

Overview of HVM Crash Testing Standards

Differences between
PAS68, ASTM and IWA14-1



● Region of implementation

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BSI PAS 68:2013

"Publicly Available
Specification"

- **Region: Great Britain**
- Latest version: BSI PAS 68 from 2013



ASTM F2656

"American Society for Testing
and Materials"

- **Region: United States of America**
- Latest version: ASTM F2656/F2656M – 20 from 2020
- Superseded "DOS" or SD/STD2.01



ISO IWA 14-1

"International Workshop
Agreement"

- **Region: Global**
- Latest version: IWA14-1 (ISO 22343-1) from 2023
- Includes all-world threat vehicles contained in PAS 68 & ASTM F2656

● Purpose and vehicle types used

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BSI PAS 68:2013

“Publicly Available
Specification”

Defines a standard method for testing the impact performance and protection rating of a VSB when impacted by different categories of UK vehicles traveling at specified speeds.

ASTM F2656

“American Society for Testing
and Materials”

Defines the method for impact testing and assigning performance ratings for a VSB when impacted by different categories of North American vehicles. Now includes a UK/European style vehicle type: C7.

ISO IWA 14-1

“International Workshop
Agreement”

To provide a single international standard for impact testing and performance classification of VSBs. To achieve this, the vehicle categories assessed have UK, European, and North American vehicle types present.

● Good to know

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DoS SD-STD-02.01

Rev. A, 2003
(Withdrawn in 2028)

Region: United States of America

Forerunner of ASTM F2656, includes only USA vehicles and defines 'K' classifications (K4, K8, K12).

DoS SD-STD-02.011 was the first standard developed by the USA Department of State in 1985, which was later handed over to the American Society for Testing and Materials, now known as ASTM.

● Current HVM Standards

ASTM F2656-20

- US standard issued by ASTM (American Society for Testing & Materials)
- Updated in 2020
- Replaces SD/STD2.01 Rev A, US Department of State Standard
- “K” Ratings no longer exist replaced by vehicle categories C, P, M, H

PAS 68:2013

- UK standard prepared in conjunction with CPNI / BSI
- Recently undergone 2nd update
- Updated in 2015

IWA14-1:2013

- World Standard prepared in conjunction with CPNI / BSI with input from US Department of State
- Combines aspects of ASTM & PAS 68
- All these tests can be conducted at a variety of impact speeds
- Will be replaced by ISO soon



● BSI PAS 68:2013

Main characteristics:

- 6 vehicle type categories.
- Impact speed 16-112 km/h.
- Vehicle penetration distance from rear edge of product structure and is exact.
- Major debris dispersion from rear edge of product structure is part of rating.

PAS 68:2013 example performance rating

PAS 68:2013 Road blocker V / 7500 (N2) / 48 / 90 : -1,9 / 0

V	7500 kg[N2]	48 km/h	90 ⁰	-1,9 m	0 m
Vehicle Impact	Vehicle Mass (class)	Impact Speed	Impact Angle	Vehicle penetration distance	Major debris distance



On the photo is a TiSO road blocker during testing for the PAS 68:2013 standard. The crash test was successful; the road blocker has confirmed its protective properties.

● ISO IWA 14-1

Main characteristics:

- 9 vehicle type categories.
- Impact speed 16-112 km/h.
- Vehicle penetration distance from the front edge of product structure.
- Major debris is reported but not part of rating.

IWA 14-1:2013 example performance rating

IWA 14-1:2013 Bollard V / 7200 [N2B] / 80 / 90 : 0.7

V	7200 kg[N2]	80 km/h	90°	0,7 m
Vehicle Impact	Vehicle Mass (class)	Impact Speed	Impact Angle	Vehicle penetration distance



On the photo is a TiSO Mobile Speedbump (road blocker) during testing for the IWA 14-1 standard. The crash test was successful; the road blocker has confirmed its protective properties.

● ASTM F2656

A classification of Test Method "F2656 M:50-P1"
is equivalent to "DOS K12"

Main characteristics:

- 6 vehicle categories.
- Impact speed 48-100 km/h.
- Vehicle penetration distance from front edge of product structure and is banded: <1m, 1-7m, 7-30m.
- Major debris is reported but not part of rating.

IWA 14-1:2013 example performance rating

F2656 – 20 M:40 - P2		
Vehicle Category	Impact Speed	Penetration Rating
M	40 mph	P2



On the photo is a TISO road blocker during testing for the ASTM F2656 standard. The crash test was successful; the road blocker has confirmed its protective properties.

● Inter-relation of the Standards – Car/LGV






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Vehicle type	BSI PAS 68:2013	ISO IWA 14-1	ASTM F2656
	Car Weight: 1500 kg Class: M1	Car Weight: 1500 kg Class: M1	Small passenger car Weight: 1100 kg Class: SC
			Multi-passenger passenger car Weight: 2100 kg Class: FS
	4x4 Pickup Truck Weight: 2500 kg Class: N1G	4x4 Pickup Truck Weight: 2500 kg Class: N1G	4x4 Pickup Truck Weight: 2300 kg Class: PU
	Day cab vehicle Weight: 3500 kg Class: N1	Day cab vehicle Weight: 3500 kg Class: N1	
	Day cab vehicle Weight: 7500 kg Class: N2	Day cab vehicle Weight: 7200 kg Class: N2A	

● Inter-relation of the Standards – Car/LGV

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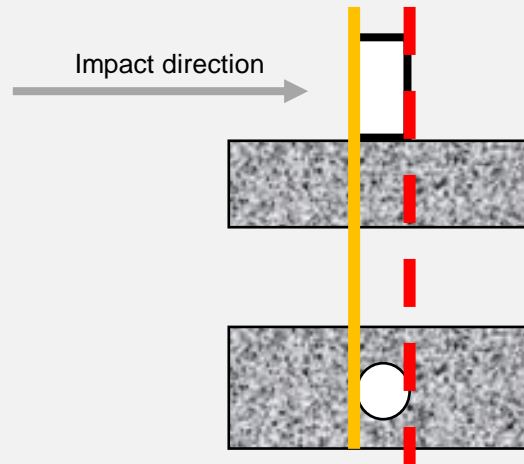
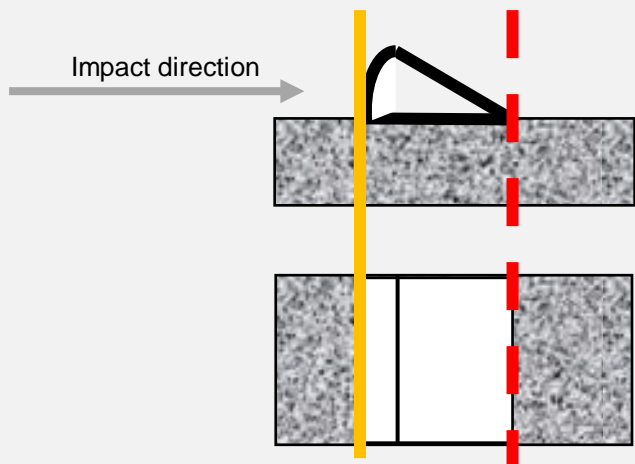
continuation

Vehicle type	BSI PAS 68:2013	ISO IWA 14-1	ASTM F2656
	N/A	Day cab vehicle Weight: 7200 kg Class: N2B	Medium-duty truck Weight: 6800 kg Class: M
	Day cab vehicle Weight: 7500 kg Class: N3	Day cab vehicle Weight: 7200 kg Class: N3C	Medium-duty truck Weight: 7200 kg Class: C7
		Day cab vehicle Weight: 12000 kg Class: N3D	
		Day cab vehicle Weight: 24000 kg Class: N3E	Heavy good vehicle truck Weight: 29500 kg Class: H
	Day cab vehicle Weight: 32000 kg Class: N3	Day cab vehicle Weight: 30000 kg Class: N3F	

● VSB DATUM POINT

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Represents the different points from where penetration distance of the vehicle is measured from in the different standards, for different types of VSB. In ASTM F2656 – 20, the VSB datum point is now at the front face of the VSB.



IWA 14-1:2013

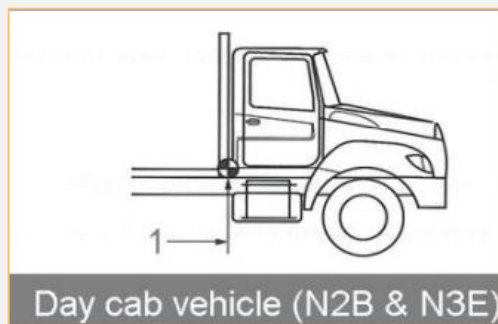
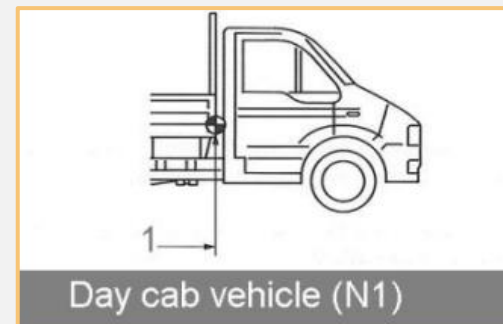
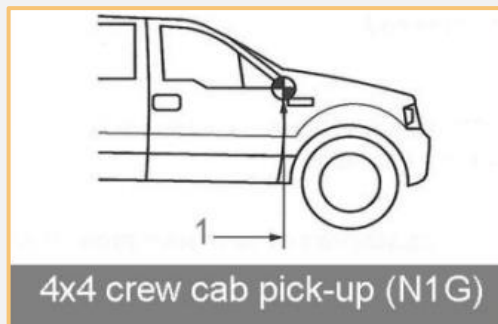
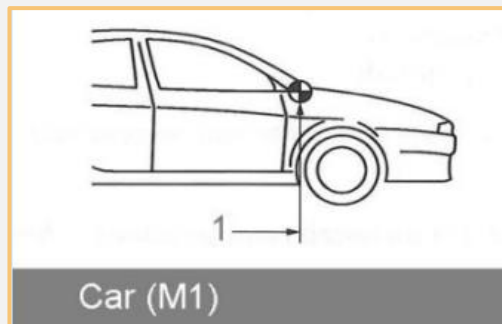


PAS68:2013 and ASTM F2656

● VEHICLE DATUM POINT

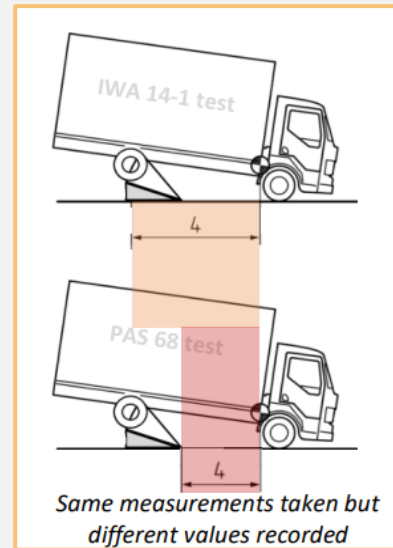
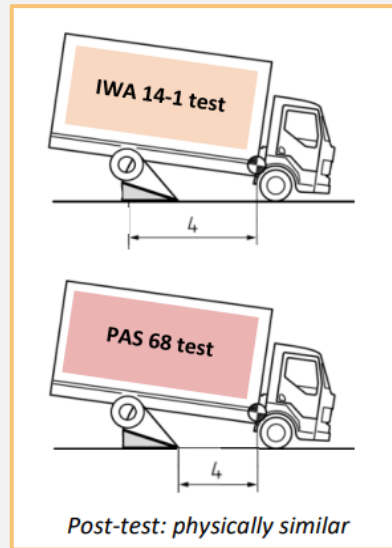
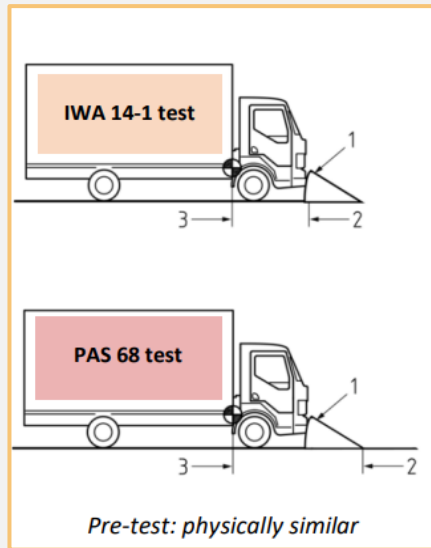
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Represents the point on the vehicle where penetration of the vehicle is measured to: marked as 1: the “circle” symbol.



● VEHICLE DATUM POINT

Example showing the physical similarities and different vehicle penetration distances for IWA 14-1 and PAS 68. Different VSB datum line locations (2) means the vehicle penetration distance (4) is different. (credit BSI PAS 68:2013 and ISO IWA 14-1:2013; modified by CPNI)



Key

1. Vehicle Security Barrier;
2. VSB datum line (at different locations in above diagrams);
3. Vehicle datum point;
4. Vehicle penetration distance (different in above diagrams)

● SUMMARY TABLE OF ALL CERTIFIED TiSO BOLLARDS AND ROAD BLOCKERS

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TiSO product range includes road blockers and bollards certified according to each of these standards that were mentioned before. In the table below, you can familiarize yourself with each certified model.

HVM type / Model	Standard	Performance rating	Crash-test video
Automatic (hydraulic) bollard / RB348	ASTM F2656-07	M30, P1 (-1,2m)	https://www.youtube.com/watch?v=kU5XeZWKcQ
Automatic (hydraulic) bollard / RB342	ASTM F2656-07	M50, P1 (-0,6m)	https://www.youtube.com/watch?v=3659eGmW8Lw
Removable bollard / RB343-68	ASTM F2656/F2656M-15 IWA 14-1:2013	M50, P2 (3,8m) Bollard V/7200 [N2B]/80/90:4.1	https://www.youtube.com/watch?v=NBICnwzVSTg
Fixed bollards (triple bollards set) / RB345-09-S	ASTM F2656/F2656M-15 IWA 14-1:2013	C750, P1 (0,7m) Bollard V/7200[N2B]/80/90:0.7	https://www.youtube.com/watch?v=fgWnyE_BB3w
Automatic (hydraulic) road blocker Cyclope series / RB320-02	ASTM F2656/F2656M-15 IWA 14-1:2013	C740, P1(-1,7m) Blocker V/7200 [N2B]/64/90:-0,2	https://www.youtube.com/watch?v=nZLchE9yctc
Automatic (hydraulic) road blocker Speedbump series / RB359-04	ASTM F2656/F2656M-15 IWA 14-1:2013	M30, P1 (-0,7m) Blocker V/7200 [N2B]/48/90:-0,3	https://www.youtube.com/watch?v=FYQehSBvLIY

● SUMMARY TABLE OF ALL CERTIFIED TISO BOLLARDS AND ROAD BLOCKERS

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continuation

HVM type / Model	Standard	Performance rating	Crash-test video
Automatic (hydraulic) road blocker / RB313	ASTM F 2656-07	M30, P1 (-2,1m)	https://www.youtube.com/watch?v=AEjJSqh3I_E
Automatic (hydraulic) mobile road blocker Speedbump series / RB358-08	ASTM F2656/F2656M-18a IWA 14-1:2013	M30, P2 (4,66m) Blocker V/7200(N2B)/48/90:5,3	https://www.youtube.com/watch?v=YXsqinNXSRg
Automatic (hydraulic) road blocker / RB333	ASTM F 2656-07	M50, P1 (-2,4m)	https://www.youtube.com/watch?v=WwWVgPzSVXY
Automatic (hydraulic) road blocker / RB313-01	PAS 68:2013 IWA 14-1:2013	Blocker V/7500[N2]/48/90:-1.9/0.0 Blocker V/7200[N2A]/48/90:-0.7	https://www.youtube.com/watch?v=xw6rkBifjhA
Automatic (hydraulic) road blocker / RB323-01	PAS 68:2013	Blocker V/7500[N3]/64/90:-1.5/0.0	https://www.youtube.com/watch?v=PhtvtIX8Nvw
Automatic (hydraulic) road blocker / RB333-01	PAS 68:2013 IWA 14-1:2013	Blocker V/7500[N3]/80/90:-1.0/24.1 Blocker V/7200[N3C]/80/90:-0.1	https://www.youtube.com/watch?v=GkY2xn_gAzo
Portable road blocker / RB319-25M	PAS 68:2013 IWA 14-1:2013	Blocker V/7500 [N2]/48/90:24.8/0.0 Blocker V/7200 [N2A]/48/90:25.4	https://www.youtube.com/watch?v=0unWRnzpgis

● FREQUENTLY ASKED QUESTIONS

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What if my client wants an ASTM K12 test?

○ 'K' ratings have never existed in ASTM F2656. 'K' ratings were superseded in 2007 by the introduction of ASTM F2656. The Department of State K12 rating should be stated as a corresponding ASTM F2656 rating: M50. This also applies to K8 and K4 ratings, which have corresponding F2656 ratings: K8 ~ M40; K4 ~ M30.

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Is there a vehicle I can use in a test to get a rating to both an international/European and ASTM F2656 standard?

○ The IWA 14-1:2013 N2B vehicle is a direct equivalent of the ASTM F2656 Medium duty truck. To qualify at this category the vehicle should be a USA style cab-behind-engine and NOT a European style cab-over the engine. To be compliant with F2656 as well as IWA 14-1, the product installation should be undertaken in accordance with the F2656 specification (non-cohesive soil surrounding the foundation). ASTM F2656 also has a site-specific ground condition which could be used for a test; this must be specified and recorded.

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Is it possible to issue a rating to cover PAS 68:2013 and IWA 14-1:2013?

○ Yes, it is possible to cover both standards with a single test as the trucks are all the same specification. Care must be taken over the test mass requirements to ensure meeting the tolerances of all of the regulations. Additionally, a reputable Test House should ensure that they are not deliberately making testing easier by choosing the lowest end of the tolerance of any of the regulations. For example, the Test House should conduct the test to PAS 68:2013 with a test mass as close to 7500kg as possible, and subsequently assess the test against IWA 14-1:2013.

● FREQUENTLY ASKED QUESTIONS

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What is the equivalent of an ASTM F2656 M50 test in PAS 68?

○ There is no equivalent. The closest test specification is PAS 68:2013 V/7500(N3)/80/90. This is the N3 class vehicle (18,000kg GVW at a test mass of 7500kg) at 80km/h and 90 degrees, however, there are significant differences in the vehicle structure that will mean markedly different vehicle impact test results.

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Does the presence of IWA 14-1 negate previously tested products or render them obsolete?

○ No, products tested to superseded/withdrawn standards retain a valid performance rating and may still be considered by the end user. The end user should satisfy themselves that the product meets their requirements, whether it should be tested against a current impact test standard or an alternative product should be used.

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Why can I not have a rating to IWA 14-1:2013 at N2A or N3C level and ASTM F2656 M level?

○ The IWA 14-1:2013 N2A/N3C vehicles are European style trucks with the cab over the engine and the F2656 M truck has the cab behind the engine. Therefore, the vehicle specifications are NOT compatible.



This material was prepared with informational support from **Perimeter Security Suppliers Association** and the **National Protective Security Authority of UK**.

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TiSO team will be glad to answer to all your questions and help you to choose equipment with the appropriate certification that will fit your project.