

Security Barrier Testing Programme:
ASTM F2656/F2656M-15 + IWA 14-1:2013
„Vehicle Crash Testing of Perimeter Barriers“



Report No.: 11523_2851_18531

Type of product: Road Blocker, Speedbump "AUIA – 359-04"

Test procedure: ASTM F2656/F2656M-15, C730; IWA 14-1: 2013: 7200[N2B]/48/90

Test Date / Test Number: 15 December 2016 / 18531

Report Issue Date: 17 January 2017

Customer / Manufacturer: TiSO Production

Summary

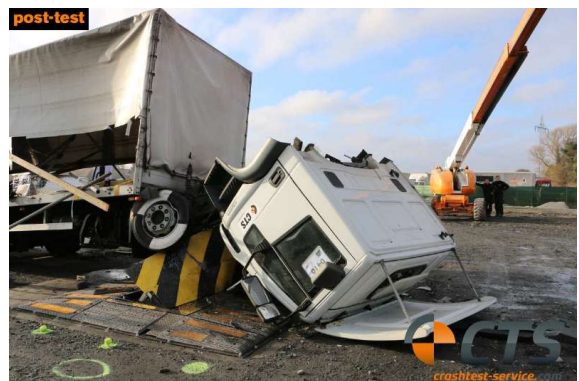
ASTM F 2656/F2656M-15 + IWA 14-1:2013 ; M30

Type of product:	Road blocker, Speedbump "AUIA – 359-04"
Vehicle penetration:	ASTM: - 0.9 m (static) / - 0.7 m (dynamic) IWA14-1: 0.0 m (static) / + 0.3 m (dynamic)
Mass [Target]:	7200 kg (± 150 kg)
Mass [Test]:	7276 kg
Impact speed [Target]:	48.0 km/h (47.0 km/h – 51.0 km/h)
Impact speed [Test]:	48.6 km/h
Angle:	90 °
Major debris:	ASTM: 0.0 m (≥ 25 kg) IWA14-1: 0.0:0.0 (≥ 25 kg)
Offset:	2.0 cm

Observations

Vehicle restrained:	Yes
Vehicle immobilized:	Yes
Angle from vertical:	137°
Angel of foundation:	0°
Foundation rotation:	No
Following vehicle could pass:	No
Road blocker still functions after impact:	No
Test vehicle kinetic energy at impact:	664 kJ

Penetration rating:	ASTM F2656/F2656M-15, P1 (-0.7 m)
Performance rating:	IWA 14-1:2013 Blocker V/7200[N2B]/48/90:0.3



Contents:

1	Test Facility.....	4
2	Description of Product.....	5
3	Test Vehicle Properties.....	7
4	Test Procedure	8
5	Results.....	10
6	Rating	11
7	Disclaimer and general remarks.....	12
8	Annex	13

1 Test Facility

- | | | |
|-----|--------------------------------|---|
| 1.1 | Name: | crashtest-service.com GmbH (CTS) |
| 1.2 | Address: | Amelunxenstraße 30
48167 Münster |
| 1.3 | Telephone: | +49 (0) 2506 70 990 70 |
| 1.4 | Fax: | +49 (0) 2506 70 990 90 |
| 1.5 | Website: | www.crashtest-service.com |
| 1.6 | Address, test facility: | crashtest-service.com GmbH
Amelunxenstraße 30
48167 Münster |
| 1.7 | Address of accreditation body: | DAkS – Deutsche Akkreditierungsstelle GmbH
Spittelmarkt 10
D-10117 Berlin |
| 1.8 | Accreditation-number: | D-PL-17359-01-00 see Annex (8) |
| 1.9 | Customer: | TiSO Production
72 Yamska str., 03150 Kyiv
Ukraine |

2 Description of Product

2.1 Name / Type of the Product:

Road Blocker, Speedbump "AUIA – 359-04"

2.2 Construction of the Product:

Description of the Product Speedbump "AUIA – 359-04"

The product to test is a hydraulic powered retractable high security road blocker. The static part of the blocker is mounted on a grade M400 foundation with reinforcement cage.

The activated blocker reaches a vertical height of about 620 mm from the road surface. The blocker is equipped with a built-in LED above the protective shutters at the impact side.

The product is mounted with 38 (Ø16 mm) and 32 (Ø20 mm) concrete anchors on the foundation. Total foundation dimensions are 5500 mm x 4450 mm x 200 mm (X, Y, Z). The foundation exists of one concrete layer up to the road surface level.

The internal construction of the road blocker is made up of rectangular shafts and vertical steel profiles and plates. These plates and profiles build the frame of the construction. All construction parts are painted steel pieces. At the backside (non-impact side) the retractable piece of the blocker is connected with heavy duty hinges.

Inside the construction frame there are four hydraulic cylinders installed which are developed for industrial applications. The cylinders can lift and lower the blocker very fast. To operate this function, there is a hydraulic fluid delivery system implemented into the controlling unit next to the blocker. The electrical controlling is also installed within this unit. It is realized by using a switchbox with a control panel.

Technical drawings and information about the foundation see Annex (1).

Note: Further information and details regarding the blocker can be requested from the manufacturer.

2.3 Product Installation Date / Foundation Date:

13-14 December 2016 (Installation)

02 December 2016 (Foundation)

2.4 Test Date:

15 December 2016

2.5 Conformity between drawing of the test product and the product to be tested?

Yes

2.6 Additional Technical Information:

For the test the road blocker was installed completely in the foundation.

See Annex (9)

The control system was also connected to enable the functions of raising and retracting.

See Annex (6)

3 Test Vehicle Properties

The test vehicle for this C730 / 7200[N2B]/48/90 test was a vehicle with the specifications of C7 (Class 7 cab over)/N2B (Day cab vehicle). It was structurally complete with no major damages and no modifications. Likewise the bumpers and the tyres were in original conditions.

The Truck was a 2006 IVECO Eurocargo MLQ4 with a longitudinally installed 6 cylinder Diesel engine, manual transmission, rear wheel drive and a conventional cab.

Test Vehicle

Supplied by:	crashtest-service.com GmbH
Vehicle classification:	C7 (Class 7 Cab over) / N2B (Day cab vehicle)
Type:	IVECO
Model	Eurocargo ML4Q
VIN:	ZCFA1EJ0202494445
Year	10/2006
Kerb weight:	6.610 kg
Ballast	666 kg
Mass [Test]	7.276 kg
GVW:	11.990 kg
Vehicle measurements:	see Annex (2)

4 Test Procedure

4.1 This Report describes and summarises a dynamic vehicle impact test of a retractable road blocker to ASTM F2656/F2656M-15 and IWA14-1: 2013. The intent of this test was to ascertain the penetration rating for the Road Blocker, Speedbump "AUIA – 359-04". Additionally, the test vehicle was equipped with a tri-axial accelerometer. Data was recorded using the KiDau unit with its software.

In achieving the specification of the two Standards, the following main criteria must be fulfilled:

- Test vehicle mass: 7.200 kg (± 150 kg)
- Impact speed: 48.0 km/h (47.0 km/h – 51.0 km/h)
- The impact point is the centre of the front of the test vehicle
- The offset must be within ± 300 mm
- Impact angle: $90^\circ \pm 2^\circ$
- Test vehicle Instrumentation
- Full installation of the test product including the foundation
- Further properties of the test facility (video and foto recording, soil conditions etc.)

The test track is made from asphalt. The journey of the test vehicle (truck) to the test object is accomplished using a cable system in an underfloor duct. The underfloor duct is made from steel, thus it is warranted to strike the impact point exactly with small tolerances.

The test vehicle is accelerated by a MAN heavy-duty truck with a reduction gear unit. To ensure „free travelling“ at the impact, the uncoupling process of the test vehicle is mechanically operated.

4.2 Soil sample test area / concrete crush test results:

Test blocks were made in parallel on the day of pouring the foundations. Crush tests were carried out on the 7th, on the 13th (test day) and on the 28th day after pouring. For results see table below and Annex (3).

Summary concrete crush test results			
Crushtest	Date	Strength (N/mm ²)	Comment
pouring	02 Dec. 2016	--	Quader: approx. 149mm x 150 mm x 150 mm
day 7	09 Dec. 2016	30.7	Test certificate no.:040046-16 93057 (1)
day 13	15 Dec. 2016	41.2	Test certificate no.:040046-16 93057 (2)
day 28	30 Dec. 2016	54.1	Test certificate no.:040046-16 93057 (3)

Soil sample test area:

Soil grade, carrying capacity and compression of the test area behind and in front of the blocker.
See Annex (4)

5 Results

5.1 Impact Description

The test vehicle hit the road blocker with an impact speed of 48.6 km/h. The truck contacted the blocker without being controlled or braked („free travelling“). The angle of impact was 90° and the offset 20 mm. The height of contact between the test vehicle and the road blocker was 35 cm above road surface.

Caused by the collision, the road blocker stopped the test vehicle. The road blocker and its foundation remained within the original footprint.

The penetration was -0.67 m (ASTM), 0.25 m (IWA-14)

The test vehicle kinetic energy at impact was 664 kJ.

5.2 System Damage

As a result of the test, the road blocker was no more functional.

The foundation displacement distance from pre-test to post-test was 0.5 cm.

As a result of the test, the static angle of the road blocker was 137° and the foundation 0°.

5.3 Vehicle Damage

As a result of the test, the vehicle was completely destroyed. It was immobilised and the engine no longer ran. The whole powertrain was demolished (engine block, gearbox, etc.). The chassis rails at the front end (impact area) are totally buckled upwards. The cab was uncoupled from its original mountings and heavily battered, but it was not separated from the chassis.

5.4 Photos and Impact Image sequence. See Annex (5)

5.5 Vehicle Acceleration data. See Annex (7)

5.6 Vehicle Penetration

Every test procedure according to the ASTM F2656-15 standard requires the determination of the penetration rating. The measurements used to formulate this C730 test rating are taken from the reference points on the road blocker and the truck.

In this C730 test the reference point / line of the road blocker is the backside (non-impact side). The position of this reference line is 90° degrees to the impact direction of the test vehicle. The lower leading edge of the cargo bed is the reference point of the test vehicle.

To calculate the penetration distance, the dynamic and the static mode are used. The highest value of both, static and dynamic are stated for the rating.

The final resting position of the test vehicle shows the static penetration further the dynamic result is calculated by analysing the high speed videos.

For limits see table below

Rating	Measured Penetration
P1	≤1 m
P2	1.01 m - 7 m
P3	7.01 m - 30 m

6 Rating

Standard	Mode	Rating	Measured Penetration
ASTM F2656/F2656M-15	static/ dynamic	P1	- 0.9 m/ - 0.7 m
IWA14-1:2013	static/ dynamic	IWA 14-1:2013 Blocker V/7200[N2B]/48/90:15.1	0.0 m/ 0.3 m

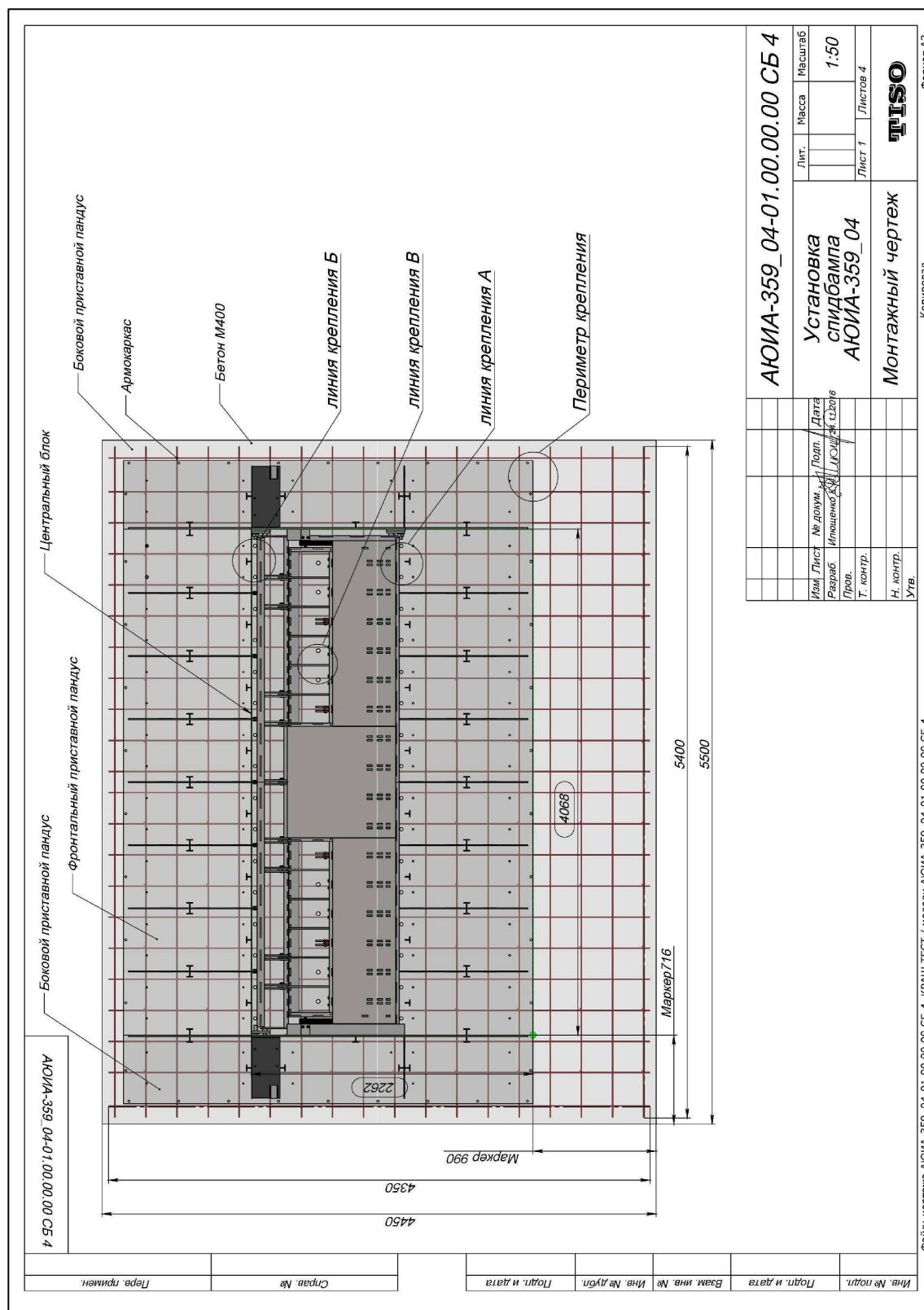
The test vehicle was restrained and immobilized. The test was compliant to ASTM F2656/F2656M-15 and IWA14-1:2013.

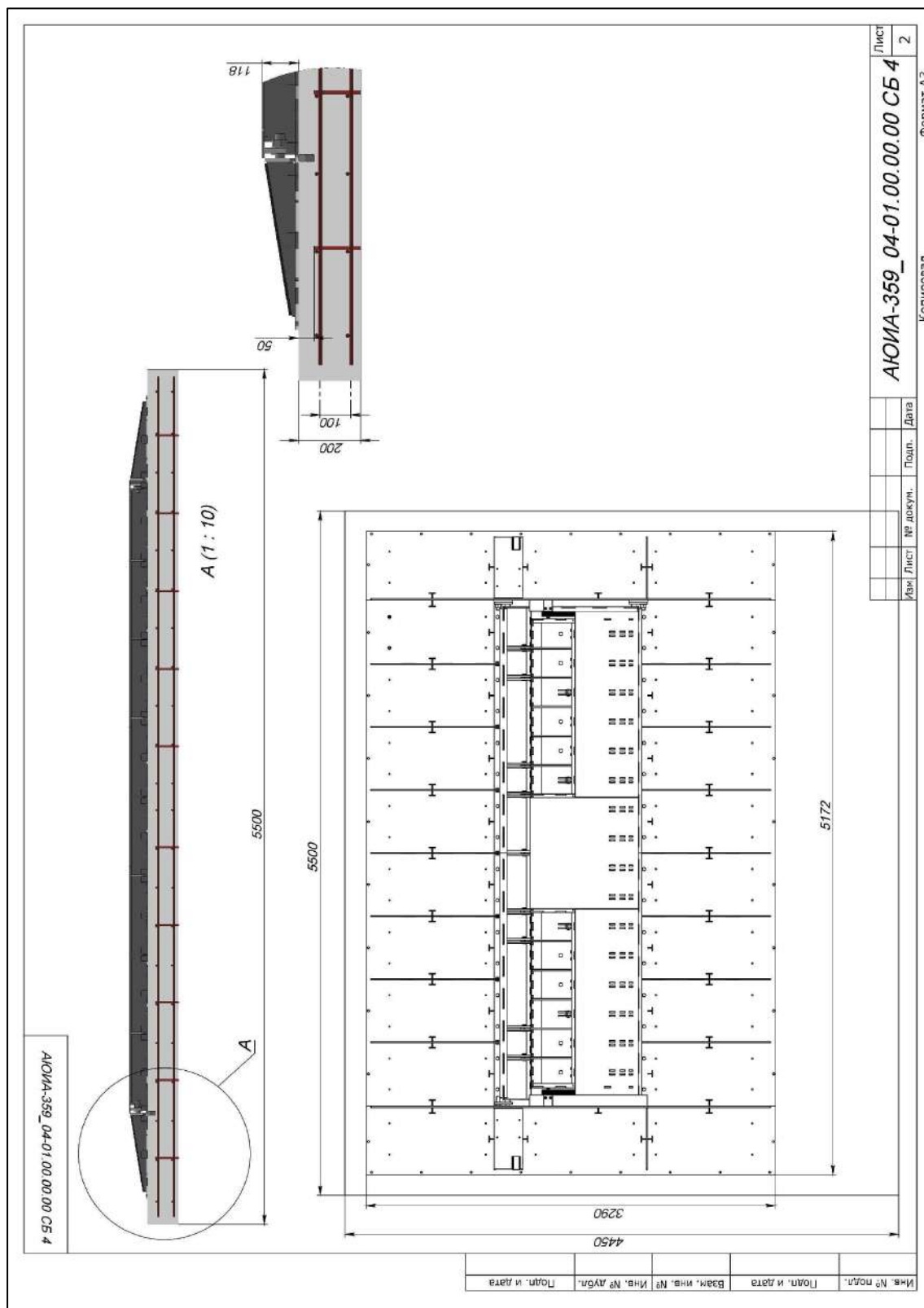
7 Disclaimer and general remarks

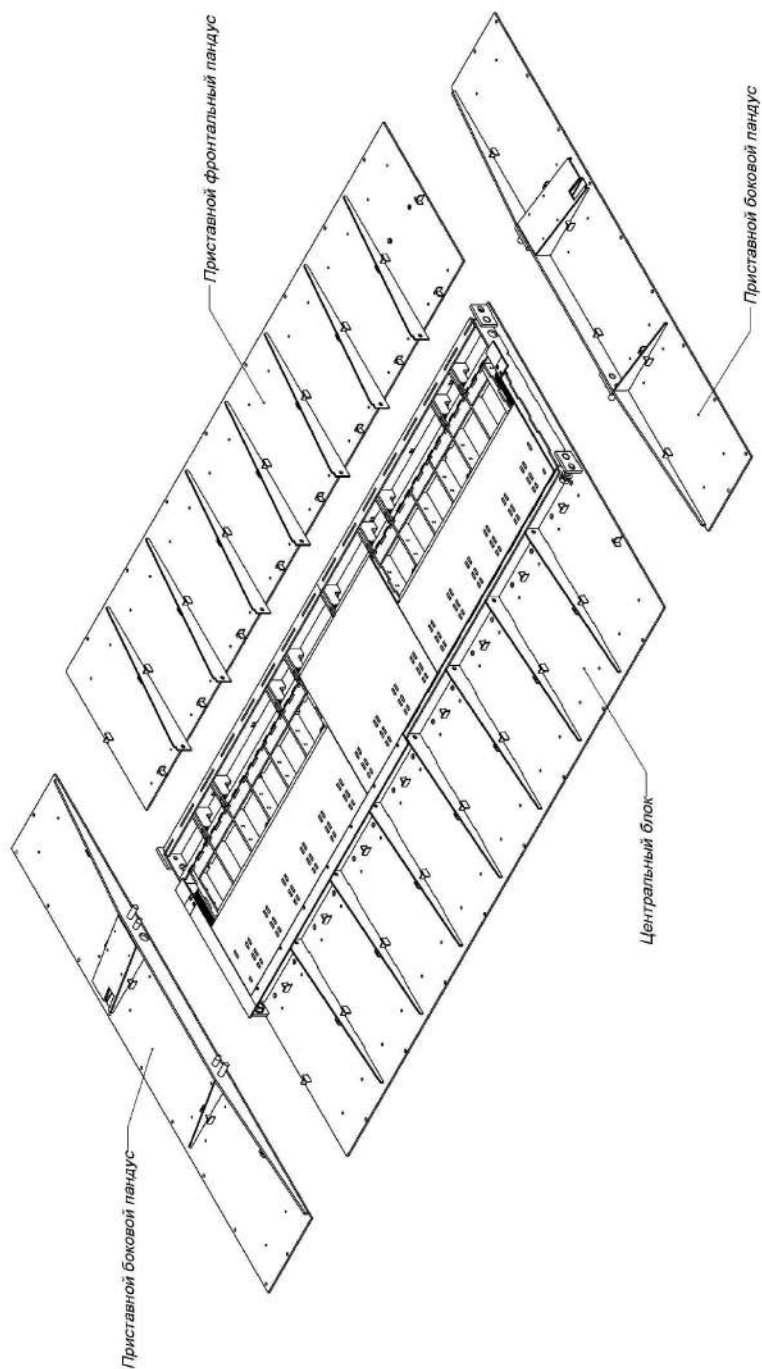
1. Results attained from this test refer only to the product as is provided, installed and operated. Potential users of this product indicated should ensure that the product installation complies completely with the manufacturers' product specifications and directives.
2. Results attained from this test were for purposes of development and indication only. The test vehicle (if applicable) was fitted with equipment including calibrated sensors and a data acquiring unit, the information resulting from the instrumentation and analysis remain unaccredited.
3. The dataset column headings are in accordance with ISO/TS 13499 – RED B: 2002 (E) and filtration of the data is in accordance with ISO 6487:2002
4. The product manufacturer or representatives of the manufacturer are responsible for the correct and proper installation of the test item in this test.
5. Preparation of the test including vehicle preparation was undertaken at crashtest-service.com.
6. This report does not include personal opinions and/or interpretations.

9 Annex

1) Product Information / Technical Drawings





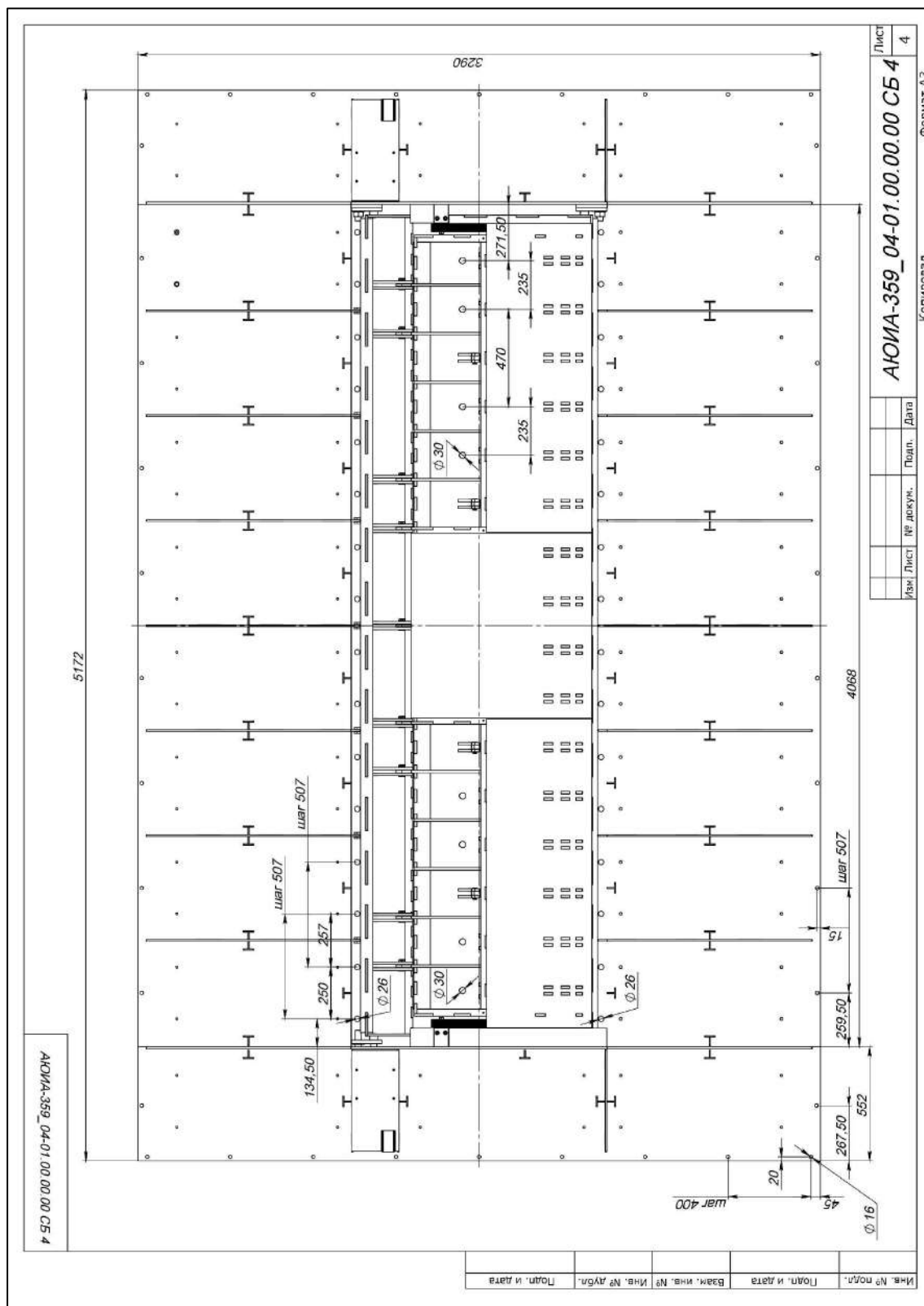


ANOVA-359_04-01.00.00.00 C53

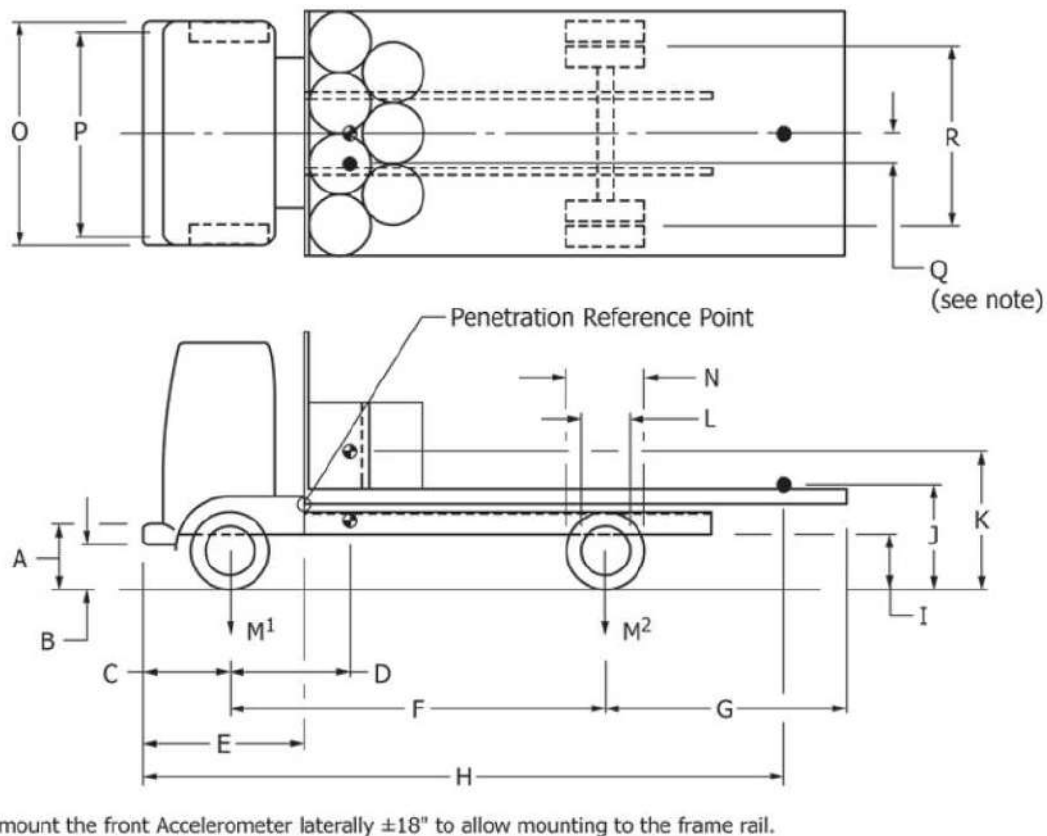
[illegible]

Копировал	Формат А3
-----------	-----------

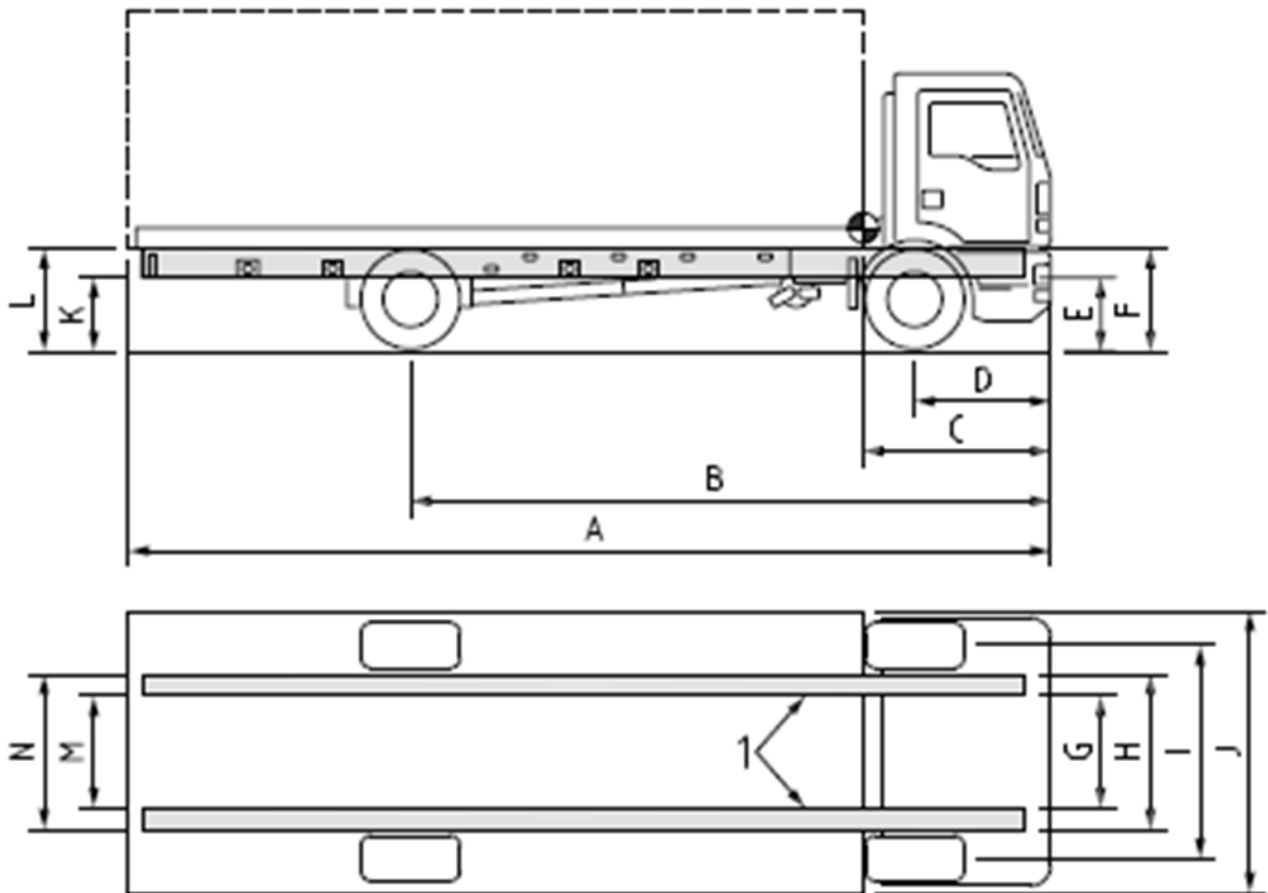
Ивв. № поглн.	Поан. и дата	Взам. ивв. №	Ивв. № аьол.	Поан. и дата
---------------	--------------	--------------	--------------	--------------



2) Vehicle Measurements



ASTM F 2656-15, test vehicle properties			
Test :	C730	Test ref. no:	18531
Vehicle classification:	C7	Test date:	15 December 2016
Vehicle:	IVECO Eurocargo	No. of drive axles:	1
Tyre size:	245/70R19.5	VIN: (CTS-No: 6418)	ZCFA1EJ0202494445
test vehicle dimensions (mm)			
A: 780	F: 4800	K: 1180	Q: 490
B: 570	G: 2850	L: 520	R: 1735
C: 1350	H: --	N: 830	
D: 2493	I: 600	O: 2550	
E: 1910	J: 1095	P: 1930	



IWA14-1: 2013, test vehicle properties			
Test :	7200[N2B]/48/90	Test ref. no:	18531
Vehicle classification:	N2B	Test date:	15 December 2016
Vehicle:	IVECO Eurocargo	No. of drive axles:	1
Tyre size:	245/70R19.5	VIN: (CTS-No: 6418)	ZCFA1EJ0202494445
test vehicle dimensions (mm)			
A: 9000	E: 570	I: 1930	M: 715
B: 6150	F: 780	J: 2550	N: 855
C: 1850	G: 710	K: 600	
D: 1350	H: 850	L: 1000	

3) Concrete Crush Test Results (day 13)



Roxeler Baustoffprüfstelle

Baustoffprüfung
Baugrundgutachten
Bauwerkserhaltung

Bauaufsichtlich anerkannte
Prüf-, Überwachungs- und Zertifizierungsstelle (PÜZ)

Notifizierte Zertifizierungsstelle gemäß
Verordnung (EU) Nr. 305/2011

Privatrechtlich anerkannte Prüfstelle nach RAP Stra
für bituminöse und mineralische Baustoffe

Durch die DAkkS nach DIN EN ISO/IEC 17025
akkreditierte Prüfstelle.

Die Akkreditierung gilt für die in der
Urkunde aufgeführten Prüfverfahren
am Standort Münster.



Roxeler Ingenieurgesellschaft mbH
Otto-Hahn-Straße 7 · 48161 Münster

crashtest-service.com GmbH
Amelunxenstraße 30

48167 Münster

Testing hardened concrete in accordance with DIN EN 12390-3



Test certificate no.: 040046-16 93057

Information of the applicant

Building measure: Crash-Test Center, Amelunxenstr. 30, 48167 Münster

Element: Speedbump

Type of test: hardening test

Number of cubes: 1

Manufacturing day: 02.12.2016

Supplier: Transportbeton A. Potthoff GmbH

Type of concrete no.: 16537271

Strength class: C30/37

Information of the testing centre

Delivery on: 02.12.2016

Storage: DIN EN 12390-2 Annex NA

Test on: 15.12.2016

At the age of: 13 days

Designation	Dimensions ¹⁾			Weight	Bulk density	Fracture load	Strength	Strength $f_{c,cube}^{2)}$	Fracture type ³⁾
	a	b	h						
	mm	mm	mm	kg	kg/m ³	kN	N/mm ²	N/mm ²	
EH2	148,5	150,0	150,0	7,950	2379	917	41,2	41,2	

1) Average in accordance with DIN EN 12390-3 Annex B

2) Conversion pursuant to DIN 1045-2, paragraph 5.5

3) In case of unusual fracture types, fracture type no. according to DIN EN 12390-3

Remark: The concrete of the tested specimen meets the requirements of the compressive strength class M400.

Münster, 15.12.2016



The test report may only be duplicated in full. Shortened copies or copies in extract must be authorised in writing by the material testing centre.

Roxeler Ingenieurges. mbH
Baustoffprüfstelle
Otto-Hahn-Straße 7
D-48161 Münster


Telefon (0 25 34) 62 00-0
Telefax (0 25 34) 62 00-32
Internet: www.roxeler.de
E-Mail: mail@roxeler.de

Geschäftsführer: Diplom Ingenieure
Dr. Markus Johow, Dr. Stefan Kordts,
Andre Liesenkötter
Amtsgericht Münster HR B 3320

Vereinigte Volksbank Münster eG
BIC: GENODEM1MSC
IBAN: DE15 4016 0050 1705 1576 00
USt-IdNr. DE 124376551

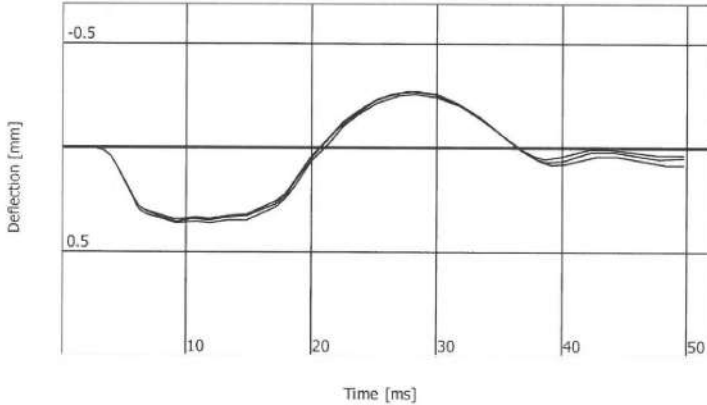
4) Grade of the area next to the road blocker

Contractor		crashtest-service.com GmbH Münster, Germany	
------------	--	--	--

		Determine of dynamic deformation modulus according TP BF-StB Teil B 8.3 Testdevice: ZFG 3.0 Manufacturer: Zorn-Instruments	
---	--	--	--

Client	TISO	Measuring time	2016.12.14 09:27:14
Project	A2851 Test-No.: 18531; Equipment-No.: CTS-40	Device number	6871
Testdepth	0,0 m	Device type	300 mm/10 kg
Layer	surface layer	Check number (No)	606
Weather	8,1 °C	Card number	40913113931
Operator	M.Osterkemper		


Result	<table border="1"> <thead> <tr> <th>Pulse</th> <th>v [mm/s]</th> <th>s [mm]</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>134.8</td> <td>0.370</td> </tr> <tr> <td>2</td> <td>129.5</td> <td>0.356</td> </tr> <tr> <td>3</td> <td>126.9</td> <td>0.351</td> </tr> <tr> <td>Ø</td> <td>130.4</td> <td>0.359</td> </tr> </tbody> </table>	Pulse	v [mm/s]	s [mm]	1	134.8	0.370	2	129.5	0.356	3	126.9	0.351	Ø	130.4	0.359	s/v: 2.753 ms Evd: 62.67 MN/m²
Pulse	v [mm/s]	s [mm]															
1	134.8	0.370															
2	129.5	0.356															
3	126.9	0.351															
Ø	130.4	0.359															



Deflection [mm]

Time [ms]

Remarks	Measure area: Next to foundation.
---------	-----------------------------------

Signature	
-----------	---

Page 1 from 1

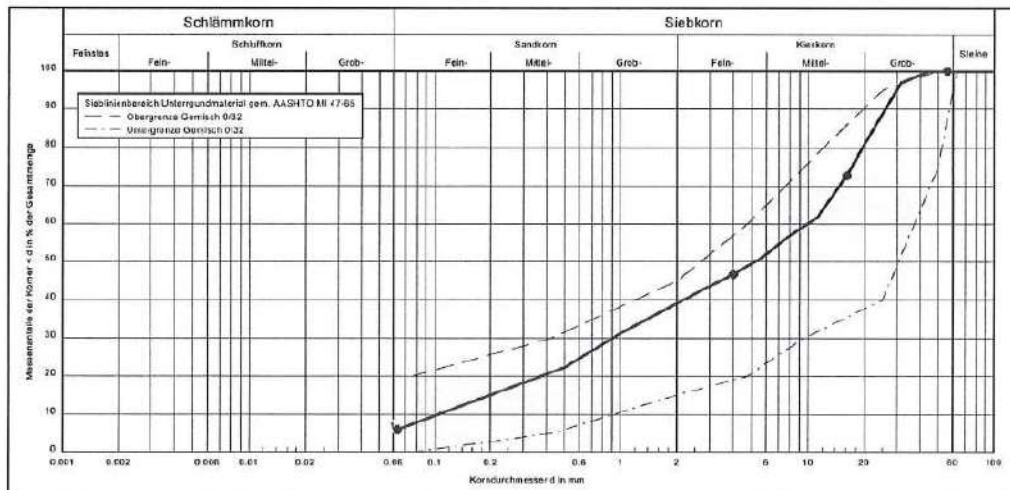


Interpolation of the intermediate values in the grading curve results in the following values for the required sieve mesh widths in accordance with AASHTO for the inspected construction material mix:

Table 2: Interpolated values of the required mesh widths

Test sieve with mesh size	Passed particles / component	Requirements according to AASHTO MI 47-65
[mm]	[M.-%]	[M.-%]
50.0	100.0	100
25.0	89.2	75 - 95
9.5	59.7	40 - 75
4.75	48.6	30 - 60
2.0	39.1	20 - 45
0.425	21.1	15 - 30
0.075	7.8	5 - 20

III. 1: Grain distribution for gravel base course material 0/32 according to AASHTO MI 47-65



This test report may not be reproduced in an abbreviated manner. Partial reproduction requires the written consent of Roxeler Ingenieurgesellschaft mbH.

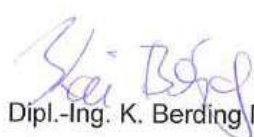


3. ASSESSMENT


The inspection performed for BV "Amelunxenstraße" in Münster led to the following results for the inspected construction material mixes:

The inspected limestone construction material mix 0/32 from the **material to be screened** fulfills the requirements in accordance with AASHTO MI 47-65 (American Association of State Highway and Transportation Officials - Road Tests) regarding the grain distribution of the construction material mix to be used.

Münster, 08/05/2015


Dipl.-Ing. K. Berding M.Sc.




Dipl.-Geol. H. Musial

5) Vehicle, Details (pre-test)

pre-test



pre-test



pre-test



pre-test



pre-test



pre-test



Vehicle Security Barrier, Overview (pre-test)



Impact configuration, Overview (pre-test)

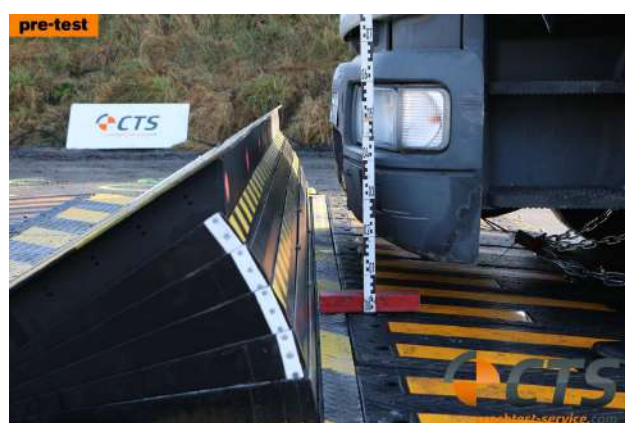
pre-test



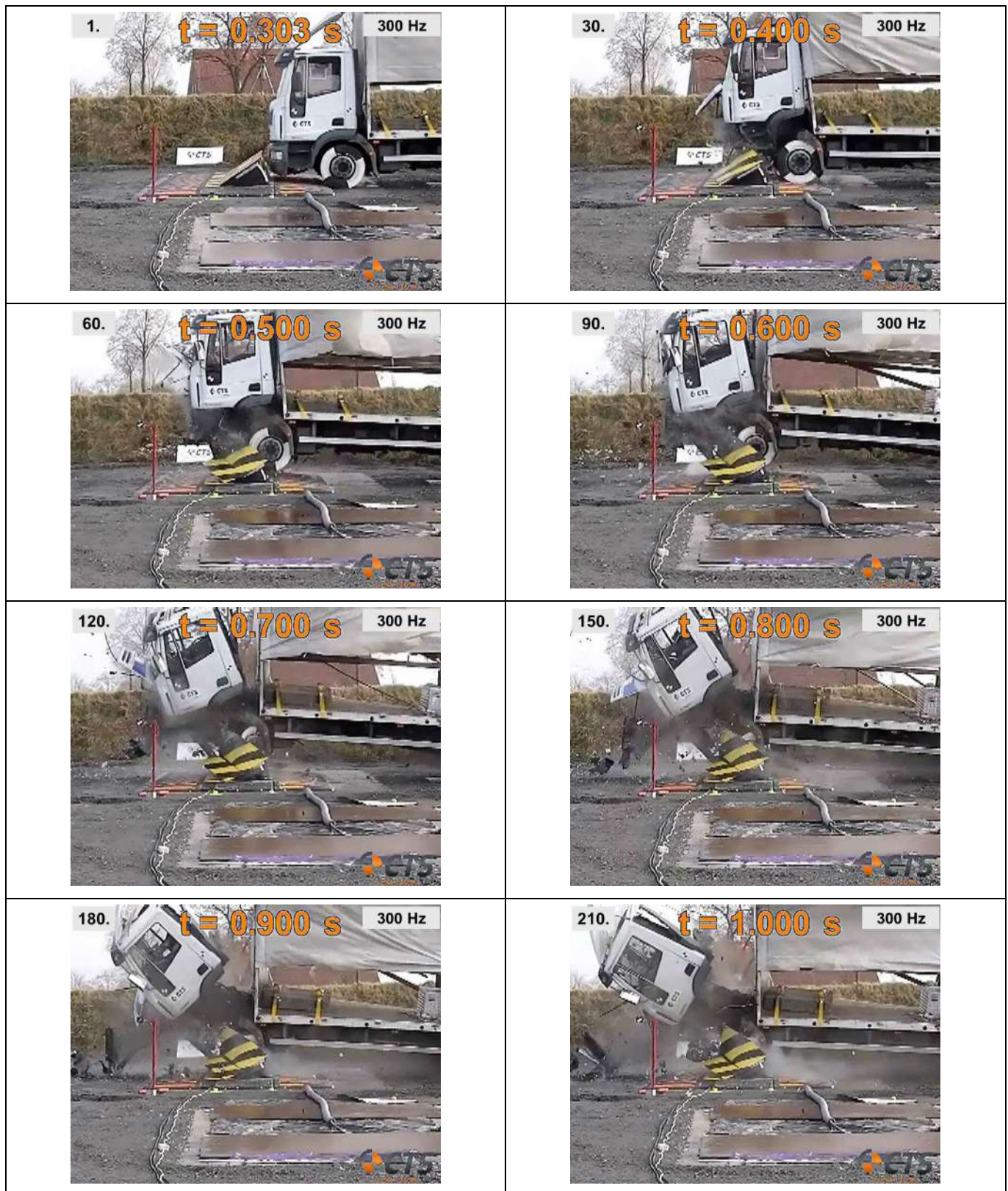
pre-test



Impact configuration, Details (pre-test)



Impact Image sequence (side view)



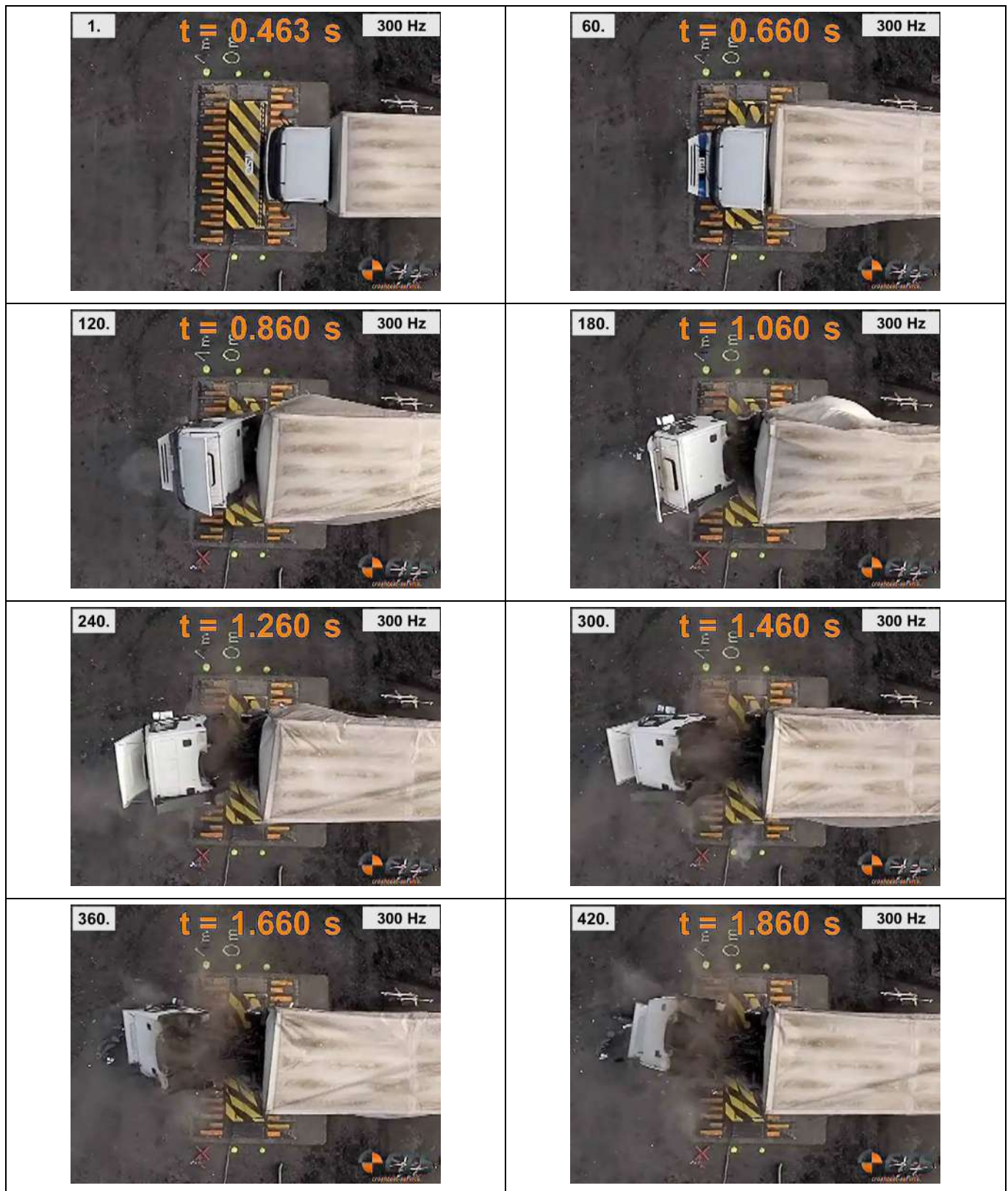


Impact Image sequence (front view)





Impact Image sequence (overhead view)



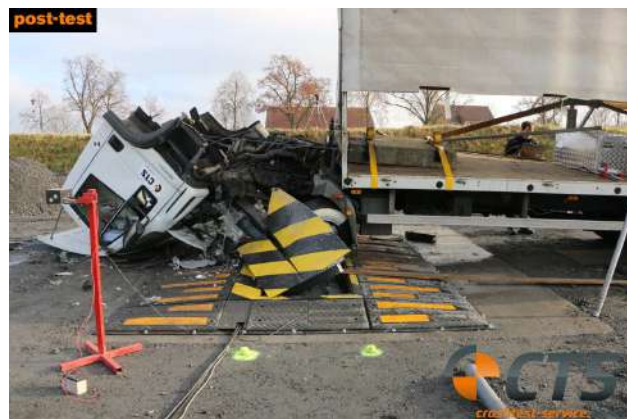
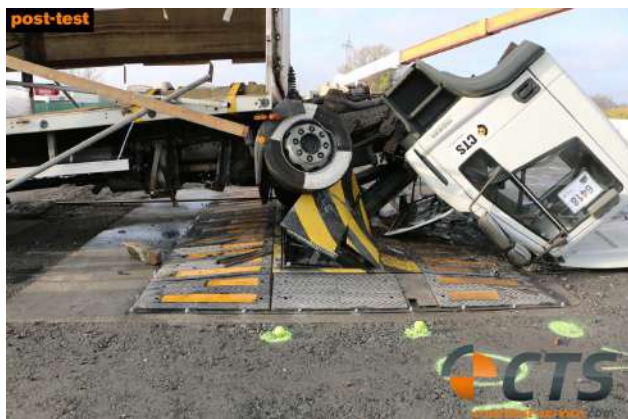
Impact Image sequence (overview)



Endposition, Overview (post-test)



Endposition, Details (post-test)



Vehicle, Overview (post-test)



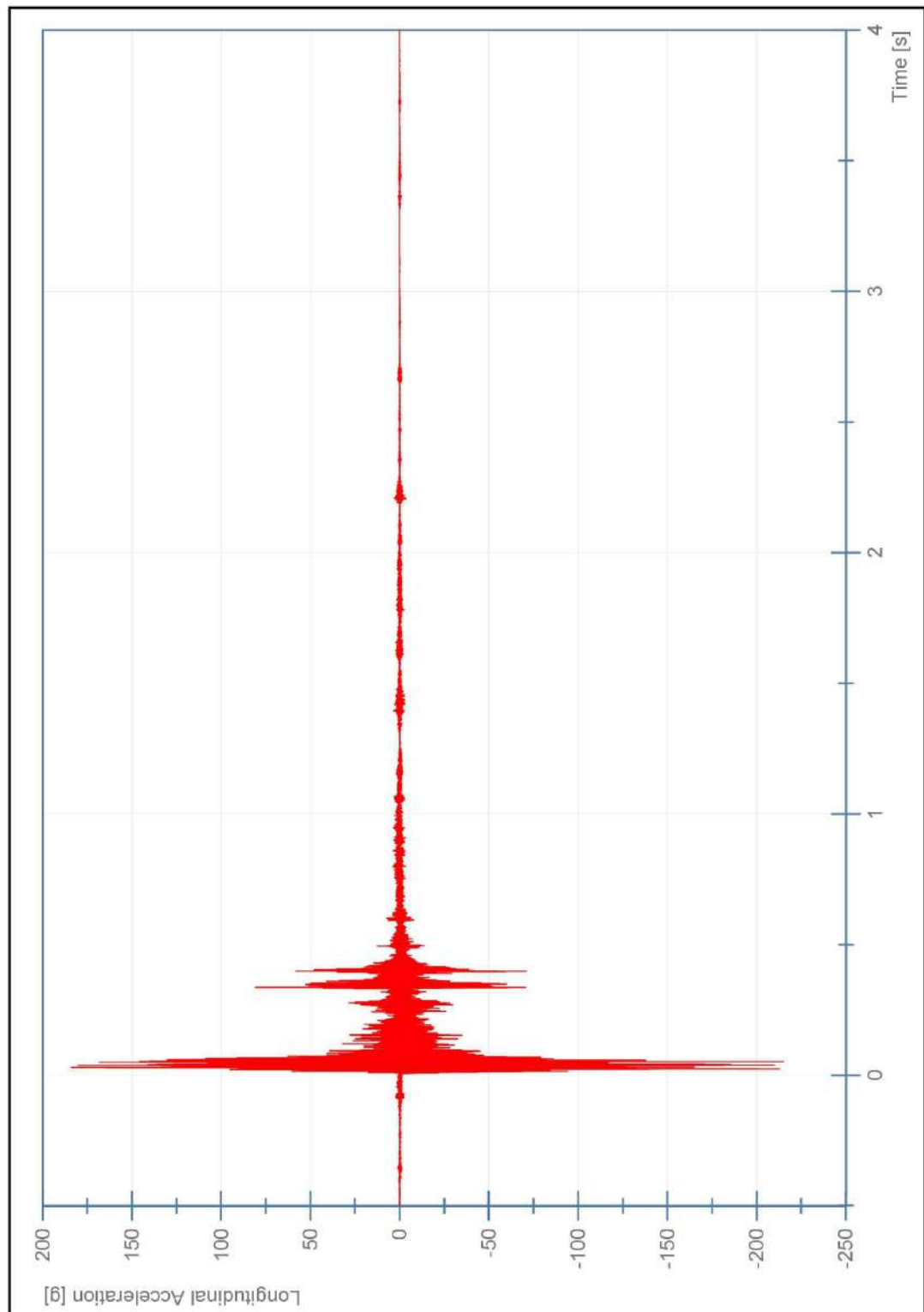
Vehicle, Details (post-test)



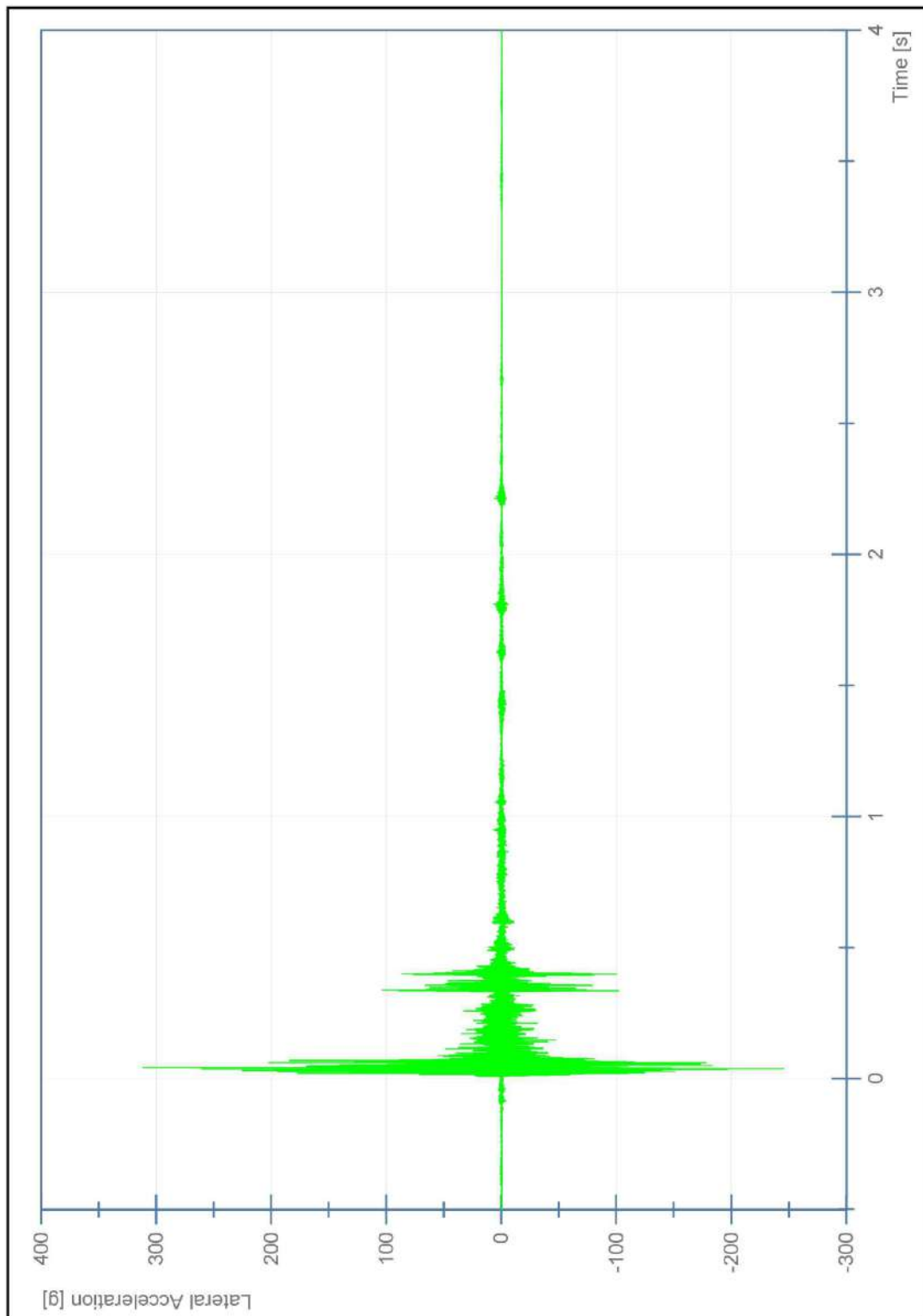
6) Function of the vehicle Security barrier (pre-test)



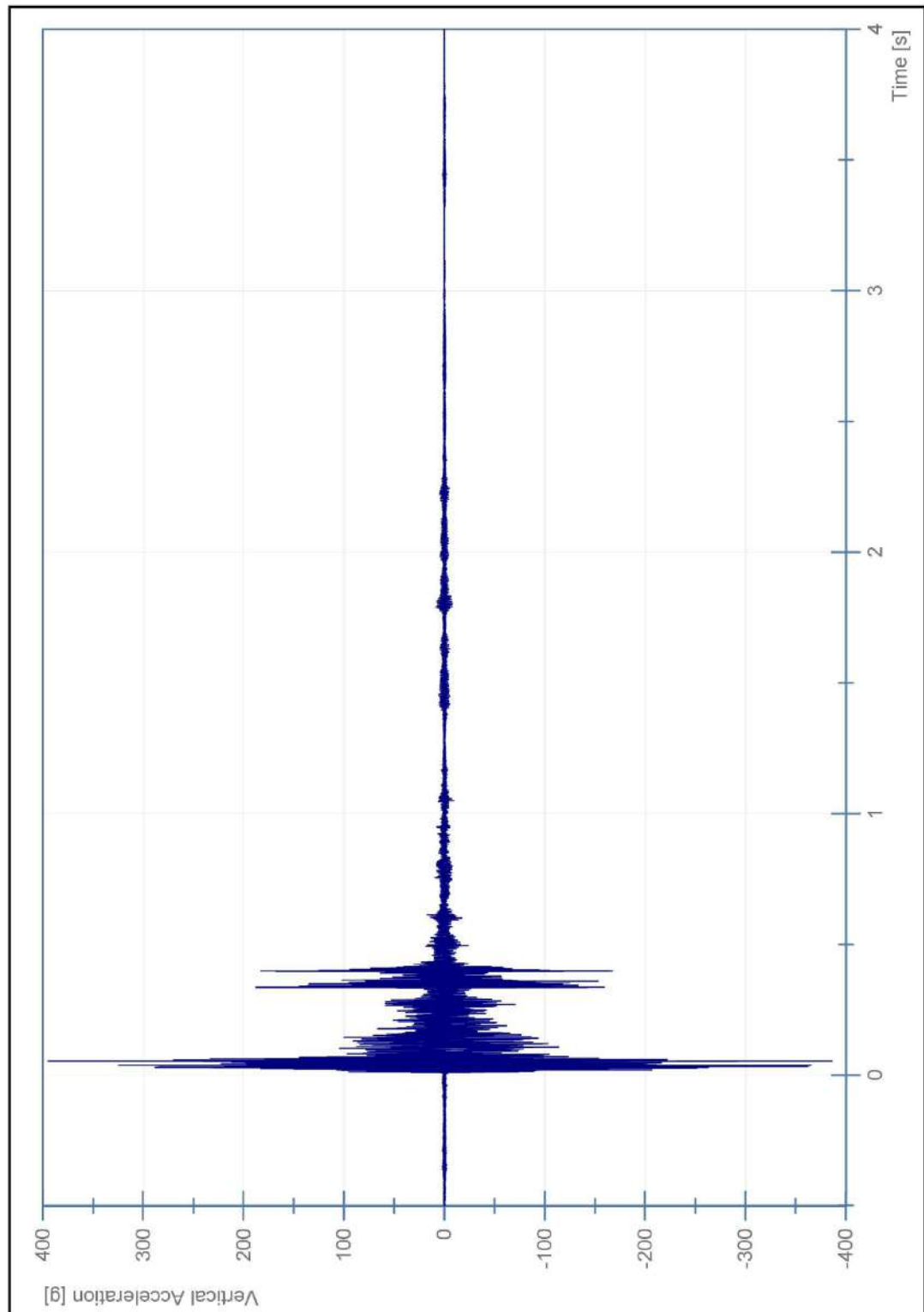
7) Acceleration Data Longitudinal



Lateral



Vertical



8) Certificate of Accreditation



Deutsche Akkreditierungsstelle GmbH

Entrusted according to Section 8 subsection 1 AkkStelleG in connection with Section 1 subsection 1 AkkStelleGBV

Signatory to the Multilateral Agreements of
EA, ILAC and IAF for Mutual Recognition

Accreditation



The Deutsche Akkreditierungsstelle GmbH attests that the testing laboratory

crashtest-service.com GmbH
Amelunxenstraße 30, 48167 Münster

is competent under the terms of DIN EN ISO/IEC 17025:2005 to carry out tests in the
following fields:

Assessment of road restraint systems

The accreditation certificate shall only apply in connection with the notice of accreditation of 15.06.2016 with the accreditation number D-PL-17359-01 and is valid until 06.05.2018. It comprises the cover sheet, the reverse side of the cover sheet and the following annex with a total of 3 pages.

Registration number of the certificate: **D-PL-17359-01-00**

Berlin,
15.06.2016

Dr. Heike Manke
Head of Division

Translation issued:
07.09.2016



Head of Division

This document is a translation. The definitive version is the original German accreditation certificate.
See notes overleaf.



Deutsche Akkreditierungsstelle GmbH

**Annex to the Accreditation Certificate D-PL-17359-01-00
according to ISO/IEC 17025:2005**

Period of validity: 15.06.2016 to 06.05.2018

Date of issue: 15.06.2016

Holder of certificate:

crashtest-service.com GmbH
Amelunxenstraße 30, 48167 Münster

Tests in the fields:

Assessment of road restraint systems

Abbreviations used: see last page

The testing laboratory is permitted, without being required to inform and obtain prior approval from DAkkS, to use standards or equivalent testing methods listed here with different issue dates. The testing laboratory maintains a current list of all testing methods within the flexible scope of accreditation.

Restraint systems

DIN EN 1317-1 2011-01	Road restraint systems – Part 1: Terminology and general criteria for test methods
DIN EN 1317-2 2011-01	Road restraint systems – Part 2: Performance classes, impact test acceptance criteria and test methods for safety barriers including vehicle parapets
DIN EN 1317-3 2011-01	Road restraint systems – Part 3: Performance classes, impact test acceptance criteria and test methods for crash cushions



Annex to the accreditation certificate D-PL-17359-01-00

E DIN EN 1317-4 2012-07	Road restraint systems – Part 4: Performance classes, impact test acceptance criteria and test methods for transitions of safety barriers
DIN V ENV 1317-4 2002-04	Road restraint systems – Part 4: Performance classes, impact test acceptance criteria and test methods for terminals and transitions of safety barriers
DIN EN 1317-5 2012-06	Road restraint systems – Part 5: Product requirements and evaluation of confirming for vehicle restraint systems
DIN CEN/TR 1317-6 2012-08	Road restraint systems – Part 6: Pedestrian restraint system – Pedestrian parapets
DIN EN 1317-7 2012-07	Road restraint systems – Part 7: Performance classes, impact test acceptance criteria and test methods for terminals of safety barriers
DIN CEN/TS 1317-8 2012-08	Road restraint systems – Part 8: Motorcycle road restraint systems which reduce the impact severity of motorcyclist collisions with safety barriers
DIN EN 12767 2008-01	Passive safety of support structures for road equipment – Requirements, classification and test methods
BS PAS 68 2010-01	Impact test specification for vehicle security barriers
BSI PAS 68 2013-08	Impact test specification for vehicle security barrier systems
ASTM F 2656 2007	Standard Test Method for Vehicle Crash Testing of Perimeter Barriers
ASTM F2556/F2656M – 15 2015	Standard Test Method for Crash Testing of Vehicle Security Barriers
IWA 14-1 2013-11	Vehicle security barriers - Part 1: Performance requirement, vehicle impact test method and performance rating



Annex to the accreditation certificate D-PL-17359-01-00

NCHRP Report 350 National Cooperative Highway Research Program
1993

MASH Manual for Assessing Safety Hardware
2009

The requirements for a testing laboratory according to article 43 of the European Construction Products Regulation are met.

Abbreviations used:

ASTM	American Society for Testing and Materials
BS PAS	British Standards Publicly Available Specification
CEN/TS	European Committee for Standardization/Technical Specifications
DIN	Deutsches Institut für Normung e.V. – German Institute for Standardisation
EN	Europäische Norm - European Standard
IWA	International Workshop Agreement - Publisher: ISO (International Organisation for standards)

9) Foundation and Installation of the Barrier (pre-test)

