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English version

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

Dispositifs routiers de retenue - Partie 3: Atténuateurs de choc - Classes de performance, critère d'acceptation des essais de choc et méthodes d'essais

Rückhaltesysteme an Straßen - Teil 3: Leistungsklassen, Abnahmekriterien für Anprallrprüfungen und Prüfverfahren für Anpralldämpfer

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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EUROPÄISCHES KOMITEE FÜR NORMUNG

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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 shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by November 2000, and conflicting national standards shall be withdrawn at the latest by November 2000.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.

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

- Part 1 : Terminologie and general criteria for test methods;

- Part 2 : Performance classes, impact test acceptance criteria and test methods for safety barriers;

- Part 3 : Performance classes, impact test acceptance criteria and test methods for crash cushions;

The following Parts have 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 and evaluation of conformity;

- Part 6: Pedestrian road restraint system, pedestrian parapet.

Introduction

Based on safety considerations, the design of roads may require the installation of crash cushions at certain locations. These are designed to reduce the severity of vehicle impact with a more resistive object.

One objective of this standard is to lead to the harmonisation of current national standards and/or regulations for crash cushions and to categorize them into performance classes.

The standard specifies the levels of performance, required of crash cushions, for the restraint and/or redirection of impacting vehicles.

The impact severity of vehicles in collision with crash cushions is rated by the indices Theoretical Head Impact Velocity (THIV), Post-impact Head Deceleration (PHD) and Acceleration Severity Index (ASI) (see EN 1317-1).

The different performance levels will enable national and local authorities to specify the performance class of crash cushions. The type or class of road, its location, its geometrical layout, the existence of a vulnerable structure or potentially hazardous area adjacent to the road are factors to be taken into consideration.

Attention is drawn to the fact that the acceptance of a crash cushion will require the successful completion of a series of tests (see table 1, 2, 3, etc.).

Additional sensitive areas, including transitions to an obstacle or a safety barrier, should be considered for tests.

To ensure proper use of this Part of the standard, it is essential to consider all of the other Parts of this standard, especially Part 5 : Durability and attestation of conformity.

1 Scope

This European Standard specifies requirements for the performance of crash cushions from vehicle impacts. It specifies performance classes and acceptance criteria for impact tests.

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 1317-1 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 Abbreviations

ASI	Acceleration Severity Index
THIV	Theoretical Head Impact Velocity
PHD	Post-impact Head Deceleration

4 Definitions

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

4.1 obstacle : The item being protected from vehicular impact by the presence of a crash cushion.

4.2 front face of the obstacle: The surface closest to a plane drawn perpendicular to the centre line of the crash cushion.

4.3 system type tested crash cushions: A System Type Tested Crash Cushion is a multiple performance product that can be assembled to form different models from the same set of components, to obtain different shapes and performances, with the same working mechanism for the system and its components.

5 Performance classes

5.1 Acceptance criteria

The acceptance of a crash cushion shall be determined as a function of the following performance criteria :

- vehicle impact severity ;
- vehicle trajectory ;
- projection and distribution of test vehicle and crash cushion debris ;
- containment level
- crash cushion deflection.

NOTE See clause 6 for further details.

5.2 Velocity classes

Velocity classes shall be :

- 50 km/h ;
- 80 km/h ;
- 100 km/h ;
- 110 km/h.

5.3 Types of crash cushion

Types of crash cushion shall be :

- redirective (R) : crash cushions which retain and redirect vehicles ;

- non redirective (NR) : crash cushions which retain but do not redirect vehicles.

Vehicle impact test criteria shall be as given in table 1.

Table 1 - Vehicle impact test criteria for crash cushions

Test [1)]	Approach	Total vehicle mass kg	Velocity km/h	Figure 1 Test N°
TC 1.1.50	Head-on centre	900	50	1
TC 1.1.80		900	80	
TC 1.1.100		900	100	
TC 1.2.80		1300	80	1
TC 1.2.100			100	
TC 1.3.110		1500	110	1
TC 2.1.80	Head-on, ¼ vehicle offset	900 [2)]	80	2
TC 2.1.100			100	
TC 3.2.80	Nose (centre), at 15°	1300	80	3
TC 3.2.100		1300	100	
TC 3.3.110		1500	110	
TC 4.2.50	Side impact at 15°	1300	50	4
TC 4.2.80		1300	80	
TC 4.2.100		1300	100	
TC 4.3.110		1500	110	
TC 5.2.80	Side impact at 165°	1300	80	5
TC 5.2.100		1300	100	
TC 5.3.110		1500	110	

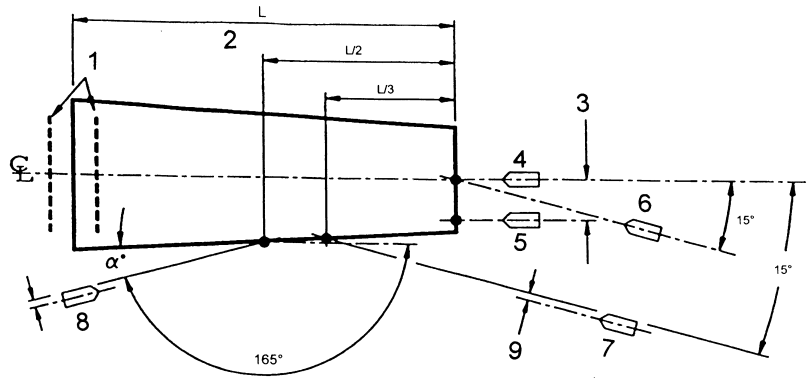
1) Test notation is as follows :

TC	**1**	**2**	**80**
Test of crash cushion	Approach	Test vehicle mass	Impact speed

2) For this test condition, the dummy is to be located at the more distant location from the centre line of crash cushion.

NOTE 1 Vehicle specifications and tolerances are specified in EN 1317-1.

NOTE 2 Test 5 will not be run for a crash cushion of non-parallel form when, at the relevant impact point, the angle (α) of the vehicle path to the traffic face of the crash cushion is less than 5°.



Key

1 Alternative locations for front face of obstacle
2 Crash cushion
3 ¼ vehicle width offset for test 2
4 Test 1
5 Test 2
6 Test 3
7 Test 4
8 Test 5
9 ½ vehicle width

Figure 1 - Vehicle approach paths for tests 1 to 5.

The crash cushion performance classes shall be as given in table 2 and table 3. These are classified according to an increasing energy absorption capacity. A successfully tested crash cushion at a given performance level, shall be considered as having met the test conditions of lower levels unless a device is present which may not function in an acceptable manner at a lower impact velocity. In this case, an additional test is required to demonstrate its performance ; this additional test shall be determined by the approved body responsible for initial type testing of the product.

Table 2 - Performance levels for redirective crash cushions.

Level	Acceptance test					
50	TC 1.1.50	-	-	-	TC 4.2.50	-
80/1	-	TC 1.2.80	TC 2.1.80	-	TC 4.2.80	-
80	TC 1.1.80	TC 1.2.80	TC 2.1.80	TC 3.2.80	TC 4.2.80	TC 5.2.80*
100	TC 1.1.100	TC 1.2.100	TC 2.1.100	TC 3.2.100	TC 4.2.100	TC 5.2.100*
110	TC 1.1.100	TC 1.3.110	TC 2.1.100	TC 3.3.110	TC 4.3.110	TC 5.3.110*

NOTE 1 Tests marked (*) will not be required where this vehicle approach is not possible (e.g. when traffic is in one direction only or at a toll booth/gate).

NOTE 2 For class 80/1 the number of tests required is reduced and the Acceleration Severity Index, crash cushion deformation and vehicle behaviour are not comparable to class 80.

Table 3 - Performance levels for non-redirective crash cushions.

Level	Acceptance test			
50	TC 1.1.50	-	-	-
80/1	-	TC 1.2.80	TC 2.1.80	-
80	TC 1.1.80	TC 1.2.80	TC 2.1.80	TC 3.2.80
100	TC 1.1.100	TC 1.2.100	TC 2.1.100	TC 3.2.100
110	TC 1.1.100	TC 1.3.110	TC 2.1.100	TC 3.3.110
NOTE For class 80/1 the number of tests required is reduced and the Acceleration Severity Index, crash cushion deformation and vehicle behaviour are not comparable to class 80.				

5.4 Impact severity

Vehicle occupant impact severity shall be assessed by the indices ASI, THIV and PHD.

These indices are explained in EN 1317-1.

The severity levels shall be determined as shown in table 4 as a function of the value of the ASI; THIV and PHD indices.

Table 4 - Vehicle impact severity values

Impact severity levels	Index values		
A	ASI ≤ 1,0	THIV ≤ 44 km/h in tests 1,2 and 3 THIV ≤ 33 km/h in tests 4 and 5	PHD ≤ 20 g
B	ASI ≤ 1,4	THIV ≤ 44 km/h in tests 1,2 and 3 THIV ≤ 33 km/h in tests 4 and 5	PHD ≤ 20 g
NOTE 1 Impact severity level A affords a greater level of safety for the occupants of an errant vehicle than level B and is preferred. NOTE 2 The limit value for THIV is higher in tests 1, 2 and 3 because experience has shown that higher values can be tolerated in frontal impacts (also because of better passive safety in this direction). Such a difference in tolerance between frontal and lateral impacts is already considered in the ASI parameter, which therefore does not need to be changed.			

For a series of tests on a particular crash cushion, all resulting impact severity levels shall be recorded in the test report.

5.5 Tests for system type tested crash cushions

A group of models can be derived from a single parent crash cushion once the latter has been successfully tested in accordance to this standard. The models in the group cover a range of velocity classes, width and taper angles. Provided that the models in the group:

- are assembled from the same set of components,
- have the same product name,

- have the same working mechanism for the system and for the components;

the group, specified by the drawings of all the models, can be tested as a single product with multiple performance possibilities. If the tests specified by the group test matrix are passed, the crash cushion is accepted as a multiple performance product, i.e. each model is accepted in the relevant performance class. All the cushions in the group shall be of the same type, i.e. all redirective or all non-redirective.

If the parent crash cushion has the minimum taper/width and belongs to the highest velocity class, the test matrix is the one shown in tables 5, 6, 7 or 8, depending on the highest velocity of the group.

Table 5 - Parent Crash Cushion with minimum taper/width, 110 km/h

Velocity class (km/h)	Taper/width		
	Minimum	Intermediate	Maximum
110	All Tests	-	TC 1.1.100 TC 4.3.110 **
100	TC 1.2.100	-	TC 4.2.100 **
80	TC 1.2. 80	-	TC 4.2. 80 **
50	TC 1.1. 50	-	TC 4.2. 50 **
NOTE Tests marked (**) will not be required for non-redirective crash cushions.			

TABLE 6 - Parent Crash Cushion with minimum taper/width, 100 km/h

Velocity class (km/h)	Taper/width		
	Minimum	Intermediate	Maximum
100	All Tests	-	TC 1.1.100 TC 4.2.100 **
80	TC 1.2. 80	-	TC 4.2. 80 **
50	TC 1.1. 50	-	TC 4.2. 50 **
NOTE Tests marked (**) will not be required for non-redirective crash cushions.			

Table 7- Parent Crash Cushion with minimum taper/width, 80 km/h

Velocity class (km/h)	Taper/width		
	Minimum	Intermediate	Maximum
80	All Tests	-	TC 1.1.80 TC 4.2.80 **
50	TC 1.1. 50	-	TC 4.2.50 **
NOTE Tests marked (**) will not be required for non-redirective crash cushions.			

Table 8 - Parent Crash Cushion with minimum taper/width, 50 km/h

Velocity class (km/h)	Taper/width		
	Minimum	Intermediate	Maximum
50	All Tests	-	TC 1.1.50 TC 4.2.50 **
NOTE Tests marked (**) will not be required for non-redirective crash cushions.			

If the parent crash cushion has the minimum taper/width, belongs to the 100 km/h velocity class and the group also covers the 110 km/h velocity class, the test matrix is the one shown in table 9:

Table 9 - Parent Crash Cushion with minimum taper/width, 100 km/h

Velocity class (km/h)	Taper/width		
	Minimum	Intermediate	Maximum
110	TC 1.3.110 TC 3.3.110	-	TC 4.3.110 **
100	All Tests	-	TC 1.1.100 TC 4.2.100 **
80	TC 1.2. 80	-	TC 4.2. 80 **
50	TC 1.1. 50	-	TC 4.2. 50 **
NOTE Tests marked (**) will not be required for non-redirective crash cushions.			

If the parent crash cushion has the maximum taper/width, belongs to the 100 km/h velocity class and the group also cover the 110 km/h velocity class, the test matrix is the one in table 10:

Table 10 - Parent Crash Cushion with maximum taper/width, 100 km/h

Velocity class (km/h)	Taper/width		
	Minimum	Intermediate	Maximum
110	TC 1.3.110 TC 3.3.110	-	TC 4.3.110 **
100	TC 1.2.100 TC 4.2.100 ** TC 5.2.100 *	-	All Tests
80	TC 1.2. 80	-	TC 4.2. 80 **
50	TC 1.1. 50	-	TC 4.2. 50 **
NOTE 1 Tests marked (**) will not be required for non-redirective crash cushions. NOTE 2 Test marked (*) will not be required where this vehicle approach is not possible (e.g. when traffic is in one direction only, or at toll booth/gate).			

Every component in the component set shall be present at least in one test. If not, additional tests shall be performed within the velocity class of the parent model.
Tables 5, 6, 7 and 8 apply when lower velocity models are obtained from the next higher performance models, just removing a component in the last third of the latter. In other cases, approach 1 tests with the light vehicle shall be added to the first column of the relevant test matrix.

If a model with Impact Severity level B is obtained from one with an Impact Severity level A by simply removing some component from the last third of the latter, the new model can be accepted with a single test with approach 1 and with the heaviest applicable vehicle.

A multiple performance product may lack one or more models, corresponding to one or more cells in the test matrix; in this case, cells can be deleted in the test matrix, from the bottom and from the top, with the following limitations:

- the row of the parent model shall not be affected;
- the cell in the first column shall not be deleted unless all the relevant row is deleted.

NOTE 1 The minimum and maximum taper and width are specified by the design of the system.

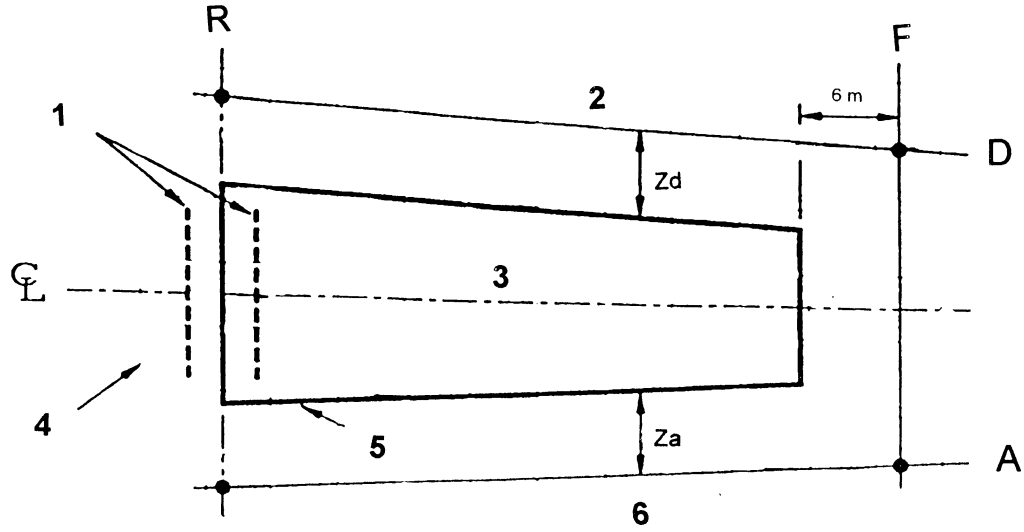
NOTE 2 Intermediate tapers may be more than one or they may be absent, as specified by the design.

NOTE 3 If the design has only one taper, this taper is considered to be the minimum and the first column of the relevant Table applies; table 10 is not applicable.

6 Impact test acceptance criteria

6.1 General

The plan profile of the crash cushion under test shall be inscribed within a trapezoidal envelope having a minimum plan area as shown in figure 2 and any essential supporting structure shall be included within this envelope.



Key

1 Alternative locations for front face of obstacle
2 Departure side
3 Crash cushion centre line
4 Ground reference grid
5 Envelope enclosing crash cushion
6 Approach side

NOTE For R, F, D, A and Za and Zd see 6.3.

Figure 2 - Exit box

For completion of a successful test the impact acceptance criteria and measurement as specified in 6.2 to 6.5 shall apply.

6.2 Crash cushion behaviour

Elements of the crash cushion shall not penetrate the passenger compartment of the vehicle. Deformations of, or intrusions into, the passenger compartment, that could cause serious injuries to the occupants, are not permitted

No major element of the crash cushion, having a solid mass greater than or equal to 2,0 kg, shall become totally detached, unless this is required by the working of the crash cushion. No major element of the crash cushion shall impede the path of adjacent traffic. The final position of the detached element shall be considered to determine the displacement classification (see 6.5).

Anchorages and fixings shall perform to the crash cushion design specifications and other specified requirements as listed in the test report. The deformed crash cushion shall not encroach into the front surface of the obstacle.

6.3 Test vehicle behaviour

The vehicle shall remain upright during and after collision although yawing and moderate rolling and pitching are acceptable. The post-impact trajectory of the test vehicle shall be controlled by means of the exit box shown in figure 2. The exit box is limited by :

- the rebound line F, perpendicular to the crash cushion centre line, 6 m ahead of the crash cushion box ;

- the two side lines A and D, parallel to the two sides of the trapezoidal envelope defined in clause 6, are at distances Za on the approach side and Zd on the departure side ;

- the line R is perpendicular to the centre line at the end of the crash cushion ;

- a broken line, see figure 2, represents the front face of the obstacle to be protected ; this line shall be specified in the design of the crash cushion and reported in the test report - it may be slightly inside or outside the crash cushion envelope.

For different tests, the vehicle post-impact trajectory shall be restricted by the following criteria :

- in any test the vehicle shall not intrude the broken line representing the front face of the obstacle;

- in tests 1 to 5 the wheels of the vehicle shall not encroach the lines of the exit box specified in table 11 unless the velocity of the vehicle centre of gravity at the instant of encroachment is less than 10 per cent of the prescribed impact speed.

Table 11 - Exit box

Test	Exit box control lines
1	F, A, D, R
2 to 4	F, A, D
5	A

The classes of crash cushions Z1, Z2, Z3 and Z4 shall be ranked according to the distances Za and Zd given in table 12 and shown in figure 2.

Table 12 - Redirection zone dimensions (Za and Zd)

Classes of Z	Approach side	Departure side
	Za m	Zd m
Z1	4	4
Z2	6	6
Z3	4	≥ 4, test 3, figure 1
Z4	6	≥ 6, test 3, figure 1

6.4 Severity index

ASI, THIV and PHD shall be computed using at least the minimum amount of vehicle instrumentation as specified in 7.6. These values shall be quoted in the test report (see EN 1317-1).

The maximum values of ASI, THIV and PHD shall not exceed the values given in table 4.

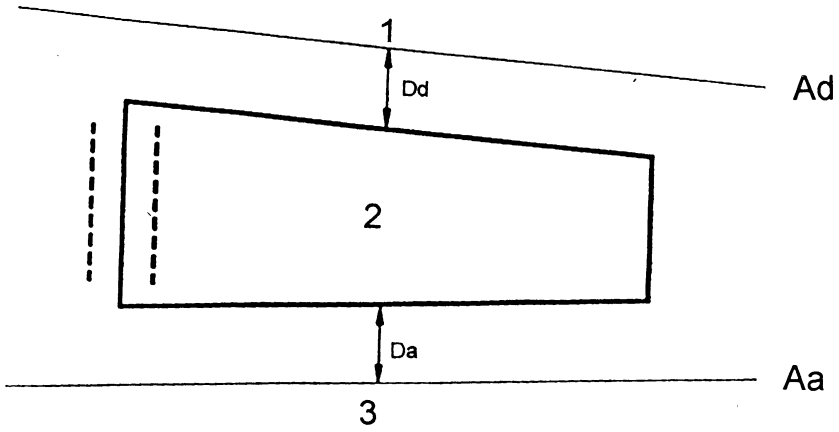
6.5 Crash cushion lateral displacement

The eight classes D1 to D8 for the permanent lateral displacement of the crash cushion shall be as shown in table 13. The permanent lateral displacement shall be measured and recorded in the test report. To meet classes D1 to D4, the crash cushion under test in tests 1, 2, 3, 4 and 5, shall remain within distances Da and Dd from the design envelope. The displacement of Da and Dd are shown by lines Aa and Ad in figure 3.

Table 13 - Permanent lateral displacement zones for crash cushions

Classes	Displacement	
	Da m	Dd m
D1	0,5	0,5
D2	1,0	1,0
D3	2,0	2,0
D4	3,0	3,0
D5	0,5	≥ 0,5 test 3, figure 1
D6	1,0	≥ 1,0 test 3, figure 1
D7	2,0	≥ 2,0 test 3, figure 1
D8	3,0	≥ 3,0 test 3, figure 1

For classes D5 to D8, the crash cushion shall meet the same test conditions as classes D1, D2, D3 and D4 with the exception that, for test 3, the crash cushion may move an unspecified distance on the departure side shown in figure 3.



Key

1 Departure side
2 Envelope for crash cushion design
3 Approach side

Figure 3 - Crash cushion permanent deflection limits

7 Test methods

7.1 Test site

The test site shall be generally flat with a gradient not exceeding 2,5 %. It shall have a level hardened paved surface and shall be clear of standing water, ice or snow at the time of the test. It 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 crash cushion is stable.

Measures shall be taken in order to minimise dust generation from the test site during the impact test so that photographic records will not be obscured.

Measures shall be taken to ensure that in the exit area the test vehicle does not collide with any independent obstruction which could cause additional deformation of the test vehicle.

7.2 Test vehicle

The vehicles to be used in the tests shall be production models representative of the current traffic, having characteristics and dimensions within the vehicle specifications defined in EN 1317-1.

The tyres shall be inflated to the manufacturers recommended pressures. The condition of the vehicle shall be such as to satisfy the requirements for the issue of a certificate of road worthiness in respect of tyres, suspension, wheel alignment and bodywork. No repairs or modifications shall be made that would alter the general characteristics of the vehicle. The vehicle shall be clean and mud or deposits, which may cause dust on impact, shall be removed prior to testing.

NOTE Marker points may be placed on external surfaces of the test vehicle to aid analysis.

The vehicle shall not be restrained by control of the steering or by any other means (e.g. braking, antilock brakes, blocking or fixing) during impact and whilst the vehicle is in the redirection zone as

defined in 6.3. If the vehicle has an automatic gearbox, positive means shall be taken to ensure that the engine is disengaged from the car immediately before, and remains so during, the impact.

All fluids shall be included in the inertial test 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.

7.3 The crash cushion

7.3.1 General

Detailed descriptions and design specifications of the crash cushion shall be included in the test report (see EN 1317-1) to enable verification of conformity of the installed system to be tested, with the design specification.

7.3.2 Installation

The installation of the crash cushion for the test shall comply with the structural design details and with the on-road system details as given in the design specification.

7.3.3 Position of the impact point

The required impact point for tests 1 to 5 shall be as defined in figure 1.

7.4 Procedures for recording test data

The following test characteristics shall be recorded.

7.4.1 Pre-test data

The following test characteristics shall be recorded:

- mass of the vehicle and location of the centre of gravity of the vehicle in the test condition including added ballast (see ISO 10392) ;

- interior and exterior photographs of the vehicle ;

- photographs of the position and construction of the crash cushion.

It is recommended that the mass vehicle moments of inertia should be reported.

7.4.2 Test data

The following test characteristics shall be recorded:

- vehicle speed at impact ;

- vehicle approach path ;

- vehicle rebound speed, if required ;

- linear accelerations and angular velocities ;

- permanent deflection of the crash cushion system, to be measured 10 to 15 minutes after impact ;

- photographic records from high speed cine film cameras and/or high speed video cameras deployed in such a way to give a complete record of the vehicle response and crash cushion behaviour, including deformation and deflection ;

- vehicle exit speed of centre of gravity when first wheel encroaches any of the lines specified in 6.3 and figure 2.

7.4.3 Post-test data

General damage and deformation of the test vehicle.

- damage to the crash cushion ;

- still photographs to aid reporting ;

- ambient temperature.

7.5 Accuracies and deviation of impact speeds and angles

7.5.1 Vehicle impact speed

Vehicle impact speed shall be measured along the vehicle approach path no further than 6 m before the impact point. The overall accuracy of speed measurement shall be within ± 1 %.

Impact speed shall be within a deviation of - 0,0 % and + 7,0 %.

7.5.2 Vehicle exit speed

Vehicle exit speed shall be measured with an accuracy of ± 5 km/h.

7.5.3 Vehicle approach angle

Vehicle approach angle shall be measured along the vehicle approach path no further than 6 m before the impact point by a suitable method. The overall accuracy shall be within ± 0,5 °.

Impact angle shall be within a deviation of ± 1,5 °.

7.5.4 Vehicle impact point

The lateral displacement of the vehicle approach path shall be measured with an accuracy of ± 0,05 m by a suitable method. The permitted deviation for the lateral displacement of the vehicle path from its prescribed path shall be less than 0,10 m at the moment of contact.

7.6 Vehicle instrumentation

The minimum vehicle instrumentation for recording linear accelerations and angular velocities, shall consists of a set of three linear acceleration transducers, mutually orthogonal, aligned with

the vehicle axis (longitudinal, transversal and vertical), plus one angular rate transducer to record yaw rate if not measured from the photographic records as described in EN 1317-1.

The three accelerometers and the yaw rate sensor should be mounted on a common block and placed as close to the vehicle centre of gravity as practical. If this cannot be achieved, reference should be made to EN 1317-1.

Acceleration and angular velocity transducers and the relevant recording channels shall comply with ISO 6487 , the minimum frequency class being CFC 180.

Frequency class CFC 180 shall be used for data analysis ; when plotting graphical results the filter frequency should be quoted.

7.7 Photographic coverage

High speed cameras and/or high speed video cameras shall be operated at a minimum of 200 frames per second.

A minimum of two high speed cameras and one normal speed camera shall be located to record the performance of the crash cushion. The recommended camera schedule comprises the following, (see figure 4) :

a) one high speed camera looking normal to the crash cushion centre line ;

b) one or two overhead high speed cameras, located in a way to cover the vehicle motion from at least 6 m before the impact point to a distance to record the performance of the crash cushion ;

c) one panned camera at normal speed sited at right angles to the path of the vehicle ;

d) (optional) one high speed camera looking from a position behind the impact point in order to record the vehicle roll, vertical lift, penetration and sequence of action as the crash cushion is struck.

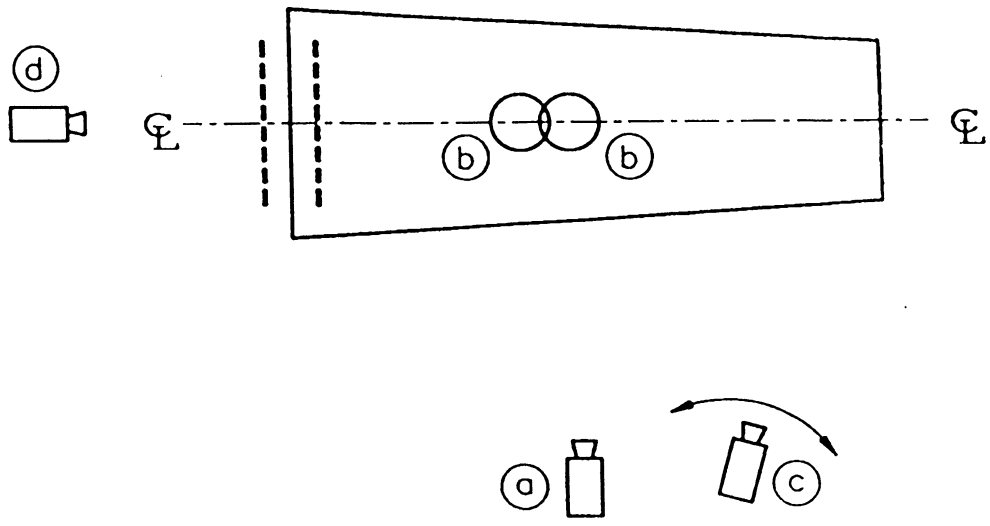


Figure 4 - Layout of cameras for recording tests

7.8 Test report

The test report shall comply with the format as given in EN 1317-1.