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CONSULTING ENGINEERS LIMITED

Client:	**Maharashtra Urban Infrastructure Development Company Limited (MUIDCL)**
Project:	**Preparation of City Mobility Plan for Sangli-Miraj-Kupwad Municipal Corporation**
Project No.:	C1112502
Title:	Draft Final Report
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0 Executive Summary

City Mobility Plan for Sangli-Miraj-Kupwad Municipal Corporation

Maharashtra Urban Infrastructure Development Company Ltd (MUIDCL) awarded the project titled "*Preparation of City Transport/Mobility Plan (CCMP) for Sangli – Miraj - Kupwad Municipal Corporation Area*" to **L&T Rambøll Consulting Engineers Limited (LTR)** vide letter no. MUIDCL/SMKCMC/CCMP/432/2011 dated 26th April, 2011.

The objective of current study is to prepare a comprehensive mobility plan for S-M-K CMC Area for the period 2012-2031 in line with National Urban Transport Policy, 2006 and identify a practicable and effective investment programme up to 2031.

Consultants have commenced the study in the month of May, 2011 and completed the study by March, 2012. The current report is Draft Final Report. The aim of the study is to forecast travel demand and recommend short, medium and long term transportation strategy for SMK-CMC and identify transportation improvement proposals up to 2031.

Sangli-Miraj-Kupwad Municipal Corporation at a glance…

- The Sangli-Miraj-Kupwad City Municipal Corporation (SMK-CMC) is located between latitude 16-15` North and longitude 74 – 36` East in the Western Maharashtra region. It is the headquarters of Sangli District.
- The area of SMK-CMC is 118.18 Sq. Km. and the population is 5.03 Lakh as per 2011 census. The population density is 43 persons/ hectare. Around 8% of S-M-K city population lives in 40 slum pockets in the city spread over an area of about 0.166 Sq. Km.
- The major economic base of the S-M-K city is Sugar factories, MIDCs, Agriculture produce market, dairies, banking and marketing etc.
- SMK-CMC is well connected by State Highways (MSH-3, SH-138, SH-10 and SH-75) with other parts of the state such as Kolhapur, Pune, Karad and Satara etc. It is about 430 km from Mumbai, 750 Km from Bangalore and 220 Km from Pune.
- The city is about 40 Km from NH-4 (Mumbai-Kolhapur-Chennai Highway) which is a part of Golden Quadrilateral meeting MSH-3 (Ratnagiri-Miraj-Nagpur Highway) at Shiroli village near Kolhapur and SH-138 (Peth-Sangli-Miraj-Vijapur Highway) at Peth Naka.
- SMK-CMC is linked by rail to Mumbai, Delhi, Bhopal, Pune, Goa, Bangalore, Mysore, Cochin, Nagpur and Chennai (Tirupati) at Miraj railway junction. Four railway lines are passing through Miraj junction. Miraj-Pune, Miraj-Kolhapur and Miraj-Belgum are the Broad Gauge lines where as Miraj-Latur is the narrow gauge line.

Figure 0-1 Study Area i.e. Sangli-Miraj-Kupwad Municipal Corporation

Landuse and Demography

Total area of S-M-K CMC is 118.18 sq.km. For planning purpose the entire area of 118.18 Sq.Km is divided into 4 sectors (74 wards) and the details are presented in **Table 0-1.**

Table 0-1 Sectors and Area

S. No	Planning Unit	Area (Sq.Km)	% of Area
1	Sangliwadi	14.05	11.9%
2	Sangli	33.28	28.2%
3	Miraj	45	38.1%
4	Kupwad	25.85	21.9%
	Total Area	**118.18**	**100%**

The current breakup of land use of study area based on Development Plan is presented in **Table 0-2.**

Table 0-2 Broad Current Breakup of Land use of SMK CMC

Landuse	Area in Sq.km.	% of Area
Developed Area	39.5	**33.4%**
Area under Agriculture	58.71	**49.7%**
Water Bodies	1.58	**1.3%**
Vacant Land	18.38	**15.6%**
Total Area	**118.18**	**100.0%**

It can be observed that 50% of the land is under agriculture use followed by Developed Area which constitutes 33% of the total area. Detailed breakup of Existing Landuse is presented in **Figure 0-2**. Area under residential use is 15.88% followed by area under Transport & Communications is 9.18%.

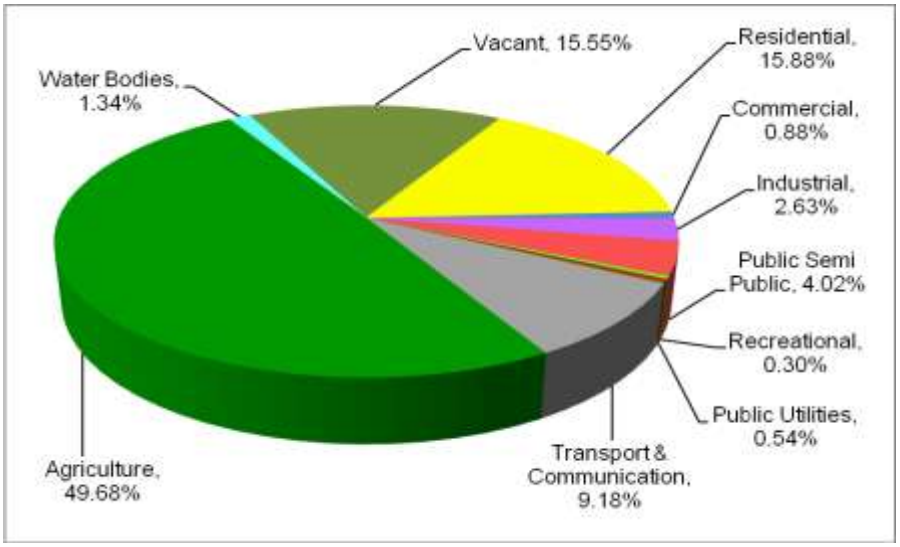

Figure 0-2 Existing Landuse as per Draft Development Plan of SMK-CMC (2011)

Population

SMK-CMC has a population of 5.03 Lakh as per the 2011 census with a decadal growth rate of 15.1%. The decadal growth during 2001-2011 was low compared to that of the past decades. It is observed that the decadal growth rate of population during 1991-2001 was 33.9%, which has dropped to 15.1% in the decade 2001-2011. Consultants have made population projections for two scenarios which are presented in **Table 0-3.**

Table 0-3 Population Projections for SMK City (for Two Scenarios)

Year	Most Likely Scenario		Optimistic Scenario	
	Population	Decadal Growth Rate	Population	Decadal Growth Rate
2011	502697		502697	
2021	580804	15.54%	634652	26.25%
2031	658910	13.45%	745587	17.48%

Employment

The total Employment as per 1991 and 2001 census is provided in **Table 0-4.**

Table 0-4 Total Employment in SMK-CMC as per Census

Year	Total Employment	Population	Worker Participation Ratio (WPR)	Decadal Growth %
1991	110902	351917	31.51%	
2001	139998	436781	32.05%	26.24%
2011	161936	502697	32.21%	15.67%

Total employment in the city for future decades is projected based on the work force participation ratio (WPR). Based on trends in other medium sized cities, the worker participation ratio will increase in future decades. Based on review of similar cities, the Worker participation ratio for 2021 and 2031 is likely to be 32.61% and 33.01% respectively. The employment thus worked out to be 1.9 Lakh and 2.2 Lakh respectively.

The share of service employment in 2011 is 39.67%. The future share of service employment for 2021 and 2031 is 42.69% and 45.55% respectively. The distribution of employment by category in S-M-K CMC area is presented in **Table 0-5.**

Table 0-5 Category-wise Employment Distribution in SMK City

Year	Most Likely Scenario				Optimistic Scenario			
	Employment Category			Total Employment	Employment Category			Total Employment
	Industrial	Trade	Employment Category		Industrial	Trade	Employment Category	
1991	NA	NA	NA	110902				
2001	48780	35849	55369	139998				
2011	56123	41569	64244	161936	56123	41569	64244	161936
2021	62365	46193	80861	189420	68147	50476	88358	206982
2031	68039	50396	99094	217529	76989	57025	112129	246144

Vehicle Registration Data

There are around 1.85 Lakh registered vehicles in Sangli city (31st March, 2011) in which two wheeler are 1.41 Lakh, followed by 19,149 four wheelers, 5,481 Auto rickshaws and 904 buses. In addition to above around 8,877 Goods vehicles are registered in Sangli-Miraj-Kupwad city. The proportion of registered vehicles in Sangli City and Sangli Rural is 40% and 60% respectively. The proportion of two wheelers is 76% of the total registered vehicles.There is no variation in the growth trend of registered motor vehicles between 2008 and 2010 and the average yearly growth rate in S-M-K- City is around 3%. However, there is a steep rise in the growth of registered vehicles of about 58% between the years 2010 and 2011.

Vehicles in Operation in SMK CMC

The residents of SMK City own are 68,587 two wheelers and 3,575 cars as per household survey. The total vehicles (Two wheeler and Car) are worked out to be around 72,161 in base year (2011). It can be observed that total vehicles operating within in SMK City is less as compared to registered vehicles collected from RTO. This is due to the fact that data collected from RTO is a cumulative value of vehicles registered over a decade and therefore does not reveal the number of vehicles in operation at present.Moreover the registered vehicles will not take into account vehicles that are scraped and no longer in use.

Vehicle ownership forecast is made taking into account motorization achieved in other metropolitan cities of India. Based on above estimates, vehicle ownership will reach 1.4 Lakh by 2021 and 2.3 Lakh by 2031.The vehicle ownership forecast have been presented in **Table 0-6**.

Table 0-6 Forecast of Vehicle Ownership for SMK City

Year	Population	2-Wheeler	Car	Total	2- Wheeler per 1000 population	Car per 1000 population
2011	502697	68587	3575	72161	136	7
2021	580804	117156	7032	124188	202	12
2031	658910	190835	12593	203428	290	19

Household Characteristics in the Study Area

- Average household size 4.35
- Average household income Rs. 9084
- Average vehicle ownership per household 1.80 vehicles including cycle and 0.74 vehicles excluding cycle
- 92% of Households owns at least one vehicle (Cycle, Two Wheeler and Car). About 74% of the households are having atleast one cycle. 54% of households own atleast one two-wheeler and 3-wheeler households own atleast one car.
- Proportion of household expenditure on travel is 10.11% of total household income
- Average number of earners per household 1.40
- Average number of students per household 1.29
- Overall 91% of the total population is literate. Majority of the population (41%) in the study area has Secondary School education followed by 21% of the population has Primary School education. Graduate and higher and professional qualified population accounted for 13%.
- Distribution of employment by employment sector reveals that service sector employs 40% followed by trade & commerce 9% and construction & manufacturing employees 29%. Employment in Agriculture is around 6% only.
- The estimated work force participation ratio (WFPR) in the study area (from household survey) is 32%.

Traffic and Travel Characteristics

Cordon Survey Results

- On an average 94,449 vehicles (1,07,931 PCUs) move in and out of S-M-K City Municipal Corporation every day. Major State Highways namely Sangli-Kolhapur Road and Miraj-Pandharpur Road carries 23% and 10% of the total traffic respectively.
- Proportion of through traffic in Goods vehicles is around 33% and proportion of through traffic in passenger traffic is 22%.
- Average share of private modes, Public Transport (Bus & Mini Bus), Goods Vehicles and Slow moving Vehicles are 68%, 5%, 18% and 10% respectively. Slow moving share is the highest on Miraj-Shirol Road with 24% in total traffic.

Screen Line Results

- Around 1.60 Lakh vehicles (3.55 Lakh commuters) are crossing East-West Screenline and 0.57 Lakh vehicles (1.46 commuters) are crossing North-South Screenline/cut points.
- The analysis of traffic composition reveals that private modes are contributing 67% and 50% of the total traffic at North-South Screenline and Cut points.
- Public transit modes contributed only 4.9% and 3.4% at north-south Screenline/cut points, which clearly indicate the low level of public transport in the city. Share of Goods traffic was observed to be 13.0% and 15.7% whereas share of slow moving vehicles (cycles, cycle rickshaw and animal drawn) constitutes 8.8% and 10.2% in the total traffic of north-south Screenline and cut points, which is significant.
- Among all the locations Goods traffic was observed to be comparatively high at Islampur bypass road (26.9%) and Sangli-Miraj highway (16.1%).
- Peak hour traffic varies between 7.9% and 14.8% of the total traffic on Screenline.

Speed and Delay Survey

- Based on speed and delay survey, the average speed on core network is 24 Km/Hr and on other parts of network it is 33.11 Km/hr. In general, delay is due to presence of signals, congestion due to illegal parking, encroachments and movement of pedestrians along with the vehicles in the carriageway.

Existing Travel Demand

- Number of trips performed by residents of the S-M-K CMC area is around 7.68 Lakhs per day.
- The overall Per Capita Trip Rate (PCTR) observed in the study area is 1.53, while the vehicular PCTR (excluding walk) is 0.83.
- The distribution of trips amongst different modes shows that the share of Two Wheelers trips is (17.89%) and ST Bus Trips (3.38%).Share of Non-Motorised mode (Walk and Bicycle) accounts for 69.60%. Auto accounts for of 4.88% of total trips.
- Trip distribution by purpose of travel shows that work & business and education trips account for 34% and 28% respectively. Shopping trips account for 25% of total share of trips.
- The average trip lengths observed are 2.83 km and 4.25 km including and excluding walk trips respectively. Trip Length Frequency Distribution (TLFD) shows that majority of the trips has trip lengths between 1 km and 4 km (84%) including walk.
- Analysis of the data for average trip length (ATL) shows that walk trips have an ATL of 1.17 km, two wheeler trips 4.93 km and car 5.47 km. Average trip cost for Two wheeler, Auto and Car is Rs.10.71, Rs.22.61 and Rs.31.57 respectively.

Travel Demand Forecast

Travel demand forecast has been done for two urban scenarios and three network scenarios. Considering the various urban and network scenarios consultants have arrived at six scenarios for horizon year modelling. They are:

- **Scenario 1**: Most Likely Urban Scenario + Do Minimum Network Scenario for the years 2021, 2031
- **Scenario 2**: Optimistic Urban Scenario + Do Minimum Network Scenario for the years 2021, 2031
- **Scenario 3**: Most Likely Urban Scenario + Do Something Network Scenario for the years 2021, 2031
- **Scenario 4**: Most Likely Urban Scenario + Do Something with Bypass Network Scenario for the years 2021, 2031
- **Scenario 5**: Optimistic Urban Scenario + Do Something Network Scenario for the years 2021, 2031
- **Scenario 6**: Optimistic Urban Scenario + Do Something with Bypass Network Scenario for the years 2021, 2031

The estimated future trips for the Scenario 1 (Most Likely urban + Do Minimum scenario) is presented **Table 0-7.**Total trips made by the residents of Sangli in 2011 are 6.87 Lakhs (excluding intrazonal trips) and this is expected to increase to 13 Lakhs by 2031.

Table 0-7 Estimated Future Trips

Year	Private	Bus	IPT	Walk	Total♦
2011	234589	137426	62814	252324	**687153**
2021	356972	240374	82228	285154	**964728**
2031	539791	399139	108862	318221	**1366013**

♦ *Excluding intra-zonal trips*

Transportation Improvement Proposals

Transportation Improvement proposals are suggested taking into account present and future travel demand. Improvement proposals are broadly classified into three categories based on the time horizon.

- Short Term Improvement Proposals (2012-2014)
- Medium Term Improvement Proposals (2015-2021)
- Long Term Improvement Proposals (2021-2031)

Short-term Improvement proposals includes Junction Improvement, Traffic Management schemes, pedestrian facilities,Signages & markings,Signalisation of Junctions, enforcement etc.Medium and Long term Improvements includes road widening, Construction of New roads, construction of ROB/RUB, construction of Bypasses, Public transport proposals, Cycle tracks, pedestrian facilities and Truck terminals etc.The estimated total cost of Improvement proposals till 2031 is **Rs 441.37 Crore** (at 2012 prices).Most of the proposals are expected to be implemented by 2021.

Estimated Cost of Implementing Master Plan Proposals

Sl. No	Item	Period of Implementation	Estimated Cost in Crore Rs.
1	Short-term Improvement	2012-2014	9.97
2	Medium-term improvement – Phase I	2012-2015	170.2
3	Medium-term improvement – Phase II	2016-2021	244.1
4	Long-term improvement Proposals	2022-2031	17.1
		Total	**441.37**

It is obvious that huge investments are required for implementation of proposals. The various sources of funding are:

- State Government (through grants and other concessions)
- Central Government (JNNURM funding from Government of India)
- Private-public partnership (PPP) mode
- Innovative Sources of Resource Mobilisation such as Real estate development, Municipal Bonds, Advertising Revenue etc.

Environmental and Social Issues

S-M-K is home to many industries, especially in sectors of Sugar, Turmeric, Fertilisers, Chemicals, Machinery tools etc. The environmental pollution that arises due to industrial activities is Water Pollution, Air Pollution, and generation of Hazardous waste & Noise Pollution. Organic Pollutants are mainly generated from distilleries, sugar, pulp, paper, food Processing, textile and pharmaceuticals. There are currently 1149 Industries located in SMK out of it 835 industries are in operational (Source: MIDC Office)

The analysis of noise quality data in S-M-K during 2010-11 shows that the Average Sound level dB (A) Leq during the survey ranged from 44 dBA to 66 dBA, which fall under safe limits. All the emissions are observed to be within the permissible limits. Nox is slowly approaching the permissible levels.

Institutional Issues

Implementation of a Comprehensive Mobility Plan is an opportunity to identify and strengthen the institutions responsible for planning, development, operation and management of the ***city transport system*** and build capacity in them to take up the programmes under the short term and long term plan, policies and programmes through public institutions on/or private sector participation. The existing institutional framework should be improved for the implementation of the urban transport proposals and is discussed below.

- The institutional capacity of SMK CMC to implement large projects is constrained and therefore they would invariably need support from other state level organisations such as MSRDC, PWD and MSRTC. SMK-CMC needs to strengthen in-house professional capacity to undertake planning, design and implementation of large scale transportation projects.
- SMK-CMC should maintain the database related to urban transport and socio-economic parameters for planning purpose.
- SMK CMC should appoint one Traffic Engineer who will be responsible for planning, design, implementation and co-ordination with all other organisations such as Traffic Police, MSRTC etc. The responsibilities of Transport Planner/Traffic Engineer are listed below:
    - to coordinate the planning and design of traffic and transport plans
    - to assist in the development and implementation of local transport policies
    - to plan, design and implement public transport and general traffic improvement schemes
    - to draw up and implement traffic regulations concerning the utilization of road space by different vehicle types and pedestrians
    - to maintain traffic signs, carriageway markings and traffic control devices
    - to monitor vehicle and pedestrian movements
    - to develop traffic schemes of a temporary or experimental nature
    - SMK CMC shall endeavour to invite, encourage and facilitate private sector participation in development of transport infrastructure. Transport terminals and facilities for inter modal integration and all associated infrastructure such as bus-bays, pedestrian and parking facilities are good candidates for private sector participation. Experience with privatization of bus services is mixed, but it is established that bus services can be privatized at affordable fares and the need for capital and revenue financing by the MSRTC can be eliminated.

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1 Introduction

Maharashtra Urban Infrastructure Development Company Ltd (MUIDCL) awarded the project titled "*Preparation of City Transport/Mobility Plan (CCMP) for Sangli – Miraj - Kupwad Municipal Corporation Area*" to **L&T Ramboll Consulting Engineers Limited (LTR)** vide letter no. MUIDCL/SMKCMC/CCMP/432/2011 dated 26th April, 2011.

The objective of current study is to prepare a comprehensive mobility plan for S-M-K CMC Area for the period 2012-2031 in line with National Urban Transport Policy, 2006 and identify a practicable and effective investment programme up to 2031. The current report is the draft final report which covers analysis of traffic surveys, travel demand forecast, suggestions for short term, medium term and long term improvement proposals etc.

1.1 About the City

1.1.1 General

The Sangli-Miraj-Kupwad City Municipal Corporation (S-M-K CMC) is located between latitude 16-15` North and longitude 74 – 36` East in the Western Maharashtra region as shown **Figure 1-1**. It is a head quarter of Sangli District. The city has a flat terrain with general slope towards Krishna River flowing along the West side of the city. This region lies in Deccan Plateau. The average level of the city is about 549 MSL. The average annual rainfall is 600 mm.

1.1.2 History

Sangli has a long pre-independence history dating back to 1799 as a capital of a separate State. The Sangli Municipality was established in the year 1876 with a population of about 4,500. Sangli was a princely state before merger into the Indian Union in 1948. This state was ruled by the princely family of Patwardhans. The old fort Ganesh Durg, adjacent buildings, the grand temple of Lord Ganesha and the Museum are all gifts of the royal family of Patwardhans to this city. Chintamanraje Patwardhan of the same family was a ruler of vision. He promoted this city as a major business centre in India. Sangli is famous for turmeric and jaggery trade.

The name Sangli means *"The city of six lanes".* The city also has a rich cultural heritage. This city is the origin of Marathi Drama. Sangli is also known as Natyapandhari, The birth place of Marathi Drama. Vasantdada Patil, former Chief Minister of Maharashtra, brought Sugar industry to Sangli which is the largest in Asia.

Miraj Municipal Council was established in 1875. It is a major railway junction and a major Healthcare centre with reputed hospitals like Cancer Hospital, Wanless Hospital, Mental Hospital, etc. Both Sangli and Miraj Municipal councils were merged in Indian Union in 1947. Kupwad Gram Panchayat is situated between Sangli and Miraj with a large industrial area being developed by Maharashtra Industrial Development Corporation (M.I.D.C).

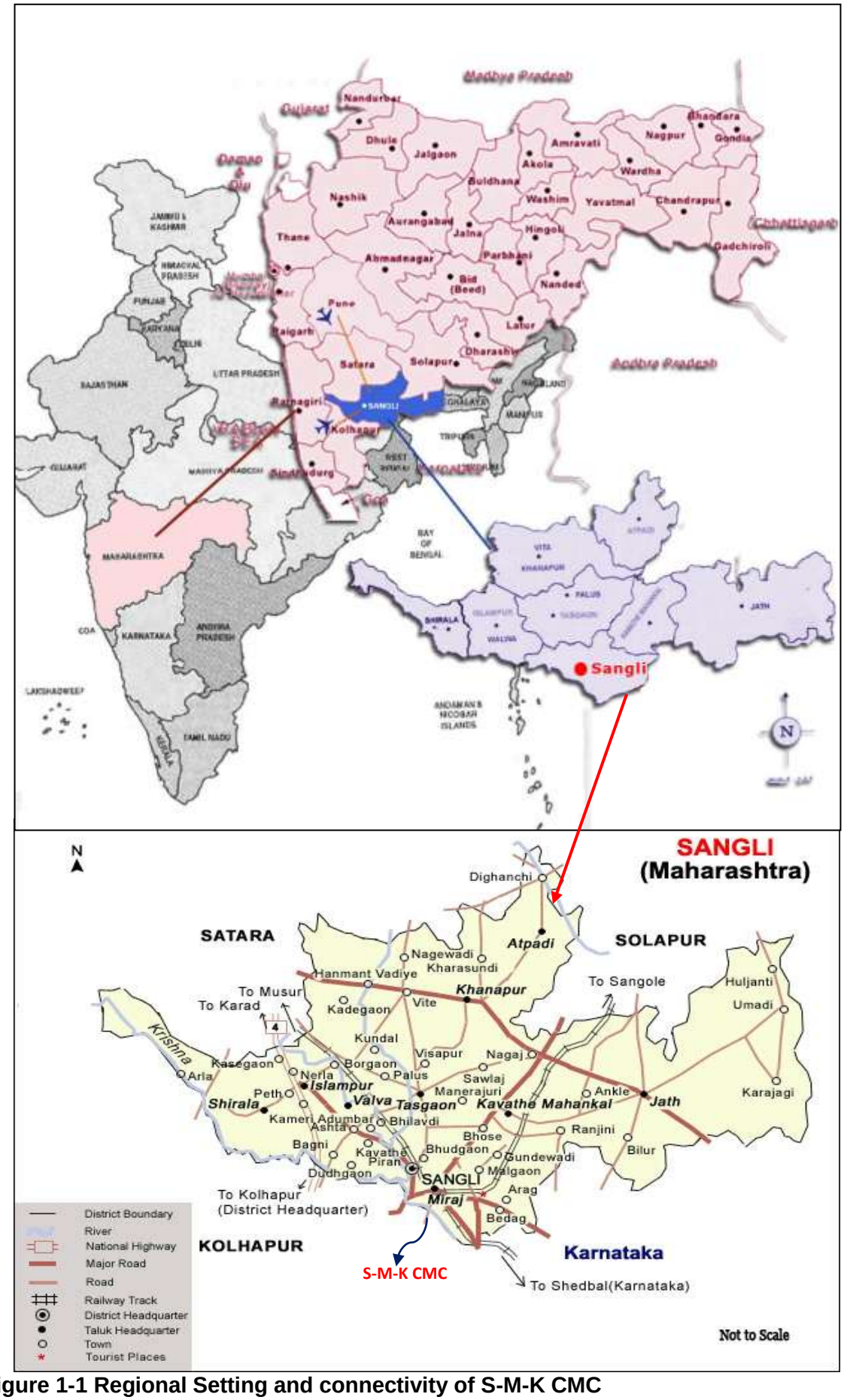

Figure 1-1 Regional Setting and connectivity of S-M-K CMC

Sangli-Miraj-Kupwad City Municipal Corporation (S-M-K CMC) was formed by the Govt. of Maharashtra by merging Sangli and Miraj Municipal Councils and Kupwad Gram Panchayat on 9th February 1998. The population of Sangli was 1.15 lakh in 1971.

1.1.3 Demography

The area of S-M-K CMC is 118.18 sq. km. and the population was 4.38 lakh in 2001. As per latest 2011 census, the population of S-M-K CMC is 5.03 lakh with population density of 43 persons/ hectare. Around 8% of S-M-K city population lives in 40 slum pockets in the city spread over an area of about 0.166 sq. km.

1.1.4 Economy

The initial major economic base of the S-M-K city was Agricultural Produce Market and other such activities related to agriculture. The development and spread of co-operative movement in the sectors of sugar factories, dairies, banking, marketing and establishment of industrial areas has resulted in the diversification of economic base of the city into trade, industry and services. Sangli-Miraj MIDC industrial area is the developed and planned industrial area in the city where as Kupwad MIDC is near to the city spreading over a large area.The city is also a centre for educational activities and facilities.

Madhavnagar famous for its cotton mills is just 4 km from Sangli. Tasgaon and Ashta are the nearest towns to S-M-K city. Tasgaon is known famous for raisin making and also has sugar factory. Islampur and Shirala talukas are within 50 km radius towards Satara. Islampur is famous as trading center and is the head quarter of Walwa taluka. Iron goods factory (agricultural implements) are made at Kirloskarwadi. There are sugar factories in Sangli, Khanpur, Atpadi, Kavthemahankal, Sirala and Walva talukas. Kolhapur is the nearest district town from the study area and is about 50 km and has around 7 industrial areas. Belgaum is the major city in Karnataka located at a radial distance of 125 km from S-M-K city. Bijapur and Bagalkot (where several cement factories are located) in Karnataka are also within 125 km radius from S-M-K city.

1.1.5 Road and Rail Connectivity

S-M-K CMC is well connected by State Highways (MSH-3, SH-138, SH-10 and SH-75) with other parts of the state such as Kolhapur, Pune, Karad and Satara etc. It is about 430 km from Mumbai, 750 km from Bangalore and 220 km from Pune. The city is about 40 km from NH-4 (Mumbai-Kolhapur-Chennai Highway) which is a part of Golden Quadrilateral meeting MSH-3 (Ratnagiri-Miraj-Nagpur Highway) at Shiroli village near Kolhapur and SH-138 (Peth-Sangli-Miraj-Vijapur Highway) at Peth Naka.

S-M-K CMC is linked by rail to Mumbai, Delhi, Bhopal, Pune, Goa, Bangalore, Mysore, Cochin, Nagpur and Chennai (Tirupati) at Miraj railway junction. Four railway lines are passing through Miraj junction. Miraj-Pune, Miraj-Kolhapur and Miraj-Belgum are the Broad Gauge lines where as Miraj-Latur is the narrow gauge line.

1.2 Objective of the Study

The objective of current study is to prepare a comprehensive mobility plan for S-M-K CMC area for the period 2011 - 2031 in line with National Urban Transport Policy, 2006, which focuses on the mobility of people and not vehicles and on the need for promoting safe pedestrian movement, bicycle movement and public transport, integration of land use and transport planning.

1.3 The Study Area

The area covered by S-M-K City Municipal Corporation (S-M-K CMC) is 118.18 Sq Km. The Study Area Map is presented in **Figure 1-2**.

1.4 Scope of the study

Scope of the present study is as follows:

i. Study of existing and proposed land use pattern, transport network pattern

ii. Identifying travel pattern of residents of the local planning area

iii. Selecting, developing and building an Urban Transport Planning (UTP) model using state of the art modelling techniques and software package, appropriate to the conditions and planning needs of the study area

iv. Assessing the relevance of the existing strategy, identifying the consequences of pursuing alternative transportation strategies and recommending / updating a short term, medium term and long term comprehensive transportation strategy for the study area up to 2031 based on evaluation of various alternatives

v. Preparing strategies for transport policy and parking policy as an integrated part of urban planning

vi. Identifying, for all modes, a phased program of appropriate and affordable investments and policy proposals and also integration of various modes of mass transits as well as public transport with IPT

vii. Assessing existing infrastructure requirements and forecast short term and long term requirements

viii. Recommending institutional mechanism

ix. Transfer all data, planning model / tools and knowledge obtained through this exercise to agencies such as Sangli – Miraj - Kupwad City Municipal Corporation (S-M-K CMC), local bus transport agency, traffic police, Regional Transport Authority (RTA).

1.5 Organisation of Report

The report is divided into the following chapters:

Chapter 0 Executive Summary

Chapter 1 Introduction

Chapter 2 The City and its Growth

Chapter 3 Traffic Surveys and Travel Characteristics

Chapter 4 Travel Demand Modelling and Forecast

Chapter 5 Transportation Improvement Proposals

Chapter 6 Cost Estimates

Chapter 7 Financial Analysis

Chapter 8 Preliminary Environment Impact Assessment

Chapter 9 Institutional Arrangement for Urban Transport

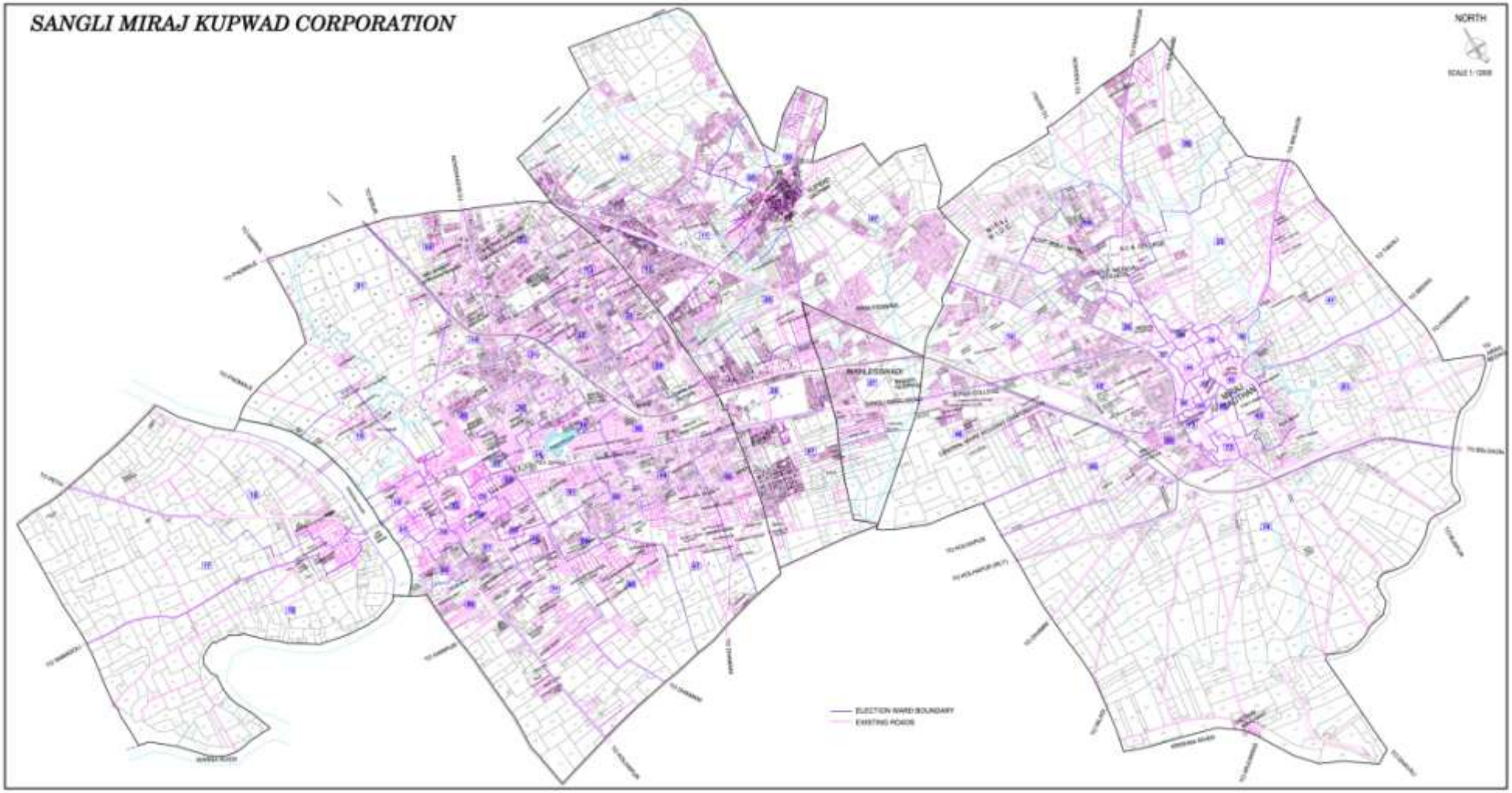

Figure 1-2 Study Area and Road Network Map

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Rev.	**Date**	**Details**	**Init.**	**Sign.**	**Init.**	**Sign.**	**Init.**	**Sign.**
			Prepared		**Checked**		**Approved**	

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2 The City and its Growth

2.1 The City

The Sangli-Miraj-Kupwad City Municipal Corporation (S-M-K CMC) is located between latitude 16-15` North and longitude 74 – 36` East in the Western Maharashtra region. It is a Head Quarters of Sangli District. The city has a flat terrain with general slope towards Krishna River flowing along the West side of the city. This region lies in Deccan Plateau. The average level of the city is about 549 MSL. The average annual rainfall is 600 mm

The Sangli Municipality was established in the year 1876 where as Miraj Municipal Council was established in 1875. Sangli-Miraj-Kupwad City Municipal Corporation (S-M-K CMC) was formed by the Govt. of Maharashtra by merging Sangli and Miraj Municipal Councils and Kupwad Gram Panchayat on 9th February 1998. The population of Sangli is 1.15 lakh in 1971. With population growth and merging of 3 towns of Sangli, Miraj and Kupwad, the S-M-K City Municipal Corporation was established in 1998. The area of S-M-K CMC is 118.18 sq. km. and the population was 4.38 lakh in 2001. **As per latest 2011 census, the population of S-M-K CMC is 5.03 lakh with population density of 43 persons/ hectare**. Around 8% of city's population lives in 40 slum pockets in the city spread over an area of about 0.166 sq. km.


Ganesh Temple - Sangli

Sangli-Miraj-Kupwad City Municipal Corporation (S-M-K CMC) Area is divided into 74 wards. The major localities in the city are Civil Hospital, Raajwada, Khanbagh, College Corner, 100 ft Road, Vishrambagh and Laxmi Market.

2.2 Landuse

2.2.1 Landuse of S-M-K CMC

Development Plans of Sangli (1977, 1981) and Miraj (1976, 1981) cities have been reviewed in the context of forecast of planning variables. The Draft Development plan of Sangli – Miraj - Kupwad City Municipal Corporation of 2008 is also reviewed. Total area of S-M-K CMC as per 2008 electoral ward map is 118.18 sq.km. For planning purpose the entire area of 118.18 sq.km is divided into 4 sectors (74 wards) and the details are presented in **Table 2-1** and **Figure 2-1.**

Table 2-1 Sectors and Area

S.No.	Planning Unit	S-M-K CMC Area (Sq.km)
1	Sangliwadi	14.05
2	Sangli	33.28
3	Miraj	45.00
4	Kupwad	25.85
Total Area		**118.18**

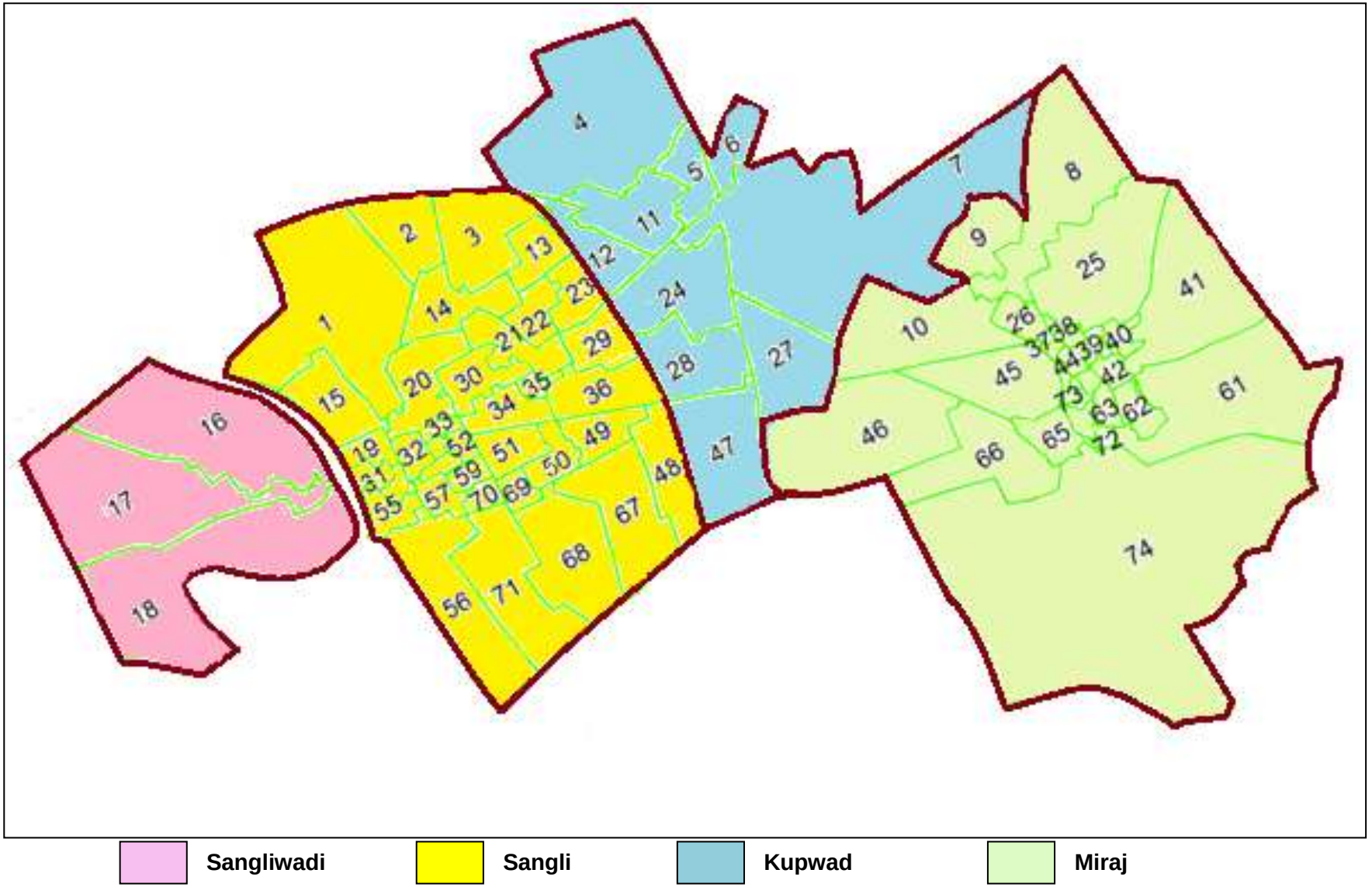


Figure 2-1 Sectors and Wards of the Study Area

The current breakup of land use of study area based on Development Plan is presented in **Table 2-2** and **Figure 2-2**.

Table 2-2 Broad Current Breakup of Land use of SMK CMC

Landuse	Area in Sq.km.	% of Area
Developed Area	39.5	**33.4%**
Area under Agriculture	58.71	**49.7%**
Water Bodies	1.58	**1.3%**
Vacant Land	18.38	**15.6%**
Total Area	**118.18**	**100.0%**

It can be observed that 50% of the land is under agriculture use followed by Developed Area which constitues 33% of the total area.

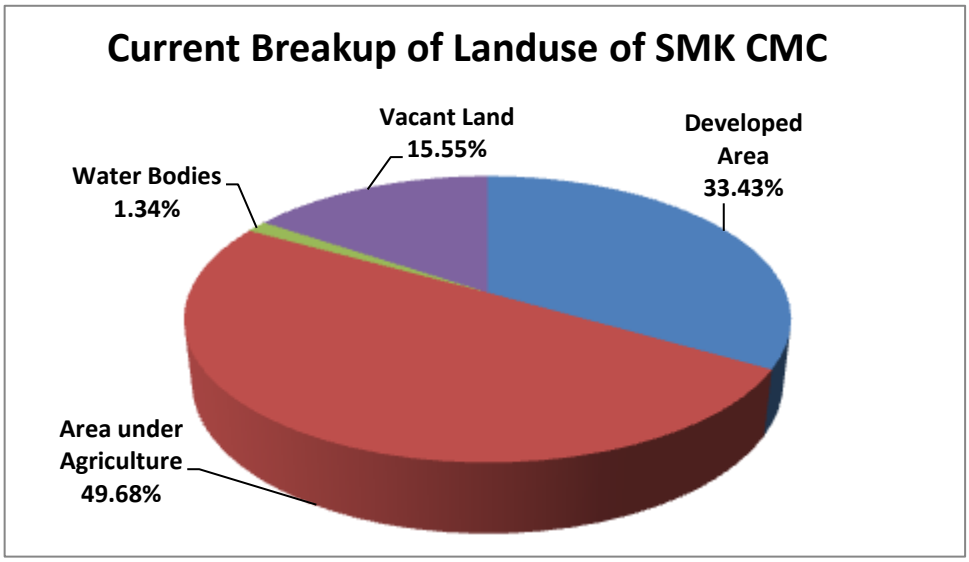


Figure 2-2 Broad Current Breakup of Land use of SMK CMC

Detailed breakup of Existing Landuse is presented in **Figure 2-3**. Area under residential use is 15.88% followed by area under Transport & Communications is 9.18%.

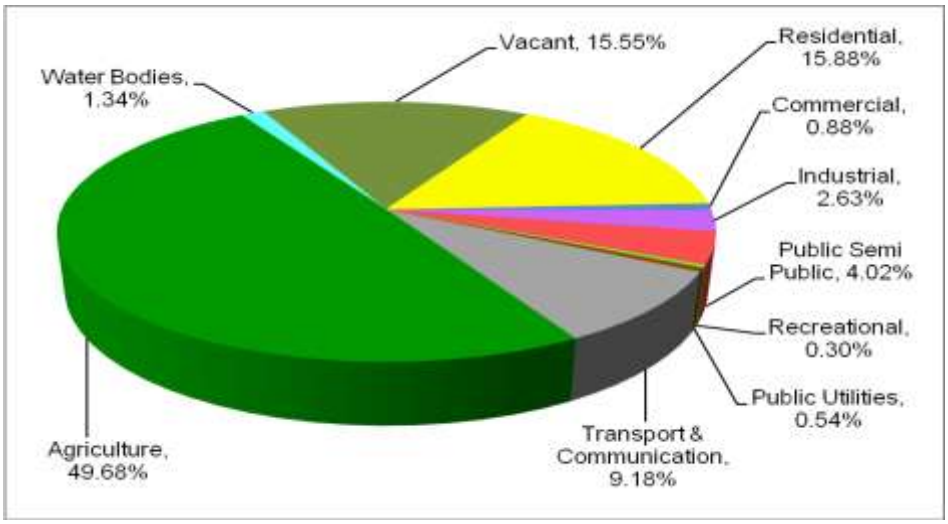


Figure 2-3 Existing Landuse as per Draft Development Plan of S-M-K CMC (2011)

The current landuse pattern (2011) as per Draft Development Plan is presented to in **Table 2-3.**

Table 2-3 Projected Land use as per Development Plan for 2011 from 2001 Land use

S.No	Landuse	Area in Ha					Area in %				
		Sangliwadi	Sangli	Kupwad & Wanleswadi	Miraj	Total SMKMC	Sangliwadi	Sangli	Kupwad & Wanleswadi	Miraj	Total SMKMC
1	Residential	47.06	790.74	578.42	486.22	1876.56	3.35	23.76	22.37	10.80	15.88
2	Commercial	1.83	75.44	3.31	22.92	103.89	0.13	2.27	0.13	0.51	0.88
3	Industrial	2.11	102.88	8.30	189.25	310.94	0.15	3.09	0.32	4.21	2.63
4	Public Semi Public	3.93	132.02	169.64	175.12	475.53	0.28	3.97	6.56	3.89	4.02
5	Recreational	0.28	30.25	1.42	3.39	35.20	0.02	0.91	0.06	0.08	0.30
6	Public Utilities	5.34	29.39	10.35	18.61	63.62	0.38	0.88	0.40	0.41	0.54
7	Transport & Communication	66.73	604.94	318.03	118.77	1085.20	4.75	18.18	12.30	2.64	9.18
	Total Developed Area	***127.28***	***1765.66***	***1089.47***	***1014.28***	***3950.94***	***9.06***	***53.06***	***42.14***	***22.54***	***33.43***
8	Agriculture	1238.85	1046.31	736.69	2777.12	5871.32	88.18	31.44	28.50	61.71	49.68
9	Water Bodies	0.00	23.14	26.83	104.71	157.82	0.00	0.70	1.04	2.33	1.34
10	Vacant	38.78	492.51	732.17	604.21	1837.91	2.76	14.80	28.32	13.43	15.55
	Total Undeveloped Area	***1277.63***	***1561.96***	***1495.69***	***3486.03***	***7867.06***	***90.94***	***46.94***	***57.86***	***77.46***	***66.57***
	Total Area	***1404.91***	***3327.62***	***2585.16***	***4500.31***	***11818.00***	***100.00***	***100.00***	***100.00***	***100.00***	***100.00***

Source: Based on Draft Development Plan of Sangli-Miraj-Kupwad Municipal Corporation - 2008
Note: Landuse Distribution for 2011 is assumed same as 2008 percentage share from Draft Development Plan of S-M-K CMC

The proposed landuse for 2031 is presented in **Table 2-4** and **Figure 2-4**.

Table 2-4 Proposed Landuse for S-M-K City – 2031

Sl.No	Landuse	Area in Ha					Area in %				
		Sangliwadi	Sangli	Kupwad & Wanleswadi	Miraj	Total SMK CMC	Sangliwadi	Sangli	Kupwad & Wanleswadi	Miraj	Total SMK CMC
1	Residential	97.28	1557.81	1298.30	1199.58	4152.97	6.92	46.81	50.22	26.66	35.14
2	Commercial	2.36	92.55	6.93	38.79	140.64	0.17	2.78	0.27	0.86	1.19
3	Industrial	1.95	90.45	6.65	186.76	285.81	0.14	2.72	0.26	4.15	2.42
4	Public Semi Public	4.14	131.95	199.44	167.49	503.02	0.29	3.97	7.71	3.72	4.26
5	Recreational	0.83	84.88	22.89	63.50	172.09	0.06	2.55	0.89	1.41	1.46
6	Public Utilities	7.81	40.91	14.54	21.49	84.76	0.56	1.23	0.56	0.48	0.72
7	Transport & Communication	78.34	674.72	465.37	302.97	1521.40	5.58	20.28	18.00	6.73	12.87
	Total Developed Area	***192.71***	***2673.28***	***2014.12***	***1980.58***	***6860.69***	***13.72***	***80.34***	***77.91***	***44.01***	***58.05***
8	Agriculture	1212.20	631.21	544.21	2415.02	4802.64	86.28	18.97	21.05	53.66	40.64
9	Water Bodies	0.00	23.13	26.83	104.71	154.66	0.00	0.69	1.04	2.33	1.31
10	Vacant	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total Undeveloped Area	***1212.20***	***654.34***	***571.04***	***2519.73***	***4957.31***	***86.28***	***19.66***	***22.09***	***55.99***	***41.95***
	Total Area	***1404.91***	***3327.62***	***2585.16***	***4500.31***	***11818.00***	***100.00***	***100.00***	***100.00***	***100.00***	***100.00***

Source: Estimated from Draft Development Plan of Sangli-Miraj-Kupwad Municipal Corporation – 2008 (Page 7, Table 12.1)

Observations:

1. The share of Residential area is proposed to be increased from 15.88% in 2011 to 35.14% in 2031.
2. The share of Total Developed area is proposed to be increased from 33.43% in 2011 to 58.05% in 2031.
3. The share of Industrial area is proposed to be reduced from 2.63% in 2011 to 2.42% in 2031.
4. The share of Agricultural land is proposed to be reduced from 49.68% in 2011 to 40.64% in 2031
5. The share of vacant land is proposed to be reduced from 15.55% in 2011 to 0.00% in 2031.

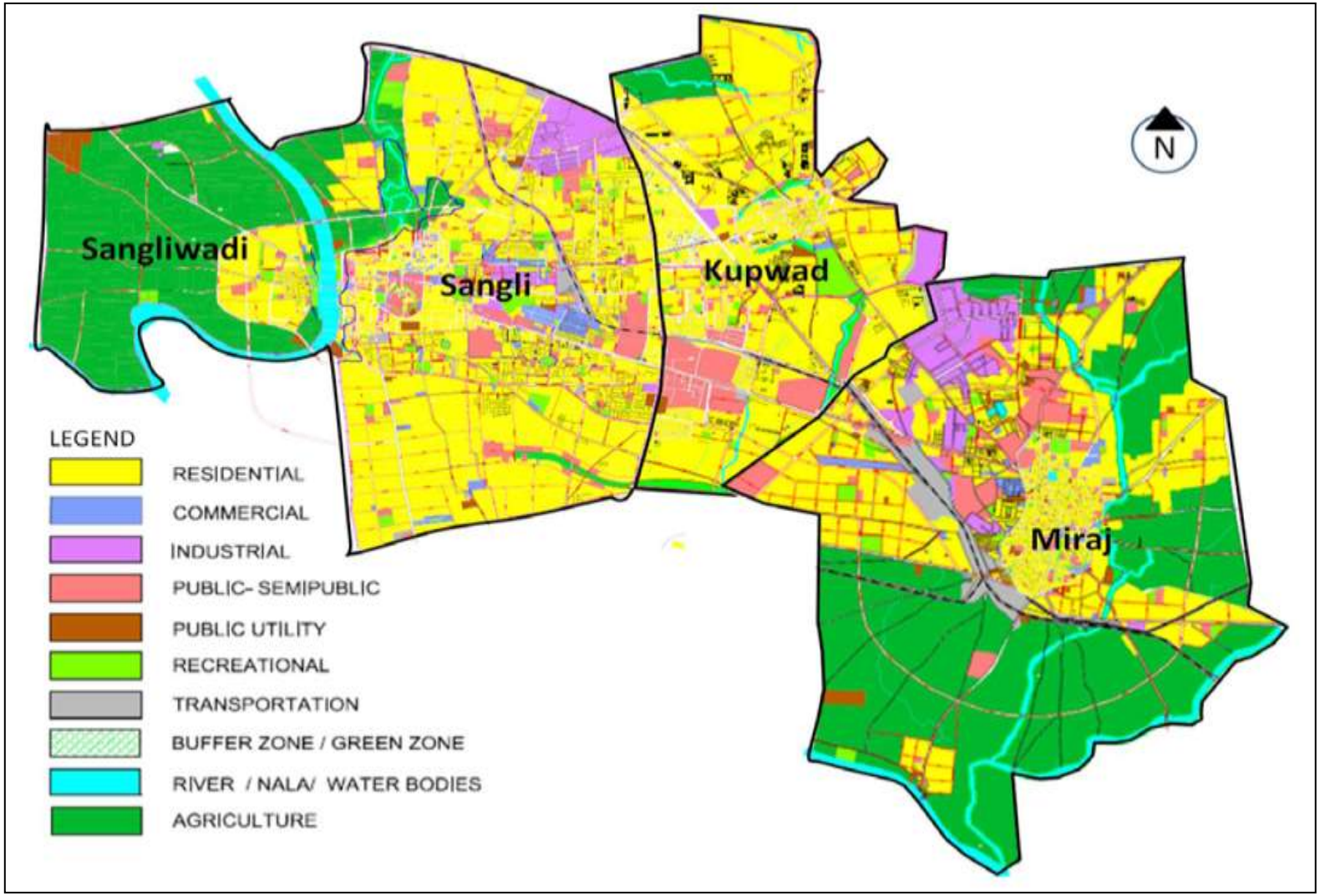


Figure 2-4 Proposed Landuse as per Draft Development Plan of S-M-K CMC (2031)

2.3 Population

S-M-K CMC has a population of 5.03 lakh as per the 2011 census with a decadal growth rate of 15.1%. Ward-wise population details for Base Year (2011) are presented in **Annexure-2-1**. The decadal growth during 2001-2011 was low compared to that of the past decades. It is observed that the decadal growth rate of population during 1991-2001 was 33.9%, which has dropped to 15.1% in the decade 2001-2011.

As per the Draft Development Plan (2008), the projected population for 2011, 2016, 2021 and 2026 is presented in **Table 2-5**.

Table 2-5 Population Forecast as per Development Plan

Year	Population in Lakh	Per annum Growth Rate (%)
2011*	4.35	
2016	5.62	5.3%
2021	6.18	1.9%
2026	6.67	1.5%

**As per Census (2011), actual population is 5.03 lakh which is 0.67 lakh more than projected population.*

2.3.1 Sector-wise Population

Sector-wise population in Base year (2011) is presented in **Table 2-6**. It can be observed that Sangliwadi with an area of 12% of total SMK CMC is housing a population of 3% only.

Table 2-6 Section-wise Population in Base Year (2011)

Name of Sector	Area (in Ha)	% of Area	Population 2011	% of Population
Sangliwadi	1404.91	12%	16001	3%
Sangli	3327.62	28%	244126	49%
Miraj	4500.31	38%	164899	33%
Kupwad	2585.16	22%	77670	15%
Total	**11818.0**	**100%**	**502697**	**100%**

2.3.2 Population Density Distribution

Ward-wise population of S-M-K CMC, its area and density for the base year as per 2011 census is presented in **Annexure 2-1**. It can be observed that average density in S-M-K CMC is 43 ppha (persons/hectare). Frequency distribution of wards by area is presented in **Table 2-7**.

It can be observed that density is less than or equal 350 persons/hectare for 65 wards out of 74 wards. Only 4 wards are having density more than 500.

Table 2-7 Distribution of Density of Population

Density in Persons/ Ha	No. of Wards in Each Range	% Wards	% Cumulative
00-050	26	35%	35%
51-100	17	23%	58%
101-150	4	5%	64%
151-200	5	7%	70%
201-250	3	4%	74%
251-300	3	4%	78%
301-350	7	9%	88%
351-400	2	3%	91%
401-450	1	1%	92%
451-500	2	3%	95%
501-550	0	0%	95%
551-600	0	0%	95%
601-700	2	3%	97%
701-800	2	3%	100%
Total	**74**	**100%**	

2.3.3 Past Growth of Population

In order to estimate the travel demand for the future years, the population needs to be projected to the horizon years. The horizon year considered for the study is 2031 and the total population of the S-M-K City has been projected for next two decades 2021 and 2031. The population growth rate of the city in the past decades was worked out from the Census data. It has been found that the city showed a decline in population growth rate in the decades 1991-2001 & 2001-2011.

Population data for the Sangli-Miraj-Kupwad City Municipal Corporation (SMK CMC) is compiled from 1961-2011 from the census department and is presented in the **Table 2-8**.

Table 2-8 Decadal Growth Trend of SMK CMC Population

Year	Population	Growth Rate (%)
1961	134458	-
1971	202461	50.6%
1981	271049	33.9%
1991	351917	29.8%
2001	436781	24.1%
2011	502697	15.1%

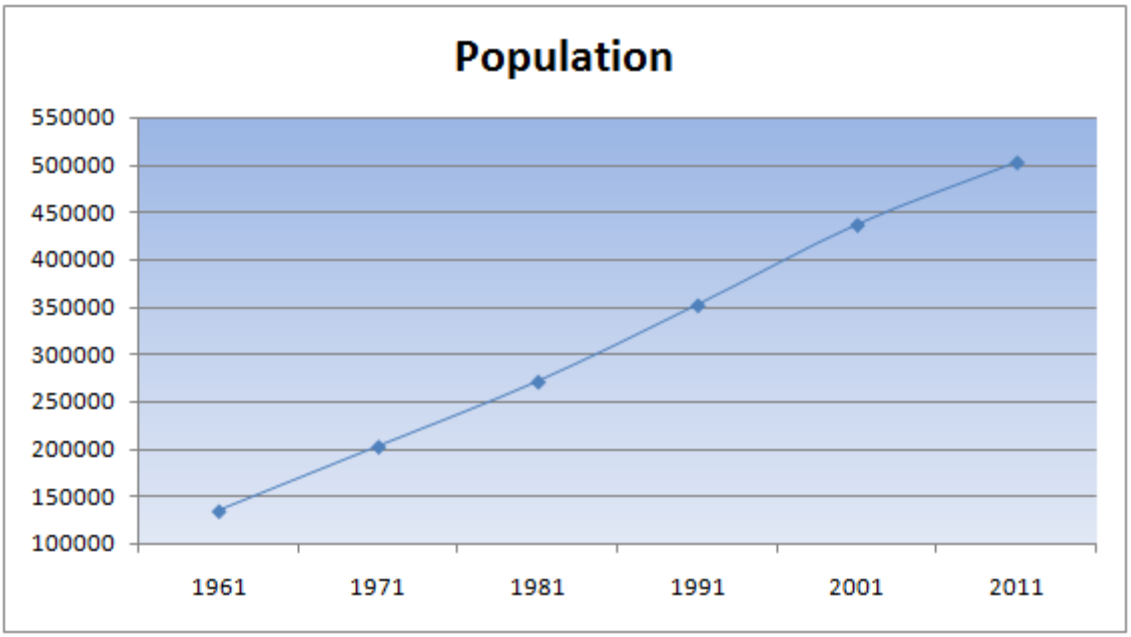


Figure 2-5 Decadal Growth Trend of SMK CMC Population

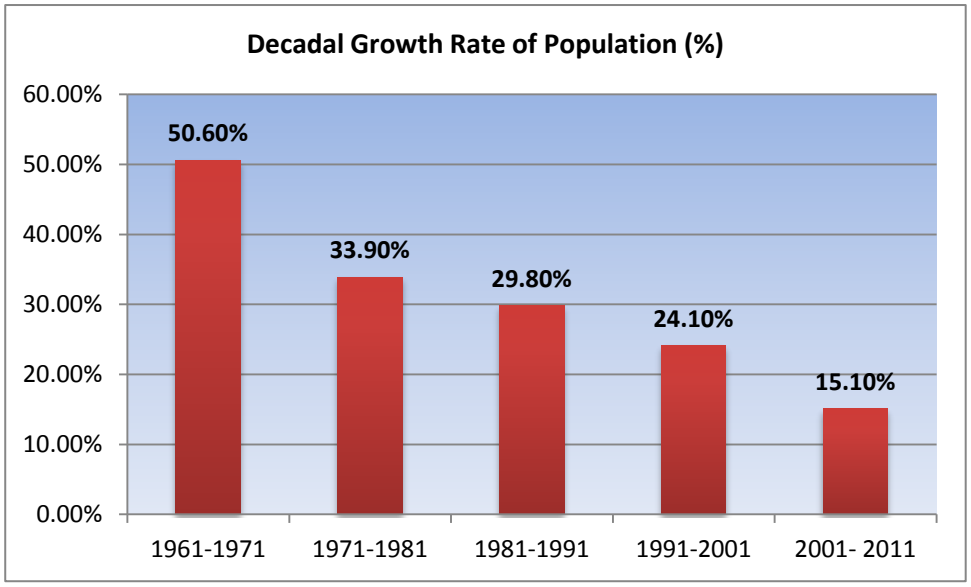


Figure 2-6 Decadal Growth Rate of SMK CMC Population

2.3.4 Growth trends in Medium Sized cities in India

The review of growth trends in medium sized cities in India is carried out to assess the potential growth prospects of S-M-K CMC in future. The decadal growth rates from 1991 to 2011 for all medium sized cities separately for Urban Agglomeration (UA) and city proper (within the Municipal Corporation area) is presented in **Table 2-9.**

In most of the medium sized cities, the growth of the population in city is more than the Growth of Urban Agglomeration which implies the city is not yet saturated. The cities such as Guwahati, Bhiwandi, Cuttack, Dehradun, Kolhapur, Jamnagar, Jammu and Sangli have shown higher growth rates in city proper (within the Municipal Corporation area) than their Urban Agglomeration. The increasing congestion in the cities lead to higher growth in Urban Agglomerations than city proper in case of Bareilly, Mysore, Jalandhar, Bhubaneswar, Warangal, Bhavnagar, Ajmer and Nellore.

Based on the review of Growth of Population in medium sized cities, It can be observed that decadal growth ranges 7.8% to 36.1%. The decadal growth (2001-2011) of Urban Agglomerations ranges from 6.5% to 39.4% with an average value of 21.2%. The decadal growth (2001-2011) of city proper ranges from 7.8% to 35.6% with an average value of 21.1%. There is overall no major change in urban agglomeration and city proper as it indicates scope for densification within the city. It is also noteworthy to see the growth of Kolhapur city in last two decades. Kolhapur has recorded a growth of 21.4% and 11.4% during 1991-2001 and 2001-2011. SMK CMC has been growing at the rate 3% more as compared to Kolhapur. Based on above review and expected economic activity in the city growth rate of SMK CMC will be close 15% in next decade.

Population density and worker participation data for medium sized cities is complied and presented in **Table 2-10**. Average density of medium sized cities is 100 persons per hectare. Density of population in SMK CMC is 43 persons per hectare which is among the lowest in medium sized cities. Only Ajmer (25) and Durgapur (37) have less density as compared to S-M-K CMC.

Table 2-9 Decadal Population and Growth Trends in Medium Sized cities in India

S.No	Name of City	1991		2001		2011		City GR (%)		UA GR (%)	
		City	UA	City	UA	City	UA	1991-2001	2001-2011	1991-2001	2001-2011
1	Guwahati (M Corp.)	5,84,342		8,09,895	8,18,809	9,63,429	9,68,549	38.6%	19.0%		18.3%
2	Bareilly (M Corp.)	5,87,211	6,17,350	7,18,395	7,48,353	8,98,167	9,79,933	22.3%	25.0%	21.2%	30.9%
3	Mysore (M Corp.)	6,06,755	6,53,345	7,55,379	7,99,228	8,87,446	9,83,893	24.5%	17.5%	22.3%	23.1%
4	Aligarh (M Corp.)	4,80,520		6,69,087		8,72,575	9,09,559	39.2%	30.4%		
5	Jalandhar (M Corp.)	5,09,510		7,06,043	7,14,077	8,62,196	8,73,725	38.6%	22.1%		22.4%
6	Bhubaneswar Town (M Corp.)	4,11,542		6,48,032	6,58,220	8,37,737	8,81,988	57.5%	29.3%		34.0%
7	Salem (M Corp.)	3,66,712	5,78,291	6,96,760	7,51,438	8,31,038	9,19,150	90.0%	19.3%	29.9%	22.3%
8	Bhiwandi (M Corp.)	3,79,070	3,92,214	5,98,741	6,21,427	7,11,329	7,37,411	57.9%	18.8%	58.4%	18.7%
9	Gorakhpur (M Corp.)	5,05,566		6,22,701		6,71,048	6,92,519	23.2%	7.8%		
10	Guntur (M Corp.)	4,71,051		5,14,461		6,51,382	6,73,952	9.2%	26.6%		
11	Warangal (M Corp.)	4,47,657	4,67,757	5,30,636	5,79,216	6,20,116	7,59,594	18.5%	16.9%	23.8%	31.1%
12	Cuttack (M Corp.)	4,03,418	4,40,295	5,34,654	5,87,182	6,06,007	6,58,986	32.5%	13.3%	33.4%	12.2%
13	Bhavnagar (M Corp.)	4,02,338	4,05,225	5,11,085	5,17,708	5,93,768	6,06,282	27.0%	16.2%	27.8%	17.1%
14	Dehradun (M Corp.)	2,70,159	3,68,053	4,26,674	5,30,263	5,78,420	7,14,223	57.9%	35.6%	44.1%	34.7%
15	Durgapur (M Corp.)	4,25,836		4,93,405		5,66,937	5,81,409	15.9%	14.9%		
16	**Kolhapur (M Corp.)**	**4,06,370**	**4,18,538**	**4,93,167**	**5,05,541**	**5,49,283**	**5,61,841**	**21.4%**	**11.4%**	**20.8%**	**11.1%**
17	Ajmer (M Corp.)	4,02,700		4,85,575	4,90,520	5,42,580	5,51,360	20.6%	11.7%		12.4%
18	Gulbarga (M Corp.)	3,04,099	3,10,920	4,22,569	4,30,265	5,32,031	5,41,617	39.0%	25.9%	38.4%	25.9%
19	Jamnagar (M Corp.)	3,41,637	3,81,646	4,43,518	5,56,956	5,29,308	6,00,411	29.8%	19.3%	45.9%	7.8%
20	Siliguri (M Corp.)	2,16,950		4,72,374		5,09,709	7,01,489	117.7%	7.9%		
21	Jhansi (M Corp.)	3,00,850	3,68,154	3,83,644	4,60,278	5,07,293	5,49,391	27.5%	32.2%	25.0%	19.4%
22	Nellore (M Corp.)	3,16,606		3,78,428	4,04,775	5,05,258	5,64,148	19.5%	33.5%		39.4%
23	Jammu (MC)	2,06,135	2,23,361	3,69,959	6,12,163	5,03,690	6,51,826	79.5%	36.1%	174.1%	6.5%
24	**Sangli Miraj Kupwad (M Corp.)**	**3,51,917**	**3,63,751**	**4,36,781**	**4,47,774**	**5,02,697**	**5,13,862**	**24.1%**	**15.1%**	**23.1%**	**14.8%**
	Average							**38.8%**	**21.1%**	**42.0%**	**21.2%**

Table 2-10 Population Density and WPR for Medium Sized Cities in India

S.No	Name of City	1991	2001	2011	Area in Sq.km	Density (Persons/ Hectare)- 2001	Density (Persons/ Hectare)- 2011	Worker Participation Ratio (%)
1	Guwahati (M Corp.)	5,84,342	8,09,895	9,63,429	216.79	37	44	52.1%
2	Bareilly (M Corp.)	5,87,211	7,18,395	8,98,167	106.43	67	84	27.1%
3	Mysore (M Corp.)	6,06,755	7,55,379	8,87,446	88.66	85	100	33.2%
4	Aligarh (M Corp.)	4,80,520	6,69,087	8,72,575	40.43	165	216	25.4%
5	Jalandhar (M Corp.)	5,09,510	7,06,043	8,62,196	102.00	69	85	33.3%
6	Bhubaneswar Town (M Corp.)	4,11,542	6,48,032	8,37,737	134.64	48	62	33.3%
7	Salem (M Corp.)	3,66,712	6,96,760	8,31,038	91.34	76	91	37.8%
8	Bhiwandi (M Corp.)	3,79,070	5,98,741	7,11,329	26.41	227	269	41.8%
9	Gorakhpur (M Corp.)	5,05,566	6,22,701	6,71,048	141.10	44	48	22.9%
10	Guntur (M Corp.)	4,71,051	5,14,461	6,51,382	45.79	112	142	35.0%
11	Warangal (M Corp.)	4,47,657	5,30,636	6,20,116	68.00	78	91	41.9%
12	Cuttack (M Corp.)	4,03,418	5,34,654	6,06,007	149.16	36	41	32.1%
13	Bhavnagar (M Corp.)	4,02,338	5,11,085	5,93,768	90.16	57	66	30.8%
14	Dehradun (M Corp.)	2,70,159	4,26,674	5,78,420	52.00	82	111	28.5%
15	Durgapur (M Corp.)	4,25,836	4,93,405	5,66,937	154.20	32	37	31.2%
16	Kolhapur (M Corp.)	4,06,370	4,93,167	5,49,283	66.82	74	82	31.6%
17	Ajmer (M Corp.)	4,02,700	4,85,575	5,42,580	218.00	22	25	28.4%
18	Gulbarga (M Corp.)	3,04,099	4,22,569	5,32,031	43.00	98	124	26.6%
19	Jamnagar (M Corp.)	3,41,637	4,43,518	5,29,308	26.40	168	200	31.6%
20	Siliguri (M Corp.)	2,16,950	4,72,374	5,09,709	41.90	113	122	33.9%
21	Jhansi (M Corp.)	3,00,850	3,83,644	5,07,293	57.65	67	88	27.4%
22	Nellore (M Corp.)	3,16,606	3,78,428	5,05,258	48.00	79	105	33.3%
23	Jammu (MC)	2,06,135	3,69,959	5,03,690	40.00	92	126	32.3%
24	Sangli Miraj Kupwad (M Corp.)	3,51,917	4,36,781	5,02,697	118.18	37	43	32.1%

2.3.5 Population Projection by Various Methods

Population projections are carried out by various methods to identify the most appropriate method for projecting the future population. The various methods considered are Arithmetic Increase method, Geometric Increase Method, Incremental Increase Method, Decreasing Rate Method and Simple Graphical Method. All the methods are explained in this section.

2.3.5.1 Arithmetic Increase method

This method is based upon the assumption that the population is increasing at a constant rate, i.e. the rate of change of population with time is constant. From the population data for the last 4 to 5 decades, the average increase per decade is calculated which is then used as the design rate of increase for calculating the design population. This method is of limited value and may be useful for smaller design periods of for old and very large cities with no industries and which have practically reached their maximum development. For developing areas, which develop faster than the past, this method is likely to give low results.

2.3.5.2 Geometric Increase Method

In this method, it is assumed that the percentage increase in population from decade remains constant. Therefore, the average value of the percentage increase is calculated and the future populations are calculated at this rate. For a young city, which at present is expanding at fasted rate, this method may give very high results and is useful for old developed cities.

2.3.5.3 Incremental Increase Method

In this method the average increase per decade is found out. The average incremental increase for each decade is also found out. The future population is calculated from the average increase and average incremental increase of population. This method is a combination of the above two methods and therefore gives the advantages of both and hence gives satisfactory results.

2.3.5.4 Decreasing Rate Method

Rate of increase in population goes on reducing as the cities reach towards saturation method, which makes use of the decrease in the percentage increase is many a times used and gives quite rational increase, which is then subtracted from the latest percentage increase for each successive decades.

2.3.5.5 Simple Graphical Method

In this method a graph is plotted from the available data, between time and population. The curve is then smoothly extended up to the desired year. This method however gives approximate results as the extension of the curve is done only by the intelligence of the designer.

The population has been forecasted using census data from 1971 to 2011. The projected population figures by using various methods for the year 2011 are presented in **Table 2-11.** The projected population for the year 2011 is compared with the actual population. It is noted from the table that the Arithmetic Increase Method gives the least percentage of error.

Table 2-11 Population Projections for the year 2011 by Various Methods

S.No.	Method	Projected	Actual	% Error
1	Arithmetic Increase Method	514888	502697	2%
2	Geometric Increase Method	564652	502697	12%
3	Incremental Increase Method	523026	502697	4%
4	Decreasing Rate Method	543332	502697	8%
5	Simple Graphical Method	531855	502697	6%

The population is projected for the year 2021 and 2031 by using all the methods. The projected values are given in the **Table 2-12.**

Table 2-12 Population Projections by Various Methods

S.No.	Method	2016	2021	2026	2031
1	Arithmetic Increase Method	540341	580804	618626	658910
2	Geometric Increase Method	571564	649865	738893	840118
3	Incremental Increase Method	544113	588942	630591	675186
4	Decreasing Rate Method	560669	625328	697442	777873
5	Simple Graphical Method	564834	634652	687887	745587

Arithmetic Increase Method gives the least error and considering the economic activities of the city, it is most appropriate method. Therefore, we have adopted arithmetic increase for forecasting the population. **Table 2-13** gives the projected population for the city in the years 2021, 2031.

Table 2-13 Population Projections for S-M-K City

Year	Population	Decadal Growth Rate
2011	502697	
2021	580804	15.54%
2031	658910	13.45%

The population distribution among the zones is carried out taking following parameters into account. Weightage is given to each parameter for arriving at the distribution.

- Population density
- Landuse
- Accessibility

2.4 Employment

2.4.1 Work Centres

The major work centers in S-M-K CMC are listed below:

Sangli-Miraj-Kupwad City Municipal Corporation		
Sangli	Miraj	Kupwad
• Harbhat Road • Maruthi Mandhir Road • Rajwada Chowk • Wakharbagh • ST Stand Area • Shivaji Vegetable Market • Peth bagh Area • Vasanthdada Sugar Factory and Industrial area • Vasanthdada Market Yard • Timber Market • Vegetable & Fruit Market in Peth bagh Area • Chandini Chowk Weekly Market	• Laxmi Market • Shaniwarpeth road • Timber market area • ST Stand road • Datta Chowk Weekly Market • Shastri Chowk • Miraj MIDC • Marathe Industrial Estate • Marathe Textile mills • Mission Hospital	• Bharat Sur Girni • Dargha • Kupwad MIDC • (Out of S-M-K CMC)

2.4.2 M.I.D.C

The total area of M.I.D.C is 390 hectares, in which is spread in Miraj and Kupwad. The area of Miraj M.I.D.C is 166.4 hectares and Kupwad M.I.D.C (out of S-M-K CMC) is 223.63 hectares. The components of M.I.D.C area are presented in **Table 2-14**.

Table 2-14 Breakup of MIDC Area

S.No	Component	Area (in hectares)		
		Miraj M.I.D.C	Kupwad M.I.D.C	Total M.I.D.C
1	Total Area	166.48	223.63	390.11
2	Total Deductions	19.57	9.99	29.56
3	Net Area	146.91	213.64	360.55
4	10% required open space	14.69	21.36	36.06
5	Provided open space	14.71	21.36	36.07
6	5% required Amenity	7.35	10.68	18.03
7	Amenity provided	8.90	10.68	19.58
8	Total road area	27.70	37.21	64.91
9	No. of Working Units	350	485	835
10	No. of Non-Working Units	132	182	314
11	Built-Up Area	112.97	136.06	253.53

Note: Number of units in Miraj M.I.D.C and Kupwad M.I.D.C is distributed based on the share in Draft Development Plan of S-M-K CMC

Employment Generation due to M.I.D.C

M.I.D.C (Miraj M.I.D.C and Kupwad M.I.D.C) area is spread over an area of 390.11 hectares. Employment generated from M.I.D.C is estimated taking into account the future growth of Built-up areas in Kupwad and Miraj M.I.D.C areas (observed from ***Stakeholders survey***. The Estimates are provided in **Table 2-15**. The growth of Built-up Area in Miraj and Kupwad M.I.D.C from 2021 to 2031 is assumed as 5% and 4%.

Table 2-15 Estimated Employment from MIDC

Year	Miraj M.I.D.C	Kupwad M.I.D.C	Total
2001	2620	3630	6250
2011	3500	4850	8350
2021	3714	5261	8975
2031	3920	6053	9973

Note: Forecast is based on the assumed growth of Built-up Area.

It can be observed that around 5% of the total workers in S-M-K City are working in M.I.D.C area.

2.4.3 Schools and Colleges

The list of educational institutions for the base year was collected from Educational Office. The zone-wise distribution of these institutions is estimated by assigning the institutions to different zones based on the locations. The employment in different categories of education sector has been summarised in **Table 2-16**.

Table 2-16 Employment in Educational Sector

Category	Number of Schools/Colleges	Employment
Primary Schools	163	3000
High Schools	147	5300
Colleges	12	700
Total	***322***	***9000***

2.4.4 Shops and Establishments

The list of shops and establishments for the year 2010 was collected from Commissioner of Labour Office. The employment in different categories of shops and establishments has been summarised in **Table 2-17**.

Table 2-17 Employment in Shops and Establishments

Category	No. of Establishments	Number of Employees
Shops	24544	6985
Commercial	11546	18144
Residential, Hotels & Restaurants	2369	3839
Theatres	72	107
Total	***38531***	***29075***

2.4.5 Total Employment

Total employment in the city for future decades is projected based on the work force participation ratio (WPR). The total Employment as per 1991 and 2001 census is provided in **Table 2-18.**

Table 2-18 Total Employment in S-M-K CMC as per Census

Year	*Total Employment*	*Population*	*Worker Participation Ratio (WPR)*	*Decadal Growth %*
1991	110902	351917	31.51%	
2001	139998	436781	32.05%	26.24%
2011	161936	502697	32.21%	15.67%

Based on trends in other medium sized cities, the worker participation ratio will increase in future decades. WRR for medium sized cities have been presented in Table 1-10. Based on review of similar cities, the Worker participation ratio for 2021 and 2031 is likely to be 32.61% and 33.01% respectively. The employment thus worked out to be 1.9 Lakh and 2.2 Lakh respectively.

The share of service employment will increase as the population grows. The share of service employment in 2011 is 39.67%. The future share of service employment for 2021 and 2031 is assumed as 42.69% and 45.55% respectively. The distribution of employment by category in S-M-K CMC area is presented in **Table 2-19.**

Table 2-19 Category-wise Employment Distribution in S-M-K City

Year	Employment Category			Total Employment
	Industrial	Trade	Service	
1991	NA	NA	NA	110902
2001	48780	35849	55369	139998
2011	56123	41569	64244	161936
2021	62365	46193	80861	189420
2031	68039	50396	99094	217529

2.4.6 Ward-wise Employment distribution

The total number of employees working in different zones within the study area and other locations within the region is an important input for the Travel Demand Modeling process. Compiled data in this regard is not available from a single source and hence consultants have collected from various sources to arrive at a reasonable estimate of employment distribution. Consultants have obtained data from Dept. of Industries and MIDC for industrial employment, shops and establishments data is collected from Commissioner of Labour office.

The past trend in the employment pattern of the city has been studied from the data collected from previous studies. The employment projection for the future decades has been done on the basis of data collected from the Development Plan, MIDC, S-M-K CMC and Department of Statistics.

The zone wise distribution of employment has been made into 3 categories i.e. Industrial, Trade & Commerce and Services. A zone wise Employment projection by categories is presented in **Annexure 2-2**.

2.4.7 Summary of Population and Employment Forecast

Based on above discussion, employment of S-M-K CMC summarised in **Table 2-20.**

Table 2-20 Population and Employment Forecast S-M-K CMC

Year	S-M-K CMC	
	Population	Employment
1991	351917	110902
2001	436781	139998
2011	502697	161936
2016	540341	175140
2021	580804	189420
2026	618626	202988
2031	658910	217529

Population and Employment for base year and horizon years is presented in **Annexure 2-2**.

Figure 2-7 to Figure 2-12 shows population, density and employment distribution in base year (2011) and horizon Year (2031).

Figure 2-13 shows the employment density distribution in base year 2011.

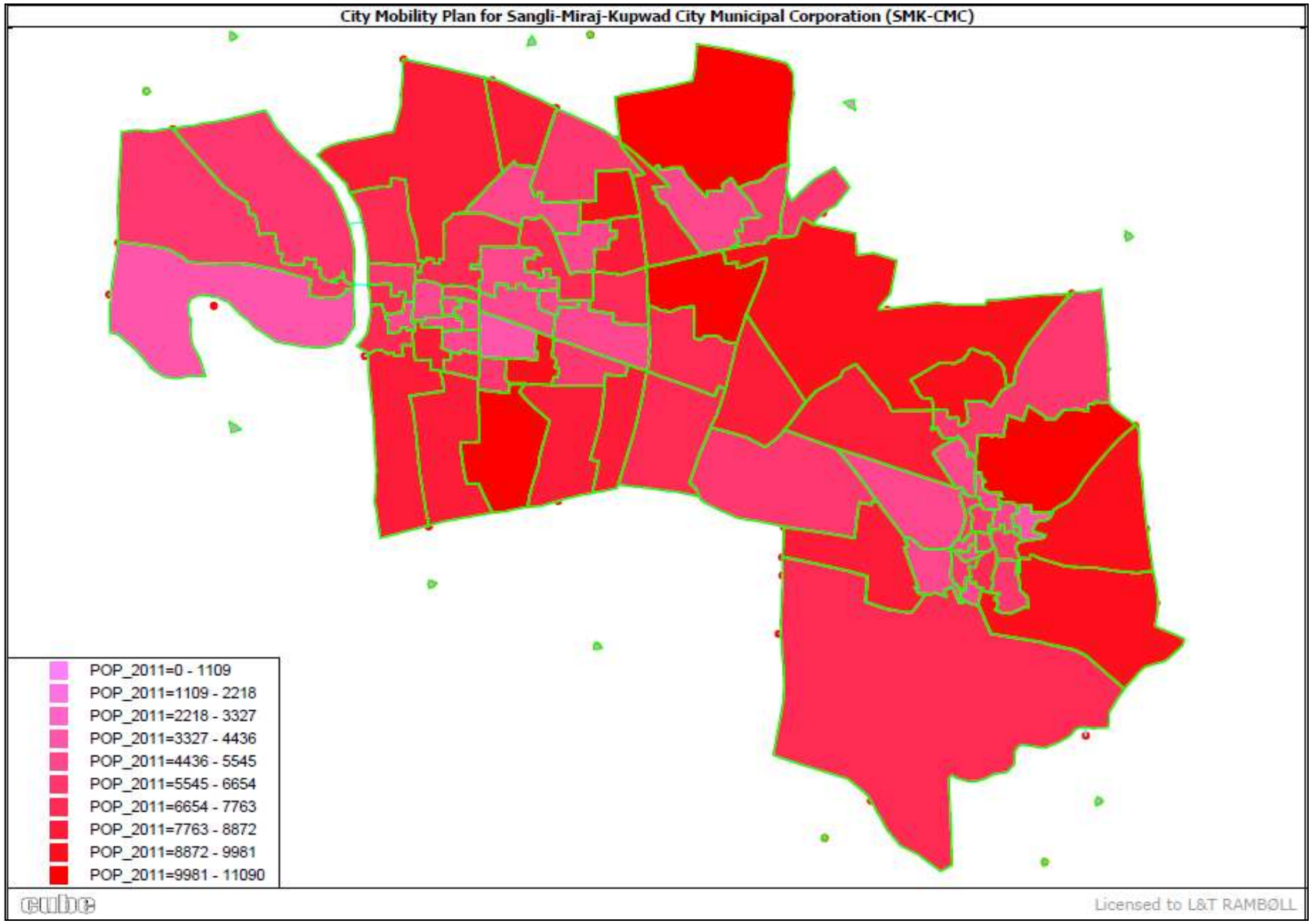


Figure 2-7 Population Distribution of the Study Area in Base Year (2011)

Figure 2-8 Population Density Distribution of the Study Area in Base Year (2011)

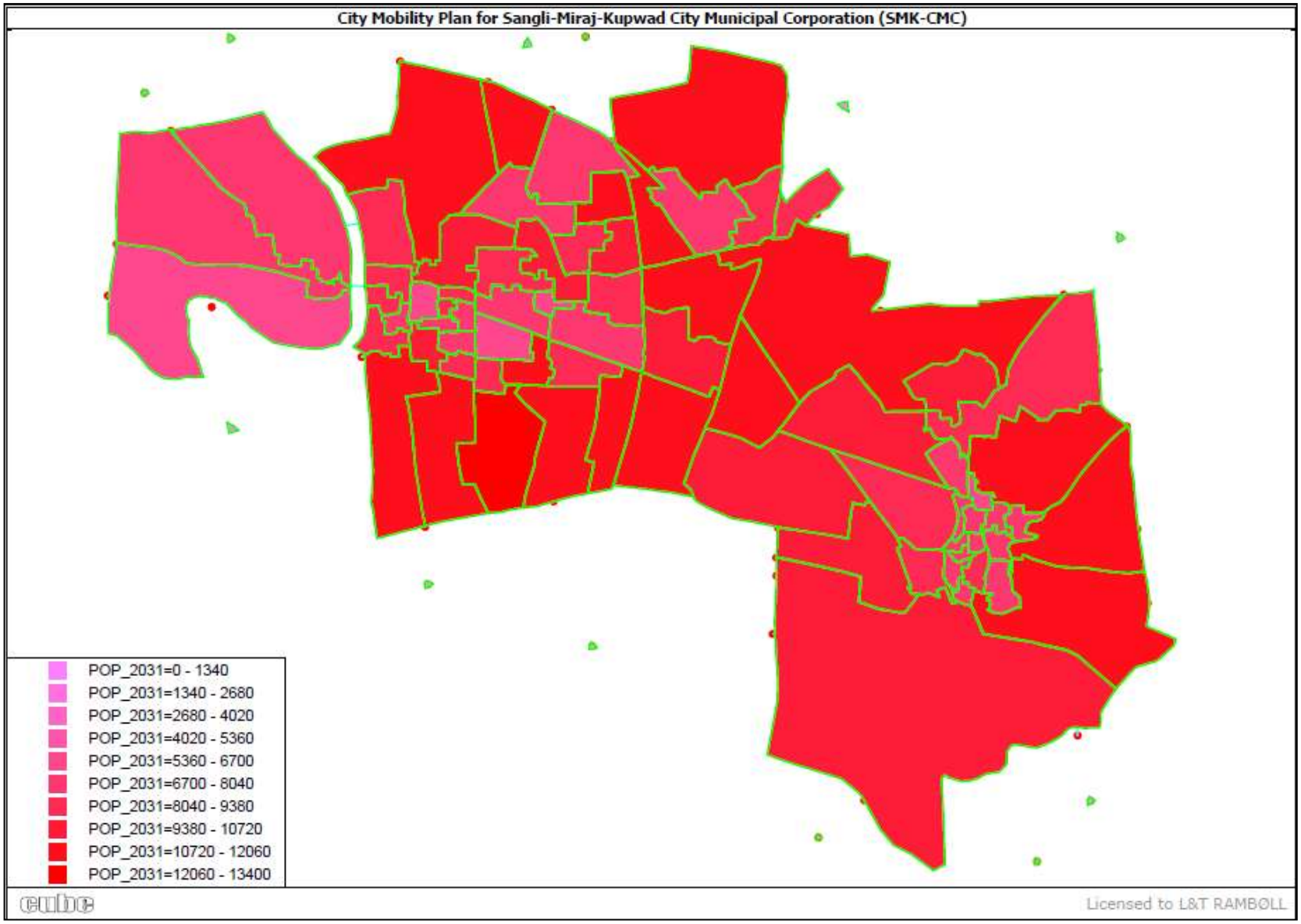


Figure 2-9 Population Distribution of the Study Area in Horizon Year (2031)

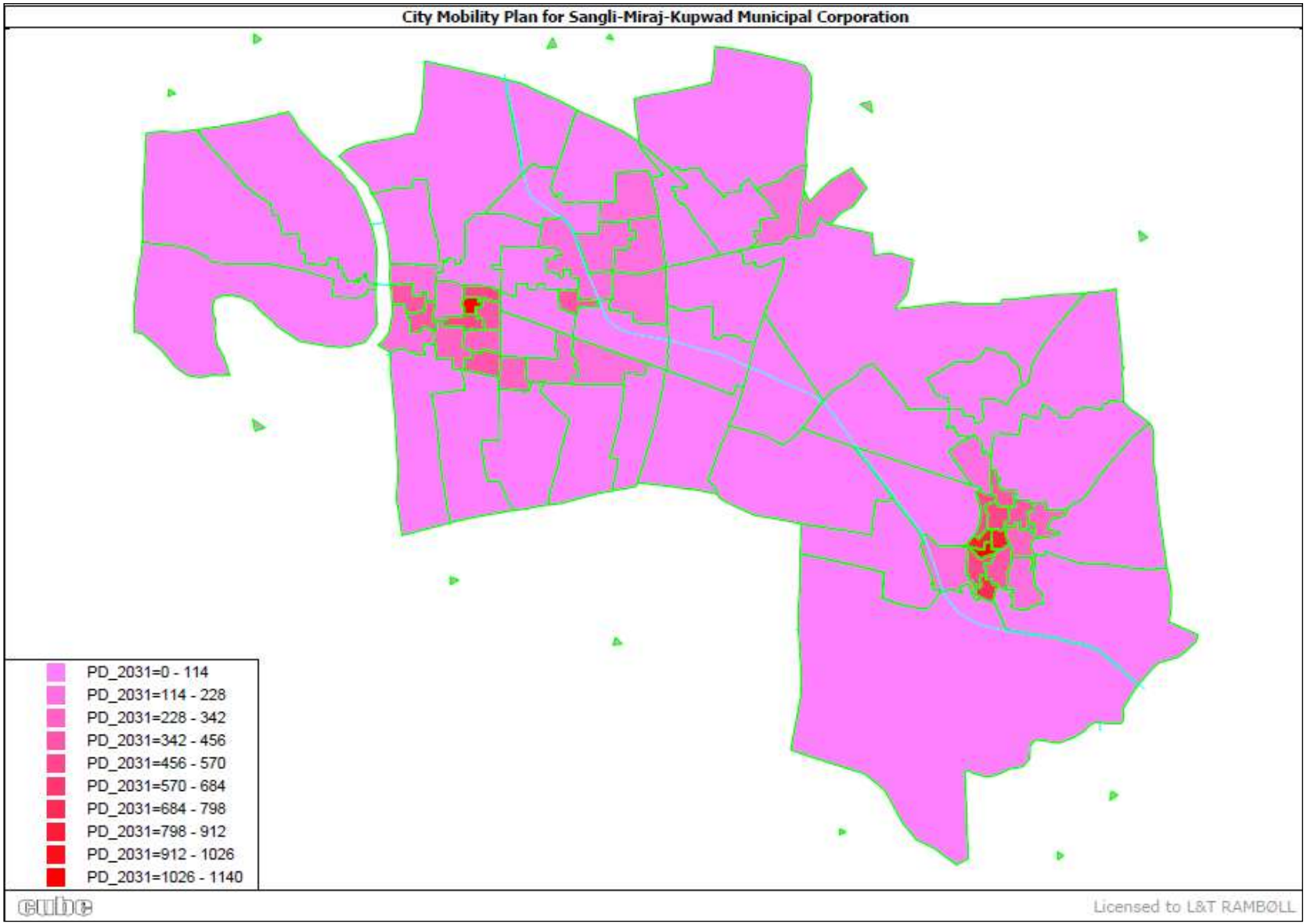


Figure 2-10 Population Density Distribution of the Study Area in Horizon Year (2031)

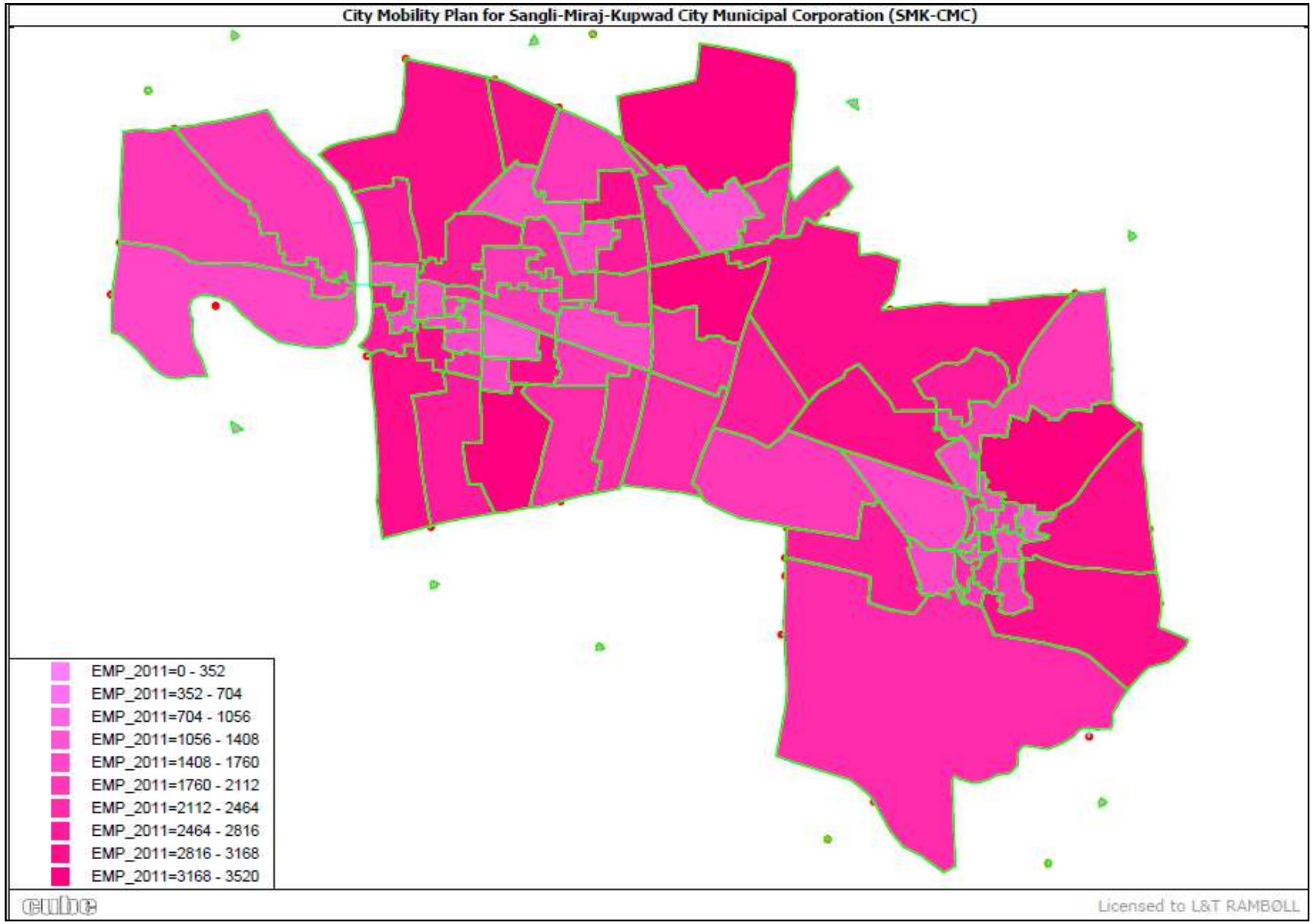


Figure 2-11 Employment Distribution of the Study Area in Base Year (2011)

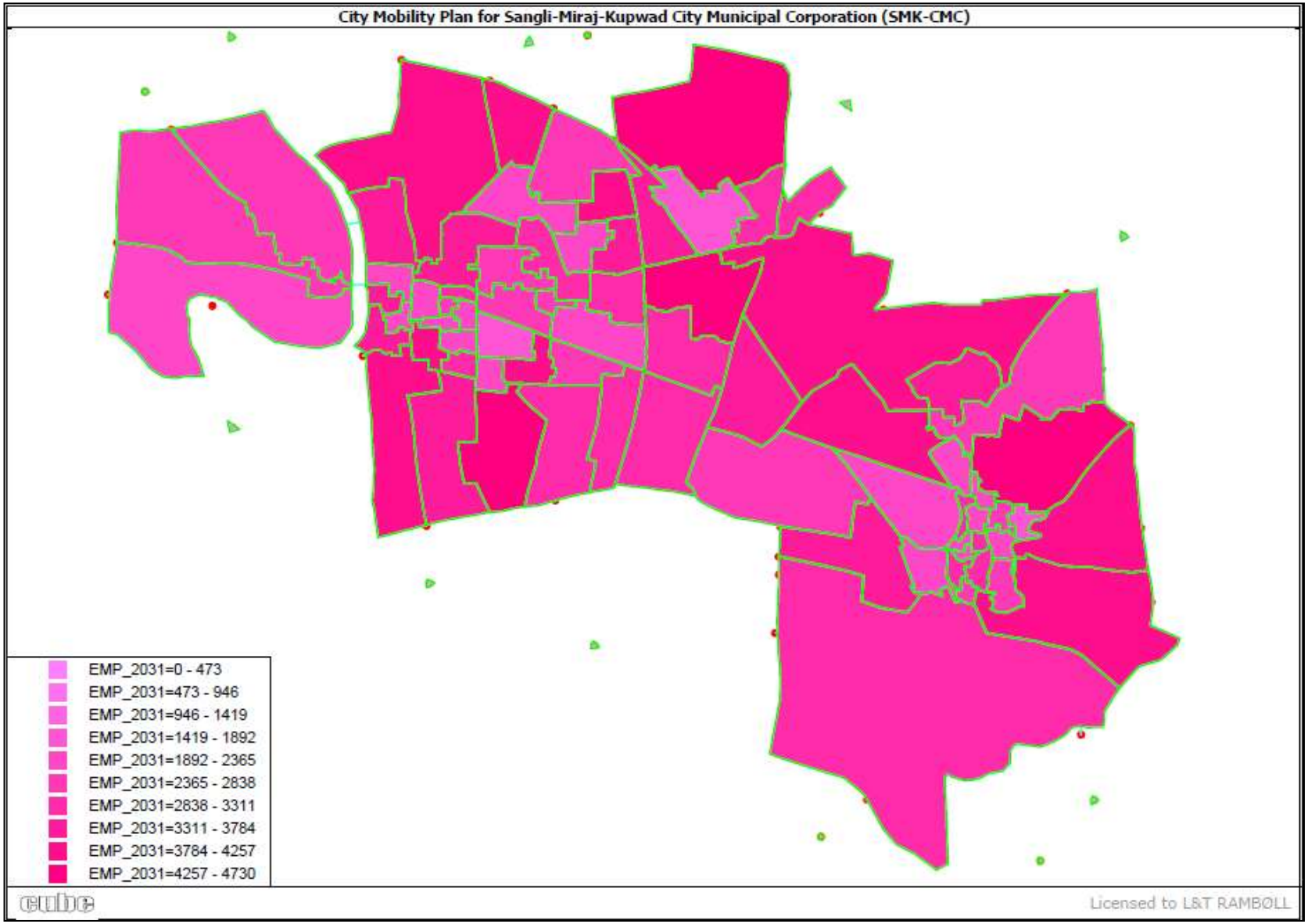


Figure 2-12 Employment Distribution of the Study Area in Horizon Year (2031)

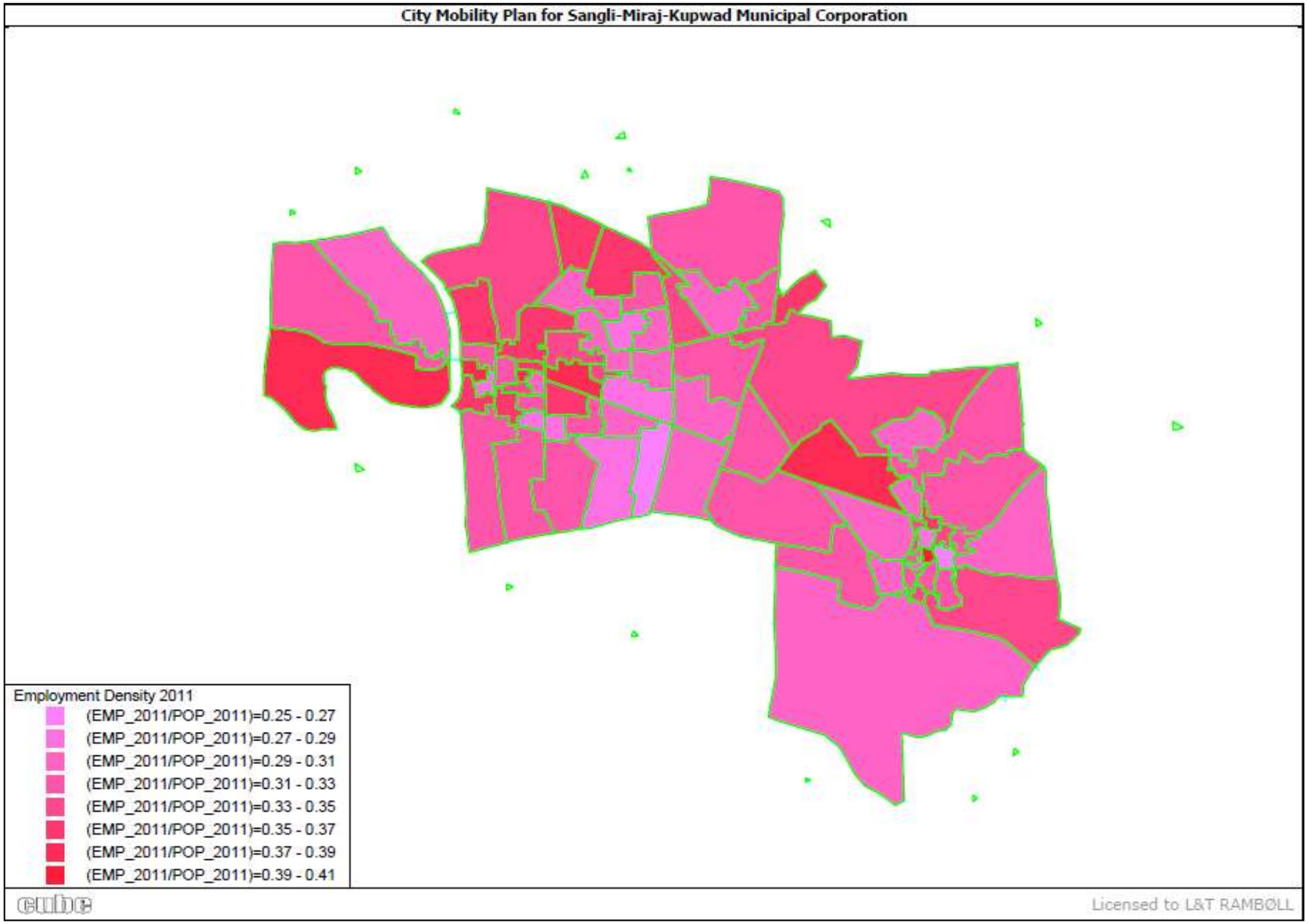


Figure 2-13 Employment Density Distribution of the Study Area in Base Year (2011)

2.5 Vehicle Ownership

2.5.1 Vehicle Registration Data

Time series vehicle registration data for Sangli District which comprises of Sangli Rural and Sangli city was collected from RTO and is presented in **Table 2-21**. Vehicle ownership levels in Sangli is increasing at faster rate due to low levels of supply of public transport and rising income levels.

There are around 1.85 lakh registered vehicles in Sangli city (31st March, 2011) in which two wheeler are 1.41 lakh, followed by 19,149 four wheelers, 5,481 Auto rickshaws and 904 buses. In addition to above around 8,877 Goods vehicles are registered in Sangli-Miraj-Kupwad city. Following observations are made based on the data:

- The proportion of registered vehicles in Sangli City and Sangli Rural is 40% and 60% respectively.
- The proportion of passengers and Goods vehicles in Sangli City is 90% and 10% respectively.
- The proportion of two wheelers is 76% of the total registered vehicles in Sangli City.
- There is no large variation in the growth trend of registered motor vehicles between 2008 and 2010 and the average yearly growth rate in S-M-K- City is around 3%. However, there is a steep rise in the growth of registered vehicles of about 58% between the years 2010 and 2011.

Table 2-21 Time series Vehicle Registration Data for Sangli District

S. No.	Vehicle Category	*Sangli Rural Area (1)*				*Sangli City (2)*				*Sangli District (1)+(2)*			
		2008	2008	2009	2010	2011	2009	2010	2011	2008	2009	2010	2011
1	Two Wheeler	1,83,117	2,00,088	2,24,023	2,11,617	86,152	90,483	93,284	1,41,074	2,69,269	2,90,571	3,17,307	3,52,691
2	Car	12,427	15,911	18,760	18,555	6,120	5,903	7,035	12,370	18,547	21,814	25,795	30,925
3	Jeeps	8,216	9,017	9,944	8,409	2,385	2,258	2,401	5,605	10,601	11,275	12,345	14,014
4	Station Wagon	264	259	259	0	88	93	93	352	352	352	352	352
5	Taxi	673	774	1,231	900	238	222	291	822	911	996	1,522	1,722
6	Auto Rickshaw	3,293	3,707	3,869	1,960	3,645	3,481	3,567	5,481	6,938	7,188	7,436	7,441
7	Stage Carriages	0	227	227	0	873	646	646	823	873	873	873	823
8	Contract Carriages/ Mini Bus	30	32	36	29	12	11	12	19	42	43	48	48
9	School Buses	20	31	37	33	15	13	16	41	35	44	53	74
10	Private Service Vehicles	12	16	18	12	13	13	13	21	25	29	31	33
11	Arti. & Multi Vehicles, Trucks & Lorries	3,355	3,936	4,092	4,329	2,480	2,173	2,259	2,891	5,835	6,109	6,351	7,220
12	Tankers	190	222	280	208	151	138	139	321	341	360	419	529
13	Delivery Van (4 Wheelers)	3,830	4,314	4,948	4,821	1,996	1,777	1,896	3,386	5,826	6,091	6,844	8,207
14	Delivery Van (3 Wheelers)	3,081	3,225	3,473	3,187	1,120	1,412	1,525	2,279	4,201	4,637	4,998	5,466
15	Tractors	9,613	10,478	11,491	11,468	2,440	2,206	2,263	4,165	12,053	12,684	13,754	15,633
16	Trailers	9,156	9,801	10,244	7,396	2,506	2,007	2,040	5,967	11,662	11,808	12,284	13,363
17	Ambulances	60	52	55	30	54	68	76	120	114	120	131	150
18	Others	128	151	233	310	98	90	104	206	226	241	337	516
Total		***2,37,465***	***2,62,241***	***2,93,220***	***2,73,264***	***1,10,386***	***1,12,994***	***1,17,660***	***1,85,943***	***3,47,851***	***3,75,235***	***4,10,880***	***4,59,207***

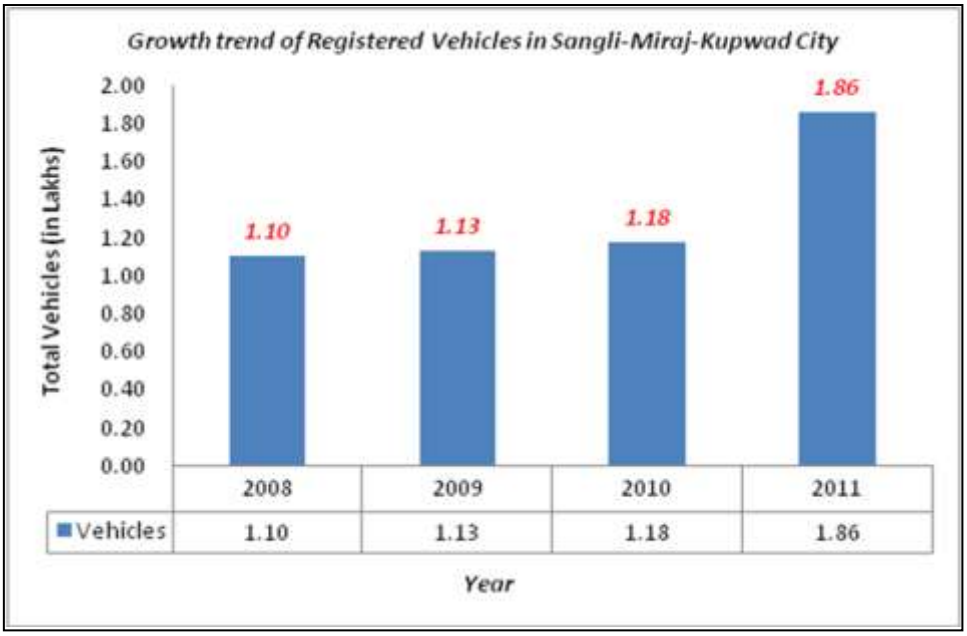


Figure 2-14 Growth Trend of Registered Motor Vehicles in Sangli-Miraj-Kupwad City

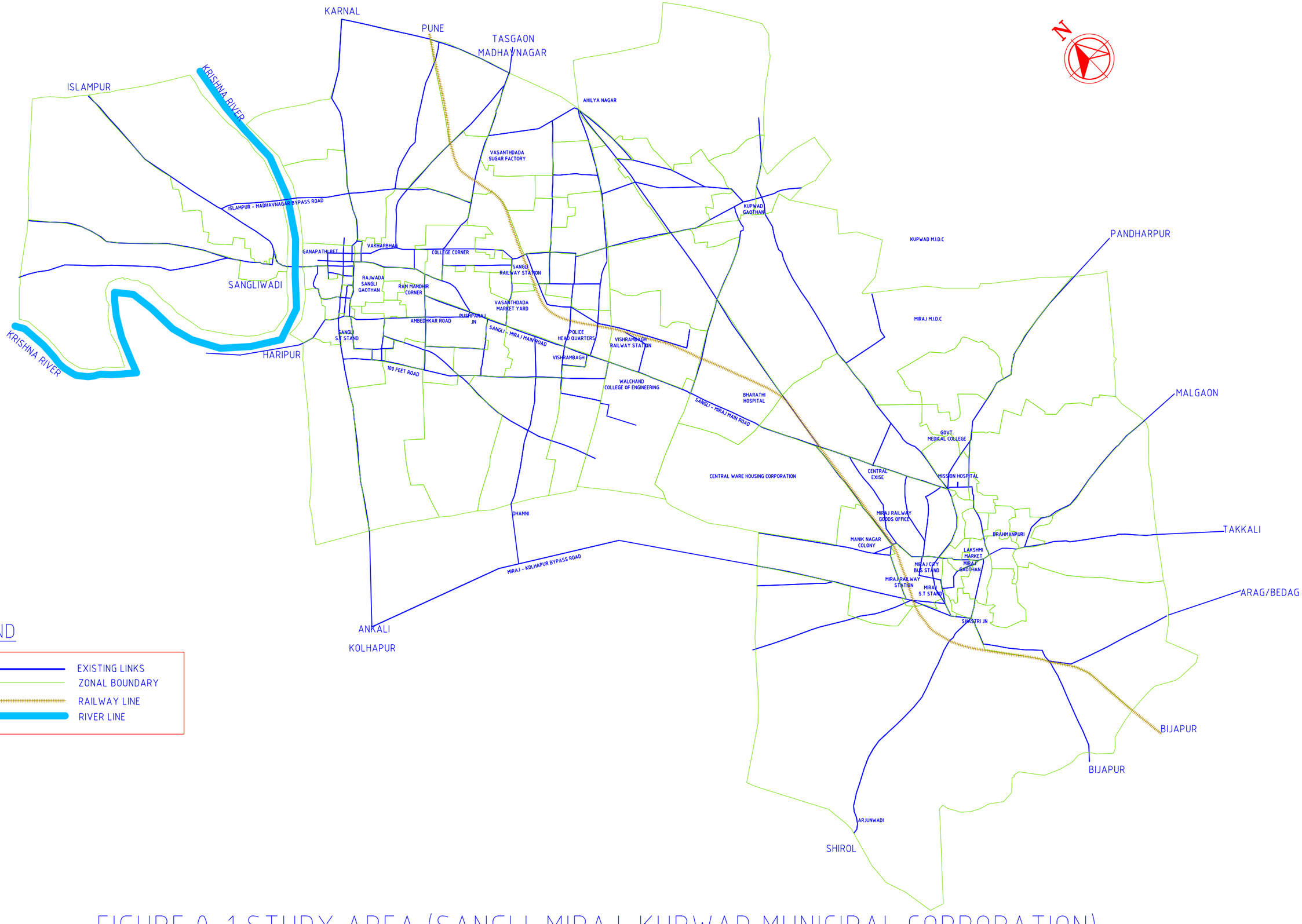
2.5.2 Vehicles in Operation in SMK CMC

It can be observed that total vehicles operating within in S-M-K City is less as compared to registered vehicles collected from RTO. This is due to the fact that data collected from RTO is a cumulative value of vehicles registered over a decade and therefore does not reveal the number of vehicles in operation at present.Moreover the registered vehicles will not take into account vehicles that are scraped and no longer in use. Therefore drawing any conclusions based on registered vehicles is misleading. Therefore, number of vehicles in operation within the city is estimated from Comprehensive Household surveys.

The residents of S-M-K City own are 68,587 two wheelers and 3,575 cars as per household survey. The total vehicles (Two wheeler and Car) are worked out to be around 72,161 in base year (2011). Vehicle ownership forecast is made taking into account motorization achieved in other metropolitan cities of India. Based on above estimates, vehicle ownership will reach 1.4 Lakh by 2021 and 2.3 Lakh by 2031. Higher vehicle ownership results low mobility levels, higher parking demand, and congestion. Environmental pollution levels will reach unsustainable levels and results in health hazards. Therefore there is a need to increase the patronage of public transport by creating necessary infrastructure and polices. The vehicle ownership forecast has been presented in **Table 2-22**.

Table 2-22 Forecast of Vehicle Ownership for S-M-K City

Year	Population	2- Wheeler	Car	Total	2- Wheeler per 1000 population	Car per 1000 population
2011	502697	68587	3575	72161	**136**	**7**
2021	580804	117156	7032	124188	**202**	**12**
2031	658910	190835	12593	203428	**290**	**19**



LEGEND

- EXISTING LINKS
- ZONAL BOUNDARY
- RAILWAY LINE
- RIVER LINE

FIGURE 0-1 STUDY AREA (SANGLI-MIRAJ-KUPWAD MUNICIPAL CORPORATION)

(SCALE 1:0.2)

L&T-RAMBØLL CONSULTING ENGINEERS LIMITED

Client:	**Maharashtra Urban Infrastructure Development Company Limited (MUIDCL)**
Project:	Preparation of City Mobility Plan for Sangli-Miraj-Kupwad Municipal Corporation
Project No.:	C1112502
Title:	Draft Final Report
Document No.:	RP005
Rev.:	0

File path:
I:\roads\2011\c1112502 - cmp sangli\outputs\reports\005-draft final report\updated chapters\chapter-3 -traffic surveys and analysis - updated.docx

Notes:

1.

Revision Details:

Rev.	Date	Details	Prepared Init.	Prepared Sign.	Checked Init.	Checked Sign.	Approved Init.	Approved Sign.
0		First Submission	DSR/ MKC		DSR		LSM	

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3 Traffic Surveys & Travel Characteristics

3.1 Primary Traffic Surveys

The following primary surveys were carried out to collect the household, land use and travel demand data, which will be used for development of the travel demand forecasting models for Sangli-Miraj-Kupwad City.

1. Household (home interview) Survey
2. Cordon Count Surveys and Origin-Destination Surveys
3. Screen line Counts with Occupancy
4. Terminal Survey
5. Junction Counts
6. Road Inventory
7. Speed and Delay Survey
8. Parking Survey
9. Pedestrian Survey
10. Goods Focal Point Survey
11. Vehicle Operating Cost Survey
12. Stakeholders Consultation Survey

3.1.1 Household Interview Survey

Household Interview Survey is a standard method for collection of socio-economic profile, origin – destination and other travel characteristics data of commuters. It provides essential information required in understanding the present behaviour and future needs of the residents as regards to their travel pattern in terms of trip purpose, frequency, modal choice, etc.

Household survey was carried out using Simple Random Sample Technique. The Methodology adopted for household survey sampling is described below:

1. Consultants have collected the latest ward-wise population of S-M-K CMC.
2. Based on ward-wise population, sample size in each ward is arrived.
3. Further, each ward is broadly divided into various blocks/major streets. Sample size to be collected in each block is estimated. Based on the number of samples every 20th house (5% sample) is chosen for conducting household survey. If household is not available (locked etc.) next house is chosen for conducting household surveys. In this manner required number of samples in each ward is collected by trained enumerators.
4. Special training programme is organised to train the enumerators for filling up entries in the specified format. The enumerators were provided with identity cards and authorisation letters issued by S-M-K CMC officials. An advertisement was given through

the local newspaper and the purpose of the survey is explained in detail to the enumerators for ensuring good response from the residents.

5. A pilot survey covering a sample of 100 households in selected wards in study area is conducted. The pilot surveys are undertaken in order to assess the suitability of the questionnaire designed in terms of sequencing, wordings of the questionnaire, time taken to collect the details and the enumerators understanding of the proforma. Pilot survey data is checked thoroughly and the response to all the questions is analysed.
6. A total of 20 trained enumerators are selected and 4 teams are formed with one supervisor in each team. Selected list of households to be interviewed in each ward is distributed to each team. During the survey, Consultants' team monitored the supervisors and enumerators at site at regular intervals every day. Rigorous checking of previous day's filled in questionnaire is done every day. Wherever missing information is observed, the enumerators are asked to revisit those houses to collect accurate information. Issues related to survey form as well as site problems are solved to minimise errors at survey stage itself. Supervisors were also appointed for cross checking of each 10th form by revisiting the house and through telephone.
7. Effort has been made to collect the information from respective persons in the household. Trip information of children is taken from elders/parents. Special attention is paid to capture non-home based trips.
8. Corrected forms were sent for coding of the data. Around 5% of the households were interviewed from 74 wards and a total of 5,226 samples were collected.

3.1.2 Cordon Surveys

Cordon surveys were conducted at the periphery of the study area for a continuous period of 24 hours on 7 major corridors (entry points to the study area), to understand the travel characteristics of the trip makers moving in and out of the study area. The map showing cordon survey locations is presented in **Figure** 3-1.


Cordon Survey on Kolhapur Road

These surveys comprise of conducting traffic volume count surveys and Origin-Destination (O-D) surveys through roadside interview method for both passenger and goods vehicles. Travel characteristics collected by randomly stopping the vehicles and interviewing the principal passenger in multi-occupancy vehicles or the driver of the single-occupancy passenger vehicles and goods vehicles. O-D of inter-city public transport buses obtained from the destination boards. Minimum 20% of the vehicles passing through these points are stopped for interviewing with drivers/passengers. The O-D matrices derived from this survey will be used to update the regional trips in the overall base year O-D matrix.

Cordon surveys were carried out at following National / State Highways connecting the S-M-K City presented in **Table 3-1**.

Table 3-1 Cordon Point Locations

Cordon No.	*Road Name*	*Location*
OC-1	Sangli-Islampur Road (SH-138)	Toll Plaza near Islampur bypass Jn
OC-2	Sangli-Karnal Road (SH-75)	Octrai near Madhavnagar Road
OC-3	Sangli-Tasgaon Road (SH-10)	Between Madhavnagar and Bhudhgaon Village
OC-4	Miraj-Pandharpur Road (MSH-3)	Octrai (Km 197/000)
OC-5	Miraj-Bijapur Road (SH-138)	Toll Plaza at ROB (Km 56/200)
OC-6	Miraj-Shirol (SH-137)	Level Crossing near Laxmi Nagar Colony
OC-7	Sangli-Kolhapur Road (MSH-3)	Abandoned Toll Plaza at Krishna River Bridge

3.1.3 Screen Line Counts

Based on reconnaissance survey, following two screen lines were identified:

- East – West Screen Line
- North – South Screen Line

Data from the screen line are used for validation of the base year travel demand model. 16 locations were identified and traffic surveys were carried out as presented in **Table 3-2** & **Table 3-3**. The screen line locations were shown in **Figure** 3-1. Occupancy surveys were also carried out simultaneously to assess the average occupancy in passenger vehicles.

Screen Line Count at Panchasheelnagar Level Crossing

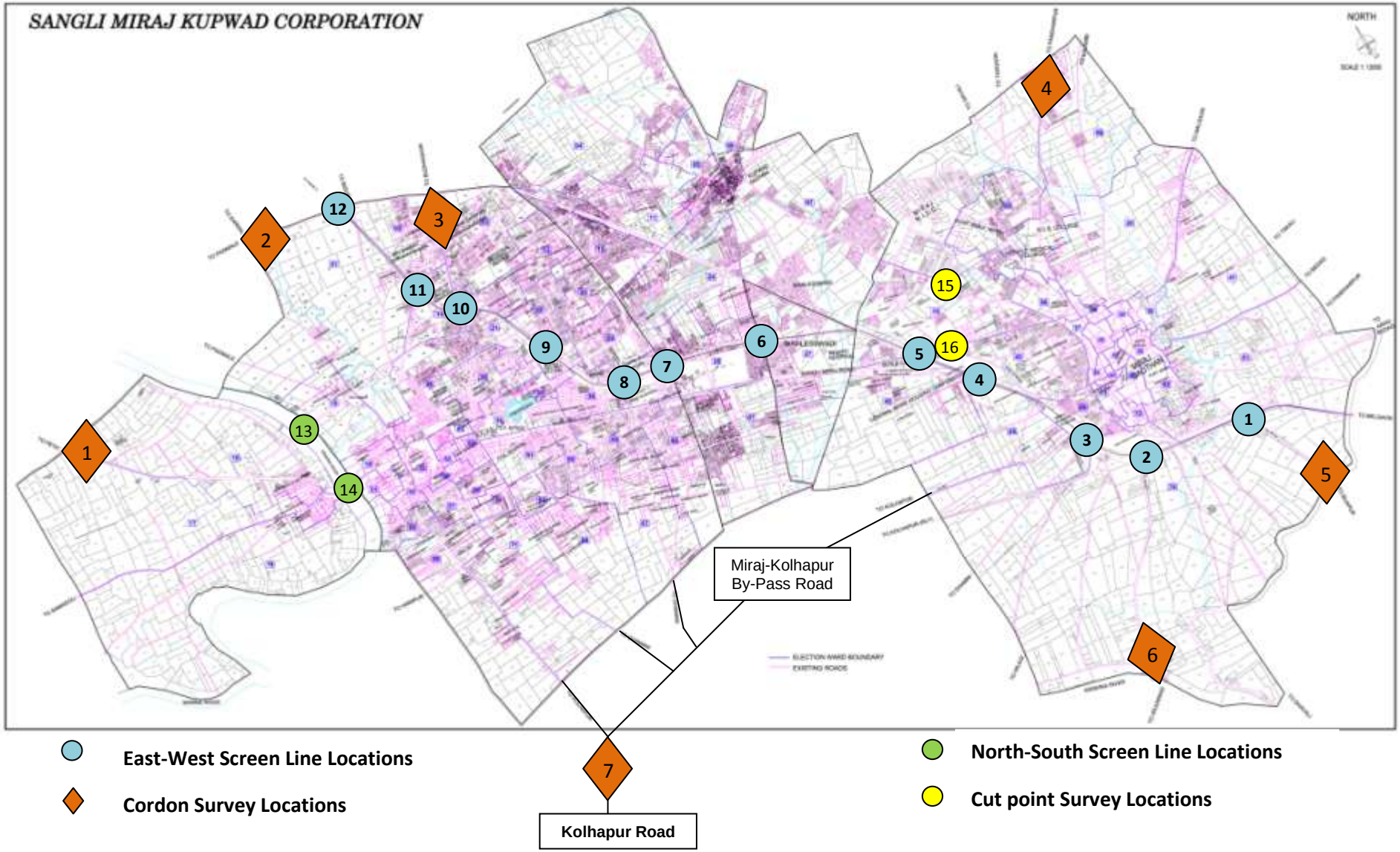

Figure 3-1 Map showing Traffic Survey Locations in S-M-K City

Table 3-2 East-West Screen Line

Screen Line No.	*Location Name*	*Duration of Survey*
SL-1	Toll plaza near ROB on Bijapur Road (SH-138)	24 hrs
SL-2	Level crossing (LC) near Laxmi Nagar Colony on Shirol Road (SH-137)	24 hrs
SL-3	ROB near Miraj Railway station on Miraj-Kolhapur bypass Road (MSH-3)	24 hrs
SL-4	RUB at St.Peter's Telugu Church, Samanthnagar near Maniknagar Colony	16 hrs
SL-5	ROB @ Richardson Leprosy Hospital (Near Maruthi Temple) on Sangli-Miraj Highway (SH-138)	24 hrs
SL-6	RUB at Vijaynagar	16 hrs
SL-7	Level crossing on Vishrambagh Main Road	16 hrs
SL-8	ROB at Police Staff Quarters, Sangli	16 hrs
SL-9	RUB @ Sangli Railway station	16 hrs
SL-10	ROB on Madhavnagar Main Road (SH-10)	16 hrs
SL-11	Level Crossing near Panchasheelnagar	16 hrs
SL-12	Level Crossing on Madhavnagar-Padmalay road (SH-139)	16 hrs

Table 3-3 North-South Screen line

Screen Line No.	*Location Name*	*Duration of Survey*
North-South Screen Line		
SL-13	Krishna river bridge (Islampur-Madhavanagr bypass road)	24 hrs
SL-14	Lord Irwin Bridge on Islampur Road	24 hrs
Cut Points (North-South direction)		
SL-15	Miraj-Kupwad Road at starting of Miraj MIDC	16 hrs
SL-16	ROB @ Richardson Leprosy Hospital (Near Maruthi Temple) on Sangli-Miraj Highway (SH-138)	24 hrs

3.1.4 Terminal Survey

3.1.4.1 Bus Terminal Surveys

In order to assess the inter-city bus passenger movement, O-D survey as well as bus counts with occupancy survey were conducted at government bus terminals. Following bus terminals were selected for terminal surveys:

- Sangli ST bus stand
- Miraj City bus stand
- Miraj ST bus stand


Origin-Destination Survey at Sangli ST bus stand

Schedule of bus services were collected. In addition

to the primary surveys, secondary data related to private bus terminals and their operations have been collected.

3.1.4.1 Rail Terminal Survey


Origin-Destination Survey at Miraj Railway Station

In order to assess the regional rail passenger movement, Rail commuter counts as well as O-D surveys were conducted at following three rail terminals. Madhav Nagar railway station was not considered due to negligible passenger movement.

- Miraj Railway Station
- Sangli Railway Station
- Vishrambagh Railway Station

Permission from Railway Authorities was taken for conducting the survey. Schedule of trains services were collected for deciding the duration of rail commuter counts.

3.1.5 Turning Movement Count Survey


Vehicular Movement at Mission Hospital Jn

Turning Movement Counts were carried out at important major junctions. The survey is carried out for a period of 16 hrs (6.00 am to 10.00 pm). This data is utilised for analysis of diversion & Junction Improvements. The Turning Movement Counts carried out at different junctions are presented in the **Table 3-4.**

Table 3-4 Turning Movement Count Locations

S. No.	*Junction Name*	*Duration of Survey*
1	Tilak Jn	16hrs
2	Maruthi Road Jn (Harbhat Road & Maruthi Road Jn)	16hrs
3	Tarun Bharath Jn	16hrs
4	Municipal Jn	16hrs
5	Rajwada Jn	16hrs
6	Congress Bhawan Jn	16hrs
7	Pushparaj Jn	16hrs
8	Vasanthdada Market Yard Jn	16hrs
9	Vishrambagh Jn (Near Ambassador Hotel)	16hrs
10	Vishrambagh Jn (Near Vishrambagh Police Station)	16hrs
11	Vantamure Corner	16hrs
12	Mahatma Gandhi Jn	16hrs

3.1.6 Road Inventory Survey

Road Inventory Surveys were carried out for about 150 km of the selected road network within the S-M-K City by physically moving through the entire road network collecting information like carriage width, median, footpath details, adjacent land use etc.

3.1.7 Speed – Delay Survey

Speed delay survey was carried out on all categories of roads to assess the speed characteristics of road network within the study area.

3.1.8 Parking Survey


Parking on Miraj Laxmi Market Road

Consultants carried out detailed parking survey at important parking locations. Consultants will review the On-street and Off-street parking data within the study area and for suggesting Parking Improvement Schemes. The review and recommendations will be presented in Transportation Improvement Proposals chapter. Parking Surveys were carried out at following four locations:

- Miraj Market road (Kisan Jn-Srikanth Jn-Vasanthdada Bank-Momin Masjid)
- Congress Bhavan road (Station Jn-Congress Bhavan)
- Ganapathi Peth road (Ganapathi Temple-Patel Jn)
- Maruthi road connecting Ganapathi Peth

3.1.9 Pedestrian Survey


Maruthi Road

Consultants have carried out pedestrian surveys at major traffic generators as well as important corridors where pedestrian movement is high. The survey was carried out for period of 12 hours (9.00 am to 9.00 pm) on a normal working day collecting number of pedestrians moving along and across the road at midblock and at intersections. This survey will provide the current pedestrian demand which will help in checking adequacy existing pedestrian facilities to meet current and forecasted demand. The survey is carried out at the following locations:

1. Harbhat Road
2. Maruthi Road

3.1.10 Goods Focal Point Survey


Vasanthdada Market Yard

The interview survey was carried out at Goods focal points to capture the travel characteristics of the Goods, and identify the facilities required in the outer cordons. Cordon counts and O-D Surveys as well counts at screen line points will also reveal travel characteristics of Goods vehicles. Consultants have carried out Goods Focal point survey at the following places:

1. MIDC (Sangli-Miraj, Kupwad)
2. Vasanthdada Market Yard

3. Ganapathipeth
4. Sangli Railway Godown
5. Bharath Petroleum Corporation Oil Ltd.

3.1.11 Vehicle Operators Survey

A total of 20 vehicle operators of taxis, auto rickshaws and two wheelers are contacted to elicit the operating characteristics of vehicles as well as cost of operation. This data will be utilized for deriving the vehicle operating costs. Vehicle operating costs (VOC) is an important input for development of travel demand models.


Vehicle Operating Cost Survey

3.1.12 Stakeholders Consultation Survey

Consultants have carried out Stakeholders Survey to elicit the opinion of various stakeholders such as Planning officials, University professors, officials of Industrial units and general public on range of development that is expected in near future. A total of 25 stakeholders were contacted for knowing the opinion regarding the growth of city, development in city, opinion regarding the mono rail and transport infrastructure and traffic problem in the city.

3.2 Traffic and Transportation System Characteristics

Traffic characteristics help in appreciating the spatial and temporal features of travel within the area, relationship of traffic intensity with network capacity and prevailing level of service obtained on various corridors of the area. To assess the traffic characteristics in the study area wide range of traffic surveys were carried out. The analyses of various traffic surveys were presented in this section.

Passenger car units (PCUs) as recommended for urban areas by **IRC 106-1990** is used for converting various categories of vehicles into single car units and presented in **Table 3-5**.

Table 3-5 Passenger Car Units for Urban Areas

Sl. No	*Vehicle Type*	*PCU*	
		5% of Total Traffic	*10% and above of Total Traffic*
1	Two Wheeler	0.50	0.75
2	Auto-rickshaw	1.20	2.00
3	Car/Jeep/Van	1.00	1.00
4	Minibus	1.10	1.80
5	Goods Auto	1.20	2.00
6	LCV	1.40	2.00
7	Bus/HCV/MAV	2.20	3.70
8	Agricultural Tractor	4.00	5.00
9	Agricultural Tractor & Trailer	4.00	5.00
10	Animal/Hand Drawn	2.00	3.00
11	Cycle Rickshaw	1.50	2.00
12	Cycle	0.40	0.50

3.2.1 Household Survey

3.2.1.1 General

The objective of carrying out Household survey is to obtain travel characteristics (i.e. such as travel needs of the people, preferences for travel modes, ability to pay for travel and their desires of travel within the area) and household characteristics (Socio-economic characteristics of household) during a typical working day. Such an understanding helps in rational policy formulation, decision making and identification of relevant transport/network system to serve the area.

A questionnaire was designed keeping with the objective, covering questions on personal, household, trip characteristics.

Household Survey was carried out, using a simple random sample technique comprising of **1,04,524** households spread over 74 traffic zones to elicit the necessary socio-economic and travel characteristics. Zone wise number of samples selected for the household survey is presented in the **Table 3-6**.

Table 3-6 Zone Wise Sample Size

Ward No	Ward Name	Population	Households	Sample Size
1	Sangli, Karnal Road	8635	1971	99
2	Sangli,Shanthiniketan	8325	1795	90
3	Sangli,Vasanthdhadha She.Sa.Saa.Kaarkhaana	5546	1280	64
4	Kupwad,Ahilyanagar	10339	2022	101
5	Kupwad,Bus Stand	6617	1250	63
6	Kupwad, Panchayaachi Taaki	6261	1357	68
7	Gaotaan, Jain Galli	9036	1897	95
8	Miraj, S.C.S.College	5627	1226	61
9	Miraj, Hudko Colony	9111	1905	95
10	Miraj, Aadharsh Colony	8055	1839	92
11	Kupwad,Dawaleshwar Colony	4578	1128	56
12	Kupwad,Yashwanthnagar	8332	1841	92
13	Sangli, Sanjaynagar	9703	2227	111
14	Sangli,Ganah Shaamnagar	5375	1132	57
15	Sangli,Gavali Galli	7179	1372	69
16	Sangliwadi,Dattmandhir	5972	1358	68
17	Sangliwadi,Gaotaan	6252	1240	62
18	Sangliwadi,Bhowddha Wa Charmkaar Vasaahat	3777	701	35
19	Sangli, Sri Ganapati Mandhir	5625	1203	60
20	Sangli, Mahaaveernagar Venkateshnagar	6914	1385	69
21	Sangli, Sambhaaji Colony,Sanjay Gaandhi Jhopadpatti	7524	1568	78
22	Sangli Abhinandhan Colony	5226	943	47
23	Sangli, Abhaynagar	8273	1736	87
24	Kupwad,Sharada Housing Society	10022	2076	104
25	Miraj Pandarpur Road	11073	2409	120
26	Miraj, Israilnagar	5368	1187	59
27	Waanleswaadi, Sainiknagar	7819	1613	81
28	Kupwad, Willingdon College	7066	1550	78
29	Sangli, Claasic Park	7159	1594	80
30	Sangli College Corner	5410	1111	56
31	Sangli,Gaobhaan Jain Basthi	6799	1617	81
32	Sangli, Raajwaadaa Parisar	5226	1011	51
33	Sangli, Daa.Ambedhkar Stadium	6248	1113	56
34	Sangli, Kaaliikan Uttar Shivaji Nagar	4906	1060	53
35	Sangli, Baalhanumaan Colony	5372	1121	56
36	Sangli, Vasanth Colony	5360	1181	59
37	Miraj, Shivajinagar,Saathputhe Galli	6416	1248	62
38	Miraj Ganesh Thalaav	4578	927	46
39	Miraj, Vidhyaamandhir Prashaalaa	5410	1187	59
40	Miraj, Baanu Thaalim	4365	1022	51

Ward No	Ward Name	Population	Households	Sample Size
41	Miraj, Indhiraanagar	9856	1944	97
42	Miraj Rewnii Galli Ma.Na.Paa. Kaaryaalay	6055	1250	63
43	Miraj, Kisaan Chowk	5654	900	45
44	Miraj, Saraaph Kattaa	5801	1095	55
45	Miraj, Daa.Ambedhkar Udhyaan	5095	1105	55
46	Miraj, Central Ware Housing	6149	1218	61
47	Kupwad Government Colony, Vishrambaagh	7600	1703	85
48	Sangli, M.S.E.B.Colony Vishrambaagh	8494	1995	100
49	Sangli, Neminaathnagar	6140	1408	70
50	Sangli, Baapat Malaa	9673	2219	111
51	Sangli Maali Chithramandhir	3666	714	36
52	Sangli Samyogh Colony	5129	1061	53
53	Sangli Khanbaagh	5537	1109	55
54	Sangli, Gaobaagh, Ankali Police Chowki	4990	1215	61
55	Sangli, Haripur Road, Siddharth Parisar	7148	1471	74
56	Sangli, Aakaashawaani Kendhra	8843	1797	90
57	Sangli, Pathrakar nagar	8238	1683	84
58	Sangli, Hirabaagh,Water works	4920	1018	51
59	Sangli, Ganesh nagar	5095	1106	55
60	Miraj-Sangli wes	5416	970	48
61	Miraj oodaa, Aarag-Bedag road	9181	1706	85
62	Miraj, Killaa baagh	5731	1095	55
63	Miraj, High school parisar	7265	1350	67
64	Miraj, Guruwaar pet	4982	808	40
65	Miraj, S.T.stand parisar	5359	1023	51
66	Miraj, Maanik nagar	8723	1726	86
67	Sangli, Oxidation Ponds	8371	1853	93
68	Sangli, Hanumaan nagar	11081	2476	124
69	Sangli, Indhiranagar Jhopadpatti	6094	1232	62
70	Sangli, Ramaamaathaa nagar	7628	1485	74
71	Sangli, Khilaare Mangal Kaaryaalay	8277	1704	85
72	Miraj, Nadhii Wes	5385	1074	54
73	Miraj, Miraasaaheb Dhargaa	6494	1166	58
74	Miraj, Krishnaa ghat road parisar	7751	1441	72
	Total	***502697***	***104524***	***5226***

Study area is divided into zones in order to have a spatially disaggregated idea of origin and destination of trips. Comprehensive zoning system was adopted so as to reveal not only travel pattern within study area but also pattern and interaction with areas outside the study area. This will help in suggesting regional linkages between different towns/areas around S-M-K City. The data analysed has also been carried out at four-spatial levels. For this purpose 74 wards have been divided into four sectors. The details of ward wise distribution within each sector have been presented in **Table 3-7** and also shown graphically in **Figure 3-2**.

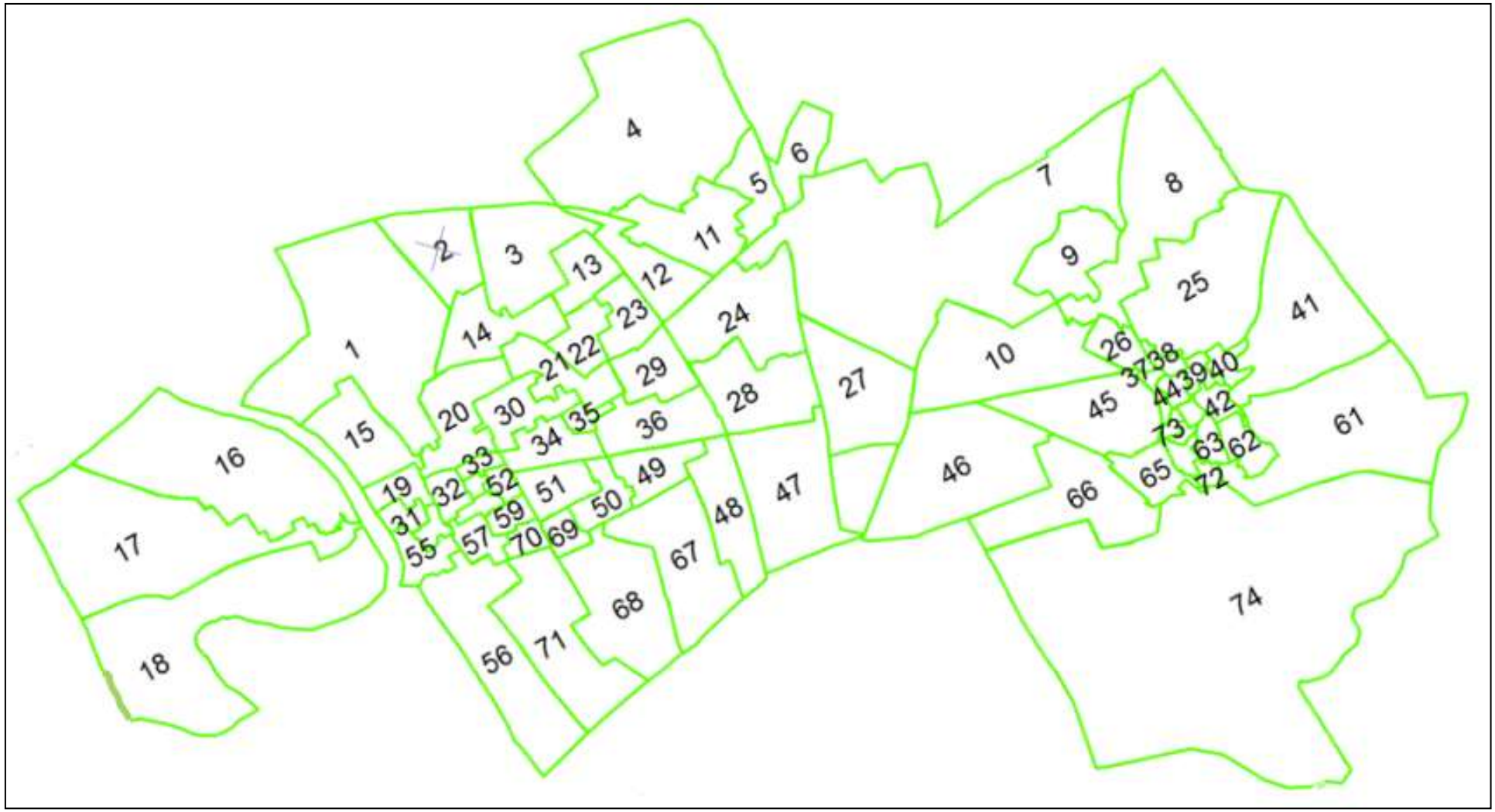

Figure 3-2 Ward Map of Study area (S-M-K City Municipal Corporation)

Table 3-7 Sector Wise Ward Distribution

Sector	No of Wards	Wards in Each Sector	Area (sq km)	% of Area
Sangli	36	1,2,3,13,14,15,19,20,21,22,23,29,30,31,32,33, 34,35,36,48,49,50,51,52,53,54,55,56,57,58,59 ,67,68,69,70,71	33.28	28.16
Sangliwadi	3	16,17,18	14.05	11.89
Kupwad	10	4,5,6,7,11,12,24,27,28,47	25.85	21.87
Miraj	25	8,9,10,25,26,37,38,39,40,41,42,43,44,45,46,6 0,61,62,63,64,65,66,72,73,74	45.00	38.08
		Total Area	***118.18***	***100***

Household survey data is analysed and presented under following heads.

- Household socio-economic characteristics
- Personal characteristics
- Trip characteristics

3.2.2 Household Socio-Economic Characteristics

3.2.2.1 Household Size

The average household size in S-M-K Study area in base year is 4.35 in which age group above 5 years is considered, as per 2001 average household size is 4.95 in which children (0-6 years) constitute around 10.1% of total population, if we take this into account average household size comes to 4.87 which is close to census. Household size in Sangli, Sangliwadi, Kupwad and Miraj is 4.34, 4.50, 4.25 and 4.39 respectively as shown in **Figure 3-3**. The distribution of households by size has been presented in **Table 3-8** & variation of Household size is shown in **Figure 3-4**.

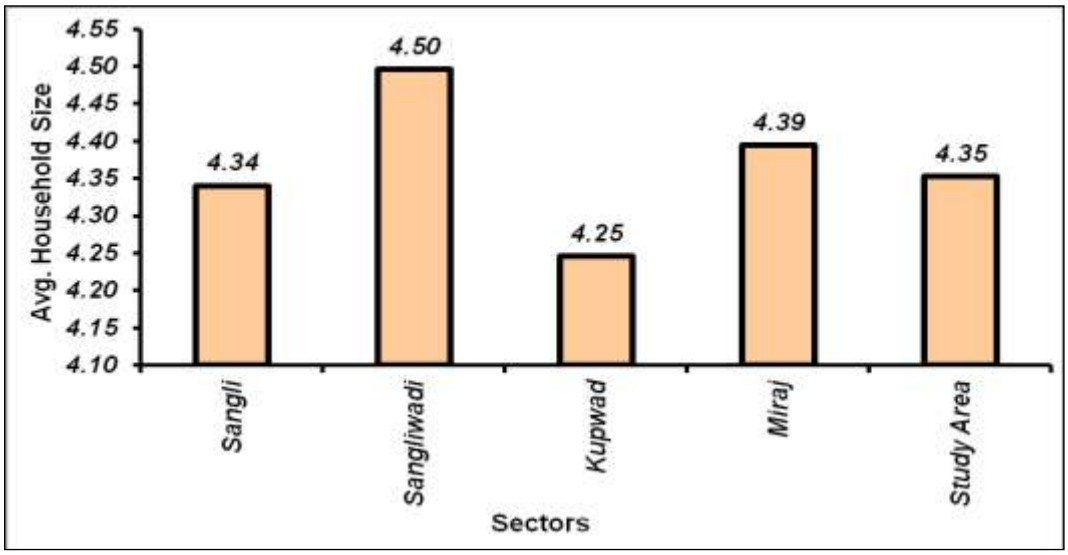

Figure 3-3 Sector wise Average Household Size

Table 3-8 Distribution of Households by Size (%)

Household Size	Sangli	Sangliwadi	Kupwad	Miraj	Study Area
1	0.36	0.00	0.00	0.21	0.24
2	2.59	0.00	1.90	2.95	2.51
3	21.01	16.44	24.49	20.13	21.11
4	38.85	47.95	40.82	34.36	38.02
5	22.57	20.55	20.41	26.44	23.40
6	9.95	8.90	8.31	10.87	9.96
7	2.54	2.05	3.06	3.58	2.93
8	0.85	2.74	0.58	0.91	0.89
9	0.80	1.37	0.00	0.49	0.60
10	0.40	0.00	0.44	0.07	0.29
>10	0.09	0.00	0.00	0.00	0.04
Total	***100***	***100***	***100***	***100***	***100***

It can be observed that 21% of the households have 3 members, 38% of households have 4 members and 23% of households have 5 members in the study area.

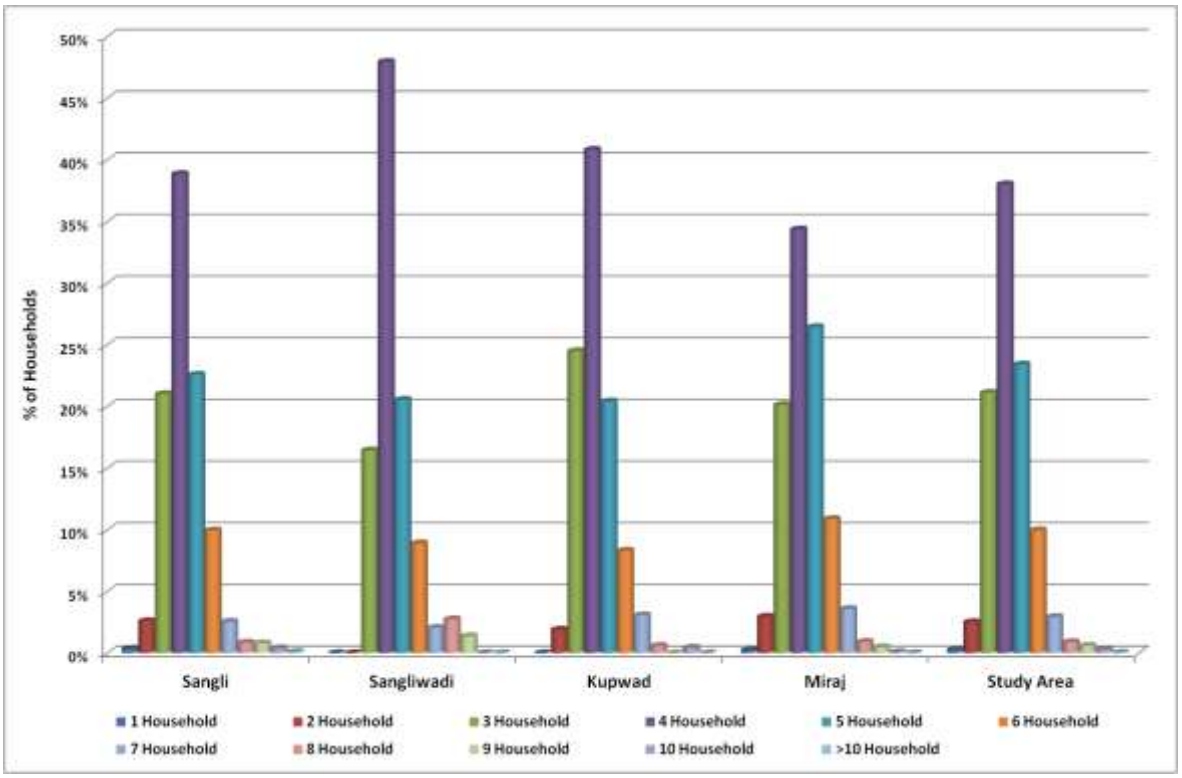

Figure 3-4 Distribution of Household Size in Study Area

3.2.2.2 Household Income

The average household income in the study area was observed to be Rs. 9084. The sector-wise average household income is presented in the **Figure 3-5.**

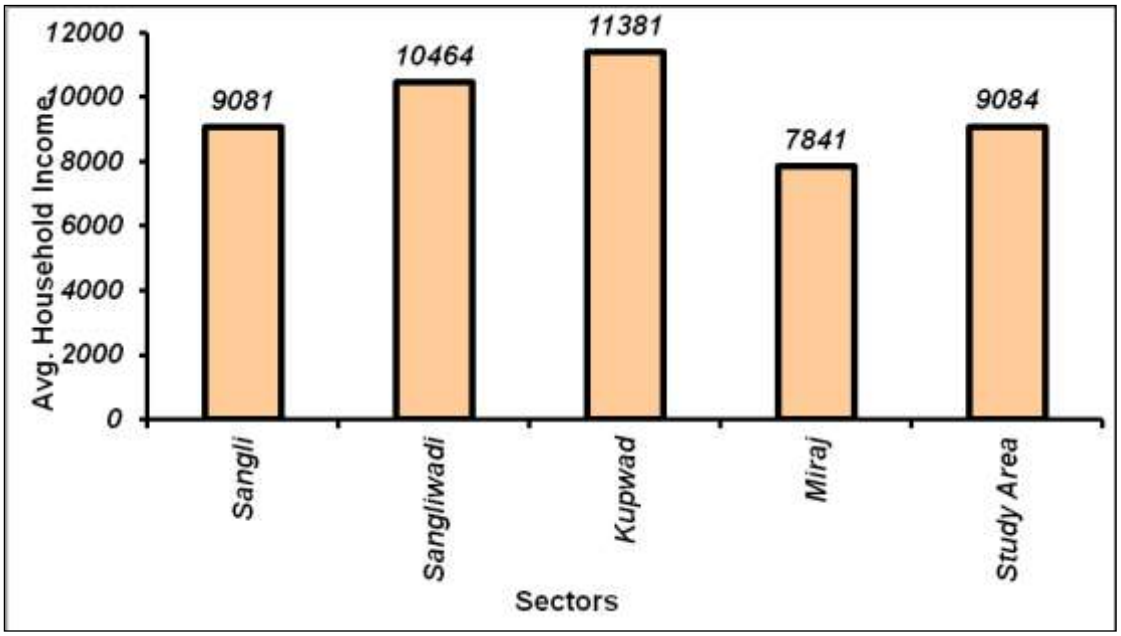

Figure 3-5 Sector-wise Average Household Income

The distribution of households under various income groups reveals that majority of the households (33.1%) fall within the income range of Rs. 2501 to Rs. 5000, followed by 34.4% households whose income was in the range of Rs. 5001 to 10000 per month. Disaggregate analysis shows that ward 22 (Abhinandhan Colony) is the most affluent zone in the study area having an average household income of Rs. 15,760 per month, while Zone 42 (Miraj Rewnii Galli) had the least at Rs.5,076. It is observed that Sangli Sector income is highest followed by Miraj, Kupwad, Sangliwadi sectors. Distribution of households under different income groups are presented in **Table 3-9**.

Table 3-9 Distribution of Households by Income (%)

Income Range	Sangli	Sangliwadi	Kupwad	Miraj	Study Area
Upto 2500	7.09	2.74	5.83	9.33	7.47
2501 – 5000	33.41	26.03	28.13	35.83	33.13
5001 – 10000	33.76	36.30	34.26	35.41	34.44
10001 – 15000	12.89	19.18	12.97	10.87	12.47
15001 – 20000	6.29	6.16	6.56	4.28	5.69
20001 – 30000	4.01	5.48	5.83	3.16	4.07
30000 – 40000	1.16	4.11	3.21	0.49	1.36
40001 – 50000	0.71	0.00	1.75	0.14	0.67
Above 50000	0.67	0.00	1.46	0.49	0.71
Total	***100***	***100***	***100***	***100***	***100***

3.2.2.3 Vehicle Ownership

The average vehicle ownership per household in the study area is 1.80 vehicles including cycles and 0.74 vehicles excluding cycle in the study area.

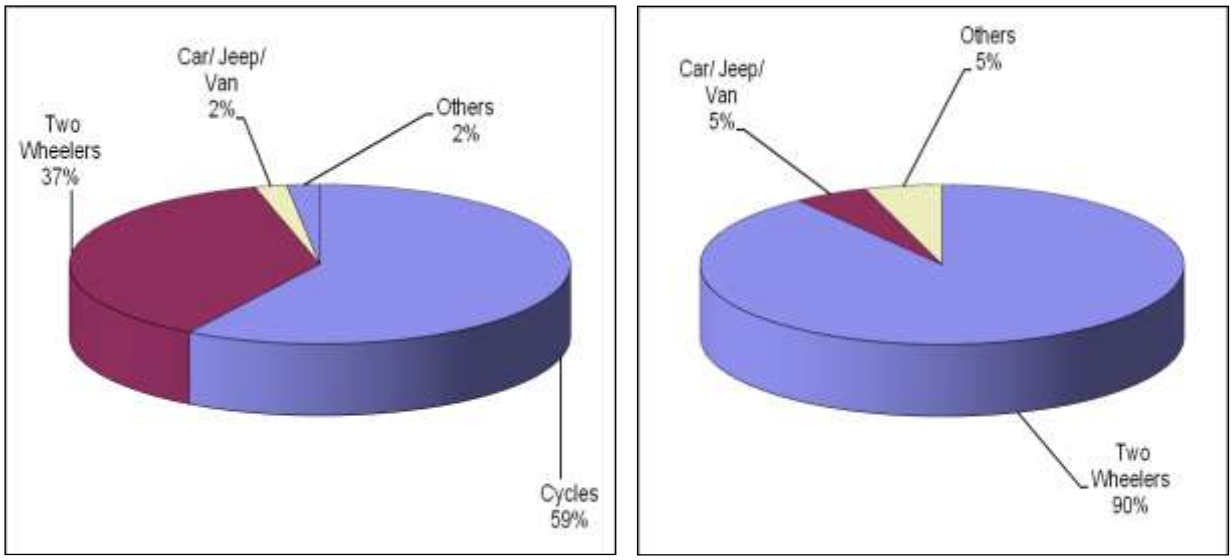

Figure 3-6 Proportion of Vehicle Ownership With & without Cycle

It is observed that the proportion of cycle, two wheeler and car in total vehicles in the study area is 59%, 37% and 2% respectively. Distribution of vehicle ownership by type is shown in **Table 3-10**.

Table 3-10 Distribution of Vehicles by Type (%)

Vehicle Type	Cycles	Two Wheelers	Car/ Jeep/ Van	Others
Sangli	58.44	37.40	2.03	2.13
Sangliwadi	50.91	43.64	1.45	4.00
Kupwad	52.59	42.53	3.89	0.99
Miraj	63.46	32.85	1.14	2.54
Study Area	***58.70***	***37.12***	***2.05***	***2.13***

Distribution of households by type of vehicle ownership is presented in the **Table 3-11**.

Table 3-11 Distribution of Households by Type of Vehicle ownership (%)

Vehicle Type	Sangli	Sangliwadi	Kupwad	Miraj	Study Area
No Vehicle	7.9%	4.1%	4.2%	10.7%	8.1%
Only Cycle	36.4%	26.7%	32.5%	42.6%	37.5%
Only Two Wheeler	16.7%	26.7%	20.8%	13.3%	16.6%
Only Car	0.4%	0.7%	0.1%	0.3%	0.3%
Only Cycle & Two Wheeler	35.8%	39.7%	35.3%	31.8%	34.6%
Only Cycle & Car	0.4%	0.7%	0.0%	0.0%	0.2%
Only Two Wheeler & Car	1.1%	0.0%	4.2%	0.6%	1.4%
Cycle, Two Wheeler & Car	1.4%	1.4%	2.8%	0.8%	1.4%
Total	**100%**	**100%**	**100%**	**100%**	**100%**

It can be observed that distribution of households by vehicle ownership (Cycle, Two Wheeler and Car) shows that about 92% households in the study area own at least one vehicle, while 8% of households do not own any vehicle. About 74% of the households are having at least

one cycle. The distribution of households by vehicle ownership (motorised) shows that about 54% households in the study area own at least own one two-wheeler whereas 3% households in the study area own at least own one car.

3.2.2.4 Household Expenditure Pattern

Average household Expenditure on travel is Rs. 918 per month on transport, which is about 11% of total household income. Proportion of expenditure on travel in total income is presented in **Table 3-12**.

Table 3-12 Proportion of Expenditure on Travel in Total Income

Sector	Proportion of Income on Travel (%)
Sangli	10.12
Sangliwadi	8.19
Kupwad	8.51
Miraj	10.22
Study Area	***10.11***

Distribution of households by travel expenditure is shown in **Table 3-13**. It can be observed that 44% of households spend around Rs.501 to Rs.1000 on travel per month.

Table 3-13 Distribution of Household by Expenditure on Travel (%)

Expenditure on Travel	% of Households
<50	0.00
51-100	0.09
101-200	1.36
201-300	5.67
301-400	11.16
401-500	11.29
501-1000	43.84
>1000	26.60
Total	***100***

Further the average travel expenditure in general, increases with increase in income in absolute terms. The average monthly household expenditure on travel by Income groups is presented in **Table 3-14**.

Table 3-14 Average Monthly Household Expenditure on Travel by Income Groups

Income Range	Average Expenditure on Travel	Proportion on Travel in Monthly Income (%)
Up to 2500	566	30.16
2501 - 5000	635	15.90
5001 - 10000	849	11.06
10001 - 15000	1116	8.57
15001 - 20000	1535	8.41
20001 - 30000	1825	7.19
30000 - 40000	1973	5.48
40001 - 50000	2427	5.23
Above 50000	4116	5.80

3.2.2.5 Earners

Average number of earners per household in S-M-K City Municipal Corporation is **1.40**. Distribution of earning members in a household is presented in **Table 3-15**. While about 64.45% of the households have single earners in the family, 25.22% of the households have two earners in the family and 7.7% of the households have three or more earners in the family.

Table 3-15 Distribution of Households by Number of Earners

No of Earning Members in Household	% of Households
0	2.64
1	64.45
2	25.22
3	6.30
>3	1.39
Avg. Earners/HH	***1.40***

3.2.2.6 Students

Average number of Students per household in S-M-K City Municipal Corporation is **1.29**. Distribution of students in a household is presented in **Table 3-16**. While about 28% of the households have no students in the family, 29% of Households have one student, 31% of the households have two students in the family and 12% of the households have three or more students in the family.

Table 3-16 Distribution of Households by Number of Earners

No of Students in Household	% of Households
0	28.06
1	29.07
2	31.05
3	10.08
>3	1.74
Avg. Students/HH	***1.29***

3.2.3 Personal Characteristics

3.2.3.1 Age Structure

Population distribution under different age groups reveals that majority of population (13%) in the study area is in the age group of 20 to 24. Population under working age group (20-60) constitutes about 63% in the total population of the study area. Population distribution under different age groups in the study area is presented in **Table 3-17** and **Figure 3-7**. It can be seen that population up to age 5 years constitute about 2%, whereas population over 60 years comprise about 9% of the total population within study area. During the household survey children whose age is below 4 years are not considered and therefore % of children of age 0-4 years is less.

Table 3-17 Population Distribution by Age

Age	%
0-4	2
5-9	6
10-14	8
15-19	11
20-24	13
25-29	11
30-34	8
35-39	8
40-44	7
45-49	7
50-54	5
55-59	4
60-64	3
65-69	3
70-74	1
75-79	1
Above 80	1
Total	***100***

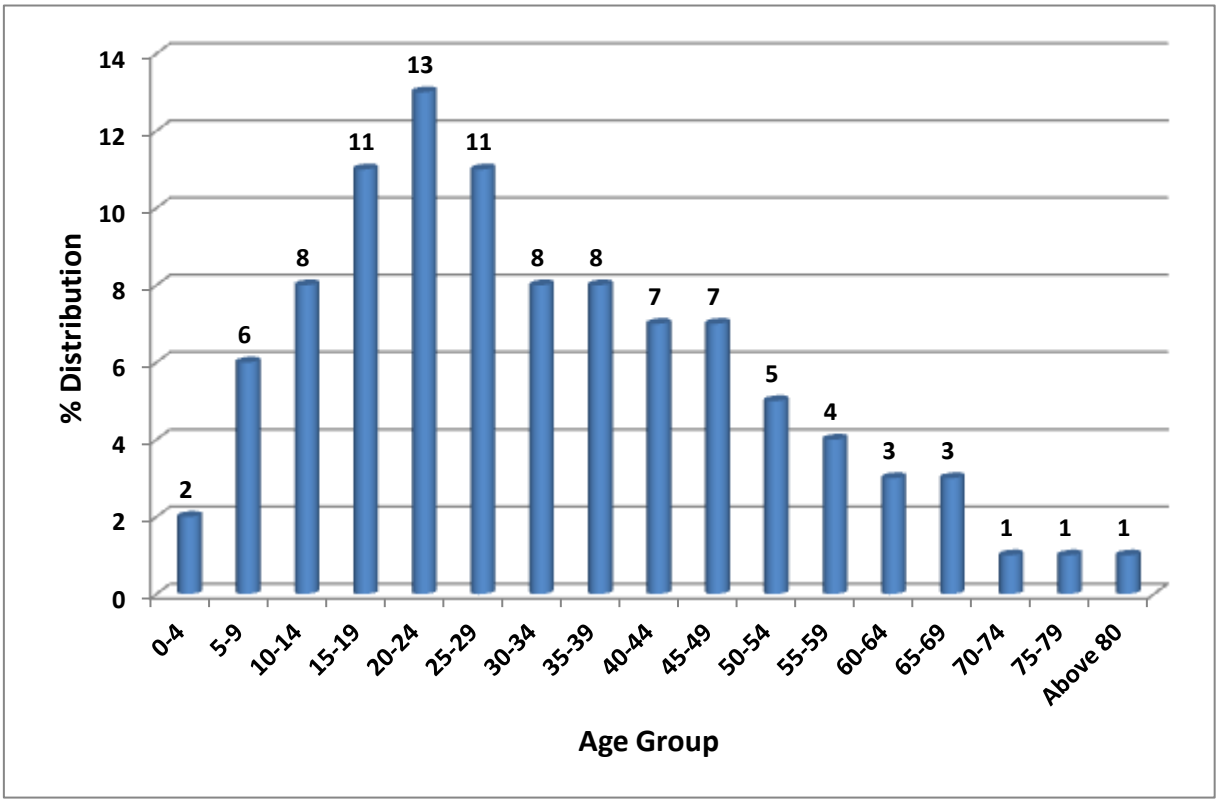

Figure 3-7 Population Distribution by Age

3.2.3.2 Gender

The Sex Ratio (number of females per thousand males) in the study area is observed as **914**.

3.2.3.3 Educational Profile

Overall 91% of the total population is literate. Majority of the population (41%) in the study area has Secondary School education followed by 21% of the population has Primary School education. Graduate and higher and professional qualified population accounted for 13%. Population distribution based on educational qualification is presented in **Table 3-18**.

Table 3-18 Distribution of Population by Educational Qualification

Education Level	Study Area (%)
Illiterate	9
Primary School	21
Secondary School	41
Up to HSC	15
Graduation	11
Post Graduation	2
Total	***100***

3.2.3.4 Occupation

The classification of workers under different occupation groups is presented in **Table 3-19**. The distribution of population by occupation reveals about 30% of the population comprise of students, while 31% comprise of housewives and is presented in **Figure 3-8**.

Table 3-19 Distribution of Population by Occupation (%)

Occupation	Sangli	Sangliwadi	Kupwad	Miraj	Study Area
Service (Govt. Sector)	4.05	5.38	4.30	3.46	***3.94***
Service (Pvt. Sector)	7.45	5.54	8.57	5.25	***6.85***
Business	4.43	1.85	2.88	3.16	***3.70***
Profession	7.47	4.15	4.65	7.16	***6.84***
Farmer	0.64	9.85	2.01	1.68	***1.49***
Worker/Labour	8.30	6.15	9.55	11.10	***9.31***
House Wife	30.70	32.77	32.84	31.16	***31.23***
Student	30.27	27.69	28.39	29.73	***29.73***
Unemployed	3.07	4.15	2.53	3.97	***3.32***
Retired	3.28	1.69	4.13	2.98	***3.26***
None	0.33	0.77	0.14	0.34	***0.32***
Total	***100***	***100***	***100***	***100***	***100***

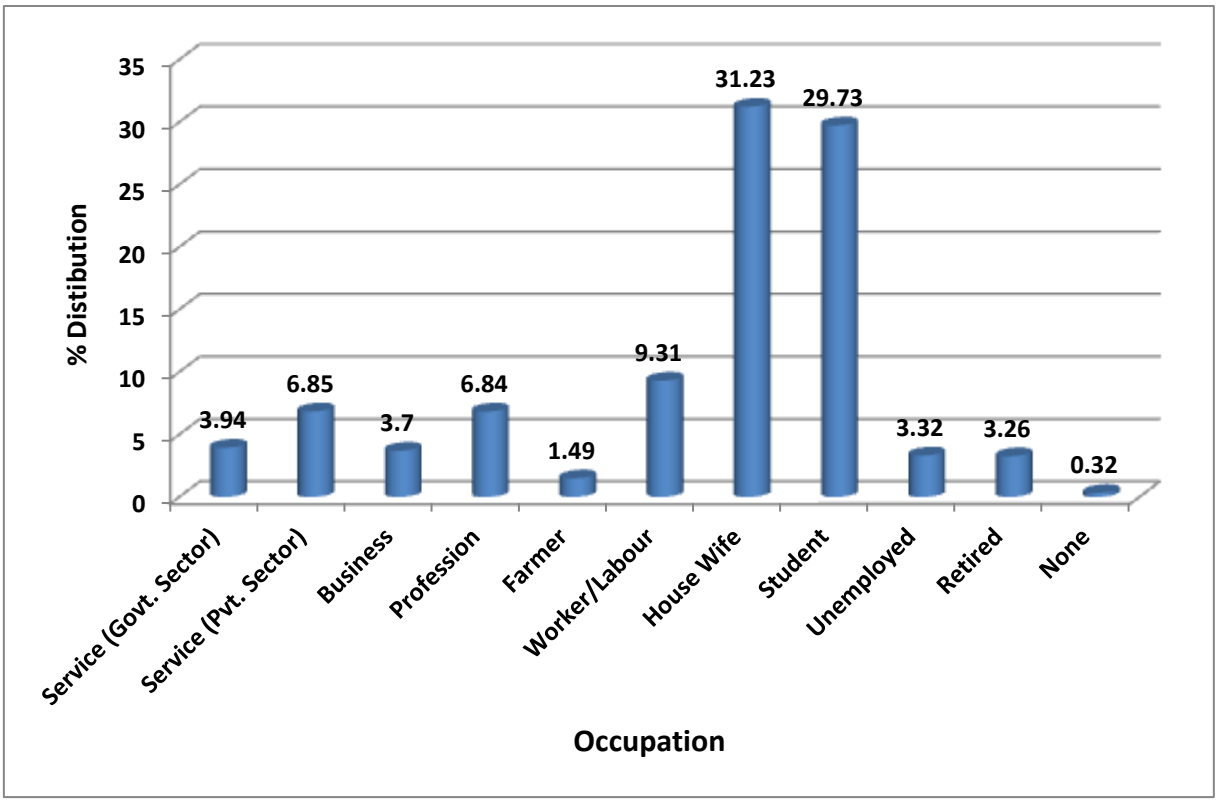

Figure 3-8 Distribution of Population by Occupation

3.2.3.5 Employment Sector

The distribution of population by employment sector is presented in **Table 3-20**. It can be observed informal employment is around 17% of the total employment. Further service sector employs 40% followed by trade & commerce 9% and construction & manufacturing employees 29%. Employment in Agriculture is around 6% only.

Table 3-20 Distribution of Population by Employment Sector

Employment Sector	Sangli	Sangliwadi	Kupwad	Miraj	Study Area
Agriculture	4.16	29.44	7.34	6.83	***6.34***
Construction/Mining	10.36	7.48	12.53	12.61	***11.30***
Manufacturing (Household)	7.54	7.48	6.37	6.93	***7.17***
Manufacturing (Others)	8.28	4.67	10.48	12.71	***9.89***
Service	30.40	32.24	34.99	23.87	***29.07***
Retail/Whole sale Trade	9.75	3.74	6.16	9.15	***8.82***
Transport/Communication/Utilities	10.04	5.14	4.21	6.78	***7.97***
Finance/Insurance/Real Estate	1.37	0.00	1.19	0.80	***1.12***
Educational	1.41	0.00	1.40	1.41	***1.36***
Informal Employment	16.69	9.81	15.33	18.89	***16.95***
Total	***100***	***100***	***100***	***100***	***100***

3.2.3.6 Worker Participation Ratio

The estimated work force participation rate (WFPR) in the study area from household survey is 32%.

3.2.3.7 Place of Work

Place of work distribution in the study area among various sectors is presented in the **Table 3-21**.

Table 3-21 Place of Work Distribution

Place of Work	% Distribution
Sangli	50
Sangliwadi	3
Kupwad	15
Miraj	32
Study Area	***100***

3.2.4 Trip Characteristics

3.2.4.1 Total Trips

An estimated 38,365 trips are made on an average day by 5226 sample households. Thus number of trips performed by residents of the S-M-K city municipal corporation study area is estimated to be around **7.68 Lakhs per day**.

3.2.4.2 Per Capita Trip Rate

The overall Per Capita Trip Rate (PCTR) observed in the study area was **1.53**, while the vehicular PCTR (excluding walk) was **0.83**.

3.2.4.3 Mode of Travel

The distribution of trips amongst different modes shows that the share of Two Wheelers trips is (17.89%) and ST Bus Trips (3.38%).Share of Non-Motorised mode (Walk and Bicycle) accounts for 69.60%. Auto accounts for of 4.88% of total trips. The details of mode wise distribution of trips including walk & excluding walk are presented in the **Table 3-22**.

Table 3-22 Mode-wise Distributions of Trips

S. No	Mode Of Travel	% of Trips Including Walk	% of Trips Excluding Walk
1	Walk	45.64	
2	Cycle	23.96	44.08
3	Scooter /Moped	17.89	32.91
4	Auto rickshaw	4.88	8.98
5	Shared Auto	2.92	5.38
6	Car/Jeep/Van	0.90	1.65
7	Taxi	0.03	0.06
8	Mini Bus	0.11	0.21
9	Govt/ST Bus	3.38	6.23
10	Company/School Bus	0.12	0.21
11	Rail	0.13	0.23
	Total	***100***	***100***

3.2.4.4 Purpose of Travel

Trip distribution by purpose of travel shows that work & business and education trips account for 34% and 28% respectively. Shopping trips account for 25% of total share of trips. The details of purpose-wise distribution of trips are given in the **Table 3-23**.

Table 3-23 Purpose-Wise Distributions of Trips

S. No	Purpose	% of Trips
1	Work/ Business	34
2	Education	28
3	Shopping	25
4	Social/ Religious/ Recreation	6
5	Health/Hospital	5
6	Other Purpose	2
	Total	***100***

3.2.4.5 Trip Length

The average trip lengths observed are 2.83 km and 4.25 km including and excluding walk trips respectively. Trip Length Frequency Distribution (TLFD) shows that majority of the trips has trip lengths between 1 km and 4 km (84%) including walk and the details are presented in **Table 3-25** and **Figure 3-9.**

Table 3-24 Distribution of Trips by Trip Length

Distance Range (in Km)	% Trips	
	Including Walk	Excluding Walk
0.5	13.13	2.39
1.00	26.44	11.29
2.00	24.11	24.29
3.00	13.17	20.93
4.00	7.28	12.58
5.00	5.02	8.72
6.00	2.58	4.67
7.00	1.94	3.50
8.00	1.07	1.96
9.00	0.78	1.44
10.00	1.11	2.04
>10.00	3.37	6.18
Total	***100***	***100***
Average	***2.83***	***4.25***

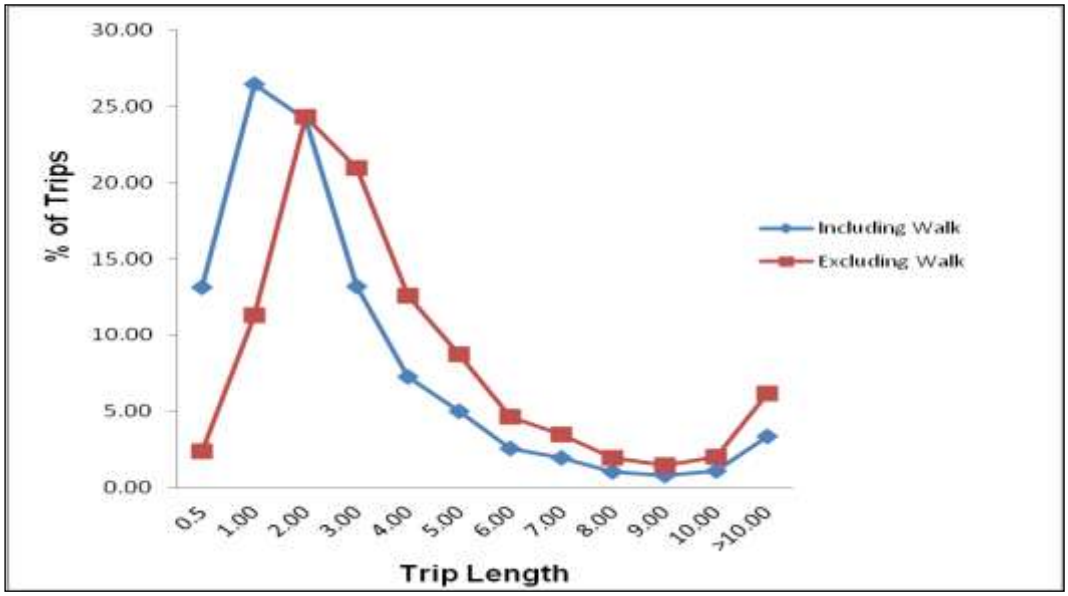

Figure 3-9 Distribution of Trips by Trip Length

3.2.4.6 Average Trip Length, Travel Cost by Mode

Analysis of the data for average trip length (ATL) shows that walk trips have an ATL of 1.17 km, two wheeler trips 4.93 km and car 5.47 km. Average trip cost for Two wheeler, Auto and Car is Rs.10.71, Rs.22.61 and Rs.31.57 respectively. The details are presented in **Table 3-25**.

Table 3-25 Mode wise ATL and ATC for S-M-K Study Area

Sl No	Mode	Avg TL (km)	Avg TT (Min)	Avg TC (Rs)	Avg WT (Min)
1	Walk	1.17	14.33	0.01	0.00
2	Cycle	2.81	17.82	0.01	0.00
3	Cycle Rickshaw	0.00	0.00	0.00	0.00
4	Scooter /Moped	4.93	16.90	10.71	0.00
5	Autorickshaw	2.77	15.92	22.61	0.77
6	Shared Auto	4.59	20.50	8.33	3.02
7	Car	5.47	21.18	31.57	0.00
8	Taxi	5.23	19.09	19.09	1.82
9	Mini Bus	5.82	18.92	11.41	0.54
10	ST Bus	10.73	35.74	12.60	7.52
11	Company/School Bus	7.07	29.84	12.32	3.68
12	Rail	20.56	47.69	18.76	10.90
	Study Area	***2.82***	***16.74***	***13.28***	***8.90***

3.2.4.7 Average Trip Length by purpose

The purpose wise distribution of ATL indicates that amongst trip purposes ' work' trips & Social/Religious/Recreation trips have maximum average trip lengths 3.97 Km & 3.79 km respectively, followed by 'Business' trips 3.27 km other purpose trips 3.21 km and. The average trip length for education trips is 2.50 km. The purpose wise ATL for the study area is presented in **Table 3-26**.

Table 3-26 Average Trip Length by Purpose of Trip

Purpose	Average Trip Length (Km)
Work	3.97
Business	3.27
Education	2.50
Shopping	1.55
Social/Religious/Recreation	3.79
Health/Hospital	2.00
Other Purpose	3.21

3.2.4.8 Purpose and Trip Length Relationship

The distribution of trips by purpose and trip length is shown in **Table 3-27**. It is observed that 81% of work trips and about 86% of business trips are confined up to a distance of 5 km while 81% of education trips are confined up to distance of 3km. Majority of other purpose trips are confined to a distance of 2.0 km.

Table 3-27 Distribution of Trips by Purpose and Trip Length (%)

Trip Length	Work	Business	Education	Shopping	Social/ Religious/Recreation	Health/ Hospital	Other Purpose	Return Home	Total
0.5	6.52	8.86	13.76	18.26	18.05	20.12	14.06	13.15	13.13
1.00	15.64	22.14	24.75	41.50	26.47	32.62	24.48	26.40	26.44
2.00	22.13	27.51	26.31	24.63	20.30	22.26	27.86	24.15	24.11
3.00	16.44	10.96	16.12	8.03	9.92	9.52	8.85	13.15	13.17
4.00	11.42	10.49	7.09	3.42	3.09	5.60	7.29	7.28	7.28
5.00	9.10	5.83	4.57	1.61	2.81	2.86	1.82	5.02	5.02
6.00	4.43	2.80	1.91	0.95	2.99	2.02	2.60	2.58	2.58
7.00	3.29	3.26	1.32	0.59	1.87	1.79	4.43	1.94	1.94
8.00	1.88	1.17	0.85	0.15	1.96	0.71	1.04	1.07	1.07
9.00	1.32	0.70	0.74	0.20	1.03	0.48	0.26	0.79	0.78
10.00	2.21	2.33	0.67	0.22	1.22	0.48	0.78	1.12	1.11
>10	5.61	3.96	1.93	0.44	10.29	1.55	6.51	3.35	3.37
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

3.2.5 Outer Cordon Survey

3.2.5.1 Traffic Intensity

On an average 94,449 vehicles (1,07,931 PCUs) move in and out of S-M-K City Municipal Corporation every day as observed at the outer cordon locations. Major State Highways namely Sangli-Kolhapur Road and Miraj-Pandharpur Road carries 23% and 10% of the total traffic respectively.

State Highways namely Sangli-Tasgaon Road/Miraj-Shirol Road, Sangli-Islampur Road, Miraj-Bijapur Road/Sangli-Karnal Road carries 15%, 14% and 12% of total traffic respectively. **Table 3-28** presents the average Daily traffic at the outer cordon locations.

Table 3-28 Average Daily Traffic (ADT) at Outer Cordons

Outer Cordon	*Road Name*	*Total*	
		Vehicle	*PCUs*
OC-1	Sangli-Islampur Road (SH-138)	12,791	16,354
OC-2	Sangli-Karnal Road (SH-75)	11,001	10,459
OC-3	Sangli-Tasgaon Road (SH-10)	14,467	15,239
OC-4	Miraj-Pandharpur Road (MSH-3)	9,024	11,906
OC-5	Miraj-Bijapur Road (SH-138)	11,072	12,158
OC-6	Miraj-Shirol Road (SH-137)	14,041	13,462
OC-7	Sangli-Kolhapur Road (MSH-3)	22,053	28,354
	All Locations	***94,449***	***1,07,931***

Summary of traffic volume data at cordon locations is presented in **Annexure 3-1**.

3.2.5.2 Traffic Composition

Composition of traffic varied considerably from road to road. The road wise traffic composition at outer cordon locations is presented in **Table 3-29**. Average Traffic composition on outer cordon locations is presented in **Figure 3-10.**

Table 3-29 Composition of Traffic at Outer Cordon Count Stations

Outer Cordon No.	*Location*	*Private Modes*			*Bus/Mini Bus*	*Goods Vehicle*	*Slow Moving Vehicles*
		2 W	*Car*	*Auto*			
OC-1	Sangli-Islampur Road (SH-138)	36%	6%	24%	8%	21%	4%
OC-2	Sangli-Karnal Road (SH-75)	50%	6%	26%	2%	10%	6%
OC-3	Sangli-Tasgaon Road (SH-10)	34%	9%	21%	4%	17%	15%
OC-4	Miraj-Pandharpur Road (MSH-3)	35%	2%	31%	5%	21%	6%
OC-5	Miraj-Bijapur Road (SH-138)	40%	3%	22%	6%	16%	12%
OC-6	Miraj-Shirol Road (SH-137)	40%	6%	18%	2%	11%	24%
OC-7	Sangli-Kolhapur Road (MSH-3)	36%	6%	25%	6%	23%	3%
	Average	***38%***	***6%***	***24%***	***5%***	***18%***	***10%***

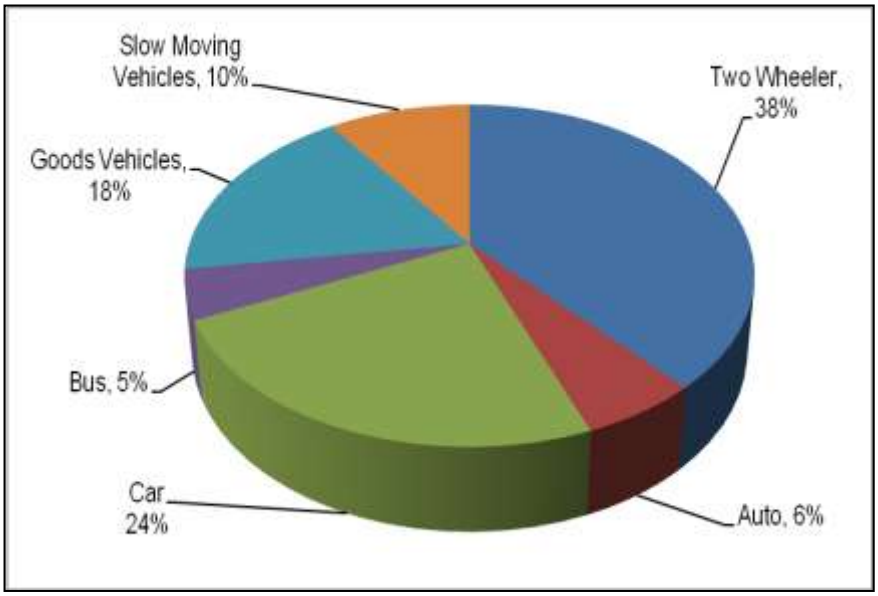

Figure 3-10 Traffic Composition at Outer Cordon Locations

The average share of private modes, Public Transport (Bus & Mini Bus), Goods Vehicles and Slow moving Vehicles are 68%, 5%, 18% and 10% respectively. Slow moving share is the highest on Miraj-Shirol Road with 24% in total traffic.

In general, the percentage of passenger traffic is high on state highways as compared to the national highways.

3.2.5.3 Temporal Variation of Traffic

One of the features of urban traffic is its temporal variation and study of which is important from the point of view of transportation system planning. This particularly gains importance when a high capacity is required during the peak period but which remains extremely underutilised during other long hours of the day. It is important to appreciate the temporal needs as manifested by traffic flow and plan the transport system and services to efficiently meet these needs at desirable levels of service.

Study of day - night traffic distribution revealed that about 78% of passenger traffic move between 8 a.m. to 8 p.m. the rest in night hours, while about 73% of total goods traffic play between 8 a.m. & 8 p.m.

Table 3-30 presents peak hour traffic and its share in the daily traffic at outer cordon locations. Percentage of traffic in peak hour ranged between 7.0% to 11.6% with an average value of 8.9%.

Table 3-30 Peak Hour Traffic at Outer Cordon (%)

Outer Cordon No.	*Location*	*Peak Hour*	*Peak Hour Traffic*	
			PCU	*% of ADT*
OC-1	Sangli-Islampur Road (SH-138)	11.45-12.45	1521	9.3
OC-2	Sangli-Karnal Road (SH-75)	12.00-13.00	889	8.5
OC-3	Sangli-Tasgaon Road (SH-10)	17.30-18.30	1772	11.6
OC-4	Miraj-Pandharpur Road (MSH-3)	18.15-19.15	830	7.0
OC-5	Miraj-Bijapur Road (SH-138)	18.45-19.45	1012	8.3
OC-6	Miraj-Shirol Road (SH-137)	10.15-11.15	1481	11.0
OC-7	Sangli-Kolhapur Road (MSH-3)	16.00-17.00	2168	7.6
	Average			***9.0***

Hourly variation of traffic on Sangli-Kolhapur Road (MSH-3), Sangli-Islampur (SH-138) and Sangli-Tasgaon Road (SH-10) is presented in **Figure 3-11** to **Figure 3-14**. Hourly variation of other roads is presented in **Annexure 3-1**.

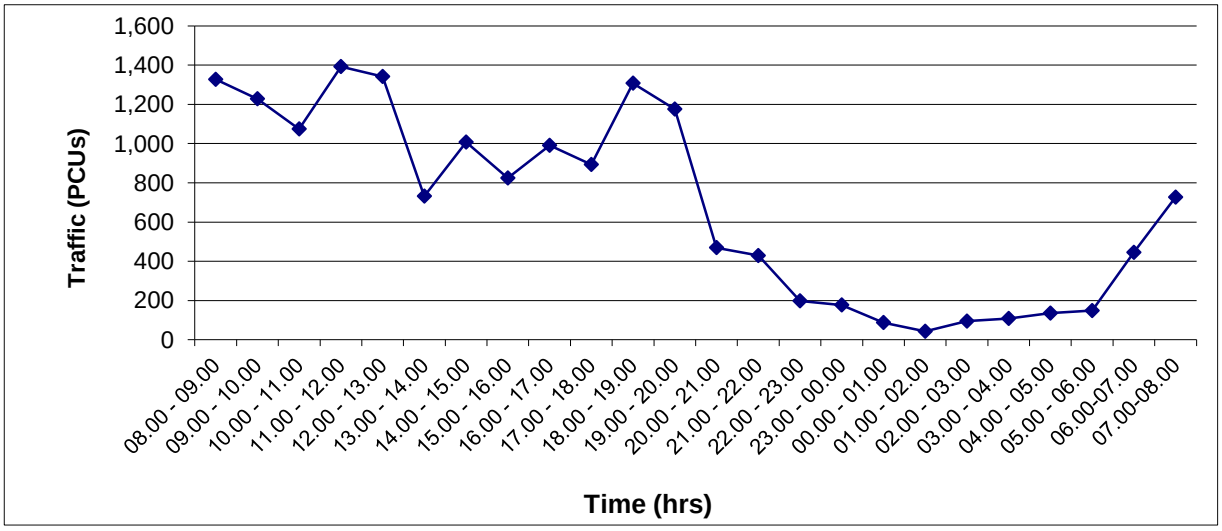

Figure 3-11 Hourly Variation of Traffic on Sangli-Kolhapur Road (MSH-3)

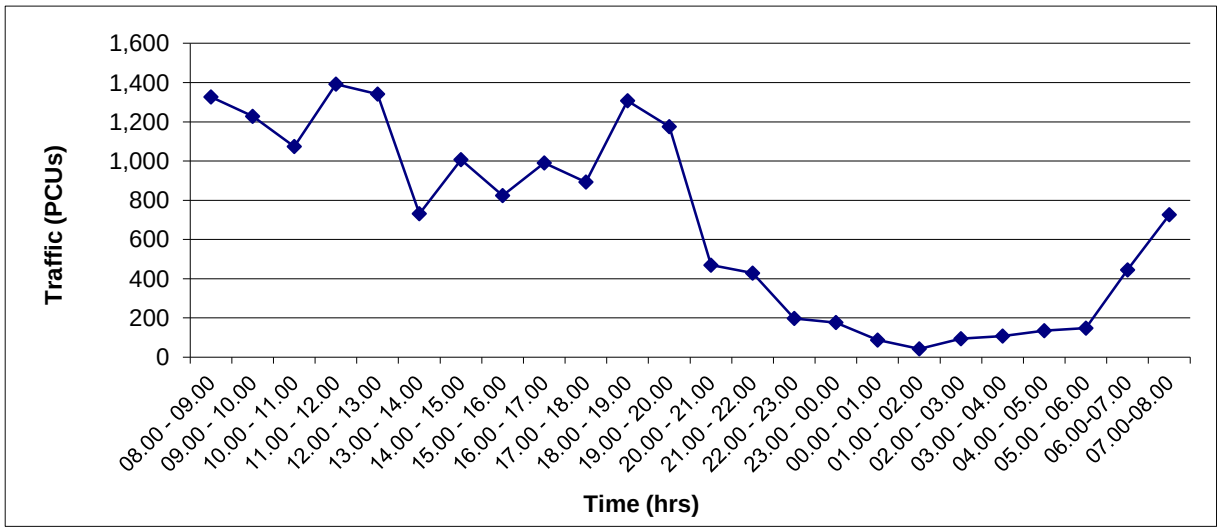

Figure 3-12 Hourly Variation of Traffic on Miraj-Bijapur Road (SH-138)

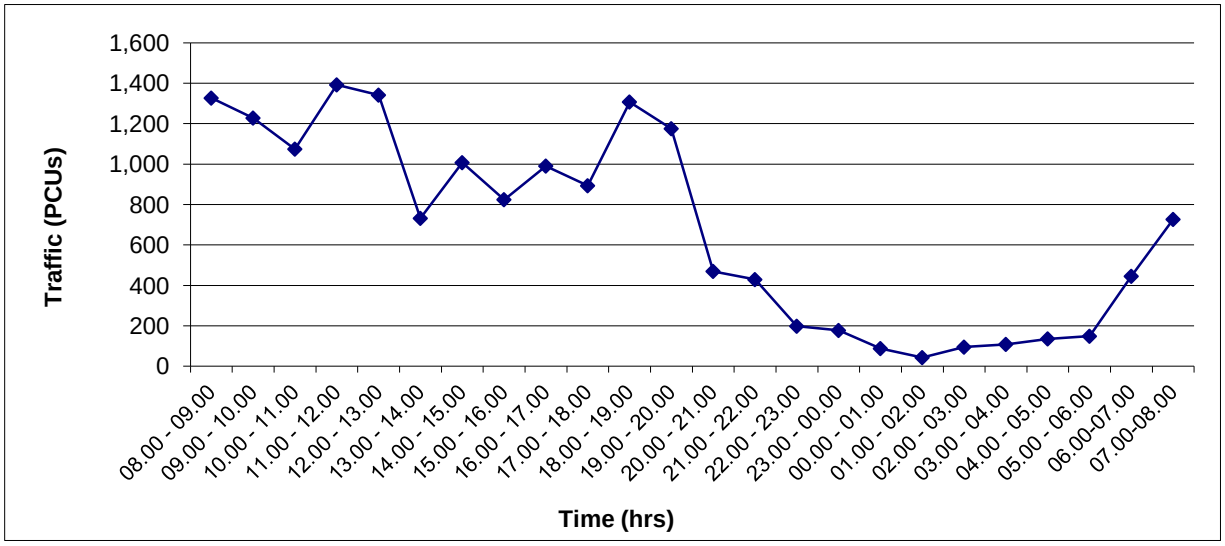

Figure 3-13 Hourly Variation of Traffic on Sangli-Tasgaon Road (SH-10)

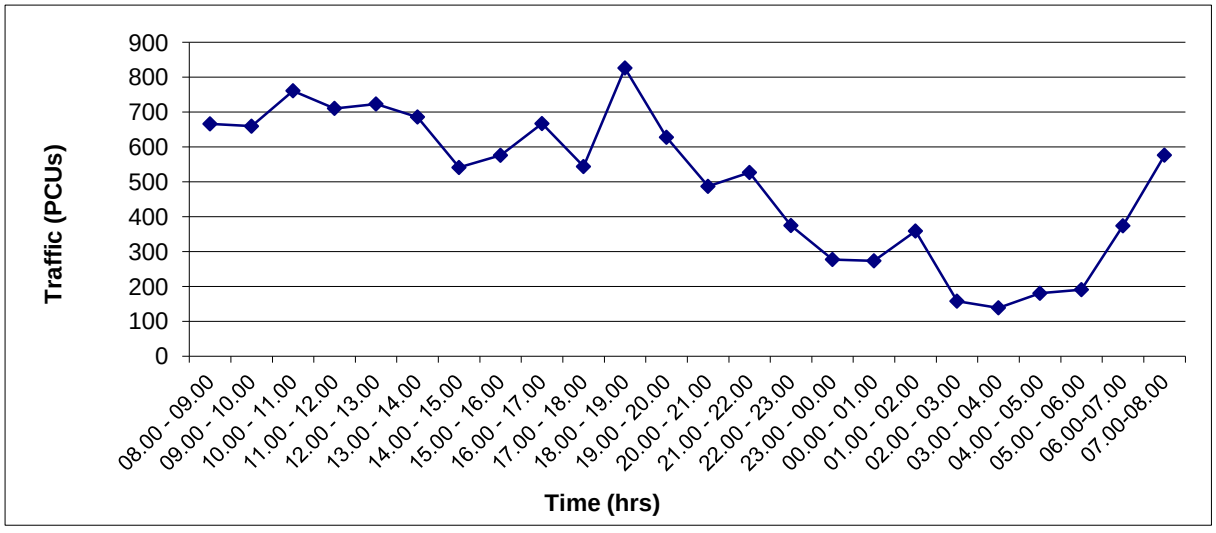

Figure 3-14 Hourly Variation of Traffic on Miraj-Pandarpur Road (MSH-3)

3.2.6 Origin-Destination Patterns

In order to understand travel desire pattern of the traffic entering/exiting the study area, Consultants have conducted Origin-Destination surveys for 24 hrs along with the classified traffic volume count survey at all the outer cordon locations. In this section, travel desire characteristics, purpose of travel, commodity carried by goods vehicles etc. have been discussed.

The S-M-K City Municipal Corporation (S-M-K CMC) Area is divided into 74 zones as per prevailing demarcation of wards. The area influencing the city is divided in to 9 zones. 6 external zones were also considered along existing State Highways. The zoning system adopted for the analysis is presented in household analysis.

3.2.6.1 Sample Size

The O-D sample size achieved at various cordon points are presented in **Table 3-31**.

Table 3-31 Sample Size Achieved at Various Cordon Locations

Vehicle Type	OC1	OC2	OC3	OC4	OC5	OC6	OC7
Two wheeler	43%	30%	29%	31%	18%	11%	24%
Auto Rickshaw	10%	39%	21%	65%	51%	17%	38%
Car/ Jeep / Van	55%	19%	40%	28%	30%	10%	28%
Mini Bus	12%	33%	17%	55%	33%	30%	62%
Govt. Bus	47%	78%	61%	88%	67%	42%	72%
Pvt. Bus	13%	57%	13%	71%	77%	14%	41%
Commercial Vehicles	58%	38%	32%	56%	66%	19%	50%
Total	***47%***	***29%***	***32%***	***39%***	***34%***	***13%***	***35%***

3.2.6.2 Travel Pattern of Passenger Vehicle Trips

Location wise travel pattern of motorised passenger traffic at the outer cordon is summarised and presented in **Table 3-32** to **Table 3-34**. Internal to Internal are the trips originating and destining within S-M-K City wards. Internal to External are the trips originating in the city and destining out of the city whereas External to Internal are the trips originating outside the city and destining in the city. External to External (Through traffic) are the trips originating and destining outside the city. While Internal to External traffic accounts for 38%, External-to Internal accounts for 37% and through traffic accounts for 22% of the total traffic.

Origin-Destination matrices developed at each outer cordon survey location have been presented in **Annexure 3-2**. It is observed that the Internal to Internal trips on Miraj-Shirol road is more (11%) due to the movement of the traffic from the periphery of the 74th ward (i.e., Laxmi Nagar Colony) to city. External to External traffic is high as 22% due to provision of bypass roads passing through the city.

Table 3-32 Travel Pattern of Passenger Vehicle by Location

Outer Cordon No.	Location	Internal to Internal	Internal to External	External to Internal	External to External	Total	Through Traffic
OC-1	Sangli-Islampur Road (SH-138)	107	4365	4081	1029	9582	11%
OC-2	Sangli-Karnal Road (SH-75)	40	3455	4358	1417	9269	15%
OC-3	Sangli-Tasgaon Road (SH-10)	88	4398	3216	2143	9844	22%
OC-4	Miraj-Pandharpur Road (MSH-3)	41	1777	2081	2683	6582	41%
OC-5	Miraj-Bijapur Road (SH-138)	203	3016	2721	1978	7918	25%
OC-6	Miraj-Shirol Road (SH-137)	1330	2734	2973	2192	9229	24%
OC-7	Sangli-Kolhapur Road (MSH-3)	265	6457	5693	3756	16171	23%
Total		***2073***	***26201***	***25123***	***15198***	***68595***	***22%***
% Share		***3%***	***38%***	***37%***	***22%***	***100%***	

Table 3-33 Mode Wise Travel Patterns of Passenger Vehicles at Outer Cordon

Vehicle Type	Internal to Internal	Internal to External	External to Internal	External to External	Total
Two Wheeler	1424	13959	13268	7707	36358
Auto	264	1944	2109	1065	5382
Car	369	8811	7935	5326	22441
Mini Bus	3	109	148	51	311
Govt. Bus	14	1284	1521	844	3662
Pvt. Bus	0	94	143	204	441
Total	***2073***	***26201***	***25123***	***15198***	***68595***

Table 3-34 Mode Wise share of Passenger Vehicles at Outer Cordon

Vehicle Type	Internal to Internal	Internal to External	External to Internal	External to External	Total
Two Wheeler	4%	38%	36%	21%	100%
Auto	5%	36%	39%	20%	100%
Car	2%	39%	35%	24%	100%
Mini Bus	1%	35%	47%	16%	100%
Govt. Bus	0%	35%	42%	23%	100%
Pvt. Bus	0%	21%	33%	46%	100%
Total	3%	38%	37%	22%	100%

3.2.6.3 Trip Purpose

The data was analysed for trip purpose. The results are presented in **Table 3-35**. Majority of trips were made for the purpose of work (38%), business (24%), education (10%) and social travel (11%).

Table 3-35 Distribution of Vehicle Trips by Purpose

Trip Purpose	*2 Wheeler*	*Auto*	*Car*	*Total*
Work	44%	32%	32%	***38%***
Business	21%	37%	24%	***24%***
Education	11%	9%	9%	***10%***
Shopping	4%	5%	7%	***5%***
Social	8%	8%	14%	***11%***
Health/Hospital	3%	3%	4%	***3%***
Other purpose	9%	7%	9%	***9%***
Total	***100%***	***100%***	***100%***	***100%***

3.2.6.4 Travel Pattern of Goods Vehicles

Data collected from Origin-Destination surveys have been analysed to study the movement pattern of Goods vehicles at the outer cordon. The movement pattern of Goods vehicles entering and leaving the study area are presented in **Table 3-36** to **Table 3-38**. The share of External to Internal (E-I) movement accounts for 35% share, whereas Internal to External (I-E) accounts for 31% share. The proportion of through traffic in Goods vehicles is around 33%. While the percentage of through is higher for Miraj-Pandarpur Road (52%), Sangli-Kolhapur Road (36%) and Sangli-Tasgaon Road (32%), it is low for Sangli-Islampur Road (29%), Miraj-Bijapur Road (26%), Miraj-Shirol Road (22%) and Sangli-Karnal Road (19%). It is observed that the Internal to Internal trips on Miraj-Shirol road is more (10%) due to the movement of the traffic from the periphery of the 74th ward (i.e, Laxmi Nagar Colony) to city.

Table 3-36 Location wise Travel Patterns of Goods Vehicles

Location	*Internal to Internal*	*Internal to External*	*External to Internal*	*External to External*	*Total*	*Through Traffic*
Sangli-Islampur Road (SH-138)	20	774	1059	767	2621	29%
Sangli-Karnal Road (SH-75)	5	347	513	198	1063	19%
Sangli-Tasgaon Road (SH-10)	33	920	632	732	2317	32%
Miraj-Pandharpur Road (MSH-3)	4	401	529	996	1930	52%
Miraj-Bijapur Road (SH-138)	13	650	595	435	1693	26%
Miraj-Shirol Road (SH-137)	135	466	408	283	1292	22%
Sangli-Kolhapur Road (MSH-3)	33	1379	1822	1839	5073	36%
Total	***242***	***4938***	***5558***	***5251***	***15989***	***33%***
% Share	***2%***	***31%***	***35%***	***33%***	***100%***	

Table 3-37 Movement Patterns by Mode at Outer Cordon for Goods Vehicles

Vehicle Type	*Internal to Internal*	*Internal to External*	*External to Internal*	*External to External*	*Total*
Goods Auto	60	1113	1003	826	3001
LCV	66	1022	1313	900	3301
2-Axle Truck	94	2104	2402	2316	6915
3-Axle Truck	18	597	713	1028	2356
MAV	4	102	128	182	416
Total	***242***	***4938***	***5558***	***5251***	***15989***

Table 3-38 Mode Wise share of Goods Vehicles at Outer Cordon

Vehicle Type	*Internal to Internal*	*Internal to External*	*External to Internal*	*External to External*	*Total*
Goods Auto	2%	37%	33%	28%	100%
LCV	2%	31%	40%	27%	100%
2-Axle Truck	1%	30%	35%	33%	100%
3-Axle Truck	1%	25%	30%	44%	100%
MAV	1%	25%	31%	44%	100%
Total	***2%***	***31%***	***35%***	***33%***	***100%***

Commodity Distribution of Goods Traffic was analysed and presented in **Table 3-39**.

Table 3-39 Commodity wise Distribution of Goods Traffic at Outer Cordon

Commodity	*Goods Auto*	*LCV*	*2-Axle*	*3-Axle*	*MAV*	*Total*
Empty	41%	41%	30%	24%	18%	34%
Vegetable/ Fruit/ Milk/Fish	18%	22%	15%	19%	10%	18%
Food Grains (Rice/ Wheat/ Jowar etc.)	13%	14%	15%	17%	13%	15%
Sand/ Brick/ Cement/ Steel/ Aggregate	5%	5%	12%	10%	15%	9%
Petrol/ Diesel/ Gas/ LPG	6%	5%	10%	7%	6%	7%
Forest Products (Wood/Rubber etc)	3%	2%	2%	3%	2%	2%
Textiles	3%	2%	2%	3%	3%	2%
Container	2%	1%	2%	3%	6%	2%
Iron Coils/Sheets	1%	1%	1%	2%	6%	1%
Consumer Goods	1%	1%	1%	2%	2%	1%
Industrial Goods (Alloy/Machine etc)	1%	1%	2%	2%	11%	2%
Chemicals & Fertilizers	1%	1%	1%	2%	1%	1%
Turmeric Products	0%	1%	1%	2%	0%	1%
Alcohol (Wine etc)	0%	0%	1%	1%	0%	1%
Others (Paper/ Plastic/ Cable Wire etc)	5%	3%	5%	5%	6%	4%
Total	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***

3.2.6.5 Passenger Flows at Cordon Points

The passenger vehicle occupancy survey was carried out at cordon point locations to estimate the average occupancy in passenger vehicles, which are crossing screen lines. The occupancy factors arrived based on occupancy survey was used to convert vehicular flows into Passenger flows. The average occupancy factor for various modes and passenger flow at all cordon points are presented in **Table 3-40** and **Table** 3-41. It can be observed that 48,576 vehicles (1.53 lakh passengers) are travelling towards the direction of the city where as 45,873 vehicles (1.35 lakh passengers) are travelling opposite to the direction of the city at all cordon points. Maximum passenger movement was observed on Sangli-Kolhapur Road (OC-7: 39,614 towards the direction of the city and 36,453 opposite to the direction of the city) and minimum passenger movement was observed on Sangli-Karnal Road (OC-2: 15,407 towards the direction of the city and 11,171 opposite to the direction of the city).

Table 3-40 Occupancy Factors arrived at Cordon Point Locations

Vehicle Type	Occupancy Factor
Two Wheeler	1.69
Auto	2.86
Car	2.97
Mini Bus	16.73
Bus	32.14
Cycle	1.0

Table 3-41 Vehicular and Passenger Flow at Cordon Points Moving Towards/ Away from the S-M-K City Municipal Corporation

Outer Cordon	*Motorised*		*Non Motorised*		*Total Vehicular Flow*		*Total Passenger Flow*	
	Towards City	*From City*	*Towards City*	*From City*	*Towards City*	*From City*	*Towards City*	*From City*
OC-1	5,921	6,378	271	221	6,192	6,599	26,567	24,612
OC-2	5,956	4,414	388	243	6,344	4,657	15,407	11,171
OC-3	5,643	6,695	845	1,284	6,488	7,979	19,299	20,263
OC-4	4,726	3,794	243	261	4,969	4,055	15,709	12,010
OC-5	4,987	4,735	743	607	5,730	5,342	21,304	17,457
OC-6	5,719	5,013	1,969	1,340	7,688	6,353	15,891	13,250
OC-7	10,785	10,567	380	321	11,165	10,888	39,614	36,453
Total	***43,737***	***41,596***	***4,839***	***4,277***	***48,576***	***45,873***	***1,53,791***	***1,35,215***

3.2.7 Screen Line Counts

3.2.7.1 East-West Screen Line

The East-West Screen line is a railway line running from east of S-M-K city (Belgaum) towards west direction of S-M-K city (Pune). Classified traffic volume counts were conducted at 12 locations. **Table 3-42** presents the 16 hour Traffic (6:00 AM-10 AM) and **Table 3-43** presents the 24 hour Traffic on the East–West Screen line locations. On an average 1,60,918 vehicles (1,76,846 PCUs) cross the East-West screen line every day of which

Sangli-Miraj ROB alone accounts for 19% followed by Madhavnagar Main Road/Sangli Railway Station RUB with 12% of the total traffic.

Table 3-42 Location Wise Traffic on East–West Screen Line for 16hrs Duration

Sl. No.	*Screenline Name*	*Location Name*	*Total Vehicles*	
			Nos.	*PCU*
1.	SL-1	ROB on Bijapur Road (SH-138)	10,114	10,912
2.	SL-2	Level crossing (LC) on Shirol Road (SH-137)	13,048	12,316
3.	SL-3	ROB Miraj-Kolhapur bypass Road (MSH-3)	9,530	11,777
4.	SL-4	RUB at St.Peter's Telugu Church, Samanthnagar near Maniknagar Colony	9,869	7,202
5.	SL-5	ROB on Sangli-Miraj Highway (SH-138)	29,125	39,292
6.	SL-6	RUB at Vijaynagar	5,610	4,429
7.	SL-7	Level crossing on Vishrambagh Main Road	15,191	16,013
8.	SL-8	ROB at Police Staff Quarters, Sangli	11,064	10,979
9.	SL-9	RUB @ Sangli Railway station	17,823	20,973
10.	SL-10	ROB on Madhavnagar Main Road (SH-10)	18,259	21,211
11.	SL- 11	Level Crossing near Panchasheelnagar	4,649	3,364
12.	SL- 12	Level Crossing on Madhavnagar-Padmalay road (SH-139)	4,513	3,877
		Total at East-West Screen Line	***1,48,795***	***1,62,346***

Table 3-43 Location Wise Traffic on East–West Screen Line for 24-hrs Duration

Sl. No.	*Screenline Name*	*Location Name*	*Total Vehicles*	
			Nos.	*PCU*
1.	SL-1	ROB on Bijapur Road (SH-138)	11,072	12,158
2.	SL-2	Level crossing (LC) on Shirol Road (SH-137)	14,041	13,462
3.	SL-3	ROB Miraj-Kolhapur bypass Road (MSH-3)	10,551	13,276
4.	SL-4	RUB at St.Peter's Telugu Church, Samanthnagar near Maniknagar Colony	10,705	7,900
5.	SL-5	ROB on Sangli-Miraj Highway (SH-138)	30,904	41,373
6.	SL-6	RUB at Vijaynagar	6,086	4,858
7.	SL-7	Level crossing on Vishrambagh Main Road	16,479	17,564
8.	SL-8	ROB at Police Staff Quarters, Sangli	12,002	12,042
9.	SL-9	RUB @ Sangli Railway station	19,334	23,005
10.	SL-10	ROB on Madhavnagar Main Road (SH-10)	19,807	23,266
11.	SL- 11	Level Crossing near Panchasheelnagar	5,043	3,690
12.	SL- 12	Level Crossing on Madhavnagar-Padmalay road (SH-139)	4,896	4,252
		Total at East-West Screen Line	***1,60,918***	***1,76,846***

Summary of Traffic Volume Counts on East-West Screen lines is presented in **Annexure 3-3.**

3.2.7.2 Traffic Composition

Composition of traffic observed on East-West screen line was presented in **Table 3-44**. Share of private modes varied between 44% (Sangli Railway Station RUB) and 64% (Madhavnagar-Padmalay Road). On average private modes commanded a share of 55% in the traffic crossing the East-West screen line. The heavy vehicles including Goods accounted for 12.7%. Slow moving vehicles contributed to 17.0% in the total traffic.

Table 3-44 Composition of Traffic at East-West Screen Line (%)

Location ID	*Private Modes*		*Auto Rick.*	*Bus*	*Goods Veh.*	*SMV*	*Total*
	2 Whlr.	*Car/ Jeep*					
ROB on Bijapur Road (SH-138)	40.3	22.3	2.8	6.1	16.3	12.2	100.0
Level crossing (LC) on Shirol Road (SH-137)	40.2	18.3	5.7	1.5	10.7	23.6	100.0
ROB Miraj-Kolhapur bypass Road (MSH-3)	32.3	25.9	7.9	3.5	26.0	4.3	100.0
RUB at St.Peter's Telugu Church, Samanthnagar near Maniknagar Colony	51.0	3.3	9.0	0.0	0.8	35.8	100.0
ROB on Sangli-Miraj Highway (SH-138)	26.8	23.7	24.2	3.6	16.1	5.6	100.0
RUB at Vijaynagar	49.8	12.0	7.4	1.0	3.8	26.4	100.0
Level crossing on Vishrambagh Main Road	43.5	13.9	18.3	2.8	5.4	16.4	100.0
ROB at Police Staff Quarters, Sangli	37.7	26.3	7.0	0.2	12.1	17.2	100.0
RUB @ Sangli Railway station	29.5	14.8	13.4	4.1	17.7	22.2	100.0
ROB on Madhavnagar Main Road (SH-10)	32.8	22.6	14.8	4.0	12.6	13.9	100.0
Level Crossing near Panchasheelnagar	50.1	1.9	3.4	0.0	3.6	41.5	100.0
Level Crossing on Madhavnagar-Padmalay road (SH-139)	53.2	10.2	1.8	0.2	11.8	23.6	100.0
Total	***36.9***	***18.4***	***12.7***	***2.8***	***12.7***	***17.0***	***100.0***

The share of public transport (i.e. Bus & Mini Bus) in total traffic is 2.8%. The share of Intermediate Public Transport (i.e. Auto rickshaw) constitutes 12.7%.

3.2.7.3 Peak Hour Characteristics

Peak hour traffic varied between 7.9% and 14.8% of the total traffic. **Table 3-45** presents the location wise peak hour traffic at East-West Screen Line locations.

Table 3-45 Peak Hour Traffic at Screen Line (East-West)

Sl. No	*Location*	*Peak Hour*	*Peak Hour Traffic*	
			PCU	*%*
1	ROB on Bijapur Road (SH-138)	18.45-19.45	1,012	8.3
2	Level crossing (LC) on Shirol Road (SH-137)	10.15-11.15	1,481	11.0
3	ROB Miraj-Kolhapur bypass Road (MSH-3)	11.00-12.00	1,214	9.1
4	RUB at St.Peter's Telugu Church, Samanthnagar near Maniknagar Colony	12.00-13.00	632	8.0
5	ROB on Sangli-Miraj Highway (SH-138)	10.45-11.45	3,622	8.8
6	RUB at Vijaynagar	12.00-13.00	395	8.1
7	Level crossing on Vishrambagh Main Road	19.15-20.15	2,592	14.8
8	ROB at Police Staff Quarters, Sangli	17.30-18.30	1,040	8.6
9	RUB @ Sangli Railway station	10.30-11.30	2,323	10.1
10	ROB on Madhavnagar Main Road (SH-10)	9.00-10.00	1,843	7.9
11	Level Crossing near Panchasheelnagar	9.00-10.00	331	9.0
12	Level Crossing on Madhavnagar-Padmalay road (SH-139)	8.45-9.45	341	8.0

3.2.7.4 Variation of Day-Night Traffic on Screenline points

In order to study the traffic component moving in night hours (10 p.m. to 6 a.m.) Consultants have conducted 24 hours survey at six locations termed as control points and are

- ROB on Bijapur Road (SH-138)
- Level Crossing on Shirol Road (SH-137)
- ROB on Miraj Kholapur Bypass (MSH-3)
- ROB on Sangli-Miraj Highway (SH-138)
- Krishna River Bridge on Islampur-Madhavanagr bypass road
- Irwin Bridge on Sangli-Islampur Road

Among the six selected locations Krishna Bridge and Irwin Bridge are along the North – South screen line and remaining are along the East – West screen line. **Table 3-46** presents the comparison of 16 and 24 hour traffic at these six locations.

Table 3-46 Ratio of 24hr Traffic to 16hr traffic on Screen lines

Location	2 Wheeler	Auto Rick	Car/Jeep	Mini Bus	Bus	Goods Auto	LCV	Trucks	MAV	Cycle
ROB on Bijapur Road (SH-138)	1.06	1.10	1.10	6.00	1.64	1.09	1.16	1.32	1.22	1.07
Level Crossing on Shirol Road (SH-137)	1.07	1.13	1.06	1.43	1.07	1.05	1.10	1.67	1.68	1.04
ROB on Miraj Kholapur Bypass (MSH-3)	1.06	1.02	1.10	1.23	1.27	1.12	1.12	1.23	1.10	1.23
ROB on Sangli-Miraj Highway (SH-138)	1.09	1.02	1.06	1.05	1.27	1.02	1.06	1.29	1.38	1.09
Krishna River Bridge on Islampur-Madhavanagr Bypass	1.07	1.25	1.13	1.50	1.17	1.05	1.09	1.17	1.24	1.16
Irwin Bridge on Sangli-Islampur Road	1.06	1.18	1.11	2.25	1.43	1.22	1.42	1.28	1.18	1.16

3.2.8 North-South Screen Line/Cut Points

3.2.8.1 Intensity of Traffic

Krishna River running North-South and passing through the S-M-K- City has been taken as North-South screen line. Two cut points were also selected in North-South direction (i.e., Sangli-Miraj ROB and Miraj-Kupwad Road @ entrance of Miraj MIDC). The magnitude of traffic crossing the screen lines/Cut Points is captured by conducting the classified traffic volume counts with occupancy for 24/16 hours at four locations.

On an average 18,269 vehicles (19,811 PCUs) cross the North-South screen line and 39,658 vehicles (49,821 PCUs) cross Cut Points every day of which Irwin Bridge and Sangli-Miraj ROB alone accounts for 73% and 78% traffic of total North-South Screenline/Cut points traffic. **Table 3-47** & **Table 3-48** present the traffic volume at the screen line count stations/cut points for 16 hours duration and 24 hours duration.

Table 3-47 Location wise Traffic on North–South Screen Line/Cut Points for 16 hrs duration

Sl. No.	*Screenline Name*	*Location Name*	*Total Vehicles*	
			Nos.	*PCU*
North-South Screen Line				
1.	SL-13	Krishna River Bridge on Islampur–Madhavnagar bypass road	4,556	5,942
2.	SL-14	Lord Irwin Bridge on Islampur Road	11,860	11,565

Sl. No.	Screenline Name	Location Name	Total Vehicles	
			Nos.	PCU
Total at North-South Screen Line			***16,416***	***17,507***
Cut Points in North-South Direction				
1.	SL-15	Miraj-Kupwad Road at MIDC entrance	8,250	8,024
2.	SL-16	ROB on Sangli-Miraj Highway (SH-138)	29,125	39,292
		Total at Cut Points	***37,375***	***47,316***

Table 3-48 Location wise Traffic on North–South Screen Line/Cut Points for 24 hrs duration

Sl. No.	Screenline Name	Location Name	Total Vehicles	
			Nos.	PCU
North-South Screen Line				
1.	SL-13	Krishna River Bridge on Islampur–Madhavnagar bypass road	5,019	6,618
2.	SL-14	Lord Irwin Bridge on Islampur Road	13,250	13,193
		Total at North-South Screen Line	***18,269***	***19,811***
Cut Points in North-South Direction				
1.	SL-15	Miraj-Kupwad Road at MIDC entrance	8,754	8,449
2.	SL-16	ROB on Sangli-Miraj Highway (SH-138)	30,904	41,373
		Total at Cut Points	***39,658***	***49,821***

The summary of traffic volume counts at screen line locations are presented in **Annexure 3-2**.

3.2.8.2 Traffic Composition at North -South Screen Line/Cut Points

The analysis of traffic composition reveals that private modes are contributing 67% and 50% of the total traffic at North-South Screenline and Cut points. Public transit modes contributed only 4.9% and 3.4% at north-south Screenline/cut points, which clearly indicate the poor state of public transport in the city. Share of Goods traffic was observed to be 13.0% and 15.7% whereas share of slow moving vehicles (cycles, cycle rickshaw and animal drawn) 8.8% and 10.2% in the total traffic of north-south Screenline and cut points, which is significant. Among all the locations Goods traffic was observed to be comparatively high at Islampur bypass road (26.9%) and Sangli-Miraj highway (16.1%). Traffic Composition at North-South screen line location/Cut points are presented in **Table 3-49**.

Table 3-49 Composition of Traffic at North-South Screen Line/Cut Points *(%)*

Location Name	*Private Modes*		*Auto Rickshaw*	*Bus*	*Goods Vehicle*	*SMV*	*Total*
	2 Wheeler	*Car/ Jeep*					
North-South Screen Line							
Krishna River Bridge on Islampur–Madhavnagar bypass road	46.9	21.9	2.0	0.3	26.9	2.1	100.0
Lord Irwin Bridge on Islampur Road	44.2	21.7	8.4	6.7	7.7	11.3	100.0
Total	***44.9***	***21.7***	***6.7***	***4.9***	***13.0***	***8.8***	***100.0***
Cut Points in North-South Direction							
Miraj-Kupwad Road at MIDC entrance	37.2	8.8	12.6	2.6	14.0	26.2	100.0
ROB on Sangli-Miraj Highway (SH-138)	26.8	23.7	24.2	3.6	16.1	5.6	100.0
Total	***29.1***	***20.4***	***21.6***	***3.4***	***15.7***	***10.2***	***100.0***

3.2.8.3 Peak Hour Characteristics

Peak hour traffic varied between 8.4% to 9.5% of the total traffic. **Table 3-50** presents the location wise peak hour traffic at North - South Screen Line locations/Cut points. The highest peak hour traffic was observed at Miraj-Kupwad road (9.5%).

Table 3-50 Peak Hour Traffic on North-South Screen Line/Cut Points

Sl.No	Location	Peak Hour	Peak Hour Traffic	
			PCU	%
North-South Screen Line				
1	Krishna River Bridge on Islampur–Madhavnagar bypass road	17.15-18.15	554	8.4
2	Lord Irwin Bridge on Islampur Road	14.15-15.15	1,145	8.7
Cut Points in North-South Direction				
3	Miraj-Kupwad Road at MIDC entrance	17.00-18.00	806	9.5
4	ROB on Sangli-Miraj Highway (SH-138)	10.45-11.45	3,622	8.8

3.2.8.4 Passenger Flows across Screen lines

The passenger vehicle occupancy survey was carried out at screen line locations to estimate the average occupancy in passenger vehicles, which are crossing screen lines. The occupancy factors used to convert vehicular flows into Passenger flows. The average occupancy factor for various modes and passenger flow across Screenline are presented in **Table 3-51** and **Table** 3-52. It can be observed that around 1.60 Lakh vehicles (3.55 Lakh commuters) are crossing East-West Screenline and 0.57 Lakh vehicles (1.46 commuters) are crossing North-South Screenline/cut points.

Table 3-51 Occupancy Factors arrived at Screen line Locations/Cut Points

Vehicle Type	Occupancy Factor
Two Wheeler	1.61
Auto	2.73
Car	2.86
Mini Bus	9.36
Bus	22.81
Cycle	1.00

Table 3-52 Vehicular and Passenger Flow across the Screenline

Screen Line	*Motorised*	*Non Motorised*	*Total Vehicular Flow*	*Total Passenger Flow*
East-West Screen Line				
SL-01	9,722	1,350	11,072	31,780
SL-02	10,732	3,309	14,041	26,313
SL-03	10,093	458	10,551	24,109
SL-04	6,863	3,836	10,705	16,185
SL-05	29,158	1,746	30,904	80,816
SL-06	4,504	1,608	6,086	10,444
SL-07	13,823	2,702	16,479	37,671
SL-08	9,997	2,069	12,002	21,135
SL-09	15,350	4,288	19,334	42,963
SL-10	17,210	2,760	19,807	49,815
SL-11	2,973	2,092	5,043	6,822
SL-12	3,778	1,153	4,896	7,136
	Total		***1,60,918***	***3,55,191***
North-South Screen Line				
SL-13	4,912	107	5,019	7,563
SL-14	11,754	1,496	13,250	41,536
	Total		***18,269***	***49,099***
Cut Points in North-South Direction				
SL- 15	6,575	2,297	8,754	17,055
SL- 16	29,158	1,746	30,904	80,816
	Total		***39,658***	***97,871***

3.2.9 Terminal Survey Analysis

Terminals are points where considerable number of trips concentrate and disperse. Hence they have an appreciable impact on other transport facilities and on surrounding development. Judiciously planned terminals, besides reducing the amount of intra-city travel on the urban road system, increases the efficiency and safety of traffic flow on the urban

corridors. Hence there is a need for proper planning of terminals and their integration with the overall transportation system. The Consultants have carried out passenger surveys at six terminals (3 bus and 3 rail) to assess the user characteristics (origin, destination mode of travel, trip length, trip time and trip cost) and secondary data has been collected for private bus terminals.

Bus Terminals	*Railway Terminals*
• Sangli ST Bus Stand • Miraj City Bus Stand • Miraj ST Bus Stand	• Miraj Railway Station • Sangli Railway Station • Vishrambagh Railway Station

3.2.9.1 Bus Terminal

Analyses of passenger trips reveal that a total of 90,007 trips are made on a normal working day. The daily passenger trips at different bus terminals are presented in **Table 3-53**. It can be observed that 60% of the trips are made from Sangli ST bus stand (City and Regional operation) followed by 24% from Miraj Regional bus stand and 16% from Miraj City bus stand.

Table 3-53 Daily (24 hrs) Passenger Trips at Bus Terminals in S-M-K City

Sl. No.	*Location*	*Direction*	*Count*
1	Miraj City Bus Stand	In	8234
		Out	6387
		Total	**14621**
2	Sangli ST Bus Stand	In	27367
		Out	26571
		Total	**53938**
3	Miraj ST Bus Stand	In	11620
		Out	9898
		Total	**21518**
	Grand Total		***90,007***

Origin-destination was also carried out to assess the access & dispersal characteristics.

3.2.9.2 Access & Dispersal Characteristics

Frequency

It has been observed that 42% of trips made at bus terminals are daily trips. **Table 3-54** shows the distribution of passenger trips at bus terminals by frequency.

Table 3-54 Distribution of Passenger Trips at Bus Terminal by Frequency

Frequency	*Miraj City Bus Stand*	*Sangli ST Bus Stand*	*Miraj ST Bus Stand*
Daily	25%	49%	36%
Occasional	75%	51%	64%

Mode of Travel

The share of public transport is 73% for accessing Miraj City bus stand where as it is only 57% and 51% for Sangli and Miraj ST bus stands. Private modes account for 16% share for Sangli ST Bus stand followed by 12% by Miraj ST Bus stand and 5% by Miraj City bus stand. **Table 3-55** presents the mode-wise distribution of access and dispersal trips to and from the bus terminal.

Table 3-55 Distribution of Passenger Trips at Bus Terminal by Mode of Travel

Mode	*Miraj City Bus Stand*	*Sangli ST Bus Stand*	*Miraj ST Bus Stand*
Walk	18%	5%	17%
Two Wheeler	3%	9%	8%
Auto	9%	21%	20%
Car/ Jeep/ Van	2%	7%	4%
Mini Bus	3%	12%	9%
City Bus	70%	45%	42%

Travel Purpose

It is observed that work, business and education trips account for 59%, 55% and 47% share of total trips at Miraj City bus stand, Sangli ST bus stand and Miraj ST Bus stand. The purpose wise distribution of trips is presented in **Table 3-56**.

Table 3-56 Distribution of Passenger Trips by Trip Purpose (in %)

Trip Purpose	*Miraj City Bus Stand*	*Sangli ST Bus Stand*	*Miraj ST Bus Stand*
Work	18%	15%	14%
Business	12%	19%	13%
Education	29%	22%	21%
Shopping	3%	9%	4%
Social/Religious/Recreation	27%	15%	27%
Health/Hospital	7%	8%	9%
Other Purpose	5%	13%	13%

Resident of Sangli

It is observed that 25%, 49% and 36% of trips made at Miraj City bus stand, Sangli ST bus stand and Miraj ST Bus stand are by residents and other trips are performed by non-residents of Sangli.

Table 3-57 Distribution of Passenger Trips by Residents/ Non-residents of Sangli

Resident/ Non-Resident	*Miraj City Bus Stand*	*Sangli ST Bus Stand*	*Miraj ST Bus Stand*
Resident of Sangli	25%	49%	36%
Non-Resident of Sangli	75%	51%	64%

3.2.9.3 Rail Terminal

Miraj Railway station is the major junction in S-M-K City. On an average, 38 trains are passing at the Miraj junction daily. Analysis of inter-regional rail passenger trips reveals that a total of 38,688 trips are made on a normal working day. The daily railway passenger trips were presented in **Table 3-58**. It can be observed that 84% of the trips are made from Miraj Railway Station followed by 12% from Sangli railway station.

Table 3-58 Daily Railway Passenger Trips in S-M-K City

Sl. No.	*Location*	*Direction*	*Count*
1	Miraj Railway Station	In	14,312
		Out	18,176
		Total	32,488
2	Sangli Railway Station	In	2,928
		Out	1,865
		Total	4,793
3	Vishrambagh Railway Station	In	910
		Out	497
		Total	1,407
Grand Total			***38,688***

Origin-destination was also carried out to assess the access & dispersal characteristics.

3.2.9.4 Access & Dispersal Characteristics

Frequency

It has been observed that only 19% of trips made at rail terminals are daily trips and 81% of trips are occasional trips. **Table 3-59** shows the distribution of passenger trips at railway terminals by frequency.

Table 3-59 Distribution of Passenger Trips at Bus Terminal by Frequency

Frequency	*Miraj Railway Station*	*Sangli Railway Station*	*Vishrambagh Railway Station*	*Overall*
Daily	15%	37%	52%	19%
Occasional	85%	63%	48%	81%

Mode of Travel

The share of public transport is accounting for 9%, 19% and 33% for accessing Miraj Railway Station, Sangli Railway Station and Vishrambagh Railway Station. While private modes account for 42%, 25% and 17% share for accessing Miraj Railway Station, Sangli Railway Station and Vishrambagh Railway Station. **Table 3-60** presents the mode-wise distribution of access and dispersal trips to and from the bus terminal.

Table 3-60 Distribution of Passenger Trips at Rail Terminal by Mode of Travel

Mode	*Miraj Railway Station*	*Sangli Railway Station*	*Vishrambagh Railway Station*	*Overall*
Walk	45%	36%	33%	43%
Two Wheeler	26%	22%	14%	25%
Auto	4%	20%	17%	6%
Car/ Jeep/ Van	16%	3%	3%	14%
Mini Bus	2%	16%	30%	4%
Bus	8%	4%	3%	7%

Travel Purpose

It is observed that work, business and education trips account for 34%, 65% and 58% share of total trips at Miraj Railway Station, Sangli Railway Station and Vishrambagh Railway Station, while social & recreational trips accounts for 53%, 13% and 28% of the total trips at Miraj Railway Station, Sangli Railway Station and Vishrambagh Railway Station. The purpose wise distribution of trips is presented in **Table 3-61**.

Table 3-61 Distribution of Passenger Trips by Trip Purpose (in %)

Trip Purpose	*Miraj Railway Station*	*Sangli Railway Station*	*Vishrambagh Railway Station*	*Overall*
Work	17%	30%	30%	19%
Business	11%	18%	13%	12%
Education	7%	17%	16%	8%
Shopping	4%	2%	2%	4%
Social/Religious/Recreation	53%	13%	28%	48%
Health/Hospital	3%	3%	3%	3%
Other Purpose	6%	17%	9%	7%

Resident of Sangli

It is observed that around 47% of the trips made at railway terminals are by residents and other trips are performed by non-residents of Sangli.

Table 3-62 Distribution of Passenger Trips by Residents/ Non-residents of Sangli

Resident/ Non-Resident	*Miraj Railway Station*	*Sangli Railway Station*	*Vishrambagh Railway Station*	*Overall*
Resident of Sangli	46%	55%	48%	47%
Non-Resident of Sangli	54%	45%	52%	53%

3.2.10 Turning Movement Analysis

Consultants conducted Turning movement surveys at 12 intersections and the data has been analysed. Traffic is projected to the base year (2011) and presented in **Table 3-63**. Total traffic at the intersection is expressed in both vehicles and in passenger car units. Among the 12 intersections maximum morning and evening peak traffic is observed at Pushparaj Jn (8,055 PCU & 8,307 PCU).

Table 3-63 Peak Hour Traffic at Intersection

S. No	Intersection Name	Peak hr Traffic (PCUs)		Type
		Morning	Evening	
1	Tilak Jn	3,276	3,212	4 Leg Jn
2	Maruthi Road Jn	2,112	2,778	4 Leg Jn
3	Municipal Jn	3,476	3,417	3 Leg Jn
4	Tarun Bharath Jn	2,487	2,509	3 Leg Jn
5	Rajwada Jn	4,116	4,211	4 Leg Jn
6	Congress Bhavan Jn	3,601	3,664	5 Leg Jn
7	Pushparaj Jn	8,055	8,307	5 Leg Jn
8	Vasanthdada Market Jn	4,611	4,222	4 Leg Jn
9	Vishrambagh Jn (Near Ambassador Hotel)	3,570	3,322	3 Leg Jn
10	Vishrambagh Jn (Near Vishrambagh Police Station)	3,946	4,435	4 Leg Jn
11	Vantamoore Corner Jn	2,708	2,804	3 Leg Jn
12	Mahatma Gandhi Jn	5,019	5,104	6 Leg Jn

3.2.11 Road Network Characteristics

The appreciation of road network characteristics is important to assess existing capacity level of the roads, identify the constraints, if any and assess the potential for improvement / up gradation of the road network to cater the existing and projected demands of traffic. The salient characteristics of major roads are presented in **Table 3-64**. Detailed Road Inventory Data is presented in **Annexure 3-3**. Majority of the roads are undivided. The roads in central areas of Sangli, Miraj and Kupwad have a large variation in carriageway width.

Table 3-64 Salient Characteristics of Road Network in S-M-K City

Roads	Length (km)	Effective Carriageway Width (m)		Divided/ Undivided
		Maximum	Minimum	
Kolhapur Road	3.2	7.0	7.0	Undivided
Haripur Road	2.8	7.0	4.5	Undivided
100 Feet Road	3.9	14.0	7.0	Undivided
Dhamni Road @ Vishrambagh Jn	2.6	4.5	4.5	Undivided
Dhamni Road @ Govt. Guest House	2.5	4.5	3.5	Undivided

Roads	Length (km)	Effective Carriageway Width (m)		Divided/ Undivided
		Maximum	Minimum	
Dhamni Road @ Wanleswadi	1.7	3.0	3.0	Undivided
Miraj-Kolhapur bypass Road	2.3	7.0	7.0	Undivided
Dhamni bypass Road (from Kolhapur Road)	2.1	4.5	4.5	Undivided
Sangli-Miraj Road	9.7	14.0	7.0	Divided & Undivided
Pandarpur-Bijapur Raod	9.2	7.0	4.5	Undivided
Miraj-Bedag Road	2.3	4.5	4.5	Undivided
Islampur-Sangli Road	5.1	7.0	7.0	Undivided
Sangli S.T Stand-Pusparaj Jn (Via S-M-K CMC Building)	2.7	14.0	7.0	Divided & Undivided
Pushparaj Jn-Congress Bhavan Jn (via Dhagdi Khan Tank)	0.9	7.0	7.0	Undivided
Islampur - Madhavnagar bypass Road	3.7	7.0	7.0	Undivided
Madhav Nagar Main Road	2.8	7.0	7.0	Undivided
Madhav Nagar-Karnal Road	2.6	3.0	3.0	Undivided
Karnal-Sangli Road	3.9	7.0	4.5	Undivided
Vishrambagh Main Road	4.2	17.0	7.0	Undivided
Aheliaya Nagar to ROB @ Sangli- Miraj Highway	6.1	4.5	4.5	Undivided
Vasant Dada Market-Sangli Railway Station Road	1.0	4.5	4.5	Undivided
Sangli Railway Station-Madhav Nagar Road	1.5	14.0	7.0	Undivided
Madhavnagar-Premnagar Road	0.5	7.0	7.0	Undivided
Old Kupwad Road	5.1	7.0	4.5	Undivided
Kupwad MIDC - Miraj (Mission Hospital Jn)	4.2	7.0	7.0	Undivided
Pandarpur Road (Via Miraj Lakshmi Market)	2.5	7.0	4.5	Undivided
Nadives Road	1.0	7.0	7.0	Undivided
Shirol Road	4.5	4.5	4.5	Undivided
Malgaon Road	3.3	7.0	4.5	Undivided
Takali Road	2.1	4.5	4.5	Undivided
Miraj Railway Station Road @ Vantamoore Corner	1.6	7.0	7.0	Undivided
Heera Hotel-ROB @ Sangli-Miraj Road (via Manik Nagar Colony)	3.0	7.0	4.0	Undivided
Maruthi Mandhir Road	1.1	7.0	3.0	Undivided
Tarun Bharat-Tilak Jn Road	0.5	4.5	4.5	Undivided
Ganapathi Peth Road	0.7	7.0	4.5	Undivided

Roads	Length (km)	Effective Carriageway Width (m)		Divided/ Undivided
		Maximum	Minimum	
Vakharbhag High School Road	1.2	7.0	7.0	Undivided
Amrai Police Jn-Azad Jn	0.2	7.0	7.0	Undivided
Congress Bhavan Jn-Shivaji Stadium	0.1	7.0	7.0	Undivided
Shivaji Stadium-Madhav Nagar Road	0.3	7.0	7.0	Undivided
Congress Bhavan Jn-Udyaog Ratan Velankar Road	0.3	7.0	7.0	Undivided
Udyaog Ratan Velankar Road-Walchand College	0.3	7.0	7.0	Undivided
Panchasheel Nagar High School Road	0.4	4.5	4.5	Undivided
Madhav Nagar-Panchasheel Nagar Rd	2.1	7.0	4.5	Undivided
Madhav Nagar Railway Station Road	1.1	7.0	3.0	Undivided
Samdoli-Sangliwadi Road	6.5	4.5	4.0	Undivided
Samdoli-Islampur Road	3.8	7.0	4.5	Undivided
Miraj-Bamini Road	3.5	3.0	3.0	Undivided
Vijaynagar-Kupwad Road	3.0	4.5	3.0	Undivided
Visharambagh Police Quarters-Sangli Station Road	1.4	7.0	7.0	Undivided
Vishrambagh Railway Station Road	0.6	4.5	4.5	Undivided
Miraj City Bus Stand- Police Sation Road	0.8	7.0	7.0	Undivided
Old Budhgaon Road	1.0	7.0	7.0	Undivided
New pride Theater-Amrai Road	1.5	7.0	3.0	Undivided
Miraj Rly Goods Office Road	1.5	4.5	4.5	Undivided
Siddhinayak Hospital to Babasaheb Udhyan Road	1.0	4.5	4.5	Undivided
Shivaji Temple Road @ Mission Hospital Jn (Mangalwarpet Road)	0.7	7.0	7.0	Undivided
Sangli - Karnal Road (via R.V Sharada Kanya College)	0.8	7.0	7.0	Undivided
Rockel Line Road	0.6	7.0	7.0	Undivided
Kapad Peth Road	0.4	7.0	7.0	Undivided
Panchamati Maurti Road	1.1	7.0	7.0	Undivided
Miraj MIDC-Kupwad Main Road	2.9	7.0	4.0	Undivided

For the present study, a detailed inventory of 144.0 km of road network was carried out in S-M-K City. The road network inventory data was analysed in terms of parameters like type of road, carriageway, type of pavement, service lane availability, on-street parking, drainage facilities, footpath, and street lighting facilities.

3.2.11.1 Carriageway Width

The distribution of road length by carriageway width show that nearly 44% of the network has a 2-lane carriageway, 34% have intermediate lane width while 13% have single lane carriageway

and 9% of road length has 4-lane carriageway. The distribution of road length by carriageway width is presented in **Table 3-65**.

Table 3-65 Distribution of Road length by Carriageway width

Carriageway width (m)	*% Road Length*
Up to 4	12.9
4 to 6	33.9
6 to 8	43.9
8 to 17	9.3
Total	**100.0**

About 94% of the road length in the city has undivided carriageway and needs attention for safety from possible head on collision accidents. Apart from Sangli-Miraj Road other important corridors are left undivided. The distribution of road length by type of carriageway is presented in **Table 3-66.**

Table 3-66 Distribution of Road Length by Type of Carriageway

Type of Carriageway	*% Road Length*
Divided	6.00
Undivided	94.00
Total	**100.0**

3.2.11.2 Type of Pavement

Nearly 99 % of the road network has bituminous pavement. Road length with Earthen Road and WBM constituted for 1%. Distribution of road length by type of road surface is presented in **Table 3-67**.

Table 3-67 Distribution of Road Length by Type of Pavement

Pavement Type	% Road Length
BT	99.0
Earthen	0.6
WBM	0.3
Total	**100.0**

3.2.11.3 On Street Parking

On-street parking results is a loss of carrying capacity of the road network. It is observed that nearly 29% of the road network has phenomena of on street parking thereby reducing the carriageway width for traffic movement. Percent road length where on street parking is observed is presented in **Table 3-68**.

Table 3-68 Distribution of Road Length by Occurrence of On Street Parking

On street Parking Observed	*% Road Length*
Observed	29.4
Not observed	70.6
Total	**100.0**

The important roads where on-street parking is observed include

- Miraj Market road (Kisan Jn-Srikanth Jn-Vasanthdada Bank-Momin Masjid)
- Congress Bhavan road (Station Jn-Congress Bhavan)
- Ganapathi Peth road (Ganapathi Temple-Patel Jn)
- Maruthi road connecting Ganapathi Peth

Analysis of the pavement condition expressed in terms of surface cracking, rutting, undulation/bumps, potholes and patches etc. reveals that the general quality of pavement is fair and on some of major corridors the incidence of pavement deterioration was observed. The distribution of road length by condition of pavement is presented in **Table 3-69**.

Table 3-69 Distribution of Road Length by Pavement Condition

Pavement Condition	*% Road Length*
Good	9.4
Fair	54.9
Poor	30.9
Very Poor	4.8
Total	**100.0**

3.2.11.4 Drainage Facilities

Only 23% of the road length has roadside drainage facility. About 77% of road length has no drainage.

3.2.11.5 Footpath Facilities

Analysis of network inventory data shows that nearly 93% of the road length has no footpath facilities thereby forcing the pedestrian to walk on the carriageway thereby reducing the width for vehicular movement. The details of the availability of footpath by carriageway width are presented in **Table 3-70**. About 6% of road length have footpath on both sides while 1% have footpath on one side.

Table 3-70 Distribution of footpath length by Carriageway width

Carriageway width (m)	*% Availability of footpath*
Up to 4	0.0
4 to 6	0.4
6 to 8	13.4
8 to 17	11.9
Total	**7.2**

3.2.11.6 Street Lighting Facilities

Inventory for availability of street light facility indicates that about 35% of the identified network has streetlights on one side. Nearly 50% of the network does not have any street lighting facility endangering the safety of road users at night. The distribution of road length by type of illumination facility is presented in **Table 3-71**.

Table 3-71 Distribution of Road Length by Availability of Street Light Facility

Status of Illumination Facility	*% Road Length*
Centre Only	6.4
Left Side Only	14.3
Right Side Only	14.0
Left and Right Sides Only	14.1
Right Side with Centre Only	0.3
Left Side with Centre Only	0.4
Three Sides	0.7
Not Available	49.7
Total	**100.0**

3.2.12 Speed and Delay Characteristics

Journey speed is an important characteristic of traffic. Measurement of speed is frequently required in transport planning particularly to evaluate the road network system, to provide vital inputs to transport demand modelling process and assist in economic analysis of improvement plans.

The speed and delay survey was carried out in peak and off peak hours adopting Moving Car Observed Method on selected roads covering all road configurations. The data collected was analysed to assess the speed characteristics along the identified roads and presented In **Table 3-72**. Detailed Speed & Delay Survey data was presented in **Annexure 3-4**.

Table 3-72 Average Speeds on S-M-K City Road Network

Sl. No	*Road Name*	*Average Journey Speed (Kmph)*
Core Network		
1	Miraj-Malgaon Road	23
2	Miraj-Takali Road	13
3	Bijapur-Miraj-Pandrapur Road	29
4	Miraj-Kupwad Main Road	28
5	Miraj MIDC-Kupwad Market Road	30
6	Madhavnagar-Kupwad Road (Old Kupwad Road)	29
7	Sangli-Miraj Road (Via Rajwada Jn)	43
8	Madhavnagar-Panchasheel Nagar Road	22
9	Madhavanagar Railway Station Road	17

Sl. No	Road Name	Average Journey Speed (Kmph)
10	Miraj Railway Station Road (@ Vantamoore Corner)	26
11	100 Feet Road	36
12	Dhamni Road (@ Govt.Guest House)	24
13	Dhamni Road (Dhamni-Octrain on Kolhapur Road)	16
14	Damini road @ Tata Motors on Sangli-Miraj Road	26
15	Miraj Darga-Police Station Road	15
16	Hera Hotel Jn-Pandrapur Road (Via Laxmi Market)	13
17	Miraj Laxmi Market-Shasthri Jn Road	18
18	Ambedhkar Road	22
19	Mangalwarpet Road @ Mission Hospital Jn	46
20	Sangli-Karnal Road (via R.V Sharada Kanya College)	10
21	Rockel Line Road	15
22	Kapad Peth Road	12
23	Panchamaruthi Road	46
24	Miraj ST Stand-Mission Hospital Jn	20
	Average Speed	**24**
Other Network		
25	Sangli-Kolhapur Road	31
26	Sangli-Karnal Road	31
27	Madhavnagar Main Road	31
28	Sangli-Haripur Road	62
29	Sangliwadi Samdoli Road	33
30	Samdoli-Islampur Road	49
31	Madhavnagar-Karnal Road	47
32	Miraj-Bamini Road	28
33	Islampur-Madhavnagar Bypass Road	51
34	Vishrambagh Railway Station Road	26
35	Vishrambagh Main Road	33
36	Aheliaya Nagar to ROB @ Sangli- Miraj Highway	51
37	Miraj Railway Goods Office Road	18
38	Miraj Railway Station @ Siddhivinayak Cancer Hospital	14
39	Manik Nagar Colony Road	23
40	Vijaynagar-Kupwad Road	29
41	Old Budhgaon Road	19
42	New pride theater-Amrai Road	20
	Average Speed	***33***

The average journey speed varies from 10 Km/h to 46 Km/h within the city. In general, delay is due to presence signals, congestion due to illegal parking, encroachments and movement of pedestrians along with the vehicles in the carriageway. Based on survey, the average speed on core network is 24 Km/Hr and on other parts of network it is 33.11 Km/Hr.

3.2.13 Parking Survey

Consultants conducted parking surveys at 4 locations and the data has been analysed. The Equivalent Car Space units used for converting all categories into single unit for various modes are presented in **Table 3-73**. Parking accumulation at these locations in Equivalent Car Space units is presented in **Table** 3-74. Among the 4 locations maximum morning and evening peak hour parking accumulation is observed at Ganapathipet Road (2,331 ECS & 2,174 ECS) due to parking of Goods Auto.

Table 3-73 Equivalent Car Space (ECS) Units for Various Modes

Vehicle Type	ECS
Two Wheeler	0.5
Auto	0.75
Car	1.0
Goods Auto	0.75
Truck	1.9
Cycle	0.5

Table 3-74 Peak Parking Accumulation at Various Parking Locations

Sl.No	*Location Name*	*Peak hr Accumulation (ECS)*	
		Morning	*Evening*
1	Miraj Market Road (Kisan Jn-Momin Masjid)	382	414
2	Congress Bhavan Road (Station Jn-Congress Bhavan)	599	795
3	Ganapathi Peth Road (Ganapathi Temple-Patel Jn)	2,331	2,174
4	Maruthi Road (Maruthi Road Jn-Ganapathipet Road Jn)	1,093	1,143

3.2.14 Pedestrian Survey

Consultants conducted pedestrian surveys at 2 locations and the data has been analyzed. Pedestrians moving along and across the roads in the peak hour were calculated and are presented in **Table 3-75**. Among the 2 location maximum morning and evening peak pedestrian movement is observed on Maruthi Road due to the Bazaar area.

Table 3-75 Pedestrian Movement at Busy Locations

S. No	*Location Name*	*Peak hr Pedestrian Movement*			
		Morning		*Evening*	
		Along	*Across*	*Along*	*Across*
1	Harbhat Road	649	645	1201	1083
2	Maruthi Road	1280	176	2950	234

3.2.15 Goods Focal Point Survey

Consultants conducted Goods focal point survey to capture the travel characteristics of the Goods Vehicles. The information regarding the movement of goods and commercial vehicles (including Goods Auto) was collected and is presented in **Table 3-76**.

Table 3-76 Goods/Commercial Vehicles Movement at Various Places in S-M-K City

S.No	*Location Name*	*No. of Commercial Vehicles*	*Goods Movement*
1	Sangli-Miraj MIDC	2116	Starch, Pulses, Metal parts, Auto parts
2	Kupwad MIDC (Out of S-M-K CMC)	5932	Soya bean, Oil, Metal Goods, Plastic Items
3	Vasanthdada Market Yard	1563	Wheat, Rice, Pulses, Turmeric, Match box
4	Ganapathipeth	919	Coconut, Crackers, Rakhi
5	Sangli Railway Godown	45	Salt, Fertilizer
6	Bharath Petroleum Corporation Oil Ltd	260	Petrol, Diesel, Kerosene

3.2.16 Vehicle Operators Survey

A total of 20 vehicle operators of taxis, auto rickshaws and two wheelers were contacted for elicit the operating characteristics of vehicles as well as cost of operation and the details are presented in **Table 3-77**. This data will be utilized for deriving the vehicle operating costs. Vehicle operating costs (VOC) is an important input for development of travel demand models.

Table 3-77 Operating Characteristics of Various Modes in S-M-K City

S. No	Mode	Two Wheeler	Auto	Taxi
1	Daily Total km	17.5	123.1	221.3
2	Daily Fuel Consumption (in lit)	0.3	4.2	16.1
3	Daily Total Revenue (in Rs.)	-	436.2	1062.5
4	Maintenance Charge per day (in Rs.)	2.5	27.2	107.5
5	Mileage (in km)	50.0	26.4	13.1
6	Number of vehicles in Operation in City	-	4154	288

3.2.17 Stakeholders Consultation Survey

Consultants have carried out Stakeholders Survey to elicit the opinion of various stakeholders such as Planning officials, University professors, Industrial units etc. on range of development that is expected in near future for the S-M-K City. A total of 25 stakeholders were contacted for knowing the opinion regarding the growth of city, development in city, opinion regarding the mono rail likely corridors and transport infrastructure and traffic problem in the city. It was opinion of stakeholders that population growth as forecasted by master plan is reasonable.

Residential developments are likely in future in the areas of Sangli-Miraj Road (Vishrambagh to Miraj), Kupwad, Dhamni Road, Kolhapur Road and 100 ft road. Commercial developments are likely in future in Madhavnagar and Vishrambagh areas whereas Industrial developments are likely in Kupwad M.I.D.C, Miraj M.I.D.C and Savali areas.

IT related industries in future are likely in the areas of Vishrambagh and Sangli areas. Agrobased industries are likely in future in Kupwad M.I.D.C whereas manufacturing industries in Miraj M.I.D.C.

The main traffic problems in S-M-K City are congestion, parking, un-signalised junctions and goods traffic movement at peak hours. The survey reveals that there is requirement of bypass roads, flyovers, widening of roads, provision of footpaths and zebra crossings, signalised intersections, requirement of bus/truck terminals, increasing the frequency of buses, reduced bus fares and improving the bus stop facilities.

The likely mono rail corridors suggested by stakeholders are Sangli-Miraj and Sangli-MIDC-Miraj.

L&T-RAMBØLL CONSULTING ENGINEERS LIMITED

Client:	**Maharashtra Urban Infrastructure Development Company Limited (MUIDCL)** [Click here and enter Client's other information]
Project:	Preparation of City Mobility Plan for Sangli-Miraj-Kupwad Municipal Corporation
Project No.:	C1112502
Title:	Draft Final Report
Document No.:	RP005
Rev.:	0

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Notes:

1.

Revision Details:

Rev.	Date	Details	Prepared Init.	Prepared Sign.	Checked Init.	Checked Sign.	Approved Init.	Approved Sign.

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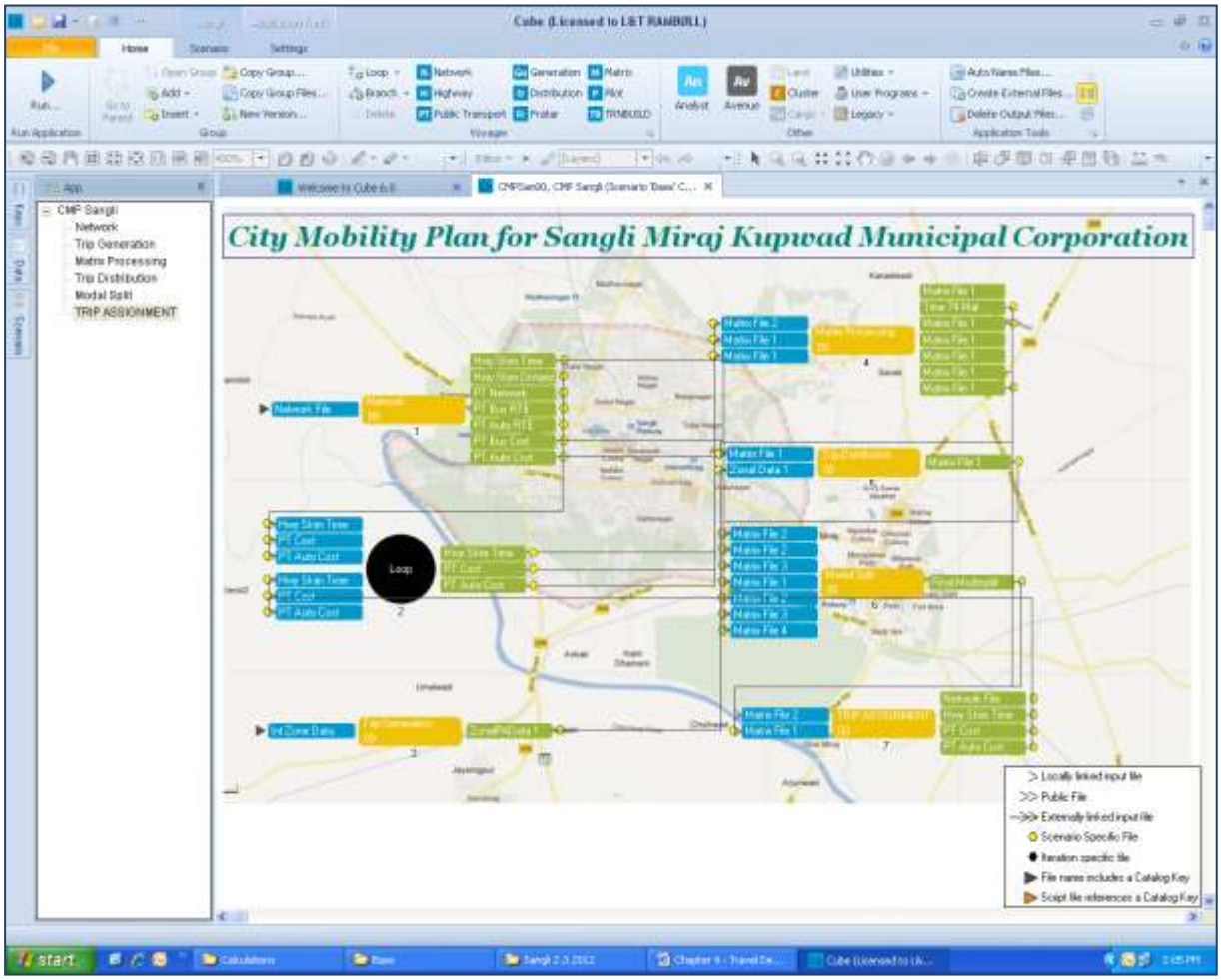
4 Travel Demand Modelling and Forecast

The current chapter discusses the development of base year travel demand model[1], its validation. Based on Calibrated base year models, horizon year models are developed to forecast traffic for various scenarios. **CUBE Voyager** Software has been used for development of travel demand model.



CUBE Voyager is the state of the art Transportation Planning software. It is designed to be integrated modelling system for transportation planning applications.

4.1 Pre-Modelling Analysis

4.1.1 Study Area and its Delineation

The study area comprises of **Sangli – Miraj – Kupwad City Municipal Corporation Area (SMK-CMC)** with an area of 118 sq.km. It has been subdivided into smaller physical units, termed as Traffic Analysis Zones (TAZs) to facilitate analysis of travel demand. Consultants have chosen current demarcated wards as zones for which demographic, socio-economic and other planning data is readily available from secondary sources. Zoning system adopted for the current study is presented in **Figure 4-1**. Details of zoning are provided in **Annexure 4-1**.

[1] Travel Demand Model is also known as UTP (Urban Transportation Planning) Model

4.1.2 Internal Zones

The Sangli – Miraj - Kupwad (SMK) Municipal Corporation Area is divided into 74 wards as per prevailing demarcation of wards. These wards are taken as **internal zones.**

4.1.3 External Zones

Regions beyond the SMK CMC have been delineated into external zones based on the catchment of the existing transport links feeding into the study area. A total of 15 external zones are considered representing the world outside the study area. In summary, the TAZs in the study area are:

Type of Zone	No. of Zone
Internal (within SMK-CMC area)	**74**
External (outside SMK-CMC area)	**15**
Total	**89**

4.1.4 Plan Period

Year 2011 is considered as Base Year. As per Terms of Reference (**TOR**) travel demand forecasts is to be prepared upto 2031. Therefore for the purpose of sequential planning and design of the systems, these travel demand forecasts are presented at ten-year intervals i.e., for the years 2021 and 2031.

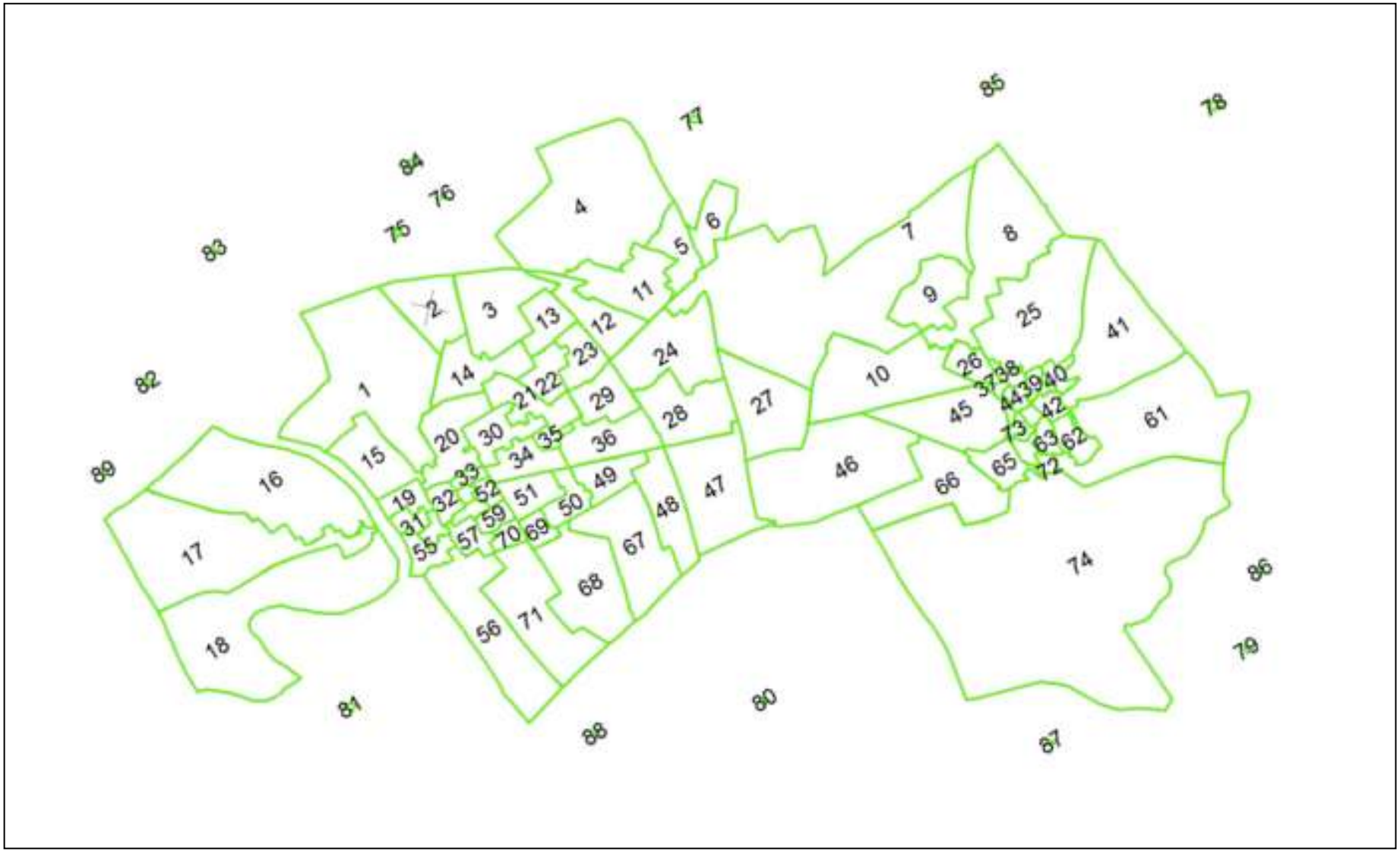


Figure 4-1 Zoning System Adopted for the Study

4.1.5 Preparation of Data Base

Data required for the analysis of travel demand can be categorized into three types.

1. Planning variables
2. Transport network
3. Travel Demand and Characteristics

The base year data is summarized in the following sections.

4.1.5.1 Planning Variables

Planning variables i.e. population, employment (category-wise), vehicle ownership etc, are some of the important data required for estimating the travel demand generated at zonal level.

Base year demographic data is obtained from the Census and SMK-CMC database. Zone-wise employment is collated from various published reports. Base year vehicle ownership within the SMK-CMC area is obtained from the vehicle registration records available with the RTO. Vehicle ownership at zonal level has been estimated by apportioning the total vehicles in SMK-CMC to each zone in proportion to the vehicle ownership as observed in the Household Interview Survey database. Compilation of zone-wise planning variables and forecast is discussed in detail in Chapter 2.

4.1.5.2 Transport Network

The transport network in the study area includes road network, public transport (bus and rail) network. **Figure 4-2** shows the base year transport network in the study area.

All the characteristics of the road links are collected by network inventory and, speed and delay surveys. Link characteristics collected include length, carriageway type (divided/ undivided), type of operation (one-way/ two-way), number of lanes, average speed, capacity etc. **Table 4-1** shows different types of road links in the study area and their characteristics.

Table 4-1 Link Details of Base Year Transport Network

No. of Lanes	Type of Carriageway	No. of Links in Network
Single lane	Undivided	6
Intermediate Lane	Undivided	51
Two lane	Undivided	184
Four lane	Undivided	24
	Divided	17
Zone Centroid Connectors		**169**
Total		**451**

Public Transport Network includes all roads on which public transport buses operate as well as the rail network. Details of bus routes, frequencies, seating capacities, maximum load factor, fares and rail network details have been collected and coded. In addition, in this study, Autorickshaw is considered as a intermediate public transport and is made available on the road links by suitably marking the routes for the mode. The road network is properly connected to all zone centroids by means of dummy links. **The base year transport network has about 451 road links and 83 bus lines (routes).**

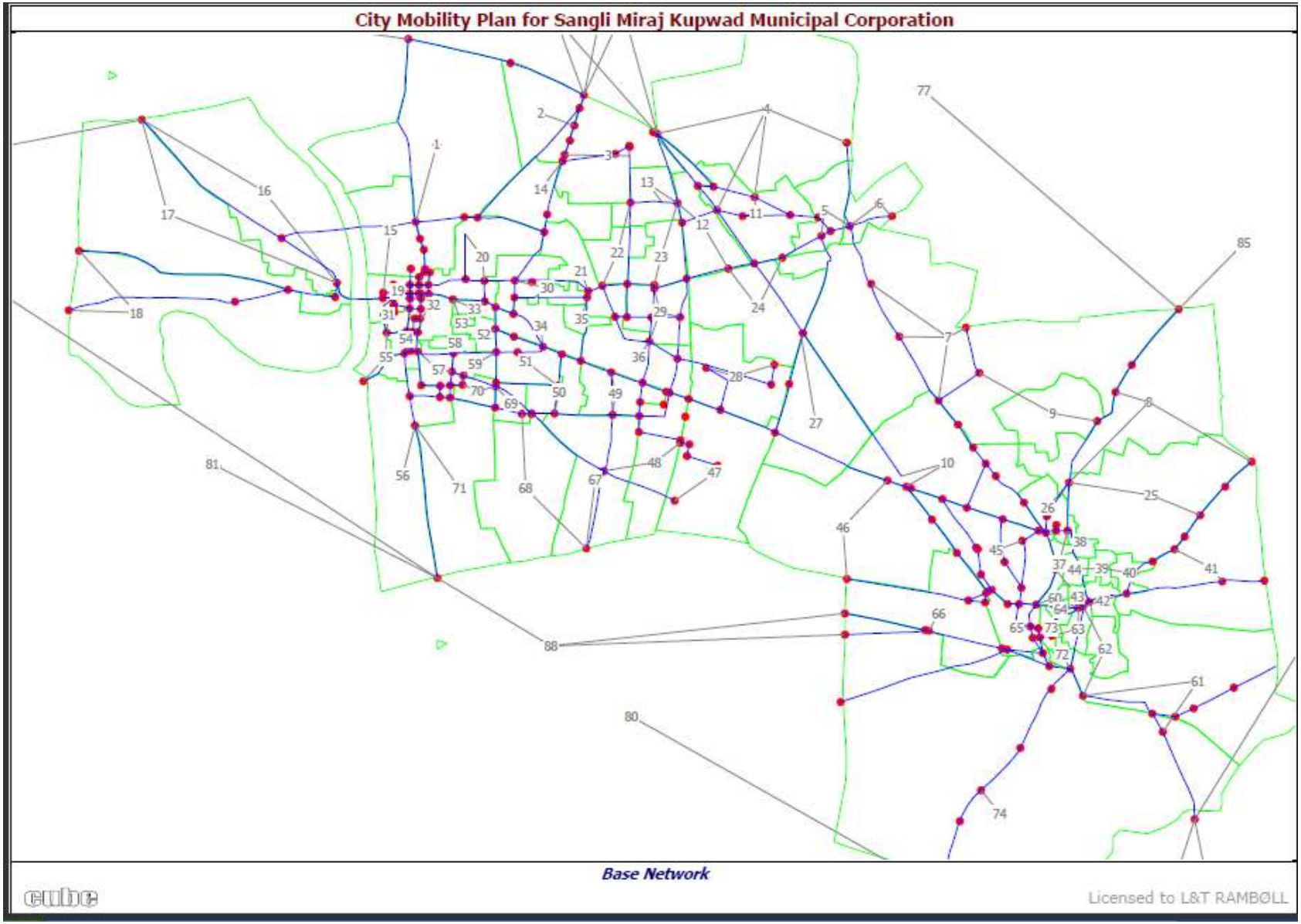


Figure 4-2 Base Year Transport Network in the Study Area

4.1.6 Travel Demand and Characteristics

Various traffic surveys are conducted to assess the base year traffic and travel characteristics in the study area. Home Interview Survey is conducted to obtain the socio-economic and travel characteristics of resident population. Outer cordon O-D and Public Transport terminal surveys are conducted to assess the intercity travel demand and its characteristics. Details of Field surveys and analysis are presented in earlier chapter titled "***Field Surveys, Data Compilation and Statistical Analysis Report***.

4.1.7 Generation of O-D Person-Trip Matrices

Using the zonal expansion factors, O-D trip matrices have been generated for the intra-city and inter-city trips by mode using the data source as presented in **Table 4-2**.

Table 4-2 Data Sources for Generation of O-D Person Trip Matrices

Intra/Intercity Trips	Category	Data Source
Intra-city Trips	Home based trips	HIS
	Non-home based trips	HIS (Supplemented by O-D surveys at terminals)
Inter-city Trips	Internal – External	Outer Cordon O-D surveys (Supplemented by HIS and O-D surveys at Terminals)
	External – Internal	Outer Cordon O-D surveys (Supplemented by HIS and O-D surveys at Terminals)
	External – External	Outer Cordon O-D surveys

Table 4-3 summarises the trips obtained from the above listed sources. The procedure adopted to obtain validated O-D matrices is shown by a flow chart in **Figure 4-3**.

Table 4-3 Summary of Base Year Trips

I. INTRACITY TRIPS (Including Intra-zonal)								
Trip Component	***Walk***	***Cycle***	***IPT***	***Two Wheeler***	***Bus***	***Car***	***Rail***	***Total***
Internal - Internal	347802	180005	57478	124626	20077	6156	394	736538
Internal - External	1677	2310	880	6401	3794	509	277	15849
External - Internal	1512	2264	1025	6444	3609	509	298	15661
Total	**350991**	**184580**	**59383**	**137471**	**27479**	**7173**	**970**	**768047**
I. INTRACITY TRIPS (Excluding Intra-zonal)								
Trip Component	***Walk***	***Cycle***	***IPT***	***Two Wheeler***	***Bus***	***Car***	***Rail***	***Total***
Internal - Internal	252129	160975	51002	114530	17724	5517	306	602183
Internal - External	1677	2310	880	6401	3794	509	277	15849
External - Internal	1512	2264	1025	6444	3609	509	298	15661
Total	**255318**	**165549**	**52907**	**127375**	**25127**	**6534**	**881**	**633692**
II. INTERCITY TRIPS								
Trip Component	**Walk**	**Cycle**	**IPT**	**Two Wheeler**	**Bus**	**Car**	**Rail**	**Total**
Cordon Survey	0	0	12564	48780	117340	53609	0	**232294**
Bus & Rail Terminal Survey	0	0	0	0	90077	0	38688	**128765**
Trips by Residents (from HH Survey)	3189	4574	1905	12845	7402	1018	575	**31509**
Trips by Non-Residents	0	0	10659	35935	109938	52591	38113	**247236**
III TOTAL TRIPS								
Intracity Trips		768047						
Intercity Trips by Residents		31509						
Intercity Trips by Non-Residents		247236						
Total Trips		**1046793**						

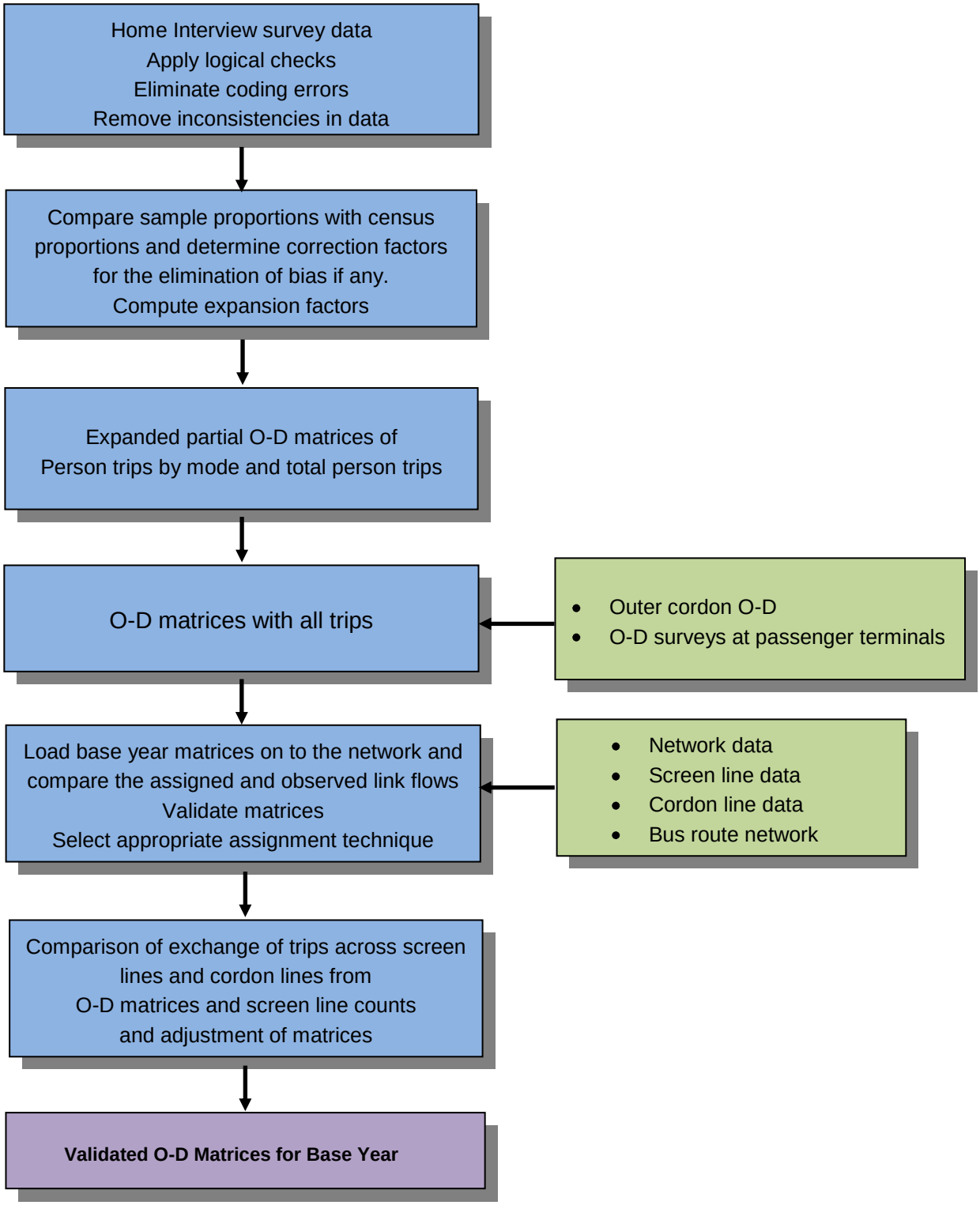


Figure 4-3 Procedures for Estimation of Base Year Matrices

Mode wise person trip matrices are prepared from the data sources mentioned. Following O-D matrices are prepared:

- *Mode wise (Walk, Bicycle, Two-wheeler, Car, IPT, Bus and Train) O-D matrices for Intra-city trips made by residents.*
- *Mode-wise (Two-wheeler, Car, IPT, Bus and Train) O-D matrices for intercity trips (i.e. I-E, E-I and E-E) by residents and non-residents.*

O-D matrices thus generated are assigned on to the network. Using the estimated matrix, assignment is made and trip exchanges observed across screen and cordon lines are compared with the trip exchanges obtained from the O-D matrices. These are tabulated in **Table 4-4**. It can be seen that the observed trip exchanges across the screen lines are close to the ones given by the O-D matrices generated. Thus the network is validated.

Table 4-4 Screen line Comparison (in Daily PCUs excluding Commercial Vehicle Trips)

Locations	Modelled	Observed	Error
East West SL	122341	134159	-9%
North South SL	14025	14177	-1%
Total	**136366**	**148336**	**-8%**

Desire line diagram of Base Year Trips (in person trips excluding cycle trips) is prepared and presented in **Figure 4-4**.

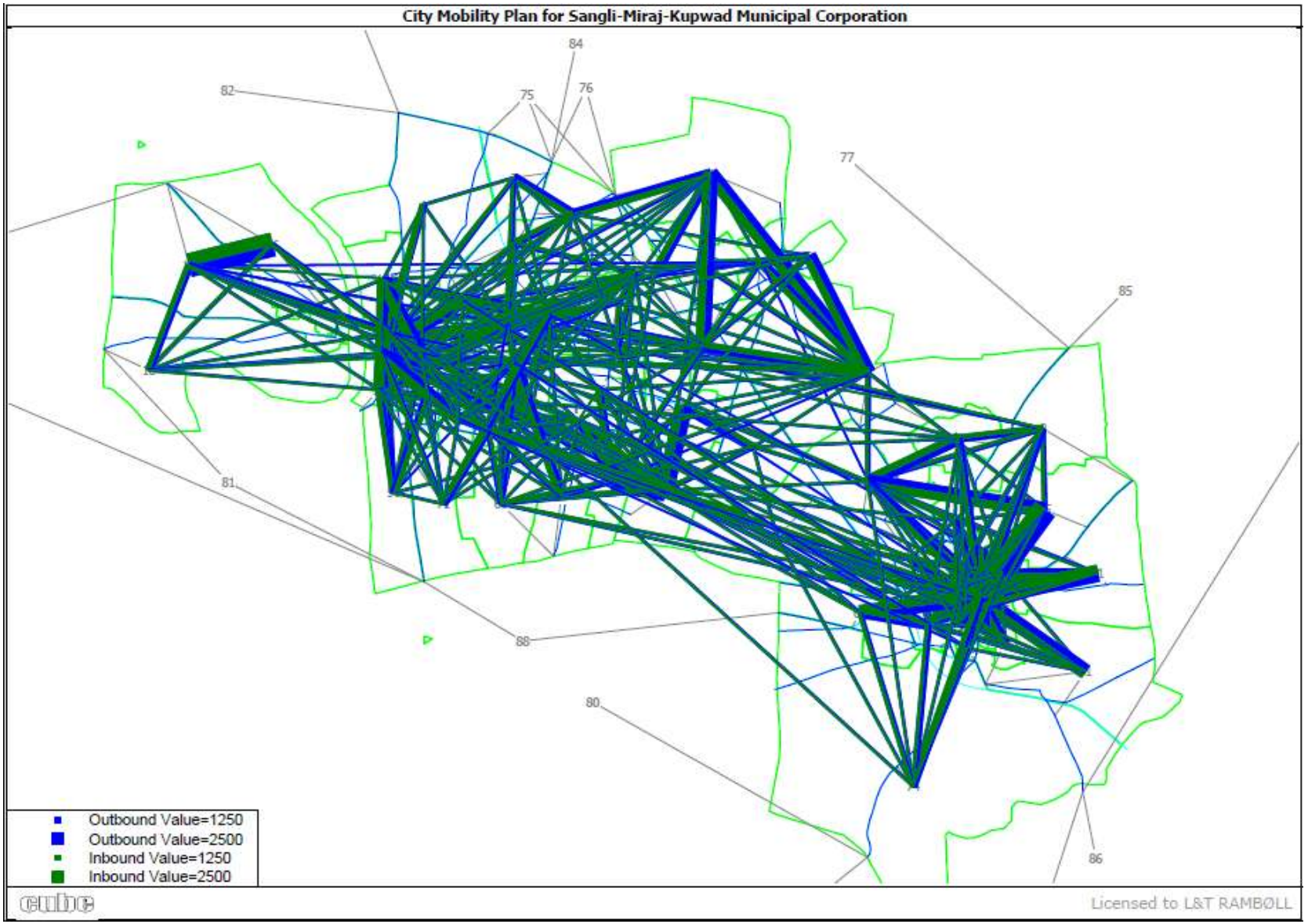


Figure 4-4 Desire line Diagram for Base Year Trips

4.2 Base Year Travel Demand Modelling

The base year travel pattern has been modelled as accurately as possible, and the calibrated models along with the horizon year planning variables and network information is used to forecast the trips for various horizon years. Traditional four-stage model using the CUBE Voyager Software package has been used for travel demand modelling. Following subsections give a detailed account of the base year modelling process and the calibration results.

Flowchart outlining overall 4-stage modelling process and Development of Base Year Model is given in **Figure 4-5** and **Figure 4-6.**

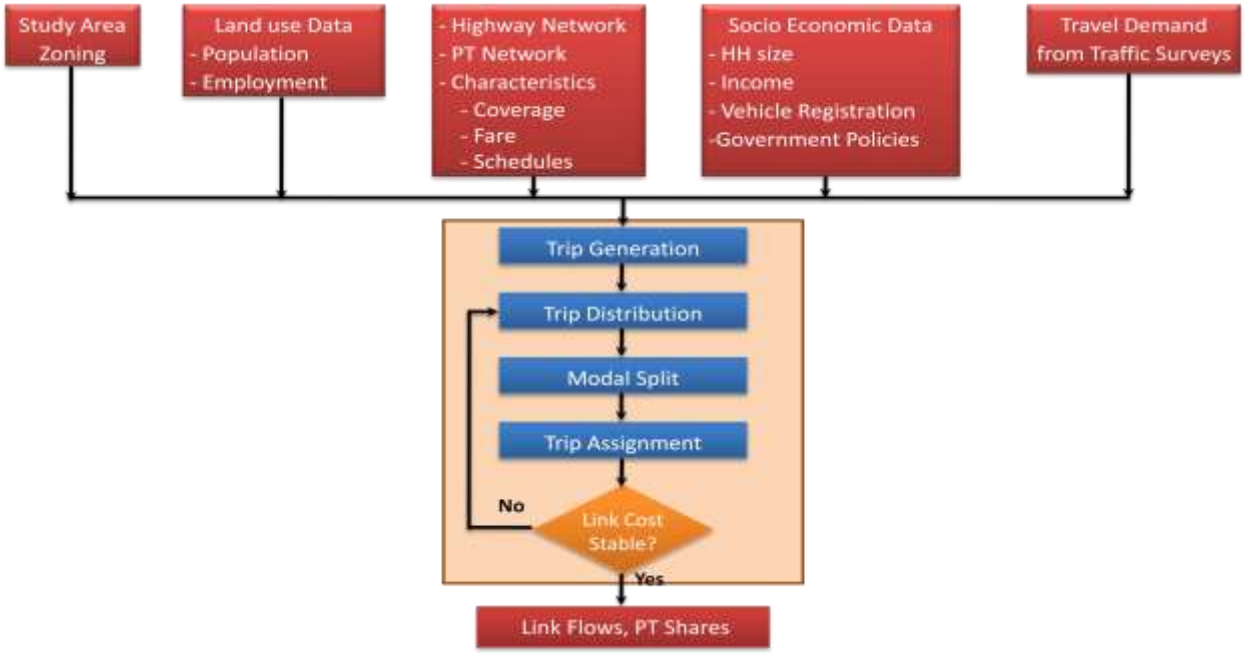


Figure 4-5 Base Year Modelling Process

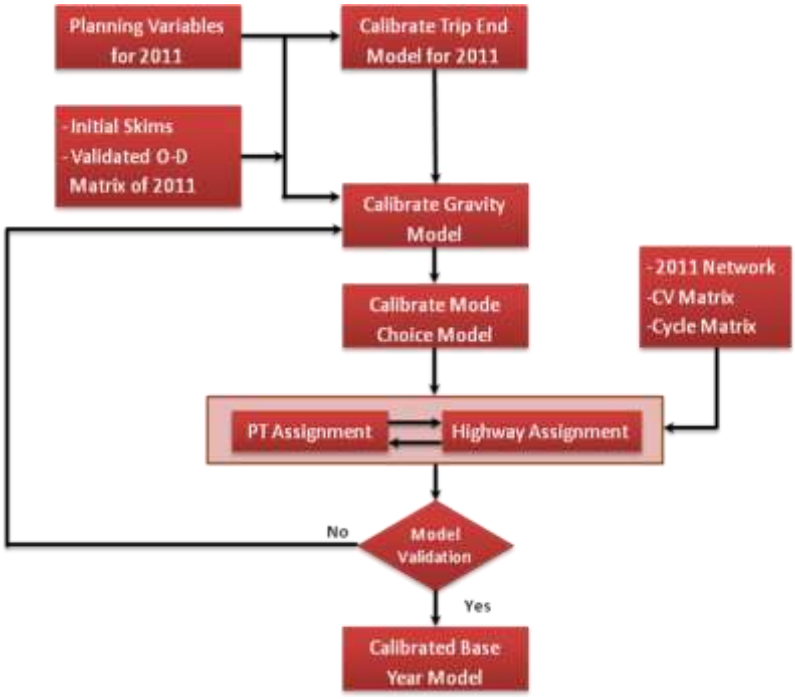


Figure 4-6 Calibration of Base Year Model

4.2.1 Trip End Modelling

Trip end models are developed for the intra-city trips made by the residents of the study area. All the other trips viz., internal to external, external to internal and external to external trips are modelled mode-wise by growth factors. Trip ends of internal trips for the base year (2011) are calculated from the validated O-D matrices. Trip end models are developed using stepwise multiple linear regression technique. The variables used for the development of linear regression models for the trip ends are presented in **Table 4-5.**

Table 4-5 Variables for Trip End Models

Variable Name	Description
POP	Population
SPECIAL ZONE	Dummy Variable for Special Zones
VEH	Number of Private Vehicles
INDEMP	Industrial Employment
TRDEMP	Trade Employment
SEREMP	Service Employment
TOTEMP	Total Employment

It is to be noted here, there are some zones where trip ends are very high (**see Table 4-6**). To model the trip ends accurately a dummy variable Special Zone has been introduced in trip end modelling, which yielded a good R^2 (Coefficient of Correlation Value) of 0.87.

Table 4-6 Special Zones

Zone No	Zone Name
19	Sangli, Sri Ganapati Mandhir
30	Sangli College Corner
31	Sangli, Gaobhaan Jain Basthi
32	Sangli, Rajwaadaa Parisar
34	Sangli, Kaaliikan Uttar Shivaji Nagar
43	Miraj, Kisaan Chowk

The developed Trip end model is:

Trip Ends = 0.75*Population + 11866.79*Special Zone
(t- values) (16.41) (10.51) **R^2 = 0.87**

It can be observed that t-values are significant for developed coefficients.

4.2.2 Growth Factors for External Trips

Since past traffic data at the external cordon points are not available, traffic growth rates have been assumed as 7.5% and 5.0% respectively upto till 2021 and beyond 2021.

4.2.3 Trip Distribution Model for Intra-City Trips

A gravity type trip distribution model of the following form is calibrated to represent the base year travel pattern within the study area.

$$T_{ij} = A_i O_i B_j D_j F_{ij}$$

Where,

$$A_i = \frac{1}{\sum_j B_j D_j F_{ij}^k}$$

$$B_j = \frac{1}{\sum_i A_i O_i F_{ij}^k}$$

F_{ij} = Friction factor as a function of C_{ij} = cost of travel from i to j

T_{ij} = Number of trips between zones i and j

This gravity model is calibrated on the intra-city trips performed by the residents of the study area. Among the parameters for deterrence (C_{ij}), highway cost is found to give better results. Maximum likelihood method of calibration is used in order to estimate the friction factor. Iterative procedure has been used to calibrate the friction factors for each trip length range. **Table 4-7** gives the results of calibration of the gravity type trip distribution model.

Table 4-7 Results of Distribution Model Calibration

Estimated Mean Trip Length	3.76 km
Observed Mean Trip Length	3.58 km**

****Excluding Cycle Trips**

Figure 4-7 gives the comparison between the observed and modelled trip length frequency distributions. It can be observed that modelled trip distribution closely matches with observed trip length distribution.

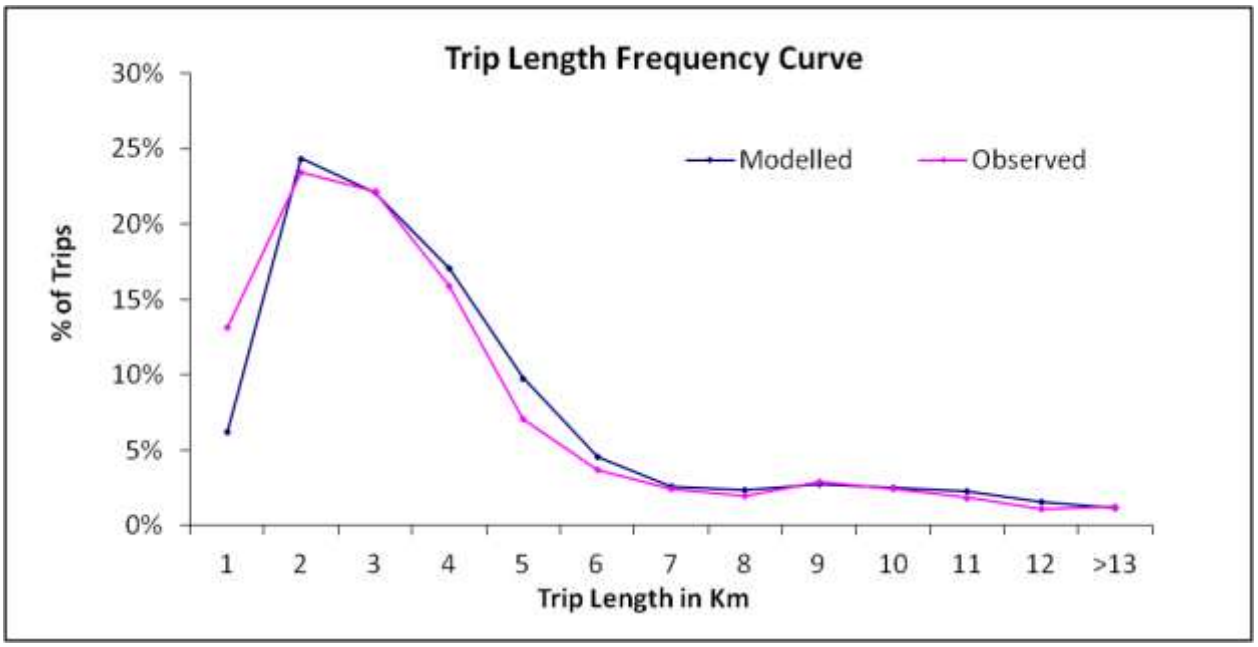


Figure 4-7 Trip Length Frequency Distribution

4.2.4 Mode Choice Model for Intra-City Trips

Incremental logit model has been used for Modal split. This model forecasts the change in demand based on change in cost from the known base situation. Initially total trips are split into private trips and public transport trips. Private trips comprises of Car and Two wheeler. Public transport trips comprises of Bus, IPT and Walk trips. In the next step private vehicles and public transport has been split. The procedure adopted is presented below:

The model inputs are base demand by mode (D_{Pvt}, D_{Pt}), base costs by mode (C_{Pvt}, C_{Pt}) and forecast costs by mode (C'_{Pvt}, C'_{Pt}). The change in cost is denoted by DC_{Pvt} and DC_{Pt} where:

$$\Delta C_{Pvt} = C'_{Pvt} - C_{Pvt}$$

$$\Delta C_{Pt} = C'_{Pt} - C_{Pt}$$

Base probabilities are denoted by P_{Pvt} and P_{Pt} where:

$$P_{Pvt} = \frac{D_{Pvt}}{D_{Pvt} + D_{Pt}}$$

$$P_{Pt} = \frac{D_{Pt}}{D_{Pvt} + D_{Pt}}$$

The choice model now takes the form of the equation below where P' denotes the forecast choice probability and λ is the scale parameter.

$$P'_{Pvt} = \frac{P_{Pvt} \exp(-\lambda \Delta C_{Pvt})}{P_{Pvt} \exp(-\lambda \Delta C_{Pvt}) + P_{Pt} \exp(-\lambda \Delta C_{Pt})}$$

$$P'_{Pt} = \frac{P_{Pt} \exp(-\lambda \Delta C_{Pt})}{P_{Pvt} \exp(-\lambda \Delta C_{Pvt}) + P_{Pt} \exp(-\lambda \Delta C_{Pt})}$$

So that the forecast demand by mode (D'_{Pvt}, D'_{Pt}) is:

$$D'_{Pvt} = (D'_{Pvt} + D'_{Pt}) P'_{Pvt}$$

$$D'_{Pt} = (D'_{Pvt} + D'_{Pt}) P'_{Pt}$$

The incremental composite cost (DC) is given by:

$$\Delta C = -\frac{1}{\lambda} \log (P_{Pvt} \exp(-\lambda \Delta C_{Pvt}) + P_{Pt} \exp(-\lambda \Delta C_{Pt}))$$

4.2.5 Commercial Vehicle (CV) Matrix Estimation

Base year CV matrix has been estimated from link counts. Daily directional volumes of commercial vehicles are available on fourteen links within the study area and seven links at the external cordon (from the primary traffic surveys). These links are spread all over the study area. Using the Analyst module of Cube, which works on the principle of entropy maximisation, a reasonable estimate of the daily CV matrix is obtained. The total number of commercial vehicles estimated using Analyst program is 42,067 PCUs. The program uses the paths that are built during highway assignment, the observed link volumes of commercial vehicles, seed matrix and the associate confidence levels for the link volumes. During the estimation process the links on which CVs are not allowed are switched off to get a realistic estimation of the CV matrix. It reproduced the observed link volumes when assigned on to the highway network. The future CV matrices are obtained by applying appropriate growth factors and by furnessing.

4.2.6 Assignment of Base year O-D Matrices and Validation

The O-D matrices generated from various data sources are combined appropriately to get the public transport and highway O-D matrices. Public transport O-D matrix contains all person trips made by residents and non-residents by the public transport modes, viz., walk, bus and IPT. Trips made for Intracity travel by rail are few and therefore not assigned. The highway O-D matrix consists of person trips made by residents and non-residents by car/ two-wheeler. Bicycle and trucks trip matrices (which are not part of either public transport or highway O-D matrices) are pre-loaded on to the network.

4.2.6.1 Public Transport Assignment

The public transport network consists of all the road links coded with appropriate characteristics like length, speed, etc. The bus and Autorickshaws routes are defined by specifying the links on which these routes traverse. Each route is characterised by its frequency, capacity, crush load, fares etc. The characteristics of these routes are coded accordingly. In addition access and egress

connectors for walk and transfers are built using Public Transport Program. Public transport assignment is done based on generalised time approach.

First the network is pre-loaded with the truck peak hour PCU matrix and bicycle peak hour PCU matrix. The daily O-D matrix of public transport passenger trips is assigned on to the preloaded network. The bus passenger link loadings and Autorickshaw passenger link loadings obtained after public transport assignment are transferred on to the road network as peak hour PCU flows by employing appropriate passenger-PCU conversion factors and peak flow to daily flow ratios applicable to bus and Autorickshaw flows.

4.2.6.2 Assignment of Private Trips

The daily matrices of car and two-wheeler person trips are converted to peak hour O-D matrices in passenger car units (PCU) by applying regional peak hour to daily flow ratios and passenger to PCU conversion factors. Then the network loaded with trucks, Cycles and PT trips is used for private trips assignment. The car and two-wheeler peak hour PCU matrix is then loaded using incremental capacity restraint procedure.

4.2.6.3 Public Transport and Private Traffic Assignment Iterations

A loop of iterations is carried out between the distribution step and assignment step to iterate the assignment process. The final highway skim costs obtained from the assignment step is taken back to the distribution stage, then modal split and assignment. Travel time considered for assignment is based on the Bureau of Public Roads formulae:

$$TC = T_0*(1+0.15*(V/C)^4)$$

Where,

TC	-	Change in Travel Time
T_0	-	Initial free flow travel time
V	-	Volume
C	-	Capacity

The public transport and highway time/cost skims are worked out based on these final link costs. These cost/time skims are used to update the matrices by applying gravity distribution and mode choice models. The whole process is then repeated till stable link costs are achieved. At this stage the loadings on bus, Autorickshaw links are taken as final.

The observed and modelled trips for base year by mode are presented in **Table 4-8.**

Table 4-8 Observed and Modelled Trips

Vehicle Type	Observed	Modelled	Error
Private	236340	234679	0.7%
Bus	139696	137400	1.7%
IPT	65128	62829	3.7%
Walk	255318	255528	-0.1%
Total	696482	690435	0.9%

4.2.7 Calibration and Validation of Base Year Network

Base year network has been calibrated and validated for the observed counts at Screen line locations and cordon locations. It has been observed that the error between the observed and modelled flows at screen lines and cordon locations are within +/- 10%. Hence the base year network is validated.

Table 4-9 Validation of Base Year Network

Locations	Modelled	Observed	Error
East West SL	122073	134159	**-9%**
North South SL	14482.8	14177	**2%**
Cordon Points	70149.9	69532.8	**1%**
Total	**206706**	**217868**	**-5%**

4.3 Base Year Model Results

From base year model the actual speed and assigned speed are compared and it has been observed that both are matching closely. Hence the base year model stands validated and it can be used for horizon year for forecasting future travel demand. **Figure 4-8** gives the graph between actual speed and assigned speed.

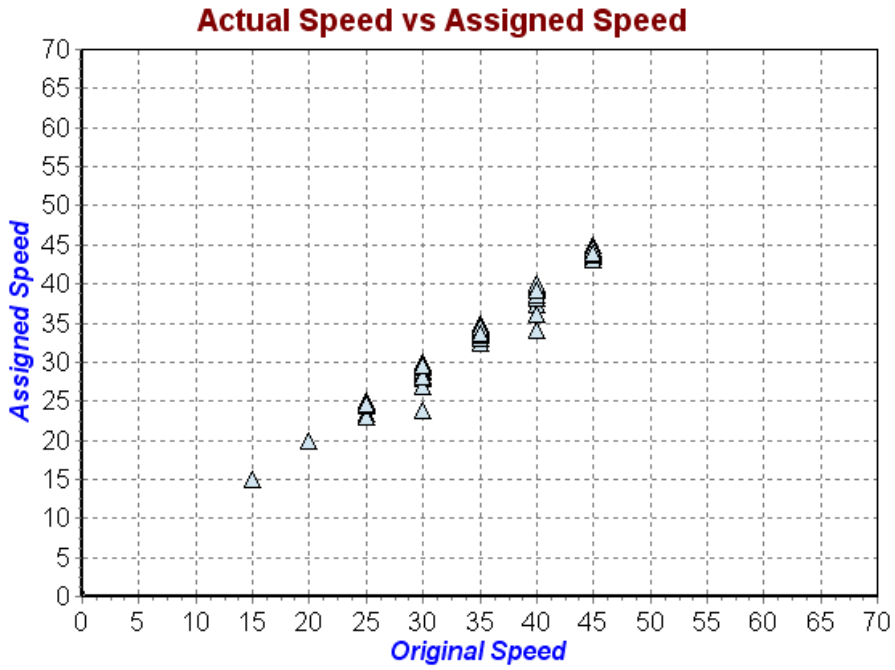


Figure 4-8 Actual Speed Vs Assigned Speed for the Base Year 2011

From the base year model V/C ratios on along some of the major roads have been compiled and presented in **Table 4-10.**

Table 4-10 V/C at Major Roads for Base Year 2011

Section	No of Lanes	Distance	Node		Capacity	LOAD	V/C
			A	B			
Shastri Jn to 100 ft road Jn (Kolhapur Rd)	2	0.57	155	170	2200	2218	1.02
Shastri Jn to Santt Kotnis Maharaj Rd Jn	2	0.09	155	290	2200	1768	0.80
Rajwada Jn to Station Jn (Old Station Rd)	4	0.32	163	289	5143	2526	0.49
Rajwada Jn to Bharathi Vidhyapeeth Jn (Old Station Rd)	4	0.1	163	409	5143	2576	0.50
Tarun Bharat Jn to Shivaji Statue Jn (Kameti Rd)	2	0.12	164	165	2200	2826	1.26
Tarun Bharat Jn to Municipal Jn (Kameti Rd)	2	0.14	164	411	2200	2498	1.12
Shivaji Statue Jn to Tarun Bharat Jn (Kameti Rd)	2	0.12	165	164	2200	2826	1.26
Bagadi Lane Jn to Sangli Stand (S.T.Stand Rd)	2	0.27	166	167	2200	2762	1.21
Shreyas Hotel Jn to Bagadi Lane/S.T Stand Jn	2	0.07	166	310	2200	2781	1.22
Jhulelal Jn to Dr.Ambedhkar Nagar Jn (Ambedhkar Rd)	2	0.46	167	173	2200	3771	1.65
100 ft road Jn to Shastri Jn (Kolhapur Rd)	2	0.57	170	155	2200	2218	1.02
100 ft road Jn to All India Radio Jn (Kolhapur Rd)	2	0.39	170	331	2200	3693	1.65
Dr.Ambedhkar Nagar Jn to Civil Hospital Jn (Ambedhkar Rd)	2	0.59	173	179	2200	4449	1.84
Azad Jn to Congress Bhavan Jn (Old Station Rd)	4	0.16	176	177	5143	3067	0.59
Azad Jn to Station Jn (Old Station Rd)	4	0.41	176	289	5143	2856	0.55
Congress Bhavan Jn to Ram Mandhir Jn (Khanbagh Rd)	4	0.28	177	178	5143	2235	0.43
Civil Hospital Jn to Civil Hospital End Jn (Ambedhkar Rd)	2	0.28	179	383	2200	3866	1.63
Pushparaj Jn to Gulmohar Colony Rd Jn (Sangli-Miraj Rd)	4	0.26	180	186	5143	7550	1.40
Civil Hospital End Jn to Pushparaj Jn (Ambedhkar Rd)	2	0.37	180	383	2200	3800	1.60
Sangli R.S Jn to RUB Jn (Sangli R.S Rd)	2	0.11	183	184	2200	2165	0.98
Gulmohar Colony Rd Jn to Pushparaj Jn (Sangli-Miraj Rd)	4	0.26	186	180	5143	7550	1.40
Gulmohar Colony Rd Jn to Vasanthdada Market Jn (Sangli-Miraj Rd)	4	0.27	186	192	5143	7402	1.38
Vasanthdada Market Jn to Jal Bhavan Jn (Sangli-Miraj Rd)	4	0.42	192	348	5143	7206	1.34

Section	No of Lanes	Distance	Node		Capacity	LOAD	V/C
			A	B			
Vishrambagh Jn at Ambassador Hotel to Vishrambagh Jn at P.S (Sangli-Miraj Rd)	4	0.34	193	301	5143	6375	1.19
Vishrambagh Jn at Ambassador Hotel to Jal Bhavan Jn (Sangli-Miraj Rd)	4	0.42	193	348	5143	6861	1.28
Vishrambagh Jn at P.S to 100 ft Rd jn at Walchand College (Sangli-Miraj Rd)	4	0.26	194	195	5143	5949	1.14
Vishrambagh Jn at P.S (Sangli-Miraj Rd)	4	0.04	194	301	5143	6377	1.19
Vishrambagh Jn at P.S to Police Quarters Rd Jn (Kupwad Rd)	4	0.44	194	345	5143	2923	0.55
100 ft Rd jn at Walchand College to Vishrambagh R.S. Rd (Sangli-Miraj Rd)	4	0.43	195	222	5143	5946	1.14
Jn at RUB to Sangli Railway Godown Jn (Sangli Railway Godown Rd)	2	0.14	199	183	2200	1966	0.91
Ahilyadevi Jn to Sangli Railway Godown Rd Jn (Old Kupwad Rd)	2	0.37	202	199	2200	1714	0.79
Siddeshwar Society Jn to Ahilyadevi Jn (Old Kupwad Rd)	2	0.35	203	202	2200	1571	0.72
Siddeshwar Society Jn to Nehrunagar Rd Jn (Old Kupwad Rd)	2	0.05	204	203	2200	1772	0.81
Nehrunagar Rd Jn to Ahilyanagar Rd Jn (Old Kupwad Rd)	2	0.44	218	204	2200	1688	0.77
Ahilyanagar/Kupwad Rd Jn to Sangli Railway Godown Rd Jn (Ahilyanagar Rd)	4	0.5	218	219	5143	2771	0.52
Ahilyanagar/Kupwad Rd Jn to Geetha Sai Nagar Jn (Ahilyanagar Rd)	2	0.74	218	415	2200	2562	1.14
Sangli Railway Godown Rd Jn to Ahilyanagar/Kupwad Rd Jn (Ahilyanagar Rd)	4	0.5	219	218	5143	2771	0.52
Sangli Railway Godown Rd Jn to Police Quarters Rd Jn (Kupwad Rd)	2	0.56	219	345	2200	2809	1.24
Vishrambagh R.S Rd Jn to Vijaynagar Rd Jn (Sangli-Miraj Rd)	4	0.77	222	223	5143	5516	1.05
Vijaynagar Rd Jn to B.PED College(Sangli-Miraj Rd)	4	1.58	223	333	5143	5274	1.01
ROB on Sangli-Miraj Rd (Sangli-Miraj Rd)	4	0.07	230	231	5143	5935	1.13
ROB on Sangli-Miraj Rd to B.PED College (Sangli-Miraj Rd)	4	0.25	230	333	5143	5342	1.02
ROB on Sangli-Miraj Rd (Sangli-Miraj Rd)	4	0.07	231	230	5143	5935	1.13
ROB on Sangli-Miraj Rd to Miraj Railway Goods Office Rd Jn (Sangli-Miraj Rd)	4	0.44	231	232	5143	5908	1.13

Section	No of Lanes	Distance	Node		Capacity	LOAD	V/C
			A	B			
ROB on Sangli-Miraj Rd to Indian Oil (Miraj Rail Goods Office Rd)	2	0.69	232	302	2200	2289	1.02
Mission Hospital Jn to Mission Hospital (Pandarpur Rd)	2	0.2	235	305	2200	2668	1.20
Mission Hospital Jn to Kokate Galli Jn (Vijapur Rd)	2	0.51	235	364	2200	3664	1.59
Govt. Medical College to Mission Hospital (Pandarpur Rd)	2	0.54	237	305	2200	2315	1.04
RUB at St. Peters Telugu Church	2	0.28	238	299	2200	2295	1.03
RUB at St. Peters Telugu Church to Indian Oil (Miraj Rail Goods Office Rd)	2	0.25	238	405	2200	2289	1.02
Marathe Textile Mill to Sangli Ves Rd/Vijapur Rd Jn	2	0.26	247	298	2200	2816	1.26
Marathe Textile Mill to Before RUB at St. Peters Telugu Church	2	0.15	247	299	2200	2295	1.03
Sangli Ves Rd/Vijapur Rd Jn to Miraj City Stand Jn (Vijapur Road)	2	0.29	248	297	2200	2054	0.92
Kokate Galli Jn to Sangli Ves Rd (Vijapur Rd)	2	0.55	248	364	2200	3141	1.36
Dhor Galli Jn to Bhudwarpeth Rd Jn (Station Rd)	2	0.12	252	343	2200	1937	0.95
Shastri Jn to Mahathma Fule Jn (Vijapur Rd)	2	0.32	256	408	2200	2079	0.93
Octrai to All India Radio Jn (Kolhapur Rd)	2	2	274	331	2200	2582	1.15
College Corner Rd Jn to Pushparaj Jn (Miraj Alternative Rd)	2	0.6	287	180	2200	2253	1.02
Station Jn to Rajwada Jn (Old Station Rd)	2	0.32	289	163	2200	2526	1.14
Sangli Stand to Jn at Shreyas Hotel (Sant Kotnis Maharaj Rd)	2	0.24	290	310	2200	2129	0.96
Miraj City Stand Jn to Sangli Ves Rd/Vijapur Rd Jn (Vijapur Road)	2	0.29	297	248	2200	2054	0.92
Miraj City Stand Jn to Miraj R.S Jn (Station Road)	2	0.2	297	298	2200	2790	1.25
Miraj City Stand Jn to Dhor Galli Jn (Station Rd)	2	0.1	297	343	2200	1977	0.97
Miraj City Stand Jn to Miraj S.T. Stand Jn (Station Road)	2	0.17	297	407	2200	2720	1.13
Before RUB at St. Peters Telugu Church to Marathe Textile Mill	2	0.28	299	238	2200	2295	1.03
Before RUB at St. Peters Telugu Church to RUB at St. Peters Telugu Church	2	0.15	299	247	2200	2295	1.03
Indian Oil to Bharat Petroleum (Miraj Railway Goods Office Rd)	2	0.03	302	406	2200	2289	1.02
Shreyas Hotel Jn to Ankali Rd Jn	2	0.07	310	156	2200	2096	0.93
Bagadi Lane/S.T Stand Jn to Shreyas Hotel Jn	2	0.07	310	166	2200	2781	1.22
Shreyas Hotel Jn to Shivaji Statue Jn (Sant Kotnis Maharaj Rd)	2	0.18	310	311	2200	2905	1.30

Section	No of Lanes	Distance	Node		Capacity	LOAD	V/C
			A	B			
Shivaji Statue Jn to Resala Rd Jn	2	0.07	311	165	2200	2887	1.29
Jal Bhavan Jn to Vasanthdada Market Jn (Sangli-Miraj Rd)	4	0.42	348	192	5143	7206	1.34
RTO Office Rd Jn to Sugar Factory (Madhavnagar Main Rd)	2	0.1	350	386	2200	2112	0.96
Sugar Factory (Madhavnagar Main Rd)	2	0.21	384	385	2200	2112	0.96
Sugar Factory (Madhavnagar Main Rd)	2	0.19	385	386	2200	2112	0.96
Kolhapur bypass Rd Jn to Miraj S.T.Stand Jn (Vijapur Rd)	2	0.24	402	407	2200	2720	1.13
Railway Goods Office to Bharat Petroleum (Miraj Rail Goods Office Rd)	2	0.34	405	406	2200	2289	1.02
Bharathi Vidhyapeeth Jn to Municipal Jn (S.T. Stand Road)	2	0.06	409	411	2200	2632	1.19

Observations:

- It has been observed that almost 50% of the existing major roads have V/C greater than 1, the prominent ones being Sangli-Miraj Road, Ambedkar Road, Kolhapur Road, Kupwad Road, ST Stand Road etc.
- Of these major roads Ambedkar road, Kolhapur road, Vijapur road have V/C more than 1.5 which needs immediate attention.

4.4 Development Scenarios, Travel Demand Modelling and Forecast

4.4.1 Urban Scenarios

Consultants have reviewed past growth of population in Sangli-Miraj-Kupwad City Municipal Corporation as well as past growth achieved in the medium size cities in India. The review of growth trends in medium sized cities in India is carried out to assess the potential growth prospects of SMK-CMC in future.

Based on the population and employment prospects two urban scenarios have been evolved for horizon year modelling i.e.

1. **Most Likely Scenario** – this scenario corresponds to realistic growth of population.
2. **Optimistic Scenario** – this scenario corresponds to optimistic growth of population.

4.4.1.1 Most Likely Scenario

SMK-CMC has a population of 5.03 Lakh as per the 2011 census with a decadal growth rate of 15.1%. It is observed that the decadal growth rate of population during 1991-2001 was 33.9%, which has dropped to 15.1% in the decade 2001-2011 due to limited employment opportunities. It is also observed that the decadal growth rate of population in Kolhapur during 1991-2001 was 21.4%, which has dropped to 11.4% in the decade 2001-2011 showing a declining trend.

Economic Activities:

S-M-K CMC has a commercial area of about 103.89 Ha and an industrial area of 310.94 Ha. The sound economical background of S-M-K CMC is due to service sector and agriculture. It is the trade centre for the commodities such as groundnut, spices including Turmeric powder, Chilli Powder and Groundnut. It is also a big centre for trading of other agricultural commodities including maize, Jaggery, Wheat, Pulses etc. The sound economical position is also due to two industrial estates and nearby two M.I.D.C blocks (Miraj and Kupwad). The industrial units in MIDC comprise mainly engineering, agro based, pharmaceutical, and chemical. Most of the industrial units are under Small Scale sector. Sangli is district headquarters.

Currently, around 11,190 workers are employed in Industrial area where as employment from shops and establishments employ around 31,000 people. The employment in schools and health facilities is around 14,800. The total employment obtained from various sources is 86,633. The total employment obtained from Household survey is 1,61,936. The remaining 75,303 employees are working in other sectors and Kolhapur.

It was also observed from Stakeholders survey, employment opportunities in future will not increase dramatically. Considering the limited employment opportunities (such as Agriculture, MIDC, Industrial Estates, Educational and Health related activities, etc.) and no major upcoming developments in S-M-K CMC, a realistic population growth projection has been arrived (Arithmetic Increase Method) as Most Likely Scenario and is presented in **Table 4-11**.


Grape Fields


Vasanthdada Sugar Factory

Table 4-11 Population and Employment Forecast SMK-CMC (Most-Likely Scenario)

Year	S-M-K CMC	
	Population	Employment
1991	351917	110902
2001	436781	139998
2011	502697	161936
2016	540341	175140
2021	580804	189420
2026	618626	202988
2031	658910	217529

4.4.1.2 Optimistic Scenario


Sangli IT Park Building near Vishrambagh Railway Station

In order to promote an all-round growth of the IT industry and to tap the potential of abundant and varied IT skills available throughout the state, the Government of Maharashtra has undertaken several key initiatives. Several IT parks and facilities have been developed throughout the state in Aurangabad, Ahmednagar, Nagpur, Latur, Kolhapur, Nashik, Sangli, Solapur as per Draft Final report on State of Environment Report, Maharashtra (2004). There is no existing developed IT park in SMK-CMC. The present population in SMK-CMC mainly depends on the Agriculture, MIDC, Industrial Estates, Educational and Health related activities, etc.

Considering the importance of IT in urban India and development of IT Park/ IT sector in SMK-CMC, Consultants assumed there will be more employment opportunities leading to more population growth. This scenario is named Optimistic Scenario and presented in **Table 4-12** the population is indicated by simple graphical method has been considered.

Table 4-12 Population and Employment Forecast S-M-K CMC (Optimistic Scenario)

Year	S-M-K CMC	
	Population	Employment
1991	351917	110902
2001	436781	139998
2011	502697	161936
2016	564834	181952
2021	634652	206982
2026	687887	224343
2031	745587	246144

4.4.2 Travel Demand for Network Scenarios

Considering the changes that might happen in the road network in the future or changes that are required in the road network, Consultants have proposed to develop three network scenarios.

1. Do Minimum Scenario
2. Do Something Scenario
3. Do Something with Bypass Scenario

Do Minimum scenarios correspond to no major changes in the network i.e. no change would be made in the road network and the same road configuration is assumed to continue in the future.

Do Something Scenario comprises of incorporating some changes to road network like

i. Augmentation of Road link capacities wherever necessary

ii. Addition of Bus routes/ increasing the frequency of bus routes.

Do Something with Bypass Scenario include changes made in the Do Something Scenario along with addition of bypasses and missing road links.

- ✓ The above proposals have been included based on the output of Most Likely + Do Minimum Network Scenario. Consultants have identified links whose V/C ratio is greater than 1.8 in 2031. These links have been taken up for capacity augmentation.
- ✓ Additional bus routes have been added. Also frequency of certain bus routes has been increased.
- ✓ 33% of goods traffic and 22% of passenger traffic which does not have the need to pass through the city are using up the internal city roads due to the absence of bypasses which adds upto the congestion inside the city. Hence, Consultants have proposed to include bypass links as well as improving the existing bypass links which have been under utilised at present. Link speeds have been increased for improved links in the Do Something with Bypass Scenario.

4.5 Various Scenarios considered for Horizon Year Modelling

Considering the various urban and network scenarios consultants have arrived at six scenarios for horizon year modelling. They are:

Scenario 1: Most Likely Urban Scenario + Do Minimum Network Scenario for the years 2021, 2031

Scenario 2: Optimistic Urban Scenario + Do Minimum Network Scenario for the years 2021, 2031

Scenario 3: Most Likely Urban Scenario + Do Something Network Scenario for the years 2021, 2031

Scenario 4: Most Likely Urban Scenario + Do Something with Bypass Network Scenario for the years 2021, 2031

Scenario 5: Optimistic Urban Scenario + Do Something Network Scenario for the years 2021, 2031

Scenario 6: Optimistic Urban Scenario + Do Something with Bypass Network Scenario for the years 2021, 2031

4.6 Horizon Year Travel Demand Modelling

Figure 4-9 shows the methodology for Horizon year travel demand modelling.

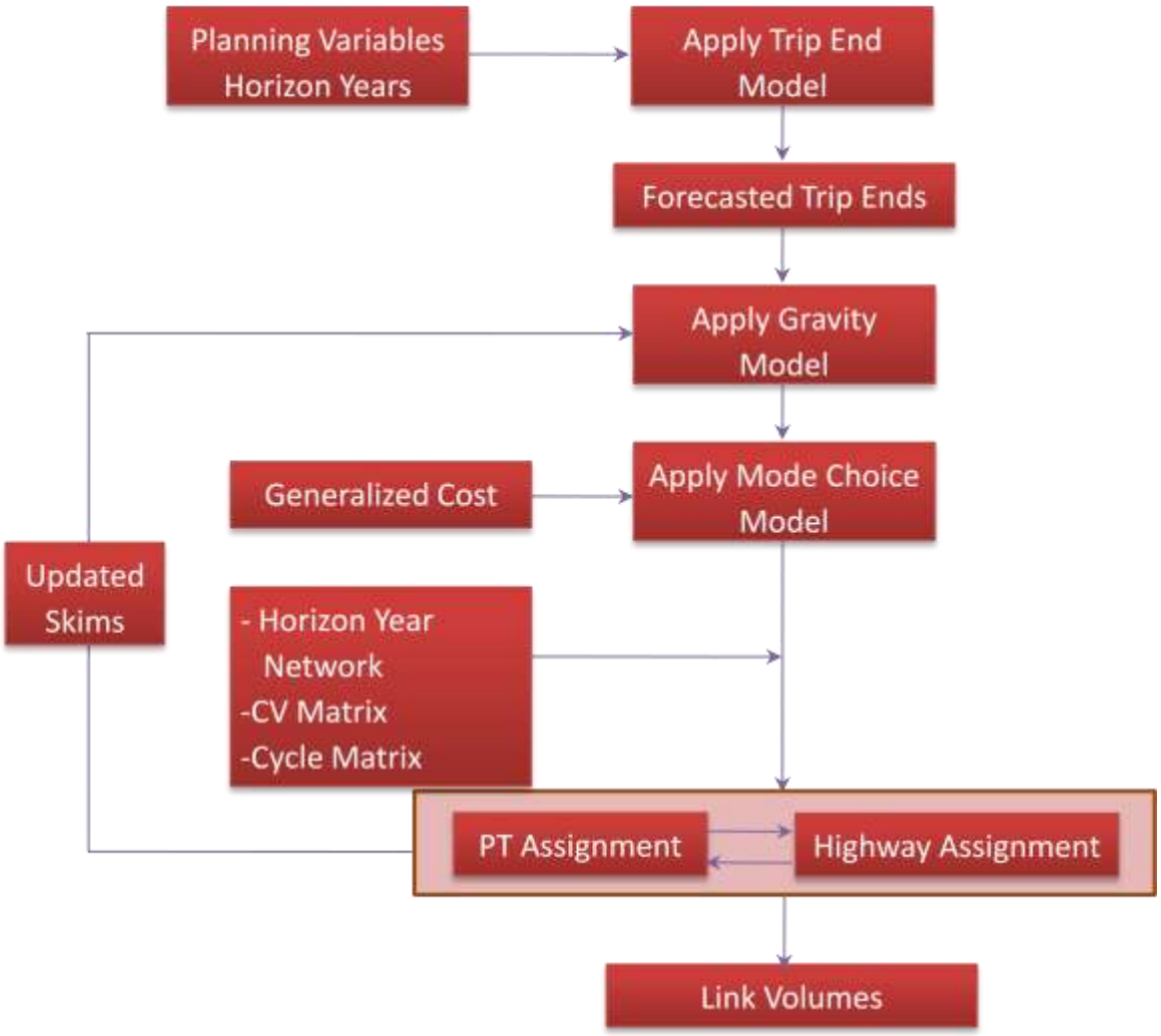


Figure 4-9 Flow Chart showing the Horizon Year Travel Demand Modelling

4.6.1 Forecasting of O-D Matrices

The calibrated trip end equations for the daily person trips made within the study area are applied on the projected planning variables for the horizon years (2021 and 2031) to get the future trip ends of intra-city trips. These future year trip ends are distributed by applying the calibrated gravity distribution model with the cost skims available for the initial run. The O-D matrix of daily person trips thus obtained for the future year under consideration is split into five O-D matrices – viz., *Car Trip matrix, Two Wheeler Trip matrix, Bus Trip matrix, IPT (Auto) Trip matrix and Walk Trip matrix* – using the calibrated mode choice model.

Truck O-D matrix, Cycle Trips and mode-wise external trips (inter-city trips) are forecasted using zonal growth factors and by furnessing. Truck trips are assumed to grow at 3.5% per year upto 2021 and 2.5% thereafter upto 2031. Cycle trips are assumed to grow at -3% per year. External trips are assumed to grow at 7.5% per year upto 2021 and at 5% per year upto 2031.

Truck trips and Cycle Trips are preloaded onto the network before assignment and this loaded network is used for further assignment. The cost skims used in gravity distribution model and mode choice models are revised using the ones obtained by assigning the public transport trips and

highway trips on to their respective networks. The cost/time skims obtained using the final stabilised link cost information is used to get the final mode wise O-D matrices of person trips. **Table 4-13** gives the estimated future trips by various modes by various scenarios. The estimated above trips exclude intrazonal trips which constitutes 17% in base year (2011).

Table 4-13 Estimated Future Trips

Year	Private	Bus	IPT	Walk	Total♦
Scenario 1 - Most Likely Urban Scenario + Do Minimum Network Scenario					
2021	356972	240360	82225	285154	964711
2031	539787	399126	108862	318221	1365996
Scenario 2 - Optimistic Urban Scenario + Do Minimum Network Scenario					
2021	367644	242896	86453	308237	1005230
2031	556966	403201	115652	355380	1431199
Scenario 3 - Most Likely Urban Scenario + Do Something Network Scenario					
2021	356974	243945	85645	278165	964729
2031	539788	403154	112694	310374	1366010
Scenario 4 - Most Likely Urban Scenario + Do Something with Bypass Network Scenario					
2021	356971	244164	85837	277785	964757
2031	539787	407095	116034	303093	1366009
Scenario 5 - Optimistic Urban Scenario - Do Something Network Scenario					
2021	367644	246768	90152	300664	1005228
2031	556964	407693	119939	346600	1431196
Scenario 6 - Optimistic Urban Scenario - Do Something with Bypass Network Scenario					
2021	367643	246971	90361	300252	1005227
2031	556965	412071	123662	338499	1431197

♦ Excluding intra-zonal trips and Cycle Trips

It has been observed that the share of Bus and IPT Trips in Scenario 4 (Most Likely Urban Scenario + Do Something with Bypass Network Scenario) has increased by 1.6% and 4.4% respectively compared to Scenario 1 (Most Likely Urban Scenario + Do Minimum Network Scenario).

4.7 Analysis of Travel Demand Modelling Output

4.7.1 Scenario 1 (Most Likely Urban Scenario + Do Minimum Network Scenario)

This scenario assesses what are all the problems that would emerge in the future if no changes are made to the present network. The same base network is adopted for the horizon years i.e. 2021, 2031 and modelled.

Table 4-14 gives the traffic characteristics of the study area extracted from the model in terms of total load, average V/C etc. There would be an increase in traffic volume on most of the road network beyond its capacity.

Table 4-14 Traffic Characteristics for Scenario 1

Scenario	2011	2021	2031
Total LOAD, PCUs	455913	557256	734533
Average V/C (Overall Network)	0.36	0.44	0.59
Average V/C (Core Network)	1.04	1.24	1.53
Daily Passenger (Trips)	319955	501009	773448
Daily Passenger Km	1218255	1971182	3114906
Average Core Network Speed	27.30	23.45	18.09
Average Overall Network Speed	29.56	28.66	26.76

The peak hour loadings and V/C ratio of the entire network for the base year as well as for horizon years 2021, 2031 is shown in **Figure 4-10 to Figure 4-15.**

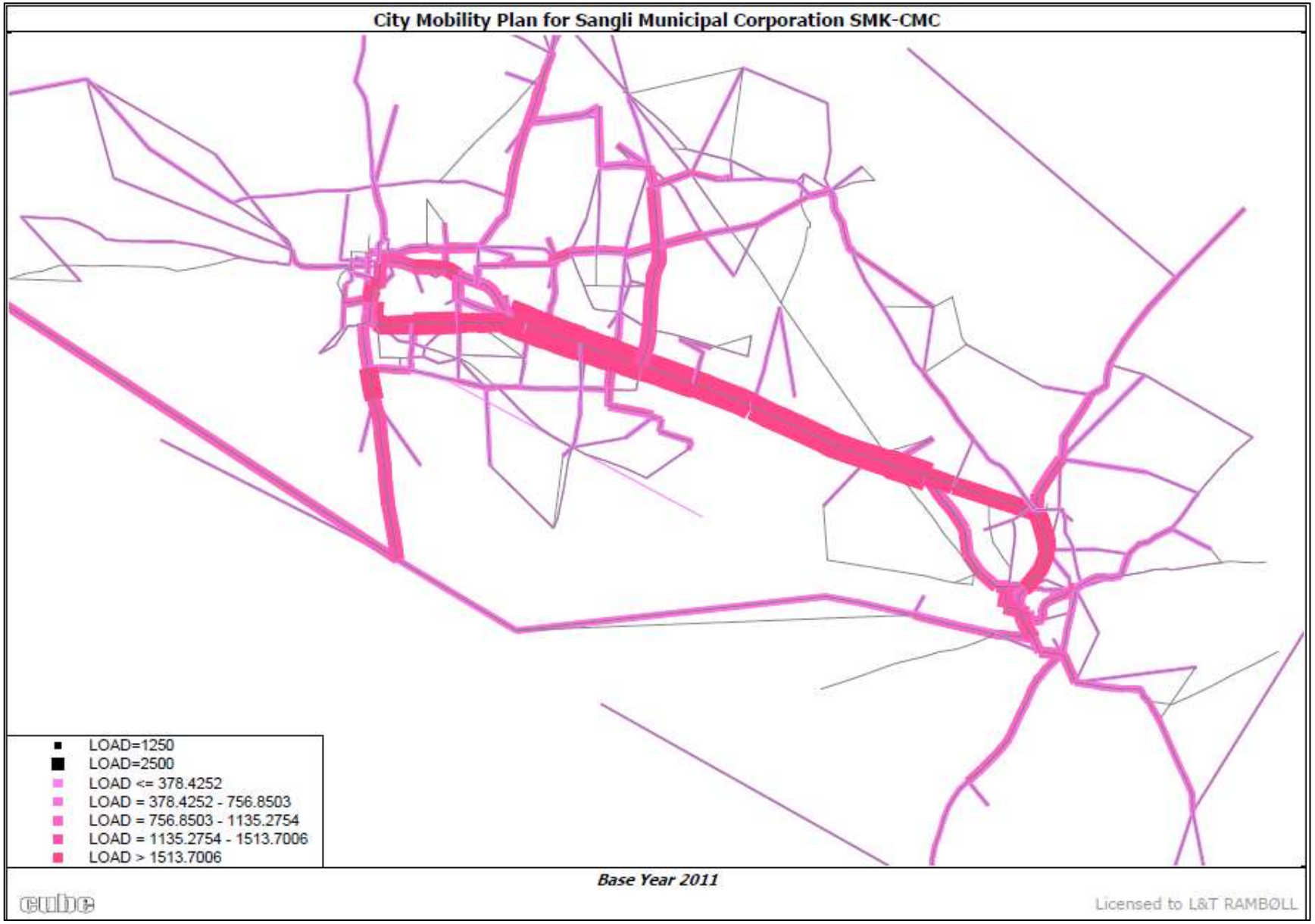


Figure 4-10 Base Year Peak Hour Traffic Loadings in PCUs

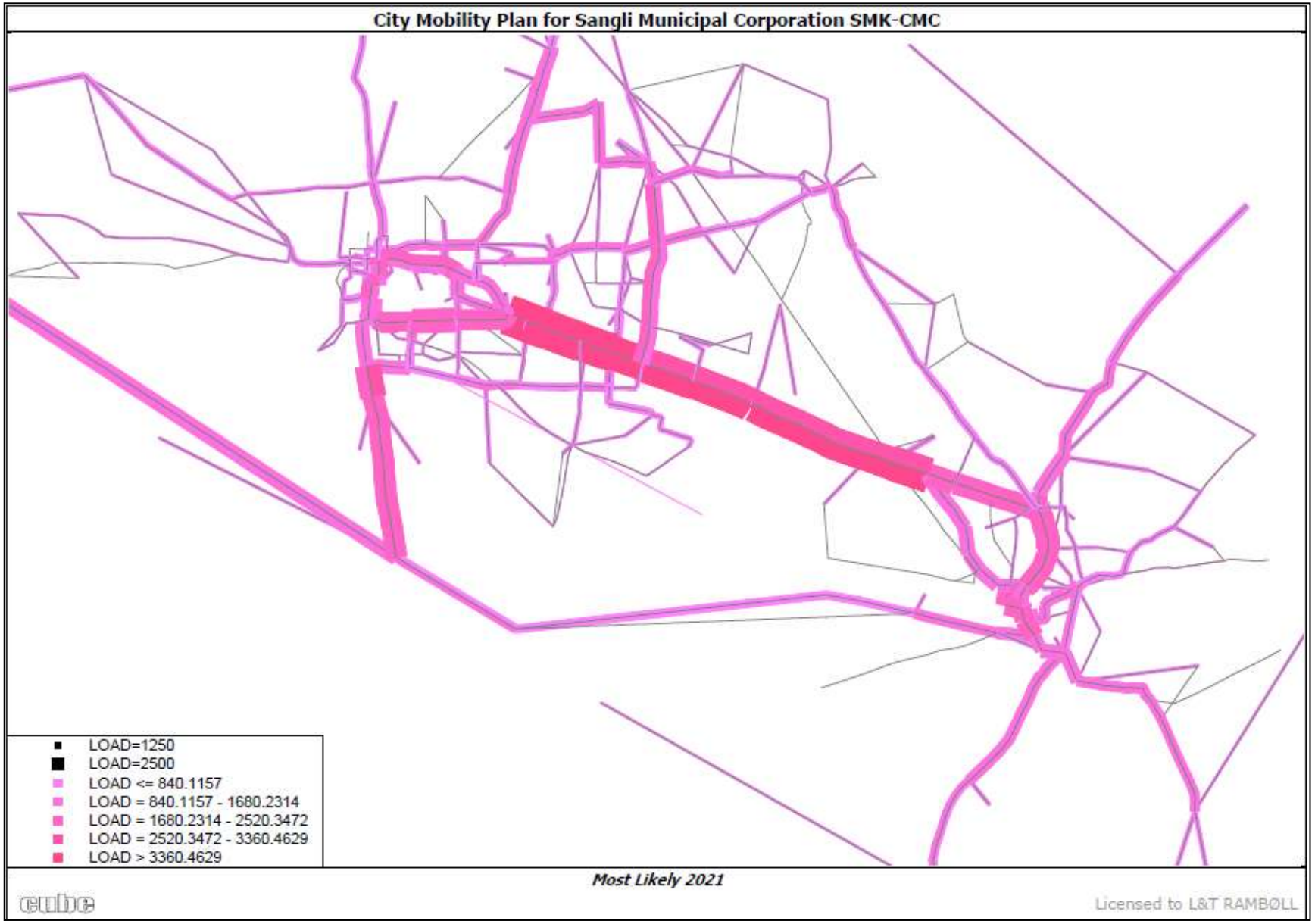


Figure 4-11 Peak Hour Traffic Loadings in PCUs for the Year 2021 (Scenario 1)

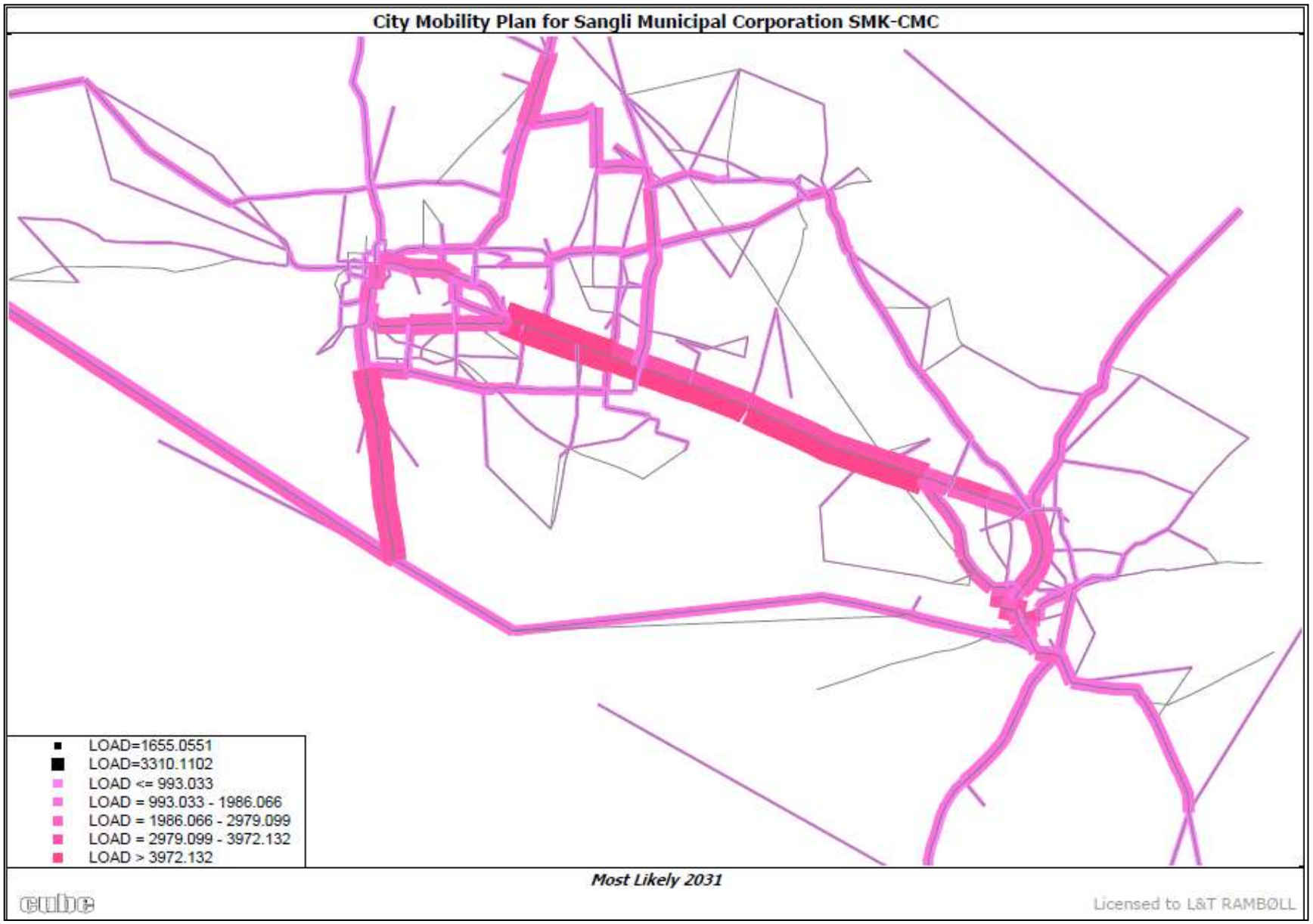


Figure 4-12 Peak Hour Traffic Loadings in PCUs for the Year 2031 (Scenario 1)

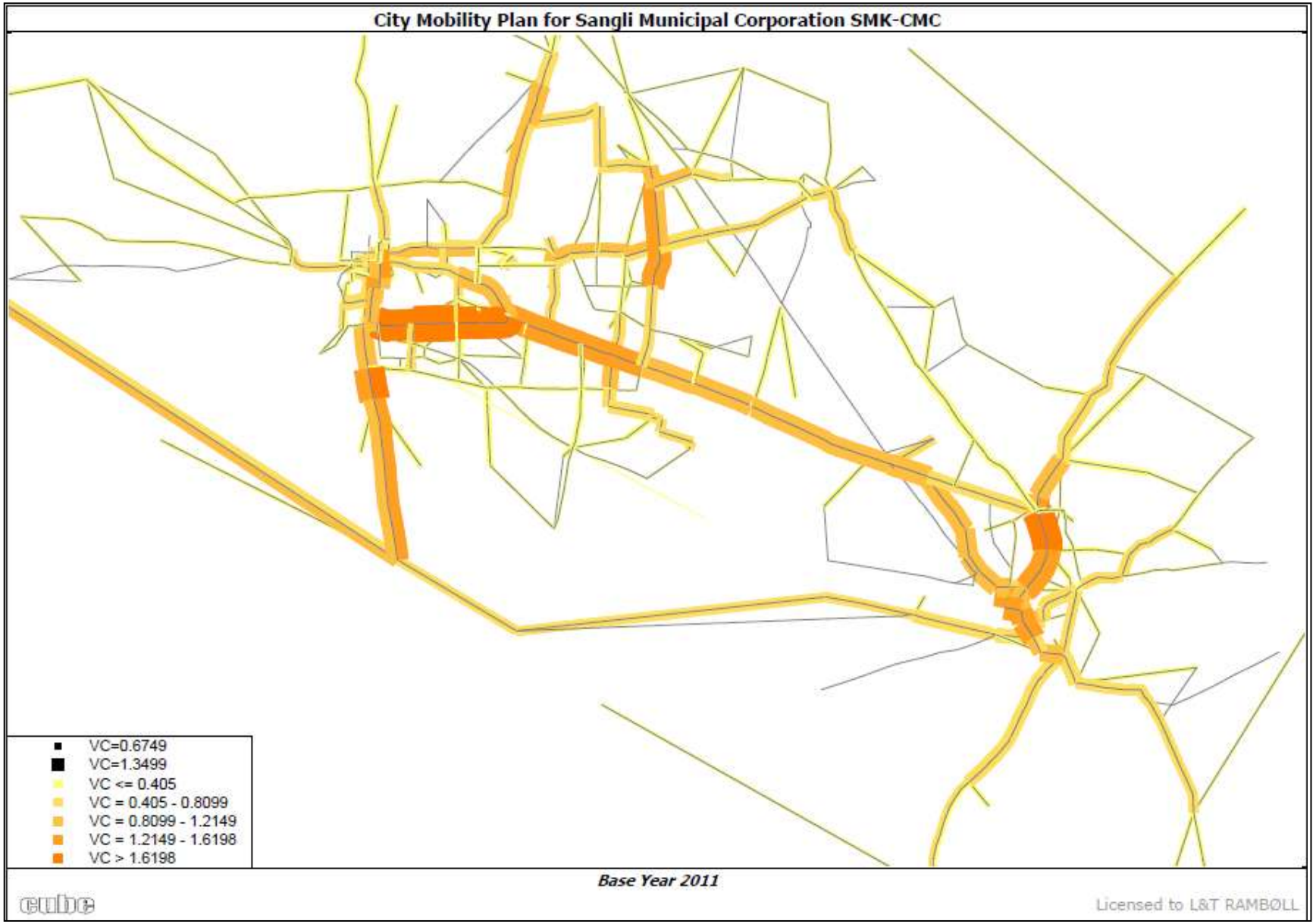


Figure 4-13 Volume/Capacity Ratios for the Base Year

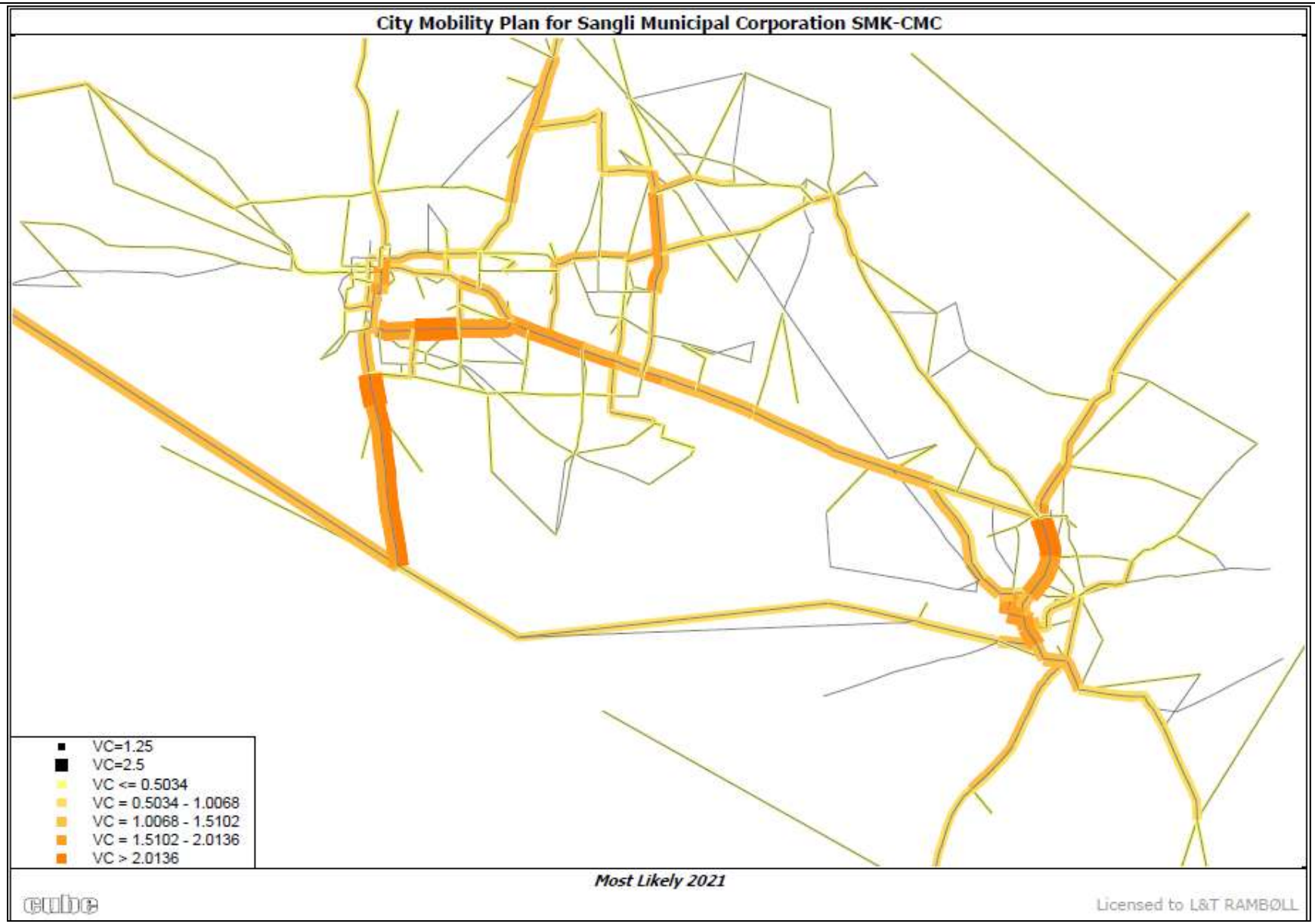


Figure 4-14 Volume/Capacity Ratios for the Year 2021 (Scenario 1)

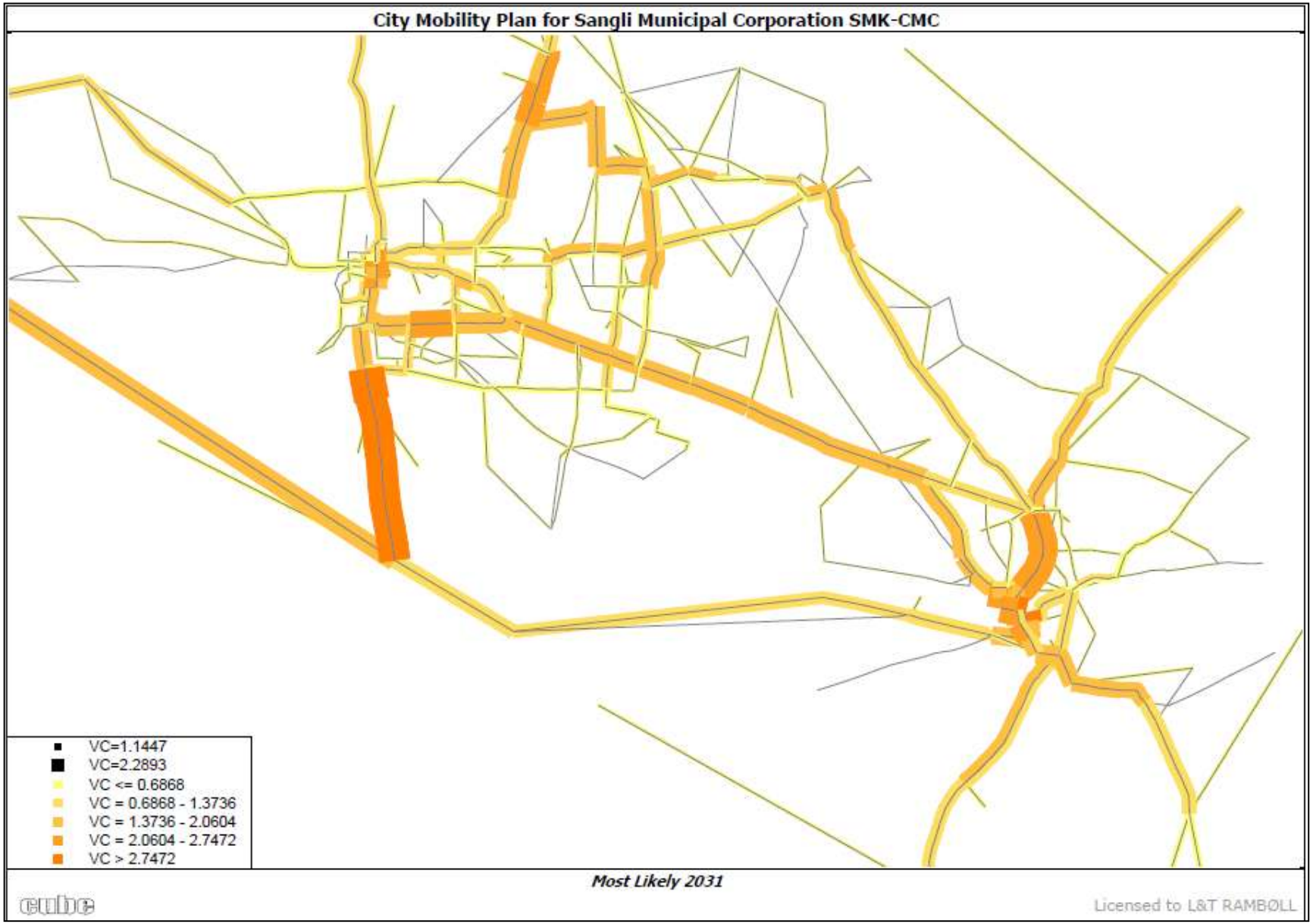


Figure 4-15 Volume/Capacity Ratios for the Year 2031 (Scenario 1)

4.7.2 Scenario 2 (Optimistic Urban Scenario + Do Minimum Network Scenario)

This scenario assesses the problems in the network that would emerge for the changes in trip ends corresponding to optimistic urban scenario. The same base network is adopted for the horizon years i.e. 2021, 2031 and modelled.

Table 4-15 gives the traffic characteristics of the study area extracted from the model in terms of total load, average V/C etc. There has been an increase in traffic volume on most of the road network beyond its capacity.

Table 4-15 Traffic Characteristics for Scenario 2

Scenario	2021	2031
Total LOAD, PCUs	567399	751577
Average V/C (Overall Network)	0.45	0.61
Average V/C (Core Network)	1.26	1.56
Daily Passenger (Trips)	513500	793496
Daily Passenger Km	2013061	3182430
Average Core Network Speed	23.06	17.65
Average Overall Network Speed	28.58	26.61

The peak hour loadings and V/C ratio of the entire network for the base year as well as for horizon years 2021, 2031 is shown in **Figure 4-16** to **Figure 4-19.**

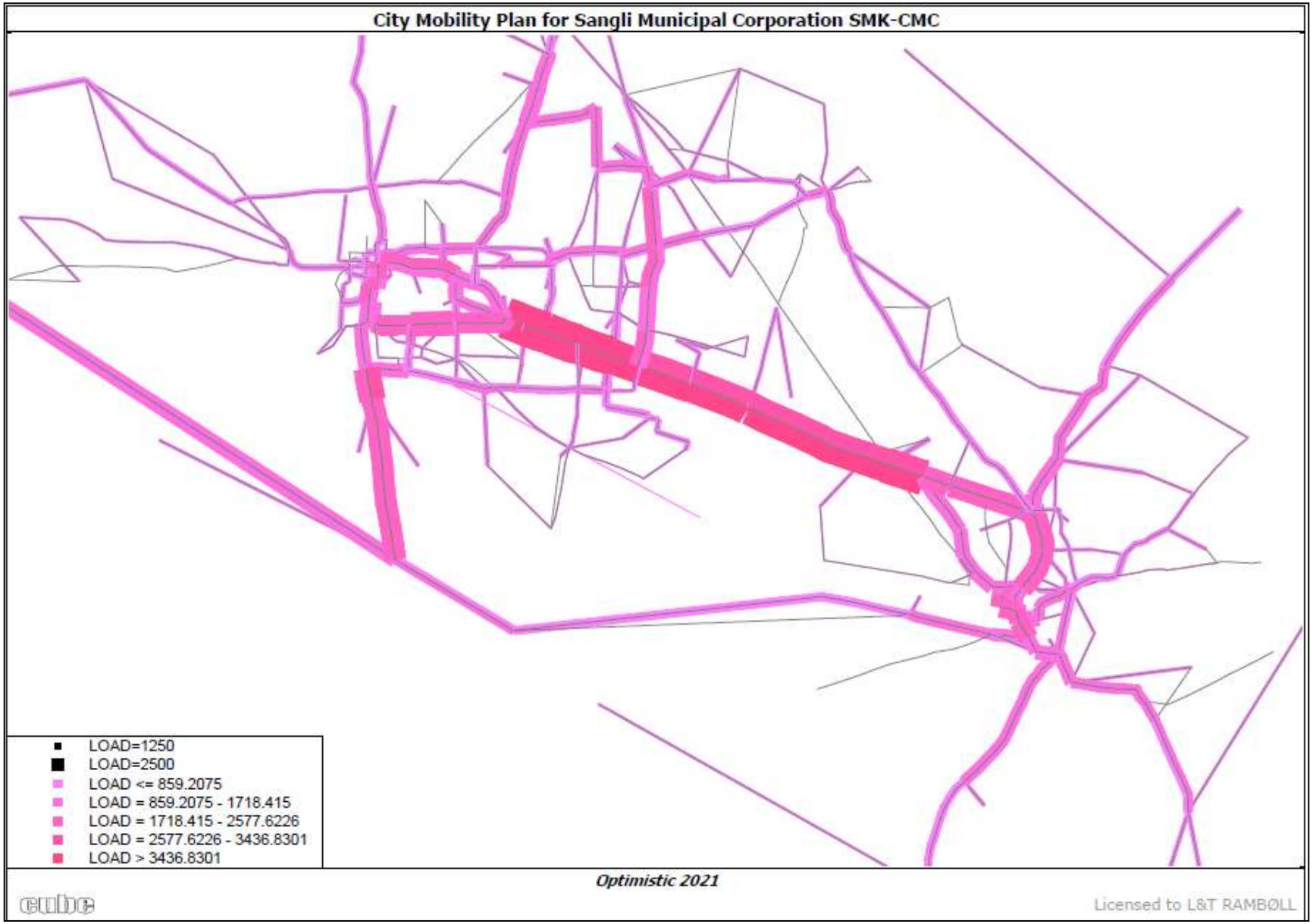


Figure 4-16 Peak Hour Traffic Loadings in PCUs for the Year 2021 (Scenario 2)

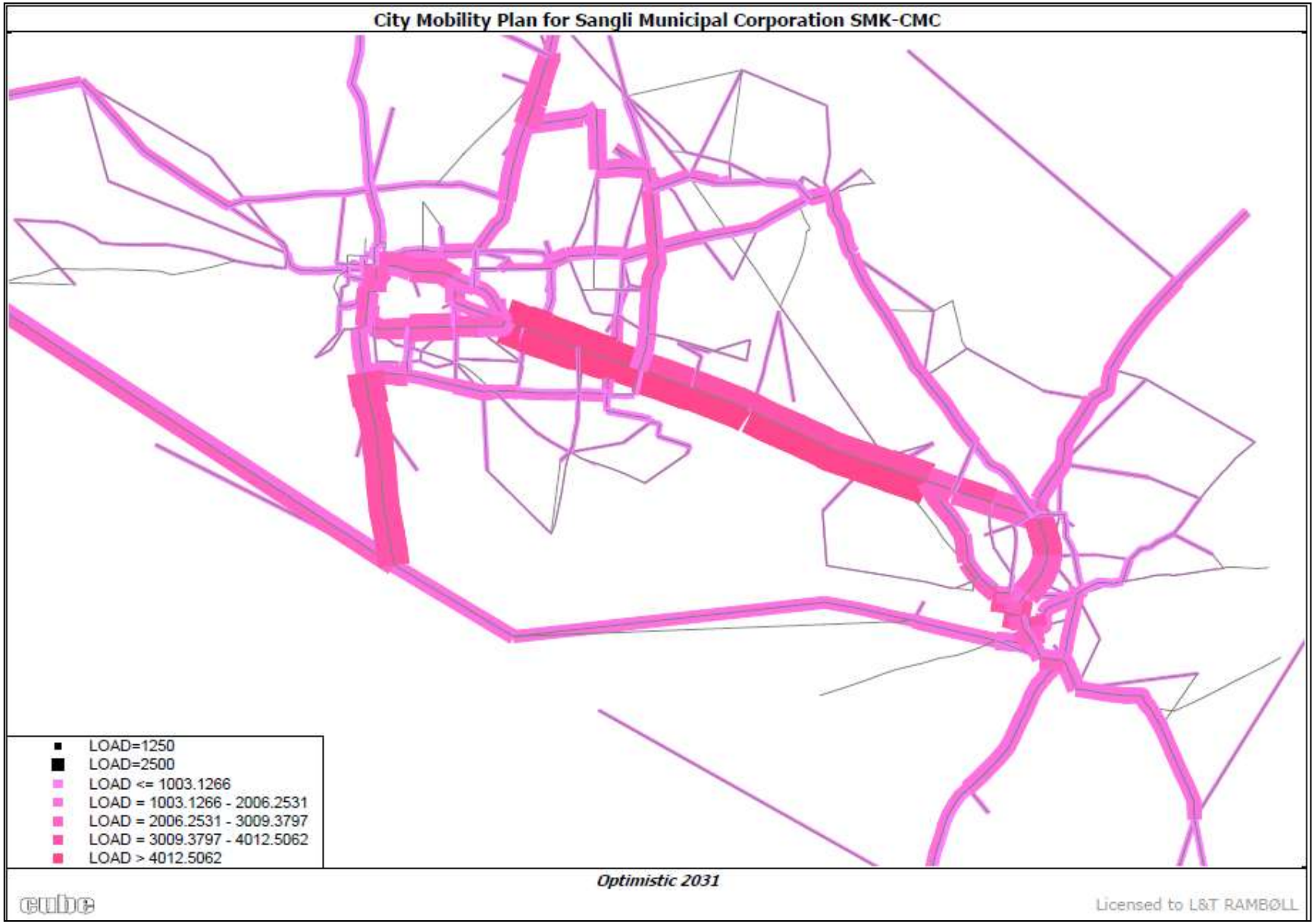


Figure 4-17 Peak Hour Traffic Loadings in PCUs for the Year 2031 (Scenario 2)

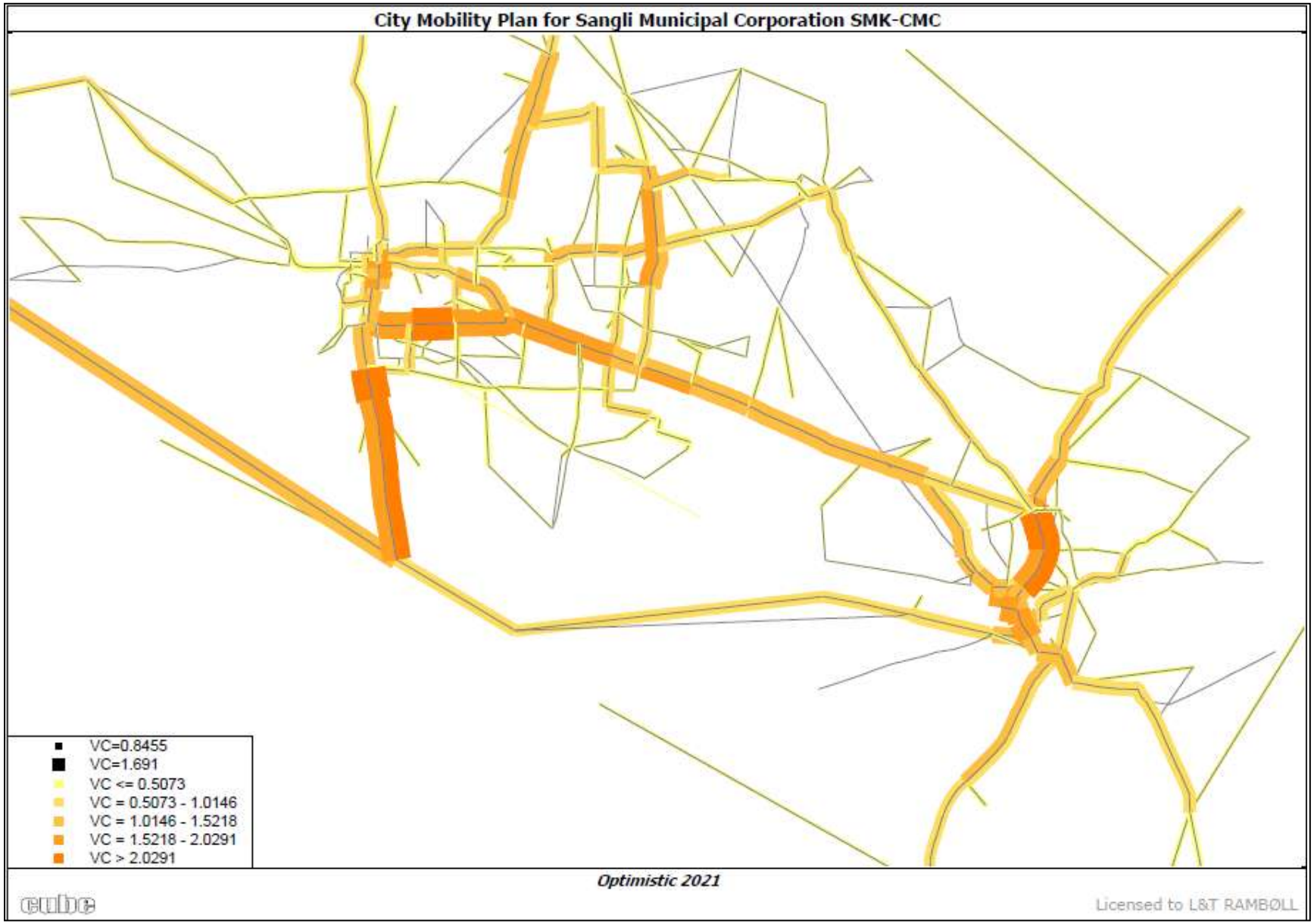


Figure 4-18 Volume/Capacity Ratios for the Year 2021 (Scenario 2)

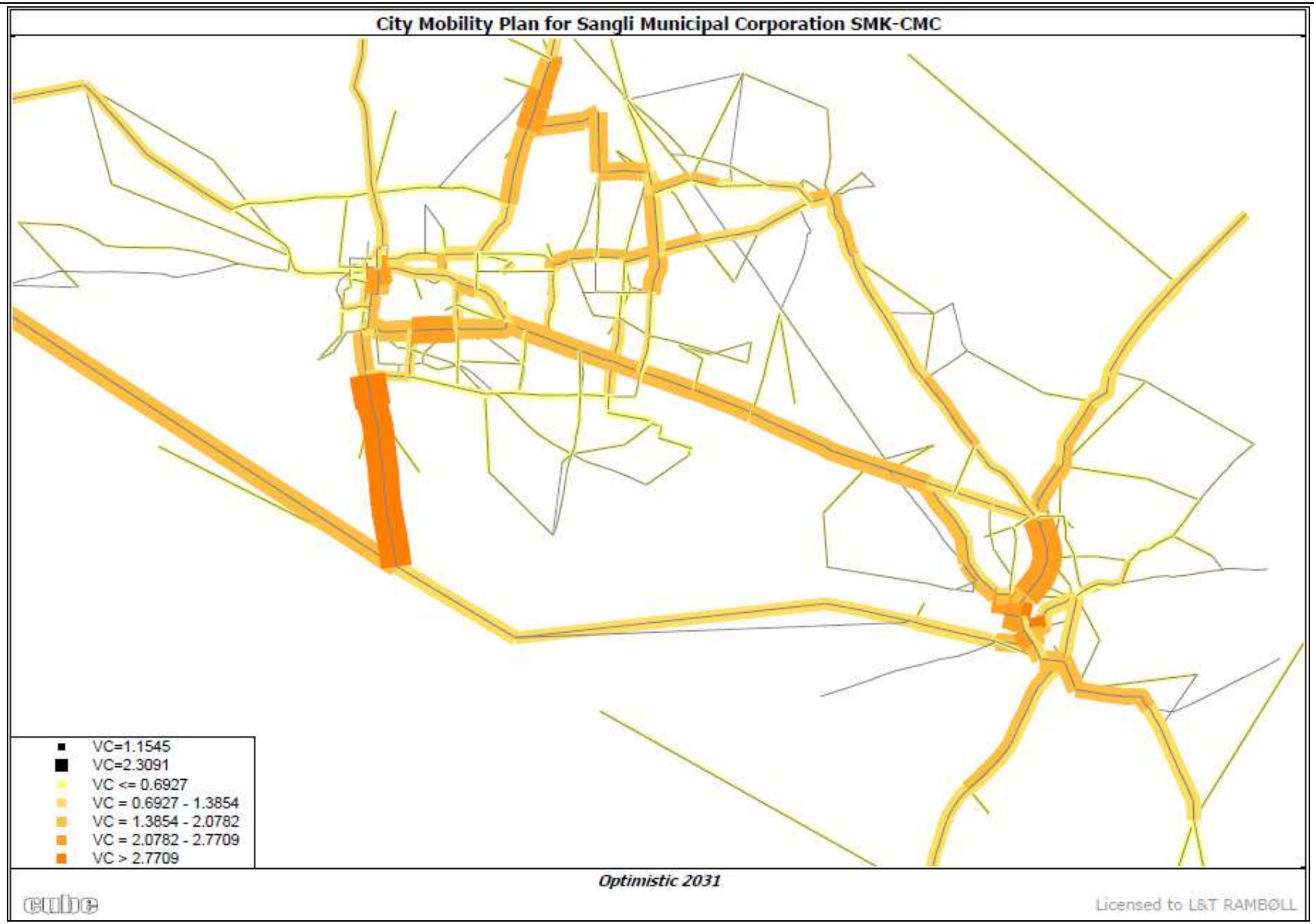


Figure 4-19 Volume/Capacity Ratios for the Year 2031 (Scenario 2)

4.7.3 Scenario 3 (Most Likely Urban Scenario + Do Something Network Scenario)

Major changes have been made in the transport network based on constraints identified through scenario 1 are implemented in the Scenario 3.

i. Based on Congestion, V/C ratio capacity augmentation of major roads in 2021.

ii. Incorporating additional bus routes and augmenting frequency of bus services.

There are many roads where V/C is greater than 1. From these roads where the V/C is greater than 1.8 for the year 2031 have been selected for scenario 3. There are routes which are not properly served by Buses where the demand is more, these routes have been identified and included in the network scenarios.

The following changes in the base network are implemented for the Do Something Network scenario.

Table 4-16 Roads/ Sections identified with Constraints in the Base Network

Section	Present Total no of Lanes	Future Required Total No of Lanes
Shastri Jn to 100 ft road Jn (Kolhapur Rd)	2	4
Jhulelal Jn to Dr.Ambedhkar Nagar Jn (Ambedhkar Rd)	2	4
100 ft road Jn to All India Radio Jn (Kolhapur Rd)	2	4
Dr.Ambedhkar Nagar Jn to Civil Hospital Jn (Ambedhkar Rd)	2	4
Civil Hospital Jn to Civil Hospital End Jn (Ambedhkar Rd)	2	4
Pushparaj Jn to Gulmohar Colony Rd Jn (Sangli-Miraj Rd)	4	6
Civil Hospital End Jn to Pushparaj Jn (Ambedhkar Rd)	2	4
Gulmohar Colony Rd Jn to Vasanthdada Market Jn (Sangli-Miraj Rd)	4	6
Vasanthdada Market Jn to Jal Bhavan Jn (Sangli-Miraj Rd)	4	6
Vishrambagh Jn at Ambassodor Hotel to Vishrambagh Jn at P.S (Sangli-Miraj Rd)	4	6
Vishrambagh Jn at Ambassodor Hotel to Jal Bhavan Jn (Sangli-Miraj Rd)	4	6
Vishrambagh Jn at P.S to 100 ft Rd jn at Walchand College (Sangli-Miraj Rd)	4	6
Vishrambagh Jn at P.S (Sangli-Miraj Rd)	4	6
Vishrambagh Jn at P.S to Police Quarters Rd Jn (Kupwad Rd)	4	2
100 ft Rd jn at Walchand College to Vishrambagh R.S. Rd (Sangli-Miraj Rd)	4	6
Jn at RUB to Sangli Railway Godown Jn (Sangli Railway Godown Rd)	2	4
Ahilyadevi Jn to Sangli Railway Godown Rd Jn (Old Kupwad Rd)	2	4
Siddeshwar Society Jn to Ahilyadevi Jn (Old Kupwad Rd)	2	4
Siddeshwar Society Jn to Nehrunagar Rd Jn (Old Kupwad Rd)	2	4
Nehrunagar Rd Jn to Ahilyanagar Rd Jn (Old Kupwad Rd)	2	4
Ahilyanagar/Kupwad Rd Jn to Sangli Railway Godown Rd Jn (Ahilyanagar Rd)	4	2
Sangli Railway Godown Rd Jn to Ahilyanagar/Kupwad Rd Jn (Ahilyanagar	4	2

Section	Present Total no of Lanes	Future Required Total No of Lanes
Rd)		
Sangli Railway Godown Rd Jn to Police Quarters Rd Jn (Kupwad Rd)	2	4
Vishrambagh R.S Rd Jn to Vijaynagar Rd Jn (Sangli-Miraj Rd)	4	6
Vijaynagar Rd Jn to B.PED College(Sangli-Miraj Rd)	4	6
ROB on Sangli-Miraj Rd (Sangli-Miraj Rd)	4	6
ROB on Sangli-Miraj Rd to B.PED College (Sangli-Miraj Rd)	4	6
ROB on Sangli-Miraj Rd to Miraj Railway Goods Office Rd Jn (Sangli-Miraj Rd)	4	6
Mission Hospital Jn to Mission Hospital (Pandarpur Rd)	2	4
Mission Hospital Jn to Kokate Galli Jn (Vijapur Rd)	2	4
Govt. Medical College to Mission Hospital (Pandarpur Rd)	2	4
Marathe Textile Mill to Sangli Ves Rd/Vijapur Rd Jn	2	4
Marathe Textile Mill to Before RUB at St. Peters Telugu Church	2	4
Sangli Ves Rd/Vijapur Rd Jn to Miraj City Stand Jn (Vijapur Road)	2	4
Kokate Galli Jn to Sangli Ves Rd (Vijapur Rd)	2	4
Shastri Jn to Mahathma Fule Jn (Vijapur Rd)	2	4
Octrai to All India Radio Jn (Kolhapur Rd)	2	4
Miraj City Stand Jn to Miraj S.T. Stand Jn (Station Road)	2	4
RTO Office Rd Jn to Sugar Factory (Madhavnagar Main Rd)	2	4
Sugar Factory (Madhavnagar Main Rd)	2	4
Sugar Factory (Madhavnagar Main Rd)	2	4
Kolhapur bypass Rd Jn to Miraj S.T.Stand Jn (Vijapur Rd)	2	4

In addition to the existing 83 bus routes the following 4 Bus routes have been added. These routes are chosen based on the demand along these routes.

i. From Sangli ST Stand to 100 ft road Junction via Kolhapur Rd – Dhamni

ii. Sangli-Civil Hospital (Ambedkar Road)- Vantamoore Corner-Miraj Railway Station- Laxmi Market

iii. Sangli ST Stand-Vakharbagh-College Corner-Sangli Railway Station-Kupwad Gaothan/ MIDC

iv. Madhav Nagar-College Corner-Sangli Railway Station-Vishrambagh-Vantamoore Corner, Miraj railway Station-Laxmi Market

Figure 4-20 and Figure 4-21 shows the existing and proposed bus route network for SMK City.

Figure 4-20 Existing Bus Route Network in S-M-K City

Figure 4-21 Proposed Bus Route Network in S-M-K City

Table 4-17gives the traffic characteristics of the study area extracted from the model in terms of total load, average V/C etc.

Table 4-17 Traffic Characteristics for Scenario 3

Scenario	Improvements 2021	Improvements 2031
Total LOAD, PCUs	555051	726766
Average V/C (Overall Network)	0.38	0.50
Average V/C (Core Network)	1.28	1.60
Daily Passenger (Trips)	521264	797827
Daily Passenger Km	2029445	3175823
Average Core Network Speed	30.49	27.10
Average Overall Network Speed	29.85	28.45

4.7.4 Scenario 4 (Most Likely Urban Scenario + Do Something with Bypass Network Scenario)

In addition to the changes made to the scenario 3 network the following bypasses and missing links are identified and included in the network for Scenario 4. Bypasses have also been included which can bypass the through traffic which does not have to pass through city and can reduce the congestion inside the city roads.

Table 4-18 Bypasses and Missing Links for Scenario 4

Sl No	Road Name
1	Islampur-Kolhapur Bypass
2	Haripur Road
3	100 Ft Road to Haripur Road
4	Dhamni Road to Haripur Rd
5	Miraj-Kolhapur Bypass
6	Ankali - Shirol Rd Bypass
7	Shirol Rd to Bijapur Rd Bypass
8	Bijapur Rd -Pandarpur Rd Bypass
9	Pandarpur-Savli Rd
10	Madhav Nagar - Ahilya Nagar Rd
11	Dhamni Rd Bypass
12	Ganapathipet - Islampur Bypass
13	Wakarbah to Islampur Bypass
14	Access Rd to Sangli Miraj ROB
15	Bijay Nagar Kupwad Rd (RUB location rd)

Figure 4-22 shows the Proposed Bypasses and Missing Links.

Table 4-19 gives the traffic characteristics of the study area extracted from the model in terms of total load, average V/C etc.

Table 4-19 Traffic Characteristics for Scenario 4

Scenario	2021	2031
Total LOAD, PCUs	532030	696448
Average V/C (Overall Network)	0.33	0.44
Average V/C (Core Network)	1.09	1.39
Daily Passenger (Trips)	512947	806482
Daily Passenger Km	2172434	3534986
Average Core Network Speed	31.27	28.43
Average Overall Network Speed	31.74	30.68

The peak hour loadings and V/C ratio for the Scenario 3 and Scenario 4 is shown in **Figure 4-23** to **Figure 4-28.**

Figure 4-22 Proposed Bypasses and Missing Links

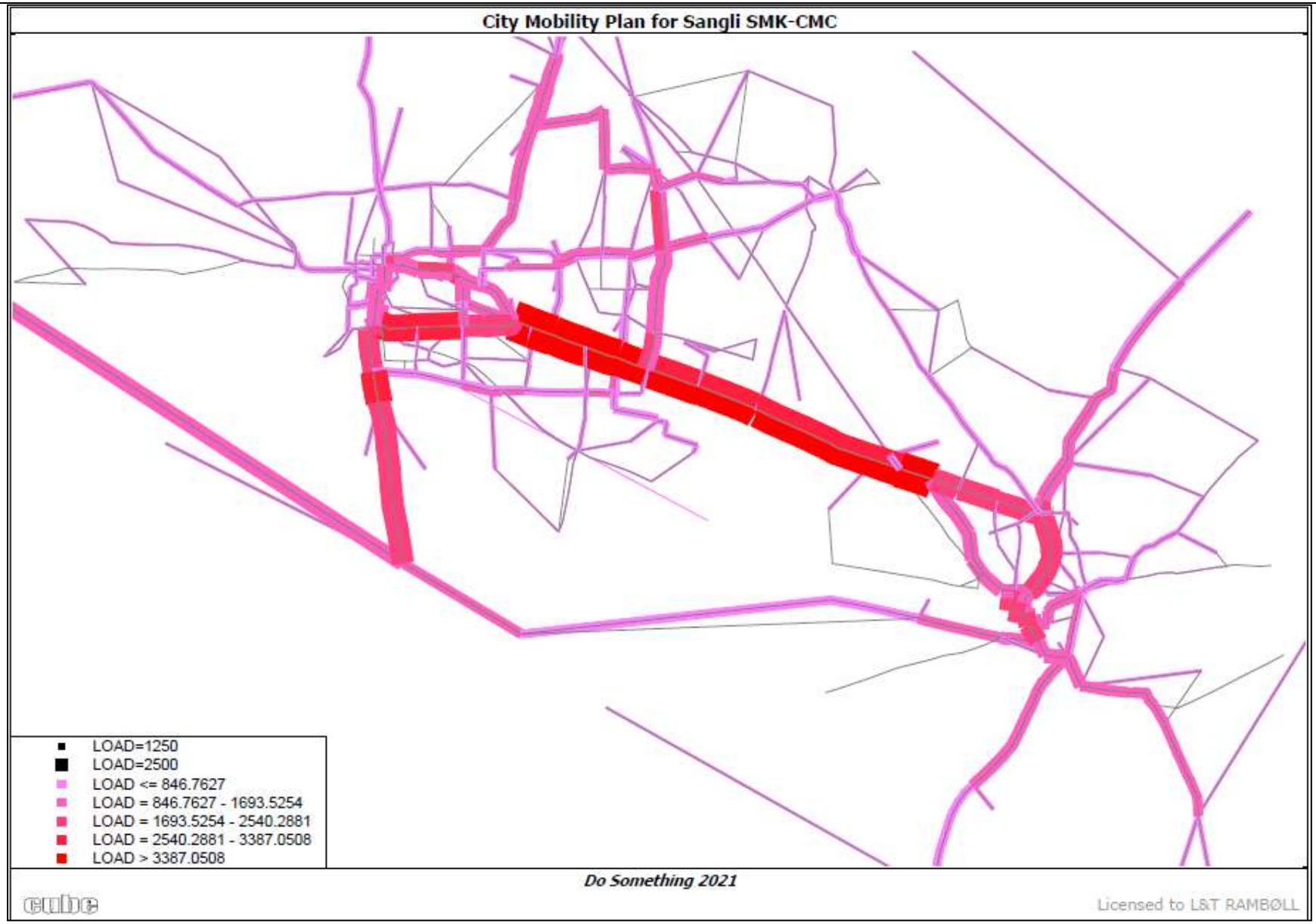


Figure 4-23 Peak Hour Traffic Loadings in PCUs for the Year 2021 (Scenario 3)

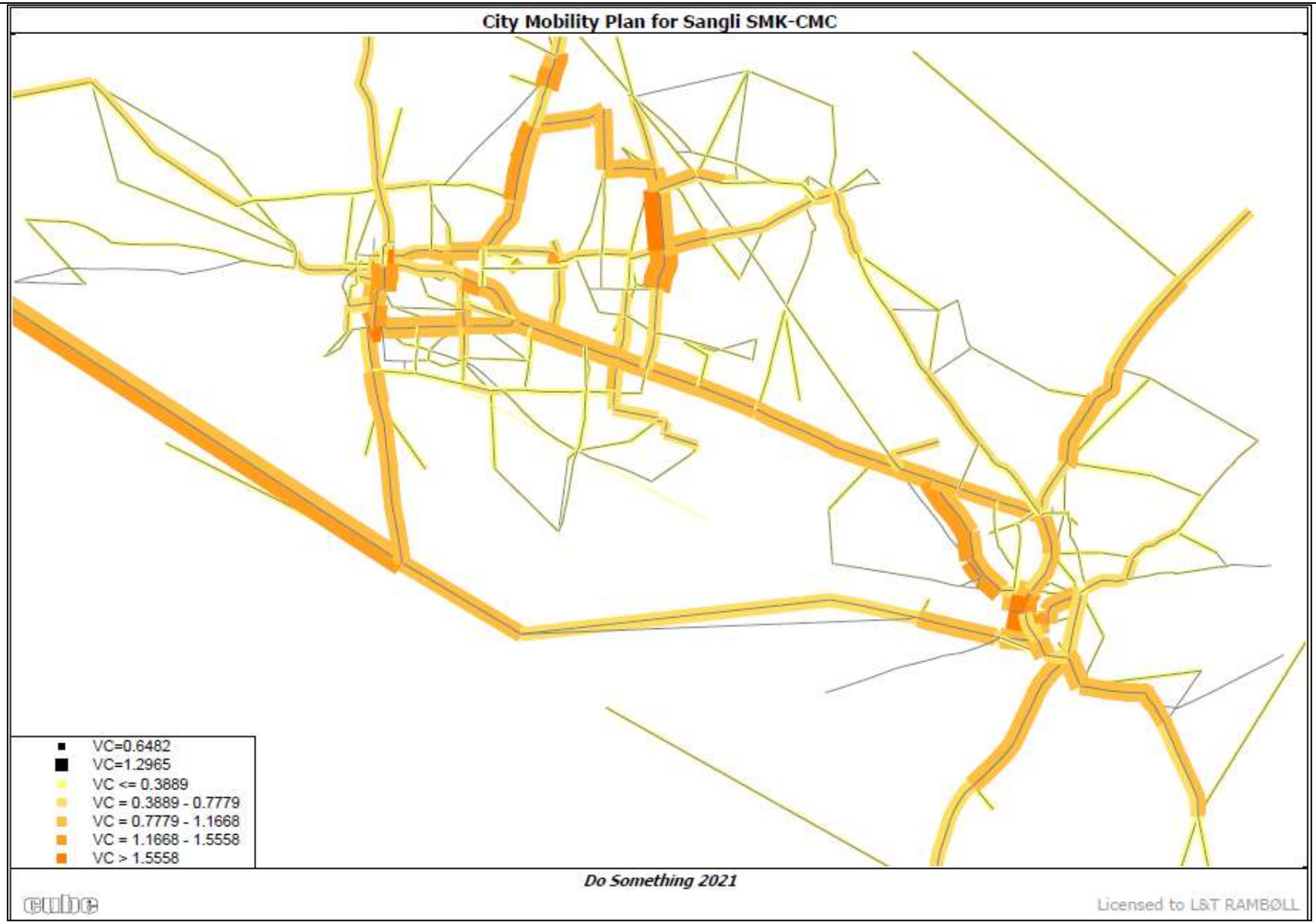


Figure 4-24 Volume/Capacity Ratios for the Year 2021 (Scenario 3)

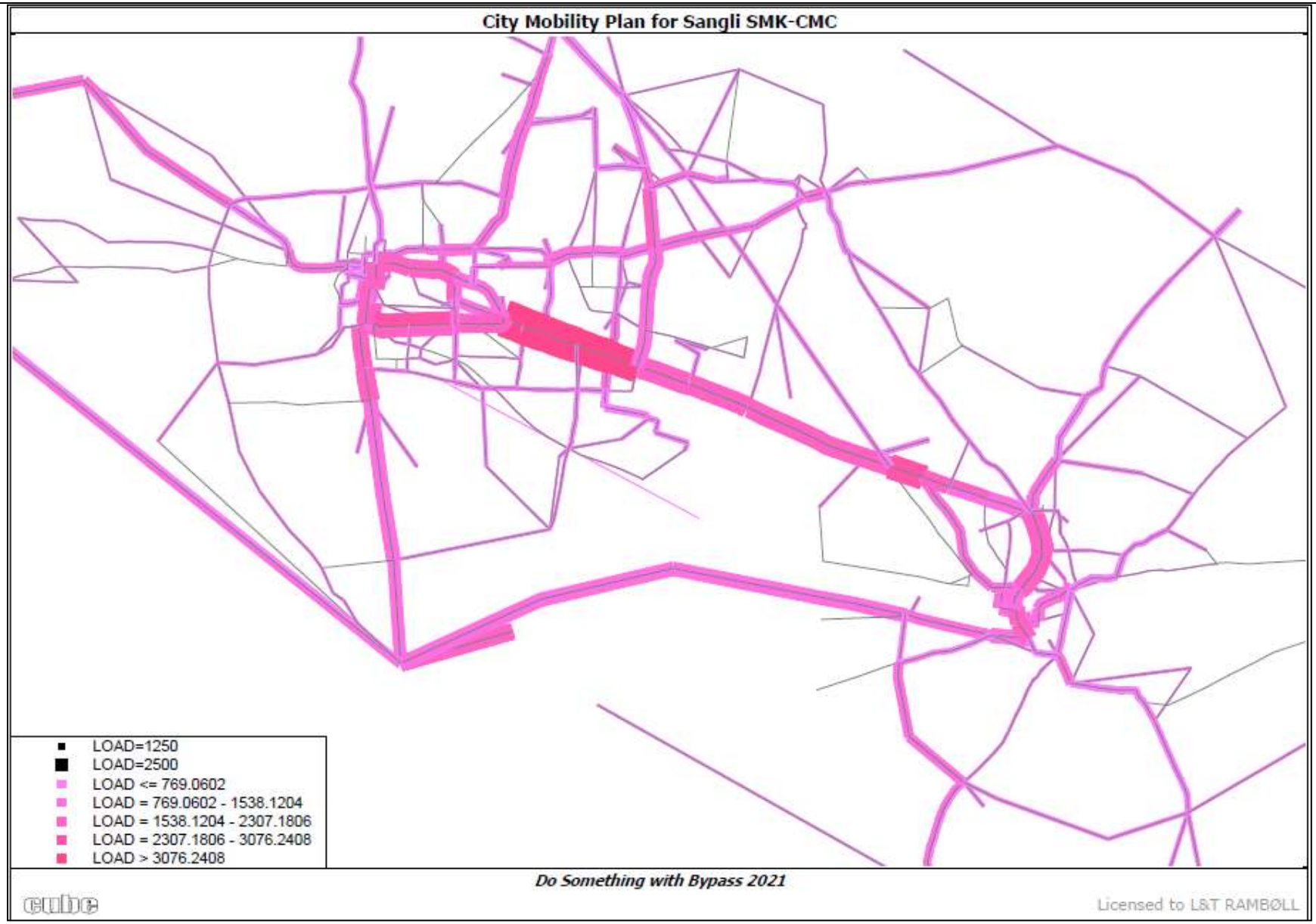


Figure 4-25 Peak Hour Traffic Loadings in PCUs for the Year 2021 (Scenario 4)

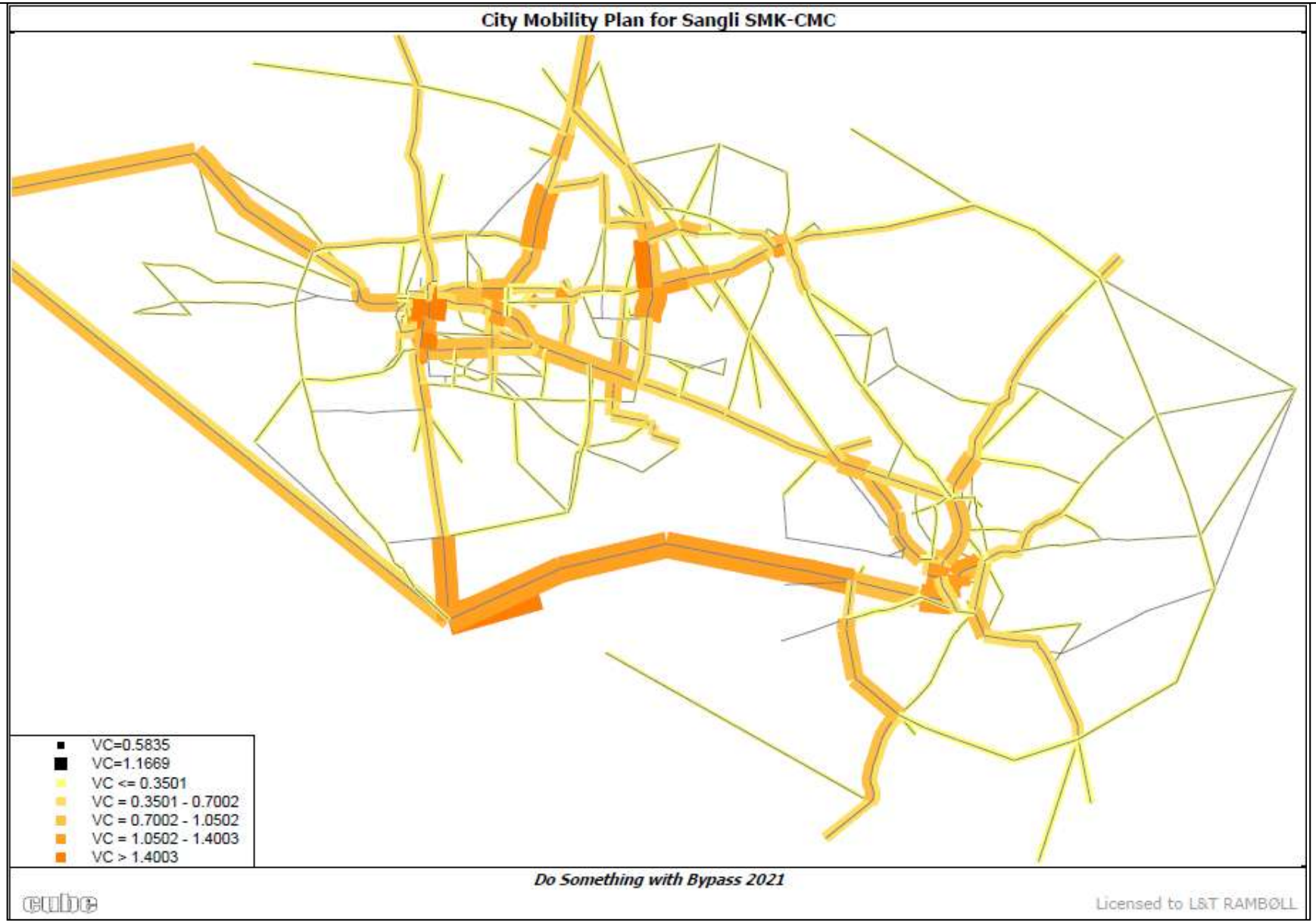


Figure 4-26 Volume/Capacity Ratios for the Year 2021 (Scenario 4)

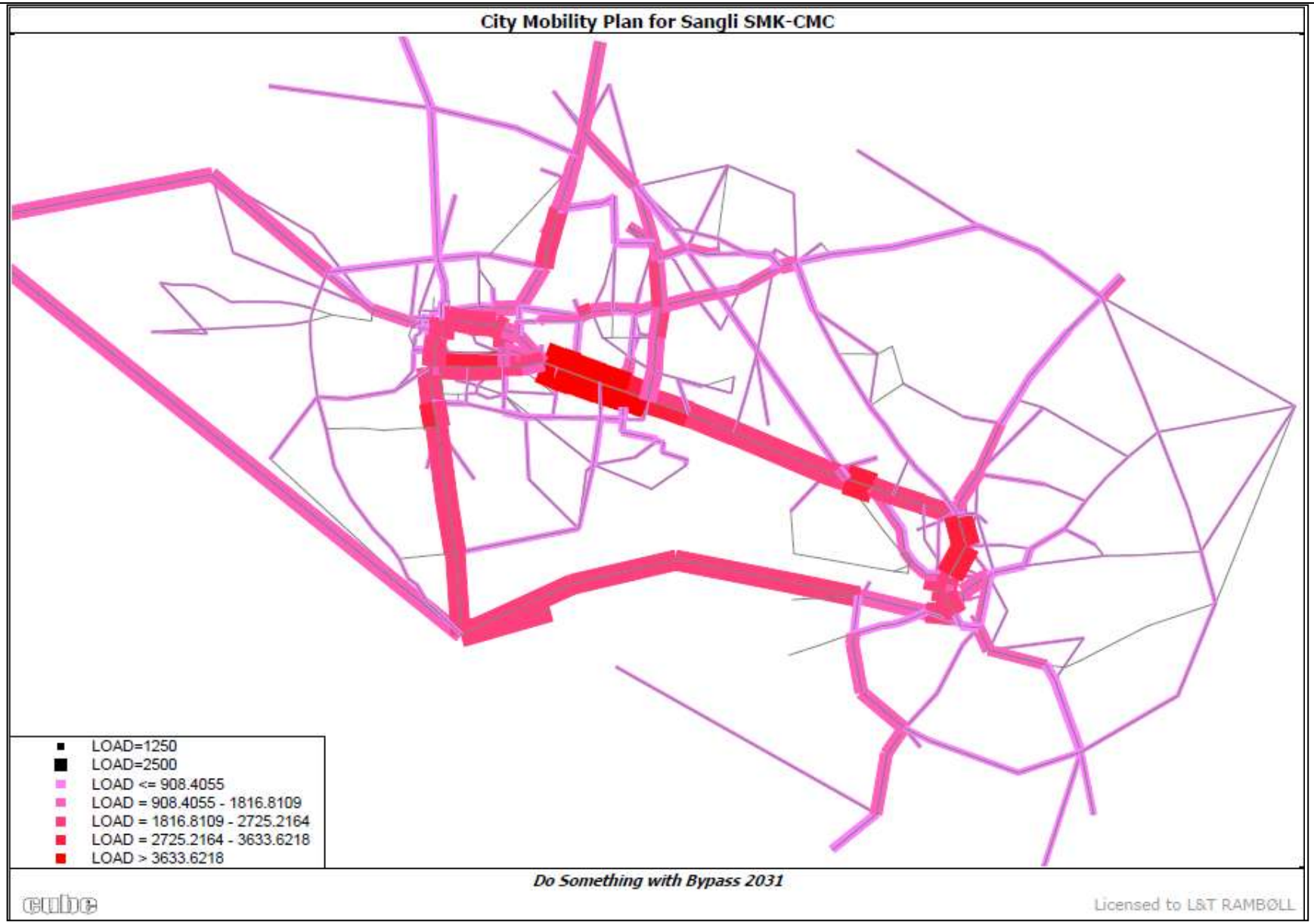


Figure 4-27 Peak Hour Traffic Loadings in PCUs for the Year 2031 (Scenario 4)

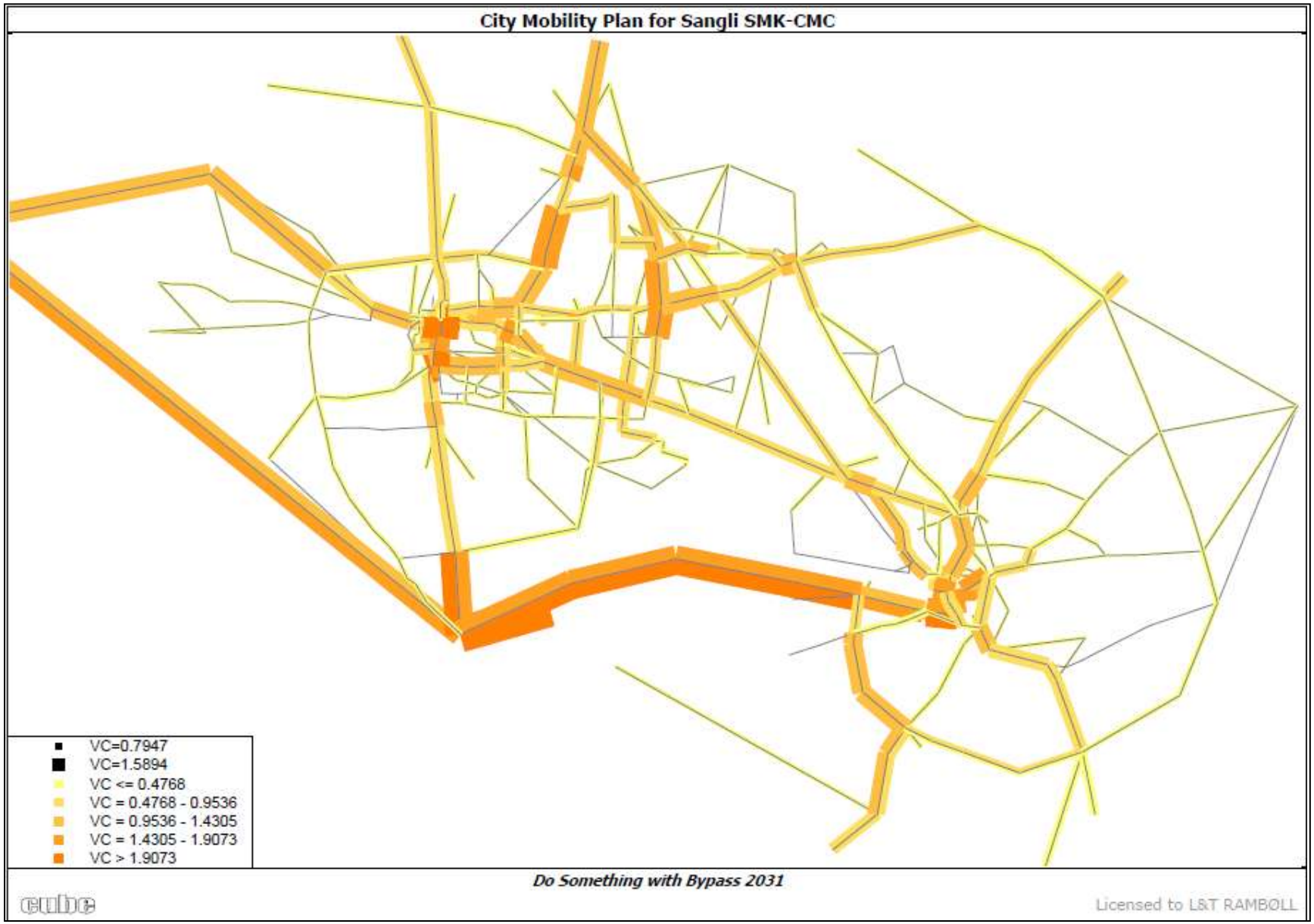


Figure 4-28 Volume/Capacity Ratios for the Year 2031 (Scenario 4)

Traffic volumes at newly added bypasses and missing links are given in **Table 4-20.**

Table 4-20 Peak Hour and Daily Volumes at Bypasses and Missing Links

Sl No	Road Name	Do Something with Bypass 2021		Do Something with Bypass 2031	
		Peak Hour Traffic, PCUs	Daily Traffic, PCUs	Peak Hour Traffic, PCUs	Daily Traffic, PCUs
1	Islampur-Kolhapur Bypass	299	3245	498	5410
2	Haripur Road	468	5084	705	7663
3	Miraj-Kolhapur Bypass	2666	28975	3743	40688
4	Ankali - Shirol Rd Bypass	1758	19112	2506	27239
5	Shirol Rd to Bijapur Rd Bypass	566	6149	883	9593
6	Bijapur Rd -Pandarpur Rd Bypass	335	3639	537	5837
7	Pandarpur-Savli Rd	815	8863	1348	14655
8	Madhav Nagar - Ahilya Nagar Rd	1422	15462	2296	24956
9	Dhamni Rd Bypass	394	4287	1005	10924
10	Ganapathipet - Islampur Bypass	183	1985	253	2750
11	Vakarbagh to Islampur Bypass	218	2373	459	4988
12	Access Rd to Sangli Miraj ROB	1554	16894	1840	19999
13	Bijay Nagar Kupwad Rd (RUB location rd)	318	3451	317	3444

4.7.5 Scenario 5 (Optimistic Urban Scenario + Do Something Network Scenario)

In Scenario 5 optimistic urban scenario trip ends are used and the Do Something Network is adopted for this scenario.

Table 4-21 gives the traffic characteristics of the study area extracted from the model in terms of total load, average V/C etc.

Table 4-21 Traffic Characteristics for Scenario 5

Scenario	2021	2031
Total LOAD, PCUs	565967	744611
Average V/C (Overall Network)	0.39	0.52
Average V/C (Core Network)	1.30	1.64
Daily Passenger (Trips)	535173	820204
Daily Passenger Km	2076357	3251667
Average Core Network Speed	30.27	26.64
Average Overall Network Speed	29.79	28.32

4.7.6 Scenario 6 (Optimistic Urban Scenario + Do Something with Bypass Network Scenario)

Optimistic urban scenario trip ends along with Do Something with Bypass network scenario is considered for this scenario.

Table 4-22 gives the traffic characteristics of the study area extracted from the model in terms of total load, average V/C etc.

Table 4-22 Traffic Characteristics for Scenario 6

Scenario	2021	2031
Total LOAD, PCUs	542656	714039
Average V/C (Overall Network)	0.34	0.45
Average V/C (Core Network)	1.12	1.43
Daily Passenger (Trips)	526965	831133
Daily Passenger Km	2220048	3621012
Average Core Network Speed	31.05	28.07
Average Overall Network Speed	31.70	30.59

The peak hour loadings and V/C ratio for the Scenario 5 and Scenario 6 is shown in **Figure 4-29** to **Figure 4-34.**

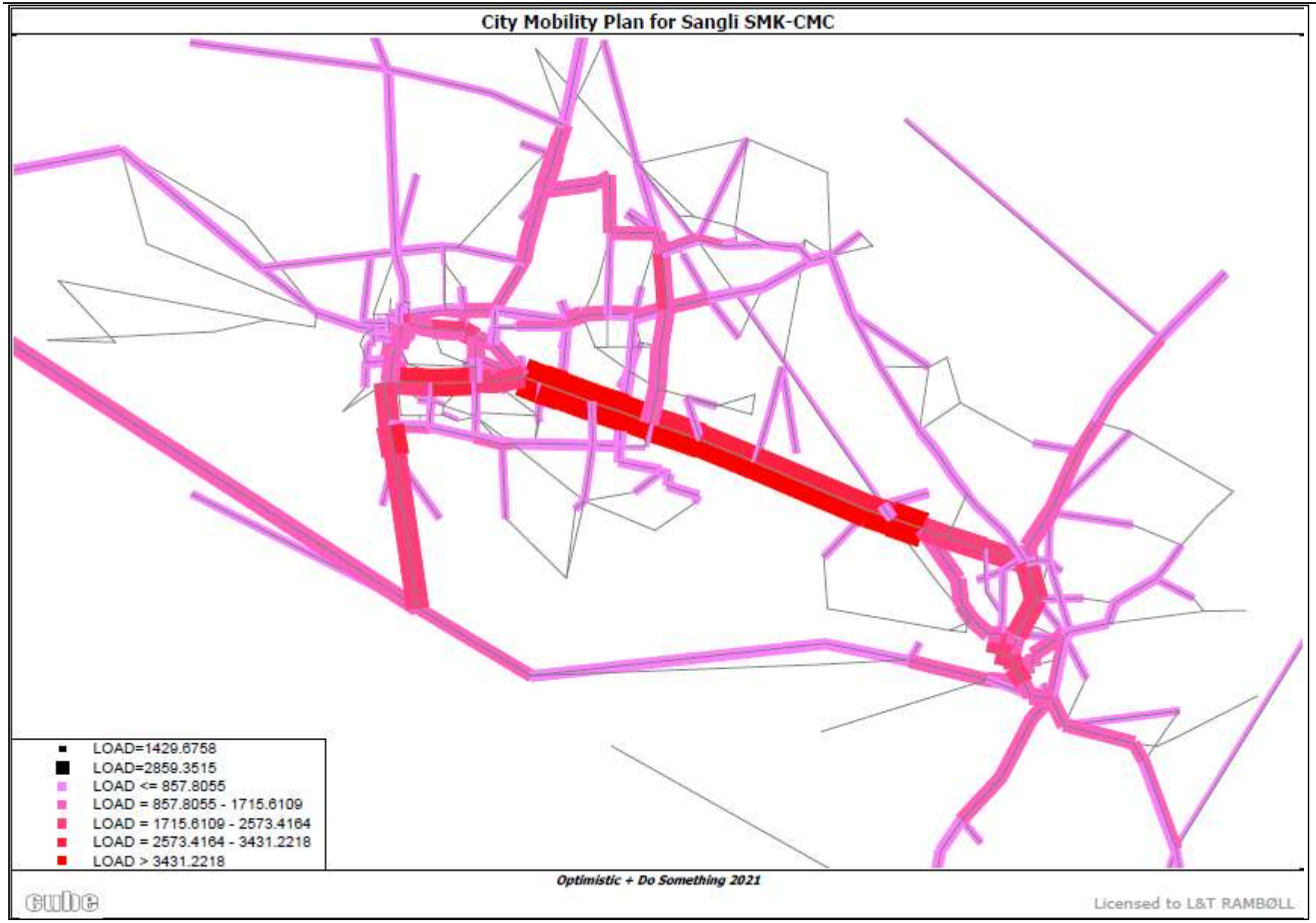


Figure 4-29 Peak Hour Traffic Loadings in PCUs for the Year 2021 (Scenario 5)

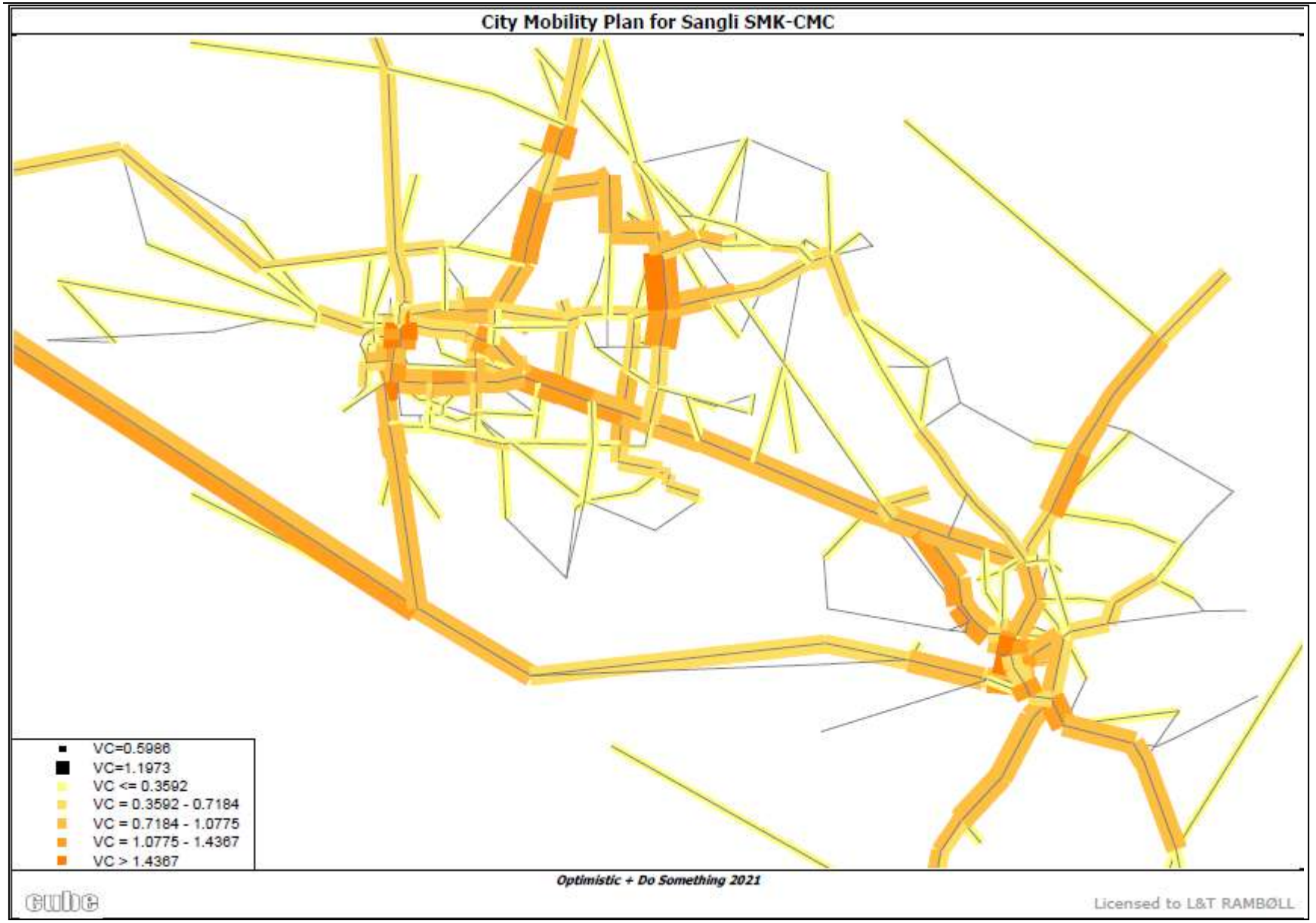


Figure 4-30 Volume/Capacity Ratios for the Year 2021 (Scenario 5)

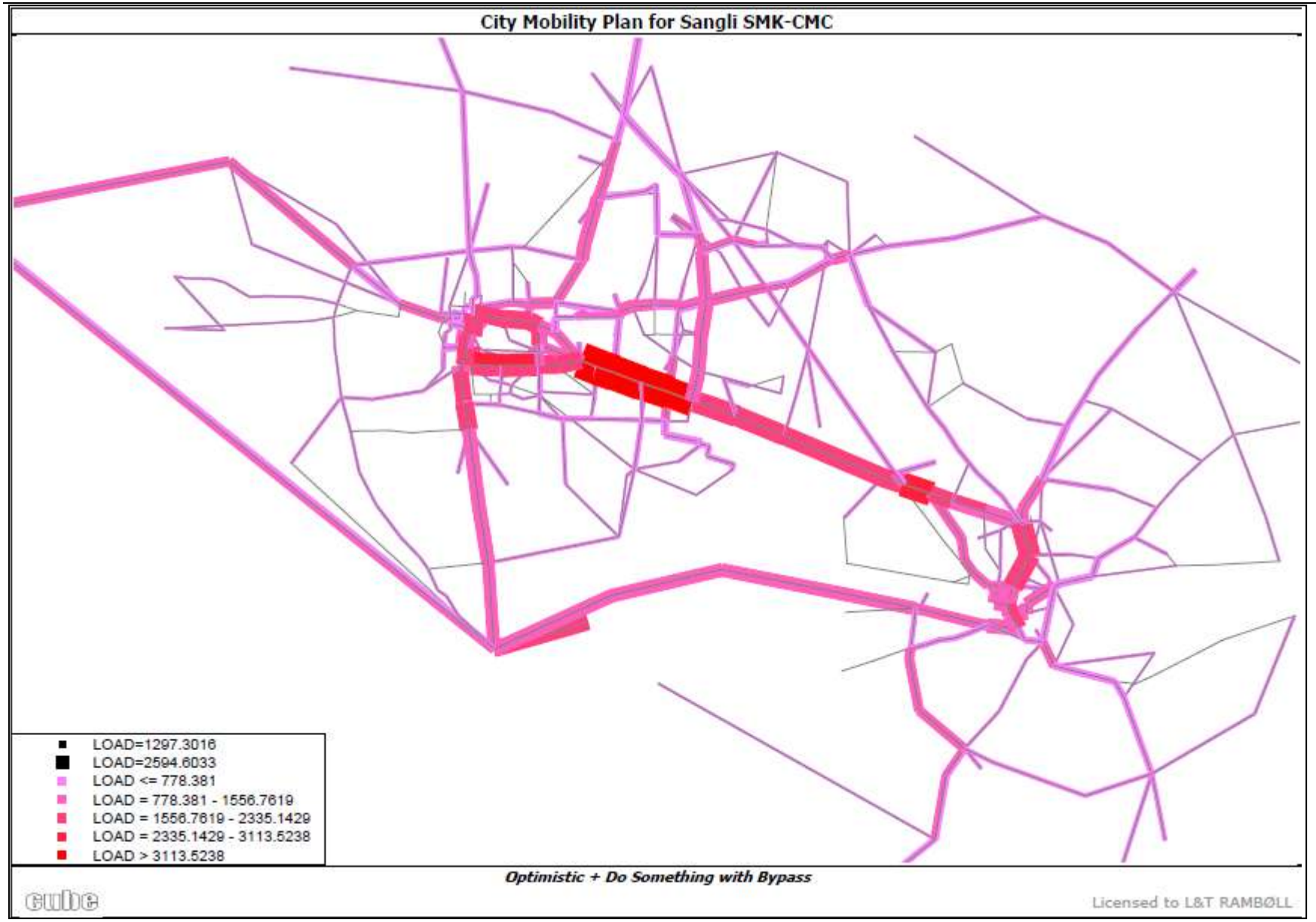


Figure 4-31 Peak Hour Traffic Loadings in PCUs for the Year 2021 (Scenario 6)

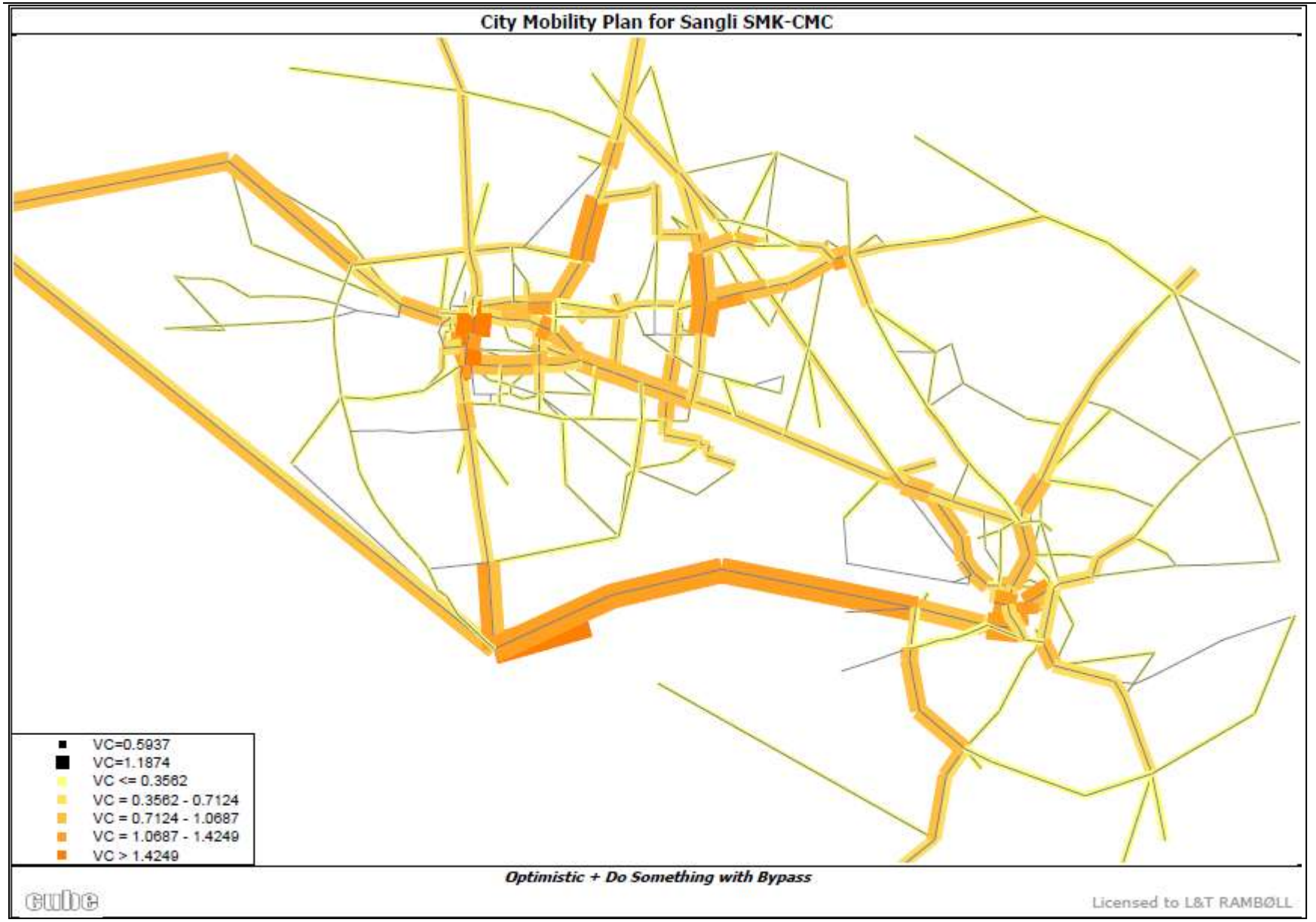


Figure 4-32 Volume/Capacity Ratios for the Year 2021 (Scenario 6)

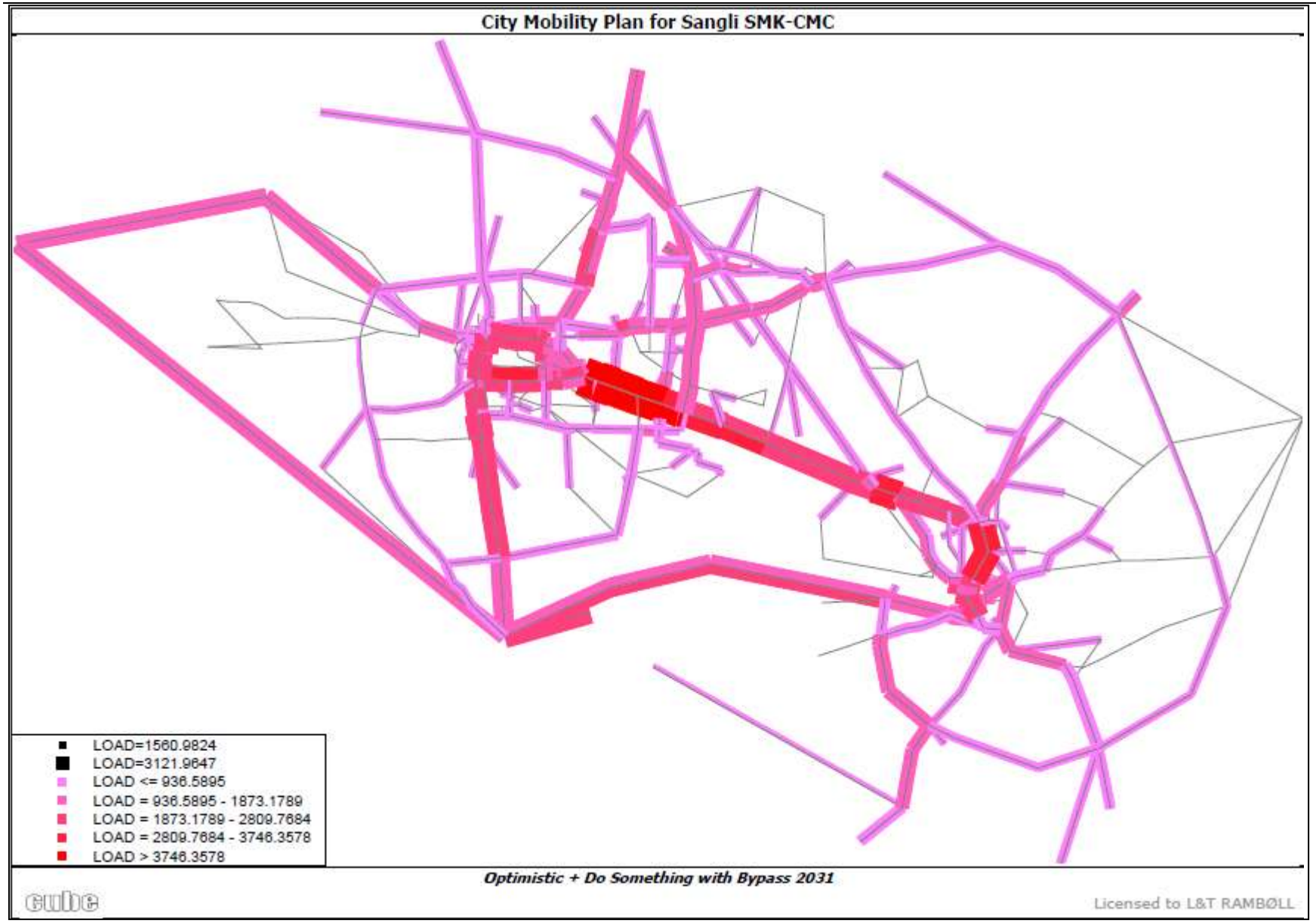


Figure 4-33 Peak Hour Traffic Loadings in PCUs for the Year 2031 (Scenario 6)

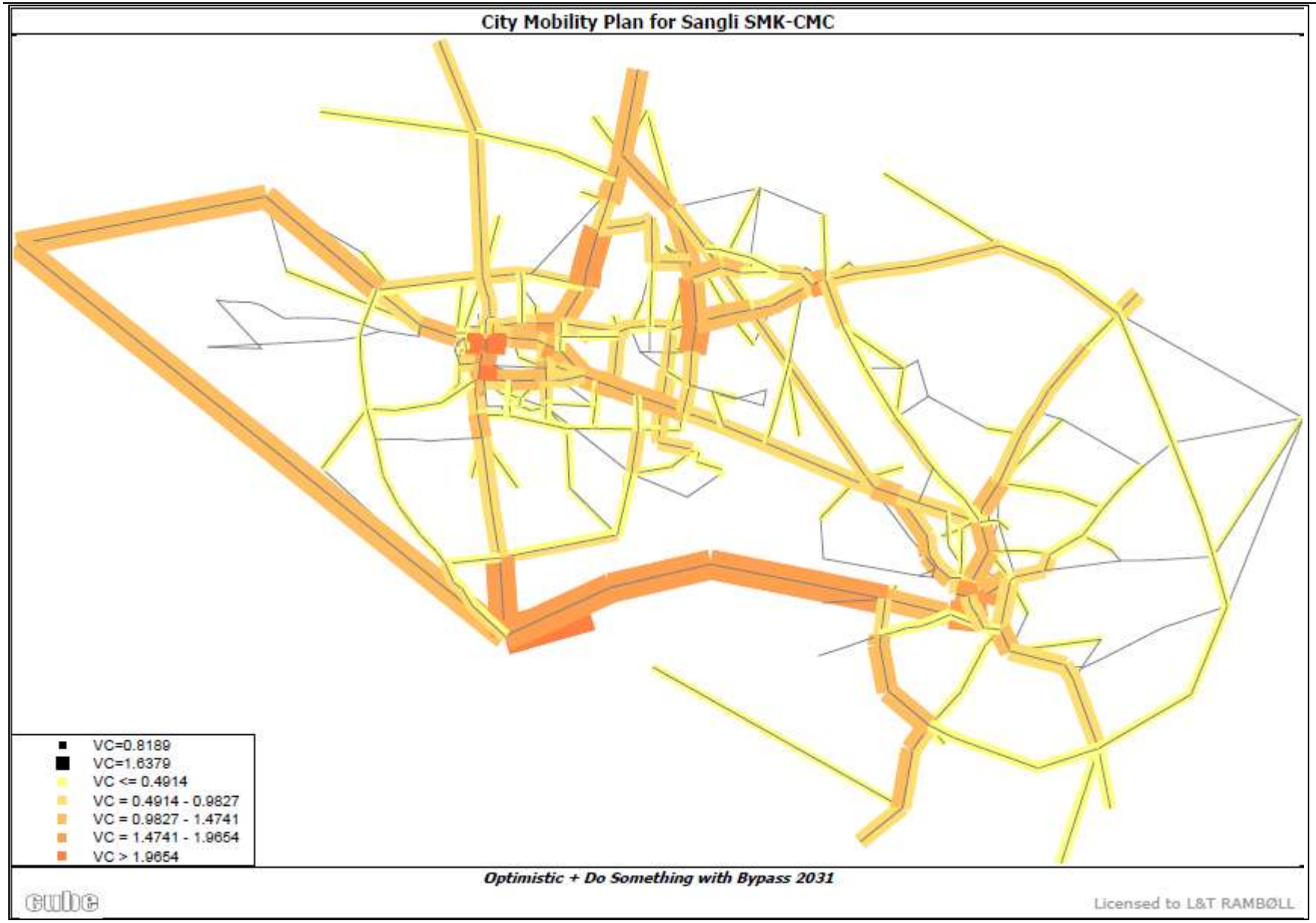


Figure 4-34 Volume/Capacity Ratios for the Year 2031 (Scenario 6)

4.8 Summary

Improvements like widening, augmentation of bus frequency tend to reduce the impact of V/C on some major roads and the overall network. Improvements along with bypass further reduce the V/C on network.

Table 4-23 Comparison of Network Attributes for Various Scenarios

Scenario	Most Likely Scenario						
	Base 2011	Do Minimum 2021	Do Minimum 2031	Do Something 2021	Do Something 2031	Do Something with Bypass 2021	Do Something with Bypass 2031
Total LOAD, PCUs	455913	557256	734533	555051	726766	532030	696448
Average V/C	0.36	0.44	0.59	0.38	0.50	0.33	0.44
Average V/C (Core Network)	1.04	1.24	1.53	1.28	1.60	1.09	1.39
Daily Passenger (Trips)	319955	501009	773448	521264	797827	512947	806482
Daily Passenger Km	1218255	1971182	3114906	2029445	3175823	2172434	3534986
Avg Core Network Speed	27.30	23.45	18.09	30.49	27.10	31.27	28.43
Average Overall Network Speed	29.56	28.66	26.76	29.85	28.45	31.74	30.68

Scenario	Optimistic Scenario					
	Do Minimum 2021	Do Minimum 2031	Do Something 2021	Do Something 2031	Do Something with Bypass 2021	Do Something with Bypass 2031
Total LOAD, PCUs	567399	751577	565967	744611	542656	714039
Average V/C	0.45	0.61	0.39	0.52	0.34	0.45
Average V/C (Core Network)	1.26	1.56	1.30	1.64	1.12	1.43
Daily Passenger (Trips)	513500	793496	535173	820204	526965	831133
Daily Passenger Km	2013061	3182430	2076357	3251667	2220048	3621012
Avg Core Network Speed	23.06	17.65	30.27	26.64	31.05	28.07
Average Overall Network Speed	28.58	26.61	29.79	28.32	31.70	30.59

i. In Scenario 1 - It has been observed that several major links carry volumes greater than its capacity for the year 2011. In 2031 the V/C ratio further increases to more than 2 to 3 at some links.

ii. In Scenario 4 (Most Likely + Do Something with Bypass Scenario) - After the inclusion of Bypasses, missing links and augmentation of bus services it has been observed that there is a reduction in V/C. The proportion of bus trips and auto trips also changes by 1.5% and 4.2% for the year 2021. Bypasses reduce the load on congested roads and decrease their V/C ratios by around 40% on the core network.

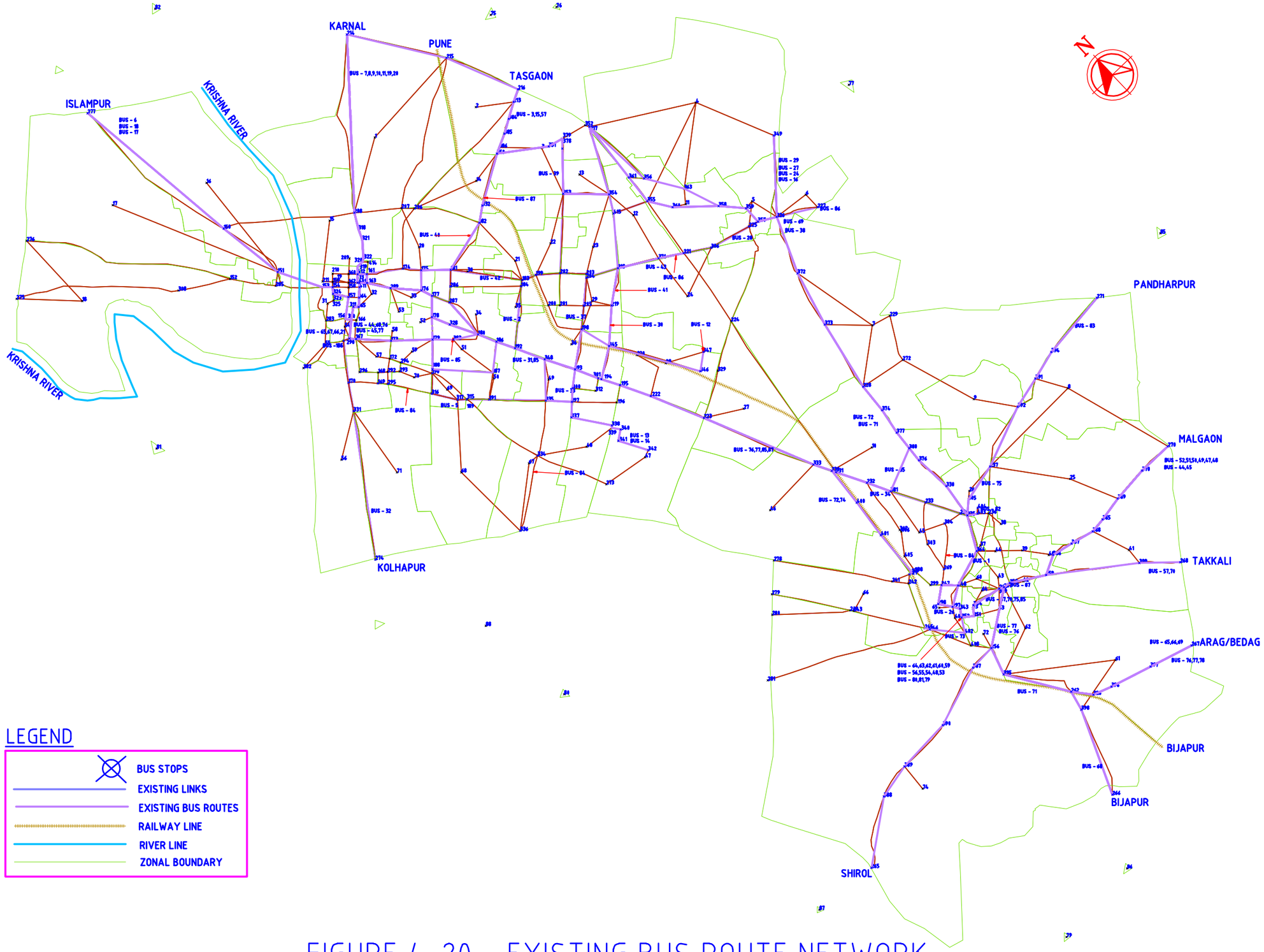


FIGURE 4-20 - EXISTING BUS ROUTE NETWORK

(SCALE 1:0.2)

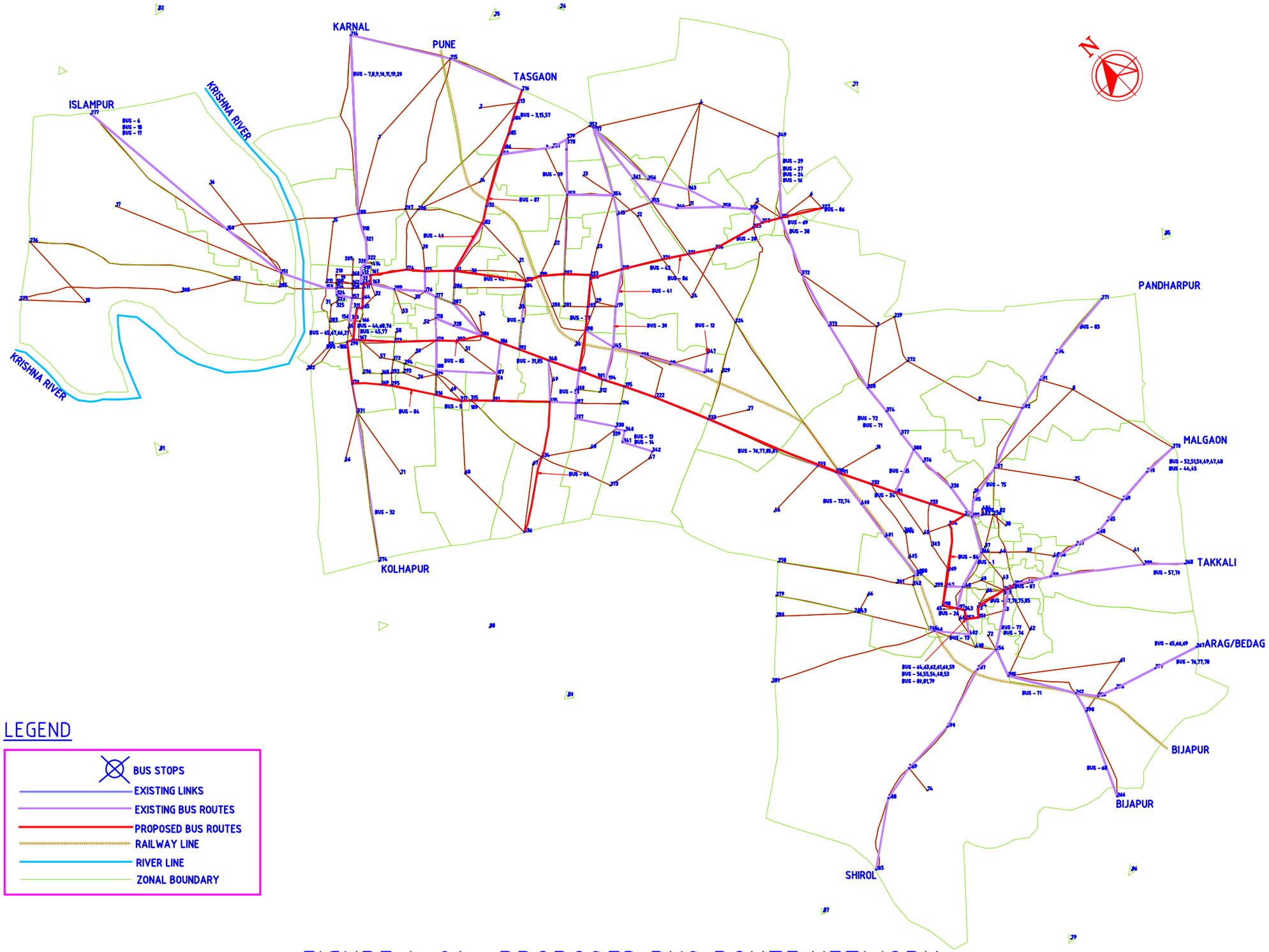


FIGURE 4-21 - PROPOSED BUS ROUTE NETWORK

(SCALE 1:0.2)

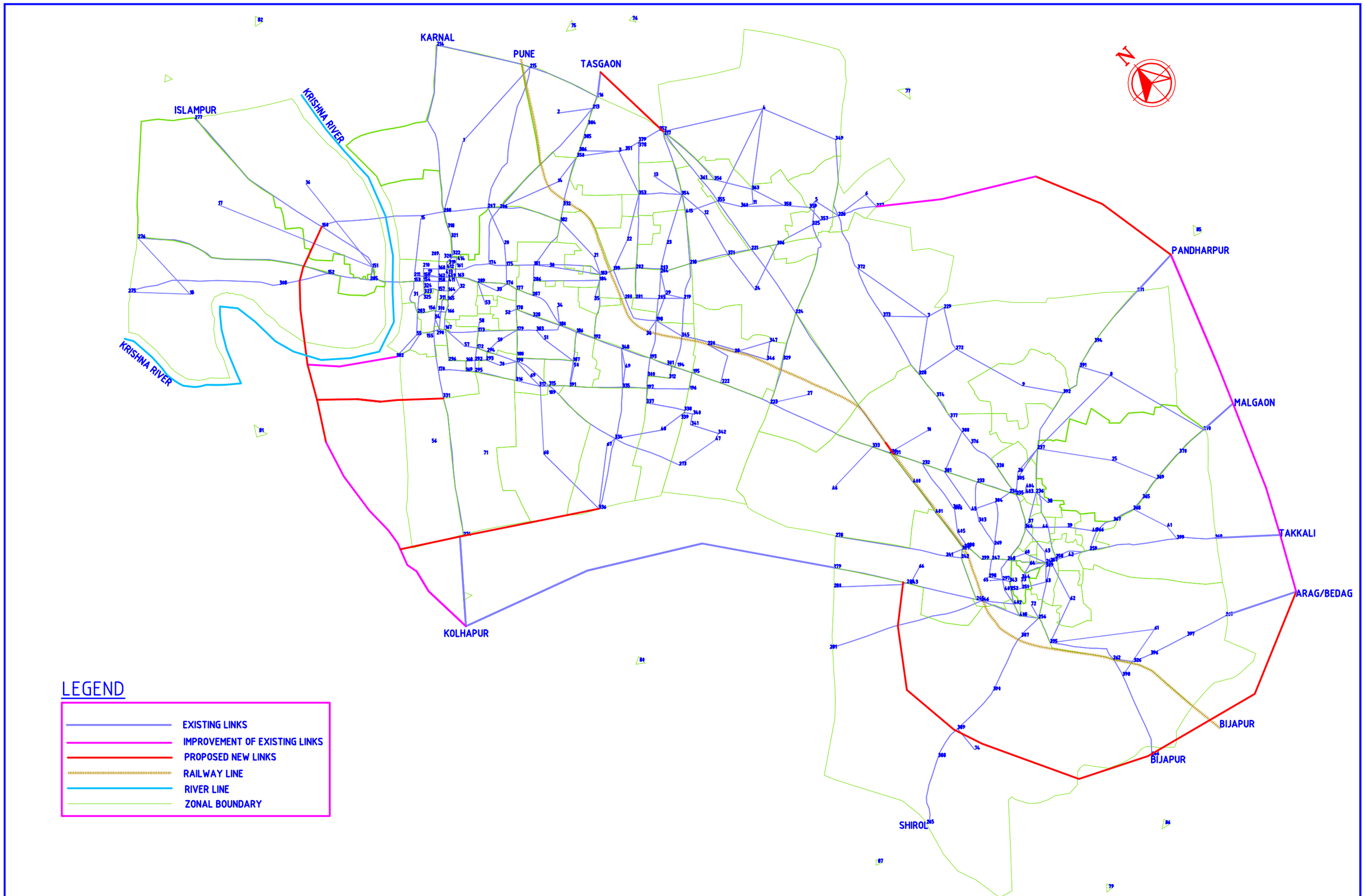


FIGURE 4-22 - ROAD NETWORK WITH ADDITIONAL LINKS AND BYPASSES (2021)

(SCALE 1:0.2)

L&T-RAMBØLL
CONSULTING ENGINEERS LIMITED

Client: **Maharashtra Urban Infrastructure Development Company Limited (MUIDCL)**

Project: Preparation of City Mobility Plan for Sangli-Miraj-Kupwad Municipal Corporation

Project No.: C1112502

Title: Draft Final Report

Document No.: RP005

Rev.: 0

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Notes:

Revision Details:

Rev.	Date	Details	Prepared		Checked		Approved	
			Init.	Sign.	Init.	Sign.	Init.	Sign.

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5 Transportation Improvement Proposals

Transportation Improvement proposals are suggested taking into account present and future travel demand. Future travel demand is obtained from travel demand models. Improvement proposals are broadly classified into three categories based on the time horizon.

- **Short Term Improvement Proposals (2012-2014)**
- **Medium Term Improvement Proposals (2015-2020)**
- **Long Term Improvement Proposals (2021-2031)**

Transportation Improvement proposals further discussed under following sections

- Traffic Management Proposals
- Junction Improvement Proposals
- Parking Demand Management
- Public Transport Improvement Proposals
- Strategy for Improving Public Transport connectivity to Railway Stations
- Intermediate Public Transport (IPT)
- Non-Motorised Transport (NMT)
- Road Widening/ Development Proposals
- Development of Missing Links
- Proposals for Grade Separators
- Rail Under Bridge (RUB)/Rail Over Bridge (ROB) Proposals
- Proposal of Bridges on the Rivers/Nallah
- Goods Transport Improvement Proposals

5.1 Short Term Improvement Proposals (2012-2014)

The increase in traffic in the city roads combined with narrow roads has resulted in congestion and has affected the smooth flow of traffic in the city roads. To accommodate increases in traffic, additional road links, widening and improvement of existing roads, more parking areas, and additional pedestrian facilities and traffic management schemes will be required. Traffic management schemes are simple and cost effective solutions. Short-term improvement proposals are discussed in the following sections.

5.1.1 Traffic Management Proposals

Short-term improvement solutions are also known as Transportation System Strategies. The short-term improvement proposal comprises of Traffic management, Parking management, Pedestrian facilities, Traffic management at rail/bus terminus, Junction improvements etc. These schemes if implemented will reduce the traffic congestion and allows optimal use of existing infrastructure at low cost. Consultants have devised the traffic improvement schemes for following areas which are located in main commercial/market areas and have inadequate road infrastructure to meet the demand.

The following are the general problems which can be observed in these areas.

1. Traffic congestion and delays due to narrow carriageway widths
2. Heavy on-street parking/parking on footpaths and near intersection
3. Lack of footpaths/Footpath encroachments
4. Improper intersection geometrics
5. Lack of Stop line markings, Pedestrian cross markings/Zebra Crossings
6. Absence of proper sign boards
7. Improper bus stop and auto stand locations/No proper Bus Shelters
8. Risk of accidents due to absence of pedestrian facilities
9. Absence of proper drainage facilities which is causing faster deterioration of pavements

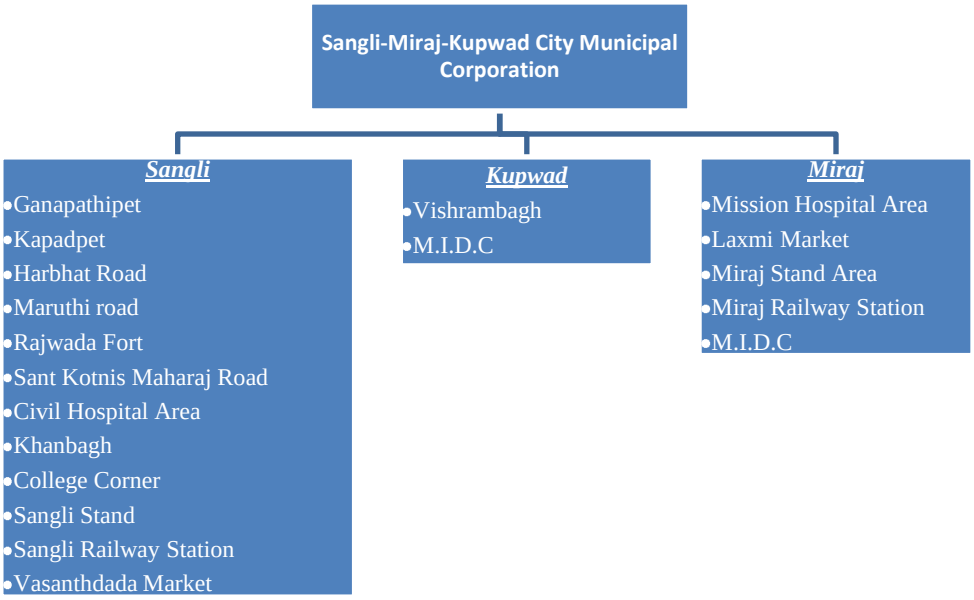


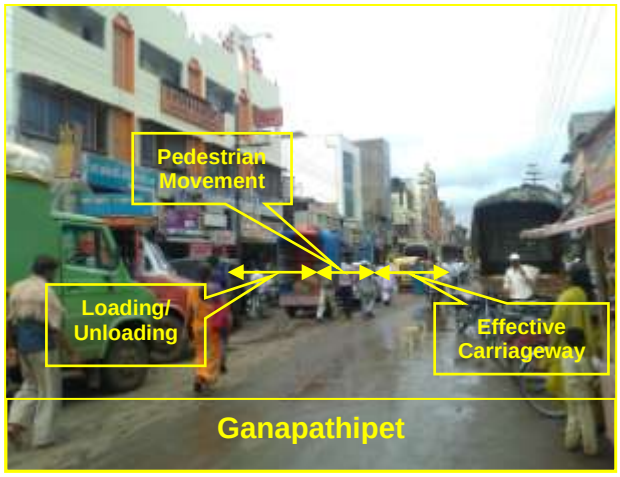
Figure 5-1 Areas identified for Traffic Management Schemes

These issues are discussed in detail in the following sections in each area.

5.1.1.1 Ganapathipet

A. Current Traffic Scenario

- Ganapathipet is an important commercial area in Sangli. The historic Ganapathi temple is located in this area where large number of people visit daily. Ganapathipet area mostly comprises of Retail/Wholesale shops due to which lot of commercial vehicles (mostly Goods Auto and LCVs) are carrying out loading and unloading activities on the carriageway.
- This area (Tilak Jn-Patel Jn) is accessed mainly from Tilak Jn, Maruthi Road and Patel Jn where the lane configuration varies from intermediate lane (Ganapathi Lane) to two lane (Ganapathipeth Road).
- The traffic flow is two way in Ganapathi Lane (Tilak Jn-Ganapathi Mandhir) whereas it is one way in Ganapathipet road (Ganapathi Mandir to Patel Jn) for all vehicles except for two wheelers. According to Sangli Traffic Office, there is no legal parking for two wheelers and four wheelers in this area where lot of parking is observed. There are no lane markings and pedestrian facilities.
- From Goods Focal Point Survey, it is observed that around 900 commercial vehicles move in and out of this area which creates congestion at Tilak Jn and Patel Jn. About 2,331 Equivalent Car Spaces (ECS) are parked on both sides along Ganapathipet road (Ganapathi Mandir to Patel Jn – Length 0.5 km) in peak hour of which 2-wheeler, 4-wheeler, Auto, Cycle and Commercial vehicles constitutes 40%, 10%, 3%, 29% and 18% respectively.
- On-street parking and loading/unloading activities are forcing pedestrians to use significant portion of the main carriageway resulting in reduction of capacity of main carriageway for vehicular traffic movement.



B. Proposed Improvements

In order to ensure smooth vehicular traffic movement on this road and reduce congestion at Tilak Jn and Patel Jn, consultants recommend following improvements:

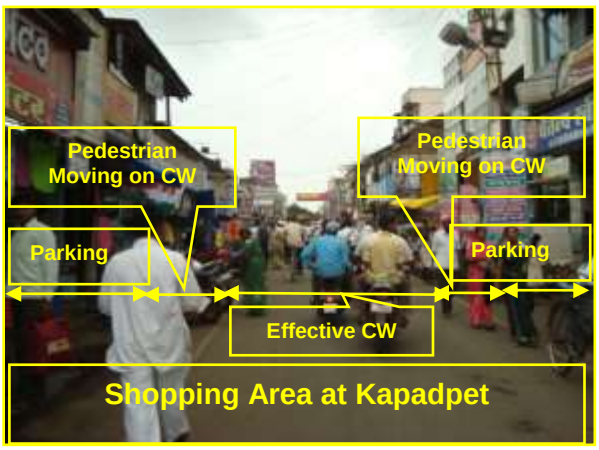
- This section of the road can be used as a two way street from Tilak Jn to Patel Jn for two wheelers and four wheelers which destine towards Miraj and reduces congestion on the parallel road (Harbhat road).
- Paid parking (Angular On-Street Parking) can be implemented for two wheelers and four wheelers on one side of the Ganapathipet road, Ganapathi Lane and other minor connecting roads whereas parking in the centre of the 2-lane road should be avoided.

- Lane Markings showing parking and pedestrian facilities with proper sign boards should be provided on either side of the road.

Proposed traffic circulation for Ganapathipet area is shown in **Figure 5-2**..

5.1.1.2 Kapadpet

A. Current Traffic Scenario



- Kapadpet is well known for shopping area in Sangli where a lot of shopping complexes, vendors and shops are densely located. Pedestrian movement is observed more on this road.
- This area is accessed mainly from Rajwada Jn, Maruthi Road and Tilak Jn where the lane configuration is two lane with length of 0.4 km. As per Draft Development Plan of S-M-K CMC, the width of the road is 18.30m.
- The traffic flow is one way for all vehicles from Jn at Karnal Road to Deval Jn except for two wheelers and four wheelers. Many two wheelers (sometimes four wheelers) and cycles use this road for travelling from nearby areas on to Harbhat road and Tilak Jn. The average journey speed on this road is 12 kmph.
- On-street parking of two wheelers and cycles is observed on the paved shoulders of this road. On-street parking along with encroachments are forcing pedestrians to use significant portion of the main carriageway resulting in reduction of its capacity for vehicular traffic movement.

B. Proposed Improvements

In order to ensure smooth vehicular traffic movement on this road, consultants recommend following improvements:

- Traffic on this road should be strictly one way flow for two wheelers, four wheelers and cycles only from Jn at Karnal road to Deval Jn.
- Pedestrian facilities should be provided by clearing encroachments with proper sign boards and enforcement.

Proposed traffic circulation in Kapadpet area is shown in **Figure 5-2.**.

5.1.1.3 Harbhat Road

A. Current Traffic Scenario

- Harbhat Road is busy shopping area in Sangli where a lot of shopping complexes are present.
- It is a 2-lane busiest road with a length of 0.5 km starting from Tilak Jn and terminating at S-M-K CMC building. As per Draft Development Plan of S-M-K CMC, the width of the road is 15.25 m. This area is accessed mainly from Tilak Jn, Maruthi road and Municipal Jn.
- Traffic on this road is one-way traffic from of Garment Jn to Municpal Jn for all

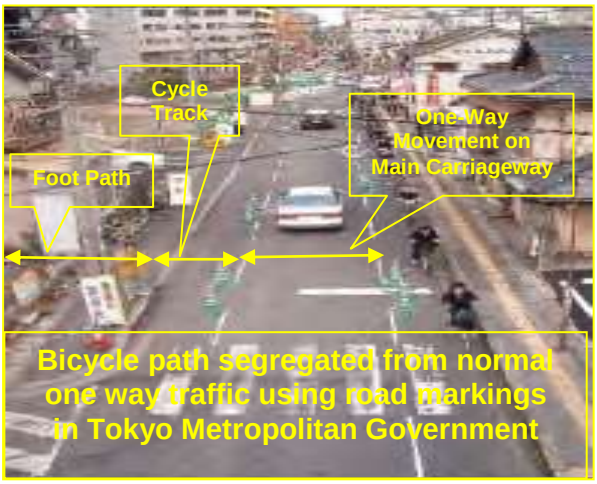
vehicles except for two wheelers whereas it is two-way flow between Garment Jn and Tilak Jn. 3-wheeler and four wheeler movement is observed from Municipal Jn to Garment Jn where enforcement is strictly required. Harbhat road carries traffic from SH-138 and Sangli Gaobhag towards Sangli and Miraj.

- Parking of two wheelers and cycles is observed on the paved shoulders of this road.
- Pedestrian movement is observed more on this road where pedestrian facilities are not available decreasing the pedestrian safety. About 1201 pedestrians move along Harbhat road whereas 1083 pedestrians move across Harbhat road at Garment Jn (Maruthi Rd Jn) during peak hour.
- High pedestrian movement is forcing the pedestrians and cycles (30% of total traffic) to use significant portion of main carriageway resulting in the congestion on this road.
- Signals present at Garment Jn are not working which is not safe for pedestrian crossing.

B. Proposed Improvements

In order to ensure smooth vehicular traffic movement on this road, consultants recommend following improvements:

- Traffic on this road should be made one way flow for all vehicles from Tilak Jn to Municipal Jn. Anand Theatre road, Kapadpet and Ganapathipeth road should be used by traffic flowing from Municipal Jn towards Tilak Jn.
- A minimum footpath width of 1.5m should be provided on either sides of Harbhat road. Pedestrian and cycle crossings should be allowed only at junctions. Zebra crossings should be provided at Tilak Jn, Garment Jn and Municipal Jn with proper signboards.



- Road and Lane markings should be marked separating the normal traffic with cycles with a width of 1.5m on either side of the road.
- Signals should be provided at Garment Jn. Signals should be designed for peak period (i.e. 6:00 P.M to 9:00 P.M) where pedestrian movement is high.

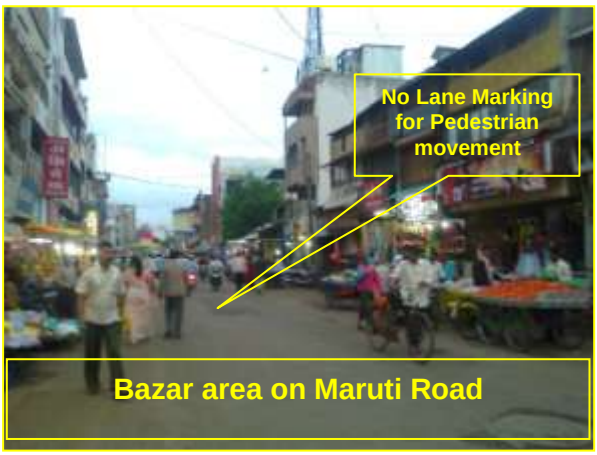
Proposed traffic circulation on Harbhat road is shown in **Figure 5-2**.

5.1.1.4 Maruthi Mandhir Road

A. Current Traffic Scenario

- Maruthi Mandhir Road is busy shopping and market area in Sangli.
- It is a 2-lane road with a length of 0.4 km starting from Maruthi Jn to Zasi Jn. As per Draft Development Plan of S-M-K CMC, the width of the road is 15.25m.
- This area is accessed mainly from Ankali road, Shivaji Mandai, Harbhat road, Ganapathipeth and other minor roads from Sangli Gaobagh.

- Traffic on this road is observed to be two-way traffic for all vehicles except for commercial vehicles and Buses which needs strict enforcement. The major portion of the traffic on this road is from Harbhat road and Anand theatre road.
- Parking on both sides of the road is observed. Irregular parking is observed at some sections of the road.
- A lot of hawkers and vendors are observed on either sides of the road.
- Pedestrian movement is high on this road due to bazar area and commercial shops. About 2950 pedestrians move along the Maruthi road and 234 pedestrians move across the Maruthi road at Anand Theatre Jn during peak hour.
- Signals present at Garment Jn are not working.
- Hawkers, Vendors and On-street parking are forcing pedestrians to use significant portion of main carriageway resulting in the congestion on this road.
- Commercial vehicle movement is observed on this road which is unsafe for the pedestrian movement and also reduce the capacity of the road in peak hour.



Bazar area on Maruti Road


Irregular Parking on Maruthi Mandhir Road

B. Proposed Improvements

In order to ensure pedestrian safety and have smooth vehicular traffic movement on this road, consultants recommend following improvements:

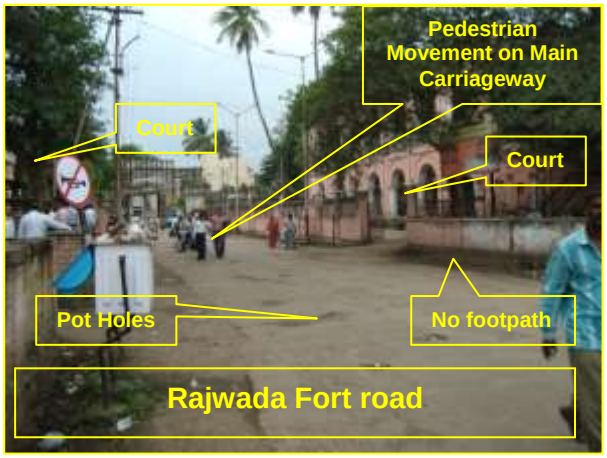
- A minimum footpath width of 1.5m should be provided on either sides of Maruthi road. Zebra crossings should be provided at Maruthi Jn, Anand Theatre Jn and Garment Jn with proper signboards such as “keep left” sign for cycles, “no entry” board for commercial vehicles and also “stop and go” sign board for vehicles in the Anand theatre road ensuring pedestrian movement in safe manner.
- Lane markings showing the parking lane should be marked on either side of the Maruthi road. Paid parking can be allowed for two wheelers and four wheelers on either side of the Maruthi road.
- Signals should be provided at Garment Jn and should be designed for peak period (i.e. 6:00 P.M to 9:00 P.M).
- Encroachments should be cleared on all the approaching roads such as Ankali road and Anand Theatre road to improve the accessibility and reduce congestion on alternate parallel roads such as Sant Kotnis Maharaj Road and Sangli S.T Stand road.
- Commercial vehicle (except Goods Auto) movement and auto stands should be restricted on this road with enforcement.

Proposed traffic circulation on Maruthi road is shown in **Figure 5-2**.

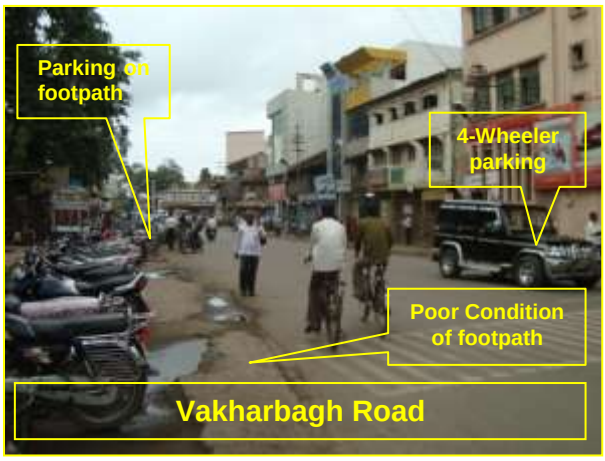
5.1.1.5 Rajwada Fort

A. Current Traffic Scenario

- Rajwada Fort area is the CBD of the Sangli where many Government offices and commercial shops are located within the vicinity of Rajwada Jn.
- This area is mainly accessed from Vakharbagh, Old Station road, Sangli Stand and Rajwada area meeting at Rajwada Jn. Rajwada Jn is a 4-legged signalised junction formed by the intersection of Old Station road, Vakharbagh road and Rajwada fort road.



- Old Station road is a 4-lane divided two way road (D.P Width = 18.68m) with a length of 1.0 km starting from S-M-K CMC Building to Congress Bhavan Road and footpath width varies between 1.5-3.0m whereas Vakharbagh high school road is a 2-lane 2-way road (D.P Width = 18.3m) with footpath width varying between 1.5-3.0m starting from Rajwada Jn to College corner. Rajwada fort road is a 2-lane road (D.P Width = 18.3m) connecting the Rajwada fort and other residential areas located inside Rajwada area. Only 2-wheeler and 4-wheeler movement is observed on the Rajwada fort road.
- Due to the location of court in the Rajwada fort, high pedestrian and vehicular movement is observed during peak hour.



- Old station road consists of four important junctions namely Rajwada Jn, Station Jn, Azad Jn and Congress Bhavan Jn with channelized islands which provide access for different parts of Sangli.
- Parking is observed on either side of all the connecting roads. Parking is observed on Old Station road of about 795 ECS during peak hour of which 2-wheeler, 4-wheeler, Auto and Cycle constitutes 45%, 12%, 14% and 28% respectively. About 19% of the traffic at Rajwada Jn constitutes cycle movement.
- Hawkers and Vendors are using the footpaths of the road at some sections of the Old Station road and Vakharbagh road.
- Poor condition of foot path is observed on Vakharbagh road forcing pedestrians to use main carriageway.
- Pot holes are observed on Rajwada fort road and Vakharbagh road which reduces journey speeds.

B. Proposed Improvements

In order to ensure smooth vehicular traffic movement on this road, consultants recommend following improvements:

- Parking at the centre of the carriageway and on footpath should be avoided on Old Station road/Vakharbagh road and also parking should be allowed only on one side of the road in a zigzag pattern based on the commercial shops location. 4-Wheeler parking on the Vakharbagh road should be avoided and can be allowed on Rockel lane road.
- A minimum footpath width of 1.5m should be provided on either sides of Rajwada fort road. Zebra crossings should be properly provided on all connecting roads at Rajwada Jn. Signal at Rajwada Jn should be redesigned for peak period considering the pedestrian movement.
- Hawkers and Vendors should be restricted from using the footpaths.
- Road and Lane markings should be marked separating the normal traffic with cycles.
- Proper sign boards showing the speed limits, pedestrian crossing, important places, etc should be placed on the Old station road and Vakharbagh road.
- Bus stop located near SFC mega mall should be separated from main road median/island. Intercity bus movement towards Miraj should be diverted from station road to Ambedhkar road.
- Maintenance work related to footpaths, potholes, etc has to be carried out on all the connecting roads.
- Commercial vehicles (except Goods Auto) should not be allowed during peak periods (i.e., 10:00 AM to 1:00 PM and 17:45 PM to 20:45 PM) and at school/college start/stop timings which should be stopped near Octroi on Islampur-Madhavnagar bypass road.

Proposed traffic circulation at Rajwada Jn is shown in **Figure 5-2**.

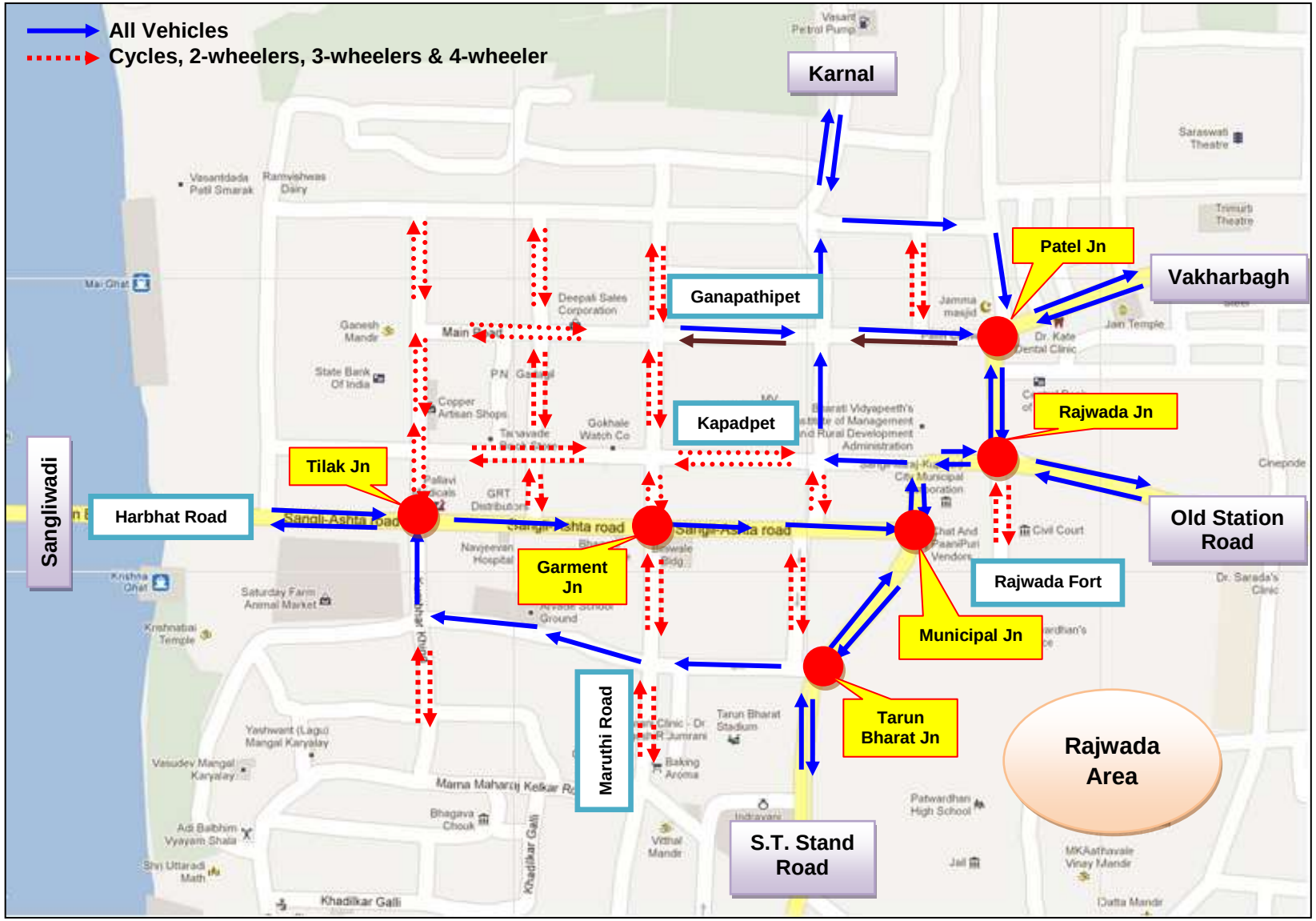


Figure 5-2 Proposed traffic circulation in Ganapathipet, Kapadpet, Harbhat Road, Maruthi Road and Rajwada Fort

5.1.1.6 Sant Kotnis Maharaj Road

A. Current Traffic Scenario


Sant Kotnis Maharaj Road


Illegal Auto Stops on Sant Kotnis Maharaj Road

- Sant Kotnis Maharaj road is a commercial area where lot of hotels, lodgings, commercial shops are present.
- It is a 2-lane one way road (D.P Width = 15.24m) with a length of 0.6 km starting from Sangli Stand to Shivaji Mandai. At times, 2-wheeler and 4-wheelers including autos are using this road as two-way where enforcement is lagging.
- This road is accessed mainly from Sangli stand, Kolhapur road and other minor roads of Sangli Goabagh.
- The major portion of the traffic on this road is from Kolhapur road. As there are only two main roads connecting Sangli and Miraj or Tasgaon through the centre of the city (Ambedhakar road and Sant Kotnis Maharaj road), more traffic is observed on this road. The average journey speed on this road is 22 kmph.
- 2-wheeler and 4-wheeler parking is observed on either sides of the road.
- Hawkers and vendors are observed near Shivaji Mandai on main road.
- At times, autos and taxis are stopping on the main road. Significant number of pedestrian movement is also observed.
- Hawkers, vendors and illegal parking is forcing pedestrians to use significant portion of main carriageway.

B. Proposed Improvements

In order to ensure smooth vehicular traffic movement on this road, consultants recommend following improvements:

- Traffic on this road should be made one-way for all vehicles with strict enforcement.
- A minimum footpath width of 1.5m should be provided on either sides of Sant Kotnis Maharaj Road. Zebra crossings with proper sign boards (such as speed limits, pedestrian crossing, no parking, no entry, etc) should be provided near Sangli Stand and Shivaji Mandai.
- Paid parking should be allowed for 2-wheeler and 4-wheeler on one side of the road in a zig-zag pattern for longer durations. Autos and Taxis should be restricted from stopping/parking on this road.
- The market area at Shivaji Mandai should be avoided from this road to the adjacent connecting roads to have a smooth flow of traffic ensuring pedestrian safety.

Proposed traffic circulation on Sant Kotnis Maharaj road is shown in **Figure 5-3**.

5.1.1.7 Sangli S.T Stand Road

A. Current Traffic Scenario

- Sangli S.T Stand road is a commercial area where lot of hotels, lodgings, commercial shops are present.
- It is a 2-lane one way road (D.P Width = 18.3m) with a length of 0.6 km starting from Shivaji Mandai to Sangli Stand and is parallel to Sant Kotnis Maharaj Road. 2-wheeler and 4-wheelers including autos are using this road as two-way where enforcement is lagging.
- This road is accessed mainly from Kameti Road, Resala road and other minor roads. The major portion of the traffic on this road is from Kameti road which carries traffic from other main parts of city. The average journey speed on this road is 22 kmph.
- 2-wheeler and 4-wheeler parking is observed on both sides of the road.
- Many private bus travel agencies are located on either side of this road at which boarding/alighting activities take place on the road side reducing the effective carriageway width and causing congestion during evening peak period.
- Hawkers and vendors are observed on either sides of the road near Resala road causing interruption to the vehicular traffic.
- Pedestrian movement is observed more on this road due to market area on Resala road and Sangli S.T Stand.

B. Proposed Improvements

In order to ensure smooth vehicular traffic movement on this road, consultants recommend following improvements:

- Traffic on this road should be made one-way for all vehicles with strict enforcement.
- A minimum footpath width of 1.5m should be provided on either sides of Sangli S.T Stand road. Zebra crossings with proper sign boards (such as speed limits, pedestrian crossing, no entry, etc) should be provided near Resala road.
- Paid parking should be allowed for 2-wheeler and 4-wheeler on one side of the road in a zigzag pattern for longer durations.
- Hawkers and Vendors should be restricted from either sides of this road.
- Private Buses should be restricted on this road during peak periods (i.e., 8:30 am to 11:30 am and 16:30 pm to 21:00 pm) where they can use 100 ft road for alighting or boarding's.

Proposed traffic circulation on Sangli S.T Stand road is shown in **Figure 5-3**.

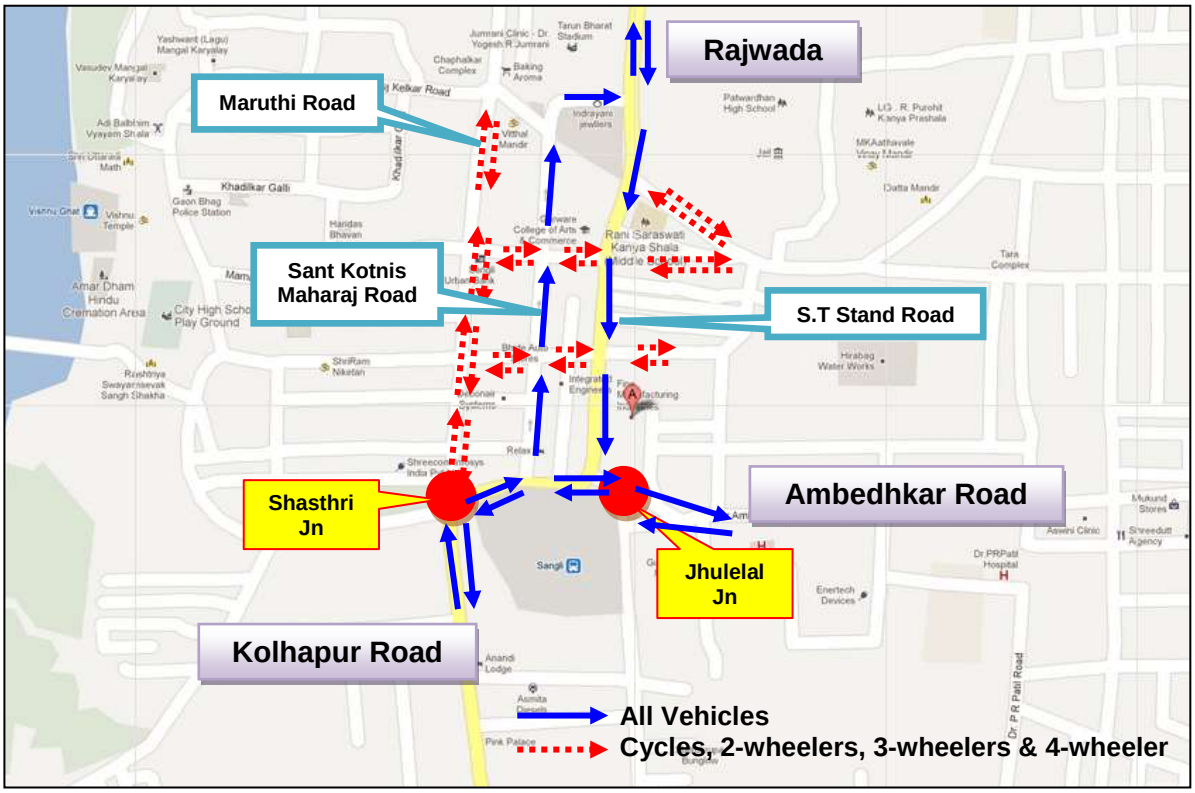


Figure 5-3 Proposed Traffic Circulation in Sant Kotnis Maharaj Road and Sangli S.T Stand Road

5.1.1.8 Civil Hospital Area

A. Current Traffic Scenario

- Civil hospital area is a busiest area where a significant pedestrian movement is observed due to the Civil Hospital and the residential areas in connecting roads.
- This area is connected by Ambedkar road with major junctions at Civil Hospital Jn leading to the Ram Mandhir corner, 100 feet road, Pushparaj Jn and Sangli Stand. All the connecting roads are 2-lane 2-way roads. Ambedkar road (D.P. Width = 20m) connects Jhulelal Jn and Pushparaj Jn with a length of 1.8 km.
- The major portion of the traffic on this road is from Kolhapur road and Sangli-Miraj main road. The average journey speed on this road is 22 Kmph. Ambedkar road and Stand road are the roads which carries most of the traffic travelling towards Sangli and Miraj or Tasgaon.
- Parking is observed on both sides of the road.
- Around 23% of vehicles on this road are cycles.
- Intra-city buses are restricted on this road where as inter-city buses use this road in one way direction (Pushparaj Jn to Sangli Stand).
- Signals provided at Civil Hospital Jn are not working which cause delays at the junction and is also not safe for pedestrian crossing. A number of accidents have occurred on this road where pedestrian safety is not ensured.

B. Proposed Improvements

In order to ensure smooth vehicular traffic movement on this road, consultants recommend following improvements:

- A minimum footpath width of 1.5m should be provided on either sides of Ambedkar road. Zebra crossings should be provided at entry/exit points to this road.
- Signals at Civil Hospital Jn should be designed for the peak period (i.e., 9:45 AM to 12:45 AM and 16:30 PM to 19:30 PM).
- Road and Lane markings should be marked with proper signboards separating the normal traffic with cycles with a width of 1.5m on either side of the road.
- Intra-city buses should pass through Sangli-Rajwada-Pushparaj Jn route and Sangli-Civil Hospital-Pushparaj Jn route whereas inter-city buses should be restricted from using Sangli-Civil Hospital-Pushparaj Jn route where they can travel through Sangli-100ft road-Vishrambagh route**.**

Proposed traffic circulation in Civil Hospital area is shown in **Figure 5-4**.

5.1.1.9 Khanbagh Area

A. Current Traffic Scenario


Sangli-Miraj Road
(At Ram Mandhir Corner)

- Khanbagh area is a commercial area (banks, shopping centres, electronic shops, etc) starting from Congress Bhavan Jn to Pushparaj Jn through Ram Mandhir corner which is a 4-lane road with a length of 1.0km and varying footpath widths. At some sections, there are no footpaths.
- This area is connected by Old Station road and Madhavnagar road at Congress Bhavan Jn, Civil Hospital road and Ram Mandhir road at Ram Mandhir Jn and Madhavnagar road, Sangli-Miraj road and Ambedkar road at Pushparaj Jn. All the connecting roads are 2-lane 2-way roads except Old Station road and Sangli-Miraj road which are 4-lane roads with a D.P width of 18.68m.
- The traffic from Old Station road is distributed on Khanbagh and Miraj roads at Congress Bhavan Jn. The traffic from Miraj road is distributed on Ambedkar road, Khanbagh road and Miraj road at Pushparaj Jn. The average journey speed on this road is 36 Kmph.
- Around 14% of vehicles on this road are cycles.
- 2-wheeler and 4-wheeler parking is observed on both sides of the road.
- At some section of the road, Hawkers and Vendors are observed on footpath of the road.
- Inter-city buses flow in one way direction from Congress Bhavan to Pushparaj Jn where as they use Ambedkar road in the opposite direction.
- Signals present at Ram Mandhir Jn are not working which is not safe for pedestrian crossing.

B. Proposed Improvements

In order to ensure smooth vehicular traffic movement on this road, consultants recommend following improvements:

- A minimum footpath width of 1.5m should be provided on either sides of Sangli-Miraj road (Ram Mandhir Jn-Pushparaj Jn). Zebra crossings should be provided on access roads at Congress Bhavan Jn, Ram Mandhir Jn and Pushparaj Jn. Signals at Ram Mandhir Jn should be designed for the peak period (i.e., 9:45 AM to 12:45 AM and 16:30 PM to 19:30 PM).
- Parking should be restricted to one side of the road in zigzag pattern.

- Road and Lane markings should be marked separating the normal traffic with cycles with a width of 1.5m on either sides of the road
- Hawkers and Vendors should be restricted from using footpaths.
- Khanbagh road and Ambedkar road should be used as bi-directional traffic for intra-city buses. Inter-city buses which flow from Pushparaj Jn-Sangli Stand through Ambedkar road should be allowed on to 100 ft road.
- Commercial vehicles should be allowed only on main roads (Sangli-Miraj Road and 100 ft road).

Proposed traffic circulation in Khanbagh area is shown in **Figure 5-4**.

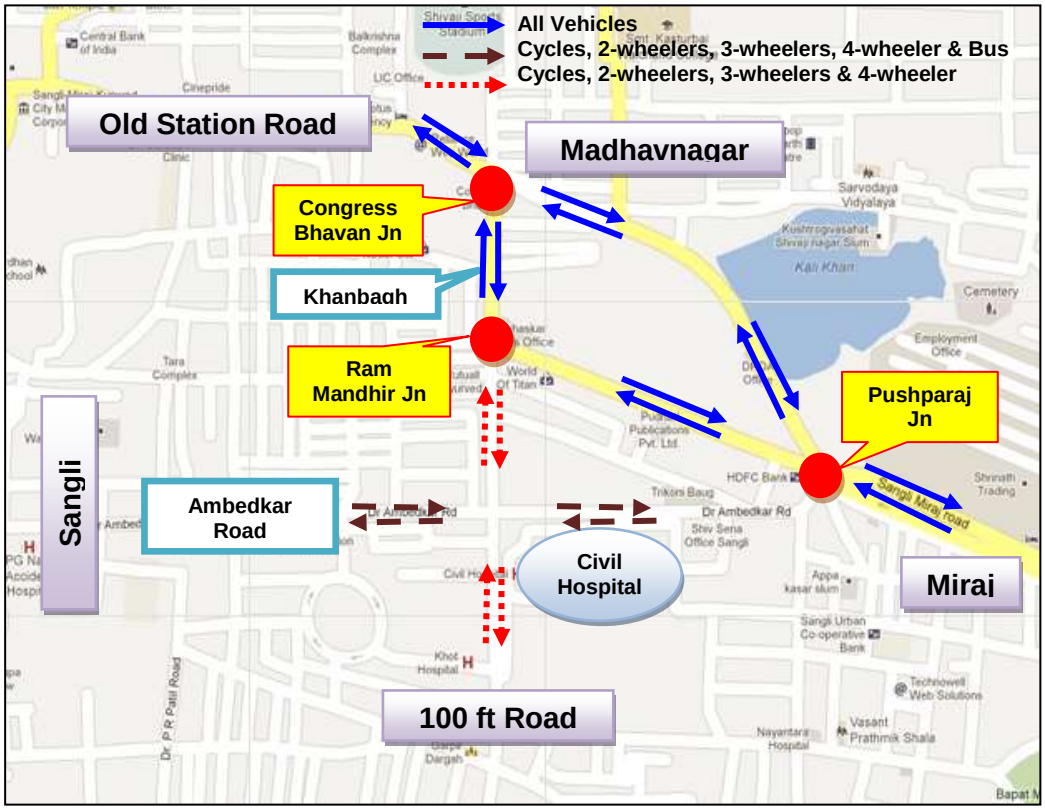
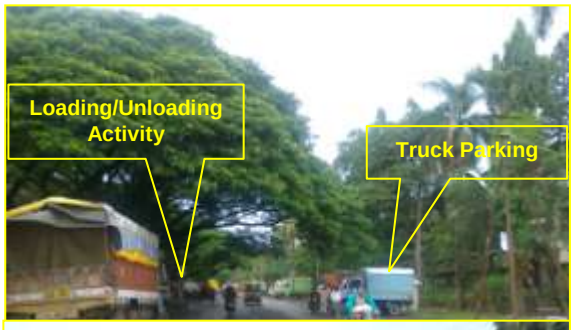


Figure 5-4 Traffic Circulation in Civil Hospital and Khanbagh areas

5.1.1.10 College Corner

A. Current Traffic Scenario

- College Corner is the busiest centre/junction where schools and colleges along with commercial shops are located.
- This area is connected by four roads namely Vakharbagh road, Madhavnagar main road, Old Kupwad road and Miraj. All the connecting roads are 2-lane 2-way roads.
- Madhavnagar road carries major traffic (23,305 PCUs) which leads to Bhudhgaon and Tasgaon areas. Vakharbagh road and Old Kupwad road (Timber area) are major goods vehicle carriers.
- A lot of commercial vehicles (Goods Auto, 2-Axle trucks and 3-Axle trucks) are



observed in Timber area where Timber shops are present and loading and unloading activities take place on the road.

- Old Kupwad road is the main road connecting from Madhavnagar to Sangli Railway station and Kupwad.
- Miraj and Vakharbagh roads are in poor condition where a number of pot holes are observed reducing journey speeds. The average journey speed on all the roads is around is 28 Kmph.
- Parking is observed on both sides of the Vakharbagh and Old Kupwad roads including Goods Vehicles.
- Significant pedestrian crossing is observed at College Corner Jn.
- Signals at College Corner Jn are not working.
- Pedestrian crossing and heavy traffic flow is responsible for congestion at college corner and is unsafe for pedestrians.

B. Proposed Improvements

In order to ensure smooth vehicular traffic movement on this road, consultants recommend following improvements:

- A minimum footpath width of 1.5m should be provided on either sides of Vakharbagh road and Miraj road. Zebra crossings should be provided on all access roads at College Corner Jn. Signals at College Corner Jn should be designed for the peak period.
- On-street parking for 2-wheelers and 4-wheelers should be restricted to one side of the Vakharbagh and Miraj road in zigzag pattern.
- Proper sign boards showing the speed limits, pedestrian crossing, important places, etc should be placed on the all connecting roads.
- Maintenance work related to footpaths, potholes, etc has to be carried out on all the connecting roads. Lane markings should be marked on all the connecting roads.

5.1.1.11 Sangli Stand

A. Current Traffic Scenario

- Sangli Stand is busiest bus terminal in Sangli which includes both regional and city buses.
- At present, around 54,000 passengers are using this terminal.
- Sangli stand has direct access from road connecting to 100ft road, Kolhapur road, Ankali road, Stand road,Sant Kotnis Maharaj Road, and Ambedhkar road. It has four entry/exit points accessing all directions.

- All the connecting roads are 2-lane roads except Ankali road which is an intermediate lane.
- Buses move on Sant Kotnis Maharaj Road, Ambedkar road, Kolhapur road and S.T stand road only.
- Parking is observed on both sides of these roads. As Sangli S.T Stand includes both city and regional operations, around 2300 daily bus trips move in and out at all the four gates.
- Private buses boarding/alighting is observed on Sant Kotnis Maharaj road reducing the effective carriageway.
- Bus circulation within the Sangli stand is congested due to less space (city and regional operation) and pedestrian waiting in the circulation area.

- Pedestrian crossings are not available on all the roads. Hawkers and Vendors are occupying significant portion of the main carriageway near Sangli S.T Stand.

Present bus circulation of intra-city and inter-city buses is shown in **Figure 5-5**.

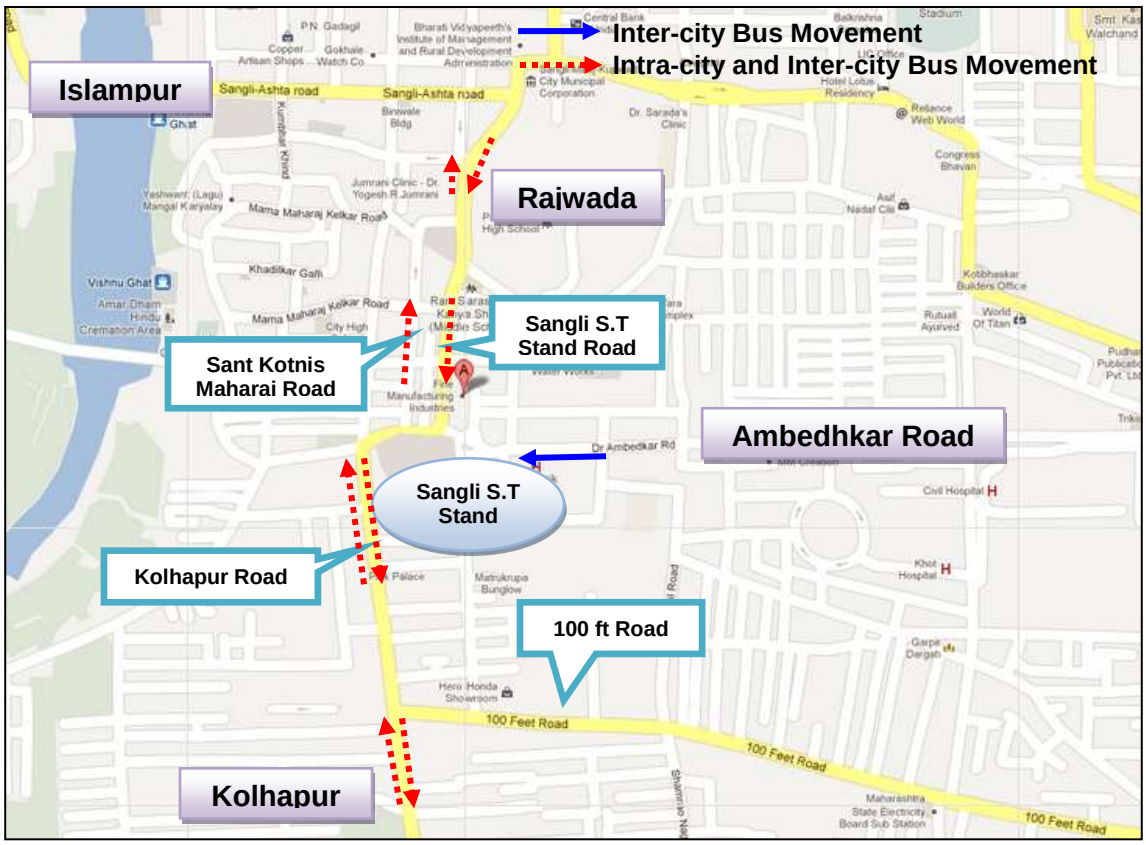


Figure 5-5 Present Bus Circulation at Sangli S.T Stand

B. Proposed Improvements

In order to ensure smooth vehicular traffic movement on this road, consultants recommend following improvements:

- A minimum footpath width of 1.5m should be provided on either sides of all the connecting roads with zebra crossings except Ankali road and road connecting to 100 ft road due to narrow road widths.
- On-street parking for 2-wheelers and 4-wheelers should be restricted to one side of the road (Sant Kotnis Maharaj Road, Ambedkar road, Kolhapur road and S.T stand road) in zigzag pattern.
- Proper sign boards showing the speed limits, pedestrian crossing, important places, etc should be placed on the all connecting roads.
- Hawkers and Vendors should be cleared from either sides of main carriageway at Sangli S.T stand.
- Buses should be stopped at platform in Sangli stand which avoids passenger spilling all over circulation area.
- The city and regional buses platforms are not sufficient which should be organised in very efficient way.
- Intra-city buses should operate on both Sangli stand road and Ambedkar road whereas inter-city buses operate on Sangli stand road (towards Islampur and Madhavnagar) and 100 ft road (towards Pandharpur, Bijapur and Kolhapur).
- Private Buses should be restricted on all the connecting roads during peak periods whereas they can use 100ft road for alighting or boarding.

- Existing and proposed improvements to Sangli S.T Stand terminal are discussed in detail in public transport improvement proposals.

Proposed bus circulation of intra-city and inter-city buses is shown in Figure 5-6.

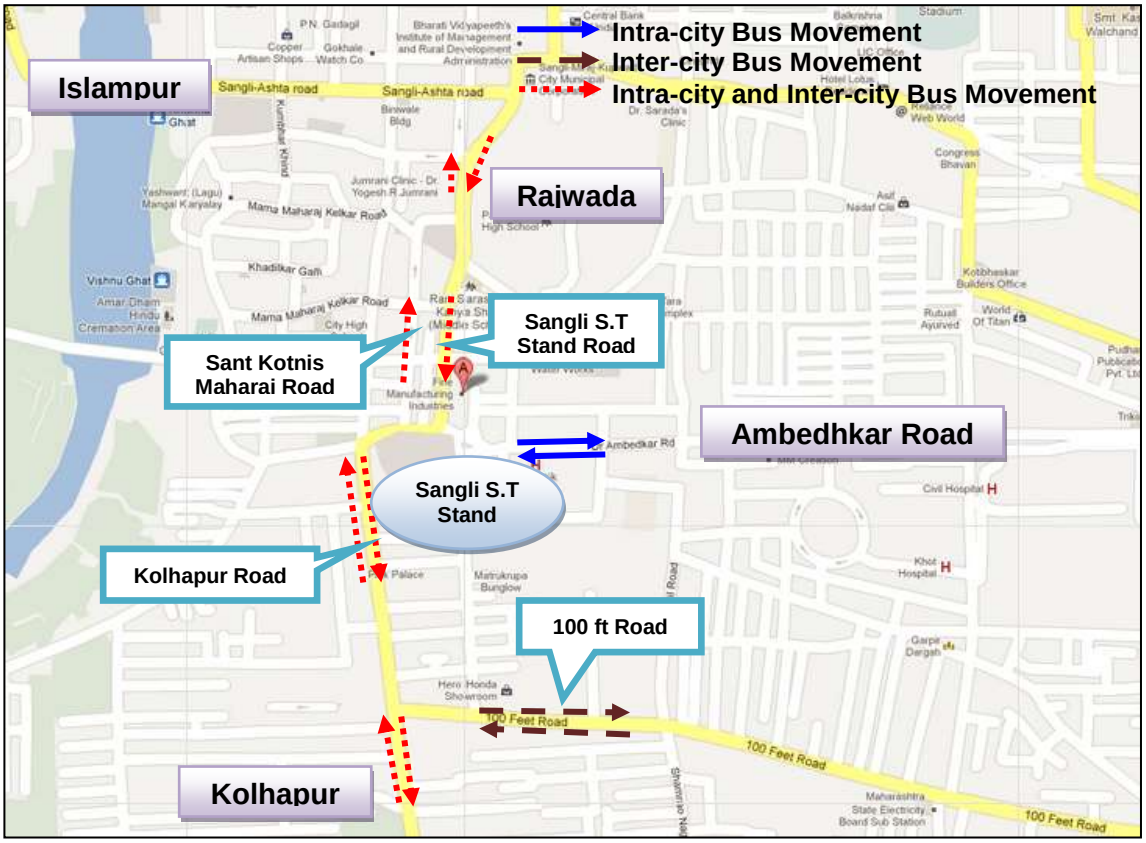


Figure 5-6 Proposed Bus Circulation at Sangli S.T Stand

5.1.1.12 Sangli Railway Station

A. Current Traffic Scenario

- Sangli railway station is located near Vassanthdada market yard.
- It is generally connected by Old Kupwad road, Prem nagar road and Vasanthdada Agricultural market yard road. All the connecting roads are 2-lane 2-way roads.
- People traveling towards Kolhpaur, Pune and Mumbai use this terminal. About 5000 passengers per day use this terminal in which around 80% of the trips travel during peak periods (6:00 A.M to 11:00 A.M and 4:00 P.M to 11:00 P.M).

- Generally, buses access through Old Kupwad road to this station.
- Auto play an important role in accessing the railway station through Sangli stand-Rajwada-Pushparaj Jn-Vasanthdada market yard route.
- A lot of commercial vehicles (Goods Auto, 2-Axle trucks and 3-Axle trucks) are observed for accessing Vasanthdada Market yard and Sangli Railway Godown where loading and unloading activities take place on the main carriageway reducing the effective carriageway.

- From Goods Focal Point survey, it is observed that around 1600 commercial vehicles move in and out of Vasanthdada Market Yard and Sangli Railway Godown. The internal roads and accessing roads for Sangli railway station and Vasanthdada market yard are in poor condition due to the absence of drainage facilities. There is no street lighting facility.
- There are no lane markings, footpaths and sign boards present on accessing roads to Sangli railway station.

B. Proposed Improvements

In order to ensure smooth vehicular traffic movement on this road, consultants recommend following improvements:

- A minimum footpath width of 1.5m should be provided on either sides of Vasanthdada market yard road with proper sign boards showing the speed limits, pedestrian crossing, important places, etc.
- Maintenance work related to potholes, lane markings, etc has to be carried out on Vasanthdada market yard road.
- Mini buses should be introduced during peak period through Sangli stand-Rajwada-Pushparaj Jn-Vasanthdada market yard route with a total length of 3.9 km.
- Commercial vehicles should use 100 ft road and Old Kupwad road for accessing Vasanthdada Market Yard and Sangli railway godown during off-peak periods.

5.1.1.13 Vishrambagh

A. Current Traffic Scenario

Vishrambagh Junction

Queue formation at Vishrambagh Level Crossing

- Vishrambagh area is the commercial development area where lot of Hotels and Computer training institues are located.
- This area is connected by four roads namely Vishrambagh road, 100 ft road and Sangli-Miraj main road at Vishrambagh Jn. All the connecting roads are 4-lane configuration. Vishrambagh main road is the major connecting link to Kupwad which is 4-lane configuration with undivided carriageway (Length = 1.1 km) contributes traffic from Sangli-Miraj road and 100 ft road. As per Draft Development Plan of S-M-K CMC, the width of the road is 30.48m. Around 17,453 PCUs flow on this road.
- The average journey speed on Vishrambagh main road is 33 Kmph.
- Signals present at the Vishrambagh Jn are not working.
- A number of accidents occur at the existing level crossing on Vishrambagh road (TVUs = 189273) and also forms queues which is the main cause for delays on this road.
- There are no footpaths available on this road.
- Parking is observed on either sides of the Vishrambagh main road.

B. Proposed Improvements

In order to ensure smooth vehicular traffic movement on this road, consultants recommend following improvements:

- A minimum footpath width of 1.5m should be provided on either sides of Vishrambagh road with proper sign boards showing the speed limits, pedestrian crossing, level crossing, etc.
- A median should be provided along the Vishrambagh main road (4-lane road portion).
- Speed breakers should be provided at level crossing with proper signboard.
- ROB is recommended at Vishrambagh level crossing to reduce accidents and formation of long queues.
- On-Street parking for 2-wheelers can be allowed on both sides of the Vishrambagh main road.
- Signals should be designed for the peak hour (i.e., 19:15 PM to 20:15 PM)
- Inter-city buses which start from Sangli stand should join at this Vishrambagh Jn and pass towards Miraj and Kupwad.

5.1.1.14 M.I.D.C

A. Current Traffic Scenario

- M.I.D.C is the major industrial area in S-M-K city. M.I.D.C area consists of two blocks namely Miraj M.I.D.C which is located within S-M-K CMC whereas Kupwad M.I.D.C located out of S-M-K CMC. Several engineering and manufacturing units are present in M.I.D.C.
- This area is accessed from Kupwad road, Pandarpur road and Mission Hospital Road. All the connecting roads are of 2-lane configuration.
- At present, most of the traffic passes through the Kupwad and Mission Hospital road creating congestion in core areas of the city (Jath road, Old Kupwad road, etc). Pandharpur road is a 2-lane road starting from Savali and joining Octroi on Pandharpur road at approximately 10 km (Narrow road is present at some section of this road).
- The average journey speed in M.I.D.C is around 28kmph.
- There is no truck parking observed in M.I.D.C area. Trucks are parked on the main road at some sections reducing the effective carriageway width.
- The access roads for M.I.D.C are in poor condition. There is no footpath available near the Kupwad area on Old Kupwad road which is not safe to pedestrians.

B. Proposed Improvements

In order to ensure smooth vehicular traffic movement on this road, consultants recommend following improvements:

- A minimum footpath width of 1.5m should be provided on either sides of Old Kupwad road near Kupwad Gaothan.
- Lane markings and zebra crossings with sign boards (such as speed limits, pedestrian crossing, etc) should be provided on all accessing roads to Kupwad Gaothan which is a residential area.
- Maintenance work related to potholes, etc has to be carried out on internal accessing roads to M.I.D.C.

5.1.1.15 Mission Hospital

A. Current Traffic Scenario

- Mission Hospital area is the busiest junction in S-M-K CMC where it is connected with six roads namely Pandarpur road (D.P Width = 45.72m), Vijapur road (D.P Width = 30.4m), Mangalwarpet road, Shivaji road and Sangli road (D.P Width = 45.7m).
- The major portion of the traffic flows on Jath road (Vijapur road and Pandarpur road) and Sangli-Miraj road.
- All the connecting roads are of 2-lane configuration whereas Sangli-Miraj is a 4-lane road.


Irregular approaching at Mission Hospital Jn

- The landuse on either sides of the Jath road is mostly commercial.
- Significant proportion of the pedestrian movement is observed at Mission Hospital due to hospital, shops, schools and colleges.
- Commercial vehicles from Bijapur road, Pandharpur road and Miraj-Kolhapur bypass road use Jath road for accessing M.I.D.C. creating heavy congestion near Miraj Stand and at Mission Hospital which are unsafe for the pedestrian movement.
- Parking is observed on both sides of the Jath road. The average speed on Jath road (Bijapur road Octroi - Pandharpur road Octroi) is 32 Kmph.
- Cycles constitutes around 20% of the total traffic at Mission Hospital Jn.
- There is no footpath facility available on this road.
- Signals are not working at Mission Hospital.
- The existing petrol bunk at the Mission Hospital Jn creates turning movement problems.
- Hawkers and Vendors are present on either sides of the road forcing pedestrians to use main carriageway causing delays and is unsafe.

B. Proposed Improvements

In order to ensure smooth vehicular traffic movement on this road, consultants recommend following improvements:

- M.I.D.C road at Mission Hospital Jn should be used as one way from M.I.D.C to Mission Hospital Jn where as opposite road of Central excise department can be used as return direction for all vehicles.
- A minimum footpath width of 1.5m should be provided on either sides of Jath road by clearing encroachments, hawkers and vendors.

- Parking can be allowed for 2-wheeler on Jath road for one side whereas paid parking should be provided for 4-wheelers on minor accessing roads.
- Pedestrian facilities like lane markings, zebra crossings and sign boards (such as speed limits, pedestrian crossing, no parking, etc) should be provided on all the major connecting roads of Jath road.
- Cycles should use left side of the road and start/stop of the private vehicles on Jath road should be avoided for longer durations.
- The approaching legs of Mission Hospital Jn should be modified to standard junction design in order to have smooth flow of traffic movement.
- The junction should be signalised due to more vehicular and pedestrian movement.
- Median should be provided on Sangli-Miraj road near Mission Hospital. Railings should be provided separating petrol bunk from main road in order to avoid tuning movement problems.

5.1.1.16 Laxmi Market

A. Current Traffic Scenario

- Laxmi Market is the busiest market area in Miraj where a lot of pedestrian movement and parking is observed on either side of the connecting roads.
- This area is accessed from Miraj stand, Shastri Jn, Malgaon road and Shaniwarpeth (D.P. Width = 15.25m).
- All the roads have very narrow widths varying from intermediate lane to two lane roads.
- Hawkers and Vendors use the part of the main carriageway reducing the capacity of the roads.
- About 1143 ECS are observed on Shaniwarpeth road (Kisan Jn-Momin Masjid, Length = 0.67 km).
- At present, major portion of the traffic on Shaniwarpeth road constitute 2-wheeler, cycle and auto which lead to the dense residential areas of the Miraj.
- Buses flow on Miraj stand road and Malgaon road.
- There are no footpath facilities available which is not safe in market area.


Parking at Laxmi Market


Hawkers and Vendors on either side of Shaniwarpeth road

B. Proposed Improvements

In order to ensure smooth vehicular traffic movement on this road, consultants recommend following improvements:

- Pedestrian facilities like lane markings, zebra crossings and sign boards (such as speed limits, pedestrian crossing, etc) should be provided on all the connecting roads at Srikanth Jn and Kisan Jn.
- Paid parking should be allowed for 2-wheelers only on all the connecting roads.
- Mini Buses can be introduced extending from Laxmi market to Shaniwarpeth road during peak hours.

- Commercial vehicles should be restricted on Shaniwarpeth road (except Goods Auto).
- Hawkers and Vendors should be cleared from either sides of the Miraj stand and Malgaon roads whereas they should be cleared from using the main carriageway on Shaniwarpeth and Shasthri Jn roads.

5.1.1.17 Miraj City Stand

A. Current Traffic Scenario


Congestion at Miraj City Stand

- Miraj city stand is congested area which is connected by Jath road (Pandharpur-Bijapur road), Darga road and Station road.
- All the connecting roads are 2-lane 2-way roads. All the turning movements at this junction are not well organised leading to congestion.
- There are no lane markings and zebra crossings.
- Hawkers and vendors are present on either side of the roads forcing pedestrians to use main carriageway.
- Parking is observed on all the connecting roads at Jn.
- Jath road is in poor condition reducing journey speeds.
- Miraj city stand is located at junction which also generates high pedestrian movement. It has three entry/exit gates. Around 1100 buses move in and out of Miraj City Stand from all the gates which is also a cause for delays at junction. A view of Miraj city stand is shown in **Figure** 5-7. At present, Gate No.1 is mostly used by pedestrians where as Gate No.2 and Gate No.3 are used by buses and pedestrians in two way direction. The turning movement of buses at Gate No.2 from Pandharpur road and Miraj city stand Jn to city stand is creating conflicts leading to delays at junction.

B. Proposed Improvements

In order to ensure smooth vehicular traffic movement on this road, consultants recommend following improvements:

- Parking should be restricted to one side of the road for 2-wheelers and 4-wheelers on all connecting roads.
- Pedestrian facilities like lane markings, zebra crossings and sign boards (such as speed limits, pedestrian crossing, no parking, etc) should be provided on all the connecting roads at Miraj city stand Jn.
- Commercial vehicles should be restricted on all roads during peak period.
- The junction should be signalised due to more vehicular and pedestrian movement.
- Hawkers and Vendors should be avoided from Jath road and Miraj city stand Jn.
- Gate No.1 and Gate No.2 should be used as one way flow from Miraj City Stand to all directions where as Gate No.3 should be one-way towards Miraj City Stand from all directions except from Bijapur road and Laxmi market road as shown in Figure 5-7.

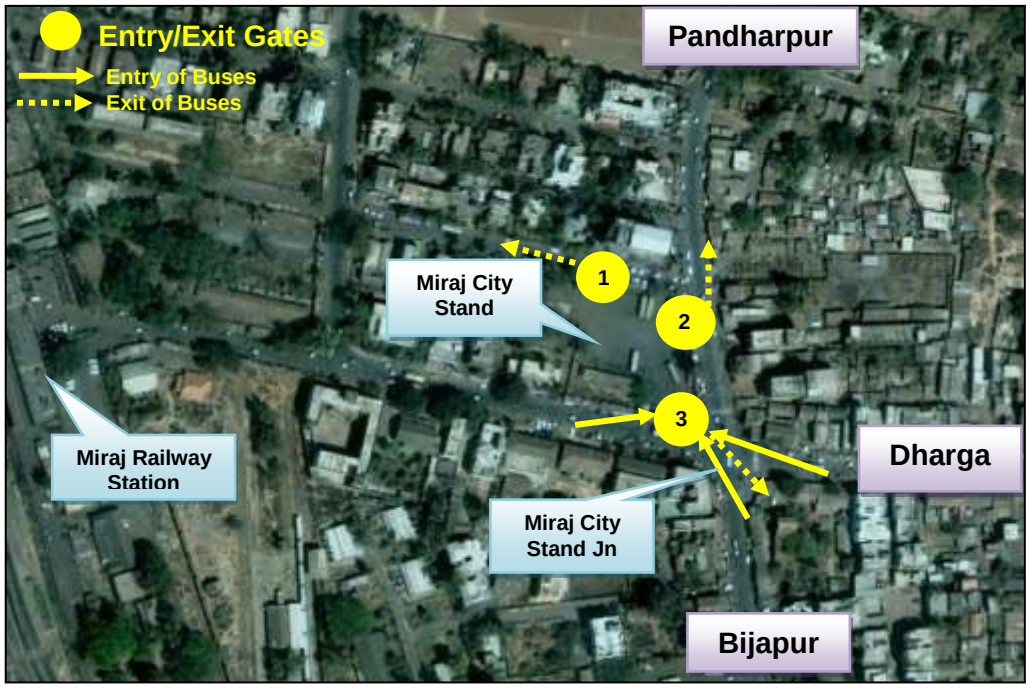


Figure 5-7 Proposed Entry/Exit movement of Bus at Miraj City Stand

5.1.1.18 Miraj Railway Station

A. Current Traffic Scenario

- Miraj railway station is located near Miraj City Bus Stand and is the busiest junction.
- It is generally connected by Station road and Vantamure Corner road. All the connecting roads are 2-lane 2-way roads. People traveling towards Kolhpaur, Pune and Mumbai use this terminal.
- About 33,000 passengers use this terminal.
- Generally, buses access through Vantamure Corner road and Station road. Buses play an important role in accessing this railway station.
- Many commercial vehicles are observed on these access roads connecting Sangli-Miraj main road.
- Vantamure Corner road is in poor condition due to the absence of drainage facilities.
- Footpath is available on both the roads (Width = 1.2m - 1.5m) where usage is less due to parking and utilities on footpath.
- There are no lane markings and proper sign boards present on accessing roads to Miraj railway station.

Approach Road at Miraj Railway Station

Poor Condition of Vantamure Corner Road

- At times, autos use to stop on road otherthan auto stand reducing the effective carraigeway. Hawkers and vendors are observed on station road.

- Parking of 2-wheelers and 4-wheelers is also observed on station road and on footpaths.

B. Proposed Improvements

In order to ensure smooth vehicular traffic movement on this road, consultants recommend following improvements:

- Existing footpaths should be cleared of from encroachments, parking and hawkers/ vendors. An extra footpath width of 1.0m can be provided on Station road with guard rails due to more pedestrian movement to Miraj Railway Station.
- Pedestrian facilities like lane markings, zebra crossings and sign boards (such as speed limits, pedestrian crossing, no parking, etc) should be provided on all the accessing roads at approach of the Miraj railway station.
- Maintenance work related to potholes, lane markings, etc has to be carried out on Vantamure Corner road.
- Auto Rickshaws are required to stop only at auto stands which require enforcement.
- Parking can be allowed for 2-wheelers and 4-wheelers on one side of station road.
- Hawkers and vendors should be avoided from using main carriageway on Station road.
- Commercial vehicles (except Goods Auto) should not be allowed during peak period which should be stopped near Octroi at all Outer Cordons.

5.1.1.19 Summary of Traffic Management Proposals

The following are the list of traffic managements proposals discussed above for the important areas in the S-M-K City.

- Proper sign boards showing regulatory, warning and guide signs boards (such as speed limits, pedestrian crossing, no parking, no entry, etc) should be provided at important junctions, arterial/sub arterial roads, entry/exit points of market areas, cordon points, accident prone locations, school/college zones and other commercial areas.
- Zebra crossings, Lane Markings and Stop lines should be marked on all arterials and sub arterial roads.
- Parking should be restricted on arterial roads where as they can be allowed partially on sub-arterial roads in zigzag pattern. Paid parking can be allowed for 2-wheelers in congested areas.
- Hawkers and Vendors should be avoided from either sides of the road on all arterial roads and they can be restricted from using the main carriageway near market areas. Hawkers and Vendors should be restricted from using footpaths.
- Maintenance work related to potholes, lane markings, etc has to be carried out in most of the S-M-K CMC roads.
- Junctions should be designed in a proper way such that merging and diverging problems can be avoided. Some of the junctions in S-M-K CMC are widely spread and needs proper design discussed in later section.
- Bus stop should be provided with proper shelter and can be separated by bus bay on arterial roads. They should be located 50-100m away from important junctions and market areas
- Auto/Taxi stand should be restricted from using arterial roads where as they should be located at 50-100m away from important junctions and market areas. Auto Rickshaw should be stopped only at auto stands which need strict enforcement.
- Before implementation of Traffic Management Schemes, traffic awareness programmes shall be organised.
- Commercial vehicles (except Goods Auto) should not be allowed during peak periods (i.e., 9:30 AM to 12:45 PM and 16:45 PM to 20:45 PM) inside the city which should be stopped near Octroi at all Outer Cordons.

5.1.2 Junction Improvement proposals

Consultants have reviewed the important junctions in the commercial areas and suggested Junction improvements below. Junction Improvement proposals comprises of improvements in geometrics, provision of signals, shifting of bus stop and auto- rickshaw stands, provision of road markings/signage, provision of lighting etc. and presented in **Table** 5-1.

Table 5-1 Area Wise Junction Improvement Proposals

Sangli	Miraj	Kupwad
✓ Tilak Jn	✓ Vantamure Corner	✓ Vishrambagh Jn (At Ambassador Hotel)
✓ Maruthi Road Jn	✓ Mission Hospital Jn	✓ Vishrambagh Jn (At Police Head Quarters)
✓ Tarun Bharat Jn	✓ City Bus Stand	
✓ Muncipal Jn		
✓ Rajwada Jn		
✓ Congress Bhavan Jn		
✓ Pushparaj Jn		
✓ Vasanthdada Market		
✓ College Corner		

5.1.2.1 Tilak Junction

A. Current Traffic Scenario/Issues

- Tilak Jn is a 4-legged uncontrolled intersection. It is formed by the intersection of Harbhat road (Sangliwadi-Municipal Jn), Ganapathi Lane Road and Anand Theatre Road. The peak hour traffic at Tilak Jn is 3276 PCUs (11:00 AM to 12:00 PM).
- The traffic flow on all the approaching roads for all vehicles (except 2-wheelers, 4-wheelers, Auto and Cycles) is one-way except on Sangliwadi road with 2-lane configuration.
- Auto and Taxi stands are present at junction. Boarding/alighting to auto and taxi is taking place on main carriageway at junction creating delays and vehicle conflicts.
- Total right turning traffic, left turning traffic and through traffic at this Jn constitutes 19%, 29% and 52% respectively.
- Cycles constitutes 31% of the total traffic. There are no foot path facilities on any of the approach roads except on Ganapathi lane road where they are occupied by parking of 2-wheelers.
- There are no clear zebra crossings and stop lines.
- A speed breaker present on the Anand theatre road is damaged.
- There are no proper sign boards present on all the roads.

B. Proposed Improvements

In order to ensure smooth vehicular traffic movement on this road, consultants recommend following improvements:

- The traffic flow on Municipal Jn road should be one-way flow whereas 2-way flow on Sangliwadi Road. The traffic flow on Anand Theatre road should be one way road towards Tilak Jn. The traffic flow on Ganapathi Mandhir road should be one way road towards Ganapathi Mandhir except for 2-wheelers.

- The traffic flow in this area should be controlled manually since it is located near Irwin Bridge.
- Zebra Crossings and Lane markings should be provided on all approaching legs of Tilak Jn. Proper sign boards showing various signs (Regulatory, Warning and Guide signs) should be placed on all approaching legs at this Jn.
- Lane markings should be marked for cycle movement on either side of the Harbhat (Municipal Jn) road.
- A minimum footpath of 1.5m should be provided on either sides of Harbhat road whereas footpath should be cleared from encroachments on Ganapathi lane road.
- The small roundabout present at the centre of the junction should be raised up to 0.5-1.0m height for visibility and convenience for turning movement traffic.
- Speed breaker of 10 cm height should be provided on the Anand Theatre road.
- Parking should be cleared of from the footpaths and should be restricted on Anand theatre road whereas parking should be allowed for 2-wheelers on other roads.
- Auto and Taxi should be strictly avoided from stopping on carriageways at Tilak Jn.

Tilak Junction is shown in **Figure** 5-8.

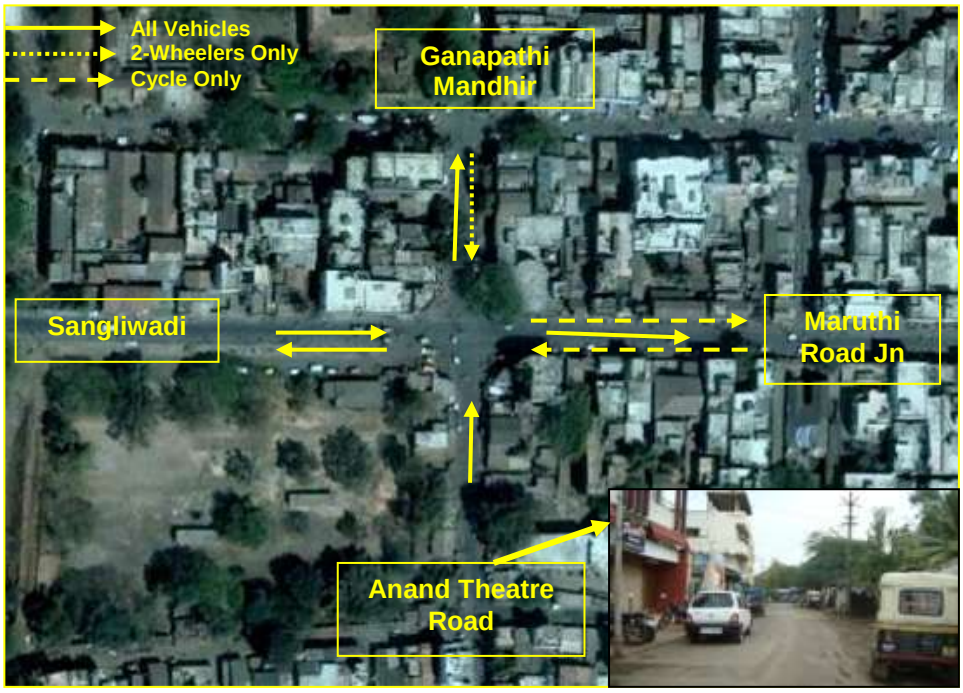


Figure 5-8 Tilak Junction

5.1.2.2 Maruthi Road Junction

A. Current Traffic Scenario/Issues

- Maruthi Road Jn (Garment Jn) is a 4-legged uncontrolled intersection. It is formed by intersection of Harbhat road and Maruthi road with 2-lane configuration.
- The peak hour traffic at Garment Jn is 2778 PCUs (19:45 PM-20:45 PM).
- The traffic flow on Maruthi road is 2-way flow for 2-wheelers, 3-wheeler and 4-wheeler only where commercial vehicle movement is also observed. The traffic flow on Harbhat road is 2-way flow for 2-

wheelers, 3-wheelers and 4-wheelers only in Tilak Jn direction whereas it is one way flow in Municipal Jn direction where 2-wheelers and cycles are exempted.

- The traffic flow at this Jn is uncontrolled and complex which is not safe.
- Pedestrian crossing is high at this Jn along Maruthi road where available zebra crossings are not clear.
- There are no stop marking/boards on the road at Jn.
- Hawkers and vendors are more on either sides of the Maruthi road near Jn.
- Parking is observed on all the approaching legs of the Jn.
- The total traffic approaching at this junction is distributed into right turning traffic, left turning traffic and through traffic which constitutes 12%, 21% and 67% respectively.
- There are no footpaths on all the approaching roads at this Jn. Signals are not working at this Jn.

B. Proposed Improvements

In order to ensure smooth vehicular traffic movement on this road, consultants recommend following improvements:

- The traffic flow on the Harbhat road should be one way for all vehicles in Municipal Jn direction whereas it should be 2-way flow on Maruthi road for Cycle, 2-wheeler and 4-wheeler.
- A minimum footpath width of 1.5m should be provided on either sides of Harbhat road and Maruthi road.
- Zebra Crossings and Lane markings with proper sign boards showing various signs (Regulatory, Warning and Guide signs) should be placed on all approaching legs at this Jn.
- Lane markings should be provided on the Harbhat road for Cycle movement on either side of the road.
- Parking can be allowed for 2-wheelers only on Harbhat road. Paid parking can be allowed for 2-wheelers and 4-wheelers on Maruthi road.
- Signals present at this Jn should be repaired and designed considering vehicle and pedestrian aspects.

Maruthi Road Jn is shown in **Figure 5-9**.

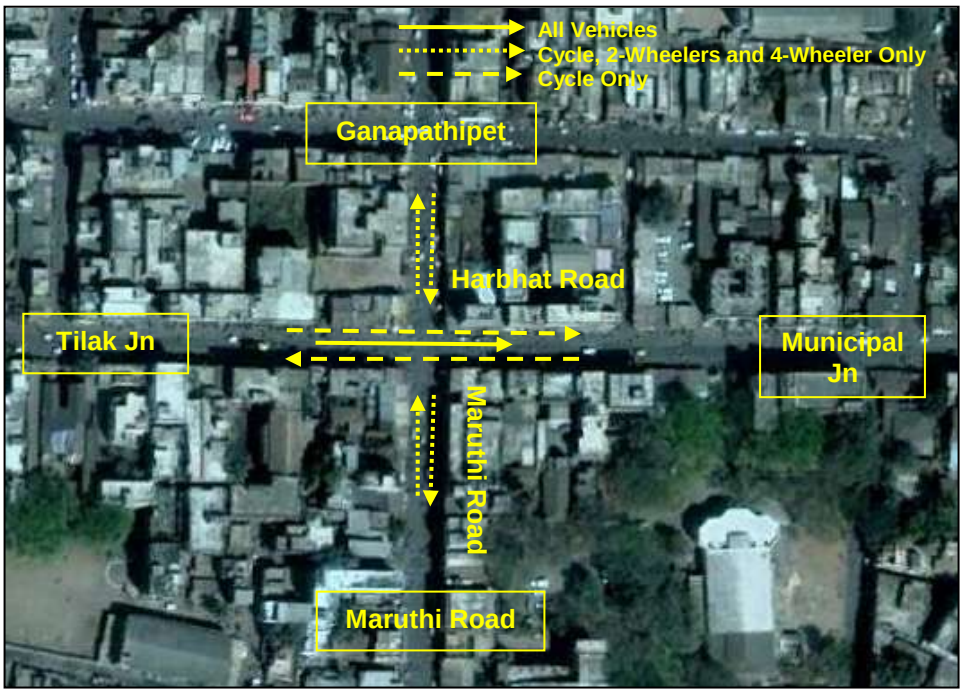


Figure 5-9 Maruthi Road Jn (Garment Jn)

5.1.2.3 Tarun Bharat Junction

A. Current Traffic Scenario/Issues


Tarun Bharat Jn

Bus Stop and Auto Stand near Tarun Bharat Jn

- Tarun Bharat Jn is a 3-legged uncontrolled intersection. It is formed with Kameti road and Anand Theatre road with 2-lane configuration. The peak hour traffic at Tarun Bharat Jn is 2509 PCUs (17:30 PM-18:30 PM).
- The current traffic flow on all the approaching roads is 2-way flow direction except Anand Theatre road where it is restricted to all vehicles other than 2-wheelers and 4-wheelers towards Jn.
- High Mast lighting is provided at the centre of the junction.
- Parking is observed near junction on Kameti road and on Anand Theatre road.
- Autos are observed to parking near bus stop illegally other than existing auto stand on minor road reducing the effective carriageway of the major road (Kameti Road).
- Total right turning traffic, left turning traffic and through traffic constitutes 9%, 27% and 64% respectively.
- Footpath is available on Kameti road with a width of 1.5m which is occupied by encroachments, hawkers and vendors at some sections.

B. Proposed Improvements

In order to ensure smooth vehicular traffic movement on this road, consultants recommend following improvements:

- Traffic flow from Anand Theatre towards Tarun Bharat Jn should be restricted which is allowed on to Harbhat road.
- Encroachments should be cleared off from footpaths on Kameti road. Hawkers and Vendors should be restricted from using footpath on Kameti road.
- Anand theatre road should be cleared from encroachments and parking should be restricted as the available D.P width is only 9.15m where as existing lane configuration is intermediate lane.
- Triangular channelized island can be provided at this Jn.
- Zebra Crossings and Lane markings with proper sign boards showing various signs (Regulatory, Warning and Guide signs) should be placed on all approaching legs at this Jn.
- Bus stops should be located at 50-100m away from junction to avoid delay at junctions. Autos should be stopped at available auto stand on minor road only. Auto parking at Bus stop should be avoided with strict enforcement.
- The traffic movement at this junction should be controlled manually by traffic police.

Tarun Bharat Junction is shown in **Figure 5-10**.

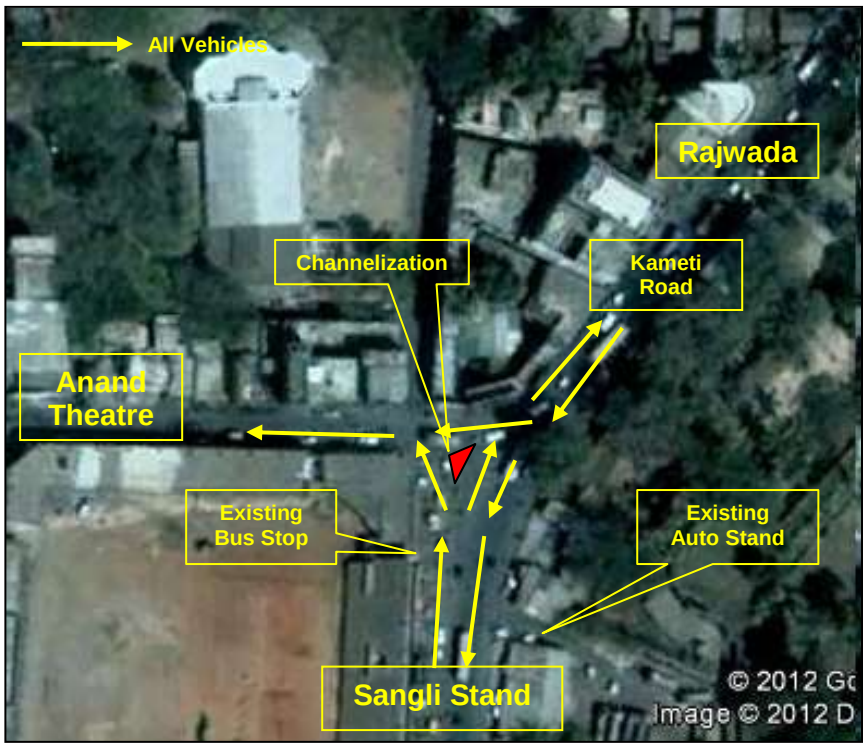


Figure 5-10 Tarun Bharat Junction

5.1.2.4 Municipal Junction

A. Current Traffic Scenario/Issues

- Municipal Jn is a 3-legged intersection. It is formed by Sangli-Miraj main road and Harbhat road with 2-lane configuration roads. The peak hour traffic at Municipal Jn is 3476 PCUs (10:00 AM-11:00 AM).
- The traffic flow on all the approaching roads is 2-way flow direction except Harbhat road where it is restricted to all other than 2-wheelers in Islampur direction.
- Parking is observed near junction on Kameti road where hawkers are using the footpath.

Hawkers at S-M-K CMC near Municipal Jn

- Auto stand is present at this junction on Harbhat road.
- Total right turning traffic, left turning traffic and through traffic at this Jn constitutes 34%, 17% and 49% respectively. It is observed right turning traffic at this junction is high which leads to more conflicts.
- Cycles constitute around 21% at this junction whereas 26% on Harbhat road.
- Footpath is available on Kameti road with a width of 1.5m which is occupied by hawkers near this junction.
- Zebra crossings and lane markings are not clearly visible on all roads.

B. Proposed Improvements

In order to ensure smooth vehicular traffic movement on this road, consultants recommend following improvements:

- Median should be provided on Kameti road at Jn towards Rajwada.

- The traffic flow on Harbhat road should be strictly made one-way towards Municipal Jn whereas cycle track is provided on Harbhat road on either side for 2-way movement. During peak periods, 2-wheelers and 4-wheelers can be allowed on the parallel road (Ganapathipeth road) towards Islampur. Another parallel road (Anand theatre road) at Tarun Bharat Jn allows one-way traffic towards Islampur.
- Hawkers should be avoided from using footpath on Kameti road. A minimum footpath of 1.5m should be provided on either sides of Harbhat road.
- Zebra Crossings and Lane markings with proper sign boards showing various signs (Regulatory, Warning and Guide signs) should be placed on all approaching legs at this Jn.
- The traffic movement at this junction should be controlled by Traffic Police as right turning traffic at this junction is more than 30% which requires rotary type of intersection where space is constraint for turning radius.

Municipal junction is shown in **Figure** 5-11**.**

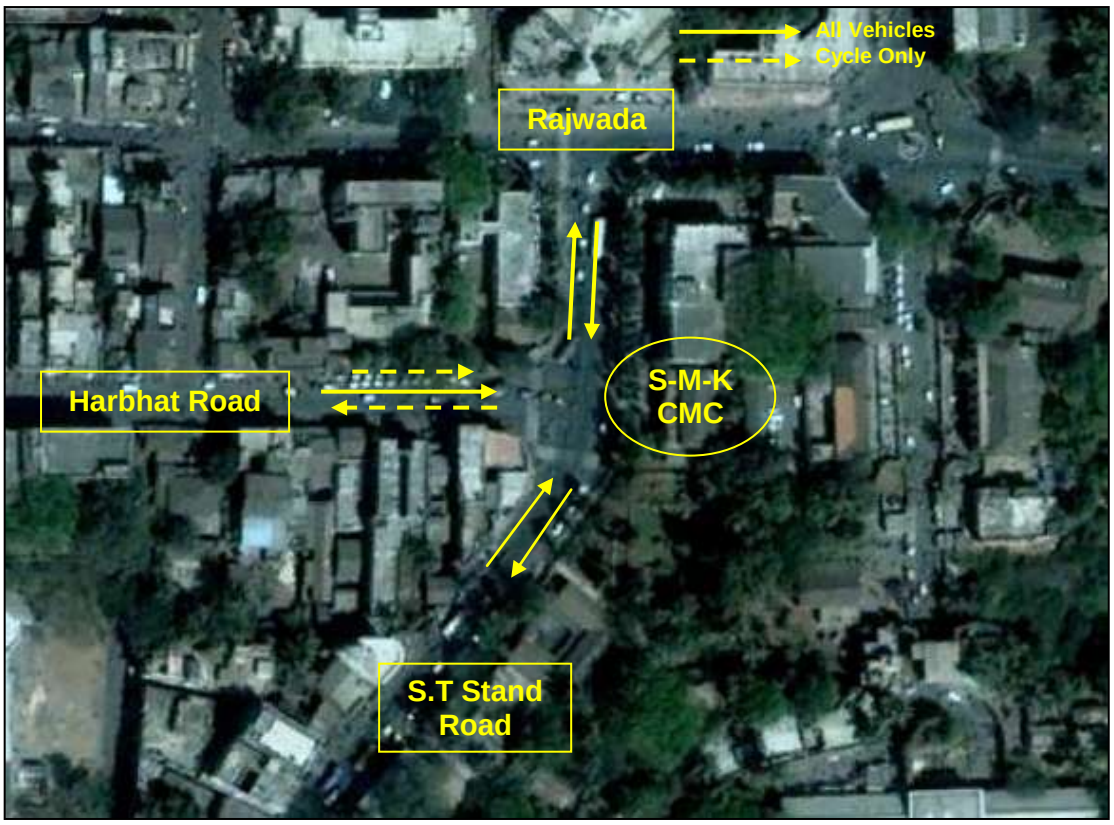


Figure 5-11 Municipal Junction

5.1.2.5 Rajwada Junction

A. Current Traffic Scenario/Issues

- Rajwada Jn is a 4-legged signalised intersection. It is formed with Old Station road (4-lane), Vakharbagh road (2-lane) and Rajwada fort road (Intermediate lane). The peak hour traffic at Rajwada Jn is 4211 PCUs respectively (17:30 PM-18:30 PM).
- The traffic flow on all the approaching roads is 2-way flow direction except on

Rajwada fort road where it is allowed for 2-wheelers and 4-wheelers only.

- Parking is observed near junction on Vakharbagh road and Rajwada fort.
- Footpath on Vakaharbagh road near junction is encroached and parking is observed on footpath.
- Auto stand is present at this junction on Rajwada fort road.
- Total right turning traffic, left turning traffic and through traffic at this Jn constitutes 23%, 22% and 54% respectively. Roundabout is present at this junction which reduces conflicting points.

Zebra Crossing on Old Station road near Rajwada Jn

- Cycles constitute around 21% at this junction whereas 35% on Rajwada fort road.
- Zebra crossings are provided on all approaching roads at improper location.

B. Proposed Improvements

In order to ensure smooth vehicular traffic movement on this road, consultants recommend following improvements:

- Rajwada fort road should be strictly allowed only for cycles, two wheelers and four wheelers.
- Parking should be avoided from using footpath on Vakharbagh road. Footpaths should be maintained properly with a minimum width of 1.5m on either sides of approaching roads.
- Zebra crossings should be provided at approach of the junction on all approaching roads.
- Lane markings with proper sign boards showing various signs (such as speed limits, pedestrian crossing, no parking, keep left, etc) should be placed on all approaching legs at this Jn.

Rajwada junction is shown in **Figure 5-12**.

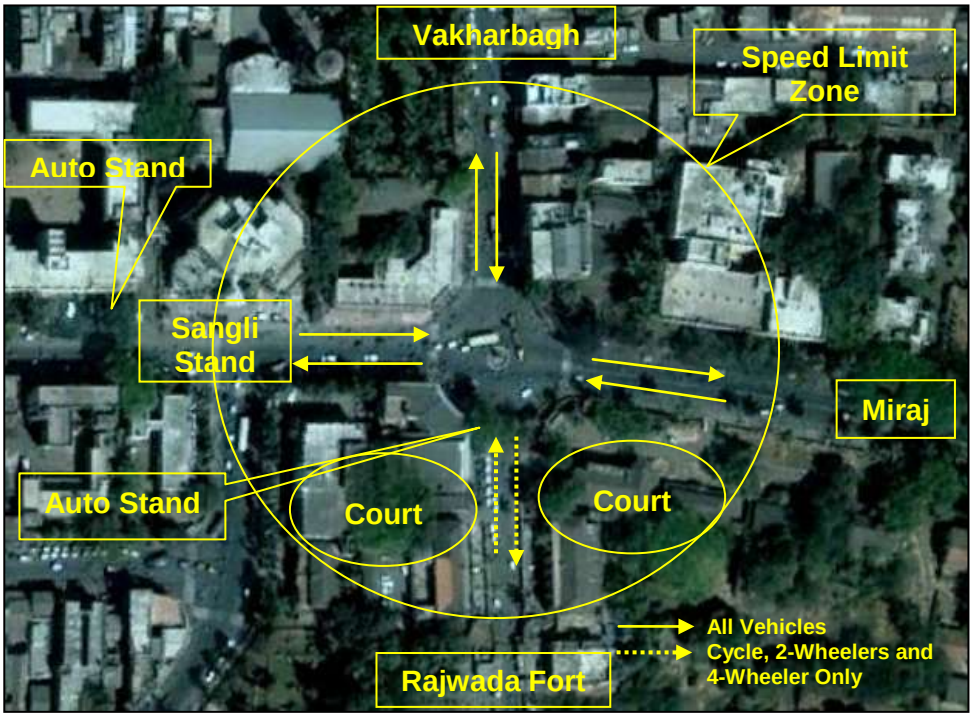


Figure 5-12 Rajwada Junction

5.1.2.6 Congress Bhavan Junction

A. Current Traffic Scenario/Issues

- Congress Bhavan Jn is a 5-legged intersection. It is formed with Old Station road (4-lane), Khanbagh road (4-lane), Miraj Road (2-lane), Madhavnagar road (4-lane) and Shivajinagar road (4-lane). The peak hour traffic at this junction Jn is 3664 PCUs (19:15 PM-20:15 PM).
- The current traffic flow on all the approaching roads is 2-way flow. Madhavnagar road and Miraj road (Pushparaj Jn) join together at Congress Bhavan Jn which is unsafe and creating conflicting area.
- This junction is spread over large area with roundabout present at junction.
- Parking is observed near junction on Old Station road and Khanbagh road. At times, footpath is occupied by parking near junction.
- Auto stand is present at this junction and autos are stopping on main carriageway of Old Station road near junction causing delays.
- Taxis are stopping on main carriageway of Madhavnagar road near bus stop at junction.

Pedestrian Movement at Congress Bhavan Jn

Existing median separating Madhavnagar road and Miraj road

- Total right turning traffic, left turning traffic and other traffic at this Jn constitutes 19%, 23% and 58% respectively.
- Cycles constitute around 24% at this junction whereas 31% on Shivajinagar road and Madhavnagar road.
- There are no zebra crossings on all approaching roads due to which pedestrian movement is observed from middle of the junction which is not safe.
- Median is provided on all roads except Shivajinagar road with sharp edges and is not continuous.

B. Proposed Improvements

In order to ensure smooth vehicular traffic movement on this road, consultants recommend following improvements:

- This junction needs finer approaching legs by providing continuous median at all existing locations with curvy edges.
- Existing 5-legged junction should be confined to 4-legged junction by making the Madhavanagar road as one-way traffic flow from Congress Bhavan Jn and Miraj road as one-way traffic flow to Congress Bhavan Jn. These two roads are separated by continuous median.
- Zebra Crossings, lane markings with proper signboards should be provided on all approaching legs to this junction. Cycle movement should be kept left side of the roads.
- Parking should be avoided from using footpath and also near junction on all approaching roads. High mast lighting should be provided in between round about.
- Taxis should be avoided from stopping near junction.

- Commercial vehicles should be restricted from using Shivajinagar road.

Congress Bhavan junction is shown in **Figure** 5-13**.**

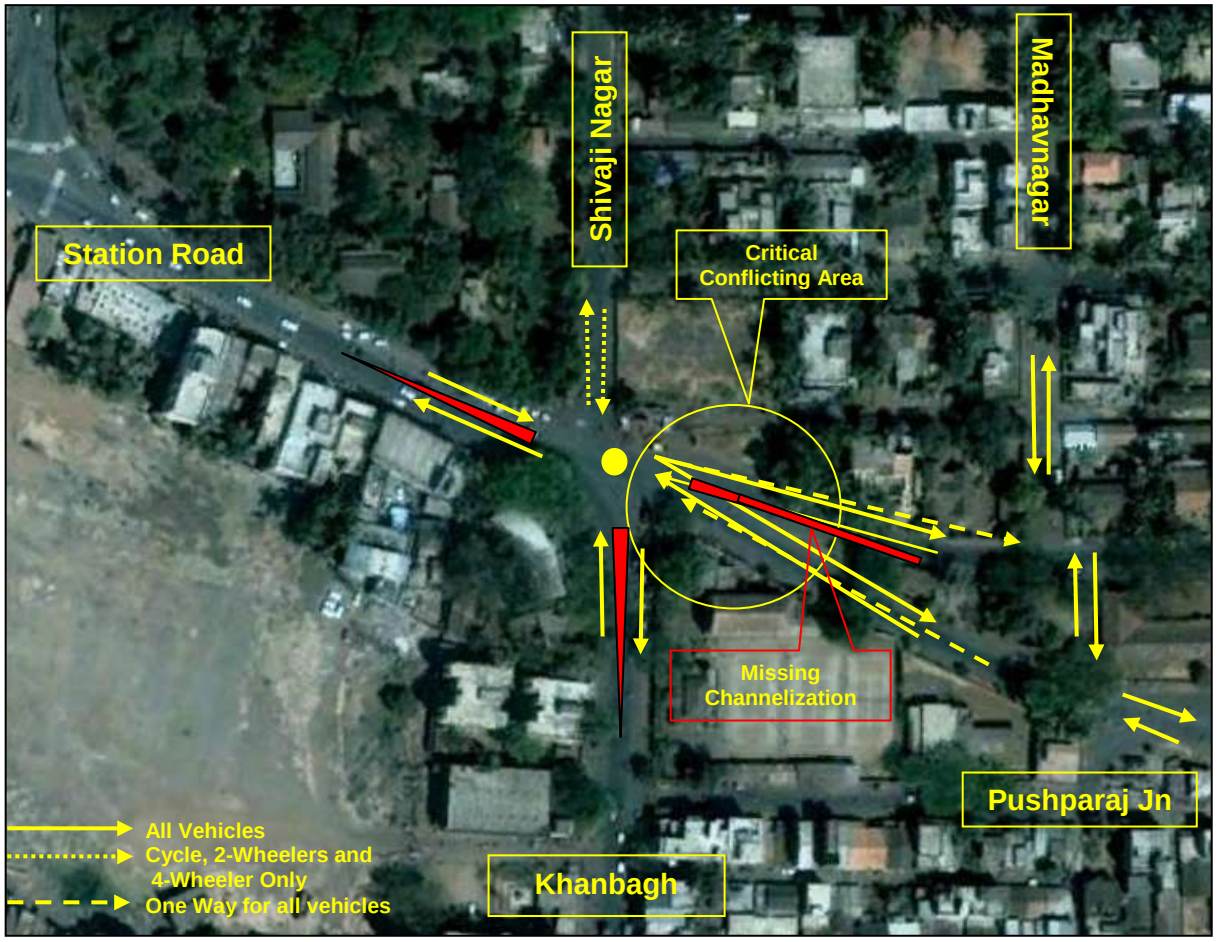


Figure 5-13 Congress Bhavan Junction

5.1.2.7 Pushparaj Junction

A. Current Traffic Scenario/Issues

- Pushparaj Junction is a 5-legged intersection. It is formed with Sangli-Miraj main road (4-lane), Madhavanagr road (2-lane), Ambedkar road (2-lane) and Chandhini Jn road (single lane). The peak hour traffic at Pushparaj Jn is 8307 PCUs (17:30 PM-18:30 PM).
- The current traffic flow on all the approaching roads is 2-way flow whereas Chandhini Jn road is used by 2-wheelers and four wheelers only.
- This junction is spread over large area with roundabout present at junction.
- Bus/Auto stop is present at this junction. Buses are stopping on main carriageway near junction causing delays.
- Total right turning traffic, left turning traffic and other traffic at this Jn constitutes 12%, 12% and 76% respectively.
- Cycles constitute around 17% at this junction.

- There are no footpaths and zebra crossings near junction due to which pedestrian movement is observed from middle of the junction which is not safe.
- Median is provided on Ram Mandhir road whereas it is absent on Miraj road.
- Channelization is provided between Madhavnagar road and Ram Mandhir road where encroachments are observed.
- Service road of 3.0m is available on Miraj road towards junction.

B. Proposed Improvements

In order to ensure smooth vehicular traffic movement on this road, consultants recommend following improvements:

- The traffic flow on Chandhini Jn road should be allowed for 2-wheelers only.
- A minimum footpath width of 1.5m should be provided on either sides of Ram Mandhir road and Ambedhkar road.
- Median should be provided on Miraj road with chanelisation at Jn.
- Existing channelization between Ram Mandhir road and Madhavnagar road should be cleared from encroachments and modified which should provide way for 2-wheelers and 4-wheelers turning movement.
- Curbs should be provided at the edges of the weaving section.
- Bus Stop should be relocated after 100m from the Junction which is not safe. Bus bay can be provided on Sangli-Miraj main road where available D.P width is 45.7m. Autos should be stopped at auto stand on service road only.
- Zebra crossings and signboards with proper signalisation should be provided at this junction.
- Commercial vehicles should be restricted from using Ambedkar road and Chandhini Jn road.

Pushparaj junction is shown in **Figure 5-14**.

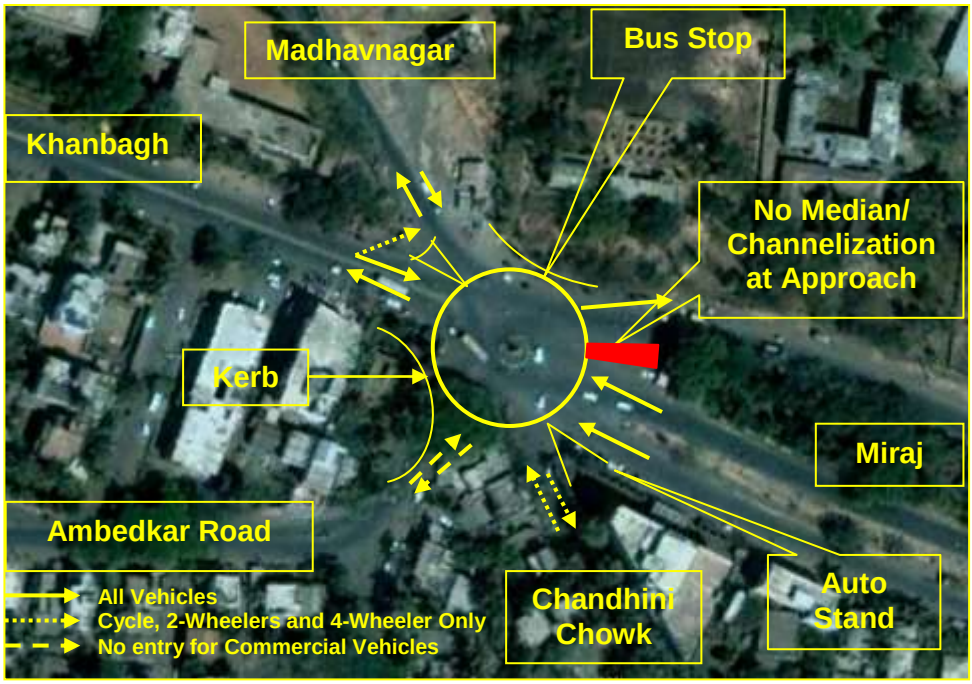


Figure 5-14 Pushparaj Junction

5.1.2.8 Vasanthdada Market Junction

A. Current Traffic Scenario/Issues

- Vasanthdada Jn is a 4-legged intersection. It is formed with Sangli-Miraj main road (4-lane), Sangli Railway station road (2-lane) and Road connecting 100 ft road. The peak hour traffic at Vasanthdada Market Jn is 4611 PCUs (11:00 AM-12:00 PM) respectively.
- The current traffic flow on all the approaching roads is 2-way flow. Petrol pump located at this junction separates to and fro traffic from Vasanthdada Market.
- Roundabout is present at the junction which reduces the conflicts.

Open Land on Sangli-Miraj road at Vasanthdada Market Jn

- Bus/Auto stop is present at this junction. Buses are stopping on main carriageway near junction causing delays.
- Total right turning traffic, left turning traffic and through traffic at Jn constitutes 14%, 16% and 70% respectively.
- Cycles constitute around 14% at this junction.
- There are no footpaths and proper zebra crossings at this junction.
- Open land is observed in middle of the road separating the two directions.
- Service road of 3.0m is available on right side of Sangli-Miraj road.

B. Proposed Improvements

In order to ensure smooth vehicular traffic movement on this road, consultants recommend following improvements:

- Open land should be converted to reserved lanes at junction which reduces conflicts of commercial vehicles with traffic on Sangli-Miraj main road.
- Kerbs should be provided at open land on Sangli-Miraj road at Jn.
- Bus Stop should be relocated after 50-100m from the Junction with proper bus bays to avoid delays at junction.
- Zebra crossings and Lane markings with proper signboards should be provided on all approaching legs at this junction.
- This junction should be controlled by traffic police due to the commercial vehicle movement from Vasanthdada Market and Sangli Railway Godown.

Vasanthdada junction and Traffic Circulation is shown in **Figure** 5-15.

Figure 5-15 Vasanthdada Junction

5.1.2.9 College Corner Junction

A. Current Traffic Scenario/Issues

- College Corner Jn is a 4-legged intersection. It is formed with Vakharbagh road, Madhavnagar Road, Kupwad Road and Congress Bhavan road. The peak hour traffic at College Corner Jn obtained from model is around 2470 PCUs.
- The traffic flow on all approaching roads (2-lane) at this junction is 2-way direction. 2-wheeler and 4-wheeler parking is observed on Vakharbagh road near Jn whereas commercial vehicle parking is observed on Kupwad road. Roundabout is present at the junction which reduces the conflicts.
- Total right turning traffic, left turning traffic and through traffic at this Jn constitutes 15%, 16% and 69% respectively. Cycles constitute around 20% at this junction.
- Significant pedestrian crossing is observed at College Corner Jn.
- There are no footpaths and proper zebra crossings at this junction.
- Signals are not working at this junction. Pedestrian crossing and uncontrolled traffic flow is responsible for congestion at college corner which is unsafe for pedestrians.

B. Proposed Improvements

In order to ensure smooth vehicular traffic movement on this road, consultants recommend following improvements:

- A minimum footpath width of 1.5m should be provided on either sides of Vakharbagh road and Congress Bhavan Road.
- Zebra Crossings and lane markings with proper signboards should be provided on all approaching legs at this junction.
- Parking near the junction should be cleared from all the approaching roads.
- Signals should be repaired and designed considering pedestrian and vehicle aspects.

College Corner Junction is shown in **Figure** 5-16.

Figure 5-16 College Corner Junction

5.1.2.10 Vishrambagh Junction at Ambassador Hotel

A. Current Traffic Scenario/Issues

- Vishrambagh Jn is a 3-legged intersection. It is formed with Sangli-Miraj main road (4-lane) and Police quarters road (2-lane). The peak hour traffic at Vishrambagh Jn is 3570 PCUs (i.e., 10:15 AM-11:15 AM).
- The current traffic flow on all the approaching roads is 2-way flow. Roundabout is present at the junction which reduces the conflicts.
- A service road of 3.0m width is present on right side of Sangli-Miraj road from which access is restricted for vehicles and pedestrians. Service road mostly used by two wheelers and four wheelers in residing area (i.e., Road connecting 100 ft road).
- Vehicles can access Sangli-Miraj main road at Vishrambagh Jn near Vishrambagh police station which is located at 300m way from this junction whereas pedestrians do not have proper access.
- Total right turning traffic, left turning traffic and through traffic at this Jn constitutes 12%, 15% and 73% respectively.

- Cycles constitute around 8% of total traffic at this junction.
- There are no proper zebra crossings at this junction.
- A median of 3.0m is provided in middle of the road separating the two directions.

B. Proposed Improvements

In order to ensure smooth vehicular traffic movement on this road, consultants recommend following improvements:

- A minimum footpath width of 1.5m should be provided from Sangli-Miraj road to Service for pedestrian access.
- Zebra Crossings and lane markings with proper signboards should be provided on all approaching legs at this junction.

Vishrambagh junction at Ambassador Hotel is shown in **Figure** 5-17.

Figure 5-17 Vishrambagh Junction (At Ambassador Hotel)

5.1.2.11 Vishrambagh Junction at Police Head Quarters

A. Current Traffic Scenario/ Issues

- Vishrambagh Jn is a 4-legged signalised intersection. It is formed with Sangli-Miraj main road (4-lane), Kupwad road (4-lane) and Road connecting 100 ft road (2-lane). The peak hour traffic at Vishrambagh Jn is 4435 PCUs (i.e., 18:15 pm-19:15 pm).
- The current traffic flow on all the approaching roads is 2-way flow. Roundabout is present at the junction which reduces the conflicts.
- This junction is spread over a large area due to 4-lane approach roads.

- A service road of 3.0m width is present on right side of Sangli-Miraj road.
- Total right turning traffic, left turning traffic and through traffic at Jn constitutes 20%, 21% and 59% respectively.

- Cycles constitute around 23% of total traffic at this junction.
- Zebra crossings are located at this Jn which are not continuous on Sangli-Miraj road.
- 2-wheeelre and 4-wheeler parking is observed on Kupwad road near junction.
- Bus stop is present at junction without any proper separator from Sangli-Miraj main road.
- There is no footpath on all approaching roads forcing pedestrians to main carriageway on Kupwad road.

B. Proposed Improvements

In order to ensure smooth vehicular traffic movement on this road, consultants recommend following improvements:

- Median should be provided on Vishrambagh main road with chanelisation at approach of the Jn
- Kerbs should be provided at median at the approach of the roads.
- A minimum footpath width of 1.5m should be provided on Kupwad road**.**
- Proper sign boards showing various signs (Regulatory, Warning and Guide signs) should be placed on all approaching legs at this Jn.
- Bus stop should be relocated to 50-100m from junction.
- Parking near the junction should be avoided and off street parking can be allowed for 2-wheelers at existing bus stop area.

Vishrambagh junction at police head quarters is shown in **Figure 5-18**.

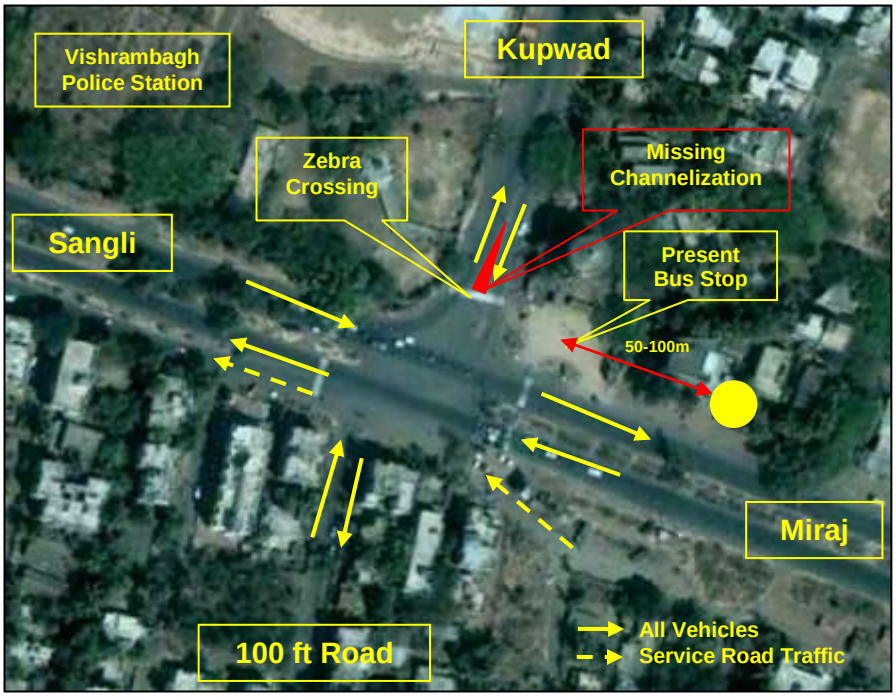
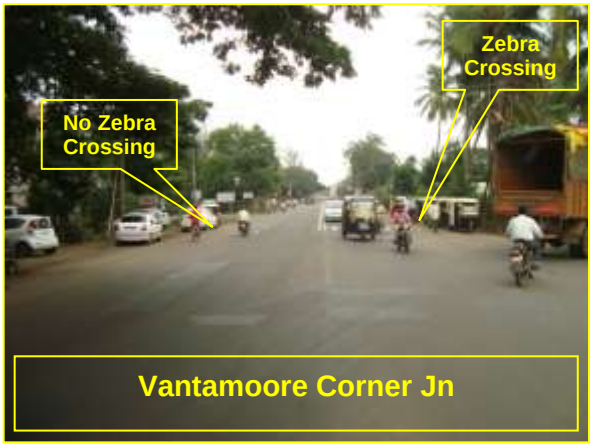


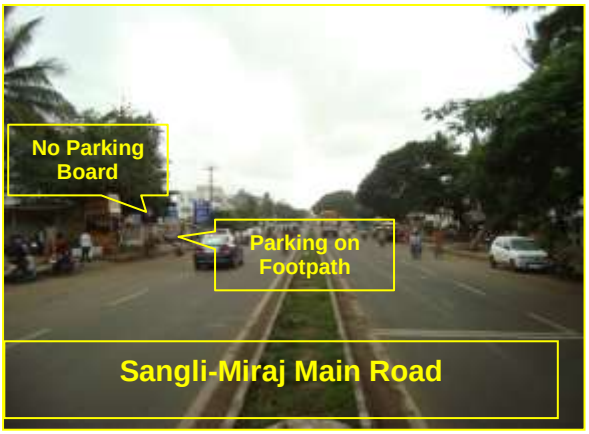
Figure 5-18 Vishrambagh Junction (At Police Head Quarters)

5.1.2.12 Vantamoore Corner Junction

A. Current Traffic Scenario/Issues

- Vantamoore Corner is a 3-legged intersection. It is formed with Miraj Station Road (2-lane) and Sangli-Miraj Road (4-lane) (i.e., 18:00 PM-19:00 PM). The peak hour traffic at Vantamoore Jn is 2804 PCUs.
- The traffic flow on all the approach roads is 2-way direction.
- Total right turning traffic, left turning traffic and through traffic art Jn constitutes 23%, 24% and 53% respectively.
- Cycles constitute around 10% of total traffic at this junction.
- Zebra crossings are located at this Jn which are not continuous on Sangli-Miraj road and there is no zebra crossing present on Miraj station road.
- 2-wheeler and 4-wheeler parking is observed on Sangli-Miraj main road and also on footpath in no parking zone.
- Median is present on Sangli-Miraj road towards Sangli where as it is absent towards Mission Hospital.





B. Proposed Improvements

In order to ensure smooth vehicular traffic movement on this road, consultants recommend following improvements:

- As Sangli-Miraj road is a 4-lane road, speeds are very high which needs to be reduced by providing proper signboards (such as speed limits, guide signs etc).
- Enforcement is required for avoiding parking on footpath and no parking zones.
- Zebra crossing should be provided continuously on all approaching roads at this junction.
- A median should be provided towards Mission Hospital on Sangli-Miraj road.

Vantamoore Junction is shown in **Figure 5-19.**

Figure 5-19 Vantamoore Corner Junction

5.1.2.13 Mission Hospital Junction

A. Current Traffic Scenario/Issues

- Mission Hospital Jn is a 6-legged intersection. It is formed with Sangli-Miraj main road (4-lane), Bijapur-Pandapur road (2-lane), M.I.D.C road (2-lane) and Miraj internal roads (intermediate lane). The peak hour traffic at Mission Hospital Jn is 5103 PCUs (i.e., 17:00 PM-18:00 PM).
- This junction is skewed over a large area. Due to this, vehicles are coming in wrong way for turning movements.
- The traffic flow on all the approach roads is 2-way direction.
- Total right turning traffic, left turning traffic and other traffic at this Jn constitutes 15%, 16% and 69% respectively.
- Cycles constitute around 21% of total traffic at this junction.
- Zebra crossings are faded at this Jn.
- Petrol pump is located at the junction from which entry/exit of vehicles from all directions interrupt smooth flow of junction traffic.
- Bus stops and auto/taxi stands are located at the junction. 2-wheeler parking is observed on Sangli-Miraj main road forcing pedestrians to use main carriageway.
- Hawkers and vendors are observed near junction on Bijapur road.
- Channelized island is observed at the junction separating Shivaji statue road and Mangalwarpet road.
- Signals are not working at this junction. Heavy traffic flow and irregular approach of traffic causes delay at the junction.

B. Proposed Improvements

In order to ensure smooth vehicular traffic movement on this road, consultants recommend following improvements:

- This junction should be confined to 5-legged junction by providing median on Sangli-Miraj road and existing channelization between Miraj internal roads should be modified in a proper way. U-turn can be provided on Sangli-Miraj road for Cycles, 2-wheelers, 3-wheelers and 4-wheelers after 50 m from the junction for travelling towards M.I.D.C.
- Railings should be provided separating the petrol pump and main road with proper entry and exit.
- Zebra crossings and signboards with proper signalisation should be provided at this junction.
- A roundabout should be provided at the centre of the junction to avoid the vehicle conflicts.
- Hawkers and Vendors should be cleared from the junction.
- Parking near the junction should be restricted and can be allowed on Mangalwarpet and Shivaji statue roads.
- The roads connecting M.I.D.C, Mangalwarpet and Shivaji statue are narrow and Goods vehicles should be restricted where as during off-peak period goods vehicles can be allowed on M.I.D.C road in M.I.D.C to Mission Hospital direction.
- Commercial vehicles use M.I.D.C road as one way towards this junction whereas they can travel towards M.I.D.C through alternate road available at Central Excise building on Sangli-Miraj main road.

Mission Hospital junction is shown in **Figure 5-20**.

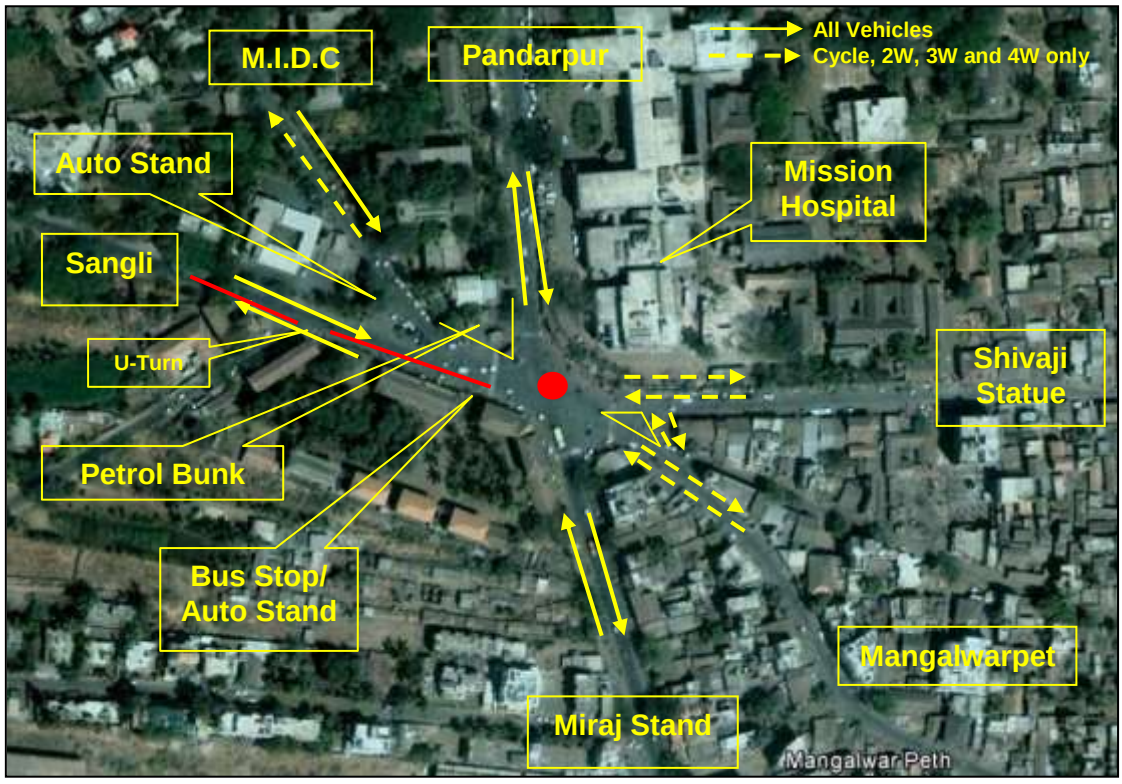


Figure 5-20 Mission Hospital Junction

5.1.2.14 Miraj City Bus Stand Junction

A. Current Traffic Scenario/Issues

- Miraj City Bus Stand Jn is a 4-legged intersection. It is formed with Pandarpur Road, Bijapur road, Laxmi Market road and Miraj Railway Station road. The peak hour traffic at Miraj City Bus Stand Jn obtained from model is around 5152 PCUs.
- The traffic flow on connecting roads is 2-way direction.
- The traffic at this junction is uncontrolled.
- There are no lane markings and zebra crossings at this junction.
- Hawkers and vendors are present near junction forcing pedestrians to use main carriageway.
- Parking is observed on all the connecting roads near Jn.
- Miraj city bus stand is located at junction. Buses access the Miraj city stand from all directions which interrupts the smooth flow of traffic.
- Pedestrian movement is high at this junction due to Miraj city stand and Miraj railway station. Signals are not working at this junction.
- There are no proper footpaths on all approach roads near the junction.

B. Proposed Improvements

In order to ensure smooth vehicular traffic movement on this road, consultants recommend following improvements:

- The traffic at this junction should be controlled by providing signals and considering the pedestrian aspects.
- Zebra Crossings, Lane markings and Signboards should be provided on all approaching legs at this junction.
- Existing footpath can be widened to 2.0 m on Station road due more pedestrian intensity.
- Buses movement should be allowed towards Miraj city stand from all roads of the junction except Pandharpur road as discussed in previous section.
- Hawkers and vendors should be cleared from the junction.
- Parking should be restricted near junction with strict enforcement.

Miraj City Stand is shown in **Figure 5-21**.

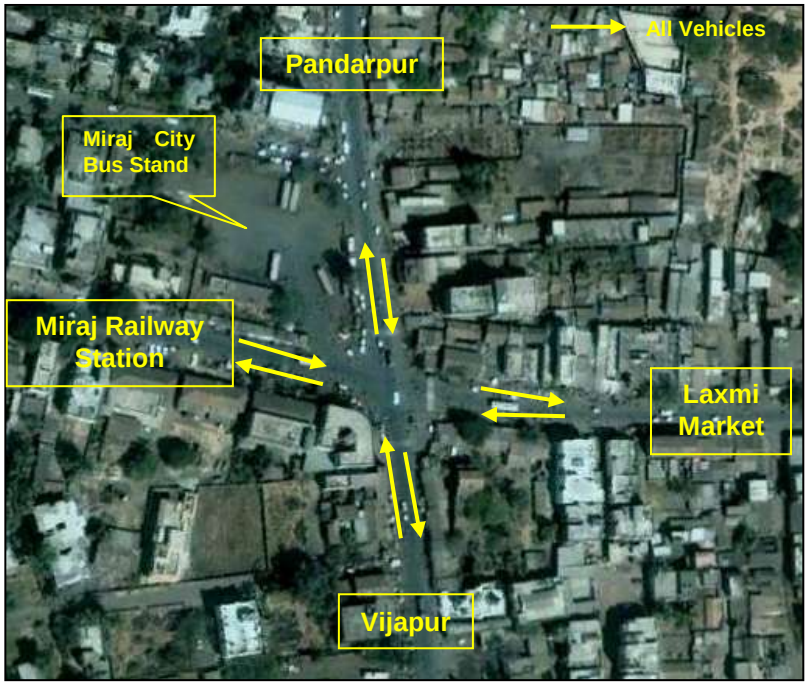


Figure 5-21 Miraj City Stand Junction

5.1.2.15 Summary of Junction Improvement Proposals

The summary of junction improvement proposals discussed above for the important junctions in the S-M-K City are present in **Table** 5-2.

Table 5-2 Summary of Junction Improvement Proposals

S. No.	Name of the Junction	Existing Situation	Proposed Improvements
1	Tilak Jn	▪ It is uncontrolled intersection with small round about present at centre of Jn ▪ Speed Breaker on Anand Theatre road is damaged ▪ No footpath facilities on approaching roads ▪ Encroachments on Ganapathi lane road	▪ Jn should be controlled by traffic police ▪ Speed Breaker of height 10cm should be provided on Anand Theatre road ▪ Foot path facilities should be provided on Harbhat road ▪ Encroachments should be cleared from Ganapathi lane road
2	Maruthi Road Jn (Garment Jn)	▪ It is uncontrolled intersection ▪ Existing signals are not working ▪ No footpath facilities on approaching roads ▪ Hawkers and Vendors near Jn on Maruthi road	▪ Signals should be repaired and should be designed considering vehicle and pedestrian aspects ▪ Foot path facilities should be provided on Harbhat road and Maruthi Road
3	Tarun Bharat Jn	▪ It is uncontrolled intersection ▪ Footpath with encroachments on Kameti road	▪ Triangular island should be provided ▪ Foot paths should be cleared from encroachments on Kameti Road
4	Muncipal Jn	▪ It is uncontrolled intersection ▪ Hawkers are using footpath on Kameti road	▪ Hawkers should be avoided from using footpath on Kameti road ▪ Foot path facilities should be provided on Harbhat road ▪ A roundabout should be provided
5	Rajwada Jn	▪ It is signalised intersection with rotary island ▪ Footpath on Vakaharbagh road near junction is encroached and parking is also observed ▪ No footpath facilities on Rajwada fort road	▪ Foot path facilities should be cleared from parking ▪ Foot path facilities should be provided on Rajwada fort road
6	Congress Bhavan Jn	▪ It is uncontrolled intersection ▪ Jn is widely spread with roundabout present at centre ▪ Existing median is not continuous and has sharp edges ▪ No footpath facilities on Shivajinagar fort road ▪ Madhavnagar road and Miraj road (Pushparaj Jn) join together at Congress Bhavan Jn creating critical conflicting area	▪ Continuous median should be provided on all approaching roads with curvy edges ▪ Foot path facilities should be provided on Shivajinagar road ▪ High mast lighting should be provided in between round about ▪ Madhavnagar road and Miraj road (Pushparaj Jn) should be separated by median and should be allowed as one-way flow

S. No.	Name of the Junction	Existing Situation	Proposed Improvements
7	Pushparaj Jn	▪ It is uncontrolled intersection ▪ Jn is widely spread with rotary island ▪ No footpath facilities on approaching roads ▪ Missing median on Miraj road ▪ Encroachments are observed at channelization	▪ Foot path facilities should be provided on Ram Mandhir road and Ambedhkar road ▪ Median should be provided on Miraj road with curvy ends till the approach of the junction ▪ Encroachments should be cleared from channelization ▪ Curbs should be provided at the edges of the weaving section ▪ Bus bay can be provided on Sangli-Miraj main road
8	Vasanthdada Market Jn	▪ It is uncontrolled intersection with roundabout present at centre of the Jn ▪ No footpath facilities on approaching roads	▪ Reserved lanes should be provided on Sangli-Miraj road at Jn ▪ Kerbs should be provided at open land on Sangli-Miraj road at Jn ▪ Jn should be controlled by traffic police ▪ Foot path facilities should be provided on Vasanthdada Market Yard road
9	College Corner	▪ It is uncontrolled intersection with roundabout present at centre of the Jn ▪ No footpath facilities on approaching roads ▪ Signals are not working at this junction	▪ Foot path facilities should be provided on Vakharbagh road and Congress Bhavan road ▪ Signals should be repaired and provided
10	Vishrambagh Jn (At Ambassador Hotel)	▪ It is uncontrolled intersection with roundabout present at centre of the Jn ▪ No proper access for pedestrians to/from service road	▪ Foot path facilities should be provided on median to access service road
11	Vishrambagh Jn (At Police Head Quarters)	▪ It is signalised intersection with roundabout present at centre of the Jn ▪ No footpath facilities on approaching roads	▪ Median and Footpath should be provided on Kupwad road ▪ Curbs should be provided on approach roads at Jn
12	Vantamure Corner	▪ It is uncontrolled intersection ▪ Parking is observed on footpath and also in no parking zone	▪ Median should be provided on Sangli-Miraj road towards Mission Hospital near Jn
13	Mission Hospital Jn	▪ It is uncontrolled intersection spread over a wide area ▪ Petrol pump is located at the junction from which entry/exit of vehicles from all directions interrupt smooth flow of junction traffic ▪ Signals are not working at this junction	▪ Railings should be provided separating the petrol pump and main road with proper entry and exit ▪ A roundabout should be provided at the centre of the junction ▪ Median should be provided on Sangli-Miraj road towards Sangli ▪ Signals should be repaired and provided

S. No.	Name of the Junction	Existing Situation	Proposed Improvements
14	Miraj City Bus Stand	▪ It is uncontrolled intersection ▪ No footpath facilities on approaching roads ▪ Signals are not working at this junction	▪ Signals should be repaired and designed considering the pedestrian aspects ▪ Footpath on Station road should be widened to 2.0m

Other issues at all junctions

- Proper sign boards are absent at many junctions in S-M-K city.
- Zebra crossings are faded and are not continuous at few junctions.
- Lane Markings and Stop lines are not present on approaching roads to the junction.
- Parking, Bus Stop and Auto/Taxi stand near Jn on approaching roads
- Existing signals are not working at many junctions
- Hawkers and Vendors are observed on footpaths and near Jn in few areas.
- Many roads are narrow in core areas of S-M-K city.

Other improvements at all junctions

- Proper sign boards showing regulatory, warning and guide signs boards (such as speed limits, pedestrian crossing, no parking, no entry, etc) should be provided
- Zebra crossings, Lane Markings and Stop lines should be marked
- Parking has to be cleared for 50-100m from Jn
- Hawkers and Vendors should be cleared for 50-100 away from Jn and from using footpaths
- Bus stop and Auto/Taxi stand has to be shifted 50-100m away from Jn
- Traffic police should be provided at all the junctions (excluding signalised junctions) for 8hr during morning and evening peak periods.
- Narrow roads at all the junctions should be widened to a 2-lane configuration. Land acquisition is required in future at junctions such as Tilak Jn, Rajwada Jn, Vantamoore Corner Jn, Mission Hospital Jn and Miraj City Stand Jn.
- Commercial vehicles (except Goods Auto) should not be allowed during peak periods (i.e., 9:30 AM to 12:45 PM and 16:45 PM to 20:45 PM) inside the city which should be stopped near Octroi at all Outer Cordons.
- Before implementation of Traffic Management Schemes, traffic awareness programmes shall be organised

5.1.3 Parking Demand Management

The registered vehicles are growing at 9% per annum in S-M-K CMC. The rise in two wheelers/Cars has led to an increase in demand for space for parking vehicles. Any vehicle that is registered requires a minimum of two places for parking. One at the origin-home and the other at the destination-work, shopping and institution. The traditional method of parking along the curb is insufficient. **The parking of vehicles along the curb is uneconomical as it reduces the effective carriageway, causes an increase in congestion, accidents and pollution. The speed of moving vehicles is reduced by almost 65% due to curb parking**. The road networks should be primarily dedicated for the purpose of public travel and any other use should be considered of secondary importance.

Unauthorised on-street parking due to lack of regulation and unavailability of off-street parking facilities are the main issues which needs to addressed in the context of growth of vehicles. There is an absence of a comprehensive parking policy for S-M-K CMC, involving control and regulation of on-street parking, provision of off-street parking facilities, parking norms and standards and demand management measures. The parking no/parking zones also need to be defined.

The current scenario in S-M-K CMC with respect to parking is as follows:

(i) Wide spread on-street parking

(ii) Parking on footpaths/lane widths

(iii) Lack of off-street parking facilities

(iv) Parking in congested roads (***shorter lane widths***)

5.1.3.1 Parking Demand

Parking is a major problem in S-M-K CMC especially in core areas of the city. Consultants carried parking survey at important locations and the parking demand and supply has been presented in **Figure 5-22**. The distribution of parking vehicles in terms of Equivalent Car Spaces constitutes 2-wheelers, Car, 3-Wheelers, Cycles and Commercial Vehicles which are about 47%, 7%, 9%, 33% and 4% respectively. Parking should be generally provided for 2-wheelers, Car and Cycle which constitute 89% of the total parked vehicles. Commercial vehicles should be restricted during peak parking periods (10:00 AM to 1:00 PM and 17:00 PM to 19:00 PM) in congested areas.

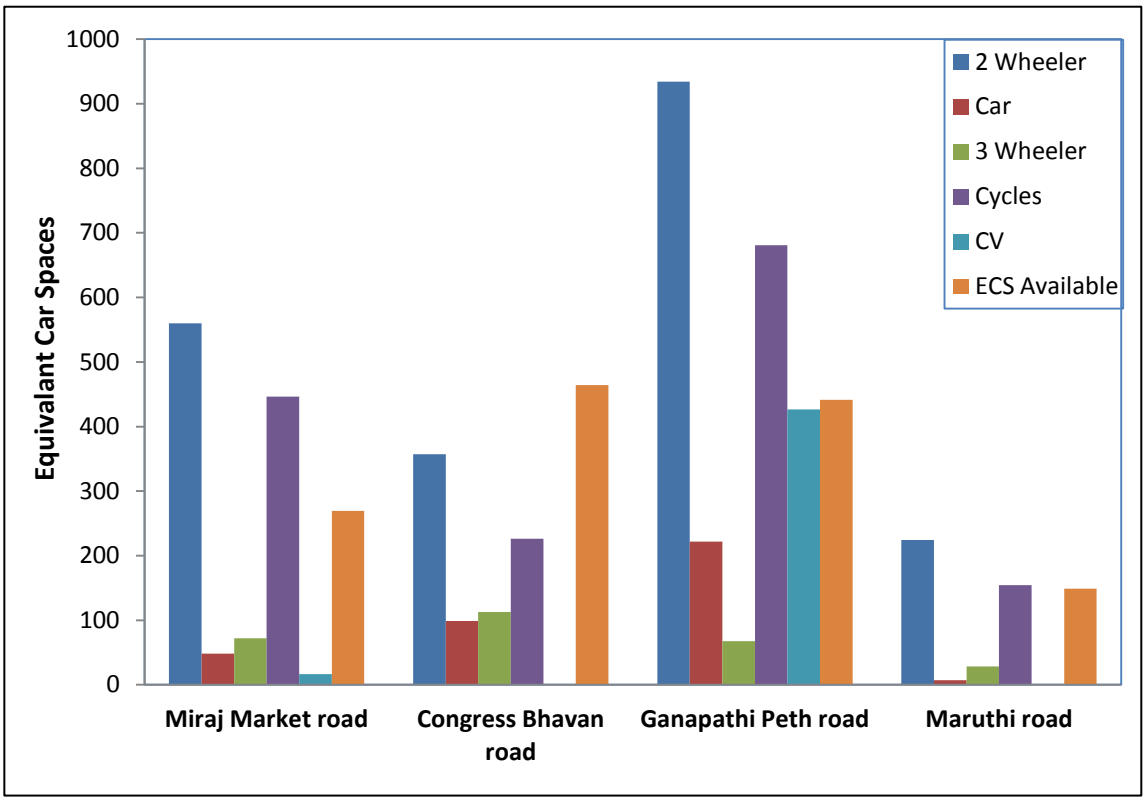


Figure 5-22 Location-wise Parking Demand

MoUD Study titled "Traffic and Transportation Policies and Strategies in Urban Areas, 1998" recommends the following norms for on-street parking:

(i) No on-street parking should be permitted at locations on primary and secondary road network where carriageway width is less than 7m.

(ii) Street parking should not be allowed on roads where V/C ratio is more than 0.8 or speeds less than 15 Kmph.

(iii) Intersections and critical locations should be kept free from parking and other encroachments

(iv) Suitable kerb side lengths should be kept clear of parked vehicles near bus bays

(v) Bus bays should be allowed on raised footpaths or other corridors meant exclusively for pedestrians

(vi) In central areas, street parking may be permitted on one side of the road.

A number of strategies are recommended for managing the parking demand.

(i) Capacity of existing facilities should be increased by using currently wasted areas (corners, edges, undeveloped land, etc.) and by changing from parallel to angular parking.

(ii) Bicycle parking facilities should be provided at almost all major destinations such as schools, offices, railway stations, shops and markets. Rickshaw stands should be provided particularly around railway stations, shops and markets.

(iii) Regulate parking demand by issuing high penalty charge for breaching the traffic rules, restricting parking duration, encouraging employees to use less convenient parking spaces (such as parking lots at the urban fringe) during peak periods in order to leave the most convenient spaces for customers, limiting the use of on-street idle

parking for longer duration by local residents and prohibiting on-street parking on certain routes (Ganapathipet Road) during peak periods to increase traffic lanes.

(iv) **Remote Parking and Improve Walkability:** Remote Parking refers to the use of off-site parking facilities located at the periphery of a business district or other activity centre which can involve use of public facilities, such as commercial parking lots. Improved walking conditions such as sidewalk, footpaths, roadway conditions; land use patterns; social acceptance; security and comfort for walking encourages park once trips, which means that visitors park their vehicles and walk to several destinations, rather than driving to, and parking at, each destination.

(v) Improved User information helps from parking problems by providing signs, maps, and electronic guidance systems for travellers regarding parking availability, regulations and price and about travel options, such as walking and transit.

(vi) Important arterial roads, where acute shortage of capacity, on-street parking should be banned.

(vii) S-M-K CMC should identify the selected roads where on-street parking can be provided. These areas should be marked very clearly. Some of these facilities should be pay and park especially near commercial areas. It is suggested that a parking fee of Rs. 4/- for two-wheelers and Rs. 10/- of cars for first two hours should be charged. Time restriction is important because it will encourage short-term parking. It is also recommended to implement a differential parking fee policy with increasing fee structure in the central area and outer areas. Paid parking can provide a means of revenue generation to the municipality.

(viii) Suitable parking policy for the off-street parking facilities needs to be formulated based on costs of development, operation, maintenance and management. Similar differential policy amongst parking sites in different zones needs to be adopted. Off-street parking facilities should be considered in PPP model.

(ix) **Enforcement:** An effective parking policy requires strict enforcement. Typically parking enforcement is carried out by traffic police, who are empowered under Transport Acts to penalise parking violations. However parking enforcement and implementation require more manpower. In Japan, private contractors undertake inspections. The inspector records vehicle registration number and attach a tag for illegal parking. Police charge penalties to the owner of the vehicle, using the registration record.

(x) Para transit and intermediate public transport modes place greater burden on on-street parking. Therefore special attention is required to manage the parking of taxies, auto-rickshaws and cycle rickshaws.

5.1.3.2 Proposed Off-street Parking locations

With increase in vehicular traffic in S-M-K CMC, there is a need to develop off-street parking facilities. Consultants have reviewed off-street parking locations by visiting the sites and recommendations/remarks are presented in **Table 5-3**.

Table 5-3 Proposed Off-Street Parking Locations

S. No.	Location	Recommendations/Remarks
1	Open Area in front of Pratap theater (Capacity = 50 2-W)	This land can be used for parking of 2W instead of On-Street Parking on Old Station Road
2	Ambedkar Stadium Partial Area	This land can be used for parking of 2W/4W instead of On-Street Parking on Old Station Road and Khan Bhag Road
3	Tarun Bharat Stadium Partial Area	This land can be used for parking of 2W/4W instead of On-Street Parking on Harbhat Road, Maruthi Road and Kapadpet
4	Open Area near Z.P. Office	This land can be used for parking of 2W/4W instead of On-Street Parking on Sangli-Miraj Road near Ram Mandhir Corner
5	Vacant Area near Bus Stop at Vishrambagh Jn	This land can be used for parking of 2W/4W instead of On-Street Parking on Kupwad road near Vishrambagh Jn.

There is a need for developing bigger off-street parking facilities near important areas such as commercial areas, office areas, special generators such as religious places etc on PPP model especially in Ganapathipet, Rajwada, Laxmi Market and transport terminals. Some of the parking facilities needed and to be explored are discussed below:

- ✓ **Parking at Bus Terminals such as Sangli S.T.Stand Road**
- ✓ **Private Buses parking such as Sangli S.T.Stand road & Jath Road (Near Miraj City Bus Stand)**
- ✓ **Additional parking at Railway Stations with co-ordination with Railways**

Open Area near Z.P.Office

Open Area in front of Pratap Theatre

5.2 Medium Term Improvement Proposals (2012-2021)

Medium term improvement proposals include proposals which are to be implemented during 2012-2021.

Draft Development Plan of S-M-K CMC has provided a list of proposals based on its own evaluation. Consultants have examined all the proposals in the light of traffic forecast based on travel demand model developed and overall transportation improvement strategies to be adopted.

5.3 Non-Motorised Transport

5.3.1 Current Situation

The most important mode of travel in S-M-K City is walking and bicycling. The share non-motorised modes in S-M-K City are 70% of the total of 7.68 Lakhs trips, which indicates importance of non-motorised modes.

The share of Walk and Cycle constitutes 46% and 24% respectively. The average trip length of Walk is 1.17 km whereas average trip length of cycle is 2.81 km. Pedestrian and other non-motorised vehicles face inhospitable walking and cycle environment in S-M-K City especially in Sangli area. Safe and comfortable facilities for pedestrian and other non-motorised vehicles should be provided. Walking is still the largest transport component in the city with nearly 3.5 Lakh trips per day. Lack of proper facilities (such as footpaths, street lighting, etc.) is a serious contributor to the traffic accidents.

Only 7.2% of the S-M-K City road network has footpath facility whereas 49.7% of the network does not have any street lighting which needs to be improved. Typical footpaths in S-M-K City are shown in Figure 5-23. Consultants have collected the accident data from 2006-2010 from Traffic Police and is presented in **Figure** 5-24 and **Table** 5-4. It is observed that accidents in Vishrambagh area are high followed by Sangli, Miraj and M.I.D.C (within S-M-K City). It can be observed that accidents are gradually decreasing till the year 2009 and thereafter have a step rise in 2010. The distribution of trips is presented in **Figure 5-25**.

Figure 5-23 Typical Footpaths in S-M-K City

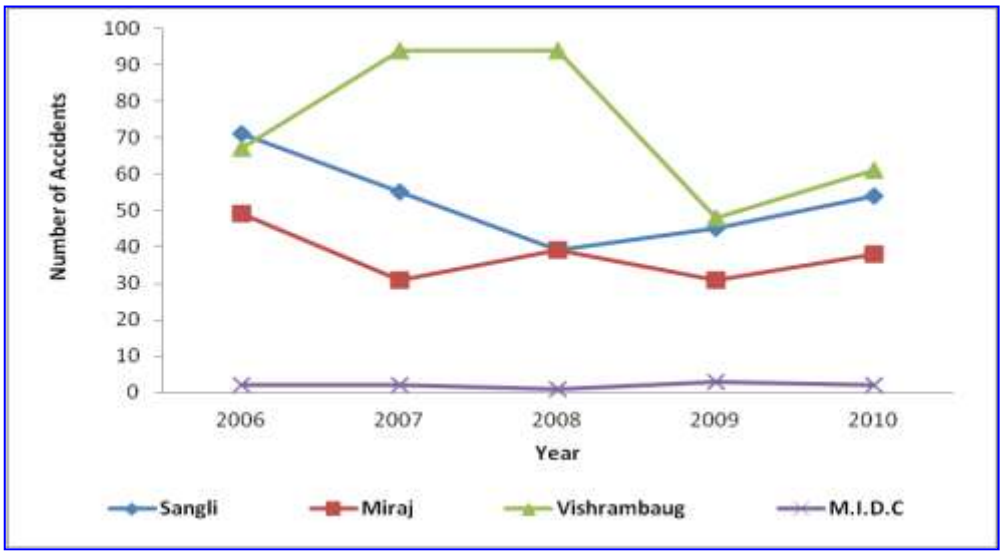


Figure 5-24 Yearly Variation of Accidents by Location

Table 5-4 Location-wise Accident Data in S-M-K City (2006-2010)

Year	No of Accidents					Percentage of Accidents				
	Fatal	Serious	Injury	Minor/ Non-Injury	Total	Fatal	Serious	Injury	Minor/ Non-Injury	Total
Sangli										
2006	2	38	18	13	***71***	3%	53%	25%	19%	***100%***
2007	2	28	14	12	***55***	4%	50%	25%	21%	***100%***
2008	7	25	2	5	***39***	18%	65%	6%	12%	***100%***
2009	0	31	10	4	***45***	0%	69%	22%	9%	***100%***
2010	1	35	11	7	***54***	2%	65%	20%	13%	***100%***
Miraj										
2006	5	27	12	5	***49***	10%	55%	24%	10%	***100%***
2007	4	8	13	6	***31***	13%	26%	42%	19%	***100%***
2008	7	13	12	7	***39***	18%	33%	31%	18%	***100%***
2009	3	4	15	9	***31***	10%	13%	48%	29%	***100%***
2010	3	12	8	16	***38***	7%	31%	21%	41%	***100%***
Vishrambagh										
2006	12	28	23	3	***67***	18%	42%	35%	5%	***100%***
2007	11	23	44	16	***94***	12%	24%	46%	17%	***100%***
2008	2	52	31	9	***94***	2%	56%	33%	9%	***100%***
2009	0	13	15	20	***48***	0%	27%	32%	41%	***100%***
2010	9	13	31	9	***61***	14%	21%	50%	14%	***100%***
M.I.D.C										
2006	0	1	1	0	***2***	0%	50%	50%	0%	***100%***
2007	0	1	1	0	***2***	0%	50%	50%	0%	***100%***
2008	0	1	0	0	***1***	0%	100%	0%	0%	***100%***
2009	0	2	1	0	***3***	0%	67%	33%	0%	***100%***
2010	0	0	2	0	***2***	0%	0%	100%	0%	***100%***

Year	No of Accidents					Percentage of Accidents				
	Fatal	Serious	Injury	Minor/ Non-Injury	Total	Fatal	Serious	Injury	Minor/ Non-Injury	Total
Overall S-M-K City										
2006	20	94	54	22	***189***	10%	50%	29%	11%	***100%***
2007	17	59	71	34	***182***	10%	33%	39%	19%	***100%***
2008	16	92	45	20	***173***	9%	53%	26%	12%	***100%***
2009	3	50	41	33	***127***	2%	39%	32%	26%	***100%***
2010	12	60	51	31	***155***	8%	39%	33%	20%	***100%***

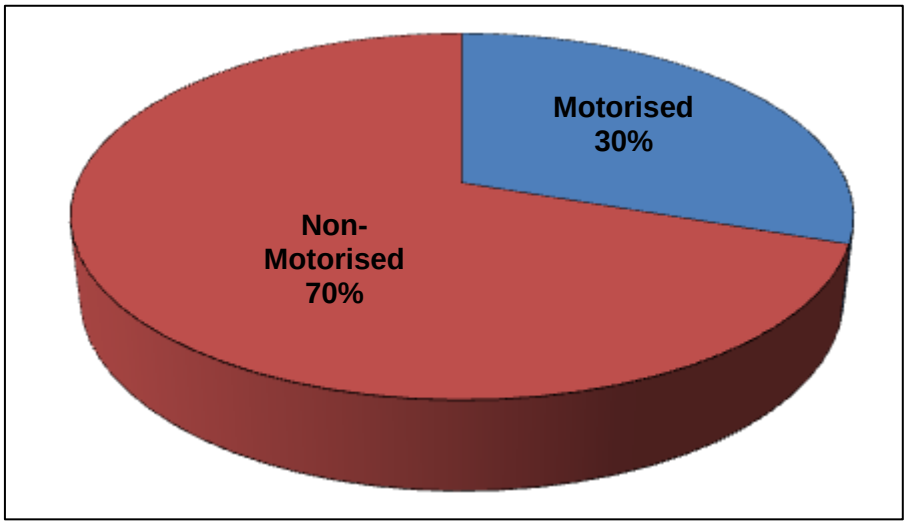


Figure 5-25 Modal Share in S-M-K City

It is observed that accidents in S-M-K city are more at cordon points, major junctions and arterials. Some of the important accident prone locations are presented in **Table 5-5**. It is observed that share of accidents by Vehicle-Vehicle conflicts, Vehicle-Pedestrian conflict and other conflicts are 67%, 20% and 13%.

The main reason for accidents in these areas is due to lack of proper signboards, over speeding, lack of road infrastructure and lack of traffic awareness. Sidewalks are non-existent or very inconvenient at places forcing pedestrians to walk on the roads reducing the road way capacity and exposing them to accidents. Analysis of network inventory data shows that nearly 93% of the road length in S-M-K City has no footpath facilities.

Some places sidewalks are due to presence of electric poles, telephone poles, sign boards, trees, vendors and public urinals. Pedestrians, Cyclist and Non-motorised Vehicles are the more critical elements in mixed traffic. If the infrastructure does not meet the requirements of these elements all modes of transport operate in sub-optimal conditions.

Table 5-5 Accident Prone Locations in S-M-K City (2006-2010)

S. No.	*Police Control Area*	*% of Accidents*	*Accident Prone Locations*
1	Sangli	32	• Kolhapur road, Islampur road, Islampur bypass and Madhavnagar road • Ambedhkar road and Old Station Road • Patel Jn, Shastri Jn, Station Jn and Jhulelal Jn
2	Miraj	23	• Pandharpur road, Sangli-Miraj road, Malgaon road and Bijapur road • Shivaji Road (Near Bus Stand surroundings) • Mission Hospital Jn and Miraj Station Jn
3	Vishrambagh	44	• Sangli-Miraj Road (Pushparaj Jn to Vantamure corner Jn) • Vishrambagh Jn and Pushparaj Jn • 100 ft Road
4	M.I.D.C	1	• Bharat Suthagirni and Kupwad Jn
5	***S-M-K CMC***	***100***	***Cordon Points, Major Junctions and Arterials***

5.3.2 Recommendations

Footpaths:

For safety of pedestrians, separate foot ways/ footpath should be provided along the carriageway of urban street on either side. As per IRC, the recommended minimum width is 1.5m. Some of the roads in S-M-K City require footpaths which prevent accidents and provides smooth flow of traffic. The following are the roads which require footpaths:

- Maruthi Road, Sangli
- Harbhat Road, Sangli
- Ambedkar Road, Sangli
- Sant Kotnis Maharaj Road
- Sangli S.T Stand Road
- Kolhapur Road
- Sangli Railway Station Road
- Miraj Railway Station Road
- Shivaji Road, Miraj
- Vishrambagh Main Road
- Old Kupwad Road, Kupwad

Following aspects needs careful attention:

- The width of footpath depends upon the pedestrian flows. The minimum width of footpath as per IRC103-1988 is 1.5 m.
- At important terminals such as Railway Stations, Bus Depots which attract huge pedestrian flow and therefore require additional pedestrian facilities, FOB and Subways for conflict free and safe movement of pedestrians. At these places, footpath should be provided with a width of 2.5m.

- In all future road widening projects and construction of flyovers footpath should planned as per pedestrian demand. Footpath facilities should be augmented by acquiring land, wherever required. This is major step towards sustainable transportation.
- At important busy roads and Junctions railing should be provided to prevent spilling of pedestrians on the carriageway.
- Footpaths should be kept free from STD booths, electric poles, dustbins, telephone chambers, parking and hawking activities etc.
- Signage and markings will encourage pedestrian to use pedestrian facilities and should be provided near important transport terminals, major traffic generators i.e. commercial areas, educational institutions, hospitals etc.

Pedestrian Subways/ Foot Over Bridge (FOB):

As the intensity of pedestrian flow is low, Consultants feel that there is no requirement of Subways which is costly. As per the pedestrian intensity and reconnaissance survey, Consultant suggests that the provision of Foot Over Bridge is not feasible due to space constraint and low pedestrian intensity.

- A FOB is suggested at Sangli Railway Station in future for accessing to Station from other side of the Sangli Railway Station (Sangli Railway Goods Office). Present passenger demand at Sangli Railway station is very low, whereas it is revealed from opinion survey for provision of access to Sangli Railway station from Sangli Railway Goods Office (Old Kupwad Road).

Cycle Track:

24% of the total 7.68 Lakh trips are made by Cycle. Cyclist creates conflict with fast moving vehicles in narrow streets, congested areas, intersections etc., As a result is cyclists are involved in a number of accidents. Therefore, in order to improve the safety and mobility, segregation of traffic is needed. However with ever-increasing demand for road space, this may not be feasible to allocate dedicated lane to cyclists. However S-M-K CMC can consider a pilot project and results can be evaluated. Based on existing travel pattern of cyclists and availability of ROW, consultants propose separate lanes for cyclists on pilot basis on following roads. More routes are required to be planned after learning from these initial projects.

- Harbhat Road (Tilak Jn - Municipal Jn)
  - ✓ The available right of way as per draft development plan of S-M-K CMC is 15.25m.
  - ✓ Cycles constitute about 22% of the total traffic on this road.
  - ✓ This is a 2-lane road with a total length of 0.5km. 2-wheeler parking is observed on either sides of the road. A minimum footpath width of 1.5m should be provided on either sides of the road. The proposed traffic flow on Harbhat road is one-way traffic from Tilak Jn to Municipal Jn. Existing right of way is sufficient for provision of cycle track of 1.5m on either sides of Harbhat road.
- Sangli-Miraj Road (Pushparaj Jn – Vantamoore Corner Jn)
  - ✓ The available right of way as per draft development plan of S-M-K CMC is 45.7m.
  - ✓ Cycles constitute about 11% of the total traffic on this road.
  - ✓ This is a 4-lane road with a total length of 7.2km and service roads of 3.0m are present at some sections on either sides of the road. Existing right of way is sufficient for provision of cycle track of 1.5m on either sides of Sangli-Miraj road.

- Vakharbagh Road (Rajwada Jn-College Corner Jn)
  - ✓ The available right of way as per draft development plan of S-M-K CMC is 18.28m.
  - ✓ Cycles constitute about 27% of the total traffic on this road.
  - ✓ This is a 2-lane road with a total length of 1.2km. Parking is observed on either sides of the road. A minimum footpath width of 1.5m should be provided on either sides of the road. Existing right of way is sufficient for provision of cycle track of 1.5m on either sides of this road.
- Ambedkar Road (Sangli S.T Stand – Pushparaj Jn)
  - ✓ The available right of way as per draft development plan of S-M-K CMC is 20m.
  - ✓ Cycles constitute about 23% of the total traffic on this road.
  - ✓ This is a 2-lane road with a total length of 1.8km. Parking is observed on both sides of the road. A minimum footpath width of 1.5m should be provided on either sides of the road. Existing right of way is sufficient for provision of cycle track of 1.5m on either sides of Sangli-Miraj road.
- Vishrambagh Main Road (Vishrambagh Jn-Sangli Railway Station Road Jn)
  - ✓ The available right of way as per draft development plan of S-M-K CMC is 30.48m.
  - ✓ Cycles constitute about 31% of the total traffic on this road.
  - ✓ This is a 2-lane road with a total length of 1.1km. Parking is observed on both sides of the road. A minimum footpath width of 1.5m should be provided on either sides of the road. Existing right of way is sufficient for provision of cycle track of 1.5m on either sides of Sangli-Miraj road.
- Pandarpur-Bijapur Road (Miraj Market road Jn-Kolhapur bypass road Jn)
  - ✓ The available right of way of Bijapur road and Pandharpur road as per draft development plan of S-M-K CMC is 30.4m and 45.72m respectively.
  - ✓ Cycles constitute about 20% of total traffic on Bijapur road and 17% of total traffic on Pandharpur road.
  - ✓ This is a 2-lane road with a total length of 3.0km. Parking is observed on both sides of the road. A minimum footpath width of 1.5m should be provided on either sides of the road. Existing right of way is sufficient for provision of cycle track of 1.5m on either sides of Sangli-Miraj road.

The minimum width of a cycle track for one-way lane is 2m and for two-way lane is 2.8 m. As per “Guidelines for Non-Motorised Transport in Medium sized Indian cities” prepared by Ministry of Urban Development, minimum width for cycle lanes varies between 1.2-2.0m whereas IRC 70-1977 suggests a minimum lane width for cycle track is 1.0m on either side of the road. A spacing of 1.5m should be provided with a minimum width of 10–15 cm solid line separating from normal traffic.

A typical view of the cycle lanes with footpath separating normal traffic is shown in Figure 5-26 Typical View of Segregated Non-Motorised Vehicular (Cycle) Lane. If traffic speed is low, NMT can be mixed with other vehicles. It has been observed from Household Survey, that percentage of students and workers using cycles to educational and work purpose is 44% and 45% respectively. Therefore more routes needs to be planned taking into account educational travel pattern and work centre locations. Targeting educational trips for usage of cycle tracks is best way to encourage the cycle use. Educational institutions should also encourage either public transport or cycle so as to minimise use of private vehicles.

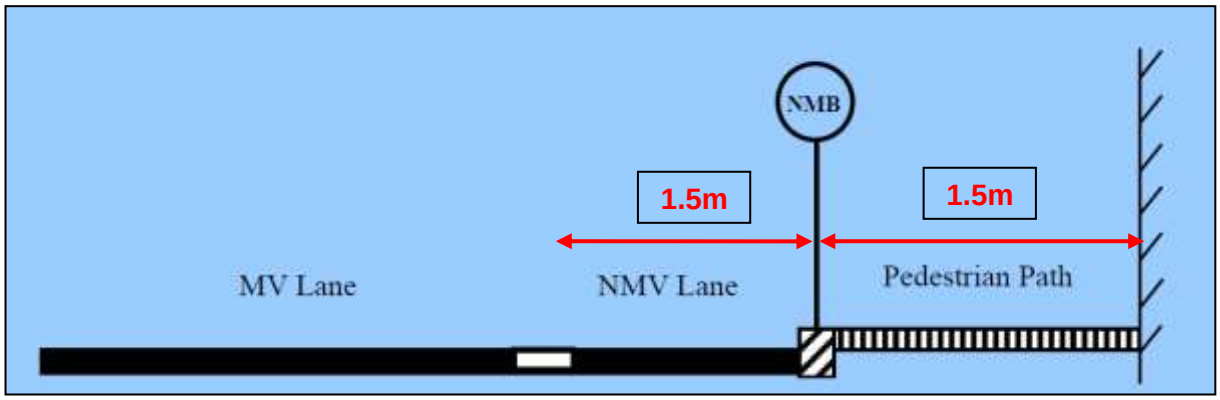


Figure 5-26 Typical View of Segregated Non-Motorised Vehicular (Cycle) Lane

As a policy free parking for cycles should be kept at important places such as railway and bus terminals, educational institutions, hospitals, commercial areas etc. This will also encourage usage of cycles.

National Urban Transport Policy for India prepared by Ministry of Urban Development, Government of India recommends the following policies for the Non-Motorised Transport:

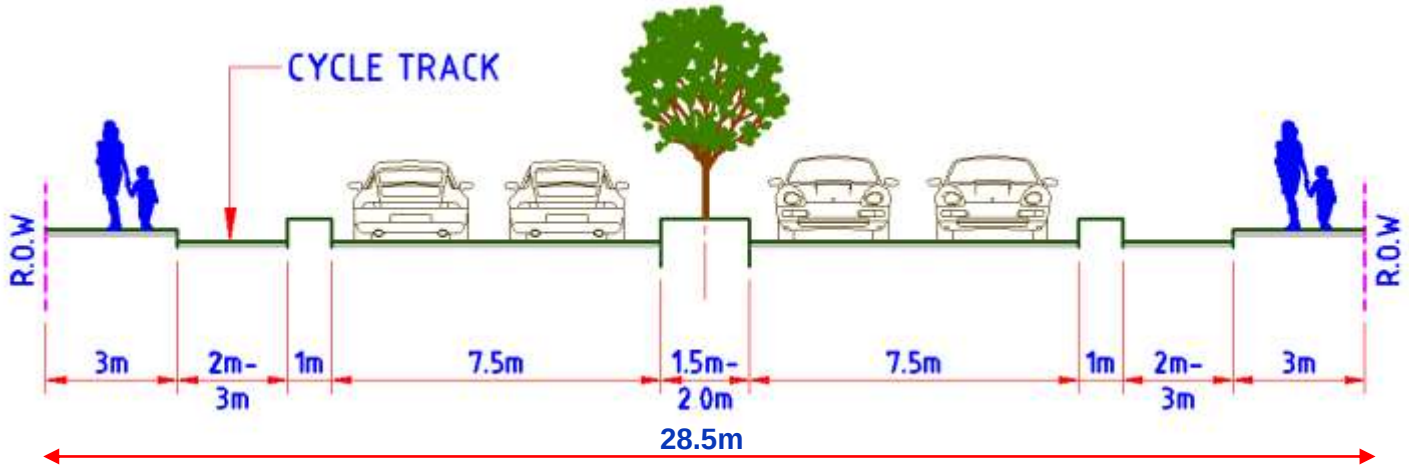
(i) The safety concerns of cyclists and pedestrians should be addressed by encouraging the construction of segregated lanes for bicycles and pedestrians. Segregation of vehicles moving at different speeds would improve traffic flow.

(ii) Segregated NMV paths are required not only along arterials but also access roads to public transport terminals. This will increase the use of the public transport system particularly when combined with the construction of NMV parking.

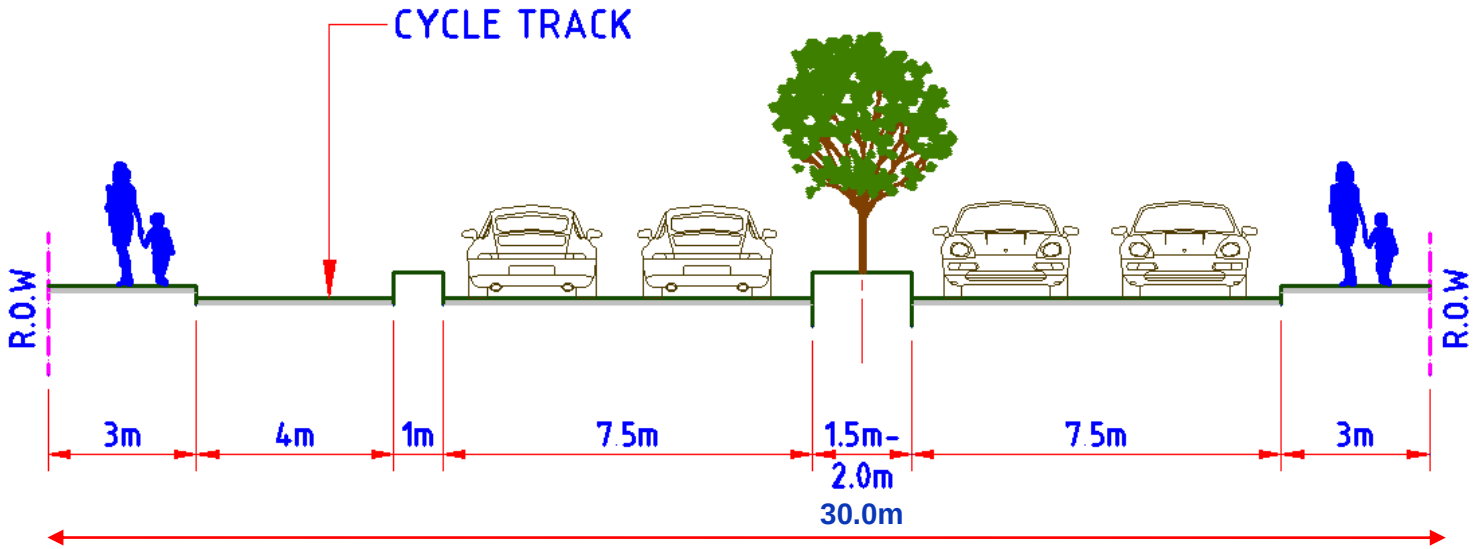
(iii) It is essential that NMT facilities be designed and constructed by consulting experts and community (i.e., potential users).

(iv) Activities on footpaths such as street vendors should be properly controlled to secure pedestrian safety.

A typical cross section showing provision of cycle tracks is presented in below.



Four Lane Divided Road with Either Side Cycle Track



Four Lane Divided Road with One Side Cycle Track

5.4 Public Transport Improvement Proposals

5.4.1 Existing Scenario

Public Transport in S-M-K City is a road based Bus, operated by M.S.R.T.C. Currently around 87 MSRTC buses (47 buses in Sangli depot, 40 buses in Miraj depot) are operational on 87 routes with a total staff of 1491 (City and Regional). The combined average number of passengers travelling per day is around 0.65 Lakh. City buses are operating within the city and also out of the S-M-K City (up to 10 Km from City).

Sangli Bus Stand (City & Regional)

The current share of Bus Transport by the residents of S-M-K City is around 3.35% (0.25 Lakh from Household Survey) of the estimated 7.68 Lakh trips and 11.08% of the total 2.32 Lakh motorised trips is as against the desired share of 25% as per the Guidelines issued by the Ministry of Urban Development, GOI. These guidelines are presented in Table 5-6. The average number of passengers travelling in 2006-07 (MSRTC) was 0.61 Lakh per day with 111 routes which have increased to 0.65 Lakh per day in 2010-11 with 87 routes. Significant number of people from nearby areas of S-M-K city are using the Intra-city buses.

Table 5-6 Desired Share of Public Transportation

S. No.	*City Population (in Millions)*	*Desired Share of Public Transport (%)*
1	0.5 -1	25
2	1-2	30-40
3	2-3	50-60
4	3-5	60-70
5	> 5	70-85

5.4.2 MSRTC Buses

MSRTC have two bus depots in S-M-K City (namely Sangli and Miraj). There are three bus terminals in S-M-K City (Sangli City and Regional bus stand, Miraj Regional bus stand and Miraj City bus stand). Buses are running at 30-min frequency during peak hour, which is inadequate. The year-wise schedule and operational characteristics of M.S.R.T.C are presented in **Table 5-7**.

Table 5-7 Operational Characteristics of Public Transport (ST Bus) in S-M-K City

S. No	Particulars	2005 - 06	2006 - 07	2007 - 08	2008 - 09	2009 - 10	2010-11
1	Avg.No.fo Sch. Operated	81	75	71	75	73	78
2	Effective Kms (In Lakhs)	70.35	64.98	64.01	66.70	63.77	66.17
3	Traffic Receipts (Rs In Lakhs)	1242.81	1163.52	1260.38	1441.89	1391.77	1499.99
4	E P K M (In Rs)	17.67	17.91	19.69	21.62	21.82	22.67
5	Concession Value Rs (In Lakhs)	238.44	249.77	279.44	352.83	376.26	426.71
6	**E P K M (In Rs) Including Concessional Value**	**21.06**	**21.75**	**24.06**	**26.91**	**27.73**	**29.11**
7	% Load Factor	58.57	59.75	66.37	65.75	67.42	70.28
8	Crew Duty (In Kms)	121.9	124.0	127.9	134.7	128.7	130.3
9	Vehicle Utilization	216.36	223.75	228.65	233.27	234.27	219.13
10	% Fleet Utilization	97.77	98.19	99.53	99.46	98.06	97.87
11	Rate Of Accidents (Per Lakh Kms)	0.14	0.08	0.20	0.15	0.16	0.18
12	Rate Of Break Downs (Per 10 Thousand Kms)	0.40	0.47	0.32	0.23	0.15	0.10
13	Total Cancelled Kms (In Lakhs)	1.66	2.46	1.40	0.78	2.53	1.52
14	% Of Cancelled Kms.	2.33	3.68	2.17	1.17	3.83	2.26
15	K P T L (HSD)	46.44	46.72	46.59	46.69	46.86	47.63
16	K P L (ENG Oil)	734	786	834	860	950	1279
17	Rate of New Tyre Consumption (Total)	0	0	0.06	0	0	0.08
18	Over Time Cost (Paise Per KM)	7.46	5.19	21.22	71.32	60.55	96.74
19	**C P K M (In Rs)**	**22.14**	**23.01**	**23.82**	**25.27**	**27.48**	**31.18**
20	Margin (Rs In Lakhs)	-314.47	-331.68	-264.12	-243.75	-360.70	563.26
21	Margin (Rs Per KM)	-4.47	-5.10	-4.13	-3.65	-5.66	-8.51
22	**Margin (Rs Per KM Incl. Concessional Value)**	**-1.08**	**-1.26**	**0.24**	**1.64**	**0.25**	**-2.07**
23	**Loss / Profit Incl. Con. Value (Rs In Lakhs)**	**-75.98**	**-81.87**	**15.36**	**109.39**	**15.94**	**-136.97**
24	Number of Routes	NA	111	93	86	87	87
25	Yearly Passengers Carried (In Lakhs)	NA	224.57	223.29	241.91	236.06	235.83
26	Average Daily Passengers Carried (In Lakhs)	NA	0.62	0.61	0.66	0.65	0.65

Notes:
1. E.P.K.M means Earnings Per Kilo Meter
2. C.P.K.M means Cost Per Kilo Meter
3. K.P.T.L means Kilometres Per Ten Litres where as K.P.L means Kilometres Per Litre

It is observed that the E.P.K.M including concession value has increased from Rs. 21.06 in the year 2005 to Rs. 29.11 in the year 2010 at an average yearly growth of 5.54% where as C.P.K.M has increased from Rs.22.14 in the year 2005 to Rs. 31.18 in the year 2010 at an average yearly growth of 5.87%. The year-wise revenue and expenditure of public transport (City ST Bus) in S-M-K City is presented in **Table 5-8**.

Table 5-8 Yearly Revenue and Expenditure of M.S.R.T.C (City Bus) in S-M-K City

Year	*Total Revenue (in Lakhs)*	*Total Expenditure (in Lakhs)*	*Net Profit/Loss (in Lakhs)*	*Benefit/Cost Ratio*
2005	1481.57	1557.55	-75.98	0.95
2006	1413.32	1495.19	-81.87	0.95
2007	1540.08	1524.72	15.36	1.01
2008	**1794.90**	**1685.51**	**109.39**	**1.06**
2009	1768.34	1752.40	15.94	1.01
2010	1926.21	2063.18	-136.97	0.93

In the last 6 years (2005 to 2010), M.S.R.T.C. (Sangli Division) has a total accumulated loss of Rs. 294.82 Lakhs with highest loss of Rs. 136.97 Lakhs in the year 2010. Year-wise passenger growth in S.T bus is presented in **Table 5-9**. There are profits during 2007, 2008 and 2009 with highest profit of Rs. 109.39 Lakhs in 2009. This is due to the variation in different characteristics such as Effective Kms, Percentage Load Factor, Vehicle Utilisation, Crew Duty and Cancelled Kms.

Table 5-9 Yearly Passenger Growth in M.S.R.T.C (City Bus) in S-M-K City

Year	*Passenger Carried (in Lakhs)*	*Growth Rate (in %)*
2006-2007	224.57	
2007-2008	223.29	-0.6%
2008-2009	**241.91**	**8.3%**
2009-2010	236.06	-2.4%
2010-2011	235.83	-0.1%

It can be observed that the growth of trips by M.S.R.T.C is almost stagnant except during 2008-2009. Rate of accidents in the year 2010 has increased from 0.14 in the year 2005 to 0.18 in the year 2010 which reduces the safety in usage of public transport.

The average yearly growth of passengers using public transport in S-M-K City is increasing at 0.98% from the year 2006 to 2010. The fare list of City buses in S-M-K City for 2011 is presented in **Table 5-10**. The minimum fare per km. for city buses in S-M-K City for the year 2011 is Rs. 6.00.

Table 5-10 Fare List of City Bus Service in S-M-K City

S.No	Km.	Fare (In Rs.) 2011		Fare (Rs. Per Km) 2011	
		Adult	Child	Adult	Child
1	0.0 to 2.0 Km.	6.00	3.00	4.00	2.00
2	2.1 to 4.0 Km.	6.00	3.00	1.97	0.98
3	4.1 to 6.0 Km.	7.00	4.00	1.39	0.79
4	6.1 to 8.0 Km.	8.00	4.00	1.13	0.57
5	8.1 to 10.0 Km.	10.00	5.00	1.10	0.55
6	10.1 to 12.0 Km.	12.00	6.00	1.09	0.54
7	12.1 to 14.0 Km.	14.00	7.00	1.07	0.54
8	14.1 to 16.0 Km.	16.00	8.00	1.06	0.53
9	16.1 to 18.0 Km.	19.00	10.00	1.11	0.59
10	18.1 to 20.0 Km.	21.00	11.00	1.10	0.58
11	20.1 to 22.0 Km.	23.00	12.00	1.09	0.57
12	22.1 to 24.0 Km.	25.00	13.00	1.08	0.56
13	24.1 to 26.0 Km.	27.00	14.00	1.08	0.56
14	26.1 to 28.0 Km.	29.00	15.00	1.07	0.55
15	28.1 to30.0 Km.	31.00	16.00	1.07	0.55
16	30.1 to 32.0 Km.	32.00	16.00	1.03	0.52
17	32.1 to 34.0 Km.	34.00	17.00	1.03	0.51
18	34.1 to 36.0 Km.	34.00	17.00	0.97	0.49
19	36.1 to 38.0 Km.	36.00	18.00	0.97	0.49
20	38.1 to 40.0 Km.	36.00	18.00	0.92	0.46
21	40.1 to 42.0 Km.	38.00	19.00	0.93	0.46
22	42.1 to 44.0 Km.	38.00	19.00	0.88	0.44
23	44.1 to 46.0 Km.	40.00	20.00	0.89	0.44
24	46.1 to 48.0 Km.	40.00	20.00	0.85	0.43
25	48.1 to 50.0 Km.	42.00	21.00	0.86	0.43

5.4.3 Mini Buses

Mini Buses are introduced by M.S.R.T.C to increase the accessibility and started operations in the year 2011 and currently a total of 5 buses are running on few routes with average seating capacity of 31.

5.4.4 Strategy for Improving Public Transport

Considering the low patronage of public transport and consequent growth of 2 –wheelers calls for intervention from planning and Government authorities. Current average trip length in S-M-K City is 2.83 km including walk and 4.25 km excluding walk. Considering the lower average trip length significant shift to Public transport (current share is only 3.35% in total trips and 11.08% in motorised trips) cannot be expected. Pro-active policies from government are required to encourage the Public Transport. We recommend a fleet comprising of Standard buses and Mini-buses. Standard buses will serve the major corridors whereas mini-bus services act as a feeder services and low demand corridors. The aim to increase the current share of Bus which is around 6.2% (excluding walk trips) to 10% with 5 years.

M.S.R.T.C should aim at following realistic targets for achieving proper share for Public Transport:

- At present, 87 standard buses and 5 mini buses are handling only 65,000 passengers per day. Frequency should be increased of these services and handling capacity can be increased to 85,000 passengers per day by increasing the load factor. Only Old buses needs to be replaced with New buses. Consultants have assumed that 20% of fleet to be replaced with New buses (around 18 new buses). In addition to Standard Buses, Mini Buses are to be acquired 15% of Standard buses (around 10 mini buses). It will be sufficient till 2014.
- In Medium term (within 5 years), MSRTC should target around 1 lakh passengers/day with a overall fleet size of 100 standard buses and 15 mini buses.
- In long term say by 2021 and 2031, M.S.R.T.C should target around 1.2 Lakh passengers/day and 1.75 Lakh passengers/day with a fleet size of a total 125 and 175 standard buses in addition to 20 and 25 mini buses.
- Coverage Area of Buses should be improved to 90%.

Following steps should be taken to improve the public transport:

- Bus Stops should be provided at every 450m to 500m
- Access to all Bus Stops should be improved. According to MoUD report titled “Guidelines and Toolkits for Urban Transport Development in Medium Sized Cities in India”, the percentage of urban area within 500m of the Bus Stop location should be between 75% and 90%.
- Feeder service (such as auto) should be encouraged to Bus stops and Bus Stands.
- Frequency of the Buses should be increased from current 15-30 min to 5-10 min during peak hours.
- There are no proper Bus Stops at present. **Figure 5-27** shows typical bus shelter in S-M-K city. Bus Stop should be provided with separate bus lane (wherever possible) with proper shelter at bus stop. Construction of New Bus Stops / Improvement of Existing Bus Stops should be planned with proper signage and information display. Bus shelter can be developed on Public-private partnership (PPP) basis generating revenue from advertisements.

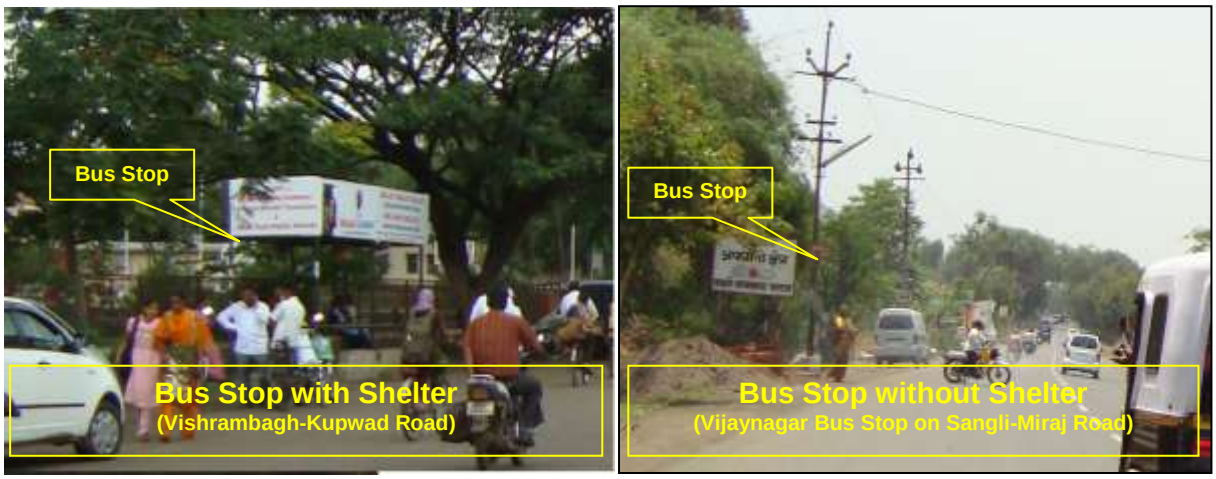


Figure 5-27 Existing Bus Stops in S-M-K City

- Transport Authority should issue a timetable and public awareness campaign should be carried out. Transport Authority should handle services professionally with a motto of serving the people. There should be Public relationship officer who is available to clarify/alleviate the public transport related issues.
- Educational trips constitute 28% of the total trips in S-M-K City. Public Transport Bus should target these education trips by introducing monthly concessional passes at 50% of the cost. This is a first major step, which is expected to increase the modal share in favour of Bus. New routes should be planned to cater to educational trips such as Engineering Colleges located at outskirts.
- For other category of commuters, some form of monthly passes should be introduced with 10%-25% of discount.
- The coverage of Bus service should be improved such as bus connectivity to Work and Educational Centres, Bus Stands and Railway Stations. In order to improve coverage, more routes need to plan which are presented below:
  - ✓ Sangli S.T Stand-100 ft road Jn (Kolhapur road)-Dhamni
  - ✓ Sangli-Civil Hospital (Ambedkar Road)-Vantamoore Corner-Miraj Railway Station-Laxmi Market
  - ✓ Sangli S.T. Stand-Vakharbagh-College Corner-Sangli Railway Station-Kupwad Gaothan/M.I.D.C
  - ✓ Madhavnagar-College Corner-Sangli Railway Station-Vishrambagh-Vantamoore Corner-Miraj Railway Station-Laxmi Market
- Mini bus with a capacity of 31 passengers should be expanded and should be operated on narrow roads along with existing routes which improve accessibility. Some of the bus routes where mini buses can be introduced are as follows:
  - ✓ Sangli S.T Stand-Rajwada-Pushparaj Jn-Vasanthdada Market-Sangli Railway station
  - ✓ Sangli S.T Stand-Rajwada-Pushparaj Jn-Miraj Railway station-Laxmi Market-Shaniwarpet
- Sangli bus terminal is congested and difficult for the circulation of buses. Existing Sangli Bus Terminal needs to be improved in terms of traffic circulation and separate city and regional terminal should be planned to cater the future passenger demand. Sangli bus terminal can be expanded by shifting the Sangli depot area and using it for the operation of regional buses whereas the present bus terminal area can be used for the city operations.

- New Bus Terminal with bus depot should be planned near Madhavnagar with a capacity of around 50 buses in the year 2016.
- Private vehicles should be discouraged by imposing pollution levy and higher registration fees. Restrictions and heavy penalties should be imposed for unauthorised on-street parking. Off-street parking should be made costly and no discounts should be given. Off-street parking facilities should be self-sustaining. These measures should only be carried once ensuring adequate supply of public transport with good level of service and frequency.
- M.S.R.T.C should carry out separate detailed transit planning Study which will identify all the Bus routes (major and minor), schedules, frequency of services, locations of Bus Stops, layout and design of bus stops, fleet size of standard bus and mini-bus, financial viability etc. Proper planning, prior study is essential for successful implementation of bus services. Adhoc decisions without proper study with respect to routes and scheduling will have huge negative impact on public transportation viability and sustainability.
- Single uniform ticket needs to be introduced for Standard Bus and Mini-bus.

5.4.5 Bus Terminals

City Bus

At present for City bus operation, there are two Bus Terminals namely Sangli and Miraj. Consultants proposed short term and long term improvement proposals for different bus terminals.

Sangli S.T Stand – Sangli bus terminal is a common bus terminal for both city and regional bus operation which is congested and difficult for the circulation of buses. It has four gates accessing from various directions. Around 2000 bus trips move in and out of Sangli terminal at all the gates. Existing Sangli Bus Terminal needs to be improved in terms of traffic circulation and separated for city and regional movement of passengers to cater the future passenger demand. Sangli bus terminal can be expanded by shifting the Sangli depot area and using it for the operation of regional buses whereas the present bus terminal area can be used for the city operation. Some of the traffic circulation improvements are discussed below:

- ✓ Buses should stop at designated platforms and all the passengers are required to be boarded from platforms. Arrival/departure of buses shall be announced through public announcement system or digital display.
- ✓ As the number of platforms are few, the waiting time of the buses at the platform should be restricted to 15-30 min in order to augment the handling capacity of terminal.
- ✓ For buses which have high turnaround time shall wait in depot areas.
- ✓ Proper signboards should be placed at the entry/exit gates of the bus terminal.
- ✓ There is no definite parking available for 2-wheeler or 4-wheeler which needs to be provided paid parking for 2-wheelers in depot area.

The traffic circulation in Sangli Stand is shown in **Figure 5-28**.

Figure 5-28 Traffic Circulation in Sangli S.T Stand

Miraj S.T Stand – Miraj city bus terminal has three gates for accessing from various directions. Around 500 bus trips move in and out of Miraj City Bus Stand through all the gates. Buses should stop at designated platforms and all the passengers are required to be boarded from platforms. Arrival/departure of buses shall be announced through public announcement system or digital display. Proper signboards should be placed at the entry/exit gates of the bus terminal. There is no definite parking available for 2-wheeler or 4-wheeler which needs to be provided for at least 2-wheelers. Private vehicles should be avoided passing through the bus stand which needs enforcement.

On a long term basis, with proposed augmentation of bus services there is a requirement additional 1 bus terminal. Year wise requirement of bus terminals are presented below:

Year	No. of Bus Terminals required	Remarks
2011	1	As Sangli S,T stand is congested, there is a need to separate City and regional operations where regional bus stand can be provided in depot area of Sangli S.T stand
2021	1	Due to increased demand and congestion at Sangli bus terminal, city bus terminal along with depot is proposed at Laxminagar near Octroi where land is allocated for bus terminal.
2031	1	Due to increased demand and fleet size, a bus terminal is proposed at Vishrambagh for operating regional buses along with private buses.

Consultants also recommend 2 bus depots exclusively for maintenance purpose by 2031. At present, a total of 260 buses (City-92 includes standard and Mini Buses and Regional-168) are in operational which have 2 bus depots for maintenance. By 2031, 200 city buses are planned to be in operational for which existing 2 bus depots are not sufficient for maintenance.

Intercity City Bus Operation

At present intercity bus operations, two government bus terminals (Sangli and Miraj) are available operated by M.S.R.T.C. A total of 168 buses (92 buses in Sangli depot and 76 buses in Miraj depot) are operating for intercity operation of which 44 buses are running more than 300 Km. Around 0.5 Lakh daily trips are made through inter-city buses in S-M-K city. Buses are running at 20-30 min frequency on routes connecting to Kolhapur, Islampur, Palus, Jath, etc. The fare list for the intercity operational buses is presented in **Table 5-11**. The traffic circulation in Sangli S.T. Stand is explained in previous section. Miraj regional stand should be improved in terms of parking for 2-wheeler and arrival and departure times of the buses should be announced to passengers through audio communication or digital display. The movement of buses should be organised in definite pattern to avoid circulation problems. Land is available for extension of bus stand to meet the future passenger demand. There is a need to develop a Bus Terminal at Vishrambagh for inter-city bus operations in future as there are only 2 bus terminals for regional operation carrying around 0.5 lakh daily trips of which Sangli S.T stand is operating both city and regional operation which is congested.

Table 5-11 M.S.R.T.C Fare List for Intercity Bus Services

S. No	Type of Service	Fare (Rs. Per Stage)
1	Ordinary	4.80
2	Express	4.80
3	Night Services	5.60
4	Semi-Luxury	6.40
5	A.C. Semi Luxury (Sheetal)	8.50
6	A.C. Shivneri	11.85
7	Janata	4.40

Around 20 travel services are operated for intercity movement in S-M-K City. Two bus terminals are used by private operators (such as Konduskar SR, Nakoda, Dolphin etc.) which do not have any demarcated areas and therefore using carriageway for parking and boarding/alighting. There are six boarding points in S-M-K City for the private bus operators which cause obstruction to the normal traffic flow and reduction of journey speeds (such as Sangli S.T.Stand Road and Jath Road near Miraj City Bus Stand). There is a need of bus terminal for the private buses which can be provided along with proposed Vishrambagh regional bus terminal.

5.4.6 Railway Stations

There are four Railway Stations in S-M-K City namely Sangli, Miraj, Vishrambagh and Madhavnagar. Around 39,000 passengers are travelling per day through train of which constitutes 5.54% of total passengers are using the Intracity movement in S-M-K City. Many passengers travel from S-M-K city to Kolhapur for the Work/Business purpose.

Miraj Railway Station is an important junction on Central Railway and is near to the Karnataka border. Miraj railway station is mostly used for long distance travel and to nearby areas such as Kolhapur, Belgaum, etc. Many passenger trains operate between S-M-K City and Kolhapur City. Sangli railway station has high passenger movement in peak hours. Vishrambagh Railway Station is operational in peak hours only and is mostly used by the passengers residing surrounding Vishrambagh. Both Sangli and Vishrambagh railway stations are used mostly by passengers travelling to nearby areas. At times, trains used to stop at Madhavnagar Railway station and no movement of passengers in Madhavnagar Railway Station.

Miraj Railway Station – Shortage of space for circulation of Autorickshaws/taxi is observed. Therefore, more parking/circulation areas are required to be provided. In view of above, possibility of procuring railway land for additional parking/circulation area should be explored. Access roads connecting to Miraj Railway station from Miraj Market and Sangli-Miraj Highway should be improved by providing good circulation of buses, signboards, speed limits and footpaths. A snapshot view of Miraj Railway Station is shown in **Figure 5-29**.

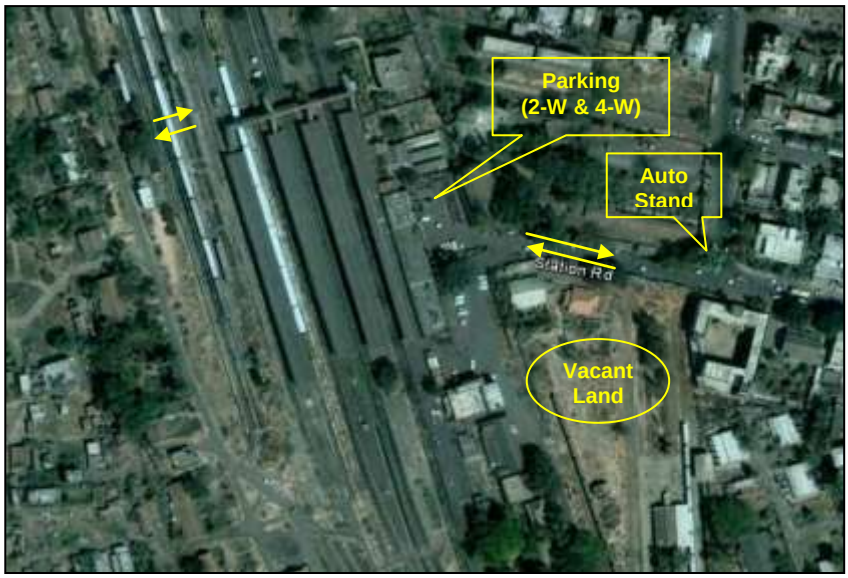


Figure 5-29 Satellite View of Miraj Railway Station

Sangli Railway Station – Existing parking/circulation area is sufficient for the present parking demand. Open land is available near railway station for accommodating the future passenger demand. Access roads connecting to the railway station are in poor condition which needs to be improved. There is a need of improving the accessibility to the railway station by providing minibuses from core areas of Sangli in peak hours. A snapshot view of Sangli Railway Station is shown in **Figure 5-30**. A FOB is suggested at Sangli Railway Station in future for accessing to Station from other side of the Sangli Railway Station (Sangli Railway Goods Office). Present passenger demand at Sangli Railway station is very low, whereas it is revealed from opinion survey for provision of access to Sangli Railway station from Sangli Railway Goods Office (Old Kupwad Road).

Figure 5-30 Satellite View of Sangli Railway Station

Vishrambagh Railway Station – At present, passenger demand at Vishrambagh railway station is very low. About 1407 passengers use this railway station daily. It is mostly accessed from nearby residents where accessing facilities are very poor (earthen road) which needs to be improved by providing block pavement/footpath facilities. Station area and accessibility should be improved.

Madhavnagar Railway Station – At present, passenger movement was not observed at Madhavnagar railway station and there is no clear access to railway station. It is found from local enquiry that trains used to stop at this station for the employees accessing Vasanthdada Sugar factory from nearby areas of S-M-K city which is not observed. In future, this station can be improved and can be operated in peak hours (like Vishrambagh railway station) for providing access to employees working in nearby areas such as Kolhapur, etc.

5.5 Intermediate Public Transport

5.5.1 Auto-rickshaws

Currently, around 4100 autos (3-seater/6-seater) are operational in S-M-K city. 3-seater auto have a trip share of 4.82% in the city with an average trip length of 2.77 km where as 6-seater auto have a trip share of 2.91% in the city with an average trip length of 4.59 km. Para transit is normally expected to fulfil a need that neither public transport or personal vehicles are able to fulfil. In absence of good public transport these are used extensively. Following aspects needs immediate attention.

Auto Stand @ Vantamure Corner on Sangli-Miraj Main Road

- **Metering** – To encourage Intermediate Public Transport, distance based fare collection (Metering) system should be followed strictly. At present metering is not followed.
- **Old or Aged Autos** – RTO/ S-M-K CMC should put restrictions on use of old autos.
- **Parking Lots** – At present, around 130 auto stands are present in S-M-K City. Many auto stands are present on road side using the carriage way and thus decreasing the capacity of road. There is need to create parking lots/auto stands so as to avoid parking on the carriageway.

5.6 Road Widening/ Development Proposals

IRC 106-1990 for Urban Roads recommend Design Service Volumes for different classification of roads at Level of Service C (i.e., Design Service Volume/Capacity = 0.7) and the estimated capacities are presented in **Table 5-12**. Required number of lanes has been worked out for each road corridor/sections on the basis of lane configuration. It is observed that no. of lane requirements is very high, which is not feasible to provide in the field. Therefore the rationalisation of lane requirements is made.

Access Road to Sangli Railway Station

The road development is proposed up to 2021, widening proposals beyond 2021 may not be feasible and therefore demand management measures and improved public transport should be considered.

Table 5-12 Estimated Capacities (PCUs per Hour) as per IRC 106-1990

Type of Carriageway	Category of Urban Road		
	Arterial	Sub-Arterial	Collector
2-Lane Two Way	2143	1714	1286
3-Lane One Way	5143	4143	3143
4-Lane Undivided Two Way	4286	3429	2571
4-Lane Divided Two Way	5143	4143	
6-Lane Undivided Two Way	6857	5429	
6-Lane Divided Two Way	7714	6143	

5.6.1 Road Improvement Proposals

The travel demand models developed for the S-M-K city, showing predominant demand of travel in east-west direction. Sangli-Miraj road is taking a significant proportion of that demand. The assignment results reveals that there is a requirement of improving other roads to serve the East-West movement of traffic and therefore consultants have identified corridors which is forecasted to have heavy traffic loadings in horizon year to the east of Sangli-Miraj road as well as west of Sangli-Miraj road. Many roads in S-M-K CMC which are providing access to Sangli-Miraj road and other important areas are in poor condition which needs maintenance related work. The list of roads which needs improvement is presented in **Table 5-13**. The improvement of roads in S-M-K CMC includes potholes filling, overlays, etc.

Access Road to Miraj Railway Goods Office

Access Road at Sangli-Miraj ROB to Ahilyanagar

The list of road widening proposals for different roads in S-M-K city is presented in **Table 5-14**.

Table 5-13 Road Improvement Proposals

S. No	Road Name	Present Lane Configuration
1	Maniknagar RUB to Sangli-Miraj ROB (via Miraj Railway Goods Office)	2-Lane
2	Sangli R.S RUB to Sangli Railway Goods Office	2-Lane
3	Vasanthdada Market to Sangli Railway Station RUB	2-Lane
4	Vakharbagh Road to Vakarbagh Truck Terminal	2-Lane
5	Miraj Station Rd at Central Excise on Sangli-Miraj Rd to Babasaheb Udhyan	2-Lane
6	Mission Hospital Jn to Shastri Jn (Vijapur Rd)	2-Lane
7	Mission Hospital Jn to Miraj Market Rd (Pandharpur Rd)	2-Lane
8	College Corner Jn to Sangli Railway Station RUB	2-Lane
9	Patel Jn to College Corner (Vakharbagh Rd)	2-Lane
10	Miraj Shastri Jn – Pandarpur Road (via Laxmi Market)	2-Lane
11	M.I.D.C @ Godrej to Mission Hospital Jn (Miraj-Kupwad Rd)	2-Lane
12	Miraj City Bus Stand Jn to Malgaon Rd/Takkali Rd Jn (Via Laxmi Market)	2-Lane
13	Shasthri Jn-Arjunwadi (Shirol Road)	2-Lane
14	100 ft Road (Sangli-Kolhapur Road to Vishrambagh Jn)	4-Lane

Table 5-14 Road widening Proposals

S. No	Road Name	Present Lane Configuration	Future Lane Configuration	Year
1	Kupwad Settlement portion (Miraj-Kupwad Main Road)	Intermediate	2-Lane	2011
2	Jhulelal Jn to Pushparaj Jn (Ambedkar Rd)	2-Lane	4-Lane	2016
3	Mission Hospital Jn to Miraj Market Road Jn (Pandarpur Rd)	2-Lane	4-Lane	2016
4	Mission Hospital Jn to Shastri Jn (Vijapur Rd)	2-Lane	4-Lane	2016
5	Octroi to Shastri Jn (Kolhapur Rd)	2-Lane	4-Lane	2016
6	Sangli Railway Godown Rd Jn to Police Quarters Rd Jn (Kupwad Rd)	2-Lane	4-Lane	2016
7	Sangli R.S RUB to Ahilyanagar/Kupwad Rd Jn (Old Kupwad Rd)	2-Lane	4-Lane	2021
8	College Corner Jn to Octroi (Madhavnagar Main Rd)	2-Lane	4-Lane	2021
9	Pushparaj Jn to ROB (Sangli-Miraj Rd)	5-Lane	6-Lane	2021
10	Pushparaj Jn to ROB (Sangli-Miraj Rd)	4-Lane	6-Lane	2021
11	Marathe Textile Mill to Sangli Ves Rd/Vijapur Rd Jn	2-Lane	4-Lane	2021
12	Marathe Textile Mill to Before RUB at St. Peters Telugu Church	2-Lane	4-Lane	2021

5.6.2 Improvement of Radial Road

Improvement of following Radial Roads are recommended for 4-lane configuration from existing 2-lane configuration by 2021.

- Sangli-Kolhapur Road (Present PCUs - 28,354)
- Sangli-Islampur Road (Present PCUs - 16,354)
- Sangli-Tasgaon Road (Present PCUs - 15,239)
- Miraj-Pandharpur Road (Present PCUs - 11,906)
- Miraj-Bijapur Road (Present PCUs - 12,158)
- Miraj-Shirol Road (Present PCUs - 14,041)


Sangli-Kolhapur Road near S.T.Office

5.6.3 Requirement of Bypass roads

In general, bypasses are required to avoid the passing of through traffic from the city. It was observed from the field surveys, that the amount of by passable traffic in S-M-K CMC is about 15,940 PCUs in the year 2011 of which major contributors are Kolhapur road, Islampur Road, Pandarpur Road, Tasgaon Road and Bijapur Road with 24%, 23%,17%,15% and 10% of by passable traffic respectively. About 33% of the Goods traffic and 22% of the Passenger traffic are external-external trips at outer cordons of S-M-K city. Presently, S-M-K City has four bypass roads namely Miraj-Kolhapur bypass, Islampur-Madhavnagar bypass, Bijapur-Pandarpur bypass road and Bhudhgaon-Pandapur road. The details of existing and proposed bypass roads are discussed below:

5.6.3.1 Existing Bypasses

Miraj-Kolhapur Bypass Road

Miraj-Kolahapur bypass is a 2-lane road with paved shoulders. This road is the part of MSH-3 i.e, Ratnagiri-Nagpur Highway. The length of bypass road is 8.5 km starting from Ankali junction to ROB at Miraj railway Station. The land use on the both sides of the road is open with some upcoming institutes. Current traffic on this road is 10,551 vehicles (13,276 PCUs). In general, the vehicles travelling from Miraj, Pandarpur and Karnataka to Kolhapur, Mumbai, etc and vice versa are using this road. This road is also accessed from Dhamni which is single lane narrow road. Dhamni road can be developed to improve the access from the centre of the city (i.e, Vasanthdada Market Yard).


Miraj-Kolhapur by pass road

Islampur-Madhavnagar Bypass Road

Islampur-Madhavnagar bypass is a 2-lane road with paved shoulders. The length of bypass road is 3.7 km starting from junction on Islampur road to junction on Madhavnagar road. The land use on the both sides of the road is open with little residential and commercial developments near Madhavnagar road. Current traffic on this road is 5,019 vehicles


Islampur-Madhavnagar Bypass Road

(6,618 PCUs). In general, the vehicles travelling from Madhavnagar, Bhudhgaon, Tasgaon and Palus to Islampur, Mumbai, etc are using this road. This road is also accessed from Karnal road and Old Budhgaon road. Karnal road is 2-lane road with good condition where as Old Bhudhgaon road is 2-lane road in poor condition. These roads can be improved to increase the access from the core areas of the city (i.e, Ganapathipet, Vakharbagh, etc.)

Bijapur-Pandhapur Bypass Road


Bijapur-Pandarpur Bypass Road

Bijapur-Pandharpur bypass (PMGSY Road-Waddi to Tasgaon) is a 2-lane road with poor condition. The length of bypass road is 12.9 km starting from junction near Waddi on Bijapur road to junction on Pandarpur road. The land use on the both sides of the road is open. Two level crossings are present on this road. Presently, very few vehicles destining towards Takkali, Malgaon and Bedag are using this road. In addition, multi axle trucks carrying heavy loads with long trailers are also using this road. Around 90% of the by passable traffic from Bijapur road to Pandarpur road are passing through the city. The length of the road from Waddi Junction to Pandarpur road Junction through the city is 12.9 km which is less than the length of the existing bypass road. This road is also accessed from Bedag road, Takkali road and Malgaon road. All the accessing roads are 2-lane roads in fair condition. The existing bypass road should be improved in combination with different alternative missing links increasing the full utilization of the bypass road.

Bhudhgaon-Pandarpur Bypass Road


M.I.D.C-Pandarpur Road

Bhudhagaon-Pandharpur bypass (PMGSY- Mahisal-Tasgaon) is a 2-lane road passing through Kupwad Gaothan and M.I.D.C areas with narrow road width at some sections. The length of bypass road is 9.3 km starting from Bhudhgaon junction to Junction on Pandharpur road. The land use on the both sides of the road is open/ agricultural with some residential/ commercial/ industrial developments at Kupwad and M.I.D.C areas. The road connecting Bhudhgaon and Kupwad is in poor condition at some sections needs improvement. In general, the vehicles travelling from Bhudhgaon and Tasgaon to Kupwad and Miraj, etc and vice versa will use this road.

Ankali-Haripur Bypass Road


Ankali-Haripur Road

Ankali-Haripur bypass (SH-139) is a single lane road with a total length of 5.4 km starting from Ankali junction to Junction on Islampur road. The land use on the both sides of the road is open/ agricultural with few settlements near Haripur. In general, the agricultural vehicles are using this road.

5.6.3.2 Proposed Bypasses

Kolhapur-Islampur Bypass Road

About 15,940 PCUs are bypassable traffic in S-M-K CMC of which 14% of the by passable traffic is between Islampur road and Kolhapur road which is highest among all cordon point combinations whereas 11% of the by passable traffic is between Madhavnagar road and Kolhapur road. The proposed bypass is a 2-lane road with an approximate length of 7.8 km starting from Ankali junction and ending at junction on Islampur road. It is a combination of existing Ankali-Haripur road (Single lane to be widened) partially with a length of 3.4 km and a new 2-lane road crossing Sangli-Haripur road and Krishna River ending at Islampur-Madhavnagar bypass road junction with an approximate length of 3.4km. According to Draft Development Plan of S-M-K CMC, the available D.P width in the proposed land use is 30.48m. The land use on the both sides of the road is open/ agricultural with some residential developments near Haripur and Sangliwadi settlements. To improve the access to this road from the city, another new 2-lane road connecting Sangli stand and Sangliwadi through Haripur road needs to be constructed where available D.P width is 30.48m as per Draft Development Plan of S-M-K CMC. The daily traffic on these roads is obtained from the model and is 3,261 PCUs in 2021 and 5,272 PCUs in 2031.

Ankali-Pandharpur Bypass Road

About 15,940 PCUs are by passable traffic in S-M-K CMC of which 14% of the by passable traffic is between Ankali road and Pandharpur road. A 2-lane bypass road is proposed connecting Ankali road and Pandharpur road with an approximate length of 12.87km. It includes a new 2-lane road connecting from Ankali road (Kolhapur bypass) at Nilgi road junction to existing PMGSY road near Bolward passing crossing Shirol road and the existing PMGSY road till Pandharpur road junction. According to Draft Development Plan of S-M-K CMC, the available D.P width in the proposed land use is 30.48m. The land use on the both sides of the road is open/ agricultural with some residential settlements near Malgaon and Takkali roads. The daily traffic on these roads is obtained from the model and is 19,315 PCUs in 2021 and 28,261 PCUs in 2031.

Madhavnagar-Pandarpur Bypass Road

About 15,940 PCUs are by passable traffic in S-M-K CMC of which 2% of the by passable traffic is between Madhavnagar road and Pandharpur road. This road acts as bypass road to Madhavnagar and Kupwad areas with an approximate length of 8.8km. The existing connectivity from Madhavnagar to Kupwad should be improved and the connectivity between Savali and Pandharpur road needs to be constructed new 2-lane road at some section. A D.P width of 30.48m is required for the improvement and construction of this link. The land use on the both sides of the road is open/ agricultural with some residential/commercial/industrial developments near Madhavnagar and M.I.D.C areas. The daily traffic on these roads is obtained from the model and is 8,728 PCUs in 2021 and 13,337 PCUs in 2031.

The summary of the all the existing and proposed bypasses is presented in **Table 5-15**.

Table 5-15 Details of Existing and Proposed Bypasses

S.No	Name of the Road	Lane Configuration	Length (Km)	Land Use	Daily Traffic (PCUs)	
					2021	2031
Existing Bypass Roads						
1	Miraj-Kolhapur Bypass	2-Lane	8.5	Open	29,424	44,967
2	Islampur-Madhavnagar Bypass	2-Lane	3.7	Open & Commercial	8,163	13,185
3	Bijapur-Pandharpur Bypass	2-Lane	12.9	Open & Commercial	3,641	5,859
4	Bhudhgaon-Pandharpur Bypass	2-Lane	9.3	Open, Residential, Commercial & Industrial	8,728	13,337
5	Ankali-Haripur Bypass	1-Lane	5.4	Open & Residential	3,261	5,272
Proposed Bypass Roads						
6	Kolhapur-Islampur Bypass	2-Lane	7.8	Open, Residential & Commercial	3,261	5,272
7	Ankali-Pandharpur Bypass	2-Lane	13.51			
a	Ankali - Shirol Road Bypass	2-Lane	2.36	Open	19,315	28,261
b	Shirol Roadd to Bijapur Rd Bypass	2-Lane	2.9	Open	6,207	10,022
c	Bijapur Road - Pandarpur Road Bypass	2-Lane	8.25	Open & Commercial	3,641	5,859
8	Madhavnagar-Pandharpur Bypass	2-Lane	8.8	Open, Residential, Commercial & Industrial	8,728	13,337

5.6.4 Missing Links

Consultants identified some of the missing links which improve accessibility and reduce congestion on other roads. The missing links provided in Draft Development Plan of S-M-K CMC has also been reviewed. The list of Missing links is presented in **Table 5-16**.

Table 5-16 List of Missing Links

S. No	Particulars	Length (km)	Comments	D.P Recommendation
1	Access Rd to Sangli Miraj ROB	0.2	To ease traffic on Vishrambagh road/Kupwad road	Recommended with a D.P width of 45.70m
2	Dhamni Rd Bypass	0.19	To reduce traffic on Kolhapur road and improve access to Dhamni	Recommended with a D.P width of 24.00m
3	Vakarbah to Islampur Bypass	0.22	To reduce goods traffic movement from the core	Recommended with a D.P width of 12.0m

S. No	Particulars	Length (km)	Comments	D.P Recommendation
			areas of the city	
4	Ganapthipet - Islampur Bypass	0.84	To reduce goods traffic movement from the core areas of the city	Recommended with a D.P width of 30.48m
5	Parallel link to Sangli-Miraj Road connecting from Ahilyanagar/Kupwad Rd Jn to Pandarpur road	5.32	To reduce the traffic on Sangli-Miraj road and to provide direct access to vehicles coming from Pandharpur road to M.I.D.C, Kupwad and Vishrambagh.	Recommended with a D.P width of 30.48m
6	VUP under Irwin Bridge connecting Haripur and Ganapathipet	0.01	To ease traffic between Sangli Gaobagh/Haripur and Ganapathipet	Recommended with a D.P width of 20.0m
7	Road from Vishrambagh/Vasanthdada market to Miraj-Kolhapur bypass road	2.60	To reduce goods traffic movement from the core areas of S-M-K city	Recommended with a D.P width of 24.4m at Vishrambagh (100 ft Road)

5.6.5 Rail under Bridge (RUB) proposals

S-M-K city has four existing RUBs at Maniknagar colony, Vijaynagar Colony, Sangli Railway Station and Miraj Railway Yard. There is a need to construct additional lane RUBs besides existing RUBs due to increase traffic in future. During implementation, care has to be taken to maintain a height of 5.5m for passage of all types of vehicles. The list of RUBs to be improved/constructed is presented in **Table 5-17** and Figure 5-31.

Table 5-17 List of RUB Proposals

Location	Present	Requirement	Year of Requirement
RUB @ Sangli Railway Station	2-Lane	4-Lane	2016
RUB @ Vijaynagar Colony	1-lane	2 Lane	2021
RUB @ Maniknagar Colony	1-Lane	2 Lane	2021

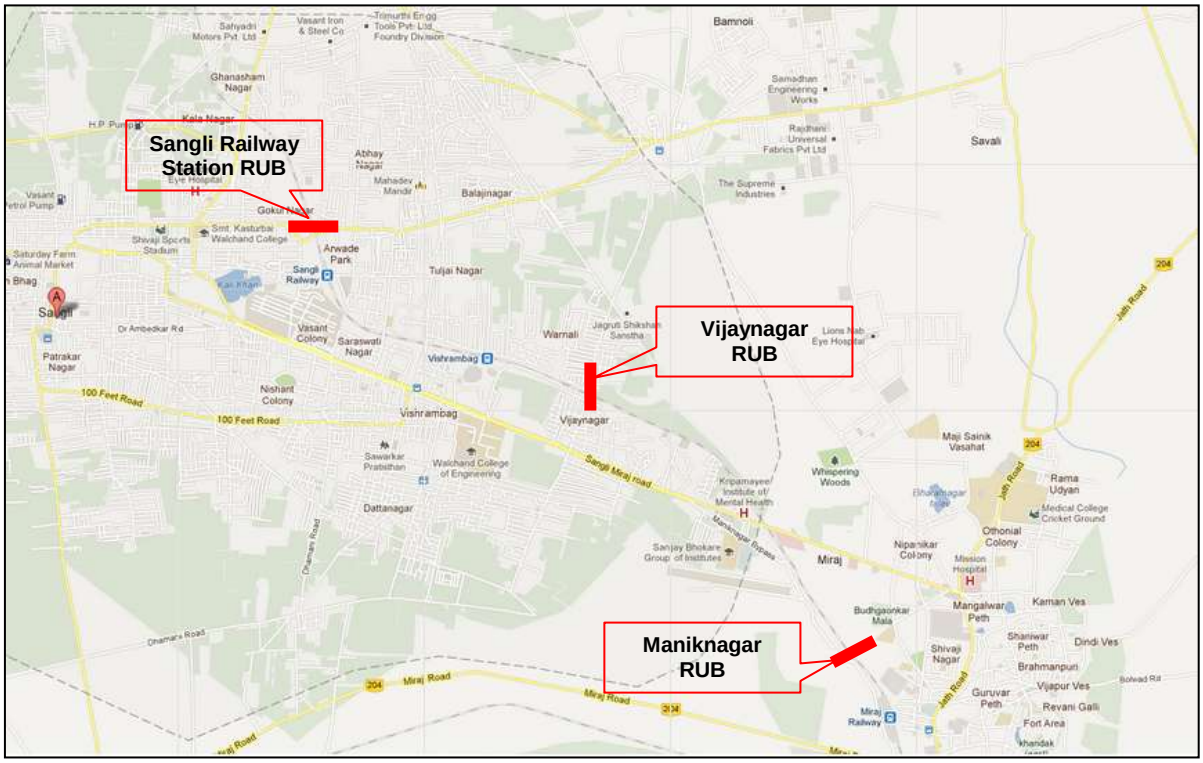


Figure 5-31 Proposed RUBs in S-M-K city

5.6.6 Rail Over Bridge (ROB) Proposals


Proposed ROB @ Vishrambagh Level Crossing

S-M-K city has five existing ROBs at Madhavnagar Road, Vijapur Road, Miraj Railway Yard, Sangli-Miraj Main Road and Vishrambagh Road (near Ambassador Hotel). There is a need to construct new/additional ROBs besides existing level crossings/ROBs due to increase in future traffic and the number of trains passing at the level crossing. Vishrambagh level crossing has the highest TVUs of 189273 followed by Shirol road with 98015 TVUs. As per standards, level crossing with TVUs more than 1,00,000 is eligible for the provision of ROB. Consultants strongly recommend ROB at Vishrambagh level crossing due to increased traffic, accidents and high TVUs. The list of ROBs to be improved/ constructed is presented in **Table 5-18**.

Table 5-18 List of ROB Proposals

Location	Configuration	Existing TVUs	Year of Requirement
Vishrambagh Main Road	4-Lane Level Crossing	189273	2011
Miraj-Shirol Road	2-Lane Level Crossing	98015	2016
Vijapur Road (SH-138)	2-Lane ROB	-	2021
Sangli-Miraj Main Road	4-Lane ROB	-	2021
Miraj-Kolhapur bypass road	2-Lane ROB	-	2021

5.6.7 Proposal of Bridges on the River

S-M-K city has two existing bridges at Sangli-Islampur Road and Islampur-Madhavnagar Road on Krishna River. There is a need to construct additional one bridge on Krishna River as part of Kolhapur-Islampur bypass road. The list of bridges to be improved/ constructed is presented in **Table 5-19** and **Figure 5-32.**

Table 5-19 List of River Bridge Proposals

Location	Requirement	Year of Requirement
Sangli-Kolhapur Road to Sangli-Islampur Road (River Portion)	New 2-Lane	2016

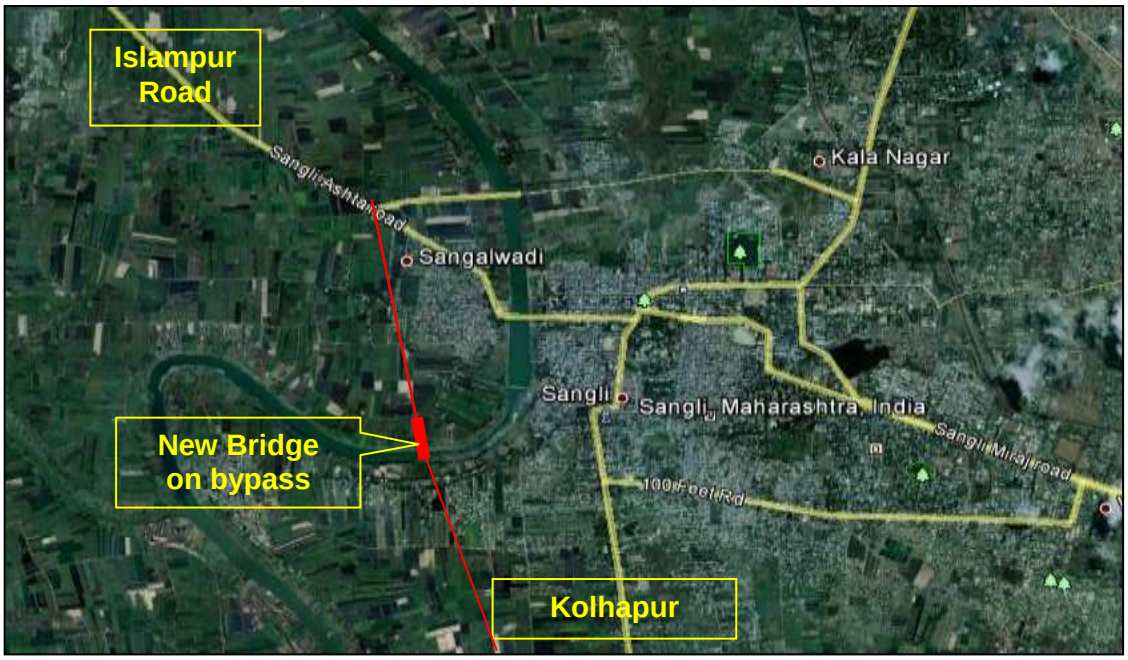


Figure 5-32 Proposed Bridges on Krishna River

5.7 Goods Transport Improvement Proposals

- S-M-K city is well known for the industries/goods such as Agro based, Sugar, Grapes, Turmeric, Indian Oil and Bharat Petroleum. There is possibility of growing more agro-based industries in Kupwad M.I.D.C.
- Currently there is only one truck terminal in S-M-K city at Vakharbagh area which has poor accessibility and in poor condition. The other truck parking areas in S-M-K city are Ganapathipet, Old Station Jn, Timber Area, Vasanthdada Market Yard, Sangli Railway Goods Office, Miraj Railway Goods Office, Sangli-Miraj M.I.D.C, Kupwad M.I.D.C and Miraj Market Yard.

Wakarbagh Truck Terminal

- The truck terminal at Vakharbagh has an approximate area of 300m x 30m accommodating around 250 trucks. This area has access from the core areas of S-M-K city which is leading to congestion to other traffic. The access roads are in very poor condition.
- Due to lack of terminal facility, trucks are getting parked on the carriageway in Vasanthdada Market Yard, M.I.D.C, Railway Godowns, Ganapathipet, Vakharbagh and Timber area for loading/unloading activities resulting in reduction of capacity of the road. It is observed that most of these areas passenger vehicles movement is observed.
- There is no truck terminal at entry points to S-M-K city (Out skirts at Cordon points). The number of commercial vehicles generated from different goods terminal points obtained from goods focal point survey (on sample basis) is presented in **Table 5-20** and the characteristics of different areas (obtained from Goods Focal Point survey) is presented in **Table 5-21**.

Table 5-20 Goods/Commercial Vehicles generation at various places in S-M-K City

S. No	*Location Name*	*No. of Commercial Vehicles (Both Directions)*
1	Sangli-Miraj MIDC	2116
2	Kupwad MIDC (Out of S-M-K CMC)	5932
3	Vasanthdada Market Yard	1563
4	Ganapathipet	919
5	Sangli Railway Godown	45
6	Bharath Petroleum Corporation Oil Ltd	260
	Total	***10834***

Table 5-21 Characteristics of different goods terminals in S-M-K city

S. No	Location Name	Type of Activity	Type of Product	Origin	Destination
1	Vasanthdada Market Yard	Storage	Rice, Wheat, Pulses, Match box & Turmeric	Raybagh, Bijapur, Karnataka,Nargundhi, Agalwadi, Pune, Latur, Barshi, Delhi, Satara & Jamkhandi	Sangli, Kolhapur & Miraj
2	Sangli Railway Godown	Storage	Salt & Urea	Pune & Mumbai	Sangli & Miraj
3	Kupwad M.I.D.C	Processing & Storage	Oil, Saraki, Soya bean, Sunflower, Palm, Plastic Item, Bedana & Metal Product	Pune, Mumbai, Malgaon, Miraj, Tasgaon, Mhaisal, Budhgaon, Jununi, Kuruchi, Bijapur, Solapur, Pandharpur, Nagpur, Goa, Karnataka, Maharashtra, Jalana & Beed	Sangli, Miraj, Kupwad, Kolhapur & Tasgaon
4	Miraj M.I.D.C	Processing & Storage	Animal Food, Starch & Auto Parts	Jaysinghpur, Kolhapur, Ichalkaanji, Bijapur, Kupwad, Mhaisal & Tasgaon	Sangli, Miraj, Jaysinghpur, Pune & Kolhapur
5	Ganapathipet	Storage	Rakhi, Cracker & Coconut	Shivkashi, Delhi & Kerala	Sangli, Miraj, Kupwad & Karnataka
6	Bharat Petroleum	Storage & Distribution	Petroleum Products	Gujarat	Sangli, Kolhapur, Ratnagiri, Sindhidurg and Satara

Consultants recommend following improvements for goods transport in S-M-K city.

- Vakharbagh truck terminal can be expanded towards Islampur-Madhavnagar bypass road where open land is available and can accommodate the more number of trucks (say 350 trucks) restricting the truck movement in day times. The access roads of this terminal area are to be improved. This can restrict the truck movement moving into Timber area and Old station Jn. Trucks generating from Ganapathipet and outer cordon on Islampur road can use this truck terminal.
- Ganapathipet should be provided access from Islampur-Madhavnagar bypass road which can reduce congestion on Harbhat road.
- It is recommended that movement of commercial Vehicles are allowed during off peak hours say 6 to 9 AM, 1 to 4 PM and 9 to 11 PM.
- Truckers are in a need of a secure place to park the vehicle. Truck terminal areas need to be provided for the areas such as Timber area (Sangli & Miraj), M.I.D.C, Sangli Railway Station, Indian Oil and Bharat Petroleum Distribution Centres (Near Miraj Railway Station) where land is constraint.
- D.P has recommended a minimum truck parking space of 300 m^2 at all Octroi collection centres on major roads which is not provided in D.P. maps of S-M-K CMC.

5.7.1 Truck Terminal Proposals

A truck terminal provides interface between intercity and local transportation facilities and which handle the distribution and collection of goods within the city. Such truck terminal will have minimum land area of 2 hectare. Some of the facilities that can part of truck terminals are as follows:

- Circulation Area and Parking Area
- Petrol Pump
- Toilets
- Restaurant /Dhabas
- Shops & STD booths
- Godown
- Weigh Bridge
- Administrative Office
- Fire Station
- Transport agents offices

The proposed truck terminal areas are listed below and are presented in Figure 5-33.

1. Sangli Railway Station Open Area
    - This terminal can be used by commercial vehicles generating from Sangli railway godown, Vasanthdada Market yard and Timber area. Open land near Sangli Railway station RUB is proposed for truck parking with a capacity of 100 trucks.
    - Commercial vehicles can park in the terminal until loading/unloading activity of particular vehicle has completed.
    - It can be given as pay and user facility.
    - There is a provision of land for truck terminal in D.P near Sangli Railway Godown.

2. Miraj Railway Goods Office Open Area
    - This terminal can be used by commercial vehicles generating from Miraj railway godown, Indian Oil and Bharat Petroleum. Open land near Miraj Railway goods office is proposed for truck parking with a capacity of 50 trucks.
    - Commercial vehicles can park in the terminal until loading/unloading activity of particular vehicle has completed.
    - It can be given as pay and user facility.
    - There is no provision of land for truck terminal in D.P near Miraj Railway goods office.
3. Open Area near Kolhapur Chal
    - This terminal can be used by commercial vehicles generating from outer cordons on Kolhapur road and Bijapur road before entering into the city. Open land near Kolhapur chal is proposed for truck parking with a capacity of 100 trucks.
    - Commercial vehicles can park in the terminal during the goods vehicles restriction into the city.
    - It can be given as pay and user facility.
    - There is no provision of land for truck terminal in D.P near Kolhapur chal.
4. Open Area at Godrej Factory in Miraj M.I.D.C on Miraj-Kupwad road
    - This terminal can be used by commercial vehicles generating from Miraj M.I.D.C, Kupwad M.I.D.C and Pandharpur road. Open land near Godrej factory in Miraj M.I.D.C is proposed for truck parking with a capacity of 200 trucks.
    - Commercial vehicles can park in the terminal until loading/unloading activity of particular vehicle has completed.
    - It can be given as pay and user facility.
    - There is no provision of land for truck terminal in D.P near Godrej factory in Miraj M.I.D.C

The above truck terminals should be provided are required in the year 2015 whereas the existing Vakharbagh truck terminal need to be improved immediately.

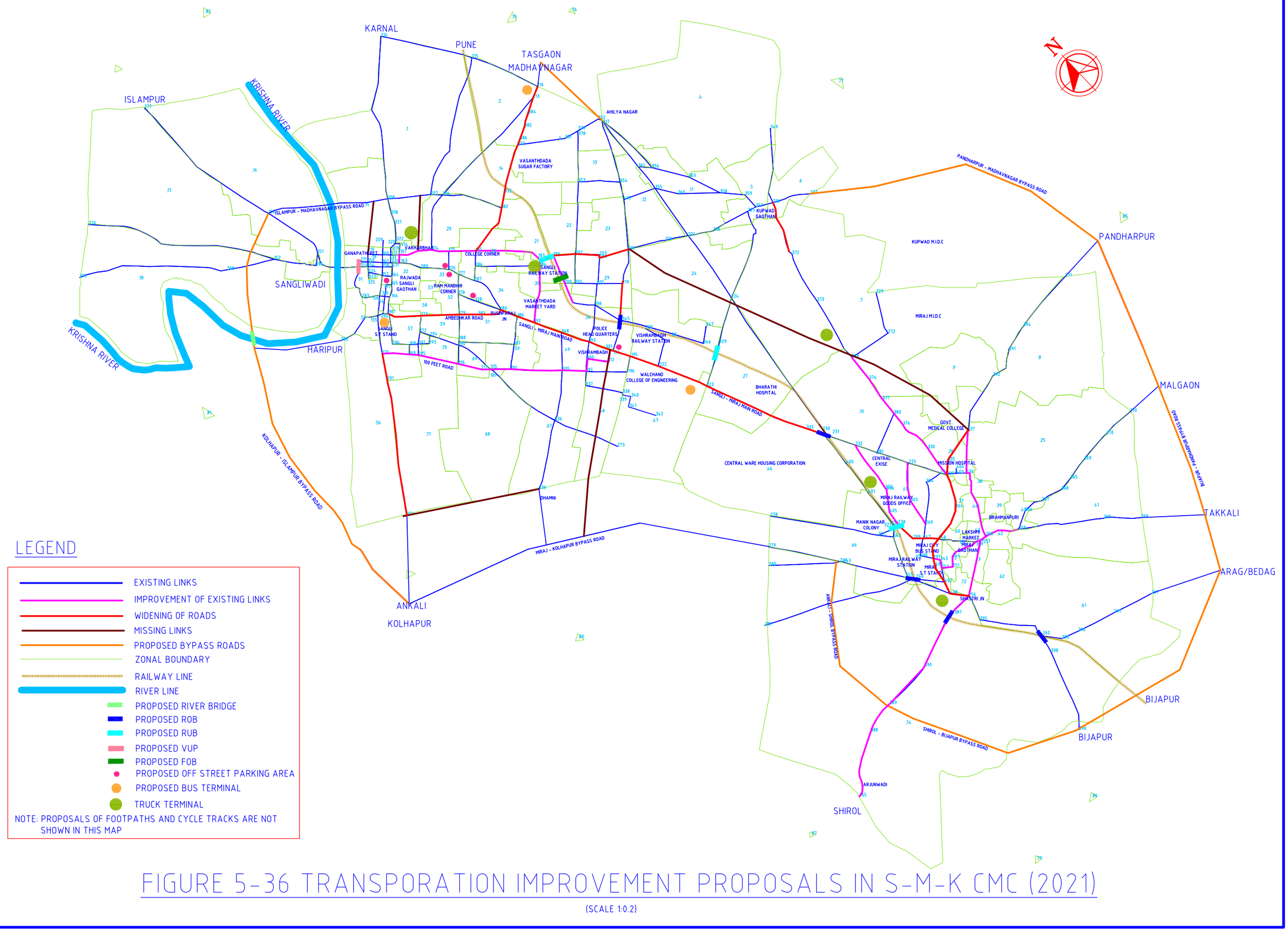
Figure 5-33 Proposed Goods Terminals in S-M-K City

Figure 5-34 Transportation Improvement Proposals in S-M-K CMC

5.8 Long Term Improvement Proposals (2021-2031)

Long term proposals depend upon realisation of several up-coming developments and attractiveness of S-M-K City for more employment opportunities.

- Creation of public transport infrastructure bus terminals/depots/bus procurement etc.
- Environment friendly policies such as use of CNG, favourable policies for public transport, more conducive environment for walking and bicycles.
- Once bus improvement options are exhausted then costly options such as Mono Rail can be explored. But, it will be required beyond 2031.



LEGEND

- EXISTING LINKS
- IMPROVEMENT OF EXISTING LINKS
- WIDENING OF ROADS
- MISSING LINKS
- PROPOSED BYPASS ROADS
- ZONAL BOUNDARY
- RAILWAY LINE
- RIVER LINE
- PROPOSED RIVER BRIDGE
- PROPOSED ROB
- PROPOSED RUB
- PROPOSED VUP
- PROPOSED FOB
- PROPOSED OFF STREET PARKING AREA
- PROPOSED BUS TERMINAL
- TRUCK TERMINAL

NOTE: PROPOSALS OF FOOTPATHS AND CYCLE TRACKS ARE NOT SHOWN IN THIS MAP

FIGURE 5-36 TRANSPORATION IMPROVEMENT PROPOSALS IN S-M-K CMC (2021)

(SCALE 1:0.2)

RAMBØLL	**L&T-RAMBØLL CONSULTING ENGINEERS LIMITED**

Client: **Maharashtra Urban Infrastructure Development Company Limited (MUIDCL)**
[Click here and enter Client's other information]

Project:	Preparation of City Mobility Plan for Sangli-Miraj-Kupwad Municipal Corporation	**Project No.:** C1112502
Title:	Draft Final Report	**Document No.:** RP005 / **Rev.:** 0

File path:
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Notes:

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Revision Details:

Rev.	Date	Details	Prepared Init.	Prepared Sign.	Checked Init.	Checked Sign.	Approved Init.	Approved Sign.

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6 Cost Estimates, Phasing and Financing Plan

Transportation improvement proposals are divided as follows considering the time horizon.

- **Short Term Improvement Proposals (2012-14) – 9.97 Crores**
- **Medium Term Improvement Proposals (2012-20) – 414.3 Crores**
  - **Phase – I (2012-15) – 170.2 Crores**
  - **Phase – II (2016-2021) – 244.1 Crores**
- **Long Term Improvement Proposals (2022-31) – 17.1 Crores**

6.1 Unit Rates

Unit rates adopted for various items for estimation of cost of proposals at 2011 prices are given in **Table 6-1**.

Table 6-1 Unit Rates

Sl No	Description	Unit	Cost (Rs)
1	Zebra Marking	Sq.m	575
2	Stop Line	m	575
3	Sign Boards	No.s	5,760
4	Speed Breaker	m	1,429
5	Signal Repair	No.s	10,000
6	New Signal Installation	No.s	25,000
7	Channelized Island	Sq.m	4,500
8	Median	m	4,500
9	High Mast Lighting	No.s	700,000
10	Approach Lanes (Accelerating/Decelerating)	m	40,000
11	Lane Markings	m	575
12	Kerb	m	690
13	Roundabout	Nos	500,000
14	Footpath Construction with RCC Box drains	Km	3,000,000
15	New 2-lane road without shoulder	Per Km	40,000,000
16	2-lane overlay without shoulders	Per Km	7,500,000
17	2-lane overlay with shoulders	Per Km	10,000,000
18	2-lane Maintenance Pot Holes	Per Sq.m	160
19	4 Lane ROB	Per Sq.m	12,500
20	2 Lane ROB	Per Sq.m	15,000
21	Additional 2 Lane ROB	Per Sq.m	66,667

Sl No	Description	Unit	Cost (Rs)
22	RUB	Per Sq.m	107,667
23	VUP	Per Sq.m	400,000
24	River Bridge	Per Sq.m	45,000
25	Foot Over Bridge (FOB)	Nos	6,000,000
26	Road Widening Proposals	Per Lane/ Km	25,000,000
27	Standard Bus	Nos	2,200,000
28	Mini Bus	Nos	1,200,000
29	Bus Shelters	Nos	200,000
30	Bus Terminus	Nos	70,000,000
31	Goods Terminal	Per Sq.m	4,000

6.2 Cost Estimates of Proposals and Phasing of Implementation

Considering the various proposed schemes such as City Bus System, Road Infrastructure, Grade Separators, Pedestrian Facilities, Goods Terminal and Transport System Management Measures and unit rates, cost estimates of these schemes have been worked out at 2011 prices. The entire transport development plan is not required to be implemented in one go. Considering the existing problems, expected traffic demand levels and schemes already under implementation/ active consideration of the Government, phasing of implementation of various projects has been suggested. Cost estimates of Short Term & Medium Term Transportation proposal improvements to be implemented in two phases are presented in **Table 6-2** and **Table 6-3.**

6.3 Short Term Improvement Proposals (2012-2014)

Table 6-2 Short Term Improvements (2012-14)

S. No	Description	Total Amount
1	Tilak Jn Improvements	87,130
2	Maruthi Road Jn Improvements	128,608
3	Tarun Bharat Jn Improvements	76,798
4	Municipal Jn Improvements	126,698
5	Rajwada Jn Improvements	115,077
6	Congress Bhavan Jn Improvements	1,862,077
7	Pushparaj Jn Improvements	954,537
8	Vasanthdada Market Jn Improvements	8,134,627
9	College Corner Improvements	160,837
10	Vantamoore Corner Improvements	154,558
11	Mission Hospital Jn Improvements	970,606

S. No	Description	Total Amount
12	City Bus Stand Jn Improvements	160,837
13	Vishrambagh Jn (Near Vishrambagh Police Station) Improvements	362,637
14	Vishrambagh Jn (Near Ambassador Hotel) Improvements	9,166,827
15	Footpath Construction (21.46 Km)	59,580,000
16	Cycle Track (30.4 Km)	17,480,000
17	One-way Scheme Sign Boards (30 Nos)	172,790
	Grand Total	**99,694,647**
	Grand Total (in Crores)	**9.97**

The breakup details of above proposals are presented in **Annexure 6.1**.

6.4 Medium Term Improvement Proposals (2012-2016)

Medium term improvement proposals include proposals which are to be implemented during 2012-2016.

Consultants have examined all the proposals in the light of traffic forecast based on travel demand model developed and overall transportation improvement strategies to be adopted.

Table 6-3 Medium Term Improvements (2012-16)

S. No	Description	Unit	Quantity	Rate, Rs (in Crores) as per 2011	Cost, Rs (in Crores)
1	**Missing Links**				
	Phase I (2012-2015)				
	Access Rd to Sangli Miraj ROB	Per Km	0.2	4	0.80
	Dhamni Rd Bypass	Per Km	1.92	4	7.68
	Wakarbah to Islampur Bypass	Per Km	0.22	4	0.88
	Ganapthipet - Islampur Bypass	Per Km	0.84	4	3.36
				Sub Total	**12.72**
	Phase II (2016-2021)				
	Isalmpur-Kolhapur Bypass	Per Km	2.9	4	11.60
	Isalmpur-Kolhapur Bypass (Additional 1-Lane)	Per Km	3.4	4	13.60
	Ankali - Shirol Rd Bypass	Per Km	2.36	4	9.44
	Shirol Rd to Bijapur Rd Bypass	Per Km	2.9	4	11.60
	Pandarpur-Savli Rd	Per Km	4.51	4	18.04
	Parallel link to Sangli-Miraj Road connecting from Ahilyanagar/Kupwad Rd Jn to Pandarpur road	Per Km	5.32	4	21.28
	Road from Vishrambagh/Vasanthdada market to Miraj-Kolhapur bypass road	Per Km	2.6	4	10.40
				Sub Total	**95.96**
2	**Rail Over Bridge (ROB)**				
	Phase I (2012-2016)				
	New 4-lane ROB on Vishrambagh Main Road	Per Sq.m	20300	0.00125	25.38

S. No	Description	Unit	Quantity	Rate, Rs (in Crores) as per 2011	Cost, Rs (in Crores)
	including Approaches				
	New 2-lane ROB on Miraj-Shirol Road including Approaches	Per Sq.m	10150	0.0015	15.23
				Sub Total	**40.60**
	Phase II (2016-2021)				
	Additional 2-lane ROB on Sangli-Miraj Main Road excluding Approaches	Per Sq.m	900	0.006667	6.00
	Additional 2-lane ROB on Miraj-Kolhapur bypass road excluding Approaches	Per Sq.m	900	0.006667	6.00
	Additional 2-lane ROB on Vijapur Road (SH-138) excluding Approaches	Per Sq.m	900	0.006667	6.00
				Sub Total	**18.00**
3	**Rail Under Bridge (RUB)**				
	Phase I (2012-2015)				
	Addition 2-lane RUB @Sangli Railway Station	Per Sq.m	300	0.010767	3.23
				Sub Total	**3.23**
	Phase II (2016-2021)				
	New 1-lane RUB @ Vijaynagar Colony	Per Sq.m	150	0.010767	1.62
	New 1-lane RUB @ Maniknagar Colony	Per Sq.m	150	0.010767	1.62
				Sub Total	**3.23**
4	**Bridges on River**				
	Phase I (2012-2015)				
	New 2-lane Bridge Sangli-Kolhapur Road to Sangli-Islampur Road	Per Sq.m	8000	0.0045	36.00
				Sub Total	**36.00**
5	**VUP**				
	Phase II (2016-2021)				
	Two Lane Box Type VUP under Irwin Bridge connecting Haripur and Ganapathipet by Box Pushing	Per Sq.m	100	0.04	4.00
				Sub Total	**4.00**
6	**Foot Over Bridge (FOB)**				
	Phase II (2016-2021)				
	Sangli Railway Station (Platform to Sangli Goods Office direction)	Nos	1	0.6	0.60
				Sub Total	**0.60**
7	**Road Improvement Proposals (Overlay)**				
	Phase I (2012-2015)				
	Road connecting Maniknagar RUB to Sangli-Miraj ROB (via Miraj Railway Goods Office)	Per Km	2.3	**1**	2.30
	Road connecting Sangli R.S RUB to Sangli Railway Goods Office	Per Km	0.6	**1**	0.60
	Road connecting Vasanthdada Market to Sangli Railway Station RUB	Per Km	1	**1**	1.00
	Vakharbagh Road to Vakarbagh Truck Terminal	Per Km	0.8	**1**	0.80
	Station Rd at Central Excise on Sangli-Miraj Rd - Babasaheb Udhyan	Per Km	1.1	**1**	1.10

S. No	Description	Unit	Quantity	Rate, Rs (in Crores) as per 2011	Cost, Rs (in Crores)
	Mission Hospital Jn to Shastri Jn (Vijapur Rd)	Per Km	2.5	**1**	2.50
	Mission Hospital Jn to Miraj Market Rd (Pandharpur Rd)	Per Km	2.5	**1**	2.50
	College Corner Jn to Sangli Railway Station RUB	Per Km	1	**1**	1.00
	Patel Jn to College Corner (Vakharbagh Rd)	Per Km	1.2	**1**	1.20
				Sub Total	**13.00**
	Phase II (2016-2021)				
	Miraj Shastri Jn – Pandarpur Road (via Laxmi Market)	Per Km	2.5	**1**	2.50
	M.I.D.C @ Godrej to Mission Hospital Jn (Miraj-Kupwad Rd)	Per Km	2.4	**1**	2.40
	Miraj City Bus Stand Jn - Malgaon Rd/Takkali Rd Jn (Via Laxmi Market)	Per Km	1.2	**1**	1.20
	Shasthri Jn-Arjunwadi (Shirol Road)	Per Km	4.5	**1**	4.50
	100 ft Road (Sangli-Kolhapur Road to Vishrambagh Jn)	Per Km	7.8	**1**	7.80
	Bijapur Rd -Pandarpur Rd Bypass (2-lane Overlay)	Per Km	8.25	**1**	8.25
				Sub Total	**26.65**
8	**Road Widening Proposals**				
	Phase I (2012-2015)				
	Jhulelal Jn to Pushparaj Jn (Ambedkar Rd) - (Additional 2-lane)	Per Lane/ Km	1.8	2.5	9.00
	Mission Hospital Jn to Miraj Market Road Jn (Pandarpur Rd) - (Additional 2-lane)	Per Lane/ Km	0.9	2.5	4.50
	Mission Hospital Jn to Shastri Jn (Vijapur Rd) - (Additional 2-lane)	Per Lane/ Km	2.5	2.5	12.50
	Octrai to Shastri Jn (Kolhapur Rd) - (Additional 2-lane)	Per Lane/ Km	3.2	2.5	16.00
	Sangli Railway Godown Rd Jn to Police Quarters Rd Jn (Kupwad Rd) - (Additional 2-lane)	Per Lane/ Km	0.03	2.5	0.15
				Sub Total	**42.15**
	Phase II (2016-2021)				
	Kupwad Settlement portion (Miraj-Kupwad Main Road)	Per Lane/ Km	2.2	2.5	5.50
	Sangli R.S RUB to Ahilyanagar/Kupwad Rd Jn (Old Kupwad Rd) - (Additional 2-lane)	Per Lane/ Km	2.6	2.5	13.00
	College Corner Jn to Octrai (Madhavnagar Main Rd) - (Additional 2-lane)	Per Lane/ Km	2.8	2.5	14.00
	Pushparaj Jn to ROB (Sangli-Miraj Rd) - (Additional 1-lane)	Per Lane/ Km	1.4	2.5	3.50
	Pushparaj Jn to ROB (Sangli-Miraj Rd) - (Additional 2-lane)	Per Lane/ Km	3.7	2.5	18.50
	Marathe Textile Mill to Sangli Ves Rd/Vijapur Rd Jn - (Additional 2-lane)	Per Lane/ Km	0.28	2.5	1.40
	Marathe Textile Mill to Before RUB at St.	Per Lane/	0.28	2.5	1.40

S. No	Description	Unit	Quantity	Rate, Rs (in Crores) as per 2011	Cost, Rs (in Crores)
	Peters Telugu Church - (Additional 2-lane)	Km			
				Sub Total	**57.30**
9	**Improved Bus System (Intracity Bus Service)**				
	Phase I (2012-2015)				
	No of Standard Buses	Nos	17	0.22	3.74
	Mini Bus	Nos	5	0.12	0.60
	Bus Terminus	Nos	1	7	7.00
				Sub Total	**11.62**
	Phase II (2016-2021)				
	No of Standard Buses	Nos	75	0.22	16.50
	Bus Shelters	Nos	12	0.02	0.24
	Bus Terminus	Nos	1	7	7.00
				Sub Total	**24.94**
10	**Bus Terminals**				
	Phase II (2016-2020)				
	Madhavnagar City Bus Stand	Nos	-	7	7.00
	Vishrambagh Regional Bus Stand	Nos	-	7	7.00
				Sub Total	**14.00**
11	**Goods Terminal**				
	Phase I (2012-2015)				
	Vakharbagh Truck Terminal Improvement	Per Sq.m	10000	0.00043	4.30
	Open Area near Kolhapur Chal	Per Sq.m	3000	0.00043	1.29
	Open area on Kupwad M.I.D.C-Savali-Padarpur Road	Per Sq.m	6000	0.00043	2.58
	Sangli Railway Station Open Area	Per Sq.m	3000	0.00043	1.29
	Miraj Railway Goods Office Open Area	Per Sq.m	2000	0.00043	0.86
				Sub Total	**10.32**
				Sub Total Phase I	**170.2**
				Sub Total Phase II	**244.1**
				Grand Total	**414.3**

The breakup details of above proposals are presented in **Annexure 6.2**.

The estimated cost of short-term improvement proposals (2012-14) is Rs. 10.45 Crores. The estimated cost of medium-term improvement proposals is 414.3 Crores. The medium term improvement proposals are planned to be implemented in two phases. Medium term proposals include improvement of public transport, Goods terminals etc.

The phase wise estimated cost is as follows:

- Phase I (2012-2015): Rs. 170.2 Crores
- Phase II (2016-2020): Rs. 244.1 Crores

6.5 Long Term Improvement Proposals (2021-2031)

Long term proposals depend upon realisation of several up-coming developments and attractiveness of S-M-K City for more employment opportunities.

- Creation of public transport infrastructure bus terminals/ depots/ bus procurement etc.
- Environment friendly policies such as use of CNG, favourable policies for public transport, more conducive environment for walking and bicycles.

Table 6-4 Long Term Improvements (2021-31)

S.N.	Description	Unit	Quantity	Rate, Rs (in Crores) as per 2011	Cost, Rs (in Crores)
1	Improved Bus System (Intracity Bus Service)				
	No of Standard Buses	Nos	75	0.22	16.50
	Mini Bus	Nos	5	0.12	0.60
				Total	**17.10**

The estimated cost for long-term improvement proposals is 17.1 Crores.

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7 Financial Analysis

7.1 Financial Profile of S-M-K CMC

In 2009-10, the revenue of S-M-K CMC is around 87 crore, in which contributions from Octroi property tax, water tax are major sources of revenue. In 2009-10, the revenue income of S-M-K CMC has grown to Rs.87 crore from Rs.53 crore in 2005-06.

The revenue account comprises two components - revenue income and revenue expenditure. Revenue income comprises internal resources in the form of Octroi, tax and non-tax items. External resources are in the form of shared taxes/transfers and revenue grants from the State and Central Government. Revenue expenditure comprises expenditure incurred on salaries, operation & maintenance cost, and debt servicing.

7.2 Revenue Income

The revenue sources of SMK CMC can be broadly categorised as own sources, grants, and contributions. The source-wise income generated is presented in **Table 7-1.** S-M-K CMC own source income includes income from Octroi, property tax, other taxes and non-tax income in the form of income from municipal properties and other miscellaneous income.

Table 7-1 Sources wise Revenue Income (in Million Rupees)

Item	2005-06	2006-07
Octroi	248	347
Property Tax	84	91
Other Taxes	48	45
Total Revenue Income	380	484
Water Charges	79	78
Other Charges	27	64
Total Non-Tax Revenues	106	141
Total Operating Revenue	486	625
Financial revenue	3	13
Capital receipts	37	22
Total Revenue Income	527	659

Note: 2005-06 and 2006-07 is sourced from International Public Finance

The single largest source of own revenue for SMK CMC is Octroi. Octroi contributed more than half its revenue in 2006-07.Property Tax constitutes the second-biggest source of SM CMC's revenue. In 2006-07, it yielded 14.6% of operating revenue.

The revenue for 2007-08, 2008-09 and 2009-10 respectively 111.0 crore, 107.5 crore and 86.7 crore respectively as per Audit reports of Maharashtra Local bodies. Breakup of revenue for these years is not available. The revenue is increasing at 13.25% CAGR.

7.3 Revenue Expenditure

Year wise Revenue expenditure of S-M-K CMC is presented in **Table 7-2**. Revenue can be classified into establishment, operations and maintenance and debt servicing.

Table 7-2 Year-wise Revenue Expenditure

Item	2005-06	2006-07
General administration	19	19
Octroi department	17	20
Property tax department	8	10
Pension	41	56
Electricity department	25	27
Cleaning department	58	71
Medical treatment services	22	27
Construction	23	33
Education and social welfare	49	59
Ward administration	36	59
Water supply and drainage	90	112
Other expenditure	31	36
Total operating expenditure	419	527
Financial expenses	3	3
Capital expenditure	93	117
Debt repayment	1	1
Total Revenue Expenditure	516	647
Net	10.9	12.0

Total Revenue Expenditure for 2007-08, 2008-09 and 2009-10 respectively 180.0 crore, 101.2 crore and 82.0 crore respectively as per Audit reports of Maharashtra Local bodies. Breakup of revenue for these years is not available.

As per 2006-07 data, the % of expenditure on construction (which may include water supply, roads etc) is around 5%.

7.4 Broad Financing of Transportation Projects

The estimated investment for the entire Mobility Plan incurred over a planning period is presented in **Table 7-3**.

Table 7-3 Estimated Cost of Implementing Master Plan Proposals

Sl.No.	Item	Duration	Estimated Investments in (Crore Rs.)
1	Short-term Improvement	2012-14	9.97
2	Medium-term improvement – **Phase I**	2012-15	170.2
3	Medium-term improvement – **Phase II**	2016-21	244.1
4	Long-term improvement	2022-2031	17.1
	Total		**441.37**

The estimated investment for the entire Mobility Plan is based on public transport oriented system for the period till 2021 is estimated to be **Rs 424.27 Crore** (at 2021 prices).

It is obvious that huge investments are required for implementation of above proposals. The various sources of funding are outlined below:

- S-M-K CMC own sources
- State Government (through grants and other concessions)
- Central Government (JNNURM funding from Government of India)
- Private-public partnership (PPP) mode
- Innovative sources of funding

Various categories of transport proposals and suggested funding pattern is presented below:

All Road Improvements and New Roads/ ROB/ RUB/VUP/Bridges: Investments to the extent of Rs 355.10 Crore proposed till 2021 for road related infrastructure would be implemented by S-M-K CMC. It is suggested that the funding for these projects be arranged under the JNNURM, state government grants, debt financing and internal sources.

City Bus System: SMK CMC should explore possibility of awarding Bus Routes to private parties on similar lines of STAR buses in Nagpur. New buses to be sought under JNNRUM. Some of the components can be developed on PPT mode such as bus stations, bus shelters etc. Investments in City bus system improvement is required to the extent of 50.56 Crores.

Footpaths, Cycle paths and FOB facilities: An amount of Rs 8.31 Crore is estimated towards improving and strengthening the pedestrian and Cycle facilities like footpaths, FOB's and Cycle paths at identified locations across the city.

Truck Terminals: Land shall be made available SMK CMC. An amount of Rs 10.32 Crore for establishing Truck terminals at 5 locations is recommended to be funded through a PPP model involving oil companies, freight operators, industries' associations and SMK CMC as the implementing agency.

7.5 Innovative Sources of Resource Mobilisation

To fund the imposing needs of urban infrastructure in general and transport in particular, there are several innovative methods, which due to their ease of implementation and high

usage are methods for many local governments as sources of general revenue. Some of the important ones are briefly described below:

a) Real Estate Development: It is one of the most widely used avenues for raising funds particularly for projects like LRT, flyovers etc. In this the property developers are invited to develop the land along the transport corridors and share profit with the transport organisation arising out of such sale of property. Hong Kong Mass Transit System was financed to the tune of 15% of the metro construction cost adopting this approach.

b) Dedicated Road Fund (Infrastructure Initiative Fund): Various states like Uttar Pradesh, Tamil Nadu, Punjab, Kerala etc. have created Dedicated Road Fund for development of roads, by charging cess on turnover, betterment levy, shops and establishment levy, tax on employment, surcharge on Octroi and other levies. The following types of cess/levy could be mobilised in the aforesaid Fund.

c) Shops and Establishment Levy: This method has the potential to be one of the large revenue gathering measures

d) Tax on Employment: An additional source of revenue can be generated by an additional levy on the employer. This has been successfully adopted in cities of developed countries like Paris.

e) Surcharge Levy on Octroi Rates: This method involves levying a surcharge on Octroi. In areas where there is a proposal for abolishment of Octroi, a substitute in the form of Entry Tax has been enforced which has potential to generate sizeable source of revenue.

f) Other Levies: There are certain other levies, which have a potential to generate revenue. These are:

Levies related with use of private transport

- Surcharge on petrol and diesel (Fuel levy)
- Surcharge on Motor Vehicle Tax
- Surcharge on sales tax on tyres, tubes, motor parts
- Surcharge on driving license fee
- Vehicle ownership charge on first time registration

Levies on Direct use of Transport Facilities

- Levy of terminal taxes for passengers
- Cess on permit fees for buses
- Goods vehicles tax
- Surcharge on freight carried
- Surcharge on fee for parking
- Surcharge on passenger fares

Other Levies

- Surcharge on property tax
- Surcharge on conversion charge for allowing commercial use of land
- Cess on liquor
- Levy on wages bill of industrial and commercial establishments

SMK CMC is authorised to levy most of the above taxes.

g) Municipal Bonds: Municipal Bonds have emerged as an important instrument for mobilising private resources for funding urban infrastructure projects. In USA, 70% of the infrastructure finance is through municipal bonds.

h) Sale of Government Land and other Property: It is convenient source of raising resources by local bodies.

i) Advertising Revenue: These could be generated through bill boards at terminals and other places.

7.5.1 Private Sector Participation

Keeping in mind the huge deficits in services and funds required for infrastructure development, the private sector needs to be brought in to assist the local bodies in development and provision of infrastructure to contribute to growth in economy. Some of the widely used forms of private sector participation in the financing of urban infrastructure are:

1. Service contracts, for performing specific tasks for short duration
2. Management contracts, for operation and maintenance of government owned businesses
3. Leasing where a lease agreement is signed whereby public facility's assets are transferred to a private firm for a fixed time period for which it pays for the right to use the facility in providing service.
4. Concession, wherein the contractor besides the operation and maintenance also assumes additional responsibility of investments

There is a lot of potential to generate surplus resources for finding transport infrastructure projects in SMK City, as evident from success stories in Indian cities. Some of the potential areas of private sector involvement could be:

i) Development & Maintenance of Terminals, Shelters, Depots
ii) Operation of Buses and Para Transit System
iii) Construction and Maintenance of Parking facilities
iv) Construction and maintenance of Toll facilities (Roads, Bridges)

Besides the private sector services could also be made use of through service/management contracts particularly in the area of:

i) Street cleaning and maintenance
ii) Maintenance of Parking Lots
iii) Maintenance of Terminals
iv) Street Lighting

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8 Environmental Impact Assessment

8.1 Introduction

Vehicle pollution is contributing 70% of the pollution in Indian Cities. The major pollutants in vehicular exhaust emission are carbon monoxide, unburnt hydrocarbons, oxides of nitrogen and sulphur, partially burnt products, particulate matters and lead components. The concentration of fuel pollutants varies with the type of engine – petrol or diesel.

The rapid urbanization in India has also resulted in a tremendous increase in the number of motor vehicles. The vehicle fleets have even doubled in some cities in the last one decade. This increased mobility, however, come with a high price. As the number of vehicles continues to grow and the consequent congestion increases, vehicles are now becoming the main source of air pollution in urban India.

Although, the air quality can be improved through a combination of technical and non-technical measures, legislative reforms, institutional approaches and market-based instruments, there are certain unique challenges which the country has to face in tackling the problem of urban air pollution. These include, the transport features which are different from the developed countries particularly in terms of the types of vehicles commonly used, the manner in which the road network is operated and sharing of the limited space by pedestrians and non-motorized modes with modern vehicles in Indian cities. Vehicles in India are often much older.

The country has however taken a number of measures for the improvement of the air quality in cities. These include, right from the improvement in the fuel quality, formulation of necessary legislation and enforcement of vehicle emission standards, improved traffic planning and management etc. The non-technical measures taken include, awareness raising regarding the possible economic and health impacts of air pollution and available measures for improving air quality, increasing use of cleaner fuels and purchase of vehicles with advance emission control devices, increasing institutional framework and capacity building for the monitoring of vehicle emissions.

Deteriorating air quality is major environmental problem in most of the Indian cities. Economic growth has triggered a boom in the number and use of motor vehicles in India. **Owing to their rapidly increasing numbers and very limited use of emission control technologies, motor vehicles are emerging as the largest source of urban air pollution and are responsible for about 70% of the air pollution loads in most of the Indian cities**. There is a general perception that the incidence of disease and premature deaths caused by vehicular pollution is on the rise in most of the Indian cities. There is an urgent need to control vehicular pollution in most of the Indian cities.

Sangli currently has a population of over 5 Lakh and around 1.86 Lakh vehicles registered (March-2011). ***This report briefly discusses the environmental and social impacts due to transportation in S-M-K city based on the review of secondary sources.***

8.2 Air Pollution

8.2.1 Air Quality Standards

Air Quality standards prescribed by Central Pollution Control Board (**CPCB**) is presented in **Table 8-1** and **Table 8-2.**

Table 8-1 Indian Air Quality Standards (CPCB) in μg/m^3

Pollution	SO_2 & NO_x	SPM
Low	0 - 40	0 - 180
Moderate	40 - 80	180 - 360
High	80 - 120	360 - 540
Critical	> 120	> 540

Table 8-2 National Ambient Air Quality Standards for Various Land uses (μg/m^3)

Pollutant	Industrial Area	Residential Area	Sensitive Area
SO_2	120	80	30
NO_x	120	80	30
SPM	500	200	100
RPM	150	100	75
CO*	5.0	2.0	1.0

8.2.2 Impact of Air Pollution

Air pollution affects our health in many ways. Numerous scientific studies have linked air pollution to a variety of health problems including: aggravation of respiratory and cardiovascular disease; decreased lung function, increased frequency and severity of respiratory symptoms such as difficulty breathing and coughing; increased susceptibility to respiratory infections; effects on the nervous system, including the brain, such as IQ loss and impacts on learning, memory and behaviour, cancer; and premature death. Heath effects caused due to various pollutants are presented in **Table 8-3**.

Table 8-3 Health effect due to various Pollutants

Pollutants	Health Effect
Oxides of Sulphur (SOx)	Aggravate asthma, leading to wheezing, chest tightness and shortness of breath, increased medication use
Particulate Matter (PM)	Short-term exposures can aggravate heart or lung diseases leading to symptoms, increased medication use, hospital admissions,
Oxides of Nitrogen (NOx)	Aggravate lung diseases leading to respiratory symptoms, hospital admissions, and increase susceptibility to respiratory infection.

Pollutants	Health Effect
Lead (Pb)	Damages the developing nervous system, resulting in IQ loss and impacts on learning, memory, and behavior in children. Cardiovascular and renal effects in adults and early effects related to anemia.
Carbon Monoxide (CO)	Reduces the amount of oxygen reaching the body's organs and tissues; aggravates heart disease, resulting in chest pain and other symptoms leading to hospital admissions and ED visits.
Ammonia (NH3)	Contributes to particle formation with associated health effects.
Other Toxic Air Pollutants	Cause cancer; immune system damage; and neurological, reproductive, developmental, respiratory, and other health problems. Some toxic air pollutants contribute to ozone and particle pollution with associated health effects

8.2.3 Emission rates for Petrol and Diesel Vehicles

Emission rates for petrol vehicles are presented in **Table 8-4** and Emission rates for diesel vehicles are presented in **Table 8-5**. However the benefit of advanced fuel efficient vehicles is nullified with huge growth of personalised modes.

Table 8-4 Emission factors for Petrol Vehicles (g/km)

Petrol Vehicles				
Three – Wheelers				
Year	**CO**	**HC**	**HC+Nox**	
1991	12-30	8-12	-	-
1996	6.75	-	5.4	-
2000	4.00	-	2	-
2005(BS II)	2.25	-	2	(DF =1.2)
Two – Wheelers				
Year	**CO**	**HC**	**HC+Nox**	
1991	12-30	8-12	-	-
1996	4.5	-	3.6	-
2000	2	-	2	-
2005(BS II)	1.5	-	1.5	(DF =1.2)
Car				
Year	**CO**	**HC**	**Nox**	**HC+Nox**
1991	14.3 - 27.1	2.0-2.9		
1996	8.68 - 12.4			3.00 - 4.36
1998*	4.34 - 6.20			1.50 - 2.18
2000	2.78			0.97
B.S II	2.2			0.5
B.S II	2.2 - 5.0			0.5 - 0.7
B.S III	2.3	0.2	0.15	
B.S III	2.3 - 5.22	0.20 - 0.29	0.15 - 0.21	

Source: SIAM : Note : * for Catalytic Converter Fitted Vehicles

Table 8-5 Emission factors for Diesel Vehicles (g/km)

Diesel Vehicles						
Diesel Vehicles (GVM Upto 3.5 Tons)						
(g/km)	**Engine Dynamometer**					
Year	**CO**	**HC**	**Nox**	**HC+Nox**	**PM**	
1992	14	3.5	18			
1996	11.2	2.4	14.4			
2000	4.5	1.1	8		0.36	
B.S II	4	1.1	7		0.15	For Four Wheelers only
Or						
(g/km)	**Chassis Dynamometer**					
Year	**CO**	**HC**	**Nox**	**HC + Nox**	**PM**	
1992	17.3 - 32.6	2.7 - 3.7				Light Duty Vehicles
1996	5.0 - 9.0			2.0 - 4.0		
2000	2.72 - 6.90			0.97 - 1.70	0.14 - 0.25	
B.S II	1.0 - 1.5			0.7 - 1.2	0.08 - 0.17	For Four Wheelers only
B.S II(2005)	1			0.85	0.1	For 2 & 3 Wheelers, Appropriate DF
B.S III	0.64 - 0.95		0.50 -0.78	0.56 - 0.86	0.05 - 0.10	
Cars						
(g/km)	**Chassis Dynamometer**					
B.S II	1			0.7	0.8	(A)
B.S II	1.0 - 1.5			0.7 - 1.2	0.8 - 0.17	(B)
B.S III	0.64		0.5	0.56	0.05	(A)
B.S III	0.64 - 0.95		0.50 -0.78	0.56 - 0.86	0.05 - 0.10	(B)

Source: SIAM

Note: upto 6 seaters **(A)** & GVW upto 2.5 tons More than 6 seaters **(B)** & GVW upto 3.5 tons **(A)(B)**

8.2.4 Current Air Quality in SMK CMC

S-M-K is home to many industries, especially in sectors of Sugar, Turmeric, Fertilisers, Chemicals, Machinery tools etc. The environmental pollution that arises due to industrial activities is Water Pollution, Air Pollution, and generation of Hazardous waste & Noise Pollution. Organic Pollutants are mainly generated from distilleries, sugar, pulp, paper, food Processing, textile and pharmaceuticals.

There are currently 1149 Industries located in SMK out of it 835 industries are in operational (*Source: MIDC Office*)

Air Quality Data collected by **MPCB** in 2011 for various land uses in S-M-K for following areas are presented in **Annexure – 8A**

- MIDC (Industrial Area)
- Razawada Chowk (Residential & Others)

- Udyog Bhavan (Residential)

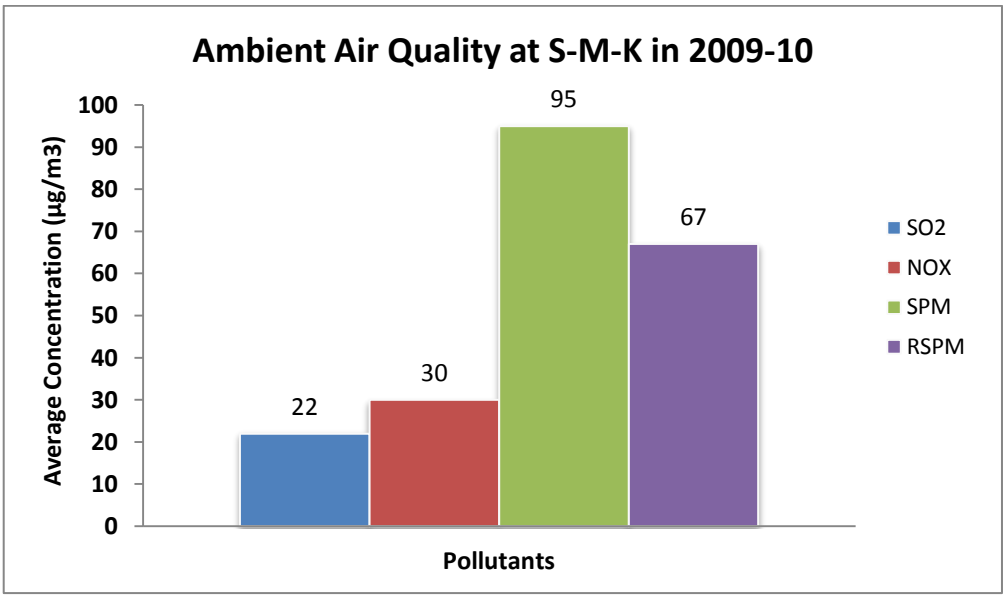
Observed Pollution Concentrations for various landuse in S-M-K City is presented in **Table 8-6** and Annual average concentration of Air Quality in S-M-K City for last two years is presented in **Table 8-7.**

Table 8-6 Observed Average Pollution Concentrations in S-M-K (μg/m^3)

Location Name	Landuse	Year	SO2	NO2	RSPM	SPM
Udyog Bhavan	Residential and others	2009-10	21	27	79	54
		2010-11	12	31	57	92
Kupwad	Industrial Areas	2009-10	24	33	113	81
		2010-11	12	29	73	100
Razawada Chowk	Residential and others	2009-10	23	31	94	67
		2010-11	13	32	68	105

Table 8-7 Annual Average Concentrations of Air Quality (μg/m^3) in SMK CMC

Pollutant	Year	Concentration (μg/m3)
SO2	2009-10	22
	2010-11	12
NOx	2009-10	27
	2010-11	30
SPM	2009-10	79
	2010-11	66
RSPM	2009-10	54
	2010-11	99



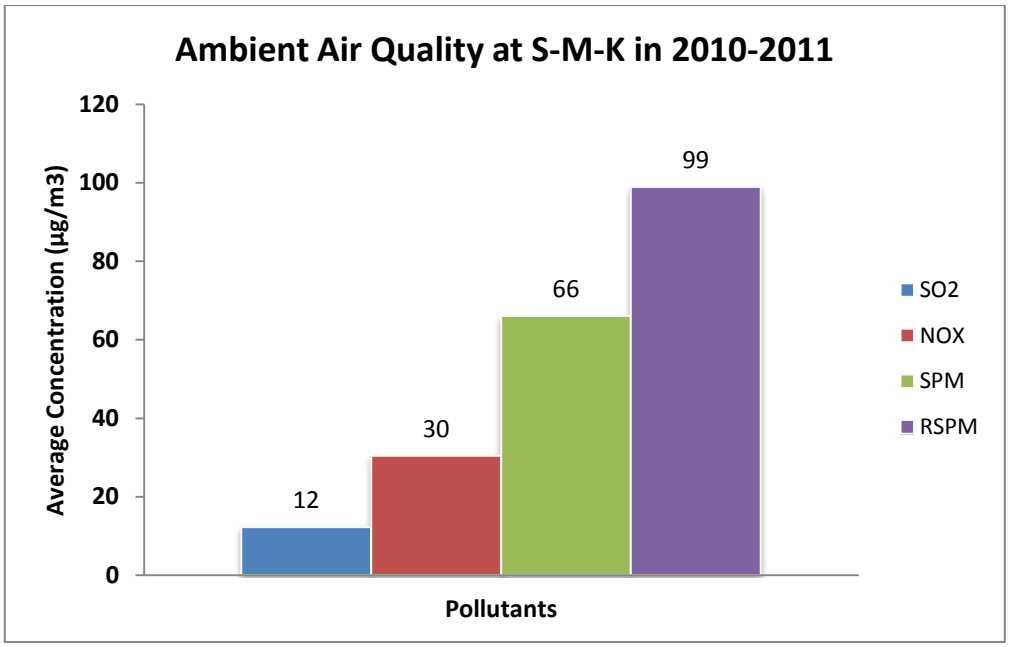


Figure 8-1 Yearly Variation of Pollutants in S-M-K during Year 2009-10 & 2010-11

All the emissions are observed to be within the permissible limits. Nox is slowly approaching the permissible levels.

8.3 Noise Pollution

8.3.1 General

Noise pollution is defined as a form of air pollution that is an audible unwanted sound that poses a threat to a person's health and well-being. Noise has been a source of discontent to the people. Noise is becoming an increasingly omnipresent, yet unnoticed form of pollution even in developed countries. Though noise pollution is a slow and subtle killer, yet very little efforts have been made to ameliorate the same.

Besides controlling the noise at the source and protecting one from the noise, the Union Government has made some rules and regulations for controlling the noise pollution. Even in the Indian Penal Code noise pollution has been included as a nuisance under IPC sections 268 and 290. Now the noise pollution is been dealt under the Air Pollution in the Air Pollution Control Act and *The Environment (Protection) Amendment Rules 2003*. The government of India has enacted *The Noise Pollution (Regulation and Control) Rules 2000* which have even been amended in 2002.

Sound is measured as Sound Level on the decibel (dB) scale, using the A-weighted frequency response unless otherwise specified. The decibel (dB) is a logarithmic unit which expresses the ratio of the sound pressure level being measured to a standard reference level. This measurement system approximates the subjective response of the human ear to a broad frequency range noise by adjusting for the relative differences in hearing sensitivity to the very low through very high frequencies of the audible spectrum. Although the standard unit of sound level is dB, it has been common to append an "A" or "(A)" to indicate use of the A-weighting filter.

8.3.2 Effect of Noise Pollution on Human beings

Noise affects human health in a number of ways. These include both direct as well indirect effects. Direct effects include annoyance, irritability, sleeplessness, and interference with communication, performance effects, effects on social behaviour and hearing loss and health effects. Health effects of noise include heartburn, indigestion, ulcers, changes in blood pressure (resulting in high blood pressure), and possibly heart disease. Indirect effects include increased health cost, decreased property values (especially near railway stations, airports, industrial areas) Continuous or prolonged exposure to noise levels of 80-85dB or more can cause deafness. Exposure to a noise of around 100dB can cause permanent loss of hearing power.

8.3.3 Noise Standards

8.3.3.1 Permissible Limits

As per the Ministry of environment and Forests, Government of India (EPA Notification G.S.R. 1063(E), dated. 26th Dec., 1989) ambient permissible standards has been set for the noise levels in different establishments during day as well as night times. These have been set under the Environment (Protection) Act 1986 and are as under are shown in **Table 8-8**.

Table 8-8 Ambient Noise Standards in India

Area	dB(A) Day Time 6:00AM-9:00PM	dB(A) Night Time 9:00PM -6:00 AM
Industrial	75	70
Commercial zone	65	55
Residential area	55	45
Silence zone (*Hospitals, educational institutesand courts)*	50	40

Human perceptions to change in sound level are shown in **Table 8-9.**

Table 8-9 Noise risk zone criteria

Intensity of noise in dB(A)	Zones
Less than 66	Safe
66-71	Tolerable
71-76	Low risk
76-81	Moderately risk
81-86	High risk
Greater than 86	Extremely risk

(Source: Banerjee et.al, 2008)

8.3.4 Current Noise Quality in SMK CMC

The Central Pollution Control Board constituted a National Committee of Experts on Noise Pollution Control. S-M-K was one of the cities selected for monitoring the Noise data. The Noise level data collected during 2010-11 at Udyog Bhavan are presented in **Annexure-8B**.

The analysis of data shows that in S-M-K during 2010-11 were monitored and Average Sound level dB (A) Leq during the survey ranged from 44 dBA to 66 dBA, which fall under safe limits.

A variation of Ambient Equivalent Sound Levels at S-M-K City during 2010-11 is presented in **Figure 8-2** and variation in Noise levels during Day & Night are presented in **Figure 8-3.**

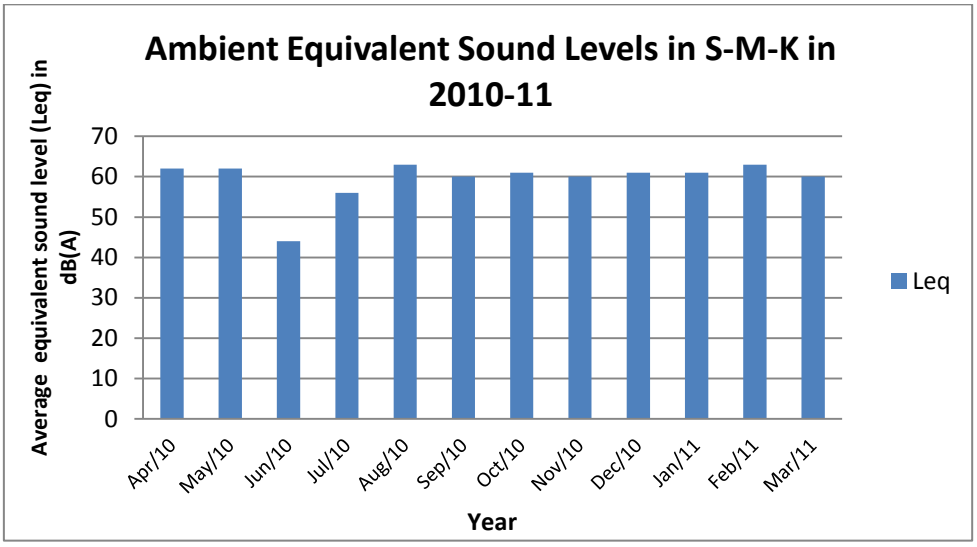
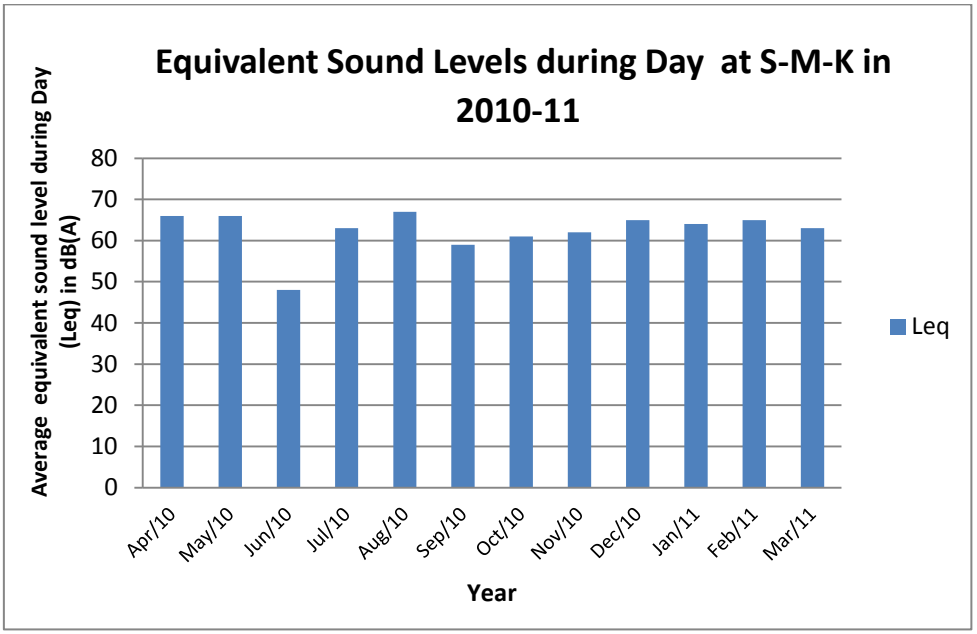


Figure 8-2 Ambient Equivalent Sound Levels at S-M-K City in 2010-11



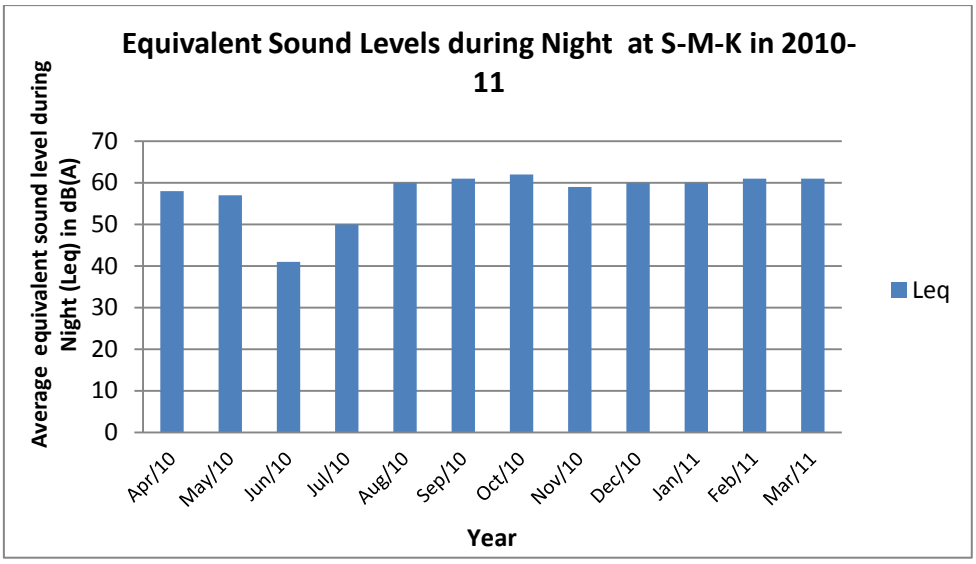


Figure 8-3 Ambient Equivalent Sound Levels at S-M-K City during Day & Night

8.4 Vehicular Ownership Forecast in Study Area

There are around 1.86 lakh registered vehicles in S-M-K (March, 2011) in which two wheeler are 1.41 lakh, followed by 1.79 lakh Cars & Jeeps, 822 Taxis, 5481 Autorickshaw and 904 buses. In addition to above around 8877 Goods vehicles and 10,458 others Vehicles are registered in S-M-K CMC.

The residents of S-M-K City own are 68,587 two wheelers and 3,575 cars as per household survey. The total vehicles (Two wheeler and Car) are worked out to be around 72,161 in base year (2011). Vehicle ownership forecast is made taking into account motorization achieved in other metropolitan cities of India. Based on above estimates, vehicle ownership will reach 1.4 lakh by 2021 and 2.3 lakh by 2031. The vehicle ownership forecast has been presented in **Table 8-10**.

Table 8-10 Forecast of Vehicle Ownership for S-M-K City

Year	Population	2- Wheeler	Car	Total	2- Wheeler per 1000 population	Car per 1000 population
2011	502697	68587	3575	72161	**136**	**7**
2021	580804	117156	7032	124188	**202**	**12**
2031	658910	190835	12593	203428	**290**	**19**

Based on above estimates, vehicle ownership will reach 1.24 lakh by 2021.Higher vehicle ownership results low mobility levels, higher parking demand, and congestion. Environmental pollution levels will reach unsustainable levels and results in health hazards. Therefore need of the hour is increase the patronage of public transport by creating necessary infrastructure and polices.

8.5 Pollution Loads in SMK CMC

Vehicular emissions depend upon two basic factors- transport demands in terms of vehicle-km for each vehicle category and emission rates for different pollutants. The former depends upon the modal share and the latter upon the vehicle technology, speed, age of vehicles and road conditions. Emission rates for different class of vehicles is discussed in **Section 8.2.3**.

Consultants have estimated pollution loads for SMK CMC for the base year which comes to 10.94 Tonnes/ Day.

8.6 Measures to Reduce Vehicular Pollution

8.6.1.1 Increased share of public transport

Public transport systems emit much less pollutant. Therefore, improved bus system with good coverage and frequency should be promoted, in order to reduce vehicular pollution.

8.6.1.2 Transport System Management Measures

At lower vehicular speeds, pollution emission levels are higher. The transport system management measures facilitate smooth flow of traffic, consequently vehicular pollution would also be reduced substantially. It is estimated that with TSM measures journey speeds can be increased by about 30% in cities of various sizes, which will reduce pollution levels[1].

8.6.1.3 Promotion of Non-motorised Transport

Provision of adequate facilities for non-motorised transport such as footpaths, pedestrian subways, cycle tracks and other priority measures will promote use of non-motorised transport, which do not cause pollution. Therefore, priority should be given to the non-motorised transport by development of suitable facilities in order to improve environment in cities.

8.6.1.4 Provision of Adequate Road Infrastructure

Vehicular speeds will increase with the provision of adequate road infrastructure, which will also result in reduction of vehicular pollution. Therefore, construction of missing links, bypasses and other roads to cater to transport demand at desired level of service will help to reduce vehicular pollution.

Inadequate and poor quality of road surface leads to increased Vehicle Operation Costs and also increased pollution. It has been estimated that improvements in roads will result in savings of about 15% of Vehicle Operation Costs.

8.6.1.5 Vehicle Manufacture and Maintenance

Environmental pollution control measures should also aim at reduction of vehicular pollution. Diesel exhaust emissions can be minimised by proper engine maintenance, engine de-rating and use of fuel additives. Proper maintenance of engine and proper driving habits can reduce exhaust smoke by 30% to 50%. Engine de-rating of buses/trucks ensures smoke free performance along with fuel economy and longer engine life. Use of anti-smoke chemical additives can bring about 50% reduction in vehicular smoke. Use of catalytic converters in petrol driven vehicles can reduce carbon monoxide and hydrocarbon levels by more than 70%.

8.6.1.6 Age Limits for Motor Vehicles.

Older vehicles are more polluting, more energy consuming and less road worthy. In addition these vehicles are more likely to have breakdowns on the road thereby causing obstruction to other traffic which results in greater pollution and more energy consumption. Therefore, government should consider adopting the policy of discouraging old vehicles and encourage their early replacements. Statutory age limits should be set for all type of vehicles used intensively. A progressive increasing road tax surcharge could be considered for imposition of all types of vehicles above 10 years of age. Fiscal incentives should be provided for early replacement of old vehicles such as lowering of registration fee and sales tax.

In SMK CMC significant proportion of old Auto are plying which needs special attention from RTO, Traffic Police and NMC.

8.6.1.7 Other Measures

As a long-term measure, it is also necessary to consider alternative clean fuels. Apart from reducing vehicular pollution, these also help in conserving petroleum products. The major alternative cleaner fuels that are finding increasing use are Alcohols (ethanol/methanol), Compressed Natural Gas (CNG) and Liquefied Petroleum Gas (LPG). CNG is being currently used in Delhi and Bombay, though on a limited basis. **India is one of the largest sugar cane producing countries in the world, which is an ideal raw material for ethanol production. However, intensive research and development efforts should be directed towards the development of clean fuels and motor vehicles, which have large potential in reducing vehicular pollution and consumption at reasonably reduced cost with large-scale commercial production.**

The combustion of fuels release SO_2, NOx, CO and ozone. The CO is highly noxious gas that forms when there is not enough oxygen during the combustion. The CO, however, oxidizes very fast and forms CO_2, which though is not noxious but is one of the major contributors of greenhouse effect. This implies a reduction of CO, hence CO_2 emissions, can only be achieved by improving the engine efficiency or by using fuels containing lower concentration of carbon such as natural gas.

The compressed natural gas (CNG) is a clean-burning alternative fuel for vehicles with a significant potential for reducing harmful emissions especially fine particles. Nylund and Lawson (2000) find that diesel combustion emits 84 grams per kilometer (gms/km) of such components as compared to only 11 gms/km in CNG. The levels of greenhouse gases emitted from natural gas exhaust are 12% lower than diesel engine exhaust when the entire life cycle of the fuel is considered. It has also been found that one CNG bus achieves emission reduction equivalent to removing 85-94 cars from the road. **Table 8-11** gives the emission benefits of replacing conventional diesel with CNG in buses.

Table 8-11 Emission Benefits of Replacing Diesel with CNG in Buses (g/km)

Fuel	CO	NOX	PM
Diesel	2.4	21	0.38
CNG	0.4	8.9	-
% Reduction	***84***	***58***	***97***

Source: World Bank

8.6.1.8 Old or Aged Autorickshaws

RTO/ SMK CMC should put restrictions on use of old autos. There is should some restriction on age of autos. It has observed that they are emitting very high noise.

8.6.1.9 Policy Initiatives

Following Policy Initiatives are require to improve the environment

- Coverage and frequency of Public Transport services should be improved.
- Construction of New Bus Stops / Improvement of Existing Bus Stops should be planned with proper signage and information display. Public-private partnership (PPP) model can be considered for adoption
- Transport Authority should issue a timetable and public awareness campaign should be carried out. Transport Authority should handle services professionally with a motto of serving the people. There should be Public relationship officer who is available to clarify/alleviate the public transport related issues.
- Educational trips which constitutes 28% of the total trips in SMK CMC. Public Transport Bus should target these education trips by introducing monthly concessional passes at 50% of the cost. This is a first major step, which is expected to increase the modal share in favour of Bus. New routes should be planned to cater to educational trips.
- For other category of commuters, some form of monthly passes should be introduced with 10%-25% of discount.
- Mini-buses should be introduced in low density corridors to minimise the dependence on Auto
- On street parking should be restricted. Minimal charges should be fixed. Off-street parking facilities should be created on BOT model
- Old Autos should be banned.

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Client:	**Maharashtra Urban Infrastructure Development Company Limited (MUIDCL)**		
Project:	Preparation of City Mobility Plan for Sangli-Miraj-Kupwad Municipal Corporation	**Project No.:** C1112502	
Title:	Draft Final Report	**Document No.:** RP005	**Rev.:** 0

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Notes:

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Revision Details:

Rev.	**Date**	**Details**	**Init.**	**Sign.**	**Init.**	**Sign.**	**Init.**	**Sign.**
			Prepared		**Checked**		**Approved**	

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9 Institutional Arrangement for Urban Transport

9.1 General

In India, the management of urban areas is essentially the responsibility of the State Government, although the 74th Constitutional Amendment devolves the responsibility of urban development to local bodies. Urban Development, and therefore, Urban Transport, is primarily the responsibility of the State Governments.

It may be observed that Urban Transport is an activity that is controlled by multiple institutions. The multiplicity of agencies providing various urban services got into a familiar bureaucratic jam. The multiplicity of institutions has resulted in:

- Fragmentation of functional responsibilities
- Lack of local resources
- Paucity of financial resources
- Lack of privatisation strategy for the sector as a whole

In fact, the responsibilities for policy making, planning, investment, operations and management are divided in Central, State and local government organisations with the result, there is no unity of command and coherent approach to various issues confronted by this sector.

Institutional gaps in Urban Transport can be summarised as follows:

- Multiplicity of organizations involved in Urban Transport
- Lack of co-ordination among organizations involved in Urban Transport
- Lack of Transport Planning expertise in the organizations
- No accountability in ownership, performance, and maintenance of transportation infrastructure and systems operations
- No single apex agency regulating, facilitating and integrating operations of different modes

9.2 Current Institutional Issues in SMK CMC

The Existing major Institutions in SMK CMC and their roles are presented in **Table 9-1** and elaborated below.

Table 9-1 Existing Institutional Arrangement for Transportation in SMK City

Sl. No	*Functions*	*Institution*
1	Road building, Maintenance, Street Lighting, Grade Separators constructions, Traffic Management System	S-M-K CMC
2	Enforcement of traffic laws and regulation	Traffic Office (Sangli & Miraj)
3	Public Transport System	MSRTC
4	Development Plans	District Town Planning Office
5	Registration of motor vehicles issue of licenses and enforcement of regulations	Regional Transport Office (RTO)
6	Monitoring of Air & Noise Quality Levels	Maharashtra Pollution Control Board (MPCB)
7	Construction and Maintenance of State Highway	PWD

9.2.1 SMK-CMC – Institutions

9.2.1.1 SMK-CMC

SMK-CMC has the key responsibility for providing basic urban services in Sangli-Miraj-Kupwad as per the Bombay Provincial Municipal Corporation (BPMC) Act, 1949. These services include water supply, sewerage, waste management, slum improvement, construction and maintenance of internal roads and bridges, street lighting, maintenance of parks and gardens, traffic management, land use planning and provision for primary health and education facilities.

The Bombay Provincial Municipal Corporation (BPMC) Act, 1949, defines the powers (including those of taxation and borrowing), duties and functions of SMKMC. S-M-K CMC has been permitted to exercise the powers of a Planning Authority in the entire area under its jurisdiction except the census towns and out growths present near S-M-K city.

SMK-CMC co-ordinates with various other government organizations like Sangli District Town Planning Office, Sangli Regional Transport Office, Maharashtra State Road Transport Corporation (MSRTC), traffic police, Maharashtra Pollution Control Board (MPCB) and Maharashtra Industrial Development Corporation (MIDC) for delivering these basic urban services.

9.2.2 Transport Department (RTO)

The Sangli Regional Transport Officer is in-charge of the licensing of the motor vehicles, issue of route permits/area of operation and monitoring condition of the vehicles by having them periodically examined and also maintaining the various statistics with regard to the transportation in the whole city. While the commercial vehicles and larger passenger vehicle

operations are licensed for statewide operation, the licensing for IPT modes like auto-rickshaws are confined to respective districts.

9.2.3 Traffic Police

The traffic Management is carried out Traffic Police from Sangli and Miraj traffic offices. In parallel, the S-M-K CMC also initiates and implements certain traffic engineering proposals as part of traffic management. The Traffic Management is considered an enforcement function and the Traffic Division under the control of Traffic Inspectors (Sangli & Miraj) does all the planning and implementation within the city as mentioned earlier.

The Traffic police are responsible for enforcement of Traffic laws and prosecuting the violators.

The issues facing the Traffic Police establishment are:

No traffic expert: The institution of traffic police does not have any experts in Traffic Management to guide the police. They know the problems and they have authority but Knowledge input is the main drawback. Many times, police play the role of planners in the absence of professional planners in police department.

No budget for improving Traffic Management: The Traffic police are starved for funds. Though, they collect lot of money as “fines” from the traffic violators, the Traffic Police is not entitled to spend any money from “Challan Fund”. The “Signages” have to be provided by Development Authority. Similarly, the establishment of Traffic Signals. The present scenario is not a satisfactory one, and there are financial hurdles, to take up even small improvements. The institutional limitations are sapping the enthusiasm of Traffic Police Authorities.

No sufficient Manpower or Automation: The traffic police are handicapped with shortage of manpower. Modern tools of automation are not available for Traffic Police, in discharging their duties. The methods are age old and the institution does not have means to face the challenges in future.

9.2.4 MSRTC

The road transport is looked after by Maharashtra State Road Transport Corporation (MSRTC) serving peripheral areas and regional towns. MSRTC has the responsibility of providing bus transport services in S-M-K CMC.

9.2.5 Urban Transport Funding

Urban transport in most cities suffers from lack of planning as well as amorphous nature of responsibilities assigned to various central, state and local government agencies. Funding has been an issue for all city governments to finance their innumerable projects. Excepting for a few metropolitan cities, many look to the State Government for financing their transportation projects. There are no regular assured allocations from State Governments to local bodies for capital expenditure on transport projects, though there are some provisions in the legislation. For example, the Maharashtra Regional and Town Planning Act provides for a grant of 23.33% of project cost from the State Government, but many times the flow of funds is uncertain as the State’s resources are not adequate enough to meet other commitments.

Municipal Corporations are not in good financial health; hence, they shy away from taking up transport projects of immediate nature. Most of the expenditure on transport relates to roads, and not to other areas like public transport or traffic management. Around 5% of the total expenditure is spent towards construction work in S-M-K CMC. The expenditure on construction has increased from Rs. 24 Crore in the year 2002 to Rs. 34 Crore in the year 2006 with a CAGR of 6.7%.

In the absence of long-term strategies, the token expenditure spent on road sector does not offer any tangible results. All estimations of investment in urban transport are unanimous in pointing out that implementing the strategies for meeting the future urban travel demand by enhancing the capacities of urban transport infrastructure in general and public transport in specific will clearly require large capital investments.

9.3 Suggested Institutional Improvements

Implementation of a Comprehensive Mobility Plan is an opportunity to identify and strengthen the institutions responsible for planning, development, operation and management of the ***city transport system*** and build capacity in them to take up the programmes under the short term and long term plan, policies and programmes through public institutions on/or private sector participation. The existing institutional framework should be improved for the implementation of the urban transport proposals and is discussed below.

- SMK-CMC need to strengthen professional capacity to undertake planning, design and implementation of large scale transportation projects.
- The institutional capacity of SMK CMC to implement large projects is constrained and therefore they would invariably need support from other state level organisations such as MSRDC, PWD and MSRTC.
- SMK-CMC should maintain the database related to urban transport and socio-economic parameters for planning purpose.
- SMK CMC should appoint one Traffic Engineer who will be responsible for planning, design, implementation and co-ordination with all other organisations such as Traffic Police, MSRTC etc. The responsibilities of Transport Planner/Traffic Engineer are listed below:
    - to coordinate the planning and design of traffic and transport plans
    - to assist in the development and implementation of local transport policies
    - to plan, design and implement public transport and general traffic improvement schemes
    - to draw up and implement traffic regulations concerning the utilization of road space by different vehicle types and pedestrians
    - to maintain traffic signs, carriageway markings and traffic control devices
    - to monitor vehicle and pedestrian movements
    - to develop traffic schemes of a temporary or experimental nature
- SMK CMC shall endeavour to invite, encourage and facilitate private sector participation in development of transport infrastructure. Transport terminals and facilities for inter modal integration and all associated infrastructure such as bus-bays, pedestrian and parking facilities are good candidates for private sector participation. Experience with privatization of bus services is mixed, but it is established that bus

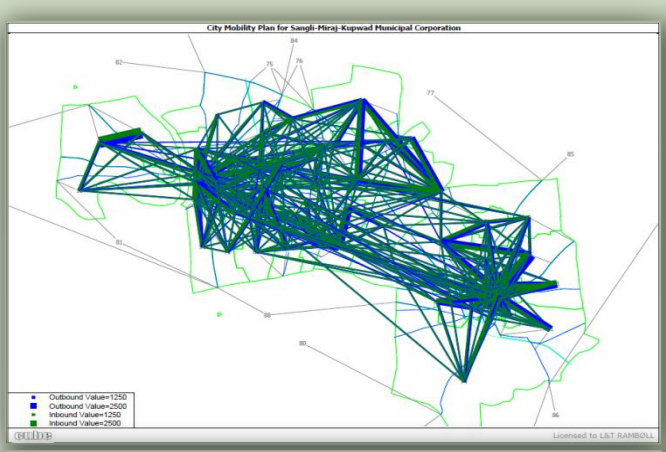
services can be privatized at affordable fares and the need for capital and revenue financing by the MSRTC can be eliminated.

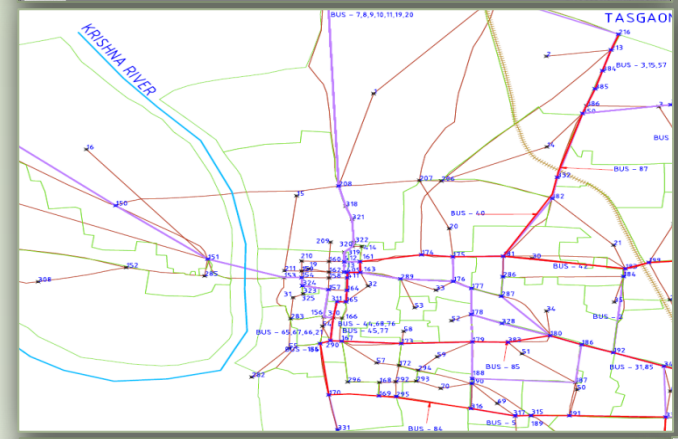
- SMK CMC shall organize number of short term training programmes on different aspects designed and delivered to upgrade the skills of the existing personnel and update the new entrees on a regular basis. For this purpose one of the help of major institutions/consultants should be taken and financial outlay to be allocated to run the training programmes on a regular and continuous basis.

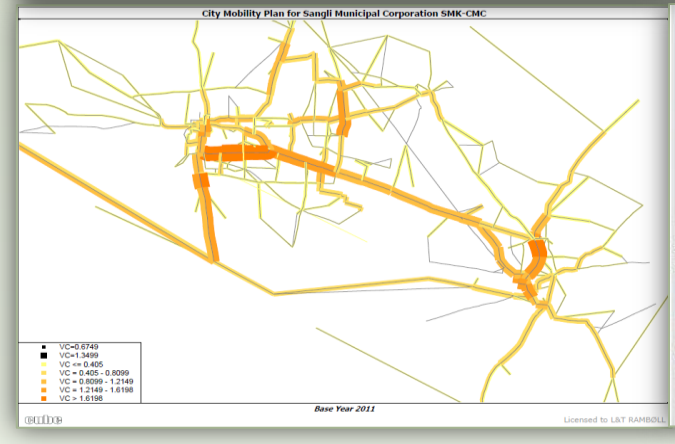
Maharashtra Urban Infrastructure Development Company Limited (MUIDCL)

On behalf of Sangli–Miraj-Kupwad Municipal Corporation (SMK CMC)

Preparation of City Mobility Plan for Sangli-Miraj-Kupwad City Municipal Corporation







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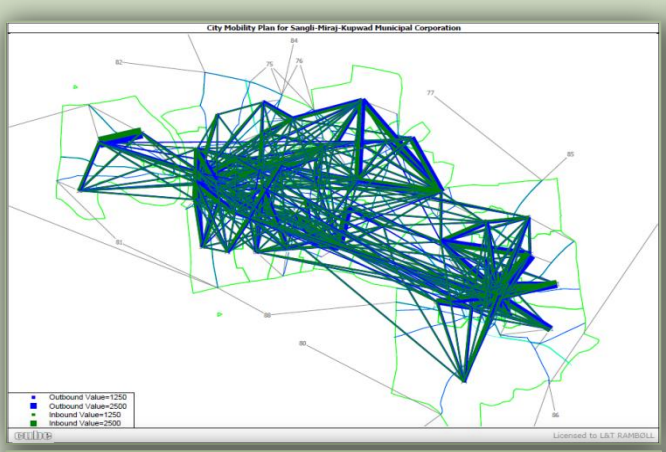

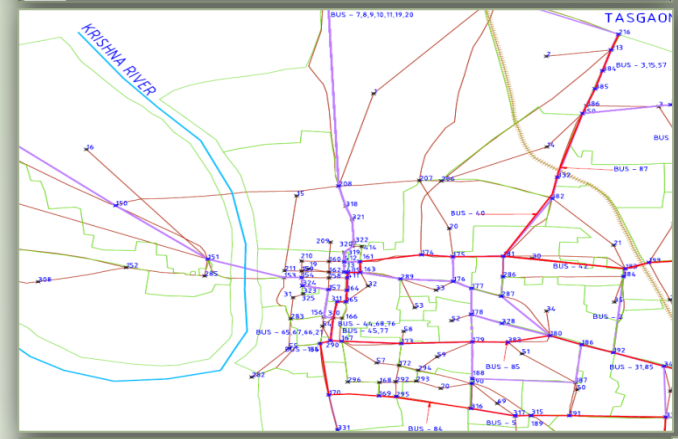

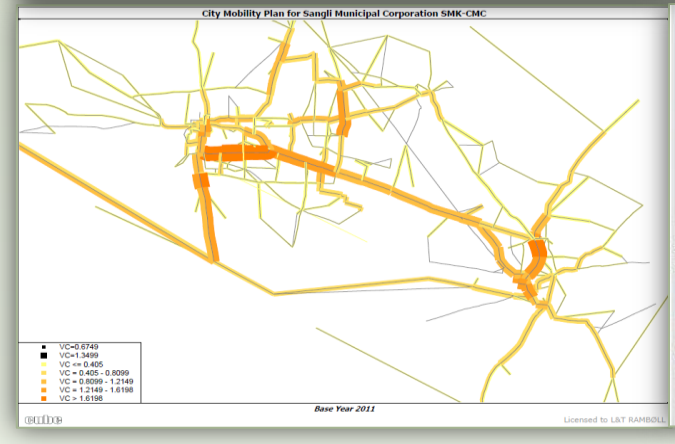

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