SLOVENSKI STANDARD
SIST EN 12767:2019

01-oktober-2019

Nadomešča:
SIST EN 12767:2008

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

Sécurité passive des structures supports d'équipements de la route - Prescriptions et méthodes d'essai

Ta slovenski standard je istoveten z: **EN 12767:2019**

ICS:

93.080.30	Cestna oprema in pomožne naprave	Road equipment and installations

SIST EN 12767:2019 **en,fr,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 12767

August 2019

ICS 93.080.30

Supersedes EN 12767:2007

English Version

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This European Standard was approved by CEN on 24 June 2019.

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Ref. No. EN 12767:2019 E

Contents

European foreword

This document (EN 12767:2019) has been prepared by Technical Committee CEN/TC 226 “Road Equipment”, the secretariat of which is held by AFNOR.

This document shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by February 2020, and conflicting national standards shall be withdrawn at the latest by February 2020.

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 EN 12767:2007.

The significant technical changes incorporated in this revision are:

— incorporation of the Regulation (EU) No 305/2011 of the European Parliament and of the Council of 9 March 2011 laying down harmonized conditions for the marketing of construction products and repealing Council Directive 89/106/EEC terminology;

— introduction of a push-pull test to enable a comparison to be made between the backfills used in the test and those on-site;

— harmonization of the boundary values for occupant safety (ASI and THIV) independent of the energy absorption class;

— replacement of the occupant safety class by an alphanumeric character instead of a number to make a clear distinction with the old (EN 12767:2007) approach. Now, NE-C, LE-C and HE-C have the same occupant safety. The best occupant safety is achieved for A;

— introduction of collapse modes to classify if test items become detached or do not become detached;

— introduction of direction classes to take into account any sensitiveness to impact angle;

— improved test description, include installation manual and translation of roof deformation into a measurable value, to reduce the influence of the vehicle structure on the test results;

— introduction of an extra test at 50 km/h for cases where the test-item is not activated at low speed. An explanation of the definition of “activated” is also given;

— better rules for the determination of families (product families) based on the tested limit(s);

— introduction of a risk assessment approach, in line with the EN 1317-1:2010, for assessing changes of a version, and the use of (for example) virtual testing in this;

— possibility to declare, under certain conditions, intermediate speed classes.

Most of the comments collected from all CEN members to the previous version of this norm are implemented or solved. The definition and use of newer technologies has to be developed before introduction into the standard.

Some added changes mentioned above are expressed in a new performance classification for the product. This results in a longer description of the overall passive safety performance, but at the end, it gives a clearer indication of product performance. For example, an old performance classification like “100, HE,

3" could be translated to "100-HE-C-S-SE-MD-1". In this example, the last 4 sub-indications stands for backfill type (S), collapse mode (SE), direction class (MD) and risk of roof indentation.

Translation of older tests to this new standard is possible when sufficient information is available in the reports, photographs and videos of the tests.

The previous version of EN 12767 included test acceptance criteria – this is now, for convenience, repeated in Annex A.

When this standard is used as a supporting standard for a product standard under CPR (e.g. sign supports) relevant clauses of Annexes A, G and H are supposed to be copied inside the product standard, and the product standard refers to the rest of this standard.

When this standard is used for testing constructions with no product standard the specifying authority is supposed to refer to whole EN 12767, including Annexes A, G and H.

Annexes A, B, D, E, G, H, I, K, L, M of this document are normative, Annexes C, F, J are informative.

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

The severity of accidents for the occupant(s) of a vehicle is affected (in part) by the performance of the support structures for items of road equipment under impact. Based on safety considerations, support structures can be designed to behave in controlled ways to reduce the overall risk.

Passive safety is intended to reduce the severity of injury to vehicle occupants of a car in an impact with support structures of road equipment.

This document has been developed in order to provide:

— test methods for determining impact safety performance; and

— methods to handle the data resulting from the impact tests;

— technical background about passive safety that can be used in the product standard.

The test procedure includes guidelines:

— for test item selection, test parameters, detailed test methods with different test conditions, the data to record, and requirements for reporting;

— to assess the performance within families of product (called “product families”) and for modified products (called “changed versions”).

This document considers:

— two kinds of test inputs:

  — three speed classes (50, 70 and 100);

  — three Backfill types (standard aggregates (S), special (X) and Rigid (R)).

— five kinds of test outcomes:

  — three energy absorption classes: high energy absorbing (HE), low energy absorbing (LE) and non-energy absorbing (NE);

  — five occupant safety classes (from A to E);

  — two modes of collapse for support structures (Separation mode (SE) and No separation collapse mode (NS));

  — three direction classes (single-directional (SD), bi-directional (BD) and multi-directional (MD));

  — two classes of risk of roof indentation (0 or 1).

In order to help to evaluate the risk in case of a product modification, this document introduces Virtual Testing through the definition of procedures for verification, validation, and development of numerical models.

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

1 Scope

This document specifies performance test procedures to determine the passive safety properties of support structures such as lighting columns, sign posts, signal supports, structural elements, foundations, detachable products and any other components used to support a particular item of equipment on the roadside.

This document provides a common basis for the vehicle impact testing of items of road equipment support structures.

This document does not apply to road restraint systems.

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 13285, *Unbound mixtures — Specifications*

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

ISO 10392, *Road vehicles — Determination of centre of gravity*

3 Terms and definitions

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

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

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

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 m 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 m beyond the impact point

Note 1 to entry: For exit speed of non-harmful products as defined in 3.16, non-harmful support structure see 7.5, simplified test method for non-harmful support structures.

3.7
test vehicle
production models representative of current traffic in Europe 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 road equipment may include luminaires, traffic signs, traffic signals and utility cables or any other equipment. 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 structure intended to hold one or more signs

3.11
signal support
support structure intended to hold one or more signals heads

3.12
lighting column
support structure intended to hold one or more luminaires, consisting of one or more parts: a post, possibly an extension piece and, if necessary, a bracket

3.13
utility pole
support structure intended to hold power transmission, telecommunication cables or similar

3.14
cantilever support
support structure with one or more legs positioned on one side of the carriageway and a cantilever arm supporting signs, signals or other equipment mounted over traffic lanes

3.15
gantry support
support structure 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, either identical or different

Note 1 to entry: The term includes structures with legs aligned transverse to the road or along the road.

3.17
non-harmful support structure
small support structure (for example some types of bollards, self-righting signs, delineators) that causes only minor damage and a small change of speed during impact

3.18
ASI
dimensionless impact severity index calculated from the tri-axial vehicle accelerations according to the procedure given by EN 1317-1:2010, 8.1.2

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 1317-1:2010, 8.1.3

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
mode by which the support structure deforms under vehicle impact

3.23
anthropomorphic test device
ATD
anthropomorphic device representative of a 50th percentile adult, specifically designed to represent in form, size and mass, a vehicle occupant, and to reproduce the dynamic behaviour of an occupant in crash testing

3.24
performance class
class for one speed class, one energy absorption level, one occupant safety class, one backfill type, one collapse mode, one direction class and risk of roof indentation

3.25
product family
product series of the same type in various sizes, made from the same materials using the same design and general construction method, and having the same performance class

3.26
object length
height of the support structure

Note 1 to entry: For lighting columns, the object length is the height above ground level (h) plus half of the horizontal bracket projection (w) in case of a bracket in top of the support structure. h and w are defined by EN 40-2.

Note 2 to entry: For other support structures, the object length is the overall height of the structure including signs, signal heads and other attachments.

3.27
object mass
mass of the part of the support structure above ground level included attachments such as signs and luminaires

4 Symbols and abbreviations

ASI	Acceleration Severity Index
THIV	Theoretical Head Impact Velocity
SE	Separation collapse mode
NS	No separation collapse mode
HE	High energy absorbing category
LE	Low energy absorbing category
NE	Non energy absorbing category
S	Backfill type S, standard aggregates
X	Backfill type X, special aggregates
R	Backfill type R, rigid
SD	Single-directional
BD	Bi-directional
MD	Multi-directional
C	Circumscribed circle of supports
O	Centre of C
L	Clear opening for multi-legged supports
v	Velocity
t	Time
VT	Virtual testing
NR	No requirement
ATD	Anthropomorphic Test Device

5 General test parameters

5.1 Test site

The test site shall be generally flat and have a level, hardened surface with a gradient not exceeding 2,5 %. The area around the test item until 15 m behind 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 levelled (no steps allowed) hardened or paved surface over the backfill volume without influencing the movement of the test item.

NOTE For the purposes of this standard, the term “paved” is used only for an installation with asphalt, brick slabs/pavers or a concrete surface.

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.

5.2 Backfill

5.2.1 General

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 aggregates
X	Special
R	Rigid

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 or pavement properties.

Within one product family, the same backfill type shall be used for all tests.

The different backfill types are described in 5.2.2 and 5.2.3.

The backfill according to which the performance of the test item is determined is part of the performance declaration (see Annex A).

5.2.2 Backfill type S and X

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

— Backfill type S grading shall be in accordance with B.3.

— 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 13285).

The results of the push/pull test should be reported according to Annex C.

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 B.1 and B.2. The backfill volume shall not be frozen at the time of test and shall be protected from rain before the impact test.

5.2.3 Backfill type R

Backfill type R identifies the use of a flat continuous rigid surface (such as asphalt and/or concrete) of a sufficient thickness to provide anchoring of the tested item without being displaced according to B.4.

NOTE This can be locally damaged in the impact area as a result of the impact test.

5.3 Test vehicle

5.3.1 General

The test vehicle shall be a standard passenger car and shall also meet the following specifications:

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

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

— the dimensions of the test vehicle are determined according to Annex D;

— front and rear wheel track: 1,35 m ± 0,20 m;

— longitudinal centre of gravity location in distance from front axle (CGx) 0,90 m ± 0,09 m. No ATD shall be in the car when the centre of gravity is determined;

The centre of gravity shall be determined in accordance with the ISO 10392.

— lateral centre of gravity location (CGy) distance from vehicle centreline ±0,07 m;

— centre of gravity height from ground (CGz) 0,49 m ± 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;

— the tyres shall be inflated to the vehicle manufacturer's recommended pressures. The condition of the vehicle shall satisfy the requirements for the issue of a vehicle 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 including reinforcement shall be made that would alter the general characteristics of the vehicle or invalidate such a certification. Any repairs shall conform to the original vehicle specification as defined by the vehicle manufacturer. The vehicle shall be clean and mud deposits, which may cause dust on impact, shall be removed prior to testing. Marker points shall be placed on external surfaces of the test vehicle to aid analysis;

— 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 (e.g. engine power, braking, anti-lock brakes, blocking or fixing);

— all fluids shall be included in the test inertial mass;

— all ballast weights shall be securely fixed to the vehicle in such a way as not to exceed the manufacturer's specifications for distribution of weight in the horizontal and vertical planes;

— ballast weights shall not be fixed in locations, which would modify the deformation of, or intrusions into, the vehicle.

The test vehicle shall satisfy the vehicle calibration test requirements of Annex E.

NOTE The use of a bogie vehicle is not accepted for determining the performance class. Nevertheless, Annex F is included in this document for technical background and stakeholders are invited to study the feasibility of replacing a real car with a bogie vehicle in the future.

5.3.2 Test vehicle instrumentation

The minimum test vehicle instrumentation and the accuracy of the measurements taken during the test shall be in accordance with EN 1317-1:2010.

Accelerometers shall be positioned as described in EN 1317-1:2010.

6 General test item parameters

6.1 General test item documentation

Before the test, the manufacturer shall supply drawings and full technical specifications for the test item. The overall tested item mass and the various component masses shall be given by the manufacturer.

Full technical specification is the material specifications and drawings necessary to uniquely identify the test item and the properties of all 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 class. Additional requirements such as foundation requirements, torque settings of brackets, sign clamps, fixing systems, anchor bolts shall be defined in the installation instructions and checked before the test.

The installation drawings shall illustrate the traffic direction. The impact safety performance of some support structures might be affected by the orientation of the impact (vehicle direction in horizontal plane). 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. The test laboratory shall verify if the test item corresponds with the information in the drawings and specifications.

6.2 Test item selection

6.2.1 General

The client shall select the configuration of test items.

The item selected for testing shall be representative of actual or future production including, where present, inspection or maintenance openings or any other device which 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 6.1. Any deviation of the installation with respect to the manufacturer's specifications shall be recorded in the test report.