Assessment of Facilities for Vulnerable Road Users at Selected Road Intersection of Rajkot City

Mr. Meet R. Kotadia
M.E Research Scholar
Department of Civil Engineering
AITS, Rajkot-360005, India

Prof. Rahul M Kasundra
Assistant Professor
Department of Civil Engineering
AITS, Rajkot-360005, India

Prof. Praful A. Shinkar
Assistant Professor
Department of Civil Engineering
AITS, Rajkot-360005, India

Abstract

Pedestrians, bicyclist and two wheelers are the vulnerable road users. The potential for problem reduction was specified for three target groups of vulnerable road users: pedestrians, cyclists, two-wheelers (i.e. motorcyclists and riders of mopeds). Walkers and cyclists has great potential to contribute to high government agendas for more sustainable development. Walking is usually the first and last mode used, providing an important link between land use and motorized travel. Bicycle is the pedal-powered two wheeler. An important subject in the study is to consider in what way safety problems of pedestrians, cyclists and two-wheelers might be related to the fact that these modes are not integrated automatically in the planning for traffic. Rajkot is the center of the Saurashtra region of Gujarat state. In addition, population dramatically increased for huge number of urban migration. But there is very lack of vulnerable road user's facilities and which are available those are not proper. Facilities are very poor in some of the areas in Rajkot cities like Gondalchowk. Gondalchowk is the starting and ending point of the BRTS corridor. GondalChowk is connected with the national highway. Finally, On the basis of survey(Road inventory, pedestrian interview, classified volume count, pedestrian volume count),and it's analysis measure have proposed which should be required immediately for safe, efficient and appropriate movement of huge number of pedestrian at selected intersection.

Keywords- Vulnerable Road Users, Walkers, Cyclist, Two Wheeler, BRTS

I. INTRODUCTION

India is the seventh largest country by area. India is the second most populous country in the world, with over 2.5 billion people. Transportation facilities are the first requirement of any nation for the infrastructure development. India has a road network of over 5,472,144 kilometers as on 31 March 2015; the second largest road network in the world.it is a second largest road network in the world. Adjusted for its large population, India has less than 3.8 kilometers of roads per 1000 people, including all its paved and unpaved roads. In terms of quality, all season, 4 or more lane highways, India has less than 0.07 kilometers of highways per 1000 people, as of 2010. These are some of the lowest road and highway densities in the world. The use of cars for short journeys is officially discouraged in many parts of the world, and separation of dedicated walking routes receives a high priority. In India many people do not have transportation at all, they simply walk or by using public transportation. Walking /pedestrian are closely linked with the public transportation pedestrian. Every public transport travel trip has a component of walk at its both ends. Facilities created to service the pedestrian will encourage use of public transportation. Increased space of vehicular movement in all parts of the city including neighborhoods, school areas and main arteries have led to increased accidents and reduced safety to the pedestrians and cyclist. Pedestrians and cyclist are exposed to danger due to conflict with the vehicular, and due to the poor infrastructure facilities. However vulnerable road users are often ignored by policy makers, planner and engineer. Therefore no policy plans for pedestrians in India cities.

A. Objectives of Study

1) To assess the vulnerable road users movement at selected intersection.
2) To recommend the facilities and suitable measures.

II. TYPES OF VULNERABLE ROAD USER'S FACILITIES

A. Overview

Vulnerable road users are an inseparable part of transportation system in the world. However, analyzing and simulating pedestrian behavior is complex phenomenon compared to vehicular movement. An important consideration that has to be faced by an engineer in designing of pedestrian planning but ignore the infrastructure for pedestrians in developing country India. Although bicyclists are not as regimented as vehicles, they tend to operate in distinct lanes of varying widths. This is far more important than the total width of the bicycle facility or of the individual lanes. Study of these problems is important for safe and effective transportation system. The planning is require because of due to that decrease the road accident on road, improve air quality and reduce noise level in urban area. This chapter addressed the Level of Service (LOS) analysis of facilities surviving pedestrians.

B. Pedestrian Facilities

1) Foot Path (Sidewalk)

Footpath (Sidewalks) are provide donmo sturbaarterials, Collector Street and in commercial and residential areas. Sidewalks and walkways are the function as integral components of pedestrian friendly street systems where pedestrians can experience comfort, safety, accessibility, and efficient mobility. Sidewalks and walkways increase pedestrian safety by separating pedestrians from vehicular traffic. The width of side walk depends upon the expected pedestrian flows on the road intersection and could be fixed with the help of IRC guidelines given in a table 1, subjected to a minimum width of 1.5m.

Table 1: capacity of side-walk (As per IRC: 1989)

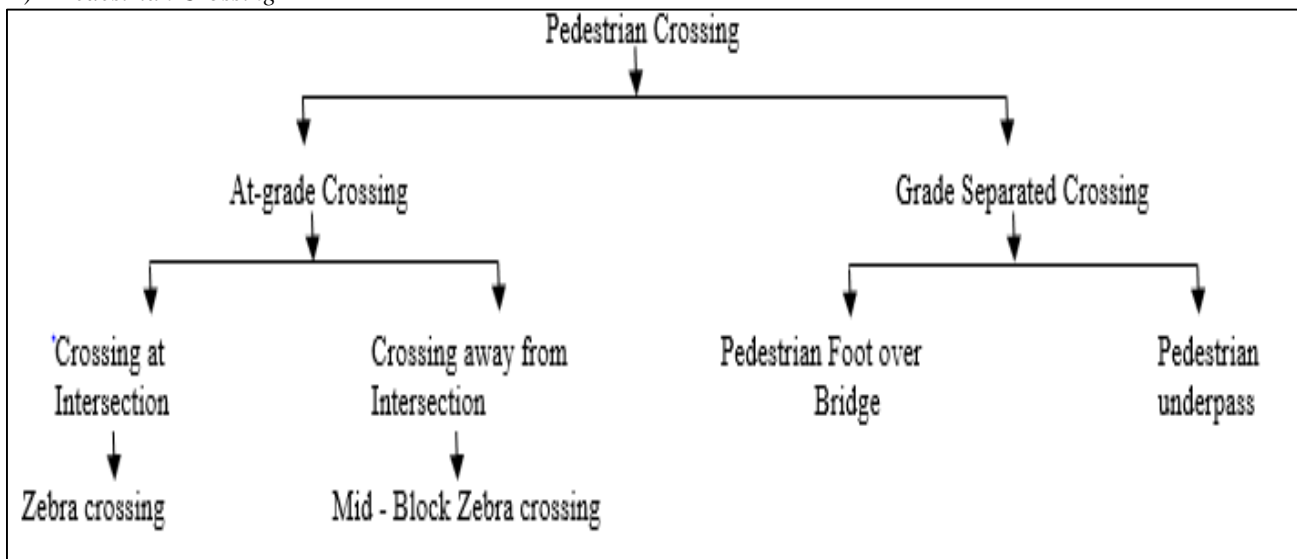| Width of side walk (meter)	Capacity in number of persons per hour	
	All in one direction	In both direction
1.50	1200	800
2.00	2400	1600
2.50	3600	2400
3.00	4800	3200
4.00	6000	4000

2) Pedestrian Crossing

Fig. 1: Types of Pedestrian Crossing

−   At – Grade Crossing: At-Grade pedestrian crossings are those where the pedestrian cross the carriageway at the same level as that of vehicular movement.
−   Grade Separated Crossing: grade separated crossing are those where the pedestrian are require to cross the carriageway at a level different from that of vehicular movement.

Fig. 2: Typical Foot Over Bridge

3) Pedestrian Sign and Signal

In U.K. practice, the don't cross indication is given by arid standing man the cross indication is a green walking man where as a flashing green signifies don't start to cross. The Indian standard on traffic signals prescribes the following symbols for pedestrians. The red standing man represents the don't cross indication and the green walking man represents cross indication

Fig. 3: Pedestrian Signal

Fig. 4: Pedestrian Sign

C. Bicyclist Facilities

Transport planning in India has focused on improving conditions for private automobiles at the expense of safe footpaths and cycling facilities. Yet the majority of the population in Indian cities relies on walking, cycling, and other forms of human-powered transport to commute to work and get around cities every day. Increasing the use of cycles and the ease of walking is one of the most affordable and practical ways to reduce CO_2 emissions, while boosting access to economic opportunity for the poor. While streets are often designed from the centerline outward, Better Streets, Better Cities urges Indian planners and engineers to explore an alternate approach that priorities the needs of cyclists.

Fig. 5: Bicyclist Street

III. REVIEW OF LITERATURE

A. Planning of Basic Pedestrian Facilities at Selected Intersection of Rajkot City (2016) Rahul M. Kasundara, Praful A. Shinkar

This study is carried out of a case study of Rajkot city. The main objectives of the study was the improve the existing facilities of pedestrian facilities. Thepedestrianfacilitiesareobservedpoorinsomeoftheareasin RajkotcitysuchasHospitalChowketc. In this work, basic pedestrian traffic planning is taking for improve and effective pedestrian facilities at these intersections. By using the various types of traffic surveys, to check the pedestrian facilities and its behavior. After data collection survey and analysis on the basis of that recommended facilities and appropriate measures.

B. Profile of Fatal Road Traffic Accidents in Rajkot City (2012)Hetal C. Kyada, et Al

Road traffic injuries are recognized as major health problems in developing countries. The prospective study was conducted in Department of Forensic Medicine, Pandit Dindayal Upadyay (P.D.U.) Medical College and Associated Hospital, Rajkot from 01-01-2008 to 31-12-2008. During that period out of 2159 autopsies, 298 cases of Fatal Road Traffic Accidents were selected for the present study. Maximum 99(33.22%) cases were observed in the age between 21-30 years and Fatal RTAs were common in males 272(91.27%) as compared to females 26(8.73%) with male to female ratio. this study showed that maximum accidents were more common in younger group and male sex during working time 12:01 p.m. to 6:00 p.m. in this study carried out the maximum victims are pedestrians 101 (33.89 %) cases and bicyclist included with 4.70%. this study concluding, Various preventing measures like avoiding high speeding and driving under the influence of alcohol, promoting the use of helmets, seat belts and other restraints, ensuring that people walking and cycling are more easily visible, improving the design of roads and vehicles, enforcing road safety regulations and improving emergency medical services could be used to control the increasing toll of deaths due to RTA.

C. Planning for Non-Motorized Transportation (2012)JigneshC.Prajapati, Prof. N.G.Raval

This study was carried out of a case study of mehsana city. The main objective of the study was to improve the existing facilities of non- motorized transportation and provide new transportation facilities for NMV. In that study, traffic volume count survey and existing inventory survey were carried out. therefore, need to improve the transport facilities.so improve the Non-Motorized Transport System and design, Reduced crash rates, Reduced severity of injuries (due to slower speeds), Reduced costs (compared to traffic signals, which require electrical power), Reduced liability by transportation agencies (there are no signals to fail), increase the fast operating of Traffic at intersection, save fuel and save environment, decrease noise pollution.

IV. STUDY ARE A SELECTION AND METHODOLOGY

A. Study Area

1) Role of Transportation in Rajkot

The Rajkot city has a dense road network. Because of the concentration of various commercial and industrial activities in Rajkot and surrounding towns. The Rajkot city road network is leading to the surrounding towns is heavily congested. The regional network includes NH-8B(NH 27), State Highways (SH-26, SH-27, SH-42) and District Roads. Rajkot city has a two ring road the influence area, in terms of travel demand, covers the revenue districts of Rajkot. There is heavy inflow and outflow of traffic from the region into the city. The Jamnagar, Gondal railway lines pass through middle of Rajkot City. The role of public

transport system for intra city passenger travel is marginal. Rajkot's major transport system relies on three wheelers, locally known as 'shuttle'. Intra-City bus services are running by State Transport and private bus operators. Most of the mini buses are operated by private operators. Transportation is the backbone to the development of urban area. As a result public transport becomes financially less viable, speed reduces and congestion levels increase and the transportation becomes source of environmental problems. Vehicles are major source of urban air pollution. Traffic transportation services and road networks are key indicators to provide the image of city, so to design the strategic plan for Rajkot city is a very critical exercise and hence it is carried out precisely.

2) *Population*

Rajkot is the fourth largest city in Gujarat. Rajkot is the 35th largest urban agglomeration in India, with a population more than 1.2 million as of 2015.

Table 2: Population Growth of Rajkot City (Source: RMC)

Year	Population	Growth Rate
1901	36,151	-
1911	34,191	-5.42
1921	45,845	+34.08
1931	59,122	+28.96
1941	66,353	+12.23
1951	132,069	+99.04
1961	194,145	+47.00
1971	300,112	+54.58
1981	445,076	+48.30
1991	559,407	+25.69
2001	1,002,000	+79.12
2011	1,286,995	+28.31

3) *Details of Study Area*

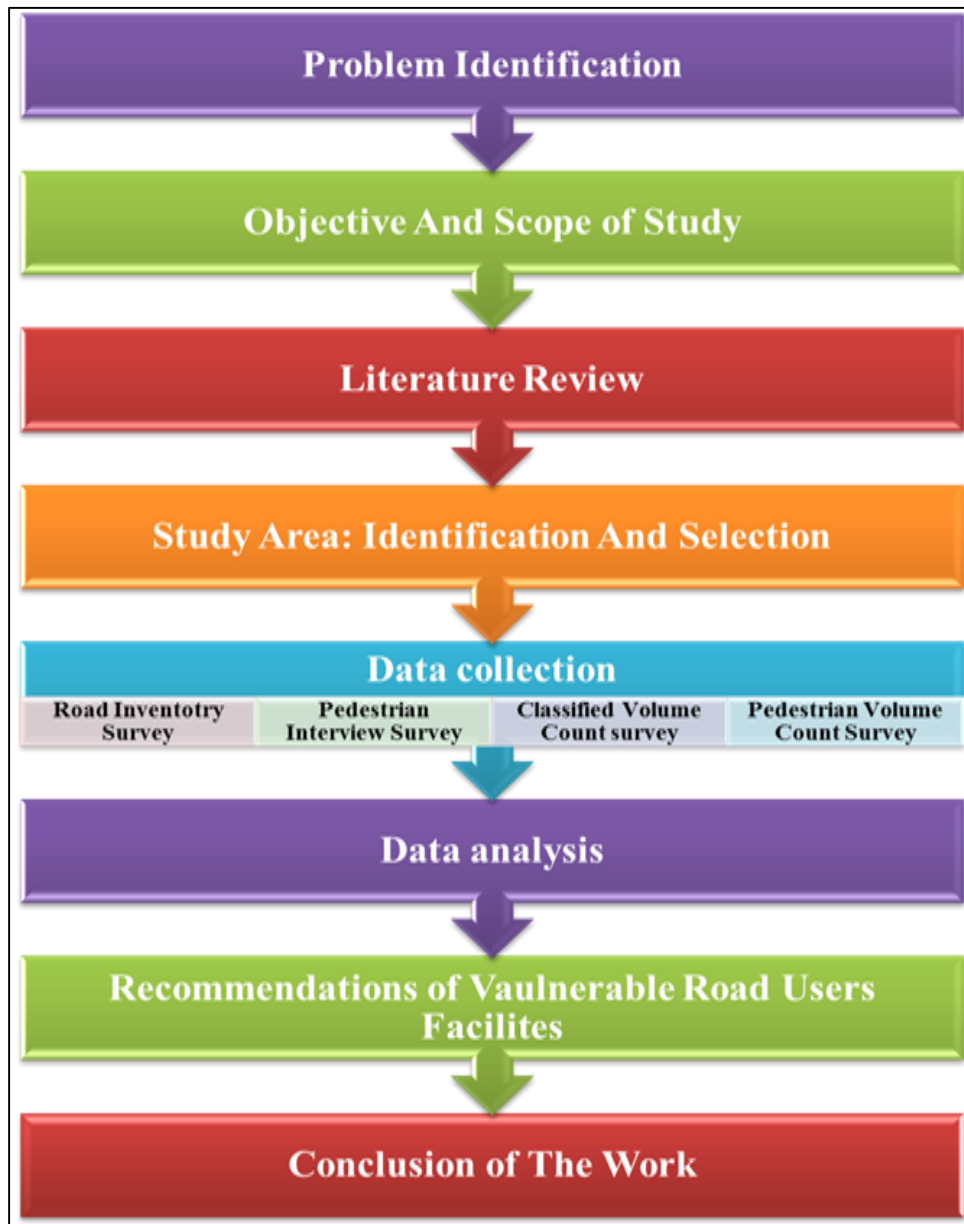Fig. 6: Google Map of Gondal Chowk

B.   Methodology

Fig. 7: Methodology of the Study

V.   DATA COLLECTION AND ANALYSIS

A.   Road Inventory Survey
Road Inventory Survey is carried out at Gondal Chowk. There collecting data of existing details of road characteristics.
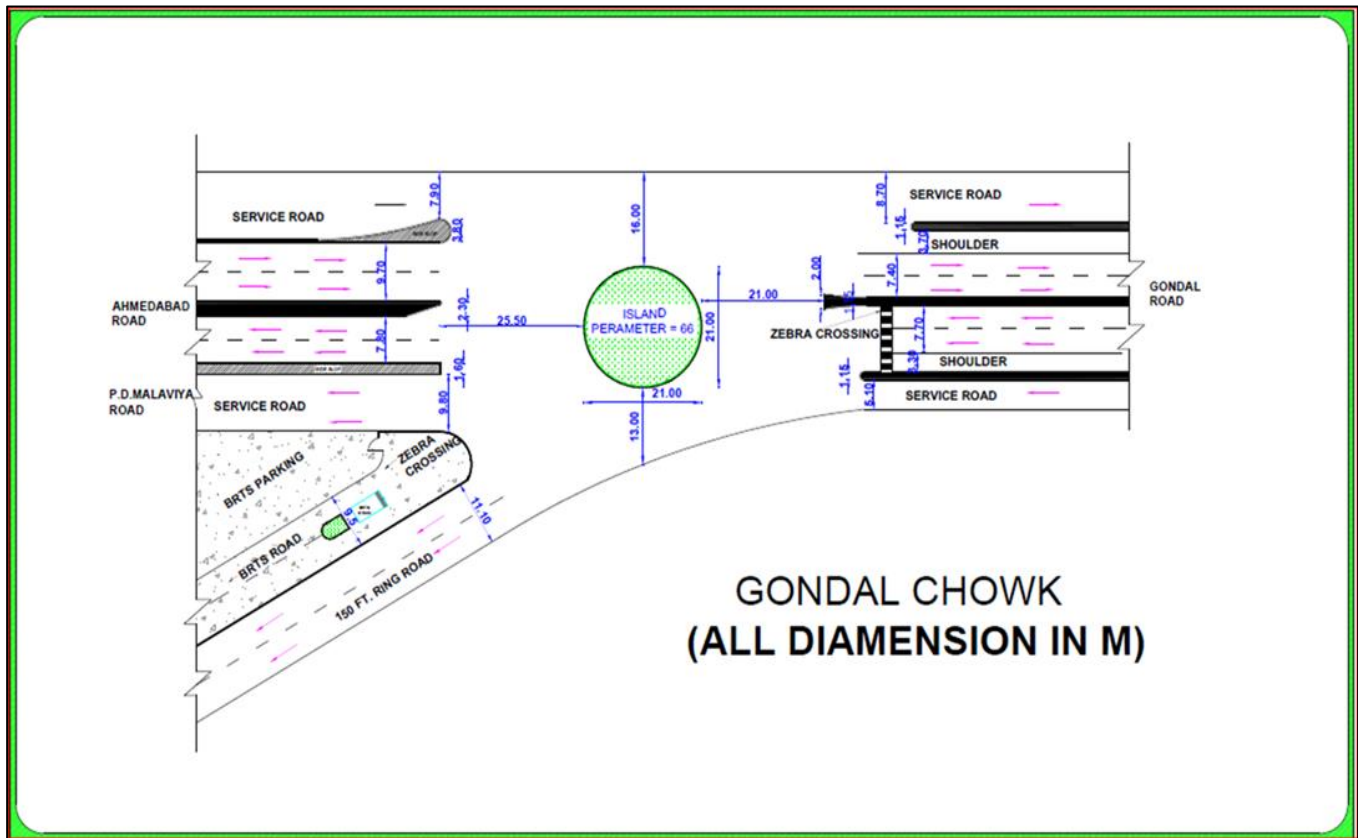
Fig. 8: Existing Lay-Out of Gondal Chowk

B. Classified Volume Count Survey

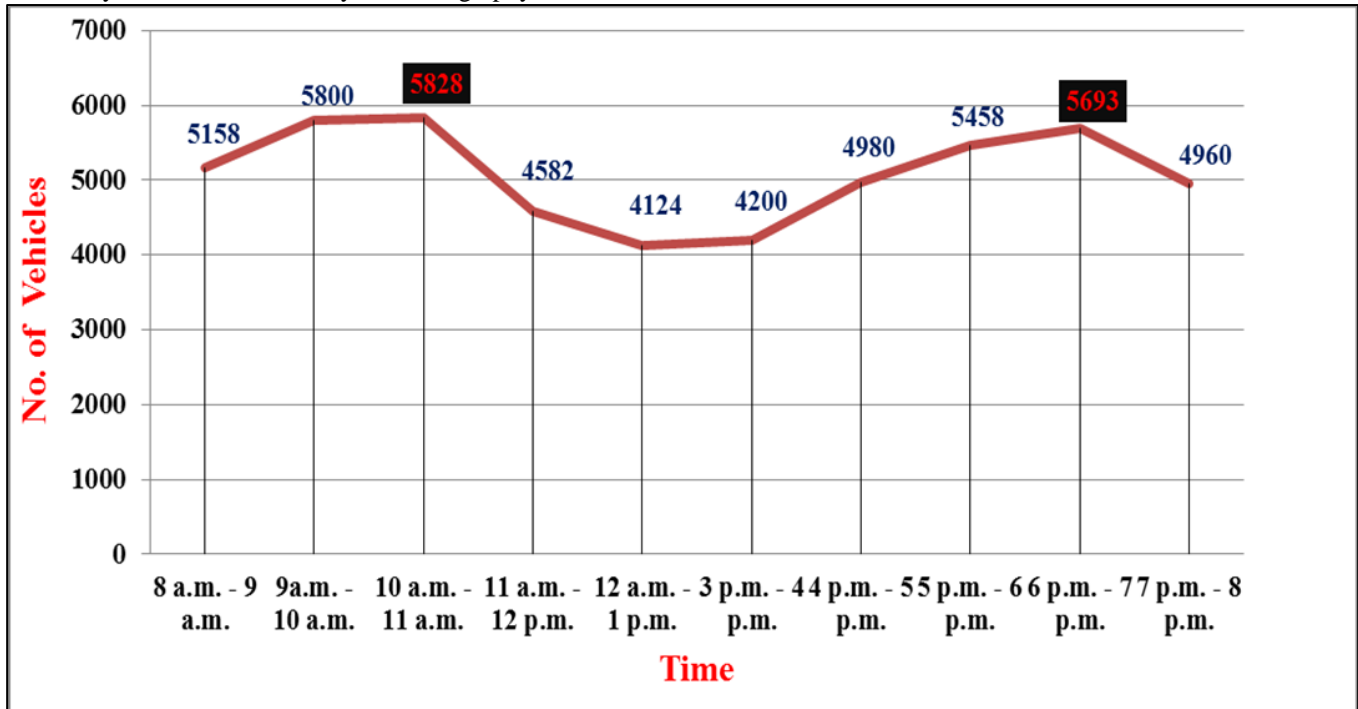This survey is to be carried out by the videography.

Fig. 9: Traffic Peak Hours at Gondal Chowk

Table 3: Total Vehicular Composition at Gondal Chowk

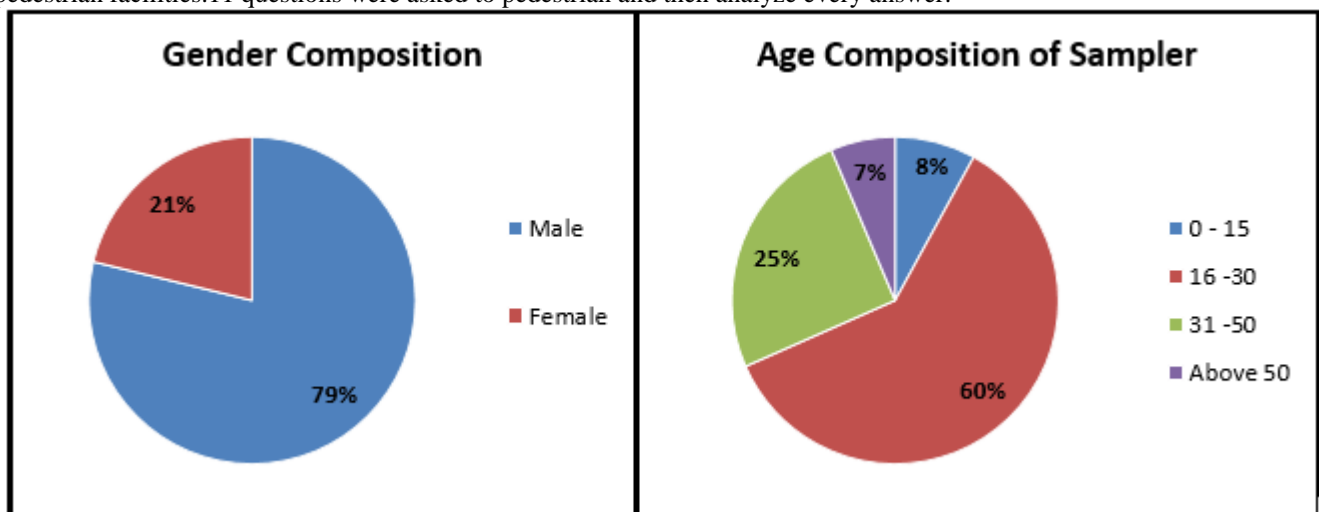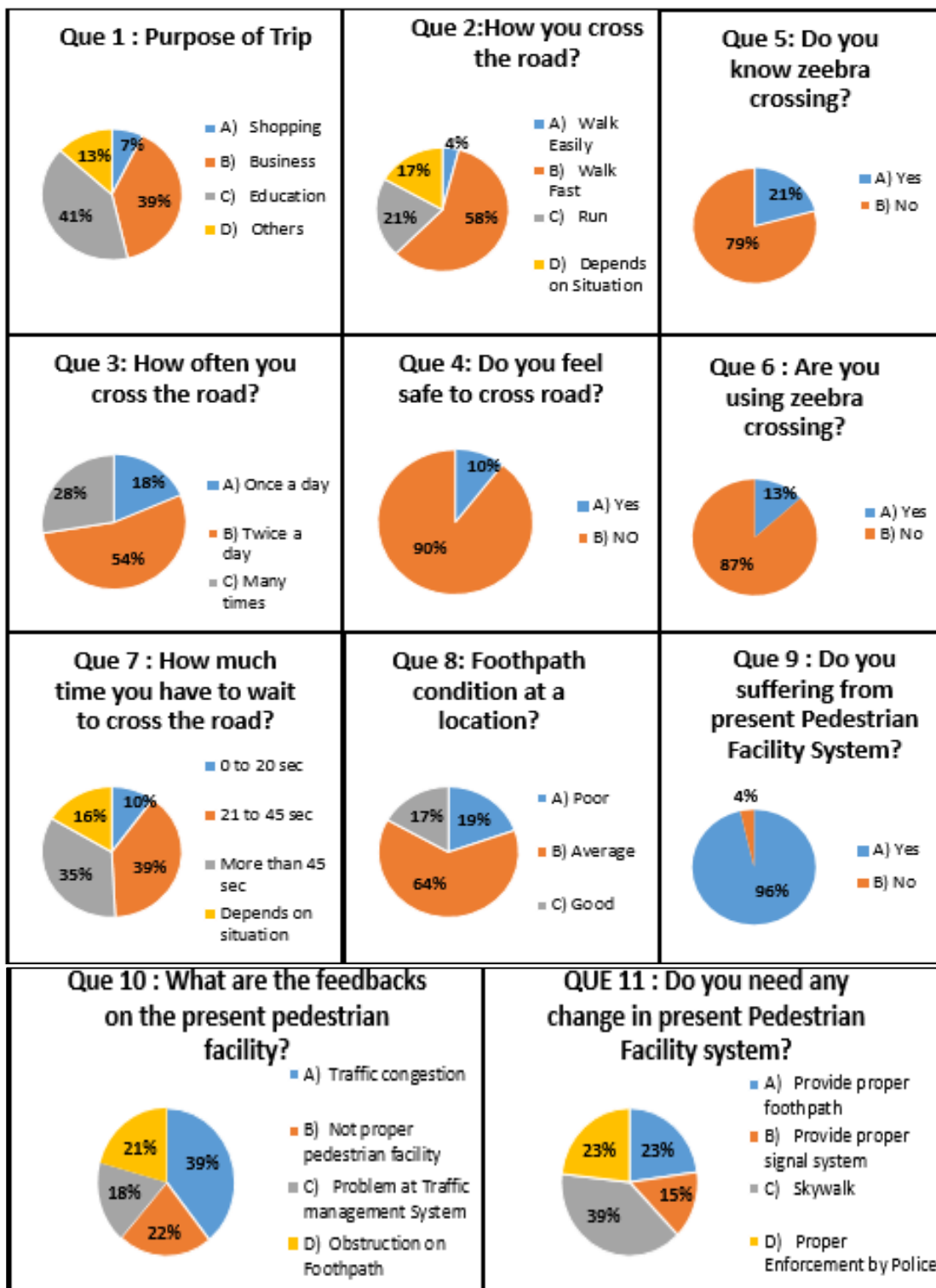| Classified Volume Count- Total Vehicular Composition									
Location	Gondal Chowk	ondal Chowk		Date	01-01-2017		Leg	Gondal Chowk	
Direction of Flow	Incomming	Incoming							
Leg Name	Passenger Vehicles					Good Vehicles			Total
	Bus	Car	2-Wheeler	3-Wheeler	Bicycle	Truck	LCV	Tractor	
A- Gondal Road	3.7	24.2	49.3	7.5	0.6	5.6	9	0.1	100
C - Ahmedabad Road	4.3	31.4	29.3	6.1	0	17.8	11	0.1	100
E -150 ft & Malaviya Road	4.8	37.5	40.9	7.4	0.4	3.9	4.9	0.2	100
Total(%)	12.8	93.1	119.5	21	1	27.3	24.9	0.4	300
Persentage(%)	4.27	31.03	39.83	7.00	0.33	9.10	8.30	0.13	100
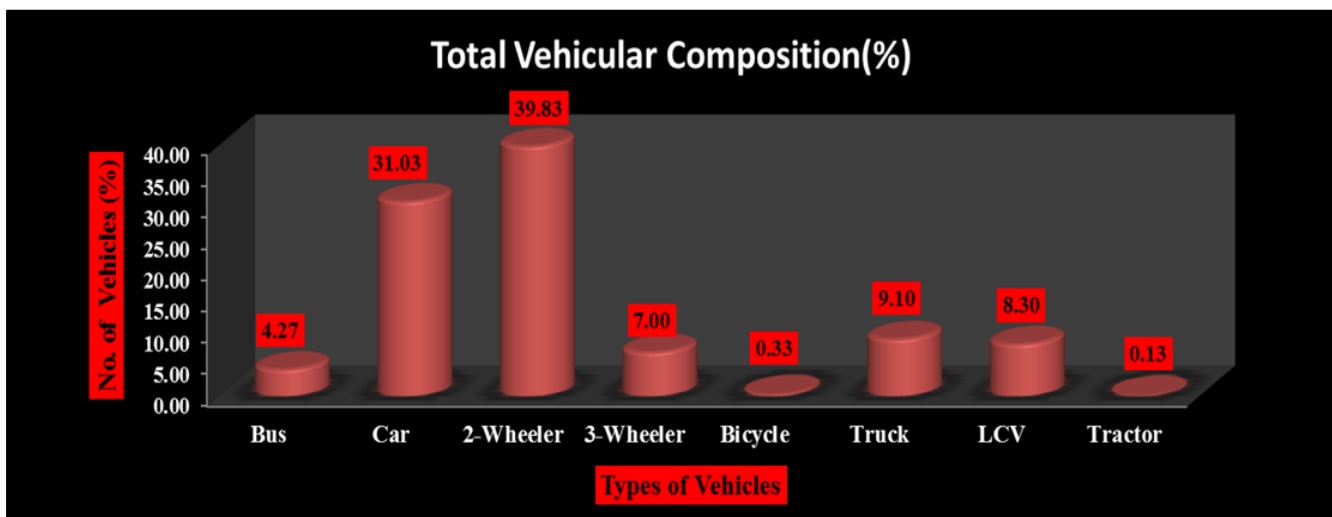
Fig. 10: Total Vehicular Composition

C. Pedestrian Interview Survey

In pedestrian interview survey, mainly collected 250 samples from pedestrians, which data is useful for planning go for basic pedestrian facilities.11 questions were asked to pedestrian and then analyze every answer.

Que 1 : Purpose of Trip

7%, 13%, 41%, 39%
A) Shopping
B) Business
C) Education
D) Others

Que 2: How you cross the road?

4%, 17%, 21%, 58%
A) Walk Easily
B) Walk Fast
C) Run
D) Depends on Situation

Que 5: Do you know zeebra crossing?

21%, 79%
A) Yes
B) No

Que 3: How often you cross the road?

18%, 28%, 54%
A) Once a day
B) Twice a day
C) Many times

Que 4: Do you feel safe to cross road?

10%, 90%
A) Yes
B) NO

Que 6 : Are you using zeebra crossing?

13%, 87%
A) Yes
B) No

Que 7 : How much time you have to wait to cross the road?

10%, 16%, 35%, 39%
0 to 20 sec
21 to 45 sec
More than 45 sec
Depends on situation

Que 8: Foothpath condition at a location?

19%, 17%, 64%
A) Poor
B) Average
C) Good

Que 9 : Do you suffering from present Pedestrian Facility System?

4%, 96%
A) Yes
B) No

Que 10 : What are the feedbacks on the present pedestrian facility?

39%, 22%, 18%, 21%
A) Traffic congestion
B) Not proper pedestrian facility
C) Problem at Traffic management System
D) Obstruction on Foothpath

QUE 11 : Do you need any change in present Pedestrian Facility system?

23%, 23%, 15%, 39%
A) Provide proper foothpath
B) Provide proper signal system
C) Skywalk
D) Proper Enforcement by Police

D. Pedestrian Volume Count Survey

Pedestrian volume counts were taken at all legs in this intersection. This survey was carried out in morning at time 8 a.m. to 1 p.m. and in the evening at time 3 p.m. to 8 p.m. pedestrian volume is mainly calculated as a vigorously and pedestrian volume count is done by pedestrian leg to leg movements count. This survey was carried out by videography survey. The data collection table and analysis of data are as below:

Table 4: Pedestrian Volume count at Gondal Chowk

| PEDESTRAIN VOLUME COUNT					
Location	Gondal Chowk	Date	04-01-2017	Leg Name	A,B,C,D,E
Direction of Flow	Incoming				
Time	Leg A: Gondal Road	Leg B: 150 ft Road	Leg C: Ahmedabad	Leg D: Malaviya Road	Leg E: Malaviya and 150 ft Road Combine	Total
8 a.m. - 9 a.m.	532	655	137	545	189	2058
9a.m. - 10 a.m.	644	734	177	629	191	2375
10 a.m. - 11 a.m.	597	707	169	680	177	2330
11 a.m. - 12 p.m.	519	710	179	616	176	2200
12 a.m. - 1 p.m.	562	703	168	595	180	2208
3 p.m. - 4 p.m.	545	598	162	499	182	1986
4 p.m. - 5 p.m.	552	652	180	591	193	2168
5 p.m. - 6 p.m.	568	692	167	699	178	2304
6 p.m. - 7 p.m.	647	715	166	728	194	2450
7 p.m. - 8 p.m.	518	667	170	672	186	2213
TOTAL	5684	6833	1675	6254	1846	22292
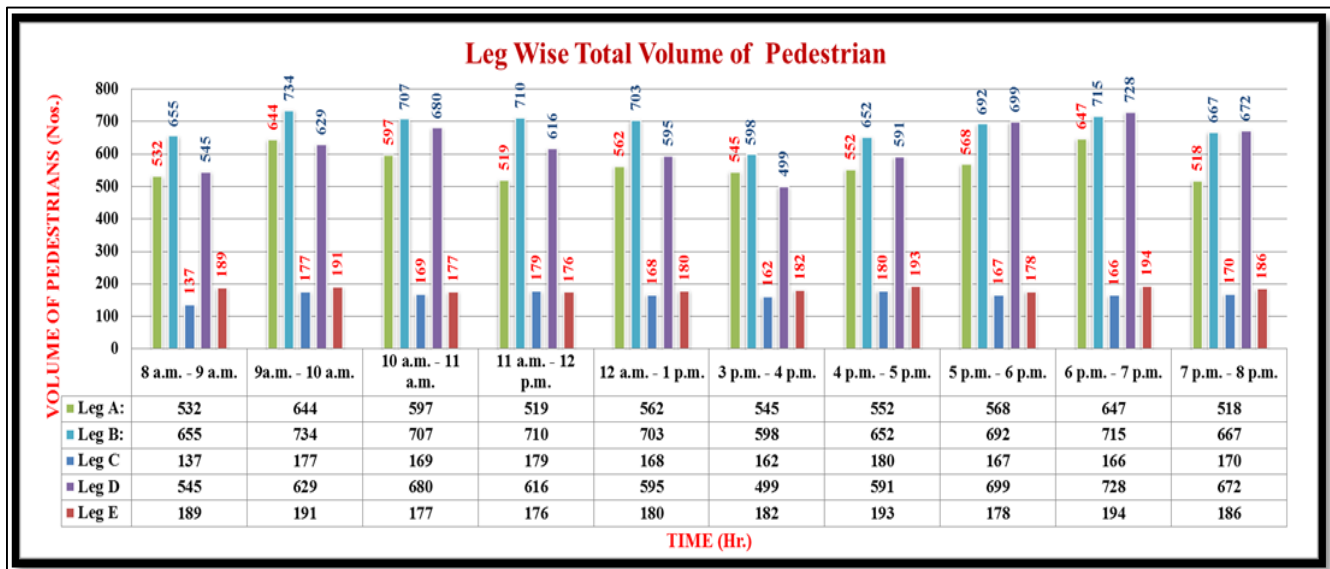
Fig. 11: Leg Wise Hourly Volume of Pedestrian
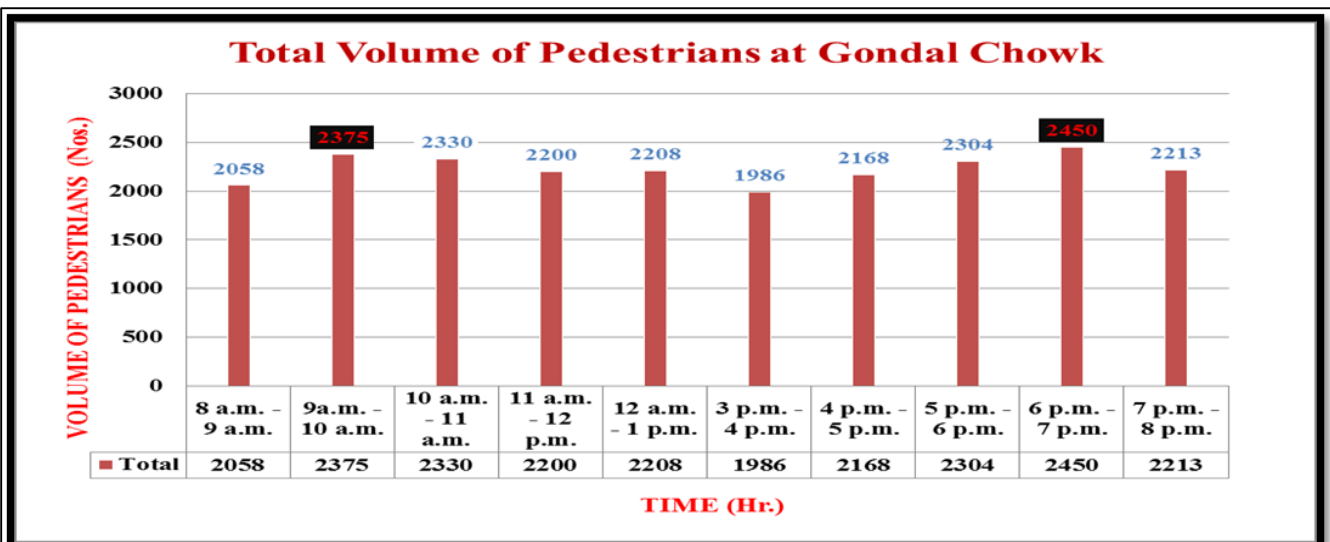
Fig. 12: Total Volume of Pedestrian at Gondal Chowk

VI. CONCLUSION

− From the road inventory survey it has been observed that road marking, foot-path and bus stop are not proper.Footh has only been provide on 150 ft. ring road and that is also suffering from road side obstruction and encroachment.
− Gondal chowk is a major intersecting points, where city and highway is meeting traffic volume count shows that, huge number of pedestrian and vehicular movements are there which is directly influencing pedestrian behavior.
− Based on pedestrian interview and pedestrian volume count, it has been conclude that there is a great requirement to improve the pedestrian facilities by providing linear walkway, sky walks, underpass etc.
− Short term measures like signs and signals, Zebra crossing can be provided, long term measure like foot-path, under pass, for also can be planned for two wheeler user and bicyclist separate lane and lane working can be provided.

REFERENCES

[1] Rahul M. Kasundara,Praful A. Shinkar (2016)"Planning of Basic Pedestrian Facilities at Selected Intersection of Rajkot City"
[2] Hetal C. Kyada, et Al(2012) "Profile of Fatal Road Traffic Accidents in Rajkot City"
[3] JigneshC.Prajapati, Prof. N.G.Raval(2012) "Planning for Non-Motorized Transportation"
[4] "Construction and Improvement of T.P. Schemes Road Network for Rajkot City (2008)" Rajkot Municipal Corporation.
[5] Highway capacity manual (2000)
[6] The Indian road congress, IRC: 103-1988