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Pasivna varnost nosilnih konstrukcij za opremo cest - Zahteve in preskusne metode

Passive safety of support structures for road equipment - Requirements and test methods

Passive Sicherheit von Tragkonstruktionen für die Straßenausstattung - Anforderungen und Prüfverfahren

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Passive safety of support structures for road equipment - Requirements and test methods

Passive Sicherheit von Tragkonstruktionen für die
Straßenausstattung - Anforderungen und Prüfverfahren

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 226.

If this draft becomes a European Standard, CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

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Foreword

This document (prEN 12767:2013) has been prepared by Technical Committee CEN/TC 226 “Road equipment”, the secretariat of which is held by AFNOR.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 12767:2007.

Annexes A, B, C, D, E, F, G, H, I, J, L, N and O of this European standard are normative, Annex K, M, P and Q is informative.

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Introduction

This European Standard provides a common basis for the vehicle impact testing of items of road equipment support. This European Standard defines the testing process and the data to be recorded, and how this is to be reported. Acceptance criteria are to be found in corresponding parts of EN 40 and EN 12899. The previous version of EN 12767 did include acceptance criteria – this is now, for convenience, repeated in informative Annex A.

All erected support structures will, for a certain level of kinetic energy during impact, collapse and fall down, posing an injury risk for road users.

The severity of accidents for the occupant(s) of a vehicle is affected by the performance of the support structures for items of road equipment under impact. Based on safety considerations, support structures can be manufactured to behave in controlled manners to reduce the overall risk. This European standard defines methods of determining impact safety performance and also defines how the determined data resulting from the impact tests can be presented by classes of convenience.

Support structures are classified in different categories, i.e. energy absorbing categories, collapse modes and directional classes.

This European standard considers three categories of passive safety support structures: high energy absorbing (HE), low energy absorbing (LE) and non-energy absorbing (NE).

Energy absorbing support structures slow the vehicle considerably and thus the risk of secondary accidents with structures, trees, pedestrians and other road users may be reduced. Non-energy absorbing support structures permit the vehicle to continue after the impact with the support structure with a limited reduction of speed. Non-energy absorbing support structures may provide a lower primary injury risk than energy absorbing support structures.

This European standard defines four mechanism of collapse for support structures, i.e. yielding, frangible, shearing or foundation lift.

Within the energy absorbing categories three types of directional classes are defined: single-directional, bi-directional and multi-directional. Performances of single directional supports are ensured only when impacted by a preferable direction equivalent to a vehicle leaving the road with an angle of 20°.

All of the impact tests use a light vehicle¹⁾ in order to verify that satisfactory attainment of the impact severity levels is compatible with the safety for the occupants of light vehicles.

Based on the evaluation of the performance of each tested support structure, National and Local road authorities will be able to specify the performance level of an item of road equipment support structure in terms of the effect on occupants of a vehicle in impact with the structure.

1) 900 kg.

1 Scope

This European Standard specifies performance test procedures to determine levels of passive safety intended to reduce the severity of injury to vehicle occupants of a small car in an impact with permanent support structures of road equipment. Test methods for determining the level of performance under various conditions of impact are given.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 933-1, *Tests for geometrical properties of aggregates — Part 1: Determination of particle size distribution — Sieving method*

EN 933-2, *Tests for geometrical properties of aggregates — Part 2: Determination of particle size distribution — Test sieves, nominal size of apertures*

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

ISO 6487, *Road vehicles — Measurement techniques in impact tests — Instrumentation*

ISO 10392, *Road vehicles with two axles — Determination of centre of gravity*

3 Terms and definitions

For the purposes of this European Standard, the following terms and definitions apply.

3.1

impact test

test in which a test vehicle impacts a test item of road equipment support structure

3.2

impact angle

angle between the intended direction of traffic and the approach path of the test vehicle into the test item

3.3

vehicle impact point

initial point of impact on the test vehicle

3.4

test item impact point

initial point of impact on the test item

3.5

impact speed, v_i

Measured impact speed of the impacting vehicle, measured along the test vehicle approach path at a distance no further than 6 meters before the impact point

3.6

exit speed, v_e

speed of the test vehicle after the impact with the test item, measured perpendicular to the extended approach path at a point 12 metres beyond the impact point

Note 1 to entry: For unarmful products as defined in Clause 4.17, this definition is replaced by Clause 8.5.

3.7**test vehicle**

commercially available production model passenger car used in an impact test to evaluate the performance of a test item

3.8**test item**

complete system of a support structure including the road equipment to be supported and foundation (if needed)

3.9**support structure**

system used to support items of road equipment

Note 1 to entry: Items of equipment may include luminaires, traffic signs, traffic signals, telephones and utility cables. The system includes posts, poles, structural elements, foundations, detachable mechanisms, if used, and any other components used to support the particular item of equipment.

3.10**sign support**

support intended to hold one or more signs, consisting of one or more parts: a post, possibly an extension piece and, if necessary, a bracket

3.11**lighting column**

support intended to hold one or more luminaires, consisting of one or more parts: a post, possibly an extension piece and, if necessary, a bracket

3.12**utility pole**

structure used to support power transmission, telecommunication cables or similar

3.13**cantilever support**

support system with a single post and a cantilever arm supporting signs, signals or other equipment

3.15**gantry support**

support system spanning a carriageway with one or more legs on each side of carriageway supporting signs, signals or other equipment

3.16**multi-legged support**

support structures with several legs. These legs can be the same, or different. The term includes structures with legs aligned transverse to the road or along the road.

3.17**unharmful support structure**

unharmful support structures are small support structures (for example some types of bollards, self-restoring signs, delineators) that cause only minor damage and a small change of speed during impact

3.18**ASI**

dimension less impact severity index calculated from the tri-axial vehicle accelerations according to the procedure given by EN 1317-1

prEN 12767:2013 (E)**3.19****THIV**

velocity, expressed in km/h, at which a hypothetical "point mass" occupant impacts the surface of a hypothetical occupant compartment and calculated in accordance with the procedure given by EN 1317-1

3.20**ballast**

mass added to a test vehicle, excluding instrumentation, to simulate cargo and/or to achieve desired test mass

3.21**total mass**

mass that includes all items in the test vehicle at the beginning of the test

3.22**collapse mode**

the mode by which the support structure deforms under vehicle impact

3.23**yielding mode**

support structure deforms under vehicle impact

3.24**shearing mode**

support structure is transversally detached from foundation at a dedicated point or mechanism

3.25**frangible mode**

support structure is totally detached by crush or fracture of the support structure

3.26**foundation lift**

soil yields instead of the support structure

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3.27**anthropomorphic test device**

anthropomorphic device representative of a 50th percentile adult male, specifically designed to represent in form, size and mass, a vehicle occupant, and to reproduce the dynamic behaviour of an occupant in crash testing

4 Abbreviations

ASI	Acceleration Severity Index
ATD	Anthropomorphic Test Device (Dummy)
THIV	Theoretical Head Impact Velocity
Y	Yielding type collapse mode
F	Frangible type collapse mode
S	Shearing type collapse mode
Z	Lift foundation collapse mode

type S	Backfill type S, standard soil
type D	Backfill type D, fine soil
type X	Backfill type X, special soil
type P	Backfill type P, paved
SD	Single directional
BD	Bidirectional
MD	Multidirectional
C	Circumscribed circle for supports theoretical alignment point
O	Centre of the circumscribed circle for supports theoretical alignment point
L	Clear opening for multi-legged supports
V	Velocity
T	Time

5 Official language

This European Standard official language is English. Other EN 12767 translations shall be seen as interpretations of this English text, and for any uncertainties of the use of or deviations in understanding the procedures, the preferential rights of interpretation is this English version.

6 General test parameters

6.1 Test site

The test site shall be generally flat with a gradient not exceeding 2,5 %, and shall be clear of standing water, ice or snow at the time of the test. The test site shall be of sufficient size to enable the test vehicle to be accelerated up to the required speed and controlled so that its approach to the test object is stable.

The test vehicle shall run on a level hardened or paved surface until the vehicle first impacts the support structure under test. Furthermore to enable the test vehicle exit characteristics to be evaluated, the hardened level surface shall extend not less than 15 m beyond the impact point.

NOTE 1 “paved” can be interpreted both as a surface that has asphalt, bricks or concrete on top, or as well compacted soil or gravel surface made hard enough to drive on. For the purposes of this standard, the term “paved” is used only for an installation with asphalt, brick slabs/pavers or a concrete surface.

The paved area of the test site shall never impede or interfere with the test item behaviour/deformation under impact.

Appropriate measures shall be taken in order to minimize dust generation from the test area and the test vehicle during the impact test so that photographic records will not be obscured.

The tests in this standard shall be carried out with the test item installed in ground or placed on a levelled surface at the same level as the adjoining carriageway.

NOTE 2 The performance of some support structures may be sensitive to differences in ground level between the position of the support structure and the carriageway if the designated mechanism is at a specific height.

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6.2 Backfill

The manufacturer shall select the type(s) of backfill to be used in the Type Tests from those given in Table 1.

Table 1 — Backfill type

Backfill type	Name
S	Standard soil
D	Fine soil
X	Special
P	Paved

NOTE Standard soil is recommended when testing new support structures.

The backfill at the test site shall be well known, repeatable and described thoroughly, either in the test report or as a reference to well-known and widely accepted geotechnical references.

The same backfill type shall be used for low speed(s) and high speed(s) test on the same product/product family.

The different backfill types are described in clause 6.2.1, 6.2.2 and 6.2.3.

6.2.1 Backfill type S, D and X

Backfill type S, D and X identify the use of soil material in the backfill volume.

Backfill type S grading shall be in accordance with Clause F.4. Backfill type D grading shall be in accordance with Clause F.5. Backfill type X shall be described by a sieving curve supplied by the manufacturer and included in the test report (grading shall be in accordance with EN 933-1 and EN 933-2).

The backfill type S, D and X shall be characterized by a push/pull test according to Clause F.3.

The minimum dimensions of the backfill volume, the positioning of the item in the volume and the compaction of the backfill material shall comply with Clause F.1 and F.2. The backfill volume shall not be frozen at the time of test and shall be protected from rain before the impact test.

Backfill type S, D and X shall not be paved with the exemption of the path of the vehicle wheel tracks.

The lateral movement at the exit side of the test item at the ground level shall be measured to an accuracy of 0,02 m after the impact, and then reported.

NOTE This reported value is used in Annex A for the classification.

6.2.2 Backfill type P

Backfill type P identifies the use of a flat continuous rigid surface (such as asphalt and/or concrete) of a sufficient thickness to provide the anchoring of the tested item without being displaced. This can be locally damaged in the impact area.

NOTE Backfill type P is not a foundation.

6.3 Test vehicle

The test vehicle shall be a standard passenger car and shall satisfy the vehicle calibration test requirements of Annex E. The test vehicle shall also meet the following specifications:

- the total mass: 900 kg \pm 40 kg. Of this, the maximum allowed combined mass of ballast and instrumentation is 120 kg;

NOTE 1 An ATD (or a driver for simplified test method) may be used; in this case the total mass includes the ATD.

- front and rear wheel track: 1,35 m \pm 0,20 m;
- longitudinal centre of gravity location in distance from front axle (CG_x) 0,90 m \pm 0,09 m;

NOTE 2 Procedures according to ISO 10392 might be used for determining the centre of gravity location. ISO 10392 does allow the use of methods proved to be more accurate than the described method in ISO 10392.

- lateral centre of gravity location (CG_y) in distance from vehicle centreline \pm 0,07 m;
- centre of gravity height in distance from ground (CG_z) 0,49 m \pm 0,05 m;
- the vehicles to be used in the tests shall be production models representative of current traffic in Europe; the vehicle shall not have a sunroof;

- additional equipment on the car, which might be important for the test, shall be of a type normally delivered by the manufacturer or otherwise approved for use on the specific car type;

- a heavy car shall not be stripped of heavy standard equipment to fit into the mass restrictions of this standard.

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The tyres shall be inflated to the manufacturer's recommended pressures. The condition of the vehicle shall be such as to satisfy the requirements for the issue of a certificate of road worthiness with respect to tyres, suspension, wheel alignment and bodywork, including windows and features that are expected to affect the test result. No repairs or modifications shall be made that would alter the general characteristics of the vehicle or invalidate such a road worthiness certification. The vehicle shall be clean and mud deposits which may cause dust on impact shall be removed prior to testing.

The vehicle shall not be restrained by control of the steering or any other means during impact and within a distance of 12 m after the impact point.

All ballast masses shall be securely fixed to the vehicle.

6.3.1 Test vehicle instrumentation

The minimum test vehicle instrumentation and the accuracy of the measurements taken during the test shall be in accordance with EN 1317-1.

Accelerometers shall be positioned as described in EN 1317-1.

7 General test item parameters

7.1 General test item documentation

The manufacturer shall select the configuration of tested items to be used in the tests.

NOTE 1 The manufacturer should keep in mind that the selection of the tested configuration has implications on the overall range of versions, see Annex B and changed versions, see Annex C.

Before the test, the manufacturer shall supply drawings and full technical specifications for the product under test. These shall be checked by the test house and any deviations shall be recorded in the test report. The overall tested item mass and the various component masses shall be reported.

NOTE 2 Full technical specification is the material specifications and drawings necessary to uniquely identify the tested product and the properties of all relevant parts. It also includes installation and maintenance drawings and instructions necessary to ensure the initial and continuing functioning of the device to the determined safety level. Additional requirements such as torque settings of brackets, sign clamps, fixing systems, anchor bolts must be defined in the installation instructions and checked before the test.

The installation drawings shall illustrate the traffic direction. If the structure is designed to perform when hit in a particular direction, the features participating to that behaviour shall be identified.

Each drawing shall have a unique number, version number and a date, in order to uniquely identify the tested item. The drawings shall only include the tested configuration, not any untested options, sizes or variations. Text on drawings shall be preferably in English or in the language of the country where the test is carried out.

NOTE 3 The impact safety performance of some support structures might be affected by the orientation of the impact (vehicle direction in horizontal plane). This may be related to a particular design (structures designed to behave in a controlled manner when hit in a preferred direction, having an expected collapse mode) or to a special requirement such as inspection or maintenance openings, see Annex A.

7.2 Test item selection <https://standards.iteh.ai/catalog/standards/sist/14fae16c-82c8-4893-acdc-e60465e83f46/osist-pren-12767-2013>

The item selected for testing shall be representative of actual or future production including, where present, inspection or maintenance openings or any other device will be in use when placed on the market.

The installation of the test item at the test site shall be made in accordance with the manufacturer's specifications as described in 7.1. Any deviation of the installation with respect to the manufacturer's specifications shall be recorded in the test report.

Specific requirements for the selection of the test item are as given below:

7.2.1 Lighting column

A lighting column shall be tested with the longest and heaviest single arm bracket, and luminaire of the greatest mass related to the bracket length, for which the column is designed.

Luminaires, and cables to luminaires, shall be installed when a lighting column is tested, including typical underground cables and connection boxes and/or fuse units, if the lighting column is intended for use with such items.

Overhead cables need not be installed for the impact tests. However, if they are used at test, the overhead cables shall be installed so as to simulate the fixing on adjacent columns/posts in service.

Underground cables shall be securely fixed outside the backfill volume in such a way that the fixing does not allow movement of the cable at the fixing point during the test.

NOTE Dedicated electrical disconnections might be installed during test, and their performance can be part of additional voluntary information in a test report, however not forming basis for any pass/fail considerations of the actual support structure.

7.2.2 Sign support

A sign support shall be tested with the largest area of symmetrically mounted sign plate for which that height of support is designed.

Any necessary electrical equipment, cables including underground cables and connection boxes and/or fuse units (for example for transilluminated signs) shall be installed.

7.2.3 Signal support

A signal support shall be tested with the heaviest signal head, together with cables including underground cables, connection boxes and/or fuse units.

Underground cables shall be securely fixed outside the backfill volume in such a way that the fixing does not allow movement of the cable at the fixing point during the test.

7.2.4 Utility pole

A utility pole shall be tested with the heaviest intended load. At least three utility poles shall be installed when overhead cables are used. The centre utility pole shall be impacted.

Overhead cables shall be installed unless the effect of the overhead cable and its fixing type on the performance is known from other tests with a similar utility pole type.

7.2.5 Other support structures

Other support structures shall be tested with the heaviest intended load. This includes unarmful support structures.

NOTE Support structures, such as mailboxes, gantries, cantilever supports, emergency telephones, camera supports, weather and traffic monitoring devices support, advertisement installations or other items not specified above might also be tested in accordance with this European Standard. In this case the test configuration should be based (as close as possible) on the principles described in Clauses 7 and 8 and the related subclauses, and the installation shall be as complete and realistic as possible.

7.2.6 Multi-legged supports

Multi-legged support structures are of two types: multi-legged support structures with identical legs and multi-legged support structures with different legs. Identical means that these legs refer to the same drawing number.

For multi-legged lighting columns, the supported light shall be selected in accordance with 7.2.1.

For multi-legged sign supports, the supported sign shall be selected in accordance with 7.2.2

For multi-legged signal supports, the supported signal shall be selected in accordance with 7.2.3.

For multi-legged utility poles, the supported load shall be selected in accordance with 7.2.4.

Other multi-legged support structures shall be selected in accordance with 7.2.5.

A particular type of multi-legged supports are the gantries. These supports can be generally tested as sign supports.