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BRT System: An Approach for Sustainable Public Transport System for Mangalore City

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Abstract—*Due to the rapid pace of urbanization, traffic problems in urban areas are increasing day by day with the increase in number of vehicles which ultimately results in excessive congestion, delays in travel times and reduction in speed on urban communication network corridors. In search of sustainable solution there need to be an efficient public transportation system along these network corridors to reduce the congestion on the main urban road networks. The main focus is to be shifted from private transit systems to public modes of transport.*

Mangalore, one of the fourth largest city of Karnataka is nominated as one of the smart cities of India. The city is highly congested along the CBD from which the roads emerged in a radial fashion thereby inter-connecting the entire city. The chaos in most of its terminals shows a lack of understanding of the complex characteristics of interchanges for the passengers. Due to lack of organization and sensitive design consideration, modal interchanges are mostly inconvenient and unsafe for the tourists and the local people. To achieve sustainable solution for the urban transportation services, there need to have an integrated development of traffic movement and networking system throughout the city.

The paper aims at proposing guidelines for transit oriented development for Mangalore City and introducing BRT system which shall be a veritable option for improving the service delivery in the public passenger transport as it affects the most predominant transportation mode of Mangalore- road transport.

The proposal includes the analysis of travel demand estimate and feasibility both at macro and micro level in terms of traffic rate and road infrastructure characteristics for selecting and phasing BRT corridor. The proposal concludes with detail study, analysis and proposal for BRT system along a stretch of main transport corridor from the Railway station to the propose transit hub assessing its feasibility.

Keywords*: BRT system, modal interchanges, networking system, road infrastructure.*

1. INTRODUCTION

Urban transportation is the backbone for the development of any urban area which facilitates the smooth access and mobility of peoples and goods within and outside the city. Efficient passenger transportation system has a foremost importance in the smooth functioning of the road network within a city. With the growth in population and its influx within a city, the mobility rate increases. People's personal choices and freedom increases in terms of private ownership of personalized vehicles. As a result, public agencies operating public transportation system often fails to restructure the service types for the people due to their changing demand pattern of transportation system which mostly make these systems financially less viable, increasing in congestion level, speed reduction and ultimately inefficient. Most of the metro cities in India are finding their public transportation system inefficient and inadequate due to rapid improvement in socio-economic conditions which majorly results in increased demand for travel.

Mangalore is the chief port city of Karnataka state which has an area of 132.5 sq.km with a gross density of 2843 persons per sq.km which is higher than the district gross density. The city is well connected through port, rail, road and air. The pattern of road is broadly classified as radial which is already established in the old city area whereas the new network road emerges along the main NH-17 in the same radial pattern linking various parts of the city. The vehicular growth rate in last five years is found to be 10.8 (Fig. 1).

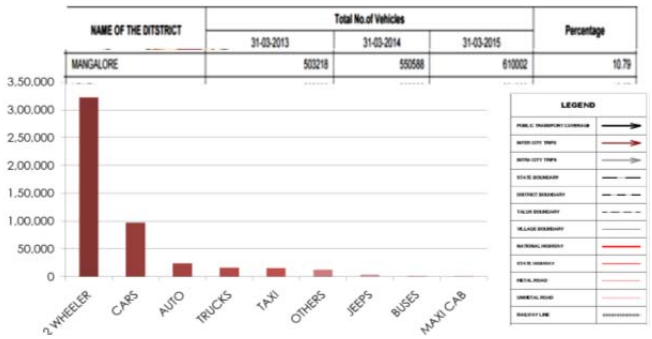


Fig. 1

2. METHODOLOGY:

The in-depth understanding about the existing base situation, proposing a solution to the issue identified and the probable outcome and its impact on the society and mankind are the three major key aspects for any successful development proposal. The systematic approach and methodology for the BRTS proposal is summarized below (Fig. 2)

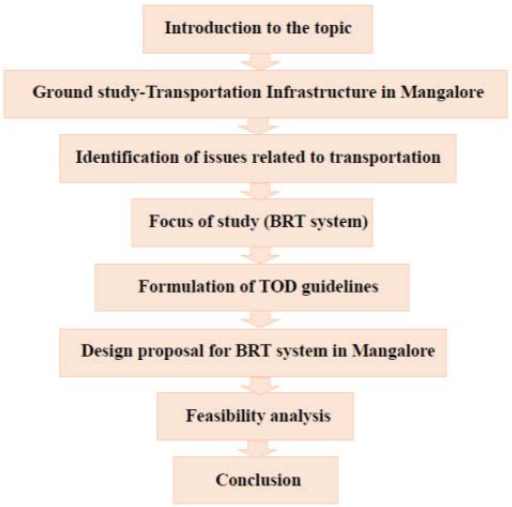


Fig. 2

3. PRESENT SCENARIO

The city has a parallel north-south growth along the sea coast and narrow network approaches from the main road to the interior development. The pattern of growth rate is also radial from the main CBD to the exterior outskirts of the city. (**Fig.** 3). The population is likely to reach 10 lac by the end of plan period. The focus on strengthening road network is to be shifted towards the outskirts so as to achieve an integrated networking system for the city considering the future growth rate.

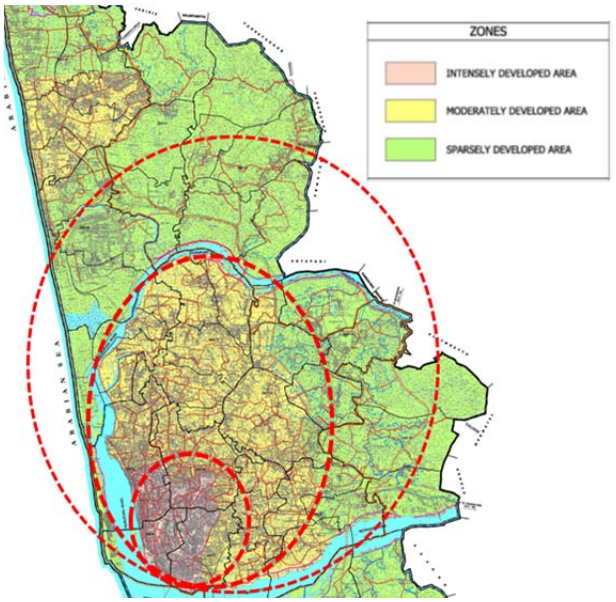


Fig. 3

Projections	2009-2014	2014-2019	2019-2024	2024-2029	2029-2034
Projected Population	5,76,000	6,52,650	7,39,500	8,37,900	9,49,400
Projected Households	1,15,200	1,30,530	1,47,900	1,67,580	1,89,880

STEM Analysis

Transportation Infrastructure in Mangalore:

The major transportation modes of the city is shown below (Fig. 4).The traffic scenario is changing rapidly with development of New Mangalore port, SEZ and industrial developments. Since all the major roads and highways traverse through the city, the intra-city vehicular traffic pressure also increases thereby resulting in a drastic increase in total volume of the traffic.

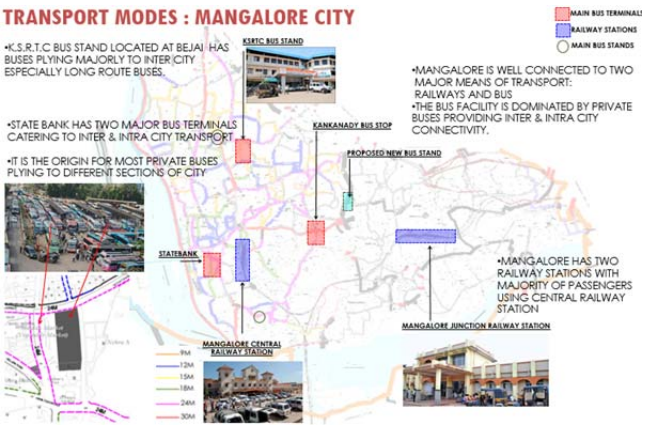


Fig. 4

Existing bus stand plying both intra city and intercity buses (Fig. 5).

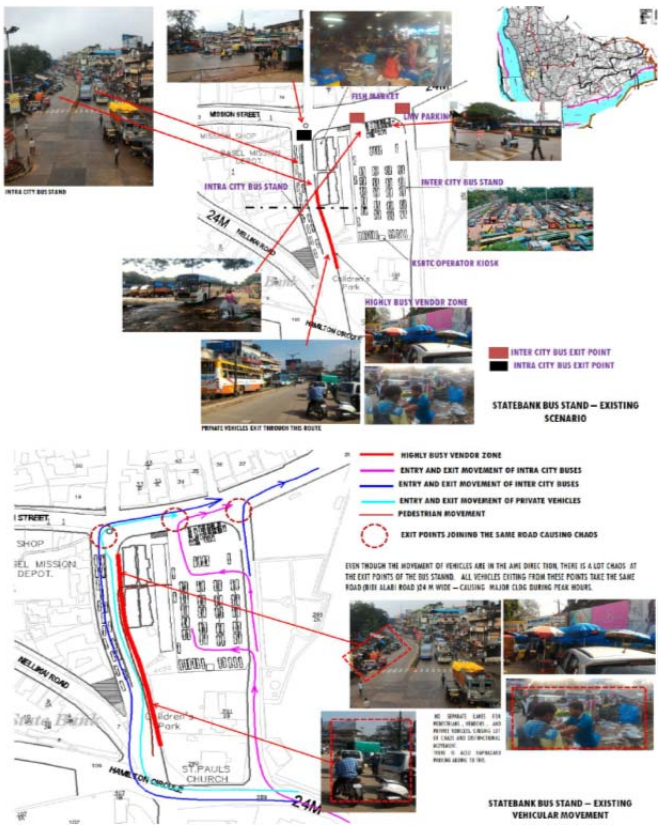


Fig. 5

Issue identification & Analysis:

Fig. 6

A survey was conducted during the peak time hours in the City Bus stand where the footfall was maximum at the time of the year including both tourists and local people plying from the stand. The critical issues were identified during these peak hours pertaining to transport modes (Fig. 6).Majority of the public transport (bus & railways) starts from and around state bank bus stand are leading to congestion during peak & non-peak hours too. There are junctions along NH designated as critical junctions which needs alterations and improvements to prevent accidents (Fig. 7).

Old CBD of the city around which dense development has happened is almost saturated. New TOD will help to in decongesting the city and reducing the travel time.

The dense areas of the city around the CBD are well connected with different modes of transport (bus, autos). The connectivity beyond NH66 can be strengthened by promoting development along and beyond it.

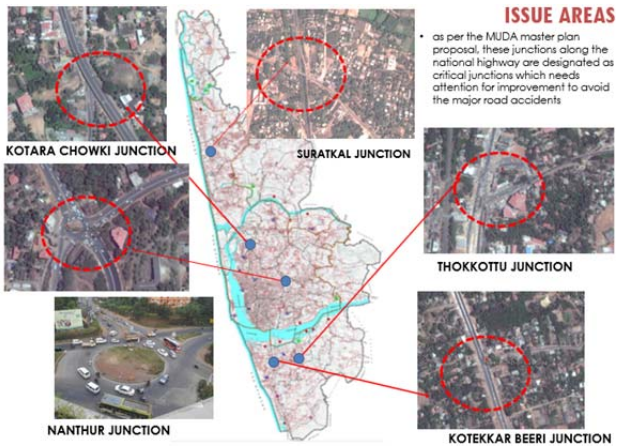


Fig. 7

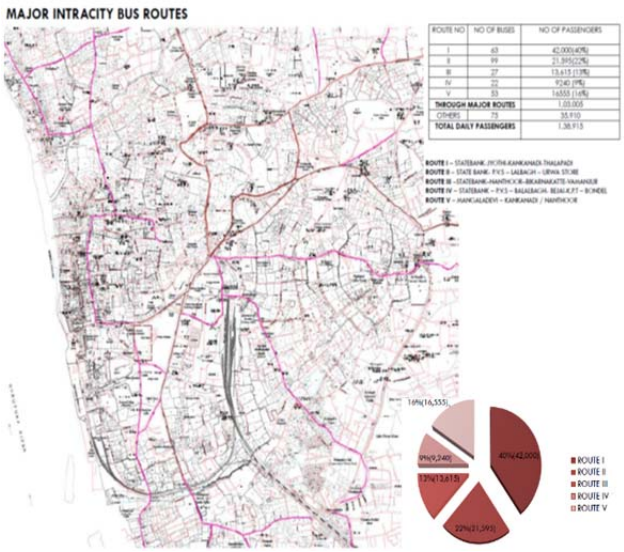


Fig. 8

ROUTE –I is the busiest with around 6000PPH
ROUTE-III-3000PPH (Fig. 8).

This indicates these routes have to be addressed in phase-I providing faster mobility service in terms of BRT, LRT etc.

As per UDPFI guidelines cities with population under 1million should have 30% dependency on public transportation (2, 01,000 for Mangalore). But currently only around 20% dependency is seen.

Development should be done in accordance to facilitate pedestrainisation and less dependency on private vehicles. The main connectivity has to be strengthened by re-organizing the road networking system to reduce the load on main arterial road existing.

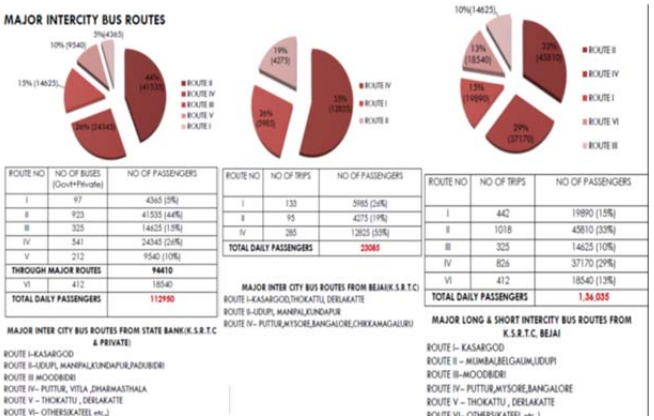


Fig. 9

ROUTE II & IV the busiest starting from both State bank and Bejai adding load on to the traffic (Fig. 9) for inter-city buses. Provision of BRT system can be recommended to facilitate the reduction in congestion of traffic within the main city. Inter-city buses could be kept at the periphery of the city with proper feeder services from various parts of the city.

Focus of study: BRT system

Before proposing the BRT system for intra-city bus service, critical areas were identified by superimposing the population density on bus routes (Fig. 10). There is a need to decongest these identified areas through BRT system.

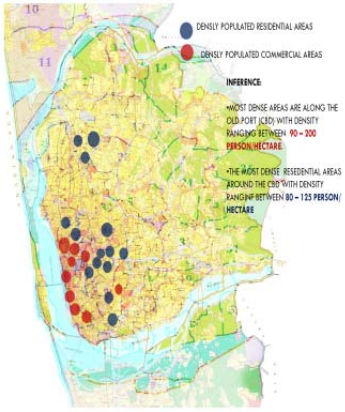


Fig. 10

Vision Smart city-2021: Mangalore

As per the Govt. of India's smart city mission, Mangalore City Corporation had conducted a survey with the major stakeholders seeking their valuable suggestions and recommendations to establish Mangalore as a clean and green port city. As per the survey, focus has to be given primarily upon transportation and mobility situation within the city (Fig. 11).

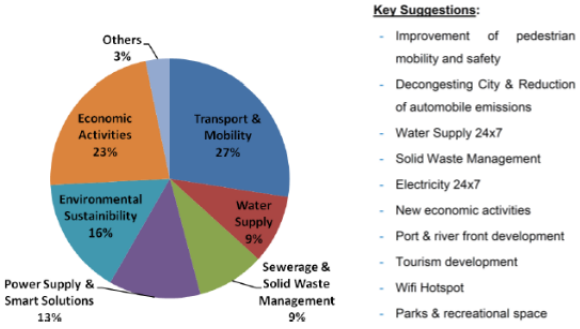


Fig. 11

In this long term development process, the key objectives of improvising the public transportation system are as follows:

- Minimize new road construction thereby altering or widening the existing roads to reduce the cost burden on local residents and businesses.
- Encourage a socially oriented healthy environment in the city.
- Minimize environmental pollution including GHG's.
- Reduce the fossil fuel consumption.
- Reduce parking demand to encourage more sustainable and compact developments.

The proposed routes for widening has to be kept in consideration for intra-city connecting bus route (Fig. 12).

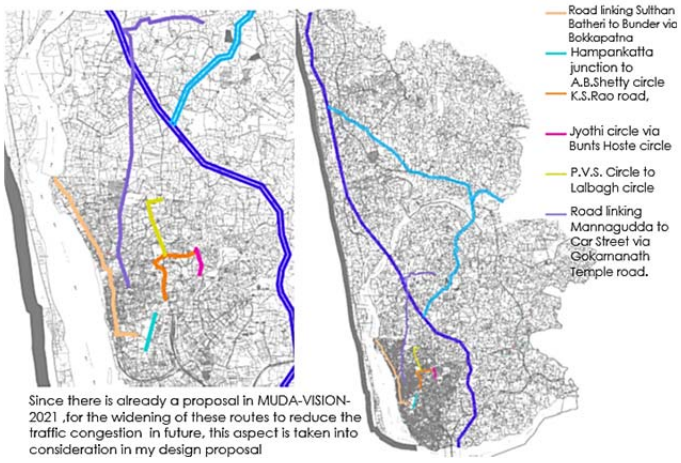


Fig. 12

At Macro level:

Design proposal for BRT system integrating the entire city road networking system (Fig. 13).

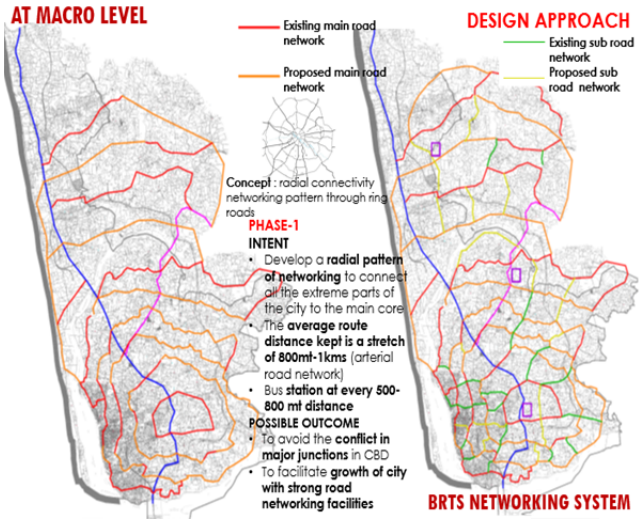


Fig. 13

At Micro level:

- The stretch of route from Balmatta Circle (Near railway station) to Kankanadi circle (proposed Transit Hub) taken is 1.7 km.
- The proposed BRTS design is been for **DESIGNATED CURBSIDE BUS-ONLY LANE**

Design features:

- Physically separated,
- Purpose - built curb side lanes for BRTS buses only
- Designated curb side bus-only lanes require physical alterations (widening) to the street ROW.
- Physical separation is accomplished with concrete barriers, raised medians or pavement, or bollards.
- Designated curb side bus-only lanes do not revert to mixed-flow traffic use like converted bus-only lanes (Fig. 14).

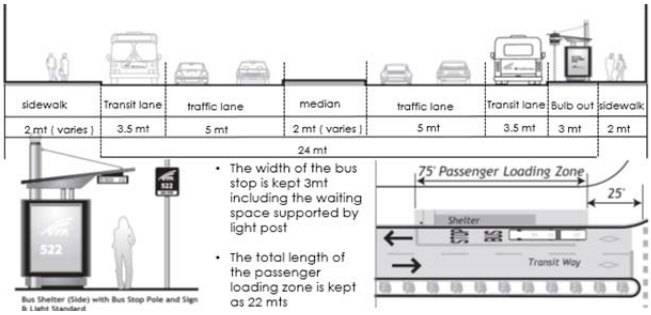
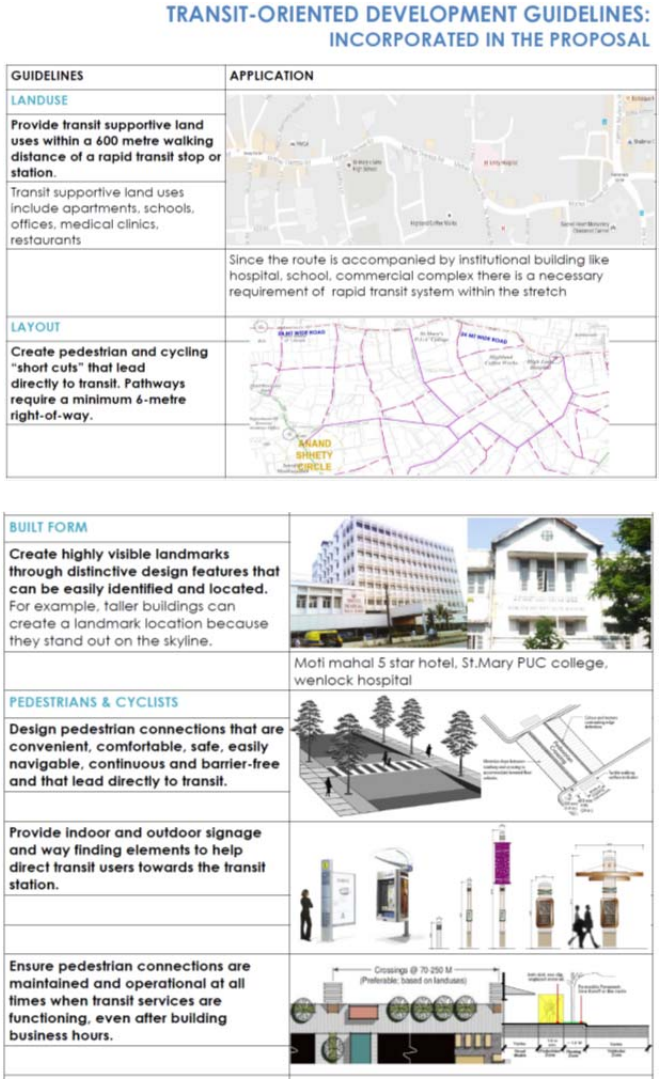


Fig. 14



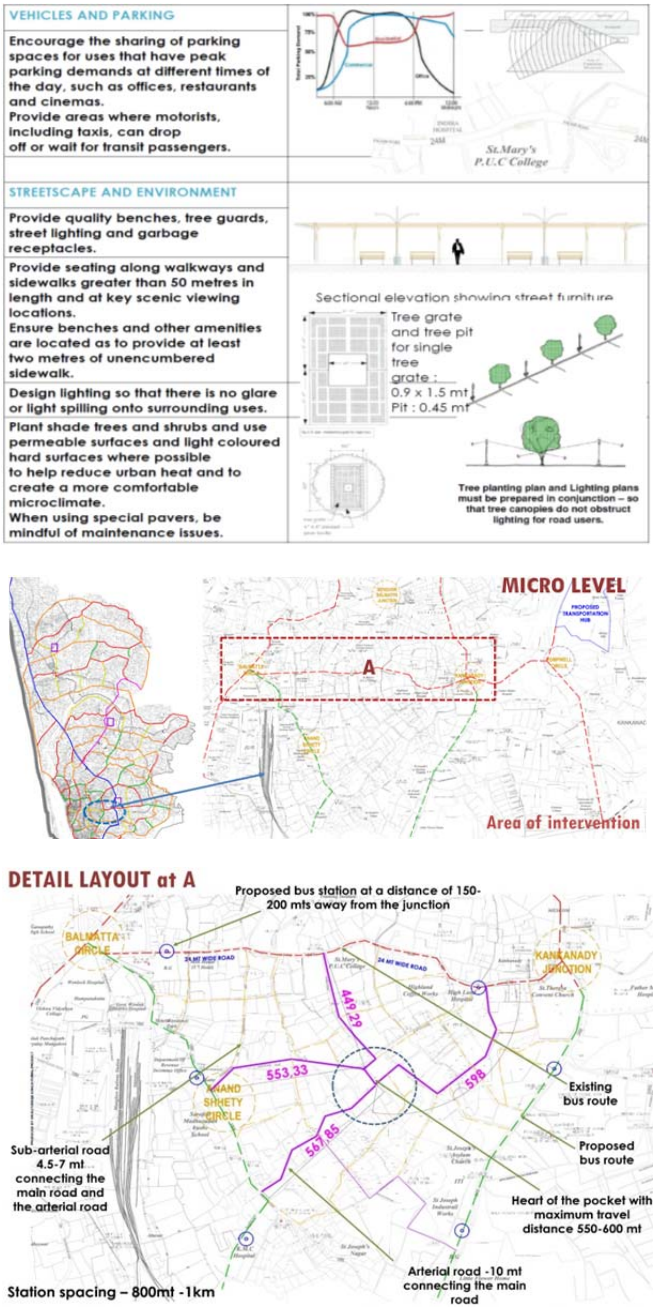


Fig. 15

Feasibility Analysis:

4. CONCLUSION:

A Bus Rapid Transit System (BRTS) offers an opportunity to create a system capable of meeting multiple needs of users and operators which combines facilities, equipment, services and intelligent transportation system elements into a permanently integrated system with a quality image and unique identity for the development of the city transportation network.

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