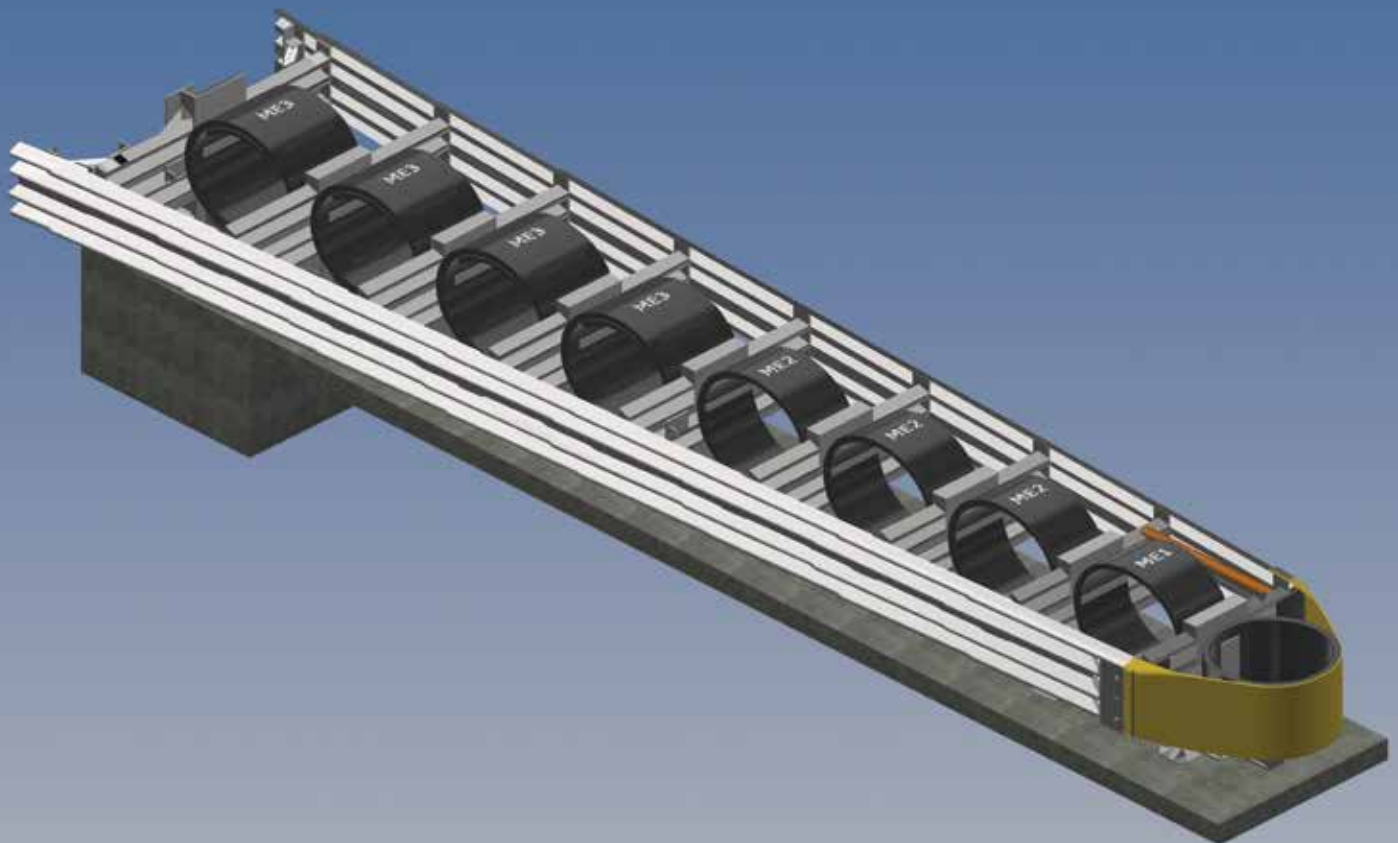


# QuadGuard® Elite M10 Wide [69"]

## Product Description Assembly Manual



**TRINITY**  
**HIGHWAY**

*Ahead of the Curve®*

# QuadGuard® Elite M10 Wide [69”]

The QuadGuard® Elite M10 Wide has been tested pursuant to American Association of State Highway and Transportation Officials (“AASHTO”) Manual for Assessing Safety Hardware (“MASH”) specifications. The QuadGuard® Elite M10 Wide has been deemed eligible for federal-aid reimbursement on the National Highway System by the Federal Highway Administration (“FHWA”).

## Product Description Assembly Manual



2525 N. Stemmons Freeway  
Dallas, Texas 75207



**Warning:** The local highway authority, distributors, owners, contractors, lessors, and lessees are **RESPONSIBLE** for the assembly, maintenance, and repair of the QuadGuard® Elite M10 Wide. Failure to fulfill these **RESPONSIBILITIES** with respect to the assembly, maintenance, and repair of the QuadGuard® Elite M10 Wide could result in serious injury or death.



**Important:** These instructions are for standard assembly specified by the appropriate highway authority. In the event the specified system assembly, maintenance, or repair would require a deviation from standard assembly parameters, contact a Trinity Highway representative. This system has been deemed eligible by the FHWA for use on the national highway system under strict criteria utilized by that agency.

**This manual must be available to the worker overseeing and/or assembling the product at all times. For additional copies, contact Trinity Highway directly at (888) 323-6374 or visit [TrinityHighway.com](http://TrinityHighway.com).**

The instructions contained in this manual supersede all previous versions. The instructions, illustrations, and specifications are based on the latest QuadGuard® Elite M10 Wide information available to Trinity Highway at publication. We reserve the right to make changes at any time. Please visit [TrinityHighway.com/Product/QuadGuard-Elite-M10/](http://TrinityHighway.com/Product/QuadGuard-Elite-M10/) to confirm the latest revision.

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## Customer Service Contacts

Trinity Highway is committed to the highest level of customer service. Feedback regarding the QuadGuard® Elite M10 Wide system, its assembly procedures, supporting documentation, and performance is always welcome. Additional information can be obtained from the contact information below:

### Trinity Highway:

|              |  |
|--------------|--|
| Telephone:   | (888) 323-6374 (USA)<br>+1 312 467 6750 (International)                          |
| Contact Link | <a href="http://TrinityHighway.com&gt;Contact">TrinityHighway.com&gt;Contact</a> |

## Important Introductory Notes

Proper assembly of the QuadGuard® Elite M10 Wide system is critical to achieve performance that has been evaluated and deemed eligible by the FHWA per AASHTO MASH criteria. These instructions should be read in their entirety and understood before assembling the QuadGuard® Elite M10 Wide. These instructions are to be used in conjunction with the assembly of QuadGuard® Elite M10 Wide and are for standard assemblies only as specified by the applicable highway authority. If you need additional information, or have questions about the QuadGuard® Elite M10 Wide, please contact the highway authority that has planned and specified this assembly and, if needed, contact Trinity Highway Customer Service. This product must be assembled in the location specified by the appropriate highway authority. If there are deviations, alterations, or departures from the assembly protocol specified in this manual, the device may not perform as tested.



**Important: DO NOT** use any component part that has not been specifically approved for this system during the assembly or repair of this system.

This product has been specified for use by the appropriate highway authority and has been provided to that user who has unique knowledge of how this system is to be assembled. No person should be permitted to assist in the assembly, maintenance, or repair of this system that does not possess the unique knowledge described above. These instructions are intended for an individual qualified to both read and accurately interpret them as written. These instructions are intended only for an individual experienced and skilled in the assembly of highway products that are specified and selected by the highway authority.

A manufacturer's drawing package will be supplied by Trinity Highway upon request. Each system will be supplied with a specific drawing package unique to that system. Such drawings take precedence over information in this manual and shall be studied thoroughly by a qualified individual who is skilled in interpreting them before the start of any product assembly.

## Safety Symbols

This section describes the safety symbols that appear in this QuadGuard® Elite M10 Wide manual. Read the manual for complete safety and assembly information.

### Symbol

### Meaning



**Safety Alert Symbol:** Indicates Important, Caution, Warning, or Danger. Failure to read and follow the Important, Caution, Warning, or Danger indicators could result in serious injury or death to workers and/or bystanders.



**Warning:** Read safety instructions thoroughly and follow the assembly directions and suggested safe practices before assembling, maintaining, or repairing the QuadGuard® Elite M10 Wide. It is the responsibility of the installer to follow the instructions contained in this manual. Failure to comply with these warnings could result in increased risk of serious injury or death in the event of a vehicle impact.



**Important:** Please keep up-to-date instructions for later use and reference by anyone involved in the assembly of the product.

## Safety Rules for Assembly

### **\* Important Safety Instructions \***

This manual must be kept in a location where it is readily available to persons who are skilled and experienced in the assembly, maintenance, or repair of the QuadGuard® Elite M10 Wide. Additional copies of this manual are available from Trinity Highway by calling (888) 323-6374 or by visiting [TrinityHighway.com/Product/QuadGuard-Elite-M10/](http://TrinityHighway.com/Product/QuadGuard-Elite-M10/). Please contact Trinity Highway if you have any questions concerning the information in this manual or about the QuadGuard® Elite M10 Wide.



**Warning:** It is the responsibility of the installer to use appropriate safety precautions when operating power equipment, mixing chemicals, and when moving heavy equipment or QuadGuard® M10 Wide components. Safety articles including but not necessarily limited to work gloves, eye protection, safety-toe shoes, and back protection should be used.



**Warning:** It is the responsibility of the installer to use all safety measures incorporating appropriate traffic control devices specified by the highway authority. These measures must be used to protect all personnel while at the assembly, maintenance, or repair site.



**Warning:** Use only Trinity Highway parts on the QuadGuard® Elite M10 Wide for assembly, maintenance, or repair. The use of component parts not specified herein is **strictly prohibited**. The QuadGuard® Elite M10 Wide assembled with Trinity Highway parts has been tested, approved, and accepted for state use by the FHWA. A QuadGuard® Elite M10 Wide Assembly using parts other than those specified herein has not been tested, approved, or accepted for state use by the FHWA. Failure to follow this warning could result in increased risk of serious injury or death in the event of a vehicle impact.

## **Limitations and Warnings**

Pursuant to **MASH** “Recommended Procedures for the Safety Performance of Highway Safety Features”, Trinity Highway contracts with FHWA approved testing facilities to perform and evaluate crash tests to prepare a crash test results report. Trinity Highway is then able to submit a Request for Federal Aid Reimbursement of Safety Hardware Devices to the FHWA for review.

The QuadGuard® M10 Wide has been deemed eligible by FHWA as meeting the requirements and guidelines of MASH. These tests evaluate product performance defined by AASHTO involving lightweight cars (approx. 2420 lb. [1100 kg]) and full size pickup trucks (approx. 5000 lb. [2270 kg]). A product can be certified for multiple Test Levels. The QuadGuard® M10 Wide is certified to the Test Level(s) as shown below:

### **Test Level 3: 62 mph [100 kph]**

**These AASHTO directed tests are not intended to represent the performance of systems when impacted by every vehicle type or every impact condition existing on the roadway. This system is tested only to the test matrix criteria of MASH as approved by FHWA.**

Trinity Highway expressly disclaims any warranty or liability for injury or damage to persons or property resulting from any impact, collision or harmful contact with products, other vehicles, or nearby hazards or objects by any vehicle, object or person, whether or not the products were assembled in consultation with Trinity Highway or by third parties.

The QuadGuard® Elite M10 Wide is intended to be assembled, delineated, and maintained within specific state and federal guidelines. It is important for the highway authority specifying the use of a highway product to select the most appropriate product configuration for site specifications. The customer should be careful to properly select, assemble, and maintain the product. Careful evaluation of site layout, traffic speed/type, direction, and visibility are some of the elements that require evaluation by the highway authority in the selection of a highway product. For example, curbs could cause an untested effect on an impacting vehicle.

After an impact occurs, the debris from the impact should be removed from the area immediately and the specified highway product should be evaluated and restored to its original specified condition or replaced as the highway authority determines as soon as possible.



**Warning:** Do not assemble, maintain, or repair the QuadGuard® Elite M10 Wide until you have read this manual thoroughly and completely understand it. Please contact Trinity Highway if you do not understand these instructions (p. 3).



**Warning:** It is the responsibility of the installer to ensure that all Danger, Warning, Caution, and Important statements within the QuadGuard® Elite M10 Wide manual are completely followed. Failure to follow this warning could result in serious injury or death in the event of a collision.

## **System Overview**

The QuadGuard® Elite M10 Wide is a potentially reusable, re-directive, non-gating crash cushion for roadside features of 69" [1,753 mm]. It consists of energy-absorbing high density polyethylene cylinders surrounded by a framework of Quad-Beam Panels.



**Important:** Trinity Highway makes no recommendation whether use or reuse of any part of the system is appropriate or acceptable following an impact. It is the sole responsibility of the project engineer and/or the local highway authority and its engineers to make that determination. It is critical that you inspect this product after assembly is complete to make certain that the instructions provided in this manual have been strictly followed.

The QuadGuard® Elite M10 Wide utilizes three types of Cylinders in a “staged” configuration that are designed and tested to address vehicles as defined by MASH for both lighter cars and heavier, high center-of-gravity vehicles.

### **Impact Performance**

The **8 Bay** QuadGuard® Elite M10 Wide has successfully passed MASH requirements stipulated for Test Level 3 tests with both the light car and pickup trucks at speeds of up to **62 mph [100 kph]** at angles up to 25 degrees.

During head-on impact testing, within MASH criteria, the QuadGuard® Elite M10 Wide has been shown to telescope rearward to absorb the energy of impact. When impacted from the side, within the applicable MASH criteria, it has been shown to redirect the vehicle back toward its original travel path and away from the highway feature.



**Warning:** It is the sole responsibility of the project engineer and/or local highway authority and its engineer to ensure that the delineation used for the QuadGuard® Elite M10 Wide meet all federal, state, specifying agency, and local specifications.



**Warning:** It is the sole responsibility of the project engineer and/or local highway authority and its engineer to ensure that the QuadGuard® Elite M10 Wide meets all appropriate Manual on Uniform Traffic Control Devices (“MUTCD”) and local standards.

### **Inspect Shipping**

Check the received parts against the shipping list supplied with the system before deploying the QuadGuard® Elite M10 Wide. Make sure all parts have been received (pp. 7 - 11).



**Important:** The manufacturer’s drawing package supplied with the QuadGuard® Elite M10 Wide must be used with these instructions for proper assembly and should take precedence over these general instructions.

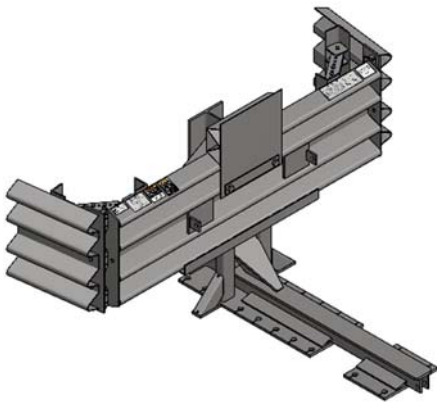
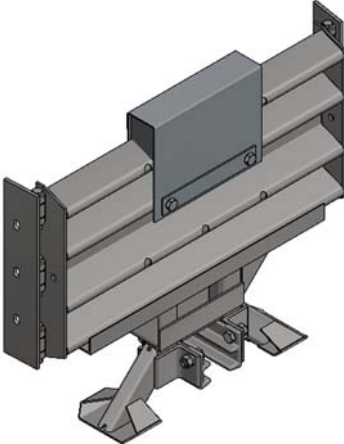

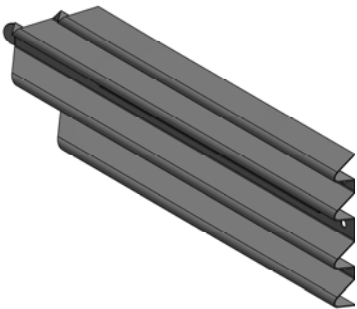
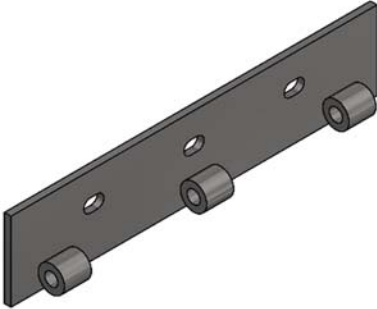

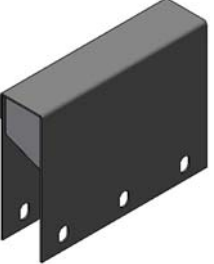



**Warning:** Do NOT modify the QuadGuard® Elite M10 Wide in any way.

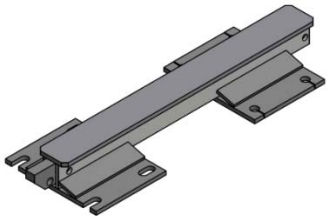
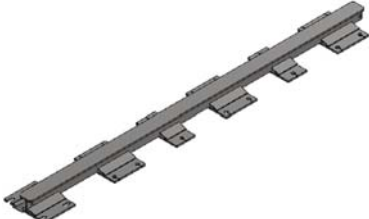
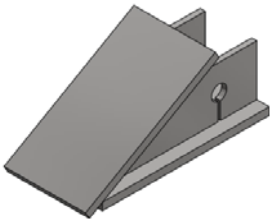
## System Components

Below is a list of system components that may be used in your particular QuadGuard® Elite M10 Wide configuration. Verify parts delivered and system details with the BOM (Bill of Materials) and system drawings shipped with your system. Please call Trinity Highway if you have any system questions (p. 3).



**Note:** Components are not shown to scale.

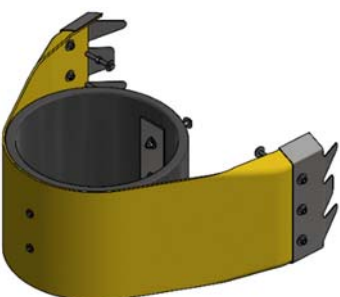
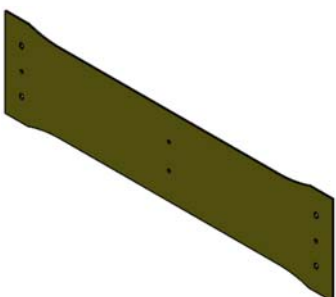

|  |  |   |  |
|--|--|---|--|
| <p>Tension Strut Backup 69"</p>  <p>627531</p>      |  | <p>Diaphragm Assembly, QG Elite M10</p>  <p>619120 - Varies</p> |  |
| <p>Panel, Side, QG, Wide</p>  <p>611900</p>       | <p>Panel, Fender, QG</p>  <p>611832</p>           | <p>Hinge Plate, Fender Panel</p>  <p>610172</p>              |  |
| <p>Extension, Backup, M10, QGE</p>  <p>618536</p> | <p>Extension, Diaphragm, Angle</p>  <p>618526</p> | <p>Monorail Guide</p>  <p>611368</p>                         |  |






|  |   |  |
|--|---|--|
| <p>Monorail, One Bay, QG</p>  | <p>Monorail, Three Bays, QG</p>  | <p>End Cap, Monorail, QG</p>  |
| 611370   | 611379  | 608136   |

|   |   |  |
|---|---|--|
| <p>Flt St 3/16X2X13, W/ Holes</p>  | <p>Die Spring, 1 1/2 ODX3/4X6</p>  | <p>Mushroom Washer</p>  |
| 618652  | 117458  | 617045   |

|  |  |
|--|--|
| <p>Clamp, Nose Belt</p>  | <p>Nose Cylinder Plate</p>  |
| 606330   | 612253   |

|   |  |   |
|---|--|---|
| <p>Belt Nose Assy QGE, 69</p>  | <p>Nose Belt</p>  | <p>Hit Indicator Assembly</p>  |
| 618870  | 605108   | 610237  |

|  |   |  |
|--|---|--|
| <p>Washer, 1/4X1</p>  | <p>Washer, Flat 1/2X1 3/8</p>  | <p>Washer, Flat, 5/8X1 3/4</p>  |
| 118013   | 118009  | 003300   |

|   |   |   |
|---|---|---|
| <p>Washer, Flat, 3/4X2</p>  <p>118027</p>    | <p>Washer, Lock, 3/8</p>  <p>118092</p>        | <p>Washer, Lock 1/2</p>  <p>118082</p>               |
| <p>Washer, Lock, 5/8</p>  <p>118100</p>      | <p>Washer, Lock, 3/4</p>  <p>118089</p>        | <p>Nut, Hex 3/8, G2</p>  <p>115960</p>               |
| <p>Nut, Hex 1/2</p>  <p>115939</p>          | <p>Rail Nut, Hex, 5/8</p>  <p>003340</p>      | <p>Nut, Hex, 5/8, A563A</p>  <p>003354</p>          |
| <p>Nut, Heavy Hex, 3/4</p>  <p>003704</p>  | <p>Screw, HWH, 1/4X1, Tap</p>  <p>116891</p> | <p>Bolt, Hex, 3/8X3 1/2, AT, G5</p>  <p>113612</p> |
| <p>Bolt, Hex, 1/2X1, G5</p>  <p>113467</p> | <p>Bolt, Hex 1/2X3, G2</p>  <p>113476</p>    | <p>Rail Bolt, 5/8X2, A307</p>  <p>003400</p>       |

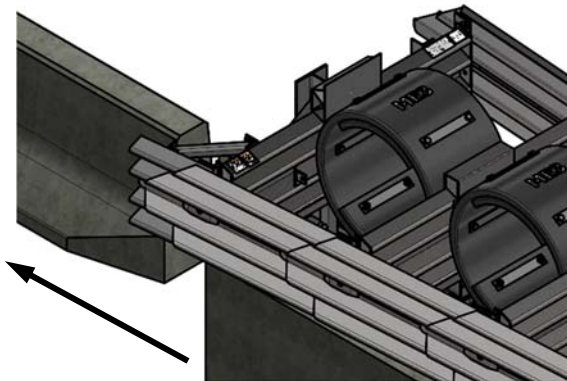
|   |  |   |
|---|--|---|
| Bolt, Hex, 5/8X3 1/2, G5<br>     | Bolt, Hex, 5/8X4, G5<br>          | Bolt, Hex, 5/8X5", G5<br>          |
| 113660  | 113666   | 113667  |
| Flat Screw 5/8X8 1/2,G8<br>      | Bolt, Hex 5/8X9 A325<br>          | Bolt, Hex, 3/4X2, G8<br>           |
| 116879  | 004489   | 113555  |
| Bolt, Hex,3/4X5,G5,G<br>        | Stud, 3/4X6 1/2, G5<br>          | Stud, 3/4X7, G5<br>               |
| 113573  | 117540   | 117542  |
| Cylinder Nose, HDPE, 28X20<br> | Cylinder ME1 MASH<br>           | Cylinder ME2 MASH<br>            |
| 606689  | 618538   | 618649  |
| Cylinder Assy ME3 MASH<br>     | Cylinder Segment, 18X9 1/2<br> | Tel 1 3/4X1 3/4X12GA, G, 10"<br> |
| 618702  | 627504   | 615756  |

|   |  |  |
|---|--|--|
| Adhesive, HY200, Hilti<br> | Anchor Kit, Hilti 3/4X7<br> | Tel 2X2X12GA, H2S, G, 10"<br> |
| 118710  | 619316   | 615765   |

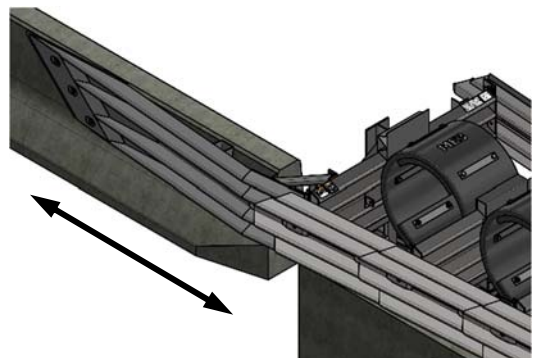
### Select Transition



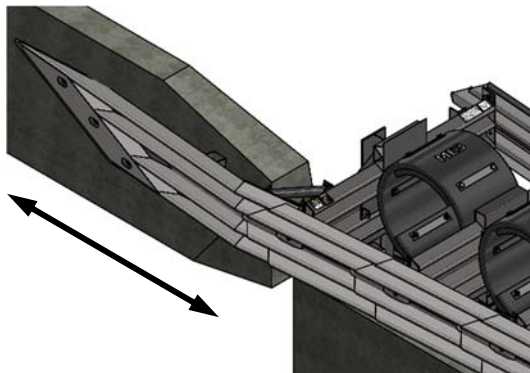
**Important:** A proper Transition Panel or Side Panel must be used on each side of the Backup. A Side Panel is not needed when a Transition Panel is used. Several types of transitions are available for use with the QuadGuard® Elite M10 Wide (Figures 1 – 6). The correct Panel(s) to use will depend on the direction of traffic and what type of barrier or road feature the QuadGuard® Elite M10 Wide is shielding. Contact Customer Service for any transition questions (p. 3).



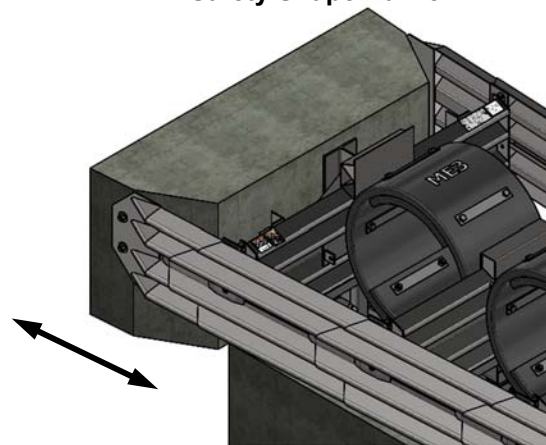
**Figure 1**  
No Transition  
(Unidirectional only)



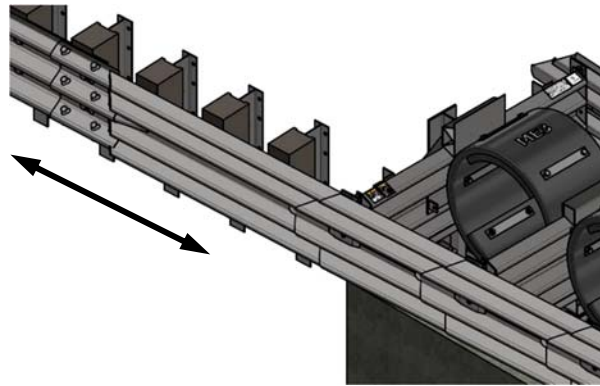
**Figure 2**  
Safety Shape Barrier



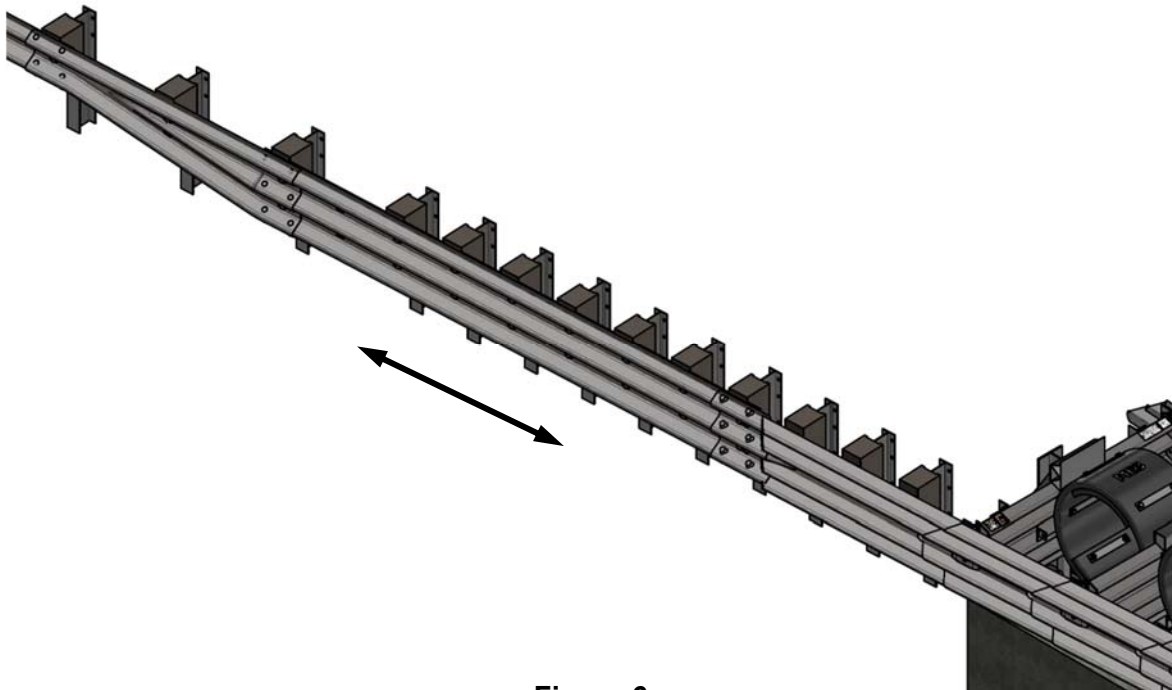
**Figure 3**  
Single Slope Offset



**Figure 4**  
Vertical Barrier



**Figure 5**  
Quad to Thrie-Beam



**Figure 6**  
Quad to W-Beam Guardrail

## **Recommend Tools**

### **Documentation**

- Manufacturer's Assembly Manual
- Manufacturer's Drawing Package

### **Personal Protective equipment**

- Eye Protection
- Gloves
- Safety Toe Shoes

## Cutting equipment

- Rotary Hammer Drill
- Rebar cutting bit
- Concrete drill (Double Fluted\*) bits –7/8" [22 mm]
- Grinder, Hacksaw or Torch (optional)
- Drill motor
- Drill bits 1/16" through 7/8"



**Important:** Trinity Highway recommends using Double Fluted drills to achieve required tensile strength when assembling the approved anchoring system.

## Hammers

- Sledgehammer
- Standard hammer

## Wrenches

- Heavy duty impact wrench
- Standard adjustable wrench
- 1/2" drive Sockets: 9/16", 11/16", 3/4", 15/16", 1 1/8", 1 1/4"
- 1/2" drive Deep Sockets: 15/16", 1 1/4"
- 1/2" drive Ratchet and attachments
- 1/2" drive Breaker Bar - 24" long
- 1/2" drive Torque Wrench: 200 ft.-lbf.
- Crescent Wrench: 12" [300 mm]
- Allen Wrench: 3/8"
- Impact Wrench: 1/2"

## Miscellaneous

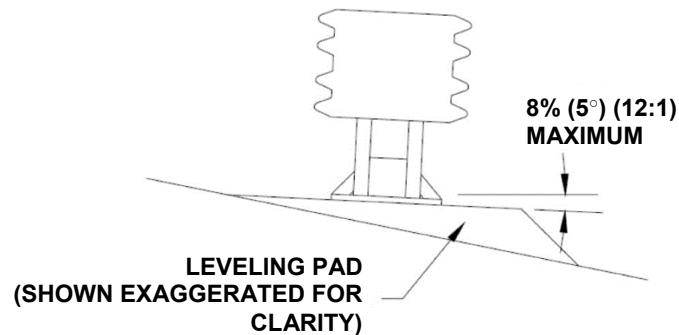
- Traffic control equipment
- Lifting and moving equipment - Minimum 5,000 lb. capacity required
- Air Compressor (100 psi) and Generator (5 kW)
- Pry bar
- Drift pin 300 mm [12"]
- Center punch
- Tape measure 25' [7.5 m]
- Chalk line
- Concrete marking pencil
- Nylon bottle brush for cleaning 7/8" drilled holes
- Rags, water, and solvent for touch-up
- Chain, 3/8" grade 40, 20' [6 m] with 1/2" [13 mm] hooks
- Acetylene torch

**Note:** The above list of tools is a general recommendation and should not be considered a complete list. Depending on specific site conditions and the complexity of the assembly specified by the appropriate highway authority, the required tools may vary. Decisions as to what tools are needed to perform the job are entirely within the discretion of the specifying highway authority and the authority's selected contractor performing the assembly of the system at the authority's specified assembly site.

## Site Preparation/Foundation

A QuadGuard® Elite M10 Wide should be assembled only on an existing or freshly placed and cured concrete foundation (4000 psi [28 MPa] minimum). Location and orientation of the concrete base and attenuator must comply with project plans or as otherwise determined by the resident project engineer.

Recommended dimension and reinforcement specifications for new concrete foundations are provided in Trinity Highway Concrete Foundation drawing, supplied with the system. The system may be assembled on a non-reinforced concrete roadway (minimum 8" [203 mm] thick). Assembly cross-slope shall not exceed 8% and should not twist more than 2% over the length of the system; the foundation surface shall have a light broom finish.



**Figure 7**  
**Cross-Slope**



**Caution:** Accurate placement of all steel rebar is critical to avoid interference with the concrete anchor bolts.



**Warning:** Location of the Backup in relation to nearby objects will affect the operation of the attenuator. Upon impact, the Fender Panels telescope rearward and extend beyond the rigid Backup as much as 25" [635 mm]. Position the Backup so that the rear ends of the last Fender Panels are a minimum of 25" [635 mm] forward of objects that would otherwise interfere with movement of the rearmost Fender Panels. Failure to comply with this requirement is likely to result in system performance which has not been crash tested pursuant to MASH criteria and may also cause component damage which will necessitate maintenance or replacement of the system.



**Warning:** It is the responsibility of the installer to ensure proper site grading for the QuadGuard® Elite M10 Wide as directed by the state or specifying agency pursuant to the AASHTO Roadside Design Guide.

## Foundation/Anchoring



**Warning:** It is the responsibility of the local DOT or appropriate highway authority to ensure that this assembly conforms to the AASHTO Roadside Design Guide.



**Warning:** It is the responsibility of the installer to ensure that your assembly procedure meets all appropriate Occupational Safety and Health Administration (“OSHA”) and local standards.

### Asphalt Installations



**Warning:** QuadGuard® Elite M10 Wide has not been tested on asphalt.

### Concrete Installations

Recommended dimension and reinforcement specifications for new concrete pads can be found on the standard drawings.

The QuadGuard® Elite M10 69” may be installed on any of the following foundations using the specified anchorage:

#### Foundation A: Reinforced Concrete Pad or Roadway

Foundation: 6” [152 mm] (reinforced) **with Anchor Block** minimum thickness P.C.C.

Anchorage: Approved adhesive with 7” [178 mm] studs 5 1/2” [140 mm] embedment

#### Foundation B: Reinforced or Non-Reinforced Concrete Pad or Roadway

Foundation: 8” [203 mm] minimum thickness P.C.C.



**Important:** To prevent sliding during impact, the pad must be placed against or tied to an existing structure. Additional below grade supports may also be necessary as the project engineer directs.)

Anchorage: Approved adhesive with 7” [178 mm] studs 5 1/2” [140 mm] embedment



## Trinity Highway Approved Adhesive Anchoring System

A Trinity Highway approved adhesive anchoring system is required to securely anchor crash cushions. Each approved adhesive kit contains adhesive, studs, nuts and washers. Both vertical and horizontal assemblies are possible using an approved adhesive anchoring system.

### Vertical Anchors

**Note:** Read all Trinity Highway approved adhesive instructions before starting.

#### 1) Prepare the Concrete Foundation



**Warning:** Do not allow anchoring adhesive to contact skin or eyes. See material safety data sheet supplied with adhesive kit for first-aid procedures. Use only in well-ventilated area. Do not use near open flame.



**Warning:** It is the responsibility of the installer to maintain a safe work area including the use of standard work zone safety equipment & PPE: gloves, safety-toe shoes, and eye / ear protection.

The anchor bolts (studs) that anchor the QuadGuard® Elite M10 Wide Backup and/or Monorail sections to the concrete foundation must be those shipped in the kit or of high strength steel (120,000 psi [830 MPa] minimum tensile strength or equal). These studs must be set in minimum 4000 psi [28 MPa] concrete. Allow the concrete to cure a minimum of seven days before applying anchoring adhesive.

#### 2) Drill Boreholes



**Caution:** It is the responsibility of the installer to consult OSHA silica respiratory standard 29 CFR 1910.134 for debris removal from borehole(s) and use Trinity Highway approved adhesive to achieve optimum tensile strength. Do not use diamond drill bits for drilling boreholes.

Use the Monorail(s) and Tension Strut Backup as drilling templates. Use a rotary hammer drill to drill the boreholes 7/8" [22 mm] diameter to the recommended depth. See the approved adhesive instructions provided with adhesive kit. Check ensure each borehole is drilled to the proper depth and aligned with the part to be anchored per Anchoring Information table.

| Anchor Information |             |              |                 |                                 |          |
|--------------------|-------------|--------------|-----------------|---------------------------------|----------|
| Stud Size:         | Orientation | Bit Size     | Minimum Depth   | Torque                          | Medium   |
| 3/4X6 1/2"         | Horizontal  | 7/8" [22 mm] | 5 1/4" [133 mm] | Adhesive<br>Manufacturer's Spec | Concrete |
| 3/4X7"             | Vertical    | 7/8" [22 mm] | 5 3/4" [146 mm] | Adhesive<br>Manufacturer's Spec | Concrete |

#### 3) Clean the Boreholes

Blow the concrete dust from the borehole using (90 psi) oil-free compressed air. Thoroughly brush the borehole with a 7/8" diameter steel bristle tube brush and then blow it out again. If the borehole is wet, completely flush it with water while brushing and then blow it clean to remove all water using oil-free compressed air.

**Note:** Use of the Trinity Highway approved vacuum drilling equipment is authorized to replace the blowing and brushing requirement of Step 3.

#### 4) Apply Approved Adhesive

Fill the borehole 100% full.



**Caution:** Fill borehole 100% full so it is even with the pavement surface per the adhesive manufacturer's instructions.

#### 5) Add the Washers and Nuts

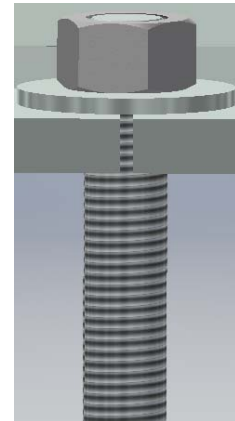
Place a flat washer onto the stud then thread a nut on until the end of the stud is flush with the nut (Figure 8).

#### 6) Insert Studs in Boreholes and Wait for Adhesive to Cure

Push the stud down through the part to be anchored and into the borehole.



**Warning:** Do not disturb or load the stud until the approved adhesive material has fully cured (reference instructions supplied with the approved adhesive kit).



**Figure 8**  
**Anchor Application**  
**(Before Applied Torque)**

#### 7) Torque the Nuts

Once the adhesive has fully cured, torque the nut to the adhesive manufacturer's recommended values.

### Steel Rebar Anchor Assembly Cautions

If steel rebar is encountered while drilling an anchor bolt borehole, apply one of the following solutions:

- A) Use a rebar drill bit for the rebar only and then switch back to the concrete bit to finish drilling into the underlying concrete until the proper borehole depth is reached.



**Caution:** Do not drill through rebar without first obtaining permission to do so from the project engineer.

- B) Drill a new borehole down at an angle past the rebar to the proper depth. Anchor the stud by completely filling both boreholes with an approved adhesive.

## Horizontal Anchors

The horizontal approved adhesive kit is the same as the vertical kit.



**Caution:** Fill borehole 100% full so it is even with the vertical concrete surface per manufacturer's instructions.

### 1) Follow the instructions supplied with your approved adhesive kit

Apply approved adhesive to each anchor per instructions.

### 2) Add the Washers and Nuts

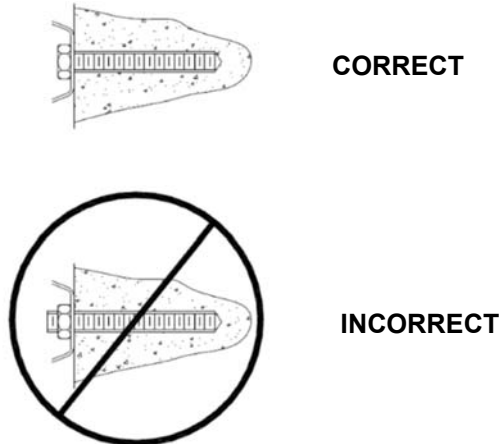
Put washer and nut on stud so the **nut is flush with end of stud**.

### 3) Insert each Stud with Washer and Nut into Borehole

Push stud with washer and nut into borehole.



**Important:** The stud should be flush with the top of the nut in both **vertical** and **horizontal** applications prior to tightening (Figure 9).



**Figure 9**  
**Horizontal Application**  
**(Before Applied Torque)**



**Caution:** Do not disturb or load the stud until the approved adhesive material has hardened (reference approved adhesive kit instructions for hardening times).

### 4) Torque the nuts

Once the adhesive has fully cured, torque nut(s) to the approved adhesive manufacturer's specification.

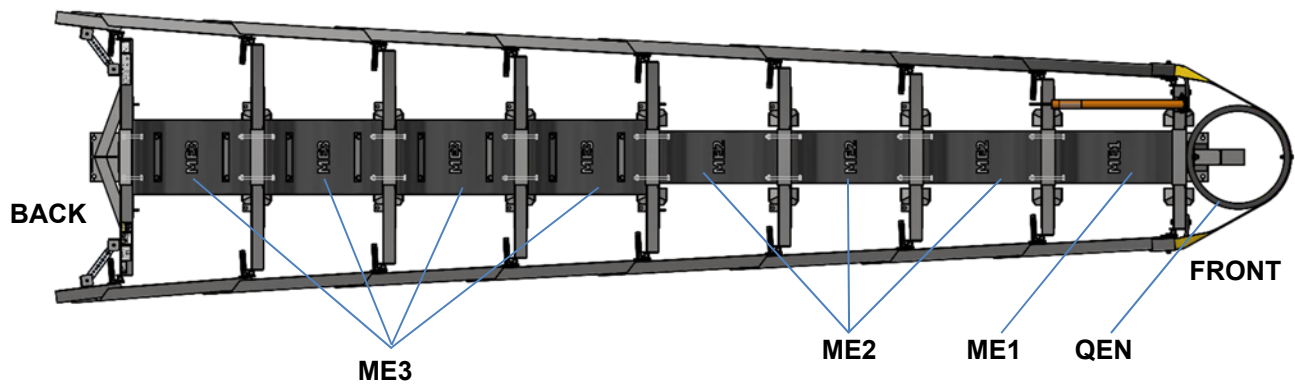


Figure 10 Plan View

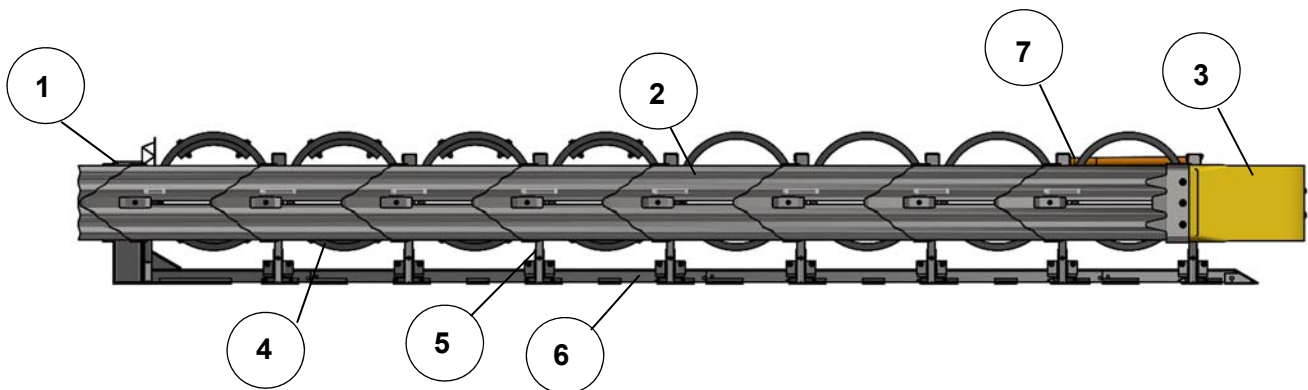


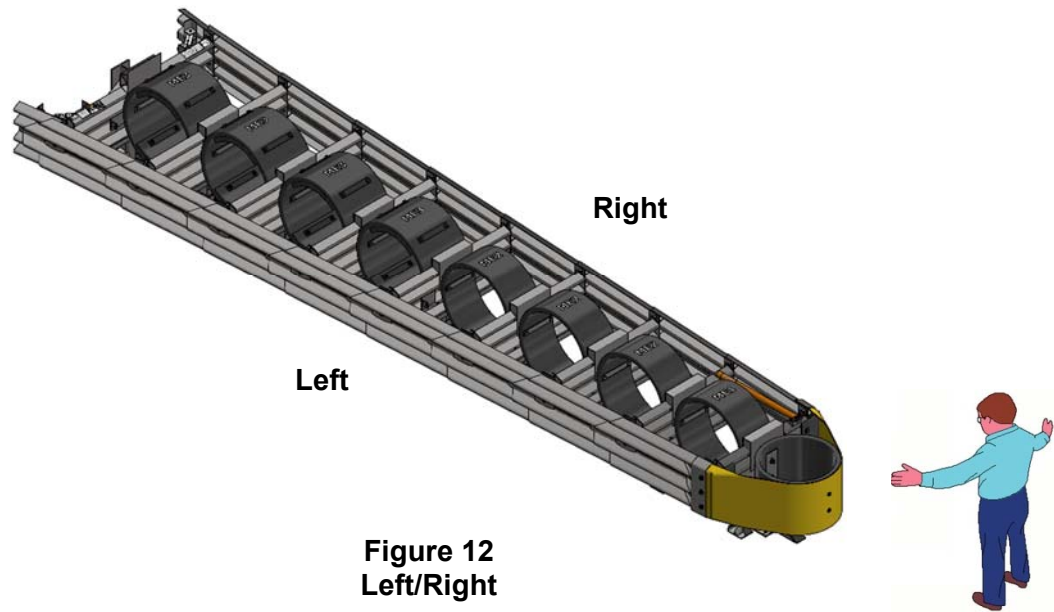
Figure 11 Elevation View

**KEY**

- 1) Backup
- 2) Quad-Beam Fender Panel
- 3) Belt Nose
- 4) Cylinder
- 5) Diaphragm
- 6) Monorail
- 7) Hit Indicator

## How to Determine Left/Right

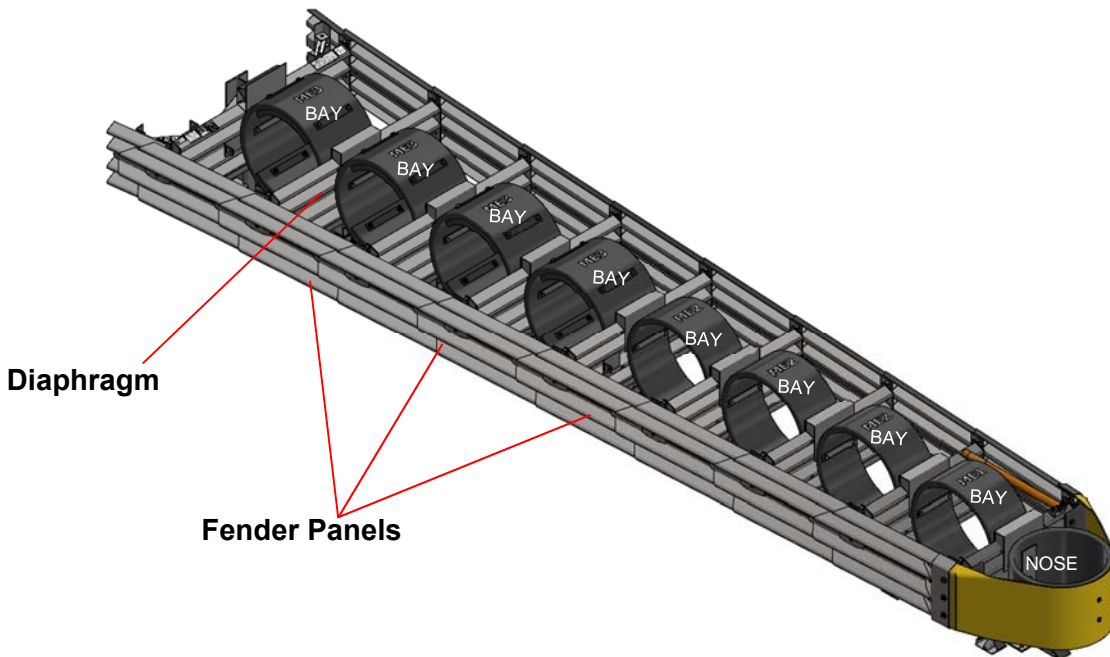
To determine left from right when ordering parts, stand in front of the system facing the hazard. Your left is the system's left and your right is the system's right.



**Figure 12**  
Left/Right

## Counting the Number of Bays

One Bay consists of one Diaphragm, two Fender Panels, etc. The Nose Assembly is not considered a Bay (Figure 13).



**Figure 13**  
Number of Bays (8 Bay System Shown)

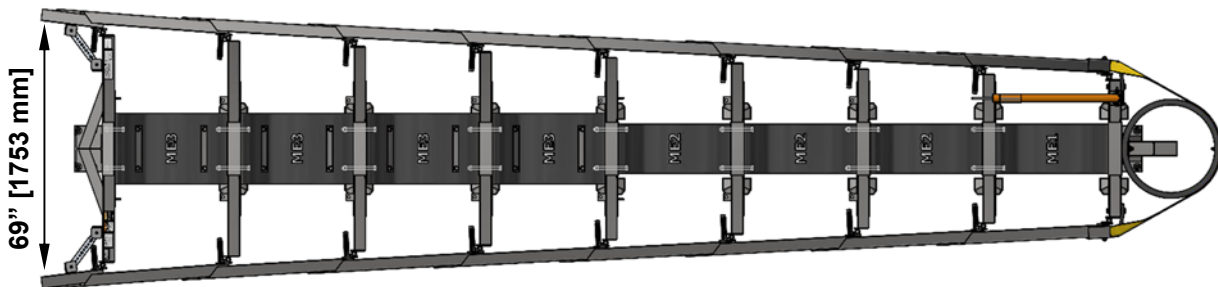
| QuadGuard® Elite M10 System Chart |                                 |
|-----------------------------------|---------------------------------|
| <b>Width</b>                      | <b>8 Bay - 62 mph [100 kph]</b> |
| 69" [1,753 mm]                    | QM10069E                        |

The nominal width of the **Tension Strut Backup** is the width between Side panels behind the Backup (Figure 14). The outside width of the system is approximately 6" [152 mm] to 9" [229 mm] wider than this measurement. The width of the system is not the same as the width of the Backup.



**Figure 14**  
Width of System with Tension Strut Backup

## System Assembly



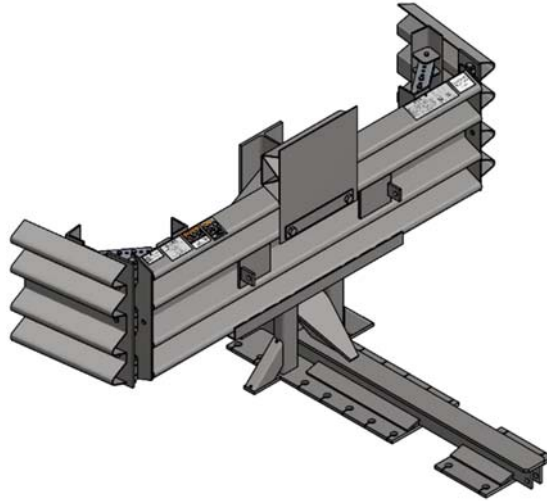
**Figure 15**

**Note:** The Drawing Package supplied with the QuadGuard® Elite M10 Wide must be used with these instructions for proper assembly and should take precedence over these general instructions.

### **1) Determine Transition Type with Tension Strut Backup**

The QuadGuard® Elite M10 Wide uses a Tension Strut Backup.

A Transition Panel or Side Panel must be used on each side of the Backup. A Side Panel is not needed when a Transition Panel is used. Several types of transitions are available for use with the QuadGuard® Elite M10 Wide.



**Figure 16**  
**Tension Strut Backup**

- A. Locate the centerline of the system by measuring the proper offset from the hazard. See the drawing package supplied with the system.
- B. Mark the centerline of the system with a chalk line.
- C. Mark a construction line parallel to the center line and offset 6.5" [165 mm] to one side as shown in Figure 17.
- D. The edge of the Monorail will be placed on this line.

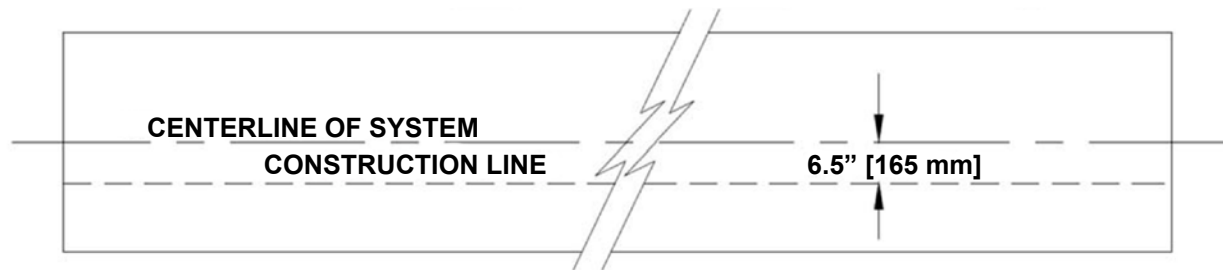
**Note:** The concrete pad must comply with the manufacturer's drawing package supplied with the system.



**Warning:** Only Strong Soil, AASHTO M147 with static performance >90% is to be used with the assembly of a transition in soil.



**Warning:** Location of system with respect to the hazard is critical and dependent on the type of Transition Panel used. See the project plans supplied with the system for details.



**Figure 17**  
**(Top view of concrete pad)**  
**Locating Construction Line**

## 2) Anchor the Backup and Monorail

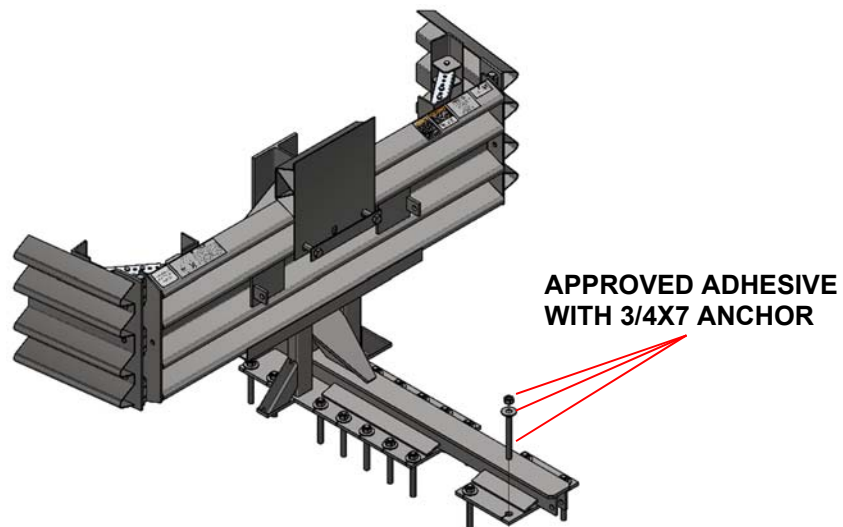
See Figure 18 (showing Backup Assembly) and Figure 20 (showing Monorail deployment). Also refer to the drawing package and the approved anchoring instructions (p. 16).



**Warning:** Location of the system is critical and dependent on the type of Transition Panel used. Consult project plans supplied by the applicable highway authority with the system for details.

### Step 1. Tension Strut Backup Assembly (Figure 18)

Locate the Backup and Monorail on the pad with the side of the Monorail on the construction line (Figure 20). Verify that applicable Transition Panels fit properly before anchoring the Backup. Drill 7/8" [22mm] diameter by 5 3/4" [146 mm] deep anchor holes in the pad using the Backup as a template. Do not drill through pad. Anchor the Backup to the concrete pad using approved adhesive kits (p. 16).



**Figure 18**  
**Anchoring Tension Strut Backup to Foundation**

### Step 2. Monorail Assembly

Locate the Monorail on the construction line as shown in the Monorail Assembly drawings. Drill 7/8" [22mm] diameter by 5 3/4" [146 mm] deep anchor holes using the Monorail as a template (Figure 20). Do not drill through the pad. Anchor each Monorail section using the provided approved adhesive kits (p. 16). It is important to attach each segment of Monorail in alignment from the back to the front of the system ( $\pm 1/4$ " [6 mm]).

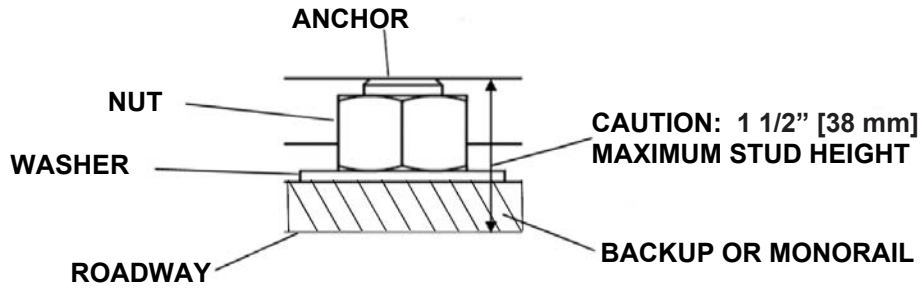


**Warning:** Improper alignment at the Monorail Splice Joints will prevent proper system collapse during an impact.

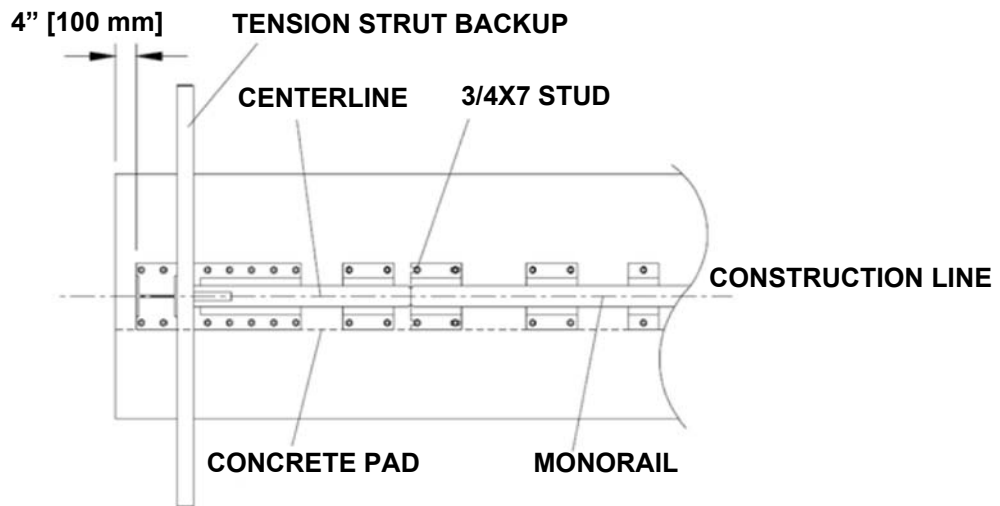


**Warning:** Every hole and slot in Backup and Monorail must have an approved adhesive stud anchoring it.

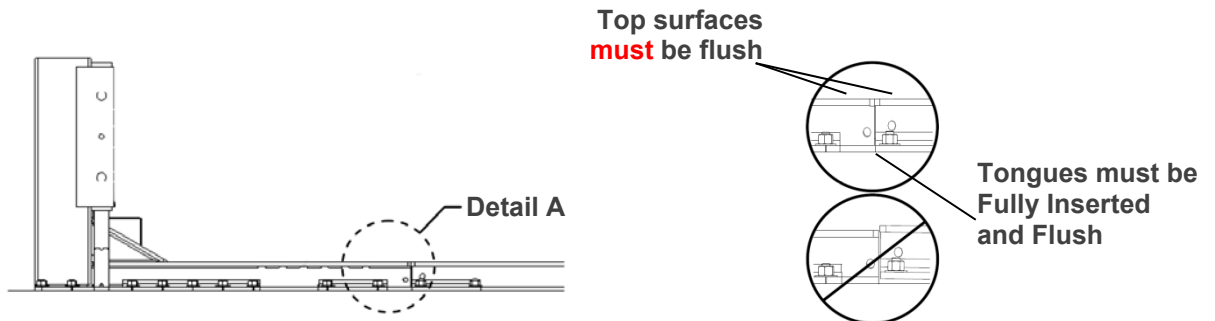




**Figure 19**  
Proper Stud Height



**Figure 20**  
Backup and Monorail Placement for Tension Strut Backup



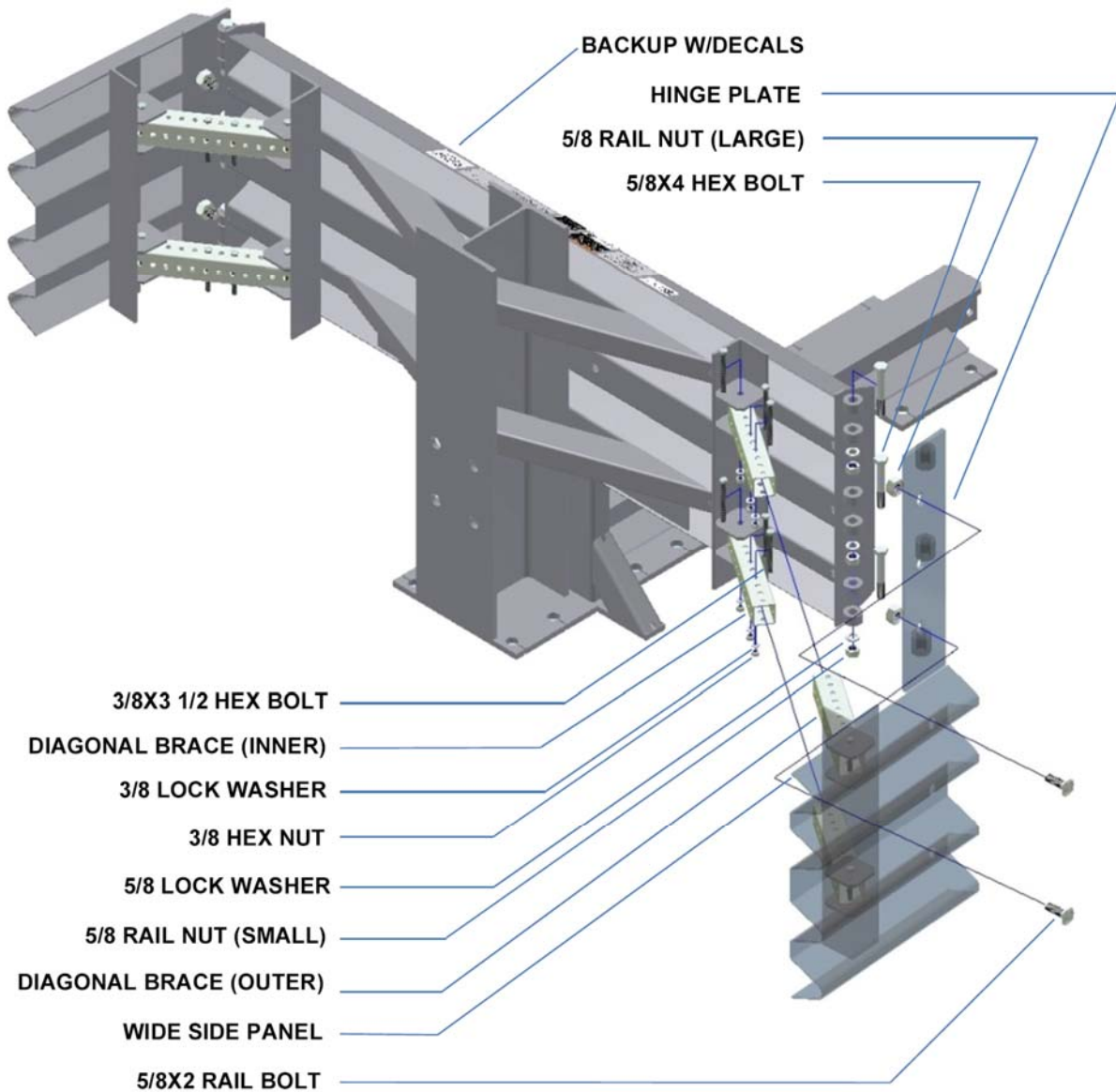
**Figure 21**  
Rail Height and Alignment

**Detail A**

### 3) Attach Side Panels / Transition Panels to Backup Assembly

Attach the Transition Panel or Side Panel as appropriate to each side of the Backup. Refer to Figure 22 and the drawing package for more information.

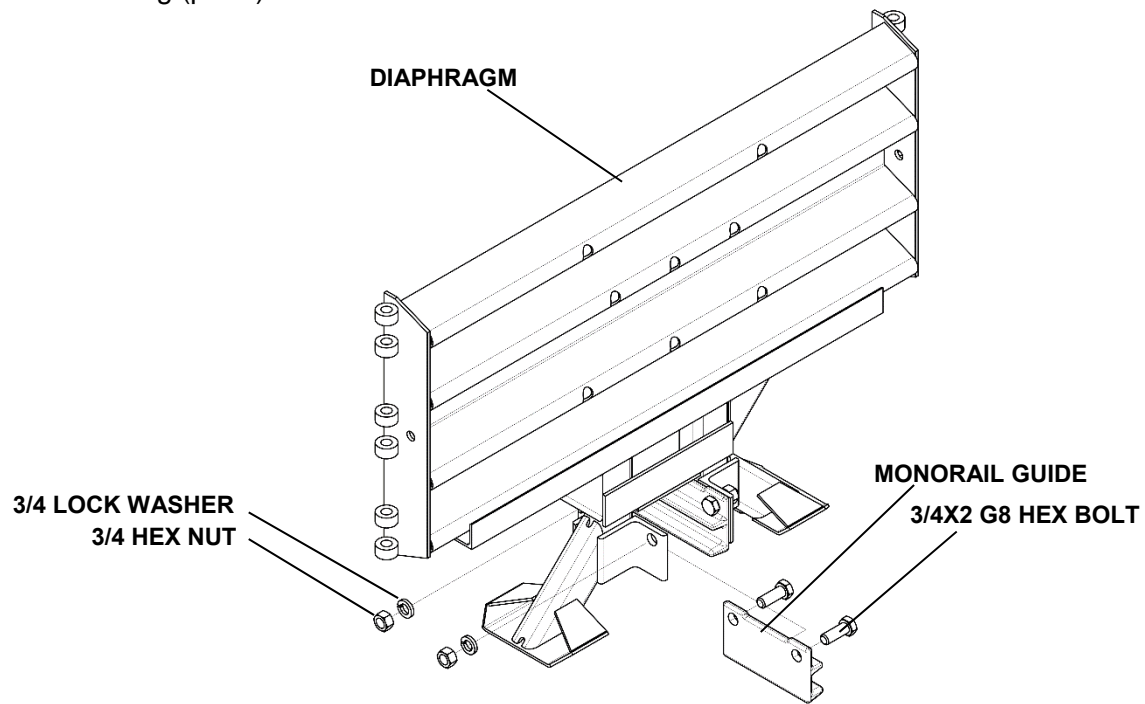
**Note:** A Side Panel is not needed when a Transition Panel is used.



**Figure 22**  
**Side Panel/Transition Panel Attachment**

#### 4) Attach Monorail Guides

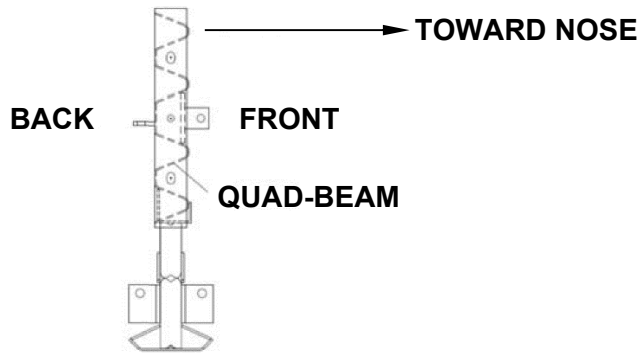
Attach Monorail Guides to Diaphragms as shown in Figure 23, and the Diaphragm Assembly drawing (p. 49).



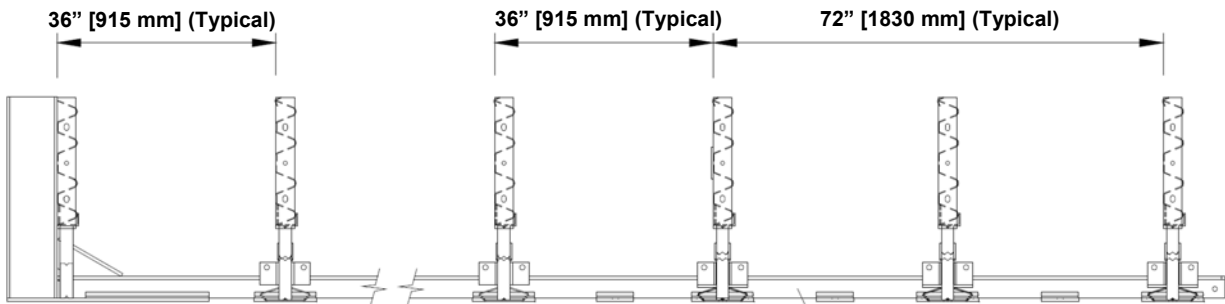
**Figure 23**  
**Monorail Guide Attachment One Side**

## 5) Deploy Diaphragms

Orient a Diaphragm so that the front face of the Quad-Beam shape faces toward the Nose of the system as shown in Figure 24. Slide one Diaphragm all the way to the Backup to ensure the system is able to collapse properly during impact. Once this has been verified, slide the Diaphragm forward to approximately 32" [813 mm] in front of the Backup. Orient and slide all Diaphragms onto Monorail and position each approximately as shown below (Figure 25).



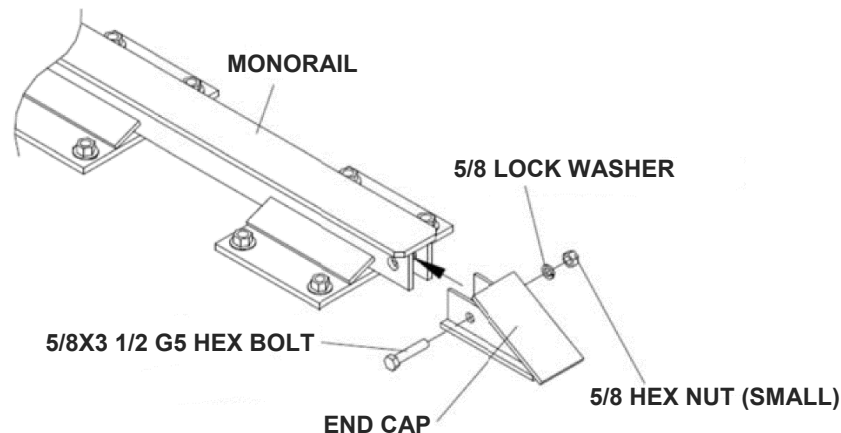
**Figure 24**  
**Diaphragm Orientation**



**Figure 25**  
**Diaphragm spacing**

## 6) Attach End Cap

Attach End Cap to the Monorail as shown in Figure 26 and the Monorail Assembly drawing.



**Figure 26**  
**End Cap Attachment**

## 7) Cylinder Attachment

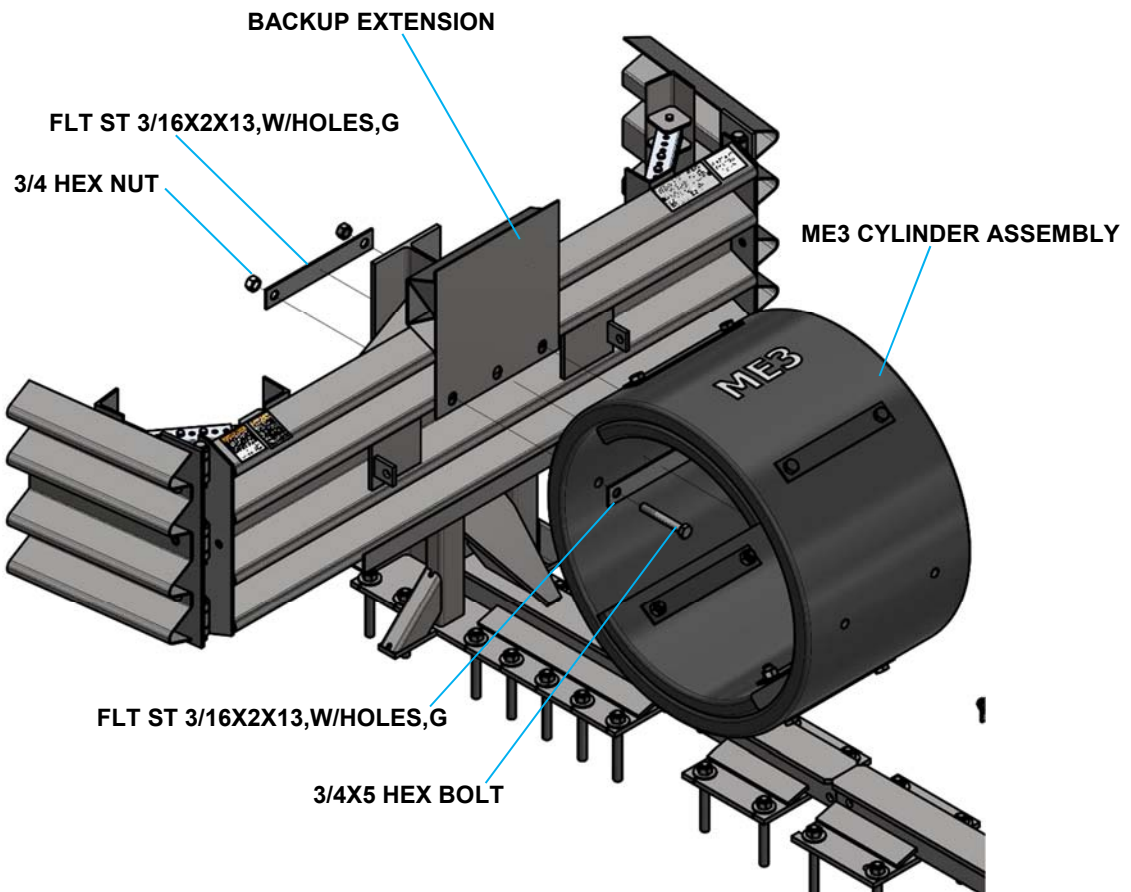
All QuadGuard® Elite M10 Wide systems utilize three Cylinder types. Bay 1 contains a Cylinder with ME1 stenciled on the outer surface. The Nose Assembly contains a single walled 28" outside diameter Cylinder with QEN stenciled on the surface. All remaining Bays have Cylinders with ME2 or ME3 stenciled on the outer surface.



**Warning:** Placing the wrong Cylinder in the nose or any Bay may result in unaccepted crash performance as described in MASH.

## 8) Attach Rear Most ME3 Cylinder

With Backup Extension in place, position a ME3 Cylinder so it is centered on the mounting holes. Fasten Cylinder to Backup using 3/4X5" hex bolts, hex nuts, and bar washers. Tighten ME3 Cylinder to Backup. Slide the next Diaphragm against the Cylinder so no gaps exist between the Backup, Cylinder, and Diaphragm. Tighten all fasteners.



**Figure 27**  
**Typical Backup ME3 Cylinder Assembly**

### 9) Attach Remaining ME3 Cylinders

Continue attaching the ME3 Cylinders to Diaphragms using 3/4X9" hex bolts, hex nuts and bar washers. Remove any clearance between the ME3 Cylinders and Diaphragms as you work forward from the Backup. Tighten all fasteners.



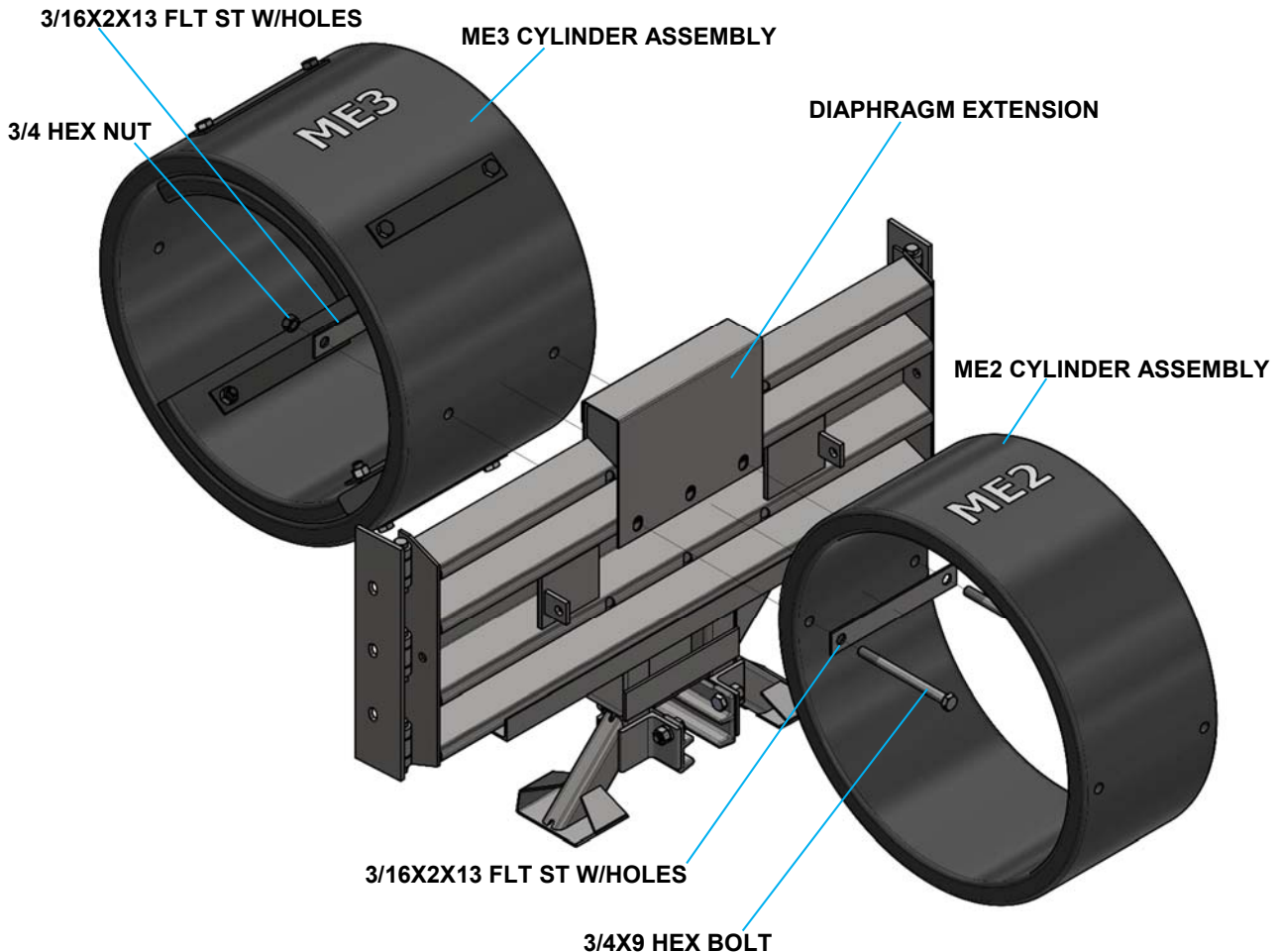
**Important:** Diaphragm Extensions must be in place before Cylinder attachment.

### 10) Attach the ME2 Cylinders

Attach ME2 Cylinders in the same way as ME3 Cylinders. Tighten all fasteners.



**Important:** Diaphragm Extensions must be in place before Cylinder attachment.



**Figure 28**  
**Typical ME3 Cylinder Mounting**

11) Attach the ME1 Cylinder in Bay 1

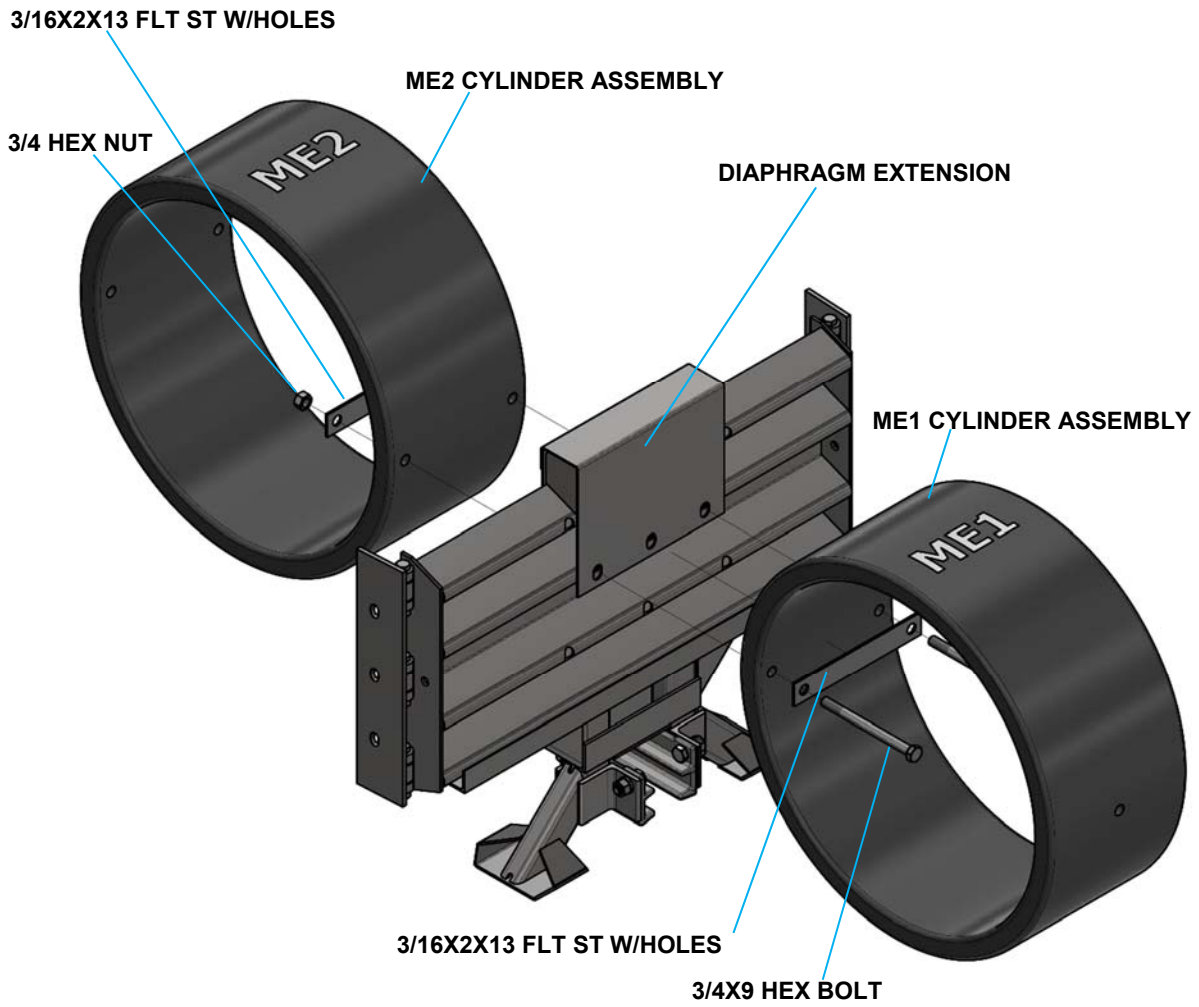
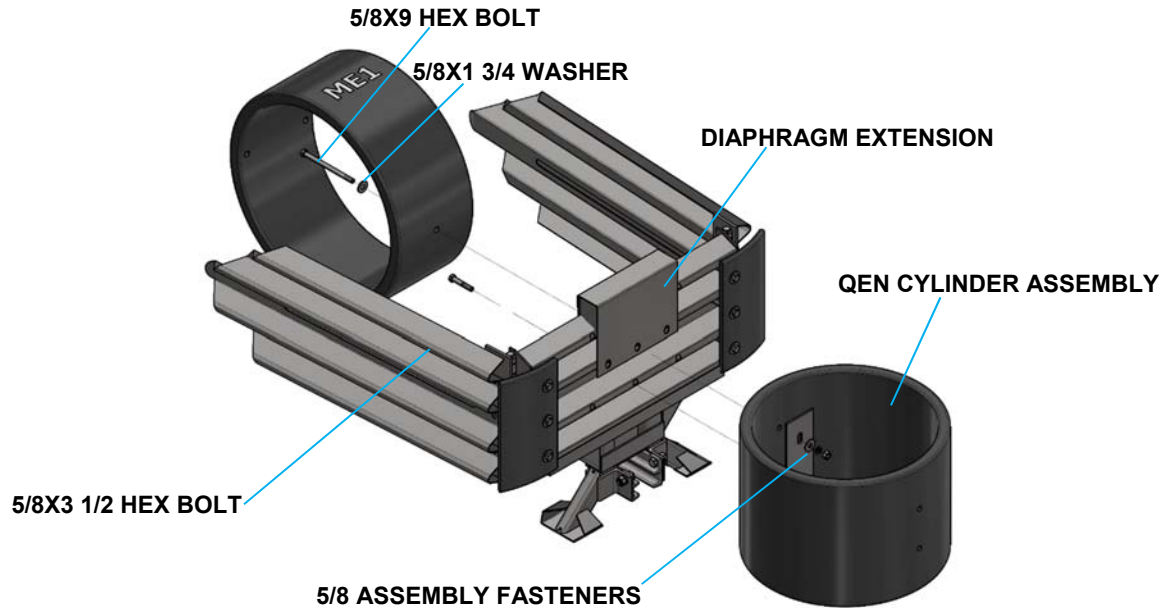


Figure 29  
Typical ME1 to ME2 Mounting

## 12) Attach Nose Cylinder

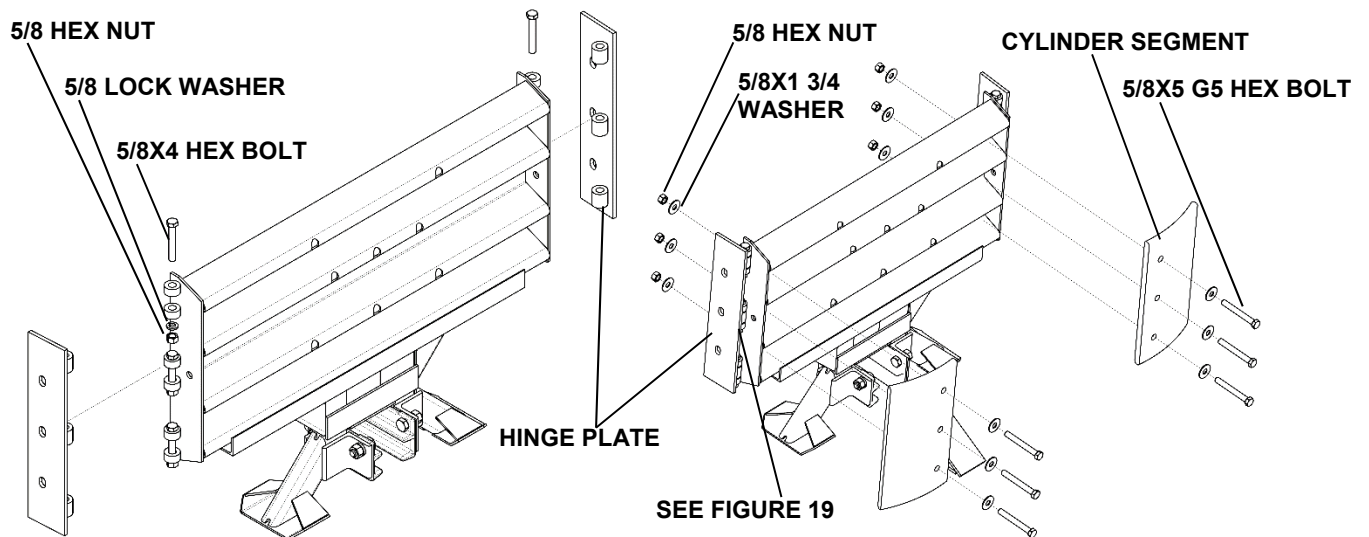
Attach the Nose Cylinder using two 5/8" bolts rods through the Nose Cylinder Plate, Nose Cylinder, and Diaphragm (Figure 30). Secure each 5/8" hex bolt with flat washers, lock washers, and hex nuts. Tighten all fasteners.



**Figure 30**  
**Attach Nose Cylinder to First Diaphragm**

## 13) Attach Hinge Plates to Diaphragm

Orient Hinge Plate with holes rearward and hinges toward the front. Insert 5/8x4" hex bolts through all hinges. Secure each bolt with 5/8" lock washer and hex nut (Figure 31). (Typical three places per side on all Diaphragms) The First Diaphragm has additional Cylinder Segments fastened with 5/8" heavy hex nuts, flat washers and 5/8x5" hex bolts (Figure 32). See pages 48 and 49 for additional information.



**Figure 31 - Hinge Plate Diaphragms 2-6**

**Figure 32 - Hinge Plate 1<sup>st</sup> Diaphragm**



## 14) Fender Panel Attachment

Starting at the Backup and working forward, assemble Left and Right Fender Panels as shown in Figure 34.

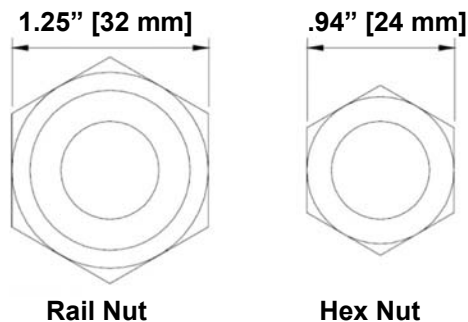
**Step 1.** Place the Fender Panel so that the center hole of the rearward Diaphragm is lined up with the approximate center of the slot in the Fender Panel.

**Attach the Mushroom Washer Assembly as shown in Figure 35 but do not torque at this time. (This helps to balance the Fender Panel.)**

**Step 2.** Slide the Fender Panel forward until the holes in the Fender Panel line up with the holes in the forward Diaphragm.

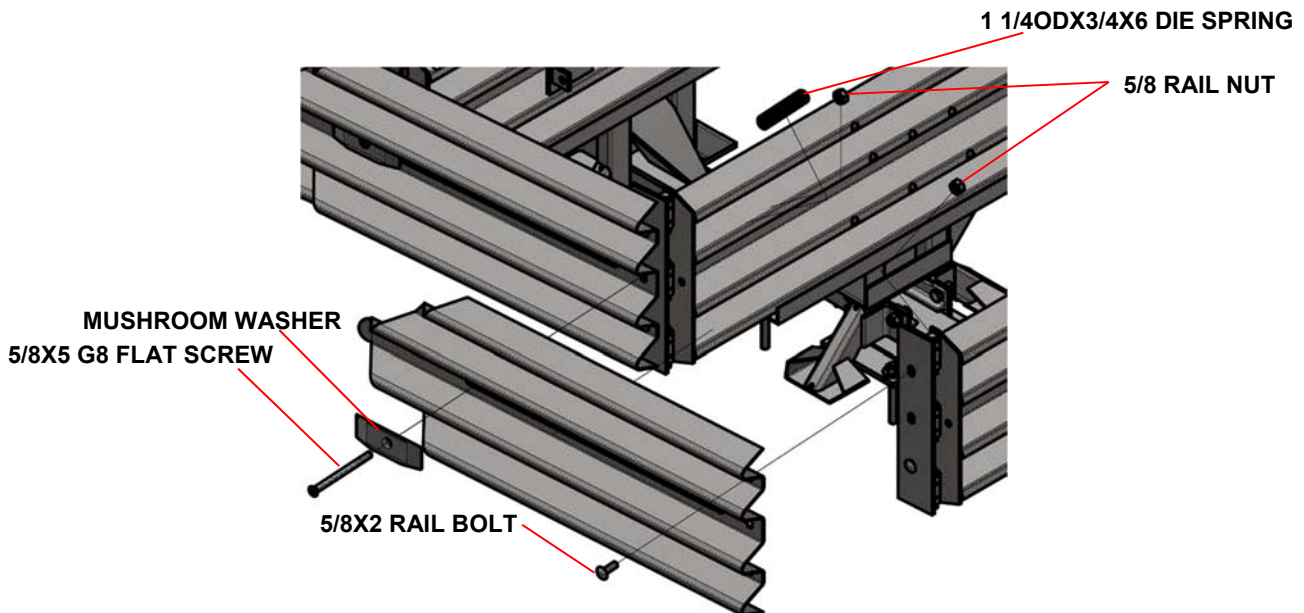
**Step 3.** Use a drift pin to align the center hole of the Fender Panel with the center hole of the Diaphragm.

**Step 4.** Attach the front of the Fender Panels to the next Diaphragm using two rail bolts and large rail nuts per side. Use only the top and bottom holes; leave the center hole open until the next Fender Panel is attached.



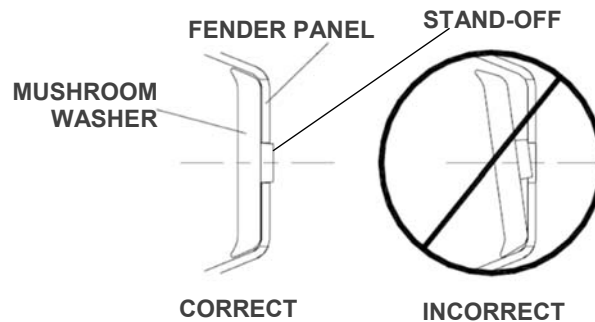
**Figure 33**  
**Rail Nuts are Oversize**

**Note:** Do not mix the 5/8" rail nuts (large) with the 5/8" hex nuts (small) (Figure 33).



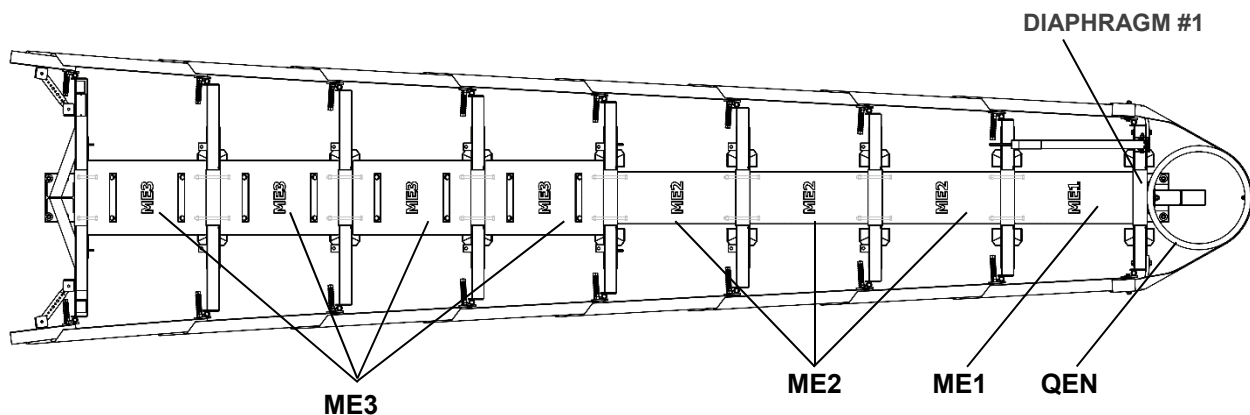
**Figure 34**  
**Fender Panel Assembly**

**Note:** Mushroom Washers lay flat against the Fender Panel as shown below. Mushroom Washer Stand-off must be seated completely through slot (Figure 35).



**Figure 35**

Continue attaching Fender Panels until you reach Diaphragm No. 1 (Figure 36).



**Figure 36**  
**Diaphragm No. 1 & Cartridge Placement**

### 15) Belt Nose Assembly

- a. Using 5/8X5" hex bolts, 5/8X1 3/4" flat washers, and 5/8" hex nuts, attach Fender Panels to Diaphragm Hinge Plates on three places per side (Figure 37 and 38). Tighten all fasteners.
- b. Thread additional 5/8" nuts onto the 5/8X5" hex bolts. Slide 5/8X1 3/4" flat washers onto bolts (three places per side). Adjust the nuts so the outside of the washers are even with the Fender Panel humps (Figure 37).
- c. Place Belt Nose over Diaphragm/Fender Panel attachment bolts.
- d. Align holes in Belt Clamps with bolts and place onto bolts against belt.
- e. Secure with 5/8X1 3/4" washers and 5/8" hex nuts in three places per side. Adjust Belt Nose Assembly so belt height is 32.0" above grade. Tighten all fasteners.
- f. Complete Belt Nose Assembly by attaching Belt to Nose Cylinder with 1/2X3" hex bolt, 1/2" washer, lock washer, and hex nut.

The Nose can be delineated to comply with local codes (chevron, reflectorized sign, etc.).



**Warning:** Placing the wrong type Cylinder in the Nose or any Bay will result in unacceptable crash performance as described in MASH.

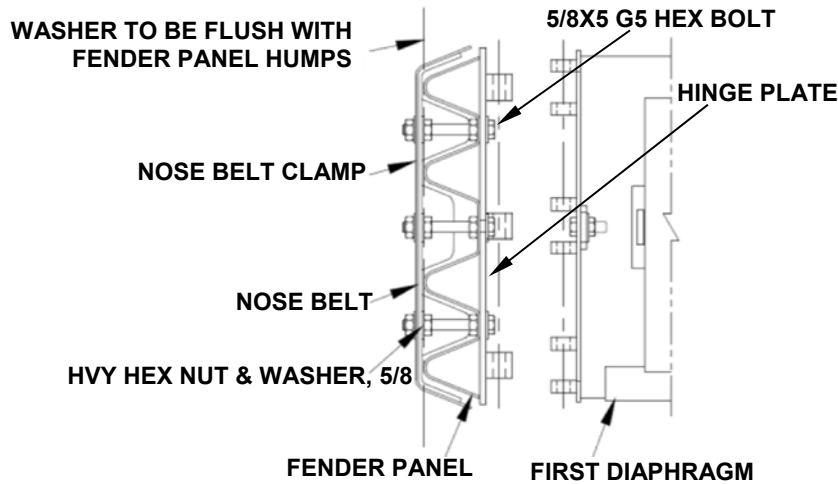


Figure 37

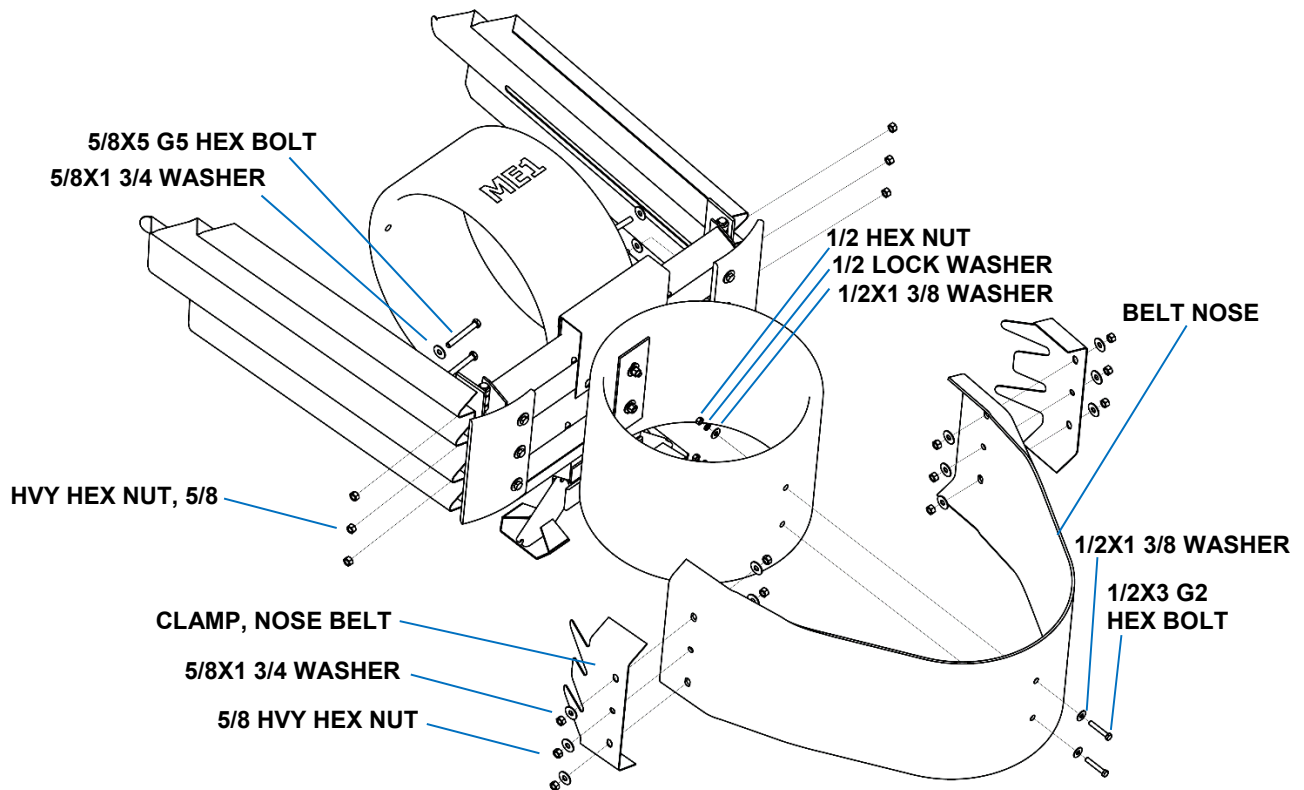


Figure 38  
Attach Nose Belt to Fender Panels

## 16) Attach Hit Indicator to Diaphragm No. 1

The Hit Indicator should be the last component attached to the system. Fasten the Hit Indicator to the first Diaphragm as shown in Figure 39. Offset component to right side of Diaphragm.

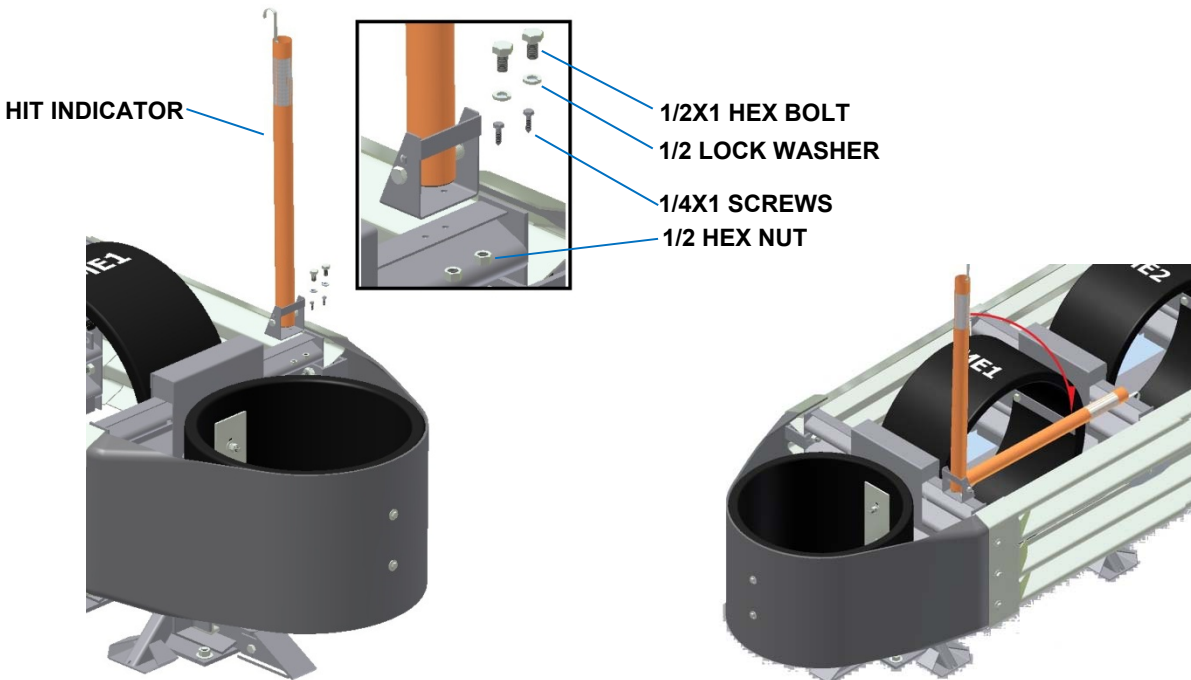
**Step 1.** Position Hit Indicator on 1<sup>st</sup> Diaphragm. Center Hit Indicator between Diaphragm Extension and edge of Diaphragm. Drill one 1/4" hole as needed to set bracket tab in Diaphragm.

**Step 2.** Attach hit indicator to 1<sup>st</sup> Diaphragm.

**Option 1.** Match drill two 9/16" holes as needed in Diaphragm. Use 1/2" hex bolts, 1/2" lock washers, and 1/2" hex nuts to attach bracket (p. 53).

**Option 2.** Use 1/4" self-drilling + tap screws along with flat washer to attach bracket.

**Step 3.** Rotate Hit indicator to horizontal position and bend trigger clip around top of 2<sup>nd</sup> Diaphragm (Figure 40).



**Figure 39**  
Attach Hit Indicator

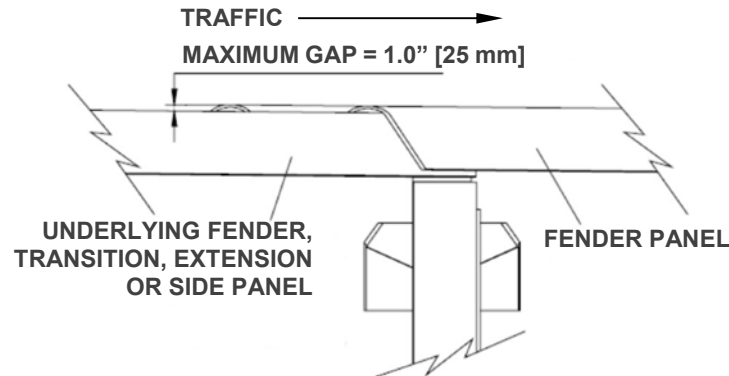
**Figure 40**  
Rotate Hit Indicator/Bend Trigger Clip

### 17) Checking The System Assembly

At this point tighten all Mushroom Washer Assembly nuts until they bottom out on the threads of screws and recheck to ensure that all fasteners are properly tightened throughout the system (anchor bolts, etc.). Check all Fender Panels. If they do not fit tightly against the underlying panel, system realignment may be necessary (Figure 41).



| Bolt Torque Specifications |  |
|----------------------------|--|
| <b>Warning:</b>            |  |
| Anchor Studs               | Torqued to Adhesive Manufacturer's Specification<br>Shall Not Extend Above Concrete Pad More than 1 1/2" (p. 24) |
| All Other Bolts            | Tightened  |
| Fender Panel               | Maximum gap allowed:<br>WIDE Systems – 1.0" [25 mm]  |



**Figure 41**  
**Fender Panel Gap**

### 18) Inspect System

Inspect the system in accordance with Maintenance Flow Chart (p. 40).

## **QuadGuard® Elite M10 Wide Final Inspection Checklist**

**Site Location:** \_\_\_\_\_

**Date:** \_\_\_\_\_

**Inspector:** \_\_\_\_\_

**Refer to the QuadGuard® Elite M10 Wide manual and/or drawing package.**

- Proper Transition Panel is used for barrier type (p. 11)
- If no transition is used, side panels are used with backup (p. 11)
- Minimum clearance of 25" behind rear Fender Panels for movement (p. 14)
- Anchor nuts are torqued to adhesive manufacturer's specification (p. 16)
- Cylinder types are properly placed (p. 19)
- Every borehole and slot in Backup and Monorail is utilized (pp. 23, 24)
- Anchor stud(s) height is 1 1/2" [38 mm] or less above the pad (p. 24)
- Monorail guides are attached to the Diaphragms (p. 26)
- Cylinder Segments are fastened on each side of the 1<sup>st</sup> Diaphragm (p. 27)
- Monorail End Cap Assembly in place (p. 27)
- Mushroom Washer Assembly nuts must be tightened to the bolt shank. (p. 32)
- Mushroom Washers tabs lay flat within Fender Panel slots (pp. 33, 39)
- Belt Nose Assembly and is 32" above grade (p. 33)
- Fender Panel gap is 1.0" [25 mm] or less for Wide systems (p. 43)
- Bolts and nuts are properly tightened throughout the system (p. 43)
- System is clear of debris

## **Maintenance and Repair**



**Important:** Inspections are recommended, as needed, based upon volume of traffic and impact history. Visual Drive-By Inspections are recommended at least once a month. Walk-Up Inspections are recommended at least once a year.

### **Visual Drive-By Inspection**

- 1) Encountering a system with the Hit Indicator in the vertical position mandates inspection of the system. A walk-up inspection will be necessary.
- 2) Inspect the system in accordance with the QuadGuard® Elite M10 Wide Maintenance Flow Chart (p. 40).



**Caution:** It is important to inspect a system after it has been impacted even if it appears to be self-restored and fully maintained. In particular, check the Fender Panels/Diaphragm attachment bolts to be sure none have failed.

- 3) Be sure the Nose assembly is in place and in good condition.
- 4) Note the location and condition of the QuadGuard® Elite M10 Wide and the date of visual drive-by inspection.

### **Walk-Up Inspection**



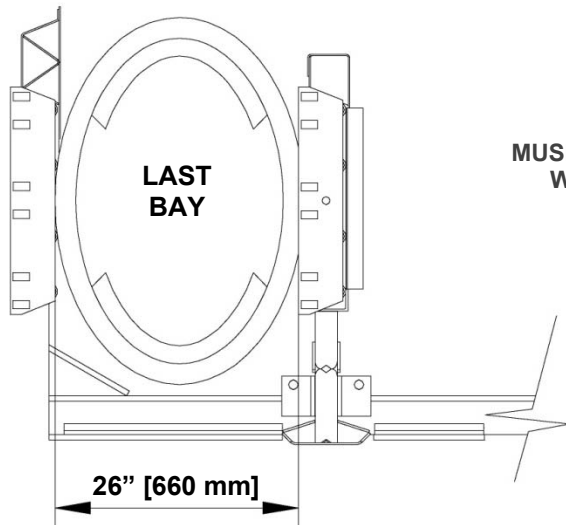
**Warning:** A system that has been impacted can store energy in collapsed Cylinders and may spring back unexpectedly causing possible serious injury. Use caution when inspecting, disassembling or restoring systems that are collapsed or compressed by any amount.

### **Maintenance Checklist**

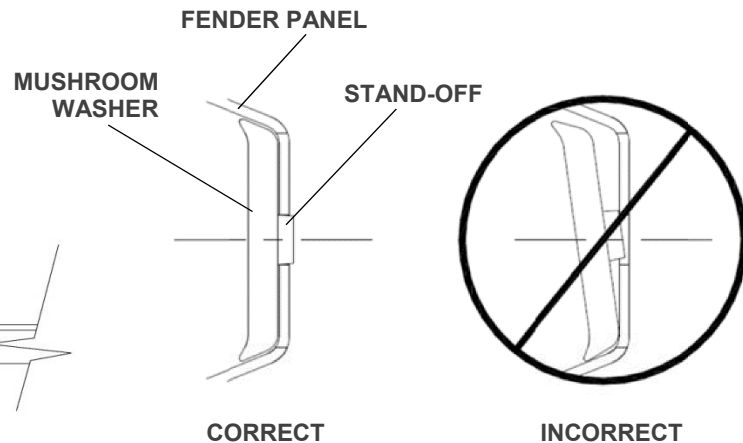
- 1) Clear and dispose of any debris on the site. Check along length of Monorail and remove any debris.
- 2) All bolts are tight and rust free.
- 3) Monorail Anchor Nuts are securely anchored.
- 4) Diaphragm Legs are straight.
- 5) All Mushroom Washer Assemblies are properly aligned and positioned (p. 43).
- 6) Fender Panels and Transition Panels should nest tightly against the system. For wrong way traffic, the maximum gap allowed is 1.0" [25 mm].
- 7) All Cylinders are in good condition and are properly positioned within each Bay.
- 8) Always inspect system if the Hit Indicator is in the UP position even if it appears normal.

**Note:** The energy absorbing HDPE Cylinders lose their ability to absorb energy with increasing number of system impacts. After multiple full capacity design impacts, the system will no longer be able to meet the requirements as specified in MASH. To ensure that Cylinder replacement is accomplished before this condition occurs, it is essential that this part of the inspection be conducted every time the Hit Indicator indicates the system has been impacted.

The rear-most Cylinder must measure at least 26" [660 mm] for proper impact performance (Figure 42). If distance is less than 26" [660 mm], replace all ME1 and ME2 Cylinders. If distance is greater than 26" [660 mm], inspect all Cylinders for major cracks, tears or cuts. Replace any damaged Cylinders. Please call Customer Service if you have any questions (p. 3).



**Figure 42**  
**Distance Across**  
**Minor Axis of ME2 Cylinder**



**Figure 43**  
**Mushroom Washer Orientation**

- 9) Ensure the system is deployed to its full length.



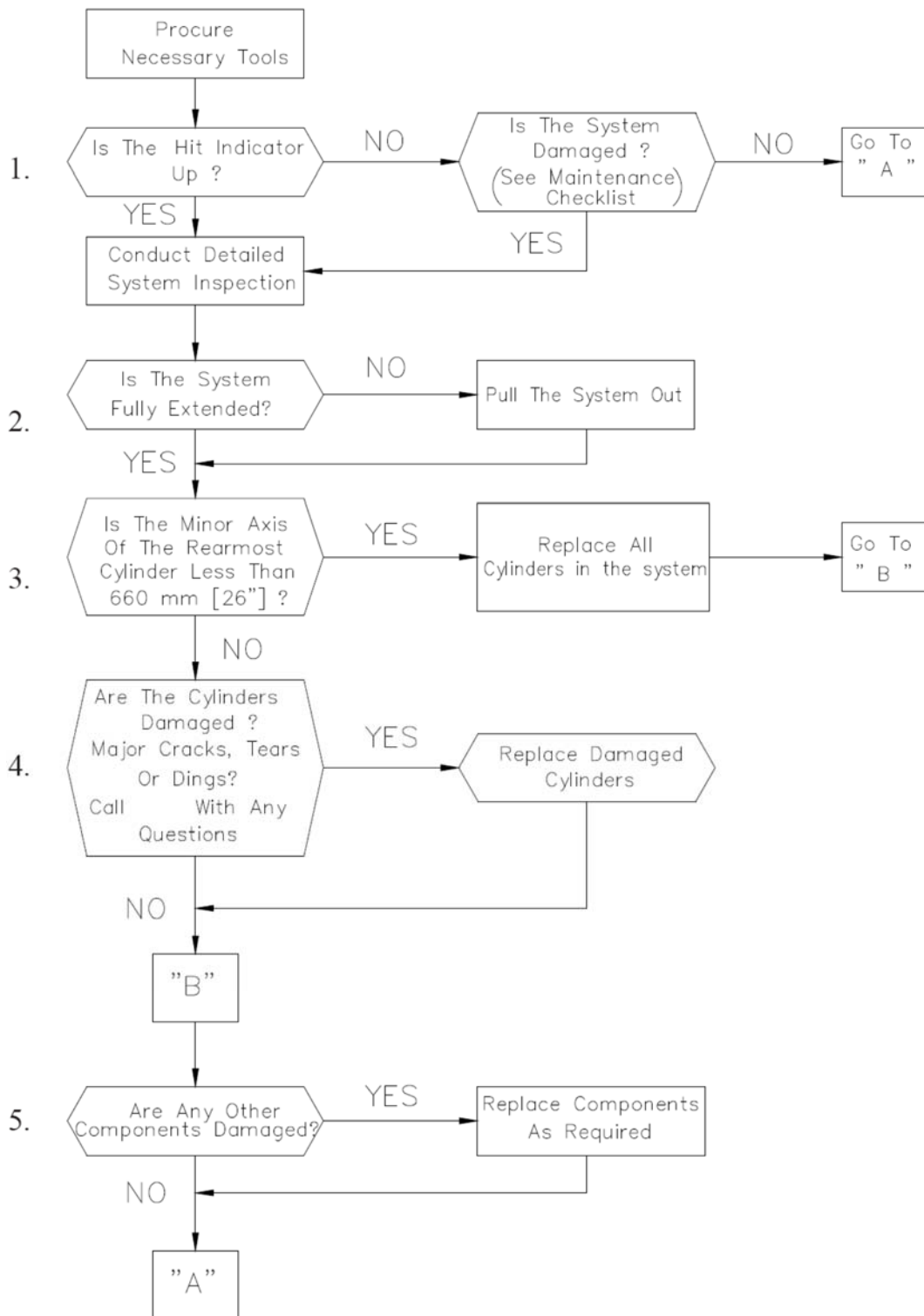
**Caution:** Systems that are not restored to their full length may not perform to impact performance standards of MASH.

- 10) Make all necessary repairs as described above and see the following page for Post-Impact Instructions.
- 11) Reset Hit Indicator if necessary.
- 12) Note the location and condition of the QuadGuard® Elite M10 Wide, and any work done, in your **Impact Attenuator Inspection Logbook** under the date of this inspection. If further repair is required, note repair request date in logbook. Walk-up inspections are recommended as needed based upon volume of traffic and impact history. Refer to Post-Impact Instructions for more information (p. 41).



## Maintenance Flow Chart

Refer to the appropriate sections of this manual for specific procedures.



## Post-Impact Instructions

- 1) Deploy the appropriate traffic-control devices to protect your crew.



**Warning:** An impacted system can store energy in collapsed Cylinders and **may spring back unexpectedly** causing serious injury. Use caution during post-impact inspections for repair or refurbishment.



**Warning:** It is the responsibility of the worker to keep hands and other body parts clear of system interaction. Be aware of tools (pry bar, etc.) that could move unexpectedly if a bind is suddenly released.

- 2) Position a minimum 1 ton pickup truck on the system just in front of the Nose Assembly. Place the truck bumper against the system. The truck bumper height, approximately 24" [610 mm], should rest against the middle center of the Nose Assembly.



**Warning:** Once the bumper is over the system's Monorail, the vehicle may be subject to pushing force due to unexpected restoration. The driver should be wearing a seat belt and have the vehicle in the lowest possible gear when approaching the system. In the event that the system unexpectedly deploys before Step 2 is complete, the driver should apply the brakes immediately to bring the vehicle to a controlled stop. The vehicle must be in neutral while still applying the brakes and then gradually release the brakes to allow the system to restore against the truck bumper in a safe and controlled way.

- 3) Once in place, carefully move the truck so the bumper displaces the Nose Cylinder 6". In the absence of the Nose assembly, place protective material between the bumper and the first Diaphragm leaving a 1.00" gap between the protective material and the truck bumper. It is the responsibility of the driver to remain in the vehicle to apply the brake during initial system displacement.



**Caution:** Use a pry bar with a 1 ton truck to release additional mechanical binds in a safe and controlled manner.

- 4) Wrap a chain, 3/8"X20' Grade 40 minimum, around the first Diaphragm (Figure 44). Attach both ends of chain to truck bumper anchor points.



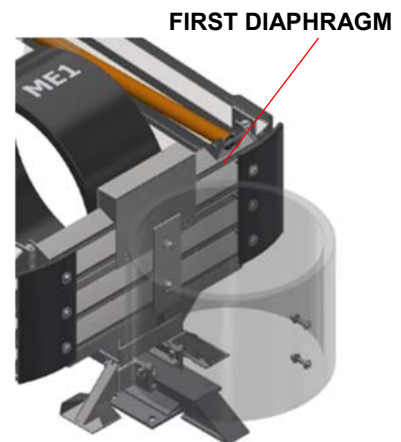
**Important:** Wrap chain around the first Diaphragm so the pull force is aligned with the long slots in the Fender Panels to ensure a smoother extension.



**Warning:** Stand clear in case chain breaks or becomes disconnected.



**Important:** Have someone watch during repositioning to ensure undetected damage does not cause the Diaphragms to bind or pull out improperly. Wait ten minutes after full extension for Cylinders to regain their former shape.



**Figure 44**  
**Attach Chain to First Diaphragm**

- 5) Ensure the Mushroom Washer Assemblies holding the Fender Panels together are still intact and the system has not been deformed to prevent it from pulling back fully to its original position.



**Caution:** Use eye protection and gloves when repairing any Mushroom Washer Die Spring Assembly. Do not place fingers underneath an assembled Mushroom Washer. Parts may suddenly shift and fingers may be pinched. If the Die Spring is still under compression, then secure it with a clamp to ensure safe action and release when the nut is removed.

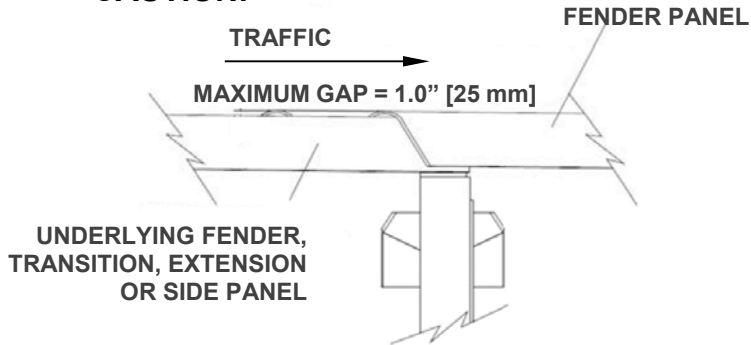
- 6) The system should now be safe to approach for debris removal and further mechanical binding inspection. Binding is typically located at the Monorail Guides near the front Diaphragms or Fender Panels.
- 7) Verify all Anchor Bolts are firmly anchored to the roadway surface. Replace any loose, broken, or pulled out Anchors. Proper performance of the system depends on the Monorail Anchors being properly deployed.
- 8) All Diaphragm Support Legs must be properly attached to the Monorail.
- 9) Inspect the system in accordance with the QuadGuard® Elite M10 Wide Maintenance Flow chart (p. 40). The Cylinders are potentially reusable after typical design speed impacts. See the Limitations and Warnings section on page 5.
- 10) Diaphragms that are bowed or have bent legs must be replaced.
- 11) Each Fender Panel must be properly attached with a Mushroom Washer Assembly. Check all Fender Panel to Diaphragm bolt connections. All damaged bolts, Fender Panels and Transition Panels must be replaced.
- 12) The maximum gap allowed for overlapping Fender Panels on the side of the system with traffic approaching from the rear (including Fender Panels overlapping components behind the system) is 1.0" [25 mm]. Mushroom Washer Assembly nuts must be tightened to the bolt shank. Replace damaged parts if a gap between any Fender Panel exceeds 1.0" [25 mm] (p. 43).
- 13) Replace all damaged Cylinders. If a Cylinder's condition is questionable, a photo of the Cylinder may be forwarded to Trinity Highway for evaluation (p. 3).
- 14) Tighten and torque all fasteners on the system (p. 36).
- 15) Clear site debris.
- 16) The QuadGuard® Elite M10 Wide is ready for use.



**Important:** Because every impact is different, Trinity Highway makes no recommendation whether use or reuse of any part of the system is appropriate or acceptable following an impact. It is the sole responsibility of the project engineer and/or the local highway authority and its engineers to make that determination. It is critical that you inspect this product after assembly is complete to make certain that the instructions provided in this manual have been strictly followed.



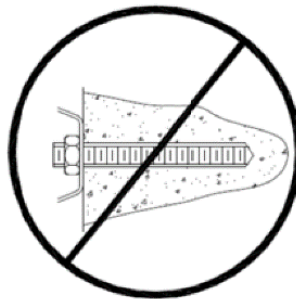
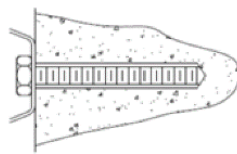
**CAUTION:**



**Figure 45  
Fender Panel Gap**



| <b>Torque Specifications</b> |  |
|------------------------------|--|
| <b>Warning:</b>              |  |
| Mushroom Bolt Assemblies     | Tighten nut to bolt shank  |
| Anchor Studs                 | Torqued to adhesive manufacturer's specification.<br>Shall Not Extend Above Concrete Pad<br>More than 1 1/2" (p. 24) |
| All Other Bolts              | Tightened  |
| Fender Panel                 | Maximum Gap Allowed  |
| <b>WIDE System</b>           | <b>1.00" [25 mm]</b>   |



**Figure 46  
Horizontal Anchor**

## **Parts Ordering Procedure and Drawings**

Make a list of all damaged parts using part descriptions illustrated on drawings in the back. Answer the following questions in the spaces provided. This information is necessary to receive the proper parts.

| <b>QuadGuard® Elite M10 Wide Ordering Information Chart</b>                 |   |                             |
|---|---|-----------------------------|
| <b>Description:</b>   | <b>Choices</b>  | <b>Fill in this section</b> |
| Transition Panel Type<br>Right side, left side, or no<br>Transition (p. 11) | W-Beam<br>Thrie Beam Guardrail<br>Safety Shape Barrier<br>Single Slope Barrier<br>Verticle Concrete |                             |
| Width of Backup   | 4" [100 mm] Offset Panel  |                             |

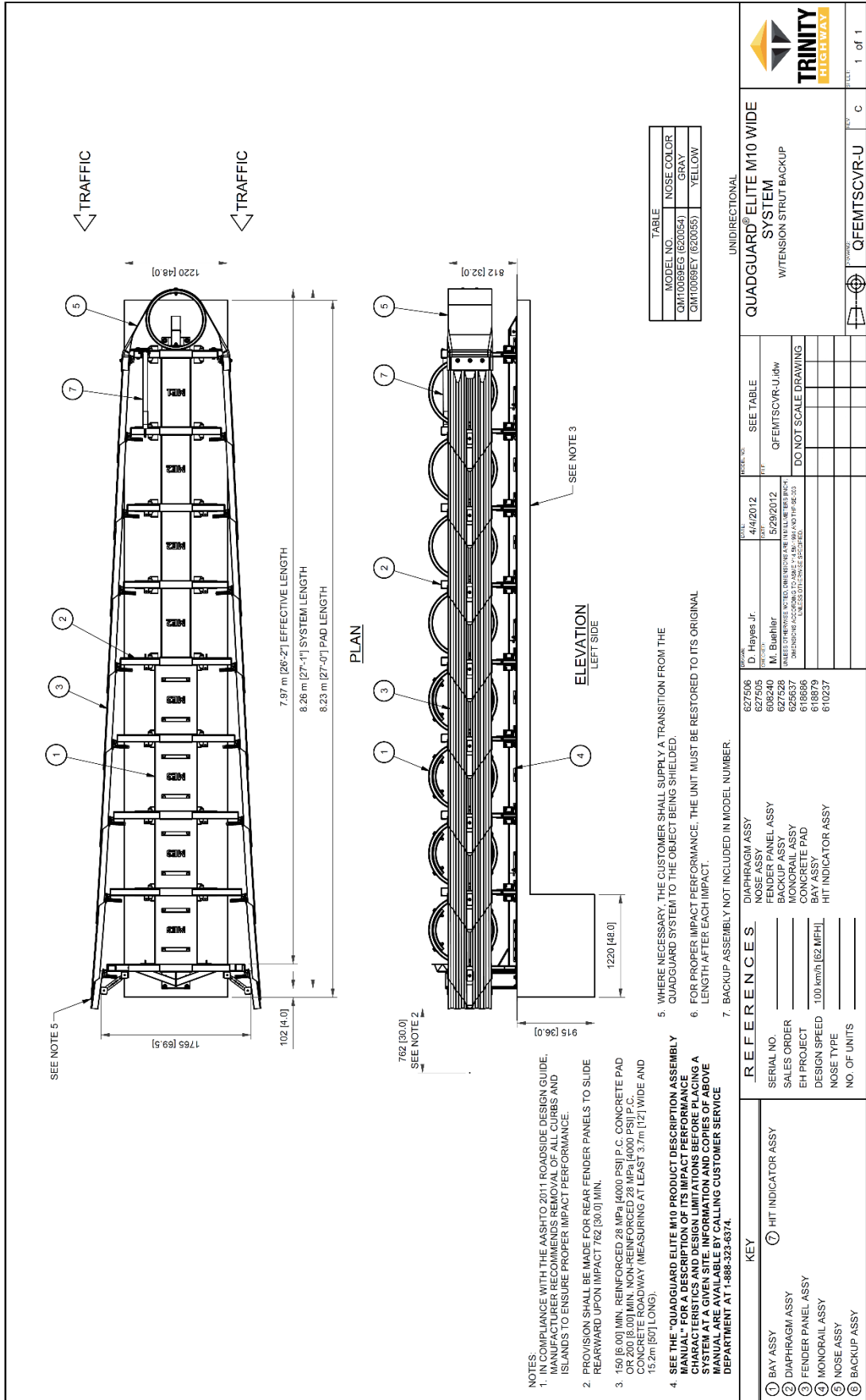
## **Parts List(s) & Quantities**

| <b>PN</b> | <b>Description</b>                 | <b>Count</b> |
|-----------|------------------------------------|--------------|
| 118710    | Adhesive,HY200,330,Hilti           | 17           |
| 618847    | Backup,TS,64,QGE,G,W/Decals        | 1            |
| 605108    | Belt,Nose,96,QGE,90,7 Bay,Y        | 1            |
| 113467    | Bolt,Hex,1/2x1,G5,G                | 2            |
| 113476    | Bolt,Hex,1/2x3,G2,G                | 2            |
| 113555    | Bolt,Hex,3/4x2,G8,G                | 32           |
| 113573    | Bolt,Hex,3/4x5,G5,G                | 2            |
| 113612    | Bolt,Hex,3/8x3 1/2,All Thread,G5,G | 16           |
| 113660    | Bolt,Hex,5/8x3 1/2,G5,G            | 1            |
| 113666    | Bolt,Hex,5/8x4,G5,G                | 54           |
| 113667    | Bolt,Hex,5/8x5,G5,G,All Thread     | 12           |
| 004489    | Bolt,Hex,5/8x9,A325                | 15           |
| 003400    | Bolt,Rail,5/8x2,G                  | 6            |
| 606330    | Clamp,Nose Belt,QG,G               | 2            |
| 618702    | Cylinder Assy,ME3,MASH,QGE         | 4            |
| 627504    | Cylinder Seg,18x9 1/2x0.8          | 2            |
| 618538    | Cylinder,ME1,MASH,QGE              | 1            |
| 618649    | Cylinder,ME2,MASH,QGE              | 3            |
| 606689    | Cylinder,Nose,HDPE,28x20           | 1            |
| 627503    | Diaphragm,QG,0993,QGE              | 1            |
| 619120    | Diaphragm,QG,1073,QGE              | 1            |
| 619121    | Diaphragm,QG,1153,QGE              | 1            |
| 619122    | Diaphragm,QG,1233,QGE              | 1            |
| 619124    | Diaphragm,QG,1313,QGE              | 1            |

| PN     | Description                          | Count |
|--------|--------------------------------------|-------|
| 619125 | Diaphragm,QG,1393,QGE                | 1     |
| 619126 | Diaphragm,QG,1473,QGE                | 1     |
| 619128 | Diaphragm,QG,1553,QGE                | 1     |
| 608136 | Endcap,Monorail,QG                   | 1     |
| 618526 | Extension,Diaphragm,Angle            | 8     |
| 618536 | Extension,Backup,M10,QGE             | 1     |
| 618652 | Flt St 3/16x2x13,W/Holes             | 16    |
| 610172 | Hinge Plate,Fender Panel,QG          | 18    |
| 610238 | Hit Indicator,LMC/Elite              | 1     |
| 611368 | Monorail Guide,QG,G                  | 16    |
| 611370 | Monorail,1 Bay,QG                    | 1     |
| 611379 | Monorail,3 Bay,QG                    | 2     |
| 003704 | Nut,Heavy Hex,3/4,A563DH             | 116   |
| 003354 | Nut,Heavy Hex,5/8,A563A              | 81    |
| 115939 | Nut,Hex,1/2,G                        | 4     |
| 115960 | Nut,Hex,3/8,G                        | 16    |
| 003340 | Nut,Hex,5/8,G,Rail                   | 52    |
| 611832 | Panel,Fender,QG                      | 16    |
| 611900 | Panel,Side,QG,Wide,G                 | 2     |
| 612253 | Plate,Nose Cylinder                  | 1     |
| 116879 | Screw,FL,5/8x8 1/2,G8,G,Socket       | 16    |
| 116891 | Screw,HWH,1/4x1,Self Drill/Tapping,G | 2     |
| 117458 | Spring,Die,1 1/2ODx3/4x6,G           | 16    |
| 117542 | Stud,3/4x7,G5,G                      | 68    |
| 615756 | Tel St,1 3/4x1 3/4x12 GAx10,H4S,G    | 4     |
| 615765 | Tel St,2x2x12 GAx10,H4S,G            | 4     |
| 118009 | Washer,Flat,1/2x1 3/8,G              | 4     |
| 118013 | Washer,Flat,1/4x1,G                  | 2     |
| 003300 | Washer,Flat,5/8x1 3/4,G              | 33    |
| 118027 | Washer,Flat,Hvy,3/4x2,G              | 68    |
| 118082 | Washer,Lock,1/2,G                    | 4     |
| 118089 | Washer,Lock,3/4,G                    | 32    |
| 118092 | Washer,Lock,3/8,G                    | 16    |
| 118100 | Washer,Lock,5/8,G                    | 57    |
| 617045 | Washer,Mushroom,Forged,QG,G          | 16    |



**Warning:** Use only Trinity Highway parts that are specified herein for assembling, maintaining, or repairing the QuadGuard® Elite M10 Wide. **Do not utilize or otherwise comingle parts from other Trinity Highway systems** Such configurations have not been tested, nor have they been deemed eligible for use. Assembly, maintenance, or repairs using unspecified parts or accessories is strictly prohibited.



- NOTES:
1. IN COMPLIANCE WITH THE AASHTO 2011 ROADSIDE DESIGN GUIDE, THE STRUCTURE SHALL BE CONSTRUCTED WITH ALL CURBS AND ISLANDS TO ENSURE PROPER IMPACT PERFORMANCE.
  2. PROVISION SHALL BE MADE FOR REAR FENDER PANELS TO SLIDE REARWARD UPON IMPACT 762 [30.0] MIN.
  3. 150 [16.00] MIN. REINFORCED 28 MPa [4000 PSI] P. C. CONCRETE PAD SHALL BE PROVIDED 25 [1.00] MIN. FROM THE EDGE OF THE CONCRETE ROADWAY (MEASURING AT LEAST 3.7m [12] WIDE AND 15.2m [50] LONG).
  4. SEE THE "QUADGUARD ELITE M10 PRODUCT DESCRIPTION ASSEMBLY MANUAL" FOR A DESCRIPTION OF ITS IMPACT PERFORMANCE CHARACTERISTICS AND DESIGN LIMITATIONS BEFORE PLACING A ORDER. THE MANUAL IS AVAILABLE BY CALLING CUSTOMER SERVICE DEPARTMENT AT 1-888-323-6374.
  5. WHERE NECESSARY, THE CUSTOMER SHALL SUPPLY A TRANSITION FROM THE QUADGUARD SYSTEM TO THE OBJECT BEING SHIELDED.
  6. FOR PROPER IMPACT PERFORMANCE, THE UNIT MUST BE RESTORED TO ITS ORIGINAL LENGTH AFTER EACH IMPACT.
  7. BACKUP ASSEMBLY NOT INCLUDED IN MODEL NUMBER.

REFERENCES

| SERIAL NO. | DESCRIPTION       |
|------------|-------------------|
| ①          | BAY ASSY          |
| ②          | DIAPHRAGM ASSY    |
| ③          | FENDER PANEL ASSY |
| ④          | MONORAIL ASSY     |
| ⑤          | NOSE ASSY         |
| ⑥          | BACKUP ASSY       |

KEY

|   |                    |
|---|--------------------|
| ① | HIT INDICATOR ASSY |
|---|--------------------|

REFERENCES

| SERIAL NO. | DESCRIPTION        |
|------------|--------------------|
| ①          | DIAPHRAGM ASSY     |
| ②          | NOSE ASSY          |
| ③          | BACKUP ASSY        |
| ④          | FENDER PANEL ASSY  |
| ⑤          | MONORAIL ASSY      |
| ⑥          | CONCRETE PAD       |
| ⑦          | BAY ASSY           |
| ⑧          | HIT INDICATOR ASSY |

REFERENCES

| SERIAL NO. | DESCRIPTION        |
|------------|--------------------|
| ①          | DIAPHRAGM ASSY     |
| ②          | NOSE ASSY          |
| ③          | BACKUP ASSY        |
| ④          | FENDER PANEL ASSY  |
| ⑤          | MONORAIL ASSY      |
| ⑥          | CONCRETE PAD       |
| ⑦          | BAY ASSY           |
| ⑧          | HIT INDICATOR ASSY |

TABLE

| MODEL NO.          | NOSE COLOR |
|--------------------|------------|
| QM10089EG (220894) | GRAY       |
| QM10089EY (220895) | YELLOW     |

UNIDIRECTIONAL

| MODEL NO.   | DESCRIPTION   | REV |
|-------------|---|-----|
| QFEMTSCVR-U | QUADGUARD® ELITE M10 WIDE SYSTEM WITENSION STRUT BACKUP | C   |

SEE TABLE

| REV | DATE      | BY           | APP | DESCRIPTION     |
|-----|-----------|--------------|-----|-----------------|
| 1   | 4/4/2012  | D. Hayes Jr. |     | INITIAL RELEASE |
| 2   | 5/29/2012 | M. Buehler   |     | REVISIONS       |

DO NOT SCALE DRAWING

| NO. | DESCRIPTION  |
|-----|--|
| 1   | QUADGUARD ELITE M10 WIDE SYSTEM WITENSION STRUT BACKUP |

TRINITY HIGHWAY

QuadGuard® Elite M10 Wide QFEMTSCVR-U

| PARTS LIST |                                    |
|------------|------------------------------------|
| ITEM       | DESCRIPTION                        |
| 1          | BACKUP.TS.OGE.WIDEAL               |
| 2          | PANEL.SIDE.OG.WIDE.G               |
| 3          | BOLT.HX.3/8X3.1/2.ALL.THREAD.GS.G  |
| 4          | NUT.HX.3/8.G                       |
| 5          | WASHER.LOCK.3/8.G                  |
| 6          | ANCHOR.MIT.HILT.1.330ml.3/4X7.(4)  |
| 7          | NUT.HX.5/8.G.RAIL                  |
| 8          | BOLT.HX.5/8X2.G                    |
| 9          | BOLT.HX.5/8X4.GS.G                 |
| 10         | WASHER.LOCK.5/8.G                  |
| 11         | 5/8" HVY HEX NUT A583A             |
| 12         | HINGE PLATE FENDER PANEL LOG       |
| 13         | TEL ST 1 3/4X1 3/4X12 GA X10.H4S.G |
| 14         | TEL ST 2X2X12 GA X10.H4S.G         |
| 15         | EXTENSION.BACKUP.M10.OGE           |
| 16         | FLT ST 3/16X2X13.WH/HOLES          |
| 17         | BOLT.HX.3/4X5.GS.G                 |
| 18         | 3/4" HVY HEX NUT A583 DH           |

| TABLE        |       |           |                      |
|--------------|-------|-----------|----------------------|
| SYSTEM       | WIDTH | 7" ANCHOR | 18" ANCHOR NO ANCHOR |
| OG ELITE     | 69"   | 604607    | 627520               |
| OG ELITE     | 90"   | 604608    | 627530               |
| OGE M10 WIDE | 69"   | 618851    | N/A 627531           |

**QUADGUARD ELITE**

|   |  |   |               |
|---|--|---|---------------|
| <p><b>QUADGUARD<sup>®</sup> FAMILY</b><br/>BACKUP ASSEMBLY, TENSION STRUT</p> | <p>DATE: 2/18/2020<br/>                 CHECKED BY: B. Eckert<br/>                 DATE: 2/25/2020<br/>                 DRAWING NO: 627528-80W<br/>                 DO NOT SCALE DRAWING</p> | <p>REV: -<br/>                 QUANTITY: 627528</p> | <p>2 of 2</p> |
|---|--|---|---------------|

**Backup Assembly, Tension Strut 627528**



| ITEM | DESCRIPTION                     |
|------|---------------------------------|
| 1    | DIAPHRAGM QB 0983 06E           |
| 2    | WASHER LOCK 3/4 G               |
| 3    | BOLT HX 3/4 X 2.08 G            |
| 4    | MONORAIL GUIDE 06 G             |
| 5    | 3/4" H VY HEX NUT A563 DH       |
| 6    | HINGE PLATE FENDER PANEL OG     |
| 7    | BOLT HX 5/8 X 4.05 G            |
| 8    | 5/8" H VY HEX NUT A563A         |
| 9    | WASHER LOCK 5/8 G               |
| 10   | EXTENSION DIAPHRAGM ANGLE       |
| 11   | CYLINDER SEG 18 X 9 1/2 X 0.8   |
| 12   | BOLT HX 5/8 X 5.05 G ALL THREAD |
| 13   | WASHER FLAT 5/8 X 1 3/4 G       |

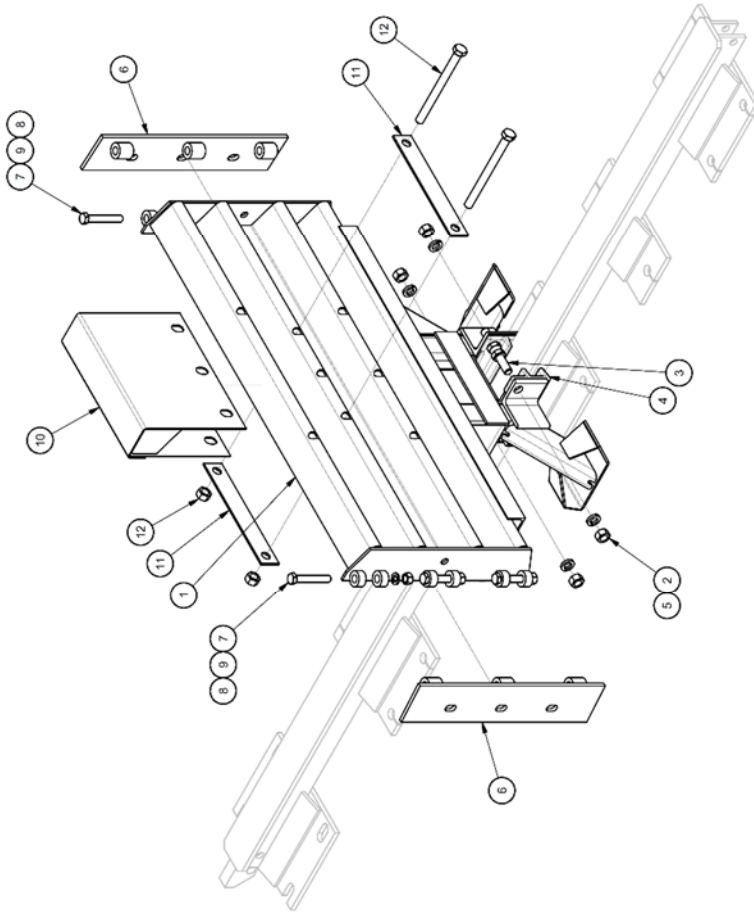
| TABLE    | WIDTH       |
|----------|-------------|
| ASSEMBLY | 0983 [38.1] |

**BAY 1 DIAPHRAGM**

|   |   |
|---|---|
| <p><b>QUADGUARD® ELITE M10</b><br/>DIAPHRAGM ASSEMBLY</p> | <p>DATE: 1/30/2020<br/>                 PREPARED BY: D. Kohfeld<br/>                 DATE: 2/10/2020<br/>                 CHECKED BY: B. Eckert<br/>                 CHECKED BY: J. Anderson<br/>                 DATE: 10/14/2020</p> <p>627506.dwg<br/>DO NOT SCALE DRAWING</p> |
|   | PART: 627506<br>REV: 1 of 3   |

**Bay 1 Diaphragm Assembly 627506**

| PARTS LIST |                             |
|------------|-----------------------------|
| ITEM       | DESCRIPTION                 |
| 1          | DIAPHRAGM QB 1073 QG6       |
| 2          | WASHER LOCK 3/4 G           |
| 3          | BOLT HX 3/4X2 GR6           |
| 4          | MONORAIL GUIDE QG G         |
| 5          | 3/4" HVY HEX NUT A563 DH    |
| 6          | HINGE PLATE/FENDER PANEL QG |
| 7          | BOLT HX 5/8X4 G5 G          |
| 8          | 5/8" HVY HEX NUT A563A      |
| 9          | WASHER LOCK 5/8 G           |
| 10         | EXTENSION DIAPHRAGM ANGLE   |
| 11         | FLT ST 3/16X2X13 W/HOLES    |
| 12         | BOLT HX 3/4X9 G5 G          |

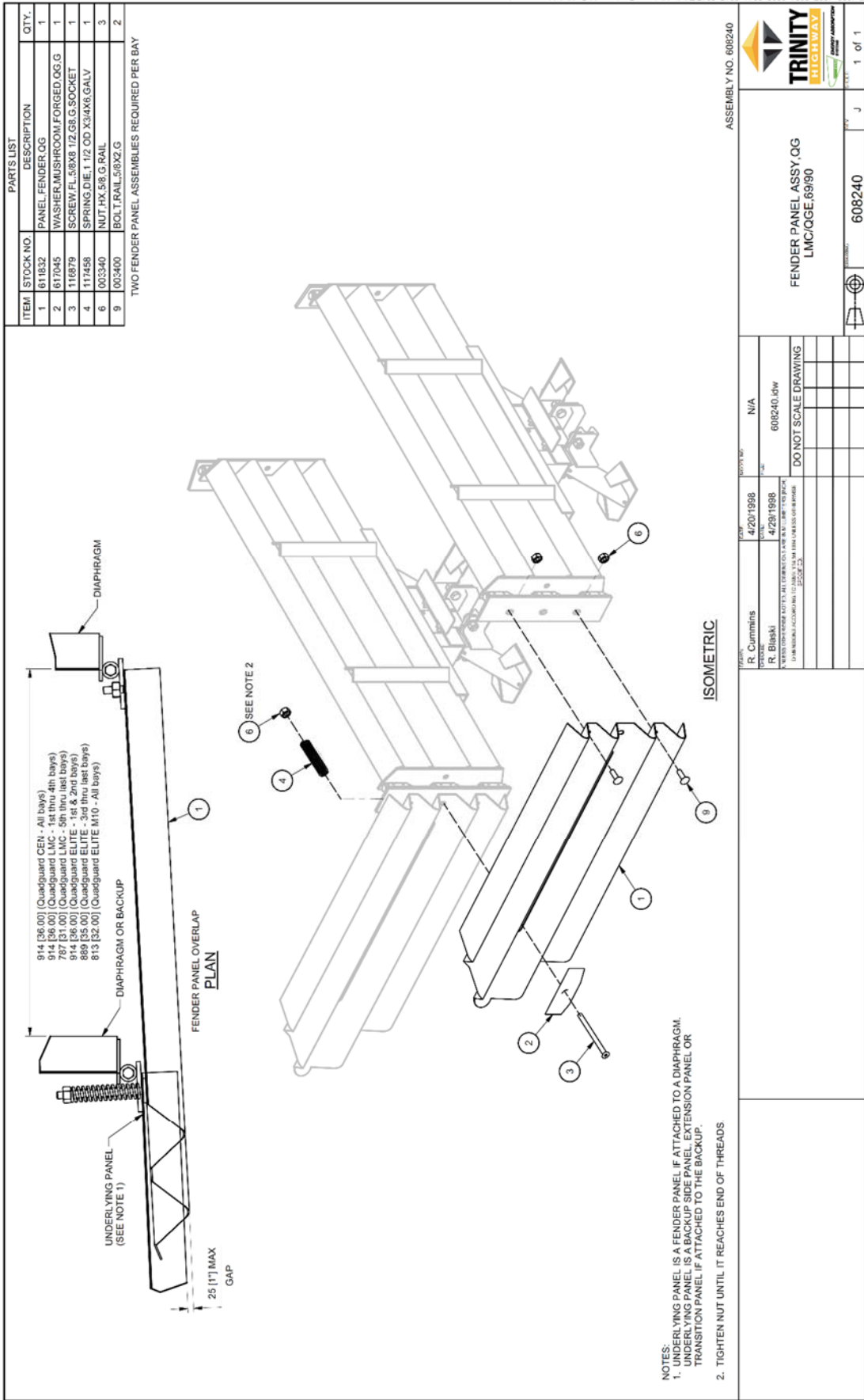


| ASSEMBLY | WIDTH       |
|----------|-------------|
| 619120   | 1073 [42.2] |
| 619121   | 1153 [45.4] |
| 619122   | 1233 [48.5] |
| 619124   | 1313 [51.7] |
| 619125   | 1393 [54.8] |
| 619126   | 1473 [58.0] |
| 619128   | 1553 [61.1] |

STANDARD DIAPHRAGMS

|  |                   |  |                   |
|--|-------------------|--|-------------------|
|  |                   | <b>QUADGUARD<sup>®</sup> ELITE M10</b><br>DIAPHRAGM ASSEMBLY |                   |
| DESIGNER<br>D. Kohfeld   | DATE<br>1/30/2020 | PART NO.<br>627506 idw                                       | REV.<br>2/10/2020 |
| CHECKED BY<br>B. Eckert  |                   |  |                   |
| THIS IS THE STANDARD MODEL. DIMENSIONS FOR THIS MODEL ARE LISTED IN THE PARTS LIST. DIMENSIONS FOR OTHER MODELS ARE LISTED IN THE PARTS LIST. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED. |                   |  |                   |
| DO NOT SCALE DRAWING   |                   |  |                   |
|  |                   | PART NO. 627506  |                   |
|  |                   | REV. 2 of 3  |                   |

Standard Diaphragm Assembly 627506

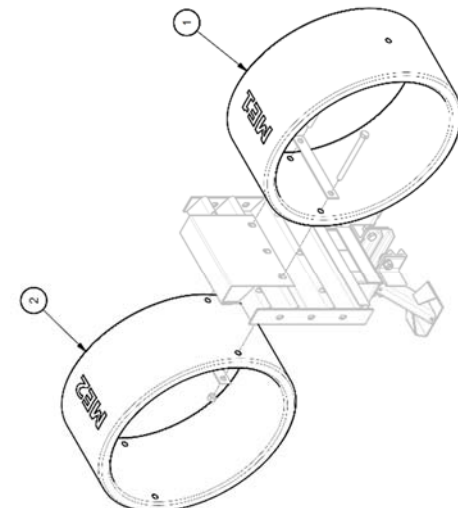


Fender Panel Assembly 608240

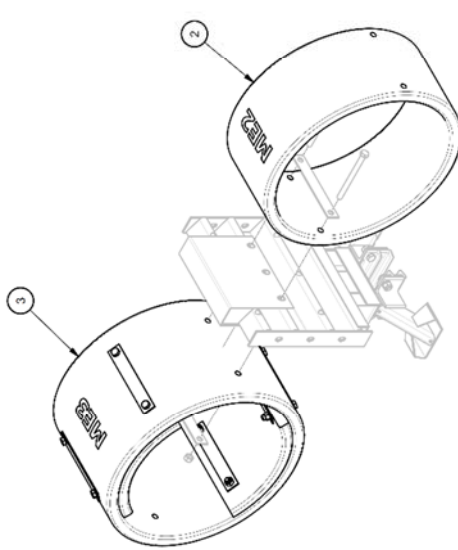
|   |                                   |                     |            |
|---|-----------------------------------|---------------------|------------|
|   |                                   | ASSEMBLY NO. 608240 |            |
| FENDER PANEL ASSY, QG<br>LMC/QGE, 69190 |                                   | J 1 of 1            |            |
| DATE: 4/20/1998<br>BY: R. Cummins       | DATE: 4/20/1998<br>BY: R. Blinski | N/A                 | 608240.dwg |
| DO NOT SCALE DRAWING                    |                                   |                     |            |

| PARTS LIST |                            |
|------------|----------------------------|
| ITEM       | DESCRIPTION                |
| 1          | CYLINDER.ME1.MASH.OGE      |
| 2          | CYLINDER.ME2.MASH.OGE      |
| 3          | CYLINDER ASSY.ME3.MASH.OGE |

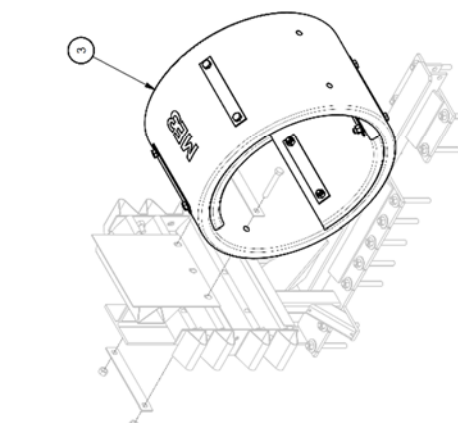
  



**ME1 TO ME2**




**ME2 TO ME3**



**ME3 TO BACKUP**

|  |   |   |                             |
|--|---|---|-----------------------------|
|  |  | <b>QUADGUARD® ELITE™ M10 SYSTEM</b><br>BAY ASSY.M10.OGE | REV: 1 of 1<br>PART: 618879 |
|  | D. Hayes Jr. 3/14/2012<br>M. Buehler 5/29/2012<br>DO NOT SCALE DRAWING              | 618879 idw  |                             |

| PARTS LIST |                               |
|------------|-------------------------------|
| ITEM       | DESCRIPTION                   |
| 1          | BELT NOSE OGE                 |
| 2          | CYLINDER NOSE HDPE 28X20      |
| 3          | NUT HX.1/2.G                  |
| 4          | WASHER FLAT.1/2X1.3/8.G       |
| 5          | BOLT HX.5/8X5.65.G.ALL THREAD |
| 6          | WASHER FLAT.5/8 X 1.3/4. G    |
| 7          | BOLT HX.1/2X3.62.G            |
| 8          | BOLT HX.5/8X3.1/2.G5.G        |
| 9          | CLAMP NOSE BELT.OG.G          |
| 10         | PLATE NOSE CYLINDER           |
| 11         | 5/8"X5" HEX BOLT A325         |
| 12         | 5/8" HVY HEX NUT A463A        |
| 13         | WASHER LOCK.1/2.G             |
| 14         | WASHER LOCK.5/8.G             |

| ASSEMBLY | COLOR  | MODELS     |
|----------|--------|------------|
| 620028   | GRAY   | 8 BAY, 60" |
| 618870   | YELLOW | 8 BAY, 60" |

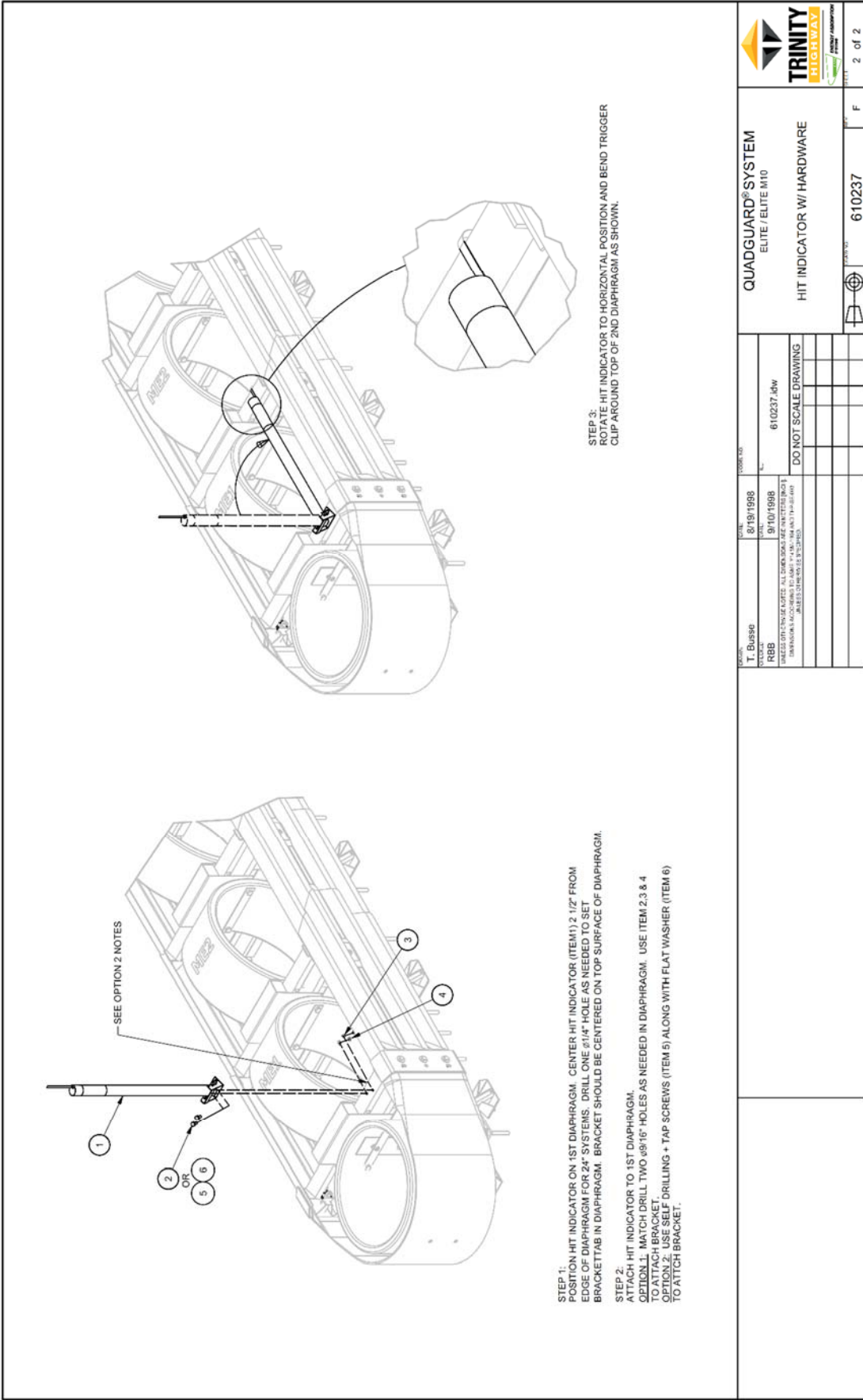
  

|   |                   |                        |                   |                     |
|---|-------------------|------------------------|-------------------|---------------------|
| DESIGNED BY<br>D. Kohfeld   | DATE<br>1/30/2020 | ISSUED BY<br>B. Eckert | DATE<br>2/10/2020 | SCALE<br>627505.dwg |
| ALL DIMENSIONS UNLESS OTHERWISE NOTED SHALL BE IN INCHES.<br>DIMENSIONS IN PARENTHESES ARE DIMENSIONS OF FITTED PARTS.<br>DIMENSIONS IN SQUARES ARE DIMENSIONS OF FITTED PARTS. |                   |                        |                   |                     |
| DO NOT SCALE DRAWING  |                   |                        |                   |                     |
|   |                   |                        |                   |                     |

|   |                                |
|---|--------------------------------|
| <b>QUADGUARD<sup>®</sup> ELITE M10</b><br>NOSE ASSY.M10.OGE | PART NO. 627505<br>REV. 1 of 1 |
|---|--------------------------------|

## Nose Assembly 627505



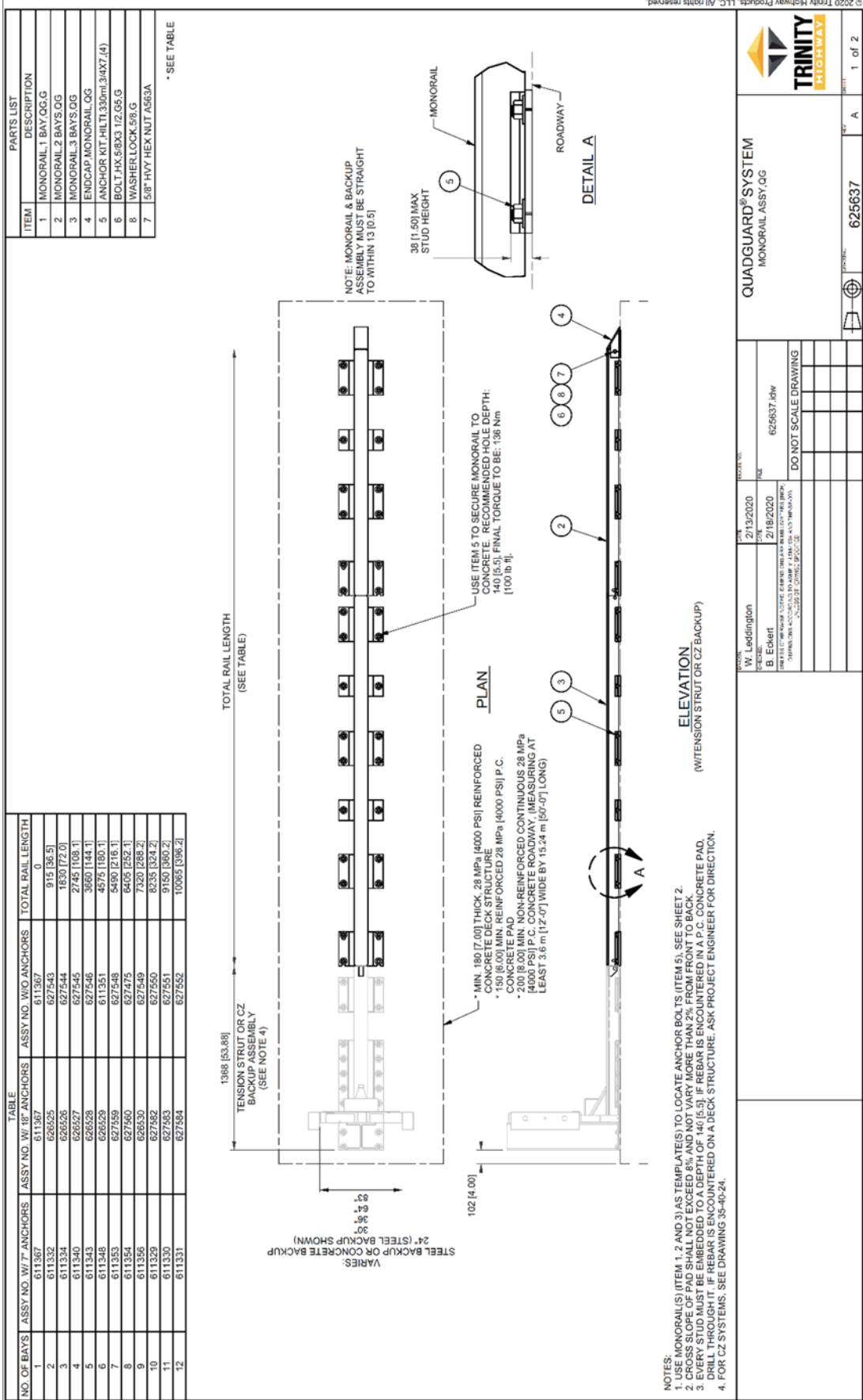
STEP 1:  
 POSITION HIT INDICATOR ON 1ST DIAPHRAGM. CENTER HIT INDICATOR (ITEM 1) 2 1/2" FROM  
 EDGE OF DIAPHRAGM FOR 24" SYSTEMS. DRILL ONE #1/4" HOLE AS NEEDED TO SET  
 BRACKETTAB IN DIAPHRAGM. BRACKET SHOULD BE CENTERED ON TOP SURFACE OF DIAPHRAGM.

STEP 2:  
 ATTACH HIT INDICATOR TO 1ST DIAPHRAGM.  
 OPTION 1: MATCH DRILL TWO #9/16" HOLES AS NEEDED IN DIAPHRAGM. USE ITEM 2,3 & 4  
 TO ATTACH BRACKET.  
 OPTION 2: USE SELF DRILLING + TAP SCREWS (ITEM 5) ALONG WITH FLAT WASHER (ITEM 6)  
 TO ATTACH BRACKET.

STEP 3:  
 ROTATE HIT INDICATOR TO HORIZONTAL POSITION AND BEND TRIGGER  
 CLIP AROUND TOP OF 2ND DIAPHRAGM AS SHOWN.

|   |  |   |  |            |  |
|---|--|---|--|------------|--|
|   |  | <b>QUADGUARD® SYSTEM</b><br>ELITE / ELITE M10 |  |            |  |
| T. Busse<br>RBB   |  | 8/19/1998<br>9/10/1998                        |  | 610237.dwg |  |
| <small>UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES (FRAC)<br/>         DIMENSIONS IN PARENTHESIS ARE IN MILLIMETERS (FRAC)<br/>         UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE TO CENTERLINE</small> |  | DO NOT SCALE DRAWING                          |  | 610237     |  |
|   |  |   |  | 2 of 2     |  |

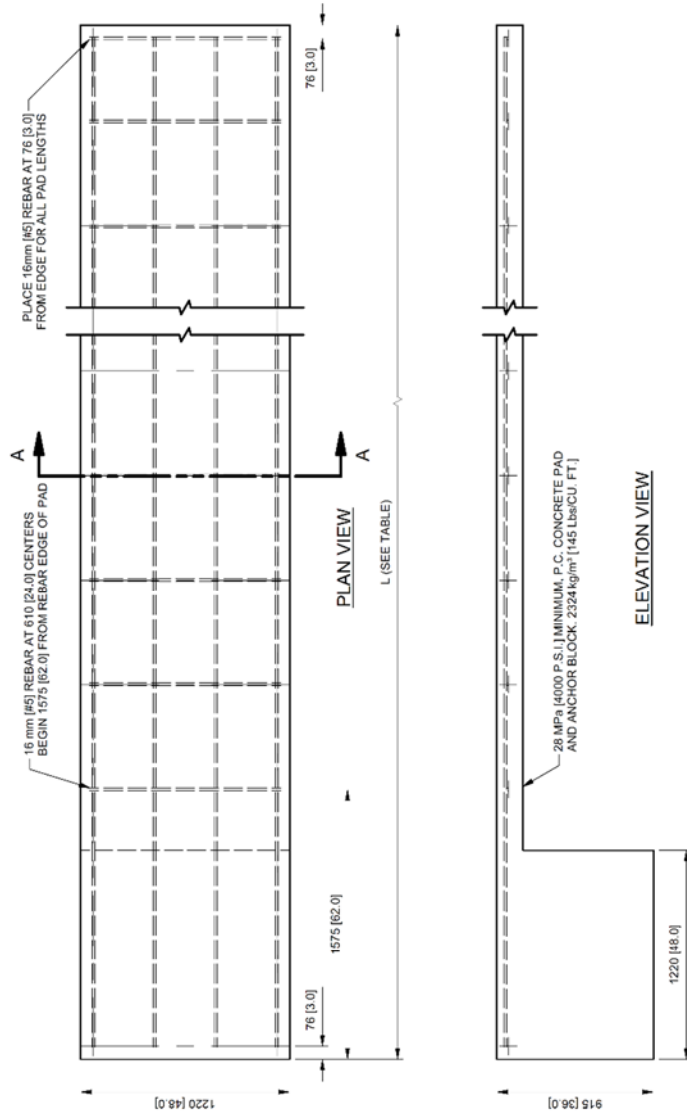
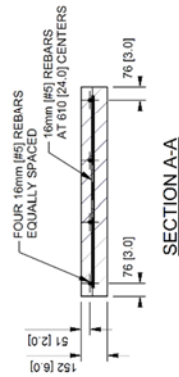
# Hit Indicator 610237



|   |                        |                                       |        |
|---|------------------------|---------------------------------------|--------|
|  |                        | QUADGUARD® SYSTEM<br>MONORAIL ASSY.OG |        |
| W. Leddington<br>B. Eckert  | 2/13/2020<br>2/18/2020 | 625637 Idw                            | 625637 |
| DO NOT SCALE DRAWING  |                        | 1 of 2                                | A      |

Monorail Assembly 625637

| NO. OF BAYS | "L" (PAD LENGTH)<br>m [ft-in] | REBAR REQUIRED<br>m [ft-in] | YARDS OF CONCRETE IN PAD<br>m³ [YARDS³] |
|-------------|-------------------------------|-----------------------------|---|
| 1           | 2.74 [9'-0"]                  | 14.83 [48'-8"]              | 1.59 [2.1]                              |
| 2           | 2.74 [9'-0"]                  | 14.83 [48'-8"]              | 1.59 [2.1]                              |
| 3           | 3.66 [12'-0"]                 | 20.73 [68'-0"]              | 1.82 [2.4]                              |
| 4           | 4.57 [15'-0"]                 | 25.50 [83'-8"]              | 1.97 [2.6]                              |
| 5           | 5.49 [18'-0"]                 | 31.39 [103'-0"]             | 2.12 [2.8]                              |
| 6           | 6.40 [21'-0"]                 | 36.17 [118'-8"]             | 2.35 [3.1]                              |
| 7           | 7.32 [24'-0"]                 | 42.06 [138'-0"]             | 2.51 [3.3]                              |
| 8           | 8.23 [27'-0"]                 | 46.84 [153'-8"]             | 2.66 [3.5]                              |
| 9           | 9.14 [30'-0"]                 | 52.73 [173'-0"]             | 2.81 [3.7]                              |
| 10          | 10.06 [33'-0"]                | 57.51 [188'-8"]             | 3.04 [4.0]                              |
| 11          | 10.97 [36'-0"]                | 63.40 [208'-0"]             | 3.19 [4.2]                              |
| 12          | 11.89 [39'-0"]                | 68.17 [223'-8"]             | 3.35 [4.4]                              |

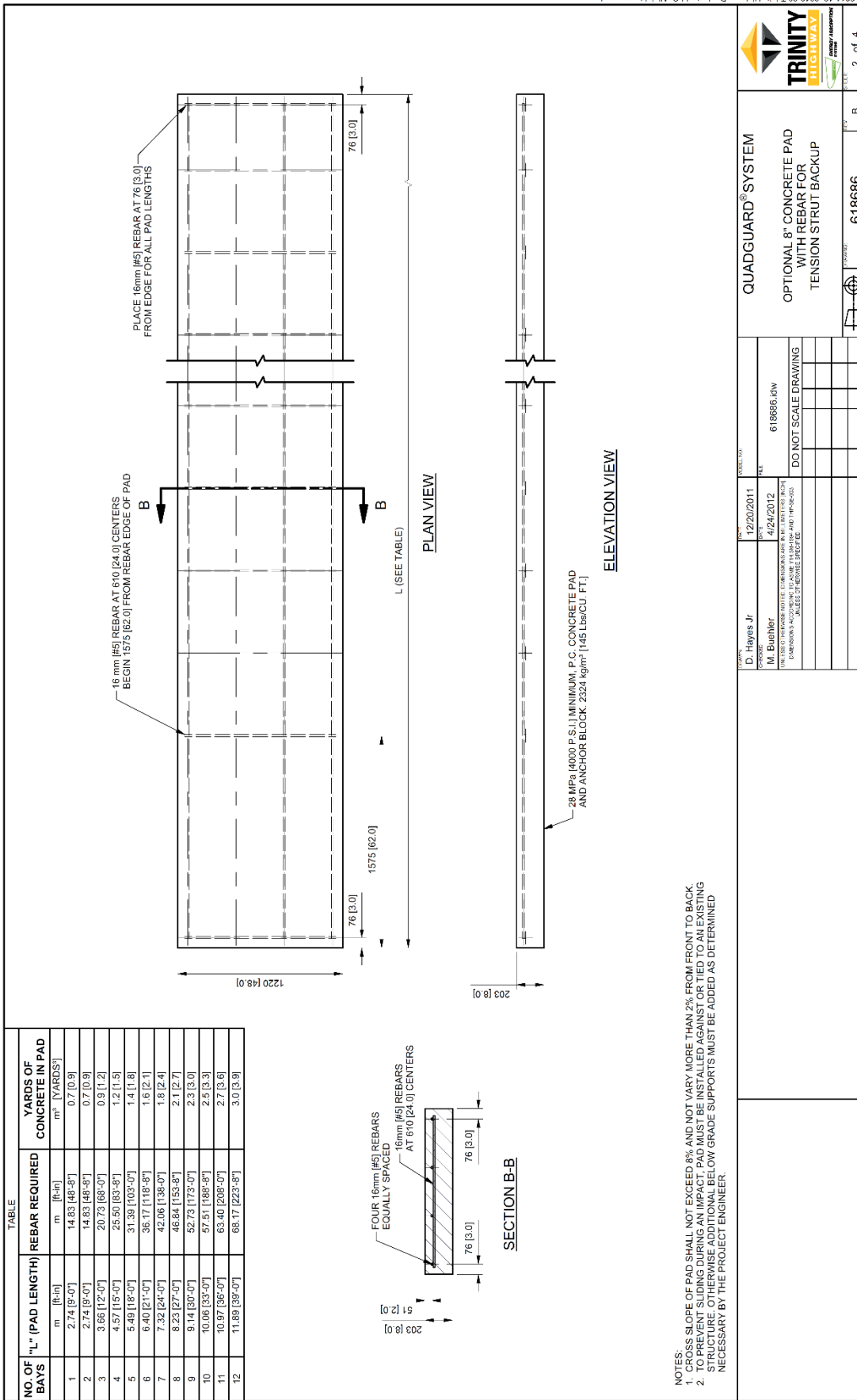


- NOTES:  
 1. CROSS SLOPE OF PAD SHALL NOT EXCEED 8% AND NOT VARY MORE THAN 2% FROM FRONT TO BACK.  
 2. ANCHOR BLOCK LOCATION IS RECOMMENDED AT BACK OF CONCRETE PAD. EXISTING CONCRETE PADS WITH BELOW GROUND OBSTRUCTIONS ARE ACCEPTABLE WITH ANCHOR BLOCKS AT THE FRONT OF THE PAD.

|                      |  |  |                         |
|----------------------|--|--|-------------------------|
|                      |  | <b>QUADGUARD<sup>®</sup> SYSTEM</b><br>CONCRETE PAD FOR TENSION STRUT BACKUP |                         |
|                      |  | D. Hayes Jr.<br>M. Buehler   | 12/20/2011<br>4/24/2012 |
| DO NOT SCALE DRAWING |  | 618686   |                         |

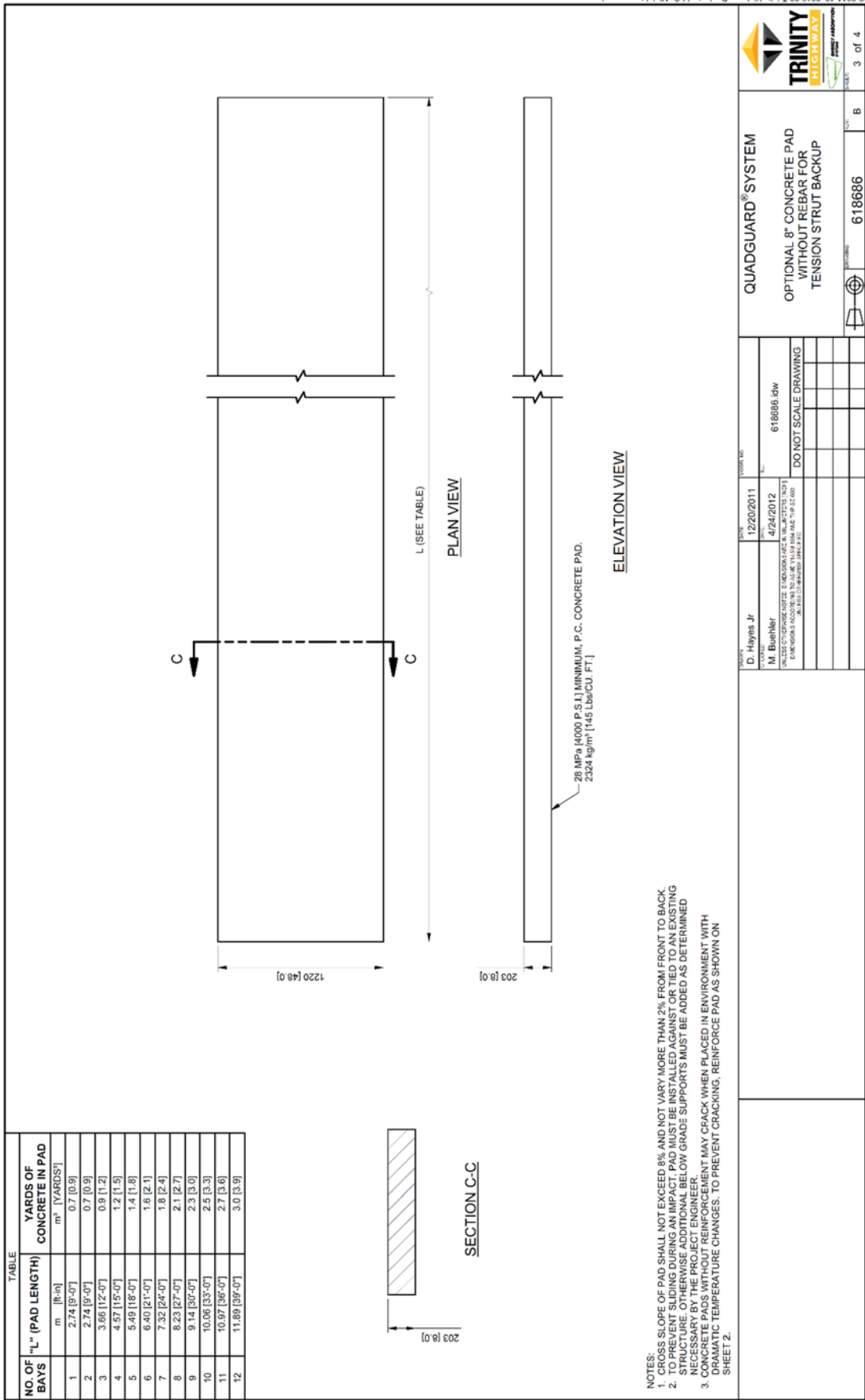
TS Concrete Pad 618686





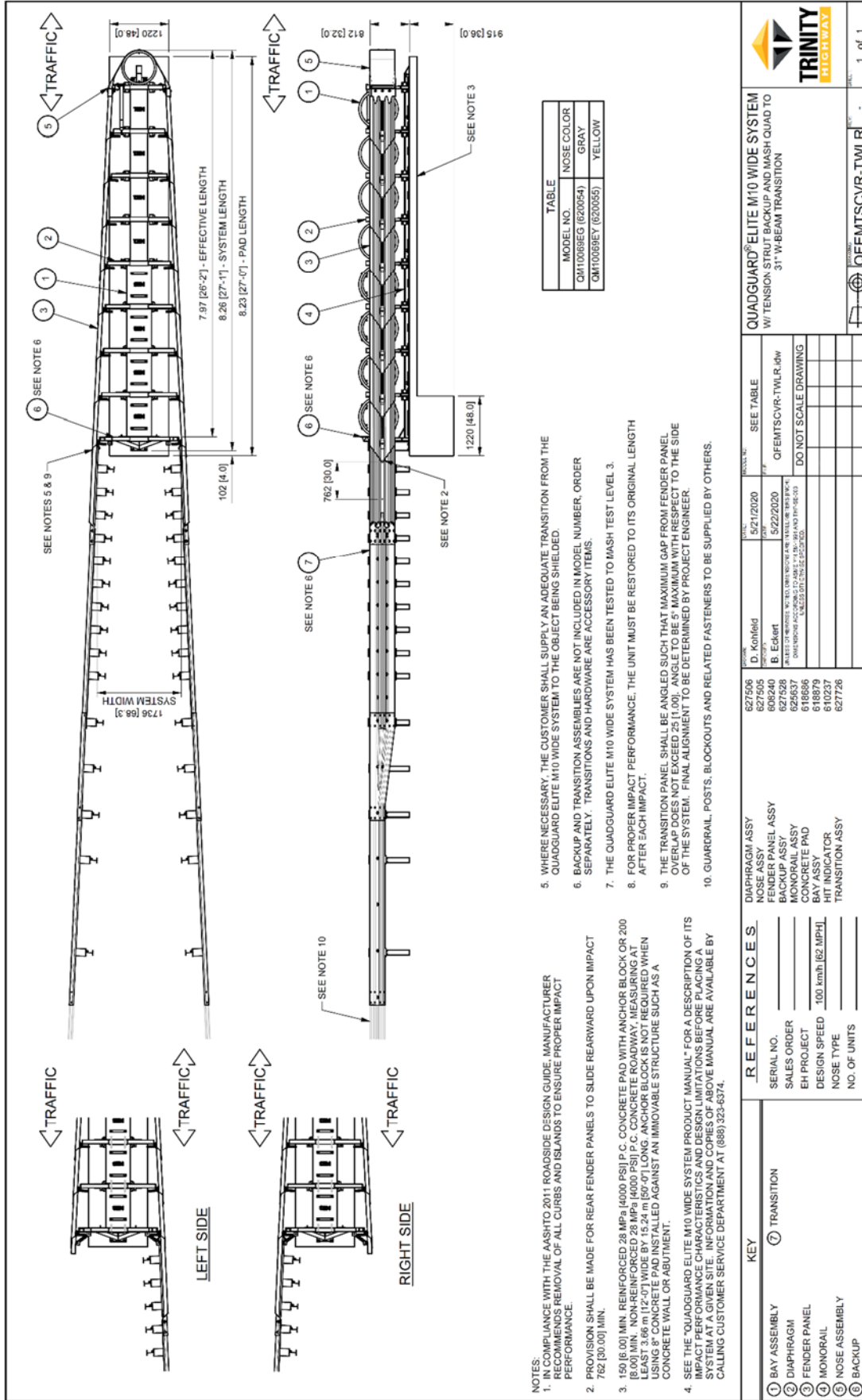
NOTES:  
 1. CROSS SLOPE OF PAD SHALL NOT EXCEED 8% AND NOT VARY MORE THAN 2% FROM FRONT TO BACK.  
 2. TO PREVENT SLIDING DURING AN IMPACT, PAD MUST BE INSTALLED AGAINST OR TIED TO AN EXISTING STRUCTURE. OTHERWISE ADDITIONAL BELOW GRADE SUPPORTS MUST BE ADDED AS DETERMINED NECESSARY BY THE PROJECT ENGINEER.

# TS Concrete Pad 8" w/Rebar



TS Concrete Pad 8" wo/Rebar

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- NOTES:
1. IN COMPLIANCE WITH THE AASHTO 2011 ROADSIDE DESIGN GUIDE, MANUFACTURER RECOMMENDS REMOVAL OF ALL CURBS AND ISLANDS TO ENSURE PROPER IMPACT PERFORMANCE.
  2. PROVISION SHALL BE MADE FOR REAR FENDER PANELS TO SLIDE REARWARD UPON IMPACT 762 [30.00] MIN.
  3. 150 [6.00] MIN. REINFORCED 28 MPa [4000 PSI] P.C. CONCRETE PAD WITH ANCHOR BLOCK OR 200 [8.00] MIN. NON-REINFORCED 28 MPa [4000 PSI] P.C. CONCRETE ROADWAY. MEASURING AT 150 [6.00] MIN. FROM THE END OF THE CONCRETE PAD. CONCRETE SHALL BE CAST AGAINST A CONCRETE WALL OR ABUTMENT.
  4. SEE THE "QUADGUARD ELITE M10 WIDE SYSTEM PRODUCT MANUAL" FOR A DESCRIPTION OF ITS IMPACT PERFORMANCE CHARACTERISTICS AND DESIGN LIMITATIONS BEFORE PLACING A SYSTEM AT A GIVEN SITE. INFORMATION AND COPIES OF ABOVE MANUAL ARE AVAILABLE BY CALLING CUSTOMER SERVICE DEPARTMENT AT (888) 323-6374.
  5. WHERE NECESSARY, THE CUSTOMER SHALL SUPPLY AN ADEQUATE TRANSITION FROM THE QUADGUARD ELITE M10 WIDE SYSTEM TO THE OBJECT BEING SHIELDED.
  6. BACKUP AND TRANSITION ASSEMBLIES ARE NOT INCLUDED IN MODEL NUMBER, ORDER SEPARATELY. TRANSITIONS AND HARDWARE ARE ACCESSORY ITEMS.
  7. THE QUADGUARD ELITE M10 WIDE SYSTEM HAS BEEN TESTED TO MASH TEST LEVEL 3.
  8. FOR PROPER IMPACT PERFORMANCE, THE UNIT MUST BE RESTORED TO ITS ORIGINAL LENGTH AFTER EACH IMPACT.
  9. THE TRANSITION PANEL SHALL BE ANGLED SUCH THAT MAXIMUM GAP FROM FENDER PANEL OVERLAP DOES NOT EXCEED 25 [1.00], ANGLE TO BE 5° MAXIMUM WITH RESPECT TO THE SIDE OF THE SYSTEM. FINAL ALIGNMENT TO BE DETERMINED BY PROJECT ENGINEER.
  10. GUARDRAIL, POSTS, BLOCKOUTS AND RELATED FASTENERS TO BE SUPPLIED BY OTHERS.

| TABLE              |            |
|--------------------|------------|
| MODEL NO.          | NOSE COLOR |
| QM1008BEG (620654) | GRAY       |
| QM1008BEY (620655) | YELLOW     |

| KEY             | REFERENCES   | DATE      | BY         | APP'D | DESCRIPTION          |
|-----------------|--------------|-----------|------------|-------|----------------------|
| ① BAY ASSEMBLY  | SERIAL NO.   | 5/21/2020 | D. Kohfeld |       | SEE TABLE            |
| ② DIAPHRAGM     | SALES ORDER  | 5/22/2020 | B. Eckert  |       | OFEMTSCVR-TWLR.dwg   |
| ③ FENDER PANEL  | EH PROJECT   |           |            |       | DO NOT SCALE DRAWING |
| ④ MONORAIL      | DESIGN SPEED |           |            |       |                      |
| ⑤ NOSE ASSEMBLY | NOSE TYPE    |           |            |       |                      |
| ⑥ BACKUP        | NO. OF UNITS |           |            |       |                      |

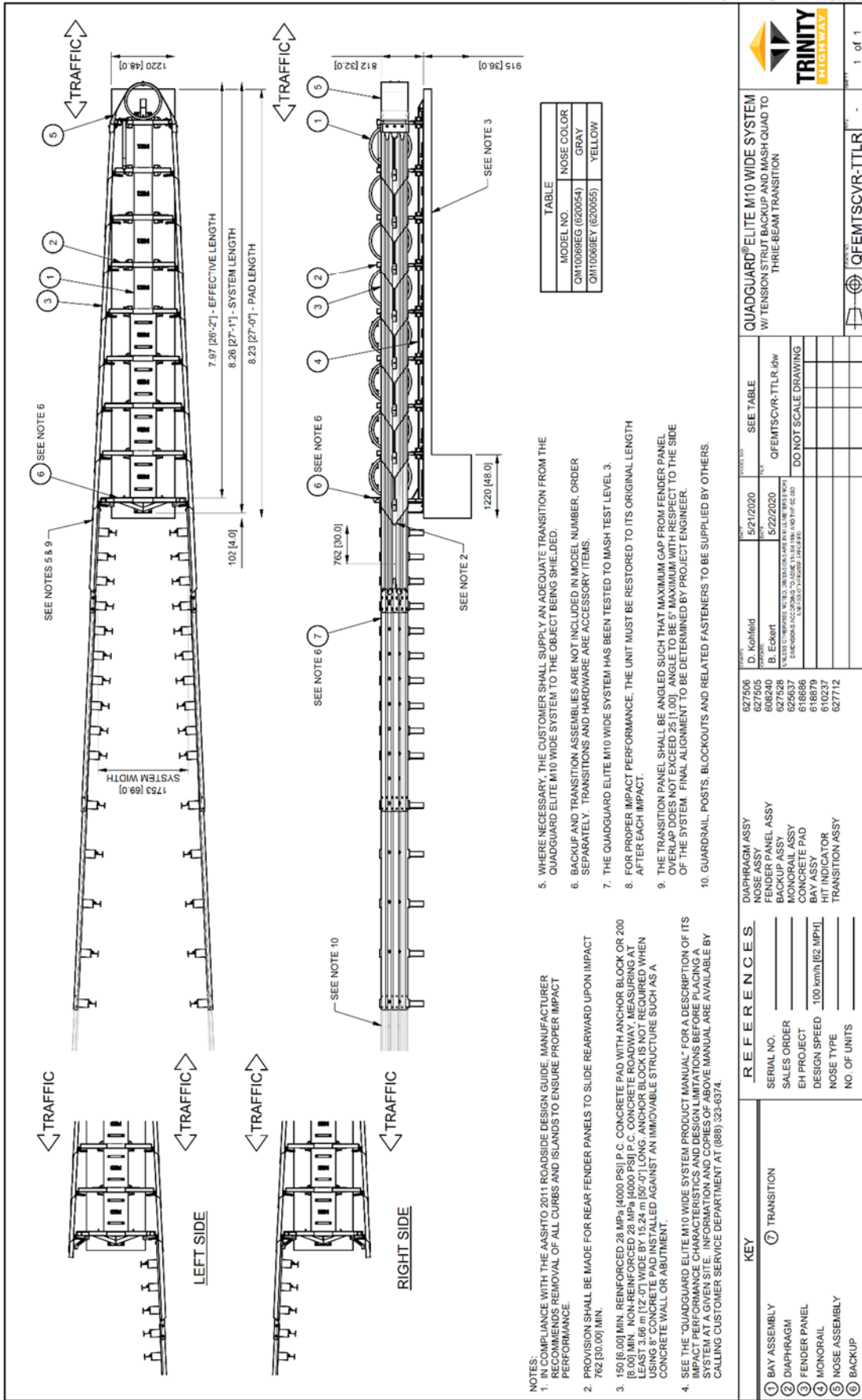
|                 |         |
|-----------------|---------|
| DIAPHRAGM ASSY  | 6275906 |
| NOSE PANEL ASSY | 6275905 |
| BACKUP ASSY     | 6275908 |
| MONORAIL ASSY   | 6275907 |
| CONCRETE PAD    | 6186866 |
| BAY ASSY        | 6188779 |
| HIT INDICATOR   | 6102337 |
| TRANSITION ASSY | 6277286 |

|  |            |                |
|--|------------|----------------|
| QUADGUARD <sup>®</sup> ELITE M10 WIDE SYSTEM                   | MODEL NO.  | OFEMTSCVR-TWLR |
| W/ TENSION STRUT BACKUP AND MASH QUAD TO 31' W-BEAM TRANSITION | NOSE COLOR | GRAY           |

# 31' W-Beam Transition QFEMTSCVR-TWLR





| TABLE               |            |
|---------------------|------------|
| MODEL NO.           | NOSE COLOR |
| QNT00089EC (620054) | GRAY       |
| QNT00089EY (620055) | YELLOW     |

- WHERE NECESSARY, THE CUSTOMER SHALL SUPPLY AN ADEQUATE TRANSITION FROM THE QUADGUARD ELITE M10 WIDE SYSTEM TO THE OBJECT BEING SHIELDED.
- BACKUP AND TRANSITION ASSEMBLIES ARE NOT INCLUDED IN MODEL NUMBER, ORDER SEPARATELY. TRANSITIONS AND HARDWARE ARE ACCESSORY ITEMS.
- THE QUADGUARD ELITE M10 WIDE SYSTEM HAS BEEN TESTED TO MASH TEST LEVEL 3.
- FOR PROPER IMPACT PERFORMANCE, THE UNIT MUST BE RESTORED TO ITS ORIGINAL LENGTH AFTER EACH IMPACT.
- THE TRANSITION PANEL SHALL BE ANGLED SUCH THAT MAXIMUM GAP FROM FENDER PANEL OVERLAP DOES NOT EXCEED 25 [1.00]. ANGLE TO BE 5° MAXIMUM WITH RESPECT TO THE SIDE OF THE SYSTEM. FINAL ALIGNMENT TO BE DETERMINED BY PROJECT ENGINEER.
- GUARDRAIL, POSTS, BLOCKOUTS AND RELATED FASTENERS TO BE SUPPLIED BY OTHERS.

| REFERENCES |                   |
|------------|-------------------|
| SERIAL NO. | DESCRIPTION       |
|            | DIAPHRAGM ASSY    |
|            | NOSE ASSY         |
|            | FENDER PANEL ASSY |
|            | BACKUP ASSY       |
|            | TRANSITION ASSY   |
|            | CONCRETE PAD      |
|            | BAY ASSY          |
|            | HIT INDICATOR     |
|            | TRANSITION ASSY   |

| REFERENCES |               |
|------------|---------------|
| SERIAL NO. | DESCRIPTION   |
|            | DIAPHRAGM     |
|            | FENDER PANEL  |
|            | MONORAIL      |
|            | NOSE ASSEMBLY |
|            | BACKUP        |

| REFERENCES |               |
|------------|---------------|
| SERIAL NO. | DESCRIPTION   |
|            | DIAPHRAGM     |
|            | FENDER PANEL  |
|            | MONORAIL      |
|            | NOSE ASSEMBLY |
|            | BACKUP        |

| REFERENCES |               |
|------------|---------------|
| SERIAL NO. | DESCRIPTION   |
|            | DIAPHRAGM     |
|            | FENDER PANEL  |
|            | MONORAIL      |
|            | NOSE ASSEMBLY |
|            | BACKUP        |

# Thrie-Beam Transition QFEMTSCVR-TTLR

**TRINITY HIGHWAY**

QUADGUARD<sup>®</sup> ELITE M10 WIDE SYSTEM  
W/ TENSION STRUT BACKUP AND MASH QUAD TO  
THRIE-BEAM TRANSITION

PROJECT: QFEMTSCVR-TTLR

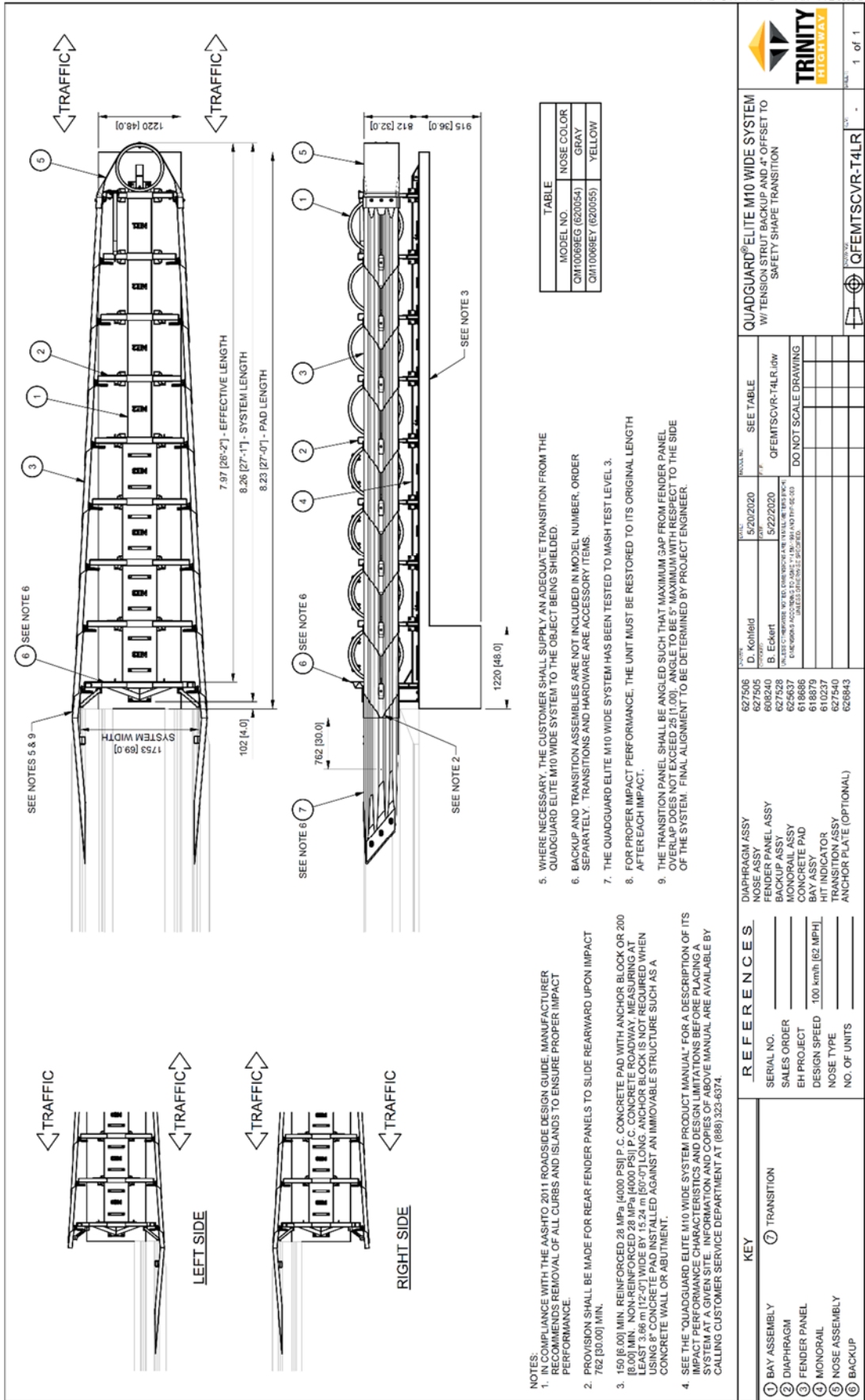
DATE: 5/22/2020

BY: B. Eckert

FOR: D. Kohfeld

SCALE: DO NOT SCALE DRAWING

1 of 1



| MODEL NO.           | NOSE COLOR |
|---------------------|------------|
| QMT1006REG (620054) | GRAY       |
| QMT1006REY (620055) | YELLOW     |

- NOTES:
- IN COMPLIANCE WITH THE AASHTO 2011 ROADSIDE DESIGN GUIDE, MANUFACTURER RECOMMENDS REMOVAL OF ALL CURBS AND ISLANDS TO ENSURE PROPER IMPACT PERFORMANCE.
  - PROVISION SHALL BE MADE FOR REAR FENDER PANELS TO SLIDE REARWARD UPON IMPACT
  - 150 [6.00] MIN. REINFORCED 28 MPa [4000 PSI] P. C. CONCRETE PAD WITH ANCHOR BLOCK OR 200 [8.00] MIN. NON-REINFORCED 28 MPa [4000 PSI] P. C. CONCRETE ROADWAY MEASURING AT MINIMUM REARWARD 100 [4.00] MM FROM CURB FACE. CONCRETE SHALL BE CAST USING 8" CONCRETE PAD INSTALLED AGAINST AN IMMOVABLE STRUCTURE SUCH AS A CONCRETE WALL OR ABUTMENT.
  - SEE THE "QUADGUARD ELITE M10 WIDE SYSTEM PRODUCT MANUAL" FOR A DESCRIPTION OF ITS IMPACT PERFORMANCE CHARACTERISTICS AND DESIGN LIMITATIONS BEFORE PLACING A SYSTEM AT A GIVEN SITE. INFORMATION AND COPIES OF ABOVE MANUAL ARE AVAILABLE BY CALLING CUSTOMER SERVICE DEPARTMENT AT (888)323-6374.
  - WHERE NECESSARY, THE CUSTOMER SHALL SUPPLY AN ADEQUATE TRANSITION FROM THE QUADGUARD ELITE M10 WIDE SYSTEM TO THE OBJECT BEING SHIELDED.
  - BACKUP AND TRANSITION ASSEMBLIES ARE NOT INCLUDED IN MODEL NUMBER, ORDER SEPARATELY. TRANSITIONS AND HARDWARE ARE ACCESSORY ITEMS.
  - THE QUADGUARD ELITE M10 WIDE SYSTEM HAS BEEN TESTED TO WASH TEST LEVEL 3.
  - FOR PROPER IMPACT PERFORMANCE, THE UNIT MUST BE RESTORED TO ITS ORIGINAL LENGTH AFTER EACH IMPACT.
  - THE TRANSITION PANEL SHALL BE ANGLED SUCH THAT MAXIMUM GAP FROM FENDER PANEL OVERLAP DOES NOT EXCEED 25 [1.00]. ANGLE TO BE 5° MAXIMUM WITH RESPECT TO THE SIDE OF THE SYSTEM. FINAL ALIGNMENT TO BE DETERMINED BY PROJECT ENGINEER.

| KEY             | REFERENCES   | REV. | DATE | BY | CHKD. | ISSUED BY | DESCRIPTION |
|-----------------|--------------|------|------|----|-------|-----------|-------------|
| ① BAY ASSEMBLY  | SERIAL NO.   |      |      |    |       |           |             |
| ② DIAPHRAGM     | SALES ORDER  |      |      |    |       |           |             |
| ③ FENDER PANEL  | EH PROJECT   |      |      |    |       |           |             |
| ④ MONORAIL      | DESIGN SPEED |      |      |    |       |           |             |
| ⑤ NOSE ASSEMBLY | NOSE TYPE    |      |      |    |       |           |             |
| ⑥ BACKUP        | NO. OF UNITS |      |      |    |       |           |             |

|        |   |           |  |  |  |  |  |
|--------|---|-----------|--|--|--|--|--|
| 627506 | D. Kohfeld  | 5/20/2020 |  |  |  |  |  |
| 627505 | B. Eckert   | 5/22/2020 |  |  |  |  |  |
| 627528 | USE QUADGUARD ACCESSORIES TO MAKE "4" IN" (101.6 mm) WIDE |           |  |  |  |  |  |
| 625637 | "MATS" SHALL BE PROVIDED.                                 |           |  |  |  |  |  |
| 618686 |   |           |  |  |  |  |  |
| 618879 |   |           |  |  |  |  |  |
| 610237 |   |           |  |  |  |  |  |
| 627540 |   |           |  |  |  |  |  |
| 626843 |   |           |  |  |  |  |  |

| MODEL NO.      | NOSE COLOR | SEE TABLE      |
|----------------|------------|----------------|
| QFEMTSCVR-T4LR | GRAY       | QFEMTSCVR-T4LR |
| QFEMTSCVR-T4LR | YELLOW     | QFEMTSCVR-T4LR |

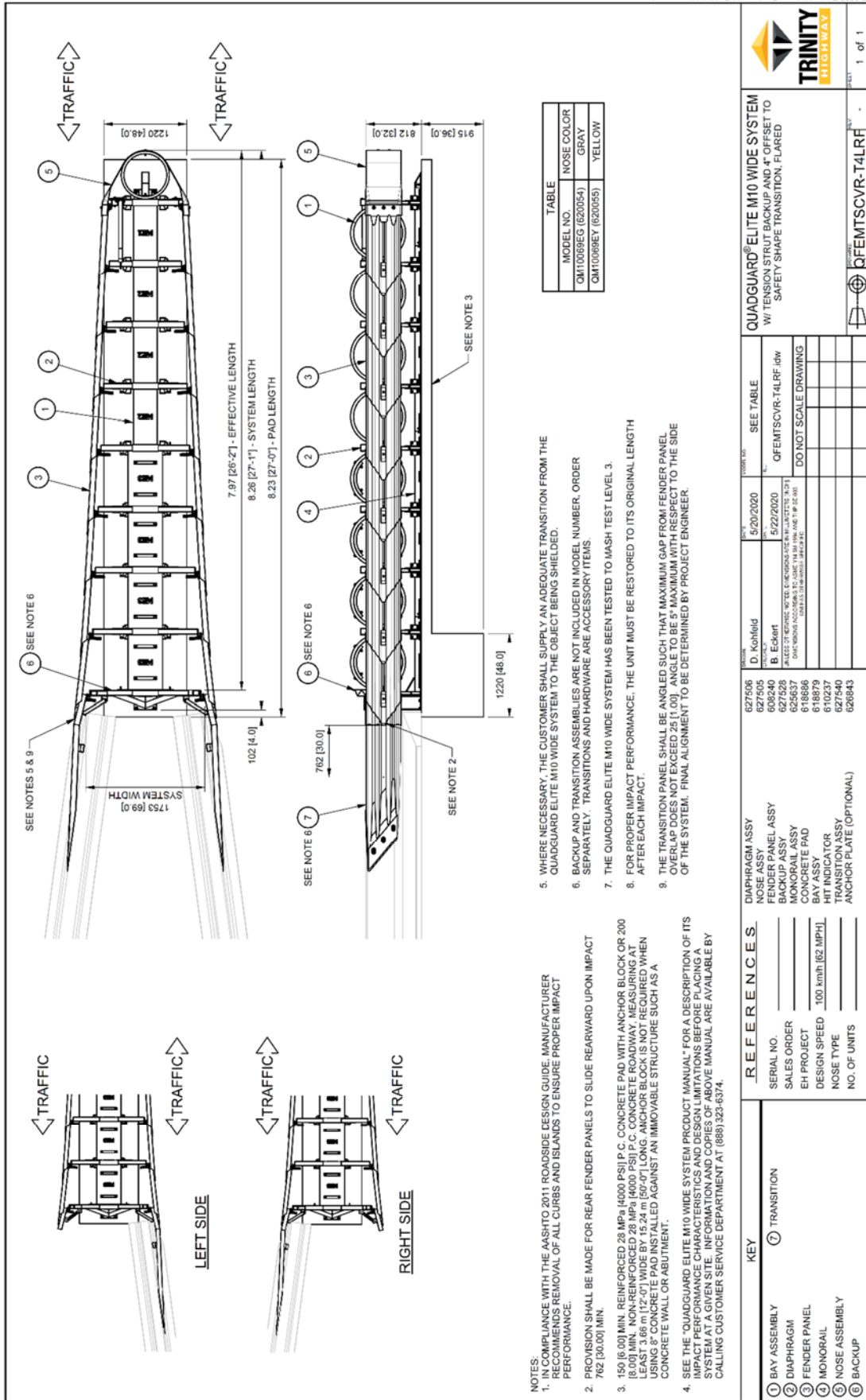
  

| QUADGUARD® ELITE M10 WIDE SYSTEM                                 |  |
|--|--|
| W/ TENSION STRUT BACKUP AND 4" OFFSET TO SAFETY SHAPE TRANSITION |  |

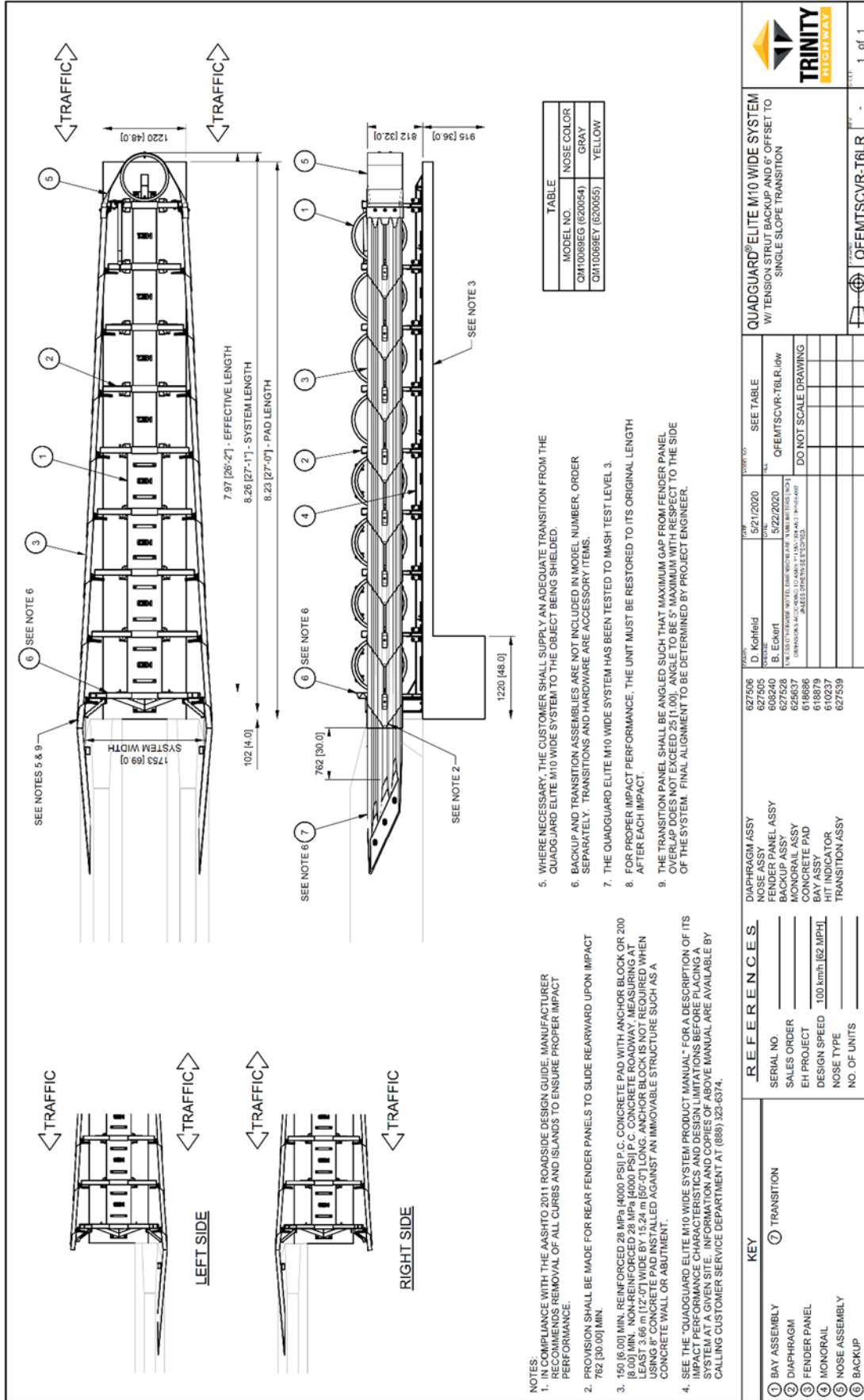
DO NOT SCALE DRAWING

SCALE: 1 of 1

4" Safety Shape Transition QFEMTSCVR-T4LR



4" Safety Shape Flared Transition QFEMTSCVR-T4LRF



TRAFFIC →

← TRAFFIC

TRAFFIC →

← TRAFFIC

TRAFFIC →

← TRAFFIC

TRAFFIC →

← TRAFFIC

- NOTES:
- IN COMPLIANCE WITH THE MASH-TO 2011 ROADSIDE DESIGN GUIDE, MANUFACTURER SHALL PROVIDE REMOVAL OF ALL CURBS AND ISLANDS TO ENSURE PROPER IMPACT PERFORMANCE.
  - PROVISION SHALL BE MADE FOR REAR FENDER PANELS TO SLIDE REARWARD UPON IMPACT.
  - 150 [6.00] MIN. REINFORCED 28 MPa [4000 PSi] 7.5 C. CONCRETE PAD WITH ANCHOR BLOCK OR 200 [7.87] IN. DIA. ANCHOR BOLT. ANCHOR BOLT SHALL BE 15.24 [60.00] LONG. ANCHOR BLOCK IS NOT REQUIRED WHEN USING 8" CONCRETE PAD INSTALLED AGAINST AN IMMOVABLE STRUCTURE SUCH AS A CONCRETE WALL OR ABUTMENT.
  - SEE THE "QUAGUARD ELITE M10 WIDE SYSTEM PRODUCT MANUAL" FOR A DESCRIPTION OF ITS IMPACT PERFORMANCE CHARACTERISTICS AND DESIGN LIMITATIONS BEFORE PLACING A SYSTEM. CHANGES TO THIS PRODUCT AND OTHER PERFORMANCE RELATED INFORMATION ARE AVAILABLE BY CALLING CUSTOMER SERVICE DEPARTMENT AT (888) 363-6374.
  - WHERE NECESSARY, THE CUSTOMER SHALL SUPPLY AN ADEQUATE TRANSITION FROM THE QUAGUARD ELITE M10 WIDE SYSTEM TO THE OBJECT BEING SHIELDED.
  - BACKUP AND TRANSITION ASSEMBLIES ARE NOT INCLUDED IN MODEL NUMBER, ORDER SEPARATELY. TRANSITIONS AND HARDWARE ARE ACCESSORY ITEMS.
  - THE QUAGUARD ELITE M10 WIDE SYSTEM HAS BEEN TESTED TO MASH TEST LEVEL 3.
  - FOR PROPER IMPACT PERFORMANCE, THE UNIT MUST BE RESTORED TO ITS ORIGINAL LENGTH AFTER EACH IMPACT.
  - THE TRANSITION PANEL SHALL BE ANGLED SUCH THAT MAXIMUM GAP FROM FENDER PANEL OVERLAP DOES NOT EXCEED 25 [1.00]. ANGLE TO BE 5° MAXIMUM WITH RESPECT TO THE SIDE OF THE SYSTEM. FINAL ALIGNMENT TO BE DETERMINED BY PROJECT ENGINEER.

TABLE

| MODEL NO.          | NOSE COLOR |
|--------------------|------------|
| QM10089EG (620854) | GRAY       |
| QM10089EY (620855) | YELLOW     |

REFERENCES

| KEY | DESCRIPTION   |
|-----|---------------|
| 1   | BAY ASSEMBLY  |
| 2   | DIAPHRAGM     |
| 3   | FENDER PANEL  |
| 4   | MONORAIL      |
| 5   | NOSE ASSEMBLY |
| 6   | BACKUP        |
| 7   | TRANSITION    |

REFERENCES

| SERIAL NO. | SALES ORDER | E# PROJECT | DESIGN SPEED      | NOSE TYPE | NO. OF UNITS |
|------------|-------------|------------|-------------------|-----------|--------------|
| 627506     |             |            | 100 km/h [62 MPH] |           |              |

REFERENCES

| DIAPHRAGM ASSY | NOSE ASSY | FENDER PANEL ASSY | MONORAIL ASSY | CONCRETE PAD | BAY ASSY | HIT INDICATOR | TRANSITION ASSY |
|----------------|-----------|-------------------|---------------|--------------|----------|---------------|-----------------|
| 627506         | 627506    | 627506            | 627506        | 618879       | 618879   | 610237        | 627539          |

REFERENCES

| DATE      | BY          | FOR | NO. | DATE      |
|-----------|-------------|-----|-----|-----------|
| 5/21/2020 | D. Koffield |     |     | 5/21/2020 |
| 5/22/2020 | B. Egarft   |     |     | 5/22/2020 |

REFERENCES

| DESCRIPTION  | DATE      | BY          | NO. |
|--|-----------|-------------|-----|
| QUAGUARD ELITE M10 WIDE SYSTEM                                   | 5/21/2020 | D. Koffield | 1   |
| W/ TENSION STRUT BACKUP AND 6" OFFSET TO SINGLE SLOPE TRANSITION | 5/22/2020 | B. Egarft   | 2   |

REFERENCES

| SCALE                | DATE | NO. |
|----------------------|------|-----|
| DO NOT SCALE DRAWING |      |     |



MODEL NO. QFEMTSCVR-T6LR

NOSE COLOR GRAY

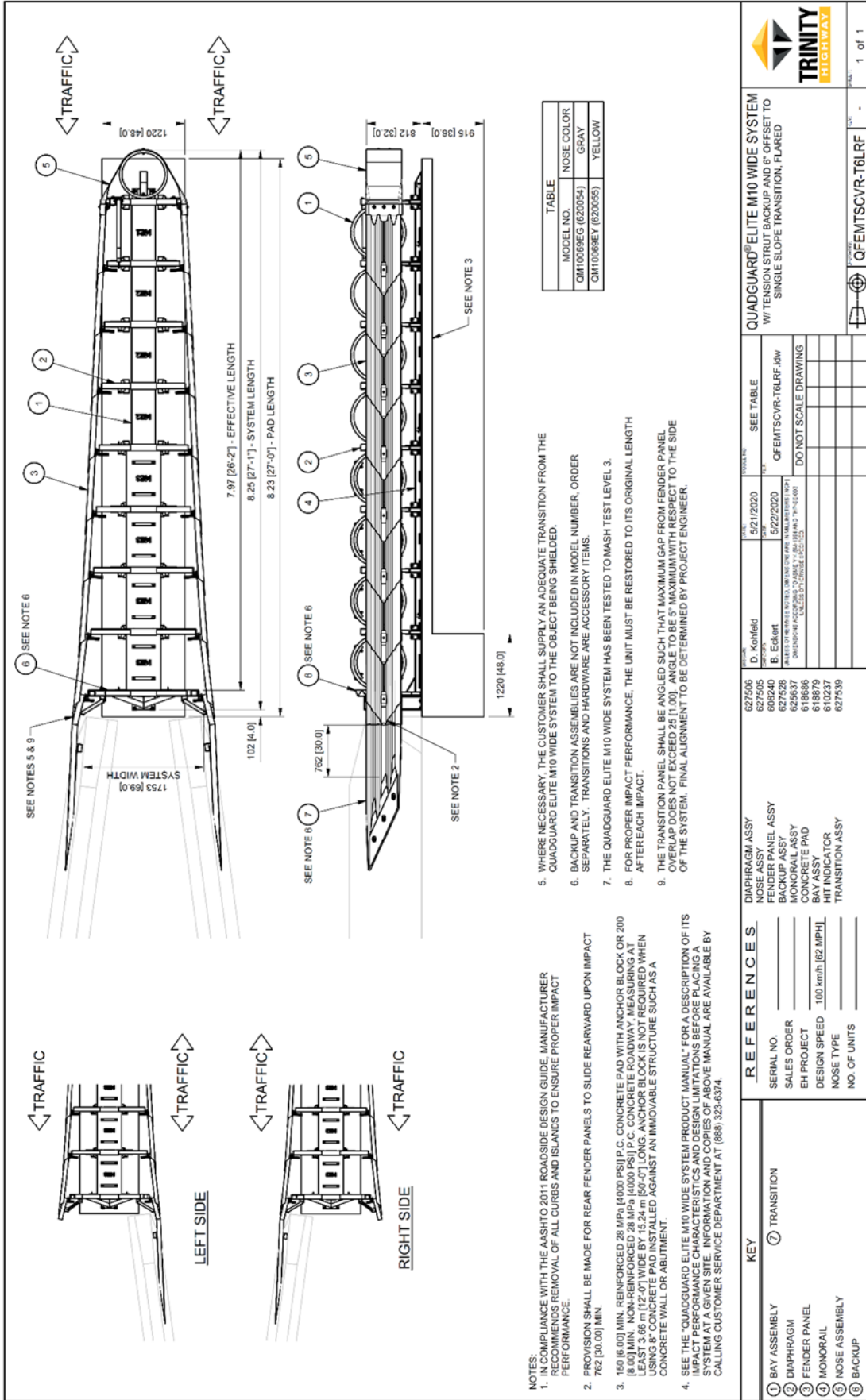
NO. OF UNITS 1 of 1

DATE 5/21/2020

BY D. Koffield

NO. 1

6" Single Slope Transition QFEMTSCVR-T6LR

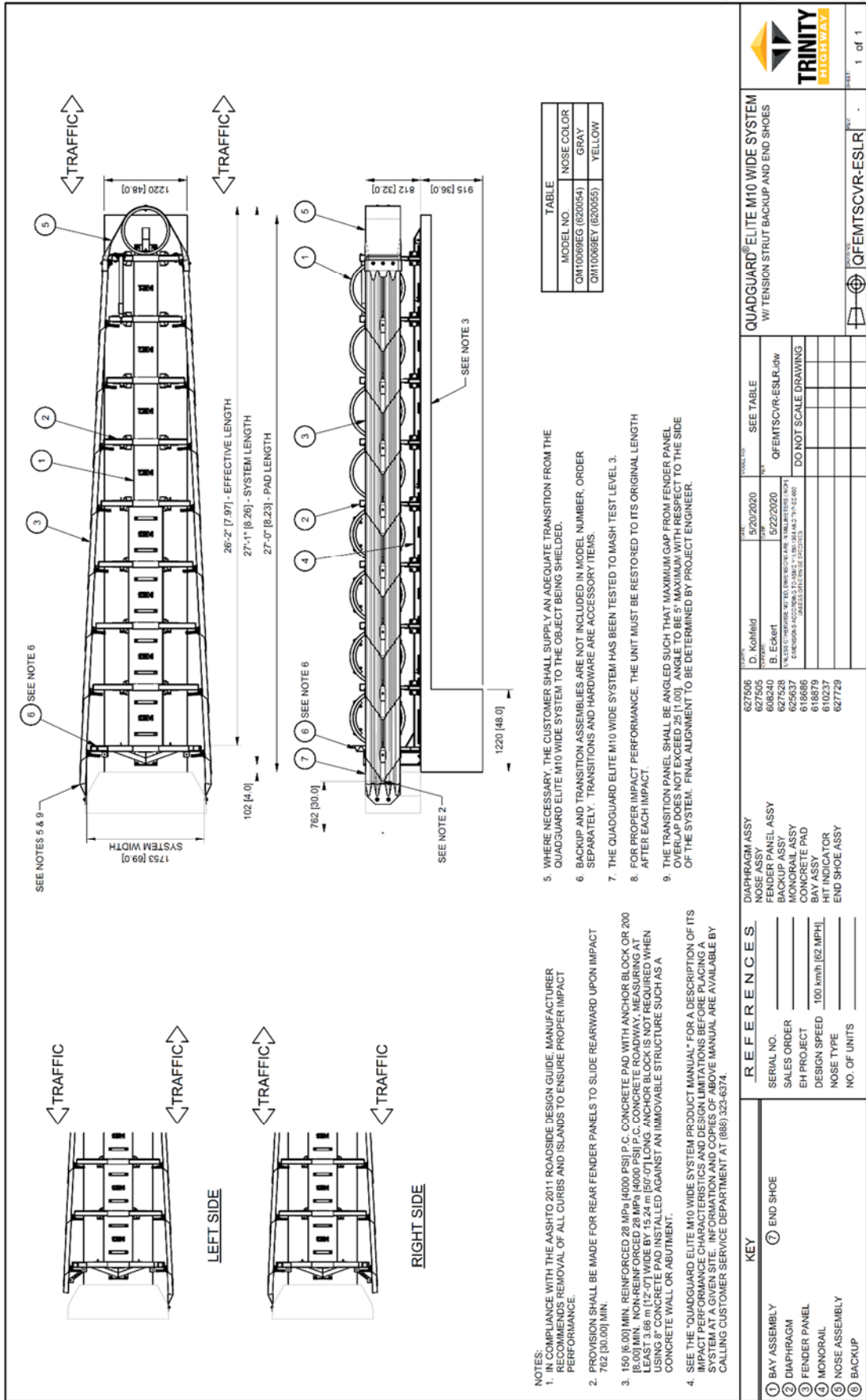


6" Single Slope Flared Transition QFEMTSCVR-T6LRF

| KEY   | REFERENCES    | DESCRIPTION       | DATE      | BY         | CHKD | REV | DESCRIPTION          |
|---|---------------|-------------------|-----------|------------|------|-----|----------------------|
| 1   | BAY ASSEMBLY  | DIAPHRAGM ASSY    | 5/21/2020 | D. Kofield |      |     | SEE TABLE            |
| 2   | DIAPHRAGM     | NOSE ASSY         | 5/22/2020 | B. Eckert  |      |     | QFEMTSCVR-T6LRF.iDW  |
| 3   | FENDER PANEL  | FENDER PANEL ASSY |           |            |      |     | DO NOT SCALE DRAWING |
| 4   | MONORAIL      | MONORAIL ASSY     |           |            |      |     |                      |
| 5   | NOSE ASSEMBLY | CONCRETE PAD      |           |            |      |     |                      |
| 6   | BACKUP        | BAY ASSY          |           |            |      |     |                      |
|   |               | HT INDICATOR      |           |            |      |     |                      |
|   |               | TRANSITION ASSY   |           |            |      |     |                      |
|   |               | NO. OF UNITS      |           |            |      |     |                      |
| <p>QUADGUARD<sup>®</sup> ELITE M10 WIDE SYSTEM<br/>W/ TENSION STRUT BACKUP AND 6" OFFSET TO<br/>SINGLE SLOPE TRANSITION, FLARED</p> |               |                   |           |            |      |     |                      |
| <p>QFEMTSCVR-T6LRF</p>  |               |                   |           |            |      |     |                      |







| MODEL NO.           | NOSE COLOR |
|---------------------|------------|
| QNF10986EG (620954) | GRAY       |
| QNF10986EY (620955) | YELLOW     |

- WHERE NECESSARY, THE CUSTOMER SHALL SUPPLY AN ADEQUATE TRANSITION FROM THE QUADGUARD ELITE M10 WIDE SYSTEM TO THE OBJECT BEING SHIELDED.
- BACKUP AND TRANSITION ASSEMBLIES ARE NOT INCLUDED IN MODEL NUMBER, ORDER SEPARATELY. TRANSITIONS AND HARDWARE ARE ACCESSORY ITEMS.
- THE QUADGUARD ELITE M10 WIDE SYSTEM HAS BEEN TESTED TO MASH TEST LEVEL 3.
- FOR PROPER IMPACT PERFORMANCE, THE UNIT MUST BE RESTORED TO ITS ORIGINAL LENGTH AFTER EACH IMPACT.
- THE TRANSITION PANEL SHALL BE ANGLED SUCH THAT MAXIMUM GAP FROM FENDER PANEL OVERLAP DOES NOT EXCEED 25 (1.00). ANGLE TO BE 5° MAXIMUM WITH RESPECT TO THE SIDE OF THE SYSTEM. FINAL ALIGNMENT TO BE DETERMINED BY PROJECT ENGINEER.



**QUADGUARD® ELITE M10 WIDE SYSTEM**  
 W/ TENSION STRUT BACKUP AND END SHOES

| DATE      | BY         | FOR                |
|-----------|------------|--------------------|
| 5/20/2020 | D. Kohfeld | SEE TABLE          |
| 5/22/2020 | B. Eckert  | QFEMTSCVR-ESLR_low |

| ITEM NO. | DESCRIPTION    | QTY |
|----------|----------------|-----|
| 627506   | DIAPHRAGM ASSY |     |
| 627505   | NOSE ASSY      |     |
| 627508   | BACKUP ASSY    |     |
| 626637   | MONORAIL ASSY  |     |
| 616686   | CONCRETE PAD   |     |
| 618879   | BAY ASSY       |     |
| 610237   | HIT INDICATOR  |     |
| 627729   | END SHOE ASSY  |     |

| REVISIONS | DATE      | BY         | DESCRIPTION        |
|-----------|-----------|------------|--------------------|
| 1         | 5/20/2020 | D. Kohfeld | SEE TABLE          |
| 2         | 5/22/2020 | B. Eckert  | QFEMTSCVR-ESLR_low |

| KEY | DESCRIPTION   |
|-----|---------------|
| ①   | BAY ASSEMBLY  |
| ②   | DIAPHRAGM     |
| ③   | FENDER PANEL  |
| ④   | MONORAIL      |
| ⑤   | NOSE ASSEMBLY |
| ⑥   | BACKUP        |
| ⑦   | END SHOE      |

| REFERENCES   | DESCRIPTION      |
|--------------|------------------|
| SERIAL NO.   |                  |
| SALES ORDER  |                  |
| EH PROJECT   |                  |
| DESIGN SPEED | 100 mph [82 MPH] |
| NOSE TYPE    |                  |
| NO. OF UNITS |                  |

| TABLE               | DESCRIPTION |
|---------------------|-------------|
| QNF10986EG (620954) | GRAY        |
| QNF10986EY (620955) | YELLOW      |

# End Shoe Transition QFEMTSCVR-ESLR

**Notes:**

**Notes:**



# TRINITY

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