AFB 20 (2) Roadside Design Safety Subcommittee on International Research Activities

European Summer Workshop

Brussels, Belgium April 11, 2013

Needs:

- Fit with EU national regulations (criteria/parameters)
- Provide comprehensive information to allow proper use of products
- Fix lacks in previous version of the standard
- Include technical evolution of last years
- Less interpretation, more objectivity
- Cope with actual needs of everday life (manufacturers/road authorities)
- Etc..

!!Work In Progress!!

The standard is still under revision:
Target: send to CEN Enquiry by May 2013
Approval estimated by 2014

Main Changes:

a. **New parameters to evaluate/choose performances**

b. **Minimum information in the installation manual**

c. **Re-definition of the durability**

d. **Revision of the concept of modified products & range of products**

e. **Soil characterization in crash test area**

f. **Materials characterization**

g. **Use of Virtual Testing**

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New informations in the CE mark

Before
EN1317-5:2007+A1+A2

Criteria	*Way of Expressing*	*Min-Max*	*Example*
Containment Level	Levels	N2 – H4b	H4b
Impact Severity	Levels	A – C	A
N Working Width	Class (metres)	W1 – W8	W5 (1.4m)
N Vehicle Intrusion	Class (metres)	VI1-VI8	VI5 (1.5m)
N Dynamic Deflection	Metres	0 - ∞	1.2 m
Durability	Declaration	//	Galva EN1461
Res to snow removal	Class	CL1 – CL4	CL2

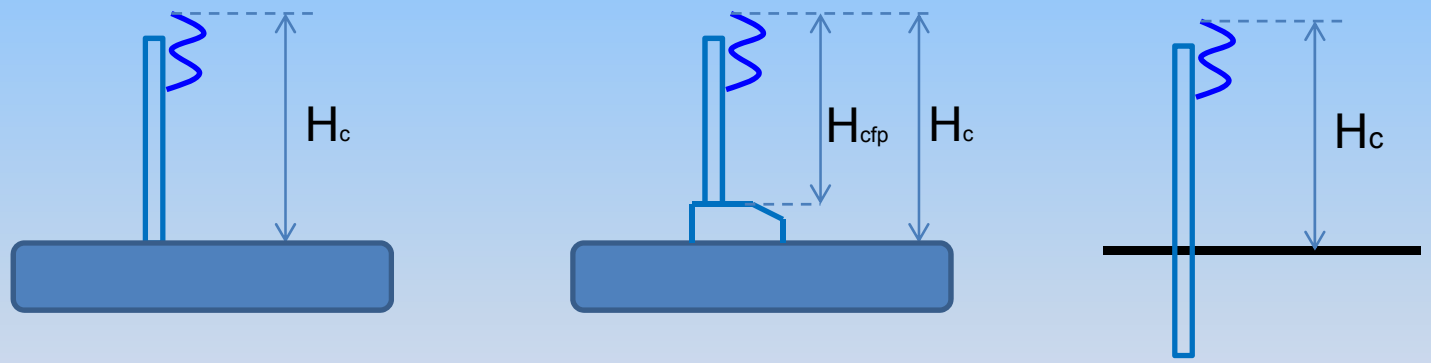
After
EN1317-5:2013

Criteria	*Way of Expressing*	*Min-Max*	*Example*
Containment Level	Levels	N2 – H4b	H4b
Impact Severity	Levels	A – C	A
N Working Width	Level (metres)	W1 – W8	W5 (1.4m)
N Working Width TB11	**Level (metres)**	**WP1-WP8**	**WP2 (0.7m)**
N Vehicle Intrusion	Level (metres)	VI1-VI8	VI5 (1.5m)
N Dynamic Deflection	Metres	0 - ∞	1.2 m
Durability	Declaration	//	Galva EN1461 - **35µm**
Res to snow removal	Category	**CL0**-CL4	CL0

Example for safety barriers

New informations to be provided to customers upon request

- **Height of the barriers:**
  - → Handrail height (H_{hand})
  - → Containment height (H_c)
  - → Handrail height for barriers used on plinth(H_{handfp})
  - → Containment height for barriers used on plinth(H_{cfp})



- **Integrity capability (detached parts >2kg): weight and localization after impact**
- **Characterization of soil: results of push-pull test**

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Minimum informations to be included in the installation manual:

Before

EN1317-5:2007+A1+A2

8 Installation of road restraint systems

The manufacturer shall provide an installation manual for the installation that will achieve the performance declared for the ITT.

Details of maintenance and inspection, as specified in 5.3, shall be included in the Installation Manual.

The use of the system relative to soil and other conditions of installation shall be defined by the manufacturer.

Systems are deemed to conform to the ITT only if they are in accordance with the manufacturer's details for road restraint systems as specified in the Installation Manual for the following:

a) erection;

b) maintenance;

c) inspection;

d) soils.

!! → Only generic guidance to the content of the manual
!! → No uniformity among manufacturers
!! → Sometimes, very poor installation manual has been issued with questionable usefulness

After

EN1317-5:2013

Addition of a dedicated annex (Annex H) with a comprehensive list of minimum information to be included in the manual
+ broadening of the information to be supplied to the customers upon request (Cl 7)

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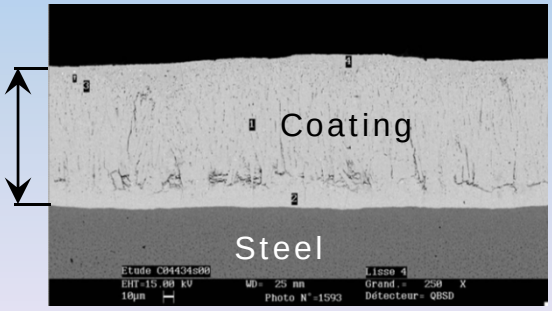
Re-definition of the durability :

→ Durability = declaration from the manufacturer

!! Concept of durability often misunderstood – Durability is intended as the working life of the product, or, in other words, the time during which the product is able to maintain its performances

2 possibilities:

1. Coated material (eg: galvanized steel): declaration of coating composition & coating thickness/mass → Reference to standard [Annex D for list of standards]
2. Uncoated material (eg: Aluminium): declaration of material type & thickness/dimensions → Reference to standard [Annex D for list of standards]



Eg: Galvanized steel

Use of steel galvanized according to EN ISO 1461
Coating thickness: 55 µm
Coating mass: 395 g/m²

Eg: Stainless steel

Use of stainless steel type 1.4462 according to EN 10088-4
Thickness: 2.2 mm

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Revision of the concept of modified products & range of products

Unchanged definition of “modified products”

!!! Despite the common thinking, the procedure for modified products can be used **only** if the information included in the DoP/CE Mark does not change!!! [Can’t have a modified product if such modification changes one of its essential characteristics eg: WW]

New definition from “family of products” to “range of products”

Products derived from an original product (called “parent version”) assessed through complete Type Testing to whose modifications are applied which may be assessed through Simplified Type Testing (eg: reduced crash test matrix, virtual testing, etc..)

Revision of the concept of modified products & range of products

1 Comprehensive procedure established to cover both cases:

- Based on a "risk analysis" and the effect of the modification
- Divided in different classes (3+4) depending on the importance of the modification
- Choice of the "category" guided by flow chart
- Different assessment method depending on the category (from static test to numerical simulations to reduced test matrix)
- Goal of the assessment: answer to the question: "does this modification increase the risks"?
- Modifications/ranges always referred to the original system
- NO EXAMPLES included

Revision of the concept of modified products & range of products

Procedure:

→ Determination of the risks related to the variation in the product
→ Determination of the assessment method:

***Category A**: Modifications to one or more components where their effect would have a negligible influence on the performance of the VRS which can be determined by simple calculation or engineering evaluation.*
A –calculation and engineer evaluation to prove out that modifications do not increase risks presented in A.4.

***Category B**: Modifications to one or more components where their effects on the performance of the VRS can be determined by static analysis or dynamic analysis of the product, modified component or only a small part of the item*
B1 – Detailed Engineering Calculations to prove out that modifications do not increase risks presented in A.4.
B2 – Modified component loading test, either static or dynamic depending on the case to assess if the modifications increase the risks presented in A.4..
B3 – Vehicle Impact Simulation (CME) following the provisions of Annex L to assess if the modifications increase the risks presented in A.4..

***Category C**: Modifications in excess of A or B*
In category C at least one of the full scale vehicle impact tests of the full type testing shall be repeated with the changed version. If all of the tests of full type testing are repeated the changed version becomes a new product and it may be used as a parent for further changes.

→ Verification of the results by a third party (eg: certification bodies)

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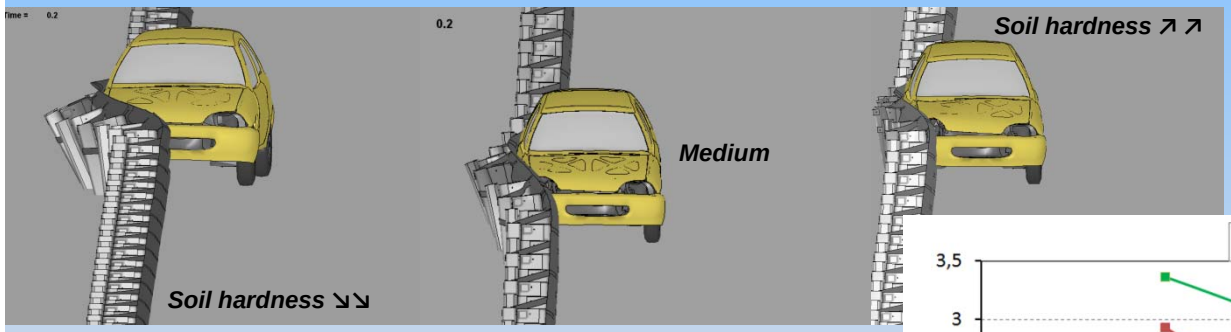
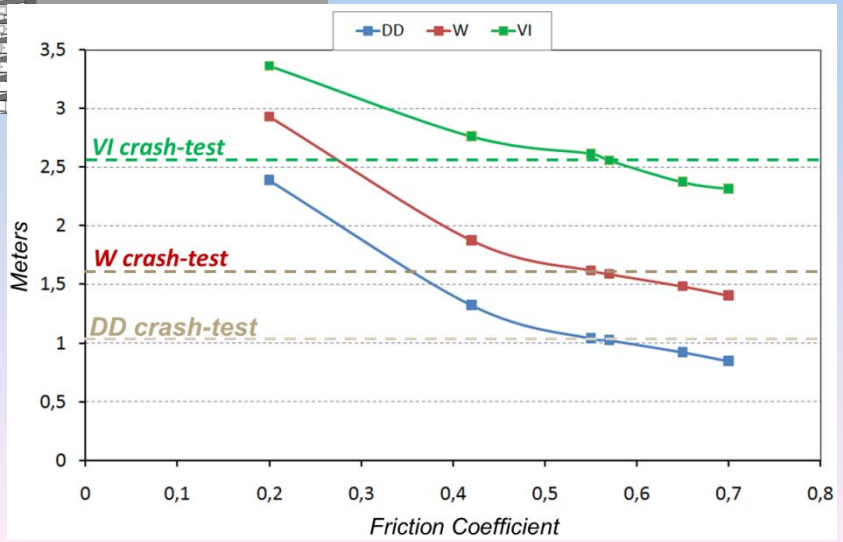
Environment characterization in crash test area

- Performance of barriers may be influenced by the soil where they're installed and/or by the pavement where they "slide"
- In real life experience barriers are used in a wide range of soils/pavements
- Need to characterise the soil/pavement in the crash test area



Example of possible effects on "post+rail" systems

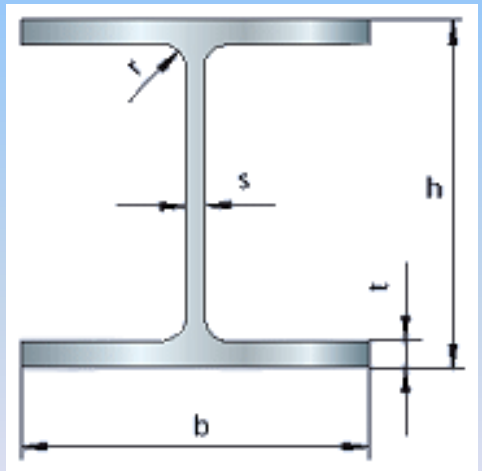


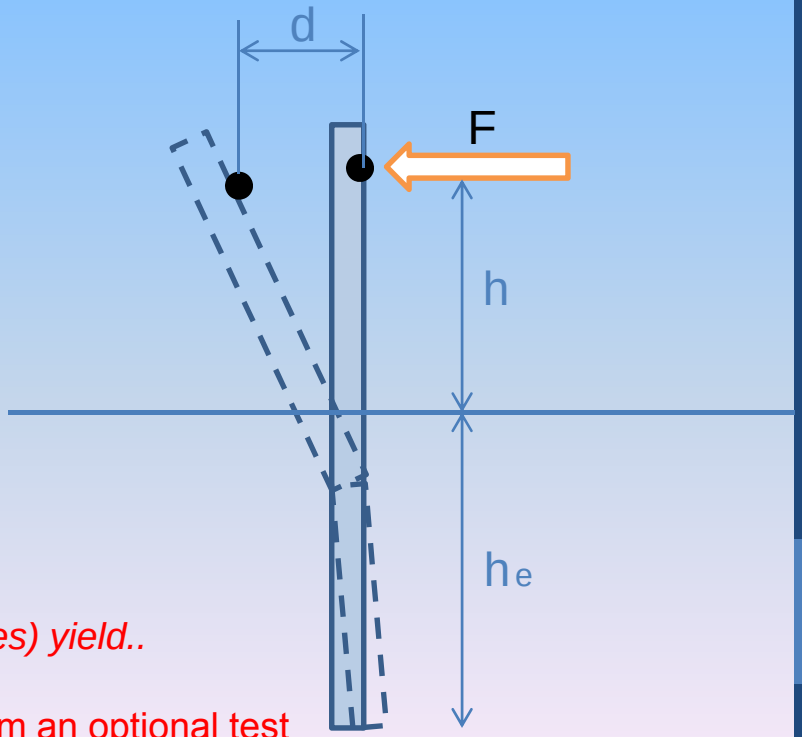
Example of possible effects on "sliding" systems

Soil characterization in crash test area

A test method using a “dummy post” has been identified to characterize the soil in the crash test: the information will be joint to the crash test report and to the information provided by the manufacturer

- → *Post defined: HE120B S355JR*
- → *Horizontal force applied perpendicular to the barrier line*
- → *Height of application of the force: h = 1.0 m*
- → *Embedment of the post: h_e = 1.0 m*
- → *4 Classes identified (from “rigid” to “soft”)*





The “dummy post” will not (in the majority of the cases) yield..
GOAL: Characterize the soil, not the post
Anyway, manufacturers have the possibility to perform an optional test on the post of the system to characterise its behaviour

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Materials characterization

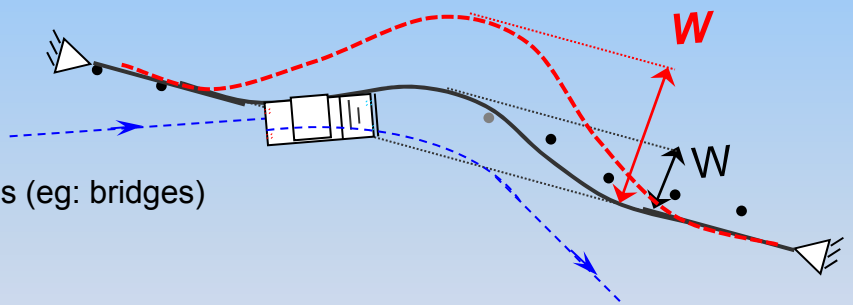
→ Property of materials defined by ranges: sometimes very wide or without upper limit defined (due to their present classification for use in structural applications)

[eg: yield limit of steel S235JR: min=235MPa, max=ND]

Risks of discrepancies between
- materials used for testing and
- materials used for production + their properties during the life-time of the system (degradation)

Possible consequences*:

- Difference of performances
- Potential loss of restraint capacity
- Increase of stresses transmitted to structures (eg: bridges)
- Increase of ASI
- Others



It is important the characterisation of the materials used for the crash test and it's important to ensure consistency with the systems installed on the road

*Amplitude of such may vary from case to case

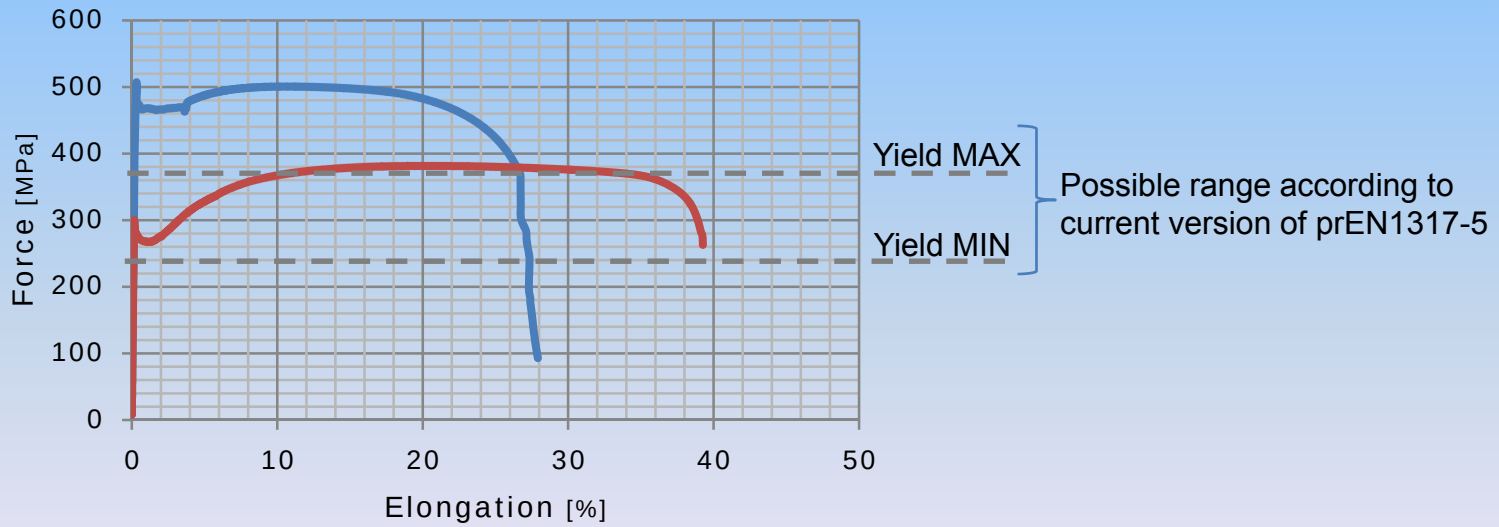
Materials characterization

Current version of the prEN1317-5:2013:

[Example for steel]

- Characterization of the materials used for the crash test through tensile tests [main components]
- Limit the width of the maximum ranges for the materials (Yield & Strenght)
  →MIN/MAX window defined by the producer → Δ130 Mpa

Example of possible differences among the "same" material
Steel – S235JR



Materials characterization

Current version of the prEN1317-5:2013:

[Example for concrete]

- Characterization of the materials used for the crash test through compression tests and appropriate class of resistance depending on the results
- Characterization/assessment of other specificities
  Eg: aggregates, durability, etc..

Compressive strength class	Minimum characteristic cylinder strength $f_{ck,cyl}$ N/mm^2	Minimum characteristic cube strength $f_{ck,cube}$ N/mm^2
C8/10	8	10
C12/15	12	15
C16/20	16	20
C20/25	20	25
C25/30	25	30
C30/37	30	37
C35/45	35	45
C40/50	40	50
C45/55	45	55
C50/60	50	60
C55/67	55	67
C60/75	60	75
C70/85	70	85
C80/95	80	95
C90/105	90	105
C100/115	100	115

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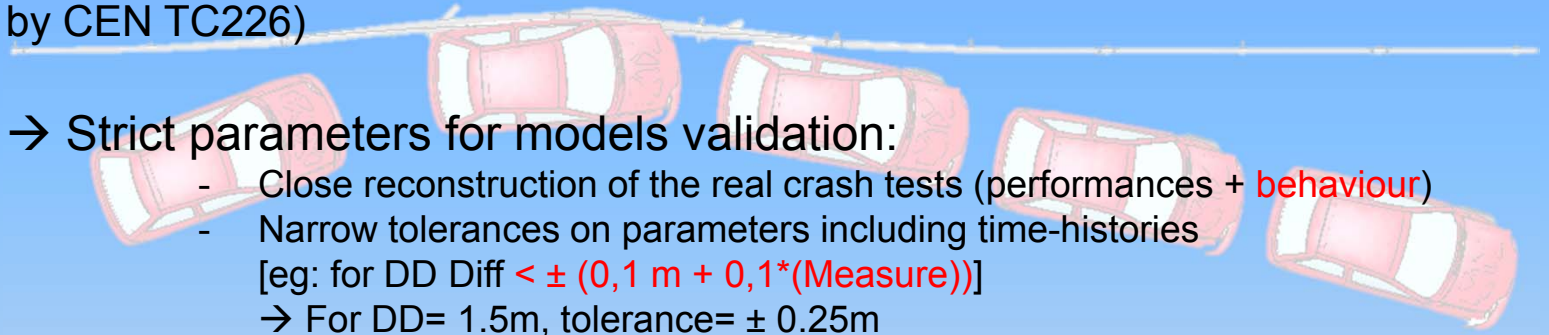
Use of Computational Mechanics / Virtual Testing

Included in the Annex L of the standard the guidelines for crash test calibration (improved version of the TR 16303 written in 2011 by CME* group and approved by CEN TC226)

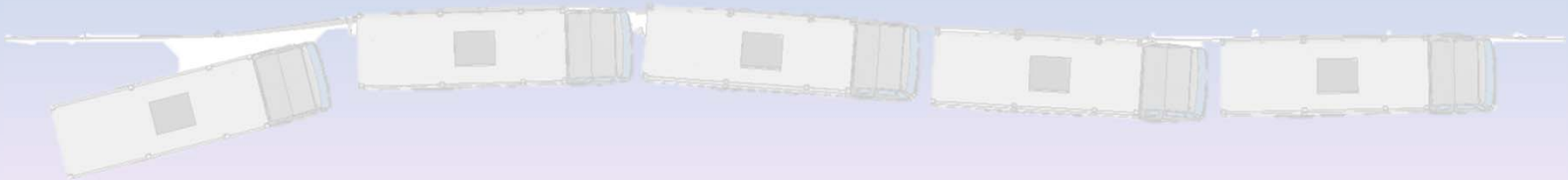


→ Strict parameters for models validation:

- Close reconstruction of the real crash tests (performances + behaviour)
- Narrow tolerances on parameters including time-histories
  [eg: for DD Diff < ± (0,1 m + 0,1*(Measure))]
  → For DD= 1.5m, tolerance= ± 0.25m
- Engineering judgement & competence on VT of crucial importance
  Need of high VT competence to review/prepare VT reports

→ Requirements for the subject who carry on the simulation

- Based on automotive requirements for VT
- Adequate software to reproduce crash analysis
- Competent people working on the simulations



*CME - Computational Mechanics Europe:
Informal group of EU experts in Computational Mechanics – Now changed into Task Group 5 of CEN TC226/WG1

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Non-profit association founded in 1975, made by 32 Member States and ricongised according to Directive 98/34/EC for preparation of European Standards

Thanks for the attention

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