Traffic Conflict Technique Development to Analyze Traffic Safety at Signalized Intersections under Mixed Traffic Conditions

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Contents

Problems

- Traffic accident not only affect on individual but also influence on society.
- Vietnam: The cost of accident =2.45 GDP/year (ADB, 2003)
- Traffic safety at signalized intersections have been facing challenges

➔It's necessary to analyze traffic safety at signalized intersections. This is meaningful under scientific and practical aspect.

➔In order to analyze and evaluate traffic safety at intersections have been classified into 2 categories:

(1) Direct analysis; (2) Indirect analysis

Traffic accident in HCMC (2009-2011)

Year	Accident location	Number of traffic accident	
2009	In HCMC	**1122**	
	Road	920	82%
	Intersections	202	18%
	Signalized intersections	75	(1) 7%; (2) 37%
2010	In HCMC	**1049**	
	Road	897	86%
	Intersections	152	14%
	Signalized intersections	112	(1) 11%; (2) 74%
2011	In HCMC	**1013**	
	Road	889	88%
	Intersections	124	12%
	Signalized intersections	98	(1) 10%; (2) 79%

(1): % the no. traffic accident at signalized intersections account for of the total in HCM

(2): % the no. traffic accident at signalized intersections account for of the total traffic accident at intersections in HCM

Data source: Traffic police in HCMC (2013)

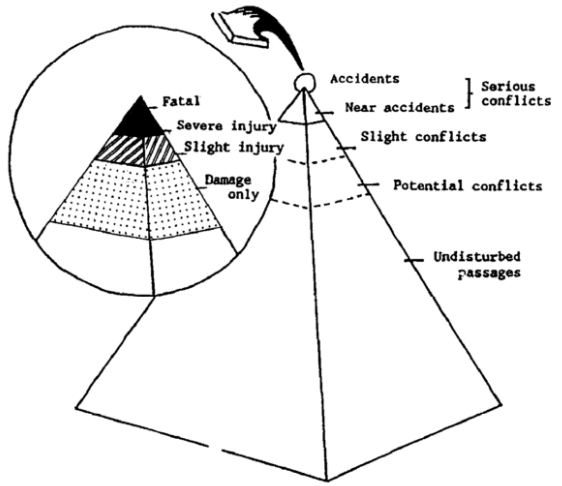
Traffic safety analysis methods

(1) **Direct** analysis method;

***Using of the historical accident data**
***Infeasible to apply this method for analyzing traffic safety where the historical accident data is unavailable like HCMC**

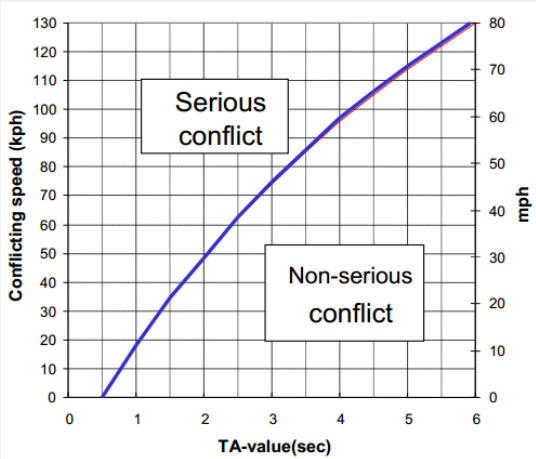
(2) **Indirect** analysis method

***Traffic conflict technique (Christer Hydén, 1987)**
***Using two fundamental indicators Time to collision (TTC) and Conflict speed (CS) in order to evaluate traffic conflict severity.**



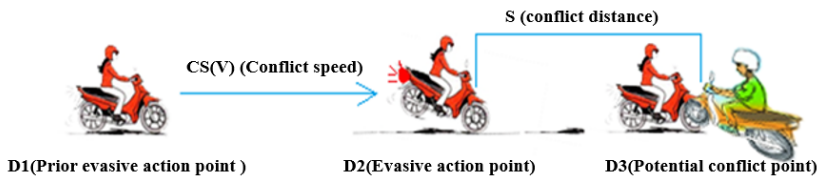
Pyramidal representation of traffic events (Hydén, 1987)

Clarify conflict severity (Hydén, 1987)

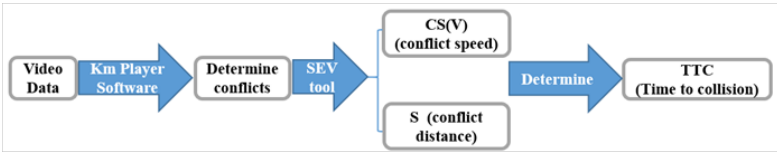


Definitions

- **Collision**: Impact event b/w two or more road users/ vehicles, or a road user and stationary object
- **Traffic conflict**: an observable situation in which two or more road users approach each other in space and time for such an extent that there is a risk of collision if their movement remain unchanged
- **Conflict speed**: denotes the original speed of vehicle taking prior evasive actions
- **Conflict distance**: the distance between potential collision location and the vehicle taking prior evasive actions denoting braking, weaving or deceleration
- **Time to collision** equals the ratio of conflict distance and conflict speed



Conflict processing simulation



Processing for determination TTC, CS value

$$TTC = S/CS \quad (1)$$

$$S = \sqrt{(x_3 - x_2)^2 + (y_3 - y_2)^2} \quad (2)$$

Data collection and Analysis

Data collection
(Video camera)

Clarify traffic conflicts severity
(Learning from previous researches)

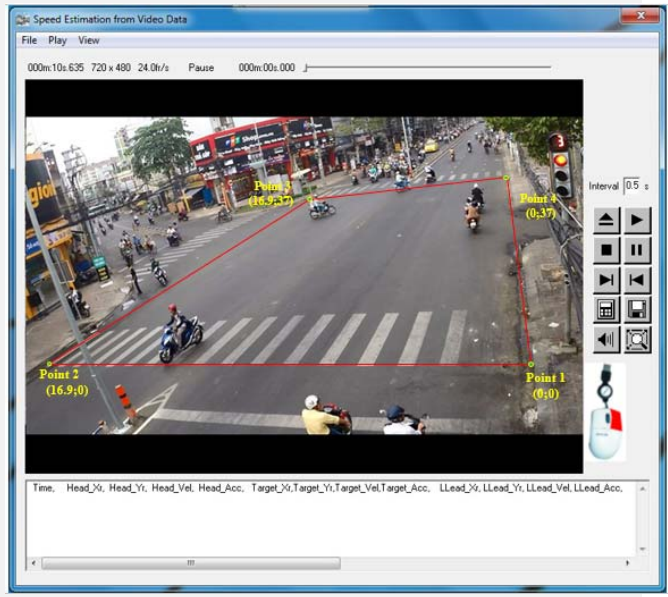
Determine the number of traffic conflicts for each conflict severity

Determine conflict distance (S) and conflict speed (CS/v)
➔ TTC= S/v (serious; non-serious conflicts)

- Cumulative frequency for TTC, CS
- Determine TTC (85%) and CS (85%)
- Use two indicators TTC, CS to category traffic conflict severity

Determine TTC, CS for two cases
(serious, non-serious conflicts)

Graph development to evaluate traffic conflict severity at signalized intersections



Speed Estimation from Video Data (SEV) tool and video post-production

Data collection and Analysis

- Most of traffic accident occur at signalized intersections at off-peak hour, accounted for 63% (Zone 1), 54% (Zone 2), and 38% (Zone 3). *(Quang Vượng; Anh Tuấn, 2014)*

➔ This research has been carried out based on traffic conflict data, which are observed at 10 signalized intersections using video camera during August-November 2014

➔This study just focus on surveying of three period times in a day (9h00-10h30’; 14h00’-15h30’; 21h30-23h00)

10 Signalized intersections survey distribution by zone

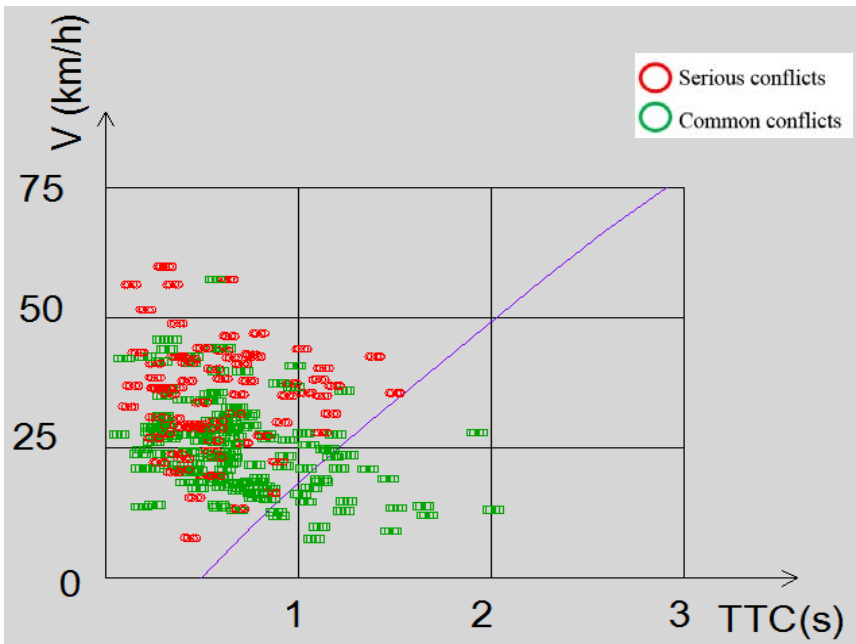
Data collection and Analysis

Signal to clarify traffic accident severity

Conflict severity	Level	Description
Common (Slight)	1	Applied the brake or direction change to avoid collision but with ample time for manoeuvre or steady deceleration
Serious	2	Applied the brake or direction change to avoid collision with less time for manoeuvre than level 1 or requiring more complex actions
	3	Rapid deceleration or rapid acceleration, direction change or stopping to avoid collision resulting in a near-miss situation
	4	Emergency braking or violent swerve to avoid collision resulting in a very near-miss situation

Source: Baguley, et al., 1982

Conflict distribution by conflict severity



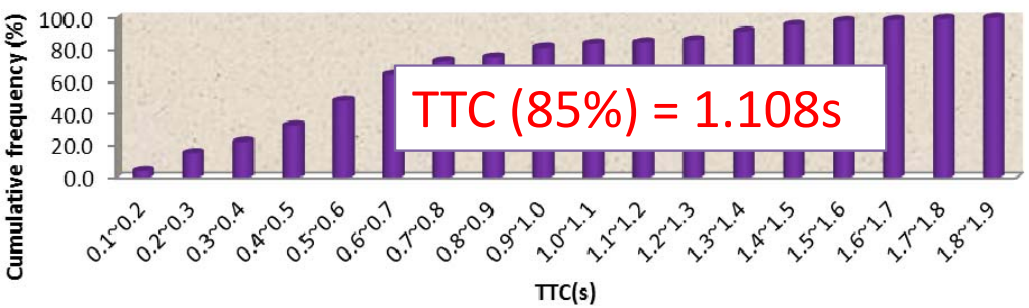
This illustrated that the result don't reflect real situation in the right way

Results

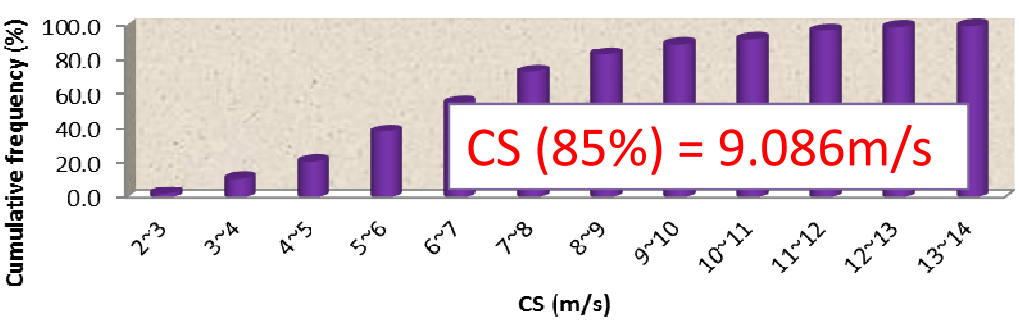
There are 3050 traffic conflicts: 2040 non-serious; 1010 serious

Non-serious conflicts

Cumulative frequency of TTC

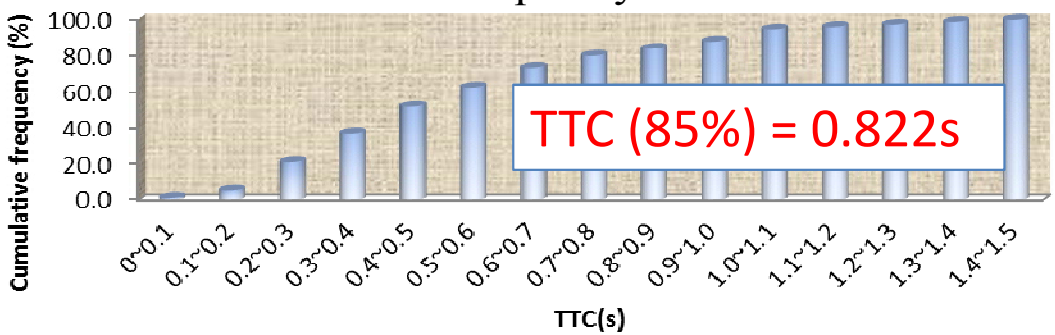


Cumulative frequency of CS

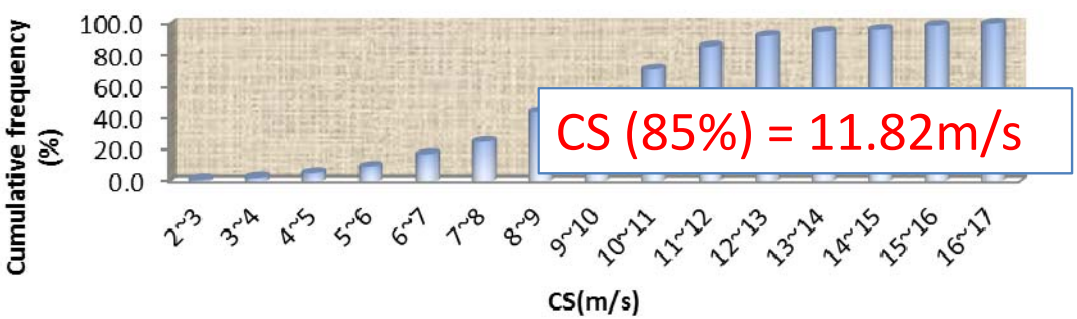


Serious conflicts

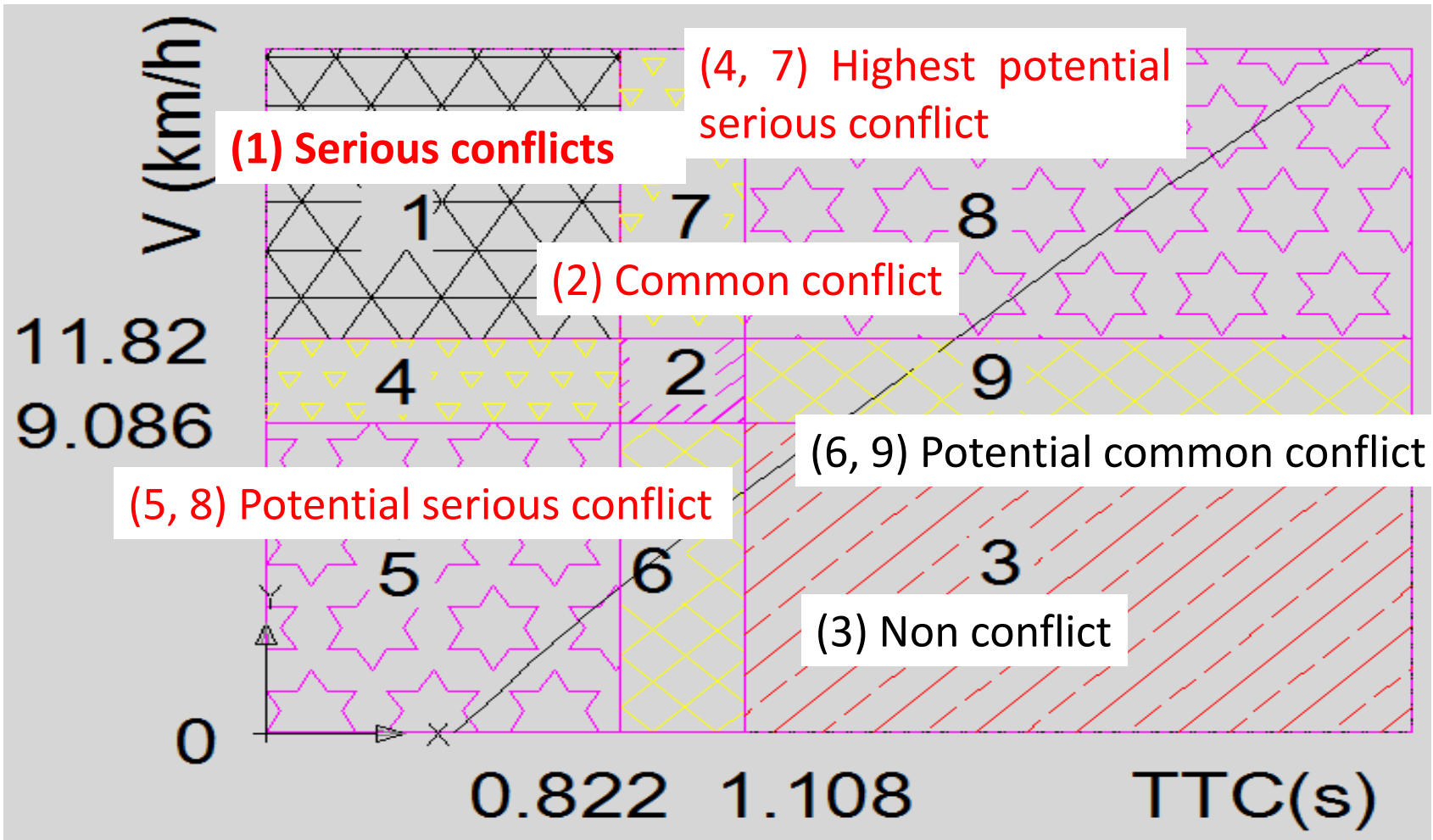
Cumulative frequency of TTC



Cumulative frequency of CS



Results- Traffic conflicts severity graph



Conclusions

- This study indicate that the graph to clarify conflict severity was developed by Hyden can't apply under mixed traffic conditions.
- This study also explore that TTC and CS are two significant indicators to determine traffic conflict severity. Serious conflict, common conflict, non-conflict, highest potential serious conflict, potential serious conflict, and potential common conflict are six zones to distinguish traffic conflict severity under mixed traffic conditions.
- The result of this research is also initial meaningful science basic for the next study regarding whether TCT can be applied to analysis traffic safety performance at signalized intersections under mixed traffic conditions

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THANK YOU FOR YOUR ATTENTION !