A STUDY OF PUBLIC TRANSIT SYSTEM PLANNING FOR THE FUTURE METRO PROJECT OF BHOPAL CITY

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ABSTRACT

The most unique civilization in the history of nature, the human civilization, is one that can reason and utilise the available resources for its own benefit. However, when it came to moving from one location to another, this evolved species also encountered a significant challenge. Transferring any important artefact from one location to another had caused considerable turmoil. Then the wheel, one of the oldest and most significant inventions in human history, was created. Everything became incredibly simple and practical. However, it had only been the beginning, laying the groundwork for the wonderful and vast transport system that we are now accustomed to seeing all around us. Nobody anticipated that travelling may actually become simple and convenient. However, a fresh page was added to the story of human civilization, the pages that listed the two Brobdingnagian pillars of urbanization and industrialization. These two innovative steps propelled the creation of the automobile into the future. However, in this highly developed period of transit, it has been demonstrated and tried to be fairly expensive for people from the middle class and lower social classes. The concept of conveyance was then added, and this is the central concept of our research. Increased demand for travel results from an increase in population. One of the most populous towns in the state of Madhya Pradesh is Bhopal. It faces an outsized range of travel demands. Now a days, Bhopal deals with an explosive growth in vehicle possession and utilization. Conveyance operators are forced to put stress on the monitoring observance of the services provided in an endeavor to handle the increasing rate of automobile possession.

1. INTRODUCTION

1.1 GENERAL

Public transport is in great demand in Indian cities since relatively few people own personal vehicles. Except in a few big cities, a vast portion of residents rely mostly on public transportation due to the low personal automobile ownership rate. People with lower incomes give up comfort for less expensive transportation services, but those with intermediate or higher incomes and those who own cars prioritise comfort and high levels of service.

Bhopal City (A Brief Outlook)

In addition to serving as the administrative centre for both Bhopal District and Bhopal Division, Bhopal serves as the capital of the Indian state of Madhya Pradesh. It is also one of the greenest cities in the world. It is the 131st largest town in the world and the sixteenth largest in India. A remarkable blend of natural beauty, old world charm, and contemporary urban planning can be found in Bhopal. This charming village also goes by the name "City of Lakes." Bhopal has developed into a modern city that preserves the aristocrati c hallmark of its former rulers despite being hip. Town has grown through time into a multipurpose regional centre for sociopolitical and economic activity. The town of Bhopal is separated into two sections: the old town and the newly created area with bodies, institutions, businesses, and homes. In Madhya Pradesh, Bhopal is the second most populous district after Indore. According to preliminary population totals from the 2011 Census of India, the Bhopal district has a population of 1,433,875 people spread across 2,772 square kilometres. The population density is 854 people per square kilometre on average. The district has an 82.3% literacy rate. The primary mode of transport in the town is currently provided by bus services. Even though buses provide the most passenger-kilometers of travel when only considering the town's mechanized transits, their proportion of total trips taken by people is still relatively low. As a result, there is significant room for improving bus modal share by enhancing bus service in Bhopal town. But during the past 20 years, the number of people using public transport has steadily increased. With the advent of modern technology, easy access to governmental programmes, and Bhopal serving as the state capital, a sizable population began moving there in search of better economic possibilities and a reasonable quality of life.

Large cities like Bhopal have grown significantly as a result of global expansion and urbanization, which has been exacerbated by an unanticipated increase in travel demand. Contrarily, the supply of transport facilities and services has fallen well behind the need. Because public sector budgets are generally constrained, funding for transit improvements is woefully insufficient. The majority of transit facilities operate well beyond their style capacity. Additionally, facilities for bikes and pedestrians are virtually nonexistent in most places, requiring them to share congested right-of-ways with rapidly moving motor vehicles. Cities that rely on road transport are experiencing social

and economic problems as a result of rising population and automobile use. Similar to this, many problems like accumulated travel time, accidents, etc. may arise as a result of the persistent traffic congestion.

As asult, Bhopal implemented its BUS public transit system, also known as BRTS. This increased the pressure on the city's road-based general public transit system. The Bhopal Municipal Corporation opened the corridor from Misrod to Sant Hirdaram Nagar in 2013, but it has faced opposition from the community ever since. Along from causing regular traffic bottlenecks on both sides of the corridor, the construction has also brought up significant safety concerns.

There are currently requests that th e project be stopped and the built structures be taken down, even from the city's non-appointive delegates. The Bhopal Municipal Corporation (BMC) established BCLL as a Special Purpose Vehicle (SPV) in order to add a unionized component to Bhopal's public transportation system. The majority of town roadways are only 60 metres wide. The basic design for creating a corridor in this case was flawed.

The Bhoj metro, also known as the Bhopal Metro, is a public transport system that is currently under development and is intended to serve Bhopal, India, the capital of the Indian state of Madhya Pradesh, in order to make up for the losses brought on by the BRTS system. However, the success of the railway line rail project largely rests on how easy it is for the general public to reach; as a result, a plan for building Bhopal's transit system of roads in addition to the railway line rail project needs to be developed. The Bhopal metro can provide Bhopal with affordable and dependable transit while cutting down on time and pollution.

1.2 NEED OF STUDY

Even though only a third of Indians live in urban areas, our cities' roadways are already congested with private vehicles, according to the 2011 Census. According to the government, 60% of people will live in cities by 2050. This can put further strain on the system of transportation. To add to the issue, experience has revealed that a single installation model might not include all relevant urban agglomerations. With turnaround times growing every day, operating bus services in congested areas grew more and more challenging. In almost all public enterprises, fleet sizes have decreased rather than increased to meet demand. Given these challenges, India faces a serious travel conundrum. Solutions have to be compelled to be developed quickly if we tend to don't wish to be caught during a severe jam.

The predicted and actual issues in the previous metropolises, including New Delhi, Mumbai, Kolkata, Bangalore, etc., were researched and experienced in relation to the future metro train project in Bhopal. One of the most significant faults in the system that was discovered was that the public transit system's road link to the metro stations couldn't keep up with the demands of the cities' constantly expanding populations.

The board of customer satisfaction defines a higher concern when services are provided when the quality criteria are not clearly specified. In order to facilitate performance comparisons both within and between industries, a great deal of study and money have been spent on establishing accurate methods of evaluating customer satisfaction at both the macro (national) and micro (organisational) level. Wherever there may be a large number of different clients, whose expectations and visions for the grade of service they require to use aren't upfront established, their needs make an outstanding mix. Users of those services can each define their own expectations independently, but residents' expectations may be vastly different. For this reason, we divided the population into the four age groups mentioned in the abstract earlier and conducted a systematic and practical survey. We provided a few justifications for our desire to conduct a study on fraudulent customer satisfaction in public transit.

2. LITERATURE REVIEW

Hong et al. investigate on used panel data the before-and-after impact of a new light rail transit line on active travel behavior. Participants were divided into a treatment group and a control group (residing <½ mile and >½ mile from a new light rail transit station, respectively). Self-reported walking (n = 204) and accelerometer-measured physical activity (n = 73) were obtained for both groups before and after the new light rail transit opened. This is the first application of an experimental-control group study design around light rail in California, and one of the first in the U.S. Our panel design provides an opportunity for stronger causal inference than is possible in the much more common study designs that use cross-sectional data. It also provides an opportunity to examine how an individual's previous activity behavior influences the role that new light rail transit access plays in promoting active travel behavior. The results show that, when not controlling for subject's before- opening walking or physical activity, there was no significant relationship between treatment group status ijnd after-opening walking or physical activity. However, when controlling for an interaction between baseline walking/physical activity and treatment group membership, we found that living within a half-mile of a transit station was associated with an increase in walking and physical activity for participants who previously had low walking and physical activity levels. The results were opposite for participants with previously high walking and physical activity levels. Future policy and research should

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consider the possibility that sedentary populations may be more responsive to new transit investments, and more targeted "soft" approaches in transit service would be needed to encourage people to make healthy travel choices [1].

B. Y. Chen and Y. Wang studies ignore human mobility due to the lack of large-scale human mobility data. This study investigates the impacts of human mobility on accessibility using massive mobile phone tracking data collected in Shenzhen, China. In this study, human mobility information is extracted from mobile phone tracking data using a time-geographic approach. The accessibility of each phone user is evaluated using fine spatial resolution across the entire city. The impacts of human mobility on accessibility are quantified by using relative accessibility ratios between phone users and a virtual stationary user in the same residential location. Results of this study enrich understandings of how land use influences relationships between human mobility and accessibility. For resource-poor regions with sparse service facilities, human mobility can greatly enhance individual accessibility. In contrast, for resource-rich regions with dense service facilities, human mobility can even reduce individual accessibility. Overall, human mobility can reduce spatial inequity of accessibility for people living in different regions of the city. The results of this study also have several important methodological implications for including human mobility and time dimension in accessibility evaluations [2].

B. Y. Chen and H. Yuan study travel time uncertainty has significant impacts on individual activity-travel scheduling, but at present these impacts have not been considered in most accessibility studies. In this paper, an accessibility evaluation framework is proposed for urban areas with uncertain travel times. A reliable space-time service region (RSTR) model is introduced to represent the space-time service region of a facility under travel time uncertainty. Based on the RSTR model, four reliable place-based accessibility measures are proposed to evaluate accessibility to urban services by incorporating the effects of travel time reliability. To demonstrate the applicability of the proposed framework, a case study using large-scale taxi tracking data is carried out. The results of the case study indicate that the proposed accessibility measures can evaluate large-scale place-based accessibility well in urban areas with uncertain travel times. Conventional place-based accessibility indicators ignoring travel time reliability can significantly overestimate the accessibility to urban services [3].

Beirao and Sarsfield Cabral presents the results of a qualitative study of public transport users and car users in order to obtain a deeper understanding of travellers' attitudes towards transport and to explore perceptions of public transport service quality. The key findings indicate that in order to increase public transport usage, the service should be designed in a way that accommodates the levels of service required by customers and by doing so, attract potential users. Furthermore, the choice of transport is influenced by several factors, such as individual characteristics and lifestyle, the type of journey, the perceived service performance of each transport mode and situational variables. This suggests the need for segmentation taking into account travel attitudes and behaviours. Policies which aim to influence car usage should be targeted at the market segments that are most motivated to change and willing to reduce frequency of car use [4].

C. Chriqui and P. Robillard describe a model for the transit assignment problem with a fixed set of transit lines. The traveler chooses the strategy that allows him or her to reach his or her destination at minimum expected cost. First we consider the case in which no congestion effects occur. For the special case in which the waiting time at a stop depends only on the combined frequency, the problem is formulated as a linear programming problem of a size that increases linearly with the network size. A label-setting algorithm is developed that solves the latter problem in polynomial time. Nonlinear cost extensions of the model are considered as well [5].

C. Morency et al. explained the potential of smart-card data for measuring the variability of urban public transit network use is the focus of this paper. Data collected during 277 consecutive days of travel on a Canadian transit network are processed for this purpose. The organization of data using an object-oriented approach is discussed. Then, measures of spatial and temporal variability of transit use for various types of card are defined and estimated using the data sets presented. Data mining techniques are also used to identify transit use cycles and homogenous days and weeks of travel among card segments and at various times of the year [6].

Eboli, L., and G. Mazzulla described the Relationships between Rail Passengers' Satisfaction and 18 Service Quality. In there work A Framework for Identifying Key Service Factors. Increasing the use of public transport is one of the most convenient strategies for alleviating the problems resulting from the excessive use of the private car in most metropolitan areas (congestion, pollution, noise, etc.). In order to improve public transport, developing appropriate tools for measuring and monitoring service quality is necessary. Among the various methods for measuring transit service quality the authors choose to adopt a method based on customer perspective because they retain that customers have the right elements for appropriately judging the used service [7]

F. Le Clercq describe a model for the transit assignment problem with a fixed set of transit lines. The traveler chooses the strategy that allows him or her to reach his or her destination at minimum expected cost. First we consider the case

in which no congestion effects occur. For the special case in which the waiting time at a stop depends only on the combined frequency, the problem is formulated as a linear programming problem of a size that increases linearly with the network size. A label-setting algorithm is developed that solves the latter problem in polynomial time. Nonlinear cost extensions of the model are considered as well [8].

3. CASE STUDY

3.1 ABSTRACT OF THE CASE STUDY

In this dissertation, a study supporting the current railway map of Bhopal has been undertaken, and a viewpoint for a reasonably priced transit system to go along with the upcoming railway rail project is developed. The majority of my study is based on my own poorly researched and well-considered opinions, and I believe that I have emerged with a new viewpoint on how the transit system needs to be improved for the passengers' increased comfort in order to prevent the project's collapse. Due to the incontrovertible fact that the success of the entire project depends on how frequently a subway-based transit system is used, the importance of the customer satisfaction index plays a crucial role in all of this Bhopal. The index makes it possible to track service quality, identify the factors that influence client happiness or discontent, and publicize strategies for improving service quality. The proposed methodology has several advantages over the others used to measure service quality, thus urban planners are the only ones who use it. A disclaimer even needs to be included, stating that none of the CSI study is directly related to what I have planned, but rather serves the study's overall proving goal.

3.2 INTRODUCTION TO METRO RAIL TRANSIT SYSTEM

By the year 2050, India is on track to become a superpower, and what is a superpower without consistently engaged citizens.

It has become urgent to develop new methods and integrate the already-existing systems within the transit situation as a result of the increase in urban population. India, like many other emerging nations, has fallen behind in creating a rail transit system to accommodate its rapidly expanding population.

Research indicates that the best mode share of transport, or MRTS, should be around 70%, but only 35% to 45% is actually achieved in Indian metropolises. This is only due to the fact that there isn't any successful connectivity or linkage to the majority of the town's areas by the railway line, and the transit system takes advantage of this drawback to monetize on its own property. With superb engineering and the ability to set out a brilliantly planned city with its resources working for every possibility, a thriving city continuously makes the best use of its resources.

As someone who has spent a significant amount of time in Delhi, I can attest that there are a tonne of challenges the city presents when it comes to real estate and connecting the highways to the railway stations. A bus stop is typically located distance from the train station, which explains why it takes longer to walk there. It also caused some discomfort, therefore as a traveller I usually chose the more comfortable mode of transportation, which is a taxi or rickshaw. In the event of an emergency, I might experience greater discomfort given the time and money I spend commuting. Numerous of these problems are the main causes of one problem, which is that while constructing our cities' road transit systems, urban planners frequently fail to take a variety of factors into account. An individual can significantly improve his quality of life by reducing the amount of time he spends travelling or moving between cities by making some little fixes and substantial modifications to the way our transit system is designed.

Even the city centre railway, which is regarded as the top triple-crown in our nation, is only somewhat triple-crown.

In terms of the domestic situation, Asian nations lack an efficient transportation system. Prior to the creation of town subterranean systems, there was only one city with an underground system, urban centre, which has been active since 1984. There have been significant discussions about a mass transit system since more than 25 years ago, but it was only in 2002 that it actually came into being.

The Bombay Residential Area Railway, also known as the Bombay Native Railway, is a very incredibly productive rail transit system, but it is not as sensitive as one may wish throughout the commute.

Other major cities with a metro rapid transit system include Bangalore, Mumbai, Gurugram, Jaipur, Chennai, Kochie, and Lucknow. These cities' metro systems are relatively new, do not cover a big region, and as a result, have minimal ridership. One could argue that it would be too soon to assess the effectiveness of these systems because they are still in an early stage of development.

The integration of the road transportation system with its nodal points in accordance with the existing nodal points in the road transportation is one of the most effective ways for a city to use its main transit system or the optimum modal transportation system, which is the metro rail.

3.3 THE BHOPAL METRO RAIL PROJECT ROUTE

The Madhya Pradesh government launched the Bhopal metro rail project to address the growing demand for mobility among the city's residents. It will cost approximately Rs. 69.41 billion.

There isn't much of an affordable transport system in Bharat, given the internal situation. There was just one city with an underground system prior to the creation of town subterranean systems, and that city is Calcutta, which has been running since 1984. Since 1995, there have been significant discussions about a mass transit system, but it wasn't until 2002 that it was really implemented.

The urban centre community Railway, which got its name from the natives of the city, is a very incredibly effective rail transit system, but it isn't as sophisticated as one could desire for commuting.

The Bhopal metro rail project will consist of 6 lines developed in different phases.

Already in its construction phase. Number of corridors: 2

1st corridor:

Karond Circle to AIIMS (15 Km) connecting to Purple Line 2 which will be elevated apart from Bhopal station and Bus station. It will connect Karond Circle-Upaj Mandi - DIG Bungalows - Sindhi Colony - Nadra Bus stand - Main station –Aishbag - Pul Bogda - Subash Nagar Underpass-Kendriya Vidyalaya-DB City Mall-Sargam Cinema-HBJ-Naka - Alkapuri Bus Stand - AIIMS.

2nd Corridor:

Bhadbhada Square to Ratnagiri Tiraha (12.87 Km) connecting to Red Line 5 featuring 16 stations, 14 of which will be elevated and 2 underground. It will connect Bhadbhada Square-Depot Square-Jawahar Chowk-Roshanpura Square-Minto Hall-Lily Talkies-Pul Bogda- Prabhat Square-Govindpura Industrial Area-JK Road-Indrapuri- Piplani-Ratnagiri Tiraha Combined Length: 27.87 Km.

At Pul Bogda station, which will serve as a connecting station, the two lines will share a concourse. The inclusion of an integrated network of feeder buses and an intermediate transit system is one of the top concerns for city planners looking to increase accessibility.

As the test region for this dissertation, the Bhopal Metro Line 2's tiny but significant DB Mall, which is now through the first phase of construction, was chosen. Karond Circle, Krishi Upaj Mandi, DIG Bungalow, Sindhi Colony, Nandra Bus Stop, Railway Station, Aishbag Crossing, Pul Bogda, Subhash Nagar Underpass, Kendriya Vidyalaya, DB City Mall, Sargam Cinema, HBJ Station, Habibganj Naka, Alkapuri Bus Stand, and AIIMS are among the locations covered by line 2. This region was chosen because it contains many important locations where commuters routinely go, including a train station, a mall, a school, a grocery shop, a movie theatre, etc. In the DB mall test region, origin-destination data were gathered via sample surveying. The pertinent information gathered for the case study.

3.4 STUDY AREA

Studies carried out over time have shown that a bus route arrangement with a 6–8 km long route close to the rail transit system (in our case, the Bhopal metro rail system), encourages passengers who are travelling by common modes of transportation (other than own vehicles), such as taxis or walking, to transfer to the general public transportation models.

Map-1 Detailed metro route map of the city Bhopal

(Source: www.mpmetrorail.com, Madhya Pradesh Metro Rail Corporation Limited, Government of Madhya Pradesh)

A circular route around the town that concentrates more feeder buses around the major city nodes like MP NAGAR, NEW MARKET, BITTAN MARKET, KAROND, and HABIBGANJ, among others, will make it easier to maximize the area lined and broaden the scope of service, drawing a significant amount of traffic through a passable bypass. According to a survey carried out in various parts of the town of Bhopal, a feeder bus that primarily transports passengers to the mail rail transit stations of a railroad line may be effective in serving oversized residential areas or relatively small markets in places where the traffic is already congested, such as the new town of Bhopal. This however also depends on how the locations where the feeder buses may operate are situated because it would be simpler if they were placed on one side of the railway line. The best route for a feeder bus to serve the Bhopal railway line transit system stations is therefore studied in this article since it is the only circulating feeder route.

4. ANALYSIS OF RESULTS

4.1 RESULT SUMMARY

Such feeder buses ought to be color-coded for the metro stations they service to prevent misunderstanding regarding which bus to take. By using colour coding, it is possible to mentally imprint the knowledge that even illiterate people can comprehend, such as that a purple bus would take passengers to a purple line metro station.

The entire idea of the metro transit system and bus transit system is brought together in order to create a single control unit to administer both types of transit systems in such a way that the fare generated by both systems would fall under one system. This might make it easier to manage several transit systems and make it simpler for users to pay fares.

Such feeder buses can be constructed using the remaining vehicles of the failed BRTS in order to establish new bus routes along the metro lines imagined by the city planners. Smart cards that are given to passengers at the beginning of their journey—in the stations or on the buses—can be used to collect fares, reducing the likelihood of corrupt behaviour on the part of the drivers and resulting in increased revenue for the government at no additional cost.

A person taking a bus at a feeder stop must swipe his revolving credit through the bus's system to record his origin purpose. When he boards a train to travel to his destination, the feeder bus can swipe the cardboard a second time to record his destination purpose. Additionally, this can help the USA understand the commuter behaviour of travellers.

5. CONCLUSION

In this dissertation, urban road link development was examined, along with the prospective demand for link feeder bus services. An ideal bus system was developed with the aid of a circular route model, where passengers can easily access and efficiently utilise resources. The small space of line two of the future railway system station was chosen as a case study for conducting survey and confirming the model's validity. The results of the survey show that travellers prefer the most convenient mode of transportation, and since these resources are lacking, they are forced to use the current model of the road transit system, which doesn't account for their convenience, time, distance or value. There will be several stations in Bhopal that are surrounded by residential buildings, colonies, significant labour areas, pike bus stations, and train stations. The service scope of the railway system transit system will not only provide convenience for the residents, but also for the new people moving into the town. For this, a customer satisfaction study was conducted in order to identify the crucial qualities that would be highly demanded by passengers travelling by bus, raising both demand and supply. As a result, the findings of the study are thoroughly examined, allowing for more practical means of transport and raising the standard of living for town residents, which is what an urban planner constantly aspires to.

6. FUTURE SCOPE

The findings of this study prove beyond a doubt that several factors affect how well clients are treated. It is essential to examine such varied elements in further analysis. Comprehensive interviews and brainstorming with a wide range of respondents may make it easier to create extra meaningful client satisfaction metrics. It is possible to persuade car owners to use public transport on buses. Future research must focus on finding a strategy to persuade people to change their preferred mode of transportation by looking into the types of public transportation that would best suit their preferences. Such issues are managed or dealt on only for convenience and through routine surveys.

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