PKR billion)			GEP per Capita (PKR '000)		
		Scenario I	Scenario II	Scenario III	Scenario I	Scenario II	Scenario III	Scenario I	Scenario II	Scenario III
1	Ravi	978	971	976	194	192	192	197.4	197.4	195.9
2	Data Gunj Baksh	968	961	966	195	194	193	201.1	201.1	199.6
3	Samanabad	990	983	988	195	194	193	196.5	196.4	194.9
4	Shalamar	790	784	788	156	155	154	196.8	196.7	195.3
5	Gulberg	850	926	931	175	190	190	204.9	204.7	203.3
6	AzizB	901	686	690	176	135	134	194.8	195.7	194.1
7	Wagah	881	713	717	144	113	113	162.9	158.1	157
8	Nishter	1906	2007	1399	320	340	228	167.7	169.2	162.6
9	Iqbal	1840	1824	1366	347	345	254	188.5	189	185.8
10	Cantt	1149	1018	1024	230	201	201	199.7	197.2	195.7
11	Ferozewala	883	1268	1275	145	218	216	163.1	171.9	168.8
12	Muridke	284	282	609	42	41	102	145.1	144.6	166.5
13	Sharaqpur	108	107	107	13	12	12	112.8	112.3	110.4
14	Kasur	179	177	520	30	30	102	166.9	166.5	196
15	Patoki	221	219	568	34	34	109	152	151.5	191.6
1-10	**Lahore**	**11252**	**10873**	**9846**	**2127**	**2054**	**1848**	**189**	**188.9**	**187.7**
11-13	**Sheikhupura**	**1274**	**1656**	**1992**	**198**	**271**	**329**	**154.9**	**163.4**	**165**
14-15	**Kasur**	**399**	**397**	**1088**	**64**	**63**	**211**	**158.6**	**158.2**	**193.7**
1-15	**LUTMP Study Area**	**12925**	**12925**	**12925**	**2387**	**2387**	**2387**	**184.7**	**184.7**	**184.7**

Source: JICA Study Team

Table 3.2.23 2030 Projected GDP and GDP per Capita by Town/Tehsil

No.	Town/ Tehsil in LUTMP Study Area	Population ('000)			GDP (PKR billion)			GEP per Capita (PKR '000)		
		Scenario I	Scenario II	Scenario III	Scenario I	Scenario II	Scenario III	Scenario I	Scenario II	Scenario III
1	Ravi	949	938	947	272	268	266	285.7	285	280.3
2	Data Gunj Baksh	970	958	967	284	280	278	292.3	291.6	287.2
3	Samanabad	1002	990	999	286	282	280	285.1	284.4	279.7
4	Shalamar	720	711	717	206	203	202	286.2	285.4	280.7
5	Gulberg	937	1102	1112	283	334	332	301.9	302.2	298.2
6	AzizB	1175	714	721	339	207	205	288.6	288.5	283.9
7	Wagah	1145	784	792	284	186	185	248	236.6	233.3
8	Nishter	3017	3226	1927	764	828	469	253.1	256.5	243.4
9	Iqbal	2857	2818	1838	816	808	513	285.3	286.5	279.1
10	Cantt	1521	1240	1251	460	366	365	302.1	295.1	291.1
11	Ferozewala	1288	2110	2130	331	568	560	256.4	269	262.7
12	Muridke	305	302	1005	66	64	260	213	211.8	258.3
13	Sharaqpur	116	114	115	21	21	20	178.9	177.2	171.3
14	Kasur	192	190	927	51	50	285	263.6	262.5	306.6
15	Patoki	238	235	983	59	58	302	246.7	245.4	306.7
1-10	**Lahore**	**14291**	**13479**	**11270**	**3990**	**3756**	**3091**	**279.2**	**278.6**	**274.2**
11-13	**Sheikhupura**	**1708**	**2526**	**3250**	**416**	**652**	**839**	**243.4**	**258**	**258.1**
14-15	**Kasur**	**430**	**424**	**1910**	**110**	**108**	**586**	**254.3**	**253**	**306.7**
1-15	**LUTMP Study Area**	**16429**	**16429**	**16429**	**4515**	**4515**	**4515**	**274.8**	**274.8**	**274.8**

Source: JICA Study Team

3.2.5 Household Income and Car Ownership

1) Current Situation

Table 3.2.24 presents the present household income and car ownership by Town/ Tehsil in the Study Area. Between car-owning and non-car-owning households, there is a big difference in household income of about 2.3 times. Thus higher-income towns/ tehsils have high car ownership. The highest car ownership is found in Cantonment at about 40 % which also has the highest average income in the Study Area. The average percentage of car-owning household is about 18% in the Study Area at present.

Table 3.2.24 Present Household's Income and Car Ownership, 2010

No.	Town/ Tehsil	No. of Households			Car Owning HH (%)	Ave. HH Income (PKR/month)		
		Car Owning	Non-Car Owning	Total		Car Owning	Non-Car Owning	Average
1	Ravi	13,052	159,723	172,775	7.5	42,356	19,098	20,855
2	Data Gunj Baksh	30,859	142,579	173,438	17.8	40,849	20,337	23,987
3	Samanabad	39,950	135,553	175,503	22.8	40,507	23,101	27,063
4	Shalamar	18,343	126,403	144,746	12.7	39,237	19,948	22,392
5	Gulberg	40,550	97,992	138,542	29.3	44,612	23,412	29,617
6	Aziz Bhatti	20,201	101,391	121,592	16.6	34,660	17,867	20,657
7	Wagah	7,432	99,347	106,779	7.0	34,035	15,976	17,233
8	Nishtar	14,408	147,451	161,859	8.9	36,428	16,314	18,104
9	Iqbal	49,646	127,990	177,636	28.0	43,550	17,735	24,949
10	Cantonment	64,188	97,114	161,302	39.8	50,950	20,215	32,446
11	Ferozewala	8,888	89,648	98,536	9.0	34,967	14,524	16,368
12	Muridike	2,991	42,274	45,265	6.6	37,829	14,754	16,279
13	Sharaqpur Sharif	3,964	23,930	27,894	14.2	39,385	18,140	21,159
14	Kasur	6,372	21,739	28,111	22.7	56,975	13,432	23,302
15	Pattoki	1,757	31,438	33,195	5.3	34,624	14,301	15,376
1-10	**Lahore**	298,629	1,235,543	1,534,172	19.5	43,099	19,371	23,990
11-13	**Sheikhupura**	15,843	155,852	171,695	9.2	36,612	15141	17,122
14-15	**Kasur**	8,129	53,177	61,306	13.3	52,144	13945	19,010
1-15	**The Study Area**	**322,601**	**1,444,572**	**1,767,173**	**18.3**	**43,009**	**18,715**	**23,150**

Source: JICA Study Team

2) Car Ownership Forecast

Car ownership has a strong correlation with household income. Therefore the first step to forecast car ownership is to estimate future household income. It is well known that income increases or decreases in proportion to GDP per capita. Since GDP and GDP per Capita have been forecast by zone as explained in the previous section, it is easy to know the income level by zone.

Next step is to analyze the interrelationship between household car ownership and household income. As analyzed by regression analysis, household car ownership and household income by zone have shown a very good correlation as anticipated. However, this analysis tends to lead very high forecast. Because all the zones have the same weight in this analysis regardless of the size of zones. Hence, the following equation was selected to forecast the future car ownership.

NC = 0.0000109 HI – 705.308

Where, NC: No. of cars by zone

HI: Total Household Income by zone

(R^2=0.69, T-statistics: 21.6 for HI and -7.3 for Constant)

In addition, for extremely densely built-up 8 zones located in the center of the city, car ownership rate was assumed to remain stable, and for other densely built-up 17 zones, car ownership was assumed to grow only by 5 % and 10 % for 2020 and 2030, respectively.

The result of forecast is shown in Table 3.2.25 to 3.2.30 for 2020 and 2030 by urban development scenario and illustrated in Figure 3.2.12 for the three urban development scenarios. Car ownership by Household will increase from 18 % in 2010 to 29-30 % and 43-45 % in 2020 and 2030, respectively.

Table 3.2.25 Household Income and Car Ownership, 2020 Scenario-I

No.	Town/ Tehsil in the Study Area	No. of Households			Car Owning HH (%)	Ave. HH Income (PKR/month)		
		Car Owning	Non-Car Owning	Total		Car Owning	Non-Car Owning	Average
1	Ravi	29,648	137,496	167,144	17.7	48,385	23,716	28,092
2	Data Gunj Baksh	57,080	115,931	173,012	33.0	48,129	24,355	32,199
3	Samanabad	69,691	103,845	173,537	40.2	48,545	28,228	36,387
4	Shalamar	33,825	100,120	133,945	25.3	47,258	24,549	30,284
5	Gulberg	58,728	82,369	140,830	41.7	54,878	26,748	38,529
6	AzizB	44,745	112,869	157,614	28.4	46,256	22,442	29,202
7	Wagah	32,182	108,870	141,052	22.8	44,584	19,644	25,334
8	Nishter	72,150	242,613	314,763	22.9	44,938	19,685	25,473
9	Iqbal	86,361	208,907	294,943	29.3	63,753	27,270	37,983
10	Cantt	92,215	132,292	224,507	41.1	63,048	24,687	43,397
11	Ferozewala	32,946	128,259	161,204	20.4	46,199	20,182	25,499
12	Muridke	8,413	35,471	43,572	19.3	45,035	16,663	22,260
13	Sharaqpur	9,361	20,362	29,724	31.5	55,777	24,854	34,593
14	Kasur	7,566	22,389	29,955	25.3	70,066	18,918	34,749
15	Patoki	4,910	30,463	35,372	13.9	54,450	21,615	26,172
1-10	**Lahore**	576,627	1,345,313	1,921,347	30.0	52,858	23,853	32,918
11-13	**Sheikhupura**	50,720	184,092	234,500	21.6	47,774	20,021	26,050
14-15	**Kasur**	12,476	52,852	65,327	19.1	63,921	20,473	30,105
1-15	**The Study Area**	**639,823**	**1,582,256**	**2,221,175**	**28.8**	**52,649**	**23,280**	**32,108**

Source: JICA Study Team

Table 3.2.26 Household Income and Car Ownership, 2020 Scenario-II

No.	Town/ Tehsil in the Study Area	No. of Households			Car Owning HH (%)	Ave. HH Income (PKR/month)		
		Car Owning	Non-Car Owning	Total		Car Owning	Non-Car Owning	Average
1	Ravi	29,416	136,511	165,927	17.7	48,364	23,711	28,081
2	Data Gunj Baksh	56,788	114,964	171,752	33.1	48,093	24,335	32,190
3	Samanabad	69,349	102,924	172,273	40.3	48,505	28,197	36,372
4	Shalamar	33,601	99,369	132,970	25.3	47,235	24,539	30,274
5	Gulberg	60,726	93,129	153,587	39.5	54,861	25,381	37,081
6	AzizB	36,370	84,593	120,962	30.1	42,622	21,750	28,026
7	Wagah	25,479	90,619	116,098	21.9	39,623	19,806	24,155
8	Nishter	76,226	252,774	329,000	23.2	45,535	19,549	25,569
9	Iqbal	83,533	221,982	305,190	27.4	70,046	30,053	41,032
10	Cantt	84,854	112,909	197,763	42.9	64,367	24,984	45,183
11	Ferozewala	57,960	183,482	241,442	24.0	52,437	22,107	29,388
12	Muridke	8,314	35,253	43,255	19.2	44,815	16,641	22,177
13	Sharaqpur	9,254	20,254	29,507	31.4	55,484	24,752	34,390
14	Kasur	7,509	22,228	29,737	25.3	70,211	18,921	34,694
15	Patoki	4,811	30,304	35,115	13.7	54,303	21,582	26,065
1-10	**Lahore**	556,342	1,309,772	1,865,522	29.8	53,578	24,289	33,389
11-13	**Sheikhupura**	75,528	238988	314204	24.0	51,972	21,525	28,865
14-15	**Kasur**	12,319	52,532	64,851	19.0	63,999	20,456	30,021
1-15	**The Study Area**	**644,189**	**1,601,293**	**2,244,578**	**28.7**	**53,570**	**23,738**	**32,658**

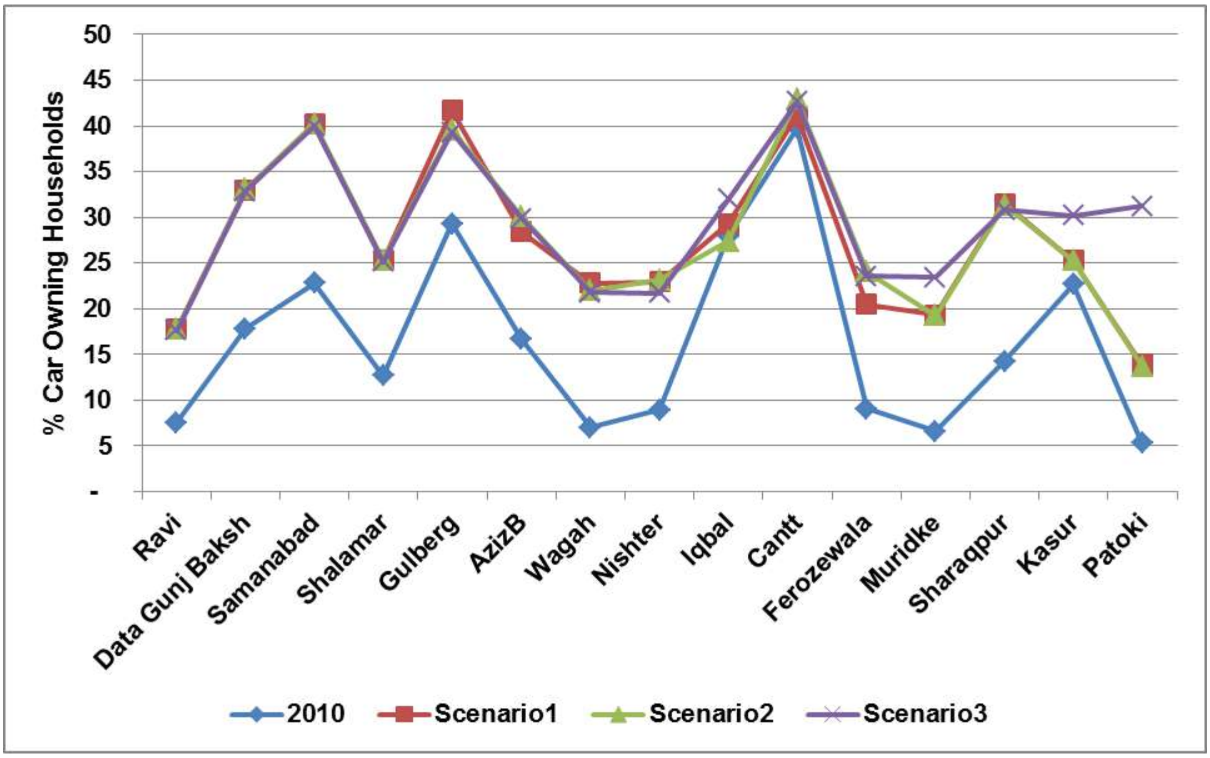
Source: JICA Study Team

Table 3.2.27 Household Income and Car Ownership, 2020 Scenario-III

No.	Town/ Tehsil in the Study Area	No. of Households			Car Owning HH (%)	Ave. HH Income (PKR/month)		
		Car Owning	Non-Car Owning	Total		Car Owning	Non-Car Owning	Average
1	Ravi	29,379	137,463	166,842	17.6	48,040	23,555	27,866
2	Data Gunj Baksh	56,734	115,965	172,699	32.9	47,862	24,185	31,964
3	Samanabad	69,247	103,977	173,223	40.0	48,201	28,012	36,083
4	Shalamar	33,577	100,126	133,704	25.1	46,953	24,381	30,050
5	Gulberg	60,685	94,017	154,435	39.3	54,552	25,248	36,807
6	AzizB	36,326	85,304	121,630	29.9	42,362	21,611	27,809
7	Wagah	25,412	91,326	116,739	21.8	39,470	19,658	23,971
8	Nishter	50,960	184,055	235,015	21.7	44,946	18,995	24,622
9	Iqbal	74,855	159,851	234,380	31.9	62,310	25,979	37,618
10	Cantt	84,751	114,103	198,854	42.6	64,091	24,840	44,883
11	Ferozewala	57,205	185,570	242,774	23.6	51,758	21,809	28,866
12	Muridke	21,488	70,615	91,791	23.4	51,061	17,807	25,652
13	Sharaqpur	9,146	20,524	29,670	30.8	54,676	24,420	33,747
14	Kasur	26,520	61,258	87,778	30.2	61,206	19,735	41,087
15	Patoki	28,539	62,994	91,534	31.2	72,443	22,971	38,396
1-10	**Lahore**	521,926	1,186,188	1,707,522	30.6	52,317	23,516	32,724
11-13	**Sheikhupura**	87,838	276709	364236	24.1	51,891	20,982	28,454
14-15	**Kasur**	55,059	124,253	179,312	30.7	67,031	21,375	39,713
1-15	**The Study Area**	**664,823**	**1,587,150**	**2,251,069**	**29.5**	**53,466**	**22,891**	**32,592**

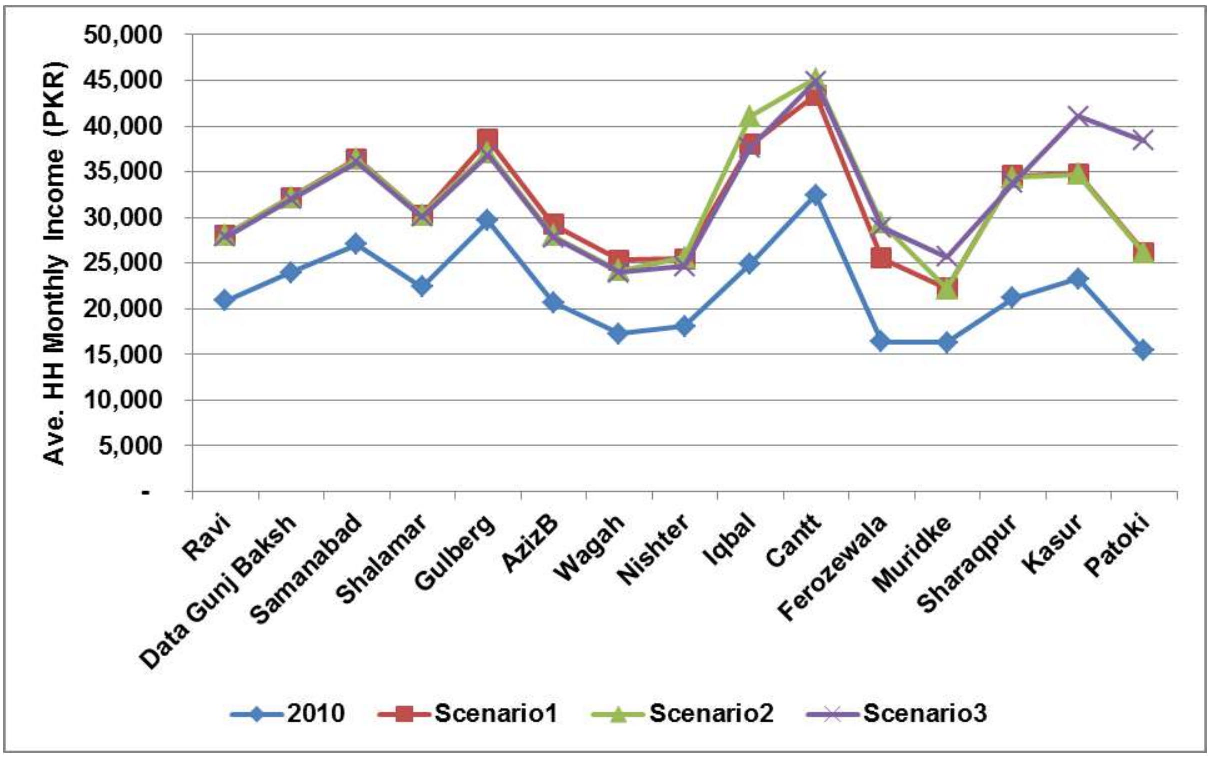
Source: JICA Study Team

Figure 3.2.12 2020 Percent of Car Owning Households for Three Scenarios



Source: JICA Study Team

Figure 3.2.13 2020 Average Household Monthly Income for Three Scenarios



Source: JICA Study Team

Table 3.2.28 Household Income and Car Ownership, 2030 Scenario-I

No.	Town/ Tehsil in the Study Area	No. of Households			Car Owning HH (%)	Ave. HH Income (PKR/month)		
		Car Owning	Non-Car Owning	Total		Car Owning	Non-Car Owning	Average
1	Ravi	47,376	114,191	161,567	29.3	61,181	32,228	40,718
2	Data Gunj Baksh	83,113	90,319	173,432	47.9	62,539	31,949	46,609
3	Samanabad	101,160	73,817	174,977	57.8	64,336	37,399	52,972
4	Shalamar	49,663	72,604	122,268	40.6	60,929	32,259	43,904
5	Gulberg	84,680	70,790	155,203	54.6	73,789	35,570	56,484
6	AzizB	89,416	115,061	204,477	43.7	63,731	29,794	44,634
7	Wagah	68,466	112,617	181,083	37.8	61,094	25,490	38,952
8	Nishter	175,964	315,741	491,705	35.8	60,375	26,466	38,601
9	Iqbal	215,074	228,394	443,142	48.5	85,630	33,714	58,935
10	Cantt	149,386	148,758	298,144	50.1	82,872	31,293	64,086
11	Ferozewala	84,670	149,224	233,893	36.2	63,776	26,241	39,828
12	Muridke	15,404	31,783	46,876	32.9	60,453	20,739	33,928
13	Sharaqpur	16,280	15,697	31,977	50.9	79,497	34,123	57,224
14	Kasur	11,390	20,836	32,226	35.3	86,188	24,262	54,655
15	Patoki	12,008	26,046	38,054	31.6	74,094	29,738	43,735
1-10	**Lahore**	1,064,297	1,342,293	2,405,998	44.2	70,709	30,693	49,267
11-13	**Sheikhupura**	116,354	196704	312746	37.2	65,536	25,981	40,723
14-15	**Kasur**	23,398	46,883	70,280	33.3	79,981	27,304	48,742
1-15	**The Study Area**	**1,204,049**	**1,585,879**	**2,789,025**	**43.2**	**70,365**	**29,980**	**48,293**

Source: JICA Study Team

Table 3.2.29 Household Income and Car Ownership, 2030 Scenario-II

No.	Town/ Tehsil in the Study Area	No. of Households			Car Owning HH (%)	Ave. HH Income (PKR/month)		
		Car Owning	Non-Car Owning	Total		Car Owning	Non-Car Owning	Average
1	Ravi	46,738	112,847	159,585	29.3	61,031	32,154	40,612
2	Data Gunj Baksh	82,173	89,132	171,305	48.0	62,385	31,861	46,503
3	Samanabad	100,047	72,784	172,831	57.9	64,154	37,276	52,835
4	Shalamar	49,046	71,722	120,768	40.6	60,780	32,172	43,790
5	Gulberg	92,078	90,996	182,807	50.4	73,630	31,466	52,750
6	AzizB	57,109	68,852	125,960	45.3	56,347	29,066	41,435
7	Wagah	49,364	78,275	127,639	38.7	52,095	25,881	36,019
8	Nishter	186,423	334,635	521,058	35.8	61,417	26,254	38,835
9	Iqbal	244,641	219,926	464,242	52.7	93,053	34,337	65,303
10	Cantt	126,773	113,960	240,733	52.7	85,726	31,322	68,420
11	Ferozewala	161,493	243,821	405,314	39.8	72,241	29,742	46,675
12	Muridke	15,146	31,467	46,301	32.7	60,043	20,672	33,691
13	Sharaqpur	15,989	15,596	31,585	50.6	78,784	33,881	56,612
14	Kasur	11,217	20,614	31,831	35.2	86,348	24,271	54,466
15	Patoki	11,731	25,856	37,588	31.2	73,843	29,657	43,447
1-10	**Lahore**	1,034,394	1,253,128	2,286,929	45.2	72,614	30,553	50,481
11-13	**Sheikhupura**	192,629	290,883	483,200	39.9	71,825	28,982	46,080
14-15	**Kasur**	22,948	46,470	9,418	33.1	79,955	27,267	48,499
1-15	**The Study Area**	**1,249,971**	**1,590,481**	**2,839,548**	**44.0**	**72,607**	**30,144**	**49,684**

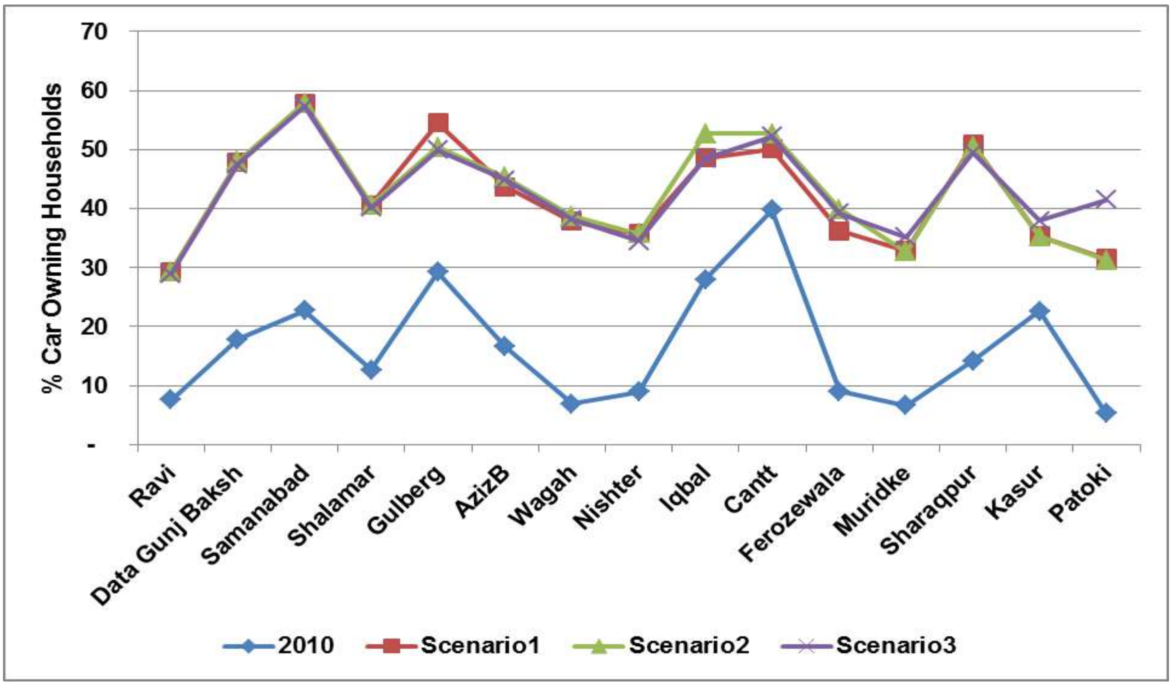
Source: JICA Study Team

Table 3.2.30 Household Income and Car Ownership, 2030 Scenario-III

No.	Town/ Tehsil in the Study Area	No. of Households			Car Owning HH (%)	Ave. HH Income (PKR/month)		
		Car Owning	Non-Car Owning	Total		Car Owning	Non-Car Owning	Average
1	Ravi	46,655	114,419	161,074	29.0	60,211	31,674	39,940
2	Data Gunj Baksh	82,123	90,780	172,903	47.5	61,686	31,434	45,803
3	Samanabad	99,909	74,534	174,443	57.3	63,300	36,760	51,960
4	Shalamar	48,979	72,915	121,894	40.2	59,994	31,688	43,062
5	Gulberg	92,138	92,641	184,512	49.9	72,782	31,158	51,988
6	AzizB	57,016	70,119	127,135	44.8	55,652	28,691	40,783
7	Wagah	49,192	79,637	128,829	38.2	51,576	25,567	35,498
8	Nishter	110,523	209,527	320,050	34.5	59,672	24,997	36,971
9	Iqbal	151,699	161,414	312,788	48.5	85,571	33,165	58,616
10	Cantt	126,786	116,193	242,979	52.2	84,907	31,018	67,573
11	Ferozewala	160,200	248,895	409,095	39.2	70,970	29,236	45,579
12	Muridke	52,871	97,963	150,522	35.1	70,229	23,909	40,228
13	Sharaqpur	15,749	16,131	31,880	49.4	76,583	33,049	54,556
14	Kasur	59,402	97,100	156,503	38.0	82,068	27,704	64,326
15	Patoki	65,808	92,956	158,764	41.5	100,666	36,802	63,274
1-10	**Lahore**	865,022	1,082,178	1,946,608	44.4	69,323	30,179	48,644
11-13	**Sheikhupura**	228,820	362,989	591,497	38.7	71,185	27,968	44,701
14-15	**Kasur**	125,210	190,056	315,267	39.7	91,843	32,154	63,796
1-15	**The Study Area**	**1,219,052**	**1,635,223**	**2,853,371**	**42.7**	**71,975**	**29,894**	**49,508**

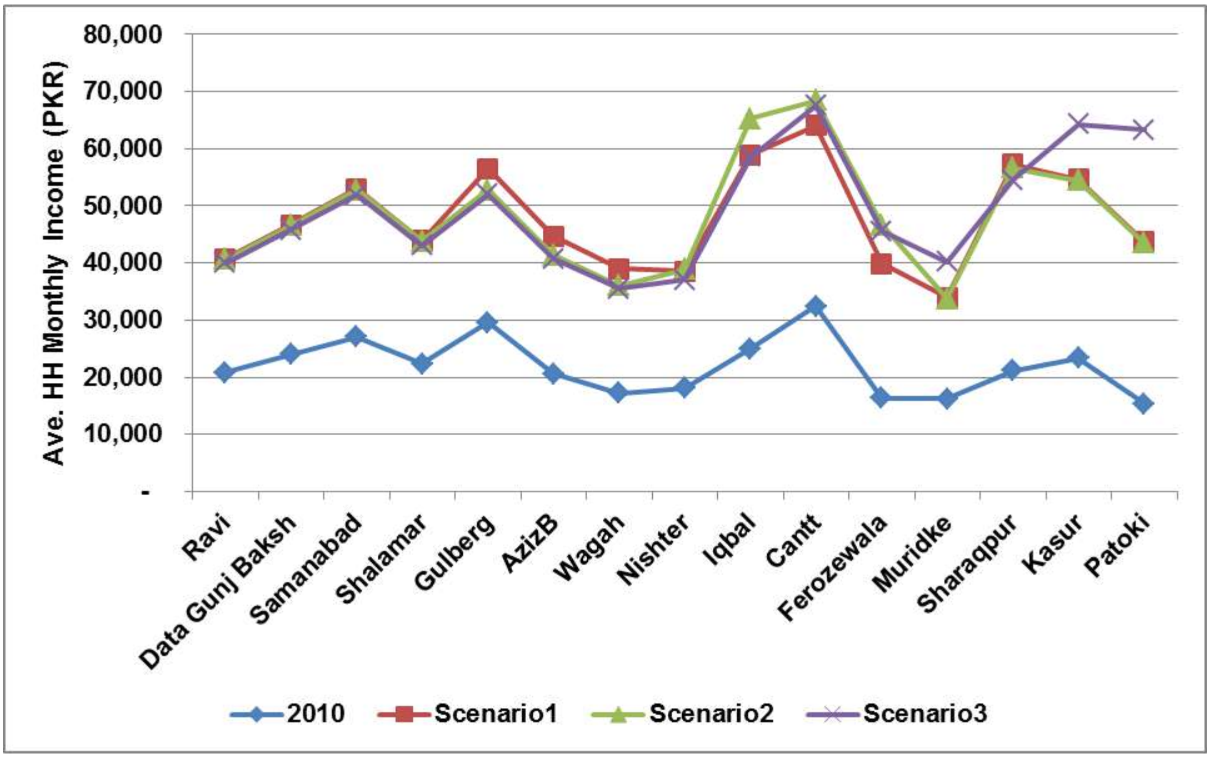
Source: JICA Study Team

Figure 3.2.14 2030 Percent of Car Owning Households for Three Scenarios



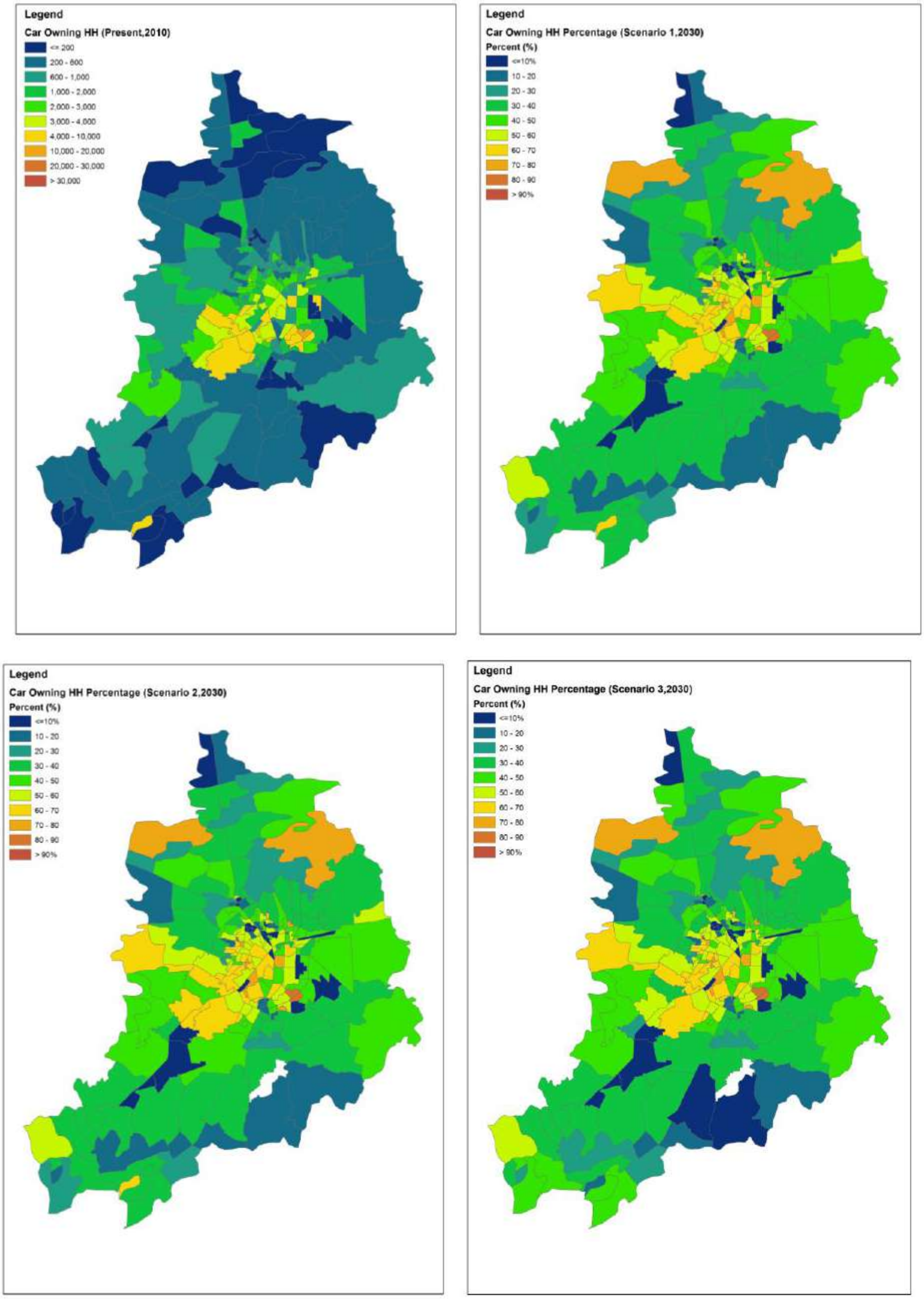
Source: JICA Study Team

Figure 3.2.15 2030 Average Household Monthly Income for Three Scenarios



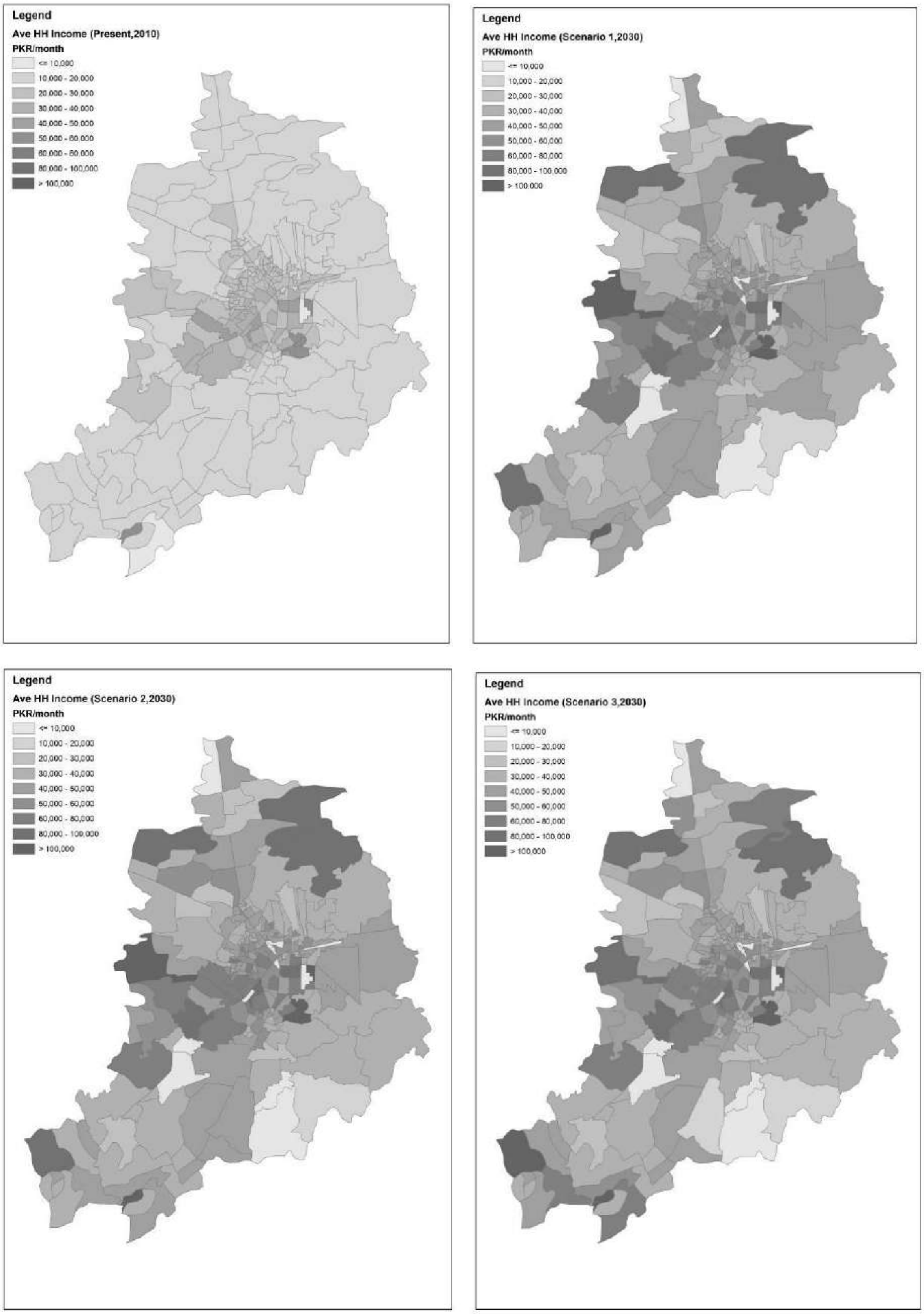
Source: JICA Study Team

Figure 3.2.16 Percent of Car Owning Households, 2010 and 2030 by Scenario



Source: JICA Study Team

Figure 3.2.17 Average Household Monthly Income, 2010 and 2030 by Scenario



Source: JICA Study Team

Volume-I – Chapter-4

TRANSPORT DEMAND CONTEXT

FINAL REPORT

4. TRANSPORT DEMAND CONTEXT

4.1 Future Transport Demand

Travel demand analysis and forecast procedure have been described in detail in Volume II, Chapter 2. This Chapter focuses on the analysis of the demand forecasts prepared for the 2020 and 2030 for the three alternative Study Area urban development scenarios. The scenario details and the socio-economic forecasts are described above in Chapter 3 of this volume.

Travel demand estimates were made for all three development scenarios. It is estimated that overall total number of trips between the three scenarios are similar. The main reason for the Study Area-wide total travel demand to be similar under all three scenarios is that the 2020 and 2030 forecast total population and economic growth is the same for the Study Area. The differences are only regional, and apply to the distribution of population within the Study Area. This result of this varied population distribution under each scenario lead to different levels of growth in trips. Table 4.1.1 below compares the overall travel demand in terms of total trip production by Town/ Tehsil and are illustrated in Figure 4.1.1.

Table 4.1.1 The Study Area Forecast Trip Production Totals ('000)

No.	Town / Tehsil Name	Trip Productions ('000)						
		Obs-2010	2020-S1	2020-S2	2020-S3	2030-S1	2030-S2	2030-S3
1	Ravi	751	974	995	1,002	1,173	1,216	884
2	Data Gunj Baksh	1,103	1,408	1,438	1,451	1,732	1,788	1,191
3	Samanabad	850	1,072	1,078	1,089	1,304	1,310	1,232
4	Shalamar	695	704	716	724	810	834	760
5	Gulberg	1,142	1,147	1,204	1,219	1,453	1,588	1,298
6	Aziz Bhatti	555	663	564	570	974	709	736
7	Wagah	405	666	562	567	1,012	773	816
8	Nishtar	482	1,369	1,340	1,026	2,428	2,366	1,992
9	Iqbal	810	1,554	1,503	1,277	2,690	2,657	1,886
10	Cantonment	725	1,083	1,006	998	1,536	1,379	1,410
11	Ferozewala	265	595	834	847	998	1,602	2,057
12	Muridke	155	236	230	386	329	315	961
13	Sharaqpur Sharif	57	108	110	112	137	142	145
14	Kasur	81	129	131	300	163	168	769
15	Pattoki	108	146	149	331	195	202	811
1-10	Lahore	7,518	10,640	10,406	9,923	15,112	14,620	12,205
11-13	Sheikhupura	477	939	1,174	1,345	1,464	2,059	3,163
14-15	Kasur	189	275	280	631	358	370	1,580
1-15	***LUTMP***	***8,184***	***11,854***	***11,860***	***11,899***	***16,934***	***17,049***	***16,948***

Source: JICA Study Team

It can be seen that by 2020 the growth in travel demand will increase by about 46 % - 50 % under all three scenarios, and would more than double by 2030 irrespective of the development scenarios. This more than doubling of trips in 20 years is based on over 60 % growth in the Study Area population (from around 10 million to 16.4 million inhabitants in the Study Area) and a sustained growth of over 5 % in Gross Domestic Product (GDP). The GDP growth increases household incomes and hence propensity to buy more motorcycles and cars – which further leads to higher growth of trips.

The travel growth in mature towns of Lahore like: Ravi, Data Gunj Baksh, and Shalamar is limited, mainly due to high population densities, no land parcels left to develop, and the housing stock is unlikely to be replaced by multi-storey buildings due to lack of technology and general people’s resistance to live in high rise block type accommodations. In addition to that vehicle ownership in these towns is also limited due to lack of personal parking, lack of access for cars among narrow streets and intensely mix land use – where by people do not have to travel far for several day to day activities.

Growth in the mainly leafy towns of Samanabad, Gulberg, Aziz Bhatti, and Cantonment would be limited by land prices (as these are high income residential areas) and are likely to stay on the limited growth path. The majority of the growth in Lahore District is therefore expected to be in Nishtar, Iqbal and Wahgah Towns, where it would more than double the existing demand levels. Under development Scenario 3, under which three new satellite towns would be developed outside the Lahore District the demand in these new development areas would be more than triple the existing level.

Travel growth outside Lahore District is mainly concentrated along radial corridors outside Lahore. Ferozewala Tehsil would grow at a faster rate than the other two Tehsils of Muridke and Sharaqpur Sharif. Same is the case with the two adjoining areas of Tehsil Kasur and Pattoki in the south. Only if, Scenario 3 is taken up then the travel demand would be much high to/ from Pattoki and Kasur areas. Total trip productions as tabulated above are also depicted in Figure 4.1.1 following this page. The growth in trips by 2020 and 2030 over 2010 is presented in Table 4.1.2, and shows that travel demand is highest under scenario 3, and lowest under Scenario 2 in Lahore district – representing the majority of the demand, for both 2020 and 2030.

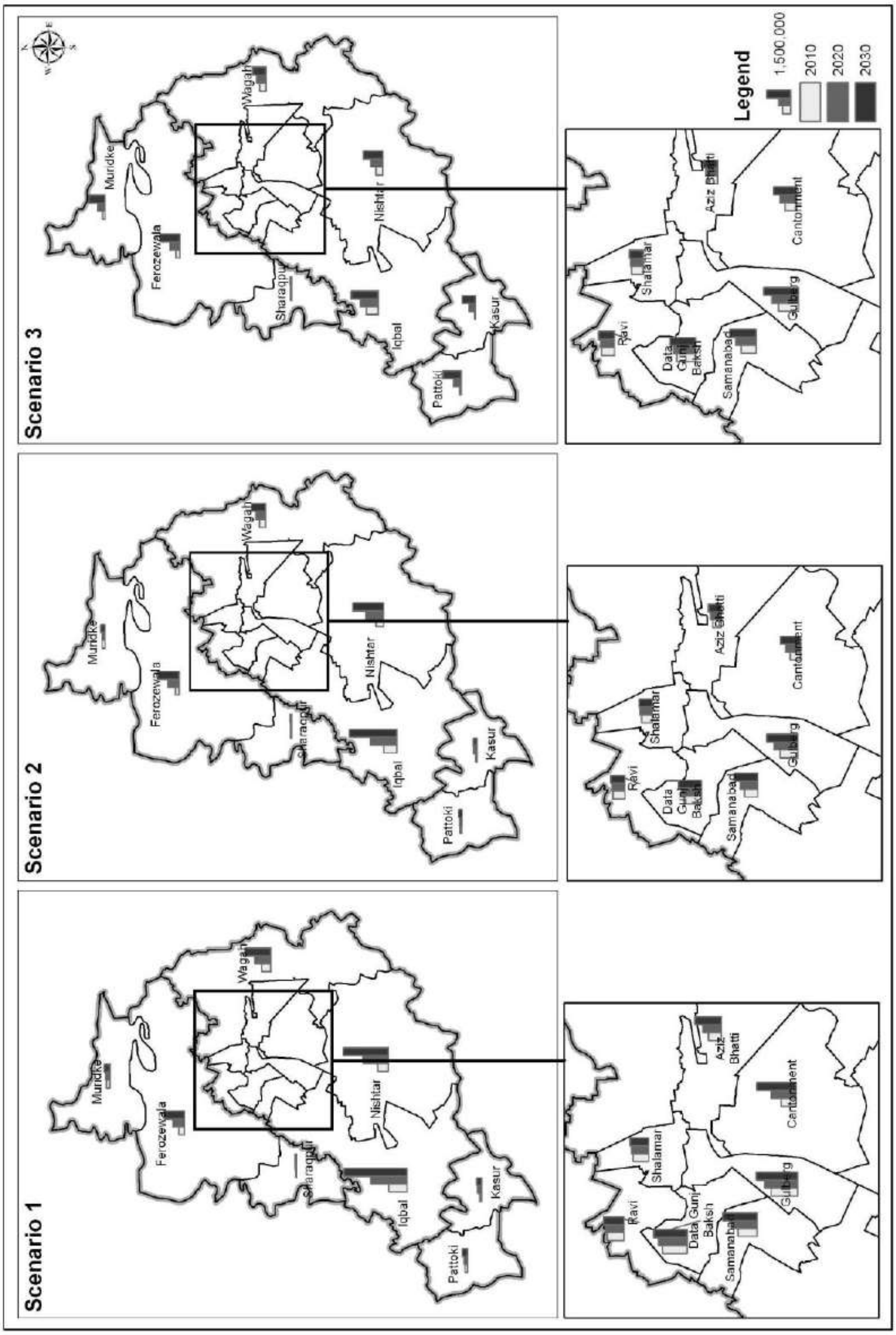
Further differences in regional growth are shown in Figure 4.1.1 on the following page for the 15 towns of Lahore and Tehsil areas of Sheikhupura and Kasur included in the Study Area.

Table 4.1.2 The Study Area Forecast Growth in Trips from 2010

No.	Town / Tehsil Name	Trip Productions ('000)						
		Obs-2010	*2020-S1*	*2020-S2*	*2020-S3*	*2030-S1*	*2030-S2*	*2030-S3*
1	Ravi	751	974	995	1,002	1,173	1,216	884
2	Data Gunj Baksh	1,103	1,408	1,438	1,451	1,732	1,788	1,191
3	Samanabad	850	1,072	1,078	1,089	1,304	1,310	1,232
4	Shalamar	695	704	716	724	810	834	760
5	Gulberg	1,142	1,147	1,204	1,219	1,453	1,588	1,298
6	Aziz Bhatti	555	663	564	570	974	709	736
7	Wagah	405	666	562	567	1,012	773	816
8	Nishtar	482	1,369	1,340	1,026	2,428	2,366	1,992
9	Iqbal	810	1,554	1,503	1,277	2,690	2,657	1,886
10	Cantonment	725	1,083	1,006	998	1,536	1,379	1,410
11	Ferozewala	265	595	834	847	998	1,602	2,057
12	Muridke	155	236	230	386	329	315	961
13	Sharaqpur Sharif	57	108	110	112	137	142	145
14	Kasur	81	129	131	300	163	168	769
15	Pattoki	108	146	149	331	195	202	811
1-10	Lahore	7,518	10,640	10,406	9,923	15,112	14,620	12,205
11-13	Sheikhupura	477	939	1,174	1,345	1,464	2,059	3,163
14-15	Kasur	189	275	280	631	358	370	1,580
1-15	***LUTMP***	***8,184***	***11,854***	***11,860***	***11,899***	***16,934***	***17,049***	***16,948***

Source: JICA Study Team

Figure 4.1.1 Forecast Trip Productions ('000) by Town/Tehsil and by Three Scenarios



Source: JICA Study Team

4.2 Assessment of Supply Demand Gaps

LUTMP 4-stage travel demand model was run for the two (2020 and 2030) forecast years and the three development scenarios. Table 4.2.1 presents the prevailing (2010) road capacity and assigned daily traffic volumes for 2010, 2020 and 2030 for all three scenarios. It can be seen that in 2010 there is limited capacity available in the network across major canal crossing, rail crossings, Ravi crossings and also in and out of the Study Area cordon. Only at Ravi the Volume / Capacity (V/C) Ratio exceeds 0.7 in 2010. This shows that overall during the day the network is operating at fairly good level of service, however during peak periods there would be higher congestion towards the city areas.

A significant reason for lower congestion across these roads is that over the last decade there has been a number of urban road improvement project e.g. Lahore Ring Road, widening of Ferozepur Road, Canal Bank Road under passes, new crossings over canal (Mall Rd 2nd Bridge), Muslim Town bridge etc.

Table 4.2.1 LUTMP Screenline and Cordon Capacity and Traffic Volume

Screenline Description	Total Daily Two Way Total (Private + Public + Goods Vehicle) PCUs ('000)							
	2010 Daily Capacity	2010, Daily Volume	2020, Daily Two Way Volumes			2030, Daily Two Way Volumes		
			Scenario-I	Scenario-II	Scenario-III	Scenario-I	Scenario-II	Scenario-III
Canal East of Mall Road	**1,193**	298	461	440	434	676	609	592
Canal West of Mall Road	**1,811**	553	879	902	886	1,337	1,369	1,319
Railway Crossings East-West	**1,186**	757	961	1,023	1,075	1,195	1,484	1,634
Railway Crossings North-South	**983**	321	540	539	534	864	844	823
Ravi River Crossings	**461**	327	461	521	577	740	899	1,033
Study Area Cordon	**1,036**	335	482	526	577	750	790	839

Screenline Description	Total Daily Two Way Volume Capacity (V/C) Ratio							
	2010 Daily Capacity	2010 V/C Ratio	2020, Daily Two Way V/C Ratio			2030, Daily Two Way V/C Ratio		
			Scenario-I	Scenario-II	Scenario-III	Scenario-I	Scenario-II	Scenario-III
Canal East of Mall Road	**1,193**	0.25	0.39	0.37	0.36	0.57	0.51	0.50
Canal West of Mall Road	**1,811**	0.31	0.49	0.50	0.49	**0.74**	**0.76**	**0.73**
Railway Crossings East-West	**1,186**	0.64	**0.81**	**0.86**	**0.91**	**1.01**	**1.25**	**1.38**
Railway Crossings North-South	**983**	0.33	0.55	0.55	0.54	**0.88**	**0.86**	**0.84**
Ravi River Crossings	**461**	**0.71**	**1.00**	**1.13**	**1.25**	**1.61**	**1.95**	**2.24**
Study Area Cordon	**1,036**	0.32	0.47	0.51	0.56	**0.72**	**0.76**	**0.81**

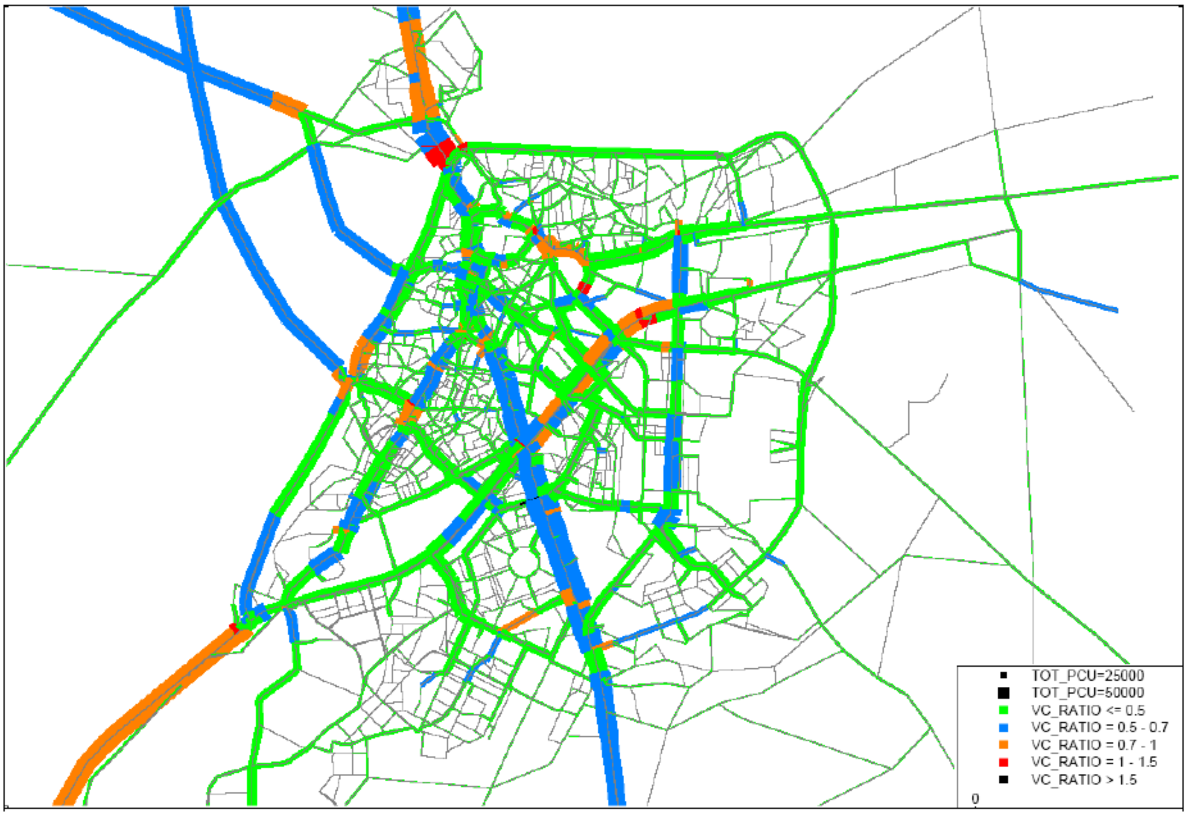
Source: JICA Study Team

By 2020 all Ravi crossings would have reached capacity for most of the day. East-west traffic across railways would be congested. Traffic across canal would be operating at about 50 % of its capacity. These roads are mostly encroachment free; therefore the level congestion on these roads is not so severe. However, the congestion on the inner city roads poses a very different picture, to be discussed later.

By 2030, irrespective of the scenarios, traffic volume on almost all screenlines would reach near capacity level, as can be seen from Table 4.2.1 above. This level of congestion is the outcome of more than doubling of total travel demand in the Study Area. In some cases the demand would even reach three times that of 2010 traffic volumes.

Figure 4.2.1 below illustrates the 2010 assigned traffic volumes. Congestion is clear by the colour Orange (V/C Ratio 0.7~1.0) indicating that the network is under stress, and in peak periods could reach capacity. Ravi Bridge is already at Capacity – colour Red (Volume / Capacity Ratio 1.0~1.5), indicating immediate action is required to address the poor traffic condition and low journey speeds to cross Ravi in the north. The blue section indicates that the network is operating at V/C ratio 0.5 to 0.7 indicates that during average hour the journey speed would be acceptable in urban areas. The Green sections show V/C Ratio below 0.5. But it does not imply that there is no congestion. These are mostly local access roads, and inner city streets. In this case the local intra-zonal traffic would take up considerable capacity, as these (intra-zonal) trips are not assigned to the network. Colour Green on Lahore Ring Road (LRR) northern and eastern sections indicates poor utilisation i.e. below 50 % of its capacity, indicates it poor accessibility and function as a *'Ring Road'* to take through traffic out of the local city roads.

Figure 4.2.1 2010 Traffic Assignment Traffic Volumes (PCU) and V/C Ratio



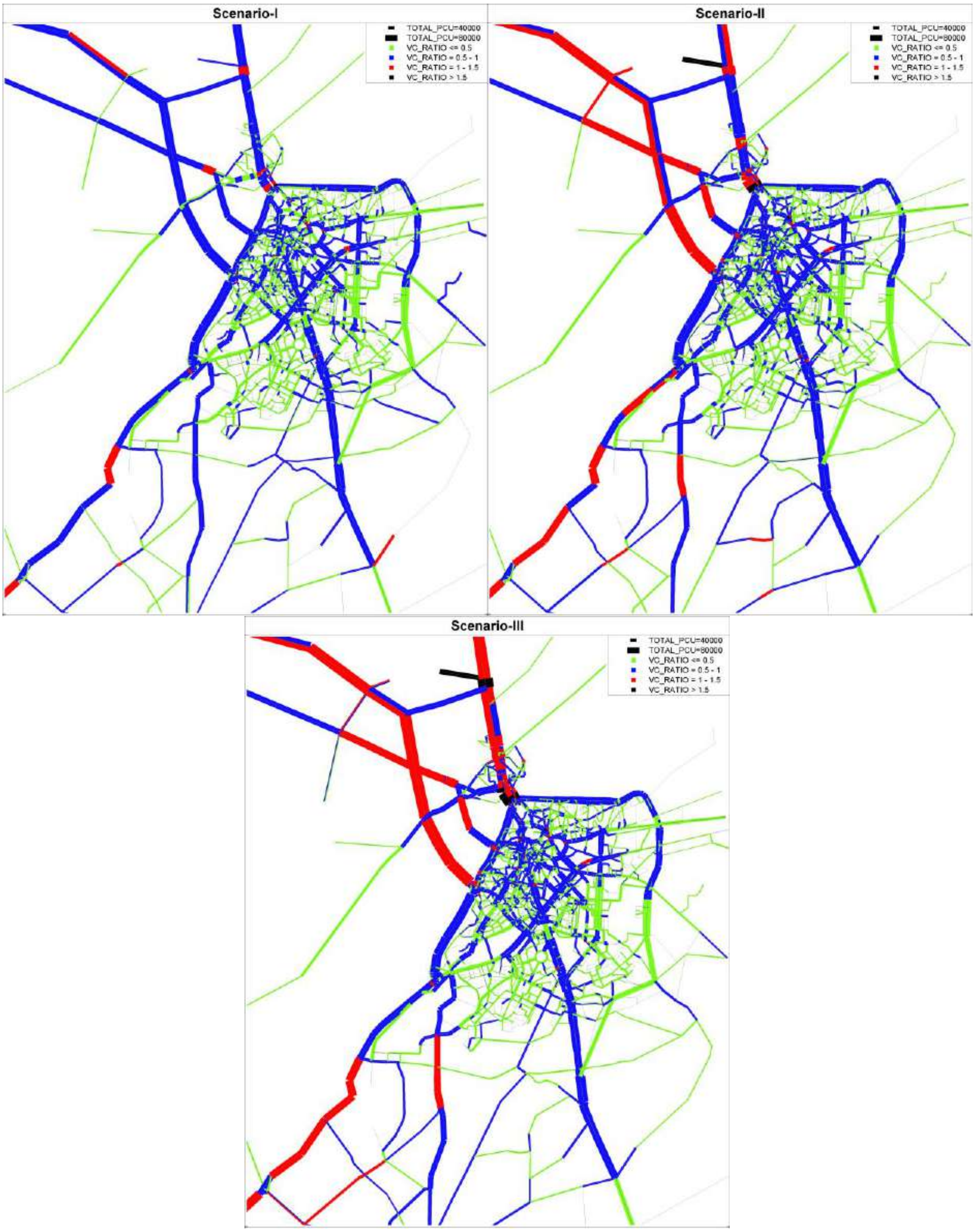
Source: JICA Study Team

Figure 4.2.2 compares the assigned traffic volumes in 2020 under three different development Scenarios. It can be seen that under these scenarios all major arterial and radial roads in/ out of the city would be at capacity. LRR still would be reasonably congestion free, indicating its poor utilisation. All three bridges would be well over capacity, except in case of Scenario 2, (compact development), as in this case motorway would still have some capacity. Scenario 3 would overload Multan Road and Raiwind Road in the south and all bridges and G.T. Road in the north; indicates much higher travel demand to/ from the three satellite towns and Lahore city.

Similarly Figure 4.2.3 compares the assigned traffic volumes in 2030 under the three different development Scenarios. It illustrates that under all scenarios all major arterial and radial roads in/ out of the city, and local distributors would be at V/C Ratio of 1.0 or even 50 % over capacity (some reaching more than twice the capacity – Ravi bridges, Ferozepur road, sections of Multan and Raiwind roads would be at more than 150 % of the capacity.

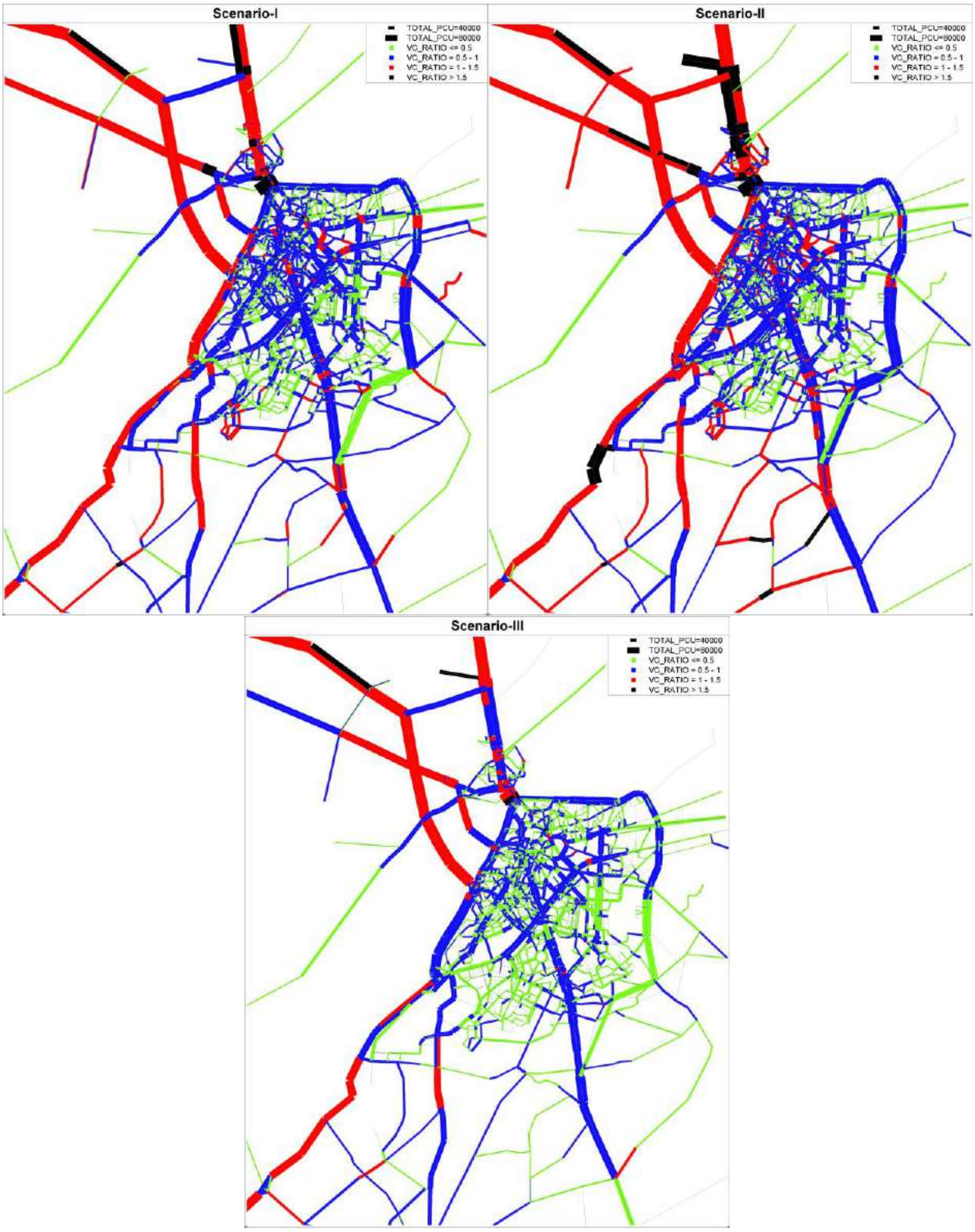
LRR still would not even be close to capacity as most of its sections would be at V/C ratio around 0.7. All three Ravi bridges would be well over capacity. Scenario 3 would overload Multan Road and Raiwind Road in the south and all bridges and G.T. Road in the north to demand levels much higher than the other two scenarios and would be well beyond their capacities by 2030.

Figure 4.2.2 2020 Traffic Assignment Traffic Volumes (PCU) and V/C Ratio



Source: JICA Study Team

Figure 4.2.3 2030 Traffic Assignment Traffic Volumes (PCU) and V/C Ratio



Source: JICA Study Team

Volume-I – Chapter-5

TRANSPORT DEVELOPMENT STRATEGY

FINAL REPORT

5 TRANSPORT DEVELOPMENT STRATEGY

5.1 Overall Transport Policy

5.1.1 Background

1) Vision 2030

Pakistan's strategic priorities are summarized in "Vision 2030" prepared by Planning Commission, Government of Pakistan in August 2007. The Vision 2030 statement approved by NEC envisages a "developed, industrialized, just and prosperous Pakistan through rapid and sustainable development in a resource constrained economy by deploying knowledge inputs".

In the "Vision 2030" there are some important comments and targets, directly or indirectly related to Lahore, for example:

- "With the present infrastructure, it will not be possible to expect our enterprises to become part *of,* and players *in* the international supply chain, or to facilitate new investments in industry, agriculture and services." (p.67)
- "Reducing delays in our transport system is critical instrument for the cost of doing business, and hence increasing our competitiveness." (p.67)
- **"**Lahore, a sprawling metropolis of 8.5 million, has fewer than 150 traffic lights, which are measures of insufficient traffic management. The result is severe traffic congestion." (p.96)
- **"**Lahore returns to being a city of intellectual activity and entertainment. Half a dozen foreign universities will have made it their first overseas campus; together with its older well known Pakistani universities. They will offer a variety of studies to people from across the world. The Mall will have a large number of theatres and restaurants, with the walled city and historical monuments becoming a heaven for tourists and students. Its industrial estates, technology parks, and shopping centres will rival the best in the region. It's cultural and art festivals will attract a large numbers of domestic and international tourists. " (p.99)

The realization of the Vision 2030 is complex, expensive, needs firm planning policy, and development strategies. Over the last decade various Governments of the Punjab have attempted to meet this challenge and started a number of projects. A number of these projects have been completed, some are on-going and numerous are still in the planning phase.

2) Current Status

The Study analysis presented in this report clearly shows that Lahore transport system is ‘living on borrowed time’, using but not maintaining – its road network, while adding little to its infrastructure inherited from our fore-fathers and the colonial masters. A clear example is the wide ‘Right of Way’ (RoW) left along almost all arterial roads and even right through the city centre for us to constantly abuse and waste away by setting up hawker stalls, storage areas for adjacent shops, out-right encroachment by buildings (including encroachment by Government buildings, police stations and mosques alike.). The continuation of this practice in a fast growing mega city, without any policy and transport development strategies, land use control, lack of project planning and implementation and enforcement of rules and regulations is unsustainable. With a relatively robust population and economic growth, the number of private cars has been increasing significantly, placing a severe burden on the roads. With a weak traffic management the congestion is becoming serious day by day.

Currently GoPb has no ‘*officially approved*’ urban transport policy to follow. In 2007 Urban Unit P&D prepared a Draft Urban Transport Policy. This document was prepared in the light of Government of Pakistan Vision 2030. It had been circulated to various departments and agencies, but still awaits final approval.

The draft policy document has no official standing. Given the current state of the urban transport in Lahore (the Punjab Capital) and other major cities of the Punjab, the document is rather ambitious, and perpetrates to achieve the unachievable, given the past record of achievements by the provincial and city authorities, and the development budget constraints of the GoPb. The draft policy document lacks clarity, and is remote from day-to-day reality as it has totally failed to address the financial aspects and social constraint to achieve the stated policy goals. However, the documents objectives are *‘noble’*, and some of these could be achieved through serious and committed GoPb unwavering *‘will’* and strong interventions for funding and implementation.

The Study’s transport development strategies try to adopt some (all or in part) of the policy objectives, where possible and feasible within the GoPb budget envelope.

5.1.2 Urban Transport Policy for Lahore

1) Objective of the Policy

The key objectives of the Lahore urban transport policy are:

- To facilitate the development and promulgation of a comprehensive legal and regulatory framework for an integrated institutional arrangement which ensures close coordination and enhances sustainability of the urban transport system.

- To provide a framework for development of a sustainable and secure financing of the urban transport system through diversified revenue sources and public private partnership.
- To facilitate the development of urban transport infrastructure and public transport facilities by responsible institutions and agencies.
- To improve and modernize the system of asset management.
- To enhance the safety, affordability and equity of the urban transport system.
- To restructure the utilization of urban road space through Integrated land-use, transport planning and traffic management.
- To progressively enhance the use of Information and Communication Technology (ICT) aiming at reduced traffic pollution and improved air quality in urban areas.
- Capacity enhancement of relevant institutions to effectively plan, implement, operate, control and manage urban transport system
- Development of responsible and mature attitude of road users, through a well designed education and campaign program.

2) General Policy Principles

Transport infrastructure is the foundation of urban development, as development takes place along, and is greatly affected by, transport facilities such as roads, urban railway, and terminals. Roads also provide important space for urban utilities, such as water supply, drainage, electricity, and telecommunications, as well as venue for the people's varied activities, opportunities for disaster prevention, and improved landscape. Efficient transport system is critical in linking Lahore to international gateways for trade and tourism, and at the same time to integrate it with other provinces in Pakistan thereby creating synergy from the growth and development being experienced in both areas. Key policy principles to remember in urban transport development are as follows:

(a) **Establish effective intermodal transport system and logistics services that are competitive in international/regional trade and passenger travel:** Since the growth and development of Lahore are becoming increasingly connected with the regional and the international communities and markets, transport infrastructure and services such as roads and railways must be continuously upgraded to ensure seamless and effective movement of people and goods.

(b) **Develop efficient and high-quality public transport system:** The future urban passenger travel of Lahore must be based on a public transport network. It must be attractive and competitive enough to encourage the people to shift from private transport use. The public transport system must have a good combination and network of urban railway, bus rapid transit (BRT), ordinary buses of different sizes offering various services, taxis, etc. Urban development must likewise be integrated with public transport development to enhance accessibility, safety, and environment.

(c) **Establish effective management system:** Effective management of traffic and transport infrastructure, including proper maintenance, traffic control, parking management, safety improvement, pollution control, pedestrian safety, among others, is critical in optimizing available, expensive infrastructure. While it is expected that traffic congestion would worsen mainly due to increases in the ownership and use of private cars, more drastic measures to manage transport demand may also have to be introduced such as higher vehicle registration fees, stricter parking management, etc. Increasing the capacity to provide funds as well as to address resettlement issues must also be seriously attended to.

3) Suggested Policies

(1) Enhancement of Institutional Capacity for Integration of Urban Transport System

An integrated urban transport system requires a unified, consolidated and an independent transport institution for the entire city, with sound mechanisms for integration and coordination with other federal, provincial and local government departments, agencies and authorities. The GoPb shall establish an effective legal and regulatory framework for the establishment and management of a unified, consolidated and independent transport institution.

Urban transport institutions in Punjab lacks in both institutional and human resource capacity. Significant efforts are required at institutional and personal level for the development of sustainable transport system. The Government shall develop capacity in the transport sector institutions by strengthening their professional and organizational capacity. In-house skill development shall be enhanced by providing scholarships for higher studies, continuous in service training programs and career development.

(2) Development of Urban Railway System

The potential roles of railway in Lahore manifest in two ways. One, it forms the backbone of the public transport system by providing efficient and high-quality services. Two, it promotes a more effective urban growth and land use through the integrated development of transport and urban development. Rail transport development is a critical determinant of the future urban growth and the realization of a public transport-based city. Key principles to be considered are as follows:

(a) **Define clearly the role and capability of Pakistan Railway:** PR has the potential to contribute to inter-city and suburban/urban transport services. However, these two services are often contradictory in large urban areas due mainly to the differences in the nature of their services and required operation, although the opportunity to use PR for suburban/urban services is large if it is improved in the nationwide scale.

(b) **Develop rapid mass transit system (RMTS):** A network of RMTS comprising urban railway lines and BRTs must be developed to provide the city with a core public transport system offering high-quality services and integrating all major urban areas and activity centers.

(c) **Establish sustainable mechanism to develop RMTS network:** RMTS requires a large amount of investment and a lengthy period of time before it is realized. It must be developed as a network with good coverage and in integration with efficient feeder services. Strategies for an integrated development, strategic funding, and phased development must be made clear to sustain the development of the envisioned network.

(3) Strengthening of Bus Transport System

Bus is and will be the most important mode of public transportation system in Lahore. Although urban rail is expected to play a major role in the future, the coverage will be limited and many corridors and areas will remain unserved because it requires lengthy time and huge costs for construction of such system. Bus also provides important feeder services for urban rail. Key planning principles should be as follows:

(a) **Develop integrated and attractive bus system:** Bus services must be developed as an integrated network to provide convenient services between origins and destinations, comprising various types of modes and services including BRT, express buses, air-conditioned buses, minibuses, wagons, etc. The services must also be attractive and competitive to encourage a shift from private transport.

(b) **Establish a sustainable bus operation and management system:** The current dominance of buses and wagons in Lahore may not guarantee further successes in the future when diversified services are required, more bus units need to be managed and wider areas have to be covered. Besides, people demand improved services at affordable prices. Hence sustainable bus operation and management systems must be established.

(c) **Provide adequate environment for private sector to invest in public transport services:** An effective way to improve bus services is providing fair competition among operators. Since Lahore needs expanded and diversified bus services, providing opportunities for new investors to offer such services in a competitive manner must be considered.

(4) Improvement of Roads

Roads are the most important and fundamental infrastructure. They provide space for traffic and various activities in urban areas, determine the growth directions and patterns of urban areas, and contribute to the improvement of landscape and disaster prevention. Roads are also important to link Lahore with other regional and international markets and communities. To achieve this, arterial roads must be upgraded, particularly for the bottlenecks across the Ravi River. Key principles to be considered are as follows:

(a) **Segregate interprovincial and urban traffic:** Interprovincial traffic must be segregated from urban traffic to prevent heavy traffic from passing through the city. Adequate interface between these two types of traffic must be provided at the peripheries of urban areas around the Lahore Ring Road which will be access-controlled with interchanges/flyovers at major intersections.

(b) **Establish clear ring and radial road systems:** Urban roads must be developed in a hierarchical manner, i.e. primary, secondary, and tertiary, wherein the primary and secondary road networks must be in good condition. The primary road system, comprising ring roads and radial roads, must be completed. The secondary road network should likewise be developed to distribute traffic to all urban areas efficiently.

(c) **Establish more effective mechanism for at-grade road development:** Tertiary and lower-level roads must likewise be developed based on traffic management plans and together with urban development control measures. Developers must provide roads or road space as specified in the plan. The integrated approach is also important to effectively secure lands for infrastructure and resettlement.

(5) Traffic Management and Safety

Effective traffic management is important not only to ensure smooth circulation and safe vehicular traffic but also to improve the amenity and safety of pedestrians, roadside residents and activities. The restricted use of road space also enhances the landscape and the city’s image. As car ownership is expected to increase sharply in the future while road development is expected to be limited, managing the demand for private transport will become a more serious concern. Key principles to consider are as follows:

(a) **Enhance people’s awareness of the need for traffic discipline and the efficient use of road space:** Many traffic accidents in Lahore are caused by human error, principally due to lack of discipline or disregard for basic traffic rules. Social awareness of road traffic safety issues must be enhanced by all means.

(b) **Establish an effective traffic management system:** Good traffic management is most fundamental in ensuring efficient flows of traffic, effective use of available facilities, as well as orderly, safe, and comfortable activities on the road space. This is particularly important in the central area of Lahore where traffic situation is serious already and is worsening rapidly.

(6) Rationalization of Freight Transport

Freight transport planning and development supported by land use control, modal integration and amalgamated with transport network is essential to improve living environment, to promote domestic labour market, to reduce local traffic congestion and to improve infrastructure life. Unregulated axle weights, unplanned truck station locations due to poor land use control and shop loading in the city centres bring about congestion and deterioration of road infrastructure and environment. This could be optimized through restraining freight movement in short term basis while can be addressed though zoning and land use control on long term basis.

(7) Non-motorized Transport

Non Motorized Transport modes (NMT) i.e. walk and bicycle has predominant share in our daily trips therefore NMT network planning must be integrated with detailed road section planning and intersection planning. Government shall develop regulatory framework for rights and responsibilities of pedestrians and cyclist in traffic enforcement laws and regulations. Government shall also develop planning guidelines and standards for provision of cyclist and pedestrian facilities in road infrastructure design.

(8) Diversification of Fund Sources

The main funding source for Lahore is derived mainly from balancing allocations of the Federal Government. Local revenue, household investments, and external sources such as Foreign Direct Investments (FDIs) and Official Development Assistance (ODA) is not salient. The revenue base should be expanded and diversified. Some of the possible initiatives are 1) Applying User Charges and Service Fees, 2) Expansion of Local Revenue Base, 3) Access to Capital Markets and Other Credit Finance, and 4) Application of Public-Private Partnership (PPP).

5.2 Selection of Urban Development Scenario

5.2.1 Scenario Assessment

In Chapter 3 of this report, three urban development scenarios were presented. These scenarios were assessed as follows:

<u>Urban development point of view</u>

Scenario 2 and 3 are both excellent for a city with a population over 10 million in terms of mobility, living environment and conservation of greeneries and agricultural land. From the standpoint of reality, Scenario 1 *(Zero Option - Trend)* is the easiest way. However, Scenario 2 and 3 are also realistic only if strong *'political will'* and leadership are guaranteed in planning and funding. Scenario 3, however, may be slightly weak in flexibility because the timing of project implementation must be consistent with population increase and high-speed transport system will be required in the long run to support the intended structure of the metropolis.

In contrast, Scenario 2 has a favourable flexibility to shift from Scenario 1 to Scenario 2 depending on the timing of public transport development.

<u>Transport development point of view</u>

It is imperative for Lahore to have a robust public transport system to serve citizen that cannot afford private cars. Moreover, under the foreseen rapid motorization, roads will be more and more seriously congested, and modal shift from private to public transport should be strategically promoted.

For this strategy, Scenario 2 is the most desirable since this scenario has been prepared and designed assuming a network of urban rail systems. Actually, patronage of the proposed RMTS lines (Green, Orange, Blue and Purple) is the highest for Scenario 2 as outlined below:

2030 Scenario 1: 1,890 thousand passengers per day

2030 Scenario 2: 2,117 thousand passengers per day

2030 Scenario 3: 1,469 thousand passengers per day

<u>Environmental/ social point of view</u>

Table 5.2.1 summarizes environmental/ social aspects of the three urban development scenarios. Generally, Scenario 3 is the most favourable. However, the difference between Scenario 3 and 2 is very small.

Table 5.2.1 Environmental/ Social Aspects of Urban Development Scenarios

Anticipated Impact	Scenario 1	Scenario 2	Scenario 3
Impacts on Social Environment	Difficult to provide favorable living environment for many people due to continued over-saturation of the built-up area in the north and insufficient mobility in the expanded residential area.	Gradual enhancement of living environment can be expected in the built-up area in the north and high mobility due to public transport development in expanded urban area can be expected.	Gradual enhancement of living environment can be expected in the built-up area in the north and urban expansion in the area of poor mobility will be restricted. Living environment in Lahore will be much improved as a whole and that of suburban cities could be favorable, depending on city planning.
Impact on Natural Environment	Due to lack of planning, disorderly land use will continue and conservation of greenery and agricultural land will become difficult.	Owing to planned urbanization control, conservation of greenery and agricultural land can be done in an orderly manner.	In terms of conservation of greenery and agricultural land, this scenario is the best for Lahore. However, the situation may become worse in suburban areas.
Impact on Environmental Pollution	Extent of environmental pollution such as air pollution, water pollution and noise will increase due to no practice of effective measures.	Extent of environmental pollution such as air pollution, water pollution and noise will improve considerably if effective measures are implemented together with greening and proper application of land use regulation. However, there is some possibility of pollution due to iron/steel industrial estate suburban areas.	Extent of environmental pollution such as air pollution, water pollution and noise will improve considerably if effective measures are implemented together with greening and proper application of land use regulation. However, there is some possibility of pollution due to iron/steel industrial estate suburban areas.

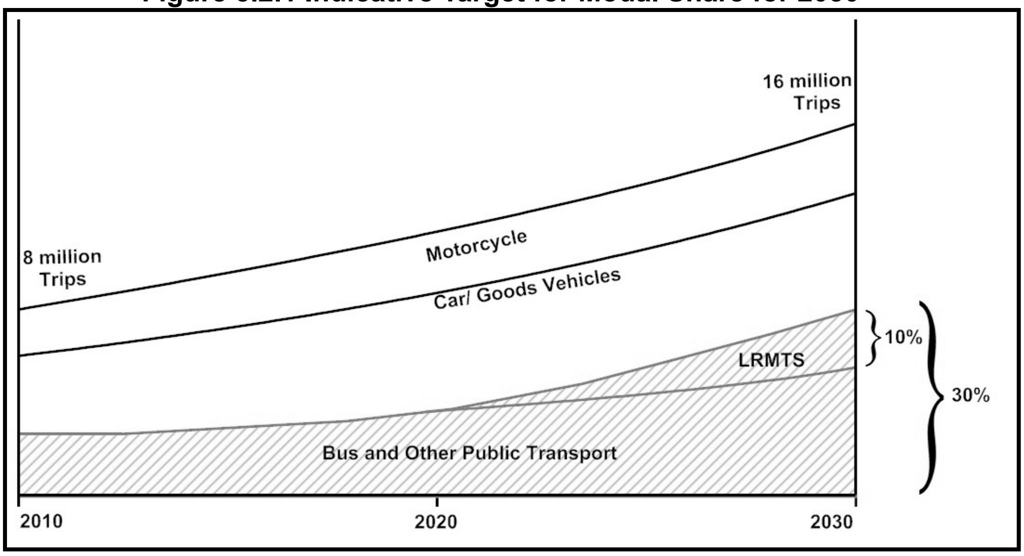
Source: JICA Study Team

5.2.2 Recommended Scenario

Based on the discussion above, Scenario 2 has been selected as the most favorable scenario.

Although rapid increase of car ownership cannot be suppressed as desired, the pace of motorization could be slowed down to a considerable extent. The following figure shows conceptually the target for mode shares for 2030. The target mode share of RMTS is 10% in 2030 excluding walk trips. If other public transport modes are taken into account, the target modal share of public transport could be about 34 % in 2030.

Figure 5.2.1 Indicative Target for Modal Share for 2030



Source: JICA Study Team

5.3 Budget Envelope

5.3.1 Context

Pakistan has huge development needs and only modest government funds. It appears to be strongly committed to largely fluctuating social, political and economic situation. In the short to medium-term (next 10 years) there is probably no realistic option other than to:

- Reform the tax system and raise own-revenues. Sector policies that are economically efficient will help do this.
- Develop the PPP framework, applying this where practicable, and
- Secure low-cost ODA (JICA provides most ODA – typically 30 year loans at <2% interest rate with 10 year grace).

5.3.2 Estimate of Budget Envelope

1) Past Investment on Transport Development

As stated earlier in Chapter 2 of this report, provincial finance of Punjab has expanded development expenditure, i.e., 24.6% of the budget in 2005-06 to 38.5% in 2009-10. As results, provincial development expenditure sharply increased from PKR 63 billion in 2005-06 to PKR 175 billion in 2009-10 or by 2.8 times. According to the Punjab Development Programme 2010-11, however, only about PKR 11 billion is allocated to urban transport development budget in Lahore. This includes road infrastructure, transport service (mainly subsidy for the purchase of bus units) and special infrastructure (LRR and RMTS).

This amount (PKR 11 billion) is equivalent to about 0.8% of the 2010 GDP of the Study Area, estimated to be PKR 1,341 billion. Although development budget is likely to increase gradually in the future, the realistic target would be 0.8% to 1.0% of the GDP.

2) Empirical Viewpoint

JICA has conducted urban transport master plan studies in various cities in the developing world. In most cases, its investment target for urban transport development has been around 3% of the city's GDP. Note, however, that this target includes maintenance of transport infrastructure, and therefore actual expenditure for new transport infrastructure is considerably lower than this level.

3) Budget Envelope

Judging from the above, the following three levels of budget envelope can be considered. That is:

1% of GDP: Conventional level

2% of GDP: Realistic if revenue measures are taken

3% of GDP: Ambitious

Note that this budget covers investment for urban transport infrastructure (including improvement and rehabilitation).

Table 5.3.1 shows budget envelop estimated for the Study Area for these three levels. For 20 years by 2030, the envelope ranges from PKR 527 billion (USD 6.2 billion) to PKR 1,582 billion (USD 18.6 billion). The envelope decreases to about 1/3 of this level for the first 10 years (2011-2020).

Table 5.3.1 Budget Envelope for Transport Development

Years	LUTMP GDP (PKR billion)	Transport Development Budget (PKR billion)		
		@ 1% of GDP	@ 2% of GDP	@ 3% of GDP
2011-15	7,730	77	155	232
2016-20	10,546	105	211	316
2021-25	14,514	145	290	435
2026-30	19,958	200	399	599
2011-20	18,276	183	366	548
2021-30	34,471	345	689	1,034
2011-30	52,747	527	1,055	1,582

Source: JICA Study Team

5.3.3 Application of Budget Envelope

1) Reason for Adopting the Budget Envelope

Budget envelope is considered essential to creating a meaningful urban transport strategy, because:

- It enables to formulate a core investment strategy consistent with the 'Low' budget estimate (that will 'almost certainly' be available), and
- It becomes possible to identify extra investments, to be implemented if higher levels of spending became available.

In LUTMP, the proposed projects have been selected vis-à-vis this budget envelope. Without this approach there is every danger the strategy would not be financially constrained. It would then be little more than a wish-list of politically attractive projects.

2) Issues in Application

In applying budget envelope, the following issues arise:

- What scale of additional financing will be available from the private sector, as a result of implemented concessions?
- It is a common practice to assume that private financing from concessions is additional to the public sector budget envelope. Also extra fund may be produced by e.g. raising fuel taxes, parking charges etc.
- The approach depends upon project costing being realistic. We know that many costing are unrealistic such that major cost escalation takes place when the project is implemented. It follows that we should check the credibility of cost estimates. If the costs are far too low they undermine the credibility of the approach.
- Part of the budget envelope is already committed by projects under construction or about to start. Line agencies naturally try to say there is a high level of commitment so that their projects can proceed.

5.4 Public Transport (PT)

5.4.1 General

The Study surveys analysis showed that in Lahore the public transport (PT) mode share is anything between 40~60% depending on the corridor and time of day. It is significant to note that many Asian cities are spending hundreds of millions of Dollars to achieve even 10% PT mode share. In Lahore, public transport system could be vastly improved, at no great cost to the public purse, and simultaneously subsidy could be reduced or removed once for all. This has been done in other big cities of Asia and the World. In view of the high mode share of buses this could be done in Lahore.

For large urban areas, such as Lahore, the only way to effectively meet transport demand is to provide the city with a high-quality public transport system which must be developed in integration with urban development. The core network will be composed of urban rail (RMTS) and bus rapid transit (BRT). Secondary and feeder services will be by buses with different sizes and types of services. However, building a good public transport system is not an easy task; it requires large amounts of funds and operation and management capacities over a long period of time. Fares to be collected from users will hardly pay for the investment cost and poorly developed systems can attract only a limited number of passengers. Experiences of successful cities clearly indicate that mass transit networks serve as the backbone of the urban structure and are integrated with urban land use and development.

A public-transport-oriented city cannot be realized solely by introducing mass transit as a mode of transportation; it must also be associated with effectively integrated urban areas and a corresponding lifestyle shift by the people. Key considerations must be given to the following:

(a) **Integrated Urban Development:** Land use and urban development must be reorganized along the mass transit corridors in a way that socio-economic activities are more effectively articulated with mass transit. This requires a review of the existing urban master plan which is rather road-transportation-based.

(b) **Adequate Role-sharing with Private Transport**: Private transport, including cars, motorcycles, and bicycles, is also an equally important mode as the society becomes affluent and demands diversify. Private transport modes are also important feeder services to mass transit systems.

(c) **Long-term Commitment:** A successful mass-transit-based city cannot be realized in a short time but needs long-term, consistent policy intervention and the people’s good understanding and support.

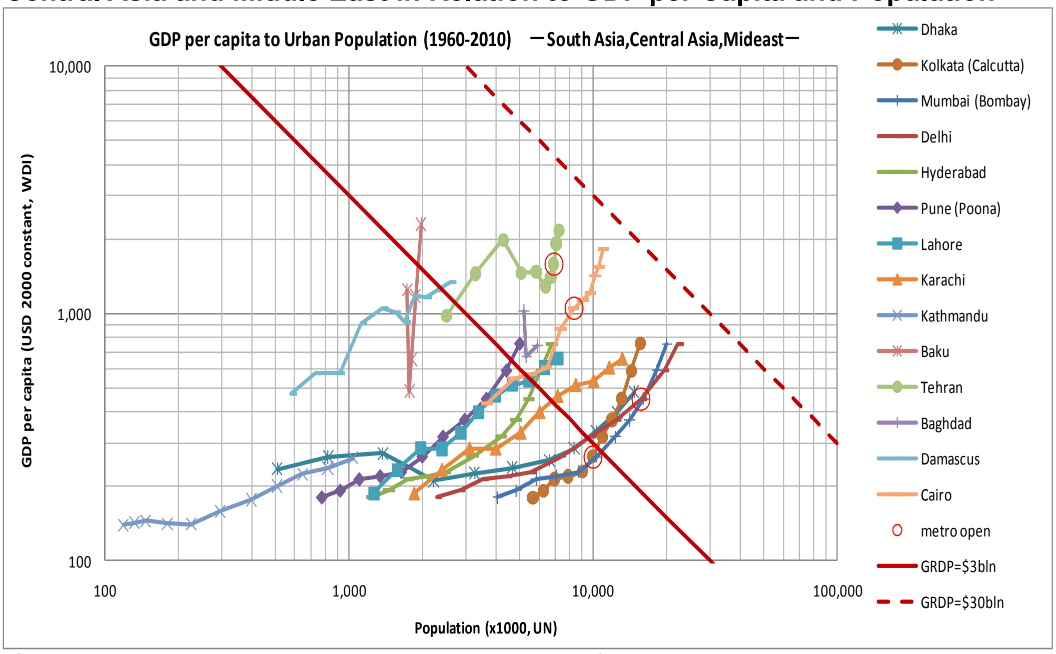
5.4.2 Urban Rail Based Mass Transit Development

Figure 5.4.1 presents the timing of urban rail development in major cities of South Asia, Central Asia and Middle East in comparison with national GDP per capita and city's population. In these regions, there are four cities where modern urban rail has been developed, i.e. Kolkata, Delhi, Cairo and Tehran.

It is interesting to note that urban railway is developed when city's GDP is between USD 3 billion and 30 billion (in 2000 constant prices) as shown in Figure 5.4.1. It is true not only in this region but in other developing regions. And more importantly, Lahore is already in the 'zone'. This implies that Lahore should have an urban rails based mass transit system judging from the world-wide trend.

Following the world trend, JICA in its previous 1991 transport master plan study had proposed an LRT system, along one of the busiest corridors of Lahore, with PT mode share reaching as high as 60% along some of its sections. However, due to various reasons the project could not be implemented.

Figure 5.4.1 Timing of Urban Rail Development in Major Cities of South Asia, Central Asia and Middle East in Relation to GDP per Capita and Population



Source: Population: World Urbanization Prospect 2009 (UN), GDP per capita: WDI2008

The GoPb also made a second attempt to give Lahore a rail based mass transit system in 2005. Consultants MVA Asia carried out a feasibility study and proposed a network of four lines to be implemented over the next 20 years. However, implementation of this plan has also not been materialized due to various reasons. Currently, the GoPb is considering to get the Chinese funding/ backing to implement the priority line in the near future. This system is essential, if implemented, it would form the back-bone of the Lahore public transport system.

5.4.3 Urban Road Based Mass Transit Development and Conventional Bus Services

Figure 5.4.1 also illustrates that cities which have just entered the rail-based mass transit zone, could very well benefit from low cost Bus Rapid Transit (BRT) system. Such BRT system could meet the PT demand not only in the short-medium term for medium demand corridors, but may be converted to a rail based mass transit high capacity system in the future.

JICA 1991 master plan had also proposed some corridors to be served by BRT systems, but none has materialized as yet. Currently, LTC is studying/ considering the introduction of the BRT along some of the medium-high demand corridors in Lahore. The status of these studies is not yet clear.

However, LUTMP recommends an integrated PT transport system for Lahore. The proposed system need to be sustainable, and should meet the future travel demand efficiently through a combination of rail-based mass transit, BRT, Large Bus, Wagon and feeder services. For BRT system development, the same key principles as urban rail may apply.

5.4.4 Bus Services

The goal should be to turn the whole of the bus industry in the Study Area to genuine private operation. GoPb has already taken steps to address this issue by setting up Lahore Transport Company (in 2010). The organization is in its infancy, and finding it hard to establish its authority. LTC goals and objectives are rather mixed. However, it has started to assert its control on illegal operation, monitoring of service quality etc. But it has a long way to go yet.

Over the last 3 to 4 years the number of large buses have declined sharply from around 1,000 to about 300, and GoPb has failed to win over private sector investment for the introduction of larger (more efficient) CNG (environment friendly) buses. It is essential that robust demand analysis be used to establish high occupancy and low occupancy routes. The existing gazetted routes were notified using the information and data from ages old routes, with very basic demand data analysis. The route definition was mostly based on intuitions and whims of the implementers, and on occasions through collusion of the route planning/ issuing authorities with the operators. Such practices lead to inefficient operation, as this was done mostly to give some operators unfair advantage by eliminating ‘fair’ competition.

It is essential that healthy competition exists; people have choice and good quality service.

This requires establishing of new High Occupancy Vehicle (HOV) (Bus Size of 50 seats) routes and rationalization of existing HoV routes. In addition rationalization of Wagon routes is also required and it is well over due. The Wagons should operate in low-medium PT demand corridors, and with more of a feeder role, than the main line haul service. In addition, para-transit modes using low demand routes also need to be reviewed to provide adequate PT demand for the Wagons.

Currently the normal bus and wagon fares are the same. These need to be reviewed to ensure that Bus operators with much higher capital cost investment (bus price) can afford to run a good service and make reasonable profit on their return. Currently, subsidy is paid to compensate for high fuel prices. But this has lead to confrontation between the operators and the GoPb, as the operators were forced to keep the fares low. Subsidy should be targeted for particular purposes and not just as a ‘safety net’ for the poor. Subsidy if provided should be with ‘stick-and-carrot’ approach. The receiving operator must ensure good, regular service, to receive subsidy, and this should be monitored through performance based targets checked regularly by independent bodies.

5.5 Road Network Development

5.5.1 Demand/ Supply Gaps

The travel demand analysis has presented the gap between the available road capacity and the demand in the previous chapter. The outcome is clear that with 3+% growth rate in population, coupled with GRDP growth of about 6% the current network will not be able to sustain the future road traffic demand. The primary strategy of road network development is to fill the gaps by increasing road capacity. This is seriously considered in the master plan particularly at the congested cross-section of Ravi River.

However, due to the fact that road development has hardly caught up with rapid motorization in many cities of the world, road development has to be implemented as a part of integrated transport system, i.e. in combination with public transport development and transport demand management (TDM).

5.5.2 Already Proposed Projects

A number of highway projects proposed by various departments and agencies are in the pipeline, at various stages of implementation. These are outlined in the next Chapter 6. Some or all of these projects were evaluated and discussed in Chapter 7 of this report to ascertain their feasibility and role in the overall highway network and the sustainable transport system for Lahore. The master plan highway network strategy is not based on demand alone. The overall consideration is based on a combination of best overall PT and highway system, which is efficient and sustainable transport system from economic, financial, operational and environmental point of views.

5.6 Traffic Management

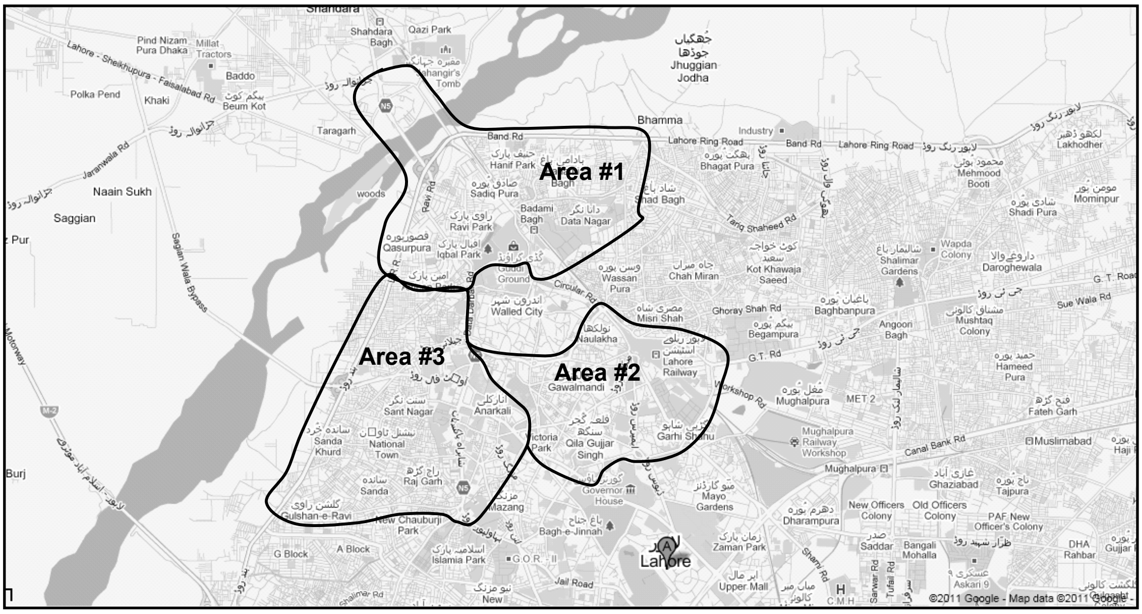
Traffic condition/ situation in the central area of Lahore is the most serious in the Study Area. Most inter-city and intra-city traffic concentrate there using radial arterial roads. Disorderly traffic management and insufficient road infrastructure aggravate the situation. The traffic management deficiencies need to be tackled urgently.

Focal areas for traffic management have been identified as shown in Figure 5.6.1. The countermeasures for these areas should form the core programme of the Action Plan proposed by the Study.

Other areas of Lahore also need attention in the master plan, such as:

- Civilizing the road system, where roads are used for travelling and not for economic activity or storage, and for waste disposal and collection.
- Pedestrian facilities
- Severance issues
- Environmental issues of Noise, air pollution,
- Safety of pedestrians, cyclists and PT passengers alike, and
- Facilities for the physically impaired and Gender issues.

Figure 5.6.1 Focus Area for Traffic Management



Source: JICA Study Team

5.7 Modal Integration

Planning by subsector or project-based approach is no longer an effective method of transport development. Concern is growing in the world on the disadvantages due to uncoordinated/ un-integrated developments resulting in higher investment cost to suppliers and low benefit and convenience to users. As urbanization proceeds, available space becomes limited, people's activity becomes concentrated, more quality services are required, and social/ environmental condition tends to be aggravated. Transport sector is thus required to adopt more integrated and coordinated approach in project planning and implementation. Integration is required in relation not only to inter-modal issues but to inter-sectoral and inter-agency activities.

In Lahore modal integration is simple, because the transport system is simple. Most of the modal interchanges are between one public mode and the other at various termini in Lahore. For example, Lahore Badami Bagh Bus terminal – where passengers change from inter-city buses to intra-city buses, wagons, or other para transit modes.

Figure 5.7.1 (photo) shows the situation of this terminal; large buses and smaller wagons park in queues in separate places without proper guideways and waiting sheds for passengers, and a number of wagons are waiting on roads surrounding the terminal.

LUTMP proposes measures to enhance the efficiency of such termini, through better management and to make public transport more attractive. Again with the goal to keep the PT mode share at least at current levels (or improve it), and save it from sliding decline. The decline in public mode share could be disastrous for the city's economy and not to mention the degradation of the environment.

Under the current transport system modal integration between PT modes is the likely scenario. However, when developing an urban road- or rail-based mass transit systems, integration of the private (car and motorcycle) and public system through park-n-ride type of operation should also be considered, at project planning and implementation stage.

Figure 5.7.1 'Bird-eye' View of Badami Bagh Bus Terminal

Source: Transport Department

5.8 Strengthening Institutional Capacity

1) Necessity of Organization Responsible for Realization of Master Plan

There is almost no Governmental organization responsible for realizing, monitoring and updating the transport master plan. According to the regulation, TEPA is mandatory to carry out such a function. TEPA's achievements give too much weight to road traffic engineering and minor road improvement. This is why in the past, transport master plans have not been implemented, or sometimes completely ignored. A powerful organization may be needed for realization of policies and projects of the transport master plan.

The transport master plan encompasses wide subsectors and a variety of projects with different natures. Therefore, the said organization will be required to make decisions from comprehensive and multidisciplinary viewpoints on project implementation.

To attain this, institutional arrangements will be necessary to establish a decision-making board consisting of high-ranked officials of transport-related organizations. It should be technically supported by a research and planning institute with high technologies and expertise. The decision making board, named **Transport Management Board (TMB),** which is strongly recommended to be established as part of institutional reforms proposed by the Study.

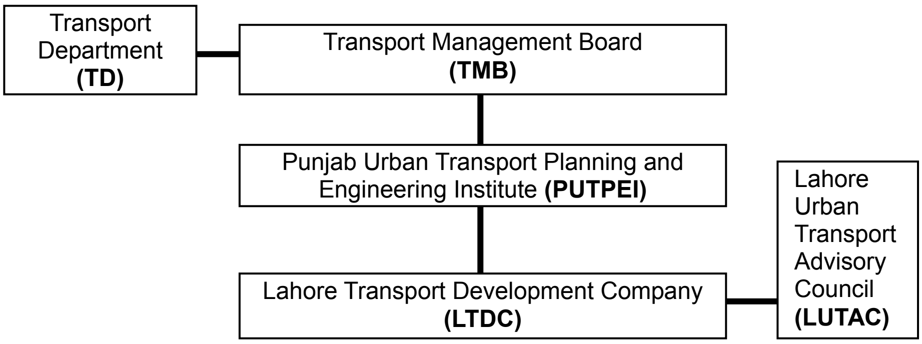
It may be almost impossible to recruit qualified professionals at such a low salaries as current wage system for Pakistan Government officials as well as other terms of recruiting conditions. Consequently, the wage system needs to be revised upwards, especially for higher ranked officials. Unless otherwise, the research and planning institute abovementioned should be established to be free from the current official wage system. On the other hand, it has to function as a part of Government under the Transport Management Board, with close relation to Transport Department (TD). This semi-Governmental agency is named **Punjab Urban Transportation Planning and Engineering Institute (PUTPEI).**

The research and planning institute should work as a brain of the decision-making board as well as the secretariat. Such institute is desirably operated not only with the official budget, but also with its own financial sources.

While PUTPEI is a research and planning institute, another agency is needed to establish for project execution, implementation and maintenance of transportation infrastructure, facilities and schemes. This agency should not be bound by the official wage system as well and to be allowed to conduct profit-oriented activities in order to become financially self-sustainable. This is recommended to develop as a province-owned company servicing to the Lahore City District, named **Lahore Transport Development Company**

(LTDC), comprising six divisions of administration, planning, rail transit, public bus, parking and traffic management.

Figure 5.8.1 New Establishment for Transportation Development



Source: JICA Study Team

Transportation policies and projects are to be implemented, by widely reflecting public opinion to exclude planners' arbitrary decision and execution. To secure this, it is recommended to establish a group advisory to LTDC, named **Lahore Urban Transport Advisory Council (LUTAC)**.

2) Capacity Development of Transport-related Organizations

Every transport-related agency is suffering from a shortage of qualified professionals especially in planning sectors. Currently, there are no effective capacity development programs or incentives for being trained. Such situations need to be improved immediately.

Transport Planning Unit (TPU)

- TPU has to maintain and update various transport-related databases and then TPU must have some staff versed in database.
- TPU will take over a set of LUTMP models and database and be responsible for undertaking feasibility study. To shoulder there tasks, more capacity building is needed especially in the field of socio-economic analysis and transport demand forecast as well as project evaluation.
- A study group on PPP shall be established in the Transport Department. TPU should take initiative in the study. To do this, more capacity building or recruitment of new staff will be needed.
- To attain above, capacity building program shall be developed together with preparation of budget to implement the program as well as utilization of international technical cooperation.

Traffic Engineering and Planning Agency (TEPA)

- TEPA should also build capacity for demand analysis and project evaluation. Demand analysis in TEPA ought to include micro-traffic simulation. Some of TEPA staffs must be familiar with micro-traffic simulation.
- TEPA is responsible to develop an inventory of parking facilities and database of parking demand. Using these inventory and database as well as LUTMP OD matrices, TEPA should develop a parking demand forecast package and then should develop capacities for these tasks.
- TEPA should start the preparatory studies for centralization of traffic signal control.

Reinforcement of Traffic Police

- Training traffic police to techniques is essential for traffic control especially at intersections, enforcement of rules and regulations and crackdown of traffic violations.
- Transfer of responsibility on Operation and Management (O&M) of traffic signal to traffic police. For this, TEPA should take initiative.
- Traffic polices are to be trained to be familiar with computerized equipment.
- Training traffic polices includes making traffic enforcers familiar with on-line operation of vehicle registration database and driving license database.

City/ District Government Office

- Historically, Pakistan Governmental Institutions has been strongly centralized and the Local Governments were kept lack of capacity. This hinders to realize decentralization policy. City District Government Lahore (CDGL) is currently responsible for construction and development of roads, street light, solid waste disposal, construction of hospital and dispensaries, primary schools and sewage facility and parks. In all sectors, capacity building is needed especially for execution and maintenance fields
- The Governments of local level are chronically suffering from shortage of capacity not only in Lahore, but in other large cities. The provincial Government prepares training programs and implements them. In the capacity development, some incentive measures should be added.

3) Preservation of Space for Transport Facility by Law

Implementation of a master plan needs a huge investment and then a long time. Some projects recommended in LUTMP would start after 10 or 15 years. Meantime, urbanization would continue outward without stopping. Therefore, a trunk road could not be constructed due to fully built-up areas in the alignment. Whereas it would be easy to build in these areas now, or require land when the area is mostly open spaces or farm land.

Thus, restrictive measures will be necessary to build a new permanent structure in the future right of way once the road alignment is officially determined based on the law. There may be strong oppositions to make such a low because it restricts free utilization of a private property. It is necessary, however, from the view of public benefits.

The urban planning law has to establish clearly;

a) Procedure to determine an urban planning road;

b) Restriction of development acts in the right of way of a determined urban planning road;

c) Compulsory submission of a promissory note by the person to build a not-permanent structure, promising that the person would demolish at the commencement of road construction;

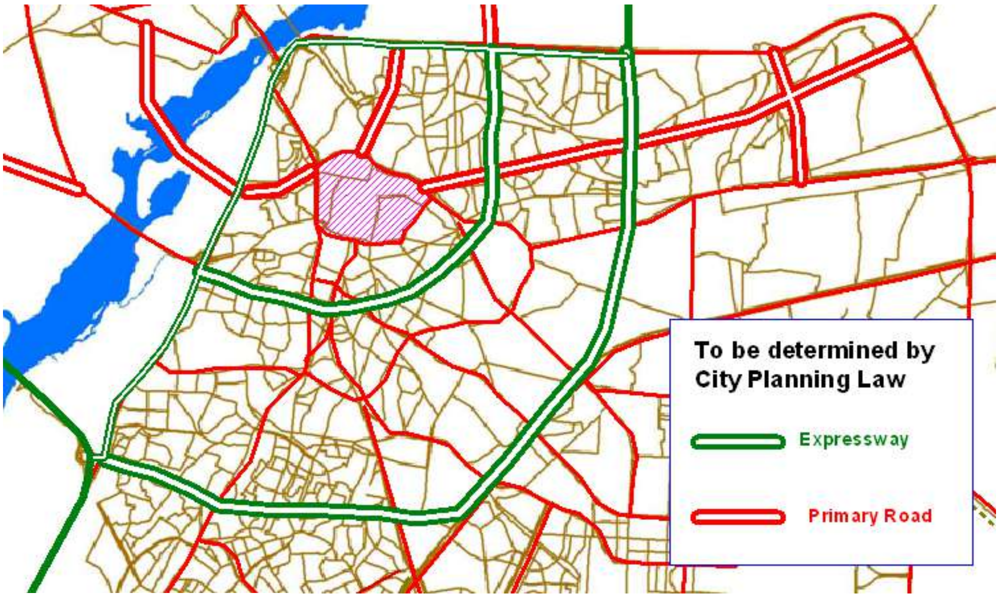
d) Land owners have to sell the land the Government at the market price; and

e) Punishment to the violators of the law.

Repetitive opinion polls and study on the similar laws in other countries would be necessary before the law is established.

Such a determination system of an urban planning road is also applicable to develop a trunk road in the central built-up area. Supposing a trunk road is planned by considering a necessary conditions and desirable alignment, but ignoring the existing buildings and officially determined taking the formal procedure provided by the law. If no building is newly built for a long time, the right of gradually changes to open space. If the Government buys vacant lots and constructs the road step by step, the road can be finally completed, presumably after 50 years or 100 years after determination. If such a century project be implemented patiently, a trunk road planned even in the urban centre. Figure 5.8.2 shows an example planned for the central area of Lahore, although new roads in the Figure are not included in the LUTMP projects. If a land readjustment system is applied together with the urban planning determination system, the construction will be accelerated and public investment would be less.

Figure 5.8.2 Road Network Development by Applying Urban Planning Determination

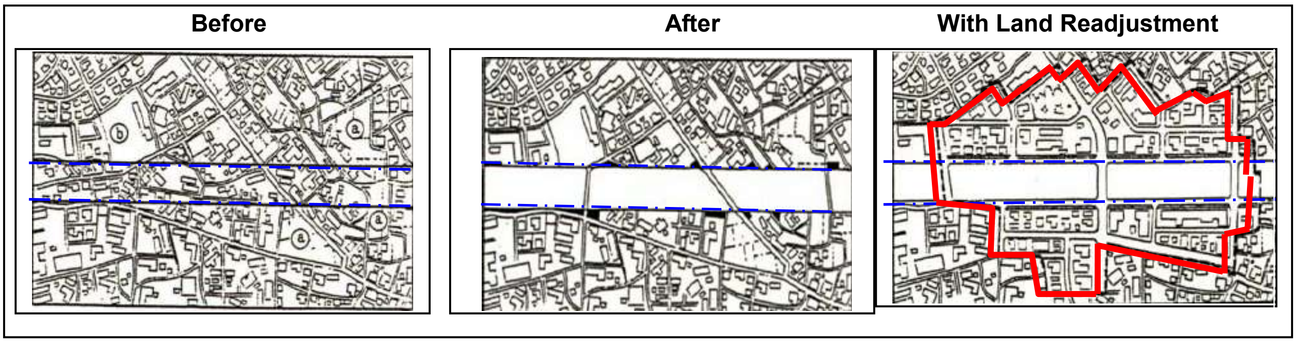


Source: JICA Study Team

Urban Planning Determination and Land Readjustment in Japan

Legal system for construction of urban roads is provided in Japanese City Planning Law, which is Land purchasing system and Land readjustment system as illustrated below. Land purchasing system in the Japanese city planning law is briefed as follows;

Once the Government makes city planning determination (official approval) on the planned roads, the road is authorized as City planning roads. After the determination, city planning restrictions are imposed within the areas of Right of Way (ROW) of the city planning roads. The restrictions include city planning restriction (prohibition of building and rebuilding activities except some removable buildings) is to be enforced by Building standard act. This aims to prevent land purchasing for the construction of the city planning roads from getting difficult mainly due to construction of irremovable buildings/structures, soaring land prices and others within ROW of the city planning roads.



Building constructions are, in principle, not allowed in areas where public facilities have been determined. However, those which can meet the following conditions can take place provided that the prefectural governor's approval is received.

- The building is no more than 2 storey high without basement.
- The main structures are simple such as those of wood, iron frames or concrete blocks.

The landowners concerned should comply with these building restrictions for the sake of public interest; there is no need for compensation, until the actual project implementation which may take scores of years to launch. The building restrictions are enforced through the process of issuing building confirmation stipulated in the Building Standard Law.

Volume-I – Chapter-6

ONGOING AND PROPOSED PROJECTS

FINAL REPORT

6. ONGOING AND PROPOSED PROJECTS

6.1. On-Going Projects

There are number of transportation related projects on-going in the Study Area in various sectors, under a number of provincial departments, local government bodies, authorities and agencies. This section provides an outline of all major on-going projects as available to the Study Team by August, 2011, and their status has been updated again in October, 2011.

6.1.1. Lahore Ring Road (LRR)

The LRR is a circumferential road planned around the city, with the objective to keep most of the through traffic out of the busy city roads, and to provide a high speed limited access direct road connecting all the radial roads around Lahore. The Lahore Ring Road Project was launched on December 22, 2004. The LRR Project is the biggest mega road project ever undertaken by the GoPb.

The project was started as a single project, but due to unforeseen circumstance the project was split into two parts: Northern and Southern sections of a loop around the city with a radius of 10 to 20 km from the city centre. The north-eastern half loop is under-construction, and likely to be completed by 2012 (*as per discussion with C&W dept.*). The construction on the project started in 2006, and progress has been rapid. Almost 80 % of the northern half of the loop has now been completed and is operational. The salient features of the Lahore Ring Road are:

- A Dual-3 with 'emergency lane hard shoulder' limited access highway; a typical cross-section of a completed section is depicted in Figure 6.1.1.
- All junctions are grade-separated, with slip roads for access and egress;
- The northern half intercepts the radial road in the north and to the east of the city; whereas the southern half loop is planned to intercept the radial routes from the south and south-west of the city – thus to keep the through traffic out of the city
- The highway permitted speed is 80 km/h.
- All vehicle types (except animal drawn carts) are allowed.
- There is no restriction for good vehicles of load/ size or time;
- Pedestrians are not allowed, nor vehicles are allowed to stop, except in case of emergency;
- The project is being implemented in stages; the Northern section is split into 16 construction packages. Packages 1 through to 13 have been completed and are operational and Packages 14~16 is under construction, due for completion by the end of 2012.

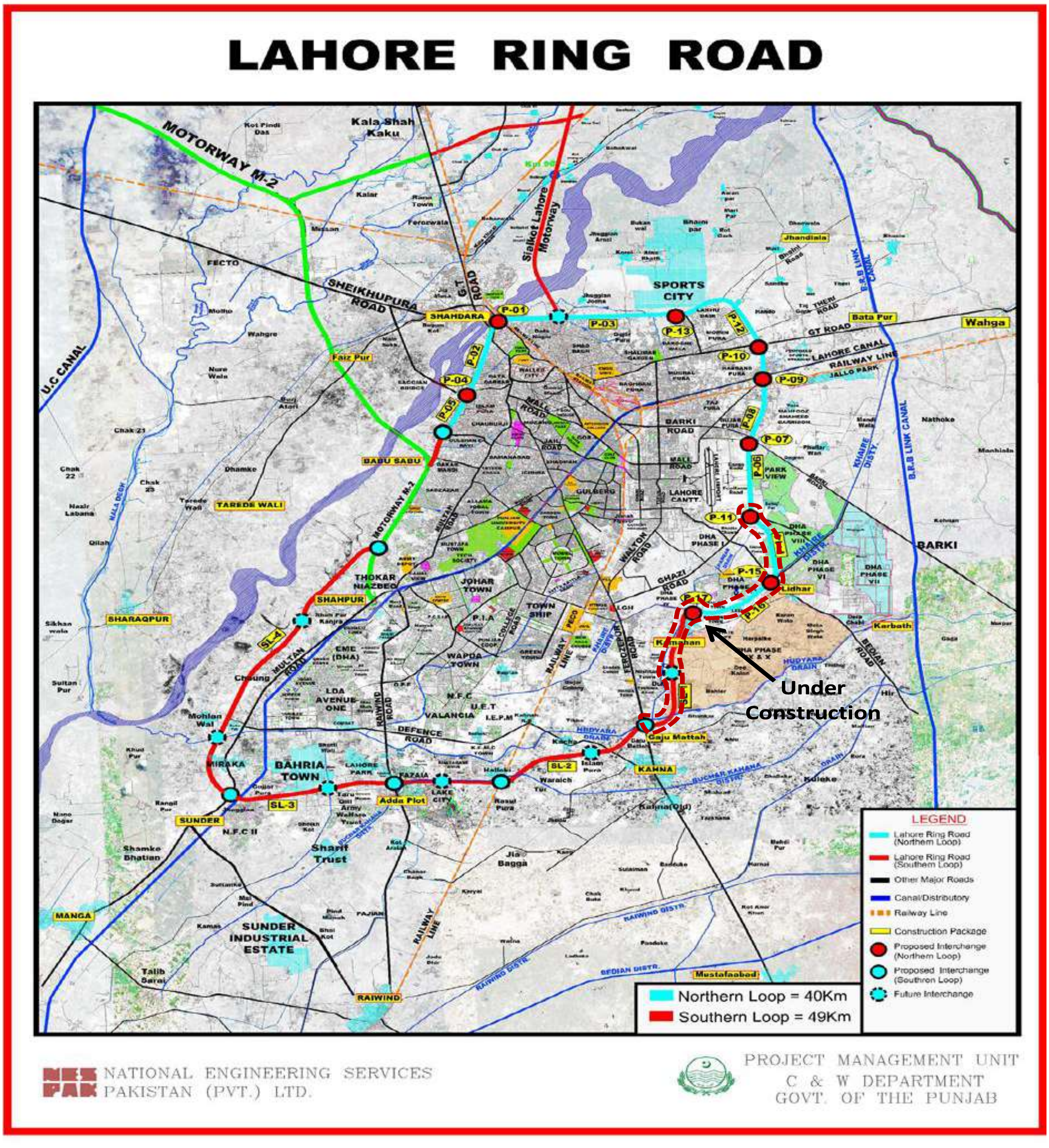
- As per recent data the estimated completion cost of the northern section is PKR 86 billion (USD 1.24 billion)
- The southern section is in the planning stages, and is discussed in the subsequent sections of this Chapter.

At present almost all of the northern and eastern part, about 43 km is complete (except the last section between Bedian Road and Ferozpur Road) with nine major interchanges, as shown in Figure 6.1.2. The figure also illustrates trial section which is under construction.

Figure 6.1.1 Typical Cross Section of a Completed Section of LRR

Source: JICA Study Team

Figure 6.1.2 LRR Northern Section Alignment and Status



Source: NESPAK

6.1.2. Lahore Rapid Mass Transit System (LRMTS)

In the 1991 JICA Master Plan Study proposed a limited mass transit system (*a Light Rail System* - LRT) a 13 km one LRT line for Lahore, along one of its busiest corridor – Ferozepur Road. However, its implementation could not be realised due to numerous unforeseen circumstance right up to 2004. In-line with the vision 2030, in 2004 the GoPb launched the Lahore Rapid Mass Transit System (LRMTS) project to provide a comprehensive network of mass transit lines for the people of Pakistan's second largest city Lahore. In the 1st phase, GoPb commissioned international consultants to review all previous work and develop a *state-of-the-art* mass transit network for the year 2025. The Study was completed in 2006. The Study proposed a rail based mass transit prioritised network of four lines (Figure 6.1.3) about 97 km, with 82 stations. The Study also completed the feasibility of the 1st priority (Green) line. Again Ferozepur Road corridor was proposed for the priority line envisioned to be completed by 2015/ 16.

GoPb taking on-board the recommendations started work in earnest on the implementation of the system, by seeking funding from the Asian Development Bank (ADB). In parallel the GoPb also commissioned consultants to proceed with the feasibility study of the 2nd priority (Orange) line and also the reference design of the Priority (Green) line. These studies were completed in 2007 and 2008 respectively. The feasibility studies concluded that the mass transit lines are economically viable, and should be implemented as planned in approximately one line every five years.

ADB conducted independent assessment of the feasibility studies, agreed to fund the LRMTS project in phases, and approved to provide a Multi-tranche financing facility (MMF) loan of USD one billion towards the capital cost of the priority (Green) line. However, since 2008 negotiations with the ADB has been suspended. GoPb is seeking alternative funding source for the 1st priority (Green) line from friendly countries. So far there is no commitment for funding, but the details are confidential, as the negotiations for the terms and conditions of the loan are on-going. The key features of the priority (Green) line are outlined below:

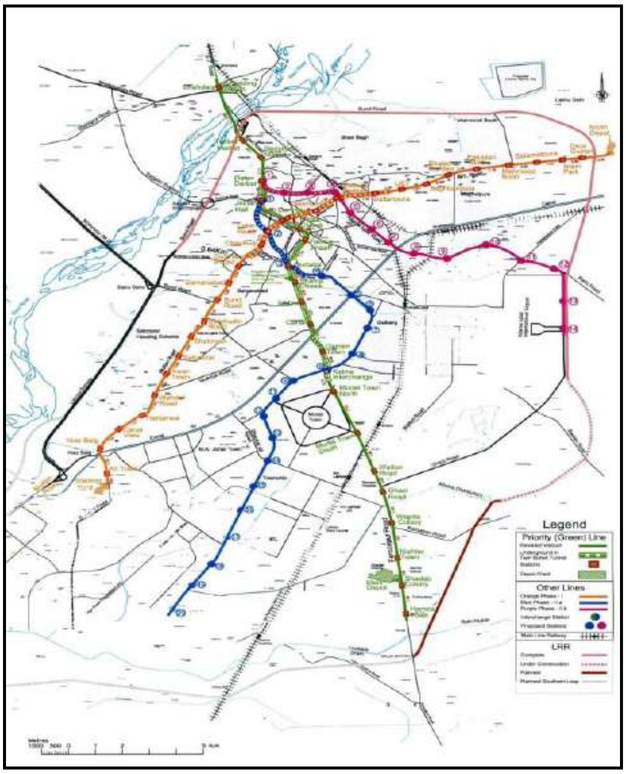
- Green Line alignment is 27 km long, (15 km underground) from Hamza Town in the South to Shahdara in the North;
- 22 stations, 12 underground 10 elevated; 5 interchange stations would provide direct transfer with the other 3 LRMTS lines.
- 2-Depots, both depot will be developed as multi-modal bus terminals for direct transfer between the buses (inter and Intra City) and the Green Line stations.
- All stations will have integrated feeder bus routes and passenger drop-off and pick-up areas with direct access to the station;
- Some station will have park-n-ride facilities;
- Fare levels will be affordable and comparable to the prevailing air-conditioned bus services
- Capital cost of the Green Line is estimated to be USD 2.4 billion (2008 prices) and

that of the Orange Line is USD 2.0 billion (2007 prices).

- Both Lines would need capital cost subsidy, however would not require operational cost subsidy.
- GoPb had set in motion a plan to operate the mass transit system under 'PPP', the modalities of which still need finalisation.
- The ADB funding was contingent upon GoPb putting the project on PPP basis for raising the part or all of the remainder (USD 1.4 billion) of the capital cost and to secure private sector operator for the system.

The GoPb from its ADP cannot afford to fund the project capital cost. As a result the project remains suspended until some form of capital cost funding could be secured, as descried above.

Figure 6.1.3 Lahore Rapid Mass Transit System (LRMTS) Network

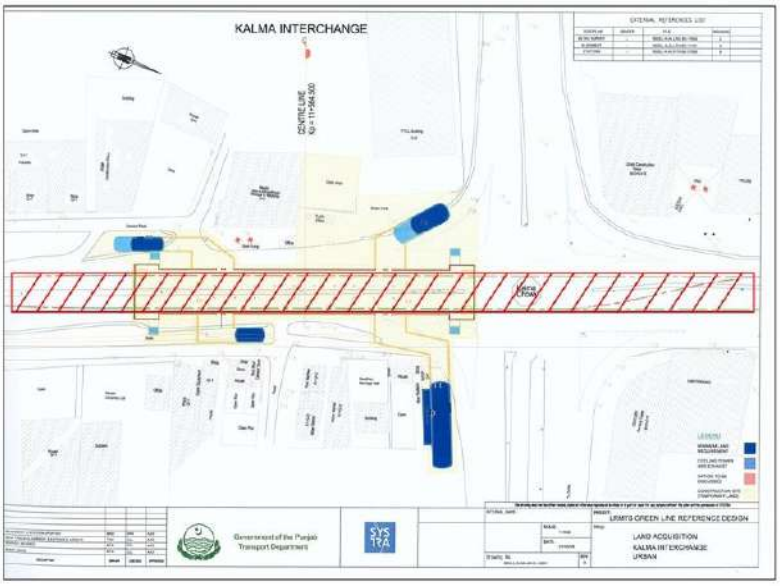


Source: LRMTS Study, 2008

GoPb, recently negotiated the project with Chinese investor company "NORNICO" who showed willingness to obtain the buyers' credit from Chinese financing institutions to provide 85 % of the contract amount; whereas GoPb would be responsible for effecting 15 % advance payment. NORINCO had to do detail design and build LRMTS; whereas LTC to engage an operator for subsequent operation of the system. No more details are available to the Study Team for further progress in this regard.

Fate of this project is under risk, as GoPb has constructed a flyover at Kalma Chowk and Canal Bank Road along Ferozpur Road. Semi Government Consultant Company was responsible for the design and construction of the Kalma Chowk flyover. LRMTS Green Line alignment and design had been completely ignored. The construction had been done on ad-hoc basis due to inability of the Consultant to understand and incorporate the complex LRMTS Green Line (GL) alignment and station design. The most serious problem is the location of flyover pillars which incurs re-design of the GL underground Kalma Chowk station as shown in Figure 6.1.4, and also the alignment from Model Town to Wahdat Road and beyond.

Figure 6.1.4 Kalma Chowk Flyover over LRMTS Planned Station



Note: The red part is the Kalma Chowk Flyover above the planned station.
Source: JICA Study Team

The situation is further made worse by the recently started construction of Canal/ Muslim Town/ Wahdat Road junction flyover. This will have the same impact on GL alignment and Canal station as did the Kalma Chowk flyover. Future LRMTS Green Line would need another review and re-design by International Consultant.

6.1.3. Monorail System in Lahore

An international group (lead by a Malaysian Co.) had submitted to Transport Department an unsolicited bid to build and operate a monorail system along the Green Line alignment on BOT basis. The proposal was being examined by the GoPb for its viability and characteristics. The technical specifications of the proposed system were also being scrutinised and confirmed. Some of the ‘claims’ regarding the system capacity, operational characteristics, source of funding, hence its technical and financial viability were in question. As a result, there has been no decision on implementing a ‘monorail’ system in Lahore.

6.1.4. Bus Rapid Transit (BRT) System for Lahore

A Korean group of investors have expressed interest in providing BRT system along the Green and Orange lines corridors on BOT basis. The GoPb has requested the Korean investors to prepare detailed feasibility study, giving details of technology, financing and implementation plan for the two BRT lines along both Green and Orange Lines corridors. The feasibility report was expected in February 2011. No further details are available to the JICA Study Team.

6.1.5. Integrated Traffic Management System (ITMS)

The Urban Sector Policy and Management Unit under Planning and Development Department, GoPb intended to design and implement an “Integrated Traffic Management System” in the five large cities of Punjab; before implementing the citywide system, GoPb planned to implement the system as a pilot project on Ferozepur Road, Lahore.

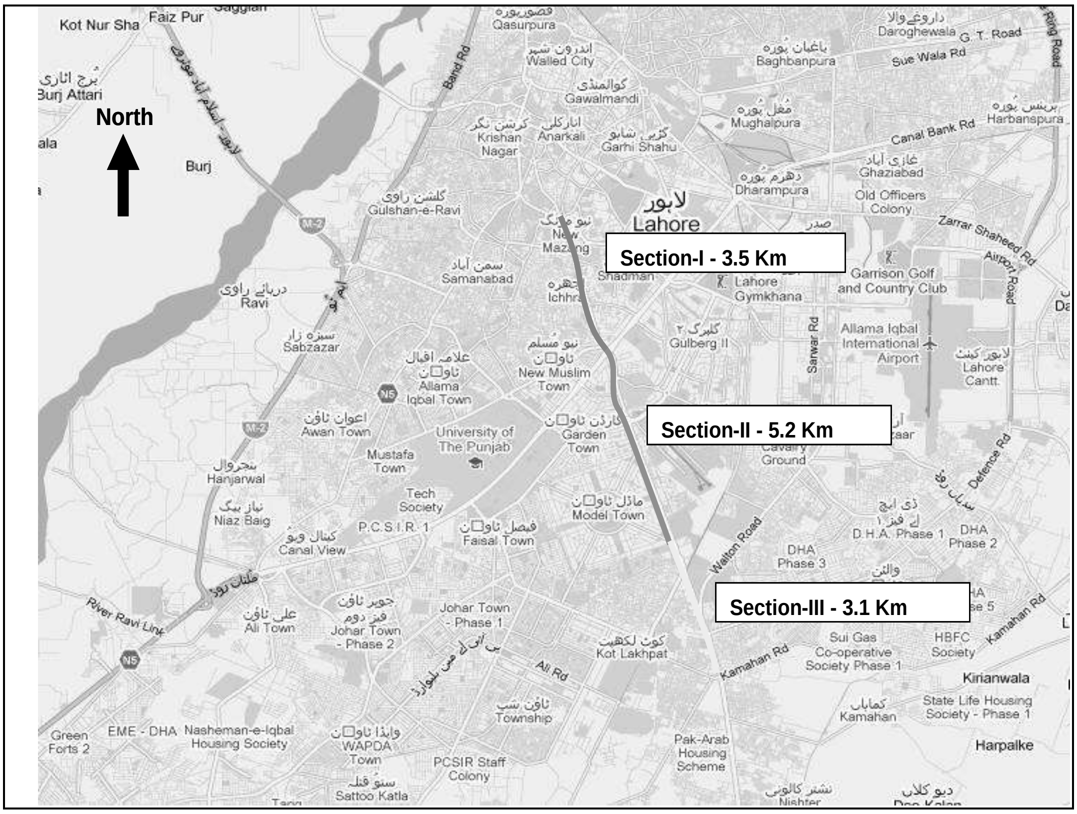
The Ferozepur road is one of the busiest radial corridors into Lahore from the south. In 2006 GoPb decided to improve the traffic condition along this dense urban corridor about 12 km of the road from Qurtaba Chowk to Khaira distributary (Figure 6.1.5). The project was launched as a pilot project, to prepare an integrated traffic management; public transport improvement; and institutional study to act as a model which could be extended over whole of the city, and also to be a stop gap measure until the LRMTS Green line is operational.

The studies were completed in 2008 by the urban unit. The outcome of the institutional study was not implemented as a whole; however some components did filter through the system and have proved useful. The traffic management study has been implemented to some extent, mostly involving minor junction improvements, and building of service road sections, where there was no service road without economic and environmental assessment. The integration of the service road to the overall road network in the corridor remains to be implemented. This is mostly due to the fact that the junction improvement, installation of modern linked signals through some kind of traffic control system remains to be implemented.

In order to improve the public transport service and facilities a number of measures were proposed. The building of bus stops and bus stop shelters have been partially built. Bus-only lanes have been planned and implemented, but effective enforcement is not a reality yet. The effectiveness of these measures has not been assessed.

The integrated management approach also provided for the implementation of co-ordinated signal system. A complete integrated/ coordinated signal system has been designed. But this component is yet to be tendered, and implemented. A number of other departments, including TEPA, C&W and Transport are also trying now to implement the system; apparently the main hurdle is the availability of finances for the system. The cost is estimated to be around USD 6 million just for this corridor and signals for a few adjacent/ crossing roads. Table 6.1.1 gives the proposed details.

Figure 6.1.5 Lahore Ferozepur Road Pilot Project – An Integrated Approach



Source: JICA Study Team, Study Area definition by Urban Unit

Table 6.1.1 Contents of Planned Centralized Traffic Control Center

Item #	Description	Unit	Qty.
NO.1 UTC Control Center Building			
Part 1	**Design & Construction of Control Center**		
1.1	Construction of Control Center including all civil works, lighting, airconditioning and elevators, furniture, transport etc (estimate and concept drawings attached)	Sum	Item
NO.2 Traffic Signal Equipment Onsite			
2.1.1	Dismantling of traffic Signal Lights, poles, foundations etc and transportation to TEPA store	Nos.	27
2.1.2	Laying of ducts and cabling i/c road cuts, restoration, foundations, draw pits earthling complete in all	site	27
2.1.3	Providing and fixing of new poles, traffic lights (LED), lights and UPS 5 KVA imported (both for UTC and Cameras) complete in all respect	site	17
2.1.4	Rehabilitation of the existing intersection other than Ferozepur road including traffic lights, UPS 5KV		10
2.1.5	Detector Loops slot cutting, lay detector, cabling, sealing and joining at stop line for each lane per	Site	27
2.1.6	Slot cutting for laying queue detectors, feeder cable, junction boxes, loop term pannel and programming complete in all respect	Sites	27
2.1.7	Feeder Cable for connecting each individual loop to the controller	Site	27
2.1.8	Supply and installation of min 16 signal group controller complete in all respects including detector arrangement, original housing imported compatable with adaptive UTC system	Nos.	27
2.1.9	Supply & Laying of Fiber Optic Cable in 2 Inch dia, G.I.Pipe including Splicing, Jointing, repeaters etc Including Road Cut and its restoration, setting and configuration Complete in all respects.	Mtr.	40,000
NO.3 CENTRAL COMPUTER CENTER			
Part No. 1 of 2: UTC Processor and Ancillary Equipment			
3.1.1	In station data transmission equipment.	Sum	1
3.1.2	In station / outstation data transmission equipment.	Nos.	1
3.1.3	In station Optical modems, Receiver Module for single mode, single fibre, I channel video plus two full duplex channels with hand shake control and PTZ control.	Nos.	27
3.1.4	Out station Optical modems Transmitter Module for single mode, single fibre, I channel video plus two full duplex channels with hand shake control and PTZ control.	Nos.	27
3.1.5	Optical Modem Rack to mount optical modem cards	Nos.	3
3.1.6	DIGI Card	Nos.	3
3.1.7	Traffic Control System Software	Job	1
3.1.8	TRS Control and Monitoring Package	Job	1
3.1.9	Traffic Control System Customization Software (Windows based) included firmware	Job	1
3.1.10	Monitoring Package	Job	1
3.1.11	Recording devices equivalent to three times the primary storage capacity.	Set	2
3.1.12	PC Workstation Software	Job	1
3.1.13	Testing, commissioning, calibration and validation of on site equipmnet i.e. controllers, loop	Nos.	27
3.1.14	Network testing, commisioning, calibration and validation with centralized UTC and CCTV system	Job	1
Part No. 2 of 2: CCTV Processor and Ancillary Equipment			
3.2.1	Special traffic Dome Cameras for day /night vision	Nos.	15
3.2.2	Control Room Hardware / software as per list attached	sum	1
3.2.3	Industrial PC with 21" LCD with Control Software	Nos.	2
3.2.4	Plasma/ LCD Screen 52"	Nos.	6
3.2.5	Hi Tech Projector and Screen	Nos.	1
3.2.6	Galvanized Pole with Brackets and Foundation 12 to 15 meters	Nos.	20
3.2.7	Flood Lights 400 Watts with wiring complete in all respects	Nos.	60
3.2.8	Distribution box with Circuit Breakers, photo cell etc complete in all respact	Nos.	20
	Communication Network		
3.2.9	Single-mode 10-bit digital video transmitter duplex data Card on 1-core Fiber	Nos.	15
3.2.10	Single-mode 10-bit digital video receiver duplex data Card on 1-core Fiber	Nos.	15
3.2.11	Chassis with 2 PSU	Nos.	2
3.2.12	Laying of Optical Fiber Cable with G.I Pipe including repeaters	Mtr.	4,500
3.2.13	Power Cable 6mm2 for Cameras	Mtr.	1,200
No 4: SPARES FOR 27 INTERSECTIONS			
4.1.1	Supply and installation of min 16 signal group controller Complete in all respects including detector arrangement, original Housing imported compatible with UTC system	Nos.	2
4.1.2	Module 16 SG	Nos.	1
4.1.3	Supply of Cards Processor required for operation of controller	Nos.	20
4.1.4	Supply of 300 mm LED Modules	Nos.	15
4.1.5	Supply of Site IDS	Nos.	4
4.1.6	Supply of 210mm 3 Aspect LED Traffic Light	Nos.	10
4.1.7	Supply of 210mm 3 Aspect Traffic Light LED Module.	Nos.	15
4.1.8	Supply of facility switch	Nos.	5
4.1.9	Supply of Filter Circuit	Nos.	15
4.1.10	Man Machine Interface / Key Board Display unit	Nos.	2
NO.5: OPERATION & MAINTENANCE			
5.1.1	Routine Maintenance of Central Computer System for a period of 1 years after taking over along with maintenance of 27-Signals	Months	12
5.1.2	Operation/Supervision of the Urban Traffic Control Centre along with traffic signals for 1 years after	Months	12
5.1.3	PC computer commercial, work stations in conjunction with server and House Keeping software and Licensed operating system.	Nos.	6
5.1.4	Laser Printers A3	Nos.	1
5.1.5	Heavy Duty Color Laser Printer A3	Nos.	1
5.1.6	CD Writer, Digital and video camera's and scanner as approved	Nos.	1
5.1.7	Consumable Items as listed below		
a	50 reams of A3 paper 95 gram listing paper for item 2/2/3	Sum	1
b	6 cartridges as appropriate for each of items 2/2/2 and 2/2/3		
c	CDS Flash Ram Accessories list attached		
5.1.8	Six Copies of documentation as Specified for the central computer system	Sum	1
5.1.9	Documentation as specified for Detectors	Sum	1
5.1.10	Operator/Traffic training Course by Foreign Experts	Job	1

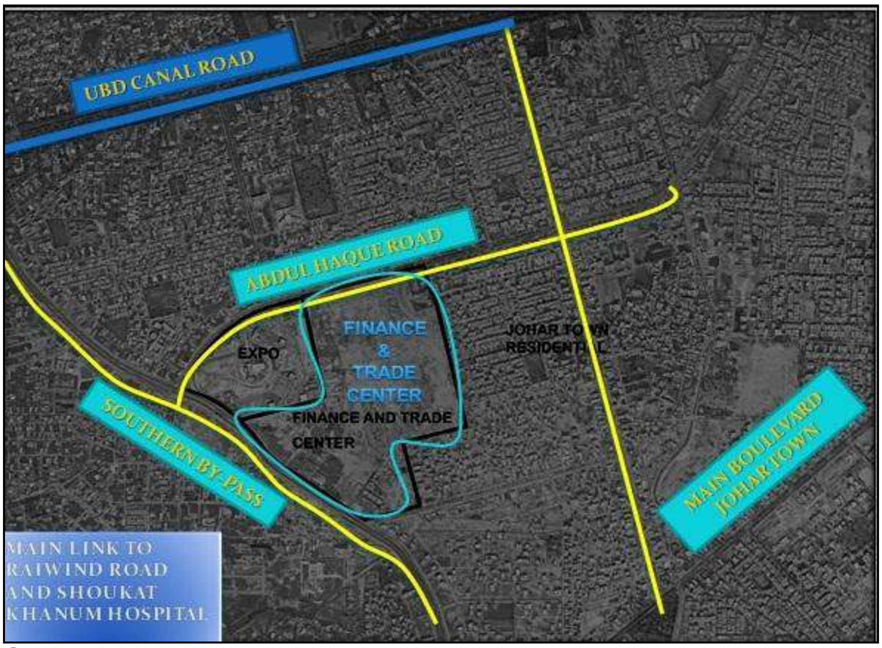
Source: TEPA

6.1.6. Finance and Trade Centre

Lahore Development Authority (LDA) has planned to build Finance and Trade Centre near Expo Centre in Johar Town with an objective to generate commercial activities in the area. The area allocated for the Finance and Trade centre is 55 ha. The proposed projects are to build a 5-Star Hotel, Big Box store, LDA Tower, Luxury Apartments, play land, lake and parks. Location is shown in Figure 6.1.6 and detail layout plan is given in Figure 6.1.7.

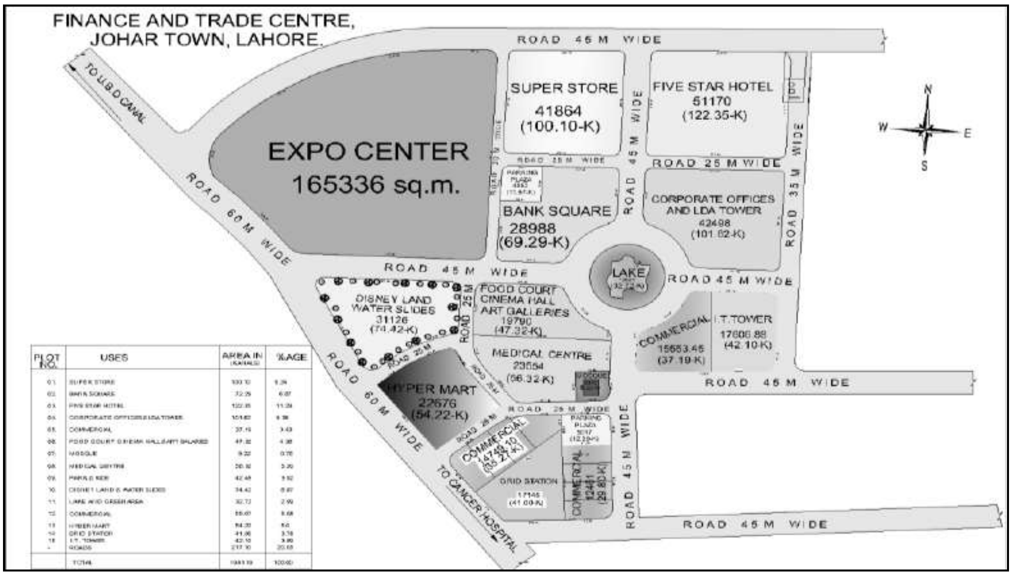
No feasibility study for the scheme was available. The impact of the development on the traffic and transport facilities in the surrounding area has not been made clear.

Figure 6.1.6 Location Map Finance and Trade Centre



Source: LDA

Figure 6.1.7 Finance and Trade Center Layout Plan



Source: LDA

6.1.7. Other On-Going Projects

There are a number of other transport improvement projects under various phases/ stages of consideration and implementation. The status of each one of these project is not clear. The list below outlines some of these projects:

- Widening and Improvement of Multan Road – the road is being realigned/ re-modelled mostly through removal of encroachments.
- Widening of Canal Bank Road project – Project was suspended by the Supreme Court of Pakistan on environmental grounds up to August, 2011. But now work has been started after SC verdict to add one lane from Jail Road underpass to Ferozepur Road underpass on both sides of BRB Canal.
- Gradual phasing out of 2-stroke engine Rickshaw and replacement by '*cleaner*' 4-stroke engine Rickshaws – project completion delayed, not sure why (but may be due to lack of funding).
- Setup of Transport Planning Unit (TPU) – Development and implementation of transport projects have been mostly under the domain of TEPA. However, over the last decade or so TEPA has done little or no planning, and has mostly focused its efforts on implementing ad-hoc projects. Much of the work done by TEPA has been based on single project development and its implementation, without any concern or priority for the overall transport needs of Lahore. As a result, TD has setup TPU under the provincial government, which helped the conduct of Lahore Urban Transport Master Plan (LUTMP) Study, with the aid of JICA. It was envisaged that TPU would gain the necessary technical skills from the JICA Study Team, through a comprehensive technology transfer programme, and would be capable of carrying out similar transport planning studies for the other major cities of the Punjab.

There are numerous other on-going projects, which are listed below in Table 6.1.2. Table also provides the details: such as executing agency, cost, completion dates etc, where available. The tabulation is for the Study Area only, and covers whole of Lahore District, and parts of Kasur and Sheikhupura districts areas within the Study Area.

Table 6.1.2 List of Other On-going Projects – A Summary

On-going Development Projects – Lahore District			
No.	**Project Description**	**Executing Agency**	**Comments**
1	Lahore Urban Transport Master Plan Study	TD	JICA Grant
2	Vehicle Inspection and Certification System	TD	
3	Multimodal Inter-City Bus Terminals in Lahore	TD	
4	Operational Cost Subsidy for Urban Public Transport System	TD and LTC	
5	E-Ticketing and Fleet Management System	TD and LTC	
6	Bus Rapid Transit System	LTC	
7	2,000 New CNG/ Diesel Buses for Lahore Intra-city Transport	LTC	Amount yet to be finalised
8	Induction of CNG Mini Buses on Urban LOV Routes	LTC	
9	Operation of Taxis in Lahore	LTC	
10	AC Coaster Service on New Routes - operational	LTC	
11	Finance and Trade Centre, Johar Town, Lahore.	LDA	
12	Commercialization of Roads	LDA	
13	ITS System for Lahore Area	TEPA	PKR 2.4billion

On-going Roads Projects – Lahore District			
No.	**Project Description**	**Executing Agency**	**Estimated Cost PKR Million**
1	Construction of Structure Road from Khayaban-e-Jinnah to Valencia Town	TEPA	480
2	Remodelling of Katcha Jail Road	TEPA	280
3	Lahore Ring Road Project (Total Northern Section - 51km)	C&W	86,400
4	Construction of 4 Lanes Lahore Wahgha Road Facility from Daroghwala to Wahgha Border (G.T. Road KM No 11.88 to 28.33 District Lahore.	C&W	1,590
5	Dualization of Lahore Ferozepur Road (Lahore to Kasur) Section km 15.15 to 26.65, from Khaira Distributors to Kahna	C&W	1,398
6	Widening/ Improving of Road from Kahna Kacha Approach Road to Raiwind City along main railway line	C&W	307
7	Widening/ Improvement of Road from Jallo More to River Ravi Siphon Along Western Bank of BRB Canal	C&W	194
8	Construction of Overhead bridge Sua Asil level crossing in Raiwind	C&W	442
9	Construction/Widening of Road from Lahore Ferozepur Road Kahna to Halloki along Both side of Butcher Kahna Distributors	C&W	780
10	Construction of Dual Carriage Way for Tarogil Road Raiwind	C&W	150
11	Detailed Engineering Design and Feasibility of Circular Road District Lahore (PC-2).	C&W	54
12	Detailed Engineering Design and Construction Supervision of Improvement, Renovation of Existing Dual Carriageway of Multan Road, Lahore	C&W	211
13	Improvement/ Rehabilitation of existing Multan road from Thokar Niaz Baig to Chauburji (Proposed Sewerage, Drainage and Water Supply System) Package III	C&W	1,825
14	Dualization of Barki Gawandi Road (Phase I, from Mehfoozpura Cant. To Klas Mari Town)	C&W	160
15	Widening/ Improving of Sua Asil to Raiwind Road	C&W	549
16	Linking of Centre Point with Ferozepur Road near Gulab Devi Hospital through Walton Airport	C&W	1,000

On-going Road Network Development Projects – Sheikhupura District			
No.	**Project Description (the Study Area Only)**	**Executing Agency**	**Estimated Cost PKR Million**
1	Construction of road from Narowal to Lahore via Badomalhi, Narang, Shahdara	C&W	417
2	Rehabilitation of Road from Shahdara Chowk to Begum Kot	C&W	156
3	Widening/Improvement of Shahdara Maqboolpura Narang Road	C&W	488
4	Rehabilitation/ Improvement of Road from Lahore Jaranwala road Thabal Stop to Marh Bhangwan Sheikhupura Sharaqpur Road via Essen and Mah Devi	C&W	80
5	Construction of Underpass at Railway Crossing at Muridke Town	C&W	199
6	Construction of Road from Abdalia Pattan Marh Bhangawan I/C New Bridge on Distributary Canal in Tehsil Sharqpur	C&W	69
7	Construction of Road from Chak No. 17 UCC to Khaira to Chak No. 19 UCC in Tehsil Sharqpur	C&W	30
8	Construction of road from Old Narang Bhatta Chowk to Narowal Road via Dera Baway Wala including Naggal Kaswala	C&W	52

Source: JICA Study Team

6.1.8. Projects Completed During the Course of the Study

TEPA and C&W departments are executing major road projects and traffic improvement schemes in Lahore areas. C&W is mainly building the provincial or inter-districts roads, and its highway division of each district is responsible for planning and execution of their regional road development projects. First update was taken from all transport related agencies over their on-going projects at the start of year 2011. The second update is taken recently to incorporate projects is proposed by the JICA Study Team evaluation and assessment. List of the completed projects by TEPA and C&W is given in Table 6.1.3.

Table 6.1.3 List of the Projects Completed by TEPA and C&W

No.	Project Description	Executing Agency	Estimated Cost PKR Million
Projects Completed – Lahore District			
1	Remodelling of Garden Town Boulevard	TEPA	400
2	Remodelling of Boulevard Gulshan-e-Ravi from Multan Road to Bund Road	TEPA	260
3	Improvement of Road along Lahore Branch Canal from Thokar Niaz Beg to Defense Road	C&W	386
	Widening/Improvement of Kamahan Lidhar Road(length in District Lahore)	C&W	136
4	Rehabilitation of Defense Road from L.M.Q road to Niaz Beg Raiwind road	C&W	147
5	Improvement/ Rehabilitation of existing Multan Road from Thokar Niaz Baig to Chauburji (Land acquisition and shifting of utilities) Package I	C&W	1,000
6	Improvement/ Rehabilitation of existing Multan Road from Thokar Niaz Baig to Chauburji (Road Works) Package II (Phase I)	C&W	675
7	Widening/ Improvement of Road from Kahna Nau to Kahna Kacha Railway Crossing	C&W	150
8	Rehabilitation/ Upgrading of road from Jallo Morr to Khaira Bridge on Eastern Bank of BRB Canal	C&W	10
9	Dualization of Lahore – Kasur Road (Kahna – Kasur)	C&W	3400
Projects Completed – Kasur District			
1	Dualization of Lahore-Kasur Road (Kahna - Kasur)	C&W	3,434
2	Construction of Dual Carriageway Phool Nagar	C&W	277
3	Dualization of Pattoki-Old Multan Road (Medina Garden to Edhi Center)	C&W	223
Projects Completed – Sheikhupura District			
1	Widening/ Improvement of Road Sharaqpur and Sheikhupura Road	C&W	557
2	Dualization of Lahore Jarana Wala Road from Faizpur Interchange to Mandi Faizabad	C&W	1,633
3	Construction of road from Lahore Sharaqpur Road Dhamakey Bus Stop to Chak No. 23 Shumali to Chak No. 23 Janubi	C&W	18
4	Construction of road from Burj Atari Nooray Wala Road Dera Odanwala to Narangi Bridge Sheikhupura Sharqpur Road	C&W	74
5	Construction of Ring Road from Kot Pindi Das along with side drains on both side	C&W	20

Source: JICA Study Team

6.2 Projects Planned by Various Agencies

There are numerous transport related projects, which have been '*planned*'. Feasibility studies of these projects have been conducted, and found to be economically feasible and are awaiting implementation. Their implementation may be imminent or some time away, may not be clear. However, full efforts have been made to advise the reader of the current status of the project. These projects are discussed further in this section.

6.2.1 Lahore Ring Road (LRR) – Southern Section

The LRR southern section was planned, and its feasibility study was completed in 2008/ 9 by NESPAK. This section is 40 km in length, with six major interchanges at major radial roads from Ferozepur road, Raiwind Road, Multan Road and the M-2 motorway. The planned alignment runs from Ferozepur road to westwards, parallel and 2~3 km south of Defense Road to Multan Road and turns northwards after its interchange with Multan Road. The complete alignment is shown in the previous section in Figure 6.1.2. The design criterion of this section is that of motorway standards, with design speed of 120 km/h. Description of each section of LRR loops; both Northern and Sothern section is given in Table 6.2.1.

To make project financial and economically feasible, ribbon development and four land clusters of housing and industry are proposed by the feasibility study. The estimated cost of the project is PKR 44.98 billion (USD 530 million), and ribbon and cluster development costs are PKR 29.5 billion (USD 347 million); which makes total cost of PKR 74.48 billion (USD 876 million).

C&W Department, GoPb proposed PPP mode for inviting the private investor which is as follows;

I.	*GoPb:*	*35 % of total cost (PKR 26.07 billion)*
II.	*Public Private Partnership:*	*75 % of total cost (PKR 48.41 billion)*
III.	*Concessionaire's Equity (20 %):*	*PKR 14.8 billion*
IV.	*Commercial Loan (45 %):*	*PKR 39.80 billion*
a.	*17 % Markup, Loan Tenure*	*10 Years + 2 Years grace period*
V.	*Concession Period:*	*17 Years*

Concessionaire is responsible for design, construction of road, land development, operation, maintenance, and collection of Toll.

Project feasibility study is considered to be weak; Project is unable to attract any investor for about 3 years. The land acquisition process is underway. The construction start date or project completion date is not clear. The main reason is the financial constraints.

Table 6.2.1 Description of Both Loops of Lahore Ring Road Project

Description		Northern Loop	Southern Loop
Length (6 Lane Carriageway)		51 Km	40 Km
Type of Land Use		Urban	-
Design Speed		100 Km / h	-
No. of Lanes		3+3 (6 Lane Carriageway)	3+3 (6 Lane Carriageway)
R.O.W		60 ~ 90 m	120 m (30 m Railway Corridor)
Interchanges	Present	9	6
	Future	1	5
Underpasses	Vehicular	10	17
	Pedestrian	6+26 Pedestrian Bridges	15

Source: C&W Department

6.2.2 Conversion of Two Stroke Cab Rickshaws to 4-Sroke

Transport Department formulated a strategy to curb the two stroke rickshaws on roads to improve the environment. This has been implemented on some roads. Project is on-going, albeit at slow pace, and further progress is not known.

6.3 Proposed Projects by Various Agencies

It is a common practice in Pakistan that numerous projects are proposed and executed, without feasibility studies, and are implemented on ad-hoc basis. Brief list of the projects categorized by proposing agency is given in Table 6.3.1. Outline of some projects is also provided.

Table 6.3.1 List of Proposed Projects – A Summary

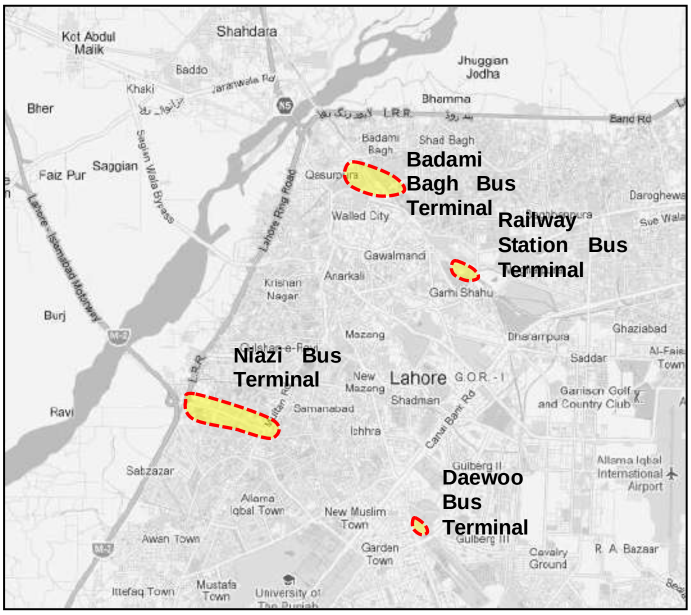
No.	Project Description (the Study Area Only)	Proposing Agency
1	Establishment of Centralized Drivers Licensing Authority	TD
2	Computerization of Transport Department under Motor Transport Management and Information System (MTMIS)	TD
3	Up-grading of 'D-Class' Bus Stands	TD
4	Effective and Efficient School Bus Service	TD and ED
5	Suburban Railway System	LTC
6	Integrated Bus Operation	LTC
7	Traffic Education and Travel Behavior	Traffic Police
8	Traffic Management Plan of City	Traffic Police
9	Two Major Housing Scheme on Ferozepur Road and Raiwind Road	LDA
10	Relocation of Proposed Lahore-Sialkot Motorway Alignment	Urban Unit
11	Institutional Development of Lahore Metropolitan Traffic and Transport Authority	Urban Unit
12	Establishment of Multimodal Truck Terminal in Sheikhupura	CDGS
13	Establishment of Multimodal Bus Terminal in Sheikhupura	CDGS

Source: JICA Study Team

6.3.1 Multimodal Inter-City Bus Terminals in Lahore

Lahore has two general bus stands under operation of City District Government of Lahore (CDGL), and eleven private inter-city bus terminals these locations are shown in Figure 6.3.1.

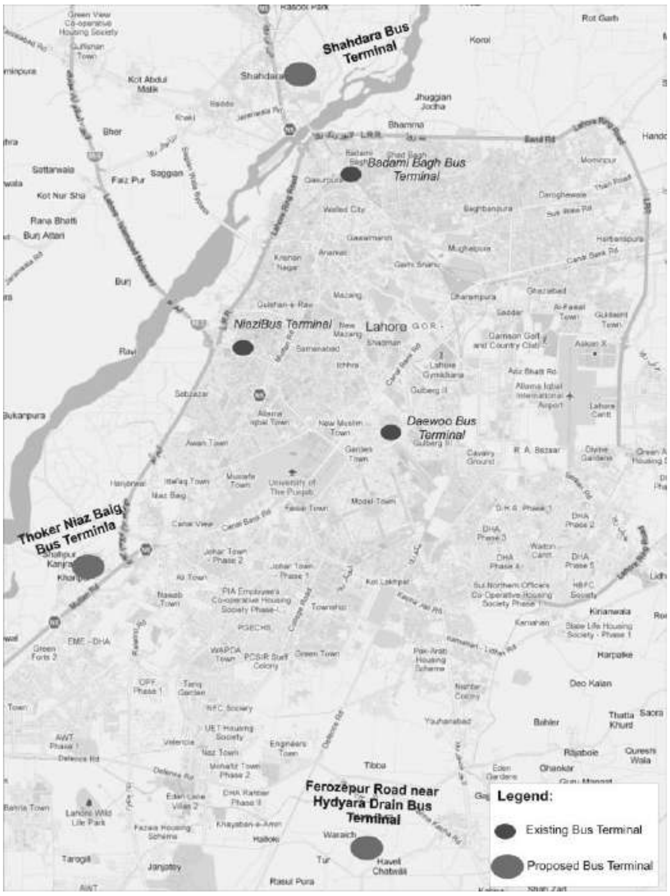
Figure 6.3.1 Locations of Bus Terminals in Lahore



Source: JICA Study Team

Transport Department intends to shift existing bus terminals to outskirts of the city which also includes shift of major bus terminal of Badami Bagh on PPP basis to locations as shown in Figure 6.3.2. It is understood that a feasibility study has or would be commissioned to finalize the project. No further details are available.

Figure 6.3.2 Proposed Location of Outskirt City Bus Terminals



Source: JICA Study Team

6.3.2 Vehicle Inspection and Certification System (VICS)

Transport Department has visual vehicle inspection system; which is mandatory for all kind of public service vehicles. Each vehicle is issued vehicle fitness certificate before allotting the route permit to ply on the inter-city or intra-city routes. Enforcement is done in Lahore by Motor Vehicle Examiners (MVOs). Project was advertised for hiring of Transaction Advisor through IPDF; no further details are available.

6.3.3 Parking Management Company

There are only three off-street parking plazas controlled by TEPA with a capacity of about 750 vehicles; CDGL is managing 72 mix, both motorcycles and cars parking stands through their town administrations along 32 major roads; which are not sufficient for the current parking demand.

To resolve these problems; TEPA proposed to either do capacity development of the CDGL or create parking management cell in TEPA or create another company similar to Lahore Transport Company. The Parking Company will be seeded through GoPb and later would generate its own funds for company expenditures and development of parking facilities in Lahore. Further details on the progress of this project are not evident.

6.3.4 Sub-urban Railway System

Lahore Transport Company envisioning that growing demand cannot be met only through BRT in the city as there is high daily inflow of passengers from Kasur, Sheikhupura, Raiwind, and Gujranwala. This justifies the need of alternate mode which should cater sub-urban demand efficiently. No further details are available on the progress of this project.

6.3.5 Institutional Development of LTTA

The Urban Unit through Ferozepur Road pilot project is proposing an institutional improvement to develop a Lahore Traffic and Transport Authority. The Urban Unit has defined its functions, further work is on-going, and realization timeframe is not clear.

6.3.6 Improvement of 52 Junctions in Lahore

TEPA intends to improve a number (about 52) of important road junctions/ interchanges along important corridors to improve the traffic flow in the city. No detailed plans or schedule of implementation was available.

Volume-I – Chapter-7

MASTER PLAN 2030

FINAL REPORT

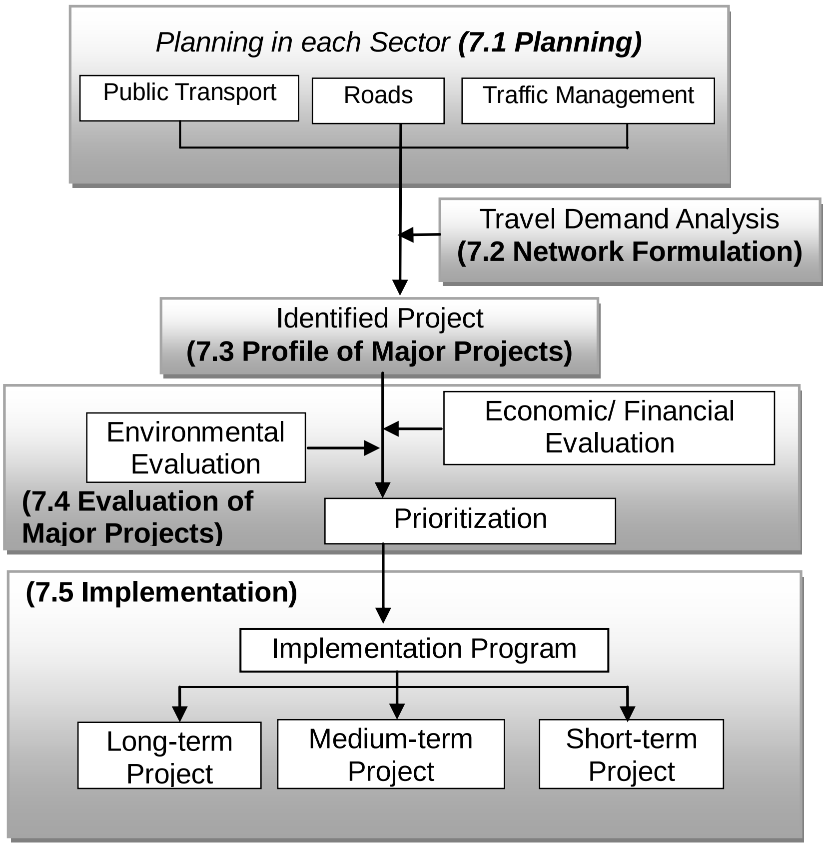
7. MASTER PLAN 2030

Development Procedure for the Master Plan 2030

The development of the Lahore Urban Transport Master Plan (LUTMP) adopted the following methodology as outlined in Figure 7.1.

1. List the projects in each sub-sector planning.
2. Analyze future traffic demand by comparing with the network capacity.
3. Conduct economic evaluation for physical projects and prioritize projects by economic, financial and operational performance.
4. Conduct a preliminary environmental assessment of each project and consider countermeasures against environmental issues, if any.
5. Prioritize all projects by examining their respective characteristics from different perspectives by Multi-Criteria Assessment (MCA) process.
6. Classify the projects into three categories: 'short', 'medium' and 'long' term according to when it needs to be implemented.
7. Prepare action plan 2020 for short and medium term projects, which is presented in Chapter 8.

Figure 7.1 Development Procedure of Master Plan 2030



Source: JICA Study Team

7.1 Transport Network Planning

7.1.1 Public Transport Network Development

1) Rail Based Mass Transit System (RMTS)

For the development of rail based mass transit system, the Study follows basically the concept and results of the recently conducted LRMTSS studies from 2005 to 2008 by MVA Asia Ltd. and SYSTRA France. The project is expected to be completed by 2025. In the first phase, two medium capacity rail based mass transit lines will be constructed; i.e. Green Line (GL) and Orange Line (OL). In the second phase, another two medium capacity lines will be completed; i.e. Blue Line (BL) and Purple Line.

However, due to low ridership estimate as detailed in Chapter 4 of this report, Purple Line has been downgraded to be a BRT Line in the Study. In other words, Lahore will have three RMTS lines by 2030. However, this may require further review, in about a decade.

2) Bus Rapid Transit (BRT)

<u>BRT Network Potential in Lahore</u>

Presently there are many adverse impacts from the intercity bus terminal located at Badami Bagh including local pollution and road congestion and the amount of intercity bus traffic across the Ravi Bridge. Removing the bus terminal to a location north of the River Ravi (*presently earmarked RMTS depot and an integrated bus terminal*) and connecting this Bus Stand via RMTS and BRT systems across the Ravi Bridge will significantly reduce bridge traffic and the traffic impacts around the walled city. RMTS and BRT will offer a high level of connectivity to the northern bus terminal as well as increasing the passenger capacity of the Ravi Bridge which presently acts as a severe bottleneck.

Once the Intercity bus terminal is moved north of the bridge, it is connected to the city via LRMTS (Green Line) and BRT across the Ravi Bridge. These mass transit links would be able to carry up to 40,000 passengers per hour per direction which represents a capacity increase equal to building 3 new bridges. To improve traffic management further, (and encourage less car usage across the Ravi) the present tolling gates can apply a road user charge on all crossing traffic, with this charge being set at a value which will encourage use of the RMTS and BRT. Motorcycles and rickshaws can be banned from the Ravi Bridge and be diverted to the Old Ravi Bridge after structural improvements with additional lane for BRT. The outcome would be that the Ravi will be utilized to their full capacity with a very low investment.

The proposed BRT network should be designed to offer good connectivity by linking mass transit systems and overlapping routes so that passengers could transfer at any station across the platform serviced by multiple routes. Integrated ticketing allows at/ across the platform transfer on the paid side without any ticket processing.

It is considered that due to passenger demand, availability of Right of Way and traffic conditions, along all main arterial bus routes in Lahore can be operated as a BRT, simply because there are no other ways to guarantee efficient bus speeds to make bus operations financially viable. However, due to budgetary constraints, all possible routes cannot be proposed in this study. High demand corridors will be selected taking into account the integration with the proposed RMTS lines. The BRTs would be built so that passengers can immediately access a trunk mass transit network and maximum early impact is gained.

Another important point is that BRT could be operated even in the corridor where RMTS is planned, if there is a time of at least 10 years before it is replaced by RMTS. In the severe lack of funding, BRT option should be considered as realistic, and safe in the sense that it remains as a trunk public transport system when RMTS is found to be un-implementable.

3) Projects for LUTMP 2030 Master Plan

(i) Committed Projects

The committed public transport projects, which are confirmed with the counterpart agencies are included in the Master Plan and are listed in Table 7.1.1.

Table 7.1.1 Public Transport Committed Projects

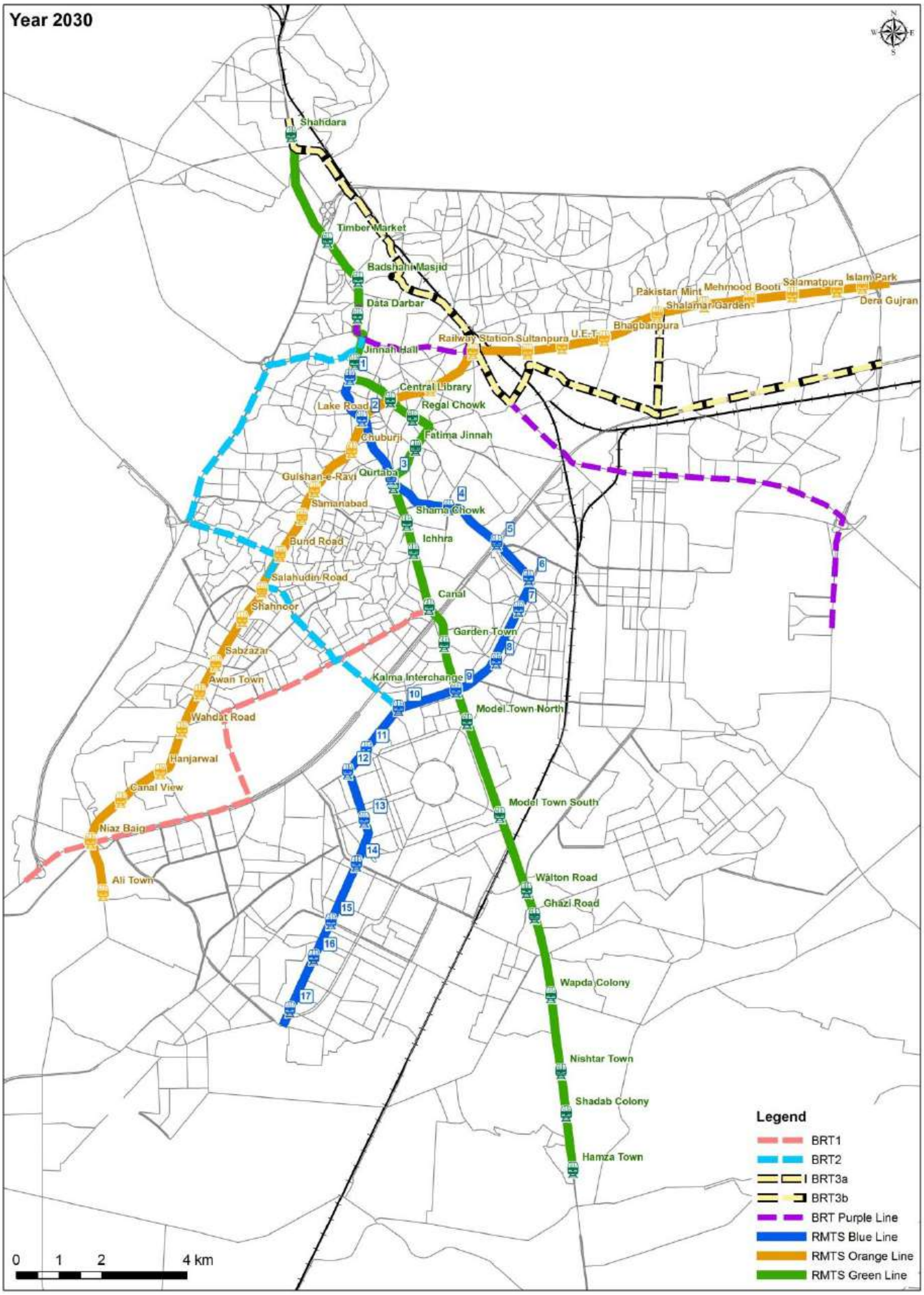
Project No.	Project Code	Project Name
PT01	C.1	Multimodal Inter-City Bus Terminals in Lahore
PT02	C.2	Effective and Efficient School Bus System
PT03	C.3	Up-grading of Bus Stands
PT04	C.4	Integrated Bus Operation
PT05	C.5	Establishment of Multimodal Bus Terminal at Shahdara

Source: JICA Study Team

(ii) RMTS/ BRT Network

The proposed RMTS/ BRT network for 2030 is presented in Figure 7.1.1. Note that some of the RMTS lines will be proposed as BRT to be operational before 2020.

Figure 7.1.1 LUTMP RMTS/ BRT Network 2030



Source: JICA Study Team

(iii) RMTS/ BRT Projects

Based on the result of travel demand forecast for 2020 and 2030, eight candidate projects were identified as RMTS/ BRT system to be included in the Master Plan. The project summary is given in the following Tables 7.1.2 and 7.1.3.

Table 7.1.2 RMTS Projects for Master Plan

Project No.	Project Code	Project Name	Alignment Description	Length (km)
PT06	**RMS1**	**Green Line**	Ferozepur Road/ Mall Road/ Ravi Road/ Shahdara	27.0
PT07	**RMS2**	**Orange Line (Initially BRT)**	Raiwind Road/ Multan Road/ Macleod Road/ Railway Station/ G.T. Road	27.1
PT08	**RMS3**	**Blue Line (Initially BRT)**	Township/ Gulberg Boulevard/ Jail Road	24.0

Source: JICA Study Team

Table 7.1.3 BRT Projects for Master Plan

Project No.	Project Code	Project Name	Alignment Description	Length (km)
PT09	**BRT1**	**Purple Line**	Bhatti Gate/ Allama Iqbal Road/ Airport	19.0
PT10	**BRT2**	**BRT Line 1** (Thokar to Muslim Town)	Multan Road/ Canal Bank Road/ University Road and terminates at Wahdat Road before Ferozepur Road and Green Line Station	14.1
PT11	**BRT3**	**BRT Line 2** (Barkat Market to Bhatti Chowk)	Khayaban-e-Jamia Punjab Road/ Maulana Sarfraz Naemi Road/ Multan Road/ Bund Road West/ Lahore Ring Road/ Outfall and terminates at Bhatti Chowk	14.3
PT12	**BRT4**	**BRT Line 3a** (Shalamar to Shahdara)	Shalamar Link Road/ Workshop Road/ Ghari Shahu/ Allama Iqbal Road/ Circular Road/ Badami Bagh and terminates at Shahdara across Ravi River and Green Line Terminal	15.7
PT13	**BRT5**	**BRT Line 3b** (Harbanspura to Shahdara)	Canal Bank Road/ Workshop Road/ Ghari Shahu/ Allama Iqbal Road/ Circular Road/ Badami Bagh and terminates at Shahdara across Ravi River and Green Line Terminal	19.1

Source: JICA Study Team

(iv) Cost Estimate

<u>RMTS Project Costs</u>

RMTS project costs were estimated based on the unit costs of the Reference Design Study Report of Green Line and the Feasibility Study of the Orange Line. The following table gives the estimated costs for each project in USD at 2010 prices. The rolling stock cost is included in the capital cost.

Table 7.1.4 RMTS Project Costs

Project No.	Project Name	Capital Cost (USD million)	Capital Cost (/km) (USD million)	Annual O&M Cost (USD million)
PT06	Green Line	2,583.0	96.7	32.8
PT07	Orange Line	2,330.0	86.0	32.1
PT08	Blue Line	1,908.0	79.5	26.1

Source: JICA Study Team

BRT Capital Cost Estimates

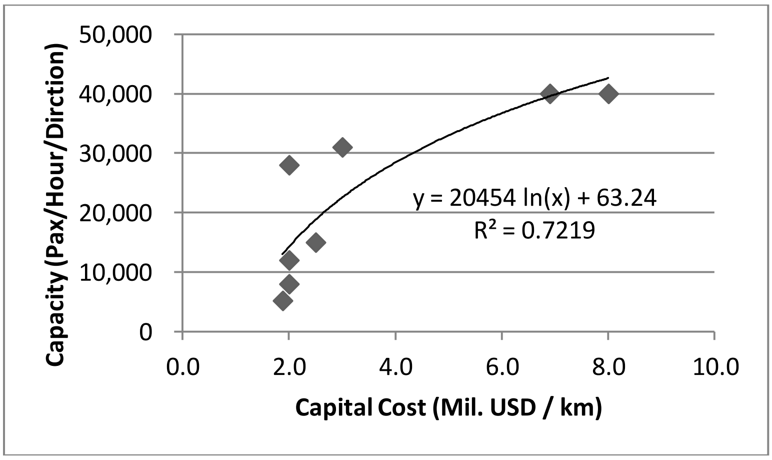
The following table compares construction cost of selected BRT projects in the world. BRT construction cost ranges from USD 2.0 to 8.0 million /km in other cities of the world. The unit cost of BRT seems to depend on its capacity. The relationship between capital cost and capacity of BRT project is shown in Figure 7.1.2 and outlined in Table 7.1.5. In this study, the BRT construction cost was estimated using this relationship between future demand and BRT costs.

Table 7.1.5 BRT Project Cost and Its Capacity

BRT System	Capital Cost /km (USD million)	Actual Capacity (Pax /hour /direction)
Bogota Trans Milenio	8.0	35,000-45,000
Bogota Trans Milenio (Phase I)	6.9	35,000-45,000
Sao Paulo Busways	3.0	27,000-35,000
Porto Alegre Busways	2.0	28,000
Curitiba Busways	2.5	15,000
Quito Bus Rapid Transit	2.0	9,000-15,000
Trans Jakarta	2.0	8,000
Hyderabad (Plan)	1.14	5,200
Hyderabad (Plan) Inc. Bus Fleet	1.88	-
Cavite Busways (Bus Lane Only)	4.1	-

Source: JICA Study Team and Hyderabad BRT - Feasibility Study ITDP (Institute for Transportation and Development Policy), excluding Bus Fleet.

Figure 7.1.2 Relationship between Capital Cost and Capacity of BRT Project



Source: JICA Study Team

O&M and Rolling Stock Costs for BRT Projects

O&M Cost: O&M cost is comprised of road maintenance cost and bus operation cost.

- Road Maintenance Cost: 1.0 % a year of the Capital Cost as Road Maintenance
- Bus Operation Cost = (No. of Bus Fleet)*(No. of Bus Trip)*VOC*Length (km))
  - VOC of Bus Fleet is assumed at PKR 105.04 /km.
  - PKR 105.04/ km is of a large Bus at an average speed of 30km per hour.

Rolling Stock (Bus Fleet) Cost: Rolling stock cost is assumed based on the following formula.

- Rolling Stock Cost = (Number of Required Bus Fleet)*(Price of Bus Fleet)
  - Standard Bus: PKR 6.2 Million (45 Seats and 75-Pax Capacity)

Cost Estimate of BRT Projects

The following table summarizes BRT cost by LUTMP project.

Table 7.1.6 Summary of BRT Cost for LUTMP Project

Project No.	Project Name	Length (km)	Capital Cost (USD million)		Annual O&M (USD million)		Cost of Bus Fleet Upgrade in 2030 (USD million)
			Construction Cost	Bus Fleet Cost	2020	2030	
PT07	Orange Line (Initially BRT)	27.1	54.2	20.2	38.1	*RMTS*	*Not Applicable*
PT08	Blue Line (Initially BRT)	24.0	48.0	10.6	20.2	*RMTS*	*Not Applicable*
PT09	BRT Purple Line	19.0	38.0	2.8	5.5	10.7	6.7
PT10	BRT Line 1	14.1	28.2	2.5	5.0	14.9	9.5
PT11	BRT Line 2	14.3	28.6	1.8	3.7	8.4	5.2
PT12	BRT Line 3a	15.7	24.6	4.1	8.0	8.4	5.4
PT13	BRT Line 3b	19.1	31.2	4.1	8.0	9.4	5.9
Total		**133.3**	**252.8**	**46.4**	**88.6**	**52.0**	**32.7**

Source: JICA Study Team

7.1.2 Highway Network Development

Lahore is bounded on the north and west by the Sheikhupura District, on the east by India and on the south by Kasur District. The Ravi River flows on the north-western side of Lahore, and it covers a total land area of 404 km^2. Lahore is the capital of the Punjab Province and the second largest city of Pakistan. The city is situated approximately 25 km from Wahgah, India border crossing. Major national road links are Motorway (M-2), National Highway N-5 (G.T. Road and Multan Road), Sheikhupura Road to the west and Ferozepur Road along with Raiwind Road to the south. Main functions of the hierarchal road transport corridor are as follows.

Functional Classification of Urban Roads

Planning of urban roads must be done with due consideration to a hierarchy of network connectivity with different level and function of roads. Urban roads in the Study Area must consider adequate connectivity with national/ regional transport network including motorways, trunk roads, and facilities like bus termini, freight centres, railway stations and international airport.

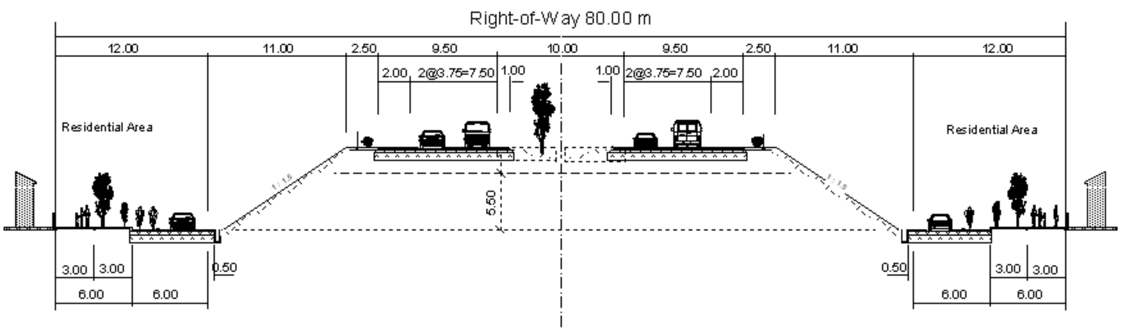
Inter provincial/ national roads in the Study Area will be developed in a way that they will not pass through urban areas to avoid conflicts and mix with urban traffic. Proper design standards will be adopted for the intersections of urban roads. To develop a proper road network, a systematic and hierarchical functional classification is necessary. The function of hierarchical classification is comprised of motorways, national roads (trunk system), urban primary, secondary, and local roads.

(i) Motorway and Trunk Road System:

Motorway and Trunk Road (Lahore Ring Road – LRR) has a function for long distance transport at higher operating speed. At some sections of LRR traffic accidents have happened. The main cause of these accidents is different running speed of traffic modes using the LRR. One should select the road design speed according to the vehicle mix likely to use the road.

It is proposed that an embankment type road structure, and service roads along the embankment. The service road is for residential/ adjacent commercial access. Service roads will be designed for broth local motorized traffic as well as pedestrian movement. This concept is shown in a typical cross-section in Figure 7.1.3.

Figure 7.1.3 Proposed Typical Cross Section for Motorway

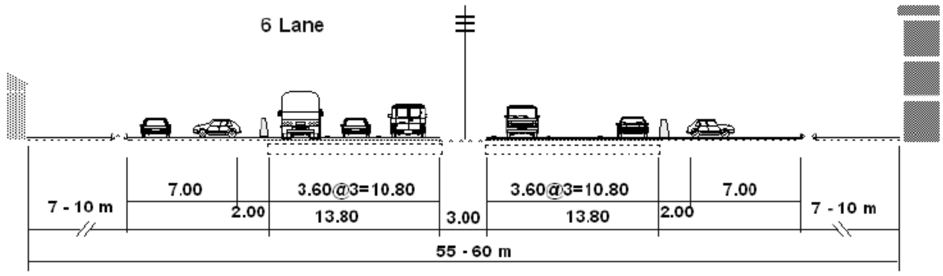


Source: JICA Study Team

(ii) Urban Primary Road System:

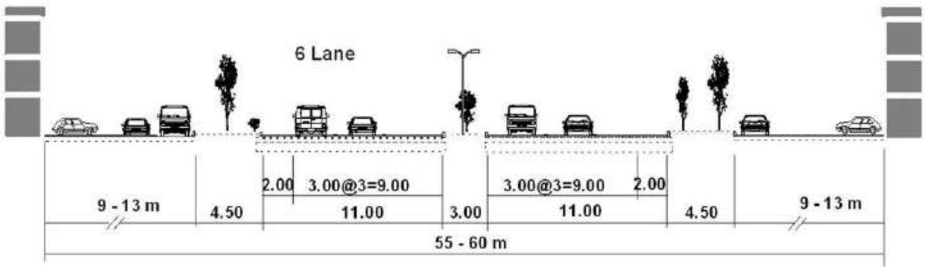
The urban primary road system serves the major percentage of trips entering and leaving urban areas as well as some of the through travel that wants to bypass the city. In addition, significant intra-urban travel, such as between CBDs and outlying residential areas, between major sub-urban centres, are served by these primary urban roads. For the proposed road network, the urban primary roads have two functions: the primary system formed the significant framework linking up with the regional trunk road network, and also primary with the secondary road network. Typical cross sections for Trunk/ National and Primary roads are depicted in Figures 7.1.4 and 7.1.5 respectively.

Figure 7.1.4 Proposed Typical Cross Section for National Road/ Trunk Road



Source: JICA Study Team

Figure 7.1.5 Proposed Typical Cross Section for Urban Primary Road

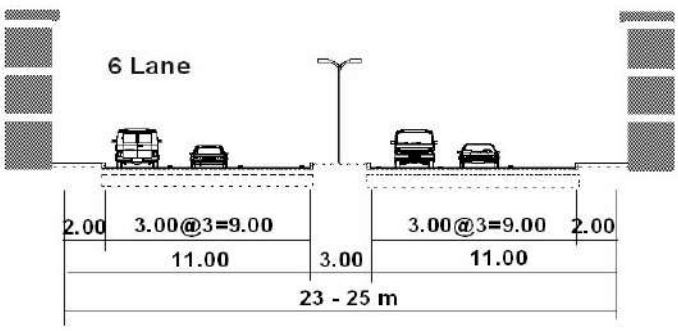


Source: JICA Study Team

(iii) Urban Secondary Road System:

The urban secondary road system interconnects with local roads and augments the urban primary road system. It provides travel with moderate trip lengths at a somewhat lower level of travel speed than primary roads. Urban secondary road typical cross-section is illustrated in Figure 7.1.6.

Figure 7.1.6 Proposed Typical Cross Section for Urban Secondary Road

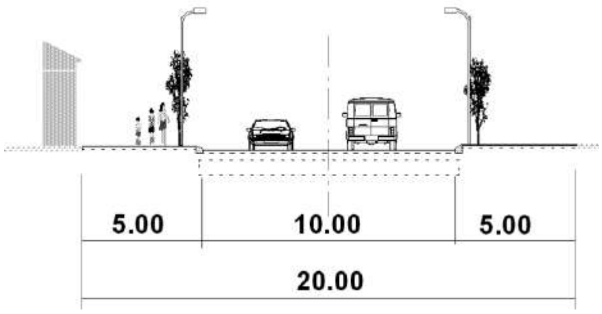


Source: JICA Study Team

(iv) Urban Tertiary Road System (Local/ Access/ Service Roads):

The urban local road system aims to provide access to areas located along the roads and to serve not only vehicular traffic but also for cyclist and pedestrians as well as roadside access activities. Some urban streets that have commercial frontage serve fairly substantial volumes of traffic. A typical cross-section is illustrated in Figure 7.1.7.

Figure 7.1.7 Proposed Typical Cross Section for Urban Tertiary Roads



Source: JICA Study Team (Length in m)

2) Design Standards

(i) Design Standard

“A Policy on Geometric Design of Highways and Streets” published by AASHTO that has been widely referred to in the preparation of the geometric design standards in many countries.

(ii) Design Speed

Design speed is the maximum speed for safe travel that can be maintained for a specified section of a road in a free flow condition, and it is determined with respect to the terrain, adjacent land use, type of road, and the design speed of merging/ diverging sections. The design speed will directly affect many geometric elements, like the horizontal and vertical alignments, sight distances, and provision of super elevation. Other features, such as lane width and shoulder width are also influenced by the design speed, as shown schematically in Figure 7.1.8.

Figure 7.1.8 Design Speed by Road Category

	Category or Class	Design Speed (km/h) 20	40	60	80	100	120
Inter-city Roads	Motorway				←	⟷	→
	Trunk Road (National Road)			← →			
Urban Roads	Primary Urban		← →				
	Secondary Urban		⟷				

Source: JICA Study Team

(iii) Cross Section Design

Cross-section elements should be based on AASHTO standards, as shown above in Figures 7.1.3 to 7.1.7.

(iv) Intersections and Interchanges

When two intersecting roads each have four or more lanes, excluding the turning lane and the speed change lane, the intersection may be grade-separated, except where the traffic volume on the intersection, traffic safety condition, road network composition, interval between intersections, and topography allow an at-grade intersection. In selecting the appropriate type of intersection, both traffic operation and economic aspects are to be considered. The road network's hierarchy should also be taken into account in accordance with a road's traffic capability and accessibility as summarized in Table 7.1.7.

Table 7.1.7 Types of Interchanges and Junctions

Intersecting Roads	Normal Arrangement
1. Motorway and Motorway	Grade separated interchanges in all cases.
2. Trunk and Primary	Interchanges, except when interchange spacing is too close.
3. Primary and Primary	Grade separations or at Grade, Evaluate each case
4. Primary and Secondary/ Secondary and Secondary	Intersections, but grade separation may be justified in the case of capacity limitation, serious delays, injury, high fatality rate and low cost.

Source: JICA Study Team

(v) Road Density

Road density is a key index of the road network's appropriateness for keeping a balance with land-use activity and intensity. Target road densities corresponding to types of land use have been introduced in various design manuals and are summarized in 7.1.8.

Table 7.1.8 Example of Target Road Density in Urban Area

Land Use	Target Road Density (km /km^2)
Residential	4
Commercial	6
Semi-Industrial/ Mixed	2
Industrial	1

Source: Ministry of Land, Infrastructure and Transport, Japan

(vi) Road and Facility Maintenance

Urban Primary road and Secondary road also require suitable and sustainable maintenance management and program. These include traffic control, traffic information and emergency services, processing of traffic accidents. Routine and periodic maintenance work is important. Maintenance works are classified into three types: routine, periodic and emergency. Routine maintenance is based on routine (daily) inspection of the condition of pavement, cut and fill slopes, drainage, bridges and other structures and facilities to monitor any defects and damage. The results of routine inspection will be promptly reported to the maintenance office for follow-up maintenance works to be undertaken either continually throughout the year or at certain intervals.

Periodic maintenance is based on detailed inspection performed at certain time intervals such as seasonally or yearly depending on the type and kind of facility. It includes checking and testing the conditions of various structures and facilities. Defects and damage will be reported for repairs or remedies.

Emergency maintenance basically comprises works to restore road and road related facilities to their normal operating conditions after they are damaged by road accidents or natural calamities. It is impossible to foresee the frequency, but such maintenance requires immediate action.

3) LUTMP Road Projects for 2030 Master Plan

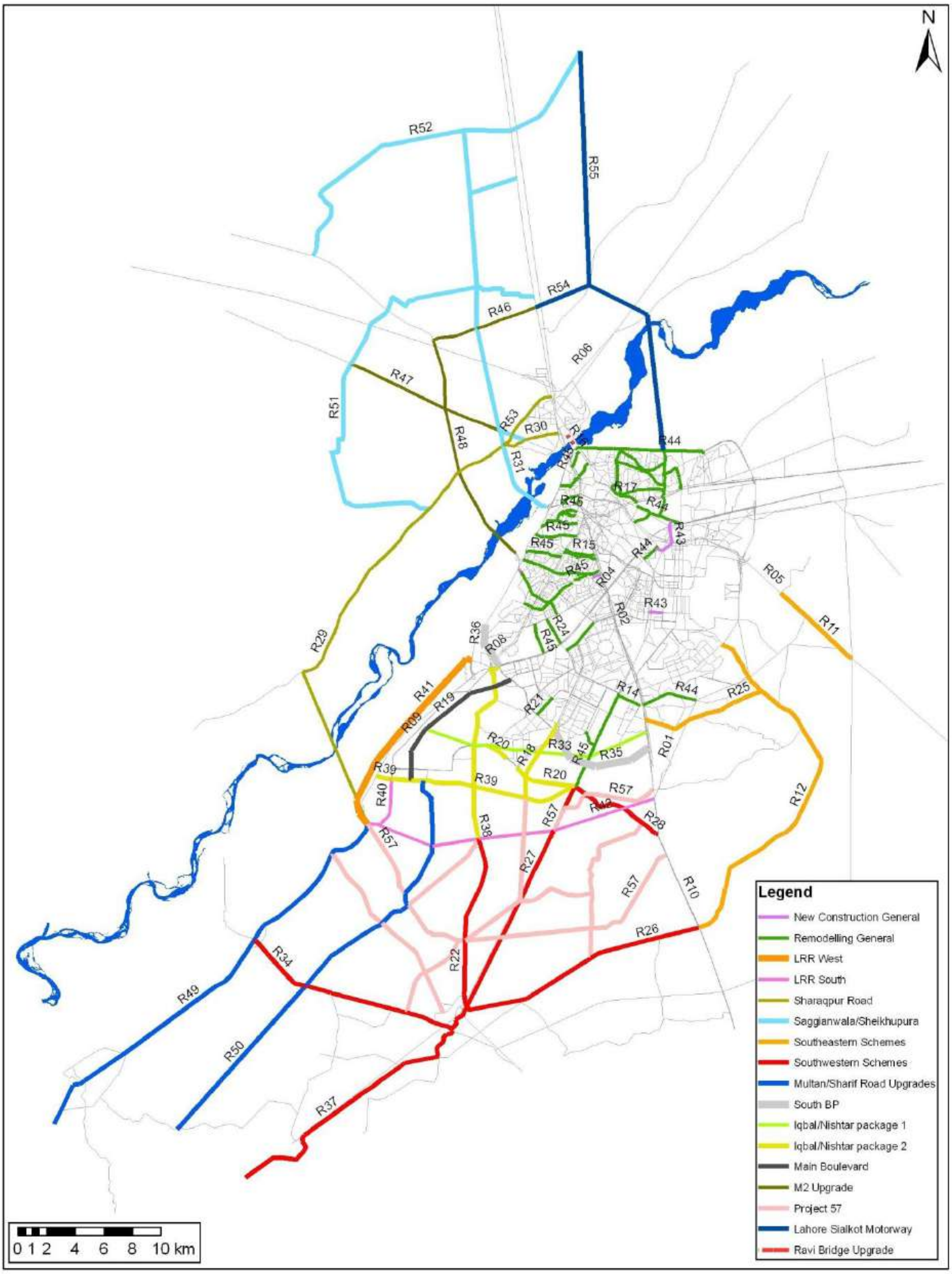
The road sub-sector projects are depicted in Figure 7.1.9 and details are provided in Section 7.3.2. However, the committed road projects, which are either completed or scheduled to be completed in the near future (2012/ 2013) are listed in Table 7.1.9. Further details of these road projects are illustrated in ***Volume-I, Annex-I***.

Table 7.1.9 List of LUTMP Committed Road Projects

Project No. (Code)	Project Description	Length (km)	Lanes	Implementation	Status/ Completion
R01 (12001)	Construction of LRR (Airport – Ferozepur Road)	13.3	D-3 and Service Road. D-2 or D-3	C&W	On-Going/ 2012-13
R02 (12002)	Construction of Kalma Chowk Flyover	3.4	D-3	C&W	Completed 2011
R03 (12003)	Construction of Canal Bank Road Flyover along Ferozepur Road	3.3	D-3	C&W	On-Going/ 2012
R04 (12004)	Remodeling of Canal Bank Road	15.6	D-3	TEPA	Completed 2012
R05 (12005)	Remodeling of Barki Road (LRR – Green City)	3.6	D-3	C&W	Completed 2012
R06 (12006)	Remodeling of Kala Khatai Road	26.9	D-2	C&W	On-Going/ 2012
R07 (12007)	Remodeling of Allama Iqbal Road	3.3	D-3	C&W	On-Going/ 2012
R08 (12008)	Remodeling of Multan Road	11.3	D-3	C&W	Completed 2011
R09 (12009)	Remodeling of Thokar Niaz Baig Road (Thokar – Defence Road)	11.0	D-3	C&W	Completed 2012
R10 (12010)	Remodeling of Ferozepur Road (Lahore Bridge – Mustafa Abad)	23.6	D-3	C&W	Completed 2012

Source: JICA Study Team

Figure 7.1.9 Proposed Road Network by 2030



Note: Further details of these road projects are illustrated in ***Volume-I, Annex-I***.
Source: JICA Study Team

7.1.3 Study Area Traffic Management

1) Examination of Typical Traffic Management Projects

The typical traffic management projects for the Master Plan 2030 were, identified and developed under the following six (a–f) broad categories. These categories may be described as follows:

(a) **Road Network Operational Efficiency Improvement:** Remove bottlenecks and provide safe traffic flow on Secondary Road network in urban areas, where traffic congestion would be getting seriously deteriorated.

(b) **Parking and Pedestrian Environment in Urban Centre:** To provide an environment of "Park and Walk" by eliminating illegal parking, in coordination with new off-street parking facilities.

(c) **TDM and Priority for Public Transport:** To enhance effective usage of the limited road capacity, by promoting public transport system, particularly new RMTS and BRT systems.

(d) **Road Function and Capacity Improvement Program:** In order to maximize the usage of the limited road space, it is important to define the traffic function of the network according to its designated hierarchy. Mix traffic and roadside activities cause traffic congestions and accident, and must be banned at least on all Trunk and Primary Roads, and must be limited on Secondary roads.

(e) **Traffic Safety Improvement:** Traffic accidents have become one of the serious social problems. More comprehensive measures shall be taken to minimise accidents.

(f) **Comprehensive Traffic Management Plan and Human Resource Development Program:** In order to implement complex traffic management, organizations involved shall improve their capacity and capability, enhanced under new institutional arrangements.

2) Traffic Management Projects for LUTMP Master Plan 2030

Transport related departments/ agencies of GoPb proposed many projects to do with effective traffic management in the city. Most of these projects will be funded by GoPb according to set priority; some of the major projects may be financed through Public Private Partnership (PPP) proposals. These committed traffic management related projects are an integral a part of the LUTMP 2030 Master Plan. Through the reviews of government plan and discussion with counterpart agencies, all committed projects were included and are listed in Table 7.1.10.

Table 7.1.10 Committed Projects included in LUTMP 2030 Master Plan

Project No.	Project Title	Schedule	Implementing Agency	Cost (USD million)	Funding Source
TM01	Establishment of Centralized Driver Licensing Authority	2012 – Onward	TD	N/A	GoPb.
TM02	Parking Management Company	2012 – Onward	TEPA	N/A	GoPb.
TM03	Traffic Education Center	2012 – Onward	Traffic Police	N/A	GoPb.
TM04	Traffic Control Plan of City	2012 – Onward	Traffic Police	N/A	GoPb.
TM05	Vehicle Inspection and Certification System (VICS)	2012 – Onward	TD	N/A	GoPb. / PPP
TM06	Construction of New Parking Plazas	2012 – Onward	TEPA	207.1	GoPb. / PPP
TM07	Construction of Pedestrian Bridges	2012 – Onward	TEPA	1.8	GoPb.
TM08	Improvement of 52 Junctions	2012 – Onward	TEPA	30.5	GoPb.
TM09	Ferozepur Road Pilot Project	2012 – Onward	TEPA	28.3	GoPb.
TM10	Conversion of Two Stroke Rickshaw into CNG Fitted Four Stroke Rickshaw	2012 – Onward	TD	12.4	GoPb.
TM11	Remodeling of Inner and Outer Circular Road	2012 – Onward	TEPA	14.1	GoPb.

Source: JICA Study Team

For the development of traffic management projects, the Study Area has been divided into six parts for the traffic management project identification purposes, due to differences in urban transport fabric and their local impact on the city's transport system. These areas are defined below and the location map is given in Figure 7.1.10.

a) **Lahore City:** All areas under the jurisdiction of Lahore City District Government (CDGL).

b) **Central Area:** Area under jurisdiction of CDGL within Lahore city.

c) **North of Ravi River:** Area north of Ravi River, part of Ravi Town and Sheikhupura Tehsil included in the Study Area

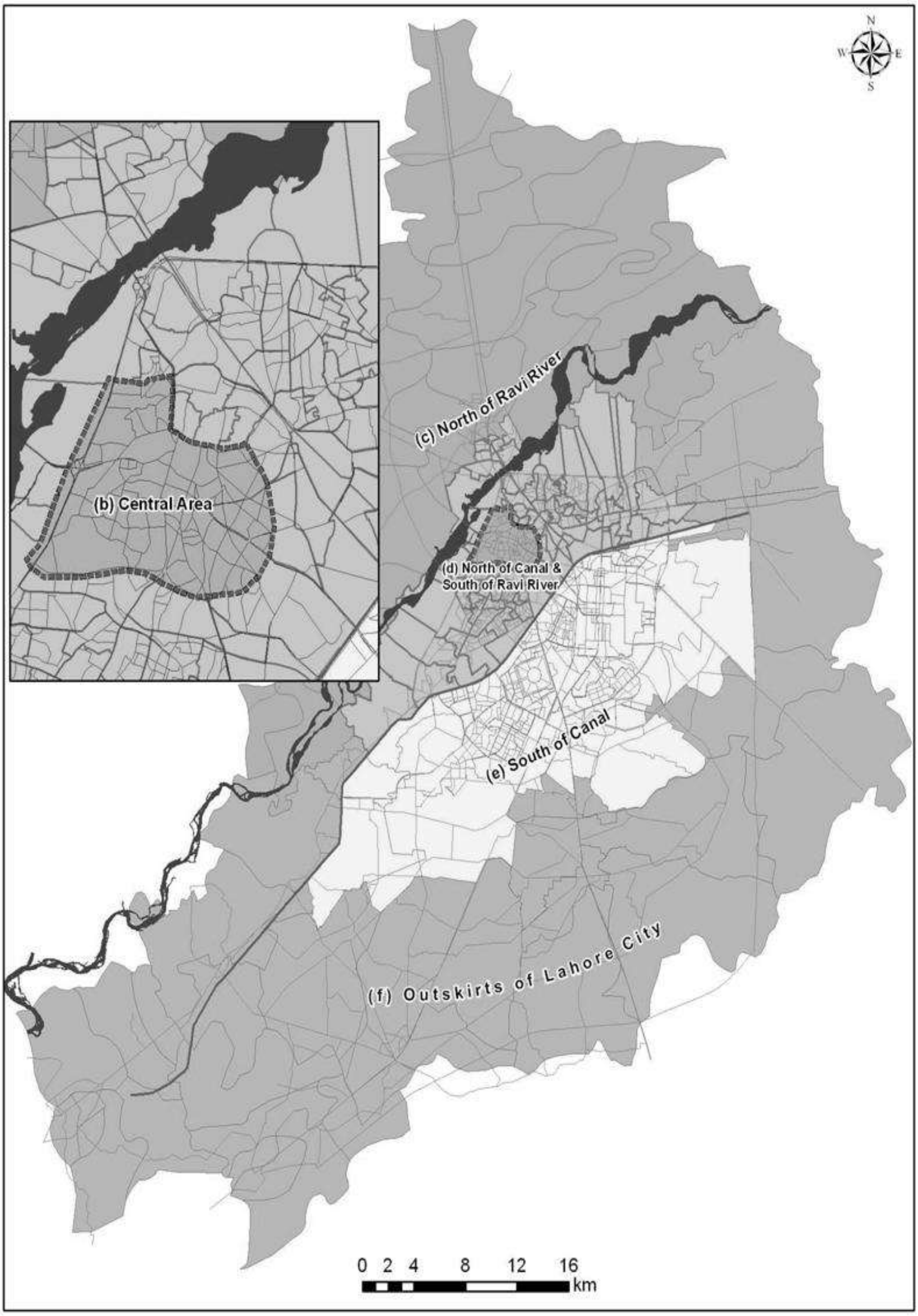
d) **North of Canal and South of Ravi River:** Area bounded between Canal Bank Road, Lahore Ring Road and part of M-2 Motorway up to Thokar Niaz-baig.

e) **South of Canal:** Whole area south of canal excluding outskirts and rural villages.

f) **Outskirts of Lahore City:** Area east of BRB Canal, south-east of DHA toward Bedian Road, Ferozepur Road, South of Defence Road, and along Multan Road towards west.

The traffic management projects identified, developed and studied for the LUTMP 2030 are listed in Table 7.1.11.

Figure 7.1.10 Traffic Management Project Areas



Source: JICA Study Team

Table 7.1.11 LUTMP 2030 Proposed Traffic Management Projects

Project No.	Project Title	Area (a-f) (Figure 7.1.10)	Cost (USD million)
A.	Road Network Operation		
TM12	A.1 Junction Design and Traffic Signal Improvement – CBD	**(b)**	4.0
TM13	A.2 Existing Junctions Design and Network Improvement	**(a)**	30.0
TM14	A.3 Road Function and Capacity Improvement Program	**(a)**	2.0
B.	Traffic Management		
TM15	B.1 Low Occupancy Vehicles Planning for Outskirt/ Rural Areas	**(f and c)**	5.0
TM16	B.2 Traffic Circulation System Design and Implementation	**(a)**	20.0
TM17	B.3 Public and Freight Transport Terminals	**(a and c)**	100.0
TM18	B.4 Linking Communities - Smart Roads	**(a)**	4.0
TM19	B.5 Feasibility Study for Traffic Demand Management Measures	**(a)**	2.5
TM20	B.6 RMTS and BRT Station Area Traffic Management	**(a)**	1.5
C.	Non-Motorized Traffic		
TM21	C.1 Planning and Design Study for Non-Motorized Traffic	**(d)**	1.5
TM22	C.2 Non-Motorized Traffic Facilities Implementation	**(d)**	6.0
TM23	C.3 Pedestrian and Bicycle Path Network	**(b and e)**	5.0
D.	Parking Management		
TM24	D.1 Comprehensive Parking System Development	**(d and e)**	2.5
TM25	D.2 Parking Facilities Implementation	**(d and e)**	60.0
TM26	D.3 Park and Ride Facilities Development	**(d and e)**	75.0
E.	Enforcement of Traffic Rules and Regulations		
TM27	E.1 Traffic Enforcement Strengthening Programme	**(a)**	3.0
F.	Traffic Safety		
TM28	F.1 Traffic Calming	**(e)**	6.0
TM29	F.2 Traffic Safety Education Improvement	**(a)**	1.0
G.	Intelligent Transportation System		
TM30	G.1 Intelligent Transportation System Development	**(a)**	38.0
H.	Standards and Guidelines		
TM31	H.1 Local Standards and Guidelines Development	**(a)**	1.5

Source: JICA Study Team

7.2 LUTMP 2030 Master Plan Network Formulation

7.2.1 Base Case Transport Network

1) Prevailing Conditions

Analysis of current transport supply and demand has been presented at various stages of the project and particularly in relation to travel demand forecast in Volume 1, Chapter 4. It has been established that the current network demand and supply situation is adequate, as it is generally perceived and as reported in the opinion surveys. The prime causes for poor network performance and traffic congestion is not due to lack of road space and capacity deficiencies but mostly due to local reasons, which could be summarised as:

- Bad traffic mix, particularly animal drawn carts, pedestrians, bus passengers and slow moving traffic – all in the same road space due to various reasons;
- Poor lane disciple and bad driving behaviour,
- Lack of understanding of traffic rules, particularly 'priority' ;
- Inefficient junction design – allowing fast merging traffic from the left; and lack of intersection control (police controlled traffic signals),
- Poorly and incorrectly laid out merges and diverges on primary and secondary roads;
- Interaction between traffic, pedestrians and frontage access; and
- Total lack of signage (even the limited signage is poorly planned, designed and located) and enforcement of traffic rules.

These comments are based on observations and also the result of several different types of surveys conducted by the Study.

2) Need for Road Network Hierarchy

Urban roads perform many functions besides providing passage for moving vehicles and pedestrians. These functions may be broadly classified as: environmental, access, local traffic and through traffic. Not all functions need to be performed by anyone road, but for purpose of planning and design, the function need to be recognised and appropriate design standards applied. When defining the function of road; assessment must be made of all the activities on and along the road. Therefore, when planning a road; a balance must be achieved between traffic capacity, operating speed, environment, safety and the convenience of road users including pedestrians. Therefore, the benefits to be achieved by classifying and managing road hierarchy could be summarised as:

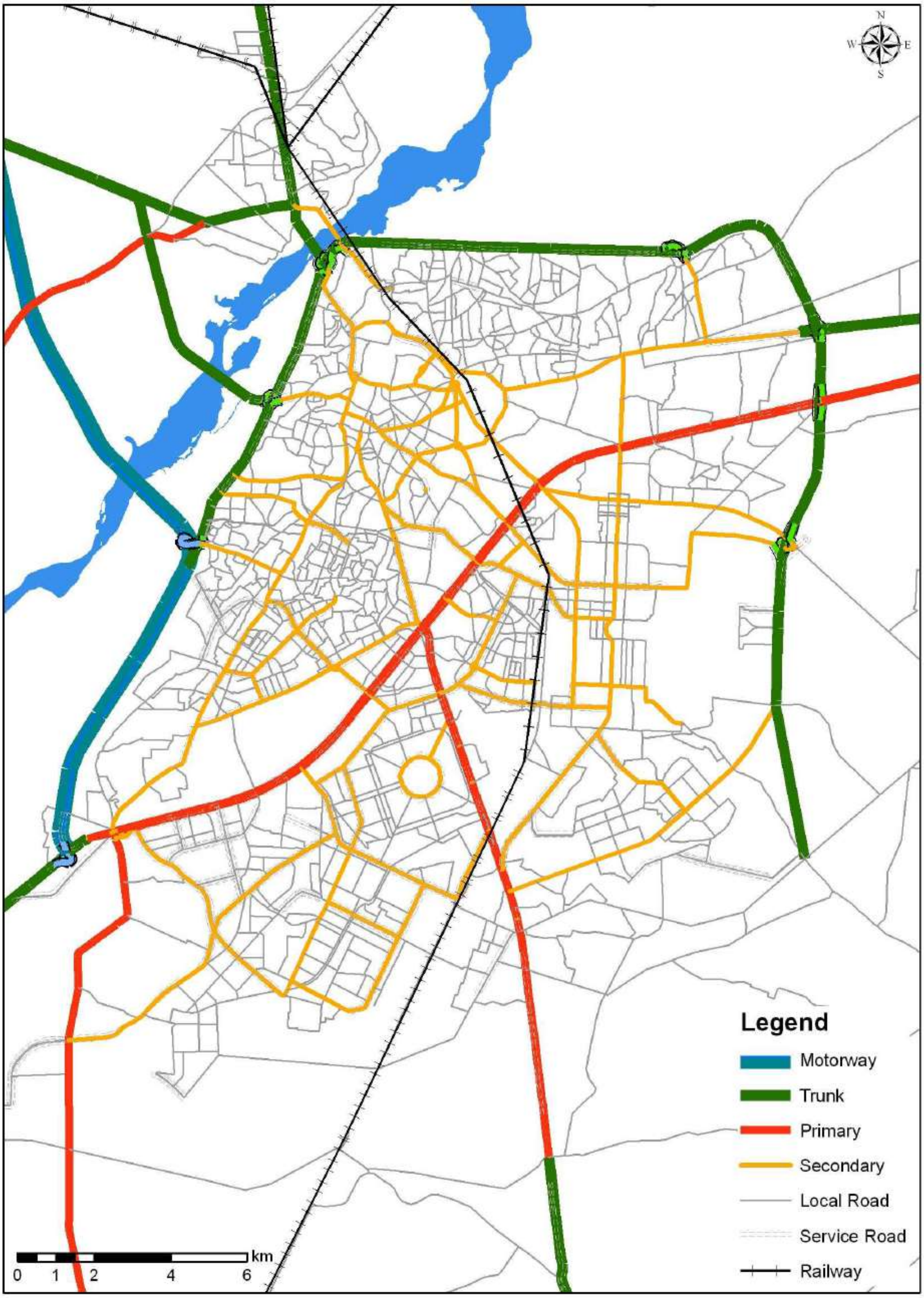
- When environment and access functions are given priority, activities related to building frontage may be allowed – ***Access/ Local roads/ Streets/ Service roads***
- Where traffic movement is given priority, activities incompatible with traffic flow may be restricted, provided the safety (pedestrian) is not compromised – ***Secondary/ Distribution roads***; and
- Capacity of roads could be immensely improved by segregating different types of traffic, and limiting access to adjoining roads, reducing the number of intersections and vehicular conflicts – ***Primary roads***
- In addition, Lahore has major intercity roads passing through or terminating on the outskirts. These roads have function of '***Trunk Roads***'; and the ***M-2 Motorway*** which links Lahore with the northern Punjab also performs the intercity linkage function.
- The road capacity in urban areas is more a function of junction design performance and control/ operation. This is essential in such that city needs all four types of roads, and the Motorways/ Trunk Roads for inter-city travel, and their connectivity through efficient junctions – ***that is what makes an efficient hierarchical road network.***

A road Hierarchy for Lahore was considered to be essential. Currently a number of radial primary routes provide access to Lahore from all directions with considerable capacity – even with excess capacity (e.g. current capacity of M-2 and LRR). Now that the LRR is a reality (after 20 years of its proposal), extending the primary network to the heart of the city is not essential. There is a need to strengthen the distribution network and access roads with clearly identified priorities. This is to ensure that there is adequate capacity to feed and distribute traffic to/ from the primary and higher level network to/ from the city. This is emphasized as essential for the road network to work in an integrated and efficient manner to provide reasonable speed for all long and short distance users. As a result the study approach was to define the existing (2010) road network hierarchy in the light of above criterion, based on surveyed information and best international practices. This hierarchy is illustrated in Figure 7.2.1 for the Study Area network.

3) Proposed Hierarchical Road Network and Current (2010) Performance

The current 2010 road network hierarchy as defined by the study is illustrated in Figure 7.2.1 and its characteristics under the current road traffic condition are summarised in Table 7.2.1. The Study Area road network as illustrated does have good road density, except in the inner city areas. The areas in the outskirts still rely mostly on a single road and basic low-grade street / rural unpaved roads (not in the LUTMP network) – such as GT Road to the east Barki Road and Bedian Road in the South-east. Similarly in the south-west and south the local and secondary road network is quite sparse and requires strengthening. On the other hand inner areas to the north of Railways and most of the western areas between Bund Road and major arterial roads lack well defined secondary/ distribution roads. Cantonment, DHA, Gulberg and Model Town areas are well laid out in terms of local and secondary road network.

Figure 7.2.1 Current (2010) Road Network Hierarchy



Source: JICA Study Team

Table 7.2.1 Current (2010) Road Network and Performance Indicators

Road Type	km	% of Network	Av. Speed (kph)	V/C Ratio	Network PCU*km (Daily)		Network PCU*Hrs (Daily)	
					('000)	%	('000)	%
Motorway	52	2%	59	0.67	2,049	11%	35	8%
Trunk	185	8%	47	0.55	5,635	31%	120	26%
Primary	127	5%	38	0.48	2,316	13%	61	13%
Secondary	212	9%	34	0.40	3,297	18%	98	21%
Local	1,818	76%	31	0.21	4,641	26%	149	32%
Total	**2,395**	**100%**	**39**	***0.37***	***17,938***	**100%**	**463**	**100%**

Source: JICA Study Team

The LUTMP hierarchically defined road network performance under the 2010 traffic situation is summarized in Table 7.2.1 and illustrated in Figure 7.2.2. The poorly planned network development is quite evident form the lower percentage of primary and secondary network in each category. Particularly secondary network is only 8% of the Study Area roads but carries 18 % of the PCU*kms and 21 % of the PCU*Hrs. Internationally there is no ideal split of road network by primary/ secondary and local roads. It depends on the form of the city, its geography (rivers etc.), and location relative to other regional centres. It can be seen that about 42 % of PCU*kms are on the motorway and trunk roads with only 10 % of the share of the network. This indicates considerable internal-external and through traffic demand on the Study Area network – requiring that due consideration be paid to the regional traffic within the Study Area.

The average daily travel speed by road type shows that most of the network operates at above 30kph. It should be noted that it is not peak period speed or by direction. The LUTMP model is strategic in nature and deals with average daily traffic volumes as 9% of the daily volumes. (Derived from cordon, screenline and traffic count surveys).

Figure 7.2.2 Current (2010) Road Network Performance

Source: JICA Study Team

4) 2020 and 2030 Road Network Performance and Capacity Deficiencies

The 2010 road network as discussed above was updated to include the following on-going schemes to represent the 'base case' network for future (2020 and 2030) demand assessment. These upgrades and new constructions include:

i. Completion of Kalma Chowk and Ferozepur Road Canal flyovers;

ii. Upgrade of Ferozepur-Kasur Road, Multan Road and Kala Khatai Road;

iii. Canal Bank Road widening, upgrade of Canal Bank Road beyond Thokar Niaz Baig; Barki Road; Allama Iqbal Road; and

iv. Completion of LRR from Bedian Road to Ferozepur Road.

These upgrades would increase the network length by about 17 km to 2,412 km, but would have limited impact on the overall network capacity and performance. The base case network is shown in Figure 7.2.3. The 2020 and 2030 (in both cases Scenario II) traffic volumes when assigned to the base case network, the results are shown in Figures 7.2.4 and 7.2.5 respectively and summarised in Table 7.2.2.

Table 7.2.2 Base Case Road Network Performance 2020 and 2030

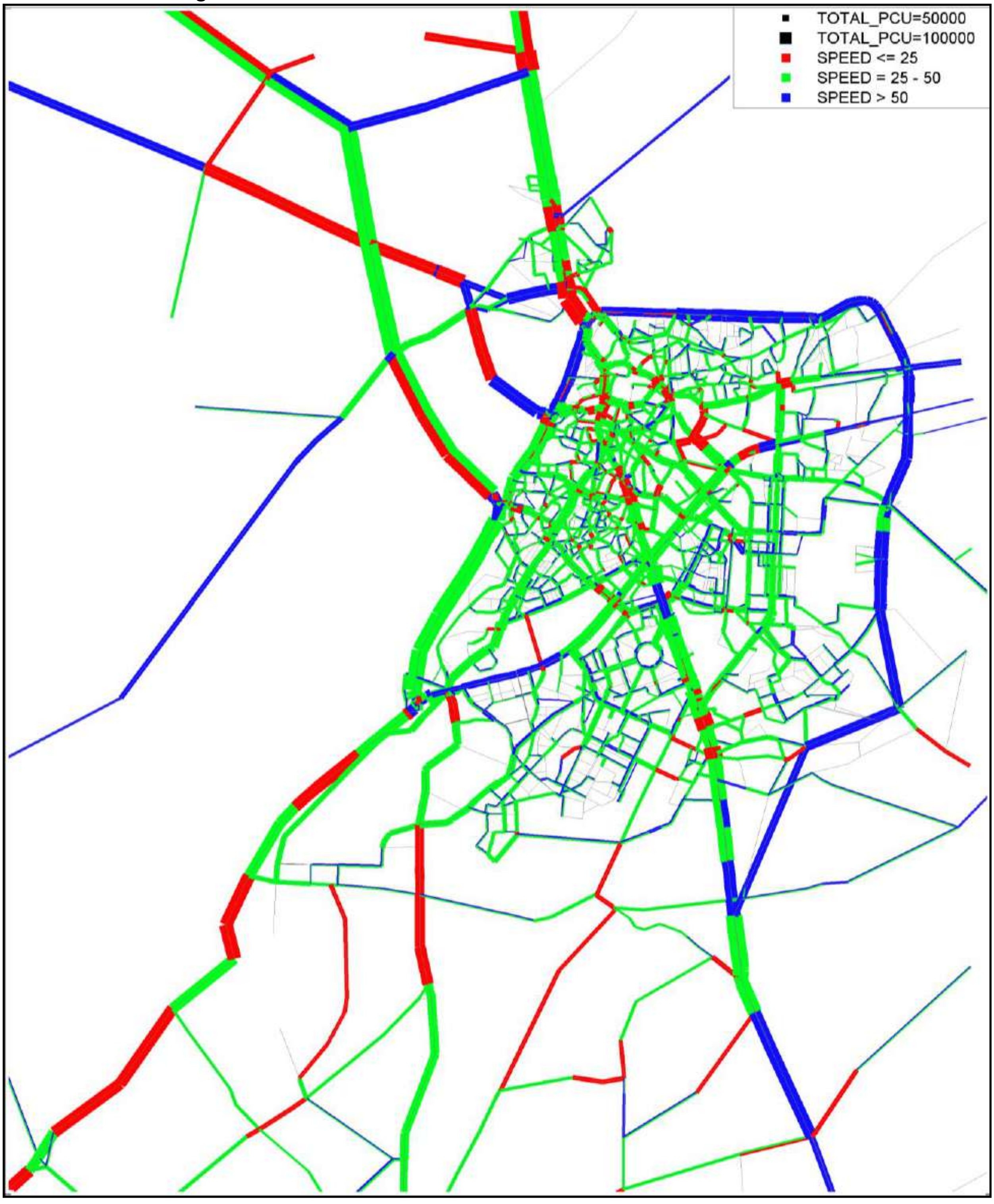
Road Type	km	% of Network	Network V/C Ratio		Network Av. Speed (kph)	
			2020	2030	2020	2030
Motorway	52	2%	0.92	1.15	28	9
Trunk	204	8%	0.66	0.93	27	10
Primary	152	5%	0.52	0.69	29	16
Secondary	226	9%	0.50	0.69	33	23
Local	1,777	76%	0.33	0.55	26	15
Total	***2,412***	**100%**	***0.49***	***0.71***	**28**	**13**

Source: JICA Study Team

Figure 7.2.3 Base Case Road Network Hierarchy

Source: JICA Study Team

Figure 7.2.4 Base Case Road Network Performance - 2020



Source: JICA Study Team

Figure 7.2.5 Base Case Road Network Performance - 2030

Source: JICA Study Team

Under the 2020 Scenario II, travel demand the exception of local network all other road types would be at V/C ratio in excess of 0.5 and the overall network speed would drop from the base case speed of about 40 kph to 28 kph. The trunk roads, primary and secondary network would be overloaded at various locations. Figures illustrates main bottlenecks would be Ravi Bridges, Multan Road (N-5), Raiwind Road, adjacent local Roads and sections of Ferozepur Road. However, the situation would be tolerable, but not conducive to a functioning modern metropolis with close to 13 million inhabitants with growing car ownership and increasing income levels.

By 2030 the situation will be further exasperated with more than doubling of the traffic volumes (see Volume 2, Chapter 4, demand forecast). The 2030 network performance posts a much bleaker picture. Almost all of the network would be above V/C ratio of 0.5 and all roads with the exception of local streets would be at level of service D or worst. Average speed except on secondary roads would drop below 20 kph. The inner city area roads may show a somewhat better picture with many roads above 25 kph, but it should be noted that the LUTMP strategic demand model does not take account of very short trips (mostly intra-zonal) in the inner-city area. With that additional volumes, which could be realised at more detailed modelling level would show much more congested local/ street network. This situation is not sustainable.

The Study Area base case road network was systematically upgraded, starting with improvement to the capacity and connectivity of the secondary road network, improvement to junctions and better utilization of service roads through 1-way operation if possible; or at least 1-way at entry and exit, but 2-way flow along the service road sections. It was estimated that additional 20 % capacity could be realised by such improvements when coupled with serious removal of encroachment and zero-tolerance for roadside activities such as hawkers, motor vehicle repairs, storage of goods for sale, garbage storage and collection, and other such activities which limit road capacity. The analysis showed that further road improvement/ upgrading would be necessary to have sustainable network speeds in 2020 and 2030.

All proposed and committed road schemes were then analysed for:

- their role and contribution to the network hierarchy,
- constructability, likely land take, and impact on community, and
- the *'need' for* in an integrated sustainable network.

The deferred (as may be considered later if needed – through proper planning and feasibility studies) are:

- Wahdat Road – Already good dual-2, with additional Right of Way (RoW), simple management would be adequate, or reconsider additional lane at the time of LUTMP BRT Line feasibility stage, not now.

- Walton Road Area – Serves No purpose, why?
- PIA Main Boulevard Housing Society – Poor connectivity, duplicates other local roads and passes through established housing areas.
- Jallo Morr to Siphon – Rural (Not in LUTMP scope to provide rural links)
- Kot Pindi Das Road – Rural (Not in LUTMP scope to provide rural links)

The 2020 demand forecast scenarios were tested including all TEPA and C&W and other proposed projects, except those listed above. The network performance was evaluated, and it was found to be seriously deficient in meeting the future travel demand. As a result the whole network was hierarchically developed and iteratively evaluated. The additional projects based on road hierarchical upgrade i.e. local to secondary upgrades, and so on were developed both for 2020 and for 2030, again based on when a project is needed. These physical/ structural details of the full master plan projects are given in the next Section (7.3) of this Chapter. The final LUTMP 2030 Master Plan is illustrated in Figure 7.2.6, and key projects are outline below:

Figure 7.2.6 LUTMP 2030 Highway Master Plan Network

Source: JICA Study Team

Key highway projects for implementation are:

- Lahore – Sialkot Motorway to LRR in the north;
- M-2 Upgrade to Dual 4 up to Kala Shah Kaku (KSK) bypass;
- Upgrade KSK by Pass to Dual-3;
- Motorway interchanges with Lahore-Sheikhupura Road and additional interchange with Muridke Road from Chand Bagh;
- Lahore-Sheikhupura Road Upgrade to Dual-3;
- Multan Road (N-5) Upgrade to Dual-3;
- Sharaqpur Road upgrade and connect across Ravi to LRR south-west section;
- LRR southern and western sections;
- New secondary road network to relieve Multan Road (N-5);
- Raiwind Road upgrade; and additional Secondary Roads upgrade south of Sua Asil Road;
- Additional secondary roads in the north west of GT Road (N-5)
- Shahdara Bypass; and additional secondary road improvements;
- 2 New Ravi bridges (one adjacent to old Ravi Bridge and another next to Saggian Bridge)
- Construction of some missing links in the south west of Lahore to improve connectivity of existing roads;
- Additional Pak Railway crossings in south west and from Noor Jahan Road to Sham Road;
- New link from UET to Zafar Ali Road using disused railway links via Dharampura and Mian Mir;
- Upgrade of Ek-Moria and Do-Moria railway underpasses;
- Upgrade of similar rail crossings (underpasses) to Dual-2;
- Defence Road upgrade;
- Construction of Southern bypass – left over from 1980 structure plan;
- Development of secondary road network almost entirely from existing roads in the northern and western parts of Lahore.
- Upgrade of all Local roads to Secondary level in the area: south of LRR and north of Sua Asil Road between Ferozepur Road and Multan Road quadrant; also addition of new Secondary roads to improve connectivity.

Full 4-stage LUTMP travel demand model runs were carried with full highway master plan network; including complete integrated public transport master plan for 2020 and 2030. Highway projects were then selected according to the need i.e. to be included in 2020 or later in 2030. The whole network was tested for their operational performance, until 2020 and 2030 and provides acceptable and sustainable level of service in the Study Area. The highway network operational performance is discussed next, and is followed by the Public Transport (PT) network development programme. The 2020 and 2030 road traffic volumes and resulting average speed are depicted in Figures 7.2.7 and 7.2.8 and are summarised in Table 7.2.3 and 7.2.4 respectively.

Table 7.2.3 Master Plan Road Network and Performance Indicators - 2020

Road Type	km	% of Network	Av. Speed (kph)	V/C Ratio	Network PCU*km (Daily)		Network PCU*Hrs (Daily)	
					('000)	%	('000)	%
Motorway	52	2%	28	0.84	2,569	10%	91	12%
Trunk	279	11%	37	0.57	9,805	37%	266	34%
Primary	129	5%	39	0.47	2,915	11%	76	10%
Secondary	502	20%	37	0.35	6,186	23%	167	21%
Local	1,571	62%	28	0.25	4,903	19%	177	23%
Total	***2,533***	**100%**	**34**	***0.41***	***26,378***	**100%**	**776**	**100%**

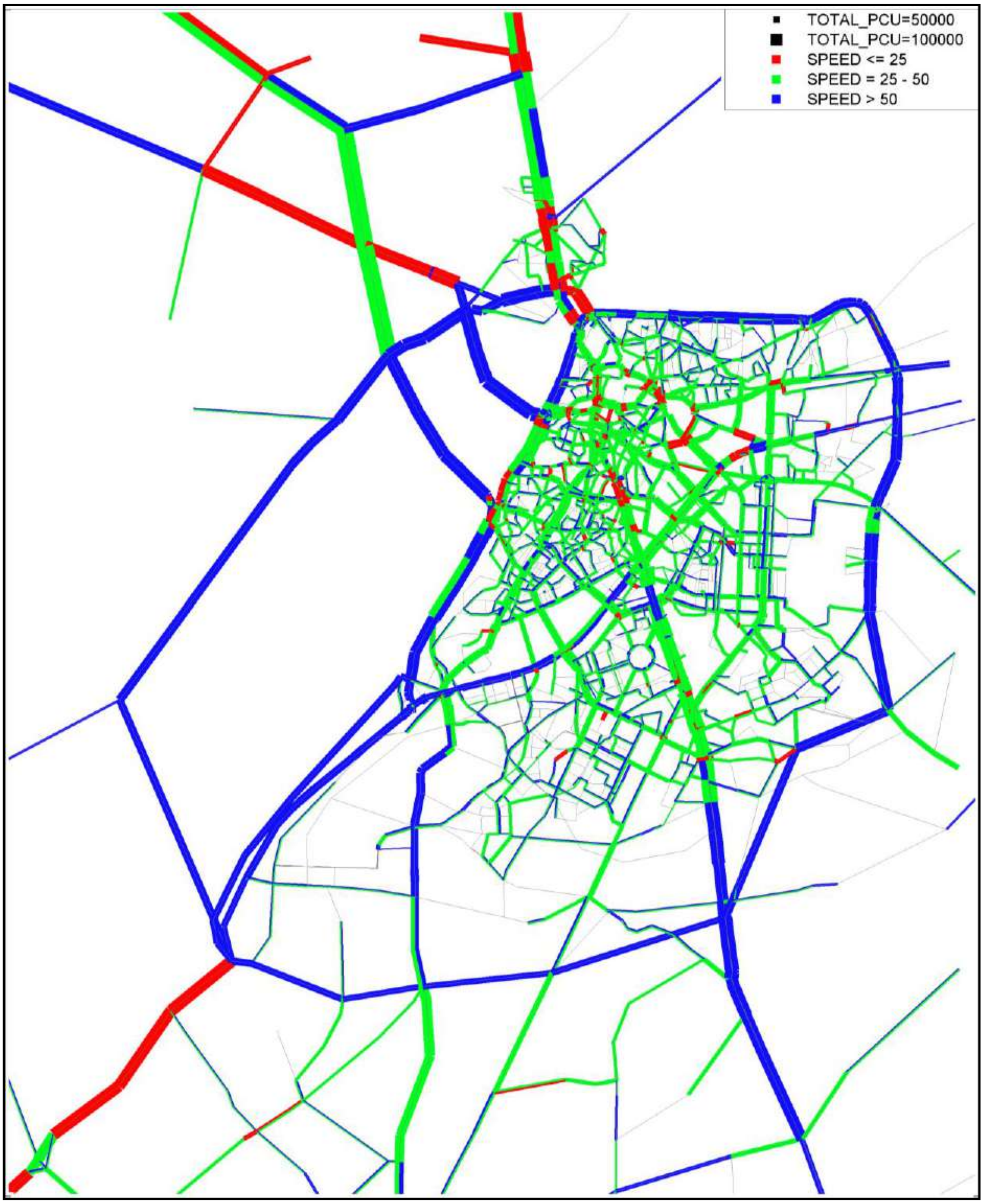
Source: JICA Study Team

Table 7.2.4 Master Plan Road Network and Performance Indicators - 2030

Road Type	km	% of Network	Av. Speed (kph)	V/C Ratio	Network PCU*km (Daily)		Network PCU*Hrs (Daily)	
					('000)	%	('000)	%
Motorway	89	3%	39	0.69	4,600	12%	117	10%
Trunk	279	11%	39	0.73	13,043	34%	332	29%
Primary	129	5%	33	0.54	3,519	9%	108	9%
Secondary	626	24%	31	0.50	11,076	29%	352	31%
Local	1,499	57%	28	0.33	6,609	17%	239	21%
Total	**2,622**	**100%**	**34**	**0.53**	**38,846**	**100%**	**1,149**	**100%**

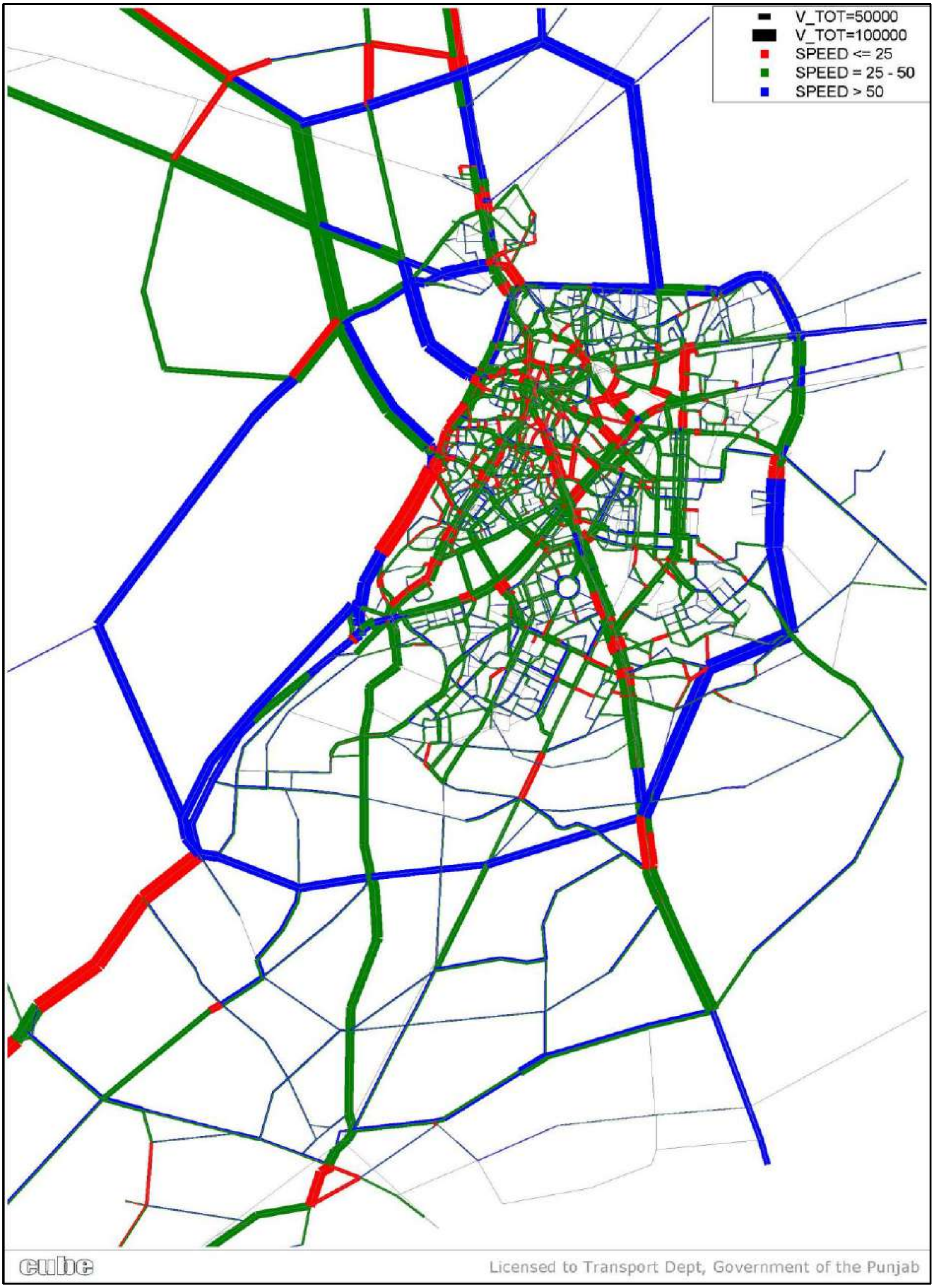
Source: JICA Study Team

Figure 7.2.7 Highway Master Plan Network Performance - 2020



Source: JICA Study Team

Figure 7.2.8 Highway Master Plan Network Performance - 2030



Source: JICA Study Team

It can be seen that through proper planning and structured highway network development with an overall increase of only 210km of new roads (9 % increase over 2010) more than double the traffic volumes (PCU*km) are accommodated without much degradation to network-wide speed – down to 34 kph in 2030 from around 40 kph in 2010. The main strategy was to create coherent secondary road network - increased by 400 km, mostly from existing local roads by getting rid of encroachment, junction improvements and limited widening/ remodelling – where appropriate. The local road network would decrease to about 1,500 km from 1,800km in 2010). This would provide major environmental benefits to the remainder of the local roads due to reduced traffic volumes. It can be seen from Table 7.2.4 that the major road network (Motorways and Trunk roads would be at around 40kph, and Secondary roads at 31kph, while local roads at just under 30 kph. It may be argued that Motorway and trunk roads should have higher average speeds, but this would require major motorway and trunk road programme which could be financially unsustainable within the GoPb budget. Another way to look at the network is to introduce further secondary road network when the areas to the west and north of Ravi are developed, which would take away local traffic of these major trunk roads.

In addition, it is also necessary to mention that: a major regional study is required to fully realise the impact and implications of external and through traffic, considered to be beyond the scope of this project. Pakistan Railway could also assist in taking away considerable external and through bus traffic off these regional roads, but again it is difficult to fully assess the impact of such regional modal shift and the level of investment required, to achieve such a shift, given the poor state and lack of capacity in Pak Rail network system. The impact of such a massive investment would or could also adversely impact the available budget for transport infrastructure programme for Lahore. Alternative would be to get National Highway Authority/ Federal Government to fund these developments to the national road network.

5) Current Public Transport Network and Systems

The Public Transport (PT) is a serious issue in Lahore and its operation and lack of performance has been discussed elsewhere. Lahore is fortunate to have 38 ~ 40 % Public Transport mode share (even with such poor and dilapidated services – as public without private vehicle have no choice). However broad PT demand has been discussed in Chapter 2 (Volume 2) Travel demand forecast are detailed in Chapter 4 (Volume 1). In brief there are currently about 53 Government *'notified'* bus routes (Large bus or some time called as HOV routes). These 53 routes are incorporated in the LUTMP *'strategic'* modelling process.

In addition 16 inter-city bus routes representing long distance travel along motorway and trunk roads were also incorporated in the model. Thus there were 69 total bus routes representing major bus travel in/ out and intra-city travel. Table 7.2.5 describes some of the key features of the current bus network in the Study Area. It can be seen that for network of about 2,400 km the bus services cover just over 1,000 km. The rest of the road network (more than half) is left to the mercy of para-transits, legal and illegal wagon operations. The total demand does not even yield one boarding per trip. This shows the sparse coverage of the Study Area by the *'notified'* bus routes, and the remainder trips are assigned to the para-transits (see Figure 7.2.9).

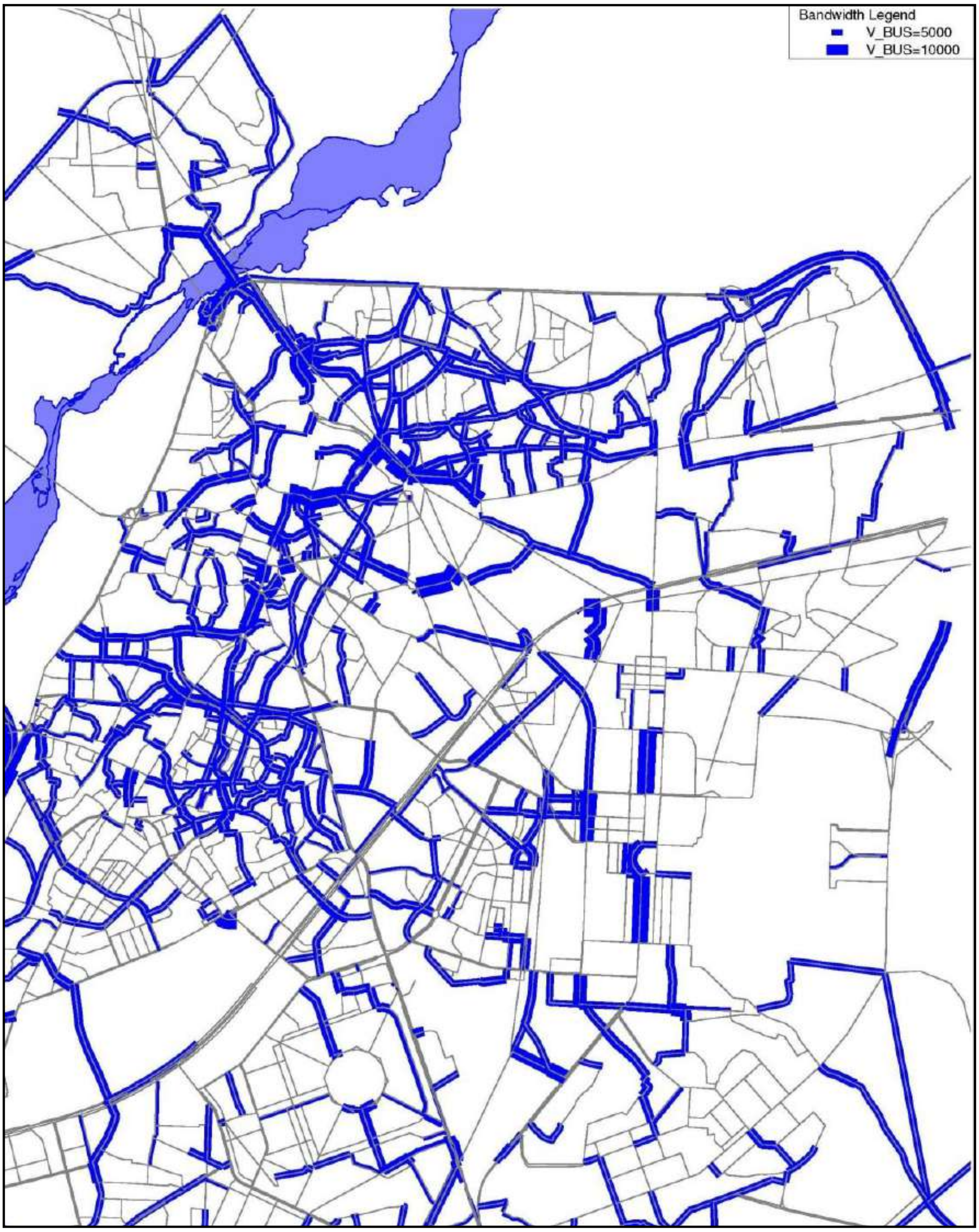
Further analysis showed that about 30 % of travel is (pax*km) is on the para-transit modes – a very high proportion resulting in in-efficient use of road space. Figure 7.2.10 shows the density of bus routes in the Study Area and on the road network to/ from the Study Area. Majority of the routes are concentrated on main roads – some roads carrying 5+ routes along the entire length from outside the city to the inner city area, like Ferozepur Road and Multan Road. Again it is a clear reflection of how much of the inner city area is not covered by regular bus routes. There may be excuse of lack of road space (width) but once the secondary road network is developed/ upgraded as described in the highway development programme, new routes could be introduced to serve these inner city areas.

Table 7.2.5 Local and Long Distance Bus Route Network and Demand

Number of Routes	Route-KM	Bus Stops	Total Boardings ('000)	Total PT Demand ('000)
Local - 53	1,040	4,000	3,994	2,870
Inter-city	These routes are from the Study Area cordon to bus termini		672	574

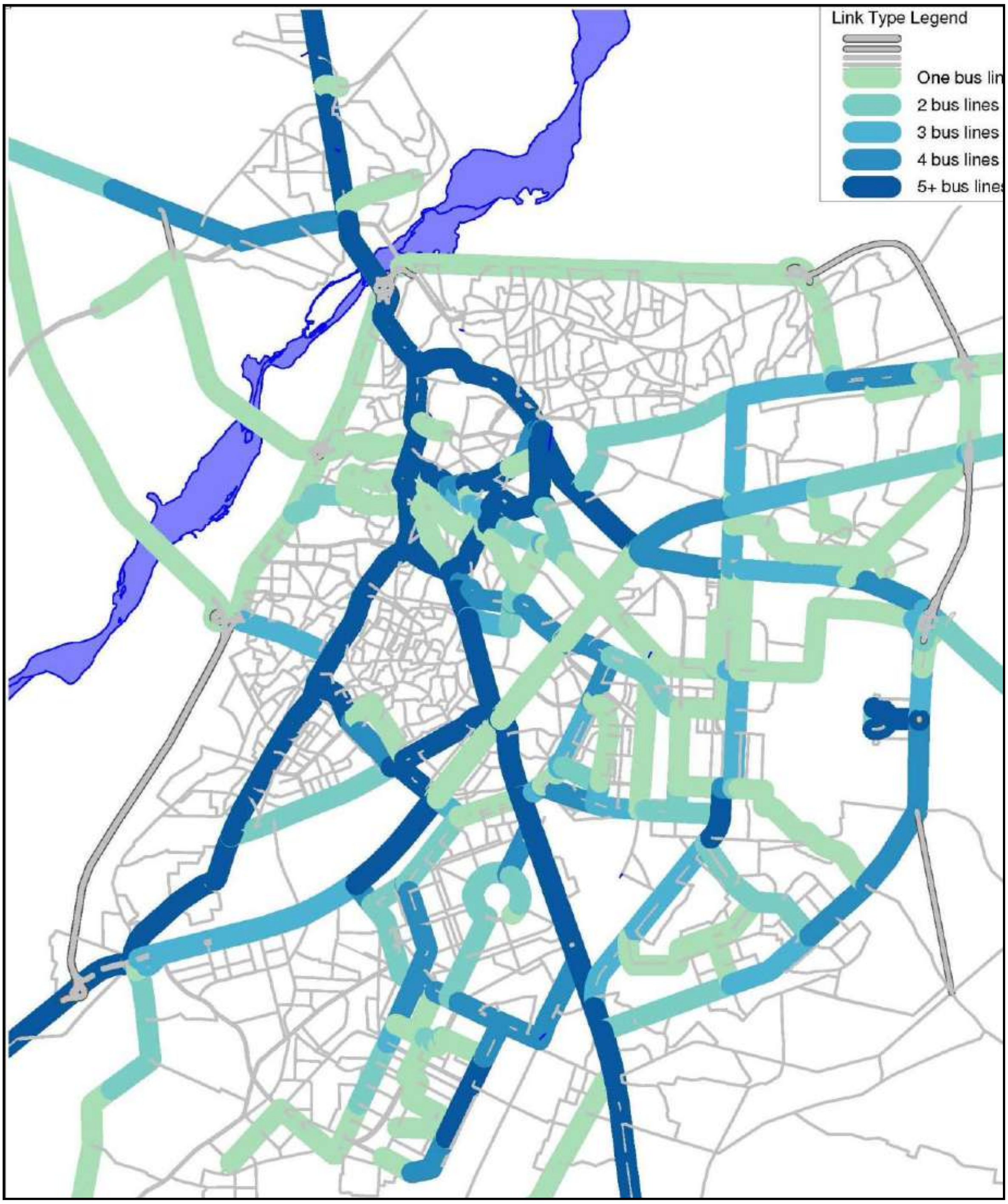
Source: JICA Study Team

Figure 7.2.9 Para-transit – 2010 Passenger Volumes



Source: JICA Study Team

Figure 7.2.10 Bus Network - 2010 Density of Bus Routes



Source: JICA Study Team

In addition, route by route patronage analysis indicated a vast difference between the daily boardings by route. About one third of the routes daily patronage is less than 15,000 boardings. 25 routes have daily boardings of 15,000 to 40,000 per day and the remainder carry in excess of 40,000 pax daily. There are some high utilization routes, which need further analysis, and such an analysis is out-side the scope of this strategic planning study, and could only be carried out in a comprehensive bus operations and route rationalisation study, based on much more detailed network representation of operational routes and further disaggregated travel demand in the inner city area.

6) LUTMP Master Plan Public Transport Network and Systems

Analysis of the 2010 network as described above not only indicated poor coverage but also lack of high capacity bus system for major demand corridors. Future PT demand has been discussed elsewhere, and is again summarised below in Table 7.2.6

Table 7.2.6 PT Travel Demand for LUTMP Master Plan (2020 and 2030 Scenario-2)

Area	Person Trips			Growth over 2010	
	2010	2020-S2	2030-S2	2020	2030
Internal	2,870,000	3,562,000	4,204,000	24%	46%
External	574,000	669,000	798,000	17%	39%
Total	**3,444,000**	**4,231,000**	**5,002,000**	**23%**	**45%**

Source: JICA Study Team

It can be seen that total travel demand for public transport would exceed 5 million trips by 2030, a modest increase of about 45% over the next 20 years. However, the current unplanned, ill-organised poorly served bus network and mixture of Paratransit as a public transport system for over 16 million inhabitants is not sustainable. High demand corridors were analysed according to the demand and a comprehensive high capacity mass transit (bus and rail based) system is planned through an iterative process using the LUTMP strategic demand forecast model. The 2020 and 2030 public transport system characteristics internal to the Study Area are summarised in Table 7.2.7.

Table 7.2.7 LUTMP Master Plan – Key Characteristics of Public Transport System

Line / Route	2010	2020	2030
Bus Lines	53	44*	44*
BRT Lines	-	7	5
RMTS Lines	-	1	3
Bus Route Km	1,040	840	840
BRT Line KM	-	148	95
RMTS Line KM	-	27	78
BRT Stations	-	260	150
RMTS Stations	-	22	68
Bus Boardings	4,616,000	4,660,000	3,855,000
BRT Boardings	-	1,533,000	1,404,000
RMTS Boardings	-	760,000	2,074,000
% Bus Boardings	100%	67%	53%
% BRT Boardings	-	22%	19%
% RRMTS Boardings	-	11%	28%
Total Boardings	**4,616,000**	**6,953,000**	**7,333,000**

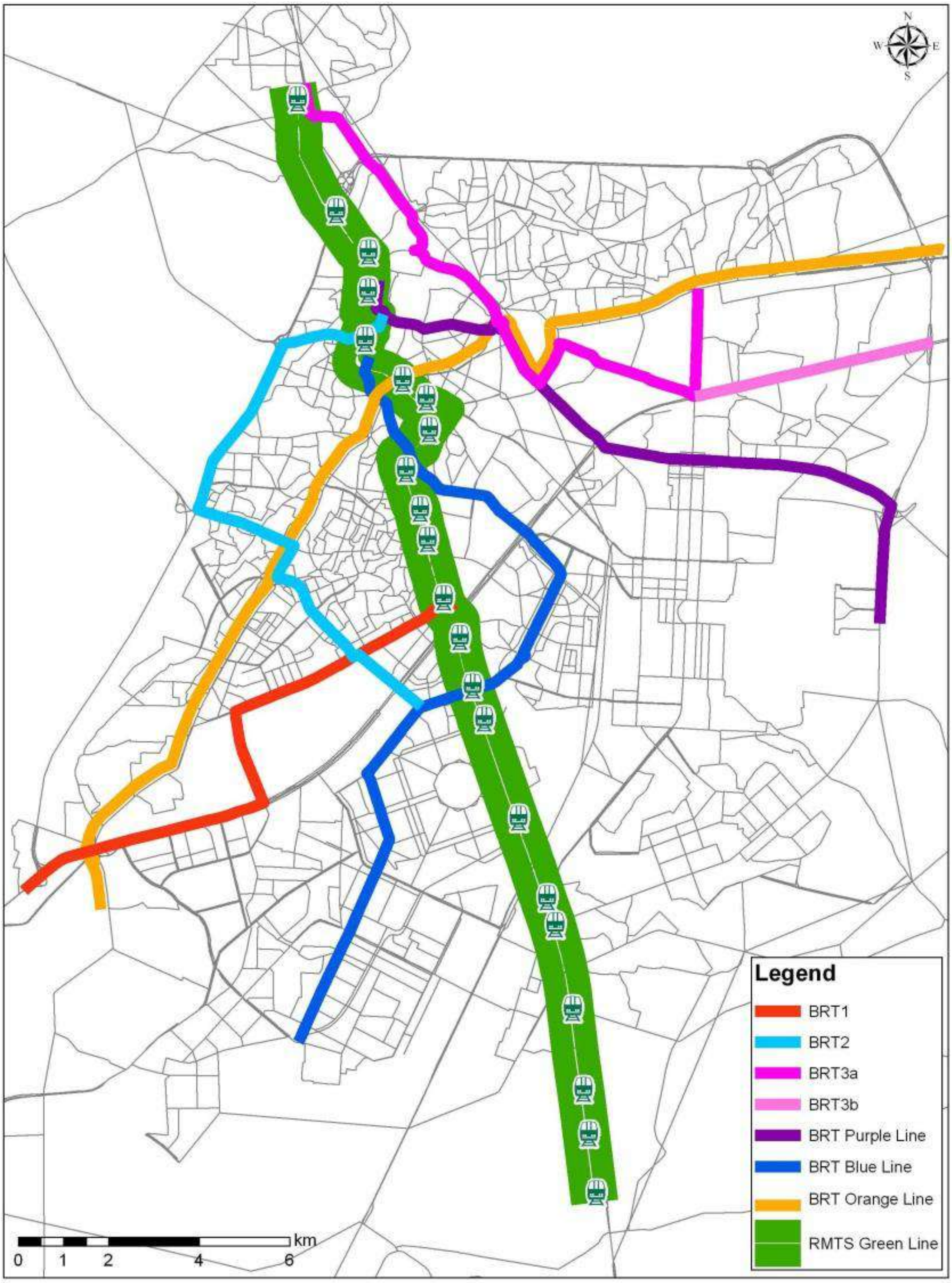
Note: 9 Bus routes were deleted –as these routes were competing with the Mass Transit Lines
Source: JICA Study Team

It can be seen that how higher capacity systems would continue to take up the future travel demand (growth) and bus share of number of passengers would be similar to 2010.

Conversion of two lines (Orange and Blue to RMTS is also essential as the loadings on these lines could not be sustained using a road based (BRT) system. At this stage the analysis is strategic, and would require further investigation at the feasibility study stage of each line. Additional patronage from Bus could be diverted to the BRT/ RMTS systems in the future years through better feeder route planning. In the LUTMP master planning the bus planning is limited to removing the competing nine (9) routes from the bus operations as these were operating almost parallel to the mass transit systems along majority of their length.

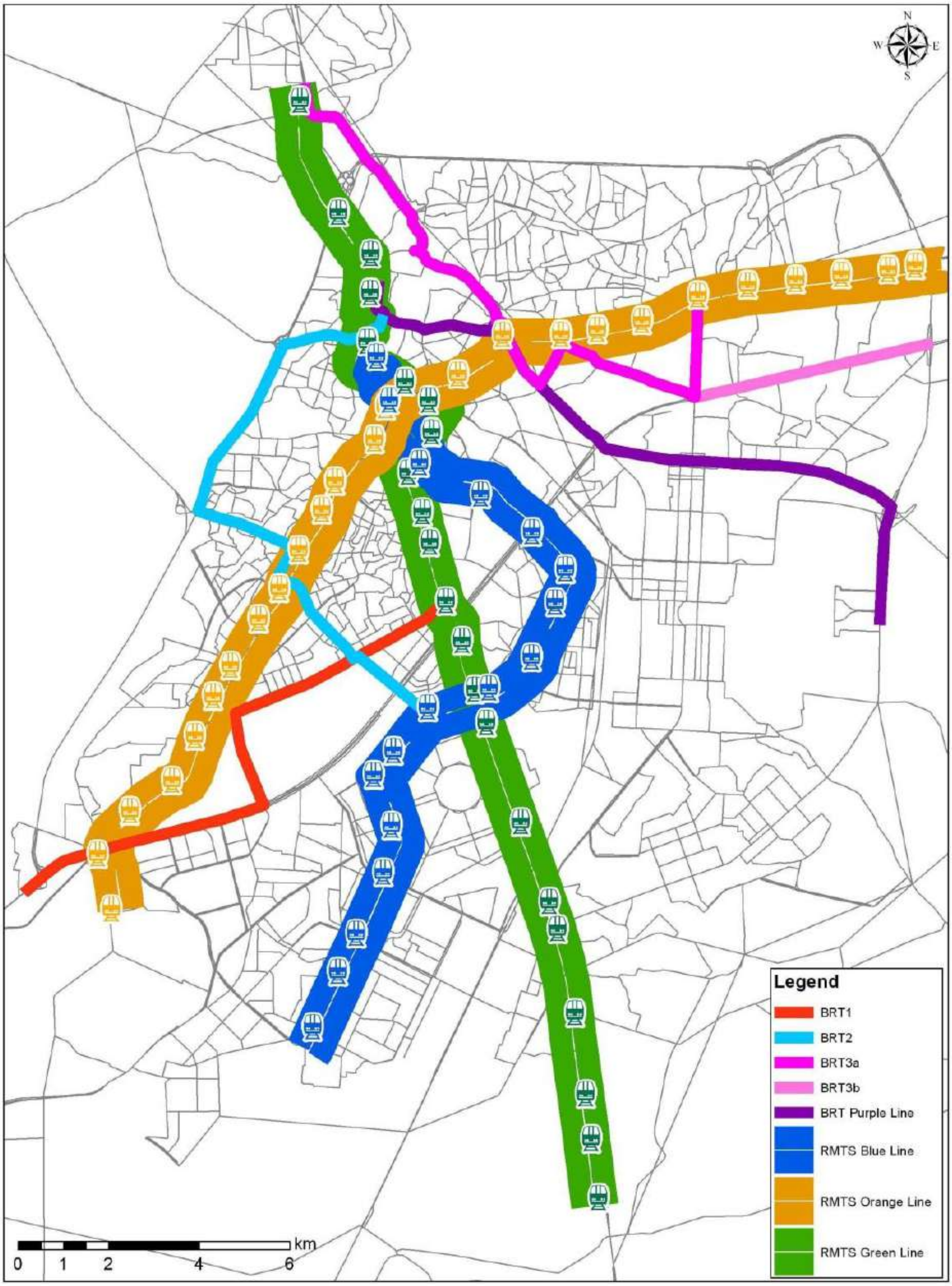
The proposed four of the eight routes (BRT and/ or RMTS) are based on the LRMTS study outputs and are reconfirmed here through LUTMP model for their viability and sustainability. However, the purple route is downgraded to be a BRT up to 2030. Similarly Orange and Blue lines are also proposed to be BRT lines up to 2020, and converted to rail based system after that. The exact timing of such conversion would be subject of further studies. The key question is more likely to be the availability of funding rather than the level of demand. The proposed BRT and RMTS systems are depicted in Figures 7.2.11 and 7.2.12 for 2020 and 2030 respectively.

Figure 7.2.11 RMTS and BRT 2020 Alignments



Source: JICA Study Team

Figure 7.2.12 RMTS and BRT 2030 Alignments



Source: JICA Study Team

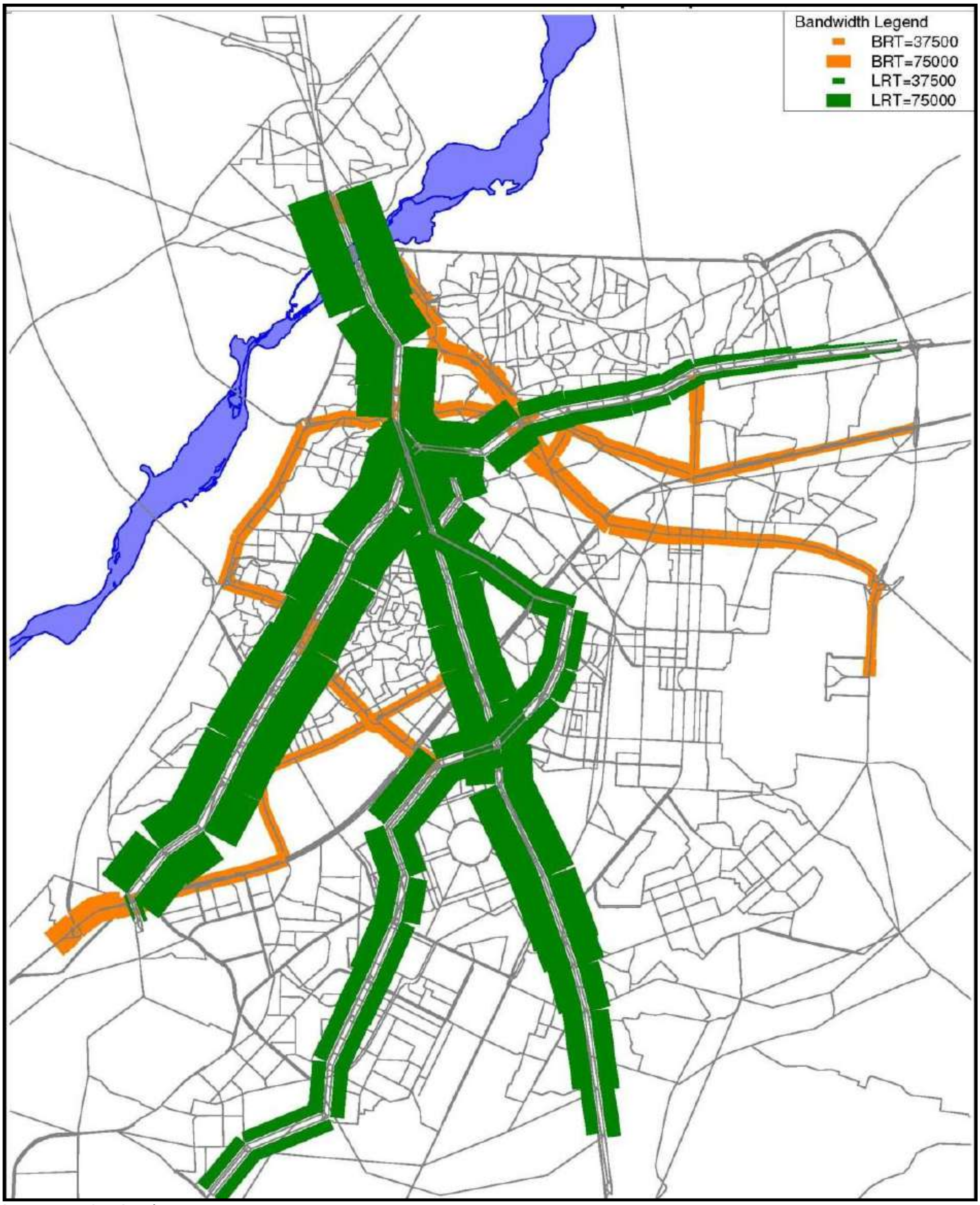
The RMTS and BRT 2030 passenger volumes are illustrated in Figure 7.2.13. The bus and para-transit volumes are excluded so that a direct assessment of the mass transit volumes could be made. The bus, para-transit (including feeder) volumes are shown in Figure 7.3.14. The performance of each of the eight BRT/ RMTS line is summarized in the Table 7.2.8.

Table 7.2.8 LUTMP 2030 – RMTS and BRT System Performance Key Characteristics

Project Code	Project Description	System	Daily Boarding			Max Line Load (Pax Per Hr Per Direction – PPHPD)		
			2020	2030	% Growth	2020	2030	% Growth
PT06	Green Line	RMTS	759,000	980,000	29	17,200	21,900	28
PT07	Orange Line	2020 BRT/ 2030 RMTS	510,000	743,000	46	9,500	20,100	102
PT08	Blue Line	2020 BRT/ 2030 RMTS	270,000	379,000	40	5,600	11,200	100
PT09	Purple Line	BRT	129,000	276,000	114	1,800	3,700	137
PT10	BRT Line 1 (Red)	BRT	88,000	285,000	224	2,100	6,800	219
PT11	BRT Line 2 (Light Blue)	BRT	109,000	331,000	204	1,500	3,700	164
PT12	BRT Line 3a (Pink)	BRT	161,000	265,000	65	3,200	3,500	12
PT13	BRT Line 3b (Pink)	BRT	167,000	248,000	49	2,700	3,200	19
Totals			**2,193,000**	**3,507,000**	**60**	**N/A**		

Source: JICA Study Team

Figure 7.2.13 Scenario-2, 2030 Public Passenger Demand on RMTS and BRT Lines



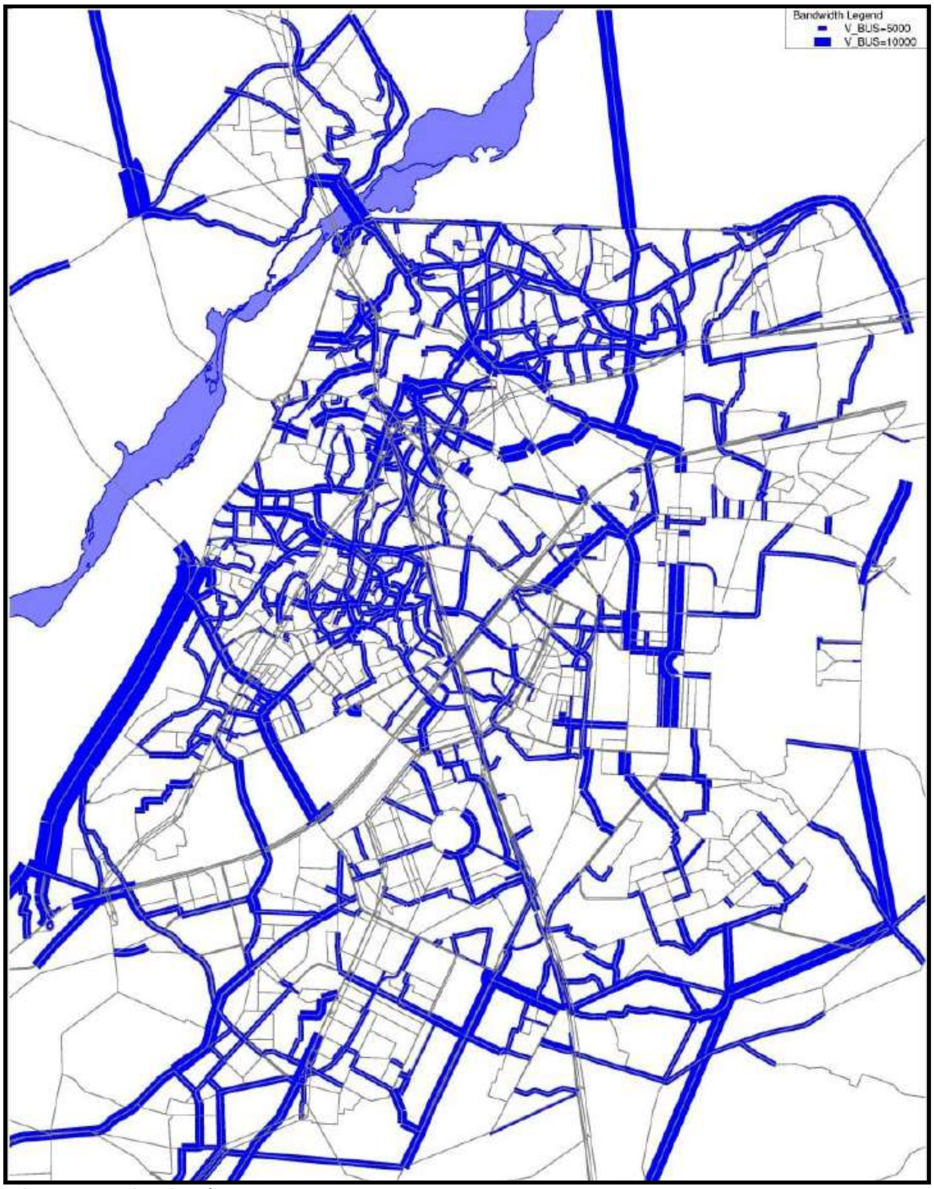
Source: JICA Study Team

Figure 7.2.14 2030 Public Transport Passengers, Excluding RMTS and BRT Lines

Source: JICA Study Team

The above analysis demonstrates that an increase of about 1.6 million person trips from 2010 to 2030 would need to be accommodated to retain the PT mode share. This could only be done efficiently through a well-developed, public transport network as developed for the 2030 LUTMP Master Plan. It shows that it is essential to provide efficient higher capacity (than just HOV bus routes) network of Bus Rapid Transit and Rail-based mass transit systems. It should also be noted from Figure 7.2.14 that having provided the mass transit systems there would still be need for bus services and para-transit trips as feeder and local services. The 2030 Para-transit only trips are shown in Figure 7.2.15.

Figure 7.2.15 2030 Public Transport Passengers, Para-transit Trips Only



Source: JICA Study Team

Previous studies, since 1991 Master Plan has advocated the introduction of Light Rail Transit System, but has not been implemented. Now we have reached a stage where further delay in the provision of high capacity public transport system would be very detrimental for the city's transport system, and its sustainability. A balanced and integrated public/ private transport system must exist in any thriving metropolitan area. Neither private nor public transport mode alone can provide an efficient system. Failure to provide much improved public transport system would drive the low-middle income households to purchase motorcycles and use them – away for public transport, where its share is already on the decline.

7.3 Profile of Major LUTMP 2030 Projects

7.3.1 Public Transport Projects

1) Committed Public Transport Projects

Some projects for improving existing public transport are committed or planned, funded by state budget. These existing committed public transport projects are supposed to be a part of the Master Plan up to 2030. Through the reviews of government plans and discussions with counterpart agencies, all committed projects were included and are listed in the following Table 7.3.1.

Table 7.3.1 Committed Public Transport Projects

Project No.	Project Code	Project Description	Original Schedule	Implementing Agency	Cost (PKR)	Funding Source
PT01	C.1	Multimodal Inter-City Bus Terminals in Lahore	2012 – Onward	TD, GoPb	N/A	GoPb and BOT/ PPP
PT02	C.2	Effective and Efficient School Bus System	2012 – Onward	TD with Education Department, GoPb	N/A	GoPb and PPP
PT03	C.3	Up-grading of Bus Stands	2012 – Onward	TD, GoPb	N/A	GoPb or PPP
PT04	C.4	Integrated Bus Operation	-	LTC	6,410 million	Lahore Transport Company
PT05	C.5	Establishment of Multimodal Bus Terminal at Shahdara	2012 – Onward	District Government of Sheikhupura, GoPb	N/A	District Government of Sheikhupura, GoPb

Source: JICA Study Team

1) LUTMP 2030 Proposed Public Transport Projects

The proposed public transport projects for 2020 and 2030 are identified and outlined in Section 7.1.1 and given in Tables 7.1.2 and 7.1.3. The proposed projects are described in the following section.

PT06: Green Line (RMTS)

The Green Line (27 km) has been planned with 12 km underground section, 12 stations, and viaduct section of 15 km with 10 stations. The line follows Ferozepur Road corridor, starting in the south just north of the Hudiara Drain Road Bridge and through Mall Road ending at Shahdara across the Ravi River.

Project Corridor: Ferozepur Road/ Mall Road/ Ravi Road/ Shahdara

Capital Cost 2,583 (USD Million)

Depot: The 2 Depot have been planned as follows;

・Main Depot (192,828 m^2) is planned near Shadab Colony Station.

・North Depot (74,981 m^2) is planned near Shahdara Station

Figure 7.3.1 Location Map of RMTS Green Line Alignment

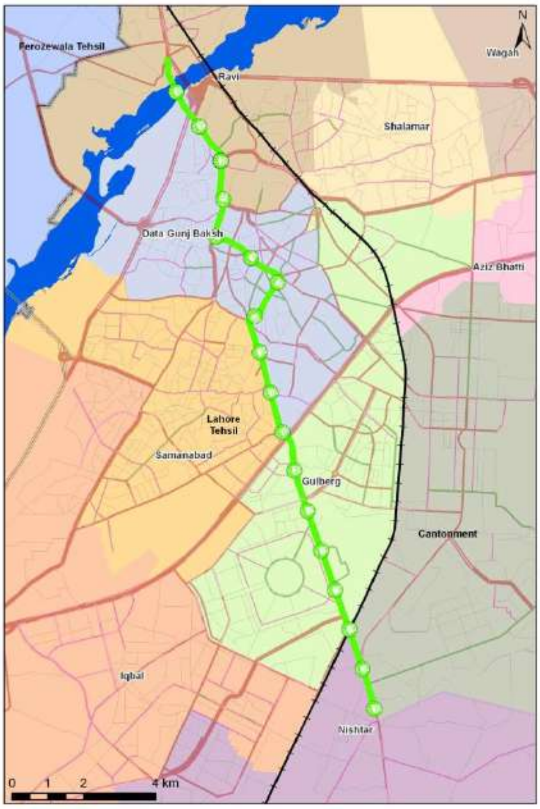
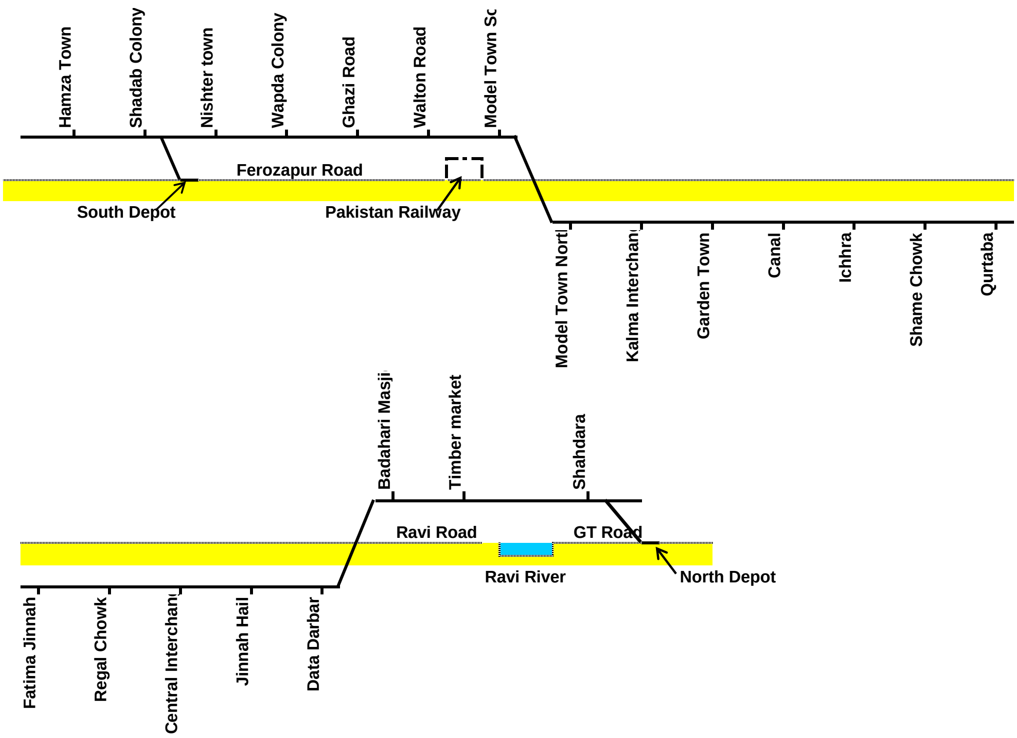


Figure 7.3.2 Planned Layout of RMTS Green Line Alignment and Station Locations



Source: JICA Study Team

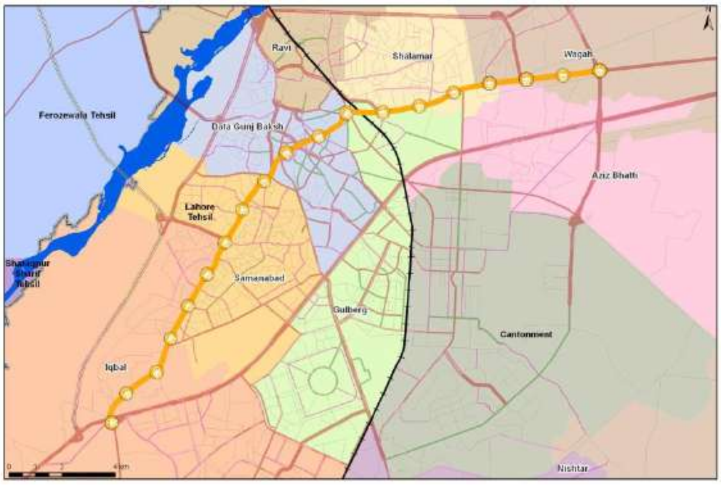
PT07: Orange Line (Initially BRT and then RMTS)

The Orange Line (27.1 km) as a RMTS has been planned with underground section of 6.9 km with 6 stations and viaduct section of 20.2 km with 20 stations. Orange Line as a BRT project would require a full feasibility study along the proposed corridor.

Project Corridor: Raiwind Road/ Multan Road/ Macloed Road/ Railway Station/ G.T. Road

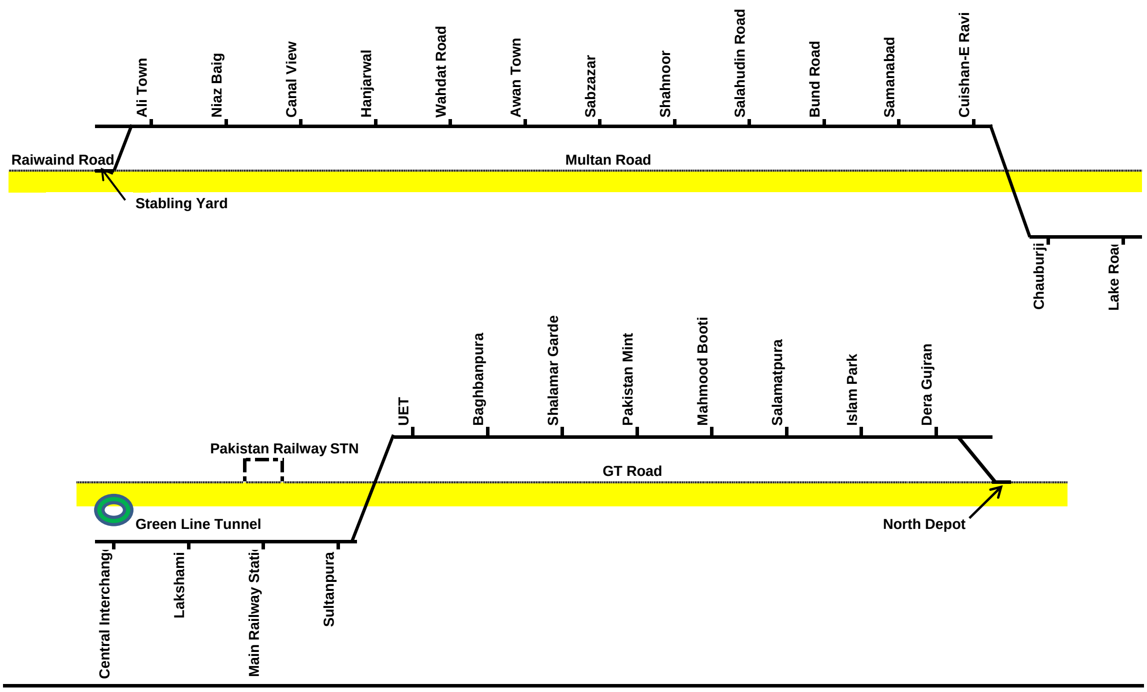
Capital Cost: [(RMTS) 2,330 (USD Million)], [(Initial BRT) 62.8 (USD Millions)]

Figure 7.3.3 Location Map of RMTS Orange Line Alignment



Source: JICA Study Team

Figure 7.3.4 Planned Layout of RMTS Orange Line Alignment and Station Locations



Source: JICA Study Team

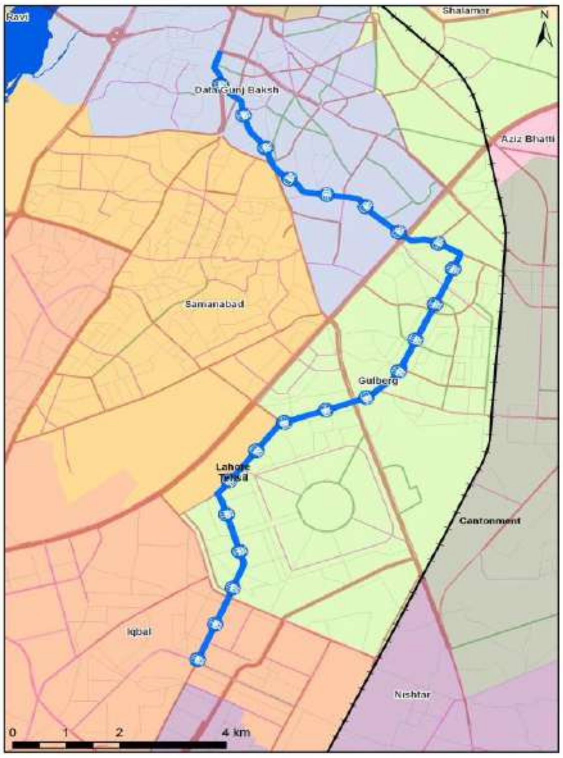
PT08: Blue Line (Initially BRT and then RMTS)

Blue Line (24.0 km) as a RMTS has been planned with underground section of 4 km with 3 stations and viaduct section of 20.0 km with 17 stations. Blue Line as a BRT project would require a full feasibility study along the proposed corridor.

Project Corridor: Township/ Gulberg Boulevard/ Jail Road

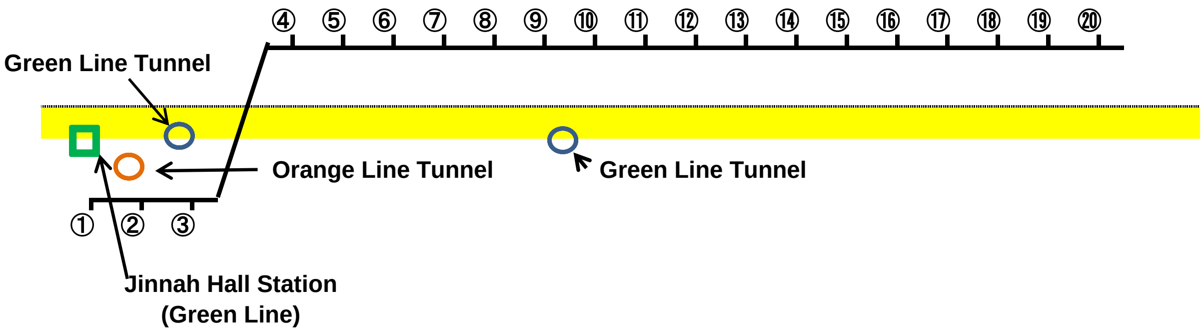
Capital Cost: [(RMTS) 1,908 (USD Million)], [(Initial BRT) 50.9 (USD Million)]

Figure 7.3.5 Location Map of RMTS Blue Line Alignment



Source: JICA Study Team

Figure 7.3.6 Planned Layout of Blue Line RMTS Alignment and Station Locations



Source: JICA Study Team

PT09: Purple Line (BRT)

Purple Line as a BRT project would require a full feasibility study along the proposed corridor.

Project Corridor: Township/ Gulberg Boulevard/ Jail Road

Capital Cost: 38.9 (USD Million)

Length: 19.0 km

Figure 7.3.7 Location Map of Purple Line BRT Corridor

Source: JICA Study Team

PT10: BRT Line 1

Project Corridor: Thokar, Canal Bank Road, Punjab University, Wahdat Road, Muslim Town, Ferozepur Road

Capital Cost: 30.5 (USD Million)

Length: 14.1 km

Figure 7.3.8 Location Map of BRT Line 1

Source: JICA Study Team

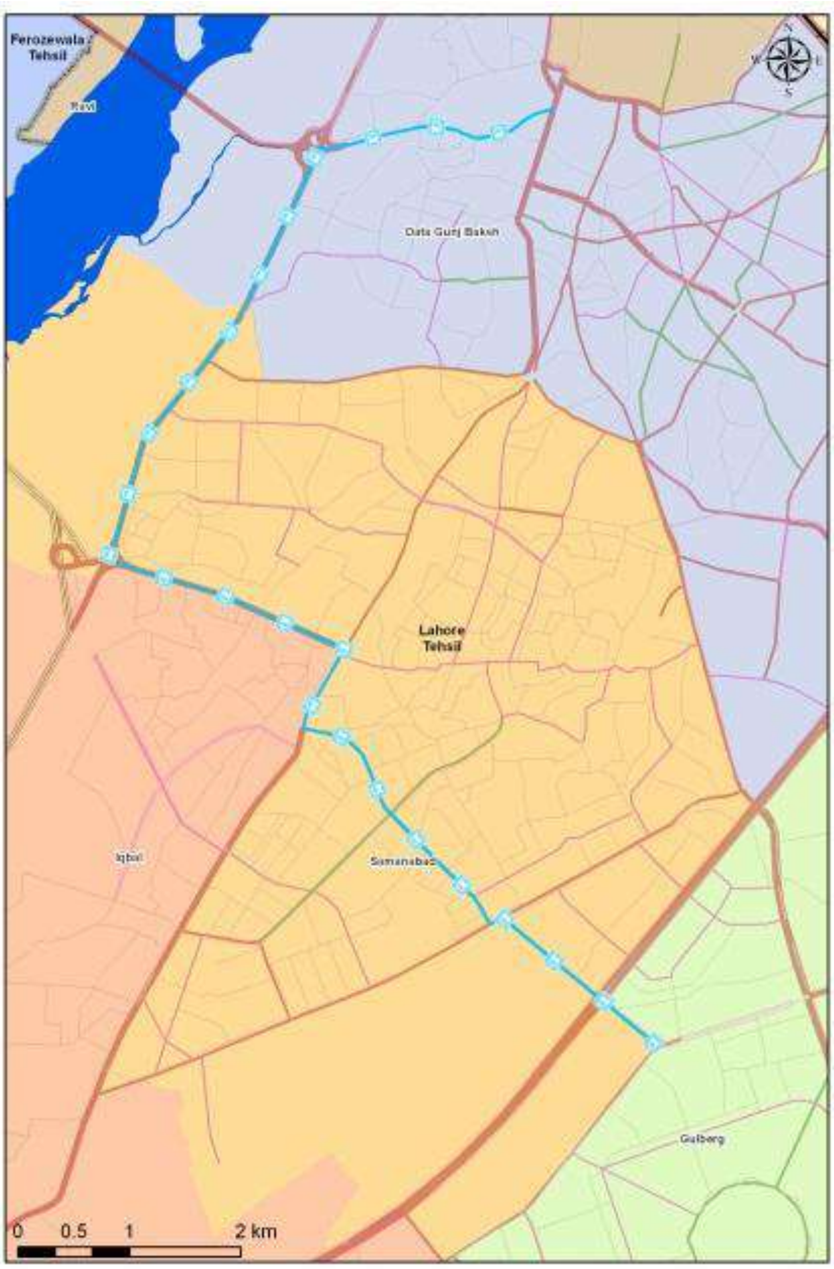
PT11: BRT Line 2

Project Corridor: Barkat Market, Jamia Punjab Road, Punjab University, Sarfraz Naeemi Road, Multan Road, Bund Road, LRR, Sagianwala Bypass, Bhatti Chowk.

Capital Cost: 30.1 (USD Million)

Length: 14.3 km

Figure 7.3.9 Location Map of BRT Line 2



Source: JICA Study Team

PT12: BRT Line 3a

Project Corridor: Shahdara, Old Ravi Bridge, G.T. Road, Badami Bagh Bus Terminal, Badshahi Mosque, Circular Road, Allama Iqbal Road, Garhi Shahu, G.T. Road, Shalamar Link Road, Shalamar Gardens.

Capital Cost: 28.1 (USD Million)

Length: 15.7 km

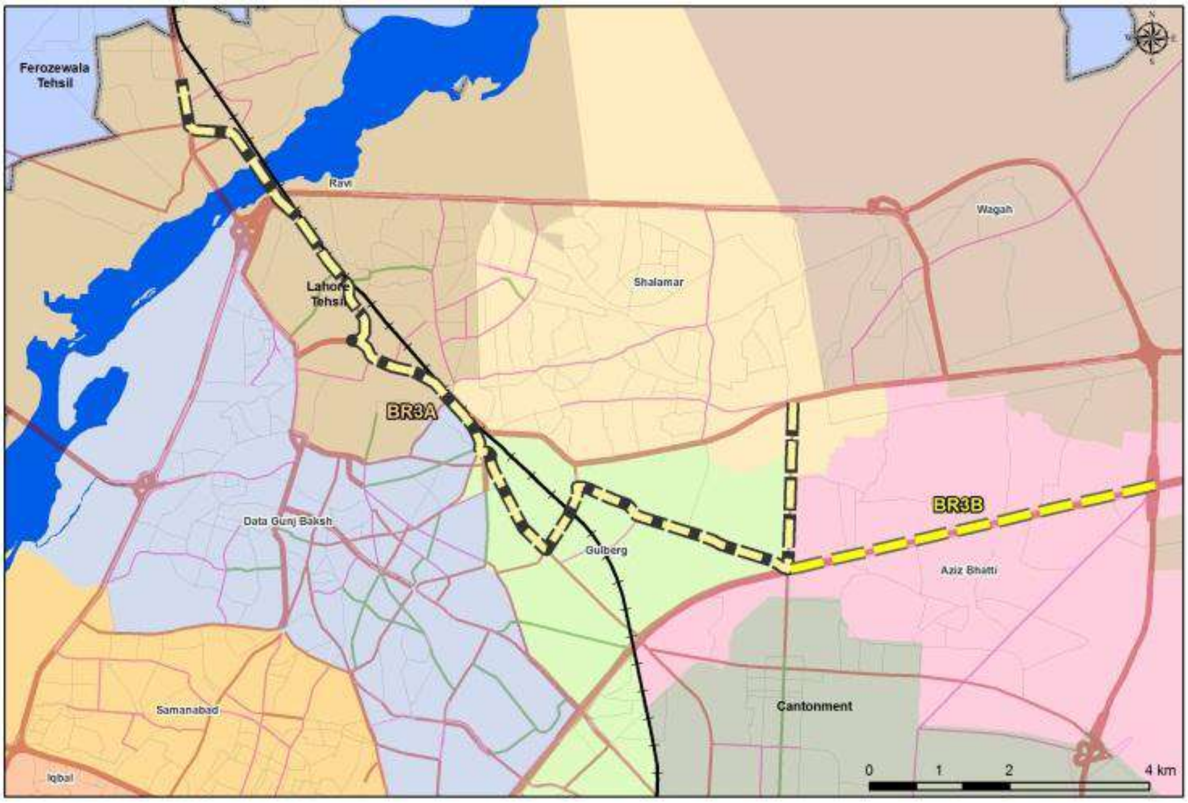
PT13: BRT Line 3b

Project Corridor: Shahdara, Old Ravi Bridge, G.T. Road, Badami Bagh Bus Terminal, Badshahi Mosque, Circular Road, Allama Iqbal Road, Garhi Shahu, G.T. Road, Canal Bank Road, Harbanspura.

Capital Cost: 35.2 (USD Million)

Length: 19.1 km

Figure 7.3.10 Location Map of BRT Lines 3a and 3b



Source: JICA Study Team

7.3.2 LUTMP 2030 Road Sub-Sector Projects

1) Committed and Proposed Road Projects for 2020 and 2030

The proposed road projects for 2030 include new construction of motorway, trunk, Primary and Secondary roads. The existing Secondary road network should be expanded to cover the fast growing outer areas. Since construction of primary road in urbanized area is very difficult, the development of Secondary roads is very crucial, as these should have at least 4–8 lanes with an adequate curbside and traffic control system.

In general, the ideal density of arterial road network (including primary and secondary roads) in urban area is said to be about 3.5 km/km^2. For the urban area of Lahore, secondary roads are to form a diverse road network.

2) Committed and Proposed Road Projects – 2020

The projects committed or proposed by TEPA, C&W or JICA Study Team are listed in Table 7.3.2.

Table 7.3.2 List of Committed and Proposed Road Projects by 2020

Project No. (Code)	Project Description	Length (km)	Proposed Lanes	Project Type	Proposed By	Status
Road Sub-sector Projects – Committed						
R01 (12001)	Construction of LRR (Airport – Ferozepur Road)	13.3	D-3	Committed	C&W	On-Going/ 2012-13
R02 (12002)	Construction of Kalma Chowk Flyover	3.4	D-3	Committed	C&W	Completed 2011
R03 (12003)	Construction of Canal Bank Road Flyover	3.3	D-2	Committed	C&W	On-Going/ 2012
R04 (12004)	Remodeling of Canal Bank Road	15.6	D-3	Committed	TEPA	Completed 2012
R05 (12005)	Remodeling of Barki Road (LRR – Green City)	3.6	D-2	Committed	C&W	Completed 2012
R06 (12006)	Remodeling of Kala Khatai Road	26.9	D-2	Committed	C&W	On-Going/ 2012
R07 (12007)	Remodeling of Allama Iqbal Road	3.3	D-4	Committed	C&W	On-Going/ 2012
R08 (12008)	Remodeling of Multan Road	11.3	D-3	Committed	C&W	Completed 2011
R09 (12009)	Remodeling of Thokar Niaz Baig Road	11.0	D-2	Committed	C&W	Completed 2012
R10 (120010)	Remodeling of Lahore Ferozepur Road	23.6	D-3	Committed	C&W	Completed 2012
Road Sub-sector Projects – LUTMP Proposed						
R11 (20002)	Barki Road (Green City – BRB Canal)	6.8	D-2	Remodeling	LUTMP	Proposed
R12 (20003)	Bedian Road (DHA – LRR – Ferozepur Road)	26.3	D-2	Remodeling	LUTMP	Proposed
R13 (20004)	Shabir Usmani Road (Barkat Market – Maulana Shaukat Ali Road)	2.8	D-3	Remodeling	TEPA	Proposed
R14 (20005)	Link Peco Road – Ferozepur Road	1.9	D-2	Remodeling	LUTMP	Proposed
R15 (20006)	Link Ferozepur Road - Nalay Wali Road (Completion of link between Ferozepur and Multan Road)	1.5	D-2	Remodeling + Construction	TEPA	Proposed
R16 (20007)	Old Ravi Bridge and Road **(Bridge 0.5km)**	1.2	D-3	Remodeling + Construction	TEPA	Proposed
R17 (20008)	G.T. Road (Cooper Store - Ek-Moria Pul)	2.1	D-2	Remodeling	TEPA	Proposed
R18 (20010)	College Road (Ghaus-e-Azam Road to Defence Road)	6.9	D-2	Remodeling + Construction	TEPA	Proposed
R19 (20011)	Structure Plan Road (Shahrah Nazria-e-Pakistan – Defence Road)	12.9	D-3	Remodeling + Construction	TEPA	Proposed
R20 (20020)	EXPO-Kahna Kacha Station Road (Khayban-e-Jinnah – Kahna Kacha Station)	7.1	D-3	Remodeling + Construction	TEPA	Proposed

Project No. (Code)	Project Description	Length (km)	Proposed Lanes	Project Type	Proposed By	Status
R21 (20021)	Main Boulevard PIA Society Road (Baig Road – Ittehad Road)	1.6	D-3	Remodeling	TEPA	Proposed
R22 (20023)	Raiwind Road (Lahore Ring Road Southern Loop – Raiwind City)	14.2	D-3	Remodeling	LUTMP	Proposed
R23 (20024)	Madrat-e-Millat Rd - Defence Road	2.6	D-3	Construction	TEPA	Proposed
R24 (20027)	Extension of Maulana Shaukat Ali Road (Canal Bank Road – Noor-ul-Amin Road through Punjab University)	2.4	D-3	Construction	LUTMP	Proposed
R25 (20041)	Kamahan Lidher Road (Ferozepur Road – Lahore Bedian Road)	8.8	D-2	Remodeling + Construction	C&W	Committed
R26 (20043)	Sua Asil Road (Ferozepur Road – Raiwind Road)	22.0	D-2	Remodeling	C&W	Committed
R27 (20044)	Kahna Station – Raiwind City (Kahna Kacha Approach Road – Raiwind City along Railway Line)	17.8	D-2	Remodeling	C&W	Committed
R28 (20046)	Kahna Kacha Road (Kahna Station – Ferozepur Road)	7.1	D-2	Remodeling	C&W	Committed
R29 (20049)	Sharaqpur Road (Lahore Ring Road – Saggian Wala Bypass) **(Bridge 0.7km)**	37.4	D-3	Remodeling	LUTMP	Proposed
R30 (20049)	Lahore-Sheikhupura Road (Saggian Wala Bypass – G.T. Road)	2.4	D-3	Construction + Remodeling	LUTMP	Proposed
R31 (20050)	Sagianwala Bypass Road (Ring Road – Sharaqpur Road) **(Bridge 0.6km)**	6.7	D-4	Remodeling + Construction	LUTMP	Proposed
R32 (20050)	Lahore-Sheikhupura Road (West) (Sharaqpur Road – Lahore-Sheikhupura Road)	1.9	D-4	Remodeling + Construction	LUTMP	Proposed
R33 (20052)	Link Thokar Niaz Baig Canal Bank Road – Ferozepur Road (Khyaban-e-Jinnah Road – Defence Road – Ferozepur Road)	17.7	D-3	Remodeling + Construction	LUTMP	Proposed
R34 (20053)	Manga-Raiwind Road (Multan Road – Raiwind Road)	15.8	D-3	Remodeling + Construction	LUTMP	Proposed
R35 (20054)	Southern Bypass South Road (Ferozepur Road – College Road)	9.9	D-3	Construction	TEPA	Proposed
R36 (20055)	Southern Bypass North Road (Canal Bank Road – M-2)	3.9	D-3	Remodeling + Construction	TEPA	Proposed
R37 (20056)	Raiwind-Pattoki Road (Raiwind City – Boundary of the Study Area)	19.8	D-3	Remodeling	LUTMP	Proposed
R38 (20057)	Raiwind Road (Thokar – Lahore Ring Road Southern Loop)	12.9	D-3	Remodeling	LUTMP	Proposed
R39 (20060)	Defence Road (Multan Road – Ferozepur Road)	14.3	D-3	Remodeling	LUTMP	Proposed
R40 (20061)	Thokar Niaz Baig Canal Road Extension (Defence Road – Lahore Ring Road Sothern Loop)	3.5	D-3	Construction	LUTMP	Proposed
R41 (20081)	Construction of LRR West (Multan Road – M2)	15.6	D-3	Construction	C&W	Committed
R42 (20082)	Construction of LRR South (Ferozepur Road – Multan Road)	21.8	D-3	Construction	C&W	Committed
R43 (20091)	Secondary Roads in Dharampura Area	5.1	D-2	Remodeling + Construction	LUTMP	Proposed
R44 (20092)	Secondary Roads in Shadbagh Area	41.0	D-2	Remodeling	LUTMP	Proposed
R45 (20093)	Secondary Roads in Samanabad Area	46.0	D-2	Remodeling	LUTMP	Proposed

Note: Further details of these road projects are illustrated in ***Volume-I, Annex-I***.
Source: JICA Study Team

3) Proposed Road Projects by 2030

The road sub-sector projects proposed for LUTMP 2030 are listed in Table 7.3.3 and depicted in Figure 7.1.9.

Table 7.3.3 List of Proposed Road Projects by 2030

Project No. (Code)	Project Name	Length (km)	Lanes	Project Type	Proposed By	Status
R46 (30,002)	Lahore Bypass (G.T. Road – Kala Shah Kaku Bypass)	7.6	D-3	Remodeling	LUTMP	Proposed
R47 (30,002)	Lahore-Islamabad Motorway (M-2) (Lahore-Sheikhupura Road – Boundary of the Study Area) **(Bridge 0.6km)**	17.3	D-4	Remodeling	LUTMP	Proposed
R48 (30,002)	Lahore-Islamabad Motorway (M-2) (Bund Road – Lahore-Sheikhupura Road)	11.6	D-4	Remodeling	LUTMP	Proposed
R49 (30,004)	N-5- Multan Road (Lahore Ring Road Sothern Loop – Boundary of the Study Area)	31.3	D-3	Remodeling	LUTMP	Proposed
R50 (30,005)	Sharif Complex Road (Defence Road – Manga Raiwind Road – Bhai Pheru Kot Rada Kishan Road)	33.2	D-3	Remodeling + Construction	LUTMP	Proposed
R51 (30,006)	North-West Secondary Ring Road (Sharaqpur Road – Lahore-Sheikhupura Road – G.T. Road)	33.8	D-3	Remodeling + Construction	LUTMP	Proposed
R52 (30,008)	Sheikhupura Muridke Road (G.T. Road – M-2)	52.7	D-3	Remodeling	LUTMP	Proposed
R53 (30,010)	Link G.T. Road (Sharaqpur Road – Lahore-Sheikhupura Road – G.T. Road)	5.0	D-3	Remodeling	LUTMP	Proposed
R54 (30,028)	Link Kala Shah Kaku – Lahore-Sialkot Motorway	4.2	D-3	Construction	C&W	Committed
R55 (30,028)	Lahore-Sialkot Motorway **(Bridge 0.8km)**	32.0	D-4	Construction	C&W	Committed
R56 (30,028)	Link G.T. Road Lahore-Sialkot Motorway	0.3	D-3	Construction	C&W	Committed
R57 (Optional)	Construction and remodeling of Secondary roads - south of LRR in the south-western quadrant between Ferozepur Road and Multan Road	93.6	D-3	Remodeling + Construction	LDA/ TEPA/ Developer	Proposed

Note: Further details of these road projects are illustrated in ***Volume-I, Annex-I***.
Source: JICA Study Team

7.3.3 LUTMP 2030 Traffic Management Projects

1) Committed Traffic Management Projects

The following committed projects are on-going or at various stages with GoPb departments/ agencies and are included in LUTMP 2030 as an integral component. The committed projects are listed below in Table 7.3.4 which also outlines their status.

Table 7.3.4 Committed Traffic Management Projects

Project No.	Project Description	Cost (USD Million)	Funding Source
TM01	Establishment of Centralized Driver Licensing Authority	N/A	GoPb
TM02	Parking Management Company	N/A	GoPb
TM03	Traffic Education Center	N/A	GoPb
TM04	Traffic Control Plan of City	N/A	GoPb
TM05	Vehicle Inspection and Certification System	N/A	GoPb/ PPP
TM06	Construction of New Parking Plazas	207.1	GoPb/ PPP
TM07	Construction of Pedestrian Bridges	1.8	GoPb
TM08	Improvement of 52 Junctions	30.5	GoPb

Project No.	Project Description	Cost (USD Million)	Funding Source
TM09	Ferozepur Road Pilot Project	28.3	GoPb
TM10	Conversion of Two Stroke Rickshaw into CNG Fitted Four Stroke Rickshaw	12.4	GoPb
TM11	Remodeling of Inner and Outer Circular Road	14.1	GoPb

Source: JICA Study Team

2) LUTMP Proposed Traffic Management Projects

In addition to the above committed projects, the study has given a full and due consideration to the role of traffic management in the LUTMP 2030. This has been defined and discussed for the traffic management project identification, selection and development in Section 7.1.3. The Following section provides an outline project description and its scope within the LUTMP 2030 for each of the twenty traffic management projects, TM12 to TM31 are listed in Table 7.1.11. The location of each project is depicted in Figure 7.1.10 under six sub-areas, a–f.

A. ***Road Network Operation***

A.1 [TM12] Junction Design and Traffic Signal Network Improvement – CBD

Description: This project is aimed to conduct a complete diagnosis of existing traffic situation and junction design, and traffic signal operation in the area. Road network and junctions designs improvement are proposed particularly to accommodate non-motorized traffic (pedestrians and bicycles). New ITS based signalized network should be established with a central control, as a pilot project.

Scope: There are about total 26 major junctions in this area. Road junction improvement and coordinated traffic signal network is proposed and to be implemented.

Area: Central (b); **Capital Cost:** USD 4.0 Million

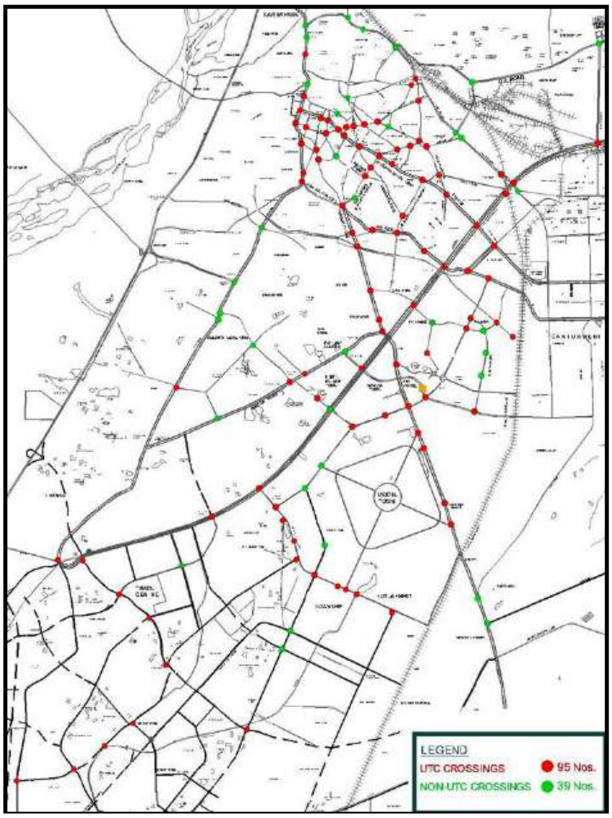
A.2 [TM13] Existing Junctions Design and Network Improvement

Description: This project will consist of three components for each junction improvement; First; build transport database, junctions topographic layout, Second; replacement of existing Non-UTC traffic signal controllers to UTC type, Third; junction design improvement, signal design and network connection of all signalized junctions.

Scope: Total major junctions in Lahore city are about 250, and this project is to cover initially 134 signalized junctions which are identified in Figure 7.3.13. Other non-signalized junctions could be studied for conversion to signalized type at a later stage.

Area: Lahore City (a); **Project Cost t:** USD 30.0 Million

Figure7.3.11 UTC and Non-UTC Traffic Signalized Junctions in Lahore



Source: TEPA

A.3 [TM14] Road Function and Capacity Improvement Program

Description: This project is aimed to enhance the existing road operational capacity by minimizing the road side activities. This will include increasing the road capacity by permanently or temporarily removing the encroachments: parking, vendors, shops, or illegal construction of houses. This will consist of three major components; First; sufficient laws and regulations should be prepared for strict land use control and enforcement, and later curb future encroachment activities. Second, prepare comprehensive road network public right of way plan for identification of encroachments of the road network. Illegal encroachment removal operation should be launched to remove the existing encroachment, immediately. Third, street vendors used to occupy space on temporary and daily basis; will not be easy to remove them. A continuous effort and strict monitoring would be required to curb such encroachments. On other hand, separate commercial facilities should be developed to accommodate all such vendors in a mix land use pattern in all large communities after identification of land area.

Scope: Development of existing right of way plan using the GIS of whole road network right of way should be measured and compared with public right of way records. Prepare comprehensive existing encroachment removal plan.

Mainly include following components; legal framework, fine system development, illegal encroachment database development, and street vendor control.

Area: Lahore City (a); **Capital Cost:** USD 2 Million

B. Traffic Management

B.1 [TM15] Low Occupancy Vehicles – Public Transport for City Outskirts

Description: Outskirts areas of Lahore in the south and east, south and south west have limited or no public transport system. This project is aimed to deploy low occupancy vehicles like Wagons, and may be Qingqis in the outskirts with defined routes. This would also provide feeder service to RMTS, BRT, and Bus transport system.

Scope: Feasibility study for low occupancy vehicle routes to be integrated with the city urban transport system in the outskirts to provide public transport to rural areas.

Area: Outskirts of Lahore City and North of Ravi River (c&f); **Capital Cost:** USD 5.0 Million

B.2 [TM16] Traffic Circulation System Design and Implementation

Description: This is to improve traffic circulation system in the urban center, and other dense parts of CBD. Detail traffic study would formulate an optimal traffic circulation plan for the CBD of Lahore.

Scope: This project should design the traffic circulation system based on traffic simulation, and propose traffic management and control devices plan. This will also include one way street system, installation of traffic control devices and pavement markings etc.

Area: Lahore City (a); **Project Cost:** USD 20 Million (Approximate)

B.3 [TM17] Public and Freight Transport Terminals

Description: Public transport terminal locations in Lahore are not optimal. Freight truck stands are illegally operating along many area and corridors of Lahore due to lack of logistic planning. All such facilities should be relocated to appropriate places with access to urban centres and limit to regional road network. Small delivery trucks and local bus services distribute goods and passengers in the city and other areas.

Scope: This project would have following key components;

i. Feasibility study for the relocation and site selection of public and freight transport terminals;

ii. Detailed design of these terminal facilities considering access to transport network both local and regional;

iii. Construction of public transport (3) and freight terminals (3);

Area: Lahore City and North of Ravi River (a&c); **Capital Cost:** USD 100 Million

B.4 [TM18] Linking Communities – Smart Roads

Description: This is an approach that manages competing interests for limited road space by giving priority use of the road to different transport modes at particular times of the day. All road users will continue to have access to all roads. However, certain routes will be managed to work better for cars, while others will be managed for public transport, cyclists, and pedestrians. It would have the following salient features;

- This would encourage walking by facilitating good pedestrian access to and within the activity centres in periods of high demand;
- Buses are to be given priority along key public transport routes that link activity centres during peak periods;
- Cars would be encouraged to use alternative routes around activity centres to reduce the level of through traffic;
- Bicycles would be encouraged through development of cycle network;
- While trucks would have access at all times to the Trunk road network, these may be given priority on important routes that link freight terminals through the regional network;

Scope: Operational road network simulation model needs to be developed with greater detail than the LUTMP strategic demand model.

Area: Lahore City (a); **Capital Cost:** USD 4.0 Million

B.5 [TM19] Feasibility Study for Traffic Demand Management (TDM) Measures

Description: There are many TDM measures which are practiced worldwide specially in developed countries. TDM measures which suitable for the local traffic and transport environment should be evaluated. This study should set the direction for future TDM strategy for the city, and recommend future needs.

Scope: Evaluation of different TDM measures implemented in many developing and developed countries. Develop options for the implementation of such measures, according to the local conditions and their acceptability to public.

Area: Lahore City (a); **Capital Cost:** USD 2.5 Million

B.6 [TM20] RMTS and BRT Station Area Traffic Management

Description: Rail based Mass Rapid Transit and Bus Rapid Transit stations will be the major multi-modal interchange points; so there needs to be traffic management plan for all station areas of RMTS and BRT lines. Feeder service, private vehicles, and modes like Rickshaws, Wagons and Qingqis need to be given access to avoid traffic chaos around the stations.

Scope: To be conducted with feasibility study of each line.

Area: Lahore City (a); **Capital Cost:** USD 1.5 Million (Approx.)

C. *Non-Motorized Traffic*

C.1 [TM21] Planning and Design Study for Non-Motorized Traffic

Description: Study for the development of pedestrian friendly city including improvement of the accessibility for the vulnerable road users. North of Lahore should be studied in detail and practical road improvements, junction improvements, traffic circulation in coordination with NMTs movements, landscaping, and NMTs user friendly facilities should be planned, and designed. Certain areas could be planned as pedestrian only areas depending upon the requirement.

Scope: This will include the detailed traffic management plan for the non-motorized traffic which includes pedestrians, bicycles, and wheelchairs. Areas should be designed with road access design, walkways, and traffic calming measures.

Area: North of Canal and South of Ravi River (d); **Capital Cost:** USD 1.5 Million

C.2 [TM22] Non-Motorized Traffic Facilities Construction

Description: NMTs planned proposals will be implemented by this project

Scope: Road geometric design, junctions design improvement, walkways, bicycle paths construction, and other proposed measures for handicap persons.

Area: North of Canal and South of Ravi River (d); **Capital Cost:** USD 6 Million

C.3 [TM23] Pedestrian and Bicycle Path Network

Description: Newly developed housing communities in last few decades; like DHA, Model Town, Gulberg, Johar Town areas do not include pedestrian or bicycle facilities at all. Traffic is moving at high speed as compared to densely mixed areas north of the canal. Pedestrians and cyclist are always at risk as they are forced to mix with fast moving traffic in the same road space.

This project objective is to study and design facilities for pedestrians and cycles to make the transport system more sustainable and environment friendly.

Scope: Study to provide segregated or mixed NMT path network with full connectivity with commercial centres, and communities. This project will include the implementation of the proposed measures.

Area: Central (b) and South of Canal (e); **Capital Cost:** USD 5 Million

D. *Parking Management*

D.1 [TM24] Comprehensive Parking System Development

Description: This includes comprehensive planning and design study for on-street and off-street parking facilities. This study would lead to the construction and operation of such facilities in Lahore. Parking Management Company should be established before the start of this project.

Scope: Project will include the following components:

i. Parking policy, guidelines and design standards development;

ii. Parking system facilities planning and design.

Area: North of Canal, and South of Canal (d&e); **Capital Cost :** USD 2.5 Million

D.2 [TM25] Parking Facilities Implementation

Description: Parking facilities construction based on the facilities proposed and designed in comprehensive parking system development project.

Scope: This will include the construction/ provision of on-street and off-street parking facilities, removal of encroachments, and enforcement mechanism for illegal parking control/ management.

Area: North of Canal, and South of Canal (d&e); **Capital Cost:** USD 60 Million (Approx.)

D.3 [TM26] Park and Ride Facilities Development

Description: Park and Ride facilities may be provided in order to attract private car users to public transport system. People can walk; take cycle, motorcycle or car to Park and Ride facility, and take BRT or RMTS to the CBD area.

Scope: Park and Ride facilities to be planned at mass transit line terminals and at the stations if feasible. To be studied in conjunction with the BRT/ RMTS line feasibility studies.

Area: Lahore City (a); **Capital Cost:** USD 75 Million (Approx.)

E. *Enforcement of Traffic Rules and Regulations*

E.1 [TM27] Traffic Enforcement Strengthening Program

Description: Traffic enforcement is the best way to control traffic violations, improve traffic safety of NMTs and other vehicles, stop reckless driving, and streamline traffic flow. Automatic traffic violations central database should be established which would assist in interactive traffic enforcement in the field and detecting vehicles with repeated violations. It would be necessary to do the capacity development of traffic police for efficient enforcement of traffic laws.

Scope: This project could have following components;

i. Traffic violations automated central record;

ii. Capacity development of traffic police;

iii. Provision of controlled space for vehicles detention;

Area: Lahore City (a); **Capital Cost:** USD 3 Million (Approx.)

F. ***Traffic Safety***

F.1 [TM28] Traffic Calming

Description: Road in Lahore have wide right-of-way, and specialy in the newly developed south and south-west side areas. This is to apply road design and traffic management techniques to control traffic speeds in these areas for pedestrian, cyclist safety and better environment.

Scope: The project objectives are to include preparation of detailed design of traffic calming measures and their implementation.

Area: South of Canal (e); **Capital Cost:** USD 6 Million

F.2 [TM29] Traffic Safety Education Improvement

Description: Sense of safety is most important for safe travel behaviour for both motorized and non-motorized traffic. This awareness can be developed through proper education during early childhood, primary school, secondary school, and drivers training.

Traffic Safety should be mandatory part of the syllabus of students in school. This should be specifically designed in context of existing traffic environment by the traffic safety experts.

Scope: Project will include designing and conduct of traffic safety course as mandatory part of education at all possible levels. Public seminars, talk shows should be organized to improve road safety sense in the young generation who are most vulnerable and reckless.

Area: Lahore City (a); **Capital Cost:** USD 1 Million

G. *Intelligent Transportation System*

G.1 [TM30] Intelligent Transportation System Development

Description: This project will consist of three components; First; study for urban traffic control and information system development. Second; will include installation of CCTV cameras and traffic detectors to control and collect real time traffic data, and use for incident management system. Third; centralization of the signal control system in order to provide area-wide real time adaptive traffic control system.

Section for the data collection and processing and dissemination for the traffic information will also be established. This whole project includes extensive component of local capacity development to operate, maintain and further expand the system to wider area.

Scope: Project will include the following components;

i. Study for Urban Traffic Control and Information System Development
ii. Centralized Urban Traffic Control Center
iii. Traffic Signals Equipment and CCTV Surveillance System
iv. Incident Management System
v. Information Dissemination System
vi. Parking Management System Provisions
vii. Enforcement System, FM Radio Channel
viii. Operation and Management of the whole ITS system

Area: Lahore City (a); **Capital Cost:** USD 38 Million

H. *Standards and Guidelines*

H.1 [TM31] Local Standards and Guidelines Development

Description: Local standards and guidelines related traffic engineering are a pre-requisite for bringing the conformity in transport facilities design. This would help to avoid unsafe and poor designs based on perception and intuitions.

Scope: These standards need to be developed considering local conditions and should involve local and international experts in each field in the design review team.

Following standards or guidelines will be developed under this project to be used in Lahore;

i. Road Geometric Design
ii. Traffic Control Devices

iii. Parking Design

iv. Traffic Signal System Design

v. Pavement Design

vi. Development Traffic Impact Assessment Guidelines

vii. Traffic Safety Standards and Guidelines

Area: Lahore City (a); **Capital Cost:** USD 1.5 Million

7.4 Evaluation of Major Master Plan Projects

In this Section, major projects in Section 7.3 are evaluated from the economic, financial and environmental points of view, based on the methodology of Strategic Environmental Assessment (SEA). Finally, these projects are prioritized and classified into the short-, medium- and long-term projects.

7.4.1 LUTMP 2030 Economic Evaluation of Projects

1) Methodology and Assumptions

Following the method of social cost-benefit analysis, all the public transport and road projects comprising the maximum network were evaluated from the economic or social point of view. As the economic benefits of a project, two direct effects by the projects were taken into consideration; one was savings in Vehicle Operating Cost (VOC) and the other was savings in Travel Time Cost (TTC). They were measured by so-called "with- and without" comparison, that is, comparison of traffic assignment results on a network with the project and without the project.

There are many projects to be evaluated and a main purpose of evaluation is to put a comparative priority on each project. Therefore, the following assumptions and standardizations were adopted for simplification and convenience of comparison.

1) **Construction Period** is assumed to be three years of 2017 to 2019 for the road and BRT projects. Construction cost was distributed among the three years, based on the previous studies. In case of RMTS projects, and large-scale highway construction projects, the construction period is assumed to be five years of 2015 to 2019. In case of public transport projects, Rolling stock (or Bus Fleet) cost of the project was allocated only in 2019.

2) **Project Life** is thirty years after starting operation. No residual value is considered.

3) **Traffic Assignment** was done for the year of 2020 and 2030, and the economic benefits were estimated for the two years and an interpolation was done for intermediate years. The economic benefits have been calculated from the results of traffic assignment. After 2030, economic benefit was assumed not to change.

4) **Three Indicators of Economic Viability** have been calculated from the annual cost and benefit streams:

    - B/C (Cost Benefit Ratio)
    - Net Present Value (NPV)
    - EIRR (Economic Internal Rate of Return)

5) **Social Discount Rate** was assumed at 12 %, which is generally used in Pakistan.

6) **Annual Maintenance Cost** of a road project was assumed to be 1.0 % of construction cost of the project. As for a public transport project, annual operation and maintenance cost was estimated separately for each project.

7) **Economic Cost** of a project was assumed to be 85 % of the financial cost of the project.

8) **Exchange Rate** was set as USD 1.00 = PKR 80.00 on December 2010.

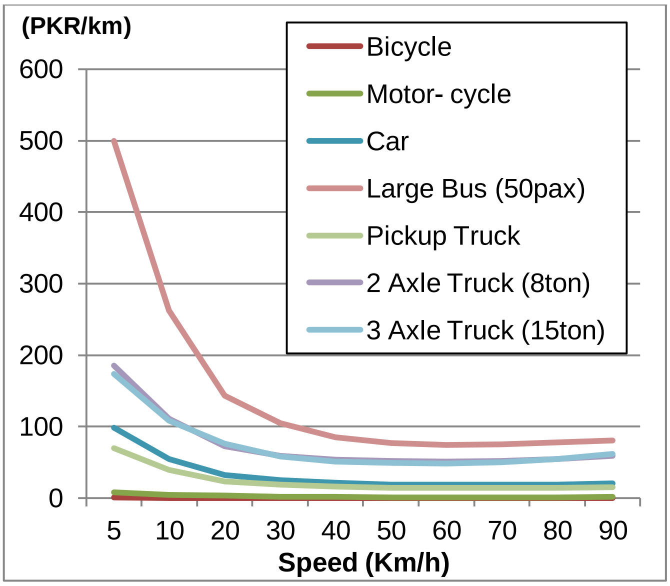
2) VOC and TTC

As savings in VOC and TTC were selected as the economic benefit of a project, unit costs of VOC and TTC were required to estimate those benefits. The unit costs were estimated in 2010.

(i) VOC (Vehicle Operating Cost)

The following figure shows the VOCs by vehicle types used in this study for a range of speeds. The important is that the VOC should be a function of vehicle speed so that the improvement of road condition would be duly reflected as economic benefit.

Figure 7.4.1 Vehicle Operating Cost by Vehicle Speed (Economic Cost)



Source: JICA Study Team

(ii) VOT (Value of Time)

VOT is an important parameter to determine the modal split of passenger traffic, and to provide the basis for economic evaluation of the proposed project. Based on the result of Willingness-To-Pay (WTP) survey conducted in this study, the value was estimated by mode of transport as summarized in Table 7.4.1. This value was assumed to grow at the same growth rate as per-capita GDP used in this study.

Table 7.4.1 The Study Estimated Value of Time (VOT)

(PKR/ Minute.)	2010	2020	2030
(1) Car/ Truck	3.68	5.03	7.49
(2) Motor-cycle	1.81	2.47	3.68
(3) Rickshaw/ Qingqi	1.34	1.83	2.73
(4) Bicycle	1.34	1.83	2.73
(5) Wagon	1.43	1.96	2.91
(6) Bus	1.42	1.94	2.89
(7) A/C Bus	2.23	3.05	4.54

Source: JICA Study Team

3) Economic and Financial Evaluation Results

Economic benefit and estimated economic internal rate of return (EIRR) of each project is given in the following tables. As the threshold of EIRR is 12 %, most projects are judged economically feasible with several expectations. EIRRs of BRT projects were higher than that of RTMS projects. Generally, many projects show extraordinarily high EIRR because of sever congestion in “without project” case.

Due to the excessive simplification of the method, the EIRR should be referred to only for project prioritization.

(i) Public Transport Projects

Table 7.4.2 Public Transport Project Economic Evaluation Results

Public Transport Projects						
Project No.	**Project Code**	**Project Description**	**Length (km)**	**Capital Cost (USD million)**	**O&M Cost (USD million/ year) in 2020**	**EIRR (%)**
PT06	RMS1	Green Line (RMTS)	27.0	2,583	32.8	12.1
PT07	RMS2	Orange Line (RMTS)	27.1	2,330	32.1	10.3
PT08	RMS3	Blue Line (RMTS)	24.0	1,908	26.1	8.0
PT07	RMS2	Orange Line (BRT)	27.1	74.5	38.1	18.8
PT08	RMS3	Blue Line (BRT)	24.0	58.6	20.2	16.7
PT09	BRT1	Purple Line (BRT)	19.0	40.8	5.5	15.5
PT10	BRT2	BRT Line 1	14.1	30.7	5.0	37.6
PT11	BRT3	BRT Line 2	14.3	30.5	3.7	43.5
PT12	BRT4	BRT Line 3a	15.7	28.7	8.0	20.3
PT13	BRT5	BRT Line 3b	19.1	35.3	8.0	

Source: JICA Study Team

Table 7.4.3 Road Sub-sector Project Economic Evaluation Results

Project No.	Project Code	Project Description	Length (km)	Project Cost (USD million)	O&M Cost (USD million)	EIRR (%)
R11	20002	Barki Road (Green City – BRB Canal)	6.8	17.0	0.17	15.6
R12	20003	Bedian Road (DHA – LRR – Ferozepur Road)	26.3	142.0	1.42	15.6
R13	20004	Shabir Usmani Road (Barkat Market – Maulana Shaukat Ali Road)	2.8	6.9	0.07	11.6
R14	20005	Link Peco Road – Ferozepur Road	1.9	6.7	0.07	11.6
R15	20006	Link Ferozepur Road - Nalay Wali Road (Completion of link between Ferozepur and Multan Road)	1.5	5.3	0.05	11.6
R16	20007	Old Ravi Bridge and Road **(Bridge 0.5km)**	1.2	5.3	0.05	56.0
R17	20008	G.T. Road (Cooper Store - Ek-Moria Pul)	2.1	6.3	0.06	11.6
R18	20010	College Road (Ghaus-e-Azam Road to Defence Road)	6.9	14.0	0.14	17.8
R19	20011	Structure Plan Road (Shahrah Nazria-e-Pakistan – Defence Road)	12.9	35.0	0.35	37.3
R20	20020	EXPO-Kahna Kacha Station Road (Khayban-e-Jinnah – Kahna Kacha Station)	7.1	29.9	0.30	17.8
R21	20021	Main Boulevard PIA Society Road (Baig Road – Ittehad Road)	1.6	4.0	0.04	11.6
R22	20023	Raiwind Road (Lahore Ring Road Southern Loop – Raiwind City)	14.2	52.5	0.53	10.7
R23	20024	Madrat-e-Millat Road - Defence Road	2.6	10.9	0.11	11.6
R24	20027	Extension of Maulana Shaukat Ali Road (Canal Bank Road – Noor-ul-Amin Road through Punjab University)	2.4	6.0	0.06	11.6
R25	20041	Kamahan Lidher Road (Ferozepur Road – Lahore Bedian Road)	8.8	26.4	0.26	15.6
R26	20043	Sua Asil Road (Ferozepur Road – Raiwind Road)	22.0	130.7	1.31	10.7
R27	20044	Kahna Station – Raiwind City (Kahna Kacha Approach Road – Raiwind City along Railway Line)	17.8	91.7	0.92	10.7
R28	20046	Kahna Kacha Road (Kahna Station – Ferozepur Road)	7.1	29.9	0.30	10.7
R29	20049	Sharaqpur Road (Lahore Ring Road – Saggian Wala Bypass) **(Bridge 0.7km)**	37.4	202.0	2.02	6.1
R30		Lahore-Sheikhupura Road (Saggian Wala Bypass – G.T. Road)	2.4	20.4	0.20	6.1
R31	20050	Sagianwala Bypass Road (Ring Road – Sharaqpur Road) **(Bridge 0.6km)**	6.7	43.4	0.43	13.3
R32		Lahore-Sheikhupura Road (West) (Sharaqpur Road – Lahore-Sheikhupura Road)	1.9	16.2	0.16	13.3
R33	20052	Link Thokar Niaz Baig Canal Bank Road – Ferozepur Road (Khyaban-e-Jinnah Road – Defence Road – Ferozepur Road)	17.7	57.6	0.58	30.2
R34	20053	Manga-Raiwind Road (Multan Road – Raiwind Road)	15.8	43.5	0.44	10.7
R35	20054	Southern Bypass South Road (Ferozepur Road – College Road)	9.9	57.0	0.57	26.6
R36	20055	Southern Bypass North Road (Canal Bank Road – M-2)	3.9	19.7	0.20	26.6
R37	20056	Raiwind-Pattoki Road (Raiwind City – Boundary of the Study Area)	19.8	73.3	0.73	10.7
R38	20057	Raiwind Road (Thokar – Lahore Ring Road Southern Loop)	12.9	54.2	0.54	17.8
R39	20060	Defence Road (Multan Road – Ferozepur Road)	14.3	60.1	0.60	17.8

Project No.	Project Code	Project Description	Length (km)	Project Cost (USD million)	O&M Cost (USD million)	EIRR (%)
R40	20061	Thokar Niaz Baig Canal Road Extension (Defence Road – Lahore Ring Road Sothern Loop)	3.5	20.8	0.21	15.6
R41	20081	Construction of LRR West (Multan Road – M2)	15.6	121.9	1.22	23.0
R42	20082	Construction of LRR South (Ferozepur Road – Multan Road)	21.8	201.2	2.01	15.6
R43	20091	Secondary Roads in Dharampura Area	5.1	38.9	0.39	35.2
R44	20092	Secondary Roads in Shadbagh Area	41.0	102.5	1.71	11.6
R45	20093	Secondary Roads in Samanabad Area	46.0	115.0	0.48	11.6
R46	30002	Lahore Bypass (G.T. Road – Kala Shah Kaku Bypass)	7.6	41.0	0.41	13.2
R47	30002	M-2 – Lahore-Islamabad Motorway (Lahore-Sheikhupura Road – Boundary of the Study Area) **(Bridge 0.6km)**	16.5	89.0	0.89	13.2
R48	30002	M-2 – Lahore-Islamabad Motorway (Bund Road – Lahore-Sheikhupura Road)	11.3	64.6	0.65	13.2
R49	30004	N-5- Multan Road (Lahore Ring Road Sothern Loop – Boundary of the Study Area)	31.3	109.7	1.10	15.7
R50	30005	Sharif Complex Road (Defence Road – Manga Raiwind Road – Bhai Pheru Kot Rada Kishan Road)	33.2	116.1	1.16	15.7
R51	30006	North-West Secondary Ring Road (Sharaqpur Road – Lahore-Sheikhupura Road – G.T. Road)	33.8	118.3	1.18	13.3
R52	30008	Sheikhupura Muridke Road (G.T. Road – M-2)	52.7	284.4	2.84	13.3
R53	30010	Link G.T. Road (Sharaqpur Road – Lahore-Sheikhupura Road – G.T. Road)	5.0	22.9	0.23	6.1
R54	30028	Link Kala Shah Kaku – Lahore-Sialkot Motorway	4.2	25.1	0.25	20.4
R55	30028	Lahore-Sialkot Motorway **(Bridge 0.8km)**	32.0	128.0	1.28	20.4
R56	30028	Link G.T. Road Lahore-Sialkot Motorway	0.3	2.2	0.02	20.4
R57	Optional	Construction and remodeling of Secondary roads - south of LRR in the south-western quadrant between Ferozepur Road and Multan Road	93.6	The Road Projects will be executed by LDA/ TEPA in conjunction with the developer's contribution towards capital cost.		

Source: JICA Study Team

7.4.2 LUTMP 2030 Financial Evaluation of Projects

1) Methodology and Assumptions

Among the projects comprising the maximum network, income generating projects such as railway projects were evaluated from the financial viewpoint, by comparing cash inflow (fare revenue) and cash outflow (construction cost and operation and maintenance cost). Overall profitability of a project was measured with the Financial Internal Rate of Return (FIRR), not considering the distribution of the profit. This is because the purpose of analysis is just for priority setting on projects.

Main assumptions for the financial analysis are as follows:

1) **Construction Period** is assumed to be three years of 2017 to 2019 for BRT projects. Construction cost was distributed among the three years, based on the

previous studies. In case of RMTS project, the construction period is assumed to be five years of 2015 to 2019. Rolling stock (or Bus Fleet) cost of the project was allocated only in 2019.

2) **Project Life** is thirty years after starting operation. No residual value is considered.

3) **Traffic Assignment** was done for the year of 2020 and 2030, and the revenues were estimated for the two years and an interpolation was done for intermediate years. After 2030, revenues were assumed not to change.

4) **Fare Revenue** was calculated based on the following fare setting and the result of traffic assignment which provided the usage. Fares are assumed to be the same as existing A/C bus in Lahore for BRT and RMTS.

Table 7.4.4 Fare Setting for Public Transport A/C Bus, BRT and RMTS Project

Distance Band	Fare (PKR)
0-5 km	**15**
5-9 km	**20**
9-13 km	**23**
13-17 km	**25**
Above 17 km	**30**

Source: Daewoo Urban A/C Bus Service Fare in 2010

5) **Miscellaneous Revenues** were assumed as 3% of fare revenue, and added to fare revenues.

6) **Impact of Inflation** has been incorporated in the revenue projections as an annual increase of 6%. In addition, 4% of inflation rate applied to O&M cost.

2) Financial Evaluation Results

The following table summarizes the results of financial evaluation. The trend of FIRR results seems to be different by the project. FIRR of RMTS Green line is higher than both: Orange and Blue Lines. FIRR results of BRTs are high, compared with that of RMTS lines.

Table 7.4.5 Financial Evaluation Results of RMTS and BRT Projects

Project No.	Project Description	Length (km)	Capital Cost (USD million)	O&M (USD million/ year) 2020	Revenue (USD million) 2020	Revenue (USD million) 2030	FIRR (%)
PT06	RMTS Green Line	27.0	2,583.0	32.8	70.1	242.7	7.1
PT07	RMTS Orange Line	27.1	2,330.0	32.1	48.9	149.2	5.7
PT08	RMTS Blue Line	24.0	1,908.0	26.1	51.7	154.4	4.9
PT07	BRT Orange Line	27.1	74.5	38.1	43.1	139.9	21.0
PT08	BRT Blue Line	24.0	58.6	20.2	41.4	128.0	17.9
PT09	BRT Purple Line	19.0	40.8	5.5	24.8	134.8	16.1
PT10	BRT Line 1	14.1	30.7	5.0	19.2	107.7	24.9
PT11	BRT Line 2	14.3	30.5	3.7	22.4	108.6	26.5
PT12	BRT Line 3a	15.7	28.7	8.0	44.5	172.8	16.3
PT13	BRT Line 3b	19.1	35.3	8.0			

Source: JICA Study Team

7.4.3 LUTMP 2030 Environmental Evaluation of Projects

1) Methodology and Assumption

Regarding project selection/ prioritization, Multi-Criterion Assessment (MCA) is used. In terms of the environmental assessment, following four environmental criteria are included as it is desirable to comply with the JICA Guidelines for Environmental and Social Considerations, regardless of extent of its contribution to the overall MCA evaluation process.

Table 7.4.6 Environmental Criteria for MCA

Criteria		Indicator	Expected Major Impacts
1	Impacts on Social Environment-1	Land acquisition and resettlement	Loss of land. assets, income, livelihood
2	Impacts on Social Environment-2	Location of project site	Projects in CBD and/or densely populated urban areas may encounter with more difficulties and conflicts of interests among stakeholders than those in other areas.
3	Environmental Pollution	Increase of NOx and PM_x emissions	Deterioration of air quality
4	Impacts on global warming	Increase of CO_2 emissions	Increase in greenhouse gases emissions

Source: JICA Study Team

Table 7.4.7 Rating and Weighting for the Criteria in MCA

Indicator		Projects Concerned	Rating (Score)					Weight (%)
			1	3	5	8	10	
1	Land acquisition and resettlement	Road project	Construction (Required land cost > USD 10 million)	Construction (Required land cost less than USD 10 million)	Remodeling, X road length > 10km (No new land required)	Remodeling, road length less than 10km (No new land required)	Soft approach, only such as institutional improvement	40
2	Location of Project site	Public Transport project/Traffic Management	Mostly CBD and/or densely populated urban area	Urban area	Suburban area	Rural area	Soft approach, only such as institutional improvement	20
3	Increase of Air Pollutants (NOx/PMx) emissions	Common	Significant increase - 1) Construction (Required land cost > USD 10 million), 2) Remodeling (> 30km, 4 lanes and > 10km with 6/8 lanes	Some increase - 1) Construction (Required land cost less than USD 10 million), 2) Remodeling < 10km with 6 lanes and > 30 km with 4 lanes	Almost no change	Some reduction (Bus transport improvement/Traffic management)	Significant reduction (RMTS/ BRT)	20
4	Increase of CO_2 emissions							20

Notes 1: a) According to World Bank and ADB Guidelines (and JICA implicitly recognizes), in case of number of project affected persons (PAPs) is more than 200 the project is classified into Category A, which require full EIA study and Resettlement Action Plan for compensation and supporting PAPs. **b)** In case of occurrence of land acquisition, it is not sufficient to compensation of required land value to land owner. Because the land acquisition and resettlement may affect not only to land, but also to relating assets, livelihood, income etc. of Project Affected Persons (PAPs). Thus, total cost required would include cost of compensation and assistance of PAPs as well as land acquisition cost. In case of no new land requirement such as remodeling of the existing road, matter of land acquisition and resettlement may enlarge with increase in length of road section and traffic volume.

Note 2: If the project sites are located in CBD and/or densely populated urban areas, it may often raise more disputes and conflicts among stakeholders over issues relating to misdistribution of benefit and damage, compensation and support of PAPs than other areas.

Note 3: In general, road transport may dominantly generate both air pollutants and CO_2 emissions resulting in air pollution and global warming in transport sector. In contrast to this, railway transport such as RMTS/BRT may bring about co-benefits in terms of air quality and global warming.

Source: JICA Study Team

2) Environmental Evaluation Results

The following Table 7.4.8 summarizes the results of environmental evaluation of LUTMP Public Transport, Road Sub-sector and Traffic Management Projects.

Table 7.4.8 Environmental Evaluation of LUTMP 2030 Projects

Project No.	Project Code	Project Description	Length (km)	Land Acquisition and Resettlement		Location		Environ-mental Pollution		Global Warming		Total Score	Rank
				Rating	Weight	Rating	Weight	Rating	Weight	Rating	Weight		
Committed Public Transport Projects													
PT01	C.1	Multimodal Inter-City Bus Terminals in Lahore	-	3	0	1	0	8	0	8	0	**5**	**B**
PT02	C.2	Effective and Efficient School Bus System	-	5	0	3	0	8	0	8	0	**6**	**B**
PT03	C.3	Up-grading of Bus Stands	-	3	0	3	0	8	0	8	0	**5**	**B**
PT04	C.4	Integrated Bus Operation	-	3	0	3	0	8	0	8	0	**5**	**B**
PT05	C.5	Establishment of Multimodal Bus Terminal at Shahdara	-	1	0	1	0	10	0	10	0	**5**	**B**
LUTMP 2030 Proposed Public Transport Projects													
PT06	RMS1	Green Line (RMTS)	27.0	1	0	1	0	10	0	10	0	**5**	**B**
PT07	RMS2	Orange Line (Initially BRT)	27.1	1	0	1	0	10	0	10	0	**5**	**B**
PT08	RMS3	Blue Line (Initially BRT)	24.0	1	0	1	0	10	0	10	0	**5**	**B**
PT09	BRT1	Purple Line (BRT)	19.0	8	0	3	0	10	0	10	0	**8**	**A**
PT10	BRT2	BRT Line 1	14.1	8	0	3	0	10	0	10	0	**8**	**A**
PT11	BRT3	BRT Line 2	14.3	8	0	3	0	10	0	10	0	**8**	**A**
PT12	BRT4	BRT Line 3a	15.7	8	0	3	0	10	0	10	0	**8**	**A**
PT13	BRT5	BRT Line 3b	19.1	8	0	3	0	10	0	10	0	**8**	**A**
Road Sub-sector Projects - Committed													
R01	12,001	Construction of LRR (Airport – Ferozepur Road)	13.3	1	0	5	0	1	0	1	0	**2**	**C**
R02	12,002	Construction of Kalma Chowk Flyover	3.4	3	0	1	0	3	0	3	0	**3**	**C**
R03	12,003	Construction of Canal Bank Road Flyover along Ferozepur Road	3.3	3	0	1	0	3	0	3	0	**3**	**C**
R04	12,004	Remodeling of Canal Bank Road	15.6	5	0	3	0	1	0	1	0	**3**	**C**
R05	12,005	Remodeling of Barki Road (LRR – Green City)	3.6	8	0	5	0	3	0	3	0	**5**	**B**
R06	12,006	Remodeling of Kala Khatai Road	26.9	5	0	3	0	3	0	3	0	**4**	**B**
R07	12,007	Remodeling of Allama Iqbal Road	3.3	8	0	3	0	3	0	3	0	**5**	**B**
R08	12,008	Remodeling of Multan Road	11.3	5	0	3	0	1	0	1	0	**3**	**C**
R09	12,009	Remodeling of Thokar Niaz Baig Road (Thokar – Defence Road)	11.0	5	0	3	0	3	0	3	0	**4**	**B**
R10	12,010	Remodeling of Ferozepur Road (Lahore Bridge – Mustafa Abad)	23.6	5	0	3	0	1	0	1	0	**3**	**C**
Road Sub-sector Projects – LUTMP Proposed													
R11	20002	Barki Road (Green City – BRB Canal)	6.8	8	0	3	0	3	0	3	0	**5**	**B**
R12	20003	Bedian Road (DHA – LRR – Ferozepur Road)	26.3	5	0	3	0	3	0	3	0	**4**	**B**
R13	20004	Shabir Usmani Road (Barkat Market – Maulana Shaukat Ali Road)	2.8	8	0	3	0	3	0	3	0	**5**	**B**
R14	20005	Link Peco Road – Ferozepur Road	1.9	8	0	3	0	3	0	3	0	**5**	**B**
R15	20006	Link Ferozepur Road - Nalay Wali Road (Completion of link between Ferozepur and Multan Road)	1.5	8	0	3	0	3	0	3	0	**5**	**B**
R16	20007	Old Ravi Bridge and Road **(Bridge 0.5km)**	1.2	8	0	1	0	3	0	3	0	**5**	**B**

Project No.	Project Code	Project Description	Length (km)	Land Acquisition and Resettlement		Location		Environ-mental Pollution		Global Warming		Total Score	Rank
				Rating	Weight	Rating	Weight	Rating	Weight	Rating	Weight		
R17	20008	G.T. Road (Cooper Store - Ek-Moria Pul)	2.1	8	0	1	0	3	0	3	0	**5**	**B**
R18	20010	College Road (Ghaus-e-Azam Road to Defence Road)	6.9	8	0	3	0	3	0	3	0	**5**	**B**
R19	20011	Structure Plan Road (Shahrah Nazria-e-Pakistan – Defence Road)	12.9	5	0	3	0	3	0	3	0	**4**	**B**
R20	20020	EXPO-Kahna Kacha Station Road (Khayban-e-Jinnah – Kahna Kacha Station)	7.1	3	0	3	0	3	0	3	0	**3**	**C**
R21	20021	Main Boulevard PIA Society Road (Baig Road – Ittehad Road)	1.6	8	0	3	0	3	0	3	0	**5**	**B**
R22	20023	Raiwind Road (Lahore Ring Road Southern Loop – Raiwind City)	14.2	5	0	3	0	1	0	1	0	**3**	**C**
R23	20024	Madrat-e-Millat Road - Defence Road	2.6	3	0	3	0	3	0	3	0	**3**	**C**
R24	20027	Extension of Maulana Shaukat Ali Road (Canal Bank Road – Noor-ul-Amin Road through Punjab University)	2.4	8	0	3	0	3	0	3	0	**5**	**B**
R25	20041	Kamahan Lidher Road (Ferozepur Road – Lahore Bedian Road)	8.8	1	0	3	0	3	0	3	0	**2**	**C**
R26	20043	Sua Asil Road (Ferozepur Road – Raiwind Road)	22.0	1	0	5	0	3	0	3	0	**3**	**C**
R27	20044	Kahna Station – Raiwind City (Kahna Kacha Approach Road – Raiwind City along Railway Line)	17.8	1	0	5	0	3	0	3	0	**3**	**C**
R28	20046	Kahna Kacha Road (Kahna Station – Ferozepur Road)	7.1	3	0	5	0	3	0	3	0	**3**	**B**
R29	20049	Sharaqpur Road (Lahore Ring Road – Saggian Wala Bypass) **(Bridge 0.7km)**	37.4	5	0	3	0	1	0	1	0	**3**	**C**
R30		Lahore-Sheikhupura Road (Saggian Wala Bypass – G.T. Road)	2.4	3	0	3	0	3	0	3	0	**3**	**C**
R31	20050	Sagianwala Bypass Road (Ring Road – Sharaqpur Road) **(Bridge 0.6km)**	6.7	3	0	3	0	3	0	3	0	**3**	**C**
R32		Lahore-Sheikhupura Road (West) (Sharaqpur Road – Lahore-Sheikhupura Road)	1.9	3	0	3	0	3	0	3	0	**3**	**C**
R33	20052	Link Thokar Niaz Baig Canal Bank Road – Ferozepur Road (Khyaban-e-Jinnah Road – Defence Road – Ferozepur Road)	17.7	1	0	3	0	3	0	3	0	**2**	**C**
R34	20053	Manga-Raiwind Road (Multan Road – Raiwind Road)	15.8	3	0	5	0	3	0	3	0	**3**	**B**
R35	20054	Southern Bypass South Road (Ferozepur Road – College Road)	9.9	3	0	3	0	3	0	3	0	**3**	**C**
R36	20055	Southern Bypass North Road (Canal Bank Road – M-2)	3.9	3	0	3	0	3	0	3	0	**3**	**C**
R37	20056	Raiwind-Pattoki Road (Raiwind City – Boundary of the Study Area)	19.8	5	0	3	0	3	0	3	0	**4**	**B**
R38	20057	Raiwind Road (Thokar – Lahore Ring Road Southern Loop)	12.9	5	0	3	0	1	0	1	0	**3**	**C**
R39	20060	Defence Road (Multan Road – Ferozepur Road)	14.3	5	0	3	0	3	0	3	0	**4**	**B**

Project No.	Project Code	Project Description	Length (km)	Land Acquisition and Resettlement		Location		Environ-mental Pollution		Global Warming		Total Score	Rank
				Rating	Weight	Rating	Weight	Rating	Weight	Rating	Weight		
R40	20061	Thokar Niaz Baig Canal Road Extension (Defence Road – Lahore Ring Road Sothern Loop)	3.5	3	0	3	0	3	0	3	0	**3**	**C**
R41	20081	Construction of LRR West (Multan Road – M2)	15.6	1	0	3	0	1	0	1	0	**1**	**C**
R42	20082	Construction of LRR South (Ferozepur Road – Multan Road)	21.8	1	0	5	0	1	0	1	0	**2**	**C**
R43	20091	Secondary Roads in Dharampura Area	5.1	1	0	3	0	3	0	3	0	**2**	**C**
R44	20092	Secondary Roads in Shadbagh Area	41.0	5	0	3	0	1	0	1	0	**3**	**C**
R45	20093	Secondary Roads in Samanabad Area	46.0	5	0	3	0	3	0	3	0	**4**	**B**
R46	30002	Lahore Bypass (G.T. Road – Kala Shah Kaku Bypass)	7.6	8	0	5	0	3	0	3	0	**5**	**B**
R47		M-2 – Lahore-Islamabad Motorway (Lahore-Sheikhupura Road – Boundary of the Study Area) **(Bridge 0.6km)**	16.5	5	0	5	0	1	0	1	0	**3**	**B**
R48		M-2 – Lahore-Islamabad Motorway (Bund Road – Lahore-Sheikhupura Road)	11.3	5	0	5	0	1	0	1	0	**3**	**B**
R49	30004	N-5- Multan Road (Lahore Ring Road Sothern Loop – Boundary of the Study Area)	31.3	5	0	5	0	1	0	1	0	**3**	**B**
R50	30005	Sharif Complex Road (Defence Road – Manga Raiwind Road – Bhai Pheru Kot Rada Kishan Road)	33.2	5	0	5	0	1	0	1	0	**3**	**B**
R51	30006	North-West Secondary Ring Road (Sharaqpur Road – Lahore-Sheikhupura Road – G.T. Road)	33.8	5	0	5	0	1	0	1	0	**3**	**B**
R52	30008	Sheikhupura Muridke Road (G.T. Road – M-2)	52.7	5	0	5	0	1	0	1	0	**3**	**B**
R53	30010	Link G.T. Road (Sharaqpur Road – Lahore-Sheikhupura Road – G.T. Road)	5.0	8	0	5	0	3	0	3	0	**5**	**B**
R54	30028	Link Kala Shah Kaku – Lahore-Sialkot Motorway	4.2	3	0	8	0	3	0	3	0	**4**	**B**
R55		Lahore-Sialkot Motorway **(Bridge 0.8km)**	32.0	1	0	8	0	1	0	1	0	**2**	**C**
R56		Link G.T. Road Lahore-Sialkot Motorway	0.3	3	0	8	0	3	0	3	0	**4**	**B**
R57	Optional	Construction and remodeling of Secondary roads - south of LRR in the south-western quadrant between Ferozepur Road and Multan Road	93.6	***The Road Projects will be executed by LDA/ TEPA in conjunction with the developer. No environmental assessment is considered essential at this stage as each sub-project must be examined on its own merits.***									
Traffic Management Projects – Committed													
TM01	-	Establishment of Centralized Driver Licensing Authority	-	10	0	10	0	8	0	8	0	**9**	**A**
TM02	-	Parking Management Company	-	10	0	10	0	8	0	8	0	**9**	**A**
TM03	-	Traffic Education Center	-	10	0	10	0	8	0	8	0	**9**	**A**
TM04	-	Traffic Control Plan of City	-	10	0	10	0	8	0	8	0	**9**	**A**
TM05	-	Vehicle Inspection and Certification System (VICS)	-	10	0	10	0	8	0	8	0	**9**	**A**
TM06	-	Construction of New Parking Plazas	-	1	0	3	0	8	0	8	0	**4**	**B**
TM07	-	Construction of Pedestrian Bridges	-	3	0	3	0	8	0	8	0	**5**	**B**
TM08	-	Improvement of 52 Junctions	-	1	0	3	0	8	0	8	0	**4**	**B**

Project No.	Project Code	Project Description	Length (km)	Land Acquisition and Resettlement		Location		Environ-mental Pollution		Global Warming		Total Score	Rank
				Rating	Weight	Rating	Weight	Rating	Weight	Rating	Weight		
TM09	-	Ferozepur Road Pilot Project	-	3	0	3	0	8	0	8	0	**5**	**B**
TM10	-	Conversion of Two Stroke Rickshaw into CNG Fitted Four Stroke Rickshaw	-	1	0	8	0	8	0	8	0	**5**	**B**
TM11	-	Remodeling of Inner and Outer Circular Road	-	1	0	8	0	8	0	8	0	**5**	**B**
Traffic Management Projects – LUTMP Proposed													
TM12	A.1	Junction Design and Traffic Signal Improvement – CBD	-	1	0	8	0	8	0	8	0	**5**	**B**
TM13	A.2	Existing Junctions Design and Network Improvement	-	8	0	10	0	8	0	8	0	**8**	**A**
TM14	A.3	Road Function and Capacity Improvement Program	-	10	0	10	0	8	0	8	0	**9**	**A**
TM15	B.1	Low Occupancy Vehicles Planning for Outskirt/ Rural Areas	-	10	0	10	0	8	0	8	0	**9**	**A**
TM16	B.2	Traffic Circulation System Design and Implementation	-	10	0	10	0	8	0	8	0	**9**	**A**
TM17	B.3	Public and Freight Transport Terminals	-	1	0	10	0	8	0	8	0	**6**	**B**
TM18	B.4	Linking Communities - Smart Roads	-	3	0	10	0	8	0	8	0	**6**	**B**
TM19	B.5	Feasibility Study for Traffic Demand Management Measures	-	10	0	10	0	8	0	8	0	**9**	**A**
TM20	B.6	RMTS and BRT Station Area Traffic Management	-	5	0	10	0	8	0	8	0	**7**	**A**
TM21	C.1	Planning and Design Study for Non-Motorized Traffic	-	10	0	10	0	8	0	8	0	**9**	**A**
TM22	C.2	Non-Motorized Traffic Facilities Implementation	-	3	0	10	0	8	0	8	0	**6**	**B**
TM23	C.3	Pedestrian and Bicycle Path Network	-	3	0	10	0	8	0	8	0	**6**	**B**
TM24	D.1	Comprehensive Parking System Development	-	10	0	10	0	8	0	8	0	**9**	**A**
TM25	D.2	Parking Facilities Implementation	-	1	0	10	0	8	0	8	0	**6**	**B**
TM26	D.3	Park and Ride Facilities Development	-	10	0	10	0	8	0	8	0	**9**	**A**
TM27	E.1	Traffic Enforcement Strengthening Programme	-	10	0	10	0	8	0	8	0	**9**	**A**
TM28	F.1	Traffic Calming	-	10	0	10	0	8	0	8	0	**9**	**A**
TM29	F.2	Traffic Safety Education Improvement	-	10	0	10	0	8	0	8	0	**9**	**A**
TM30	G.1	Intelligent Transportation System Development	-	3	0	10	0	8	0	8	0	**6**	**B**
TM31	H.1	Local Standards and Guidelines Development	-	10	0	10	0	8	0	8	0	**9**	**A**

Source: JICA Study Team

The ranking thresholds used in project ranking are given in Table 7.4.9.

Table 7.4.9 Ranking Threshold in Environmental Evaluation

Ranking	Extent of Negative Impact	Total Score
A	Little or negligible impacts	10 to 7
B	Not significant but some impact	7> to 3
C	Significant impact	3 >

Note 1: Public transport and traffic management projects may cause in general little negative impact. However, if the project sites are located in CBD and/or densely populated urban areas, and land acquisition and resettlement are required, it may raise disputes and conflicts among stakeholders over compensation and/or relocation of PAPs including encroachment and illegal occupants. Therefore, severe rating value such as 1 or 3 was applied to some projects of public transport and traffic management.

Source: JICA Study Team

Results of environmental evaluation ranking are briefly described below:

- Projects of ranking C (significant negative impacts expected) are mostly those of construction of roads.
- Projects of ranking B (not significant but some negative impacts expected) are those of RMTS, remodeling of roads (shorter length), and some projects of traffic management and bus transport improvement.
- Projects of ranking A (Little or negligible negative impacts expected) are those of BRT and most of the traffic management projects

7.4.4 Environmental and Social Considerations in MCA

1) Scope of Environmental and Social Considerations

In this study, it is required that Initial Environmental Examination (IEE) level study for several priority projects including scenarios of the regional development plan as well as reviewing existing IEE/ EIA level should be studied separately. In these studies some elements of Strategic Environmental Assessment (SEA) must also be examined.

2) Methodology of Environmental and Social Considerations

(a) Role and Components of Strategic Environmental Assessment

In the JICA Guidelines for Environmental and Social Consideration (April, 2010), SEA is defined as “an assessment being implemented at the policy, planning and program level rather than a project-level EIA.”

In general most of the components of a SEA are the following:

- Comprehensive assessment with integrated evaluation by environmental and social considerations as well as economic, financial, operational and technical factors at the program, plan and policy levels;
- Impact assessment at the early decision-making stage (e.g. planning stage);
- Consideration of alternatives;
- Public participation and information disclosure at the earliest stages;
- Assessment of accumulated impacts beyond one project, if sub-projects are involved.

Regarding major components of SEA, as for comprehensive assessment is concerned, it is conducted by using MCA as described in the previous section. As for public participation and information disclosure at the earlier stage frequent meetings with stakeholders were already held including International Seminar (four times) in the Study.

(b) Examination of Environmental and Social Considerations in the Master Plan

Examination of Environmental and Social Considerations were conducted for the following four types of projects/ plans.

- Public Transport – RMTS, BRT and Bus Transport Improvement projects
- Road Transport projects
- Traffic Management projects
- Urban Development plans

(c) Methodology for IEE Level Study

i) Setting of Environmental Components

- According to JICA Guidelines for Environmental and Social Considerations, anticipated impacts to be assessed include impacts on human health and safety, as well as on the natural environment, that are transmitted through air, water, soil, waste, accidents, water usage, climate change, ecosystems, fauna and flora, including trans-boundary or global scale impacts. These also include social impacts, including migration of population and involuntary resettlement, local economy such as employment and livelihood, utilization of land and local resources, social institutions such as social capital and local decision-making institutions, existing social infrastructures and services, vulnerable social groups such as poor and indigenous peoples, equality of benefits and losses and equality in the development process, gender, children's rights, cultural heritage, local conflicts of interest, infectious diseases such as HIV/AIDS, and working conditions including occupational safety.
- In addition to the direct and immediate impacts of projects, the derivative, secondary, and cumulative impacts as well as impacts associated with indivisible projects will also be assessed with regard to environmental and social considerations, so far as it is rational.
- In this examination thirty five (35) environmental items/ components (social environment, natural environment and environmental pollution) are selected with taking into considerations the above and laws and relevant guidelines of Pakistan Government as well as feature of the project and location of project. These components are given in Table 7.4.10.

Table 7.4.10 Environmental Components for an IEE Level Study

Environmental Component		Remarks/ Comments
A. Social Environment		
1	Involuntary Resettlement (Land Acquisition and Resettlement)	Land acquisition and/or resettlement to secure Right of Way and land for transport related facilities and structures
2	Local economy	Situation of employment and livelihood etc.
3	Land use and utilization of local resources	Change of land use and utilization of local resources
4	Social institutions	Social infrastructure and local decision-making institutions, split of communities
5	Existing social infrastructures and services	Other than Transport infrastructures and services
6	Transport and traffic conditions	Including non-mechanized transport and walks
7	The poor, indigenous of ethnic people	1) Peoples living in slum areas (Katchi Abbadis) and below poverty level, 2) dignity, human rights, economics and cultures of ethnic minority group
8	Gender Issues	Consideration of gender equality and women's empowerment
9	Children's Rights	Interruption of children's schooling and increase in number of children encountered traffic accidents)
10	Misdistribution of benefit and damage	Equality of benefits and losses and equality involved in development process
11	Local conflict of interests	Possible cause for destruction of community structures
12	Cultural property and heritage	Cultural, religious, archaeological and heritage sites
13	Fishing Rights, Water Rights and Rights of Common	Existence of rights ownership
14	Public health and Sanitation	Health condition, prevalence of diseases and sanitary condition
15	Infectious diseases such as HIV/AIDS	Other developing countries infection of HIV/AIDS were often reported due to contact of workers with HIV/AIDS affected people at their camp.
16	Working condition	Including occupational safety
17	Hazard/ Risk (disaster, security)	Including cyclone, seismicity, free from danger (safety and security)
18	Accidents	Traffic accidents and accidents during construction work
B. Natural Environment		
1	Topography and Geology	Specific/valuable feature of topography and geology
2	Soil erosion	Susceptibility to erosion or landslide
3	Groundwater	Major water supply resources of the area
4	River, canal and storm water drainage	1) River and canal flow; 2) Storm water drainage water conditions
5	Flora, Fauna and Biodiversity	1) Valuable and endangered species; 2) Trees and green spaces along the roads and surrounding areas
6	Protected areas	1) National Parks, Nature Reserves, Bird Sanctuaries etc. 2) City parks
7	Landscape and visual amenity	Esthetic value of green area and landmarks
8	Meteorology	Change of local climate condition
9	Global Warming	Greenhouse gas emissions from vehicles and construction machines

Environmental Component		Remarks/ Comments
C. Environmental Pollution		
1	Air pollution	Air pollutants emissions such as NOx and PM_x from vehicles and construction work
2	Water pollution	Discharge of water pollutants during construction work
3	Soil contamination	Contamination of toxic materials in soil
4	Bottom sediment	Contamination of toxic materials in bottom sediment of water bodies
5	Waste	Waste generation during construction work
6	Noise and Vibration	Noise and vibration due to vehicles and construction work
7	Ground Subsidence	Situation of foundation and pumping up of groundwater
8	Offensive odor	Bad smell due to exhaust emission and factories

Source: JICA Study Team

ii) Identifying Project activity

Activities which might affect environmental impacts due to the projects are identified for three stages of implementation, i.e. (a) planning, (b) construction and (c) operation stages.

iii) Identifying of Anticipated Environmental Impacts-1, Formulation of Impact Matrix

By correspondence of each activity to each environmental item extent of anticipated environmental impacts are evaluated one by one with rating.

Anticipated environmental and social impacts due to the project are identified, predicted and evaluated with rating for 35 items according to the scoping procedure as given above in Table 7.4.9.

<u>Rating of the impacts on each item</u>

In general, both positive (beneficial) impact (+) and negative (adverse) impact (-) are expected due to the project activities for the three (planning, construction and operation) stages. Thus the following rating criteria are adopted depending on the extent of impacts:

A (+/-) --- Significant positive/negative impact is expected,

B (+/-) --- Positive/negative impact is expected to some extent,

C (+/-) --- Extent of positive/negative impact is unknown or not clear (Further examination is needed. It should be taken into consideration that impacts may become clearer as study progresses.),

Blank --- Negligible or No impact is expected.

Overall rating --- Overall rating is determined by adopting the worst (negative) value of rating among the three stages.

Extent of anticipated environmental impacts is identified one by one according to the rating corresponding to each activity to each environmental item and the results are expressed with the formulated Impact Matrix.

iv) Identification of Anticipated Environmental Impacts-2, Provisional Scoping

Anticipated environmental impacts are identified and described for each environmental item with provisional scoping table.

v) Possible Mitigation Measures

The above mentioned impacts should be fully taken into considerations to conduct further baseline survey in case of lack of required information and to examine the possible mitigation measures and monitoring as much as possible.

- Baseline survey will be done to make further understanding of existing environment and the effects expected to be caused by the project activities.
- Mitigation measures will minimize the negative impact to an acceptable level through the planning, construction and operation phases. Monitoring is required to ensure that the specified mitigation measures are properly carried out through construction and operation stages.

3) Results of IEE Level Study-1, Overall Comparison of the Projects

Table 7.4.11 shows that the overall comparison of the results. Project categorizations according to JICA Guidelines for Environmental and Social Considerations are also shown in the final column of this Table.

Table 7.4.11 Overall Comparison of the Projects by IEE Level Study

Environmental Component		RMTS	BRT	Road Const.	Road Remod.	Traffic Mgmt.	Bus Improv.	Urban Dev.
A. Social Environment								
1	Involuntary Resettlement (Land Acquisition and Resettlement)	A-	C-	A-	B-	B-	B-	A-
2	Local economy	B+	B+	B+	B+	B+	B+	B+
3	Land use and utilization of local resources	B-	B-	B-	B-	B-	C-	A-
4	Social institutions	A-	B-	A-	B-	B-	B-	A-
5	Existing social infrastructures and services	B-	B-	B-	B-	C-	C-	B-
6	Transport and traffic conditions	B-	B-	B-	B-	C-	C-	B-
7	The poor, indigenous of ethnic people	B-	B-	C-	C-	C-	C-	C-
8	Gender Issues	C-	C-	C-	C-	C-	C-	C-
9	Children's Rights	C-	C-	C-	C-	C-	C-	C-
10	Misdistribution of benefit and damage	A-	B-	A-	B-	B-	B-	A-
11	Local conflict of interests	A-	B-	A-	B-	B-	B-	A-
12	Cultural property and heritage	A-	C-	B-	B-	B-	B-	B-
13	Fishing Rights, Water Rights and Rights of Common	C-	C-	C-	C-	C-	C-	C-
14	Public health and Sanitation	B-	B-	B-	B-	C-	C+	B-
15	Infectious diseases such as HIV/AIDS	B-	B-	B-	B-	B-	B-	B-
16	Working condition	B-	B-	B-	B-	B-	C-	B-
17	Hazard/ Risk (disaster, security)	B-	B-	B-	B-	C-	C-	B-
18	Accidents	B-	B-	B-	B-	B-	B-	B-
B. Natural Environment								
1	Topography and Geology	A-	C-	B-	B-	C-	C-	C-
2	Soil erosion	A-	C-	B-	B-	C-	C-	B-

Environmental Component		RMTS	BRT	Road Const.	Road Remod.	Traffic Mgmt.	Bus Improv.	Urban Dev.
3	Groundwater	B-	B-	B-	B-	C-	C-	B-
4	River, canal and storm water drainage	B-	B-	B-	B-	C-	C-	B-
5	Flora, Fauna and Biodiversity	B-	B-	B-	B-	B-	B-	B-
6	Protected areas	C-	C-	C-	C-	C-	C-	C-
7	Landscape and visual amenity	B-	B-	B-	B-	C-	C-	B-
8	Meteorology	C-	C-	C-	C-			C-
9	Global Warming	B-	B-	B-	B-	C-	C-	C-
C. Environmental Pollution								
1	Air pollution	A-	B-	A-	B-	B-	B-	A-
2	Water pollution	A-	B-	B-	B-	C-	C-	A-
3	Soil contamination	A-	B-	B-	B-	C-	C-	B-
4	Bottom sediment	C-	C-	C-	C-	C-	C-	C-
5	Waste	A-	B-	B-	B-	B-	B-	A-
6	Noise and Vibration	A-	B-	A-	B-	B-	B-	A-
7	Ground Subsidence	C-	C-	C-	C-			C-
8	Offensive odor	C-	C-	C-	C-	C-	C-	C-

Note 1: Overall Rating (Magnitude of impacts); In general, both positive (beneficial) impact (+) and negative (adverse) impact (-) are expected due to the project activities. A (+/-) - Serious impact is expected, B (+/-) - Some impact is expected, C (+/-) - Extent of impact is unknown or not clear (Further examination is needed. It should be taken into consideration that impacts may become clear as study progresses.), Blank - Negligible or No impact is expected. Overall Rating corresponds to the worst value of rating for three stages.
Note 2: C.5, C.6 and C.7 - Assuming in cases of relocation and/or land requirement, and construction of transport related structures in CBD and/or densely populated urban areas.
Source: JICA Study Team

<u>Public Transport (RMTS) Projects</u>

For the RMTS projects considerable area of land would be required for stations (elevated stations and underground station) and elevated sections, depots and multimodal terminals. In addition, a large scale of construction work may cause significant negative impacts, especially in Walled City and high-density urban area. Therefore, RMTS projects are classified as Category A.

In this regards, for RMTS Green Line an EIA level study was conducted in the Reference Design to comply with ADB Safeguard Policies. In the Reference Design stage, unexpectedly major environmental impacts are also examined in detail such as land acquisition and resettlement plan (LARP) for Project Affected Persons (PAPs) including entitlement matrix, quantitative prediction of air quality improvement, measures to protect archaeological and historical sites.

For the RMTS Orange Line project about the same scale of land requirement and construction work is required according to the Feasibility study 2007. At the next step, Reference Design stage, similar to that of the RMTS Green Line, the environmental impacts will be studied.

<u>Public Transport (BRT) Projects</u>

In general little negative impacts are expected of BRT projects. However, some change of existing alignment would be necessary due to encroachment by mosques and other structures in the Walled City area and in central urban areas. Thus, BRT projects are classified as Category B.

Road Transport Projects – Construction of Motorway, Trunk Roads etc.

In case of new construction of Motorway, Trunk Road etc. considerable area of permanent land for road, RoW, related structures (including flyovers, bridges, underpasses, interchanges), and for construction site, would be required. Therefore, land acquisition and resettlement may occur at a larger scale. In addition, construction of structures is also expected to be of larger scale like 4 km length new road bridge across Ravi River. These activities may cause significant impact. Therefore, these projects are classified as Category A.

Road Sub-sector Projects - Remodeling of Existing Roads

In the case of remodeling of existing roads ROW is mostly available. Thus, land acquisition and resettlement may occur at a small scale. However, if the project area is located in high-density, urban consensus of local communities and citizens is an important issue. In general, these projects are classified as Category B.

Traffic Management Projects

Projects are expected to improve vehicular air pollution and greenhouse gases emission due to reducing idling time of vehicles travelling at optimal speed and tend to decrease traffic accidents. However, if the project sites are located in CBD and/ or densely populated urban areas, and land acquisition and resettlement are required, it may raise issues and create conflicts among stakeholders over compensation and/or relocation of PAPs including encroachment and illegal occupants. Therefore, projects are classified as Category B or C, depending on the project.

Bus Transport Improvement Projects

Projects are expected to enhance efficient passenger transportation. However, if the project sites are located in CBD and/or densely populated urban areas, and land acquisition and resettlement are required, it may raise issues and disputes among stakeholders similar to the traffic management projects. Therefore, projects are classified as Category B or C, depending on the project.

Urban Development Plans

Plan of each project relevant to urban development scenario is not in the scope of work as all projects are tested against a single urban development scenario. Therefore at present to examine IEE level study is not necessary. However, projects are as a whole classified into Category A or B through coarse examination.

4) Results of IEE Level Study – General Suggestions and Recommendation

a) Compliance with Both Laws of Pakistan and JICA Guidelines for the Environmental and Social Considerations

Take fully into considerations the differences of relevant environmental laws and regulations, procedure of Environment Approval, EIA Categorization and the land acquisition and resettlement policy between the two: JICA Guidelines and Pakistan.

There are gaps in the compensation and resettlement assistance between Pakistan Government and foreign donors. For example, resettlement assistance to illegal occupants for eligibility and non-depreciated value of structures and assets for valuation are included in the donors' policy, while there are no such considerations for compensation measures in Pakistan laws as shown in Table 7.4.12.

Table 7.4.12 Comparison of Land Acquisition Policies between Pakistan and International Donors including WB, ADB and JICA

No.	Existing Pakistan Land Acquisition Procedure	Donor's Involuntary Resettlement Policy*
1	Land compensation only for titled land owners or holders of customary rights	Lack of title should not be a bar to compensation and/or rehabilitation.
		Non-title holders are to be rehabilitated
2	Crop losses compensation provided only to registered landowners and lease/sharecrop tenants (Non-registered are often deprived).	Crop compensation is provided to landowners and sharecrops/lease tenants according to their shares whether they are registered or not.
3	Tree losses are compensated on the basis of officially fixed rates by the Forest and Horticulture Departments.	Tree losses are compensated according to actual worth of affected trees based on market rates.
4	Land valuation based on the median registered land transfer rate over the previous 3 years.	Land valuation is to be based on current replacement (market) value.
5	Structures valuation based on official rates, with depreciation deducted from the gross value.	Valuation of structures based on current market value/ cost of new construction of the structure.
6	Land Acquisition Collector (LAC) is the only pre-litigation final authority to decide disputes and address complaints regarding quantification/ compensation for the affected lands and other assets.	Complaints and grievance are resolved informally through community participation in the Grievance Redress Committees (GRC), local governments, NGO and/ or local-level community based organizations.

Source: JICA Study Team

b) Land Use Rules 2009

The GoPb enacted new land use rules on 10th February, 2009 based on the 1975 Lahore Development Authority Act. The Rules intend to determine land use in "controlled" areas according to land use classification. In Lahore land use plan in any development should comply with land use classification and sub-classification of the Rules.

c) Public Participation

As described in Volume II Chapter 4.3 Public participation is another pillar of SEA, information disclosure and public participation should be fully considered for all the stakeholders from early stage of planning for obtaining thorough understanding and consensus of the people and communities. In addition, delay or suspension of the project implementation and a split of communities may occur. Full consideration is to be given to minimize misdistribution of benefits and damage, and to avoid local conflict of interest.

d) Alternative Comparisons

Proposed projects should be evaluated with alternatives including “no action” or do nothing case in the SEA process. In the Feasibility Study of Lahore Ring Road Southern Loop project following four alternative routes (A1, A, C and D) in the project area and alternative D was selected finally as shown in Table 7.4.13.

Table 7.4.13 Comparison of Alternative Routes for Lahore Ring Road Southern Loop

No.	Evaluation Item	Alternative A1	Alternative A	Alternative C	Alternative D
1	Utility Services Upgrades	++	++	+	+
2	Right of Way Restrictions/	+++	+++	+	+
3	Height Restrictions	+++	++	-	-
4	Constructability Constraints	+++	+++	+	+
5	Off-Site Improvements	+++	+++	+	+
6	New Interchanges	+	++	++	++
7	Parallel Roads	++	+++	-	-
8	Environmental Impacts	+++	++	++	+
9	Economic And Financial Viability	+	++	+	+++

Note 1: Extent of negative impact - (+++) High, (++) Medium, (+) Low, (-) Negligible
Note 2: “No action” and Alternative B cases are excluded.
Source: JICA Study Team

e) Environmental Components to be Considered

- Impact on global warming: reduction of CO_2 emission is not estimated quantitatively.
- Vulnerable social groups such as poor and gender aspects.

5) Results of IEE Level Study-2, Suggestions and Recommendation for Major Components/ Items

(a) Land Acquisition and Resettlement Issues

One of the most critical issues in development projects is land acquisition and resettlement. In the transport development if the land for the Right of Way (ROW) is required for the alignment and related structures, land acquisition and resettlement issues would need to be considered.

In order to make it clear that the occurrence of land acquisition and resettlement, following survey are required in general:

- Survey of ownership, usage and usufruct rights of the project site.
- Inventory survey on facilities and structures along corridor/ road and encroachment on the ROW. --- Identify the occurrence and features of land acquisition and resettlement and anticipated PAPs through the detailed survey of RoW based on Cadestral map.
- Survey on legal and institutional framework for resettlement and compensation.

If the occurrence of land acquisition and resettlement are anticipated, project proponent should provide adequate information to PAPs and consult with stakeholders including PAPs to reach an agreement or thorough understanding of the issues from an early stage of the project plan as much as possible.

Project proponent should also formulate LARP (Land Acquisition and Resettlement Plan) according to both Pakistan Laws and JICA Guidelines and monitor result of the compensation and restoring living conditions and livelihood after implementation.

Figure 7.4.2 Examples of Project Site – RMTS Depots

	
(1) Green Line South Depot located in Shadab Colony (150,000m^2)	(2) Orange Line South Stabling Yard at Ali town (50,000m^2)

Source: LRMTS Studies

b) Special Concerns with Archaeological and Heritage Sites

There are no archaeological sites protected under the Federal Antiquities Act near or adjacent to the alignment and works area. However, the RMTS alignments will run through important historic areas of Lahore and close to a number of historical buildings. Therefore, there is some possibility of impacts on currently unidentified archaeological deposits. In this regard, special concerns of examination of possible impacts and mitigation measures are to be undertaken.

c) Measures to Avoid and/ or Minimize Split of Community/ Severance

Road structure should be somewhat elevated structure with underpass for non-motorized transport and walking at appropriate stretch/ interval to be provided and not at-grade for the length of the project.

To avoid split of community and interference of cattle movement devices such as underpass and walking bridge are required for road structure design. According to C&W Department, LRR EIA study report was submitted to EPD and they have received an Environmental Approval.

Figure 7.4.3 Measures to Minimize Split of Community/ Severance

	
(1) Concrete fence on central median (Multan Road), severe case of severance	(2) Foot bridge for Multan Road crossing severance mitigation

Source: JICA Study Team

d) Working Condition

A large scale of construction work including underground station requires a large number of construction workers would be engaged in the work. Thus, safety and health condition of the workers may be jeopardized due to construction work.

- Prepare tangible safety considerations for individuals involved in the project, such as the installation of safety equipment which prevents accidents, and management of hazardous materials.
- Plan and implement intangible measures for individuals involved in the project, such as the establishment of a safety and health program, and safety training for workers etc.

e) Infectious Diseases such as HIV/ AIDS

In general, road construction workers, and construction vehicle drivers are considered as having high potential for the spread of sexually transmitted diseases (STDs) and HIV/AIDS virus due to their mobility. Infection with HIV/AIDS and venereal disease was often reported at worker's camps during road construction in other countries.

f) Topographical and Geological Impacts

In transport projects considerable scale topographical and geological alteration are expected for road and railway constructions such as a bridge crossing of Ravi River and underground sections and stations of RMTS. In these cases precise topographical and detailed geotechnical survey are necessary at the Detailed Design phase. In Reference Design of RMTS Green Line the survey by drilling exploratory boreholes and measuring geotechnical parameters such as standard penetration test (SPT) and field permeability test etc., were conducted and due care was taken to note the existence of any archeological deposits.

g) Measures Against Inundation

There is some possibility of inundated water to result in flooding of structures/ facilities, especially underground station due to poor drainage condition of the project area.

h) Flora, Fauna and Ecosystem

A tree-cutting permit shall be secured by the contractor prior to removal of vegetation. In general, for every tree felled, four trees need to be planted to compensate for the loss in vegetation.

Selection of appropriate species and the design of the planting and maintenance program shall be carried out by the contractor in close consultation with the Forestry Department.

Figure 7.4.4 Endangered Greenery along Main Boulevard Gulberg

(1) Greenery along the road

Source: JICA Study Team

i) Global Warming

In case of category A project, increase or reduction of greenhouse gases emissions due to the project should be roughly estimated quantitatively in order to make the extent of negative/positive impact more persuasive.

In this regards, CO_2 emission is applicable as an indicator of greenhouse gases emissions using appropriate emission factor.

j) Air Pollution

In case of category A project, increase or reduction of vehicle exhaust emissions due to the project should be roughly estimated quantitatively in order to make the extent of the negative/positive impact more persuasive.

In this regards, NO_X, PM_X and other pollutants due to vehicles emissions are applicable as indicators of air pollutants emissions using appropriate emission factor.

In the Reference Design Study of RMTS Green Line the ambient air quality effects of traffic emissions were evaluated for seven locations at the busiest and most congested areas such as Badshahi Masjid Chowk along the corridor using the CALINE4 dispersion model.

k) Formulation of Environmental Management Plan Including Monitoring

Anticipated negative impacts should be fully taken into considerations to conduct further necessary baseline survey and examine the mitigation measures including avoidance and monitoring as much as possible.

- Baseline survey will be conducted to make further understanding of existing environment and affects expected to be caused by the project activities.
- Mitigation measures will minimize the adverse impact to an acceptable level through the planning, construction and operation phases. Monitoring is required to ensure that the specified mitigation measures are properly implemented throughout the construction and operation stages.

In general, to ensure the implementation of mitigation measures including monitoring, a comprehensive environmental management plan is needed. The plan portrays expected impacts, mitigation measures and responsible organizations for planning, construction and operation stages of a project.

7.4.5 Overall MCA of LUTMP 2030 Projects

1) Road and Public Transport Project

When the public sector invests in transport facilities, the primary purpose is “the public service”, or the social benefit. The proposed projects were evaluated for their economic IRRs to assign priority accordingly. The social benefit of a given project can be paraphrased as its impact in serving the twin purposes of reducing the operational cost of all the transport means available and reducing the travel time of all passengers on the available transport means (both users and non-users).

In addition, the projects are evaluated on the following aspects of implementation.

- **A.** Economic Viability
- **B.** Traffic Demand (Contribution to the improvement of transport capacity), Operational aspects
- **C.** Consistency with Land Use
- **D.** Financial Viability
- **E.** Environmental and Social Impacts

As a first step, the scores are aggregated per project and are used to prioritize. Each project is evaluated by the threshold defined in the following Table 7.4.14.

Table 7.4.14 Ranking Threshold by Evaluation Criteria

Criteria		Weight	Indicator	X	Y	Z
A. Economic Return		0.4	Economic IRR	X>20%	20>X>12%	12%>X
B. Demand in 2020	Road	0.15	(Veh.* km)/km	X>30,000	30,000-10,000	10,000<X
	Public Transport		Pax/day	X>800,000	800,000-500,000	500,000<X
C. Consistency with Land Use Plan		0.15	-	Contribute	Supportive	No Relation
D. Financial Return		0.15	Financial IRR	X>5%	5>X>2%	2%>X or No income
E. Environmental Evaluation		0.15	(SEC result)	No impact (no mark)	Some impact (+)	Serious impact (++)

Source: JICA Study Team

As the second step, the rankings by five criteria were aggregated into a single rank, taking such process as (1) to give five points to rank “A”, three points to rank “B” and one point to rank “C”, (2) to add up each point after multiplication with “weight”, and (3) Classify into “Short-term” if the total is greater than 3.5 points; rank “Medium-term” if the total is greater than 2.5 and less than 3.5; otherwise “Long-term”. Results of the evaluation are given in Table 7.4.15 for the LUTMP Projects

Table 7.4.15 MCA Evaluation Results of LUTMP 2030 Public Transport and Road Projects

No.	Project Code	Project Description	Length (km)	EIRR	Demand 2020	Land Use	FIRR	Env.	Total Score	Rank	Remarks
				Weights							
				0.4	0.15	0.15	0.15	0.15			
Public Transport Projects – Committed											
PT01	C.1	Multimodal Inter-City Bus Terminals in Lahore	-	-	-	3	1	5	-	S	On-going
PT02	C.2	Effective and Efficient School Bus System	-	-	-	1	1	5	-	S	On-going
PT03	C.3	Up-grading of Bus Stands	-	-	-	1	1	5	-	S	On-going
PT04	C.4	Integrated Bus Operation	-	-	-	1	1	5	-	S	On-going
PT05	C.5	Establishment of Multimodal Bus Terminal at Shahdara	-	-	-	3	1	5	-	S	On-going
Public Transport Projects – LUTMP Proposed											
PT06	RMS1	RMTS Green Line	27.0	1	5	5	5	3	3.1	M	LUTMP
PT07	RMS2	RMTS Orange Line (Initially BRT)	27.1	1	3	5	3	3	2.5	L	LUTMP
PT08	RMS3	RMTS Blue Line (Initially BRT)	24.0	1	3	5	3	3	2.5	L	LUTMP
PT09	BRT1	BRT Purple Line	19.0	3	1	5	5	5	3.6	S	LUTMP
PT10	BRT2	BRT Line 1	14.1	5	1	5	5	5	4.4	S	LUTMP
PT11	BRT3	BRT Line 2	14.3	5	1	5	5	5	4.4	S	LUTMP
PT12	BRT4	BRT Line 3a	15.7	5	3	5	5	5	4.7	S	LUTMP
PT13	BRT5	BRT Line 3b	19.1	5	3	5	5	5	4.7	S	LUTMP
Road Sub-sector Projects – LUTMP Committed											
R01	12001	Construction of LRR (Airport – Ferozepur Road)	13.3	-	1	5	1	1	-	S	On-going
R02	12002	Construction of Kalma Chowk Flyover	3.4	-	1	5	1	1	-	S	Completed
R03	12003	Construction of Canal Bank Road Flyover	3.3	-	1	5	1	1	-	S	On-going
R04	12004	Remodeling of Canal Bank Road	15.6	-	1	5	1	1	-	S	Completed

No.	Project Code	Project Description	Length (km)	EIRR	Demand 2020	Land Use	FIRR	Env.	Total Score	Rank	Remarks
				Weights							
				0.4	0.15	0.15	0.15	0.15			
R05	12005	Remodeling of Barki Road (LRR – Green City)	3.6	-	1	5	1	3	-	S	On-going
R06	12006	Remodeling of Kala Khatai Road	26.9	-	1	5	1	3	-	S	On-going
R07	12007	Remodeling of Allama Iqbal Road	3.3	-	1	5	1	3	-	S	On-going
R08	12008	Remodeling of Multan Road	11.3	-	1	5	1	1	-	S	Completed
R09	12009	Remodeling of Thokar Niaz Baig Road	11.0	-	1	5	1	3	-	S	On-going
R10	12010	Remodeling of Lahore Ferozepur Road	23.6	-	1	5	1	1	-	S	Completed
Road Sub-sector Projects – LUTMP Proposed											
R11	20002	Barki Road (Green City – BRB Canal)	6.8	3	3	3	1	3	2.7	M	LUTMP
R12	20003	Bedian Road (DHA – LRR – Ferozepur Road)	26.3	3	3	3	1	3	2.7	M	LUTMP
R13	20004	Shabir Usmani Road (Barkat Market – Maulana Shaukat Ali Road)	2.8	1	1	5	1	3	1.9	L	LUTMP
R14	20005	Link Peco Road – Ferozepur Road	1.9	1	1	5	1	3	1.9	L	LUTMP
R15	20006	Link Ferozepur Road - Nalay Wali Road (Completion of link between Ferozepur and Multan Road)	1.5	1	1	5	1	3	1.9	L	Committed
R16	20007	Old Ravi Bridge and Road **(Bridge 0.5km)**	1.2	5	5	1	1	3	3.5	M	Committed
R17	20008	G.T. Road (Cooper Store - Ek-Moria Pul)	2.1	1	1	5	1	3	1.9	L	Committed
R18	20010	College Road (Ghaus-e-Azam Road to Defence Road)	6.9	3	3	3	1	3	2.7	M	Committed
R19	20011	Structure Plan Road (Shahrah Nazria-e-Pakistan – Defence Road)	12.9	5	5	3	1	3	3.8	S	Committed
R20	20020	EXPO-Kahna Kacha Station Road (Khayban-e-Jinnah – Kahna Kacha Station)	7.1	3	3	3	1	1	2.4	L	Committed
R21	20021	Main Boulevard PIA Society Road (Baig Road – Ittehad Road)	1.6	1	1	5	1	3	1.9	L	Committed
R22	20023	Raiwind Road (Lahore Ring Road Southern Loop – Raiwind City)	14.2	1	1	3	1	1	1.3	L	LUTMP
R23	20024	Madrat-e-Millat Road - Defence Road	2.6	1	1	5	1	1	1.6	L	Committed
R24	20027	Extension of Maulana Shaukat Ali Road (Canal Bank Road – Noor-ul-Amin Road through Punjab University)	2.4	1	1	5	1	3	1.9	L	Committed
R25	20041	Kamahan Lidher Road (Ferozepur Road – Lahore Bedian Road)	8.8	3	3	3	1	1	2.4	L	Committed
R26	20043	Sua Asil Road (Ferozepur Road – Raiwind Road)	22.0	1	1	3	1	1	1.3	L	Committed
R27	20044	Kahna Station – Raiwind City (Kahna Kacha Approach Road – Raiwind City along Railway Line)	17.8	1	1	3	1	1	1.3	L	Committed
R28	20046	Kahna Kacha Road (Kahna Station – Ferozepur Road)	7.1	1	1	3	1	3	1.6	L	Committed
R29	20049	Sharaqpur Road (Lahore Ring Road – Saggian Wala Bypass) **(Bridge 0.7km)**	37.4	1	3	1	1	1	1.3	L	Committed
R30		Lahore-Sheikhupura Road (Saggian Wala Bypass – G.T. Road)	2.4	1	3	1	1	1	1.3	L	LUTMP
R31	20050	Sagianwala Bypass Road (Ring Road – Sharaqpur Road) **(Bridge 0.6km)**	6.7	3	1	1	1	1	1.8	L	LUTMP
R32		Lahore-Sheikhupura Road (West) (Sharaqpur Road – Lahore-Sheikhupura Road)	1.9	3	1	1	1	1	1.8	L	LUTMP
R33	20052	Link Thokar Niaz Baig Canal Bank Road – Ferozepur Road (Khyaban-e-Jinnah Road – Defence Road – Ferozepur Road)	17.7	5	5	3	1	1	3.5	M	LUTMP
R34	20053	Manga-Raiwind Road (Multan Road – Raiwind Road)	15.8	1	1	3	1	3	1.6	L	LUTMP
R35	20054	Southern Bypass South Road (Ferozepur Road – College Road)	9.9	5	5	3	1	1	3.5	M	LUTMP
R36	20055	Southern Bypass North Road (Canal Bank Road – M-2)	3.9	5	5	3	1	1	3.5	M	Committed

No.	Project Code	Project Description	Length (km)	EIRR	Demand 2020	Land Use	FIRR	Env.	Total Score	Rank	Remarks
				Weights							
				0.4	0.15	0.15	0.15	0.15			
R37	20056	Raiwind-Pattoki Road (Raiwind City – Boundary of the Study Area)	19.8	1	1	3	1	3	1.6	L	LUTMP
R38	20057	Raiwind Road (Thokar – Lahore Ring Road Southern Loop)	12.9	3	3	3	1	1	2.4	L	LUTMP
R39	20060	Defence Road (Multan Road – Ferozepur Road)	14.3	3	3	3	1	3	2.7	M	LUTMP
R40	20061	Thokar Niaz Baig Canal Road Extension (Defence Road – Lahore Ring Road Sothern Loop)	3.5	3	3	3	1	1	2.4	L	LUTMP
R41	20081	Construction of LRR West (Multan Road – M2)	15.6	5	5	3	1	1	3.5	M	Committed
R42	20082	Construction of LRR South (Ferozepur Road – Multan Road)	21.8	3	3	3	1	1	2.4	L	Committed
R43	20091	Secondary Roads in Dharampura Area	5.1	5	5	5	1	1	3.8	S	LUTMP
R44	20092	Secondary Roads in Shadbagh Area	41.0	1	1	5	1	1	1.6	L	LUTMP
R45	20093	Secondary Roads in Samanabad Area	46.0	1	1	5	1	3	1.9	L	LUTMP
R46	30002	Lahore Bypass (G.T. Road – Kala Shah Kaku Bypass)	7.6	3	3	3	1	3	2.7	M	LUTMP
R47		M-2 – Lahore-Islamabad Motorway (Lahore-Sheikhupura Road – Boundary of the Study Area) **(Bridge 0.6km)**	16.5	3	3	3	1	3	2.7	M	LUTMP
R48		M-2 – Lahore-Islamabad Motorway (Bund Road – Lahore-Sheikhupura Road)	11.3	3	3	3	1	3	2.7	M	LUTMP
R49	30004	N-5- Multan Road (Lahore Ring Road Sothern Loop – Boundary of the Study Area)	31.3	3	3	1	1	3	2.4	L	LUTMP
R50	30005	Sharif Complex Road (Defence Road – Manga Raiwind Road – Bhai Pheru Kot Rada Kishan Road)	33.2	3	3	1	1	3	2.4	L	LUTMP
R51	30006	North-West Secondary Ring Road (Sharaqpur Road – Lahore-Sheikhupura Road – G.T. Road)	33.8	3	1	1	1	3	2.1	L	LUTMP
R52	30008	Sheikhupura Muridke Road (G.T. Road – M-2)	52.7	3	1	1	1	3	2.1	L	LUTMP
R53	30010	Link G.T. Road (Sharaqpur Road – Lahore-Sheikhupura Road – G.T. Road)	5.0	1	3	1	1	3	1.6	L	LUTMP
R54	30028	Link Kala Shah Kaku – Lahore-Sialkot Motorway	4.2	5	3	1	1	3	3.2	M	LUTMP
R55		Lahore-Sialkot Motorway **(Bridge 0.8km)**	32.0	5	3	1	1	1	2.9	M	LUTMP
R56		Link G.T. Road Lahore-Sialkot Motorway	0.30	5	3	1	1	3	3.2	M	LUTMP
R57	Optional	Construction and remodeling of Secondary roads - south of LRR in the south-western quadrant between Ferozepur Road and Multan Road	93.6	MCA was not conducted as project EIRR, FIRR and Landuse not available.					Project is LDA/ TEPA/ Private Developer Promoted.		

Note 1: S: Short Term, M; Medium Term, L: Long Term
Source: JICA Study Team

2) MCA Evaluation of Traffic Management Project

Traffic Management Projects – Evaluation Criteria

Traffic management projects will be most effective in alleviating of traffic congestion, improving traffic safety and mobility of non-motorized transport user. Especially, the alleviation of traffic congestion will contribute to improvement of air pollution, along project site. Therefore, these three items will be the main criteria for the traffic management project evaluation. On the other hand, feasibility of these projects depends on capacity of executing agencies, project cost and technical difficulty. Taking into these things, the prioritization of traffic management projects is evaluated by the following eight (8) criteria components:

- **A.** Congestion Alleviation: Contribution to the alleviation of traffic congestion. This will contribute to the improvement of air pollution along project sites, from view point of environmental consideration;
- **B.** Contribution to Traffic Safety;
- **C.** Contribution to Non-Motorized Transport User;
- **D.** Environmental Evaluation;
- **E.** Institutional Capacity: Some projects will require new law, new legal system and inter-sectoral coordination among relevant agencies. Therefore, its difficulty will be divided into 3 grades;
- **F.** Implementation Experience;
- **G.** Technical Difficulties: Some projects would require application of new technology, so its difficulty will be divided into 3 grades; and
- **H.** Scale of Cost

The following Table 7.4.16 shows the evaluation criteria and its ranking threshold.

Table 7.4.16 Evaluation Criteria for Traffic Management Projects

Evaluation Criteria		Weight	X	Y	Z
A. Congestion Alleviation		0.20	Big Effect	Some Effect	Less Effect
B. Contribution for Traffic Safety		0.20	Big Effect	Some Effect	Less Effect
C. Contribution to Non-motorized Transport		0.20	Big Effect	Some Effect	Less Effect
D. Environmental Evaluation		0.10	No impact	Some impact	Serious impact
Capacity of Executing Agencies	**E.** Institutional Capacity	0.05	No Difficulty	Some Difficulty	Serious Difficulty
	F. Implementation	0.05	Enough	Some	No
	G. Technical Difficulties	0.05	No Difficulty	Some Difficulty	Serious Difficulty
H. Scale of Cost		0.15	Low	Medium	High

Source: JICA Study Team

Rankings by five criteria were aggregated into single rank, taking such process as: (1) to give five points to rank “A”, three points to rank “B” and one point to rank “C”, (2) to add up each point after multiplication with “weight”, and (3) Classify into “Short-tem” if the total is greater than 3.5 points, rank “Medium-term” if the total is between 2.5 and 3.5; otherwise “Long-term”.

Results of the evaluation of the traffic management projects are given for the committed projects in Table 7.4.17, and for the LUTMP proposed projects in Table 7.4.18.

Table 7.4.17 Evaluation Results of Committed Traffic Management Projects

Project No.	Project Description	A Cong.	B Road Safety	C NMT Traffic	D Env.	E Inst.	F Exp.	G Tech.	H Cost	Total Score	Ranking
		Weight									
		0.2	0.2	0.2	0.1	0.05	0.05	0.05	0.15		
TM01	Establishment of Centralized Driver Licensing Authority	3	5	1	5	3	1	3	5	3.4	M
TM02	Parking Management Company	3	3	3	5	1	1	1	5	3.2	M
TM03	Traffic Education Center	3	5	3	5	3	1	3	5	3.8	S
TM04	Traffic Control Plan of City	5	3	5	5	1	1	1	5	4.0	S
TM05	Vehicle Inspection and Certification System (VICS)	1	5	1	5	1	1	1	5	2.8	M
TM06	Construction of New Parking Plazas	3	1	1	5	5	3	3	3	2.5	L
TM07	Construction of Pedestrian Bridges	1	5	5	5	5	5	5	3	3.9	S
TM08	Improvement of 52 Junctions	5	3	3	5	1	1	1	3	3.3	M
TM09	Ferozepur Road Pilot Project	1	3	1	5	1	1	1	3	2.1	L
TM10	Conversion of Two Stroke Rickshaw into CNG Fitted Four Stroke Rickshaw	5	3	5	5	3	3	3	3	4.0	S
TM11	Remodeling of Inner and Outer Circular Road	5	3	5	5	1	1	1	5	4.0	S

Source: JICA Study Team

Table 7.4.18 Evaluation Results of LUTMP 2030 Traffic Management Projects

Project No.	Project Description	A Cong.	B Road Safety	C NMT Traffic	D Env.	E Inst.	F Exp.	G Tech.	H Cost	Total Score	Ranking
		Weight									
		0.2	0.2	0.2	0.1	0.05	0.05	0.05	0.15		
TM12	A.1 Junction Design and Traffic Signal Improvement – CBD	5	5	5	5	1	1	1	5	4.4	S
TM13	A.2 Existing Junctions Design and Network Improvement	4	4	4	4	1	1	1	3	3.4	M
TM14	A.3 Road Function and Capacity Improvement Program	5	4	5	5	3	3	3	5	4.5	S
TM15	B.1 Low Occupancy Vehicles Planning for Outskirt/ Rural Areas	3	2	2	5	3	1	3	5	3.0	M
TM16	B.2 Traffic Circulation System Design and Implementation	5	3	3	5	1	1	1	3	3.3	M
TM17	B.3 Public and Freight Transport Terminals	5	3	2	5	1	1	1	3	3.1	M
TM18	B.4 Linking Communities - Smart Roads	4	5	5	5	1	1	1	5	4.2	S
TM19	B.5 Feasibility Study for Traffic Demand Management Measures	3	3	3	5	1	1	1	5	3.2	M
TM20	B.6 RMTS and BRT Station Area Traffic Management	1	1	1	5	0	1	1	3	1.7	L
TM21	C.1 Planning and Design Study for Non-Motorized Traffic	3	5	5	5	0	1	1	5	4.0	S
TM22	C.2 Non-Motorized Traffic Facilities Implementation	3	5	5	5	5	5	5	5	4.6	S
TM23	C.3 Pedestrian and Bicycle Path Network	3	5	5	5	1	1	1	5	4.0	S
TM24	D.1 Comprehensive Parking System Development	4	4	4	5	1	1	1	3	3.5	S
TM25	D.2 Parking Facilities Implementation	2	2	2	1	2	2	2	2	1.9	L
TM26	D.3 Park and Ride Facilities Development	1	1	1	5	1	1	1	1	1.4	L
TM27	E.1 Traffic Enforcement Strengthening Programme	3	5	3	5	4	3	3	5	4.0	S
TM28	F.1 Traffic Calming	3	5	5	5	2	1	1	4	3.9	S
TM29	F.2 Traffic Safety Education Improvement	2	5	3	5	3	1	3	5	3.6	S
TM30	G.1 Intelligent Transportation System Development	3	2	2	2	1	1	1	2	2.1	L
TM31	H.1 Local Standards and Guidelines Development	5	5	5	5	1	1	1	5	4.4	S

Source: JICA Study Team

7.5 LUTMP 2030 Implementation

7.5.1 Implementation Schedule and Responsible Agency

1) Implementation Schedule

Table 7.5.1 presents indicative implementation schedule of the LUTMP projects already committed and proposed in LUTMP, together with needed funding by year. This schedule was determined based on the result of overall evaluation of the projects.

Public Transport Projects

All committed projects were allocated to short-term (2012-15) and medium-term (2016-2020). Among proposed projects, RMTS Green Line and eight BRT lines were allocated by 2020. However for RMTS Green Line and BRT Orange Line (to be converted to RMTS by 2030), the first investment should be done in the short-term (by 2015). Construction of RMTS Orange Line and Blue Line are scheduled for long-term (by 2030).

As a result, the amount of yearly investment is heavy during 2012-20 and 2025-30.

Road Projects

All committed projects are scheduled for short- and medium-term similarly to the public transport projects. Proposed projects are distributed almost equally in the plan period, i.e. 2012-30.

Traffic Management Projects

Most of the committed and proposed projects are allocated for short- and medium-term. This is due to the urgency and low-cost features of the projects.

Table 7.5.1 Indicative Implementation Timetable for Committed and Proposed Projects

Project No.		Project Description	Implem-entation	Period (Year)	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Public Transport Projects – Committed																							
PT001	C.1	Multimodal Inter-City Bus Terminals in Lahore	**S**	**2**																			
PT002	C.2	Effective and Efficient School Bus System	**S**	**2**																			
PT003	C.3	Up-gradation of Bus Stands	**S**	**2**																			
PT004	C.4	Integrated Bus Operation	**S**	**3**																			
PT005	C.5	Establishment of Multimodal Bus Terminal at Shahdara	**S**	**4**																			
Public Transport Projects – LUTMP 2030 Proposed																							
PT006	RMS1	LRMTS Green Line	**M**	**5**																			
PT007	RMS2	LRMTS Orange Line (Initially BRT)	**L**	**8**																			
PT008	RMS3	LRMTS Blue Line (Initially BRT)	**L**	**8**																			
PT009	BRT1	BRT Purple Line	**S**	**3**																			
PT010	BRT2	BRT Line 1	**S**	**3**																			

Project No.	Project Description		Implem-entation	Period (Year)	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
PT011	BRT3	BRT Line 2	S	3																			
PT012	BRT4	BRT Line 3a	S	3																			
PT013	BRT5	BRT Line 3b	S	3																			
Road Sub-sector Projects – Committed																							
R01	Construction of LRR (Airport – Ferozepur Road)		S	3																			
R02	Construction of Kalma Chowk Flyover		S	3																			
R03	Construction of Canal Bank Road Flyover		S	3																			
R04	Remodeling of Canal Bank Road		S	3																			
R05	Remodeling of Barki Road (LRR – Green City)		S	3																			
R06	Remodeling of Kala Khatai Road		S	3																			
R07	Remodeling of Allama Iqbal Road		S	3																			
R08	Remodeling of Multan Road		S	3																			
R09	Remodeling of Thokar Niaz Baig Road		S	3																			
R10	Remodeling of Lahore Ferozepur Road		S	3																			
LUTMP 2030 Road Sub-sector Projects – Proposed																							
R11	Barki Road (Green City – BRB Canal)		M	3																			
R12	Bedian Road (DHA – LRR – Ferozepur Road)		M	5																			
R13	Shabir Usmani Road (Barkat Market – Maulana Shaukat Ali Road)		L	3																			
R14	Link Peco Road – Ferozepur Road		L	3																			
R15	Link Ferozepur Road - Nalay Wali Road (Completion of link between Ferozepur and Multan Road)		L	3																			
R16	Old Ravi Bridge and Road **(Bridge 0.5km)**		M	3																			
R17	G.T. Road (Cooper Store - Ek-Moria Pul)		L	3																			
R18	College Road (Ghaus-e-Azam Road to Defence Road)		M	3																			
R19	Structure Plan Road (Shahrah Nazria-e-Pakistan – Defence Road)		S	3																			
R20	EXPO-Kahna Kacha Station Road (Khayban-e-Jinnah – Kahna Kacha Station)		L	3																			
R21	Main Boulevard PIA Society Road (Baig Road – Ittehad Road)		L	3																			
R22	Raiwind Road (Lahore Ring Road Southern Loop – Raiwind City)		L	3																			
R23	Madrat-e-Millat Road - Defence Road		L	3																			
R24	Extension of Maulana Shaukat Ali Road (Canal Bank Road – Noor-ul-Amin Road through Punjab University)		L	3																			
R25	Kamahan Lidher Road (Ferozepur Road – Lahore Bedian Road)		L	3																			
R26	Sua Asil Road (Ferozepur Road – Raiwind Road)		L	5																			
R27	Kahna Station – Raiwind City (Kahna Kacha Approach Road – Raiwind City along Railway Line)		L	3																			
R28	Kahna Kacha Road (Kahna Station – Ferozepur Road)		L	3																			
R29	Sharaqpur Road (Lahore Ring Road – Saggian Wala Bypass) **(Bridge 0.7km)**		L	5																			
R30	Lahore-Sheikhupura Road (Saggian Wala Bypass – G.T. Road)		L	3																			
R31	Sagianwala Bypass Road (Ring Road – Sharaqpur Road) **(Bridge 0.6km)**		L	3																			
R32	Lahore-Sheikhupura Road (West) (Sharaqpur Road – Lahore-Sheikhupura Road)		L	3																			

Project No.	Project Description	Implem-entation	Period (Year)	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
R33	Link Thokar Niaz Baig Canal Bank Road – Ferozepur Road (Khyaban-e-Jinnah Road – Defence Road – Ferozepur Road)	**M**	**3**																			
R34	Manga-Raiwind Road (Multan Road – Raiwind Road)	**L**	**3**																			
R35	Southern Bypass South Road (Ferozepur Road – College Road)	**M**	**3**																			
R36	Southern Bypass North Road (Canal Bank Road – M-2)	**M**	**3**																			
R37	Raiwind-Pattoki Road (Raiwind City – Boundary of the Study Area)	**L**	**3**																			
R38	Raiwind Road (Thokar – Lahore Ring Road Southern Loop)	**L**	**3**																			
R39	Defence Road (Multan Road – Ferozepur Road)	**M**	**3**																			
R40	Thokar Niaz Baig Canal Road Extension (Defence Road – Lahore Ring Road Sothern Loop)	**L**	**3**																			
R41	Construction of LRR West (Multan Road – M2)	**M**	**5**																			
R42	Construction of LRR South (Ferozepur Road – Multan Road)	**L**	**5**																			
R43	Secondary Roads in Dharampura Area	**S**	**3**																			
R44	Secondary Roads in Shadbagh Area	**M**	**5**																			
R45	Secondary Roads in Samanabad Area	**M**	**3**																			
R46	Lahore Bypass (G.T. Road – Kala Shah Kaku Bypass)	**M**	**3**																			
R47	M-2 – Lahore-Islamabad Motorway (Lahore-Sheikhupura Road – Boundary of the Study Area) **(Bridge 0.6km)**	**M**	**3**																			
R48	M-2 – Lahore-Islamabad Motorway (Bund Road – Lahore-Sheikhupura Road)	**M**	**3**																			
R49	N-5- Multan Road (Lahore Ring Road Sothern Loop – Boundary of the Study Area)	**L**	**5**																			
R50	Sharif Complex Road (Defence Road – Manga Raiwind Road – Bhai Pheru Kot Rada Kishan Road)	**L**	**5**																			
R51	North-West Secondary Ring Road (Sharaqpur Road – Lahore-Sheikhupura Road – G.T. Road)	**L**	**5**																			
R52	Sheikhupura Muridke Road (G.T. Road – M-2)	**L**	**5**																			
R53	Link G.T. Road (Sharaqpur Road – Lahore-Sheikhupura Road – G.T. Road)	**L**	**3**																			
R54	Link Kala Shah Kaku – Lahore-Sialkot Motorway	**M**	**3**																			
R55	Lahore-Sialkot Motorway **(Bridge 0.8km)**	**M**	**5**																			
R56	Link G.T. Road Lahore-Sialkot Motorway	**M**	**3**																			
R57 (Optional)	Construction and remodeling of Secondary roads - south of LRR in the south-western quadrant between Ferozepur Road and Multan Road	**N/A**	**10**	**Tentative Program**																		
Traffic Management Projects – Committed																						
TM01	Establishment of Centralized Driver Licensing Authority	**M**	**3**																			
TM02	Parking Management Company	**M**	**3**																			
TM03	Traffic Education Center	**S**	**2**																			
TM04	Traffic Control Plan of City	**S**	**3**																			
TM05	Vehicle Inspection and Certification System (VICS)	**M**	**4**																			
TM06	Construction of New Parking Plazas	**L**	**6**																			
TM07	Construction of Pedestrian Bridges	**S**	**3**																			
TM08	Improvement of 52 Junctions	**M**	**7**																			
TM09	Ferozepur Road Pilot Project	**L**	**3**																			
TM10	Conversion of Two Stroke Rickshaw into CNG Fitted Four Stroke Rickshaw	**S**	**4**																			
TM11	Remodeling of Inner and Outer Circular Road	**S**	**3**																			

Project No.	Project Description	Implem-entation	Period (Year)	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Traffic Management Projects – Proposed by LUTMP 2030																						
TM12	A.1 Junction Design and Traffic Signal Improvement – CBD	S	3	■	■	■																
TM13	A.2 Existing Junctions Design and Network Improvement	M	4				■	■	■	■												
TM14	A.3 Road Function and Capacity Improvement Program	S	2		■	■																
TM15	B.1 Low Occupancy Vehicles Planning for Outskirt/ Rural Areas	M	2				■	■														
TM16	B.2 Traffic Circulation System Design and Implementation	M	5		■	■	■	■	■													
TM17	B.3 Public and Freight Transport Terminals	M	8		■	■	■	■	■	■	■	■										
TM18	B.4 Linking Communities - Smart Roads	M	4				■	■	■	■												
TM19	B.5 Feasibility Study for Traffic Demand Management Measures	M	2					■	■													
TM20	B.6 RMTS and BRT Station Area Traffic Management	L	2										■	■								
TM21	C.1 Planning and Design Study for Non-Motorized Traffic	S	3			■	■	■														
TM22	C.2 Non-Motorized Traffic Facilities Implementation	S	4						■	■	■	■										
TM23	C.3 Pedestrian and Bicycle Path Network	S	3			■	■	■														
TM24	D.1 Comprehensive Parking System Development	S	3	■	■	■																
TM25	D.2 Parking Facilities Implementation	L	6							■	■	■	■	■	■							
TM26	D.3 Park and Ride Facilities Development	L	6													■	■	■	■	■	■	■
TM27	E.1 Traffic Enforcement Strengthening Programme	S	3	■	■	■																
TM28	F.1 Traffic Calming	S	2		■	■																
TM29	F.2 Traffic Safety Education Improvement	S	2	■	■																	
TM30	G.1 Intelligent Transportation System Development	L	5													■	■	■	■	■		
TM31	H.1 Local Standards and Guidelines Development	S	5	■	■	■	■	■														

Note: S: Short Term; M: Medium Term; L: Long Term
Source: JICA Study Team

2) Responsible Agency for Project Implementation

Table 7.5.2 shows the responsibility allocation of project implementation among government agencies. Note that this allocation assumes the present organizational/ institutional setup. If this changes in the future, the responsibility goes automatically to the redefined agency. Transport Department (TD) oversees and monitors the implementation of the LUTMP projects.

Table 7.5.2 Responsible Agency for LUTMP 2030 Project Implementation

Project No.	Project Description		Project Cost (USD million)	Assumed Year in Operation	Status	Proposed by	Responsible Agency
Public Transport Projects – Committed							
PT01	C.1	Multimodal Inter-City Bus Terminals in Lahore	N/A	2014	On-going	TD	TD
PT02	C.2	Effective and Efficient School Bus System	N/A	2014	Planned	TD	TD
PT03	C.3	Up-grading of Bus Stands	N/A	2015	Planned	TD	TD
PT04	C.4	Integrated Bus Operation	80.1	2015	Planned	LTC	LTC
PT05	C.5	Establishment of Multimodal Bus Terminal at Shahdara	N/A	2017	Planned	TD	TD
Public Transport Projects – Proposed							
PT06	RMS1	RMTS Green Line	2,583.0	2020	Designed	TD	TD
PT07	RMS2	RMTS Orange Line	2,330.0	2031	F. Study	TD	TD
PT08	RMS3	RMTS Blue Line	1,908.0	2031	Planned	TD	TD

Project No.	Project Description		Project Cost (USD million)	Assumed Year in Operation	Status	Proposed by	Responsible Agency
PT07	RMS2	BRT Orange Line (Initially BRT)	74.5	2015	-	LUTMP	TD/ LTC
PT08	RMS3	BRT Blue Line (Initially BRT)	58.6	2020	-	LUTMP	TD/ LTC
PT09	BRT1	BRT Purple Line	40.8	2020	-	LUTMP	LTC
PT10	BRT2	BRT Line 1	30.7	2020	-	LUTMP	LTC
PT11	BRT3	BRT Line 2	30.5	2020	-	LUTMP	LTC
PT12	BRT4	BRT Line 3a	28.7	2020	-	LUTMP	LTC
PT13	BRT5	BRT Line 3b	35.3	2020	-	LUTMP	LTC
Road Sub-sector Projects – Committed							
R01	Construction of LRR (Airport – Ferozepur Road)		113.0	2015	On-going	C&W	C&W
R02	Construction of Kalma Chowk Flyover		17.5	2015	Completed	C&W	C&W
R03	Construction of Canal Bank Road Flyover		17.5	2015	On-going	C&W	C&W
R04	Remodeling of Canal Bank Road		43.8	2015	On-going	TEPA	TEPA
R05	Remodeling of Barki Road (LRR – Green City)		2.0	2015	On-going	C&W	C&W
R06	Remodeling of Kala Khatai Road		10.8	2015	On-going	C&W	C&W
R07	Remodeling of Allama Iqbal Road		16.1	2015	On-going	C&W	C&W
R08	Remodeling of Multan Road		46.8	2015	On-going	C&W	C&W
R09	Remodeling of Thokar Niaz Baig Road		4.8	2015	On-going	C&W	C&W
R10	Remodeling of Lahore Ferozepur Road		17.5	2015	On-going	C&W	C&W
Road Sub-sector Projects – Proposed							
R11	Barki Road (Green City – BRB Canal)		17.0	2020	Proposed	LUTMP	C&W
R12	Bedian Road (DHA – LRR – Ferozepur Road)		142.0	2026	Proposed	LUTMP	C&W
R13	Shabbir Usmani Road (Barkat Market – Maulana Shaukat Ali Road)		6.9	2021	Planned	TEPA	TEPA
R14	Link Peco Road – Ferozepur Road		6.7	2021	Proposed	LUTMP	TEPA
R15	Link Ferozepur Road - Nalay Wali Road (Completion of link between Ferozepur and Multan Road)		5.3	2021	Planned	TEPA	TEPA
R16	Old Ravi Bridge and Road **(Bridge 0.5km)**		5.3	2018	Planned	TEPA	TEPA
R17	G.T. Road (Cooper Store - Ek-Moria Pull)		6.3	2019	Planned	TEPA	TEPA
R18	College Road (Ghaus-e-Azam Road to Defence Road)		14.0	2020	Planned	TEPA	TEPA
R19	Structure Plan Road (Shahrah Nazria-e-Pakistan – Defence Road)		35.0	2018	Planned	TEPA	TEPA
R20	EXPO-Kahna Kacha Station Road (Khayban-e-Jinnah – Kahna Kacha Station)		29.8	2024	Planned	TEPA	TEPA
R21	Main Boulevard PIA Society Road (Baig Road – Ittehad Road)		4.0	2024	Planned	TEPA	TEPA
R22	Raiwind Road (Lahore Ring Road Southern Loop – Raiwind City)		52.5	2025	Proposed	LUTMP	C&W
R23	Madrat-e-Millat Road - Defence Road		10.9	2024	Planned	TEPA	TEPA
R24	Extension of Maulana Shaukat Ali Road (Canal Bank Road – Noor-ul-Amin Road through Punjab University)		6.0	2024	Planned	TEPA	TEPA
R25	Kamahan Lidher Road (Ferozepur Road – Lahore Bedian Road)		26.4	2027	Committed	C&W	C&W
R26	Sua Asil Road (Ferozepur Road – Raiwind Road)		130.7	2030	Committed	C&W	C&W
R27	Kahna Station – Raiwind City (Kahna Kacha Approach Road – Raiwind City along Railway Line)		91.7	2027	Committed	C&W	C&W
R28	Kahna Kacha Road (Kahna Station – Ferozepur Road)		29.8	2027	Committed	C&W	C&W
R29	Sharaqpur Road (Lahore Ring Road – Saggian Wala Bypass) **(Bridge 0.7km)**		202.0	2030	Proposed	LUTMP	C&W
R30	Lahore-Sheikhupura Road (Saggian Wala Bypass – G.T. Road)		20.4	2028	Proposed	LUTMP	C&W
R31	Sagianwala Bypass Road (Ring Road – Sharaqpur Road) **(Bridge 0.6km)**		43.4	2028	Proposed	LUTMP	C&W

Project No.	Project Description	Project Cost (USD million)	Assumed Year in Operation	Status	Proposed by	Responsible Agency
R32	Lahore-Sheikhupura Road (West) (Sharaqpur Road – Lahore-Sheikhupura Road)	16.2	2028	Proposed	LUTMP	C&W
R33	Link Thokar Niaz Baig Canal Bank Road – Ferozepur Road (Khyaban-e-Jinnah Road – Defence Road – Ferozepur Road)	57.5	2022	Proposed	LUTMP	TEPA
R34	Manga-Raiwind Road (Multan Road – Raiwind Road)	43.5	2028	Proposed	LUTMP	C&W
R35	Southern Bypass South Road (Ferozepur Road – College Road)	57.0	2022	Planned	TEPA	TEPA
R36	Southern Bypass North Road (Canal Bank Road – M-2)	19.7	2022	Planned	TEPA	TEPA
R37	Raiwind-Pattoki Road (Raiwind City – Boundary of the Study Area)	73.3	2028	Proposed	LUTMP	C&W
R38	Raiwind Road (Thokar – Lahore Ring Road Southern Loop)	54.2	2028	Proposed	LUTMP	C&W
R39	Defence Road (Multan Road – Ferozepur Road)	60.1	2022	Proposed	LUTMP	C&W
R40	Thokar Niaz Baig Canal Road Extension (Defence Road – Lahore Ring Road Sothern Loop)	20.8	2028	Proposed	LUTMP	C&W
R41	Construction of LRR West (Multan Road – M2)	121.8	2024	Committed	C&W	C&W
R42	Construction of LRR South (Ferozepur Road – Multan Road)	201.2	2030	Committed	C&W	C&W
R43	Secondary Roads in Dharampura Area	38.9	2018	Proposed	LUTMP	TEPA
R44	Secondary Roads in Shadbagh Area	102.5	2018	Proposed	LUTMP	TEPA
R45	Secondary Roads in Samanabad Area	115.0	2017	Proposed	LUTMP	TEPA
R46	Lahore Bypass (G.T. Road – Kala Shah Kaku Bypass)	41.0	2022	Proposed	LUTMP	NHA
R47	M-2 – Lahore-Islamabad Motorway (Lahore-Sheikhupura Road – Boundary of the Study Area) **(Bridge 0.6km)**	89.0	2022	Proposed	LUTMP	NHA
R48	M-2 – Lahore-Islamabad Motorway (Bund Road – Lahore-Sheikhupura Road)	64.6	2022	Proposed	LUTMP	NHA
R49	N-5- Multan Road (Lahore Ring Road Sothern Loop – Boundary of the Study Area)	109.7	2029	Proposed	LUTMP	C&W
R50	Sharif Complex Road (Defence Road – Manga Raiwind Road – Bhai Pheru Kot Rada Kishan Road)	116.1	2029	Proposed	LUTMP	C&W
R51	North-West Secondary Ring Road (Sharaqpur Road – Lahore-Sheikhupura Road – G.T. Road)	118.3	2031	Proposed	LUTMP	C&W
R52	Sheikhupura Muridke Road (G.T. Road – M-2)	284.4	2031	Proposed	LUTMP	C&W
R53	Link G.T. Road (Sharaqpur Road – Lahore-Sheikhupura Road – G.T. Road)	22.9	2027	Proposed	LUTMP	C&W
R54	Link Kala Shah Kaku – Lahore-Sialkot Motorway	25.0	2022	Planned	C&W	C&W/ NHA
R55	Lahore-Sialkot Motorway **(Bridge 0.8km)**	128.1	2024	Planned	C&W	C&W/ NHA
R56	Link G.T. Road Lahore-Sialkot Motorway	2.2	2022	Planned	C&W	C&W
R57	Construction and remodeling of Secondary roads - south of LRR in the south-western quadrant between Ferozepur Road and Multan Road	The Road Projects will be executed by LDA/ TEPA in conjunction with the developer's contribution towards the project capital cost.				
Traffic Management Projects – Committed						
TM01	Establishment of Centralized Driver Licensing Authority	-	2016	Planned	TD	TD
TM02	Parking Management Company	-	2018	Planned	TEPA	TEPA
TM03	Traffic Education Center	-	2014	Planned	Traffic Police	Traffic Police
TM04	Traffic Control Plan of City	-	2015	Planned	Traffic Police	Traffic Police
TM05	Vehicle Inspection and Certification System (VICS)	-	2021	Ongoing	TD	TD
TM06	Construction of New Parking Plazas	207.1	2020	Ongoing	TEPA	TEPA
TM07	Construction of Pedestrian Bridges	1.8	2016	Ongoing	TEPA	TEPA
TM08	Improvement of 52 Junctions	30.5	2021	Planned	TEPA	TEPA
TM09	Ferozepur Road Pilot Project	28.3	2022	Ongoing	TEPA	TEPA
TM10	Conversion of Two Stroke Rickshaw into CNG Fitted Four Stroke Rickshaw	12.4	2019	Planned	TD	TD

Project No.	Project Description	Project Cost (USD million)	Assumed Year in Operation	Status	Proposed by	Responsible Agency
TM11	Remodeling of Inner and Outer Circular Road	14.1	2015	Planned	TEPA	TEPA
Traffic Management Projects – LUTMP Proposed						
TM12	A.1 Junction Design and Traffic Signal Improvement – CBD	4.0	2015	Proposed	LUTMP	TEPA
TM13	A.2 Existing Junctions Design and Network Improvement	30.0	2019	Proposed	LUTMP	TEPA
TM14	A.3 Road Function and Capacity Improvement Program	2.0	2015	Proposed	LUTMP	TEPA and CDGL
TM15	B.1 Low Occupancy Vehicles Planning for Outskirt/ Rural Areas	5.0	2017	Proposed	LUTMP	LTC
TM16	B.2 Traffic Circulation System Design and Implementation	20.0	2018	Proposed	LUTMP	TEPA
TM17	B.3 Public and Freight Transport Terminals	100.0	2021	Proposed	LUTMP	TEPA and CDGL
TM18	B.4 Linking Communities - Smart Roads	4.0	2019	Proposed	LUTMP	TEPA
TM19	B.5 Feasibility Study for Traffic Demand Management Measures	2.5	2018	Proposed	LUTMP	TEPA
TM20	B.6 RMTS and BRT Station Area Traffic Management	1.5	2023	Proposed	LUTMP	TEPA
TM21	C.1 Planning and Design Study for Non-Motorized Traffic	1.5	2017	Proposed	LUTMP	TEPA
TM22	C.2 Non-Motorized Traffic Facilities Implementation	6.0	2021	Proposed	LUTMP	TEPA
TM23	C.3 Pedestrian and Bicycle Path Network	5.0	2017	Proposed	LUTMP	TEPA
TM24	D.1 Comprehensive Parking System Development	2.5	2015	Proposed	LUTMP	TEPA
TM25	D.2 Parking Facilities Implementation	60.0	2024	Proposed	LUTMP	TEPA
TM26	D.3 Park and Ride Facilities Development	75.0	2030	Proposed	LUTMP	TEPA
TM27	E.1 Traffic Enforcement Strengthening Programme	3.0	2015	Proposed	LUTMP	Traffic Police
TM28	F.1 Traffic Calming	6.0	2015	Proposed	LUTMP	TEPA
TM29	F.2 Traffic Safety Education Improvement	1.0	2014	Proposed	LUTMP	Traffic Police and 1122
TM30	G.1 Intelligent Transportation System Development	38.0	2029	Proposed	LUTMP	TEPA
TM31	H.1 Local Standards and Guidelines Development	1.5	2017	Proposed	LUTMP	TEPA

Note: Committed: officially approved by GoPb; Planned: waiting for approval.
Source: JICA Study Team

7.5.2 LUTMP 2030 Financing Program

1) Proposed Financing Program

Table 7.5.3 gives summary of investment available/ required for the LUTMP 2030 projects. Public transport projects share about 66% of the total, while road and traffic management share 28% and 6%, respectively. As compared to the other urban transport master plans conducted by JICA in Asian cities, the share of public transport projects is on the high side and road projects on the low side.

The budget envelope estimated in Chapter 5 of this report is USD 6.6~19.8 billion for the entire LUTMP plan period of 2012 to 2030, and USD 2.3~6.9 billion for the Action Plan period of 2012 to 2020. Compared to this budget envelop, the planned investment falls within the budget range. However, the percentage of the investment to Lahore's GDP is on the high side at 2.6% for the action plan period. This is about 3 times that of the current level of investment. For the entire plan period, the investment is equivalent to 1.7% of the Lahore GDP.

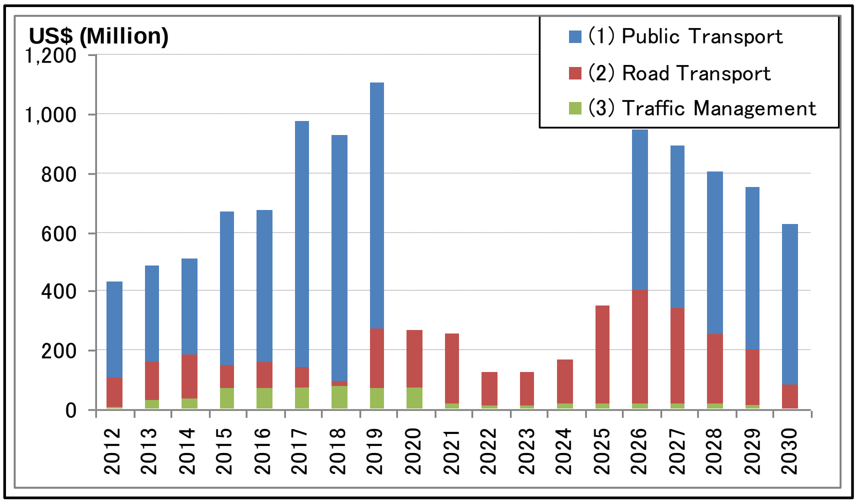
Table 7.5.3 LUTMP 2030 Planned Investment Summary (USD million)

Project	Short Term 2012-2015	Medium Term 2016-2020	Long Term 2021-2030	Total
Public Transport	1,499	3,021	2,742	7,262
Road Sub-sector	450	570	2,139	3,159
Traffic Management	146	363	154	663
Total	**2,095**	**3,954**	**5,035**	**11,084**

Source: JICA Study Team

Yearly distribution of the proposed investment is illustrated in Figure 7.5.1. As stated earlier, investment on public transport projects becomes minimal during 2020-2025. This, however, does not mean that no effort would be made to improve public transport system during this period. For the opening of the two RMTS lines (Orange and Blue) by 2030, major studies and arrangements should be made here. In addition, loan repayment for RMTS Green Line will start during this period.

Figure 7.5.1 Assumed Investment Schedule of LUTMP 2030



Source: JICA Study Team

If PPP is taken into account in the proposed RMTS/ BRT projects, how much public investment can be saved was estimated assuming a percentage of contribution from the private sector as shown in Table 7.5.4. The reduction was estimated at about USD 800 million equivalent to 11 % of the total investment.

Table 7.5.4 Cost Reduction by Applying PPP Scheme to RMTS/ BRT Projects

Project No.	Code	Project Name	EIRR (%)	FIRR (%)	Project Cost (USD million)	% Private Sector	Cost to Gov't (USD million)
PT06	RMS1	RMTS Green Line	12.1	7.1	2,583.0	20	2,066.4
PT07	RMS2	RMTS Orange Line	10.3	5.7	2,330.0	0	2,330.0
PT08	RMS3	RMTS Blue Line	8.0	4.9	1,908.0	0	1,908.0
PT07 (Initially BRT)	RMS2	BRT Orange Line	18.8	21.0	74.5	100	0.0

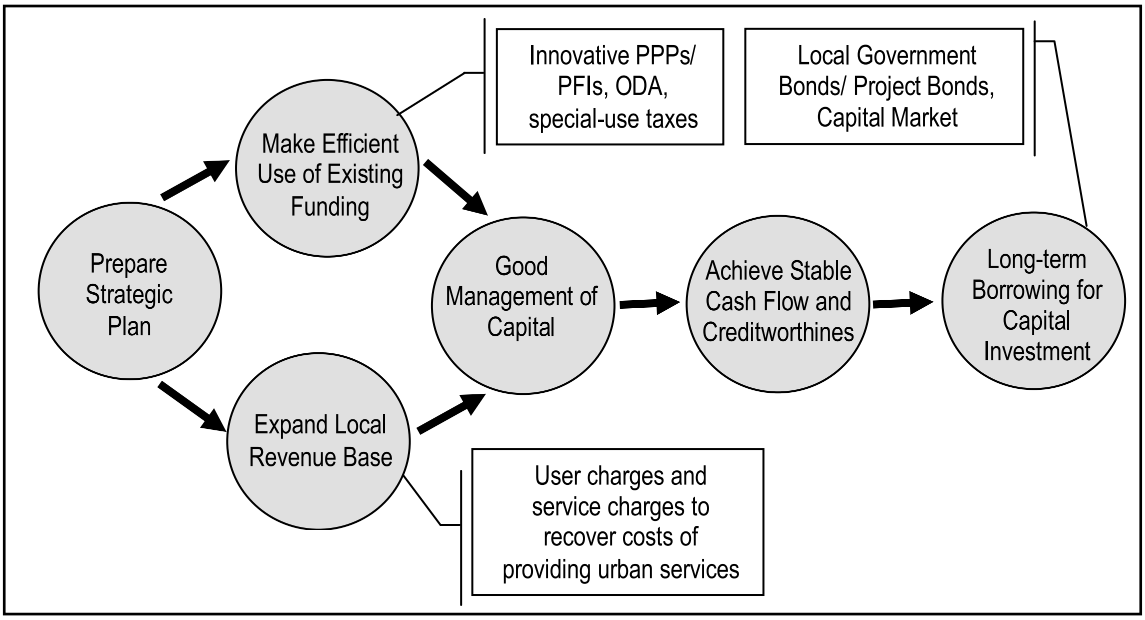
Project No.	Code	Project Name	EIRR (%)	FIRR (%)	Project Cost (USD million)	% Private Sector	Cost to Gov't (USD million)
PT08 (Initially BRT)	RMS3	BRT Blue Line	16.7	17.9	58.6	80	11.7
PT09	BRT1	BRT Purple Line	15.5	16.1	40.8	50	20.4
PT10	BRT2	BRT Line 1	37.6	24.9	30.7	100	0.0
PT11	BRT3	BRT Line 2	43.6	26.5	30.5	100	0.0
PT12	BRT4	BRT Line 3a	20.4	16.3	28.7	50	14.4
PT13	BRT5	BRT Line 3b			35.3	50	17.7
Total					**7,120.1**	**10.6**	**6,368.5**

Source: JICA Study Team

2) Applicable Financing Strategies

The existing revenue base of Lahore is not sufficient to fund future infrastructure projects. As part of the financial strategy, the city may have to expand the local revenue base, make efficient use of existing funding sources and exercise good management of capital financing. This process is depicted in the Figure 7.5.2 below.

Figure 7.5.2 Strategic Mobilization of Funding



Source: JICA Study Team

(ii) Efficient Use of Funding

The main funding source for Lahore is derived mainly from balancing allocations of the Federal Government. Local revenue, household investments, and external sources such as FDIs and ODA is not salient. There has to be greater efficiency in the use of these funds especially through the development of management information systems and strategic financial planning. Some of the key initiatives in this area are the following:

(a) **Contracting Out Services:** The existing practice of contracting out urban services especially for infrastructure maintenance should continue and be expanded to new areas. This will provide greater opportunities for the private sector to participate and would generally lead to more efficient service delivery if managed well.

(b) **Applying User Charges and Service Fees:** Direct cost recovery through user charges is usually more effective than indirect cost through property taxes. User charges are generally applied for electricity and water and as tolls for bridges and expressways. More recently, these are also used for area road pricing to discourage private transport into the city center during peak hours and to encourage the use of public transport instead. While user charges should help recover maintenance costs, the capital costs for roads and other transport infrastructure cannot be directly recovered from them. Some form of property tax may be needed to recover the capital cost.

(iii) Expansion of Local Revenue Base

While it may be difficult for local authorities to rely totally on locally generated funds to finance large urban development and infrastructure projects, it is important for city governments to expand the local revenue base within the provisions of the law. Some of the initiatives could be expanded further in Lahore. This will be further discussed in Chapter 8 of this report.

(iv) Good Management of Capital Financing

Good management of capital financing is important to reduce the prolonged financial burden of repaying long-term debts. While ODA lending is usually at subsidized rates, it does create long-term debts for the city. Refinancing ODA funds at higher commercial rates in the form of state investment credit is a popular source of funding for social investment projects in various countries in the developing world.

(a) Access to Capital Markets and Other Credit Finance: It is also important to ensure funding for urban development projects. The use of stocks and shares as collateral for loans is not common and could be developed further with the strengthening of the stock market and the Securities Law. The other strategy is to introduce government-guaranteed bonds. Currently, many of the larger cities have issued municipal bonds to raise capital. It is important that in issuing bonds, the capacity of the city to repay promptly is important to ensure the long-term viability of raising finance through this means. Good management of capital finance is also related to the various types of project implementation methods that could be utilized to reduce the financial burden on the city.

(b) Effective Project Implementation Methods: Include measures, such as BOT (Build Operate and Transfer), BT (Build and Transfer) and deferred payment schemes which have been widely applied on highway and water supply projects in some developing countries. The city should also continue with further initiatives in outsourcing urban services. This could be extended to bus transport operation, public infrastructure maintenance and operation of parking facilities and other public facilities.

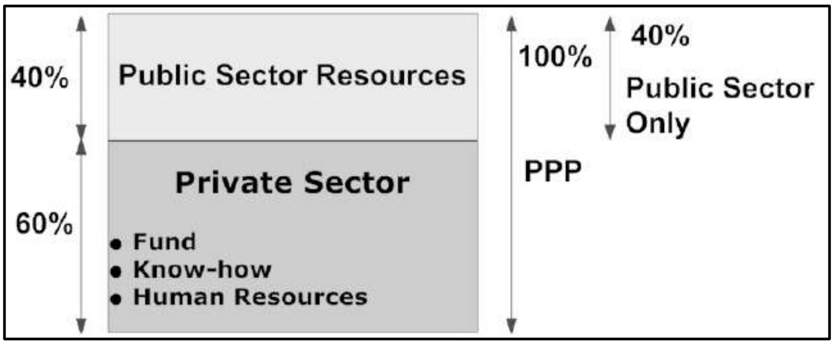
3) Application of Public-Private Partnership (PPP)

As economy and private sector grow further, application of PPP concept is becoming critical for effective management of urban and transport development and sector administration. Main aspects of the PPP are as explained below.

(i) Maximizing the Effect of Public Sector Resource Allocation

Resources in public sector such as fund and man power are very limited. A key concept of PPP is to maximize the effect of public sector resource allocation when implementing public sector projects. Under the PPP arrangement, the effect may expand to a considerable extent with the power of private sector resources (fund, knowhow and human resources) allocated to the project. In other words the public sector may be able to "leverage" the effect of the input of 40 to become the output of 100 by introducing the PPP concept as illustrated in Figure 7.5.3.

Figure 7.5.3 Effect of PPP



Source: JICA Study Team

(ii) Adopting Different PPP Models on the Basis of Profitability

Profitability of the project will decide what type of PPP model to be applied as shown Figure 7.5.4. Usually, urban and transport infrastructure projects have a wide range of profitability from very profitable to non-profit producing (no user charges). In LUTMP, however, the proposed projects fall mostly in the category of "Medium Profitability with Risk", or "Low Profitability or No Profit".

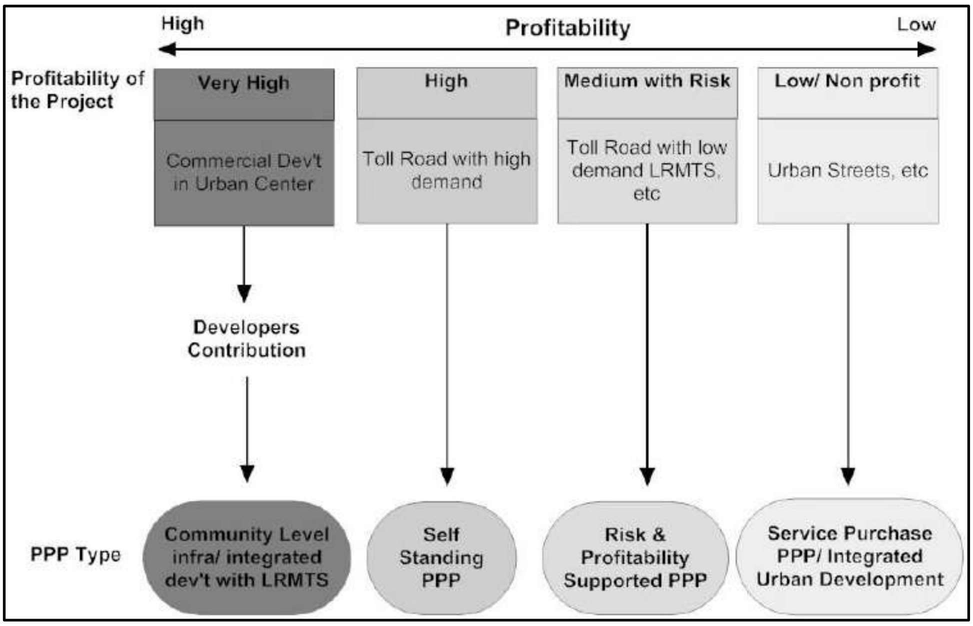
(a) Very High Profitability: If the project is highly profitable such as commercial development in urban center, the GoPb could arrange a PPP on the basis of LDA's rules to ask for developer's contribution for community level infrastructure projects like Road Project R57. This PPP concept may also be applied to the integrated urban development with the RMTS systems.

(b) High Profitability: When profitability is high enough for the project to be financially self-sustainable, self-standing PPP model may be applied. Example of this may be a toll road project with high traffic demand. Project of this type could go on the conventional BOT bidding procedure.

(c) Medium Profitability with Risk: The third type model, risk and profitability supported PPP will be applied to those projects that have a limited degree of profitability. Majority of revenue producing projects in LUTMP will fall into this category and require a careful PPP structuring. Toll road with low traffic demand, RMTS systems, BRTs and so on are the example of this type. GoPb will have to be involved in PPP structuring in terms of necessary risk and profitability support.

(d) Low Profitability or Non-profit: Service purchase PPP model may have to be applied to those projects with very low profitability where GoPb will "purchase" the service that the private sector produces by allocating GoPb's own funding resources. Examples are the public bus operation on public service obligation basis and non-revenue generating road and traffic management projects.

Figure 7.5.4 PPP Models on the Basis of Profitability



Source: JICA Study Team

(iii) Value Capturing of External Benefit of RMTS Systems

External benefit which a RMTS system (Green/ Orange Line) brings about to the City is very large and its huge investment can only be recouped when the City is able to successfully capture the value that the RMTS system creates along its corridor. Tax revenue and user charge are used to fund its construction and operation, but it is also essential to capture the value which people and business benefit from the operation of the RMTS system (beneficiary charge or betterment charge). In order to do the above, GoPb should take an initiative in applying various PPP models in implementing integrated commercial, office and residential projects that are: **a**) directly integrated with the stations/ terminals, **b**) developed in the vicinity of the station/ terminals and **c**) developed along the corridors of the RMTS systems. Thus, GoPb will be able to share a part of benefit that those PPP arrangements produce in the future to recoup its huge initial investment in the long run.

(iv) PPP Opportunities in the LUTMP Projects

There are a variety of PPP opportunities in implementing the LUTMP proposed projects are outlined in Table 7.5.5. There are many opportunities such as some of the Trunk roads to be tolled, and also some of the traffic management projects may yield revenue through user charges. The BRT projects may well be on the concession and the RMTS lines may be implemented under PPP scheme although GoPb may have to shoulder the cost of infrastructure. Some of the Secondary and Local roads may be developed through the urban development projects initiated by the private sector developers, like Road Project R57.

Table 7.5.5 PPP Opportunities in LUTMP Projects

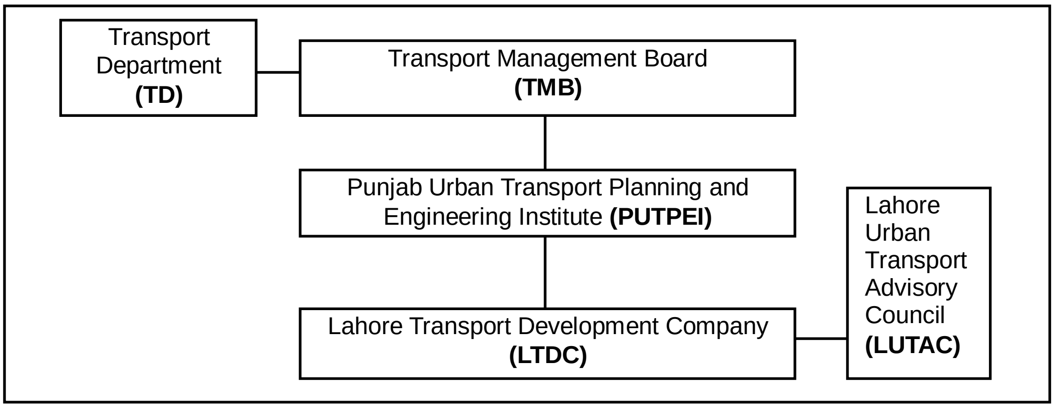
Subsector		PPP Opportunities			Remarks
		Construction	Maintenance	Operation	
Road	Motorway	yes but limited	yes	yes	With high traffic demand
	Primary Road	yes but limited	yes	yes	With high traffic demand
	Secondary Road	yes but limited	yes but limited	N/A	Through urban development
	Local Road	yes but limited	yes but limited	N/A	Through urban development
Public Transport	RMTS	yes but limited	yes	yes	Infrastructure developed by public sector
	BRT	yes	yes	yes	Concession PPP
	Bus Transportation	yes	yes	yes	Concession PPP
Traffic Management	Traffic Management	yes	yes	yes	Large support needed

Source: JICA Study Team

7.5.3 Strengthening of Transport Sector Institutional Capacity

As stated in Chapter 5 of this report, there is a crucial need to establish new organizational setup to make decisions on various transport projects from comprehensive and multidisciplinary viewpoints. For this reason, Transport Management Board (TMB), Punjab Urban Transportation Planning and Engineering Institute (PUTPEI), Lahore Transport Development Company (LTDC) and Lahore Urban Transport Advisory Council (LUTAC) are proposed for establishment to control the urban transport sector of Lahore as presented in Figure 7.5.5. This institutional setup is expected also to monitor and manage the progress of the LUTMP proposed projects.

Figure 7.5.5 New Establishment for Transport Sector Development



Source: JICA Study Team

(a) Setting-up Transport Management Board (TMB)

Transport Management Board is an inter-departmental board, chaired by the Permanent Secretary of the Transport Department (TD), comprised of the heads of transport-related organizations such as P&D, C&W, HUD&PHED/ LDA, Traffic Police, Cantonment Board, DHA and National Highway Authority (NHA).

TMB is the highest decision making body concerning transport at the provincial level and technically supported by PUTPEI, which will function as a secretariat of TMB. Regular meeting will be held once a month and ad-hoc meeting will be occasionally called by the chairman.

P&D keeps the budget allocation function and endorses all the project implementation. However, the resolutions of TMB shall be respected because P&D also sends an official presumably in-charge of budgeting for the transport sector, to the TMB as a member.

(b) Establishment of Punjab Urban Transport Planning and Engineering Institute (PUTPEI)

PUTPEI is a semi-governmental institute of research and planning of urban transport and main function is to monitor, revise and promote the Lahore Urban Transport Master Plan

(LUTMP). The Institute manages the implementation program of LUTMP and prepare the materials for discussion to TMB and acts as the secretariat. Other functions are listed below:

- To manage the progress of the current transportation master plan.
- To conduct feasibility studies on demand (contract research).
- To be a window entity for BOT/ PPP projects.
- To be a key agency to support large projects technically such as urban rail transit and BRT projects and a traffic control center project.
- To maintain and provide transport-related databases such as those developed in LUTMP, vehicle registration and driving license database.
- To assist traffic police and other organizations for capacity development.

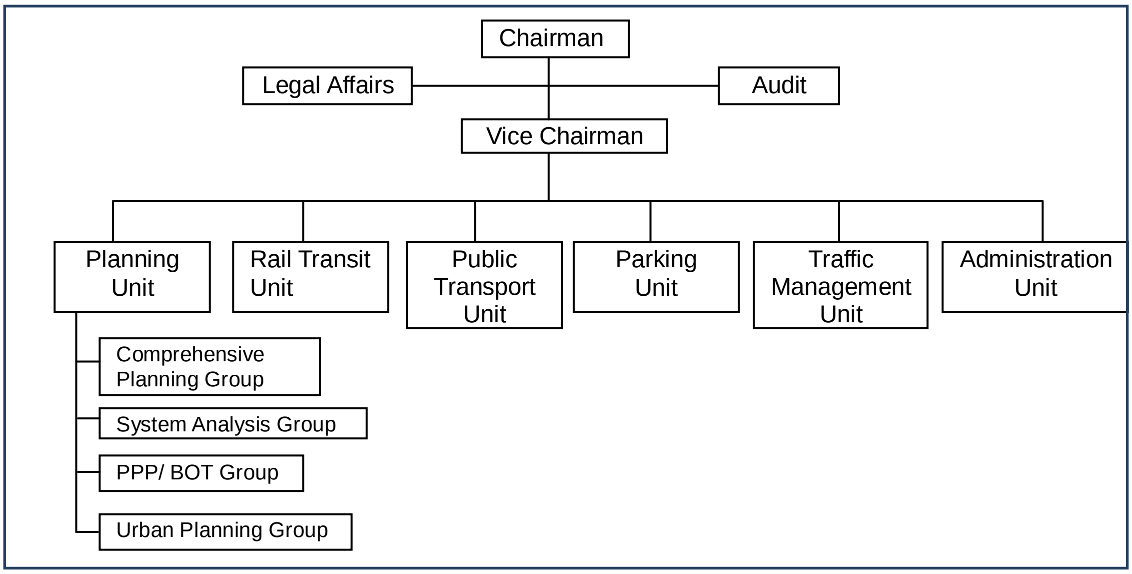
The Institute is owned by GoPb. Most part of PUTPEI's expense is financed by the provincial budget but it can have own financial source such as dividends and research commissions from LTDC (see below). In a certain period, it aims to be a financially self-sustainable institute. However, it is a non-profit organization in nature.

To achieve the listed functions, PUTPEI's initial organization would be as proposed in Figure 7.5.6, consisting of six units of administration, transport planning unit and the other four are corresponding to the four subsectors. Assuming each unit holds at least 20 professionals, the institute would be a think tank with more than 100 researchers and planners.

Under the planning unit, there is a group (sub-unit) named PPP/ BOT Group with capacity of developing a PPP/ BOT scheme for a project based on the financial analysis and a database with abundant success and failure examples. Without a high degree of expertise on PPP/ BOT in the Government side, any PPP project would hardly succeed. If the Punjab Government has an intention to carry out any PPP project, such professional group is inevitable.

The planning unit includes also urban planning group because every transportation master plan require clear vision on urban structure and land use as a base map for planning. To secure the land for future road and railway, urban planning will become more important as state the item (4) in this section.

Figure 7.5.6 Conceptual Organization of PUTPEI



Source: JICA Study Team

(c) Lahore Transportation Development Company (LTDC)

On the tier of City District, it is recommended to establish Lahore Transportation Development Company (LTDC) as an executing and administration agency. The function is near to private sector's business, LTDC is a company and main shareholder is PUTPEI. Therefore, LTDC is a public-owned company.

As many projects come from PUTPEI, the organization of LTDC would be very similar to that of PUTPEI, consisting of five divisions (so naming to distinguish from units of PUTPEI) of planning, rail transit, public bus, parking and traffic management in addition to administration, as proposed in Figure 7.5.7. Functions of each division are as outlined in Table 7.5.6.

Table 7.5.6 Outline Functions of Six Divisions of LTDC

Division	Outline of Functions
1. Planning Division	• Overall planning of LTDC's activities • Interface with planning unit of PUTPEI
2. Rail Transit Division	• Promotion of Rail Transit Project under PPP scheme • Bidding and Selection of proponents • Interface of Public and Private • Supervision of Rail Transit Operator
3. Public Bus Division	• Promotion of BRT Project under PPP scheme • Bidding and Selection of proponents for BRT project • Interface of Public and Private in BRT PPP project • Supervision of BRT Operator and Bus Operator • Monitor and Revise Bus Network
4. Parking Division	• Contract and Supervise Parking Operator (Collector of road-side parking and off-road parking operator) • Bidding and Selection of proponents for off road parking project • Interface of Public and Private • Supervision of Parking operation
5. Traffic Management Division	• Signal installation and promotion of control center project • Bidding and Selection of proponents for signal and others • Execution of traffic management project • Training of traffic enforcer/ warden and traffic police
6. Administration Division	• Personnel Affairs and general affairs • Accounting • Various Contract • Quality Control

Source: JICA Study Team

Out of six divisions, three divisions of Rail Transit, Public Bus and Parking would yield revenue while Planning Division may yield some revenue and Administration Division none. Each of the former three is the representative body of the Government side in PPP projects. The Company as a whole aims at being financially sustainable. However, internal cross-subsidy among income generating divisions and non-income generating division would be possible.

(1) Among six divisions, Administration Division, Planning Division and Traffic Management Division are non-profit departments, while other three of Rail Transit Division, Public Transport Division and Parking Development Division are profit divisions.

(2) The Rail Transit Division will be indispensable, in any case, to promote the Lahore Railway Transit projects as well as the PPP Section under the Planning Division.

(3) Lahore Transport Company can be the parent organization of the Public Transport Division of the LTDC. In the same way, Traffic Engineering and Transport Planning Agency (TEPA) can be the parent organization of the Traffic Management Division.

(4) Reinforced TPU can be transformed to the Planning Division of LTDC.

- Maintenance and update of LUTMP
- Maintenance of transport-related database
- Integration of planning and prioritization function in the transport sector
- Planning and monitoring PPP-schemed projects, Including BRT projects
- Monitoring and planning of revision of public transport fare system
- Setting-up of a professional group responsible for review and updating of transport rules and regulations.

Institutional arrangements, their functions and interactions as stated above, are further illustrated in Figure 7.5.7.

(d) Lahore Urban Transport Advisory Council (LUTAC)

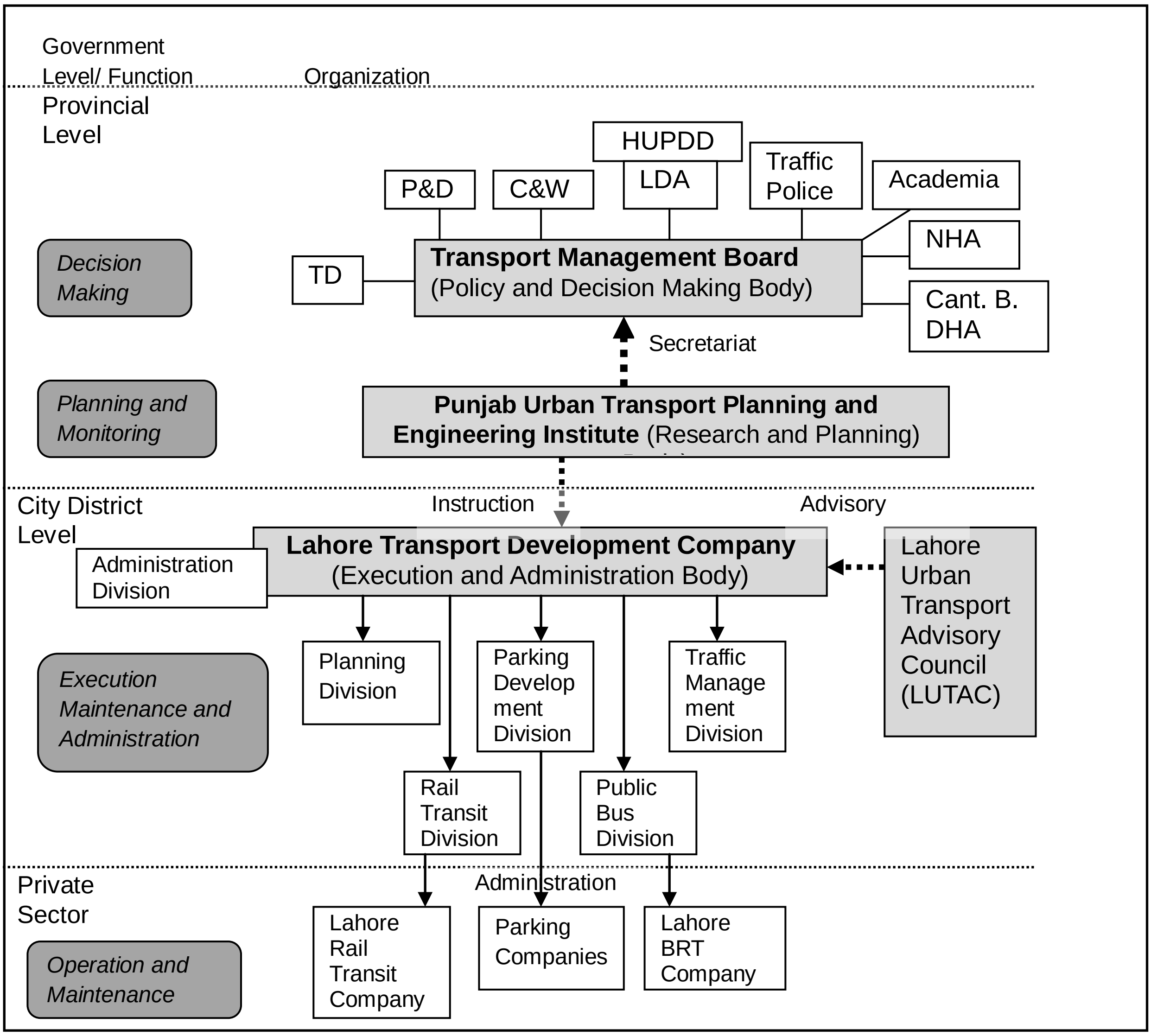
Lahore Urban Transport Advisory Council (LUTAC) should be set up in order to advise to LTDC and at the same time to watch LTDC not to behave arbitrarily. About ten council members may be appointed by the chairman of PUTPEI among people in academia, journalism, writers, and others *'notable'* members of the Society.

LTDC has to request advice of the (LUTAC) council before starting new scheme or projects with strong impact upon people's daily life. On a request, the council should have a series of meeting and submit the written opinion to the CEO of LTDC. LTDC has to respect the opinion of the LUTAC although it would not obligatory to follow the opinion.

(e) Functions of Existing Related Organizations

- ***TPU*****:** Transport Planning Unit (Transport Department) is to be a core body of the planning unit of PUTPEI
- ***TEPA:*** Planning section of TEPA is to be the parent of the traffic management unit and some staff will be transferred to the planning unit of PUTPEI. Operation sectors of TEPA shall be merged to LTDC.
- ***LTC:*** Lahore Transport Company is to be the parent of the public bus unit of PUTPEI and some operational staff shall be transferred to the public transport division of LTDC.
- ***The UU:*** Urban planners are to be transferred to the Urban Planning Group of Planning Unit of PUTPEI.

Figure 7.5.7 Overall Institutional Reform for Lahore Transport Sector Development



Source: JICA Study Team

Volume-I – Chapter-8

ACTION PLAN 2020

FINAL REPORT

8. LUTMP ACTION PLAN 2020

8.1 Development of Action Plan

8.1.1 Action Plan Development Approach

To understand and tackle the current transport/ traffic problems urgently, an Action Plan has been formulated for the year 2020. The primary components of the Action Plan include the following:

1) Project Integration and Coordination

While some major projects are underway in transport sector, the coordination among the projects is insufficient in terms of facility and service at many locations. For instance, intersection improvement should be implemented with due consideration, if the planned urban railway (RMTS) and/ or BRT is to be realised without excessive additional cost, particularly at road intersections. The Action Plan focuses on integrating new and the existing facilities, and serves to maximize the potential benefits of investment.

2) New Strategy

The future transport/ traffic situation will never improve if Lahore relies on conventional countermeasures, like ad-hoc solutions for localised problems. Rapid growth of population and urbanization has been a continued pressure on transport development. Rapidly growing vehicle ownership (car and motorcycle) and usage are the most serious threat to the living environment of Lahore. Hence the Action Plan intends to introduce possible new strategies to promote more effective use of existing infrastructure and attempts to moderately control the transport demand. The Carrot and Stick strategy will be adopted. This is with improvement of public transport and road traffic vs. stricter traffic management and control.

3) Reality

Public investment during the action plan period is severely constrained due to the lack of funding sources, and existing commitment to several mega projects. Institutional and organizational capacity also needs improvement. In the light of the budget envelope, realistic projects are proposed in the Action Plan 2020.

8.1.2 Available Funds for Action Plan

As estimated in Chapter 5 of this report, the budget envelop until 2020 for Action Plan in the Study Area is as follows:

2012 – 2015 Total: PKR 77 ~ 232 billion, (USD 1,000 ~ 2,900 million)

2016 – 2020 Total: PKR 105 ~ 316 billion, (USD 1,300 ~ 4,000 million)

2012 – 2020 Total: PKR 182 ~ 548 billion, (USD 2,300 ~ 6,900 million)

Realistically, the total fund available for the next 9 years (2012-2020) should be considered - at best this would amount to PKR 250 billion (USD 3,100 million). It should be noted, that most of this fund would need to be allocated to already on-going and committed projects.

8.1.3 Broad Priorities for Action Plan

Under these severe financial constraints, investment priorities have been broadly determined as follows:

- Preparatory but urgent works for establishing convenient and robust trunk public transport system in Lahore. This includes RMTS Green Line and all seven (7) BRT lines.
- Management of network for improved efficiency and low-cost traffic management measures such as, upgrade and development of secondary road network, minor road improvement, intersection improvement and upgrading of public transport. This is crucial to alleviate the current disorderly traffic situation in central Lahore.
- Primary and secondary arterial roads. Particularly missing links in east-west direction in central Lahore, access roads to Lahore Ring Road and roads necessary to guide sound urbanization in the south-west quadrant should be given priority.

8.1.4 LUTMP 2020 Action Plan – Core Programs 1 and 2

A number of transport projects have been proposed in the Master Plan (previous) chapter of this report. Among those projects, there are many projects that need immediate government action due to urgent needs of the citizen. These projects are categorized as follows:

1. Trunk public transport system - RMTS and BRT; (***Core Program-1***).
2. Traffic management in central Lahore; particularly around the Walled City, by a combination of minor road improvement, junction re-design, parking management, pedestrian/ bicycle paths development and other cost effective traffic management measures (***Core Program-2***).

These projects may be considered as the core program of the LUTMP Action Plan 2020. Other cost effective projects to supplement the projects mentioned above may be included in the core program.

8.2 Trunk Public Transport System – Core Program-1

8.2.1 Proposed Trunk Public Transport System

In the Action Plan period (2012-2020), one RMTS line (Green) and seven BRT lines are proposed. Later by 2030, two BRT lines (Orange and Blue) will be upgraded to RMTS. Table 8.2.1 illustrates the RMTS and BRT performance in 2020. It can be seen that Orange Line would be virtually operating at capacity by 2020.

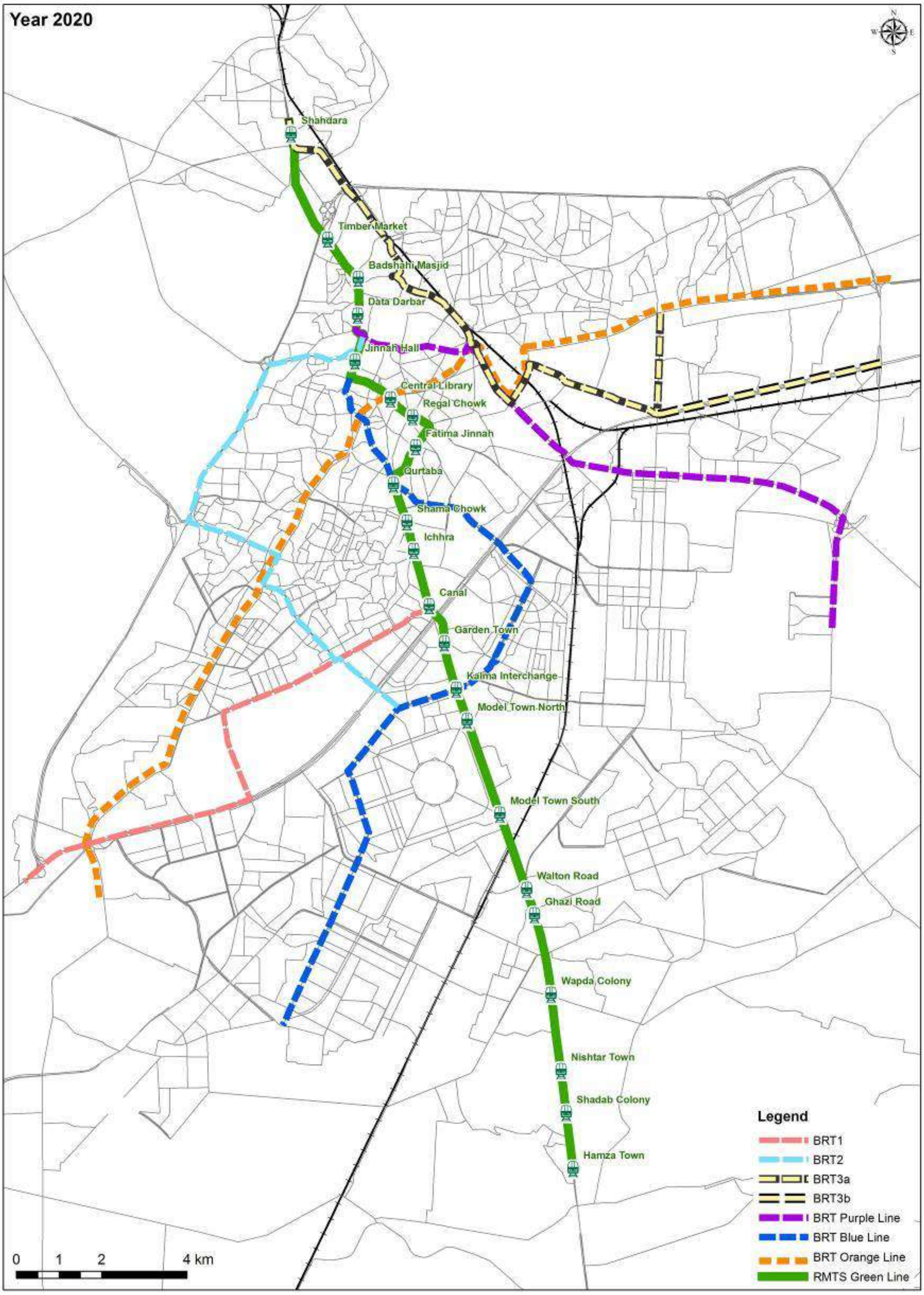
Table 8.2.1 RMTS and BRT Proposed Core Program-1 Systems Performance

System 2020		Route/ Line	2020 System Performance	
			Daily Boarding	Max. Line Load (PPHPD)
PT06	RMTS	Green Line	759,000	17,200
PT07	BRT	Orange Line	510,000	9,500
PT08	BRT	Blue Line	270,000	5,600
PT09	BRT	Purple Line	129,000	1,800
PT10	BRT	Line – 1	88,000	2,100
PT11	BRT	Line – 2	109,000	1,500
PT12	BRT	Line – 3a	161,000	3,200
PT13	BRT	Line – 3b	167,000	2,700

Source: JICA Study Team

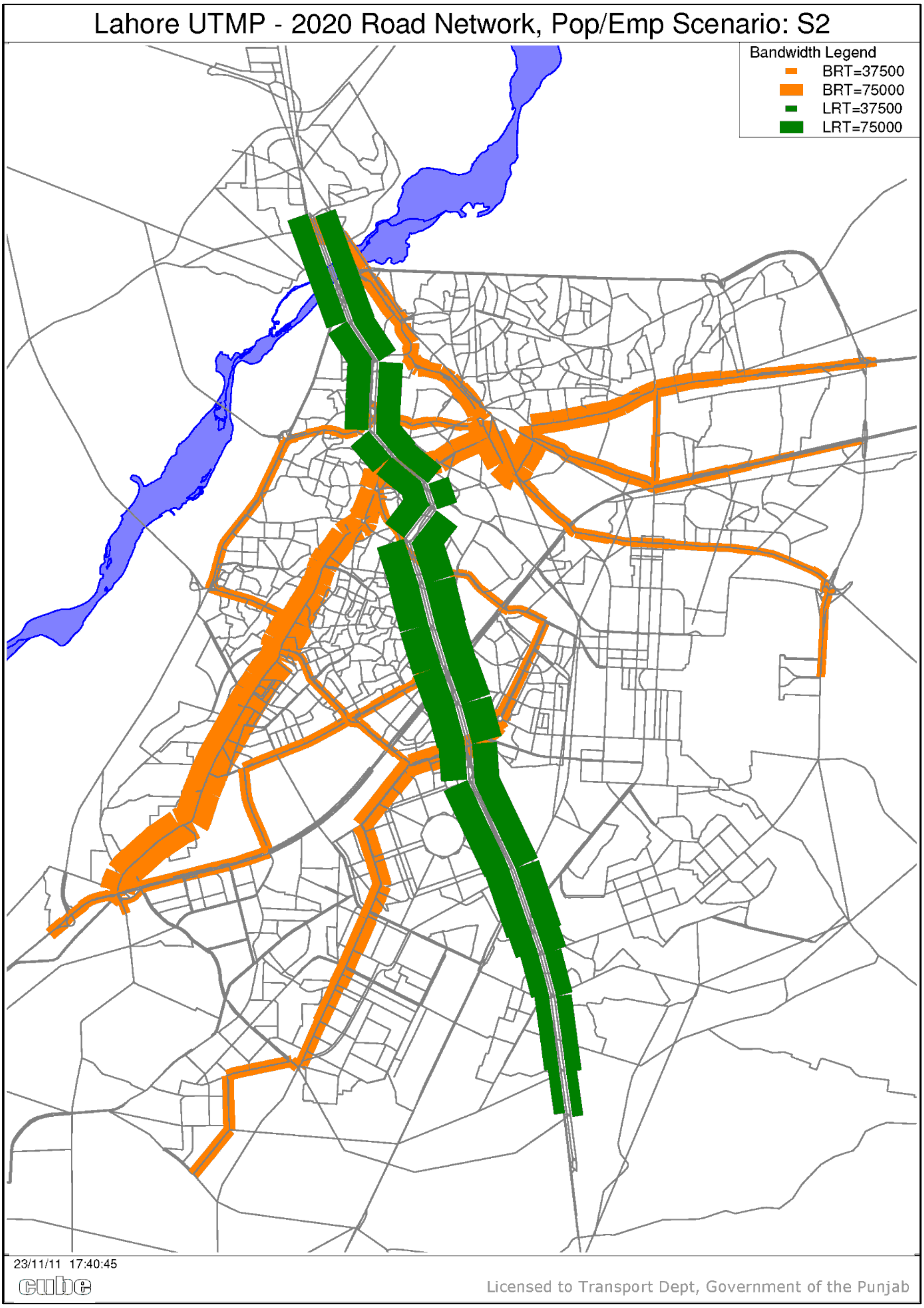
Figure 8.2.1 broadly defines the corridor location of these projects, and the forecast 2020 travel demand on RMTS/ BRT lines is shown as volume along the alignment in Figure 8.2.2.

Figure 8.2.1 Route Alignment of RMTS/ BRT Lines for 2020



Source: JICA Study Team

Figure 8.2.2 Estimated RMTS/ BRT Travel Demand for 2020



Source: JICA Study Team

8.2.2 Required Actions for Truck Public Transport System

To launch a transport development project, a series of actions are needed. These are, in general, as follows:

1. **PC-1 or PC-2:** This process is required for government agencies to launch a project (PC-1 for construction and PC-2 for studies, equipment and so on). For each action described below, PC-1 or PC-2 should be prepared and PDWP approval obtained in a timely manner.
2. **Feasibility Study (FS):** For Green Line, FS was completed in 2006. Other lines need FS. Note that FS was also completed for Orange Line in 2007. However, this was done as an RMTS line, not as a BRT. Therefore Feasibility Studies of Orange, Blue, Purple lines, and other four BRT Lines (1, 2, 3a and 3b) are required.
3. **Environmental Impact Assessment (EIA):** EIA is necessary for all proposed projects. Both GoPb and international funding organizations require EIA of their own standards.
4. **Detailed Design (DD):** Green Line reference design was completed in 2008, DD is still required. All other projects need DD as well.
5. **Land Acquisition and Resettlement Plan (LARP):** Land should be acquired before construction starts. But some international funding organizations require earlier land acquisition as one of their requirement to provide finance. Relocation of affected people should be duly conducted according to the rules.
6. **Relocation of Utilities:** In the case of Green Line, it was estimated that utility removal/ relocation would take 18 months, at cost of over PKR 5 billion. This process must be completed before the land is handed over to contractors for construction.
7. **Procurement of General Consultant (Transaction Adviser, etc.):** The General Consultant plays an important role in assisting GoPb to prepare tenders as well as detailed design project. The GC should be selected right after financing perspective becomes clear.
8. **Tendering:** In large-scale projects such as RMTS Green Line, international tender is required. The process from call for tender to selection of the winner requires 9 months at least. Moreover, prior to the tender, well elaborated tender documents should be prepared as a joint effort of General Consultant and GoPb. This process will take 6-12 months in general.

9. **Construction:** In the case of Green Line, the construction period is estimated at 5 years. Procurement of tunnel boring machine takes 12 months. Thus the construction of Green Line should be commenced before 2016 if it can open for service in 2020. In the case of BRTs, construction period is about 2-3 years, and since project cost is less than RMTS (roughly 1/ 10 per km) the works stated above can be simplified or shortened.

10. **Operation:** Green Line RMTS will start operation in 2020. Among BRTs, Orange Line BRT is proposed to start operation by 2016 while others by 2020 or earlier.

In Pakistan, there have been cases that project plan and finance should have to be largely changed from the original plan due to the delay in the actions mentioned above. Table 8.2.2 summarizes the actions needed by 2020.

Table 8.2.2 Necessary Actions to Construct Trunk Public Transport System

Route/ Line		System	Actions Needed
PT06	RMTS Green Line	RMTS	EIA, detailed design, land acquisition, utility relocation and procurement of transaction adviser are needed immediately. Tender and financial arrangement by 2015. Completion by 2019/20.
PT07	RMTS Orange Line	BRT	Reference Design is needed urgently to firm up costs for budgeting, land acquisition etc. Other actions (EIA etc.) by 2015.
PT08	RMTS Blue Line	BRT	FS is needed by 2015. Other actions by 2019.
PT09	BRT Purple Line	BRT	All actions by 2019.
PT10	BRT Line – 1	BRT	All actions by 2019.
PT11	BRT Line – 2	BRT	All actions by 2019.
PT12	BRT Line – 3a	BRT	All actions by 2019.
PT13	BRT Line – 3b	BRT	All actions by 2019.

Source: JICA Study Team

8.2.3 Financing Arrangements for Core Program-1

1) RMTS Green Line

The study for RMTS was first completed in 2006. The study proposed a rail based mass transit prioritised network of four lines of about 97 km, with 82 stations. The study also completed the feasibility study of the 1st priority (Green) line in 2007. Again Ferozepur road corridor was proposed for the priority line envisioned to be completed by 2015/16.

GoPb taking on-board the recommendations started work in earnest on the implementation of the system, by seeking funding from the Asian Development Bank (ADB). In parallel the GoPb also commissioned consultants to proceed with the reference design of the Green Line, and also the feasibility of the 2nd priority (Orange) line. These studies were completed in 2008 and 2007 respectively. The feasibility studies concluded that the mass transit lines are economically viable, and should be implemented as planned in approximately one line after every five years.

ADB conducted independent assessment of the feasibility studies, agreed to fund the RMTS project in phases, and approved to provide a multi-tranche loan of USD one billion towards the capital cost of the Green Line. However, since 2008 negotiation with the ADB has been suspended. The GoPb from its ADP cannot afford to fund the project capital cost. As a result the project remains suspended until some form of capital cost funding could be secured.

GoPb, recently negotiated the project with Chinese company "NORNICO" who showed willingness to obtain the buyers' credit from Chinese financing institutions including China Exim Bank to provide 85% of the contract amount; whereas GoPb would be responsible for effecting 15% advance payment. NORINCO had to do detail design and build Green Line; whereas LTC to engage an operator for the subsequent operation of the system. No further details are available to the JICA Study Team for further progress in this regard. The GoPb should do its maximum effort, assisted by the federal government, to ensure the finance for the project

2) Bus Rapid Transit (BRT) Lines

Unlike RMTS, financial condition for BRT projects is generally favourable. This is due to the lower cost (roughly 1/ 10 of RMTS per km), and profit from BRT business can be expected. Owing to the "profitability", the private sector can be involved, or PPP scheme could be applied for less profitable lines. Therefore, the role of GoPb is primarily to seek for reliable service suppliers. After feasibility study is conducted for each line, the projects should be announced to the public based on the proposed financing scheme (e.g. purely private or PPP), and tender shall be called on competitive basis.

8.2.4 Intermodal Integration with Public Transport Trunk System

1) Development of Feeder Services

RMTS Green Line will have a significant impact on people's travel behaviour. As the new system offer faster and more reliable services than existing wagon, bus, rickshaw and Qingqi, considerable number of passengers will shift from these conventional/ paratransit modes to RMTS and BRTs. In other words, the operators of conventional public transport will be affected by RMTS and BRTs. The impact of RMTS Green Line was estimated in its feasibility study that Buses would lose 30-50 % passengers by 2021 along Ferozepur Road corridor, and in the north across Ravi.

In order to alleviate this negative impact on bus/ wagon, and to ensure quick smooth transfers between modes, well-coordinated feeder services should be provided. Buses and wagons could be used as feeder services for the trunk public transport system; RMTS and BRTs. This is modal integration of conventional public transport and RMTS/ BRTs. For buses/ wagons feeder service is an expansion of their market, and for RMTS/ BRTs it offers an opportunity to increase their patronage. Various actions are needed to promote this integration. Rerouting plans of bus/ wagon should be formulated prior to the operation of RMTS/ BRTs.

In addition, common (electronic/ smart card type) ticketing system needs investigation for future application under the initiative of Transport Department and LTC.

2) Multi-modal Terminals

At present, relocation of the congested bus terminal at Badami Bagh is planned. The relocation sites are three; Shahdara, Thokar Niaz-baig and Ferozepur Road near Hudiara Drain. These bus terminals serve as interchange facilities of intercity and intra-city buses. These bus terminals will function as multi-modal terminals if transfer facility is provided between bus terminal and RMTS/ BRT station.

Among these three terminals - Shahdara is to be located north of Ravi Bridge (adjacent to GL Terminal, as planned in the GL design studies), will play the most important role as the interface between intercity and intra-city bus/ wagon and RMTS/ BRTs of Lahore. By this project, all the available public transport modes will be integrated at one location to offer integrated services to passengers. Similarly an integrated bus terminal is planned at the Green Line South Depot/ Station (Shadab Colony), about 4km north of Hudiara Drain. A similar location should be considered as a priority option, when conducting Feasibility Studies for the southern multi-modal bus terminal along Multan Road. For other terminals, similar concepts should be applied.

8.2.5 Preparatory Actions for RMTS System

1) Staff Training for Opening the RMTS Green Line

The railway differs entirely from other transport modes such as road, aviation and shipping. In case of road, after completion, some bus companies operate buses and some transport companies operate trucks and private cars use the road. Purchase of vehicles and training of drivers are in the transport companies, and private cars are used by individuals under their own responsibility.

However, Railway Company should do all the necessary works themselves, including construction of infrastructure, purchase of rolling stock, training of drivers, conductors maintenance staff, daily operation works, and safety treatment of level crossing and so on. Therefore, to establish a good railway company is not an easy task. Of particularly importance is the training of railway staff that will be responsible for all the work necessary for railway operation. This is a point often overlooked in railway development and planning.

Long period of time will be required for training drivers to operate urban trains safely. For the operation of the RMTS Green Line, about 350 staffs will be needed as per Japanese railway standard. Since operation of the RMTS Green Line is proposed to start in 2020, preparatory works should start as soon as possible, and not later than 2016.

Table 8.2.3 Estimated Number of Staff for RMTS Green Line Operation

Staff Position / Task	Number
Conductor / Driver	50
Conductor Administration/Station Staff	180
Electrical / Signal Staff	40
Track Works	40
Rolling Stock Maintenance Staff	40
Total	**350**

Source JICA Study Team

In Japan, seven to eight years are usually required for the training of train drivers and other auxiliary staff as illustrated in Figure 8.2.3.

Figure 8.2.3 Typical Training of Train Drivers in Japan

Employed by Railway Company 【High school graduates at 18 years old】
↓
Work as **Station Staff** for **2 years**
↓
Appointment examination for train conductor/ Passing
↓

Training Center:
・Subject to study, **3 weeks**
↓
Termination exam./ Passing
↓
・Practices Training：**7 weeks**
↓
Termination exam./ Passing

↓
Work as **Train Conductor** for **2 years**
↓
Appointment examination for train driver/ Passing
↓

Training Center
・Subject to study **4 months**：（By using driving Simulator）
↓
Termination exam./ Passing
↓
・Practices Training：**4 months**：Enforcement training in actual railway
↓
・Termination exam./ Passing in training center (Act as Govt. Duty)
↓
・Get Government certificate issued (Mail later from Government）

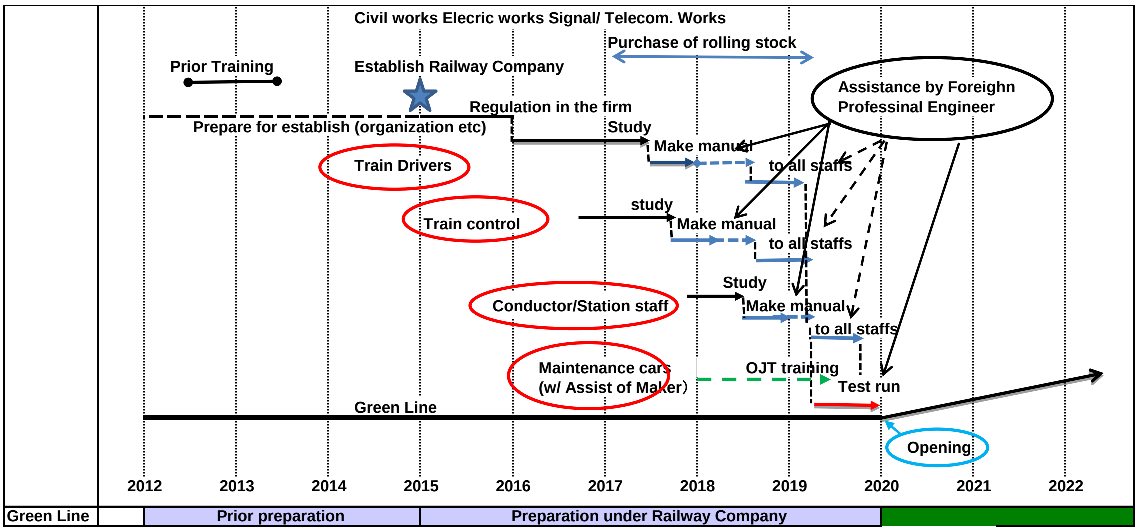
↓
Work as **Urban Railway Driver**
↓

Re-education in Training Center shall be required as follows;
(After **1-year, 2-years, 3-years, and 10 years** from the star of working as a Driver

Source JICA Study Team

All the trained staff should be ready to work before the opening day. As a reference, Line-1 in Hanoi, Vietnam, while the opening year is set at 2018, first driver trainees have already been sent to Japan, and training has already started. As the income for Railway Company is zero before railway service is commenced, special financial assistance from the government is required.

Figure 8.2.4 Proposed Staff Training Program to Open RMTS Green Line



Source JICA Study Team

To learn the basics of railway engineering, it is desired that training will be executed by Pakistani natives. Therefore, after establishment of a training center, the core staffs i.e. teachers in each field should be appointed at first, and they prepare textbooks and manuals, then excellent railway engineer and staffs shall be trained by On-the-Job Participation (OJP).

2) Compensation for Relocation and Resettlement

The Green Line project involves relocation of shop, commercial buildings and residential buildings along the alignment. The number of affected families and people is approximately 400 and 2,800, respectively. The railway is planned almost on the central part of existing roads, i.e. Government land, but stations and depots need private land of approximately 33,500m^2. This land acquisition is crucial for early completion of Green Line. This compensation for the land including of the following items:

a) Compensation for Loss of Land

b) Compensation for Loss of Trees

c) Compensation for Relocation and Resettlement

For the BRT projects, this compensation is not expected though feasibility studies are needed to establish land requirement and integration of access arrangements to the adjacent amenities.

8.3 Core Program-2 – Traffic Management (TM) Projects

8.3.1 Selection of Areas for Priority Traffic Management Projects

The selection of project areas for the LUTMP 2020 Action Plan, Core Program-2 is based on detailed analysis, evaluation, and prioritisation of projects as described in Sections 7.4 and 7.5 of this report. In addition, it is also influenced by the in depth knowledge of the area gained from traffic and transport condition surveys by the Study Team, about the special/ specific needs of the citizens of certain areas.

The core of the city urgently needs proper planning, and network connectivity, operation of its road network in hierarchical fashion and state-of-the-art junction design equipped with modern centrally controlled signal system. The transport network should accommodate all types of users according to the local condition. Non-motorized traffic (pedestrians and bicycles) is to be given priority, where possible, as the most vulnerable and neglected group in the existing transport system. LUTMP HIS survey results showed that there are about 45% of all travel either by walk or cycle in the Study Area.

Provision of planned parking facilities both on-street and off-street are one of the most important component of transport system of the city, but it is poorly managed and uncontrolled. Proper parking arrangement can help in removing illegal parking, temporary encroachments and improve traffic circulation and the environment. Travel behaviour issues are also needed to be seriously addressed, which is the major factor in the worsening of traffic situation and traffic safety. The main reasons are lack of traffic education, poor signage, and very week enforcement of traffic rules and regulations.

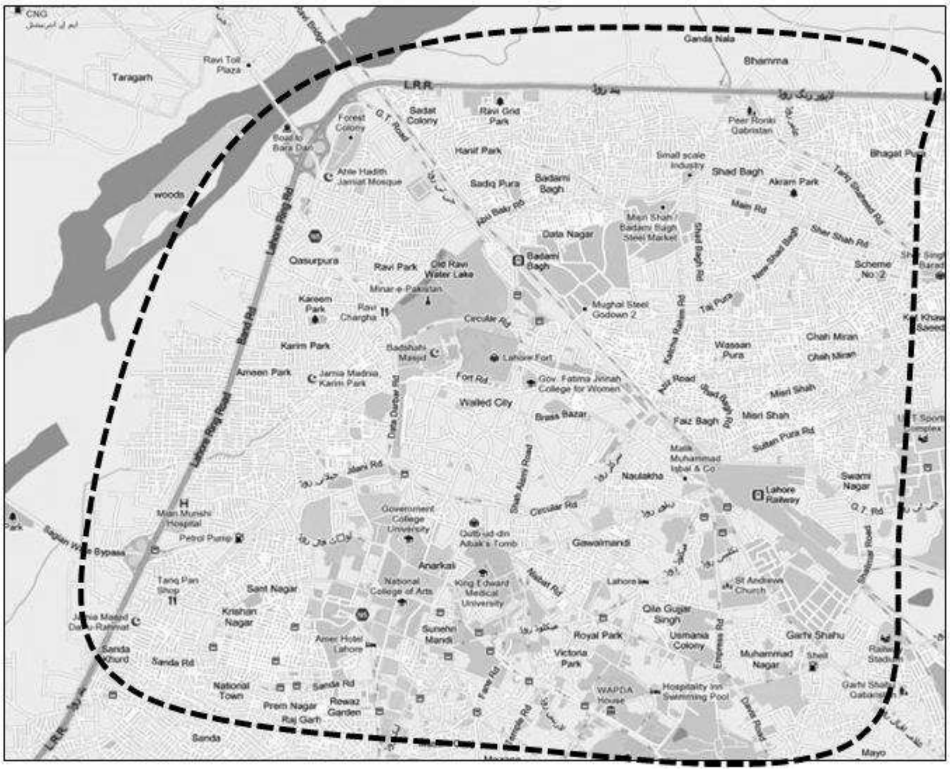
Developed countries in the world are preserving their environment and heritage by limiting the traffic access in central areas through various traffic demand management measures. This factor is also given a high priority, in addition to those mentioned above, in the selection of action plan areas. However, certain areas have been identified to need immediate attention and action, because of the dire state of the traffic and environment in these areas. These areas have been given high priority in the Action Plan, irrespective of the small differences in the MCA evaluation results of these projects in these areas.

1) Lahore CBD Area for Priority TM Projects

The Walled city and surrounding area is considered to be the city centre of Lahore, because of its location and outward expansion in a radial pattern. Areas surrounding the walled city have been poorly developed *without:* road network planning, traffic management, and land use control. Areas of concern include: Ravi, Data Gunj Baksh, and Samanabad towns, and also parts of Iqbal and Gulberg towns. This area is considered as the Central Business District (CBD) of the Lahore. It is the major commercial '***hub'*** not only of the Lahore city/ district, but also of the whole of the Punjab province. It includes markets, different types of service sector businesses, small cottage industries, all major provincial and local government offices, recreational areas, and most of the historical/ heritage places. In the Study this area is considered to be the CBD area of Lahore, and it is broadly shown in Figure 8.3.1. The chaotic traffic situation and poor living environment in this area is evident from the picture depicted as Figure 8.3.2.

This CBD area totally lacks facilities for pedestrians and cyclists, limited public transport which is mostly Para-transit based, and it infiltrated by illegal Qingqis. Other major issues: include encroachment of already scarce public spaces; roads and footpaths by legal and illegal parking, lack of parking provision, uncontrolled commercialization, and poor traffic circulation arrangements. These result in traffic chaos and bottlenecks, noise and air pollution and poor environment. Legal and illegal intercity and intra-city public transport stops/ terminals are operating in this area without any check and control, causing traffic mayhem and unsafe passenger/ pedestrian environment. Specifically, acidic rain from air pollutants of the Badami Bagh bus terminal is causing an irreparable damage to the marble exterior of the of the Badshahi mosque – a world heritage site.

Figure 8.3.1 Lahore CBD Area for Action Plan Projects



Source: JICA Study Team

Figure 8.3.2 Traffic on Fleming Road in Lahore CBD Area

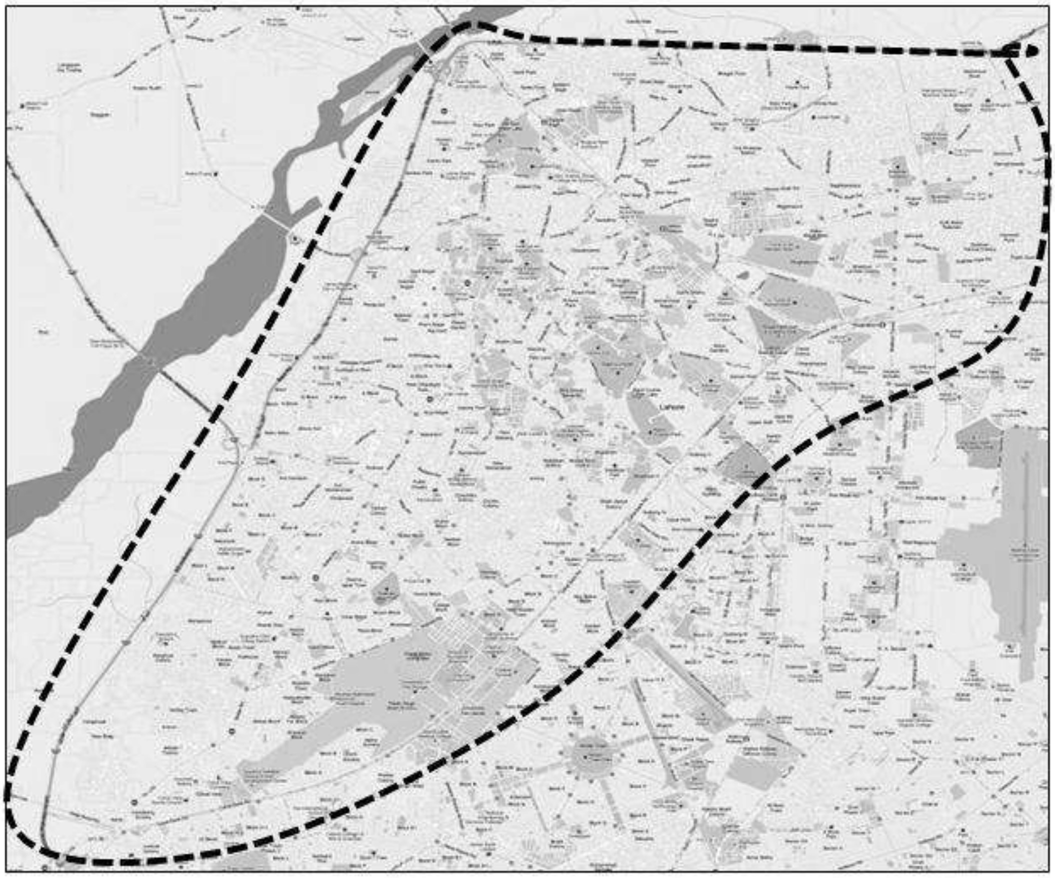
Source: JICA Study Team

2) Lahore City Area – North of Canal to Ravi

This area of Lahore city is locally called as ‘old Lahore’. It includes CBD area, and an illustrative map is given below Figure 8.3.3. The area is more compact compared to the south and south-western areas of Lahore District. The general situation in this area is worsening rapidly due to uncontrolled traffic situation and lack of planning and land use or development density control. This lack of urban development planning and control has resulted in uncontrolled commercialization; which is mostly approved without any traffic or development impact assessment. No traffic planning has been applied to manage the generated traffic/ travel demand from these commercial centres and mix developments. This has converted the area traffic in to uncontrolled mix of motorized and non-motorized traffic. Traffic situation is further aggravated by the lack of public transport; and illegal Qingqi and wagon operations. Legal and illegal intercity bus operation and trucking on the Bund Road East are the major factors in worsening the traffic situation in the area and along Multan Road.

Area to the east of the Walled city has the biggest steel market of Lahore, but it is without any direct access or egress to any trunk road like G.T. Road or Lahore Ring Road. Trucks and heavy tractor-trailers (commonly and illegally) are used for movement of heavy goods and containers. Situation is worsened by the limited capacity local roads, unplanned and illegal truck stands, and unplanned fruit market in the area. These are the major impediments to the smooth traffic flow and also for the poor local living environment.

Figure 8.3.3 Lahore City Action Plan Area – North of Canal to South of Ravi



Source: JICA Study Team

8.3.2 Selection of TM Priority Projects – Core Program-2

In total thirty one (31) Traffic Management projects (TM01-TM31) have been proposed and assessed in the LUTMP 2030. Eleven (TM01-TM11) of these Traffic Management projects are the committed Government projects, and some of these are on-going or at various stages of implementation. Therefore these projects are not included or further discussed here under the LUTMP 2020 Action Plan, Core Program-2.

An outline description and scope of each of the remaining twenty (TM12-TM31) projects have been given in Section 7.3.3. A comprehensive Multi Criteria Assessment (MCA) and prioritisation of these projects has been presented in Sections 7.4 and Table 7.4.17. The implementation schedule in the context of budget envelope, and agencies responsible for the project implementation have been discussed in Section 7.5 and presented in Tables 7.5.1 and 7.5.2 of this Report.

The implementation schedule as proposed in Table 7.5.1 suggests that most of these traffic management projects need to be implemented either in the Short or Medium term time frame. In order to further prioritise these projects for their implementation, it was estimated that the six of the short term projects (TM14, TM21, TM22, TM27-TM29) are mostly low cost (USD 1~6 million) 'soft' – limited scale feasibility/ initial studies and could be implemented in the earlier years of the Action Plan 2020 timeframe, without burdening/ disrupting the budget envelope. Therefore, for the implementation of these studies, ToR should be prepared based on the outline project description and scope of work as given in Section 7.3.3. It is recommended that TD should proceed with these projects as soon as possible, along with the committed projects.

In addition, Government should also start the process for the medium term projects like [TM15] 'Public Transport in Rural Areas', as soon as the condition of the public transport in the city is improved. Whereas, medium term project like [TM13] 'Existing Junction Design and Network Improvement' would have wait for the completion of short study [TM12] prior to its implementation.

The remaining eight Short (5) and Medium (3) term traffic management projects are included in the LUTMP 2020 Action Plan 2020 Core Program-2. Further detailed description and scope of work of these projects is illustrated in the following two Sections 8.4 and 8.5 respectively, as summarised in the following Table 8.3.1.

The table also includes three (R44, R45 and R57) of the road sub-sector projects included in the Action Plan 2020. These projects under MCA evaluation did not score so high to be recognised as Short Term projects. However, the local traffic and environment situation in these areas is dire. It demands that high priority should be given to the improvement of roads/ junctions, general traffic situation, and pedestrian environment in the areas of projects R44 and R45.

The road sub-sector project R57 is listed here as, it is part of the LDA/ TEPA on-going projects. It involves new housing developments in the south-west of Lahore. LDA/ TEPA are responsible for the development or road network to sustain the developments either by upgrading the existing roads or by building new roads in conjunction with the private sector/ developers, as part of old Lahore Master Plan 2021.

Table 8.3.1 LUTMP 2002 Action Plan Projects – Core Program-2

Project No.	Project Description	Report Section	Implementation
TM12	A.1 Junction Design and Traffic Signal Improvement – CBD	**8.4.1**	Short Term
TM18	B.4 Linking Communities - Smart Roads	**8.4.2**	Short Term
TM23	C.3 Pedestrian and Bicycle Path Network	**8.4.3**	Short Term
TM24	D.1 Comprehensive Parking System Development	**8.4.4**	Short Term
TM31	H.1 Local Standards and Guide Lines Development	**8.4.5**	Short Term
TM16	B.2 Traffic Circulation System Design and Implementation	**8.5.1**	Medium-term
TM17	B.3 Public and Freight Transport Terminals	**8.5.2**	Medium-term
TM19	B.5 Feasibility Study for Traffic Demand Management Measures	**8.5.3**	Medium-term
R44 and R45	Shadbagh Area (Roads - R44) and Samanabad Area (Roads R45) – Secondary Road Network Development	**8.6.1**	Urgent Action
R57	Construction and Remodeling of Secondary roads - south of LRR in the south-western quadrant between Ferozepur Road and Multan Road	**8.6.2**	On-Going Developments

Source: JICA Study Team

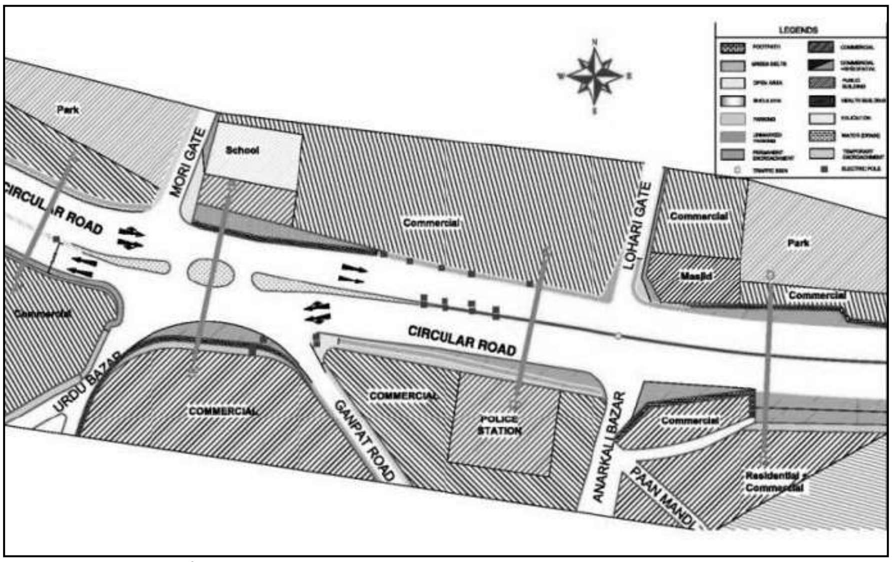
8.4 Core Program-2 – Short Term Traffic Management Projects

8.4.1 [TM12] Junction Design and Traffic Signal Improvement – CBD Area

1) Introduction

Lahore CBD area road junctions are poorly designed, if at all. It is clear that their layout is not based on any traffic data, traffic engineering design principles, safety considerations and they lack even the basic concept of time and space segregation of vehicles of conflicting movements. This result in unnecessary and avoidable delays, poor and unsafe environment for all the road users and local area communities. A typical example, Lohari Gate junction layout is given below in Figure 8.4.1 and it is further illustrated by pictures of various cross-sections of roads in Figure 8.4.2. At the junction five streets have access/ egress. It is not at all clear which movement has priority over the other. It is 'free-for-all' situation. There is no provision for pedestrians to even cross the main Circular Road. Five streets are directly entering the main traffic stream without any merging, diverging lanes. This results in congestion, which often locks the junction during peak periods.

Figure 8.4.1 Existing Situation Lohari Gate Junction – Poor Junction Design



Source: JICA Study Team

Figure 8.4.2 Lohari Gate Junction – Pictures at Marked Sections

Section: A-A’ Section: B-B’

Section: C-C’ Section: D-D’

Source: JICA Study Team

This situation is common throughout the CBD area. It is further exacerbated by mix land use and uncontrolled development, without due consideration to the impact of development on the traffic. Lack of parking spaces, legal and illegal parking on the footpaths (thereby making the pedestrians to walk in the road) limits the already scarce road space. Strewn street furniture like garbage containers, not to mention the ever present hawkers interrupt the traffic flow endlessly. The solution is comprehensive traffic management study of the area, scope of which should include, but not be limited to the following components.

2) Project Area and Components

The proposed project area has already been defined as the CBD area of Lahore, which is described above in Section 8.3.1 and the map is shown Figure 8.3.1. The major project components are as follows:

- Urban planning and street design in the context of the land use in area;
- Road network and junction operational assessment, design and improvements;
- Traffic signal system design according to the junction and network requirements;
- Planning and design of a pilot central traffic control system;
- Traffic circulation system design and pilot implementation;
- Parking facilities planning and design;

- Pedestrian paths and road crossing facilities design;
- Bicycle paths and network planning and design;
- Pedestrianization of certain areas, and associated traffic circulation plan; and
- Capacity building and training of local traffic engineers through OJP.

3) Implementation Strategy and Schedule

It is suggested that international consultant with considerable experience of such projects should be commissioned. They should be supported by local consultants and TPU staff to gain necessary experience. The project should involve network simulation techniques to achieve the best design for the CBD area as whole. This project should be executed by TEPA with the involvement of TPU as the overseeing authority.

This project is of high priority as established by the MCA evaluation process, and the implementation of a number of projects depends upon the successful completion of the project as soon as possible. This project is proposed to start immediately, and should be implemented by year 2014. Tentative implementation schedule of various project components is given in Table 8.4.1. The estimated project cost is USD 4.0 million, including the implementation of the pilot scheme.

Table 8.4.1 Tentative Implementation Schedule of TM12

Project Activities	2012	2013	2014
Conduct of traffic surveys, and identify major issues (Comprehensive problem statement)			
Planning and design based on the identified problems and issues			
Proposed designs/ improvements implementation under the supervision of consultant or contractor			

Source: JICA Study Team

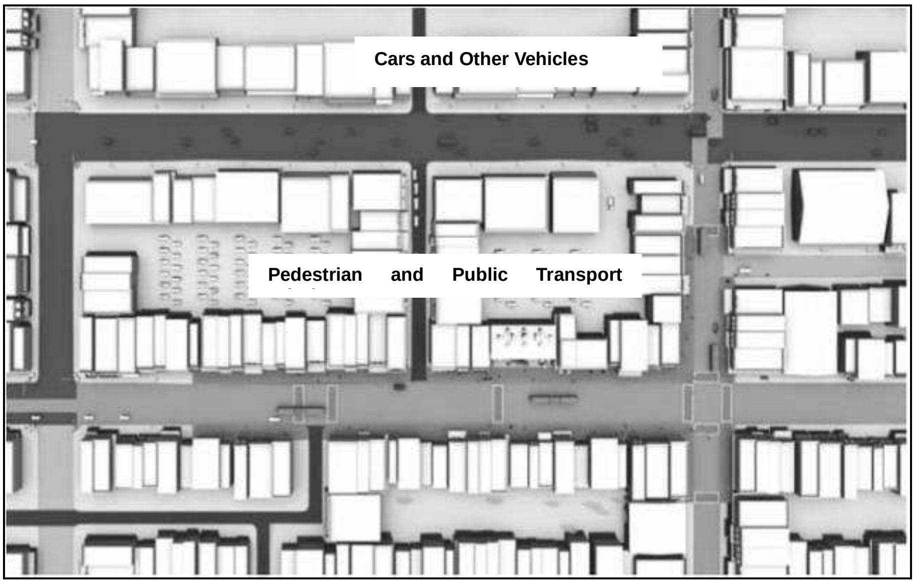
8.4.2 [TM18] Linking Communities – Smart Roads

1) Introduction

Under this approach it is ensured that most effective use is made of the scarce road space for the most suitable and sustainable transport mode(s). It should recognize the importance of activities in areas these take place, such as places to live, work and enjoy. Under this plan, certain routes will be managed to perform better for cars, and other will be best suited for public transport or pedestrians as shown in Figure 8.4.3.

Public would be encouraged to walk and cycle by making places more environment friendly by ensuring that the cyclists have improved access to activity centers and other public transport services. This project is important to shift the emphasis from building new expensive transport infrastructure to effectively and efficiently manage the operation of existing road network.

Figure 8.4.3 Smart Road Concept – Activity Centers Network in Operation



Source: JICA Study Team

Figure 8.4.4 Pedestrians, Public Transport and Private Traffic

Source: JICA Study Team

2) Project Components and Area Description

This project relies upon road network operational efficiency improvement through traffic management and planning techniques. However, local transport related agency has to work with broad range of relevant stakeholders in developing and implementing this concept in the city effectively. This needs extensive consultation within government departments and agencies, and also with relevant stakeholders in the private sector.

The project components may be broadly defined as follows:

- Road Use Hierarchy by Time Period
- Network Operation Plans by Time Period
- Evaluation of Network Operation
- Using Smart Roads Effectively

This proposed project area where it would be most suited to is shown above, with possible road usage hierarchy as a pilot, and then it could be extended to the other areas of Lahore District. However, on the other hand the concept implementation may be less restrictive/ easy in the south of Lahore (South of Canal). Implementation in the Old Lahore area would be tedious due to high density and limited options of alternative routes for different modes of transport.

3) Implementation Strategy and Schedule

It is suggested that an international consultant would be commissioned with extensive traffic modelling/ simulation, local area modelling, pedestrian planning and design experience. Consultant should help design the above mentioned system as a pilot project of considerable size area where benefits of the scheme could be quantified and realised by public at large. TEPA should prepare the project ToR for specific area following the above guidelines.

As the project would be implemented from the concept stage to its implementation TEPA should use this as capacity building exercise, and commit their staff as counterpart to work with international consultants as an OJP training exercise, so that similar schemes could be implemented in other parts of the Study Area. TEPA staff should also be able to monitor the project performance as 'before' and 'after' study comparison. A tentative implementation schedule is given below in Table 8.5.3. The project is to be implemented by TEPA, and estimated cost is USD 4.0million.

Table 8.4.2 [TM18] Tentative Implementation Schedule

Project Activity	2015	2016	2017	2018
Project Preparation and Consultant Engagement				
Adopt LUTMP Model for Local Area				
Define Road Use Hierarchy				
Network Operation Plans				
Evaluation of Alternative Network Operations				
Using Smart Roads – In Operation and Monitoring				

Source: JICA Study Team

8.4.3 [TM23] Pedestrian and Bicycle Path Network

1) Introduction

Developed and developing countries are moving toward the development of sustainable urban transport system, to revitalize the central urban areas, by incorporating pedestrian and cycling facilities in the design as high priority, and even replacing the existing dependence on motor vehicle. Pedestrian and cycling facilities are incorporated as an integral component of the modern urban fabric. Some examples of sidewalks with bicycle path are depicted in Figure 8.4.5.

Figure 8.4.5 Side-walk Photos in Fukuoka Japan

Source: JICA Study Team

Currently there is no transport policy or strategy to move the city towards such sustainable transport system for the city. The Study HIS survey showed that; about 41 % of the trips in the Study Area are by walk and 5 % by bicycle and rest of the 54 % are by all other modes. This is an asset of the city that shows the importance of walk and cycling, and should not be squandered in favour of motorisation.

Figure 8.4.6 Pedestrian Endeavor to Cross Gulberg Main Boulevard

Source: JICA Study Team

Pedestrian Facilities

In the recently developed areas of Johar Town, DHA and also in older areas like Gulberg, and Model Town; walk culture is limited and it is discouraged, as there are absolutely no footpaths in these areas. Walking is only possible in the main carriageway, even in cases where there are service roads, walking is hazardous among parked vehicles and other street furniture. This causes most nuisances in the commercial areas without walking facilities, as result shoppers tend to park their vehicle nearest to the shop of their choice. Road crossing is serious hazard, as can be seen above in Figure 8.4.6. Road crossing facilities are either not provided at all, or if available, are ignored by motorists. This also hampers the access to public transport (bus stops etc.). In some parts of Lahore attempts have been made to create better pedestrian environment, but designs are poor, and compliance is limited.

It has been observed that Old Lahore area severely lacks proper provisions for pedestrians, footpaths and road crossing facilities. Examples of poor facilities in several residential, commercial and other mix areas are shown in Figure 8.4.7 and are outlined below which need urgent attention:

- Shadbagh area - small scale industries and biggest steel market of Lahore;
- Walled city area congested by commercial activities and truck stands,
- Badami Bagh bus terminal without any waiting areas, walkways, access to local transport stands, and parking facilities, and
- Niazi bus terminal along Bund Road East and Babu Sabu area bus stands lack pedestrian facilities and is most dangerous for passengers to cross the busy roads.

Figure 8.4.7 Badami Bagh Bus Terminal – No Pedestrians/ Passengers Facilities

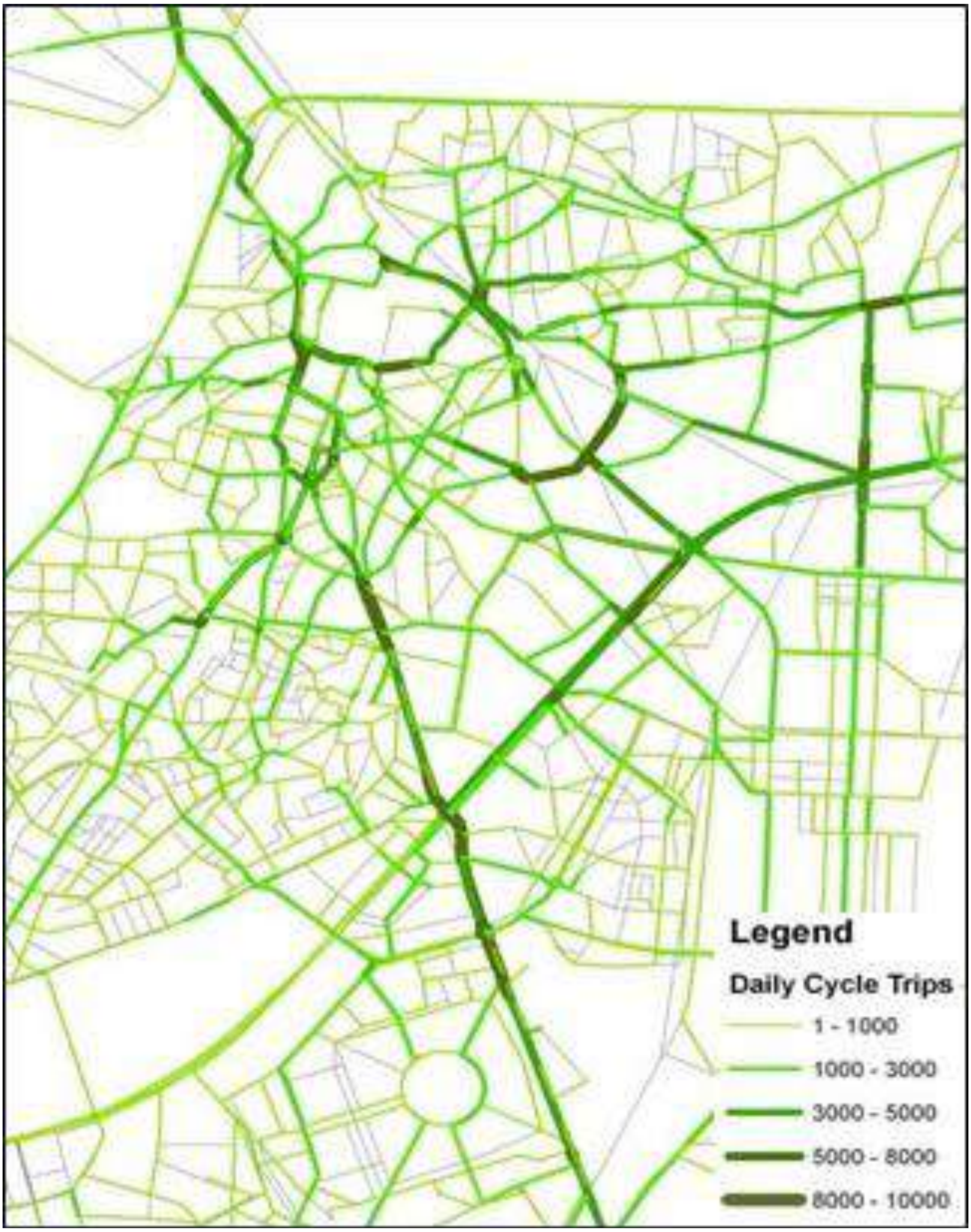
Source: JICA Study Team

Cycling In Lahore!

There is no provision at all for cyclists on the entire road network of Lahore. The level of cycling is common and it is (from LUTMP Travel Demand Model) illustrated in Figure 8.4.8. This shows that how much cycling is common in the entire Lahore City area, and on some roads daily cycle volume is in thousands (2010 volumes). Some of these roads are primary, while others are secondary and local streets. Cycling on most major roads is hazardous and dangerous, accidents/ fatalities are common, and the root cause is lack of clearly planned, designed and marked provision of cycling facilities. There is also no regard for cyclists by the motorists – a common driving misbehaviour problem, as cycling rights are not spelled out officially. Therefore, it is essential that due consideration be given to cycling as a mode of transport, and this can be best achieved through planning, design and implementation of cycling facilities in the Lahore City area.

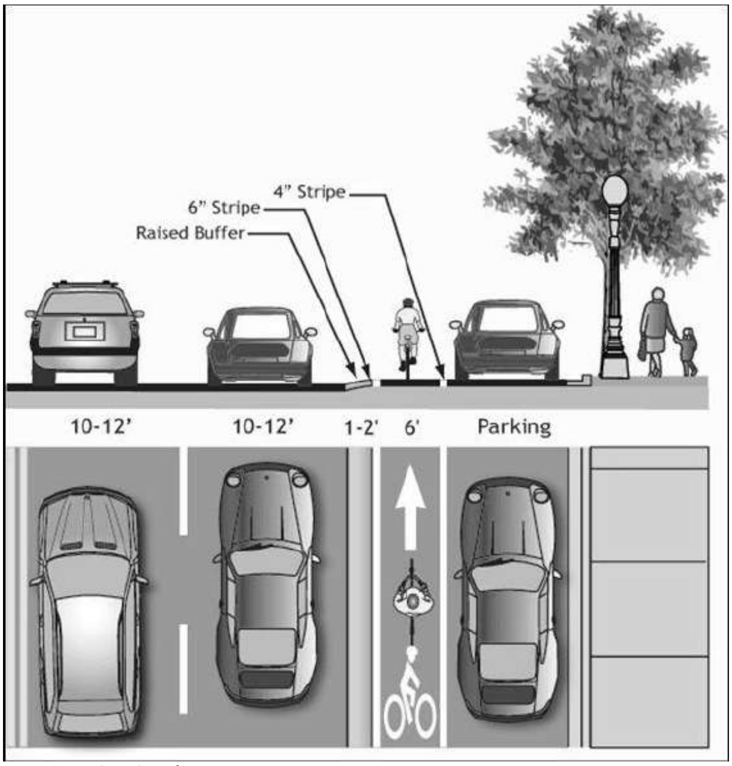
Design concepts of integrated walkways and cycling facilities are illustrated in the following Figures 8.4.9 to 8.4.13 along with the maps of Lahore areas depicting where such concepts should be applied to provide safe and better environment.

Figure 8.4.8 Daily Bicycle Demand in 2010



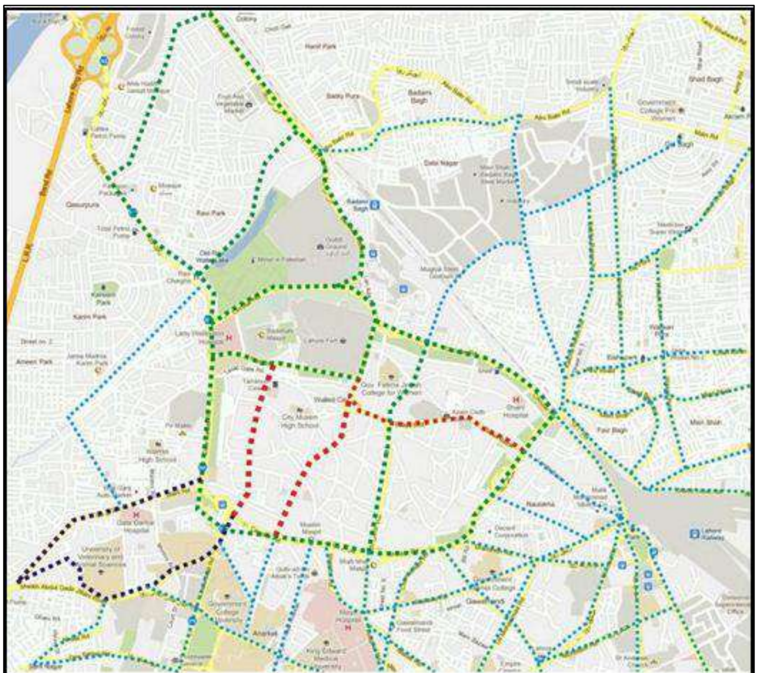
Source: JICA Study Team (LUTMP Model)

Figure 8.4.9 Integrated Design Concept for Walkways, Bicycle Lane and Parking



Source: JICA Study Team

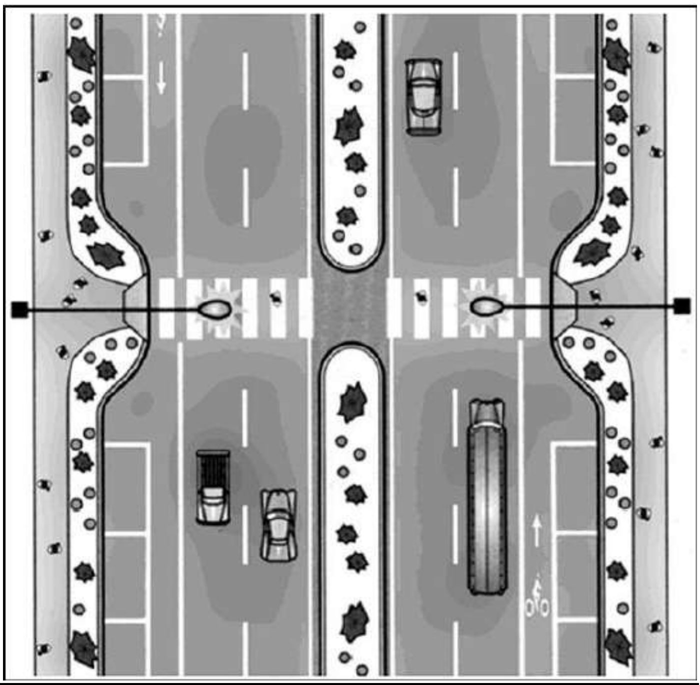
Figure 8.4.10 Application of Integrated Pedestrian and Cycling Design in Central Lahore



Green – Historical Monuments – Wider walkways, Bicycle Lanes, restrict heavy vehicles
Red – Pedestrianize the area
Blue – Wide Footpaths along both sides of roads
Black – Pedestrianize the Area

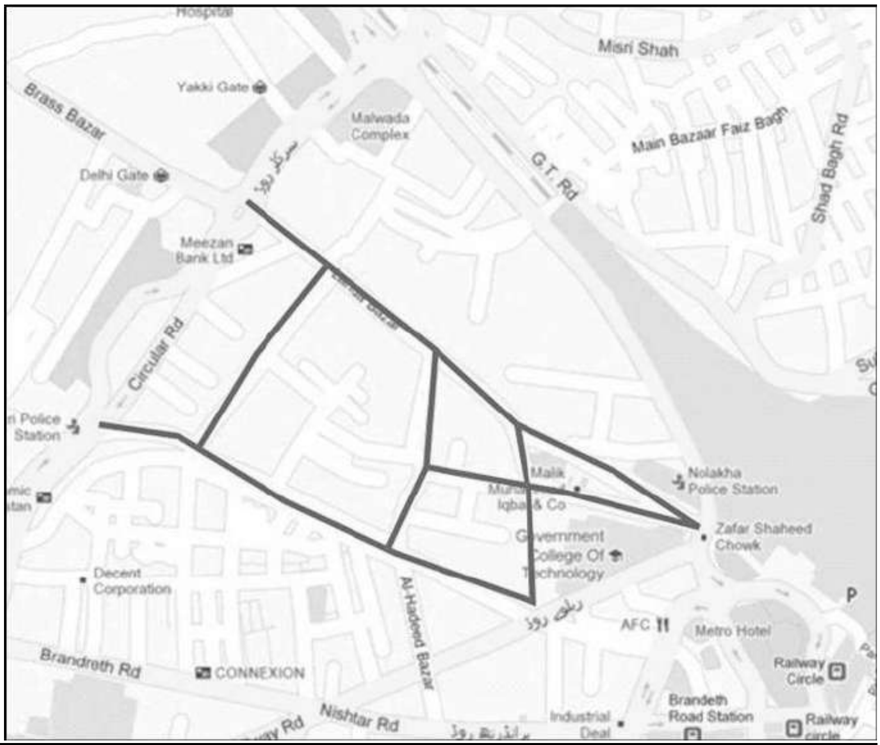
Source: JICA Study Team

Figure 8.4.11 Concept Design of Mid-block Safe Pedestrian Road Crossing



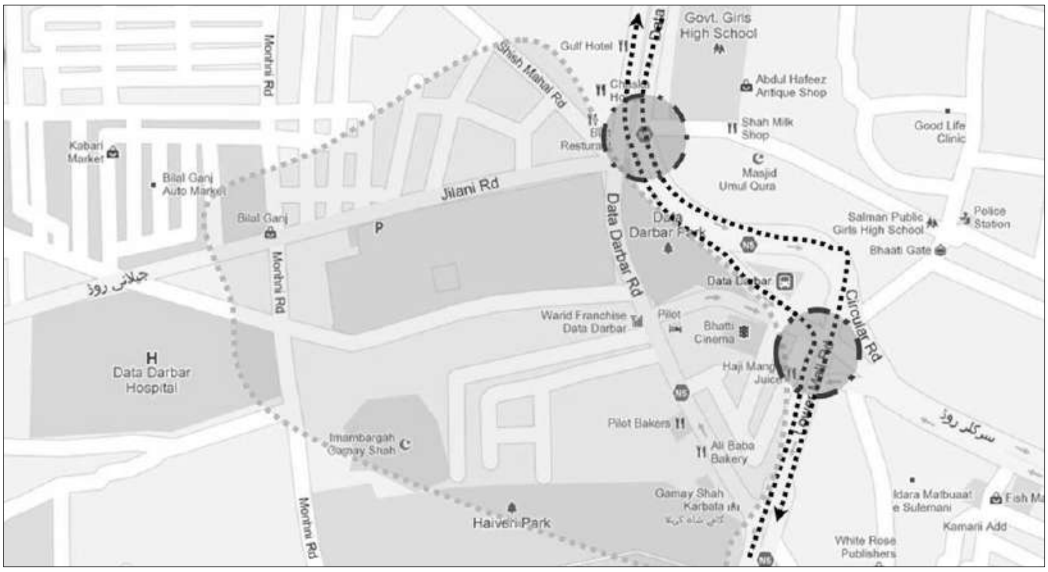
Source: JICA Study Team

Figure 8.4.12 Some Street of Central Lahore Identified for Pedestrianization



Note: Al-Hadeed and Lanada Bazar Areas
Source: JICA Study Team

Figure 8.4.13 Data Darbar Area for Pedestrianization



Note: Highlighted Junctions Needs Special Junction Design
Source: JICA Study Team

2) Project Components and Priority Areas

This project includes comprehensive pedestrian and cycle path planning and design study for the Old Lahore area. The study scope should include detail design of pedestrian and bicycle path network based on demand, and also local area traffic management plans where Pedestrianization is proposed.

Areas south of the Canal should be also studied, but are not a high priority as Old Lahore area, where pedestrian and cycle volumes are relatively much higher. Traffic calming measures for secondary and local roads should be an integral part of the network. In addition special commercial areas should be given high priority for Pedestrianized areas similar to Liberty Market, but with better segregation of traffic and pedestrians, and also with full traffic circulation plan around the area. Areas to be given priority could be: Sadar Bazar, Model Town Link Road Market, Moon Market Iqbal Town. Major components of the projects are as follows:

- Non-Motorized traffic demand and interview surveys;
- Topographic surveys of the road sections for design of walkways and bicycle path network;
- Removal of permanent as well as temporary encroachments;
- Bicycle and pedestrian path network plan, design and construction;
- Traffic circulation plans for the pedestrianized zones;
- Pedestrian planning of major commercial areas with their traffic circulation plans and parking facilities;
- Traffic calming measures for Secondary roads associated with Pedestrianization

and Cycle path network;

- Improved and mandatory pedestrian crossing facilities in all commercial areas.

3) Implementation Strategy and Schedule

This project is proposed to start from year 2014 after completion of Junction design project [TM12]. TEPA should be the executing agency. It is proposed that TEPA should carry out the projects with its local resources, with limited help from international consultants.

LUTMP database could be used to calculate pedestrian and bicycle demand by area and road network. However, supplementary localized pedestrian and bicycles demand and interview survey would need to be required and should be conducted in a manner that data could be incorporated in the LUTMP model for network-wide analysis and forecast purposes. The project is proposed to last three years from 2014 to 2016. Some of the key project activities with timescale are given in Table 8.4.3. The project cost is estimated at USD 5 million, but depend upon the size of area.

Table 8.4.3 [TM23] Pedestrian and Cycling - Tentative Implementation Schedule

Project Activity	2014	2015	2016
Planning, design and construction of Pedestrian path network			
Planning, design and construction of Bicycle path network			

8.4.4 [TM24] Comprehensive Parking System Development

1) Introduction

CDGL has provided small scale parking stands along 32 major roads in Lahore for motorcycles and cars; which are neither planned nor designed for such activity. The roads already lack capacity, and parking is a major encroachment of the road space. There is no signage for Parking or No Parking, legal and illegal parking is common, and enforcement of legal parking is non-existent. CDGL is only authority who is providing on-street parking facilities; however they do not have technical capability to plan, design and manage parking at any level. They simply contract out a section of road (often including footpath) to be used as *'legal parking'*, and the contract amount is the revenue for CDGL without any specific expenditure against this income.

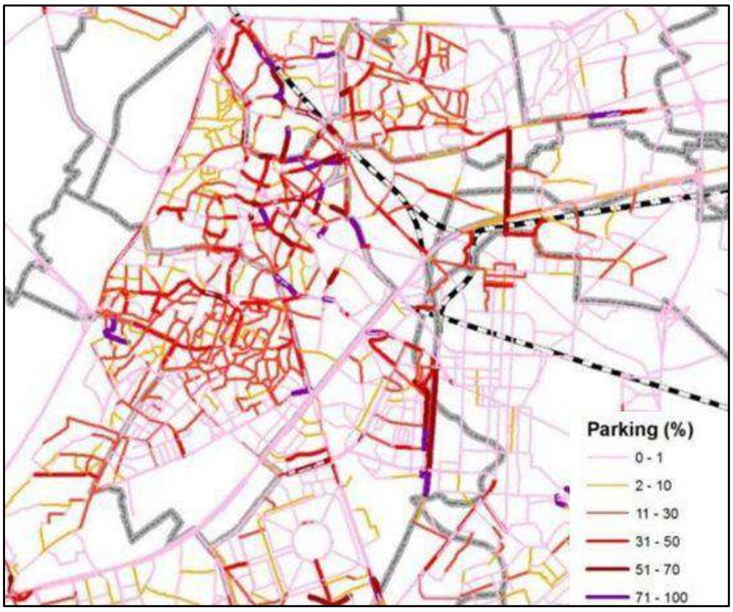
Parking facilities: on or off-street, planning, design, implementation and enforcement should the responsibility of a single competent agency. It is already under TEPA, but due to various historical reasons and lack of local planning laws it is also in the domain of CDGL. This makes the situation unnecessarily complex, and has left this area of traffic management completely without direction and control. As a result there is no concept of parking demand and required/ necessary supply quantification, strategies to provide parking or restrain it? Recent trend is to build multi-storey parking plaza objective is that it would reduce congestion, whereas basic transport planning suggests that it would increase traffic demand to the area, and worsen congestion. The result of total ineffective control and lack of planning is evident from the picture in Figure 8.4.14.

Figure 8.4.14 Discriminate Parking at Panorama Shopping Centre – The Mall

Source: JICA Study Team

There are only three car parking plazas in the whole of Lahore, parking integral to large development often ends up as commercial space (like Panorama Shopping Centre basement) due to lack of building control. Encroachment of local road network was observed during the LUTMP surveys and is illustrated in Figure 8.4.15 with the aid of LUTMP model. The Figure also gives the level of demand as percentage of the street section is occupied by legal/ illegal parking.

Figure 8.4.15 On-street Legal/ Illegal Parking in Lahore – LUTMP Surveys



Source: JICA Study Team

2) Project Components and Study Area

There is no local institution with capacity to plan, design and manage the parking in the city. Development of an institution responsible for such a task is essential. Setup of a company for the Development of Parking Management is a step in the right direction. However, the main components of the project are briefly described as:

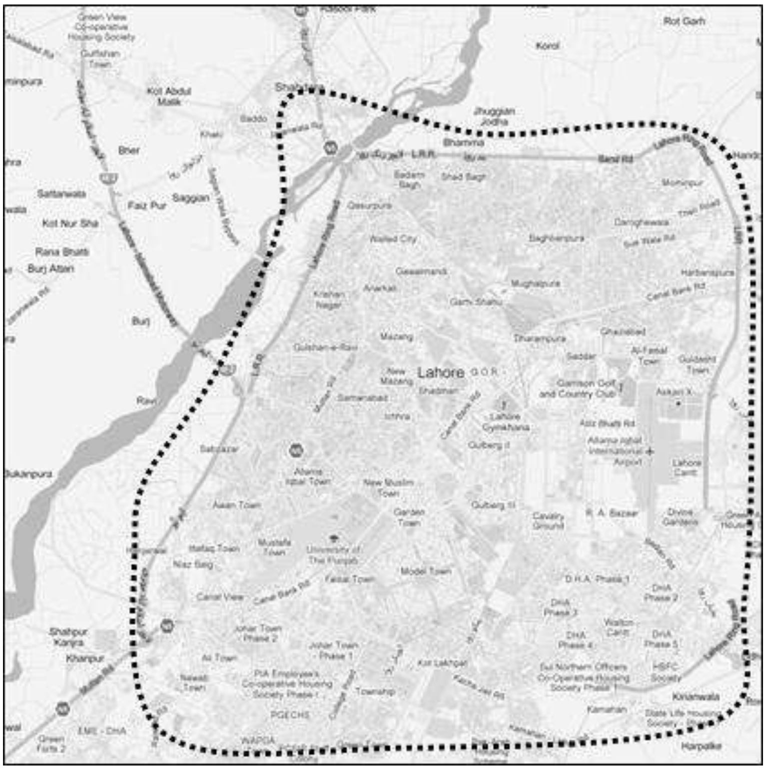
- Institutional planning study leading to development of Parking Management Company prior to the starting of the parking system study.
- Capacity building of parking management company would be the major part of the institutional development exercise.
- Comprehensive parking demand surveys needs to be conducted; this need to be supported with details of the associated land use of the area to estimate parking demand by volume and time period.
- Commercial activity centres would be identified and studied in detail for their parking demand and provisions.
- On-street parking facilities would be planned and designed based on demand, and supply, possibly with parking restraint as a policy. The strategies should be proposed based on the environmental impact of parking provision in the area.
- Off-street parking facilities feasibility study should be conducted according to demand and impact on the local road network and the associated environmental impacts.
- Pilot off-street parking facility detail design as a capacity building exercise for the parking management company and TEPA.
- Comprehensive parking policy and strategy would be formulated based on the existing parking demand analysis and parking behaviour in the city.
- This study should lead to the development of Parking Design Guidelines for both on-street and off-street facilities.

This proposed project area includes the Old Lahore (as described above in Section 8.3.1 and shown in Figure 8.3.3), and the areas south of Canal including Model Town, Iqbal Town, Gulberg, and DHA as mapped out below in Figure 8.4.15.

3) Implementation Strategy and Schedule

It is suggested that a local and/ or international consultant could be engaged; who have extensive experience of institutional development and conduct of such studies in the developing countries. This exercise can effectively be utilized by TEPA and Parking Management Company as capacity building exercise. Parking Management Company could also be made responsible for planning, designing, development, and management of all parking facilities in Lahore. Tentative implementation schedule of the project is given below in Table 8.4.4, and project cost is estimated at USD 2.5 million.

Figure 8.4.15 [TM24] Parking Study – Proposed Project Area



Source: JICA Study Team

Table 8.4.4 [TM24] Parking Study Tentative Implementation Schedule

Project Components/ Activity	2012	2013	2014
Institutional Study			
Parking Management Company Development			
Parking Planning Study			
Parking Design Study			
Capacity Building of TEPA			
Project Implementation			

Source: JICA Study Team

8.4.5 [TM31] Local Standards and Guide Lines Development

1) Introduction

Currently no standards or guidelines exist for transport planning and traffic engineering in Pakistan. Previous attempts by NTRC (National Transport Research Center) and other provincial institutions failed to produce documents of international standards, which could be adopted as Standards/ Guidelines. Even the documents which exist do not fully reflect the local conditions.

The Urban Unit recently prepared a 'Punjab Traffic and Transport Manual' which includes traffic signs in English language only and does not include the signs recently used (on

LRR). Hence, it completely lacks the local context, in terms of ability of local *totally illiterate* drivers to understand these signs in English or its use for signage in Punjab, at least new roads. However, this manual could be used as starting point for this study. It would need to be completely revised in the local area context. Its legal status needs to be ascertained and reasons for lack of its implementation needs to be determined. This is a serious concern, as enforcement would be the key issue for the implementation and conformity to such a document. This project is considered as a core project for all traffic management and traffic engineering design work; and can bring conformity to the design of transport facilities.

2) Project Components and Area of Implementation

Different transport facilities design standards and guidelines would be developed under this project. The proposed standards and guidelines documents needed to be produced are briefly outlined below:

1. Road Geometric Design Standards
2. Parking Facilities Design Manual
3. Traffic Control Devices Manual
4. Traffic Signal System Design Manual
5. Development or Traffic Impact Assessment Guidelines

These guidelines would be designed in the local context, and should be applicable in the whole of Pakistan. These standards and guidelines should be applicable to all major cities and towns. However, if the situation demands (to be ascertained by the study), these standards and guidelines may be relaxed for rural or outlying areas. This relaxation should be clearly documented, and where possible supplementary guidelines would need to be prepared for such areas.

3) Implementation Strategy and Schedule

TEPA or other transport sector institutions should have full technical involvement with the project, and must have technical capacity to formulate such comprehensive document of standards or guidelines. Project should be executed by commissioning international consultants with full involvement of all stakeholders. The standards and guidelines thus developed are mandatory on all transport sector concerned agencies.

Table 8.4.5 [TM31] Development of Guidelines and Standards Tentative Schedule

Standards and Guidelines	2012	2013	2014	2015	2016
1. Road Geometric Design Standards			Project Review/ Implementation Period Involving Other On-Going Traffic Management Project.		
2. Parking Facilities Design Manual					
3. Traffic Control Devices Manual					
4. Traffic Signal System Design Manual					
5. Development or Traffic Impact Assessment Guidelines					

Source: JICA Study Team

8.5 Core Program-2 – Medium Term Traffic Management Projects

There are in total five (5) medium traffic projects in the LUTMP 2030, and two of these have been included in Core Program-2. These projects are deemed to be essential as the start of implementation is vital for the city's traffic management system, as explained below under each project description.

8.5.1 [TM16] Traffic Circulation System Design and Implementation

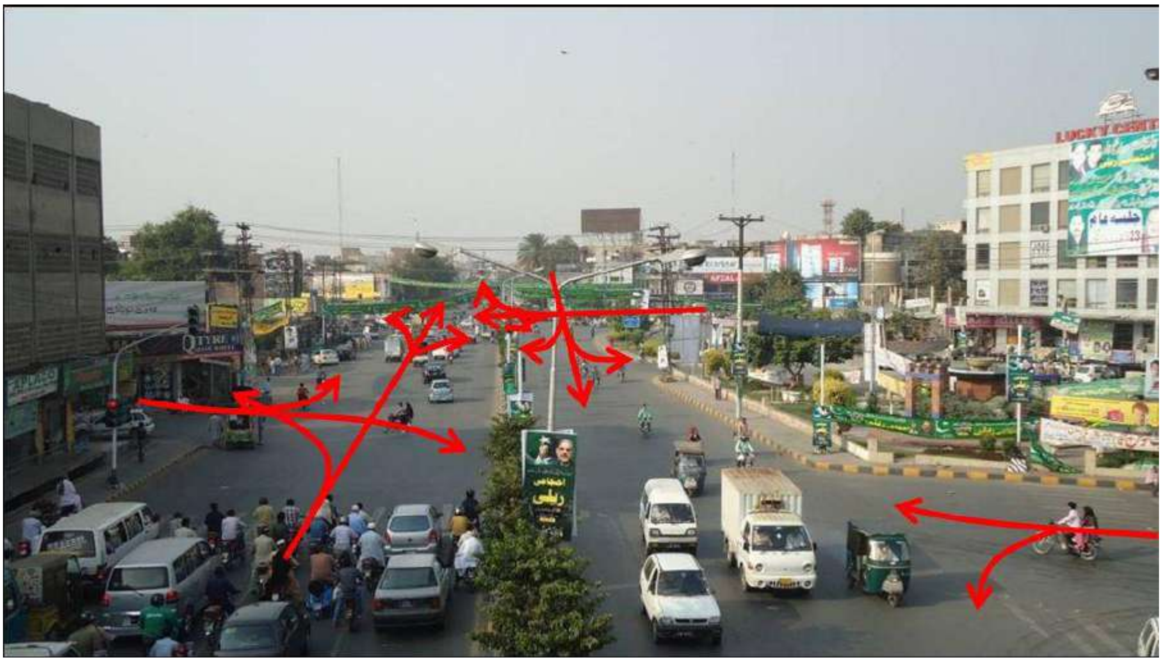
1) Introduction

In a large metropolis an effective traffic circulation system is essential to get the best operational efficiency from its road network. The traffic circulation design concept is commonly used in the developed countries to improve the functional and operational efficiency of road network as whole. Under this concept a carriageway is made one-way (sometimes for peak periods only) to reduce conflicts along its length to improve its capacity. It should be understood that a 1-way carriageway has 30 % more capacity than a 2-way undivided carriageway of the same width. Conversely, if a 1-way carriageway is turned into 2-way operation, there would be a loss of up to 30~50 % of its total capacity. Similarly, junction capacity in a 1-way system is also enhanced, and this further improves the network operational efficiency. On the other hand 1-way system does increase the trip length over a limited area, hence its implementation needs to be carefully planned, and evaluated before implementation.

Lahore has many dual carriageways, very wide roads and often with service roads along most of their length, which often extend right into the city centre. Sadly this available road capacity is simple wasted away due to total lack of directional control of traffic. Most service roads operate 2-way, without any provision of such contra-flow movements at junctions. This causes total chaos at junction, when vehicle end up travelling in the contra-flow direction. Such 2-way operation of service roads is not only inefficient, but dangerous and is major cause of junction blockage, accidents, sometime serious and fatal. Major advantage of this concept is to effectively minimize the severity and minimize the number of conflicting movements at the junctions. The chaos caused by conflicting movements by not having clearly defined efficient traffic flow system is shown in the following Figures 8.5.1 to 8.5.4.

Currently, LUTMP road network traffic circulation is very inefficient from the reasons outlined above; specifically where it could be implemented without much investment – an example is to enforce 1-way use of service roads, or at least at the junctions. This simple measure would improve junction efficiency and link capacity, not only of the service roads but also of the main carriageways, due to reduction of conflicts at the carriageway junctions.

Figure 8.5.1 Poor Traffic Circulation at Qurtaba Chowk – Note Conflicting Movements



Source: JICA Study Team

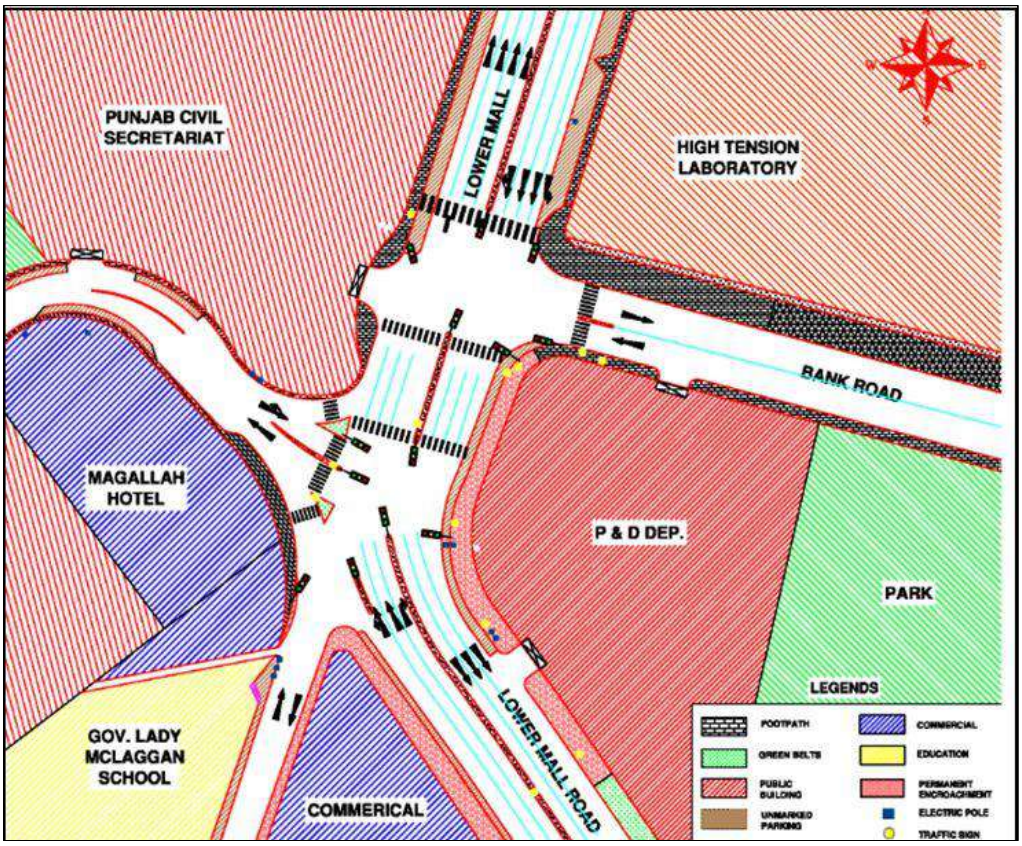
Figure 8.5.2 Dual Carriageway Ferozepur Road – Note Traffic in Contra-flow Direction

Source: JICA Study Team

Figure 8.5.3 Poor Gyratory System Design without Traffic Channelization

Source: JICA Study Team

Figure 8.5.4 Secretariat Junction – 2-way Junctions are Too Close



Source: JICA Study Team

2) Project Components

For this project network simulation model would be required, which could initially be setup using a ‘window approach’ to the LUTMP strategic model, for local area data extraction. Traffic circulation system need to be designed on an area-wide network basis and not for streets / roads in isolation to get the best performance from the road network. The project would include the following major components, but not limited to:

- New simulation model would need to be developed, whereas the LUTMP strategic model would provide the area-wide traffic cordon flows.
- The simulation model need to be based on state-of-the-art software, and would require calibration for the area of application.
- Topographic survey, and other related transport and traffic surveys of the local area road network as input data to the simulation model;
- Pilot traffic circulation system design could be broadly evaluated using a smaller/ local area version of the LUTMP transport model.
- All new schemes of road and traffic management should be assessed and evaluated, initially in the LUTMP model then through the simulation model prior to implementation.
- Junctions should then be designed as modelled, including traffic signals, and control devices as per plan and design of the scheme.
- Capacity building of traffic police is needed to effectively enforce such traffic circulation system, and not interfere with the system, unless in case of an emergency.

3) Area Description

This project should be initially planned, designed and implemented as pilot project at location/ for an area where enforcement is not a major challenge. It should then be implemented in stages, to cover the CBD area, and other stand-alone independent areas like Gulberg Market areas and the adjacent network.

4) Implementation Strategy and Schedule

TPU/ TEPA do not have technical capacity to fully comprehend and modify the LUTMP model, and develop traffic simulation model for this project. Therefore, it is suggested that international consultant should be commissioned with experience in such detailed traffic modelling, both at strategic and simulation levels. TPU/ TEPA should prepare the project ToR with the above components as a ‘must be’, and with proposals for a pilot area. The project should be used as capacity building exercise for both TPU/ TEPA staff.

This project is designed to efficiently manage existing road network operation, and would enhance the network capacity without major investment in road building and grade separation. Table 8.5.1 provides a tentative implementation schedule for the whole project within the LUTMP Core Program-2. Project should be executed by TPU, in conjunction with TEPA and should take account of other on-going short term projects. Estimated project cost is USD 20million, less than a single grade separation cost, but would yield far more benefits

Table 8.5.1 [TM16] Traffic Circulation Project Tentative Implementation Schedule

Project Activity	2013	2014	2015	2016	2017
Project Preparation and Consultant Appointment					
Development of Simulation Model					
Pilot Project Implementation					
Old Lahore Area Traffic					
South of Canal Areas Circulation System Design					
The Study Area wide Application of Concept					
Traffic Control Devices Installation and Implementation					
Traffic Police Capacity Development					

Source: JICA Study Team

8.5.2 [TM17] Public and Freight Transport Terminals

1) Introduction

District Regional Transport Authority (DRTA) is responsible for planning, issuing permits, and overall operation of inter-city bus terminals in Lahore. DRTA has approved eleven 'D' class bus stands which are operational. In addition there are main bus terminals like Badami Bagh, Daewoo, Multan Road (near M-2), and Niazi Bus Terminals. Locations of these terminals are shown in Figure 8.5.5.

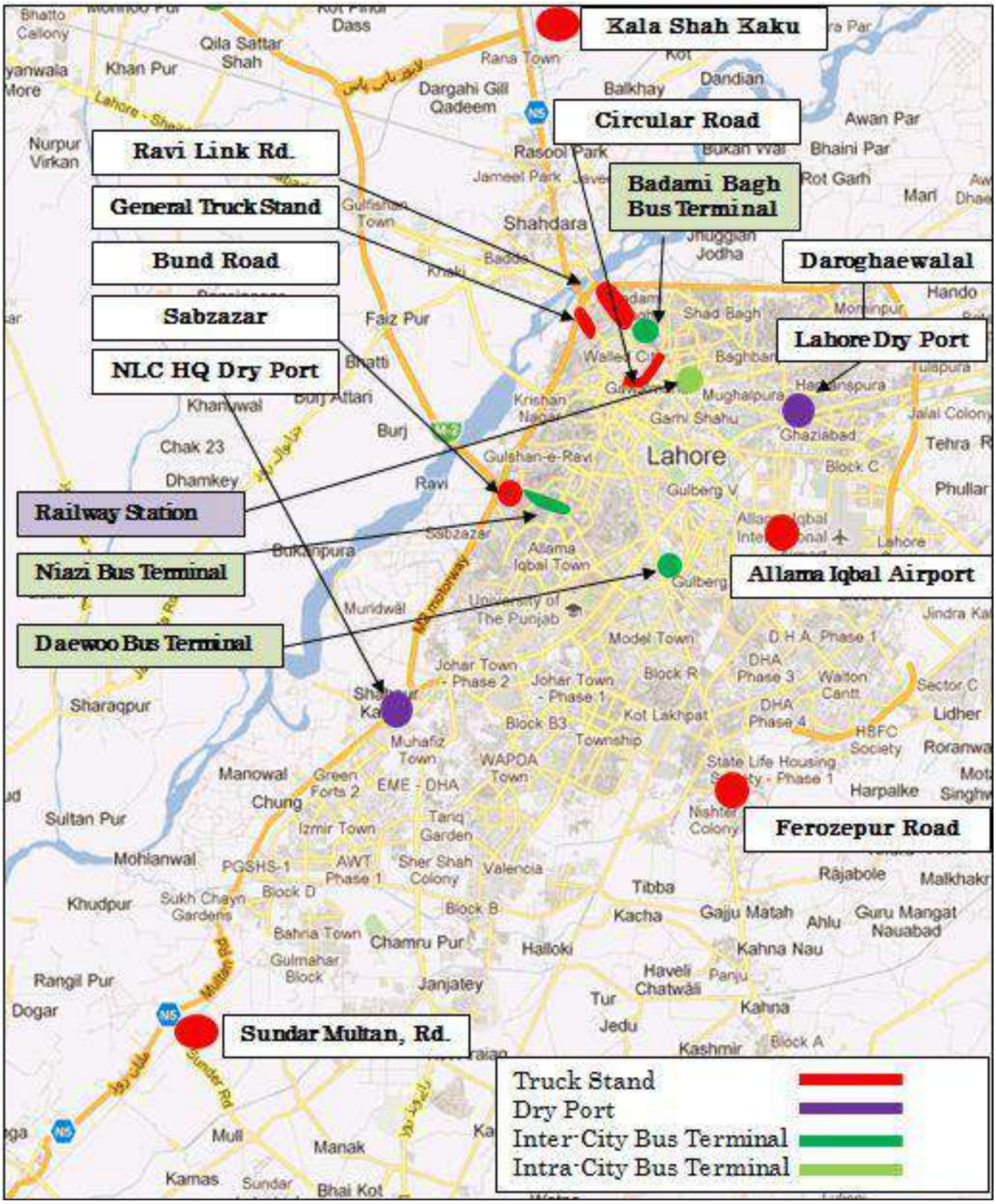
<u>Bus Terminals</u>

Badami Bagh bus terminal is the largest and oldest of all. It was planned to be an inert-city bus terminal and was built to shift the inter-city bus operation from the Lahore Railway Station area in late 1960's. It was a well-planned, designed terminal, with integrated intra-city travel facilities at that time. However, now it's nothing more than a slum area and a collection of bus stands without any order or planning of amenities for passengers. Its location is ideal for passengers, as it is located in the city centre, but it is a serious environmental hazard for the heritage sites. The bus terminal has been unlawfully expanded to areas adjacent to the Lahore Fort, which is a serious environmental issue. Location of the heritage sites and the bus terminal traffic circulation is shown in Figure 8.5.6. The CDGL bus terminal on Bund Road East is better planned, and functions well compared to the other bus stands in that area, which are mostly located and operated at the convenience of the bus operators.

Truck Terminals

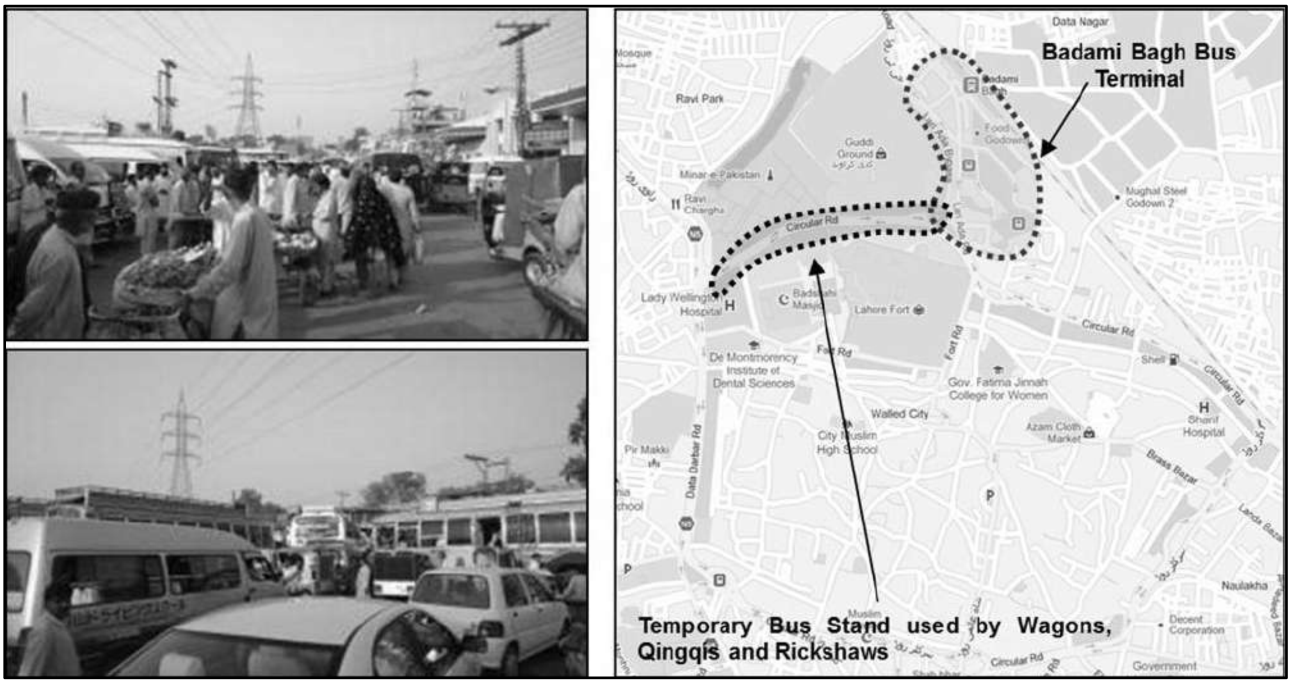
Existing truck terminals condition is worse than the bus terminals. Most of these are located in the dense urban areas and use road-side for loading and unloading. There is usually no off-road designated parking space or other facilities, for overnight parking and maintenance for the owner-operators. It should be noted that most of the trucking fleet is a single truck owner-operators. Therefore road space is often used for parking and maintenance. Condition and plight of some of the trucking areas so called the ‘truck stands’ is evident from the pictures in Figure 8.5.7.

Figure 8.5.5 Location of Public Transport and Truck Facilities in Lahore



Source: JICA Study Team

Figure 8.5.6 Bus Terminal Operation around Heritage Sites



Source: JICA Study Team

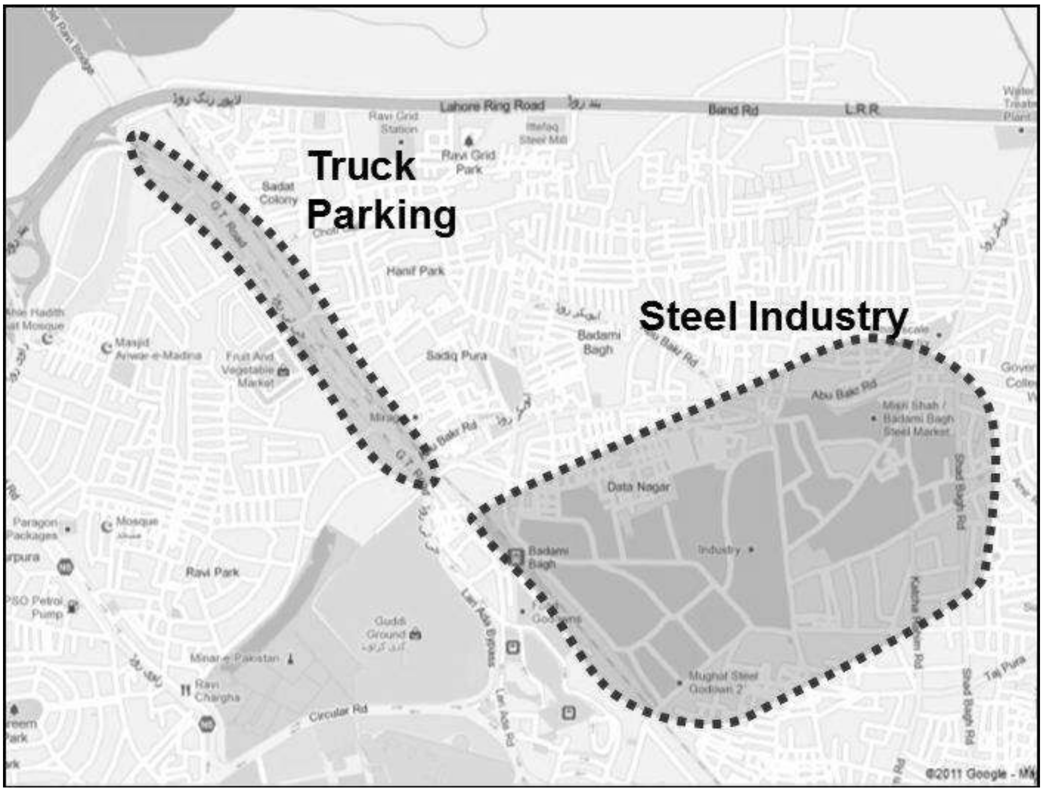
Figure 8.5.7 Condition of Existing Truck Stand/ Terminal at Sabzazar

Source: JICA Study Team

The area shown in Figure 8.5.8 is the Cottage Steel Industry, which is located in the centre of the CBD area, a totally inappropriate location for such commercial activity. This attracts trucking activity, but has no space and associated road network to function efficiently. As a result the ‘steel market’ activity is a traffic nuisance and the industrial/ commercial activity is a serious environmental and safety hazard for the local community.

The relocation of the whole of the ‘steel market’ industrial/ commercial activity is essential for the trucking activity to be limited in the area. This would be a major challenge to relocate the steel industry/ market to and industrial estate, and regenerate this inner CBD area of Lahore, just like the Dockland in London. It is a project, with many facets, and could not be done over-night, by ad-hoc decisions. It needs careful land use planning, and a phased implementation, and may take the rest of this decade to be fully implemented. This LUTMP proposal is being put forward with a ‘vision’ of Lahore as city of gardens.

Figure 8.5.8 Steel Industry/ Commercial Activity in CBD Area



Source: JICA Study Team

2) Project Components – Public Transport Terminals

For such a complex project, it is nearly impossible to list out all the project components, it requires a comprehensive understanding of the subject, which should be done in house by TPU/ LDA/ TEPA to ascertain how to handle this mega-project, and then proceed with caution. Following points give a brief list of components which are must, and cannot be ignored.

- A detailed feasibility study should be conducted to fully understand and realise the existing intercity and intra-city terminal operation, estimate future travel demand requirement for the additional terminals in medium to long term.
- The choice of terminal location should take account of the terminals proposed as part of the RMTS development program, and the planned/ designed bus terminals located

at the end of these BRT/ RMTS lines, and integrated with their respective depot sites.

- Based on the feasibility study recommendation; detail design study should be conducted for the proposed terminals;
- Construction and operation of bus terminals in the specified locations with all requirements necessary for a modern multi-modal transport interchange.
- For operation PPP options should be explored to reduce the financial burden on the public.
- Traffic management studies should be conducted as part of the feasibility study, to facilitate all traffic movement necessary for such terminal operation taking account of the trunk and secondary road network.

3) Project Components – Freight Terminals

It is recommended that the project should include the Following key/ vital components on board.

- Comprehensive freight planning study should be conducted for Lahore; which should accommodate current demand and supply, and future needs of the city.
- The study outcome/ recommendation should be the feasible locations of the truck terminals, conceptual designs, freight distributary network, local delivery system, and long term plan based on the industrial growth;
- Account should also be taken of Rail-freight terminals/ ‘dry-ports’ proposed or operated by Pakistan railways. This component is essential, as it is far more economical to transport bulk/ container freight over long distances by rail than road; e.g. goods movement between Lahore and Karachi.
- Design study should follow the feasibility study recommendations and design truck terminal facilities;
- Construction and operation of truck terminal facilities;
- For operation PPP options should be explored to reduce the financial burden on the public.
- Traffic management study should be conducted as part of the location feasibility study to take account of trunk and primary road network. Due attention should be given to day time truck ban in the inner city area. Therefore access to the secondary road network may need to be developed for the distribution of goods by smaller vehicles during the day.

4) Project Components – Steel Industry/ Market Relocation

Following are the main recommendations for the relocation project, but would need stakeholder involvement at the outset.

- Detailed assessment of exiting industrial and marketing activity to ascertain, what is really going on.
- Feasibility study to seek alternative location(s), their evaluation and stakeholder's views of these sites.
- Plan and design industrial area, this may be equivalent to the size of Sundar Industrial estate, or even larger.
- The relocation study, should be conducted taking account of the location of truck terminals, otherwise both relocation of trucking and steel Industry/ market would be a failure.
- The detailed lay out design of the industrial estate development at the proposed locations with access roads to secondary and trunk road system.
- Account should also be taken of labour/ workers in this regard; their housing and need for other amenities should be incorporated. This is because the current industry is a family business and has been going on for generations.
- An urban regeneration study of the existing area, its effective use should be conducted involving the current stake holders/ owners, so that they also benefit from the gains of relocation.

5) Implementation Strategy and Schedule

It is suggested that an international consultant in urban planning, transport planning and industrial development design should be commissioned for a strategic study for the whole project. They should then set up the three further studies for bus terminals/ freight centres, and relocation of steel industry/ market coupled with regeneration study of existing area. Only after the completion of these studies, individual projects should go out to tender.

The project has to be handled involving many provincial and local departments and agencies. It is proposed that the project initially should be started by LDA under P&D Department, and with close liaison with Transport department, TEPA, CDGL and LTC. Transport Department deals with inter-city public transport terminals, LDA/ CDGL with freight and local industries, LTC with intra-city operations and facilities, and TEPA for traffic engineering components. In addition, as the scope of the project is extensive, it would be appropriate to have an overall general consultant commission at the outset, and would be responsible for the project until its implementation and operation.

A tentative project implementation schedule is outlined in Table 8.5.2, with key project components and activities, essential for its success. Project cost is estimated at USD100 million.

Table 8.5.2 Bus and Freight Terminals Project – Tentative Implementation Schedule

Project Components/ Activities	Year, 2000+							
	13	14	15	16	17	18	19	20
Prepare Master Plan of all Projects and Commission General Consultant to Oversee the Complete Project								
Public Transport Terminals								
Feasibility study for public transport terminal relocation								
Design study for public transport facilities detailed design								
Construction of proposed terminals								
Operation of proposed terminals								
Traffic management planning and design study of terminals								
Freight Terminals								
Comprehensive freight planning study								
Detail design study for the freight terminals								
Construction of freight terminal facilities								
Operation of freight terminal facilities								
Traffic management planning and design study of terminals								
Steel Industry/ Market Relocation								
Feasibility and Design study for shifting the steel market								
Development of Industrial area								

Source: JICA Study Team

8.5.3 [TM19] Feasibility Study for Traffic Demand Management Measures

1) Introduction

Traffic/ transport/ travel demand management (TDM) is a general term for various strategies that increase transport system efficiency. TDM treats mobility as a means to an end, rather than an end in itself. It emphasizes the movement of people and goods, rather than motor vehicles, and so gives priority to more efficient modes (such as walking, cycling, car-pooling, and public transit), particularly under congested traffic conditions. It prioritizes travel based on the value and costs of each trip, giving high value trips and lower cost modes priority over, lower value high cost travel, in doing so increase overall system efficiency.

The TDM is 'carrot and stick approach', and would fail if adequate alternative transport is not available. For example, restricting cars into the city centre during peak periods could only be implemented if alternative public transport is reliable, efficient and comfortable, coupled with direct access to amenities through integrated station design. Therefore, following projects are assumed to be completed and operational prior to study/ implementation of TDM project;

- Rail mass rapid transit system (Green line) and some of the bus rapid transit lines should be operational;
- Connecting communities (smart roads) and traffic circulation system design, and

public and freight transport terminals traffic management projects would have been completed;

Presently, there is no concept of TDM in Lahore; however its need would be evident as the congestion increases over time, and ad-hoc solutions of spot problem fixing are no longer have impact. This will put extra strain over the scarce road space and poorly managed network of Lahore through mode growth (car ownership growth is estimated to be 45 % by 2030). This vehicle growth cannot be stopped due to increase in income levels and local culture. But the rate of growth could be reduced by sustainable management of the people and goods movement in the city's network. This would require some tough decisions in limiting vehicle ownership, and parking restraint policies, totally contrary to the current trends of trying to meet traffic demand at all cost. This will also require tough political decisions, contrary to current belief that we can build our way out of congestion – no nation has done it, how we could do - That is where and when TDM will come in, so we should prepare for it now.

Individual TDM strategies can only affect a small portion of total travel, and their benefits would appear modest with respect to any particular problem, however, overall impacts are cumulative and have synergy. When all benefits and costs are considered, TDM programs are the most cost effective way to improve travel condition for all and for the overall benefit of the community. Key steps involved in the development and implementation of TDM measures could be summarized as follows, and some of the commonly applied traffic demand management measures practiced in the developed and developing countries are listed in Table 8.5.3.

Policy and Planning Reforms

More funding for alternative modes, increased support for TDM programs, changes in land use planning practices etc.

Changes in Travel Options and Incentives

Improved walking and cyclcing facilities, improved bus and and public transit services, more compact and mixed land use development, increased parking fees, road user charges for peak periods, reduced transit fares.

Travel Pattern Changes

Shifts in travel time, destination, mode, route choice, and frequency.

Outcomes of TDM Measures

Reduced traffic congestion, accrued revenue from and parking charges and road user charges, accident reductions, energey conservation, pollution emission reductions, improved mobility for non-vehicle owners, and most of better environment.

Table 8.5.3 Traffic Demand Management Strategies

Improves Transport Options	Incentives	Land Use Management	Policies and Programs
Bike/ Transit integration	Parking pricing	Location-efficient development	Campus transport management
Car sharing	Commuter financial incentives	Car free planning	Commuter trip reduction
Flex-time	Distance-based fares	New urbanism	Freight transport management
Guaranteed ride home	Fuel tax increases	Parking management	Least-Cost planning
HOV Priority	Non-motorized encouragement	Smart growth	Market reforms
Non-motorized improvements	Pay-as-you-drive vehicle insurance	Traffic calming	Performance Evaluation
Rideshare programs	Road pricing	Transit oriented development	TDM marketing
Taxi improvements	Better land values near transit nodes	Compact development	TDM Programs
Telework			Tourist transport management
Transit improvements			

Source: JICA Study Team

2) Project Components

The proposed feasibility study is to be conducted in the medium term timeframe. Its key objectives are to prepare comprehensive TDM program for Lahore for next 20 years. The project objectives are to review and develop various TDM options/ strategies in order to improve the available transport options for travelers in Lahore under local conditions. Some provide incentives to change trip time, route choice, mode selection, or even alternative destination, while others reduce the need to travel at all through more efficient land use practices. Most individual TDM strategies affect small portion of total travel; so this study should develop a comprehensive TDM program of a number of measure to be implemented collectively; which would have significant effects on travel behavior, and the measureable social and environmental benefits. The TDM program should cover the following;

- *Congestion Reduction*
    - ✓ Reduces traffic congestion delays and associated travel costs
- *Road User Charges and Parking Fees*
    - ✓ Increased revenue to support public transport costs
- *Consumer Savings (Vehicle Cost)*
    - ✓ Consumers capital cost saving for not owning a car/ motorcycle
- *Transport Choice*
    - ✓ Improved travel options, particularly for non-vehicle available group

- *Road Safety*
  - ✓ Reduced accidents, and less social cost due to fewer fatalities
- *Environmental Protection*
  - ✓ Reduced air, and noise pollution, and better environmental
- *Efficient Land Use*
  - ✓ Supports land use strategies, compact development requiring less green filed sites and less urban sprawl, short trips.
- *Community Livability*
  - ✓ Improved environment quality for the community as whole.
- *Economic Development*
  - ✓ Supports community's economic objectives, such as increased productivity, employment, and increase property values, more equitable.
- *Physical Fitness and Health*
  - ✓ More physical activities, through increased walking and cycling

3) Implementation Strategy and Schedule

This is assumed that TPU would have achieved technical capacity in transport planning, and traffic management planning by the year 2015 to be able to implement such a project. However, it is recommended that international consultant should be commissioned to work with TPU staff for preparing this feasibility study due to its complex and advance scope of multi-disciplinary traffic demand management tasks.

This project could be used as capacity building exercise, and selected transport planners and traffic engineers should work as counterpart staff to the international consultant for OJP. After, the study local staff should have enough training to improve, modify and implement the TDM strategies in as the implementation starts in earnest. The tentative project implementation schedule is outlined in Table 8.5.4.

Table 8.5.4 [TM19] TDM Project Tentative Implementation Schedule

Project Activity/ Components	2016	2017
Project Preparation and Commissioning of International Consultant		
Feasibility Study for TDM measures		

Source: JICA Study Team

8.6 Core Program-2 – Road Sub-sector Projects

8.6.1 [R44 and R45] Shadbagh and Samanabad Areas – Secondary Roads Development

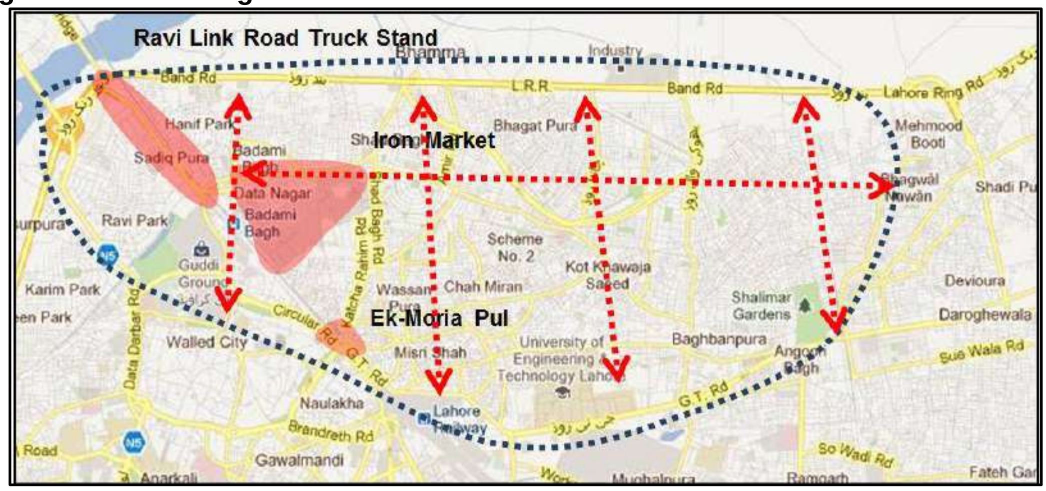
1) Introduction

As discussed, road network hierarchy is essential for the overall road network performance. This has been the essence of LUTMP 2030 Road Sub-sector development. The road network hierarchy, particularly development of secondary and local road network is non-existent in these two dense urban areas of Lahore. The result is total traffic chaos, road blocks, bottlenecks due to encroachments or narrowing of roads, junction grid-lock due to lack of proper priority junctions, or signalized junction control. These areas have been given priority for the improvement of the road network, overall better traffic conditions and social and environmental benefits, rather than just as simple high EIRR of the projects.

2) Shadbagh and Samanabad Areas

Shadbagh and Samanabad areas are part of old Lahore area, and its community and the urban fabric is a compact mix of land use and activities. Shadbagh area can be regarded as land locked between Lahore Ring Road, G.T. Road, Ravi Link Road and the Pakistan Railways in the east. The access to the area is limited, and has no links with the Trunk or Primary road network. Traffic access to this area is mostly *'Ek-Moria pull'* a four-lane underpass to cross the railway track, with no channelization or area based traffic circulation system in place. The numbers of railway crossings are limited, and have not been increased in line with increase in population and commercial activity in the area since 1947. Figure 8.6.1 illustrates the area, and the constraints to internal traffic circulation and access issues.

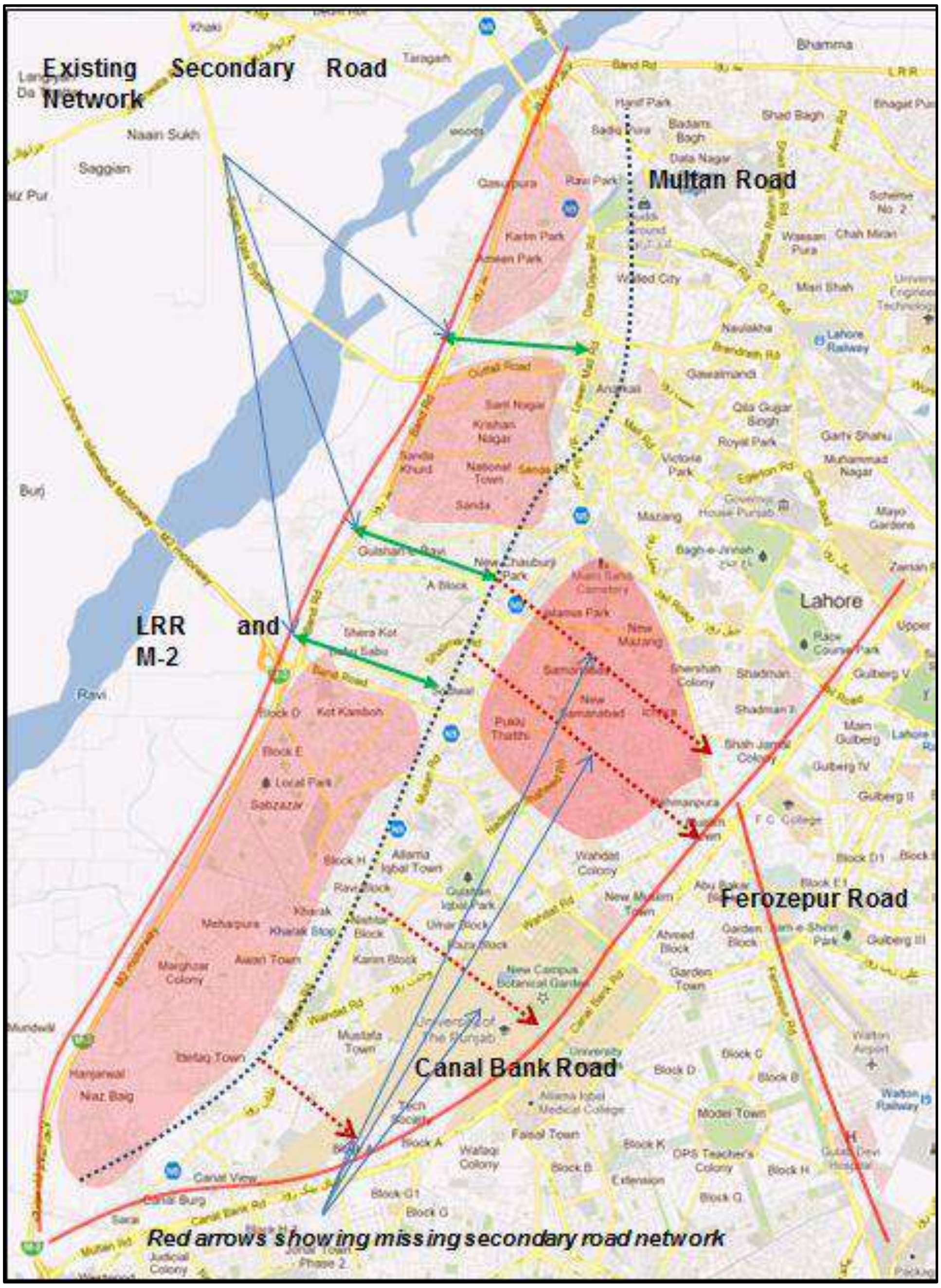
Figure 8.6.1 Shadbagh Area Lack of Access and Issue of Internal Traffic Circulation



Source: JICA Study Team

Samanabad area has three main secondary roads Gulshan-e-Ravi, Bund Road East, and Outfall Road which extends to Multan Road. There is lack of access from these major trunk and primary roads, and the inter-connectivity of secondary roads is also limited. This results in traffic convergence on to Multan Road and Ferozepur Road junctions to access the area, which also has limited internal secondary road network for local distribution of traffic from the external primary network. Figure 8.6.2 below illustrates these network deficiencies in the Samanabad area.

Figure 8.6.2 Samanabad Area Lack of Internal Secondary Roads and External Linkages



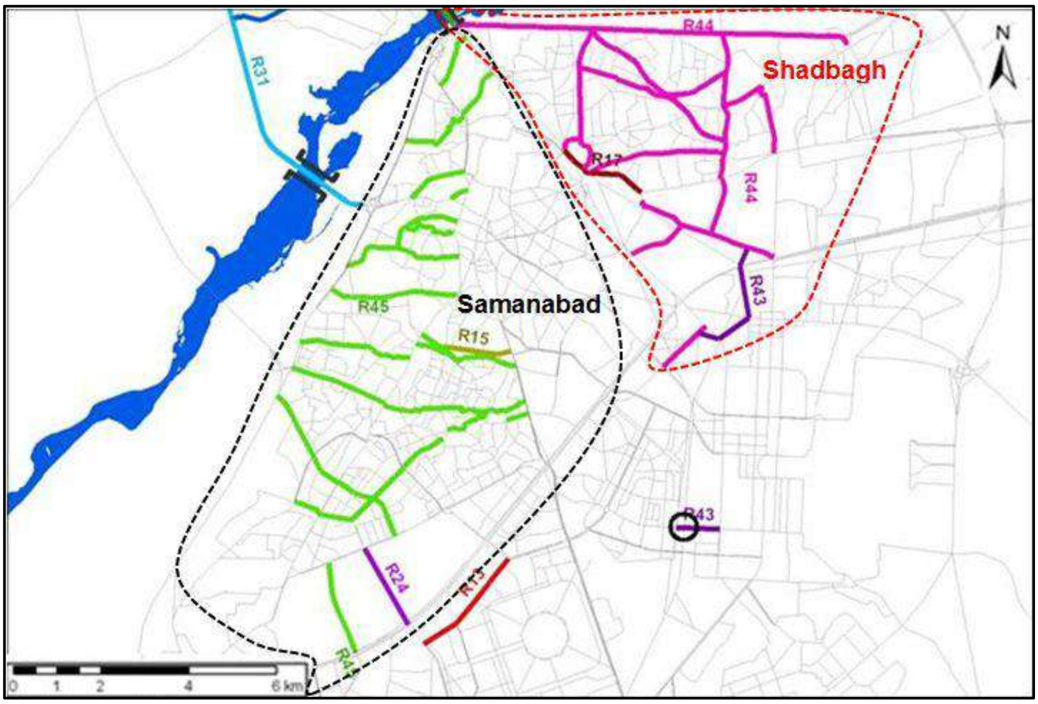
Source: JICA Study Team

3) Project Components

This project includes improvements (remodeling/ re-construction, and construction of small sections of new roads to improve connectivity/ linkages) of internal roads to a uniform secondary and local road standards, as described in Chapter 7, Section 7.1.2 of this report. The identification of these roads was the outcome of LUTMP model assignment process, which detailed the roads/ sections with capacity deficiencies. The road sections identified through LUTMP modelling are defined below under two project headings; namely Roads 'R44' for Shadbagh area, and 'R45' for Samanabad area. As a result, and through local area surveys it was decided to propose linkages between the primary roads, by the development of secondary road network to increase the overall road network performance. Shadbagh and Samanabad area are especially focused to handle extra traffic demand in future from external zones to inner area of Lahore.

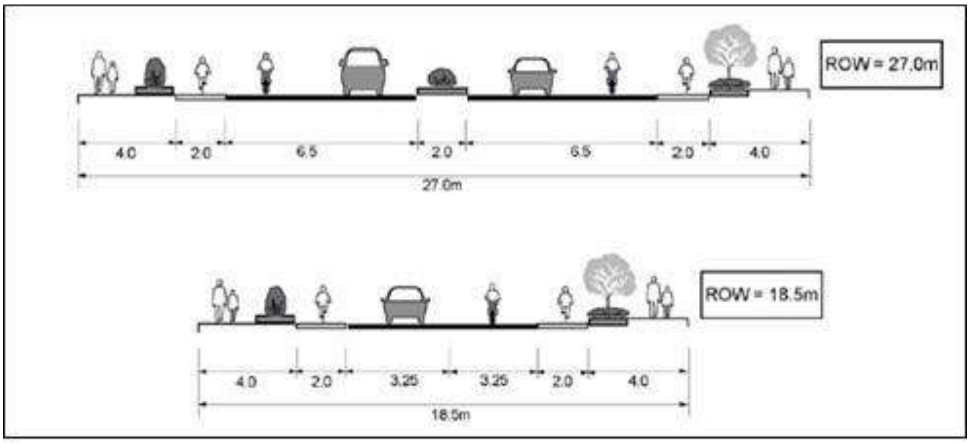
Proposed secondary road network development is shown in Figure 8.6.3. The secondary road network to be developed should either adopt the standards specified, in section 7.1.2 or due to local area land constraints may adopt the cross section outlined in Figure 8.6.4 and further illustrated in Figure 8.6.5. Bus bays should be designed and implemented by giving proper access to pedestrians as shown in Figure 8.6.6. Whereas, street concept designs for dense urban areas are depicted in Figures 8.6.7 and 8.6.8. These figures show that how well designed urban streets can be environment friendly and can co-exist with traffic, pedestrians, cyclists, and even at-grade public transit system.

Figure 8.6.3 Proposed Secondary Roads (R44 and R45) Development



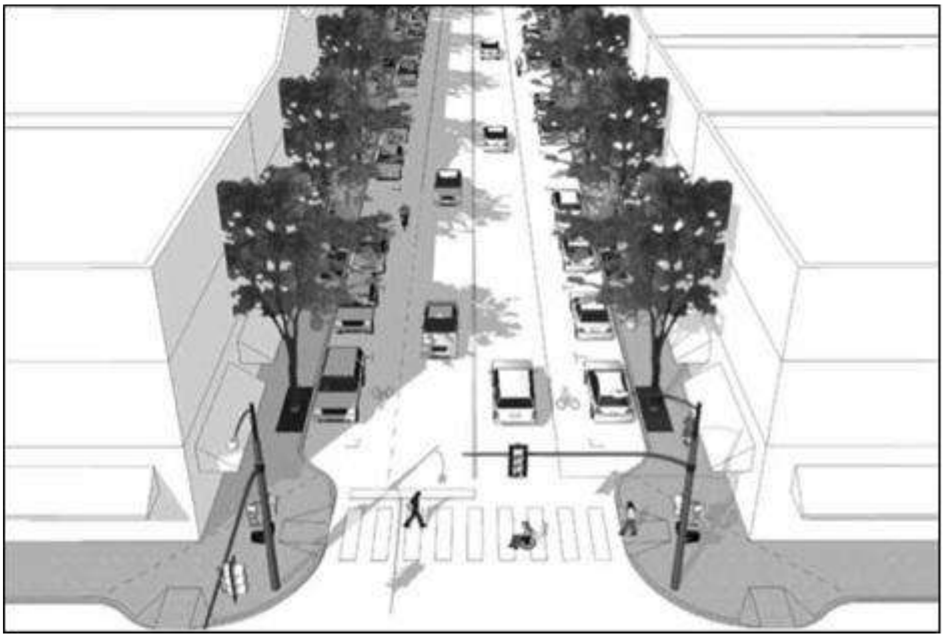
Source: JICA Study Team

Figure 8.6.4 Proposed Urban Secondary Road Cross Section



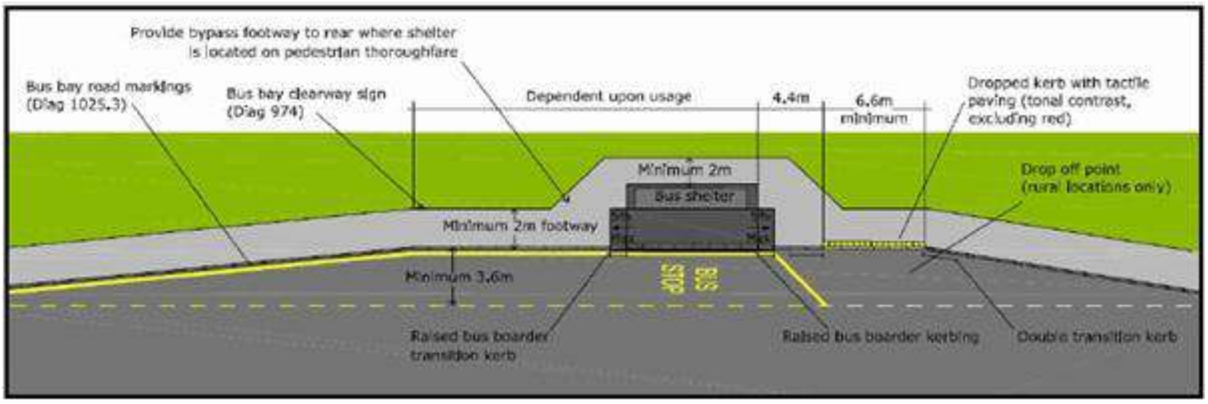
Source: JICA Study Team

Figure 8.6.5 Urban Secondary Concept Design



Source: JICA Study Team

Figure 8.6.6 Bus Bay Concept Design for Secondary Roads



Source: JICA Study Team

Figure 8.6.7 Urban Street Concept Design for Dense Populated Area

Source: JICA Study Team

Figure 8.6.8 Urban Street Concept Design, Pedestrians, Cars, Buses and at-Grade LRT Coexist, in Pleasant Urban Environment

Source: JICA Study Team

4) Project Implementation Strategy and Schedule

TEPA should review each link improvement proposed in the project for its potential improvement or new construction following the above cross sectional design guidelines. Each secondary road link should be classified in to secondary, urban secondary or local road. Urban secondary should be designed by giving more priority to pedestrians, cyclists and community activities; whereas secondary roads would be prioritized for traffic. Local street network should be similar to urban secondary roads, with additional provision for access to adjacent facilities.

TEPA should do detailed study of all these proposed roads, and prepare their feasibility study or studies for the approval of project from GoPb. TPU should be the project monitoring authority, and would be responsible for further prioritisation of road sections included in the two projects within the scope of the LUTMP 2030 overall project prioritization. The project is expected to take up rest of the decade, and should be implemented in stages. Cost estimates for both projects are given in Chapter 7, Section 7.5, along with project evaluation results at macro level. A tentative schedule is given below in Table 8.6.1

Table 8.6.1 [R44 and R45] Tentative Implementation Schedule

Project Activity	Year 2000+								
	12	13	14	15	16	17	18	19	20
Project preparation	■								
Road Re-modelling and Construction		■	■	■	■	■	■	■	■

Source: JICA Study Team

8.6.2 [R57] Development of Secondary Roads in South-west Lahore

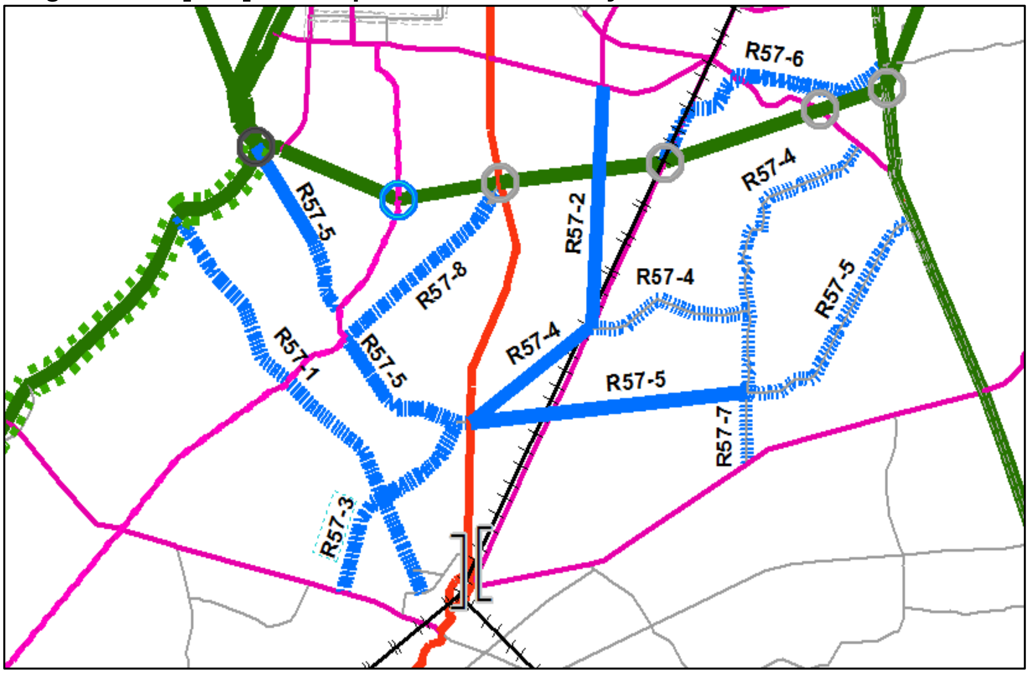
1) Introduction

LUTMP 2030, proposed and committed road sub-sector projects have been discussed in Chapter 7, Section 7.1.2, and details are presented in Annex-1. The committed projects included all on-going, planned, committed and proposed projects by the relevant government departments and agencies, mostly by the C&W and LDA/ TEPA. The Study also reviewed and included projects from other studies. In the past development of Lahore transport infrastructure was guided by the 1991 Lahore master plan, prepared by JICA. This was followed by the LDA Lahore 2021 master plan. Both of these master plans had proposed extensive urban development in the south-west quadrant of Lahore. This urban development was supported by road network.

The LDA 2021 master plan proposed road network is without hierarchy, and is not supported by the corresponding travel demand analysis. It also does not take account of the recent major transport infrastructure developments in the area, like LRR, RMTS along Ferozepur Road. LUTMP 2030, after taking these factors into account has proposed major road network developments in the south-west. Most of the proposed projects involve upgrading of exiting local roads to primary or secondary standards, to support the trunk road network of LRR, Ferozepur Road, Raiwind Road, Multan Road, and M-2 Motorway.

However, LDA/ TEPA required inclusion of some new secondary roads and upgrade of existing road to secondary standards, based on the commitments from private sector to develop the area in the near future. LUTMP 2030 is not rigid, and it is only a framework for the development of transport infrastructure. Building of new secondary roads/ or remodeling exiting roads to higher standards would be appropriate under the LUTMP 2030, provided the primary and truck road network could support such upgrades. The LDA/ TEPA proposed upgrades/ re-modelling and new roads were reviewed, majority of the proposed roads were already in the LUTMP 2030, but needed upgrades. Inclusion of proposed new links was also reviewed; and those links which fully supported the network structure, hierarchy and enhanced connectivity have been included in LUTMP 2030. The proposed upgrades and new roads under this project 'R57' are shown in the following Figure 8.6.9.

Figure 8.6.9 [R57] Development of Secondary Roads in South-west Lahore



Source: JICA Study Team

2) Project Components

Road sub-sector project R57 total length is 93.6 km, and each of the eight (8) section length is given below in Table 8.6.2. No project costing or evaluation has been carried out, as the Project R57 is considered as committed, and would be supported by the private sector developments in the area.

Table 8.6.2 [R57] Road Section Details

R57 – Section	Section Length (km)		
	New Construction	Remodelling	Total
1	13.9	-	13.9
2	-	7.1	7.1
3	6.5	-	6.5
4	12.7	4.8	17.5
5	16.2	12.2	28.4
6	8.8	-	8.8
7	4.6	-	4.6
8	6.8	-	6.8
Total	**69.5**	**24.1**	**93.6**

Source: JICA Study Team

3) Project Implementation Strategy and Schedule

LDA/ TEPA would review each link its importance and contribution of the private sector towards its implementation, only then it should be implemented. The project timeframe is set as the LDA 2021 master plan, i.e. Completion by 2020.

8.7 Action Plan 2020 – Implementation

8.7.1 Implementation Schedule and Responsible Agency

1) Implementation Schedule

Indicative implementation schedule of the committed and LUTMP proposed projects to be implemented by 2020 is given in Tables 8.7.1 to 8.7.3 for the Public Transport, Road Sub-sector and Traffic Management projects respectively, together with the investments required by year. This schedule was determined based on the result of overall Multi-criteria Assessment (MCA) evaluation of projects.

Public Transport Projects

All committed projects were allocated to short-term (2012-15) and medium-term (2016-2020). Among proposed projects, RMTS Green Line and seven (7) BRT lines are proposed as Core Program-1 of the Action Plan to be implemented by 2020. Particularly for RMTS Green Line and BRT Orange Line (to be converted to RMTS by 2030), the first investment should be done in the short-term (by 2015).

Road Sub-sector Projects

All committed projects are scheduled for implementation in the short and medium term similarly to the public transport projects. Proposed road projects for implementation during the Action Plan period are mostly less expensive, requiring remodelling of existing roads coupled with the proposed traffic management measures to improve the much needed network efficiency.

Traffic Management Projects

Most of the committed and proposed projects are allocated for short and medium term. This is due to the urgency and low-cost features of these projects.

2) Responsible Agency

Tables 8.7.4 to 8.7.6 show the responsibility allocation of project implementation among existing government agencies for public transport, roads and traffic management projects respectively. Note that this allocation assumes the present organizational/ institutional setup. If this changes in the future, the responsibility goes automatically to the redefined agency. However, Transport Department (TD) oversees and monitors implementation of these projects.

Table 8.7.1 Indicative Implementation Timetable for Public Transport Projects

Project No.		Project Description	Project Cost (USD Million)	Period (Year)	2012	2013	2014	2015	2016	2017	2018	2019	2020
Committed Projects													
PT001	C.1	Multimodal Inter-City Bus Terminals in Lahore	-	**2**									
PT002	C.2	Effective and Efficient School Bus System	0.01	**2**									
PT003	C.3	Up-gradation of Bus Stands	-	**2**									
PT004	C.4	Integrated Bus Operation	80.1	**3**									
PT005	C.5	Establishment of Multimodal Bus Terminal at Shahdara	-	**4**									
LUTMP 2020 Proposed Projects													
PT006	RMS1	LRMTS Green Line	2,583.0	**5**									
PT007	RMS2	LRMTS Orange Line (as a BRT)	74.5	**8**									
PT008	RMS3	LRMTS Blue Line (as a BRT)	58.6	**8**									
PT009	BRT1	BRT Purple Line	40.8	**3**									
PT010	BRT2	BRT Line 1	30.7	**3**									
PT011	BRT3	BRT Line 2	30.5	**3**									
PT012	BRT4	BRT Line 3a	28.7	**3**									
PT013	BRT5	BRT Line 3b	35.3	**3**									

Source: JICA Study Team

Table 8.7.2 Indicative Implementation Timetable for Road Sub-sector Projects

Project No.	Project Description	Project Cost (USD Million)	Period (Year)	2012	2013	2014	2015	2016	2017	2018	2019	2020
Committed Projects												
R01	Construction of LRR (Airport – Ferozepur Road)	113.0	**3**									
R02	Construction of Kalma Chowk Flyover	17.5	**3**	Completed 2012								
R03	Construction of Canal Bank Road Flyover	17.1	**3**									
R04	Remodeling of Canal Bank Road	43.8	**3**	Completed 2012								
R05	Remodeling of Barki Road (LRR – Green City)	2.0	**3**									
R06	Remodeling of Kala Khatai Road	10.8	**3**									
R07	Remodeling of Allama Iqbal Road	16.1	**3**									
R08	Remodeling of Multan Road	46.4	**3**	Completed 2012								
R09	Remodeling of Thokar Niaz Baig Road	4.8	**3**									
R10	Remodeling of Lahore Ferozepur Road	17.5	**3**									
LUTMP 2020 Proposed Projects												
R11	Barki Road (Green City – BRB Canal)	17.0	**3**									
R12	Bedian Road (DHA – LRR – Ferozepur Road)	142.0	**5**									
R13	Shabir Usmani Road (Barkat Market – Maulana Shaukat Ali Road)	6.9	**3**									
R14	Link Peco Road – Ferozepur Road	6.7	**3**									
R15	Link Ferozepur Road - Nalay Wali Road (Completion of link between Ferozepur and Multan Road)	5.3	**3**									
R16	Old Ravi Bridge and Road **(Bridge 0.5km)**	5.3	**3**									
R17	G.T. Road (Cooper Store - Ek-Moria Pull)	6.3	**3**									
R18	College Road (Ghaus-e-Azam Road to Defence Road)	14.0	**3**									
R19	Structure Plan Road (Shahrah Nazria-e-Pakistan – Defence Road)	35.0	**3**									

Project No.	Project Description	Project Cost (USD Million)	Period (Year)	2012	2013	2014	2015	2016	2017	2018	2019	2020
R20	EXPO-Kahna Kacha Station Road (Khayban-e-Jinnah – Kahna Kacha Station)	29.9	**3**									
R21	Main Boulevard PIA Society Road (Baig Road – Ittehad Road)	4.0	**3**									
R22	Raiwind Road (Lahore Ring Road Southern Loop – Raiwind City)	52.5	**3**									
R23	Madrat-e-Millat Road - Defence Road	10.9	**3**									
R24	Extension of Maulana Shaukat Ali Road (Canal Bank Road – Noor-ul-Amin Road through Punjab University)	6.0	**3**									
R25	Kamahan Lidher Road (Ferozepur Road – Lahore Bedian Road)	26.4	**3**									
R26	Sua Asil Road (Ferozepur Road – Raiwind Road)	130.7	**5**									
R27	Kahna Station – Raiwind City (Kahna Kacha Approach Road – Raiwind City along Railway Line)	91.7	**3**									
R28	Kahna Kacha Road (Kahna Station – Ferozepur Road)	29.9	**3**									
R29	Sharaqpur Road (Lahore Ring Road – Saggian Walla Bypass) **(Bridge 0.7km)**	202.0	**5**									
R30	Lahore-Sheikhupura Road (Saggian Walla Bypass – G.T. Road)	20.4	**3**									
R31	Sagianwala Bypass Road (Ring Road – Sharaqpur Road) **(Bridge 0.6km)**	43.4	**3**									
R32	Lahore-Sheikhupura Road (West) (Sharaqpur Road – Lahore-Sheikhupura Road)	16.2	**3**									
R33	Link Thokar Niaz Baig Canal Bank Road – Ferozepur Road (Khyaban-e-Jinnah Road – Defence Road – Ferozepur Road)	57.6	**3**									
R34	Manga-Raiwind Road (Multan Road – Raiwind Road)	43.5	**3**									
R35	Southern Bypass South Road (Ferozepur Road – College Road)	57.0	**3**									
R36	Southern Bypass North Road (Canal Bank Road – M-2)	19.7	**3**									
R37	Raiwind-Pattoki Road (Raiwind City – Boundary of the Study Area)	73.3	**3**									
R38	Raiwind Road (Thokar – Lahore Ring Road Southern Loop)	54.2	**3**									
R39	Defence Road (Multan Road – Ferozepur Road)	60.1	**3**									
R40	Thokar Niaz Baig Canal Road Extension (Defence Road – Lahore Ring Road Sothern Loop)	20.8	**3**									
R41	Construction of LRR West (Multan Road – M2)	121.9	**5**									
R42	Construction of LRR South (Ferozepur Road – Multan Road)	201.2	**5**									
R43	Secondary Roads in Dharampura Area	38.9	**3**									
R44	Secondary Roads in Shadbagh Area	102.5	**5**									
R45	Secondary Roads in Samanabad Area	115.0	**3**									
R46	Lahore Bypass (G.T. Road – Kala Shah Kaku Bypass)	41.0	**3**									
R47	M-2 – Lahore-Islamabad Motorway (Lahore-Sheikhupura Road – Boundary of the Study Area) **(Bridge 0.6km)**	89.0	**3**									

Project No.	Project Description	Project Cost (USD Million)	Period (Year)	2012	2013	2014	2015	2016	2017	2018	2019	2020
R48	M-2 – Lahore-Islamabad Motorway (Bund Road – Lahore-Sheikhupura Road)	64.6	**3**									
R49	N-5- Multan Road (Lahore Ring Road Sothern Loop – Boundary of the Study Area)	109.7	**5**									
R50	Sharif Complex Road (Defence Road – Manga Raiwind Road – Bhai Pheru Kot Rada Kishan Road)	116.1	**5**									
R51	North-West Secondary Ring Road (Sharaqpur Road – Lahore-Sheikhupura Road – G.T. Road)	118.3	**5**									
R52	Sheikhupura Muridke Road (G.T. Road – M-2)	284.4	**5**									
R53	Link G.T. Road (Sharaqpur Road – Lahore-Sheikhupura Road – G.T. Road)	22.9	**3**									
R54	Link Kala Shah Kaku – Lahore-Sialkot Motorway	25.1	**3**									
R55	Lahore-Sialkot Motorway **(Bridge 0.8km)**	128.0	**5**									
R56	Link G.T. Road Lahore-Sialkot Motorway	2.2	**3**									
R57 (Optional)	Construction and remodeling of Secondary roads - south of LRR in the south-western quadrant between Ferozepur Road and Multan Road	**N/A**	**10**	**Tentative Program Defined by LDA/ TEPA and Development Based**								

Source: JICA Study Team

Table 8.7.3 Indicative Implementation Timetable for Traffic Management Projects

Project No.	Project Description	Project Cost (USD Million)	Period (Year)	2012	2013	2014	2015	2016	2017	2018	2019	2020
Committed Projects												
TM01	Establishment of Centralized Driver Licensing Authority	**N/A**	**3**									
TM02	Parking Management Company	**N/A**	**3**									
TM03	Traffic Education Center	**N/A**	**2**									
TM04	Traffic Control Plan of City	**N/A**	**3**									
TM05	Vehicle Inspection and Certification System (VICS)	**N/A**	**4**									
TM06	Construction of New Parking Plazas	207.1	**6**									
TM07	Construction of Pedestrian Bridges	1.8	**3**									
TM08	Improvement of 52 Junctions	30.5	**7**									
TM09	Ferozepur Road Pilot Project	28.3	**3**									
TM10	Conversion of Two Stroke Rickshaw into CNG Fitted Four Stroke Rickshaw	12.4	**4**									
TM11	Remodeling of Inner and Outer Circular Road	14.1	**3**									
LUTMP 2020 Proposed Projects												
TM12	A.1 Junction Design and Traffic Signal Improvement – CBD	4.0	**3**									
TM13	A.2 Existing Junctions Design and Network Improvement	30.0	**4**									
TM14	A.3 Road Function and Capacity Improvement Program	2.0	**2**									
TM15	B.1 Low Occupancy Vehicles Planning for Outskirt/ Rural Areas	5.0	**2**									
TM16	B.2 Traffic Circulation System Design and Implementation	20.0	**5**									
TM17	B.3 Public and Freight Transport Terminals	100.0	**8**									

Project No.	Project Description	Project Cost (USD Million)	Period (Year)	2012	2013	2014	2015	2016	2017	2018	2019	2020
TM18	B.4 Linking Communities - Smart Roads	4.0	**4**									
TM19	B.5 Feasibility Study for Traffic Demand Management Measures	2.5	**2**									
TM20	B.6 RMTS and BRT Station Area Traffic Management	1.5	**2**									
TM21	C.1 Planning and Design Study for Non-Motorized Traffic	1.5	**3**									
TM22	C.2 Non-Motorized Traffic Facilities Implementation	6.0	**4**									
TM23	C.3 Pedestrian and Bicycle Path Network	5.0	**3**									
TM24	D.1 Comprehensive Parking System Development	2.5	**3**									
TM25	D.2 Parking Facilities Implementation	60.0	**6**									
TM26	D.3 Park and Ride Facilities Development	75.0	**6**									
TM27	E.1 Traffic Enforcement Strengthening Programme	3.0	**3**									
TM28	F.1 Traffic Calming	6.0	**2**									
TM29	F.2 Traffic Safety Education Improvement	1.0	**2**									
TM30	G.1 Intelligent Transportation System Development	38.0	**5**									
TM31	H.1 Local Standards and Guidelines Development	1.5	**5**									

Source: JICA Study Team

Table 8.7.4 Public Transport Project – Responsible Agency

Project No.	Project Code	Project Description	Cost (USD Million)	Assumed Year in Operation	Proposed by:	Responsible Agency
Public Transport – Committed Projects						
PT01	C.1	Multimodal Inter-City Bus Terminals in Lahore	-	2014	TD	TD
PT02	C.2	Effective and Efficient School Bus System	0.01	2014	TD	TD
PT03	C.3	Up-gradation of Bus Stands	-	2015	TD	TD
PT04	C.4	Integrated Bus Operation	80.1	2015	LTC	LTC
PT05	C.5	Establishment of Multimodal Bus Terminal at Shahdara	-	2017	TD	TD
Public Transport – LUTMP 2020 Proposed Projects						
PT06	RMS1	LRMTS Green Line	2,583.0	2020	TD	TD
PT07	RMS2	LRMTS Orange Line (as a BRT)	74.5	2015	LUTMP	LTC
PT08	RMS3	LRMTS Blue Line (as a BRT)	58.6	2020	LUTMP	LTC
PT09	BRT1	BRT Purple Line	40.8	2020	LUTMP	LTC
PT10	BRT2	BRT Line 1	30.7	2020	LUTMP	LTC
PT11	BRT3	BRT Line 2	30.5	2020	LUTMP	LTC
PT12	BRT4	BRT Line 3a	28.7	2020	LUTMP	LTC
PT13	BRT5	BRT Line 3b	35.3	2020	LUTMP	LTC

Source: JICA Study Team

Table 8.7.5 Road Sub-sector Projects – Responsible Agency

Project No.	Project Description	Cost (USD Million)	Assumed Year in Operation	Proposed by:	Responsible Agency
Road Sub-sector – Committed Projects					
R01	Construction of LRR (Airport – Ferozepur Road)	113.0	2015	C & W	C & W
R02	Construction of Kalma Chowk Flyover	17.5	2015	C & W	C & W
R03	Construction of Canal Bank Road Flyover	17.1	2015	C & W	C & W
R04	Remodeling of Canal Bank Road	43.8	2015	TEPA	TEPA
R05	Remodeling of Barki Road (LRR – Green City)	2.0	2015	C & W	C & W
R06	Remodeling of Kala Khatai Road	10.8	2015	C & W	C & W
R07	Remodeling of Allama Iqbal Road	16.1	2015	C & W	C & W
R08	Remodeling of Multan Road	46.4	2015	C & W	C & W
R09	Remodeling of Thokar Niaz Baig Road	4.8	2015	C & W	C & W
R10	Remodeling of Lahore Ferozepur Road	17.5	2015	C & W	C & W
Road Sub-sector – LUTMP 2020 Proposed Projects					
R11	Barki Road (Green City – BRB Canal)	17.0	2020	LUTMP	C & W
R13	Bedian Road (DHA – LRR – Ferozepur Road)	6.9	2021	TEPA	TEPA
R14	Shabir Usmani Road (Barkat Market – Maulana Shaukat Ali Road)	6.7	2021	LUTMP	TEPA
R15	Link Peco Road – Ferozepur Road	5.3	2021	TEPA	TEPA
R16	Link Ferozepur Road - Nalay Wali Road (Completion of link between Ferozepur and Multan Road)	5.3	2018	TEPA	TEPA
R17	Old Ravi Bridge and Road **(Bridge 0.5km)**	6.3	2019	TEPA	TEPA
R18	G.T. Road (Cooper Store - Ek-Moria Pull)	14.0	2020	TEPA	TEPA
R19	College Road (Ghaus-e-Azam Road to Defence Road)	35.0	2018	TEPA	TEPA
R33	Structure Plan Road (Shahrah Nazria-e-Pakistan – Defence Road)	57.5	2022	LUTMP	TEPA
R35	EXPO-Kahna Kacha Station Road (Khayban-e-Jinnah – Kahna Kacha Station)	57.0	2022	TEPA	TEPA
R36	Main Boulevard PIA Society Road (Baig Road – Ittehad Road)	19.7	2022	TEPA	TEPA
R39	Raiwind Road (Lahore Ring Road Southern Loop – Raiwind City)	60.1	2022	LUTMP	C & W
R43	Madrat-e-Millat Road - Defence Road	38.9	2018	LUTMP	TEPA
R44	Extension of Maulana Shaukat Ali Road (Canal Bank Road – Noor-ul-Amin Road through Punjab University)	102.5	2018	LUTMP	TEPA
R45	Kamahan Lidher Road (Ferozepur Road – Lahore Bedian Road)	115.0	2017	LUTMP	TEPA
R46	Sua Asil Road (Ferozepur Road – Raiwind Road)	41.0	2022	LUTMP	NHA
R47	Kahna Station – Raiwind City (Kahna Kacha Approach Road – Raiwind City along Railway Line)	89.0	2022	LUTMP	NHA
R48	Kahna Kacha Road (Kahna Station – Ferozepur Road)	64.6	2022	LUTMP	NHA
R52	Sharaqpur Road (Lahore Ring Road – Saggian Walla Bypass) **(Bridge 0.7km)**	284.4	2031	LUTMP	C & W

Project No.	Project Description	Cost (USD Million)	Assumed Year in Operation	Proposed by:	Responsible Agency
R53	Lahore-Sheikhupura Road (Saggian Walla Bypass – G.T. Road)	22.9	2027	LUTMP	C & W
R54	Sagianwala Bypass Road (Ring Road – Sharaqpur Road) **(Bridge 0.6km)**	25.0	2022	C & W	C & W
R56	Lahore-Sheikhupura Road (West) (Sharaqpur Road – Lahore-Sheikhupura Road)	2.2	2022	C & W	C & W
R57 (Optional)	Link Thokar Niaz Baig Canal Bank Road – Ferozepur Road (Khyaban-e-Jinnah Road – Defence Road – Ferozepur Road)	N/A	2012 To 2020	LDA/ TEPA	LDA/ TEPA

Source: JICA Study Team

Table 8.7.6 Traffic Management Projects – Responsible Agency

Project No.	Project	Cost (USD Million)	Assumed Year in Operation	Proposed by:	Responsible Agency
Traffic Management – Committed Projects					
TM01	Establishment of Centralized Driver Licensing Authority	-	2016	TD	TD
TM02	Parking Management Company	-	2018	TEPA	TEPA
TM03	Traffic Education Center	-	2014	Traffic Police	Traffic Police
TM04	Traffic Control Plan of City	-	2015	Traffic Police	Traffic Police
TM05	Vehicle Inspection and Certification System (VICS)	-	2021	TD	TD
TM06	Construction of New Parking Plazas	207.1	2020	TEPA	TEPA
TM07	Construction of Pedestrian Bridges	1.8	2016	TEPA	TEPA
TM08	Improvement of 52 Junctions	30.5	2021	TEPA	TEPA
TM09	Ferozepur Road Pilot Project	28.3	2022	TEPA	TEPA
TM10	Conversion of Two Stroke Rickshaw into CNG Fitted Four Stroke Rickshaw	12.4	2019	TD	TD
TM11	Remodeling of Inner and Outer Circular Road	14.1	2015	TEPA	TEPA
Traffic Management – LUTMP 2020 Proposed Projects					
TM12	A.1 Junction Design and Traffic Signal Improvement – CBD	4.0	2015	LUTMP	TEPA
TM13	A.2 Existing Junctions Design and Network Improvement	30.0	2019	LUTMP	TEPA
TM14	A.3 Road Function and Capacity Improvement Program	2.0	2015	LUTMP	TEPA and CDGL
TM15	B.1 Low Occupancy Vehicles Planning for Outskirt/ Rural Areas	5.0	2017	LUTMP	LTC
TM16	B.2 Traffic Circulation System Design and Implementation	20.0	2018	LUTMP	TEPA
TM17	B.3 Public and Freight Transport Terminals	100.0	2021	LUTMP	TEPA and CDGL
TM18	B.4 Linking Communities - Smart Roads	4.0	2019	LUTMP	TEPA
TM19	B.5 Feasibility Study for Traffic Demand Management Measures	2.5	2018	LUTMP	TEPA
TM20	B.6 RMTS and BRT Station Area Traffic Management	1.5	2023	LUTMP	TEPA
TM21	C.1 Planning and Design Study for Non-Motorized Traffic	1.5	2017	LUTMP	TEPA
TM22	C.2 Non-Motorized Traffic Facilities Implementation	6.0	2021	LUTMP	TEPA
TM23	C.3 Pedestrian and Bicycle Path Network	5.0	2017	LUTMP	TEPA
TM24	D.1 Comprehensive Parking System Development	2.5	2015	LUTMP	TEPA

Project No.	Project	Cost (USD Million)	Assumed Year in Operation	Proposed by:	Responsible Agency
TM25	D.2 Parking Facilities Implementation	60.0	2024	LUTMP	TEPA
TM27	D.3 Park and Ride Facilities Development	3.0	2015	LUTMP	Traffic Police
TM28	E.1 Traffic Enforcement Strengthening Programme	6.0	2015	LUTMP	TEPA
TM29	F.1 Traffic Calming	1.0	2018	LUTMP	Traffic Police and 1122
TM31	F.2 Traffic Safety Education Improvement	1.5	2017	LUTMP	TEPA

Source: JICA Study Team

8.7.2 Action Plan Projects – Investment Plan

1) Proposed Investment Program

Table 8.7.7 shows investment summary of LUTMP for the Action Plan period. Public transport projects share about 75% of the total, while road and traffic management share 17 % and 8 %, respectively.

The budget envelope estimated in Chapter 5 of this report is USD 2.3~6.9 billion for the Action Plan period (2011 to 2020). The planned investment falls in this range. However, the percentage of the investment to Lahore's GDP is on the high side at 2.6 % for the action plan period. This is about 3 times of the current level of investment. Private sector finance should be sought for these projects and measures to raise government revenue should be taken. However, level of the proposed investment on transport infrastructure is not considered too high. In Thailand, during the high-growth period, this investment level reached 7-8 % of the GDP.

Table 8.7.7 Planned Investment Summary (USD million)

Period (Year)	Short Term 2012-2015	Medium Term 2016-2020	Total
Public Transport	1,499	3,021	4,520
Road Sub-sector	450	570	1,020
Traffic Management	146	363	509
Total	***2,095***	***3,954***	***6,049***

Source: JICA Study Team

Possible reduction of public investment has been estimated assuming PPP scheme on the proposed RMTS/ BRT projects. This was done assuming a percentage of contribution from the private sector as shown in Table 8.7.8. The reduction was estimated at about USD 751.5 million equivalent to 26% of the total investment. Although investment amount is small compared to RMTS, BRT seems to be hopeful to curtail the cost to the government by attracting private funding or some form of PPP for the proposed public transport projects.

Table 8.7.8 Cost Reduction by Applying PPP Scheme to RMTS/ BRT Projects

Project No.	Project Description	Project Cost (USD million)	EIRR (%)	FIRR (%)	Private Sector (%)	Cost to Gov't (USD million)
PT06	RMTS Green Line	2,583.0	12.1	7.1	20	2,066.4
PT07	Orange Line (as a BRT)	74.5	18.8	21.0	100	0.0
PT08	Blue Line (as a BRT)	58.6	16.7	17.9	80	11.7
PT09	BRT Purple Line	40.8	15.5	16.1	50	20.4
PT10	BRT Line 1	30.7	37.6	24.9	100	0.0
PT11	BRT Line 2	30.5	43.6	26.5	100	0.0
PT12	BRT Line 3a	28.7	20.4	16.3	50	14.4
PT13	BRT Line 3b	35.3			50	17.7
Total		**2,882.1**			**26.1**	**2130.5**

Source: JICA Study Team

2) Cost Recovery from Urban Development Benefit

This should be taken into account to implement RTMS in Lahore. RTMS projects are economically feasible in general, while financial viability is low and its financing becomes a critical issue.

Traditionally, private railway companies have constructed railways on the understanding that capital costs would be recovered through fare revenues. Recently, however, railway development has become increasingly complicated due to the change of passengers' demand, stricter regulation on safety, more sophisticated equipment, social/ environmental requirement and so on. Thus the required cost has soared to the extent that it needs government support. This may be a direct subsidy from the government to railway companies. However, if the government funding capability is limited, other revenue sources should be sought for, under the permission and institutional arrangements of the government. Some of the initiatives that could be expanded further in Lahore, are not limited to, but could include the following:

(a) **Property Assessment Taxes:** In addition to land taxes, many cities also impose property assessment taxes. These taxes constitute a major portion of the revenue of cities. For example in Kuala Lumpur, Malaysia, it constitutes 62 % of the operating revenue of the city. Property assessments are based on the annual rental value of a property. Differential assessment rates are determined based on the type of property, e.g. residential, industrial, commercial, vacant land, utility or government land. Assessments are collected twice a year by the city from all property owners in the city. Key to establishing such a system in Lahore will depend on establishing a comprehensive valuation list of all properties in the city.

(b) **Betterment Charges:** Betterment charges are imposed to compensate for the improved value that is accrued to the property owners as a result of constructing a public facility, such as railway stations, access roads and drainage facility in the area. The landowners who benefit from the facility will be required to pay a betterment charge to the city. However, for this to be effective an equitable formula for determining betterment charges has to be derived that would be acceptable to the affected community. For example, landowners who gain access to a newly constructed urban railway could be assessed proportionately to also pay a part of the compensation cost for the removed houses. Similarly, landowners who lose a portion of their land to railway construction projects should be compensated only after taking into account the improved land value of the remaining portion of their land. The introduction of land development techniques, such as land readjustment, where betterment values are equitably incorporated in the land re-plotting exercise is an effective method of practically applying these charges.

(c) **Development Charges:** Development charges are applied as an urban planning tax that is imposed on the developer at the time of applying for development permission from LDA. Development charges constitute about 6% of the operating revenue in the case of Kuala Lumpur. The development charge includes payment for the improved value of land as a result of rezoning or increased densities given to the landowner as a result of revisions / amendments to the authorized plan. Development charges are also collected by the city as in lieu payments for the non-provision of facilities, such as car parking areas and school sites, as required under the planning standards. The funds are used by the city to provide the necessary facilities in a coordinated manner.

Although application of these initiatives needs careful examination before these are implemented, the revenue potential is huge, presumably at an order of several tens of billion rupees. It is recommended for GoPb to investigate the possibility in relation to LDA's land use rules and regulations.

8.7.3 Institutional Reform

Institutional reform is critical for urban transport sector development of Lahore as mentioned in Chapter 5 of this report. The following actions are needed immediately.

(1) To Set Up a Preparatory Committee for Institutional Reform

A large scale institutional reform plan was suggested in this Master Plan, aiming at integration of transport-related organizations into self-sustainable agencies. It may take a time to reach a consensus for the reform. As an action plan, establishment of a preparatory committee for the reform is strongly recommended. This committee shall be an inter-departmental one, operated under the initiatives of the Transport Department.

(2) To Set Up a Professional Group for Preparation of PPP Projects

There are many projects expected to be implemented by applying a PPP scheme. In GoPb, as well as the central Government, however, no professional agency deals with such projects. The world's experiences show a successful PPP project will be never brought about without the initiative of the public side. In this sense, a PPP study group should be set up under the Transport Department, possibly in TPU. Some expertise for demand forecast is required for the relevant studies.

(3) To Study Legal Arrangement for the Urban Planning Determination

Non-stopping urbanization is in progress with non-stop in the suburban area. Therefore, it is undoubtedly an urgent need to stop new construction in the designated right of way of the future roads in the Master Plan. An effective legal arrangement should be taken and the preparatory works should be immediately started.

Volume-I – Annex-I

LUTMP PROPOSED ROAD SUB-SECTOR PROJECTS

FINAL REPORT

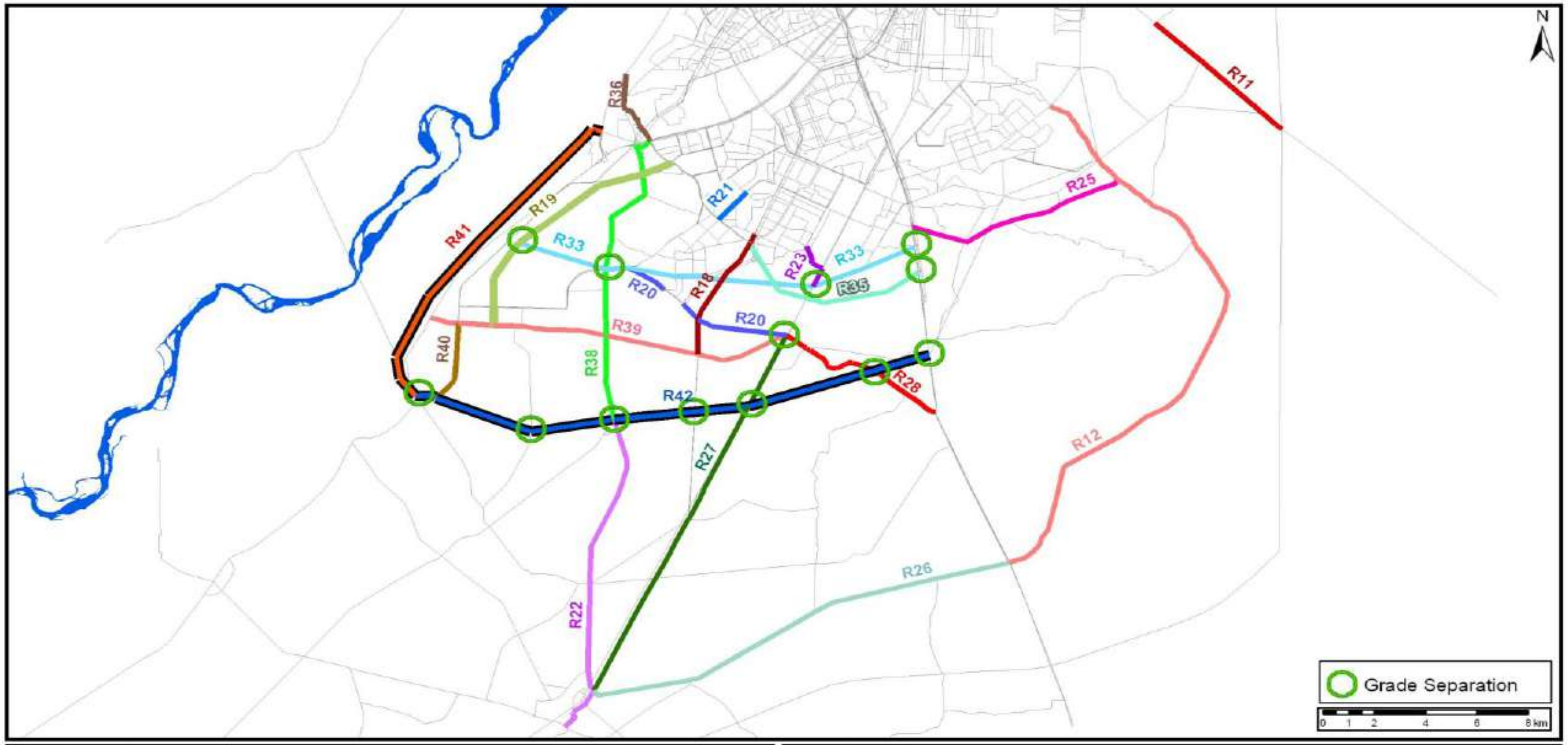
ANNEX 1 - LUTMP Proposed Road Sub-sector Projects

LUTMP Proposed Road Sub-sector projects are described in Section 7.3.2 of Chapter 7 and listed in Table 7.3.2 and 7.3.3. Figures in this appendix show the geographical location of these projects. The following table gives the page number where project alignment is shown.

Project No.	Project Code	Project Description	Page No.
R11	20002	Barki Road (Green City – BRB Canal)	A-4
R12	20003	Bedian Road (DHA – LRR – Ferozepur Road)	A-4
R13	20004	Shabbir Usmani Road (Barkat Market – Maulana Shaukat Ali Road)	A-5
R14	20005	Link Peco Road – Ferozepur Road	A-5
R15	20006	Link Ferozepur Road - Nalay Wali Road (Completion of link between Ferozepur and Multan Road)	A-5
R16	20007	Old Ravi Bridge and Road **(Bridge 0.5km)**	A-5
R17	20008	G.T. Road (Cooper Store - Ek-Moria Pull)	A-5
R18	20010	College Road (Ghaus-e-Azam Road to Defence Road)	A-4
R19	20011	Structure Plan Road (Shahrah Nazria-e-Pakistan – Defence Road)	A-4
R20	20020	EXPO-Kahna Kacha Station Road (Khayban-e-Jinnah – Kahna Kacha Station)	A-4
R21	20021	Main Boulevard PIA Society Road (Baig Road – Ittehad Road)	A-4
R22	20023	Raiwind Road (Lahore Ring Road Southern Loop – Raiwind City)	A-4
R23	20024	Madrat-e-Millat Road - Defence Road	A-4
R24	20027	Extension of Maulana Shaukat Ali Road (Canal Bank Road – Noor-ul-Amin Road through Punjab University)	A-5
R25	20041	Kamahan Lidher Road (Ferozepur Road – Lahore Bedian Road)	A-4
R26	20043	Sua Asil Road (Ferozepur Road – Raiwind Road)	A-4
R27	20044	Kahna Station – Raiwind City (Kahna Kacha Approach Road – Raiwind City along Railway Line)	A-4
R28	20046	Kahna Kacha Road (Kahna Station – Ferozepur Road)	A-4
R29	20049	Sharaqpur Road (Lahore Ring Road – Saggian Wala Bypass) **(Bridge 0.7km)**	A-6
R30	20049	Lahore-Sheikhupura Road (Saggian Wala Bypass – G.T. Road)	A-5
R31	20050	Sagianwala Bypass Road (Ring Road – Sharaqpur Road) **(Bridge 0.6km)**	A-5
R32	20050	Lahore-Sheikhupura Road (West) (Sharaqpur Road – Lahore-Sheikhupura Road)	A-5

Project No.	Project Code	Project Description	Page No.
R33	20052	Link Thokar Niaz Baig Canal Bank Road – Ferozepur Road (Khyaban-e-Jinnah Road – Defence Road – Ferozepur Road)	A-4
R34	20053	Manga-Raiwind Road (Multan Road – Raiwind Road)	A-7
R35	20054	Southern Bypass South Road (Ferozepur Road – College Road)	A-4
R36	20055	Southern Bypass North Road (Canal Bank Road – M-2)	A-4
R37	20056	Raiwind-Pattoki Road (Raiwind City – Boundary of LUTMP Study Area)	A-7
R38	20057	Raiwind Road (Thokar – Lahore Ring Road Southern Loop)	A-4
R39	20060	Defence Road (Multan Road – Ferozepur Road)	A-4
R40	20061	Thokar Niaz Baig Canal Road Extension (Defence Road – Lahore Ring Road Sothern Loop)	A-4
R41	20081	Construction of LRR West (Multan Road – M2)	A-4
R42	20082	Construction of LRR South (Ferozepur Road – Multan Road)	A-4
R43	20091	Secondary Roads in Dharampura Area	A-5
R44	20092	Secondary Roads in Shadbagh Area	A-5
R45	20093	Secondary Roads in Samanabad Area	A-5
R46	30002	Lahore Bypass (G.T. Road – Kala Shah Kaku Bypass)	A-8
R47	30002	M-2 – Lahore-Islamabad Motorway (Lahore-Sheikhupura Road – Boundary of LUTMP Study Area) **(Bridge 0.6km)**	A-8
R48	30002	M-2 – Lahore-Islamabad Motorway (Bund Road – Lahore-Sheikhupura Road)	A-8
R49	30004	N-5- Multan Road (Lahore Ring Road Sothern Loop – Boundary of LUTMP Study Area)	A-7
R50	30005	Sharif Complex Road (Defence Road – Manga Raiwind Road – Bhai Pheru Kot Rada Kishan Road)	A-7
R51	30006	North-West Secondary Ring Road (Sharaqpur Road – Lahore-Sheikhupura Road – G.T. Road)	A-8
R52	30008	Sheikhupura Muridke Road (G.T. Road – M-2)	A-8
R53	30010	Link G.T. Road (Sharaqpur Road – Lahore-Sheikhupura Road – G.T. Road)	A-8
R54	30028	Link Kala Shah Kaku – Lahore-Sialkot Motorway	A-8
R55	30028	Lahore-Sialkot Motorway **(Bridge 0.8km)**	A-8
R56	30028	Link G.T. Road Lahore-Sialkot Motorway	A-8
R57	Optional	Construction and remodelling of Secondary roads - south of LRR in the south-western quadrant between Ferozepur Road and Multan Road	A-9

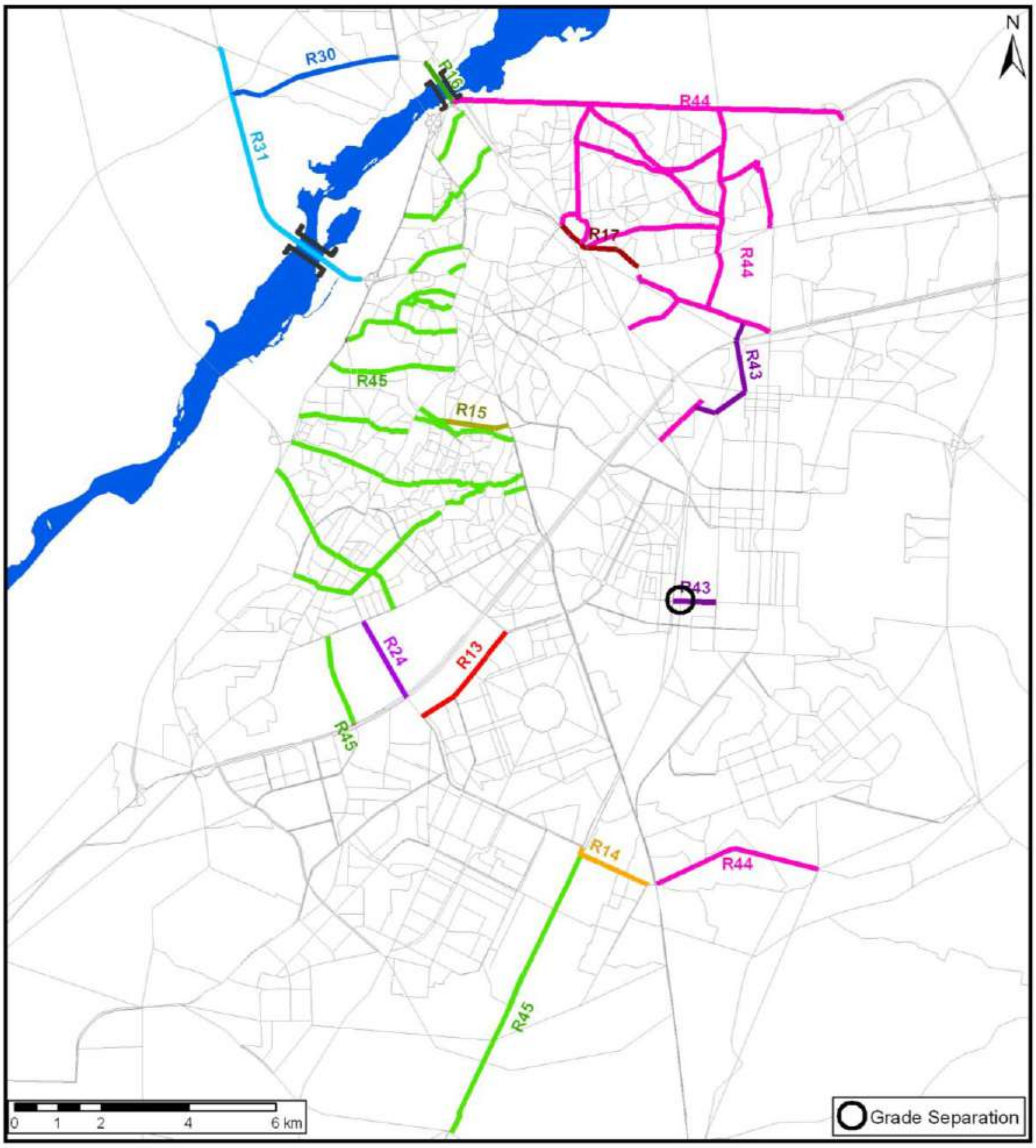
Figure 1 LUTMP Proposed Road Sub-sector Projects



Project No.	Project Code	Project Description	Length (km)	Proposed Lanes
R11	20.002	Barki Road (Green City to BRB Canal)	6.8	D-2
R12	20.003	Bedian Road (DHA – LRR – Ferozepur Road)	28.3	D-2
R18	20.010	College Road (Ghaus-e-Azam Road to Defence Road)	6.9	D-2
R19	20.011	Structure Plan Road (ShahrahNazria-e-Pakistan – Defence Road)	12.9	D-3
R20	20.020	EXPO-Kahna Kacha Station Road (Khayban-e-Jinnah – Kahna Kacha Station)	7.1	D-3
R21	20.021	Main Boulevard PIA Society Road (Baig Road – Ittehad Road)	1.6	D-3
R22	20.023	Raiwind Road (Lahore Ring Road Southern Loop – Raiwind City)	14.2	D-3
R23	20.024	Madrat-e-Millat Road - Defence Road	2.6	D-3
R25	20.041	Kamahan Lidher Road (Ferozepur Road – Lahore Bedian Road)	8.8	D-2
R26	20.043	Sua Asil Road (Ferozepur Road – Raiwind Road)	22.0	D-2
R27	20.044	Kahna Station – Raiwind City (Kahna Kacha Approach Road – Raiwind City along Railway Line)	17.8	D-2

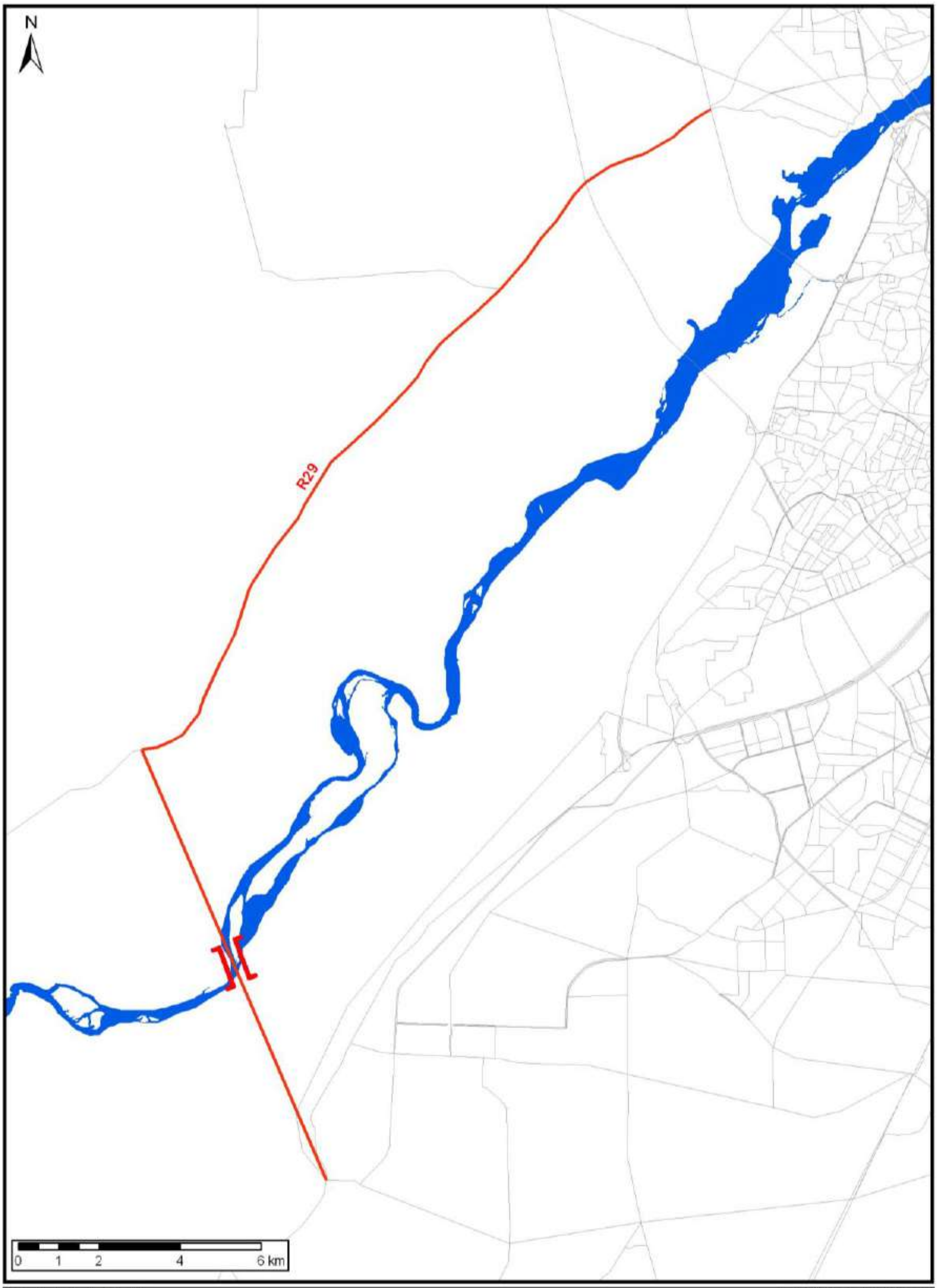
Project No.	Project Code	Project Description	Length (km)	Proposed Lanes
R28	20.046	Kahna Kacha Road (Kahna Station – Ferozepur Road)	7.1	D-2
R33	20.052	Link Thokar Niaz Baig Canal Bank Road – Ferozepur Road (Khyaban-e-Jinnah Road – Defence Road – Ferozepur Road)	17.7	D-3
R35	20.054	Southern Bypass South Road (Ferozepur Road – College Road)	9.9	D-3
R36	20.055	Southern Bypass North Road (Canal Bank Road – M-2)	3.9	D-3
R38	20.057	Raiwind Road (Thokar – Lahore Ring Road Southern Loop)	12.9	D-3
R39	20.060	Defence Road (Multan Road – Ferozepur Road)	14.3	D-3
R40	20.061	Thokar Niaz Baig Canal Road Extension (Defence Road – Lahore Ring Road Sothern Loop)	3.5	D-3
R41	20.081	Construction of LRR West (Multan Road – M2)	15.6	D-3
R42	20.082	Construction of LRR South (Ferozepur Road – Multan Road)	21.8	D-3

Figure 2 LUTMP Proposed Road Sub-sector Projects



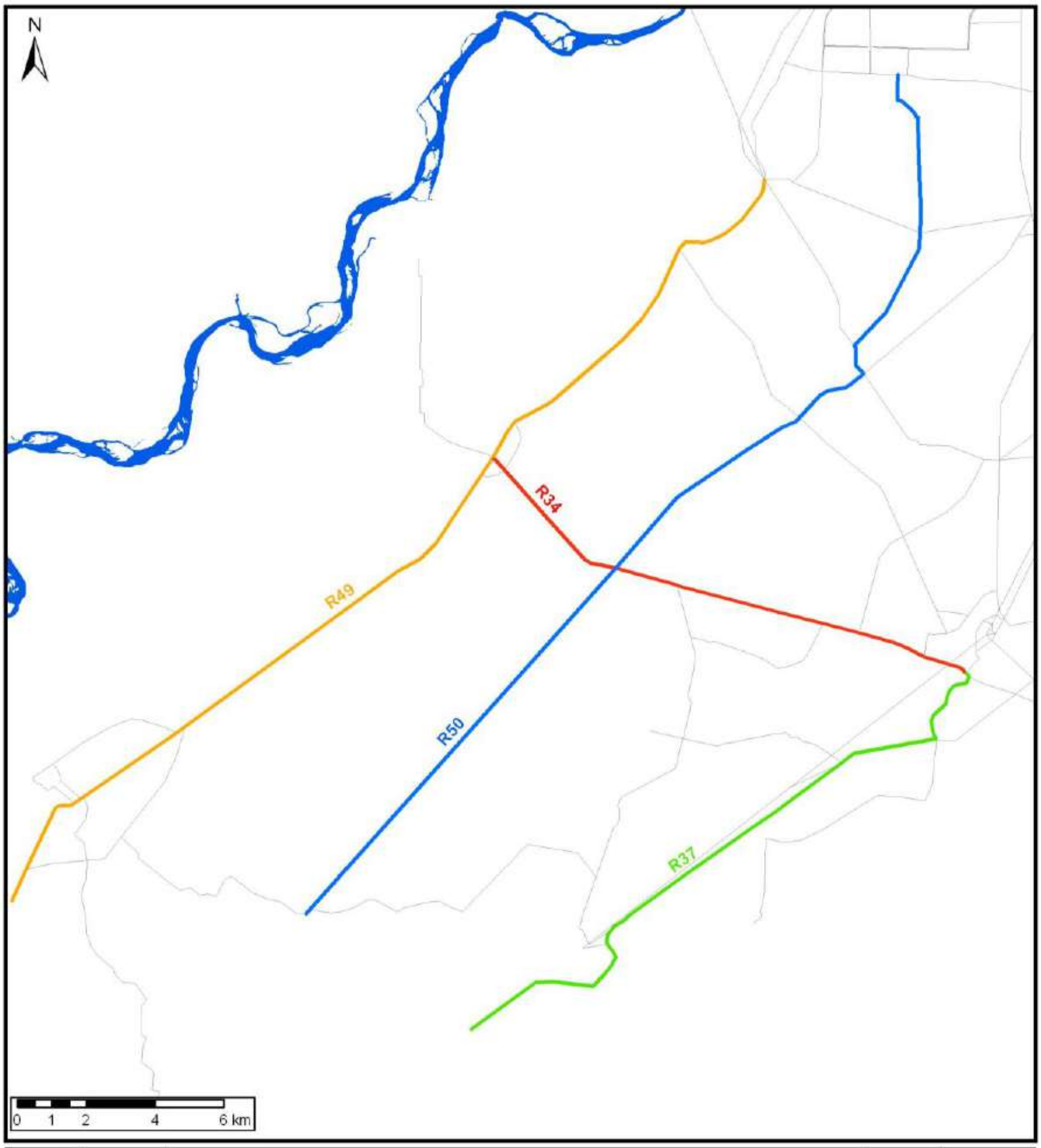
Project No.	Project Code	Project Description	Length (km)	Proposed Lanes
R13	20,004	Shabir Usmani Road (Barkat Market – Maulana Shaukat Ali Road)	2.8	D-3
R14	20,005	Link Peco Road – Ferozepur Road	1.9	D-2
R15	20,006	Link Ferozepur Road - Nalay Wali Road (Completion of link between Ferozepur and Multan Road)	1.5	D-2
R16	20,007	Old Ravi Bridge and Road (**Bridge 0.5km**)	1.2	D-3
R17	20,008	G.T. Road (Cooper Store - Ek-Moria Pul)	2.1	D-2
R24	20,027	Extension of Maulana Shaukat Ali Road (Canal Bank Road – Noor-ul-Amin Road through Punjab University)	2.4	D-3
R30	20,049	Lahore-Sheikhupura Road (Saggian Wala Bypass – G.T. Road)	2.4	D-3
R31	20,050	Sagianwala Bypass Road (Ring Road – Sharaqpur Road) (**Bridge 0.6km**)	6.7	D-4
R32	20,050	Lahore-Sheikhupura Road (West) (Sharaqpur Road – Lahore-Sheikhupura Road)	1.9	D-4
R43	20,091	Secondary Roads in Dharampura Area	5.1	D-2
R44	20,092	Secondary Roads in Shadbagh Area	68.2	D-2
R45	20,093	Secondary Roads in Samanabad Area	19.2	D-2

Figure 3 LUTMP Proposed Road Sub-sector Projects



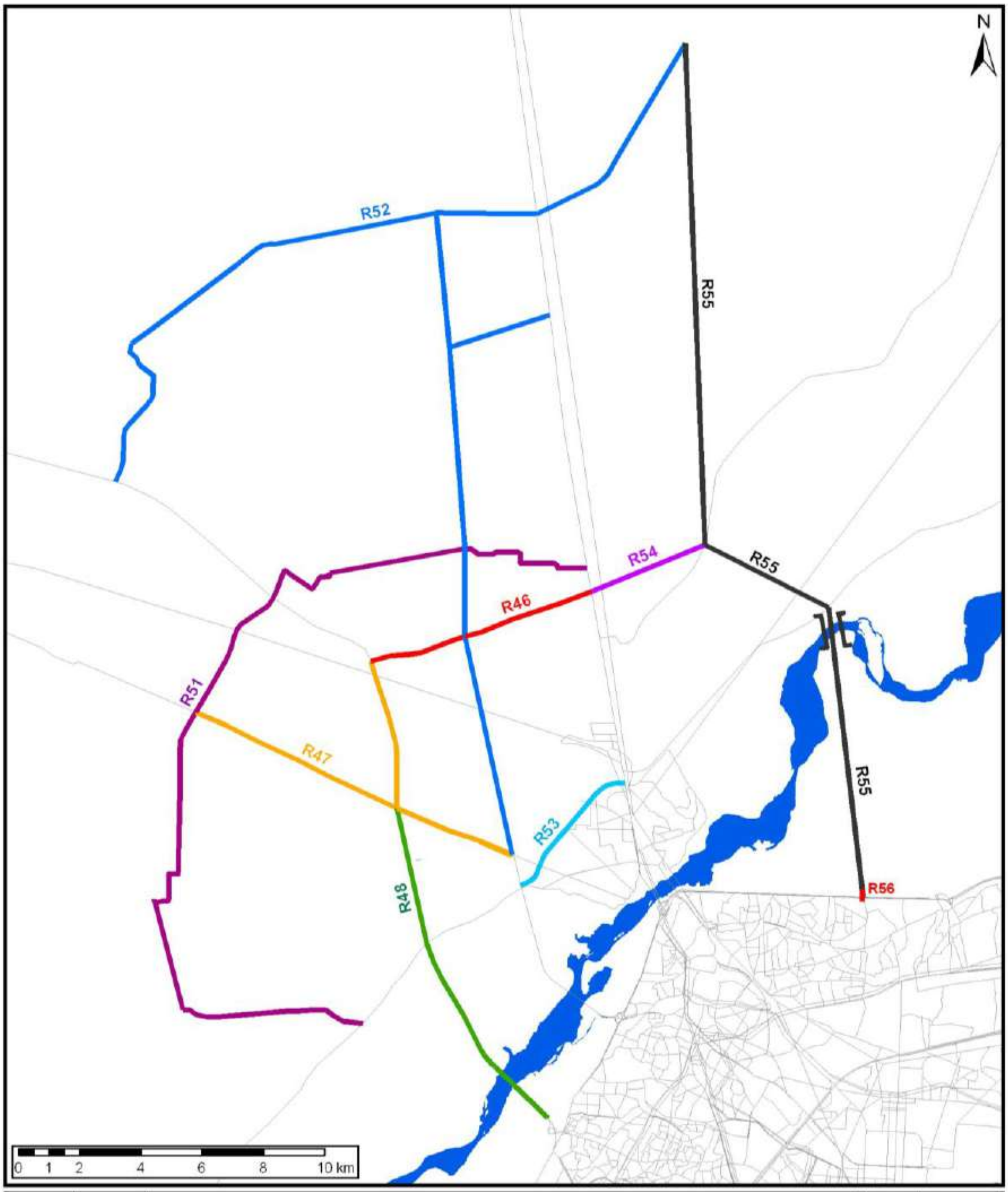
Project No.	Project Code	Project Description	Length (km)	Proposed Lanes
R29	20,049	Sharaqpur Road (Lahore Ring Road – Saggian Wala Bypass) **(Bridge 0.7km)**	37.4	D-3

Figure 4 LUTMP Proposed Road Sub-sector Projects



Project No.	Project Code	Project Description	Length (km)	Proposed Lanes
R34	20,053	Manga-Raiwind Road (Multan Road – Raiwind Road)	15.8	D-3
R37	20,056	Raiwind-Pattoki Road (Raiwind City – Boundary of LUTMP Study Area)	19.8	D-3
R49	30,004	N-5- Multan Road (Lahore Ring Road Sothern Loop – Boundary of LUTMP Study Area)	31.3	D-3
R50	30,005	Sharif Complex Road (Defence Road – Manga Raiwind Road – Bhai Pheru Kot Rada Kishan Road)	33.2	D-3

Figure 5 LUTMP Proposed Road Sub-sector Projects



Project No.	Project Code	Project Description	Length (km)	Proposed Lanes
R46	30,002	Lahore Bypass (G.T. Road – Kala Shah Kaku Bypass)	7.6	D-3
R47	30,002	M-2 – Lahore-Islamabad Motorway (Lahore-Sheikhupura Road – Boundary of LUTMP Study Area) **(Bridge 0.6km)**	17.3	D-4
R48	30,002	M-2 – Lahore-Islamabad Motorway (Bund Road – Lahore-Sheikhupura Road)	11.6	D-3
R51	30,006	North-West Secondary Ring Road (Sharaqpur Road – Lahore-Sheikhupura Road – G.T. Road)	33.8	D-3
R52	30,008	Sheikhupura Muridke Road (G.T. Road – M-2)	52.7	D-3
R53	30,010	Link G.T. Road (Sharaqpur Road – Lahore-Sheikhupura Road – G.T. Road)	5.0	D-3
R54	30,028	Link Kala Shah Kaku – Lahore-Sialkot Motorway	4.2	D-3
R55	30,028	Lahore-SialkotMotorway **(Bridge 0.8km)**	32.0	D-4
R56	30,028	Link G.T. Road Lahore-SialkotMotorway	0.3	D-3

Figure 6 LUTMP Proposed Road Sub-sector Projects

Project No.	Project Code	Project Description	Length (km)	Proposed Lanes
R57	Optional	Construction and remodeling of Secondary Roads - south of LRR in the south-western quadrant between Ferozepur Road and Multan Road	93.6	D-3