SLOVENSKI STANDARD

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Pasivna varnost podpornih 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 Straßenaustattung - Anforderungen und Prüfverfahren

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

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
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Central Secretariat: rue de Stassart, 36 B-1050 Brussels

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Foreword

This European Standard 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of an identical text or by endorsement, at the latest by September 2000, and conflicting national standards shall be withdrawn at the latest by September 2000.

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

The annexes A, B, C and D of this European Standard are normative, annex E is informative.

Introduction

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

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

The 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 relating to the performance under impact of each of the three energy absorbing categories of support structure:

- impact speed (km/h) : 50, 70 and 100;
- impact severity levels, ASI: 0,6; 1,0; 1,2; 1,4 and THIV (km/h): 3; 11; 27; 33; 44.

There are four levels of occupant safety levels.

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

- a test at 35 km/h to ensure satisfactory functioning of the support structure at low speed.
- a test at the class impact speed as given in table 1.

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

All the tests use a light vehicle in order to verify that satisfactory attainment of the impact severity levels are 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 structure in terms of the effect on occupants of a vehicle in impact with the structure. Factors to be taken into consideration include:

- the type of road and its geometrical layout;
- the typical vehicle speeds at the location;
- the presence of other structures, trees and pedestrians;
- the perceived injury accident risk and probable cost benefit;
- the presence of vehicle restraint systems.

These support structures are to be specifically designed and qualified in order to fulfil their function successfully. Quality of manufacture, durability and satisfactory installation conditions are important safety criteria that should be considered in the application of these support structures.

This European Standard provides a common basis for the testing of vehicle impacts with items of road equipment support structures so that test data and research can be used to improve future specifications, including a review of impact severity levels and the method of specifying impact severity.

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 in impact with the permanent support structures of road equipment. Consideration is also given to other traffic, pedestrians or personnel in a work zone. Two energy absorption types are considered. Test methods for determining the level of performance under various conditions of impact are given. It excludes vehicle restraint systems, noise barriers and transilluminated traffic bollards. It also excludes temporary work zone traffic control devices.

2 Normative references

This European Standard 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 these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 933-1	Tests for general 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 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 10 392	Road vehicles with two axles – Determination of centre of gravity

3 Definitions

For the purposes of this European Standard the following 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, which is oriented as it would typically be 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 tests according to the simplified method (see 5.6) for unharmful support structures the impact speed is measured immediately before the impact.

3.5 exit speed, v_e: speed of the test vehicle after the impact with the test item, measured at a point beyond the impact point, at a distance equal to the height of the test item but not less than 5 m

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

3.7 test item: complete system of a support structure including the road equipment

3.8 support structure: system used to support items of road equipment and other equipment found a long side roads

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 supporting 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 supporting 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 to be 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, at which 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 vehicle, other than dummy and instrumentation, to simulate cargo and/or to 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 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, but not necessarily the maximum capacity of fluids, and all items rigidly attached to the vehicle's structure, including ballast and instrumentation, but excluding dummy.

3.19 gross static mass: sum of inertial test mass and mass of dummy

NOTE In some standards this is referred to as the "total vehicle static mass"

4 Test parameters

4.1 General parameters

4.1.1 Speed class

The manufacturer shall state if the support structure shall be tested to speed classes 50, 70 or 100. Two impact tests shall be carried out for the selected speed class as indicated in table 1.

Table 1 - Impact speeds

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

4.1.2 Energy absorption categories

The performance types in 5.2 are based on the absorption category of the tested support structure. There are High Energy absorbing (HE), Low Energy absorbing (LE) and Non-Energy absorbing (NE) support structures. This distinction is based on the result from the high-speed test in accordance with table 2.

Table 2 - Energy absorption categories

Impact speed, v_i km/h	50	70	100
	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	$5 < v_e \leq 50$	$30 < v_e \leq 70$	$70 < v_e \leq 100$

4.1.3 Levels of occupant risk

The occupant risk requirements ASI and THIV in 5.2.2.3 and 5.2.2.4 determine the occupant safety level in accordance with 5.4. The occupant safety levels are numbered 1 to 4 in accordance with table 3.

Table 3 - Occupant risk

Occupant safety level	Comments
1 to 3	Support structures with increased safety
4	Unharmful support structures, evaluated or tested in accordance with the simplified procedure described in 5.5

4.2 Other parameters

4.2.1 Backfill types and foundations

The manufacturer shall select the type(s) of backfill and foundation to be used in the tests from those given in table 4.

Table 4 - 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.

4.2.2 Steep slopes

Where the roadside area is significantly lower than the road a vehicle may impact the device at a higher level than in the test. It should be evaluated whether this may have an adverse effect on the performance of the support structure, especially a structure with a designated point or a short section designed to fracture or detach due to the impact.

4.3 Particular test parameters for different roadside objects

4.3.1 General

The support structure shall be tested with a load corresponding to the maximum design load in respect of mass and, if critical, area or other dimensions.

4.3.2 Lighting columns

Luminaires shall be installed on the lighting column when tested.

Electrical cables may be installed.

Overhead cables are not needed in the impact test, though they might be used in normal installations. However, the effect of the overhead cable and its fixing type on the performance shall be known from other tests with a similar lighting column type.

NOTE Catenary lighting columns are other support structures to be tested in accordance with 4.3.7.

4.3.3 Sign supports

Luminaires and illuminated signs shall be included if the support structure is intended for that use.

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

Pedestrian restraint systems shall be tested against the terminal and any other location that may be considered dangerous by the approved certification body.

4.3.7 Other support structures

Other support structures, not specified above, may also be tested in accordance with this European Standard. In this case the test configuration shall be decided by the approved certification body based on the principles described in 4.3.1 to 4.3.6.

5 Requirements

5.1 General

The requirements are divided into two sections:

- general requirements (5.2);
- additional requirements for cantilever and gantry sign supports (5.3).

Class 0 has no requirements and no test is required.

Each tested support structure is described as a performance type expressed as (speed class, energy absorption category, occupant safety level), as given in table 5.

Table 5 - Performance types

	Alternatives	Clause
Speed class	50, 70 or 100	4.1.1
Energy absorption category	HE, LE or NE	4.1.2
Occupant safety level	1, 2, 3 or 4	4.1.3

In order to qualify as a certain type, the support structure shall meet the general requirements of 5.2 and the additional requirements of 5.3 for both the high speed (50 km/h, 70 km/h or 100 km/h) and the low speed (35 km/h) tests. The ASI and THIV values shall be less than the maximum limits in both corresponding tests as given in table 6.

The support structure shall be tested with a load corresponding to the maximum design load in respect of mass and, if critical, area or other dimensions. A successful test is also valid for all loads less than the one used in the test.

If a support structure exists in different sizes or heights, but can be regarded as belonging to the same product family with regard to construction, the largest and smallest support structure versions of the range selected by the manufacturer shall be tested. If the approved certification body considers that the difference in size or height will not affect the performance, it may decide not to test the smallest version.

If the test of the largest and smallest support structure versions show that the performance types are the same, except for the occupant safety level, intermediate sizes and heights of the