



Suitability of UN R160 EDR triggers for 8–12 tonnes vehicles

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24th IWG EDR/DSSAD | Marcus Wisch | BAST

Context

- ▶ IWG discussion on suitability of UN R160 triggers for vehicles with gross vehicle weight of 8–12 tonnes, in particular regarding:
 - ▶ Starting position: Arguably, in collisions with lighter vehicles such as passenger cars the host vehicle will experience a much lower change in velocity (especially when fully laden) than M1/N1 vehicles, which R160 was designed for, would. This raises the question whether the deceleration thresholds defined in R160 would still capture most of the relevant collisions.
- ▶ AAPC provided FARS collision data analysis (EDR-DSSAD-IWG-24-02) and concluded that:
 - ▶ “the most relevant crash conditions would be a rollover event”
 - ▶ “over half of the manner of collision variables show the first harmful event was not a collision with another vehicle”
 - ▶ “there is no one single situation that can be reviewed [to judge suitability of triggers]”
- ▶ BASt has performed collision data analysis to contrast these conclusions with FARS data and with data from the German national road traffic accident statistics



FARS – Analysis Review

Conspicuous features in EDR-DSSAD-IWG-24-02:

- ▶ The stated conclusions cannot be substantiated on the basis of the data presented. The connections are unclear. The conclusions do not address the raised question.
- ▶ Unclear why “large trucks” have been analysed although the target group of 8-12 tonnes (~17,600 lbs - ~26,500 lbs) can be represented with FARS.
 - ▶ “A large truck as defined [...] is any medium or heavy truck, excluding buses and motor homes, with a gross vehicle weight rating (GVWR) greater than 10,000 pounds. These large trucks include both commercial and non-commercial vehicles. **In 2020 seventy two percent of the large trucks involved in fatal traffic crashes were heavy, large trucks (GVWR > 26,000 lbs.).** *
- ▶ It seems categories of “first harmful events” and further collision details have been mixed up.

* Source: National Center for Statistics and Analysis. (2022, April). Large trucks: 2020 data (Traffic Safety Facts. Report No. DOT HS 813 286). NHTSA.



FARS – New Analysis Approach

Try to stay as close as possible to analysis by AAPC (insofar as it makes sense):

- ▶ Using the “Fatality and Injury Reporting System Tool” (FIRST)
- ▶ Filter criteria:
 - ▶ “Occupants Involved in Fatal Crashes”
 - ▶ Vehicle body type: “Large trucks” and “buses”
 - ▶ Gross Vehicle Weight Rating: 16,001 – 26,000 lbs
 - ▶ Person Type: Driver ; or Occupant
 - ▶ Years 2020-2022
- ▶ Checked for “First Harmful Event” (37 categories)



FARS – New Analysis Approach (8-12 t vehicles)

Results focusing on numbers of fatalities or injured drivers / occupants involved in relevant crashes of years 2020-2022

- The most relevant first crash condition is a collision with another motor vehicle in-transport (leading to 38% of fatalities and 83% of injured casualties).
- Rollover/overtake constitutes the second major FHE

First Harmful Event (FHE)	Person Injury Type			
	Fatal		Injured (any)	
	#	Col %	#	Col %
Rollover/Overtake	64	19	22	3
Fell/Jumped from Vehicle	7	2	1	0
Motor Vehicle In-Transport	127	38	592	83
Parked Motor Vehicle (Not in Transport)	7	2	9	1
Other Object (not fixed)	5	1	4	1
Guardrail Face	23	7	7	1
Concrete Traffic Barrier	5	1	6	1
Utility Pole/Light Support	7	2	3	0
Culvert	4	1	0	0
Ditch	11	3	8	1
Embankment	9	3	5	1
Fence	4	1	2	0
Tree (Standing Only)	17	5	2	0
Other Fixed Object	4	1	0	0
Guardrail End	4	1	0	0
Cable Barrier (since 2008)	5	1	2	0
Traffic Sign Support (since 2010)	9	3	4	1
OTHERS (all other categories with <4 fatalities)	24	9	47	7
Total	336	100	714	100

Data Sources: Fatality Analysis Reporting System (FARS): 2018-2021 Final File and 2022 Annual Report File (ARF), Report Generated: Tuesday, April 2, 2024 (3:25:04 AM), VERSION 7.2, RELEASED APR 01, 2024



Conclusions from new FARS Analysis

- ▶ The most frequent first crash condition (First Harmful Event) for vehicles with gross vehicle weight of 8-12 tonnes is a collision with another motor vehicle in-transport followed by “rollover / overturn” and impacts to “guardrail face”, “tree” and “ditches”.
 - ▶ There are multiple situations that would have to be reviewed more in detail to judge suitability of triggers.
- ▶ Hence, the original question whether the deceleration thresholds defined in R160 would still capture most of these relevant collisions is still open.
- ▶ Note: The results may be biased due to the restricted data selection procedure.
 - ▶ “The Fatality Analysis Reporting System (FARS) [...] contains data on a census of fatal traffic crashes within the 50 States, the District of Columbia, and Puerto Rico. To be included in FARS, a crash must involve a motor vehicle traveling on a traffic way customarily open to the public, and must result in the death of a vehicle occupant or a nonoccupant within 30 days of the crash.” (Source: <https://www.nhtsa.gov/crash-data-systems/fatality-analysis-reporting-system>)



German National Road Traffic Accident Statistics

– Analysis Approach

Filter criteria

- ▶ Accidents with personal injury (imply that irrespective of the amount of the material damage persons were killed or injured)
- ▶ Crashes of buses and goods road transport vehicles registered in Germany with permissible gross vehicle weight of 8-12 tonnes (here: “target group”)
 - ▶ Includes buses and coaches with more than 9 seats including driver's seat, coaches, buses and school buses
 - ▶ Includes trucks with a tanker bed without a trailer, trucks with a gross weight over 3.5 tonnes with and without a trailer, tractor units, other tractors (including with tankers) and trucks with special bodies
- ▶ Years 2019 to 2022

German National Statistics – Results (1)

Number of casualties per location

- ▶ Severe accidents occur most often on rural roads

	Urban	Rural (w/o Autobahn)	Autobahn	Total
Number of fatalities	20	44	18	82
Number of seriously injured	255	303	179	737
Number of slightly injured	1588	1008	490	3086
Number of casualties in total	1863	1355	687	3905

Proportion of single-vehicle accidents

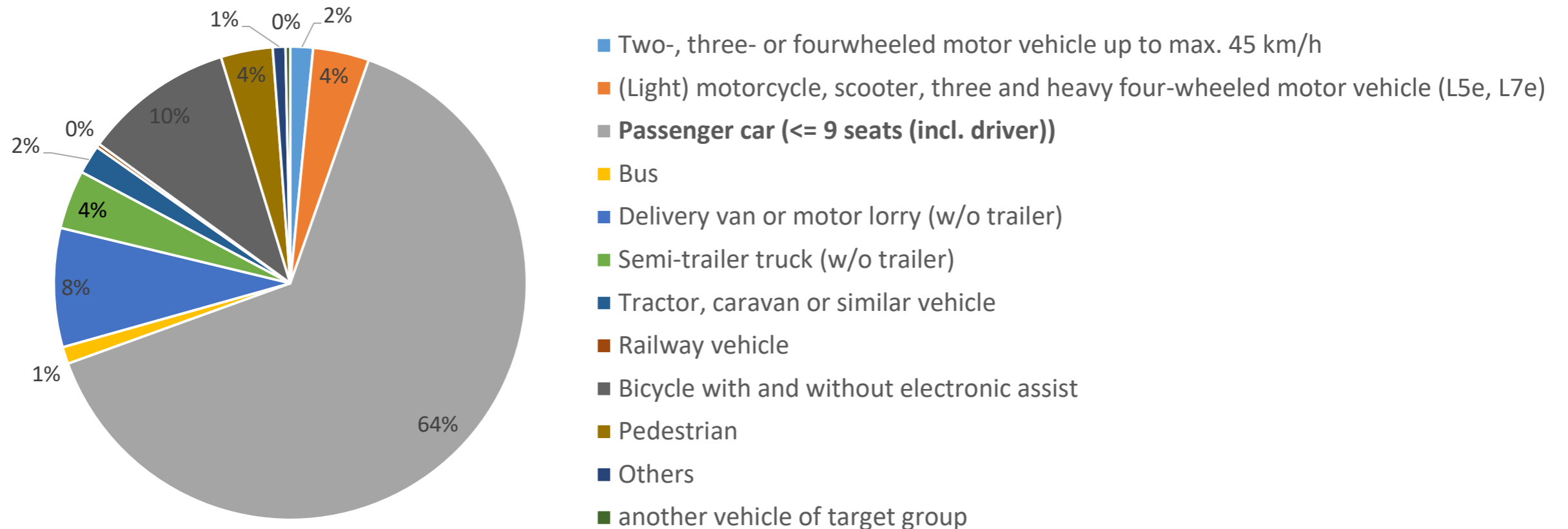
- ▶ Single-vehicle accidents (most likely to be associated with rollover events*, if any) are rare (4%)

	N	%
No single-vehicle accident	3782	96%
Single-vehicle accident	174	4%
Total	3956	100%

* Rollovers are not statistically recorded at national level

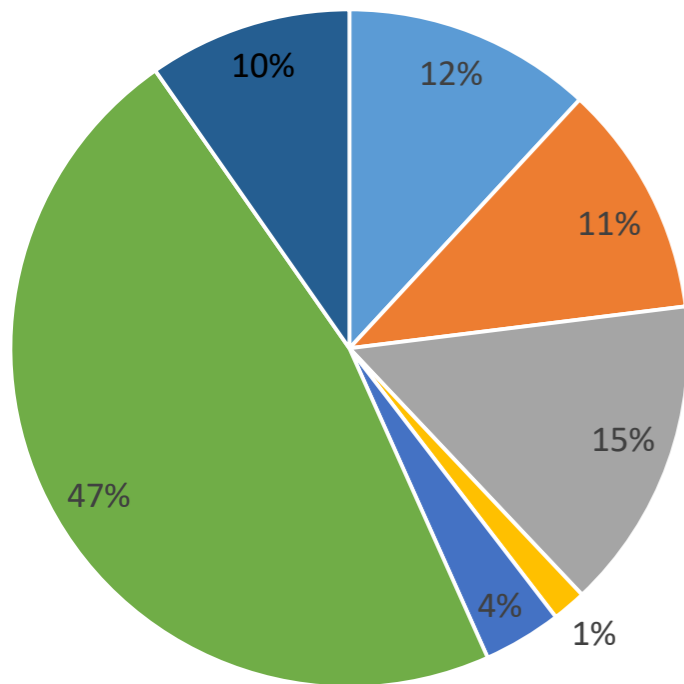
German National Statistics – Results (2)

Type of involvement of the other party in the accident with two participants
 (regardless of who caused the accident; N = 3,103 accidents)



German National Statistics – Type of Accident

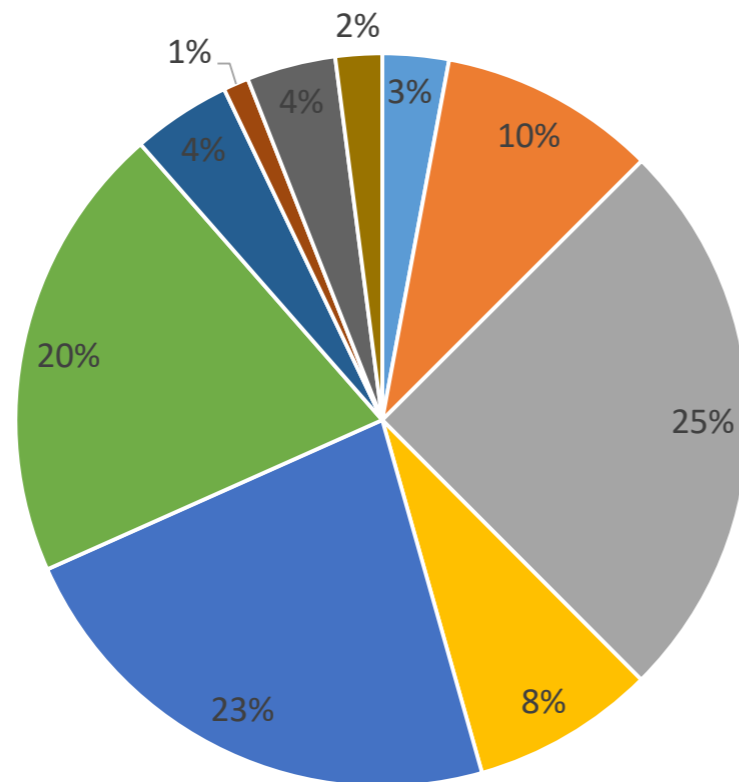
- ▶ The type of accident describes the conflict situation which resulted in the accident, i.e. a phase in the traffic situation where the further course of events could no longer be controlled because of improper action or some other cause.
- ▶ Focus on target group accidents ended up with fatalities or seriously injured (N = 1,607)



- Control loss** Accident caused by loss of control of the vehicle (due to inappropriate speed or incorrect assessment of the course of the road, road conditions, etc.), but not, e.g., as a result of sudden physical incapacity or sudden vehicle damage.
- Turning off** Conflict between a turning driver and a road user (including pedestrians) coming from the same or opposite direction at intersections, property or parking lot entrances or similar.
- Turning into a road or crossing it** Conflict between a vehicle waiting to turn or cross and a vehicle with right of way at intersections, junctions or exits from properties and parking lots.
- Crossing the road** Conflict between a vehicle and a pedestrian on the road, provided the pedestrian was not walking in the longitudinal direction and the vehicle did not turn. This also applies if the pedestrian was not hit.
- Stationary traffic** Conflict between a vehicle in moving traffic and a vehicle that has parked/stopped or performed corresponding maneuvers. Accidents involving vehicles only waiting due to traffic conditions are not included.
- Same or opposite direction** Conflict between road users moving in the same or opposite direction.
- Others** Examples: Turning, reversing, parking between each other, obstacle or animal on the road, sudden vehicle damage (brake failure, tire damage, etc.)

German National Statistics – Kind of Accident

- ▶ The kind of accident describes of the entire course of events in an accident the direction into which the vehicles involved were heading when they first collided on the carriageway or, if there was no collision, the first mechanical impact on a vehicle. There are 10 kinds of accidents.
- ▶ Focus on target group accidents ended up with fatalities or seriously injured (N = 1,607)



- Accident of another kind
- Collision with another vehicle which starts, stops or is stationary
- Collision with another vehicle moving ahead
- Collision with another vehicle moving laterally in the same direction
- Collision with another oncoming vehicle
- Collision with another vehicle which turns into or crosses a road
- Collision between vehicle and pedestrian
- Collision with an obstacle in the carriageway
- Leaving the carriageway to the right
- Leaving the carriageway to the left

German National Statistics – Major findings

- ▶ Single-vehicle accidents account for 4%
 - ▶ Rollovers are not statistically recorded at national level, but the above results suggest that rollovers as a first collision are very rare
- ▶ In accidents with another road traffic participant, passenger cars account for 64%
- ▶ Most severe accidents:
 - ▶ Occur on rural roads (without Autobahn)
 - ▶ Most frequent type of accident: Same or opposite direction
 - ▶ Most frequent kinds of accident – collisions with...: 1. another vehicle moving ahead, 2. another oncoming vehicle, 3. another vehicle which turns into or crosses a road

Concluding remarks

- ▶ The data shows that the most common first events in road accidents involving vehicles with gross vehicle weight of 8–12 tonnes (~17,600 lbs - ~26,500 lbs) are collisions with other vehicles. Rollover accidents play a subordinate role.
- ▶ By that, relevant deceleration situations in accidents are most likely and hence, the usefulness of the discussion on the suitability of UN R160 triggers for vehicles with gross vehicle weight of 8-12 tonnes is supported by these results.

Many thanks.

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Picture source DE flag:

https://de.freepik.com/vektoren-kostenlos/illustration-der-deutschen-flagge_2922487.htm#fromView=search&page=1&position=1&uuid=648d76c5-9bc1-4c3e-bc89-765655affa08>Bild von rawpixel.com auf Freepik

Picture source US flag:

https://de.freepik.com/vektoren-kostenlos/illustration-der-usa-flagge_2807790.htm#fromView=search&page=1&position=0&uuid=92908c7b-0574-43bf-9a3c-46dbfe726af6>Bild von rawpixel.com auf Freepik