



U.S. Department
of Transportation
**Federal Highway
Administration**

January 26, 2024

1200 New Jersey Ave., SE
Washington, D.C. 20590

In Reply Refer To:
HSST-1/CC-176

Gerrit C. Verwijs
Verdegro Holding BV
Munnikenheiweg 59, 4879 NE
Netherlands

Dear Mr. Verwijs,

We received your correspondence of February 8, 2022 requesting issuance of a reimbursement eligibility letter under the Federal-aid highway program for the roadside safety system, device, design, product, or hardware (collectively “device”) described below. This letter is assigned Federal Highway Administration (FHWA) control number CC-176.

ELIGIBILITY LETTERS

The FHWA issues Federal-aid reimbursement eligibility letters for new roadside safety devices that are crash tested in accordance with the industry standard of the American Association of State Highway and Transportation Officials (AASHTO) Manual for Assessing Safety Hardware (MASH).

FHWA, the Department of Transportation, and the United States (government) do not regulate roadside safety devices, crash test facilities, or the manufacturing industry. Issuance of eligibility letters is discretionary and provided only as a service to the states. FHWA may, at its discretion, decline to issue, revise, or rescind an eligibility letter. Eligibility letters are only issued by the FHWA headquarters Office of Safety.

Eligibility letters are issued only as notice to the states that a device is eligible for reimbursement under the Federal-aid highway program. They do not establish approval or certification for any other purpose. Issuance of an eligibility letter is not a prerequisite or requirement for state transportation agencies seeking to use Federal-aid funds for roadside safety devices. State agencies may use a device for which an eligibility letter has not been issued and seek Federal-aid reimbursement.

FEDERAL-AID REIMBURSEMENT

The request for issuance of this letter certified the device was crash tested in accordance with the industry standard of AASHTO’s MASH. This eligibility letter is based on that certification and the material offered in support of its issuance. The device described below is eligible for reimbursement under the Federal-aid highway program.

Name of system: Verdegro BLADE TMA

Type of system: TMA
Test Level: Test Level 3
Testing conducted by: Texas A&M Transportation Institute
Date of request: February 8, 2022

Information about the device, including material such as the eligibility request, crash test reports, drawings, or images are included in one or more attachment(s) to this letter.

Eligibility letter CC-176 is inapplicable to devices, optional equipment, alternate materials, or other features that were not crash tested in accordance with AASHTO's MASH.

This letter is issued only for the subject device as crash tested under AASHTO's MASH. Later modification(s) of the device are not eligible for Federal-aid reimbursement under this letter.

Notice of later modification(s) should be given to transportation agencies, facility owners, and operators (collectively "agencies").

Agencies should be provided appropriate information about the device's design, installation, maintenance, materials, and mechanical properties.

Issuance of this letter is discretionary, and it may be revised or rescinded at FHWA's discretion. This letter is not a determination of compliance with the Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD) or ownership of any intellectual property rights.

This eligibility letter is not a determination by the government that a crash involving the subject device will result in any particular outcome. It is limited to only the device's eligibility for Federal-aid reimbursement.

INTELLECTUAL PROPERTY

Issuance of this eligibility letter does not convey property rights of any sort nor any exclusive privilege. This letter is not authorization or consent by the government for the use, manufacture, or sale of any patented or proprietary system, device, design, product, or hardware for which the requester is not the patent owner. Eligibility letters are not an expression of any view, position, or determination by the government as to the validity, scope, or ownership of any intellectual property rights to a specific device. These letters do not grant, impute, suggest, or otherwise establish any ownership, distribution, or licensing rights to the requester. The government expresses no opinion about the intellectual property rights relating to any device for which this or any other eligibility letter is issued.

PUBLIC DISCLOSURE

To prevent any misunderstanding, and as discussed above, this eligibility letter is assigned FHWA control number CC-176. It should only be reproduced in full with its attachment(s). This letter and the material offered by the requester supporting its issuance is public information. All eligibility letters and supporting material are subject to public disclosure under the Freedom

of Information Act (FOIA). Eligibility letters are available to the public at https://safety.fhwa.dot.gov/roadway_dept/countermeasures/reduce_crash_severity/.

If you have any questions please contact Aimee Zhang at Aimee.Zhang@dot.gov.

Sincerely,

A handwritten signature in black ink that reads "Robert Ritter". The signature is written in a cursive style with a large initial "R".

Robert Ritter

Director, Office of Safety Technologies
Office of Safety

Enclosures

Request for Federal Aid Reimbursement Eligibility of Highway Safety Hardware

Submitter	Date of Request	February 08, 2022	<input checked="" type="radio"/> New <input type="radio"/> Resubmission
	Name:	Gerrit C. Verwijs	
	Company:	Verdegro Holding BV	
	Address:	Munnikenheiweg 59, 4879 NE	
	Country:	Netherlands	
	To:	Michael S. Griffith, Director FHWA, Office of Safety Technologies	

I request the following devices be considered eligible for reimbursement under the Federal-aid highway program.

Device & Testing Criterion – Enter from right to left starting with Test Level

!-!-!

System Type	Submission Type	Device Name / Variant	Testing Criterion	Test Level
'CC': Truck-Mounted Attenuators (TMA)	<input checked="" type="radio"/> Physical Crash Testing <input type="radio"/> Engineering Analysis	Verdegro® BLADE TTMA	AASHTO MASH	TL3

By submitting this request for review and evaluation by the Federal Highway Administration, I certify that the product(s) was (were) tested in conformity with the AASHTO Manual for Assessing Safety Hardware and that the evaluation results meet the appropriate evaluation criteria in the MASH.

Individual or Organization responsible for the product:

Contact Name:	Gerrit C. Verwijs	Same as Submitter <input checked="" type="checkbox"/>
Company Name	Verdegro Holding BV	Same As Submitter <input checked="" type="checkbox"/>
Address:	Munnikenheiweg 59, 4879 NE	Same as Submitter <input checked="" type="checkbox"/>
Country:	Netherlands	Same as Submitter <input checked="" type="checkbox"/>

Enter below all disclosures of financial interests as required by the FHWA 'Federal-Aid Reimbursement Eligibility Process for Safety Hardware Devices' document.

Texas A&M Transportation Institute (TTI) was contracted by Verdegro Holding BV to perform full-scale crash testing of the Verdegro® BLADE TTMA. There are no shared financial interests in the Verdegro® BLADE TTMA, or between Verdegro Holdings BV® BLADE TTMA and TTI, other than costs involved in the actual crash tests and report for this submission to FHWA.

690902-VER 5-6 & 9-10 & 15

PRODUCT DESCRIPTION

- New Hardware or Significant Modification
 Modification to Existing Hardware

Each test was performed using a proprietary Truck Trailer Mounted Attenuator ("TTMA"), manufactured by Verdegro® Holding BV, and attached per the manufacturers instructions to a 1999 Ford F-750 single-unit support truck.

The TTMA is attached to the rear end of the support truck via a special hitch system, which attaches then to the main body of the TTMA. The TTMA has a sleeve on each side, which has metal slides that can slide into the sleeves to collapse the TTMA down for transport. The rear end of the TTMA connects the two slides together with a panel system. The trailer has two wheels, and also a sign board which extends above the trailer there the receiving hitch meets the body of the trailer. The TTMA measured 6.2 m (247 inches) long from the pintle hitch to the back of the TMA in the deployed position. The TTMA itself measured 5 m (197 inches) in length and its hitch attachment assembly measured 1.2 m (50 inches) in length. The TTMA with both mast and arrow board weighed 1243 kg (2740 lb).

CRASH TESTING

By signature below, the Engineer affiliated with the testing laboratory agrees in support of this submission that all of the critical and relevant crash tests for this device listed above were conducted to meet the MASH test criteria. The Engineer has determined that no other crash tests are necessary to determine the device meets the MASH criteria.

Engineer Name:	D. Lance Bullard, Jr.	
Engineer Signature:	D. Lance Bullard, Jr.	Digitally signed by D. Lance Bullard, Jr. Date: 2022.09.28 09:33:46 -05'00'
Address:	1254 Avenue A, Bldg 7091, Bryan, Texas 77807	Same as Submitter <input type="checkbox"/>
Country:	USA	Same as Submitter <input type="checkbox"/>

A brief description of each crash test and its result:

Required Test Number	Narrative Description	Evaluation Results
3-50 (1100C)	<p>Test 690902-VER5 Test 3-50 involves an 1100C vehicle impacting the test article at a target impact speed of 100 km/h \pm4 km/h (62 mi/h \pm2.5 mi/h) and target angle of 0° \pm1.5°. The target impact orientation was for the centerline of the test vehicle to align with the centerline of the TTMA. The TTMA support truck was ballasted to the heaviest weight specified by Verdegro®.</p> <p>The results of the test conducted on August 5, 2019 are found in TTI Test Report No. 690902-VER 5-6 & 9-10 & 15. The test vehicle was traveling at a speed of 102.0 km/h (63.4 mi/h) at 1.4° as it contacted the Verdegro® BLADE TTMA 20 mm (0.77 inch) to the right of centerline. Minimum target kinetic energy (KE) was \geq390 KJ (288 kip ft), and actual KE was 442 KJ (326 kip-ft).</p> <p>The Verdegro® BLADE TTMA brought the 1100 C test vehicle to a controlled stop and the test vehicle remained engaged with the TTMA. Maximum dynamic displacement of the rear of the TTMA during the test was 3848 mm (151.5 inches). No detached elements, fragments, or other debris were present to penetrate or show potential for penetrating the occupant compartment, or to present hazard to others in the area. The support vehicle rolled forward 865 mm (34.0 inches). No occupant compartment deformation or intrusion occurred. The 1100C test vehicle remained upright during and after the collision sequence. Maximum roll and pitch angles were 3 degrees and 4 degrees respectively. Longitudinal OIV was 10.3 m/s (33.8 ft/2), and lateral OIV was 0.3 m/s (1.0 ft/s). Maximum longitudinal ridedown acceleration was 9.3 g, and maximum lateral ridedown acceleration was 1.6 g. Occupant risk factors were within the limits specified in MASH.</p> <p>The Verdegro® BLADE TTMA performed acceptably for MASH test 3-50.</p>	PASS

Required Test Number	Narrative Description	Evaluation Results
3-51 (2270P)	<p>Test 690902-VER6</p> <p>Test 3-51 involves an 2270P vehicle impacting the test article at a target impact speed of 100 km/h \pm4 km/h (62 mi/h \pm2.5 mi/h) and target angle of 0° \pm1.5°. The target impact orientation was for the centerline of the test vehicle to align with the centerline of the TTMA. The TTMA support truck was ballasted to the heaviest weight specified by Verdegro®.</p> <p>The results of the test conducted on August 5, 2019, are found in TTI Test report No. 690902-VER 5-6 & 9-10 & 15. The test vehicle was traveling at a speed of 99.5 km/h (61.8 mi/h) at 0.02° as it contacted the Verdegro® BLADE TTMA 51 mm (2.0 inches) to the right of centerline. Minimum target KE was \geq806 KJ (594 kip-ft), and actual KE was 870 KJ (641 kip ft).</p> <p>The Verdegro BLADE TTMA brought the 2207P test vehicle to a controlled stop and the test vehicle remained engaged with the TTMA. Maximum dynamic displacement of the rear of the TTMA during the test was 5105 mm (201.0 inches). Some debris from the TTMA were present, however, none of the debris penetrated or showed potential for penetrating the occupant compartment, or to present hazard to others in the area. The support vehicle rolled forward 3957 mm (155.8 inches). No occupant compartment deformation or intrusion occurred. The 2270P test vehicle remained upright during and after the collision event. Maximum roll and pitch angles were 1 degree and 7 degrees, respectively. Longitudinal OIV was 7.8 m/s (25.6 ft/s), and lateral OIV was 0.1 m/s (0.3 ft/s). Maximum longitudinal ridedown acceleration was 13.0 g, and maximum lateral ridedown acceleration was 1.4 g. Occupant risk factors were within the preferred limits specified in MASH.</p> <p>The Verdegro® BLADE TTMA performed acceptably for MASH test 3-51.</p>	PASS

3-52 (2270P)	<p>Test 690902-VER9</p> <p>Test 3-52 involves a 2270P vehicle impacting the test article at a target impact speed of 100 km/h \pm4 km/h (62 mi/h \pm2.5 mi/h) and target angle of 0° \pm1.5°. The target impact orientation was for the centerline of the test vehicle to align with the one-third point (767 mm (30.2 inches)) to the left of the centerline of the TTMA. The TTMA support truck was ballasted to the heaviest weight specified by Verdegro®. The results of the test conducted on February 4, 2021, are found in TTI Test Report No. 69092-VER5-6 & 9-10 & 15. The test vehicle was traveling at a speed of 101.7 km/h (63.2 mi/h) at 0.2° as it contacted the modified Verdegro® BLADE TTMA 13 mm (0.5 inch) to the left of the one-third point of the TTMA. Minimum target kinetic energy (KE) was 806 kJ (594 kip ft), and the actual KE was 911 kJ (672 kip ft). The modified Verdegro® BLADE TTMA redirected and slowed the 2270P test vehicle, which disengaged from the TTMA and came to rest 46.3 m (152 ft) downstream of and 3 m (10 ft) to the right of the impact point. Maximum dynamic displacement of the rear of the TTMA during the test was 3886 mm (153.0 inches). Some debris from the TTMA were present, however, none of the debris penetrated or showed potential for penetrating the occupant compartment, or to present hazard to others in the area. The support vehicle rolled forward 1956 mm (77.0 inches). Maximum occupant compartment deformation was 57 mm (2.25 inches) in the right front kick panel/floor pan area. The 2270P test vehicle remained upright during and after the collision event. Maximum roll and pitch angles were 24 degrees and 7 degrees, respectively. Longitudinal OIV was 7.7 m/s (25.3 ft/s), and lateral OIV was 1.6 m/s (5.2 ft/s). Maximum longitudinal ridedown acceleration was 16.7 g, and maximum lateral ridedown acceleration was 9.9 g. Occupant risk factors were within the limits specified in MASDH.</p> <p>The Verdegro® BLADE TTMA performed acceptably for MASH test 3-52.</p>	PASS
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<p>3-53 (2270P)</p>	<p>Test 690902-VER10 Test 3-53 involves a 2270P vehicle impacting the test article at a target impact speed of 100 km/h \pm4 km/h (62 mi/h \pm2.5 mi/h) and target angle of 10° \pm1.5°. the target impact orientation was for the centerline of the test vehicle to align with the one-quarter point (575 mm (22.6 inches)) to the left of the centerline of the TTMA. The TTMA support truck was ballasted to the lightest weight specified by Verdegro®.</p> <p>The results of the test conducted on February 5, 2021, are found in TTI Test Report No. 690902-VER 5-6 & 9-10 & 15. The test vehicle was traveling at a speed of 102.5 km/h (63.7 mi/h) at 9.5° as it contacted the modified Verdegro® BLADE TTMA 8 mm (0.3 inch) to the left of the one-quarter point of the TTMA. Minimum target KE was 806 kJ (594 kip ft), and actual KE was 900 kJ (664 kip-ft) at 9.5 degrees (equivalent to 925 kJ (682 kip ft) at 0 degree).</p> <p>The modified Verdegro® BLADE TTMA redirected and slowed the 2270P test vehicle, which disengaged from the TTMA and came to rest 24.4 m (80 ft) downstream of and 2.1 m (7 ft) left of the impact point. Maximum dynamic displacement of the rear of the TTMA during the test was 4247 mm (167.2 inches). Some debris from the TTMA were present, however, none of the debris penetrated or showed potential for penetrating the occupant compartment, or to present hazard to others in the area. The support vehicle rolled forward 6400 mm (252 inches). No occupant compartment deformation or intrusion occurred. The 2270P test vehicle remained upright during and after the collision event. Maximum roll and pitch angles were 3 degrees and 7 degrees, respectively. Longitudinal OIV was 7.6 m/s (24.9 ft/s), and lateral OIV was 1.3 m/s (4.3 ft/s). Maximum longitudinal ridedown acceleration was 7.3 g, and maximum lateral ridedown acceleration was 4.7 g. Occupant risk factors were within the preferred limits specified in MASH. The Verdegro® BLADE TTMA performed acceptably for MASH test 3-53.</p>	<p>PASS</p>
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<p>3-54 (1500A)</p>	<p>Test 690902-VER15 Test 3-54 involves a 1500A vehicle impacting the test article at a target impact speed of 100 km/h \pm4 km/h (62 mi/h \pm2.5 mi/h) and target angle of 0° \pm1.5°. the target impact orientation was for the centerline of the test vehicle to align with centerline of the TTMA. The TTMA support truck was ballasted to the lightest weight specified by Verdegro®. The results of the test conducted on November 4, 2021, are found in TTI Test Report No. 690902-VER 5-6 & 9-10 & 15. The test vehicle was traveling at a speed of 100.1 km/h (62.2 mi/h) at 0.3° as it contacted the Verdegro® BLADE TTMA on the centerline. Minimum target KE was \geq532 kJ (392 kip-ft), and actual KE was 581 KJ (429 kip-ft). The Verdegro® BLADE TTMA brought the 1500A test vehicle to a controlled stop and the test vehicle rebounded 305 mm (12 inches) from the TTMA. Maximum dynamic displacement of the rear of the TTMA during the test was 4336 mm (170.7 inches). Some debris from the TTMA were present, however, none of the debris penetrated or showed potential for penetrating the occupant compartment, or to present hazard to others in the area. The support vehicle rolled forward 1422 mm (56 inches). No occupant compartment deformation or intrusion occurred. The 1500A test vehicle remained upright during and after the collision event. Maximum roll and pitch angles were 2 degrees and 4 degrees, respectively. Longitudinal OIV was 8.9 m/s (29.2 ft/s), and lateral OIV was 0.2 m/s (0.7 ft/s). Maximum longitudinal ridedown acceleration was 12.4 g, and maximum lateral ridedown acceleration was 1.7 g. Occupant risk factors were within the preferred limits specified in MASH. The Verdegro® BLADE TTMA performed acceptably for MASH test 3-54.</p>	<p>PASS</p>
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Full Scale Crash Testing was done in compliance with MASH by the following accredited crash test laboratory (cite the laboratory’s accreditation status as noted in the crash test reports.):

Laboratory Name:	Texas AM Transportation Institute	
Laboratory Signature:	Bill Griffith	Digitally signed by Bill Griffith Date: 2024.01.03 10:05:11 -06'00'
Address:	1254 Avenue A, Bldg 7091, Bryan, Texas 77807	Same as Submitter <input type="checkbox"/>
Country:	USA	Same as Submitter <input type="checkbox"/>
Accreditation Certificate Number and Dates of current Accreditation period :	ISO 17025-2017 Laboratory A2LA Certificate Number: 2821.01 Valid To: April 30, 2023	

Submitter Signature*: **Gerrit Verwijs**
Digitaal ondertekend door Gerrit Verwijs
Datum: 2024.01.04 13:43:11 +01'00'

Submit Form

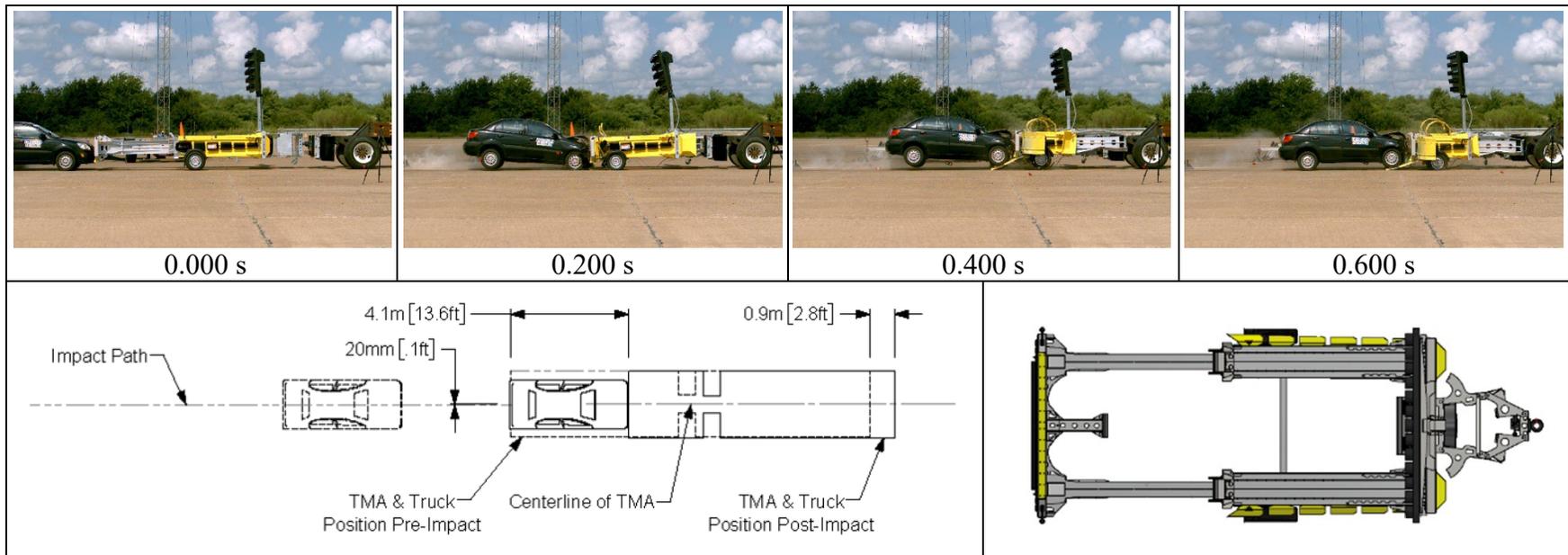
ATTACHMENTS

Attach to this form:

- 1) Additional disclosures of related financial interest as indicated above.
- 2) A copy of the full test report, video, and a Test Data Summary Sheet for each test conducted in support of this request.
- 3) A drawing or drawings of the device(s) that conform to the Task Force-13 Drawing Specifications [[Hardware Guide Drawing Standards](#)]. For proprietary products, a single isometric line drawing is usually acceptable to illustrate the product, with detailed specifications, intended use, and contact information provided on the reverse. Additional drawings (not in TF-13 format) showing details that are relevant to understanding the dimensions and performance of the device should also be submitted to facilitate our review.

FHWA Official Business Only:

Eligibility Letter		Key Words
Number	Date	



General Information

Test Agency..... Texas A&M Transportation Institute (TTI)
 Test Standard Test No..... MASH Test 3-50
 TTI Test No. 690902-VER5
 Test Date 2019-08-05

Test Article

Type Trailer-Mounted Attenuator (TMA)
 Name..... Verdegro® BLADE TTMA
 TMA Weight 1209 kg (2665 lb) w/ mast & board
 TMA Length..... 6306 mm (248.25 inches)
 Material or Key Elements.... Proprietary trailer mounted attenuator (TMA)coupled to single-unit support truck

Soil Type and Condition Concrete Pavement, Dry

Support Truck 1999 Ford F-750 Truck
 Total Ballasted Weight..... 14 978 kg (33,020 lb)

Test Vehicle

Type/Designation..... 1100C
 Make and Model 2009 Kia Rio
 Curb..... 1058 kg (2332 lb)
 Test Inertial..... 1101 kg (2427 lb)
 Dummy 75 kg (165 lb)
 Gross Static..... 1176 kg (2592 lb)

Impact Conditions

Speed 102.0 km/h (63.4 mi/h)
 Angle 1.4°
 Location/Orientation..... 20 mm (0.77 inches) to the right of centerline

Kinetic Energy 442 KJ (326 kip-ft)

Exit Conditions

Speed Stopped
 Angle NA

Occupant Risk Values

Longitudinal OIV 10.3 m/s (33.8 ft/s)
 Lateral OIV 0.3 m/s (1.0 ft/s)
 Longitudinal Ridedown..... 9.3 g
 Lateral Ridedown..... 1.6 g
 THIV 37.2 km/h (10.3 m/s)
 ASI 1.4

Max. 0.050-s Average
 Longitudinal..... -16.0 g
 Lateral -0.6 g
 Vertical -3.1 g

Post-Impact Trajectory

Test Vehicle Rebound..... None
 Test Vehicle At-Rest..... Against TMA
Support Truck Roll-Ahead 864 mm (34 inches)

Test Vehicle Stability

Maximum Roll Angle 3°
 Maximum Pitch Angle 4°
 Maximum Yaw Angle 2°

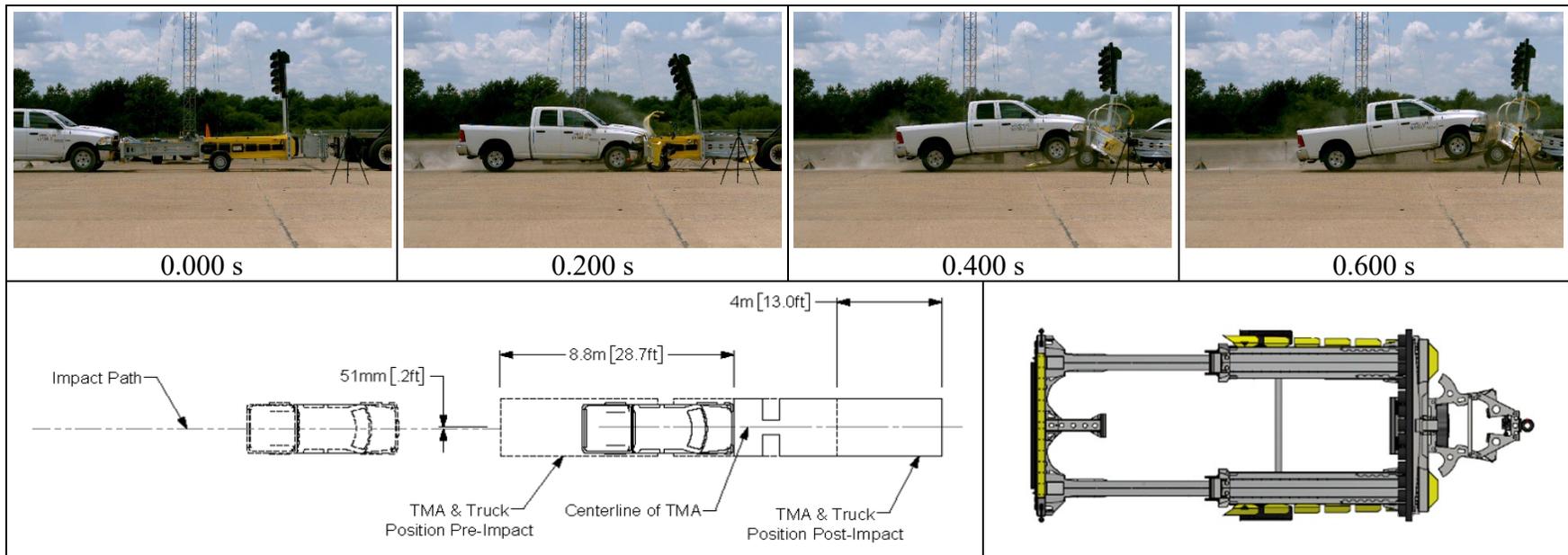
TMA & Support Truck

Support Truck Displacement... 864 mm (34 inches)
 TMA Dynamic Compression.... 3848 mm (151.5 inches)
 TMA Permanent Compression 3272 mm (128.8 inches)

Test Vehicle Damage

VDS 12FD5
 CDC..... 12FDEW5
 Max. Exterior Deformation 12.0 inches
 OCDI FS0000000
 Max. Occupant Compart. Deformation..... None

Figure 5.11. Summary of Results for MASH Test 3-50 on Verdegro® BLADE TTMA.



General Information

Test Agency..... Texas A&M Transportation Institute (TTI)
 Test Standard Test No..... MASH Test 3-51
 TTI Test No. 690902-VER6
 Test Date 2019-08-05

Test Article

Type Trailer-Mounted Attenuator (TMA)
 Name..... Verdegro® BLADE TTMA
 TMA Weight 1209 kg (2665 lb) w/ mast & board
 TMA Length 6306 mm (248.25 inches)
 Material or Key Elements Proprietary trailer mounted attenuator (TMA) coupled to single-unit support truck

Soil Type and Condition

..... Concrete Pavement, Dry

Support Truck

..... 1999 Ford F-750 Truck
 Total Ballasted Weight 14 978 kg (33,020 lb)

Test Vehicle

Type/Designation 2270P
 Make and Model 2013 RAM 1500 Pickup Truck
 Curb 2243 kg (4944 lb)
 Test Inertial 2278 kg (5022 lb)
 Dummy No dummy
 Gross Static 2278 kg (5022 lb)

Impact Conditions

Speed99.5 km/h (61.8 mi/h)
 Angle0.2°
 Location/Orientation51 mm (2.0 inches) to the right of centerline

Kinetic Energy

.....870 KJ (641 kip-ft)

Exit Conditions

SpeedStopped
 AngleNA

Occupant Risk Values

Longitudinal OIV7.8 m/s (25.6 ft/s)
 Lateral OIV0.1 m/s (0.3 ft/s)
 Longitudinal Ridedown13.0 g
 Lateral Ridedown1.4 g
 THIV28.2 km/h (7.8 m/s)
 PHD13.1 g
 ASI1.0

Max. 0.050-s Average

Longitudinal-11.1 g
 Lateral-0.8 g
 Vertical-3.3 g

Post-Impact Trajectory

Test Vehicle Rebound None
 Test Vehicle At-Rest Against TMA
Support Truck Roll-Ahead 4.0 m (13 ft)

Test Vehicle Stability

Maximum Roll Angle 1°
 Maximum Pitch Angle 7°
 Maximum Yaw Angle 3°

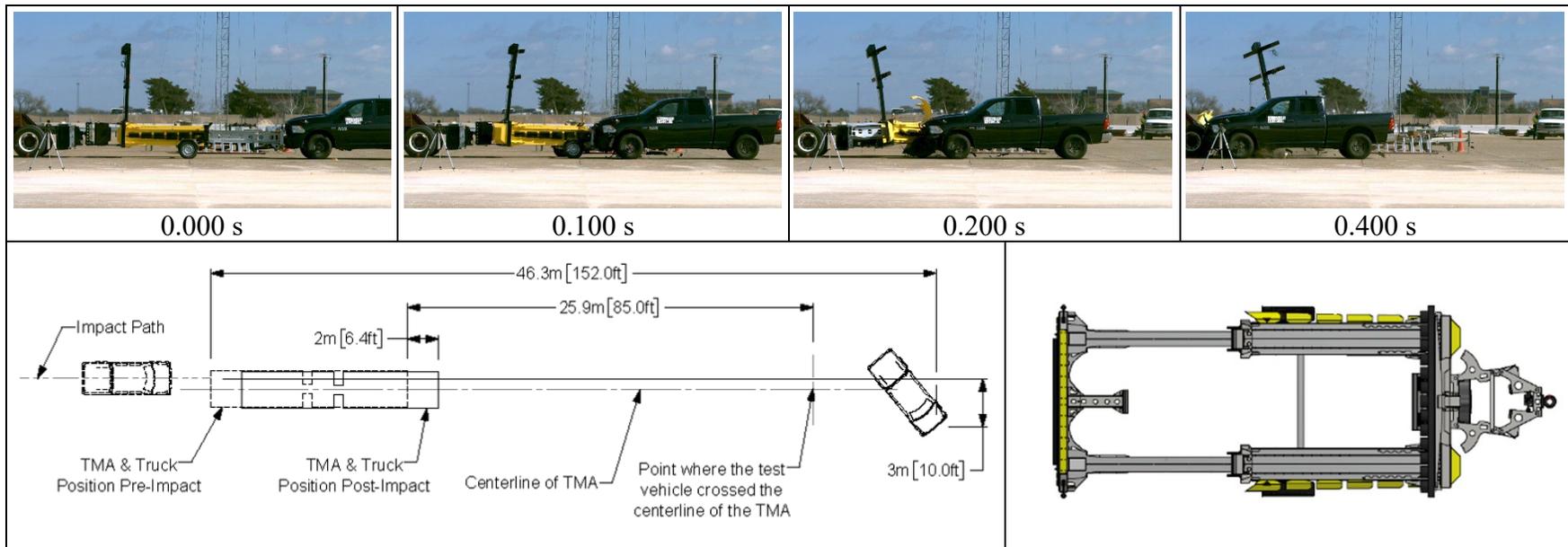
TMA & Support Truck

Support Truck Displacement 3957 mm (155.8 inches)
 TMA Dynamic Compression 5105 mm (201.0 inches)
 TMA Permanent Compression .. 4801 mm (189.0 inches)

Test Vehicle Damage

VDS 12FD4
 CDC 12FDEW3
 Max. Exterior Deformation 305 mm (12.0 inches)
 OCDI FS0000000
 Max. Occupant Compart. Deformation None

Figure 6.9. Summary of Results for MASH Test 3-51 on Verdegro® BLADE TTMA.



General Information

Test Agency..... Texas A&M Transportation Institute (TTI)
 Test Standard Test No..... MASH Test 3-52
 TTI Test No. 690902-VER9
 Test Date..... 2021-02-04

Test Article

Type Trailer Mounted Attenuator (TMA)
 Name..... Verdegro® BLADE TTMA
 TMA Weight..... 1139 kg (2511 lb) w/ mast only
 TMA Length..... 6166 mm (242.75 inches)
 Material or Key Elements..... Proprietary trailer mounted attenuator (TMA) coupled to single-unit support truck

Soil Type and Condition Concrete Pavement, Dry

Support Truck 1999 Ford F-750 single-unit

Total Ballasted Weight..... 15 027 kg (33,130 lb)

Test Vehicle

Type/Designation..... 2270P
 Make and Model..... 2017 RAM 1500
 Curb 2243 kg (4945 lb)
 Test Inertial..... 2284 kg (5036 lb)
 Dummy No dummy
 Gross Static..... 2284 kg (5036 lb)

Impact Conditions

Speed..... 101.7 km/h (63.2 mi/h)
 Angle..... 0.2°
 Location/Orientation 13 mm (0.5 inch) left of the one-third point

Kinetic Energy 911 kJ (672 kip ft)

Exit Conditions

Speed..... 38.1 km/h (23.7 mi/h)
 Trajectory/Heading Angle 35.0°/5.3°

Occupant Risk Values

Longitudinal OIV..... 7.7 m/s (25.3 ft/s)
 Lateral OIV 1.6 m/s (5.2 ft/s)
 Longitudinal Ridedown 16.7 g
 Lateral Ridedown 9.9 g
 THIV 7.9 m/s
 ASI 0.9

Max. 0.050-s Average

Longitudinal..... -8.3 g
 Lateral..... -4.5 g
 Vertical..... -6.2 g

Post-Impact Trajectory

Test Vehicle Rebound..... None
 Test Vehicle At-Rest 46.3 m (152 ft) d/s & 3.0 m (10 ft) right

Support Truck Roll-Ahead 2 m (6.4 ft)

Vehicle Stability

Maximum Roll Angle 24°
 Maximum Pitch Angle 8°
 Maximum Yaw Angle 17°

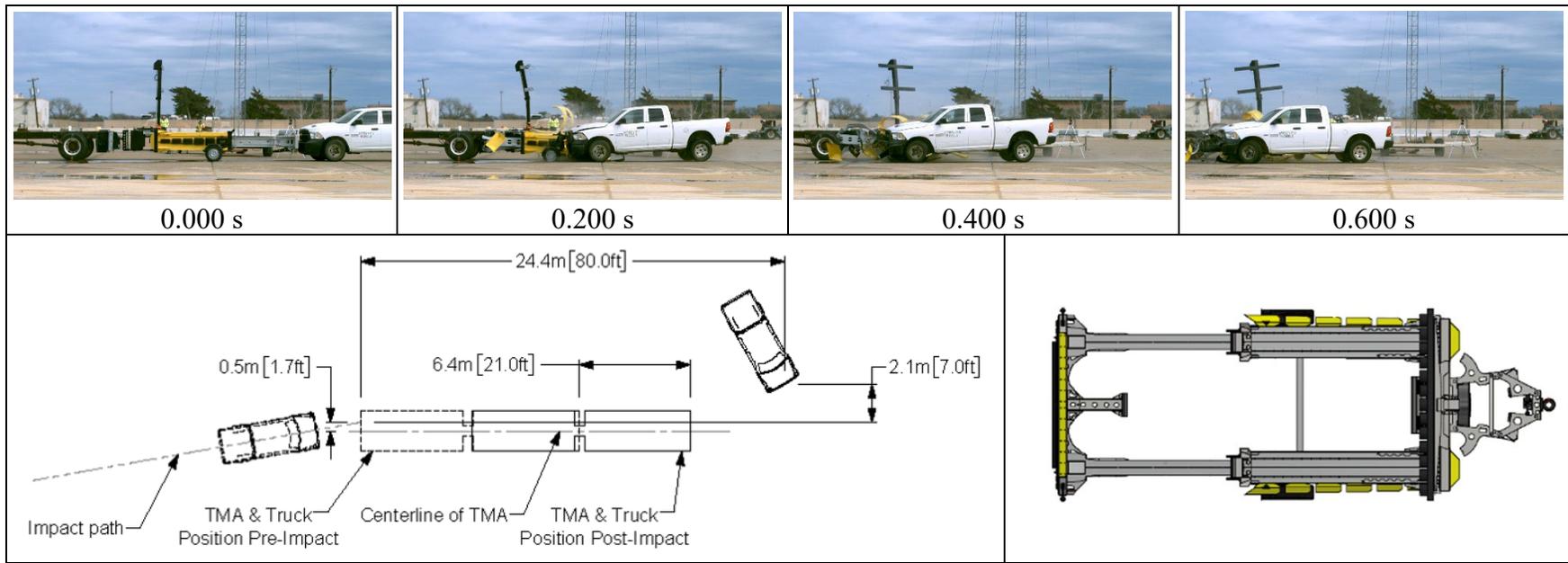
TMA & Support Truck

Support Truck Displacement 1956 mm (77 inches)
 TMA Dynamic Compression..... 3886 mm (153.0 inches)
 TMA Permanent Compression 3289 mm (129.5 inches)

Test Vehicle Damage

VDS 01RFQ4
 CDC..... 01FREW3
 Max. Exterior Deformation..... 254 mm (10.0 inches)
 OCDI FS0000000
 Max. Occupant Compartment Deformation 57 mm (2.25 inches) in the right front floor pan

Figure 7.8. Summary of Results for MASH Test 3-52 on Verdegro® BLADE TTMA.



General Information

Test Agency..... Texas A&M Transportation Institute (TTI)
 Test Standard Test No..... MASH Test 3-53
 TTI Test No. 690902-VER10
 Test Date..... 2021-02-05

Test Article

Type Trailer Mounted Attenuator (TMA)
 Name..... Verdegro® BLADE TTMA
 TMA Weight..... 1139 kg (2511 lb) w/ mast only
 TMA Length..... 6172 mm (243 inches)
 Material or Key Elements.... Proprietary trailer mounted attenuator (TMA) coupled to single-unit support truck

Soil Type and Condition Concrete Pavement, Damp

Support Truck 1999 Ford F-750 single-unit
 Total Ballasted Weight..... 5466 kg (12,050 lb)

Test Vehicle

Type/Designation..... 2270P
 Make and Model 2016 RAM 1500 Pickup
 Curb..... 2254 kg (4970 lb)
 Test Inertial..... 2282 kg (5031 lb)
 Dummy No dummy
 Gross Static..... 2282 kg (5031 lb)

Impact Conditions

Speed 102.5 km/h (63.7 mi/h)
 Angle 9.5°
 Location/Orientation..... 8 mm (0.3 inch) left of quarter point

Kinetic Energy 0°: 925 kJ (682 kip ft)
 9.5°: 900kJ (664 kif-ft)

Exit Conditions

Speed 37.6 km/h (23.3 mi/h)
 Trajectory/Heading Angle... 28.6°/12.8°

Occupant Risk Values

Longitudinal OIV 7.6 m/s (24.9 ft/s)
 Lateral OIV..... 1.3 m/s (4.3 ft/s)
 Longitudinal Ridedown..... 7.3 g
 Lateral Ridedown..... 4.7 g
 THIV 7.7 m/s
 ASI..... 0.9

Max. 0.050-s Average

Longitudinal -8.2 g
 Lateral -2.9 g
 Vertical 1.6 g

Post-Impact Trajectory

Test Vehicle Rebound None
 Test Vehicle At-Rest..... 24.4 m (80 ft) d/s & 2.1 m (7 ft) left

Support Truck Roll-Ahead..... 6.4 m (21 ft)

Vehicle Stability

Maximum Roll Angle..... 3°
 Maximum Pitch Angle..... 7°
 Maximum Yaw Angle..... 13°

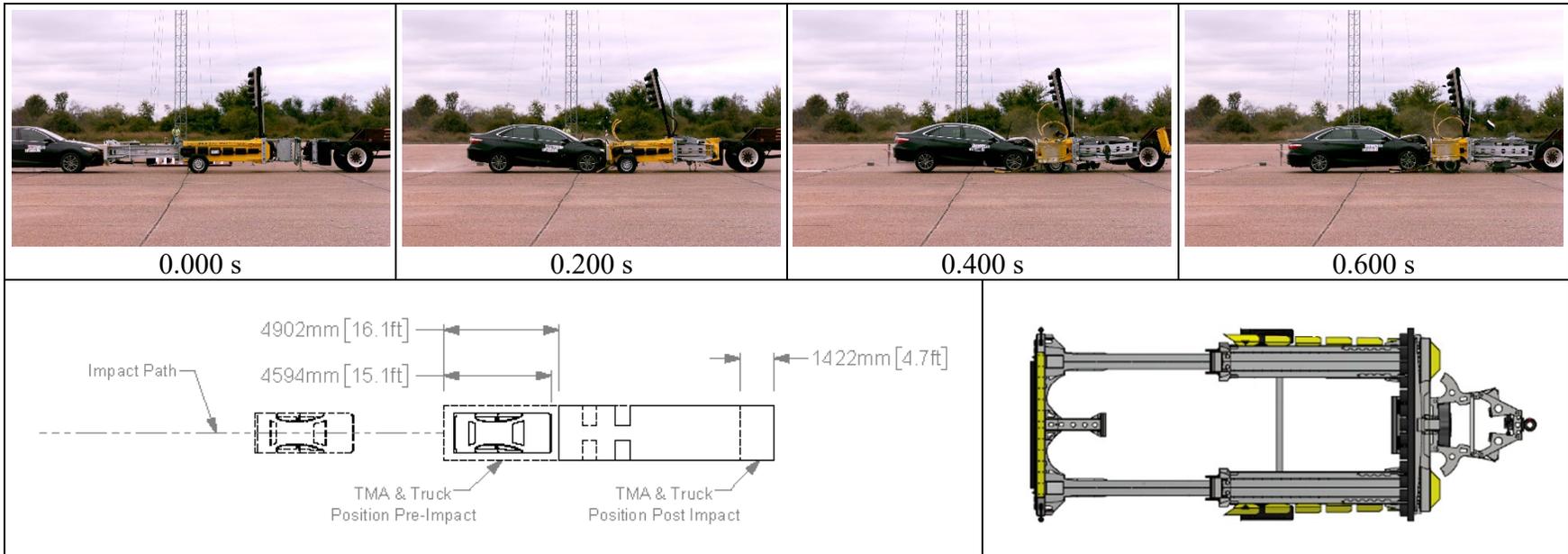
TMA & Support Truck

Support Truck Displacement..... 6400 mm (252 inches)
 TMA Dynamic Compression 4247 mm (167.2 inches)
 TMA Permanent Compression.... 3564 mm (140.3 inches)

Test Vehicle Damage

VDS..... 01RFQ3
 CDC 01FREW3
 Max. Exterior Deformation 356 mm (14.0 inches)
 OCDI FS0000000
 Max. Occupant Compartment Deformation..... None

Figure 8.8. Summary of Results for MASH Test 3-53 on Verdegro® BLADE TTMA.



General Information

Test Agency..... Texas A&M Transportation Institute (TTI)
 Test Standard Test No..... MASH Test 3-54
 TTI Test No. 690902-VER15
 Test Date 2021-11-04

Test Article

Type Trailer-Mounted Attenuator (TMA)
 Name..... Verdegro® BLADE TTMA
 TMA Weight 1243 kg (2740 lb) w/ mast & board
 TMA Length..... 6172 mm (243 inches)
 Material or Key Elements.... Proprietary trailer mounted attenuator
 (TMA)coupled to single-unit support truck

Soil Type and Condition Concrete Pavement, Dry

Support Truck 1999 Ford F-750 Truck
 Total Ballasted Weight..... 15 023 kg (33,120 lb)

Test Vehicle

Type/Designation..... 1500A
 Make and Model 2016 Toyota Camry
 Curb..... 1422 kg (3136 lb)
 Test Inertial..... 1503 kg (3314 lb)
 Dummy N/A
 Gross Static..... 1503 kg (3314 lb)

Impact Conditions

Speed..... 100.1 km/h (62.2 mi/h)
 Angle 0.3°
 Location/Orientation.... Centerline of vehicle at
 centerline of TMA

Kinetic Energy 581 KJ (429 kip-ft)

Exit Conditions

Speed..... Stopped
 Angle N/A

Occupant Risk Values

Longitudinal OIV 8.9 m/s (29.2 ft/s)
 Lateral OIV 0.2 m/s (0.7 ft/s)
 Longitudinal Ridedown. 12.4 g
 Lateral Ridedown..... 1.7 g
 THIV 8.9 m/s
 ASI 1.2

Max. 0.050-s Average
 Longitudinal..... -12.7 g
 Lateral -1.2 g
 Vertical 2.1 g

Post-Impact Trajectory

Test Vehicle Rebound..... 305 mm (12 inches)
 Test Vehicle At-Rest 4594 mm (180.1 inches)
 downstream
Support Truck Roll-Ahead 1422 mm (56 inches)

Test Vehicle Stability

Maximum Roll Angle 2°
 Maximum Pitch Angle 4°
 Maximum Yaw Angle 1°

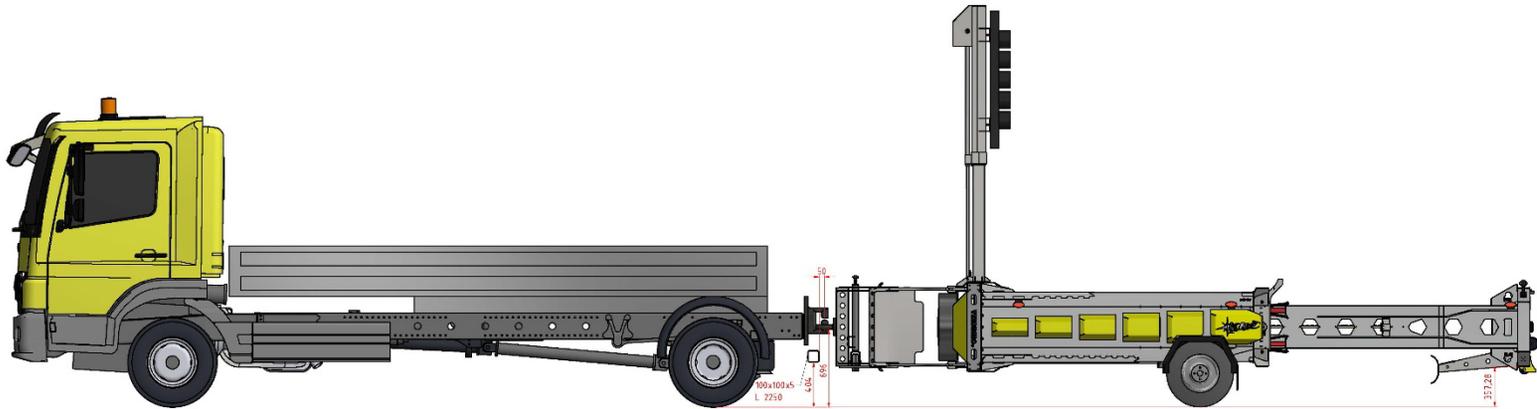
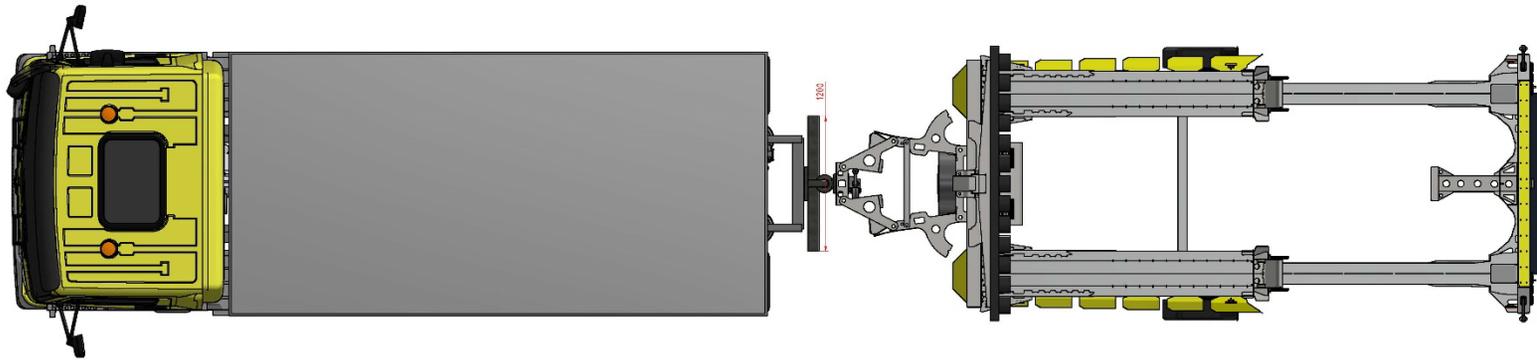
TMA & Support Truck

Support Truck Displacement... 1422 mm (56 inches)
 TMA Dynamic Compression.... 4336 mm (170.7 inches)
 TMA Permanent Compression 3785 mm (149 inches)

Test Vehicle Damage

VDS 12FD5
 CDC..... 12FDEW5
 Max. Exterior Deformation 10.0 inches
 OCDI FS0000000
 Max. Occupant Compart.
 Deformation..... None

Figure 9.11. Summary of Results for MASH Test 3-54 on Verdegro® BLADE TTMA.



900x100x45
L. 2250

4000
6000

307.24

Remark:			Weight: 8720,85 kg
1.30.1.1.4			
VERDEGRO			
VERDEGRO GROUP			
Verdegroweg 53			
4379 NL EIJDELLER			
0179794245			
PROJEKT: Truck with TTMA Idv	www.VERDEGRO.com		
		1.250x116	
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