

Overview

1. Summary
2. Details - Accident Research: Variant A - Germany
3. Details - Accident Research: Variant B - Germany
4. Details - Accident Research: Variant C - Japan

Comparison HGV Accident Situation Germany & Japan

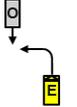
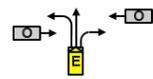
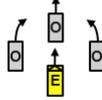
		Germany* (2019)	Japan** (2019)
Fatalities	HGV vs other	11% (322 / 3'046) of all fatalities	18% (590 / 3'215) of all fatalities
	HGV vs vehicle (car, truck, bus)	11% (172 / 1'523) of vehicle occupant fatalities, (caused by HGV)	23% (248 / 1'083) of vehicle occupant fatalities (involving HGV)
	HGV vs VRU (motorcycle, bicycle, pedestrian)	10% (150 / 1'467) of VRU fatalities	16% (342 / 2'118) of VRU fatalities
	HGV vs motorcycle	5% (31 / 605) of motorcycle	14% (73 / 511) of motorcycle fatalities
	HGV vs bicycle	15% (66 / 445) of bicycle fatalities	21% (92 / 434) of bicycle fatalities
	HGV vs pedestrian	13% (53 / 417) of pedestrian fatalities	15% (177 / 1'173) of pedestrian fatalities
Accidents with personal injuries	HGV vs other	8% (22'717 / 300'143) of all accidents	7% (26'835 / 381'237) of all accidents
	HGV vs vehicle (car, truck, bus)	7'453 HGV-vehicle accidents (caused by HGV)	20'019 HGV-vehicle accidents (involving HGV)
	HGV vs motorcycle	870 HGV-motorcycle accidents	2'345 HGV-motorcycle accidents
	HGV vs bicycle	1'900 HGV-bicycle accidents	2'800 HGV-bicycle accidents
	HGV vs pedestrian	1'203 HGV-pedestrian accidents	1'671 HGV-pedestrian accidents

*German Federal Statistical Office (DESTATIS F8R7), 2019. DESTATIS special evaluation, 2019. German In-Depth Accident Study (GIDAS), 2005-2020. GIDAS data weighted and representative for Germany. Extrapolated to total Germany.

**Institute for Traffic Accident Research and Data Analysis (ITARDA), 2019.

HGV = Heavy Goods Vehicle M2/3, N2/3.

Accident Scenarios involving HGV (M2/M3, N2/N3)

HGV vs Vehicle		Germany		Japan
		Speed [km/h]	Accidents (caused by HGV) (n=7453, GIDAS*)	Accidents (involving HGV) (n=20019, ITARDA**)
Turning oncoming		Vego: 10-30	2%	3%
Crossing		Vego: 0-40	13%	11%
Run up moving M3, N2>8t, N3		Vego: 50-90 Vrel: 0-70	36%	44%
Run up moving N2<8t, M2				
Run up standing		11% ≤ 7,5t		
Other**		Vego: 50-90	18%	
			31%	42%

*German In-Depth Accident Study (GIDAS), 2005-2020. GIDAS data weighted and representative for Germany. Extrapolated to total Germany.

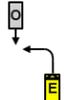
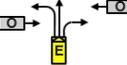
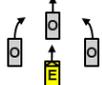
**Institute for Traffic Accident Research and Data Analysis (ITARDA), 2019

HGV = Heavy Goods Vehicle M2/3, N2/3. AEBS = Advance Emergency Braking System. BSIS = Blind Spot Information System. MOIS = Moving-Off Information System. Motorcycles are L3e/L4e only. Bicycle include pedelecs.

Method: Speed distributions according to GIDAS accident reconstruction data including all injury severities. Note that higher speeds are more relevant for serious and fatal accidents.

***Includes Lane Change, Oncoming and Rest.

Accident Scenarios involving HGV (M2/M3, N2/N3)

HGV vs Motorcycle (HGV participation)		Germany		Japan	
		Ego speed [km/h]	Accidents (n=870, GIDAS*)	Accidents (n=2345, ITARDA**)	
Turning oncoming		10-30	7%	17%	
Crossing		0-50	27%	82% > 7,5t	19%
				18% ≤ 7,5t	
Run up		0-90	11%	100% > 7,5t	13%
				0% ≤ 7,5t	
Oncoming		30-70	12%	2%	
Other**			43%	49%	

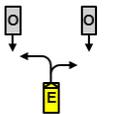
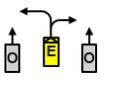
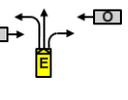
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***Includes Rear, Lane Change and Rest.

Accident Scenarios involving HGV (M2/M3, N2/N3)

HGV vs Bicycle (HGV participation)		Germany			Japan
		Ego speed [km/h]	Accidents (n=1900, GIDAS*)		Accidents (n=2800, ITARDA**)
Turning oncoming		0-10	1%		9%
		20	2%		
Turning behind		0-20	27%		28%
Crossing		0-10	12%	83% > 7,5t 17% ≤ 7,5t	31%
		20-50	20%		
Run up		0-10	2%	76% > 7,5t 24% ≤ 7,5t	3%
		20-50	10%		
Other***			26%		29%

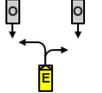
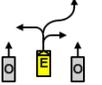
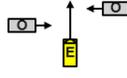
*German In-Depth Accident Study (GIDAS), 2005-2020. GIDAS data weighted and representative for Germany. Extrapolated to total Germany.

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***Includes Lane-Change and Rest.

Accident Scenarios involving HGV (M2/M3, N2/N3)

HGV vs Pedestrian (HGV participation)		Germany		Japan
		Ego speed [km/h]	Accidents (n=1203, GIDAS*)	Accidents (n=1671, GIDAS**)
Turning oncoming		0-10	2%	30%
		20-30	1%	
Turning behind		0-30	7%	8%
Crossing		0-10	18%	92% > 7,5t 8% ≤ 7,5t
		20-50	54%	
Runup		0-90	2%	10%
Backing up		0-10	16%	10%
Other***			0%	20%

*German In-Depth Accident Study (GIDAS), 2005-2020. GIDAS data weighted and representative for Germany. Extrapolated to total Germany.

**Institute for Traffic Accident Research and Data Analysis (ITARDA), 2019

HGV = Heavy Goods Vehicle M2/3, N2/3. AEBS = Advance Emergency Braking System. BSIS = Blind Spot Information System. MOIS = Moving-Off Information System. Motorcycles are L3e/L4e only. Bicycle include pedelegs.

Method: Speed distributions according to GIDAS accident reconstruction data including all injury severities. Note that higher speeds are more relevant for serious and fatal accidents.

***Rest.

Details

Accident Research: Variant A

Germany

Revision of UN Regulation 131

Research Question:

- › Relevance of M2/3, N2/3 accidents with
 - › Cars
 - › Motorcycles
 - › Bicycles
 - › Pedestrians
- › Accident scenarios
- › Speed distribution

A. Terms of Reference

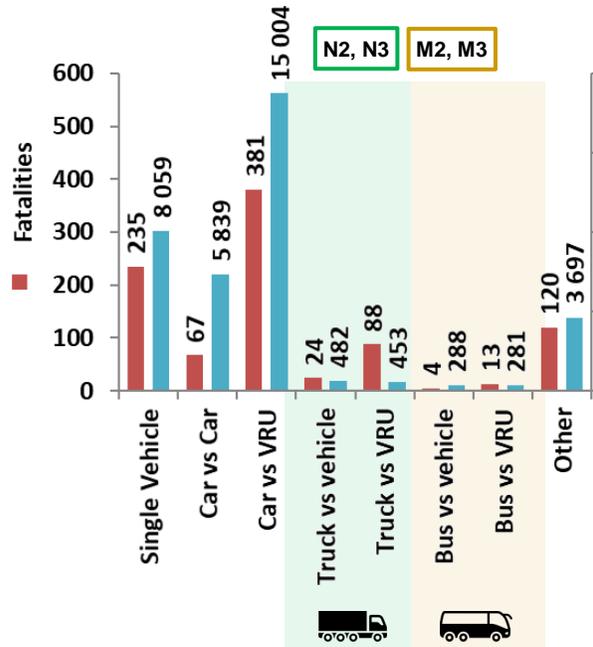
1. The Informal Working Group (IWG) shall develop a draft regulatory proposal to revise UN-Regulation No. 131 with the aim to adapt the Regulation to the state of the art technology and to align it with new concepts which were developed for Advanced Emergency Braking Systems (AEBS) for M₁ and N₁ vehicles (UN Regulation No.152).
2. In particular the IWG shall address the following issues:
 - a. Assess the accident situation for heavy duty vehicles in regions where UN Regulation No. 131 is presently applied, looking at the effectiveness of the current performance requirements, differentiated between M₂/N₂-vehicles and M₃/N₃-vehicles, and differentiated after accident collision partner (specifying car, VRU, construction vehicles, toll barriers, big animals, others).

Method:

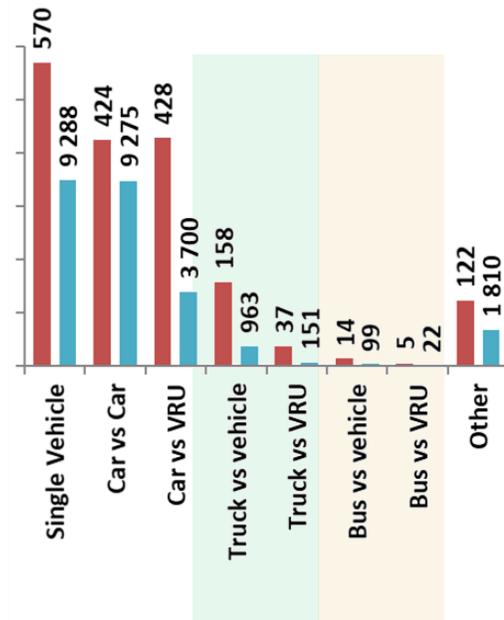
- › Accidents overview in Germany from DESTATIS
 - › HGV vs other participants
- › In-depth analysis of GIDAS sample
 - › Accident causation
 - › Clustering of scenarios
 - › Reconstruction data
- › Estimation of accident numbers in EU28

HGV Involved Traffic Accidents Based on Locations

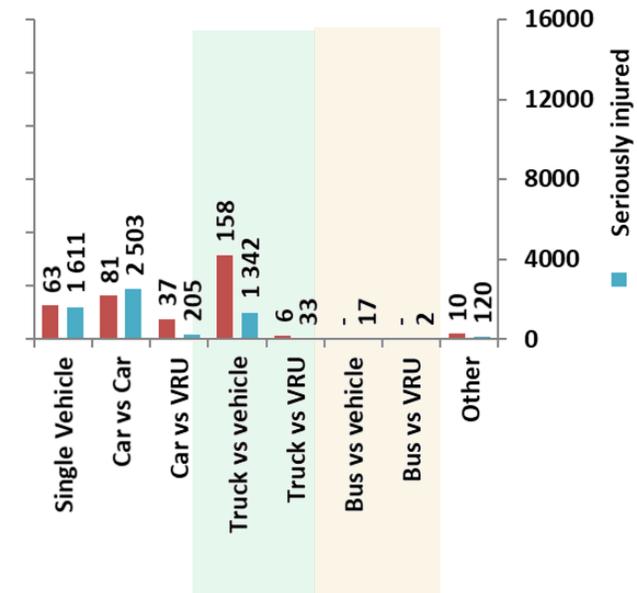
DESTATIS 2019: 3 046 fatalities, 65 244 ser. injured



Urban roads: 932 fatalities, 34 103 ser. injured



Rural roads: 1 758 fatalities, 25 308 ser. inj.



Motorways: 356 fatalities, 5833 ser. inj.

HGV Involved Traffic Accidents

All Locations

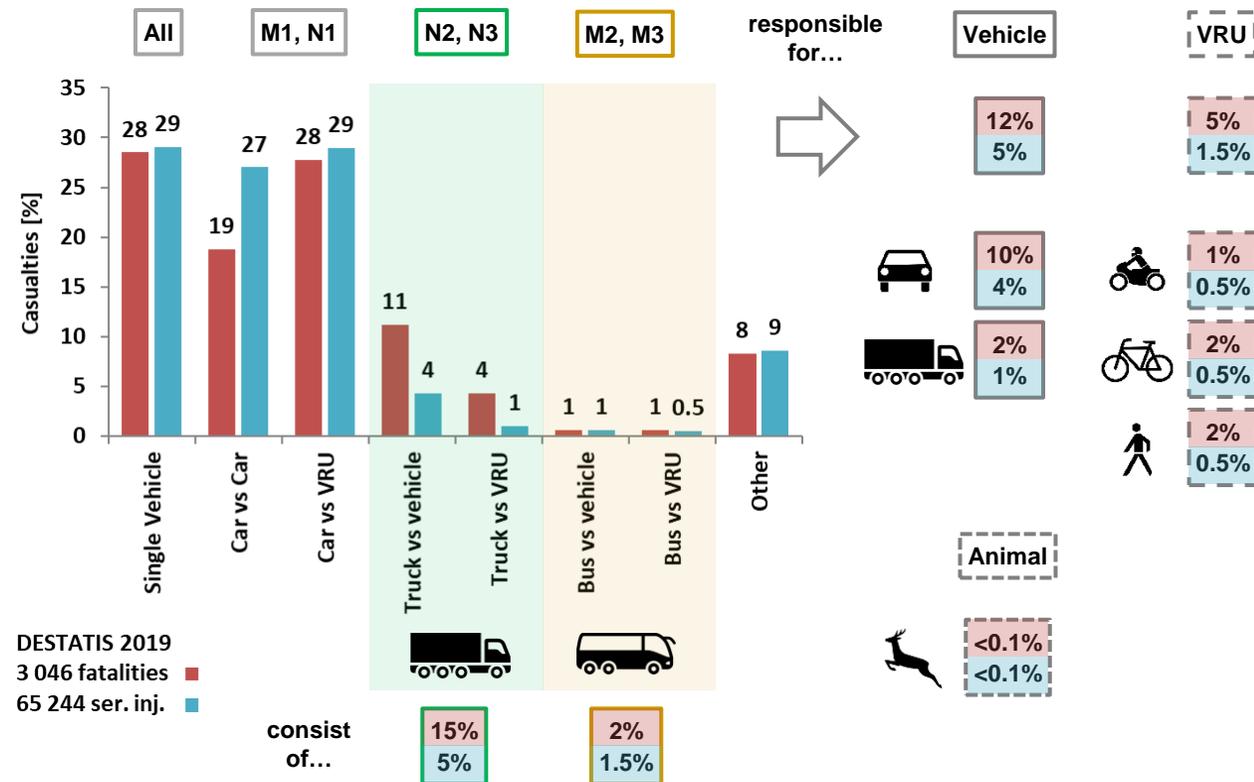
Relevance in German traffic accidents

HGV accidents consist of:

- › Trucks (N2, N3) involved in 15% of all fatalities
- › Busses (M2, M3) involved in 2% of all fatalities

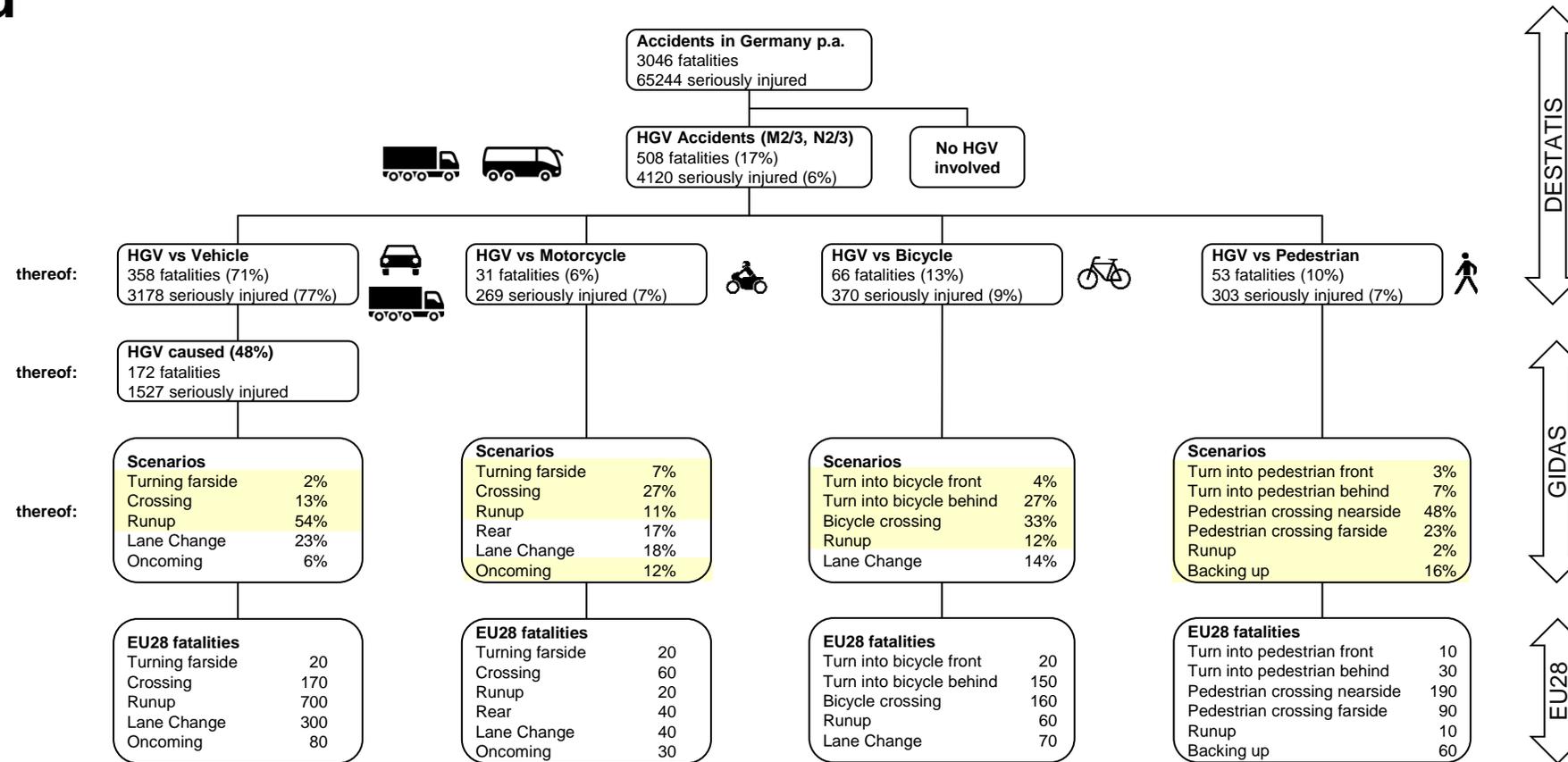
HGV responsible for:

- › 12% of all fatalities occur in accidents between HGV and other vehicles
- › 5% of all fatalities occur in accidents between HGV and VRUs
- › Animal collisions not relevant



Data: German Federal Statistical Office (DESTATIS), 2019. Based on Continental requested data sample.

Method



Data: German Federal Statistical Office (DESTATIS), 2019. German In-Depth Accident Study (GIDAS), 2005-2020.

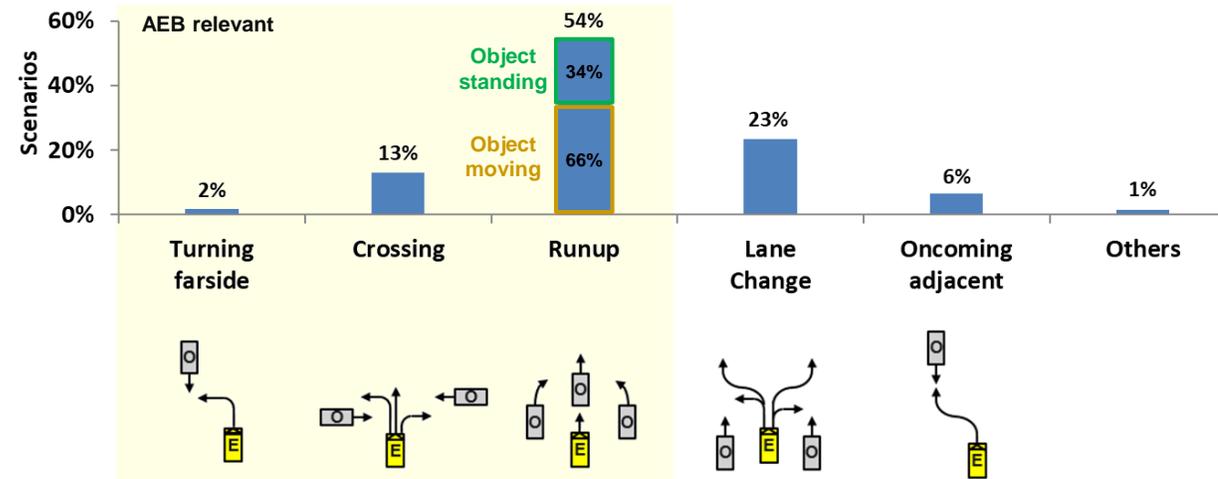
Method: Analysis of GIDAS accidents with personal injuries. German fatalities and seriously injured based on DESTATIS total numbers and on accident distribution in GIDAS. EU28 values are estimations based on EU fatalities and seriously injured numbers.

HGV vs Vehicle

HGV causing accidents with other vehicles   vs   

AEBS relevant scenarios

- > 2% left turn across path
- > 13% other vehicle crossing
- > 54% run-up to other vehicle



Method:

Extrapolation of GIDAS sample to German and EU fatalities and seriously injured



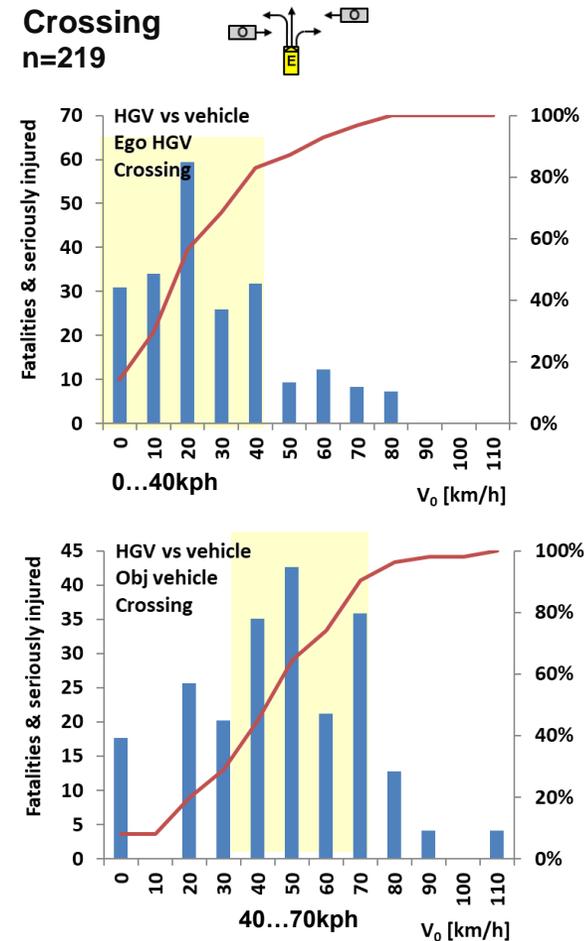
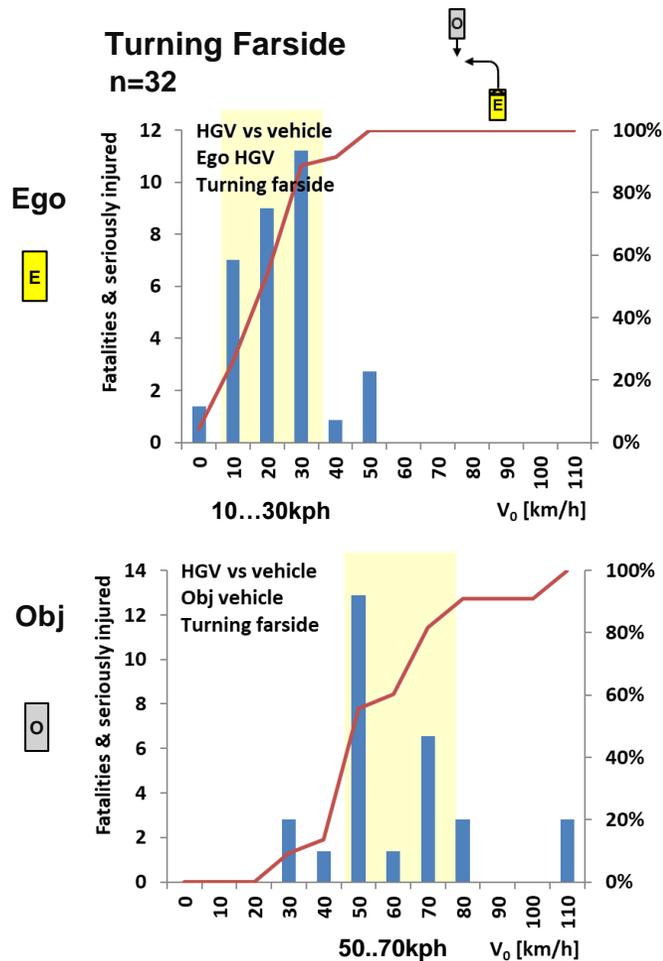
	Turning farside	Crossing	Runup	Lane Change	Oncoming Adjacent	Total
GIDAS	13	88	368	159	44	682
GER p.a.	3	22	93	40	11	172
EU28 p.a.	20	170	700	300	80	1270

Data: German Federal Statistical Office (DESTATIS), 2019. German In-Depth Accident Study (GIDAS), 2005-2020.

Method: Analysis of GIDAS accidents with personal injuries. German fatalities and seriously injured based on DESTATIS total numbers and on accident distribution in GIDAS. EU28 values are estimations based on EU fatalities and seriously injured numbers.

HGV vs Vehicle

HGV causing accidents with other vehicles

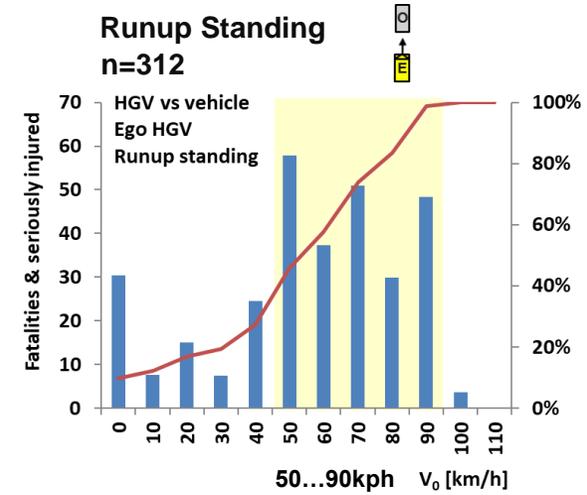
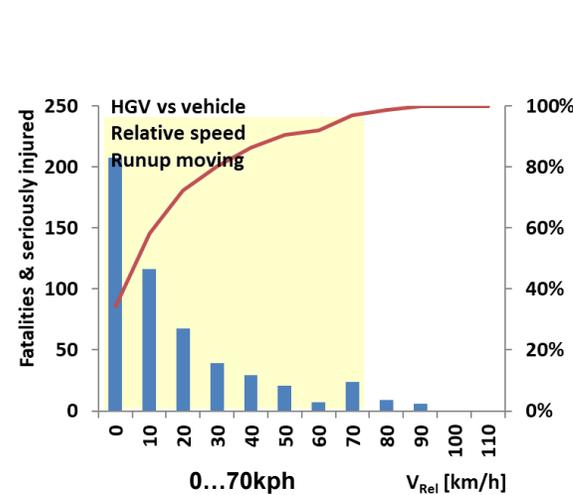
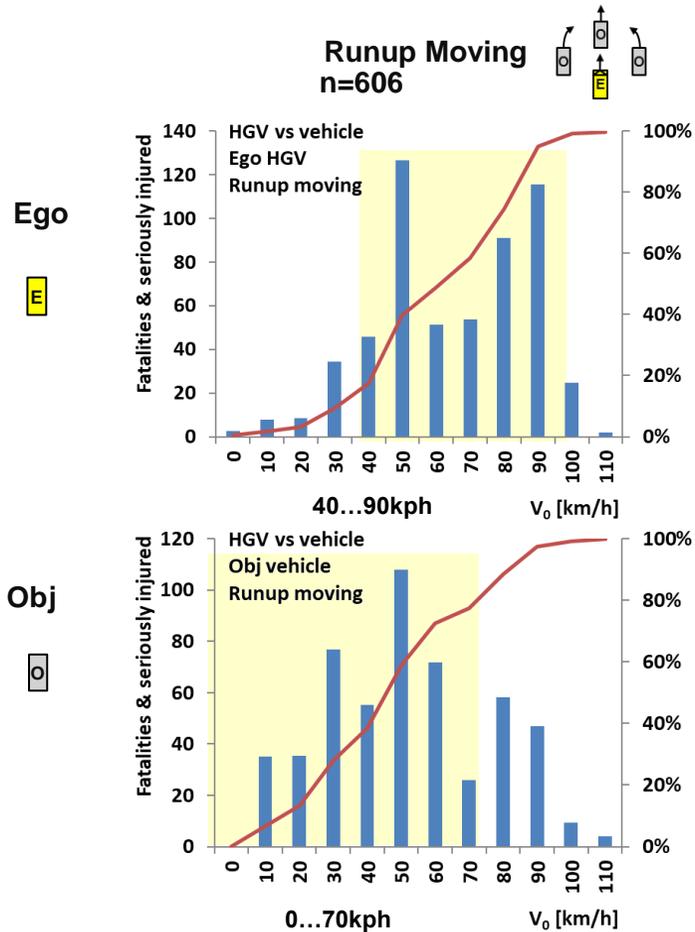


Data: German Federal Statistical Office (DESTATIS), 2019. German In-Depth Accident Study (GIDAS), 2005-2020.

Method: Analysis of GIDAS accidents with personal injuries. German fatalities and seriously injuries based on DESTATIS total numbers and on accident distribution in GIDAS.

HGV vs Vehicle

HGV causing accidents with other vehicles

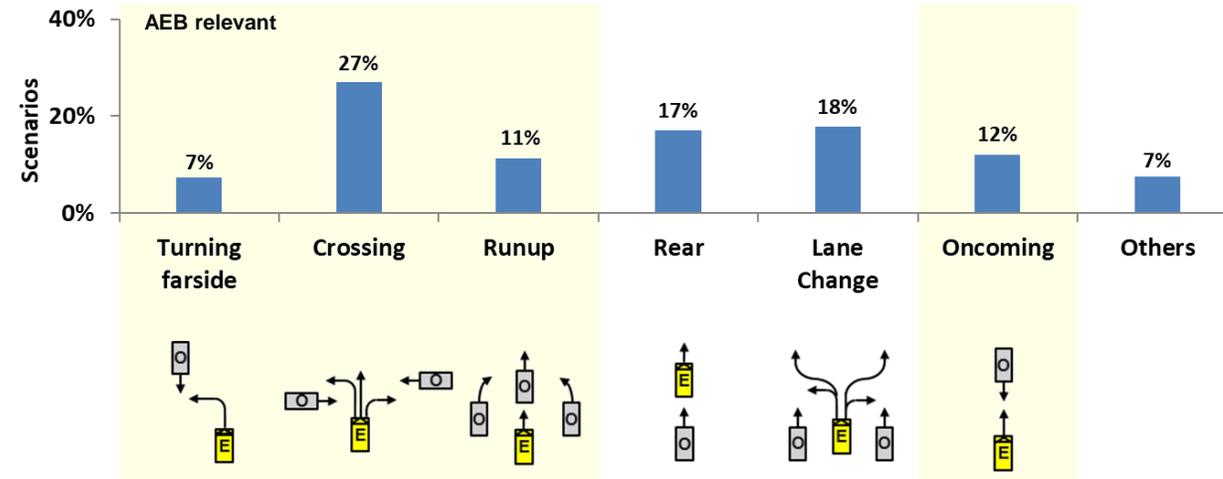


HGV vs Motorcycle

HGV involved in accidents with motorcycles  vs 

AEBS relevant scenarios

- › 7% left turn across path
- › 27% other vehicle crossing
- › 11% run-up to other vehicle
- › 12% oncoming



	Turning farside	Crossing	Runup	---	Lane Change	Oncoming	Total
GIDAS	6	21	9	14	14	10	80
GER p.a.	2	8	3	5	6	4	31
EU28 p.a.	20	60	20	40	40	30	210
	40	130	50	80	80	60	440

Method:

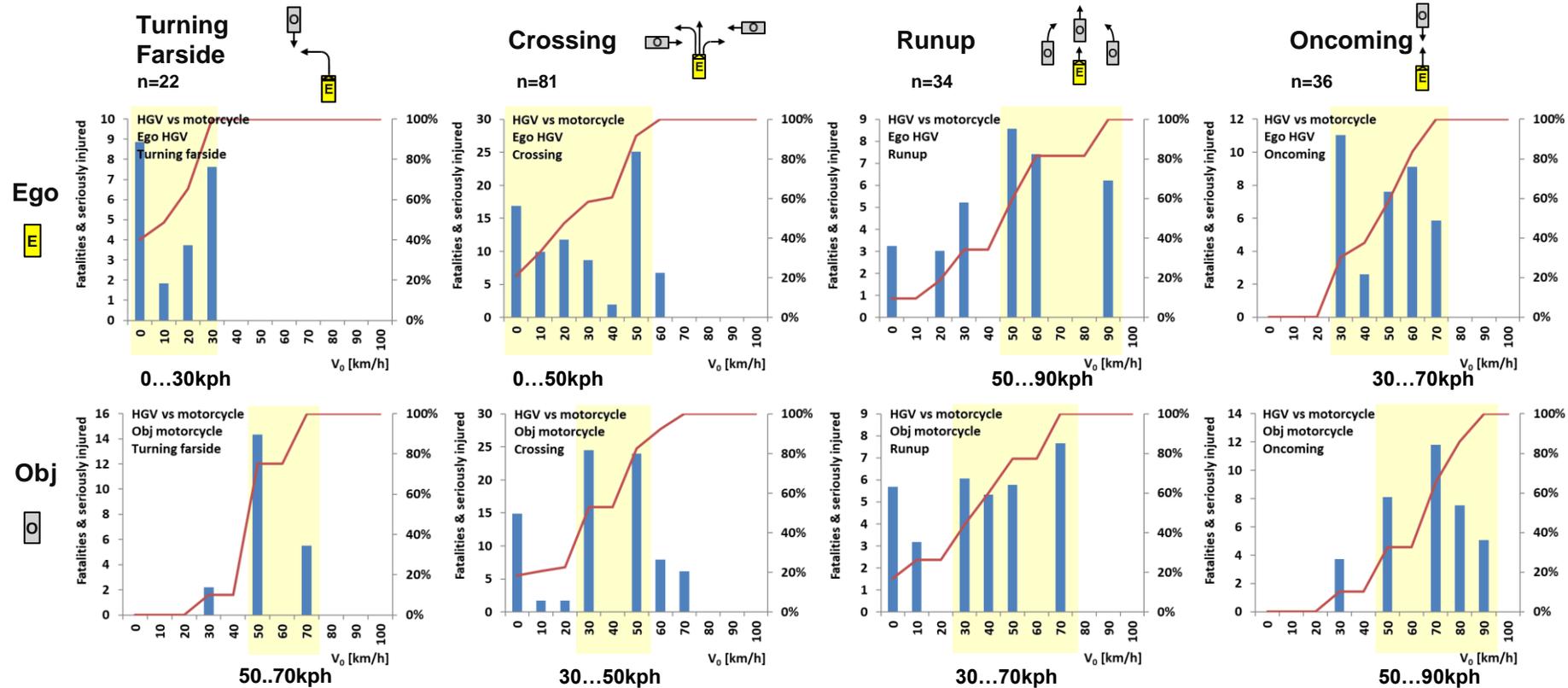
Extrapolation of GIDAS sample to German and EU fatalities and seriously injured

Data: German Federal Statistical Office (DESTATIS), 2019. German In-Depth Accident Study (GIDAS), 2005-2020.

Method: Analysis of GIDAS accidents with personal injuries. German fatalities and seriously injured based on DESTATIS total numbers and on accident distribution in GIDAS. EU28 values are estimations based on EU fatalities and seriously injured numbers.

HGV vs Motorcycle

HGV involved in accidents with motorcycles   vs 



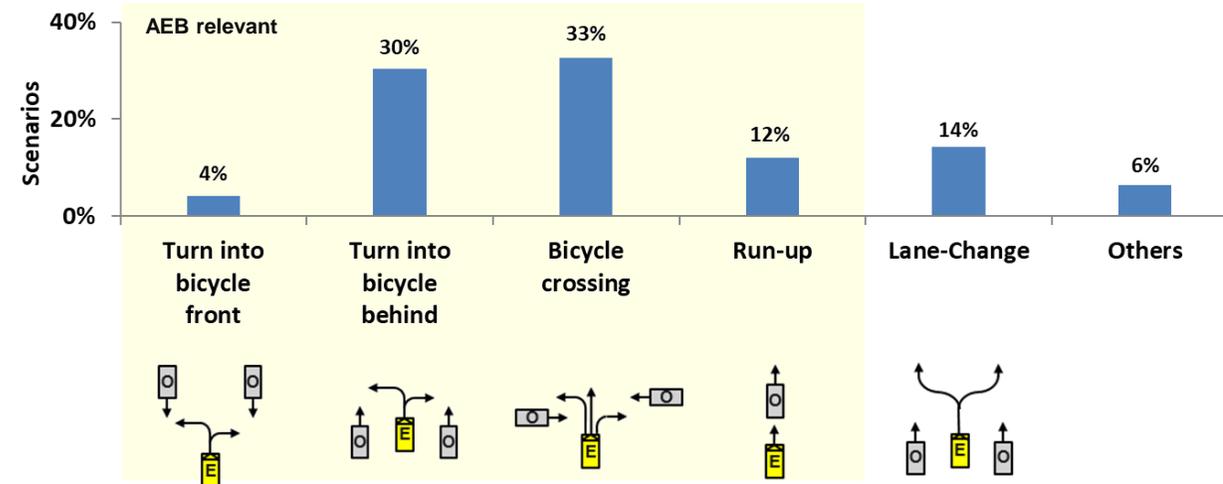
HGV vs Bicycle

HGV involved in accidents with bicycle



AEBS relevant scenarios

- > 4% turning and bicycle oncoming
- > 30% turning and bicycle from behind
- > 33% bicycle crossing
- > 12% run up to bicycle



	Turn into bicycle front	Turn into bicycle behind	Bicycle crossing	Run-Up	Lane-Change	Total
GIDAS	7	53	57	21	25	174
GER p.a.	3	20	22	8	9	66
EU28 p.a.	15	113	121	45	53	370
	20	150	160	60	70	460
	30	200	220	80	90	620

Method:

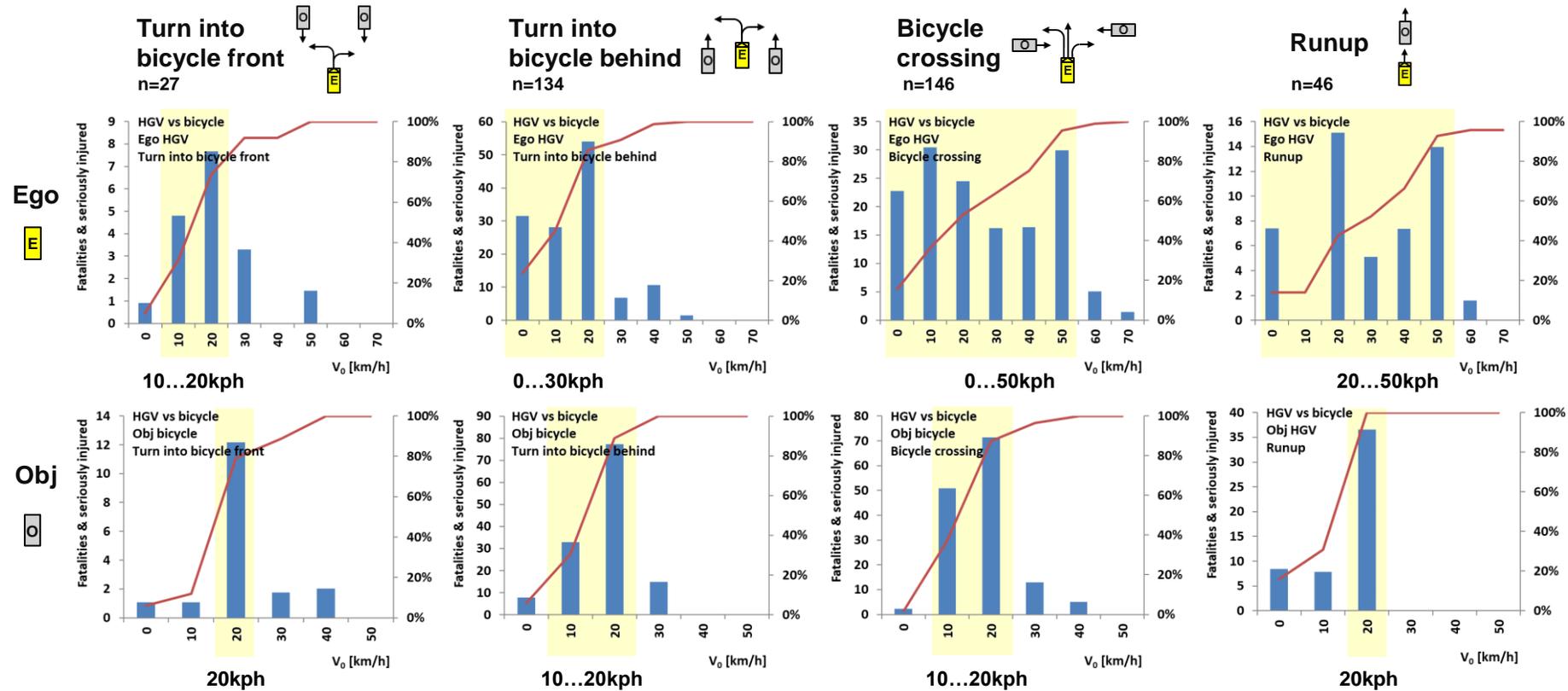
Extrapolation of GIDAS sample to German and EU fatalities and seriously injured

Data: German Federal Statistical Office (DESTATIS), 2019. German In-Depth Accident Study (GIDAS), 2005-2020.

Method: Analysis of GIDAS accidents with personal injuries. German fatalities and seriously injuries based on DESTATIS total numbers and on accident distribution in GIDAS. EU28 values are estimations based on EU fatalities and seriously injured numbers.

HGV vs Bicycle

HGV involved in accidents with bicycle



Data: German Federal Statistical Office (DESTATIS), 2019. German In-Depth Accident Study (GIDAS), 2005-2020.

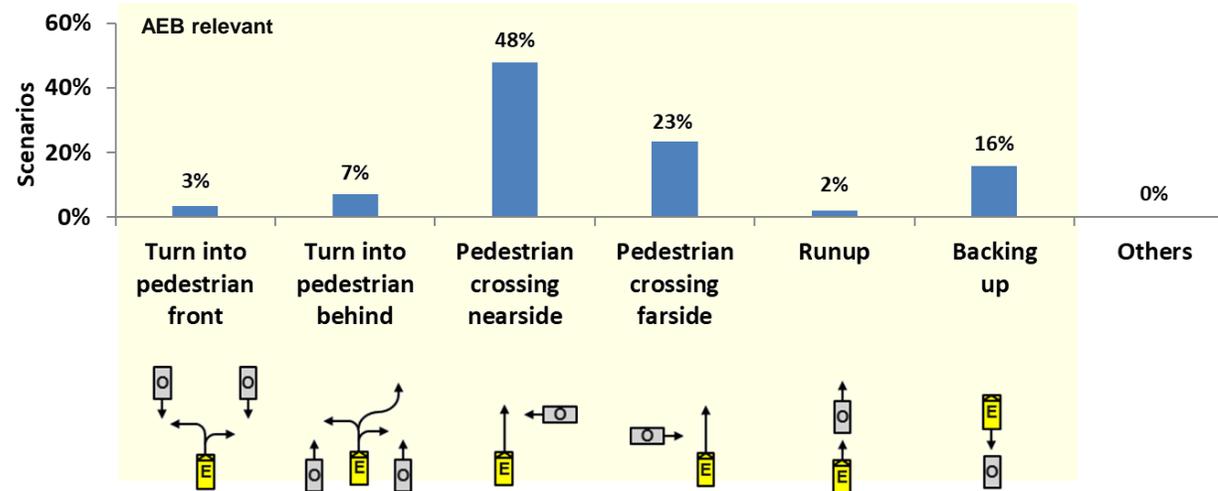
Method: Analysis of GIDAS accidents with personal injuries. German fatalities and seriously injuries based on DESTATIS total numbers and on accident distribution in GIDAS.

HGV vs Pedestrian

HGV involved in accidents with pedestrians   vs 

AEBS relevant scenarios

- › 3% turning and pedestrian oncoming
- › 7% turning and pedestrian from behind
- › 48% pedestrian crossing nearside
- › 23% pedestrian crossing farside
- › 2% run up
- › 16% baking-up



	Turn into pedestrian front	Turn into pedestrian behind	Pedestrian crossing nearside	Pedestrian crossing farside	Runup	Backing up	Total
GIDAS	4	8	53	26	2	17	110
GER p.a.	2	4	25	12	1	8	53
EU28 p.a.	10	30	190	90	10	60	390
	11	22	145	71	7	48	303
	20	40	260	130	15	80	545

Method:

Extrapolation of GIDAS sample to German and EU fatalities and seriously injured



Data: German Federal Statistical Office (DESTATIS), 2019. German In-Depth Accident Study (GIDAS), 2005-2020.

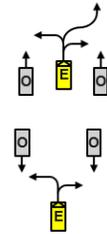
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HGV vs Pedestrian

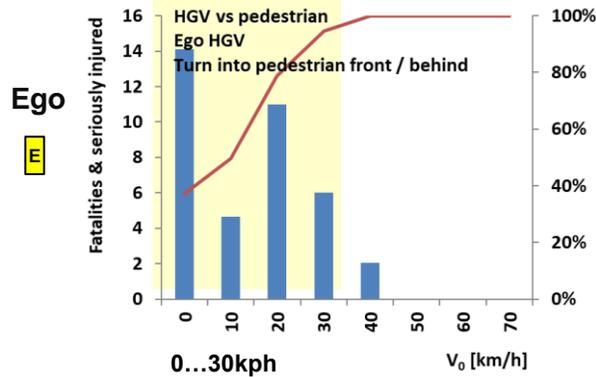
HGV involved in accidents with pedestrians



Turn into pedestrian front / behind



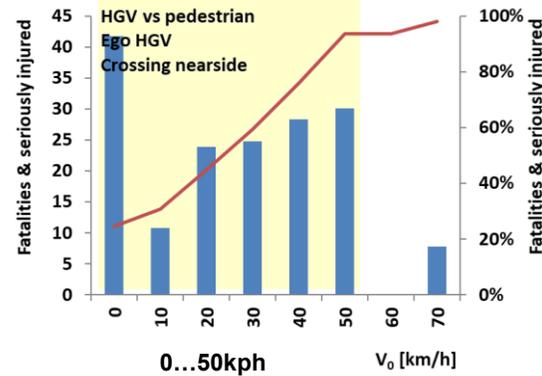
n=38



Pedestrian crossing nearside



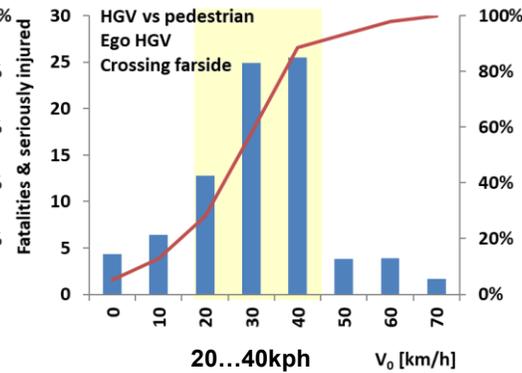
n=170



Pedestrian crossing farside



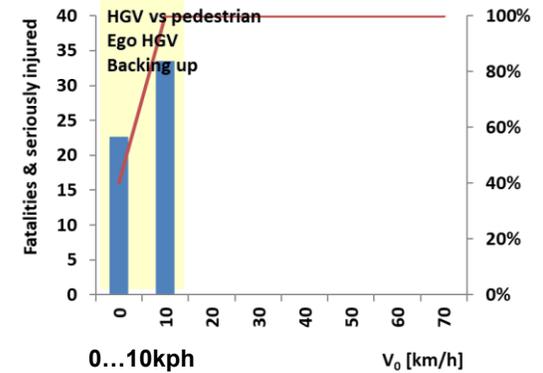
n=83



Backing up



n=56



Details

Accident Research: Variant B

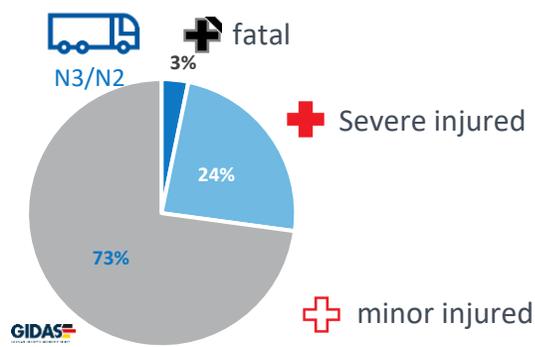
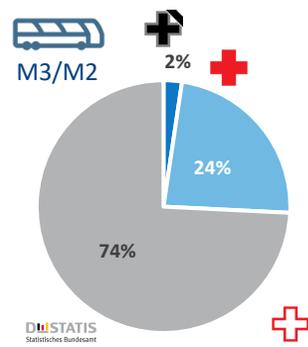
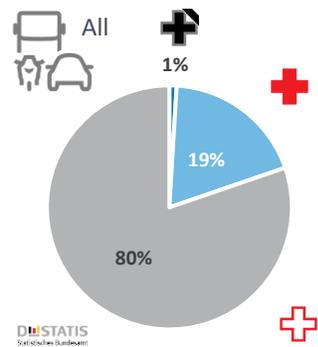
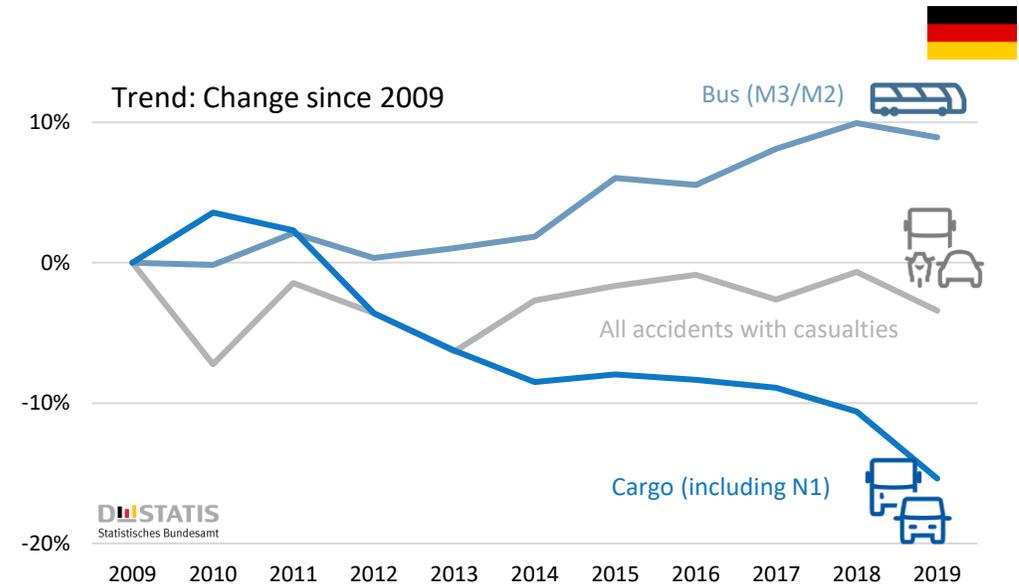
Germany

Details – Accident Research: Variant B - Germany

Commercial Vehicles Status Germany 2019

► Facts

Accidents with casualties ...	
Total	300.143
Bus (M3/M2) involvement	5.917
Truck (N3/N2) involvement	~ 16.800



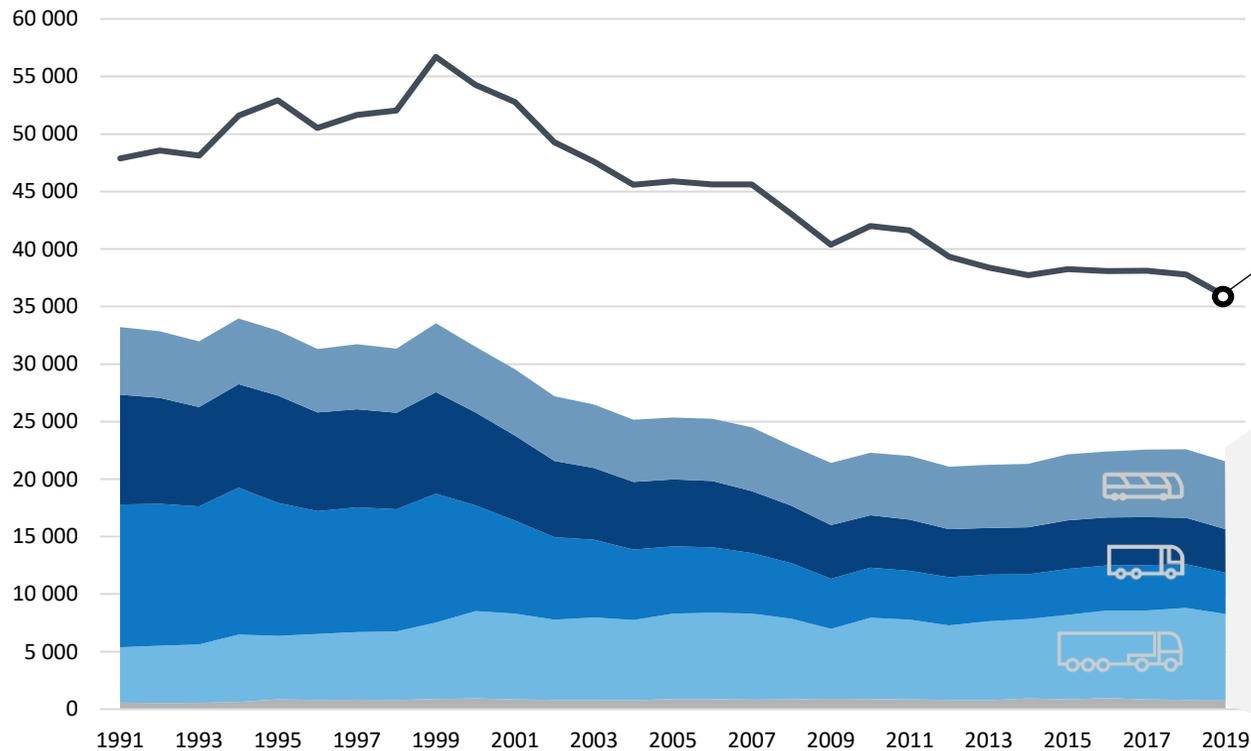
► Higher accident severity seen in N3/N2 accidents – Increasing trend of M3/M2 accidents



Commercial Vehicles

Trend – Involved N3/N2 and M3/M2 vehicles

► Vehicles involved in accidents with casualties in Germany



Status 2019:

All N3/N2/N1 and M3/M2 Vehicles
~35.900 Vehicles in 33.000 accidents
there of involved in accidents with casualties:

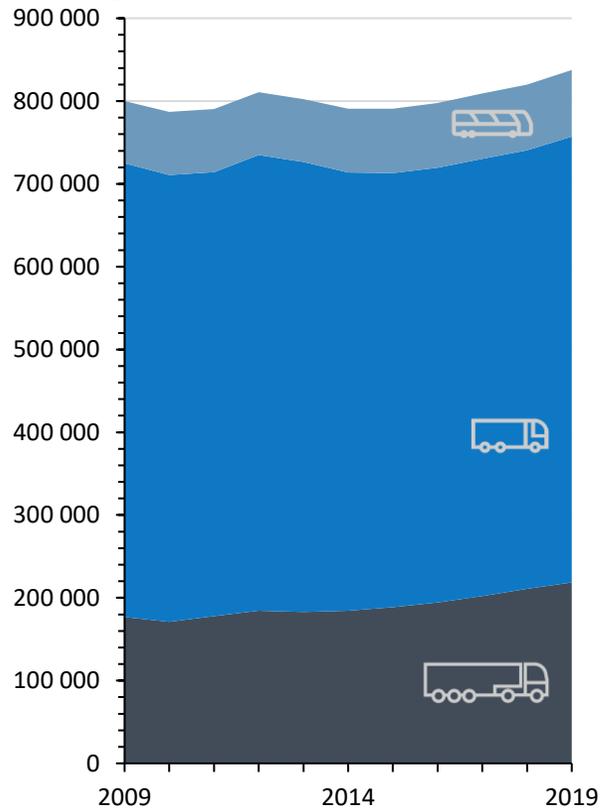
Bus M3/M2:	~5.900 vehicles
Cargo N2:	~3.800 vehicles
Cargo N3:	~3.600 vehicles
Semi-trailer tractor:	~7.500 vehicles
Other goods vehicle:	~ 800 vehicles



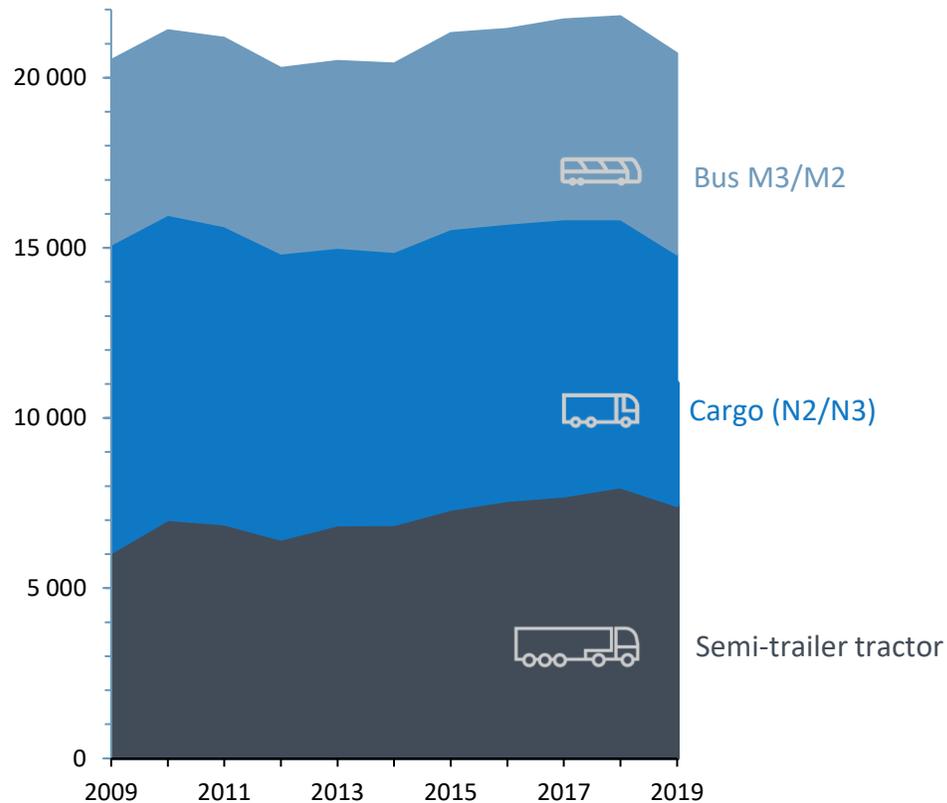
Commercial Vehicles

Trend – Registered Vehicles vs. Vehicle involved in accidents

▶ Registered Vehicles



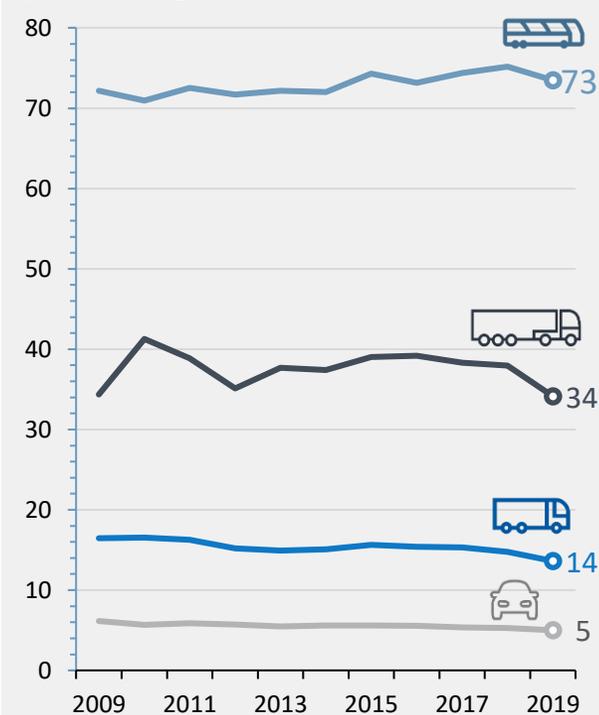
▶ Vehicles involved in accidents*



*with casualties in Germany

▶ Index

Vehicles involved in accidents per 1000 registered Vehicles



Source: Federal Statistical Office [1,2]



Commercial Vehicles

Method – Field of Effect (Safety Systems)

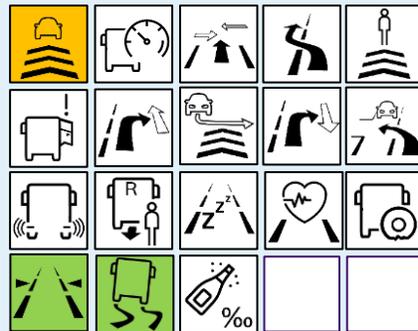


n = 28.233 accidents with casualties (2005 – 2020)

n = 1.958 accidents (N3/N2 or M3/M2 involved)



Case individual analysis



Code for each function

```

sql=['UPDATE 01_UNWELT INNER JOIN 26_BETEIL ON
'WHERE ((([26_BETEIL_FAS].AEB_L_WF)=9) AND (([
invoke(HDataBase,'Execute',sql);

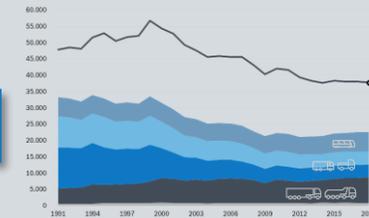
sql=['UPDATE 01_UNWELT INNER JOIN 26_BETEIL ON
'WHERE ((([26_BETEIL_FAS].AEB_L_NF)=9) AND (([
invoke(HDataBase,'Execute',sql);

sql=['UPDATE 01_UNWELT INNER JOIN 26_BETEIL ON
'WHERE ((([26_BETEIL_FAS].AEB_L_WF)=9) AND (([
invoke(HDataBase,'Execute',sql);

disp(' 7. AEB_L_WF wird bei allen relevanten U
sql=['UPDATE 01_UNWELT INNER JOIN (26_BETEIL I
'WHERE ((([26_BETEIL_FAS].AEB_L_WF)=9) AND (([
invoke(HDataBase,'Execute',sql);
    
```



Official accident numbers Germany



weighting

mapping

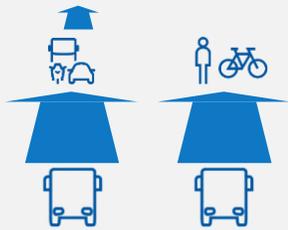
Results valid for Germany



Commercial Vehicles

Analysis of typical AEB Scenarios

Pre-Filter:



1. AEB relevant situation for relevant Ego vehicle (Vehicle, Bicycle, Pedestrian ahead)

2. Relevant Ego vehicle class (N2/N3/M2/M3)



...by location of the accident



City



Rural



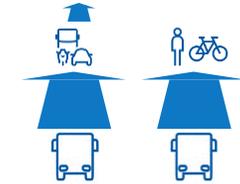
Expressway

...by Ego vehicle speed



*Initial speed **AND** Collision speed*
in AEB city related range (10 – 60 km/h)

All results are weighted to Germany 2019 (accidents with casualties)

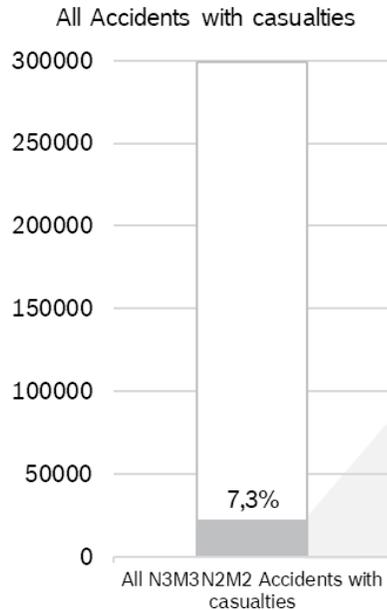


Commercial Vehicles

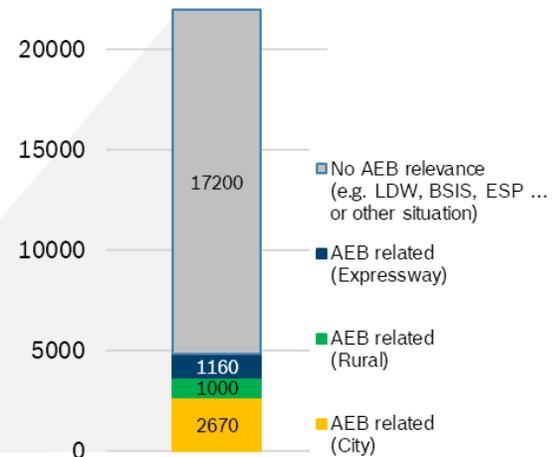
Analysis of typical AEB Scenarios N3/N2 and M3/M2

...by location of the accident

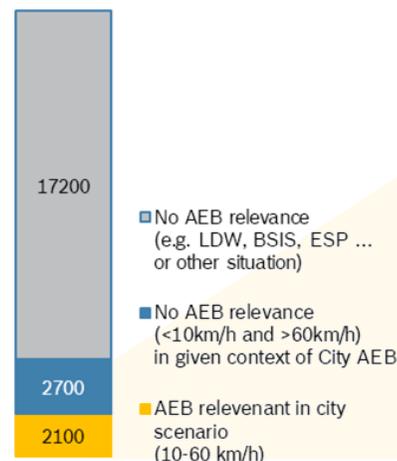
...by Ego vehicle speed



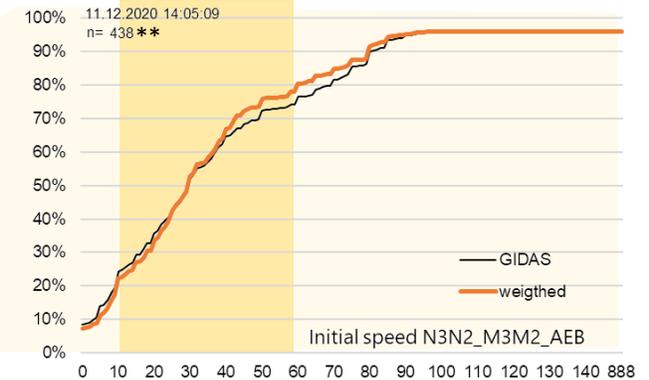
* Ego vehicle in N3, N2, M3 or M2 classification
Total accidents in Germany 2019



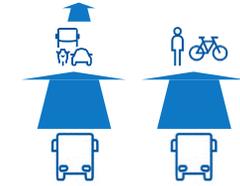
GIDAS
GERMAN IN-DEPTH ACCIDENT STUDY
n = 473



** For overall evaluation, additional parameters are considered, Vehicles per accident (double counting possible) number of evaluable vehicles can be different



44% (2100) of all AEB related accidents* with casualties occurs in urban speed range (10-60 km/h)

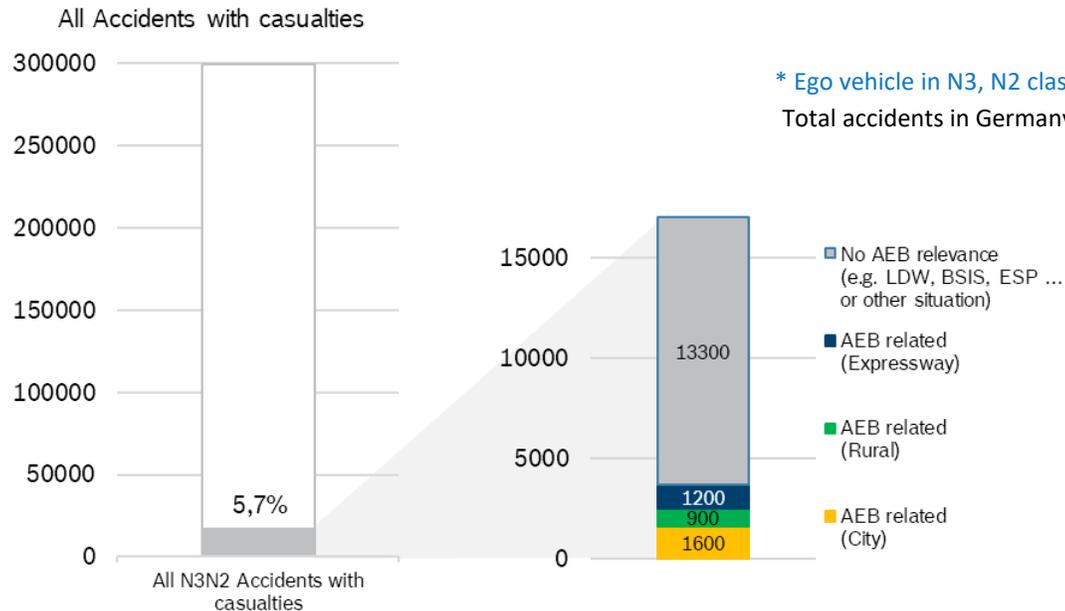


Commercial Vehicles

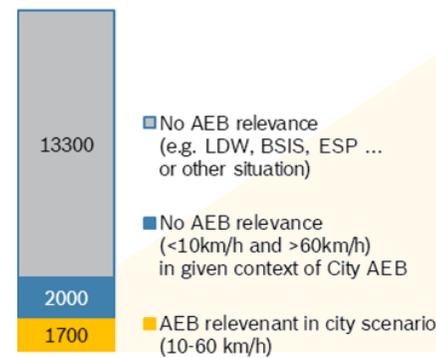
Analysis of typical AEB Scenarios N3/N2

...by location of the accident

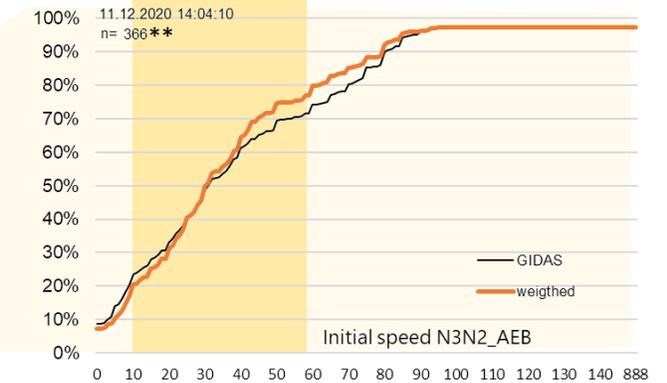
...by Ego vehicle speed



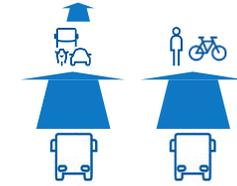
GIDAS
GERMAN IN-DEPTH ACCIDENT STUDY
n = 351



** For overall evaluation, additional parameters are considered, Vehicles per accident (double counting possible) number of evaluable vehicles can be different



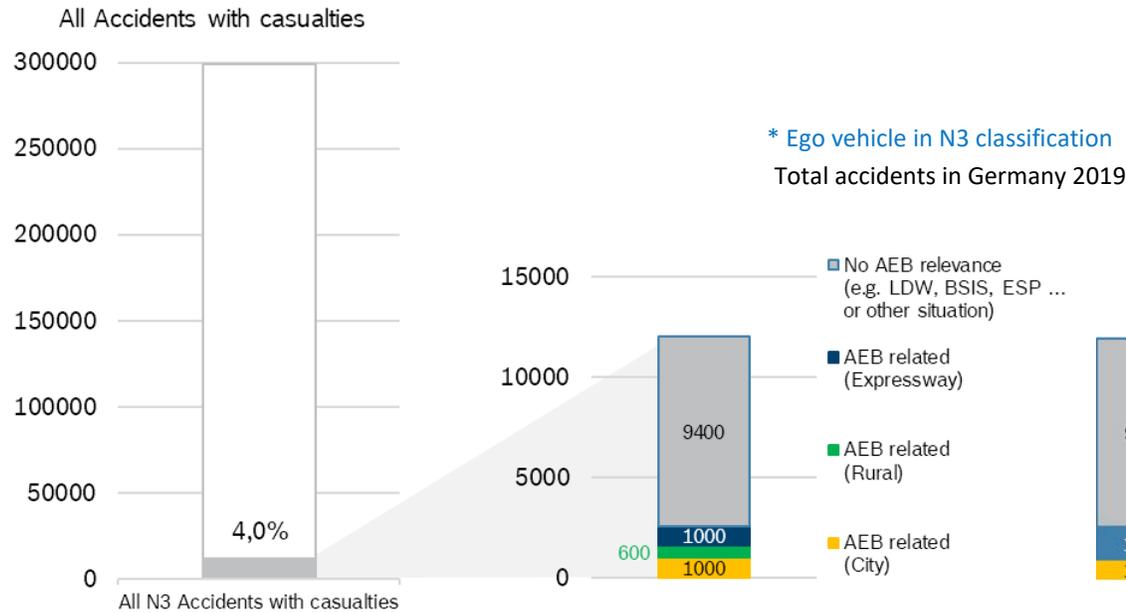
46% (1700) of all AEB related accidents* with casualties occurs in urban speed range (10-60 km/h)



Commercial Vehicles

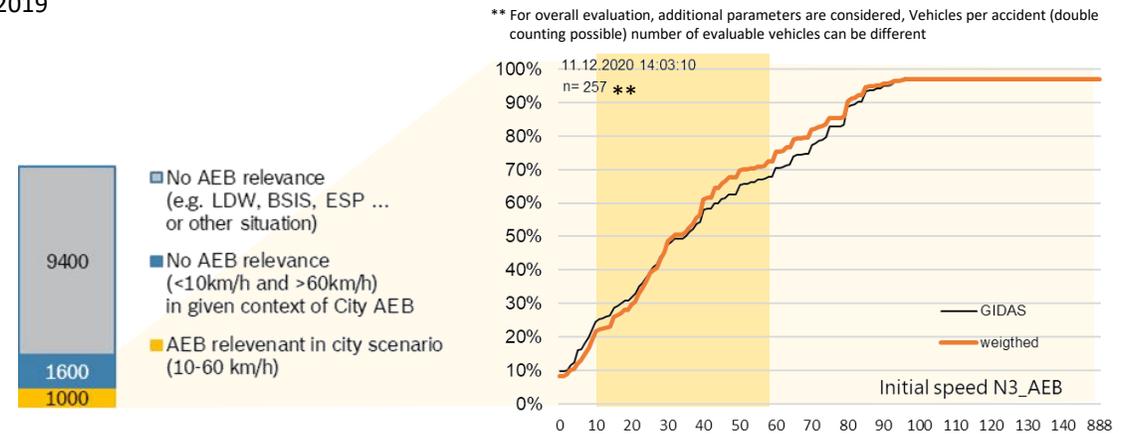
Analysis of typical AEB Scenarios N3

...by location of the accident



...by Ego vehicle speed

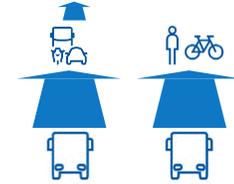
GIDAS
GERMAN IN-DEPTH ACCIDENT STUDY
n = 246



38% (1000) of all AEB related accidents* with casualties occurs in urban speed range (10-60 km/h)

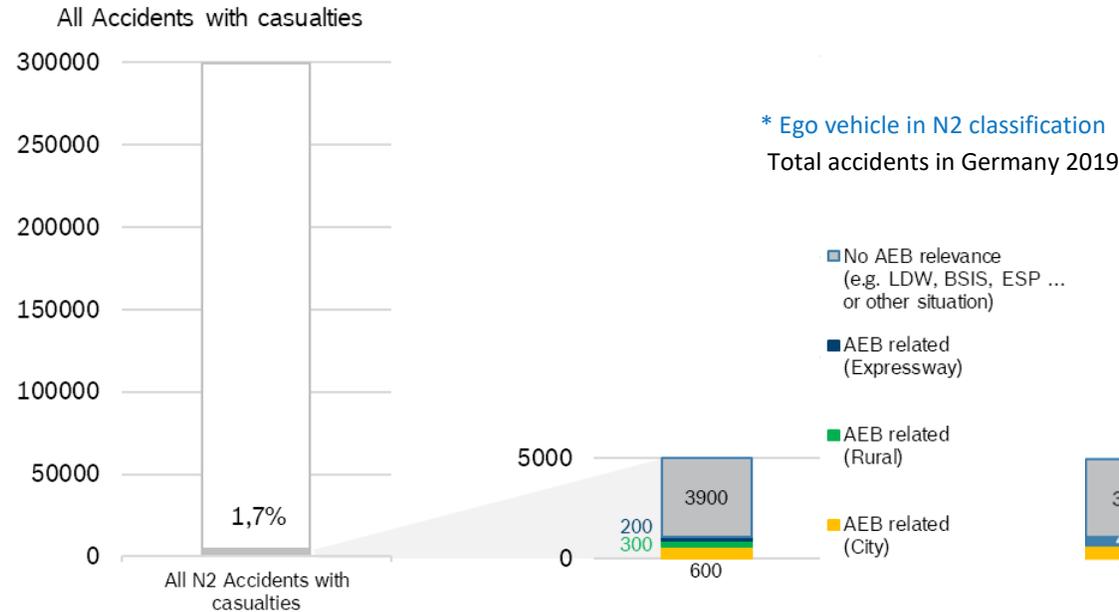
Commercial Vehicles

Analysis of typical AEB Scenarios N2

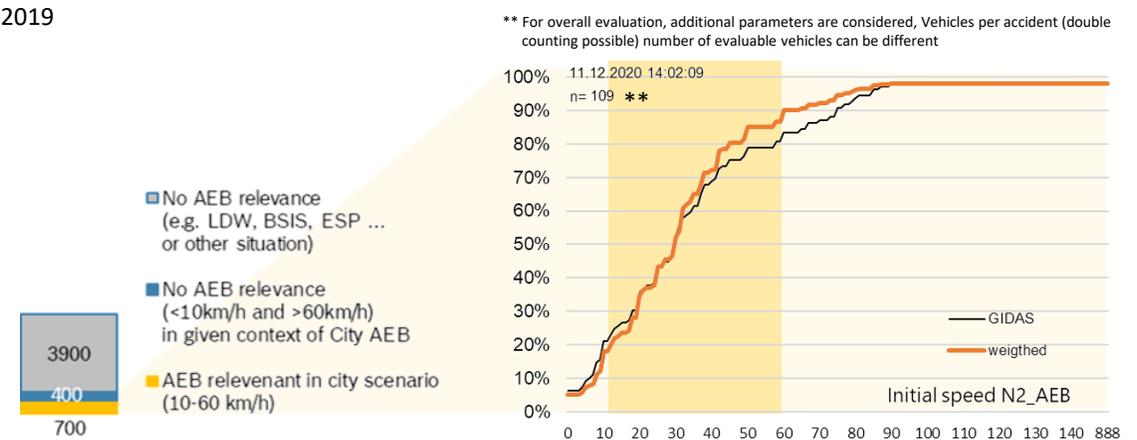


...by location of the accident

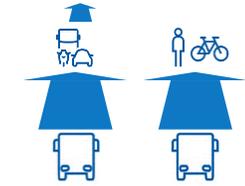
...by Ego vehicle speed



GIDAS
GERMAN IN-DEPTH ACCIDENT STUDY
n = 105



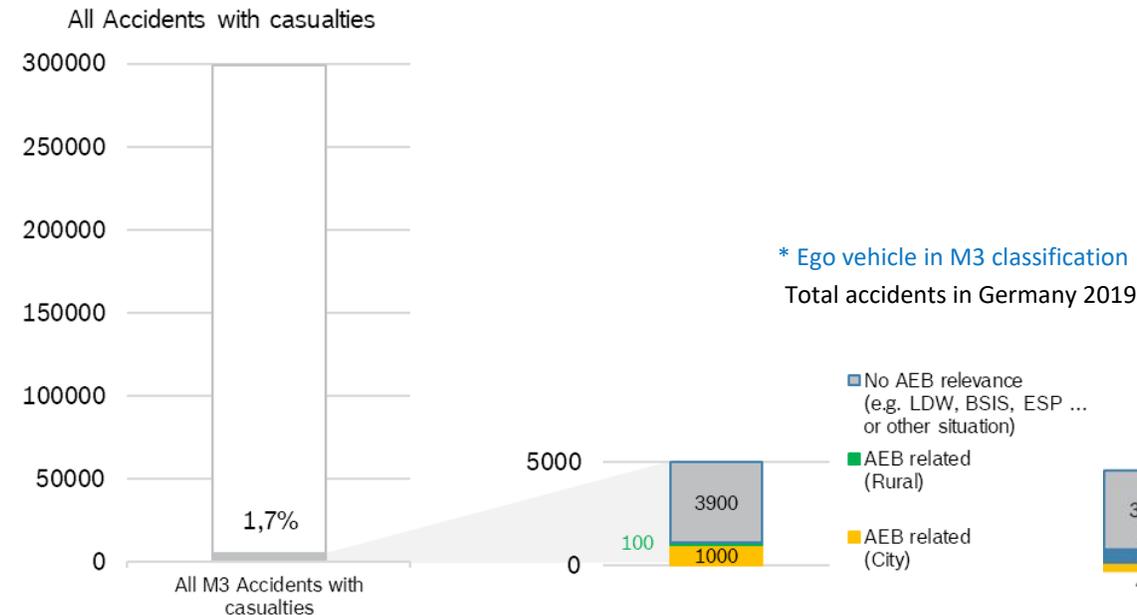
63% (700) of all AEB related accidents* with casualties occurs in urban speed range (10-60 km/h)



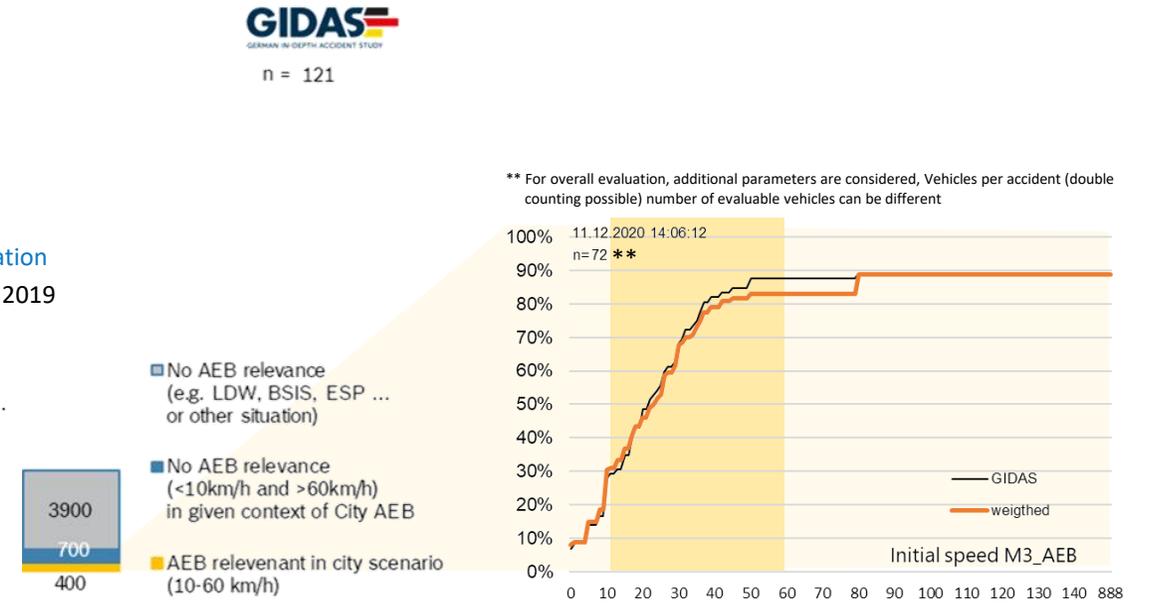
Commercial Vehicles

Analysis of typical AEB Scenarios M3

...by location of the accident



...by Ego vehicle speed



36% (400) of all AEB related accidents* with casualties occurs in urban speed range (10-60 km/h)

Accident Research

Sources

- [1] DESTATIS Unfälle von Güterkraftfahrzeugen im Straßenverkehr 2019, 5462410-19700-4, published 16. November 2020
- [2] DESTATIS Unfälle von Bussen im Straßenverkehr 2019, 5462411-19700-4, published 20. December 2019 (updated 14. January 2020)
- [3] DESTATIS Verkehrsunfälle 2019, Fachserie 8 Reihe 7, 2080700-19700-4 published 14. July 2020
- [4] DESTATIS special evaluation on behalf of Bosch 2020, 2019, 2018, 2017, 2016, 2015
- [5] GIDAS 07/2020 – 2005-2020 Data weighted to Germany status 2019

Details

Accident Research: Variant C

Japan

Details – Accident Research: Variant C - Japan

HGV Involved Traffic Accidents All Locations

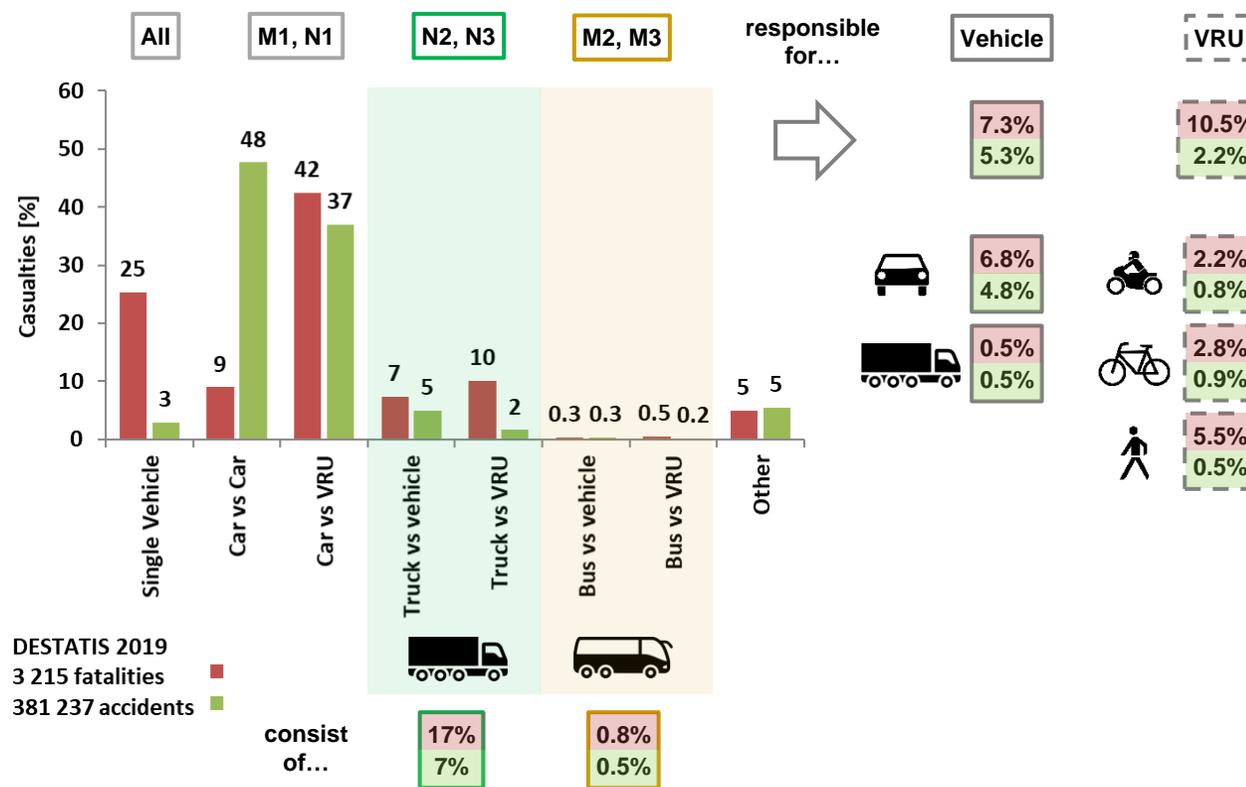
Relevance in Japan traffic accidents

HGV accidents consist of:

- › Trucks (N2, N3) involved in 17% of all fatalities
- › Busses (M2, M3) involved in 0.8% of all fatalities

HGV responsible for:

- › 7.3% of all fatalities occur in accidents between HGV and other vehicles
- › 10.5% of all fatalities occur in accidents between HGV and VRUs



HGV vs Vehicle

HGV accidents with other vehicles

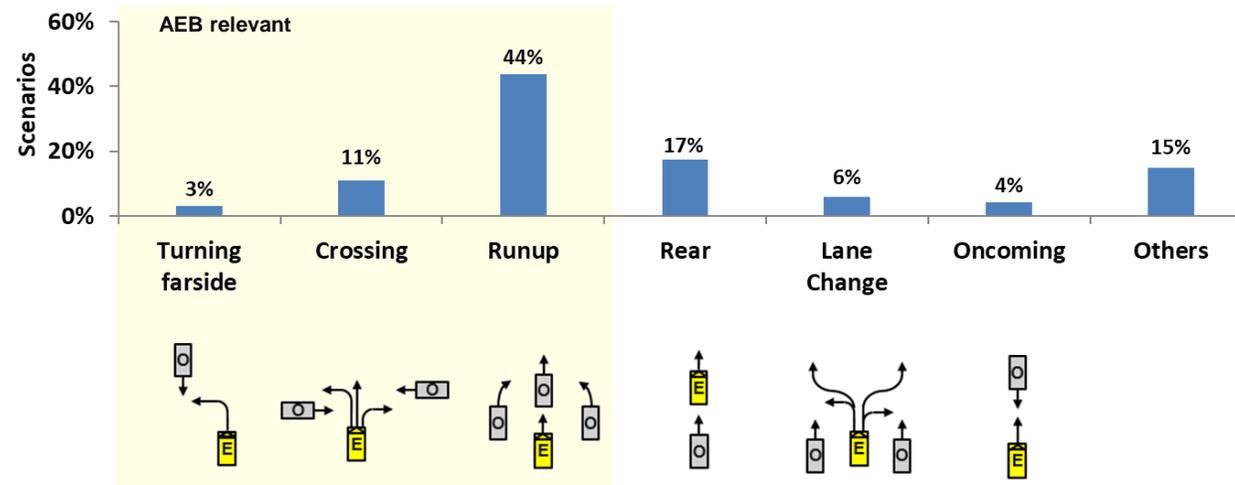


HGV traffic accidents with other vehicles account for

- > 7.3% of all fatalities
- > 5.3% of all accidents

Thereof AEBS relevant accident scenarios

- > 3% left turn across path
- > 11% other vehicle crossing
- > 44% run-up to other vehicle



		Turning farside	Crossing	Runup	Rear	Lane Change	Oncoming	Total
JP p.a.	fatalities /	6	36	28	29	0	143	266
	accidents	652	2 390	9 531	3 794	1 263	929	21 764

HGV vs Motorcycle

HGV accidents with motorcycles

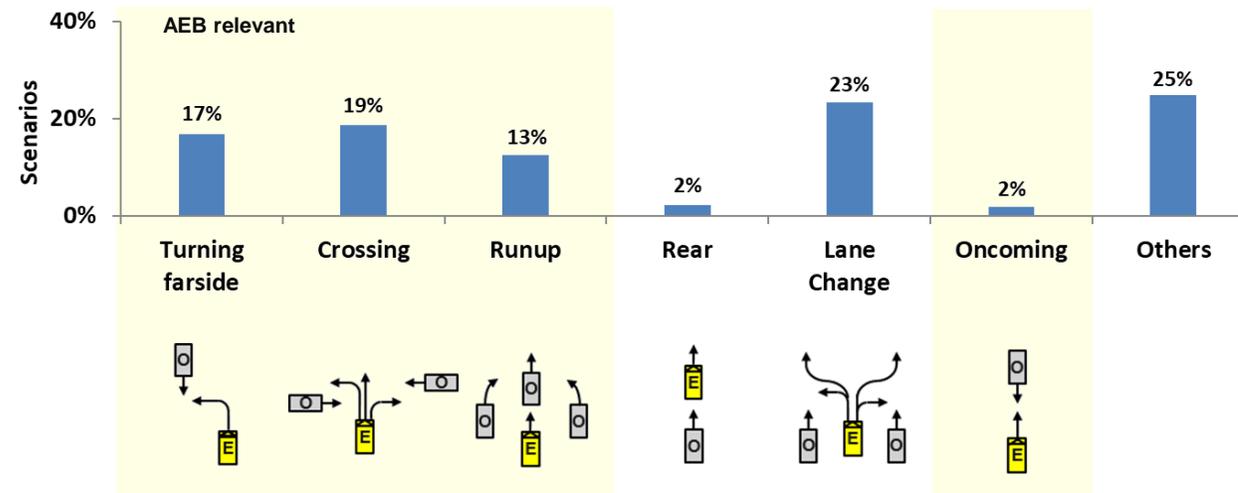


HGV traffic accidents with motorcycles account for

- > 2.2% of all fatalities
- > 0.8 % of all accidents

Thereof AEBS relevant accident scenarios

- > 17% left turn across path
- > 19% other vehicle crossing
- > 13% run-up to other vehicle
- > 2% oncoming



		Turning farside	Crossing	Runup	Rear	Lane Change	Oncoming	Total
JP p.a.	fatalities /	4	23	7	6	19	1	73
	accidents	393	438	294	50	546	43	2 345

HGV vs Bicycle

HGV accidents with bicycles

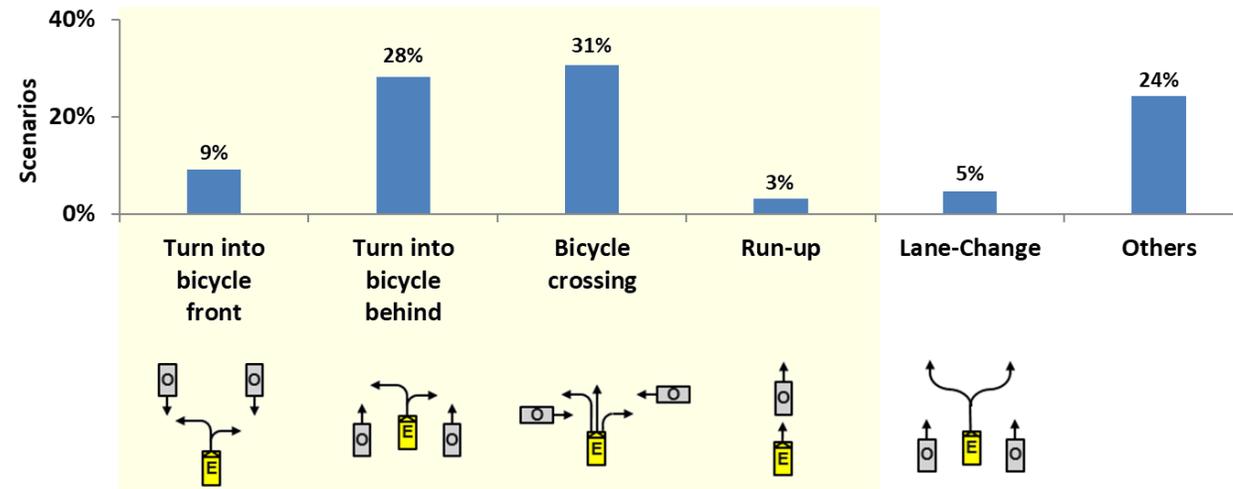


HGV traffic accidents with bicycles account for

- > 2.8% of all fatalities
- > 0.9 % of all accidents

Thereof AEBS relevant accident scenarios

- > 9% turning and bicycle oncoming
- > 28% turning and bicycle from behind
- > 31% bicycle crossing
- > 3% run up to bicycle



		Turn into bicycle front	Turn into bicycle behind	Bicycle crossing	Run-Up	Lane-Change	Total
JP p.a.	fatalities / accidents	4 / 255	25 / 790	36 / 858	13 / 88	5 / 131	92 / 2 799

HGV vs Pedestrian

HGV accidents with pedestrians

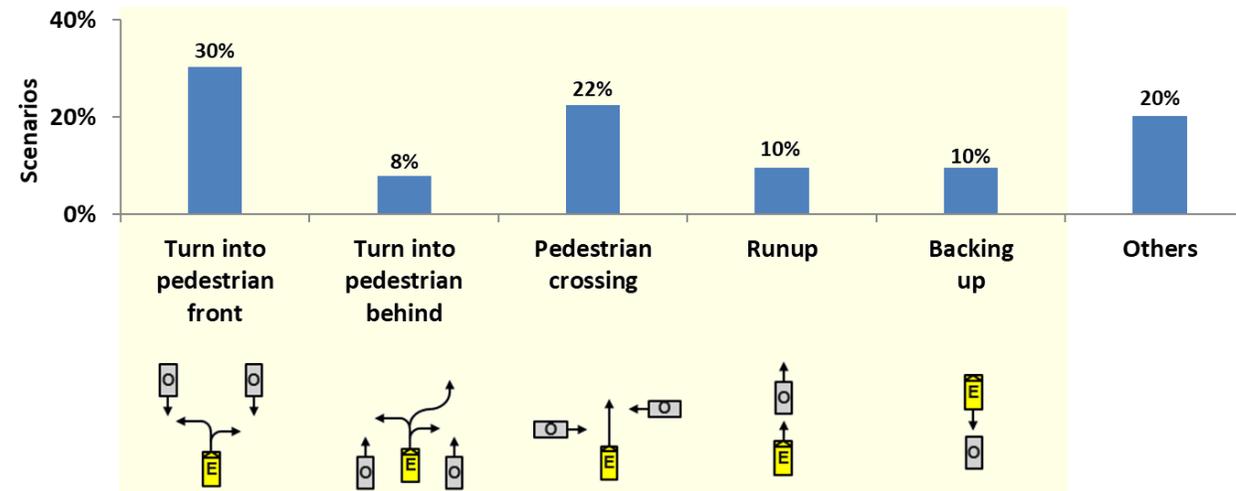


HGV traffic accidents with pedestrians account for

- > 5.5% of all fatalities
- > 0.5 % of all accidents

Thereof AEBS relevant accident scenarios

- > 30% turning and pedestrian oncoming
- > 8% turning and pedestrian from behind
- > 22% pedestrian crossing nearside
- > 10% run up
- > 10% baking-up



		Turn into pedestrian front	Turn into pedestrian behind	Pedestrian crossing	Runup	Backing up	Total
JP p.a.	fatalities / accidents	27 / 507	11 / 132	55 / 375	19 / 159	6 / 160	177 / 1 671

Thank you