



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

400 Seventh St., SW.  
Washington, D C. 20590

Refer To: HSA-CC65

JUL 14 1999

Mr. Dave Gertz  
Director of Engineering  
TraFFix Devices, Inc.  
220 Calle Pintesresco  
San Clemente, CA 92672

Dear Mr. Gertz:

Mr. Richard Powers of my staff has received your April 20 letter and your June 6 follow-up which included additional test reports and other information on your Scorpion 10,000 truck-mounted attenuator (TMA). In your June 21 letter you sent corrected pages for incorporation into the original test reports. You requested that the basic design (cartridge section) be accepted for use as a National Cooperative Highway Research Program (NCHRP) Report 350 device at test level 2 (TL-2) and that an extended design (strut and cartridge sections) be accepted at Report 350 test level 3 (TL-3). To support your request, you also submitted six test reports prepared by the KARCO Engineering Automotive Research Center in Adelanto, California. Two of these test reports covered NCHRP Report 350 tests 2-50 and 2-51 for TL-2 certification. The other four covered tests 3-50 and 3-51 plus optional tests 3-52 and 3-53 for TL-3 certification. Summary sheets for each of these six tests are shown in Enclosure 1. In each test, the support vehicle was a 9000 kg (19,842 pound) dump truck. Maximum reported roll-ahead of the support truck was 5.56 m (18.2 feet) in test 3-51.

The TL-2 design, called the Scorpion A 10,000 and shown in Enclosure 2, consists of 64-kg (141-pound) mounting hardware, a 310-kg (683-pound) steel back-up structure (Enclosure 2A) and a 255-g (562-pound) cartridge section consisting of aluminum honeycomb inside three separate aluminum boxes. These three energy-absorbing units are supported by and within a 114-mm (4.5-inch) diameter tubular aluminum frame. This design is 2060-mm (81-inches) long and its total weight, including the mounting hardware is 629 kg (1386 pounds).

The TL-3 design, called the Scorpion C 10,000 and shown in Enclosure 3, adds a 1500-mm (59-inches) long crushable aluminum strut section between a back-up structure and the cartridge assembly used by itself in the TL-2 design. The strut weighs 249 kg (549 pounds). The total length of the TL-3 design is 3560-mm (140-inches) and it weighs 632 kg (1393 pounds), including mounting hardware weighing 64 kg (141 pounds) and a back up plate that also weighed 64 kg (141 pounds). The backup plate used in the TL-3 tests was different from the one used in the TL-2 test series and is shown in Enclosure 3A.

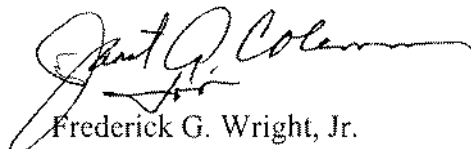
Both units are 2440-mm (96-inches) wide, 635-mm (25-inches) deep, and have a ground clearance of approximately 305-mm (12 inches) when lowered to their operating positions. Telephone conversations between you and Mr. Powers of my staff indicated that you were requesting acceptance of either backup design for use with either the TL-2 or the TL-3 TMAs. If the heavier backup is used with the TL-3 model, the total weight of the TMA, including its mounting hardware would be approximately 878 kg (1935 pounds).

Based on a review of the test reports and crash test videotapes, I agree that the cartridge, when used alone (the Scorpion A 10,000) meets NCHRP Report 350 TL-2 evaluation criteria and that when used in combination with the strut, the Scorpion C 10,000 TMA satisfies TL-3 evaluation criteria. Either design may be used with either of the tested backup plates and both are considered acceptable for use on the National Highway System (NHS). This acceptance assumes that production models will be essentially identical to the prototype designs that were tested and that you will be able to certify to users that the product supplied has the same internal and external dimensions and construction as the tested models. Since these are both proprietary designs, their use on the NHS, when specified by the contracting agency, is subject to the conditions listed in Title 23, Code of Federal Regulations, Section 635.411. A copy of this regulation is enclosed (Enclosure 4) for your ready reference.

The tests recommended in NCHRP Report 350 address only the crash performance of a TMA. Consequently, as with all TMA acceptances, this letter is not intended to address other performance factors such as long-term durability, the mobility of the support vehicle, the effects of road-induced vibration, or the influence of temperature and moisture variations. Additionally, this acceptance is based on the Scorpion 10,000 performance when it is used behind a support vehicle weighing approximately 9000 kg (19,842 pounds). The use of significantly lighter or heavier vehicles is not recommended unless tests are conducted using lighter or heavier support trucks.

Since numerous errata sheets were submitted to supplement the original test reports, I would appreciate two complete copies of each of the corrected test reports for our files. Please call Mr. Powers of my staff at (202) 366-1320 if you have any questions regarding this acceptance letter.

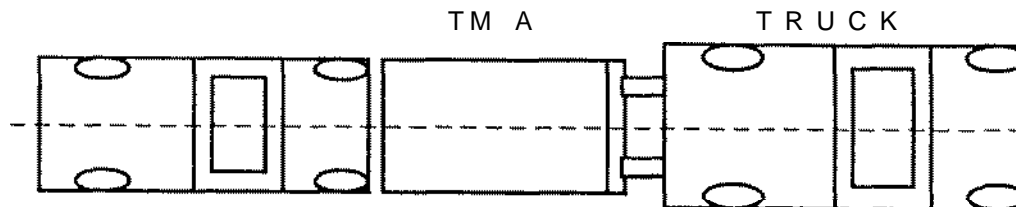
Sincerely yours,



Frederick G. Wright, Jr.  
Program Manager, Safety

6 Enclosures

SUMMARY OF RESULTS t-OK EST NO. 2-50



GENERAL INFORMATION

TEST AGENCY	KARCO ENGINEERING
TEST NO.	2-50
DATE	05/10/00
TEST ARTICLE	
TYPE	TRUCK MOUNTED ATTENUATOR
INSTALLATION LENGTH (m)	N/A
DIMENSIONS OF KEY ELEMENTS	N/A
SOIL TYPE AND CONDITION	N/A
TEST VEHICLE	
TYPE	PRODUCTION
DESIGNATION	820C
MODEL	FORD FESTIVA
MASS (CURB)	798 kg
MASS (TEST INERTIAL)	794 kg
DUMMY(s) MASS	N/A
GROSS STATIC WEIGHT	871 kg
IMPACT CONDITIONS	
SPEED (km/h)	73.0
ANGLE (Deg.)	0
IMPACT SEVERITY (kJ)	N/A
EXIT CONDITIONS	
SPEED (km/h)	0
ANGLE (Deg.)	0

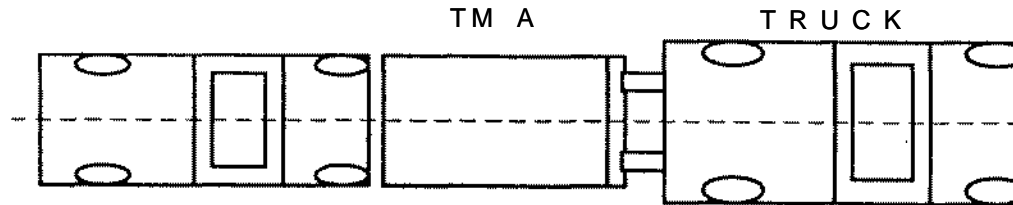
OCCUPANT RISK VALUES

IMPACT VELOCITY (m/sec)	
X-DIRECTION	11.08
Y-DIRECTION	-1.28
THIV (optional)	N/A
RIDEDOWN ACCELERATION (g's)	
X-DIRECTION	-16.80
Y-DIRECTION	-2.47
PHD (optional)	N/A
ASI (optional)	1.458
TEST ARTICLE DEFLECTIONS (m)	
DYNAMIC	N/A
PERMANENT	N/A
VEHICLE DAMAGE	
EXTERIOR	
VDS	
CDC	
INTERIOR	
OCDI	
POST IMPACT VEHICULAR BEHAVIOR	
MAXIMUM ROLL ANGLE (Deg.)	6.64
MAXIMUM PITCH ANGLE (Deg.)	9.84
MAXIMUM YAW ANGLE (Deg.)	-48.44

ENCLOSURE 1 (1 OF 6)

DATA SHEET NO. 4

SUMMARY OF RESULTS FOR TEST NO. 2-51



GENERAL INFORMATION

TEST AGENCY	KARCO ENGINEERING
TEST NO.	2-51
DATE	05/12/00
TEST ARTICLE	
TYPE	TRUCK MOUNTED ATTENUATOR
INSTALLATION LENGTH (m)	N/A
DIMENSION OF KEY ELEMENTS	N/A
SOIL TYPE AND CONDITION	N/A
TEST VEHICLE	
TYPE	PRODUCTION
DESIGNATION	2000p
MODEL	CHEVROLET PICKUP TRUCK
MASS (CURB)	2148 kg
MASS (TEST INERTIAL)	2034 kg
DUMMY(s) MASS	N/A
GROSS STATIC WEIGHT	2034 kg
IMPACT CONDITIONS	
SPEED (km/h)	71.1
ANGLE (Deg.)	0
IMPACT SEVERITY (kj)	N/A
EXIT CONDITIONS	
SPEED (km/h)	0
ANGLE (Deg.)	0

OCCUPANT RISK VALUES

IMPACT VELOCITY (m/sec)	
X-DIRECTION	10.03
Y-DIRECTION	0.19
THIV (optional)	N/A
RIDEDOWN ACCELERATION (g's)	
X-DIRECTION	-14.56
Y-DIRECTION	3.06
PHD (optional)	N/A
ASI (optional)	1.069
TEST ARTICLE DEFLECTIONS (m)	
DYNAMIC	1.59
PERMANENT	1.59
VEHICLE DAMAGE	
EXTERIOR	
VDS	
CDC	
INTERIOR	
OCDI	
POST IMPACT VEHICULAR BEHAVIOR	
MAXIMUM ROLL ANGLE (Deg.)	-2.97
MAXIMUM PITCH ANGLE (Deg.)	7.45
MAXIMUM YAW ANGLE (Deg.)	0.73

DATA SHEET NO. 4

SUMMARY OF RESULTS FOR TEST NO. 3-50

GENERAL INFORMATION

TEST AGENCY	KARGO ENGINEERING
TEST NO.	3-50
DATE	03/09/00
TEST ARTICLE	
TYPE	TRUCK MOUNTED ATTENUATOR
INSTALLATION LENGTH (m)	N/A
SIZE AND/OR DIMENSION OF KEY ELEMENTS	N/A
SOIL TYPE AND CONDITION	N/A
TEST VEHICLE	
TYPE	PRODUCTION
DESIGNATION	B20C
MODEL	FORD FESTIVA
MASS (CURB)	796.4 kg
MASS (TEST INERTIAL)	883.4 kg
DUMMY(s) MASS	160 kg
GROSS STATIC WEIGHT	883.4 kg
IMPACT CONDITIONS	
SPEED (km/h)	100.1
ANGLE (Deg.)	0
IMPACT SEVERITY (kJ)	N/A
EXIT CONDITIONS	
SPEED (km/h)	0
ANGLE (Deg.)	0

OCCUPANT RISK VALUES

IMPACT VELOCITY (mlsec)	
X-DIRECTION	11.57
Y-DIRECTION	-0.56
THIV (optional)	N/A
RIDEDOWN ACCELERATION (g's)	
X-DIRECTION	-19.08
Y-DIRECTION	-1.20
PHD (optional)	N/A
ASI (optional)	1.483
TEST ARTICLE DEFLECTIONS (m)	
DYNAMIC	N/A
PERMANENT	N/A
VEHICLE DAMAGE	
EXTERIOR	
VDS	
CDC	
INTERIOR	
OCDI	
PUS I IMPAC; I VEHICULAR BEHAVIOR	
MAXIMUM ROLL ANGLE (Deg.)	1.91
MAXIMUM PITCH ANGLE (Deg.)	7.25
MAXIMUM YAW ANGLE (Deg.)	4.86

DATA SHEET NO. 4

SUMMARY OF RESULTS FOR TEST NO. 3-51

GENERAL INFORMATION

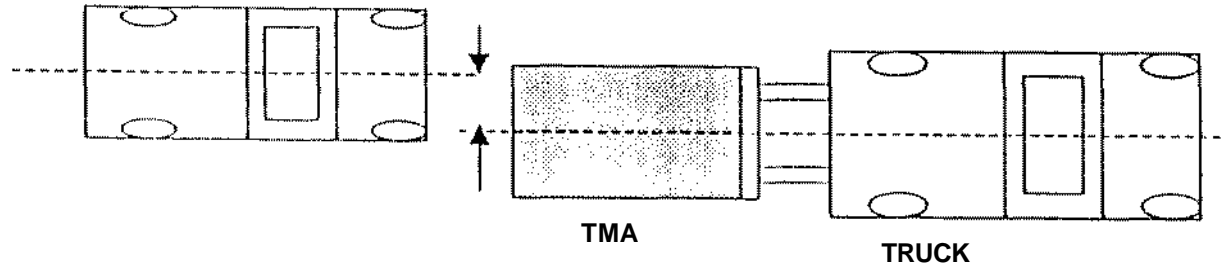
TEST AGENCY	KARCO ENGINEERING
TEST NO.	3-51
DATE	03/17/00
TEST ARTICLE	
TYPE	TRUCK MOUNTED ATTENUATOR
INSTALLATION LENGTH (m)	N/A
SIZE AND/OR DIMENSION OF KEY ELEMENTS	N/A
SOIL TYPE AND CONDITION	N/A
TEST VEHICLE	
TYPE	PRODUCTION
DESIGNATION	2000P
MODEL	CHEVROLET PICKUP TRUCK
MASS (CURB)	1969.2 kg
MASS (TEST INERTIAL)	1961.0 kg
DUMMY(s) MASS	N/A
GROSS STATIC WEIGHT	1961.0 kg
IMPACT CONDITIONS	
SPEED (km/h)	99.0
ANGLE (Deg.)	0
IMPACT SEVERITY (kJ)	N/A
EXIT CONDITIONS	
SPEED (km/h)	0
ANGLE (Deg.)	0

OCCUPANT RISK VALUES

IMPACT VELOCITY (m/sec)	
X-DIRECTION	11.25
Y-DIRECTION	.02
THIV (optional)	-N/A
RIDEDOWN ACCELERATION (g's)	
X-DIRECTION	-18.61
Y-DIRECTION	-5.42
PHD (optional)	N/A
ASI (optional)	1.177
TEST ARTICLE DEFLECTIONS (m)	
DYNAMIC	N/A
PERMANENT	N/A
VEHICLE DAMAGE	
EXTERIOR	
VDS	
CDC	
INTERIOR	
OCDI	
POST IMPACT VEHICULAR BEHAVIOR	
MAXIMUM ROLL ANGLE (Deg.)	-2.32
MAXIMUM PITCH ANGLE (Deg.)	5.92
MAXIMUM YAW ANGLE (Deg.)	3.97

DATA SHEET NO. 4

SUMMARY OF RESULTS FOR TEST NO. 3-52



GENERAL INFORMATION

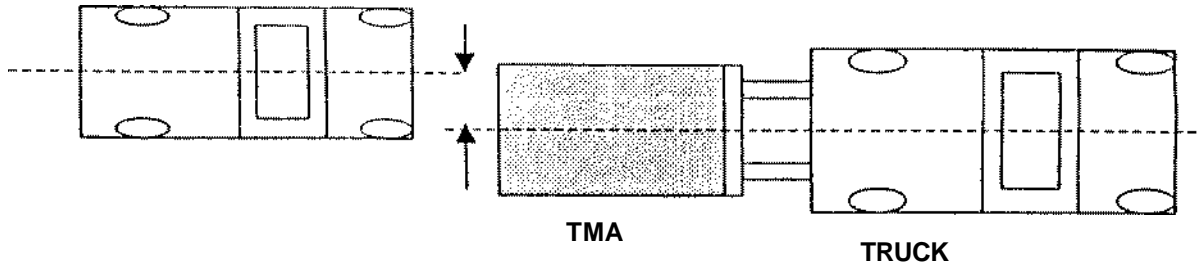
TEST AGENCY	KARCO ENGINEERING
TEST NO.	3-52
DATE	06/05/00
TEST ARTICLE	TRUCK MOUNTED ATTENUATOR
TYPE	
INSTALLATION LENGTH (m)	5.98
SIZE AND/OR DIMENSION OF KEY ELEMENTS	N/A
SOIL TYPE AND CONDITION	N/A
TEST VEHICLE	PRODUCTION
TYPE	
DESIGNATION	2000P
MODEL	CHEVROLET CHEYENNE
MASS (CURB)	1722 kg
MASS (TEST INERTIAL)	2012 kg
DUMMY(S) MASS	N/A
GROSS STATIC WEIGHT	2012 kg
IMPACT CONDITIONS	
SPEED (km/h)	98.7
ANGLE (Deg.)	0
IMPACT SEVERITY (kj)	N/A
EXIT CONDITIONS	
SPEED (km/h)	0
ANGLE (Deg.)	0

OCCUPANT RISK VALUES

IMPACT VELOCITY (m/sec)	
X-DIRECTION	10.10
Y-DIRECTION	1.26
r <sub>IIV</sub> (optional)	N/A
RIDEDOWN ACCELERATION (g's)	
X-DIRECTION	-14.28
Y-DIRECTION	7.15
PHD (optional)	N/A
ASI (optional)	0.926
TEST ARTICLE DEFLECTIONS (ii)	
DYNAMIC	N/A
PERMANENT	N/A
VEHICLE DAMAGE	
EXTERIOR	
VDS	
CDI	
INTERIOR	
OC DI	
POST IMPACT VEHICULAR BEHAVIOR	
MAXIMUM ROLL ANGLE (Dcg.)	13.73
MAXIMUM PITCH ANGLE (Deg.)	20.13
MAXIMUM YAW ANGLE (Dcg.)	98.48

DATA SHEET NO. 4

SUMMARY OF RESULTS FOR TEST NO. 3-53



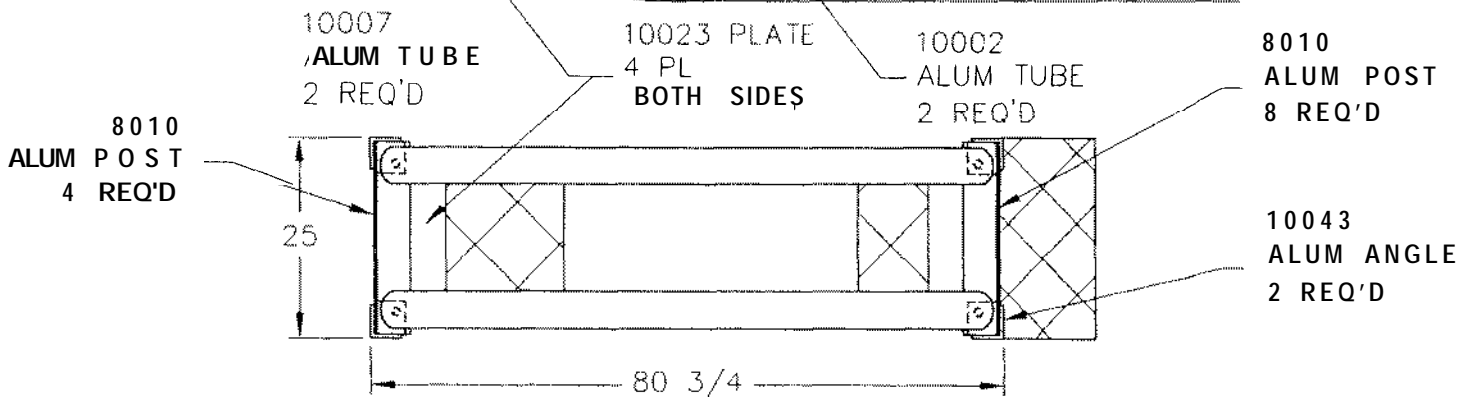
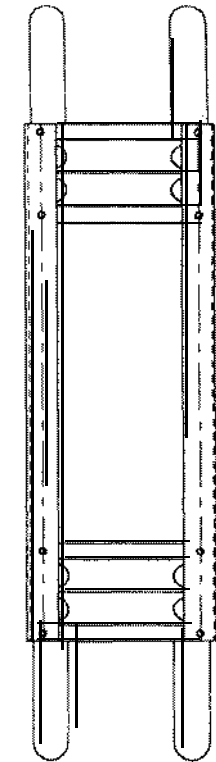
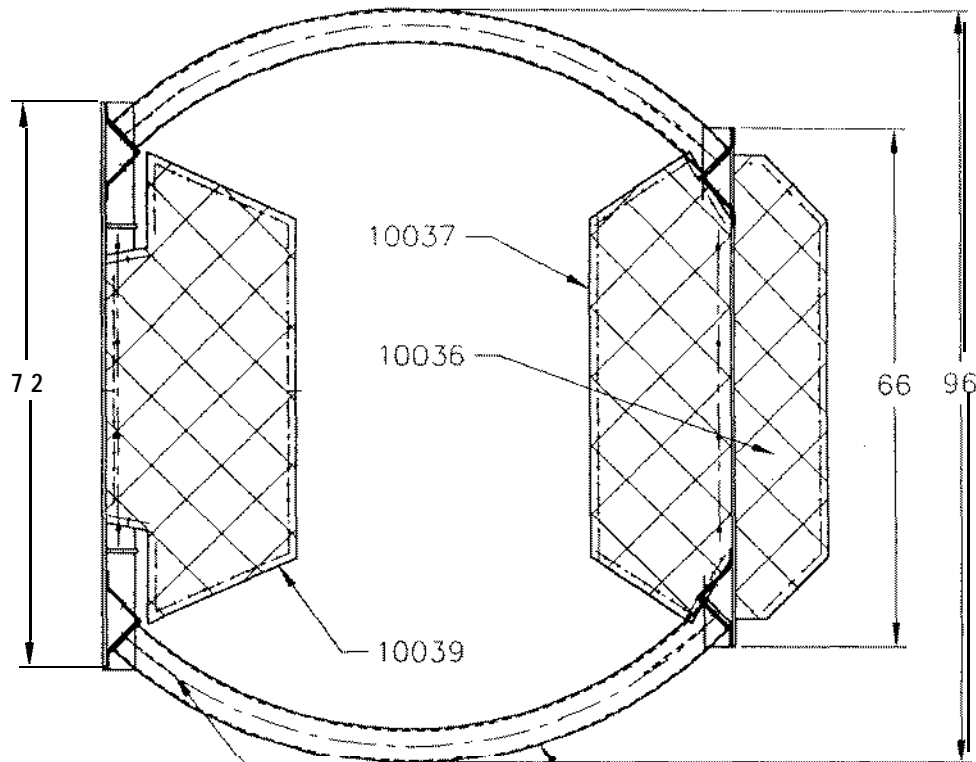
GENERAL INFORMATION

TEST AGENCY	KARCO ENGINEERING
TEST NO.	3-53
DATE	04/04/00
EST ARTICLE	
TYPE	TRUCK MOUNTED ATTENUATOR
INSTALLATION LENGTH (m)	N/A
SIZE AND/OR DIMENSION OF KEY ELEMENTS	N/A
SOIL TYPE AND CONDITION	N/A
EST VEHICLE	
TYPE	PRODUCTION
DESIGNATION	2000P
MODEL	CHEVROLET CHEYENNE
MASS (CURB)	1947.9 kg
MASS (TEST INERTIAL)	2024.6 kg
DUMMY(s) MASS	N/A
GROSS STATIC WEIGHT	2024.6 kg
MPACT CONDITIONS	
SPEED (km/h)	97.4
ANGLE (Deg.)	10
IMPACT SEVERITY (kJ)	N/A
EXIT CONDITIONS	
SPEED (km/h)	0
ANGLE (Deg.)	0

OCCUPANT RISK VALUES

IMPACT VELOCITY (m/sec)	
X-DIRECTION	0.03
Y-DIRECTION	1.08
TIIV (optional)	N/A
RIDEDOWN ACCELERATION (y's)	
X-DIRECTION	-16.52
Y-DIRECTION	6.62
PHD (optional)	N/A
ASI (optional)	0.891
TEST ARTICLE DEFLECTIONS (m)	
DYNAMIC	N/A
PERMANENT	N/A
VEHICLE DAMAGE	
EXTERIOR	
VDS	
CDC	
INTERIOR	
OCDI	
POST IMPACT VEHICULAR BEHAVIOR	
MAXIMUM ROLL ANGLE (Deg.)	10.63
MAXIMUM PITCH ANGLE (Deg.)	9.75
MAXIMUM YAW ANGLE (Deg.)	80.07

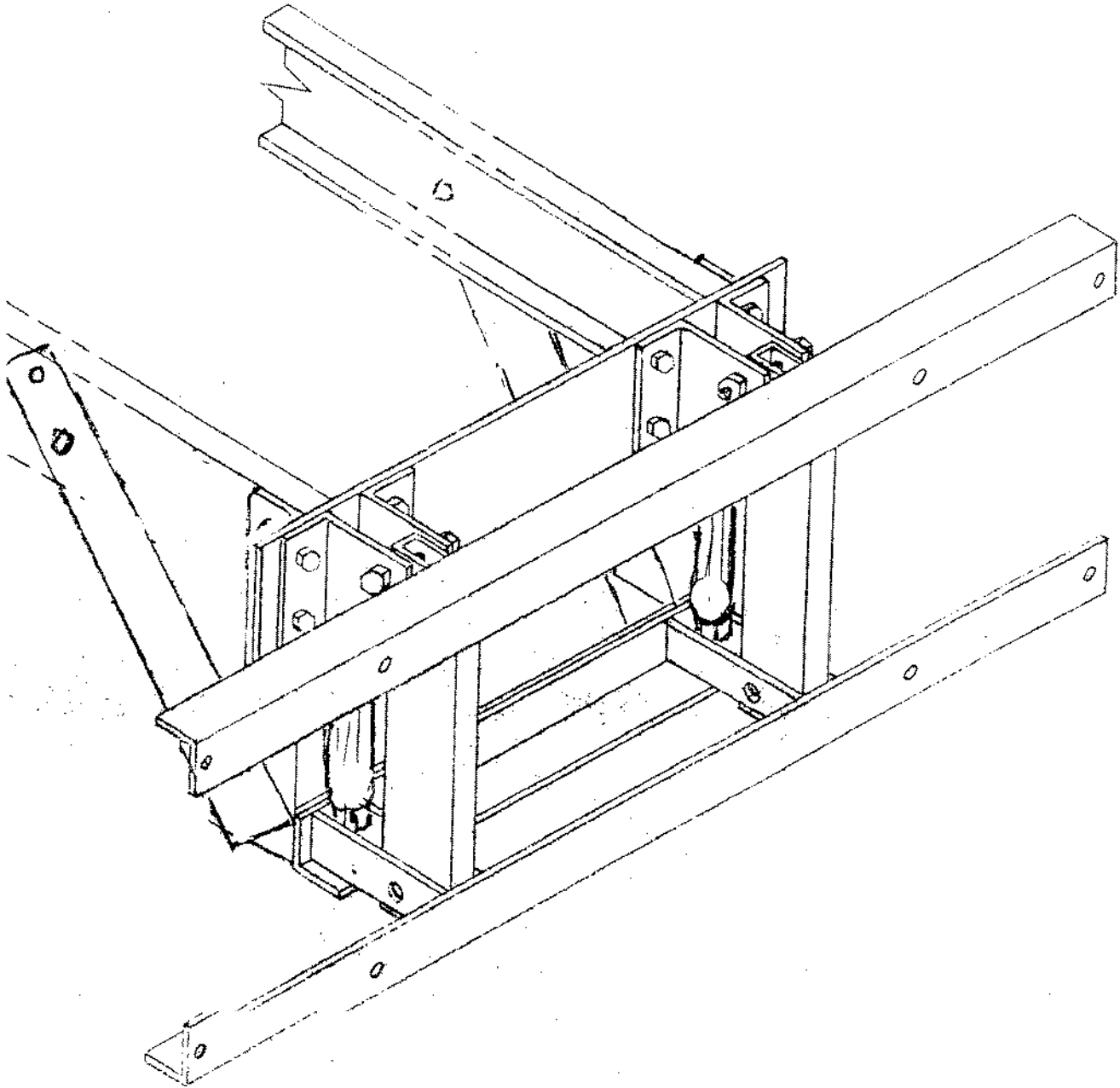




ENCLOSURE 2

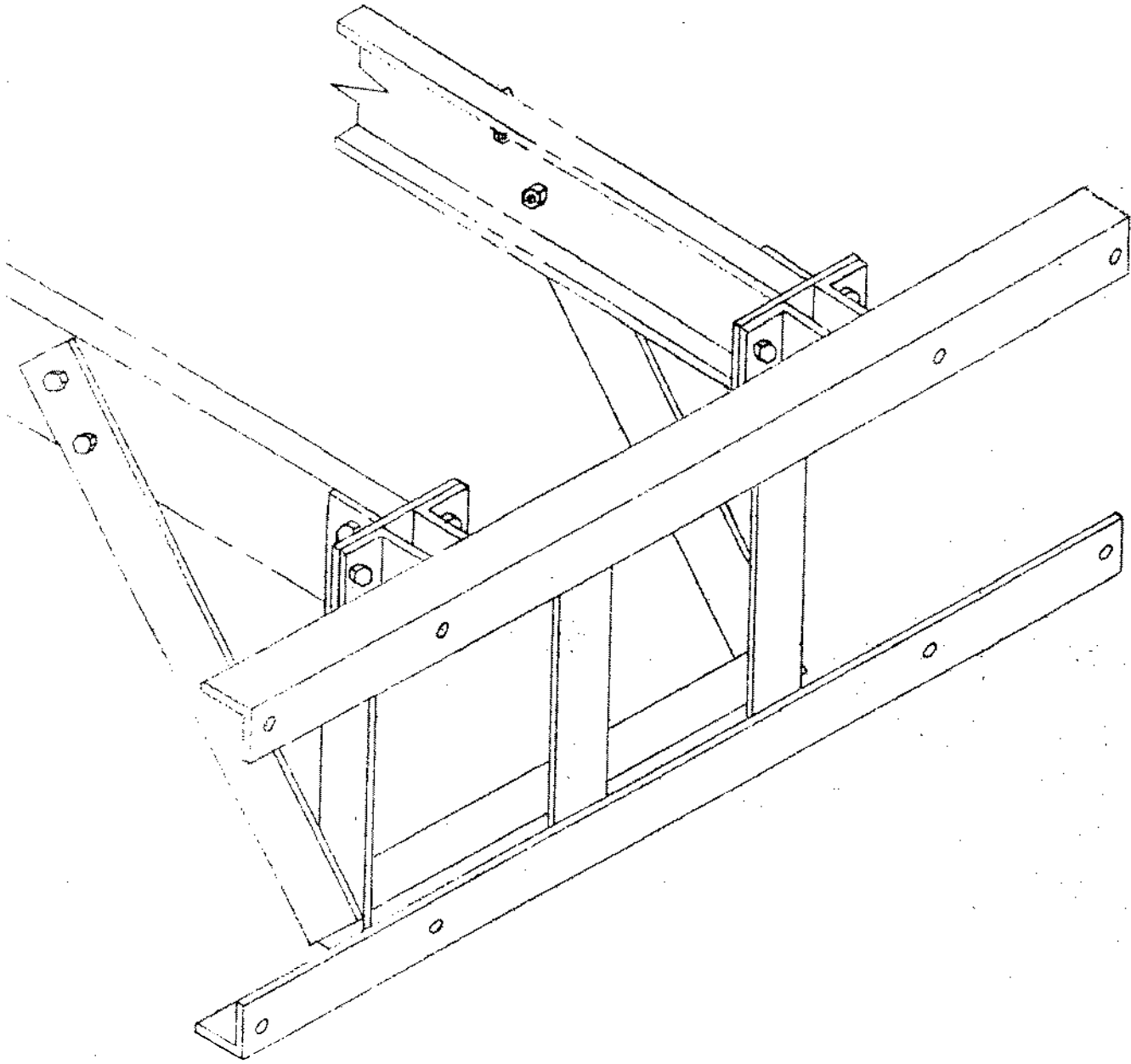

TOLERANCES UNLESS OTHERWISE SPECIFIED  
 DIMENSIONS IN INCHES  
 REF - 1.000  
 TRADE SIZE  
 11/20 - 0

Traffic Devices, Inc.	
ASSEMBLY: TL2, TMA	
10069	10069



ENCLOSURE 2A





ENCLOSURE 3A

**Sec. 635.411 Material or product selection.**

(a) Federal funds shall not participate, directly or indirectly, in payment for any premium or royalty on any patented or proprietary material, specification, or process specifically set forth in the plans and specifications for a project, unless:

(1) Such patented or proprietary item is purchased or obtained through competitive bidding with equally suitable unpatented items; or

(2) The State highway agency certifies either that such patented or proprietary item is essential for synchronization with existing highway facilities, or that no equally suitable alternate exists; or

(3) Such patented or proprietary item is used for research or for a distinctive type of construction on relatively short sections of road for experimental purposes.

(b) When there is available for purchase more than one nonpatented, nonproprietary material, semifinished or finished article or product that will fulfill the requirements for an item of work of a project and these available materials or products are judged to be of satisfactory quality and equally acceptable on the basis of engineering analysis and the anticipated prices for the related item(s) of work are estimated to be approximately the same, the PS&E for the project shall either contain or include by reference the specifications for each such material or product that is considered acceptable for incorporation in the work. If the State highway agency wishes to substitute some other acceptable material or product for the material or product designated by the successful bidder or bid as the lowest alternate, and such substitution results in an increase in costs, there will not be Federal-aid participation in any increase in costs.

(c) A State highway agency may require a specific material or product when there are other acceptable materials and products, when such specific choice is approved by the Division Administrator as being in the public interest. When the Division Administrator's approval is not obtained, the item will be nonparticipating unless bidding procedures are used that establish the unit price of each acceptable alternative. In this case Federal-aid participation will be based on the lowest price so established.

(d) Appendix A sets forth the FHWA requirements regarding (1) the specification of alternative types of culvert pipes, and (2) the number and types of such alternatives which must be set forth in the specifications for various types of drainage installations.

(e) Reference in specifications and on plans to single trade name materials will not be approved on Federal-aid contracts.