

PAS 68:2010



BSI Standards Publication

Impact test specifications for vehicle security barriers

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Summary of pages

This document comprises a front cover, an inside front cover, pages i to ii, pages 1 to 26, an inside back cover and a back cover.

Foreword

This Publicly Available Specification (PAS 68:2010) has been developed for the UK Government's Centre for the Protection of National Infrastructure (CPNI) by the Transport Research Laboratory (TRL) in collaboration with the British Standards Institution (BSI).

This supersedes PAS 68:2007, which is withdrawn.

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Introduction

PAS 68:2010 has been prepared to address the needs of organizations who wish to have assurance that vehicle security barriers will provide the level of impact resistance which is sought.

Many systems are available that are either promoted or considered suitable for use as vehicle security barriers. As their characteristics differ in both function and form, a comparative means of assessing their performance is required.

This Publicly Available Specification identifies impact test methods, tolerances, test vehicle type and vehicle performance criteria that need to be met in order to conform to PAS 68. Design guidance for installing barriers is provided in PAS 69:2006.

1 Scope

This Publicly Available Specification (PAS) cites a classification system for the performance of vehicle security barriers and their supporting foundations when subjected to a single horizontal impact.

This PAS specifies two test methods of determining the performance classification of vehicle security barriers:

- the vehicle impact method;
- the design method [which includes the use of finite element analysis (FEA) techniques if validated by test data].

This PAS lists alternative test methods for determining the performance classification of a vehicle security barrier (see Annex C).

This PAS does not cover the performance of a vehicle security barrier when subjected to blast or ballistic impact.

2 Normative references

The following referenced documents are required 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.

BS EN 1992-1-1:2004, *Eurocode 2: Design of concrete structures – General rules and rules for buildings*

NA to BS EN 1992-1-1:2004, *UK National Annex to Eurocode 2 – Design of concrete structures. General rules and rules for buildings*

BS EN ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*

3 Terms and definitions

For the purposes of this PAS the following terms and definitions apply.

3.1 ballast

weight securely fixed to the vehicle

3.2 cargo

loose material, which is in increments of not more than 25 kg, which is not securely fixed to the vehicle

NOTE Such material can include fluids, but only where the vehicle is designed to carry such fluids and the weight of a (75 kg) anthropomorphic dummy if requested.

3.3 impact angle

angle in the horizontal plane between the intended impact face and the approach path of the test vehicle into the test item

3.4 impact point

initial point of contact between the centre of the test vehicle and the test item

3.5 test vehicle impact speed

speed of the test vehicle measured along its approach path at a point no further than 8 m before the impact point

3.6 unladen weight

weight of test vehicle, with standard equipment, quantities of engine oil and coolant, and minimum amount of fuel to ensure engine operation during the test in order to facilitate power steering and braking systems

3.7 dispersion

the distance beyond the rear face of the barrier to the location of the furthest item of major debris

3.8 major debris

any single item totally detached from the test vehicle, its ballast, or the vehicle security barrier having a weight of more than 25 kg, as a consequence of the impact and projected beyond the original position of the back face of the test item

NOTE Dispersion distance of any major debris will be included within test reports to assist specifiers in the choice of an appropriate system.

3.9 fixed bollard

fixed vertical post/tube embedded into specified foundations and designed to prevent the passage of a vehicle

3.10 passive system

static security barrier which is fixed in place or is removable using personnel or plant

NOTE For example a structural wall, a fixed bollard, a removable bollard or a planter.

3.11 active system

security barrier which requires operation either by personnel or powered equipment

NOTE For example a manual dropping/ lifting-arm barrier or an automated retractable/rising bollard.

3.12 generic rigid test foundation

foundation that can be used for testing a vehicle security barrier, usually a bollard, which is not specifically designed with a bespoke foundation

3.13 integral test foundation

foundation which is designed and sized solely for use with the product tested

NOTE Any deformation / displacement of the foundation is a function of the overall performance and hence deformation / displacement should be reported.

3.14 leading edge of load bed

forward edge of the upper surface of the load bed intersecting the head-board or the transverse line where the head-board would be fitted

NOTE In the case of a goods vehicle, the equivalent longitudinal position (Datum) should be marked on the vehicle chassis. Experience has shown that a second mark should be made towards the rear of the chassis and the distance from the datum recorded. This enables the position of the leading edge of the load bed to be determined more readily if the front of the vehicle / chassis is distorted due to the vehicle impact with the vehicle security barrier.

3.15 test system

the operating equipment required for the test and specified foundations

3.16 test vehicle

commercially available vehicle with an unmodified chassis, load bed and frontal structure used in an impact test to evaluate the performance of a vehicle security barrier

NOTE Modifications may be made to the vehicle solely for the purpose of restraining forward movement of ballast.

3.17 vehicle penetration

maximum distance between the leading edge of the load platform of a commercial vehicle as marked on the chassis, or the base of the "A" pillar of a car or 4x4 pickup and the original rear face of the vehicle security barrier, measured at 90 degrees to the barrier system, during (e.g. by analyzing film, video and or instrumentation) or after the impact

3.18 vehicle security barrier

system designed and installed to bring to rest or redirect an impacting vehicle

3.19 inertial test vehicle mass

mass of vehicle including ballast and excluding cargo

4 Vehicle impact method – Classification code

4.1 Vehicle impact method

The performance class shall be expressed in terms of a 7-part classification as follows.

The classification code shall include the letter V.

Table 1 Performance classification – Vehicle impact test

1	2	3	4	5	6	7
Barrier type	V	Test mass (kg)	Impact speed (km/h)	Impact angle (degrees)	Vehicle Penetration (m)	Dispersion of major debris (m)
Example: Fixed bollard	V	4 or 5 digit test mass and test vehicle classification if a 7 500kg test mass	2 digit impact speed	Any angle between 0° to 90° in 5° intervals	To 1 decimal place where X.X is the penetration	To 1 decimal place where Y.Y is the dispersion distance

Performance classes:

EXAMPLE 1

(A) Fixed bollard V/1 500/48/90:1.7/5.2 denotes:

1. a fixed bollard;
2. tested using the vehicle impact method;
3. capable of withstanding an impact by a 1 500 kg car;
4. impact speed of 48 km/h;
5. impacted at 90 degrees to the front face of the bollard;
6. where the vehicle penetration was 1.7 m beyond the original position of the rear face of the bollard;
7. where major debris landed no more than 5.2 m beyond the original position the rear face of the bollard.

EXAMPLE 2

(B) Anti ram fence V/7 500(N3)/80/45:2.0/3.4 denotes:

1. anti ram fence;
2. tested using the vehicle impact method;
3. capable of withstanding an impact by a 7 500 kg goods vehicle of N3 classification;
4. impact speed of 80 km/h;
5. impacted at an angle of 45 degrees to the front face of the fence;
6. where the vehicle penetration was 2.0 m beyond the original position of the rear face of the fence;
7. where the major debris landed no more than 3.4 m beyond the original position of the rear face of the fence.

The vehicle weight and impact speed combination shall be selected from one of the combinations specified in Table 2.

Table 2 Vehicle impact test criteria

Test vehicle classification		Test classification kg – km/h	Test speed km/h	Equivalent test speed (nominal) (mph)	Impact angle degrees (±2°)	
Car	M1	1 500-16	16 ± 2	(10)	0° to 90° in 5° intervals	
		1 500-32	32 ± 2	(20)		
		1 500-48	48 ± 3	(30)		
		1 500-64	64 ± 3	(40)		
		1 500-80	80 ± 5	(50)		
		1 500-96	96 ± 5	(60)		
		1 500-112	112 ± 5	(70)		
4×4 single cab pick-up	M2	2 500-16	16 ± 2	(10)		
		2 500-32	32 ± 2	(20)		
		2 500-48	48 ± 3	(30)		
		2 500-64	64 ± 3	(40)		
		2 500-80	80 ± 5	(50)		
		2 500-96	96 ± 5	(60)		
		2 500-112	112 ± 5	(70)		
Day cab vehicles	3 500 kg Flat bed (RWD)	N1	3 500-16	16 ± 2	(10)	
			3 500-32	32 ± 2	(20)	
			3 500-48	48 ± 3	(30)	
			3 500-64	64 ± 3	(40)	
			3 500-80	80 ± 5	(50)	
			3 500-96	96 ± 5	(60)	
	7 500 kg 2-axle rigid	N2	7 500-16	16 ± 2	(10)	
			7 500-32	32 ± 2	(20)	
			7 500-48	48 ± 3	(30)	
			7 500-64	64 ± 3	(40)	
	18 000 kg 2-axle rigid	N3	7 500-16	16 ± 2	(10)	
			7 500-32	32 ± 2	(20)	
			7 500-48	48 ± 3	(30)	
			7 500-64	64 ± 5	(40)	
			7 500-80	80 ± 5	(50)	
	32 000 kg 4-axle rigid	N3	30 000-16	16 ± 2	(10)	
			30 000-32	32 ± 2	(20)	
			30 000-48	48 ± 3	(30)	
			30 000-64	64 ± 3	(40)	
			30 000-80	80 ± 5	(50)	

NOTE 1 Vehicle speeds in km/h have been rounded up to the nearest integer value.

NOTE 2 The N2 test vehicle is only acceptable for impact speeds up to and including 64 km/h. This is due to an inability to ensure that the ballast remains fixed to the load bed, without major modifications to the vehicle, at the moment of impact.

5 Vehicle impact assessment

5.1 Performance requirements

When tested using the vehicle impact method the vehicle security barrier shall bring to rest or redirect and contain an impacting vehicle on the approach side of the barrier.

Damage to, or movement of the vehicle security barrier shall be recorded and reported. The measurement shall record a maximum horizontal opening measured 600 mm above finished ground level.

NOTE 1 A gap of 1.2 m or more measured at 600 mm above finished ground level is deemed to be encroachable by a second vehicle.

If the vehicle security barrier consists of bollards (active or passive), all bollards shall meet the performance requirements individually.

Movement, lateral and rotational, of any foundation, and/or the bollard, shall be recorded and reported (see Figure 1).

NOTE 2 If the vehicle security barrier is also intended to resist access by pedestrian intruder, then following a vehicle impact, the barrier should be assessed using the test block shown in Figure 2. The test block should be offered to the opening formed in the vehicle security barrier by the impact to assess whether or not the full length of the block can pass axially through the opening; the result should be reported in the 'Observations' section of the Test Report (see 5.3.3 and C.6).