Pre-Feasibility Study on Urban Transport, Rajkot

April 2011
Executive Summary

Prepared by GOPA Consulting
### Executive Summary

#### A. Introduction

1. This pre-feasibility study (PFS) was undertaken between May and December 2010 for the Rajkot Municipal Corporation (RMC), under the auspices of the Cities Development Initiative for Asia (CDIA). The outputs of the PFS include a transport sector strategy for Rajkot, together with transport sector investment proposals for immediate implementation, which will demonstrate the benefits of a coordinated approach to public transport planning, and which can subsequently be replicated throughout the city.

2. These investment proposals relate to bus services, bus priorities including bus rapid transit (BRT) lines and bus lanes, improved provision for parking of private cars and motorcycles, relatively low-cost but effective road improvements to facilitate traffic flow, and improved facilities for pedestrians, including some pedestrian precincts. In addition, there are proposals for capacity building within the RMC and Rajkot Urban District Authority (RUDA) to enhance their capability to implement the various measures; for the development of an appropriate institutional framework for the planning and regulation of urban transport; and for a long-term urban transport plan for Rajkot, to address the longer-term issues and requirements which did not fall within the scope of the PFS.

3. The Final Report of the PFS has been produced in three volumes:

- Volume 1 – Executive Summary (this volume, which summarizes Volumes 2 and 3);
- Volume 2 – Background and Analysis; and
- Volume 3 – Project Packages.

#### B. PFS objectives

**Study area**

4. This Pre-Feasibility Study (PFS) covers the area within the jurisdiction of the Rajkot Urban Development Authority (RUDA), which includes the area administered by RMC and part of the surrounding area. The area is illustrated in the map at Figure 2-1.

**Study objectives**

5. The principal objective of this Pre-Feasibility Study (PFS) of Urban Transport is to identify a viable package of prioritized transport investments for Rajkot.

6. RMC has already developed a comprehensive programme of plans for improvements to transport infra-structure and systems. Some of these plans have already been implemented, or are in the process of implementation, but implementation of the full programme will require substantial resources in terms of funding, expertise and time. These resources are limited and Rajkot is therefore seeking an achievable prioritized urban transport investment programme. This is the overall objective of this PFS. Within this objective, the Terms of Reference specify three key requirements:

   6.1. to identify priority transport projects and investments for Rajkot that benefit all citizens, and contribute to improved overall environmental conditions;

   6.2. to build and strengthen the capacity of key institutions involved in the management and service delivery of the transport sector; and
6.3. to identify gap funding for Jawaharlal Nehru National Urban Renewal Mission (JnNURM) projects for urban transportation projects in Rajkot.

Current situation

**Characteristics of Rajkot**
7. Rajkot is situated in the State of Gujarat in the north-west of India. The RMC area covers 105 km$^2$ while the RUDA area covers 668 km$^2$. The projected populations for the two areas in 2011 are 1,190,000 and 360,000 respectively. The city has experienced high population growth with a 79.1% increase between 1991 and 2001; recent growth is attributable to a large influx of immigrants from the surrounding countryside, and to the extension of city boundaries.

8. Rajkot is an industrial city, with light industry and textiles dominating. The income per household in Rajkot is approximately USD 4,000 a year, which places it 13th in a list of 35 Indian cities with more than one million populations.

**Transport issues in Rajkot**
9. Rajkot is becoming increasingly urbanized and is experiencing significant growth in private vehicle use. In particular, the number of motorcycles is increasing dramatically: as incomes rise, more people will be able to afford motorcycles and many existing motorcycle owners are likely to purchase cars. The result will be increasing traffic congestion, adverse environmental impact, and increasingly difficult operating conditions for public transport services. Already, when the Ministry of Urban Development (MoUD) benchmarks and performance indicators for assessing the service level of urban transport in Indian cities are applied to Rajkot, they indicate that the city has serious traffic and transport problems.

10. A Short-term Traffic and Transportation Improvement Study (STTIP) were carried out between 2001 and 2004. Subsequently RMC has produced a City Development Plan (CDP), a Comprehensive Mobility Plan (CMP), and a Detailed Project Report for a Bus Rapid Transit system. These plans and reports made extensive use of the data and recommendations of the STTIP but relatively little new information has been collected. STTIP and CMP included plans for numerous improvements to transport infrastructure and services, but to date few have been implemented.

11. Rajkot has not yet reached the point like many larger cities where motor traffic dominates city life to the detriment of life-quality for everybody, but if the rapid growth in the number of motorcycles and cars continues at its present rate, and appropriate measures are not taken, the quality of life in the city will deteriorate rapidly. RMC has already recognized this and its CMP caters for a substantial increase in the role of public transport, the control of private vehicle use and the facilitation of NMT and pedestrian movement; long-term proposals include world-class mass transit systems. Unlike other cities of similar size, there has been no large-scale construction of urban highways in the central area.

12. The PFS team, in consultation with RMC and other stakeholders, has developed an urban transport vision statement for Rajkot which spells out the future characteristics of its transport infrastructure and services, as follows:

“All citizens of Rajkot and visitors to the city, including the poor and disadvantaged, will enjoy sustainable, accessible, affordable, convenient and safe mobility. This will be achieved through controlled growth in the use of individual private transport, the provision of world-class public transport and encouragement of non-motorized modes, to ensure optimal use of infrastructure and minimal adverse social and environ- mental impact.”
13. This vision has been kept in mind when developing the recommendations of this PFS.

**Transport policy, legislative and institutional issues**

14. There is consistency in national and local transport policy in that the development of efficient public transport systems in India’s cities is regarded as a priority to improve mobility and avoid degradation of the urban environment. Public transport must provide an acceptable alternative to the rapidly growing use of private cars and motorcycles. However, despite the specific strategies set out in the National Road Transport Policy, a commitment to implement them in Rajkot is not yet evident.

15. The focus of the city's transport strategy is on the improvement of infrastructure, including the construction of new roads, a BRT alignment and providing missing links in the road network. In the longer-term, light rail transit (LRT) is proposed. While the proposed new infrastructure will improve traffic capacity, greater improvements in mobility, safety and urban amenity could be realized, at relatively low cost, by investing more in the efficient management of existing road space and development of the public transport system.

16. National and State legislation with regard to transport is not always consistent and in some cases militates against international best practice. The recommendations of this PFS are designed to comply with existing legal requirements but where there are inconsistencies, or where existing legislation precludes an optimal solution, these are indicated in the Report. Compliance with transport regulations is generally insufficient, and this is a major contributory factor to Rajkot's transport problems.

17. The transport institutional framework is determined largely at national and state levels and the scope for change is limited, although there is some scope for reform which would improve the delivery of transport services. In Rajkot, the functions and responsibilities for managing urban transport are dispersed over a number of agencies, many of which lack capacity and authority. In some cases jurisdictions overlap and in others there are functional gaps. There is a need, wherever possible, to consolidate, integrate and co-ordinate institutional functions to achieve key urban transport objectives.

18. Several different structures for urban transport administration in Rajkot have been proposed by recent studies, but have not been implemented. These include a Traffic Engineering and Management Unit (TEMU) to take responsibility for all traffic management; a Unified Metropolitan Transport Authority (UMTA) with wide-ranging responsibilities for the provision of transport infrastructure and services; and an Urban Mass Transit Agency (also UMTA) as a Special Purpose Vehicle (SPV) to operate the BRT system.

19. Best practice in the creation of transport authorities is that they should be formed by merging technical departments, not by superimposing a superior body above the technical departments and creating another layer of bureaucracy, which tends to complicate and delay decision-making. It is therefore recommended that instead of implementing the proposed changes listed above, a single department (Traffic Management Department, or TMD) of the RMC should be established to take responsibility for both traffic management and public transport management, including management of BRT operations.

20. Much of RMC’s urban transport capacity is currently focused on the planning and improvement of infrastructure, although more efficient management of the existing road network and public transport system could yield major benefits in mobility, journey speeds and safety at relatively low cost. RMC provides training programmes for its staff, but these
tend to be administrative rather than technical and have not included training in traffic management or public transport management.

21. The recommended institutional strategy calls for more resources to be deployed on traffic management and public transport management. There is, however, little local experience of public transport planning or market-sensitive regulation of private bus operators. The necessary skills will need to be developed by a combination of recruitment of qualified and experienced staff, and by training.

**Social issues**

22. The cross-cutting issues of poverty reduction, women-empowerment and child protection must be considered in the context of a comprehensive, integrated urban transport system. For example, the geographic coverage of proposed bus routes should include low-income areas on the periphery of the city, and services should be affordable to inhabitants of those areas.

23. There is a strong link between transport and poverty issues. An efficient and affordable transport system plays an important role in targeting poverty by creating employment opportunities, facilitating the marketing of products and services and the quick transportation of raw materials and final products to their markets. Accessibility to services, such as education and health, also depends on the availability and accessibility of effective public transport. However, at present the provision of transport services to poor communities is far from adequate.

24. The travel requirements of men are frequently given precedence over those of women. Mobility and access are essential to enable women to carry out their many roles, but often their specific requirements are not adequately met. Women tend to multi-task, and make more complex journeys than men, often travelling to childcare facilities, school, shops, markets and work, and a single journey is likely to involve multiple stops for diverse purposes. When using public transport, therefore, women often make more trips during the course of the day than men, paying multiple fares and often travelling during off-peak hours when service frequencies tend to be low.

25. Most public transport services, however, are based on the requirements of the male breadwinner, who typically travels from home to his place of work in the morning and back again in the early evening. Largely because services do not cater adequately for their needs, female public transport users are in the minority, and women’s access to the labour market is constrained by poor public transport. Public transport services must be planned and designed to accommodate women’s specific needs in terms of the routes they travel, the times of the day when they depend on public transport, the places where they wait for public transport vehicles and the places where they are set down.

26. Other marginal sections of society, principally the disabled, the elderly, children and other vulnerable groups, also need to be considered in public transport planning. At present, auto-rickshaws and city buses and associated infrastructure in Rajkot are not convenient for use by disabled, frail or elderly passengers. Sidewalks are obstructed and often in poor condition, impeding invalid carriages or wheelchairs which must therefore use the roadway, endangering their occupants. Low-floor buses and ramps or built-up kerbs at bus stops, dropped kerbs to provide wheelchair access to sidewalks at appropriate points, and tactile sidewalk surfaces to assist the visually impaired, are some measures that could help these groups.
Environmental issues
27. Exhaust emissions from motorcycles, chakdas and auto-rickshaws are a major source of vehicular pollution in Rajkot. SO$_2$ and NOx levels are currently within the permissible limits but are increasing, while the levels of respirable suspended particulate matter (RSPM) and suspended particulate matter (SPM) already exceed the permissible limits.

28. Noise levels are high on the roads in Rajkot; major sources of noise are vehicle horns and engine noise, from chakdas and motorcycles in particular. As the number of motor vehicles increases, permitted levels will be exceeded significantly unless measures are introduced such as restrictions on the use of horns, more stringent controls of vehicle exhaust noise, and control of traffic volumes.

29. Urban plantation and afforestation work has been carried out in the city to protect flora and fauna; any transport infrastructure project must take these requirements into consideration.

Economic and financial issues
30. Urban infrastructure and transport projects need financial sustainability to ensure that operating and maintenance costs are covered, and that investment aims are achieved over the project lifespan. The condition of the existing transport infrastructure reflects a funding deficiency which must be addressed.

31. Urban transport projects may be funded in various ways. Rajkot is a beneficiary of the JnNURM programme to encourage reforms and to fast-track planned city developments. Most urban transport infra-structure projects are eligible for JnNURM funding, which is already funding the initial phase of the BRTS. Another exceptional source is the Chief Minister’s Urban Development Scheme, a one-time grant of USD 43.3m. budgeted for 2010/2011 which is intended to help city development projects on the occasion of Gujarat State’s fiftieth birthday. There is no certainty that either of these two sources can continue to make a significant contribution to the city’s resources after the next two years, and there is a pressing need for the city to develop additional ways of financing and sustaining investment projects.

32. Municipal revenue may be an appropriate means of funding for part of the transport system, for example road maintenance and traffic management. The revenue income of RMC has shown more or less static growth during the 2006–2009 period, mainly due to the abolition of octroi in 2007 and a substantial de-cline in various revenue grants. There is a positive growth in the tax sector, however, mainly due to property tax reforms in conformity with JnNURM requirements. Current RMC (revenue) expenditure is growing at an average of 13% a year. General establishment and other administration (including salary and wages of staff) accounted for more than half the current expenditure in 2008/2009 for which data are available. This has left very little money for the operation and maintenance of the core municipal ser-vices.

33. RMC does not have much outstanding debt liability, and its borrowings are regularly being repaid. The debt was reduced from INR 108.2m. to INR 69.0m. between 2006/7 and 2008/9, a favourable trend.

Roads
34. Rajkot has a dense road network with major inter-urban routes designated as either National or State Highways, which enter the city in a radial pattern. The balance of the road
network comprises municipal roads, including the Ring Road, part of which has been built as a four-lane dual carriageway.

35. The rights of way on regional roads vary between about 12 and 66 m; those on city roads vary between 8.8 and 64.4 m, and those on city centre roads between 6.8 and 41.5 m. The CMP of 2007 showed that 60% of the entire road network comprised roads between 3.0 and 4.5 m wide; nearly 18% were only 4.7 to 7.0 m wide. There is often a substantial difference between the right of way width and the effective carriageway width, caused by encroachments such as shrines and utility poles. This is illustrated in Table 2-1, based on data from the 2004 STTIP Report; some roads have been built, and some improvements carried out since the 2004 Report, but most of the data are still valid.

36. The standard of maintenance on many city roads is no more than ‘fair’, whilst on many roads in suburban districts there are numerous deep ruts, potholes and cracked or unmade surfaces. Many pavement surfaces do not reach the edges of the road. An associated problem is the general absence of ditches or drainage inlets along roads. In general the higher level roads are provided with sidewalks on both sides although these are

<table>
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<tr>
<th>Table 2-1: Characteristics of Major Roads</th>
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<tr>
<td>Roads in the Central Area</td>
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<tr>
<td>Length (km)</td>
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<tr>
<td>Canal Road</td>
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<td>Dheerubhain Road</td>
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<td>B’ Road</td>
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<td>Jawaharlal Road</td>
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<td>Kasar-e-Hind Bridge Road</td>
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<td>Palace Road</td>
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<td>Kanta Vikes Road</td>
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<tr>
<td>Laxmiwadi Main Road</td>
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<tr>
<td>Keydawadi Main Road</td>
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<td>Hath Khana Main Road</td>
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<td>Karan Smljni Road</td>
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<td>Jilla Garden Road</td>
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<td>Lakhan Raj Road</td>
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<td>Janana Hospital Road</td>
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<td>City roads</td>
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<tr>
<td>Ring Road</td>
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<td>Mavadi Road</td>
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<td>Raia Road</td>
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<td>Dr. Yagnik Road</td>
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<td>Doodh Sagar Road</td>
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<tr>
<td>University Road</td>
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<td>Sait Kaudi Road</td>
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<tr>
<td>Race Course Road</td>
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<tr>
<td>Amin Road</td>
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<tr>
<td>Regional roads</td>
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<tr>
<td>Morbi Road</td>
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<tr>
<td>Bhavnagar Road</td>
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<tr>
<td>Gondal Road</td>
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<tr>
<td>Kalawad Road</td>
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<tr>
<td>Jamnagar Road</td>
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<tr>
<td>Ahmedabad Road</td>
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<tr>
<td>Kothariya Main Road</td>
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</table>
often narrow (one metre or less). Sometimes these are merely earth road shoulders. Where side-walks are provided they are often not paved or, in shopping areas, local businesses have provided paving for the sidewalks which however frequently results in discontinuities in sidewalk levels from shop to shop.

37. Intersections are the main determinant of urban road network capacity. The vast majority of intersections in the city are uncontrolled; traffic signals are rarely seen working in Rajkot except for some in flashing amber mode, and at three junctions traffic signals have been dismantled despite plans to improve them. During busy periods the traffic police control the signaled intersections together with traffic wardens but this manual control does not appear to be effective in reducing traffic delays. Of 19 intersections which the CMP recommended for improvement, none has been completed according to the recommendations. Even where schemes have been implemented, there is a lack of the road markings and pedestrian crossings that were recommended. In the absence of adequate traffic management or control, intersections are a major cause of traffic delay.

38. There are only three grade-separated road junctions, and a 1.5 km-long flyover is under construction along the Ring Road at KKV Hall, which will lift through traffic above Kalavad and University roads. The CMP proposed additional flyovers, but none of these has yet been built.

39. There are generally no clear priorities at intersections and drivers battle their way through the junctions as best they can. With the future growth in four-wheeled vehicles the queues and delays will grow. The re-cent substitution of roundabouts for proposed signalised junctions cannot be regarded as a long-term solution as most of these roundabouts provide less capacity than signalised junctions.

40. There are six shallow road under-bridges (RUBs) where roads pass under railway lines. These RUBs offer only about two metres of headroom, which restricts their availability to cars, cyclists and motorcyclists, and light vehicles; buses and emergency vehicles are unable to pass. A seventh RUB beneath the Gondal line on Kalawad Road has two twin-lane full-height traffic under-bridges and two pedestrian-an/cycle underpasses. There is a narrow road over-bridge (ROB) where the Jamnagar Road crosses the railway and a long ROB is under construction to lift Gondal Road above the railway in south-central Rajkot.

41. There are at least twelve level rail crossings within the Ring Road, plus several non-gated crossings of lanes and tracks. Several are on major roads, including the Ring Road, which has two. A lack of traffic discipline results in long delays at these crossings.

42. Rajkot does not have a formally adopted functional hierarchy of roads which is essential for effective traffic management. Missing links should be connected to provide a continuous network of primary and district distributors, although any roads or streets which are incapable of handling through traffic should be downgraded to local distributors. Local distributors should not provide direct through routes from one district to another. In special cases, such as Old Rajkot, with its narrow streets, the complete exclusion of motor traffic during business hours should be considered as an appropriate solution.

43. Speed breakers have been liberally applied throughout Rajkot on all but the fastest roads. While they may be favoured because of their traffic calming characteristics, speed breakers are hazardous to cyclists and motorcyclists; bus bodies suffer disproportionate structural damage when buses are repeatedly driven across them, and bus drivers and passengers are subjected to discomfort and sometimes injury. Policy on speed breakers
should be reviewed: other than on local roads in residential areas, speed breakers should be used sparingly, whilst the configuration of existing ones should be examined.

44. Rajkot suffers from a dearth of traffic signs and road markings. The main problems are:

44.1. inadequate coverage – traffic signs are rare in Rajkot;

44.2. inconsistency with Indian and international standard signs; and

44.3. the use of non-standard materials, with rust-prone steel plates, ‘home-made’
sign-writing and poor-quality paint.

45. The proper application and adequate display of traffic signs and road markings would do much to improve traffic discipline and assist in the enforcement of traffic rules by the police.

46. Pedestrian facilities in Rajkot are seriously inadequate. The volume of pedestrians in the city centre is relatively small, although walking remains a major form of travel in the city’s poorer outskirts. Pedestrian crossings are provided but are often not well sited and traffic does not stop for pedestrians. Signal-controlled crossings have been provided at some locations but the signals are invariably out of use. The STTIP Report in 2004 identified fifteen road crossings as presenting a ‘very high risk’ to pedestrians; little has been done to improve the situation at these crossings in subsequent years.

47. Even where they are provided, most sidewalks are too narrow or too obstructed to be of any practical value. Pedestrians typically must walk in the carriageway, where they are at constant risk of injury from moving vehicles. These problems are compounded after dark, when dim or non-existent street lighting renders walking difficult and perilous. Substantial progress is being made on the provision of pedestrian sidewalks, but even when completed, the work fails to meet accepted international standards.

48. Non-motorized vehicles, particularly bicycles, comprise a significant proportion of traffic on Rajkot’s roads, yet there is no special provision for them. All of these road users are obliged to mingle with motor traffic, creating side-friction and placing them at risk.

49. Also the transport infrastructure in Rajkot needs improvement. There is a backlog of maintenance due to lack of funds, shortage of manpower and institutional weaknesses. One of the recommended projects is to make good these deficiencies, but it is essential that provision is made for continuous maintenance to pre-vent a recurrence of the present problems. In addition, any new infrastructure must be adequately maintained. Continuing maintenance is not normally regarded as a project as it is a recurrent rather than capital cost. Nevertheless the value of many infrastructure projects is greatly diminished by a lack of subsequent maintenance, and this should be avoided as far as possible.

50. Street cattle constitute a major traffic problem in Rajkot. An estimated 26,000 cattle in Rajkot wander uncontrolled on nearly all roads, including the main corridors, causing traffic delays and accidents. With-out intervention, the ‘cattle problem’ is likely to worsen as the numbers of both cattle and vehicles in-crease. Measures could include restrictions on cattle ownership, installation of cattle grids across the full width of selected roads to insulate primary and district distributors from cattle altogether, and creating common pasturelands on vacant plots within the RMC and RUDA areas to which cattle could be allocated.
**Road traffic**

51. It is estimated that there are currently about 334 motorized two-wheelers to every 1,000 people and 32 cars per 1,000 people. Growth rates for buses, cars, auto-rickshaws and 2-wheelers in Rajkot District are very high. Available data suggest that:

51.1. 2-wheeler (scooter, motorcycle) growth rates peaked during 2003-2007 and are beginning to slow down;

51.2. car ownership is ‘taking off’ with ownership rates increasing sharply; auto-rickshaw numbers are increasing sharply; and

51.3. the number of buses has leveled off.

52. **Table 2-2** shows the growth rates in vehicle registrations provided by the Regional Traffic Office for the Rajkot District. The rates of growth for buses, cars, auto-rickshaws and two-wheelers are very high. If these growth rates continue for another five years the total number of vehicles will increase by 40% with an increasing proportion of cars and auto-rickshaws. As the number of larger vehicles increases compared with a preponderance of two-wheelers today, the demand for road space will increase drastically with an accompanying increase in traffic congestion unless strategies for managing the road network change.

<table>
<thead>
<tr>
<th>Vehicle Type</th>
<th>1996-97</th>
<th>2000-01</th>
<th>2009-10</th>
<th>Average growth rate/year</th>
</tr>
</thead>
<tbody>
<tr>
<td>HGV</td>
<td>13,750</td>
<td>15,380</td>
<td>22,279</td>
<td>4.2% (2001-10)</td>
</tr>
<tr>
<td>LGV</td>
<td>10,960</td>
<td>17,310</td>
<td>32,318</td>
<td>7.2% (2001-10)</td>
</tr>
<tr>
<td>Buses</td>
<td>1,630</td>
<td>1,870</td>
<td>4,792</td>
<td>11.0% (2001-10)</td>
</tr>
<tr>
<td>Car, Taxi, Jeep</td>
<td>24,500</td>
<td>33,760</td>
<td>79,125</td>
<td>9.9% (2001-10)</td>
</tr>
<tr>
<td>Auto-Rickshaw</td>
<td>4,450</td>
<td>6,080</td>
<td>15,515</td>
<td>9.8% (2001-10)</td>
</tr>
<tr>
<td>Other</td>
<td>24,250</td>
<td>33,240</td>
<td>56,166</td>
<td>6.0% (2001-10)</td>
</tr>
<tr>
<td>2-wheeler (motorised)</td>
<td>250,060</td>
<td>370,580</td>
<td>779,470</td>
<td>8.6% (2001-10)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>329,420</td>
<td>478,820</td>
<td>989,665</td>
<td>8.4% (2001-10)</td>
</tr>
</tbody>
</table>

53. There are probably between 200,000 and 300,000 pedal cycles used in urban Rajkot. Bicycle usage is likely to decrease as the popularity of motorcycles and scooters increases; already, greater use is made of bicycles in the poorer outskirts of Rajkot than in the city centre.

54. A consequence of increasing traffic volume is a likely increase in traffic accidents. Available data do not show any serious rise in accidents over the years, probably because traffic is generally slow moving. However, fatalities are high compared with other cities of similar size.

55. Use of the right of way on Rajkot’s road network is mainly given over to motorized transport to the disbenefit of pedestrians and NMT modes. The physical elements of traffic management are deficient in Rajkot, comprising little more than a few one-way streets, four (non-functioning) signalised intersections and limited road markings and traffic signs. No area or corridor traffic schemes are developed, and ambitions are currently restricted to local remedial measures.

56. Rajkot is now in a situation where the supply of road space cannot satisfy the demands of all road users. The winners at the moment are owners of individual transport
modes (car, scooter) and paratransit operators (three-wheelers) and the losers are the poorest sector of society (who walk or cycle to work or use public transport). The city now needs to formulate an approach for allocating and managing road space which is equitable for all sectors of society.

57. Parking of cars and motorcycles is a serious problem in Rajkot and one that is increasing as car and motorcycle ownership increases. Parked vehicles obstruct roads and sidewalks, impeding vehicle and pedestrian movements and affecting safety. Measures to control on-street parking have been implemented but for various reasons, including inadequate resources and institutional weakness, these are not very effective. Main problems are:

57.1. little control or enforcement of on-street parking; a shortage of purpose-built car parks;

57.2. a lack of any system of charging for vehicle parking;

57.3. insufficient signage and inadequate road markings for on-street parking; and cluttering of sidewalks and streets with parked motorcycles and scooters.

58. Improved management and enforcement of on-street parking is vital for the authorities to control use of the right of way. The imposition of parking charges would have several important benefits:

58.1. It would depress demand.

58.2. RMC would be able to control the distribution of parking and discriminate between short and long stay parkers.

58.3. It would raise revenue for RMC.

58.4. Control of parking cost and supply can be used as a demand management tool.

59. There is a requirement for public off-street parking facilities for both cars and motorcycles to supplement the supply of on-street spaces when effective parking controls are deployed. The provision and operation of off-street car parks is an opportunity for the RMC to use PPPs to supplement the parking supply. Some sites have been identified for the development of public car parks but not all are of sufficient size for car parks which make efficient use of the space: if multi-storey parks are to be constructed on sites with inadequate “footprints” an excessive proportion of the space would be required for access ramps. Some smaller sites may, however, be suitable as exclusive facilities for motorcycle parking, while some sites could accommodate car parking at street level, with motorcycle parking on a single level above it.

60. Rationing parking provision by space, cost or time (or combinations thereof) can be used as a demand management tool to reduce the number of motor vehicle trips. Suitable alternatives must be offered if motorists are not to seek alternative destinations, which means providing an attractive public transport service. A useful compromise is ‘park and ride’, whereby vehicle parks are built outside city centres and journeys are completed by public transport, usually for a fare inclusive of parking and the journey.

61. Driving standards in Rajkot need to be improved. Drivers and motorcyclists practice ‘defensive’ driving, in the sense that they are invariably prepared for conflicts and strive to
avoid collisions. The consequence of this is that traffic speeds are generally low. Driving on the wrong side of the road is commonplace, especially on the approaches to junctions and around roundabouts, and against the flow on dual carriage-ways. The following actions would raise driving standards but this cannot be achieved in the short-term:

61.1. more rigorous driver tuition, education, training and retraining; more demanding driving tests;

61.2. an increase in the numbers of traffic police and traffic wardens;

61.3. an effective way of enforcing traffic violations (which should not be seen as a means of raising revenue in response to predetermined targets);

61.4. an improved driving environment through provision good street surfaces and an absence of livestock; clear information for drivers through provision of traffic signs and road markings; and

61.5. provision of self-enforcing traffic measures to reduce some of the illegal or inconsiderate driving habits.

Public transport
62. Public transport services within Rajkot are almost entirely road-based. External travel also depends heavily on road transport, although three railway routes radiate from Rajkot Junction and there is an air service to and from Mumbai. Public transport within, to and from Rajkot is handled by various organizations and individuals, with various forms of ownership and structure. Internal movements are handled by a small fleet of private-sector buses operating under a RMC concession, plus maxicabs, large numbers of auto-rickshaws, and a relatively small fleet of taxis.

63. Services to external communities are handled by state-owned buses operated by the Gujarat State Road Transport Corporation (GSRTC), private sector buses and the nationalised railways. Rajkot's air services are handled by two airlines, one state-owned and the other private.

Buses
64. Urban bus services within Rajkot are operated exclusively by The Raj City Bus Service (RCBS) under contract to RMC. Its 45-vehicle operational fleet is standardized on medium-sized buses providing accommodation for about 40 passengers. Various types of minibus operate to carry employees of private organizations within Rajkot, including numerous 8-12 seat ‘maxicabs’ and passenger vans: some of these vehicles appear to fill spare capacity illegally with local passengers. Yellow school buses range in size from maxicab-type vehicles to full-size single-deckers.

65. Although the present condition of most of the roads in Rajkot necessitates the operation of robust vehicles such as those currently used, street improvement measures would allow the adoption of more suitable city service buses. The most desirable features in a new bus fleet would be:

65.1. high capacity;

65.2. ‘accessible’ interiors, preferably with low floors; optimal street ‘footprint’;
65.3. durability of chassis, bodywork and mechanical units; and low emissions.

66. RCBS carries 18,000 passengers daily. Its vehicles have ample spare capacity during off-peak hours, but are loaded well beyond capacity at peak times. The CMP projections indicate that daily boardings should have been expected to be about 503,000 in 2010, or nearly 28 times the actual figures: there is clearly enormous potential for more, better bus services. Meanwhile, the demand is being met by auto-rickshaws, whilst the purchase of motorcycles and cars is encouraged by the lack of adequate bus services.

67. RCBS has no identifiable termini: buses turn in the road at the ends of their routes. Passenger shelters are provided at the majority of bus stops, under a PPP contract between RMC and a private sector contractor which provides and maintains the shelters in return for the right to sell advertising space. The shelters are robustly designed, but in most cases occupy the full width of the sidewalks so that pedestrians and bus passengers must walk in the roadway to pass them or to gain access to them.

68. Within Rajkot, the GSRTC’s hub is the State Transport (ST) Bus Stand to the south-east of the city centre. This occupies approximately 1.9 ha and handles 875 scheduled departures daily, but in its present configuration is inadequate for its task, and the bays are often so congested that buses must queue to enter and to exit. GSRTC has plans to redevelop the terminal, incorporating commercial developments, on a PPP basis. Terminal facilities for long-distance bus services operated by the private sector are minimal, and typically occupy unsurfaced roadside plots. Private-sector buses are not permitted to operate within Rajkot between 0900 and 2100: during these hours, they load and unload at four informal terminals points around the Ring Road; some use points along the future BRT track as terminals.

69. The potential for private sector long-distance services is severely limited by the prohibition on operation within the city during the daytime, and the lack of formal terminal facilities. There is no logical reason why public sector, but not private sector buses should be permitted to enter the city at all times, and it would make sense to allow all bus operators to share the same terminal facilities, in order to provide passengers with a wider choice of services and to foster controlled competition between operators, in accordance with international practice.

70. RCBS has a single depot which it leases from RMC. The 5,500 m² site is basic, with no paving or covered buildings for the bus fleet. GSRTC has a depot and workshop in south Rajkot. RUDA has also reserved a 0.78 ha site near Nodhampur Village for a new depot, presumably for GSRTC. The CMP proposes the provision of 12 bus depots and one workshop by 2021 to accommodate the fleet of approximately 1,000 buses required by that time. A depot site has been identified for approximately 40 BRT vehicles alongside the Ring Road, but limitations of the site would impair its efficiency and safety and the depot would not cater for larger buses of suitable design for BRT services.

71. Bus depots should be constructed in phases as the bus service and fleet expands. Initially one new depot with a capacity of approximately 150 buses should be constructed, and the depot currently used by the RCBS and owned by RMC should be upgraded with a concrete surface and adequate administrative and maintenance buildings. Buses for the BRTS service could also use this depot initially. Additional depots should be constructed as required but each should be of approximately 100-175 buses capacity. Depots may be provided by RMC and leased to bus operators, or by the bus operators themselves.
73. There are no bus priorities in Rajkot. Both the operator and the police favour the use of narrow midibuses because they are considered sufficiently manoeuvrable to negotiate Rajkot’s disorganised traffic, but the application of bus priorities, together with other traffic management measures, would improve overall efficiency by permitting the introduction of full-size buses. It is recommended that bus priority schemes should be introduced throughout the city as part of a general improvement in traffic management, and a start should be made as soon as possible on the implementation of bus priority measures.

**BRT proposals**

74. There are plans to develop a three-corridor bus rapid transit (BRT) network in Rajkot with a combined length of 63.5 km utilising dedicated rights of way. The 16.5 km “Red Corridor” will run roughly from east to west, starting at the Kuvadwa Road/Eastern Bypass crossing and terminating to the west of the 150 ft Ring Road at Kalawad Road Octroi Naka. The 18 km “Green Corridor” will serve a NW-SSE axis between the Jamnagar Road/150 ft Ring Road Crossing and Kothariya Road Octroi Naka. The 29 km “Blue Corridor” will follow the Ring Road throughout.

75. Although the Blue Corridor was a late addition to the network, it is being built first. The initial segment between the Jamnagar Road/150 ft Ring Road Crossing and the Ring Road/Gondal Road Crossing comprises a side-fenced and eight-metre wide, bi-directional concrete-slab bus road aligned between the inner and outer carriageways of a dual-two lane road. Construction is expected to be completed in early 2011. Meanwhile, the BRT reserve is extensively used for the parking of trucks, buses and cars, and already some surfaces and fences are prematurely dilapidated. Design work has yet to begin on the Green and Red corridors that will cross the city and penetrate the central area. It is anticipated that the provision of fast buses will be difficult along the congested parts of these routes.

76. The Detailed Project Report for the Rajkot Bus Rapid Transit System anticipated completion of the Red and Green Corridors, and the first phase of the Blue Corridor, by 2009. So far, the only item near to completion is the busway itself. No progress has been made on developing the ‘special purpose vehicle’ that will inaugurate the selection of an operator, and it is understood that no design work has been undertaken on the Green or Red corridors.

77. Proposals for the bus service to use the first segment of the BRT network and the proposed use of conventional single-deck buses hardly meet the criteria for bus rapid transit. The dwell times which have been built into the planning assumptions for Rajkot’s BRT would result in a service barely faster than the existing Raj City Bus Service. Furthermore, unless the BRT bus service is extended into the city centre, the purpose of the BRT link would have to be seriously questioned.

78. The design features of the BRT system as proposed lack most of those that distinguish BRT from ordinary bus services. Specific features of BRT services that should be reconsidered for Rajkot include:

78.1. 18-metre articulated buses;

78.2. multiple doors (preferably four) along the length of the bus;

78.3. (possible) use of central or island platforms, with offside doors on the buses to enable boarding and alighting, although doors would still have to be
provided on the nearside to enable the buses to operate along ordinary streets, where there is insufficient width for a dedicated busway;

78.4. platform level boarding, variously with low boarding platforms and low-floor buses (recommended if BRT services operate on-street as well as on dedicated busways);

78.5. off-vehicle ticketing, using smartcards or coin payments to actuate barriers at the entrance to boarding platforms;

78.6. suitable signage and enforcement measures, and other means to keep non-bus traffic out of busways such as rising bollards, and boom barriers;

78.7. appropriate means of enabling pedestrians to reach bus stops/BRT stations in safety when crossing lateral traffic lanes, such as foot over-bridges or signal-protected pedestrian crossings; and

78.8. specifically in Rajkot, the entrance to every section of busway should be protected by cattle grids.

79. No bus design has yet been confirmed for the BRT route(s): no decision has been taken as to whether the vehicles should be high- or mid-floor, and whether they should load through doors in the normal left-hand position, or on the right side to serve centre island platforms. Even as the choice of buses remains open, kern-height bus boarding platforms are being built in the conventional position to the left of the direction of travel.

80. In the short-term, more efficient bus services can be introduced on all main corridors in the city using ordinary roads, provided that suitable vehicles are used, and that there is a basic framework of traffic management and control, with effective enforcement. Some bus priority measures, and facilities such as passenger shelters at bus stops, may be required, but otherwise relatively little new infrastructure is necessary at this stage.

Motorcabs

81. The Motorcab is designed to carry no more than six passengers. There are two distinct groups: four-wheeled saloon taxis, of which approximately 250 operate in Rajkot, and three-wheeled auto-rickshaws. The majority of three-wheelers comprise small Bajaj-built vehicles designed to seat three passengers plus the driver, and slightly larger Atal Shakti vehicles, designed to carry up to six passengers, but regularly carry illegal loads of up to ten passengers. The latter type is commonly found on informal fixed routes; there are eleven such routes, plus four variants. About 1,000 vehicles are deployed on the fixed routes.

82. The number of auto-rickshaws in Rajkot District is increasing rapidly: by March 2010 there were 15,515, which represented a mean annual increase of more than 20% in each of the previous two years. It is estimated that about 10,000 auto-rickshaws are operating within Rajkot itself. Auto-rickshaws provide cheap, convenient, and readily available public transport, but the vehicles are noisy and a danger to their drivers, their passengers and other road users. The trade lacks proper organisation, and there are no formal facilities such as termini or stands. From an environmental viewpoint auto-rickshaws may pollute the air less now than in the past because many now burn comparatively clean CNG fuel, but their sheer numbers con-trIBUTE to traffic congestion.
83. Rajkot’s ‘auto-rickshaw problem’ is typical of many Asian cities which have become dominated by large numbers of small paratransit vehicles. Attempts to ban them have seldom been successful or popular. The best approach to the problem would be to gradually reduce dependence on auto-rickshaws by improving formal bus services, and to curb the growth in the number of auto-rickshaws by limiting the number of new licences issued each year and strictly controlling their operation by administrative measures.

84. Notwithstanding these recommendations for tackling the auto-rickshaw problem, the decline of this form of transport will be protracted; in the meantime measures should be taken to improve their operation by such measures as dedicated auto-rickshaw stands and the use of taximeters. Ideally, the contraction of the auto-rickshaw trade would parallel the growth of bus services, whilst natural wastage should be able to account for the operatives without any need for widespread retraining programmes.

85. Saloon car taxis currently make a negligible contribution to travel within Rajkot. Taxis are generally acknowledged as an alternative to private car travel, so the inauguration of a proper taxi service within Rajkot should be regarded as a priority.

86. Auto-rickshaws and taxis have a legitimate role in public transport, but primarily for individuals or small groups of people making journeys which cannot conveniently be made by bus. An important objective of an integrated public transport system is to ensure that each sector of the market is served by the most efficient transport mode. This means that high volume traffic should be handled by buses, BRT or LRT, rather than by low-capacity vehicles such as auto-rickshaws, which should be confined to individual point-to-point journeys.

Rail transport

87. The Western Railway serves the entire state of Gujarat, plus portions of neighbouring states. Rajkot Junction Station handles local, express and mail trains, and is the focus of three lines which radiate towards Ahmedabad, Jamnagar and Veraval. The second station at Bhaktinagar is served only by stopping trains on the Somnath line. All routes are single track, constraining their capacity considerably.

88. The passenger train service is probably approaching capacity. Strengthening trains by adding more carriages is not an option, except for a few local trains on the Somnath line: the long-distance passenger trains are already amongst the world’s longest. Longer trains would require platform extensions at every station, and would need greater motive power. Although there is no general intention to double-track local lines, one section of 65 km will be doubled in the relatively near future, which will add more than 60% to the capacity of the section, and enable trains to be accelerated.

89. There is no suburban train service, nor is there any intention by the Western Railway to introduce one. However, a suburban ridership pattern appears to have emerged, partly because Bhaktinagar is an industrial zone that suffers from poor or non-existent bus services. The 2004 STTIP Report recommended that suburban train services should be introduced along all three lines radiating from Rajkot, and that to handle the requirements of both long-distance and suburban trains the track capacity should be increased, presumably by double-tracking.

90. The Western Railway should be encouraged to double-track the line between Ahmedabad and Rajkot, and onwards to Bhaktinagar and Gondal; the Jamnagar line could be considered later. This would enable the operation of more frequent passenger trains, including a basic suburban service, and would assist the expansion of rail freight services.
The adoption of multiple-unit passenger trains could reduce costs and increase system capacity further.

**Civil aviation**

91. Rajkot’s civil airport is owned by the Gujarat Airport Authority and is conveniently located at Govind Nagar close to the city centre. It is currently served by three daily flights to and from Mumbai, one by Indi-an Airlines and two by JetLite, and handles about 20 charter flights and private aircraft every month. It handles about 410 passengers daily.

92. The airport loses money and is subsidised by the State. Its 1,841 m long runway can accept only medium-sized jet airliners, such as those currently operated, and there is limited scope for extension within the existing boundaries, which are constrained by major roads and a rail line at the ends of the runway. It is questionable if there is any immediate demand to expand the number of flights or the range of destinations served. Potentially, the Airport could handle over 120 flight movements per day, although the staff establishment would have to be substantially increased and the terminal buildings would need significant enlargement.

93. There have been calls for an entirely new international airport to serve Rajkot. However, it is difficult to identify the strength of demand for international flights. The existing airport could handle international flights if it were to be provided with customs and immigration facilities.

**Freight transport and distribution**

94. Rajkot’s industrial base is expanding along with its population, and the city has a constant requirement to import raw materials and fuel and to export its finished products, as well as to meet the daily need for foodstuffs and agricultural raw materials.

95. A variety of freight vehicle types and sizes is required to meet these needs, and there is a need for trans-shipment between different vehicle types. Roads must be adequate to cater for freight vehicles, and it may be necessary to control vehicle use on certain roads at certain times, which in turn will influence the requirement for parking. Already, heavy goods vehicles are banned from entering the city between 0900 and 2100, and must enter the prohibited zone outside these hours or must tranship their goods to smaller vehicles.

96. Road freight haulage is handled by a variety of ‘goods carriages’ ranging from conventional two-axle trucks to three-axle vehicles and articulated semi-trailer combinations, the largest of which are five-axle ‘eighteen wheelers’. Performance is often suspected, not only because overloading appears to be routine, but also because prime movers are clearly underpowered for the tasks that they are expected to perform. Within the city, two-axle goods vehicles may operate at any time, and may be seen at various locations in the city, available for hire. The three-wheel chakda is a common goods transport vehicle in Rajkot, and agricultural tractors pulling open trailers are used extensively within the city for carrying general merchandise in addition to agricultural produce.

97. There is no dedicated road freight handling facility in Rajkot, and most goods are handled at the roadside. There is an almost total absence of infrastructure such as rest stops, eateries and motels that has developed in many countries to cater for the haulage trade. The closest approximation to a freight-handling centre for road vehicles is the Marketing Yard adjacent to the Eastern Bypass. This is the main centre for the wholesale handling of vegetables, other agricultural produce and cotton. A feature of the Marketing
Yard is the large number of trucks lined up along the Eastern Bypass service road waiting to enter.

98. Rail freight is probably approaching the limits of capacity within the existing track configuration, and contributes to Rajkot’s economy to a lesser extent than road haulage. About 460 wagons originate from the city every day with capacity for up to 58 tonnes each. The main commodities handled are refined petroleum and diesel spirit, coal, fertilizers and grain. Container traffic is increasing.

99. A 65 km section of line leading to Rajkot is scheduled to be doubled, which will halve the time required for freight trains to traverse the section. Rail freight handling could be modernised, with modern container-handling facilities and the possible provision of an ‘inland port’ facility at the railway freight yard. Major users of rail-borne merchandise could be encouraged to develop private sidings for their own use. The need for modernisation is vital and has been neglected for far too long. It must be borne in mind that regardless of how progressive industry and commerce may be in any city, without proper means to move raw materials and finished products such industries will ultimately be overtaken by competitors elsewhere.

100. Given the very rapid growth of freight transport and road haulage in the Rajkot area, a freight transport study is recommended to establish trends and future requirements, and to make specific recommendations.

Recommended strategy

Public transport improvements

101. Public transport improvements form a major part of the package of urban transport projects required to achieve the vision for Rajkot. The following measures are required:

(a) Short-term

- strengthen enforcement of regulations and compliance with the city bus concession;
- plan and immediately implement improved bus services and reduce the numbers of auto-rickshaws on main corridors;
- develop an initial plan for a supplementary network of bus services throughout the RMC/RUDA area; extend the city bus concession or offer additional concessions;
- introduce bus priority measures, including exclusive busways, bus lanes and bus-only streets; upgrade the bus depot currently used by the RCBS;
- construct a new bus depot located near the Ring Road, in the south-eastern or eastern sectors; and commission a Rajkot Urban Public Transport Master Plan.

(b) Medium-term

- implement medium-term measures which will be specified in the Rajkot Urban Public Transport Master Plan;
• construct additional bus depots in suitable locations in the city in accordance with the Rajkot Urban Public Transport Master Plan;

• upgrade bus services on main corridors to BRT as appropriate; and update the Rajkot Urban Public Transport Master Plan.

(c) Longer-term

• implement long-term measures specified in the updated Rajkot Urban Public Transport Master Plan.

102. Various proposals have been made in the STTIP, CDP and CMP, including the introduction of a Bus Rapid Transit System, which would subsequently be upgraded to light rail. Other proposals include the introduction of metro and monorail lines on main corridors, and a network of street tramways. However, the only significant developments to date have been the introduction of the Rajkot City Bus service in 2007, and commencement of construction of the BRT track on the Ring Road.

103. For most of the city, the principal form of public transport in the foreseeable future will be some form of conventional bus service. Where traffic volumes are high, other modes may eventually be appropriate; the principal options are guided buses, trams (or light rail transit, or LRT) and monorails.

104. Guided buses represent a particular variety of BRT and take two main forms:

104.1. German technology that pioneered lateral kerb guidance with small horizontal guide wheels on the bus to bear against the kerbs; and

104.2. French guided buses that use various types of central guide rail.

105. The French technology has been applied in various places in the last decade, but not with complete success. The German system was developed in the 1980s and was used successfully in Germany, Australia, and in the United Kingdom; it has the advantage of not requiring a full-width black-top or concrete bus road. Kerb-guided buses do not require any special features apart from small horizontal guide-wheels, which can be retracted when not in use.

106. Within the last 30 years there has been a marked revival of interest in tramway or LRT technology. About 150 new systems have been opened, doubling the number of systems in the world. LRT may operate on streets together with other traffic, or on dedicated tracks at street level, underground, or on elevated tracks.

107. Monorails are sometimes regarded as ‘cutting edge’ technology but have no advantages over conventional elevated LRT: a monorail is a particularly awkward type of railway, requiring complex moveable track sections where routes converge and diverge. Moreover, monorail technology is not ‘generic’, unlike BRT, LRT or railways, so the operator is committed to a particular supplier.

108. It is recommended that no firm commitment should be made to any innovative public transport mode, until the proposed long-term public transport plan has examined all alternative mass transport systems to identify the most appropriate system for Rajkot.
109. Formalising the public transport system, as recommended in this Report, will require changes in the structure and ownership of the industry. Formal public transport services, such as bus services or LRT, are most effectively operated by formal organizations, which are also more easily regulated and controlled by government where this is appropriate. Private sector ownership is generally more effective than state ownership through its greater flexibility, and indeed the GSRTC withdrew from the operation of urban bus services in Rajkot three years ago, so that all services are now operated by the private sector. There are economies of scale in the operation of urban bus services, and measures should be introduced to ensure that these are achieved, by limiting the number of operators and applying appropriate criteria for eligibility to operate urban services.

110. Informal operators are generally more efficient for individual modes such as auto-rickshaws and taxis. However, there is no reason why more formal organizations, such as companies owning large fleets of auto-rickshaws or taxis, should not also participate in the market: there is room for both forms of ownership in this sector of the market.

**Infrastructure development**

111. Phase 1 infrastructure development projects will be mainly those required to complement the softer measures, such as improvements to selected road junctions and bridges and other road improvements which are essential in the immediate future, and the construction of off-street parking facilities.

112. It is necessary to improve the condition of the existing infrastructure, where necessary, to a standard consistent with new construction, and to ensure that the use of infrastructure, principally the road system, is optimised through effective management of the road network, traffic and parking, and enforcement of regulations. An effective maintenance regime must also be put in place. Such measures will increase the capacity of the existing system, reduce the requirement for future investment and construction, and provide a firm basis for development. This will require capacity building and development of the institutional and regulatory framework applicable to transport infrastructure and services.

**Road traffic improvements**

113. Two key recommendations will underpin a more effective and equitable use and management of the road network and road transport system, and help to make more effective use of the capacity of the existing network and defer the onset of severe traffic congestion. These are:

113.1. to manage use of the right of way to safeguard its use by pedestrians and cyclists, and to facilitate the use and reliability of public transport vehicles; these actions will necessarily involve some restraint for the use of individual transport modes; and

113.2. to augment and intensify road, traffic and parking management and techniques to support the above, and to lead to safer roads and effective control of traffic congestion.

114. From the above recommendations other more detailed recommendations and actions follow:

114.1. impose parking charges as a means of managing the spatial distribution, amount and duration of parking; the private sector will have a role to play
through the provision off-street car parks and collection of on-street parking charges;

114.2. control cattle on main routes, mainly through the installation of cattle grids;

114.3. more widespread deployment of traffic signs and road markings to aid traffic movement and increase road safety;

114.4. strengthen RMC’s capacity for traffic engineering including routine data collection, monitoring of traffic conditions and analysis of traffic impacts and proposals; better use of modern traffic engineering techniques can also reduce the task for enforcement of regulations by, for example, introducing self-enforcing measures and ITS systems;

114.5. implement stronger intersection controls, in particular through the installation of modern traffic signal equipment; this will include capacity building to strengthen skills in traffic signal analysis and operational design;

114.6. improvement of key traffic routes and traffic bottlenecks (for example sub-standard RUBs);

114.7. implement public transport priority schemes including BRT, bus priorities and bus-only streets;

114.8. implement area traffic management schemes to safeguard the environment, amenity and safety of homogenous areas such as the Old City, residential areas, market areas; and

114.9. improve sidewalks so that they are of sufficient width and clear of obstructions.

Future planning requirement

115. In addition to the Feasibility Study, which will examine in detail all potential projects identified for early implementation, there is an immediate requirement for a detailed Urban Public Transport Master Plan for Rajkot and the surrounding commuter area, to address the following:

115.1. an urban bus route network plan;

115.2. capacity requirements for each route;

115.3. vehicle requirements (number of vehicles and types for each route); fare policy, fare structures;

115.4. fare collection systems;

115.5. integration and appropriate application of various transport modes, specifying the optimal use of such modes as buses/BRT, minibuses, taxis, auto-rickshaws, trams, and a monorail;

115.6. design BRT infrastructure as required; service standards;
115.7. regulatory framework (examine options such as the granting of concessions and licensing); management and monitoring;

115.8. future planning procedures;

115.9. requirement for infrastructure (depots, terminals and bus stops/shelters); design of infrastructure;

115.10. immediate action; and long-term strategy.

116. In addition, there is a requirement for a detailed study of freight transport requirements in Rajkot in order to identify future requirements for infrastructure such as lorry parks, trans-shipment facilities and other facilities for truck servicing and driver welfare, as well as the potential for increasing the volume of freight carried by rail.

**Institutional development and capacity building**

117. Before embarking upon major infrastructure projects such as the construction of new roads or rail-based public transport systems, there are certain fundamental issues which must be addressed. A prerequisite is that there must be the capability within RMC to manage the transport infrastructure and services in Rajkot, and to manage the implementation of the various project packages. The lack of sufficient capability in these areas up to now has been largely responsible for the existing transport problems in the city, and the slow progress in the implementation of earlier plans. If these issues are not addressed, the benefits of major projects will at best be diluted, and at worst will be negated altogether.

118. The principal institutional requirement in the context of this PFS is that there should be the capability within the RMC and other relevant organizations to carry out effectively the necessary tasks to plan, regulate and manage the urban transport system. This activity should include the enforcement of all relevant regulations, maintaining all transport infrastructure and ensuring the successful implementation of the various urban transport projects. At present there are institutional weaknesses which militate against these objectives. If these weaknesses are not rectified, the success of the recommended urban transport projects will be seriously jeopardised. The following measures are urgently required:

118.1. reallocation of responsibilities to make use of existing capabilities;

118.2. training to develop individuals’ capabilities; and

118.3. direct involvement of relevant personnel at all levels in the Feasibility Study, the Urban Public Transport Master Plan and the implementation of all urban transport projects.

**Recommended Phase 1 project packages**

**Geographic considerations**

119. The need for improvement extends throughout the Study area. However, it would be impossible to make available the resources which would be required to address simultaneously all problems throughout the area, and any such attempt is likely to be doomed to failure. Implementation of the projects must therefore be selective in geographic terms.
120. Some projects, such as institutional changes or the development of a bus route network, can be implemented on a citywide basis only. Some, such as area traffic control, must be implemented on an area basis, although the area need cover only a small part of the city. Others, such as sidewalk improvements, surfacing, road signs, junction improvements and drainage, should ideally be implemented together along a corridor so that the combined benefits of the various measures can be demonstrated over an appreciable distance. Measures should be extended 50 metres down all adjoining side streets.

121. “Public Transport Development” is not a discrete project but is a combination of several measures to be implemented under the various packages. Planning and regulating is part of the institutional element, and bus priority measures, busways, etc. fall under road infrastructure or traffic management. The operation of bus services should be by private sector operators, but planned and regulated by RMC; as such it is also an element of institutional development.

122. Whatever is proposed should be doable, manageable, and ultimately replicable throughout the city. It must also be doable quickly so that the benefits of all measures can be realized simultaneously. It must make an impact, and be seen as an example to be emulated elsewhere: the difference, in terms of the benefits, between the selected corridor/area and others must be clear for all to see.

123. It is therefore proposed that the Phase 1 project packages should be implemented on a citywide, area or corridor basis as appropriate. A package of infrastructure projects, for specific locations throughout the city, should be supplemented by a package dealing with institutional and planning requirements. The proposed packages have been discussed and agreed with RMC.

Summary of Phase 1 project packages

124. The projects selected for more detailed examination at the Feasibility Study stage have been grouped together in two packages. The first consists of ‘soft’ measures, focused largely on institutional development and capacity building; the second consists of ‘hard’ infrastructure items. The package of “soft” components is an essential prerequisite to the successful implementation of substantive urban transport infrastructure projects and to the progressive implementation of a long-term urban transport strategy for Rajkot. Each package comprises three distinct components, as follows:

1. Institutional:
(A) RMC and RUDA capacity building;
(B) Urban transport institutional and service development;
(C) Rajkot Urban Transport Plan.

2. Infrastructure:
(A) Improvements on selected main road corridors;
(B) Central area improvement;
(C) Bottleneck elimination.

125. These are described and discussed in detail in Volume 3, but the essential features are summarised below.

Component 1A: RMC and RUDA capacity building

126. This component will develop the capability of RMC and RUDA to provide, manage and maintain urban transport infrastructure and services, through capacity building for officers within the two authorities who have responsibilities in these areas. The project will be
undertaken at all RMC and RUDA offices and would be implemented by RMC, with input by RUDA as required.

127. It is estimated that this project component can be completed within one year. Implementation of some of the measures identified during the course of the project, such as recruitment of staff to fill new positions, or arranging training for existing staff, can commence within the project time frame; thereafter, staff recruitment, training and development will be a continuing process. There is limited potential for private investment although the private sector may be involved in areas such as training and recruitment.

128. It is estimated that the capacity building component will cost approximately INR 9m., plus technical assistance for one year at an estimated cost of USD 400,000. It will also be necessary to purchase additional equipment to meet identified requirements; the cost will not be known until the project has been under way for several months, but it is suggested that approximately INR 35m. should be budgeted for this in the first year.

**Component 1B: Urban transport institutional and service development**

129. This component embraces the establishment of a new Transport Management Department (TMD) within RMC to take responsibility for the planning and regulation of public transport services, and the management of road space and infrastructure in the city. It also includes the planning and introduction of an initial network of urban bus services, which will form the basis of a city-wide public transport system to be introduced in the longer-term, based on the proposed urban transport plan (Component 1C). The project component will cover the entire RMC and RUDA areas and would be implemented by RMC. Other agencies involved would include RUDA, Traffic Police, Rajkot District and Gujarat State, including RTO to help ensure that the TMD objectives can be met.

130. It is estimated that it will cost RMC approximately INR 4m. to set up the Transport Management Department, and that continuing operating expenses, including staff salaries, will be approximately INR 33m. annually. In addition, technical assistance will be needed for first two years, at an approximate cost of USD 400,000.

131. The bus services will be provided by private sector operators. The cost of providing the services will be fully recoverable from revenue from passenger fares: it is not recommended that RMC should subsidise the initial bus services. Fares should be set at a level which is adequate to cover all costs, including a reasonable return on the investment, and the fare structure should be such that all passengers are treated as equitably as possible.

**Component 1C: Rajkot urban transport plan**

132. The most recent comprehensive study of urban transport in Rajkot was the Short-Term Traffic and Transportation Improvement Plan (STTIP) carried out between 2001 and 2004. The STTIP made recommendations regarding public transport, the provision of terminals and the need for parking and other facilities for road freight transport vehicles, but none of these recommendations were specific. Rajkot has grown since preparation of the STTIP, and the requirement for efficient public transport is becoming widely recognised as levels of traffic congestion, and its impact on the environment, increase.

133. RMC has a long-term vision which includes modern forms of rail-based mass transit, but no specific short-term plans or comprehensive long-term strategy. It is necessary to develop a detailed plan for public transport in the city, so that short-term measures will lead progressively towards achievement of the long-term vision. Similarly, the requirements for facilities for freight vehicles must be identified and catered for.
134. An essential component of Package 1 is therefore a comprehensive study of passenger and freight transport requirements in Rajkot, and development of a medium-term plan and long-term strategy for the next twenty years. The plan will cover the RMC and RUDA areas and will be implemented by RMC. Other agencies involved would include RUDA and RTO.

135. It is estimated that the plan will be carried out over an 18-month period. The total cost is estimated at approximately USD 1m., including survey costs. A more precise specification for the project, and hence a more accurate budget, will be determined during the course of the Feasibility Study.

Component 2A: Improvements on selected main road corridors

136. Improvements are required to all main road corridors leading into Rajkot. Mavdi Road has been selected as a pilot project for the implementation of a series of measures on a corridor basis, involving improvements and selected widening to parts of Mavdi Road and the connecting Dhebar Road, together with improvements to bus services, facilities for pedestrians, junctions and management of road space including rationalisation of parking and traffic management. The component will also include traffic management measures in the sections of Gondal Road and Dhebar Road from Mavdi Road north to the city centre.

137. Mavdi Road forms a radial arterial route running NE/SW from Gondal Road to the Ring Road. The corridor commences at Mavdi Gam, outside the Ring Road to the southwest of Rajkot, and follows the line of the Mavdi Road to its junction with Gondal Road. It then follows Gondal Road northwards to its junction with Dr Yagnik Road and Jawahar Road. Shree Dhebarbhai Road (Dhebar Road), which runs parallel to Gondal Road, is also included north of the Mavdi Road/Gondal Road junction.

138. The main features of this component are:

138.1. completion of the road in the Mavdi Gam residential area with access for buses;

138.2. repair and widening of sections of Mavdi Main Road to make it dual carriageway throughout and provision traffic signals at key junctions;

138.3. bus stops to be provided approximately every 400 metres;

138.4. improvements to pedestrian crossings, footways, rationalisation of roadside parking, containment of street vendors and cattle grids on each side-road junction;

138.5. measures to make Gondal Road one-way northbound and Dhebar Road southbound from the 80-foot Main Road to Hospital Chowk;

138.6. bus service plan to be developed;

138.7. invite bus operators to offer to provide the services, and ensure the required service is provided and maintained with performance standards to be laid down; and
138.8. arrangements for buses in both directions to cross the railway on the level, so that bus stops can be located at the junction at convenient location for passengers.

139. The total cost of implementing this component would be approximately INR 332m. It would be implemented by RMC. Other agencies involved would include RUDA, RTO, Traffic Police and Western Rail-way.

140. Project benefits include considerable significant time and operating cost savings for road users, increased mobility, improved safety and improved pedestrian facilities. Reduction in auto-rickshaw traffic, and im-proved traffic flow, will have a beneficial effect on energy consumption and reduce environmental dam-age.

141. Additional road corridors have been identified as high priorities for short/medium-term improvements. These corridors, which have not been surveyed or analysed in detail, are:

141.1. 80-foot Main Road (3.8 km);
141.2. Nanamava Main Road (West of RUB) (2.5 km); Bhavnagar Road (3.9 km);
141.3. Dudhsagar Road (2.2 km); and
141.4. Kotharia Nagar Main Road (2.6 km).

Component 2B: Central area improvement

142. This component would cover an area of approximately one square kilometre, bounded by Jamnagar Road, Aji River, Police Chowki, Balaji Temple, Trikon Bagh and Shree Dhebarbhai Road, and involves the control of access by motorized vehicles into the core of the Old City during the working day, supported by the provision of on- and off-street parking facilities on the fringes of the area.

143. The Old City is a historic area of dense development and areas of intense commercial activity. It has many small shops and markets that suffer poor business as the area is not easily accessible and has poor environmental conditions (dust, traffic including a high volume of motor cycle traffic and parking). It has very narrow lanes that cannot be used by four-wheel vehicles, or, in some parts, by three-wheel vehicles either. Almost all the network of lanes is accessible by motorcycles excepting some locations where there are steps. There are no formal pedestrian footways and all the streets in the area operate as shared space between pedestrians and two- or three-wheeled vehicles.

144. If the area could be made more pedestrian-friendly and accessible to bus passengers, with adequate vehicle parks and auto-rickshaw stands on its periphery, it would be very good for businesses and tourism in the area, which adjoins the attractive location of the Aji River. A footbridge links the area with the opposite river bank, and that side of the river bank could also benefit from more tourists and other visitors strolling across the river.

145. The proposed improvements comprise mainly general road network and traffic improvements to the Old City and adjoining areas including:

145.1. control of entry of motorized vehicles into the inner core area of the Old City between 0900-2100; no three- or four-wheel vehicles would be allowed to enter;
145.2. a reduced amount of parking for two-wheelers within the inner core area at a higher charge compared with now;

145.3. parking would be provided in new car parking structures or surface car parks on the periphery of the Old City at current rates;

145.4. two stretches of road would be pedestrianised;

145.5. bus circulation would be provided for and access roads to the Old City improved; and

145.6. improvement would be made to road surfaces, drainage and pedestrian facilities.

146. Six potential sites for parking developments have been identified which would provide about 1,500 two-wheeler spaces and 245 car spaces. The same locations can also be used as auto-rickshaw stands.

147. There are estimated to be some 25,000 pedestrians in the Old City during business hours Monday to Saturday who would benefit from the improved accessibility to the Old City, the ease of movement within the inner core area and increased safety due to the reduced motorized traffic in the area. The changes in parking arrangements and, in particular, the imposition of parking charges, will generate revenues for the city.

148. The component would cost approximately INR 237.9m. to implement and would be implemented by RMC. Traffic police, residents and businesses located in the area should be consulted during the planning stage.

Component 2C: Bottleneck elimination

149. This component comprises improvements to selected major junctions and other bottlenecks. These are principally junctions where arterial roads intersect but also include a key arterial/sub-arterial road junction where congestion is becoming increasingly severe and a physical ‘pinch point’ where there is a sub-standard railway under-bridge on an otherwise high quality sub-arterial route. Improvements include measures such as junction redesign, installation of traffic signals, control of parking and traffic management schemes.

150. The locations are:

150.1. Jawahar Road/Jamnagar Road (Hospital Chowk);

150.2. Kuvadva Road/Dhebar Road (Mochi Bazaar Chowk); Dhebar Road/Kenal Road (Bhutkhana Chowk);

150.3. Gondal Road/80 ft Main Road (Makkam Chowk);

150.4. Dhebar Road/80 ft Main Road (Nagrik Bank Chowk); and

150.5. Lakshminagar RUB at Nanamava Main Road.

151. Congestion, delays, and restrictions at these locations are severe, and reduce the capacity of the adjacent roads: the proposed improvements will increase capacity and enable traffic to flow more easily through-out the city’s road system. In particular, the
improvements will facilitate the development of high-quality bus services, and improve access for emergency vehicles.

152. The component would cost approximately INR 137.2m. to implement, of which INR 27m. is for the junction improvements and INR 110 is for the improvement to the road under-bridge. It would be implemented by RMC; other agencies involved would include Gujarat State (Bhavnagar Road is SH 42) and the Traffic Police.

**Phase 2 and subsequent projects**

153. Later phases of the long-term programme will see the implementation of other projects identified in the CMP, and others identified subsequently.

**Results of the economic and financial analysis of the proposed investment projects**

154. The economic project analysis indicates that the investment proposals considered under the different project packages are economically viable, with the calculated EIRR values exceeding the economic opportunity cost of capital.

155. The sensitivity analysis has demonstrated the robustness of this result, and the subproject component remained economically viable even when the combination of all changed assumptions was tested.

156. Among the investment proposals considered, only the parking component under ‘Central Area Development’ is amenable for user fee charges. Hence this parking component was subjected to financial feasibility analysis under the present project. The parking investment proposal is found to be financially viable with a combined IRR of ~10% for the total investment proposal. This FIRR is higher than the weighted average cost of capital and the sensitivity analyses underline the robustness of this result even under unfavourable scenarios.