Analysis of Causal Factors of Accidents on Highways in Haryana

Gyanendra Singh[1], S. N. Sachdeva[2], Mahesh Pal[3],

[1](Department of Civil engineering DCRUST, Murthal, Sonepat, India)
[2,3](Department of Civil engineering, NIT, Kurukshetra, India)

Abstract : *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 and design of crossings Traffic from nearby villages merges with the through traffic in a very dangerous manner resulting a large number of traffic accidents and fatalities. For this study traffic and accident data on NH-1, SH-11 and SH-20 was collected and the trends were analyzed. The results indicate the presence of mixed traffic on various roads but the share of non motorized traffic was found very low on NHs. The trends of fatalities indicate heavy involvement of trucks and cars in accidents, and VRUs as major victims.*
Keywords—*Highway Safety Mixed Traffic, Road Accidents, Traffic Volume, Vulnerable Road Users (VRU).*

I. Introduction

Indian road network of more than 48.65 lakh kms,[1] is one of the largest in the world and experiencing a fast and unprecedented growth through NHDP and PMGSY. Total number of vehicles on Indian roads has approximately tripled in the last decade, increasing from 37 million in 1997 to 114 million in 2010. But road safety in India is amongst the poorest in the world. India is home to the largest number of road deaths in the world, an estimated 1,37,000 deaths in 2013. [2] While the total number of fatalities increased at an average rate of about 4% per year in the period 1997-2003, the rate has doubled to 8% per year since then.[3] Estimated social cost of accidents in India is around Rs. 1,00,000 Crores per year which constitutes about 3% of GDP [4] and is almost twice the cost of building the golden quadrilateral.

Road accidents kill more people than any other natural or manmade disaster, from terrorism to earthquakes. The safety deficiencies in the road infrastructure need urgent attention.

II. Need of Specific Study In Indian Condition

Unlike developed countries India faces a situation where technologically advanced vehicles, driven by drivers with little traffic education use relatively less advanced roadways. Indian traffic flow is heterogeneous, consisting of various modes of varying dynamic and static characteristics sharing the same road space. This traffic is characterized by lack of any effective channelization, mode segregation or control of speed.[5] "Vulnerable road users" account for 84 per cent of deaths in cities and 67 per cent on highways.[6] In MORTH documents 78% accidents are recorded as drivers fault but according to Haryana DGP "80 per cent of accidents that took place happened due to engineering faults of roads."[7] Detailed crash data have not been available to have a correct understanding of the causal factors associated with road accidents. Therefore India specific study to assess traffic safety performance of various roads is need of the hour.

III. Literature Review

There exists a serious lack of research and development work related to road safety in our country. Very little literature is available on safety assessment of a particular road and identification of causal factors of road accidents. One major cause for this lack seems to be scarcity of systematic data.
In 2002, a study in 6 developing countries [8] found AADT, Curvature and Gradient as significant explanatory variables. Accident rate was found increasing with increasing AADT, sharpness of the curve or steepness of the gradient. Singh and Dhattarwal (2004) [9] analysed 2000-2001 data of road accidents of PGIMS, Rohtak. The study shown that 59% accidents occurred on Highways, 60% deaths were from VRU category, more than 70% from working age group, maximum accidents occurred in winter between 6-8 pm, heavy vehicles were found responsible for 38.9% fatalities followed by cars and jeeps (30.4%). Drivers were at fault in majority of cases (55.6%). Out of 104 motor cyclists only one was wearing helmet. None of the occupants of cars used protective seat belts. Out of the total deaths only 40% were within 1 hour of the accident, 98% deaths occurred within 2 weeks period.

Another important study was conducted in Tamil Nadu.(2006) [10]. Accident data, Road environment and inventory/survey data, Traffic flow and speed data were collected on 14 roads of various types and at 28 locations for 3-4 years. On National Highways side friction, road marking provision, number of lanes and shoulder width; and on State highways road condition, road markings, number of lanes were found significant variables affecting accident occurrence. Rokade et.al. (2010) [11] studied the impact of cross-section dimensions, traffic volume, speed, road shoulder width, lighting conditions, traffic signs and traffic signals on road accidents. Dinu R.R. and Veeraragavan, A. (2011) [12] analysed three year accident data from nearly 200 km of highway segments and studied the effect of traffic volume, proportion of cars, motorized two-wheelers and trucks in traffic, and driveway density and horizontal and vertical curvatures on accidents. Singh and Suman (2012) [13] analysed 10 year data of road accidents on NH-77 from Hajipur to Muzaffarpur. Heavy vehicles were found involved in almost 48% accidents followed by two-wheelers 16%, car 12% and bus 10%.

IV. Data Collection

Traffic volume and accidents data for NH-1, SH-11and SH-20 was collected on identified stretches. For traffic volume data on SHs the PWD B&R office of Haryana was contacted and their traffic count registers were obtained. The traffic volume data for NHs has been obtained from Panipat Toll Plaza. The FIR data of vehicle accidents was collected from police stations Gannaur, Murthal, Sonipat, Mohana, Kharkhoda and Gohana. The problem encountered with FIR data is that FIRs are registered only in fatal and severe accident cases. Moreover, no FIR is registered if compromise reached between parties. Though statement of party is recorded, but the prescribed Performa is not filled. No information is registered in police station if the victim dies at a later stage.

V. Analysis of The Data

Traffic volume data clearly indicates presence of mixed traffic conditions on Highways (Fig.1,2 & 3), particularly on State Highways where the proportion of slow moving traffic is 29-37% (Table 1.).

Table 1. Proportion of fast and slow moving traffic on Highways

Highway	ADT	% slow moving traffic
NH-1	42418	3%
SH-11	26399	29%
SH-20	10427	37%
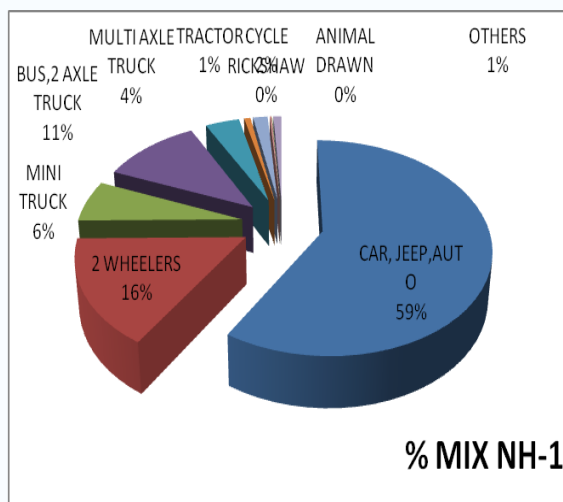
Fig.1. Traffic Mix on NH-1   **Fig.2.** Traffic Mix on SH-20

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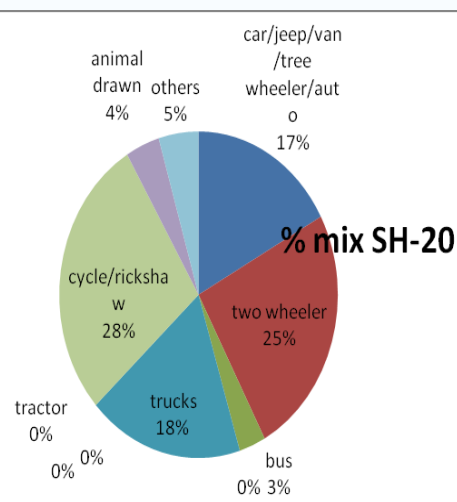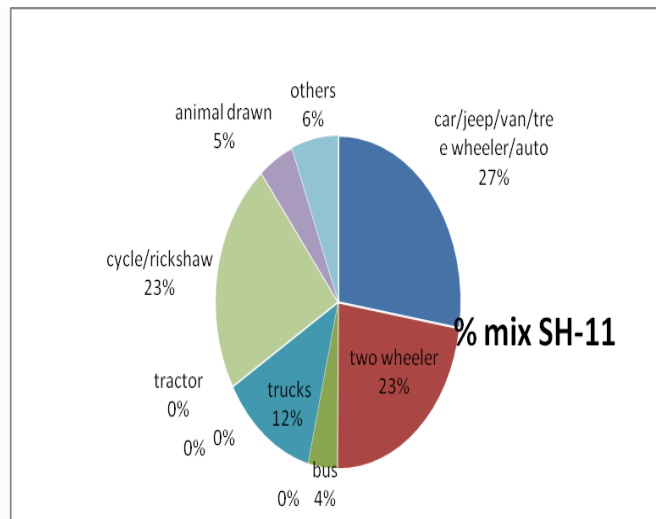**Fig.3.** Traffic Mix on SH-11

FIRs data of road accidents on Gannaur-Murthal (9 km) and Murthal-Bahalgarh (8 km) sections of NH-1; both 6 lane sections with 2.5-3 m median width, 1.5 m paved and 1 m unpaved poorly maintained shoulder, and fair condition of markings has been compiled and analysed so far according to type of accidents: severe, major, minor, property damage only; vehicles or road users involved in accident; Nature of accident: head on, side swipe, parked hit, hit pedestrian, crossing; time of the day; Month of the year; age and caste of the victims and for causes wherever mentioned in the FIR.

The data clearly indicates that Cars (38%) and truck-canter (34%) are the major categories of vehicles involved in fatal accidents (Fig.4). On the other hand pedestrians (29%) and two-wheeler (25%) riders are major victims (Fig.5). Vulnerable road users in total are victims in 60% cases.
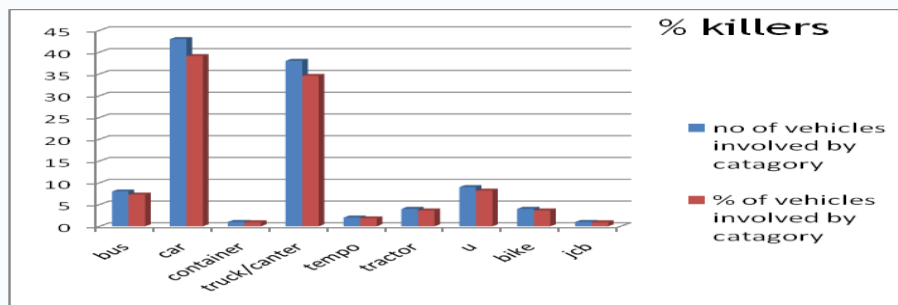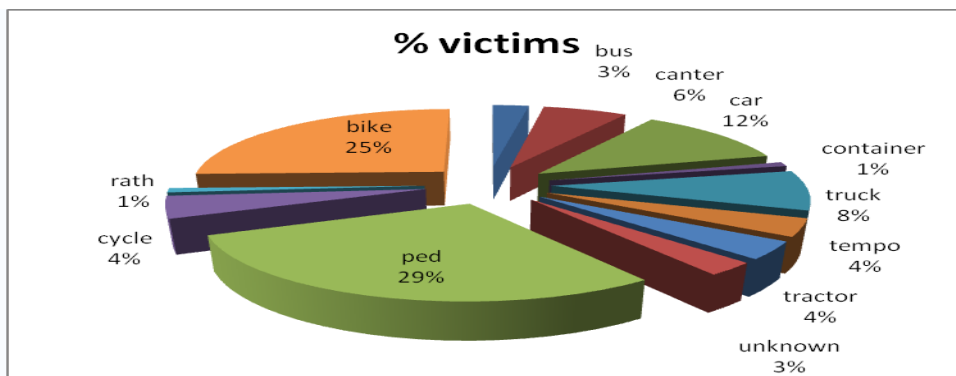

Fig.4. Killer Vehicles

Fig.5. Victims of road accidents

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Analysis of nature of road accidents indicates that more than 50% of accidents on NH-1 are fatal. 28% of the accidents occur at minor access roads or intersections, 23% are rear end collisions occurring either at intersections or due to sudden breaking of forward vehicle. 15% accidents are side swipe accidents and 7% of total accidents are head on accidents occurring due to wrong side traffic. (Fig.6. and Fig.7.) This is happening due to the traffic coming to the highway from nearby villages and developments and crossing the road in very dangerous situations.
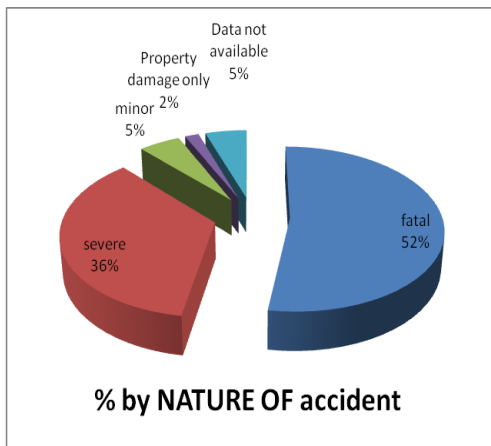

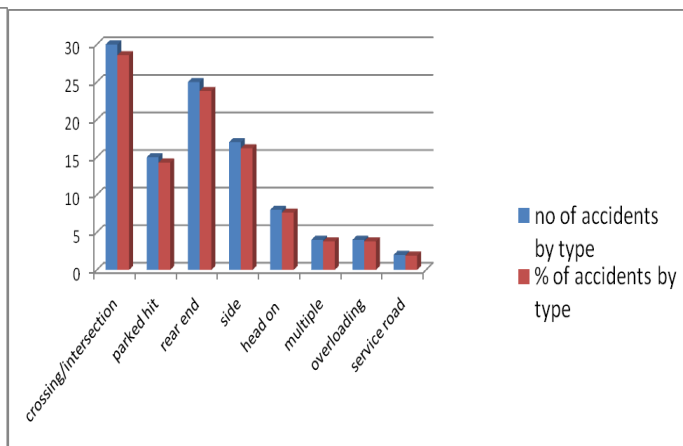Fig.6. Accidents classified by Nature   Fig.7. Accidents classified by Type

The location wise distribution of accidents clearly indicates this (Fig.8. and Fig.9.). Most of the accidents may be associated to some village access or to some road side eatery.
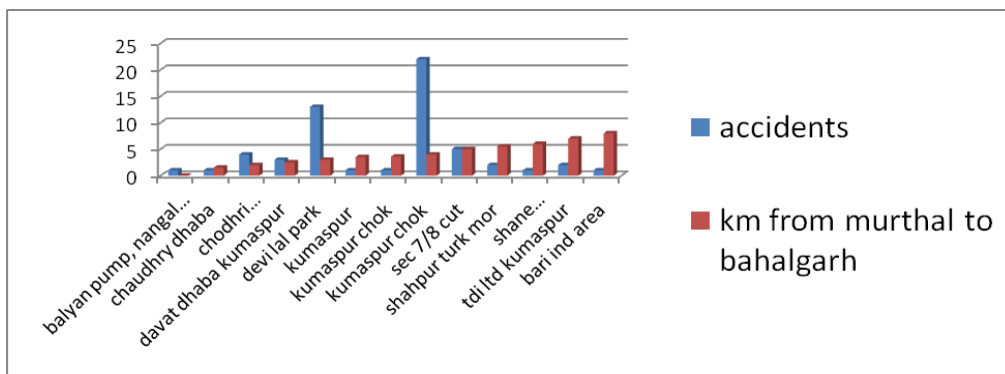

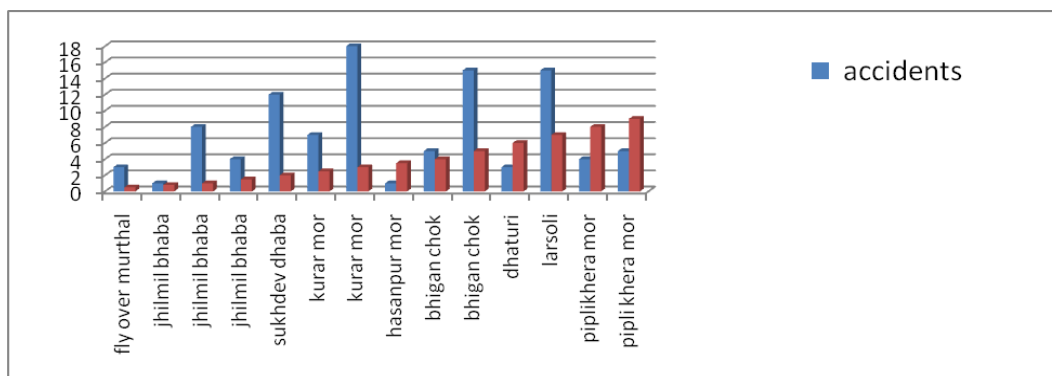
Fig.8. Location wise distribution of Accidents

Fig.9. Location wise distribution of Accidents

Most of the accidents are occurring between 6-10 PM (Fig.10.). The reason may be effect of alcohol, drowsiness, fatigue, late our rush and the reduction in capacity due to entry of trucks on highway.
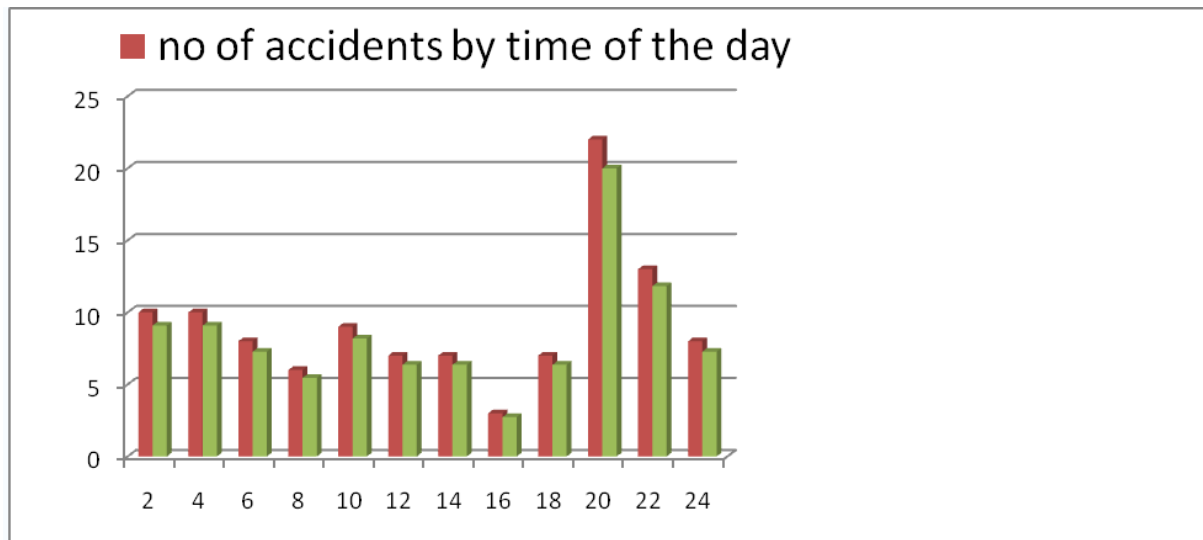

Fig.10. Accidents by Time of the Day

VI.   Conclusions

The major findings of the analysis are:
i.   The problem of traffic mix exists on all highways, particularly on SHs where slow moving vehicles proportion is 23-47%.
ii.   About two-third of victims are VRUs,
iii.   Cars (38%) and truck-canter (34%) are the two major categories of vehicles causing accidents,
iv.   Peak time for accidents is the period 6-10 pm. The same was also observed by Haryana traffic police (Indian express, Chandigarh, 26/05/2011) and Singh and Dhattarwal (2004) who analysed one year data of PGIMS Rohtak.
v.   25-30% of the total accidents are due to uncontrolled access and wrong side entry, no of uncontrolled accesses seems to be an important independent variable.
vi.   There is no clear pattern of accident occurrence with month of the year.
vii.   Most of the persons killed are of working age group and from worker's or peasant's class.

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