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POST ENCROACHMENT TIME (PET) TO ESTIMATE CRASH RISK OF RIGHT-TURN VEHICLES ENTERING TWO-WAY TWO LANE DIVIDED HIGHWAYS

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ABSTRACT - When a minor road vehicle enters a multi-lane highway with a right turn, higher number of conflict points are created due to the complexity of the vehicle trajectories. Right turn vehicle entering a two-lane two-way divided highway from a minor road, therefore created four conflict points including 3 crossing conflict points and one merging conflict point. This research study focuses on minimizing the imposed *Crash Risk* due to a right-turn vehicle entering from a minor road to a two-lane two-way divided highway at an unsignalized T-intersection. *Crash Risk* is defined using Post Encroachment Time (PET). Data obtained from CCTV recordings were extracted using a tracker software to find PET related to each conflict. PET data was represented as percentage cumulative frequency graphs, and thereby estimated the percentile PET values. 15th percentile cumulative frequency of conflicts are at 2.4s, 1.4s, 3.0s and 6.0s of PET values in the 1st, 2nd, 3rd and 4th lanes respectively. Out of 4 lanes based on 15th percentile PET value, 2nd lane seems to be the most critical lane.

Keywords: Right-turn; Crash risk; Two-lane Two-way highways; T intersection; Post Encroachment Time

1. INTRODUCTION

With the rapid increase of vehicles, number of road traffic accidents increases day by day. Out of the mostly contributing factors, the location of the accident is also of importance. Bonela and Kadali,2022 identified among different types of locations, T junctions were classified as hazardous locations by past research studies in India.

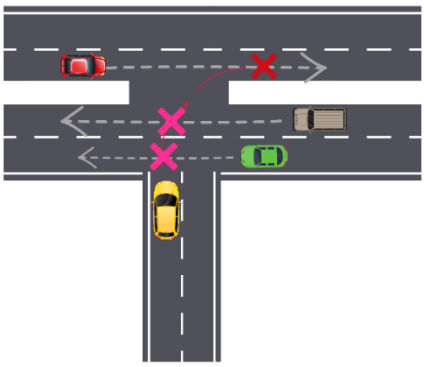

Figure 1. Conflicts Points

As shown in Figure 1 at the T junction where the two-way two-lane divided highway, right turn vehicles have to cross a minimum of three lanes while making two crossing conflict points which are indicated in pink color and one merging conflict point which is in red color.

Therefore, this study is to use Post Encroachment Time (PET) to define the crash risk which is created when a minor road vehicle enters a two-way two-lane highway divided highway with a right turn at an unsignalized T intersection. PET refers to the closeness of two vehicles flow in angular pathways to each. Smaller PET value indicates that possibility of conflict is high.

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2. MATERIALS AND METHODS

2.1. Methodology

A unsignalized T junction located in an arterial road in Kandy city was selected for data collection. It is located on a flat terrain. Data collection was done using CCTV cameras and about 48-hour recordings were collected which included every period of the day. PET values were extracted using the Tracker software with an accuracy of 0.1s. For this a grid system was used. Grid was based on lanes and length of one grid is equal to lane width. PET was calculated from the difference between the frame number of right turner leaves from the grid and frame number of major road vehicle enters the grid as shown in Figure 2. The PET values which are higher than 15 seconds can be neglected as the two vehicles are not much closer and the accident risk of them is less.

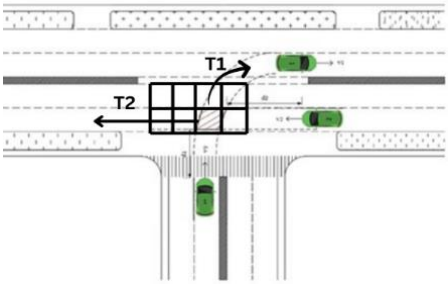

Figure 2. Post Encroachment Time

During the analysis process, PET values were clustered into value groups and found the percentage cumulative frequency values. PET values less than 1 second were divided into 0.25 intervals while PET from 1 second up to 15 seconds were divided in to 1 second intervals. PET ranges were defined based on the risky trajectories that were identified in the extraction of data. Then the percentage frequency diagram was drawn and 15th and 50th percentile values for each lane were obtained.

3. RESULTS AND DISCUSSION

From the extracted data 247 out of 460 were used for the graphical representation. Lane wise 15th and 50th percentile of cumulative percentage of conflicts were obtained.

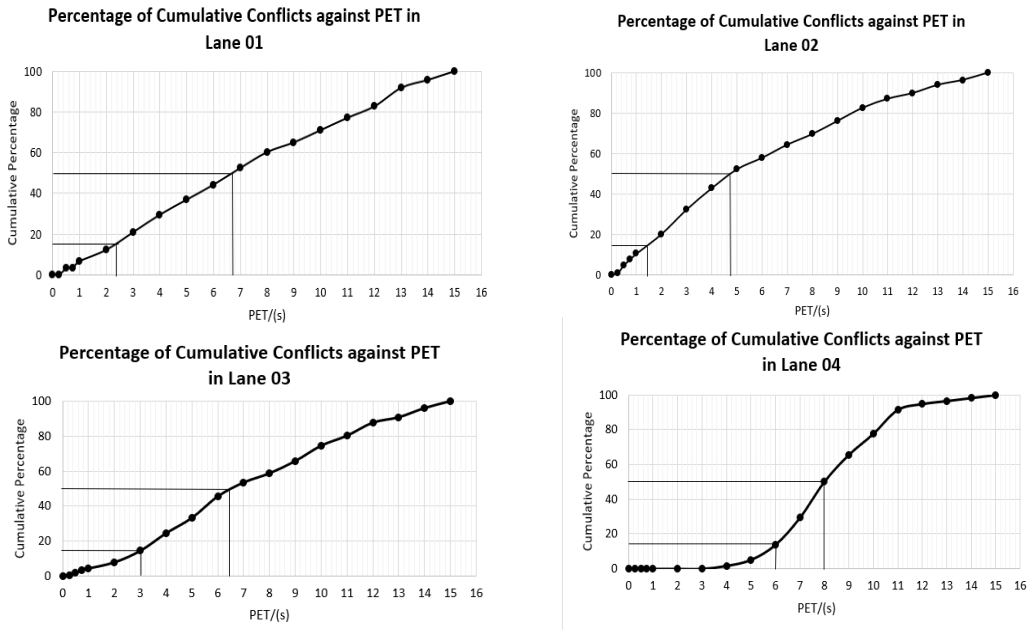

Figure 3. Percentages of cumulative conflicts against PET in each lane

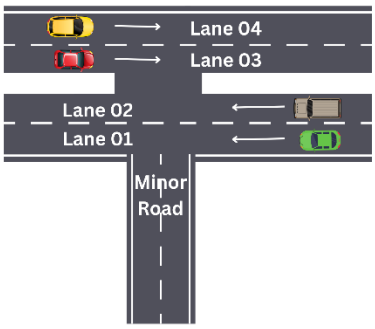

Figure 4. Numbering of Lanes in Main Road

Table 1. PET values of 15th and 50th percentile cumulative frequency value of conflicts (seconds)

	15th	50th
Lane 1	2.4	6.7
Lane 2	1.4	4.8
Lane 3	3.0	6.4
Lane 4	6.0	8.0

4. CONCLUSION

This research study was conducted to define and evaluate the Crash Risk due to a right turn vehicle entering from a minor road to a two-lane two-way divided highway at an unsignalized intersection. Data collection was done using videography surveying techniques and about 48 hours of data was collected from the selected location while it covers all the time periods in a day. As the main parameter, Post Encroachment Time was selected to define crash risk.

This extracted data was analyzed graphically by cumulative percentage of conflicts under each PET range. The crash risk is high when the PET value is closer to zero. 15th percentile cumulative frequency conflicts are at 2.4s, 1.4s, 3.0s and 6.0s of PET values in the 1st, 2nd, 3rd and 4th lanes respectively. In addition to that 50th percentile cumulative frequency percentage of conflicts are 6.7s, 4.8s, 6.45s, and 8.0s. This can be concluded based on the observation that a significant percentage (15%) of conflicts occur at relatively low PET values in each lane. This indicates that vehicles with lesser PET values are more possible to have accidents during right-turns entering from the minor road. And the 50th percentile of cumulative percentage of conflicts (median) is provided for each lane, indicating the PET values at which half of the conflicts occur.

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