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Development of Mass Rapid Transit System- Necessity of Lucknow City: A Review

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Abstract - *With rising traffic demand, the idea of coordinating the development of numerous modes of transportation, with public transit as the dominant option, has gained traction. Many big cities are working to establish three-dimensional urban rail transit and build a public transportation system using urban rail transit as the backbone. Medium volume traffic is preferred by many cities due to its low volume and flexibility in route choices. Based on the study and analysis of several intermediate-mass rapid transit systems, this article develops a complete decision-making model for the system using the DEA data envelopment analysis approach. The adaptability of Bus Rapid Transit (BRT), Autonomous Rail Rapid Transit (ART), and Rail Transit were analyzed and graded using Yongxiu County in Jiangxi province as a case study. Meanwhile, this article looked at the system selection for the mass transit system. The population grows geometrically over time as a result of the city's development as well as accompanying infrastructure expansions such as traffic and transportation. The mobility strength and mode have both been found to have enhanced. As a result, we saw the necessity for a transportation system that could move a large number of passengers in a short amount of time. The solution to this problem is the Mass Rapid Transit System (MRTS). MRTS, which may be based on rail or bus, is popular across the world and must be a long-term transportation solution.*

Key Words: Mass rapid Transit System, Lucknow, Urban Area, Transportation System, BRT.

1. INTRODUCTION

For the evaluation, mass rapid transit is defined as public transportation that involves a significant degree of collectivization or connecting individual journeys into common trunk links. It includes modes that are based on a fixed track or exclusive and segregated use of a possibly shared user road track. As a result, it comprises isolated or mostly separated busways, but not bus lanes or other kinds of bus priority in mixed traffic. As part of the overall system, the nature and relevance of secondary ways of entrance and egress to the trunk facility are evaluated. The assessment includes urban settlements of all sizes and is not limited to megacities' experiences. In emerging cities, mass transportation must be able to transport huge numbers of people in a short amount of time. In the absence of significant subsidies, this necessitates both low cost (therefore low fares) and high operational speed. The vulnerability of urban transportation networks has become a hot and difficult subject in contemporary research on road networks [1] because of the fast expansion of automobile ownership and the lag in the building of road infrastructure in recent years. The medium urban mass rapid transit system has gained increasing favor and attention as a result of its benefits and growth potential and has steadily evolved into a powerful supplement to the ground and rail mass transportation systems. Rail Transit, Bus Rapid Transit (BRT), and Autonomous Rail Rapid Transit (ART), which are relatively new, are the primary components of the middle urban mass rapid transit system. Figure 1 depicts the classification of urban public transportation system types.

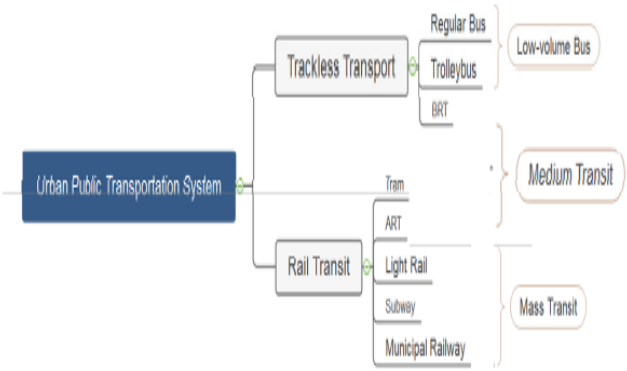

Figure-1: Types of urban public transport systems

1.1. Analysis of Middle Urban Mass Rapid

Public Transportation Low- and medium-speed trams, Bus Rapid Transit (BRT), and the recently developed Autonomous Rail Rapid Transit (ART) are examples of medium-capacity buses. Bus Rapid Transit (BRT) is a new type of transportation system that combines rail transit and conventional buses in terms of speed and passenger capacity. It can achieve high capacity and high-efficiency transportation capacities through its exclusive bus corridor and uses the "transit priority" transportation strategy to increase operation speed. Trams are electric-powered light rail vehicles that can transport up to 6,000 passengers per hour. Modern trams, unlike classic trams, may be constructed to travel in a variety of right-of-way configurations [03].

1.2. Selection of Evaluation Indexes

The design of the evaluation index system for urban mass transit system should have the following characteristics:

1. 1. The planning and evaluation indices for urban bus lines shall adhere to the national standard for an urban bus.

2. 2. To evaluate the degree of urban bus line service planning and the impact of real urban bus line service in a precise and reasonable manner.

3. The design of the index system should be as basic as possible, as long as it does not directly impair its accuracy. After conducting the study, the following four factors were identified as indicators for evaluating the rationality of bus line transfer space planning connectivity: line length, number of stations, average station distance, average station transit speed, and peak load rate. This study examines and creates a set of relatively conventional evaluation index systems of bus line service level based on the above knowledge of the evaluation index content of service level of medium volume rapid transit system.

2. LITERATURE REVIEW

[1] Fouracr, Gardner (2000) These two authors studied his research work about "Mass Transit in Developing Cities" and conclusions are given that, The construction of guided busways, at-grade LRT, and lightweight metro systems is increasingly being proposed. It is impossible to determine if they are precise alternatives for bus or metro, or whether they offer benefits for a certain range of passenger management demands, possibly somewhere in between bus and metro, until an additional study is conducted to demonstrate their performance under diverse situations. Any new development will require significant funding. Finance packages from aid agencies and manufacturers in industrialized nations appear to be easily accessible for metro projects, while less encouragement appears to be available for busway projects, perhaps because beneficiaries have yet to be convinced of their value (as previously stated). According to the findings of the TRL research, there should be more assistance for busway developments.

[2] Asato Saito (2003) The author studied his research work about "The Politics Of Urban Development In A Global City: Tokyo And Waterfront Sub-Centre Project" and conclusions are given that, In the case of Tokyo, various publications have noted some of the characteristics of the national political economy known as the Capitalist Developmental State (CDS) about urban transformation (Fujita, 2000; Hill and Kim, 2000). However, the definition of CDS and how it related to urban spatial development were unclear. As a result, this thesis defines the notion of CDS by developing a five-fold definition based on Palan, Abbott, and Dean (1996), and connects it to the state's involvement in infrastructure development and construction through the concept of Public Work State (PWS) (Honma, 1996). The state-led public works project fueled economic development, but it also forged a strong connection between state authorities and construction-related businesses, which LDP lawmakers helped to bridge. It has evolved into a self-sustaining, all-encompassing mechanism that assures a strong state presence in Japanese spatial planning systems and development initiatives. This is not taken into consideration in existing analyses of Tokyo as a global metropolis. Another issue with previous Tokyo studies on the global economy is that they mostly rely on macroeconomic data and perceive urban transformation as a mechanical result of external forces. As a result, they neglected to address the underlying mechanics of how the global economy operates through the interplay of major agencies engaged in the development of the world metropolis. Existing research focuses on economic transformation, such as changes in the labor market, rather than on intentional policy responses to global economic change.

[3] FUKUDA (2006) The author studied his research work "A Study On The Introduction Of Bus Rapid Transit System In Asian Developing Cities" and conclusions are given that, numerous ideas for implementing a successful BRT system in Asian emerging cities, beginning with identifying key factors that contribute to the success of existing BRT systems. The report then outlines the factors that impede BRT implementation in Asian emerging cities. These findings have prompted the creation of several measures to solve the problem and improve the BRT system's development in these cities. This research primarily focuses on supply-demand methods for the BRT system, formalizing their principles and assessing their performance. Rather than standard TDM techniques (high-density land use allocation, park and ride facilities, etc.), two strategies of well-integrated paratransit as a feeder to the BRT and a reduction in the number of local buses in BRT corridor regions are advocated. The study suggests that the paratransit system feeder and other recommended measures might improve the performance of the BRT system by improving traffic network circumstances.

[4] Agarwal et al (2010) These authors studied his research work about "An Overview On Bus Rapid Transit System" and conclusions are given that, BRTS has a lot of versatility, which is a huge plus. This method allows for progressive issue learning and error correction as the project progresses. Taxpayers are also not committed to a single technology or solution because of the comparatively cheap installation expenses. Commuters prefer to board/alight at intersections, resulting in unofficial bus stops that produce dangerous traffic congestion. It is thus recommended that facilities be planned to meet the needs of commuters.

[5] Mishra et al (2013) These authors studied their research work about "Study of Bus Rapid Transit system In Respect to Growing Cities of India" and conclusions are given that, the physical and operating characteristics of India's BRT networks The majority of the BRT systems studied have certain BRT elements in common, but not all. When planning a BRT system, the elements should be chosen based on the project budget, local users, and traffic and corridor conditions, and then integrated to maximize ridership and operational speed. The BRT characteristics have been divided into three deployment phases, taking into account the limited success and ridership of BRT in Indian cities, as well as the expensive cost of right-of-way. The features indicated in each step increase in cost, technical sophistication, and implementation timeframes, but they also correspond to greater beneficial benefits on passenger attractiveness and operating speed. For a BRT system to be viable, the phases may be deployed in order.

[6] Chaurasia (2014) The author studied his research work about "Bus Rapid Transit System (BRTS): A Sustainable Way of City Transport (Case Study of Bhopal BRTS)" and conclusions are given that, BRTS is for Bus Rapid Transit System; I want to emphasize the word 'System' since it refers to an integrated strategy that includes not just dedicated bus lanes but also safe and comfortable corridors for walkers, bicycles, and motor vehicles. Bus stops, Foot Over Bridges, Pedestrian Subways, platforms, curbs, railings, Public Information systems, Pedestrian Crossing Signals, Signages, and road markings should be passenger/user friendly for people of all ages (Old age, Children), gender, and people with various physical conditions (Pregnant Woman, Wheel Chair Bound Person, Vision Impaired), among other things. To put it another way, the BRT system allows us to create our cities holistically so that everybody may proudly utilize them.

[7] Neuenfeldt et al (2016) These authors studied his research work on "The scientific research context of urban transports for Bus Rapid Transit systems applications" and conclusions are given that, It was discovered that there is still a need for public transportation research, particularly in the context of BRT, where we found just six papers with this concentration. There is a need to develop techniques to promote the performance evaluation of installed systems to argue the possibility of a broad field for exploration, particularly for issues related to ways to optimize the public spaces required for urban displacements to occur in the most efficient manner possible. As a result, it may be concluded that scientific study on urban transportation is still in its early stages. . In terms of future research potential, it is envisaged that, in the future, tools geared to the issue will be developed and utilized to address various management challenges related to Transportation Engineering systems, following the study's context.

[8] Vo Van Dut (2017) The author studied his research work about "Accessibility And Connectivity Challenges of Mass Rapid Transit In Kuala Lumpur, Malaysia" and conclusions are given that, MRT is one of the most popular means of transportation in many cities because of its great efficiency and large energy savings—both important economic and environmental concerns. They are usually reasonably priced, offering high-quality service at a fair price. MRT also allows for interaction with existing rail networks, resulting in more dependable public transportation in cities. Local governments must address both accessibility and connection to properly adopt MRT. MRT's successful implementation can aid in the reduction of traffic and pollution, as well as the decarbonization of metropolitan areas.

[9] Mutyam Vijaya Bhaskar Reddy (2017) These two authors studied his research work about "Pre-Feasible Study For Introducing Bus Rapid Transit System In Jalandhar" and conclusions are given, that, In a wide range of circumstances, BRT systems and monetary advances can entice new passengers to travel and commence transport-related land use. BRT systems are high-capacity, low-cost public transportation systems. Integrated BRT enhances the efficiency of existing transit systems by improving their flow. The majority of highways in Jalandhar have a right of way of fewer than 30 meters. The volume of pedestrians and two-wheelers is significant, necessitating additional right-of-way width. The roadway width is typically 14-20m, occupying the majority of the right-of-way width and minimizing the area necessary for the pedestrian facility. There is no pedestrian crossing on the city's main route, as far as we can tell. Through traffic, the inference is created. The number of private automobiles in Jalandhar is rapidly increasing, and there are no parking spaces for them. On-street parking is used by the cars, which limits the road width available for traffic movement. Because of the huge population of students and employed people in Jalandhar, the peak hour is from 8 to 10 a.m. The movement of public transportation in Jalandhar city is inadequate, with maximum speeds of 18-25 kph. This is because the number of private buses and minibusses has increased. The average delay time on Jalandhar's roads is more than 60 seconds. This is due to poor traffic management and crowded highways.

[10] Wani, Singh (2018) These two authors studied his research work about "Mass Rapid Transit System (MRTS)-A sustainable Transport System" and conclusions are given that, Metro systems are more dependable, pleasant, and safe than road-based systems, and they help to decrease traffic congestion. However, systems designed in India have shown cost overruns and capacity underutilization. The methodology and reasons used to support these systems must be thoroughly scrutinized. A high-capacity system does not always imply a high level of demand. The whole travel of commuters, including access time, should be included when estimating passenger demand for transportation services.

[11] Debasis Sarkar (2018) The author studied his research work on "Integrated Mass Rapid Transit System for

Smart City Project in Western India" and conclusions are given that, Multiple linear regression analyses were performed after assessing numerous parameters by which MRTS integration would become achievable via questionnaire survey, yielding the following findings. The most critical determinants for switching to public transportation, according to the multiple linear regression analysis, were journey time, cost savings, and comfort rating. In terms of individuals switching to public transportation, cost savings and accessibility were not as crucial. The comfort rating exhibited the highest coefficients, followed by trip time savings, with cost-saving and accessibility having minimal effects on mode shifting behavior. It's also worth noting that, when compared to other more relevant criteria like comfort and travel time savings, age, gender, and employment were not statistically significant. Integrating different modes of transit on different routes, such as a metro rail with BRTS, metro rail with Indian railways, metro rail with monorail, and BRTS with the monorail, appropriate locations for developing multimodal hubs are found by proposing different modes of transit on different routes.

[12] Aqib et al (2019) These authors studied his research work about "Rapid Transit Systems: Smarter Urban Planning Using Big Data, In-Memory Computing, Deep Learning, and GPUs" and conclusions are given that, By combining four cutting-edge technologies: big data, deep learning, in-memory computing, and GPUs, we have suggested a comprehensive solution to large-scale and speedier metro system characteristic prediction. To show the success of our suggested strategy, we used the London Metro system as a case study. The RODS data was used to estimate the number of people that traveled to and from each London Metro station using the various entrance and egress options. We've also forecasted the number of people who would commute between specified pairs of stations at different times. Furthermore, we forecasted the number of passengers commuting between specific OD station pairs to look at the link between the number of passengers and the distance between the stations. The forecast enables improved spatiotemporal planning of the whole urban transportation system, including the metro subsystem and its many means of entrance and egress. In our deep learning models, we employed CNNs for prediction. The accuracy of the predictions was assessed using MAE and MAPE, as well as a comparison of actual and expected metro features. A variety of forecast accuracies, from high to fair, was collected and discussed. This is the first research of its type to use cutting-edge technologies to simulate and forecast the performance of a real rapid transit system holistically.

[13] Verbavatz et al (2020) These authors studied his research work about "Access to mass rapid transit in OECD urban areas" and conclusions are given that, We get comparable findings using identical definitions for cities and transit systems, supporting our technique and computations. To make future research easier to compare, we advocate utilizing the Functional Urban Areas definition of cities, which is widely used and already standardized across OECD nations. When it comes to transit systems, we believe it is more relevant and verifiable to assess them according to their categories (Rail vs. Road) rather than arbitrary and less universal spacing and timetable criteria. As a consequence, after confirming that our technique is sound by comparing our results to those in the IDTP report, we opted to preserve our unmodified estimates for the cities under consideration.

[14] Patel et al (2021) These authors studied their research work about "A Case Study on the Urban Mass Transit System and Sustainable Development in India" and conclusions are given that, Bengaluru's transportation system and strategies to improve the present public transportation situation by implementing two sustainable transportation policies: BMTC's fare restructuring policy and the installation of BRT lanes. According to the report, reorganizing the BMTC bus service's fares and installing BRT lanes will assist decongest Bengaluru's roadways while also cutting automobile emissions. After studying the current travel pattern by different modes and discovering that there is a need to minimize the rate of increase of bus fees for journeys of short and small-medium lengths, the report advises that bus rates be revised. The simulation reveals that restructuring the BMTC rates has a favorable effect, as it increases the mode share of buses by over 2% while simultaneously boosting revenue by over 15%. According to emission plots, the fee restructuring would cut total Vehicle Kilometers Traveled (VKT) by all modes combined, reducing NOx, CO, CO2, PM, and HC emissions into the environment. The establishment of Bus Rapid Transit (BRT) lanes on a few key metropolitan highways not served by proposed or planned metro lines is also recommended in this study. The BRT lanes are critical in the city because public transportation buses are becoming increasingly unreliable owing to severe traffic congestion at every intersection. The BRT lanes will significantly improve the performance of bus transportation in the city by significantly improving its speed on crowded and busy roadways. According to the analytical output and emission plots, BRT will boost BMTC ridership by more than 4%, increase income by about 23%, and substantially reduce NOx emissions as well as total Vehicle Kilometers Traveled by all modes. When both possibilities (fare and BRT) are considered combined, the BMTC's ridership and income will grow, even more, resulting in better and more sustainable urban transportation in the city. Further analysis of BMTC's income revealed that the EMPKMM is growing by 2% and 9% from BAU to S1 and S2, respectively.

[15] Weiwei Liu et al (2021) These authors studied his research work about "Study on the Selection of Middle Urban Mass Rapid Transit System and Adaptability Analysis" and conclusions are given that is a critical path for urban transportation development both at home and abroad. The general situation of the development, application, and technical characteristics of three types of traffic in the city MRT system (BRT, ART, and modern tram) are summarised, the research analyzed the main factors affecting system

choice, using the data envelopment analysis DEA, the absorption of expert experience and knowledge at the same time reflects the importance of easiness. For Yongxiu County to select a somewhat adequate development standard. The selection of a standard for urban rail transit is a complicated system engineering problem with several affecting aspects. This report is merely a first look at the topic; more research is needed to improve the existing assessment index system. The peak period is used as the research goal in a study on the standard selection of a mid-volume rapid transit system in Yongxiu County. The travel plan can be more precise according to the traffic demand of a certain period on a route, and the marshaling method can be defined in future research.

3. CONCLUSION

The main difference is that most Asian developing city structures have been solely developed under a road transport city plan and a lack of land-use control, resulting in a variety of problems such as poor urban development patterns, low-density urban sprawls, haul lines, and space deficiency to establish transit corridors, as well as traffic congestion. At bus stops, proper attention must be paid to pedestrian approach, crossing, and circulation. The challenges of pedestrian circulation and passenger transfer should be minimized by the further development of BRT stations and layouts. This means that stations should be as close as possible to junctions. Transit stations should be positioned in the center of the service areas they are intended to serve.

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