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A Case Study on the Urban Mass Transit System and Sustainable Development in India.

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ABSTRACT
The main objective of this paper to discuss sustainable, quick, and least-cost public mass transit service by taking of case study of Bengaluru. Also, The improvement in existing public mass transit service and Sustainability. The reduction in pollutants like NOx, PM, CO2, CO. The promoting of public mass transit mode And discouraging the use of private vehicles. The metropolitan city suffering from traffic congestion, pollution, noise. Due to increase no of vehicles. This paper discusses the improvement in Bengaluru metropolitan transport corporation (BMTC), policies, that can be implemented in order and detailed analysis that police is reducing total vehicular emission. This paper shows that making police simple impact the ridership.
KEYWORDS: *planning, Mass Transit System, mode choice model, network pattern, Transport policies.*

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I. INTRODUCTION

In the 20th century, the mass transit system was an essential service for city people. This paper discussed the Bengaluru city case study of Bengaluru city. Bengaluru is the capital of Karnataka state, which was known as an IT hub of India. Bengaluru city established many multinational companies. Bengaluru city provides employment and Ammonites. Due to many multinational companies Established in the outskirts of The City. As a result of increasing population and vehicle population which affects the surrounding environment. Most of the public used Bengaluru Metropolitan Transport Corporation (BMTC). Which is the largest city bus service in India. (Harsha et al., 2020) Bengaluru Metropolitan Transport Corporation (BMTC) is currently the most important city bus company in India with a fleet size of quite 6500 buses plying the total of 1.15 Million kilometers of service through 45 depots acquiring the traffic revenue of about INR 50 Million a day". (Harsha et al., 2020) Bengaluru city has been a profit-making public bus transit system in India. The BMTC has faced a loss of profit due to an increases the private vehicle's use.

The mass transit system has the tools to overcomes many problems. They have to provide many advantages. the mass transit system has the backbone of cities. The developed country has a good and effective mass transit system. The mass transit system has played a vital role in the economy. They have contributions to increase the rate of GDP.

1.1 transportation and Sustainability

it's better to begin by defining sustainable mobility. According to the definition by the Centre of Sustainable Transportation, there are 3 major criteria for a mobility system to be sustainable (Bräuninger et al., 2012); firstly, it allows basic access needs to be met in a safe and consistent manner with human and ecosystem health, secondly, it is affordable, efficient, offers transport mode-choice and is supportive of economy growth, thirdly, it restricts emissions and waste, minimizes consumption of non-renewable resources, reuses and recycles its components and minimizes the use of land and noise production. It has been seen that mobility pattern dictates the transport system thus affecting population density which in turn controls per capita energy use and thereby affect overall sustainability of urban ecosystem (Bräuninger et al., 2012). Hence, in the transportation sector, public transit directly relates to 'sustainability' as it provides basic mobility to the majority of the population, more so in developing countries. In this research work we are focussing on the second and third aspect of 'sustainable mobility' i.e. how public transit development policies support 'sustainable' growth of the system.

It has been important to develop a rapid mass transit system. due to heavy private vehicular traffic facing by city. The rising more demand for cheap, rapid planned, and safe. Also, population growth has the reason of any problem. Government have to making police for development of rapid mass transit system.

There are different policies to promote the sustainable mobility across the world which can be predominantly grouped into 3 types – avoid, shift and improve (ASI) (Bräuninger et al., 2012). ASI corresponds to the policy interventions like shortening trip lengths and/or compact planning, promoting modal shift to public transit and improving sustainability of all modes respectively. It's worth mentioning here that ASI does not work in a similar way in different countries as avoid strategies tend to be more successful in poorer countries whereas richer countries having widespread motorisation mainly relies on shift strategies (Bräuninger et al., 2012). There are different policies to promote the sustainable mobility across the world which can be predominantly grouped into 3 types – avoid, shift and improve (ASI) (Bräuninger et al., 2012). ASI corresponds to the policy interventions like shortening trip lengths and/or compact planning, promoting modal shift to public transit and improving sustainability of all modes respectively. It's worth mentioning here that ASI does not work in a similar way in different countries as avoid strategies tend to be more successful in poorer countries whereas richer countries having widespread motorisation mainly relies on shift strategies (Bräuninger et al., 2012).

In this paper authors are focusing on the impact of the improvement policies. The transport planning agencies off late have been prioritising measures like development of mass rapid transit, and incorporation of intelligent transportation system (ITS) instead of better planning of transit services (e.g. last mile connectivity).as well as different approaches like coordination of activities (e.g. peak hour scheduling), route management (e.g. removal of overlapping routes), management of traffic flows (e.g. use of paratransit as feeder network), structure variation of vehicle fleet which are proving to be effective solution to transportation problem (Makarova et al., 2017). Such policies could be rational in the context of a developing country like India.

1.2 Sustainable transportation in developing countries

Most developing countries specifically in Asia lack integrated land use-transportation planning and consequently suffer from the weakness of loose land-use control which has aggravated several problems like unplanned urban sprawl and severe traffic congestion (Satiennam et al., 2006). The mass transit system has been According to the data from Global BRT, 163 cities have implemented BRT, mostly after the year 2000 and this proliferation can be attributed to perceived low capital cost, flexibility and potential for integration with non-motorized transport (NMT)(Cao et al., 2015).

In most developing countries specifically in India, the major problem has been the lack Infrastructure facilities like roads, water supply, sanitation, and road network. Good quality of transit service required Well planned infrastructure and government norms. The mass transit system has one of the tool to generating revenue from the users.

At the same time similar reaction has been shown to subway/metro projects specifically in smaller cities without a robust MT system e.g. Jaipur and Kochi in India which likely points to the political influence over these major infrastructural projects instead of assessing 'sustainability' quotient. Different news sources confirm that subway projects in all 4 megacities in India i.e. Delhi, Mumbai, Chennai and Kolkata have not only experienced cost escalation during their construction period, but also are running in losses. The primary reasons of such cost escalation/operational loses are due to reasons like faulty ridership forecasts, and land acquirement issues. The amount of financial loss is significant, which varies from INR 100 crores to as high as 300 crores per annum. Despite such losses, quite a few BRT projects, a high profile one being Delhi BRT, and most of the subway projects have turned into politically motivated projects, rather than being driven by transport analyses (Rizvi

1.3 Challenges In Implementing Sustainable mass transit system

1. Lack of awareness about the low-cost and rapid mass transit system.
2. The public has to use more private vehicles.
3. Some areas have not prospered road network.
4. The quality of the road is a bad condition which affects many things like travel time, travel cost, traffic volume density, etc.
5. The bad quality of road increases the number of accidents.
6. The many place contactor is not using specified material while they have constructed road. Due to earn more capital.
7. The growth pattern has been affecting mass transit system development.
8. Urbanization and industrialization have the main factors that have an increasing demand for a mass transit system.

II. SUSTAINABLE TRANSPORT DEVELOPMENT IN DEVELOPED COUNTRIES

The developed countries like the USA, UK, Japan, Russia have efficient and low-cost rapid mass transit system developed in developed countries. Which has to provide many facilities, safe and hygienic

environment provides to the public. In developed countries most people have been using the mass transit systems, developed countries have properly planned road network for a mass transit system which helps to reduces travel time and cost of trips and traffic congestions, road accidents, traffic volume density. The developed countries people prepared the mass transit service rather than private vehicles. That agenda has to reduce pollution and traffic-related problems. The mass transit system has one of the tools of revenue generation. also, they help transport at the destination. The developed country has a highly accessible mass transit system.

III. LITERATURE REVIEW

The different studies was carried in Bengaluru have been carried out one and half decade, In year 2003 - 04, the study carried out for the preparation of Detailed Project Report (DPR) of Bengaluru Metro Rail Project, stated that the total vehicular population is increasing at the rate of 10% per annum while two wheelers alone are increasing at 17% per annum. The study show that city needed mass transit service. This study includes an observation that majority of the composition of traffic on Bengaluru roads, consists of low occupancy vehicles, i.e. two wheelers. This has been observed and noted again in the report on Bangalore Mobility Indicators 2010-11 carried out by Urban Mass Transit Company Limited and submitted to the Directorate of Urban Land Transport (DULT).The study is suggested improvement in city existing network and wider the road .In year 2015, a study done by Centre for Study of Science Technology & Policy (C-STEP) it is reported that BMTC (Bengaluru Metropolitan Transport Corporation) bus service which was known as the only profit making public bus operator, has incurred significant losses in last few years (CSTEP, 2015). This report suggests the requirement of heavy investment on bus service in the form of subsidy and the need of improvement in Non-Motorized Transport (NMT). Addressing the problems of scheduling delays and bus bunching, research has also stated the requirement of developing Hub and Spoke model for BMTC and the benefits of implementing it instead of existing destination-based model (Verma et. Al., 2017). The CLIMATRANS report (Verma et. Al.,2018) which talks about the detailed mitigation policy bundles to be implemented for sustainable transportation in Bengaluru, emphasizes on policies for better walking and cycling infrastructure and suggests the measures such as congestion pricing, car-pooling and mixed land use development. The study also talks about the positive environmental effects (such as reduced NOx and COx emissions) due to policies like High Occupancy Vehicle (HOV) lanes in the outer periphery of the city including outer ring road, NICE road and other highways approaching the city from all sides showing that the HOV lanes, if implemented, will reduce the overall emissions by considerable.

The paper has to show that the efficient

And planned rapid system have helped to state for a reduction In carbon, nitrogen, and CO2 Etc harm-full gases. the have reduction In traffic volume, traffic density. They have helped to reduce pollution, traffic congestion, travel time, travel expenses etc.

While the research suggests the need for the bus transit in metropolitan cities should be totally affordable for urbanpoor (Badami et. Al., 2007), there has been no significant research done on the effects of restructuring the fare and its impact on the bus transit mode share. Multiple corridors included in the study regarding HOV lanes have been now considered for mass transit projects and there has been no study on the implementation of Bus Rapid Transit System (BRTS) within the city limits in the city of Bengaluru.

The paper has shown the role and importance of mass transit system. They have to helps the economic development of the system. Also, the government policies and norms affecting the efficiency of a mass transit system. The developed country having adopted an effective good quality of road and road patterns to easily managed and maintain the mass transit service.

This paper deals with the testing of policies and there modelling keeping into mind the changes required in the fare structure and the possibility of new BRT lanes on heavy traffic holding roads inside the city limits.

Motivation for Developing Public Transport Policies Bangalore

Bangalore Mobility Indicators 2011, a report based on the study carried out by Urban Mass Transit Company limited and submitted to Directorate of Urban Land Transport (DULT), reported an observation that more than 40% of the roads in Bengaluru have public transport buses running at the average speed lesser than 10 km/h. We observed that this average speed has further decreased in past 7 years, becoming as low as 4 - 5 km/h on few major corridors in Bengaluru. Out of these major corridors, few roads like Mysore Road, Tumkuru Road, already have a metro route running parallel to or over them while many roads, such as Outer Ring road have already planned metro lines over them. Apart from these there are few major traffic prone roads with sufficient road width, i.e. more than 2 lanes on either side, were selected, modeled and tested for the potential BRT lanes in this paper. The Bengaluru Metropolitan Transport Corporation buses operating in Bengaluru is a

stagecoach bus service. The stagecoach type bus services operate with the stage wise fare collection system. We observed that the existing fare structure is such that the ticket prices increase suddenly in first few stages and then the rate reduces making the plot of fare v/s distance, logarithmic. Such fare structure seems to be promoting the usage of buses for longer distances than short ones. Today, with Bengaluru having a mass rapid transit, i.e. metro service, already in place, the BMTC buses should be used more as a short trip, cheaper mode or as a last mile connecting feeder system instead of long trip provider.

We modeled and tested a scenario by reducing fares for short - medium trips keeping a slow and steady fare increment for initial stages. The BMTC considers standard stage distance as 2 kilometers and this standard is used by many public bus operators across India. We observed that more than one third of the total number of BMTC stops across Bengaluru Metropolitan Region (BMR), are assigned as a stage stops. This implies that the average inter-stop distance is around 670 m, which is higher than the international standards of 400 m distance for a city bus service. This is reducing the accessibility of public transit network further along with the decreasing value of acceptable walking distance, with increasing vehicular ownership. With the above mentioned and identified problems, the scenarios were built and modeled to forecast the possible ridership and revenue increment for BMTC, subsequently reducing the overall emission and hence contributing in improving the liveability of the city.

IV. CONCLUSION

This paper provided an insight into the public transportation system of Bengaluru city and the ways to develop the current public transport scenario by developing two sustainable transport policies which are Fare restructuring policy of BMTC and provision of BRT lanes. The study states that the fare restructuring of BMTC bus service and introducing BRT lanes will be helpful in decongesting the roads in Bengaluru as well as in reducing the vehicular emission. The paper suggests the revision of bus fares after analyzing the present-day travel pattern by different mode and finding out that there is a requirement to reduce the rate of increment of bus fares for the trips of small and small-medium distances. The modelling shows the positive effect of restructuring the BMTC fares as it is increasing the mode share of the buses by more than 2% and also increasing the revenue by more than 15%. From emission plots the fare restructuring would actually reduce the total Vehicle Kilometers Travelled (VKT) by all modes combined and will help reducing the emission of NOx, CO, CO2, PM, HC into the atmosphere. This paper also suggests the introduction of Bus Rapid Transit (BRT) lanes on few major roads in the city which are not covered under proposed or planned metro lines. The BRT lanes are important in the city considering the increasing unreliability of public transport buses due to severe congestion at every intersection. The BRT lanes will improve the performance of bus transit in the city by increasing its speed on busy and congested roads by a large margin. The analysis output and emission plots show that BRT will increase the ridership of BMTC by more than 4% and will also improve the revenue by almost 23% along with drastically reducing the NOx emissions as well as the total Vehicle Kilometers Travelled by all modes. Considering both the scenarios (fare and BRT) together, will increase the ridership and revenue of BMTC even more, resulting in better and sustainable urban transport in the city. Further evaluating the revenue of BMTC showed that the EMPKMM is increasing from BAU to S1 and S2 by 2% and 9% respectively. The CPKMPP has reduced from BAU by 12% and 15% reducing the negative margin by 46% and 76% (Harsha et al., 2020)

REFERENCES

[1]. Badami, Madhav G., and Murtaza Haider. "An analysis of public bus transit performance in Indian cities."
[2]. Transportation Research Part A: Policy and Practice 41.10 (2007): 961-981.
[3]. Bangalore Mobility Indicators (2011), Directorate of Urban Land Transport.
[4]. Chandel M. et.al. (2018). Estimation of Emission Factors for Different Vehicles, CESE, IIT Bombay, India.
[5]. CSTEP (2015), Need for Government Support for Public Bus Transport (CSEP Report-2015-05)
[6]. Delhi Metro Rail Corporation, RITES Ltd. (2003). Detailed Project Report, Bangalore Metro (Phase I): Government of Karnataka.
[7]. Verma, A., Kumari, A., Tahlyan, D., & Hosapujari A.B. (2017). Development of hub and spoke model for improving operational efficiency of bus transit network of Bangalore city. Case Studies on Transport Policy, 5(1), 71-79.
[8]. Verma A., Vajjarapu H., Hemanthini AR., (2018). Sustainable Transport Measures for Livable Bengaluru, Project Sub Report, IISc Bangalore, India.
[9]. Wilbur Smith Associates, "Comprehensive Traffic and Transportation Study for Bangalore Metropolitan Region (CTTS)", June 2010.
[10]. Sustainable Urban Transport Policies to Improve Public Transportation System: A Case Study of Bengaluru, India
[11]. SATIENNAM, T., FUKUDA, A., & OSHIMA, R. (2006). a Study on the Introduction of Bus Rapid Transit System in Asian Developing Cities.
[12]. Bräuninger, M., Schulze, S., Leschus, L., Perschon, J., Hertel, C., Field, S., & Nicole, F. (2012). Achieving sustainability in urban transport in developping and transition countries.
[13]. Makarova, I., Pashkevich, A., & Shubenkova, K. (2017). Ensuring Sustainability of Public Transport System through Rational Management. Procedia Engineering, 178, 137–146. https://doi.org/10.1016/j.proeng.2017.01.078
[14]. Bhaduri, E., Goswami, A. K., & Moeckel, R. (2020). How sustainable is the growth of mass transit system in developing countries - An Indian perspective. *Transportation Research Procedia*, *48*(2018), 2706–2724. https://doi.org/10.1016/j.trpro.2020.08.244