

TTMA-100 Trailer TMA NCHRP 350 TL-3 Trailer Truck Mounted Attenuator



FOREWORD

Thank you for your purchase of the Trailer Truck Mounted Attenuator, Model 100, from **Barrier Systems, 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 +1 (707) 374-6800, email at info@barriersystemsinc.com, or conventional mail at Barrier Systems Sales and Service 3333 Vaca Valley Pkwy, Ste. 800, Vacaville, CA 95688.**

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.
- **Assembly Guidelines.** Directions on the assembly of the TTMA-100 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.

The T-TMA 100 is manufactured by Gregory Industries, Canton, OH.

CUSTOMER SERVICE CONTACTS

Barrier Systems, 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 **BSI** via telephone, e-mail or conventional mail:

Telephone: +1 (707) 374-6800

Email: info@barriersystemsinc.com

Website: www.barriersystemsinc.com

Mail: **Barrier Systems Sales and Service**
3333 Vaca Valley Pkwy, Ste. 800
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TABLE OF CONTENTS

	<u>Page</u>
FOREWORD	ii
CUSTOMER SERVICE CONTACTS	iii
TTMA-100 DESIGN AND MAJOR COMPONENTS	1
General	1
Figure 1. Schematic and Parts Layout of TTMA-100	2
Table 1. General Specifications	3
Table 2. Trailer Component and Parts List	4
Figure 2. TTMA-100 Wiring and Light Layout	5
Wiring Instructions	6
INSTALLATION GUIDELINES	8
Shipping Package	8
Recommended Tool List	8
Bolt Torque Specifications	8
Pintle Hook	9
OPERATION GUIDELINES	10
Minimum Weight of Tow Vehicle	10
Tow Vehicle Roll Ahead Distances	10
Table 3. Calculated Roll Ahead Distances for Shadow Vehicles	12
Table 4. Calculated Roll Ahead Distances for Barrier Vehicles	13
Attachment of TTMA-100 to Tow Vehicle	14
Operation of TTMA-100	14
MAINTENANCE GUIDELINES	16

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:

<u>Component</u>	<u>Description</u>
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 general specifications for the Trailer TMA, including:

- Overall dimensions, i.e., length, width and maximum height to the top of the impact head and the top of the light bar
- Weight of the trailer with no optional equipment and the tongue weight. Note the small tongue weight of the trailer, which would not affect the load carrying capacity of the tow vehicle.
- The capacity and mounting height of the pintle hook.
- Information on the axle assembly, i.e., load rating, wheel and tire sizes, and cold inflation pressure.

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 later in this section.

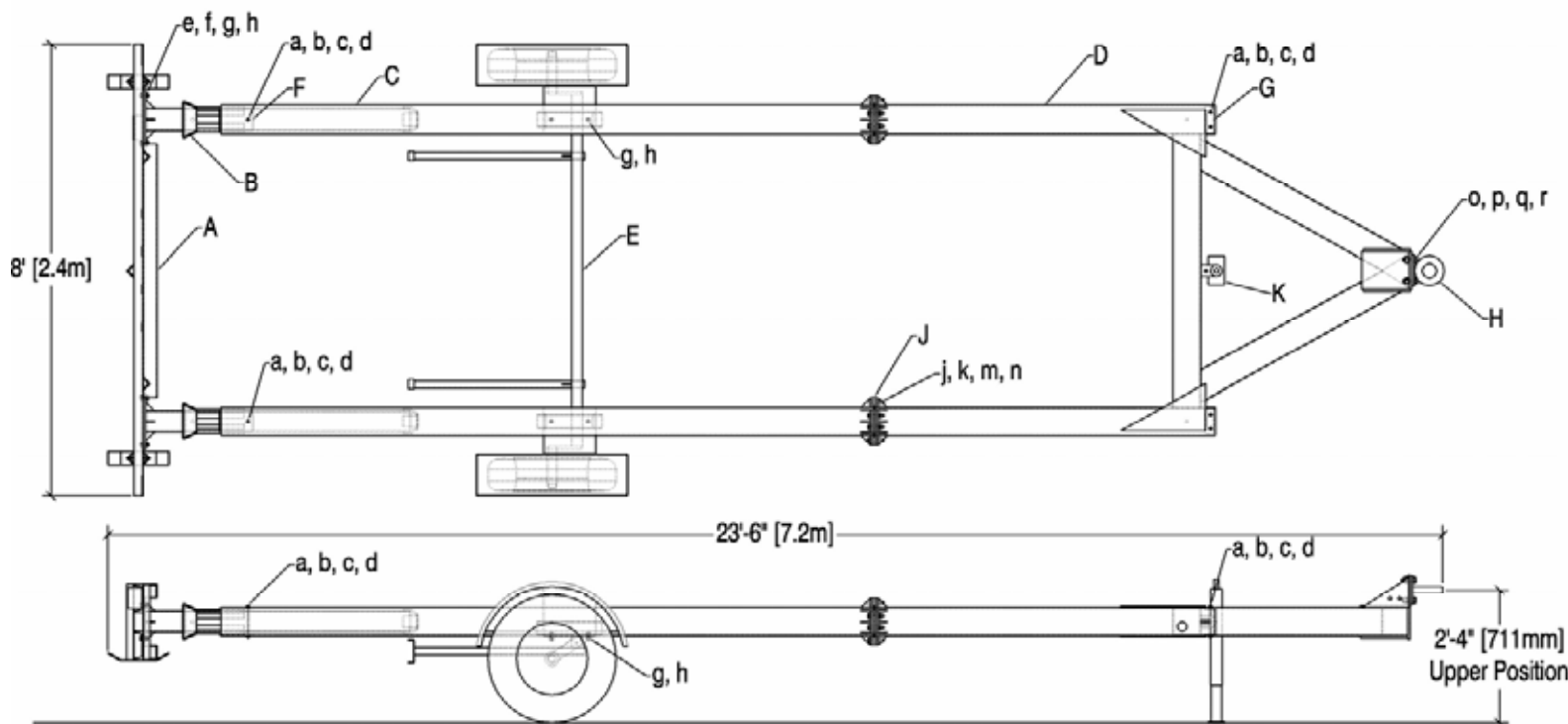


Figure 1. Schematic and Parts Layout of TTMA-100

TABLE 1. GENERAL SPECIFICATIONS

Overall Dimensions:

Length	23 ft 6 in.	7200 mm
Width	8 ft 0 in.	2440 mm
Maximum Height (to top of impact head)	2 ft 7 in.	788 mm
Maximum Height (to top of light bar)	3 ft 1 in.	940 mm

Weight:

Basic Trailer Weight with No Optional Equipment	1,450 lb	660 kg
Approximate Tongue Weight	150 lb	68 kg

Pintle Hook:

Capacity Rating (Minimum)	8 tons	7250 kg
Mounting Height	19.5-32.0 in.	500-800 mm

Breakaway Axle:

Rating	1,750 lb	795 kg
Tire Size	205/75D15	205/75D15
Rim Size	15x5JJ	15x5JJ
Cold Tire Inflation Pressure	30 psi	210 Kpa

TABLE 2. TRAILER COMPONENT AND PARTS LIST

TRAILER COMPONENTS			
ITEM	PART #	QUANTITY	DESCRIPTION
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			
ITEM	PART#	QUANTITY	DESCRIPTION
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

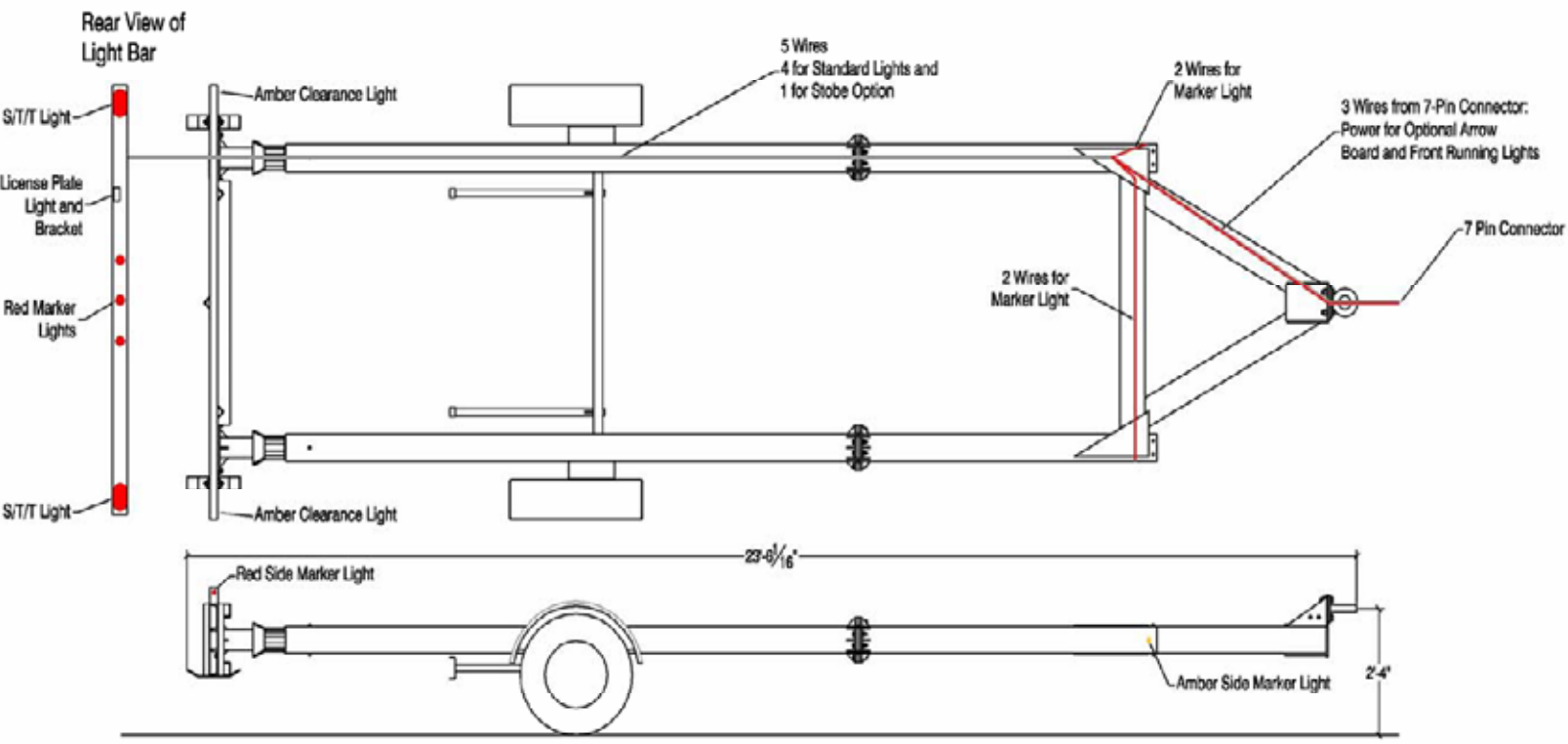


Figure 2. TTMA-100 Wiring and Light Layout

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 in the following photographs. 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

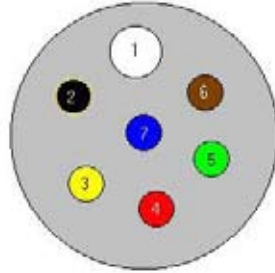


Standard Wiring For RV Plugs With Separate Brake Wire



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)

Standard Wiring For Heavy Duty Truck Plugs



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

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.

INSTALLATION INSTRUCTIONS

SHIPPING PACKAGE

This manual is intended for the operation and maintenance of the TTMA-100. If you ordered and received the unit in a partially assembled state, please refer to the accompanying Assembly Manual for detailed instructions. If you have any questions in this regard, please contact **BSI** Customer Services prior to utilizing the trailer.

RECOMMENDED TOOL LIST

The following is the recommended tool list for assembling the TTMA-100:

- Socket wrenches: 1/2", 3/4", 13/16", 15/16"
- Open end wrenches: 1/2", 3/4", 13/16", 15/16"
- Pneumatic wrench
- Drift pin
- Wire crimper
- Round and flat metal files
- Electric drill and bits
- 4-ft level
- Measuring tape

Optional:

- Fork lift/crane for parts manipulation. Note that some parts are very heavy and care should be taken in assembling and disassembling the unit.

BOLT TORQUE SPECIFICATIONS

All bolts should be tightened to the specified torque prior to use of the Trailer TMA. 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

PINTLE HOOK

The pintle hook should have a minimum capacity rating of 8 tons (7,250 kilograms). 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 (710 mm) and the nominal height for the lower position is 23.5 inches (600 mm). The TTMA-100 can accommodate a variation of up to 4 inches (100 mm) 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. (610 mm) to a maximum of 32 in. (810 mm) 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. (495 mm) to a maximum of 27.5 in. (699 mm) in height.



OPERATION GUIDELINES

MINIMUM WEIGHT OF TOW VEHICLE

The minimum recommended weight for the tow vehicle is 10,000 lb (4,536 kg) 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. In other words, the trailer can be attached to any support truck weighing more than 10,000 lb (4,536 kg), even a truck weighing as much as 100,000 lb (45,360 kg) or more.

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 3 and 4 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.

The roll ahead calculations shown in Table 3 and 4 are based upon procedures presented in “Guidelines for the Use of Truck-Mounted Attenuators in Work Zones,” by Jack B. Humphries and T. Darcy Sullivan, TRR No. 1304, 1991, 292-302.

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 10 to 20 mph (16 to 32 km/h). In a stationary operation, the shadow vehicle is stopped with the parking brakes on. Use Table 3 for moving operations and Table 4 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 (4,535, 6,800, 10,900, 18,000, 27,000, or 36,000 kg). 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 (72, 88 or 104 km/h).

4. Select the weight of the impact vehicle to be contained: 10,000, 15,000, or 24,000 lb (4,536, 6,800, or 10,900 kg).
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 lbs. (6,800 kg) as a stopped shadow vehicle in an area where the operating traffic speed is 45 mph (72 km/h), and there are few if any large trucks in the mix of traffic. You would start with Table 4, select the appropriate values from above, and determine that the maximum roll ahead distance would be 11' (3.4m). This is the distance from the front of the tow vehicle to the work area that should be provided.

Table 3. Calculated Roll Ahead Distances for Moving Operation

Tow Vehicle Weight, lb (kg)	Traffic Operating Speed, mph (km/h)	Impact Vehicle Weight, lb (kg)			
		4500 (2,050)	10000 (4,550)	15000 (6,800)	24000 (10,900)
10000 (4,550)	65 (105)	119' (36.3 m)	205' (62.5 m)	261' (79.6 m)	333' (102 m)
	55 (89)	97' (29.6 m)	158' (48.2 m)	198' (60.4 m)	247' (75.3 m)
	45 (72)	77' (23.5 m)	118' (36.0 m)	143' (43.6 m)	174' (53.0 m)
15000 (6,800)	65 (105)	93' (28.3 m)	161' (49.1 m)	211' (64.3 m)	278' (84.7 m)
	55 (89)	78' (23.8 m)	127' (38.7 m)	162' (49.4 m)	209' (63.7 m)
	45 (72)	65' (19.8 m)	97' (29.6 m)	120' (36.6 m)	150' (45.7 m)
24000 (10,900)	65 (105)	71' (21.6 m)	118' (36.0 m)	157' (47.9 m)	215' (65.5 m)
	55 (89)	62' (18.9 m)	97' (29.6 m)	124' (37.8 m)	165' (50.3 m)
	45 (72)	54' (16.5 m)	77' (23.5 m)	96' (29.3 m)	122' (37.2 m)
40000 (18,200)	65 (105)	56' (17.1 m)	86' (26.2 m)	112' (34.1 m)	155' (47.2 m)
	55 (89)	50' (15.2 m)	73' (22.3 m)	92' (28.0 m)	123' (37.5 m)
	45 (72)	45' (13.7 m)	61' (18.6 m)	74' (22.6 m)	95' (29.0 m)
60000 (27,250)	65 (105)	48' (14.6 m)	68' (20.7 m)	86' (26.2 m)	118' (36.0 m)
	55 (89)	44' (13.4 m)	60' (18.3 m)	73' (22.3 m)	96' (29.3 m)
	45 (72)	41' (12.5 m)	52' (15.8 m)	61' (18.6 m)	77' (23.5 m)
80000 (36,400)	65 (105)	44' (13.4 m)	59' (18.0 m)	73' (22.3 m)	97' (29.6 m)
	55 (89)	41' (12.5 m)	53' (16.2 m)	63' (19.2 m)	81' (24.7 m)
	45 (72)	39' (11.9 m)	47' (14.3 m)	54' (16.5 m)	67' (20.4 m)

Table 4. Calculated Roll Ahead Distances for Stationary Operation

Tow Vehicle Weight, lb (kg)	Traffic Operating Speed, mph (km/h)	Impact Vehicle Weight, lb (kg)			
		4500 (2,050)	10000 (4,550)	15000 (6,800)	24000 (10,900)
10000 (4,550)	65 (105)	38' (11.6 m)	103' (31.4 m)	152' (46.3 m)	216' (65.8 m)
	55 (89)	27' (8.2 m)	74' (22.6 m)	109' (33.2 m)	155' (47.2 m)
	45 (72)	18' (5.5 m)	50' (15.2 m)	73' (22.3 m)	104' (31.7 m)
15000 (6,800)	65 (105)	22' (6.7 m)	68' (20.7 m)	108' (32.9 m)	166' (50.6 m)
	55 (89)	16' (4.9 m)	49' (14.9 m)	77' (23.5 m)	119' (36.3 m)
	45 (72)	11' (3.4 m)	33' (10.1 m)	52' (15.8 m)	80' (24.4 m)
24000 (10,900)	65 (105)	11' (3.4 m)	38' (11.6 m)	65' (19.8 m)	111' (33.8 m)
	55 (89)	8' (2.4 m)	27' (8.2 m)	47' (14.3 m)	80' (24.4 m)
	45 (72)	6' (1.8 m)	18' (5.5 m)	32' (9.8 m)	54' (16.5 m)
40000 (18,200)	65 (105)	5' (1.5 m)	18' (5.5 m)	34' (10.4 m)	64' (19.5 m)
	55 (89)	4' (1.2 m)	13' (4.0 m)	24' (7.0 m)	46' (14.0 m)
	45 (72)	3' (0.9 m)	9' (2.7 m)	16' (4.9 m)	31' (9.4 m)
60000 (27,250)	65 (105)	3' (0.9 m)	10' (3.0 m)	19' (5.8 m)	38' (11.6 m)
	55 (89)	2' (0.6 m)	7' (2.1 m)	13' (4.0 m)	27' (8.2 m)
	45 (72)	2' (0.6 m)	5' (1.5 m)	9' (2.7 m)	18' (5.5 m)
80000 (36,400)	65 (105)	2' (0.6 m)	6' (1.8 m)	12' (3.7 m)	25' (7.6 m)
	55 (89)	1' (0.3 m)	5' (1.5 m)	9' (2.7 m)	18' (5.5 m)
	45 (72)	1' (0.3 m)	3' (0.9 m)	6' (1.8 m)	12' (3.7 m)

ATTACHMENT OF TTMA-100 TO TOW VEHICLE

The TTMA-100 is attached to the tow vehicle via the 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.

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.

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	••			
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			••	
Bolts and 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.				••