

# QuadGuard<sup>®</sup> M Wide

## CRASH CUSHIONS

### PRODUCT MANUAL



# QuadGuard<sup>®</sup> M Wide

The QuadGuard<sup>®</sup> M Wide has been tested pursuant to AASHTO MASH specifications. The FHWA has determined that the QuadGuard<sup>®</sup> M Wide is eligible for Federal-aid reimbursement on the NHS.

## Product Description Assembly Manual



15601 Dallas Parkway  
Suite 525  
Addison, Texas 75001



**Warning:** The local highway authority, distributors, owners, contractors, lessors, and lessees are **RESPONSIBLE** for the assembly, maintenance, and repair of the QuadGuard<sup>®</sup> M Wide. Failure to fulfill these **RESPONSIBILITIES** with respect to the assembly, maintenance, and repair of the QuadGuard<sup>®</sup> M 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 Valtir representative. This system has been deemed eligible for reimbursement by the FHWA on the NHS 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 Valtir directly at (888) 323-6374 or visit [Valtir.com](http://Valtir.com).**

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

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## Customer Service Contacts

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

### Valtir

Telephone	(888) 323-6374 (USA) +1 312 467-6750 (International)
Contact Link	<a href="http://Valtir.com/Contact">Valtir.com/Contact</a>

## Abbreviations

AASHTO	American Association of State Highway and Transportation Officials
FHWA	Federal Highway Administration
MASH	Manual for Assessing Safety Hardware
MUTCD	Manual on Uniform Traffic Control Devices
PPE	Personal Protective Equipment

## Important Introductory Notes

Proper assembly of the QuadGuard® M Wide is critical to performance. The QuadGuard® M Wide has been deemed eligible by the FHWA per MASH criteria. These instructions should be read in their entirety and understood before assembling the QuadGuard® M Wide. These instructions are to be used in conjunction with the assembly of QuadGuard® M 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® M Wide, please contact the highway authority that has planned and specified this assembly and, if needed, contact Valtir's Customer Service Department. 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 specified herein for the QuadGuard® M Wide during the assembly or repair of this system (pp. 7 – 13).

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 herein. 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 Valtir 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® M 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® M 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® M Wide. Additional copies of this manual are available from Valtir by calling (888) 323-6374 or by visiting [Valtir.com/Product/](http://Valtir.com/Product/). Please contact Valtir if you have any questions concerning the information in this manual or about the QuadGuard® M Wide.

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® M 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:** Failure to comply with these warnings could result in increased risk of serious injury or death in the event of a vehicle impact.



**Warning:** Use only Valtir parts on the QuadGuard® M Wide for assembly, maintenance, or repair. The use of component parts not specified herein is **strictly prohibited**. A QuadGuard® M Wide using parts other than those specified herein has not been tested. 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**

Valtir contracts with independent crash testing facilities to test and prepare crash test reports for FHWA review.

The QuadGuard® M Wide has been deemed eligible for reimbursement by the FHWA per AASHTO 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® M Wide is certified to the Test Level(s) as shown below:

### **TL-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.**

Valtir 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 Valtir or by third parties.

The QuadGuard® M 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® M Wide until you have read this manual thoroughly and completely understand it. Please contact Valtir 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® M 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® M Wide is a re-directive, non-gating crash cushion for roadside features of 69" [1753 mm] or less in width with use of approved transitions. It consists of energy-absorbing cartridges surrounded by a framework of Quad-Beam Fender Panels.



**Important:** Valtir 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® M Wide utilizes two types of cartridges 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 six (6) Bay QuadGuard® M Wide has successfully passed the requirements stipulated in MASH with both the light car and pickup trucks at speeds of up to 62 mph [100 kph] at redirection angles up to 25 degrees.

During head-on impact testing, within MASH criteria, the QuadGuard® M 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 QuadGuard® M Wide and delineation used 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® M Wide meets all appropriate MUTCD and local standards.

### **Inspect Shipping**

Check the received parts against the shipping list supplied with the system before deploying the QuadGuard® M Wide. Make sure all parts have been received (pp. 7 - 13).



**Important:** The Manufacturer’s Drawing Package supplied with the QuadGuard® M Wide must be used with these instructions for proper assembly and should take precedence over these general instructions.



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

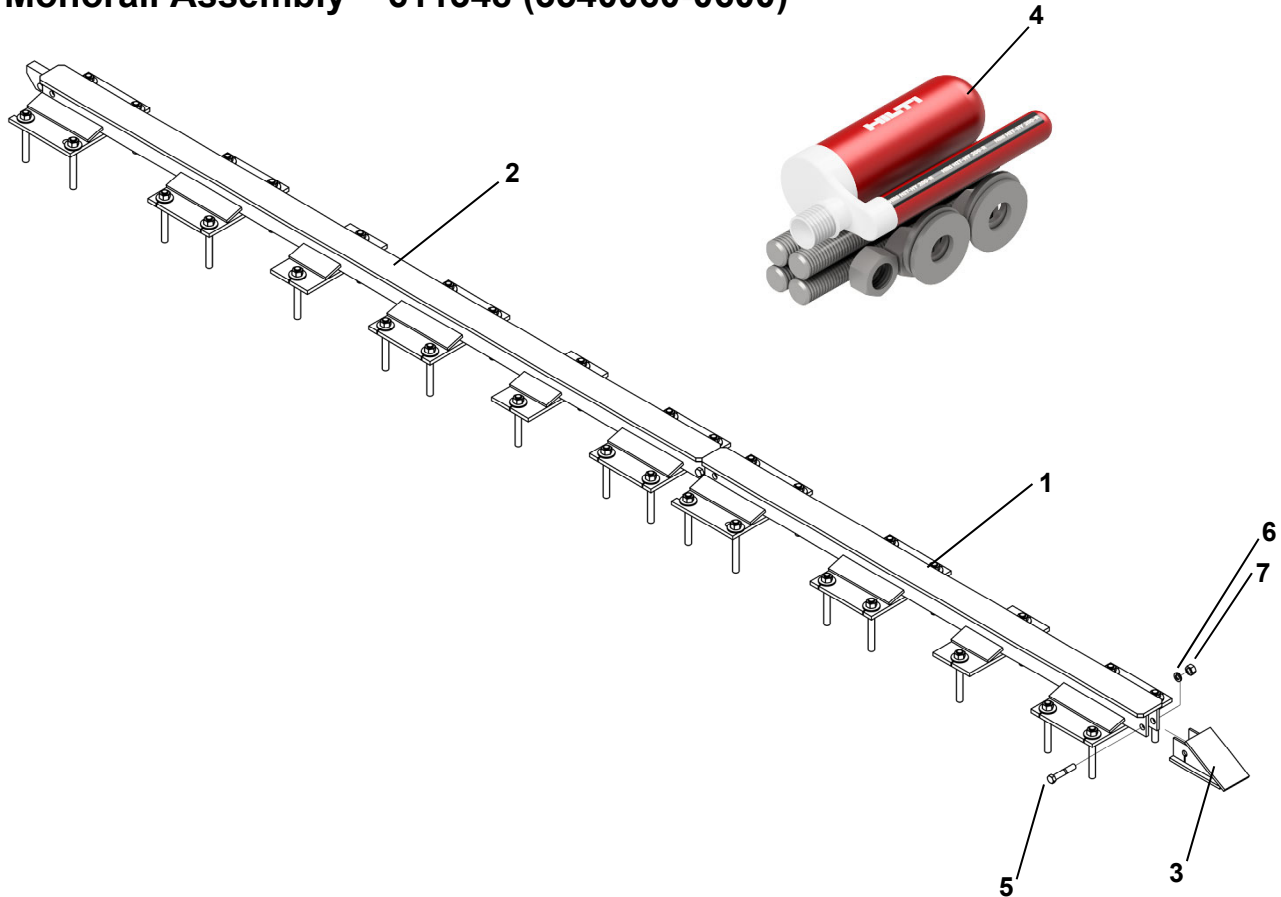


## System Assemblies

System assemblies that may be ordered in your particular QuadGuard® M Wide configuration. Verify parts delivered and system details with the BOM (Bill of Materials) and system drawings shipped with your system. Please call Valtir if you have any system questions (p. 3).

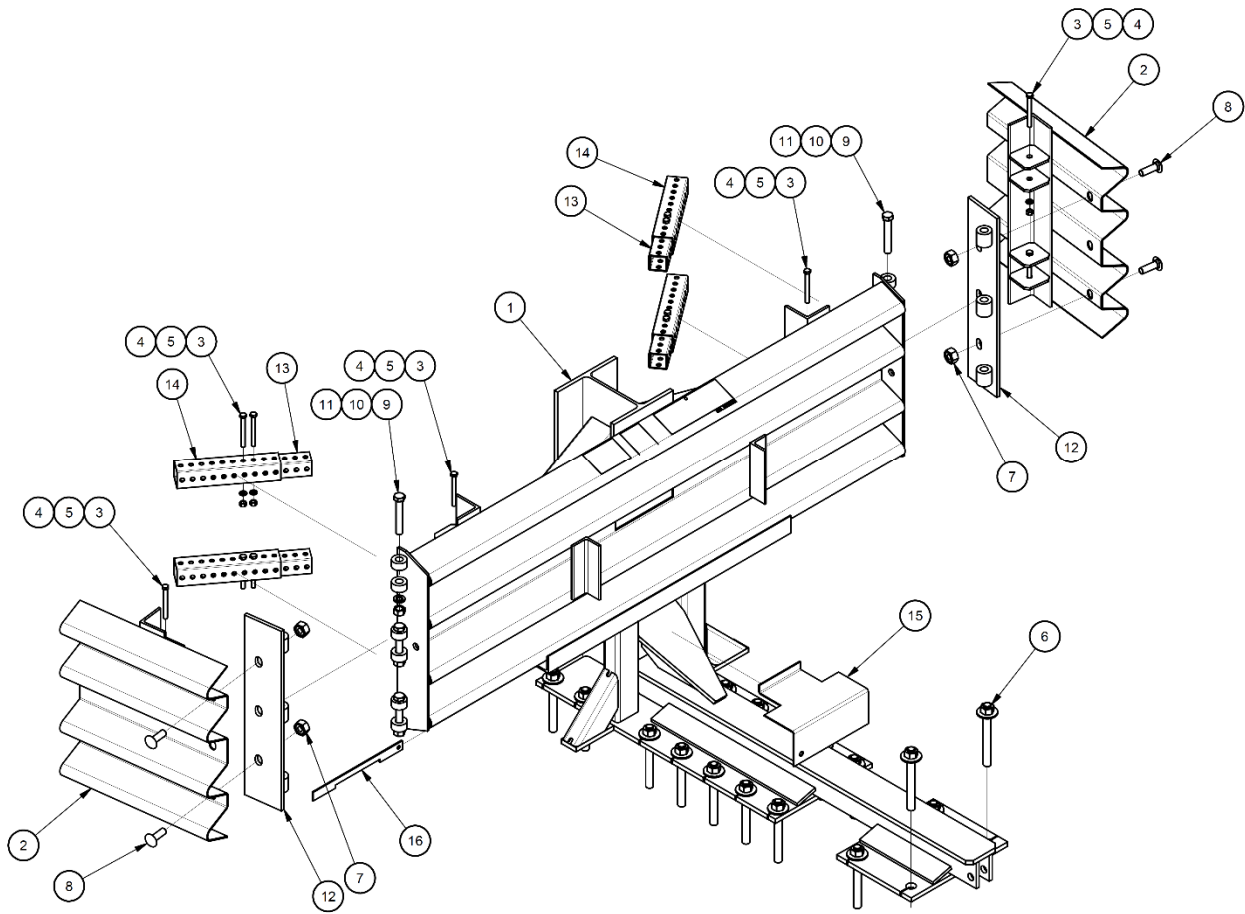
**Note:** Parts and Assemblies are not shown to scale.

### Monorail Assembly – 611348 (3540060-0600)



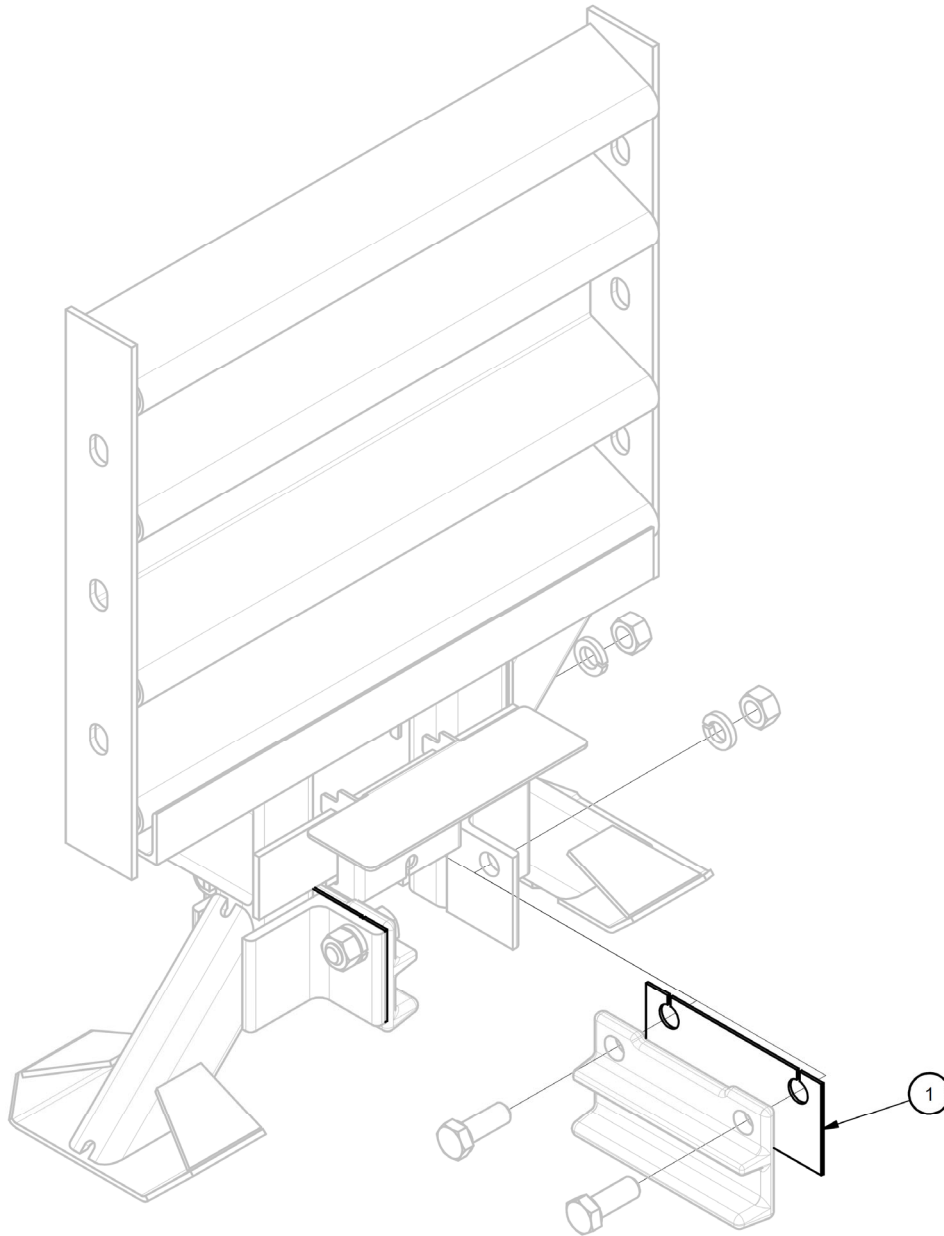
Item	PN	EAS PN	Description	Qty
1	611375	2760061-0000	Monorail, 2 Bays	1
2	611379	2760071-0000	Monorail, 3 Bays	1
3	608136	2760041-0000	Endcap, Monorail	1
4	619316	619316	Anchor Kit, Hilti, 330 ml, 3/4x7 (4)	9
5	113660	2699571-0000	Bolt, Hex, 5/8x3 1/2, G5	1
6	118100	2708231-0000	Washer, Lock, 5/8	1
7	003354	2704141-0000	Nut, Heavy Hex, 5/8, A563	1

# Backup Assembly - 627512



Item	PN	EAS PN	Description	Qty
1	627511	2760451-0000	Backup, TS, 64, Wide, W/Decal	1
2	611900	2760471-0000	Panel, Side, QG, Wide	2
3	113612	2699601-0000	Bolt, Hex, 3/8x3 1/2, All Thread, G5	16
4	115960	2704031-0000	Nut, Hex, 3/8x	16
5	118092	2708041-0000	Washer, Lock, 3/8	16
6	619316	619316	Anchor Kit, Hilti, 330 ml, 3/4x7 (4)	5
7	003340	2704191-0000	Nut, Hex, 5/8, Rail	4
8	003400	2699341-0000	Bolt, Rail, 5/8x2	4
9	113666	2701991-0000	Bolt, Hex, 5/8x4, G5	6
10	118100	2708231-0000	Washer, Lock, 5/8	6
11	003354	2704141-0000	Nut, Heavy Hex, 5/8, A563	6
12	610172	2760435-0000	Hinge Plate, Fender Panel	2
13	615756	2760501-0000	Tel St 1 3/4x1 3/4x12 GAx10, H4S	4
14	615765	2760502-0000	Tel St 2x2x12 GAx10, H4S	4
15	605447	2760293-0000	Bracket, Cartridge Support, TS B/U	1
16	611266	2760294-0000	Locking Bar, Cartridge Support	1

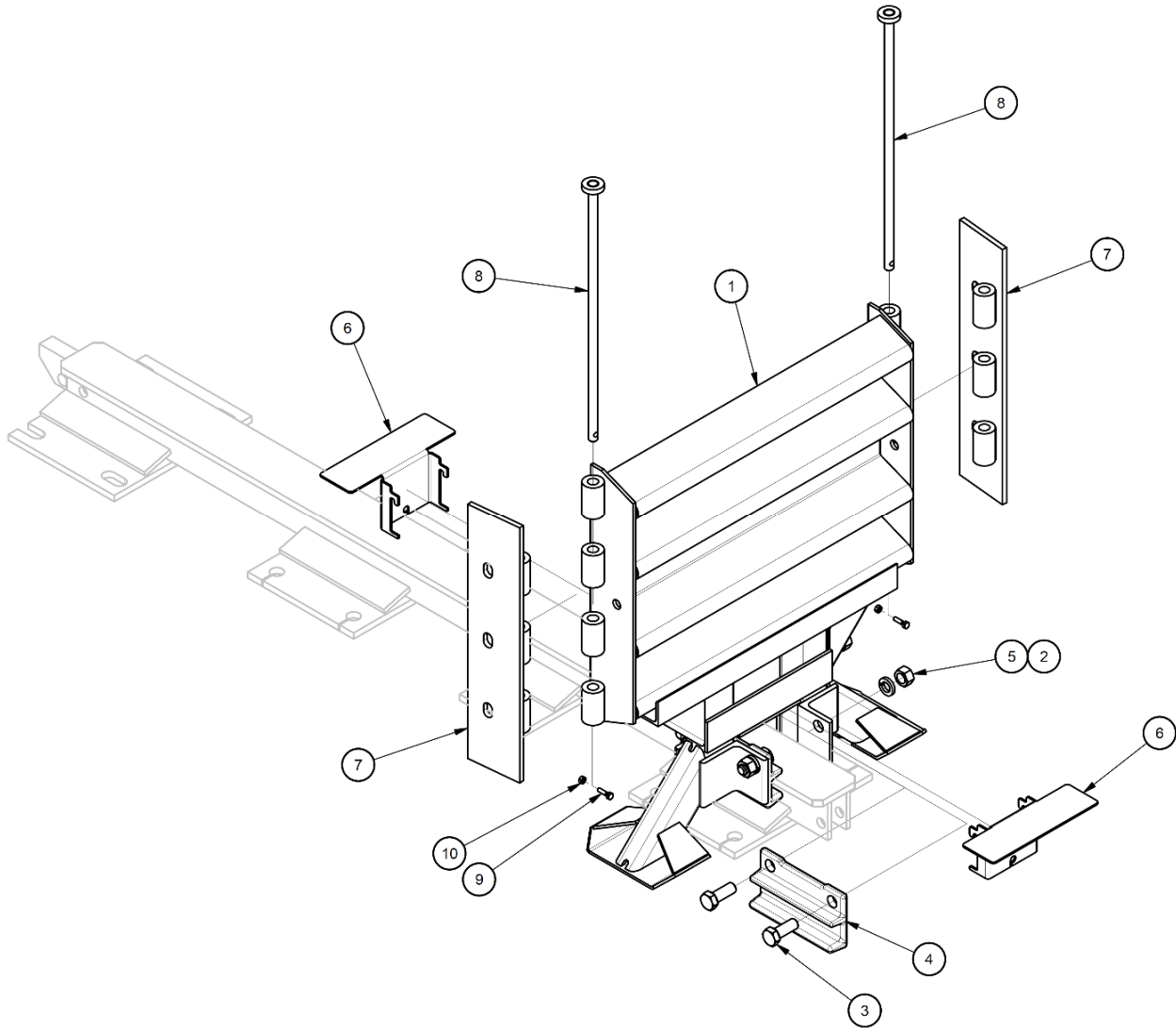
# Shim Kit Rail Guide Assembly - 614050



Item	PN	EAS PN	Description	Qty
1	614062	2723315-0000	Shim, 12GA, 3 5/8x8	2



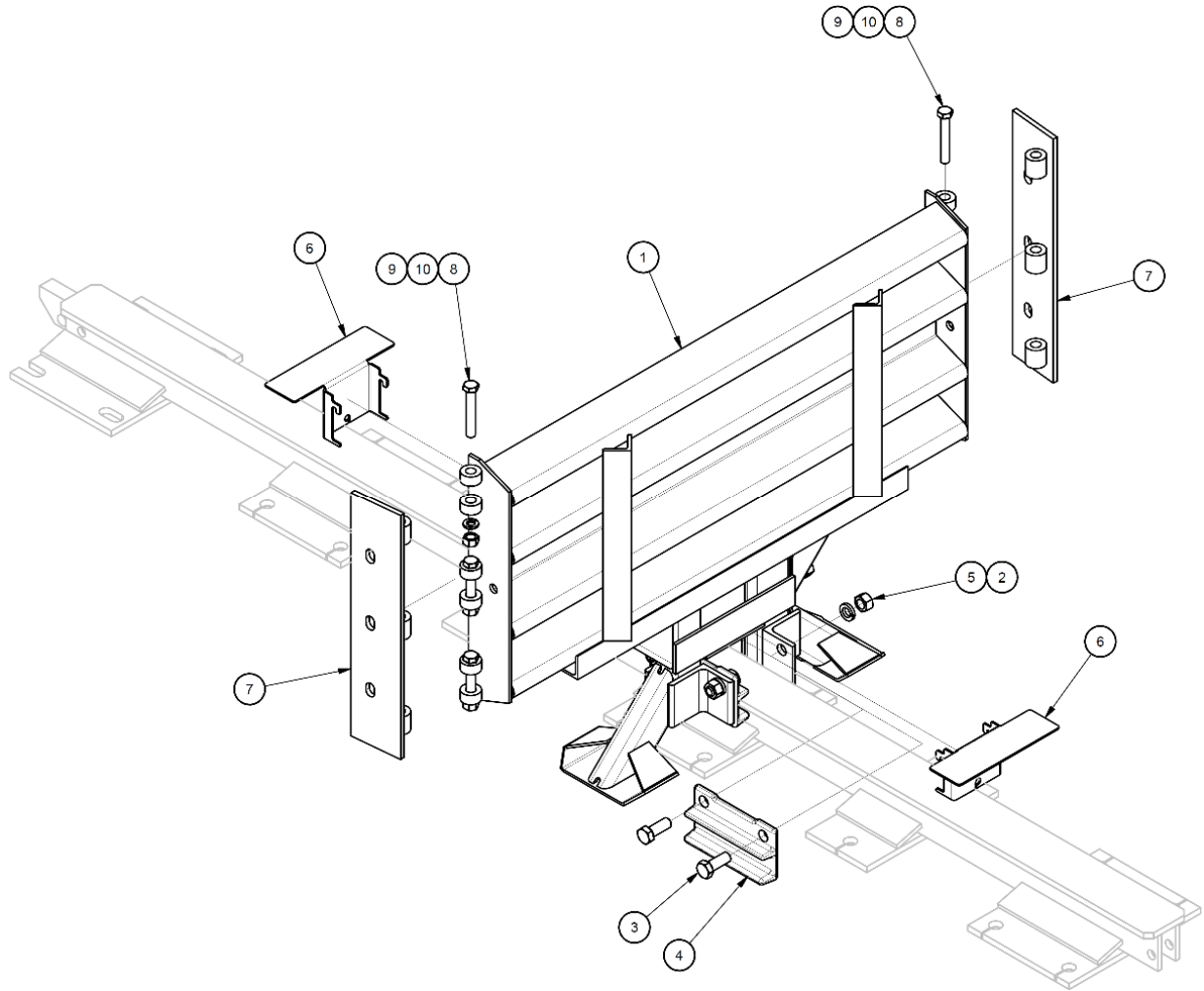
# Diaphragm 1 Assembly – 627526



Item	PN	EAS PN	Description	Qty
1	627532	627532	Diaphragm, Full Length, 0673	1
2	118089	2708201-0000	Washer, Lock, 3/4	4
3	113555	2699121-0000	Bolt, Hex, 3/4x2, G8	4
4	611368	2760091-0000	Monorail Guide	2
5	003704	2704341-0000	Nut, Hex, 3/4	4
6	605446	605446	Bracket, Cartridge Support	2
7	627524	627524	Hinge Plate, Full Length	2
8	627525	627525	Hinge Pin, DIA, Full Length	2
9	113508	2700251-0000	Bolt, Hex, 1/4x1, G5	2
10	115946	2704151-0000	Nut, Hex, 1/4	2

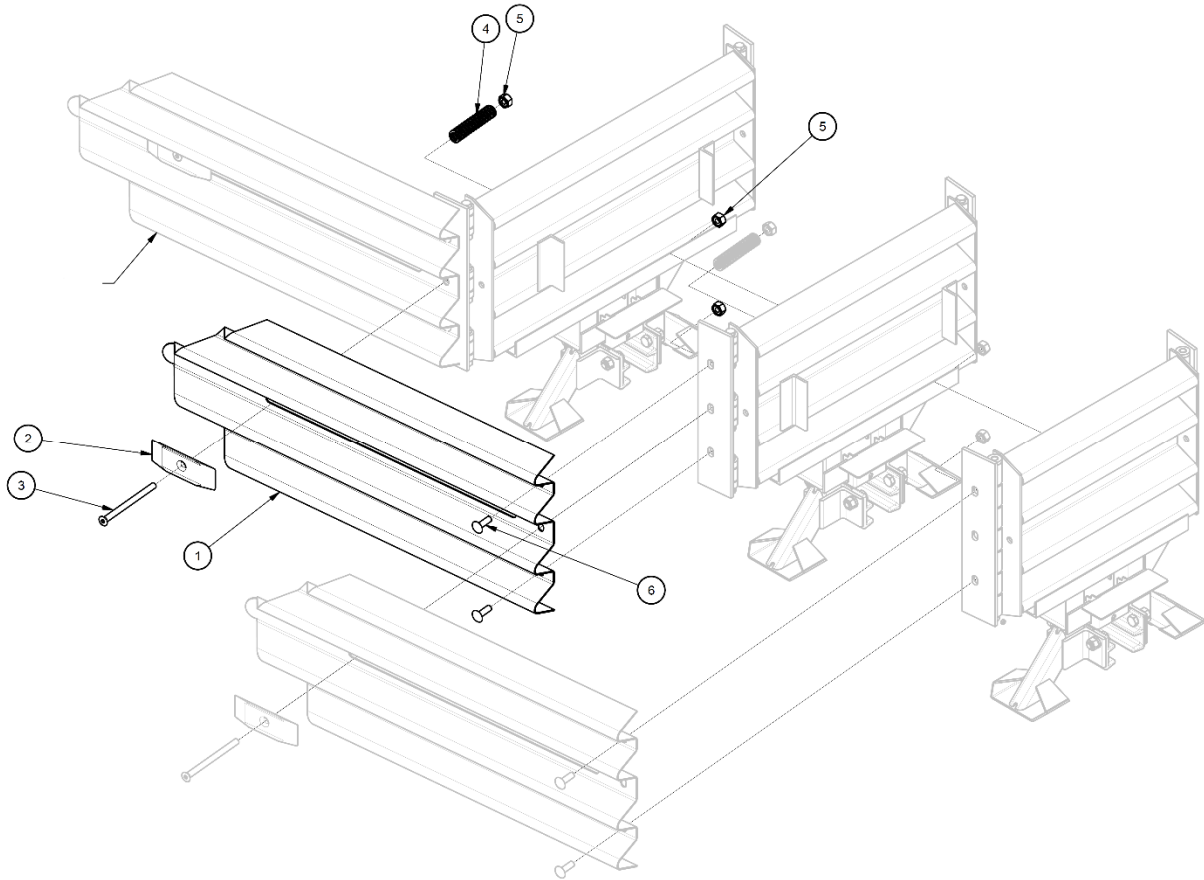
## Diaphragm Assembly 2-6

Diaphragm Assemblies		
PN	EAS PN	Width
607175	3540340-0833	32.8" (833 mm)
607177	3540340-0993	39.1" (993 mm)
607146	3540340-1153	45.4" (1153 mm)
607150	3540340-1313	51.7" (1313 mm)
607152	3540340-1473	58.0" (1473 mm)



Item	PN	EAS PN	Description	Qty
1	See Chart Above		Diaphragm(s)	1
2	118089	2708201-0000	Washer, Lock, 3/4	4
3	113555	2699121-0000	Bolt, Hex, 3/4x2, G8	4
4	611368	2760091-0000	Monorail Guide	2
5	003704	2704341-0000	Nut, Hex, 3/4	4
6	605446	2760292-0000	Bracket, Cartridge Support	2
7	610172	2760435-0000	Hinge Plate, Fender Panel	2
8	113666	2701991-0000	Bolt, Hex, 5/8x4, G5	6
9	003354	2704141-0000	Nut, Heavy Hex, 5/8, A563	6
10	118100	2708231-0000	Washer, Lock, 5/8	6

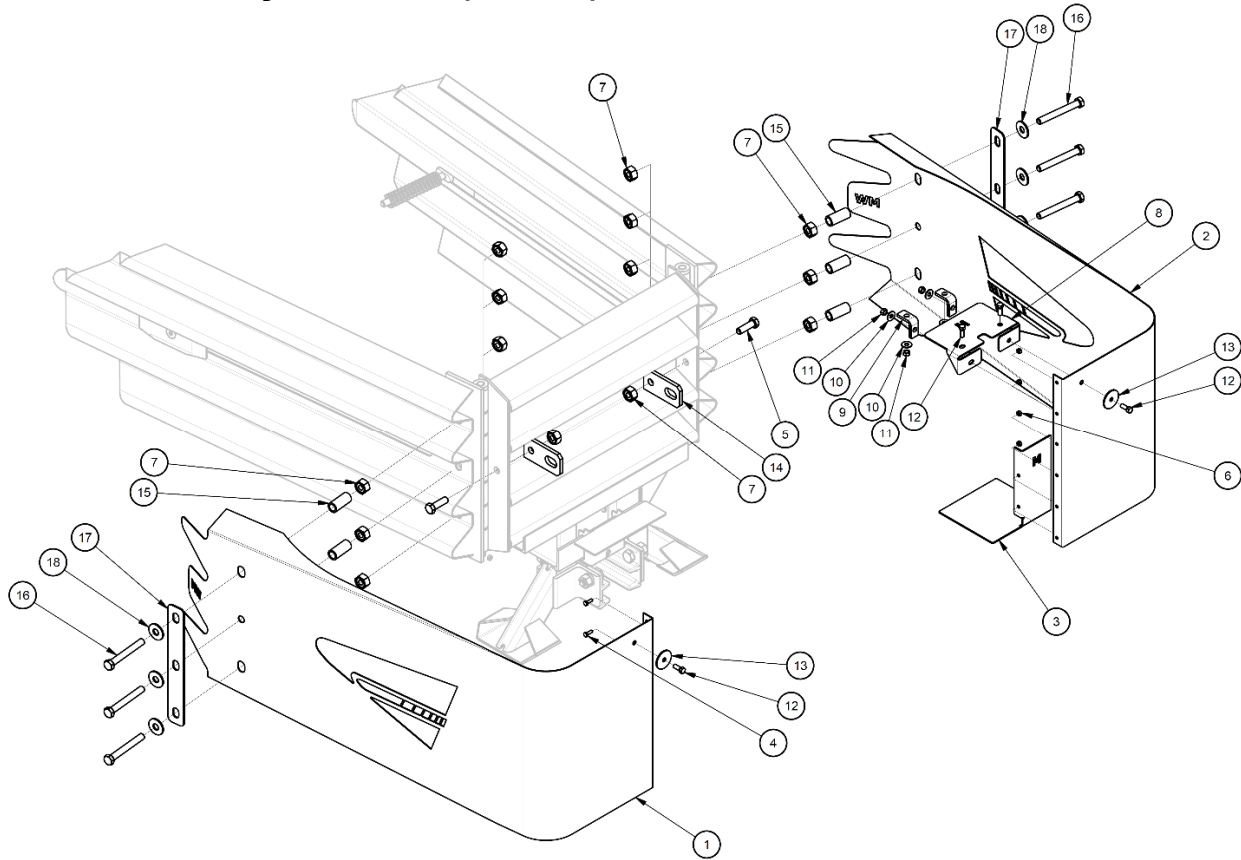
## Fender Panel Assembly – 608240 (3540472-0000)



Item	PN	EAS PN	Description	Count
1	611832	2760081-0000	Fender Panel	1
2	617045	2708841-0000	Washer, Mushroom	1
3	116879	2706605-0000	Screw, Flat, 5/8x8 1/2, G8, Socket	1
4	117458	2715044-0000	Spring, Die, 1 1/2 ODx3/4x6	1
5	003340	2704191-0000	Nut, Hex, 5/8, Rail	3
6	003400	2699341-0000	Bolt, Rail, 5/8x2	2



## Nose Assembly – 627521 (Yellow)



Item	PN	EAS PN	Description	Qty
1	627513	627513	Nose, L, QG M Wide	1
2	627514	627514	Nose, R, QG M Wide	1
3	626816	626816	Bracket, Cartridge Support, Nose	1
4	113518	2699065-0000	Bolt, Hex, 1/4x3/4, G5	6
5	118570	118570	Bolt, Hex, 5/8x2, G5	2
6	115946	2704151-0000	Nut, Hex, 1/4	6
7	003340	2704191-0000	Nut, Hex, 5/8, Rail	14
8	626815	628815	Bracket, Cartridge Hold Down, QG M	1
9	626817	626817	Bracket, Angle, 2x1, W/Holes	2
10	118036	2708021-0000	Washer, Flat, 3/8x1	4
11	115960	2704031-0000	Nut, Hex, 3/8	4
12	113596	2701221-0000	Bolt, Hex, 3/8x1, G5	4
13	118038	2708031-0000	Washer, Flat, 3/8x2	2
14	605535	2760251-0000	Bracket, Pull-Out	2
15	626819	626819	Pipe 3/4 Sch 80x2 5/16	6
16	119163	119163	Bolt, Hex, 5/8x5, G8, P, F/T	6
17	626818	626818	Washer, Bar, 10GAx2x14, Slots	2
18	003300	2708291-0000	Washer, Flat, 5/8x1 3/4	6

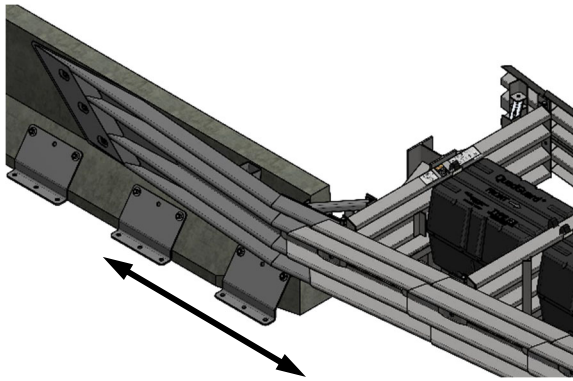
**Note:** Referenced parts are for the Yellow Nose assembly. Contact Customer Service for other color options (p. 3).

## Select Transition

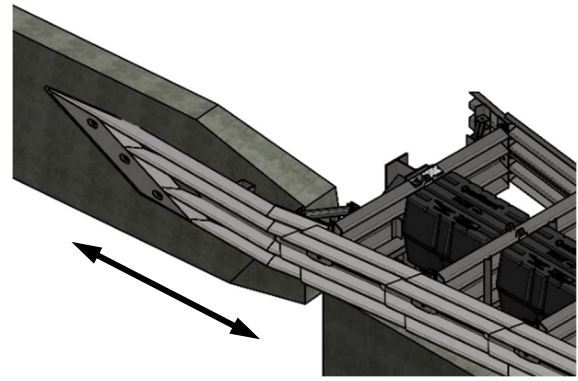
**Note:** A proper Transition Panel or Side Panel must be used on each side of the Backup. A Side Panel is not needed when a Transition Panel is used. Several types of transitions are available for use with the QuadGuard M Wide (Figures 1 – 5). The correct Panel(s) to use will depend on the direction of traffic and what type of barrier or road feature the QuadGuard® M Wide is shielding. Contact Customer Service prior to deployment if you have any questions (p. 3).



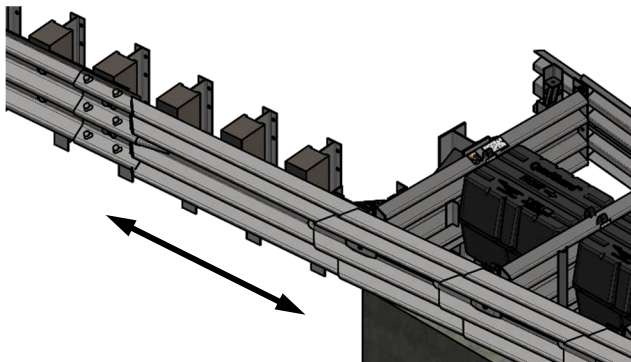
**Important:** The QuadGuard M Wide is available with transitions to concrete barrier, guardrail, and other roadside features. Contact Customer Service for any transition questions (p. 3).



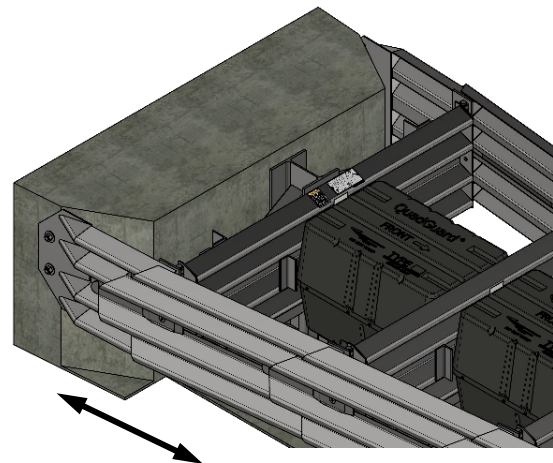
**Figure 1**  
Safety Shape Barrier, 4" Offset



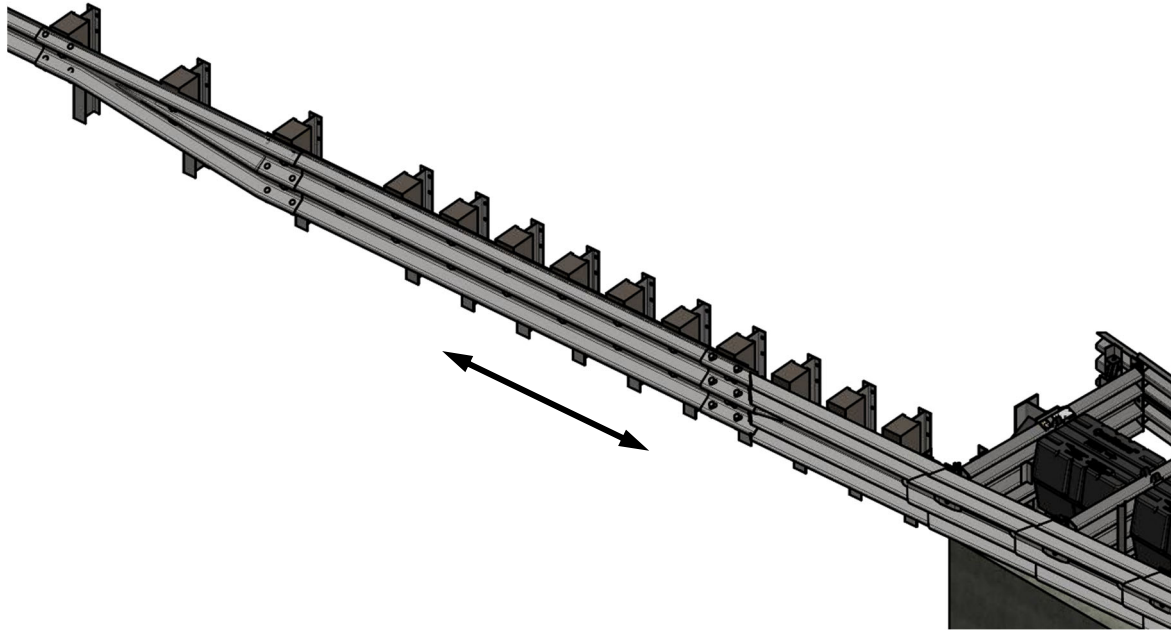
**Figure 2**  
Single Slope Barrier, 6" Offset



**Figure 3**  
Quad to Thrie-Beam Guardrail



**Figure 4**  
Vertical Wall



**Figure 5**  
Quad to W-Beam Guardrail

## **Recommended Tools**

### **Documentation**

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

### **Personal Protective equipment**

- Eye Protection
- Gloves
- Safety-toe Shoes
- Protective Clothing
- Reflective Vest

### **Cutting equipment**

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



**Important:** Valtir recommends using **double-fluted** drill bits to achieve optimum tensile strength when applying an approved adhesive anchoring system (p. 19).



## Hammers

- Sledgehammer
- Standard hammer

## Wrenches

- Heavy duty 1/2" drive impact wrench
- 1/2" drive sockets: 7/16", 9/16", 15/16", 1 1/16", 1 1/8", 1 1/4"
- 1/2" drive Deep well 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-lb
- Combination wrench(s): 7/16", 9/16", 15/16", 1 1/8"
- Hex Key (Allen) wrench: 3/8"

## Miscellaneous

- Traffic control equipment
- Lifting and moving equipment (A lifting device is preferred although a forklift can be used.) Minimum 5,000 lb. capacity required.
- Air Compressor (100 psi minimum) and Generator (5 kW)
- Long pry bar
- Drift pin 12" [300 mm]
- Center punch
- Tape measure 25' [7.5 m]
- Chalk line
- Concrete marking pencil
- Steel bristled tube brush for cleaning 7/8" drilled boreholes
- Rags, water, and solvent for touch-up

**Note:** The provided list of tools is a general recommendation and should not be considered an extensive 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 the responsibility 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® M Wide, for permanent applications, should be assembled on an existing or freshly placed and cured concrete base (28 MPa [4000 psi] minimum). Location and orientation of the concrete base and attenuator must comply with project plans or as otherwise determined by the local highway authority.

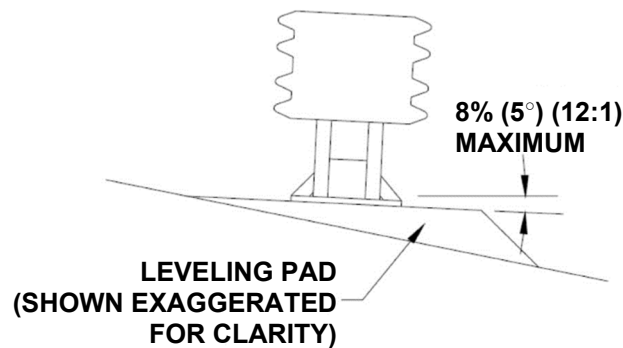
Recommended dimension and reinforcement specifications for new concrete foundations are provided in Valtir concrete foundation drawings, supplied with the system. The system may also be assembled on reinforced or non-reinforced concrete roadway (minimum 8" [200 mm] thick). Deployment cross-slope shall 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.



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



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



**Figure 6**  
**Cross-Slope**



**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 30" [762 mm]. Position the Backup so that the rear ends of the last Fender Panels are a minimum of 30" [762 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.



**Important:** QuadGuard® M Wide cannot be mounted on asphalt.

## Foundation/Anchoring



**Important:** 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.

### Concrete Installations

For concrete installations, the QuadGuard® M Wide should be installed only on an existing or freshly placed and cured concrete base (4000 psi [28 MPa] minimum). Orientation of the concrete base and the attenuator must comply with the project plans or as otherwise determined by the resident project engineer or appropriate highway authority.

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

The QuadGuard® M Wide 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

# Valtir Approved Adhesive Anchoring System

A Valtir 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 Valtir 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® M 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 Valtir 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.

Anchoring Information					
Stud Size:	Orientation	Bit Size	Minimum Depth	Torque	Medium
3/4x7"	Vertical	7/8" [22 mm]	5 3/4" [145 mm]	100 ft-lb [136 N-m]	Concrete
3/4x6 1/2"	Horizontal	7/8" [22 mm]	5 1/4" [133 mm]	100 ft-lb [136 N-m]	Concrete

### 3) Clean the Boreholes

Blow the concrete dust from the borehole using oil-free compressed air. Thoroughly brush it 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 Valtir 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 manufacturer's instructions.

#### 5) Add the Washers and Nuts

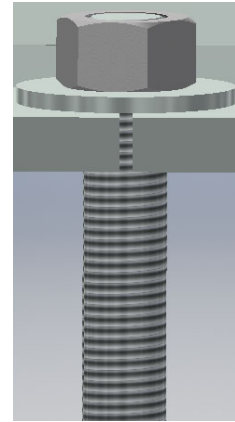
Place a flat washer onto the stud then thread a nut on until the end of the stud is flush with the nut (Figure 7).

#### 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.



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



**Figure 7**  
**Vertical Application**  
**(Before Applied Torque)**

#### 7) Torque the Nuts

Once the adhesive has fully cured, torque each nut to 100 ft-lb.

### Anchor Assembly Cautions

#### 1) Steel rebar

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

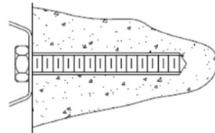
Put washer and nut on stud so the **nut is flush with end of stud**.

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

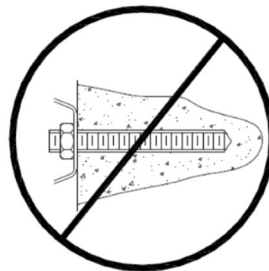
Push stud with washer and nut into borehole.



**Important:** The stud should be flush with the top of the nut in both **vertical** and **horizontal** applications prior to tightening (Figure 8).



CORRECT



INCORRECT

**Figure 8**  
**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 each nut to 100 ft-lb.

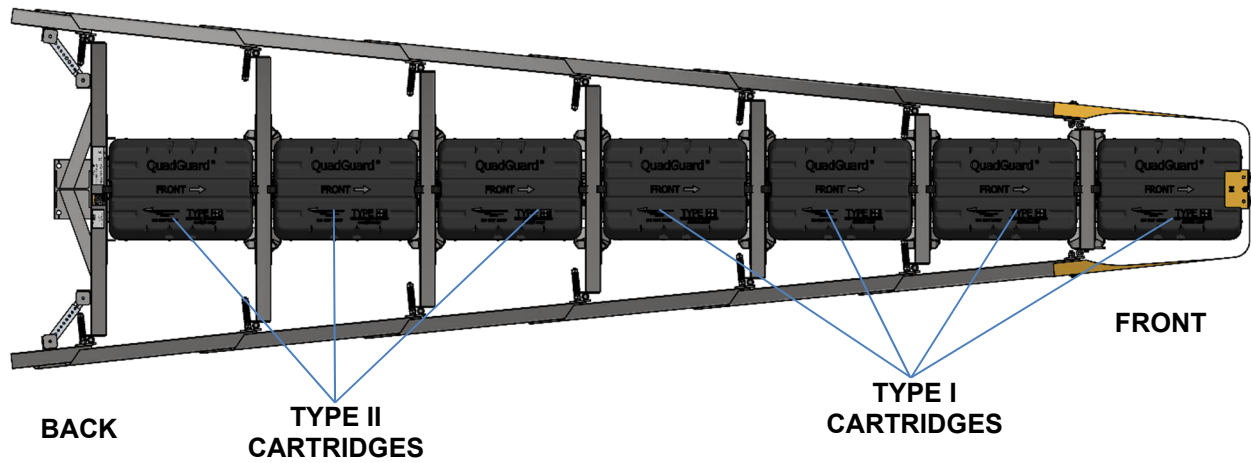


Figure 9 Plan View

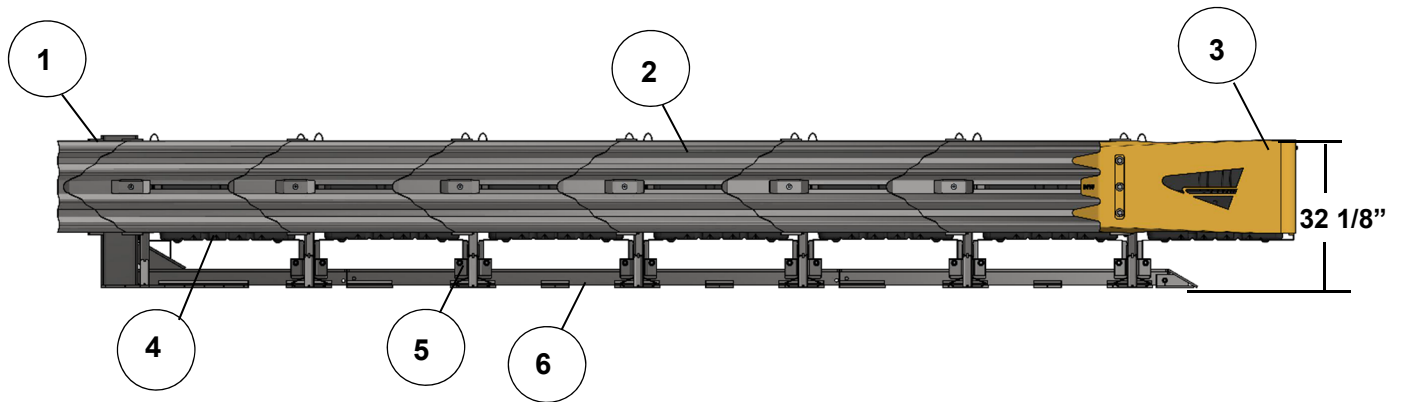


Figure 10 Elevation View  
6 Bay TL-3

**KEY**

- 1) Backup
- 2) Quad-Beam Fender Panel
- 3) Nose
- 4) Cartridge
- 5) Diaphragm
- 6) Monorail

## How to Determine Left/Right

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

## Counting the Number of Bays

One Bay consists of one Cartridge, one Diaphragm, and two Fender Panels. The Nose section is not considered a Bay, though there is a Cartridge in the Nose of each system.

**Note:** There will always be one more Cartridge in the system than the number of Bays in the system. To determine number of Bays, count Fender Panels on one side (Figure 11).

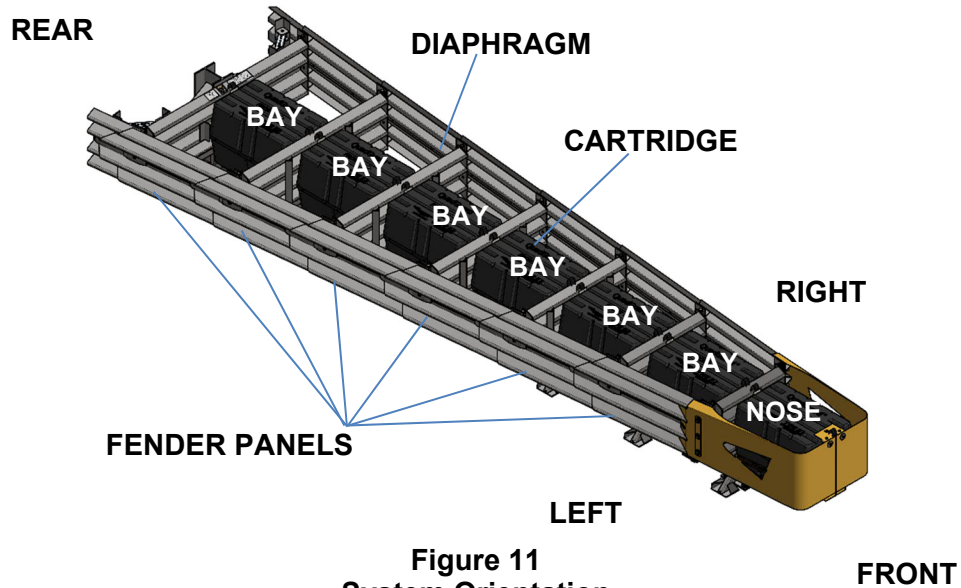


Figure 11  
System Orientation

## Measuring the Width

The nominal width of a **Wide (flared)** system is the width at the location shown (Figure 12).

The outside width of the system is approximately 6" [152 mm] wider than the nominal width.

**Note:** The outside width of the system is not the same as the width of the Backup.

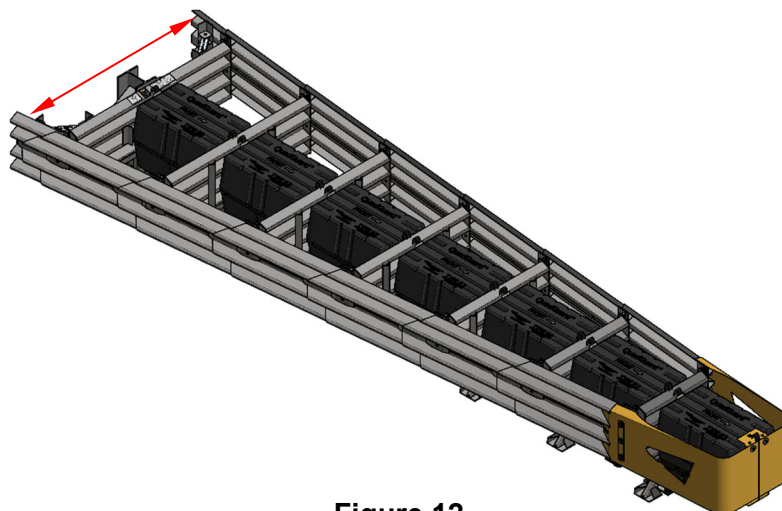


Figure 12  
Width of Flared System

## System Assembly



**Warning:** It is the responsibility of the installer to ensure the assembly procedure meets all appropriate OSHA and local standards.

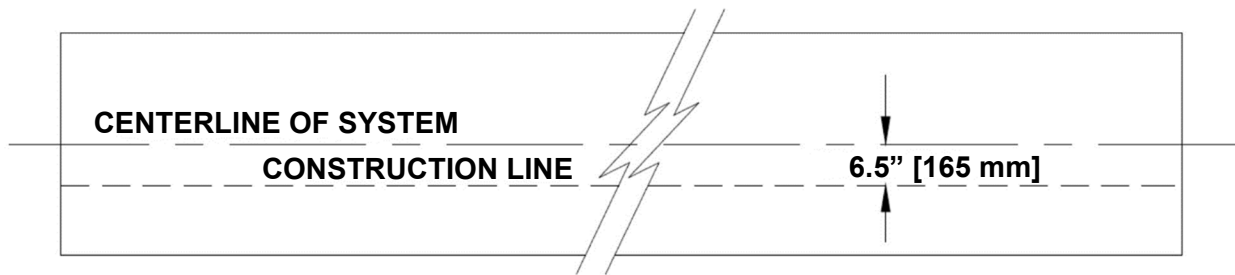
### 1) Mark System Location

Locate the centerline of the system by measuring the proper offset from the fixed object. Refer to the Drawing Package supplied with the system. Place chalk line to mark the centerline of the system. Mark a construction line parallel to the center line and offset 6.5" [165 mm] to one side as shown in Figure 13. The edge of the Monorail will be positioned on this line.

**Note:** The concrete foundation must comply with the Manufacturer's Drawing Package supplied with the system.



**Warning:** Location of system with respect to the roadside obstacle is critical and dependent on the type of Transition Panel used. Please refer to the Drawing Package supplied with the system for details.



**Figure 13**  
**(Top view of concrete foundation)**  
**Locating Construction Line**



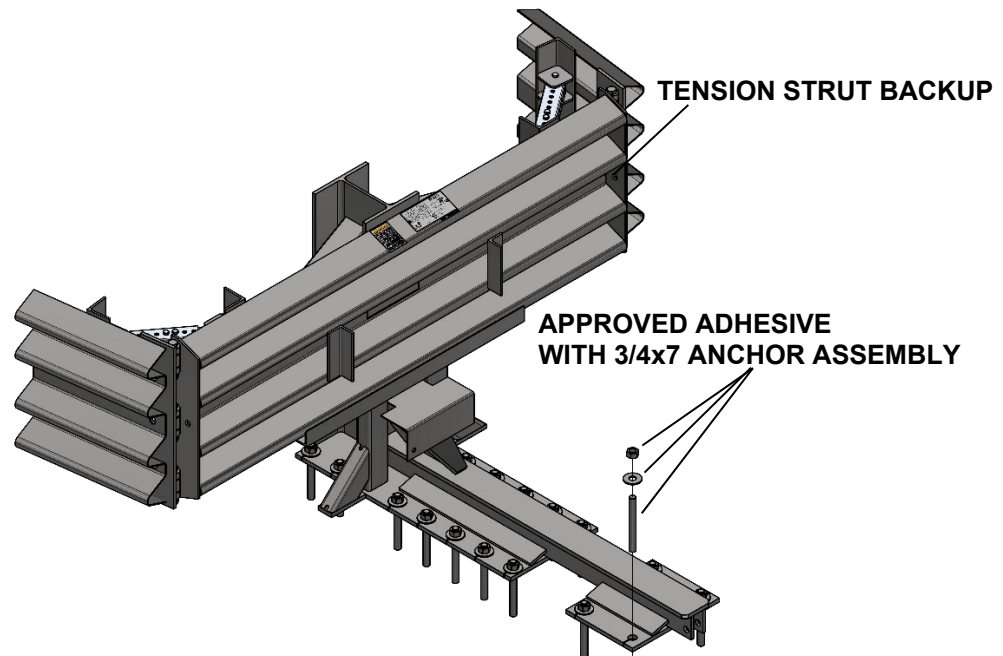
## 2) Anchor the Tension Strut Backup (Figure 14)

Place Tension Strut Backup and Monorail on foundation with side of Backup and Monorail on the construction line and rear edge of backup mounting pad 4" forward of foundation edge (p. 26). **Verify that any applicable Transition Panels fit properly before anchoring Backup.** Drill 7/8" [22 mm] diameter by 5 3/4" [145 mm] anchor boreholes in foundation using the Backup as template. Anchor the Backup to the concrete foundation using an approved adhesive supplied with the QuadGuard® M Wide.

**Note:** Verify that any applicable Transition Panels fit properly before anchoring Backup.



**Caution:** Every hole in the Backup and Monorail must be anchored by a stud using an approved adhesive.



**Figure 14**  
**Anchoring Tension Strut Backup to Foundation**

## 3) Anchor the Monorail

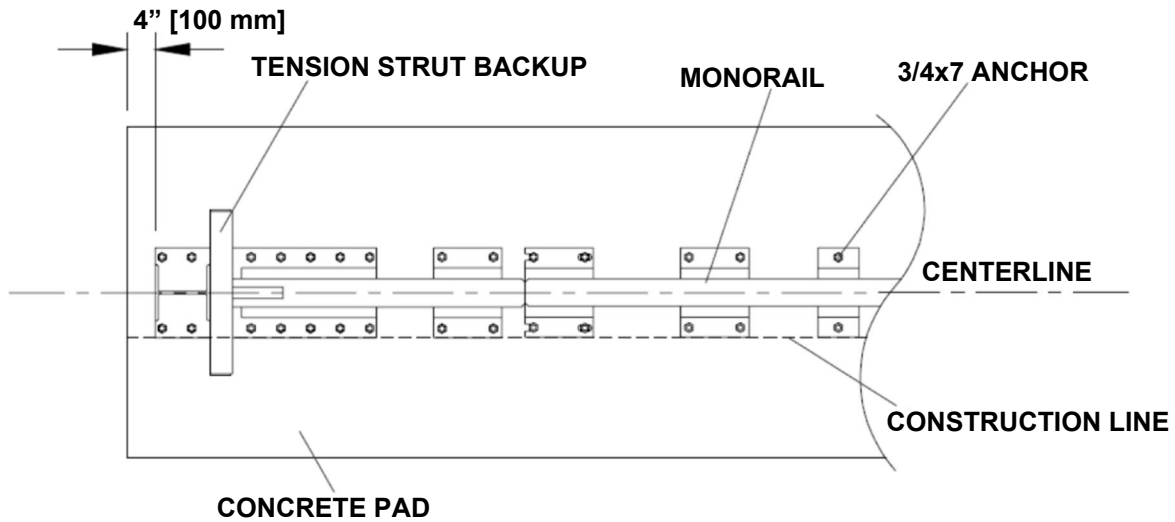
### Monorail Placement for Tension Strut Backup (Figure 15)

Place Monorail on foundation with side of Monorail on construction line. Orient the Monorail so the Monorail tongue faces the Backup and inserts into the backup monorail.



**Warning:** Improper alignment at the Monorail splice joints may prevent proper system collapse during an impact (p. 26, Detail A).

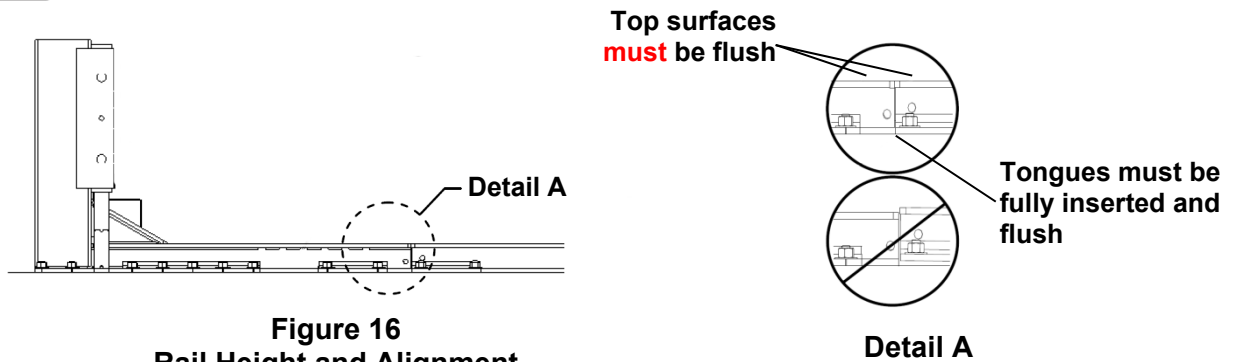
It is important to align each segment of Monorail from the back to the front of the system within ( $\pm 1/4$ " [6 mm]) along the length. Anchor each Monorail section using the Valtir approved adhesive kits provided.



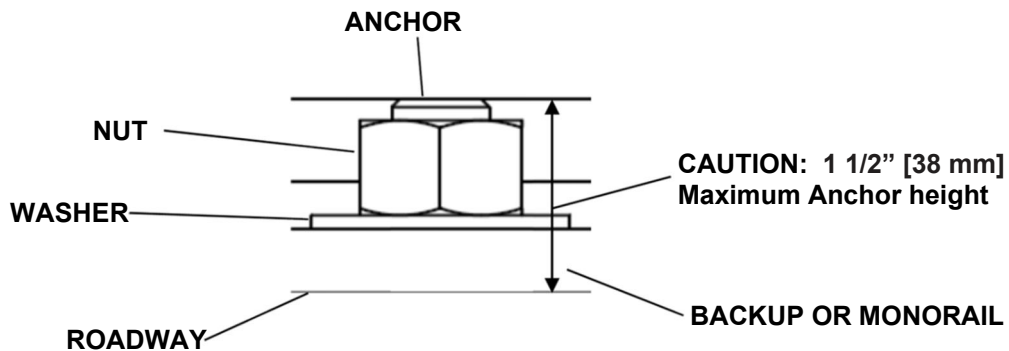
**Figure 15**  
**Backup and Monorail Location for Tension Strut Backup**



**Important:** Drill 7/8" [22 mm] diameter by 5 3/4" [145 mm] boreholes using the Monorail as a template. Do not drill through foundation.



**Figure 16**  
**Rail Height and Alignment**



**Figure 17**  
**Final Anchor Height**  
**(After Applied Torque)**

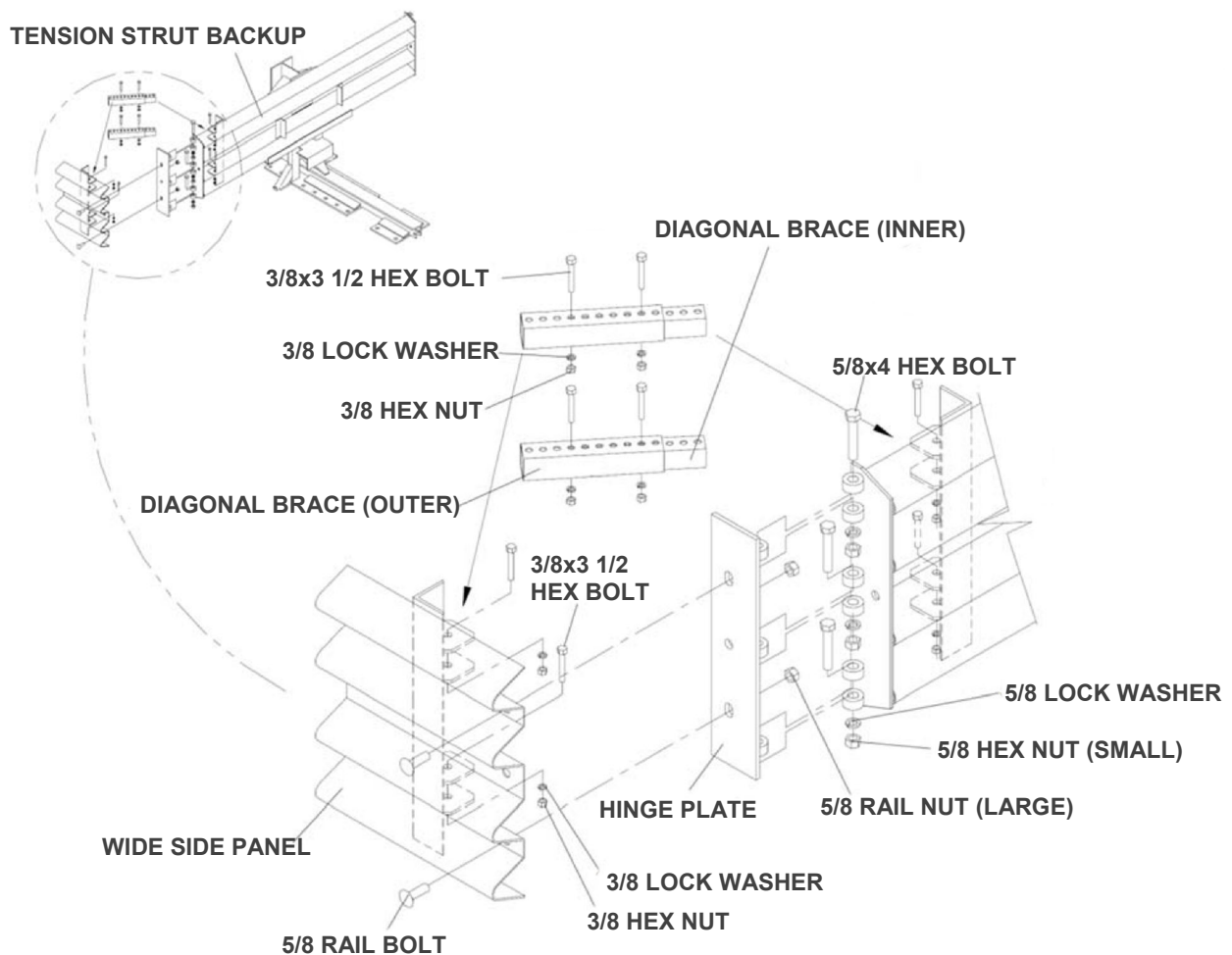
#### 4) Attach Side Panels and/or Transition Panels to Backup Assembly

- A. Attach Hinge Plates to Backup (three (3) places on each side of Backup) using a 5/8" rail bolt, lock washer, and hex nut.
- B. Attach Transition Panel or Side Panel to Hinge Plate using a 5/8" rail bolt and rail nut (two places - top and bottom holes only). See Backup Assembly drawing(s) below.
- C. Attach diagonal brace to Side Panel or transition and Backup using 3/8" a hex bolt, lock washer, and hex nut (two (2) places per brace and four (4) places per side).
- D. Secure each diagonal brace set in two (2) places with a 3/8" hex bolt, lock washer, and hex nut (Figure 18).

**Note:** A Side Panel is unnecessary when a Transition Panel is used.

#### **Assembly Tip:**

Use a drift pin to align the center hole of the Side Panel with the center hole of the Backup before inserting the Rail Bolts.



**Figure 18**  
**Side Panel/Transition Panel Attachment**

## 5) Attach Monorail Guides

Attach Monorail guides to Diaphragm as follows:

Insert 3/4x2" G8 hex bolt through Monorail guide and Diaphragm with a shim placed between them and oriented as shown in Figure 19. Secure with 3/4" lock washer and 3/4" hex nut (typical 4 places). See the Diaphragm Assembly drawing supplied with the system.

Repeat process for each Diaphragm.

## 6) Attach Diaphragms

Orient the widest Diaphragm so that the front face of the Diaphragm shape faces toward the Nose of the system as shown in Figure 20. The widest Diaphragm must be attached closest to the Backup with each subsequent Diaphragm being progressively narrower.



**Important:** Slide the widest Diaphragm all the way to the Backup to ensure the system is able to collapse properly during impact. Once verified, slide the Diaphragm forward to 36" [914 mm] in front of the Backup.

Orient and slide all other Diaphragms onto Monorail and position each approximately as shown in Figure 21.

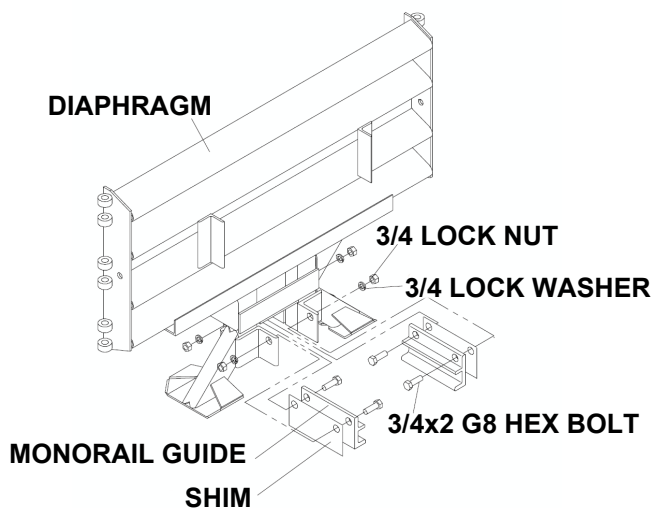


Figure 19  
Monorail Guide Attachment

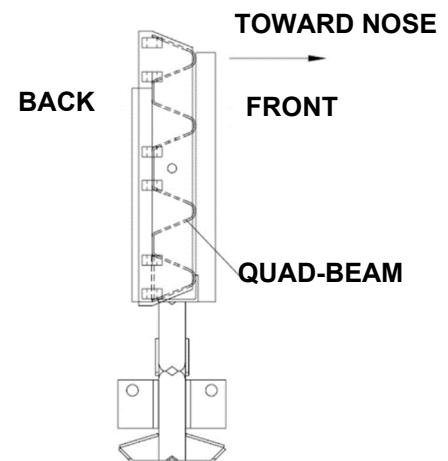


Figure 20  
Diaphragm Orientation

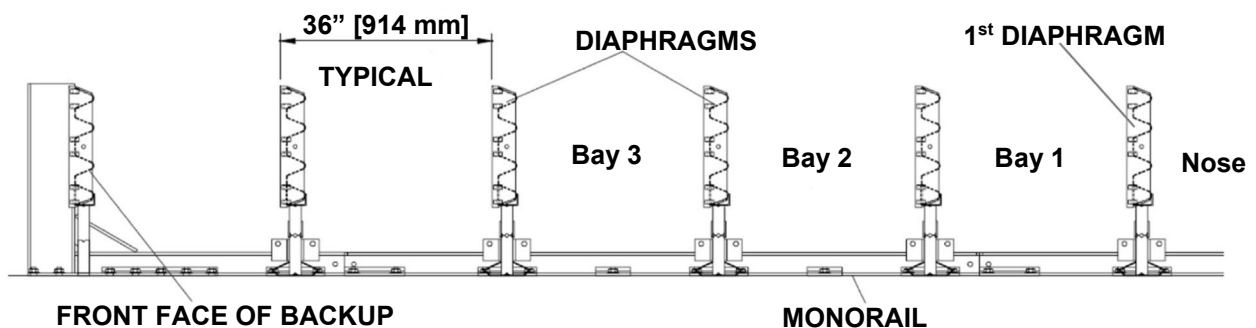


Figure 21  
Diaphragm Spacing

## 7) Attach Hinge Plates to Diaphragm

Attach Hinge Plates to each Diaphragm so the hinge pivot is toward the front of the system. Insert 5/8"x4" hex bolts through all hinges. Secure each bolt with 5/8" lock washer and heavy hex nut (Figure 22). (Typical three places per side on Diaphragms 2-6) Insert Full Length Pin and secure with 1/4x1" bolt and hex nut on 1<sup>st</sup> Diaphragm (Figure 23). See pages 48 and 49 for additional information.

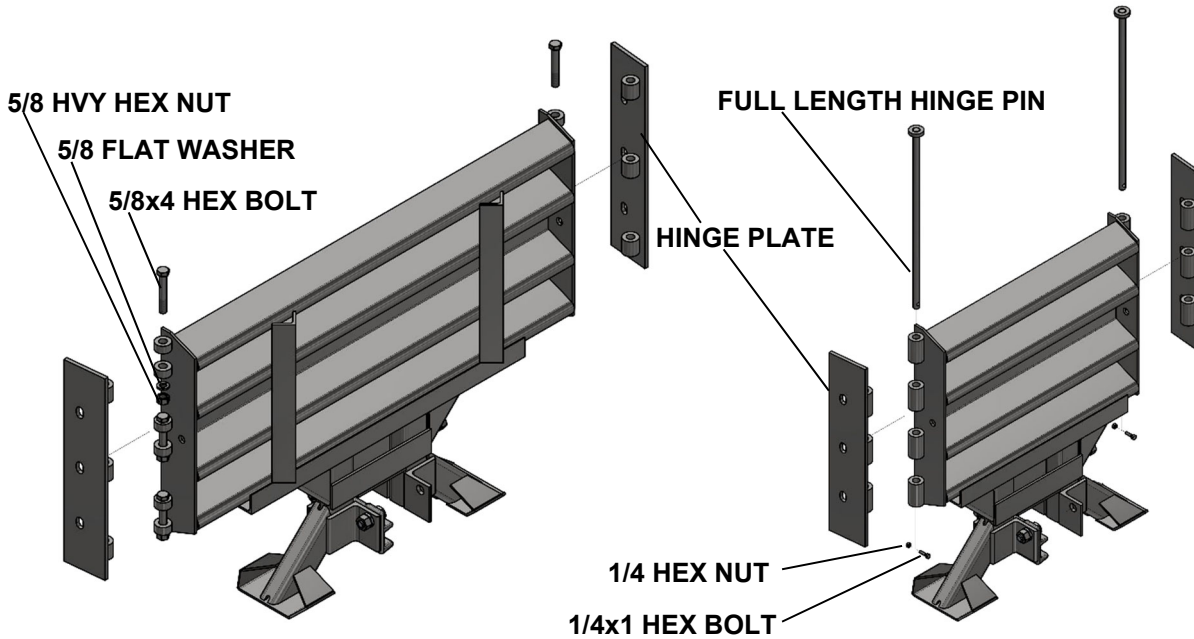


Figure 22 - Hinge Plate Diaphragms 2-6

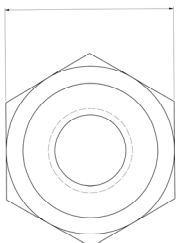
Figure 23 - Hinge Plate 1<sup>st</sup> Diaphragm

## 8) Attach Fender Panels



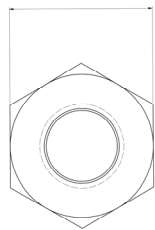
**Important:** Do not mix the 5/8" rail nuts (larger) with the 5/8" heavy hex nuts (smaller) (Figure 24).

1 1/4" [32 mm]



RAIL NUT W/RECESS  
(LARGER)

1 1/16" [27 mm]



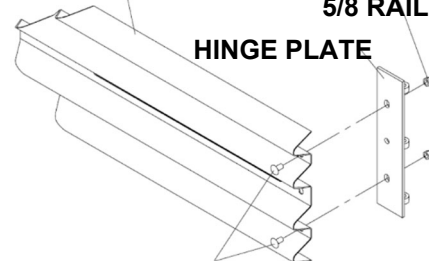
HVY HEX NUT  
(SMALLER)

Figure 24  
Rail Nuts are Oversize



**Important:** For proper impact performance, Wide systems must use Hinge Plates.

FENDER PANEL



5/8 RAIL BOLTS

Figure 25 - Hinge Plate to Panel



**Note:** Starting at the Backup, attach left and right Fender Panels shown below in Step(s) 4 & 5 with each tapered end pointing toward the rear of the system.

**Step 1**

Place the Fender Panel so that the center of the slot of the backup Hinge Plate is lined up with the approximate center of the slot in the Fender Panel.

Attach Mushroom Washer Assembly as shown in Figure 26, Detail A, and B. Do not tighten fasteners at this time. This first step helps balance the Fender Panel.

**Step 2**

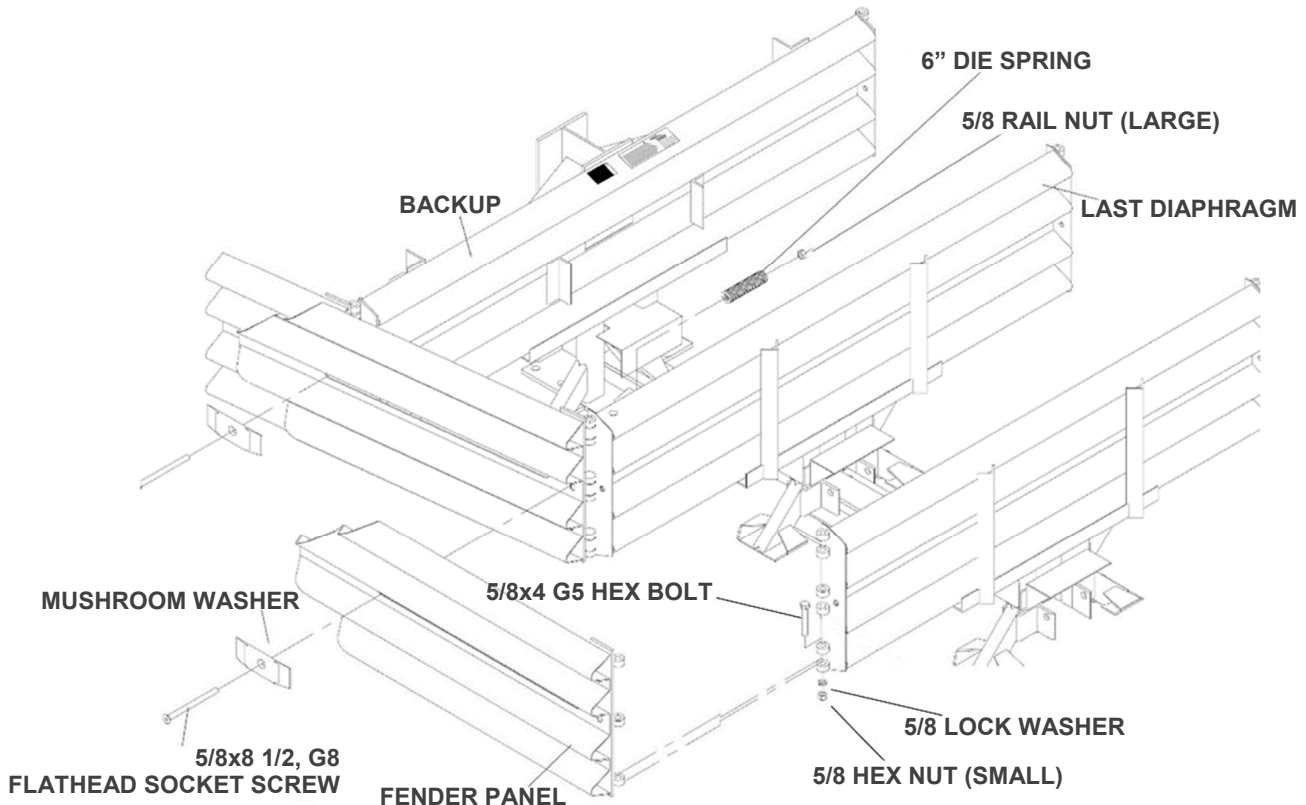
Slide the Fender Panel forward until the holes in the Fender Panel line up with the holes in the forward Diaphragm Hinge Plate.

**Step 3**

Use a drift pin to align the center hole of the Fender Panel with the center hole of the Diaphragm Hinge Plate.

**Step 4**

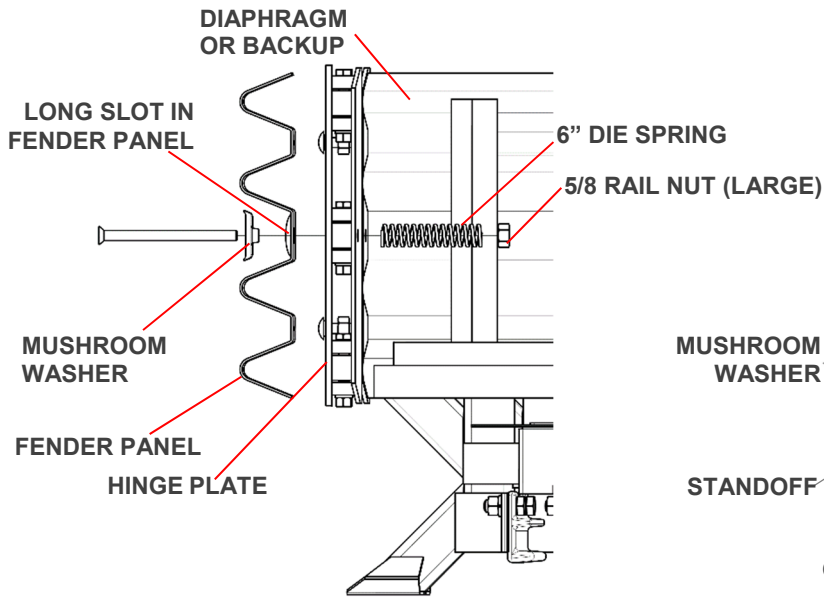
Attach the front of the Fender Panels to the next Diaphragm Hinge Plate using two (2) rail bolts and large hex nuts per side. Use only the top and bottom holes and leave the center hole open until the next Fender Panel is attached.



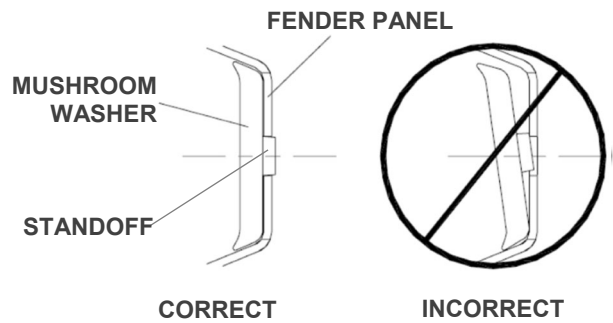
**Figure 26**  
**Wide Fender Panel Assembly**

### Step 5

The Mushroom Washer must lay flat against the Fender Panel with its standoff completely through the Fender Panel slot (Detail B).



**Detail A**  
**Mushroom Washer Attachment**



**Detail B**  
**Mushroom Washer Orientation**



**Important:** Starting from the Backup, attach and tighten each Bay section one at a time.

### Step 6

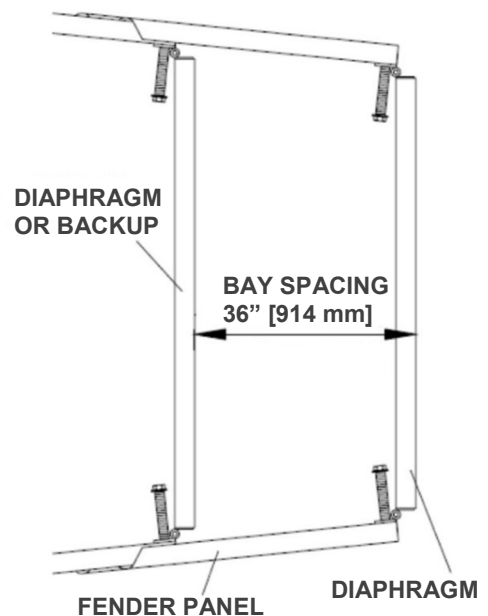
Check Diaphragm spacing to ensure 36" [914 mm] between rear faces of consecutive Diaphragms as shown in Fender Panel assembly drawing (Figure 27).

### Step 7

Once proper spacing has been achieved, tighten the Mushroom Washer Assembly (small hex) nut until it reaches the end of the screw threads.

Assemble the remaining Diaphragms and Fender Panels following the same procedure.

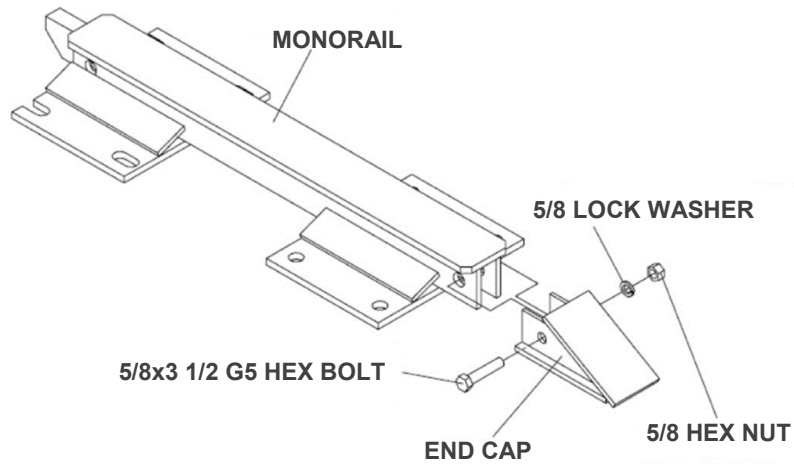
Tighten rail nuts (large hex) at the front of the Fender Panels. Ensure the rail bolt shoulder is seated within the Fender Panel slot.



**Figure 27**  
**Proper Diaphragm Spacing**

**9) Attach End Cap**

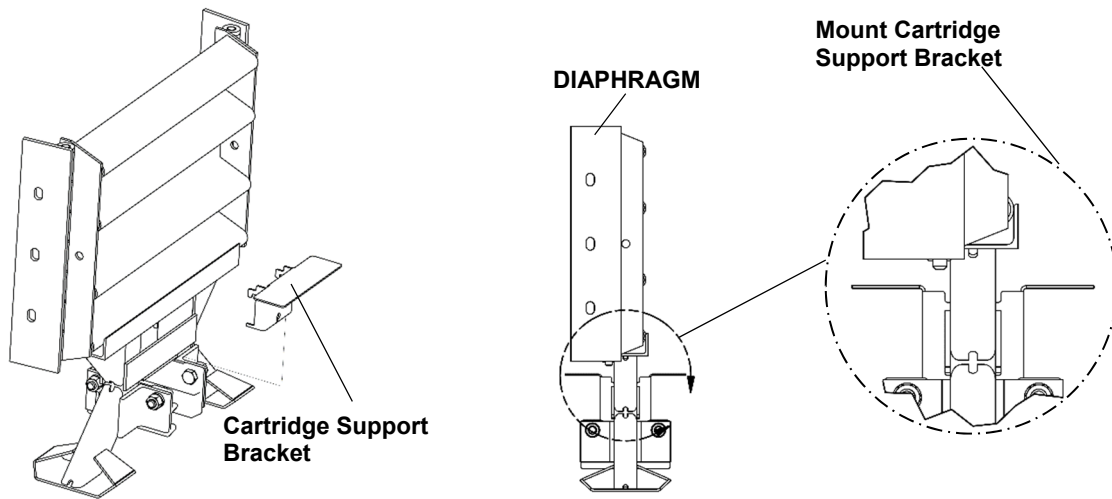
Attach the End Cap to the front of the first Monorail segment, as shown below and the Monorail Assembly drawing.



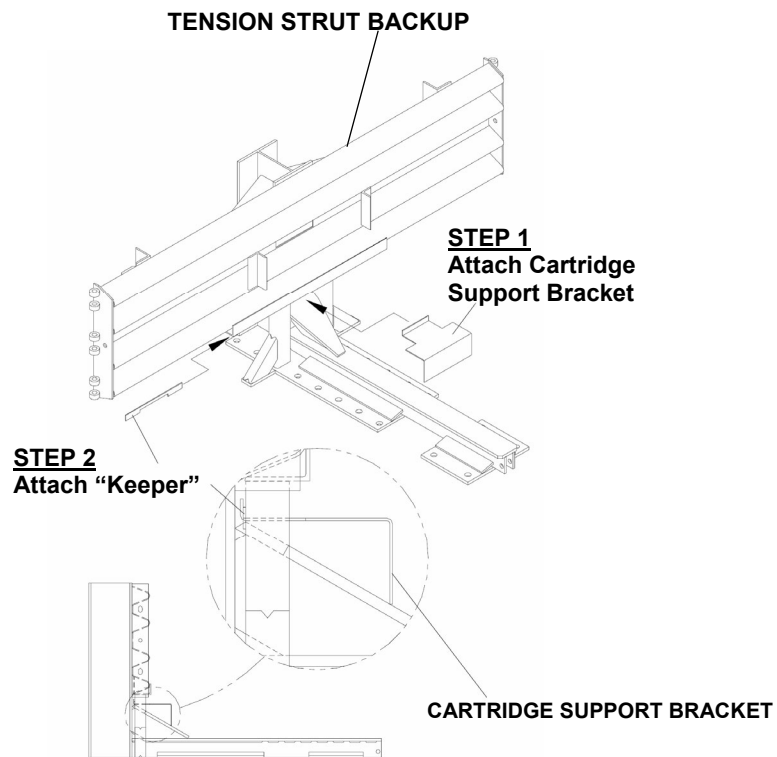
**Figure 28**  
**Monorail End Cap Attachment**

### 10) Attach Lower Cartridge Support Brackets

Attach lower Cartridge Support Bracket to the front and back of all Diaphragms and also to the front of the Backup as shown below.

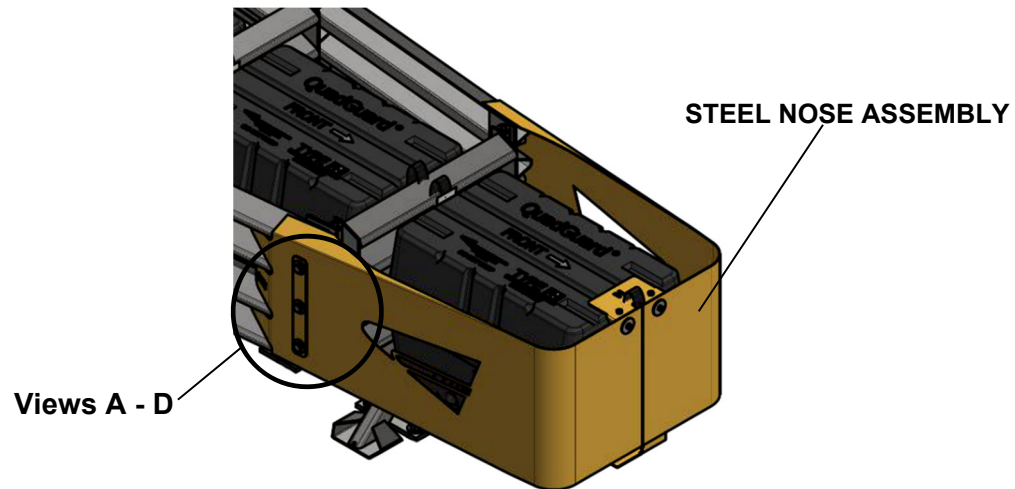


**Figure 29**  
**Lower Cartridge Support Bracket Assembly**



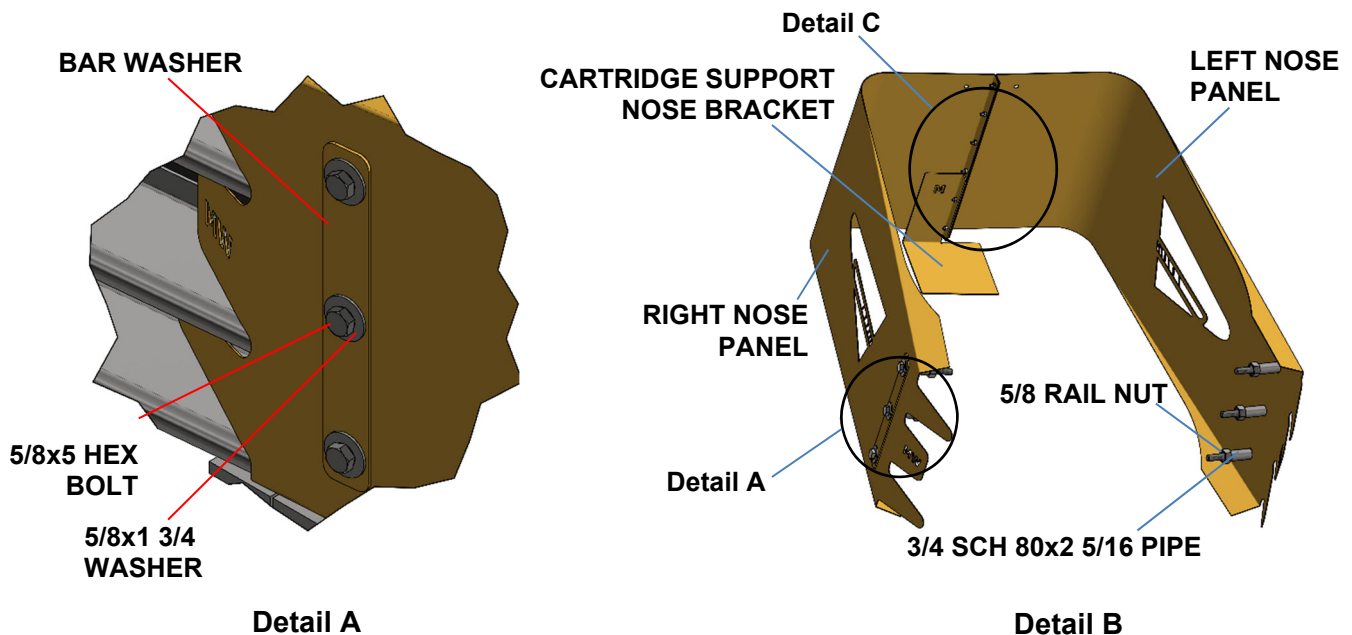
**Figure 30**  
**Cartridge Support Bracket Assembly**  
**(Tension Strut Backup)**

## 11) Nose Assembly

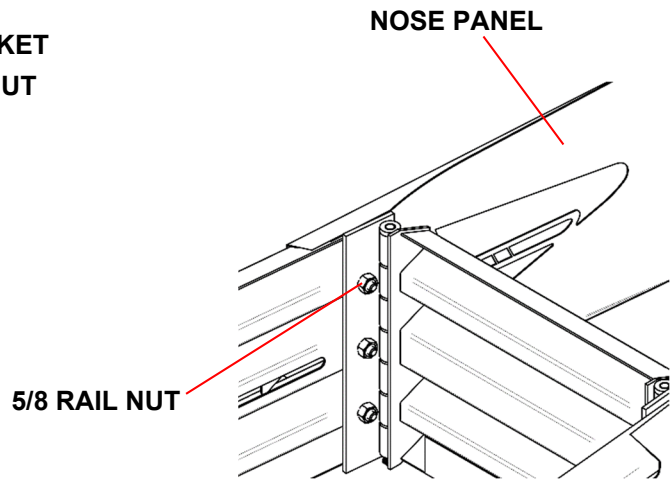
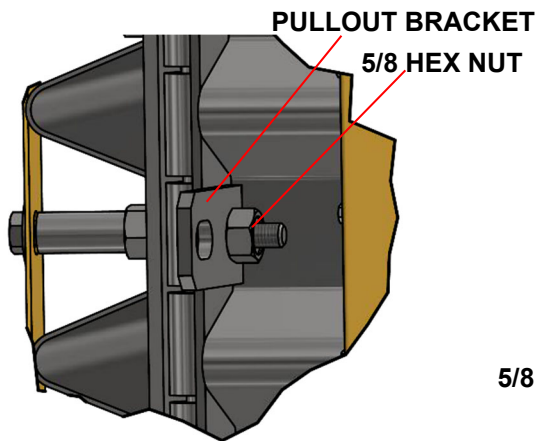
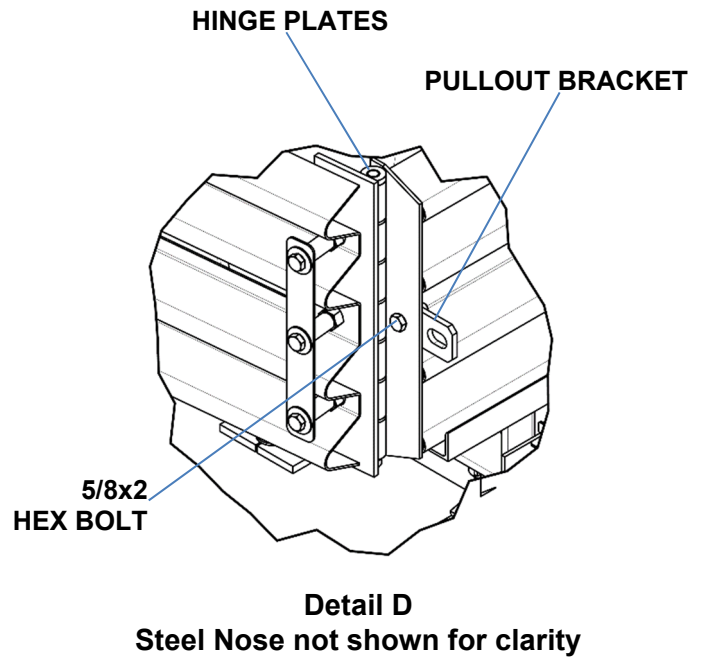
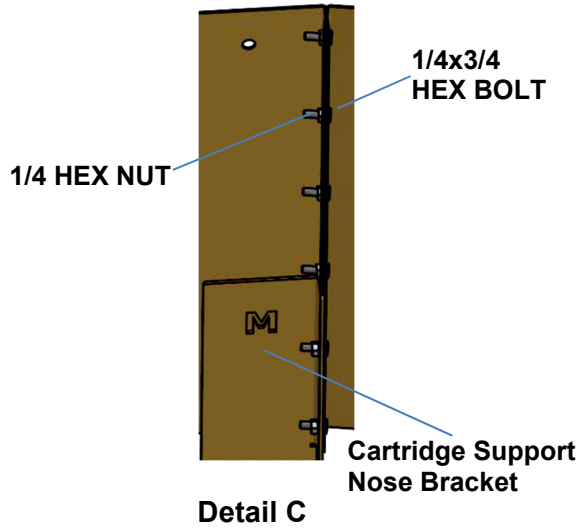


**Figure 31**  
**NOSE ASSEMBLY (p. 54)**

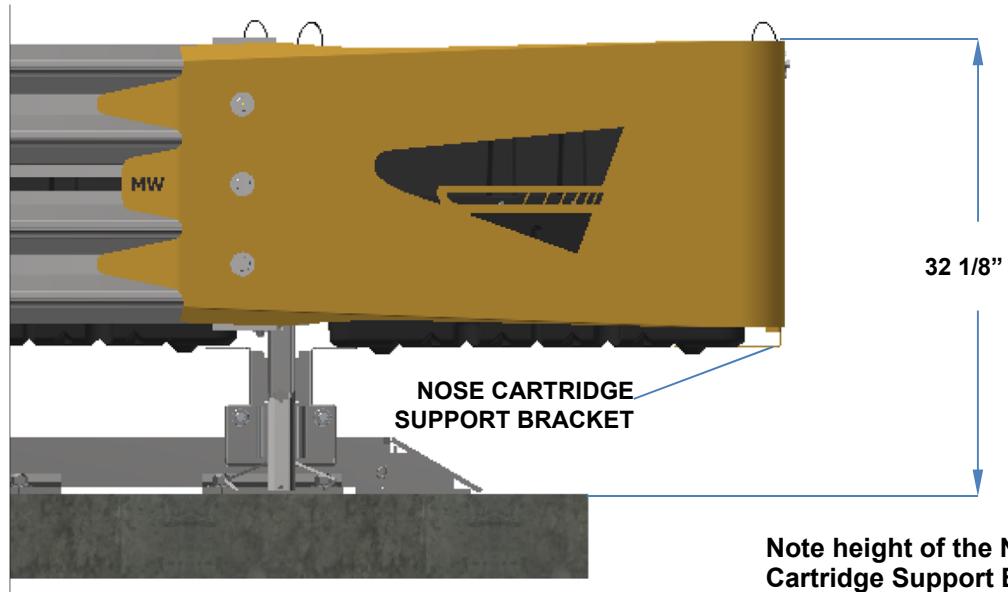
- A. Pre-assemble each Nose Assembly half with 5/8x5" hex bolt, 5/8x1 3/4" flat washer, bar washer, 3/4" schedule 80 pipe, and 5/8" rail nut (three (3) places per half (Detail A & B)). Tighten.
- B. Join both pre-assembled Nose halves with Cartridge Support Nose Bracket using 1/4x3/4" hex bolts and nuts in six (6) places (Detail B & C). Tighten.
- C. Fasten Pull-Out Brackets to front Diaphragm with 5/8x2" hex bolts and rail nuts. Tighten (Detail D & E).
- D. Attach Nose to Fender Panel and Diaphragm Hinge Plates with 5/8" rail nuts. Adjust Nose assembly height so top front Nose is 32 1/8" above the concrete pad. Tighten all six (6) nuts (Detail F & G).
- E. Install Type I Cartridge insuring directional arrow is pointing to front of system.
- F. Attach Hold Down Bracket to front of Nose with 5/8" fasteners (p. 36).







Note: Detail G shows proper placement of Nose Cartridge Support Bracket.



Detail G

Note height of the Nose Cartridge Support Bracket. The Nose Cartridge sits at the same level as the other Cartridges to the rear.

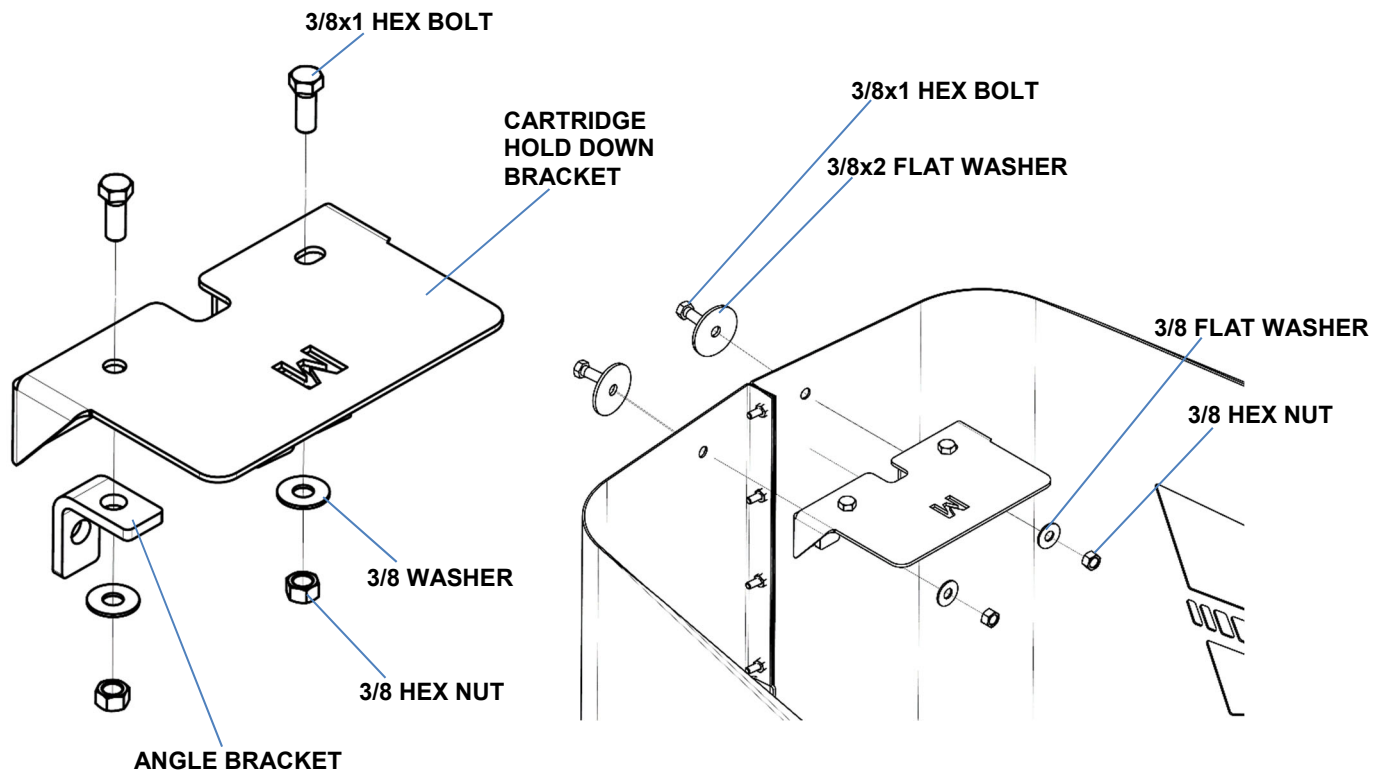


Figure 32  
Hold Down Bracket Assembly

## 12) Checking the System Assembly

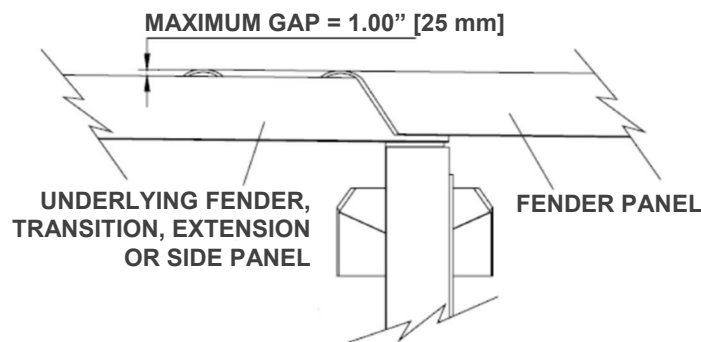
Ensure all fasteners are properly tightened throughout the system (anchor bolts, etc.). See torque requirements below. Check all Fender Panels. If they do not fit tightly against the underlying Panel, system realignment may be necessary (Figure 33).



**Important:** Top of Steel Nose is 32 1/8" above grade (p. 36).



Warning	
Anchor Torque and Clearance Requirements	
Torque Requirements – 100 ft-lb. Anchor clearance above nuts – Figure 17, p. 26	
Fender Panel Critical Clearances	
Fender Panel Gap Wide – 1.00" [25 mm]	



**Figure 33**  
**Fender Panel Gap**

## 13) Cartridge Placement

The Nose Cartridge must be the same height as every other Cartridge. To complete the assembly of a QuadGuard® M Wide, place the appropriate Cartridge in each Bay of the system. Type I Cartridges are placed toward the front (Nose) of the system; Type II Cartridges are placed toward the rear (Backup) of the system (p. 22).



**Warning:** Placing the wrong Cartridge in the Nose or Bay(s) could result in unacceptable crash performance per MASH criteria and cause serious injury or death to occupants and/or bystanders in the event of a vehicle impact.



**Important:** The QuadGuard® M Wide is a six (6) Bay configuration.

## **QuadGuard® M Wide Final Inspection Checklist**

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

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

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

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

- Clearance of 30" behind rear Fender Panels for stroke (p. 17)
- Anchor nuts are torqued to 100 ft-lb. (p. 19)
- Cartridges are level and the same height in each Bay (p. 22)
- Correct Cartridge is placed in each Bay and pointing to front of system (p. 22)
- Every hole and slot in Backup and Monorail is anchored (pp. 25 - 26)
- If no transition, side panels at backup are required (p. 27)
- Anchor stud(s) are 1.5" maximum above the pad) (p. 26)
- Monorail guides are attached to Diaphragms (p. 28)
- Diaphragm Shims installed between Diaphragm & Monorail guides (p. 28)
- Each Fender Panel has a tension Die Spring (p. 30)
- Mushroom Washers seated in slots (p. 31)
- Monorail has End Cap attached (p. 32)
- Front of the Nose assembly is 32 1/8" above concrete pad (p. 36)
- Nose Cartridge is at the same height as Bay Cartridges (p. 36)
- Cartridge Hold Down Bracket is secure and engaged with Nose Cartridge (p. 36)
- Fender Panel gap is maximum of 1.00" [25 mm] (p. 37)
- Bolts and nuts are properly tightened (p. 37)
- System is clear of debris

## **Maintenance and Repair**

### **Inspection Frequency**

Inspections for QuadGuard® M Wide 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) Is there is evidence of an impact? If so, perform a walk-up inspection.
- 2) Are Cartridges properly seated on the Support Brackets? All damaged Cartridges must be replaced.



**Warning:** See Cartridge placement instructions on page 22.

- 3) Steel Nose is properly attached and 32 1/8" above grade (p. 36).
- 4) Note the location and condition of the QuadGuard® M Wide and the date of visual drive-by inspection.

### **Walk-Up Inspection Checklist**

- Clear and dispose of on-site debris.
- Clear and remove excessive dirt from around the Monorail and Diaphragm feet.
- Bolts are tight and rust free.
- Anchor bolts are securely anchored.
- Diaphragm Legs are straight.
- All Mushroom Washer Assemblies are flat and properly seated through Fender Panel slot.
- Fender Panels and Transition Panels should nest tightly against the system.
- Cartridges have not been damaged and are properly seated on their Support Brackets. To ensure intended speed characteristics, partially crushed Cartridges (due to low speed impacts) must be replaced.
- Make all necessary repairs as described above. See Post-Impact Instructions for more information on next page.
- To determine if a product should be replaced or is potentially reusable, a trained engineer experienced in highway products and directed by the DOT, or other appropriate local highway authority, must be consulted.

## Post-Impact Instructions



**Important:** Valtir 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 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.

- 1) Deploy appropriate traffic-control devices.
- 2) Ensure all anchor bolts have remained firmly anchored in the roadway surface. Replace any loose, broken, or pulled out anchors.

**The performance of the system during an angle impact depends on a properly anchored Monorail.**

- 3) Clear and dispose of any debris on site.
- 4) Ensure the Mushroom Washer Assemblies are intact so the system can be restored to its original position.

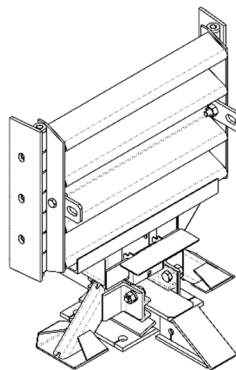


**Caution:** Use eye protection and gloves when refurbishing the Mushroom Washer Die Spring Assembly. Do not place fingers underneath an assembled Mushroom Washer. Parts may suddenly shift and fingers may be pinched. If the Die Spring is still under compression as the nut is nearing the end of the bolt, to prevent injury make sure that the Die Spring is restrained with a clamp so it does not suddenly release when the nut is removed from the Mushroom Washer Bolt.

- 5) The Diaphragm Support Legs are all properly attached to the Monorail.
- 6) Remove the Nose Assembly and attach a chain to the Pullout Brackets on the first Diaphragm (Figure 34). Attach both ends of chain to a heavy vehicle (such as a 1 ton pickup).



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



**Figure 34**  
**Pullout Brackets**



**Important:** Slowly pull the system forward to its original length. Have someone watch the repositioning to ensure undetected damage does not cause the Diaphragms to bind or pull out improperly.



- 7) Remove all crushed Cartridges.
- 8) All Diaphragms are in usable condition. Diaphragms which are bowed or have bent legs must be replaced.
- 9) Each Fender Panel is properly attached with Mushroom Washer Assemblies. Damaged Fender and Transition Panels must be replaced.

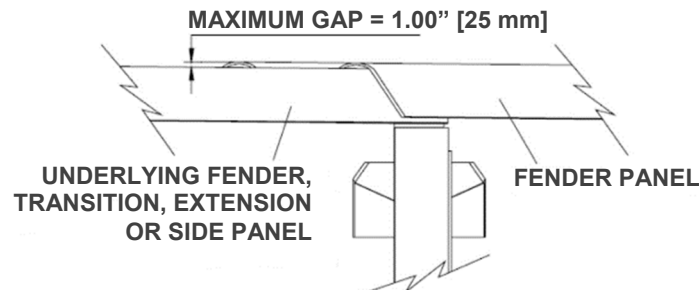


<b>Warning</b>	
<b>Anchor Torque and Clearance Requirements</b>	
Torque Requirements – 100 ft-lb. Anchor clearance above nuts – Figure 16, p. 26	
<b>Fender Panel Critical Clearances</b>	
Fender Panel Gap– 1.00” [25 mm]	

- 10) Check the **gaps between Fender Panels**. The maximum gap allowed for these overlapping parts (including Fender Panels overlapping Panels behind the system) is 1.00” [25 mm].



**Important:** Ensure the Mushroom Washer rail nuts are tightened to the end of the bolt threads. If the gaps between the Fender Panels are still too large, it may be necessary to replace bent parts.



**Figure 35**  
**Fender Panel Gap**

- 11) Replace all crushed Cartridges and damaged Cartridge Support Brackets. See Cartridge Placement on page 21.
- 12) Remove damaged Nose Assembly. Attach the new Nose to the first Diaphragm. See pages 33 - 35 and 53 for Nose attachment instructions.
- 13) All bolts on the system are adequately tight.
- 14) Site is free from debris.
- 15) The QuadGuard® M Wide is now ready for use.

## Parts Ordering Procedure

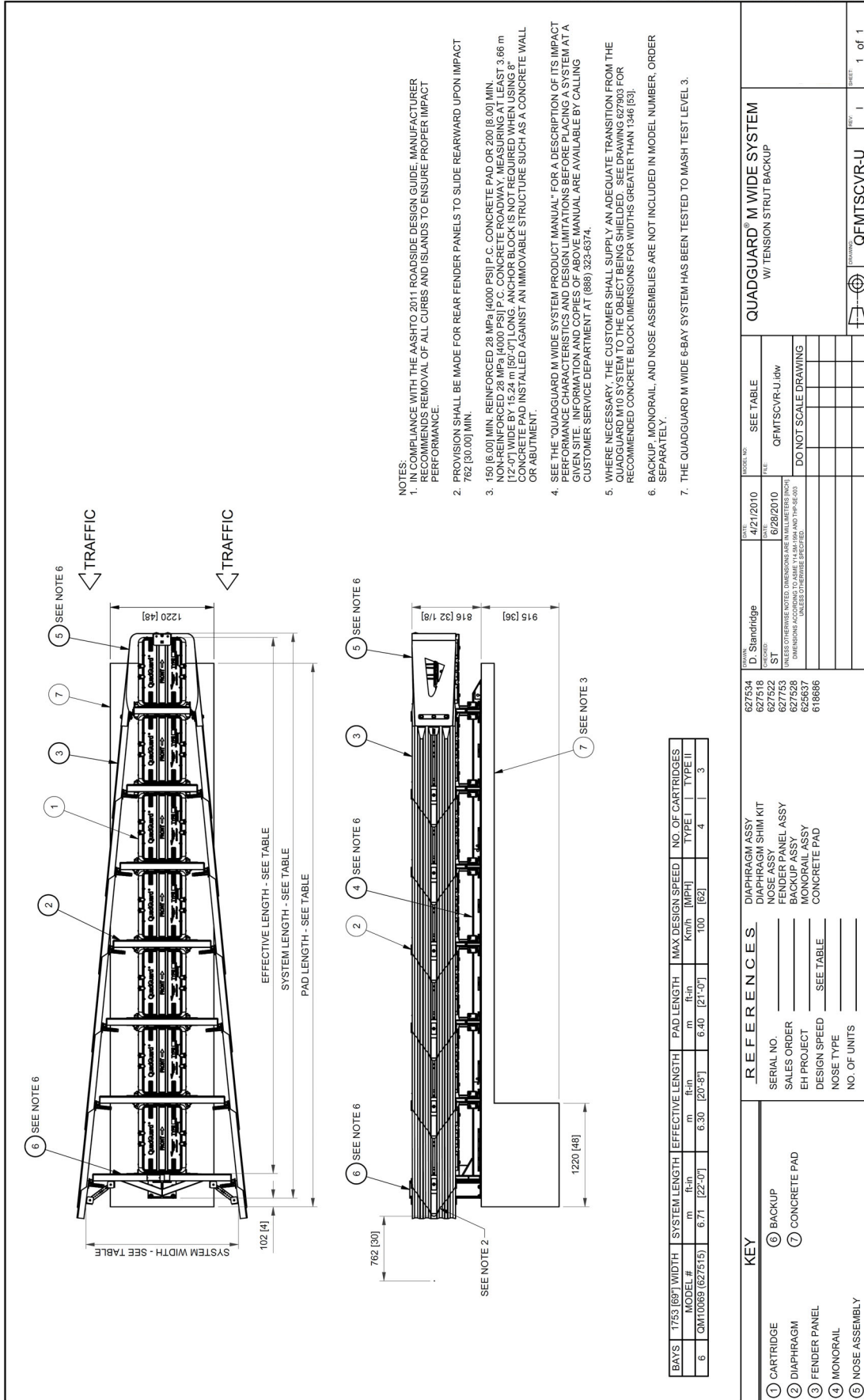
Make a list of all damaged parts from the System Assemblies section in this manual (p. 7 – 13). Answer the following questions in the spaces provided. This information is necessary to receive the proper parts.

QuadGuard® M Wide Ordering Information Chart		
Description:	Choices	Fill in this section
<p><b>Transition Panel Type?</b></p> <p>Transition Panel Types (pp. 14 &amp; 15). Include Transition options for both sides if necessary. How to Determine Left/Right is on page 23.</p>	<ul style="list-style-type: none"> <li>• Quad to W-Beam Guardrail</li> <li>• Quad to Thrie Beam Guardrail</li> <li>• Quad to Safety Shape Barrier</li> <li>• Quad to Single Slope Barrier</li> <li>• Quad to Vertical Concrete End Shoe</li> <li>• None</li> </ul>	



**Warning:** Use only Valtir parts that are specified herein for assembling, maintaining, or repairing the QuadGuard® M Wide. **Do not utilize or otherwise comingle parts from other Valtir 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.

# Drawings



- NOTES:
1. 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 OR 200 (8.00) MIN. NON-REINFORCED 28 MPa (4000 PSI) P.C. CONCRETE ROADWAY, MEASURING AT LEAST 3.66 m (12'-0") WIDE BY 15.24 m (50'-0") LONG. ANCHOR BLOCK IS NOT REQUIRED WHEN USING 8" CONCRETE PAD INSTALLED AGAINST AN IMMOVABLE STRUCTURE SUCH AS A CONCRETE WALL OR ABUTMENT.
  4. SEE THE 'QUADGUARD M WIDE SYSTEM PRODUCT MANUAL' FOR A DESCRIPTION OF ITS IMPACT PERFORMANCE. 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 M10 SYSTEM TO THE OBJECT BEING SHIELDED. SEE DRAWING 627803 FOR RECOMMENDED CONCRETE BLOCK DIMENSIONS FOR WIDTHS GREATER THAN 1346 [53].
  6. BACKUP, MONORAIL, AND NOSE ASSEMBLIES ARE NOT INCLUDED IN MODEL NUMBER, ORDER SEPARATELY.
  7. THE QUADGUARD M WIDE 6-BAY SYSTEM HAS BEEN TESTED TO MASH TEST LEVEL 3.

BAYS	1753 [69"]	WIDTH	SYSTEM LENGTH	EFFECTIVE LENGTH	PAD LENGTH	MAX DESIGN SPEED	NO. OF CARTRIDGES
MODEL #		ft-in	m	ft-in	m	Kmph [MPH]	TYPE I   TYPE II
6	QM10069 (627515)	6.71 [22'-0"]	6.30 [20'-8"]	6.40 [21'-0"]	6.40 [21'-0"]	100 [62]	4   3

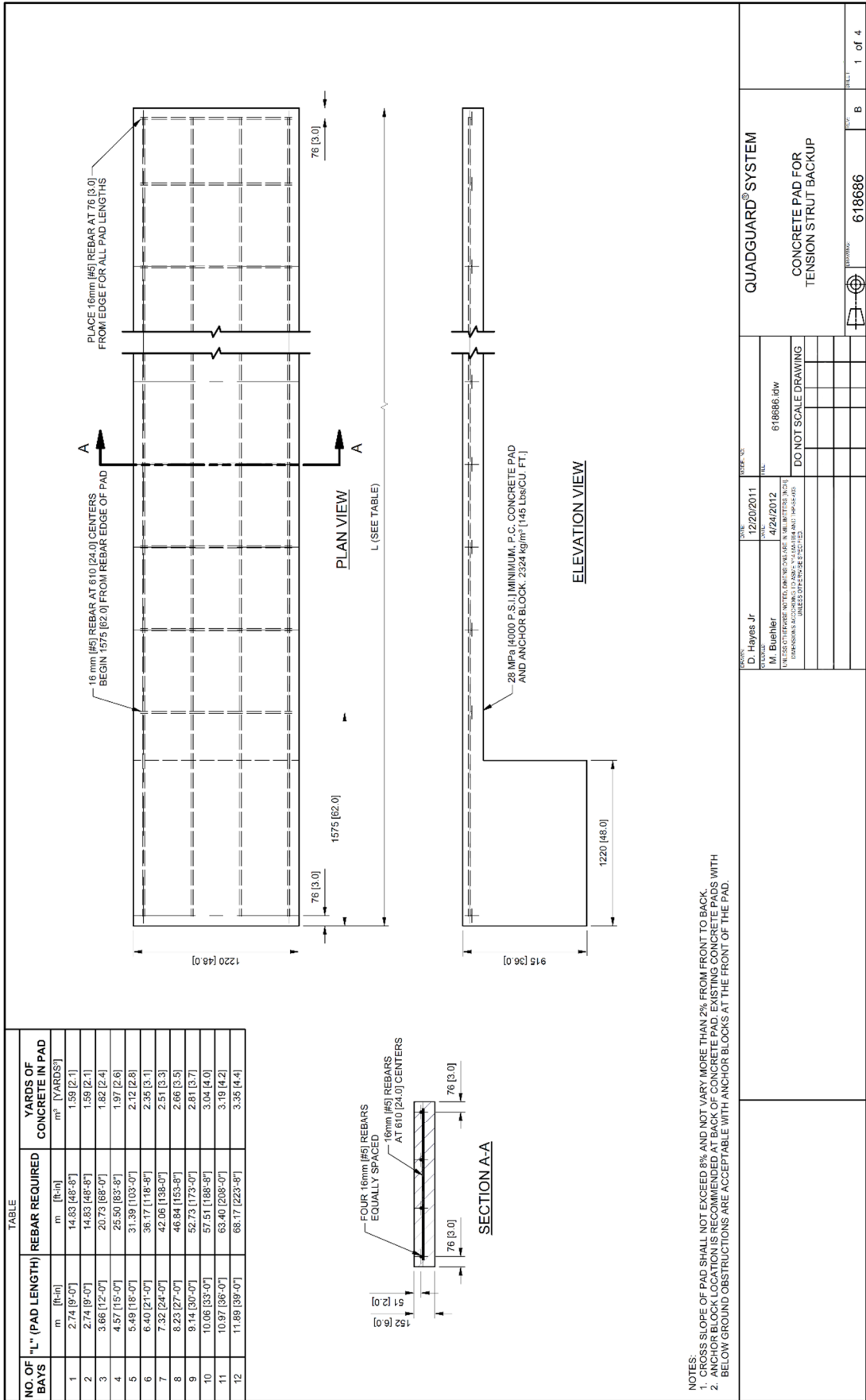
KEY	
1	CARTRIDGE
2	DIAPHRAGM
3	FENDER PANEL
4	MONORAIL
5	NOSE ASSEMBLY
6	BACKUP
7	CONCRETE PAD

REFERENCES	
SERIAL NO.	DIAPHRAGM ASSY
SALES ORDER	NOSE ASSY
EH PROJECT	FENDER PANEL ASSY
DESIGN SPEED	MONORAIL ASSY
NOSE TYPE	CONCRETE PAD
NO. OF UNITS	

REV.	DATE	DESCRIPTION
1	4/21/2010	ISSUED
2	6/28/2010	REVISED

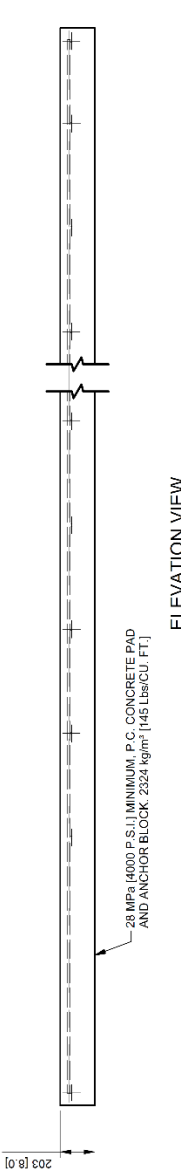
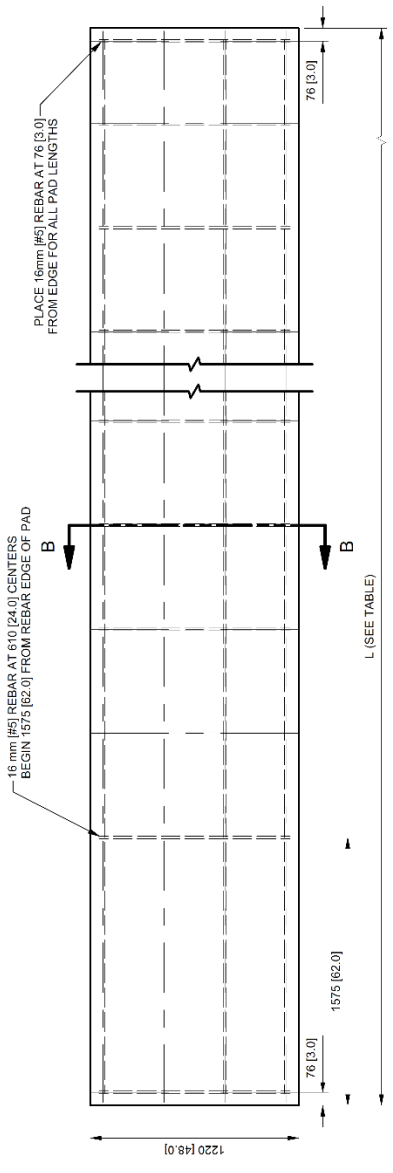
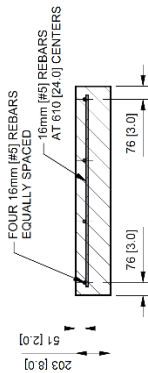
MODEL NO.	QUADGUARD® M WIDE SYSTEM
FILE	W/ TENSION STRUT BACKUP
FILE	QFMTSCVR-U.idw
DO NOT SCALE DRAWING	

**QuadGuard® M Wide Tension Strut Backup QFMTSCVR-U**



Concrete Pad 618686

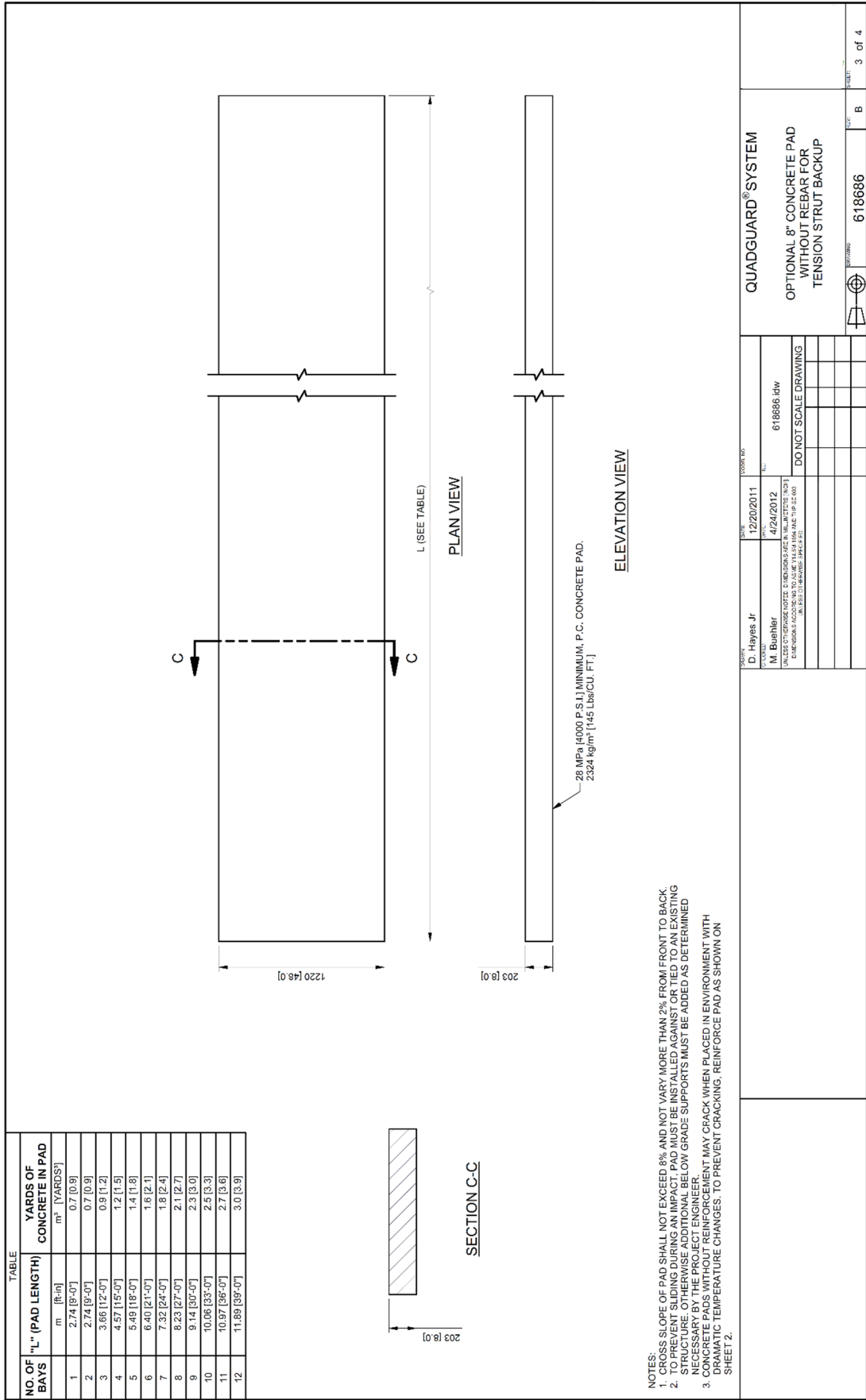
NO. OF BAYS	TABLE		YARDS OF CONCRETE IN PAD
	"L" (PAD LENGTH)	REBAR REQUIRED	
	m [ft-in]	m [ft-in]	m <sup>3</sup> [YARDS <sup>3</sup> ]
1	2.74 [9'-0"]	14.83 [48'-8"]	0.7 [0.9]
2	2.74 [9'-0"]	14.83 [48'-8"]	0.7 [0.9]
3	3.66 [12'-0"]	20.73 [68'-0"]	0.9 [1.2]
4	4.57 [15'-0"]	25.50 [83'-8"]	1.2 [1.5]
5	5.49 [18'-0"]	31.39 [103'-0"]	1.4 [1.8]
6	6.40 [21'-0"]	36.17 [118'-8"]	1.6 [2.1]
7	7.32 [24'-0"]	42.06 [138'-0"]	1.8 [2.4]
8	8.23 [27'-0"]	46.84 [153'-8"]	2.1 [2.7]
9	9.14 [30'-0"]	52.73 [173'-8"]	2.3 [3.0]
10	10.06 [33'-0"]	57.51 [188'-8"]	2.5 [3.3]
11	10.97 [36'-0"]	63.40 [208'-0"]	2.7 [3.6]
12	11.89 [39'-0"]	68.17 [223'-8"]	3.0 [3.9]



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.

QUADGUARD <sup>®</sup> SYSTEM OPTIONAL 8" CONCRETE PAD WITH REBAR FOR TENSION STRUT BACKUP		PROJECT NO. 618686 SHEET 2 of 4
DRAWN BY: D. Hayes Jr. CHECKED BY: M. Buehler DATE: 12/20/2011 DATE: 4/24/2012 FILE: 618686.dwg	DO NOT SCALE DRAWING	QUADGUARD <sup>®</sup> SYSTEM OPTIONAL 8" CONCRETE PAD WITH REBAR FOR TENSION STRUT BACKUP

TS Concrete Pad 8" w/Rebar 618686



**TS Concrete Pad 8" wo/Rebar 618686**



PARTS LIST			
ITEM	DESCRIPTION	QTY	UNIT
1	BACKUP, TS, WIDE, W/DECAL		
2	PANEL, SIDE, OG, WIDE, G		
3	BOLT, HK, 3/8X3 1/2, ALL, THREAD, GS, G		
4	NUT, HK, 3/8, G		
5	WASHER, LOCK, 3/8, G		
6	ANCHOR KIT, HILT, 1.350ml, 3/4X7 (4)		
7	NUT, HK, 5/8, G, RAIL		
8	BOLT, RAIL, 5/8X2, G		
9	BOLT, HK, 5/8X4, GS, G		
10	WASHER, LOCK, 5/8, G		
11	5/8" HVY HEX NUT A563A		
12	HINGE PLATE, FENDER, PANEL, OG		
13	TEL ST, 1 3/4X1 3/4X1 1/2, GA, X10, HAS, G		
14	TEL ST, 2X2X1/2, GA, X10, HAS, G		
15	BRACKET, CART, SUPT, TS, BU, OG		
16	LOCKING BAR, CARTRIDGE, SUPT, OG		

TABLE			
SYSTEM	WIDTH	7" ANCHOR	18" ANCHOR
OG, QGH, QGHS	69"	604596	626520
OG, QGH, QGHS	90"	604599	626521
OG, M, WIDE	69"	627512	N/A
			627523

QUADGUARD FAMILY

## Tension Strut Backup 627528

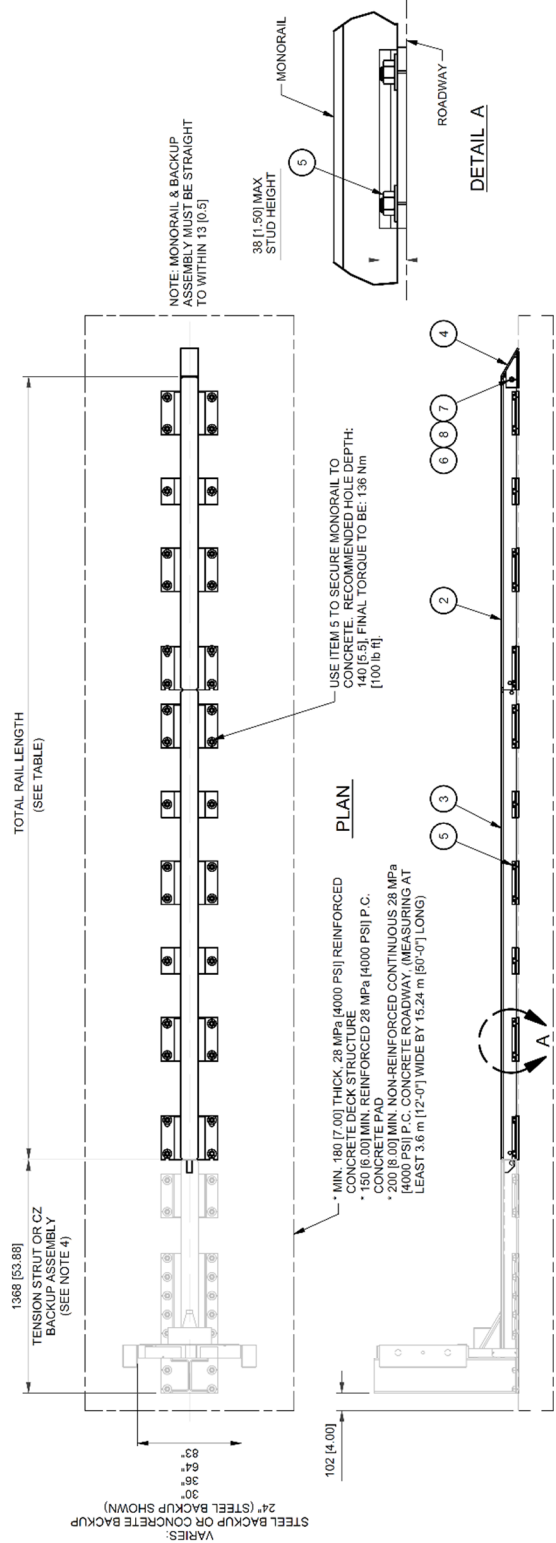
DESIGNER: D. Kohfeld CHECKER: B. Eckert <small>LINE IS NOT TO BE USED FOR ORDERING. FOR MATERIALS, CONTACT THE SALES DEPARTMENT. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED.</small>	DATE: 2/18/2020 DATE: 2/25/2020 FILE: 627528.dwg DO NOT SCALE DRAWING
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<b>QUADGUARD® FAMILY</b> BACKUP ASSEMBLY, TENSION STRUT	
PART NO: 627528	REV: 1 of 2

TABLE			
NO. OF BAYS	ASSY NO. W/ 7" ANCHORS	ASSY NO. W/ 18" ANCHORS	ASSY NO. W/O ANCHORS
1	611367	611367	611367
2	611332	626525	627543
3	611334	626526	627544
4	611340	626527	627545
5	611343	626528	627546
6	611348	626529	627548
7	611353	627559	627549
8	611354	627560	627550
9	611355	627561	627551
10	611329	627562	627552
11	611330	627563	627553
12	611331	627564	627554

ITEM	DESCRIPTION	TOTAL RAIL LENGTH
1	MONORAIL, 1 BAY, QG, G	0
2	MONORAIL, 2 BAYS, QG	915 [36.5]
3	MONORAIL, 3 BAYS, QG	1830 [72.0]
4	MONORAIL, 4 BAYS, QG	2745 [108.1]
5	ANCHOR KIT, H/LTI, 330ml, 3/4x7, (4)	3660 [144.1]
6	BOLT, HX, 5/8X3 1/2, G5, G	4575 [180.1]
7	WASHER, LOCK, 5/8, G	5490 [216.1]
8	5/8" H/VT HEX NUT A563A	6405 [252.1]
9		7320 [288.2]
10		8235 [324.2]
11		9150 [360.2]
12		10065 [396.2]



NOTES:

- MONORAIL (S) (ITEM 1, 2 AND 9) AS TEMP. ATE(S) TO LOCATE ANCHOR BOLTS (ITEM 5). SEE SHEET 2.
- CONCRETE PAD SHALL NOT EXCEED 8% AND NOT VARY MORE THAN 2% FROM FRONT TO BACK.
- EVERY STUD MUST BE EMBEDDED TO A DEPTH OF 140 (5.5). IF REBAR IS ENCOUNTERED IN A P.C. CONCRETE PAD, DRILL THROUGH IT. IF REBAR IS ENCOUNTERED ON A DECK STRUCTURE, ASK PROJECT ENGINEER FOR DIRECTION.
- FOR CZ SYSTEMS, SEE DRAWING 35-40-24.

PARTS LIST		QUADGUARD® SYSTEM	
ITEM	DESCRIPTION	MONORAIL ASSY, QG	
1	MONORAIL, 1 BAY, QG, G		
2	MONORAIL, 2 BAYS, QG		
3	MONORAIL, 3 BAYS, QG		
4	MONORAIL, 4 BAYS, QG		
5	ANCHOR KIT, H/LTI, 330ml, 3/4x7, (4)		
6	BOLT, HX, 5/8X3 1/2, G5, G		
7	WASHER, LOCK, 5/8, G		
8	5/8" H/VT HEX NUT A563A		

DATE	2/13/2020	DATE	2/18/2020
BY	W. Leedington	BY	B. Eckert
FILE	625637.dwg	FILE	625637.dwg
DO NOT SCALE DRAWING			

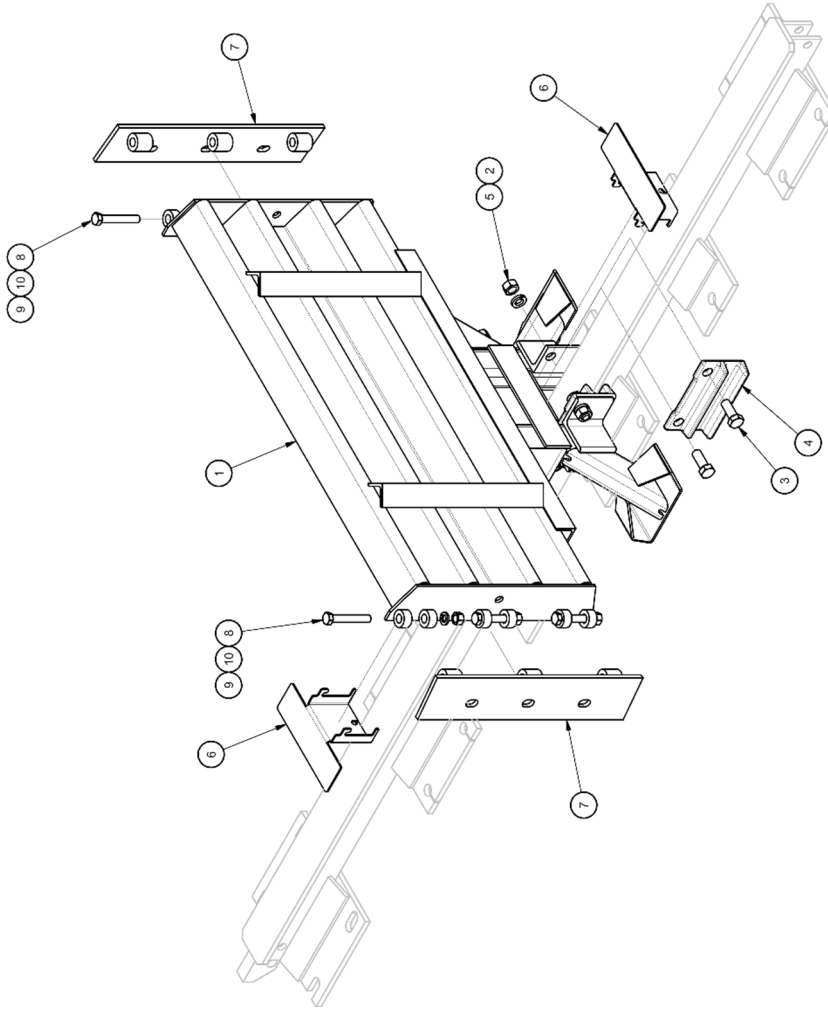
  

NO.	625637	REV.	A	1 of 2
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# Monorail Assembly 625637



ITEM	PARTS LIST DESCRIPTION
1	DIAPHRAGM DR
2	WASHER LOCK 3/4.G
3	BOLT FH. 3/4X2.68.G
4	MONORAIL GUIDE QG.G
5	3/4" H VY HEX NUT A563 DH
6	BRACKET CART SUPT. DIA FOLDED QG
7	HINGE PLATE FENDER PANEL QG
8	BOLT FH. 5/8X4.65.G
9	5/8" H VY HEX NUT A563A
10	WASHER LOCK 5/8.G

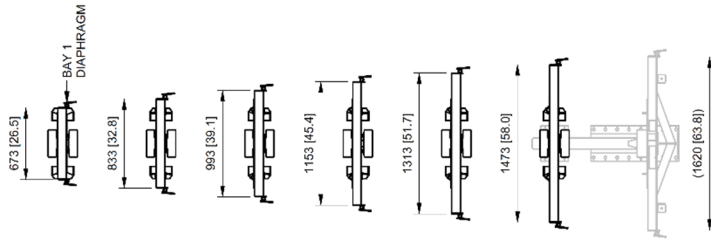


STANDARD DIAPHRAGMS

ASSEMBLY	WIDTH
607175	833 [32.8]
607177	993 [39.1]
607146	1153 [45.4]
607150	1313 [51.7]
607152	1473 [60.0]

QUADGUARD® QG M WIDE DIAPHRAGM ASSEMBLY	
DATE: 2/20/2020 DRAWN BY: D. Kofield	DATE: 2/25/2020 CHECKED BY: B. Eckert
UNLESS OTHERWISE NOTED, DIMENSIONS ARE IN INCHES AND DECIMALS THEREOF. DIMENSIONS IN PARENTHESES ARE IN MILLIMETERS. UNLESS OTHERWISE NOTED, DIMENSIONS ARE IN MILLIMETERS AND DECIMALS THEREOF.	
DO NOT SCALE DRAWING	
PART NUMBER: 627534.dwg	REV: -
PART NUMBER: 627534	SHEET: 2 of 3

Diaphragm Assembly 2-6 627534



QG M WIDE SYSTEMS - 1759 1691

ISSUED BY <b>D. Korfield</b>		DATE <b>2/20/2020</b>	PROJECT NO. <b>627534 idw</b>	<b>QUADGUARD QG M WIDE DIAPHRAGM ASSEMBLY</b>	
CHECKED BY <b>B. Eckert</b>		DATE <b>2/25/2020</b>	FILE <b>627534 idw</b>		
<small>UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES (FRAC.) AND DECIMALS THEREOF. DIMENSIONS IN PARENTHESES ARE IN MILLIMETERS (FRAC.).</small>					
DO NOT SCALE DRAWING					
ECO I	Date	Rev	By	Chk.	
6821	2/26/20	-	DK	/	
INITIAL RELEASE					
				PART NO.	<b>627534</b>
				QUANTITY	<b>3 of 3</b>

PARTS LIST	
ITEM	DESCRIPTION
1	SHIM

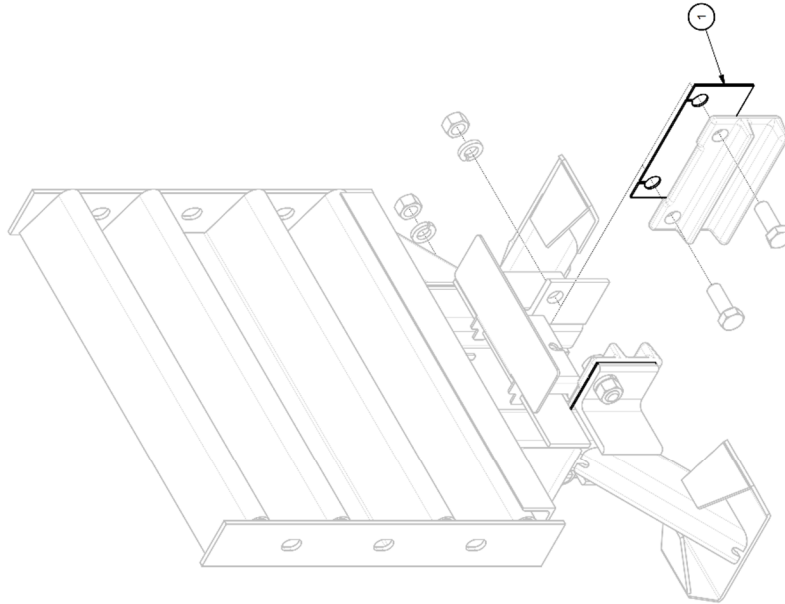


TABLE	
KIT	THICKNESS
614050	12 GA

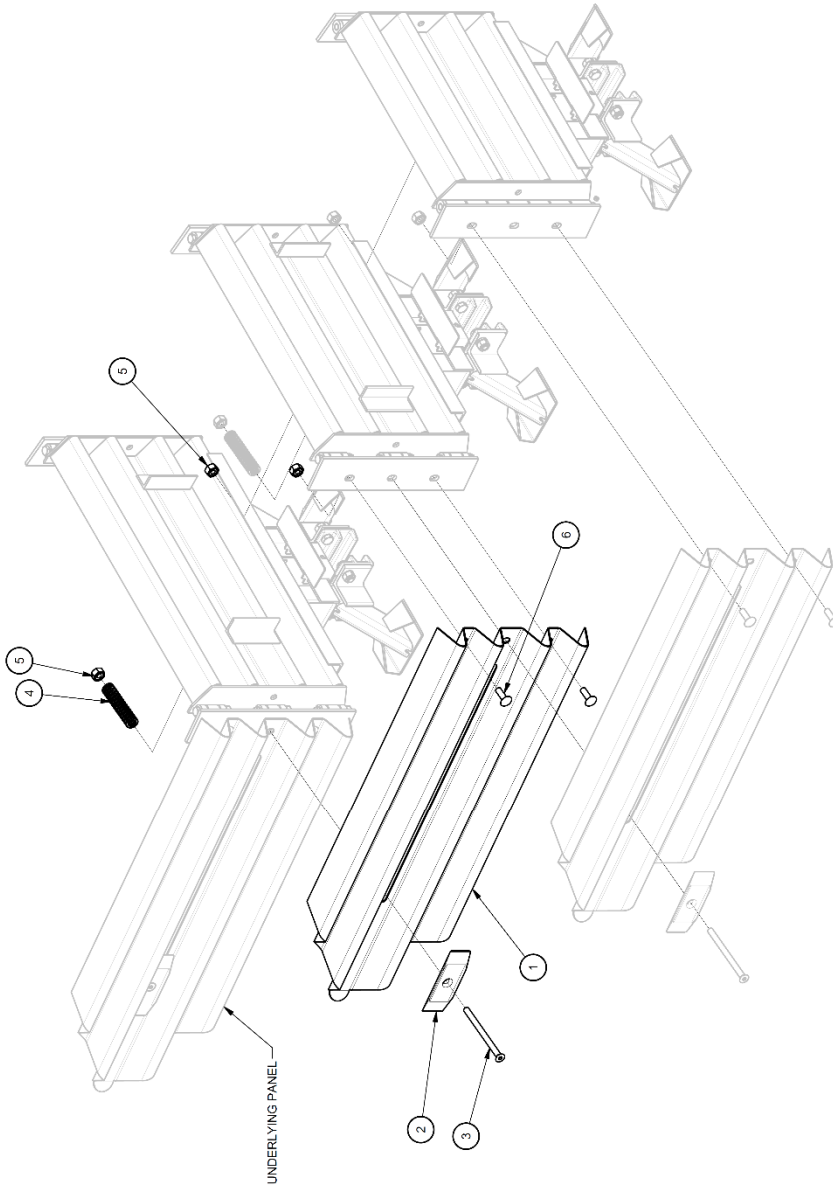
DESIGN D. Kohfeld DATE 2/19/2020	DRAWING NO. 627518.dwg	SHEET NO. 1	SHEET TOTAL 1	TITLE SHIM KIT	FAMILY QUADGUARD® FAMILY	PART NO. 627518	REV. -	QUANTITY 1 of 1

## Shim Kit 627518



PARTS LIST	
ITEM	DESCRIPTION
1	PANEL FENDER LOG G
2	WASHER MUSHROOM FORGED LOG G
3	SCREW FL. 5/8X8 1/2 GR G SOCKET
4	SPRING DIET 1/2 OD X 3/4X6 GALV
5	NUT HX 5/8 G RAIL
6	BOLT RAIL 5/8X2 G

TABLE	
SYSTEM	ASSEMBLY
QUADGUARD FAMILY	608240



- NOTES:
1. UNDERLYING PANEL IS A FENDER PANEL IF ATTACHED TO A DIAPHRAGM. UNDERLYING PANEL IS A BACKUP SIDE PANEL, EXTENSION PANEL, OR TRANSITION IF ATTACHED TO THE BACKUP.
  2. THERE IS TO BE A MINIMUM OF ONE WASHER PER SCREW.
  3. THERE IS TO BE A MAX. 25 (1) MAX GAP BETWEEN ANY FENDER PANEL AND THE UNDERLYING PANEL.
  4. TWO FENDER ASSEMBLIES REQUIRED PER BAY.

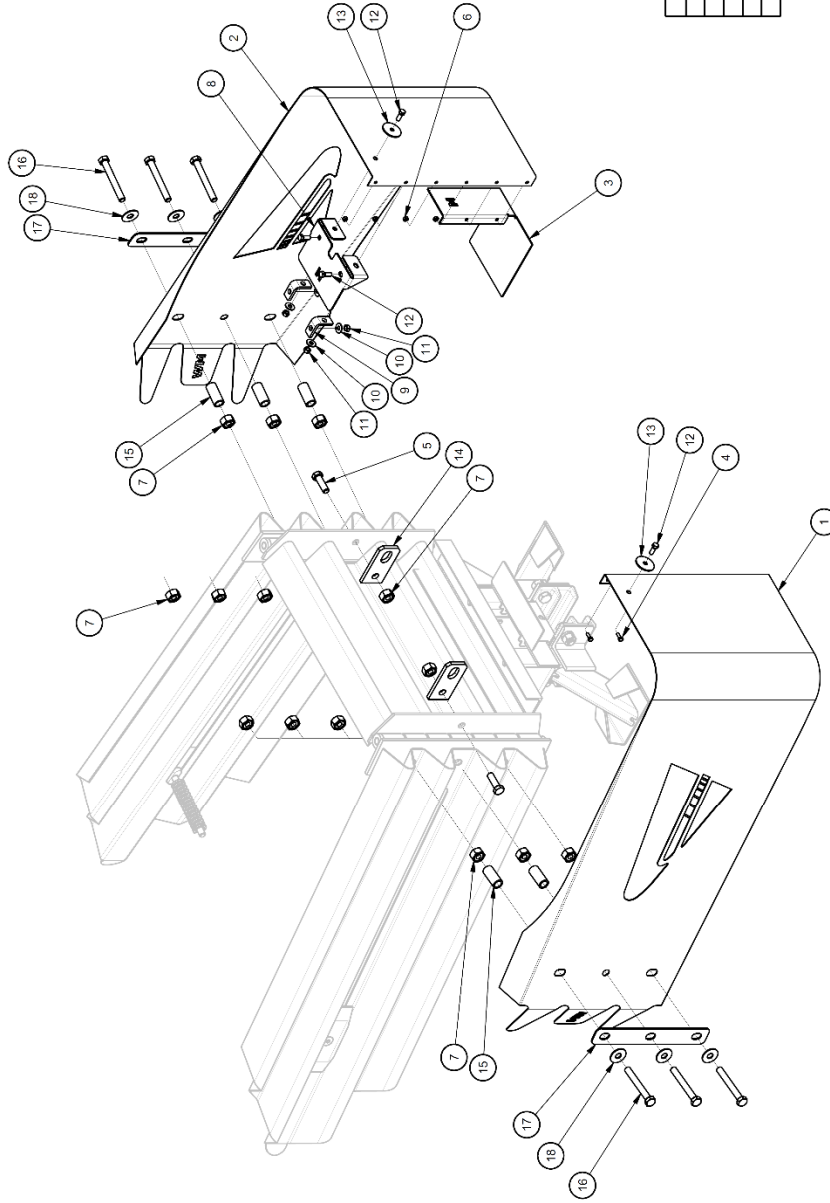
DESIGN	D. Kohfeld	DATE	8/19/2020	VALUES/ITERABLES/SHOULD BE DIMENSIONS	
REVISION	J. Oliphant	DATE	8/27/2020	VALUES/ITERABLES/SHOULD BE DIMENSIONS	
				THIS IS NOT A 3D MODEL AND IT IS NOT TO SCALE	
				DO NOT SCALE DRAWING	

QUADGUARD <sup>®</sup> SYSTEM	
FENDER PANEL ASSY, WIDE SYSTEMS	
REV	627753
OF	1 of 1

# Fender Panel Assembly 627753

ITEM	DESCRIPTION
1	NOSE LOG M WIDE
2	NOSE R LOG M WIDE
3	BRACKET CART SUPPORT NOSE LOG M
4	BOLT HX 1/4X3/4 .05 G
5	BOLT HX 5/8X2 .05 G
6	NUT HX 1/4 G
7	NUT HX 5/8 G RAIL
8	BRACKET CART HOLD DOWN LOG M
9	BRACKET ANGLE 2X1 WHOLE
10	WASHER FLAT 3/8X1 G
11	NUT HX 3/8 G
12	BOLT HX 3/8X1 .05 G
13	WASHER FLAT 3/8X2 G
14	BRACKET PULL-OUT LOG
15	PIPE 3/4 SCH 80X2 5/16
16	BOLT HX 5/8X5 .08 FT
17	WASHER BAR 1.00AX2X14 SLOTS
18	WASHER FLAT 5/8 X 1 3/4 G

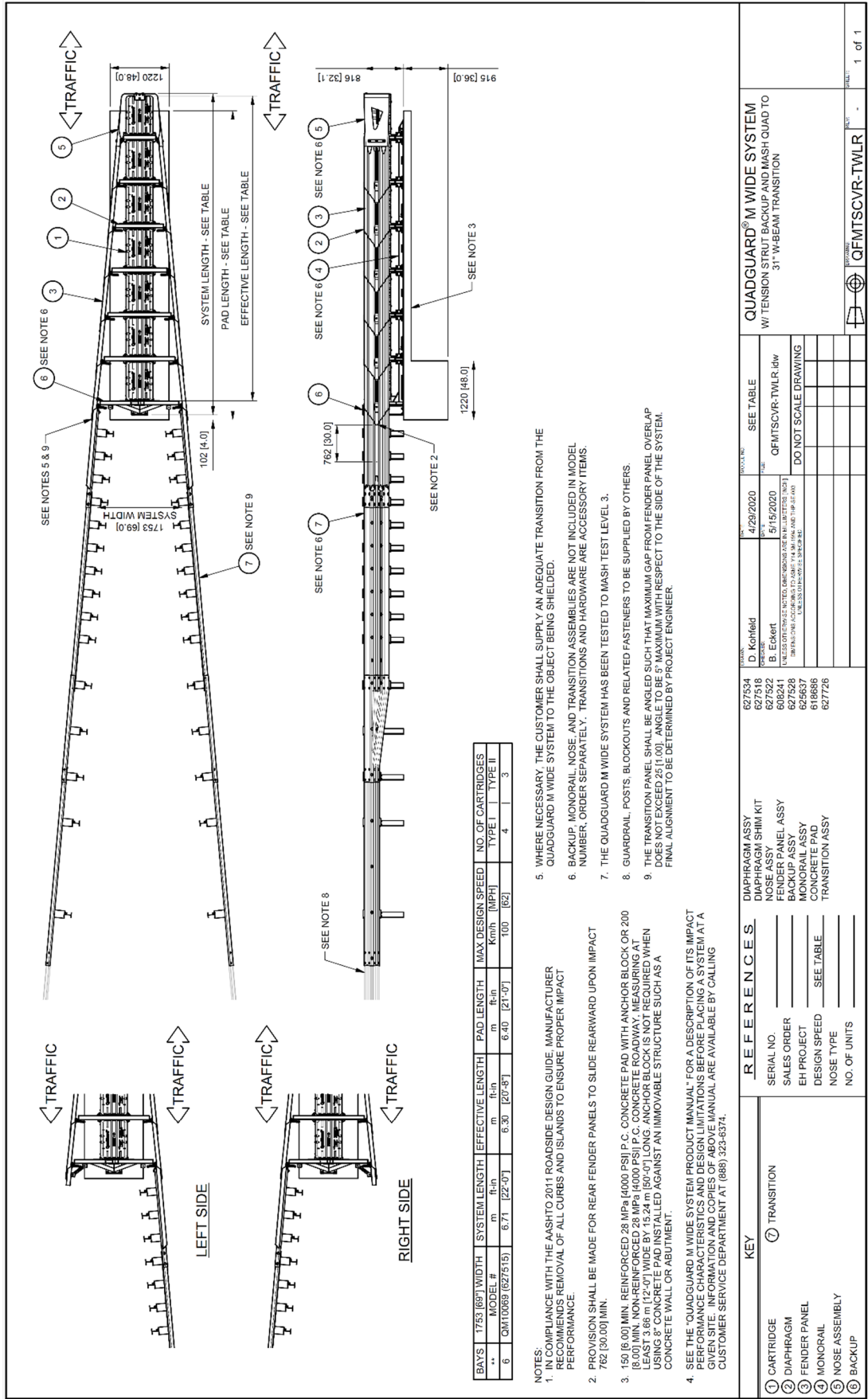
ASSEMBLY	COLOR
627516	BLACK
627517	GALVANIZED
627521	YELLOW
627984	GALV/YELLOW



QUADGUARD® SYSTEM NOSE ASSY WIDE LOG M10	
DATE	2/17/2020
BY	D. Kohfeld
DATE	2/25/2020
BY	B. Eckert
DO NOT SCALE DRAWING	
REV	A
QTY	1
OF	1

# Nose Assembly 627522





KEY	REFERENCES	REVISIONS	DATE	BY	DESCRIPTION
①	CARRIDGE	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			

DATE	BY	DESCRIPTION
4/29/2020	D. Kohfeld	SEE TABLE
5/15/2020	B. Ebert	QFMTSCVR-TWLR.idw
DO NOT SCALE DRAWING		

QUADGUARD® M WIDE SYSTEM	WI TENSION STRUT BACKUP AND MASH QUAD TO 31" W-BEAM TRANSITION
QFMTSCVR-TWLR	

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 LEAST 3.66 m [12'-0"] WIDE BY 15.24 m [50'-0"] LONG. ANCHOR BLOCK IS NOT REQUIRED WHEN USING 8" CONCRETE PAD INSTALLED AGAINST AN IMMOVABLE STRUCTURE SUCH AS A CONCRETE WALL OR ABUTMENT.

4. SEE THE "QUADGUARD M 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) 323-8374.

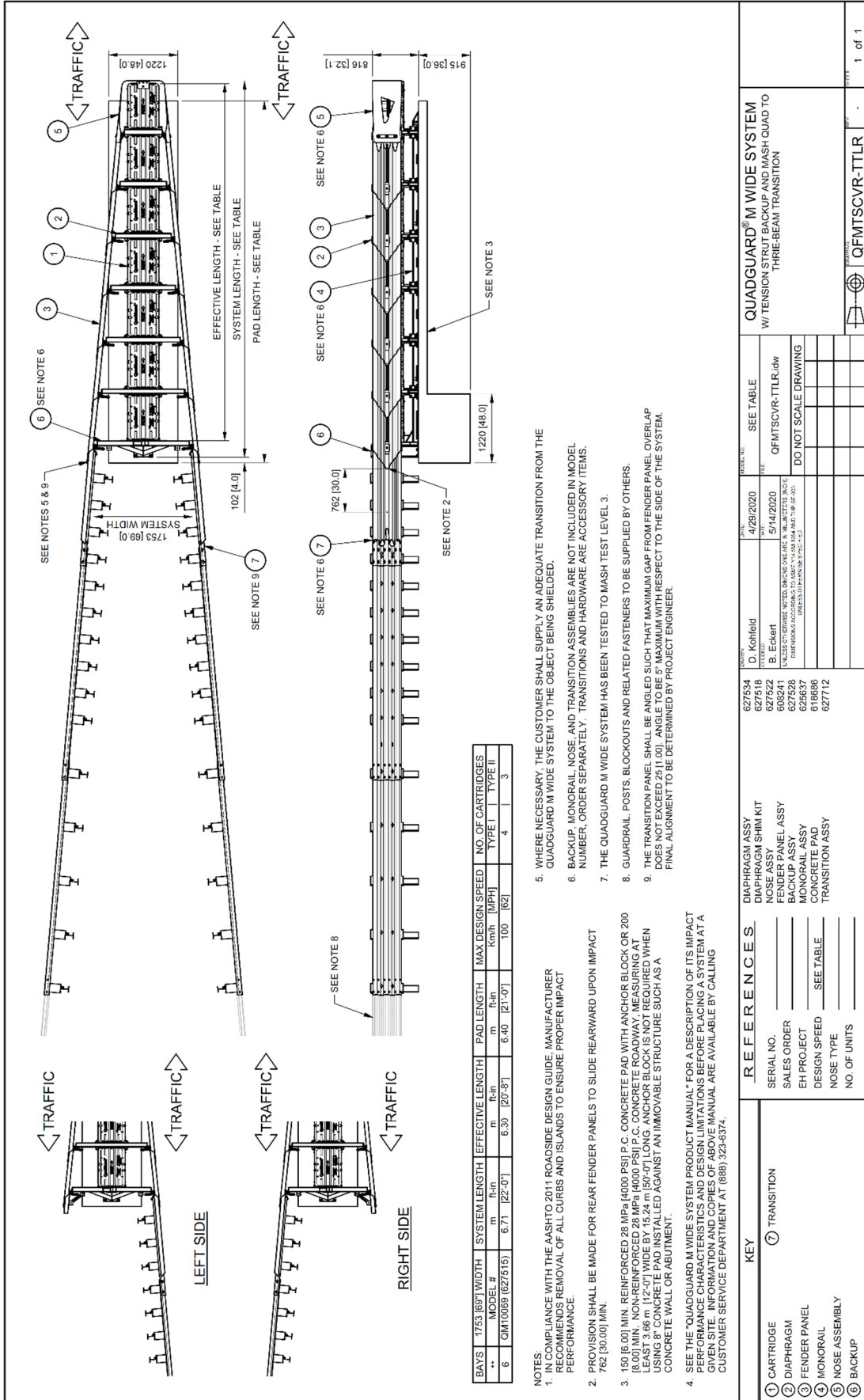
5. WHERE NECESSARY, THE CUSTOMER SHALL SUPPLY AN ADEQUATE TRANSITION FROM THE QUADGUARD M WIDE SYSTEM TO THE OBJECT BEING SHIELDED.

6. BACKUP, MONORAIL, NOSE, AND TRANSITION ASSEMBLIES ARE NOT INCLUDED IN MODEL NUMBER, ORDER SEPARATELY. TRANSITIONS AND HARDWARE ARE ACCESSORY ITEMS.

7. THE QUADGUARD M WIDE SYSTEM HAS BEEN TESTED TO MASH TEST LEVEL 3.

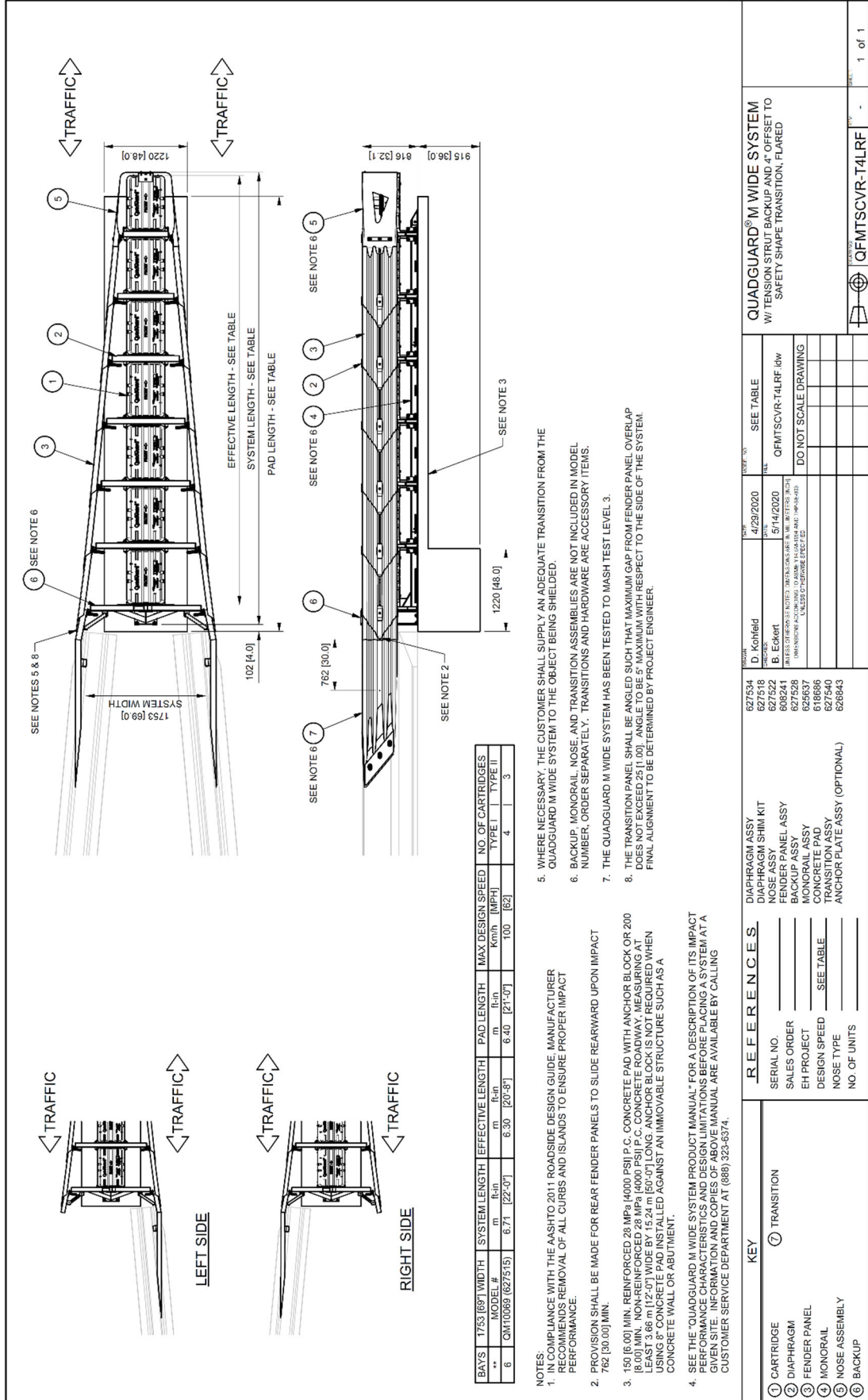
8. GUARDRAIL, POSTS, BLOCKOUTS AND RELATED FASTENERS TO BE SUPPLIED BY OTHERS.

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.









# Flared Safety Shape Barrier Transition

1 of 1

QFMTSCVR-T4LRF

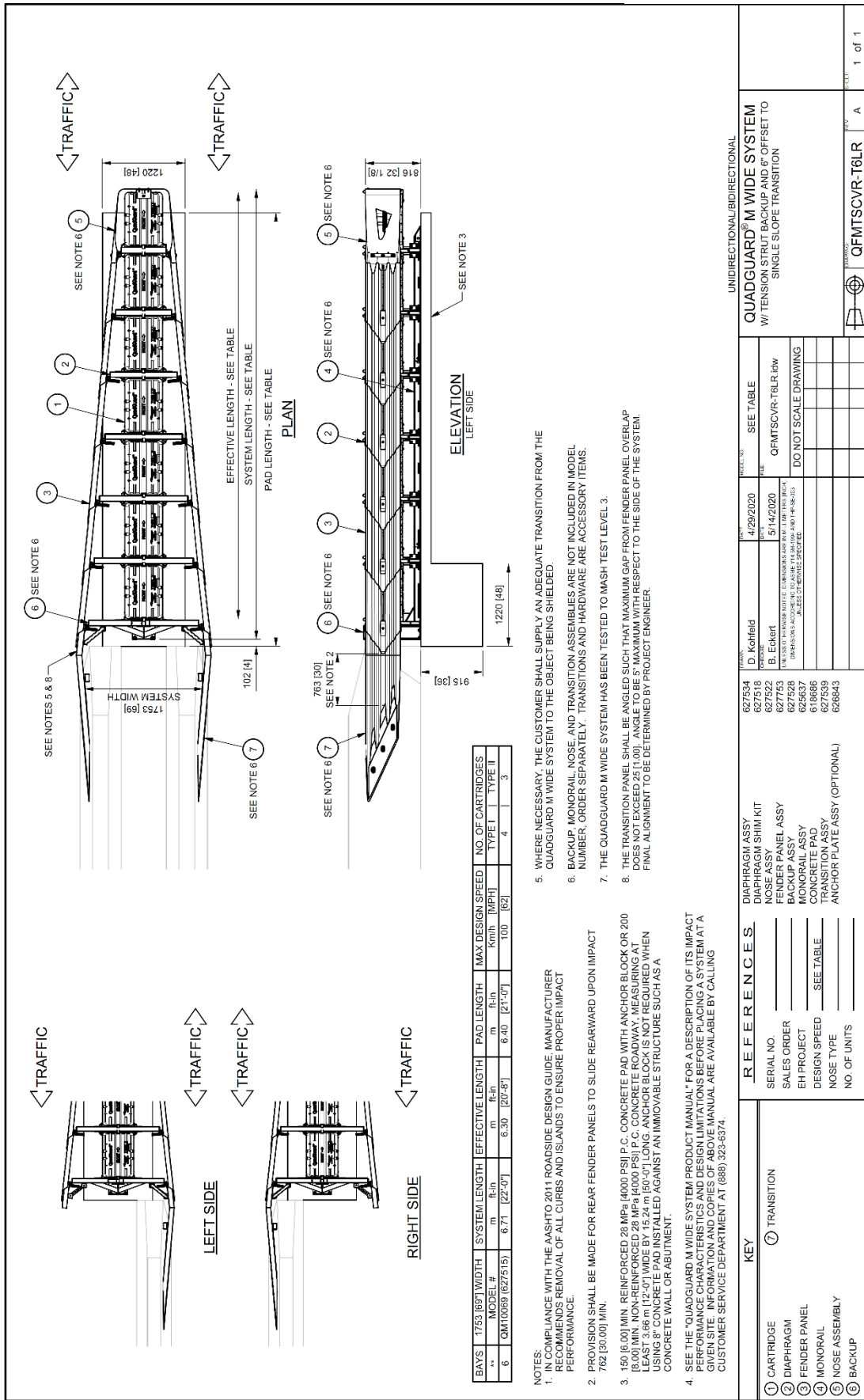
KEY	REFERENCES	DATE	DESCRIPTION
① CARTRIDGE	DIAPHRAGM ASSY	4/29/2020	SEE TABLE
② DIAPHRAGM	DIAPHRAGM SHIM KIT		
③ FENDER PANEL	FENDER PANEL KIT		
④ MONORAIL	FENDER PANEL ASSY		
⑤ NOSE ASSEMBLY	BACKUP PANEL ASSY		
⑥ BACKUP	BACKUP ASSY		
	CONCRETE PAD		
	TRANSITION ASSY		
	ANCHOR PLATE ASSY (OPTIONAL)		
	NOSE TYPE		
	NO. OF UNITS		
	DESIGN SPEED		
	EH PROJECT		
	SALES ORDER		
	SERIAL NO.		

QUADGUARD<sup>®</sup> M WIDE SYSTEM  
W/ TENSION STRUT BACKUP AND 4" OFFSET TO SAFETY SHAPE TRANSITION, FLARED

QFMTSCVR-T4LRF

1 of 1

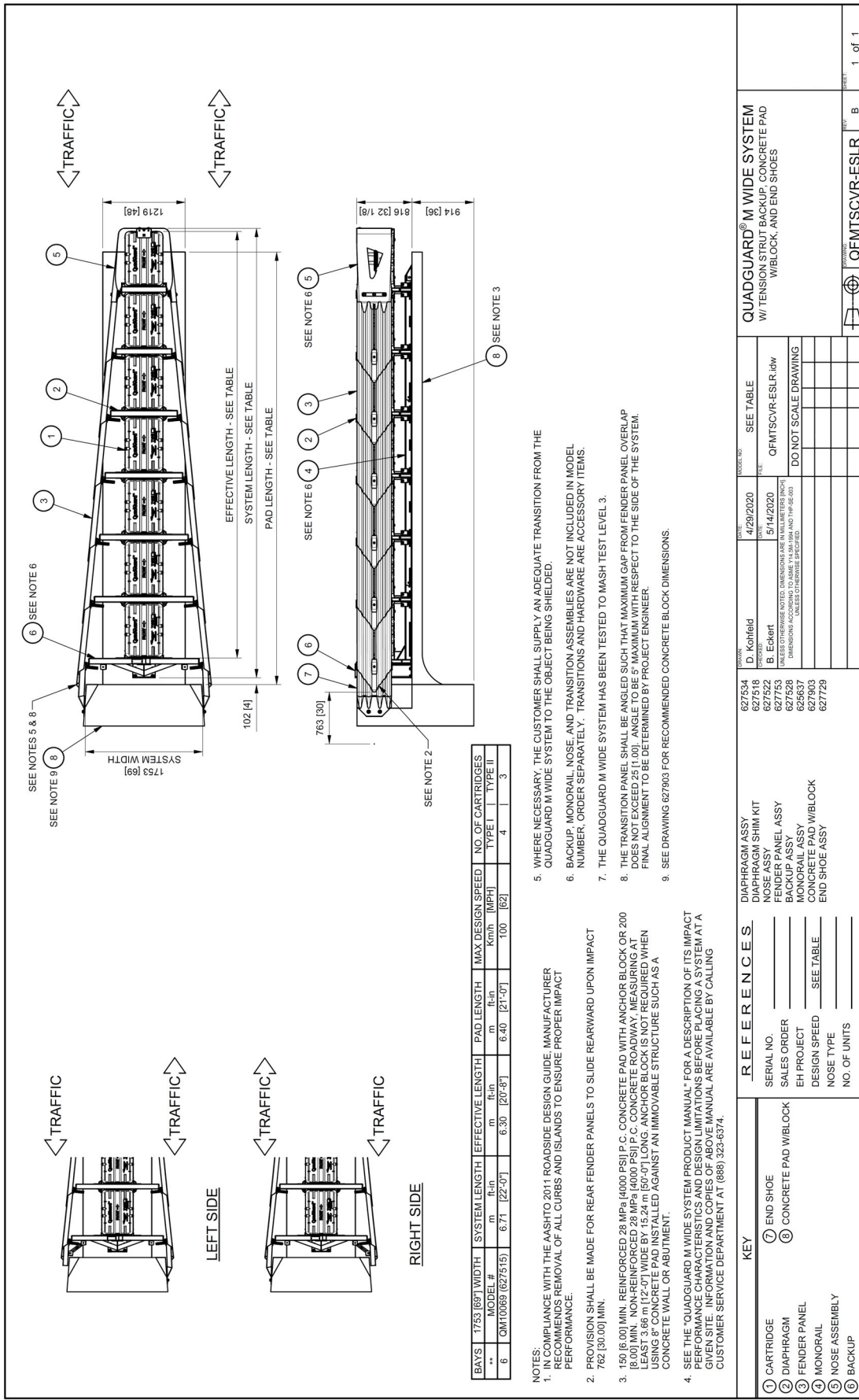




Single Slope Transition QFMTSCVR-T6LR







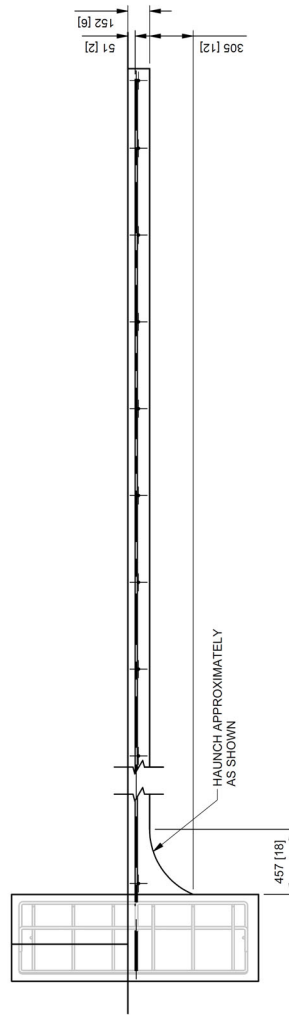
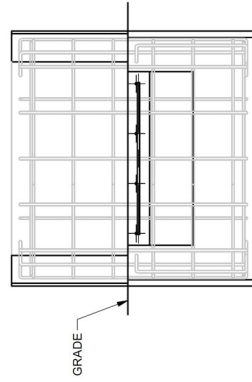
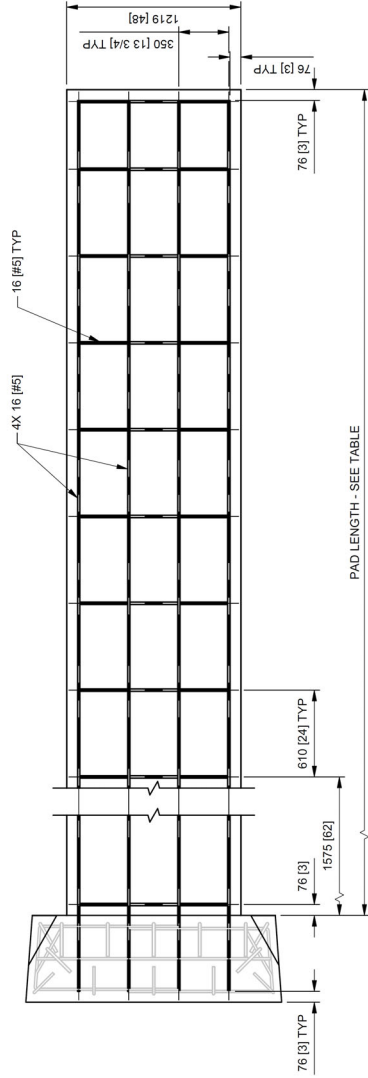
BAYS	1753 [69]	WIDTH	SYSTEM LENGTH	EFFECTIVE LENGTH	PAD LENGTH	MAX DESIGN SPEED	NO. OF CARTRIDGES	
**	MODEL #	m	ft-in	m	ft-in	Kmph [MPH]	TYPE I	TYPE II
6	QM10069 [627515]	6.71 [22'-0\"]	6.30 [20'-8\"]	6.40 [21'-0\"]	100 [62]	4	3	

- 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 762 [30.00] MIN.
  - 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 LEAST 3.66 m [12'-0\"] WIDE BY 15.24 m [50'-0\"] 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 "QUADGUARD M 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 M WIDE SYSTEM TO THE OBJECT BEING SHIELDED.
  - BACKUP, MONORAIL, NOSE, AND TRANSITION ASSEMBLIES ARE NOT INCLUDED IN MODEL NUMBER, ORDER SEPARATELY. TRANSITIONS AND HARDWARE ARE ACCESSORY ITEMS.
  - THE QUADGUARD M WIDE SYSTEM HAS BEEN TESTED TO MASH TEST LEVEL 3.
  - 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.
  - SEE DRAWING 627903 FOR RECOMMENDED CONCRETE BLOCK DIMENSIONS.

KEY		REFERENCES	
①	CARTRIDGE	SERIAL NO.	DIAPHRAGM ASSY
②	DIAPHRAGM	SALES ORDER	DIAPHRAGM SHIM KIT
③	FENDER PANEL	EH PROJECT	NOSE ASSY
④	MONORAIL	DESIGN SPEED	FENDER PANEL ASSY
⑤	NOSE ASSEMBLY	NOSE TYPE	MONORAIL ASSY
⑥	BACKUP	NO. OF UNITS	CONCRETE PAD W/BLOCK
			END SHOE ASSY

MODEL NO.	DATE	REV	DESCRIPTION
627534	4/29/2020	D	Kotfield
627518	5/14/2020	B	Eckert
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BAYS	PAD LENGTH	REBAR REQ'D	REBAR REQ'D	CONCRETE REQUIRED
		15 [#5]	20 [#6]	
6	6.4 m [21']	80 m [262']	17 m [55']	3.1 m <sup>3</sup> [4.0 yd <sup>3</sup> ]



- NOTES:
1. CONCRETE TO BE 28 MPa [4000 PSII] P. C.
  2. BLOCK AND PAD TO BE POURED MONOLITHICALLY.
  3. CROSS SLOPE OF PAD SHALL NOT EXCEED 5% AND NOT VARY MORE THAN 2% FROM FRONT TO BACK.

DESIGNER	DATE	REVISIONS
D. Kohfeld	2/11/2021	1. INITIAL DESIGN AND DIMENSIONS
B. Eckert	2/25/2021	2. REVISED TO ASME F14.5M-1994 AND TYP-SE-003

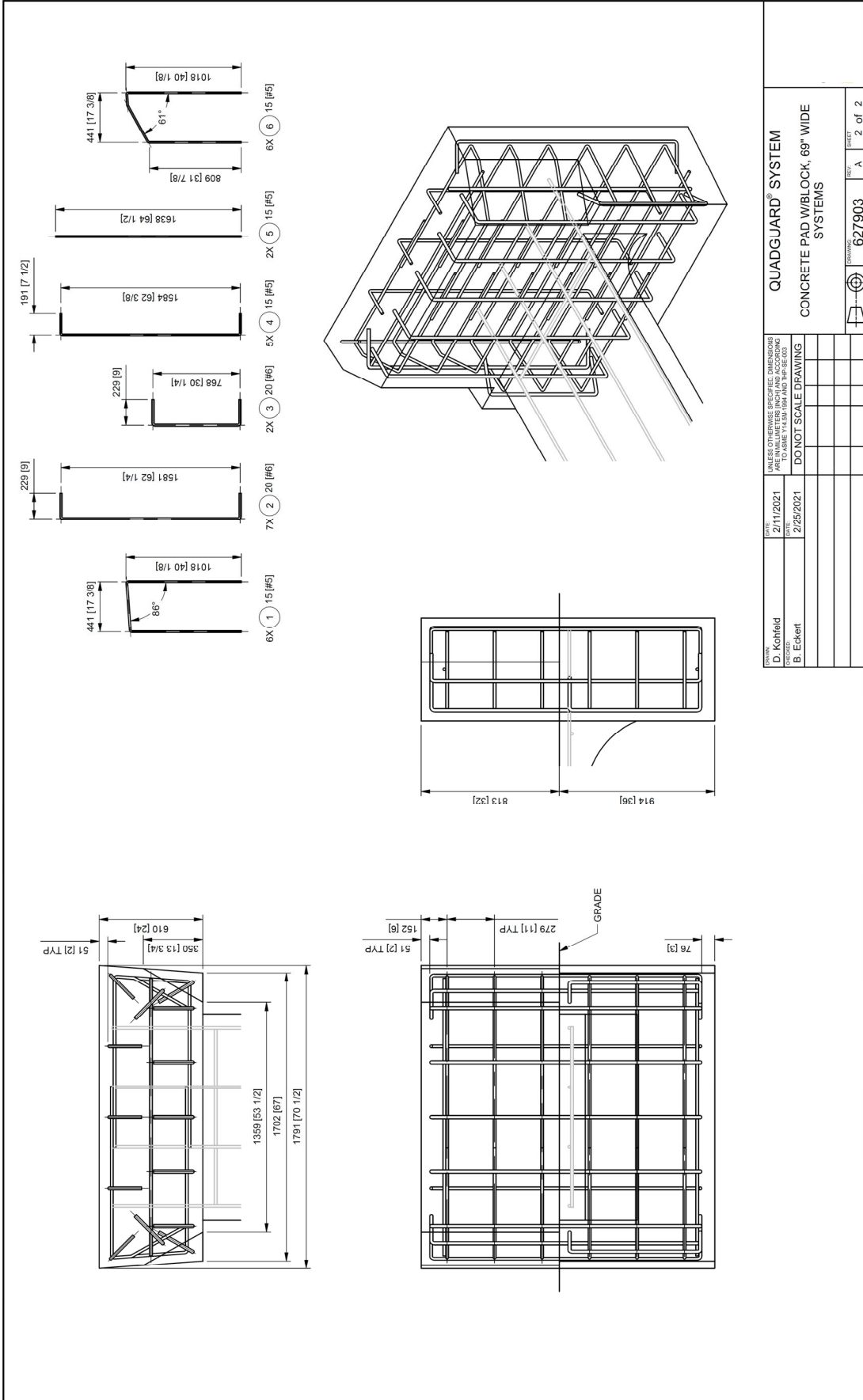
DO NOT SCALE DRAWING

QUADGUARD® SYSTEM	REV.	SHEET
CONCRETE PAD W/BLOCK, 69" WIDE SYSTEMS	627903	A 1 of 2

TSR 12-006 Rev. 11-12-2009

# TS Concrete Pad w/Block 627903





DATE	2/11/2021	BY	D. Kohfeld
DATE	2/25/2021	BY	B. Eckert
UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE TO FACE Y14, Y18, Y19 AND Y19-SE-200			
DO NOT SCALE DRAWING			
PROJECT	627903	SHEET	A
		OF	2

QUADGUARD® SYSTEM  
 CONCRETE PAD W/IBLOCK, 69" WIDE  
 SYSTEMS

1/14/16 000 Rev A, 1/17/2020

**Notes:**





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**1.888.323.6374**