Need for Government Support for Public Bus Transport

BMTC

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Team Members

Anantha Lakshmi Paladugula
Sujaya Rathi
Vivek Vaidyanathan

Center for Study of Science, Technology and Policy

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Center for Study of Science, Technology and Policy
18, 10th Cross, Mayura Street,
Papanna Layout, Nagasettyhalli, RMV II Stage,
Bangalore – 560094, Karnataka, INDIA
Tel.: +91 (80) 6690-2500
Fax: +91 (80) 2351-4269
Email: cpe@cstep.in

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Abbreviations

AMTC	Ahmedabad Municipal Transport Services
BBMP	Bruhat Bangalore Mahanagara Palike
BEST	Brihanmumbai Electricity Supply and Transport Undertaking
BMR	Bangalore Metropolitan Region
BMRCL	Bangalore Metro Rail Corporation Limited
BMTC	Bangalore Metropolitan Transport Corporation
BPKM	Billion Passenger Kilometres
CNG	Compressed Natural Gas
CSTC	Calcutta State Transport Corporation
CSTEP	Centre for Study of Science Technology and Policy
CTU	Chandigarh Transport Undertakings
DTC	Delhi Transport Corporation
GHG	Green House Gases
GoI	Government of India
GoK	Government of Karnataka
ITS	Intelligent Transport Systems
JICA	Japan International Cooperation Agency
JNNURM	Jawaharlal Nehru National Urban Renewal Mission
LRT	Light Rail Transport
MoUD	Ministry of Urban Development
MTC	Metropolitan Transport Corporation of Chennai
NUTP	National Urban Transport Policy
PKM	Passenger Kilometres
PMPML	Pune Mahanagar Parivahan Mahamandal Limited
TTMC	Traffic and Transport Management Centres

Executive Summary

With increasing trends in road congestion, air pollution, energy demand and emissions, there is a need to look for effective solutions to meet the urban transport demand in Bangalore. Investment in public transport is imperative. Buses are the cheapest, relatively energy and emission efficient form of public transport systems which can be proposed to provide service to the core and peripheral areas in a shorter time span. Bangalore Metropolitan Transport Corporation (BMTC) with good network coverage in Bangalore Urban district and as well as some areas in Bangalore Rural district needs to be supported to provide better service.

BMTC with an existing ridership of 50 lakh passenger trips per day should be able to serve the projected demand in order to maintain the current mode share of public transport. To maintain, improve and increase the public transport share of the city, the bus system needs to be upgraded and the fleet needs to be augmented significantly. BMTC and Bangalore Metro Rail with their collective network can contribute to an effective and integrated public transport system in Bangalore. The imperatives for sustained investments in a bus system are listed below:

1. **Investment requirement for buses is much less, and network coverage is higher** than other transport modes like Light Rail, Mono Rail and Metro Rail
2. **Ridership estimates are realised in a very short time**, and modifications (extension, re-routing, etc.) can be incorporated easily (as a city grows, new activity centers emerge)
3. **Other mass rapid transport infrastructure has a risk of lock-in** (money, time and space) and needs careful analysis of alternatives
4. **Existing right of way can be utilised quickly** (instead of dedicated lane systems in some cases)
5. **Operational and maintenance costs are relatively less** than other modes of urban public transport
6. **Acts as a complimentary network** with mass rapid transport systems such as Bangalore Metro Rail
7. **GHG and local emission reduction** due to reduction in the personal vehicle kilometers
8. **Reduces fuel consumption.**

<u>Recommendations</u>

Support for existing bus system which has high network coverage in Bangalore and serving 50 lakh passenger trips per day is important. The following points are recommended:

- **Innovative financial strategies** other than fare box revenues need to be explored to meet the cost involved in providing a long-term service (land monetization, advertising, consultancy)
- **Need for dedicated budget allocation** (for capital cost of buses) to ease the financial burden on BMTC and also to meet the **future ridership demand**
- **Promotion of fiscal incentives** (Central Excise, exemption from Motor Vehicle Tax, exemption from VAT)
- Need to move toward **energy efficient technology** solutions (CNG, Electric, ITS).

1 Background and Scope of this Study

The Bangalore Metropolitan Transport Corporation (BMTC) is a government organisation that operates the public transport bus service in Bruhat Bangalore Mahanagara Palike (BBMP) area and parts of the Bangalore Metropolitan Region (BMR). At present, BMTC is one of the better run bus transport systems in the country. BMTC operates approximately 2440 routes with a fleet of about 6775 buses catering to approximately 45-50 lakh passenger trips per day. The trend in increase of the bus fleet size over the years is shown in Figure 1. It is expected that by 2021, at least 67 lakh passenger trips per day have to be served by buses only. In addition to Bangalore city, BMTC provides transport services to areas such as Hoskote, Anekal, Kengeri, Magadi, Nelamangala, Dodaballapur and Devanahalli.

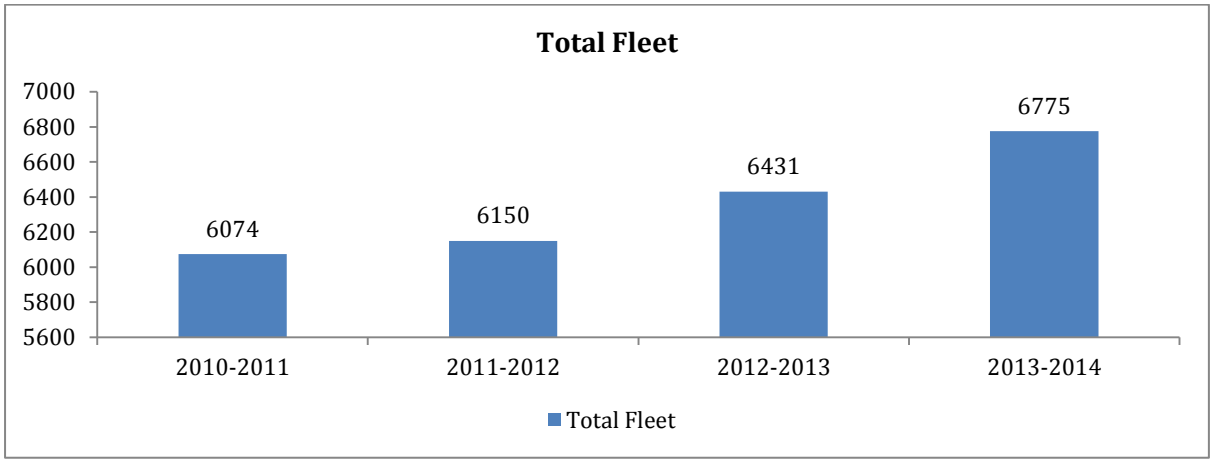

Figure 1: Total fleet of BMTC
Source: BMTC data provided to CSTEP

BMTC has been upgrading its services, through increase in fleet size, improved buses, better customer service, etc. However, to make bus public transport a mode of choice, there is a need for constant up-gradation and it should be kept in mind that some of these costs of upgrades are based on market rates, which ideally should not be passed on to the customer, through frequent bus fare hikes. BMTC was known to be the one organisation that earned operating profits, though in the last two years this has changed and they have incurred significant losses. There is a need for state government to support for the required up-gradation of services, and fleet enhancement for BMTC.

Requisites to make public transport a preferred mode choice:

- Reliable - high frequency, timely service
- Flexible - rational routing systems, adaptive to change in urban densities
- Comfortable - comfort in aspects of entry/exit, seating, leg space, ventilation and other aspects, buses which provide accessibility for the differently-abled
- Affordable - To various socio economic groups
- Energy and emission efficient
- Seamless connectivity to other transport/para-transport modes - Use of Intelligent Transport Systems
- Integrated planning (last/first mile connectivity) - Feeder systems, accessible bus stops

In this context, BMTC, Government of Karnataka has requested Centre for Study of Science, Technology and Policy (CSTEP) to assist in proposing a case for justification for Government support for BMTC.

Based on the above requirement, CSTEP conducted an independent assessment for the above within the given time frame. The assessment is based on secondary information, and primary data/information made available by BMTC.

The following sections present a summary of findings by CSTEP from the interactions with BMTC.

2 The Role of Public Transport

The National Urban Transport Policy (NUTP) has long recognised transport as a public benefit. Around the world, nowhere passenger fares are expected to fully cover operating costs, much less capital costs. Public transport replaces congestion and pollution, otherwise generated by low-occupancy private cars. It thus conserves fuel, and it provides an affordable option of transportation. It is crucial to people without vehicles or to vehicle owners when their regular transport modes are unavailable. Accessible transport helps differently-abled persons and senior citizens and those with reduced mobility to lead a more independent life. The social benefits of public transport cannot be denied, and all this come at a cost to the public transport authority.

The urban population in India is growing, along with motorisation rates. The growth in the number of registered motor vehicles in India during 1981-2011 was about 26 times while the population increase and urban population increase was about 1.8 times and 2.4 times respectively. Motorised two-wheelers occupy the dominant share in a city's vehicular fleet. Public transport systems have proved inadequate to help reverse the motorisation trends. By and large, BMTC, Chandigarh Transport Undertakings (CTU) and Metropolitan Transport Corporation of Chennai (MTC) have tended to perform well in the public transport systems. BMTC was known to be the one organisation that earned operating profits, though in 2012-13 even they incurred losses. In fact, in many cases, the inability to replace old vehicles through fleet renewal has led to poor services and informal private operators taking over the role of providing urban public transport services.

A study by the Institute of Urban Transport (IUT) and CSTEP anticipates that the passenger travel demand from urban areas (cities with population > 1 lakh) would double by 2021(1448 BPKM) and triple by 2031 (2315 BPKM). Energy consumption by the urban transport sector is likely to increase dramatically in the coming decades. This will impact the quality of life in cities and increase dependency on oil imports, thus threatening our energy security. Focus on high cost transport projects have not eased the growing motorisation rates. Air pollution, fuel consumption and the impact on our import bill have been severe. Clearly, the situation will only get worse.

The same study reveals that the annual fuel consumption from urban transport (cities with population > 1 lakh) will increase by two times by 2021 and four times by 2031 in the Business

As Usual (BAU) scenario. The scenario analysis in this study highlights that Scenario 3 which focused on efforts towards increasing the share of public transport, makes the highest impact in reduction of energy consumption, and emissions. The same scenario is best when compared to fairly aggressive strategies such as 'urban structure control' and ''form control' that is unlikely to be realised in a short to medium term. The scenarios considered in the IUT and CSTEP study "Review of Urban Transport in India, 2014" are described in detail below:

Scenario 1- represents the future based on the existing trends, BAU.

Scenario 2- considers improvement in Non-Motorized Transport (NMT) infrastructure with the assumption of increasing the modal share of NMT modes by 10%.

Scenario 3- presumes an increase in public transport mode share, through improvements in public transport systems.

Scenario 6A & 7 –concentrate on improving urban structure, form control and in essence are extremely aggressive and relatively long-term strategies to cut down crude oil consumption and reduce CO_2 emissions.

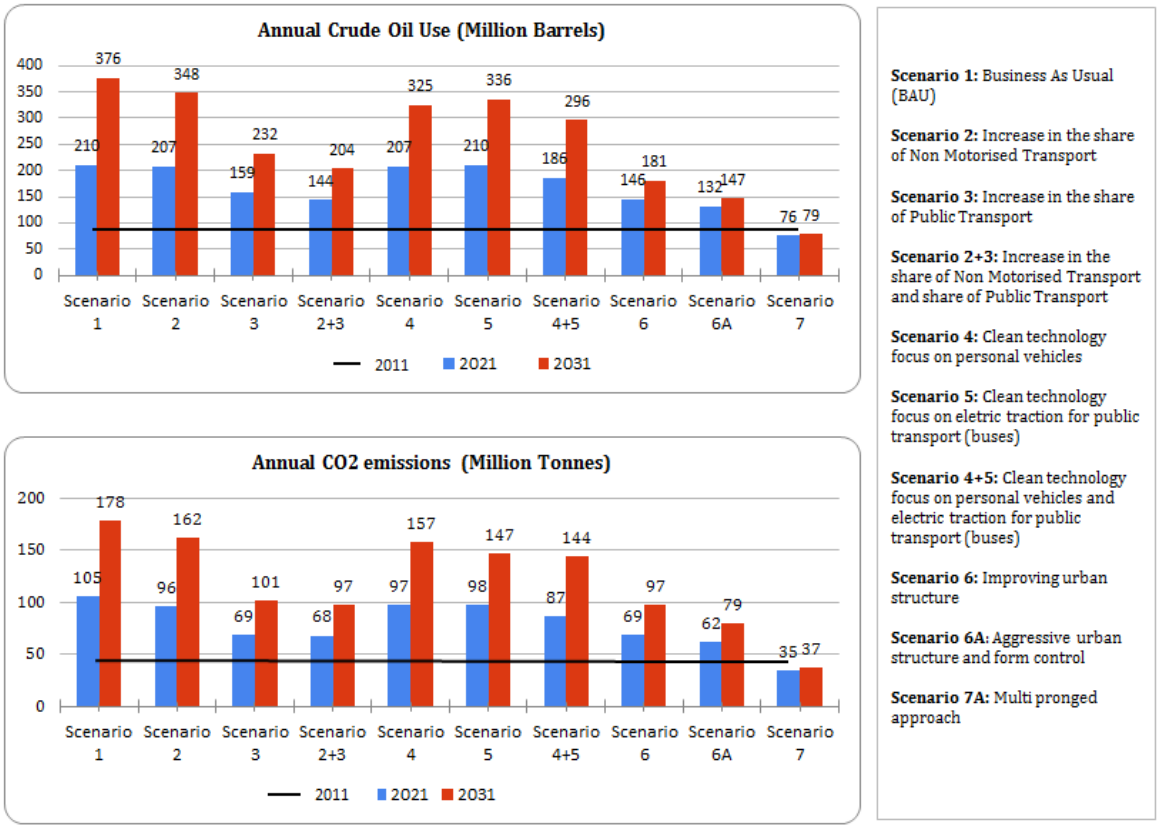

Figure 2: Annual Crude Oil Use & CO_2 Emissions
Source: (CSTEP & IUT, 2014)

Figure 2 demonstrates investments in public transport are imperative. It also shows that in the short-term it is relatively easier to move towards an increase in public transport share

primarily aided by investments in bus-based systems and a comprehensive transport network comprising different public transport modes.

Impact of increase in public transport - Scenario 3

An intervention, specifically Scenario 3 would lead to the following outcomes as against the BAU (Scenario 1)

- Annual Passenger Vehicle Kilometres (BPKMS)
  - Decrease by 36% in 2021 from BAU scenario
  - Decrease by 50% in 2031 from BAU scenario
- Annual Crude Oil Use (Million Barrel)
  - Decrease by 24% in 2021 from BAU scenario
  - Decrease by 38% in 2031 from BAU scenario
- Annual Emissions –CO_2
  - Decrease by 34% in 2021 from BAU scenario
  - Decrease by 43% in 2031 from BAU scenario

Figure 3 demonstrates the need for sustained investments in a dedicated bus transport system without which there is a cyclical effect on urban transport and other important sectors. A lack of available funding has many cataclysmic effects including increased maintenance costs of the existing fleet, which in turns reduces the budget to purchase additional fleet. A lack of regular maintenance would also have a direct impact on the reliability of bus (frequency and timings). Finally, even those who would like to use the bus system would be forced to move to other modes of transport including private modes of transport which proliferate among cities and result in high pollution, congestion and other forms of economic loss. Thus investments in public transport should be a priority.

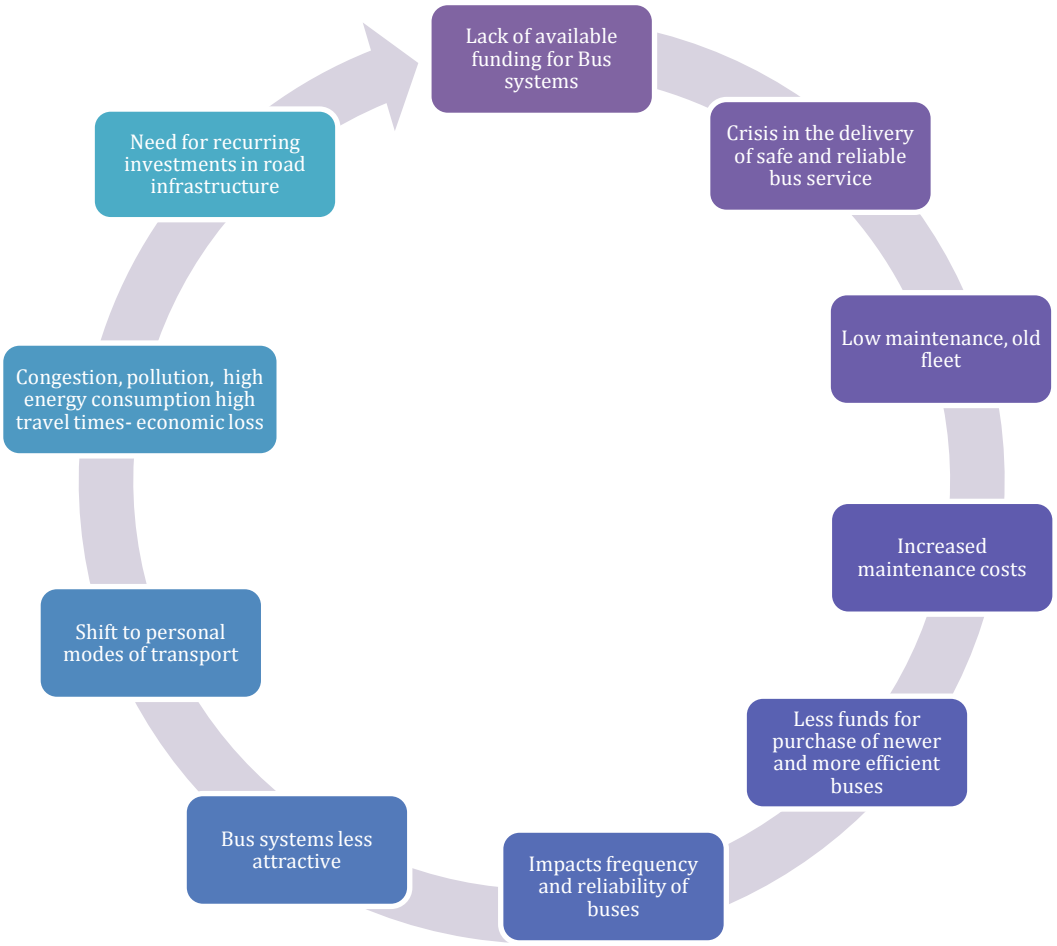

Figure 3: Effects of non-investments in public transport

3 Choice of Different Modes of Public Transport –Impact

Public transport systems require high investments and have a long lock in period. Thus decisions regarding investments require a careful analysis, looking at different alternatives and their impacts on various development parameters (improving mobility spatially, environmental, economic and financial impacts, including induced effects of better transport infrastructure).

3.1 Energy and Emissions

According to a TERI study titled "Life cycle analysis of transport modes", it is evident that bus-based solutions emerge as the most efficient and low emission generating mode. The different transport modes compared in the study are rail, bus and metro rail. The energy requirement per km of bus lane during construction and maintenance is less compared to others as shown in Figure 4.

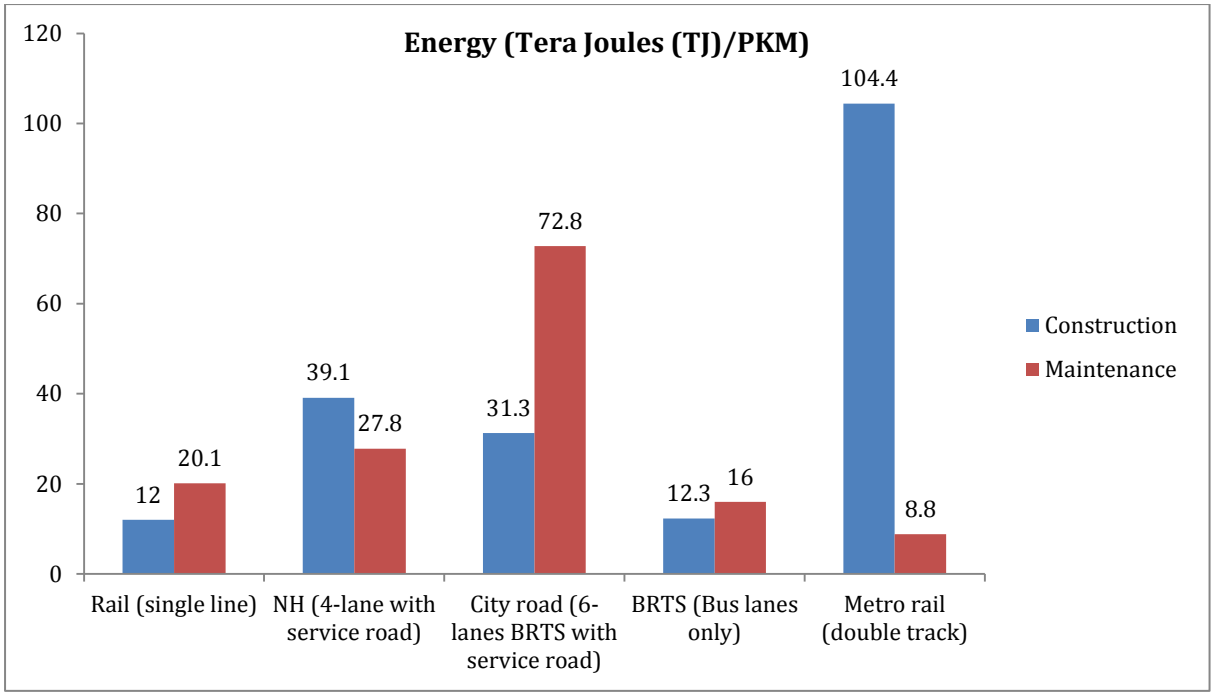

Figure 4: Construction and Maintenance Energy Requirement (TJ/km) - Mode of Transport
Source: (TERI, 2013)

CO_2 emissions (tonnes per km) during construction and maintenance of bus lane are less compared to others as shown in Figure 5.

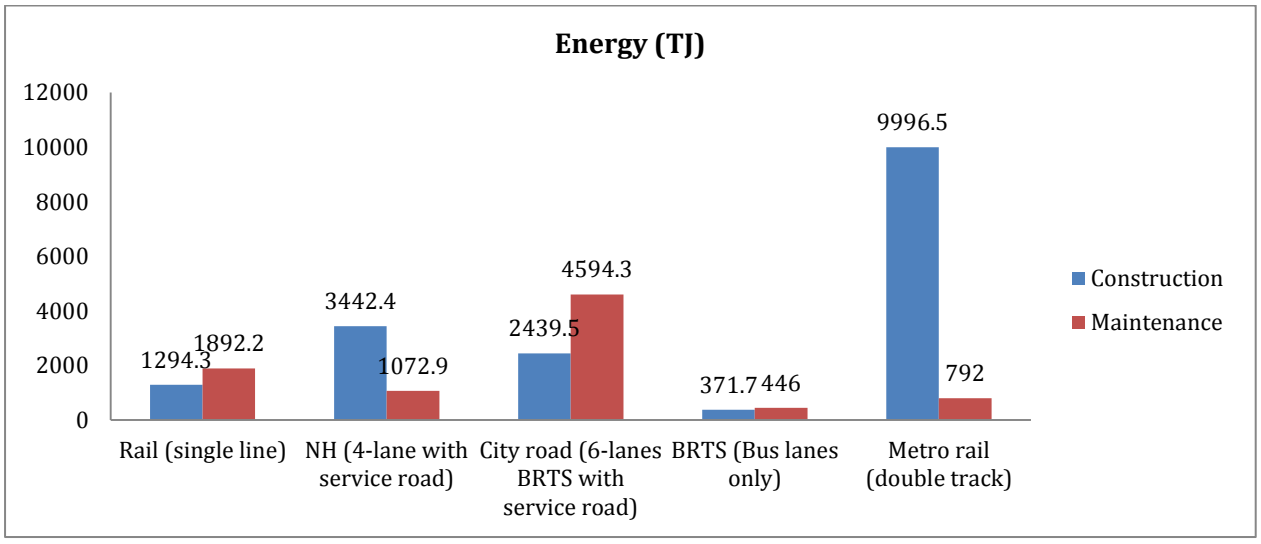

Figure 5: Construction and Maintenance CO_2 Emissions - Mode of Transport
Source: (TERI, 2013)

Embodied energy consumption for rolling stock and embodied CO_2 of rolling stock comparison are given in Figure 6 & 7. Energy consumption (Kilo Joules/PKM) is less for urban bus systems (e.g. Bangalore) by 2 times when compared to two wheelers and 10 times with car (all fuel types).

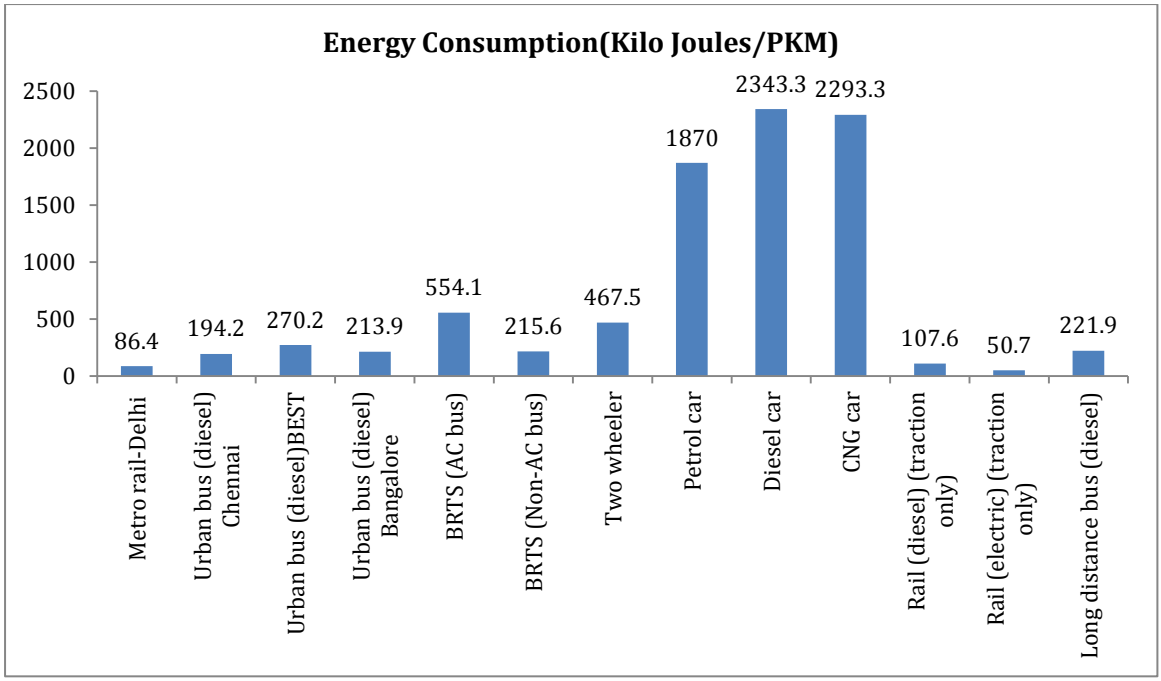

Figure 6: Energy Consumption (KJ/PKM)
Source: (TERI, 2013)

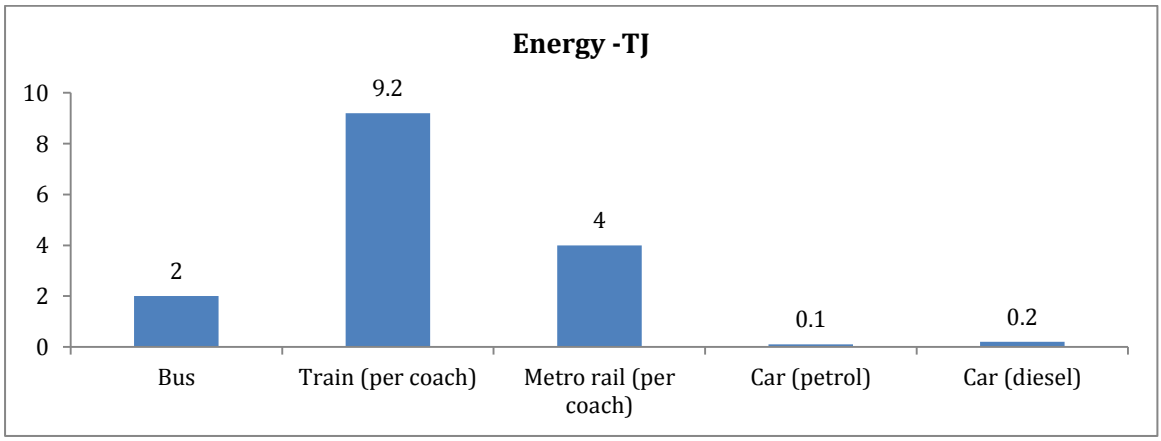

Figure 7: Energy Consumption (TJ/PKM) and TJ- Mode of Transport
Source: (TERI, 2013)

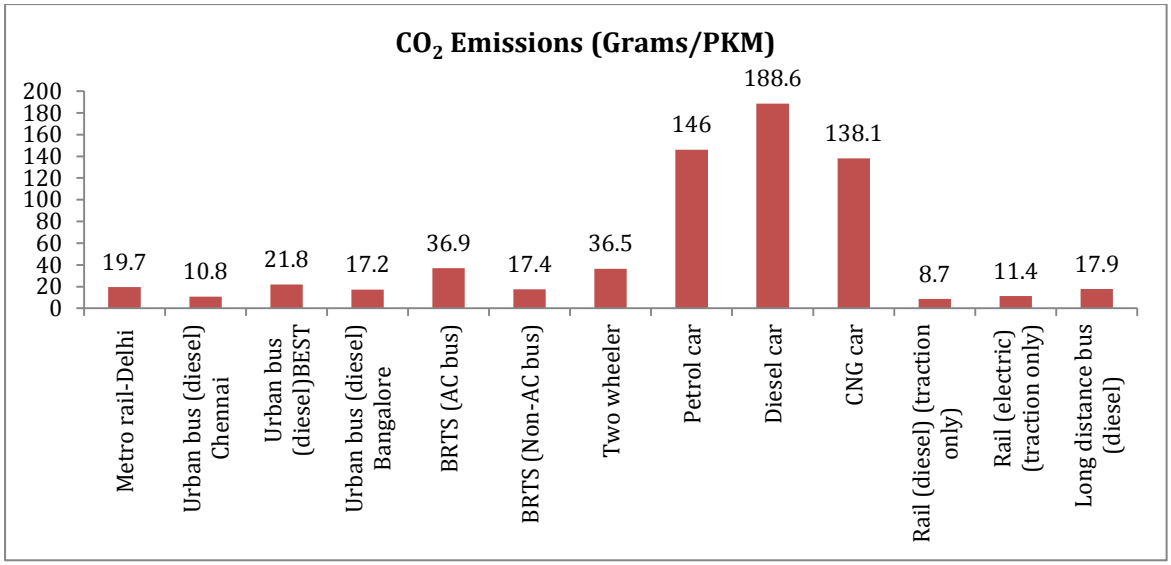

Figure 8: CO_2 Emissions (Grams/PKM)
Source: (TERI, 2013)

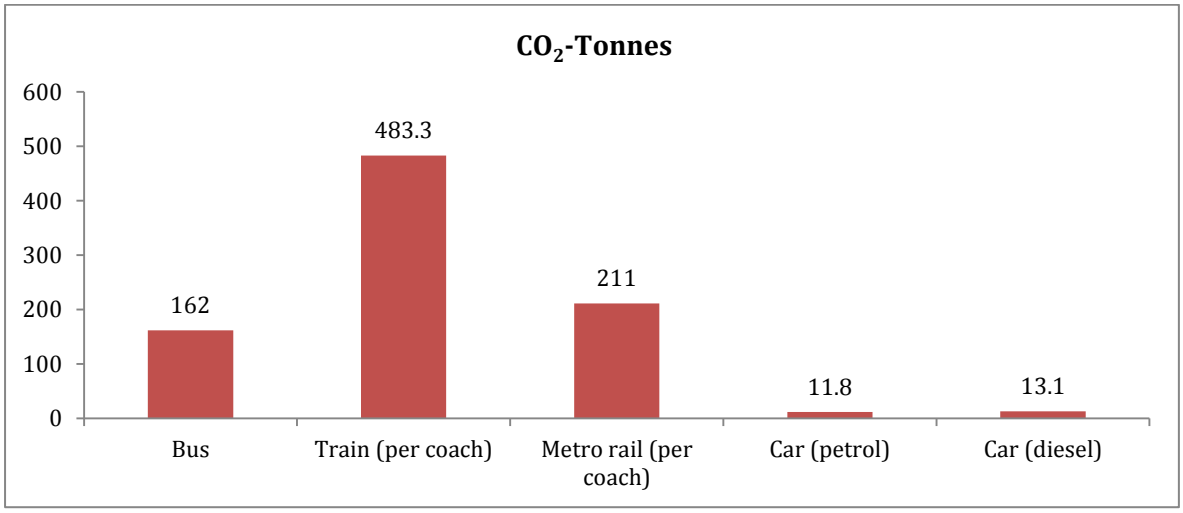

Figure 9: CO_2 Emissions (Tonnes) - Mode of Transport
Source: (TERI, 2013)

CO_2 Emissions (g/PKM) is less for urban bus systems (Bangalore) by 2 times when compared to two wheelers and 9 times with car (all fuel types) as shown in Figures 8 &9. The energy consumption and CO_2 emissions during construction, maintenance and operation phases of the bus system are relatively less when compared to other modes of transport.

3.2 Cost

Costs associated with commuter rail, Metro-rail, Monorail, LRT, BMTC bus are compared in Table 1 based on station spacing, seated capacity of mode, total carrying capacity, approximate Operation and Maintenance cost (O&M) cost per km and also approximate capital cost per km.

Table 1: Mode Wise Parameters Comparison

Transport Mode	Commuter Rail	Metro	Monorail	LRT	BMTC
Station Spacing (Approx.)	3 -15 km	1 - 2 km	1 km	1.5 km	0.5 km
Seated Capacity	90-185 per car	60-80 per car	25 - 45 per car	65-85 per car	40 Standard; 75 Articulated; 125 Double Articulated
Total Capacity	-	100 – 250 per car	50 - 100 per car	75 – 225 per car	50 – 100 Standard
App O & M Cost per km	40-60 Lakhs	100-200 Lakhs	40-60 Lakhs	50-60 Lakhs	~2.8 Lakhs **
App Capital Cost per km (Rupees)	80 Crores	250 Crores (Elevated) 550 Crores (Underground)	80 Crores	150 Crores	~42 Lakhs per bus***

Source: BMTC data provided to CSTEP
(**Calculation: *Rs 44/km/day/bus – buses per day -6473, *** Average cost of bus (all types)***

3.2.1 Key Features of Metro Rail Systems in India

The capital costs, daily passengers, planned length of different metros in Indian cities are given in Table 2. It can be observed that the cost per kilometre was as high as Rs. 232 crore per km in case of Bangalore Metro Rail. Delhi Metro with an operational length of 193 kilometres caters to about 25 lakh passenger trips per day (Modal share – 4.1% in 2008)(Tiwari, 2011). However the passengers served per kilometre in case of Delhi metro is only 60% of what Mumbai Metro (Phase I) serves per km.

Table 2: Key Features of Metro Rail Systems in India – Comparison

Metro	Daily passengers (lakhs)	Operational length (kms)	Total Length (kms)	Passenger served/km	Capital Investment (crores)	Cost/km (crores)
Delhi Metro	25.23	192.81	193	13087	29700	154
Bangalore Metro	0.41	14.6	112	2808	26000	232
Mumbai Metro (Phase I)	2.5	11.4	145	21930	25400	175
Gurgaon Rapid Metro	0.32	5.1	6	6275	1100	183

Source: (DMRCL, n.d.; Metrobits, n.d.)

3.3 Spatial Coverage

As shown in Figure 10, as in the case of Bangkok, the spatial coverage achieved by bus systems for a certain amount of investment is much higher than any other public transport mode.

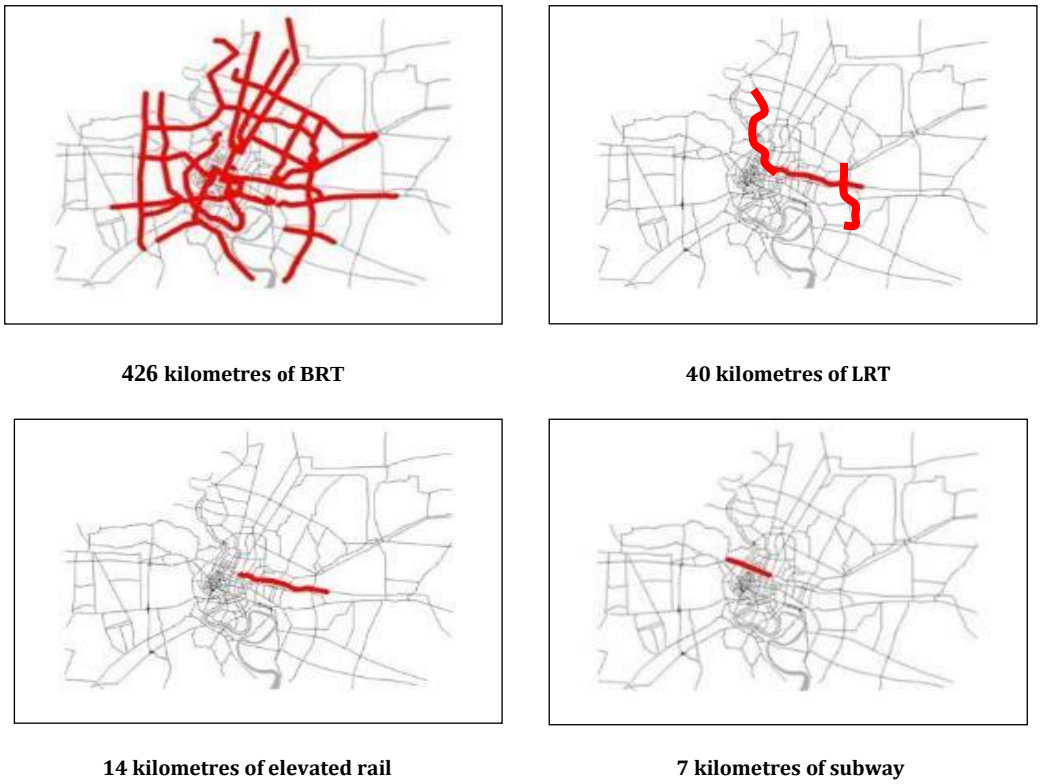

Figure 10: Spatial Coverage for 1 Billion USD - Bangkok Case

Source: (ENOTRANS, n.d.)

Bus systems are cost-effective, and relatively more energy and emission efficient compared to other modes of transport. The spatial coverage of the bus networks is generally denser than other modes of transport, and the flexible nature of this system is an advantage. It serves urban and sub-urban areas as the primary mode of transport in major cities in India and complements the mass rapid transport system such as metro.

4 Fiscal Policies related to Public Transport

4.1 The Conflict in Policy and Fiscal Measures

Rapid increase in the growth rate of two wheelers and car population has been the current trend in Indian cities. As per the statistics given by the Ministry of Road Transport and Highways (MORTH), the total number of buses was 17 lakhs in 2012 which is only 1.5 % of the number of registered two wheelers in India. Similarly out of the total registered vehicles in Bangalore, buses contribute to only 0.7 % (2012). The dependency on two wheelers in India, and Bangalore is evident from the share of buses in the total registered vehicles as shown in Figures 11 and 12. In addition to this, the financial performance of bus transport service providers in major cities of India (Delhi, Mumbai, Ahmedabad and Chennai) is such that they are not able to recover the total cost incurred.

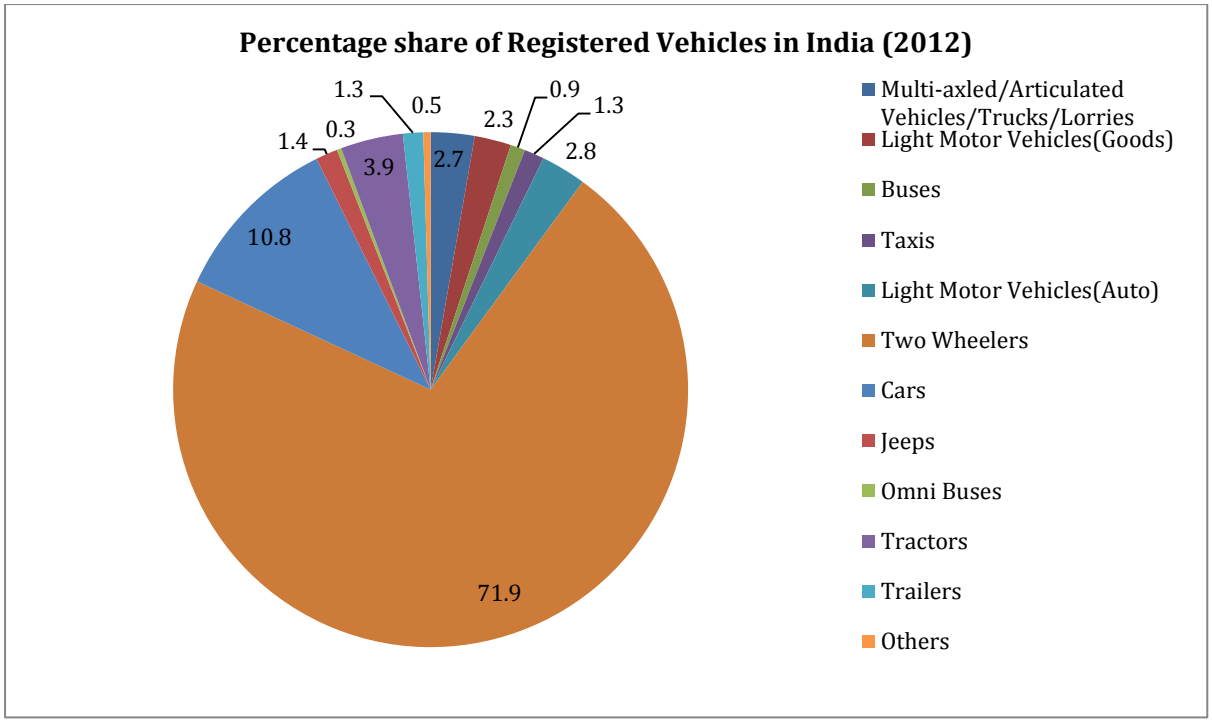

Figure 11: Registered Vehicles share in India (2012)
Source: (Ministry of Road Transport and Highways, 2012)

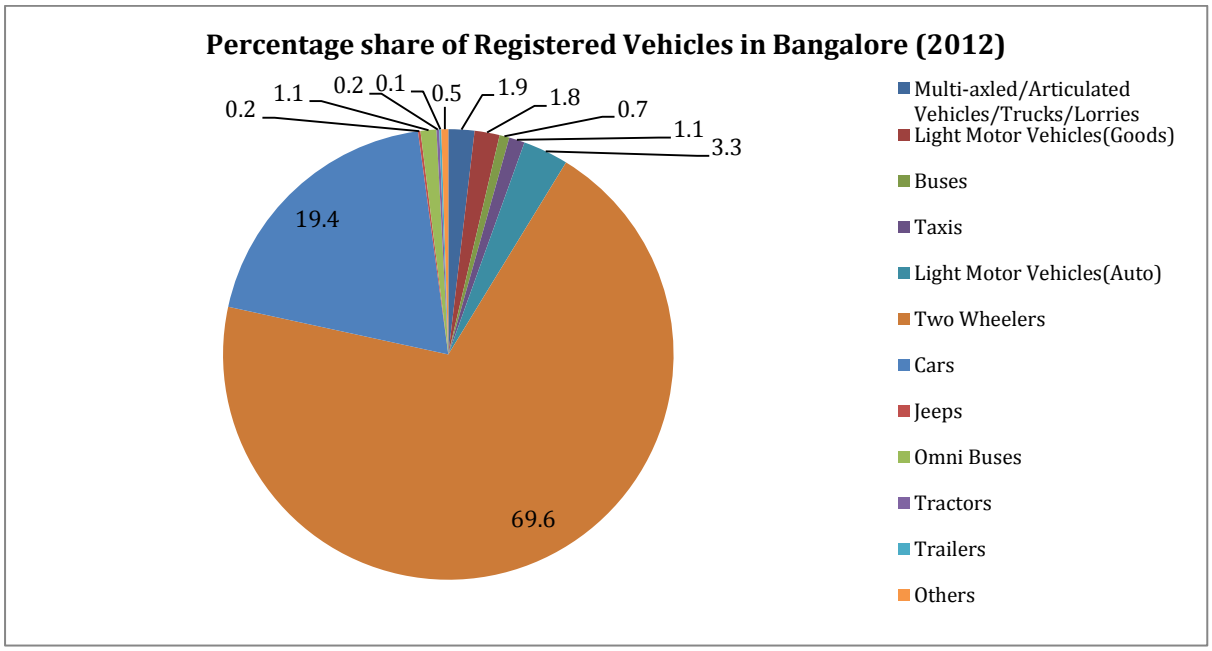

Figure 12: Registered Vehicles share in Bangalore (2012)
Source: (Ministry of Road Transport and Highways, 2012)

To promote the mobility of people over mobility of vehicles, the National Urban Transport Policy (NUTP) encourages greater use of public transport and non-motorised transport. It also calls for the establishment of quality focused integrated multi-modal public transport systems in urban areas. However the fiscal incentives from Central government through Jawaharlal Nehru National Urban Renewal Mission (JNNURM) focussed on provision of inventory in terms of buses to urban areas to meet public transport demand; however issues concerning

operational costs were not considered. Alternatively, it may have been worthwhile, to provide incentives based on strategies formulated by respective state governments for effective service delivery. The disparities in allocation of funds is evident from the cost of projects sanctioned for mass rapid transport projects under JNNURM's sub mission, 'Urban Infrastructure and Governance' which is 67% of the cost of projects sanctioned for roads and flyovers. The allocation of JNNURM funds with respect to various sectors is given in Figure 13. In the case of Bangalore, the approved cost under JNNURM, for roads and flyovers amounts to Rs. 304 crores (Ministry of Urban Development, 2014). The financial allocation pattern so adopted does not support the main objectives of NUTP. Moreover, as per the Bangalore Mobility Indicators 2011, the congestion index and travel time index for the city has deteriorated, over that of 2008. Congestion index for 2011 was 0.45, while it was 0.33 in 2008 (increase in congestion). Travel time penalty of 69% in 2011 compared to 57% in 2008.

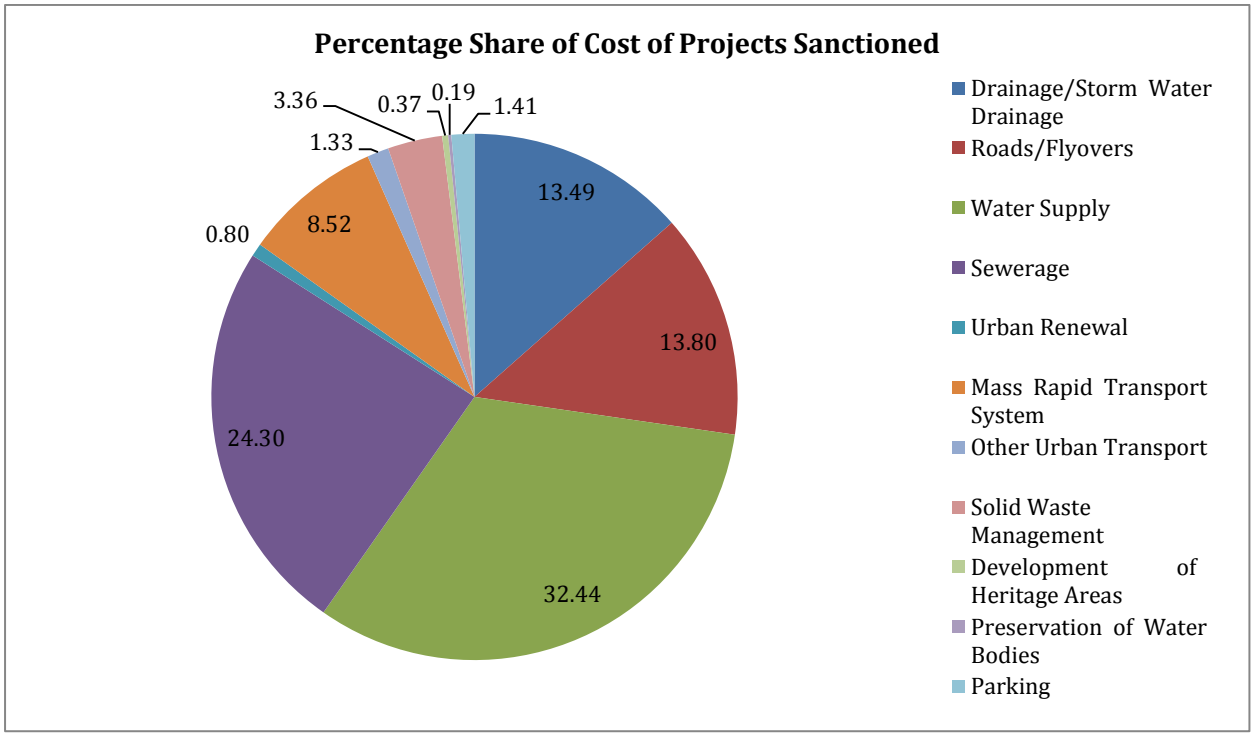

Figure 13: Percentage share of cost of projects sanctioned under JNNURM – 2014

Source: (Ministry of Urban Development & JNNURM, 2014)

Public transport revenue generation models implemented in major cities in India are highly fare box revenue based which is insufficient to meet the operating and maintenance costs. In case of Bangalore, about 89% of the cost incurred is recovered from the fare box revenue as of 2013-2014 and the rest from non-fare box revenue. The rate per km is different for various public transport providers in India. Bus fares in Bangalore range from Rs. 5.0 to Rs. 44.00 for ordinary bus service where as in Chennai the range is from Rs 3.0 to Rs 14.00; however in the case of Delhi, the fare ranges between Rs. 5.0 to Rs. 15.00. The cost per kilometre for two wheelers works out to be cheaper (Re. 1/km)than the minimum fare charged by public transport providers (Rs. 5 for buses in Bangalore) **(Centre for Science & Environment, 2012).** In the case of Bangalore, buses are taxed more than personal vehicles based on the traffic revenue generated. In case of BMTC, the tax is about 5.5 % of the traffic revenue. This can be seen from Tables 3 & 4.

Table 3: Taxes paid by Car and Bus Comparison

Mode of Transport	Bangalore	Delhi	Mumbai
Car	Rs. 2,600/year	Rs. 533 per year	Rs. 9,000 (Life Time Tax)
Bus	5.5% of traffic revenue (1.7lakhs per year)	Rs. 13,765 per year	Rs. 41,000 per annum

Source: (Business Economics, 2013), BMTC data provided to CSTEP

Table 4: RTO fees of New Registration of Vehicles in Karnataka

Particulars	Bus	Car
Registration Fee	600	200
FC Fee	500	-
Smart Card	200	200
Total	1300	400
Road Tax	5.5% of Traffic Revenue Average Rs.1.7 lakhs per year	-
		-
Life Time Tax	15 years = Rs. 26 lakhs (approx. 1.7*15)	Up to Car price of Rs. 5 lakhs (Rs. 3,575 per year)
		Up to Car price of Rs. 5 to 10 lakhs (Rs.7,700 per year)
		Up to Car price of Rs. 10 to 15 lakhs(Rs. 18,700 per year)
		Above Car price of Rs. 20 lakhs (Rs.22,850 per year)

Source: BMTC data provided to CSTEP

BMTC pays on an average Rs. 1.7 lakhs per year per bus as part of the lifetime tax. Cars in Karnataka with the price range up to Rs. 5.0 lakhs pay about Rs. 7,700 per year which is only 2.5 percent of the tax paid by BMTC bus which is negligible. Thus there is a disconnect between NUTP and fiscal strategies wherein the NUTP talks about promoting public transport, but fiscal strategies favour the use of private transport modes. Therefore funding strategies need to be explored to maintain the share of public transport in Bangalore.

4.2 Public Transport Fiscal Measures – Inconsistencies

Mass rapid transport systems such as Metro Rail projects are capital intensive and have a longer lock in period. NUTP recommends various financial models for funding public transport projects in India. The financing models adopted by various metro projects in India are given in the Table 5. Gurgaon and Hyderabad are two cases where maximum funding is from private agencies. Delhi Metro Phases I and II are one of the capital intensive projects listed in the Table 5 having an equal share from the State and Government of India (GoI), however with a major share from Japan International Cooperation Agency (JICA) **(Goel & Tiwari, 2014).**

Table 5: Urban Rail Transport Investments in India

Metro Project	GoI (%)	State Govt. (%)	JICA (%)	Others (%)	Total (USD Crores)
Delhi Metro Phases I & II	18	18	53	10	590
Kolkata	100	0	0	0	40
Kolkata East-West Corridor	24	30	46	0	90
Bangalore	15	15	45	25	160
Chennai	20	20	59	0	296
Public –Private Partnerships (PPP)					
Delhi Airport Express Link	19	19	0	62	80
Mumbai Phase I	9	22	28	41	510
Hyderabad	9	0	0	91	330
Gurgaon	0	0	0	100	22

Source: (India Infrastructure Research, 2011)

Table 5 also demonstrates that if GoI can invest in metro rail and given that these are extremely capital intensive, surely the government can also fund bus systems which cater to a significant share of population in urban areas. It is also important that while GoI has already funded purchase of buses under JNNURM, it might also be worthwhile to consider funding of operations and maintenance costs as well.

A comparison of Tax Liabilities of Delhi Transport Corporation (DTC) and Delhi Metro Rail Corporation (DMRC) is shown in the Table 6.

Table 6: DTC and Delhi Metro Tax Comparison

Delhi Transport Corporation Pays:	Delhi Metro Rail Corporation Pays:
1.Wealth Tax **1.Taxes on acquisition of immovable property**: a. Tax on acquisition of land (State) b. Property Tax (Municipal Body) **2.Taxes on acquisition of buses:** a. VAT (State) b. Central Excise (Centre) c. Customs Duty in case of Imports (Centre) d. Octroi (Municipal body) e. Entry tax (State) **3.Taxes related to operations:** a. Excise Duty on consumables (Centre) b. VAT on consumables (State) c. Excise and VAT on spare parts	**1.Wealth Tax** **DMRC is 'exempted' from the following taxes:** 1.Property Tax 2.Sales Tax 3.Works' Contract Tax 4.Income Tax 5.Capital Gains Tax 6.Customs 7.Excise

4.Tax on use of vehicles for transporting passengers: a. Motor Vehicle Tax (State) **5.Advertisement Tax (City)**	

Source: (Kharola & Tiwari, 2008)

Tax Liabilities of BMTC is shown in the Table 7.

Table 7: Taxes paid by BMTC

Tax Category	BMTC
Excise Duty	10.125% on Basic Price of Chassis (as on 2014)
Motor Vehicle Tax	5.5% on Traffic Revenue Traffic (1.7 lakh/bus/year)
VAT	14.5%
Fuel Tax	Rs.112.83 crores per year (Entry Tax @ 5% and Local Sales Tax @ 15.65%)
Property Tax	Rs. 510 lakhs

Source: BMTC data provided to CSTEP

5 Public Transport in Bangalore

As mentioned in the earlier sections, BMTC is the backbone of public transport in Bangalore. BMTC operates approximately 2,440 routes with a fleet of about 6,775 buses serving approximately 45-50 lakh passenger trips per day. Till recently, it also was the only profit making public transport entity in the country. This has subsequently changed with the entity registering successive losses in 2012-2013 and 2013-2014. In the past few years, BMTC has been the recipient of JNNURM funding and has been able to acquire hundreds of buses including air-conditioned buses. While non-air-conditioned buses run on regular BMTC network, air-conditioned buses are usually limited to the more lucrative Information Technology corridor. It is also noticed that out of 6,700 odd buses, the operational strength is around 6,400 buses. Recently the BMTC also had to scrap its 92 air-conditioned Marco Polo buses because of poor performance standards **(Times of India, 2015)**.

The other public transport service provider is Bangalore Metro Rail Corporation Limited (BMRCL). The Bangalore Metro Rail Phase I consists of two corridors, East –West (Baiyappanahalli Terminal to Mysore Road Terminal – 18.10 km) and North-South corridors (Hesaraghatta cross station to Puttenahlli cross-24.20 km) with a total length of 42.30 km. Out of the total length approximately 80% (i.e. 33.48 km) of the metro alignment is elevated and the remaining length is an underground section. The average speed is around 34 kmph, with an average travel time of 33-44 minutes (end-to-end). For Metro Phase I, the total cost of the project was Rs. 11,609 crores where in GoI funding share was 25%, GoK share was 30% and JICA share was 45% of the total cost. Bangalore Metro Rail Phase II proposed 6 alignments (4 extensions for Phase I and 2 new lines) with a total length of 72.095 kms at an estimated cost of Rs. 26,405.14 crores.

Figure 14 below displays BMTC bus network coverage and Bangalore Metro Rail network coverage. It can be observed that the spatial network coverage of bus network is evident in Bangalore Urban district and few areas in Bangalore Rural district. It can also be observed from

the Figure 14 that a large section of the area in BBMP is not densely populated with the population density ranging from 700 to 10,000 persons per sq.km. Only a few pockets have high density population. From the evident low population densities, the bus network is more suitable at the sub urban areas in BBMP area.

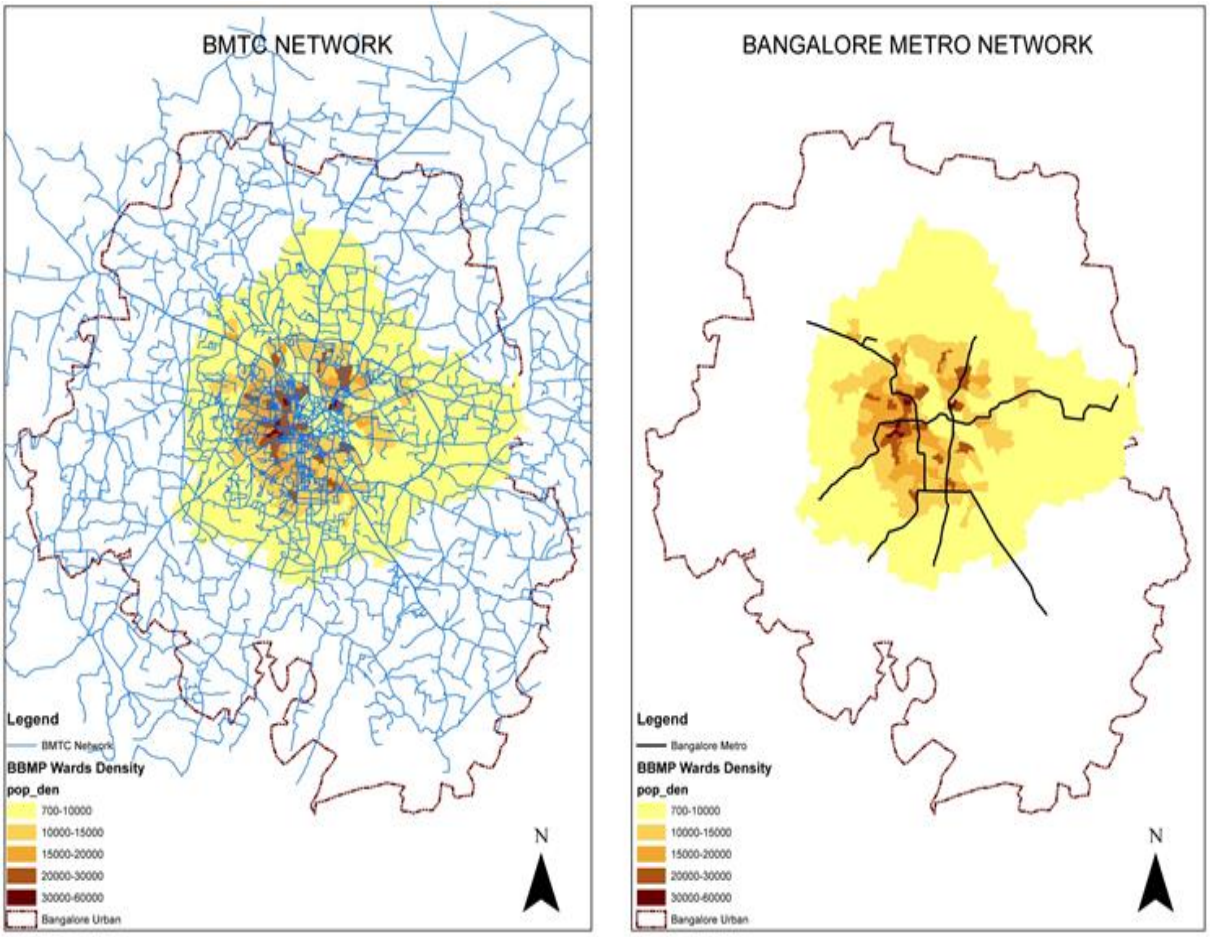

Figure 14: BMTC and Bangalore Metro Public Transport Network
Source: BMTC data provided to CSTEP

Based on the existing mode of public transport in Bangalore, the ridership, inventory requirement and costs involved are projected and scenarios are worked out over the 'Business-As-Usual' case. A second scenario, Scenario -2 is also represented. This scenario assumes a reduced modal split for BMTC over the coming decades. These scenarios help to understand the public transport mode share between the two different modes of public transport in Bangalore and also estimate the inventory requirement and costs involved to meet the projected ridership by BMTC. A third scenario, Scenario -3 was also considered which assumes that BMTC will serve to 50% of the projected passenger trips per day. The scenarios considered are given in Table 8.

Table 8: List of Scenarios

Scenarios	Description
Scenario 1	BMTC will cater to 30% share of the projected passenger trips per day and tries to maintain the current public transport mode share for the projected years
Scenario 2	BMTC and Bangalore Metro Rail will cater to 35% share of the projected passenger trips per day. The public transport mode share of BMTC will decline for the projected years (mode shift to Metro)
Scenario 3	BMTC will cater to 50% of the projected passenger trips per day. The total Public Transport (PT) mode share will be approximately 60%

5.1 Public Transport System, Bangalore – Scenario 1

BMTC serves about 45-50 lakh passenger trips per day (2011), which is about 30% of the 2011 census Bangalore Urban population. As per the Bangalore Metro Rail Detailed Project Report (DPR), it was projected that approximately 10.2 lakh passenger trips/day will be served during the same period, which is about 7% of the modal share. In this scenario, the following assumptions are considered:

a) Bangalore Metro Rail will meet approximately 10% of the projected passenger trips per day trips
b) BMTC will cater to 30% share of the projected passenger trips per day
c) Projected Bangalore Urban population was the basis for an analysis for BMTC and Bangalore Metro Rail passengers per day ridership.

The projected ridership for Bangalore Metro Rail and BMTC are given in Table 9 below. As per the analysis it was estimated that BMTC has to cater to 73 lakh passenger trips per day by 2031 in order to maintain a modal share of 30%. Table 9 also reveals that if BMTC maintains its present modal share and if Bangalore Metro Rail keeps up to its DPR ridership projections, Bangalore would have a strong public transport position where it would cater to almost 42% of the modal share. And once again, BMTC would provide the backbone of the public transport services.

Table 9: Scenario 1- Public Transport Share

Year	BMTC (Passenger trips per day/ modal share)	BMRCL (Actual passenger trips per day/ modal share)	Projected Ridership (Projected passenger trips per day/ modal share)	Best Case total PT Coverage (BMTC + BMRCL) – in lakhs/percentage of PT
2011	45-50 lakhs /30%	0.41 lakhs/ (0.2%)	10.2 lakhs/ 7%	50.41/30%
2016	56 lakhs/30%		14.8 lakhs/8.1%	71.8 lakhs/38%
2021	67 lakhs/30%		22 lakhs/9.5%	89 lakhs/39.5%
2031	73 lakhs/30%		28 lakhs/11.5%	101 lakhs/41.5%

Source: BMTC data provided to CSTEP

5.1.1 Investment requirements for BMTC @ Scenario 1

If BMTC has to maintain the current modal share of ~ 30%* over the coming decades, the investment requirements are given in Table 10. Additional passenger trips per day to be served by BMTC by 2021 will be approximately 22 lakhs, and by 2031 approximately 28 lakhs. Based on this demand in 2021 and 2031, additional bus requirements will be approximately 3,000 & 3,250 respectively as given in Table 10. In order to finance the purchase of vehicles, BMTC would need to invest Rs. 1,250 crores to purchase buses. Similarly by 2031, BMTC needs to invest Rs. 1,600 crores[1].

Table 10: Scenario 1 – Investment Requirement

Year	Total passenger trips served/to be served (lakhs)	Additional passenger trips to be served (lakhs)	Total Bangalore Population (lakhs)	Additional buses required (to cater to incremental passenger trips)	Investment Need in Rs. crores
2011	~45	Base figure (~ 45 lakhs passenger trips served/day)	87	Base figure (~ 6100 operational buses fleet)	NA
2021	~67	~22	132	~3000	~ 1250
2031	~73	~28	144	~3250	~1600

Sources: (BMRDA, 2009),(Directorate of Economics and Statistics, 2013)

5.2 Public Transport System, Bangalore – Scenario 2

In this scenario, it was assumed that there will be some shift to Metro from the existing bus share, and BMTC mode share of 30% in the projected years is likely to decline. The total public transport mode share by BMTC and Bangalore Metro Rail is maintained at an average of 35% approximately. In Table 11 given below, it can be observed that the mode share of BMTC is declining and an assumption that there is an increased modal share in favour of Bangalore Metro Rail (as projected in the DPR). As shown in Table 11, the current share of BMRCL is far below the projections for 2011.

Table 11: Scenario 2 - Public Transport Share

Year	BMTC (Passenger trips per day/ modal share)	BMRCL (projected passenger trips per day/ modal share)*	Best Case total PT Coverage (BMTC + BMRCL) – in lakhs/percentage of PT
2011	45 lakhs /30%	0.41 lakhs/0.2%	50.41 lakhs/30%
2016	51 lakhs/28%	14.8 lakhs/8.1%	71.8 lakhs/36%
2021	56 lakhs/25%	22 lakhs/9.5%	89 lakhs /34.5%
2031	56 lakhs/23%	28 lakhs/11.5%	101 lakhs /34.5%

Calculations based on actual BMRCL DPR projections, GoI/GoK population projections

[*] *Current mode share assumed=30% (27% PT mode share – Bangalore Mobility Indicators, 2011 and 34% according to MOUD, 2008 – Study in traffic and transportation policies and strategies in urban areas in India)*

Source: BMTC data provided to CSTEP

5.2.1 Investment Requirements for BMTC @ Scenario 2

If the public transport mode share of 35% has to be met by BMTC and Bangalore Metro Rail, where in there is a declining share of passenger trips per day served by BMTC, the investment requirements are given in Table 12. In this case, additional passenger trips per day to be served by BMTC by 2021 are 6 lakhs, and by 2031 approximately 11 lakhs. Based on this demand in 2021 and 2031, additional buses required are approximately 1,860 for both the time periods. By 2021 in order to purchase 1,860 buses, BMTC will need to invest Rs. 780 crores. Similarly by 2031, BMTC needs to invest Rs. 780 crores to meet the demand from 56 lakh passenger trips per day.

Table 12: Scenario 2 - Investment Requirement

Year	BMTC (Passenger trips per day in lakhs/ modal share)	Additional passengers to be served in lakhs	Total fleet requirement	Additional fleet requirement	Investment required in Rs. crores
2011	45 lakhs /30%	Base figure = 45 lakhs passengers served	6,100	NA	NA
2016	51 lakhs/28%	6	~7,250	~1,150	~480
2021	56 lakhs/25%	11	~7,960	~1,860	~780
2031	56 lakhs/23%	11	~7,960	~1,860	~780

Source: CSTEP Analysis

In both the scenarios considered, there is a need to meet the projected public transport ridership by BMTC. There is also a need to invest in an additional fleet to serve the projected ridership. Based on these scenarios, it is evident that investment in the bus system is essential, irrespective of maintaining the share or declining public transport share.

5.3 Public Transport System, Bangalore – Scenario 3

In this scenario, it was assumed that there public transport will be benchmarked at 60% of all motorized passenger trips per day. BMTC is expected to have a mode share of 50% in the projected years. As mentioned earlier this is best case scenario for public transport and BMTC. In Table 13 given below, it can be observed that the mode share of BMTC is increasing (50%) and an assumption that the modal share in of Bangalore Metro Rail is as projected in its DPR.

Table 13: Scenario 3 - Public Transport Share

Year	BMTC (Passenger trips per day/ modal share)	BMRCL (projected passenger trips per day/ modal share)*	Best Case total PT Coverage (BMTC + BMRCL) – in lakhs/percentage of PT
2011	45 lakhs /30%	0.41 lakhs/0.2%	50.41 lakhs/30%
2021	110 lakhs/50%	22 lakhs/9.5%	132 lakhs /59.5%
2031	122 lakhs/50%	28 lakhs/11.5%	150 lakhs /61.5%

Calculations based on actual BMRCL DPR projections, GoI/GoK population projections

Source: BMTC data provided to CSTEP

5.3.1 Investment Requirements for BMTC @ Scenario 3

If the mode share of 50% has to be met by BMTC, where in there is an increasing share of passenger trips per day served by BMTC, the investment requirements are given in Table 14. In this case, additional passenger trips per day to be served by BMTC by 2021 are 60 lakhs, and by 2031 approximately 72 lakhs. Based on this demand in 2021 and 2031, additional buses required are approximately 7,820 by 2021 and 9,280 by 2031. By 2021 in order to purchase 7,820 buses, BMTC will need to invest Rs. 3,503 crores. Similarly by 2031, BMTC needs to invest Rs. 4,640 crores to meet the demand from 122 lakh passenger trips per day.

Table 14: Scenario 3 - Investment Requirement

Year	BMTC (Passenger trips per day in lakhs/ modal share)	Additional passengers to be served in lakhs	Additional fleet requirement	Investment required in Rs. crores
2011	50 lakhs	Base figure = 50 lakhs passengers served	NA	NA
2021	110 lakhs/50%	60	~7,820	~3,503
2031	122 lakhs/50%	72	~9,280	~4,640

Source: CSTEP Analysis

5.4 Summary of Scenarios – An Overview

Figure 15 and 16 represent the additional fleet requirement and the associated cost for procuring that fleet respectively; this representation is a comparison across three scenarios which have been described in detail in the previous sub- section. Since Scenario 3 represents a benchmark case, the additional fleet requirement as well as the cost of procuring that additional fleet goes up considerably.

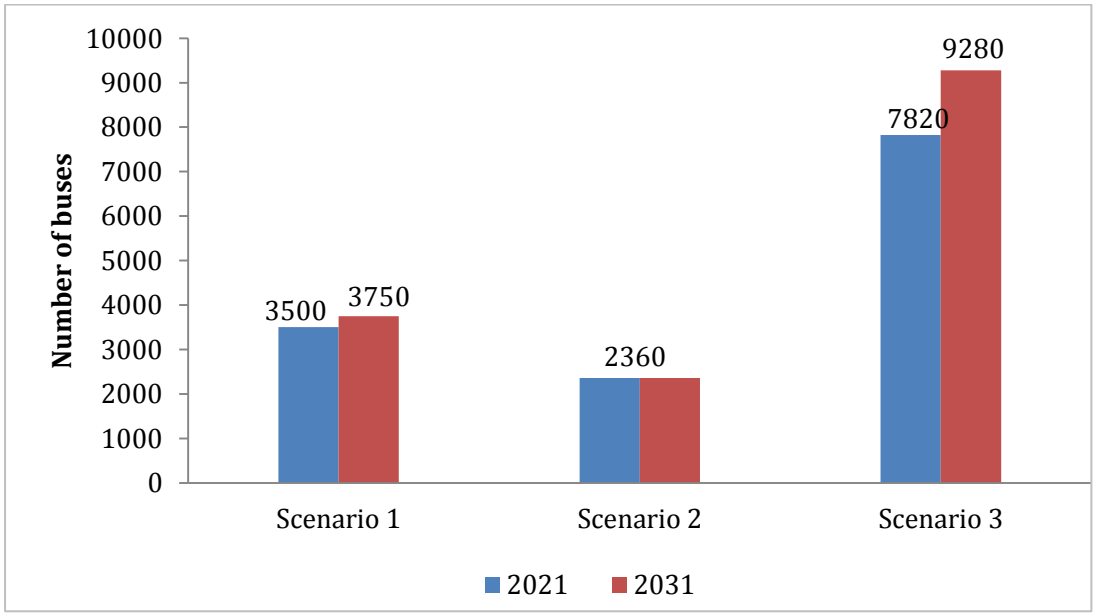

Figure 15: BMTC Additional Fleet Requirement across Scenarios

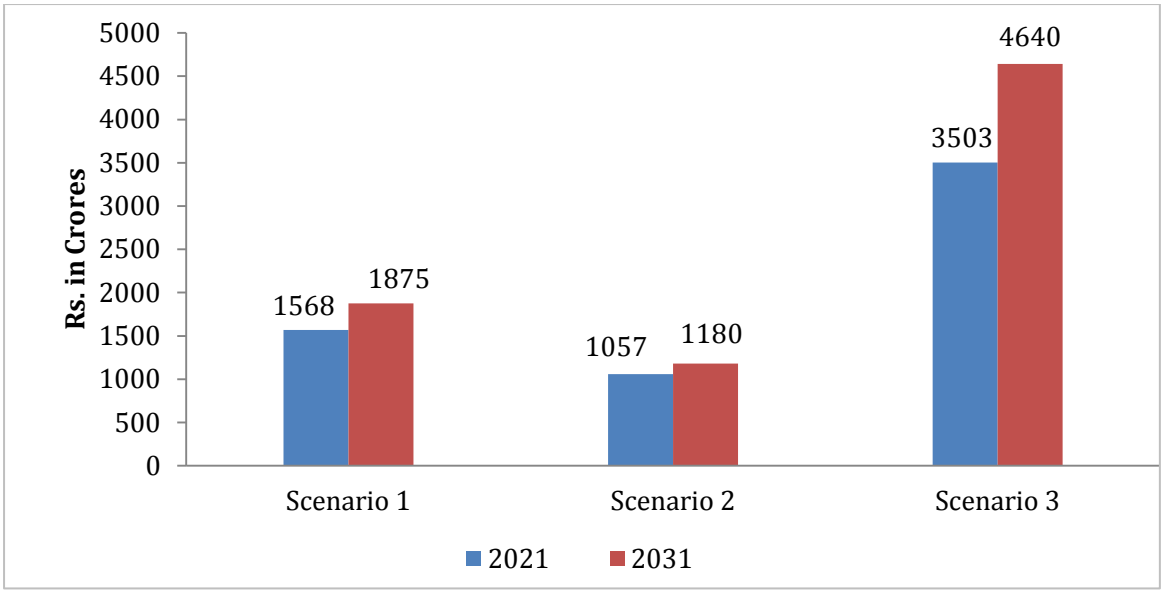

Figure 16: BMTC Cost of Procuring Additional Bus Fleet across Scenarios

In the context of public transport scenarios, specifically comparing bus systems and metro rail systems, it might be good to compare ridership details from different transport systems world over. This is shown in Table 15.

Table 15: Modal Split of Metros across the World

City	Metro Modal split as a % of all modes)	Number of passengers (lakhs)	Operational length (kms)	Bus share in Modal split as a % of all modes
Hong Kong (2011)	25%	39.6	175	55% (Bus +Tram)
Singapore (2011)	19%	21.8	150.8	25%
New York (2010)	12%	45.3	368	10%
London (2010)	10%	32.1	402	15- 20% (Bus + Tram)

Sources: (Acharya, 2013; LTA, 2011),(Transport for London, 2011)

What Table 15 reveals is that even with an extensive rail network, metro systems in cities like London and New York don't carry more than 10-12% of the modal split. One might also argue that the bus systems in those cities also don't carry more passengers. However a look at the Singapore model or the Hong Kong one reiterates the fact that systemic investments in different public transport modes are required. These include metro rail, bus systems, trams, and other modes, and only integration of these modes will create a robust public transport network. Thus in the case of Indian cities, especially Bangalore it once again points out that BMTC needs to be supported along with the Bangalore Metro Rail.

Figure 17 clearly reveals the extent of BMTC's network coverage which as can be seen covers not just Bangalore Urban District, but also certain parts of the outlying areas. However, it would also be very interesting to understand deeper issues of coverage by plotting information on frequency, bus-stops, real-time data on location of buses etc. By plotting that information, one would get a true sense of the extensive nature of BMTC operations. As can be seen from the Figure 17, the Bangalore Metro Rail network in some cases complements the BMTC network (especially in those areas where BMTC already has a wider coverage) and in some other areas it

proposes to play a primary role especially in those outlying areas where the BMTC network might not be so robust or saturated.

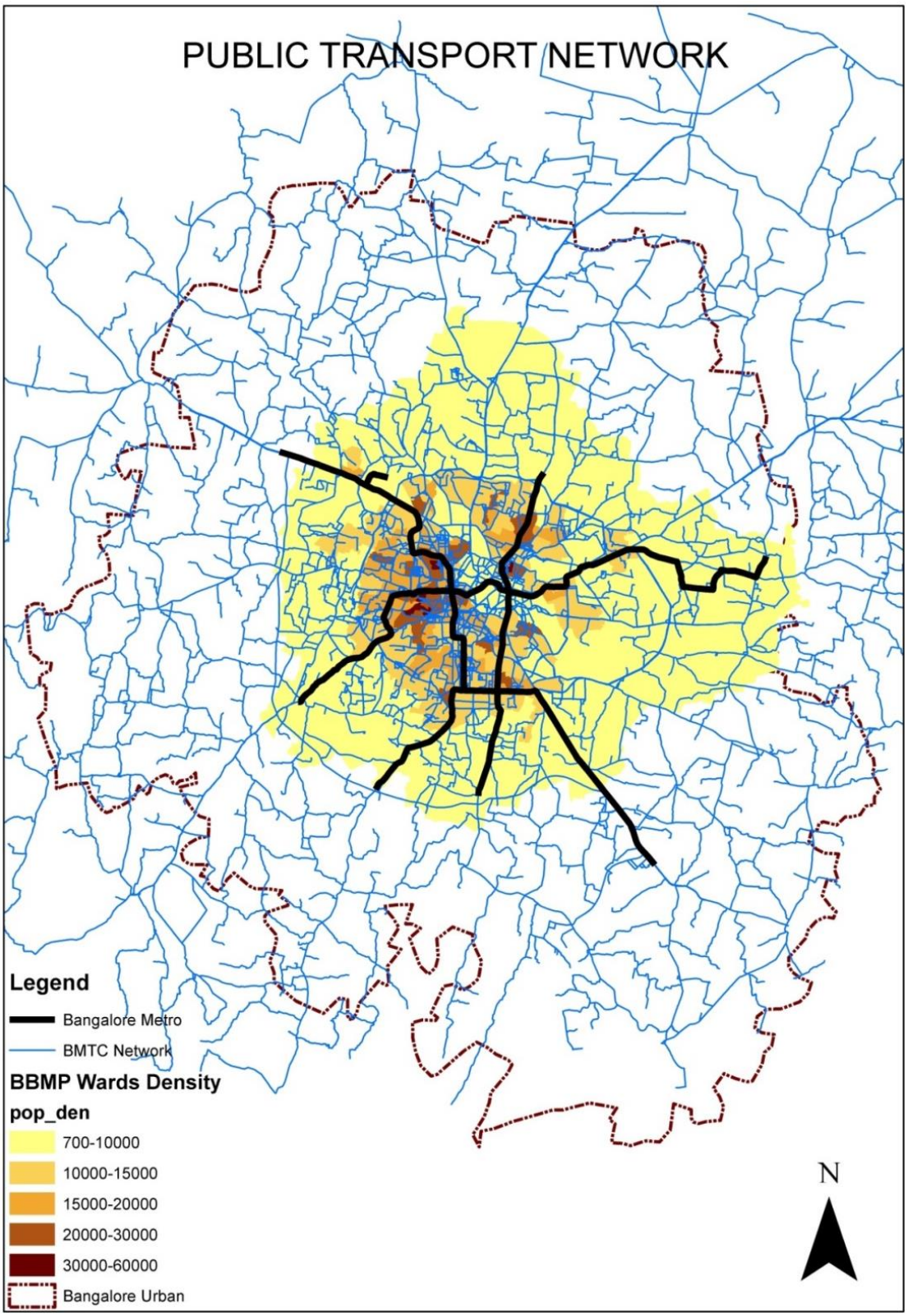

Figure 17: Public Transport Network – Bangalore
Source: BMTC data provided to CSTEP, CSTEP Analysis

6 Case of Bangalore Metropolitan Transport Corporation (BMTC)

This section discusses the performance of BMTC, and also highlights the initiatives undertaken by the organisation, as well as their future plans. BMTC serves around 50 lakh passenger trips per day, with an approximate fleet size of around 6775 – which is the largest public transport fleet size in the country. Each bus approximately completes 277 kms per day that translates to approximately 738 passengers per vehicle/day.

Another interesting aspect is the cost recovery ratio which is around 89%. This percentage is significant because it means that the BMTC depends to a large extent on fare-box collections to tide over costs and while this appears to be a positive statistic, it also probably translates into frequent fare hikes to cover operating costs (based on fuel price hikes). This was something which was witnessed in 2013, when BMTC commuters were subject to frequent fare hikes by the BMTC. These hikes were on account of rise in diesel prices which BMTC had to pass on to commuters. Thus there appears to be a need to re-look at the notion of fare-box collections covering the bulk of the operations cost. A summary of BMTC physical, financial parameters are listed in Table 16 below.

Table 16: BMTC Key Statistics

Role and importance of BMTC	
Total population in service area	87 lakhs
Total daily passenger trips by public transport	50 lakhs
Population served	26 lakhs
Percent mode share to public transport	30%
Percent mode share to bus	30%
Fleet description	
Fleet size	6,775 buses (2013-2014)
No. of buses per 1000 people	0.778
Average vehicle age	4.6
Output performance measures	
Average vehicle utilisation rate (Percentage of available buses actually used)	91%
Average daily km per bus	277.5 km (2013-2014)
Km per breakdown in service/10,000 kms	0.06
Passenger loading and adequacy of capacity	
Passenger per vehicle per day	738
Average peak hour occupancy ratio at maximum load point	68.1 (2013-2014)
Daily passenger km	540 lakhs
Average load factor (passenger –km/place-km)	

Staff	
Staff to bus ratio	5.42
Staff	35,298
Financial performance	
Cost recovery ratio	89%

Source: (BMTC, n.d.; World Bank, 2006)

Figure 18 refers to the BMTC bus network and also plots the population densities both in BBMP and BMR areas. As can be seen, there is a fairly dense BMTC network which covers the core BBMP areas through the three primary bus depots, namely Kempegowda Bus Station (KBS – Majestic), Shivajinagar Bus Station & K.R. Market Bus Station. In addition to the core areas and other BBMP wards, BMTC also serves BMR areas which do not have a high population density. In addition to serving Bangalore Urban District, BMTC also serves Bangalore Rural District, though the coverage in that area would probably not be as dense as in BBBMP areas.

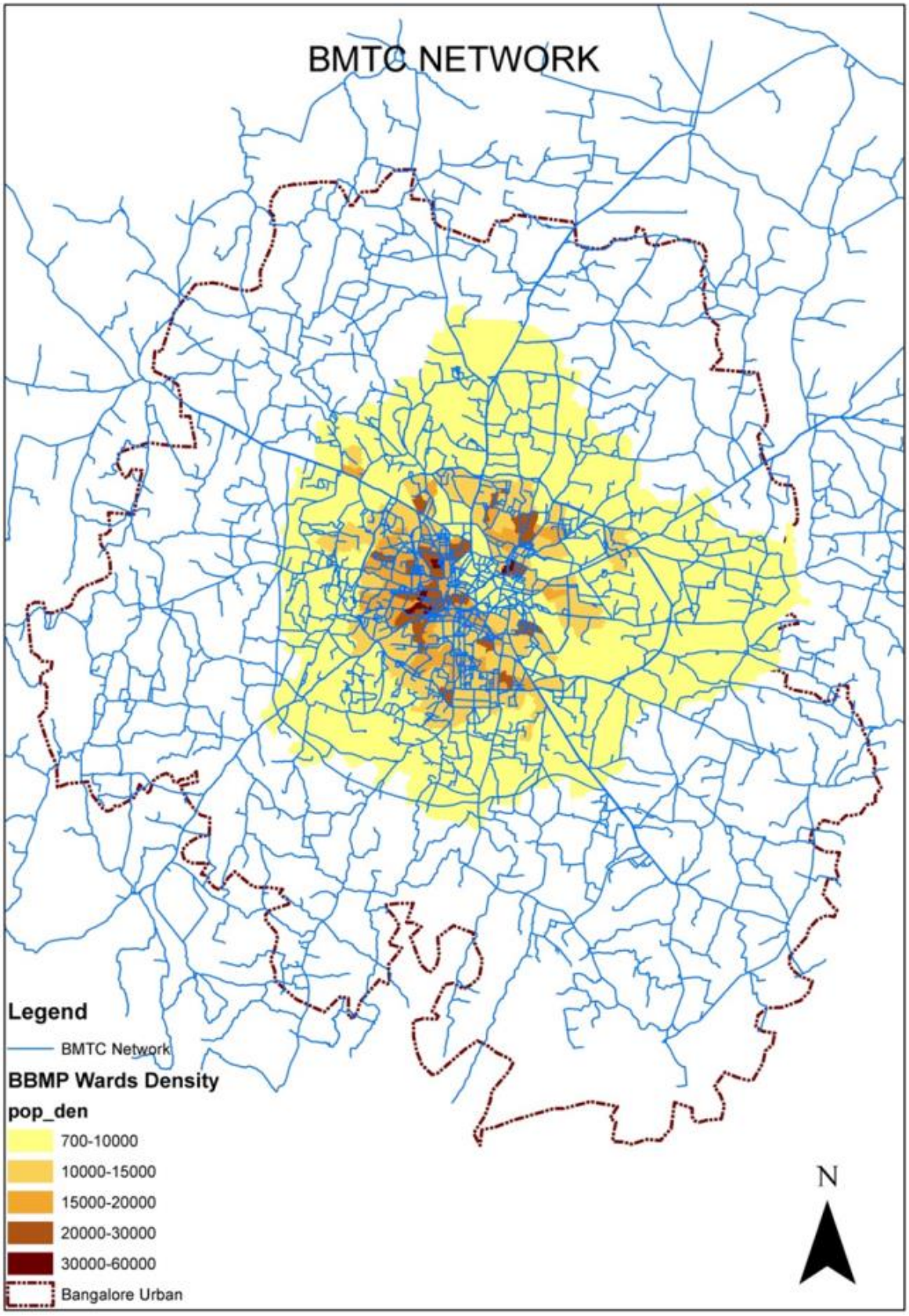

Figure 18: BMTC Network Coverage
Source: BMTC data provided to CSTEP, CSTEP Analysis

6.1 Performance of BMTC Public Transport Facilities

As per the Service Level Benchmarks for Urban Transport, "Public transport facilities indicates the city-wide level of services provided by public transport systems which include rail, organised bus-based system during peak hours (8 to 12 noon & 4 to 8 pm)" **(Ministry of Urban Development, n.d.).** Factors considered to determine public transport include:

1. Presence of organized public transport system in urban area (%) – Level of Service value[2] -1
2. Extent of supply availability LOS value -1
3. Service coverage in the city LOS value -2
4. Average waiting time for public transport users (minutes) LOS value -2
5. Level of comfort LOS value -1
6. % of fleet as per urban bus specification LOS value -3

Overall level of Service of Public Transport facilities city wide = 10 = 1+1 +2 +2 +1 +3

Table 17: Level of Service - Bangalore Public Transport

Benchmark	LOS calculated	LOS range suggested by MOUD
Public Transport Facilities	10	<12

According to the Ministry of Urban Development (MoUD) Service Level Benchmarks for Urban Transport, Bangalore has a good public transport system which is wide-spread and easily available to the citizens. The System provided is comfortable. **(Directorate of Urban Land Transport, 2011; Ministry of Urban Development, n.d.)**

6.1.1 Operational and Financial Performance

A comparison across different bus service providers across the country reveals some very interesting statistics (Figure 19). Firstly, BMTC has the largest fleet of approximately 6,400 (2012-2013), with Delhi Transport Corporation (DTC) coming in second with a fleet size of 5602, followed by Brihanmumbai Electricity Supply and Transport (BEST) with a fleet size of 4,259. In terms of passengers carried per bus/day, Metropolitan Transport Corporation, Chennai (MTC) ranks the highest with a figure of 1,340 followed by BEST with each bus carrying approximately 906 passengers per day. BMTC does not fare too badly either carrying around 740 passengers per bus/day. MTC's performance however needs to be analysed more carefully, specifically because in spite of a smaller fleet size, they are able to perform consistently better both in terms of 'vehicle productivity', 'occupancy ratio' & 'passengers carried per day'. What it probably denotes is that the commuters of that system are probably more reliant on this bus service. It would be interesting to see what can be done with BMTC to get these numbers.

The other interesting statistic which comes to the fore is fuel efficiency. BMTC with an average fleet age of 4.6 years has a fuel efficiency of 3.84 kms/litre while MTC which has a similar fleet age of 4.3 years, has a higher fuel efficiency of 4.34 kms/litre. Even DTC with an average fleet age of 6.1 years has a fuel efficiency of 3.62 kms/litre. What probably makes this difference is

[2] LOS Value –Level of Service (1 -4, where 1 being the highest and 4 being the lowest to measure performance benchmark)

the mix of buses (diesel v/s CNG v/s electric) as well as issues of traffic congestion which might affect the mileage. It might help to understand how these parameters mentioned above can make a difference in terms of better mileage if applied to the BMTC case.

However, in spite of all these issues, BMTC till very recently was the only state run bus service provider which was making profits and that is something for which it needs to be lauded. As mentioned elsewhere in this report, fare-box revenue account for 89% of cost recovery and that revenue source is something which the BMTC might well want to diversify in the medium to long term.

An analysis of the data which the BMTC provided further reveals that BMTC's operational performance is good, and financial performance has been relatively good when compared to other state run public transport operators. Over the last four years, BMTC's revenue has had a net growth of 15% (2010-2014). The total cost of operations has shown an average net growth of 18% (2010 -2014). The physical parameters of State Road Transport Undertakings (STRU) are listed in Figure 19 below.

Providers	AMTS	BMTC	BEST	CSTC	CTU	DTC	MTC(CNI)	PMPML
Average fleet held(number)	1120	6330	4259	779	472	5602	3585	1832
Staff/Bus ratio	5.12	5.42	8.6	7.04	4.07	6.8	6.56	5.94
Staff Productivity (kms/staff/day)	25.83	37.07	19.84	13.01	53.22	25.41	40.1	26.6
Average age of fleet(years)	6.7	4.6	6.6	5.4	6.1	6.5	4.3	7.2
Percentage of over aged buses	25.5	5.1	0	17	23.5	30.1	10.1	0
Vehicle productivity(kms/ buses/day)	132.35	200.76	170.6	91.57	216.6	172.84	263.1	157.94
Occupancy ratio (%)	62.1	70.9	65.4	82.4	92	45.3	75.8	75.1
Revenue earning kilometres (Lakhs)	541.06	4638.4	2652	260.4	373.2	3534.1	3442.7	1056.1
Passenger carried(Lakhs)	2396	17111.7	14096	1077.2	671.6	17071.8	17544	4604.9
Passengers carried per bus/day(Number)	586.1	740.6	906.8	378.8	389.8	834.9	1340.7	688.7
Fuel efficiency(km/l)	3.17	3.84	2.87	2.97	3.62	2.39	4.34	3.32
Net Profit / Loss								
2010-11	-1392	504	-3813	-1492	-391	-21102	-1056	-
2011-12	-1409	250	-3680	-1722	-438	-24311	-2298	-
2012-13	-1722	-726	-6304	-1481	-631	-29144	-1162	-1078

Figure 19: Physical Parameters of State Road Transport Undertakings (STRUs)
Source:(Ministry of Road Transport and Highways, 2014)

The total fleet currently owned by BMTC was 6,775 buses in 2013-2014 as against 6,074 buses in 2010-2011. The total fleet registered a growth rate of 11 % during 2010 – 2014. On an average during the same period the fleet utilization was approximately 96%. The number of kilometres serviced has increased by only 5% and the number of passengers carried growth rate increased by 15% during 2010-2014 as shown in Figure 20 below.

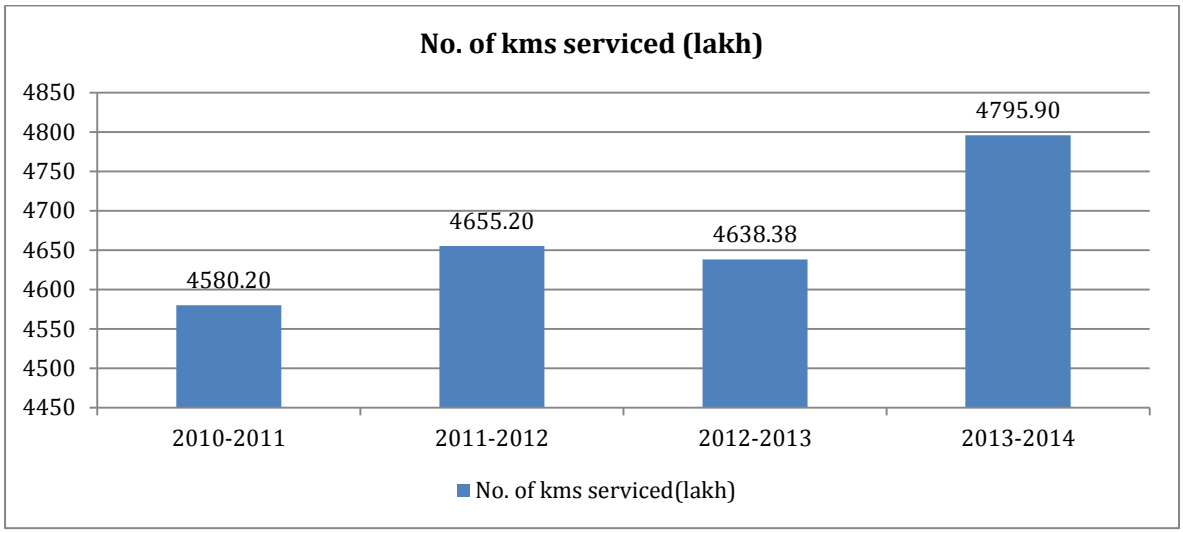

Figure 20: No. of Kilometres serviced (Lakh) - BMTC
Source: BMTC data provided to CSTEP

The number of passengers carried growth rate increased by 15% during 2010-2014 with an increase of 11% increase in growth rate of total fleet as shown in Figure 21 below.

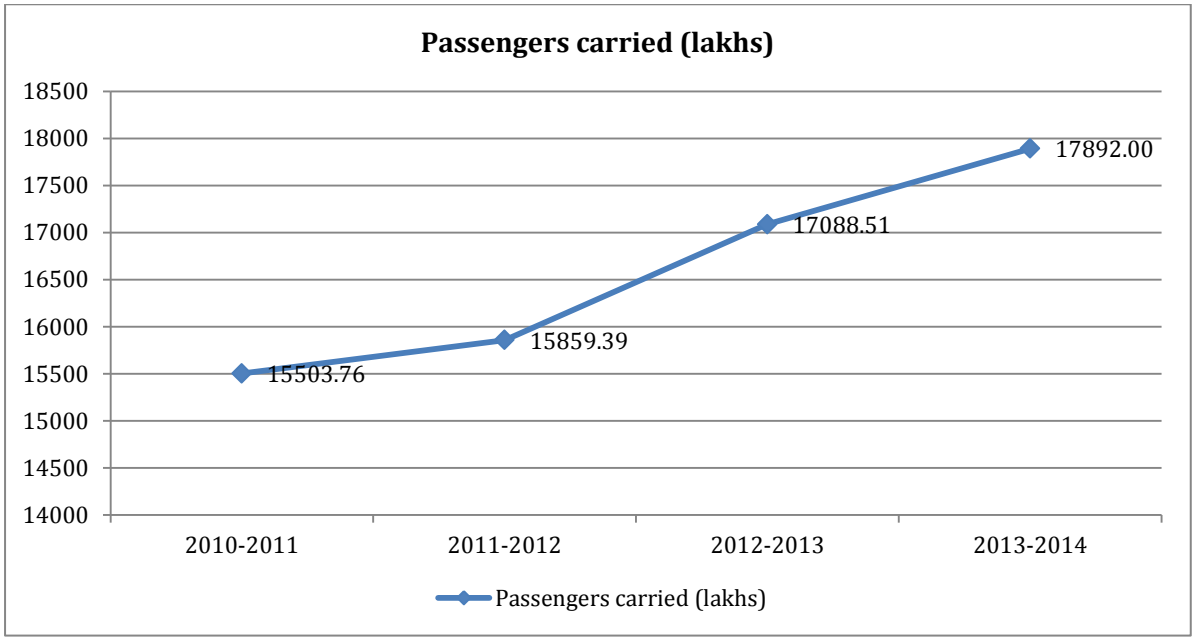

Figure 21: Passengers Carried (Lakhs) - BMTC
Source: BMTC data provided to CSTEP

The staff and fuel costs contribute to about 75 to 77 % of the total cost incurred. The cost involved for staff and fuel are plotted in Figure 22. The staff cost has almost increased by 95 % within a span of 4 years (2010-2014).

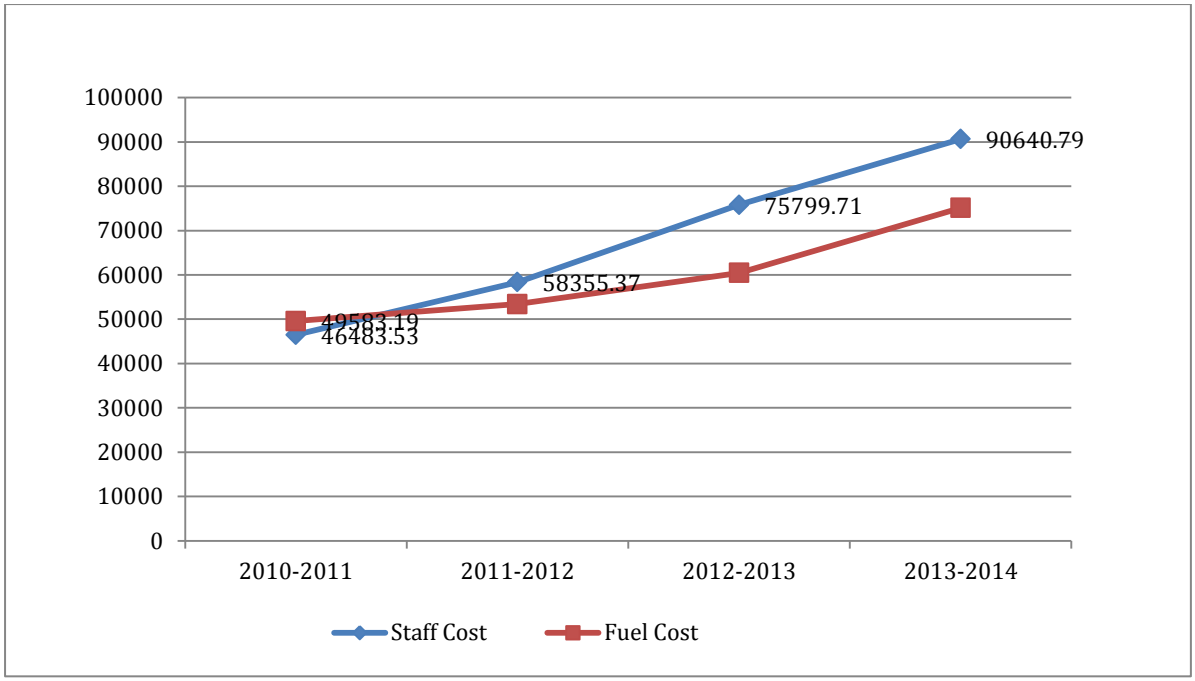

Figure 22: Staff Cost and Fuel Cost - BMTC
Source: BMTC data provided to CSTEP

Taxes paid are excise, property tax, Value Added Tax (VAT), Motor Vehicle (MV) Tax, fuel tax, passenger tax, land acquisition tax, customs and advertisement tax and income tax – whereas other modes of public transport have been exempted from some of these.

Fare box revenue cannot compensate the operational cost increases (otherwise public transit will not be affordable).

6.2 Initiatives by BMTC and how they connect with National Urban Transport Policy

Table 18 demonstrates how certain initiatives taken by the BMTC compare with the National Urban Transport Policy (NUTP). A quick comparison reveals that BMTC does extremely well on some aspects like use of appropriate technology, financial sustainability while there are other indicators which need attention. An overall comparison is given below.

Table 18: Initiatives by BMTC in line with NUTP

No	BMTC Initiatives	What does the NUTP say
1	Increased operational efficiency - Use of customised software to plan scheduling	While the NUTP does not explicitly talk about operational efficiency, it does encourage bus operators to become more efficient
2	Technological advancement - Installation of In-bus Closed Circuit Cameras with digital video recording facility in 500 buses on pilot project, if financial assistance at Rs.112.62 crores for 6,000 buses is sanctioned	The NUTP talks quite extensively about the use of appropriate technology and the features introduced by BMTC seem to be in line with what the BMTC proposes

	- ITS and Passenger Information System for 6,700 buses and all bus stations	
3	Infrastructure development - Development of Traffic and Transport Management Centres (TTMC)	The NUTP envisages the government providing the appropriate infrastructure for integrated public transport development. Towards this end, the TTMC's are the first step. They still need to be integrated with other modes of transport
4	Increased public responsiveness - Installation of passenger information touch screen kiosks at TTMCs, major bus stations and Kempegowda International Airport	This falls within the realm of technology development which the NUTP encourages. However, the NUTP does not explicitly talk about increased public responsiveness
5	Contained vehicular air pollution - Induction of Compressed Natural Gas (CNG) buses with financial support from Government both on Capital cost (CAPEx) and Operational and Maintenance cost (O&M). Towards CAPEx of Rs.180 crore, towards O&M of Rs.191.90 crore. The total cost Rs.371.90 Crore - Plan to induct electric buses if financial assistance is sanctioned by Government of Karnataka	The NUTP allocates high priority to controlling vehicular pollution and talks about investing in appropriate technologies towards this end. The BMTC has made some strides in this matter, but more needs to be done and it depends on the state government
6	Improved road safety management - Bus day on every 4th of every month (awareness and promotion of bus transport system)	The NUTP makes a passing mention of improving road safety and it is important to acknowledge the strides that BMTC has made in this regard.

Source: (Ministry of Urban Development, 2006)

For some of the parameters mentioned above, the BMTC requires sustained investments and these investment requirements have been detailed in Figure 23 below.

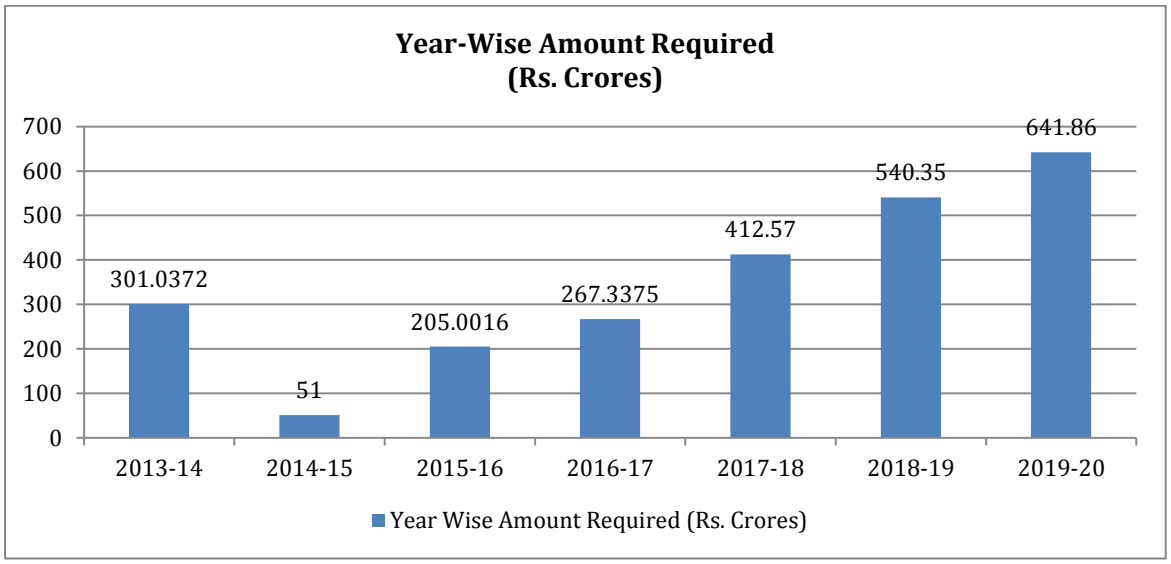

Figure 23: Investment required year-wise – BMTC

Source: BMTC data provided to CSTEP

7 Conclusion

- **Investment in Public Transport is imperative** – reduced congestion, reduced energy needs, reduced emission.
  a) Buses (BMTC) are the cheapest and relatively energy and emission efficient form of public transport
  b) To maintain, improve and increase the public transport share of the city – the bus system needs to be upgraded and fleet needs to be augmented significantly
  c) BMTC and Bangalore Metro Rail with its network collectively contribute to an effective and integrated public transport system.
- **Investment requirement for buses is much less, and network coverage is higher** than other transport modes like Light Rail, Mono Rail or the Metro
- **Ridership estimates are realised in a very short time**, and modifications (extension, re-routing, etc.) can be incorporated easily (as city grows, new activity centers emerge)
- **Other mass rapid transport infrastructure has a risk of lock-in** (money, time and space) and need careful analysis of alternatives.

8 Recommendations

For BMTC, the dependence on fare box earnings is very high (89 %). Increasing fares is not sustainable in the long run. A variety of methods need to be employed to mobilise funding for BMTC. Existing sources of revenue including subsidy/reimbursements or non-traffic revenue like advertisement, commercial development etc., are minimal and need to be rethought. Some recommendations to identify potential sources of revenue are as follows:

1. **Prioritising public transport budgetary allocation:** Under JNNURM transport sector funding, roads and flyovers were allocated close to 80% of the total funds. That needs to change if the government is keen on 'moving people instead of vehicles' as envisaged in the NUTP. Even the recently published 'Smart-City' project concept note talks about the need for good public transport projects along with an emphasis on non-motorised transport as well. Thus budget allocations need to reflect this policy imperative.
2. **Tax exemptions**: Allow BMTC to be exempted from major taxes (Central Excise, Motor Vehicle Tax, VAT and so on) which would be at par with tax breaks provided for other public transport projects (Bangalore Metro Rail /Delhi Metro Rail) in India. In the case of Bangalore, one such public initiative has suggested that the state government subsidise BMTC to the tune of Rs. 1,300 crores (Rs. 1,000 crores to fund purchase of buses, Rs. 300 crores to build bus-shelters)**(Bengaluru Bus Prananikara Vedike, 2014).**
3. **Lowering the interest burden**: The interest burden on loans taken by BMTC which keeps compounding every year needs to be reduced. The current interest burden is on account of loans taken to augment fleet capacity. Since the decision to augment the fleet size is a long term strategy towards sustainable transport, it would be advisable to lower the interest rates.
4. **Need for segregated priority lane for public bus**: Fuel costs is one of the major part of the cost of operations (35%) along with the staff cost (42%). Fuel inefficiency can be attributed to traffic congestion. Studies carried out by BMTC have indicated that reduced

traffic congestion increase the fuel efficiency of buses. Thus, segregated lanes for public transport should be a priority.

5. **Administrative and operational reforms**: Financial reforms need to be complemented with administrative and operational reforms. Use of Intelligent Transport Systems (ITS) for reliable and timely service is the need of the hour. Along with segregated lanes, priority signalling would be helpful in this cause.
6. **Increase revenue from sources under bus corporations' control:** BMTC needs to expand its net to earn revenue from sources that are under their control. The key ones include advertisement and commercial development in their depots and terminals (TTMCs). World over many models have been used to finance public bus transport and a few of them are mentioned in the Table 19 below:

Table 19: Method of Financing Public Transport

City	Method of financing
London	Advertisement revenue
	Congestion pricing
	Borrowing at low-interest from Public Works Loan Board
	Land value taxation
Mexico	Fuel surcharge
	Vehicle tax
France	Bonus and penalty based on CO_2 emissions of cars
	Income tax on wage bill of employers to pay for public transport
Hong Kong	Commercial exploitation
Columbia	Betterment levy on the enhanced value along transport corridors

Source: (Centre for Science & Environment, 2012)

9 Way Forward

One of the things which have been mentioned in the previous section has been the need for BMTC to find ways to generate internal revenues. Thus while BMTC approaches the State for funding, there is also a need to explore alternate and innovative funding and revenue sources. This would probably involve identifying inefficiencies, land-monetisation, a forward looking advertising policy, consulting opportunities, a re-look at the nature of buses which are purchased, better negotiation with vendors, and other such measures. This would also entail studying cases from the world which are able to generate internal revenues and identify how to apply them to the BMTC case.

As a way of going forward, CSTEP proposes to partner with BMTC and identify such measures which would help the organisation realise alternate sources of revenue and achieve financial sustainability in the long run.

References

Acharya, S. R. (2013). Microsoft PowerPoint - Acharya - Transport in Asian megaties-Workshop - surya-acharya-transport-in-asian-megaties.pdf. Retrieved March 11, 2015, from

http://www.atse.org.au/Documents/Events/atse-ia-international-workshop/presentations/surya-acharya-transport-in-asian-megaties.pdf
Bengaluru Bus Prananikara Vedike. (2014). Petition · Bengaluru needs BUS BHAGYA! Allocate 1300 crores in 2015-16 budget to make BMTC affordable, reliable and equitable! Retrieved March 16, 2015, from https://www.change.org/p/shri-siddaramaiah-bengaluru-needs-bus-bhagya-allocate-1300-crores-in-2015-16-budget-to-make-bmtc-affordable-reliable-and-equitable
BMRDA. (2009). *Bangalore Metropolitan Region Revised Structure Plan 2013* (p. 346). Bangalore. Retrieved from http://www.bmrda.kar.nic.in/rsp_report.pdf
BMTC. (n.d.). BMTC at a glance | Bangalore Metropolitan Transport Corporation. Retrieved March 11, 2015, from http://www.mybmtc.com/bmtc_glance
Business Economics. (2013, January 16). Private vehicles rise, public transport struggles, roads look helpless. Retrieved March 11, 2015, from http://www.cseindia.org/userfiles/BEJanuary_16_31.pdf
Centre for Science & Environment. (2012). Waiting for the Bus: Paying for Mobility in Our Cities. Retrieved March 11, 2015, from Centre for Science & Environment
CSTEP & IUT. (2014). Review of Urban Transport in India.
Directorate of Economics and Statistics, G. of K. (2013). Projected Population 2012-2021.pdf. Retrieved March 10, 2015, from http://des.kar.nic.in/docs/Projected%20Population%202012-2021.pdf
Directorate of Urban Land Transport, G. of K. (2011). Bangalore Mobility Indicators 2011. Retrieved March 11, 2015, from http://www.urbantransport.kar.gov.in/Bangalore%20Mobility%20Indicators_(22-12-2011).pdf
DMRCL. (n.d.). Delhi Metro Rail Corporation Ltd. | DMRC Project Update. Retrieved March 11, 2015, from http://www.delhimetrorail.com/project_updates.aspx
ENOTRANS. (n.d.). What Does a Billion US Dollars Buy in Bangkok?The Eno Center for Transportation. Retrieved March 11, 2015, from https://www.enotrans.org/ctp-blog/what-does-a-billion-us-dollars-buy-in-bangkok
Goel, R., & Tiwari, G. (2014). *Promoting Low Carbon Transport in India: Case Study of Metro Rails* (No. 978-87-93130-14-2) (p. 88). New Delhi: UNEP. Retrieved from http://www.unep.org/transport/lowcarbon/PDFs/CaseStudy_MetroRails.pdf
India Infrastructure Research. (2011). Urban Rail Transport in Indian 2011. India Infrastructure Research.
Kharola, P. S., & Tiwari, G. (2008). Urban public transport systems: are the taxation policies congenial for their survival and growth? *Economic and Political Weekly*, *XLIII*(41), 725–739.
LTA. (2011). J11Nov-p60PassengerTransportModeShares.pdf. Retrieved March 11, 2015, from http://www.lta.gov.sg/ltaacademy/doc/J11Nov-p60PassengerTransportModeShares.pdf
Metrobits. (n.d.). World Metro Database - metrobits.org. Retrieved March 11, 2015, from http://mic-ro.com/metro/table.html
Ministry of Road Transport and Highways. (2012). Road Transport Year Book, 2012.
Ministry of Road Transport and Highways, T. R. W. (2014). *Review of the performance of State Road Transport Undertakings (Passenger Services for April, 2012 - March, 2013)* (p. 42). New Delhi. Retrieved from http://www.indiaenvironmentportal.org.in/files/file/Review%20of%20performance%20of%20SRTUs.pdf
Ministry of Urban Development. (2006). National Urban Transport Policy. Government of India. Retrieved from http://moud.gov.in/sites/upload_files/moud/files/pdf/TransportPolicy.pdf
Ministry of Urban Development. (2014). List of completed projects under UIG: Karnataka. JNNURM.

Ministry of Urban Development, G. of I. (n.d.). Service Level Benchmarks for Urban Transport at a Glance. Retrieved March 11, 2015, from http://jnnurm.nic.in/wp-content/uploads/2010/12/SLB-Urban-Transport.pdf

Ministry of Urban Development, & JNNURM. (2014, March 31). Sectorwise Details of Sanctioned Projects Under JNNURM (UIDSSM). Retrieved from http://jnnurm.nic.in/wp-content/uploads/2014/05/SECTOR-WISE-DETAILS-OF-PROJECTS-UNDER-UIDSSMT.pdf

TERI. (2013). Life cycle analysis of transport modes. Retrieved March 10, 2015, from http://www.teriin.org/upfiles/projects/ES/ES2011UD02.pdf

Times of India. (2015, January 9). Karnataka scraps 142 Marcopolo buses. Retrieved March 12, 2015, from http://timesofindia.indiatimes.com/city/bengaluru/Karnataka-scraps-142-Marcopolo-buses/articleshow/45825746.cms

Tiwari, G. (2011, October 19). Metro systems in India: Case Study DMRC. Retrieved April 13, 2015, from http://www.unep.org/transport/lowcarbon/StakeHolders_2011_NewDehli/Oct%2020/Session%20V/Metro%20Systems%20in%20India_Case%20Study%20DMRC_Tiwari.pdf

Transport for London. (2011). Travel in London, Report 4. Retrieved March 11, 2015, from http://www.tfl.gov.uk/cdn/static/cms/documents/travel-in-london-report-4.pdf

World Bank, P. (2006). Urban Bus Toolkit: Tools and options for reforming urban bus system. Retrieved March 11, 2015, from http://www.ppiaf.org/sites/ppiaf.org/files/documents/toolkits/UrbanBusToolkit/assets/1/1c/1c.html

Center for Study of Science, Technology and Policy

18, 10th Cross, Mayura Street,

Papanna Layout, Nagashettyhalli, RMV II Stage,

Bangalore-560094

Karnataka, INDIA

www.cstep.in