ORIGINAL RESEARCH ARTICLE

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FEASIBILITY STUDY TO IMPROVE ROUTES OF EXISTING URBAN MASS TRANSIT NETWORK OF VADODARA CITY

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ABSTRACT

Due to rapid urbanization and vehicular growth most of the cities are congested with traffic flow. To mitigate the traffic congestion effective mass transportation system is necessary in the cities. Urban mass transit system can work efficiently if proper routing and scheduling are implemented. The routing plays a very significant role in public transport system. When the development takes place on the periphery of an urban area then additional trips are generated between this area and CBD. To accommodate this additional trips, routing and scheduling of existing urban mass transit system should be enhanced. Vadodara city is an appropriate example of developing city in which residential and other land uses are taking place on boundaries of the city. The existing city bus service is inadequate to handle this increased demand. Therefore, this study is aimed to determine the additional routes and fleet size of city bus service optimally. This study may be helpful to improve existing city bus service by optimal extended routes as per demand considering effective accessibility and mobility.

INTRODUCTION

India's transport sector is large and diverse, it caters to the transport needs of 1.1 billion people. In 2012-2013, the sector contributed about 5.2 per cent to the nation's GDP, with road transportation having a major share of it.1 Good physical connectivity in urban and rural areas is essential for economic growth. Since the early 1990s, India's growing economy has witnessed a rise in demand for transport infrastructure and services. Efficient and reliable urban transport systems are crucial for India to sustain high economic growth. The significance of urban transport in India stems from the role that it plays in reduction of poverty, by improving access to labour markets and thus increasing incomes in poorer communities (Antonio Estache, 2007). Services and manufacturing industries particularly concentrate around major urban areas, and require efficient and reliable urban transport systems to move workers and connect production facilities to the logistics chain. In spite of the large diversity in the urban size,

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form and growth patterns of the 468 cities in India, there are several common factors that contribute to the severity of urban transport problems.

Within the scope of this study, the main objectives are as follows

- To determine the public demand for transportation in the area where mass transit system is not available.
- To determine the routes where allocation of bus service is required.
- To find the possibilities of new routes for mass transit system.
- To suggest the new routes for mass transit system for better operation of system so in order to encourage public to use mass transit system.

Problem Statement

Vadodara city is the developing city in which residential and other land uses are taking place on boundaries of the city. The

existing city (Vitcos) bus service is unable to handle this increased demand. Therefore, additional routes are needed for improving existing City (VITCOS) bus transit network in Vadodara city.

Aim of Study

The Aim of this study is to assess the existing routes and determine the need for new routes where bus service is not available in order to meet the public demand. It is also aimed to prepare optimized schedule of the proposed new routes for the mass transit system so that it is easily assessable for public to rely on transit system.

Objectives

- To identify Route Choice behaviour of Travellers'.
- Test the hypothesis that travel time and travel distance are the only significant factors that influence drivers' route choice decisions.
- To identify that how level of service influence the driver.
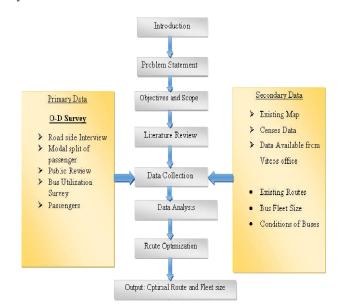- To predict traffic flow distribution on each route.

Scope

This study is limited to the areas of the Vadodara city where mass transit system is not available and it is required to provide mass transit system in those areas. This study may be helpful to improve existing city bus service by optimal extended routes as per demand considering effective accessibility and mobility. This study aims to provide optimal routes and schedules of the mass transportation facility where it is not available.

MATERIALS AND METHODS

Road-side Interview Survey

Road-side interview survey is one of the methods of carrying out a screen-line or cordon survey. The road side interview survey can be done either by directly interviewing drivers of the vehicles at selected survey points or by issuing prepaid post cards containing the questionnaire to all or a sample of the drivers. The survey points are selected along the junction of the cordon-line or screen-line with the roads. The cordons may be in the form of circular rings, radial lines of rectangular grids. For small towns, say with a population less than 5000, single circular cordon at the periphery of the town should suffice. The internal travel being light, the external cordon survey in that case will give the origin-destination data. In the case of medium sized cities, say with a population in the range 5000 to 75,000 two cordon lines are necessary, the external cordon at the edge of the urban development and the internal cordon at the limits of the central business district. Road side interviews at the intersection of roads with these two cordon lines should be able to fairly access the patterns of travel in such cities. For large cities, the cordon-lines and screen lines may be more complicated, and the home-interview technique cannot be dispensed with. Cordon line and screen line surveys by the road side interview technique serve to check the accuracy of the home-interview survey data. For dual carriage way or roads with very little traffic the traffic in the both the directions each dealt with simultaneously. In other cases the traffic in two directions will be interviewed at different times.

If the survey covers most of the day it may be sufficient to interview traffic in one direction only and to assume that the journeys in the opposite direction are the same as in the direction interviewed. It is impractical to stop and interview all the vehicles. Sampling is, therefore, necessary. The number of samples depends on the number of interviewers and the traffic using the road. It may become necessary to vary the sampling rate at the traffic flow changes during the different parts of the day. Sampling methods should eliminate any element of bias. A convenient method is to sample one in a fixed number of vehicles which every tenth, fifteenth or twentieth vehicle etc. Another simple method is to select the next vehicle as soon as each interview is completed. Since interviews may last for several minutes, vehicles must be stopped in an interview bay so that traffic flow is not obstructed. Suitable advance warning signs should be erected. The interviewers have not statutory powers to stop the vehicles and question the drivers. This makes it necessary to seek the help of the police to control and direct the traffic for being interviewed. The period and duration of the survey are important matters that need careful prior thought. A 24 hours count will not normally be needed, and the survey is often restricted to 16 hours in a day. For the reminder of the day, vehicular counts are, however, made. In order to eliminate bias due to unusual conditions on any particular day, it is the practice to obtain data for each week day.

Study Area

Vadodara also known as Baroda formerly, is the 3rd largest city in terms of population in the western Indian State of Gujarat. Vadodara had a population of 1.7 million people and is on the list of top ten fastest developing cities of India. It is located at 22.30°N 73.19°E in western India. (Source: Census 2011, Government of India). Vadodara is a traffic congested city. Traffic problems are increasing day by day. The reason is increasing private vehicles. Different modes of public transportation are available in Vadodara city like Auto, Taxi, city bus service etc. Among them City bus service is most commonly use because of its flexibility, expandability, and low cost. City bus service operated by "Vinayak logistics Transportation Cooperative Society Pvt. Ltd. (VITCOS)" and is located at the CBD area of city near the bus station. It provides its service throughout the city from 6:00 AM to 9:30 PM. Total 101 number of buses are available for 33 routes with 124 pick-up stands.

No	City Profile of Vadodara	
1	Area of VMC limit	159.3 sq.km
2	Population (2011 censes)	17,54,206
3	Literacy rate	90.63%
4	Total Wards (Administrative)	13
5	Total Road Length	Mettaled-843.05 km
		Unmottled-172.71 km
6	Total area Covered by road	11.47 sq.km which is 10.59% of Total Area

There are some development areas which are selected for this study

Dumad X

Dumad X is located at 22.23°N 73.08°E. It has an area where the travellers coming from Ahmedabad, Surat and Savli are gathered. It is an crossing of NE 1 and SH158.

Sayaji Township

Sayaji Township is a coming in a boundary portion of Vadodara City. It is an area where most of the living persons are workers. The government had made a Township near the Sayaji Township for those who were living in slums before. In this area many new housing schemes are taking in place.

Bill Gam

Bill Gam is the last portion in Vadodara city when you are travelling towards Padara. It is an industrial area and also around the Bill Gam Many residential schemes are taking place. Also, many of them are ready and right now it has been used by peoples.

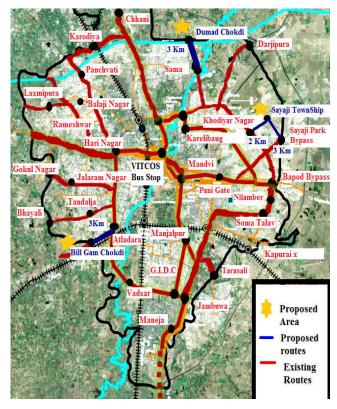**Map of study area showing existist and proposed routes of city bus service is given below**

Figure 1. Existing and Proposed Route of City Bus

Data Collection and Analysis

City Bus service of Vadodara

Initially the city bus service was run by the Gujarat State Road Transport Corporation (GSRTC) and the bus fleet was declined from 200 in 2003 to 85 in 2005. Vadodara Mahanagar Seva Sadan (VMSS) took up the initiative of organizing a city bus service on the basis of PPP model. The VITCOS Transportation Pvt Ltd had entered on 18th may, 2008 after an agreement with Vadodara Municipal Corporation. Gradually the fleet increased and in March 2010 there were 120 CNG buses operated on 42 routes. In May 2013, after expiration of contract with Vitcos, Vinayaka Logistics came into the picture. Currently, there are total fleets of 83 buses with 60 routes. In this buses 38 buses are CNG while 42 buses are Diesel. They also run a 10 setter Van for nearest routes from Bus stop. Around 1,20,000 passengers travels daily in city bus service between 5:45 AM to 9:30 PM. Data collection was conducted by road side interview regarding characteristics of travellers and their willingness to shift to the public transit. Data collection carried out in such a way that main focus will be on daily trip makers. So, data is collected about recurrence of the trip also. Data were collected at all three locations, i.e. at Dumad chokdi, Sayaji township, and Billgam chokdi. Sample size of data collection decided on basis of the pilot survey conducted at those locations.

Dumad: At this location it is observed that around 700-800 trips are produced at those location as it is the focal point of surrounding locality at with people or trip makers gathered to have access to the different modes to reach their respective destination within different localities of Vadodara city. It is decided to carry-out survey for 180-200 samples size, i.e. approximately one fourth of the trips generated from that place. 180 interviews were carried out at those location and then it is analysed.

Billgam chokdi: As per the observation during the pilot survey total 800-850 trips were generated from the place. As it is located on peripheral area of the Vadodara city, people living in that area seek to make trips in the internal areas of city for various purpose such as work, education, medical and all other. Around 200 samples were decided to be collected and total 195 samples were collected at those locations.

Sayaji Township: Total sample size decided as around 250 samples as people living in areas surrounding is having approximate population of 1500. It is also observed that around 1000 trips produced from the location in one day. 267 samples were collected at this particular location and analysed separately.
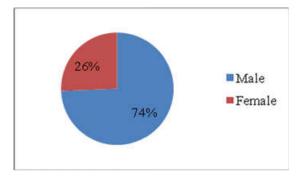

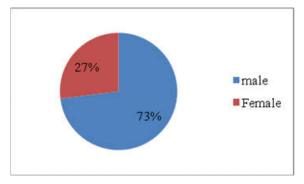**Figure 2. Male Female Ratio for Dumad X Samples**
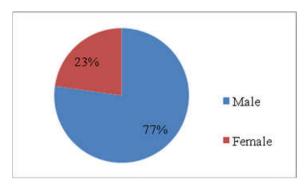
Figure 3. Goods and Passenger Vehicle Share

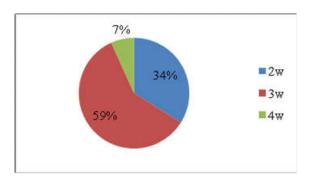**Figure 4. No. of Occupants in Vehicle**

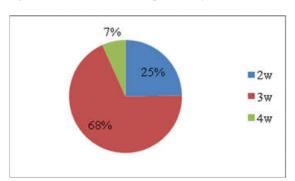**Figure 5. Mode Share of People Surveyed at Dumad X**

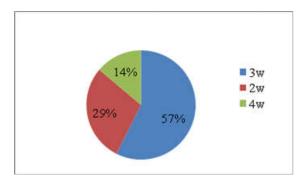**Figure 6. Mode Share of People Surveyed at Sayaji Township**

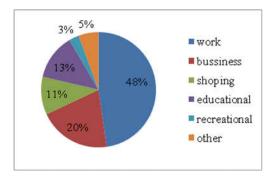**Figure 7. Mode Share of People Surveyed at Bill Gam**

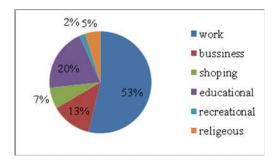**Figure 8. Trip Purpose Classification for Samples taken at Dumad X**

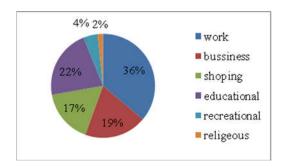**Figure 9. Trip Purpose Classification for Samples taken at Sayaji Township**

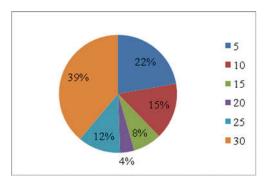**Figure 10. Trip Purpose Classification for Samples taken at Bill Gam**

Figure 11. Percentage Share for Waiting Time Capacity of Travellers for Dumad X (In Min.)
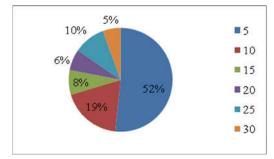

Figure 12. Percentage Share for Waiting Time Capacity of Travellers for Sayaji Township (In Min.)
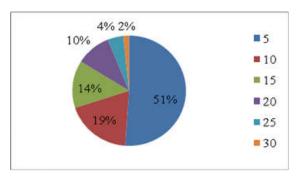
Figure 13. Percentage Share for Waiting Time Capacity of Travellers for Bill Gam (In Min.)
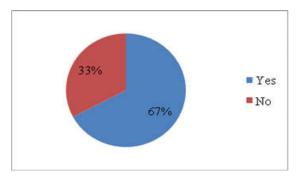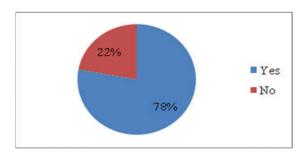

Figure 14. Willingness to Shift for Dumad X

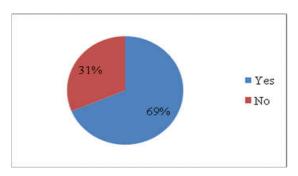**Figure 15. Willingness to Shift for Sayaji Township**

Figure 16. Willingness to Shift for Bill Gam

Conclusion

- The main conclusion of this study is that peoples have shown their willingness to shift to public transit if the service is provided.
- For Dumad X 67% of Persons shown their willingness to shift from IPT or from Private Vehicles to Public Transit.
- Number of trips that will be generated at Dumad chokdi will be 460 public transit trips and 345 trips will be of peak period of 8 AM to 11 AM.

- For Sayaji Township area around 79% of travellers shown their willingness to travel in Public Transit instead of Private Vehicles or IPT's.
- Number of trips that will be generated at Sayaji township will be 470 public transit trips and 353 trips will be of peak period of 8 AM to 11 AM.
- 69% of Travellers are ready to shift to Public transit in Bill Gam Area where 31% have refused to shift.
- Number of trips that will be generated at Billgamn chokdi will be 550 public transit trips and 412 trips will be of peak period of 8 AM to 11 AM.
- The most of the persons who shown their willingness to shift are working salaried persons or students.

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