

# Identification and Improvements of Accident Prone Stretches: A Case Study of Bhavnagar City

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**Abstract**— Transportation sector plays the important role in any country development. Road traffic accident have Increase in the recent years due to several reasons. The rapid population growth and increasing number of motor vehicles on the road has created a major social problem- the loss of lives through road accidents. Thus, road traffic accident is collisions between vehicles, between vehicles and pedestrians, between vehicles and animals, or between vehicles and any other objects. Accident prone location should be identified so the accident can be reduced with proper action on the prone location. This study is relevance in this context for mitigating accident problems on Bhavnagar city roads through systematic identification, analysis and measure of accident prone stretches. Based on Accident Severity Index (ASI) method the top most three accident prone stretches are identified and studied and suggested improvements.

**Key words:** Transportation, Road Traffic Accidents, Accident Prone Area

## I. INTRODUCTION

The economic, industrial, social and cultural development of any countries are depended on the transportation sector in this country. Due to the increase in population, number of vehicles is increase which leads to the increase in road network so road accident are also increase. Road traffic accidents can be defined as “An accident that occurred on a road open to a public traffic; resulting in personal injury, damages to the property and loss of life in which at least one moving vehicle was involved.” The basic elements in traffic accidents are vehicles, road, road condition, environmental factors and road users for pedestrians, animals, hand drawn vehicle etc. In India there are every year over 100000 deaths occur on roads due to accidents. The death include people walking, people driving, people traveling in cars, buses, trucks, three wheelers, two wheelers and four wheelers. It also consider people not traveling at all but simply passing the time of the day (or night) by the side of the road.

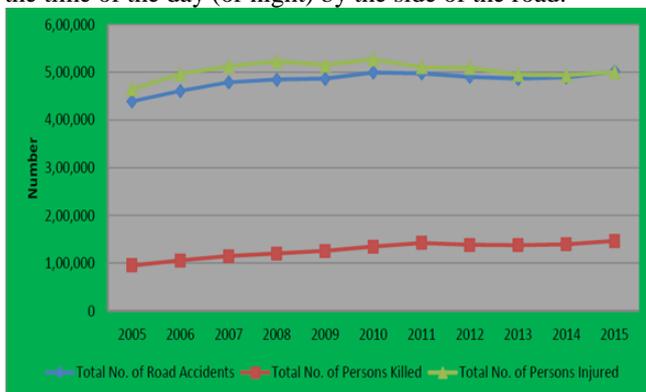


Fig. 1: Road Accident Statistics 2005 – 2015

During 2015, a total of 5, 01,423 road accidents were reported by all States/Union of these 26.3 per cent (1, 31,726) were fatal accidents. The number of persons killed in road accidents were 1, 46,133 i.e. an average of one fatality per 3.4 accidents. The number of road accidents, road accident fatalities and persons injured in road accidents in India during 2005 to 2015 shown in fig 1.

## II. LITERATURE REVIEW

A. Gourav Goel & S.N. Sachdeva (2014) “Identification of Accident Prone Locations Using Accident Severity Value on a Selected Stretch of NH-1”

Gourav Goel & S.N. Sachdeva studied on road accident data of a selected stretch of NH-1 (Delhi-Ambala-Amritsar Road). A 50 km road stretch between RD 98 km to 148 km was selected and road accident data of four years 2007-2010 was collected. The 6-laning work of NH-1 is in progress during the selected period so the study considers the effect of widening project on road accidents also. The effect of 6-laning work on road accidents has been evaluated by dividing total number of accidents into two groups before construction and after construction work started. To identify the accident prone locations the total stretch was divided into smaller sections of 5 km each. Total accidents and accident severity value has been used to rank the accident prone locations. The stretch of the road 140-144 km is found to be the most accident prone followed by the stretch 98-104 km and the stretch 145-148 km. A field study has been conducted to compare the analysis with field results.

B. Pavan R Vyas Et. Al.(2015) “Identification Of Black Spots For Safe Commuting Using Weighted Severity Index And GIS”

Pavan R Vyas et. Al. carried out a detailed analysis the present state of traffic accident information on SH-85 from Tavarekere to Magadi Town in Karnataka State. In this study, the various factors, which tend to influence the occurrence of accidents on roads, are assigned weights on a scale of 1-10 in such a manner that the factor, which tends to increase the probability of the accidents are assigned lower weights. The entire stretch is segmented using dynamic segmentation tool in Arc GIS After the analysis, most of the hazardous locations were obtained in the map. The Weighted Severity Index (WSI) method was used to rank the probable accident locations.

## III. DATA COLLECTION

Road accident statistics of Bhavnagar city from the year 2006 to 2016 is shown in Table 1. Accidents are classified in fatal accidents, grievous injury accidents, minor injury accidents and non-injury accidents. In the year 2006 the total number of accidents was 435 and in the year 2016 the

total number of accidents was 242. During these eleven years the population and vehicle ownership have increased but the number of fatal accidents has remained approximately constant in the city and number of total accidents has decreased in the city. This may be because of improved quality of roads, introduction of new roads, increased width of roads, installation of traffic control devices (sing, signals etc.) at junctions, channelizing island at intersection, introducing medians on roads and improvement in geometrics of roads of the Bhavnagar city. This may also be due to increased traffic sense in the people and strictly implementation of traffic rules by traffic police of Bhavnagar city.

For the present study accident data, vehicle registration data and other data of study area are required, which is a laborious work. Global and national level data are obtained and from various journals and different technical published papers. State level data are collected and compiled from State Traffic Branch. Vehicle registration data is collected from Regional Transport Office of study area. Population, land use pattern, physical features of various roads, map of study area etc. are collected from municipal corporation office of Bhavnagar city. The accident data of last eleven years will be collected from police stations of Bhavnagar city for the research work.

Year	Fatal (F)	Grievous Injury (GI)	Minor Injury (MI)	Non-Injury (NI)	Total Accident	Killed	Injured
2006	29	176	146	84	435	31	345
2007	30	187	140	81	438	33	356
2008	34	193	141	80	448	37	369
2009	17	163	125	77	382	20	320
2010	25	145	49	63	282	26	210
2011	38	125	45	68	276	43	181
2012	28	121	48	57	254	30	183
2013	27	97	66	78	268	28	176
2014	25	92	51	80	248	29	155
2015	33	96	31	72	232	38	138
2016	31	92	54	65	242	33	156
<b>Total</b>	<b>317</b>	<b>1487</b>	<b>896</b>	<b>805</b>	<b>3505</b>	<b>348</b>	<b>2589</b>

Table 1: Accidents Classified According to the Year from 2006 to 2016 of Bhavnagar city accident data

IV. DATA ANALYSIS

A. Accident Severity Index Method

Accident Severity Index (ASI) method suggest average accident weightage points of a stretch per km per year. In this method is employed for ranking the most severe stretches, as it involves all type of accidents with proper weightage. For computation of Accident Severity Index, the accidents are classified into four group's namely (1) fatal accidents, (2) grievous injury, (3) minor injury and (4) non-injury accidents. Weightage is assigned to categories based on relative cost of accidents. As Chakraborty et. al in 1995 has given weightage points as follows:

- Fatality = 6
- Grievous Injury = 3
- Minor Injury = 0.8
- Non-Injury = 0.2

Using the above weightage points Accident Severity Index is calculated by the following formula:

$$I = (n1w1+n2w2+n3w3+n4w4) \div 5L$$

Where

I= Accident Severity Index

L= Length of road

n1, n2, n3, n4 = Number of fatal, grievous and minor injury and non-injury accidents.

w1, w2, w3, w4 = Corresponding weight age points for each kind of accidents.

Based on ASI ranking of the accident prone stretches are done. Higher the value more severe is the stretch. In police department fatal and total accidents details according to different stretch are available. Top ten Ranking of accident prone stretches is based on accident rate and accident severity index method is shown in Table 2 and graphically presented in figure 2

SR. No.	Number of Stretch	Length (in Km)	ASI	Ranking of Stretches
1	Bhavnagar Rajkot Road	4.7	53.69	1
2	Station Road	1.3	52.98	2
3	Ganga jaliya talav Road	0.55	48.22	3
4	Ghogha Road	1.4	39.97	4
5	Dary Road	1.5	36.67	5
6	Kalanala Road	1.1	29.38	6
7	Bhavnagar Mahuva Road	4	26.34	7
8	Nava para Road	0.9	24.76	8
9	Shishuvihar to Manekvadi	0.3	24.67	9
10	Tilaknagar Road	0.24	24	10

Table 2: Accident Prone Stretches in Bhavnagar city

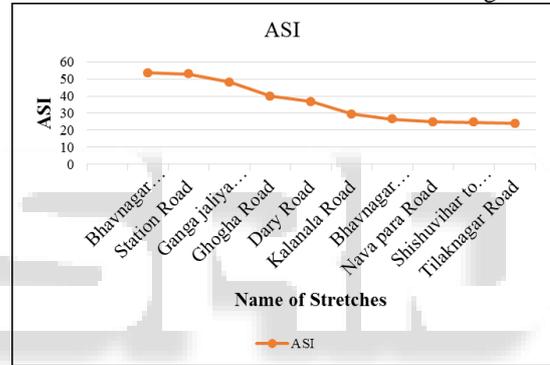


Fig. 2: Accident Severity Index of top ten Stretch from Year 2006 to 2016

In this study, the top three most severe stretches are identified as below:

- 1) Bhavnagar Rajkot Road (Vadla Circle to Nari Circle) – ASI 53.69
- 2) Station Road – ASI 52.98
- 3) Ganga Jaliya Talav Road – ASI 48.22

B. Bhavnagar Rajkot Road

Bhavnagar Rajkot Road starting from to Nari circle to RTO circle. The length of this road is 4.5 km. Effective carriageway with is 10-15 meters.

1) Problem Identification

Based on field survey of this road following problems are identified:

- 1) Chitra ST work shope and Diamond industries on that road. Many numbers of assistant persons work in industries so, there are very heavy traffic volume 2w and pedestrian congest during peak hours on this road.
- 2) At nari circle large hoardings on both side obstruct the visibility. This increases the reaction time of driver.
- 3) At chitra vegetable marketing yard maximum number of accident occurred. Trucks and other heavy vehicles maximum traffic on road so, there is very heavy traffic volume congestion on this road. Absence of traffic control devices at this place.

- 4) Gaytri Temple and Mastrambapa Temple junction is uncontrolled intersection on Bhavnagar Rajkot road. During the religious festival season, high intensity of pedestrian movement across the Rajkot road towards Mastarambapa Temple and Gaytri Temple would take place. This is reason of traffic jammed condition.
- 5) No pedestrian facilities provided on Bhavnagar Rajkot road.
- 6) In monsoon season, rain water spills over the road of near press kvaters due to poor drainage facilities.
- 7) Encroachment on Both the side also make conflicts.
- 8) Traffic control devices are absence entire road.
- 9) There is high commercial vehicle movement on this road. So heavy vehicle conflicts are observed.

#### 2) Proposed Improvements

Following improvement measures are suggested to improve the accident scenario of this road:

- 1) Proper drainage facilities at press kvatrs should be introduced.
- 2) Pedestrian facilities, foot path with guard rails in the intersection area should be provided on throughout the stretch.
- 3) Road signage and markings should be introduced at appropriate places.
- 4) There should be a provision of channelized Intersection to stream line traffic movement.
- 5) Proper action should be taken against large hoardings. .
- 6) Pedestrian crossing provided at chitra vegetable marketing yard.

#### C. Station Road

This is a fully divided road starting from Jashonath chowk to Nilambag Circle. The length 1.3 kms.

##### 1) Problem Identification

From the field survey of this road, problems identified are enlisted below:

- 1) ST bus station is on this road which mostly affect adversely to the effectiveness of carriage way.
- 2) At ST bus station not provide any traffic control devise and pedestrian crossing. So, more number of pedestrian killed and injured at this place.
- 3) Several collages, hotels and hospitals have very poor parking facilities in their own premises.
- 4) Central divider are not provided on this road.
- 5) On street parking facility not provide.

##### 2) Proposed Improvements

To reduce the accident proneness of this road following measures are proposed:

- 1) Traffic police should be provided at ST bus station.
- 2) Foot path is required to be widened to at least 1.5 meters on both the side of the roads.
- 3) Parking is required to be shifted from the intersection area to off street.
- 4) Foot path should be provided both side of road, so that pedestrian can use it and road way conflicts can be reduced.
- 5) Central divider are provided on this road.

#### D. Ganga Jaliya Talav Road

Ganga Jaliya Talav Road is two lane without central divider starting Jashonath chowk to Ghogha gate. Length of this stretch is 0.55kms.

#### 1) Problem Identifications

From field survey following problems are identified:

- 1) No Pedestrian walk way on throughout the road.
- 2) Ganga Jaliya Talav Road inside the bazaar religion so, 2w vehicle movement make a conflicts in traffic at intersection.
- 3) Commercial and shopping area on this road so, pedestrian movement make a conflicts.
- 4) On street parking are make a conflicts in traffic.
- 5) Irregular Auto rickshaws parking make a conflicts in traffic



Fig. 3: Irregular parking at Ganga Jaliya Talav

#### 2) Proposed Improvements

To reduce the accident proneness of this road following measures are proposed:

- 1) Foot path should be provided throughout the road.
- 2) Proper traffic control devices like pavement markings and traffic sign and Signals should be provided at suitable locations.
- 3) There should be a provision of chandeliers to stream line traffic movement.
- 4) On street or off street parking provide.

## V. CONCLUSION

The study presented in the paper has been conducted to identify the accident black spots on the selected stretch and improvement suggested.

- Proper action should be taken against large hoardings.
- There should be a provision of channelized Intersection to stream line traffic movement.
- Proper drainage facilities at press kvatrs should be introduced.
- Traffic signal system is proposed at Gaytri Temple, Mastrambapa Temple, Chitra ST work shop junction for safe movement of vehicular and pedestrian traffic and to optimize the intersection performance.
- Pedestrian crossing provided at chitra vegetable marketing yard.
- Traffic police should be provided at ST bus station.
- At panwadi chowk, signalized intersection is required to be working for the whole day as this is the main road of the city leading bus station, Aaryuvud collage and Bagarangdas hospital carries heavy traffic throughout the day.
- Pavement markings and traffic signs should be introduced at proper locations to control the traffic.
- The electrical poles should be removed or proper planning and to be made underground cable systems.
- On street or off street parking provide.

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