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Study on road accident and improved safety measures of road accident

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ABSTRACT

Road accidents are an outcome of the interplay of various factors, some of which are the length of the road network, vehicle population, human population and adherence/enforcement of road safety regulations etc. Road accident causes injuries, fatalities, disabilities, and hospitalization with severe socio-economic costs across the country. Road traffic injuries cause considerable economic losses to victims, their families, and to nations as a whole. Almost 90% of the world's fatalities on the roads occur in low- and middle-income countries, even though these countries have approximately half of the world's vehicles. Half of those dying on the world's roads are "vulnerable road users": pedestrians, cyclists, and motorcyclists. Without action, road traffic crashes are predicted to rise to become the 7th leading cause of death by 2030. There are a total 1, 03,933 km of National Highways in India and out of the total length of 1, 03,933 km of National Highways, 57,511 km is with the State Public Works Departments (State PWDs), 32,155 km with the National Highways Authority of India (NHAI), 1616 km with NHIDCL and 4,550 km with Border Roads Organization (BRO), balance length of 4,642 km is yet to be entrusted to the executing agencies. Although National Highways constitute nearly about 2 percent of the total road network as on 31st December 2015, they carry 40 per cent of the total road traffic. The capacity of National Highways in terms of handling traffic (passenger and goods) needs to be in pace with the industrial growth. India has one of the largest road networks of over 54.72 lakh km. It comprises of National Highways, Expressways, State Highways, and Major District Roads, Other District Roads and Village Roads as shown below.

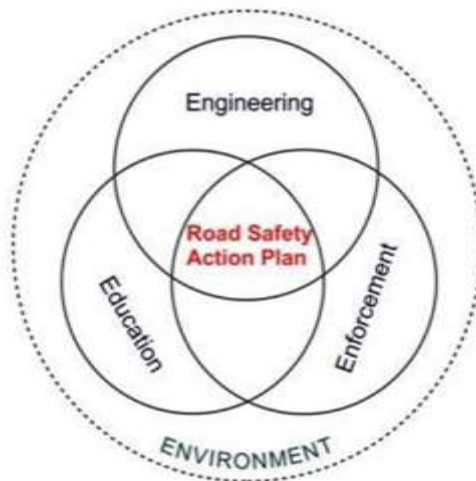
Keywords: Road accident, Safety measures, Human population, Vehicle population.

1. INTRODUCTION

The fast growth in the Road Transportation Sector in India has been a key element in the economic development of the country. But on the other hand, this fast growth in Transportation Sector led in to increase in traffic accidents too. Though the accident rate is decreased during the last 25 years due to awareness among people education and safety programmes still the accident rate is very high as compared to the developed nations. The total number of road accidents increased by 2.5 per cent from 4, 89,400 in 2014 to 5, 01,423 in 2015. The total number of persons killed increased by 4.6 per cent from 1, 39,671 in 2014 to 1, 46,133 in 2015. Road accident injuries have also increased by 1.4 per cent from 4, 93,474 in 2014 to 5, 00, 279 in 2015. Accident severity (number of persons killed per 100 accidents) has gone up from 28.5 in 2014 to 29.1 in 2015. The analysis of road accident data 2015 reveals that about 1374 accidents and 400 deaths take place every day on Indian roads. It further reveals that 57 accidents take place and 17 lives are lost every hour on an average in road accidents in our country. This increasing trend in injuries and fatalities has been recognized as a public health problem of significance by the authorities and public at large. In economic terms, the cost of the road crash injuries is estimated at roughly one percent of gross national product in low-income countries, 1.5 percent in middle-income countries and 2 percent in high-income countries.

Table 1 Showing Road Accident Parameters: 2014 and 2015

Parameter	2014	2015	%change
Total Accidents in the country	4,89,400	5,01,423	2.5
Total number of Persons Killed in the country	1,39,671	1,46,133	4.6
Total number of Persons Injured in the country	4,93,474	5,00,279	1.4



2. SCOPE

The study mainly focused on identification of existing and potential safety hazards and recommendation of the cost-effective measures for the overall safety improvement of NH-709 (Rohtak bypass to Panipat Bypass Corridor) by Road Safety Auditing process. This stretch is about 63.6KM long and has been recently built 4- lane highway.

So for this stretch safety evaluation would be done and it will provide a systematic way of being proactive in reducing the future likelihood of accidents. Audit of existing roads involves a similar approach to that for new road projects. As with a safety evaluation of any type of project, the road should be inspected from the point of view of all the likely road user groups and not just motorists. For conducting safety evaluation of existing roadway sections field studies like road inventory, classified volumes counts, speed survey, and study of first information reports are essential

3. LITERATURE REVIEW

Speedy growth of population coupled with increased trade and industry activities has favored in incredible growth of motor vehicles. This is one of the primary factors responsible for road accidents. Haryana is one of the states experiencing a fast growth of road network through NHDP and PMGSY. This has resulted in a rapid growth of various types of traffic modes on the highways. In absence of proper safety measures resulting in a large number of traffic accidents and fatalities, unfortunately, inadequate attention to safety results in loss of people’s life, wealth and health. Main reasons for this large number of accidents are lack of traffic signals, parking areas, markings and geometric designs of the road. There exists a serious lack of research and development work related to road safety in our country. Very little literature is available on the safety assessment of a particular road and identification of causal factors of road accidents. One major cause for this lack seems to be a scarcity of systematic data.

Singh et.al (2006) carried out road accident analysis in Patna city and studied about the various reasons for accidents. Urban transport facilities in most of the Indian cities are inadequate and deteriorating over the years. As a result, the use of the undesirable modes such as personalized transport, mainly two-wheelers, and intermediate public transport, mainly three-wheelers, is growing at a rapid speed.

The vehicular population growth is tremendous in Patna, with just 4,384 registered motor vehicles in 1981 to 294,164 in 2001, an increase of 67 fold in a span of just two- decades. If we calculate it from 1981 to 2001, annual growth rate figure goes up to around 23%. It is observed that growth of personalized vehicles such as two-wheelers and cars is very steep due to non-availability of the mass transport system.

From the year 2000 onwards, new bypass road on national highway (NH - 38) is considered to be the most accidents prone location in the city where around 15% of all the accidents occur during recent years. It is estimated that the total economic loss due to road accidents is of the order of Rs. 60 billion each year in India.

Dr.S.N.Sachdeva et.al (2015) Accident safety is one of the major concerns for the economy in a developing country. According to UN report, world economy loses over the US \$50 billion per year in accident crashes. The vehicular population is increasing at a very high rate from the beginning of 21st century. From observing the studies done in past, the vehicle population is doubled within 5 years duration but the length of roads existing has not been able to cope up with this increased traffic.

Traffic and accident data for various countries are gathered and it is compared with Indian scenario. And in the same manner, a comparison is made between Haryana and India. The various factors viz. population, number of fatal accidents, accident severity, vehicular population and traffic density are considered, compared and discussed. From the observed data, it can be said that India has to take strong measures to counteract and

4. EXPERIMENTAL WORK

Spot Speed Survey

A spot speed is made by measuring the individual speeds of a sample of the vehicle passing a given spot on a street or highway. Spot speed studies are used to determine the speed distribution of a traffic stream at a specific location. The data gathered in spot speed studies are used to determine vehicle speed percentiles, which are useful in making many speed-related decisions.

Spot speed data have a number of safety applications, including the following:

- Speed trends
- Traffic control planning
- Accidental analysis
- Geometric design
- Road Safety Audits

Methods of conducting spot speed Studies are divided into two main categories:

- Manual
- Automatic

Spot speeds may be estimated by manually measuring the time it takes a vehicle to travel between two defined points on the roadway a known distance apart (short distance), usually less than 90m. The distance between two points is generally depending upon the average speed of traffic stream.

Table 4 Recommended study length (in meters) for various average stream speed ranges (in kmph)

Traffic Stream Average Speed	Recommended Study Length (m)
Below 40 kmph	30
40 – 65 kmph	50
Above 65 kmph	80

The Pavement Marking method was used to successfully complete a spot speed study using a small sample size taken over a short period of time.

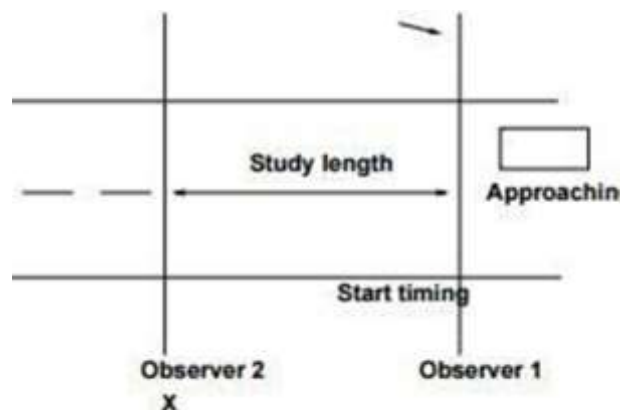


Figure 11 Pavement Marking Method

In this method, markings of pavement are placed across the road at each end of the trap. Observer starts and stops the watch as the vehicle passes lines. In this method, minimum two observers required to collect the data, of which one is standing at the starting point to start and stop the stop watch and another one is stand at end point to give an indication to stop the watch when the vehicle passes the end line. Advantages of this method are that after the initial installation no set-up time is required, markings are easily renewed. The spot speed survey was carried out at a chainage of 35+00 KM on 20th March 2017.

The data collected in the Spot Speed Survey was done by the pavement marking method and was represented in the form of the following table:

Table 5 Spot Speed Data

S.NO.	DISTANCE (80m)	TIME (SECONDS)	SPEED (m/s)	SPEED (kmph)
1	80	2.96	27.03	97.30
2	80	4.35	18.39	66.21
3	80	2.61	30.65	110.34
4	80	3.09	25.89	93.20
5	80	4.84	16.53	59.50
6	80	7.82	10.23	36.83
7	80	5.21	15.36	55.28
8	80	2.53	31.62	113.83
9	80	2.87	27.87	100.35
10	80	2.12	37.74	135.85
11	80	2.79	28.67	103.23
12	80	3.28	24.39	87.80
13	80	3.14	25.48	91.72
14	80	4.36	18.35	66.06
15	80	3.92	20.41	73.47
16	80	2.09	38.28	137.80
17	80	2.63	30.42	109.51
18	80	2.94	27.21	97.96
19	80	2.41	33.20	119.50
20	80	4.58	17.47	62.88
21	80	3.91	20.46	73.66
22	80	2.41	33.20	119.50
23	80	2.19	36.53	131.51
24	80	3.74	21.39	77.01
25	80	2.67	29.96	107.87
26	80	3.17	25.24	90.85
27	80	3.49	22.92	82.52
28	80	11.93	6.71	24.14
29	80	3.37	23.74	85.46
30	80	4.21	19.00	68.41
31	80	6.12	13.07	47.06
32	80	2.28	35.09	126.32
33	80	2.48	32.26	116.13
34	80	3.1	25.81	92.90
35	80	2.83	28.27	101.77
36	80	2.49	32.13	115.66
37	80	2.09	38.28	137.80
38	80	2.26	35.40	127.43
39	80	3.3	24.24	87.27
40	80	3.19	25.08	90.28
41	80	4.73	16.91	60.89
42	80	2.73	29.30	105.49
43	80	3.28	24.39	87.80

44	80	2.79	28.67	103.23
45	80	2.92	27.40	98.63
46	80	9.37	8.54	30.74
47	80	3.16	25.32	91.14
48	80	5.38	14.87	53.53
49	80	4.84	16.53	59.50
50	80	3.49	22.92	82.52
51	80	2.81	28.47	102.49
52	80	2.39	33.47	120.50
53	80	3.22	24.84	89.44
54	80	2.87	27.87	100.35
55	80	3.54	22.60	81.36
56	80	2.99	26.76	96.32
57	80	2.38	33.61	121.01
58	80	13.43	5.96	21.44
59	80	4.57	17.51	63.02
60	80	2.13	37.56	135.21
61	80	3.61	22.16	79.78
62	80	5.92	13.51	48.65
63	80	3.26	24.54	88.34
64	80	2.32	34.48	124.14
65	80	2.96	27.03	97.30
66	80	2.78	28.78	103.60
67	80	11.8	6.78	24.41
68	80	2.81	28.47	102.49
69	80	2.69	29.74	107.06
70	80	2.43	32.92	118.52
71	80	3.14	25.48	91.72
72	80	2.93	27.30	98.29
73	80	2.45	32.65	117.55
74	80	2.39	33.47	120.50
75	80	2.48	32.26	116.13
76	80	3.42	23.39	84.21
77	80	2.86	27.97	100.70
78	80	4.69	17.06	61.41
79	80	2.87	27.87	100.35
80	80	3.14	25.48	91.72
81	80	2.07	38.65	139.13
82	80	2.94	27.21	97.96
83	80	7.91	10.11	36.41
84	80	3.04	26.32	94.74
85	80	2.67	29.96	107.87
86	80	3.49	22.92	82.52
87	80	8.12	9.85	35.47
88	80	7.37	10.85	39.08
89	80	2.42	33.06	119.01
90	80	2.73	29.30	105.49

91	80	4.21	19.00	68.41
92	80	3.52	22.73	81.82
93	80	2.49	32.13	115.66
94	80	4.21	19.00	68.41
95	80	7.39	10.83	38.97
96	80	2.93	27.30	98.29
97	80	2.48	32.26	116.13
98	80	3.14	25.48	91.72
99	80	2.53	31.62	113.83
100	80	3.05	26.23	94.43
101	80	2.26	35.40	127.43
102	80	12.74	6.28	22.61
103	80	3.84	20.83	75.00
104	80	2.91	27.49	98.97
105	80	3.02	26.49	95.36
106	80	2.42	33.06	119.01
107	80	2.19	36.53	131.51
108	80	8.21	9.74	35.08
109	80	3.85	20.78	74.81
110	80	2.91	27.49	98.97
111	80	3.01	26.58	95.68
112	80	2.08	38.46	138.46
113	80	3.05	26.23	94.43
114	80	2.26	35.40	127.43
115	80	3.84	20.83	75.00
116	80	2.91	27.49	98.97
117	80	3.02	26.49	95.36
118	80	7.39	10.83	38.97
119	80	2.42	33.06	119.01
120	80	2.49	32.13	115.66

5. REFERENCES

- [1] From data simulation, it is found that Road Signs, Condition of Blinkers & rumble strips, median opening, people’s negligence and lack of enforcement were main parameters for causing accidents.
- [2] Due to newly upgraded four-lane National Highway-709 between Rohtak bypass and Panipat Bypass Corridor, the road standards have been raised suddenly. But other related factors are not brought to this level such as road user behavior, surrounding prevailing conditions etc.
- [3] A total of 11% of the road signs were found to be broken, another 11% road signs had obstruction on their line of visibility, other 6% were not even found on the site & lastly rest 72% were found to be appropriate, which in turn causes confusion for the vehicles plying on the highway and thus resulting in accidents, so once the road signs are made appropriate the accidents could reduce.
- [4] Around 27% of the total guard rail was found to be broken, other 28% was appropriate, which causes the vehicles to jump off the highway and land in the fields nearby. This could result in fatalities, thus to reduce it the guard rails should be repaired as soon as possible.
- [5] The 16% of the delineators are found to be broken, 58% are found to be appropriate. By comparing the data we can say that around 25% accidents occur at night time and if the delineators are repaired then this 25 % can be reduced to a much low level.
- [6] Around 21% of accident share is occurring during mist/ fog, once the delineators are improved this 21% share can be reduced to low levels.
- [7] Degree of access control is not consistent with the road’s function. The occurrence of unexpected events due to numerous private and commercial property entrances, driveways, roadside developments, uncontrolled side roads etc. are found to be complicating

the driving task. So the railings provided for controlling the access should be repaired and installed again at Chidana, Mundalana & Israna village, where they have been removed or broken.

[8] All unauthorized median openings should be closed and adequate provisions for crossing local people be made on priority.

[9] All undeveloped major and minor intersections must be developed with adequate lighting provisions as quickly as possible. The pedestrian movement should be smooth and provisions should be there for them to cross the road like a foot over bridge.

[10] This is a National Highway with design speed 100 kmph & Upper Safe Speed Limit to be 90 KMPH. From 'speed study', it is found that along this highway, 98th percentile speed is 132 kmph and 85th percentile speed is 113 kmph. The road standards are permitting high speeds, but prevailing traffic conditions are not conducive to such speeds.

[11] Over speeding itself is having 48% share in the causes of accidents which means it is an alarming issue and should be taken care of on priority basis by deploying enforcement on the highway as there are no speed checks on this stretch due to the absence of interceptor vehicle at all the police stations in the jurisdiction of this highway.

[12] The major share of the total accidents are taken by the Car/ Jeep / Van i.e. 31%, around 29% accidents are of the Truck/ Bus and around 14% are due to 2- wheelers.

[13] The accident data reveals that 14% accidents occurring in a year are fatal, so to reduce the fatalities the measures suggested should be implemented on priority basis.

[14] Around 7% Share of accidents is due to drunken driving which is also a serious concern, again the enforcement should be strengthened on the highway.

[15] Study also reveals that around 25% share of accidents is occurring during night time, so the blinkers and delineators should be properly placed and should be functional.

[16] It was also seen that slow-moving traffic was creating hazards for fast moving traffic as it always occupied the innermost lane of the highway which shares the 14% of total accidents.