Vägutrustning – Skyddsanordningar –
Del 4: Vägräckesändar och övergångar –
Prestandakrav vid kollisions-provning samt
provningsmetoder

Road restraint systems –
Part 4: Performance classes, impact test
acceptance criteria and test methods for
terminals and transitions of safety barriers


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Road restraint systems - Part 4: Performance classes, impact test acceptance criteria and test methods for terminals and transitions of safety barriers

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Foreword

This European Prestandard has been prepared by Technical Committee CEN/TC 226 "Road equipment", the secretariat of which is held by AFNOR.

This European Prestandard under the general title “Road restraint systems” consists of the following Parts:

- Part 1: Terminology and general criteria for test methods;
- Part 2: Performance classes, impact test acceptance criteria and test methods for safety barriers;
- Part 3: Performance classes, impact test acceptance criteria and test methods for crash cushions;

The following Parts are not yet available but in course of preparation:

- Part 4: Performance classes, impact test acceptance criteria and test methods for terminals and transitions of safety barriers;
- Part 5: Product requirements, durability and evaluation of conformity;
- Part 6: Pedestrian restraint systems, pedestrian parapet.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to announce this European Prestandard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.
Introduction

The design purpose of safety barriers installed on roads is to contain or to contain and redirect errant vehicles that either leave the carriage way or are likely to encroach into the path of oncoming vehicles. EN 1317-2 deals with the impact performance of a safety barrier. However, difficulties arise in providing adequate safe terminations to the barrier. Consequently, terminals, which are defined as the beginning and/or end treatment of a safety barrier, are required to have specified impact performances. A terminal provides a smooth transition from no containment to the containment of the barrier, without introducing additional hazard for head on impacts.

Problems may also arise in the connection between two different safety barriers having consistent difference in stiffness. Transitions may be needed, that are required to have specified impact performances.

The objective of this prestandard is to lead to the harmonization of current National Regulations, to categorize them into performance classes and help develop new systems and improve existing systems.

This Part of the prestandard defines the classes of performance required of terminals and transitions for the restraint.

The impact severity of vehicles in collision with terminals and transitions is rated by the indices acceleration severity index (ASI), theoretical head impact velocity (THIV) and post-impact head deceleration (PHD).

Attention is drawn to the fact that the acceptance of a terminal or transition will require the successful completion of a series of tests (see Tables 1 to 8).

To ensure proper use of this Part of this series, it is essential to consider all the other relevant documents within the series. Additionally, the quality of manufacture, durability, satisfactory roadside installation and ease of maintenance are important safety criteria.

1 Scope

This European Prestandard specifies requirements for the performance of terminals and transitions. It defines performance classes and acceptance criteria for impact tests.

2 Normative references

This European Prestandard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text, and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Prestandard only when incorporated in it by amendments or revisions. For undated references the latest edition of the publication referred to applies (including amendments).

EN 1317-2, Road Restraint Systems - Part 2: Performance classes, impact test acceptance criteria and test methods for safety barriers.

ISO 6487, Road vehicles - Measurement techniques in impact tests - Instrumentation.

ISO 10392, Road vehicles with two axles - Determination of centre of gravity.

3 Abbreviations

ASI    Acceleration severity index;
THIV   Theoretical head impact velocity;
PHD    Post-impact head deceleration;
VCDI   Vehicle cockpit deformation index;
U      Terminal on upstream position;
D      Terminal on downstream position;
A      Terminal on upstream as well as downstream position;
L      Length of terminal or transition.

Impact speed classes abbreviations are:

<table>
<thead>
<tr>
<th>Speed</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>80</td>
<td>80 km/h</td>
</tr>
<tr>
<td>100</td>
<td>100 km/h</td>
</tr>
<tr>
<td>110</td>
<td>110 km/h</td>
</tr>
</tbody>
</table>

Test vehicle mass codes are:

<table>
<thead>
<tr>
<th>Mass</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>900</td>
<td>1</td>
</tr>
<tr>
<td>1300</td>
<td>2</td>
</tr>
<tr>
<td>1500</td>
<td>3</td>
</tr>
</tbody>
</table>

4 Terms and definitions

4.1 terminal
treatment of the beginning and/or the end of a safety barrier

NOTE In addition it can provide an anchorage for the barrier system. The length L of a terminal is the longitudinal distance from the nose to the end of the terminal, i.e. to the beginning of the barrier. The length of a terminal is shown diagrammatically in Figure 1 for two alternative shapes.
Key
A   Barrier
B   Terminal
3   Side view
4   Plan view – a)
5   Plan view – b)

Figure 1 – Length of a Terminal with two alternative shapes (a and b)

4.2 system type tested terminal
multiple performance product that can be assembled to form different models from the same set of components, to obtain different performances, with the same working mechanism for the system and for its components

4.3 transition
so that interface between two safety barriers of different cross section or different lateral stiffness, the containment is continuous

NOTE 1 The purpose of transitions is to provide a gradual change from the first to the second barrier, to prevent the hazards of an abrupt variation. A transition is designed to connect two specified barriers. The
length of a transition is the distance between the ends of the two barriers connected by the transition, as shown schematically in Figure 2.

Key
A Barrier B
B Transition
C Barrier A

Figure 2 – Length of a Transition

NOTE 2 The junction between two barriers having the same cross-section and the same material, and differing in the working width no more than one class, is not be considered a transition.

4.4 removable barrier section
part of barrier which allow for quick removal and reinstallation for emergency reasons provision may be required for barrier sections to be temporarily opened, but yet having containment performances

NOTE If such a barrier has a length not exceeding 40 m, it is be considered to be a special transition.

5 Terminals

5.1 Performance classes
Terminals shall be tested in accordance with Table 1. The length of the terminal shall conform to the design specification and be installed together with sufficient length of safety barrier so as to demonstrate the performance of the terminal.

A successfully tested installation at a given performance class, shall normally be considered as having met conditions of lower classes.

NOTE The acceptance tests required for each terminal performance class are reported in Table 1. These are classified according to an increasing containment capacity.
### Table 1 - Terminals: vehicle impact test criteria and performance classes

<table>
<thead>
<tr>
<th>Performance class</th>
<th>Location</th>
<th>Tests</th>
</tr>
</thead>
</table>
|                   |          | Approach | Approach reference | Vehicle mass (kg) | Velocity (km/h) | Test code ¹)
| P1                | A        | head on nose 1/4 offset to roadside | 2 | 900 | 80 | TT 2.1.80 |
|                   | A        | head on nose 1/4 offset to roadside | 2 | 900 | 100 | TT 2.1.100 |
|                   | D        | side, 15° 2/3 L | 4 | 1 300 | 80 | TT 4.2.80 |
|                   | D        | side, 165° 1/2 L | 5 | 900 | 80 | TT 5.1.80 |
| P2                | A        | head on nose 1/4 offset to roadside | 2 | 900 | 100 | TT 2.1.100 |
|                   | U        | head on centre | 1 | 1 300 | 100 | TT 1.2.100 |
|                   | U        | side, 15° 2/3 L | 4 | 1 300 | 100 | TT 4.2.100 |
|                   | D        | side, 165° 1/2 L | 5 | 900 | 100 | TT 5.1.100 |
| P3                | A        | head on nose 1/4 offset to roadside | 2 | 900 | 100 | TT 2.1.100 |
|                   | U        | head on centre | 1 | 1 500 | 110 | TT 1.3.110 |
|                   | U        | side, 15° 2/3 L | 4 | 1 500 | 110 | TT 4.3.110 |
|                   | D        | side, 165° 1/2 L | 5 | 900 | 100 | TT 5.1.100 |
| P4                | A        | head on nose 1/4 offset to roadside | 2 | 900 | 100 | TT 2.1.100 |
|                   | U        | head on centre | 1 | 1 500 | 110 | TT 1.3.110 |
|                   | U        | side, 15° 2/3 L | 4 | 1 500 | 110 | TT 4.3.110 |
|                   | D        | side, 165° 1/2 L | 5 | 900 | 100 | TT 5.1.100 |

¹) Test code notation is as follows:

<table>
<thead>
<tr>
<th>TT</th>
<th>1</th>
<th>2</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test of Terminal</td>
<td>Approach</td>
<td>Test vehicle mass</td>
<td>Impact speed</td>
</tr>
</tbody>
</table>

NOTE 1  To avoid ambiguity, the numbering of the approach path in Table 1 and in Figure 3 is the same as in EN 1317-3: approach 3 is present in EN 1317-3 as test 3 for crash cushions, but it is not required for Terminals.

NOTE 2  The test with approach 5 is not run for a flared terminal when, at the relevant impact point, the angle (α) of the vehicle path to the traffic face of the terminal is less than 5°.
Key

1. Approach 1
2. Approach 2
3. Approach 4
4. Approach 5
5. Approach 5

1. Barrier
2. Terminal
3. 1/2 vehicle width
4. 1/4 vehicle width

Figure 3 – Vehicle approach paths with two alternative shapes of Terminal (a and b)