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

Passive safety of support structures for road equipment - Requirements, classification 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

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Foreword

This document (EN 12767:2007) has been prepared by Technical Committee CEN/TC 226 “Road equipment”, the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by May 2008, and conflicting national standards shall be withdrawn at the latest by May 2008.

This document supersedes EN 12767:2000.

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Introduction

The severities of accidents for vehicle occupants are affected by the performance of support structures for items of road equipment under impact. Based on safety considerations, these can be made in such a way that they detach or yield under vehicle impact.

This European Standard provides a common basis for testing of vehicle impacts with items of road equipment support.

This European standard considers three categories of passive safety support structures:

— high energy absorbing (HE);

— low energy absorbing (LE);

— 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 can be reduced.

Non-energy absorbing support structures permit the vehicle to continue after the impact with a limited reduction in speed. Non-energy absorbing support structures may provide a lower primary injury risk than energy absorbing support structures.

In this European Standard, several levels of performance are given using the two main criteria related to the performance under impact of each of the three energy absorbing categories of support structure.

Support structures with no performance requirements for passive safety are class 0.

There are four levels of occupant safety.

Levels 1, 2 and 3 provide increasing levels of safety in that order by reducing impact severity. For these levels two tests are required:

— test at 35 km/h to ensure satisfactory functioning of the support structure at low speed.

— test at the class impact speed (50, 70 and 100) as given in Table 1.

Level 4 comprises very safe support structures classified by means of a simplified test at the class impact speed.

All the tests use a light vehicle to verify that impact severity levels are satisfactorily attained and compatible with safety for occupants of a light vehicle.

The different occupant safety levels and the energy absorption categories will enable national and local road authorities to specify the performance level of an item of road equipment support structures in terms of the effect on occupants of a vehicle impacting with the structure. Factors to be taken into consideration include:

— perceived injury accident risk and probable cost benefit;

— type of road and its geometrical layout;

— typical vehicle speeds at the location;

— presence of other structures, trees and pedestrians;

— presence of vehicle restraint systems.

1 Scope

This European Standard specifies performance requirements and defines levels in passive safety terms intended to reduce the severity of injury to the occupants of vehicles impacting with the permanent road equipment support structures. Consideration is also given to other traffic and pedestrians. Three energy absorption types are considered and test methods for determining the level of performance under various conditions of impact are given.

This European Standard excludes vehicle restraint systems, noise barriers and transilluminated traffic bollards. It also excludes temporary traffic control devices.

2 Normative references

The following referenced documents are indispensable for the application 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 40-3-2, Lighting columns - Part 3-2: Design and verification-Verification by testing

EN 40-3-3, Lighting columns - Part 3-3: Design and verification-Verification by calculation

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 where a test vehicle impacts a test road equipment support structure item

3.2
impact angle
angle between the intended direction of traffic and the approach path of the test vehicle into the test item, which is oriented as it would when typically in service

3.3
impact point
initial point of impact between the test vehicle and the test item

3.4
impact speed, v_i
speed of the vehicle measured along the test vehicle approach path at a point no further than 6 m before the impact point

NOTE For further details, see 6.7.

3.5
exit speed, v_e
speed of the test vehicle after impact with the test item, measured along the line of the extended approach path at a point 12 m beyond the impact point

NOTE For further details, see 6.7.

3.6
test vehicle
commercially available production model passenger car used in impact tests to evaluate the performance of a test item

3.7
test item
complete system of a support structure including the road equipment to be supported

3.8
support structure
system used to support items of road equipment

NOTE 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.

3.9
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

NOTE It does not include columns for catenary lighting.

3.10
utility pole
structure used to support power transmission or telecommunication cables

3.11
cantilever support
support system with a single post and a cantilever arm that supports signs, signals or other equipment mounted over traffic lanes

3.12
gantry support
support system spanning a carriageway with one or more posts on each side of carriageway that supports signs, signals or other equipment mounted over the traffic lanes

3.13
ASI
Acceleration Severity Index
value calculated from the triaxial vehicle accelerations

NOTE The maximum ASI value is considered as an assessment of the accident severity for the occupants of the impacting vehicle. ASI is a non-dimensional quantity. ASI is calculated in accordance with EN 1317-1.

3.14
THIV
Theoretical Head Impact Velocity
velocity, expressed in km/h, where a hypothetical "point mass" occupant impacts the surfaces of a hypothetical occupant compartment

NOTE THIV is calculated in accordance with EN 1317-1.

3.15
ballast
mass added to a vehicle other than dummy and/or instrumentation, to simulate cargo and/or achieve desired inertial test mass

3.16
dummy
artefact or surrogate occupant used to simulate the effects of and/or study the dynamic response of an occupant in the test vehicle

3.17
kerb mass
mass of the test vehicle type, with standard equipment, maximum capacity of engine fuel, oil and coolant

NOTE It does not include occupants and cargo.

3.18
inertial test mass
mass of the test vehicle including fluids (not necessarily the maximum capacity of fluids), and all items rigidly attached to the vehicle's structure, including a ballast and instrumentation, but excluding a dummy

3.19
gross static mass
total vehicle static mass
sum of inertial test mass and mass of the dummy

3.20
bending moment resistance of a lighting column
resistance to bending moment M_u at ground level

NOTE bending moment resistance of a lighting column is calculated or tested in accordance with EN 40-3-2 and 40-3-3.

3.21
mass of a lighting column
total mass of the column above ground level including shaft and bracket arm, if fitted

NOTE Luminaires, connection devices and cables are excluded.

3.22
length of a column
length of a column (h + w/2) is the height of the column (h) plus half of the horizontal projection of the bracket (w)

NOTE h and w are defined by EN 40-1.

3.23
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 mechanism or construction designed to separate, break or deform on impact

4 Test parameters

4.1 General parameters

4.1.1 Speed class

The manufacturer shall select the speed classes under which the support structure is tested from Table 1. A test shall be carried out at each of the two impact speeds for the selected speed class, except in the case of non-harmful small support structures described in 5.6.

Table 1 — Impact speeds

Speed class km/h	Impact speeds km/h
50	35 and 50
70	35 and 70
100	35 and 100

4.1.2 Energy absorption categories

Support structures shall be classified according to the energy absorbing category for the selected speed class related to the exit speed in Table 2. The categories are High Energy absorbing (HE), Low Energy absorbing (LE) and Non-Energy absorbing (NE) support structures.

Table 2 — Energy absorption categories

Impact speed, v_I km/h	50	70	100
Energy absorption category	Exit speed, v_e km/h		
HE	$v_e = 0$	$0 \leq v_e \leq 5$	$0 \leq v_e \leq 50$
LE	$0 < v_e \leq 5$	$5 < v_e \leq 30$	$50 < v_e \leq 70$
NE	$5 < v_e \leq 50$	$30 < v_e \leq 70$	$70 < v_e \leq 100$

If the actual impact speed is not the nominal speed but is still within permitted tolerances given in 6.7, the measured exit speed used for energy absorption categorisation according to Table 2 shall be adjusted, in relation to the actual measured impact speed, to the value of adjusted exit speed given by the formula

$$\sqrt{V^2_{NOMINAL\ IMPACT\ SPEED} - V^2_{MEASURED\ IMPACT\ SPEED} + V^2_{MEASURED\ EXIT\ SPEED}} = V_{ADJUSTED\ EXIT\ SPEED} \qquad (1)$$

For a combination of a high impact speed and low exit speed, the formula returns invalid results. When the sum under the square root is a negative number, the measured exit speed is of such low value that the adjusted exit speed goes below zero. For such cases theoretical adjustments are not appropriate and the exit speed shall be taken as 0 km/h.

4.1.3 Levels of occupant safety

Support structures shall be classified in terms of the occupant safety level by means of the ASI and THIV values, related to the speed class and energy absorbing categories in Table 5. Occupant safety level NE4 is restricted to non-harmful products, as described in 5.6.

4.2 Backfill types

The manufacturer shall select the type(s) of backfill and foundation to be used in the tests from those given in Table 3.

Table 3 — Backfill type

Backfill type	Name	Definition
S	Standard soil	Clause A.1
R	Rigid	Clause A.2
X	Special	By the manufacturer
NOTE Standard soil is recommended when testing new support structures.		

The backfill types are described in Annex A. The control and installation of the backfill is described in Annex B.

4.3 Particular test parameters for different roadside objects

4.3.1 Lighting columns

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 test. However, if overhead cables are to be used in actual installations, the effect of the overhead cable and its fixing arrangement shall be known from other tests with similar columns.

Underground cables shall be fixed outside the backfill volume in such a way that that the fixing does not allow the cable to move from the fixing point during the test. Overhead cables shall to be installed to simulate the fixing on adjacent columns/posts in service.

4.3.2 Traffic sign supports

A sign plate shall be installed when a sign support is tested. Luminaires or transilluminated signs or other electrical equipment and cables including typical underground cables and connection boxes and/or fuse units, shall be installed if the sign support is intended for use with such items.

4.3.3 Traffic signal supports

The maximum intended number of signal heads together with cables including underground cables, connection boxes and/or fuse units shall be installed when a traffic signal support is tested.

4.3.4 Utility poles

Overhead cables are needed in the impact test 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. At least three utility poles shall be installed when overhead cables are used.

4.3.5 Mailboxes

Mailboxes shall be tested with the maximum mass of mail for which they are intended, typically 0,5 kg/dm³ of the volume of the mailbox.

4.3.6 Pedestrian restraint systems

If pedestrian restraint systems are evaluated according to this standard, they shall at a minimum be tested for the risk of occupant compartment penetration whilst impacting against the terminal, in the direction of the longitudinal axis of the system, and any other location and angle that may be considered dangerous.