



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

400 Seventh St., S.W.  
Washington, D.C. 20590

June 15, 2005

In Reply Refer To: HSA-10/CC-78C

Mr. Barry D. Stephens, P.E.  
Sr. Vice President Engineering  
Energy Absorption Systems, Inc.  
3617 Cincinnati Avenue  
Rocklin, California 95678

Dear Mr. Stephens:

Mr. Douglas Bernard recently delivered your June 7, 2005 letter to Mr. Richard Powers of my staff. In this letter, you requested the Federal Highway Administration (FHWA) acceptance of a modified version of your existing Safe Stop 180 TMA, specifically a new trailer version with wheels and a towing hitch. You refer to this unit as the Safe Stop Trailer TMA. To support your request you submitted drawings, an April 2005 test report prepared by E-TECH Testing Services, Inc. entitled "NCHRP Report 350 Crash Test Results for the Safe-Stop Trailer TMA" and crash test videotapes.

You stated that the Safe Stop Trailer TMA uses the same collapsible arms, impact frame, support frame and energy absorbing cartridges as the original Safe Stop 180 TMA previously submitted to our office for acceptance (reference FHWA letter HSA-10/CC78 & CC78A). The total length of this TMA is 5.77 m (18'-11") including the trailer hitch, and its maximum width at the impact face is 2.36 m (7'-9"). It weighs 1186 kg (2615 lbs). Two modifications were made to the Safe Stop 180 to create the new Safe-Stop Trailer TMA: (1) the upward folding mid-frame elements and hydraulic system were replaced with a rigid frame that incorporates a suspended axle and wheels, and (2) a trailer hitch was added to the front of the unit along with a damper system that allows the system to articulate like a normal trailer behind the support vehicle but locks to prevent the trailer from rotating during off-set or angled impacts. These before-and-after modifications are summarized in Enclosure 1, where it is also noted that the two truck cylinder mounts and an optional truck pintle hook assembly are included with the TMA. The cylinder mounts must be aligned with the frame rails of the support vehicle and its bumper must be able to resist the anticipated test level 3 (TL-3) design impact loads to ensure optimal attenuator crash performance.



We agree these modifications and attachment details are unlikely to affect the test results previously submitted for the Safe Stop 180 TMA for the two required TMA tests, i.e., tests 3-50 and 51. At our request, you conducted optional test 3-52 to validate acceptable performance in the off-center impact that we believed to be the most demanding of the two optional tests currently recommended in the NCHRP Report 350. You subsequently decided to run optional test 3-53 as well to demonstrate that the trailer hitch dampening system would prevent the TMA from rotating even in an offset, angled impact into the rear of the unit. In both of these tests, the Safe Stop Trailer TMA did resist rotation and collapsed in a manner similar to that seen in your earlier end-on tests into the Safe Stop 180. The summary results of both supplementary tests with the Safe Stop Trailer TMA are shown in Enclosure 2.

Based upon our review of the information you sent us, the FHWA acknowledges that the Safe Stop Trailer TMA can be assumed to meet all evaluation criteria in the NCHRP Report 350 for tests 3-50 and 3-51, and specifically met these criteria in optional tests 3-52 and 3-53. It may be used as a TL-3 TMA on the National Highway System (NHS) when such use is acceptable to the contracting authority.

Please note also that the following provisions apply to the FHWA letters of acceptance:

- This acceptance is limited to the crashworthiness characteristics of the device and does not cover its structural features, durability, or its conformity with the Manual on Uniform Traffic Control Devices pertaining to reflectorization of its impact face.
- Any design changes that may adversely influence the crashworthiness of the device may require additional tests and a new acceptance letter.
- Should the FHWA discover that the qualification testing was flawed, that in-service performance evaluations reveal unacceptable safety problems, or that the device being marketed is significantly different from the version that was submitted for review and acceptance, we reserve the right to modify or revoke this acceptance.
- You will be expected to supply potential users with sufficient information on installation and operational requirements to ensure proper performance. Specifically, the trailer hitch connections to the support vehicle must be designed to withstand the anticipated day-to-day and impact loads expected during use.
- You will be expected to certify to potential users that the hardware furnished has essentially the same chemistry, mechanical properties, and geometry as that submitted for acceptance.
- To prevent misunderstanding by others, this letter of acceptance, designated as number CC-78C shall not be reproduced except in full. This letter, and test documentation upon which this letter is based, is public information. All such letters and documentation may be reviewed at our office upon request.
- The Safe-Stop Trailer TMA is a patented product and considered proprietary. If proprietary devices are specified by a highway agency for use on a Federal-aid projects, except exempt, non-NHS projects, they; (a) 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 yours,

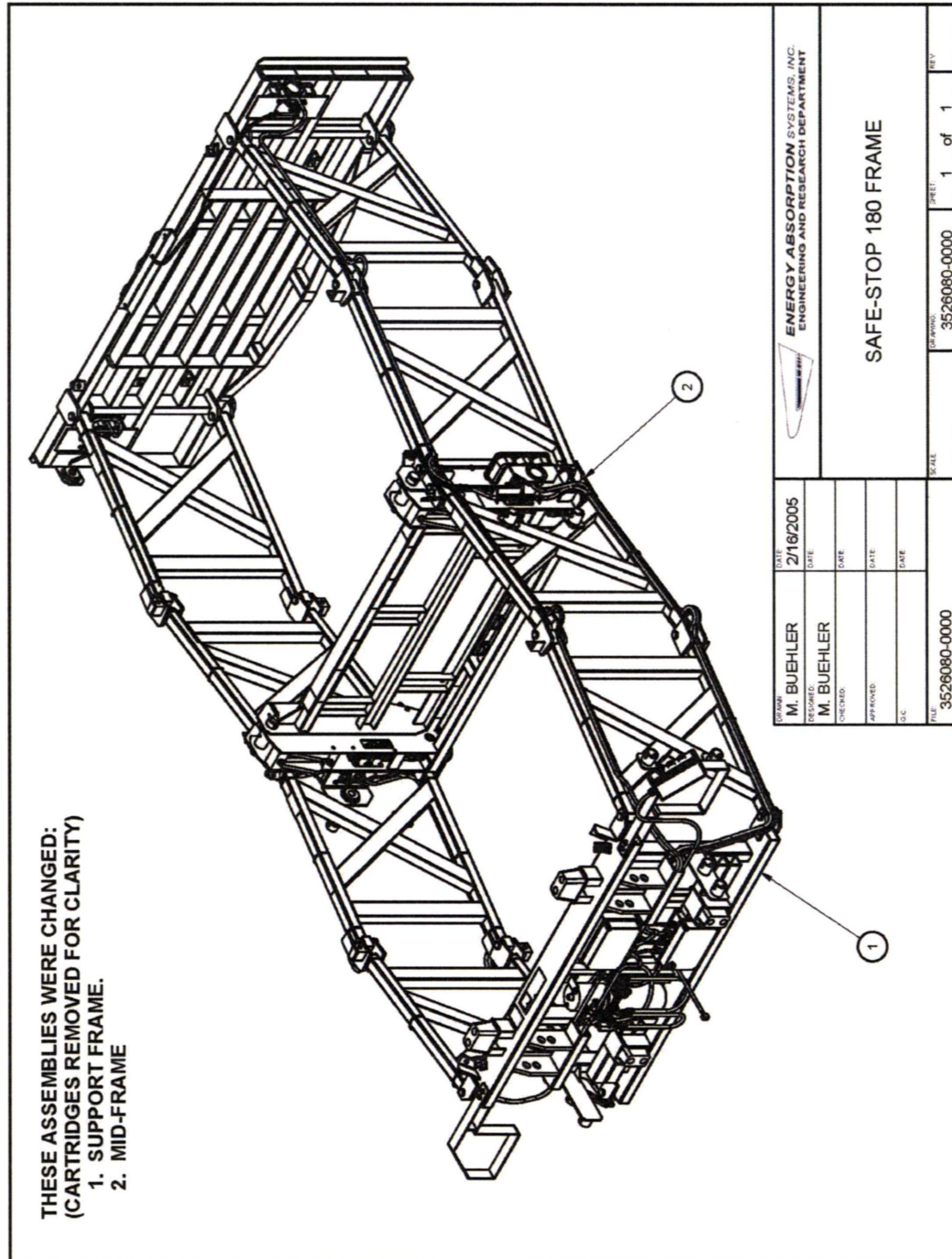
*/original signed by/*

John R. Baxter, P.E.  
Director, Office of Safety Design  
Office of Safety

2 Enclosures

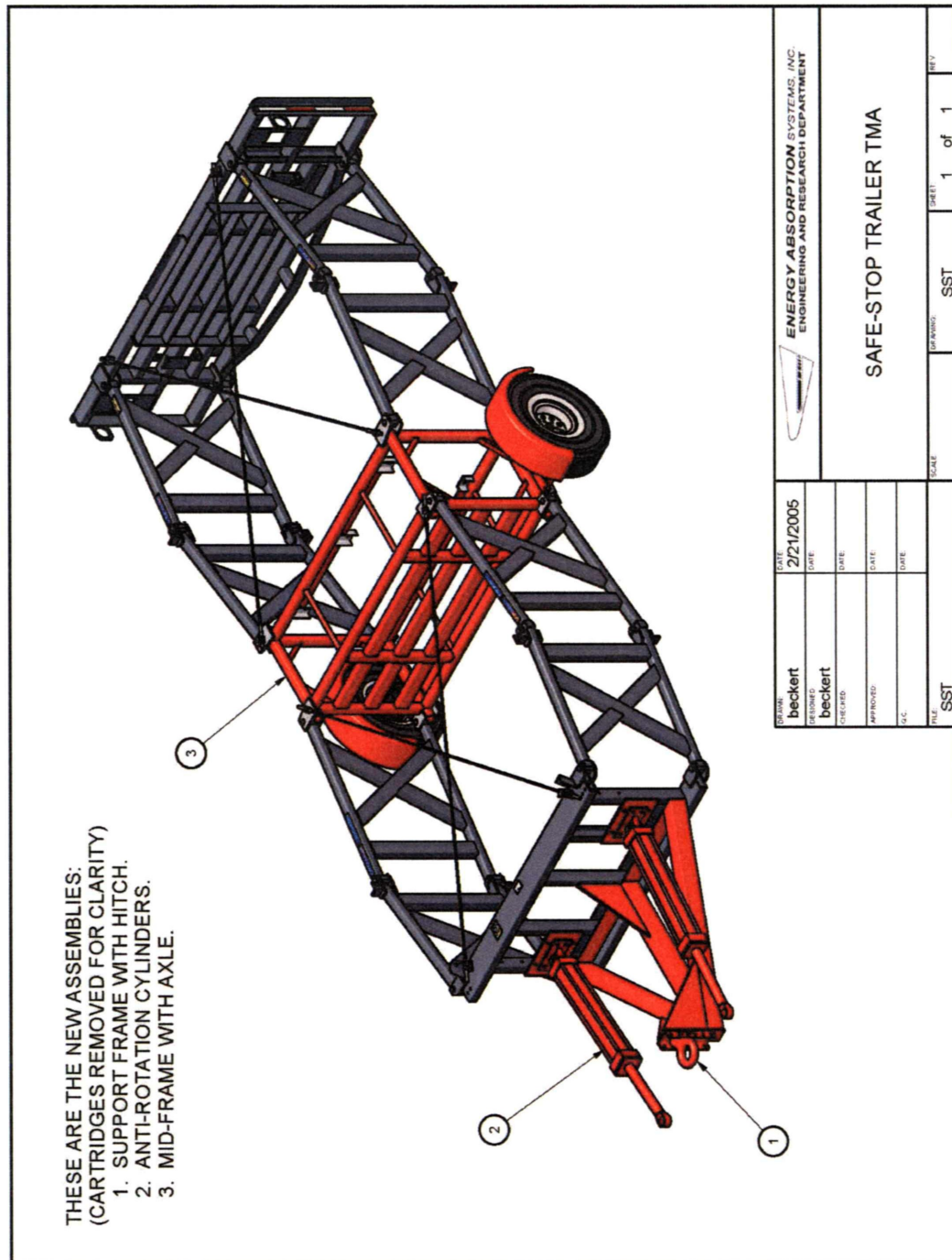
# Safe-Stop Trailer TMA Engineering Summary

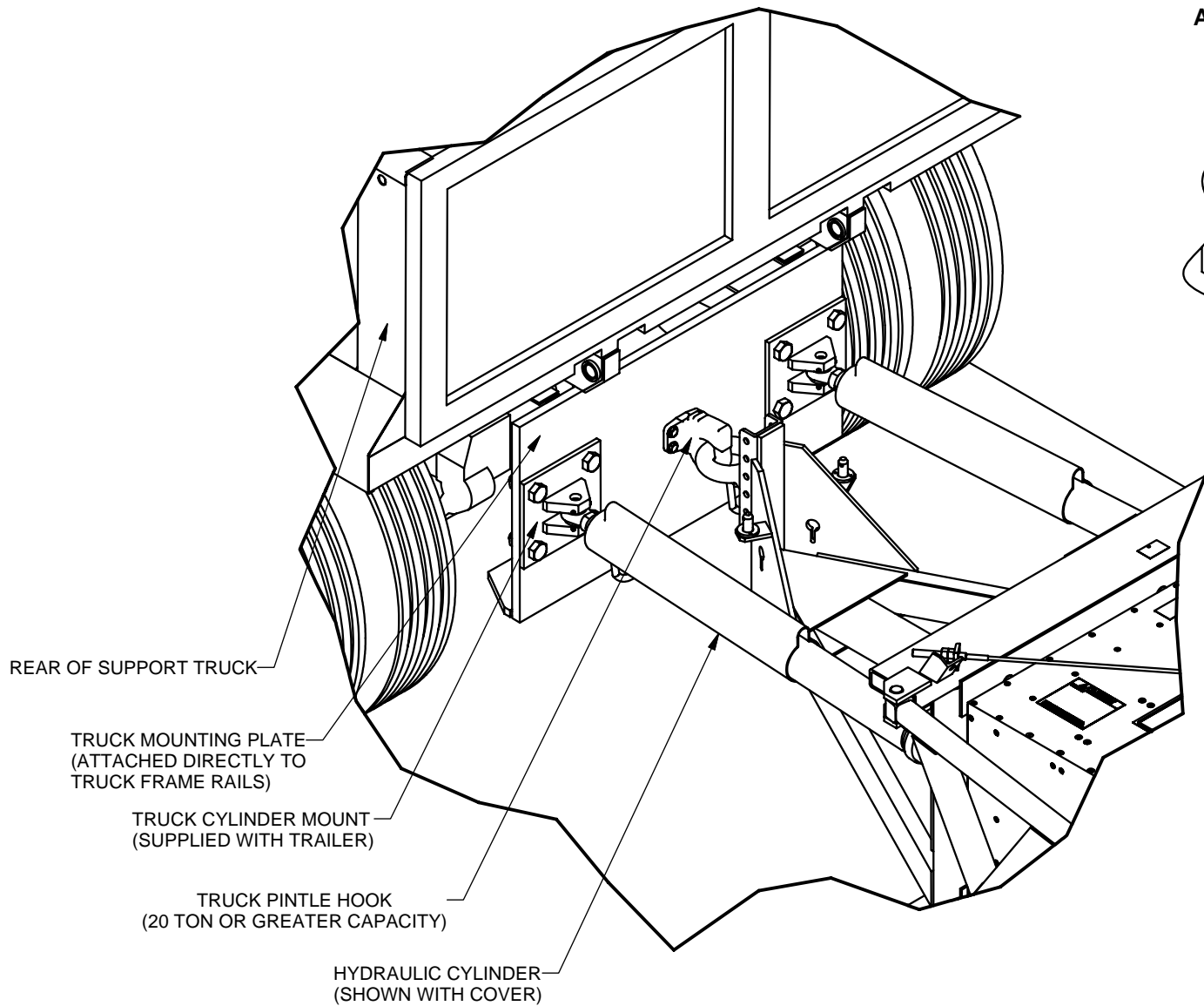
**Figure 1: Safe-Stop™180 Framework:**



# Safe-Stop Trailer TMA Engineering Summary

**Figure 2: Safe-Stop Trailer TMA Framework.**





REAR OF SUPPORT TRUCK

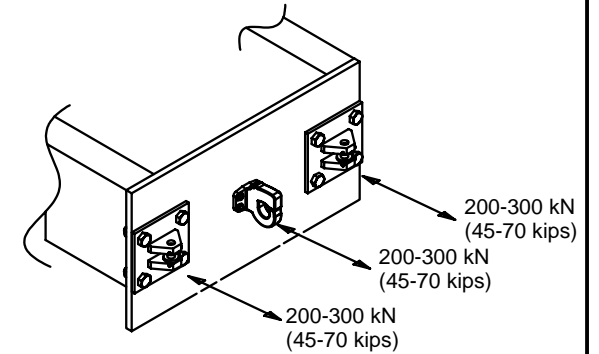
TRUCK MOUNTING PLATE  
(ATTACHED DIRECTLY TO  
TRUCK FRAME RAILS)

TRUCK CYLINDER MOUNT  
(SUPPLIED WITH TRAILER)

TRUCK PINTLE HOOK  
(20 TON OR GREATER CAPACITY)

HYDRAULIC CYLINDER  
(SHOWN WITH COVER)

**ANTICIPATED LOADS ON REAR BUMPER  
(FREE BODY DIAGRAM)**



**0 DEG, 0 OFFSET IMPACT**

NOTE:

THE REAR TOWING PLATE SHALL BE ATTACHED DIRECTLY TO THE TRUCK FRAME RAILS AND SHALL BE CAPABLE OF SUPPORTING THE ANTICIPATED LOADS FROM THE SAFE-STOP TRAILER TMA. ENERGY ABSORPTION SYSTEMS INC. WILL OFFER EVALUATIONS AND ENGINEERING SUPPORT TO RESOLVE BUMPER STRENGTH ISSUES.

DRAWN: <b>B Eckert</b>	DATE: <b>6/14/2005</b>
DESIGNED: <b>B Eckert</b>	DATE:
CHECKED:	DATE:
APPROVED:	DATE:
Q.C.	DATE:
FILE: <b>TMA9000</b>	



**ENERGY ABSORPTION SYSTEMS, INC.**  
ENGINEERING AND RESEARCH DEPARTMENT

**SAFE-STOP TRAILER TMA**

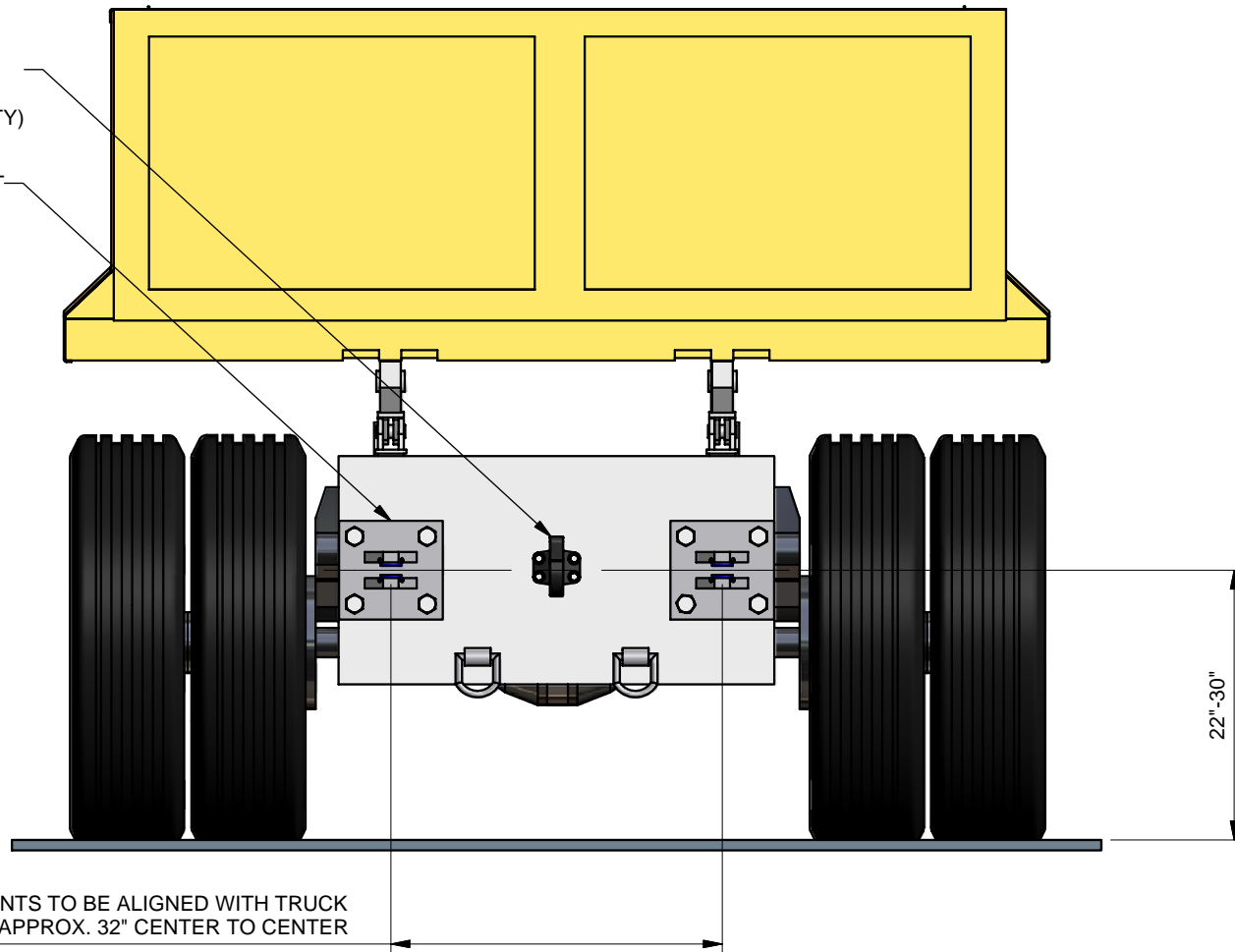
SCALE:	DRAWING: <b>TMA9000</b>	SHEET: <b>4 of 5</b>	REV:
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PINTLE HOOK  
(20 TON OR  
GREATER CAPACITY)

CYLINDER MOUNT

NOTE: PINTLE HOOK AND CYLINDER  
MOUNT TO BE ALIGNED ON SAME  
CENTER LINE



CYLINDER MOUNTS TO BE ALIGNED WITH TRUCK  
FRAME RAILS - APPROX. 32" CENTER TO CENTER

**REAR OF SUPPORT TRUCK**

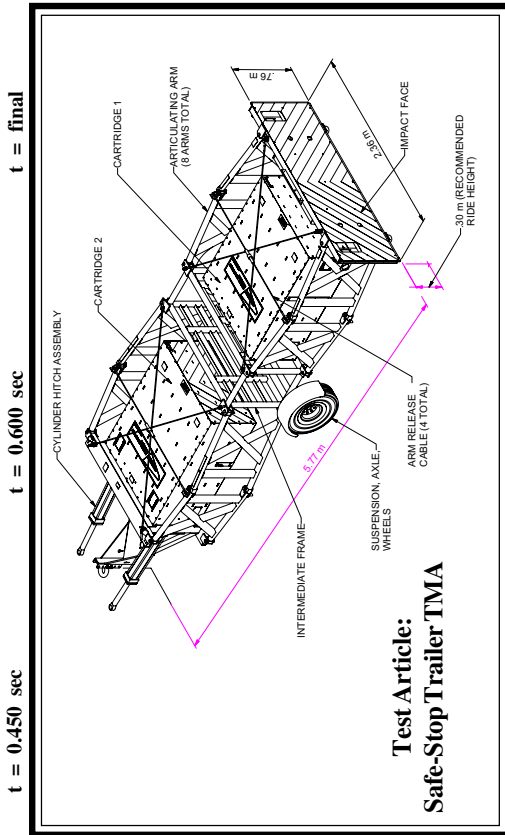
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DESIGNED: <b>B Eckert</b>	DATE:
CHECKED:	DATE:
APPROVED:	DATE:
Q.C.:	DATE:
FILE: <b>TMA9000</b>	



**ENERGY ABSORPTION SYSTEMS, INC.**  
ENGINEERING AND RESEARCH DEPARTMENT

**SAFE-STOP TRAILER TMA**

SCALE:	DRAWING: <b>TMA9000</b>	SHEET: <b>5 of 5</b>	REV
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**Test Article:**  
**Safe-Stop Trailer TMA**

t = final

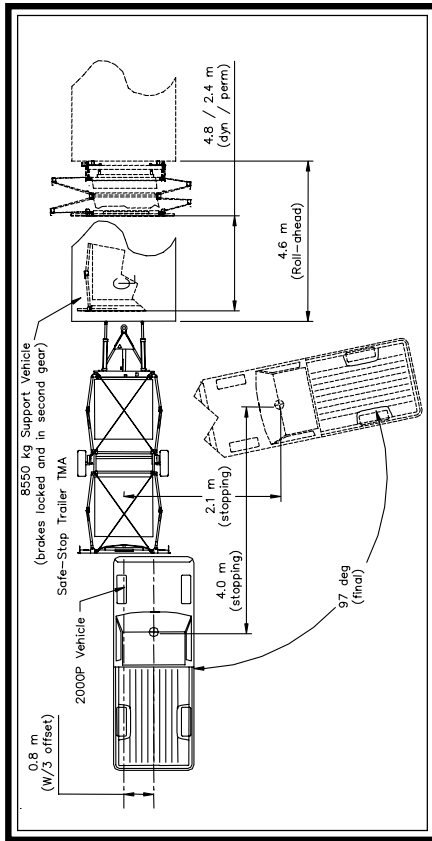
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t = 0.450 sec

t = 0.300 sec

t = 0.150 sec

t = 0.000 sec



**General Information**

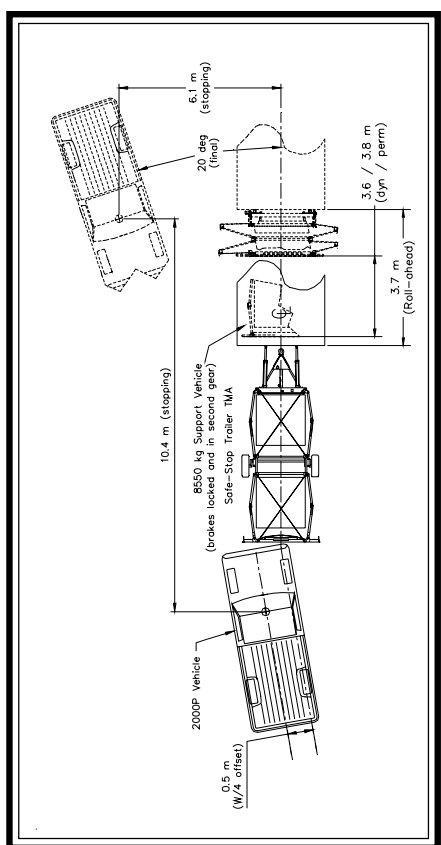
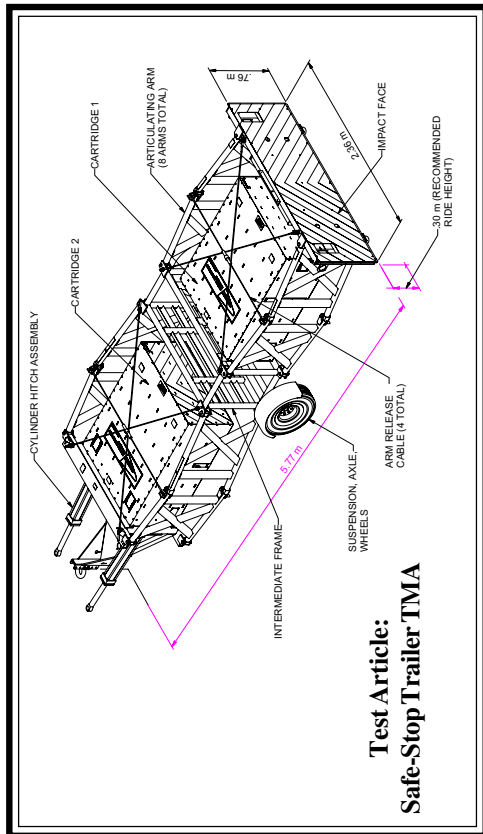
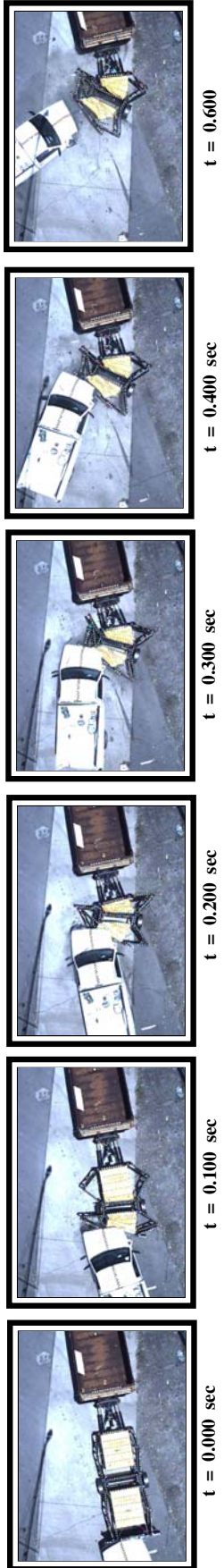
Test Agency .....	E-TECH Testing Services, Inc.
Test Designation .....	NCHRP 350 Test 3-52
Test No. ....	01-5432-001
Date .....	3/24/05
Test Article .....	Energy Absorption Systems, Inc. Safe-Stop Trailer TMA
Type .....	5770 mm (overall system)
Installation Length, (mm) .....	(2) Aluminum Cartridges; LxHxW
Material and key elements .....	1524 mm x 572 mm x 1219 mm
Foundation Type and Condition .....	Concrete, clean and dry
Test Vehicle .....	Production Model
Type .....	2000P Pickup
Designation .....	1995 GMC
Model .....	2150
Mass (kg) .....	2014
Curb .....	N/A
Test inertial .....	2014
Dummy .....	1970 GMC 7500 T/A Dump
Gross Static .....	8550
Support Vehicle .....	Park brakes on / second gear
Model .....	
Test Inertial Mass (kg) .....	
Restraint .....	
Impact Conditions .....	
Speed (km/h) .....	99.7
Angle (deg) .....	0
Impact Severity (kJ) .....	771.7

**NCHRP 350 Occupant Risk Values**

Impact Velocity (m/s) .....	9.0
x-direction .....	0.3
y-direction .....	-19.8
Ridedown Acceleration (g/s) .....	-8.4
x-direction .....	
y-direction .....	5.6
Support Vehicle Acceleration (g/s) .....	
x-direction .....	
European Committee for Normalization (CEN) Values .....	
THIV (km/h) .....	32.3
PHD (g/s) .....	19.9
ASI .....	1.4
Test Article Deflections (m) .....	
Dynamic .....	4.8
Permanent .....	2.4
Vehicle Damage .....	
Exterior .....	
VDS .....	FD-4
CDC .....	12FDEW4
Interior .....	
OCDI .....	AS0000000
Deformation (mm - max) .....	Negligible
Post-Impact Vehicular Behavior (deg - rate gyro) .....	
Maximum Roll Angle .....	-12.8
Maximum Pitch Angle .....	8.0
Maximum Yaw Angle .....	-97.3

**Figure 1. Summary of Results - Safe-Stop Trailer TMA Test 01-5432-001**





**General Information**

Test Agency .....	E-TECH Testing Services, Inc.
Test Designation .....	NCHRP 350 Test 3-53
Test No. ....	01-5432-002
Date .....	6/2/05
Test Article .....	Energy Absorption Systems, Inc. Safe-Stop Trailer TMA
Installation Length, (mm) .....	5770 mm (overall system)
Material and key elements .....	(2) Aluminum Cartridges; LxHxW 1524 mm x 572 mm x 1219 mm Concrete, clean and dry
Foundation Type and Condition .....	
Test Vehicle .....	
Type .....	2000P Pickup
Designation .....	1995 Chevrolet
Model .....	
Mass (kg) .....	2093
Curb .....	1988
Test inertial .....	N/A
Dummy .....	1988
Gross Static .....	
Support Vehicle .....	
Model .....	1970 GMC 7500 T/A Dump
Test Inertial Mass (kg) .....	8550
Restraint .....	Park brakes on / second gear
Impact Conditions .....	
Speed (km/h) .....	100.4
Angle (deg) .....	10
Impact Severity (kJ) .....	772.4

**NCHRP 350 Occupant Risk Values**

Impact Velocity (m/s)	
x-direction .....	9.2
y-direction .....	-0.9
Ridedown Acceleration (g's)	
x-direction .....	-17.8
y-direction .....	-10.2
Support Vehicle Acceleration (g's)	
x-direction .....	6.3
European Committee for Normalization (CEN) Values	
THV (km/h) .....	33.3
PHD (g's) .....	17.8
ASI .....	1.0
Test Article Deflections (m)	
Dynamic .....	3.6
Permanent .....	3.8
Vehicle Damage	
Exterior	
VDS .....	FD-4
CDC .....	12FDEW4
Interior	
OCDI .....	AS000000
Deformation (mm - max) .....	Negligible
Post-Impact Vehicular Behavior (deg - rate gyro)	
Maximum Roll Angle .....	28.2
Maximum Pitch Angle .....	-5.9
Maximum Yaw Angle .....	168.5

**Figure 6. Summary of Results - Safe-Stop Trailer TMA Test 01-5432-002**