

**IMPROVEMENT OF GSRTC BUS TRANSIT SYSTEM OF BHILODA DEPOT BY
ENHANCING ROUTING**¹Dhuwad S.A., ²Varia H. R., ³Patel H. B.¹M.E. Student, Tatva institute of Technological studies-Modasa,²Principal, Tatva institute of Technological studies-Modasa,³M.E. Student, Tatva institute of Technological studies-Modasa.

Abstract—This study way to coordinate routing and scheduling in a bus transit modes to satisfy these area passengers such as maximum and minimum departure interval as the demand of public review by considering all among the buses. It had been observed that services are less. A study is conducted to routing of these villages that are less connected or not connected to BHILODA bus transit system. Suggestions are made for appropriate improvement in services based on present study. The need of public transport and importance of punctuality and regulatory in public transportation are outlined. Various performance indicators are defined. All the bus routes which connect BHILODA city depot in Aravalli district of Gujarat state importance location like Idar, Vijaynagar, Himmatnagar and Modasa is taken are study area. Here study is made to less connected or not connected villages on basis of performance of route and schedule is evaluated. Theses studied are highlighted with suggestions to economy and improve transit system performance.

Key words;Routing, Decision support system.

1. INTRODUCTION

Transportation is a main component of supply chain competitiveness since it plays a major role in in-bound inters facility and out-bound facility. In a most of countries transit services are provided by private or government sectors. In these transit sectors provide services to passengers within town or any other place where they can by different modes such as train, bus, car, etc. The primary purpose for the existence of a transit system is to move safely. Bus transport is the most desirable and sustainable system from societal perspective. A well planned bus system can provide a high level of mobility to a large section of the population with least cost. A flexible, comfortable, easily available and reliable bus service may encourage shift from private vehicles to public transport. The public transit planning process is usually divided in a sequence of three steps: (1) The design of routes (2) The setting of frequencies, (3) The timetabling. Such bus stations typically have multiple number of intersecting Routes, connected to multiple parallel or sequential stopping points (platforms). The Buses differ in their types, speeds, desired departure times and arrival times, origins and destination.

2. Identification of problem

More than eight to nine thousand passengers are monthly travelling in Bhiloda Taluka to reach their Bhiloda or surrounding other destination. In absence of an efficient bus system in the villages, people switch to other mode of travel like three wheeler, auto-rickshaws, jeep, and chhakdo-rickshaws on various routes. Therefore, most of the GSRTC (Gujarat State Road Transport Corporation) routes are making loss. To understand the actual problems of existing bus transit routes and to suggest the possible improvement steps the detailed study is necessary, considering this, the present study is focused on the improvements of GSRTC bus transit system at Bhiloda depot.

3. Aim of the Study

The main aim of the study is to suggest improved routing of the existing GSRTC bus transit system at Bhiloda depot.

4. Review of Literature

Han and Wilson (1982) have considered the general formulation of the problem as the minimization of the objective function subject to the constraints of loading feasibility, passenger flow assignment, and fleet size. It was suggested that the objective function in the general case would include wait time and crowding levels. However, a simpler objective of minimizing the occupancy level at the most heavily loaded point on any route in the system was considered. The loading feasibility constraint ensures that passenger demand along each route is satisfied (considering fixed seating capacity) by the frequency of buses allocated to the route. The constraint of passenger flow assignment takes into consideration the flow pattern given the origin-destination matrix and a set of routes with frequencies. In the base allocation stage, the minimum frequencies required satisfying the feasibility, passenger flow assignment, and fleet constraints are computed. In the surplus allocation

stage, final frequencies are obtained to minimize the selected objective subject to the constraints of minimum (base) frequencies and fleet size. In computing the minimum (base) frequencies and the corresponding fleet size, the capacity of bus has been taken to be more than the actual seating capacity allowing overcrowding.

Rao et al. (2001) have represented the base frequencies are determined for the given set of routes (some of these may be overlapping) and O-D matrix for passenger demand. Initially, the passenger demand is assigned to different routes and the load on each route of the network is computed. Base frequencies are worked out to satisfy the demand on the peak-loaded on each route. The demands will be satisfied allowing a certain degree of overcrowding of buses on the peak time. Route choice of passengers is dependent on whether (1) the demand between a particular O-D pair can be served along the shortest paths by more than one route; and (2) a transfer is needed at any intermediate node to satisfy the demand. While the route choice behavior of passengers is influenced by bus frequencies allocated to different routes, the frequencies have to be determined based on the passenger flow assigned to different routes.

M. Savsar et al. (2011) has represented in this paper presents Bus scheduling and routing problems have been studied for more than 40 years. The results show significant improvements and cost savings. In order to analyze the public transport system, a complete study of the current routes and schedules is necessary. The new routing system obtained from the model output will have new schedules for buses and drivers that vary in accordance with passenger demands per time slot. This will result in an improved utilization by 10% with a balanced bus utilization along the routes as well as reducing working hours by 20% which eventually will result in saving costs of salaries by 15%, fuel by 18%, replaced parts by 19%, and depreciation of buses by 19%. Overall, the proposed system is estimated to produce around 100,000 KD in savings per month. The results show that the modeling approach presented in this paper can result in significant improvements in the bus routing system.

Advani and Tiwari. (2006) have represented solving a routing and scheduling problem involves many compromises within a set of conflicting goals and constraints, like using the main roads other than the shortest route, and giving a better average service rather than a better overall service. For a bus transit service, it is always preferable to expand its catchment area as much as possible. But as demand varies with time it is not feasible to provide best services at all the time. Low demand at non-peak hours and high operators' costs result in excess capacity if service levels are not changed. All major destination points should be covered in the route. Therefore service should be provided in a way, which satisfies the major requirements without increasing operating cost. This process usually prompts more modifications, which in turn must be evaluated. Recent publications on operational strategies of bus transit service have addressed the following areas: 1) Route optimization 2) Transfer optimization 3) Feeder buses

Ming et al. (2015) have represented to coordinate timetables in a regional bus transit with multiple transport modes to satisfy numerous realistic constraints, such as maximum and minimum departure intervals, by considering transfer among buses, subways, and passenger special lines with intersecting routes. A multi-mode transport network is categorized into two according to the operational characteristics of each transport mode. A timetable is constantly adjusted to adapt to the fluctuation rule of regional passenger flow, such as conventional public transport, which is recorded as the first level of a public transport network. Few changes are made once a schedule is set, such as in subways and long-distance passenger transports, which are demand as second levels of a public transport network. A synchronous transfer mathematical model of a Multi-Mode Regional Bus Timetable (MMRBT) is established in this study to investigate the first level of a conventional public transport network, wherein the transfer of passengers among public buses, subways, and passenger special lines in the second level of a public transport network is considered. The solutions are obtained via Bacterial Foraging Optimization (BFO). Factors that influence MMRBT are extremely complex. Randomly generating a feasible solution is difficult for individual bacterium. A heuristic algorithm is designed to generate a feasible individual to constitute the initial population to solve the problem

Hsun-jung and Chih-ku. (2007) have represented the performance measurement for transit firms restrict its analysis to the use of either efficiency or effectiveness. Concept of three dimensions of transit performance: cost efficiency, service effectiveness, and cost effectiveness. Effectiveness has two essential components:

- (1) Service effectiveness—the relationship between produced services (e.g., vehicle miles) and consumed final services (e.g., passenger miles)
- (2) Cost effectiveness—the relationship between input and consumed services (e.g., passenger miles or passengers). Cost effectiveness is concerned with the demand side of relationships.

These components lend themselves in a natural way to the identification of catching up and the identification of innovation, respectively. Furthermore, technical efficiency change was decomposed into pure technical efficiency and scale efficiency components.

5. METHODOLOGY

The methodology of work is part of that planning phase. It covers the whole work which is going to be carried out for the completion of thesis. The first step in methodology is to identify the problem; it covers the subject of work. The next is literature review, in this step the previous year's works on that subject are collected and has been studied carefully. The third step is to select study area for implementing thought of work and it should be suitable for objective. After the selection of study area the objective of work should be decided. For achieving that goal, the data collection and data analysis results some remedial measure for road safety is going to be suggested. Last step is to give conclusion of this whole work done.

5.1 Road side interview

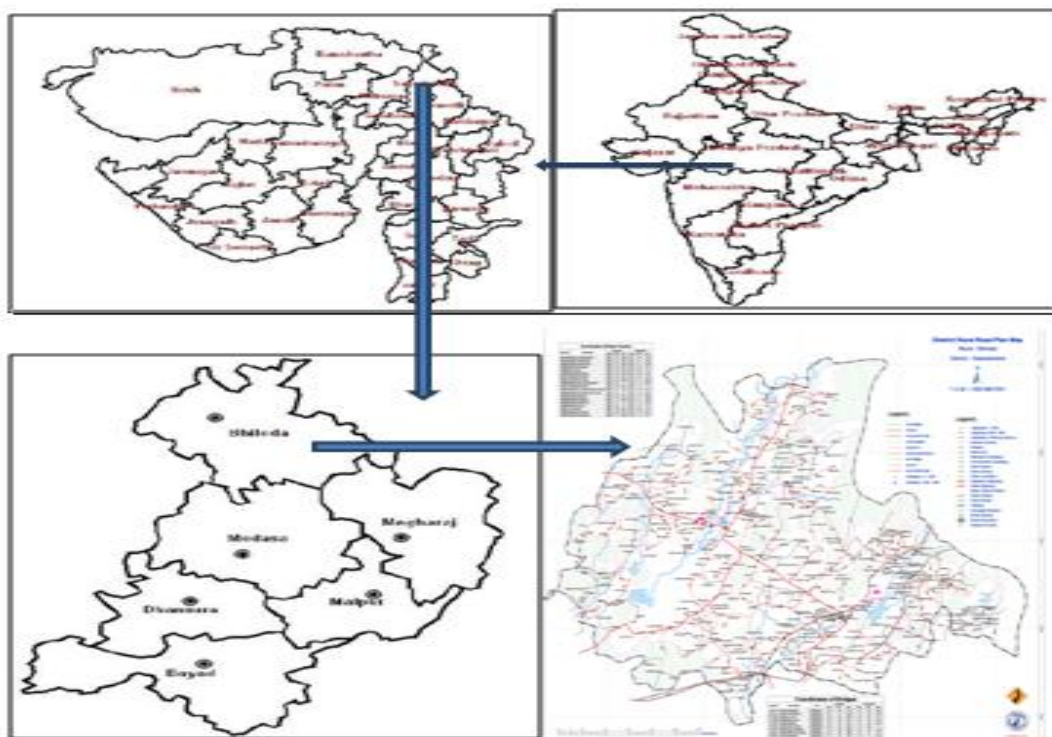
This survey helps to know time wise O-D demand on the stops of bus routes. During interview of the users, their opinion and requirements regarding existing bus service can be collected. This information helps to decide how to improve bus facilities, timings and routes for the Bhiloda depot.

5.2 Mode utilization by the passengers

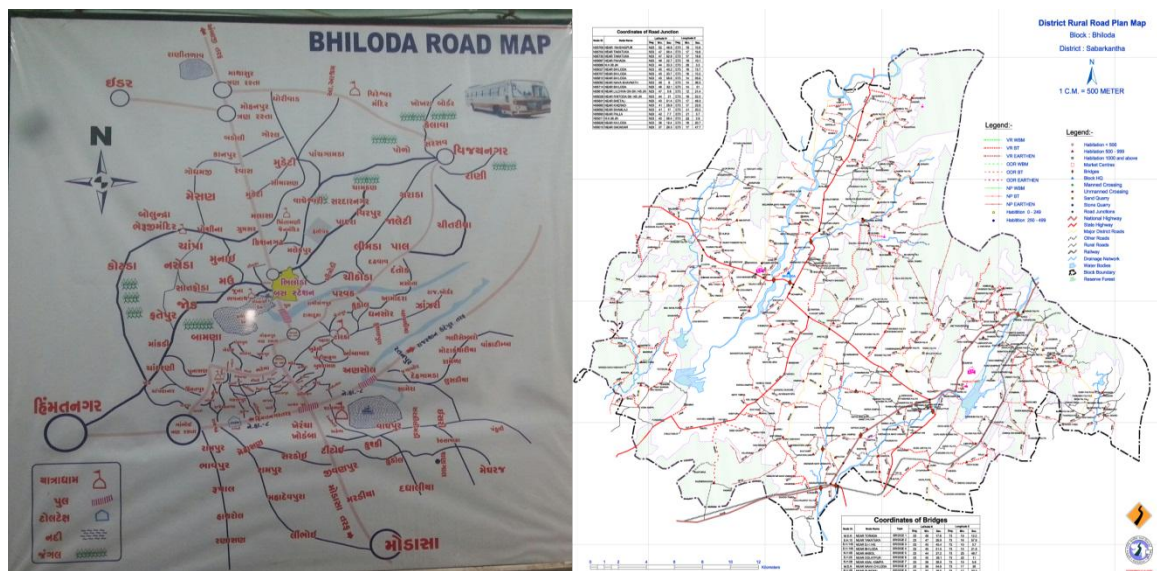
On the existing bus routes passengers use GSRTC bus as well as IPT (Intermediate Public Transit) and personalized modes during the day time. Hence, it is necessary to collect the data of different mode utilization by the passengers on the stops of bus routes. It gives existing percentage share of different modes time wise.

6. STUDY AREA

Bhiloda exists in Aravalli district, Gujarat state with $23^{\circ}28'N73^{\circ}09'E/23.46^{\circ}N73.15^{\circ}E$ at an average elevation of about 80 meters and total area of Bhiloda town is 23.40 sq. km. the total population of Bhiloda 22410 as per census 2011. Bhiloda is located in north corner of Gujarat Bhiloda is 131 KM from the Ahmedabad and 175 KM from Udaipur, Rajasthan. The town is center for social, commercial, residential, cultural, political and economic activities of Bhiloda taluka.



Location of BHILODA taluka



Bhiloda road map

6.1 No. of buses scheduled for each route per day.

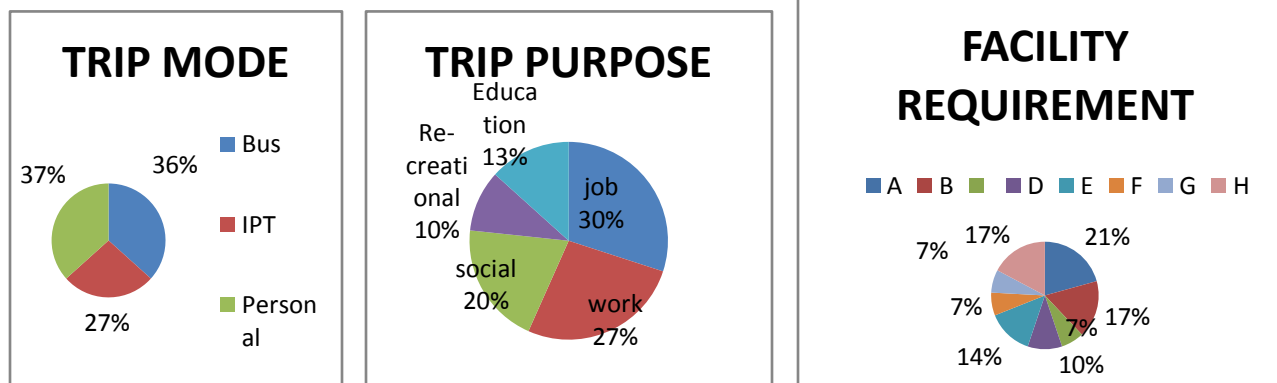
Sr . No.	Route Name	No of Bus Schedule per day
1	Bhiloda To Modasa	21
2	Bhiloda to Himatnagar	34

7. DATA ANALYSIS

(1) For Modasa to Bhiloda Stretch

(i) At Modasa

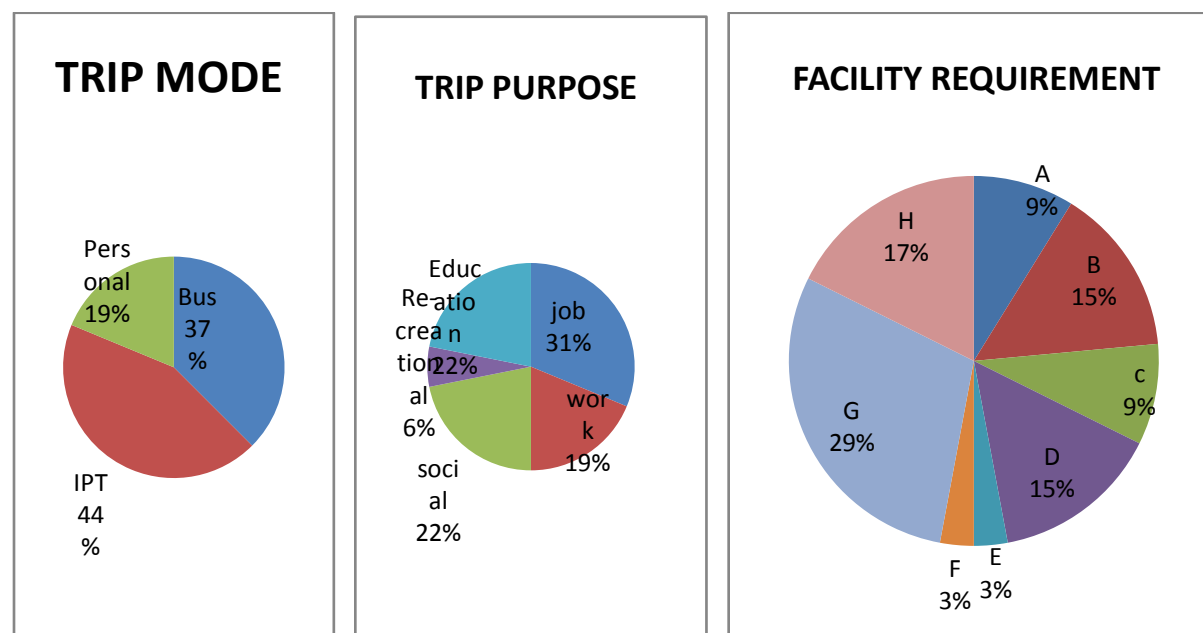
SR.NO.	ORIGIN	DESTINATION	TRIP MODE	TRIP PURPOSE	TRAVEL TIME (Min.)	TRAVEL DISTANCE	FACILITY REQUIREMENT
1	MODASA	TINTOI	BUS	Work	30	18	H
2	MODASA	SHAMLAJI	BUS	Re-creational	40	28	H
3	MODASA	PALLA	BUS	Work	45	37	C
4	MODASA	MARADIYA	IPT	Job	20	11	E
5	MODASA	SHAMLAJI	BUS	Education	40	28	F
6	MODASA	MARADIYA	BUS	Social	20	11	B
7	MODASA	TINTOI	IPT	Work	25	18	B
8	MODASA	SHAMLAJI	IPT	Job	40	28	B
9	MODASA	KHERANCHHA	BUS	Social	35	23	H
10	MODASA	KHODAMBA	PERSONAL	Social	40	25	G
11	MODASA	PALLA	BUS	Work	60	37	H
12	MODASA	SHAMLAJI	BUS	Education	40	28	E
13	MODASA	SURPUR	PERSONAL	Social	20	13	D
14	MODASA	JIVANPUR	IPT	Work	25	12	B
15	MODASA	TINTOI	BUS	Work	25	18	H
16	MODASA	BHILODA	PERSONAL	Job	90	49	A
17	MODASA	BHILODA	PERSONAL	Job	90	49	A
18	MODASA	SHAMLAJI	PERSONAL	Job	40	28	A
19	MODASA	BHILODA	PERSONAL	Job	90	49	A
20	MODASA	TORDA	IPT	Re-creational	80	48	G
21	MODASA	BHILODA	BUS	Social	70	49	E
22	MODASA	SHAMLAJI	PERSONAL	Job	35	28	F
23	MODASA	TINTOI	IPT	Work	25	18	E
24	MODASA	BHILODA	BUS	Work	90	49	B
25	MODASA	MARADIYA	PERSONAL	Job	15	11	D
26	MODASA	SURPUR	PERSONAL	Job	20	13	D
27	MODASA	SHAMLAJI	IPT	Re-creational	30	28	C
28	MODASA	KHERANCHHA	BUS	Social	30	23	H
29	MODASA	SHAMLAJI	PERSONAL	Education	40	28	A
30	MODASA	SHAMLAJI	PERSONAL	Education	40	28	A



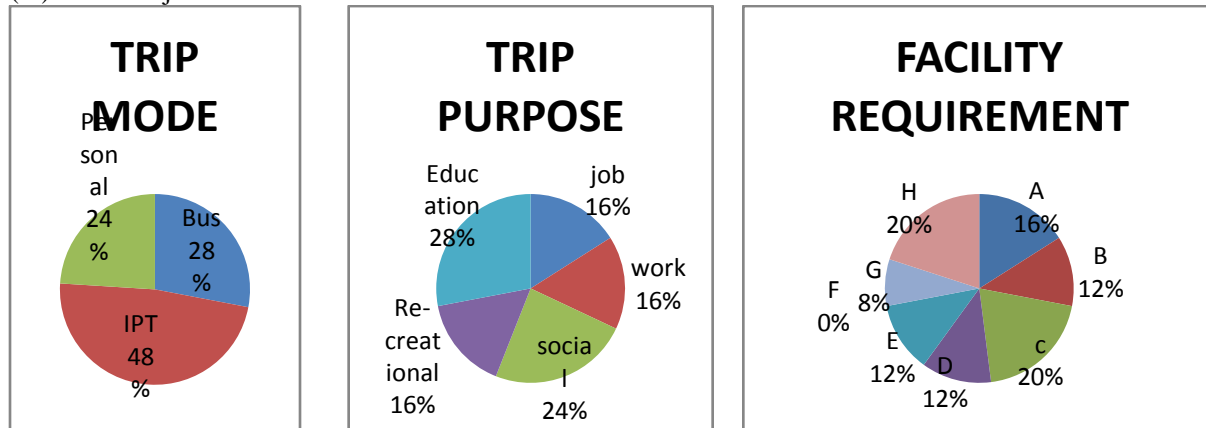
Where,

- A= Less Frequency of bus in peak hour
- B=Average speed is low
- C= Delay due to slow bus
- D=Prefer trip by own vehicle for short distance
- E= Bus timing are not reliable
- F= Less comfort
- G=Bus is not connected up to some village
- H=complete

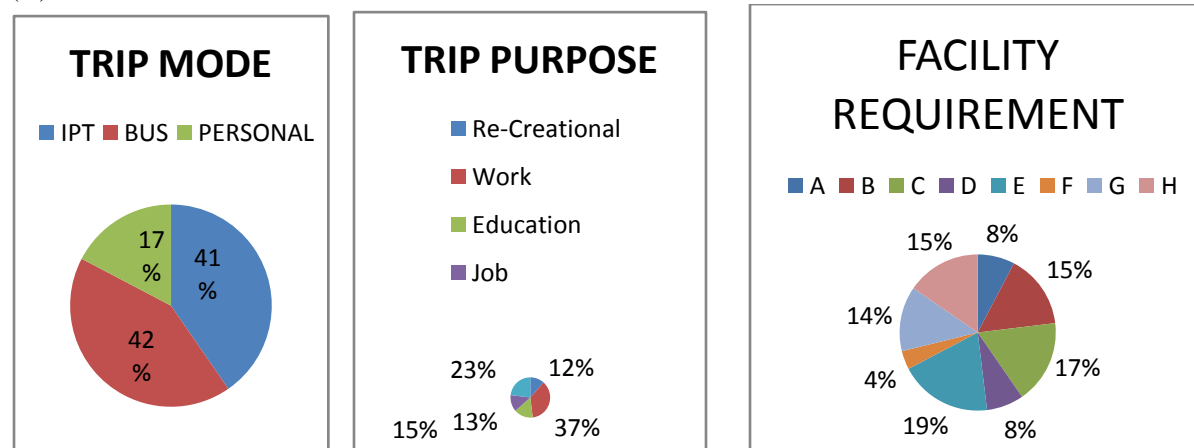
(ii) At Tintoi



(iii) At Shamlaji

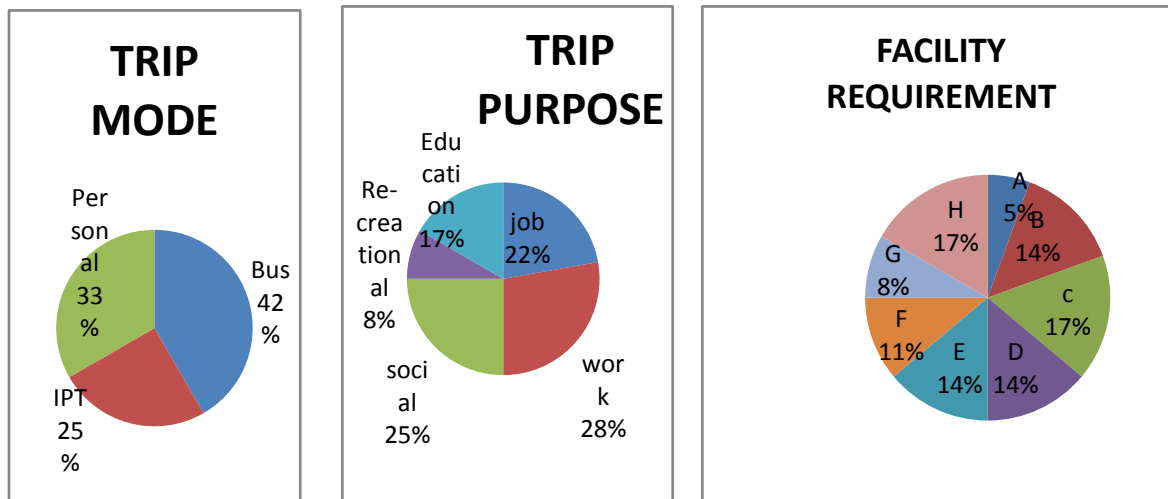


(iv) at Bhiloda

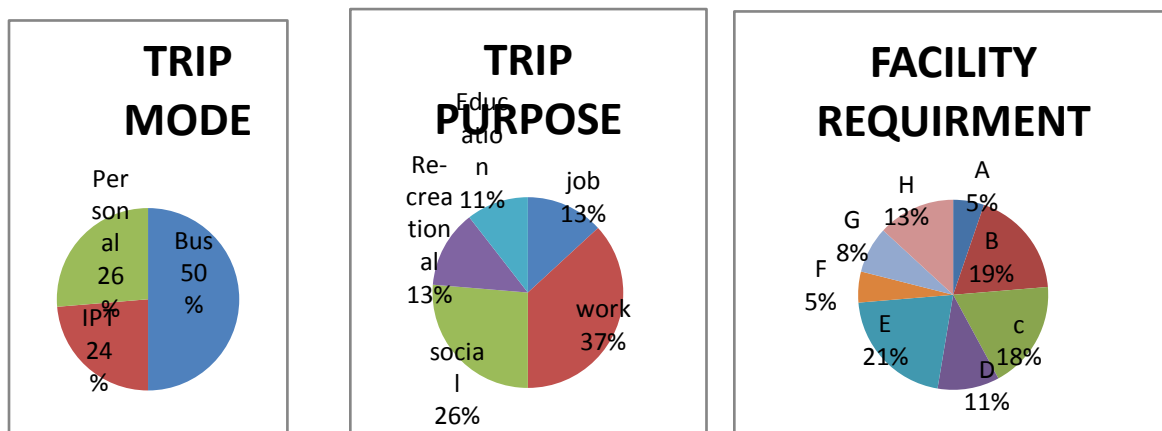


(2) For Bhiloda to Himmatnagar stretch.

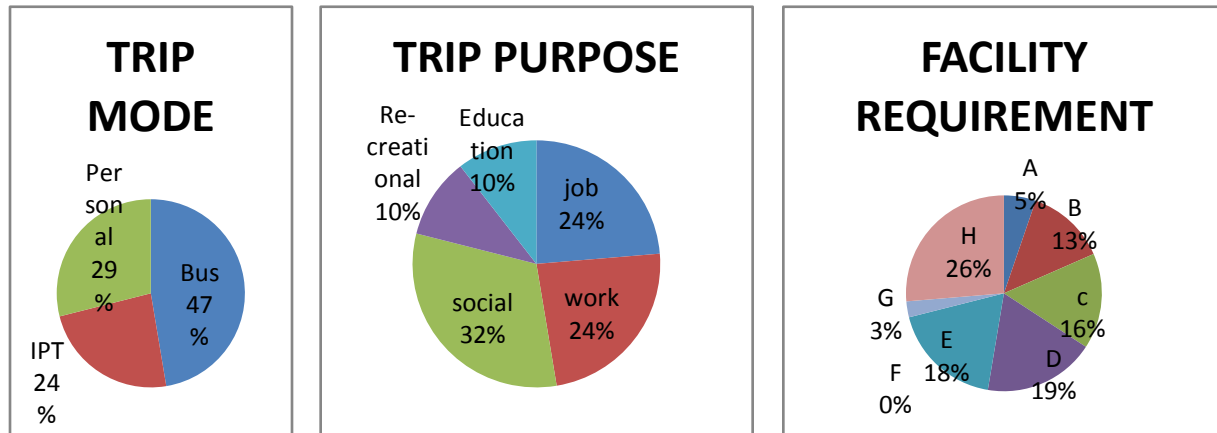
(i) At Mau



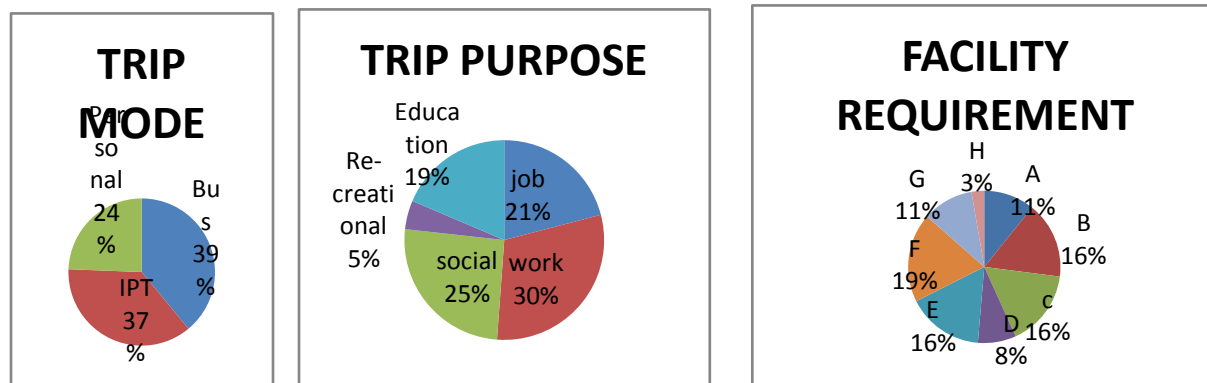
(ii) At Jod



(iii) at chandarani



(iv) At Himatnagar

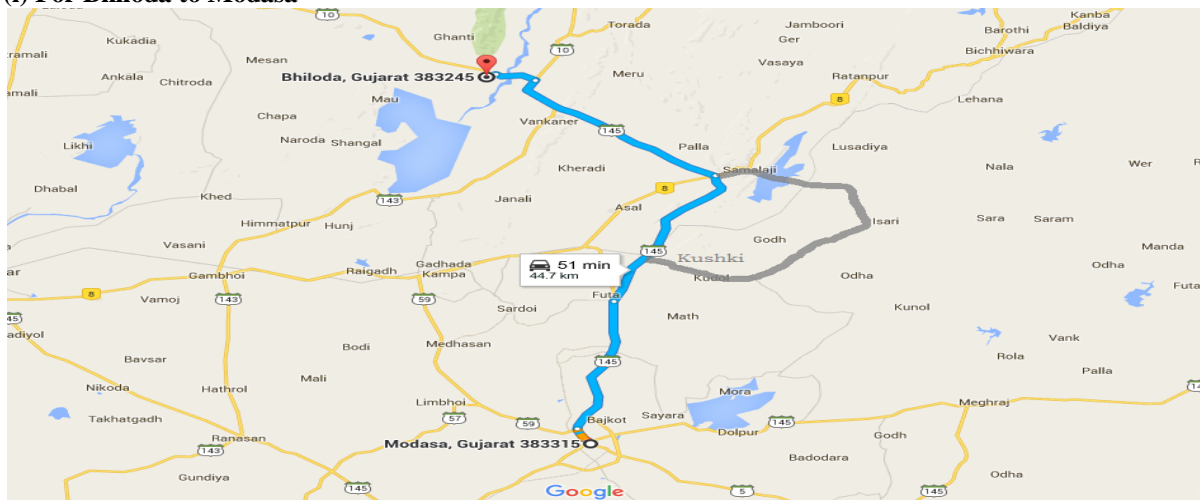


7.2 Actual condition of transportation by IPT mode



7.3 Proposed route for improvement

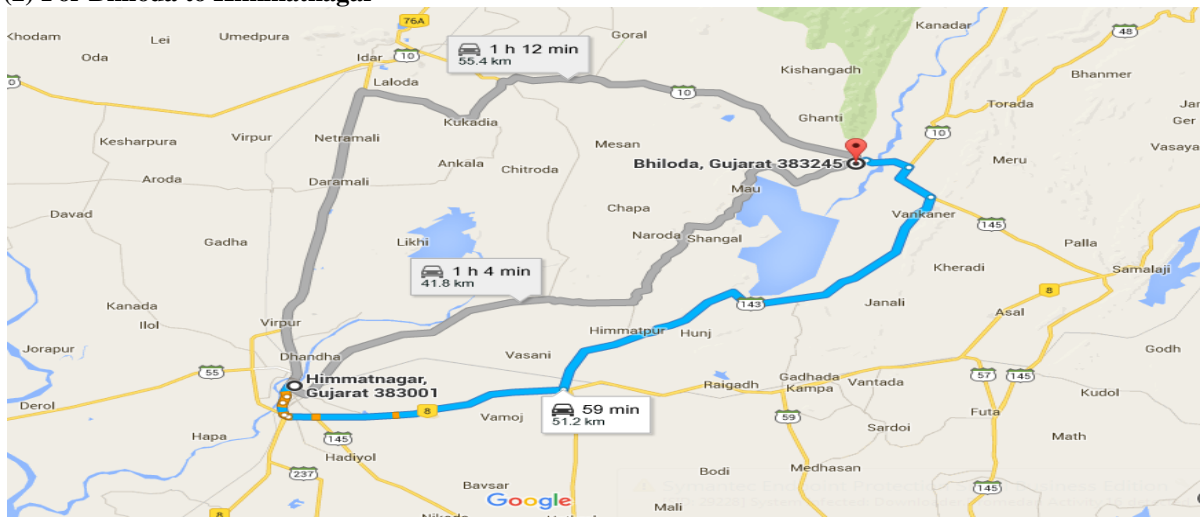
(i) For Bhiloda to Modasa



Proposed improvement in route for Bhiloda to Modasa

The proposed route from Bhiloda to Modasa who shown in fig.5.18 will satisfy the demand of passenger. It is beneficial to earning more revenue which is good for bus transportation system. There are daily 21 trips of buses for Bhiloda to Modasa. Out of these trips, if one or more trips will be diverted to the proposed route, then it provides more comfort to the passengers travelling from the remote villages which generate more revenue. Also, this connectivity to the interior villages will solve the problem of less connectivity. That ultimately improves the socio-economic level of (4 villages, 2100 population) of these remote villages. Due to this proposed route 23 km of route length will be increased which may consume about 4 liter (240 rupees) more diesels. Against net consumption net revenue of 600 to 700 will be generated.

(2) For Bhiloda to Himmatnagar



Proposed improvement in route for Bhiloda to Himatnagar

The proposed route from Bhiloda to Himatnagar who shown in fig.5.21 will satisfy the demand of passenger. It is beneficial to earning more revenue which is good for bus transportation system. There are daily 34 trips of buses for Bhiloda to Himatnagar. Out of these trips, if one or more trips will be diverted to the proposed route or proposed new bus then it provides more comfort to the passengers travelling from the remote villages which generate more revenue. Also, this connectivity to the interior villages will solve the problem of less connectivity. That ultimately improves the socio-economic level of (4 villages, 1500 population) of these remote villages. Due to this proposed route only 7 km of route length will be decrease which may consume about 1.2 liter (60 rupees) less diesel. Against net consumption net revenue of 600 to 700 will be generated.

Conclusion.

- As for the road side interview survey for the route no. 1(Bhiloda to Modasa) not connected villages passengers are in need of S.T. bus service about 52% persons are in fever of S.T. bus.
- For route no. 2 (Bhiloda to Himatnagar) not connected villages passengers are in need of S.T. bus service about 53% persons are in fever of S.T. bus.
- It is found that on the existing route the bus frequency is less and users have to spent more time for average time 40 to 45 minute in peak hour
Therefore they prefer to travel by IPT modes like jeep, chakado, autorikshwo etc...
- Percentage share of IPT mode on route no.1at Modasa 27%, at tintoi 48%, at shamalaji 46%, at Bhiloda 47% and route no.2 at mau 25%, at jod 24%, at chanarani 24%, at Himatnagar 28%.
- According to the existing demand Route no. 1 is proposed to extent to connect 4 villages(2100 populations).
- On the route no. 2 new route is proposed other than existing route between Himatnagar to Bhiloda the newly proposed route connected 4 villages of total population (1500) and revenue generated 700 to 800 rupee per one time going to bus.

References

- Anandkrishna Srinivasan (2011) "Location Based Services to Improve Public Transportation" The University of Toledo
- American public transit association (1998) "Manual for the development of bus transit system safety program plans" bus safety management program
- A.Sbihi and R.W. Eglese "The Relationship between Vehicle Routing & Scheduling and Green Logistics" Department of Management Science, Lancaster University Management School
- Dr. L.R.Kadiyali "Transportation planning and transportation engineering" Mahajan publications
- Electricwala Fatima, Rakesh Kumar(2014) "Introduction of public bus transit in Indian cities" International Journal of Sustainable Built Environment
- Gymmy Joseph Kattor, Abdul Malik K.V., Pretina George (2013) "Analysis of Trip Attraction Characteristics of Commercial Land Use in Medium Sized Towns in Kerala" International Journal of Innovative Technology and Exploring Engineering (IJITEE)
- MUKTI ADVANI AND GEETAM TIWARI (2006) "Review of Capacity Improvement Strategies for Bus transit service" INDIAN JOURNAL OF TRANSPORT MANAGEMENT
- PETER G. FURTH AND NIGEL H.M. WILSON (1983) "Setting Frequencies on Bus Routes: Theory and Practice" Transportation Research Record
- Ramachandra Rao Kalaga, R. N. Datta, and K. Sudhakar Reddy (2001) "ALLOCATION OF BUSES ON INTERDEPENDENT REGIONAL BUS TRANSIT ROUTES" JOURNAL OF TRANSPORTATION ENGINEERING
- Wei Ming, Chen Xue-wu, Sun bo (2015) "Model and Algorithm of Schedule Coordination in Regional Bus Transit with Multiple Transport Modes" Journal of Highway and Transportation Research and Development
- Wei Wang "Bus Passenger Origin-Destination Estimation and Related Analyses Using Automated Data Collection Systems" The World Bank Group

Web site:

www.google.com
www.wikipidia.com