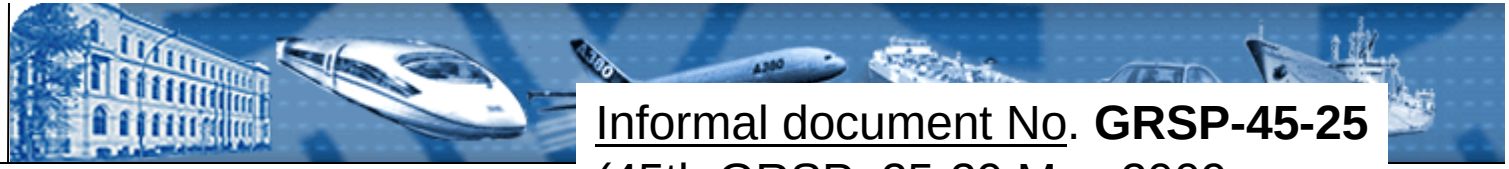


Informal document No. **GRSP-45-25**
(45th GRSP, 25-29 May 2009
agenda item 4(b))

Proposed amendment to GTR No 9 - Pedestrian Protection Exemption of Flat Front Vehicles (FFV)

45th GRSP
May 25-29, 2009

Richard Damm

Content

Objective

Document ECE/TRANS/WP.29/2009/80 proposes an amendment to the scope of GTR No 9. By amending the scope, vehicles with a Flat Front (defined by longitudinal distance between front axle and driver's R-point) shall be exempted from the scope.

This presentation gives a justification why these types of vehicles shall be exempted.

Background

(1)Some Contracting Parties requested an analysis based on real world accident data before being able to agree to an amendment of the GTR for Flat Front Vehicles.

(2)Review background of suggested changes for the geometric parameter.

Analysed data bases

(1) Since the scope extension of pedestrian legislation will affect all countries of the EU, the inclusion of data from other European countries was intended. In the present case data from OTS (UK) and STRADA (Sweden) was considered to be included in the study. Due to lack of detail (e.g. no reconstruction in the Swedish data) or sample size (only very few pedestrian accidents with relevant vehicles) the inclusion of this was not possible.

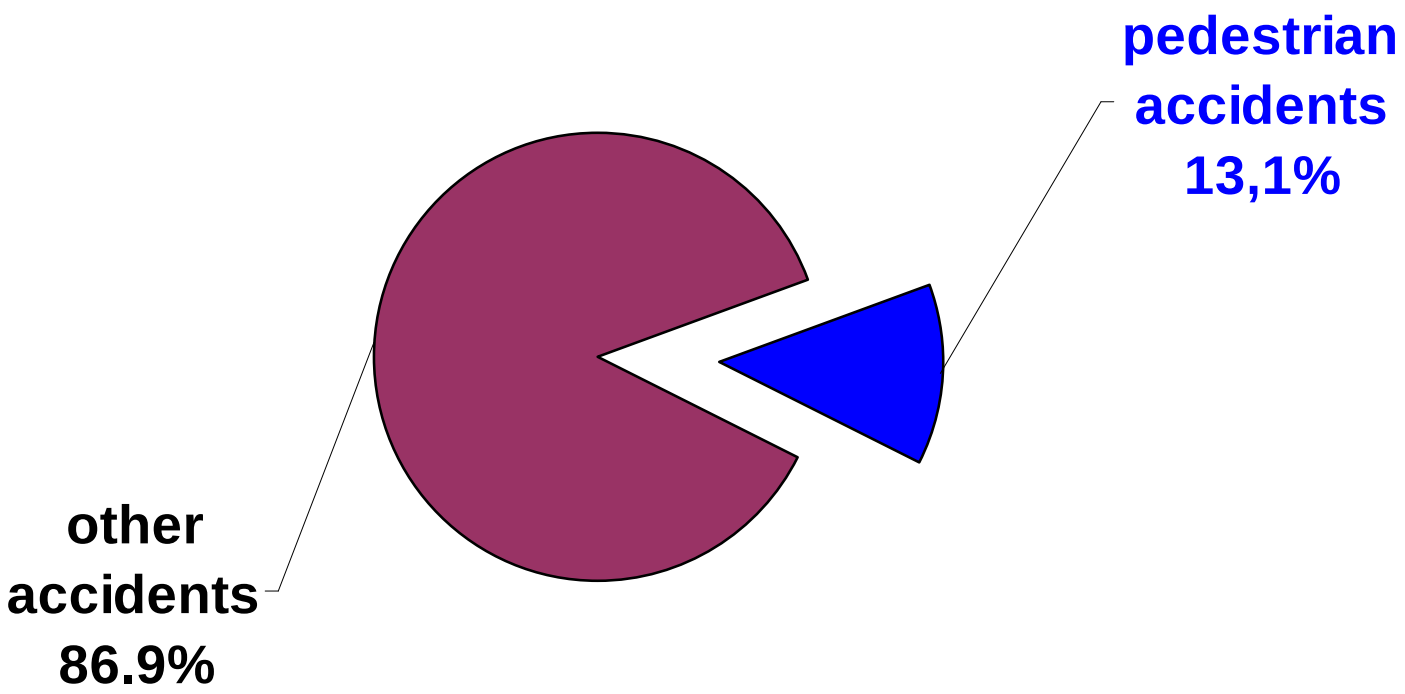
(2) Statement made by the Technical University of Dresden in their report of June 2007.

GIDAS German In-Depth Accident Study

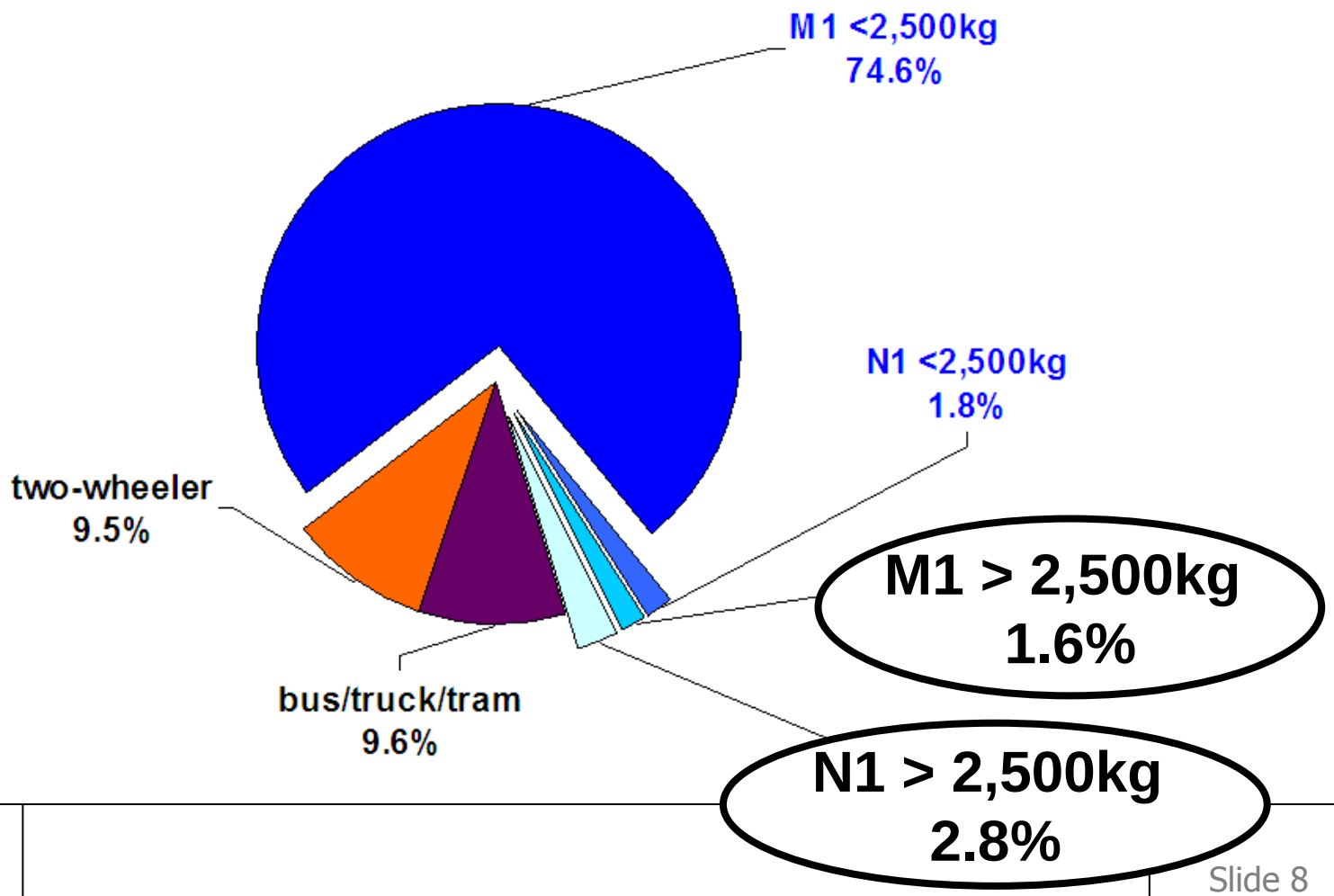
Comparison of the German vehicle population (01/2006) with GIDAS (12/2006)

	distribution of relevant vehicle classes in German vehicle population (2006)		distribution of relevant vehicle classes in GIDAS dataset (12/2006)	
M1 veh. / GVW up to 2,500kg	44,210,963	92.2%	11,228	92.1%
N1 veh. / GVW up to 2,500kg	651,604	1.4%	208	1.7%
M1 veh. / GVW above 2,500kg	1,816,006	3.8%	360	3.0%
N1 veh. / GVW above 2,500kg	1,254,991	2.6%	394	3.2%

proportion of pedestrian accidents in GIDAS (out of n = 9,953 reconstructed accidents of all types)

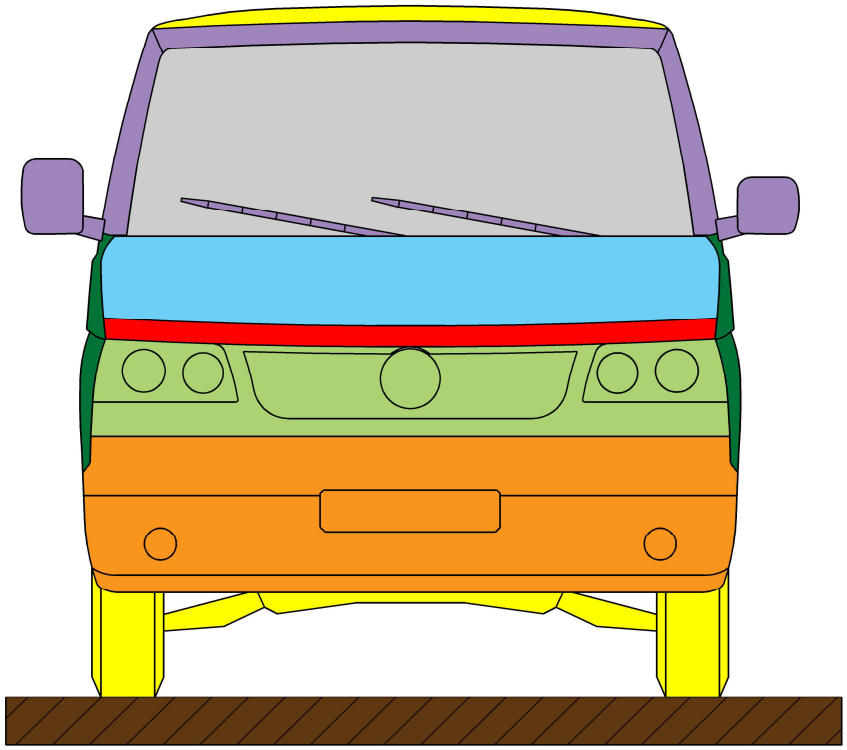


distribution of vehicle classes in all GIDAS pedestrian accidents (n = 1,305)



Distribution of injury causing parts for M1 vehicles > 2.500kg GVM

	head	*neck*	*thorax*	*abdomen*	*spine*	*upper extremities*	*lower extremities*	*TOTAL*
window frame	-	-	-	-	-	1	-	**1**
windscreen	4	-	-	-	-	-	-	**4**
bonnet	1	-	-	1	-	1	-	**3**
BLE	-	-	-	-	-	-	-	**-**
wing	-	-	-	-	-	-	-	**-**
grill & headlamps	-	-	-	-	-	-	2	**2**
bumper	-	-	-	-	-	-	3	**3**
other veh. parts	-	-	-	-	-	-	-	**-**
front, n.f.s.	-	-	-	-	-	2	1	**3**
ground impact	5	-	-	-	-	5	1	**11**
body motion	-	-	-	-	-	-	-	**-**
unknown	2	-	1	-	-	1	2	**6**



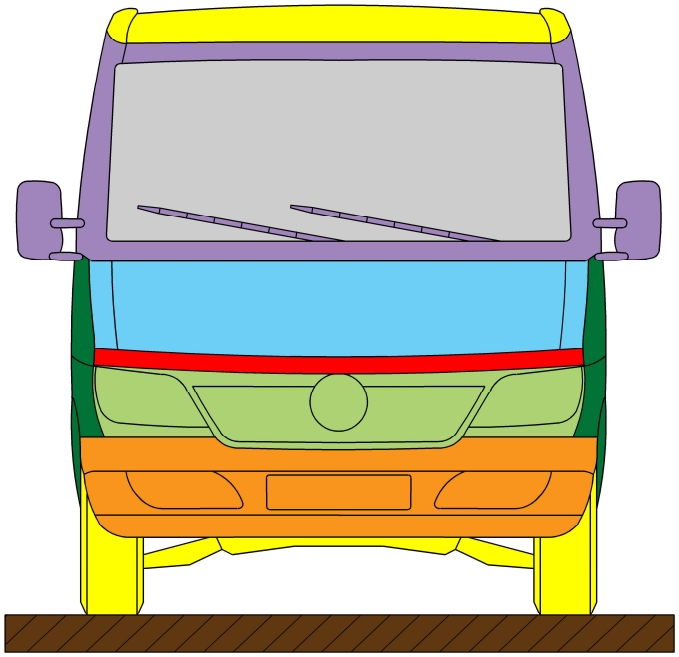
Σ 33

M1 vehicles with Gross Vehicle Weight above 2,500kg

Freiheit
Einheit
Demokratie

Distribution of injury causing parts for Commercial Vehicles > 2.500kg GVM

	head	*neck*	*thorax*	*abdomen*	*spine*	*upper extremities*	*lower extremities*	*TOTAL*
window frame	2	-	-	-	1	-	-	**3**
windscreen	8	-	1	-	-	3	-	**12**
bonnet	1	-	1	-	-	1	1	**4**
BLE	-	-	2	-	1	1	1	**5**
wing	1	-	-	-	-	-	-	**1**
grill & headlamps	-	-	3	2	-	-	-	**5**
bumper	-	-	-	1	-	-	1	**2**
other veh. parts	-	-	-	-	-	1	4	**5**
front, n.f.s.	-	-	-	-	-	-	2	**2**
ground impact	11	-	3	-	-	7	6	**27**
body motion	-	-	-	2	1	-	-	**3**
unknown	1	-	-	-	-	-	1	**2**
								∑ 71



N1 vehicles with Gross Vehicle Weight above 2,500kg

Pedestrian Kinematics

➔ Differentiation into 4 categories:

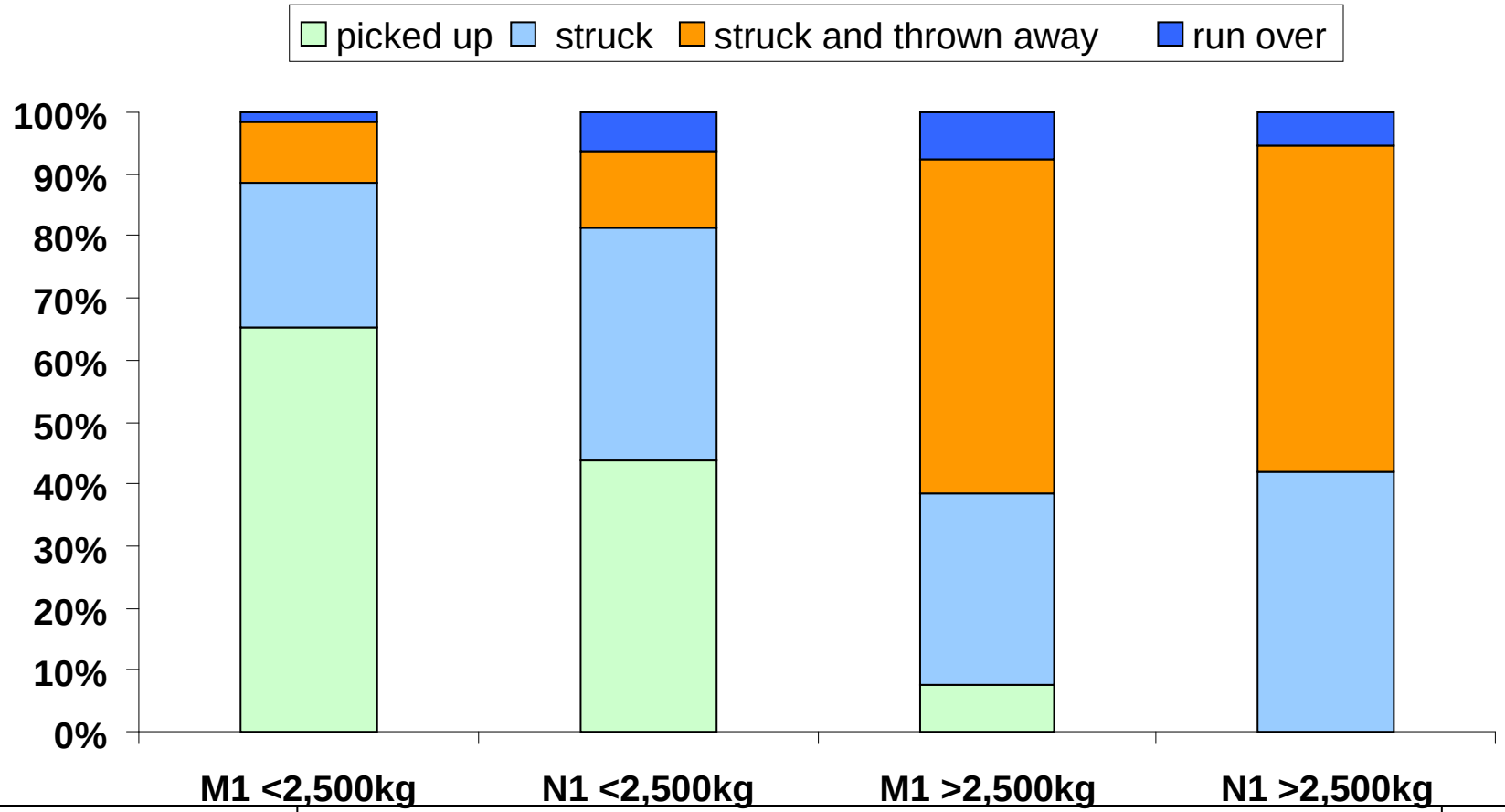
- pedestrian is **struck** by the car (mostly at low collision speeds)

- pedestrian is **struck and thrown away** (without being loaded on bonnet)

- pedestrian is **picked up** (pedestrian is loaded on the bonnet surface)

- **run over**

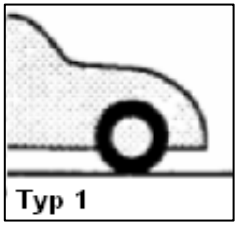
Pedestrian motional mechanism separated by vehicle classes / frontal pedestrian accidents (n = 679)

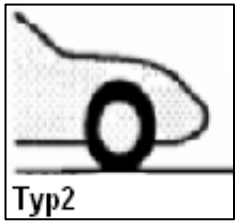


Shape of vehicle front

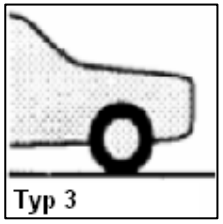
- five shapes for typical passenger car design

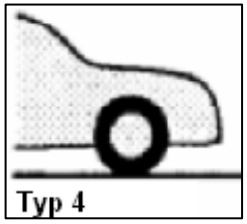
wedge shapes

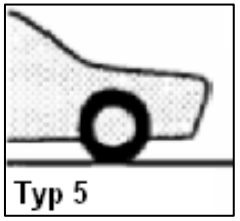




pontoon shapes

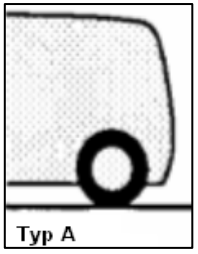




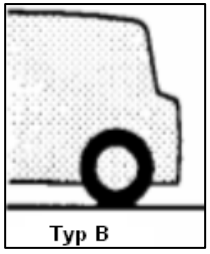


- three different one-box shapes

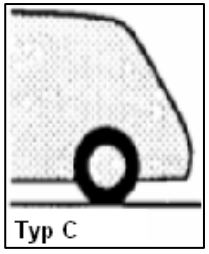
one-box A



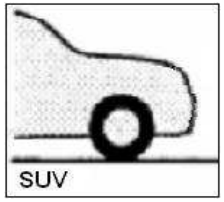
one-box B



one-box C



- SUV shape



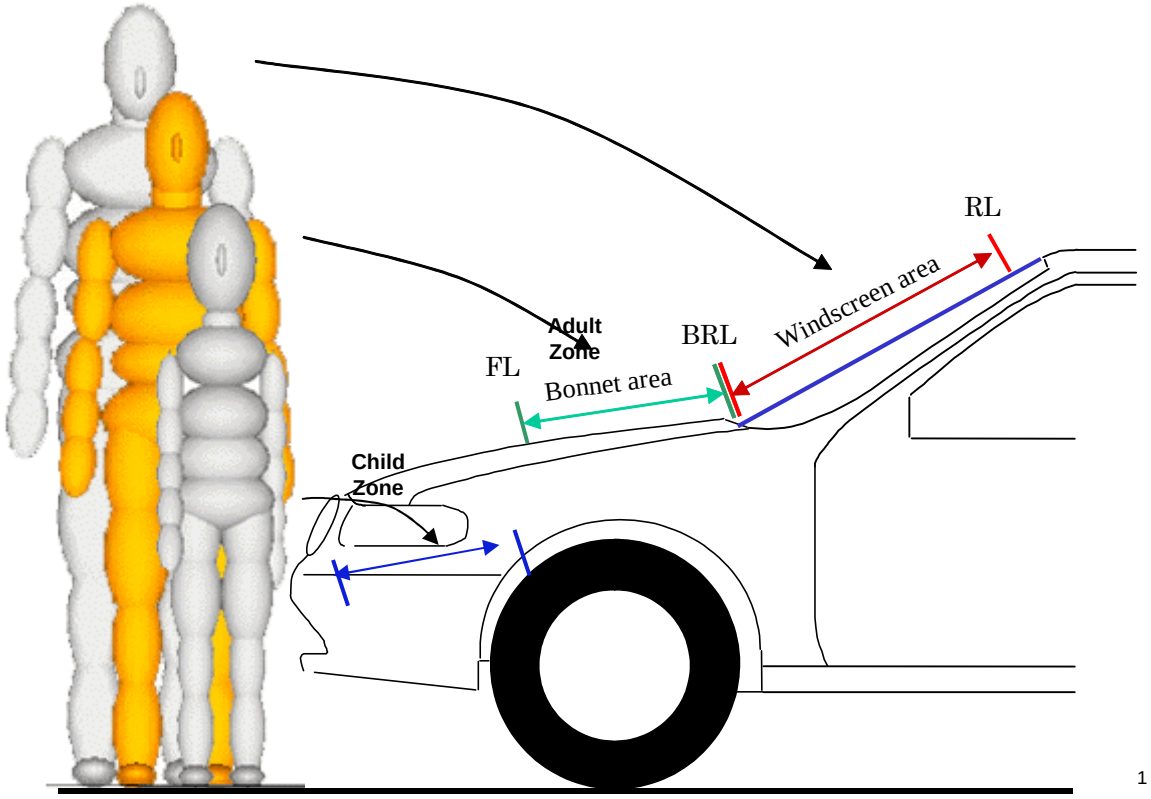
Pedestrian Kinematics

The Pedestrian Protection GTR test procedure was developed based on sedan type cars.[1]

95th %ile
male dummy

50th %ile
male dummy

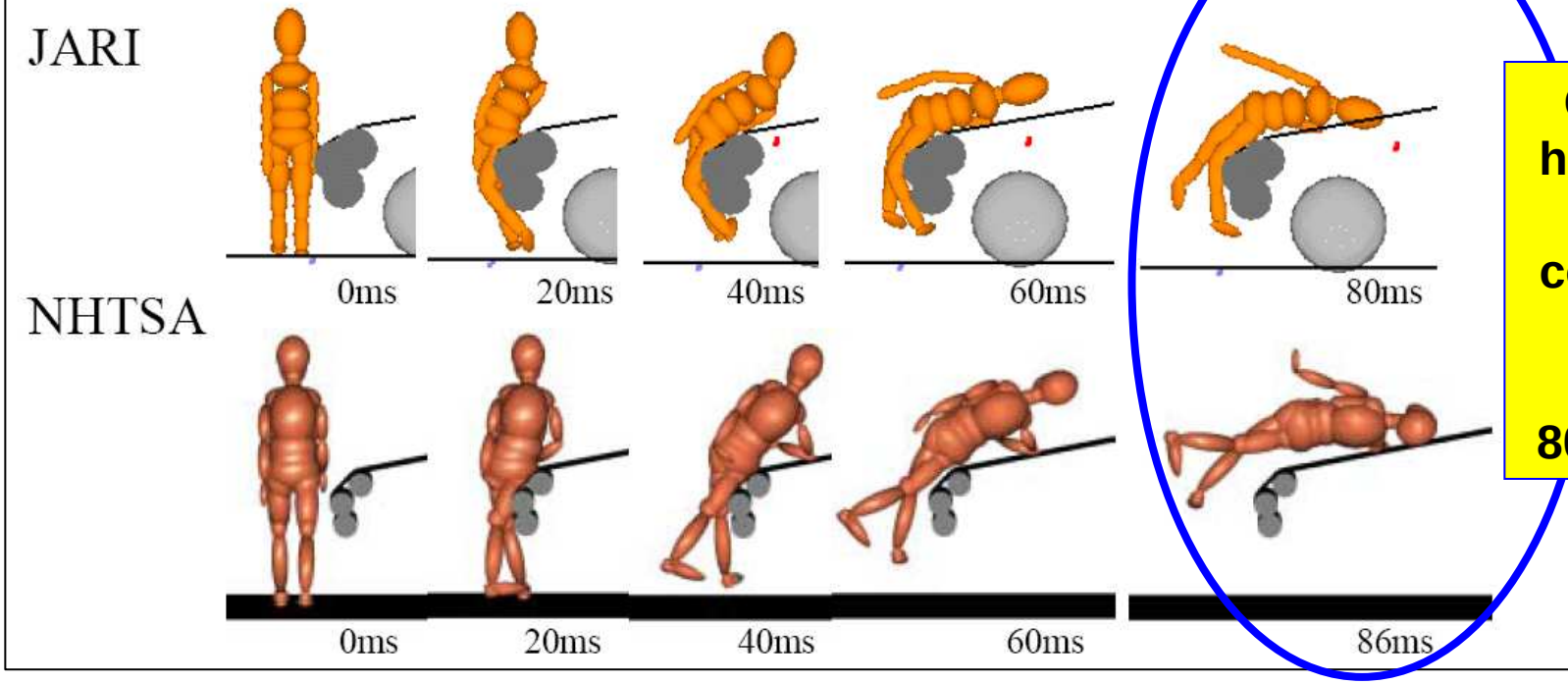
6 year old
child dummy



[1] Source: GTR 1/26/2009, pg. 7

Pedestrian Kinematics

Kinematics (Child-6YO, Sedan - lower)



Child head to hood contact time near 80msec

The GTR's head form speed, mass and contact angle are derived from pedestrian interaction with sedan type vehicles.[1]

[1] Source: GTR 1/26/2009, pg. 7

Source for figure: 11th IHRA/PS 215 (1/2), Computer Simulation Analysis For Pedestrian Head Impact Condition

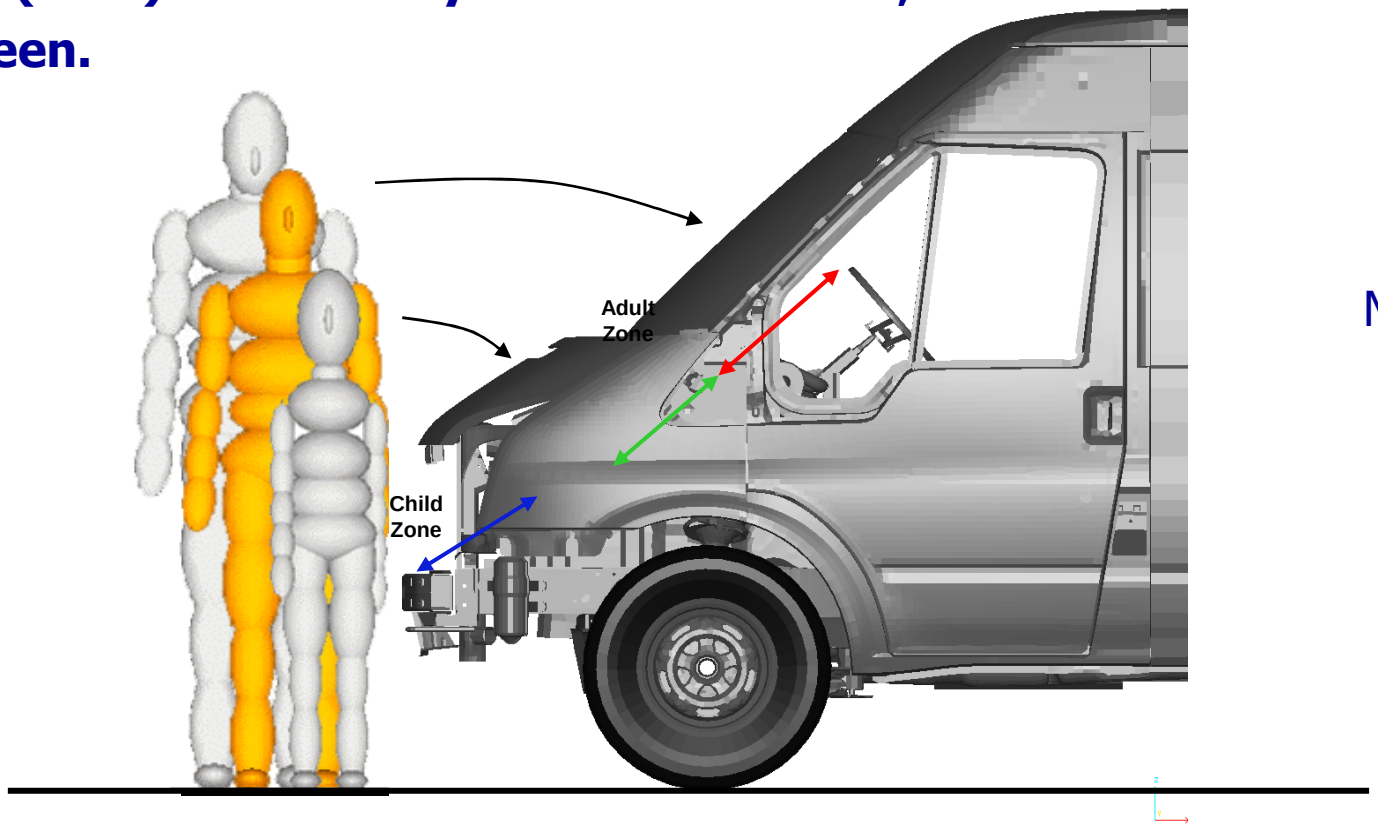
Pedestrian Kinematics

Due to the height and small area of the hood. Medium Commercial Vehicles (MCV) tend to only have a child zone; the adult zone is on windscreen.

95th %ile male dummy

50th %ile male dummy

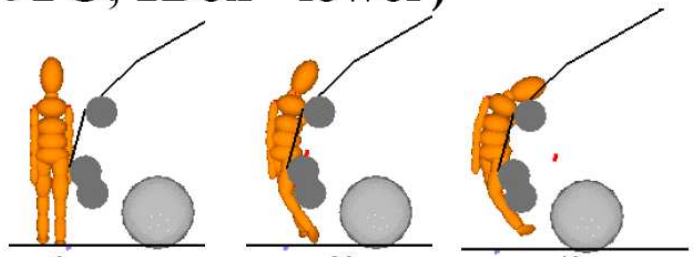
6 year old child dummy



MCV

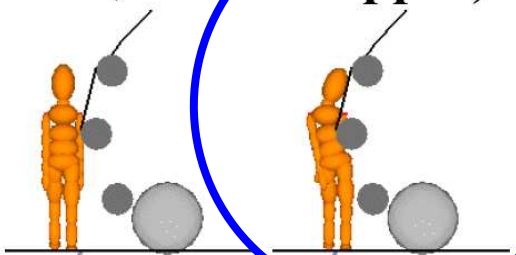
Kinematics (Child-6YO, 1Box - lower)

JARI



Kinematics (Child-6YO, 1BOX - upper)

JARI



Child head to hood contact time near 10msec

Source for figure: 11th IHRA/PS 215 (1/2), Computer Simulation Analysis For Pedestrian Head Impact Condition

MCV pedestrian kinematics compared to sedan:

(1)The child head to hood contact angle is larger than the GTR test procedure

(2)The head impact speed is similar to vehicle speed.

(3)Child head to hood contact time is sooner (current technology would not support deployable hood as a countermeasure).

Pedestrian Kinematics

"The test procedures in the GTR are based largely on the classic vehicle shape with a large bonnet.[1]" Therefore, the MCV pedestrian kinematics differs from the established GTR protocol.

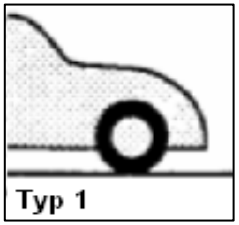
- **MCV child head impact angles are more perpendicular to the hood than sedan impacts.**
- **For a fully flat fronted vehicle, head impact speed is close to vehicle speed. For a typical car, head impact energy is a function of wrap around characteristics.**
- **The MCV child head contact time is near 10msec as compared to 80msec for passenger cars. This removes the current deployable hood countermeasure from the tool box where approximately 50msec is required for deployment.**
- **Actual child contact zone is smaller than the GTR defined zone.**

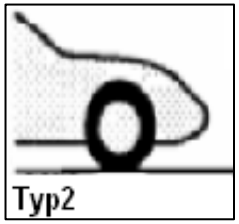
[1] Source: GTR 1/26/2009, pg. 14 A.55

Shape of vehicle front

- five shapes for typical passenger car design

wedge shapes





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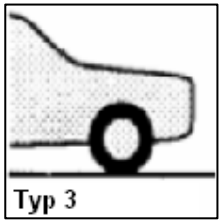

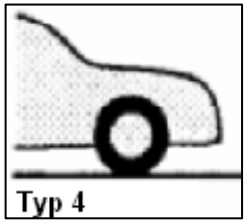

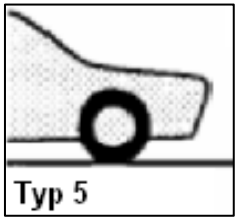

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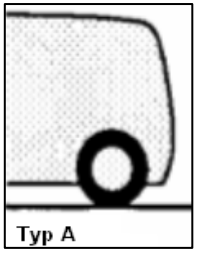
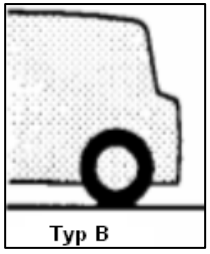
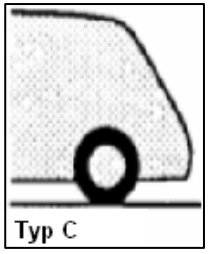
one-box A



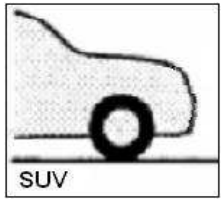
one-box B



one-box C

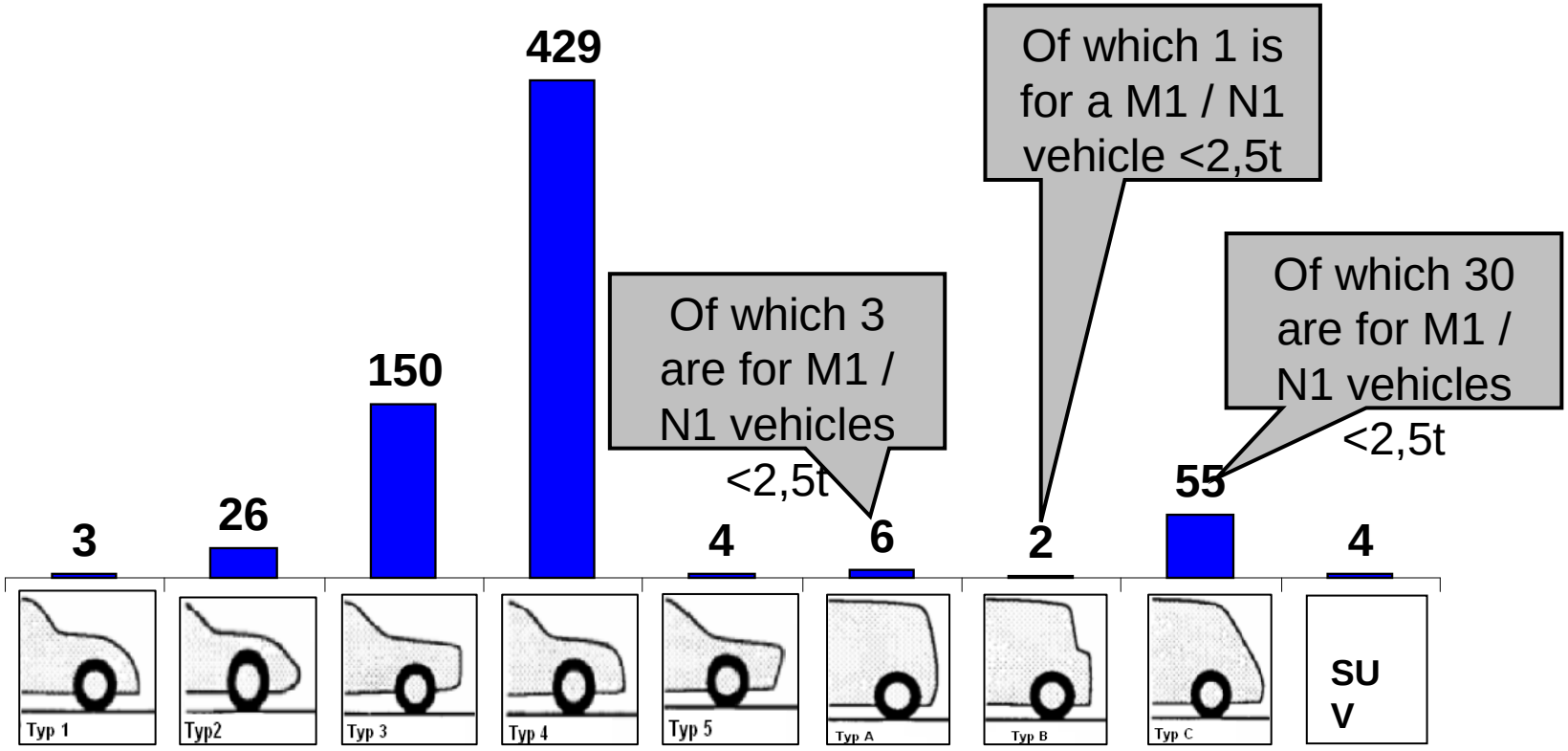


- SUV shape



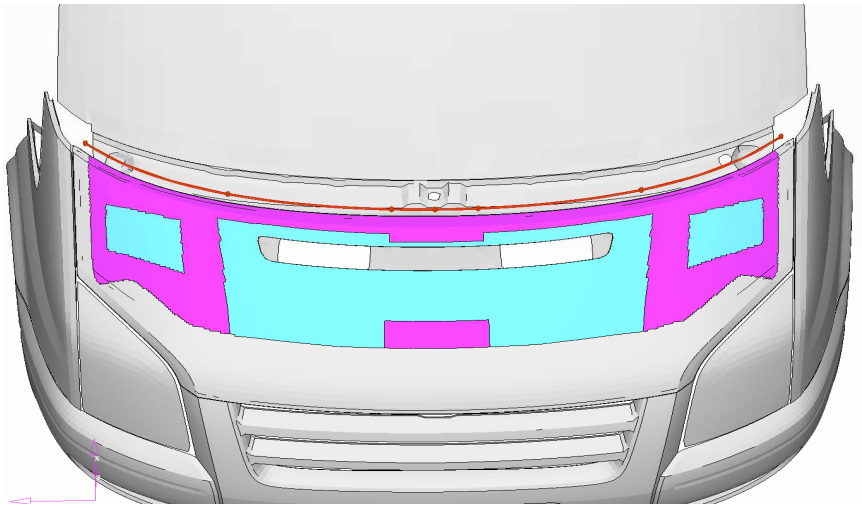
Shape of vehicle front

Vehicle front shape in frontal pedestrian accidents / all vehicle classes (n = 679)



Effect of unharmonised regulatory requirements for global commercial vehicle platforms

Zone distribution on a current Medium Commercial Vehicle



Medium Commercial Vehicles are typically available as N1/N2 (cat 2) as well as M1/M2 (cat 1-1 & cat. 1-2) vehicles. Consequences of the current definitions are:

➔ N1/N2 & M1/M2: okay for Europe → EC-Regulation 78/2009

➔ N1/N2 & M1/M2: ? Rest of the world (even with R-Value being increased to 1100mm)

Section 2 – Geometric parameter

- **R-value of 1000mm was not confirmed based on vehicle fleet analysis at the time of the GTR approval.**
- **In Europe an R-value of 1000mm cuts across the very important segment called Medium Commercial Vehicles (MCV).**
- **Due to this fact the EU decided to change the R-value to 1100mm which provides a level playing field in this segment.**
- **The change does not affect vehicles that were intended to be covered by the regulation from the outset.**

Summary

- **"The test procedures in the GTR are based largely on the classic vehicle shape with a large bonnet." Therefore, the MCV pedestrian kinematics differs from established GTR protocol.**
- **There is no currently available toolbox for MCVs. Tools such as a deployable hoods and sensor technology do not support child head contact times. Package space for energy absorption features or collapsible components are reduced.**
- **As MCVs are typically derived from a commercial vehicle platform, the passenger car variants need to be treated in the same way (add cat. 1-1 to the exempted FFVs).**
- **Since the R-value of 1000mm was not confirmed based on vehicle fleet analysis at the time of the GTR approval, a level playing field was not introduced. 1100mm would meet this requirement and not exempt vehicles that were considered from the outset.**
- **MCV's are an unique vehicle class which offers customers a commercial fuel efficient large cargo vehicle in relation to their actual size.**