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Traffic volume and spot speed analysis on a busy corridor (NH-5)

[1] P Anusha, [*2] M Anvesh Kumar

[1] Student, M. Tech, department of civil engineering, Visvodaya engineering college, kavali, India.

[2] Assistant Professor, Department of civil engineering, Visvodaya engineering college, kavali, India.

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.

In the present study, the accident data, volume, spot speed 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.

Keywords: Parking spaces, RTS-B Ramagundam, socio economic, Ramagundam thermal power station.

1. Introduction

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.

Traffic volume studies are conducted to determine the number, movements, and classifications of roadway vehicles at a given location. These data can help identify critical flow time periods, determine the influence of large vehicles or pedestrians on vehicular traffic flow, or document traffic volume trends. The length of the sampling period depends on the type of count being taken and the intended use of the data recorded. For example, an intersection count may be conducted during the peak flow period. If so, manual count with 15-minute intervals could be used to obtain the traffic volume data.

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:

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 summarized in Table 1.1 and Figure 1.1.

1.3 Using Count Period to Determine Study Method

Two methods are available for conducting traffic volume counts: (1) manual and (2) automatic. Manual counts are typically used to gather data for determination of vehicle classification, turning movements, direction of travel, pedestrian movements, or vehicle occupancy. Automatic counts are typically used to gather data for determination of vehicle hourly patterns, daily or seasonal variations and growth trends, or annual traffic estimates.

The selection of study method should be determined using the count period. The count period should be representative of the time of day, day of month, and month of year for the study area. For example, counts at a summer resort would not be taken in january. The count period should avoid special event or compromising weather conditions (sharma 1994). Count periods may range from 5 minutes to 1 year. Typical count periods are 15 minutes or 2 hours for peak periods, 4 hours for morning and afternoon peaks, 6 hours for morning, midday, and afternoon peaks, and 12 hours for daytime periods for example, if you were conducting a 2-hour peak period count, eight 15-minute counts would be required.

The study methods for short duration counts are described in this chapter in order from least expensive(manual) to most expensive (automatic), assuming the user is starting with no equipment.

1.4 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.

1.5 Organization of Thesis

This dissertation report briefly has been divided into five chapters.

Chapter-1 A brief introduction to present work has been reported.

Chapter-2 Deals with variation of accident according to traffic volume and spot speed studies.

Chapter-3 Detailed summary and recommendations are presented in the last chapter.

2. Literature Review

2.1 General

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

The phenomenon of accident clusters has been recognized for many years and there is considerable evidence showing that the identification and treatment of such sites with low-cost engineering remedial measures can be extremely cost-effective.

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.

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.

2.2.3.2. Empirical Bayes Method

Hauer and Persaud (1984) [1]. suggest an Empirical Bayes (EB) method for identification of high crash locations-. 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. 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.

2.2.4.1. 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

2.2.4.2. 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

2.2.4.3. Traffic Conflict Studies

Traffic conflict studies involves 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.

2.2.5 Choice of Remedial Measure

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.
3. There are not likely to be any unacceptable effects on traffic movement or the
4. Environment.

5. The countermeasure should not adversely affect the surrounding network.

It should be stressed that safety at the site under study should not be the only consideration when choosing an appropriate countermeasure. The effects of that measure on the surrounding network should be estimated. For example, a self-enforcing speed reducing device like a series of road humps on a local collector road may have the effect of making a large proportion of drivers choose an alternative route along quieter residential streets.

2.2.6. Detailed Design an Implementation of Counter Measures

2.2.6.1. Detailed Design Phase

The next stage after selecting an appropriate remedial measure is the detailed design. This is likely to be carried out by a different unit to that investigating the problems. The design drawings will need to be based on the proposals/outline plans of the accident investigators and this same team should also remain actively involved with the designers throughout the design process.

If it is being implemented in conjunction with other works at the site or nearby, it is important that these other works do not introduce any new safety problem. If there is any reason for concern, road safety engineering advice (e.g. in the form of a detailed design stage road safety audit) should be sought. An 'outline' scheme design should be drawn up which may include several different approaches and engineering measures for achieving the objection of the scheme.

2.2.6.2. Implementation Phase

Consultation will largely take place after an outline scheme design has been proposed and before full design is finalized. The various stages of scheme design, consultation etc. should be documented, to reduce the amount of work necessary incase a similar scheme be installed in future.

During the implementation phase, traffic safety will continue to be important. Work zones can be potential places for crashes, due to the changes in road layout and the temporary absence of permanent kerbing, delineation, markings or signs.

2.2.7 Monitoring and Evaluation

Monitoring is usually carried out using 'Before and After' studies in conjunction with selected control data. Control data may be from untreated sites in the locality with similar characteristics to that of the treated sites or from reliable regional or provincial data. Use of control site data helps in eliminating extraneous factors that might affect the 'After' treatment accident levels e.g., government legislation that influences vehicle speeds etc. 'After`. Data should be examined in some detail.

Monitoring and evaluation are tasks, which typically occur after counter measure treatment is implemented. *Monitoring* is the systematic collection of data about the performance of road safety treatments after their implementation. *Evaluation* is the statistical analysis of that data to assess the extent to which the treatment or treatment program has met the accident reduction objectives.

2.2.7.1. Evaluation

This final step of the procedure focuses on evaluating whether the treatment has been successful in achieving its objective of reducing the number of accidents. This, therefore, requires comparison of the number of accidents in the target group "before" the treatment with the number "after" treatment (with the assumption of a similar before pattern if nothing were done), and to study whether any other accident type has increased.

2.9. Road and Traffic Data

The set of data can include features as follows:

1. Road description (tangential section, type of intersection, road number, road category, cross section)
2. Specific places/objects (pedestrian crossing, rail crossing, bridge, tunnel, bus/tram stop, parking place, petrol station)
3. Road alignment (evident deficiency or not, slope, narrowing)
4. Road surface (type, permanent state, actual conditions- e.g.: snowy, wet, icy surface)
5. Road signing and marking (availability, condition, location)
6. Road side obstacles (tree, column, bridge)

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.

3.2 Investigation of Accident Prone Stretches

Preliminary investigation of accident - prone stretches selected for detailed study was carried out to identify the deficiency in the highway system and the extent of various surveys to be conducted at those locations. Based on the field visit, various traffic and topographic studies were carried out at the identified accident-prone stretches. The preliminary surveys carried out included:

1. Traffic volume count survey.
2. Spot speed survey.
3. Topographic survey

3.3 Analysis of Traffic Flow Characteristics

All secondary and primary data collected were edited, coded and analyzed systematically through MS-Excel. These analyses include Hourly variation of traffic flow, Composition of traffic. Spot speeds were analyzed to obtain maximum and minimum observed speeds as per direction for flow as well as mean speeds,

4. Data Collection and Analysis

4.1 General

In this chapter Based on the field visit various traffic studies were carried out at the two identified accident – prone stretches. The two stretches are Gudur (NH-5) to Nellore cross roads at Venkatachallam rural and Nellore to Gudur at Audisankara Group of Institutions. The primary surveys carried for

i. Traffic volume
ii. Spot speed

4.2 Traffic Volume Count Survey

Traffic volume survey was carried out at the sections in the selected stretches round the clock for 24 hours to know the total volume of traffic, composition of traffic and hourly variation of traffic. Traffic volume counts at 15 minutes interval were taken at each of these locations to compute peak hour traffic flow characteristics.

Table 4.1. Traffic Volume (24hours) on GUDUR to Nellore (NH-5)

From 7:30am on 24-9-2015 to 25-9-2015 on 7:30am					
Location: GUDUR				Direction: From: GUDUR to NELLORE	
Day of Survey: 24-9-2015					
Time	**Buses**	**Truck**	**Cars**	**Auto rickshaw**	**2wheeler**
6:30 to 7:30	17	103	61	26	42
7:30 to 8:30	24	112	46	37	47
8:30 to 9:30	21	92	37	28	65
9:30 to 10:30	25	104	25	15	54
10:30 to 11:30	21	106	42	28	65
11:30 to 12:30	29	105	56	50	59
12:30 to 13:30	25	107	41	57	69
13:30 to 14:30	20	99	57	56	45
14:30 to 15:30	23	89	52	67	36
15:30 to 16:30	28	59	43	72	35
16:30 to 17:30	27	76	36	79	32
17:30 to 18:30	19	101	32	76	38
18:30 to 19:30	21	108	18	55	55
19:30 to 20:30	21	101	21	52	55
20:30 to 21:30	21	95	14	37	40
21:30 to 22:30	19	88	28	26	41
22:30 to 23:30	12	103	47	36	58
23:30 to 00:30	10	118	48	24	61
00:30 to 01:30	6	96	44	32	55
01:30 to 02:30	1	66	46	21	48
02:30 to 03:30	2	48	46	30	42
03.30 to 04.30	45	38	44	45	38
04:30 to 05:30	8	65	33	31	34
05:30 to 06:30	13	91	30	38	34
TOTAL	417	2184	947	1018	1148

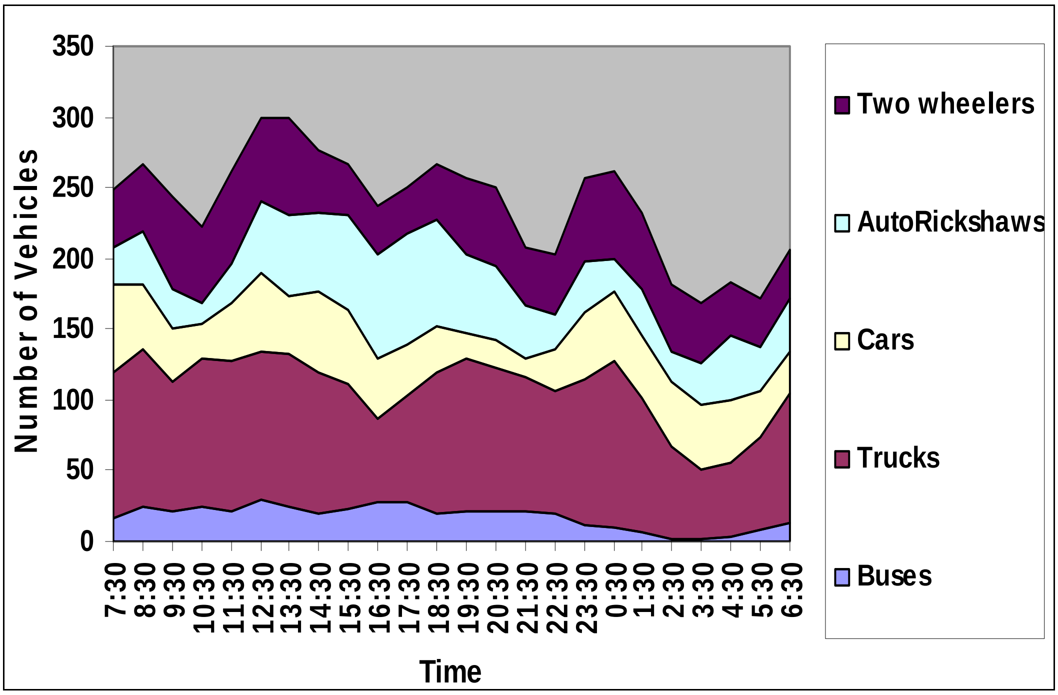

Fig 4.2. Hourly Variation of Classified Traffic Volume on Gudur to Nellore at Audisankara (NH-5)

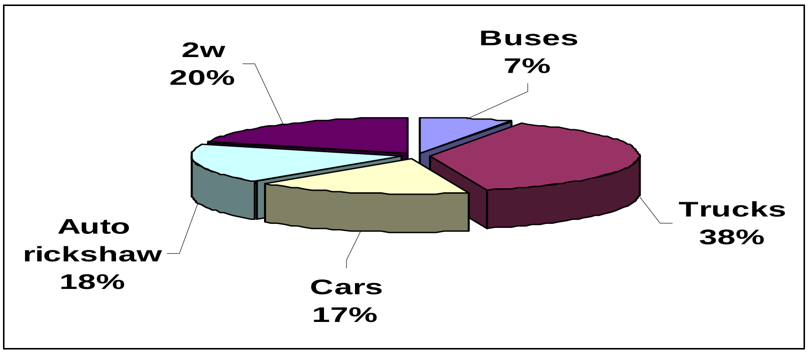

Fig 4.3: Hourly Variation of Classified Traffic Volume on Venkatachallam to Gudur

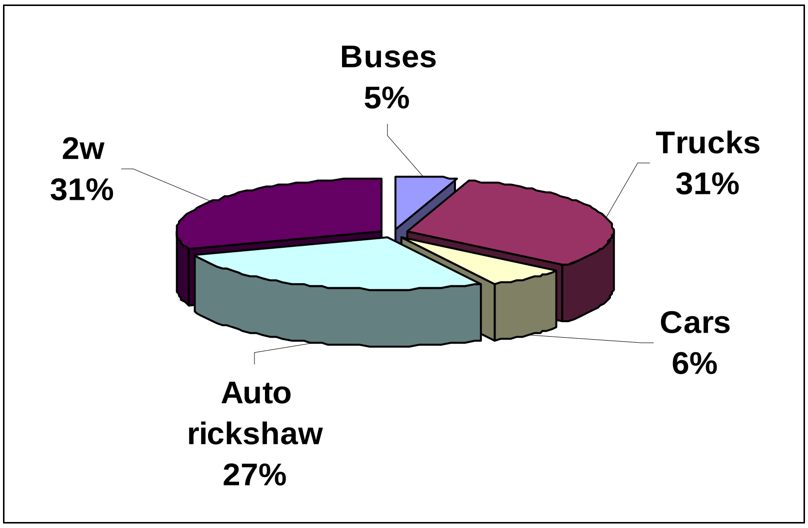

Fig 4.7: Composition of vehicles on Venkatachallam to Gudur at Swarna Toll Plaza

4.3 Spot Speed Analysis

Spot speed data was collected on a sampling basis at typical locations i.e. on Nellore to Gudur (Audisankara cross roads) and Gudur to Nellore on NH-5 along with the traffic volume counts during day time and evening time. Spot speeds at different locations as per direction and different vehicle types were recorded and fed into computers in Excel format for analyses. Hourly variation of spot speeds was analyzed to obtain maximum and minimum observed speeds as per direction for flow as well as mean speeds, 85th percentile speeds and they are presented in Table 4.4 to 4.8

Table 4.4: Spot speeds at Audisankara Group of Institution at Sharp curve

Location and Type of section:		**At Audisankara group section: Sharp Curve**		
Period: 23-9-2015		**Day from 08:00am to 09:00am**		
Vehicle Type	**Maximum**	**Minimum**	**85th Percentile Speed**	**Mean**
Two Wheeler	55	9	42.9	39.1
Truck	80	14	52	45.5
Car	68	14	52	45.5
Bus	59	22	48.2	46.5
Auto	52	8	24.7	24

Table 4.5: Spot speeds at Audisankara group of institution on rolling terrain

Location and Type of section:		**At Audisankara group section: Sharp Curve**		
Period:23-9-2015		**Day from 09:00am to10:00am**		
Vehicle Type	**Maximum**	**Minimum**	**85th Percentile Speed**	**Mean**
Two Wheeler	77	17	52.2	44.5
Truck	68	14	58.1	44.8
Car	97	12	71.5	60.4
Bus	86	25	63.3	56.3
Auto	73	13	55.5	48

Table 4.6: Spot speeds at Audisankara group of institution on rolling terrain

Location and Type of section:		At Audisankara group section: Sharp Curve		
Period: 23-9-2015		**Day from 10:00am to 11:00am**		
Vehicle Type	**Maximum**	**Minimum**	**85th Percentile Speed**	**Mean**
Two Wheeler	63	9.0	41.2	37.3
Truck	110	18.0	72.8	55.1
Car	84	36	69.3	61.46552
Bus	75	18.0	49.725	43.24561
Auto	49	12.0	37.0	31.6

Table 4.7: Spot speeds at Audisankara group of institution on rolling terrain

Location and Type of section:		At Audisankara group section: Sharp Curve		
Period: 23-9-2015		**Day from 11:00am to 12:00 noon**		
Vehicle Type	**Maximum**	**Minimum**	**85th Percentile Speed**	**Mean**
Two Wheeler	69	14	40.2	34.5
Truck	109	34	78.9	68.7
Car	117	35	86.5	73.1
Bus	109	52	83.4	74.7
Auto	100	37	57.4	54.3

Table 4.8: Spot speeds at Audis Ankara group of institution on rolling terrain

Location and Type of section:		At Audis Ankara group section: Sharp Curve		
Period: 23-9-2015		**Day from 15:00pm to 16:00pm**		
Vehicle Type	**Maximum**	**Minimum**	**85th Percentile Speed**	**Mean**
Two Wheeler	70	19	48	43.7
Truck	80	14	51.9	45.6
Car	97	19	52.7	47.6
Bus	70	19	51.6	46.9
Auto	66	9	51.3	46.3

Table 4.9: Spot speeds at Audis Ankara group of institution on rolling terrain

Location and Type of section:		At Audis Ankara group section: Sharp Curve		
Period: 23-9-2015		**Day from 16:00pm to 17:00pm**		
Vehicle Type	**Maximum**	**Minimum**	**85th Percentile Speed**	**Mean**
Two Wheeler	80	14	51.9	45.6
Truck	68	12	55.8	50.4
Car	66	25	53.2	50.7
Bus	59	22	48.2	46.5
Auto	59	19	38.4	36.9

Table 4.10: Spot speeds at Audis Ankara group of institution on rolling terrain

Location and Type of section:		At Audis Ankara group section: Sharp Curve		
Period: 23-9-2015		**Day from 17:00pm to 18:00pm**		
Vehicle Type	**Maximum**	**Minimum**	**85th Percentile Speed**	**Mean**
Two Wheeler	52	8	26.4	24.8
Truck	66	17	54.3	49.3
Car	56	13	42.4	35.3
Bus	48	15	34.3	31.6
Auto	48	7	21.8	20.5

NH-5 is a National Highway passing through the Gudur and Nellore, having a total length of 40.9 km, all with two lane bitumen surface. Layout of NH-5 is shown in the following figure.

4.6. Summary

In this present chapter general analysis of accidents has been done and cross analysis between different characteristics with comparison of total number of accidents. Next, black spot identification has been done based on crash density method and crash frequency method.

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.

5.2 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

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