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Identification of Accident Prone Locations Using Accident Severity Value on a Selected Stretch of NH-1

Gourav Goel *, S.N. Sachdeva **
*(Department of Civil Engineering, M. M. Engineering College, Mullana-133207, Haryana, India
Email: gouravgoelshinu@gmail.com)
** (Department of Civil Engineering, NIT, Kurukshetra, India
Email: snsachdeva@yahoo.co.in)

ABSTRACT
Growing number of road accidents needs to be controlled by identifying the accident prone locations on road stretches. In this paper a study has been carried out 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. 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.

Keywords **-** Road Accidents, Accident Prone Location, Accident Severity Value.

I. INTRODUCTION

Road transportation provides benefits to everybody by facilitating the movement of goods and people. It enables increased access to jobs, economic markets, education and health care, which in turn have direct and indirect positive impacts on the health of population of the country. However, increase in road transportation has considerably increased the number of road accidents also. A number of studies on road accident study pattern have been carried in India in the past. In [2], authors used accident prone index to identify black spots on roads. In [1], authors ranked accident prone locations by calculating accident rates. In India we have only 2% of road length of national highways out of total road length to accommodate 40% of the total traffic on Indian roads. This has resulted in a steep increase in number of road accidents fatalities in India which is alarming. Between 1970 to 2009, the number of road accidents increased by 4.3 times with more than 7 fold increase in injuries and about 8.7 times increase in fatalities in the backdrop of about 3 fold increase in road network. Around 56 road accidents take place every hour in which 14 deaths occurs on roads in India. There is a great need to take up measures that can help improve road safety in the country. Safety on roads has become a major area of concern. The number of persons killed in road accidents has increased considerably from during in the last decade. The road accident data in India during 2002-2009 has been given in Table 1, [4].

Table 1: Numbers of Accidents during 2002-2009 in India

Year	Number of Accidents	Number of Persons Killed
2002	4,07,497	84,674
2003	4,06,726	85,998
2004	4,29,910	92,618
2005	4,39,255	94,968
2006	4,60,920	1,05,749
2007	4,79,216	1,14,444
2008	4,84,704	1,19,860
2009	4,86,384	1,25,660

As NHs are responsible for causing about 40% of fatalities on Indian roads. The present study has been undertaken to identify and suggest remedies for the accident prone locations on road stretch RD 98km-148km of NH-1.

II. DATA COLLECTION

The accident data is collected for four years from 2007 to 2010 from National Highway Authority of India (NHAI) and SOMA Isolux. NHAI is associated with maintenance and construction of NHs in the country. The SOMA Isolux construction

company is presently engaged in widening project of NH-1 from Panipat to Jalandhar. The study also evaluates the impact of 6-laning widening project on road accidents which started in May, 2009. The accident data includes that data also. The accident data contain the information like date, time and location of accidents. The data also include type of accident (fatal / minor or serious injury), number of persons dead / injured, vehicles involved in accident, probable cause of accident and the jurisdiction of the police station.

III. METHODOLOGY OF STUDY

The study aims at identifying and improving the accident prone locations on a given stretch of NH-1. With this objective in view, the accident data of the selected road stretch for the study, 98km-148km of NH-1, were collected from different sources. The collected data of the year 2007 to 2010 has been analyzed by dividing the selected stretch of NH-1 from 98 km to 148 km into smaller stretches of approximately 5 km each. After analysis of the data, the results are summarized. 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. The accident prone locations are identified using the concept of Accident Severity Value (ASV) and field visits are made to check the real time locations conditions.

IV. EFFECT OF 6-LANING PROJECT

The data of accidents is analyzed with reference to location of occurrence of accident. Table 2 shows the total number of accidents per year that occurred on different locations in the period 2007-10. It is clear that the number of accidents in every stretch increased considerably after construction work. It is worth noticing that in 2009 construction work started in May only. The maximum number of accidents takes place between 98-104 km followed by 105-109 km and 109-114 km.

It shows that construction activity has led to significant increase in accidents on the road. The increase in accidents can very well be attributed to non-compliance of safety measures in the construction zones and increased congestion on the road due to lesser carriageway available for the movement of traffic.

Table 2: Total Number of Accidents during 2007-2010

Year / Stretch	Before Construction			After construction Work Started	
	2007	2008	2009	2009	2010
98-104	6	2	0	60	123
105-109	3	1	0	32	103
110-114	5	0	2	42	100
115-119	5	4	0	29	63
120-124	10	7	1	37	51
125-129	7	13	1	37	69
130-134	13	11	4	40	69
135-139	6	15	3	41	77
140-144	7	19	5	48	82
145-148	11	10	5	36	69

V. IDENTIFICATION OF ACCIDENT PRONE LOCATIONS

Accident prone locations are identified by using the concept of Accident Severity Value (ASV).

a. Accident Severity Value:

The Accident Severity Value measures the severity or injury level of an accident. In this concept different injury levels are given some values based on their severity. For this study, following values have been given to different types of accidents.

- Fatal Accident: It is a serious accident in which death occurs either at the spot or later provided the cause of death is the injury received in the accidents. The severity value given to the fatal accident is 10.
- Serious Injury Accident: It is an accident in which a person is injured badly or severity is more but no death occurs. The severity value given to the serious injury accident is 5.
- Minor Injury Accident: It is an accident in which a person suffers minor injury. The value given to this type of accident is 3.
- Non Injury Accident: It is an accident in which no injury takes place. The severity value given to this type of accident is 2.

By using the values assigned to each type of injury level, Accident Severity Value has been calculated various locations of the studied stretch and tabulated in Table 3.

Table 3 Accident Prone Locations by ASV

Sr. No.	Stretch (km)	Fatal Injury	Serious Injury	Minor Injury	Non Injury	Total No. of Accident	Accident Severity Value	Ranking of Stretch
1.	98-104	10	36	40	115	191	630	2
2.	105-109	7	47	23	78	139	581	6
3.	110-114	4	27	18	96	149	487	7
4.	115-119	6	27	15	58	101	431	9
5.	120-124	4	25	10	72	110	429	10
6.	125-129	2	37	20	67	127	459	8
7.	130-134	8	50	31	67	137	584	5
8.	135-139	12	45	37	67	142	599	4
9.	140-144	10	61	37	62	161	649	1
10.	145-148	10	70	24	44	131	658	3

It is observed from the table that maximum number of accidents take place on 98-104 km stretch followed by 140-144 km and 110-114 km. However, when we take severity of accident into consideration, stretch 140-144 km comes out to be the most critical followed by 98-104 km and 145-148 km.

b. Field Visits

In order to understand the location specific causes, field visits were taken up. The photographs of various locations of the road have been given from Fig 2, Fig 3, Fig 4, and Fig 5.

Fig 2: Lack of Proper Diverging Lane (RD 143.400 Km)

Fig 3: Sharp Diversion (RD 140.000 Km)

Fig 4: Wrong Signage near Toll Barrier (RD 145.000 Km)

Fig. 5 Road Side Development on Y- Junction (RD 129.030 Km)

VI. IMPROVEMENT MEASURES

Over speeding/ driver's fault and lack proper control measures are found to be main reason for most of accidents taking place on the road, effective speed regulation measure need to be taken on the road. This results in high speed driving even through

these stretches leading to more accidents in these areas. It is suggested that:

1. Rational speed safe limits should be determined based upon 85th percentile speed of vehicles on the road.
2. Proper signage should be put in place and violators be punished by the enforcement agencies.
3. Proper diverging lane should be provided.
4. Road side development should be discouraged.
5. It is observed through analysis of collected road accident data that accident increased tremendously after construction work for widening of 6-laning started in May, 2009. Field study of various sits of the studied stretch indicated that proper safety measures have not been taken in the construction zones. A layout plan of signs and control devices for a typical road with a diversion as recommended by IRC-SP-55 is shown in Fig 6. It is seen that nowhere in the studied stretch of the road the guidelines of IRC-SP-55 have been followed which is one of the main reasons for increase in number of accidents after start of construction of widening project.

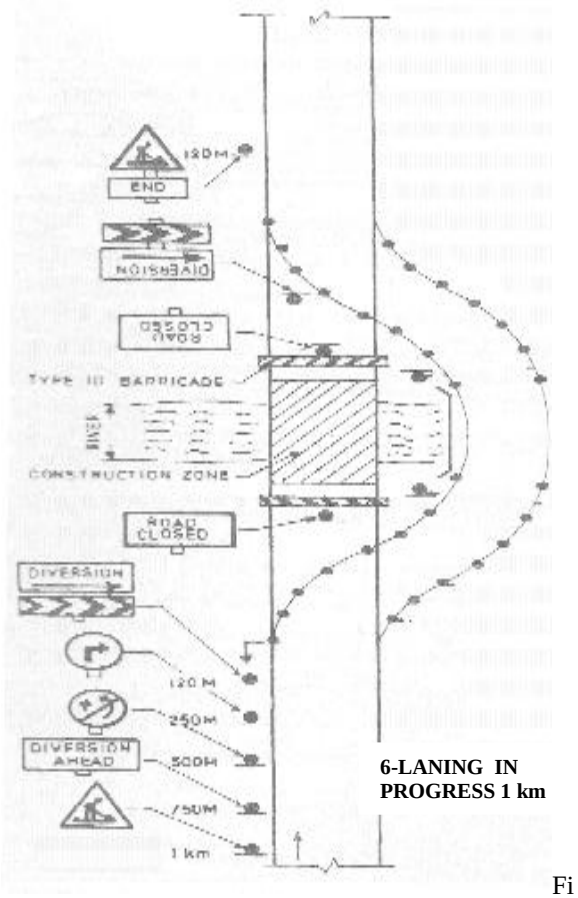

Fig 6: Layout of signs and control devices for road closed with diversion

VII. CONCLUSIONS

The study presented in the dissertation has been conducted to identify the accident prone locations on the selected stretch (98-148 km) of NH-1 and suggest the improvements. The following are the main conclusions drawn from the study:

1. The road accident data for the year 2007-10 for the stretch 98-148 km of NH-1 was collected from NHAI and Soma Isolux, the agency involved in widening project of NH-1.
2. The number of accidents increases tremendously after the start of construction work in May, 2009 for widening of NH-1.
3. The concept of accident severity value has been used to identify more accident prone locations on the studied stretch of the road. The selected 50 km stretch of the road is further divided into sub-stretches of length about 5 km each. Using the concept of accident severity value these sub-stretches have been ranked 1 to 10 in order of their decreasing accident severity value.
4. 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.

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