Searching for the severity dimension of traffic events

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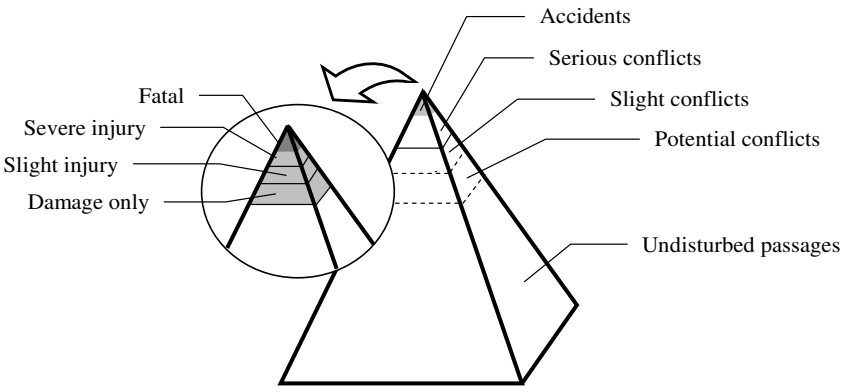
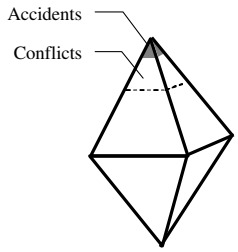
Safety pyramid



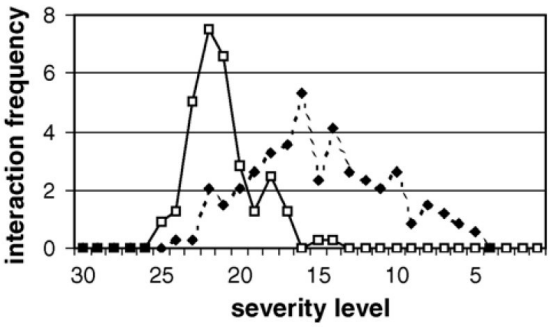
C. Hydén, 1987

Safety pyramid



Svensson, 1998

Hydén & Svensson, 2006



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**

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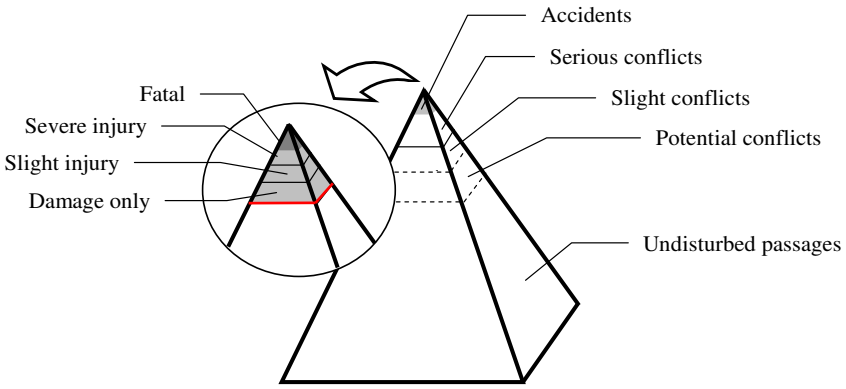
What is ”**severity**” then?



C. Hydén, 1987

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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?

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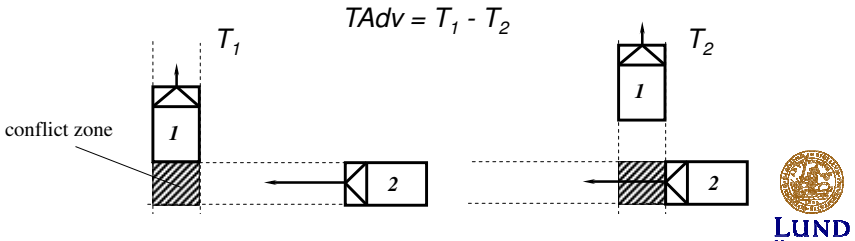
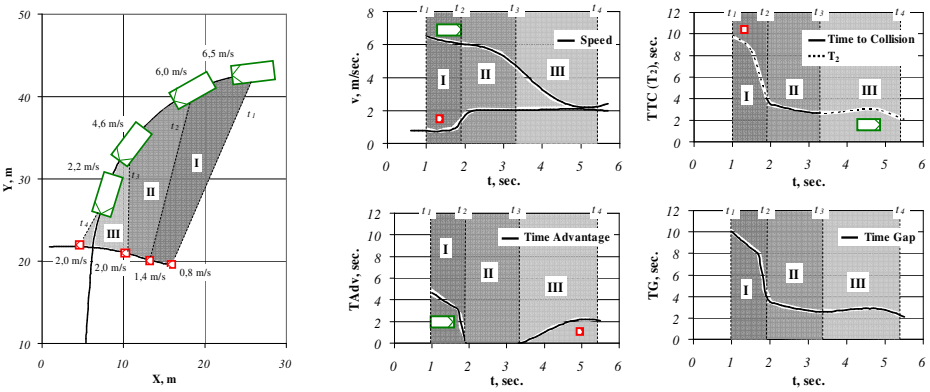
How to measure **nearness-to-collision**?

- **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”?

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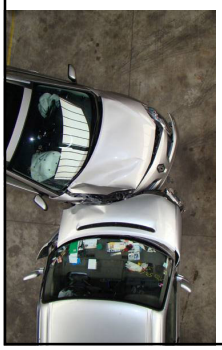
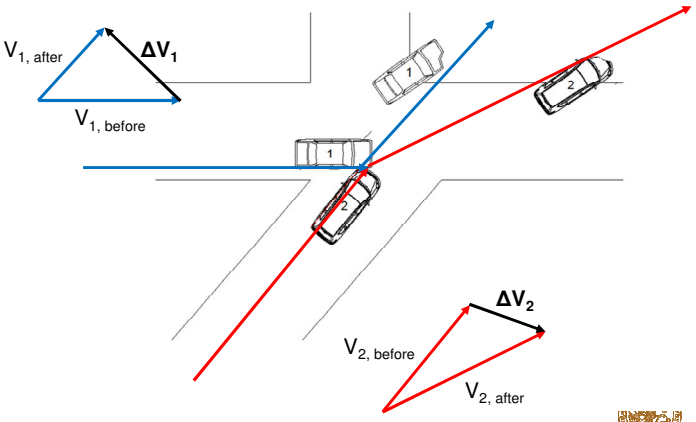
How to measure **consequences**?

Delta V





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

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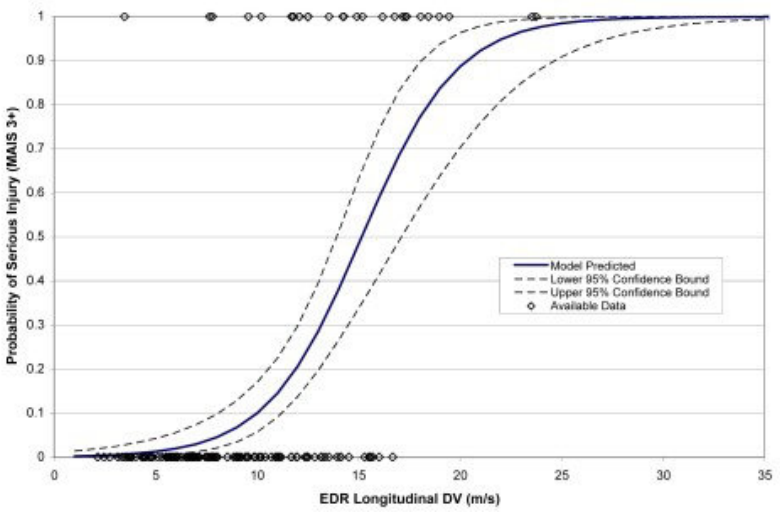
How to measure **consequences**?



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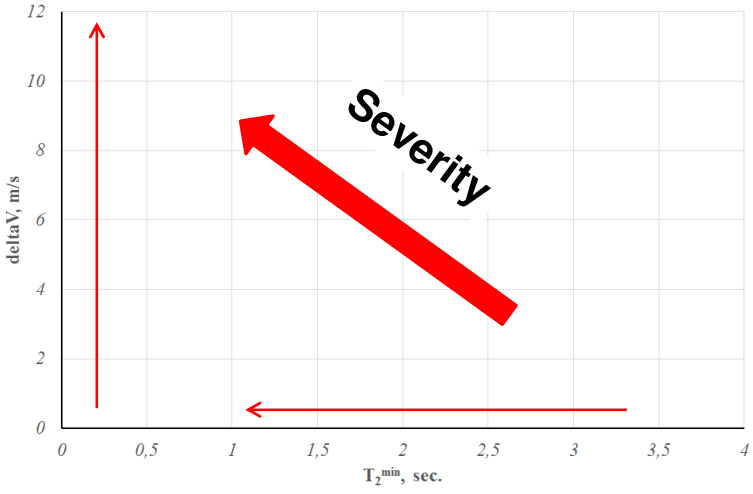
What is "**severity**" then?



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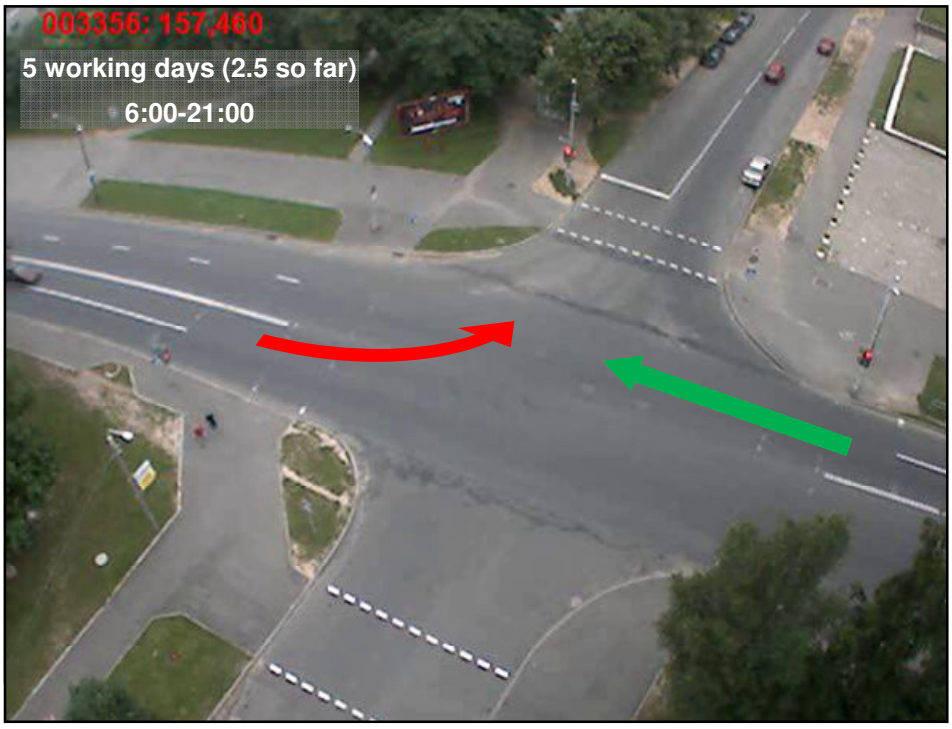

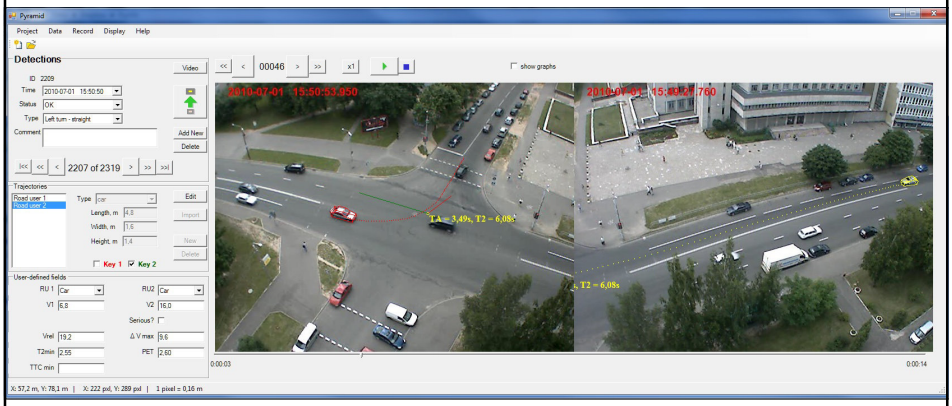

T-Analyst, 2014

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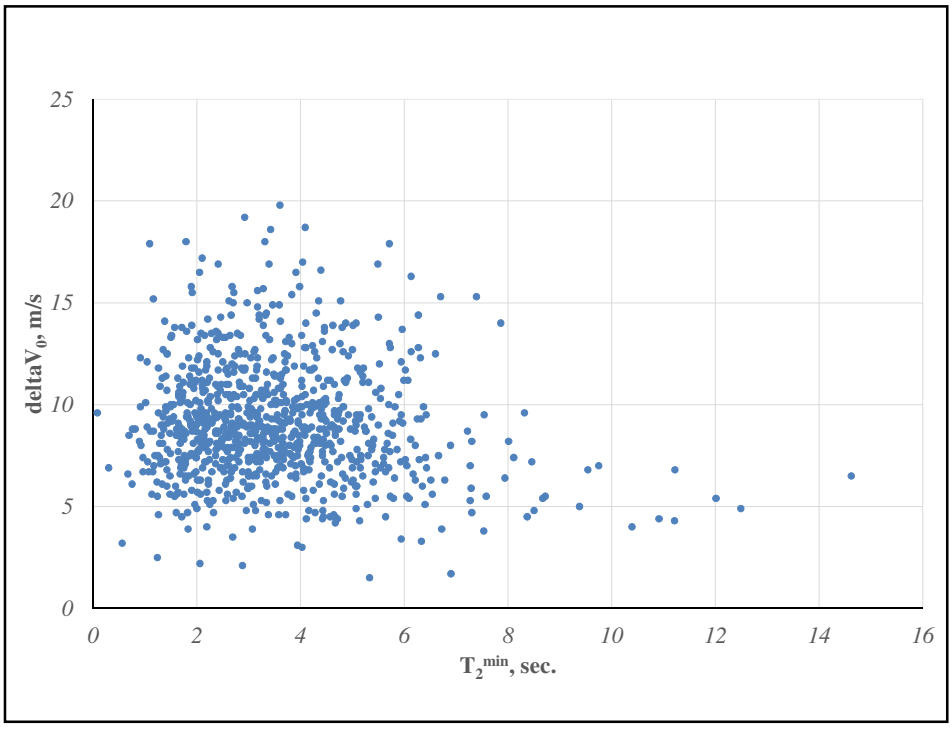
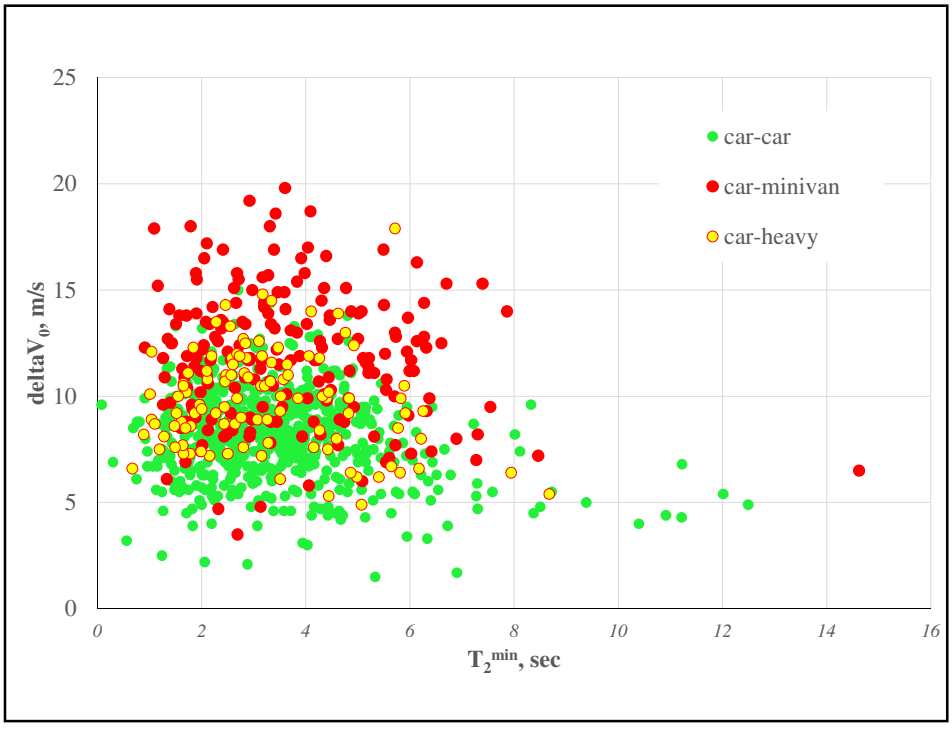
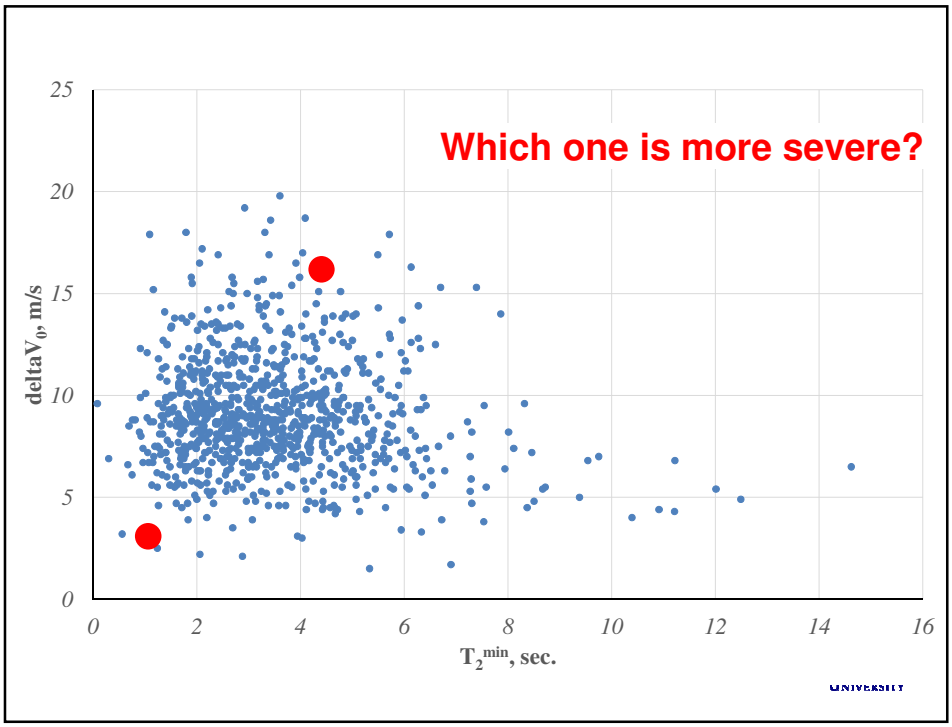
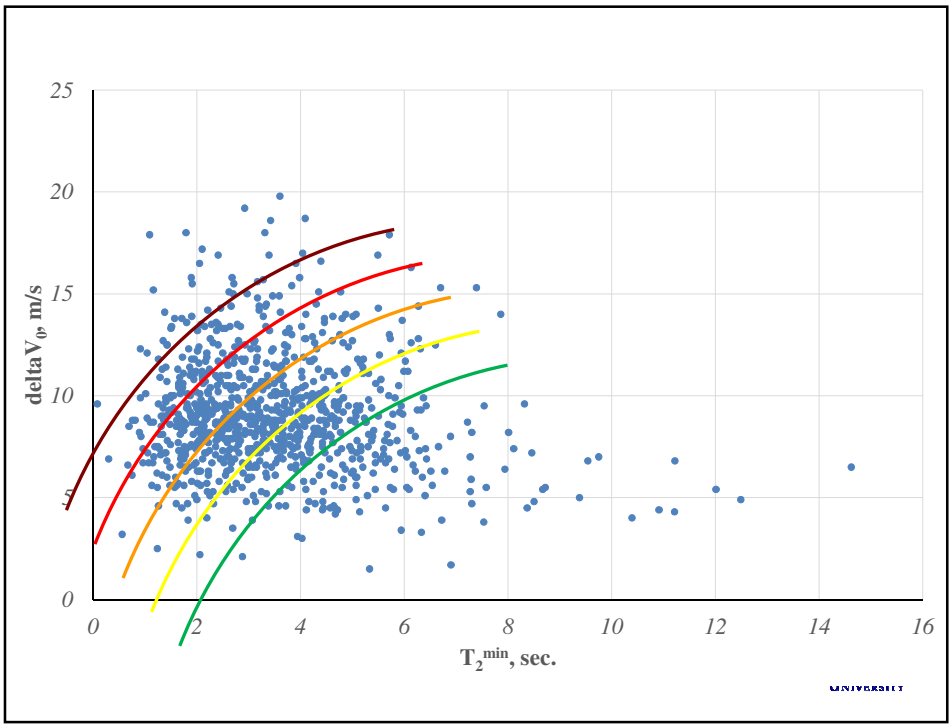

25
20
15
10
5
0
deltaV0, m/s
0
2
4
6
8
10
12
14
16
T2min, sec.


25
20
15
10
5
0
deltaV0, m/s
0
2
4
6
8
10
12
14
16
T2min, sec
car-car
car-minivan
car-heavy


Which one is more severe?
25
20
15
10
5
0
deltaV0, m/s
0
2
4
6
8
10
12
14
16
T2min, sec.


25
20
15
10
5
0
deltaV0, m/s
0
2
4
6
8
10
12
14
16
T2min, sec.

How to ”weigh” together?

- T_2^{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^{min}?

- But at what deceleration rate?

4 m/s² – normal braking

8 m/s² – emergency braking

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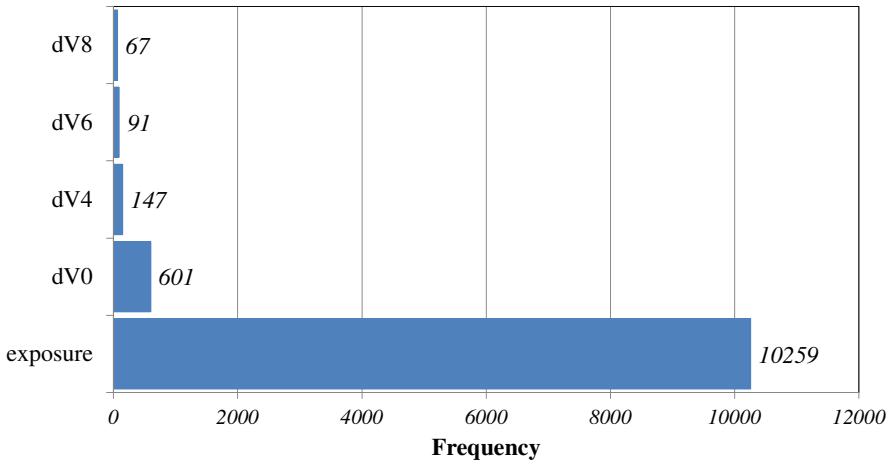
How to ”weigh” together?



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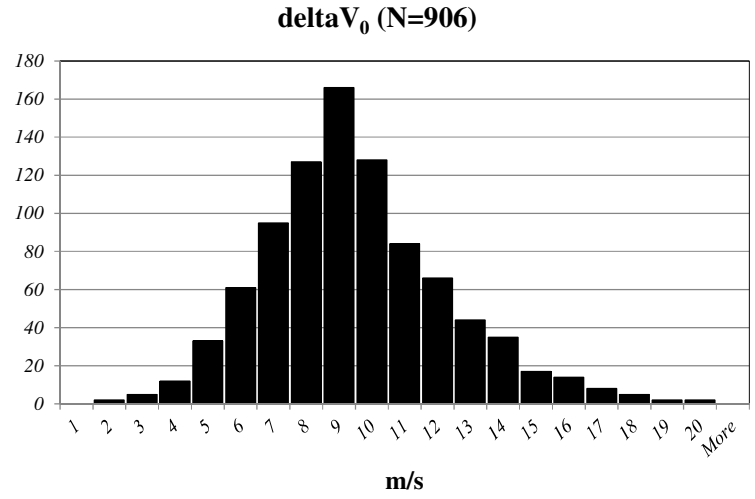

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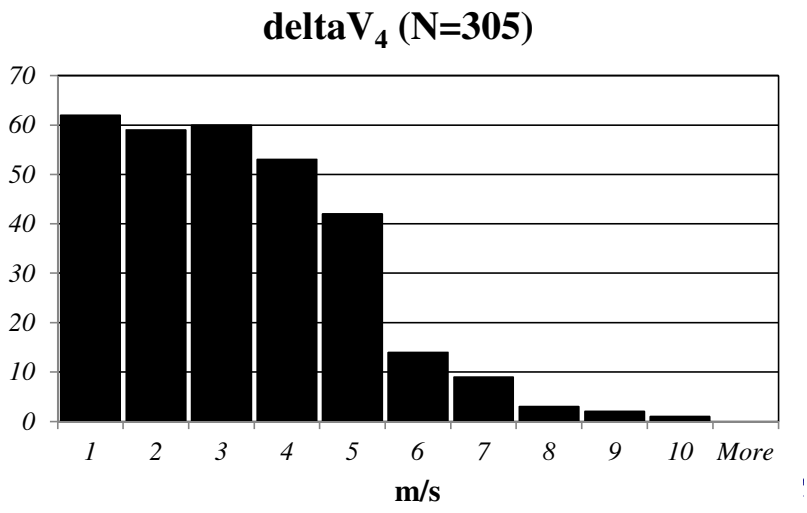

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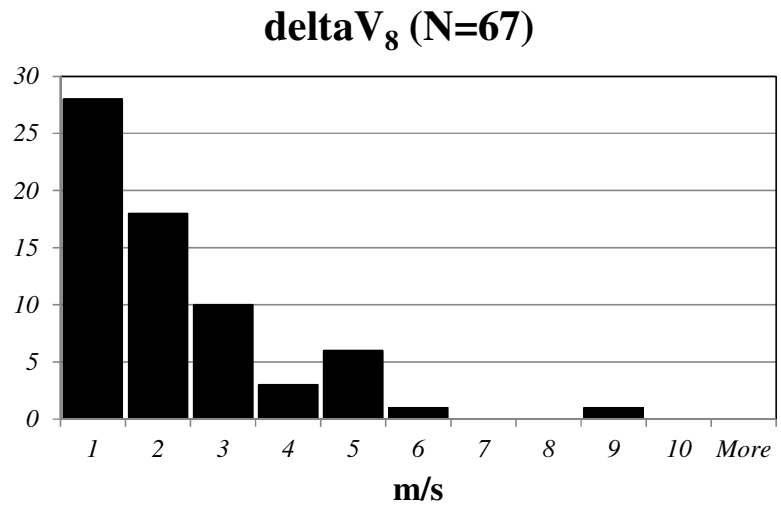

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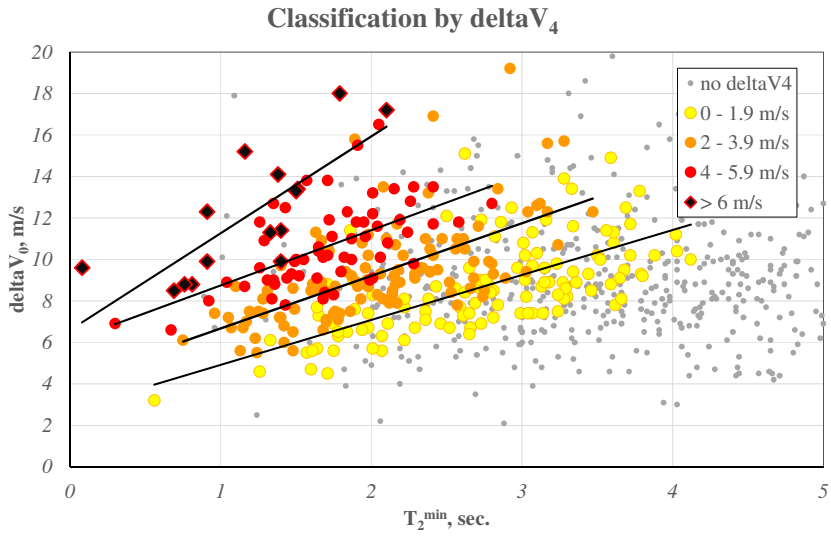

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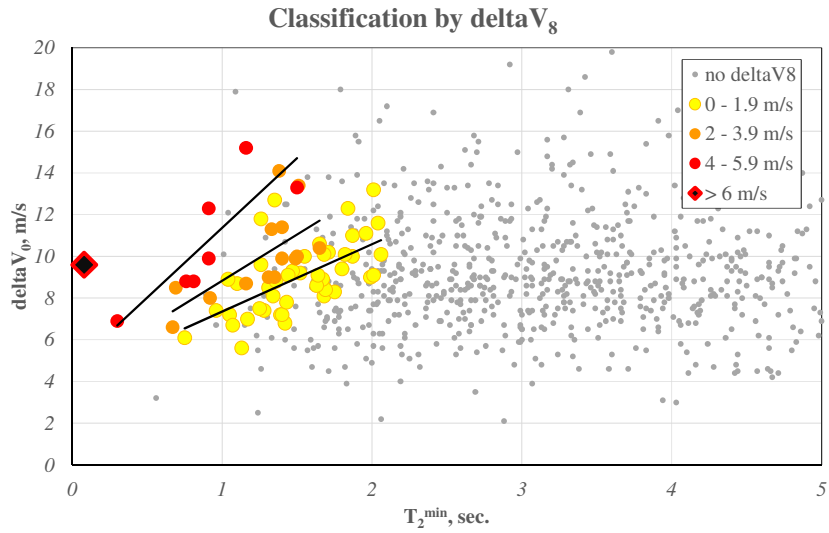

Ranking…

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