SLOVENSKI STANDARD
SIST EN 1317-1:1999

01-november-1999

Oprema cest - 1. del: Terminologija in splošna merila za preskusne metode

Road restraint systems - Part 1: Terminology and general criteria for test methods

Rückhaltesysteme an Straßen - Teil 1: Terminologie und allgemeine Kriterien für Prüfverfahren

Dispositifs de retenue routiers - Partie 1: Terminologie et dispositions générales pour les méthodes d'essais

Ta slovenski standard je istoveten z: EN 1317-1:1998

ICS:

01.040.93	Nizke gradnje (Slovarji)	Civil engineering (Vocabularies)
93.080.30	Cestna oprema in pomožne naprave	Road equipment and installations

SIST EN 1317-1:1999 **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 1317-1

April 1998

ICS 01.040.93; 13.200; 93.080.30

Descriptors: road safety, pavements : roads, roads, safety devices, crash barriers, definitions, specifications, tests, impact tests

English version

Road restraint systems - Part 1: Terminology and general criteria for test methods

Dispositifs de retenue routiers - Partie 1: Terminologie et dispositions générales pour les méthodes d'essais

Rückhaltesysteme an Straßen - Teil 1: Terminologie und allgemeine Kriterien für Prüfverfahren

This European Standard was approved by CEN on 5 March 1998.

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. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

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.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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

Central Secretariat: rue de Stassart, 36 B-1050 Brussels

Ref. No. EN 1317-1:1998 E

Contents

Foreword

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

This European Standard consists of the following Parts under the general title : Road restraint systems.

- 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 : Crash cushions - 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 : Impact tests acceptance criteria and test methods for terminals and transitions of safety barriers ;

- Part 5 : Durability criteria and evaluation of conformity ;

- Part 6 : Pedestrian road restaint system.

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 October 1998, and conflicting national standards shall be withdrawn at the latest by October 1998.

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.

Introduction

In order to improve and maintain highway safety, the design of safer roads requires the installation, on certain sections of road and at particular locations, the installation of devices to restrain vehicles and pedestrians from entering dangerous zones or areas. The road restraint systems designated in this standard are designed to specified peformance levels of containment and to redirect errant vehicles and to provide guidance for pedestrians or other road users.

The objective of the standard is to provide a procedure whereby the present national standards and regulations, which currently pertain in member countries, can be harmonised to a common European Standard.

Many types of road restraint systems are available ; their characteristics differ both by function and by on-road. European standardisation requires common terminology in order to provide a clear understanding of the design, performance, production and construction of the various road restraint systems.

The standard identifies impact test tolerances and vehicle performance criteria that need to be met to gain approval. The design specification, for road restraint systems entered in the test report, should identify the on-road site conditions under which the road restraint system should be installed.

The performance range of restraint systems, designated in this standard, enables national and Local Authorities to recognize and specify the performance class to be deployed.

The range of possible vehicular impact into an on-road road restraint system is extremely large in terms of speed, approach angle, vehicle type, vehicle attitude, and other vehicle and road conditions. Consequently the actual on-road impacts which occur may vary considerably from the specific standard test conditions. However, adequate implementation of the standard should identify the characteristics, in a candidate safety road restraint system, that are likely to achieve maximum safety and reject those features which are unacceptable.

It is recommended that this standard is reviewed within a period of five years or following the completion of a proposed set of impact validation tests.

1 Scope

This European Standard gives the definitions of the principal terms used for road vehicle restraint systems and pedestrian restraint systems in other Parts in this standard. It also specifies the general provisions for test methods.

Informative annexes B and C give information on impact kenetic energy and vehicle acceleration.

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 any 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 1317-2 Road restraint systems - Part 2 : Performance classes, impact test acceptance criteria and test methods for safety barriers

prEN 1317-3 Road restraint systems - Part 3 : Performance classes, impact test acceptance criteria and test methods for crash cushions

3 Abbreviations

ASI : Acceleration severity index

THIV : Theoretical head impact velocity

PHD : Post-impact head deceleration

OIV : Occupant impact velocity

ORA : Occupant ridedown acceleration

VCDI : Vehicle cockpit deformation index

VIDI : Vehicle interior deformation index

4 Road restraint system terminology

The types of systems are shown in figure 1 :

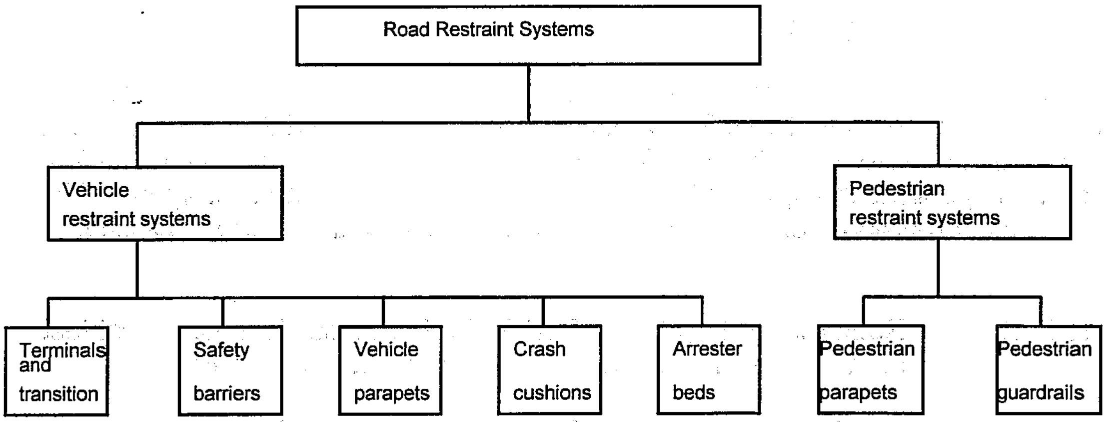

Figure 1 : Types of systems

For the purposes of this standard, the following definitions apply :

4.1 **road restraint system** : General name for vehicle restraint system and pedestrian restraint system use on the road.

4.2 **vehicle restraint system** : A system installed on the road to provide a level of containment for an errant vehicle.

4.3 **safety barrier** : A road vehicle restraint system installed alongside, or on the central reserve, of a road.

4.4 **permanent safety barrier** : A safety barrier installed permanently on the road.

4.5 **temporary safety barrier** : A safety barrier which is readily removable, and used at road works, emergencies or similar situations.

4.6 **deformable safety barrier** : A safety barrier that deforms during a vehicle impact and may suffer permanent deformation.

4.7 **rigid safety barrier** : A safety barrier that has negligible deflection during a vehicle impact.

4.8 **single sided safety barrier** : A safety barrier designed to be impacted on one side only.

4.9 **double sided safety barrier** : A safety barrier designed to be impacted on both side.

4.10 **terminal** : The end treatment of a safety barrier.

4.11 **leading terminal** : A terminal placed at the upstream end of a safety barrier.

4.12 **trailing terminal** : A terminal placed at the downstream end of a safety barrier.

4.13 transition : Connection of two safety barriers of different designs and or performances.

4.14 vehicle parapet : A safety barrier installed on the edge of a bridge or on a retaining wall or similar structure where there is a vertical drop and which may include additional protection and restraint for pedestrians and other road users.

4.15 crash cushion : A road vehicle energy absorbtion device installed in front of a rigid object to reduce the severity of impact.

4.16 redirective crash cushion : A crash cushion designed to contain and redirect an impacting vehicle.

4.17 non-redirective crash cushion : A crash cushion designed to contain and capture an impacting vehicle.

4.18 arrester bed : An area of land adjacent to the road filled with a particular material to decelerate and arrest errant vehicles.

4.19 pedestrian restraint system : A system installed and to provide guidance for pedestrians.

4.20 pedestrian parapet : A pedestrian or "other users" restraint system along a bridge or on top of a retaining wall or similar structure and which is not intended to act as a road vehicle restraint system.

4.21 pedestrian guardrail : A pedestrian or "other user"restraint system along the edge of a footway or footpath intended to restrain pedestrians and other users from stepping onto or crossing a road or other area likely to be hazardous.

NOTE : "Other users" include provision for equestrians, cyclists and cattle.

5 Vehicle specifications under test conditions

Vehicle specifications under test conditions are specified in table 1.

Table 1 : Vehicle specifications

MASS kg								
Vehicle mass (1)	825 ±40	1 300 ±65	1 500 ±75	10 000 ±300	13 000 ±400	16 000 ±500	30 000 ±900	38 000 ±1 100
Including maximum ballast (2)	100	160	180	-	-	-	-	-
Dummy	75	-	-	-	-	-	-	-
Total test mass	900 ±40	1 300 ±65	1 500 ±75	10 000 ±300	13 000 ±400	16 000 ±500	30 000 ±900	38 000 ±1 100
DIMENSIONS m (limit deviation ± 15%)								
Wheel track (front and rear)	1,35	1,40	1,50	2,00	2,00	2,00	2,00	2,00
Wheel radius (unloaded)	-	-	-	0,46	0,52	0,52	0,55	0,55
Wheel base (between extreme axles)	-	-	-	4,60	6,50	5,90	6,70	11,25
Number of axles	1S + 1 (3)	1S + 1	1S + 1	1S + 1	1S + 1	1S + 1/2	2S + 2	1S + 3/4
Ground clearance of the front bumper measured at the corner	-	-	-	0,58	-	0,58	0,58	0,58
CENTRE OF GRAVITY LOCATION m (limit deviation ± 10%)								
Longitudinal distance (4) from front axle (CGX) ± 10 %	0,90	1,10	1,24	2,70	3,80	3,10	4,14	6,20
Lateral distance from vehicle center line. (CGY)	± 0,07	± 0,07	± 0,08	± 0,10	± 0,10	± 0,10	± 0,10	± 0,10
Height above ground (CGZ) :								
Vehicle mass (± 10 %)	0,49	0,53	0,53	-	-	-	-	-
Load (+ 15 % - 5 %)	-	-	-	1,50	1,40	1,60	1,90	1,90
TYPE OF VEHICLE	Car	Car	Car	Rigid HGV	Bus	Rigid HGV	Rigid	Articulated HGV

(1) Including load for heavy goods vehicles (HGV)

(2) Including measuring and recording equipment

(3) S : steering axle

(4) vehicle mass

6 Measurement of the acceleration severity index (ASI)

6.1 Calculation of ASI

The acceleration severity index ASI is a function of time, computed with the following equation (1) :

$$ASI(t) = \left[(\bar{a}x/\hat{a}x)^2 + (\bar{a}y/\hat{a}y)^2 + (\bar{a}z/\hat{a}z)^2\right]^{1/2} \tag{1}$$

where :
$\hat{a}x$, $\hat{a}y$ and $\hat{a}z$ are limit values for the components of the acceleration along the body axes x,y and z ; $\bar{a}x$, $\bar{a}y$ and $\bar{a}z$ are the components of the acceleration of a selected point P of the vehicle, averaged over a moving time interval δ = 50 ms, so that :

$$\bar{a}x = \frac{1}{\delta}\int_t^{t+\delta} ax\,dt\,; \quad \bar{a}y = \frac{1}{\delta}\int_t^{t+\delta} ay\,dt\,; \quad \bar{a}z = \frac{1}{\delta}\int_t^{t+\delta} az\,dt\,; \tag{2}$$

The index ASI is intended to give a measure of the severity of the vehicle motion for a person seated in the proximity of point P during an impact.

The average in equation (2) is actually a low pass filter, taking into account the fact that vehicle accelerations can be transmitted to the occupant body through relatively soft contacts, which cannot pass the highest frequencies.

The equation (1) is the simplest possible interaction equation of three variables x, y and z : If any two components of vehicle acceleration are null, ASI reaches its limit value of 1 when the third component reaches its limit acceleration ; but when two or three components are non null ASI may be 1 with the single components well below the relevant limits.

The limit accelerations are interpreted as the values below which passenger risk is very small (light injures if any).

For passengers wearing safety belts, the generally used limit accelerations are :

$$\hat{a}x = 12g,\ \hat{a}y = 9g,\ \hat{a}z = 10g, \tag{3}$$

where :

g = 9,81 ms^{-2} is the reference for the acceleration.

With the equation (1) ASI is a non dimensional quantity, which is a scalar function of time, and in general of the selected vehicle point, having only positive values. The more ASI exceeds unity, the more the risk for the occupant in that point exceeds the safety limits ; therefore the maximum value attained by ASI in a collision is assumed as a single measure of the severity, or :

$$ASI = \max\,[ASI(t)] \tag{4}$$

6.2 Vehicle instrumentation

Vehicle acceleration shall be measured at a single point (P) within the vehicle body close to the vehicle centre of gravity. Then three acceleration transducers (or one tri-axial transducer) are required.

However experience shows that, due to physical constraints, the actual placement of the set of accelerometers may be offset several centimeters from the centre of gravity ; then, significant differences can occur between measured accelerations and those at the center of mass, due to angular motions. In these cases a second tri-axial transducer set of accelerometers shall be placed along the longitudinal axis.

In long vehicles acceleration can vary considerably from the front to the rear, mainly due to yaw motion. For example, in a bus colliding with a side barrier, it is recommended to evalute ASI in two points (P_1 and P_2), corresponding to the extreme forward and backward passenger positions : the most direct way to do that is to place two tri-axial transducers right in such positions.

Alternatively, if a complete set of transducers is installed to record the six degrees of freedom motion of the vehicle, the complete vehicle acceleration field can be computed, and then the ASI index can be easily evaluated in any point.

The transducers, filters and recording channels shall comply with the frequency class specified in EN 1317-2 and prEN 1317-3.

6.3 Summary of the procedure to compute ASI

a) Record the measures of the three components of vehicle acceleration with the prescribed instrumentation. In general such measures are stored on a magnetic support, as three series of N numbers, sampled at a certain sampling rate S (samples per second).

For such three series of measures :

$$ {}^{1}a_x,\ {}^{2}a_x,\ldots,\ {}^{k-1}a_x,\ {}^{k}a_x,\ {}^{k+1}a_x,\ldots,\ {}^{N}a_x $$

$$ {}^{1}a_y,\ {}^{2}a_y,\ldots,\ {}^{k-1}a_y,\ {}^{k}a_y,\ {}^{k+1}a_y,\ldots,\ {}^{N}a_y $$

$$ {}^{1}a_z,\ {}^{2}a_z,\ldots,\ {}^{k-1}a_z,\ {}^{k}a_z,\ {}^{k+1}a_z,\ldots,\ {}^{N}a_z $$

the acceleration of gravity g is the unit of measurement.

b) Find the number *m* of samples in the averaging window $\delta = 0{,}05$ s :

$m = \mathrm{INT}(\delta * S) = \mathrm{INT}(0{,}05 * S)$, where INT(R) is the integer nearest to R. For example, If S = 500 samples/s, $m = 25$.