Identification of Black-spots In Stretch Naidupeta to Yerpedu (NH71)

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Abstract- Due to the increasing traffic, accidents are became major problem in view of traffic safety. Accidents are being a multi factor event, there are many causes like driver's condition, vehicle condition and environmental condition. In the present study the accident data for proposed stretch is collected from the police station from the year 2012-2016 as per prepared formats. The data sheet contains all the required accident details and the analysis is carried out for the available data. After this using crash density and crash frequency method black spots were identified.

Index Terms- Accident Data, Black-spots, Crash Density, Crash Frequency, Road accidents.

I. INTRODUCTION

Transportation plays a key role in the growth of economy of country. Transportation fulfills the essential wants in human life. Therefore there by the traffic is increasing per annum. This leads to the increase of road accidents per annum and it became a significant downside in entire world in different terms. Majority of road accidents seldom make big impacts on the general public. The explanation behind this is often the cause for road accidents that are complicated and inform a finger is troublesome and hence the remedy becomes evasive. One more cause for it is often that a lot of individuals assume accidents are inescapable and it is associated to the road network. Driver, vehicle and road conditions are the major three components relative to the highways. The inconvenience in any part of these components will cause accidents. The driver is the main controlling factor in charge of the machine. His behavior influences the vehicle operation whereas this is dependent on the sharpness of his body elements,

training he has obtained and his attitudes. He must suit the traffic situation; to overtake, to give way at times, to perform turning maneuver, to contend with pedestrians, slow moving vehicles etc. He must build variety of selections in fraction of seconds. Any call incorrectly taken by the driver during this tiny time-frame might lead to accidents. Even though, the manufacturers of vehicles claim that they have come up with modern design with enhanced safety, the role of vehicle components in road accidents is still significant. It has been projected that 2.5% of accidents take place purely due to vehicle related reasons. The design of road has much effect on the accident occurrence. The roads condition may directly or in combination affect the safety aspects. There are however, different factors, that contribute directly or indirectly to the accidents embrace road, vehicle, road user and environmental factors.

The main objective of the study is identification of black spots.

II. OBJECTIVES AND DETAILS OF PRESENT INVESTIGATION

A. Preparation of accident data format:

The First stage of the study includes preparation of accident information. The accident information from is gathered from the police stations. The forms are ready as per IRC: 53-1982. These forms if stuffed properly give the required data regarding the accidents like date of incidence, day of incidence, time of accident, kind of space, chainage, atmospheric phenomenon, Classification of the accident, range of deaths, no of wounded, nature of accident, defendant vehicle driver gender and age, person driving vehicle,

kind of defendant and victim vehicles, kind of license, kind of maneuver, responsibility of driver, kind of junction, kind of control, reason behind accident, and collision diagram. The formats of the forms are designed to facilitate computer process such every information is split into completely different sub classes and everyone those classes are given writing. For instance kind of space is split into 10 sub classes and given writing like close to college or faculty, close to a stop, close to a temple, at cross over etc.

B. Accident data collection from secondary sources:

The accident information of NH71 for stretch from Naidupeta to Yerpedu for 5 consecutive years i.e. 2012, 2013, 2014, 2015 and 2016 needs to be collected from FIR reports. In the FIR reports the whole details regarding the accidents are obtained, and whatever the information is important to fill the accident information sheet that needs to be noted down for every accident that was recorded in this police office. In the same method all the police stations covering the actual stretch, the accident information needs to be collected.

C. Tabulation and General analysis of collected data:

The collected information is to be tabulated in MS-Access and General analysis must be disbursed. General analysis includes looking for total number of accidents in police station regions, Composition of vehicles concerned within the accidents, Nature of accidents occurred, supported sort of space, sort of suspect and victim vehicles, sort of maneuver, responsibility of driver etc. Then cross analysis must be disbursed for relating 2 or more classes at a time with the quantity of accidents occurred. In the cross analysis necessary classes like type of suspect vehicle, type of victim vehicle, type of maneuver, responsibility of driver and classification of accidents are compared in mixtures.

D. Selection of Blackspot identification method:

After the general analysis, based on the information availability, 2 or a more black spot identification strategies are to be designated for comparison among them. For this study Crash Density and Crash Frequency strategies are considered. In the Crash Density methodology a stretch (section of road under a particular police station) is selected in which a lot of amount of accidents occurred when compared with length of the stretch. In the Crash Frequency methodology accident prone locations within the stretch are identified.

E. Analysis and identification of Black spots:

Black spots will be known in stretch according to crash density and crash frequency strategies from the analysis of accident information collected for the road stretch. Critical crash density and critical crash frequency values are calculated for all the accident locations. The locations that are having the more crash frequency or crash density values than their critical values are known as important locations i.e, Blackspot locations.

III.   ANALYSIS OF ACCIDENT DATA

A.The description of study area:

NH71 is a Highway passing in the Nellore and Chittoor districts runs between Madanapalle and Naidupeta, having a complete length of 191 km, in which 43.8 km length of stretch from Naidupeta to Yerpedu the analysis of crashes is done. In which 19.3 km covered in Nellore and 24.5 km in Chittoor districts, all with 2 lane bitumen surface. Layout of NH 71 is shown in the below figures
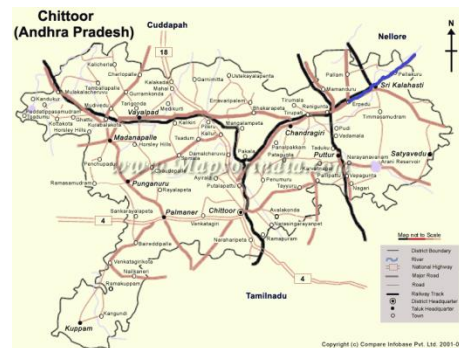

Figure:1: Nellore district road map

Figure:2: Chittoor district road map

B. General analysis of accident data:

The general analysis of collected crash details is completed by consolidating the entire variety of accidents in step with every police station, type of accused and victim vehicle, nature of accident occurred, form of space, responsibility of driver, etc. accident knowledge is shown in Tables 1 to 8

Table 1 shows the police station wise distribution of accidents for the NH71 stretch that is Naidupeta to Yerpedu. Total seven police stations are covered in the entire stretch, two police stations under Nellore district and five police stations under Chittoor district.

Table 1: Police station wise accident details

Name of police station	District	Total no of accidents in 5 years
Naidupeta	Nellore	75
Pellakuru	Nellore	99
Thottambedu	Chittoor	45
Srikalahassthi II town	Chittoor	52
Srikalahasthi I town	Chittoor	42
Srikalahasthi Rural	Chittoor	58
Yerpedu	Chittoor	55

Table 2: Analysis of accidents according to nature of accident

Nature of accident	No.of accidents	% of accidents
Over turn	16	3.576
Head on collision	133	31.220
Rear end collision	89	20.892
Sideswipe	37	8.686
Right angled collision	68	15.962
Skidding	32	7.512
Right turn collision	5	1.174
Others	46	10.798

Table 3: Analysis according to type of area

Type of area	No of accidents	% of accidents
Near College or School	19	4.460
Near or Inside village	203	47.653
Near Factory or Industrial area	24	5.634
Near religious area	3	0.704
In bazaar	11	2.580
Near office complex	14	3.285
Residential area	8	1.876
Open area	67	15.728
Near Bus stop	38	8.920
Near petrol Bunk	21	4.978
Near Recreation place	18	4.182

Table 4: Analysis of accidents according to the type of accused vehicle

Type of accused vehicle	No of accidents	% of accidents
2 Wheeler	65	15.258
3 Wheeler or Autorikshaw	37	8.685
Lorry/DMC/Tractor/Truck	142	33.333
Car/Van/Jeep	104	24.413
Bus/Ambulance	53	12.442
Unknown	25	5.869

Table 5: Analysis of accidents according to the type of victim vehicle

Type of victim vehicle	No of accidents	% of accidents
2 Wheeler	84	19.718
3 Wheeler or Autorikshaw	47	11.033
Lorry/DMC/Tractor/Truck	78	18.309
Car/Van/Jeep	66	15.493
Bus/Ambulance	39	9.155
Cycle	18	4.225
ADV	43	10.094
Unknown	51	11.973

Table 6: Analysis of accidents according to the type of maneuver

Type of maneuver	No of accidents	% of accidents
Diverging	2	0.469
Merging	22	5.164
Crossing	81	19.015
Stationary	41	9.625
Temporary heldup	12	2.817
Parked	7	1.643
Stopping	19	4.460

Starting from near side	9	2.113
Starting from off side	6	1.408
Turning right	35	8.216
Going ahead on Overtaking	144	33.802
Unknown	48	11.268

Table 7: Analysis of accidents according to the responsibility of driver

Responsibility of driver	No of accidents	% of accidents
Consumption of Alcohol or drugs	17	3.990
Exceeding lawful speed	322	75.587
Not giving right of way to vehicles	10	2.348
Not giving right of way to pedestrian	3	0.704
Overtaking improperly	19	4.460
Driving on wrong side of road	5	1.174
Diversion of attention of driver	26	6.103
Failed to give signal	5	1.174
Turning improperly	7	1.643
Others	12	2.817

Table 8: Analysis of accidents according to the classification of accidents

Classification of accidents	No of accidents	% of accidents
Fatal	156	36.620
Grievous	72	16.901
Minor injury	198	46.479

IV. IDENTIFICATION OF BLACK SPOTS

Some specific spots in the road network wherever the accidents are occurring a lot usually, that accident prone areas are referred to as "Black spots". Identification of black spots is locating that exact dangerous spots on the road. Identification of black spots is that the beginning in up road safety.

The brief description of identification of black spots strategies are given in the chapter 2. For this analysis "Crash density" and "Crash frequency" strategies were selected.

A. Crash Density method:

Crash density is nothing but the no of accidents per kilometer in stretch per annum. During this methodology the chosen stretch, from Naidupeta to Yerpedu on NH71 is split into little stretches according to the various police stations covering the whole stretch. Stretches covering every police office is taken as one stretch. Crash density is calculated for every stretch using length and no of accidents occurred. After calculating crash density for every stretch critical crash density is calculated. From critical crash density black spots are identified. For the stretches that have greater crash density than critical crash density are known as black-spot stretches.

Critical Crashdensity = Average crash density + Standard deviation of crash density

The crash density analysis results are summarized in the table 9

Table 9: Crash Density analysis

Name of police station	Total no of accidents	Average	Length of stretch in	Crash Density
Naidupeta	75	15	2.6	5.77
Pellakuru	99	19.8	16.6	1.19
Thottambedu	45	9	3.5	2.57
Srikalahassthi II town	52	10.4	7	1.49
Srikalahasthi I town	42	8.4	3.1	2.71
Srikalahasthi Rural	58	11.6	5.9	1.97
Yerpedu	55	11	5.1	2.16

Average crash density = 2.55
Standard deviation of crash density = 1.52
Critical Crash density = 2.55+1.52= 4.07

From the above crash density analysis Naidupeta stretch is identified as a major accident prone area, for which crash density is 5.77 which is more than the critical crash density 4.07.

B. Crash Frequency method

Crash frequency is that the average no of accidents per annum per km of stretch. In the crash frequency methodology at every location crash frequency is known with accessible accident information and compared with the critical crash frequency. Such that locations have greater crash frequency than critical crash frequency are termed as Black-spots.

Critical crash frequency=average crash frequency + standard deviation of crash frequency

Total 34 locations are identified in the total stretch from the crash frequency analysis. In these total locations 9 locations are identified as black-spots, for which crash frequency is more than the critical crash frequency. These locations are summarized in the following table 10.

Table 10: Crash frequency analysis

locations	No of accidents	Accidents per year
Gomathi garden hotel center	25	5
Chembedu cross road	21	4.2
Near Singamala	21	4.2
Poyya	26	5.2
AMC Check post	25	5
SKIT College	21	4.2
Lanco gate	26	5.2
Merlapaka Harizanawada	22	4.4
Venkatagiri-Yerpedu cross road	26	5.2

Average crash frequency of total 34 locations= 2.54
Standard deviation of crash frequency for total 34 locations on the stretch= 1.6
Critical crash frequency of 34 locations = 2.54+1.6=4.13

V. RESULT OF GENERAL ANALYSIS OF ACCIDENT DATA

The general analysis is conducted to the accident information collected from every station covering the selected stretch. Information is collected for the previous five years i.e., 2012-2016. The collected information accommodates the main points like location of accident, date and time of incidence of accident, type of vehicles concerned, condition of driver, type of maneuver of vehicle, classification of accident etc.

Table 11 shows that each characteristic wise accident data analysis in which type more accidents are occurring out of 426.

Table 11: Characteristic wise peak accident record

Characteristic of accident	Type of characteristic with max no of accidents	No of accidents
Nature of accident	Head on collision	133
Type of area	Near or Inside village	203
Type of accused vehicle	Lorry/DMC/Tractor/ Truck	142
Type of victim vehicles	2 Wheeler	84
Type of maneuver	Going ahead on Overtaking	144
Responsibility of driver	Exceeding lawful speed	322
Classification of accidents	Minor injury	198

To spot out the black spots the "Crash Density" and "Crash frequency" strategies are adopted. In crash density technique the crashes per km for each stretch is identified and then using standard deviation "Critical Crash density" is found. The crash density in which location is more than the critical crash density is known as Black spots. Through crash density technique Naidupeta stretch is identified as a blackspot. Similarly crash frequency technique is also conducted. In crash frequency technique crashes for each location is calculated. For the locations that have

crash frequency more than the critical crash frequency is identified as black spots.

VI. CONCLUSION

- From the general analysis of accident data collected from police stations it was observed that head on collisions are occurring more (31.22%), accidents are majorly occurring near or inside the village (47.65%), while the major accused vehicle is Lorry/Trailor/Tractor/DMC (33.33%), the major victim vehicle is2 wheeler (19%), going ahead on over taking is the major type of maneuver in which accidents are occurring (33.8%), due to exceeding lawful speed is causing almost 75% accidents in the selected stretch.

- From the cross analysis of characteristics of accident information it was clearly ascertained that once the defendant vehicle is lorry and victim vehicle is 2 wheeler a lot of no of accidents are occurring, whereas going ahead on overtaking a lot of no of minor and major accidents are occurring, major accidents are occurring in the combination of going ahead on overtaking and defendant vehicle is lorry, and in the combination of maneuver going ahead on overtaking and kind of victim vehicle car/van major no of accidents are occurring, exceeding lawful speed in the combination of lorry as defendant and victim vehicle are inflicting major no of accidents, exceeding lawful speed whereas passing is inflicting a lot of no of accidents.

- From the crash density method the Naidupeta police station stretch is identified as a Black spot with crash density 5.77 which is more than the critical crash density 4.07.

- From crash frequency method nine spots are identified as black spots.

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