Development of Accident Prediction Model and Black Spot Study on a National Highway in Bihar

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Abstract-

The automobile accident has grown to be a global issue in recent years, ranking as the ninth leading cause of mortality worldwide. The enormous number of traffic accidents that occur each year has made it a serious issue. Consequently, a comprehensive analysis is needed to tackle this overwhelming scenario. There are 33 lakh kilometers of roads in Bihar, and of those, over 65% of freight traffic and 80% of passenger traffic occur on the networks. Although making up only 1.7% of the total road network, national highways handle 40% of all traffic. Over the course of the last five years, the number of automobiles has increased at a regular rate of 10.16% per year. A road safety audit is a systematic process used to evaluate the likelihood of accidents and safety performance when developing new road plans, enhancing current ones, and maintaining existing ones. The two primary approaches in road safety are accident reduction and accident prevention. The roadway includes several conflict points, including settlements and industries, and carries a sizable amount of traffic throughout the day. A thorough examination of the NH will be conducted, focusing on safety and geometric design elements. The purpose of this article is to pinpoint shortcomings, enhance the design elements, and raise the road's trustworthiness.

Keywords— *Accident Prediction Model, Black Spot, National Highway in Bihar, Developing New Road Plans, Enhancing Current Ones, Maintaining.*

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INTRODUCTION

A Road Traffic Accident (RTA) can be defined as, 'An event that occurs on a way or street open to public traffic; resulting in one or more persons being injured or killed, where at least one moving vehicle is involved. In the present scenario everyone has noticing newspapers, magazines, news in channels and also watching directly and nearly shown that more than half of the people have affected road accidents, died and injured on the road. In the road accident not only having on vehicle riding people but also effect on pedestrians. In today's world road and transport has become an integral part of growth and development of a nation. Everybody is a road user in one or other shape. The present transport system has minimized the distance but it has on the other hand increased the life risk. Every road crashed result in loss of lakh of lives and serious to injuries to corers of people. Bihar has a total of about 2 million kilometers of roads out of which 960,000 km are surfaced road and about 1 million km of roads in Bihar are of poor quality. Rural areas have unsurfaced roads and urban areas have high severity of congestion. In Bihar there are over 100000 deaths occur on roads due to accidents. The death include young and old people, people walking, people driving, people traveling in buses, cars, trucks, two wheelers and three wheelers. It also consider people on bicycles and people not traveling at all but simply passing the time of the day by the side of the road. Given that the population is increasing every day and the number of vehicles are coming on to the roads is increasing fast the future looks very miserable unless something is done.

Accidents cannot be totally restricted but through scientific analysis and proper engineering measures their frequency and severity can be decreased. Therefore, traffic engineer has to identify systematic accident studies to explore the causes of accidents and to take preventive measures in terms of design and control. It is needed to analyze every individual accident and to keep zone wise accident records. These are some of the major problem face on any Biharn roads. This is very serious situation and requires proper attention with the use of some statistical methods. In today's world where the number of road commuters is increasing drastically, demanding more and safer roads to have accident free roads. A lot of initiative are being taken up by the government to tackle this issue but needs a little more research attention. This study is an effort to make roads safer for road user. The problem of accident is very acute in highway transportation due to complex flow pattern of vehicular traffic. Traffic accident leads to loss of life and property. Thus, Traffic engineers have to undertake a big responsibility. There has been a dramatic increase in road accidents across the globe; out of which Bihar ranks among the top with 1 in every 9 deaths due to road accident, is reported in Bihar. It is seen that road accidents are the No. 1 cause of death among children and young adults in the age groups of 5-29 years. In Bihar more than 150,000 lives are lost in road accident, every day 400 people are injured. Primarily in Bihar, we need to do a lot more to reduce accident- prone locations and to help us understand the ways to improve the road safety scenario. In Bihar at present there are road safety audits to be undertaken. However, Bihar has also started the importance of road safety audits. It is because of ministry of road transport and highways sponsored the project on "Development of safety Audit methodology for existing roadway section" to Central Road Research Institute in April 2002. In systematic approach for evaluation of existing or new roads by an independent audit team at the stages of planning, design, construction, operation and maintenance to achieve accident free roads and to enhance overall safety performance. Road accidents are major causes of loss all over the word. They are the cause of over 50 million injuries every year and sum up to over US$ 65 billion in the developing countries. These deaths are more in number than many other accidents due to different modes put together and the cost to the society is much more than the office aid received by the developing countries all over the word. In Bihar, more than 100,000 lives are lost in road accidents every year while 400,000 people are injured. Sweden has set itself a target of vision zero by 2020 it might be difficult to achieve something similar in Bihar in the near future on such a grand scale. Primary aim of any transportation infrastructure is to provide mobility. Accidents pose as threats to the improvement of the system, which need to be controlled in order to achieve the objective. Primarily in Bihar, we need to do a lot more to reduce accident prone locations and to help us understand the ways to improve the road safety scenario. There may be various reasons for an accident, one such paper from identifies rainfall as one of the reasons, it states road crashes are a complex interaction of different parameters like road, vehicle, environment, human etc. skidding of road vehicles is considered as one of the major cause of road accidents occurring all over the world. Skidding, caused by lack of tire to road friction, is of the most important single causes of traffic accidents. This paper aims to critically analyse the weather and wet road related crashes. The road accident situation in Bihar is alarming. Records show that there is one death at every 2.75 minutes because of road accidents. The high accidents rate is largely attributed to the inadequacy of the highways and other main roads to meet the traffic demands, road user behaviour, vehicle defects, poor road geometrics and visibility. Road accidents cannot be totally prevented but by suitable traffic engineering and management the accident rate can be reduced to certain extant. For this reason, systematic study of traffic accidents is required to be carried out. Proper investigation of the cause of accident will help to propose preventive measures in terms of design and control. The objective of the study is the identification of accident prone area on the road from FIR, to study the effect of roadway geometrics and traffic condition on the road stretch and development of statistical relationship between accident rates and various factors causing accidents. The scope of the study is to reduce accidents on road network, reducing severity of accidents and the need for costly remedial work is reduced.

LITERATURE REVIEW

Arun S Bagi, Dheeraji N Kumar (2012):"Road safety audit" Road safety audit is formal procedure for accessing accident potential and safety performance in the provision of new road schemes, the improvement and rehabilitation of existing road and in maintenance of roads. Dr. S.S Jain (2011):"Road safety audit for four lane national highway" The study aims to evaluate road safety audit of a section of four lane national highway and will focus on evaluating the benefits of the proposed actions that have emanated from deficiencies identified through the audit process. Hitesh Kumar, mrs. Monika (2017): "Road safety audit and a case study" The primary role of auditing identifying the potential problems of a highway project by conducting the site inspection and collecting data. The objective of the study in the identification of accident-prone area on the road from FIR, to study the effect of roadway geometrics and traffic conditions on the road. Rakesh Kumar singh and S.K. Suman (2012): Accident analysis and prediction of model on national highways road stretch isNH-77 Hajipur to muzaffarpur. Hinted that accident prone locations can be identified by ranking the parameters based on severity index parameters which causes a maximum number of accident wore assign maximum weighted. Accident prediction model developed in the present study show that number of accidents per km-year increase with AADT and decrease with improvement in road /shoulder condition. Sanjay Kumar Sing (2016): "Road traffic accidents in India issues and challenges" The main aim of this paper is to analyse the road accidents in India at national level, State, and metropolitan city level. Analysis shows that the distribution of road accidental deaths and injuries in India varies according to age, gender, month and time . Many researchers have studied and research related to accident study and road safety improvements for a particular place or select stretch in a different manner. Some of the reviews are carried out in this paper related to accident data analysis. Conducted accident analysis and identification of black spot its objective was analysis of road traffic accident data and identify black spot. In this study accident analysis was carried out for five years (2010-2014). The result shows 509 accidents occurred in the year 2010-2014. Identified the black spot based on maximum number of accident rate on the study area. And finally they concluded the following estimations from accident analysis: Estimates maximum number of accident occurs due to head collision there was no facility median on center of lane.

- Two wheelers (20.62%) and four wheelers (27.5%) involve the highest share of percentage in total road traffic accident.
- Highest number of accident occurred in month of March and April.
- Majority of accidents have been occurred in summer season (42.63%)

Carried out analysis of road accident its aim was to analyze the traffic accidents occurring in a selected stretch by statistical method which is facing strain as diminished level of administration and increment in numerous quantities of accidents because of vast number of road user clients, specially four wheelers. It achieves exploratory inspection of the mishaps information and suggests remedial measures for reduction in accidents on stretch. Accident data was collected from various police stations along the study area stretch. The collected data are analyzed according to the following Parameters: yearly variation of accident, classified according month, according day ,according collision type, according accident spot, according to vehicle type, according to time, according vehicle maneuver , according drivers error , according drivers age, according weather and according alcohol/drugs. Have finalizes their work by proposed safety measures. Studied related with identification of black spot and its objective was to gather accident data on Islampur and Ashta road for last five year, to identify the black spots on Islampur Ashta road, to transfer out the surveys on black spots area and to give remedial measures for reduction in accidents on selected road. Studied identification of black spot in Ahmedabad city and its objective was to carry out study of existing condition and to identify the black spots in the study area. Accident data carried out from the Sola-high court police station last five years from the 2008 to 2012. Inventory survey was carried out five different locations. The road width, footpath, Median and Service lane are also measured at those locations. The summary of Inventories of five locations on the study area, Spot speed survey is carried out between Thaltej cross road to Umiya Campus. Pedestrian survey carried out between Thaltej cross road to Umiya campus evening peak hour at Five locations. Among these, Thaltej circle is having highest number of Pedestrian Volume 1325 /

hour, Classified volume count survey carried out between Thaltej cross road to Umiya campus in morning and evening peak hour and identified black spot based on the accidents recorded, Speed observed, Deficiency of the Geometry and Pedestrian volume

COLLECTION OF DATA AND ANALYSIS

Analysis based on accident location on right as well as left lane where highest no. of accidents occur. The time at which highest accident occur also predict. Using prediction equation and proper parameters, prediction for classification of accident that can occur determined. For prediction purpose, random 60 values from available accident data is chosen for input variables and prediction is made using equation. Predicted values from regression equation were compared with available accident data.

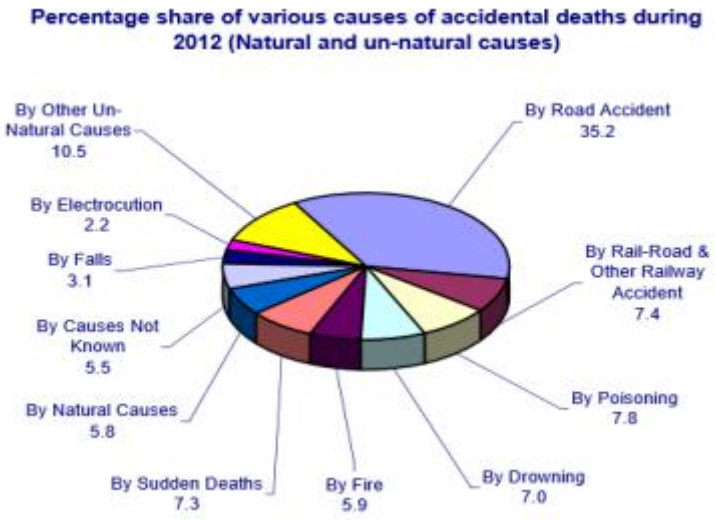

Figure 1-showing percentage share of major states in accidental deaths during 2012 (Natural and un-natural causes)

ROAD ACCIDENT AND BLACK SPOT

An accident (collision, overturning or slipping) which occur or originated on a road open to public traffic resulting in either injury or loss of life, or damage to property, in which at least one moving vehicle is involved is known as Road accident. The place where the accident occurs frequently in the given location is called Black Spot.

(i) Need for Analyzing Accident at Black Spot- The spectacular increase in the number of motor vehicle on the road has created a major social problem – the loss of lives through road accidents. A multidisciplinary approach is needed in understanding the problem and providing solutions. The features of highway affect the safety of vehicles and road users; it has to be designed properly. The analysis of accident statistics provides clues to the many factors that lead to the accidents and improvements that may be desired. Accident data also supply valuable information to control, to regulate and manage the traffic more efficiently. Hence, based on these studies, the traffic engineer must devise ways to reduce accidents through better planning, design, construction, maintenance, traffic operation with timely regulation and management of traffic to ensure safety for the road users.

(ii) Road accident scenario in Bihar- Many development countries/state including India/Bihar has a serious road accident problem. Fatality rates defined as, road accidental death per 10,000 vehicles is quite high in comparison to developed countries. While in Europe and North America the situation is generally improving, many developing countries faces a worsening situation. The road accident costs of developing countries are increasing at least 3% of their gross national product and in further expected to increase further. Apart from increased accident cost the number of deaths by road accident is increasing drastically. Also, the proportion of commercial and public service vehicles involved. Numerous studies have been conducted to investigate the relationships between vehicle accidents and the geometric design of roadways. These studies have indicated that improvements to highway geometric design could significantly reduce the number of vehicular accidents.

(iii) Causes for Accidents- There are four basic elements in a traffic accident they are the road users the vehicles the road and its condition and environmental factors traffic weather etc. the road user responsible for the accidents may be the drive of one or more vehicles involved, pedestrians or the passengers. Vehicles involved in the accident may also be defective. The

condition of the road surface or other existing geometric features or any of the environmental conditions of the road may not be to the expectation causing an accident. An accident may be caused due to a combination of several reasons and seldom due to one particular reason. Hence it is often not possible to pin point a particular single cause of an accident.

(iv) Need for Analyzing Accident at Black Spot- The spectacular increase in the number of motor vehicle on the road has created a major social problem the loss of lives through road accidents. A multidisciplinary approach is needed in understanding the problem and providing solutions. The features of highway affect the safety of vehicles and road users; it has to be designed properly. The analysis of accident statistics provides clues to the many factors that lead to the accidents and improvements that may be desired. Accident data also supply valuable information to control, to regulate and manage the traffic more efficiently. Hence, based on these studies, the traffic engineer must devise ways to reduce accidents through better planning, design, construction, maintenance, traffic operation with timely regulation and management of traffic to ensure safety for the road users.

METHODOLOGY

(i) Volume Studies- The traffic volumes at National Highway-48 of Hassan city are to be determined by manual counting method during morning peak, evening peak and off peak hours. Manual counting method requires simply counting of every vehicle seen to pass a fixed point on a road. In its simplest from the observer record on a specially prepared field sheet, the passage of each vehicle. It is normally done pen or pencil, method of recording and summarizing the traffic volumes at intersections where the volumes of the various turnings movements are required to be recorded. Equivalent PCU values are to be multiplied to the obtained classified vehicles volume, total PCU during morning peak, evening peak and off-peak hour is to be obtained.

(ii) Traffic Volume Study - Classified traffic volume count can be done at a time interval of 15 minutes, 30 minutes or one hour. In the study of traffic volume data collected from NHAI. Classified traffic volume count survey was carried out near RIT collage. The main objective of classified traffic volume count was to assess the traffic characteristics on project road section in terms of hourly traffic variation, peak hour traffic, average daily traffic, traffic composition and directional distribution. Traffic composition were car, Mini Bus, Bus, light commercial vehicle (LVC), Multi Axel Vehicle (MAV), Private Bus (PVT Bus), Trucks – 2 axels, Truck -3 axel, Tractors, Two-wheelers (TW), Auto-Rickshaw and Animal Drawn vehicles (ADV). The survey was carried out by manual vehicle counting and classified the vehicles passing through survey station. The counts were made separately for motorized and non-motorized vehicles.

(iii) Accident Studies - The various objective of the accident studies are, to study the causes of accidents and to suggest corrective treatment at potential location, to evaluate existing designs, to support proposed designs, to carry out before and after studies and demonstrate the improvement in the problem, to make computations of financial loss, and to give economic justification for the improvements suggested by the traffic engineer.

(iv) Accident Investigations- The scientific approach suggested that a mobile laboratory may be kept ready in every city. A bus equipped with essential instruments to measure the alcohol content in the breath, reaction time and other driver characteristics, skid resistance of pavement surface, etc. and a traffic engineer and his assistants may from the proposed mobile laboratory which should reach the accident spot as soon as possible after an accident.

(v) Spot speed studies- Spot speed is the instantaneous speed of the vehicle at a specified location. Speed of vehicle fluctuates from time to time along the road and its value as shown on the speedo meter at a particular spot is called the „spot speed". In these speed-checks at problematic locations (spots), while a trip maker is more interested in total journey time involved in the complete journey speed are maintained on the highway system. For maintaining good journey speeds, the delays or involuntary stop due to road congestion should be minimum and vehicle should be running smoothly. This involves the concept of running speed of vehicle. For speed analysis in each circle by 50m length on the road, at starting point the stop clock is turned ON and when the vehicle reaches 50m length at the time stopping the stop clock. This results in knowing the

time taken by each vehicle to pass 50m length. By using this data, the speed approaching lane is obtained.

(vi) Road Safety Audit (RSA)- A Road Safety Audit (RSA) is the strict safety performance examination of an existing or future road or intersection by an independent, multidisciplinary team. It qualitatively evaluates and reports on prospective road safety issues and recognizes opportunities for improvements in safety for all road users. A key feature of a road safety audit is the use of a team of professionals with wide-ranging expertise. The team should comprise highway safety engineers, highway design engineers, maintenance personnel, and law enforcement. The team members must not be involved in the design or maintenance of the facility being examined, so that they can have an objective point of view. The road safety audit may examine general safety conditions, or it may concentrate on specific concerns or users. Walkability audits concentrate on pedestrian safety and accommodation and transit audits emphasis on safety of bus and train users.

CONCLUSION

Severity of accident can be reduced by applying prediction model with proper input of parameters. The likelihood of accidents on the highway can be reduced. Lighting provisions must be improved for 18:00-20:59 hours on the highway. Other conclusions are:

- Road management is a main source for economic responsibility, irresponsible road activities leads to the building of rush situation, accident and loss of economic goods.
- Moreover, the traffic safety management should confirm the directions of the road safety developments in future.
- Use of 3-Dimensional speed breaker should be taken into account.
- Shoulders across the Highway should be in Level.
- Subways should be constructed at every Chowk for safer travel of pedestrians.
- General Awareness about Road Safety and control.
- Speed Limit of vehicles should be followed and monitored by Authorities.
- Traffic Rules should be strictly followed and action should be taken by Authorities if someone violets the Rules

The current study provides insight into how traffic accident analysis might be approached from the perspective of reducing it through the creation of appropriate safety measures. The majority of incidents involving heavy vehicles, such as trucks, occur on two-lane roadways. Trucks are thought to be responsible for 59% of facilities, with the other 26%, bikes at 7%, jeeps at 5%, and buses at 3%. It is important to increase road users' awareness of road safety. The NH-75 is designed to travel at 80 km/h, however our spot speed analysis shows that the cars can travel up to 105 km/h. According to the traffic volume analysis, there is a large amount of bike travel because the RIT is close by. Additionally, there is more HPCL there due to the movement of the HPCL trucks (2 and multi axel). The adjacent research indicates that the number of accidents is increasing annually, leading to the suggestion that it is a black spot. The two-lane, 10.25-meter-wide NH should be converted to a one-way street. Additionally, as previously said, a new road should be planned and built next to it. Vehicle mobility should be accommodated in the design and layout of service roads and underpasses. To allow for traffic division, Bommanayakanahalli Road should be extended to HPCL Road. To lessen the likelihood of an HPCL truck and a college vehicle colliding, the trucks could be rerouted to Bommanayakanahalli road.

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