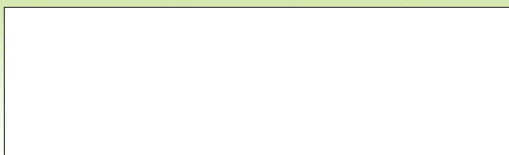


Brakemaster® 350



DESIGN

A Proven-Effective Crash Cushion



ENERGY ABSORPTION
SYSTEMS, INC.

A Quixote Company
Saving Lives By Design

Corporate Offices:
35 East Wacker Dr., 11th Floor
Chicago, IL 60601-2076
Telephone: (312) 467-6750
FAX: (312) 467-1356
<http://www.energyabsorption.com/>

Engineering and Manufacturing Facilities:
Rocklin, CA
Pell City, AL

Brakemaster[®] 350

General Information

Table of Contents

System Introduction/Overview	3
Brakemaster 350 System Design Criteria	4
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Important Introductory Notes

Proper installation of the Brakemaster 350 System is essential to assure maximum performance. Take the time to review the installation instructions and product limitations thoroughly before performing the necessary work. Do not attempt to install any crash cushion without the proper plans and Installation Manual from the manufacturer.

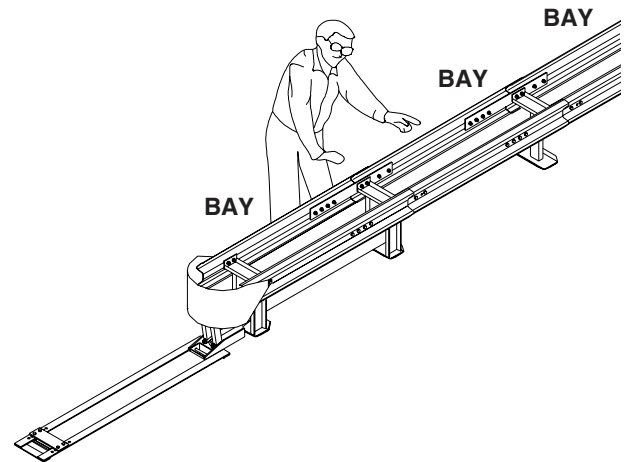
If you need additional information, or have questions about the Brakemaster 350 System, please call Energy Absorption Systems' **Customer Service Department at (888) 32-ENERG.**

System Overview

The Brakemaster 350 System is specially designed to shield narrow hazards in low frequency impact areas (see Limitations and Warnings). For protection of narrow hazards in a greater number of applications and easier refurbishment, the QuadGuard System remains the most versatile impact attenuator available.

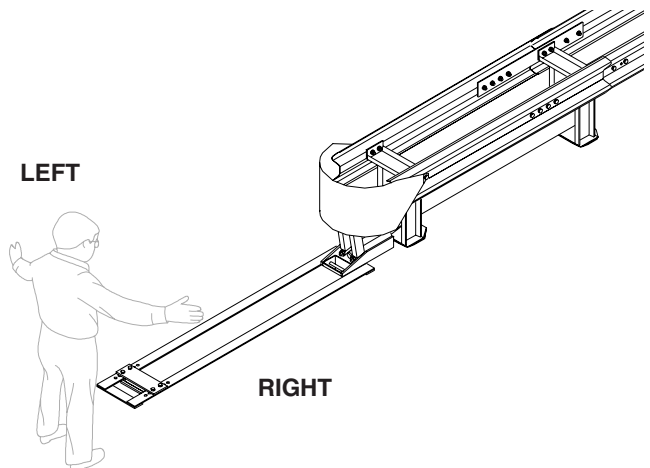
Counting The Number of Bays

One bay consists of one diaphragm, two fender panels, etc. Determine the number of bays by counting the fender panels on one side.



How to Determine Left/Right

To determine left from right when ordering parts, stand in front of the unit facing the hazard. Your left is the unit's left and your right is the unit's right.



Brakemaster[®] 350

Design Criteria

Design, selection, and placement of crash cushions and end terminals shall conform to and utilize devices described in:

- 1) American Association of State Highway and Transportation Officials (AASHTO) 1996 "Roadside Design Guide."
- 2) U. S. Department of Transportation/Federal Highway Administration (FHWA) Report No. 5040.16 "Crash Cushions, Selection Criteria, and Designs."

The BRAKEMASTER 350 System has been fully tested and evaluated per the recommendations of the National Cooperative Highway Research Program (NCHRP) Report 350 and has been approved by FHWA.

The BRAKEMASTER 350 System is designed to attach to w-beam guardrail with a nominal width of 460 mm [18 inches] and a centerline height of 533 mm [21"]. To ensure proper performance, the first 1905 mm [6'-3"] guardrail section behind the BRAKEMASTER 350 System should not angle more than 3 degrees laterally from the system centerline.

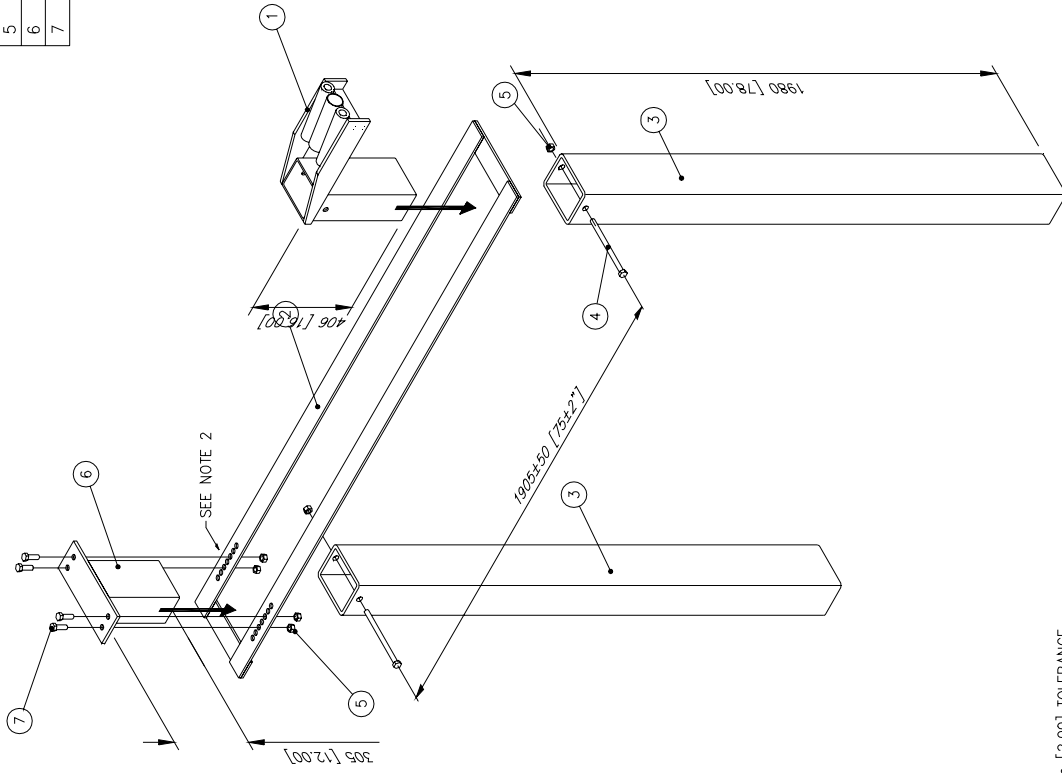
Special Site Conditions

- 1) Are curbs, islands or elevated objects (delineators, signs) present at the site? What height and width are they? All curbs and elevated objects over 102 mm [4"] high should be removed. If possible, curbs under 102 mm [4"] high should be removed a minimum of 15 m [50 feet] in front of the BRAKEMASTER 350 System and as far back as the rear of the system.
- 2) Other factors that may affect your design: insufficient space for the BRAKEMASTER 350 System length, the existence of drain inlets, junction boxes or other appurtenances located near the hazard (can they be relocated?).
- 3) In addition to the hazard's width, factors such as the hazard's height and the material from which it is made need to be considered. Is it concrete or steel? The transition and final attachment design are dependent

on these factors.

- 4) What is the general geometry of the site, including the roadway for 150 m [500'] in front, so traffic patterns can be visualized?
- 5) Is there a cross slope? If there is a cross slope of more than 8% (4.5 degrees), a leveling pad must be used.
- 6) Generally, the presence of expansion joints does not present a problem, but contact Energy Absorption Systems, Customer Service Department before proceeding with your design.
- 7) Is the unit in a two-way traffic situation, with traffic going in opposite directions on either side of the system? In these cases, the centerline of the BRAKEMASTER 350 System must be parallel to the centerline of the median behind the unit to within plus or minus 1 degree.
- 8) What type of transition is preferred? See transitions in the Applications section of this manual. Custom designs to meet your specific needs are available, please contact Energy Absorption Systems, Customer Service Department.
- 9) If there are any other unique features at the site that may affect positioning or performance of the BRAKEMASTER 350 System, please contact Energy Absorption Systems, Customer Service Department.
- 10) To ensure proper performance, the BRAKEMASTER 350 System should be installed on soils having a strength in the range of 10 to 60 blow counts per foot [300 mm] (per ASTM D1586). The standard anchor is an embedded concrete pile anchor. For other anchoring options, please contact Energy Absorption Systems Customer Service Department.
- 11) The location and orientation of the BRAKEMASTER 350 System must comply with the project plans or as otherwise specified by the project engineer.
- 12) The pad surface finish shall be standard firm soil, compacted subbase, oiled crushed rock, asphalt, or concrete. For questions regarding surface conditions, please contact Energy Absorption Systems Customer Service Department.

1	9202025-0000	ANCHOR ADAPTER,BITS TO FOUND. TUBE	1.00
2	9202026-0000	ANCHOR STRAP,BRS	1.00
3	9202028-0000	FOUNDATION TUBE,78,BRS	2.00
4	2701992-0000	BOLT,HX,5/8X10,G5,G	2.00
5	2704191-0000	NUT,HX,5/8,G,RAIL	6.00
6	9202033-0000	ANCHOR PLUG, FOUNDATION TUBE	1.00
7	2700501-0000	BOLT,HX,5/8X2,G2,G	4.00



NOTES:
 1. TIGHTEN NUTS 1/2 TURN BEYOND SNUG.
 2. EXTRA HOLES IN ITEM 2 ARE FOR ±50mm [2.00] TOLERANCE.
 3. UNITS OF MEASURE ARE IN MILLIMETERS [INCHES] UNLESS OTHERWISE NOTED.

ASSEMBLY NO. 9202024-0000

ENERGY ABSORPTION SYSTEMS, INC.
 ENGINEERING AND RESEARCH DEPARTMENT

BRAKEMASTER® 350 SYSTEM (BRS)
 ANCHOR ASSY, FOUNDATION TUBE,
 2m [6'-6"], BRS

Brakemaster® 350

PARTS LIST			
ITEM	STOCK NO.	DESCRIPTION	RECD
1	9202021-0000	ANCHOR, EMBEDDED, W/DECAL	1
2	9202031-0000	SUPPORT, WOOD, 1X4X48	2
3	2689141-0100	BOLT, HX, 1/4X1, 3/4, G2P	4
4	2708271-0000	WASHER, FLAT, 1/4X1 1/2, G	4
5	2704151-0100	NUT, HX, 1/4, P	4

TRAFFIC

1524 [60.00]

610 [24.00] DIAMETER HOLE

SEE NOTE 1

SEE NOTE 2

FIELD CONFIGURATION

13 [0.50] MIN.

SIDE VIEW

610 [24.00] DIAMETER HOLE

SEE DETAIL A

DETAIL A

CAUTION: Proper placement of this assembly is critical to the final assembly of the system. Read and follow the installation instructions.

ASSEMBLY NO. 9202010-0000

ENERGY ABSORPTION SYSTEMS, INC.
ENGINEERING AND RESEARCH DEPARTMENT

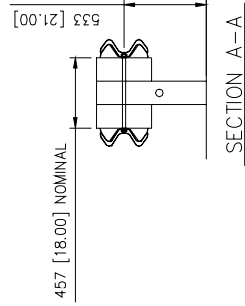
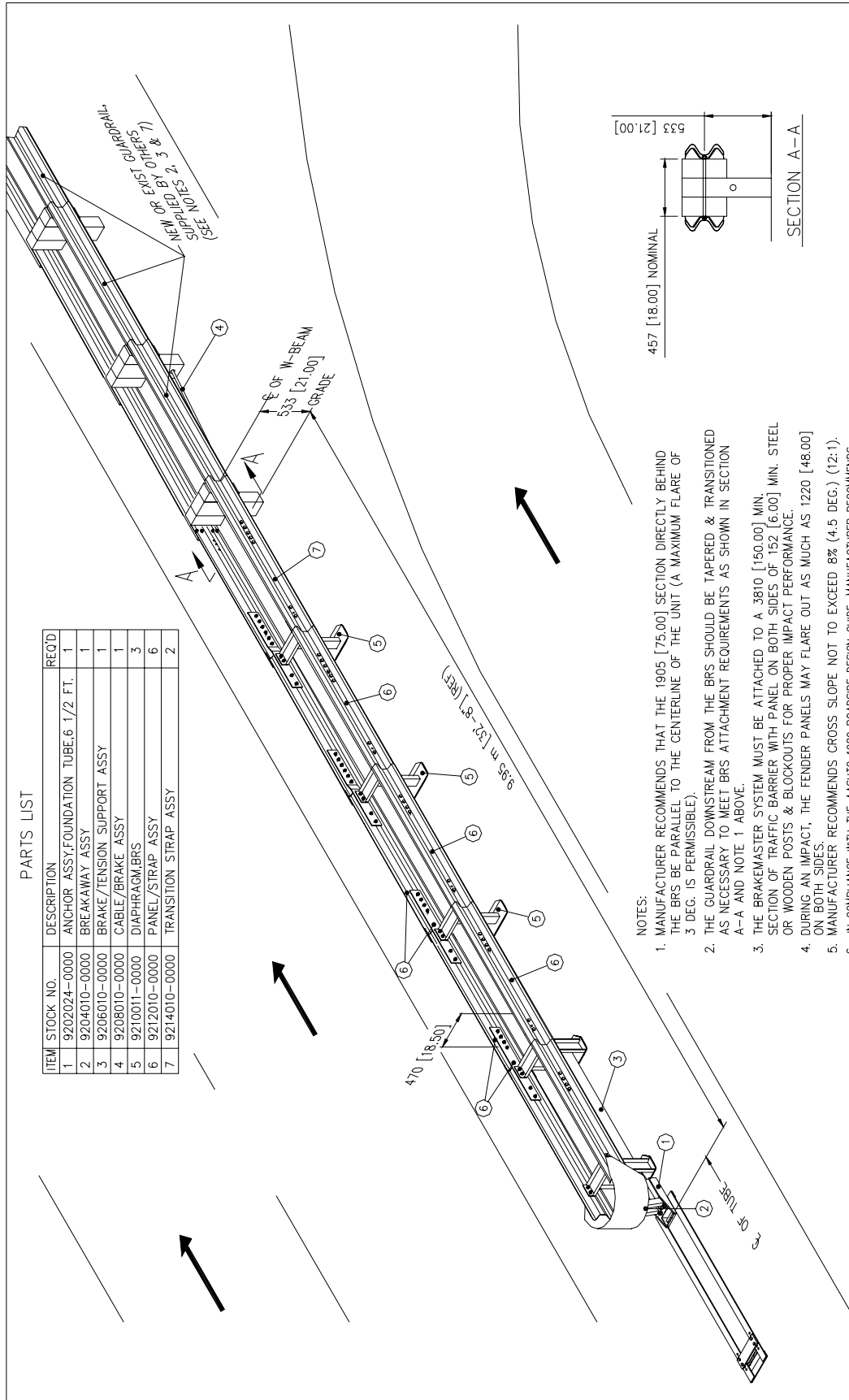
BRAKEMASTER SYSTEM® 350 (BRS)
ANCHOR ASSY, EMBEDDED, BRS

NOTES:

1. ATTACH ITEMS 2 TO ITEM 1 AS SHOWN PRIOR TO INSTALLATION. REMOVE AFTER CONCRETE HAS SET.
2. NOTE DIRECTION OF ANCHOR: SEE DECAL.
3. UNITS OF MEASURE ARE IN MILLIMETERS [INCHES] UNLESS OTHERWISE NOTED.

PARTS LIST

ITEM STOCK NO.	DESCRIPTION	REQ'D
1	9202024-0000 ANCHOR ASSY.FOUNDATION TUBE.6 1/2 FT.	1
2	9204010-0000 BREAKAWAY ASSY	1
3	9206010-0000 BRAKE/TENSION SUPPORT ASSY	1
4	9208010-0000 CABLE/BRAKE ASSY	1
5	9210011-0000 DIAPHRAGM.BRS	3
6	9212010-0000 PANEL/STRAP ASSY	6
7	9214010-0000 TRANSITION STRAP ASSY	2



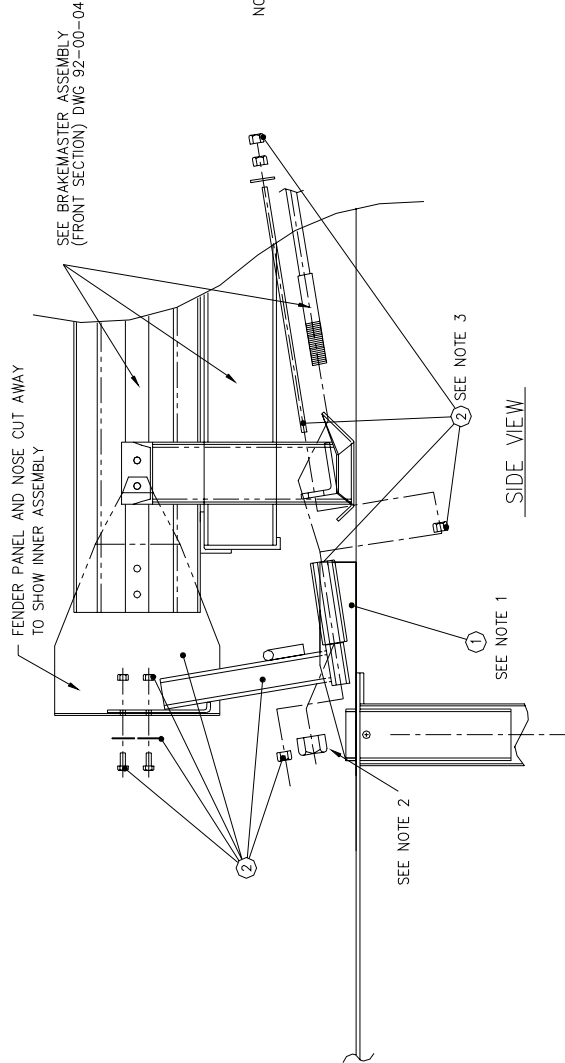
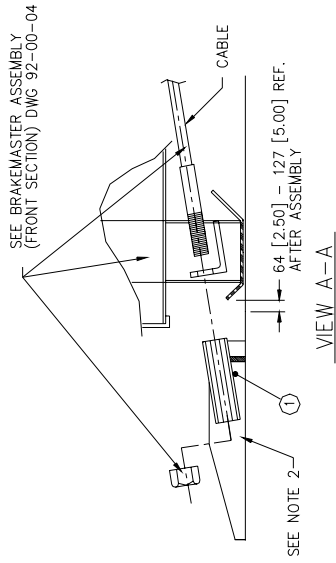
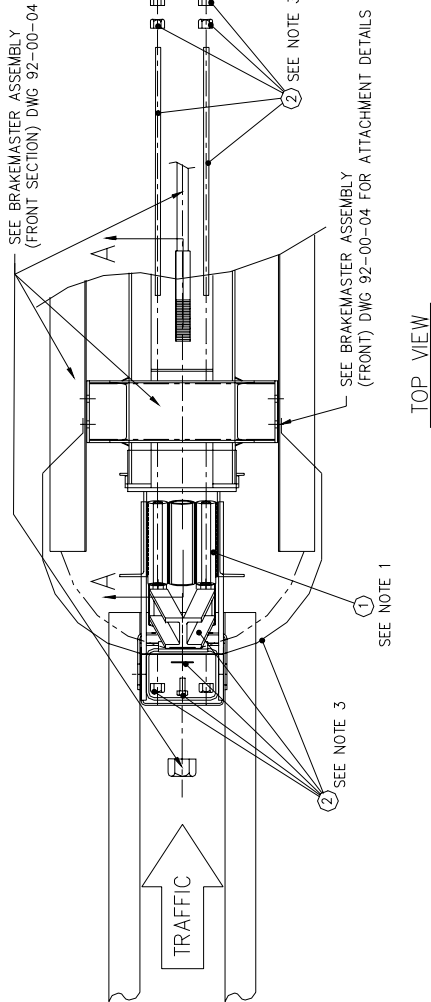
- NOTES:
1. MANUFACTURER RECOMMENDS THAT THE 1905 [75.00] SECTION DIRECTLY BEHIND THE BRS BE PARALLEL TO THE CENTERLINE OF THE UNIT (A MAXIMUM FLARE OF 3 DEG. IS PERMISSIBLE).
 2. THE GUARDRAIL DOWNSTREAM FROM THE BRS SHOULD BE TAPERED & TRANSITIONED AS NECESSARY TO MEET BRS ATTACHMENT REQUIREMENTS AS SHOWN IN SECTION A-A AND NOTE 1 ABOVE.
 3. THE BRAKEMASTER SYSTEM MUST BE ATTACHED TO A 3810 [150.00] MIN. SECTION OF TRAFFIC BARRIER WITH PANEL ON BOTH SIDES OF 152 [6.00] MIN. STEEL OR WOODEN POSTS & BLOCKOUTS FOR PROPER IMPACT PERFORMANCE.
 4. DURING AN IMPACT, THE FENDER PANELS MAY FLARE OUT AS MUCH AS 1220 [48.00] ON BOTH SIDES.
 5. MANUFACTURER RECOMMENDS CROSS SLOPE NOT TO EXCEED 8% (4.5 DEG.) (12:1).
 6. IN COMPLIANCE WITH THE AASHTO 1989 ROADSIDE DESIGN GUIDE, MANUFACTURER RECOMMENDS REMOVAL OF ALL CURBS AND ISLANDS FOR PROPER IMPACT PERFORMANCE.
 7. DOWNSTREAM GUARDRAIL MUST BE ANCHORED TO WITHSTAND A TENSION OF 534 KN [120,000 LBS.] WHICH COULD DEVELOP DURING A SIDE ANGLE IMPACT.
 8. CAUTION: DO NOT ATTACH THE BRAKEMASTER SYSTEM DIRECTLY TO A RIGID CONCRETE BARRIER. A GUARDRAIL TRANSITION SECTION IS REQUIRED. CONTACT ENERGY ABSORPTION SYSTEMS AT (312) 467-6750 FOR MORE INFORMATION.
 9. UNITS OF MEASURE ARE MILLIMETERS [INCHES] UNLESS OTHERWISE NOTED.
 10. SEE THE "BRAKEMASTER SYSTEM DESIGN MANUAL" CODED ENE 704-1091 FOR A DESCRIPTION OF ITS IMPACT PERFORMANCE CHARACTERISTICS AND DESIGN LIMITATIONS BEFORE PLACING A SYSTEM AT A GIVEN SITE. INFORMATION AND ADDITIONAL COPIES OF ABOVE MANUAL ARE AVAILABLE BY CALLING THE CUSTOMER SERVICE DEPARTMENT AT (312) 467-6750.

MODEL NO. 106106BRS5
ENERGY ABSORPTION SYSTEMS, INC.
 ENGINEERING AND RESEARCH DEPARTMENT

BRAKEMASTER®350 SYSTEM (BRS)
 GENERAL ASSEMBLY
 (UNIDIRECTIONAL SYSTEM)

Brakemaster® 350

PARTS LIST	
ITEM	STOCK NO. DESCRIPTION
1	9202024-0000 ANCHOR ASSY. FOUNDATION TUBE, 6 1/2 FT
2	9204010-0000 BREAKAWAY ASSY



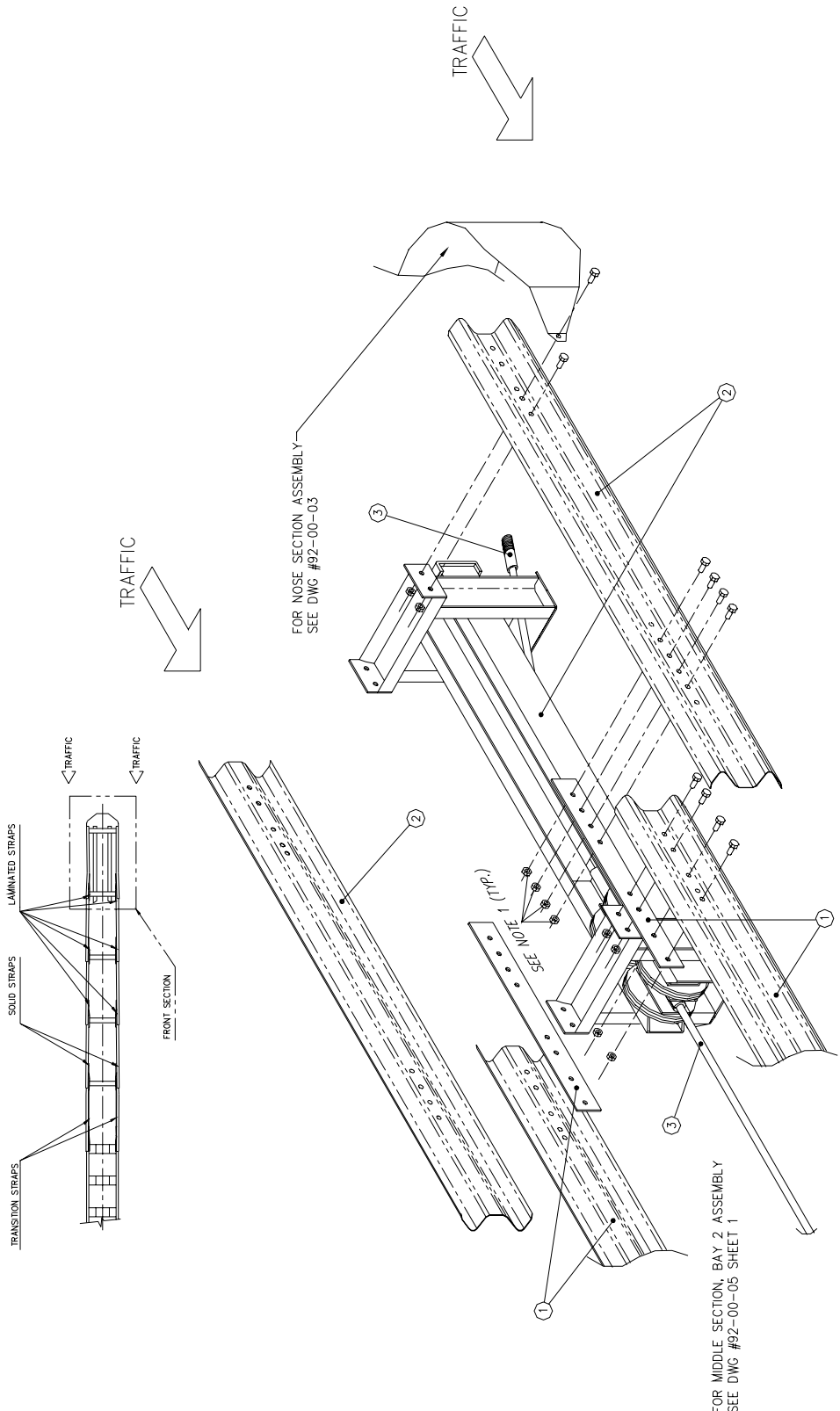
NOTES:

1. PLACEMENT OF EMBEDDED ANCHOR IS CRITICAL. REFER TO DETAILED INSTRUCTIONS IN INSTALLATION MANUAL.
2. NUT TO BE HAND TIGHT.
3. NUTS TO BE WRENCH TIGHT.
4. UNITS OF MEASURE ARE MILLIMETERS [INCHES] UNLESS OTHERWISE NOTED.

ENERGY ABSORPTION SYSTEMS, INC.
ENGINEERING AND RESEARCH DEPARTMENT

BRAKEMASTER® 350 SYSTEM (BRS)
ASSEMBLY
(NOSE SECTION)
UNIDIRECTIONAL

PARTS LIST	
ITEM	STOCK NO. DESCRIPTION
1	9212010-0000 PANEL/STRAP ASSY
2	9206010-0000 BRAKE/TENSION SUPPORT ASSY
3	9208010-0000 CABLE/BRAKE ASSY



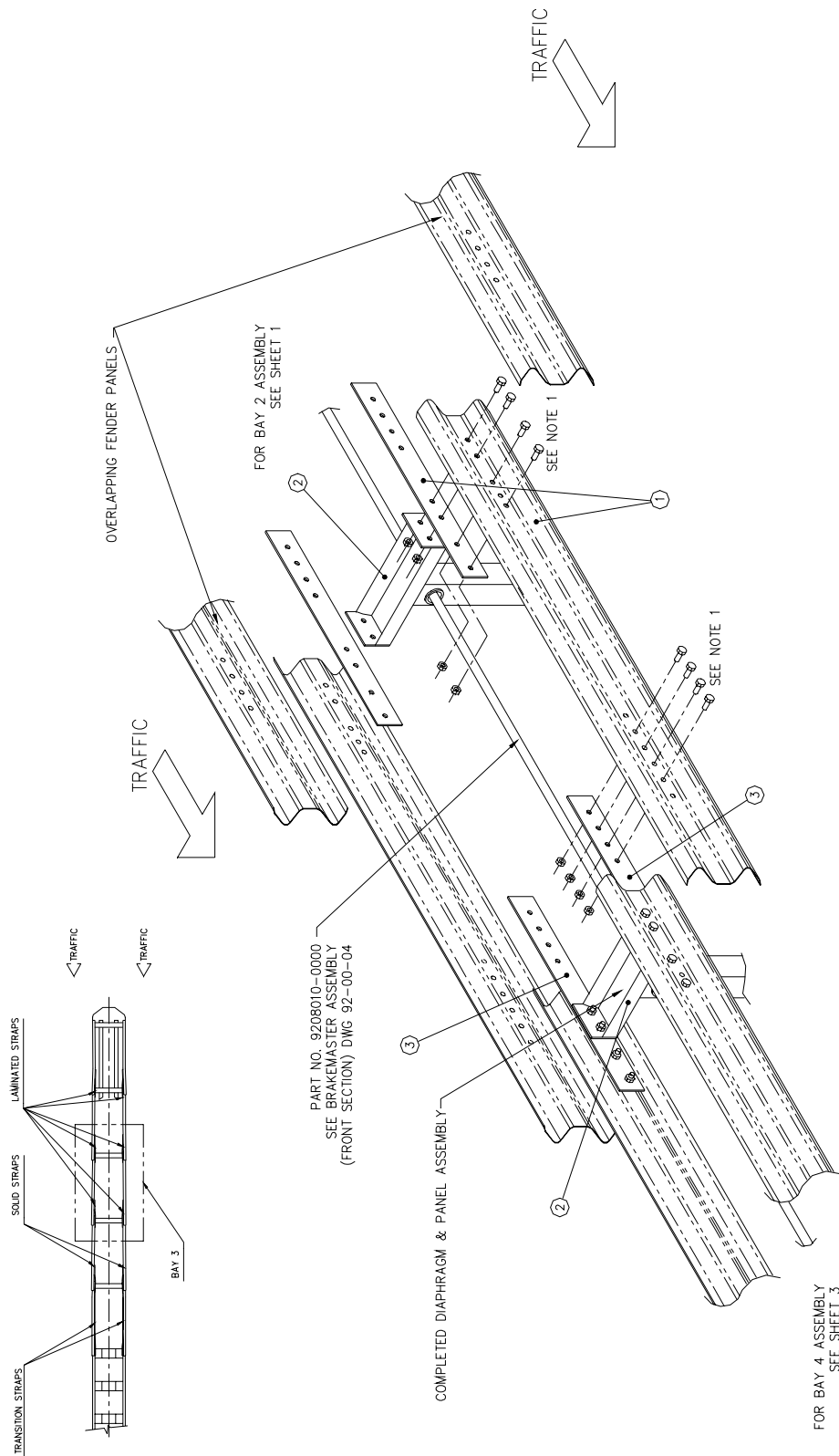
ENERGY ABSORPTION SYSTEMS, INC.
ENGINEERING AND RESEARCH DEPARTMENT

BRAKEMASTER®350 SYSTEM (BRS)
ASSEMBLY
(FRONT SECTION)
UNIDIRECTIONAL

NOTE:
1. TORQUE NUTS TO 136±14 Nm [100±10 FT.-LBS]

Brakemaster® 350

PARTS LIST	
ITEM	STOCK NO. DESCRIPTION
1	9212010-0000 PANEL/STRAP ASSY
2	9210011-0000 DIAPHRAGM, BRS
3	9216021-0000 STRAP, LAMINATED

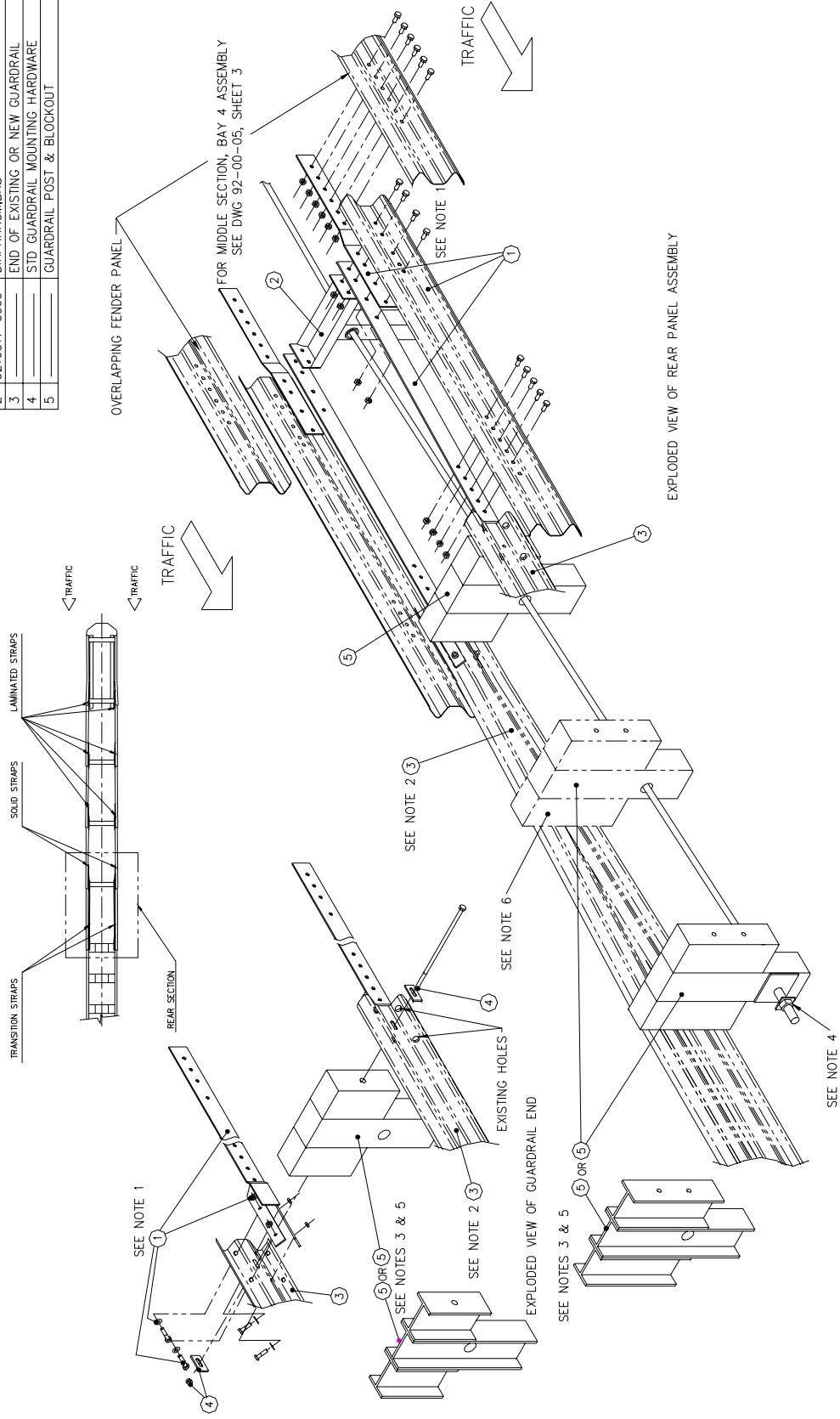


ENERGY ABSORPTION SYSTEMS, INC.
ENGINEERING AND RESEARCH DEPARTMENT

BRAKEMASTER® 350 SYSTEM (BRS)
ASSEMBLY
(MIDDLE SECTION)
UNIDIRECTIONAL

NOTE:
1. TORQUE NUTS TO 136±14 Nm [100±10 FT-LBS]

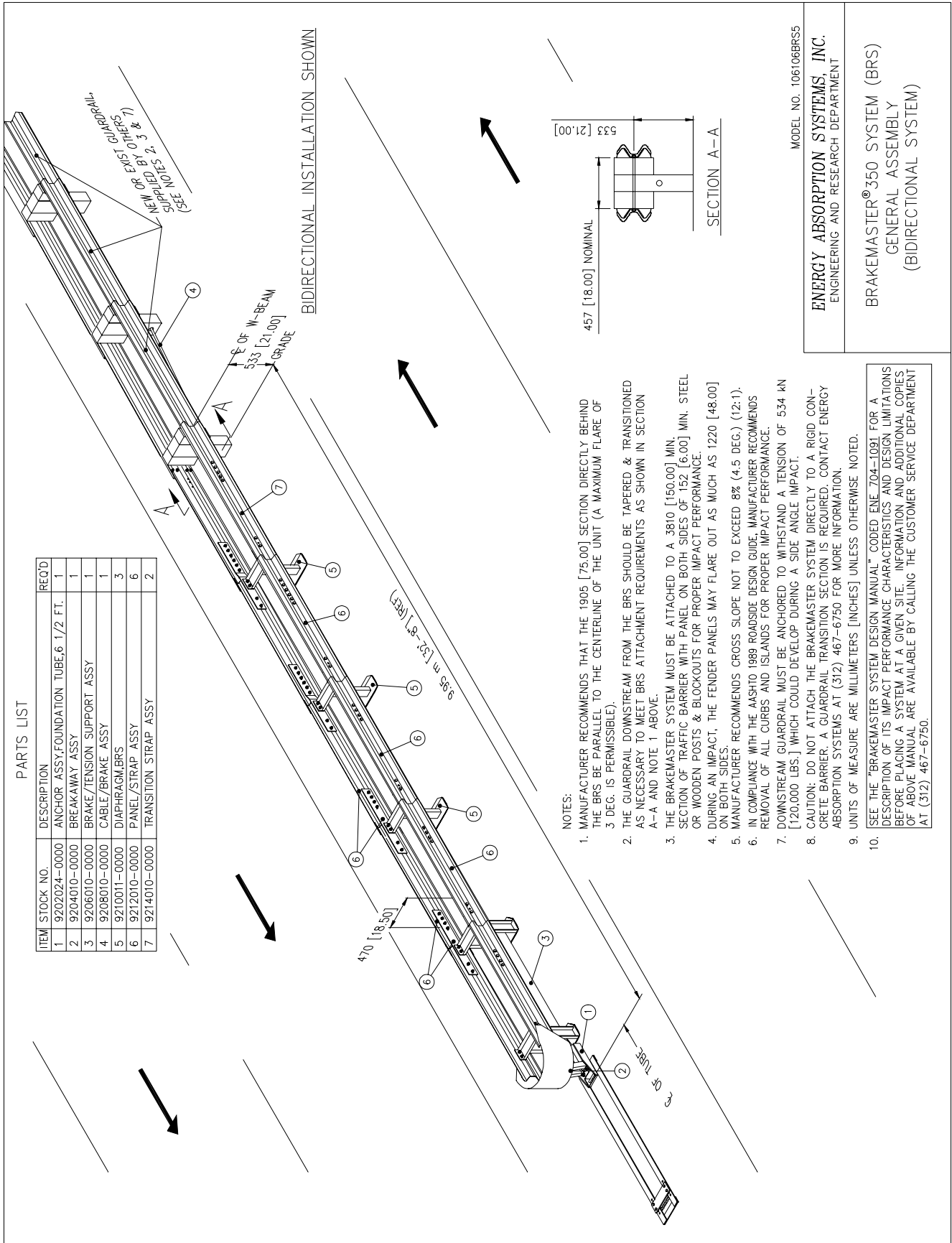
PARTS LIST	
ITEM	STOCK NO. DESCRIPTION
1	9214010-0000 TRANSITION STRAP ASSY
2	9210011-0000 DIAPHRAGM/BRS
3	END OF EXISTING OR NEW GUARDRAIL
4	STD GUARDRAIL MOUNTING HARDWARE
5	GUARDRAIL POST & BLOCKOUT



ENERGY ABSORPTION SYSTEMS, INC.
 ENGINEERING AND RESEARCH DEPARTMENT
BRAKEMASTER® 350 SYSTEM (BRS)
 ASSEMBLY
 (REAR SECTION)
 UNIDIRECTIONAL

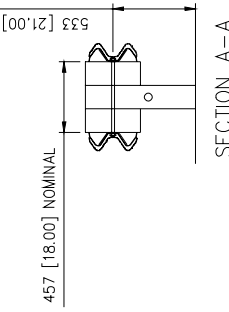
- NOTES:
1. TORQUE NUTS TO 136 ±14 Nm [100±10 FT-LBS].
 2. DISASSEMBLY OF EXISTING GUARDRAIL NOT NECESSARY.
 3. SEE BRAKEMASTER INSTALLATION MANUAL FOR REQUIRED POST HOLE LOCATIONS.
 4. NUT TO BE HAND TIGHT.
 5. POSTS AND BLOCKOUTS MAY BE WOOD OR STEEL.
 6. THIS POST MAY NOT BE REQUIRED. SEE ROADWAY AUTHORITY REQUIREMENTS.

Brakemaster® 350



PARTS LIST

ITEM STOCK NO.	DESCRIPTION	REQ'D
1 9202024-0000	ANCHOR ASSY.FOUNDATION TUBE.6 1/2 FT.	1
2 9204010-0000	BREAKAWAY ASSY	1
3 9206010-0000	BRAKE/TENSION SUPPORT ASSY	1
4 9208010-0000	CABLE/BRAKE ASSY	1
5 9210011-0000	DIAPHRAGM.BRS	3
6 9212010-0000	PANEL/STRAP ASSY	6
7 9214010-0000	TRANSITION STRAP ASSY	2



SECTION A-A

MODEL NO. 106106BR35

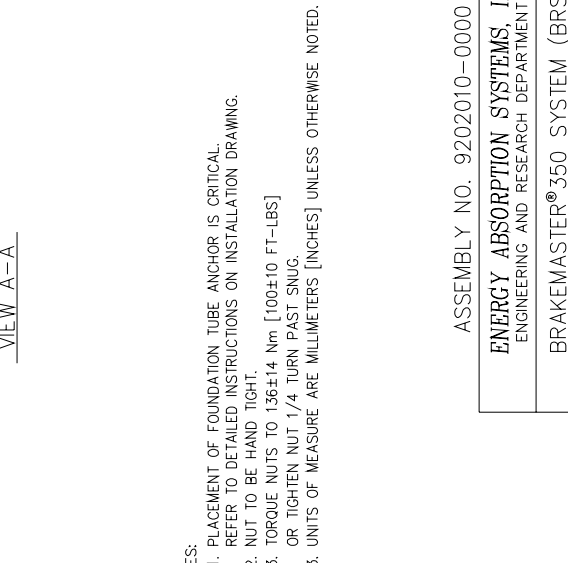
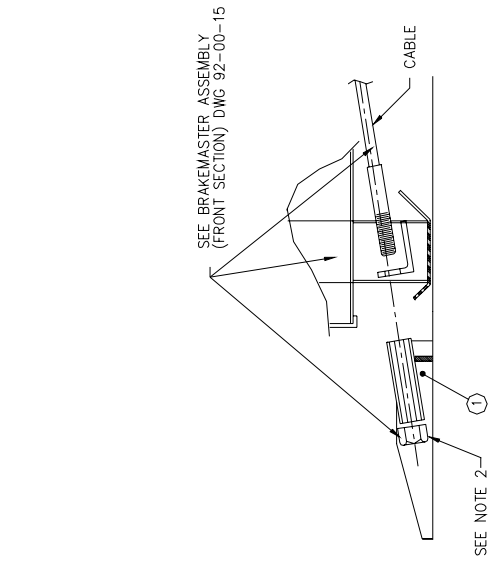
ENERGY ABSORPTION SYSTEMS, INC.
ENGINEERING AND RESEARCH DEPARTMENT

BRAKEMASTER®350 SYSTEM (BRS)
GENERAL ASSEMBLY
(BIDIRECTIONAL SYSTEM)

NOTES:

1. MANUFACTURER RECOMMENDS THAT THE 1905 [75.00] SECTION DIRECTLY BEHIND THE BRS BE PARALLEL TO THE CENTERLINE OF THE UNIT (A MAXIMUM FLARE OF 3 DEG. IS PERMISSIBLE).
2. THE GUARDRAIL DOWNSTREAM FROM THE BRS SHOULD BE TAPERED & TRANSITIONED AS NECESSARY TO MEET BRS ATTACHMENT REQUIREMENTS AS SHOWN IN SECTION A-A AND NOTE 1 ABOVE.
3. THE BRAKEMASTER SYSTEM MUST BE ATTACHED TO A 3810 [150.00] MIN. SECTION OF TRAFFIC BARRIER WITH PANEL ON BOTH SIDES OF 152 [6.00] MIN. STEEL OR WOODEN POSTS & BLOCKOUTS FOR PROPER IMPACT PERFORMANCE.
4. DURING AN IMPACT, THE FENDER PANELS MAY FLARE OUT AS MUCH AS 1220 [48.00] ON BOTH SIDES.
5. MANUFACTURER RECOMMENDS CROSS SLOPE NOT TO EXCEED 8% (4.5 DEG.) (12:1).
6. IN COMPLIANCE WITH THE ASHTO 1988 ROADSIDE DESIGN GUIDE, MANUFACTURER RECOMMENDS REMOVAL OF ALL CURBS AND ISLANDS FOR PROPER IMPACT PERFORMANCE.
7. DOWNSTREAM GUARDRAIL MUST BE ANCHORED TO WITHSTAND A TENSION OF 534 kN [120,000 LBS.] WHICH COULD DEVELOP DURING A SIDE ANGLE IMPACT.
8. CAUTION: DO NOT ATTACH THE BRAKEMASTER SYSTEM DIRECTLY TO A RIGID CONCRETE BARRIER. A GUARDRAIL TRANSITION SECTION IS REQUIRED. CONTACT ENERGY ABSORPTION SYSTEMS AT (312) 467-6750 FOR MORE INFORMATION.
9. UNITS OF MEASURE ARE MILLIMETERS [INCHES] UNLESS OTHERWISE NOTED.
10. [SEE THE "BRAKEMASTER SYSTEM DESIGN MANUAL" CODED ENE 704-1091 FOR A DESCRIPTION OF ITS IMPACT PERFORMANCE CHARACTERISTICS AND DESIGN LIMITATIONS BEFORE PLACING A SYSTEM AT A GIVEN SITE. INFORMATION AND ADDITIONAL COPIES OF ABOVE MANUAL ARE AVAILABLE BY CALLING THE CUSTOMER SERVICE DEPARTMENT AT (312) 467-6750.]

PARTS LIST	
ITEM	STOCK NO. DESCRIPTION
1	9202024-0000 ANCHOR ASSY, FOUNDATION TUBE, 6 1/2 FT
2	9204010-0000 BREAKAWAY ASSY



- NOTES:
1. PLACEMENT OF FOUNDATION TUBE ANCHOR IS CRITICAL. REFER TO DETAILED INSTRUCTIONS ON INSTALLATION DRAWING.
 2. NUT TO BE HAND TIGHT.
 3. TORQUE NUTS TO 136±14 Nm [100±10 FT-LBS] OR TIGHTEN NUT 1/4 TURN PAST SNUG.
 3. UNITS OF MEASURE ARE MILLIMETERS [INCHES] UNLESS OTHERWISE NOTED.

ASSEMBLY NO. 9202010-0000

ENERGY ABSORPTION SYSTEMS, INC.
ENGINEERING AND RESEARCH DEPARTMENT

BRAKEMASTER®350 SYSTEM (BRS)
ASSEMBLY
(NOSE SECTION)
BIDIRECTIONAL

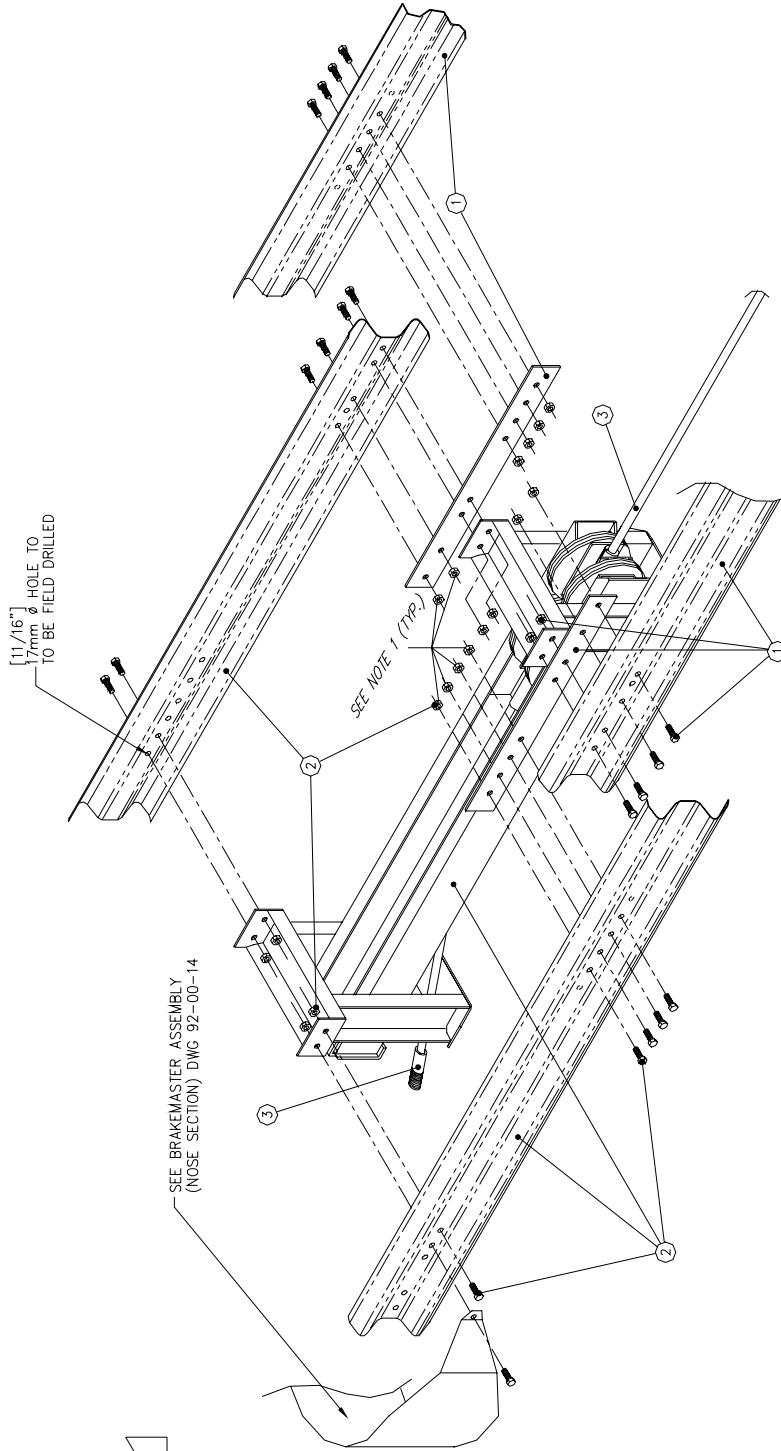
Brakemaster® 350

PARTS LIST	
ITEM	STOCK NO. DESCRIPTION
1	9212010-0000 PANEL/STRAP ASSY
2	9206010-0000 BRAKE/TENSION SUPPORT ASSY
3	9208010-0000 CABLE/BRAKE ASSY

TRAFFIC



TRAFFIC

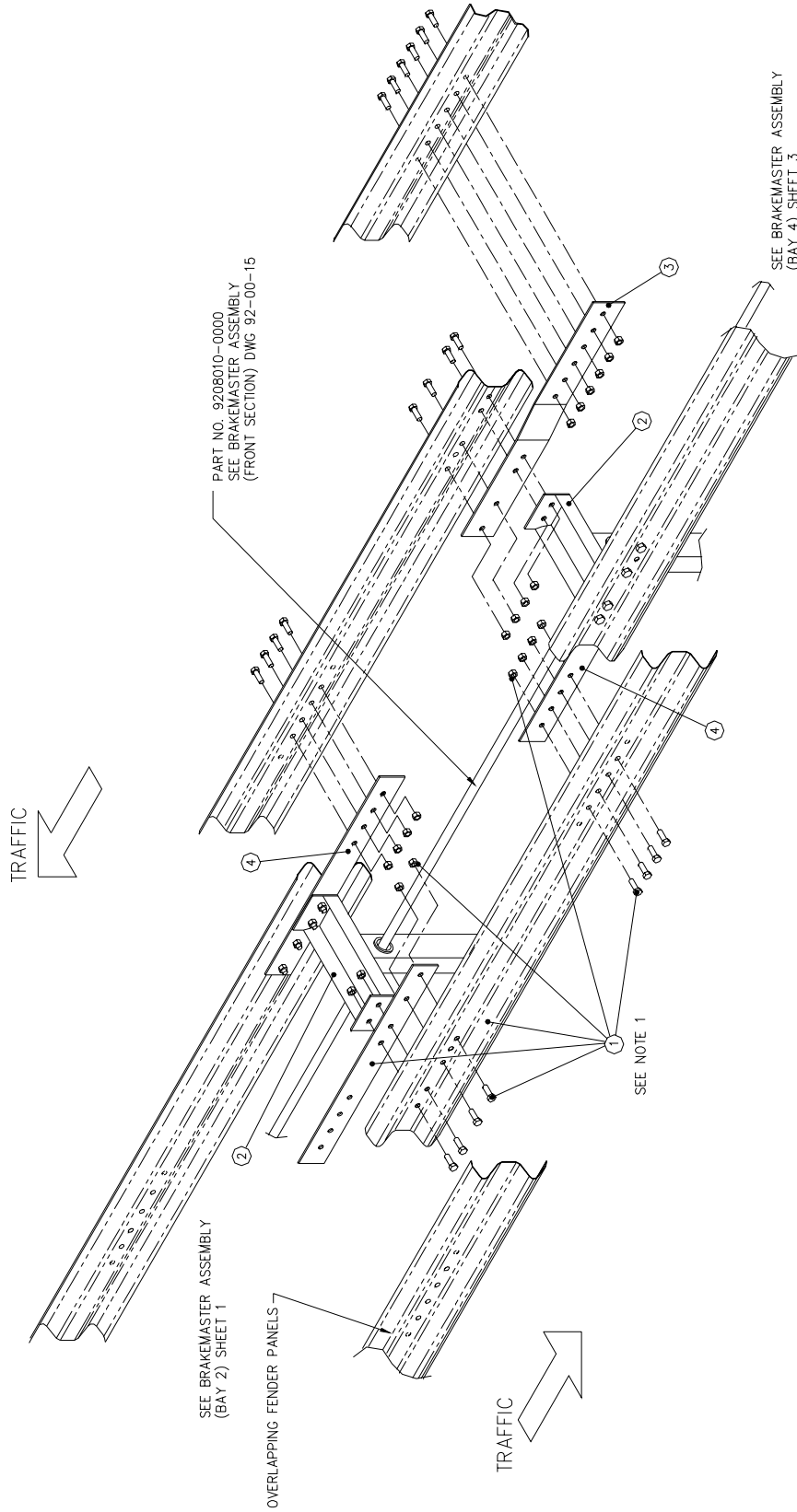


ENERGY ABSORPTION SYSTEMS, INC.
ENGINEERING AND RESEARCH DEPARTMENT

BRAKEMASTER® 350 SYSTEM (BRS)
ASSEMBLY
(FRONT SECTION)
BIDIRECTIONAL

NOTE:
1. TORQUE NUTS TO 136±14 Nm [100±10 FT-LBS]

PARTS LIST		RECD
ITEM	STOCK NO.	DESCRIPTION
1	9212010-0000	PANEL/STRAP ASSY
2	9210011-0000	DIAPHRAGM,BRS
3	9218011-0000	STRAP,SOLID W/DECAL
4	9216021-0000	STRAP,LAMINATED

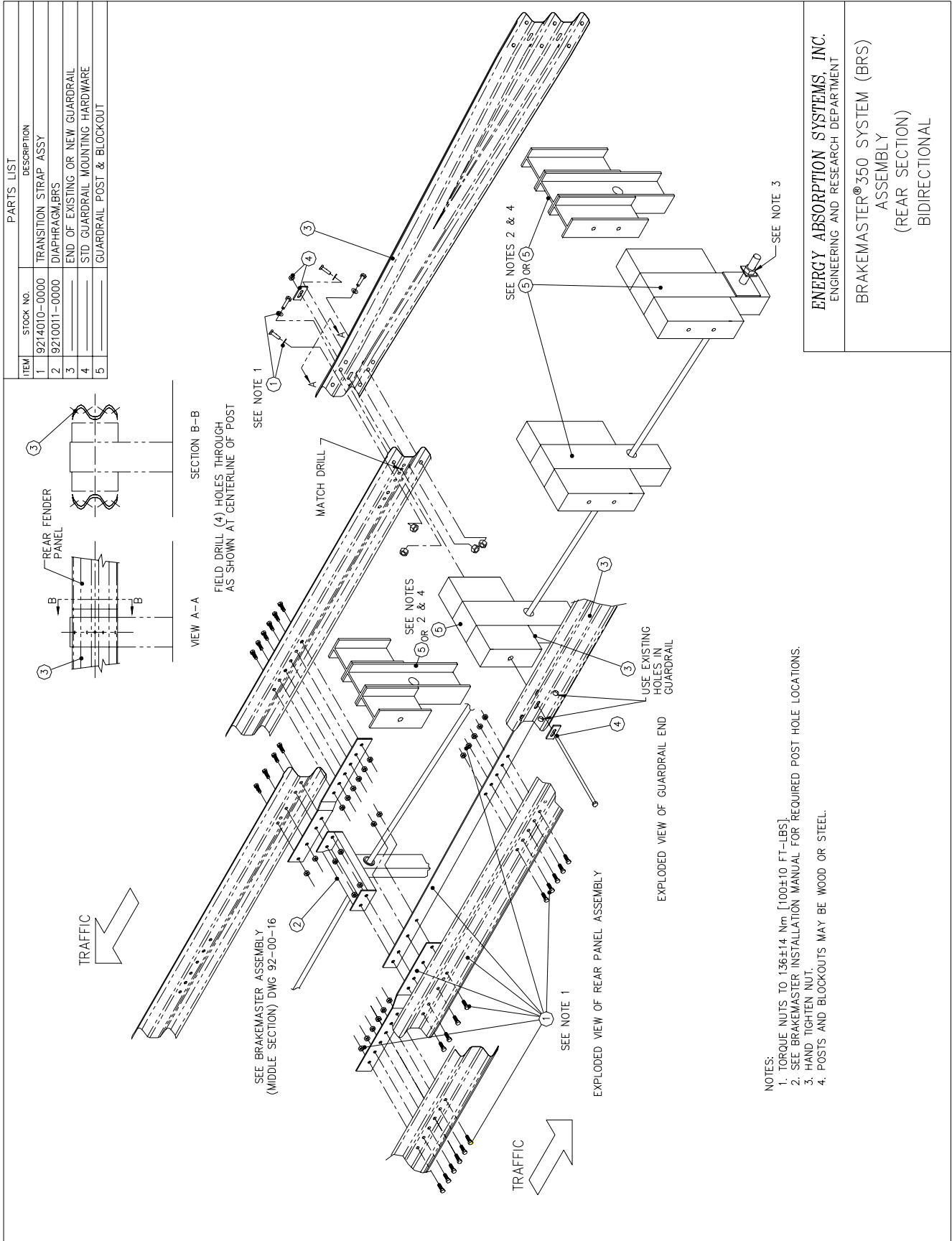


ENERGY ABSORPTION SYSTEMS, INC.
 ENGINEERING AND RESEARCH DEPARTMENT

BRAKEMASTER® 350 SYSTEM (BRS)
 ASSEMBLY
 (MIDDLE SECTION)
 BIDIRECTIONAL

NOTE:
 1. TORQUE NUTS TO 136±14 Nm [100±10 FT-LBS]

Brakemaster® 350

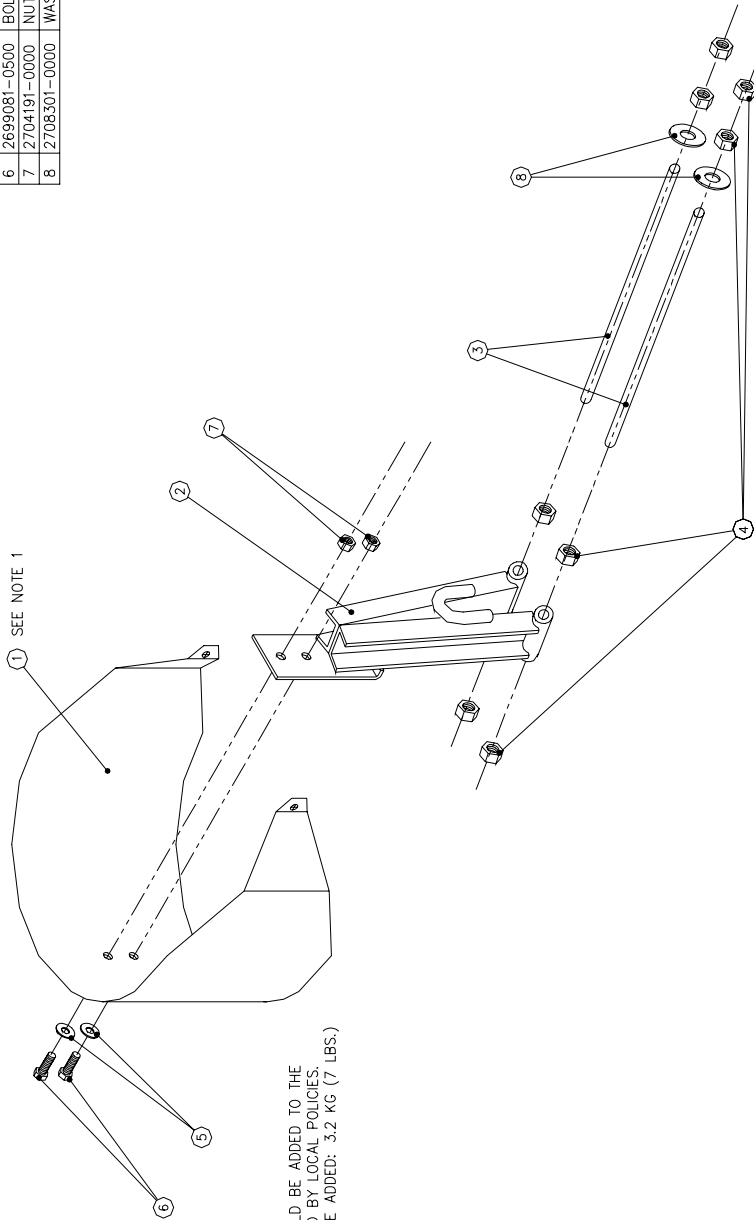


ENERGY ABSORPTION SYSTEMS, INC.
ENGINEERING AND RESEARCH DEPARTMENT

BRAKEMASTER®350 SYSTEM (BRS)
ASSEMBLY
(REAR SECTION)
BIDIRECTIONAL

- NOTES:
1. TORQUE NUTS TO 136±14 Nm [100±10 FT-LBS].
 2. SEE BRAKEMASTER INSTALLATION MANUAL FOR REQUIRED POST HOLE LOCATIONS.
 3. HAND TIGHTEN NUT.
 4. POSTS AND BLOCKOUTS MAY BE WOOD OR STEEL.

PARTS LIST			
ITEM	STOCK NO.	DESCRIPTION	RECD
1	9204021-0000	NOSE,BRS	1
2	9204031-0000	BREAKAWAY ARM	1
3	2699272-0500	ROD,THREADED,7/8X28,G5,G	2
4	2704441-0000	NUT,HX,7/8LG,GR DH	8
5	2708291-0000	WASHER,FLAT,5/8X1.3/4,G	2
6	2699081-0500	BOLT,HX,5/8X1.1/2,G5,G	2
7	2704191-0000	NUT,HX,5/8,G,C,RAIL	2
8	2708301-0000	WASHER,FLAT,7/8X2.1/4,G	2



DELINEATION SHOULD BE ADDED TO THE NOSE AS REQUIRED BY LOCAL POLICIES.
MAX. WEIGHT TO BE ADDED: 3.2 KG (7 LBS.)

NOTES:
1. FORM FROM FLAT IN FIELD.
2. SHIPPED DISASSEMBLED.

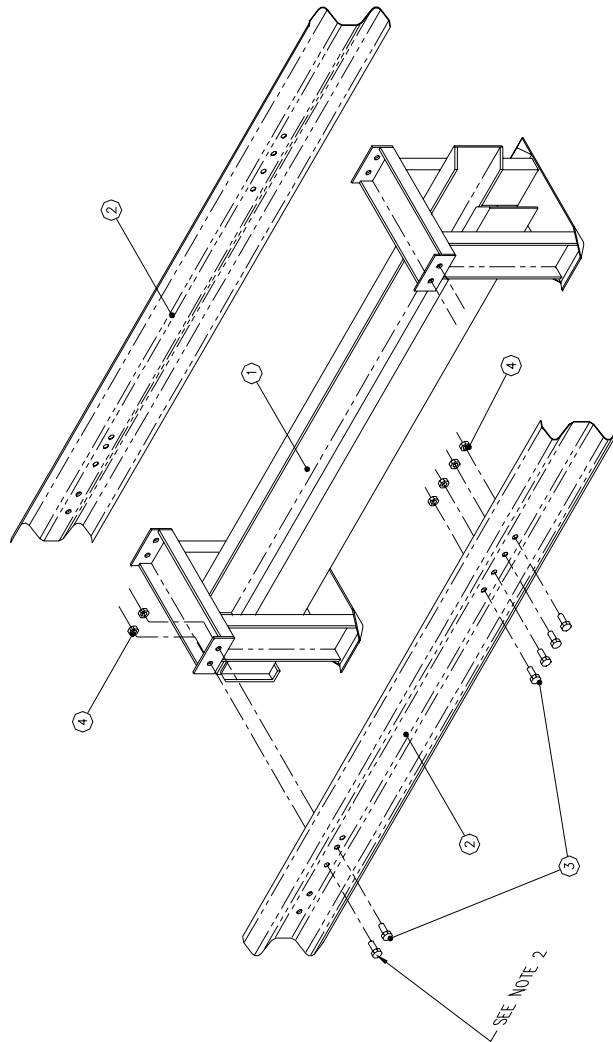
ASSEMBLY NO. 9204010-0000

ENERGY ABSORPTION SYSTEMS, INC.
ENGINEERING AND RESEARCH DEPARTMENT

BRAKEMASTER® 350 SYSTEM (BRS)
BREAKAWAY ASSEMBLY

Brakemaster® 350

PARTS LIST			
ITEM	STOCK NO.	DESCRIPTION	RECD
1	9206021-0000	BRAKE/TENSION SUPPORT	1
2	9212021-0000	PANEL/FENDER,BRS	2
3	2699081-0500	BOLT,HX,5/8X1 1/2,95,G	12
4	2704191-0000	NUT,HX,5/8,G,RAIL	12



ASSEMBLY NO. 9206010-0000

ENERGY ABSORPTION SYSTEMS, INC.
ENGINEERING AND RESEARCH DEPARTMENT

BRAKEMASTER® 350 SYSTEM (BRS)
BRAKE/TENSION SUPPORT ASSEMBLY

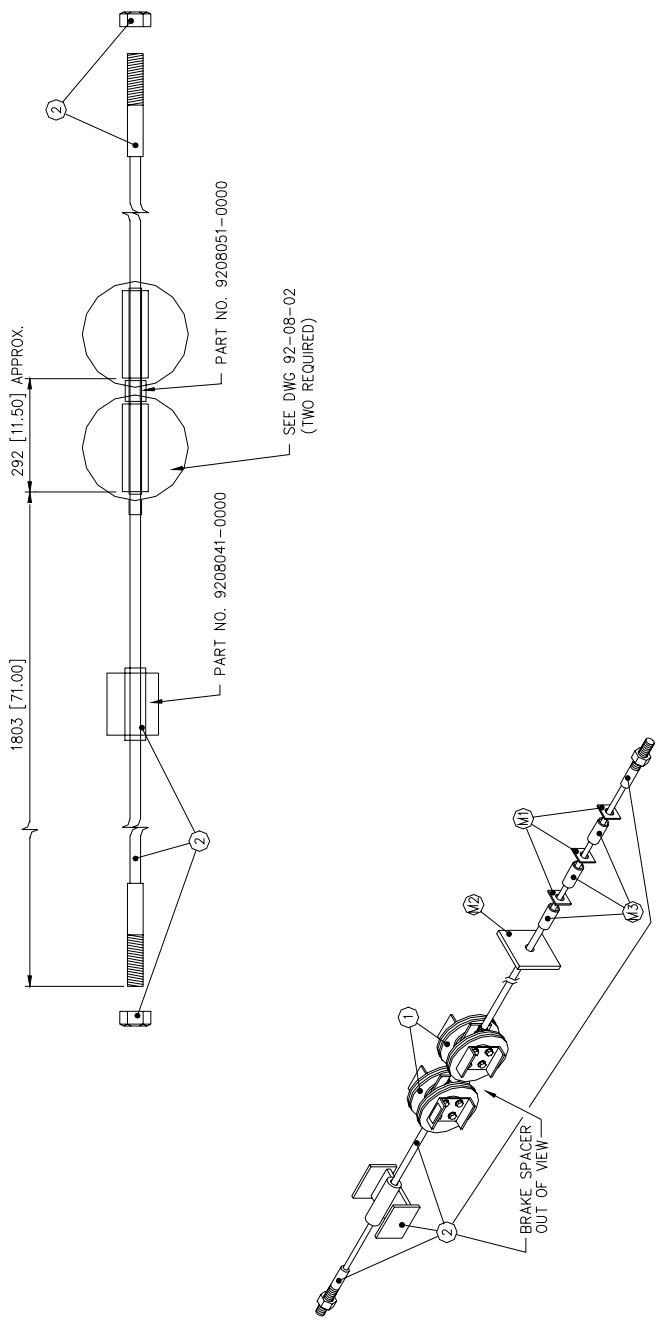
- NOTES:
1. SHIPPED DISASSEMBLED.
 2. THIS BOLT IS USED TO ATTACH THE BRAKEMASTER NOSE.
SEE BRAKEMASTER ASSEMBLY (FRONT SECTION) DWG 92-00-04.

PARTS LIST		
ITEM	STOCK NO.	DESCRIPTION
1	9208021-0000	BRAKE ASSY
2	9208032-0000	CABLE ASSY, 2 STUD ENDS, BRS
M1	2708491-0000	WASHER BAR, 1/4X3X3, C
M2	2708671-0000	WASHER BAR, 3/4X8X8
M3	9208101-0000	SPACER, BRS

920801B-0000
CABLE/BRAKE ASSY
LESS MISC HARDWARE

920801A-0000
MISC CABLE HRDWR

*SEE NOTE 1



NOTES:
1. MISC CABLE HRDWR SHIPPED DISASSEMBLED.
2. UNITS OF MEASURE ARE MILLIMETERS [INCHES] UNLESS OTHERWISE NOTED.

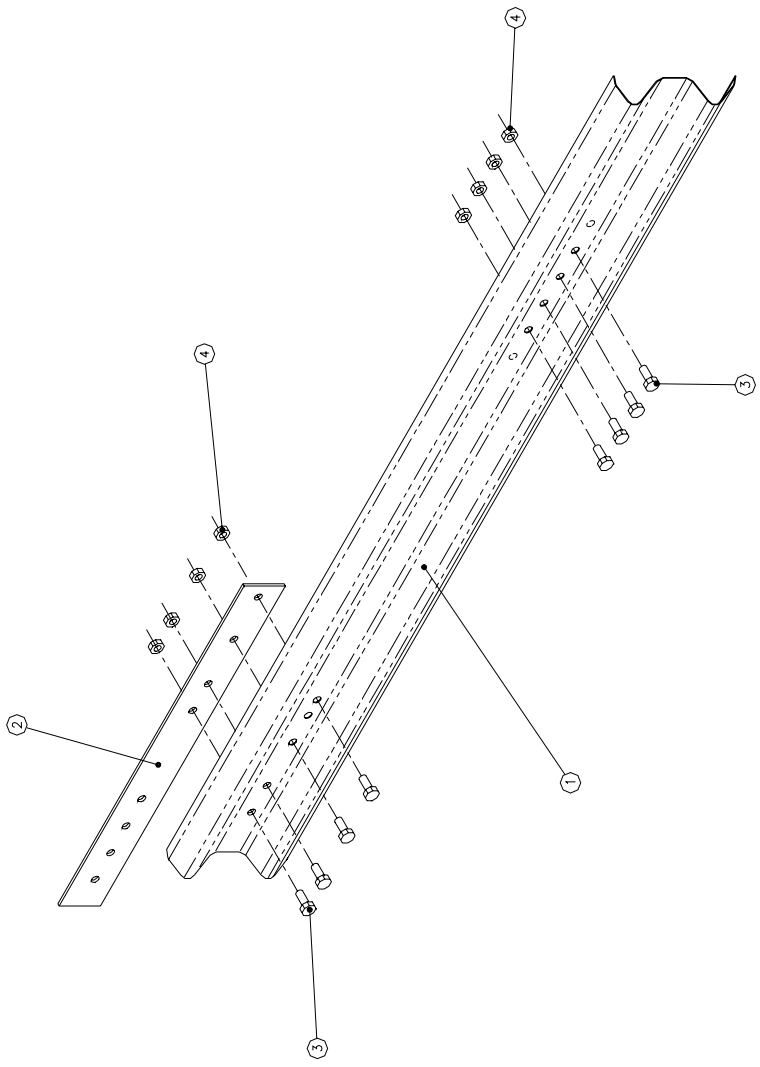
ASSEMBLY NO. 9208010-0000

ENERGY ABSORPTION SYSTEMS, INC.
ENGINEERING AND RESEARCH DEPARTMENT

BRAKEMASTER®350 SYSTEM (BRS)
CABLE/BRAKE ASSEMBLY

Brakemaster® 350

PARTS LIST			
ITEM	STOCK NO.	DESCRIPTION	REQD
1	9212021-0000	PANEL,FENDER,BRS	1
2	9216021-0000	STRAP,LAMINATED	1
3	2699081-0500	BOLT,HX,5/8X1 1/2,05,G	8
4	2704191-0000	NUT,HX,5/8,G,RAIL	8



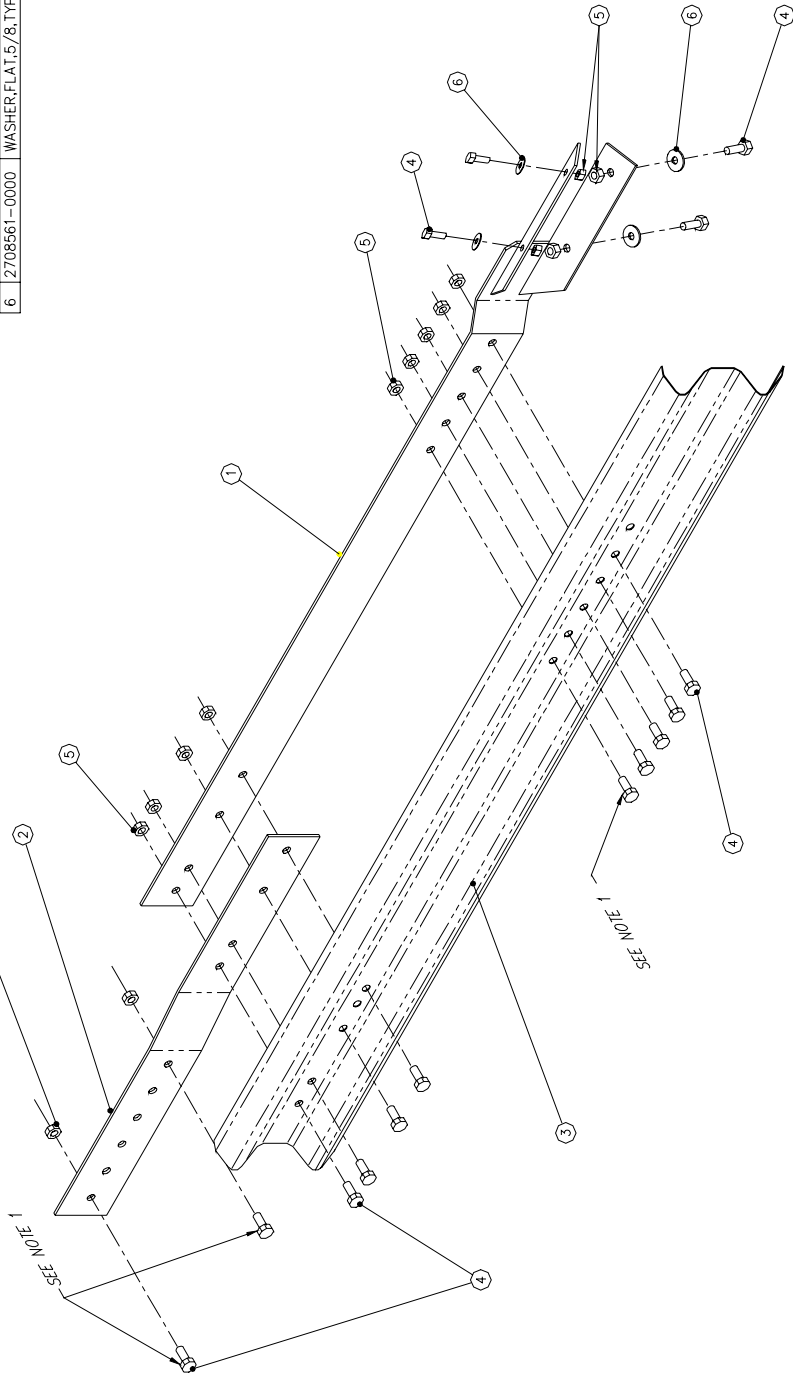
ASSEMBLY NO. 9212010-0000

ENERGY ABSORPTION SYSTEMS, INC.
ENGINEERING AND RESEARCH DEPARTMENT

BRAKEMASTER®350 SYSTEM (BRS)
PANEL/STRAP ASSEMBLY

NOTE:
1. SHIPPED DISASSEMBLED

PARTS LIST			
ITEM	STOCK NO.	DESCRIPTION	RECD
1	9214021-0000	STRAP, TRANSITION	1
2	9218011-0000	STRAP, SOLID	1
3	9212021-0000	PANEL, FENDER, BRS	1
4	2699081-0500	BOLT, HX, 5/8X1 1/2, GS, G	15
5	2704191-0000	NUT, HX, 5/8, G, RAIL	15
6	2708561-0000	WASHER, FLAT, 5/8, TYPE A, WIDE, G	4



ASSEMBLY NO. 9214010-0000

ENERGY ABSORPTION SYSTEMS, INC.
ENGINEERING AND RESEARCH DEPARTMENT

BRAKEMASTER® 350 SYSTEM (BRS)
TRANSITION STRAP ASSEMBLY

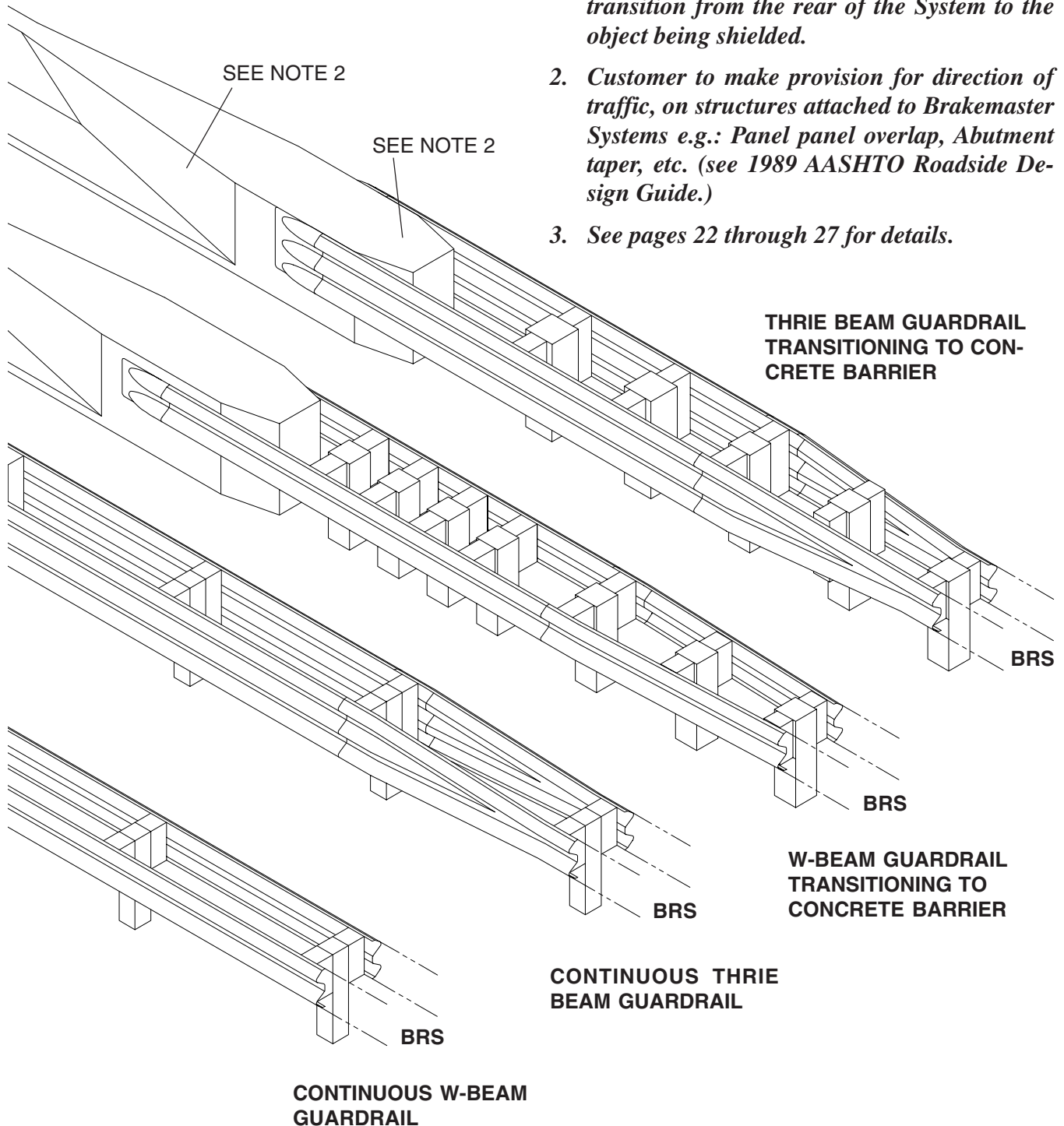
- NOTES:
1. POSITION FASTENERS IN LANCED PANEL KNOCK-OUT.
 2. SHIPPED DISASSEMBLED.

Brakemaster® 350

TYPICAL TRANSITION SECTIONS

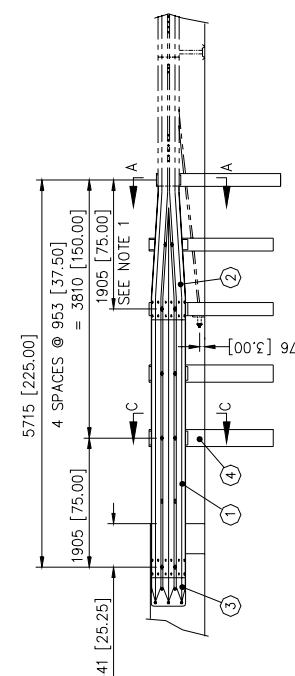
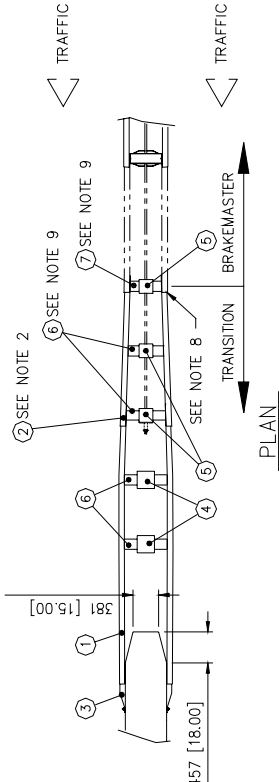
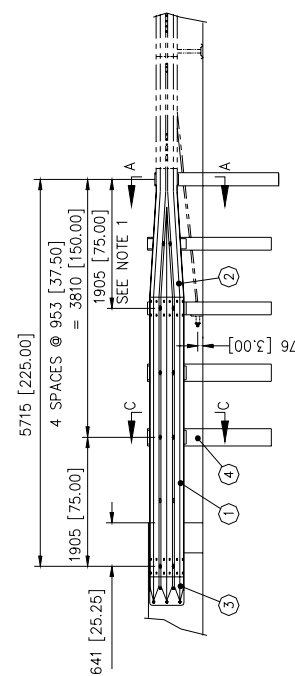
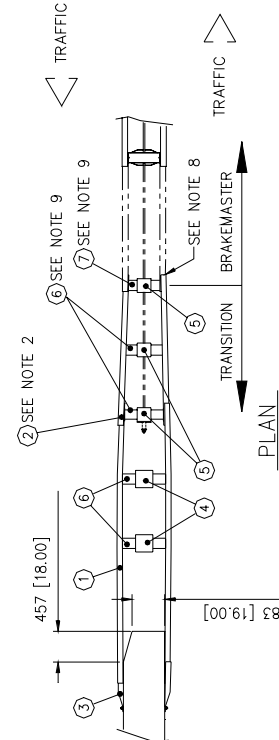
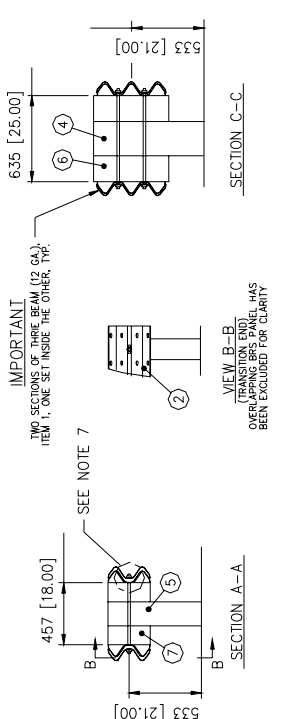
Notes:

1. *Where necessary, the customer shall supply a transition from the rear of the System to the object being shielded.*
2. *Customer to make provision for direction of traffic, on structures attached to Brakemaster Systems e.g.: Panel panel overlap, Abutment taper, etc. (see 1989 AASHTO Roadside Design Guide.)*
3. *See pages 22 through 27 for details.*



- KEY**
- ① GUARDRAIL SECTION
 - ② TRANSITION PANEL
 - ③ END SHOE
 - ④ POST-10"x10"x6" WOOD
 - ⑤ POST-8"x6"x6" WOOD
 - ⑥ BLOCKOUT-6"x8"x1'-10 1/2" WOOD
 - ⑦ BLOCKOUT-6"x6"x1'-2" WOOD

- NOTES:**
1. MANUFACTURER RECOMMENDS THAT THE 1905 [76.00] SECTION DIRECTLY BEHIND THE BRS BE PARALLEL TO THE CENTERLINE OF THE UNIT (A MAXIMUM FLARE OF 3 DEG. IS PERMISSIBLE).
 2. THE GUARDRAIL DOWNSTREAM FROM THE BRS SHOULD BE TAPERED & TRANSITIONED AS NECESSARY TO MEET BRS ATTACHMENT REQUIREMENTS AS SHOWN IN SECTION A-A AND NOTE 1 ABOVE.
 3. MANUFACTURER RECOMMENDS CROSS SLOPE NOT TO EXCEED 8% (4.5 DEG.).
 4. MANUFACTURER RECOMMENDS REMOVAL OF CURBS AND ISLANDS UNDER THE BRS TO DOWNSTREAM.
 5. DOWNSTREAM IMPERIAL MUST BE ANCHORED TO WITHSTAND A TENSION OF 534 kN [120,000 LBS.] WHICH COULD DEVELOPE DURING A REDIRECT IMPACT.
 6. USE ONLY STANDARD HIGHWAY HARDWARE.
 7. SEE BRS INSTALLATION MANUAL FOR PROPER ASSEMBLY. AFTER TIGHTENING NUTS, TRIM OFF EXCESS THREADED ROD.
 8. TRIM PROPER OVERLAP OF PANELS FOR DIRECTION OF TRAFFIC.
 9. TRIM TRANSITION BLOCKOUTS AS NECESSARY TO ACHIEVE 457 [18.00] REQUIRED WIDTH AT BRAKEMASTER INTERFACE. SECTION A-A.
 10. UNITS OF MEASURE ARE MILLIMETERS [INCHES] UNLESS OTHERWISE NOTED.



ENERGY ABSORPTION SYSTEMS, INC.
ENGINEERING AND RESEARCH DEPARTMENT

BRAKEMASTER® 350 SYSTEM (BRS)
THREE BEAM TRANSITION SECTION
ATTACHED TO CONCRETE BARRIER
FOR MEDIAN APPLICATIONS

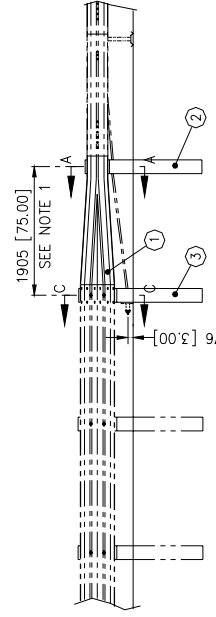
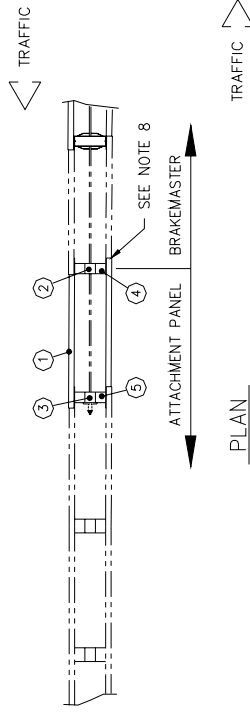
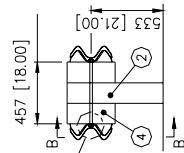
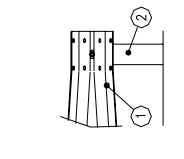
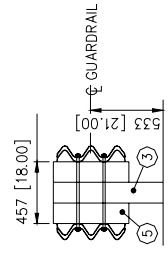
Brakemaster® 350

KEY

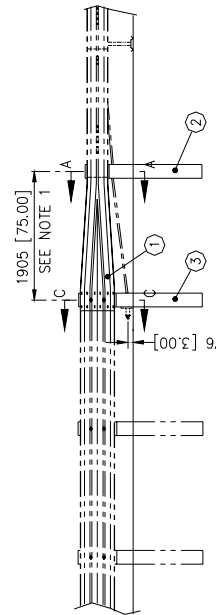
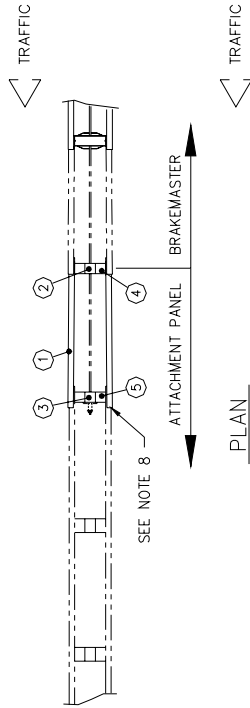
- ① TRANSITION PANEL
- ② POST-6"6"x6"-8", WOOD
- ③ POST-6"6"x6"-6", WOOD
- ④ BLOCKOUT-6"6"x1"-2", WOOD
- ⑤ BLOCKOUT-6"6"x1"-10", WOOD

NOTES:

1. MANUFACTURER RECOMMENDS THAT THE 1905 [75.00] SECTION DIRECTLY BEHIND THE BRS BE PARALLEL TO THE CENTERLINE OF THE UNIT (A MAXIMUM FLARE OF 3 DEG. IS PERMISSIBLE).
2. THE GUARDRAIL DOWNSTREAM FROM THE BRS SHOULD BE TAPERED & TRANSITIONED AS NECESSARY TO MEET BRS ATTACHMENT REQUIREMENTS AS SHOWN IN SECTION A-A. SEE NOTE 7.
3. MANUFACTURER RECOMMENDS CROSS SLOPE NOT TO EXCEED 8% (4.5 DEG.).
4. MANUFACTURER RECOMMENDS REMOVAL OF CURBS AND ISLANDS UNDER THE BRS TO ENSURE PROPER IMPACT PERFORMANCE.
5. DOWNSTREAM GUARDRAIL MUST BE ANCHORED TO WITHSTAND A TENSION OF 534KN [120,000 LBS.] WHICH COULD DEVELOPE DURING A REDIRECT IMPACT.
6. USE ONLY STANDARD HIGHWAY HARDWARE.
7. SEE BRS INSTALLATION MANUAL FOR PROPER ASSEMBLY. AFTER TIGHTENING NUTS, EXCESS WIRE-ROD SHOULD BE CUT OFF FOR DIRECTION OF TRAFFIC.
8. NOTE PROPER OVERLAPPING FOR SECTION A-A.
9. UNITS OF MEASURE ARE MILLIMETERS [INCHES] UNLESS OTHERWISE NOTED.



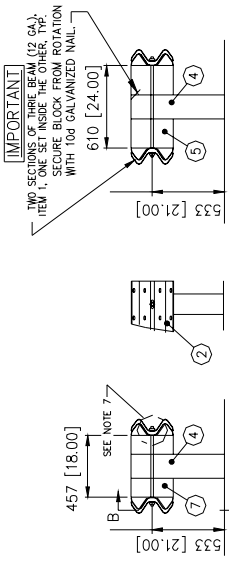
BIDIRECTIONAL



UNIDIRECTIONAL

ENERGY ABSORPTION SYSTEMS, INC.
ENGINEERING AND RESEARCH DEPARTMENT

BRAKEMASTER®350 SYSTEM (BRS)
ATTACHED TO THREE BEAM GUARD RAIL
FOR MEDIAN APPLICATIONS



VIEW B-B
(TRANSITION END)
OVERLAPPING BRS PANEL HAS
BEEN EXCLUDED FOR CLARITY

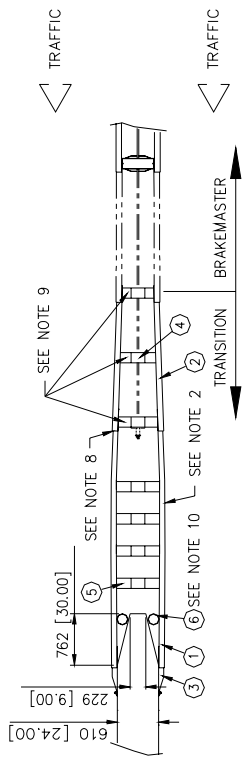
NOTES:

1. MANUFACTURER RECOMMENDS THAT THE 1905 [75.00] SECTION DIRECTLY BEHIND THE BRS BE PARALLEL TO THE CENTERLINE OF THE UNIT (A MAX. FLARE OF 3 DEG. IS PERMISSIBLE).
2. THE GUARDRAIL DOWNSTREAM FROM THE BRS SHOULD BE TAPERED & TRANSITIONED AS NECESSARY TO MEET BRS ATTACHMENT REQUIREMENTS AS SHOWN IN SECTION A-A AND NOTE 1 ABOVE.
3. MANUFACTURER RECOMMENDS GROSS SLOPE NOT TO EXCEED 8% (4.5 DEG.).
4. MANUFACTURER RECOMMENDS REMOVAL OF CURBS AND ISLANDS UNDER THE BRS TO EXCEED PROPER DRAINAGE.
5. DOWNSTREAM GUARDRAIL MUST BE ANCHORED TO WITHSTAND A TENSION OF 554 kN [120,000 LBS.] WHICH COULD DEVELOP DURING A REDIRECT IMPACT.
6. SEE ONLY STANDARD HIGHWAY HARDWARE.
7. TRIM OFF EXCESS THREADED ROD.
8. NOTE PROPER OVERLAP OF PANELS FOR DIRECTION OF TRAFFIC.
9. TRIM TRANSITION BLOCKOUTS AS NECESSARY TO ACHIEVE 457 [18.00] REQUIRED WIDTH AT BRAKEMASTER INTERFACE, SECTION A-A.

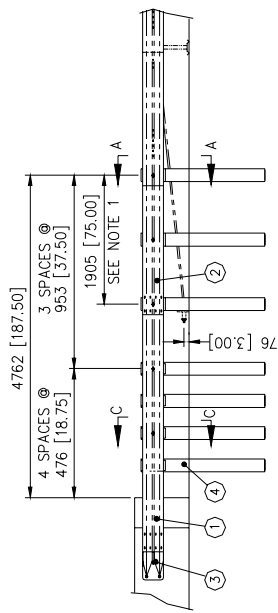
KEY

- 1 GUARDRAIL SECTION A
- 2 GUARDRAIL SECTION B
- 3 END SHOE
- 4 POST-6"x8"x6" WOOD
- 5 BLOCKOUT-6"x8"x1'-2" WOOD
- 6 SPACER TUBE

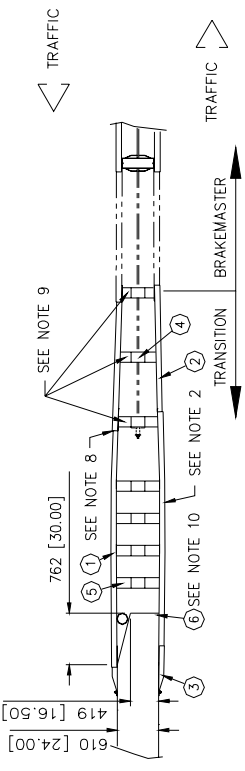
10. THE STEEL SPACER TUBE (6" I.D. x 10" LONG, SCHEDULE 40 GALVANIZED PIPE) IS CONNECTED ONLY TO THE GUARDRAIL BEAM. SPACERS MADE OF SOLID WOOD & STEEL ARE NOT RECOMMENDED.
11. THIS GUARDRAIL TRANSITION IS APPROPRIATE FOR A CONNECTION TO A VERTICAL CONCRETE SHAPE & SHOULD NOT BE CONNECTED DIRECTLY TO A SAFETY SHAPE. CONCRETE TRANSITION SHOULD BE CONNECTED TO A VERTICAL SHAPE AT THE GUARDRAIL CONNECTION.
12. UNITS OF MEASURE ARE MILLIMETERS [INCHES] UNLESS OTHERWISE NOTED.



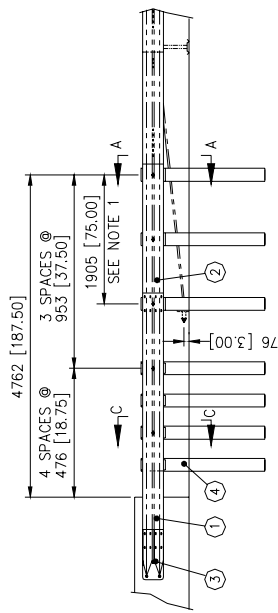
PLAN



ELEVATION



PLAN



ELEVATION

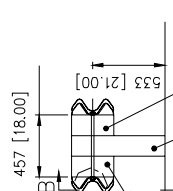
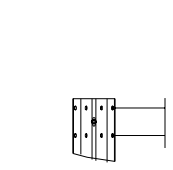
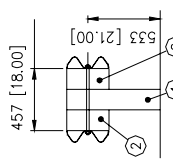
ENERGY ABSORPTION SYSTEMS, INC.
ENGINEERING AND RESEARCH DEPARTMENT

BRAKEMASTER® 350 SYSTEM (BRS)
W-BEAM TRANSITION SECTION
ATTACHED TO VERTICAL CONCRETE
FOR MEDIAN APPLICATION

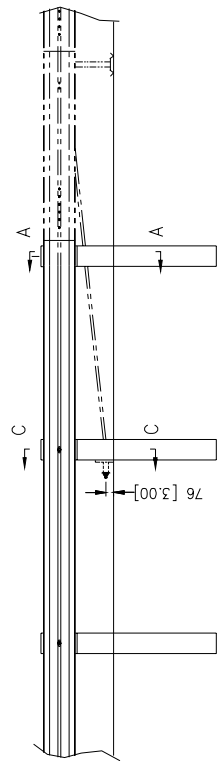
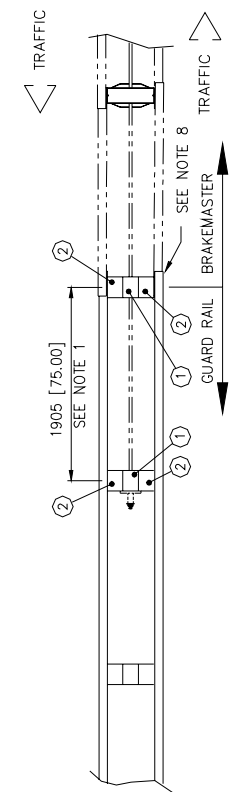
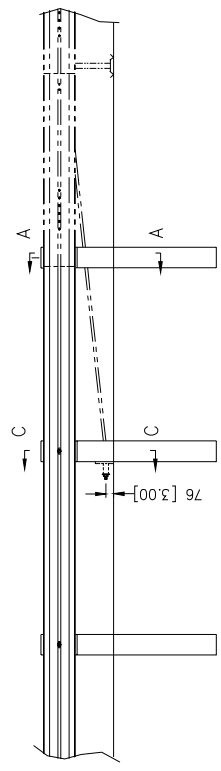
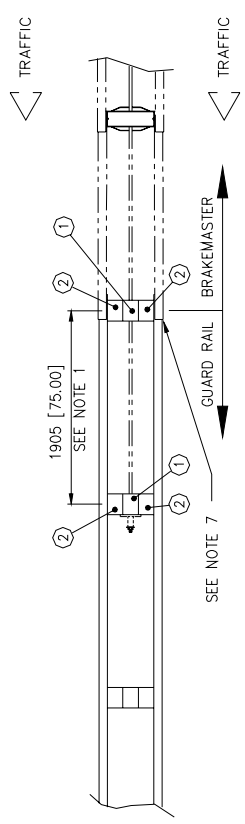
Brakemaster® 350

KEY:
 (1) POST - 6" x 6" x 6', WOOD
 (2) BLOCKOUT - 6" x 6" x 1'-2", WOOD

- NOTES:
1. MANUFACTURER RECOMMENDS THAT THE 1905 [75.00] SECTION DIRECTLY BEHIND THE BRS BE PARALLEL TO THE CENTERLINE OF THE UNIT (A MAXIMUM FLARE OF 3 DEG. IS PERMISSIBLE).
 2. THE GUARDRAIL DOWNSTREAM FROM THE BRS SHOULD BE TAPERED & TRANSITIONED AS NECESSARY TO MEET BRS ATTACHMENT REQUIREMENTS AS SHOWN IN SECTION A-A AND THE DOWNSTREAM CROSS SLOPE NOT TO EXCEED 8% (4.5 DEG.).
 3. MANUFACTURER RECOMMENDS REMOVAL OF CURBS AND ISLANDS UNDER THE BRS TO ENSURE PROPER IMPACT PERFORMANCE.
 4. DOWNSTREAM GUARDRAIL MUST BE ANCHORED TO WITHSTAND A TENSION OF 534 kN [120,000 LBS.] WHICH COULD DEVELOP DURING A REDIRECT IMPACT.
 5. USE ONLY STANDARD HIGHWAY HARDWARE.
 6. SEE BRS INSTALLATION MANUAL FOR PROPER ASSEMBLY. AFTER TIGHTENING NUTS, TRIM OFF EXCESS THREADED ROD.
 7. NOTE PROPER OVERLAP OF PANELS FOR DIRECTION OF TRAFFIC.
 8. UNITS OF MEASURE ARE MILLIMETERS [INCHES] UNLESS OTHERWISE NOTED.



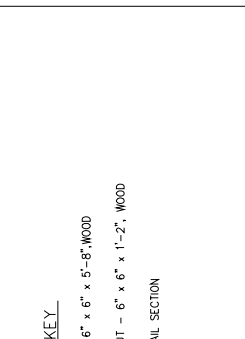
EXCLUDES OVERLAPPING BRS PANEL



UNIDIRECTIONAL

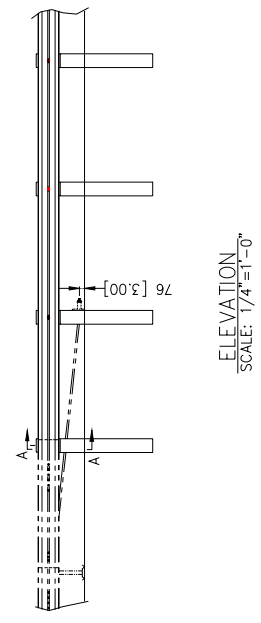
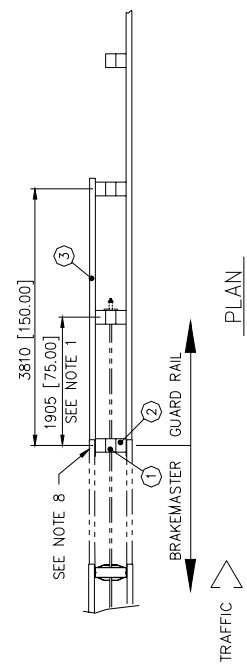
BIDIRECTIONAL

ENERGY ABSORPTION SYSTEMS, INC.
 ENGINEERING AND RESEARCH DEPARTMENT
 BRAKEMASTER® 350 SYSTEM (BRS)
 ATTACHED TO W-BEAM GUARDRAIL
 FOR MEDIAN APPLICATION

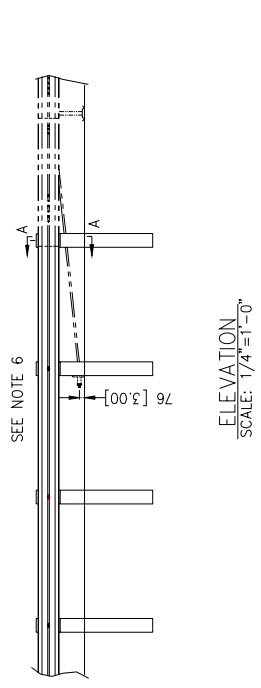
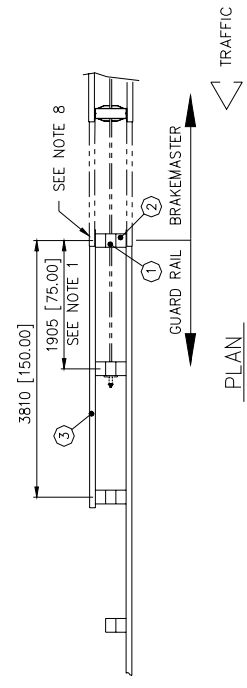


- NOTES:**
1. MANUFACTURER RECOMMENDS THAT THE 1905 [75.00] SECTION DIRECTLY BEHIND THE BRS BE PARALLEL TO THE CENTERLINE OF THE UNIT (A MAX. FLARE OF 3 DEG. IS PERMISSIBLE).
 2. THE GUARDRAIL DOWNSTREAM FROM THE BRS SHOULD BE TAPERED & TRANSITIONED AS NECESSARY TO MEET BRS ATTACHMENT REQUIREMENTS AS SHOWN IN SECTION 3.
 3. MANUFACTURER RECOMMENDS GROSS SLOPE NOT TO EXCEED 8% (4.5 DEG.).
 4. MANUFACTURER RECOMMENDS REMOVAL OF CURBS AND ISLANDS UNDER THE BRS TO ENSURE PROPER IMPACT PERFORMANCE.
 5. DOWNSTREAM GUARDRAIL MUST BE ANCHORED TO WITHSTAND A TENSION OF 534 kN [120,000 LBS] WHICH COULD DEVELOPE DURING A REDIRECT IMPACT.
 6. USE ONLY STANDARD HIGHWAY HARDWARE.
 7. SEE BRS INSTALLATION MANUAL FOR PROPER ASSEMBLY. AFTER TIGHTENING NUTS, TRIM OFF EXCESS THREADED ROD.
 8. NOTE PROPER OVERLAP OF PANELS FOR DIRECTION OF TRAFFIC.
 9. UNITS OF MEASURE ARE MILLIMETERS [INCHES] UNLESS OTHERWISE NOTED.

- KEY**
- ① POST - 6" x 6" x 5'-6" WOOD
 - ② BLOCKOUT - 6" x 6" x 1'-2" WOOD
 - ③ GUARDRAIL SECTION



RIGHT SIDE OF ROAD



LEFT SIDE OF ROAD

ENERGY ABSORPTION SYSTEMS, INC.
ENGINEERING AND RESEARCH DEPARTMENT

BRAKEMASTER®350 SYSTEM (BRS)
ATTACHED TO W-BEAM GUARD RAIL
FOR ROADSIDE APPLICATION

Brakemaster® 350

KEY

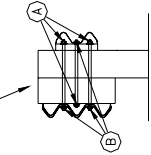
- ① GUARDRAIL SECTION A
- ② GUARDRAIL SECTION B
- ③ TRANSITION PANEL
- ④ END SHOE
- ⑤ POST-10"x10"x6", WOOD
- ⑥ POST-8"x8"x6", WOOD
- ⑦ BLOCKOUT-6"x8"x1"-10 1/2", WOOD*
- ⑧ BLOCKOUT-6"x8"x1"-2", WOOD*
- ⑨ BLOCKOUT-2"x6"x1"-2", WOOD*

*STEEL POSTS AND BLOCKOUTS MAY BE SUBSTITUTED FOR WOOD.

NOTES:

1. MANUFACTURER RECOMMENDS THAT THE 1905 [75.00] SECTION DIRECTLY BEHIND THE BRS BE PARALLEL TO THE CENTERLINE OF THE UNIT (A MAXIMUM FLARE OF 3 DEGREES IS ALLOWED).
2. THE GUARDRAIL DOWNSTREAM FROM THE BRS SHOULD BE TAPERED & TRANSITIONED AS NECESSARY TO MEET BRS ATTACHMENT REQUIREMENTS AS SHOWN IN SECTION A-A AND NOTE 1 ABOVE.
3. MANUFACTURER RECOMMENDS CROSS SLOPE NOT TO EXCEED 8% (4.5 DEG.). ENSURE PROPER IMPACT PERFORMANCE.
4. MANUFACTURER RECOMMENDS REMOVAL OF CURBS AND ISLANDS UNDER THE BRS TO ALLOW FOR PROPER DRAINAGE DURING A REDIRECT IMPACT.
5. SEE INSTALLATION MANUAL FOR PROPER ASSEMBLY. AFTER TIGHTENING NUTS, TRIM OFF EXCESS THREADED ROD.
6. NOTE PROPER OVERLAP OF PANELS FOR DIRECTION OF TRAFFIC.
7. TRIM TRANSITION BLOCKOUTS AS NECESSARY TO ACHIEVE .457 [18.00] WIDTH AT BRAKEMASTER INTERFACE, SECTION A-A.
8. UNITS OF MEASURE ARE MILLIMETERS (INCHES) UNLESS OTHERWISE NOTED.

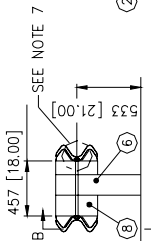
IT IS IMPORTANT TO INSTALL THE HARDWARE IN THE FOLLOWING ORDER: 1) PLACE THREADED RODS THROUGH POSTS & BLOCKOUTS. 2) ATTACH WASHERS & NUTS THAT WILL BE UNDER PANELS (SEE ② ON DETAIL D). 3) ATTACH PANELS. 4) ATTACH WASHERS & NUTS (SEE ④ ON DETAIL D).



DETAIL D
SCALE: 1/2"=1'-0"

IMPORTANT

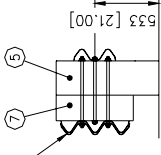
TWO SECTIONS OF THREE BEAM (2 GA.) ITEM 1, ONE SET INSIDE THE OTHER, TP.



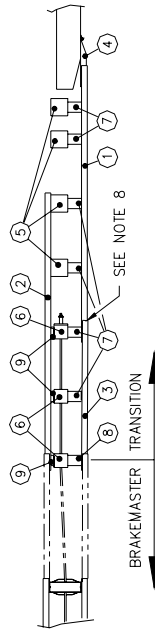
SECTION A-A
SCALE: 1/2"=1'-0"

VIEW B-B

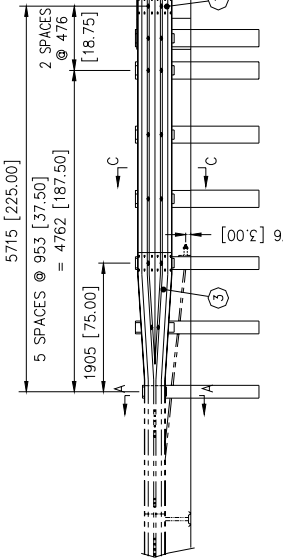
(TRANSITION END)
OVERLAP OF PANELS HAS BEEN EXCLUDED FOR CLARITY
SCALE: 1/2"=1'-0"



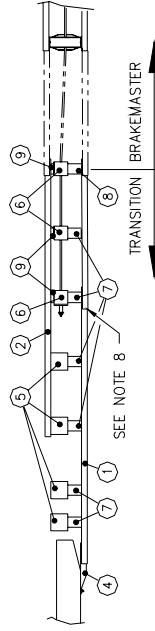
SECTION C-C
SCALE: 1/2"=1'-0"



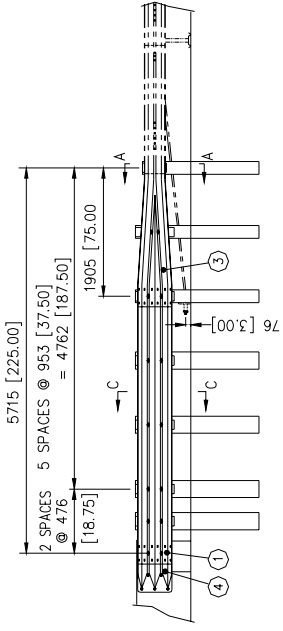
PLAN
TRAFFIC



ELEVATION
SCALE: 1/4"=1'-0"



PLAN
TRAFFIC



ELEVATION
SCALE: 1/4"=1'-0"

ENERGY ABSORPTION SYSTEMS, INC.
ENGINEERING AND RESEARCH DEPARTMENT

BRAKEMASTER® 350 SYSTEM (BRS)
THREE BEAM TRANSITION SECTION
ATTACHED TO CONCRETE BARRIER
FOR ROADSIDE APPLICATION

Limitations and Warnings

The BRAKEMASTER™ System has been tested and evaluated per the recommendations of the National Cooperative Highway Research Program (NCHRP) report 350.* The BRAKEMASTER™ System as currently designed, is capable of: decelerating and stopping light and heavy weight vehicles (820 to 2000 kg [1804 to 4400 lb]) when impacted head-on at 100 kph [62.1 m.p.h.]; and redirecting light and heavy weight vehicles (820 to 2000 kg [1804 to 4400 lb]) when impacted at 100 kph [62.1 m.p.h.] along the system's side for right way impacts of 20 degrees or less and wrong way impacts at an angle of 20 degrees or less. Tests are conducted on slopes less than 8 degrees and without curbs.

A smooth transition must be provided when attaching the BRAKEMASTER™ System to a rigid object. This transition may be purchased as an extra piece of hardware from Energy Absorption Systems or provided by the customer.

Refer to the BRAKEMASTER™ System Maintenance Manual for components needing replacement after partial impacts to ensure the energy absorbing capacity of the unit has not been adversely impaired.

Excessive curb height may create a ramping effect, which could create an unsafe vehicle trajectory.

Impacts that exceed the design capabilities described in this manual (vehicle weight, speed and impact angle) may not result in acceptable crash performance as described in NCHRP 350 relative to structural adequacy, occupant risk and vehicle trajectory factors.

* Copy may be obtained from:
Transportation Research Board
National Research Council
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