



## SESSION 5.1 VEHICLE RESTRAINT SYSTEMS

CONDUCTING ROAD SAFETY AUDITS & APPRAISALS

PRESENTED BY: RTS & AGTT

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### Categories of vehicle restraint systems

#### EN 1317 compliant systems

- Safety Barriers
- Temporary Safety Barriers
- Parapets
- Terminals
- Vehicle Attenuators
- Transitions
- Crash Cushions
- Miscellaneous



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## Vehicle restraint systems: Eurocode EN1317

### Containment levels

- **Containment level** indicates the containment capacity of the system. Each containment level is defined by the crash tests that the road barrier has to withstand.

EN 1317 Containment Levels

Containment Class	EN-1317 Containment Level
Normal	N1
	N2
High	H1
	H2
	H3
Very High	H4a
	H4b



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## Vehicle restraint systems: Eurocode EN1317

### Working width

- **Normalised Working width** is a measure of the deformation of the barrier under impact. It is usually considered as the main parameter to calculate the space needed behind the barrier in order for the system to work properly

Normalised Working Width Classes	Normalised Working Width Value (W), in metres
Wn1	$Wn1 \leq 0,6$
Wn2	$0,6 < Wn2 \leq 0,8$
Wn3	$0,8 < Wn3 \leq 1,0$
Wn4	$1,0 < Wn4 \leq 1,3$
Wn5	$1,3 < Wn5 \leq 1,7$
Wn6	$1,7 < Wn6 \leq 2,1$
Wn7	$2,1 < Wn7 \leq 2,5$
Wn8	$2,5 < Wn8 \leq 3,5$



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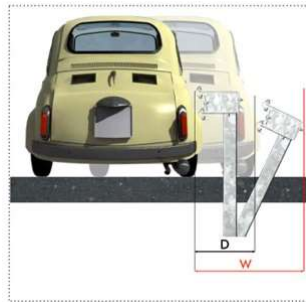


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## Normalised Dynamic Deflection

- **Normalised Dynamic Deflection** is the second parameter to evaluate the deformation of the system under impact and it is calculated as the distance between the traffic face of the system in its initial condition and its maximum displacement. measured in meters.

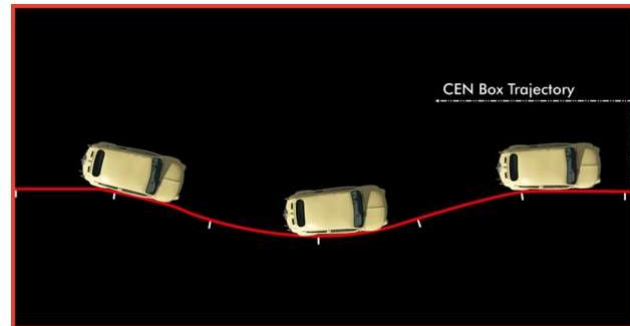


## Impact severity

- **Impact Severity** is an index that assesses the severity of an impact against the tested restraint system based on the results of different parameters. The impact severity is divided in 3 levels, from A to C, according to the growing severity of the consequences of the impact on the car's occupant. The Impact Severity A affords a greater level of safety for the car's occupants than level B and the same for level B compared to level C

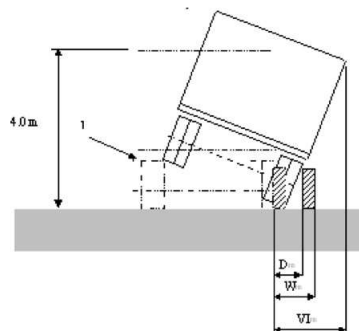
## Redirection

- **Redirection** is the capacity of a restraint system to return a vehicle to the road in a controlled manner following impact against that same restraint system



## Vehicle intrusion

- The vehicle intrusion (VI) is the maximum vehicle deviation dimension of the impacting vehicle from the traffic face of the VRS.



### Restraint system requirements

A restraint system, in order to 'pass' the crash test, needs to fulfil a series of requirements:

- The safety barrier shall contain and redirect the vehicle without complete breakage of the principal longitudinal elements of the system
- Elements of the safety barrier shall not penetrate the passenger compartment of the vehicle
- Deformations of, or intrusion into the passenger compartment that can cause serious damage are not permitted
- The centre of gravity of the vehicle shall not cross the centreline of the deformed system
- The vehicle must not roll over (including rollover of the vehicle onto its side) during or after impact, although rolling pitching and yawing are acceptable
- For tests with Heavy Good Vehicles, no more than 5% of the mass of the ballast shall become detached or be split during the test, until the vehicle comes to rest.
- Following impact into the safety barrier or parapet, the vehicle when bouncing back is not permitted to cross a line parallel to the initial traffic face of the system



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### EN 1317 Crash Test Specifications

EN-1317 CONTAINMENT LEVEL	EN-1317 TEST DESIGNATION	VEHICLE TYPE	TEST CONDITIONS		
			VEHICLE MASS (KG)	SPEED (KM/H)	ANGLE OF IMPACT (°)
N1	TB31	LIGHT 	1,500	80	20
	TB32	LIGHT 	1,500	110	20
N2	TB11	LIGHT 	900	100	20
	TB42	HEAVY, NON-ARTICULATED 	10,000	70	15
H1	TB11	LIGHT 	900	100	20
L1	TB32	LIGHT 	1,500	110	20



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H2	TB51	BUS		13,000	70	20
	TR11	LIGHT		900	100	20
L2	TB32	LIGHT		1,500	110	20
H3	TB61	HEAVY, NON-ARTICULATED		16,000	80	20
	TB11	LIGHT		900	100	20
L3	TB32	LIGHT		1,500	110	20
H4a	TB71	HEAVY, NON-ARTICULATED		30,000	65	20
	TB11	LIGHT		900	100	20
L4a	TB32	LIGHT		1,500	110	20
H4b	TB81	HEAVY, ARTICULATED		38,000	65	20
	TR11	LIGHT		900	100	20
L4b	TB32	LIGHT		1,500	110	20



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## International best practice: illustrations

W steel barriers: semi-flexible  
 Cable barriers: flexible  
 Concrete barriers: rigid  
 End treatment  
 Crash cushions

SOURCE: RSM



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