VALTIR

QUEST® Classic

CRASH CUSHIONS

PRODUCT DESCRIPTION ASSEMBLY MANUAL

PN 115311
REVISION F FEBRUARY 2023

QUEST® Classic

The QUEST® Classic system has been tested pursuant to National Cooperative Highway Research Program ("NCHRP") Report 350 specifications. The QUEST® Classic system has been deemed eligible for federal-aid reimbursement on the National Highway System by the Federal Highway Administration ("FHWA").

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 QUEST® Classic system. Failure to fulfill these RESPONSIBILITIES with respect to the assembly, maintenance, and repair of the QUEST® Classic system 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 result in a deviation from these assembly instructions, contact the appropriate highway authority engineer.

This manual must be available to the worker overseeing and/or assembling the product at all times. For additional copies, contact Valtir at (888) 323-6374 or visit Valtir.com.

The instructions contained in this manual supersede all previous information and manuals. All information, illustrations, and specifications in this manual are based on the latest QUEST® Classic system information available to Valtir at the time of printing. We reserve the right to make changes at any time. Please contact Valtir to confirm that you are referring to the most current instructions.

Part No. 115311

Table of Contents

Customer Service Contacts

Valtir is committed to the highest level of customer service. Feedback regarding the QUEST® Classic system, 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) (214) 589-8140 (International)
E-mail:	Valtir.com/Contact/
Website:	Valtir.com

Important Introductory Notes

Proper assembly of QUEST® Classic system is critical to achieve performance that has been evaluated and accepted by the FHWA per NCHRP Report 350. These instructions should be read in their entirety and understood before assembling the QUEST® Classic system. These instructions are to be used only in conjunction with the assembly of the QUEST® Classic system and are for standard assemblies only as specified by the applicable highway authority. If you need additional information, or have questions about the QUEST® Classic system, 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 it was tested.

Important: **DO NOT** use any component part that has not been specifically specified herein for the QUEST® Classic system during assembly or repair.

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 QUEST® Classic system manual. Read the manual for complete safety and assembly information.

Symbol	Meaning
	**Safety Alert Symbol:** Indicates Danger, Warning, Caution, or Important. Failure to read and follow the Danger, Warning, Caution, or Important indicators could result in serious injury or death to the workers and/or bystanders.
	**Important:** Read safety instructions thoroughly and follow the assembly directions and suggested safe practices before assembling, maintaining, or repairing the QUEST® Classic system. It is the responsibility of the installer to follow these warnings. 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.
	**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 assemble, maintain, or repair the QUEST® Classic system. Additional copies of this manual are immediately available from Valtir by calling (888) 323-6374 or contacting us at Valtir.com/Contact. Please contact Valtir if you have any questions concerning the information in this manual or about the QUEST® Classic system. This manual may also be downloaded directly from the website below.

It is the responsibility of the installer to use appropriate safety precautions when operating power equipment, mixing chemicals, and when moving heavy equipment or QUEST® Classic system components. Work gloves, apron, safety goggles, safety-toe shoes, and back protection shall be used.

Safety measures incorporating traffic control devices specified by the highway authority must be used to provide safety for personnel while at the assembly, maintenance, or repair site.

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: Do not assemble, maintain, or repair the QUEST® Classic system until you have read this manual thoroughly and completely understand it. Ensure that all Danger, Warning, Caution, and Important statements within the manual are completely followed. Please call Valtir at (888) 323-6374 if you do not understand these instructions.

Limitations and Warnings

Valtir, in compliance with the National Cooperative Research Highway Program Report 350 (NCHRP Report 350) “Recommended Procedures for the Safety Performance of Highway Safety Features”, contracts with FHWA approved testing facilities to perform crash tests, evaluation of tests, and submittal of results to the FHWA for review.

The QUEST® Classic system has been approved by FHWA as meeting the requirements and guidelines of NCHRP Report 350. These tests typically evaluate product performance defined by Report 350 involving a range of vehicles on roadways, from lightweight cars (approx. 1800 lb. [820 kg]) to full size pickup trucks (approx. 4400 lb. [2000 kg]). The QUEST® Classic system is certified to the Test Level(s) as shown below:

Test Level 3: 62 mph [100 km/h]

These FHWA 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 NCHRP Report 350 as approved by FHWA.

Valtir neither represents nor warrants that the impact results of these federally established test criteria prevent or reduce the severity of any injury to person(s) or damage to property. These tests only demonstrate the occurrence of certain results following an impact within NCHRP Report 350 criteria. Every departure from the roadway is a unique event.

The QUEST® Classic system 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 its site specifications. The customer should be careful to properly select, assemble, and maintain the product. Careful evaluation of the site lay out, vehicle population type; speed, traffic direction, and visibility are some of the elements that require evaluation 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.

Important: It is the sole responsibility of the project engineer and/or the local highway authority and its engineers to determine whether use or reuse of any part of the system is appropriate or acceptable following an impact. Valtir makes no recommendation or suggestion regarding this determination. Each impact is unique.

System Overview

The QUEST® Classic system is a potentially reusable, re-directive, non-gating crash cushion for roadside obstacles up to 24” [610 mm] in width if impacted within the applicable NCHRP Report 350 criteria. The Steel Backup is designed to be placed against and nest around the roadside obstacle, resulting in a shorter overall assembly length.

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.

Warning: Do NOT modify the QUEST® Classic system in any way.

Warning: It is the responsibility of the installer to ensure that the QUEST® Classic system and delineation used meet all federal, state, specifying agency, and local specifications.

Warning: It is the responsibility of the installer ensure that your assembly meets all appropriate Manual on Uniform Traffic Control Devices and local standards.

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.

Inspect Shipping

Before deploying the QUEST® Classic, check the received parts against the shipping list supplied with the system to ensure all parts are included.

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

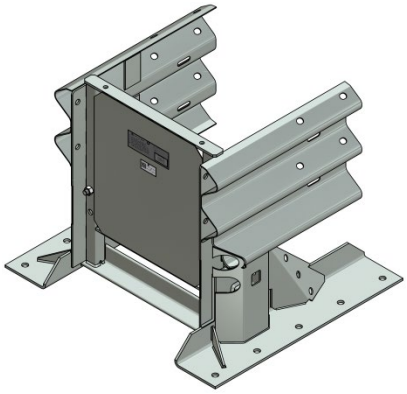
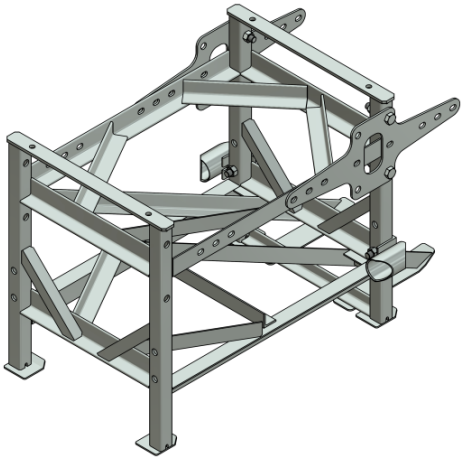
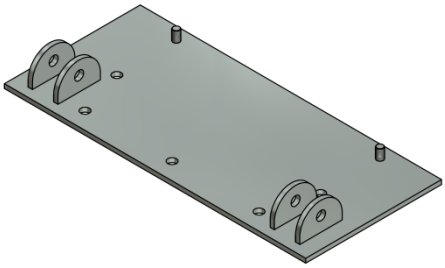
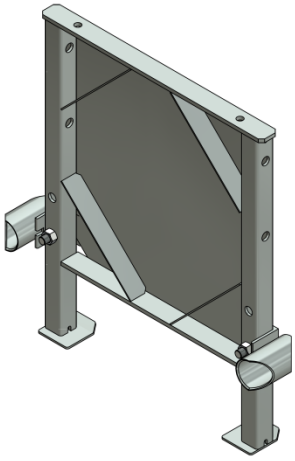
System Components

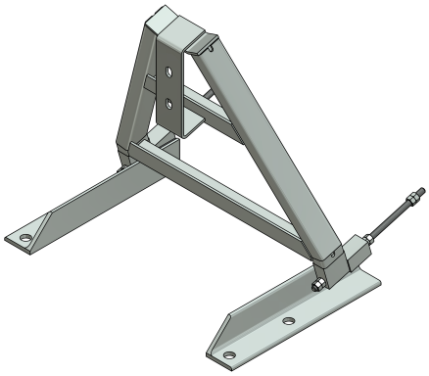
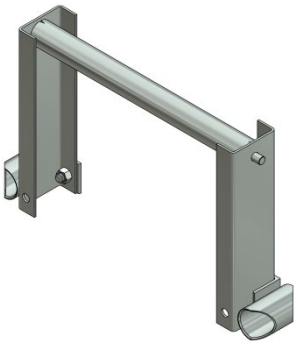
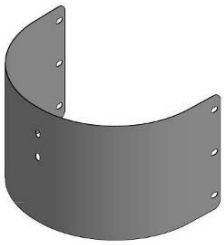
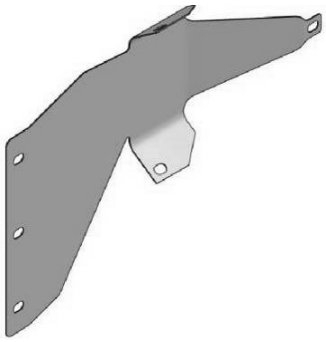
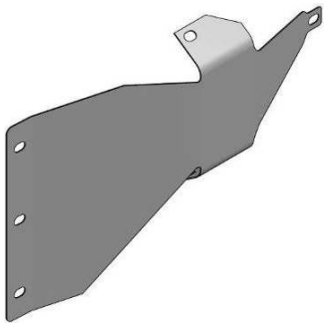
Below is a list of system components of the QUEST® Classic. Please call Valtir customer support if you have any system questions (p. 3).

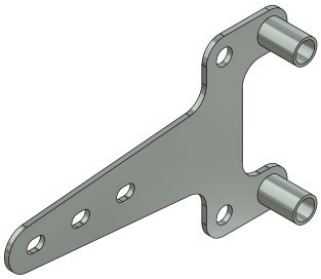
Warning: Use only Valtir parts on the QUEST® Classic for assembly, maintenance, or repair. The use of component parts not specified herein is **strictly prohibited**. The QUEST® Classic with Valtir Parts has been tested, approved, and accepted for state use by the FHWA. A QUEST® Classic using parts other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

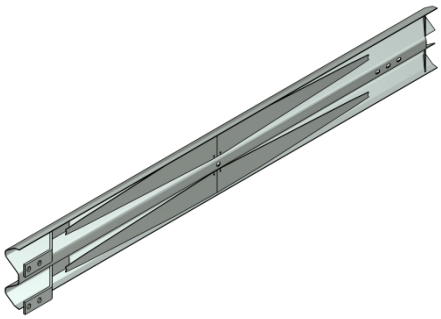
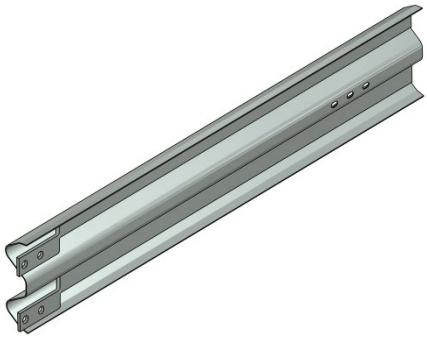
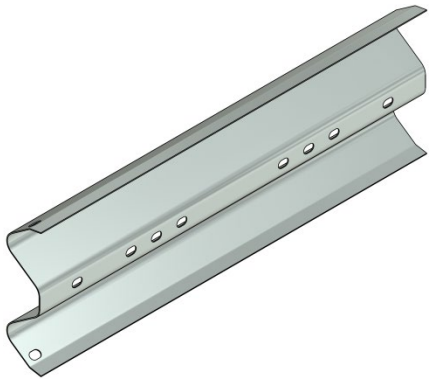
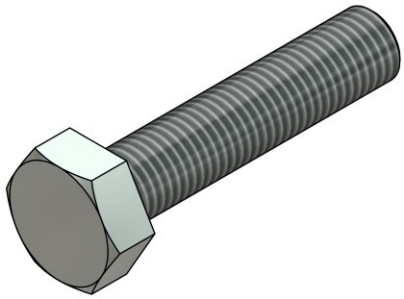
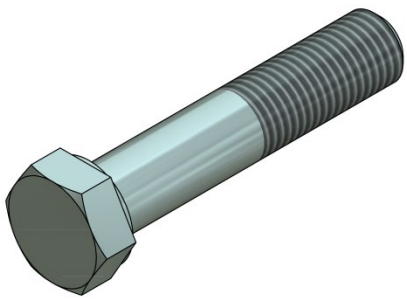
Parts List (QUEST® CLASSIC)			
Item	**Part No.**	**Description**	**Qty.**
1	604486	BACKUP ASSEMBLY, 24, QUEST	1
2	615461	SUPPORT FRAME ASSY, BAY 1, 24, QUEST	1
3	617605	ANCHOR, FRONT, QUEST, 24, G	1
4	606804	DIAPHRAGM ASSEMBLY, 24, BAY 3, QUEST	1
5	616211	TRIGGER ASSEMBLY, QUEST	1
6	605656	BRIDGE, 24, BAY 2, QUEST	1
7	611678	NOSE, QUEST, G, PT	1
8	611641	NOSE TRANSITION, L, QUEST, G, PT	1
9	611642	NOSE TRANSITION, R, QUEST, G, PT	1
10	614028	SHAPER RAIL, L, QUEST, G	1
11	614034	SHAPER RAIL, R, QUEST, G	1
12	605529	BRACKET, PANEL, DIAPHRAGM, G	2
13	613661	REAR RAIL, QUEST, G	2
14	616230	TRIGGER STRAP, QUEST, G	2
15	611794	PANEL, BAY 2, QUEST, G	2
16	611795	PANEL, BAY 3, QUEST, G	2
17	611791	PANEL, BAY 1, QUEST, G	2
18	113558	BOLT, HX, 3/4X3 1/2, G5, G	16
19	113538	BOLT, HX, 1X5, G8, G	2
20	003360	BOLT, RAIL, 5/8X1 1/4, G	38
21	113547	BOLT, HX, 3/4X1 1/2, G5, G	4
22	003340	NUT, HX, 5/8, G, RAIL	38
23	115953	NUT, HX, 3/4, G	20
24	115931	NUT, HX, 1, G	2
25	617010	WASHER, BAR, 2X2X1/4, G	2
26	617005	WASHER, BAR, 1/8X1 1/4X2, ROUNDED, G	8
27	115311	ASSEMBLY MANUAL, QUEST	1
28	115674	MATERIAL SAFETY INFO NOTICE	1
29	118026	WASHER, FLAT, 3/4X1 1/2, G	16
30	113530	BOLT, HX, 1X3 1/2, G5, G	2
31	614533	SPACER, RAIL TENSION, QUEST	2
32	115954	NUT, HX, 3/4, GR DH	2
33	118027	WASHER, FLAT, 3/4X2, HVY, G	2

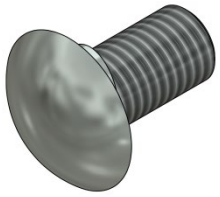
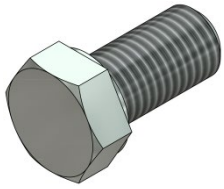
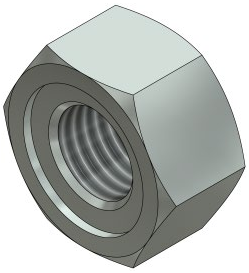
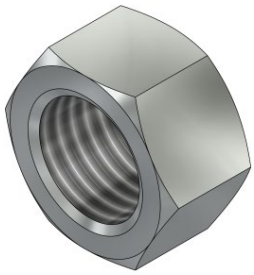
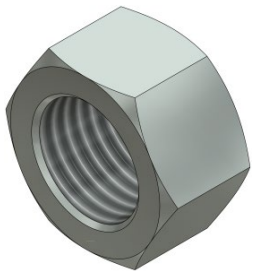
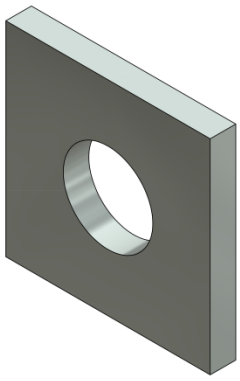
Note: Components are not shown to scale.

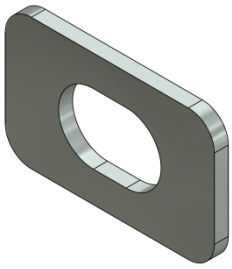
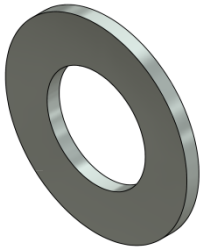
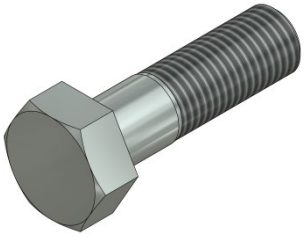
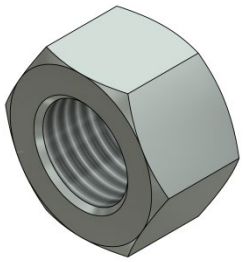
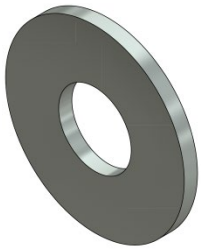
	**ITEM 1** 604486 BACKUP, 24, QUEST (1)
	**ITEM 2** 615461 SUPPORT FRAME ASSY, 24, QUEST (1)
	**ITEM 3** 617605 ANCHOR,FRONT, QUEST, 24, G (1)
	**ITEM 4** 606804 DIAPHRAGM ASSEMBLY, 24, BAY 3, QUEST (1)

	**ITEM 5** 616211 TRIGGER ASSY,QUEST (1)
	**ITEM 6** 605656, BRIDGE, 24, BAY 2, QUEST (1)
	**ITEM 7** 611678 NOSE, QUEST, G, PT (1)
	**ITEM 8** 616641 NOSE TRANSITION, L, QUEST, G, PT (1)
	**ITEM 9** 611642 NOSE TRANSITION,R,QUEST,G,PT (1)

	**ITEM 10** 614028 SHAPER RAIL, L, QUEST, G (1)
	**ITEM 11** 614034 SHAPER RAIL, R, QUEST, G (1)
	**ITEM 12** 605529 BRACKET, PANEL, DIAPHRAGM, G (2)
	**ITEM 13** 613661 REAR RAIL, QUEST, G (2)
	**ITEM 14** 616230 TRIGGER STRAP,QUEST, G, (2)

	**ITEM 15** 611794 PANEL, BAY 2, QUEST, G (2)
	**ITEM 16** 611795 PANEL, BAY 3, QUEST, G (2)
	**ITEM 17** 611791 PANEL, BAY 1, QUEST, G (2)
	**ITEM 18** 113558 BOLT, HX, 3/4X3 1/2, G5, G (16)
	**ITEM 19** 113538 BOLT, HX, 1X5, G8, G (2)

	**ITEM 20** 003360 BOLT, RAIL, 5/8X1 1/4, G (38)
	**ITEM 21** 113547 BOLT, HX, 3/4X1 1/2, G5, G (4)
	**ITEM 22** 003340 NUT, HX, 5/8, G, RAIL (38)
	**ITEM 23** 115953 NUT, HX, 3/4, G, (20)
	**ITEM 24** 115931 NUT, HX, 1, G, (2)
	**ITEM 25** 617010 WASHER, BAR, 2X2X1/4, G (2)

	**ITEM 26** 617005 WASHER, BAR, 1/8X1 1/4X2, ROUNDED G (8)
	**ITEM 29** 118026, WASHER, FLAT, 3/4X1 1/2, G (16)
	**ITEM 30** 113530 BOLT, HX, 1X3 1/2, G5, G (2)
	**ITEM 31** 614533 SPACER, RAIL TENSION, QUEST (2)
	**ITEM 32** 115954 NUT, HX, 3/4, GR DH (2)
	**ITEM 33** 118027 WASHER, FLAT, 3/4X2, HVY, G (2)

Foundation/Anchoring

Important: It is the responsibility of the local DOT or appropriate authority to ensure 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 OSHA and local standards.

Concrete Installations

For concrete anchoring, the QUEST® Classic system should be mounted 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.

Asphalt Installations

Assemblies on Asphalt Concrete **("A.C.")** must provide a minimum of 3" [76 mm] layer of asphalt over a minimum of 3" [76 mm] layer of **Portland Cement Concrete ("P.C.C.")**, 6" [152 mm] layer of asphalt over 6" [152 mm] layer of subbase, or 8" [203 mm] layer of asphalt with no subbase.

Important: Only 18" [460 mm] threaded rods, utilizing Valtir approved adhesive, can be used with asphalt foundations. Contact Customer Service for a complete list of approved adhesives (p. 3).

The QUEST® Classic system may be placed on any of the following foundations using the specified anchorage:

Foundation A: Concrete Pad or Roadway

Foundation: 6" [150 mm] minimum depth P.C.C.

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

Foundation B: Asphalt over P.C.C.

Foundation: 3" [76 mm] minimum A.C. over 3" [76 mm] minimum P.C.C.

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

Foundation C: Asphalt over Compacted Subbase ("C.S.")

Foundation: 6" [150 mm] minimum A.C. over 6" [150 mm] minimum **C.S.**

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

Foundation D: Asphalt Only

Foundation: 8" [200 mm] minimum A.C.

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

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. Anchors used on systems mounted on asphalt must be inspected every six months. See Post Impact Instructions and Maintenance and Repair instructions on page 38 & 39.

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, washers and instructions. Both vertical and horizontal assemblies are possible using an approved adhesive anchoring system.

Important: Follow adhesive manufacturer's temperature storage requirements.

l Assemblies

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 (studs) that anchor the QUEST® Classic system 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 part that is to be anchored as a drilling template. 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 your kit. Check to ensure all the boreholes are drilled to the proper depth and aligned with the part to be anchored per the chart below.

Anchoring Information

Stud Size:	Orientation	Bit Size	Minimum Depth	Torque	Medium
3/4"x 6 1/2"	Horizontal	7/8" [22 mm]	5 1/4" [133 mm]	Manufacturer Spec	Concrete
3/4"x 7"	Vertical	7/8" [22 mm]	5 3/4" [145 mm]	Manufacturer Spec	Concrete
3/4"x 18"	Vertical	7/8" [22 mm]	16 3/4" [425 mm]	10 ft-lb [15 N-m]	Asphalt

Important: When mounting on asphalt, initial torque shall be as shown in the Anchoring Information chart. Due to the properties of asphalt, anchors may loosen over time. For this reason Valtir 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 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 Valtir approved vacuum drilling equipment is authorized to replace the blowing and brushing requirement in 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 1).

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

Push the stud, nut, and washer assembly down through the part and into the borehole until the washer is seated against the part (Figure 1).

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

7) Torque the Nuts

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

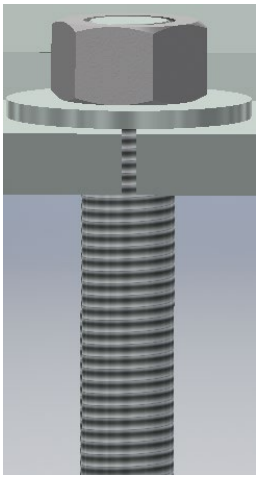


Figure 1
Anchor Application
(Before Applied Torque)

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 Application

1) Add the Washers and Nuts

Put washer and nut on stud leaving nut flush with end of anchor (Figure 2).

2) Insert Studs into Holes

Push stud through part to be anchored and into hole. Twist the anchor in the adhesive to wet the threads.

Note: In vertical and horizontal applications the anchor should be flush with the top of the nut (Figure 2).

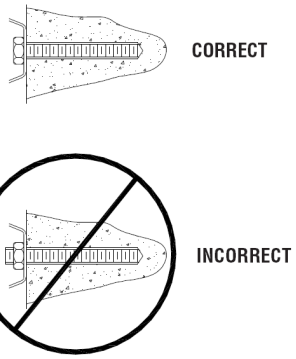


Figure 2
Horizontal Application

Caution: Do not disturb or load the stud until the adhesive material has hardened (instructions provided with adhesive).

3) Torque the nuts

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

Recommended Tools

Documentation

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

Cutting equipment

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

∗ Valtir recommends using **double-fluted** drill bits to achieve optimum tensile strength when applying an approved anchoring system.

Hammers

- Sledgehammer
- Standard hammer

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.

Wrenches

- Heavy duty impact wrench 1/2" drive
- Standard adjustable wrench 12” [300 mm]
- 1/2" drive sockets: 1 1/8", 1 1/4", 1 1/2"
- Deep sockets: 1 1/4"
- Ratchet and attachments for the above sockets
- 1/2" drive Breaker bar - 24" long
- 1/2" drive Torque wrench: 200 ft-lb
- 2 ea. Open/Box End Wrench – 3/4"

Personal Protective equipment

- Safety Glasses
- Gloves
- Safety-Toe Shoes
- Protective Clothing

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 brush for cleaning 7/8” drilled holes
- Rags, water, and cold galvanizing paint for touch-up

Note: The tools listed herein 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.

How to Determine Left/Right

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

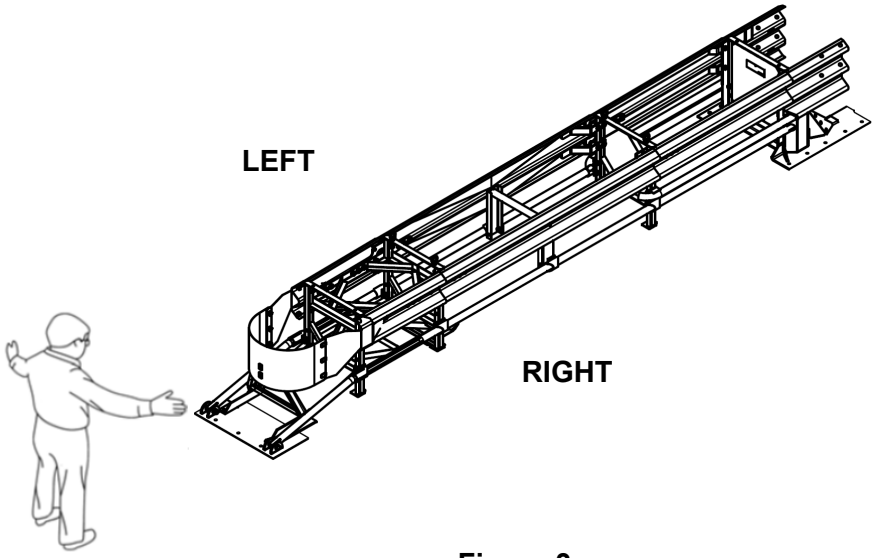


Figure 3

Defining the Bays

Bay 1 consists of a steel framework, Bay 2 consists of two Fender Panels and a Bridge, Bay 3 consists of one Diaphragm and two Fender Panels. Determine the number of Bays by counting the Fender Panels on one side.

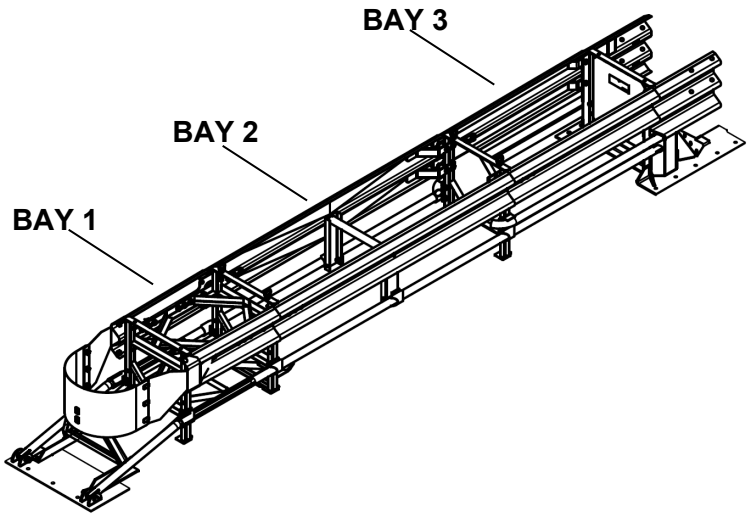


Figure 4

Site Preparation/Foundation

Concrete Foundation Assembly

A QUEST® Classic system should be assembled on an existing or freshly placed and cured concrete base (28 MPa [4000 psi] minimum). Use 7" [180 mm] Threaded Rods attached with Valtir approved adhesive. Location and orientation of the concrete base and attenuator must comply with project plans or as otherwise determined by the resident project engineer.

For an independent, soil-supported concrete foundation, include a below-grade anchor block as part of the foundation. The large block will keep the foundation from sliding during an impact. Additional details can be found on the standard drawings and project plans.

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

Warning: Ensure that there is proper site grading for the QUEST® Classic system placement as dictated by the state or specifying agency, pursuant to FHWA acceptance.

Caution: It is the responsibility of the installer to ensure accurate placement of all steel rebar to avoid interference with the concrete anchor bolts.

Warning: Location of the Backup in relation to the roadside feature and nearby objects will affect the operation of the attenuator. Upon impact, the Shaper Rails telescope rearward and extend beyond the rigid Backup and roadside feature as much as 5' [1.5 m] from their pre-impact location; therefore, the Backup must nest around concrete walls, barriers, and pillars. Failure to comply with this requirement may result in untested system performance and could result in component damage rendering the system unusable.

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

Cross-Slope

Assembled cross-slope shall not exceed 8% (Figure 5) and should not twist more than 2% over the length of the system; the foundation surface shall have a light broom finish.

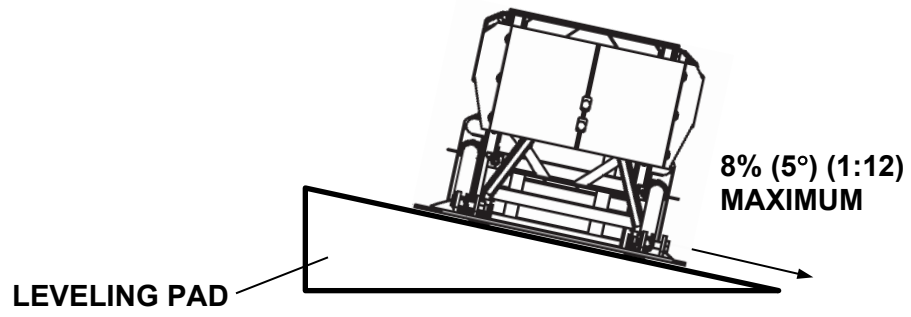


Figure 5
Cross-Slope

Assembly

Inspect Shipping

Before deploying the QUEST® Classic system, check the received parts against the shipping list supplied with the system. Make sure all parts have been received.

The following are instructions on how to preassemble the QUEST® Classic system prior to on-site deployment.

1) Bolting Bay 3 Fender Panels to the Backup

a. Bolt the Diaphragm Panel Brackets to the Bay 3 Fender Panels (Figure 6). Hand-tighten nuts.

b. Stand up Diaphragm and place about 5’ in front of the Backup.

c. Hold up one of the Bay 3 Fender Panels to the Backup and Diaphragm aligning holes (Figure 7). Place bolts through the holes in the Backup and rear of the Fender Panel for support and hand-tighten nuts. Next, place bolts through the Diaphragm and Panel Bracket in the front of the Fender Panel in order to hold the Panel in place (do not use nuts at this time). Repeat this procedure for the Fender Panel on the opposite side.

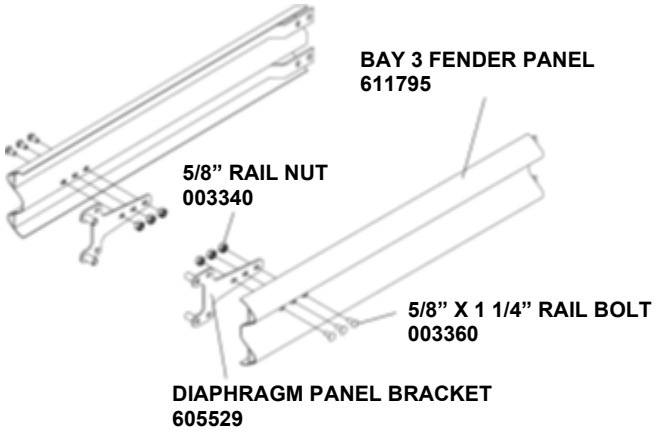


Figure 6

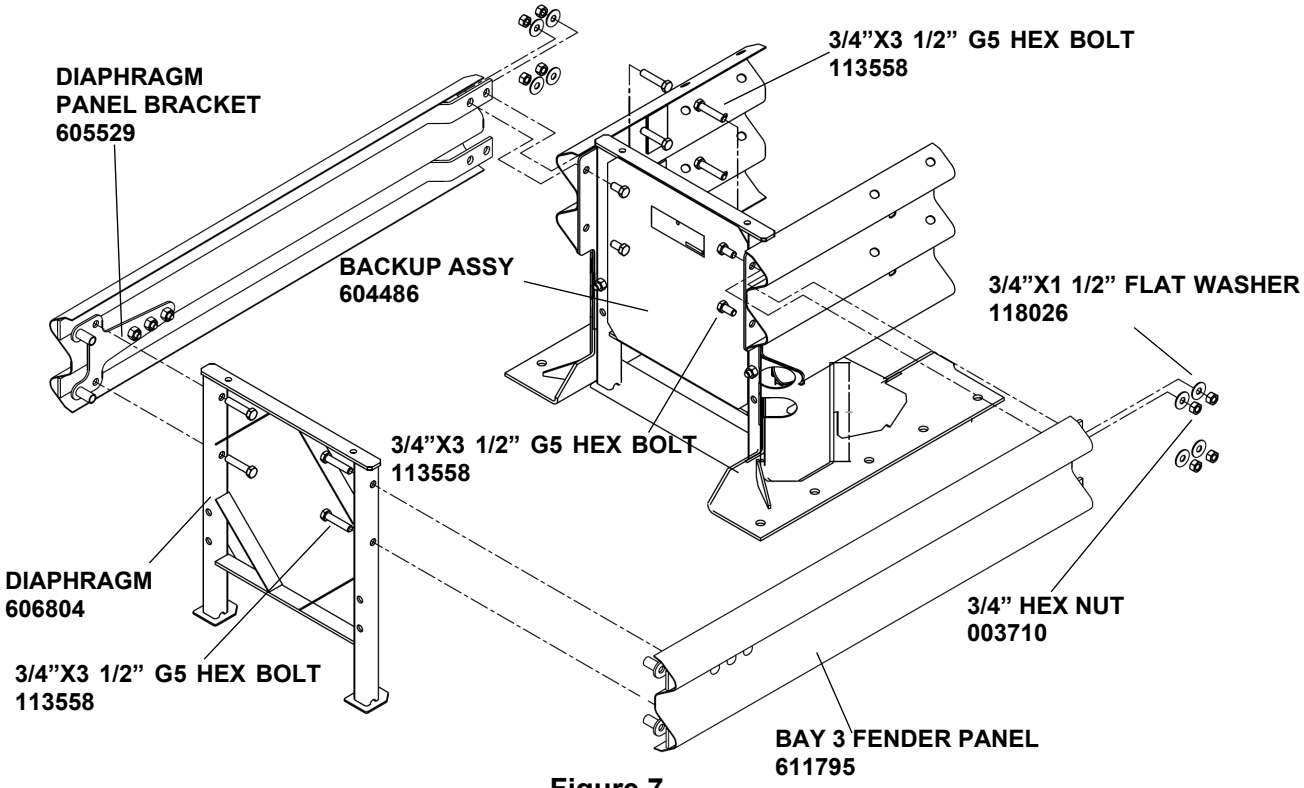


Figure 7

2) Attaching Fender Panels for Bay 2 and Bay 1

a. Attach Support Frame Panel Brackets to the Bay 2 Fender Panel (Figure 9). Hand-tighten nuts.

b. Make sure that the gap at the end of Bay 2 Fender Panel measures 5 13/16” ± 1/16” (Figure 8). The gap can be adjusted using a large wrench.

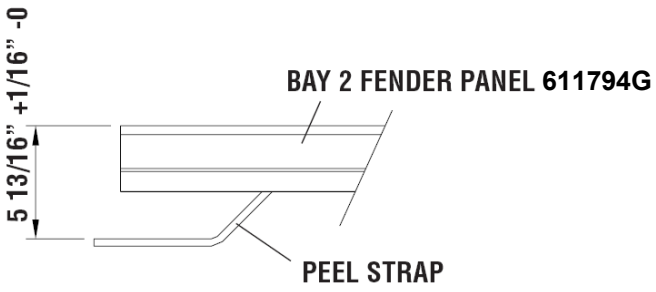


Figure 8

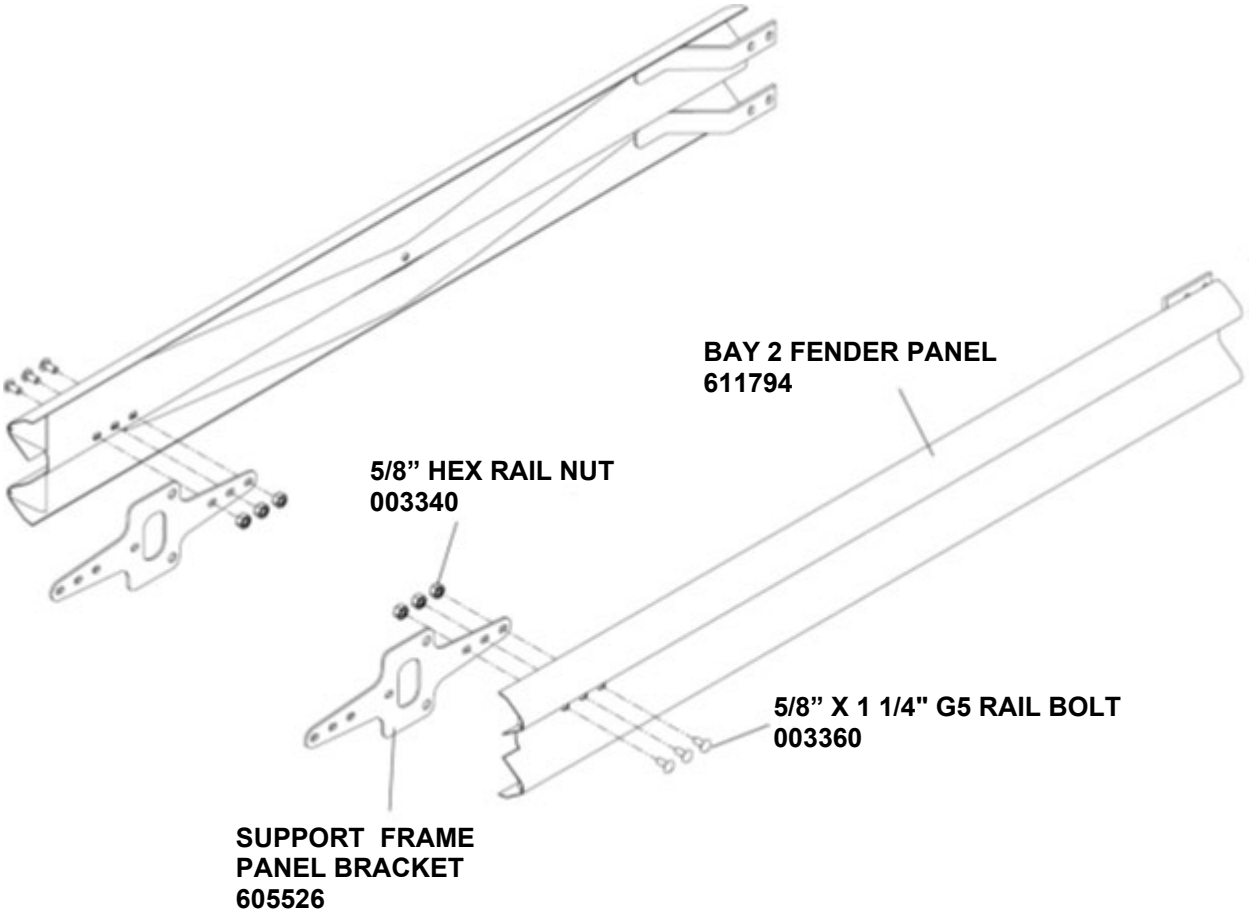


Figure 9

c. Lift a Bay 2 Fender Panel with a fork lift or other means and hold in place about 19” off the ground.

d. Position Fender Panel by removing the bolts holding Bay 3 Fender Panels in place and butting the Peel Strap ends up against the Diaphragm, on the inside of the Diaphragm leg, aligning the bolt holes. The Bay 2 Fender Panel should overlap the Bay 3 Fender Panel. Using the bolts that were holding the Bay 3 Fender Panel in place, attach the Bay 2 Fender Panel to the Diaphragm. Bolts and nuts should only be hand-tightened (Figure 10).

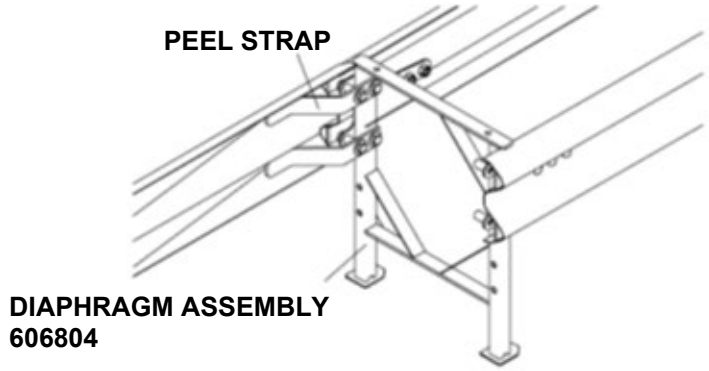


Figure 10

e. Place the Support Frame into position at the front end of the Bay 2 Fender Panel (Figure 11).

f. Once the Support Frame is in place, attach the Support Frame Panel Bracket to it using 3/4" x 3 1/2" hex bolts.

g. Attach the Bay 1 Fender Panel to the Support Frame using Rail Bolts. The Bay 1 Fender panel will overlap the Bay 2 Fender Panel.

h. Leave bolts hand tightened until assembly is completed.

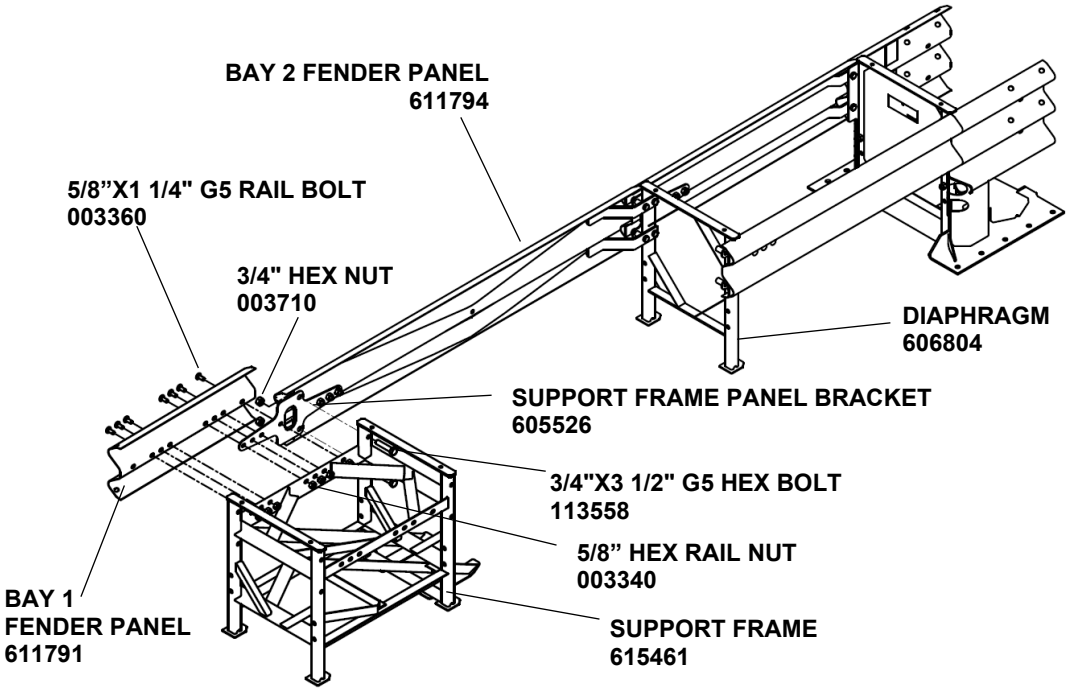


Figure 11

i. Repeat procedures 2b, 2c, 2d, 2f, and 2g on the other side (Figure 12).

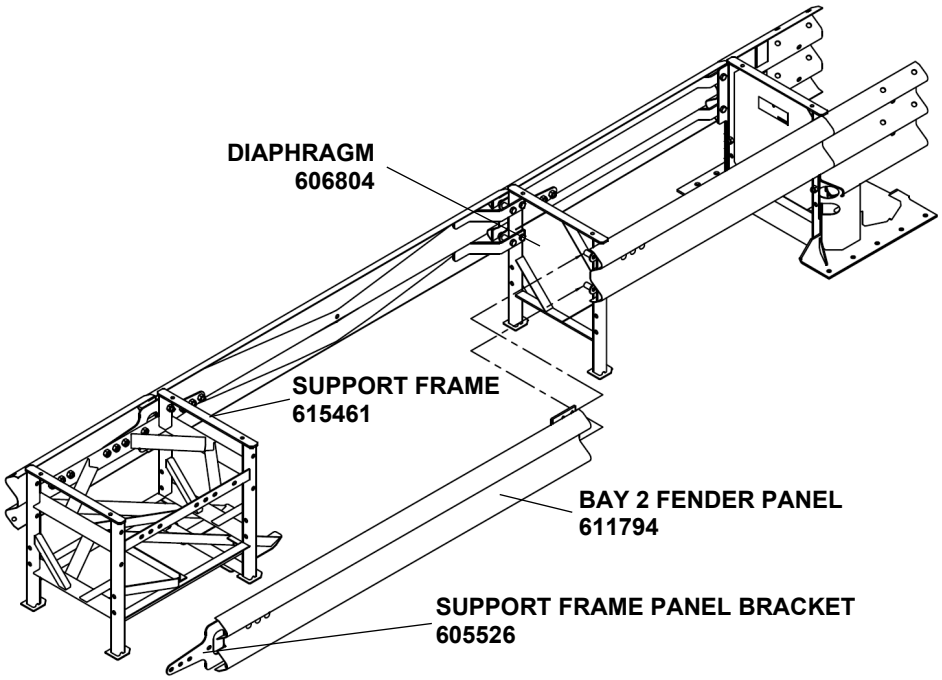
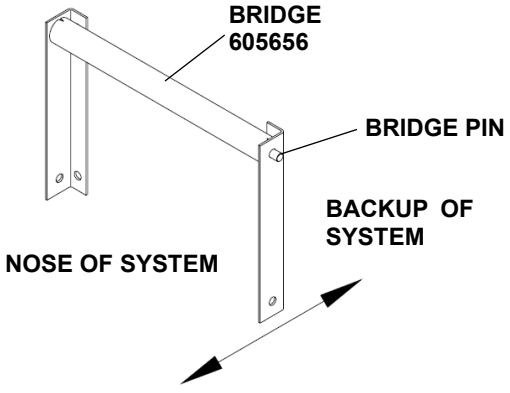


Figure 12

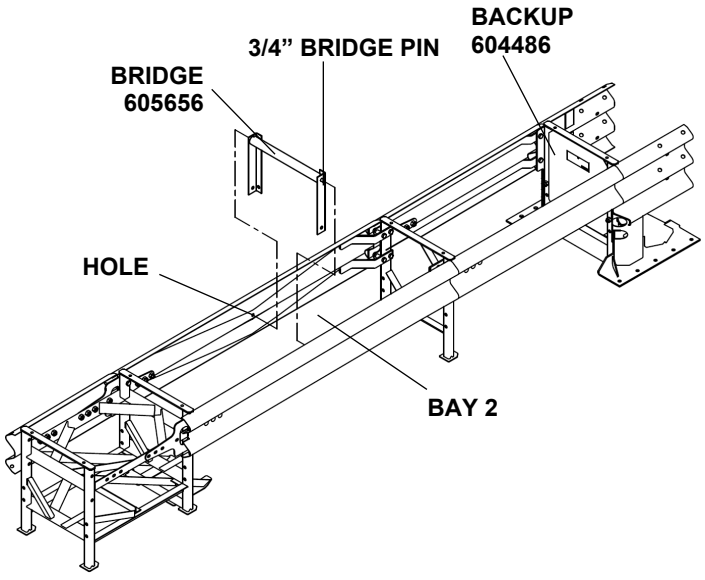
3) Inserting Bridge

a. Place the Bridge midway between the Bay 2 Panels and position the 3/4" Bridge Pins through the holes at the center of the Panels. Take care to orient the leg of the Bridge angle (Detail 12a & 12b).

b. Once Bridge is in place, attach the Support Frame Panel Bracket to the Support Frame using 3/4" x 3 1/2" hex bolts. Place bolts through the inside of the support Frame and hand tighten nuts (Detail 12b).



Detail 12a
Correct orientation to Bridge



Detail 12b

c. Repeat procedures 2f and 2g to finish the assembly of Bay 1 (Figure 13).

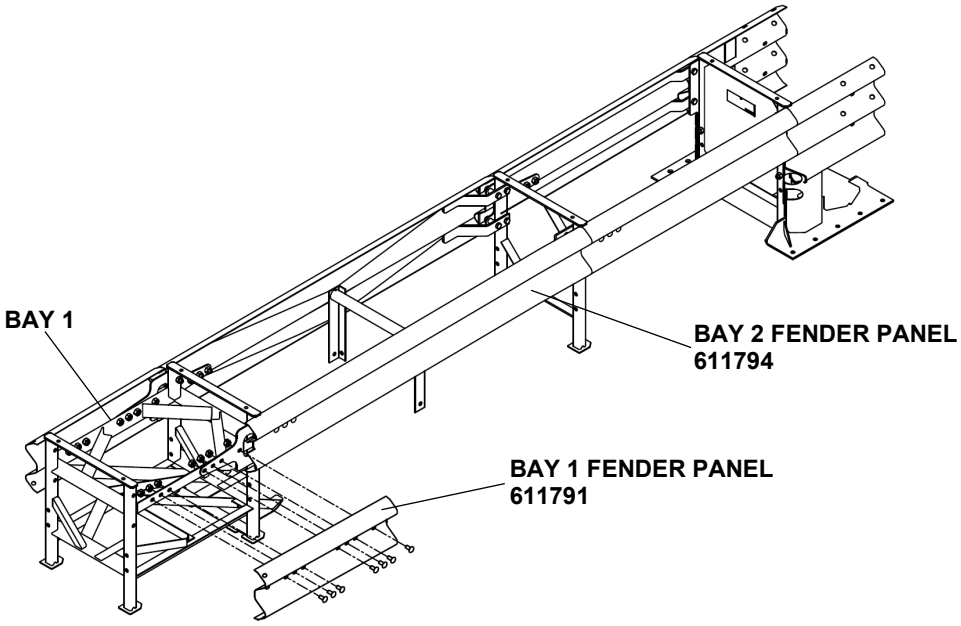


Figure 13

4) Inserting Rear Rails

a. Insert the crimped end of the Rear Rail into the Upper Tube hole located in the Backup (Figure 14).

b. Bolt the bent portion of the Rear Rail Assembly to the back side of the Diaphragm using 3/4" x 3 1/2” hex bolt (Figure 14).

c. Repeat process for other side of unit.

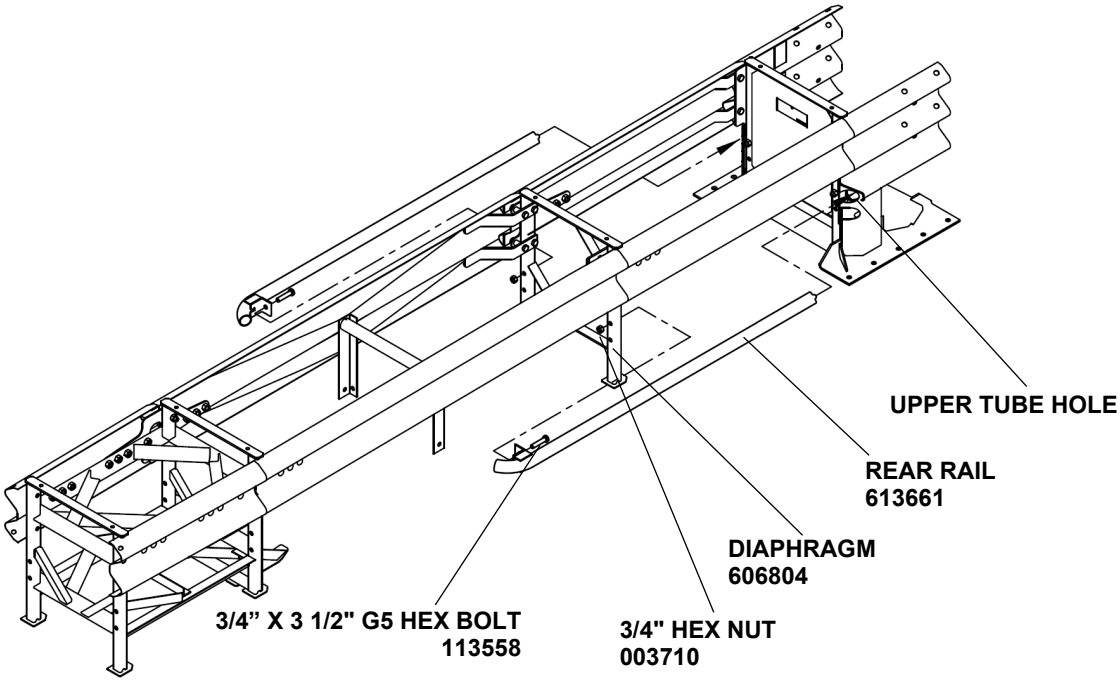


Figure 14

5) Inserting Rear Shapers

a. Slide the Rear Shaper over the crimped end of the Rear Rail.

b. Bolt the Rear Shaper to the Backup Frame and hand tighten nuts (Figure 15).

c. Repeat process for other side.

6) Assemble the Trigger

a. Place a double nut midway on each of the Threaded Rods.

b. Slide the rods through the Trigger Anchor and Trigger Frame (Figure 16).

c. Thread another double nut on each rod to sandwich the Trigger Frame and the Trigger Anchors (Figure 17 and Detail 17a). Tighten double nuts.

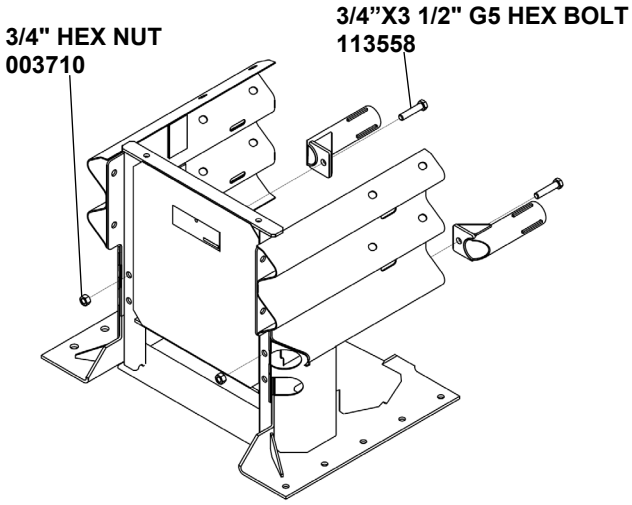


Figure 15

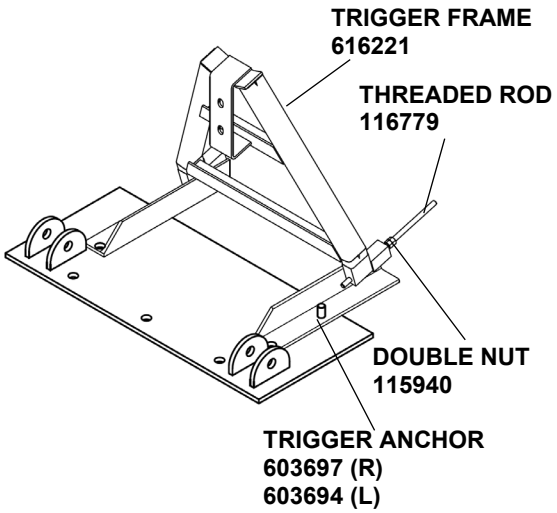


Figure 16

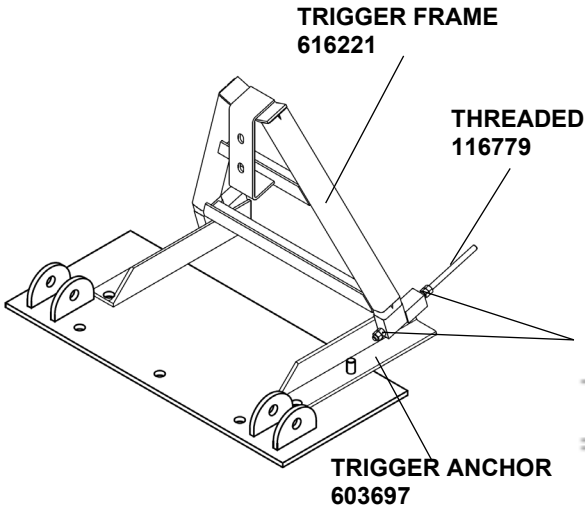
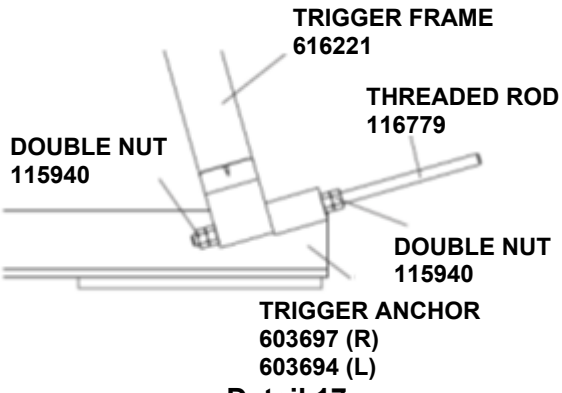


Figure 17



Detail 17a

d. Slide the Trigger Straps over the Threaded Rods (Figure 18).

e. Place final double nut on the Threaded Rod to complete the assembly (Figure 19). Keep the last double nut toward the end of the rod. This will be used to tension the trigger assembly after deployment.

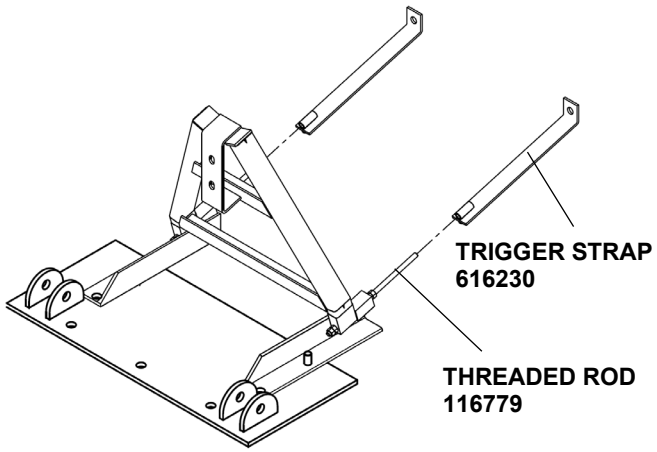


Figure 18

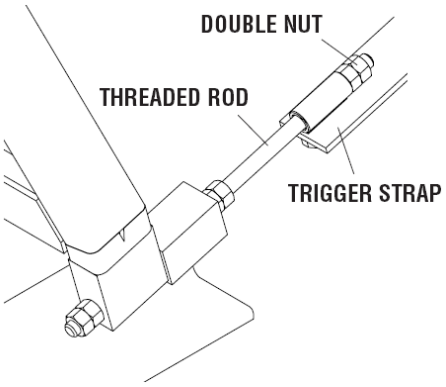


Figure 19

7) Attaching the Shaper Rail Assembly

a. Bolt the Rail Guides onto Bay 1 and the Diaphragm. Be sure to orient the Guides correctly (Figure 20).

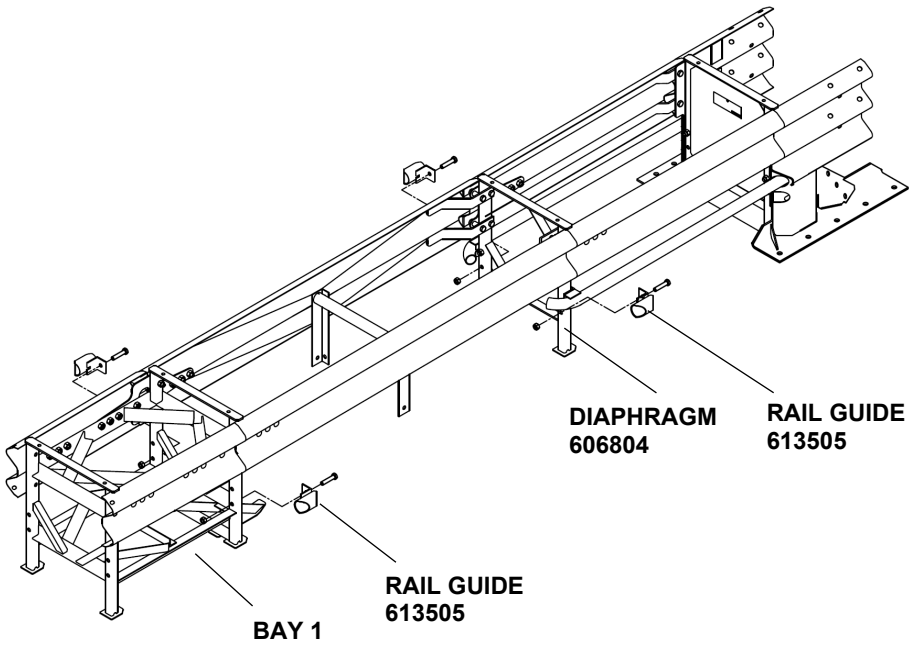


Figure 20

b. Slide the Shaper Rail (right side shown) through Bay 1 guide then slide the Bridge's Rail Guide over the Bridge's Guide to the Bridge (Figure 21).

c. Continue to slide the Shaper Rail through the Diaphragm's guide and into the Backup (Figure 22). Rotate Shaper Rail so that angle tab clears the Support Frame Leg. Insert the 1" x 3 1/2" hex bolt into the end of the Shaper Rail at the Backup. Do not tighten at this time.

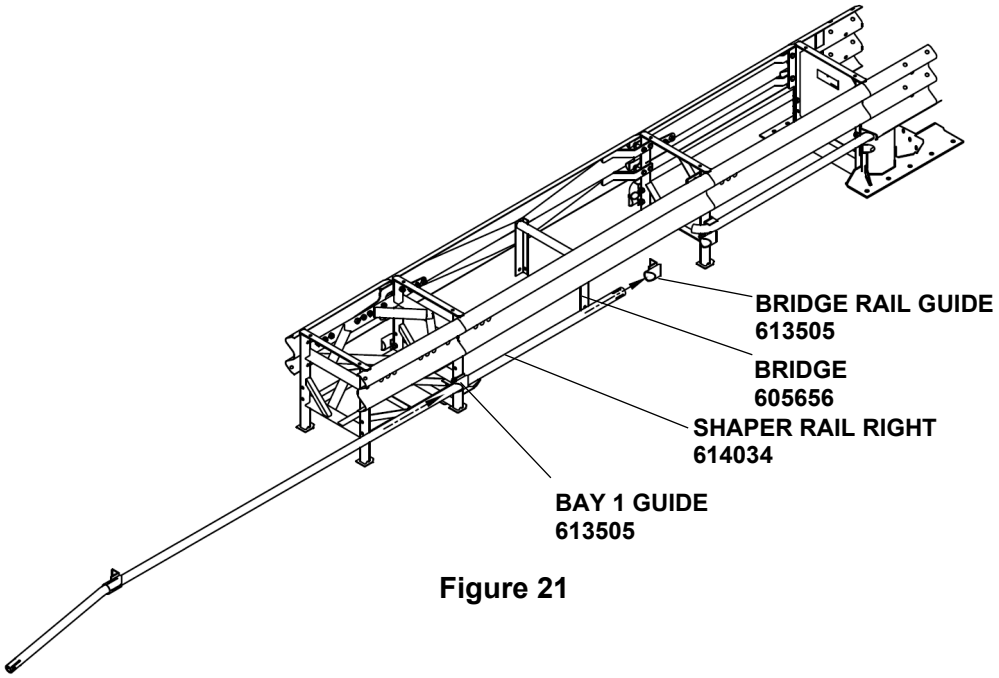


Figure 21

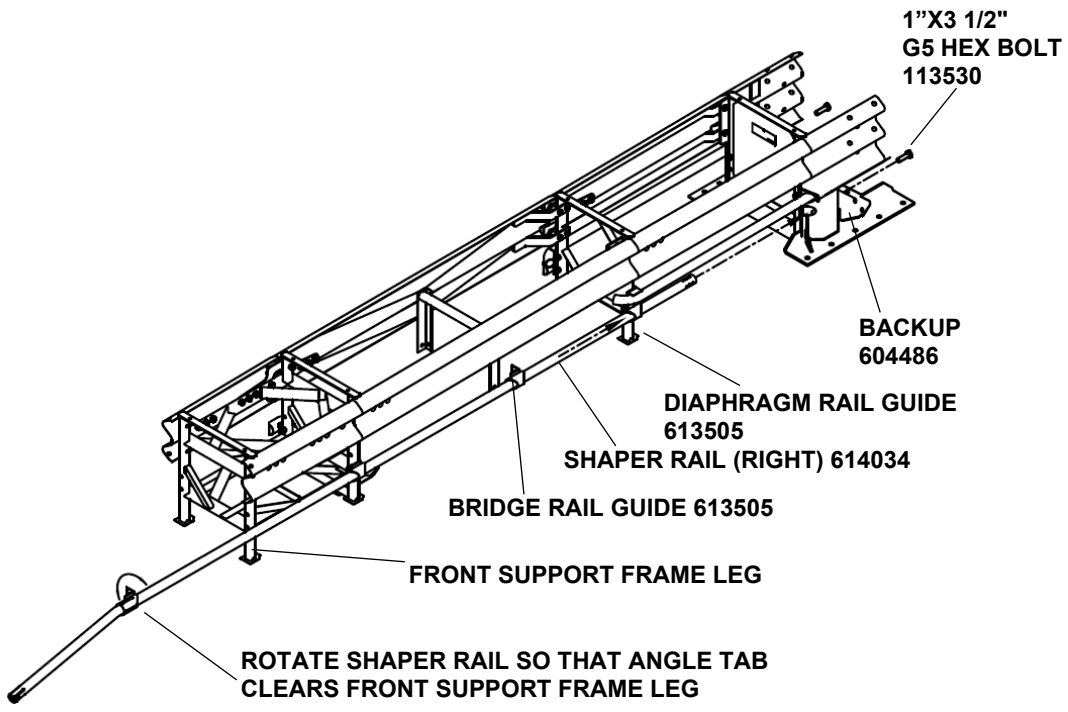


Figure 22

d. Attach Shaper and Trigger Assembly to Bay 1 and attach the loose Rail Guide to the Bridge. Be sure to orient the Guide correctly (Figure 23).

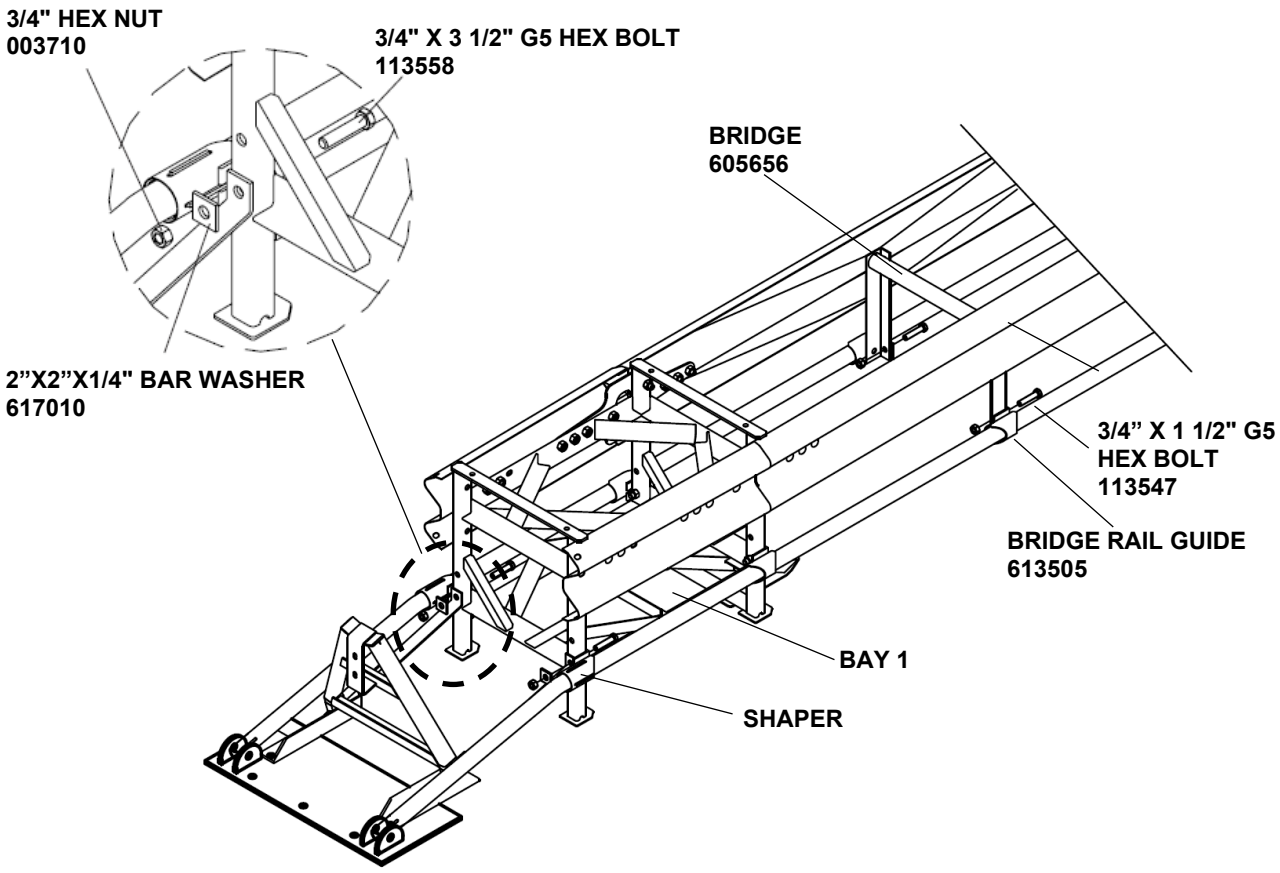


Figure 23

e. Bolt Shaper Rail Assembly to the Front Anchor Plate (Figure 24).

f. Repeat steps 7b through 7c to connect the other Shaper Rail (p. 28).

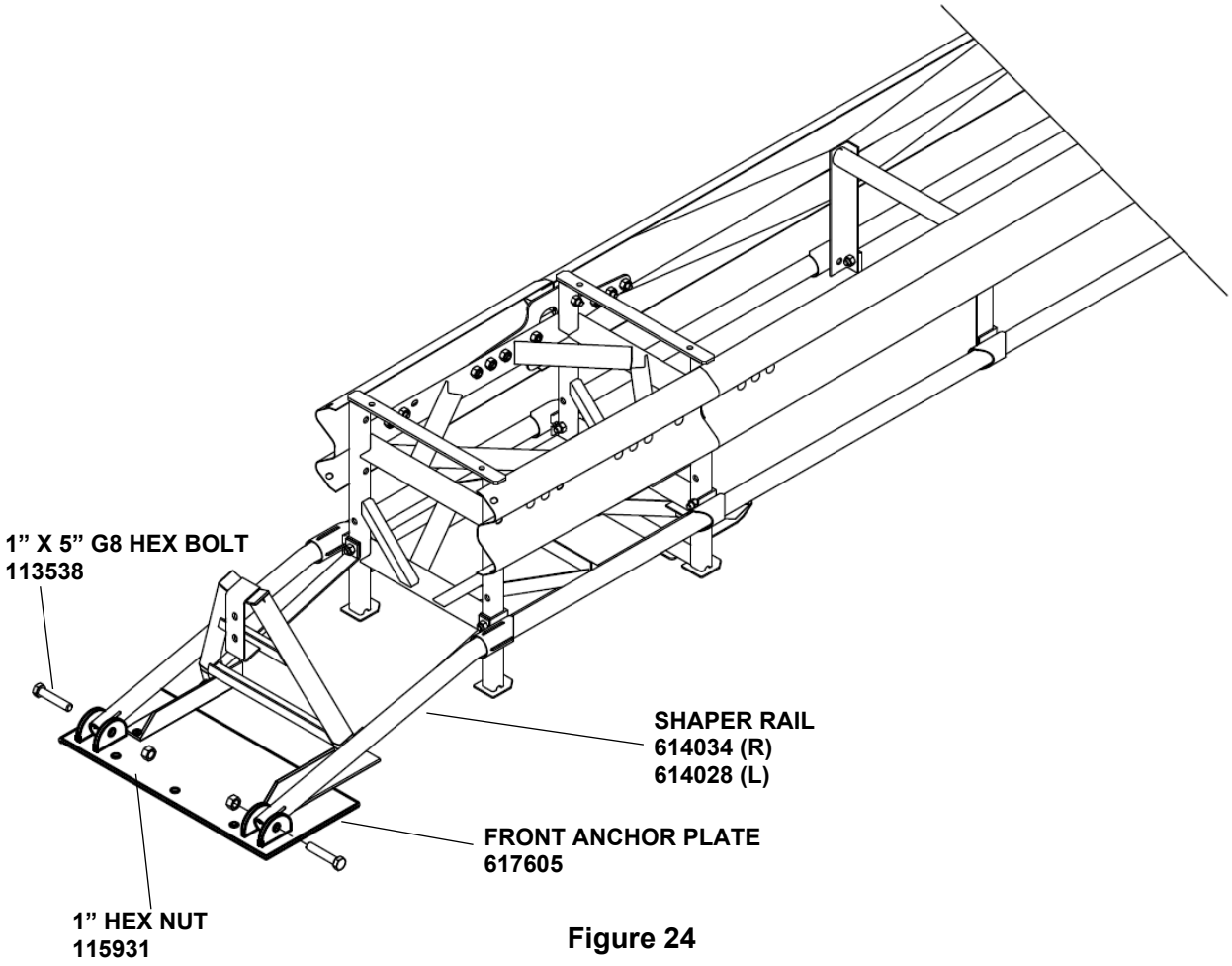


Figure 24

8) Attaching Nose Assembly

a. Use Rail Bolts, washers, and nuts to attach the Nose Plates to Bay 1 (Figure 25).

b. Bolt the center of the Nose Wrap to the Trigger Frame with Rail Bolts, washers, and nuts (Figure 26).

c. Bolt the Nose Wrap to one of the Nose Plates and then bring it around the other Nose Plate and fasten with Rail Bolts, washers, and nuts (Figure 26).

Note: For ease of assembly, Nose Assembly should be left off until system is anchored.

9) Checking the System Assembly

At this point, tighten all bolts except for Trigger assembly and larger shaper Rail Bolts located at the rear of the system.

Warning: The Backup is designed to nest around concrete walls, barriers, and pillars 24” [610 mm] in width or less. Failure to nest the backup around these types of obstacles may result in impaired system performance.

- Check bridge in Bay 2
- Check all Fender Panels
- Check orientation of Shaper Rail Guides
- Check Trigger Assembly

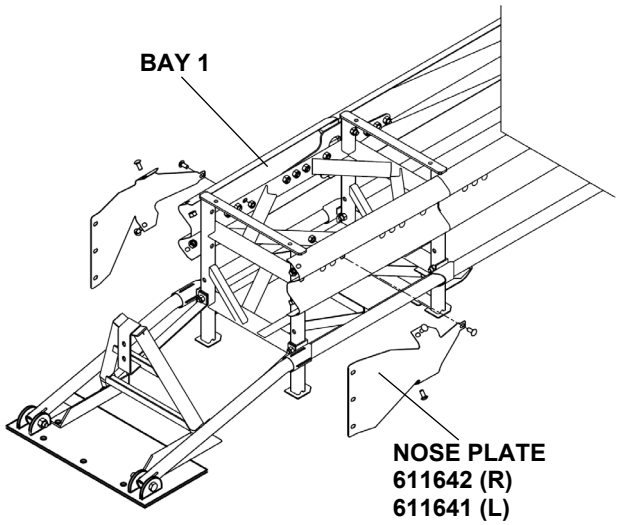


Figure 25

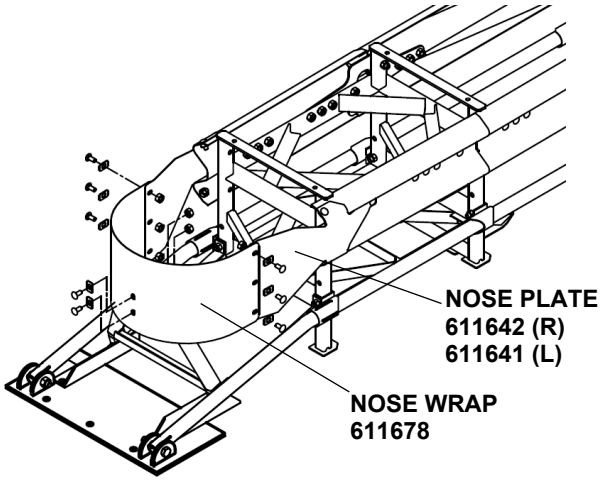


Figure 26

Assembly Procedures

Note: The drawing package provided with the QUEST® Classic system must be used with these instructions for proper assembly and should take precedence over these general instructions.

1) **Deploy Traffic Control**

   A traffic control plan appropriate to the complexity of the project should be prepared and understood by all parties before the QUEST® Classic system is assembled. The plan by the local DOT or appropriate highway authority should be followed.

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

Deploy the appropriate work zone safety devices, as specified by the DOT or appropriate highway authority, prior to beginning the deployment and keep them present through all phases of assembly.

2) **Determining the Basepoint and Centerline**

   Typically the Basepoint of the QUEST® Classic system will be the midpoint of the roadside obstacle at its front face.

Warning: The Backup is designed to nest around concrete walls, barriers, and pillars 24” [610 mm] in width or less. Failure to nest the backup around these types of obstacles may result in impaired system performance.

Extend a chalk line from the Basepoint so it is perpendicular to the roadside obstacle face or as determined by project engineer. Your chalk line should be longer than the maximum length of the QUEST® Classic system (refer to the drawings provided). The chalk line will become the centerline for the QUEST® Classic system (Figure 27).

Note: The QUEST® Classic system, when properly assembled, appears to be an extension of the object which it is shielding (Figure 28).

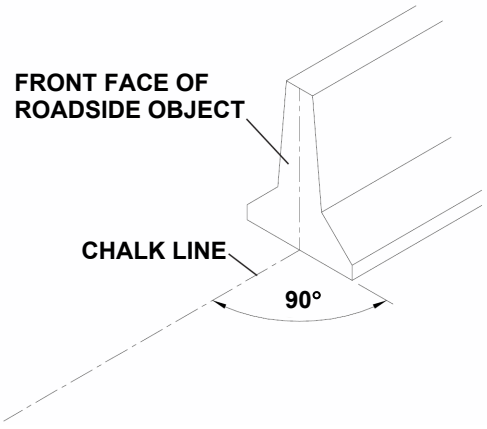


Figure 27

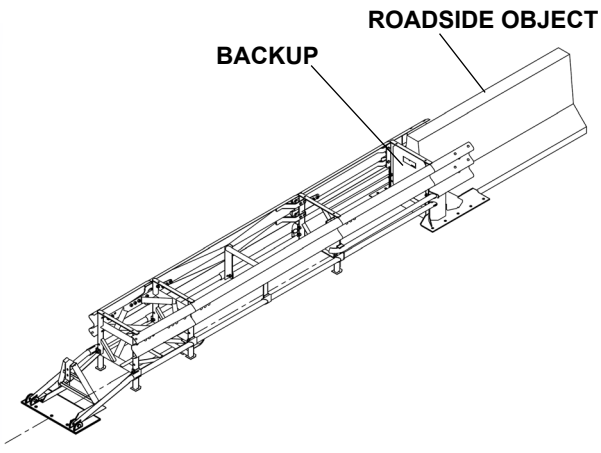


Figure 28

3) Lifting/Placing the System

Use the lifting points to lift the QUEST® Classic system into place (Figure 29).

Important: **DO NOT LIFT SYSTEM USING THE TUBE RAILS!**

Use fixed-length slings with 3,000 lb. [1,365 kg] minimum capacity. Fixed slings will prevent system tipping. At **no** time should anyone be allowed to walk under an elevated unit.

Warning: Do not lift the system over any personnel. Do not stand below or behind the system when performing this function. Failure to heed this warning could result in injury or death.

For assemblies shielding concrete wall, safety shape barrier or pillar, the steel backup should be nested around the roadside feature (Figure 30).

Warning: Lift only fully assembled systems.

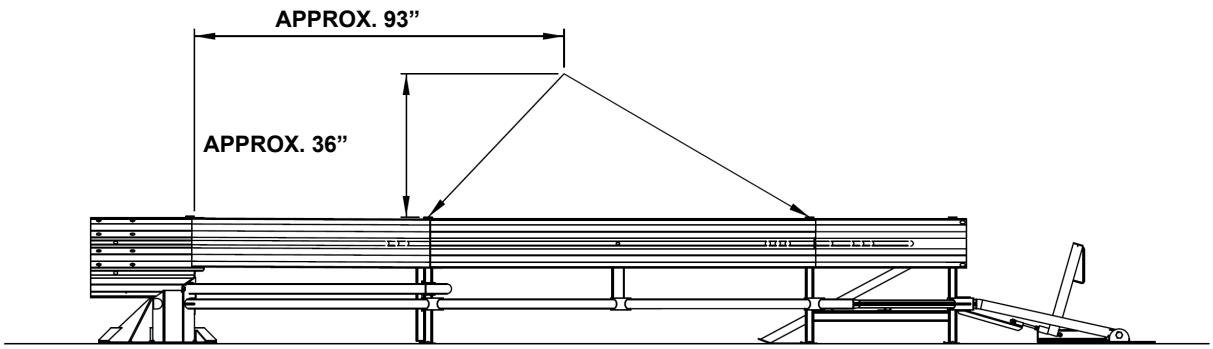


Figure 29

4) Adjusting the Shaper Rails

Adjust the shaper rails and front anchors as necessary to properly align the system.

5) Drill and Set Anchors

Use the holes in the Backup and Front Anchor Plates as a template to locate and drill holes.

For Concrete Assemblies

The Backup requires ten (10) Valtir approved adhesive anchors, five (5) anchors on both the left and right sides.

Every anchor hole in the front anchor assemblies must be anchored by an anchor stud.

The front anchor assemblies require five (5) anchors.

Drill 7/8” [22 mm] diameter x 5 3/4” [145 mm], deep holes into the concrete pad or roadway (Figure 30). Use Valtir approved adhesive kits to assemble 3/4" diameter x 7” long studs using instructions included with kit. After adhesive is hardened, use 3/4" flat washers and nuts provided with kit to anchor system to foundation.

Asphalt Assemblies

Every anchor hole in the Backup and front anchor assemblies must be anchored.

Drill 7/8” [22 mm] diameter x 16 1/2” [420 mm] deep holes into the asphalt roadway. Use Valtir approved adhesive kits to assemble 3/4” diameter x 18” long studs using instructions included with kit. After adhesive is hardened, use 3/4" flat washers and nuts provided with kit to anchor system to foundation.

6) Adjusting the Trigger Assembly

Tension Threaded Rod by tightening the upper nut approximately 1/8 to 1/4 turn past snug. Attach second nut on upper side and jam (typical both sides) (Figure 30). See procedure outlined in the drawing package.

7) Tension Shaper Rails

Tighten large bolts in the rear of the shaper rail assembly (Figure 22 on p. 28).

Warning: Once the adhesive has hardened, refer to page 15.

- 3/4” x 7” Anchor Torque fasteners to manufacturer’s recommended values. Anchors may protrude above threads (Figure 30).
- 3/4” x 18” Anchor Torque to manufacturer’s recommended values.
- Trigger Assembly Tighten
- Large Bolt Tighten

Note: For ease of assembly, nose assembly should be left off until system is anchored. See Attaching Nose Assembly on page 31 (Step 8).

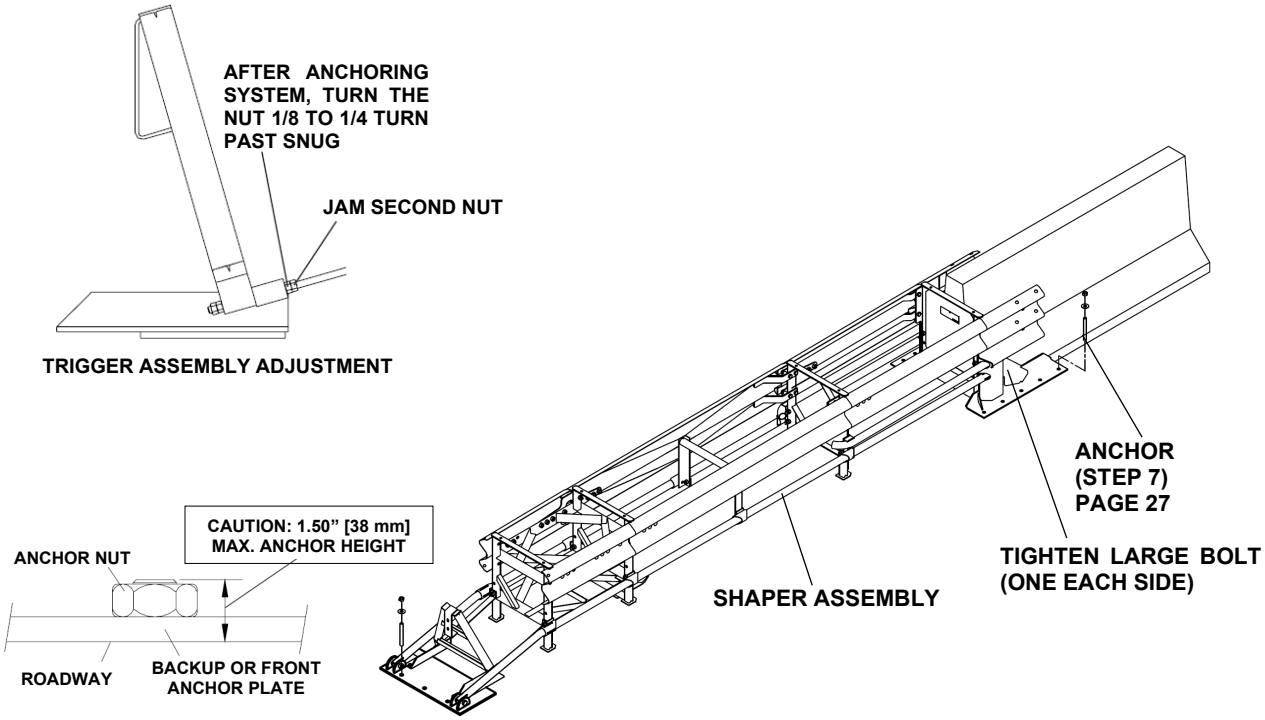


Figure 30

Bidirectional Traffic

If a QUEST® Classic system is placed in a location where traffic will be approaching from the rear, a transition from the object being shielded to the backup may be required. Hardware is available to mount guardrail or a safety shaped barrier to the Steel Backup of the QUEST® Classic system.

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

Transition and Side Panel Types

Note: The proper Transition or Side Panel must be used for optimum impact performance of the system. The correct panel to use will depend on the direction of traffic and what type of barrier or roadside object the QUEST® Classic system is shielding.

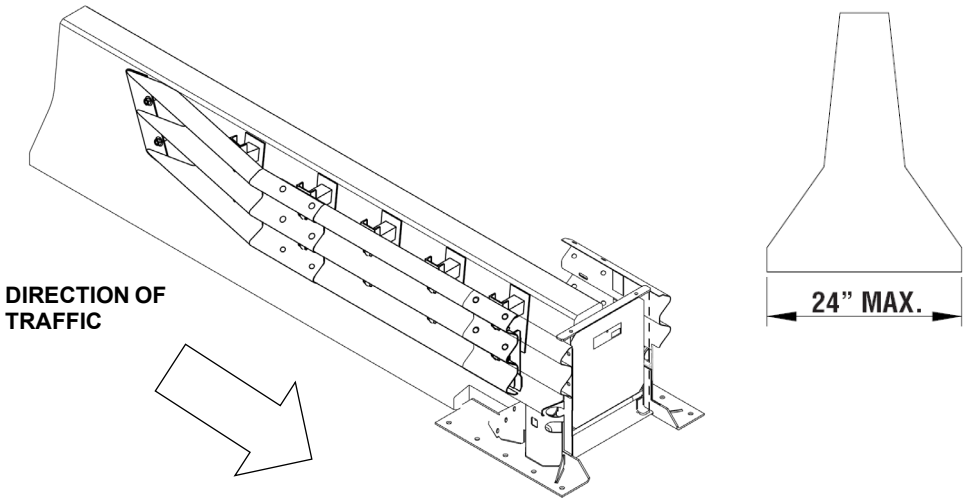


Figure 31 – Thrie-Beam to Safety Barrier Transition

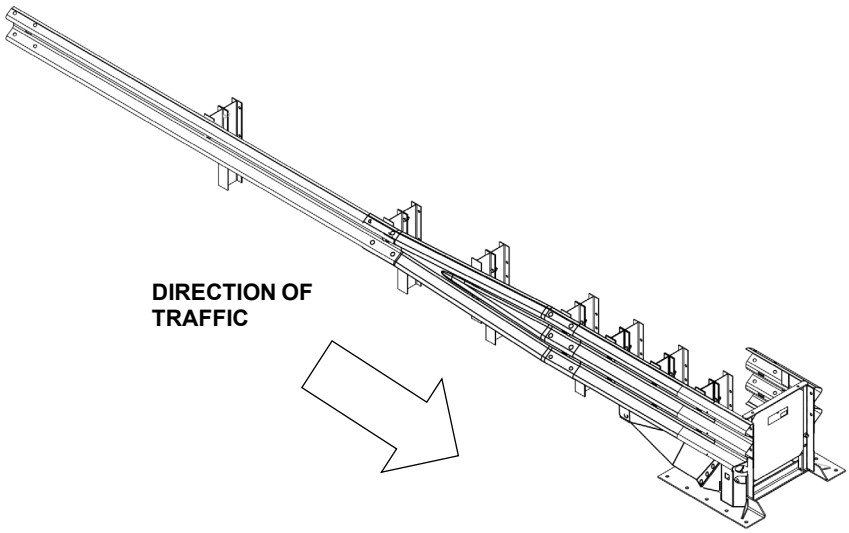


Figure 32 – Thrie-Beam to W-Beam Transition

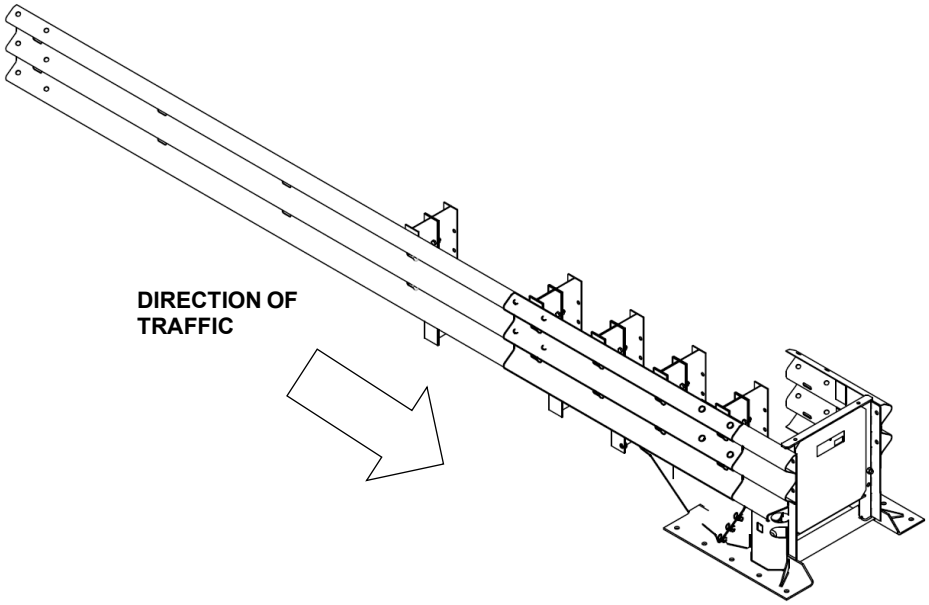


Figure 33 – Transition to Thrie-Beam Guardrail

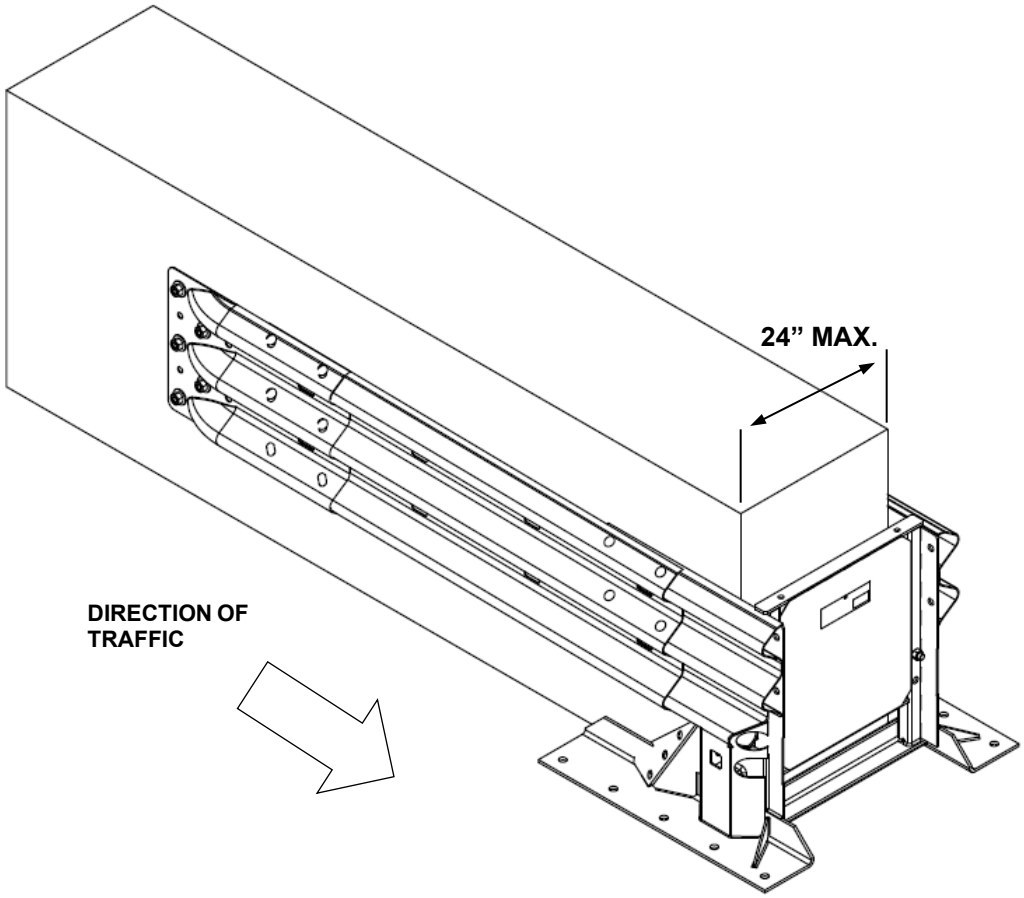


Figure 34 – Thrie-Beam End Shoe Transition

QUEST® Final Inspection Checklist

Date: _____

Inspector: _____

Location: _____

- Clearance of 6’ behind rear shaper rails for slide back
    - All curbs and elevated objects over 4” [100 mm] high are removed.
- Transition Panel fits for the off set
- Every hole in front and rear anchor plates has an anchor
- Anchor stud(s) are almost flush with nut(s) (1.5” from the pad)
- Rear Shaper rail is installed
- Bolts at rear of the shaper rail are tight.
- Nose is level
- Bolts and nuts are tightened
- Anchors are properly torqued

Important: It is critical that you inspect this product after assembly is complete to make certain that the instructions provided in the QUEST® Classic manual have been strictly followed.

Maintenance and Repair

Inspection Frequency

Inspections are recommended, as needed, based upon volume of traffic and impact history. Visual Drive-By Inspections are recommended at least once a month. Walk-Up Inspections are recommended at least twice a year for a QUEST® Classic on asphalt.

Visual Drive-By Inspection

1) Check to see if there is evidence of an impact. If so, a walk-up inspection will be necessary.

2) Check to see that the surface under the system is clear of debris to ensure proper performance.

3) Note the location and condition of the QUEST® Classic and the date of visual drive-by inspection. Drive-by inspections are recommended on an as needed basis based upon traffic volume, site accident history, etc.

Walk-Up Inspection

1) Clear and dispose of any debris on the site.

2) Be sure all bolts are tight and rust free.

3) Be sure concrete anchors are securely anchored (p. 15).

4) Be sure the tube rails are tensioned and rust-free.

5) Check to see that the trigger bolts in the front anchor assembly are intact.

6) Check to see that the support frame assembly has not engaged the shaper rails. Both shapers must be over the most forward part of the pre-crimped portion of the shaper rails.

7) Check to see that the peel straps at the Fender Panels are intact and connection points are attached correctly.

8) Check to make sure that the Diaphragm legs are on the grade level and clear of debris.

9) Check to make sure that the bridge is in place midway between Bay 2.

10) Note the location and condition of the QUEST® Classic for entry in the impact attenuator inspection logbook under the date of this inspection. Walk-up inspections are recommended on an as needed basis based upon traffic volume, foundation material, site accident history, etc.

11) Refer to Post Impact instructions for more information (p. 39).

Post-Impact Instructions

1) Deploy the appropriate traffic control devices for protection. Use the traffic control plan specified by the DOT or highway authority.
2) Check to see that all anchor bolts have remained firmly anchored in the roadway surface. Replace any that are loose, broken, or pulled out.

   If the system is anchored to asphalt, up to 10% of the total anchors may be replaced if damaged. If more than 10% of the anchors are damaged, the system should be relocated to fresh, undisturbed asphalt and redeployed using the 18" [460 mm] threaded rods.
3) Clear and dispose of any debris on the site.
4) Check all components of the QUEST® Classic system; any components that are bent or damaged must be replaced. After a design speed impact on the Nose, it is possible that the only parts that will be reusable are the Backup and front anchor assemblies.
5) To refurbish the QUEST® Classic system, disassemble the system and replace the damaged parts with new parts.
6) The shaper rail assemblies must be replaced if the support frame has begun to crimp the pipes.
7) During the process of refurbishment, follow the assembly drawings and instructions.
8) Check to be certain that the site is free from any debris. The QUEST® Classic system is now ready for use.

Warning:	
Anchors	Torque: p. 15 May Protrude Above Nuts (Figure 30 on p. 34)
All Other Bolts	Tightened
Fender Panel	Maximum Gap Allowed (p. 22)

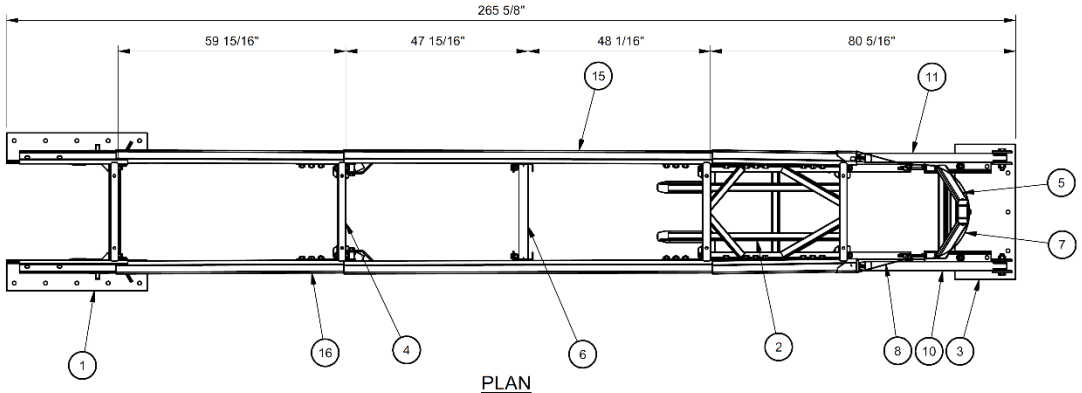
Parts Ordering Procedure

1. Make a list of all damaged parts using part descriptions and part numbers shown on the assembly drawings and on pages 7 - 13.

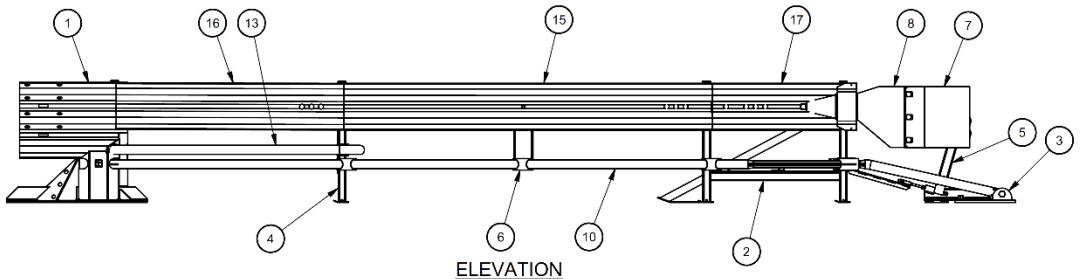
2. Contact the Valtir Customer Service Department (p. 3).

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

613490 - 1 of 2

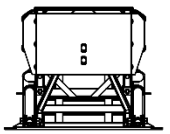


PLAN



ELEVATION
LEFT SIDE

PARTS LIST			
ITEM	STOCK NO.	DESCRIPTION	QTY.
1	604486B	BACKUP ASSEMBLY,24,QUEST	1
2	615461B	SUPPORT FRAME ASSY,BAY 1,24,QUEST	1
3	617605G	ANCHOR,FRONT,QUEST,24,G	1
4	606804B	DIAPHRAGM ASSEMBLY,24,BAY 3,QUEST	1
5	616211B	TRIGGER ASSEMBLY,QUEST	1
6	605656B	BRIDGE,24,BAY 2,QUEST	1
7	611678W	NOSE,QUEST,G,PT	1
8	611641W	NOSE TRANSITION,L,QUEST,G,PT	1
9	611642W	NOSE TRANSITION,R,QUEST,G,PT	1
10	614028G	SHAPER RAIL,L,QUEST,G	1
11	614034G	SHAPER RAIL,R,QUEST,G	1
12	605529G	BRACKET,PANEL,DIAPHRAGM,G	2
13	613661G	REAR RAIL,QUEST,G	2
14	616230G	TRIGGER STRAP,QUEST,G	2
15	611794G	PANEL,BAY 2,QUEST,G	2
16	611795G	PANEL,BAY 3,QUEST,G	2
17	611791G	PANEL,BAY 1,QUEST,G	2
18	113558G	BOLT,HX,3/4X3 1/2,G5,G	16
19	113538G	BOLT,HX,1X5,G8,G	2
20	003360G	BOLT,RAIL,5/8X1 1/4,G	38
21	113547G	BOLT,HX,3/4X1 1/2,G5,G	4
22	003340G	NUT,HX,5/8,G,RAIL	38
23	115953G	NUT,HX,3/4,G	20
24	115931G	NUT,HX,1,G	2
25	617010G	WASHER,BAR,2X2X1/4,G	2
26	617005G	WASHER,BAR,1/8X1 1/4X2,ROUNDED,G	8
27	115311B	INSTALL INSTRUCTIONS,QUEST	1
28	115674G	MATERIAL SAFETY INFO NOTICE	1
29	118026G	WASHER,FLAT,3/4 X 1 1/2,G	16
30	113530G	BOLT,HX,1X3 1/2,G5,G	2
31	614533B	SPACER,RAIL TENSION,QUEST	2
32	115954G	NUT,HX,3/4",GR DH	2
33	118027G	WASHER,FLAT,3/4X2,HVY,G	2



ASSEMBLY NO. 613490B

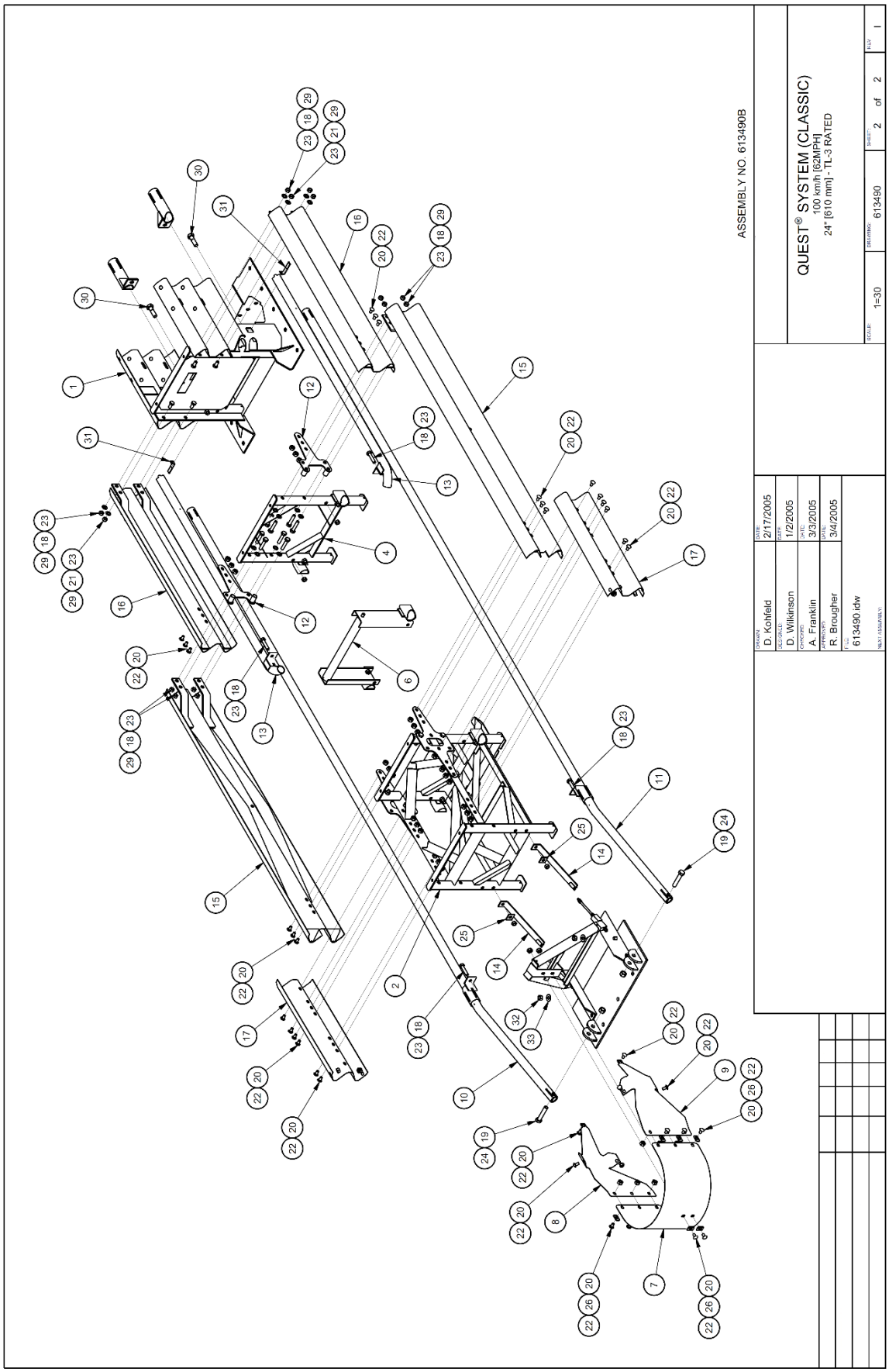
DRAWN: D. Kohfeld	DATE: 2/17/2005
DESIGNED: D. Wilkinson	DATE: 1/2/2005
CHECKED: A. Franklin	DATE: 3/3/2005
APPROVED: R. Brougher	DATE: 3/4/2005
FILE: 613490.idw	
NEXT ASSEMBLY	

QUEST® SYSTEM (CLASSIC)
100km/h [62MPH]
24" [610 mm] - TL-3 RATED

SCALE:	DRAWING:	SHEET:	REV:
1=30	613490	1 of 2	I

QUEST® System (Classic) TL-3

613490 - 2 of 2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QUEST® SYSTEM (CLASSIC)
100 km/h [62MPH]
24" [610 mm] - TL-3 RATED
SCALE: 1=30
DRAWING: 613490
SHEET: 2 of 2
REV: 1
DRAWN: D. Kohfeld 2/17/2005
DES.SPVZ: D. Wilkinson 1/2/2005
CHKD/RD: A. Franklin 3/3/2005
APPROVED: R. Brougher 3/4/2005
FILE: 613490.idw
NEXT ASSEMBLY:

Notes:

VALTIR
A TIER ABOVE

For more complete information on Valtir products and services, visit us on the web at www.valtir.com. Materials and specifications are subject to change without notice. Please contact Valtir to confirm that you are referring to the most current instructions.

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