

The use of computer simulations for the development and the European certification of Road Restraint Systems

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Assessment of Road Safety Systems



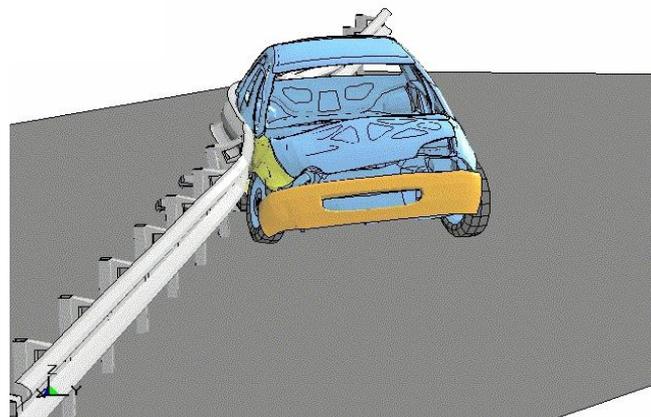
Combined Use of Various Means of Evaluation

crash tests

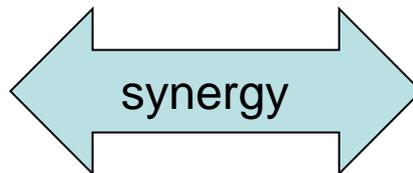


- Road side barriers
- Crash cushions
- Support structures
- Security bollards
- etc....

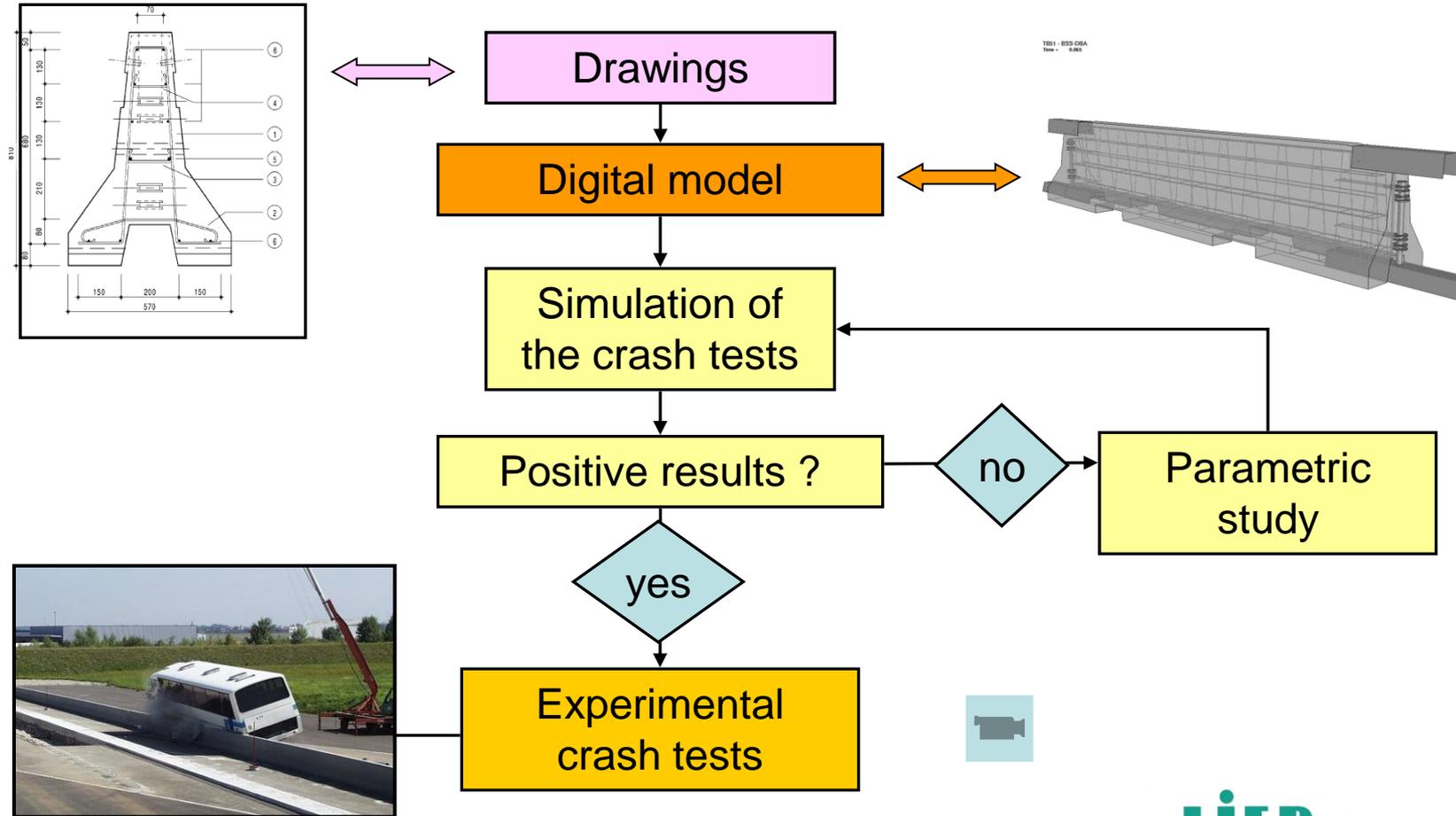
computer simulations



- New product developments
- Optimisation of existing products
- Certification of modified products
- Accident reconstructions



New product development studies



Sofia, Bulgaria

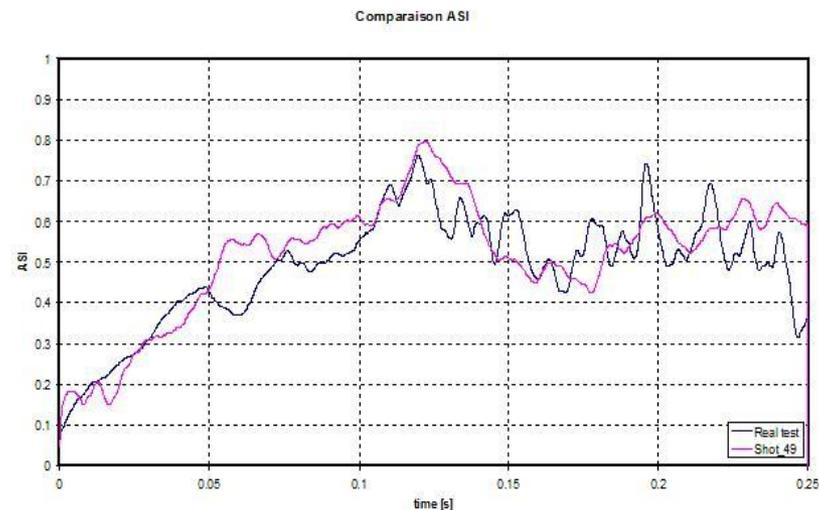
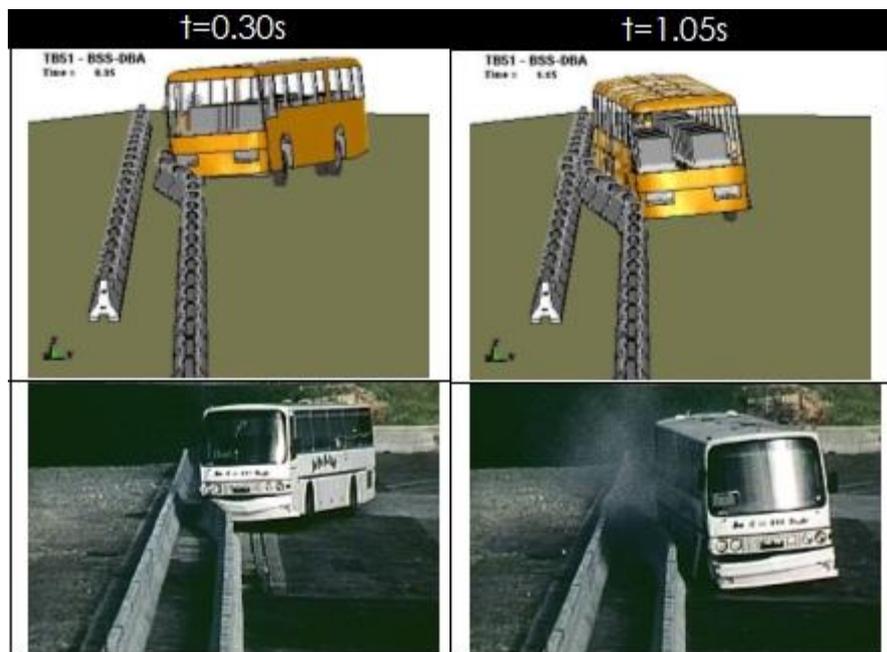
Studies on already tested devices with computed mechanics

several objectives :

- product optimization (performance, weight,...)
- performance assessment in different use conditions than the standard conditions : impact speeds, angles, ground conditions,...
- evaluation of product modifications

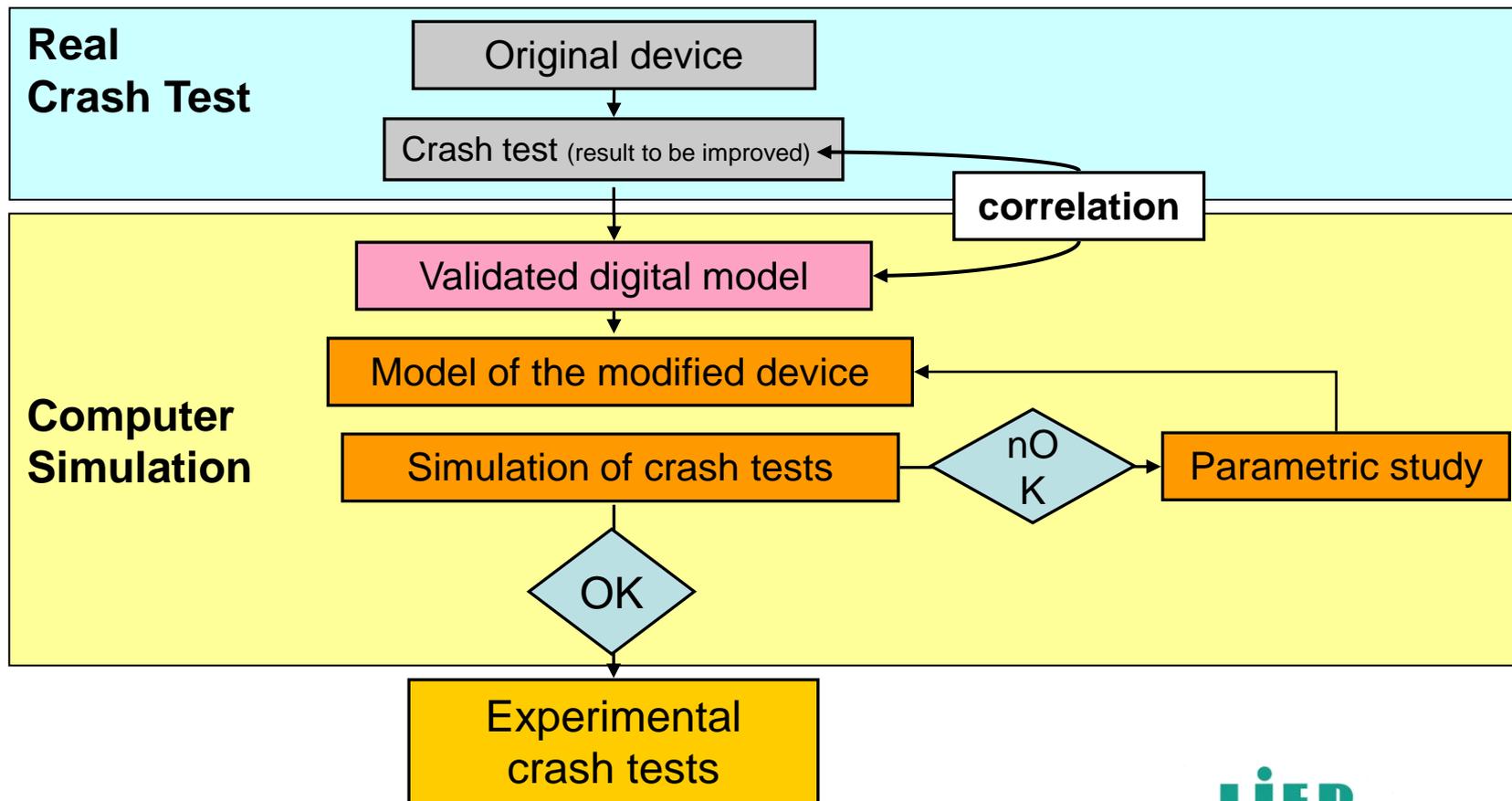
Studies on already tested devices

Need for validated numerical models based on simulations correlated with real crash tests



Studies on already tested devices

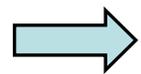
RRS optimization after first crash tests



CE Certificatin of a modified product



When a CE marked product is modified,

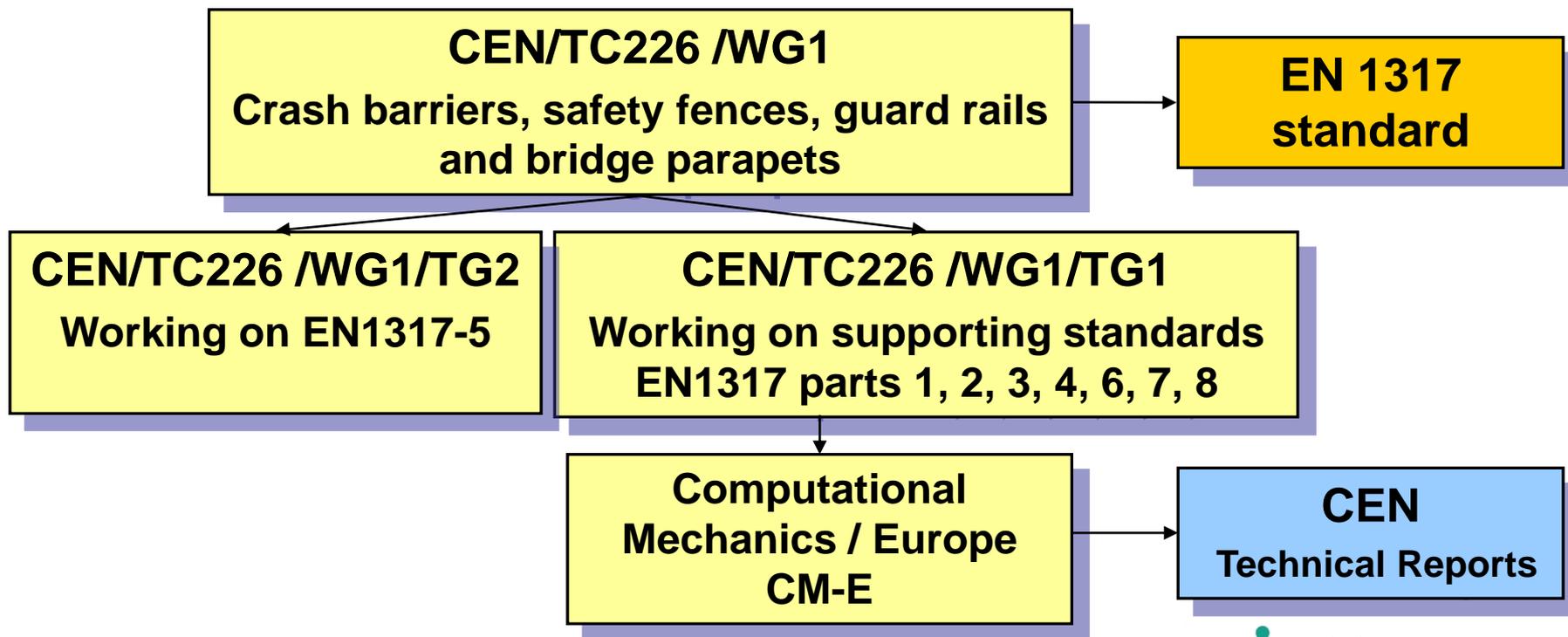


EN 1317 – Road Restraint Systems standard
allows the certification with computer simulation of the
modified product (if modifications are moderate)

CE Certification of a modified product



CEN Organisation



CE Certification of a modified product



CEN Technical Reports 16303

Road restraint systems – Guidelines for computational mechanics of crash testing against vehicle restraint system

The focus of these guidelines will be on establishing **accuracy, credibility and confidence** in the results of crash test simulations to roadside safety devices through the definition of **procedures for verification and validation** in roadside safety application.

Part 1: Common reference information and reporting

Part 2: Vehicle Modelling and Verification

Part 3: Test Item Modelling and Verification

Part 4: Validation Procedures

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Part 1: Common reference information and reporting

General considerations on the modelling techniques

Finite Element methodologies and rigid body (or multi-body) dynamic codes can be used in the simulation of crash scenario. Due to different requirements and different technical approaches in modelling the two methods need a specific knowledge in the use of the software.

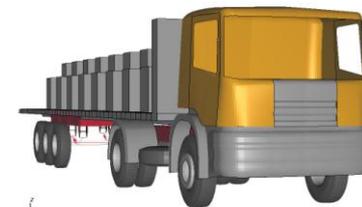
These guidelines are in any case applicable for use on software where the background knowledge and experience is well-known. The software should be able to provide the tools that the user needs to correctly replicate the full scale test and obtain consistent results.

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Part 2: Vehicle Modelling and Verification

- General considerations on the modelling techniques of a vehicle
- Step by step development of a vehicle for crash test analysis
- Validation procedures of a vehicle for crash test analysis
- Annex A : Recommendations for the mesh of Finite Elements vehicle models addressed to crash simulations
- Annex B : Recommendations and criteria for multi body vehicle models addressed to crash simulations
- Annex C : Test methodology
- Annex D : Phenomena importance ranking table for vehicles
- Annex E : Phenomena importance ranking table for test item and vehicle interaction

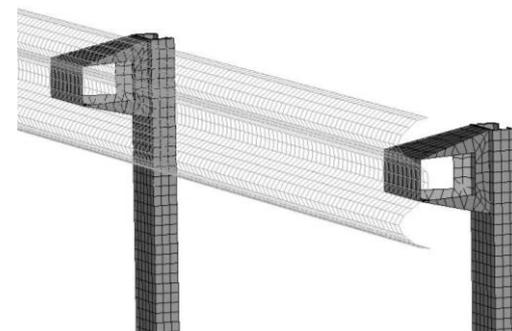


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Part 3: Test Item Modelling and Verification

- General considerations on the modelling technique
- VRS model
- Verification of the model
- Collection Data
- Annex A : Recommendations for the mesh of Finite Elements VRS models addressed to crash simulations
- Annex B : Recommendations for the development of Multi-Body VRS models addressed to crash simulations
- Annex C : Phenomena importance ranking table for test items



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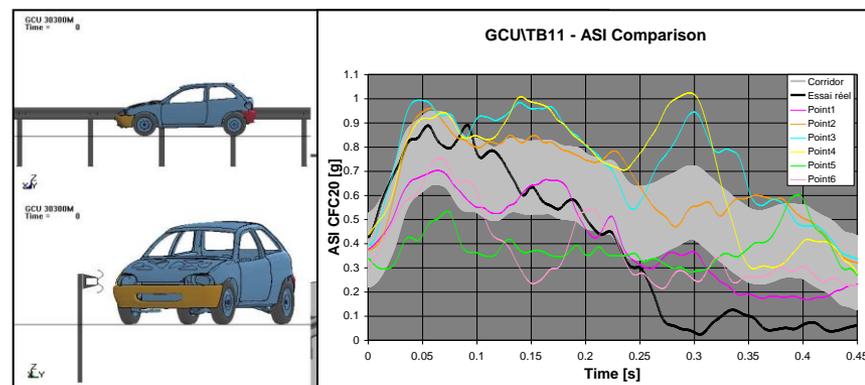


Part 4: Validation Procedures

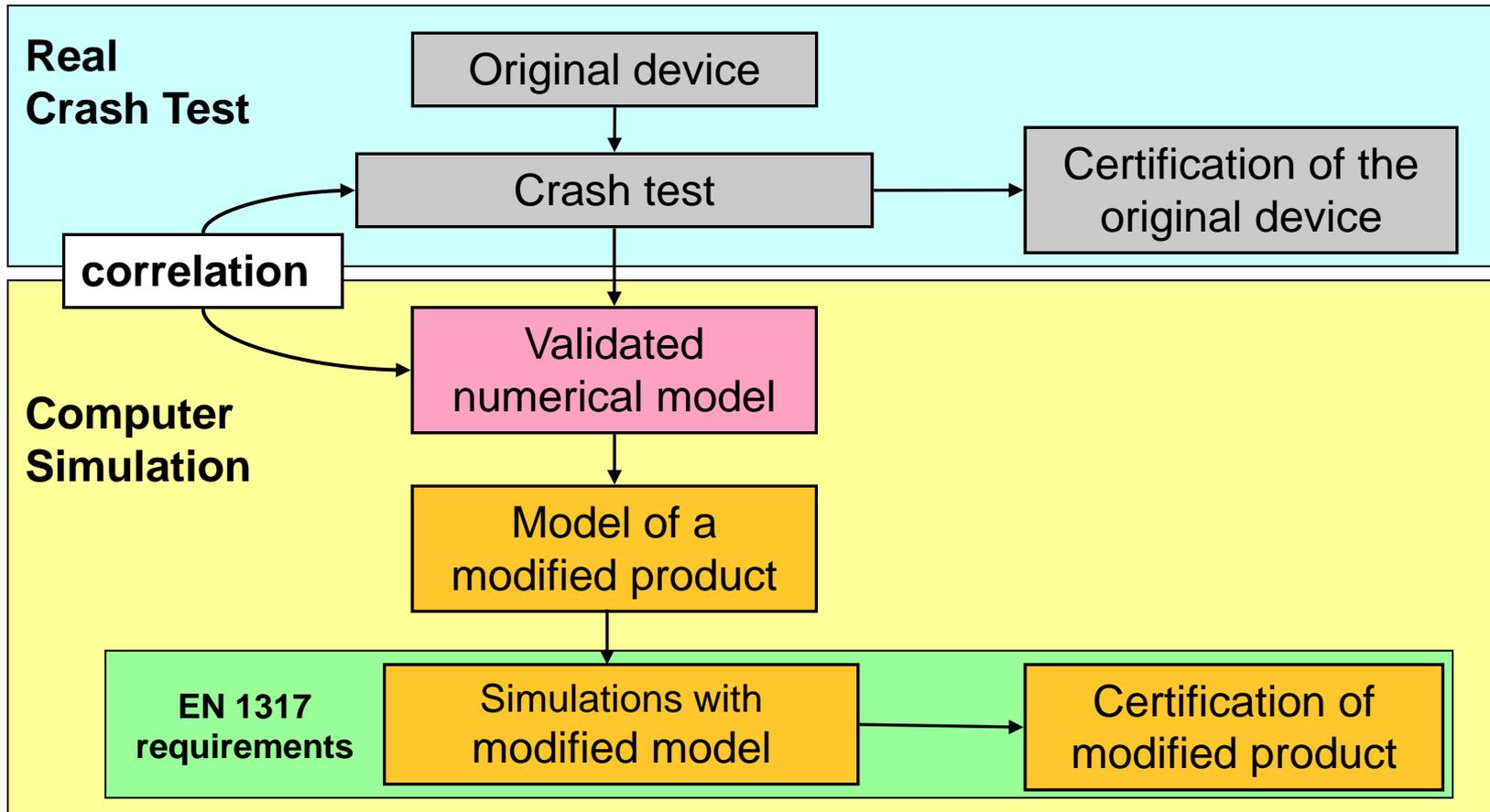
Comparison tables

<u>Critical behaviour</u>	<u>type</u>	<u>Comparison: Yes / No</u>
Containment	Required	Yes/no
Rollover	Required	Yes/no
Exit box for barrier	Required	Yes/no (1317-2-3-4 criteria)
Wheel trajectory	Required	Yes/no (1317-2-3-4 criteria)
Redirection zone for crash cushion and terminals	Required	Yes/no (1317-3-4 criteria)
Suspension failure	Informative	Yes/no
Failure of longitudinal elements	Required	Yes/no
Dynamic deflection for barrier	Required	Yes/no (Paragraph 4.1.1 criteria)
Vehicle intrusion	Required	Yes/no (Paragraph 4.1.2 criteria)
Lateral displacements for crash cushion and terminals	Required	Yes/no (Paragraph 4.1.3 criteria)
Penetration of parts inside the vehicle.	Required	Yes/no
comparison between final shapes of test article	Informative	Yes/no (Paragraph 4.1.4 criteria)

<u>Criteria</u>	<u>Type</u>	<u>Comparison: Yes / No</u>
ASI	Required	Yes/no (Paragraph 4.2.1 criteria)
Thiv	Required	Yes/no (Paragraph 4.2.1 criteria)
Time histories	Required	Yes/no (Paragraph 4.2.2 criteria)



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