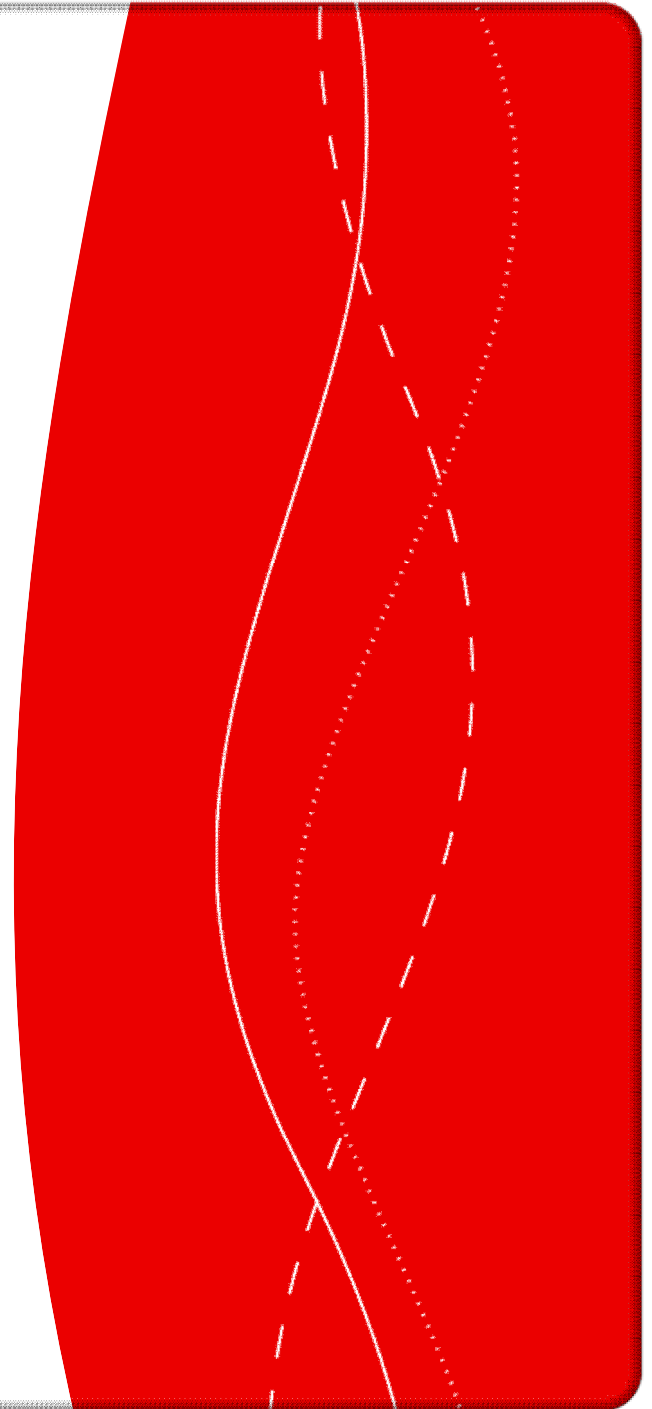




FINDING A BETTER WAY

**Estimation of the severity
of traffic conflicts in
naturalistic driving studies**

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Aim

Development of a method to estimate the severity of traffic conflicts in naturalistic driving studies, NDS.

“Not dependent on visual analysis

” Applicable on large databases.

“Combine measure of safety margins with a measure of possible injury risk

” Aims to give a realistic severity estimate of the situation

Why study traffic conflicts?

Theory of common logical chain of events

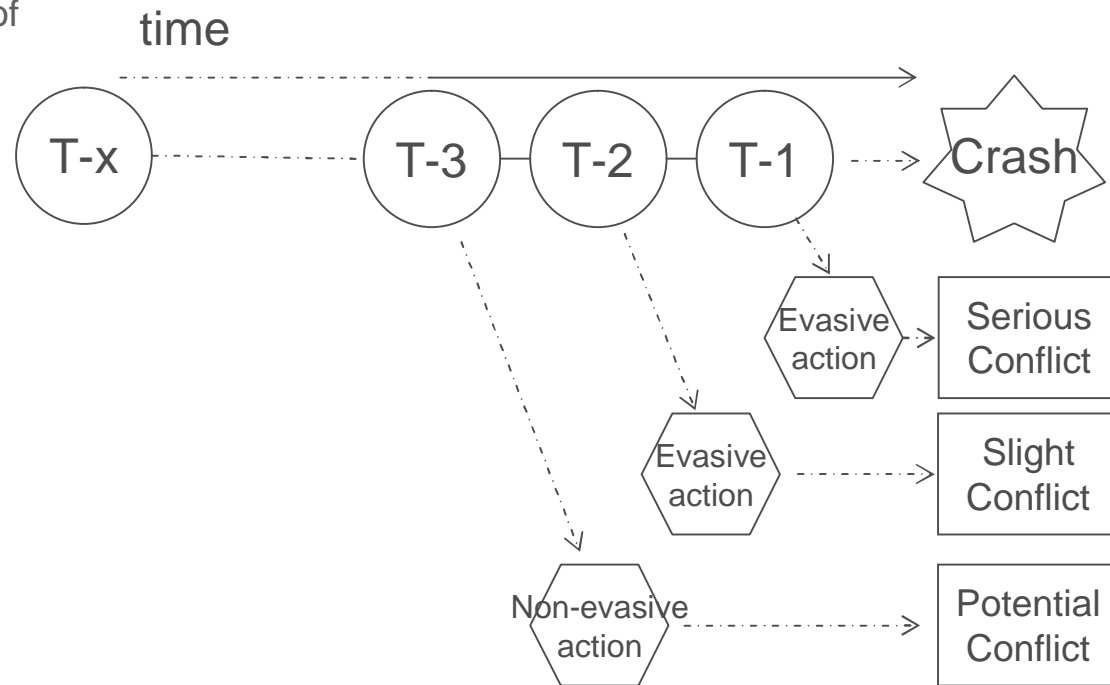
Theory vs real life

Difficulties studying conflicts

Different ways of measure

Correlations to accidents

Relevant events



Finding the conflicts

Naturalistic driving studies
In-vehicle sensors
Extremely large databases
Visual analysis not practical

Need a #trigger+

Detection of events in NDS

Finding events that are relevant to accidents with logged data only.

Analysis of logged data from an ISA study.

Showed a relationship between critical braking behaviour and accident involvement for cars.

Developed a method to identify these critical brakings for cars.

Applied the #trigger+on the NDS database

Resulted in 36 events with private cars as the subject vehicle.

Additional video analysis for finding events with heavy trucks as subject vehicle resulted in another 27 events.

Giving a total of 63 conflicts to analyze

Estimation of severity

Are the identified events relevant events?

A severity estimation is needed

Several methods exist, for instance

- “Time Gap

- “Post encroachment time

- “Time To Collision, TTC

- “Amongst others

Different methods give different results.

Most common method and perhaps the most validated is Traffic conflict technique, uses TTC at the onset of braking combined with conflict speed.

Severity estimation

Estimation of safety margins

Possible consequences are not taken into account

Except TCT that uses conflict speed as a severity factor, i.e higher speed leads to higher severity.

Does this produce a realistic estimate?

Consider:



Speed and size does matter

Accident analysis studies shows that

Speed of the involved road users need to be taken into account

As well as the kind of road users that's involved

Previous studies concludes: Evans and Wasielewski (1987), Ernst et al. (1991), Evans and Frick (1994, 1995), Fontaine (1994), Wood (1995) and others

The relative risk of being injured are related to the mass ratio of the involved vehicles.

Conflict Severity Estimate

Calculates the severity by combining a measure of safety margins and a measure of injury risk.

Injury risk is calculated as: $\Delta V = MAX\left(\frac{V1-V2}{1+Rm}\right)$; where

Rm is the mass ratio; $= \frac{m2}{m1}$

Definition of safety margin

Available time to compensate to erroneous driving or unforeseen events

Measure of Safety margin - $TTC_{Braking}$

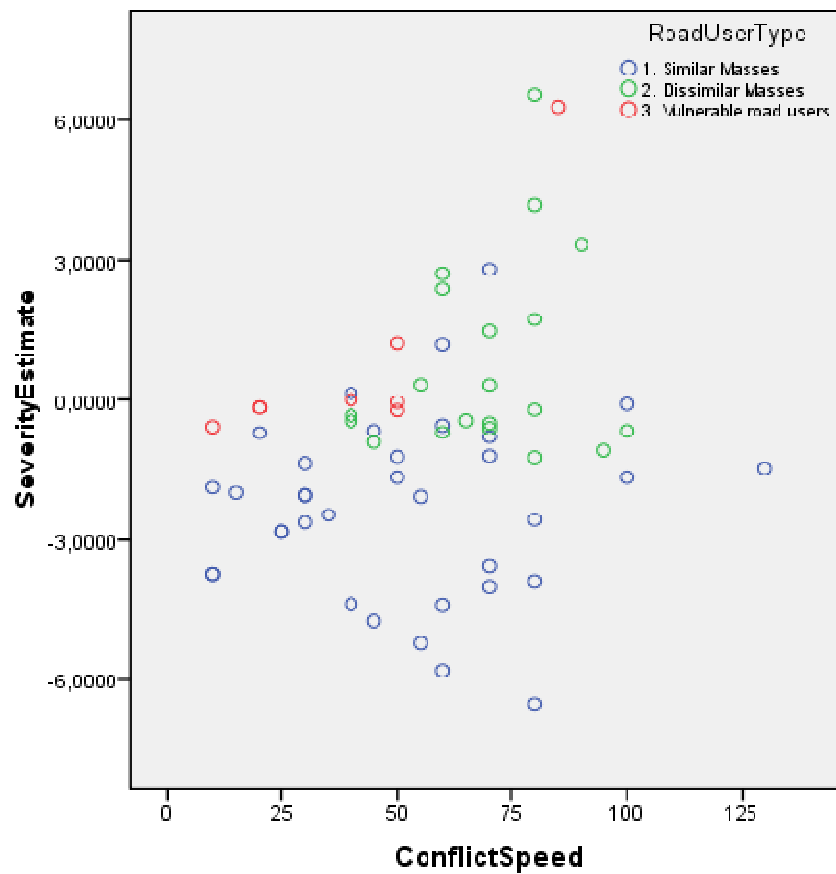
Conflict severity is calculated as

$$CSE = \frac{m_2(\Delta V - TTC_{Braking} * acc)}{m_1 + m_2}; \text{ where}$$

acc is the maximum average deceleration

Results

The analysis of the 63 events gave:



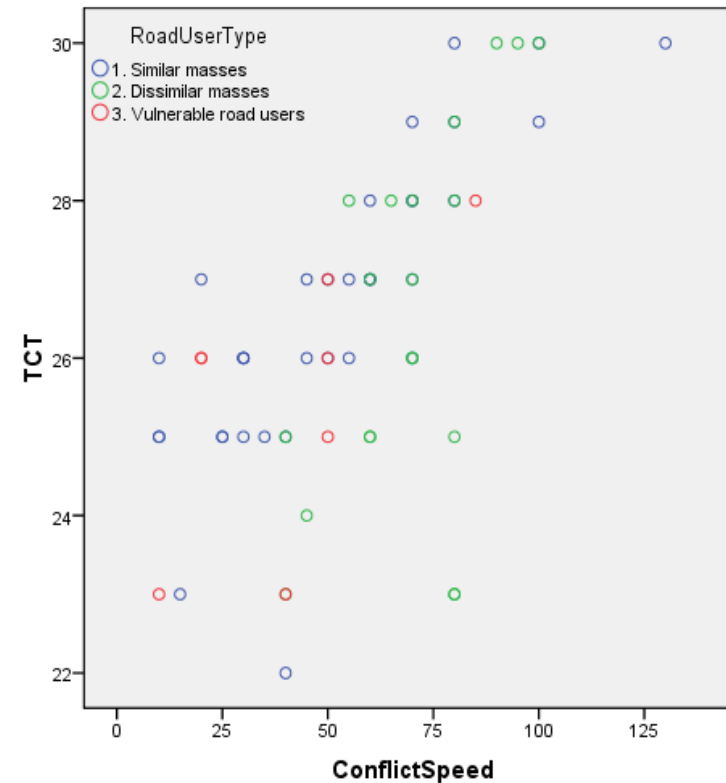
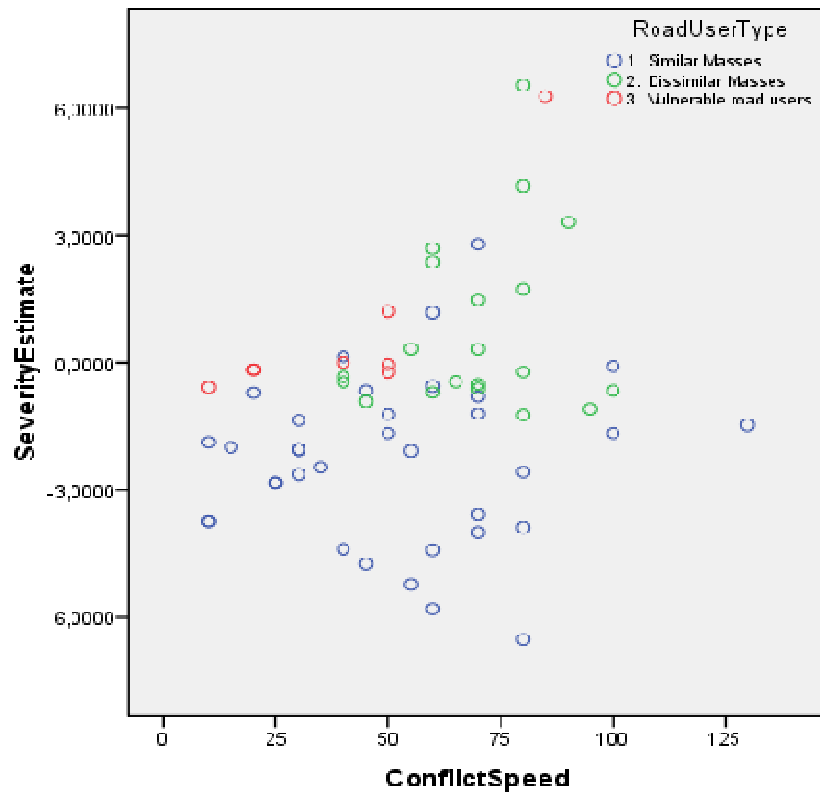
Multiple Comparisons

SeverityEstimate
Tukey HSD

(I) RoadUserType	(J) RoadUserType	Mean Difference (I-J)	Std. Error	Sig.
1	2	-3,095486*	,5716033	,000
	3	-3,095633*	,7991303	,001
2	1	3,095486*	,5716033	,000
	3	-,000147	,8530636	1,000
3	1	3,095633*	,7991303	,001
	2	,000147	,8530636	1,000

Evaluation of the severity estimate

A somewhat unfair comparison with the Traffic Conflict Technique
Differs by the fact that road users nor the relative speed are not taken into account by TCT.
TCT suggest that severity is closely related to conflict speed



An evaluation of the severity estimate should therefore include the relative speed.

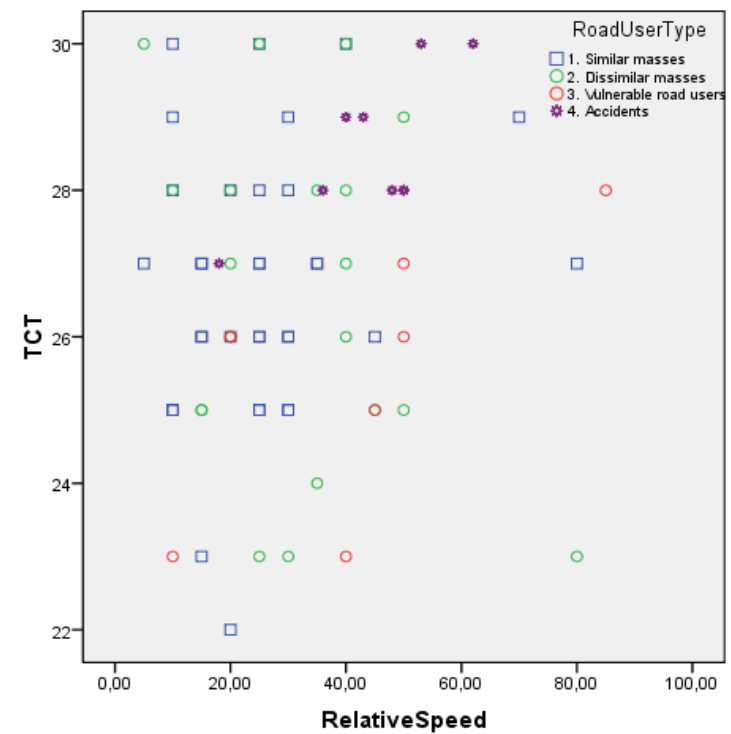
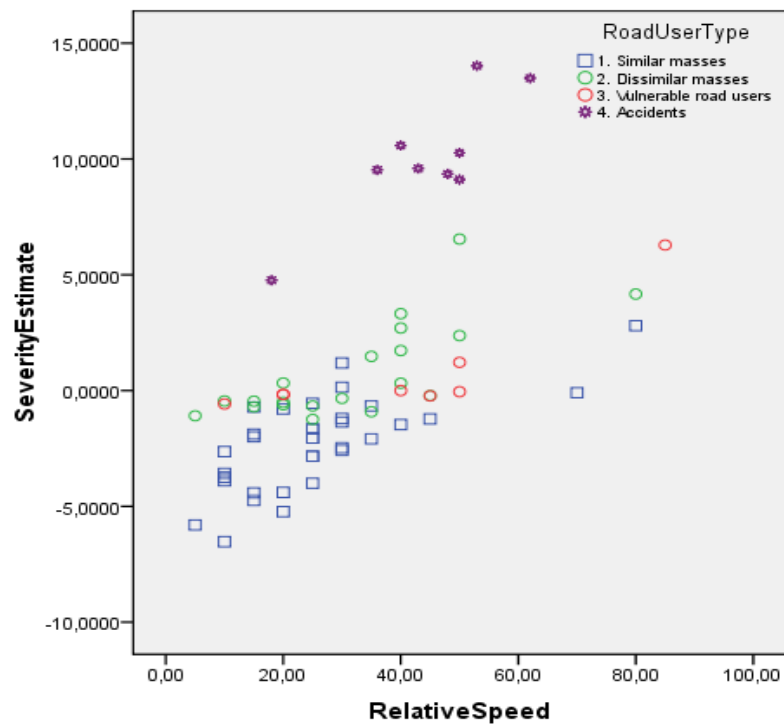
In addition

Analysis of real accident data has also been added

A set of 10 accidents involving private cars and pedestrians has been estimated using the same method.

The accident data comes from a Finnish study made by Pasanen in 1993

Video filmed an intersection from which the necessary data was obtained for accident analysis.



Accident relevant events

In theory:

Serious conflicts are strongly correlated to accidents.

In reality:

Only low correlations has been found, so far.

Different methods gives different results, sets of events

The question remains:

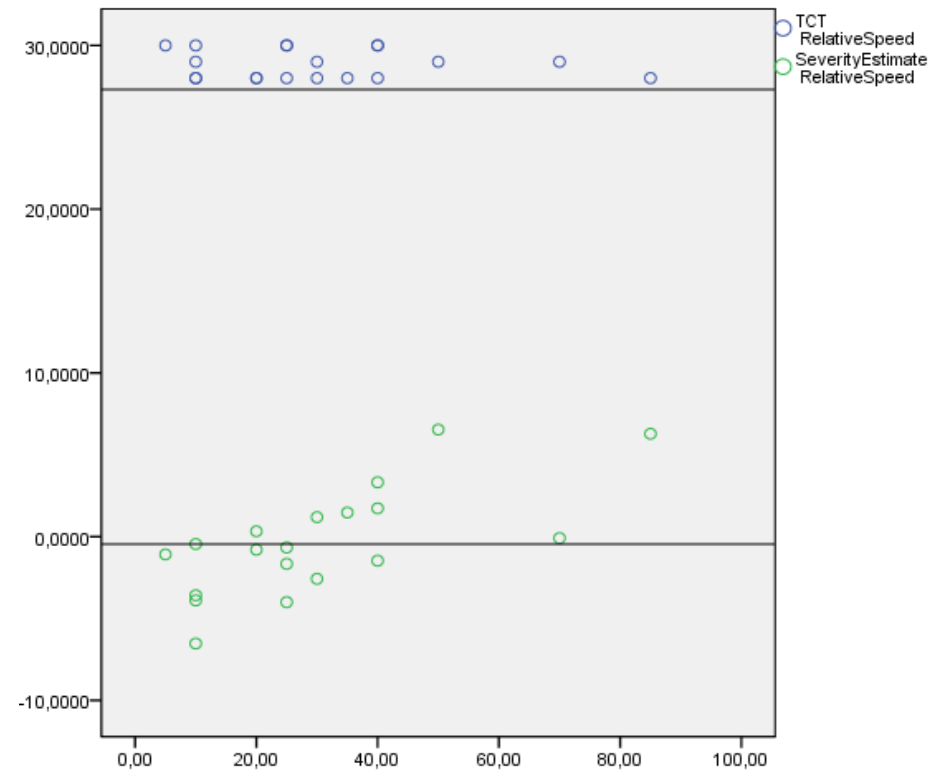
Does the selection of serious events based on this severity estimate give a better correlation between serious conflicts and accidents?

Too few accidents

So far, NDS studies does not include many accident (fortunately)

Serious conflicts according to TCT vs. the proposed method.

Extreme value statistics



Further research

Calibration

Low speed accidents vs
High speed conflicts

