

QuadGuard® M10 CZ

Product Manual Supplement

Australia and New Zealand only



INGAL
CIVIL PRODUCTS
A valmont COMPANY



TRINITY
HIGHWAY

Ahead of the Curve®

QuadGuard® M10 CZ System

The QuadGuard M10 CZ system allows anchoring into asphalt and portability. The information provided in this supplement manual is given with the intent for it to be used in conjunction with the QuadGuard M10 manual. The QuadGuard M10 system itself is to be assembled and installed as per shown in the QuadGuard M10 manual, in order to comply with the test level and installation requirements.

Product Description Supplement Manual



Warning: The distributors, owners, contractors, lessors, and lessees are **RESPONSIBLE** for the assembly, maintenance, and repair of the QuadGuard® System. Failure to fulfill these **RESPONSIBILITIES** 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 an Ingal Civil Products 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 Ingal Civil Products on 1300 446 425

The information contained in this manual supersedes all previous versions. The instructions, illustrations, and specifications are based on the latest QuadGuard® System information available to Ingal Civil Products publication. We reserve the right to make changes at any time. Please visit www.ingalcivil.com.au/products/road-safety-barriers/crash-cushions/quadguard-cz to confirm the latest revision.

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Customer Service Contacts

Ingal Civil Products is committed to the highest level of customer service. Feedback regarding the QuadGuard® M10 CZ , its assembly procedures, supporting documentation, and performance is always welcome. Additional information can be obtained from the contact information below:

Ingal Civil Products

Telephone	1300 446 425
Contact Link	ingalcivil.com.au/contact-us

Important Introductory Notes

Proper assembly of the QuadGuard® M10 CZ is critical to achieve tested performance that has been evaluated and deemed eligible by the FHWA per AASHTO MASH criteria. These instructions should be read and understood in their entirety before assembly. These instructions are for standard assemblies and used in conjunction with the assembly of the QuadGuard® M10 CZ as specified by the applicable highway authority. If you need additional information, or have questions about the QuadGuard® M10 CZ, please contact the highway authority that has planned and specified this assembly and, if needed, contact Ingal Civil Products. This product must be assembled in the location specified by the appropriate project engineers. 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® M10 CZ during the assembly or repair of this system.

This product has been specified for use 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.

A manufacturer's drawing package will be supplied by Ingal Civil Products 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 manual. Read the manual for complete safety and assembly information.

<u>Symbol</u>	<u>Meaning</u>
	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® M10 CZ. 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® M10 CZ. Additional copies of this manual are available from Ingal Civil Products on 1300 446 425 or by visiting ingalcivil.com.au/products/road-safety-barriers/crash-cushions/quadguard-cz. Please contact Ingal Civil Products if you have any questions concerning the information in this manual or about the QuadGuard® M10 CZ.

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 CZ 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 with a system that has not been accepted by the FHWA.

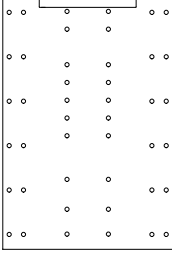
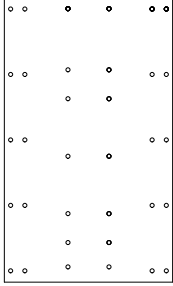
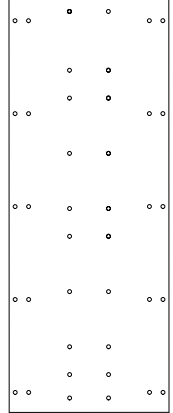

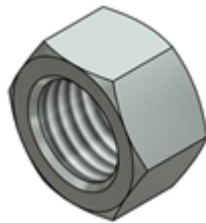


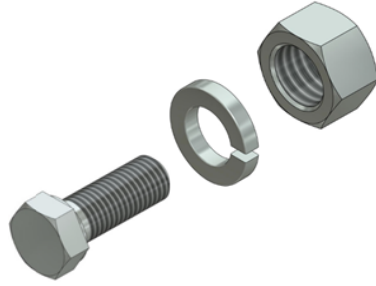
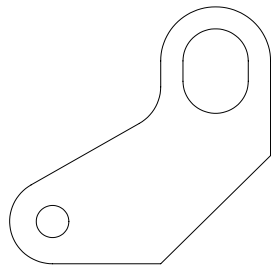


Warning: Use only Trinity Highway parts on the QuadGuard® M10 CZ for assembly, maintenance, or repair. The use of component parts not specified herein is **strictly prohibited**. The QuadGuard® M10 CZ assembled with Trinity Highway parts has been tested, approved, and accepted for use by the FHWA. A QuadGuard® M10 CZ using parts other than those specified herein has not been tested, approved, or accepted for 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.

System Components

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

Note: Components are not shown to scale.

CZ Plate TS Gal 1548mm 	CZ Plate 2Bay Gal 1830mm 	CZ Plate 3Bay Gal 2743mm 
10102912	10102909	10102910
CZ Anchor M20 x 460mm Rod 	M20 Structural Nut 	M20 Structural Flat Washer 
10102911	10102538	10102539
Hilti Injection Mortar HIT-HY 200-R 500/2/EE 	Bolt S/Hex 8.8 G M20 x 50mm 	Lifting Bracket QG , G 
10102902	10102540	10102418

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 – 22 mm] (**Double-Fluted**)
- Grinder, Hacksaw or Torch (optional)



Important: Trinity Highway recommends using **double-fluted** drill bits to achieve optimum tensile strength when applying an approved adhesive anchoring system (p. 11).

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"



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 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.

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 300 mm
- Center punch
- Tape measure 7.5m [25']
- Chalkline
- Concrete marking pencil
- Steel bristled tube brush for cleaning 22mm 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, the required tools may vary. Decisions as to what tools are needed to perform the job are entirely the responsibility of the selected contractor performing the assembly of the system at the specified assembly site.

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 1).

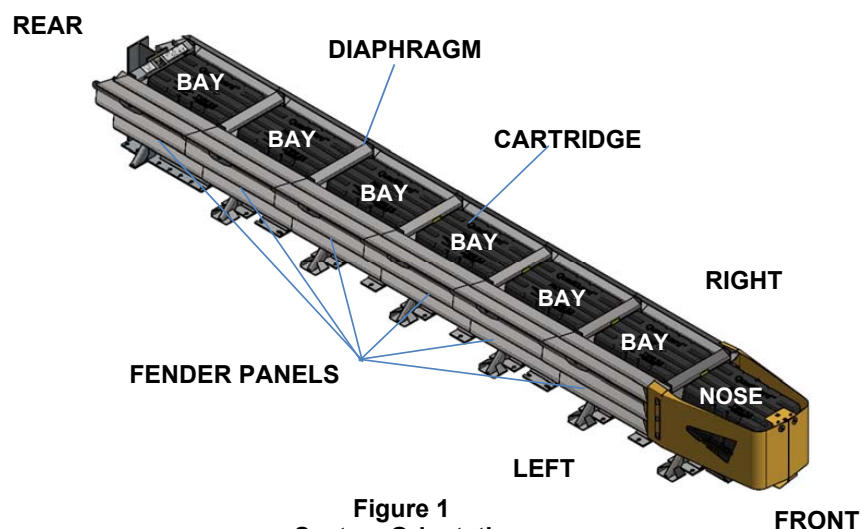


Figure 1
System Orientation

Lifting and Positioning a CZ System

Lifting brackets are installed on the QuadGuard CZ. The location of the lifting brackets will vary by system and are attached to the appropriate diaphragms using the top rail bolts. Diaphragms are numbered starting from the nose of the system. Refer to Table A. below for lifting bracket locations.

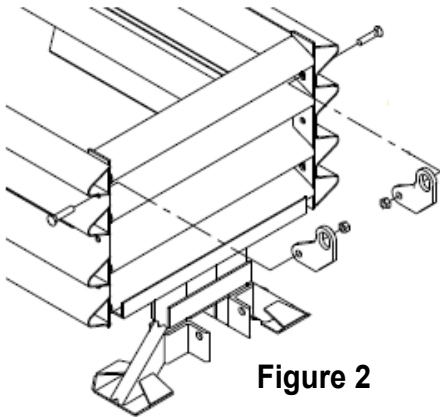


Figure 2

Table A.

Lifting Bracket Location Chart		
No. of Bays (Diaphragm)	Attach to Diaphragm no.	System Total Weight
3	2 & 3	1150kg
6	3 & 5	1835kg

Count the diaphragms starting from the nose section to determine lifting bracket location. Attach lifting brackets to the QuadGuard CZ using the top rail bolts. Refer to figure 2, 3 & 4.

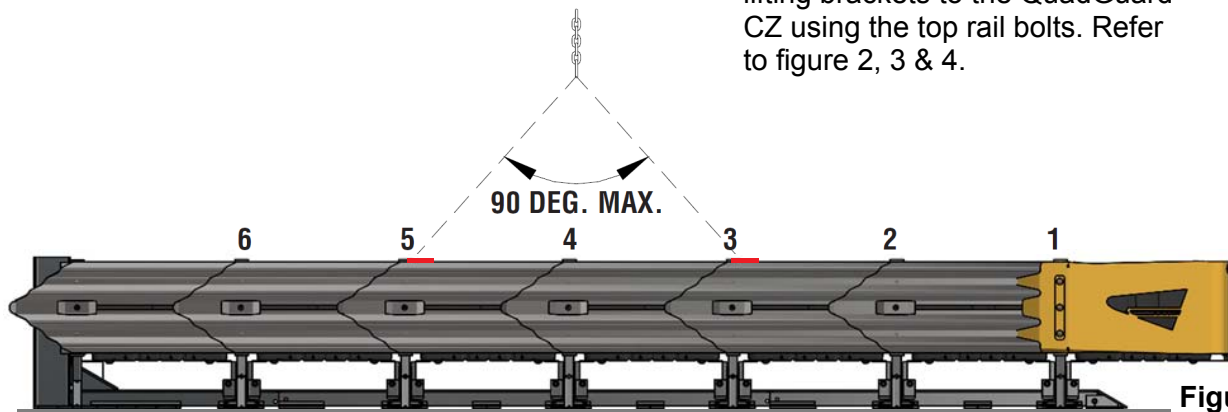


Figure 3

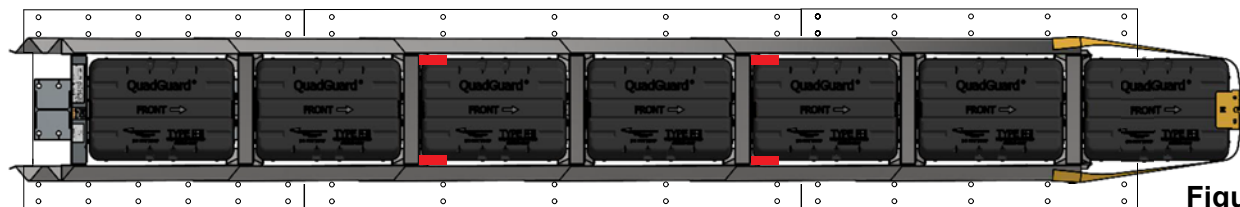


Figure 4



Warning: It is the responsibility of the installer and crane operator to ensure proper equipment is being used to lift a system. As variants in system sizes can vary the total system weight, it is the responsibility of the installer and crane operators to obtain the correct weights to ensure the crane and it's equipment are rated adequately.

Site Preparation/Foundation

A QuadGuard® M10 CZ is a variant of the QuadGuard M10 system, therefore any site layouts and or limitations of the QuadGuard M10 are the same as that of the QuadGuard M10 CZ system. This manual should always be used in conjunction with the QuadGuard M10 manual, which can be found at ingalcivil.com.au/products/road-safety-barriers/crash-cushions/quadguard-m10-mash.



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

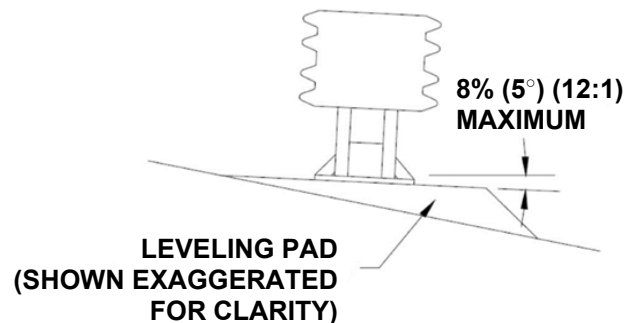


Figure 8
Cross-Slope



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 Backups as much as 765 mm [30"]. Position the Backup so that the rear ends of the last Fender Panels are a minimum of 765 mm [30"] 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: Systems mounted on asphalt must be replaced and mounted on fresh, undisturbed asphalt if more than 10% of anchors are found to be loose, broken, or show signs of pull out. If 10% or fewer anchors are damaged, replace the damaged anchors in the existing asphalt. Anchor bolts used on systems mounted on asphalt must be inspected every 6 months. Review Maintenance and Repair Instructions and Post-Impact Instructions (pp. 19-20).

Foundation/Anchoring



Important: It is the responsibility of the local DOT 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

QuadGuard M10 CZ systems may be temporarily installed in construction zones on asphalt. Assemblies on **Asphalt Concrete (“A.C.”)** must provide a minimum of 76 mm [3”] [76 mm] layer of asphalt over a minimum of 76 mm [3”] layer of **Portland Cement Concrete (“P.C.C.”)**, 152 mm [6”] layer of asphalt over 152 mm [6”] layer of subbase, or 200 mm [8”] layer of asphalt with no subbase.



Important: Only 460 mm [18”] threaded rods, utilizing Trinity Highway approved adhesive, can be used with **asphalt** foundations (p. 11). Contact Ingal Civil Products for a complete list of approved adhesives (p. 3).

Concrete Installations

For concrete installations, the QuadGuard® M10 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.

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

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

Foundation A: Reinforced Concrete Pad or Roadway

Foundation: 152 mm [6”] minimum depth P.C.C.

Anchorage: Approved adhesive with 180 mm [7”] studs 140mm [5 1/2”] embedment

Foundation B: Asphalt over P.C.C.

Foundation: 76 mm [3”] minimum asphalt concrete (A.C.) over 76 mm [3”] minimum P.C.C.

Anchorage: Length of anchor required is 460 mm [18”] and embedment of 420 mm [16 1/2”]

Foundation C: Asphalt over Subbase

Foundation: 152 mm [6”] minimum A.C. over 152 mm [6”] minimum Compacted Subbase (C.S.)

Anchorage: Approved adhesive with 460 mm [18”] studs 420 mm [16 1/2”] embedment

Foundation D: Asphalt Only

Foundation: 200 mm [8”] minimum A.C.

Anchorage: Approved adhesive with 460 mm [18”] studs 420 mm [16 1/2”] 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.

Vertical Anchors

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

1) Prepare Foundations



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 in 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® M10 CZ plates to the foundation must be those shipped in the kit or of high strength steel (120,000 psi [830 MPa] minimum tensile strength or equal).

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 CZ plates as drilling templates. Use a rotary hammer drill to drill the boreholes 22 mm [7/8"] 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
M20 x 180mm	Vertical	22 mm [7/8"]	145 mm	Manufacturer Spec	Concrete
M20 x 460mm	Vertical	22 mm [7/8"]	425 mm	10 ft-lb [15 N-m]	Asphalt



Important: When mounting on asphalt, initial torque shall be as shown above. Due to the properties of asphalt, anchors may loosen over time. For this reason Trinity Highway recommends anchoring to asphalt only at temporary locations. It is recommended to re-torque anchors in asphalt every six (6) months to the proper initial torque specified.

3) Clean the Boreholes

Blow the 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 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 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 5).

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).

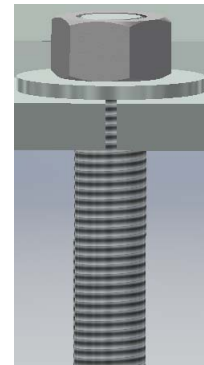


Figure 5
Vertical Application
(Before Applied Torque)

7) Torque the Nuts

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

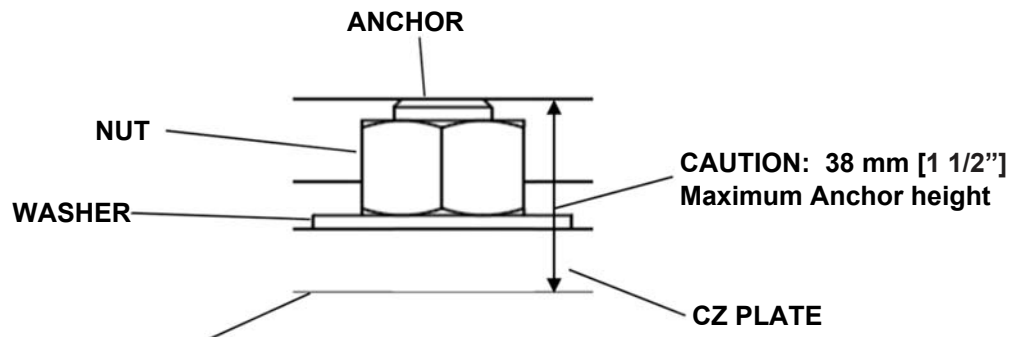


Figure 6
Final Anchor Height
(After Applied Torque)

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.

Vertical Anchor Placement

A QuadGuard M10 CZ system has anchor holes around the outer perimeter of the CZ plates. When anchoring a system, only use the outer holes (shown in figure 7 & 8) along each side as well as the two holes at the front of the system. Removal of the nose cone cartridge is required to gain access to these two front anchor holes. Ensure nose cone cartridge and its hold-down bracket are correctly reinstalled when anchoring is completed.

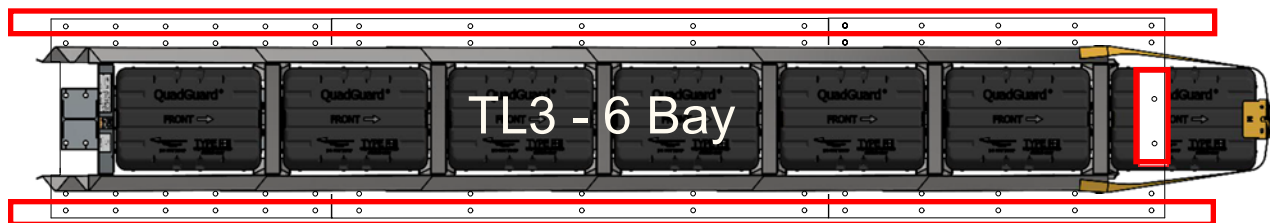


Figure 7

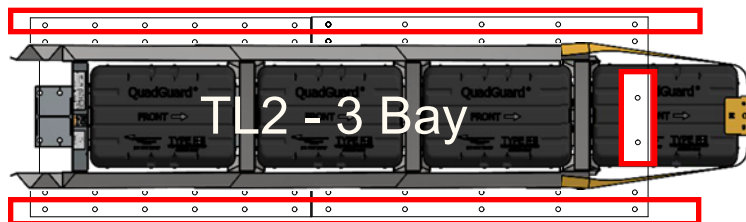


Figure 8

Anchor Requirements	
No. of Bays (Diaphragms)	Quantity of Anchors req.
3	24
6	34

Table B



Caution: Always ensure the front centre anchors under the nose cone are installed. Failure to install the anchoring system completely (as shown in figure 7 & 8) may result in the system not performing as per tested. Total Anchors required per QuadGuard M10 CZ system are shown in Table B.

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 533 mm to one side as shown in Figure 9. The long edge of the CZ plate will be positioned on this line.



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 QuadGuard M10 system for details.



Figure 9
(Top view of foundation)

2) Anchor the CZ Plates

Locate the QuadGuard M10 CZ System on foundation with side of CZ Plates on the construction line (figure 9). **Verify that any applicable Transition Panels fit properly before anchoring Backup.** Drill 22 mm [7/8"] diameter by 425 mm anchor boreholes in foundation using the CZ Plates as template. Anchor the CZ Plates to the foundation using an approved adhesive supplied with the QuadGuard® M10 CZ (p. 11).

Note: Verify that any applicable Transition Panels fit properly before anchoring CZ System.



Caution: Every outer hole in the CZ Plates must be anchored by a stud using an approved adhesive (p. 11).

3) Diaphragm Spacing

There is a possibility that during transport and lifting the positioning of the Diaphragms have shifted.

Check Diaphragm spacing to ensure 915 mm [36"] between rear faces of consecutive Diaphragms as shown in Fender Panel assembly drawing (Figure 10).

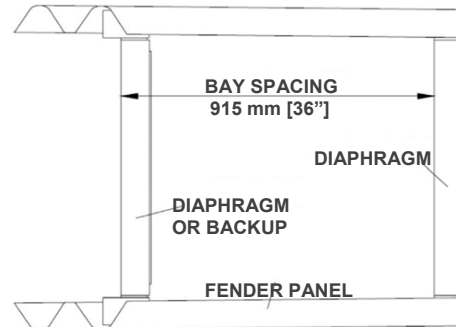


Figure 10
Proper Diaphragm Spacing

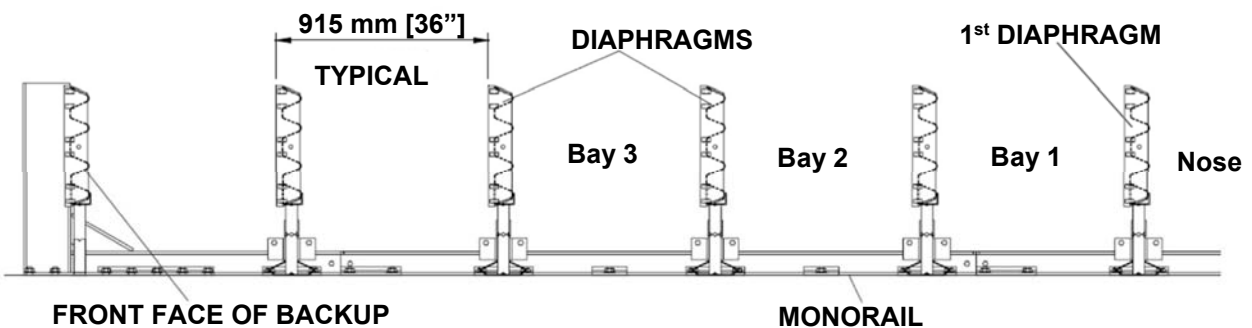


Figure 11
Diaphragm Spacing

4) Transport Bolts



Warning: If the QuadGuard system has been supplied pre-assembled, it will have transport bolts with warning tags installed in the monorail. These monorail bolts are used to hold the system together while in transit and therefore are for transportation purposes only. They **MUST** be removed during installation of the QuadGuard system. It is solely the responsibility of the installer to ensure any transport bolts are completely removed. Failure to remove can affect the systems performance and may result in personal injury or death.



5) 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.

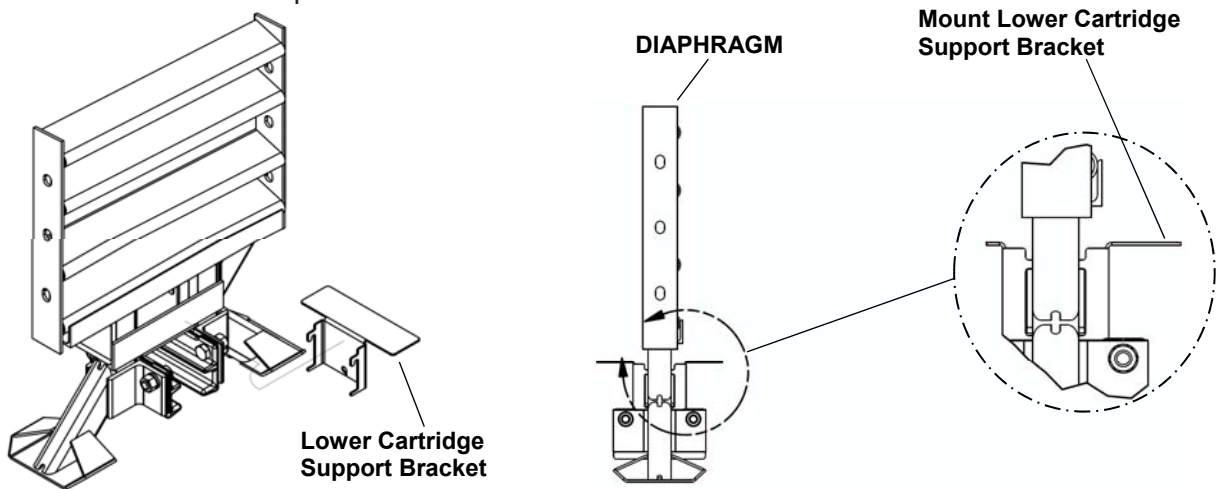


Figure 12
Lower Cartridge Support Bracket Assembly

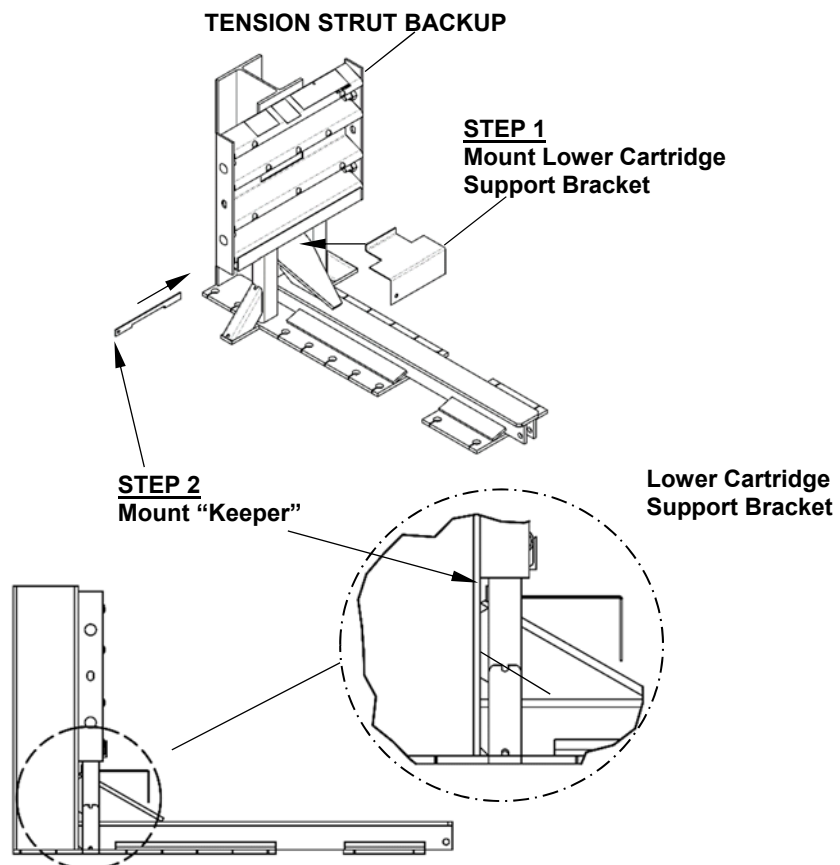


Figure 13
Lower Cartridge Support Bracket Assembly
(Tension Strut Backup)

6) Checking the System Assembly

At this point recheck to ensure that 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 14).



Warning	
Bolt Torque Requirements	
Anchor Studs – p. 11	
Critical Clearances	
Anchor Studs above nuts – p. 12, Figure 6	
Fender Panel Gap – 20mm [.78"] Figure 14	

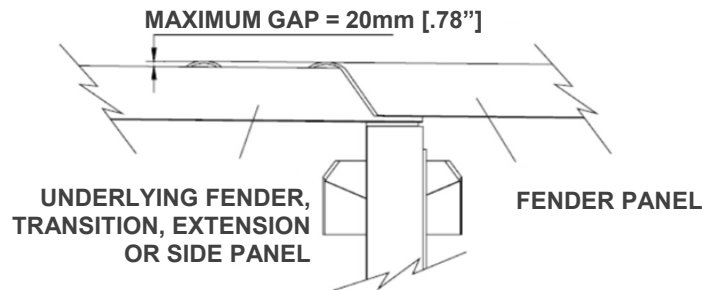


Figure14
Fender Panel Gap

12) Cartridge Placement

The top surface of the Nose Cartridge should be horizontal. To complete the assembly of a QuadGuard® M10 CZ, place the appropriate Cartridge in each Bay and Nose section 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. 19).



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® M10 CZ is either a six (6) Bay or three (3) Bay configuration.

QuadGuard® M10 CZ 610mm [24"] Final Inspection Checklist

Site Location: _____

Date: _____

Inspector: _____

Refer to the QuadGuard® M10 CZ 610mm [24]" manual and / or drawing package.

- ☐ Transition Panel fits for the offset (p. 11)
- ☐ Clearance of 765 mm behind rear Fender Panels for slide back (p. 14)
- ☐ Anchor nuts are torqued to manufacturer specification (p. 16)
- ☐ Top of Nose panels are 815 mm above plates (p. 19)
- ☐ Cartridges are level and the same height in each Bay
- ☐ Correct Cartridge is placed in each Bay and pointing to front of system (p. 17)
- ☐ Cartridge Hold Down Bracket is secure and engaged with Nose Cartridge (p. 13 & 23)
- ☐ Every outer hole in the CZ Plates is anchored (p. 13)
- ☐ Anchor stud(s) are 38 mm maximum above the pad) (p. 12)
- ☐ Diaphragm spacing is 915mm between Diaphragms (p. 15)
- ☐ Mushroom Washers lay flat in fender slots (p. 17)
- ☐ Nose Cartridge is at the same height as Bay Cartridges
- ☐ Fender Panel gap is 20 mm for Narrow systems (p. 17)
- ☐ Bolts and nuts are properly tightened (p. 17)
- ☐ System is clear of debris with any monorail transport bolts (if fitted) removed (p. 15)

Maintenance and Repair

Inspection Frequency

Inspections for QuadGuard® M10 CZ 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. Any asphalt anchors should be re-torqued every 6 months

Visual Drive-By Inspection

- 1) Check to see if there is evidence of an impact. If so, perform a walk-up inspection.
- 2) Check to see if the Cartridges are properly seated on the Support Brackets. Any damaged Cartridges must be replaced.



Warning: See Cartridge placement instructions in QuadGuard M10 CZ Manual.

- 3) Be sure the Steel Nose is in place.
- 4) Note the location and condition of the QuadGuard® M10 CZ 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 properly seated.
- ☐ 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 must be consulted.

Post-Impact Instructions



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 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 15). 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.

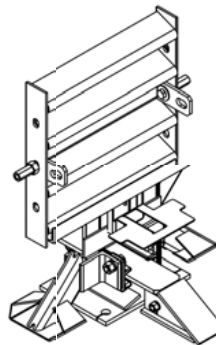


Figure15
Pullout Brackets



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.



Warning	
Anchor Torque and Clearance Requirements	
Torque Requirements – Adhesive Manufacturer Spec Anchor clearance above nuts – Figure 20, p. 24	
Fender Panel Critical Clearances	
Fender Panel Gap – 20mm	

- 10) Check the **gaps between Fender Panels**. The maximum gap allowed for these overlapping parts (including Fender Panels overlapping Panels behind the system) is 20 mm.



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

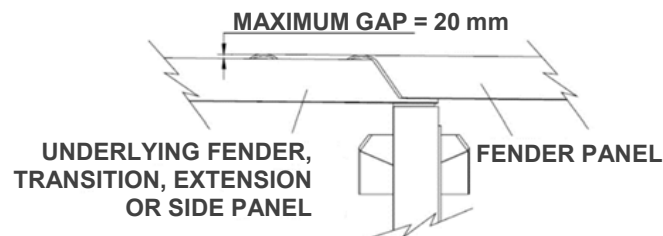
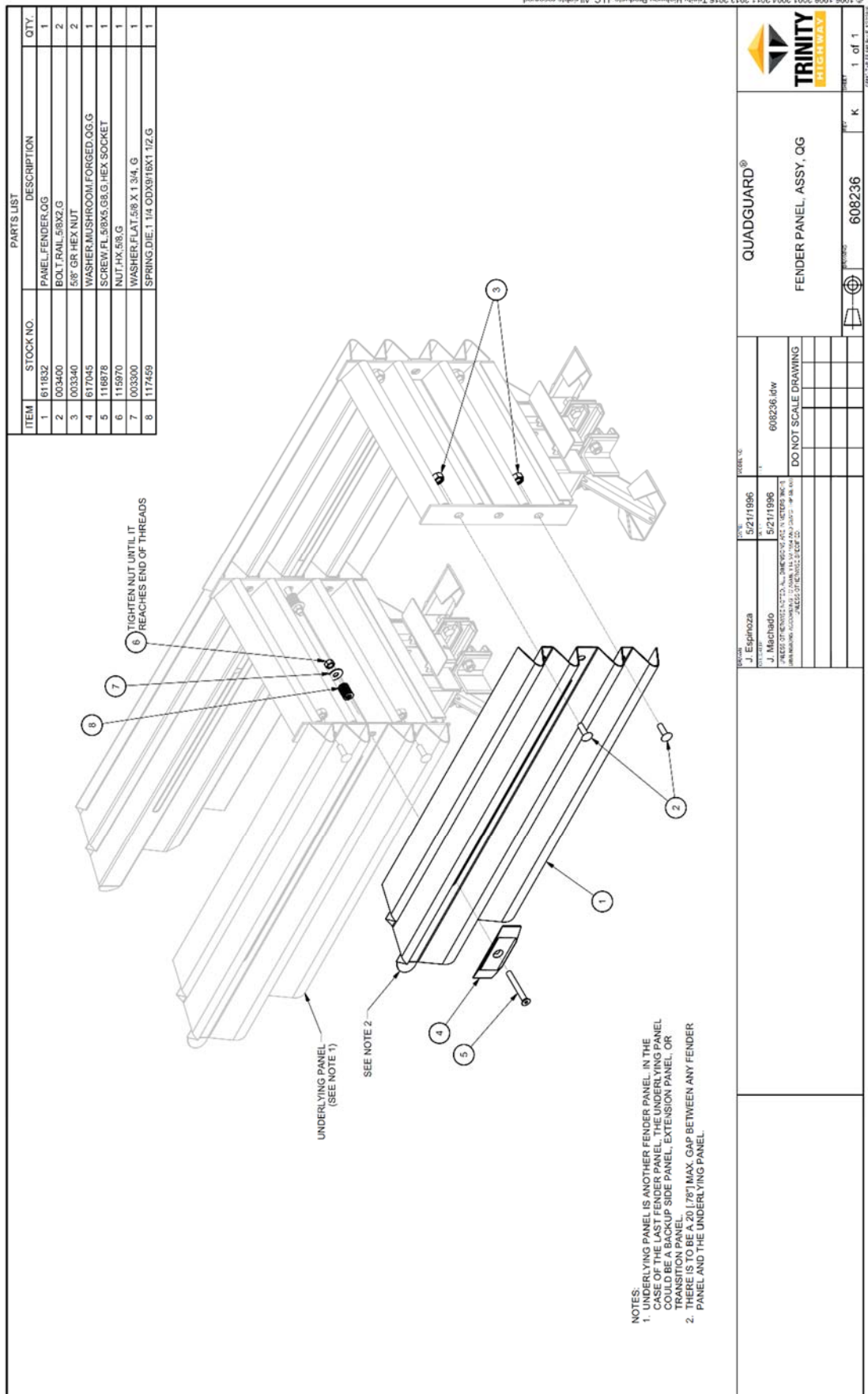
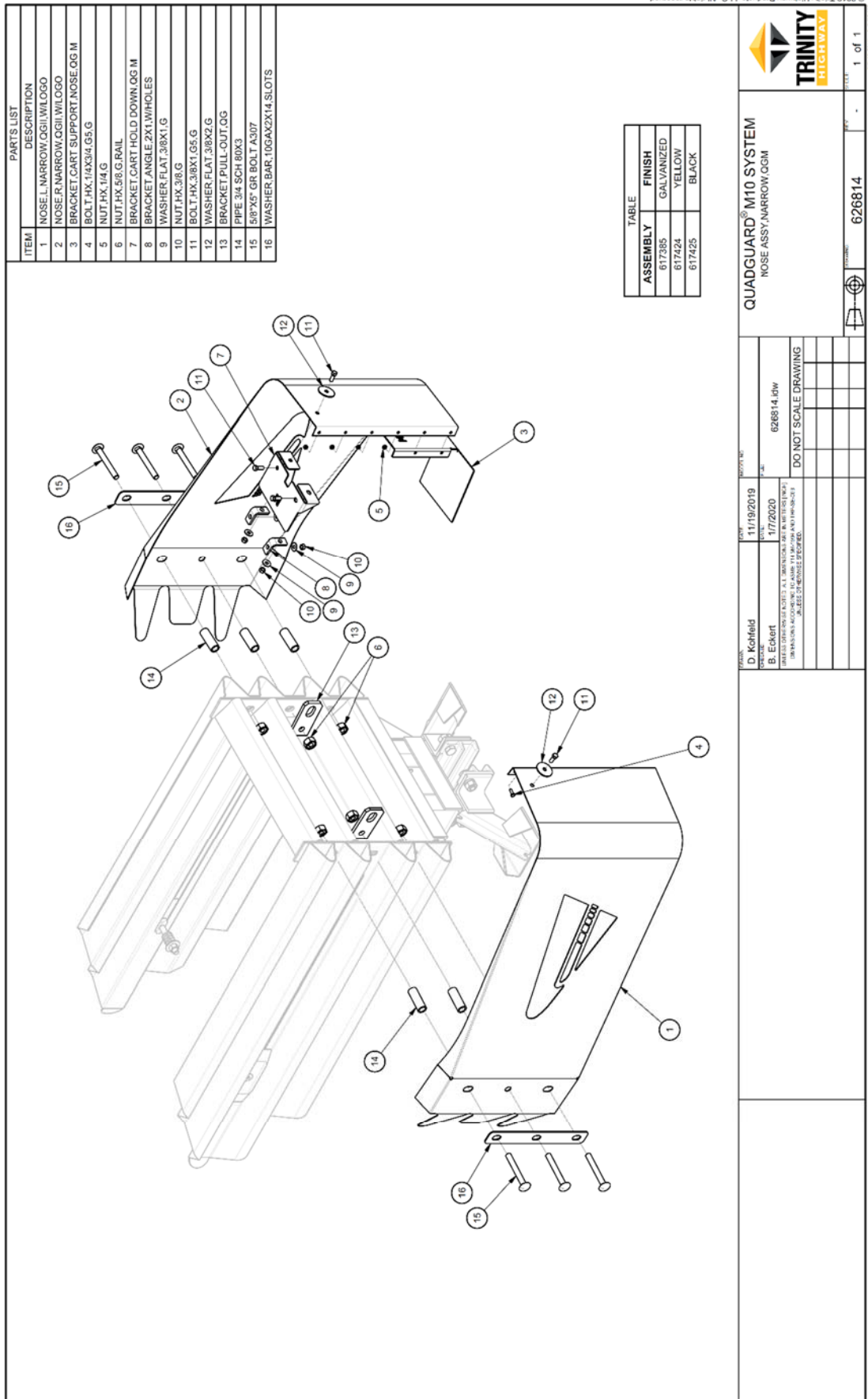


Figure 16
Fender Panel Gap

- 11) Replace all crushed Cartridges and damaged Cartridge Support Brackets.
- 12) Remove damaged Nose Assembly. Attach the new Nose to the first Diaphragm. See page 23 for Nose attachment drawings or QuadGuard M10 manual.
- 13) All bolts on the system are adequately tight.
- 14) Site is free from debris.
- 15) The QuadGuard® M10 CZ is now ready for use.



Fender Panel Assembly 608236



Nose Assembly 626814

NOTES:



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