Parameters and statistical modeling for comparison of simulated and observed traffic conflicts. A case study on 2+1 road sections

Presenter: Carmelo D’Agostino

31st ICTCT Conference - Porto, Portugal on 25th – 26th October 2018

Introduction

Objectives

Method

Observed Vs Predicted

Future work

• Statistically-based prediction methods require significant efforts in crash data collection and long periods to observe crash occurrence
• Defining the optimum design standard from crash data is a reactive approach
• Traffic conflict studies can mitigate this issue using a short time survey to count the number and severity of traffic conflicts which are assumed as surrogate measures of safety.
• Short 2+1 passing sections can limit the ability to disperse traffic platoons and it may lead to hazardous maneuvers (aggressive lane changing, increase of conflicts)
Introduction

Objectives

Method

Observed Vs Predicted

Future work

• Statistically-based prediction methods require significant efforts in crash data collection and long periods to observe crash occurrence
• Defining the optimum design standard from crash data is a reactive approach
• Traffic conflict studies can mitigate this issue using a short time survey to count the number and severity of traffic conflicts which are assumed as surrogate measures of safety.
• Short 2×1 passing sections can limit the ability to disperse traffic platoons and it may lead to hazardous maneuvers [aggressive lane changing, increase of conflicts]

Observed VS Predicted Traffic Conflicts

One of the main problem in simulated conflicts study is the validation of simulation results against real world conditions.

The aim of the paper is to assess the reliability of traffic conflict measures obtained by microsimulation against real world observation.

Observed VS Predicted Traffic Conflicts

One of the main problem in simulated conflicts study is the validation of simulation results against real world conditions.

The aim of the paper is to assess the reliability of traffic conflict measures obtained by microsimulation against real world observation.
Parameters and stat. modeling for comparison of sim. and obs. TC. A case study on 2+1 roads

Introduction

Objectives

Method

Observed Vs Predicted

Future work

• simulated conflicts (VISSIM and SSAM)

• observed conflicts video recording and analysis of vehicle trajectories in the merging area on 2+1 roads. Starting from those data, trajectories were extrapolated and conflicts detected and analyzed.

Simulated conflicts

• Estimation by SSAM software using micro-simulation trajectory outputs of VISSIM,

• The analysis included lane-changing conflicts estimated for TTC higher than 1.0 sec and less than 5.0 sec,

• Passing lane lengths varying from 500 m to 1200 m with steps of 100 m

• Traffic volume was varied from 300 to 1200 veh/h/dir with a step of 100 veh/h/dir, (80 simulation scenarios)

• More detailed evaluation was carried out by varying the merging length from 50 to 250 m with a step of 50 m (55 simulation scenarios).

• 5 hours simulation run time and warm-up time of 30 minutes for each simulation.

Calibration of microsimulation model

The aim of the calibration was to obtain a reliable share of platooning vehicles in simulation environment.

\[ R^2 = 1 - \frac{\text{SSR}}{\text{SST}} = 0.882 \]

Comparison of micro-simulation results after the calibration versus collected data.

Mean Absolute Percentage Error for all simulation runs was 8.3%.
In total 10 hours of video recording were analyzed to evaluate conflicts, on the merging area of 6 2+1 segments with different traffic condition and length of the additional lane.

<table>
<thead>
<tr>
<th>Method</th>
<th>Traffic volume - H veh</th>
<th>TTCmin = V*S(TTC)car</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roadway 1 hour</td>
<td>201407 124</td>
<td>219545 131</td>
</tr>
<tr>
<td>Piaski 1</td>
<td>201407 124</td>
<td>219545 131</td>
</tr>
</tbody>
</table>

Video were analyzed frame by frame (25 Hz), vehicle trajectories were identified by using a software for image analysis able to correct distortion of images, by imputing real measures of fixed points in the frames.
Parameters and statistic modeling for comparison of sim. and obs. TC. A case study on 2+1 roads

Introduction

Objectives

Method

Observed Vs Predicted

Future work

Analysis of vehicle trajectories

where:

\[ L = \alpha + \beta Q \]

- \( L \) – length of the passing lane [m],
- \( Q \) – traffic flow [Vehicle/h/day],
- \( \alpha \), \( \beta \) – regression parameters.

<table>
<thead>
<tr>
<th>Coeff.</th>
<th>Stdev</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Intercept)</td>
<td>-30.7971</td>
<td>1.1707</td>
</tr>
<tr>
<td>(Traffic)</td>
<td>3.9886</td>
<td>0.1710</td>
</tr>
</tbody>
</table>

Dispersion parameter \( k \) = 0.0542

Scaled Deviance (SC/DF*) = 68.71 (0.88 DF=78)

Pearson Chi-square (Chi-square/DF) = 78.0620 (1.0008 DF=78)

The identification of conflicts for different values of TTC has to be extended at different values of Post Enchrochment Time (PET).

- Comparison of simulated and observed conflicts, even at the early stage of investigation of the present research work, shows a significant linear correlation, but with a factor of 1/10 between simulated and observed numbers of conflicts.
- The relationship between traffic and simulated conflicts can resemble the nonlinear relationship that exists between traffic and crashes and can represent the next step for a proactive approach to road safety.
The identification of conflicts for different values of TTC has to be extended at different values of Post Enrochement Time (PET).

Comparison of simulated and observed conflicts, even at the early stage of investigation of the present research work, shown a significant linear correlation, but with a factor of 1/10 between simulated and observed number of conflicts.

The relationship between traffic and simulated conflicts can resemble the non-linear relationship that exist between traffic and crashes and can represent the next step for a proactive approach to road safety.