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RESEARCH ARTICLE

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ROAD ACCIDENT INVESTIGATIONS

P.ANUSHA[1], M.ANVESH KUMAR

[1]anushapattabhi@gmail.com

P.ANUSHA

ABSTRACT

Demand for transportation, safety is an issue of major social concern and an area of extensive research work. The rate of accident in developing countries like India increases year by year.

The location in a road where the traffic accidents often occur is called a Black Spot. To reduce this adverse effect of transportation the work towards road safety is become necessary now a day. The main objective of this paper is to find out black spots and to understand the importance of road safety audit in the developed as well as in developing country for reducing vulnerability of accident in the main corridor of urban area.

In the present study, the accident data of the proposed stretch from the year 2010-2014 has been collected from concerned police stations in prepared data formats. The data sheet covers all the accident details. At each police station First Information Reports were referred to note down the accident particulars. The analysis work was carried out for the proposed stretch and black spots were identified. After this, the main data required is the geometrics of the road way which will be useful for the evaluation of the black spot locations. A model is built with the accident rate as dependent variable and road environment factors such as road width, shoulder width, curvatures, sight distances, radius and number of crossroads or junctions, no of culverts etc. as independent variables.

1. INTRODUCTION

1.1 GENERAL

Road safety is a serious concern in the developing countries. In India, the growth in vehicle population without adequate road infrastructure has been responsible for increase in the number of accidents. Heterogeneous mix of traffic, poor road geometrics and ineffective traffic control are some of the important contributing factors to the high accident rates.

There are two complementary approaches to accident investigation work; accident reduction, in which measures are, taken; to reduce the number and severity ofaccidents, and accident prevention, Accident prevention is the application of remedial measures preventing accidents from taking place in the future.

1.2 THE PRESENT NATURAL SCENARIO

Though vehicles have increased in multiplicity, courtesy multinational companies, the roads are not adequate to that. Reasons are social, political and others. The figure of accidents in our country as follows:

(A) Killed – 85,000 Nos per annum

(B) Injured – 5,00,000 Nos per annum

In our country, an accident occurs at every 1.2 minute and a person is killed in every six minutes, this is to say that 235 persons die every

day and 1243 persons get injured in road accidents. Nearly 60% of total accidents take place during nights though the night traffic is hardly 15% of 24 hours volume which means that the accidents in India during night 8 times greater than the day traffic. Road accident scenario in India for the last four decades is

1.3 ACCIDENT CAUSATIVE FACTORS

"Road accidents do not just happen but are caused" is a common cliché in the area of traffic safety. Thus, is accidents are caused by some agents, surely they could be identified and appropriate remedial measures could be developed and implemented for their prevention to the extent feasible for the reduction of the ill effects and trauma of the accidents. There are however, other factors, which contribute directly or indirectly to the road accidents. These are

1. The road
2. The vehicle
3. The road user
4. Environmental factors

1.4 IMPROVING ACCIDENT PRONE LOCATIONS

It is generally agreed that up to 25% of accidents can be averted by just improving the accident prone locations in any city. It is also estimated that accident prone locations account for 1 to 3 percent of the total road length and therefore it is implied that a moderate investment in improving accident prone locations would reduce accident costs by 25%.

1.5 SCOPE AND OBJECTIVE OF THE STUDY

This study represents an attempt to investigate the Accident black spots (with in Gudur to Nellore crossroads at Audisankara Group of Institutions), finding the causative factors in accident and suggesting mitigation measures for minimizing the road accidents.

2. LITERATURE REVIEW

2.1 GENERAL

In this chapter various conventional black spot investigation procedures are presented.

Approaches to accident cluster reduction includes Single Site, Mass, Area and Route Action plans. Of the four basic strategies, the potential for accident reduction using simple low-cost remedial measures at single hazardous sites are particularly high. In terms of accident reduction and prevention, local authorities in the UK have considerable success with low-cost engineering safety improvements directed towards treating accident clusters at localized sites..

Treatment of locations involving such single sites, are generally known as 'black spots' or 'high accident treatment sites'. In countries with limited experience of accident remedial measure work, this straightforward approach is likely to be the most effective.

2.2 TECHNICAL PROCEDURES AND DATA REQUIREMENTS

2.2.1 DATA COLLECTION

Figure 2.1 illustrates 12 essential steps of accident investigation. The success of most accident reduction programmes are heavily dependent on the existence of a reliable and easily analyzed data base. Probably the most valuable and common source of road accident data are the accident report forms/booklets recorded by local at accident spot.

2.2.2 SITE SELECTION

Defining a black spot is not straight forward. Given a range of approaches to data collation and variations in areas and locations under consideration, investigating bodies differ in defining what constitutes a black spot. Resources available are also a consideration.

2.2.3 IDENTIFICATION OF BLACK SPOTS

The most frequently used methods to identify and prioritize candidate high crash locations include the Crash Frequency Method, Crash Rate Method, Frequency-Rate Method

Black spots on the roads are those places, where accidents often appear to cluster or concentrate. These stretches are termed as accident prone locations or "black spots". Studies conducted in the developed countries show that identification and improvement of accident prone black spot locations reduces the occurrence of accident significantly..

2.2.3.1. CRASH FREQUENCY METHOD

The Crash Frequency Method summarizes the number of crashes by location. The main

advantage to this method is that it is simple to use and doesn't require additional information beyond number and location of crashes.

2.2.3.2. CRASH DENSITY METHOD

The Crash Density Method is closely related to the crash frequency method, the crash density method summarizes the number of crashes per mile for highway sections. Sections are defined as a minimum length of roadway with consistent characteristics, with the minimum distance used frequently being one mile. Locations are ranked by descending crash density and those with more than a predetermined density of crashes are classified as high-crash locations to be further scrutinized for statistical significance.

2.2.3.3. EMPIRICAL BAYES METHOD

Hauer and Persaud (1984)[1] suggest an Empirical Bayes (EB) method for identification of high crash locations. The EB method attempts overcome the difficulties with some of the conventional techniques. The EB method controls the randomness of crash data by using an estimate of the long-term mean number of crashes at a location. This method is used for predicting crashes in the future and then ranking based on the predicted number of crashes.

Techniques for the identification of black spot may be categorized as

a. Statistical methods
b. Bio-medical engineering approach
c. Engineering methods
d. Subjective assessment techniques

2.2.4. OTHER METHODS

2.2.4.1. STATISTICAL METHODS

Accident statistics are intended to provide insight in to the general safety of highway safety &systematic contributing causes of accidents. Although use of statistics and statistical analysis can yield valuable information for the engineer, providing insight that help in the development of corrective measures. Accident statistics are most often used to quantify and describe three principle information elements.

a) Accident occurrences
b) Accident involvement
c) Accident severity

Statistics in each of these three categories can be stratified and analyzed in an finite number of ways, depending upon the factors of interest to the analyst. Accident statistic and their proper analysis reveal commonalities and trends concerning to the under lying causes of the accident. Some of the criteria in define accident black spots based on statically methods are

1. Annual accident total methods
2. Weighted severity index method
3. Quantum of accident method
4. Accident rate based on traffic flow
5. Multi factor approach
6. Accident prone index
7. Potential accident reduction procedure

In the annual accident total method the no of accident in the year are considered and the stretches having the more number of accident are taken as accident prone stretches. Weighted severity index method assigns weight to different types of accident and their weighted severity total has been calculated. This value ranges from 0 to 90, the stretches that are having 90 or more were taken as accident prone stretches.

MEDICAL BIO- ENGINEERING APPROACH

Allen (1970)[2] During, a driver receives and process much information coming to him. If the amount of information to be processed for taking decision increases, the perceptual load of the drivers increases. This over-load causes nerve-physical strain of drivers. The effect of the perceptual the driving task is discussed.

Babkov(1975)[3] For number of years, the chair of the road design of Moscow highway engineering institutive has been investigating of the features of perception by driver of road condition in order to design the road standards.

Wardrop's(1952)[4] first principle which can be stated as: Traffic system on a network reached equilibrium when no driver can reduce his travel cost by switching to another route. In this case the proportion of trips between an O-D pair using each route depends on the actual flows on each link.

Diversion curves: Moskowitz k (1956)[5] proposed this technique which is one of the frequently used assignment techniques, in which the curves

represent empirically derived relationship showing proportion of traffic that is likely to be diverted once such facility is constructed. So this technique can assign only two alternative routes for each pair of zones. So this is eminently useful for new facilities. .

2.2.4.4. ENGINEERING METHODS

Composition etc.., which are responsible for the accidents. The methods that are suggested under this are innumerable but for the purpose of selection of appropriate techniques the following procedures are discussed. These are

1. Speed profile method
2. Safe coefficient method
3. Traffic conflict studies
4. Wheel path study of vehicle
5. Accident coefficient method

2.2.4.5. SPEED PROFILE METHOD

In the speed profile method, a test vehicle is driven on the road stretch for a couple of time under physically free conditions. The speed of the test vehicle on different runs along the road over different stretches is calculated by knowing elapsed time. These are plotted as a profile along the test section. The basic premise of this method is that the variance the speed will be large at accident –prone locations

2.2.4.6. SAFE COEFFICIENT METHOD

Instead of using the speed profiles, Babcov recommends the use of the ratio between the vehicle speeds in neighbouring road sections, which he called as safe coefficient. According to him greater the difference between speeds on adjacent sections and smaller the coefficient, greater will be the accident proneness of the section.

2.2.4.7. TRAFFIC CONFLICT STUDIES

Traffic conflict studies involve watching the traffic and weighting for a vehicle to break to avoid a possible collision. details of the event leading up to the evasive action and severity of the accident are noted on the study format . the conflicts are recorded on a sheet and the conflict severity are identified.

2.2.6 CHOICE OF REMEDIAL MEASURE

Unless there are good reasons for it not working, it would be normal to implement the lowest cost solution after first detailed plans have been prepared. Upon completion the scheme should be carefully monitored, Implementation of works should take place as soon as possible after unexpected problems had been introduced at the site.

The measures are likely to decrease the type of accident at which they are aimed.

1. No further increase in other types of accident is likely to occur as a result of the selected
2. measure.

2.3.EARLIER STUDIES FOR ACCIDENT INVESTIGATION

Accident investigation manual developed by Colorado State Patrol Academy (2002) stated that there are 11 stages of accident investigation to be done.

1. Accident Classification
2. Accident Scene Priorities
3. Accident Scene Investigation
4. Interviewing Drivers and Witnesses
5. Evidence from the road
6. Tire marks and skid marks

2.6. Accident investigation progress chart

2.6.1.NOTIFICATION

1. Time
2. Location
3. 3.know area
4. Type
5. Fatal
6. Injury
7. Property damage
8. Unknown

2.6.2.PLAN RESPONSE

1. Legalities
2. Route
3. Traffic
4. Weather
5. Preliminary plan
6. Scene protection
7. Notification
8. Ambulance
9. Wrecker
10. Departing vehicles
11. Hit and run
12. Witnesses

2.6.3.ARRIVAL

1. Park car
2. Survey scene
3. Hazards
4. Assistance
5. Supervisor
6. Traffic control

2.6.4.CARE FOR INJURED

1. Rescue
2. Breathing
3. Bleeding
4. Poisoning
5. Other injuries
6. Transportation

2.6.5.SCENE PROTECTION

Perimeter protection hazardous material

1. Identify type
2. Control runoff
3. Direct traffic

2.6.6. INVESTIGATION

2.6.6.1. Drivers

2.6.6.2. Witness

.4.3. CLEAR SCENE

1. Wrecker
2. By Standers

2.4.4. FOLLOW UP

1. Hospital
2. Statements
3. Injuries
4. Witnesses
5. Crime Lab
6. Department of Revenue
7. Enforcement Action
8. Accident Cause
9. Accident Reconstruction

2.4.5. REPORTS

1. Accident Reports
2. Case
3. Summary for Filling

2.4.6. COURT

1. Testimony
2. Facts
3. Documentation
4. Information about an Accident.
5. Can Include Counter Reports.

3. METHODOLOGY

3.1 GENERAL

The intent of this chapter is to explain the procedure which is going to adopt in this present study. A flow chart involving proposed methodology is shown in figure 3.1. Six steps are identified and each is discussed in the following paragraphs.

3.2COLLECTION OF ACCIDENT DATA

The accident data for the five-year period (2010-2014) pertaining to each of the stretch under study i.e from Gudur to Nellore cross roads at cross roads of audisankara group of institution spot on NH-5(AH-45) were collected from the police stations falling under the jurisdiction of the project road. Details of accident data collected include the following:

1. Date and time of accident
2. Section-wise details of accidents
3. Total number of accidents
4. Type of vehicles involved
5. Nature and collision type of accidents
6. Total number of injuries and Fatalities

3.3 IDENTIFICATION OF ACCIDENT PRONE STRETCHES

There are several methods, available to determine accident-prone locations. In the present study, two methods were used, such as Quantum of accidents method and Accident prone index method, were considered for identification of accident – prone stretches.

4.DATA COLLECTION AND ANALYSIS.

4.1.ANALYSIS OF ACCIDENT DATA

4.1.1.STUDY AREA DESCRIPTION

NH-5 is a National Highway passing through the Gudur and Nellore, having a total length of 4 0 . 9 km, all with two lane bitumen surface. Layout of NH- 5 is shown in the following figure.

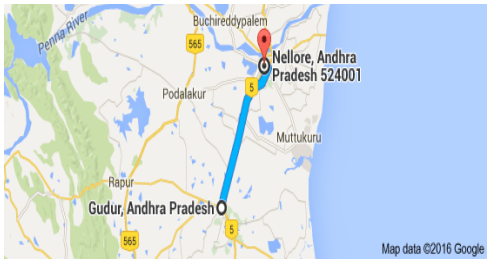

Figure 4.9. Route Map of Nellore to Gudur

Table 4.14 briefs the total number of accidents and nature of accident.

Name of the Police Station	Total no of accidents in 5 years
On NH-5 Near Gudur Circle road	69
On NH-5 Near Puritipallem	17
On NH-5 Near Audisankara College	64
On NH-5 Near Baddevolu	47
On NH-5 Near Manubolu	24
On NH-5 Near manubollu Circle	27
On NH-5 Near Pallava Granites	25
On NH-5 Near power Grid Circle	41
On NH-5 Near Ramadasu Kandriga	28
On NH-5 Near Venkatachallam	14
On NH-5 Near Kasumuru Road	8
On NH-5 Near gollagamudi Road	23
On NH-5 Near Chowdary Petrol Bunk	17
On NH-5 Near Survepalli	19
On NH-5 Near kakkutturu	29
On NH-5 Near chemudugunta	21
On NH-5 Near sirids Kalyana Mandapam	7
On NH-5 Near Jain Temple	13
On NH-5 Near buranpur	15
On NH-5 Near Buju buju Nellore Circle	31
On NH-5 Near Rtc colony	24
On NH-5 Near Nellore Circle	29
On NH-5 Near NHAI Office	9
On NH-5 Near Kothapalli	10
On NH-5 Near Vikram Colony road	8
On NH-5 Near 5th Town Police Station	67
On NH-5 Near Dycus Road	24
On NH-5 Near Ayappagudi	61
On NH-5 Near Ayappagudi Circle	29
On NH-5 Near Podalakur Road	16

.Table 4.15: Accident details based on Nature of accident occurred

Nature of accident	No of accidents	% of accidents
Over turning	56	7
Head on collision	118	14.46
Rear end collision	216	26.5
Side swipe	86	10.5
Right angled collision	54	6.25
Skidding	76	9.3
Right turn collision	125	15.31
Others	85	10.41

Table 4.16: Accident details based on Type of area

Type of Area	No of accidents	% of accidents
Near school or college	74	9.06
Near or inside a village	85	10.4
Near a factory/Industrial area	126	15.4
Near a religious place	201	24.6
In Bazaar	173	21.2
Near office complex	98	12.0
Residential areas	35	4.28
Open area	24	2.9

Table 4.17: Accident details based on Type of accused vehicle

Type of accused vehicle	No of accidents	% of accidents
Unknown	136	16.66
2Wheeler	124	15.19
AUTO	100	12.25
Lorry/ DCM / Tractor /Truck	239	29.28
Car / Van /Jeep	123	15.07
Bus / Ambulance	94	11.51

Table 4.18: Accident details based on Type of victim vehicle

Type of victim vehicle	No of accidents	% of accidents
Unknown	77	9.43
2 Wheeler	133	16.29
AUTO	129	15.80
Lorry/ DCM / Tractor /Truck	167	20.46
Car / Van /Jeep	94	11.5
Bus / Ambulance	101	12.37
Cycle	49	6.00
ADV	66	8.08

Table 4.19: Accident details based on Typeof manoeuvre

Type of maneuver	No of accidents	% of accidents
Unknown	99	12.13
Diverging	127	15.56
Merging	166	20.34
Crossing	146	17.89
Stationary	111	13.6
Temporary held up	100	12.25
Parked	67	8.21

Table 4.20: Accident details based on Responsibility of Driver

Responsibility of Driver	No of accidents	% of accidents
Consumption of Alcohol or Drugged	155	18.99
Exceeding lawful speed	96	11.76
Did not give right of way to vehicle	54	6.617
Did not give right of way to Pedestrian	66	8.08
Improper overtaking	129	15.80
On wrong side of road	35	4.28
Failed to give signal	33	4.04
Gave improper signal	56	6.86
Improper turn	81	9.92
Attention diverted	74	9.06
Others	37	4.53

Table 4.21: Accident details based on Classification of Accident

Classification of accident	No of accidents	% of accidents
Fatal	303	37.13
Grievous injury	346	42.40
Minor injury	167	20.47

Table 4.23: Type of accused vehicle Vs Type of victim vehicle

Type of Accused Vehicle	Type of victim vehicle								Total
	Unknown	2 Wheeler	Auto	Lorry/ Tractor	Car/ Van	Bus	Cycle	ADV	
Unknown	12	21	12	10	15	18	15	9	112
2w	20	23	17	25	22	5	10	11	133
3w/ Auto	9	15	20	45	10	15	5	10	129
Lorry/ Tractor	67	10	25	12	3	17	13	20	167
Car/ Van	42	10	20	30	23	15	2	3	145
Bus	50	5	5	15	13	17	10	14	130
Total	200	84	100	137	86	87	55	67	816

Table 4.24: Type of maneuver Vs Classification of accident

Type of maneuver	Classification of accident			Total
	Fatal	Grevious	Minor	
Diverging	23	24	21	68
Merging	22	15	23	60
Crossing	20	28	28	76
Stationary	15	24	29	68
Temporary held up	20	21	13	54
Parked	22	27	25	74
Stopping	25	25	39	89

Starting from near side	20	25	5	50
Starting from off side	17	38	15	70
Turning right	18	14	33	65
Going ahead overtaking	34	15	24	73
Unknown	34	18	17	69
Total	270	274	272	816

5. DISCUSSIONS AND CONCLUSIONS

5.1 CONCLUSIONS

The following conclusions can be drawn based on the present data

The traffic volume at peak hour reaches the maximum capacity of the carriageway it leads to congestion further there is an increase in rear end collisions.

1. From the spot speed analysis, it can be inferring that most number of accidents occurred during day time.
2. More number of accidents is occurred in Gudur compared to Nellore rural.
3. More number of deaths is recorded in Gudur compared with Nellore.
4. Heavy vehicles were major cause of accidents.
5. It could be observed that there is not much variation in speeds of straight sections and sharp curves during day time at Audisankara college of engineering and technology.
6. Advisory speed limit should have to be provided to reduce the accident rates.

5.2 RECOMMENDATIONS

1. Obey Traffic Rules
2. Wear seat belts
3. Read caution signs
4. Adopt antiskid break system in the cars
5. Roads should be in good condition
6. Avoid drugs and alcohol while driving
7. Falling asleep behind the wheel
8. Speed limit should be provided cautionary

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