Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 7 Issue 04, April-2018

Analysis of Route Choice behaviour of Trip Makers from Godhra to Ahmedabad

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Abstract: **Efficient transportation network is important for safe and timely movement of passengers and goods vehicles. Generally, people choose the route in such a way that it should minimize the overall travel cost. When there is more than one route available then how the travelers chose a particular route is interesting. Some of the researchers have worked on route choice behaviour. In the proposed study it is aimed to determine that how the travelers chose the particular route and which the significant parameters are for that. In this regard the routes between Godhra to Ahmadabad are selected. There are main four routes: (I) Godhra- Balasinor- Ladvel X- Kathlal- Chhipdi- Odhav- Ahmadabad (127 km), (II) Godhra- Dakor- Mahudha- Khatraj X- Hathijan Circle- Ahmadabad (131 km), (III) Godhra- Dakor- Umreth- Nadiad Bypass- NE 1- CTM- Ahmadabad (147 km) and (IV) Godhra- Sevaliya- Dakor- Nadiad- Kheda- Bareja- Narol- Ahmadabad (151 km).**

A toll plaza existing at Vavadi Khurd, Godhra is an appropriate location to collect the data. Roadside Interview has been carried out at this toll plaza for all types of vehicles which are going from Godhra to Ahmadabad. Travel time, travel cost, place of destination, type of vehicle, commodity in the goods vehicle, etc. parameters has been asked to the vehicle owner/drivers. From this collected data, analysis has been carried out to ascertain the significant parameters for route selection. The results of this study may be helpful for predicting traffic flow distribution on each route.

Keywords: Route-choice behaviour, Roadside Interview, Traffic flow distribution

I. INTRODUCTION

The problem of route choice faced by an automobile driver is complex. First, there are a large number of possible alternative routes through road networks between a origin and destination pair, and there are complex patterns of overlap between the various route alternatives [Antonisse et al., 1989]. Second, the ultimate route choice decision is the result of many factors: travelers' socioeconomic characteristics such as age, gender, income, personality, habits and preference; travelers' driving experience, and familiarity with the transportation network; trip characteristics, including trip purpose, time and location, flexibility in arrival time, availability of alternative routes, and traffic conditions. Third, traffic information influences travelers' route choice decisions, both before the trip and en-route.

The decision-making process of route choice is also a dynamic process. A learning process is central to the driver's cognition as the information acquired through experience of earlier travel choices is processed before the next decision is made. Moreover, the characteristics of each known alternative route do not have the same importance in a driver's final decision. Based on the relative importance of each characteristic, travelers formulate a choice set of sufficiently attractive alternatives. From this set, travelers make their choices. The chosen route is the one that best satisfies their needs and is consistent with their personal constraints and preferences. Finally, inertia also plays a role in choice behaviour, dictating that certain thresholds be crossed before drivers change their habitual behaviour [Polydoropoulou et al., 1994].

A. Problem Statement

Urban commute journeys have been of significant interest to transportation researchers because the journey to work places great strain on the urban transportation system due to its temporal peak. Due to large number of possible alternative routes available on road networks between an origin and destination, and there are complex patterns of overlap between the various route alternatives. Therefore, this study focuses on automotive route choice. Therefore, it is interesting to analyze the route choice behaviour of trip makers. In view of this the proposed study is carried out to analyze the route choice behaviour of trip makers between Godhra to Ahmadabad.

B. Aim of Study

The aim of the study is to determine that how travellers' chose the particular route and which the significant parameters are for that. In this regard the routes between Godhra to Ahmadabad are selected.

C. 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.

D. *Scope*

- This study is limited with available routes to travel from Godhra to Ahmadabad.

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- Determination of the influence of travel-time and travel-cost on driver's route-choice behaviour. Also, determinations of the influence of other factors are there or not.
- This study may be useful for forecasting the traffic on those routes.
- This study may be useful for understanding the behaviour of users for selecting routes from available routes.

II. TERMINOLOGY RELATED TO ROUTE CHOICE

Link: - A roadway segment with homogeneous traffic and roadway characteristics (e.g. same number of lanes, base lane capacity, free-flow speed, speed-at-capacity, and jam density). Typically networks are divided into links for traffic modelling purpose.

Route or Path: - A sequence of roadway segments used by a driver to travel from point of origin to destination.

Traffic Routing: - The procedure that computes the sequence of roadways that minimize some utility objective function. This utility function could be travel time or a generalized function that also includes road tolls.

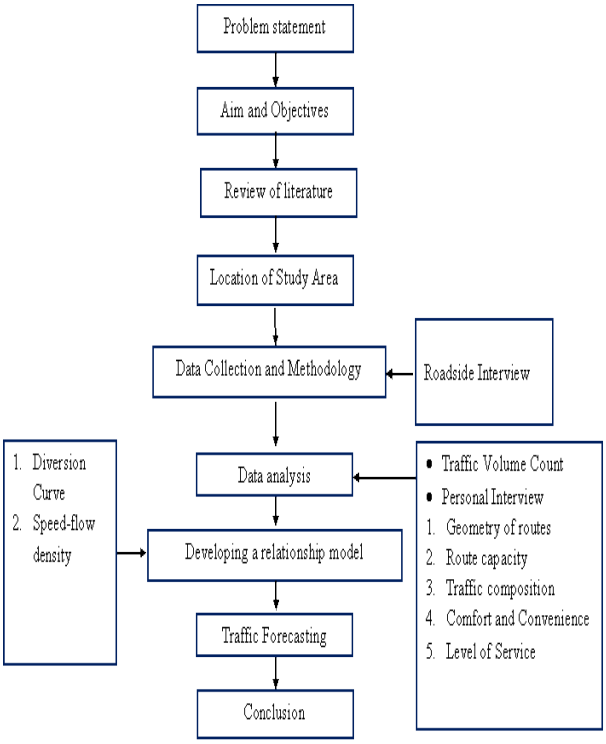
Traffic Assignment: - The procedure used to find the link flows from the Origin-Destination (O-D) demand. Traffic assignment involves two steps: (1) traffic routing and (2) traffic demand loading. Traffic assignment can be divided into static, time-dependent, and dynamic.

User Equilibrium Traffic Assignment: - The assignment of traffic on a network such that it distributes itself in a way that the travel costs on all routes used from any origin to any destination are equal, while all unused routes have equal or greater travel costs.

System Optimum Traffic Assignment: - The assignment of traffic such that the average journey travel time of all motorists is a minimum, which implies that the aggregate vehicle-hours spent in travel is also minimum.

Time-Dependent Traffic Assignment: - An approximate approach to modelling the dynamic traffic assignment problem by dividing the time horizon into steady-state time intervals and applying a static assignment to each time interval.

III. METHODOLOGY



IV. 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

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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.

V. STUDY AREA

In this study the route which have more alternative routes are selected. Some of them are 2-Way 2-Lane and 2-Way 4-Lane which is selected based on options available for traffic to divert on other routes before selection.

Godhra is a municipality in Panchmahal district in Gujarat, India. Godhra is one of the oldest district headquarters of Gujarat before Independence. It is located in the heart of central Gujarat. Godhra city is Tribal and minority dominated area and presently it is a Headquarter of Panchmahal District. Godhra is situated at 22º N Latitude and 73º E Longitude.

Ahmadabad, the economic hub of Gujarat state is declared as Mega City by the Central government in the year 2005. With the city been awarded the status of Mega City a lot of efforts have been started by the local authorities namely the Ahmadabad Municipal Corporation (AMC) and Ahmadabad Urban Development Authority (AUDA) to improve the city's overall development. Ahmadabad is situated at 230 01' North Latitude and 720 41' East Longitude.

National Highway No. 59(New NH47), connecting Ahmadabad with Indore, is one of the important Highway corridors of the country. It serves as an important link to connect Indore-Ahmadabad important cities with its rich hinterland part of Gujarat and Madhya Pradesh. NH-59(New NH47), which originates from Ahmadabad and ends at Indore, en route passing through very important cities & Towns like Kanbha, Kathlal, Balasinor, Sevaliya, Timba, Godhra, Piplod, Limkheda, Dahod, Katwara, Jhabua, Rajgarh, Dhar and Lebad travelling a distance of 376 Km. through the state of Gujarat (212 Km) and Madhya Pradesh (164 Km.). The Concession Agreement was signed between NHAI and M/s BSCPL Godhra Toll ways Limited on 25th February, 2010. The Concessionaire appointed M/s BSCPL Infrastructure Limited as their EPC Contractor for carrying out and implements the project works under the scope of the project highway.

Available Routes between Godhra- Ahmadabad are:

Godhra- Balasinor- Ladvel X- Kathlal- Chhipdi- Odhav- Ahmadabad (127 km),

Godhra- Dakor- Mahudha- Khatraj X- Hathijan Circle- Ahmadabad (131 km),

Godhra- Dakor- Umreth- Nadiad Bypass- NE 1- CTM- Ahmadabad (147 km) and

Godhra- Sevaliya- Dakor- Nadiad- Kheda- Bareja- Narol- Ahmadabad (151 km).

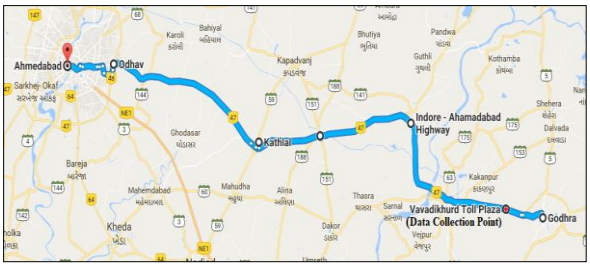

Figure 1 Location Map of Route 1(Source: Google Maps)

Figure 2 Location Map of Route 2(Source: Google Maps)

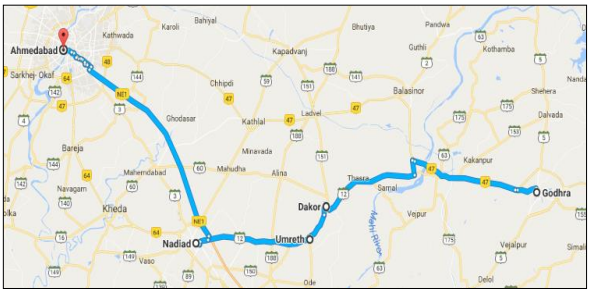

Figure 3 Location Map of Route 3(Source: Google Maps)

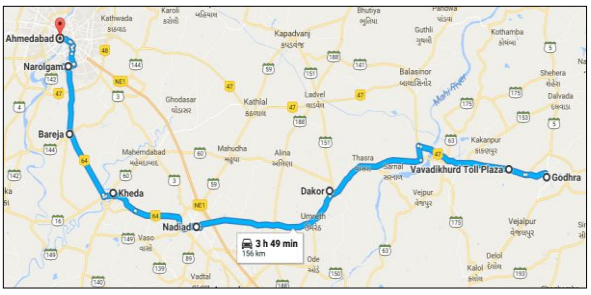

Figure 4 Location Map of Route 4(Source: Google Maps)

International Journal of Engineering Research & Technology (IJERT)
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Vol. 7 Issue 04, April-2018

VI. DATA COLLECTION AND ANALYSIS

A. Basic Analysis

Road side Interview has been done at Vavadi Khurd Toll Plaza near Godhra City. 732 samples were taken on 8th-11th November, 2017. The time period of data sampling is 9:00 AM to 6:30 PM. The questionnaire of the survey is shown at the end of this paper. The analysed data shows result like below:

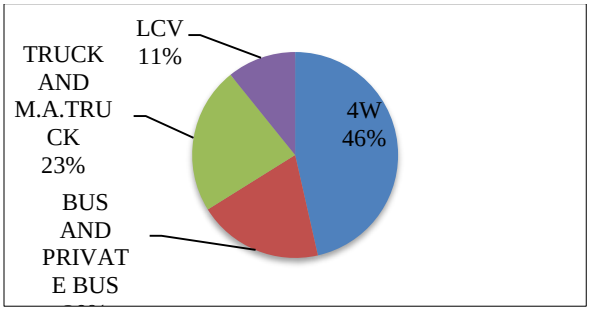

Figure 5 Classified Vehicle Count (In Percentage)

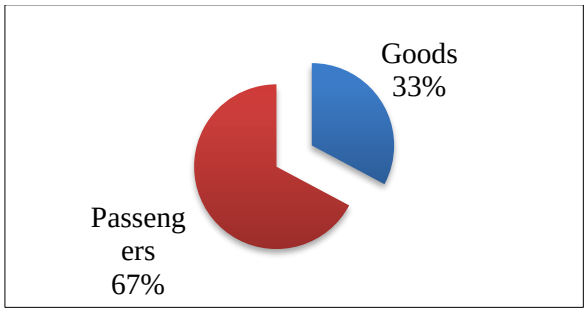

Figure 6 Goods and Passenger Vehicle Share

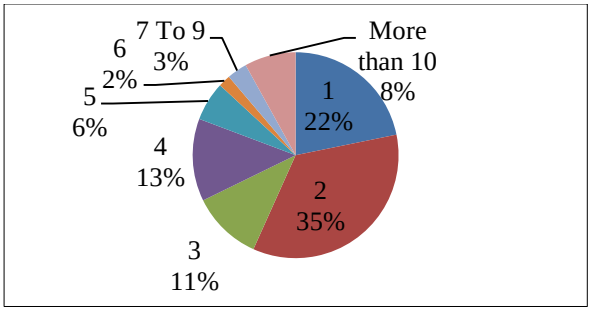

Figure 7 No. of Occupants in Vehicle

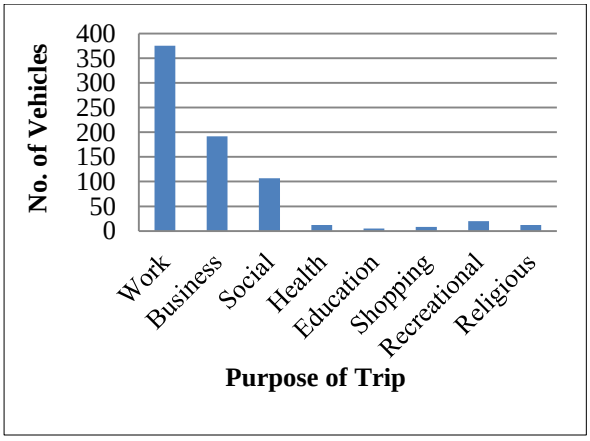

Figure 8 Purpose of Trip

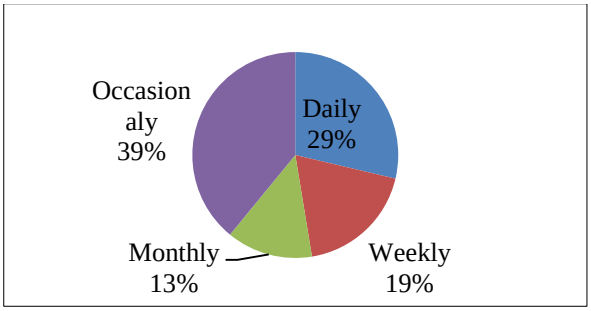

Figure 9 Type of Trip

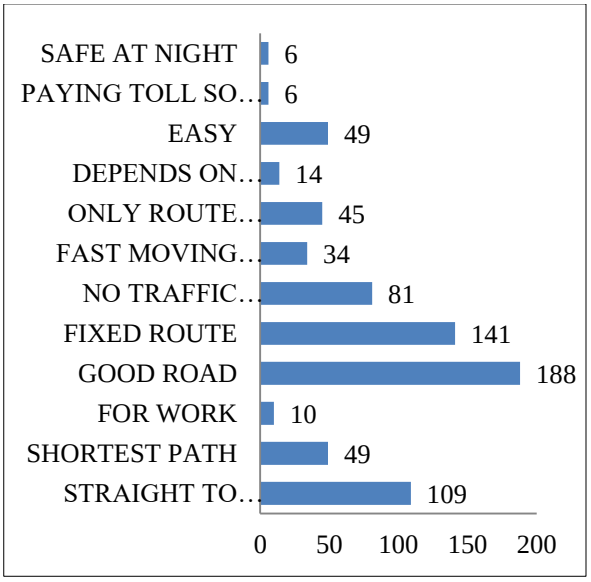

Figure 10 Reason to choose particular route (For No. of Respondents)

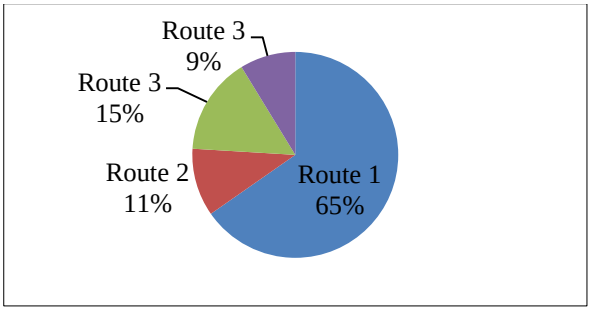

Figure 11 Route Choice Behaviour of all Vehicles

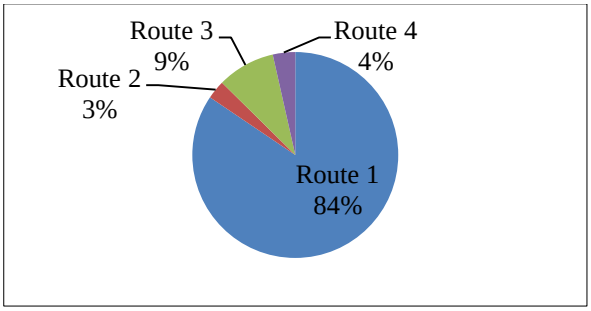

Figure 12 Route Choice Behaviour for 4W

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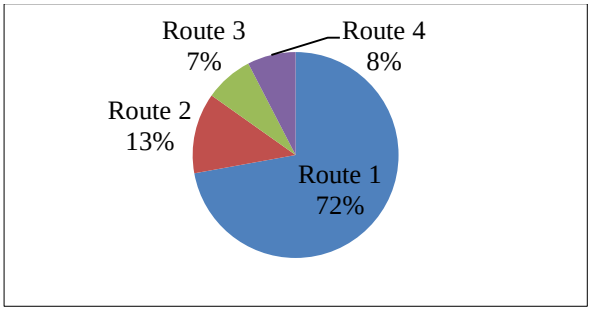

Figure 13 Route Choice Behaviour for LCV

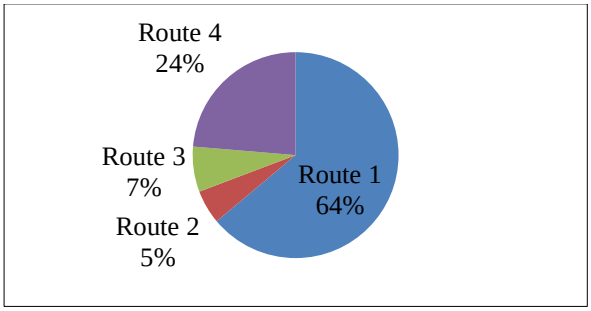

Figure 14 Route Choice Behaviour for Truck and M.A. Truck

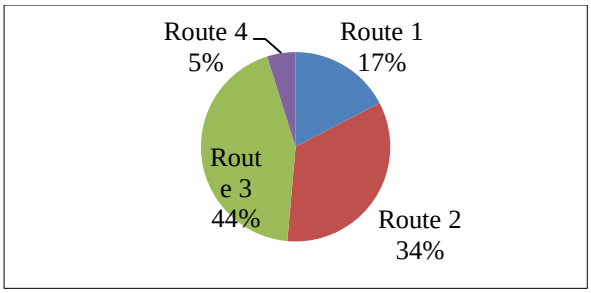

Figure 15 Route Choices Behaviour for Bus and Pvt. Bus

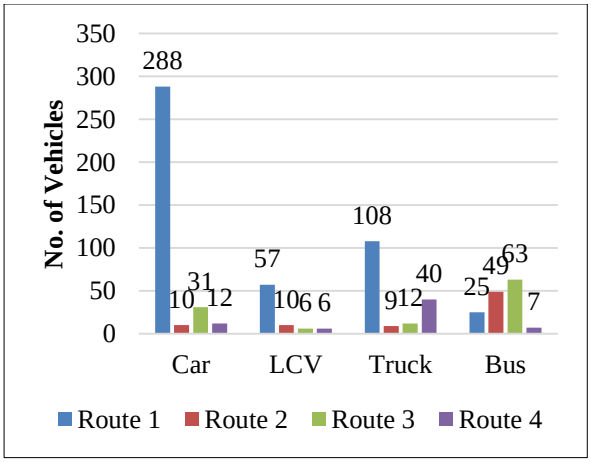

Figure 16 Classified Volume Counts on Different Routes

B. Level of Service

To find the Level of Service for all the routes it is challenging thing to do it for long routes. To find the level of service of the route here Travel Time and Delay Study method has taken. In which the use of technology had also been done. The android Mobile Application name Speedometer GPS is used to get the speed variation graph of the whole trip. The application is giving the file output as a .gpx file which can be scan at a website of GPX Scan where we can get a graph of the result speed. It also gives the Travel Time, Travel Distance and Average Speed of the Trip as a Result as shown in Fig 17, 18, 19 and 20. And from the average speed the LOS of the Route is decided as per the table 2.1.

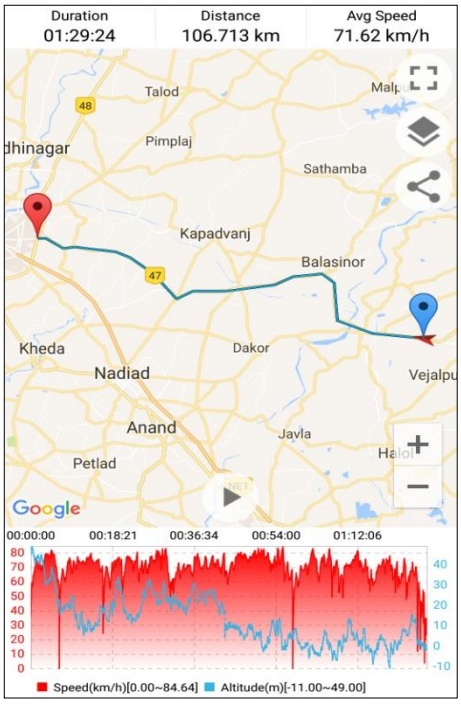

Figure 17 Output data of Speedometer GPS for Route 1 (Source: Speedometer GPS Android Application)

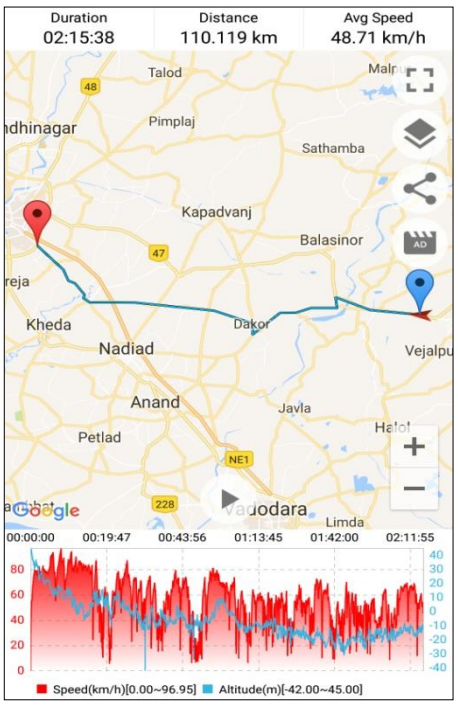

Figure 18 Output data of Speedometer GPS for Route 2 (Source: Speedometer GPS Android Application)

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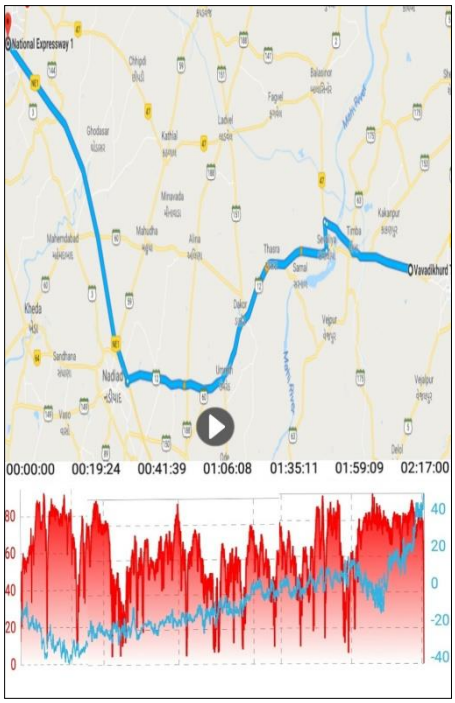

C. Figure 19 Output data of Speedometer GPS for Route 3 (Source: Speedometer GPS Android Application)

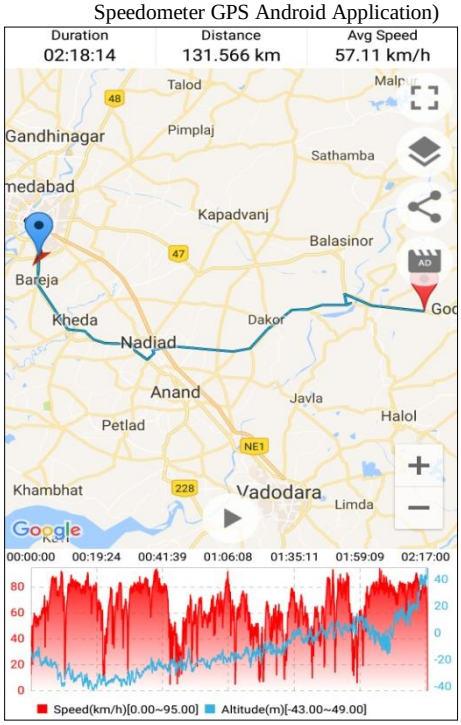

Figure 20 Output data of Speedometer GPS for Route 4 (Source: Speedometer GPS Android Application)

So, Level of Service for each routes are shown below:

Route No.	Average Speed	Max. Needed speed at Midblock for nearest LOS	LOS
1	71.62 kmph	80	A
2	48.71 kmph	50	D
3	58.39 kmph	60	C
4	57.11 kmph	60	C

D. Diversion Curves

Bureau of Public Roads Diversion Curve :

Undoubtedly, the most widely used method of diversion is that which is available in Bureau of Public Road's series if traffic planning computer programs. This form of diversion is dependent on one parameter only, the ratio of travel time or travel cost.

$$\text{Travel time ratio} = \frac{\text{Time on new system}}{\text{Time on old system}}$$

$$\text{Travel cost ratio} = \frac{\text{Cost on new system}}{\text{Cost on old system}}$$

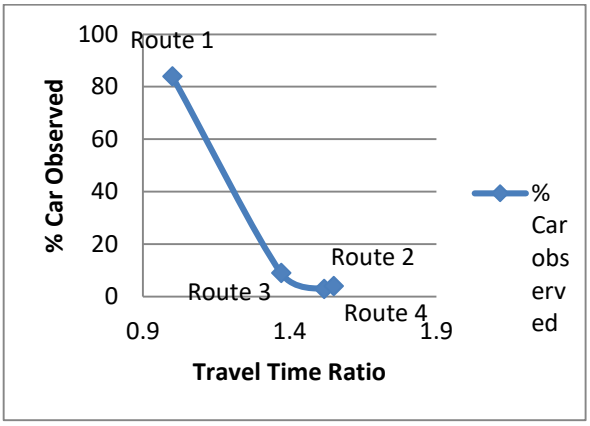

Figure 21 Diversion Curve for Car w.r.t Travel Time Route 1

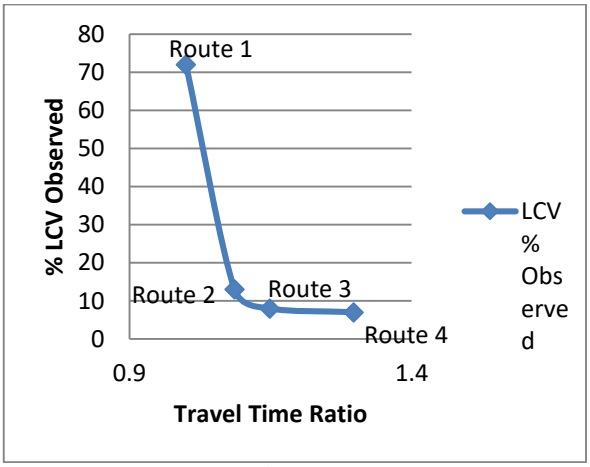

Figure 22 Diversion Curve for LCV w.r.t Travel Time Route 1

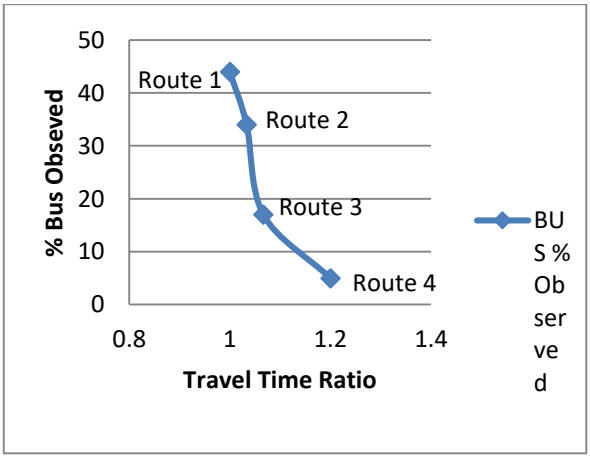

Figure 23 Diversion Curve for Bus w.r.t Travel Time Route 1

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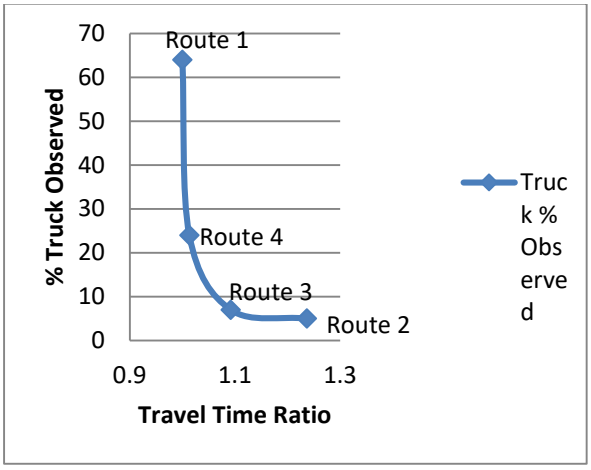

Figure 24 Diversion Curve for Truck w.r.t Travel Time Route 1

E. Output of SPSS Software as Predicted Table

Observed	Predicted				
	1.00	*2.00*	*3.00*	*4.00*	*Percent Correct*
1.00	477	0	1	0	99.8%
2.00	0	68	0	10	87.2%
3.00	1	2	109	0	97.3%
4.00	0	6	0	58	90.6%
Overall Percentage	65.3%	10.4%	15.0%	9.3%	97.3%

VII. CONCLUSION

- The basic analysis of Trip Maker's shows that 51% trip maker's travel to Ahmadabad for their work where 26% of trip maker's make trip for Business work.
- 39% of trip maker's make trip to Ahmadabad due to reasons only where 29% of trip maker's are daily users
- 65% of the trip maker's chose Route 1, 11% chose Route 2, 15% chose Route 3 and only 9% Route 4.
- It's found that most of the vehicles are chosing Route 1 in which majority of the vehicles was 4W and Goods Vehicles like LCV and Trucks. While Government Buses (GSRTC) and Private Buses are mostly focused on passenger's availability for which they mostly use Route 2 and Route 3.
- After analyzing the data safety is also important thing user's raised. Specially, at night people like to choose Route 3 due to guard rails around road at NE 1.

Route No.	Average Speed	Max. Needed speed at Midblock for nearest LOS	LOS
1	71.62 kmph	80	A
2	48.71 kmph	50	D
3	58.39 kmph	60	C
4	57.11 kmph	60	C

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