Searching for the severity dimension of traffic events

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Safety pyramid

- Accidents
- Serious conflicts
- Slight conflicts
- Potential conflicts
- Undisturbed passages

C. Hydén, 1987
Safety pyramid

Svensson, 1998

What is ”severity” then?

- Nearness to a collision…
- Nearness to a collision + consequences (somehow)…

Vision Zero: “traffic system with no fatalities or serious injuries”

Suggested definition:
Severity = Nearness to a person serious injury/fatality
What is "severity" then?

Still, the questions remain:
• How near was an encounter to a collision?
• What the consequences would have been if the collision had taken place?
• ... And how to weigh these two together?
How to measure **nearness-to-collision**?

- **Time-to-Collision** (*TTC*)
- **Time Advantage** (*TAdv*) – the expected time between the first road user leaving the conflict zone and the second one arriving at it.
- *T₂*

\[
T_{Ad} = T_1 - T_2
\]

Laureshyn, 2010
Example

2 events

$T_2^{\text{min}} = 0.7$ sec in both

Do they feel equally “severe”?
How to measure consequences?

Delta V

\[ \Delta V_{1} = V_{1, \text{after}} - V_{1, \text{before}} \]

\[ \Delta V_{2} = V_{2, \text{after}} - V_{2, \text{before}} \]

\[ \Delta V_{\text{after}} = \frac{m_{1} \cdot \Delta V_{1} + m_{2} \cdot \Delta V_{2}}{m_{1} + m_{2}} \]
How to measure consequences?

What is "severity" then?
5 working days (2.5 so far)  
6:00-21:00
Which one is more severe?
How to ”weigh” together?

- $T_{2,\text{min}}$ reflects the time margin between the road users
- This time still can be used for **braking**
- deltaV with speeds **after braking** during $T_{2,\text{min}}$?
- But at what deceleration rate?

$4 \text{ m/s}^2$ – normal braking

$8 \text{ m/s}^2$ – emergency braking

How to ”weigh” together?

<table>
<thead>
<tr>
<th>dV8</th>
<th>67</th>
</tr>
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<tbody>
<tr>
<td>dV6</td>
<td>91</td>
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<td>dV0</td>
<td>601</td>
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<td>exposure</td>
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**Frequency**

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<th>6000</th>
<th>8000</th>
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<td>91</td>
<td>147</td>
<td>601</td>
<td>10259</td>
<td></td>
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</table>
How to "weigh" together?

\[ \delta V_0 \ (N=906) \]

How to "weigh" together?

\[ \delta V_4 \ (N=305) \]
How to "weigh" together?

\[ \text{deltaV}_8 (N=67) \]

How to ”weigh” together?

Classification by \( \text{deltaV}_4 \)
How to ”weigh” together?

Classification by deltaV₈

<table>
<thead>
<tr>
<th>ID</th>
<th>deltaV₈, m/s</th>
<th>dV8</th>
<th>dV6</th>
<th>dV4</th>
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Discussion

- New indicator to measure "severity" – nearness to collision & consequences. VRU!!!

- Parameters (a, elasticity, RU type, angle) still needs to be validated

- Hard to define threshold if Extreme Value Theory methods are applied for estimating accident number

- TTC with accurate measurements is often of no use