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Development of a Methodology for the Evaluation of Safety at Unsignalized Intersection

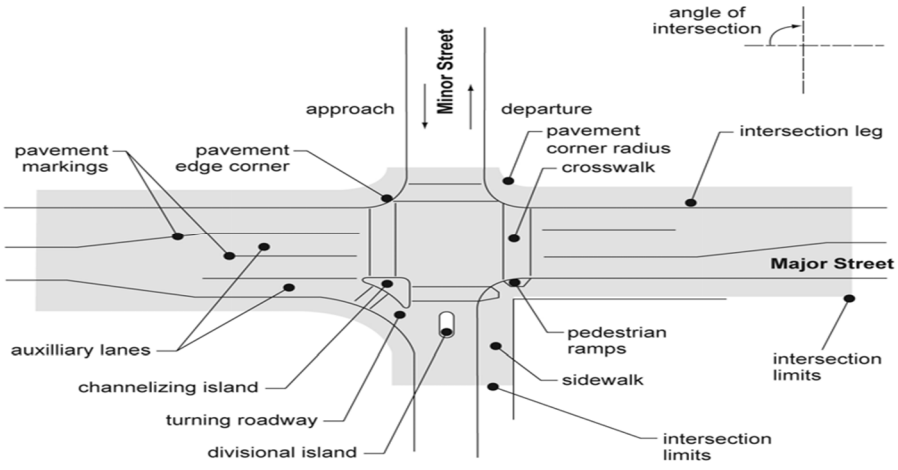
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Abstract: ***The measure of street accidents and fatalities at crossing point in worldwide is disturbing. An extensive number of car crashes occur at crossing points on urban streets in India. These factual information demonstrate that intersections are the spot of genuine security concern. Highway crossing points are hubs of street systems and clumsy areas.the spot of vehicle entry end exit at rotary various directions meet and collide with each other. Due to the collide from all users, more traffic crashes could happen at un-signalized intersection as compared with roadway segment. Its real capacity is to control vehicles to their particular bearings.The geometric design features of road such as inadequate visibility of the intersection, sight distances, width of pavement, inadequate guidance for motorists, improper installation of traffic signs horizontal and vertical alignment design details and intersection design elements are checked and corrected if necessary. Where the necessary by-pass may be constructed to separate through traffic from local traffic. To minimize delay and conflicts at the intersections, it may be essential to design and construct grade separated intersections or fly overs. These types of complex movements of vehicles with different speed and different capacity make un-signalized intersection more vulnerable causing road accidents. It might be reasoned that un-signalized intersections are among the most risky areas on Indian roadway framework.***

Keywords: Road Accident, IRC(Indian road congress), passanger car unit Intersection, Rotary , Traffic Sign, Vehicle

I. INTRODUCTION

The road traffic is composed of various categories of vehicular traffic and the pedestrian traffic. Un-signalized crossing points are mind boggling areas on any roadway. Generally un-signalized intersections are given in low volume streats. In this examination we are intrigued to talk about the different issues and their answers identified with street security. Un-signalized Intersections are the most dangerous areas in any street node. Particularly in any urban street node, working of un-signalized crossing point influences the general effectiveness of the whole transport arrangement of nation. Subsequently it is important to distinguish all the major and minor elements which are in charge of improve the street wellbeing at these areas. Moreover, the people on foot additionally look for same space for intersection.



A. Profile and Pattern of Road Accidents

In year 2018, the total number of accidents reported at 4,80,652 is lower by 4.1 % as compared with 5,01,423 in previous year(2017). Number of persons damaged in road accidents at 4,94,624 in 2018is also lower by 1.1 % from 5,00,279 in 2017.

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II. METHODOLOGY

A. General

The fundamental goal of this part is to build up an methodology for evaluation of safety at un-signalized intersection. To accomplish this target with least multifaceted nature and simpler method for introduction the work is partitioned into three noteworthy advances viz.Identification of factors, Evaluation of factors affecting safety at un-signalized intersections and Development of safety index. The breakdown of the work is examined underneath in detail with the assistance of Framework. Developed methodology will be useful for evaluation of safety of new proposed un-signalized intersection and it can also be used for comparing two or more un-signalized intersections as far as safety is concern.

B. Framework for Proposed Methodology

As talked about in the past section there is a need to build up an exhaustive methodology for evaluation of safety at un-signalized intersection. The target of this area is to build up a framework for the proposed methodology for evaluation of safety at un-signalized intersections, also the brief introduction and details of each stage is discussed in this section. Figure 3.1 presents the framework for proposed methodology.

Based on the framework five major stages identified to evaluate the safety at un-signalized intersections are summarized as follows:

1) *Stage I:* Development of a hierarchical Structure to identify critical factors affecting safety at un-signalized intersections.
2) *Stage II:* Data Collection at un-signalised intersection
3) *Stage III:* Determination of relative importance of identified hazardous factors.
4) *Stage IV:* Assessment of un-signalized intersection safety hazardous factors.
5) *Stage V:* Evaluation of overall weighted hazardous factors at un-signalized intersection by developing un-signalized intersection Safety Index (USISI).

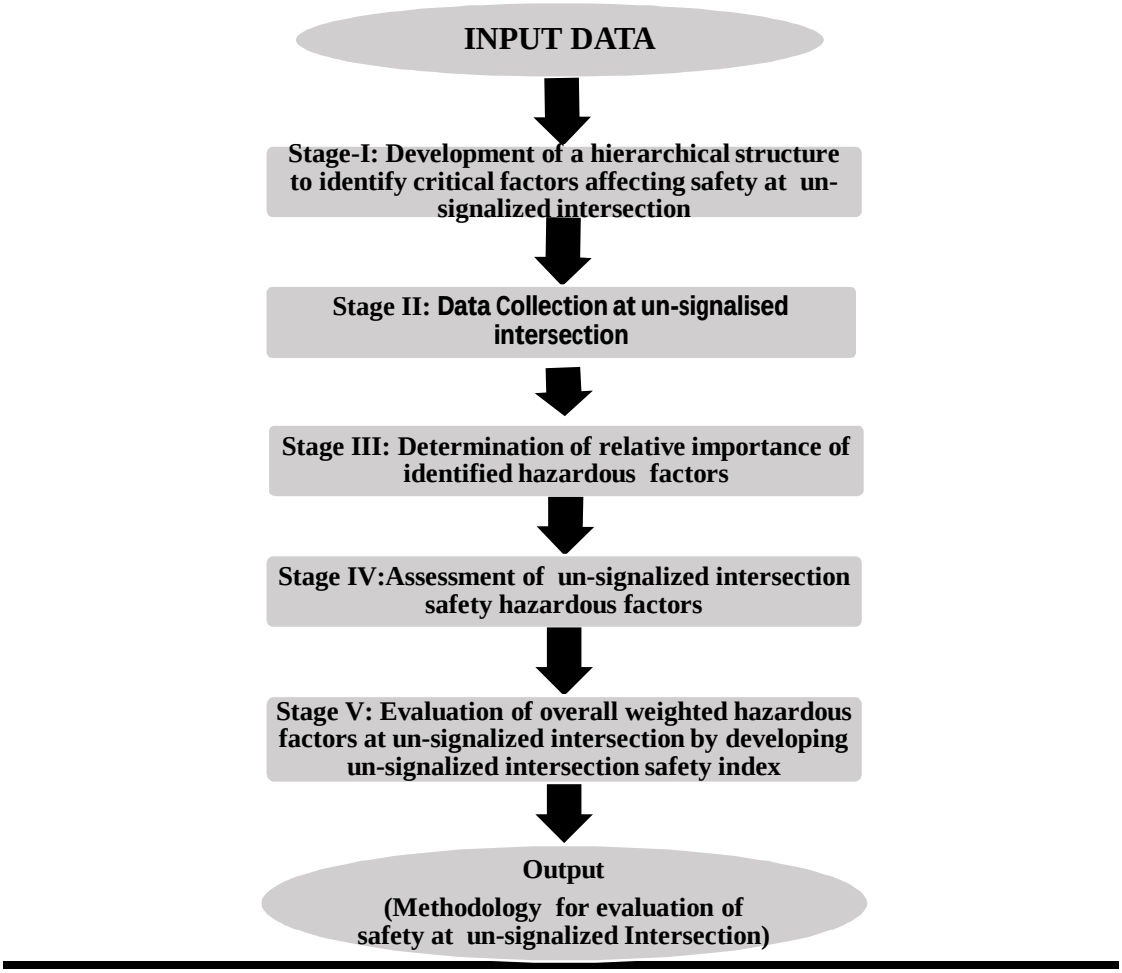


Figure : Framework for Proposed Methodology

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a) Stage I: Development of a hierarchical Structure to identify critical factors affecting safety at un-signalized intersections.

The first stage of this proposed methodology is to develop a hierarchical structure to identify critical factors affecting safety at un-signalized Intersections. A various hierarchical structure is should have been created to distinguish basic variables influencing safety at Un-signalized Intersections in a well-characterized chain of command way with the goal that every single risky segment can be recognized. A by and large various hierarchical structure is created to recognize basic elements at un-signalized Intersections. Therefore, first un-signalized Intersections are decomposed in to different factors i.e. (i) Improper Intersection Geometry (ii) Unsafe Traffic operation (iii) Improper installation of traffic indicator and pavement markings (iv) Other hazardous factors.

b) Stage II: Data Collection at un-signalised intersection

The data set pertaining to the independent variable and the dependent variable were obtained by conducting the traffic surveys at study intersections. Ordered turning development volume traffic of vehicles of every one of three gatherings i.e., light vehicles (two-wheelers, cars, auto-rickshaws, LCVs), heavy vehicles (buses, trucks, tractors, mini-bus/tempo vans) and non-motorized vehicles (cycles, cycle-rickshaws), for each direction of movements (LT, RT, and TH) at each of the approaches (three or four) were done simultaneously for 3hours in the morning session

i) Peak Hour Flow Rates: The pinnacle hour stream rates for various turning developments (TH, LT, and RT) for each methodology and all out methodology stream rates for all the three crossing points has been introduced through below tables. The layout of the three intersections has been shown in the figure

Table Peak Hour Flow rates

Approach Movement	Movement	Peak Hour Flow Rate		Approach Flow Rate	
		Veh/hr	PCU/hr	Veh/hr	PCU/hr
Board Office Square	TH	2130	1695	2740	2470
	LT	240	360		
	RT	370	415		
Jyoti Takies Square	TH	220	260	995	1177
	LT	465	573		
	RT	310	344		
ISBT Tiraha	TH	1400	1750	1698	2520
	LT	150	200		
	RT	148	570		

c) Stage III: Determination of relative importance of identified hazardous factors

Second stage of the proposed methodology is to determine the relative importance of hazardous factors affecting un-signalized intersection safety. The hazardous factors may not equally affect the safety of un-signalized intersection

d) Stage IV: Assessment of un-signalized intersection safety hazardous factors.

Third stage of the anticipated methodology is to assess the hazardous condition of different hazardous factors affecting un-signalized intersection safety. In this stage, safety hazardous condition index is developed for each hazardous factor at un-signalized intersection. Condition indices for each hazardous factor are developed in such an approach so that the value obtained should be lie between zero to one. Where zero indicates the safety at its highest level and one indicates unsafe condition.

e) Stage V: Evaluation of overall weighted hazardous factors at un-signalized intersection by developing un-signalized intersection Safety Index (USISI).

i) Fourth stage of the proposed methodology is to evaluate the overall safety hazardous factors at un-signalized intersection. In this stage an overall Un-signalized Intersection Safety Index ($USISI_{ER}$) is developed at existing road to evaluate the safety level at a particular un-signalized intersection. Safety Index of un-signalized intersaection is lies between zero to one. Value of un-signalized intersection Safety Index equal to one shows the least safe un-signalized intersection and value of un-signalized intersection Safety Index equal to zero shows the safest un-signalized intersection.

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III. RESULTS

A. *Selection Of Three Intersections*

To check the validation of the methodology some signalized intersections has to be identified. In the process of identification of signalized intersections it is kept in the mind that we cover the un-signalized intersections having different features. Three un-signalized intersections has been identified viz. (I) Board office Square Bhopal, it is a four lagged un-signalized intersection in Bhopal city of Madhya Pradesh. (II) , Chetak Bridge square Bhopal, it is a four lagged un-signalized intersection in Bhopal city of Madhya Pradesh. (III) ISBT Tiraha, it is a three lagged un-signalized intersection in Bhopal city of Madhya Pradesh. Photograph 4.1, Photograph 4.2, Photograph 4.3 shows the three un-signalized intersections viz. Board office Square, Chetak Bridge square, and ISBT tiraha respectively.



Figure 1 Board Office



Figure2 Chetak Bridge



Figure3 Isbt Square

IV. CONCLUSIONS

The main objective of this study is to develop a methodology for evaluation of the safety at un-signalized intersections. Further this study is also helpful in comparing the level of safety among different identified un-signalized intersections. Following are the main conclusions drawn from the study.

1) All around the world, road accidents are considered as one of the major factors causes death. Intersections are the most dangerous location of any roadway network. Further un-signalized intersections are supposed to be safe and efficient traffic movement nevertheless still many sever crashes occurs at these locations.

2) Various types of crash pattern occurred at un-signalized intersection has shown in this study and cause of their occurrence is also discussed.

3) From the literature review chapter it is clear that very few studies are available for evaluating the safety at un-signalized intersections. This study will be helpful for the engineers to evaluate the safety at un-signalized intersections

A. *Recommendation for Future Work*

This study presents a comprehensive methodology for evaluation of safety at un-signalized intersections. However certain limits are there in this methodology. To overcome from these limits and to develop a more comprehensive methodology for evaluation of safety at un-signalized intersections following works are recommended to carry out.

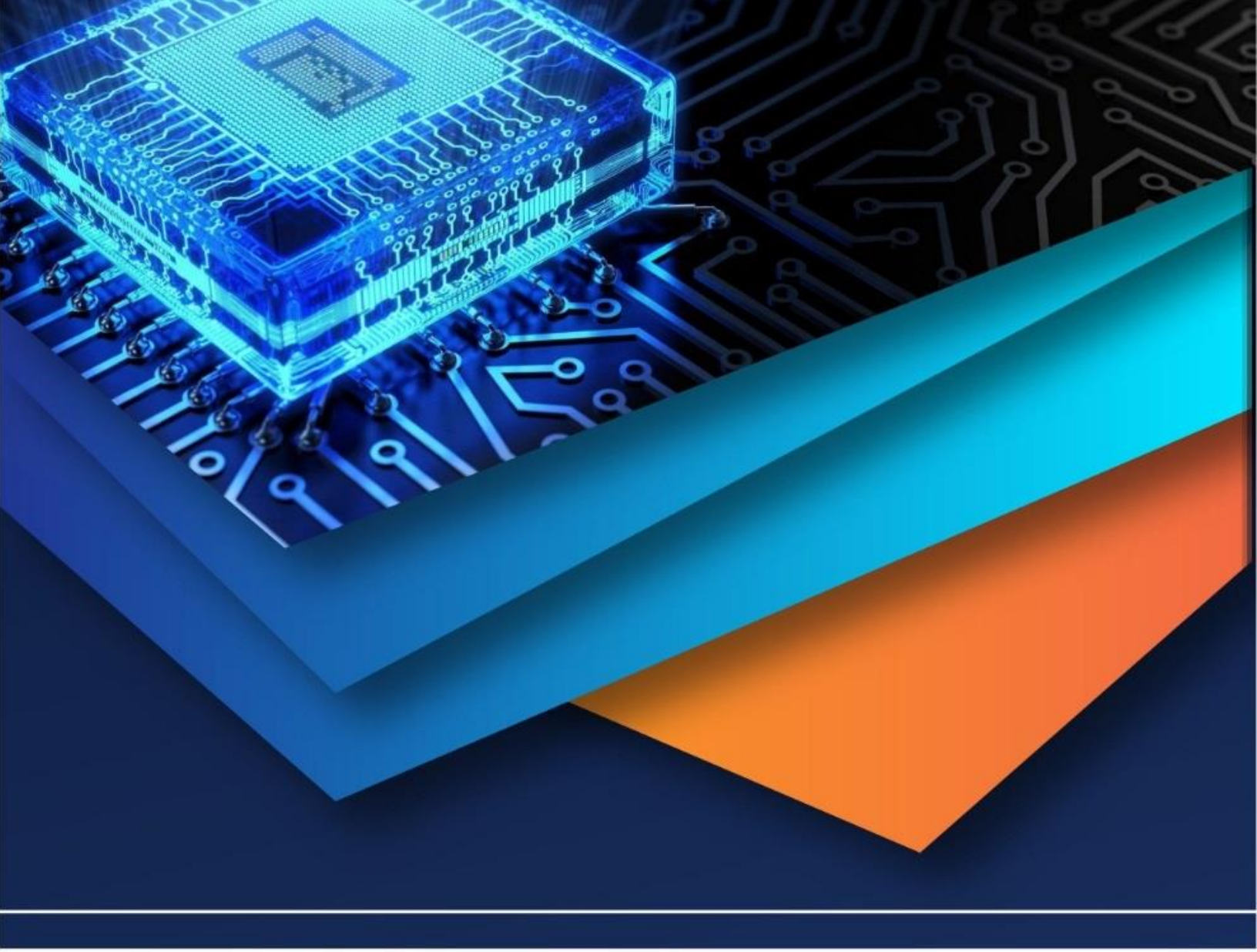
1) Weight of the identified factors is determined based on expert opinion, further any technique may be develop to determine the relative importance of the identified factors on safety at un-signalized intersections.

2) Some of the factors in this study are evaluated based on the judgments only like gradient of the intersecting legs, lightening at the junction etc. Hence it is recommended to develop technique to evaluate these factors so that methodology may be more effective and absolute.

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