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
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9	Iqbal	810	1,554	1,503	1,277	2,690	2,657	1,886
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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
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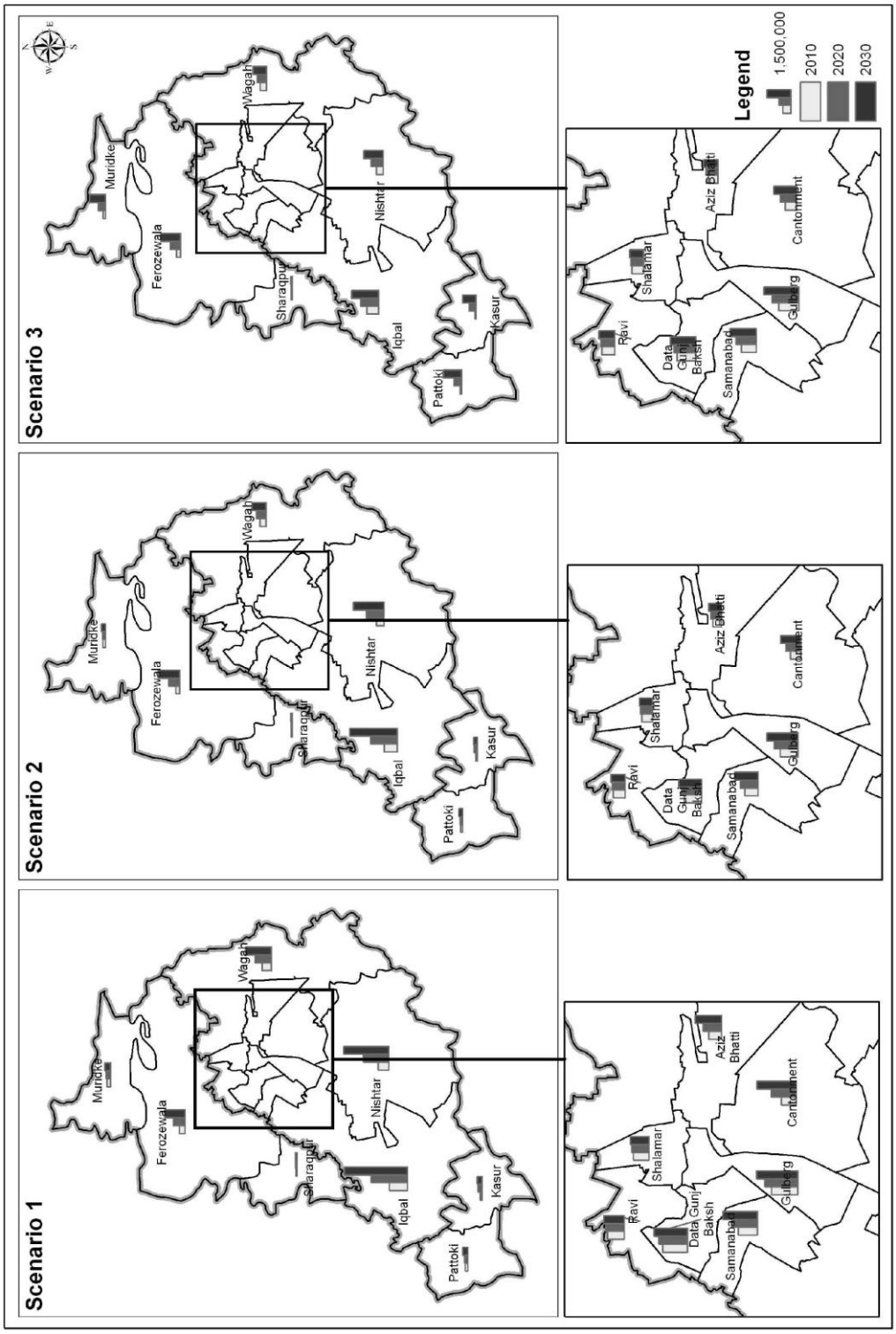
11-13	Sheikhupura	477	939	1,174	1,345	1,464	2,059	3,163
14-15	Kasur	189	275	280	631	358	370	1,580
1-15	***LUTMP***	***8,184***	***11,854***	***11,860***	***11,899***	***16,934***	***17,049***	***16,948***

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**

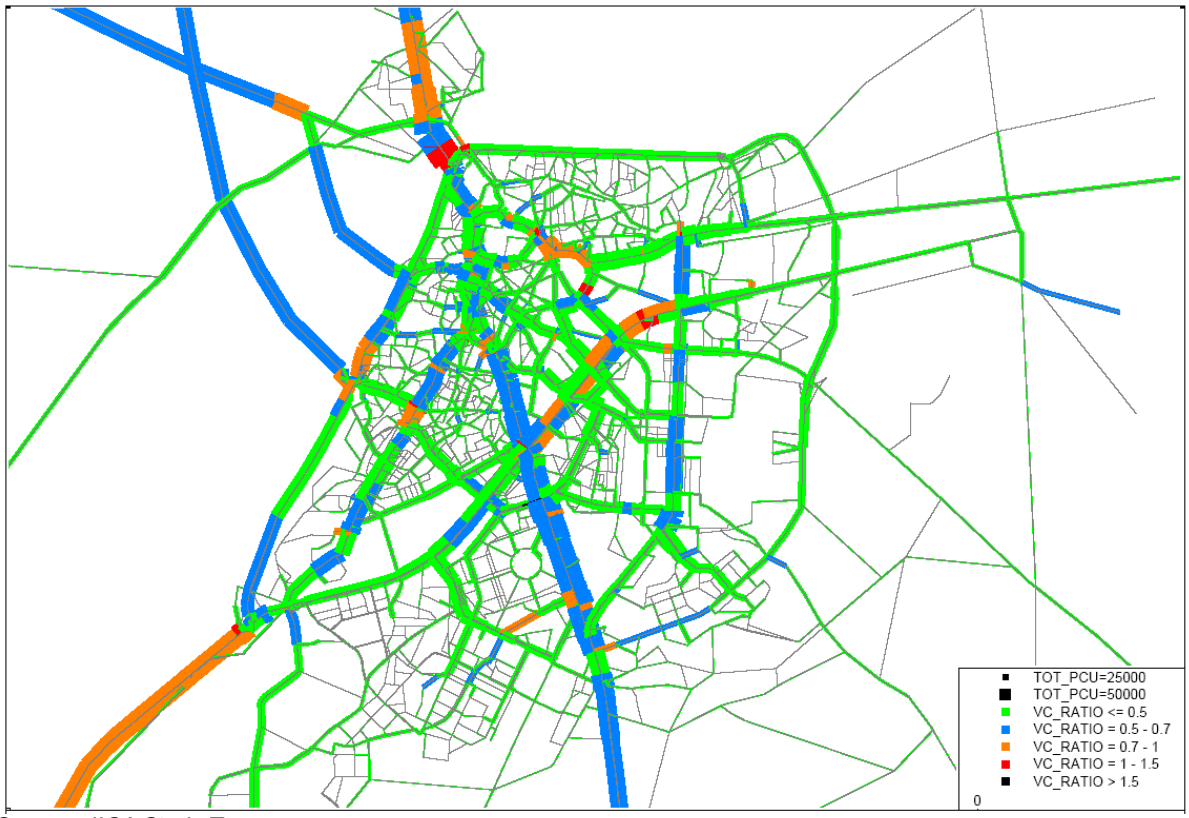
Source: JICA Study Team

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



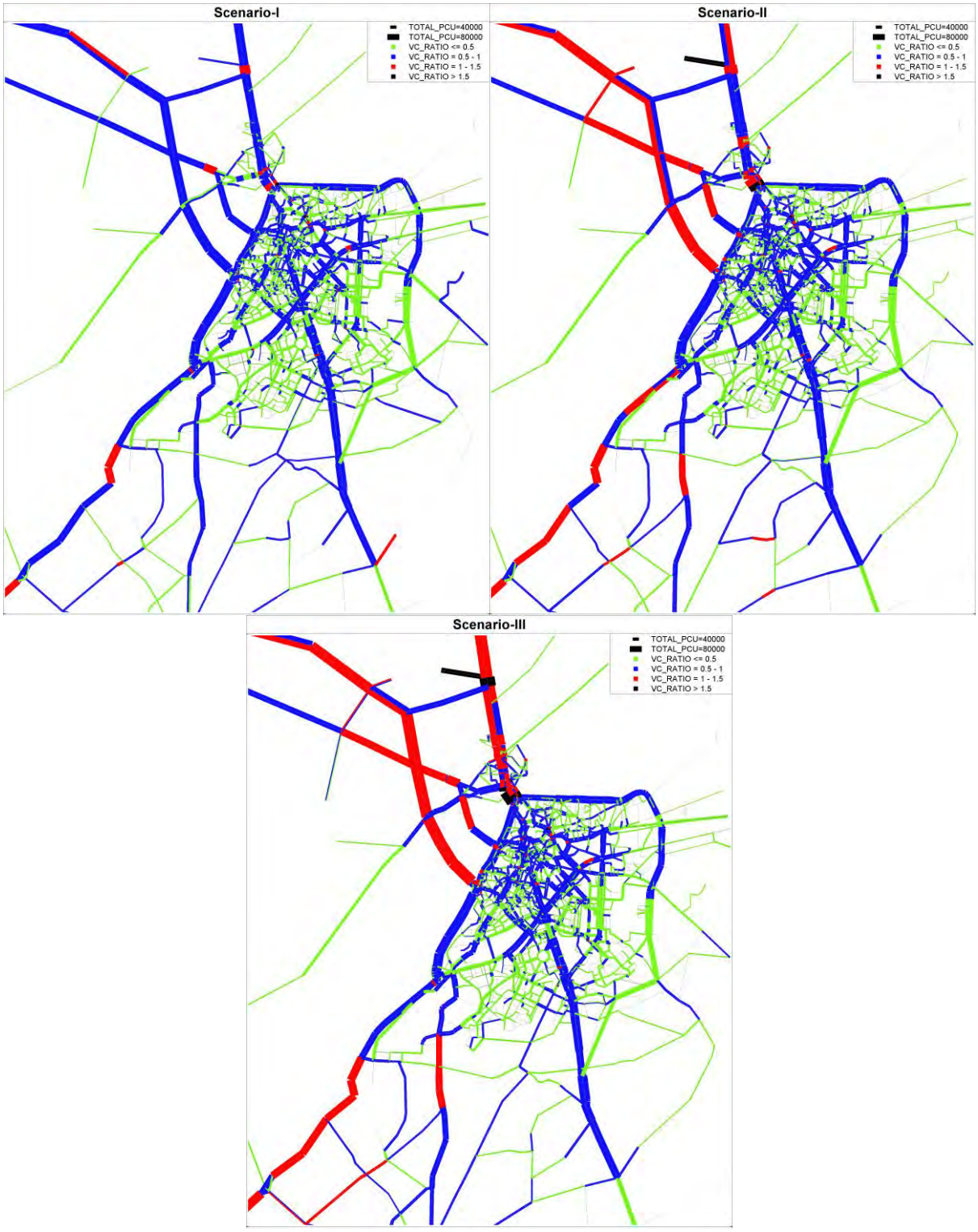
Source: JICA Study Team

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.

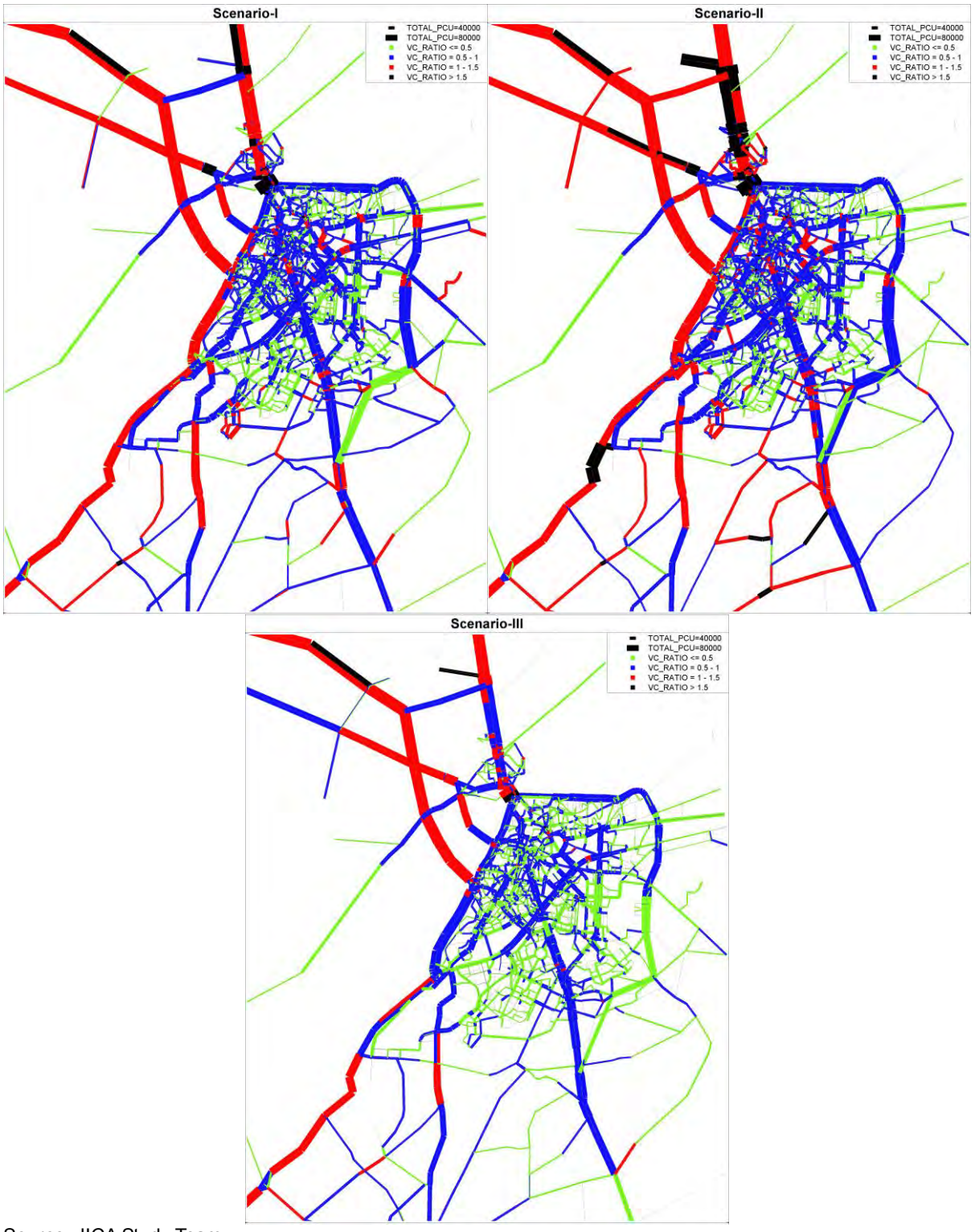
LRR still would not even be close to capacity as most of its sections would be at V/C ratio around 0.7. All three Ravi bridges would be well over capacity. Scenario 3 would overload Multan Road and Raiwind Road in the south and all bridges and G.T. Road in the north to demand levels much higher than 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:

Urban development point of view

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.

Transport development point of view

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

Environmental/ social point of view

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.

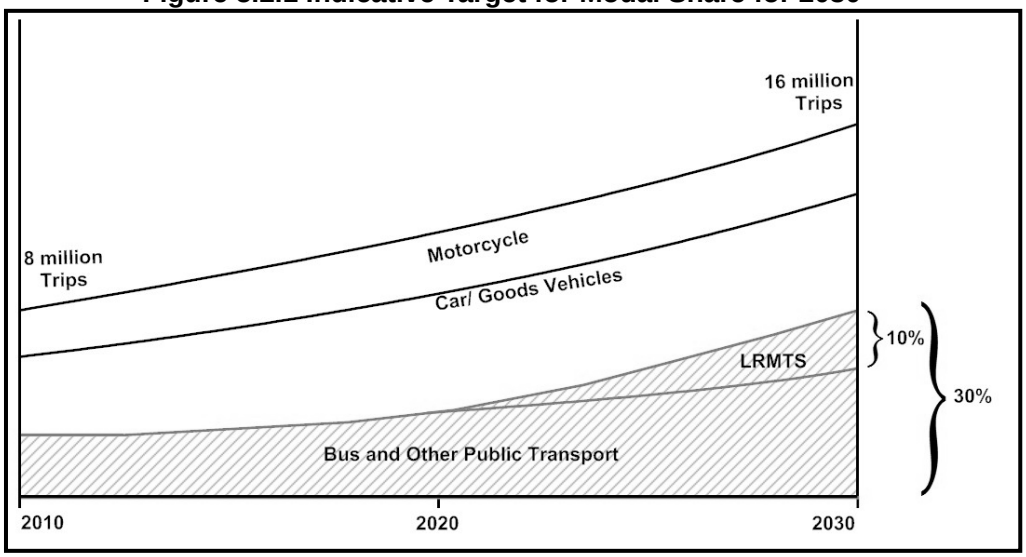
Source: JICA Study Team

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.

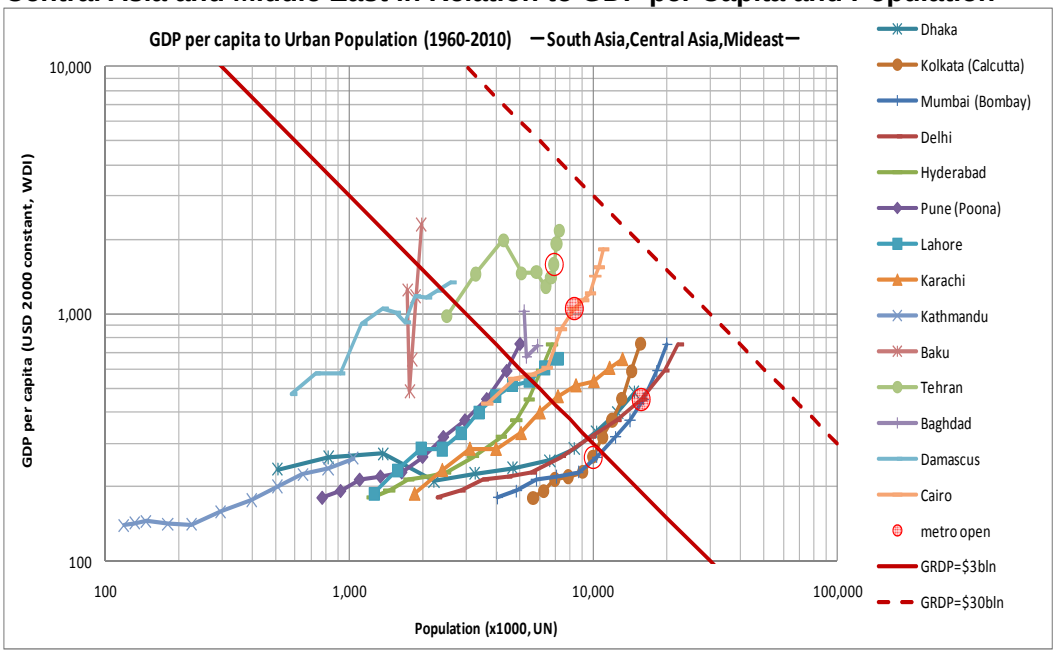
5.4.2 Urban Rail Based Mass Transit Development

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

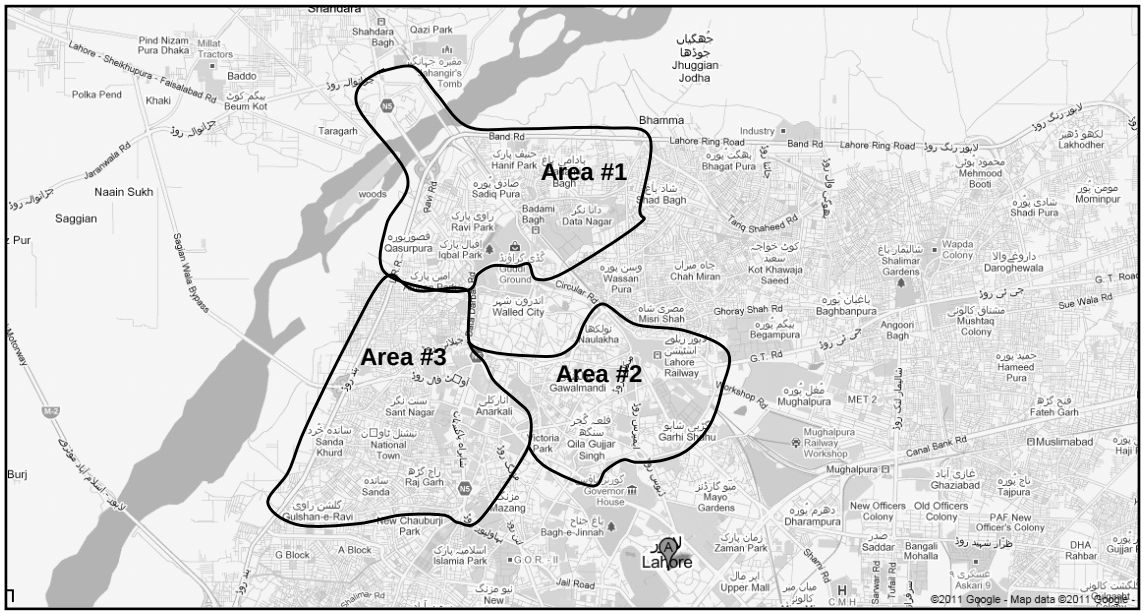
Traffic condition/ situation in the central area of Lahore is the most serious in the Study Area. Most inter-city and intra-city traffic concentrate there using radial arterial roads. Disorderly traffic management and insufficient road infrastructure aggravate the situation. The traffic management deficiencies 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.

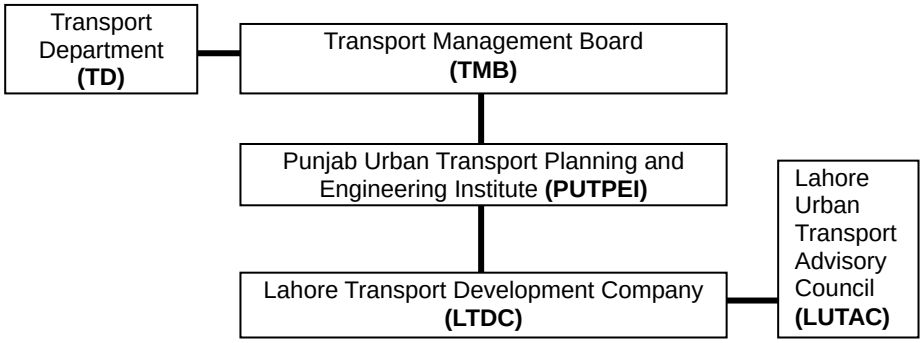
It may be almost impossible to recruit qualified professionals at such a low salaries as current wage system for Pakistan Government officials as well as other terms of recruiting conditions. Consequently, the wage system needs to be revised upwards, especially for higher ranked officials. Unless otherwise, 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;

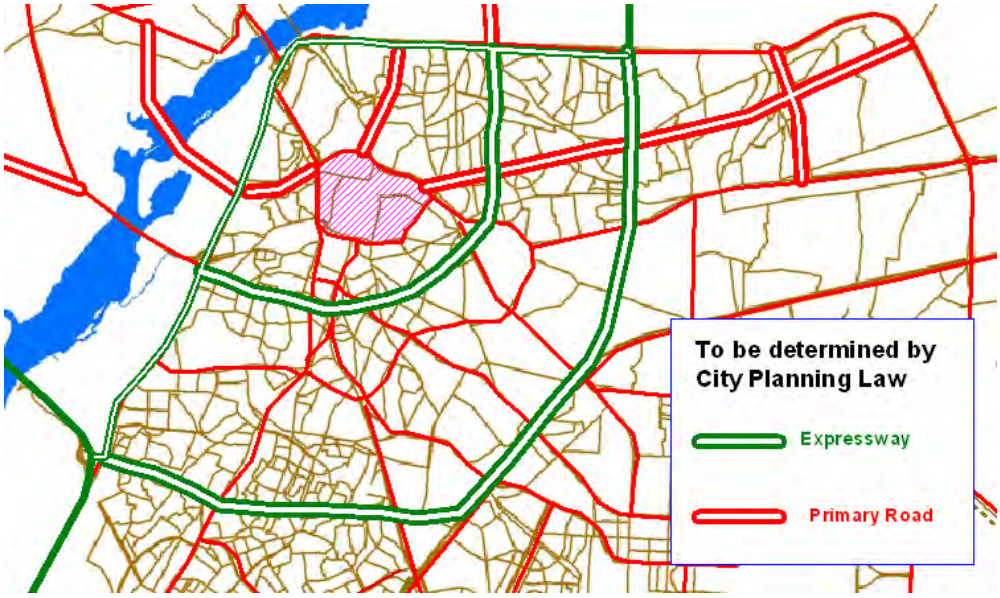
d) Land owners have to sell the land the Government at the market price; and

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

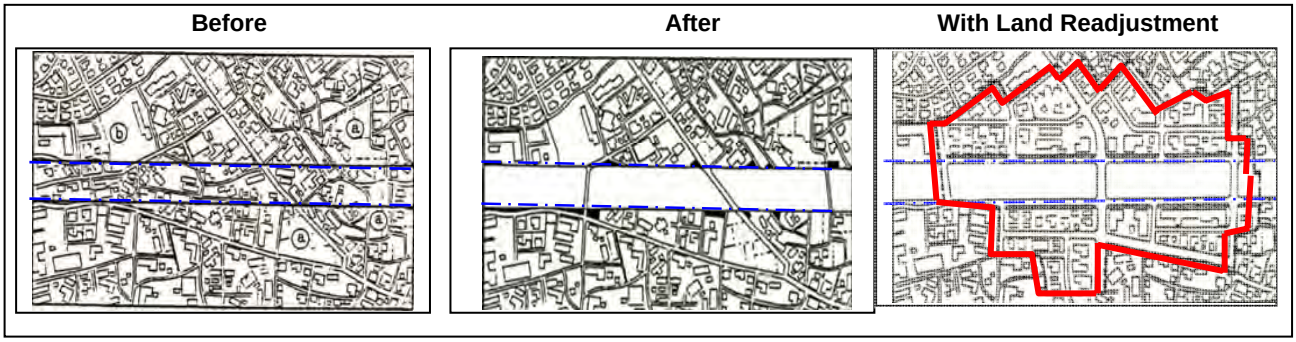


Source: JICA Study Team

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.

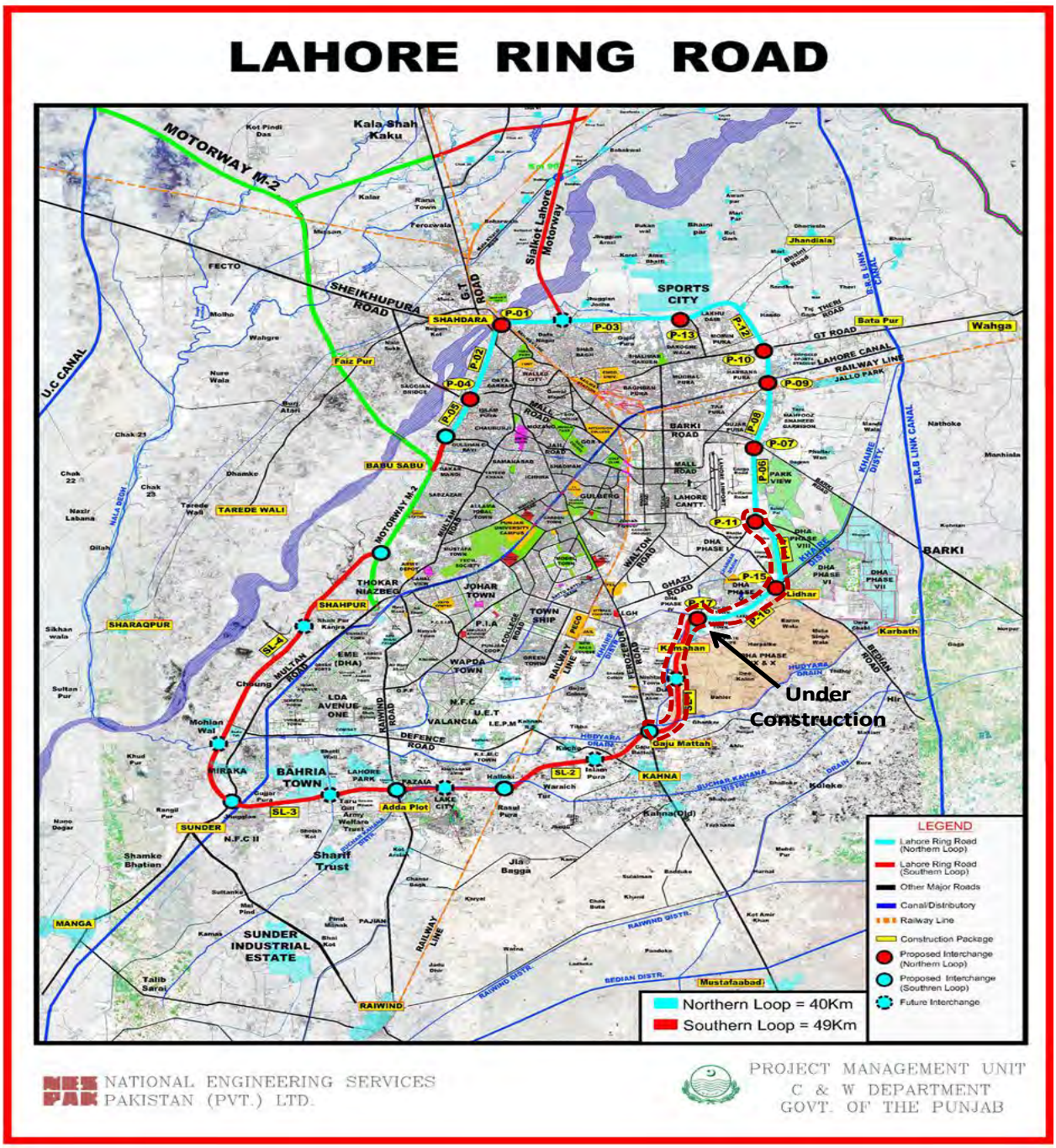
- As per recent data the estimated completion cost of the northern section is PKR 86 billion (USD 1.24 billion)
- The southern section is in the planning stages, and is discussed in the subsequent sections of this Chapter.

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:

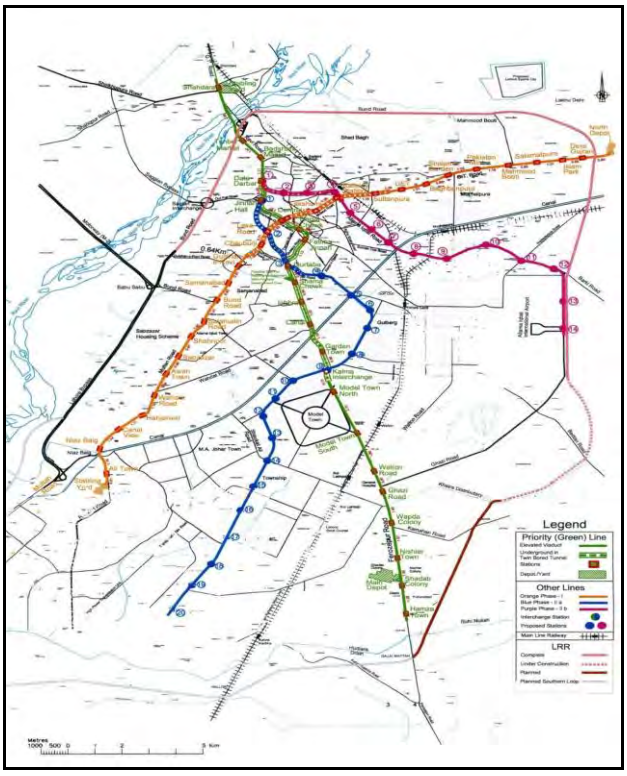
- Green Line alignment is 27 km long, (15 km underground) from Hamza Town in the South to Shahdara in the North;
- 22 stations, 12 underground 10 elevated; 5 interchange stations would provide direct transfer with the other 3 LRMTS lines.
- 2-Depots, both depot will be developed as multi-modal bus terminals 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



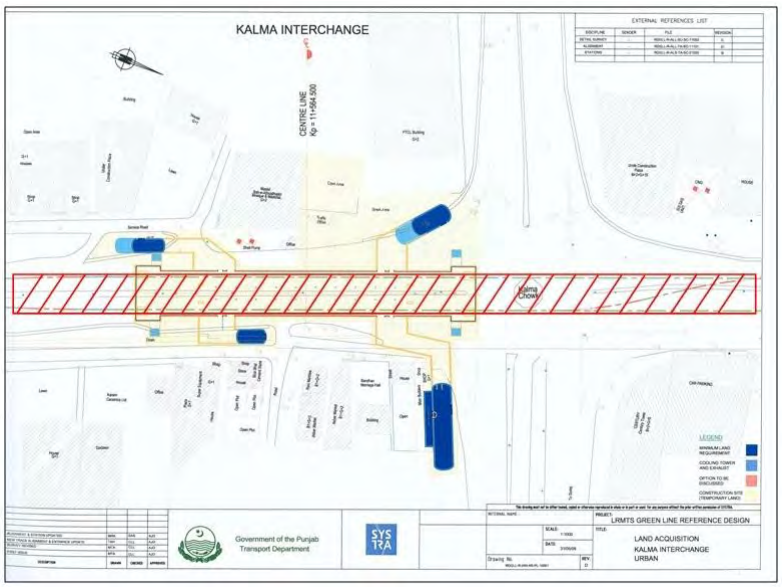
Source: LRMTS Study, 2008

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.

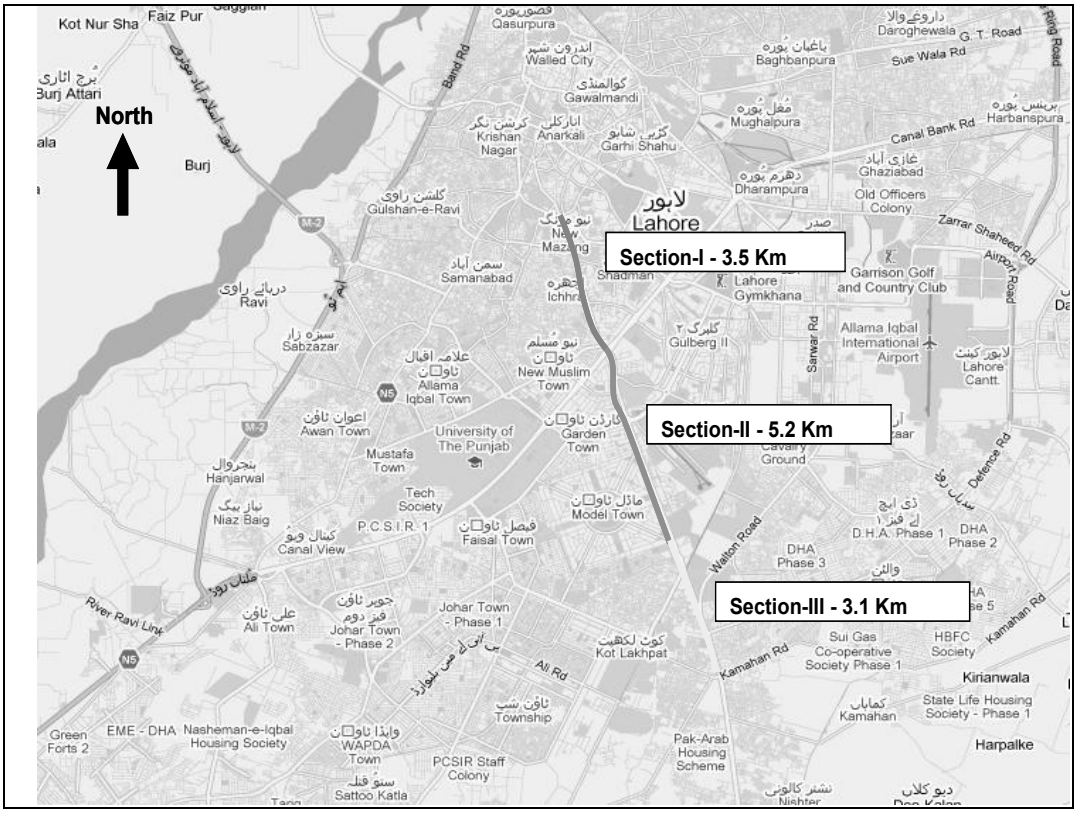
The studies were completed in 2008 by the urban unit. The outcome of the institutional study was not implemented as a whole; however some components did filter through the system and have proved useful. The traffic management study has been implemented to some extent, mostly involving minor junction 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

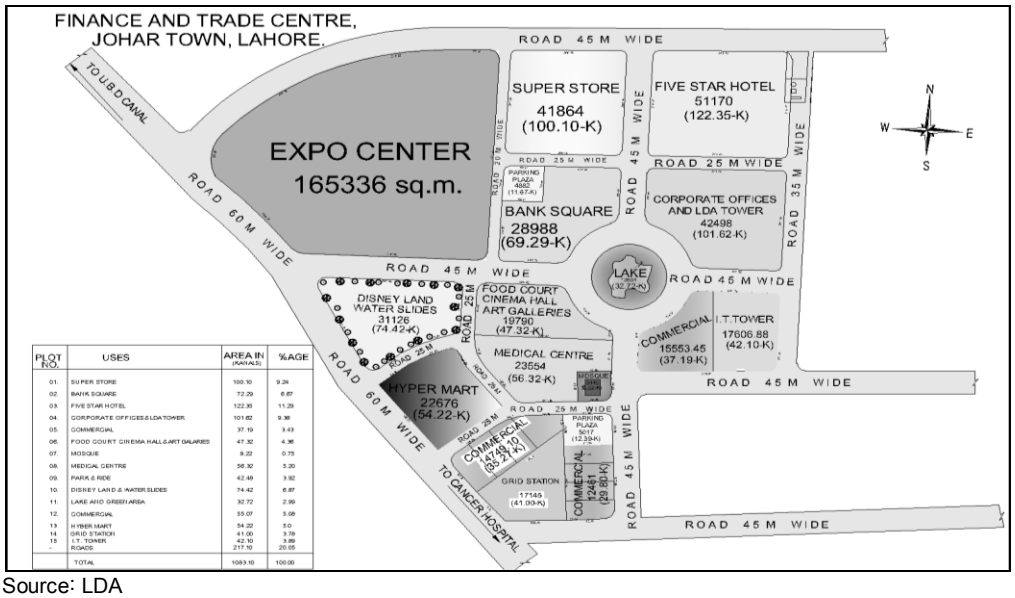
Lahore Development Authority (LDA) has planned to build Finance and Trade Centre near Expo Centre in Johar Town with an objective to generate commercial activities in the area. The area allocated for the Finance and Trade centre is 55 ha. The proposed projects are to build a 5-Star Hotel, Big Box store, 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



PLOT NO.	USES	AREA IN (KANALS)	%AGE
01.	SUPER STORE	100.10	9.24
02.	BANK SQUARE	72.29	6.67
03.	FIVE STAR HOTEL	122.35	11.29
04.	CORPORATE OFFICES & LDA TOWER	101.62	9.38
05.	COMMERCIAL	37.19	3.43
06.	FOOD COURT, CINEMA HALL & ART GALARIES	47.32	4.36
07.	MOSQUE	8.22	0.75
08.	MEDICAL CENTRE	56.32	5.20
09.	PARK & RIDE	42.49	3.92
10.	DISNEY LAND & WATER SLIDES	74.42	6.87
11.	LAKE AND GREEN AREA	32.72	2.99
12.	COMMERCIAL	55.07	5.08
13	HYPER MART	54.22	5.0
14	GRID STATION	41.00	3.78
15	I.T. TOWER	42.10	3.89
	ROADS	217.10	20.05
	TOTAL	1083.10	100.00

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

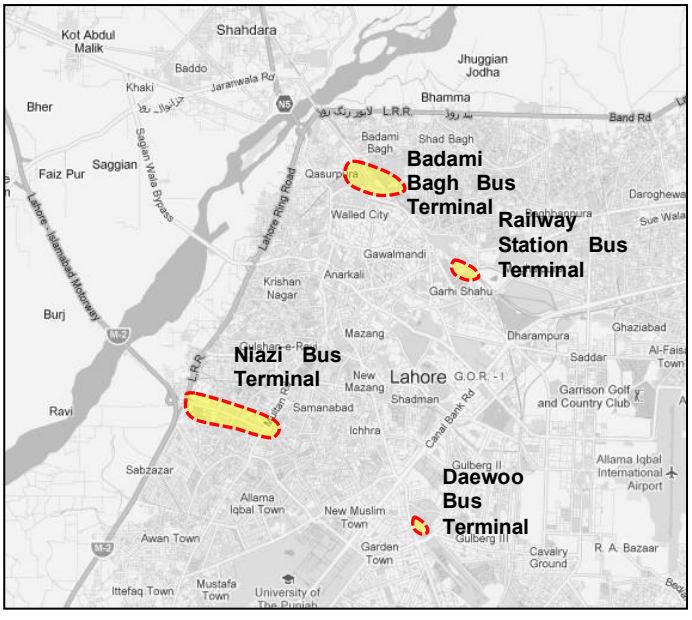
No.	Project Description (the Study Area Only)	Proposing Agency
1	Establishment of Centralized Drivers Licensing Authority	TD
2	Computerization of Transport Department under Motor Transport Management and Information System (MTMIS)	TD
3	Up-grading of 'D-Class' Bus Stands	TD
4	Effective and Efficient School 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.

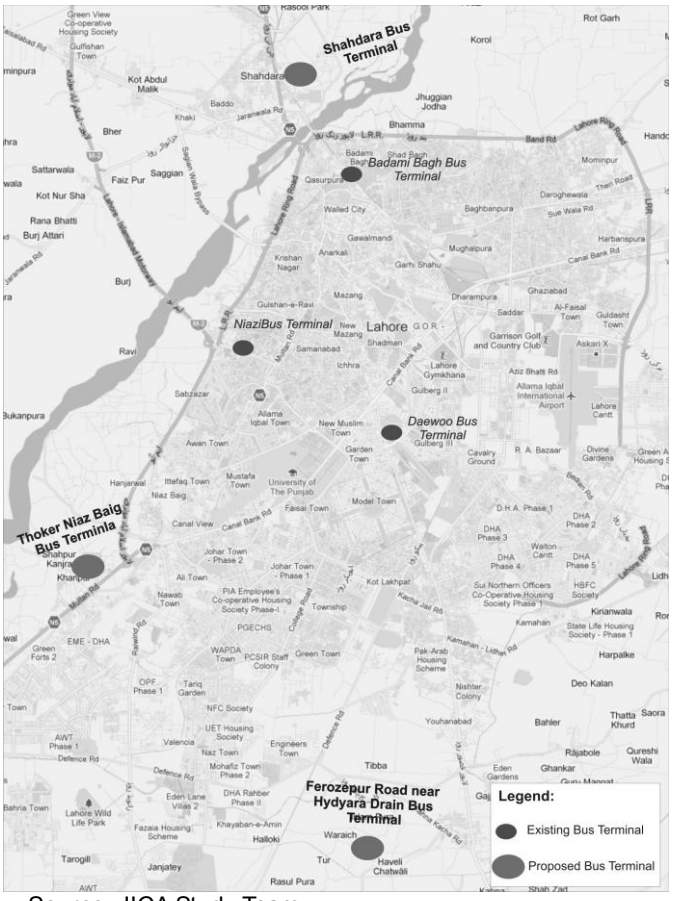
Figure 6.3.1 Locations of Bus Terminals in Lahore



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

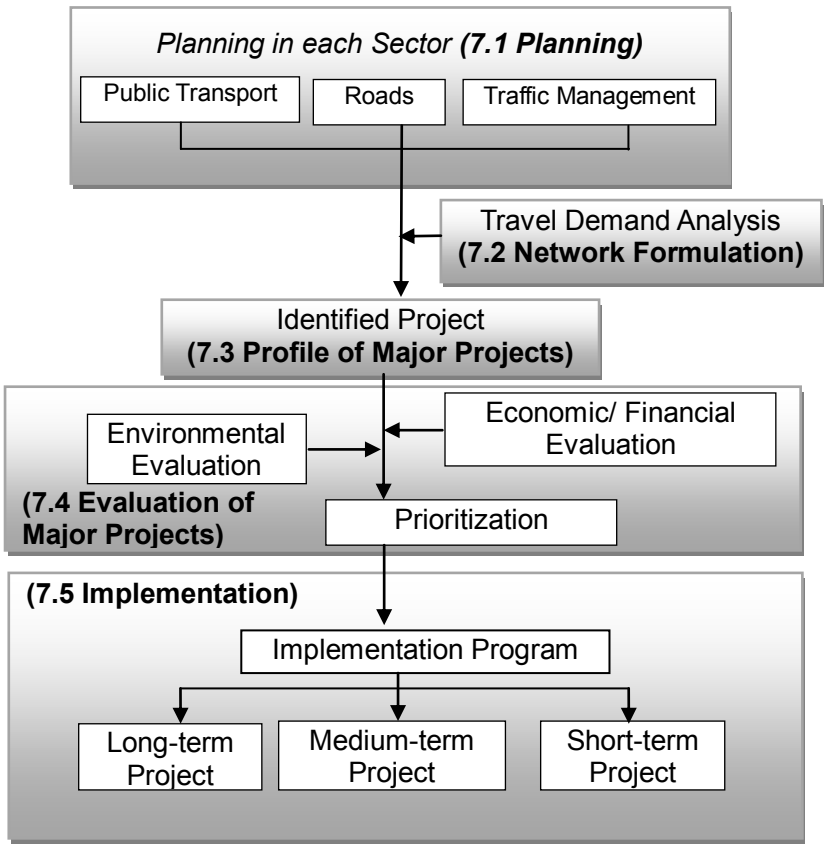
7. MASTER PLAN 2030

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)

BRT Network Potential in Lahore

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

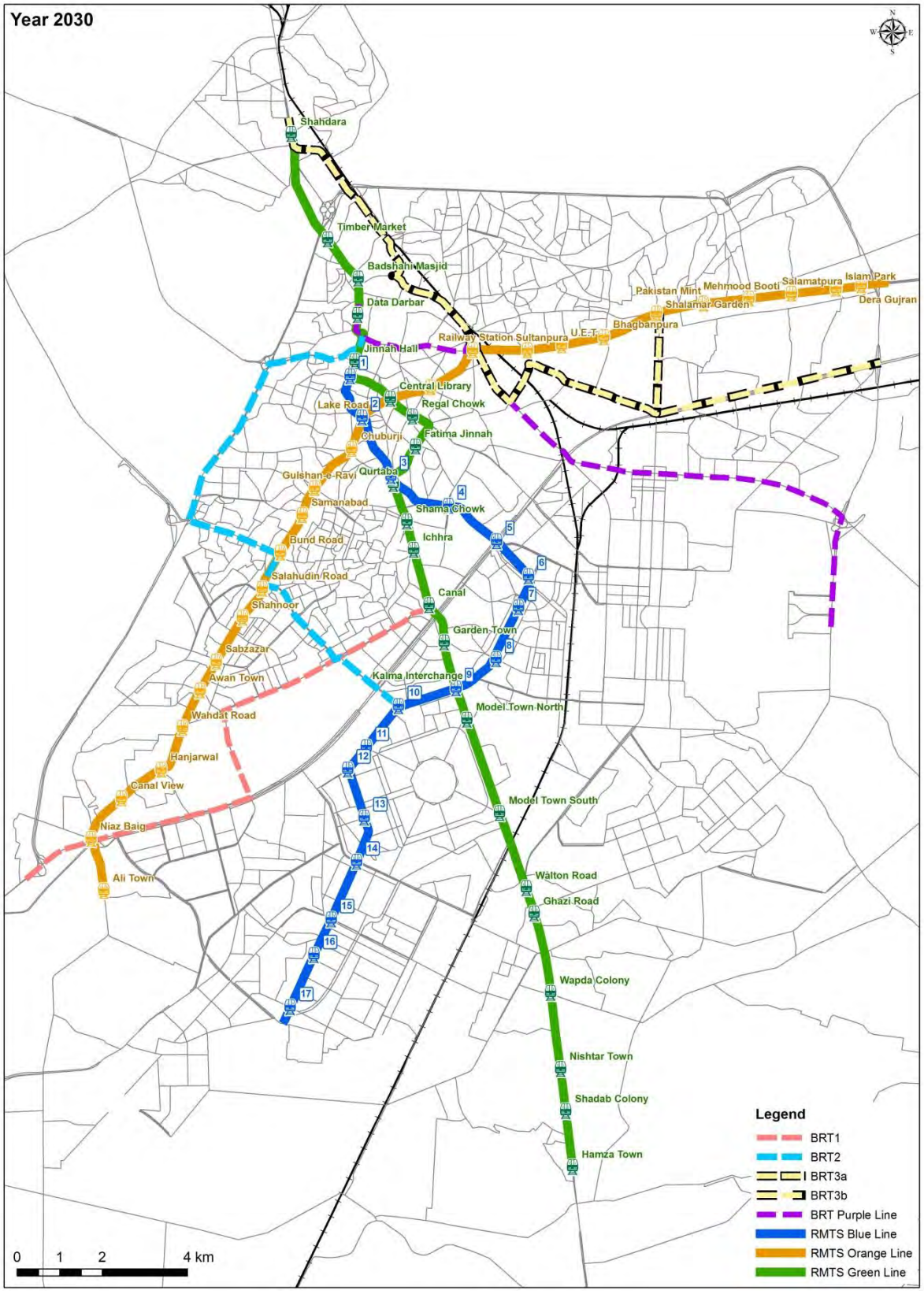
Project No.	Project Code	Project Name
PT01	C.1	Multimodal Inter-City Bus Terminals in Lahore
PT02	C.2	Effective and Efficient School Bus System
PT03	C.3	Up-grading of Bus Stands
PT04	C.4	Integrated Bus Operation
PT05	C.5	Establishment of Multimodal Bus Terminal at Shahdara

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

RMTS Project Costs

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

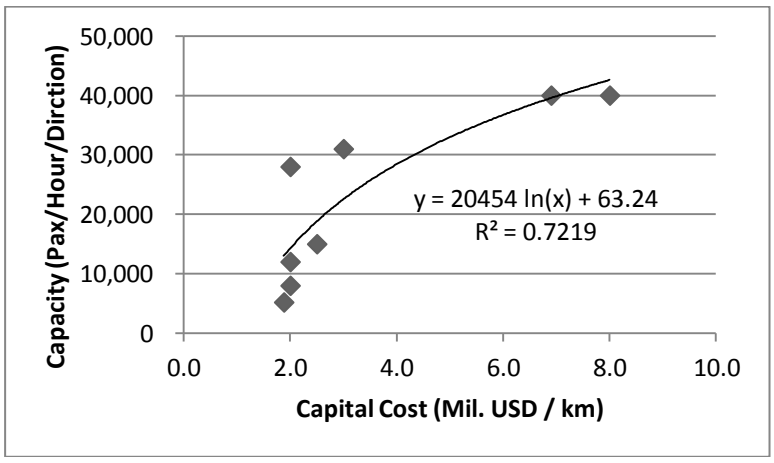
The following table compares construction cost of selected BRT projects in the world. BRT construction cost ranges from USD 2.0 to 8.0 million /km in other cities of the world. The unit cost of BRT seems to depend on its capacity. The relationship between capital cost and capacity of BRT project is shown 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 km². 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.

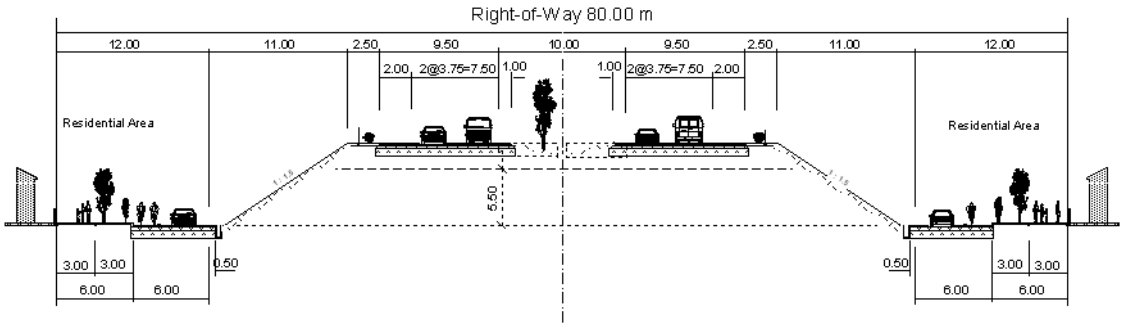
Inter provincial/ national roads in the Study Area will be developed in a way that they will not pass through urban areas to avoid conflicts and mix with urban traffic. Proper design standards will be adopted for the intersections of urban roads. To develop a proper road network, a systematic and hierarchical 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



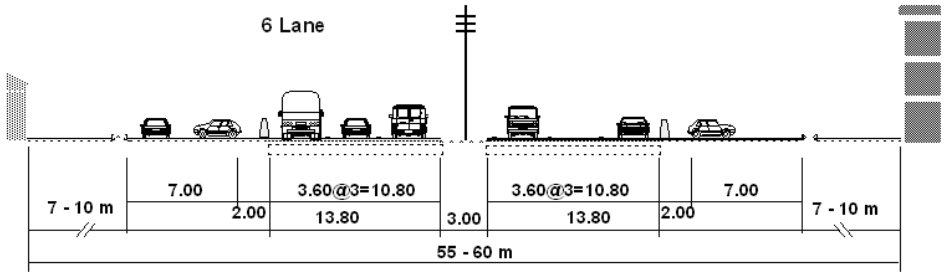
Source: JICA Study Team

(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

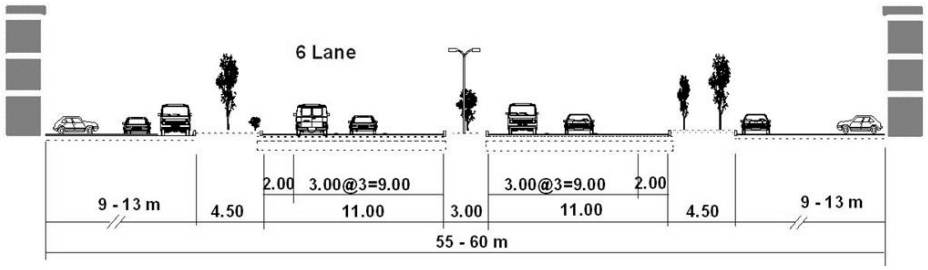
system formed the significant framework linking up with the regional trunk road network, and also primary with the secondary road network. Typical cross sections for Trunk/ National and Primary roads are depicted in Figures 7.1.4 and 7.1.5 respectively.

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

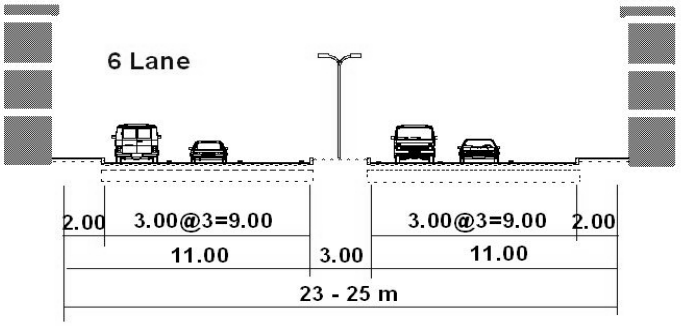


Source: JICA Study Team

(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



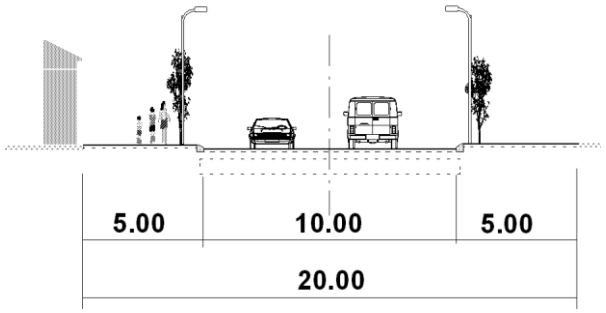
Source: JICA Study Team

(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

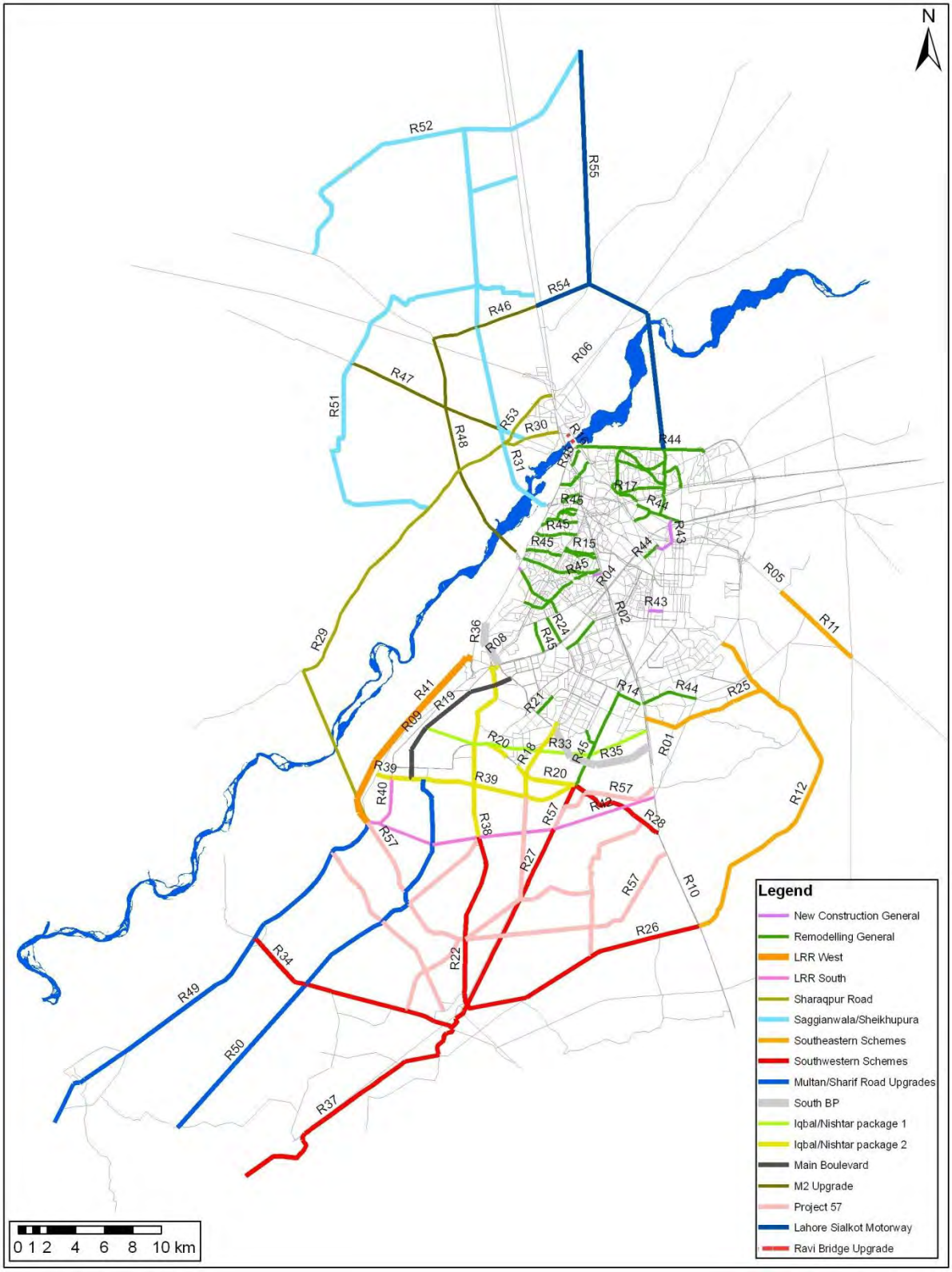
The road sub-sector projects are depicted in Figure 7.1.9 and details are provided in Section 7.3.2. However, the committed road projects, which are either completed or scheduled to be completed in the near future (2012/ 2013) are listed in Table 7.1.9. Further details of these road projects are illustrated 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

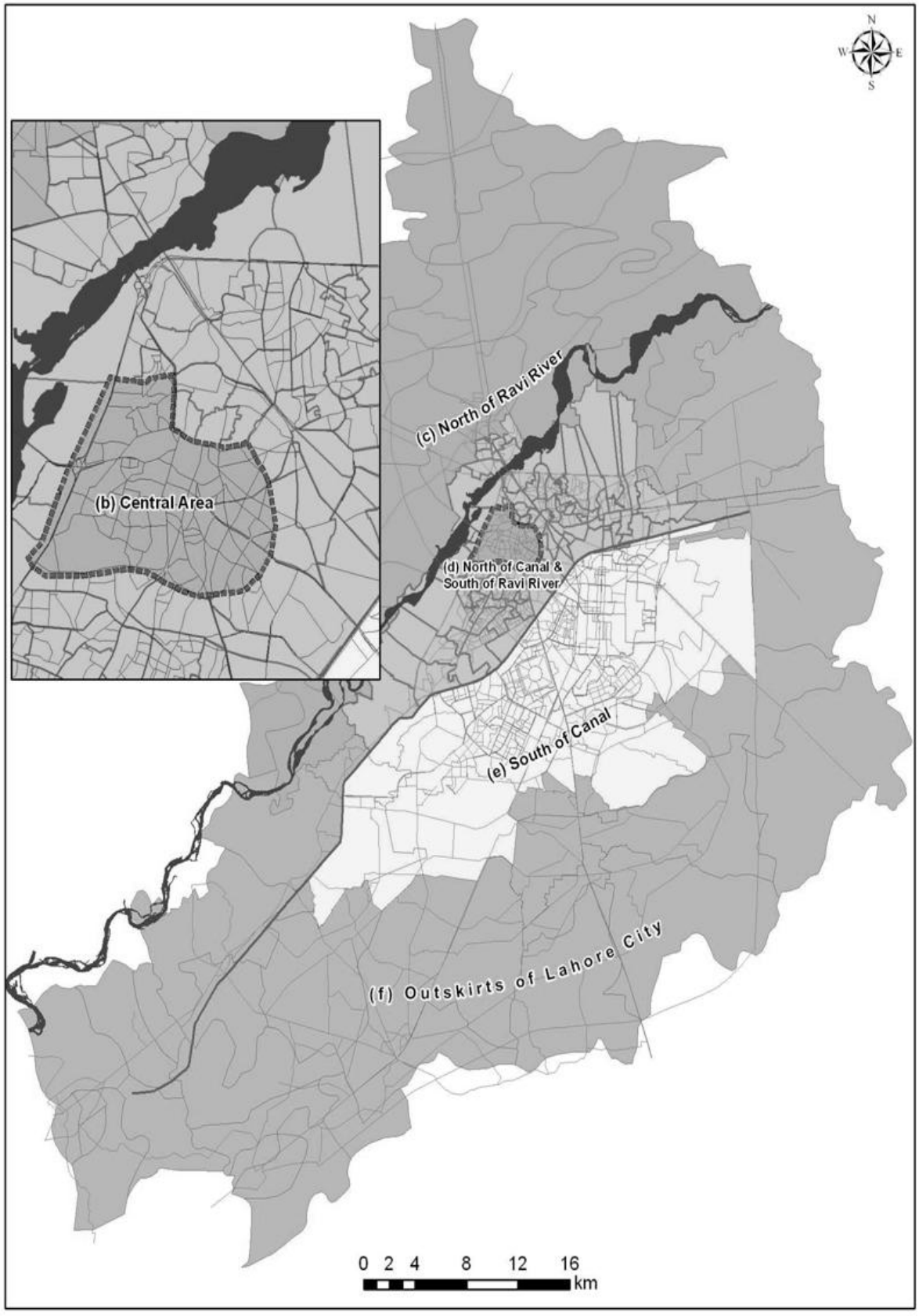
d) **North of Canal and South of Ravi River:** Area bounded between Canal Bank Road, Lahore Ring Road and part of M-2 Motorway up to Thokar Niaz-baig.

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