



U.S. Department
of Transportation
Federal Highway
Administration

MAR 05 2019

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

In Reply Refer To:
HSST-1 / CC-152

Mr. Frederick Mauer
Gregory Industries
4100 13th Street, SW
Canton, OH. 44710

Dear Mr. Mauer:

This letter is in response to your November 2, 2018 request for the Federal Highway Administration (FHWA) to review a roadside safety device, hardware, or system for eligibility for reimbursement under the Federal-aid highway program. This FHWA letter of eligibility is assigned FHWA control number CC-152 and is valid until a subsequent letter is issued by FHWA that expressly references this device.

Decision

The following device is eligible within the length-of-need, with details provided in the form which is attached as an integral part of this letter:

- Truck Tailor Mounted Attenuator - 200

Scope of this Letter

To be found eligible for Federal-aid funding, new roadside safety devices should meet the crash test and evaluation criteria contained in the American Association of State Highway and Transportation Officials' (AASHTO) Manual for Assessing Safety Hardware (MASH). However, the FHWA, the Department of Transportation, and the United States Government do not regulate the manufacture of roadside safety devices. Eligibility for reimbursement under the Federal-aid highway program does not establish approval, certification or endorsement of the device for any particular purpose or use.

This letter is not a determination by the FHWA, the Department of Transportation, or the United States Government that a vehicle crash involving the device will result in any particular outcome, nor is it a guarantee of the in-service performance of this device. Proper manufacturing, installation, and maintenance are required in order for this device to function as tested.

This finding of eligibility is limited to the crashworthiness of the system and does not cover other structural features, nor conformity with the Manual on Uniform Traffic Control Devices.

Eligibility for Reimbursement

Based solely on a review of crash test results and certifications submitted by the manufacturer, and the crash test laboratory, FHWA agrees that the device described herein meets the crash test and evaluation criteria of the AASHTO's MASH. Therefore, the device is eligible for reimbursement under the Federal-aid highway program if installed under the range of tested conditions.

Name of system: Truck Tailor Mounted Attenuator - 200
Type of system: Attenuator
Test Level: MASH Test Level 3 (TL3)
Testing conducted by: Applus IDIADA KARCO Engineering
Date of request: November 2, 2018

FHWA concurs with the recommendation of the accredited crash testing laboratory on the attached form.

Full Description of the Eligible Device

The device and supporting documentation, including reports of the crash tests or other testing done, videos of any crash testing, and/or drawings of the device, are described in the attached form.

Notice

This eligibility letter is issued for the subject device as tested. Modifications made to the device are not covered by this letter. Any modifications to this device should be submitted to the user (i.e., state DOT) as per their requirements.

You are expected to supply potential users with sufficient information on design, installation and maintenance requirements to ensure proper performance.

You are expected to certify to potential users that the hardware furnished has the same chemistry, mechanical properties, and geometry as that submitted for review, and that it will meet the test and evaluation criteria of AASHTO's MASH.

Issuance of this letter does not convey property rights of any sort or any exclusive privilege. This letter is based on the premise that information and reports submitted by you are accurate and correct. We reserve the right to modify or revoke this letter if: (1) there are any inaccuracies in the information submitted in support of your request for this letter, (2) the qualification testing was flawed, (3) in-service performance or other information reveals safety problems, (4) the system is significantly different from the version that was crash tested, or (5) any other information indicates that the letter was issued in error or otherwise does not reflect full and complete information about the crashworthiness of the system.

Standard Provisions

- To prevent misunderstanding by others, this letter of eligibility designated as FHWA control number CC-152 shall not be reproduced except in full. This letter and the test documentation upon which it is based are public information. All such letters and documentation may be reviewed upon request.
- This letter shall not be construed as authorization or consent by the FHWA to use, manufacture, or sell any patented system for which the applicant is not the patent holder.
- This FHWA eligibility letter is not an expression of any Agency view, position, or determination of validity, scope, or ownership of any intellectual property rights to a specific device or design. Further, this letter does not impute any distribution or licensing rights to the requester. This FHWA eligibility letter determination is made based solely on the crash-testing information submitted by the requester. The FHWA reserves the right to review and revoke an earlier eligibility determination after receipt of subsequent information related to crash testing.
- If the subject device is a patented product it may be considered to be proprietary. If proprietary systems are specified by a highway agency for use on Federal-aid projects: (a) they must be supplied through competitive bidding with equally suitable unpatented items; (b) the highway agency must certify that they are essential for synchronization with the existing highway facilities or that no equally suitable alternative exists; or (c) they must be used for research or for a distinctive type of construction on relatively short sections of road for experimental purposes. Our regulations concerning proprietary products are contained in Title 23, Code of Federal Regulations, Section 635.411.

Sincerely,



Michael S. Griffith
Director, Office of Safety Technologies
Office of Safety

Enclosures

Request for Federal Aid Reimbursement Eligibility of Highway Safety Hardware

Submitter	Date of Request:	January 30, 2019	<input checked="" type="radio"/> New <input type="radio"/> Resubmission
	Name:	Robert Ramirez	
	Company:	Applus IDIADA KARCO Engineering	
	Address:	9270 Holly Rd. Adelanto, CA 92301	
	Country:	United States	
	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	TTMA-200	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:	Frederick Mauer	Same as Submitter <input type="checkbox"/>
Company Name:	Gregory Industries	Same as Submitter <input type="checkbox"/>
Address:	4100 13th Street SW Canton OH 44710	Same as Submitter <input type="checkbox"/>
Country:	USA	Same as Submitter <input type="checkbox"/>
Enter below all disclosures of financial interests as required by the FHWA 'Federal-Aid Reimbursement Eligibility Process for Safety Hardware Devices' document.		
Gregory Industries and Applus IDIADA KARCO Engineering LLC share no financial interests between the two organizations. This includes no shared financial interest but not limited to: i. Compensation including wages, salaries, commissions, professional fees, or fees for business referrals iii. Research funding or other forms of research support; iv. Patents, copyrights, licenses, and other intellectual property interests; vi. Business ownership and investment interests;		

PRODUCT DESCRIPTION

☒ New Hardware or
Significant Modification
 ☐ Modification to
Existing Hardware

The TTMA-200 is trailer attenuator designed to dissipate the kinetic energy of an impacting vehicle to reduce the severity of a crash. As the impact head and mandrel are pushed forward into the first tube, the tapered mandrel bursts the first tube at the corners into four (4) straps. The bursting of the first tube dissipates the kinetic energy of the impacting vehicle. The trailer attenuator has a length of 23.6ft (7.2 m) with an optional hitch extension its total tested length was 24.9 ft. (7.6 m) and a max width of 8.0 ft. (2.4 m). The TTMA-200 is supported by a wheel and axle assembly and is attached to the support truck with a lunette ring.

All testing of the TTMA-200 was conducted with an optional 4.0 ft. x 8.0 ft. (1.2 m x 2.4 m) arrow board and arrow board frame that attached to the trailer frame assembly. The arrow board frame was attached to the trailer frame assembly with two (2) 5/8" grade 5 bolts and six (6) 1/2" grade 5 bolts. The arrow board was secured to the arrow board frame with five (5) 3/8" grade 5 bolts. An optional 16.0 in. (406 mm) hitch extension bolted to the trailer frame assembly with four (4) 5/8" grade 5 bolts. The TTMA-200 lunette ring was inserted into a standard 8-ton pintle hitch mounted on the support truck at a height of 19.5 in. (495 mm). Complete detail of the assemblies can be found in the manufacturer's drawings.

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:	Robert Ramirez	
Engineer Signature:	Robert Ramirez	Digitally signed by Robert Ramirez DN: cn=Robert Ramirez, o=KARCO Engineering, ou=Project Engineer, email=rramirez@karco.com, c=US Date: 2018.11.02 11:47:20 -07'00'
Address:	9270 Holly Rd. Adelanto, CA 92301	Same as Submitter <input type="checkbox"/>
Country:	United States	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>IDIADA KARCO Test Number P38077-01. An 1100C test vehicle impacting the TTMA-200 at a nominal impact speed and angle of 62 mph and 0°, respectively. The primary intent of this test is to evaluate the impact performance of the TTMA-200 during small car impacts. The support vehicle was blocked against forward movement. The support vehicle was also placed in second gear with the parking brake engaged and the front wheels were centered with no steering angle. The test vehicle, 2012 Kia Rio impacted the TTMA-200 at a speed and angle of 61.94 mph (99.68 km/h) and 0.2°. The TTMA-200 brought the vehicle to a controlled stop. There was no penetration into the occupant compartment and the deformation limits were not exceeded. The Occupant Impact Velocities (OIV) in the longitudinal and lateral directions were 32.5 ft/s (9.9 m/s) and 0.3 ft/s (0.1 m/s), respectively. The Ridedown acceleration in the longitudinal and lateral directions were -15.2 g and 3.6 g, respectively. The TTMA-200 met all the requirements for MASH Test 3-50.</p>	PASS
3-51 (2270P)	<p>IDIADA KARCO Test Number P38076-01. An 2270P test vehicle impacting the TTMA-200 at a nominal impact speed and angle of 62 mph and 0°, respectively. The primary intent of this test is to evaluate the energy dissipation capacity of the TTMA-200, structural adequacy and occupant risk. The support vehicle was blocked against forward movement. The support vehicle was also placed in second gear with the parking brake engaged and the front wheels were centered with no steering angle. The test vehicle, 2012 RAM 1500 impacted the TTMA-200 at a speed and angle of 64.11 mph (103.18 km/h) and 0.3°. The TTMA-200 brought the vehicle to a controlled stop. There was no penetration into the occupant compartment and the deformation limits were not exceeded. The Occupant Impact Velocities (OIV) in the longitudinal and lateral directions were 29.2 ft/s (8.9 m/s) and 0.7 ft/s (0.2 m/s), respectively. The Ridedown acceleration in the longitudinal and lateral directions were -14.9 g and -3.1 g, respectively. All the occupant risk values were below the preferred values in MASH. The TTMA-200 met all the requirements for MASH Test 3-51.</p>	PASS

Required Test Number	Narrative Description	Evaluation Results
3-52 (2270P)	<p>IDIADA KARCO Test Number P38078-01. An 2270P test vehicle impacting the TTMA-200 offset 1/3 the vehicles overall width at a nominal impact speed and angle of 62 mph and 0°, respectively. The primary intent of this test is to evaluate structural adequacy and occupant risk. The support vehicle was blocked against forward and lateral movement. The support vehicle was also placed in second gear with the parking brake engaged and the front wheels were centered with no steering angle. The test vehicle, 2013 RAM 1500 impacted the TTMA-200 at a speed and angle of 62.99 mph (101.37 km/h) and 0.1°. The TTMA-200 brought the vehicle to a controlled stop. There was no penetration into the occupant compartment and the deformation limits were not exceeded. The Occupant Impact Velocities (OIV) in the longitudinal and lateral directions were 28.2 ft/s (8.6 m/s) and 2.0 ft/s (0.6 m/s), respectively. The Ridedown acceleration in the longitudinal and lateral directions were -16.4 g and 2.5 g, respectively. The TTMA-200 met all the requirements for MASH Test 3-52.</p>	PASS
3-53 (2270P)	<p>IDIADA KARCO Test Number P38075-02. An 2270P test vehicle impacting the TTMA-200 offset 1/4 the vehicles overall width at a nominal impact speed and angle of 62 mph and 10°, respectively. The primary intent of this test is to evaluate structural adequacy and occupant risk. The support truck weighed 10,337 lbs and was tested with the parking brake engaged, transmission placed in second gear and the front wheels centered with no steering angle. The test vehicle, 2012 RAM 1500 impacted the TTMA-200 at a speed and angle of 63.49 mph (102.18 km/h) and 10.1°. The TTMA-200 brought the vehicle to a controlled stop. There was no penetration into the occupant compartment and the deformation limits were not exceeded. The Occupant Impact Velocities (OIV) in the longitudinal and lateral directions were 26.6 ft/s (8.1 m/s) and 1.3 ft/s (0.4 m/s), respectively. The Ridedown acceleration in the longitudinal and lateral directions were -9.8 g and -4.0 g, respectively. The support vehicle had a maximum roll ahead measurement 34.8 ft. (10.6 m). The TTMA-200 met all the requirements for MASH Test 3-53.</p>	PASS
3-54 (1500A)	Per MASH this test is optional	Non-Relevant Test, not conducted

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:	Applus IDIADA KARCO Engineering		
Laboratory Signature:			Digitally signed by Alex Beltran DN: cn=Alex Beltran, o=KARCO Engineering, ou=Testing Laboratory, email=abeltran@karco.com, c=US Date: 2018.11.02 11:57:28 -07'00'
Address:	9270 Holly Rd. Adelanto, CA. 92301	Same as Submitter <input type="checkbox"/>	
Country:	United States	Same as Submitter <input type="checkbox"/>	
Accreditation Certificate Number and Dates of current Accreditation period :	TL-371 Valid through July 1, 2019.		

Submitter Signature*: Robert Ramirez

Digitally signed by Robert Ramirez
DN: cn=Robert Ramirez, o=KARCO Engineering, ou=Project Engineer,
email=rramirez@karco.com, c=US
Date: 2018.11.02 12:04:17 -07'00'

Submit Form

ATTACHMENTS

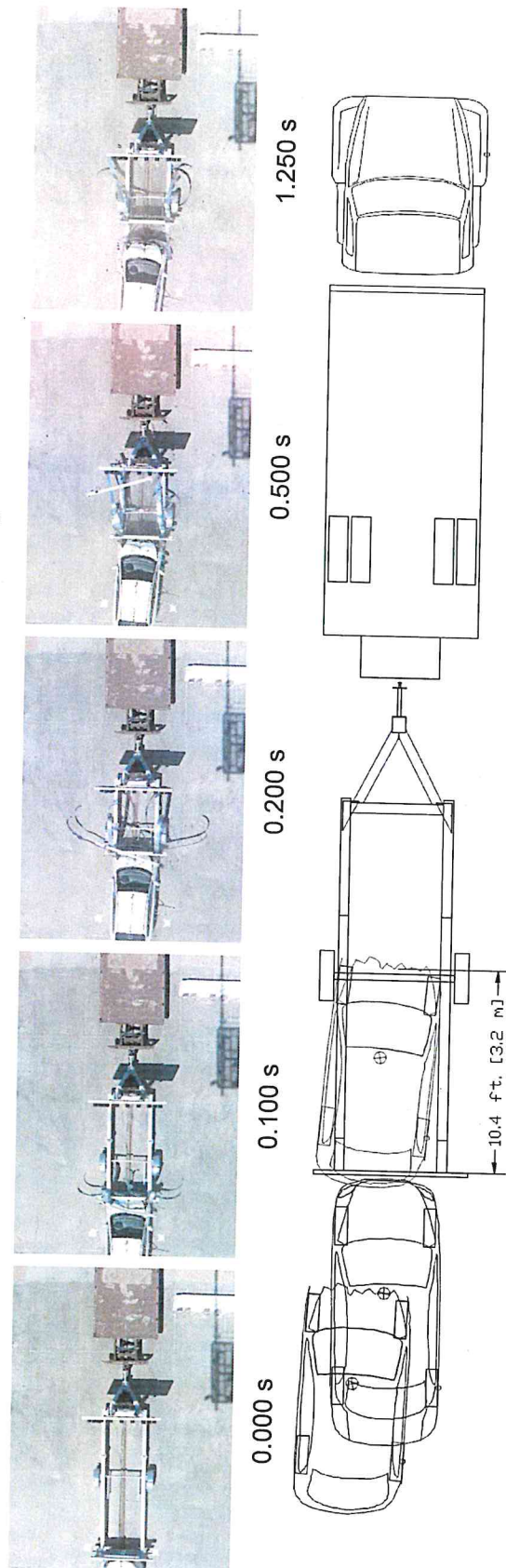
Attach to this form:

- 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		
Number	Date	Key Words

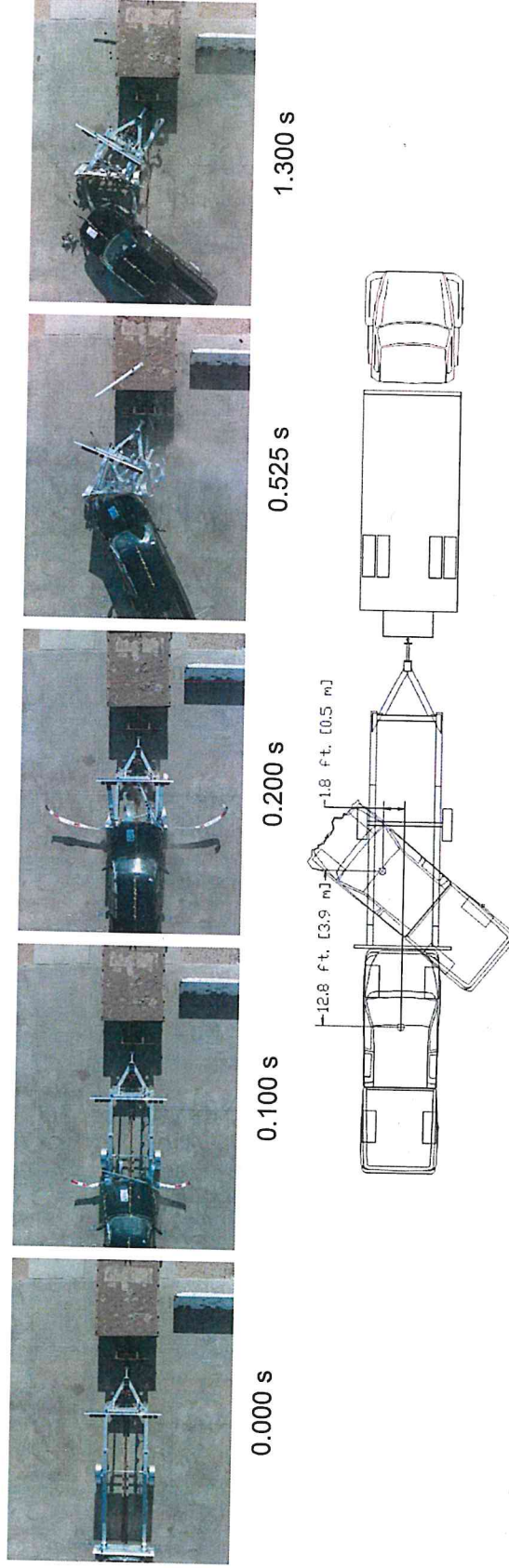
MASH 2016 Test 3-50 Summary



GENERAL INFORMATION	
Test Agency.....	KARCO Engineering, LLC.
KARCO Test No.....	P38077-01
Test Designation.....	3-50
Test Date.....	07/25/18
TEST ARTICLE	
Name / Model.....	TTMA200
Type.....	Trailer Mounted Attenuator
Support Vehicle Length.....	25.0 ft. (7.6 m)
TMA Length.....	24.9 ft. (7.6 m)
Road Surface.....	Concrete
Support Vehicle Restraint.....	Blocked Against Roll Ahead
TEST VEHICLE	
Type / Designation.....	1100C
Year, Make, and Model.....	2012 Kia Rio
Curb Mass.....	2,355.6 lbs (1,068.5 kg)
Test Inertial Mass.....	2,457.0 lbs (1,114.5 kg)
Gross Static Mass.....	2,623.5 lbs (1,190.0 kg)
Impact Conditions	
Impact Velocity.....	61.94 mph (99.68 km/h)
Impact Angle.....	0.2°
Location / Orientation.....	0.8 in. Right of CL
Kinetic Energy.....	315.1 kip-ft (427.3 kJ)
Exit Conditions	
Exit Velocity.....	N/A
Exit Angle.....	N/A
Final Vehicle Position.....	4.7 ft. (1.4 m) Upstream
Exit Box Criteria Met.....	1.6 ft. (0.5 m) left
Vehicle Snagging.....	N/A
Vehicle Pocketing.....	None
Vehicle Stability.....	Satisfactory
Maximum Roll Angle.....	4.3°
Maximum Pitch Angle.....	5.0°
Maximum Yaw Angle.....	-4.7°
Occupant Risk	
Longitudinal OIV.....	32.5 ft/s (9.9 m/s)
Lateral OIV.....	0.3 ft/s (0.1 m/s)
Longitudinal RA.....	-15.2 g
Lateral RA.....	3.6 g
THIV.....	32.5 ft/s (9.9 m/s)
PHD.....	15.2 g
ASI.....	1.40
Test Article Deflections	
Static.....	4.1 ft. (1.2 m)
Dynamic.....	6.4 ft. (2.0 m)
Working Width.....	14.0 ft. (4.3 m)
Debris Field.....	1.0 ft. (0.3 m) Upstream
Vehicle Damage	1.4 ft. (0.4 m) Left
Vehicle Damage	
Vehicle Damage Scale.....	12-FD-4
CDC.....	12FDEW2
Maximum Intrusion.....	0.4 in. (10 mm)

Figure 4 Summary of Test 3-50

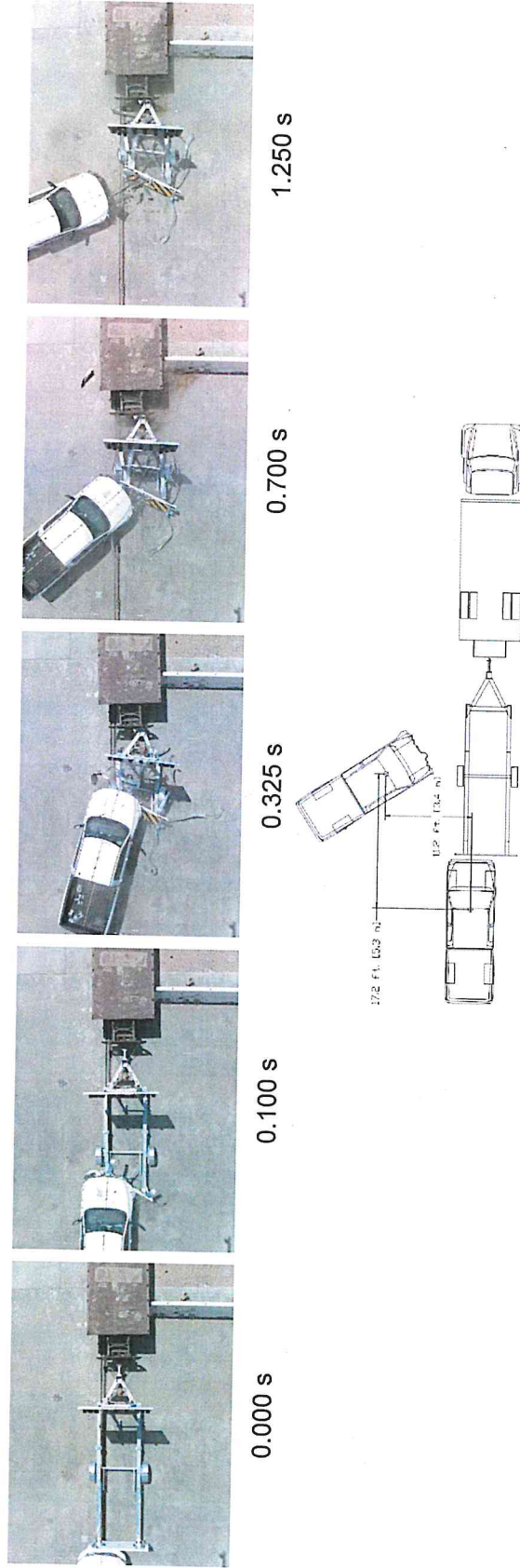
MASH 2016 Test 3-51 Summary



GENERAL INFORMATION		Impact Conditions	
Test Agency.....	KARCO Engineering, LLC.	Impact Velocity.....	64.11 mph (103.18 km/h)
KARCO Test No.....	P38076-01	Impact Angle.....	0.3°
Test Designation.....	3-51	Location / Orientation.....	1.0 in. (25 mm) Right of TMA CL
Test Date.....	07/25/18	Kinetic Energy.....	685.5 kip-ft (929.4 kJ)
TEST ARTICLE		Exit Conditions	
Name / Model.....	TTMA-200	Exit Velocity.....	N/A
Type.....	Trailer Mounted Attenuator	Exit Angle.....	N/A
Support Vehicle Length.....	25.0 ft. (7.6 m)	Final Vehicle Position.....	12.8 ft. (3.9 m) Downstream
TMA Length.....	24.9 ft. (7.6 m)		1.8 ft. (0.5 m) Left
Road Surface.....	Concrete	Exit Box Criteria Met.....	N/A
Support Vehicle Restraint....	Blocked Against Roll Ahead	Vehicle Snagging.....	None
TEST VEHICLE		Vehicle Pocketing.....	None
Type / Designation.....	2270P	Vehicle Stability.....	Satisfactory
Year, Make, and Model....	2012 RAM 1500	Maximum Roll Angle.....	-2.5°
Curb Mass.....	4,987.9 lbs (2,262.5 kg)	Maximum Pitch Angle.....	10.7°
Test Inertial Mass.....	4,989.0 lbs (2,263.0 kg)	Maximum Yaw Angle.....	48.8°
Gross Static Mass.....	4,989.0 lbs (2,263.0 kg)		
Occupant Risk		Test Article Deflections	
Longitudinal OIV.....	29.2 ft/s (8.9 m/s)	Static.....	5.1 ft. (1.6 m)
Lateral OIV.....	0.7 ft/s (0.2 m/s)	Dynamic.....	10.8 ft. (3.3 m)
Longitudinal RA.....	-14.9 g	Working Width.....	17.8 ft. (5.4 m)
Lateral RA.....	-3.1 g	Debris Field.....	67.2 ft. (20.5 m) Downstream
THIV.....	29.2 ft/s (8.9 m/s)		4.0 ft. (1.2 m) Left
PHD.....	14.9 g	Vehicle Damage	
ASI.....	0.97	Vehicle Damage Scale....	12-FD-4
		CDC.....	12FDEW2
		Maximum Intrusion.....	Negligible

Figure 4 Summary of Test 3-51

MASH 2016 Test 3-52 Summary



GENERAL INFORMATION Test Agency..... KARCO Engineering, LLC. KARCO Test No..... P38078-01 Test Designation..... 3-52 Test Date..... 07/26/18		TEST ARTICLE Name / Model..... TTMA-200 Type..... Trailer Mounted Attenuator Support Vehicle Length..... 25.0 ft. (7.6 m) TMA Length..... 24.9 ft. (7.6 m) Road Surface..... Concrete Support Vehicle Restraint..... Rigidly Blocked		Impact Conditions Impact Velocity..... 62.99 mph (101.37 km/h) Impact Angle..... 0.1° Location / Orientation..... 26.7 in. (678 mm) Left of TMA CL Kinetic Energy..... 623.0 kip-ft (844.7 kJ)	
TEST VEHICLE Type / Designation..... 2270P Year, Make, and Model..... 2013 RAM 1500 Curb Mass..... 4,990.1 lbs (2,263.5 kg) Test Inertial Mass..... 5,009.9 lbs (2,272.5 kg) Gross Static Mass..... 5,009.9 lbs (2,272.5 kg)		Exit Conditions Exit Velocity..... N/A Exit Angle..... N/A Final Vehicle Position..... 17.2 ft. (5.2 m) Downstream Exit Box Criteria Met..... N/A Vehicle Snagging..... None Vehicle Pocketing..... None Vehicle Stability..... Satisfactory Maximum Roll Angle..... 5.4° Maximum Pitch Angle..... 7.6° Maximum Yaw Angle..... -68.2°		Occupant Risk Longitudinal ON..... 28.2 ft/s (8.6 m/s) Lateral ON..... 2.0 ft/s (0.6 m/s) Longitudinal RA..... -16.4 g Lateral RA..... 2.5 g THV..... 28.2 ft/s (8.6 m/s) PHD..... 16.5 g ASI..... 0.96	
		Test Article Deflections Static..... 4.1 ft. (1.2 m) Dynamic..... 11.1 ft. (3.4 m) Working Width..... 16.4 ft. (5.0 m) Debris Field..... No Article Debris		Vehicle Damage Vehicle Damage Scale..... 12-FD-4 CDC..... 12FDEW3 Maximum Intrusion..... 0.2 in. (5 mm)	

Figure 4 Summary of Test 3-52

MASH 2016 Test 3-53 Summary

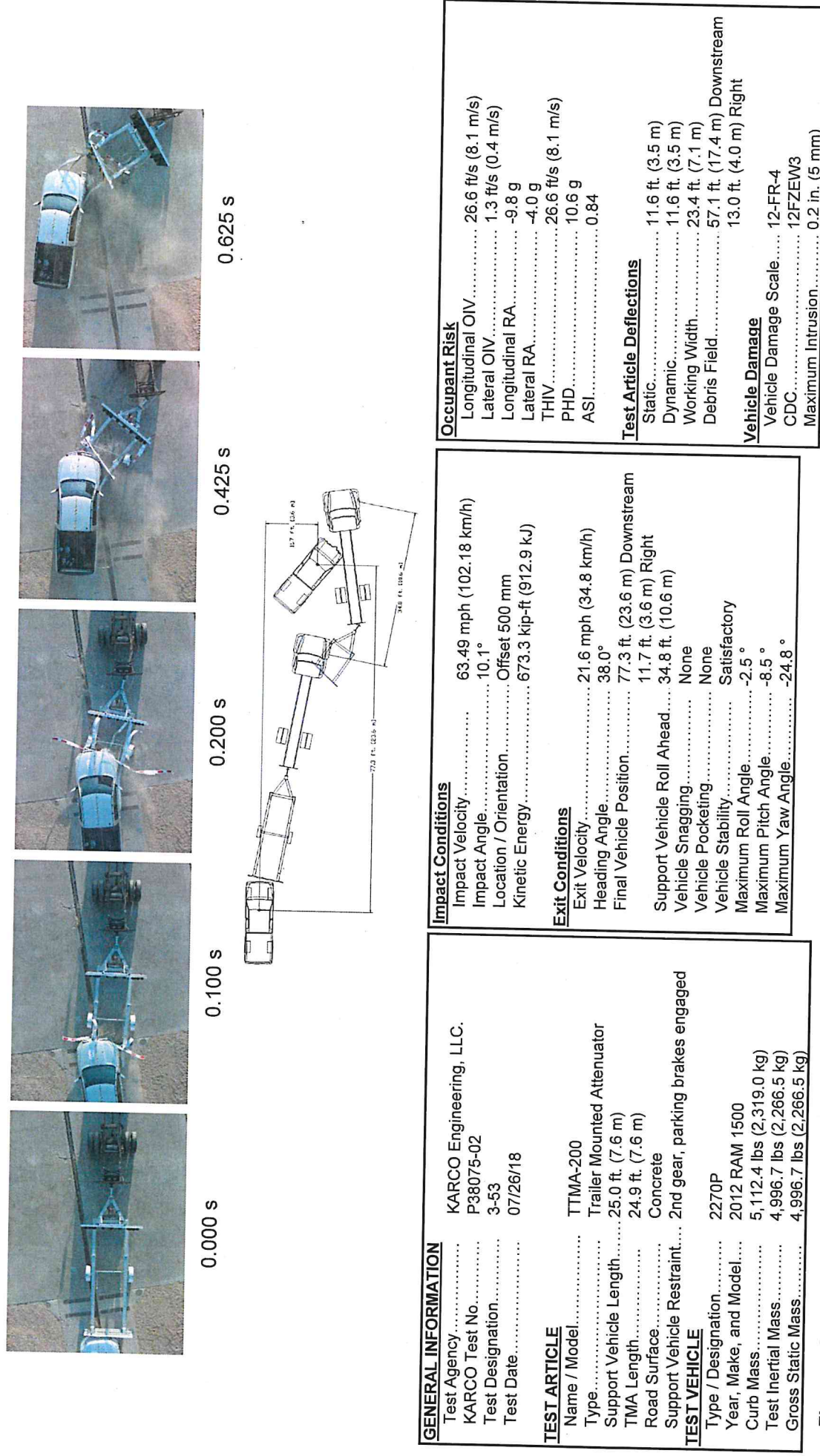
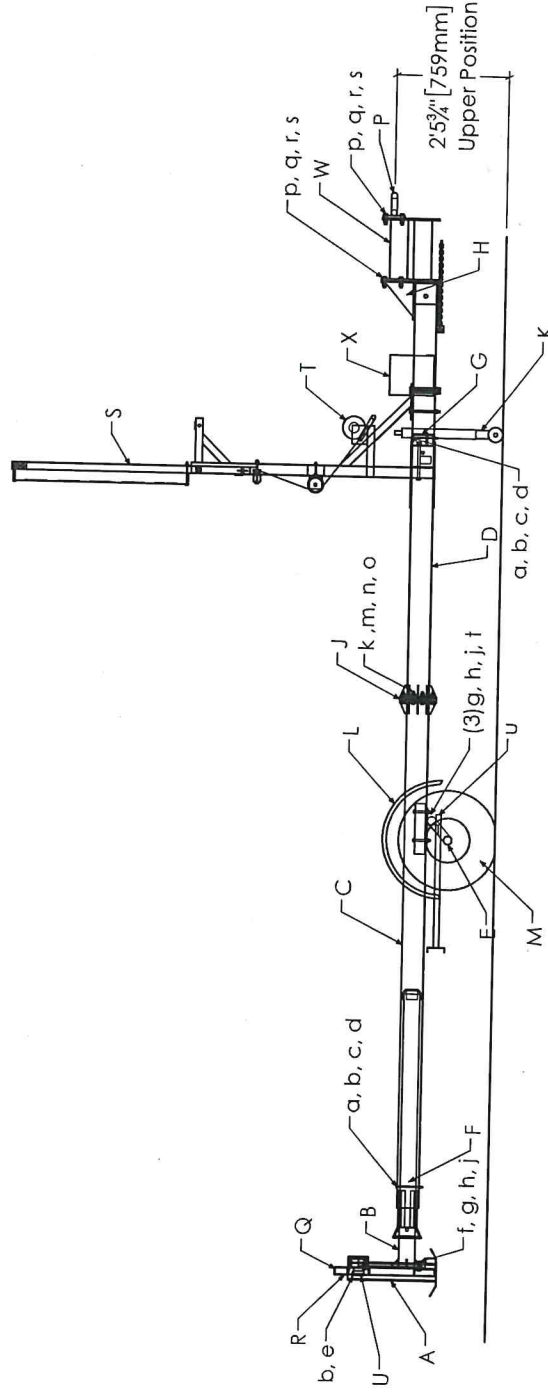
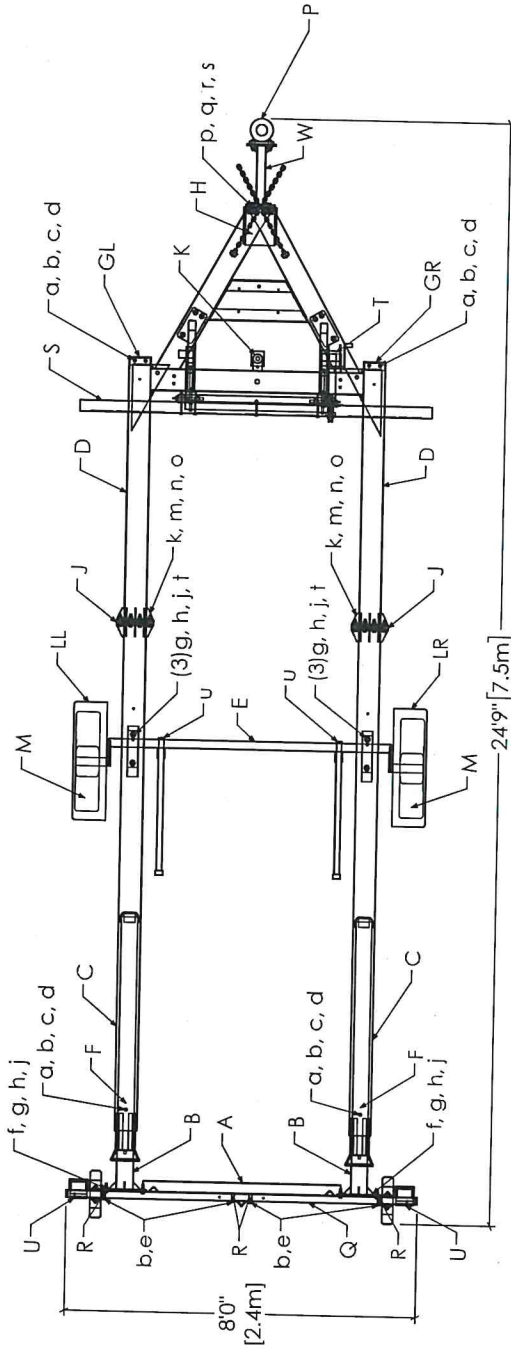


Figure 4 Summary of Test 3-53

ITEM	QTY	DESCRIPTION	ITEM	QTY	DESCRIPTION
a	6	5/16" x 7" Grd 5 Hex Bolt	h	12	1/2" Heavy Lock Washer
b	10	5/16" Washer	j	12	1/2" Grd 5 Hex Nut
c	6	5/16" Heavy Lock Washer	k	16	9/16" x 3" Grd 5 Hex Bolt
d	6	5/16" Grd 5 Hex Nut	m	16	9/16" SAE Washer
e	4	5/16" Tech Screws	n	16	9/16" Heavy Lock Washer
f	8	1/2" x 2.25" Grd 5 Hex Bolt	o	16	9/16" Grd 5 hex Nut
g	20	1/2" Washer	p	8	5/8" x 2 1/2" Grd 5 Hex Bolt*



ITEM	QTY	DESCRIPTION
A	1	Impact Head
B	2	Bursling Mandrel
C	2	First Tube
D	1	Trailer Frame
E	1	Axle Assembly
F	4	Plastic Guide Plates
G	2	End caps (R-right, L-left)
H	1	Hitch Assembly
J	8	Spacer
K	1	Commercial Jack
L	2	Fender Assembly (R-right, L-left)
M	2	Tire and Rim
P	1	Lunette (8 tons)
Q	1	Light Bar
R	4	Light Bar Mounting Bracket
S	1	Arrowboard and Stand (Optional)
T	1	Winch (Optional)
U	2	Whelen Lights (Optional)
V	1	Steel Ballast Plate (Optional)
W	1	Hitch Extension (Optional)
X	1	Battery Box (Optional)

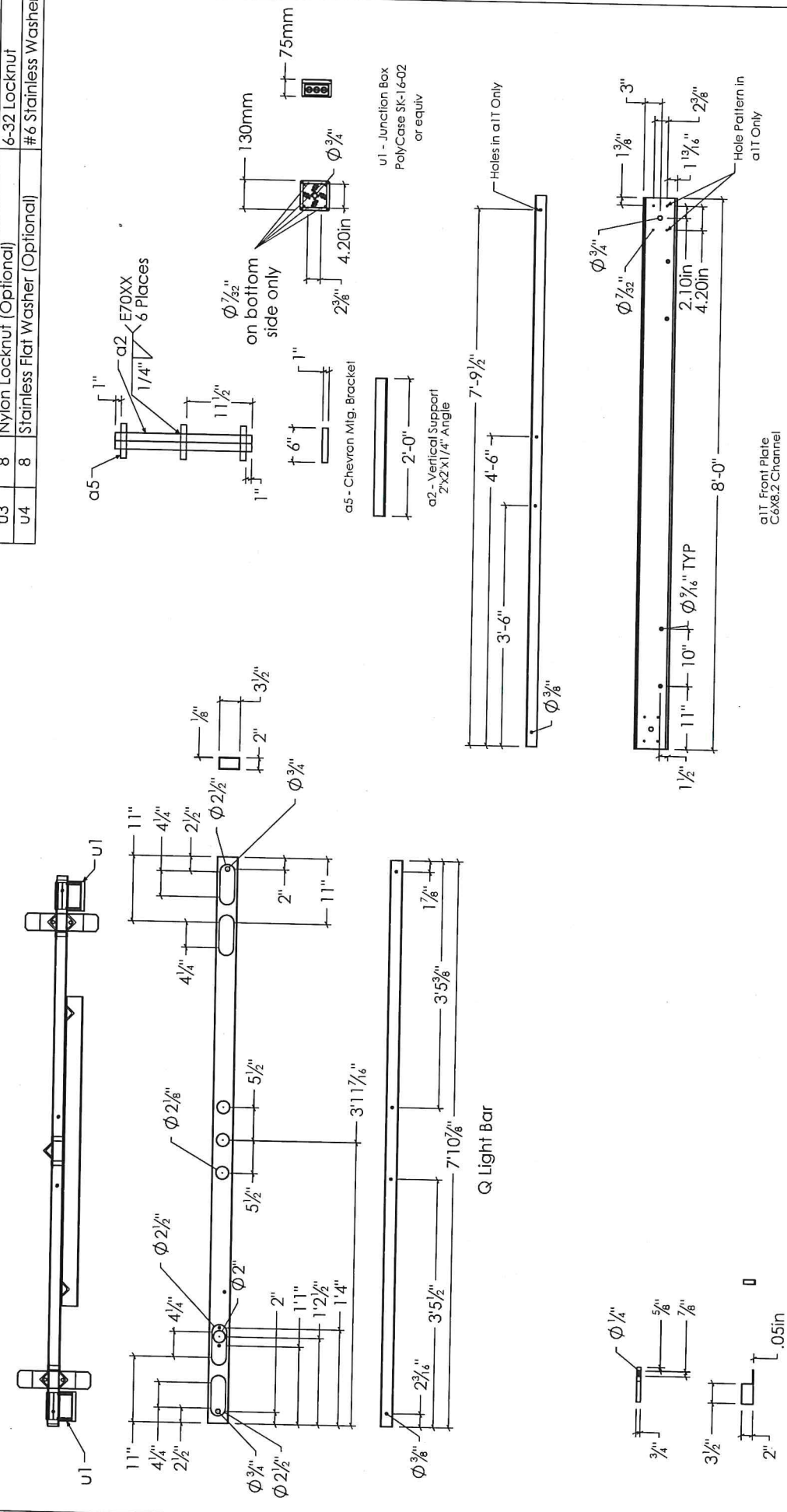
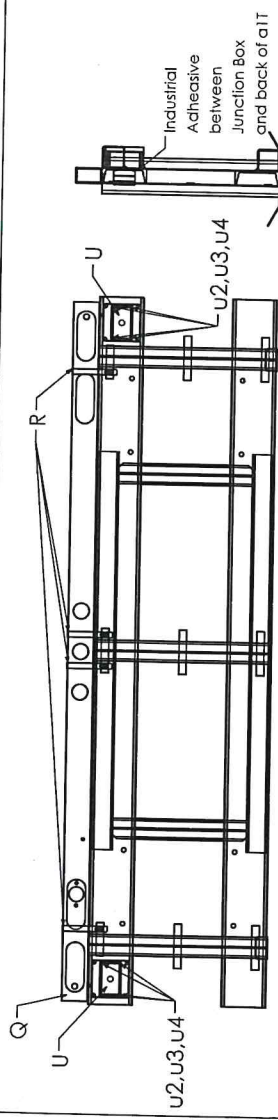
REV	DESCRIPTION	DATE
A	ADDED TOLERANCE AND FINISH DETAILS	06/21/2018
B	ADDED LIGHT BAR MOUNTING BRACKET, 5/16" TECH SCREW, AND 1/2" WASHERS	09/27/2018
C	ADDED TIGHTENING AND APPROVED, HIGH EXTENSION, LIGHT BAR, WHELEN LIGHTS, BATTERY BOX, WINCH	09/27/2018

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
SURFACE: HOT DIP GALVANIZED
TOLERANCE:
LINEAR: ±1/16"
BOLT HOLE: +1/16", -0"
ANGULAR: ±1°

Gregory
Gregory Industries, Inc.
4100 13th Street SW
Canton, Ohio 44710
Phone: 330-447-4800x123

TTMA-200
Assembly
Drawing Name: TTMA-200
Scale: 1:50
Sheet: 100
Date: 1/29/2019
By: JMS

ITEM	QTY	DESCRIPTION	MATERIAL
A	1	Impact Head	
a1T	1	Front Plate - Top Lighting Package	C6X8.2 Channel
a2	5	Vertical Supports	2"x2"x1/4" Angle
a5	9	Chevron Mounting Bracket	12 Gage
Q	1	Light bar	
R	4	Light Bar Mounting Bracket	
U	2	Whelen Light or equiv (Optional)	
u1	2	Junction Box (Optional)	
u2	8	Stainless Machine Screw (Optional)	6-32 x 3" Stainless
u3	8	Nylon Locknut (Optional)	6-32 Locknut
u4	8	Stainless Flat Washer (Optional)	#6 Stainless Washer



Gregory
Gregory Industries, Inc.
4100 13th Street, SW
Canton, Ohio 44710
Phone: 330-447-4800x123

TTMA-200
Impact Head Lighting Package

Sheet: **109**

Date: 1/29/2019

Rev: JMS

Scale: 1:25

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
SURFACE: HOT DIP GALVANIZED
TOLERANCE:
LINEAR: ±1/16"
BOLT HOLE: +1/16", -0"
ANGULAR: ±1°

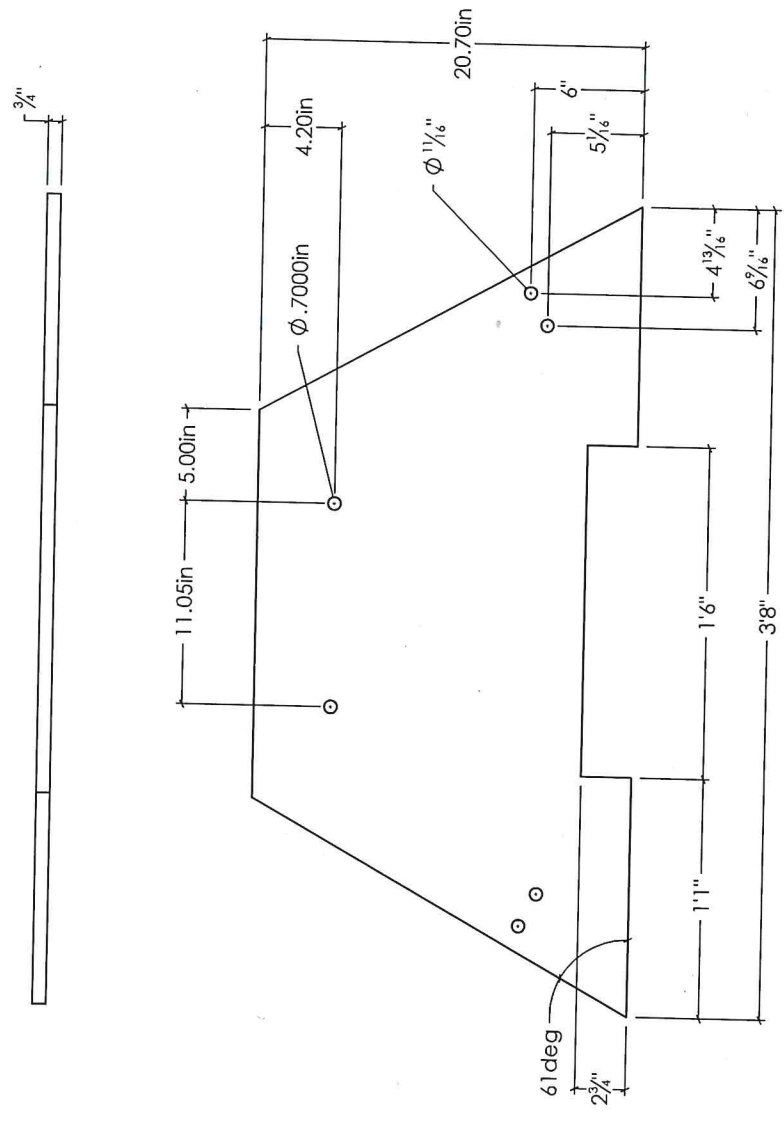
REV DESCRIPTION DATE

A ADDED TOLERANCE AND FINISH DETAILS 06/21/2018

B ADDED LIGHTBAR AND LIGHTBAR BRACKET 01/29/2019

R Light Bar Mounting Bracket

ITEM	QTY	DESCRIPTION	MATERIAL
R	2	Ballast Plate	3/4" A36
r1	6	5/8" x 9" Grd 5 Hex Bolt	
r2	12	5/8" Flat Washer	
r3	6	5/8" Lock Washer	
r4	6	5/8" Grd 5 Hex Nut	



UNLESS OTHERWISE SPECIFIED:
 DIMENSIONS ARE IN INCHES
 SURFACE: HOT DIP GALVANIZED
 TOLERANCE:
 LINEAR: $\pm 1/16$ "
 BOLT HOLE: $\pm 1/16$ ", -0"
 ANGULAR: $\pm 1^\circ$

Gregory Industries, Inc.
 4100 13th Street, SW
 Canton, Ohio 44710
 Phone: 330-447-4800x123

TTMA-200

Steel Ballast Plate (Optional)

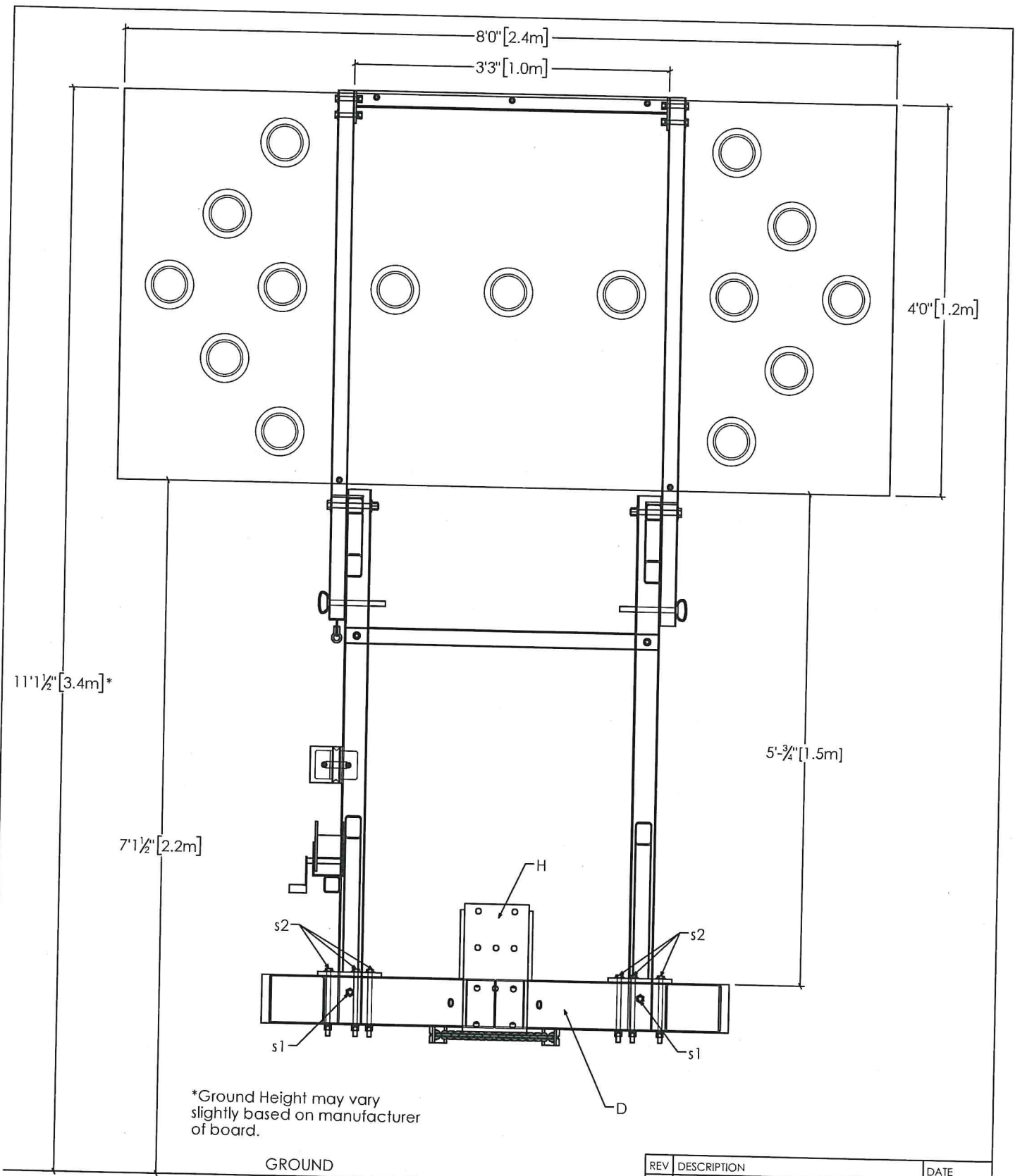
Sheet: **110**

Date: 1/29/2019

Rev: JMS

Scale: 1:10

REV	DESCRIPTION	DATE
A	ADDED TOLERANCE AND FINISH DETAILS	06/21/2018



REV	DESCRIPTION	DATE
A	ADDED TOLERANCES AND FINISH	06/22/2018

ITEM	QTY	DESCRIPTION
s1	4	5/8" x 10 1/2" Grade 5 w/ Washer, Nut and Lock Washer
s2	6	1/2" X 8" Grade 5 w/Washer, Nut and Lock Washer

UNLESS OTHERWISE SPECIFIED:
 DIMENSIONS ARE IN INCHES
 SURFACE: HOT DIP GALVANIZED
 TOLERANCE:
 LINEAR: $\pm 1/16"$
 BOLT HOLE: $+1/16", -0"$
 ANGULAR: $\pm 1^\circ$



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TTMA-200
Arrow Board Attachment

Drawing Name:
 TTMA-200

Scale:
 1:16

Sheet:
111
 Date:
 2/5/2019
 By:
 JMS
 Rev.