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BSI Standards Publication

Road restraint system

Part 10: Assessment methods and design guidelines for transitions and terminal and crashcushion connection — Transitions

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National foreword

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The UK participation in its preparation was entrusted to Technical Committee B/509/1, Road restraint systems.

A list of organizations represented on this committee can be obtained on request to its committee manager.

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Dispositifs de retenue routiers ¿ Méthodes d'évaluation et lignes directrices de conception pour les raccordements et les raccordements d'extrémités de file et d'atténuateur de choc

Rückhaltesysteme an Straßen - Prüfmethoden und Design-Richtlinien für Übergangskonstruktionen und Anbindungen von Anpralldämpfern und von Anfangs- und Endkonstruktionen an Schutzeinrichtungen

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European foreword

This document (CEN/TR 1317-10:2023) has been prepared by Technical Committee CEN/TC 226 “Road equipment”, the secretariat of which is held by AFNOR.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes ENV 1317-4:2001 in conjunction with CEN/TS 1317-7:2023, CEN/TS 1317-9:2023.

This document is read in conjunction with EN 1317-1:2010, EN 1317-2:2010, EN 1317-3:2010, EN 1317-5:2007+A2:2012, EN 16303:2020 and CEN/TS 1317-7:2023, CEN/TS 1317-9:2023, CEN/TS 17342:2019.

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Introduction

In the design of roads, safety problems may arise in the connection between two different safety barriers having consistent difference in design and/or in performance. Transitions are required to provide a smooth and safe change from one safety barrier to another.

If the two safety barriers are not connected or if the connection is not strong enough to resist the forces under impact and to transfer these forces at least from the weaker to the stronger safety barrier, an impact on the connection, or its vicinity, may represent an undue risk. A similar risk can arise if the change from one safety barrier to the other is not gradual enough.

A special type of transition is the connection of two parts of the same barrier separated by a span with particular requirements that cannot be covered by a piece of the same barrier. For example, the barrier expansion joint corresponding to a bridge deck expansion joint with large movement. In this document such connections are called barrier interruptions.

The performances of transitions can be ascertained by tests, with the test methods and the acceptance criteria similar to those specified for safety barriers in EN 1317-2:2010. Due to the increasing number of different safety barrier types, which leads to a high number of barrier combinations for which transitions are needed, efforts have been made to propose simplified assessment methods for some types of transition that can be assessed more easily.

For these reasons, different Countries have established different assessment methods for transitions or, in some cases, simple design rules. Such different assessment methods and design rules cannot be considered equivalent but, if correctly applied, can allow the development of performing transitions.

Some similar problems might arise in the connection of crash cushions with barriers and in the connections of terminals with barriers different from the one connected in the terminal TT installation. As for the transitions, also these connections provide a continuous passage to and from the barrier.

A barrier-to-barrier transition should have, all along its length, at least the same containment category value as the lowest value containment level of the connected barriers (as defined in EN 1317-2:2010). On the contrary this is not required for a barrier-terminal system tested in accordance with FprCEN/TS 1317-7:2023. The terminal is always connected at the beginning (or at the end) of a barrier whose performance is measured at one third of the test installation length. The main requirement of the terminal-to-barrier connection is to carry the axial forces of barrier end anchorage and the push of the terminal. Furthermore, the surface of the connection that can come in contact with the vehicles should be continuous and smooth. Similar considerations apply to the connections of crash cushions with barriers.

For all these reasons, connections of terminals and crash cushions to barrier are not denominated transitions but terminal connection-transitions.

Due to specific local conditions on national and local road networks there might be a need to connect safety barrier(s) or cushions to other infrastructures. Road authorities can see the need to require specific connections that in part, or as a whole, can be assessed according to the principles of the methods in this document. Every connection scenario (e.g. to tunnel portal, bridge pier or a sign gantry pillar) should be analysed individually. In general, the testing and assessment methods describe herein can have a wider application than the one specified in the scope of this document.

This document is a guideline for assessment methods and design rules that are not equivalent, but are good practice for designing performing transitions and terminal connections.

This document aims to propose a set of assessment methods that might help to move closer to the harmonization of assessment methods in different countries.

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1 Scope

This document defines assessment methods for transitions, considered as the linkage between safety barriers or between safety barriers and removable barrier sections.

This document also defines assessment methods for connection-transitions to terminals and crash cushions.

Road Authorities and regulatory authorities are free to determine assessment methods, values, measurements etc. and to fix the details of the requirements.

Assessment methods and design rules can also be utilized in connection with the evaluation of changed versions.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 1317-1:2010, *Road restraint systems - Part 1: Terminology and general criteria for test methods*

EN 1317-2:2010, *Road restraint systems - Part 2: Performance classes, impact test acceptance criteria and test methods for safety barriers including vehicle parapets*

EN 1317-3:2010, *Road restraint systems - Part 3: Performance classes, impact test acceptance criteria and test methods for crash cushions*

3 Terms and definitions

For the purposes of this document, definitions given in EN 1317-1:2010, EN 1317-2:2010, EN 1317-3:2010 as well as the following terms and definition apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at https://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp

3.1
transition
device connecting two safety barriers of different design and/or performance assessed in accordance with this document

3.2
transition element
transition used to join two similar safety barriers

Note 1 to entry: Such transition may be a simple joint and its length may be 0.

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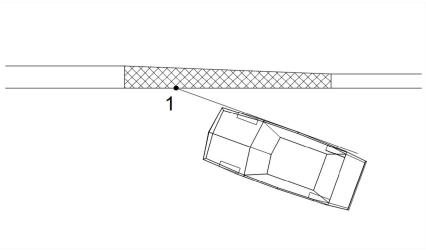
3.3
length of a transition
distance between the start and end points of the transition

Note 1 to entry: A transition's start and end points are located where a safety barrier starts to have changes in its standard design pattern that exists over the complete length of the safety barrier. Such changes could be post distance spacing, changes in the material or in its composition, additional/other elements such as spacers, different/additional beams, height, width, etc.

3.4
severity test
initial type test carried out with a passenger car, which focuses on measuring the severity of the impact

Note 1 to entry: These are the tests listed in the column labelled "impact severity level ASI-THIV" in EN 1317-2:2010, Table 6.3.5

3.5
impact point
point of intersection of a straight line parallel to the vehicle centreline, at the maximum width of the vehicle, with the traffic side of the transition, or of the safety barrier (see Figure 1)



Key
1 Impact point

Figure 1 — Impact point

3.6
critical impact point
CIP
impact point identified to reasonably represent the worst case for testing the transition

Note 1 to entry: An impact point can be critical from several points of view, e.g. containment, deflection or severity. Hence, critical impact points may be different from test to test.

3.7
containment test
vehicle impact test providing the highest impact momentum among tests specified for the chosen containment level in accordance with EN 1317-2:2010, Table 2

Note 1 to entry: The term "containment category" used in this document has the same meaning as the term "containment level" used in EN 1317-2:2010

3.8
full scale test
real crash test performed with a physical vehicle and a physical test item

Note 1 to entry: See also EN 1317-1:2010 and EN 1317-2:2010

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