

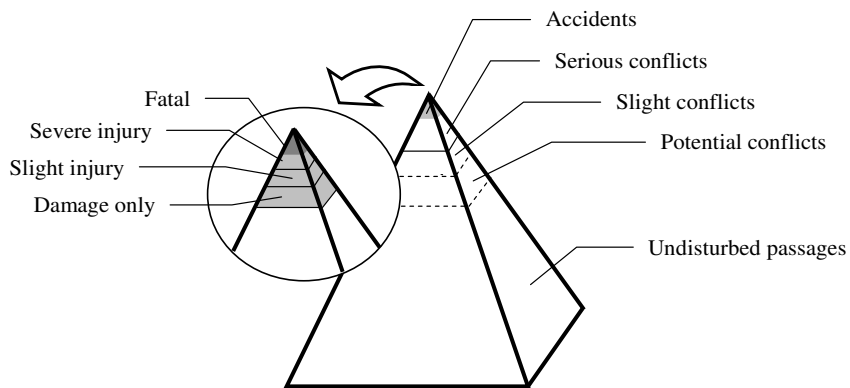


Searching for the severity dimension of traffic events

ALIAKSEI LAURESHYN, TIM DE CEUNYNCK,
CHRISTOFFER KARLSSON, ÅSE SVENSSON



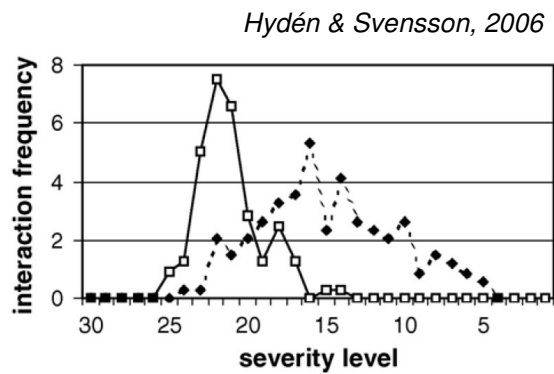
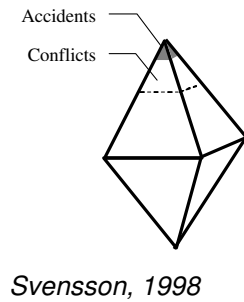
Safety pyramid



C. Hydén, 1987



Safety pyramid



What is "severity" then?

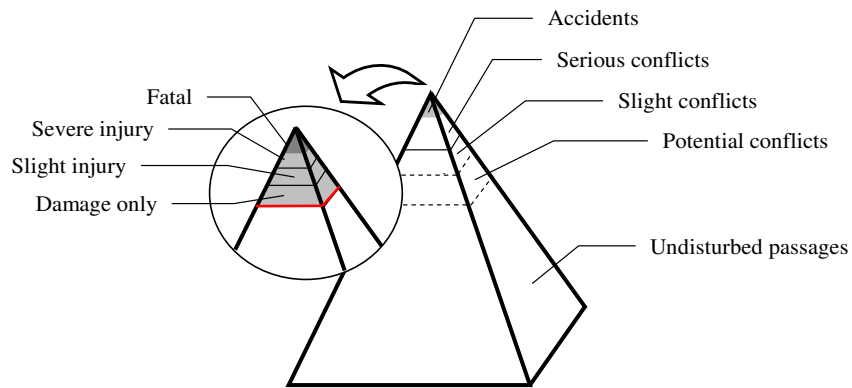
- Nearness to a **collision**...
- Nearness to a **collision + consequences** (somehow)...

Vision Zero: "traffic system with no fatalities or serious injuries"

Suggested definition:

Severity = Nearness to a **person serious injury/fatality**

What is "severity" then?



C. Hydén, 1987



What is "severity" then?

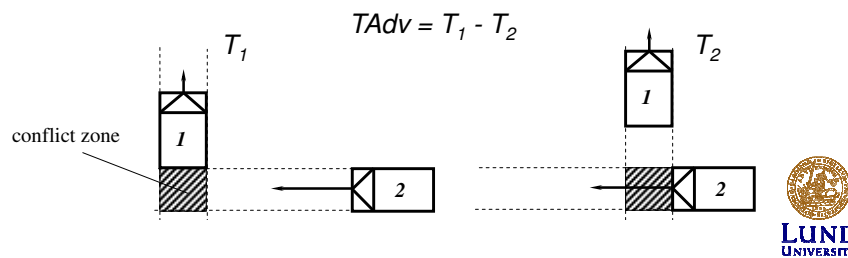
Still, the questions remain:

- 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?**

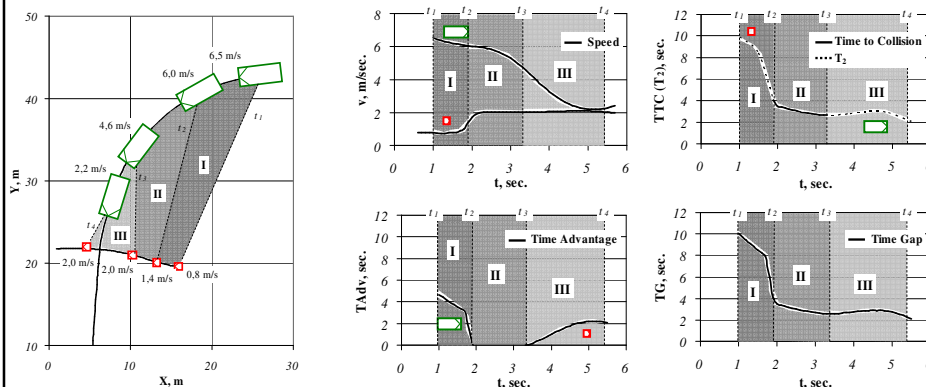


How to measure nearness-to-collision?

- **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.
- T_2



How to measure nearness-to-collision?



Laureshyn, 2010

Example

2 events

$T_2^{\min} = 0,7$ sec in both

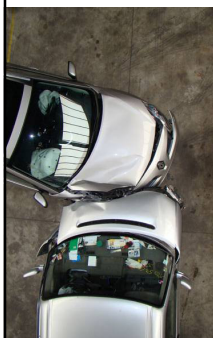
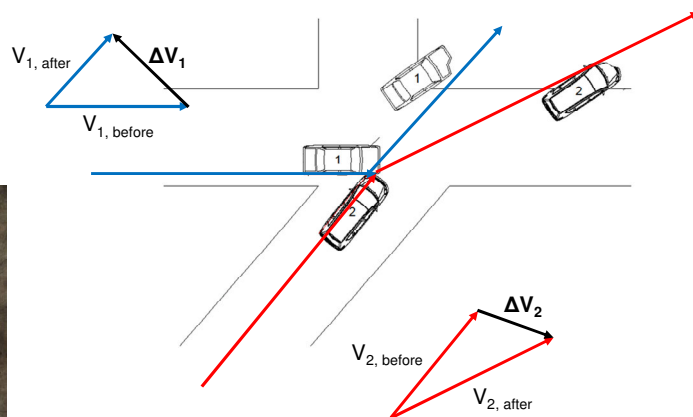
Do they feel equally "severe"?





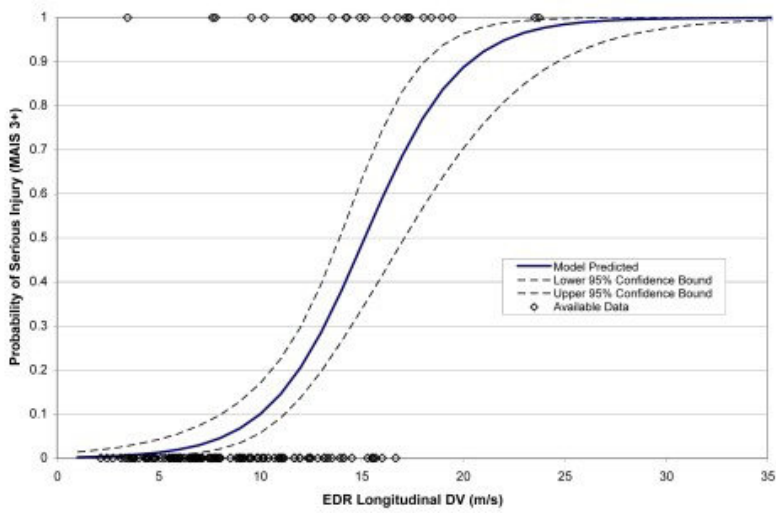
How to measure consequences?

Delta V

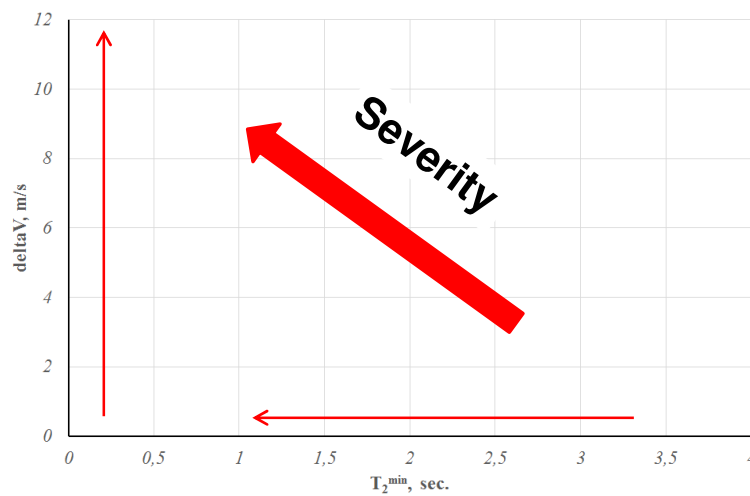


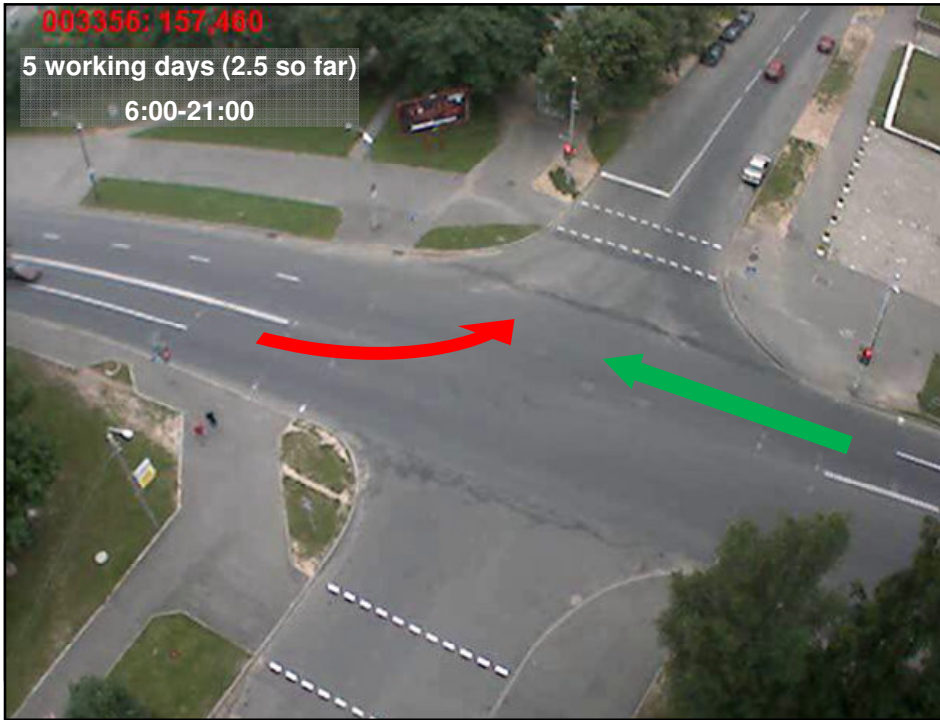
$$v_{after} = \frac{m_1 \cdot v_{1before} + m_2 \cdot v_{2before}}{m_1 + m_2}$$

How to measure consequences?

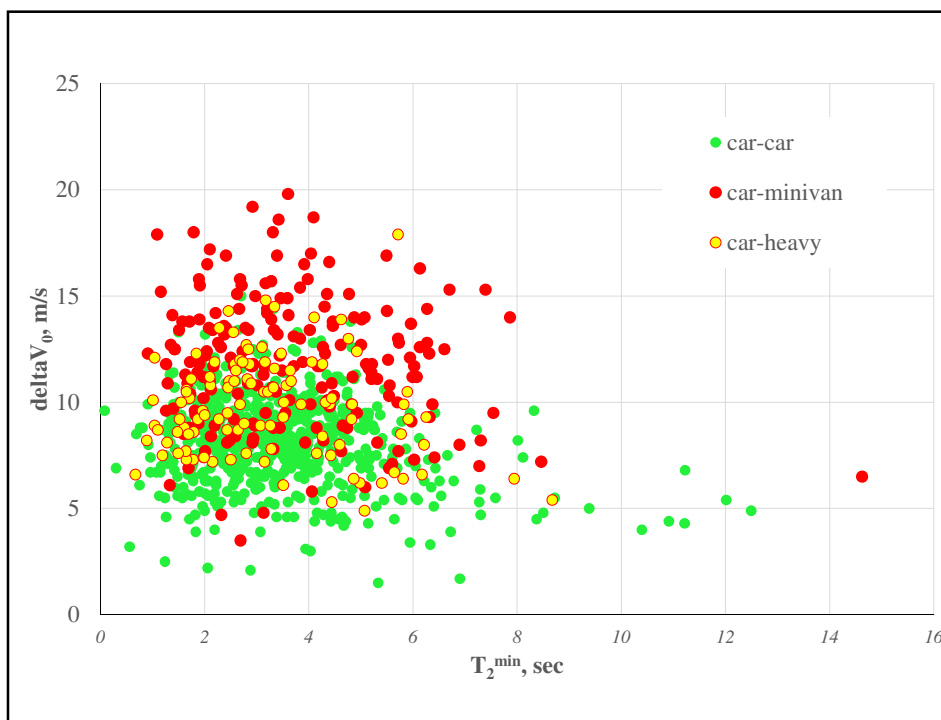
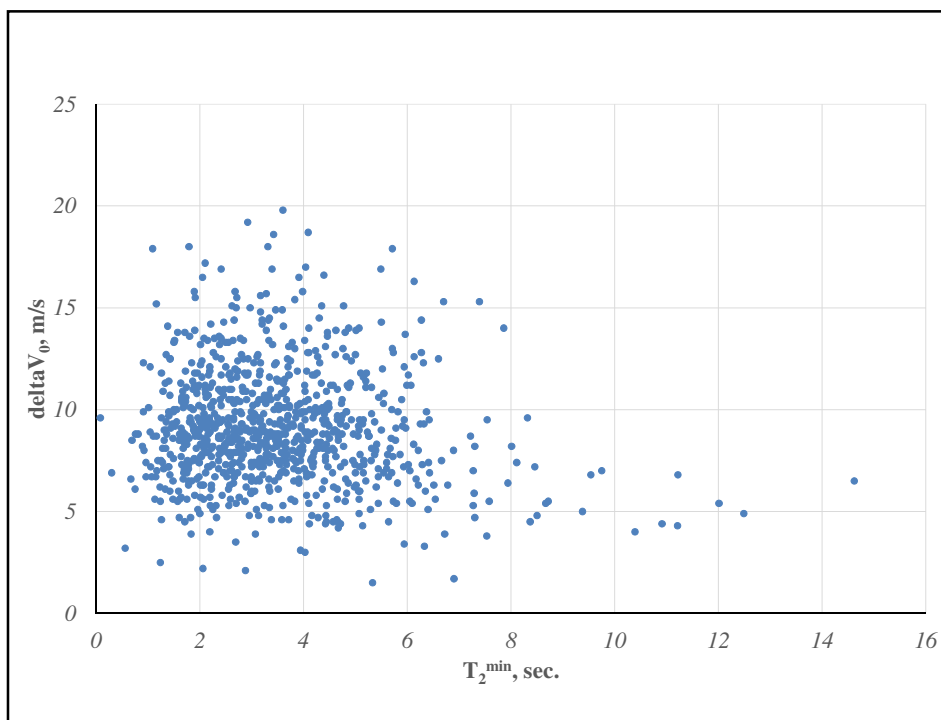


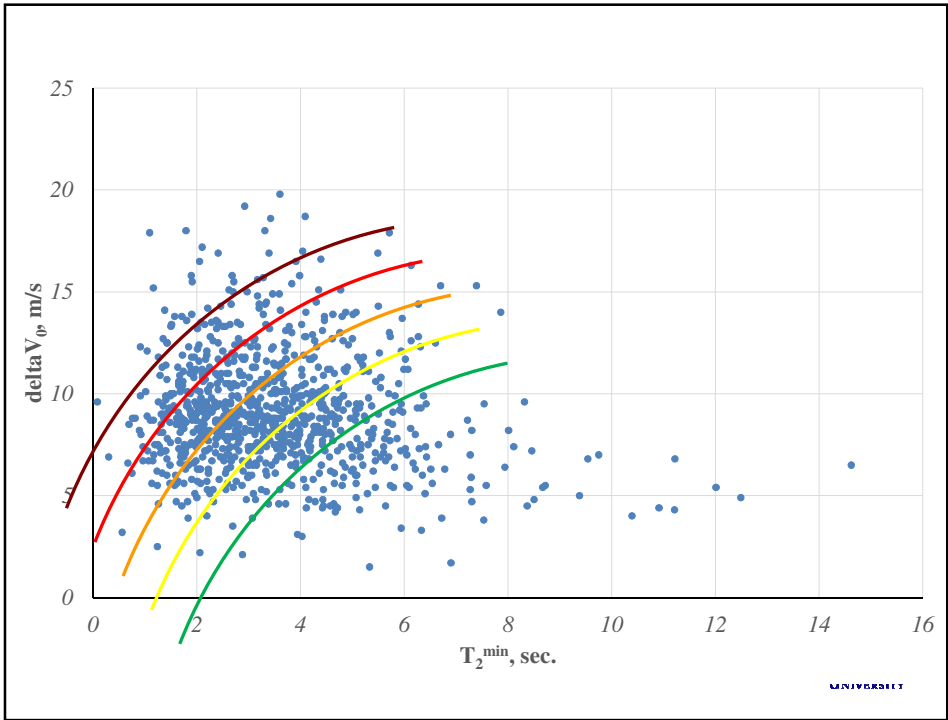
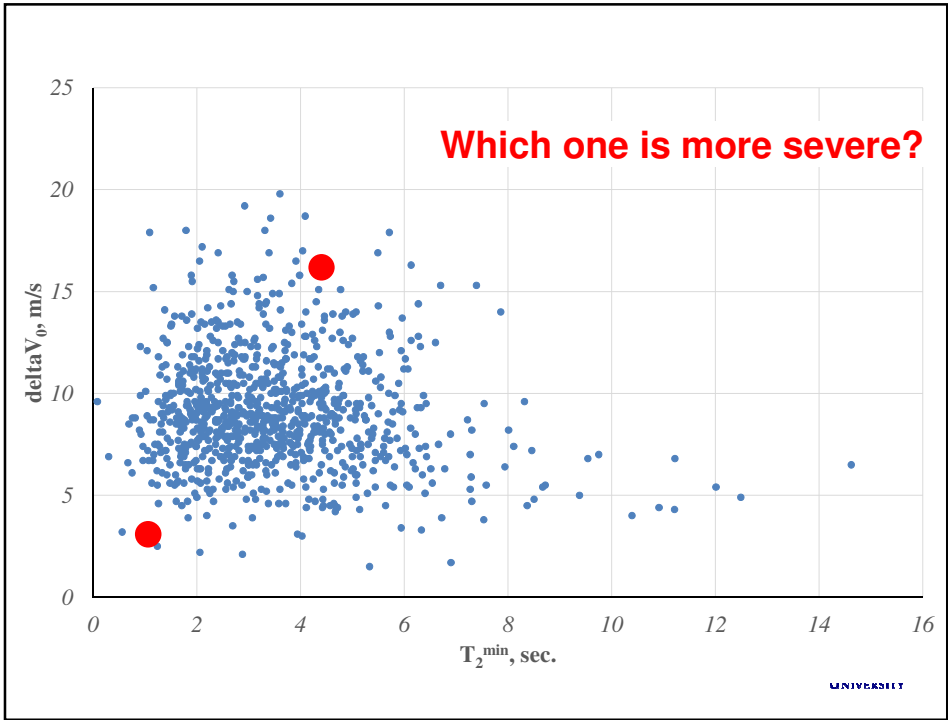
What is "severity" then?





The screenshot shows the T-Analyst software interface. At the top, there are menu options: Project, Data, Record, Display, Help. Below the menu is a video player with a timestamp of 00046. The video player shows two frames of the intersection. The left frame has a timestamp of 2010-07-01 15:50:57.950 and shows a red car. The right frame has a timestamp of 2010-07-01 15:50:57.760 and shows a white van. Below the video player are several data fields and controls. On the left, there are fields for ID (2209), Time (2010-07-01 15:50:58), Status (OK), Type (Left-turn - straight), and Comment. Below these are buttons for Add New, Delete, and a video control bar. In the center, there are fields for Trajectories, Type (car), Length (3.5), Width (1.6), and Height (1.4). On the right, there are fields for User-defined fields, RU1 (Car), RU2 (Car), V1 (6.8), V2 (16.0), Serious? (), Wvl (19.2), ΔV max (35.6), T2min (2.58), PET (2.60), and TTC min. At the bottom, there are coordinates: X: 57.2 m, Y: 78.1 m | X: 222 pix, Y: 289 pix | 1 pixel = 0.16 m. The bottom right corner shows a timestamp of 0:00:14.





How to "weigh" together?

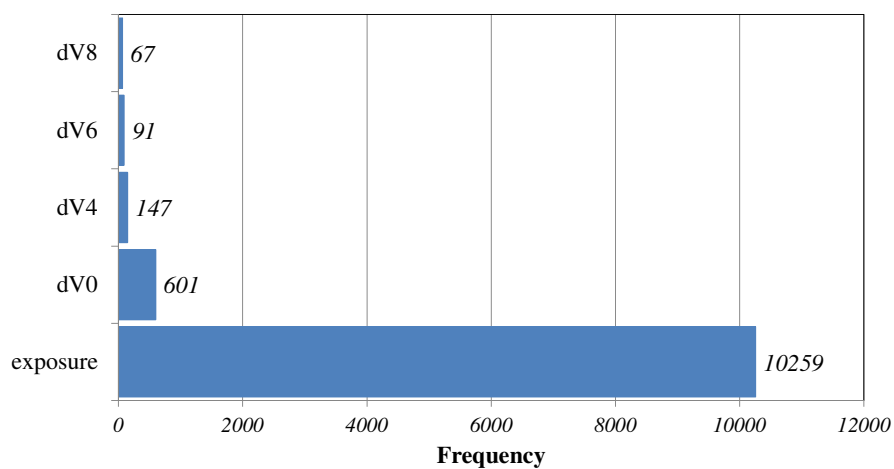
- T_2^{\min} reflects the time margin between the road users
- This time still can be used for **braking**
- ΔV with speeds **after braking** during T_2^{\min} ?

- But at what deceleration rate?

4 m/s^2 – normal braking
 8 m/s^2 – emergency braking

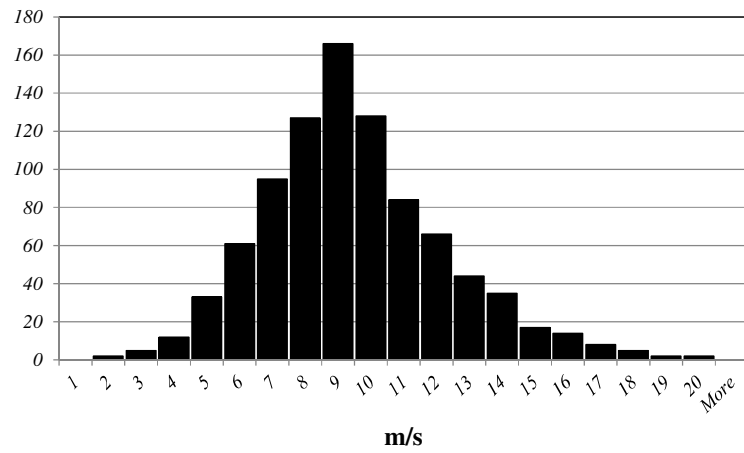


How to "weigh" together?



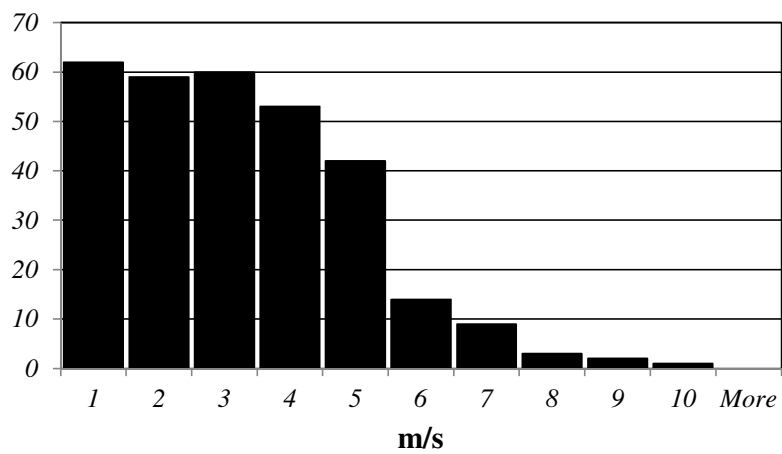
How to "weigh" together?

ΔV_0 (N=906)



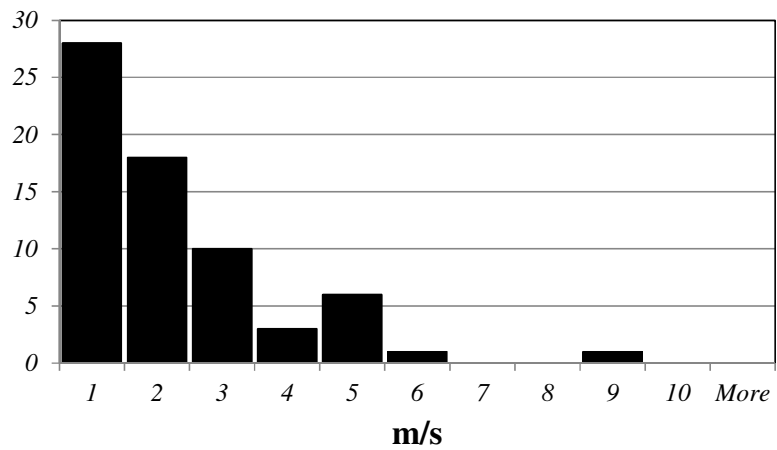
How to "weigh" together?

ΔV_4 (N=305)



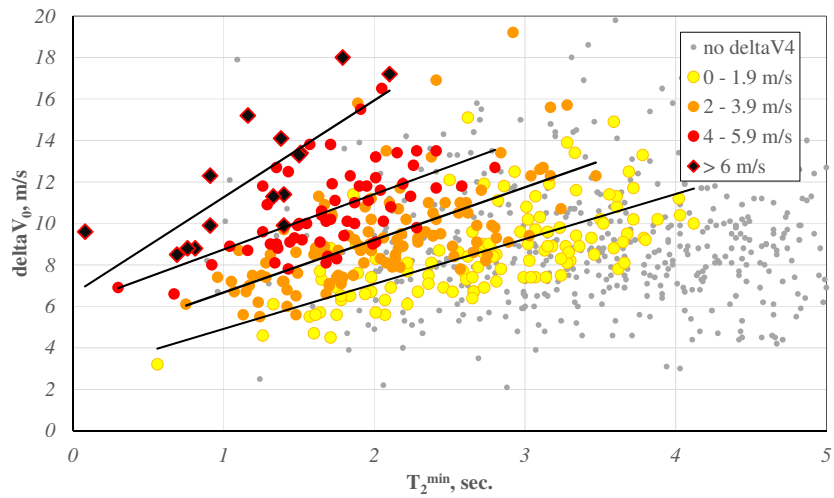
How to "weigh" together?

delta V₈ (N=67)

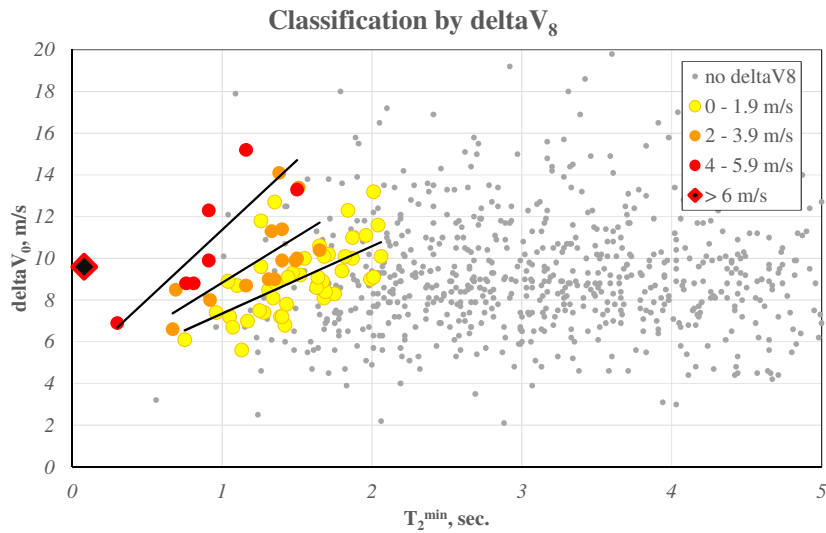


How to "weigh" together?

Classification by delta V₄



How to "weigh" together?



Ranking...

ID	dV8, m/s	Ranks					
		dV8	dV6	dV4	dV0	TTC ^{min}	T_2^{\min}
2322	9,0	1	1	1	326	1	1
481	5,8	2	2	2	115	no value	11
2170	4,7	3	8	17	716	no value	2
2025	4,4	4	7	14	455	no value	7
1974	4,3	5	10	12	452	no value	8
2280	4,3	6	3	3	28	no value	25
32	4,2	7	6	8	287	9	10
1934	4,2	8	5	5	75	no value	68
821	3,7	9	9	9	296	29	50
2224	3,7	10	11	15	509	4	5
2497	3,6	11	4	4	48	no value	48
2360	3,0	12	15	10	177	no value	41
574	2,9	13	18	45	747	63	4

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

