State of West Virginia
Department of Administration
Purchasing Division
2019 Washington Street East
Post Office Box 50130
Charleston, WV 25305-0130

# Request for Quotation

| RFQ NUMBER | PAGE |
|---|---|
| 708EC011 | 1 |

ADDRESS CORRESPONDENCE TO ATTENTION OF:
MICHAEL AUSTIN
304-558-2402

VENDOR
RFQ COPY
TYPE NAME/ADDRESS HERE

Specialty Groups, Inc.
PO Box 96
Bridgeport, WV 26330-0096

SHIP TO
DIVISION OF HIGHWAYS
EQUIPMENT DIVISION
ROUTE 33
BRUSHY FORK ROAD
BUCKHANNON, WV
26201 304-472-1750

| DATE PRINTED | TERMS OF SALE | SHIP VIA | F.O.B. | FREIGHT TERMS |
|---|---|---|---|---|
| 03/18/2008 | | | | |

BID OPENING DATE: 04/23/2008 BID OPENING TIME 01:30PM

| LINE | QUANTITY | UOP | CAT. NO. | ITEM NUMBER | UNIT PRICE | AMOUNT |
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| 0001 | 1 | EA | | 550-42 | | |

ATTENUATOR, TRAILER MOUNTED

OPEN END CONTRACT

TO PROVIDE TRAILER MOUNTED ATTENUATOR PER THE ATTACHED SPECIFICATIONS.

THERE WILL BE A MANDATORY PRE-BID CONFERENCE AT THE STATE CAPITOL COMPLEX, BUILDING 15, 2019 WASHINGTON ST., EAST CHARLESTON, WV 25305 AT 10:00 AM ON 04/10/08 FAILURE TO ATTEND THE PRE-BID WILL RESULT IN BID DISQUALIFICATION.

QUESTIONS: WRITTEN QUESTIONS WILL BE ACCEPTED THROUGH CLOSE OF BUSINESS (5:00 PM EST.) ON WEDNESDAY 04/02/08
SEND YOUR QUESTIONS TO: PURCHASING DIVISION
ATTENTION: MICHAEL AUSTIN
2019 WASHINGTON STREET EAST
CHARLESTON, WV 25305

QUESTIONS MAY BE SENT VIA FAX, E-MAIL OR REGULAR MAIL
E-MAIL: MICHAEL.D.AUSTIN@WV.GOV
FAX: 304-558-4115
IT IS THE VENDORS RESPONIBILITY TO VERIFY THAT THEIR QUESTIONS HAVE BEEN RECEIVED BY CALLING 304-558-2402.

EXHIBIT 2

LIFE OF CONTRACT: THIS CONTRACT BECOMES EFFECTIVE ON ..... AND EXTENDS FOR A PERIOD OF ONE (1) YEAR OR UNTIL SUCH "REASONABLE TIME" THEREAFTER AS IS

RECEIVED
2008 APR 23 A 11:25
PURCHASING DIVISION
STATE OF WV

SEE REVERSE SIDE FOR TERMS AND CONDITIONS

SIGNATURE [signature] TELEPHONE (304) 623-3844 DATE 4-22-08

TITLE Pres. Manager FEIN 55-0614471 ADDRESS CHANGES TO BE NOTED ABOVE

WHEN RESPONDING TO RFQ, INSERT NAME AND ADDRESS IN SPACE ABOVE LABELED 'VENDOR'

## GENERAL TERMS & CONDITIONS
## REQUEST FOR QUOTATION (RFQ) AND REQUEST FOR PROPOSAL (RFP)

1. Awards will be made in the best interest of the State of West Virginia.

2. The State may accept or reject in part, or in whole, any bid.

3. All quotations are governed by the ***West Virginia Code*** and the ***Legislative Rules*** of the Purchasing Division.

4. Prior to any award, the apparent successful vendor must be properly registered with the Purchasing Division and have paid the required $125.00 registration fee.

5. All services performed or goods delivered under State Purchase Orders/Contracts are to be continued for the term of the Purchase Order/Contract, contingent upon funds being appropriated by the Legislature or otherwise being made available. In the event funds are not appropriated or otherwise available for these services or goods, this Purchase Order/Contract becomes void and of no effect after June 30.

6. Payment may only be made after the delivery and acceptance of goods or services.

7. Interest may be paid for late payment in accordance with the ***West Virginia Code***.

8. Vendor preference will be granted upon written request in accordance with the ***West Virginia Code***.

9. The State of West Virginia is exempt from federal and state taxes and will not pay or reimburse such taxes.

10. The Director of Purchasing may cancel any Purchase Order/Contract upon 30 days written notice to the seller.

11. The laws of the State of West Virginia and the ***Legislative Rules*** of the Purchasing Division shall govern all rights and duties under the Contract, including without limitation the validity of this Purchase Order/Contract.

12. Any reference to automatic renewal is hereby deleted. The Contract may be renewed only upon mutual written agreement of the parties.

13. **BANKRUPTCY:** In the event the vendor/contractor files for bankruptcy protection, this Contract may be deemed null and void, and terminated without further order.

14. **HIPAA Business Associate Addendum** - The West Viginia State Government HIPAA Business Associate Addendum (BAA), approved by the Attorney General, and available online at the Purchasing Division's web site (**http://www.state.wv.us/admin/purchase/vrc/hipaa.htm**) is hereby made part of the agreement. Provided that, the Agency meets the definition of a Covered Entity (45 CFR §160.103) and will be disclosing Protected Health Information (45 CFR §160.103) to the vendor.

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## INSTRUCTIONS TO BIDDERS

1. Use the quotation forms provided by the Purchasing Division.

2. **SPECIFICATIONS:** Items offered must be in compliance with the specifications. Any deviation from the specifications must be clearly indicated by the bidder. Alternates offered by the bidder as **EQUAL** to the specifications must be clearly defined. A bidder offering an alternate should attach complete specifications and literature to the bid. The Purchasing Division may waive minor deviations to specifications.

3. Complete all sections of the quotation form.

4. Unit prices shall prevail in cases of discrepancy.

5. All quotations are considered F.O.B. destination unless alternate shipping terms are clearly identified in the quotation.

6. **BID SUBMISSION:** All quotations must be delivered by the bidder to the office listed below prior to the date and time of the bid opening. Failure of the bidder to deliver the quotations on time will result in bid disqualifications.

**SIGNED BID TO:**

Department of Administration
Purchasing Division
2019 Washington Street East
Post Office Box 50130
Charleston, WV 25305-0130

**SGI Specialty Groups, Inc.**

April 23, 2008

Mr. Michael Austin, Buyer
WV Purchasing Div.
2019 Washington St. East
Charleston, WV 25305

**RE: Bid Delivery**
**RFQ: 708EC011**

Dear Mr. Austin,

Enclosed is the original bid documents with the required attachments for the above referenced bid that was delivered by fax the day of the bid. These originals include the entire bid package in addition to that which was already delivered for completeness. The bid did not require a bid bond.

The equipment manuals and other information were too lengthy to fax.

If you have any questions or concerns, please call me any time at (304) 623-3844 x304.

Sincerely,

Robert S. Hamilton
Project Manager

WV 005768
PO Box 96 Bridgeport, WV 26330
Phone (304) 623-3844 Fax (304) 623-3843
www.SpecialtyGroups.com

State of West Virginia
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# Request for Quotation

| RFQ NUMBER | PAGE |
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| 708EC011 | 2 |

ADDRESS CORRESPONDENCE TO ATTENTION OF:
MICHAEL AUSTIN
304-558-2402

VENDOR:
RFQ COPY
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Specialty Groups, Inc.
PO Box 96
Bridgeport, WV 26330-0096

SHIP TO:
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EQUIPMENT DIVISION
ROUTE 33
BRUSHY FORK ROAD
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26201 304-472-1750

| DATE PRINTED | TERMS OF SALE | SHIP VIA | F.O.B. | FREIGHT TERMS |
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NECESSARY TO OBTAIN A NEW CONTRACT OR RENEW THE ORIGINAL CONTRACT. THE "REASONABLE TIME" PERIOD SHALL NOT EXCEED TWELVE (12) MONTHS. DURING THIS "REASONABLE TIME" THE VENDOR MAY TERMINATE THIS CONTRACT FOR ANY REASON UPON GIVING THE DIRECTOR OF PURCHASING THIRTY (30) DAYS WRITTEN NOTICE.

UNLESS SPECIFIC PROVISIONS ARE STIPULATED IN THIS CONTRACT DOCUMENT, THE TERMS, CONDITIONS, AND PRICING SET HEREIN ARE FIRM FOR THE LIFE OF THE CONTRACT.

RENEWAL: THIS CONTRACT MAY BE RENEWED UPON THE MUTUAL WRITTEN CONSENT OF THE SPENDING UNIT AND VENDOR, SUBMITTED TO THE DIRECTOR OF PURCHASING THIRTY (30) DAYS PRIOR TO THE EXPIRATION DATE. SUCH RENEWAL SHALL BE IN ACCORDANCE WITH THE TERMS AND CONDITIONS OF THE ORIGINAL CONTRACT AND SHALL BE LIMITED TO TWO (2) ONE (1) YEAR PERIODS.

CANCELLATION: THE DIRECTOR OF PURCHASING RESERVES THE RIGHT TO CANCEL THIS CONTRACT IMMEDIATELY UPON WRITTEN NOTICE TO THE VENDOR IF THE COMMODITIES AND/OR SERVICES SUPPLIED ARE OF AN INFERIOR QUALITY OR DO NOT CONFORM WITH THE SPECIFICATIONS OF THE BID AND CONTRACT HEREIN

OPEN MARKET CLAUSE: THE DIRECTOR OF PURCHASING MAY AUTHORIZE A SPENDING UNIT TO PURCHASE ON THE OPEN MARKET, WITHOUT THE FILING OF A REQUISITION OR COST ESTIMATE, ITEMS SPECIFIED ON THIS CONTRACT FOR IMMEDIATE DELIVERY IN EMERGENCIES DUE TO UNFORESEEN CAUSES (INCLUDING BUT NOT LIMITED TO DELAYS IN TRANSPORTATION OR AN UNANTICIPATED INCREASE IN THE VOLUME OF WORK).

QUANTITIES: QUANTITIES LISTED IN THE REQUISITION ARE APPROXIMATIONS ONLY, BASED ON ESTIMATES SUPPLIES BY THE STATE SPENDING UNIT. IT IS UNDERSTOOD AND AGREED THAT

SEE REVERSE SIDE FOR TERMS AND CONDITIONS

| SIGNATURE | TELEPHONE | DATE |
|---|---|---|
| | | |

| TITLE | FEIN | ADDRESS CHANGES TO BE NOTED ABOVE |
|---|---|---|
| | | |

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THE CONTRACT SHALL COVER THE QUANTITIES ACTUALLY ORDERED FOR DELIVERY DURING THE TERM OF CONTRACT, WHETHER MORE OR LESS THAN THE QUANTITIES SHOWN.

ORDERING PROCEDURE: SPENDING UNIT(S) SHALL ISSUE A WRITTEN EQUIPMENT CONTRACT ORDER (FORM NUMBER WV-35) FOR COMMODITIES COVERED BY THIS CONTRACT. THE ORIGINAL WV-35 MUST BE SENT TO THE PURCHASING DIVISION OF THE DEPARTMENT OF ADMINISTRATION. AFTER APPROVAL AND ENCUMBRANCE, ONE COPY OF THE PURCHASE ORDER WILL BE RETURNED TO THE SPENDING UNIT AND ONE COPY FORWARDED TO THE VENDOR AS AUTHORIZATION FOR SHIPMENT. NO ORDER IS VALID UNLESS APPROVED AND ENCUMBERED BY THE PURCHASING DIVISION.

BANKRUPTCY: IN THE EVENT THE VENDOR/CONTRACTOR FILES FOR BANKRUPTCY PROTECTION, THIS CONTRACT IS AUTOMATICALLY NULL AND VOID, AND IS TERMINATED WITHOUT FURTHER ORDER.

REV. 9/98

EXHIBIT 6

PRICE ADJUSTMENT PROVISION:
THE STATE OF WEST VIRGINIA WILL CONSIDER BIDS THAT CONTAIN PROVISIONS FOR PRICE ADJUSTMENTS PRIOR TO THE ORIGINAL EXPIRATION OF THE CONTRACT, PROVIDED THAT SUCH PRICE ADJUSTMENT COVERS BOTH UPWARD AND DOWNWARD MOVEMENT OF THE COMMODITY PRICE, AND THAT ADJUSTMENT IS BASED ON THE "PASS THROUGH" INCREASE OR DECREASE OF RAW MATERIALS AND/OR LABOR, WHICH MAKE UP ALL OR A SUBSTANTIAL PART OF A PRODUCT. ADJUSTMENTS ARE TO BE BASED UPON AN ACTUAL DOLLAR FIGURE, NOT A PERCENTAGE.

SEE REVERSE SIDE FOR TERMS AND CONDITIONS

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ALL PRICE ADJUSTMENT REQUESTS MUST BE SUBSTANTIATED IN A MANNER ACCEPTABLE TO THE DIRECTOR PURCHASING, E.G. GOVERNMENTAL BENCH MARKS, GENERAL MARKET INCREASE, PUBLISHED PRICE LISTS. SUCH REQUESTS FOR AND INCREASE SHOULD BE RECEIVED IN WRITING BY THE DIRECTOR OF PURCHASING AT LEAST 30 DAYS IN ADVANCE OF THE EFFECTIV DATE OF THE INCREASE. ANY TIME THE VENDOR REQUESTS A PRICE ADJUSTMENT, THE PURCHASING DIVISION MAY EITHER ACCEPT THE PRICE ADJUSTMENT AND AMEND THE CONTRACT ACCORDINGLY OR REJECT THE ADUSTMENT IN ITS ENTIRETY AND CANCEL THE CONTRACT.

EXHIBIT 10

REQUISITION NO.: 708EC011

ADDENDUM ACKNOWLEDGEMENT

I HEREBY ACKNOWLEDGE RECEIPT OF THE FOLLOWING CHECKED ADDENDUM(S) AND HAVE MADE THE NECESSARY REVISIONS TO MY PROPOSAL, PLANS AND/OR SPECIFICATION, ETC.

ADDENDUM NO.'S:

NO. 1 ..... No Addendums

NO. 2 .....

NO. 3 .....

NO. 4 .....

NO. 5 .....

I UNDERSTAND THAT FAILURE TO CONFIRM THE RECEIPT OF TH

SEE REVERSE SIDE FOR TERMS AND CONDITIONS

| SIGNATURE | TELEPHONE | DATE |
|---|---|---|
| [signature] | (304) 623-3844 | 4-22-08 |

| TITLE | FEIN | ADDRESS CHANGES TO BE NOTED ABOVE |
|---|---|---|
| Proj. Manager | 55-0614471 | |

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ADDENDUM(S) MAY BE CAUSE FOR REJECTION OF BIDS.

VENDOR MUST CLEARLY UNDERSTAND THAT ANY VERBAL REPRESENTATION MADE OR ASSUMED TO BE MADE DURING ANY ORAL DISCUSSION HELD BETWEEN VENDOR'S REPRESENTATIVES AND ANY STATE PERSONNEL IS NOT BINDING. ONLY THE INFORMATION ISSUED IN WRITING AND ADDED TO THE SPECIFICATIONS BY AN OFFICIAL ADDENDUM IS BINDING.

Robert L. Hamlett
SIGNATURE

Specialty Groups, Inc.
COMPANY

4-22-08
DATE

VENDOR PREFERENCE CERTIFICATE

CERTIFICATION AND APPLICATION* IS HEREBY MADE FOR PREFERENCE IN ACCORDANCE WITH WEST VIRGINIA CODE, 5A-3-37 (DOES NOT APPLY TO CONSTRUCTION CONTRACTS).

A. APPLICATION IS MADE FOR 2.5% PREFERENCE FOR THE REASON CHECKED:

( ) BIDDER IS AN INDIVIDUAL RESIDENT VENDOR AND HAS RESIDED CONTINUOUSLY IN WEST VIRGINIA FOR FOUR (4) YEARS IMMEDIATELY PRECEDING THE DATE OF THIS CERTIFICATION; OR

(✓) BIDDER IS A PARTNERSHIP, ASSOCIATION OR CORPORATION RESIDENT VENDOR AND HAS MAINTAINED ITS HEAD-

SEE REVERSE SIDE FOR TERMS AND CONDITIONS

| SIGNATURE | TELEPHONE | DATE |
|---|---|---|
| Robert L. Hamlett | (304) 623-3844 | 4-22-08 |

| TITLE | FEIN | ADDRESS CHANGES TO BE NOTED ABOVE |
|---|---|---|
| Prop. Manager | 55-0614471 | |

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QUARTERS OR PRINCIPAL PLACE OF BUSINESS CONTINUOUSLY IN WEST VIRGINIA FOR FOUR (4) YEARS IMMEDIATELY PRECEDING THE DATE OF THIS CERTIFICATION; OR 80% OF THE OWNERSHIP INTEREST OF BIDDER IS HELD BY ANOTHER INDIVIDUAL, PARTNERSHIP, ASSOCIATION OR CORPORATION RESIDENT VENDOR WHO HAS MAINTAINED ITS HEADQUARTERS OR PRINCIPAL PLACE OF BUSINESS CONTINUOUSLY IN WEST VIRGINIA FOR FOUR (4) YEARS IMMEDIATELY PRECEDING THE DATE OF THIS CERTIFICATION; OR

( ) BIDDER IS A CORPORATION NONRESIDENT VENDOR WHICH HAS AN AFFILIATE OR SUBSIDIARY WHICH EMPLOYS A MINIMUM OF ONE HUNDRED STATE RESIDENTS AND WHICH HAS MAINTAINED ITS HEAQUARTERS OR PRINCIPAL PLACE OF BUSINESS WITHIN WEST VIRGINIA CONTINUOUSLY FOR THE FOUR (4) YEARS IMMEDIATELY PRECEDING THE DATE OF THIS CERTIFICATION.

B. APPLICATION IS MADE FOR 2.5% PREFERENCE FOR THE REASON CHECKED:

(X) BIDDER IS A RESIDENT VENDOR WHO CERTIFIES THAT, DURING THE LIFE OF THE CONTRACT, ON AVERAGE AT LEAST 75% OF THE EMPLOYEES WORKING ON THE PROJECT BEING BID ARE RESIDENTS OF WEST VIRGINIA WHO HAVE RESIDED IN THE STATE CONTINUOUSLY FOR THE TWO YEARS IMMEDIATELY PRECEDING SUBMISSION OF THIS BID;
OR
( ) BIDDER IS A NONRESIDENT VENDOR EMPLOYING A MINIMUM OF ONE HUNDRED STATE RESIDENTS OR IS A NONRESIDENT VENDOR WITH AN AFFILIATE OR SUBSIDIARY WHICH MAINTAINS ITS HEADQUARTERS OR PRINCIPAL PLACE OF BUSINESS WITHIN WEST VIRGINIA EMPLOYING A MINIMUM OF ONE HUNDRED STATE RESIDENTS WHO CERTIFIES THAT, DURING THE LIFE OF THE CONTRACT, ON AVERAGE AT LEAST 75% OF THE EMPLOYEES OR BIDDERS' AFFILIATE'S OR

SEE REVERSE SIDE FOR TERMS AND CONDITIONS

SIGNATURE [signature] TELEPHONE (304) 623-3844 DATE 4-22-08

TITLE Proj. Manager FEIN 55-0614471 ADDRESS CHANGES TO BE NOTED ABOVE

WHEN RESPONDING TO RFQ, INSERT NAME AND ADDRESS IN SPACE ABOVE LABELED 'VENDOR'

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SUBSIDIARY'S EMPLOYEES ARE RESIDENTS OF WEST VIRGINIA WHO HAVE RESIDED IN THE STATE CONTINUOUSLY FOR THE TWO YEARS IMMEDIATELY PRECEDING SUBMISSION OF THIS BID.

BIDDER UNDERSTANDS IF THE SECRETARY OF TAX & REVENUE DETERMINES THAT A BIDDER RECEIVING PREFERENCE HAS FAILED TO CONTINUE TO MEET THE REQUIREMENTS FOR SUCH PREFERENCE, THE SECRETARY MAY ORDER THE DIRECTOR OF PURCHASING TO: (A) RESCIND THE CONTRACT OR PURCHASE ORDER ISSUED; OR (B) ASSESS A PENALTY AGAINST SUCH BIDDER IN AN AMOUNT NOT TO EXCEED 5% OF THE BID AMOUNT AND THAT SUCH PENALTY WILL BE PAID TO THE CONTRACTING AGENCY OR DEDUCTED FROM ANY UNPAID BALANCE ON THE CONTRACT OR PURCHASE ORDER.

BY SUBMISSION OF THIS CERTIFICATE, BIDDER AGREES TO DISCLOSE ANY REASONABLY REQUESTED INFORMATION TO THE PURCHASING DIVISION AND AUTHORIZES THE DEPARTMENT OF TAX AND REVENUE TO DISCLOSE TO THE DIRECTOR OF PURCHASING APPROPRIATE INFORMATION VERIFYING THAT BIDDER HAS PAID THE REQUIRED BUSINESS TAXES, PROVIDED THAT SUCH INFORMATION DOES NOT CONTAIN THE AMOUNTS OF TAXES PAID NOR ANY OTHER INFORMATION DEEMED BY THE TAX COMMISSIONER TO BE CONFIDENTIAL.

UNDER PENALTY OF LAW FOR FALSE SWEARING (WEST VIRGINIA CODE 61-5-3), BIDDER HEREBY CERTIFIES THAT THIS CERTIFICATE IS TRUE AND ACCURATE IN ALL RESPECTS; AND THAT IF A CONTRACT IS ISSUED TO BIDDER AND IF ANYTHING CONTAINED WITHIN THIS CERTIFICATE CHANGES DURING THE TERM OF THE CONTRACT, BIDDER WILL NOTIFY THE PURCHASING DIVISION IN WRITING IMMEDIATELY.

BIDDER: Specialty Groups, Inc.

SEE REVERSE SIDE FOR TERMS AND CONDITIONS

| SIGNATURE | TELEPHONE | DATE |
|---|---|---|
| Kurt A. Ford | (304) 623-3844 | 4-22-08 |

| TITLE | FEIN | ADDRESS CHANGES TO BE NOTED ABOVE |
|---|---|---|
| Proj. Manager | 55-0614471 | |

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DATE: April 22, 2008

SIGNED: Robert A. Hamilton

TITLE: Project Manager

* CHECK ANY COMBINATION OF PREFERENCE CONSIDERATION(S) IN EITHER "A" OR "B", OR BOTH "A" AND "B" WHICH YOU ARE ENTITLED TO RECEIVE. YOU MAY REQUEST UP TO THE MAXIMUM 5% PREFERENCE FOR BOTH "A" AND "B".
(REV. 12/00)

NOTICE

A SIGNED BID MUST BE SUBMITTED TO:

DEPARTMENT OF ADMINISTRATION
PURCHASING DIVISION
BUILDING 15
2019 WASHINGTON STREET, EAST
CHARLESTON, WV 25305-0130

THE BID SHOULD CONTAIN THIS INFORMATION ON THE FACE OF THE ENVELOPE OR THE BID MAY NOT BE CONSIDERED:

SEALED BID

BUYER: 33

RFQ. NO.: 708EC011

BID OPENING DATE: 04/23/2008

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|---|---|---|
| Robert A. Hamilton | (304) 623-3844 | 4-22-08 |

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|---|---|---|
| Asst. Manager | 55-0614471 | |

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| 03/18/2008 | | | | |

BID OPENING DATE: 04/23/2008 BID OPENING TIME 01:30PM

| LINE | QUANTITY | UOP | CAT. NO. | ITEM NUMBER | UNIT PRICE | AMOUNT |
|---|---|---|---|---|---|---|
| | | | | | | |

BID OPENING TIME: 1:30 PM

PLEASE PROVIDE A FAX NUMBER IN CASE IT IS NECESSARY TO CONTACT YOU REGARDING YOUR BID:

(304) 623-3843

CONTACT PERSON (PLEASE PRINT CLEARLY):

Robert Hamilton

Please See Attached Bidders Evaluation Report

****** THIS IS THE END OF RFQ 708EC011 ****** TOTAL:

SEE REVERSE SIDE FOR TERMS AND CONDITIONS

SIGNATURE [signature] TELEPHONE (304) 623-3844 DATE 4-22-08

TITLE Pres. Manager FEIN 55-0614471 ADDRESS CHANGES TO BE NOTED ABOVE

WHEN RESPONDING TO RFQ, INSERT NAME AND ADDRESS IN SPACE ABOVE LABELED 'VENDOR'

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
EQUIPMENT DIVISION

PROCUREMENT SPECIFICATIONS
NO. 937-1-A

OPEN END CONTRACT
ATTENUATOR, TRAILER MOUNTED

## 1.0 PURPOSE

It is the purpose of these specifications to describe a Trailer Mounted Attenuator System for mobile work zone shadow vehicles and stationary work zone barrier vehicles (hereinafter referred to as a "attenuator", "TMA", or a "unit") to be purchased for use by the West Virginia Division of Highways (DOH) on an open end contract basis.

**The System must provide impact protection during collisions into the rear of a truck in work zone operations. The System design will dissipate the collision energy of standard passenger vehicles traveling at speeds up to 100Km/h (62 MPH).**

**Trailer mounted attenuator must provide the following when properly deployed:**

1. **Reduce impact severity for occupants of the barrier or shadow vehicle**
2. **Reduce or eliminate damage to barrier or shadow vehicle**
3. **Reduce incident management time**
4. **Increase survival rate for the occupants of impacting vehicles**
5. **Lower injury rate of the occupants of impacting vehicles**

## 2.0 BIDDING PROCEDURES

**The current purchasing procedures regarding bidding as established by the Department of Administration, Purchasing Division, shall apply**. Failure to submit the " Request for Quotation" forms, complete in its entirety and according to directions indicated, may subject the bidder to disqualification. **Each bid submitted shall also be accompanied by a Bidder's Evaluation Report completed in detail**. Addendums in order, along with exception sheets, should be with Bidder's Evaluation Report. FAILURE TO SUBMIT THE BIDDER'S EVALUATION REPORT, COMPLETE IN ITS ENTIRETY, MAY RESULT IN AUTOMATIC DISQUALIFICATION.

## 3.0 SPECIFICATIONS

The specifications named herein, mandatory and non-mandatory, establish the acceptable level of quality only and are not intended to reflect a preference or favor any particular brand or vendor.

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3.1 EXCEPTIONS TO NON-MANDATORY SPECIFICATIONS

Exception to a non-mandatory unit specification may be made by the bidder, providing the exception is not available from the manufacturer. **Any such exception must be noted on the bidder's evaluation report and should be accompanied by supporting documentation/literature from the manufacturer. Any exception must be indicated on a separate attachment to the bidder's evaluation report and labeled as "Exception to Specifications".** The state reserves the right to determine whether the stated exception does or does not reduce the quality and performance of the unit. Failure to provide information for any exceptions may be grounds for rejection of the bid. The state reserves the right to waive minor irregularities in bids or specifications in accordance with §148-1-4(f) of the WV Legislative Rules and Regulations.

3.2 MANDATORY SPECIFICATIONS

**All specifications preceded by "shall, will, and/or must" or are stated as a "minimum and/or maximum" are mandatory as stated in Purchasing Divisions Policies and Procedures. Any bid failing to meet any mandatory item shall be immediately disqualified.** Failure to respond in the appropriate evaluation section may also be grounds for immediate disqualification at the discretion of the State.

A mandatory pre-bid conference is scheduled for this equipment purchase as stated in the RFQ. Vendors having products with variations or exceptions in specified mandatory items are expected to address any such variations or exceptions during the pre-bid conference. **The State shall review and consider any such variation or exception, and may at its sole discretion, issue an addendum to change mandatory specifications deemed to be in the State's best interest. Bids from any vendor failing to attend the mandatory pre-bid shall be disqualified. Bids containing any variation or exception to a mandatory specification that was not addressed during the pre-bid conference and accepted by the issuance of an Addendum shall be disqualified.**

4.0 REPRESENTATIVE UNIT FOR TEST

**The successful vendor must (if specified) provide DOH one (1) completed representative unit to be observed and evaluated on each order to insure compliance with specification. If requested, the time period for testing and evaluation shall be seven (7) working days following receipt of the unit.** DOH will incur no obligation for deterioration of surfaces, finishes, seals, and mechanical or electrical parts on the unit resulting from operation and testing within the limits of these specifications; nor will DOH incur obligation for damage to the unit resulting from failure to meet specifications when due care and attention is given by DOH and testing is done within the limits of these specifications. **Failure of the pilot unit to satisfactorily meet specifications as bid shall be cause for cancellation of the purchase order, and return of the delivered unit along with all associated equipment to the vendor at the vendor's expense.**

4.1 CONDITION OF UNIT(S) UPON DELIVERY

**All units must arrive at the prescribed delivery point having been completely preserviced with oil, lubricants, and coolant.** All prescribed precautions pertaining to first operations and break-in of the unit are to be posted conspicuously on the unit for ready observance by the operator.

4.2 DELIVERY

Delivery point of the completely assembled representative unit will be the DOH, Equipment Division, Route 33 at Brushy Fork Road, Buckhannon, West Virginia (26201).

The vendor is responsible for guaranteeing delivery of the completed units within the time specified and agreed to by the State. Delivery is preferred within 60 days after receipt of purchase agreement. The vendor is responsible for establishing and coordinating delivery terms with allied manufacturers or suppliers. **Delivery terms shall be stated in the bid and the State reserves the right to accept or negotiate such terms**. Failure to reach an agreement may result in rejection of the bid. **The successful bidder shall provide their manufacturer's confirmation of the order to the WVDOH contact person within seven (7) working days after receiving the approved purchase order.**

**A completed pilot model for inspection must be provided within 30 calendar days after receipt of the purchase agreement by the successful vendor.**

Delivery is an integral part of this specification and failure to comply will be cause to initiate a D.O.T. Administrative Form WV-82, Vendor Performance Form. The WV-82 Form will provide a means of officially notifying the Purchasing Division and the vendor of unsatisfactory performance; such as late deliveries, poor service, inadequate parts supplies, etc.

**The decision to initiate subject Form will be at the sole discretion of the D.O.H. Commissioner's established Equipment Review Board.**

**Issuance of the WV-82 Vendor Complaint Form on unsatisfactory delivery against any vendor will be cause to refuse to consider similar items from those vendors on future Request For Quotations.**
(NOTE: Delivery time could be altered due to labor strikes, severe inclement weather conditions, etc.)

5.0 AWARD CRITERIA

5.1 **DOH will recommend the award in accordance with the RFQ evaluation criteria described in the requisition. The award shall be made to the lowest unit cost vendor that meets or exceeds the specifications.**

**Prices for the units shall be in quantities of 1-5, 6–10 and 11 and over**. However, for evaluation purposes, **we will use quantities 1-5.** DOH reserves the right to place multiple orders in any quantity.

6.0 SPECIFICATIONS AND GUIDELINES - GENERAL

6.1 IDENTIFICATION OF THE UNIT BEING PROPOSED

**The bidder must identify the unit by manufacturer, model, series, and year of manufacture, in the bid to enable identification by DOH in the manufacturer's specifications of the proposed unit. The bidder will submit complete descriptive literature of the proposed unit, to establish that the bid is the manufacturer's most**

13 **current model, including latest engineering improvements, which have been, or will imminently be, regularly advertised and sold on the open market.** The unit specified herein and offered to be manufactured after January 1, 2008 and be clearly identified and marked with date of manufacture.

6.2 OPERATING AND SERVICE MANUALS AND PARTS LISTS

**An operator's manual must be included with each unit upon delivery. A "line sheet" (if applicable) and Equipment Preventative Maintenance Questionnaire (as shown in X6.2 of the Bidder's Evaluation Report) must be with pilot unit upon delivery. In addition, there must be 12 service, shop, or maintenance manuals; ten (10) to be distributed to the Districts and two (2) for the Equipment Division. Also, there must be 14 parts manuals; ten (10) to be distributed to the Districts and four (4) for Equipment Division use.** CD ROM is preferred in lieu of parts manuals.

* **NOTE: MANUALS SHALL BE DELIVERED UPON COMPLETION OF DELIVERY OF TOTAL UNITS.** FAILURE TO DO SO WILL DELAY PAYMENT.

6.3 TRAINING:

**Manufacturers and/or dealers will be required to stage a thorough seminar on the subjects of Preventative Maintenance, Operator and Mechanic Training. In order to keep the operators and mechanics updated, the successful vendor shall conduct training with each purchase order against this open end contract.** Training is preferred within 2 working days after delivery of the pilot unit on the individual purchase order.

**Manufacturers and/or dealers shall be required to furnish the Training Academy with one (1) Operator's Manual to be shipped direct to WVDOH Training Academy, Post Office Box 610, Buckhannon, West Virginia 26201 prior to delivery of the pilot.**

The seminar to be held at the W. Va. Division of Highways, Equipment Division, Buckhannon, West Virginia.

6.4 PREVENTIVE MAINTENANCE AND OPERATOR PROCEDURES:

**Manufacturers and/or dealers will be required to submit to the Equipment Division, in addition to the operating and service manuals, booklets and pamphlets explaining the Preventive Maintenance and Operator Procedures to be used by the operators of this equipment, and must include such things as daily prestart inspection procedure, service schedule, and routine maintenance required, safety precautions, etc.**

**The successful vendor shall furnish all training aids; i.e., videos, projectors, etc. required in conducting the training.**

6.5 WARRANTY AND SERVICE POLICY

The Manufacturers warranty or service policy is to apply to the unit. Such warranty or service policy is to be recognized at any authorized unit dealer, representing manufacturer of proposed unit throughout the State of West Virginia. **The applicable warranty or service policy will not be contingent upon obtaining routine service, lubrication, and servicing of the unit from factory authorized agencies. It will be the**

**responsibility of the bidder to have available labor to repair or replace any defective replacement parts, components and materials, and to have available those replacement parts, components, and/or materials found to be defective during the terms of the warranty period.** The bidder should state the labor rates, locations where parts will be stocked, availability of parts, and discounts offered for parts, when terms of the warranty offer a pro-rated cost for parts and labor. In addition, the successful bidder should offer field work to repair or replace defective parts, components, and materials found to be defective during the terms of the warranty and should provide mechanic's travel rates, mileage charges, field mechanic rates, and any surcharge for miscellaneous items, if applicable, for field work during the warranty period. Submit to Division of Highways any technical or engineering improvements during the term of the warranty. **The unit must be accompanied upon delivery by the unit's manufacturer's executed warranty or service policy.**

**A mandatory minimum two (2) year bumper to bumper basic parts and labor warranty is required for this unit.**

**THE "WARRANTY AND SERVICE POLICY QUESTIONNAIRE" ATTACHED IN THE BIDDER'S EVALUATION REPORT MUST BE COMPLETED IN ITS ENTIRETY BY THE SUCCESSFUL BIDDER OR MANUFACTURER PRIOR TO DELIVERY OF THE PILOT MODEL.** (SEE SECTION X6.5 OF BIDDER'S EVALUATION REPORT).

## 6.6 EVALUATION COMMITTEE REQUIREMENTS

Detailed component specifications, product literature, component models, required for specification compliance determination by the Evaluation Committee should be provided with each bid. Any information supplied that is contrary to/or conflicting with the specifications and/or attached Bidders Evaluation Report may be sufficient cause for rejection of bid.

## 6.7 UNSPECIFIED ACCESSORIES & FEATURES

**All parts, equipment, accessories, material, design and performance characteristics not specified herein, but which are necessary to provide a complete unit, must be furnished with each unit and required to conform to strength, quality of material, and quality of workmanship to those which are advertised and provided to the market in general by the unit industry.**

**All parts and accessories advertised and regularly supplied as standard shall be included, except those which would represent duplication of these specified, and except those which, by specification, are not to be furnished. All standard safety features, required by Federal and State Law, shall be included.**

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7.0 SPECIFICATIONS OF THE QUOTED UNIT ARE AS FOLLOWS:

**The Trailer Mounted Attenuator must provide the impact protection and deployment as detailed in Section 1.0 – Purpose.**

**7.1 Attenuator must meet NCHRP (National Cooperative Highway Research Program) Report 350, Test Level 3 (TL-3) criteria.**

**7.2 The attenuator coupled to the truck shall have a maximum skid distance of 25 feet when impacted at NCHRP Report 350, TL-3 Test 3-51 impact conditions. (Dependent on the truck weight, transmission in 2nd gear, and park brake set on clean dry pavement.)**

7.3 Attenuator to be designed to be used with any weight vehicle over 4500 Kg (9,920 lbs.)

**7.4 The attenuator shall be designed to make attachment or detachment from the truck simple and fast.**

**7.5 Attenuator frame must be capable of collapsing when impacted.**

**7.6 No portion of the TMA shall protrude under the truck damaging its vital elements during an impact.**

**7.7 TMA will not impede the line of site of an arrow board or message board mounted on the truck**

7.8 Major Components:

**7.8.1 The trailer TMA shall consist of the following components:**

**7.8.1.1 Trailer frame assembly or support structure with articulating arms**

**7.8.1.2 Two (2) bursting tubes or safe-stop 180/SST Type A and Type B cartridges**

**7.8.1.3 Axle assembly with axle push tubes (if required), wheels, and tires**

**7.8.1.4 Suspension or torsion axle**

**7.8.1.5 Impact head or frame**

**7.8.1.6 Intermediate frame (if required)**

**7.8.1.7 Hitch assembly (lunette ring/pintle hook) design**

**7.8.1.8 Two (2) tube bursting mandrels (if required)**

7.9 Lights and visibility:

**7.9.1 Lighting assembly shall conform to FMVSS No. 108 "Lamps, Reflective Devices, and Associated Equipment"**

**7.9.2 Lights to include but not limited to shall be**

**7.9.2.1 Brake lights**

**7.9.2.2 Taillights**

**7.9.2.3 Turn signals**

**7.9.2.4 ICC bar lights**

**7.9.3 A standard single, seven (7) pin connector shall make the connection for all lights**

**7.9.4 Conspicuity tape and reflectors will be installed following the same standards as the lighting**

7.10 Jack

**7.10.1 One (1) hand crank with swivel caster shall be supplied to facilitate removal from prime mover for storage**

7.11 Corrosion Protection

**7.11.1 All components of the energy dissipation system shall be hot dip galvanized or powder coated to prevent corrosion**

7.12 Product Approval

**7.12.1 Trailer mounted attenuator must have passed the following test and have attached letter of approvals**

**7.12.1.1 NCHRP – Report 350, Test Level 3**

**7.12.1.2 Tests 3-50, 3-51, 3-52, and 3-53**

**7.12.1.3 Unit should also be on the West Virginia approval to use list (If not, manufacturer shall contact Ted Whitmore (Traffic Engineering Division) Charleston, West Virginia (304-558-9468)**

7.13 Dimensions and Weights

**7.13.1 Height from ground: Minimum 31 inches – Maximum 45 inches**

**7.13.2 Width (at impact head or face): Minimum 93 inches – Maximum 96 inches**

**7.13.3 Length: Minimum 19 feet 3 inches – Maximum 23 feet 6 inches**

**7.13.4 Weight (without optional equipment): Minimum 1400 lbs. – Maximum 2650 lbs.**

7.14 Advertising: No visible decals or nameplates or painted on names representing the manufacturer or model number or trademark should appear on the exterior surfaces of the unit. Such logos created through the stamping or casing process of manufacture are accepted.

**7.15 All other features considered as standard equipment but not specifically addressed above shall be provided.**

7.16 Preventive Maintenance and Operators Training School:

**Manufacturers and/or dealers will be required to stage a thorough seminar on each order on the subjects Preventive Maintenance and Operator Training**. The seminar should be held at the Equipment Division.

In addition to the operating and service manuals, booklets and pamphlets explaining the Preventive Maintenance and Operator Training procedures to be used by the operators of this equipment are also required. **Must include such things as daily prestart inspection procedure, service schedule and routing maintenance required, safety precautions, etc.**

Bidder to attach a copy of the proposed program with his bid, state the time required to perform the program, and briefly describe his program.

The successful vendor to furnish all training aids; i.e. videos, projectors, etc., required in conducting the training.

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
EQUIPMENT DIVISION

BIDDER'S EVALUATION REPORT

PROCUREMENT SPECIFICATIONS FOR OPEN END CONTRACT
NO. 937-1-A

ATTENUATOR, TRAILER MOUNTED

NOTE TO BIDDER: Procurement Specification No. 937-1-A, Paragraph 2.0 recommends the completion and submittal of this Report with your bid. Purpose of this Report is to enable the West Virginia Division of Highways Evaluation Committee to make full and fair evaluation of the bid. Addendums in order, along with a summary of exception as a separate attachment, should be with Bidder's Evaluation Report.
FAILURE TO SUBMIT THIS REPORT, COMPLETE IN ITS ENTIRETY, MAY SUBJECT THE BIDDER TO DISQUALIFICATION.

Reference Requisition No.: 708EC011

Bidder's Name: Specialty Groups, Inc.

Address: PO Box 96 Bridgeport, WV 26330

Telephone Number: (304) 623-3844

Years Bidder has been registered to do business with the State of West Virginia: 25+ YRS.

Years Company has been an authorized dealer for proposed unit: >1 YRS.

X3.2 Have you complied with all mandatory specifications? ✓ YES ____ NO

X4.2 DELIVERY:

**X4.2.1 Delivery date of completed representative unit:** 21 **Calendar Days After Receipt of Purchase Agreement**

X4.2.2 Delivery date of balance of completed units: 30 Calendar Days After Receipt of Purchase Agreement

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PO Box 96
Bridgeport, WV 26330-0096

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PO Box 96
Bridgeport, WV 26330-0096

X5.0 AWARD CRITERIA;

**X5.1 Prices for unit in quantities of**

| | | |
|---|---|---|
| 1-5 | 13,450.00 | per unit |
| 6-10 | 12,800.00 | per unit |
| 11 and over | 12,800.00 | per unit |

X6.0 SPECIFICATIONS - GENERAL

**X6.1 Manufacturer, model, series, and date of manufacture of proposed unit:**

Safety Trailers Inc., TTMA-100 (2008)

Is descriptive literature, fully describing proposed unit attached to your bid? ✓ YES _____ NO

If not, why? N/A

**X6.2 Will the required number of service manuals, and complete parts list be delivered to the Equipment Division at Buckhannon upon completion of delivery of total units?**

✓ **YES** _____ **NO**

**Will the required Equipment Preventive Maintenance Form (Section X6.2 of Bidders Evaluation Report) be provided upon inspection of the pilot unit?** ✓ **YES** _____ **NO**

Specialty Groups, Inc.
PO Box 96
Bridgeport, WV 26330-0096



X6.2
2-10-00

**EQUIPMENT PREVENTATIVE MAINTENANCE QUESTIONNAIRE**

THIS FORM MUST BE COMPLETED IN ITS ENTIRETY BY SUCCESSFUL BIDDER OR MANUFACTURER'S TECHNICAL REPRESENTATIVE PRIOR TO DELIVERY OF PILOT MODEL TO THE WVDOH.

DESCRIPTION: Trailer Mounted Attenuator MAKE: Safety Trailers, Inc. (STI)

MODEL: TTMA-100 YEAR: 2008 PURCHASE AMOUNT: _____

ENGINE: MAKE: N/A MODEL: N/A FUEL TYPE: N/A

HORSEPOWER: N/A CYLINDER: N/A ENGINE SERIAL: N/A

COOLING SYSTEM CAPACITY: N/A

BELTS: DESCRIPTION: PART NUMBERS:

N/A N/A

N/A N/A

GVW: 1450 lbs AXLE CAPACITY:FRONT: N/A REAR: N/A

TIRES: FRONT MAKE & SIZE: N/A

REAR MAKE & SIZE: _____

DIMENSIONS OF UNIT: LENGTH: 23'-6" WIDTH: 8'-0" LENGTH: N/A

VENDOR CONTACT PERSON: Jim Herron PHONE: (304) 623-3844

PARTS:

BATTERY MAKE: N/A MODEL: N/A CCA: N/A
TOP OR SIDE POST: N/A DIMENSIONS: LENGTH N/A WIDTH N/A HEIGHT N/A
SPARK PLUGS OR FUEL INJECTORS MAKE: _____ PART # _____
FUEL PUMP OR INJECTION PUMP MAKE: _____ MODEL: _____
ALTERNATOR MAKE: _____ PART #: _____
STARTER MAKE: _____ PART #: _____
TURBO CHARGER MAKE: N/A PART #: N/A
TRANS. MAKE: _____ MODEL: _____ AUTO/MANUAL: _____
HYDRAULIC PUMP MAKE: _____ MODEL: _____

| FILTERS | MAKE | PART NO. | LUBRICANT | MANUFACTURER TYPE |
|---|---|---|---|---|
| OIL | | | ENGINE | |
| AIR INNER | 30 psi | | TRANSMISSION | |
| AIR OUTER | | | POWER STEERING | |
| FUEL PRIMARY | | | HYDRAULIC | |
| FUEL SECONDARY | N/A | | DIFFERENTIALS | N/A |
| COOLANT | | | BRAKE FLUID | |
| HYDRAULIC | | | COOLANT | |
| OTHER | | | OTHER | |

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X6.3 TRAINING:

Will training seminar be conducted on Preventive Maintenance, Operator and Mechanic Training
✓ YES _____ NO

**Will you conduct training with each purchase order against this open end contract?**
✓ **YES** _____ **NO**

Will training be conducted within 2 working days from the delivery of the pilot unit on the individual purchase order? ✓ YES _____ NO

If NO, explain time frame_____

**Will an Operator's Manual be furnished directly to Training Academy prior to the delivery of the pilot?** ✓ **YES** _____ **NO**

**X6.4 If you are the successful vendor, will you furnish all training aids, i.e., videos, projectors, required in conducting the training?** ✓ **YES** _____ **NO**

**X6.4.1 Will all manuals, booklets, etc. explaining preventive maintenance, operator procedures, and service schedule be delivered with each unit?** ✓ **YES** _____ **NO**
**If NO, explain** _____

X6.5 WARRANTY AND SERVICE POLICY

Will the warranty and service you provide comply with all areas as stated in Section 6.5 of specifications
✓ YES _____ NO

Is warranty literature attached? ✓ YES _____ NO

**Is a minimum two (2) year bumper to bumper basic parts and labor warranty included?**
✓ **YES** _____ **NO**

Describe:

_____

_____

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## X6.5 WARRANTY AND SERVICE POLICY QUESTIONNAIRE

**THIS FORM MUST BE COMPLETED IN ITS ENTIRETY AND SUBMITTED WITH YOUR BID.**
(If additional lines are needed, make copies of form.)

1. Define the terms of the standard warranty. If not offered, so state. (Attach copy)
The warranty for the WVDOH is 2 years, bumber to bumper.

2. Define warranty service to be performed at DOH facilities and warranty service to be performed at manufacturer's representative facility. List name and location of manufacturer's representative.
All warranty Service will be performed at the Manufacturer representative, Specialty Groups, Inc. less than 20 miles from the Buckhannon equipment Div.

3. List locations for parts inventories that are within the State of West Virginia. Also, list availability levels, if known.
Specialty Groups, Inc. Rt 20 & Raccoon Creek Road Harrison Co. All parts are available.

4. During the term of warranty, list the guarantee discount to manufacturer's published list price for parts that bidder will sell the parts to owner.

A. Terms: Net 30 — Manufacturer's published list price less: 1.5 % discount
B. Terms: Net 60 — Manufacturer's published list price less: 1.0 % discount
C. Terms: Net 90 — Manufacturer's published list price less: 0.5 % discount

5. During the term of warranty, will all manufacturers or engineering improvements be submitted to Division of Highways?
✓ YES _____ NO

6. During the term of warranty, list the guaranteed rates charged for repair to the unit.

A. Shop Rate — $ 70.00 per mechanic hour

B. Travel Time Charge — $ 50.00 per mechanic hour
(Specify if one-way) _____; port to port ✓

C. Mileage Charge — $ 2.00 per vehicle mile
(Specify if one-way _____; port to port ✓

D. Field Mechanic Rate — $ 80.00 per mechanic hour

E. Specify period of time that prices are in effect: 2 years from Bid

F. Surcharge for miscellaneous items: 20.0 %

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X6.6 EVALUATION COMMITTEE REQUIREMENTS

Is all component specifications, product literature, component models provided for Evaluation Committee bid determination? ✓ YES ____ NO

**X6.7 Will all parts, equipment, accessories, material, design and performance characteristics not specified herein, but which are necessary to provide a complete unit, be furnished with the unit and conform in strength, quality of material, and quality of workmanship to those which are advertised and provided to the market in general by the unit industry?**
**✓ YES ____ NO**

**X6.7.1 Are all parts and accessories adequate and regularly supplied as standard to be included except those which may be duplications of specifications herein, and except these by specification are not to be furnished?** **✓ YES ____ NO**

**X6.7.2 Are all standard safety features that are required by Federal and State statutes of law included?**
**✓ YES ____ NO**

X7.0 SPECIFICATIONS OF THE QUOTED UNIT

The bidder should complete the following schedule in order for the Division to compare the actual bid unit to the specifications. Should the bidder except a requirement, then such exception may be only on the basis that such feature is not offered by the manufacturer. **The Division will have the sole discretion as to whether the bidder's substitution meets the requirements of the specifications.**

**Does the trailer mounted attenuator provide the impact protection and deployment as detailed in Section 1.0 – Purpose** **✓ YES ____ NO**

Manufacturer: STI; Safety Trailers Inc Model: TTMA-100

**X7.1 Does the attenuator meet NCHRP (National Cooperative Highway Research Program) Report 350, Test Level 3 (TL-3) criteria** **✓ YES ____ NO**

**X7.2 The attenuator coupled to the truck has a skid distance of Ø feet when impacted at NCHRP Report 350, TL-3 Test 3-51 impact conditions** **✓ YES ____ NO**

X7.3 Is the attenuator designed to be used with any weight vehicle over 4500 Kg (9,920 lbs.)
✓ YES ____ NO

**X7.4 Is the attenuator designed to make attachment or detachment from the truck simple and fast**
**✓ YES ____ NO**

**X7.5 Is the attenuator frame capable of collapsing when impacted** **✓ YES ____ NO**

**X7.6** Does any portion of the TMA protrude under the truck damaging its vital elements during an impact 24
____ YES ✓ NO

**X7.7** Does the TMA impede the line of site of an arrow board or message board mounted on the truck
____ YES ✓ NO

X7.8 Major Components:

**X7.8.1** Does the trailer TMA consist of the following components:

**X7.8.1.1** Trailer frame assembly or support structure with articulating arms
✓ YES ____ NO

**X7.8.1.2** Two (2) bursting tubes or safe-stop 180/SST Type A and Type B cartridges
✓ YES ____ NO

**X7.8.1.3** Is axle assembly with axle push tubes required ✓ YES ____ NO
Axle assembly with axle push tubes, wheels, and tires ✓ YES ____ NO

**X7.8.1.4** Suspension or torsion axle ✓ YES ____ NO

**X7.8.1.5** Impact head or frame ✓ YES ____ NO

**X7.8.1.6** Intermediate frame ____ YES ✓ NO
Is it required ____ YES ✓ NO

**X7.8.1.7** Hitch assembly (lunette ring/pintle hook) design ✓ YES ____ NO

**X7.8.1.8** Two (2) tube bursting mandrels ✓ YES ____ NO
Are they required ✓ YES ____ NO

X7.9 Lights and visibility:

**X7.9.1** Does lighting assembly conform to FMVSS No. 108 "Lamps, Reflective Devices, and Associated Equipment"
✓ YES ____ NO

**X7.9.2** Do the lights include:

**X7.9.2.1** Brake lights ✓ YES ____ NO

**X7.9.2.2** Taillights ✓ YES ____ NO

**X7.9.2.3** Turn signals ✓ YES ____ NO

**X7.9.2.4** ICC bar lights ✓ YES ____ NO

**X7.9.3** Does a standard single, seven (7) pin connector make the connection for all lights
✓ YES ____ NO

**X7.9.4** Will conspicuity tape and reflectors be installed following the same standards as the lighting
✓ YES ____ NO

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X7.10 Jack:

**X7.10.1** **Will one (1) hand crank with swivel caster be supplied to facilitate removal from prime mover for storage** ✓ **YES** ____ **NO**

X7.11 Corrosion Protection:

**X7.11.1** **Are all components of the energy dissipation system hot dip galvanized or powder coated to prevent corrosion** ✓ **YES** ____ **NO**

X7.12 Product Approval:

**X7.12.1** **Does the trailer mounted attenuator pass the following test and have attached letter of approvals** ✓ **YES** ____ **NO**

**X7.12.1.1** **NCHRP – Report 350, Test Level 3** ✓ **YES** ____ **NO**

**X7.12.1.2** **Tests 3-50, 3-51, 3-52, and 3-53** ✓ **YES** ____ **NO**

**X7.12.1.3** **Is the unit on the West Virginia approval to use list** ____ **YES** ✓ **NO**

**If not have you contacted Traffic Engineering Division** ✓ **YES** ____ **NO**

X7.13 Dimensions and Weights:

**X7.13.1** **Height from ground:** 37 **inches**

**X7.13.2** **Width (at impact head or face):** 96 **inches**

**X7.13.3** **Length:** 23 **feet** 6 **inches**

**X7.13.4** **Weight (without optional equipment):** 1450 **lbs.**

X7.14 Does unit conform to advertising guidelines ✓ YES ____ NO

**X7.15 All other features considered as standard but not addressed:**

Please see attached literature

**X7.16 Preventive Maintenance and Operators Training School:**

**X7.16.1** **Have you attached a copy of proposed training program along with schedule of course. Will you furnish all training aids?** ✓ **YES** ____ **NO**

Specialty Groups, Inc.
PO Box 96
Bridgeport, WV 26330-0096

RFQ No. 708EC011 26

STATE OF WEST VIRGINIA
Purchasing Division

# PURCHASING AFFIDAVIT

**West Virginia Code §5A-3-10a states:** No contract or renewal of any contract may be awarded by the state or any of its political subdivisions to any vendor or prospective vendor when the vendor or prospective vendor or a related party to the vendor or prospective vendor is a debtor and the debt owed is an amount greater than one thousand dollars in the aggregate

**DEFINITIONS:**
"Debt" means any assessment, premium, penalty, fine, tax or other amount of money owed to the state or any of its political subdivisions because of a judgment, fine, permit violation, license assessment, defaulted workers' compensation premium, penalty or other assessment presently delinquent or due and required to be paid to the state or any of its political subdivisions, including any interest or additional penalties accrued thereon.

"Debtor" means any individual, corporation, partnership, association, limited liability company or any other form or business association owing a debt to the state or any of its political subdivisions. "Political subdivision" means any county commission; municipality; county board of education; any instrumentality established by a county or municipality; any separate corporation or instrumentality established by one or more counties or municipalities, as permitted by law; or any public body charged by law with the performance of a government function or whose jurisdiction is coextensive with one or more counties or municipalities. "Related party" means a party, whether an individual, corporation, partnership, association, limited liability company or any other form or business association or other entity whatsoever, related to any vendor by blood, marriage, ownership or contract through which the party has a relationship of ownership or other interest with the vendor so that the party will actually or by effect receive or control a portion of the benefit, profit or other consideration from performance of a vendor contract with the party receiving an amount that meets or exceed five percent of the total contract amount.

**EXCEPTION:** The prohibition of this section does not apply where a vendor has contested any tax administered pursuant to chapter eleven of this code, workers' compensation premium, permit fee or environmental fee or assessment and the matter has not become final or where the vendor has entered into a payment plan or agreement and the vendor is not in default of any of the provisions of such plan or agreement.

**LICENSING:** Vendors must be licensed and in good standing in accordance with any and all state and local laws and requirements by any state or local agency of West Virginia, including, but not limited to, the West Virginia Secretary of State's Office, the West Virginia Tax Department, West Virginia Insurance Commission, or any other state agencies or political subdivision. Furthermore, the vendor must provide all necessary releases to obtain information to enable the Director or spending unit to verify that the vendor is licensed and in good standing with the above entities.

**CONFIDENTIALITY:** The vendor agrees that he or she will not disclose to anyone, directly or indirectly, any such personally identifiable information or other confidential information gained from the agency, unless the individual who is the subject of the information consents to the disclosure in writing or the disclosure is made pursuant to the agency's policies, procedures and rules. Vendors should visit **www.state.wv.us/admin/purchase/privacy** for the Notice of Agency Confidentiality Policies.

Under penalty of law for false swearing (West Virginia Code, §61-5-3), it is hereby certified that the vendor acknowledges the information in this said affidavit and are in compliance with the requirements as stated.

Vendor's Name: Specialty Groups, Inc.

Authorized Signature: [signature] Date: 4-22-08

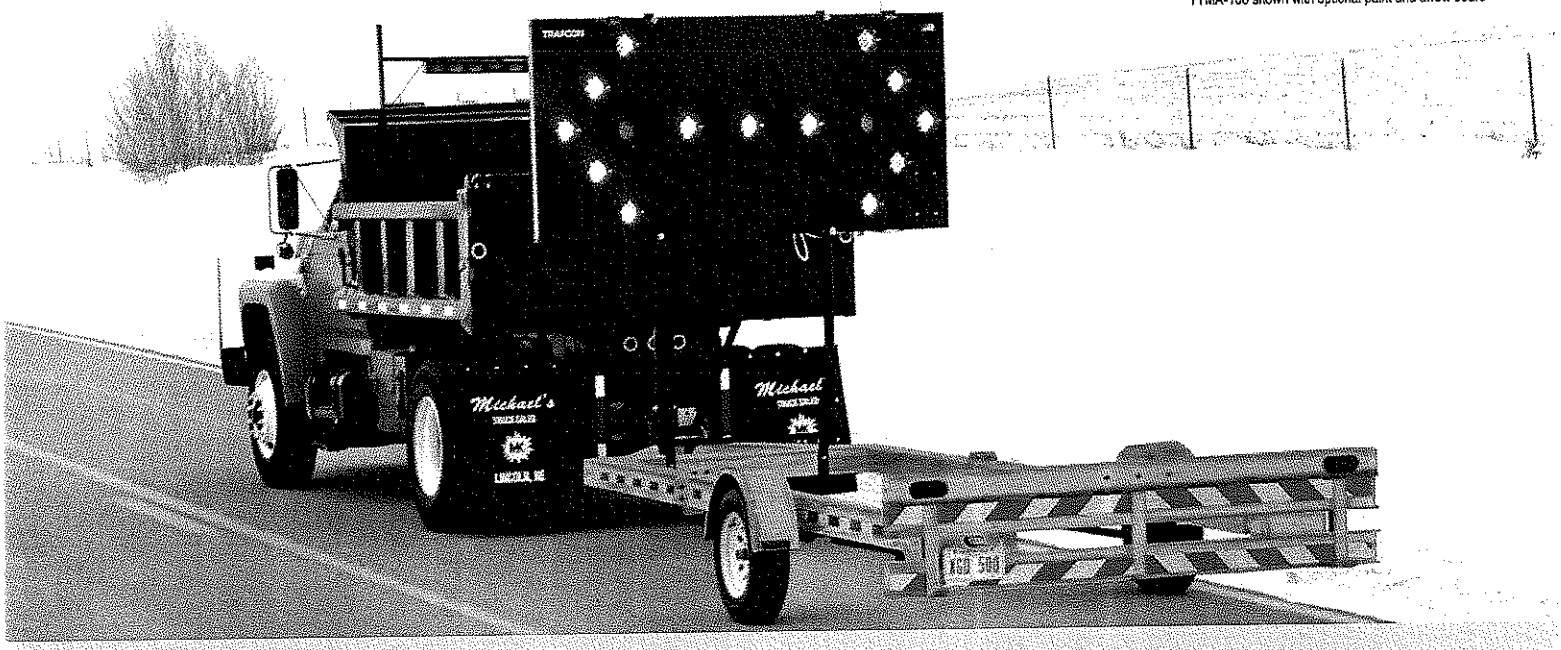
*Purchasing Affidavit (Revised 06/15/07)*

# TTMA-100

## Trailer Truck Mounted Attenuator

**INNOVATIVE - FLEXIBLE - AFFORDABLE**

TTMA-100 shown with optional paint and arrow board



**SAFETY TRAILER'S** innovative, flexible and affordable trailer truck mounted attenuator (TMA), **TTMA-100**, is the first approved hitch-mounted TL-3 TMA that can be used with almost any vehicle in your fleet from 10,000 lbs to unlimited GVW. Utilizing a standard 8-ton pintle hitch, the 1,450-lb TTMA-100 can be attached to the towing vehicle in a few minutes with absolutely no modification. The TTMA-100 offers the most affordable and flexible TMA safety on the market today.

### FEATURES & BENEFITS

- Patented tube bursting technology utilizes the trailer frame as the energy absorber thus *simplifying* the design and *reducing* cost.
- Meets all *required* and *optional* NCHRP 350 Test Level 3 (TL-3) test criteria with the support vehicle blocked to eliminate all forward movement (worse case scenario).
- Provides continuous protection at *all* times and speeds; no need to raise TMA to vertical position for transport; no overhead clearance issues.
- Can be used with *any* support vehicle of 10,000-lb GVW or more equipped with a standard 8-ton pintle hook.
- No maximum support vehicle weight limit.
- No need for dedicated support vehicle; change support vehicle in a matter of minutes.
- Fully galvanized for long-term moisture and corrosion protection; built to last.
- Can be attached directly to snow-plowing, and some sanding and salting equipment.
- Can be equipped with arrow board or variable message sign panels (optional).
- Field replacement components for low-cost in-field repair after nuisance hits.
- Tongue weight of only 200 lbs. does not significantly reduce the load carrying capacity of the support vehicle.
- Operates like any trailer and does not change the operating characteristics of the support vehicle.

### SPECIFICATIONS

- W 96 in. x H 31 in. x L 23 ft.-6 in.
- 1,450 lbs. (200 lb. tongue weight)
- 1,750 lbs. with arrow board
- (400 lb. tongue weight)
- 8-ton pintle hook - height 19.5 in. to 32 in.
- Hot-dip galvanized
- NCHRP 350 TL-3 compliant (passed all required and optional tests)

Can be purchased without arrow-

Shown attached to snow

Optional arrow board


**STI Safety Trailers Inc.**

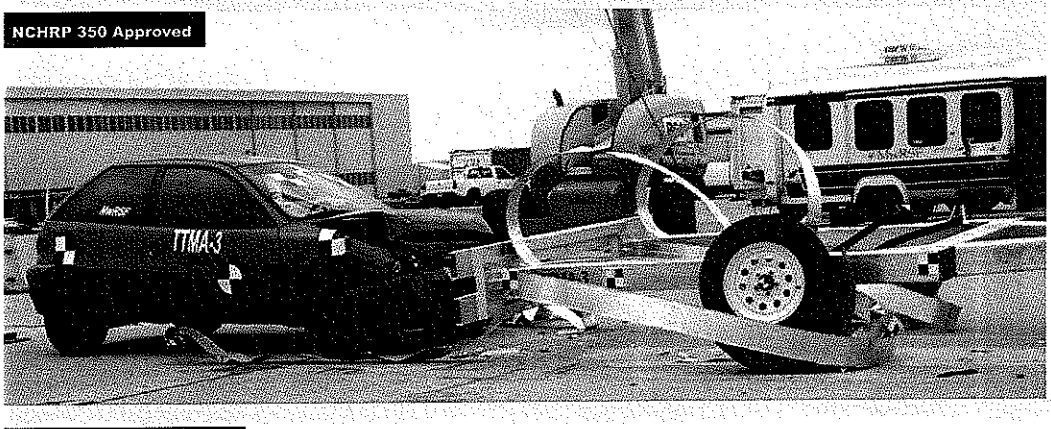
(210) 464-3465
FAX (210) 698-0556
www.safetytrailers.com

# TTMA-100

**Trailer Truck Mounted Attenuator**

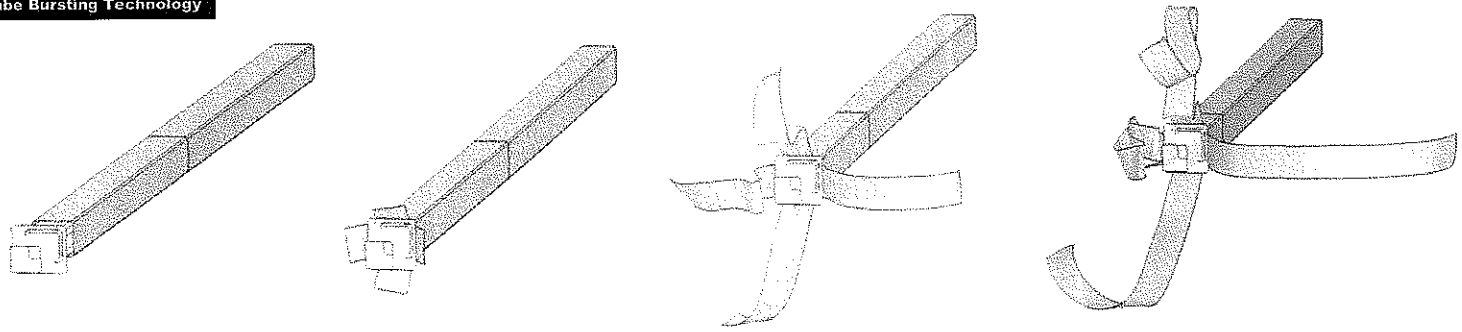
## TECHNICAL HIGHLIGHTS

NCHRP 350 Approved

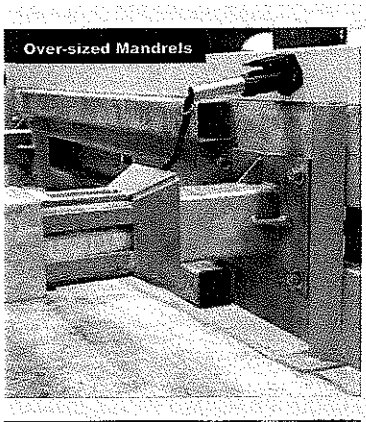



**NCHRP 350 TL-3 compliant.** Successfully passed all NCHRP 350 required and optional crash tests with the support vehicle blocked against all forward movement (worst case scenario) for test level 3 (TL-3) conditions at an impact speed of 62 mph. Photo shows result of small car head-on test. Note the relatively minor damage to the vehicle and lack of loose debris.

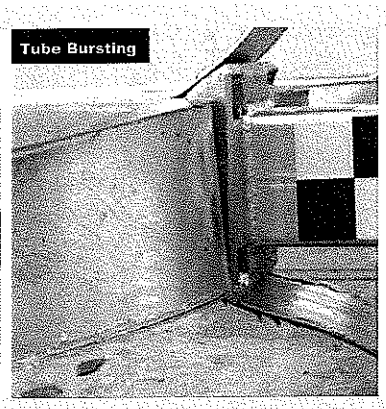
Tube Bursting Technology



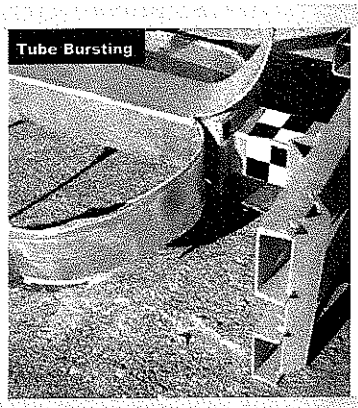
Over-sized Mandrels



Tube Bursting

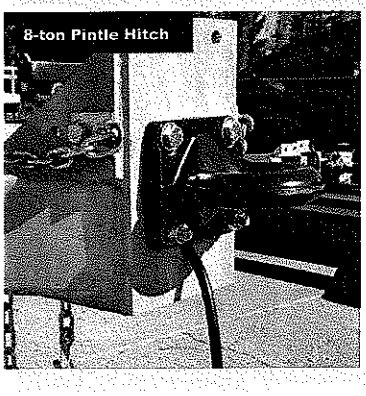


Tube Bursting

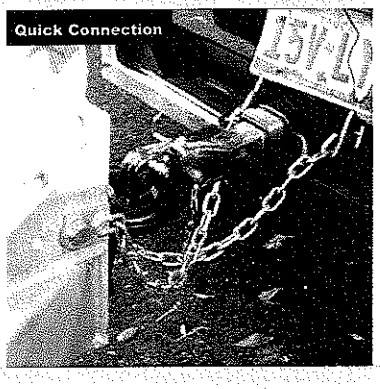


**Patented tube bursting technology.** As illustrated in the graphics above, an over-sized mandrel is pushed into the smaller tube and splits the tube into four straps of metal while dissipating the impact energy. The metal straps remain with the trailer and do not pose any hazard to adjacent traffic. This allows the trailer frame to also serve as the energy absorber, simplifying the design and reducing cost.

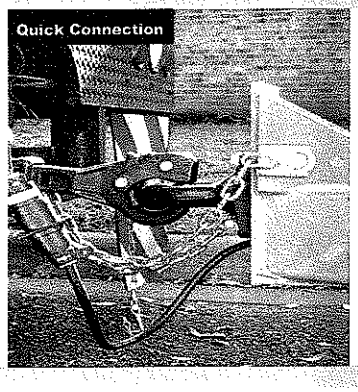
8-ton Pintle Hitch



Quick Connection



Quick Connection



**Flexibility.** Quick attachment to any support vehicle with GVW of 10,000 lbs or more (no maximum weight limit). Only a standard 8-ton pintle hitch is needed for towing with no vehicle modifications. no need for dedicated support vehicle. Low tongue weight does not significantly reduce load-carrying capacity of support vehicle.

**STI Safety Trailers Inc.**

**(210) 464-3465**
**FAX (210) 698-0556**
**www.safetytrailers.com**

**STI Safety Trailers, Inc.**

Innovative - flexible - affordable

## FEATURES & BENEFITS

- Patented tube bursting technology utilizes the trailer frame as the energy absorber, thus simplifying the design and reducing cost.
- Meets all required and optional NCHRP 350 Test Level 3 (TL-3) criteria with the support vehicle blocked to eliminate all forward movement (worse case scenario).
- Provides continuous protection at all times and speeds.
- No need to raise TMA to vertical position for transport; no overhead clearance issues.
- Can be used with any support vehicle of 10,000-lb GVW or more equipped with a standard 8-ton pintle hook.
- No modification of support vehicle required.
- No maximum support vehicle weight limit.
- No need for dedicated support vehicle; change support vehicle in a matter of minutes.
- Fully galvanized for long-term moisture and corrosion protection; built to last.
- Can be attached directly to snow plowing equipment and some sanding and salting equipment.
- Can be equipped with arrow board or variable message sign panels (optional) for improved conspicuity.
- Field replacement components for low-cost in-field repair after nuisance hits.
- Tongue weights of less than 200 lbs. empty and 500 lbs. with arrow board do not significantly reduce the load carrying capacity of the support vehicle.
- Operates like any trailer and does not change the operating characteristics of the support vehicle.
- Low cost starting at $13,900.

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

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

In Reply Refer To:
HSA-10/CC-90A

September 18, 2006

Dean L. Sicking, P.E., Ph. D.
CEO, Safety By Design Co.
5931 The Knolls
Lincoln, NE 68512

Dear Dr. Sicking:

In my April 15, 2005, acceptance letter to you, designated as HSA-10/CC90, I accepted your Burster Energy Absorbing Technology trailer TMA as a National Cooperative Highway Research Program (NCHRP) Report 350 truck-mounted attenuator at test level 3 (TL-3) based on successful completion of the mandatory TMA tests prescribed by Report 350. On June 21, 2006, I received a request that this device also be noted as having met the two optional tests identified in Report 350. With your letter, you sent copies of test reports and videotapes documenting the results of the two optional tests.

Staff review of the optional tests you conducted on modified versions of the original design raised questions concerning the use of these tests to certify the original design as meeting the evaluation criteria for the optional tests. Furthermore, although the support vehicle was blocked to prevent forward movement in both optional tests, the rear axle was lifted off the ground and the truck shifted several feet sideways in test 3-53, casting some doubt on the validity of the test to show that there was no upper weight limit to the support vehicle. After much discussion with my staff, it was mutually agreed that you would re-run test 3-53 using the original TMA design (with the relatively minor design changes as noted below) and with the support truck fully blocked to prevent motion in any direction. We agreed to accept the results of test 3-52 if the second test 3-53 was successful.

Your August 25, 2006, letter to Mr. Richard Powers of my staff transmitted the results of your second test. Enclosure 1 shows a drawing of your final design. You reported that this design differs from the originally accepted version in that the 1) the bolted splice in the middle of the first stage energy absorbing tube has been moved to the junction between the second and third stages and 2) the third stage energy absorbing tubes were scored over the first 305 mm (12 inches). Enclosures 2A-2C are the test summary sheets for test 3-52, the first 3-53 test, and the final 3-53 test on the modified original design, respectively.

I agree that the final design may be considered to meet all four Report 350 TMA tests and may be used with a support vehicle with no upper weight limit. Since the lowest acceptable weight limit has not been established through testing, it remains the manufacturer's responsibility to advise potential users of the TMA as to what lower limit is appropriate to ensure the safety of occupants of an impacting vehicle, the driver of the support truck, and other motorists and workers in the immediate area. Primary concerns with the use of a relatively light (and untested) support vehicle are the unknown post-crash stabilities and trajectories of both the impacting vehicle and the support truck.

Please note that the standard provisions to the Federal Highway Administration acceptance letters included in our original letter remain applicable to this modification as well.

Sincerely yours,

**/original signed by/**

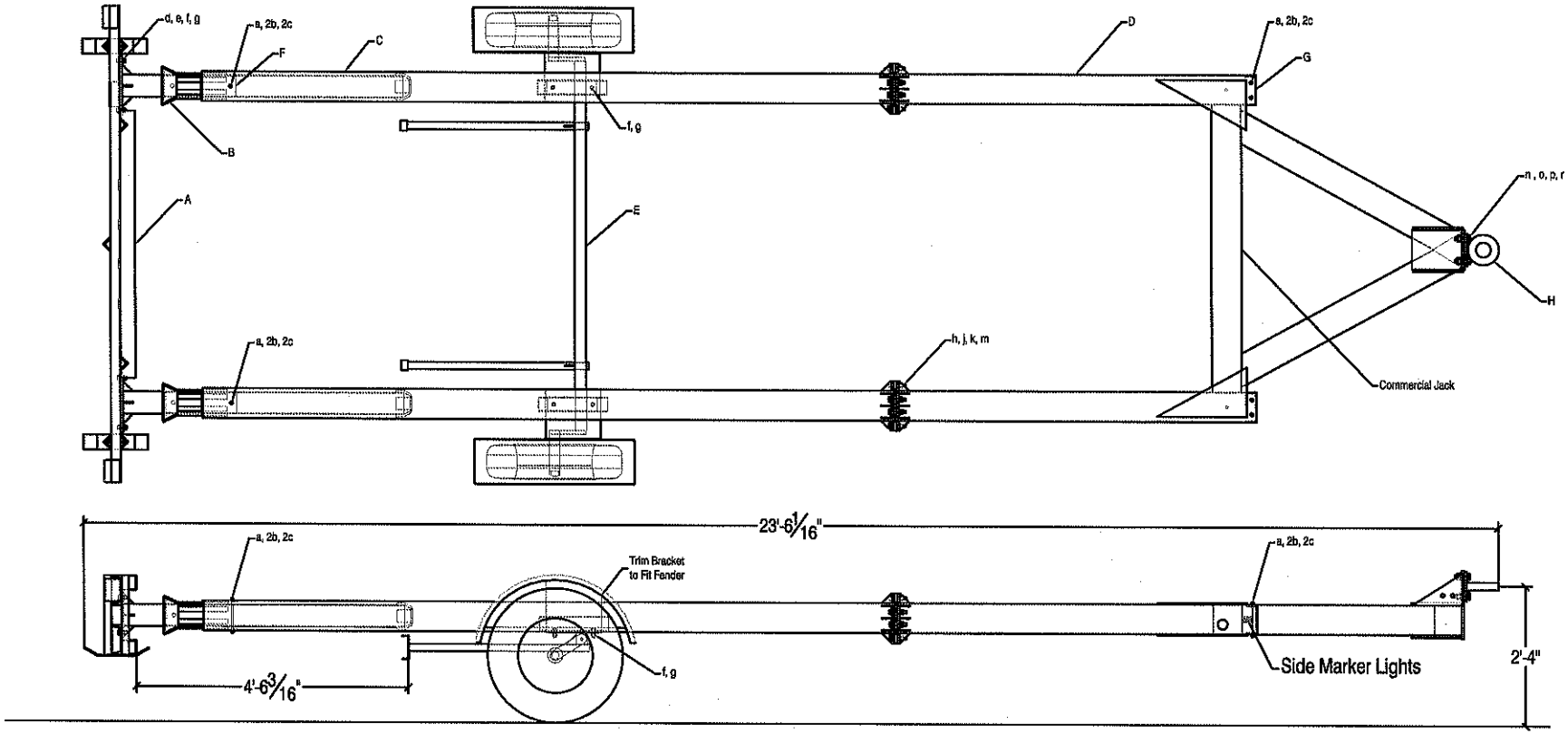
John R. Baxter, P.E.
Director, Office of Safety Design
Office of Safety

2 Enclosures

| ITEM | QTY | DESCRIPTION |
|---|---|---|
| a | 6 | 5/16" x 7" Grd 5 Thrd Rod |
| b | 12 | 5/16" Heavy Lock Washer |
| c | 12 | 5/16" Grd 5 Hex Nut |
| d | 8 | 1/2" x 1 1/2" Grd 5 Hex Bolt |
| e | 8 | 1/2" Washer |
| f | 12 | 1/2" Heavy Lock Washer |
| g | 12 | 1/2" Grd 5 Hex Nut |

| ITEM | QTY | DESCRIPTION |
|---|---|---|
| h | 16 | 9/16" x 3" Grd 5 Hex Bolt |
| j | 16 | 9/16" SAE Washer |
| k | 16 | 9/16" Heavy Lock Washer |
| m | 16 | 9/16" Grd 5 Hex Nut |
| n | 4 | 5/8" x 2 1/2" Grd 5 Hex Bolt* |
| o | 4 | 5/8" Washer |
| p | 4 | 5/8" Heavy Lock Washer |
| r | 4 | 5/8" Grd 5 Hex Nut |

| ITEM | QTY | DESCRIPTION |
|---|---|---|
| A | 1 | Impact Head |
| B | 2 | Bursting Mandrel |
| C | 2 | First Tube |
| D | 1 | Trailer Frame |
| E | 1 | Axle Assembly |
| F | 4 | Plastic Guide Plates |
| G | 2 | End Caps |
| H | 1 | Hitch Assembly |




**Safety Trailers, Inc.**
San Antonio, TX
Phone: 970 819 1741

**Safety Trailers, Inc.**
**Trailer TMA**

**Assembly**

Sheet: **100**

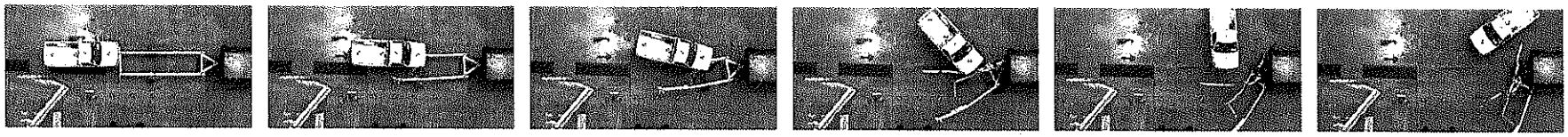
Date: 6/15/06

Drawing Name: TTMA - 100

Scale: NONE

By: JRR

Rev: 0



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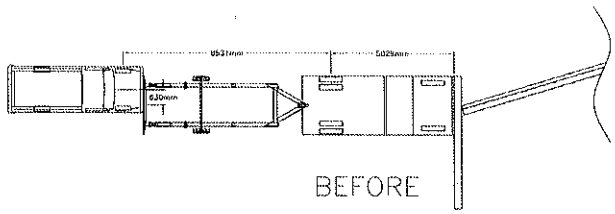
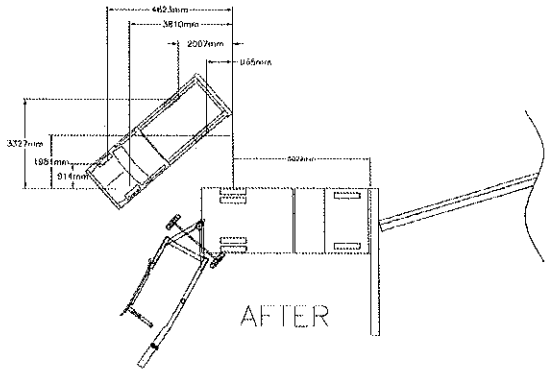
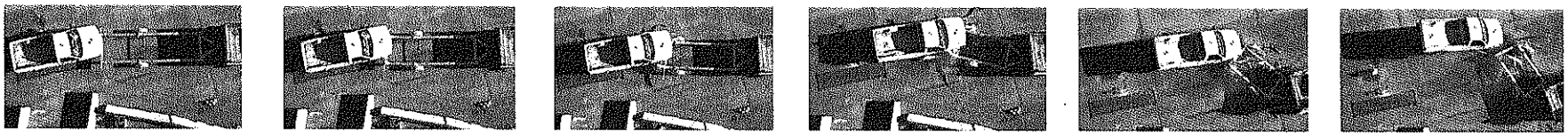



- Test Number ..... TTMA-5
- NCHRP 350 Test Designation ... 3-52
- Date ..... 7/29/05
- Test Article
  - Type ..... Trailer TMA
  - Key Elements ..... Trailer TMA impact head
    ..... Tubular steel frame
    ..... Trailer wheel and axle assembly
  - Orientation ..... Centerline offset by one-third of width
- Soil Type ..... NA
- Vehicle Model ..... 2000 Chevrolet C2500
  - Curb ..... 2,021 kg
  - Test Inertial ..... 2,024 kg
  - Gross Static ..... 2,024 kg
- Vehicle Speed
  - Impact ..... 102.1 km/h
  - Exit (not required) ..... NA
- Vehicle Angle
  - Impact (trajectory) ..... 1.3 deg
  - Exit (not required) ..... NA
- Vehicle Stability ..... Satisfactory
- Occupant Ridedown Deceleration (10 msec avg.)
  - Longitudinal ..... 14.30 g's < 20 g's
  - Lateral ..... 6.68 g's < 20 g's
- Occupant Impact Velocity
  - Longitudinal ..... 10.66 m/s < 12 m/s
  - Lateral ..... 1.04 m/s < 12 m/s
- Post-Impact Head Deceleration and Theoretical Head Impact Velocity
  - THIV ..... 10.75 m/s < 12 m/s (not req.)
  - PHD ..... 18.07 g's < 20 g's (not req.)
- Vehicle Damage ..... Moderate
  - TAD[8] ..... 12-FR-4
  - SAE[9] ..... 12FYEW3
  - OCDI ..... F000000000
- Vehicle Stopping Distance ..... 5.03 m downstream
- Test Article Damage ..... Moderate
- Maximum Deflection
  - Permanent Set ..... NA
  - Dynamic ..... NA
- Working Width ..... 7.86-m long by 12.78-m wide

Figure 19. Summary of Test Results and Sequential Photographs, Test TTMA-5



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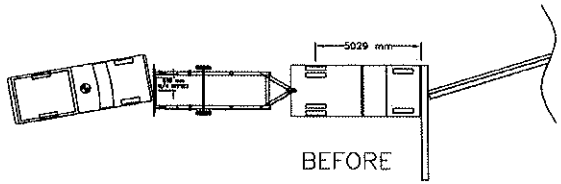
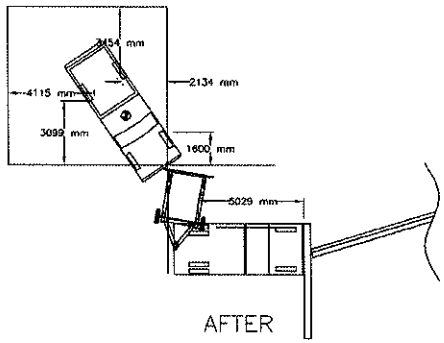
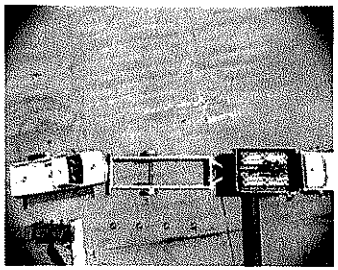



- Test Number ..... TTMA-7 (3-53)
- Date ..... 12/20/05
- Test Article
  - Type ..... Trailer TMA
  - Key Elements ..... Trailer TMA impact head
    Tubular steel frame
    Trailer wheel and axle assembly
  - Orientation ..... Centerline offset by one-fourth of width
- Soil Type ..... NA
- Vehicle Model ..... 1999 Chevrolet C2500
  - Curb ..... 1,956 kg
  - Test Inertial ..... 2,013 kg
  - Gross Static ..... 2,013 kg
- Vehicle Speed
  - Impact ..... 99.9 km/h
  - Exit ..... NA
- Vehicle Angle
  - Impact (trajectory) ..... 11.0 deg
  - Exit (trajectory) ..... NA
- Vehicle Stability ..... Satisfactory
- Occupant Ridedown Deceleration (10 msec avg.)
  - Longitudinal ..... 12.83 g's < 20 g's
  - Lateral ..... 9.15 g's < 20 g's
- Occupant Impact Velocity
  - Longitudinal ..... 10.80 m/s < 12 m/s
  - Lateral ..... 1.50 m/s < 12 m/s
- Post-Impact Head Deceleration and Theoretical Head Impact Velocity
  - THIV ..... 11.10 m/s < 12 m/s (not req.)
  - PHD ..... 14.31 g's < 20 g's (not req.)
- Vehicle Damage ..... Moderate
  - TAD[9] ..... 12-FR-4
  - SAE[10] ..... 12FZEW4
  - OCDI ..... F000000000
- Vehicle Stopping Distance ..... 7.38 m downstream
- Test Article Damage ..... Moderate
- Maximum Deflection
  - Permanent Set ..... NA
  - Dynamic ..... NA
- Working Width ..... 9.04 m long by 13.00 m wide

Figure 18. Summary of Test Results and Sequential Photographs, Test TTMA-7



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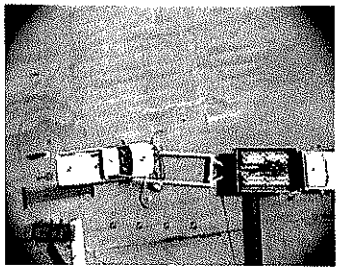

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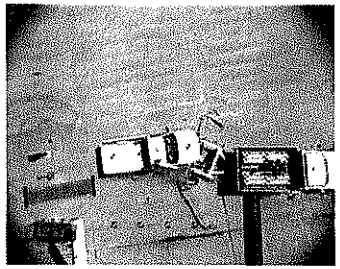

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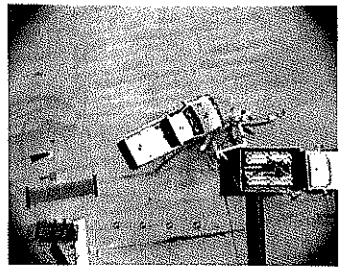

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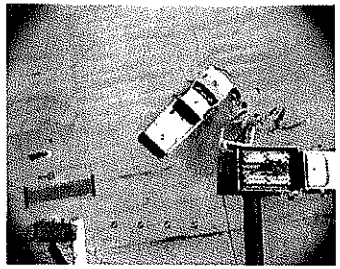

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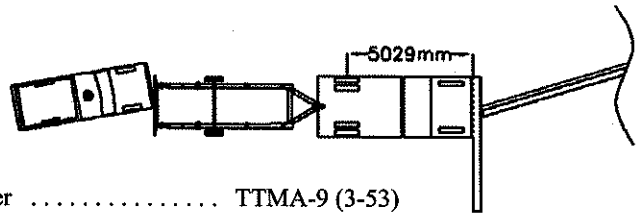
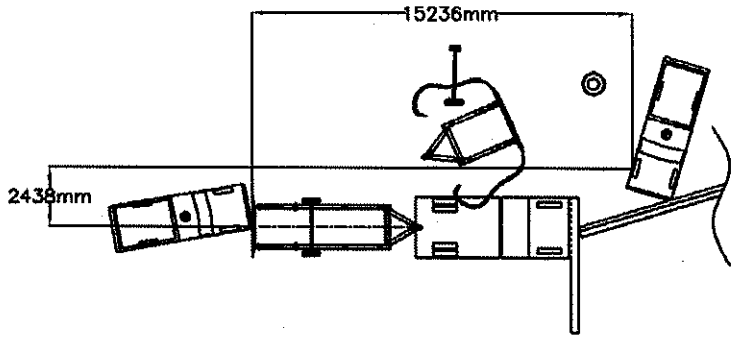



- Test Number ..... TTMA-9 (3-53)
- Date ..... 8/18/06
- Test Article
  - Type ..... Trailer TMA
  - Key Elements ..... Trailer TMA impact head
    Tubular steel frame
    Trailer wheel and axle assembly
  - Orientation ..... Centerline offset by one-fourth of width
  - Shadow Vehicle ..... Right-rear tire blocked against lateral movment
    Ballasted to total weight of 10,433 kg
- Soil Type ..... NA
- Vehicle Model ..... 1999 Chevrolet C2500
  - Curb ..... 2,105 kg
  - Test Inertial ..... 2,023 kg
  - Gross Static ..... 2,023 kg
- Vehicle Speed
  - Impact ..... 100.4 km/h
  - Exit ..... NA
- Vehicle Angle
  - Impact (trajectory) ..... 9.3 deg
  - Exit (trajectory) ..... NA
- Vehicle Stability ..... Satisfactory
- Occupant Ridedown Deceleration (10 msec avg.)
  - Longitudinal ..... -11.27 g's < 20 g's
  - Lateral ..... -6.43 g's < 20 g's
- Occupant Impact Velocity
  - Longitudinal ..... -9.21 m/s < 12 m/s
  - Lateral ..... -0.65 m/s < 12 m/s
- Vehicle Damage ..... Moderate
  - TAD[9] ..... 12-FD-4
  - SAE[10] ..... 12FDEW4
  - OCDI ..... F000000000
- Vehicle Stopping Distance ..... 15.24 m downstream
  2.44 m toward the left
- Test Article Damage ..... Moderate
- Maximum Deflection
  - Permanent Set ..... NA
  - Dynamic ..... NA
- Working Width ..... 18.33 m long by 14.93 m wide

Summary of Test Results and Sequential Photographs, Test TTMA-9

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

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

April 15, 2005

In Reply Refer To: HSA-10/CC-90

Dean L. Sicking, P.E., Ph.D.
CEO
Safety By Design Company
6307 Yellowstone Circle
Lincoln, Nebraska 68510

Dear Dr. Sicking:

In your March 10 letter, you provided design and crash test information on a Trailer Truck-Mounted Attenuator (TMA) and requested formal acceptance of this device for use on the National Highway System (NHS) at the National Cooperative Highway Research Program (NCHRP) Report 350 test level 3 (TL-3). To support your request, you also sent me a copy of the Midwest Roadside Safety Facility's February 28 report entitled "Performance Evaluation of the Trailer-Truck-Mounted Attenuator (Trailer TMA) – NCHRP 350 test nos. 3-50 and 3-51 (TTMA-3 and TTMA-4)" and videotapes of the crash tests conducted.

The Trailer TMA design is based on the bursting tube technology originally developed for the energy-absorbing terminal for box-beam guardrail and subsequently adopted for use on trailer-mounted changeable message signs/arrow boards. The Trailer TMA includes four major components: an impact head assembly, a trailer frame, a hitch assembly, and a breakaway axle assembly. The trailer frame incorporates three levels of energy absorption: (1) a 610-mm (24-in) long bursting tube fabricated from 152 mm x 152 mm x 3.2 mm (6 in x 6 in x 1/8 in) ASTM A500 Grade B structural tube, (2) a 2594-mm (9-ft, 6.125-in) long second stage bursting tube of the same size and material, and (3) an 1834-mm (6-ft, 3/16-in) 152 mm x 152 mm x 4.8 mm (6 in x 6 in x 3/16 in) ASTM A500 Grade B structural tube. The general design of the Trailer TMA is shown in Enclosure 1. As noted therein, the total length of the tested design is 7050 mm (23 ft, 1-9/16 in) and its width is 2438 mm (8 ft) at the impact plate assembly. The trailer frame is 464 mm (18.25 in) above the ground and the total weight of the TMA is approximately 640 kg (1410 lbs). I am assuming that users may obtain detailed drawings directly from you and that such drawings will accurately depict the device that was crash tested.

The safety performance of the Trailer TMA was verified through full-scale crash testing. Both mandatory NCHRP Report 350 tests required for a truck-mounted attenuator were conducted: the 820-kg car (test 3-50) and the 2000-kg pickup truck (test 3-51) impacting head-on at

100 km/h. Summary sheets for these two tests are shown in Enclosure 2. In both tests, the support truck was blocked to prevent any forward movement. Thus, there is no upper limit to the weight of the support vehicle with which the Trailer TMA is used.

Although TMAs may also be used with lighter support vehicles, potential users must be made aware that its use with a ***significantly*** lighter vehicle, while likely to decrease impact forces on the occupants of the errant vehicle, will increase the forces transmitted to the driver of a lighter support vehicle. It then becomes critical that the support vehicle has proper headrest supports and that the driver be securely belted. Furthermore, the support vehicle roll-ahead and the post-crash trajectories (particularly following off-center impacts) of both vehicles will differ considerably from those seen in tests with the "standard" 9000 kg (19,840 lbs) support vehicle. Thus, it is not recommended that any TMA be used with a support vehicle as light as a pickup truck without test verification.

You have also submitted results of a bogie test showing an offset impact with the device similar to optional test no. 3-52. While the results of the bogie test indicate that the device may meet Report 350 evaluation criteria under offset impact conditions, the two optional tests (nos. 3-52 and 3-53) recommended in Report 350 should be conducted to confirm that the device will perform satisfactorily in these two tests.

Based on the above, I conclude that your tested design meets the NCHRP Report 350 evaluation criteria for tests 3-50 and 3-51 and may be used on the NHS if such use is acceptable to the contracting agency.

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

- Our acceptance is limited to the crashworthiness characteristics of this device and does not cover its structural features or durability, or its conformity with the Manual on Uniform Traffic Control Devices insofar as impact face reflectorization is concerned.
- Any design changes that may adversely affect the crashworthiness of the device will require a new acceptance letter.
- Should the FHWA discover that the qualification testing was flawed, that in-service performance reveals unacceptable safety problems, or that the device being marketed is significantly different from the version that was crash tested, we reserve the right to modify or revoke our acceptance.
- This letter shall not be construed as authorization or consent by the FHWA to use, manufacture, or sell any patented device for which the applicant is not the patent holder. The FHWA is neither prepared nor required to become involved in issues concerning patent law. Any such issues that may arise are to be resolved by the applicant.
- You will be expected to supply potential users with sufficient information on design and installation requirements, including specifications for the support vehicle trailer hitch attachment, to ensure proper performance in a crash.
- 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 acceptance letter, designated as acceptance letter CC-90, shall not be reproduced except in full. This letter, and the 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 Trailer TMA is a patented device and is considered "proprietary." The use of proprietary hardware in a work zone on Federal-aid projects is generally of a temporary nature. These features are usually *selected by the contractor* for use as needed and removed upon completion of the project. Under such conditions they can be presumed to meet requirement (a) given below for the use of proprietary products on Federal-aid projects. On the other hand, if proprietary devices are *specified by a highway agency* for use on 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 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.

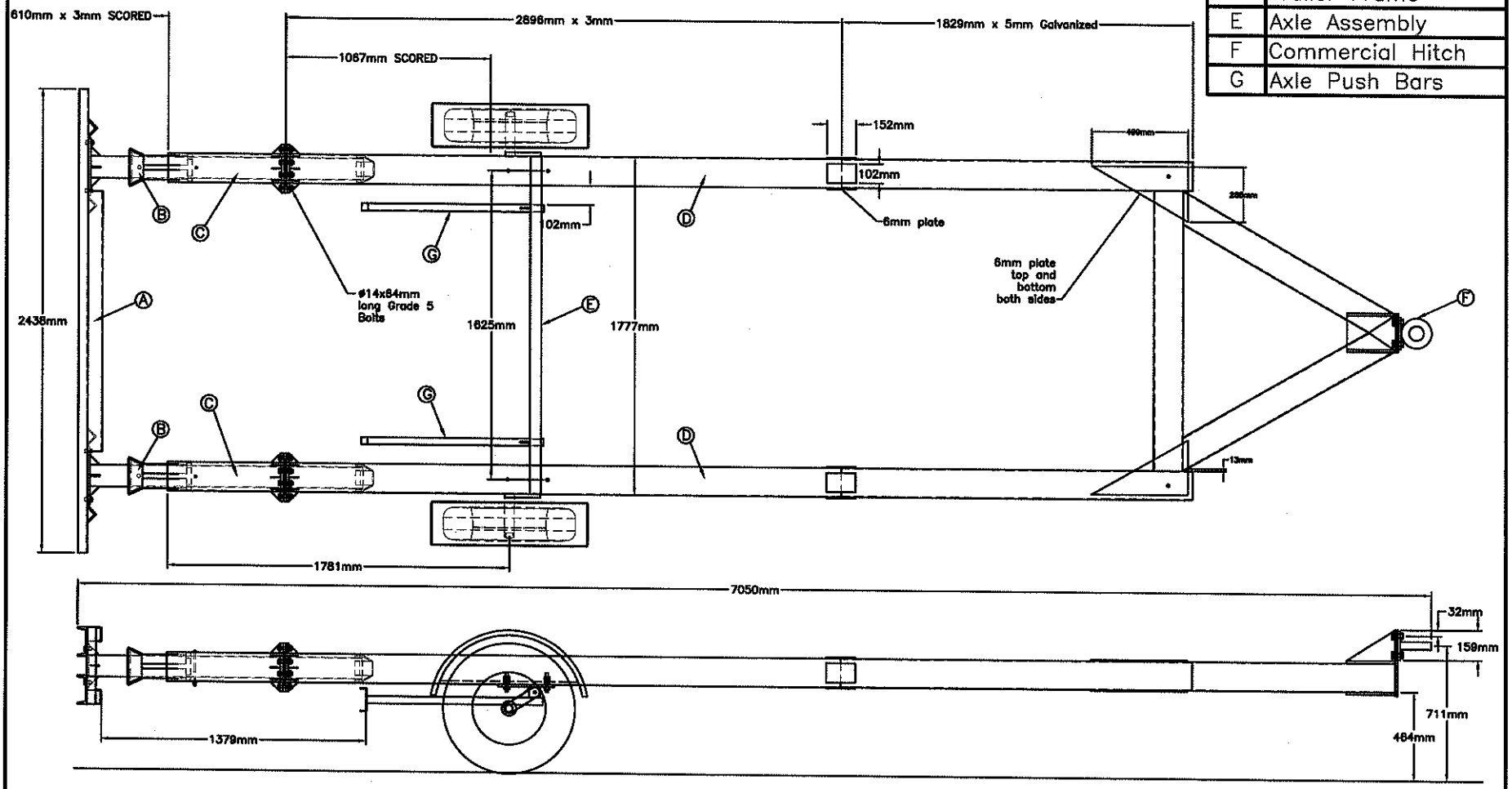
Sincerely yours,

***/original signed by/***

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

2 Enclosures

| ITEM | DESCRIPTION |
|---|---|
| A | Impact Head |
| B | Mandrel |
| C | First Tube |
| D | Trailer Frame |
| E | Axle Assembly |
| F | Commercial Hitch |
| G | Axle Push Bars |

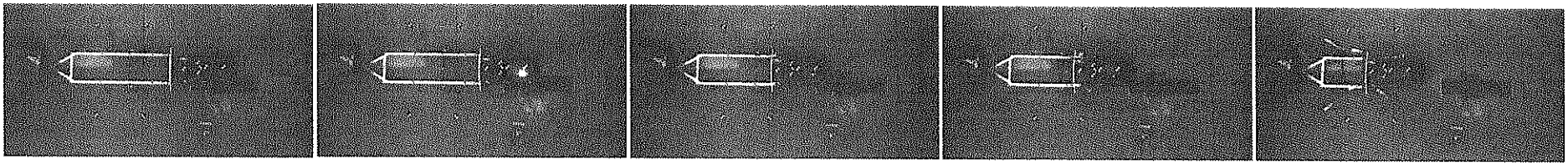



Midwest Roadside Safety Facility

Safety By Design Company
Trailer TMA

Layout

| | |
|---|---|
| Drawing Name: | TTMA-3 R2.dwg |
| Scale: | 1=30 |
| Sheet: | system |
| Date: | 01/26/2005 |
| By: | JRR |
| Rev: | |



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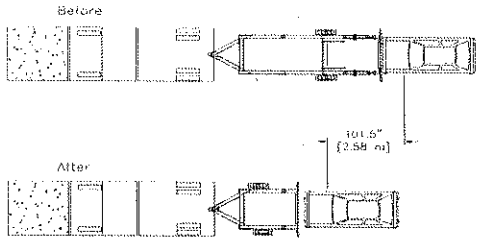
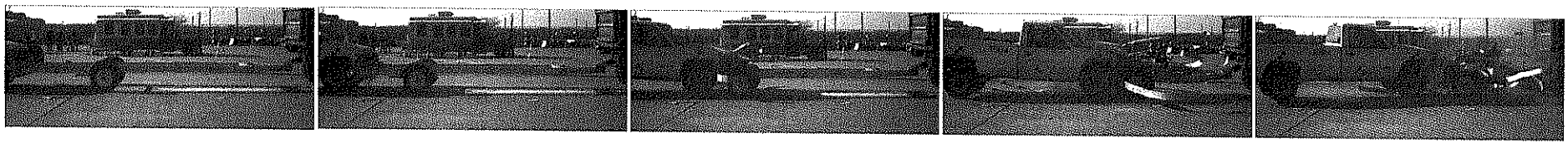
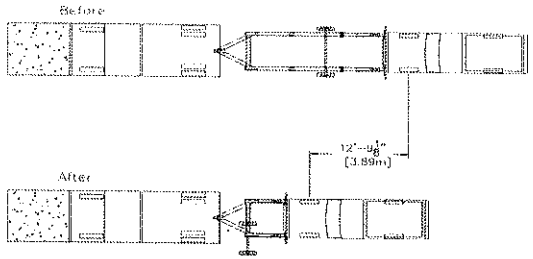



- Test Number ..... TTMA-3 (3-30)
- Date ..... 8/04/04
- Test Article
  - Type ..... Trailer TMA
  - Key Elements ..... Trailer TMA impact head
    Tubular steel frame
    Trailer wheel and axle assembly
  - Orientation ..... center of vehicle with center of TMA
- Soil Type ..... NA
- Vehicle Model ..... 1999 Geo Metro
  - Curb ..... 743 kg
  - Test Inertial ..... 821 kg
  - Gross Static ..... 897 kg
- Vehicle Speed
  - Impact ..... 96.0 km/h
  - Exit ..... 0.0 km/h
- Vehicle Angle
  - Impact (trajectory) ..... 0.13 deg
  - Exit (trajectory) ..... NA
- Vehicle Stability ..... Satisfactory
- Occupant Ridedown Deceleration (10 msec avg.)
  - Longitudinal ..... 11.86 g's < 20 g's
  - Lateral ..... 2.11 g's < 20 g's
- Occupant Impact Velocity
  - Longitudinal ..... 11.42 m/s < 12 m/s
  - Lateral ..... 0.02 m/s < 12 m/s
- Post-Impact Head Deceleration and Theoretical Head Impact Velocity
  - THIV ..... 11.41 m/s < 12 m/s (not req.)
  - PHD ..... 11.89 g's < 20 g's (not req.)
- Vehicle Damage ..... Moderate
  - TAD[7] ..... 12-FD-4
  - SAE[8] ..... 12FDEW2
- Vehicle Stopping Distance ..... 2.58 m downstream
- Test Article Damage ..... Moderate
- Maximum Deflection
  - Permanent Set ..... 3,102 mm
  - Dynamic ..... 3,077 mm
- Working Width ..... 6.97-m long by 5.05-m wide

Figure 21. Summary of Test Results and Sequential Photographs, Test TTMA-3



0.000 sec 0.038 sec 0.090 sec 0.210 sec 0.822 sec




- Test Number ..... TTMA-4 (3-51)
- Date ..... 12/14/04
- Test Article
  - Type ..... Trailer TMA
  - Key Elements ..... Trailer TMA impact head
    Tubular steel frame
    Trailer wheel and axle assembly
  - Orientation ..... center of vehicle with center of TMA
- Soil Type ..... NA
- Vehicle Model ..... 1999 GMC 2500
  - Curb ..... 1,955 kg
  - Test Inertial ..... 2,012 kg
  - Gross Static ..... 2,012 kg
- Vehicle Speed
  - Impact ..... 99.5 km/h
  - Exit ..... 0.0 km/h
- Vehicle Angle
  - Impact (trajectory) ..... 0.63 deg
  - Exit (trajectory) ..... NA
- Vehicle Stability ..... Satisfactory
- Occupant Ridedown Deceleration (10 msec avg.)
  - Longitudinal ..... 17.69 g's < 20 g's
  - Lateral ..... 4.11 g's < 20 g's
- Occupant Impact Velocity
  - Longitudinal ..... 8.59 m/s < 12 m/s
  - Lateral ..... 0.21 m/s < 12 m/s
- Post-Impact Head Deceleration and Theoretical Head Impact Velocity
  - THIV ..... 8.58 m/s < 12 m/s (not req.)
  - PHD ..... 17.72 g's < 20 g's (not req.)
- Vehicle Damage ..... Moderate
  - TAD[7] ..... 12-FD-3
  - SAE[8] ..... 12FDEW2
- Vehicle Stopping Distance ..... 3.89 m downstream
- Test Article Damage ..... Moderate
- Maximum Deflection
  - Permanent Set ..... 4,632 mm
  - Dynamic ..... 5,132 mm
- Working Width ..... 6.97-m long by 7.21-m wide

Figure 35. Summary of Test Results and Sequential Photographs, Test TTMA-4

**STI Safety Trailers, Inc.**
Innovative - flexible - affordable

# TTMA-100
# TECHNICAL SPECIFICATIONS

Trailer:

- Overall Dimensions:
  - Length ..... 23'-6"
  - Width ..... 8'-0"
  - Height (to top of impact head) ..... 31"
  - Height (to top of light bar) ..... 37"
  - Ground Clearance (to bottom of impact head) ..... 13"

- Capacity:
  - Trailer Weight (w/o Optional Equipment) ..... 1,450 lb
  - Approximate Tongue Weight (w/o Optional Equipment) ..... 190 lb
  - Minimum support truck weight ..... 10,000 lb
  - Maximum support truck weight ..... Unlimited

- Pintle Hook:
  - Hitch ..... Lunette ring with no other structural attachment
  - Capacity Rating (Minimum) ..... 8 tons
  - Mounting Height ..... 19.5"-32.0"

- Breakaway Axle:
  - Rating ..... 1,750 lb
  - Tire Size ..... 205/75D15
  - Rim Size ..... 15x5JJ
  - Cold Tire Inflation Pressure ..... 30 psi

- Lighting:
  - Lighting ..... Integrated light bar
  - Lighting standard ..... FMVSS 108

Construction:

- Frame ..... Open design
- All energy absorbing components ..... Heavy gage steel
- All structural members in impact system ..... Hot-dipped galvanized
- Axle ..... Mid-mounted breakaway
- Fender ..... Full-fender

Safety Performance:

- NCHRP 350 required tests ..... FHWA approved
- NCHRP 350 optional tests ..... FHWA approved
- Support truck weight - NCHRP Report 350 Tests 3-50 & 3-51 ..... Unlimited
- Support truck weight - NCHRP Report 350 Tests 3-52 & 3-53 ..... Unlimited
- Energy Absorbing System ..... Bursting Tube Technology

Warranty:

- Warranty against defects in material and workmanship ..... One year

STI Safety Trailers, Inc.
Innovative - flexible - affordable

# TTMA-100
# GENERAL SPECIFICATIONS

## I. Scope

These general specifications present product information for the Trailer Truck Mounted Attenuator, Model TTMA-100 manufactured, and distributed by Safety Trailers, Inc. (STI). The specifications include the following sections:

- Intended applications
- Support truck guidelines
- Product description
- Product approvals
- Product durability
- Mounting of optional equipment
- Dimensions and weight

## II. Intended Applications

The Trailer TMA is designed to protect motorists and workers in both moving shadow vehicle and stationary barrier vehicle applications. The TTMA has been successfully crash tested with both small car and pickup truck test vehicles impacting at speeds up to 62 mph. When properly deployed, the Trailer TMA will:

1. Reduce the severity of impact for occupants of errant vehicles that collide with the rear of a shadow or barrier vehicle.
2. Reduce crash severity for occupants of shadow vehicles.
3. Minimize or prevent damage to the shadow or barrier vehicle.
4. Reduce the time required to clear the accident scene and restore traffic flow.

The TTMA-100 utilizes the patented tube bursting technology to dissipate the energy in vehicular impacts. The structural tube rail members of the trailer also function as energy absorbers, thus simplifying the attenuator design and keeping the costs low.

Figure 1 illustrates the patented tube bursting process. An over-sized mandrel is inserted into the energy absorbing tube and held in place with a restraining or shear bolt. In a crash, the impacting vehicle would push the mandrel forward and shear off the restraining bolt. As the over-sized mandrel is pushed into the energy absorbing tube by the impacting vehicle, cracks would develop at the corners of the tube, splitting the tube into four straps, thus dissipating the energy.

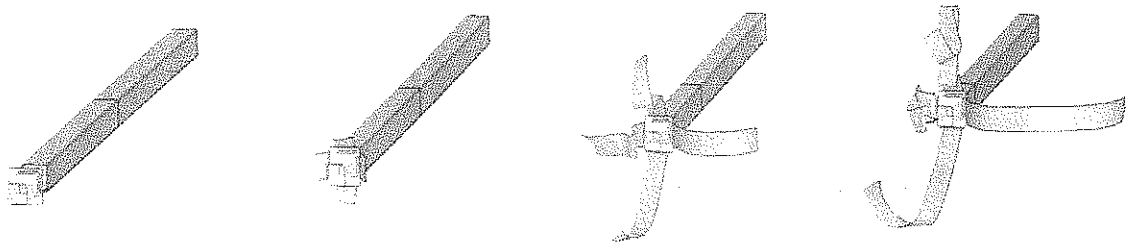


Figure 1. Tube Bursting Process

The straps would remain attached to the tube, thus there are no detached elements. Also, the straps have no structural strength and do not pose any hazard for the impacting vehicle, the shadow vehicle, or workers and others in the immediate vicinity of the impact. The level of energy dissipation is controlled by the tube thickness, the length of the tube sections, and scoring of the tubes. This allows the Trailer TMA to be designed to provide a smooth deceleration to the impacting The straps remain attached to the tube, thus there are no detached elements. Also, the straps have no structural strength and do not pose any hazard for the impacting vehicle, the shadow vehicle, or workers and others in the immediate vicinity of the impact. The level of energy dissipation is controlled by the tube thickness, the length of the tube sections, and scoring of the tubes. This allows the Trailer TMA to be designed to provide a smooth deceleration to the impacting vehicle.

## III. Support Truck Guidelines

The TTMA-100 may be attached directly to the work truck or to a support truck that serves as a barrier or moving shadow vehicle. In either case, the minimum weight of the tow vehicle should be 10,000 lbs. FHWA does not recommend the use of any TMA system with the support truck weighing less than 10,000 lbs due to concern over the potential for high roll-ahead distance that could pose a hazard to workers and others in the path of the support truck. In general, lighter support trucks would increase the risk to shadow vehicle operators and the vehicle roll-ahead distance during an impact. Note that support truck drivers should utilize an adequate head rest, lap belt, and shoulder harness at all times, regarding of the support truck weight.

On the other hand, heavier support trucks would increase the deceleration rate and the impact force on the occupants of the impact vehicle. A support weight of 20,000 lbs is used in all of the NCHRP Report 350 required and optional crash tests. The TTMA-100 is the only TMA design that has utilized a support truck blocked against forward motion to simulate an infinitely heavy vehicle in all of the NCHRP Report 350 required and optional crash tests. All other trailer and conventional TMA systems have utilized a 20,000 lb truck in at least some of their crash tests. Therefore, the TTMA-100 is the only system that can be safely used on support trucks weighing more than 20,000 lbs. In fact, there is no upper limit on the acceptable support truck weight for the TTMA-100.

The distance between the shadow vehicle and work zone activities should be maintained at acceptable minimums to prevent the support truck from rolling into workers or other

construction equipment. Support truck roll-ahead distance is a function of the weight and speed of both the shadow truck and the impacting vehicle. Table 1 shows calculated shadow vehicle roll-ahead distances for a variety of shadow and impacting vehicle weights and impact speeds. Roll-ahead calculation procedures were adapted to include the weight of the Trailer TMA and are based upon a shadow vehicle speed of 15 mph.

Table1. Calculated Roll-Ahead Distances for Shadow Vehicles (Moving at 15 mph).

| Support Truck Weight, lb | Traffic Operating Speed, mph | Impact Vehicle Weight, lb | | | |
|---|---|---|---|---|---|
| | | 4500 | 10000 | 15000 | 24000 |
| 10,000 | 65 | 119′ | 205′ | 261′ | 333′ |
| | 55 | 97′ | 158′ | 198′ | 247′ |
| | 45 | 77′ | 118′ | 143′ | 174′ |
| 15,000 | 65 | 93′ | 161′ | 211′ | 278′ |
| | 55 | 78′ | 127′ | 162′ | 209′ |
| | 45 | 65′ | 97′ | 120′ | 150′ |
| 24,000 | 65 | 71′ | 118′ | 157′ | 215′ |
| | 55 | 62′ | 97′ | 124′ | 165′ |
| | 45 | 54′ | 77′ | 96′ | 122′ |
| 40,000 | 65 | 56’ | 86’ | 112’ | 155’ |
| | 55 | 50’ | 73’ | 92’ | 123’ |
| | 45 | 45’ | 61’ | 74’ | 95’ |
| 60,000 | 65 | 48’ | 68’ | 86’ | 118’ |
| | 55 | 44’ | 60’ | 73’ | 96’ |
| | 45 | 41’ | 52’ | 61’ | 77’ |
| 80,000 | 65 | 44’ | 59’ | 73’ | 97’ |
| | 55 | 41’ | 53’ | 63’ | 81’ |
| | 45 | 39’ | 47’ | 54’ | 67’ |

Calculated roll-ahead distances for stationary barrier vehicles utilizing a Trailer TMA are shown in Table 2. When the Trailer TMA is attached to a stationary barrier vehicle, the support truck should be placed in second gear with the parking brake fully engaged. In order to minimize barrier truck roll-ahead distance, the vehicle's parking brake should be maintained in good operating condition.

Table 2. Calculated Roll-Ahead Distances for Barrier Vehicles.

| Support Truck Weight, lb | Traffic Operating Speed, mph | Impact Vehicle Weight, lb | | | |
|---|---|---|---|---|---|
| | | 4500 | 10000 | 15000 | 24000 |
| 10,000 | 65 | 38′ | 103′ | 152′ | 216′ |
| | 55 | 27′ | 74′ | 109′ | 155′ |
| | 45 | 18′ | 50′ | 73′ | 104′ |
| 15,000 | 65 | 22′ | 68′ | 108′ | 166′ |
| | 55 | 16′ | 49′ | 77′ | 119′ |
| | 45 | 11′ | 33′ | 52′ | 80′ |
| 24,000 | 65 | 11′ | 38′ | 65′ | 111′ |
| | 55 | 8′ | 27′ | 47′ | 80′ |
| | 45 | 6′ | 18′ | 32′ | 54′ |
| 40,000 | 65 | 5’ | 18’ | 34’ | 64’ |
| | 55 | 4’ | 13’ | 24’ | 46’ |
| | 45 | 3’ | 9’ | 16’ | 31’ |
| 60,000 | 65 | 3’ | 10’ | 19’ | 38’ |
| | 55 | 2’ | 7’ | 13’ | 27’ |
| | 45 | 2’ | 5’ | 9’ | 18’ |
| 80,000 | 65 | 2’ | 6’ | 12’ | 25’ |
| | 55 | 1’ | 5’ | 9’ | 18’ |
| | 45 | 1’ | 3’ | 6’ | 12’ |

The Trailer TMA is attached to the tow vehicle using a standard pintle hook rated at 8 tons or more. Otherwise, no other modification is needed for the tow vehicle for use with the TTMA-100. The pintle hook must be securely mounted to an appropriately strong structural component on the frame of the support truck. The pintle hook should be mounted at a nominal height of approximately 28 in. The pintle hook height, after ballast is added to the support truck, must be maintained between 20 and 32 in. The lunette ring should be placed in the lower mounting holes when the pintle hook is mounted between 20 and 26 in. and in the upper mounting holes when the pintle hook is mounted between 26 and 32 in. The support truck must be equipped with a standard wiring connector to power the Trailer TMA marker and brake lights. The trailer can be supplied with any standard 4, 6, or 7 pin connector.

Connecting the Trailer TMA to a tow vehicle is a simple task that involves the following steps and takes only a few minutes:

1. Move the tow vehicle or the trailer so that the lunette ring on the trailer is lined up with the pintle hook on the tow vehicle. Note that, when the TTMA-100 is not in use, the trailer is kept at a horizontal position with a trailer jack located on the cross member of the A-frame.
2. Place the lunette ring in the truck's pintle hook and close the hook.
3. Connect the trailer lighting connector and attach the safety chains.
4. Raise the trailer jack to a horizontal position and the trailer is ready for operation.

The light weight of the Trailer TMA at 1,450 lbs and its very low tongue weight of approximately 200 lbs make the connection process very quick and easy. Even with the addition of the optional arrow board and mount, the tongue weight is still below 500 lbs, thus not significantly affects the load carrying capacity of the support truck,

## IV. Product Description

A. Major Components

The Trailer TMA incorporates the following major components:

1. A-frame assembly
2. Energy absorbing tubes
3. Axle assembly with push rods
4. Fender, wheel and tire assembly
5. Mandrels
6. Impact Head

B. General Assembly

The two energy absorbing tubes are attached to the A-frame assembly with a special splice connection. The A-frame and the two energy absorbing tubes serve as the primary longitudinal frame elements as well as the primary energy dissipation system. The axle assembly is bolted onto the energy absorbing tube and includes: the axle, fenders, and wheels and tires. There are also two push rods welded to the axle. The impact head would contact these push rods and break away the axle prior to the impact head reaching the axle. Two over-sized mandrels are inserted into the two energy absorbing tubes on one end and attached to the impact plate on the other end. A lunette ring is attached to the end of the A-frame assembly for connection to the tow vehicle equipped with a standard 8 ton or larger pintle hook.

C. Trailer TMA Function

The Trailer TMA is designed to safely attenuate passenger vehicle impacts on the rear of the trailer. When a vehicle strikes the rear of the trailer, the impact head is forced forward and it drives the tube bursting mandrels into the bursting tubes. Energy dissipation by the bursting tubes provides a controlled deceleration of the impacting vehicle. As the tube bursting mandrels continue forward, they contact axle shear

connectors and fracture the bolts holding the trailer axle to the bursting tubes. Shortly thereafter, the trailer's impact head contacts the axle push tubes and moves the axle toward the front of the trailer. For high energy impacts, the impact head will continue forward until the bursting tubes are completely ruptured. If needed, the side rails of the trailer frame assembly will then begin to burst and the energy dissipation will continue until the impacting vehicle is brought to a safe stop.

During high energy impact testing, the Trailer TMA proved to be capable of attenuating all of the impact energy without producing any damage to undercarriage, suspension, or tires of the tow vehicle. Structural components of the Trailer TMA should be not forced under the support vehicle during high energy passenger vehicle impacts.

During moderate energy impacts, trailer damage should be limited to the two bursting tubes which can be easily replaced. This process involves removing the impact head, tube bursting mandrels, and the axle assembly from the trailer by removing four bolts and pulling the system apart. The damaged bursting tubes will then need to be replaced and the axle, tube bursting mandrels and impact head can be re-attached. Note that the trailer wiring and light system must be carefully inspected and any needed repairs made before placing the restored trailer back into service. Complete repair should be accomplished with simple hand tools and the appropriate replacement parts.

The trailer is capable of absorbing low-speed impacts up to 5 mph without sustaining any damage.

D. Lights and Visibility

The TTMA-100 is equipped with the following items to enhance the visibility and conspicuity of the trailer:

- An integrated light bar bolted to the top of the impact head,
- Side lights and markers,
- Reflective tapes on the sides, and
- Chevron panels on the face of the impact head. The chevron panels have highly reflective sheeting and may be ordered in the following color combination: yellow/black, white/orange or white/red stripes.

The lighting assembly meets, and actually exceeds, the lighting requirements set forth under FMVSS No. 108, "Lamps, Reflective Devices, and Associated Equipment." It should be borne in mind that FMVSS 108 represents a minimum requirement. Any modification or additions to the lighting, marker, and reflectivity should conform to these specifications.

E. Corrosion Protection

All components of the energy dissipation system, including the impact head, tube bursting mandrels, bursting tubes, and trailer frame assembly are hot-dip galvanized to

prevent corrosion. Bolts and other exposed attachment hardware are also galvanized where possible to prevent corrosion.

## V. Product Approvals

The TTMA-100 was approved by the Federal Highway Administration (FHWA) as a Test Level-3 (TL-3) Trailer Truck Mounted Attenuator (TMA) in a letter dated April 15th, 2005. It has also been recognized by FHWA as meeting the TL-3 optional tests set forth in NCHRP Report 350 in a letter dated September 18th, 2006. Many states do not require individual approval of TMA systems and rely only on FHWA approval. The TTMA-100 is now fully qualified for use in all of these states.

Safety Trailers Inc. is pursuing approval in every state where a separate approval process is required. If your state requires individual approval of TMA's and the Trailer TMA is not listed on the appropriate approved product list, please call Safety Trailers, Inc. at (210)-464-3465 for information regarding approval status in your state.

## VI. Product Durability

The TTMA-100 has been subjected to extensive road testing at both high and low speed operations on both paved and unpaved roadways. This testing has shown no evidence of fatigue failure of any components of the Trailer TMA. Safety Trailers Inc. is also conducting vibration testing of the trailer to assure that no fatigue problems develop. If your state requires special testing of TMA durability, please contact Safety Trailers Inc. for help in testing the new Trailer TMA to meet any state standards and gaining the needed state approval.

## VII. Optional Equipment

The Trailer TMA is designed to accommodate optional flashing arrow boards and variable message signs attached to the front of the trailer. A specially designed arrow board support mount is available as optional equipment.

Note that the TTMA-100 has not been crash tested with an arrow board and Safety Trailers, Inc. has not sought FHWA approval. Supports for an arrow board or variable message sign support are only subjected to impact loads when the TTMA-100 and the support truck are accelerated forward during a crash. All crash tests of the TTMA-100 were conducted with the support truck blocked to simulate infinite weight. Hence, the TTMA-100 was not subjected to high accelerations that would cause problems for an arrow board or VMS. However, design loads for the TTMA-100's sign mounting system were obtained from the highest sustained accelerations measured during test 3-51. This maximum acceleration was converted to an equivalent force that was then applied to the lightest allowable support truck and trailer combination, a 10,000-lb truck with a 1,400-lb trailer. The trailer acceleration resulting from this level of applied force was then used as a design load when analyzing the stresses in the sign mounting system.

It is important to note that this procedure for estimating sign support loading is very conservative. Forces applied to an impacting vehicle are greatly reduced when the support truck

is allowed to roll ahead. Therefore, when attached to a lighter support truck, actual accelerations on the trailer and support truck combination are much lower than those used in the sign support design process and the loading of the sign support system would be much lower. Users wishing to supply a different mounting system must design it to withstand a 10 g acceleration with the sign in the maximum height configuration without collapse.

Note that the wiring harness supplied with the Trailer TMA provides a convenient power source for an arrow board, VMS sign, or other warning device.

The TTMA-100 should not used to carry any equipment other than the optional arrow board or variable message sign. It is recommended that the users to contact Safety Trailers Inc. for additional advice if additional equipment is attached to the trailer.

## VIII. Dimensions and Weight

The TTMA-100 has an overall length of 23 ft-6 in. and an overall width of 8 ft-0 in. The trailer has a very low profile, with a maximum height of 31 in. to the top of the impact head and 37 in. to the top of the integrated light bar. The ground clearance to the bottom of the impact head is 13 in. This low profile allows excellent visibility for any optional equipment, such as a flashing arrow board attached to the front of the trailer.

The weight of the TTMA-100 without any optional equipment is approximately 1,450 lbs with a tongue weight of 190 lbs. With the optional arrow board and mount, the total weight is still under 2,000 lbs and the tongue weight is under 500 lbs.

## IX. Warranty

There is a one-year warranty against defects in material and workmanship.

# STI Safety Trailers, Inc.

**Innovative, Flexible and Affordable**

# TTMA-100

# User's Manual

**Safety Trailers, Inc.**
9 Cotswold Lane
San Antonio, TX 78257
(210) 464-3465
www.safetytrailers.com

January 2008

# FOREWORD

Thank you for your purchase of the Trailer Truck Mounted Attenuator, Model 100, from Safety Trailers, Inc. (herein referred to as the TTMA-100). The TTMA-100 is a Test Level 3 (TL-3) crash cushion designed for use with a support truck in both stationary and moving work zones. We are committed to providing our customers with highway safety products that have the best performance and value for your money, as well as the highest level of customer service. The TTMA-100 is one of the most innovative TMA's in the market, offering a higher level of performance with heavy tow vehicles and requiring no modification of the tow vehicle. It has successfully passed all required and optional crash tests set forth in NCHRP Report 350 and is fully approved for use on the National Highway System by the Federal Highway Administration.

This manual has been written to help you with the operation and maintenance of the TTMA-100. Please read and understand the recommendations contained in this manual thoroughly before use, and keep it handy for future reference. If you have any questions or comments regarding the operation and maintenance of this product, please do not hesitate to contact us by telephone at (210)-464-3465, e-mail at technical@safetytrailers.com, or conventional mail at 9 Cotswold Lane, San Antonio, TX 78257.

This manual is divided into five sections:

- TTMA Design and Major Components. An overview of the Trailer TMA design and major components are presented in this section, including the product specifications and parts list. Also, instructions for wiring the trailer plug for connection to the tow vehicle are provided.

- How It Works. A brief explanation of the innovative features of the TTMA-100 and how it works to absorb and dissipate the energy from an impacting vehicle are outlined and illustrated in this section.

- Operation Guidelines. Guidelines pertaining to the operation of the Trailer TMA are presented in this section, such as minimum support truck weight, roll-ahead distances, connections, and other operational items.

- Maintenance Guidelines. Considerations on the routine maintenance of the Trailer TMA are outlined in this section.

- Repair of Damaged Trailer. Discussion of impacts by an errant vehicle and the associated repair and replacement of trailer parts are presented in this section.

# CUSTOMER SERVICE CONTACTS

Safety Trailers, Inc. is committed to providing the best service and care to our customers. You are automatically registered with your purchase and you will be notified of any future changes or upgrades to the TTMA-100. If you have any comments or questions regarding this product, please contact STI via telephone, e-mail or conventional mail:


Telephone: (210)-464-3465; Monday to Friday, 9:00 a.m. to 5:00 p.m. Central Time.

Fax: (210) 698-0556

Email: technical@safetytrailers.com

Web Site: http://www.safetytrailers.com

Mail: Safety Trailers, Inc.
9 Cotswold Lane
San Antonio, TX 78257.

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# TTMA-100 DESIGN AND MAJOR COMPONENTS

## GENERAL

A schematic of the TTMA-100 is shown in Figure 1. The major components of the TTMA-100, as shown in Figure 1, are as follows:

| Component | Description |
|---|---|
| A | Impact Head |
| B | Bursting Mandrel |
| C | First Energy Absorbing Tube |
| D | Trailer Frame |
| E | Axle Assembly |
| F | Plastic Guide Plates |
| G | End Caps |
| H | Hitch Assembly |
| J | Spacer |
| K | Jack Assembly |

Table 1 presents the technical specifications for the Trailer TMA, including:

- Overall dimensions,
- Capacity of the trailer,
- Capacity and mounting height of the pintle hook.
- Information on the axle assembly,
- Construction of the trailer.
- Safety performance of trailer, and
- Warranty.

Table 2 provides a list of parts with legends and part numbers. Please refer to these part numbers and legends for ordering of spare parts. Note that this is not a complete parts list. Please inquire about the complete parts list and pricing from the manufacturer, distributor, or reseller of the Trailer TMA.

Figure 2 shows the schematic of the wiring details of the Trailer TMA. Also, detailed instructions on the wiring of the trailer TMA are provided in a separate Wiring Manual and will not be repeated herein. However, the trailer TMA is fully wired at the time of delivery. The only item that may require attention of the user is the wiring of the trailer plug for connection to the tow vehicle. More detailed instructions on are provided in the next section.

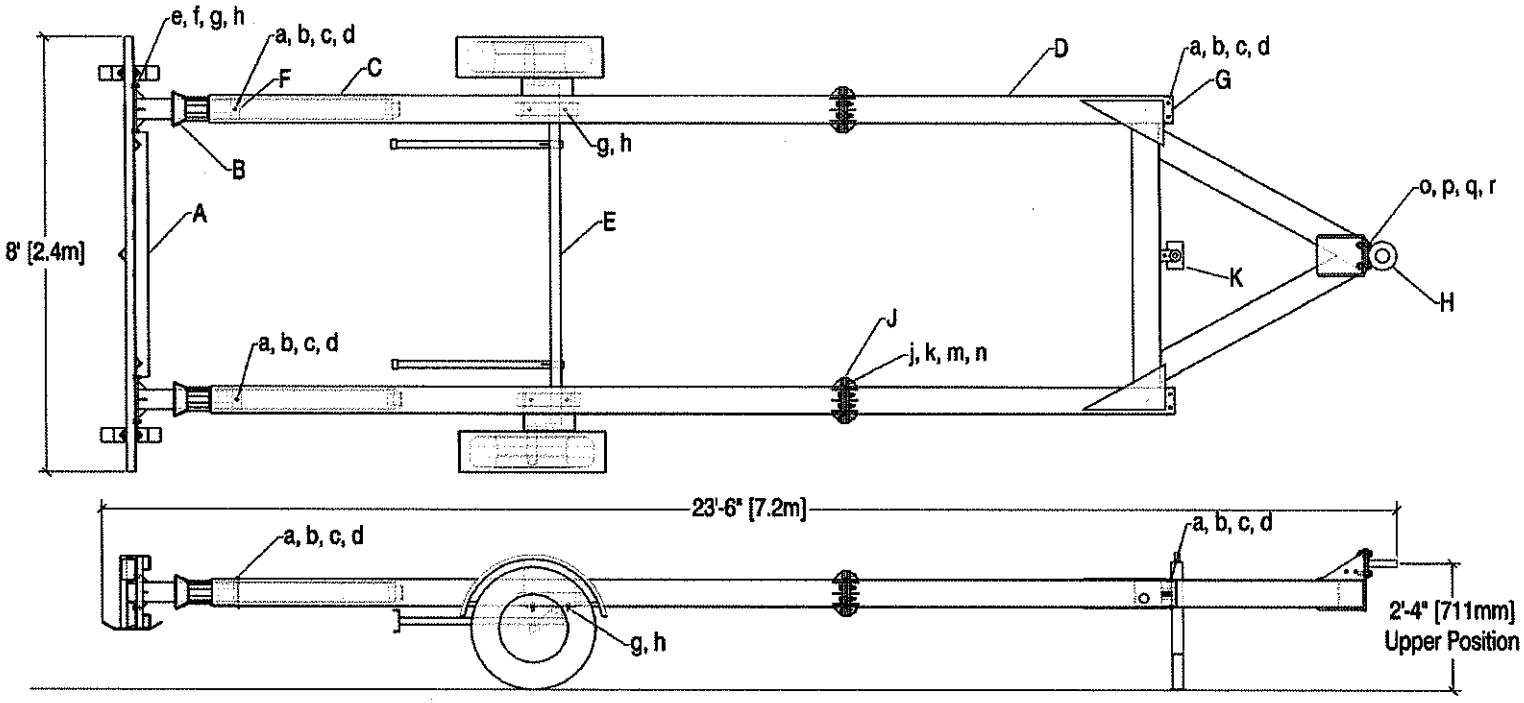



Figure 1. Schematic and Parts Layout of TTMA-100

## Table 1. TTMA-100 Technical Specifications

**Trailer:**

- Overall Dimensions:
  - Length ..... 23'-6"
  - Width ..... 8'-0"
  - Height (to top of impact head) ..... 31"
  - Height (to top of light bar) ..... 37"
  - Ground Clearance (to bottom of impact head) ..... 13"

- Capacity:
  - Trailer Weight (w/o Optional Equipment) ..... 1,450 lb
  - Approximate Tongue Weight (w/o Optional Equipment) ..... 190 lb
  - Minimum support truck weight ..... 10,000 lb
  - Maximum support truck weight ..... Unlimited

- Pintle Hook:
  - Hitch ..... Lunette ring with no other structural attachment
  - Capacity Rating (Minimum) ..... 8 tons
  - Mounting Height ..... 19.5"-32.0"

- Breakaway Axle:
  - Rating ..... 1,750 lb
  - Tire Size ..... 205/75D15
  - Rim Size ..... 15x5JJ
  - Cold Tire Inflation Pressure ..... 30 psi

- Lighting:
  - Lighting ..... Integrated light bar
  - Lighting standard ..... FMVSS 108

**Construction:**

- Frame ..... Open design
- All energy absorbing components ..... Heavy gage steel
- All structural members in impact system ..... Hot-dipped galvanized
- Axle ..... Mid-mounted breakaway
- Fender ..... Full-fender

## Table 1. TTMA-100 Technical Specifications (Continued)

**Safety Performance:**

- NCHRP 350 required tests ..... FHWA approved
- NCHRP 350 optional tests ..... FHWA approved
- Support truck weight – NCHRP Report 350 Tests 3-50 & 3-51 ..... Unlimited
- Support truck weight – NCHRP Report 350 Tests 3-52 & 3-53 ..... Unlimited
- Energy Absorbing System ..... Bursting Tube Technology

**Warranty:**

- Warranty against defects in material and workmanship ..... One year

## Table 2. Trailer Component And Parts List

| ITEM | PART # | QUANTITY | DESCRIPTION |
|---|---|---|---|
| | | **TRAILER COMPONENTS** | |
| A | T100A | 1 | Impact Head |
| B | T100B | 2 | Bursting Mandrel |
| C | T100C | 2 | First Stage Energy Absorber |
| D | T100D | 1 | Trailer A-Frame |
| E | T100E | 1 | Axle Assembly |
| F | T100F | 4 | Plastic Guide Plates |
| G | T100G | 2 | End Caps |
| H | T100H | 1 | Hitch Assembly |
| J | T100J | 8 | Spacer |
| K | T100K | 1 | Jack Assembly |
| | | **HARDWARE ITEMS** | |
| a | B0516070A | 6 | 5/16" x 7" Grade 5 Hex Bolt |
| b | W0516 | 6 | 5/16" Washer |
| c | LW0516A | 6 | 5/16" Heavy Lock Washer |
| d | N0516A | 6 | 5/16" Grade 5 Hex Nut |
| e | B0816020A | 8 | 1/2" x 2" Grade 5 Hex Bolt |
| f | W0816 | 8 | 1/2" Washer |
| g | LW0816A | 12 | 1/2" Heavy Lock Washer |
| h | N0816A | 12 | 1/2" Grade 5 Hex Nut |
| j | B0916030A | 16 | 9/16" x 3" Grade 5 Hex Bolt |
| k | W0916S | 16 | 9/16" SAE Washer |
| m | LW0916A | 16 | 9/16" Heavy Lock Washer |
| n | N0916A | 16 | 9/16" Grade 5 Hex Nut |
| o | B1016025A | 4 | 5/8" x 2 1/2" Grade 5 Hex Bolt |
| p | W1016 | 4 | 5/8" Washer |
| q | LW1016A | 4 | 5/8" Heavy Lock Washer |
| r | N1016A | 4 | 5/8" Grade 5 Hex Nut |

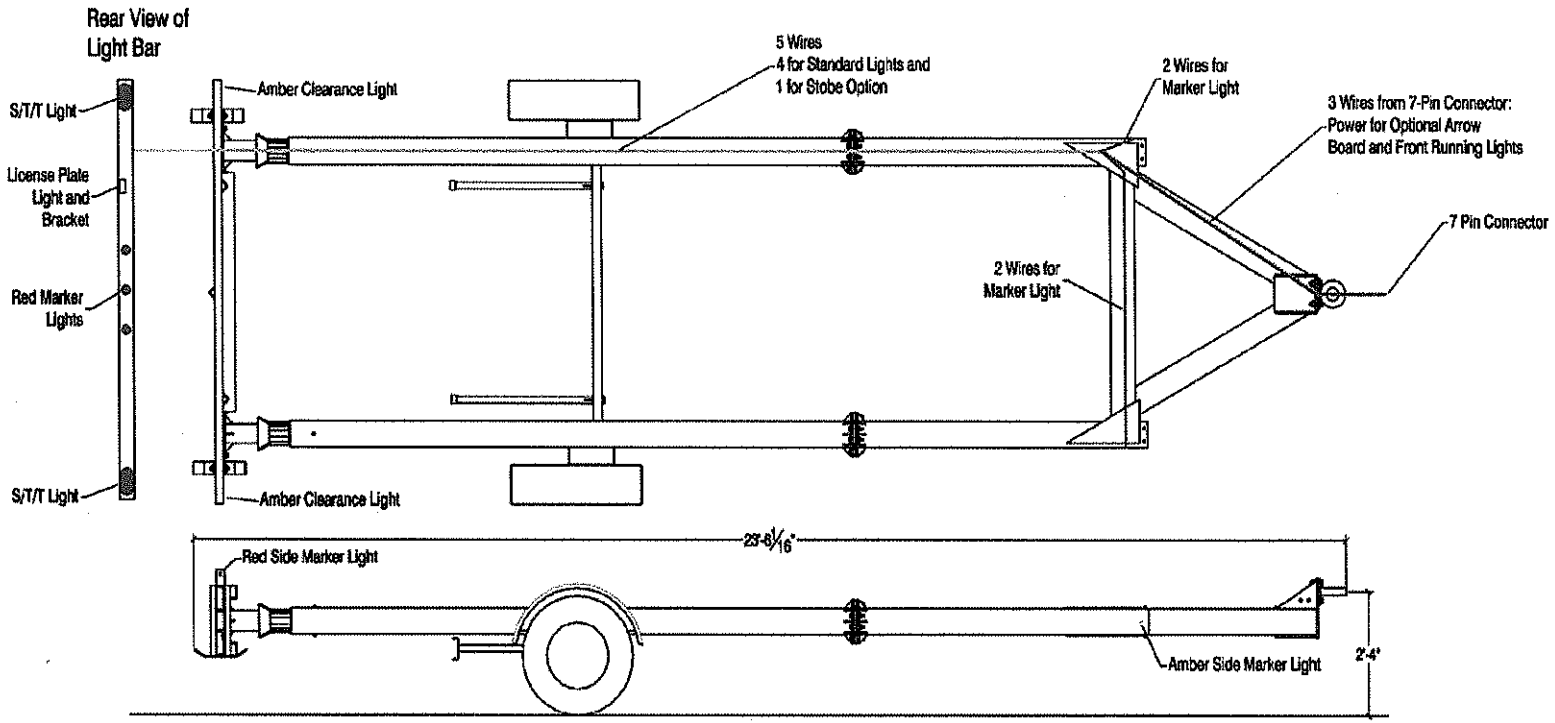



Figure 2. TTMA-100 Wiring and Light Layout

## WIRING INSTRUCTIONS

As mentioned previously, the only item that may require attention of the user is the wiring of the trailer plug for connection to the tow vehicle. There are two distinctly different wire plugs that are not compatible, one is the RV plug and the other is the heavy duty truck plug. It is necessary to first determine which type of plug is used with the tow vehicle, i.e., an RV plug or a heavy duty truck plug. The shapes of the two plug types are easier distinguishable as shown Figure 3. Also, the RV plug uses blades and the truck plug uses round pins. Note that the wiring scheme for the two plug types are totally different, details of which are shown in the following tables.

RV Plug

Heavy Duty Truck Plug

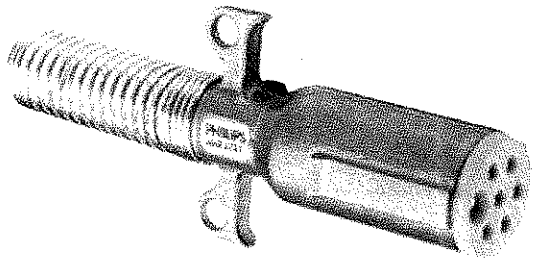
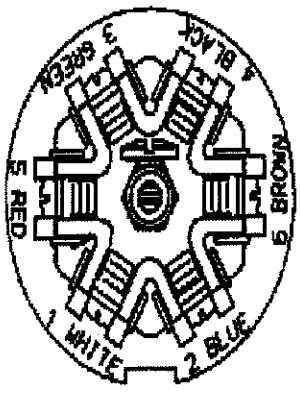


**Figure 3. Photographs of RV and Heavy Duty Truck Plugs**

Figure 4 shows the different standard wiring layouts for the RV plug and the heavy duty truck plug. Details of the wiring layouts are shown in Table 3.

RV Plug




Heavy Duty Truck Plug

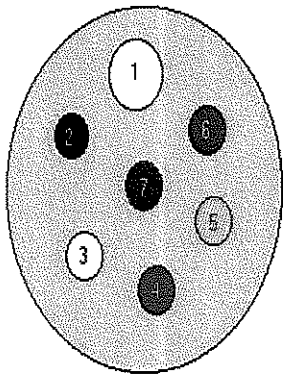



**Figure 4. Standard Wiring Layouts of RV and Heavy Duty Truck Plugs**

## Table 3. Standard Wiring Layouts of RV and Heavy Duty Truck Plugs

### RV Plugs with Separate Brake Wire

| Function | Trailer Wire Color | Plug Labels | |
|---|---|---|---|
| | | Number | Color |
| Common Ground | White | 1 | White |
| Auxiliary | Black | 2 | Black |
| Left Turn | Yellow | 3 | Yellow |
| Brake light | Red | 4 | Red |
| Right Turn | Green | 5 | Green |
| Tail/Marker lights | Brown | 6 | Brown |
| 12V Power supply | Blue | 7 | Blue |

### Heavy Duty Truck Plugs

| Function | Trailer Wire Color | Plug Labels | |
|---|---|---|---|
| | | Number | Color |
| Common Ground | White | 1 | White |
| Brake light | Red | 2 | Blue |
| Tail/Marker lights | Brown | 3 | Green |
| 12V Power supply | Blue | 4 | Black |
| Left Turn | Yellow | 5 | Red |
| Right Turn | Green | 6 | Brown |
| Auxiliary | Black | 7 | (center) |

Note that the above wiring patterns represent standard wiring for the tow vehicle. The above pattern may need to be adjusted if the tow vehicle does not use standard wiring.

# HOW IT WORKS

## TUBE BURSTING TECHNOLOGY

The TTMA-100 uses a patented tube bursting technology to dissipate the energy of the impacting vehicle. The basic concept is quite simple. When a tapered mandrel with a square cross-section is forced into a square tube with smaller inside dimensions, the mandrel pushes against the inside of the tube. The outward forces on the inside of the tube concentrate stresses in the corners, creating a controlled cracking of the steel. As the mandrel proceeds forward, the tube is split into four flat straps of metal that are curled outward by the flared portion of the mandrel. The graphics shown in figure 5 illustrate this bursting process.

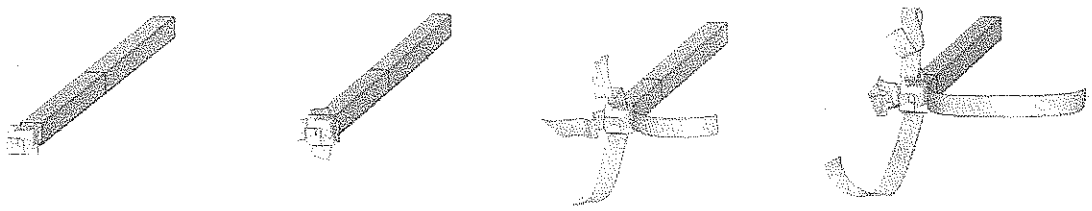
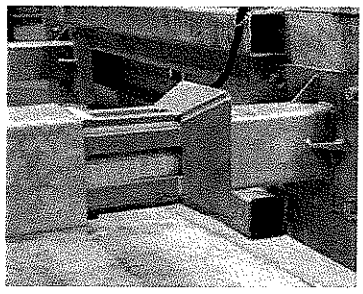
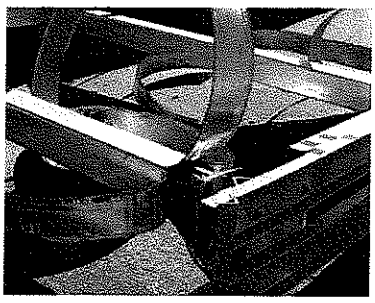


**Figure 5. Tube Bursting Process**

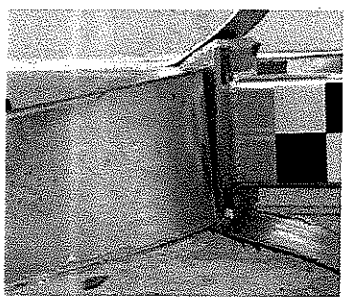
The setup of the mandrel and the actual bursting process are demonstrated in the photographs shown in Figure 6.



Tapered and over-sized mandrel inserted into the energy absorbing tube.



The mandrel cracks the energy absorbing tube at the corners and split it into four flat straps of metal.



Close-up view of mandrel and energy absorbing tube.

**Figure 6. Photographs Illustrating the Bursting Process**

This bursting process, i.e., cracking of the tube at the corners and splitting it into four straps of flat metal, dissipates the energy of the impacting vehicle. The level of energy dissipation can be regulated by using different thickness of tubing and scoring of the tube, i.e., cutting grooves into the tubes at the corners reduce the energy dissipated during cracking. By adjusting the level of energy dissipation and the lengths of the energy absorbing tubes, the amount of energy dissipation and the rate of vehicle deceleration can be controlled to bring the impacting vehicle to a gradual and safe stop.

Tube bursting technology allows the TTMA-100 to use the trailer frame as the energy absorber, thus eliminating the need for a separate energy absorbing material. This simplifies the design and reduces the costs of the TTMA-100. Also, the straps of metal have no structural strength and curl up and away from the impacting vehicle, thus eliminating any hazard posed to the impacting vehicle. Furthermore, the straps of metal remain securely attached to the un-bursted section of the tube. Thus there are no detached elements that can be thrown forward and pose hazard to workers and adjacent traffic.

## PINTLE HOOK ATTACHMENT

Another major improvement in TMA safety technology is the TTMA-100's ability to rotate. While competing trailer attenuators utilize rotational restraints to prevent the attenuator from rotating, the TTMA-100 allows the trailer to rotate in order to keep the system aligned with the impacting vehicle to maximize energy dissipation. It is this innovative approach to energy management that has allowed the TTMA-100 to become the only TMA system to successfully pass NCHRP Report 350 optional offset and angled tests when attached to a support truck blocked against forward motion.

The primary concern about allowing a trailer to rotate is that the impacting vehicle could push the trailer out of its path and directly strike the rear of the support truck. However, as shown in Figure 7, an impacting vehicle must slide along the trailer's impact face in order to disengage from the trailer.

The patented innovation that eliminates this risk is the way the TTMA-100 engages an impacting vehicle. The TTMA-100's impact plate is designed to capture the front of a vehicle and lock the trailer between the impacting vehicle and the tow vehicle. The TTMA-100's impact head, shown in Figure 8, utilizes vertical steel angles to prevent impacting vehicles from sliding horizontally along the face of the trailer. The impact head also utilizes steel channels with the legs oriented toward traffic to prevent vertical motion on the front of an impacting vehicle to eliminate the risk of diving under or riding over the attenuator.

The effectiveness of this mechanical interlock system can be illustrated by comparing final rest locations from NCHRP Report 350 pickup truck offset and angled tests (tests 3-52 and 3-53, respectively) for the three trailer TMA systems that have received FHWA approval. Figure 9 shows the final rest locations of the three trailer TMA systems for the optional offset and angled tests, as developed from FHWA approval letters.

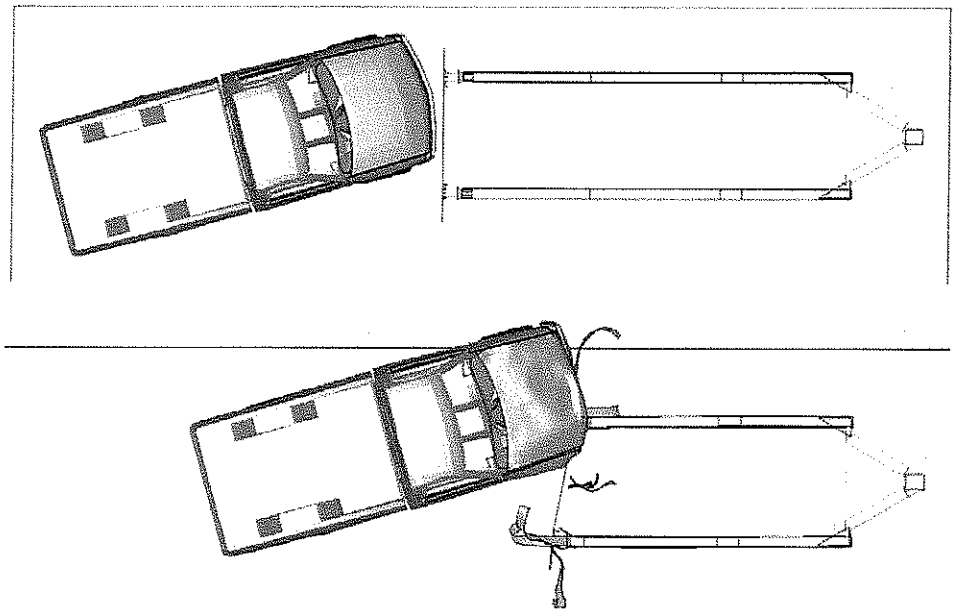


**Figure 7. Simulation of Vehicle Disengaging from a Trailer.**

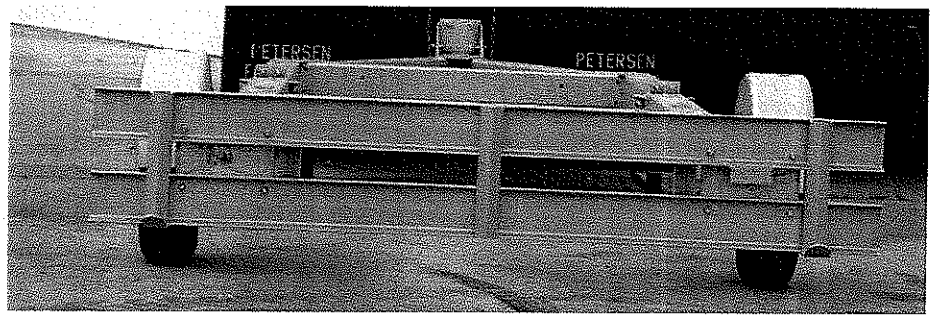



**Figure 8. TTMA-100 Impact Head.**

As shown in the figure, the final rest positions for the three designs are not substantially different, even though the TTMA-100 was tested under much more severe condition with the support truck blocked against forward movement. The other two trailer TMA systems were tested with 20,000-lb support trucks which were allowed to roll ahead during the crash. Figure 9 clearly demonstrates that the TTMA-100's simple pintle hook attachment and its vehicle capturing impact head are able to perform very well during offset and angled impacts, even when attached to an infinitely heavy support truck.

In fact, the combination of the simple pintle hook attachment and the trailer's connection with the support vehicle, forces the trailer to rotate and align itself with the impacting force, which would in turn maximize energy dissipation. Hence, the TTMA-100 provides maximum energy dissipation for impacts at any angle to provide maximum safety to both motorists and construction workers.

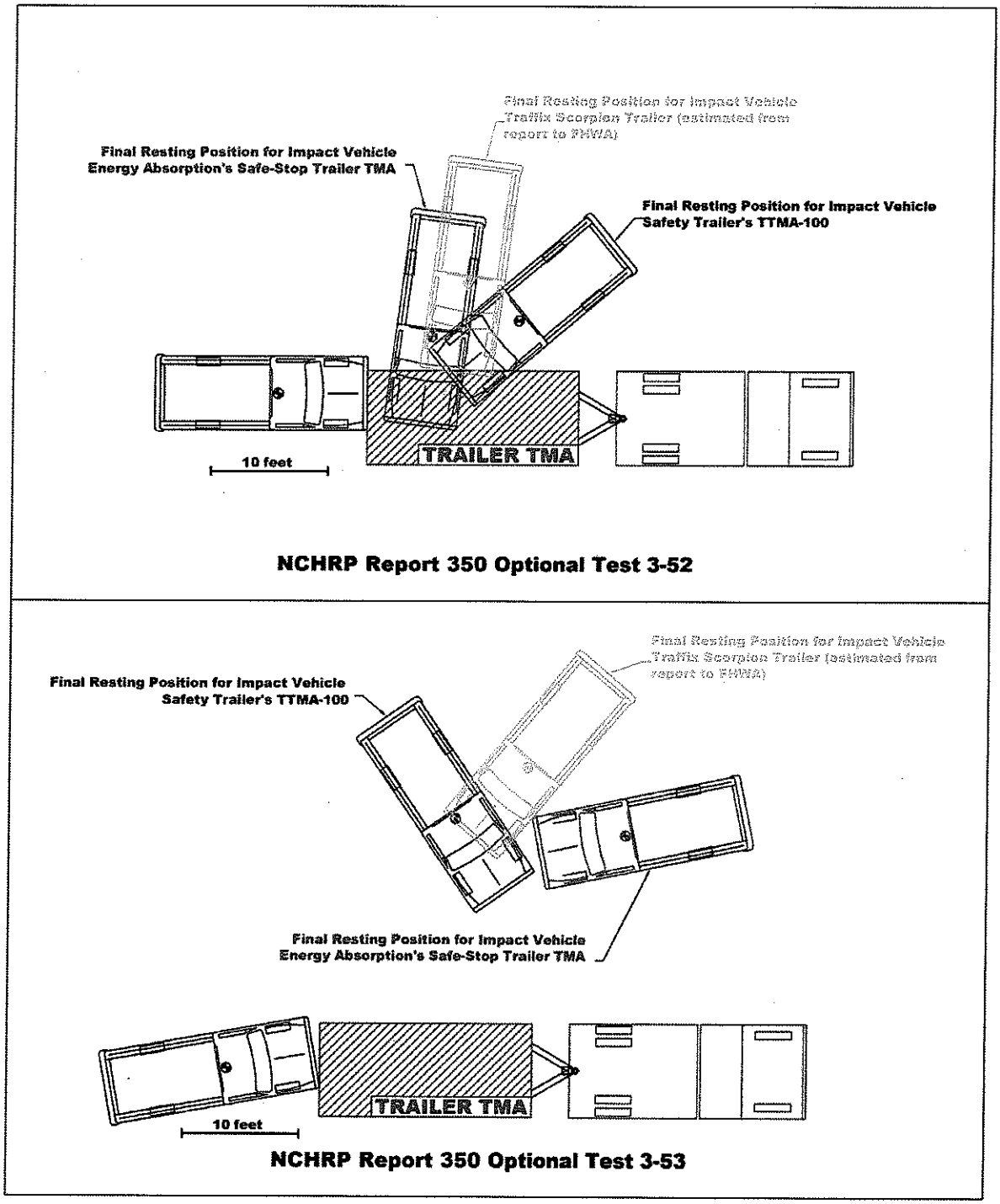



**Figure 9. Final Rest Locations of Trailer TMA Systems**

# OPERATION GUIDELINES

## INITIAL SETUP

This TTMA-100 should be delivered fully assembled. If there are problems with the delivered trailer, please contact STI Customer Services immediately.

There are three items that will require your attention prior to utilizing the trailer:

- Check to make sure that there are no missing bolts and the bolts are tightened to the specific torque. The following are the recommended torques to the bolts according to the bolt size:

| Bolt Size (in) | 5/16" | 1/2" | 9/16" | 5/8" |
|---|---|---|---|---|
| Torque (ft-lb) | 15 | 60 | 85 | 115 |
| Torque (N-m) | 20 | 81 | 115 | 156 |

- Check to make sure that the wiring of the trailer plug for connection to the tow vehicle is appropriate. As mentioned previously, there are two distinctly different wire plugs that are not compatible, one is the RV plug and the other is the heavy duty truck plug. Make sure that you have the correct type of plug and that the plug is wired properly. Also, check to confirm that the lights are functioning properly prior to putting the TTMA into service.

- Check to make sure that the pintle hook is mounted properly. Due to the wide variations in the frame structures of different tow vehicles, there is not a single standard means of mounting the pintle hook assembly to the frame of the tow vehicle. The major considerations in mounting of the pintle hook are the strength of the attachment and the mounting height.

  The pintle hook assembly may be welded or bolted to the frame of the tow vehicle. Regardless of the method of mounting or attachment to the tow vehicle, it is critical to ensure that the strength of the attachment exceeds the rated capacity of the pintle hook with a wide margin of safety. **It is the obligation of the users to ensure that their particular pintle hook attachment system meets these strength requirements.**

  There are two mounting positions for the lunette ring. The nominal height of the upper mounting position is 28 inches and the nominal height for the lower position is 23.5 inches. The TTMA-100 can accommodate a variation of up to 4 inches from the nominal

height. Hence, when the lunette ring is in the upper position, the TTMA-100 can be attached to a pintle hitch ranging from a minimum of 24 in. to a maximum of 32 in. in height. When the lunette ring is in the lower position, the TTMA-100 can be mounted on pintle hooks ranging from a minimum of 19.5 in. to a maximum of 27.5 in. in height.

Figure 10 shows the lunette ring in the lower position. Note the bolt holes that can be used with the upper position.

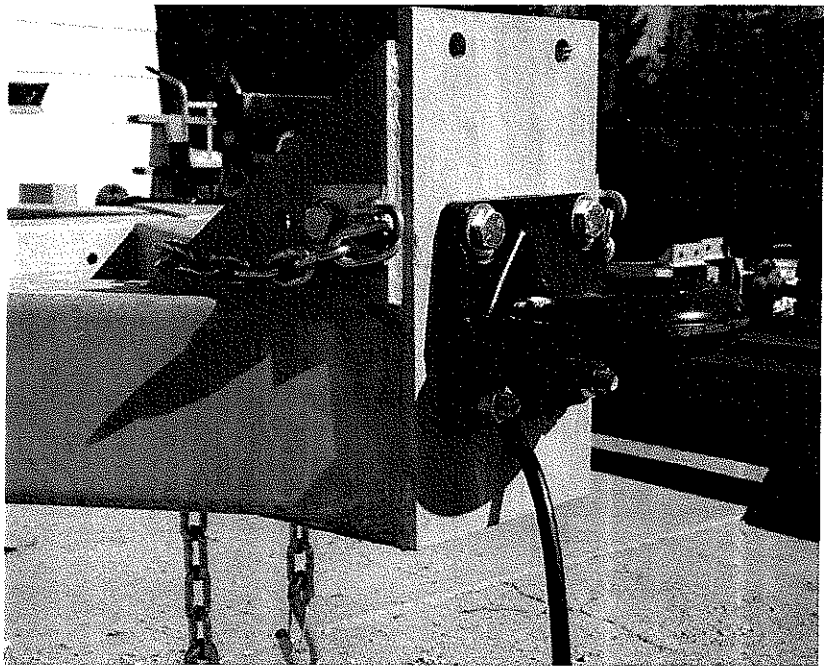


**Figure 10. Mounting Position of Lunette Ring**

## MINIMUM AND MAXIMUM WEIGHT OF TOW VEHICLE

The minimum recommended weight for the tow vehicle is 10,000 lb gross vehicle weight (GVW). There is no specified maximum weight for the tow vehicle. All TTMA-100 crash tests, including the required and optional crash tests specified under NCHRP Report 350, were conducted with the Trailer TMA attached to a tow vehicle that was blocked against any forward movement.

## TOW VEHICLE ROLL AHEAD DISTANCES

One of the major safety considerations is the roll ahead distance of the shadow vehicle when impacted by an errant vehicle. When the tow vehicle with a TTMA-100 attached is impacted by

an errant vehicle, it will move forward. It is therefore important to allow sufficient space between the tow vehicle and the workers so that the roll ahead of the tow vehicle would not pose a safety concern for the workers. Tables 4 and 5 show the expected roll ahead distances for rolling and stationary tow vehicles, respectively, as a function of impact speed and weights of the support truck and impacting vehicle. The space between the support vehicle and the workers should exceed the roll ahead distance under the prevailing operating conditions.

Please follow the following steps to determine the appropriate roll ahead distance:

1. Assess the nature of the operation (i.e., moving or stationary operation). In a moving operation, the tow vehicle is moving at slow speed, such as 15 mph. In a stationery operation, the shadow vehicle is stopped with the parking brakes on. Use Table 4 for moving operations and Table 5 for stationary operations.

2. Select the weight that best approximates the actual weight of the tow vehicle: 10,000, 15,000, 24,000, 40,000, 60,000 or 80,000 lb. Note that the weight of the support truck should include the weights of items to be carried on the truck during the operation and the weight of the TTMA-100.

3. Select the range of prevailing speed of the traffic at the work zone: 45, 55 or 65 mph.

4. Select the weight of the impact vehicle to be contained: 10,000, 15,000, or 24,000 lb.

5. Select from the appropriate table the expected roll ahead distance

For example: If you are operating a tow vehicle with a gross weight of 15,000 lb as a stopped shadow vehicle in an area where the operating traffic speed is 45 mph, and there are few if any large trucks in the mix of traffic. You would start with Table 5, select the appropriate values from above, and determine that the maximum roll ahead distance would be 11 ft. This is the distance from the front of the tow vehicle to the work area that should be provided.

## ATTACHMENT OF TTMA-100 TO TOW VEHICLE

The TTMA-100 is attached to the tow vehicle via a pintle hook with a minimum capacity of 8 tons.

**Warning! Verify that the retaining pin for the pintle hook is properly locked to avoid accidental release of the pintle hook and the TTMA-100.**

**Warning! Make sure that the trailer lights are connected to the tow vehicle and are operating properly.**

**Warning! Ensure that the safety chains properly secure the TTMA-100 to the tow vehicle.**

## Table 4. Calculated Roll Ahead Distances for Moving Operation (15 mph)

| Tow Vehicle Weight | Traffic Operating Speed | Impact Vehicle Weight | | | |
|---|---|---|---|---|---|
| | | 4500 lb | 10000 lb | 15000 lb | 24000 lb |
| 10000 lb | 65 mph | 119 ft | 205 ft | 261 ft | 333 ft |
| | 55 mph | 97 ft | 158 ft | 198 ft | 247 ft |
| | 45 mph | 77 ft | 118 ft | 143 ft | 174 ft |
| 15000 lb | 65 mph | 93 ft | 161 ft | 211 ft | 278 ft |
| | 55 mph | 78 ft | 127 ft | 162 ft | 209 ft |
| | 45 mph | 65 ft | 97 ft | 120 ft | 150 ft |
| 24000 lb | 65 mph | 71 ft | 118 ft | 157 ft | 215 ft |
| | 55 mph | 62 ft | 97 ft | 124 ft | 165 ft |
| | 45 mph | 54 ft | 77 ft | 96 ft | 122 ft |
| 40000 lb | 65 mph | 56 ft | 86 ft | 112 ft | 155 ft |
| | 55 mph | 50 ft | 73 ft | 92 ft | 123 ft |
| | 45 mph | 45 ft | 61 ft | 74 ft | 95 ft |
| 60000 lb | 65 mph | 48 ft | 68 ft | 86 ft | 118 ft |
| | 55 mph | 44 ft | 60 ft | 73 ft | 96 ft |
| | 45 mph | 41 ft | 52 ft | 61 ft | 77 ft |
| 80000 lb | 65 mph | 44 ft | 59 ft | 73 ft | 97 ft |
| | 55 mph | 41 ft | 53 ft | 63 ft | 81 ft |
| | 45 mph | 39 ft | 47 ft | 54 ft | 67 ft |

## Table 5. Calculated Roll Ahead Distances for Stationary Operation

| Tow Vehicle Weight | Traffic Operating Speed | Impact Vehicle Weight | | | |
|---|---|---|---|---|---|
| | | 4500 lb | 10000 lb | 15000 lb | 24000 lb |
| 10000 lb | 65 | 38 ft | 103 ft | 152 ft | 216 ft |
| | 55 | 27 ft | 74 ft | 109 ft | 155 ft |
| | 45 | 18 ft | 50 ft | 73 ft | 104 ft |
| 15000 lb | 65 | 22 ft | 68 ft | 108 ft | 166 ft |
| | 55 | 16 ft | 49 ft | 77 ft | 119 ft |
| | 45 | 11 ft | 33 ft | 52 ft | 80 ft |
| 24000 lb | 65 | 11 ft | 38 ft | 65 ft | 111 ft |
| | 55 | 8 ft | 27 ft | 47 ft | 80 ft |
| | 45 | 6 ft | 18 ft | 32 ft | 54 ft |
| 40000 lb | 65 | 5 ft | 18 ft | 34 ft | 64 ft |
| | 55 | 4 ft | 13 ft | 24 ft | 46 ft |
| | 45 | 3 ft | 9 ft | 16 ft | 31 ft |
| 60000 lb | 65 | 3 ft | 10 ft | 19 ft | 38 ft |
| | 55 | 2 ft | 7 ft | 13 ft | 27 ft |
| | 45 | 2 ft | 5 ft | 9 ft | 18 ft |
| 80000 lb | 65 | 2 ft | 6 ft | 12 ft | 25 ft |
| | 55 | 1 ft | 5 ft | 9 ft | 18 ft |
| | 45 | 1 ft | 3 ft | 6 ft | 12 ft |

## OPERATION OF TTMA-100

Operation of the Trailer TMA is similar to that of other trailers. Special attention should be given to the following issues:

**Warning! The TTMA-100 device does not have brakes. All braking will be dependent on the tow vehicle. Thus, additional distance should be allowed for in braking and stopping of the tow vehicle.**

**Warning! Do not use the Trailer TMA for hauling. Objects on the trailer would be a hazard for vehicles impacting the TTMA-100.**

**Warning! Attachment of the trailer TMA results in wider turns. Drivers should be aware of this need for wider turning radius and adjust their driving accordingly.**

**Warning! Attachment of any trailer TMA will result in different handling for the tow vehicle while backing up. Drivers should be aware of this difference in vehicle handling characteristics and adjust their driving accordingly.**

**Warning! Tow vehicles should be equipped with head rests, lap belts and shoulder straps to provide proper crash protection for the driver and passengers. Operators should adjust their head rest to contact the center of the head and should wear seat belt and shoulder strap at all times.**

**Warning! Do not attach any item to the trailer or hitch without explicit approval from the manufacturer. Contact STI Technical Support or Customer Service for any question regarding attachments to the trailer (technical@safetytrailers.com, Phone: 210-464-3465).**

This manual does not cover the operation of optional equipment such as arrow boards, variable message sign boards, and other approved hitch mounted equipment. Please see appropriate operating manuals accompanying those devices for instructions.

# MAINTENANCE GUIDELINES

Proper maintenance of the TTMA-100 is critical to assure continuing safe operation and long-term durability of the device. Even though the unit is galvanized, the outside of the TTMA-100 should be washed periodically, particularly during winter usage, to eliminate salt and other road contaminants. The inside of the frame should also be washed annually. The end caps (Item G) can be removed to allow rinsing the inside of the frame. Care should be taken with the wiring for the side marker lights during this process. Note that all critical parts of the TTMA-100 are hot-dip galvanized, thus require minimal maintenance.

The following preventive maintenance schedule is recommended:

| Item | Function Required | Before Each Use | Weekly | 3 Months/ or 3,000 Miles | 12 Months or 12,000 Miles |
|---|---|---|---|---|---|
| Lighting System | Test that all lights are operational | •• | | | |
| Pintle Hook | Check capacity and verify that the retaining pin is properly inserted | •• | | | |
| Safety Chains | Check that they are properly attached | •• | | | |
| Mandrel Restraining Bolts | Check that the restraining bolts are not missing, bent, or broken, and tightened to the specified torque | •• | | | |
| Tire Inflation | Set to 30 psi | | •• | | |
| Tire Condition | Inspect for cuts, wear, bulging, etc… | | | •• | |
| Wheels | Inspect for cracks, dents, distortion or other signs of wear | | | •• | |
| Splice Bolts | Check that the splice bolts are not missing, bent, or broken, and tightened to the specified torque | | | •• | |
| Wheel Nuts | Tighten to manufacturer specified torque values | | | •• | |
| Wheel Bearings and Cups | Inspect for corrosion or wear. Clean and repack | | | | •• |
| Frame Welds | Check for cracks, call STI for instruction if cracks are detected. | | | | •• |

# REPAIR OF DAMAGED TRAILER

## IMPACT BY ERRANT VEHICLE

The TTMA-100 is designed to reduce the impact severity for both the occupants of the impacting vehicle and the tow vehicle by dissipating the impact energy in a gradual and controlled manner. When the TTMA-100 is impacted by an errant vehicle, the following sequence of events will occur (all references to parts are depicted in Figure 1 and described in Table 2):

1. For impacts of 5 mph or less, which are generally termed as nuisance hits, results from crash testing have shown that there is typically no damage to the energy absorption assembly of the TTMA-100.

2. For higher speed impacts, the shear bolts holding the mandrels (Part a) to the energy absorbing tubes will be sheared off, thus releasing the mandrels to move forward.

3. The mandrels (Part B) are pushed forward by the impacting vehicle and engage the ends of the energy absorbing tubes (Part C).

4. As the mandrels are pushed forward, bursting of the energy absorbing tubes into four strips of metal is initiated as shown in Figure 11, thereby dissipating the energy from the impacting vehicle.

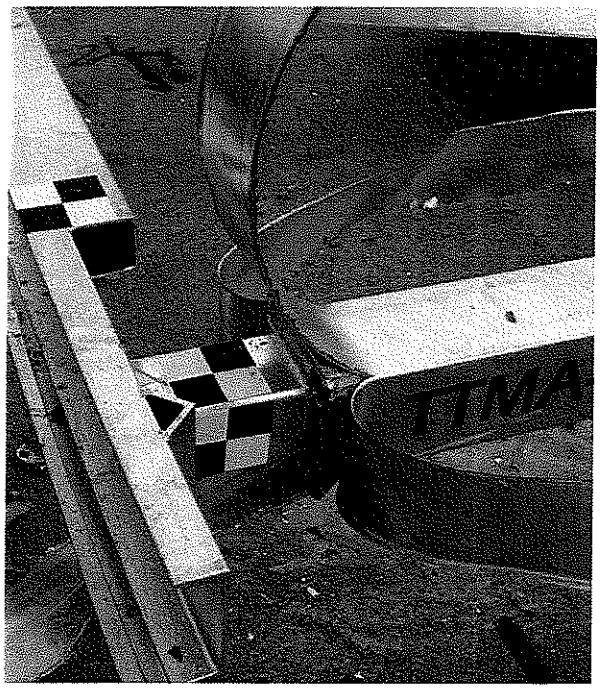



**Figure 11. Bursting of Energy Absorbing Tube**

5. The sequence of events from here on depends on the speed and weight of the impacting vehicle.

Low-speed impact:

a. The impacting vehicle comes to a complete stop prior to the mandrels (Part B) reaching the breakaway axle (Part E)

Medium-speed impact:

a. The mandrels (Part B) reach the breakaway axle and shear off the bolts connecting the axle assembly to the energy absorbing tube, thus releasing the axle.
b. The impact head (Part A) contacts the axle push rods and move the axle forward as the bursting process continues.
e. The impacting vehicle comes to a complete stop prior to the mandrels reaching the splice connecting the energy absorbing tubes and the trailer frame (Part D).

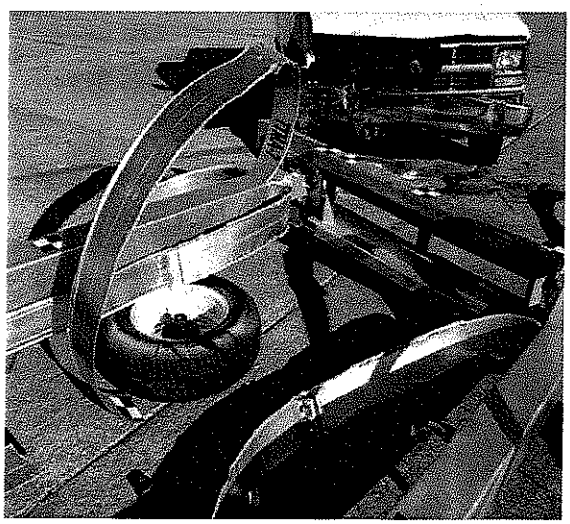


**Figure 12. Damage from Medium-Speed Impact**

High-speed impact:

a. The mandrels (Part B) continue past the splice connecting the energy absorbing tubes (Part C) and the trailer frame (Part D). The vehicle is eventually brought to a safe stop against the impact head or disengages from the impact head and spins out prior coming to a complete stop.

## TTMA-100 REPAIR

For impacts requiring repair and replacement of parts on the TTMA-100, Safety Trailers, Inc. offers different parts packages depending on the extent of damage sustained by the unit. These parts packages come with specific instructions regarding repair of your damaged trailer. These parts packages are available through STI or a designated distributor in your area.

**FOR A LIMITED TIME, REBATES OF 20 PERCENT OFF THE MSRP WILL BE OFFERED ON REPLACEMENT PARTS IN EXCHANGE FOR DOCUMENTATION OF THE IMPACTS AND/OR ACCIDENTS.**

To facilitate our evaluation of the in-service performance of the TTMA-100, we offer, for a limited time, a rebate equal to 20 percent off the MSRP of the repair parts packages, if complete records of the incident are forwarded to STI within 30 days of the occurrence. These records include a completed STI incident report (available on our web site www.safetytrailers.com or by calling 210-464-3465) and one or more of the following items: photographs of damaged trailer, photographs of the impacting and tow vehicles, and police accident report if available.

## DAMAGE ASSESSMENT AND REPAIR PARTS PACKAGES

Inspect the trailer TMA to assess the extent of the damage and the necessary repairs. Due to the simple design of the TTMA-100, damages to the trailers are usually very evident. Nevertheless, **the trailer should be thoroughly inspected to assure that it is in proper working order prior to returning the trailer into service.**

The extent of damage to the trailer will vary greatly, depending on the nature and severity of the impact. It would not possible to cover all situations that could potentially be encountered in real-world crashes. Thus, the instructions are presented in general terms for the following levels of damage to the trailer.

- No apparent damage to trailer.
- Energy absorbing tubes (Part C) bursted, but axle assembly (Part E) not detached.
- Energy absorbing tubes (Part C) bursted and axle assembly (Part E) detached, but the bursting does not reach the trailer A-frame (Part D).
- Bursting reaches trailer A-frame.

Detailed discussions on the required repair and replacement parts for each level of damage are presented as follows.

### No Apparent Damage to Trailer

- Inspect shear bolts (Part a) holding mandrels (Part B) in place with the energy absorbing tubes (Part C). If the shear bolts are bent or broken, replace the bolts.

- Inspect trailer lighting system for damage. If the lighting system sustains only minor damage, such as a broken lens or light bulb, repair the damaged items, which may be readily purchased from automotive supplies stores. Make sure that all the lights are working properly prior to returning the trailer to service.

- The following replacements parts are typically required for repair with this severity of damage sustained by the trailer..

| Part No. | Items in Package |
|---|---|
| NHRC | Shear bolts, nuts, washers and plastic guide plates. |

- Replacement of the shear bolts and plastic guide plates for the mandrels and repair of the lights may be conducted in the field by the user without involving the distributor or manufacturer.

**Axle Assembly not Detached**

- Replace energy absorbing tubes (Part C) and shear bolts (Parts a, b, c, d).

- Inspect trailer lights for damage. If the lighting system sustains only minor damage, such as a broken lens or light bulb, repair the damaged items, which may be readily purchased from automotive supplies stores. Make sure that all the lights are working properly prior to returning the trailer to service. If the lighting system is severely damaged and no longer functional, replace the entire lighting system.

- Inspect impact head (Part A) and mandrels (Parts B) for damage. For this severity of impact, it is unusual for either the impact head or the mandrels to be damaged to the extent that they are no longer usable and needs to be replaced. Nonetheless, check to make sure that the impact head and mandrels are not severely bent and are properly aligned with the energy absorbing tubes.

- Inspect lunette ring and pintle hook for damage. For this severity of impact, it is unusual for either the lunette ring or the pintle hook to be damaged to the extent that they are no longer usable and needs to be replaced. Nonetheless, check to make sure that the lunette ring and the pintle hook are not severely bent and can be hooked up properly.

- The following replacements parts are typically required for repair with this severity of damage sustained by the trailer. It is recommended that such repairs be conducted by a manufacturer certified technician, either at the facility of a distributor or at the facility of the user.

| Part No. | Items in Package |
|---|---|
| LSRC | 2 each (Parts C, a, b, c, d, g, and h) |
| T100-LB | Basic light system |

**Axle Assembly Detached, but No Damage to Trailer A-Frame.**

- Replace energy absorbing tubes (Part C) and shear bolts (Parts a, b, c, d, g and h).

- Inspect the breakaway axle assembly (Part E) for damage. Replace axle if visibly bent. If the axle is not damaged, but the push rods are bent, straighten out the push rods. Make sure that the push rods are attached to the axle properly. If the axle is not damaged, but the fenders are severely bent, replace only the fenders.

- Inspect trailer lights for damage. If the lighting system sustains only minor damage, such as a broken lens or light bulb, repair the damaged items, which may be readily purchased from automotive supplies stores. Make sure that all the lights are working properly prior to returning the trailer to service. If the lighting system is severely damaged and no longer functional, replace the entire lighting system.

- Inspect impact head (Part A) and mandrels (Parts B) for damage. For this severity of impact, it is unusual for either the impact head or the mandrels to be damaged to the extent that they are no longer usable and needs to be replaced. Nonetheless, check to make sure that the impact head and mandrels are not severely bent and are properly aligned with the energy absorbing tubes.

- Inspect lunette ring and pintle hook for damage. For this severity of impact, it is unusual for either the lunette ring or the pintle hook to be damaged to the extent that they are no longer usable and needs to be replaced. Nonetheless, check to make sure that the lunette ring and the pintle hook are not severely bent and can be hooked up properly.

- The following replacements parts are typically required for repair with this severity of damage. It is recommended that such repairs be conducted by a manufacturer certified technician, either at the facility of a distributor or at the facility of the user.

| Part No. | Items in Package |
|---|---|
| LSRC | 2 each (Parts C, a, b, c, d, g, and h) |
| T100-AA | Axle Assembly (Part E) |
| T100EF | Fenders (2) |
| T100-LB | Basic lighting system |

**Bursting Reaches Trailer A-Frame**

For this high severity of impact, it is not advisable to repair the trailer. It is recommended that the user should consider purchasing a new trailer. First, the cost for the replacement parts would approach that of a new trailer. Second, extensive assembly would be required, which may pose some problems for someone not familiar with the details of the trailer.

## TECHNICAL ASSISTANCE

If you have any questions regarding these inspections and assessment of damage to the trailer or required repair parts, please contact your distributor or STI Technical Help by telephone at (210)-464-3465, e-mail at technical@safetytrailers.com, or conventional mail at 9 Cotswold Lane, San Antonio, TX 78257. In order for STI Technical Assistance to better provide assessment of the trailer or required repair parts, it would be most helpful if you can send photographs of the damaged trailer, both showing the overall damages and damages to the specific areas or parts in question.

**STI Safety Trailers, Inc.**
**Innovative - flexible - affordable**

# INCIDENT REPORT FORM

## GENERAL INFORMATION

- Date of Incident: _____ Time of Incident: _____ a.m, / p.m.
  mm/dd/yyyy
- Company:

  Name: _____

  Address: _____

  _____

  Contact Person: _____

  Telephone No.: (_____) _____ - _____

## INCIDENT INFORMATION

- Describe briefly what happened (attach additional sheets if necessary): _____

  _____

  _____

  _____

  _____

- Location of Incident: _____

  _____

- Support Vehicle:

  Year, Make and Model: _____

  Approximate Weight: _____ lbs.

  Vehicle was: Actual work vehicle / shadow vehicle / in transit

  Stationary / moving at _____ mph

  Injury to Support Truck Operator: None / Minor / Severe

  Name and Phone No. of Truck Operator: _____

  May we contact him/her for more information? Yes / No

9 Cotswold Lane, San Antonio, Texas 78257
210-464-3465 § 210-698-0556 (fax) § www.safetytrailers.com

- Impacting Vehicle:

  Year, Make and Model _____

  Impact Configuration: End-on / Offset / Angled

  Estimated Impact Speed: _____ mph

  Injury to Impacting Vehicle Driver/Occupant: None / Minor / Severe

**DOCUMENTATION**

- Police Accident Report No / Yes (attached)
- Photos of Damage to TTMA and Support Vehicle No / Yes (attached)
- Photos of Damage to Impacting Vehicle No / Yes (attached)

# TRAINING PACKAGE OUTLINE

| | Estimate Time (min) |
|---|---|
| I. INRODUCTION | 15 |
| Overall View of TTMA-100 Trailer TMA | |
| Major Components of TTMA-100 | |
| Optional Equipment | |
| Customer Service Contacts | |
| II. TTMA-100 DESIGN | 30 |
| How It Works | |
| Bursting Technology | |
| Breakaway Axle Assembly | |
| Hitch Assembly | |
| NCHRP 350 Crash Testing | |
| Testing Requirement | |
| Testing Results – Summary and Videos | |
| Significance of Blocked Support Truck | |
| Durability Testing | |
| III. OPERATION GUIDELINES | 20 |
| Minimum Support Truck Weight | |
| Support Truck Roll Ahead Distances | |
| Barrier Operation | |
| Moving Operation | |
| Attachment of TTMA-100 to Support Truck | |
| Pintle Hook | |
| Power Connection | |
| Operation of TTMA-100 | |
| IV. MAINTENANCE GUIDELINES | 10 |
| Prior to Each Use | |
| Quarterly | |
| Annually | |
| V. REPAIR GUIDELINES | |
| Impact and Corresponding Damages to Trailer TMA | 15 |
| Nuisance Hit | |
| Minor Impact | |
| Moderate Impact | |
| Severe Impact | |
| TTMA-100 Repair | |
| Nuisance Hit | |
| Minor Impact | |
| Moderate Impact | |

# TRAINING PACKAGE

Attached is an outline of the proposed training package. The training session is tentatively set for a total length of 2 hours, although the session length can be adjusted to fit in with the available time span.

There are six sections to the training package:

I. Introduction.

Provide an overall view of the TTMA-100 trailer TMA, its major components, and available optional equipment. Also, information on customer service contacts will be provided.

II. TTMA-100 Design.

Provide a brief description on how the TTMA-100 trailer TMA works to absorb the impact energy of an errant vehicle. First, an explanation and illustration of the bursting technology, i.e., using an oversized mandrel to create cracks at the corners of a square tube and split it into four strips of flat plates, and how this bursting process dissipates the impacting energy. Second, a discussion on the use of a splice and a breakaway axle assembly so as to minimize the number of components that need to be replaced in minor and moderate impacts. Finally, the use of standard 8-ton pintle hook for the hitch assembly so that the Trailer TMA can be hooked up and used with any support truck in a matter of minutes.

Provide a discussion of the NCHRP 350 crash testing requirements, which the TTMA-100 has successfully met, including the two mandatory and the two optional tests. Show summary of the crash test results and videos of the crash tests. Also, briefly mention the significance of the blocked support truck in the crash tests.

Provide a brief report on the durability testing of TTMA-100, including road and speed bump tests and the vibration test.

III. Operation Guidelines

Provide instructions on the minimum support truck weight and the roll ahead distances for both barrier and moving operations.

Provide instructions on the attachment of the TTMA-100 to the support truck, including the Pintle hook and connection of the power plug.

Provide discussion on the field operation of the TTMA-100, including tongue weight, turning radius, and backing up.

IV. Maintenance Guidelines

Provide instruction on maintenance of the TTMA-100: prior to each use, quarterly and annually.

V. Repair Guidelines

Provide discussions on various impact severity and corresponding damages to the trailer TMA. There are basically four severity levels: nuisance hits of 5 mph or less; minor impacts in which the energy absorbing tubes were damaged, but not the breakaway axle; moderate impacts in which the energy absorbing tubes and the breakaway axle were damaged; and finally, severe impacts in which the trailer is essentially totaled.

Provide discussions on repair to the TTMA-100 for each of the impact severity levels, i.e., nuisance hit, minor impact, moderate impact and severe impact

VI. Questions and Answers

Allow for questions and answers on any issue pertaining to the TTMA-100.

VII. Field Demonstration

Allow the attendees to actual see and have a first-hand experience with the TTMA-100.

## Rob Hamilton

**From:** jherron@specialtygroups.com
**Sent:** Tuesday, April 22, 2008 5:36 PM
**To:** rhamilton@specialtygroups.com
**Subject:** [Fwd: Warranty for WVDOT RFQ No. 708EC011]

untitled-2.htm (2 KB)

---------- Original Message ----------
Subject: Warranty for WVDOT RFQ No. 708EC011
From: "Sales" <sales@safetytrailers.com>
Date: Tue, April 22, 2008 5:28 pm
To: jherron@specialtygroups.com
Cc: "'Dean Sicking'" <deans@safetytrailers.com>

---

Dear Jim,

This is to confirm that Safety Trailers, Inc. will extend its standard one-year warranty to a two-year bumper to bumper basic parts and labor warranty for the subject RFQ.

Best regards,

King Mak

Safety Trailers, Inc.

210-464-3465