STUDY OF GEOMETRIC FUTURES OF ROAD AND ACCIDENT RATES OF HYDERABAD TO NALGONDA

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ABSTRACT
The expansion in activity over the world has come about inside develop the measure of mischance on street transport. This has come about inside the investigation of the clarifications for mishaps and moreover the variables that reason them. Amid this arrangement, the elements upsetting the calamity rate are contemplated and furthermore however a not too bad arrangement they present to the mishap rate has been perceived exploitation multivariate examination and investigation of change. Standard by walking might be a noteworthy way of pass on in Indian town and moreover efficient way of transport for petite excursion. The secure very surprising areas data was bi-directional stream uneven data and moreover gather uni-directional stream data from Nalgonda to Fruit Market at Hyderabad. The adversity rate has been set up out by decay think about for different numerical skin of street like level span, super rise, K-esteem, vertical level and mischance rate. Person on foot fundamental and walker qualities are relies upon sex of the passerby, age of any sort of offices (walkways, wide walkways and president's). The discoveries demonstrate that the mishap rate is to a great degree affected by the components like super rise, even sweep, K-esteem just if there should arise an occurrence of plain and moving package.
Key words: AADT (annual average daily traffic), AR (accident rate), Super elevation, Horizontal Radius, Geometric options, K-value, Visibility, Pedestrians, Sidewalks, Pedestrian Characteristics (speed, flow and density), Hypothesis testing, Capacity and level of service.

INTRODUCTION

1.1. General

Highway engineers are look with the challenge of tending to insurance issue contained by the 3 noteworthy activity security columns animal, car, and street and rail arrange show. Each of the 3 viewpoints ought to be a piece of an activity security organize and disallowed subject to spending impediments. Therefore, the esteem intensity of frameworks and counter measures are imperative elements for political assessments.

The European Commission (EC) subsidized the RANKERS venture inside the Framework examination Program. The callous goal of this improvement was to increment experimentally inquired about system changes ideal basic leadership by street experts in their endeavors to energize more secure streets and kill dangerous way area. It totally was moreover styled to acknowledge new information by playacting investigation and observational investigations of the street's collaboration with the main impetus and their vehicle in order to spot street plan proposals and anticipate their effect on wellbeing.

1.2 Geometric parameters road safety

A mishap is generally described by numerous causes. The arrangement of street is a critical impact factor: measurement of radii, quantitative connection of successive bends, measurement of vertical bends and sight separate conditions. In a few investigations of well being impacts of street style parts it appears this poor capacity to clear up coincidentally marvel in truth the most reasons for mishap is conduct of driver, that is particularly affected by his demeanor, aptitudes, and information. Besides, outer effects like (i) climate, (ii) street conditions, (iii) time of day, or (iv) light weight conditions impact the main impetus conduct further. It's out of question that dissecting mischance's and their reliance on specialized esteems or human variables has persistently to mull over these cooperation's.

A fresh and again examinations demonstrate that equivalent bends are portrayed by very surprising mishap pervasiveness. One reason can be an extraordinary driving conduct:

- Lower speeds are less critical than higher speeds in bends. Many examinations, acquainted to frame connections amongst incidentally and independent factors, were gotten in a certain unique circumstance thus, in every option entirely unexpected conditions, climate, client conduct, and so forth.
- The impact of those variables should be pondered, e.g. institutionalization method. Condensed, mishaps don't depend on just 1 factor mischance's are caused rather by a blend of many variables.

1.3 The relationship between speed and safety

Speed is one in everything about fundamental parameters in geometric style and security is substitutable with mishap considers. Also it's normally acknowledged that there are generous wellbeing preferences from bring down controls. For instance, lessening provincial speed limits from a hundred km/hr to ninety km/hr has been prognosticated to downsize losses by concerning.

1.4 Impacts of characteristics of road geometrical on traffic accident

Portions of the primary geometric style parts which will affect on course security are roadway, level, even and flow, bear, middle, vertical bend. The connection between a few attributes of those parts and car crashes, and additionally contemplates made in a few nations is arranged into gatherings across impacts and Alignment impacts.

1.4.1 Cross-Section Effects

The widths of the differed cross segment parts affect the capability of driver to perform equivocal moves and affirm the sidelong clearances each amongst vehicles and amongst vehicles and option street clients. Inside the current writing are specified especially the resulting parameters.

1.4.2 Road Path Width

More extensive paths are generally identified with higher agent speeds and expanded wellbeing. The course capacity Manual reports those more extensive paths for three-path roadways end in higher free-stream speeds.

1.5 Objectives of the Study

The essential target of this investigation was to search out unsafe street parameters touching the crash rate and crash sort. To extra explore the feasible systems for the accidents, the crash sort dispersion for the known hazardous street parameters were also concentrated to help in trademark worthy techniques for countermeasures.

- Understanding passerby speed, stream, thickness and their connections.
- Comparison of person on foot qualities with speculation check.
- To locate the Pedestrian ability and level of administration ponder for giving higher offices to walkways.
- Comparison of fundamental outlines amongst informal and two-way person on foot streams.

LITERATURE REVIEW

In past section is clarified by ME. Passerby qualities like speed stream and densities especially vital for style of any higher office related with people on foot. At present a day's urban development rate was expanded over the planet, and a considerable measure of in Bharat, person on foot offices was enhanced by leading field study in a few places in a few urban communities because of we as a whole know the walker qualities. Group pounds also have been decreased by hard future person on foot rate of development. Person on foot strolling has been produced by a few voyages in creating nations like Bharat. Walker pounds will be happened due to pool of person on foot offices.

2.1 Accident causative factors overview

Feng-Bor Lin (1990) studied on flattening of horizontal curve on rural two lane highways and found that horizontal curves on highways are on average more hazardous than tangent sections. As their curvatures increase, horizontal curves tend to have higher accident rates. He suggests that the differences between the 85th percentile speeds and the safe speeds have no statistically significant relationships with the accident rates. In contrast, the magnitudes of speed reduction, when vehicle moves from a tangent section to a curve, have a significant impact on traffic safety.

Y. Hassan et al. (2003) studied on effect of vertical alignment on driver perception of horizontal curves and found that perception of the driver of the road features ahead is an important human factor and should be addressed in road design.

2.2 Accident prediction model

Eric T. Donnell et al. (2009) studied on appraisal of the interactive highway safety design model's crash prediction and design consistency modules and evaluated the safety and operational effects of geometric on two lane rural highways through interactive highway safety design model (IHSDM).

2.3 Accident optimization model

A.F. Iyinam et al. (1997) studied relationship between highway safety and road geometric design elements and observed that the relationship between safety and road geometric has meaningful relationships through regression analysis. They suggested that the control of the road factor is much easier than the human factor and by making a geometrically good *d*esign, it was even possible to compensate for the other factors and thus decrease the number of traffic accidents through a regression analysis is made between the geometric parameters and accident rates.

2.4 Model based on speed

A utilized mischance concerned vehicles on multilane and that multilane provincial roadways and interstates as their unit of investigations. Their investigations measurable the dynamic deviation from the mean speed of the mischance concerned vehicle's speed. They found that the base mischance rate happened inside a speed shift of fifteen to twenty % more than the mean speed.

METHODOLOGY

For this study, two roads in plain & rolling terrain National Highway (NH) 565 &65 and two roads in mountainous & steep terrain National Highway 9 were selected. Various field data such as 3D Topographic features, Accident records and Traffic volume were collected for these roads. Careful observation and collection of such data with accuracy were carried out.

National Highway 565 (NH-565) is a 459 km National Highway in, traverse in south-northeast direction and end at km 230/0 near village Nalgonda. This part of the road falls in the Hyderabad and situated between 31° 18.78' N & 31° 44.48' N latitude, 77° 27.28' E & 78° 44.14' E longitude. Total length of the study corridor is about 100km.

National Highway 65 (NH-65) is a National Highway in Northern India. NH-65, which runs for a distance of 316 km, This part of the road falls in the state of 29° 20.65' N & 29° 38.33' N latitude, 79° 28.98' E & 79° 34.56' E longitude. Total length of the study corridor is about 70km.

National Highway 9 (NH-9) is a 459 km National Highway in. This part of the road falls in situated between 21° 25.92' N & 20° 56.84' N latitude, 85° 11.21'E & 85° 16.30'E longitude. Total length of the study corridor is about 67km.

3.1 Experiments on effect of walkers on foot attributes

In this area, tests led in Hyderabad town and intended to create fundamental charts for passerby stream on walkways. It will be said here that comparable analyses were led before this examination to build up the essential charts {for very surprising for various} puts in Bharat further as better places inside the world. Resulting subdivision will be clarified concerning test set-up and subtle elements on however data is gathered.

3.1.1 Experimental set-up and data combination

The data combination segment size and frame as appeared in figure 3.1, 3.2, and 3.3 is considered on a fixed walkways, these data will be bi-directional person on foot stream data. Fig 3.4 demonstrated the area is inside the HYD to NALGONDA this segment will be gathered person on foot uni-directional stream data. When gathering those data approximately a considerable measure of spots data will be gathered for future work, they're Nalgonda and sector2. In the principle the data has gathered from 3 areas in Hyderabad town, first area at every day showcase. The length of first segment, l = 3.0 m and in this way the measurement of first segment w = 1.8 m. these anticipated area will be utilized for data combination. The camera is prepared at a separation of 2.1 m from the inward edge of the found area. The camera is mounted higher than at revise area, wherever that is the place to shroud every one of the four corners of Associate in Nursing found segment. The length of second segment, l = 3.0 m and consequently the measurement of second segment w = 2.3 m. the length of third area, l = 2.5 m and in this manner the measurement of third segment, w = 2.7 m. we have a tendency to pick area and fix the examination space by checking with chalk. The length of the segment is 3m and measurement of segment is same as measurement of asphalt. Person on foot speed will be differ less generally vehicle speed because of data grouping area are taking shift little length.

3.2 Information coding

After culmination grouping information will be decoded by ME. First compute what level of walkers cross the area at that point note passerby getting into time and person on foot leave time at that point figures each person on foot speeds exploitation cry condition.

$U\ p = l_0/t_i - t_o$

Where

U p = person on foot speed,
Lo = perception length of site,
Tin =pedestrian passage time,
Tout = person on foot leave time
Tin-tout = crossing time.
Units of person on foot speed = m/sec.

3.3 Analysis methods for accident rates

1. Linear Regression analysis
2. Multiple linear regression analysis
3. Queuing analysis

Linear Regression Analysis: Is commonly faced with the problem of predicting whether any relationship can be established between two or more variables.

1. The total number of trip produced in an area is seen to depend upon some variable such as family income, family size, and employment structure. A large data have been collected giving the number of trips on one hand and the values of family income, family size, and employment structure.
2. Plot of a number of observations of speed and concentration of vehicles on a long crowed street indicates a scatter. The general tendency observed from the scatter is that as the concentration increases the speed tends to fall.

Multiple Linear Regressions: A statistical technique which will be most frequently encountered by a traffic engineer and transport planner is the multiple linear regression analysis. The problem concerns with the establishment of relationship between a variable which is known to respond to changes in two or more other variables. The variable which is known to respond, Y variable, is commonly called the dependent variable, and the other variables influencing it are called the independent variables, i.e., X variables.

3.4 Regression analysis

Analysis of Variance (ANOVA) shows that the highway alignment geometric elements like, radius, super elevation, K-value and visibility are significant to cause accident on NH-565 & NH-65 in plain & rolling terrain and geometric elements like, radius, super elevation, vertical gradient and visibility are significant to cause accident on NH-9 in mountainous & steep terrain. The group effect of highway geometric element on accident rate has been calculated through regression model.

3.8 Basic Parameters of Highway Geometric

3.8.1 Terrain/Topography

The classification of the terrain is done by means of cross slope of the country, i.e., slope approximately perpendicular to the centre line of the highway location. To characterize

Variations in topography, engineers separate it into four classifications according to terrain as listed in Table3.1.

3.8.8.3 Traffic Survey Methodology

The homogeneous traffic sections have been identified based on the locations of major intersection along the study corridor. The directional classified traffic volume count has been carried out for each traffic homogeneous section for 24 hours a day continuously for 3 days. The survey stations have been located, away from urban area and villages to minimize interference of local traffic. The vehicle classification has been prepared as per IRC: SP 19-1991 and IRC: 9-1972 code requirements as given in Table 3.2.

Table 3.2 Vehicles Classification System

Motorized Vehicle	Non Motorised Vehicle
• 2-Wheeler & 3-Wheeler	• Cycle
• Passenger Car	• Cycle Rickshaw
• Utility Vehicle (Jeep, Van, etc.)	• Animal Drawn Vehicle
• Bus (mini bus, standard bus)	• Other Non-Motorized Vehicle
• Light Commercial Vehicle (freight)	
• Truck	
▪ MCV (2-axle rigid chassis)	
▪ HCV (Multi-axle Rigid)	
▪ HCV (Multi-axle articulated)	
Agricultural Tractors (with trailer/without trailer)	

The seasonal correction factors (SCF) adopted for the calculation of AADT has been furnished in Table 3.3.

Table 3.3: Seasonal Correction Factor (SCF)

Sl. No	Study Corridor	Seasonal Correction Factor (SCF)
1	NH-565	0.96
2	NH-65	1.15
3	NH-9	0.85

Table 3.4: Summary of Annual Average Daily Traffic

Sl. No	National Highway No	AADT
1	565	2108
2	65	5039
3	9	2300

3.9 Accident Statistics

3.9.1 Cost of Road Accident

Road accidents carry high economic and social costs, which are not easy to measure. The cost of road related injuries and accidents can be viewed in terms of (a) medical costs (b) other cost related to administrative legal and police expenditure (c) collateral damage in terms of damage to property and motor vehicle and (d) loss due to income. In addition, accident survivors often live a poor quality of life and have to live with pain and suffering which are difficult to estimate. In economic terms, the cost of road crash injuries creates direct impact to gross domestic product (GDP) of the country.

RESULTS AND DISCUSSIONS

The consequences of this theory are separating into four components. Amid these first half outcomes on free stream speed will be presented. Amid this second a large portion of the outcomes on the natural relations of people on foot will be given. Inside the third half passerby capacity and level of administration will be given. Inside the fourth impact of person on foot stream (uni-directional stream and two-route stream) on essential relations of walker stream will be given.

4.1 Examination on free stream speed

In this proposal walker free stream speed will be ascertained in a few areas in Hyderabad town. The free stream speeds will be

- Mean speed of aggregate people on foot at area one (every day advertise) is 1.17m/s, mean speed of male walkers at area one is 1.24m/s and mean speed of ladylike people on foot is 1.09m/s.
- Mean speed of aggregate people on foot at area two (day by day showcase) is 1.24m/s, mean speed of male walkers at this area is 1.34m/s and mean speed of female people on foot at this area is 1.14m/s.
- The higher than 2 areas are inside a similar space however mean paces of first area have horribly low moderately second area. Inside the first area they require some deterrent are blessing because of person on foot speeds will be less. Inside the second segment they require no hindrance because of person on foot speeds will be a great deal of.

4.1.1 Study on correlation of person on foot speeds by speculation testing

Theory check was directed to call attention to the person on foot speed examinations between very surprising blends in higher than 3 areas in Hyderabad. Amid this investigation first speculation check was done might be the walker speed refinement amongst male and ladylike specifically 3 areas.

The outcomes will be discovered once theory testing is blessing in roar unthinkable sort. Inside the outcomes blend was got Z found worth is a littler sum than Z critical worth because of can't dismiss the invalid speculation H0.

Table.4.1. Z-test results for all mixtures in particular 3 locations

combination	z(Observed value)	|z| (Critical value)	p-value(Two-tailed)	alpha
f1&f2	-2.128	1.96	0.033	0.05
f1&f3	-9.015	1.96	<0.0001	0.05
f2&f3	-3.89	1.96	0	0.05
m1&m2	-3.519	1.96	0	0.05
m1&m3	-7.104	1.96	<0.0001	0.05
m2&m3	-0.95	1.96	0.342	0.05
m1&f1	10.882	1.96	<0.0001	0.05
m2&f2	5.237	1.96	<0.0001	0.05
m3&f3	4.499	1.96	<0.0001	0.05
T1&T2	-3.329	1.96	0.001	0.05
T2&T3	-3.341	1.96	0.001	0.05
T1&T3	-10.431	1.96	<0.0001	0.05
M&F	11.622	1.96	<0.0001	0.05

4.1.2 Accident Rate

The accident rate is defined as the ratio between the number of accidents which happened in a given year and the number of vehicles with kilometers of travels length during that same year. It is generally expressed in crashes per million vehicle-kilometers of travel.

AR = C x 100,000,000 / V x N x L

The variables in this equation are:

AR = Accident Rate expressed as crashes per 100 million vehicle-kms of travel (100mvkm)

C = Total number of crashes in the study period

V = Traffic volumes using Annual Average Daily Traffic (AADT)

N = Number of years of data

L = Length of the roadway in km

The summary of Accident Rate in all study corridors have been furnished in Table 4.2.

Table 4.2: Summary of Accident Rate of Highway

Variables	NH-565	NH-65	NH-9
C	54	62	165
V	2417	2300	5039
N	3	3	3
L	60	70	66.5
AR	**34.01**	**35.17**	**44.97**

4.2 Regression analysis

Analysis of Variance (ANOVA) shows that the highway alignment geometric elements like, radius, super elevation, K-value and visibility are significant to cause accident on NH-565 & NH-65 in plain & rolling terrain and geometric elements like, radius, super elevation, vertical gradient and visibility are significant to cause accident on NH-9 in mountainous & steep terrain. The group effect of highway geometric element on accident rate has been calculated through regression model as below and same has been furnished in Figure 4.1. (a), 4.1. (b), 4.1(c).

Accident Rate (NH-565) = -0.002(RA) + 2.7349(SE) - 0.0279(K) - 0.0476(VB) + 10.7396

Accident Rate (NH-65) = -0.0022(RA) + 3.7610(SE) - 0.0249(K) - 0.0600(VB) + 9.4498

Accident Rate (NH-9) = -0.0159(RA) + 1.9043(SE) + 1.0129(G) - 0.2326(VB) + 15.1894

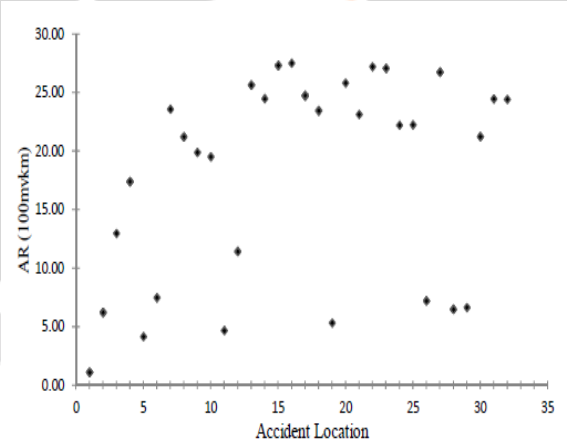


Fig 4.1.a: Accident Rate on NH-565

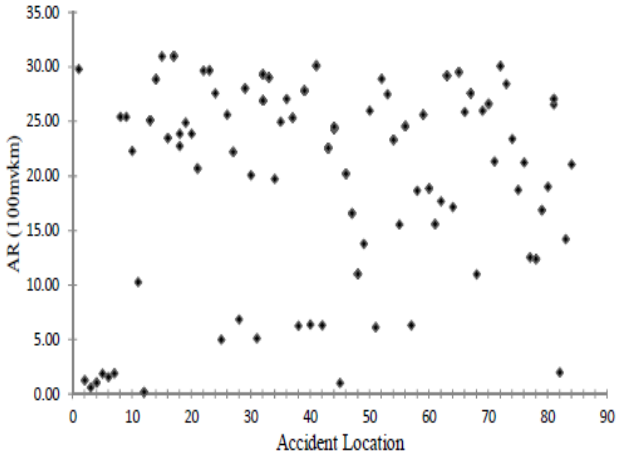


Fig 4.1.b: Accident Rate onNH-65

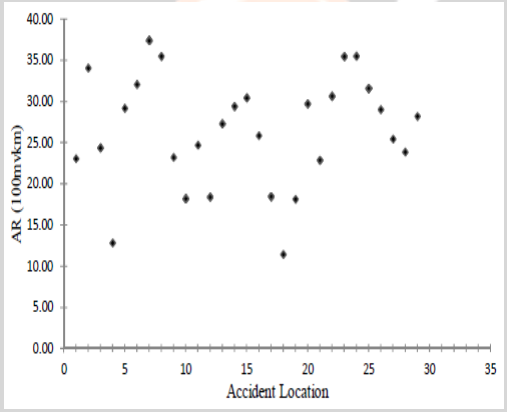


Fig 4.1.c: Accident Rate on NH-9

Table 4.3a: Descriptive Statistics of the Calibration set of Data of NH-565

Variables	Min	Max	Mean	Std. Deviation	Std. Error
Radius	27	2080	324.80	460.16	72.76
Superelevation	2.85	7.00	5.97	1.12	0.18
K-value	4.88	166.67	47.60	49.02	9.43
Visibility	32	158	68.81	29.47	4.05
Accident Rate	1.11	27.50	18.36	8.81	1.20

Table 4.3b: Descriptive Statistics of the Calibration set of Data of NH-65

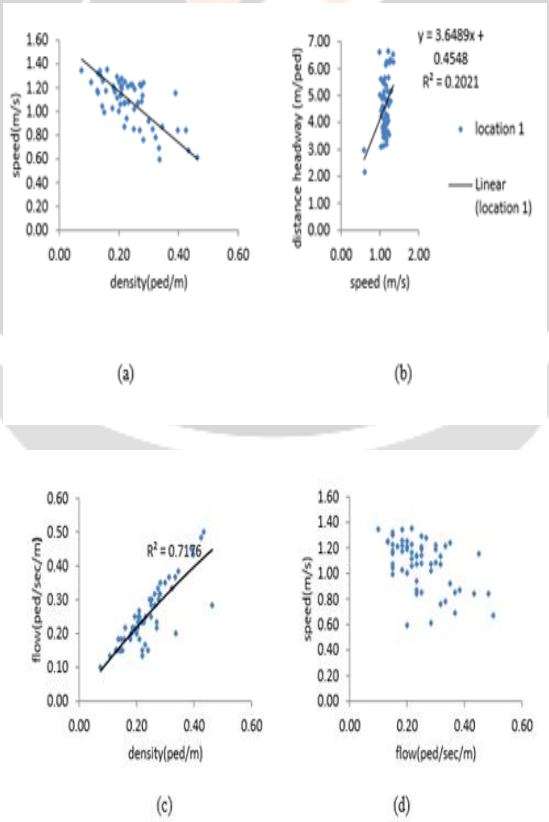
Variables	Min	Max	Mean	Std. Deviation	Std. Error
Radius	7.5	475	91.11	92.25	11.72
Superelevation	3.20	10.00	8.17	1.68	0.21
Vertical Gradient	1.00	8.00	5.37	2.10	0.27
Visibility	15	55	29.95	12.36	1.57
Accident Rate	11.46	37.42	27.77	6.81	0.86

Table 4.3c: Descriptive Statistics of the Validation set of Data of NH-9

Variables	Min	Max	Mean	Std. Deviation	Std. Error
Radius	55	2150	405.81	366.40	30.32
Superelevation	2.60	7.00	5.48	1.19	0.10
K-value	6.15	142.86	29.20	29.80	4.83
Visibility	41	180	82.24	35.62	2.77
Accident Rate	0.21	31.00	21.78	8.29	0.65

4.3 Studies on basic relations

The speed(u)-density(k), flow(q)-density(k), speed(u)-flow(q) curves are going to be premeditated information getting from higher than 3 locations (Fig 4.1 (a), Fig 4.2 (b), Fig4.3 (c), 4.4 (d)).



Graph 4.1: (a) speed-density (u-k) (b) speed-distance headway (u-h) (c) flow-density (q-k) (d) speed-flow (u-q) these basic diagrams are drawn information getting from location one at daily market in Hyderabad

SUMMARY, CONCLUSIONS

5.1 Summary

In this project works, an attempt has been made to study the various elements of the road / pavement with reference to the accidental rate for a road from Hyderabad to Nalgonda having 3 segments from various locations up to Nalgonda. The data of accidental rate has been collected from traffic control department / L. B. Nagar / Hyderabad, and make use in the present linear Regression analysis to determine accidental rate for the three National Highways. In this analysis the in-dependant variables like, speed, density, super elevation, visibility, k-value, are the elements taken / considered against the dependable variables, in the Regression analysis.

5.2 Conclusion

Analysis of variance shows that the highway alignment geometric elements like, speed, radius, visibility, density, k-value, and vertical gradient are significant to cause accidents in the above 3 highways. The group affects of geometric elements on accidental rate has been done using Regression model. From the Regression model analysis, using the above variables, the accident rate resulted is appeared to be more. This analysis has been studied using the graphs (a) Flow-density, (b) Speed-flow, (c) speed-density, (d) distance-speed. After the above detailed analysis, it is very clear that, the standards available at present like speed, density, visibility, super elevation, and k-value, are to be re-examined with reference to the standards as per IRC recommendations (IRC: 38-1988) and remedy measures are to be taken accordingly. As a student my observation is thrown to control the speed at super elevation and vertical gradient are very necessary to minimize the accidents. However the following suggestions are drawn to minimize the accident at National Highways.

- The driver's communities are to be educated at the time of issues of driving licenses, until or otherwise, it may be very difficult to control the traffic to avoid the accidents.
- Necessary steps are to be provided by the government to educate the drivers about the drunken driving especially in highways.
- Also over turning of vehicles due to hitting the dividers / medians because of loss of head light collision in nights are to be taken care of, by growing the trees in the space available in the medians.
- However as these are normal practices, no drivers is taking care off to avoid the accidents and are becoming idol to the accident causes.
- Rest locations in the form of sleeping facilities are to be considered by the government as a relief part of the drivers in the journey through National Highways.

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