

Planning of Public Transport for Mysuru City Master Plan 2031

Dr. K.C.Manjunath
Associate Professor
Dept. of Civil Engineering
NIE, Mysuru

Samatha B S, Nikhilash M
Poojitha K, Manikantha Reddy S Benal
B.E. Civil Engineering
NIE, Mysuru

Abstract:- Transportation is considered as an essential part of human life and backbone of national, regional and local economy. Transportation sector plays a crucial role in boosting up the life styles of common man by providing facilities and accessibilities as required. Public transportation systems include a variety of transit options such as buses, light rail, and subways. Public transportation is a shared transportation service, and includes urban public transit and intercity public transportation. Public transport in Mysuru City was selected for the case study as it is the third-largest city in the state of Karnataka, with a well-planned CDP for future growth. Mysuru city has radial and grid-iron pattern road network with arterial roads originating from the city center. But increase in population and increase in the motor vehicles have resulted in congested roads and delay in transportation. Public transportation in Mysuru city is majorly by bus and it serves only 17% of LPA population as per 2016 data. Due to lack of interconnectivity between the planning districts the existing public transportation is inadequate for present and future population. By planning an efficient public transport system the percentage usage of public transport can be increased in the coming years. The Study has suggested a good transportation system through Multiple Bus Stands, Bus Rapid Transit System in arterial roads and Monorail along Ring road for Mysuru City.

Keywords:- Master Plan, Mysuru City, Multimodal Transport System, Bus Rapid Transit System, Monorail.

1. INTRODUCTION

Urbanisation is taking place at a faster rate in India. Rapid rise in urban population, in India, is leading to many problems like increase in slums, decrease in standard of living in urban areas, also causing environmental damage and transportation problems.

In India, the nomenclature Master plan or Comprehensive Development Plan (CDP) is being used as a statutory instrument for controlling, directing and promoting sound and rational development and redevelopment of an urban area with a view to achieving maximum economic, social and aesthetic benefits.

1.1 TRANSPORTATION

Transportation is considered as an essential part of human life and backbone of national, regional and local economy. Transportation sector plays a crucial role in boosting up the life styles of common men by providing facilities and accessibilities as required to them.

Public transportation systems include a variety of transit options such as buses, light rail, and subways. These systems are available to the general public, may require a fare, and run at scheduled times. The purpose of introducing or expanding public transportation is to increase access and use of public transit while simultaneously reducing motor vehicle miles driven and traffic congestion.

Mysuru is the third-largest city in the state of Karnataka, India. The city has expanded spatially in a concentric manner since 1971. The city is located in the southern part of Karnataka. The city is well connected by road, rail and airport. Mysuru city has radial and grid-iron pattern road network with arterial roads originating from the city center.

1.2 OBJECTIVES

The study has been taken up with the following objectives,

1. To study existing Public Transport system in Mysuru city.
2. To identify the deficiency in the existing modes of transport system especially in public transport system.
3. To propose a new plan for public transport for the year 2031 compatible with Master plan.

2. LITERATURE REVIEW

The studies carried out by Ashish Verma (2013), considering the present trends of urbanization and motorization in India, suggested there is an urgent need for integration, revitalization and renewal of the smaller towns and cities to make urban areas more sustainable.

Public transportation is a shared transportation service, and includes urban public transit and intercity public transportation. The main transportation modes in urban public transit are buses, trams, trolleybuses, trains, and metro. They employ thousands of drivers and supporting staff (Milan Janić, 2015).

The number of motor vehicles in Mysuru has more than doubled in less than a decade. Motor vehicles registered with the state transport department as on Dec.31, 2016, stood at 8.15 lakh with two wheelers accounting for 6.51 lakh of them or almost 80%, followed by 90517 cars (11.10%). 21642 autos, and 4000 KSRTC buses form major part of public transport (Star of Mysore 2017).

Bus Rapid Transit System (BRTS) is a safe, economical, rapid, convenient and new concept of Public

transport in Indian scenario. Perhaps there are more than 150 series of BRTS running successfully worldwide. Few examples include Bogota and Beijing. Ahmedabad (India) is also a successful example of BRTS. It is the most economical and eco-friendly solution of public transportation for growing cities of India (Ajay Mishra et al. 2013).

The study conducted by Liu Xi et al. (2014) describes the development of Monorail transit system and its present situation, the application and classification of monorail vehicles. The monorail transit system vehicles in Japan and China are taken as examples to discuss the development and application of monorail transit system in the urban areas.

3. METHODOLOGY

3.1 DATA COLLECTION

3.1.1 Existing Road Network of Mysuru City

The data of existing road network for Mysuru City is obtained from Mysuru Urban Development Authority. The city has radial and grid-iron pattern road network with arterial roads originating from the city center. The palace is the focal point of origin of all arterial roads running radially to outer areas of the city. The road network of the city includes three ring roads. They are outer ring road, intermediate ring road and inner ring road. In addition arterial roads, sub-arterial roads, collector roads also form a major part of road network. The three ring roads not only collect traffic from other roads but also act as by-pass roads at their respective locations in order to avoid congestion especially at the core of the city. **3.1.2 Existing Road Width of Arterial Roads**

The Existing road widths of Major Arterial roads of Mysuru city is shown in Table 1.

Table 1 List of Existing Road Widths of Arterial Roads

No.	Name of the Road	Average Existing Road width (m)
1	Bangalore Nilgiri Road	30
2	Mahadevapura Road	24
3	Bannur Road	24
4	T.Narasipura Road	32
5	HD Kote Road	24
6	Bogadi Road	22
7	Hunsur Road	30
8	KRS Road	24
9	Nanjungud Road	30
10	Outer Ring Road	45

3.1.3 Present City Bus Service

Mysuru city has a city bus transportation facility managed by state transport corporation. The city services division of the KSRTC has been operating in the city as

well as suburban areas in the entire Local Planning Area (LPA) connecting the following places, namely Chamundi Hill, K.R.Sagar, Srirangapatnam, Elwala, Melapura, Mellahalli, Mahadevapura, Wajamangala, and Siddharamaiana hundi. More than 4000 buses are put in service for public transport.

3.2 GROWTH PROJECTION

3.2.1 Population Projection for 2031

Population projections for the year 2031 are given in the Table 2. The LPA for Mysore-Nanjangud is conveniently grouped under four categories for design purpose which are as follows:

- Mysore Urban
- Nanjangud Urban
- KRS Area
- Other Rural Area (LPA Rural)

Table 2 Projected Populations for Mysuru LPA 2031

No	Area	Population 2011	Population 2031
1	Mysuru City	1,120,000	2,100,000
2	Nanjangud Town	67,500	80,000
3	KRS Area	17,000	30,000
4	LPA Rural	121,150	167,000
Total Population of LPA		1,325,650	2,377,000

3.2.2 Vehicular Growth

The study of the vehicle growth, as registered by the Regional Transport Office (RTO) Mysuru reveals that during 2011 about 4 lakh vehicles were registered in RTO and by December 2016 there were about 8.15 lakh vehicles in LPA region. In addition to this about 10,000 other state vehicles are present in LPA region. Further the occupancy of registered vehicles on road is about 72.5% only.

3.3 PLANNING FOR 2031

A detailed analysis of existing transportation facilities and future requirements were made to come out with a suitable multimodal transport system involving the following systems.

- Multiple Bus Stands at Corridors
- BRTS (Bus Rapid Transit System)
- Monorail

4. PLANNING AND DISCUSSIONS

4.1 MULTIPLE BUS STANDS

The study comprised of collecting primary data on classified traffic volume counts on major roads, O-D survey reports and road inventory details. Secondary data was obtained from the transport model from Comprehensive Mobility Plan (CMP) report related to the trip generation zones and destination zones. Parallely the existing and proposed land use and activity pattern was studied from the Master plan.

4.1.1 Road Network Characteristics

The city of Mysuru is served by a well-established grid network. It is essentially grid based with arterial

roads radiating from the city Centre. The total road network amounts to 1170 km. The city is connected to nearby towns and cities via National and State highways. The city is also served by the National Railway network. Almost all roads are of good quality with Right of Way (RoW) of 18 m to 30 m. The city bus system forms the mode of public transport in the city which has a high spatial coverage.

4.1.2 Traffic Survey Inferences

A CMP was conducted for Mysuru in 2011. The study results of traffic and travel survey has been appended with some data from that report. Classified volume counts were carried out in the following locations to accumulate the following data.

1. Average daily traffic (ADT)
2. Hourly variation and peak hour flows
3. Directional distribution by hour of the day
4. Traffic composition.

It is observed that the traffic volume is as high as 73,444 PCU. From analyzed data it is observed that the intensity of a 2-wheeler is predominant in most of the roads with the composition varying between 19% and 50% while that of cars is 17% to 35%. Total PHPDT (peak hour peak direction trip) on major roads range 12,000 to 15,000 trips.

Classified volume counts at the outer cordon locations were conducted to gauge the traffic characteristics at the various access points pertaining to the study area. From the analysis it is observed that the volume of traffic is highest towards Bangalore Road.

4.1.3 Traffic Model Inferences

The actual trip pattern in the city is generated by the survey results of CMP report. The 65 wards of the Mysuru City Corporation were considered as traffic zones. An analysis of trip by purpose and trip length indicates that maximum number of trips are performed within 5 km– 10 km distance and average trip length is 7.8 km. Maximum number of trips are made by 2-wheelers, followed by buses including mini (private) tourist buses. The major trip producing zones were found in the north-west, south-west and south east of the city and are shown in Fig 1 and Fig 2. The zones confirm with the land use pattern of Mysuru.

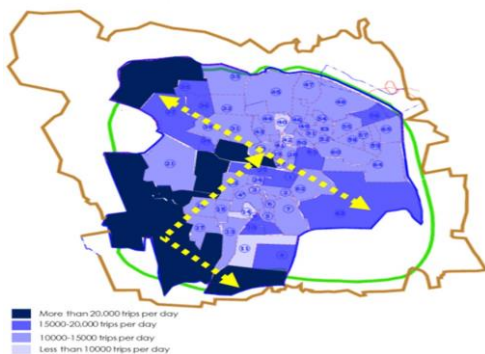


Fig 1 Trip Attraction Zones

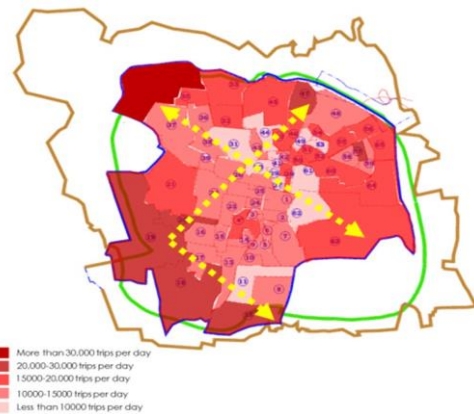


Fig 2 Trip Production Zones

Major travel corridors can be derived from this study. It also shows that the traffic in Mysuru has huge externalities owing to the volume of regional traffic inflow into the city. Hence it can be inferred that without any major change in the economic geography of the region the travel corridors would remain constant.

4.1.4 Planned Location of Multiple Bus Stands

The Planned bus stands are as shown in Fig 3 and are classified as following

Major bus stands at

1. The Bangalore Road
2. Mahadevpura Road
3. Bannur and T.Narsipur Road
4. Nanjungud Road
5. H.D kote Road
6. Hunsur Road

Small bus stands at

1. Bogadi Road
2. KRS Road

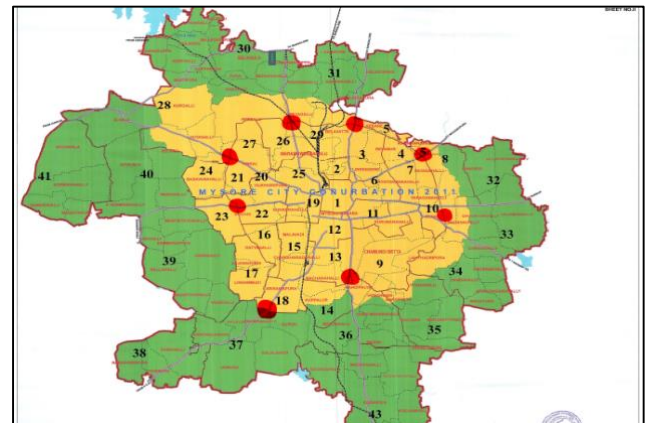


Fig 3 Planned Multiple Bus Stands at Corridors

4.2 BUS RAPID TRANSIT SYSTEM (BRTS)

4.2.1 Principles of BRTS

- Move people as effectively as possible at a potentially lower initial capital cost.

- Fully utilize existing roadways, rights-of-way, and station sites.
- The operation of BRTS maximizes flexibility of Public transport system.

4.2.2 Need of BRTS

There are many reasons for developing Bus Rapid Transit system:

- Central Business Districts (CBD) have continued to prosper and grow in ways that require more transport capacity and improved access.
- In India, the low cost/low quality public buses are now not preferred by the upwardly mobile strata, so BRT systems can often be implemented quickly and incrementally.
- For a given distance of dedicated running way, BRTS is generally less costly to build than Rail transit system
- BRTS is designed and developed to tackle all the drawbacks of the existing bus system in an economical and efficient manner.

4.2.3 Components of BRTS

A BRT system combines flexible service and new technologies to improve customer convenience and reduce delays. While specific BRT applications vary, the components may include

- Running Ways
- Bus Stop
- Vehicles
- Platform level Boarding
- Fare collection
- ITS

4.2.4 Planning of BRTS for Mysuru City

BRTS is planned for arterial roads of Mysuru city as shown in Fig 4. As per Master Plan 2031 the existing arterial road widths are up to 24 m to 30 m .In some stretches where the road width is less than 24 m one way carriageway can be suitably planned.

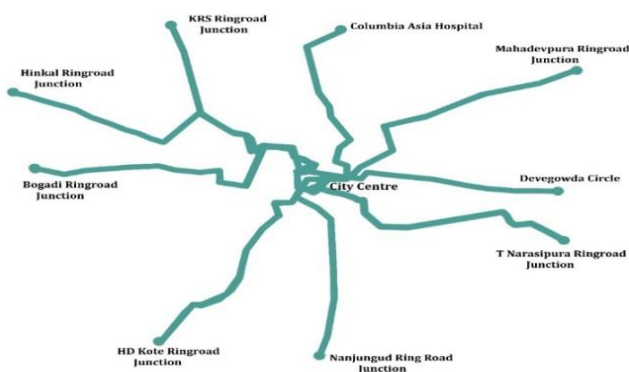


Fig 4 BRTS Route Network for Arterial Roads

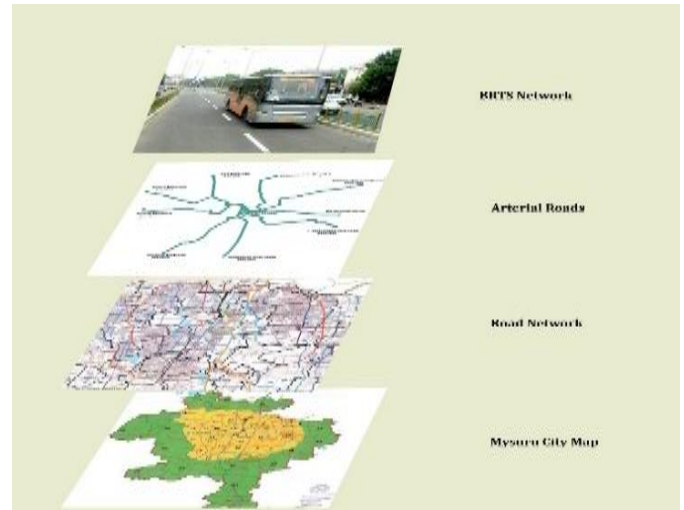


Fig 5 Thematic Layers Showing BRT System

BRTS is planned for arterial roads. However for connecting the planning districts within the arterial roads minibuses of capacity 20-25 passengers are planned. Frequency of this bus depends on traffic demand characteristics of that area. By planning the minibuses inter connectivity between the arterial roads can be achieved and public transportation becomes more flexible and efficient.

4.2.5 Microbus

To meet the problem of accessibility, between the arterial roads minibuses can be provided. These buses in public transport can be made to run between adjacent arterial roads and a segment of ring rail. This helps in connecting different parts in that area. Number of buses and trips can be fixed to satisfy the demand in the area after studying the pattern of commuters flow. An exclusive yard has to be provided at multiple bus stands to shelter the minibuses.

Adopting minibuses has following benefits.

- Space occupancy on road is less
- Frequency is increased in the same cost as compared to a full-size bus
- Employment opportunities are augmented.

4.2.6 Public Shared Taxi

The Taxi-sharing services are planned in those areas of the city that are poorly served by public transport and in residential areas. The taxi-sharing service will improve access in the local area as well as enabling people to connect with onward travel by bus or rail. This indicates that the shared taxi service provides a socially necessary service, enabling elderly people and people with disabilities to access other public transport in a flexible manner. It also helps to provide door to door public transport service facility within the city. It also creates employment opportunities among the youths. This system reduces the congestion on roads caused due to private vehicles.

4.3 RINGRAIL

The Ring Railway is a circular rail network which runs parallel to the Ring Road. The length of outer ring road in Mysuru is about 32.5 km. Since ring road is of 45 m width, a ring rail along the ring road is found to be highly suitable for mass transport. Hence a suitable ring rail is planned. The planned ring rail in Mysuru acts as a feeder network for multiple bus stands at corridors.

4.3.1 Planning of Suitable Rail Transit

Since the 1880s the rapid rail transit, which is convenient, energy saving and environmental friendly has become an efficient mode of transportation for the cities. It not only promotes the improvement and integration of public transport networks, but also enhances the liquidity and attractiveness of the city. It can be combination of underground, ground and air which form the three-dimensional public transport system. Rail traffic has greatly improved the problem of urban traffic congestion.

Rail transit system may be one of the following types:

- Tram
- Light Rail
- Rapid Rail
- Mono Rail
- Commuter rail

Based on the detailed study on various urban rail transit systems and by considering the factors such as aesthetic view, low cost of construction, flexibility etc., straddle beam type Monorail is suggested along the outer ring road of Mysuru city.

4.3.2 Mono Rail

A Monorail is a mass transit system in which the track consists of a single rail. The term is also used to describe the beam of the system, or the vehicles traveling on such a beam or track. To differentiate monorails from other transport modes, the Monorail Society says "Monorail is a single rail serving as a track for passenger or freight vehicles. In most cases rail is elevated, but monorails can also run at grade, below grade or in subway tunnels. Vehicles are either suspended form or straddle type. Monorail vehicles are wider than the guide way that supports them.



Fig 6 Typical Monorail

4.3.3 Advantages of Straddle Type Monorail

- Monorail can be built in a congested, overcrowded area.

- It consumes minimal space since straddle-beam is of width 0.6 to 0.9m.
- Elevated rail transit system does not affect the road traffic.
- Elevated rail transit system at outer ring road does not affect the skyline of the city.
- It can be built at a faster pace when compared to metro with low cost.
- Capable of having small radius of running through the curve track.



Fig 7 Thematic Representation of Monorail

4.4 PUBLIC TRANSPORT USAGE

Public transport is a shared passenger-transport service which is available for use by the general public. It is better than taxicab, carpooling, hired buses, and transportation network companies, which are not shared by the general public without private arrangement. In conclusion, one should use public transportation, because it is good for environment, it is cheap, and it has better accessibility. In most of the developed countries the percentage use of public transport is higher than developing countries due to efficient and flexible multimodal type of public transport.

At present the public transport usage of Mysuru City is only 17%. This is due to inefficient public transport system. Thus by planning an efficient multimodal public transportation system the percentage usage of public transport can be increased by 2031. The percentage use of public transport in various cities is shown in Table 3.

Table 3 Public Transport in various Cities

Sl.no	City	Percentage use of public transport
1	Mumbai, India	88%
2	Pune, India	18%
3	Lucknow, India	28%
4	Ahmedabad, India	47%
5	Bengaluru, India	37%
6	Hyderabad, India	35%
7	Mysuru, India	17%

5. CONCLUSIONS

4.4.1 Tangible and Intangible Benefits of Efficient Public Transport

- Public transport users are more active.
- Buses are safer than individual vehicles.
- Public transportation reduces stress.
- Public transport provides faster city traffic movement for all modes.
- Riding public transportation saves money.
- Public transportation provides access to essential needs later in life.
- Efficient Public Transportation impact on Environment.

The positive environmental impacts are listed below

- Reduction in road accidents
- Reduction in Air Pollution
- Reduction in Noise pollution
- Less fuel consumption.

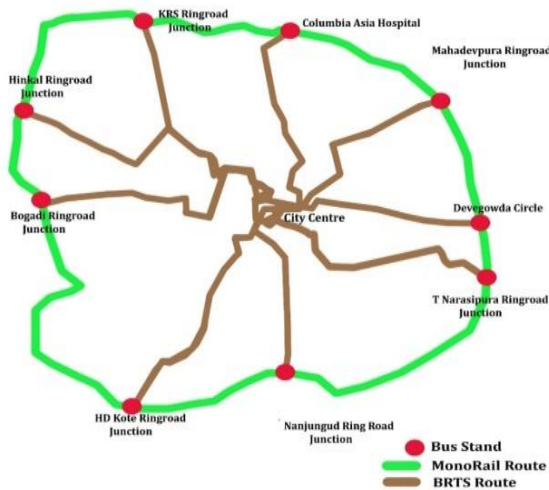


Fig 8 Public Transportation Plan for Mysuru City Master Plan 2031

1. Public transportation in Mysuru city is majorly by bus and it serves only 17% of LPA population as per 2016.
2. Present public transport system is inadequate and inefficient since there is a lack of interconnectivity between the planning districts.
3. The result of study strongly indicates BRTS can be used as efficient mass rapid transit system for Mysuru city.
4. Based on the planning, multiple bus stands serves in decongesting the Central business district by deviating buses to outer ring road.
5. Multimodal public transport using BRTS in arterial roads and Monorail along Ring road can serve up to 30% of LPA population.

6. REFERENCES

1. Agarwal, O.P., 2006. Urban transport. Chapter 6 in India Infrastructure Report 2006, Oxford University Press, New Delhi, pp. 106–129.
2. Agarwal P K, Sharma Anupama, Singh A P (2010), JERS Vol.I “An overview on bus rapid transit system”.
3. Asaul, N.A. (2013). Strategic Objectives of the Russian Transport System Development. vol.1, pp. 87–98.
4. Ahmedabad urban development authority(AUDA) 2015, “Janmarg- A Report on BRTS”. Ahmedabad.
5. Bus Rapid Transit Features and Deployment Phases for U.S. Cities Published on Journal of Public Transportation, Vol. 12, No. 2, 2009
6. Bus Rapid Transit System, Bhopal, Presentation by BCEOM International France, Bhopal Municipal Corporation. 2008.
7. IRC Highway Research Board, Case study: Social Cost and Benefit Analysis for BRT, Road Research in India 2008-2009.
8. Kadiyali L.R, (2008), Traffic Engineering and Transportation Planning, Khanna Publishers, Seventh Edition, Delhi.
9. Mysore urban development authority (MUDA), 2016, “Master plan 2031”. PP 73-84.
10. Wang Wei-jie.2009, Analysis of influence factors of straddle type monorail Vehicle tire life, Urban Rapid Rail Transit. PP 89-91.