QuadGuard®

Product Description Manual

Part No. 619185B

Created May 2013

TRINITY
HIGHWAY PRODUCTS
ENERGY ABSORPTION SYSTEMS

QuadGuard®

Product Description Manual

TRINITY
HIGHWAY PRODUCTS
ENERGY ABSORPTION SYSTEMS

2525 Stemmons Freeway
Dallas, Texas 75207

Important: These instructions are to be used only in conjunction with the assembly, maintenance, and repair of the specified QuadGuard® system. These instructions are for standard assembly specified by the appropriate highway authority only. In the event the specified system assembly, maintenance, or repair would require a deviation from standard assembly parameters, contact the appropriate highway authority engineer. This system has been accepted by the Federal Highway Administration for use on the national highway system under strict criteria utilized by that agency. Energy Absorption Systems representatives are available for consultation if required.

This Manual must be available to the worker overseeing and/or assembling the product at all times. For additional copies, contact Energy Absorption Systems at (888) 323-6374 or download from websites below.

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 QuadGuard® system information available to Energy Absorption Systems at the time of printing. We reserve the right to make changes at any time. Please contact Energy Absorption Systems to confirm that you are referring to the most current instructions.

Part No. 619185B
Created May 2013

Table of Contents

Customer Service Contacts

Energy Absorption Systems (a Trinity Highway Products company) is committed to the highest level of customer service. Feedback regarding the QuadGuard® system, its assembly procedures, supporting documentation, and performance is always welcome. Additional information can be obtained from the contact information below:

Energy Absorption Systems:

Telephone:	(888) 323-6374 (USA Only) (214) 589-8140 (USA or International)
E-mail:	customerservice@energyabsorption.com
Internet: Energy Absorption Systems Trinity Highway Products, LLC	http://www.energyabsorption.com http://www.highwayguardrail.com

Important Introductory Notes

Proper assembly of the QuadGuard® system is essential to achieve performance of the system under appropriate federal and state criteria. These instructions should be read in their entirety and understood before assembling the QuadGuard® system. These instructions are to be used only in conjunction with the assembly of the QuadGuard® system and are for standard assemblies only as specified by the applicable highway authority. In the event your system assembly requires or involves deviation from standard parameters or, during the assembly process a question arises, please contact the appropriate highway authority that specified this system at this particular location for guidance. Energy Absorption Systems is available for consultation with that agency. These instructions are intended for an individual who is qualified to both read and accurately interpret them as written. They are intended for the individual who is experienced and skilled in the assembly of highway products which are specified and selected by the highway authority.

A set of product drawings will be supplied by Energy Absorption Systems. The drawings will be for each section of the assembly. These drawings should be reviewed and studied thoroughly by a qualified individual who is skilled in interpreting them before the start of any assembly.

If you need additional information, or have questions about the QuadGuard system, please contact the highway authority that has planned and specified this assembly and, if needed, contact Energy Absorption System Customer Service Department.

Important: Read safety instructions thoroughly and follow the assembly directions and suggested safe practices before assembling, maintaining, or repairing QuadGuard® system. Failure to follow this warning can result in serious injury or death to workers and/or bystanders. It further compromises the acceptance of this system by the FHWA. Please keep these instructions for later use.

Warning: Ensure that all of the QuadGuard® system Warnings, Cautions, and Important Statements within the QuadGuard® Manual are completely followed. Failure to follow this warning could result in serious injury or death in the event of a collision.

Recommended 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 QuadGuard® system. Additional copies of this Manual are available from Energy Absorption Systems by calling (888) 323-6374. Please contact Energy Absorption Systems if you have any questions concerning the information in this Manual or about the QuadGuard® system. This Manual may also be downloaded directly from the websites indicated below.

Always use appropriate safety precautions when operating power equipment, mixing chemicals, moving heavy equipment or QuadGuard® system components. Gloves, safety goggles, safety toe shoes, and back protection should 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.

Safety Symbols

This section describes the safety symbols that appear in this QuadGuard® Manual. Read the Manual for complete safety, assembly, operating, maintenance, repair, and service information.

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

Warnings and Cautions

Read all instructions before assembling, maintaining, or repairing the QuadGuard® system.

Warning: Do not assemble, maintain, or repair the QuadGuard® system until you have read this Manual thoroughly and completely understand it. Ensure that all Warnings, Cautions, and Important Statements within the Manual are completely followed. Please call Energy Absorption Systems at (888) 323-6374 if you do not understand these instructions. Failure to follow this warning could result in serious injury or death in the event of a collision.

Warning: Safety measures incorporating appropriate traffic control devices specified by the highway authority must be used to protect all personnel while at the assembly, maintenance, or repair site. Failure to follow this warning could result in serious injury or death in the event of a collision.

Warning: Use only Energy Absorption Systems parts that are specified herein for the QuadGuard® system for assembling, maintaining, or repairing QuadGuard® system. Do not utilize or otherwise comingle parts from other systems even if those systems are other Energy Absorption Systems or Trinity Highway Products systems. Such configurations have not been tested nor have they been accepted for use. Assembly, maintenance, or repairs using unspecified parts or accessories is strictly prohibited. Failure to follow this warning could result in serious injury or death in the event of a vehicle impact with an UNACCEPTED system.

Warning: Do NOT modify the QuadGuard® system in any way. Failure to follow this warning could result in serious injury or death in the event of a collision.

Warning: Ensure that the QuadGuard® system and delineation used meet all federal, state, specifying agency, and local specifications. Failure to follow this warning could result in serious injury or death in the event of a collision.

Warning: Ensure that your assembly meets all appropriate Manual on Uniform Traffic Control Devices (MUTCD) and local standards. Failure to follow this warning could result in serious injury or death in the event of a collision.

Limitations and Warnings

Energy Absorption Systems, in compliance with the National Cooperative Research Highway Program 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 Federal Highway Administration for review.

The QuadGuard® system has been approved by FHWA as meeting the requirements and guidelines of NCHRP Report 350 TL-2 (3 bay system) and TL-3 (6 bay system). These tests, typically evaluate product performance by utilizing established criteria impacts involving a typical range of vehicles on our roadways, from lightweight cars (approx. 820kg [1800 lb.]) to full size pickup trucks (approx. 2000 kg [4400 lb.]) as specified by the FHWA. A product can be certified for multiple Test Levels. The QuadGuard® system is certified to the Test Level(s) as shown below:

Test Level 2: 70 km/h [44 mph]
Test Level 3: 100 km/h [62 mph]

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 350 as approved by FHWA.

Energy Absorption Systems does not represent nor warrant that the results of these NCHRP tests show that vehicle impacts with the products in other conditions would necessarily avoid injury to person(s) or property. Impacts that exceed criteria capabilities of the product may not result in acceptable impact performance as outlined in NCHRP Report 350, relative to structural adequacy, occupant risk, and vehicle trajectory. Energy Absorption Systems expressly disclaims any warranty or liability for injury or damage to persons or property resulting from any impact, collision, or harmful contact with products, other vehicles, or nearby hazards or objects by any vehicle, object or person, whether or not the products were assembled by or in the presence of Energy Absorption Systems representatives or by third parties.

The QuadGuard® system is intended to be assembled, delineated, and maintained in accordance with specific state and federal guidelines. It is important to select the most appropriate product configuration for a site. The customer should be careful to properly select, assemble, and maintain the product. Careful evaluation of the site geometry, vehicle population type, speed, traffic direction, and visibility are some of the elements that require evaluation in the proper selection of a safety appurtenance. For example, assemblies on curbs have not been tested, nor evaluated and should not be permitted. Before assembly of this system at any location, these issues need to be fully discussed with the appropriate highway authority planning and specifying the installation.

After an impact occurs, the product should be restored to its original condition as soon as possible. When a potentially reusable highway product is impacted, it is still necessary to restore the product to its original length and inspect all the components as necessary. What constitutes a potentially reusable highway product should only be determined by a trained engineer, experienced in highway products, directed by the DOT, or other appropriate local highway authority.

System Overview

The QuadGuard® system is a potentially reusable, redirective, non-gating crash cushion for hazards ranging in width from 610 mm to 3200 mm (24" to 126"). After those impacts observed within NCHRP 350 criteria, it has been observed that, potentially, the bulk of the system can be reused. The system consists of energy-absorbing Cartridges surrounded by a framework of Quad-Beam™ Panels. What constitutes a potentially reusable highway product should only be determined by a trained engineer, experienced in highway products, directed by the DOT, or other appropriate local highway authority.

The QuadGuard® system utilizes two types of Cartridges in a "staged" configuration to address both lighter cars and heavier, high center-of-gravity vehicles. Its modular design allows the system length to be tailored to the design speed of a site. See Table A on Page 12 to determine the appropriate length system for a given speed.

Impact Performance

The 6 bay QuadGuard® system has successfully passed the requirements stipulated in NCHRP Report 350, Test Level 3 tests with both the light car and pickup at speeds of up to 100 km/h [62 mph] at angles up to 20 degrees.

During head-on impacts, the QuadGuard® system telescopes rearward and crushes to absorb the energy of impact. When impacted from the side, within NCHRP 350 criteria, it has been observed to safely redirect the vehicle back toward its original travel path and away from the hazard.

How to Determine Left/Right

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

Counting the Number of Bays

One Bay consists of one Cartridge, one Diaphragm, two Fender Panels, etc. The Nose section is not considered a Bay, though there is a Cartridge in the Nose of each system. Note that this means 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 (See Figure 1). Five Bay system shown (See Figure 1).

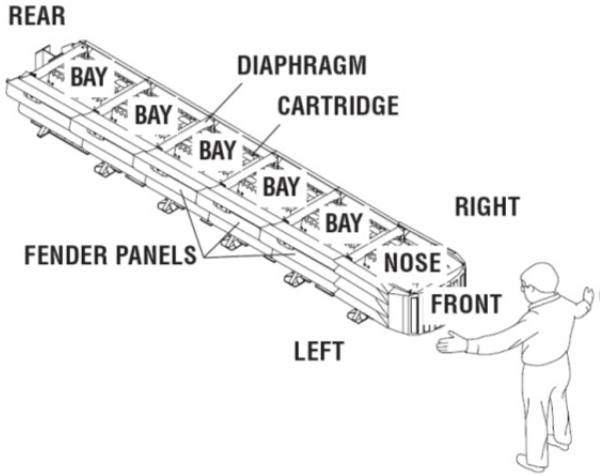


Figure 1
System Orientation

Measuring the Width

The QuadGuard® system is available in seven nominal widths:

- 610 mm [24”]
- 760 mm [30”]
- 915 mm [36”]
- 1220 mm [48”]
- 1755 mm [69”]
- 2285 mm [90”]
- 3200 mm [126”]

The nominal width of a system with Tension Strut Backup is the width between Side Panels behind the Backup (See Figure 2).

The nominal width of a system with Concrete Backup is the width of the Concrete Backup at location shown in Figure 3.

The outside width of the system is approximately 150 mm [6”] to 230 mm [9”] wider than the nominal width. The width of the system is not the same as the width of the Backup.

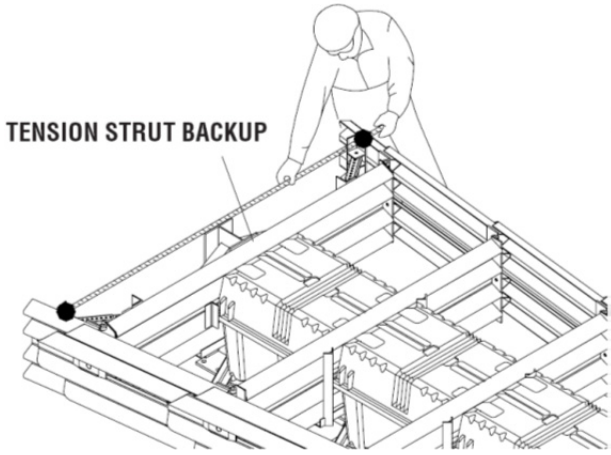


Figure 2
Width of system with Tension Strut Backup

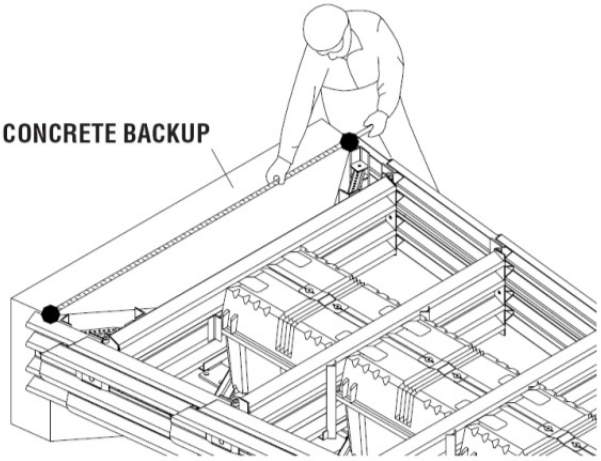


Figure 3
Width of system with Concrete Backup

QuadGuard® System Criteria

Contact Energy Absorption Systems Customer Service Department if you would like input as to your specific application. Proper model selection is essential to the performance of the QuadGuard® System. You will need to answer the following questions:

1) Specification of System Width

The QuadGuard® system is available in seven nominal widths:

- 610 mm [24”]
- 760 mm [30”]
- 915 mm [36”]
- 1220 mm [48”]
- 1755 mm [69”]
- 2285 mm [90”]
- 3200 mm [126”]

As a general rule, selection of the narrowest width that adequately shields the hazard is recommended.

2) Specification of System Length

System length is specified by the number of Bays the system includes. The number of Bays required is a function of the intended speed of the roadway.

3) Specify Foundation

Note that the system must be anchored. MP-3® polyester anchor bolts will be supplied for all required anchorages in concrete. Refer to QuadGuard® Assembly Manual or MP-3® kits for detailed assembly instructions.

A. Is the system to be placed on existing concrete?

Existing concrete – Concrete must be at least 150 mm [6”] thick, reinforced 28 MPa [4000psi] Portland cement concrete (P.C.C.), or 200 mm [8”] thick non-reinforced 28 MPa [4000 psi] P.C. Concrete Roadway, measuring at least 3.66 m [12’-0”] wide by 15.24 m [50’-0”] long. The concrete should be in good condition and be free of major cracks.

New concrete – If existing concrete does not meet these criteria, then a new concrete pad must be placed to properly secure the system. See concrete pad details supplied with the system on Page 17 and Concrete Pad Reference drawings.

B. Is there a cross-slope at the construction site?

Cross-slope exists – If there is a cross-slope of more than 8% (5 degrees), or if the cross-slope varies (twists) more than 2% (1 degree) over the length of the system, a concrete leveling pad may be required (See Figure 4).
No Cross-slope – No additional action is required.

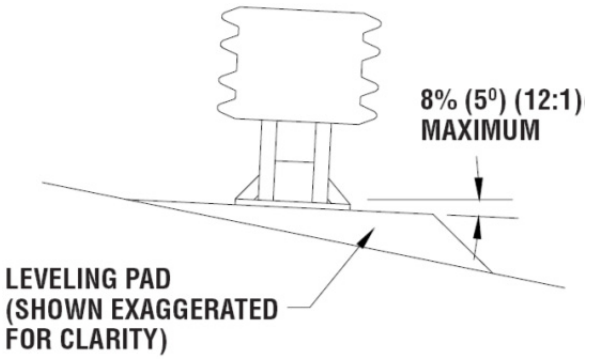


Figure 4
Cross-Slope

4) Specify Backup Structure

The two Backup designs available are the Tension Strut Backup and the Concrete Backup. Both types are appropriate for use on grade or deck.

5) Special Site Conditions

Contact Energy Absorption Systems Customer Service Department if you would like input with your application. You will need to answer the following questions:

1. **Are curbs, islands, or elevated objects (delineators or signs) present at the site? What height and width are they?** All curbs and elevated objects over 100 mm [4”] high should be removed. If possible, curbs taller than 100 mm [4”] high should be removed approximately 15 m [50’] in front of the QuadGuard® systems and as far back as the system’s Backup. Any curbs that must remain should be 100 mm [4”] maximum and be mountable.
2. If the construction site is a gore area (place where two roads diverge), **what is the angle of divergence?**
3. **What is the general geometry of the site**, including the roadway for at least 150 m [500’] in front, so traffic patterns can be visualized?
4. **Is there an existing barrier?** Where there is an existing guardrail or median barrier at the site, the Backup of the QuadGuard® system should tie into it when possible.
5. **Will there be traffic approaching from the rear of the system?** Is the system in a two-way traffic situation, with traffic going in opposite directions on either side of the system? Or, is the system on the side of the road in a location where crossover traffic is a concern? If so, a Transition from the back of the system to the hazard is necessary to prevent vehicle interaction (See Page 22).
6. **Are there any other unique features at the site that may affect positioning or performance of the QuadGuard® system?**

6) Other Factors that May Affect Your Deployment:

1. The existence of drain inlets.
2. Junction boxes or other appurtenances located near the hazard.
3. Insufficient space for the length preferred.
4. The location and movement of expansion joints.

If these or any other special site conditions exist, please contact Energy Absorption Systems Customer Service Department before proceeding with your design (See Page 3).

Impact conditions which differ from those described in the NCHRP 350 test matrix for non-gating redirecting crash cushions, may result in different crash results than those encountered in testing.

Furthermore, impacts in excess of TL-3 impact severity, or the existence (at the site of assembly) of curbs or cross-slopes in excess of 8%, may yield performance which does not meet NCHRP 350 evaluation criteria relative to structural adequacy, occupant risk, and vehicle trajectory factors.

These following charts represent the modified versions of the QuadGuard® system length relative to impact speed, which is based on the capacity of the system using a 2000 kg [4400 lb] pickup truck.

Table A

QuadGuard Design Table (Avg G deceleration values)

No. Bays	Effective Length	Design Velocity km/h (mph)	40 (25)	50 (31)	60 (37)	70 (44)	80 (50)	90 (56)	100 (62)	105 (65)	110 (68)	115 (71)	120 (75)
12*	11.79 m (38'-8")	120 (75)	---	---	---	---	---	---	---	---	---	5.2	5.6
11*	10.87 m (35'-8")	120 (75)	---	---	---	---	---	---	---	---	5.2	5.6	6.1
10*	9.96 m (32'-8")	120 (75)	---	---	---	---	---	---	---	---	5.6	6.1	6.7
9	9.04 m (29'-8")	115 (71)	---	---	---	---	---	---	---	5.6	6.2	6.8	7.4
8*	8.13 m (26'-8")	110 (68)	---	---	---	---	---	---	5.7	6.3	6.9	7.5	8.2
7*	7.21 m (23'-8")	105 (65)	---	---	---	---	---	5.2	6.4	7.1	7.8	8.5	9.2
6	6.30 m (20'-8")	100 (62)	---	---	---	---	4.7	5.9	7.3 (TL-3)	8.1	8.9	9.7	---
5*	5.38 m (17'-8")	90 (56)	---	---	---	4.2	5.5	7.0	8.6	9.5	10.4	---	---
4*	4.47 m (14'-8")	80 (50)	---	---	3.7	5.1	6.6	8.4	10.4	---	---	---	---
3	3.56 m (11'-8")	70 (44)	---	3.2	4.7	6.4 (TL-2)	8.3	10.5	---	---	---	---	---
2*	2.64 m (8'-8")	60 (37)	2.8	4.4 (TL-1)	6.3	8.6	11.2	---	---	---	---	---	---
1*	1.73 m (5'-8")	40 (25)	4.3	6.7	9.6	---	---	---	---	---	---	---	---

*System capacity estimated through calculation.

Avg G deceleration values are based upon average values calculated for vehicles 820 to 2000 kg (1800 to 4400 lbs.) that stop in a distance equal to 85% of the systems length.

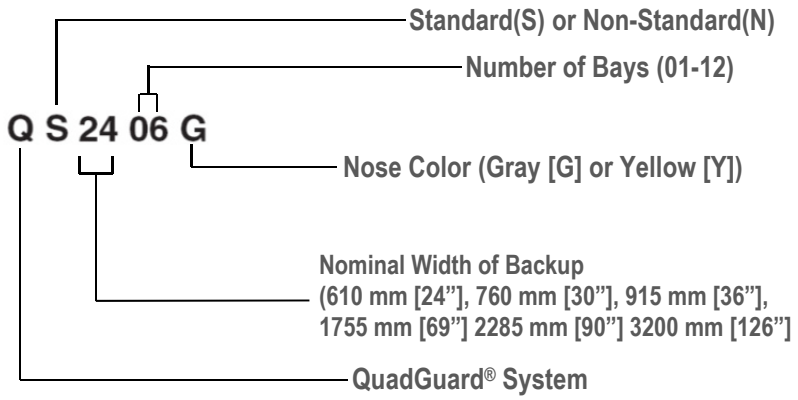
Warning: Shaded area denotes excessive decelerations based upon occupant risk recommendations outlined in NCHRP 350 for 2000 kg (4400 lb.) vehicles. Energy Absorption Systems does not recommend choosing systems from this area of the chart.

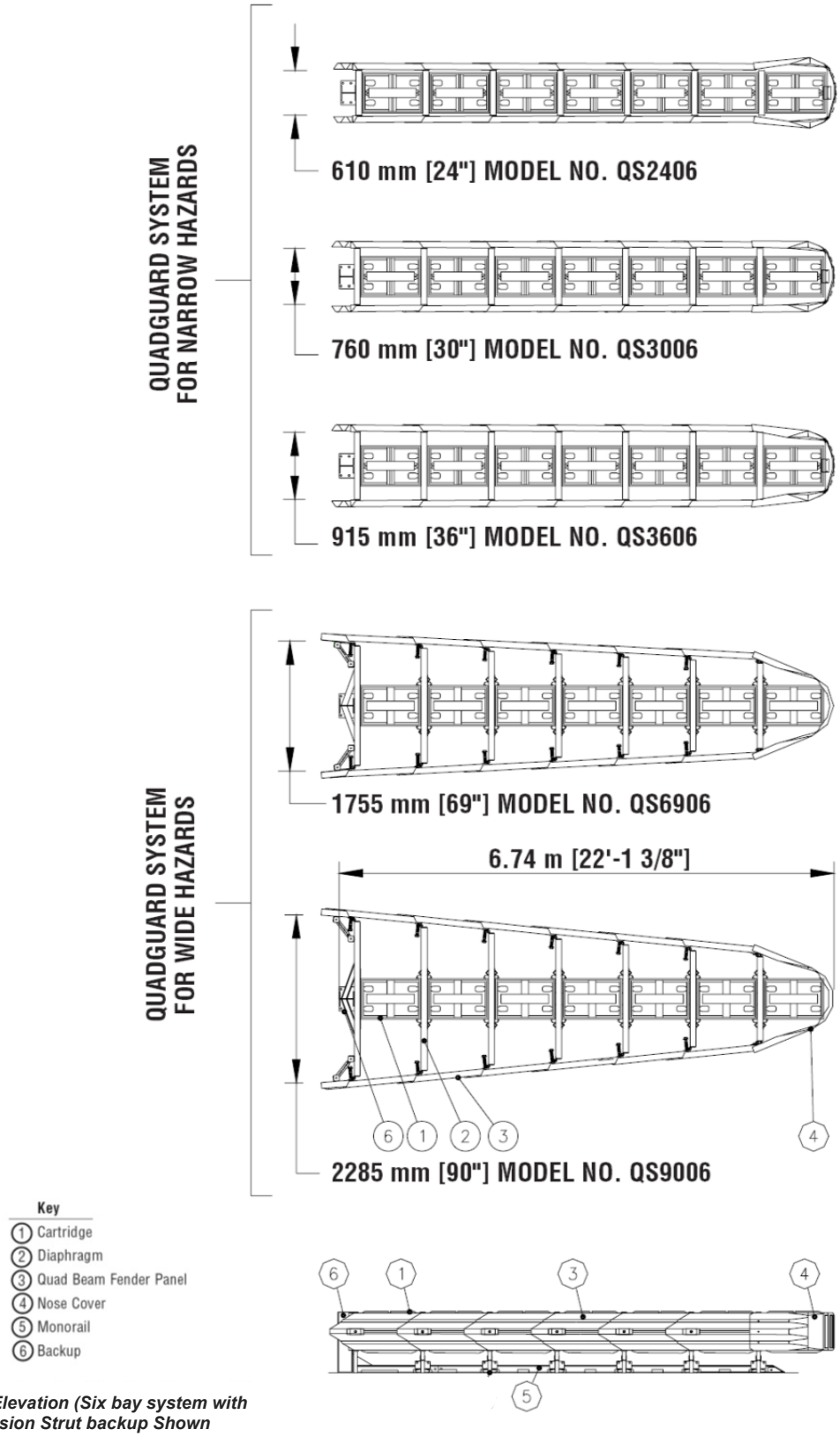
Table B

QuadGuard® Standard System Model Numbers

Number of Bays	Nominal Width				
	610 mm [24"]	760 mm [30"]	915 mm [36"]	1755 mm [69"]	2285 mm [90"]
1	QS2401G or Y	QS3001G or Y	QS3601G or Y	N/A	N/A
2	QS2402G or Y	QS3002G or Y	QS3602G or Y	N/A	N/A
3	QS2403G or Y	QS3003G or Y	QS3603G or Y	QS6903G or Y	QS9003G or Y
4	QS2404G or Y	QS3004G or Y	QS3604G or Y	QS6904G or Y	QS9004G or Y
5	QS2405G or Y	QS3005G or Y	QS3605G or Y	QS6905G or Y	QS9005G or Y
6	QS2406G or Y	QS3006G or Y	QS3606G or Y	QS6906G or Y	QS9006G or Y
7	QS2407G or Y	QS3007G or Y	QS3607G or Y	QS6907G or Y	QS9007G or Y
8	QS2408G or Y	QS3008G or Y	QS3608G or Y	QS6908G or Y	QS9008G or Y
9	QS2409G or Y	QS3009G or Y	QS3609G or Y	QS6909G or Y	QS9009G or Y
10	QS2410G or Y	QS3010G or Y	QS3610G or Y	QS6910G or Y	QS9010G or Y
11	QS2411G or Y	QS3011G or Y	QS3611G or Y	QS6911G or Y	QS9011G or Y
12	QS2412G or Y	QS3012G or Y	QS3612G or Y	QS6912G or Y	QS9012G or Y

Model Number Description





Plan & Elevation (Six bay system with Tension Strut backup Shown

Figure 4
Plan and Elevation (Six bay System with Tension Strut backup Shown)

QuadGuard® CZ Design Criteria

This portable compact crash cushion is for construction zones. The QuadGuard® CZ system is available in the same narrow sizes as permanent systems. Wide systems are not available.

The QuadGuard® CZ system must be properly anchored. See Page 17 for the recommended anchorage for various foundations.

Table C

QuadGuard® CZ System Plate Model Numbers

Number of Bays	Nominal Width		
	610 mm [24"]	760 mm [30"]	915 mm [36"]
3	QZ2403PG or Y	QZ3003PG or Y	QZ3603PG or Y
4	QZ2404PG or Y	QZ3004PG or Y	QZ3604PG or Y
5	QZ2405PG or Y	QZ3005PG or Y	QZ3605PG or Y
6	QZ2406PG or Y	QZ3006PG or Y	QZ3606PG or Y
7	QZ2407PG or Y	QZ3007PG or Y	QZ3607PG or Y
8	QZ2408PG or Y	QZ3008PG or Y	QZ3608PG or Y
9	QZ2409PG or Y	QZ3009PG or Y	QZ3609PG or Y

Model Number Description

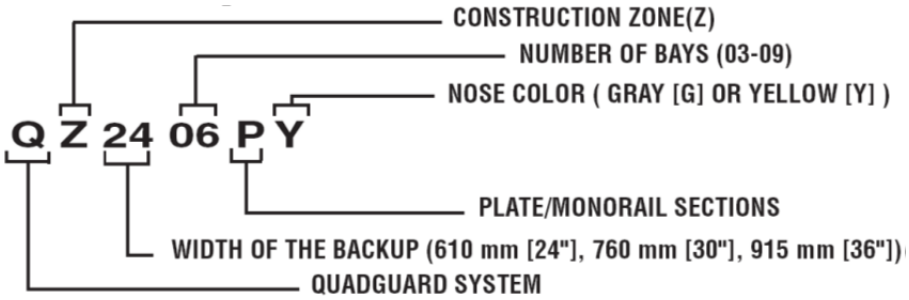


Table D

QuadGuard® CZ System Table (Avg G deceleration values)													
No. Bays	Effective Length	Design Velocity km/h (mph)	40 (25)	50 (31)	60 (37)	70 (44)	80 (50)	90 (56)	100 (62)	105 (65)	110 (68)	115 (71)	120 (75)
9	9.04 m (29'-8")	115 (71)	---	---	---	---	---	---	---	5.6	6.2	6.8	7.4
8*	8.13 m (26'-8")	110 (68)	---	---	---	---	---	---	5.7	6.3	6.9	7.5	8.2
7*	7.21 m (23'-8")	105 (65)	---	---	---	---	---	5.2	6.4	7.1	7.8	8.5	9.2
6	6.30 m (20'-8")	100 (62)	---	---	---	---	4.7	5.9	7.3 (TL-3)	8.1	8.9	9.7	---
5*	5.38 m (17'-8")	90 (56)	---	---	---	4.2	5.5	7.0	8.6	9.5	10.4	---	---
4*	4.47 m (14'-8")	80 (50)	---	---	3.7	5.1	6.6	8.4	10.4	---	---	---	---
3	3.56 m (11'-8")	70 (44)	---	3.2	4.7	6.4 (TL-2)	8.3	10.5	---	---	---	---	---

*System capacity estimated through calculation.

Average G deceleration values are based upon average values calculated for vehicles 820 to 2000 kg (1800 to 4400 lbs.) that stop in a distance equal to 85% of the systems length.

Warning: Shaded area denotes excessive decelerations based upon occupant risk recommendations outlined in NCHRP 350 for 2000 kg (4400 lb.) vehicles. Energy Absorption Systems does not recommend choosing systems from this area of the chart.

QuadGuard® and QuadGuard® CZ Foundation/Anchoring

Concrete Installations

For concrete installations, the QuadGuard® system should be installed only on an existing or freshly placed and cured concrete base (28 MPa [4000 psi] 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

For asphalt installations in construction zones, QuadGuard® system may be installed on asphalt. Only systems with a Tension-Strut Backup may be installed on asphalt. Provide a minimum of 76 mm [3”] layer of asphalt over a minimum of 76 mm [3”] layer of Portland Cement concrete, 152 mm [6”] layer of asphalt over 152 mm [6”] layer of subbase, or 203 mm [8”] layer of asphalt with no subbase or 460 mm [18”] threaded rods, installed with the two-part MP-3® grout must be used for these foundations.

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. See Post Impact Instructions and Maintenance and Repair instructions in the QuadGuard® Assembly Manual for details.

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

Foundation A: Concrete Pad or Roadway

Foundation: 150 mm [6"] minimum depth Portland Cement Concrete (P.C.C.)

Anchorage: MP-3® with 180 mm [7"] studs 140 mm [5.5"] 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"] 420 mm [16.5”] embedment

Foundation C: Asphalt over Subbase

Foundation: 150 mm [6"] minimum A.C. over 150 mm [6"] minimum Compacted Subbase (C.S.)

Anchorage: MP-3® with 460 mm [18"] studs 420 mm [16.5"] embedment

Foundation D: Asphalt Only

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

Anchorage: MP-3® with 460 mm [18"] studs - 420 mm [16.5"] embedment

Foundation Specifications

for Foundations A, B, C and D mentioned above:

A. C. (Asphalt Concrete)

AR-4000 A. C. (per ASTM D3381 '83) .75" Maximum, Medium (Type A or B) aggregate

Sieve Size	Operating Range (%) Passing
1"	100
3/4"	95-100
3/8"	65-80
No. 4	49-54
No. 8 3	6-40
No. 30 1	8-21
No. 200	3-8

Caution: Walk-up inspections are recommended at least once every six months for installations on asphalt.

P.C.C. (Portland Cement Concrete)

Stone aggregate concrete mix

4000 psi minimum compressive strength

(Sampling per ASTM C31-84 or ASTM C42-84a, testing per ASTM C39-84)

C.S. (Compacted Subbase)

150 mm [6"] minimum depth 95% compaction

Class 2 aggregate

Sieve Size	Moving Average % Passing
3"	100
2 1/2"	90-100
No. 4	40-90
No. 200	0-25

Site Preparation/Foundation

Establish Required System Footing

Note that the system must be anchored. MP-3® polyester anchor bolts will be supplied for all required anchorages in concrete. Refer to QuadGuard® Assembly Manual or MP-3® kits for detailed assembly instructions.

A. Is the system to be placed on existing concrete?

Existing concrete – Concrete must be at least 150 mm [6”] thick, reinforced 28 MPa [4000psi] Portland Cement Concrete (P.C.C.), or 200 mm [8”] thick non-reinforced 28 MPa [4000 psi] P.C. Concrete Roadway, measuring at least 3.66 m [12’-0”] wide by 15.24 m [50’-0”] long. The concrete should be in good condition and be free of major cracks.

New concrete – If existing concrete does not meet these criteria, then a new concrete pad must be placed to properly secure the system. See concrete pad details supplied with the system.

B. Is there a cross-slope at the construction site?

If Cross-slope– If there is a cross-slope of more than 8% (5 degrees), or if the cross-slope varies (twists) more than 2% (1 degree) over the length of the system, a concrete leveling pad may be required (See Figure 10).

No Cross-slope – No additional action is required.

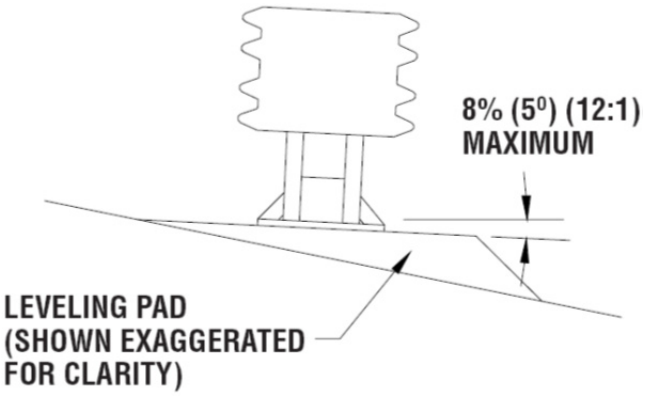


Figure 5
Cross-Slope

The QuadGuard® system is potentially reusable. Depending on the impact, components may get damaged and need replacement. The system must be inspected and restored after each impact by the appropriate highway authority.

Recommended Tools

Documentation

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

Cutting equipment

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

Note: Energy Absorption Systems recommends using two fluted drills to achieve optimum tensile strength when applying the MP-3® anchoring system. That decision must be confirmed with the highway authority authorizing the assembly and confirmed that it is assembled to their specification.

Hammers

- Sledgehammer
- Standard hammer

Wrenches

- Heavy duty impact wrench
- Standard adjustable wrench
- 1/2" drive sockets: 9/16", 11/16", 3/4", 15/16", 1 1/8", 1 1/4"
- 1/2" drive Deep sockets: 5/16", 1 1/4"
- Ratchet and attachments for the above sockets
- 1/2" drive Breaker bar - 24" long
- 1/2" drive Torque wrench: 200 ft.-lbs.
- Crescent Wrench: 300 mm [12"]
- Allen Wrench: 3/8
- Impact Wrench: 1/2"

Personal Protective equipment

- Safety glasses
- Gloves
- Safety toe shoes
- Apron

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 [12”]
- Center punch
- Tape measure 7.5 m [25’]
- Chalk line
- Concrete marking pencil
- Nylon bottle brush for cleaning 7/8” drilled holes
- Rags, water, and solvent for touch-up

Note: The above list of tools is a general recommendation. Depending on specific site conditions and the complexity of the assembly specified by the appropriate highway authority, additional or fewer tools may be required. Decisions as to what tools are required to perform the job are entirely within the discretion of the specifying highway authority and the authority’s selected contractor performing the assembly of the system at the authority’s specified site.

Transitioning

Quad-Beam End Shoe

Transition Panel

The Quad-Beam End Shoe Panel transitions the QuadGuard® system to vertical faced concrete structures whether it is a concrete backup or concrete barrier wall (See Page 22). An Extended End Shoe is also available. In cases where the corners of the hazard are not chamfered it may be necessary to add wheel deflectors to the structure in order to prevent wheel interaction.

Quad-Beam to Guardrail Transition Panel (W-Beam and Thrie-Beam)

The Quad-Beam to W-Beam and Quad-Beam to Thrie-Beam Transition Panels transition the QuadGuard® system to new and existing runs of standard guardrail (See Page 22).

Quad-Beam to Safety Barrier Transition Panel

There are several options available when transitioning the QuadGuard® system to safety shape barrier depending on the shape and position of the barrier.

When transitioning to barriers with a “New Jersey” style profile, the 4" offset transition panel is most commonly used (See Page 22). For transitioning to barriers that are in line with the side of the system, use transition assembly 354018L or R. For transitioning a wide system to barrier that runs parallel to the centerline of the system, transition assembly 354042L or R is used. A 9" offset transition panel is also available for transitioning to barriers that are in line with the side of the system.

When transitioning to Single Slope style barriers and parapets, 6” and 8” offset transition panels are available. For transitioning a wide system to Single Slope style barrier that runs parallel to the centerline of the system, a 6” offset Panel is available.

How do you determine the transition panel offset?

Transition Panel Offset is determined by measuring the distance between the face of the barrier and the top edge of the backup diaphragm at 32" above ground level **(See Figure 7)**. Remember, when installing the QuadGuard® system that the correct transition panel offset must be achieved in order for the offset bracket to nest between the barrier and transition panel ensuring proper performance of the transition.

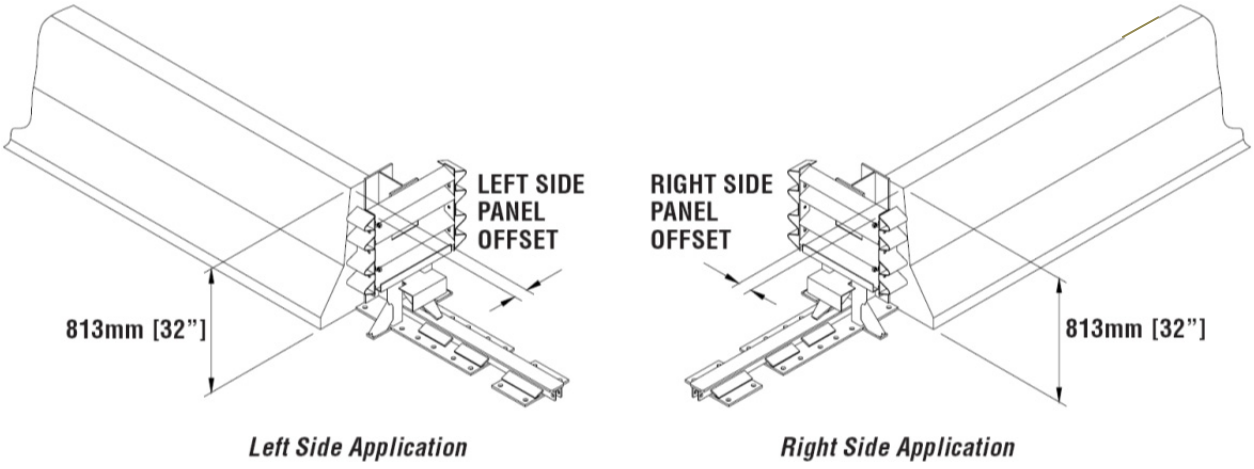


Figure 6
Transition Panel Offset

Transition Panel Types

If a system is placed in a location where traffic will be approaching from the rear, a transition panel is necessary. Figures 6, 7, 8 and 9 show standard Panel types. There are variations for each panel type. The specific Panel applied will depend on system and site conditions. Therefore, it is important to send site specific data to the customer service department for a recommendation for exact Panel requirements of your application.

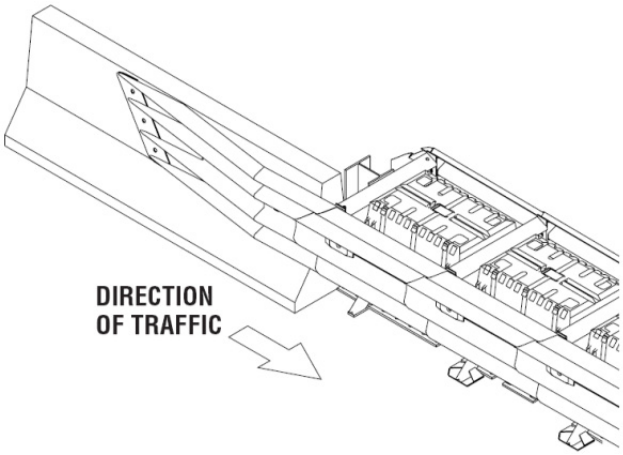


Figure 7
Quad-Beam to Safety Barrier (NJ shape) Transition Panel

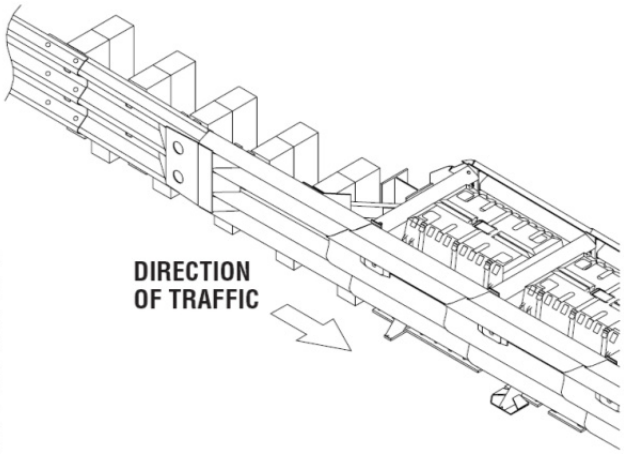


Figure 8
Quad-Beam to Thrie-Beam Transition Panel

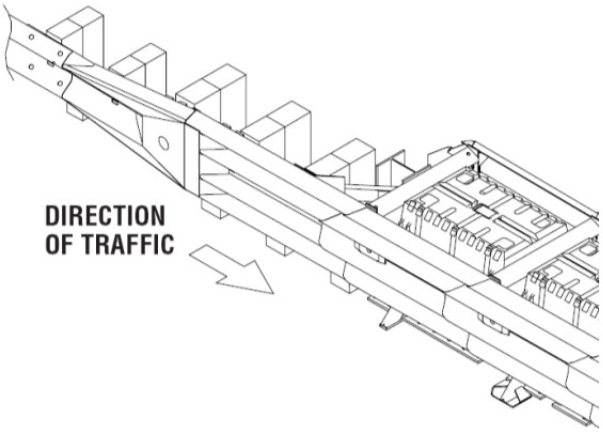


Figure 9
Quad-Beam to W-Beam Transition Panel

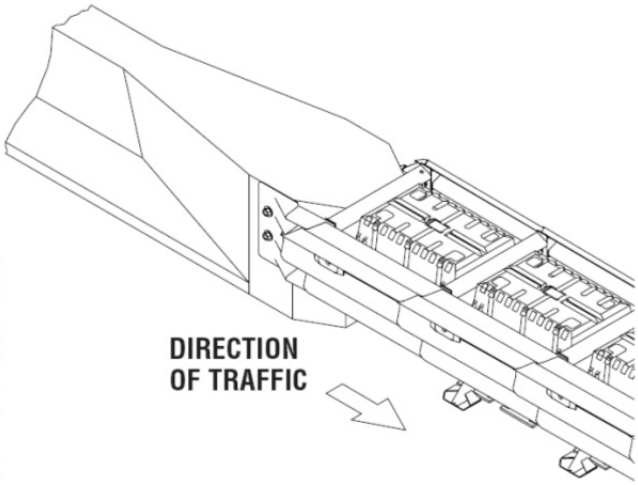


Figure 10
Quad-Beam End Shoe Transition Panel

Life Expectancy

Environment

It is anticipated that the Cartridges will survive in a highway environment for a period ranging from 10 to 15 years from the date of manufacture unless impact damage renders them otherwise. This is an estimate and should, in no way, be interpreted as a guarantee, or a warranty. All conditions and environments are different and the ultimate decision as to a whether or not the Cartridge is viable is within the sound discretion of the highway authority that owns and has specified the use of the system.

Impacts

Life expectancy is also dependent on the impacts. This includes:

1. Number of impacts
2. Severity of the impacts

Systems must be inspected after each impact. Any Cartridge that is crushed or otherwise damaged shall be replaced and the system pulled out to its original length.

NOTES:
1. IN COMPLIANCE WITH THE AASHTO 2002 ROADSIDE DESIGN GUIDE, MANUFACTURER RECOMMENDS REMOVAL OF ALL CURBS AND ISLANDS TO ENSURE PROPER IMPACT PERFORMANCE.
2. PROVISION SHALL BE MADE FOR REAR FENDER PANELS TO SLIDE REARWARD UPON IMPACT 762 [30.00] MIN.
3. 150 [6.00] MIN. REINFORCED 28 MPa [4000 PSI] P.C. CONCRETE PAD OR 200 [8.00] MIN. NON-REINFORCED 28 MPa [4000 PSI] P.C. CONCRETE ROADWAY, MEASURING AT LEAST 3.66 m [12'-0"] WIDE BY 15.24 m [50'-0"] LONG.
4. **SEE THE "QUADGUARD SYSTEM PRODUCT MANUAL", FOR A DESCRIPTION OF ITS IMPACT PERFORMANCE CHARACTERISTICS AND DESIGN LIMITATIONS BEFORE PLACING A SYSTEM AT A GIVEN SITE. INFORMATION AND COPIES OF ABOVE MANUAL ARE AVAILABLE BY CALLING CUSTOMER SERVICE DEPARTMENT AT (888) 323-6374.**
5. WHERE NECESSARY, THE CUSTOMER SHALL SUPPLY AN ADEQUATE TRANSITION FROM THE QUADGUARD SYSTEM TO THE OBJECT BEING SHIELDED.
6. UNITS OF MEASUREMENT ARE MILLIMETERS [INCHES], UNLESS OTHERWISE NOTED.
7. BACKUP AND NOSE ASSEMBLIES NOT INCLUDED IN MODEL NUMBER. ORDER SEPARATELY.
8. THE NUMBER OF BAYS INDICATED IN THE TABLE IS BASED ON CALCULATED VALUES TO ENSURE ADEQUATE SYSTEM CAPACITY TO DISSIPATE THE LONGITUDINAL IMPACT ENERGY OF A 2000 kg VEHICLE TRAVELING AT THE SPEED INDICATED.
△9. THE SIX BAY SYSTEM HAS BEEN FULLY TESTED AT 100 km/h UNDER THE FULL 8 TEST MATRIX OF NCHRP 350 TL-3. SYSTEMS LONGER THAN SIX BAYS SHALL ALSO BE CAPABLE OF MEETING THE OCCUPANT RISK CRITERIA AS RECOMMENDED IN NCHRP 350 FOR VEHICLES WEIGHING 2000 kg IMPACTING HEAD ON AT THE SPEED INDICATED IN THE TABLE.

UNIDIRECTIONAL

* G = GREY or Y = YELLOW

BAYS	610 [24"] WIDTH MODEL#	762 [30"] WIDTH MODEL#	914 [36"] WIDTH MODEL#	SYSTEM LENGTH m	SYSTEM LENGTH ft–in	EFFECTIVE LENGTH m	EFFECTIVE LENGTH ft–in	PAD LENGTH m	PAD LENGTH ft–in	MAX DESIGN SPEED km/h [MPH]	# OF CARTRIDGES TYPE I	# OF CARTRIDGES TYPE II
1	QS2401*	QS3001*	QS3601*	2.16	[7'–1"]	1.73	[5'–8"]	2.74	[9'–0"]	40 [25]	2	0
2	QS2402*	QS3002*	QS3602*	3.08	[10'–1"]	2.64	[8'–8"]	2.74	[9'–0"]	60 [37]	2	1
3	QS2403*	QS3003*	QS3603*	4.00	[13'–1"]	3.56	[11'–8"]	3.66	[12'–0"]	70 [44]	3	1
4	QS2404*	QS3004*	QS3604*	4.91	[16'–1"]	4.47	[14'–8"]	4.57	[15'–0"]	80 [50]	3	2
5	QS2405*	QS3005*	QS3605*	5.83	[19'–1"]	5.38	[17'–8"]	5.49	[18'–0"]	90 [56]	4	2
6	QS2406*	QS3006*	QS3606*	6.74	[22'–1"]	6.30	[20'–8"]	6.40	[21'–0"]	△100 [62]	4	3
7	QS2407*	QS3007*	QS3607*	7.65	[25'–1"]	7.21	[23'–8"]	7.32	[24'–0"]	△105 [65]	4	4
8	QS2408*	QS3008*	QS3608*	8.57	[28'–1"]	8.13	[26'–8"]	8.23	[27'–0"]	△110 [68]	4	5
9	QS2409*	QS3009*	QS3609*	9.49	[31'–1"]	9.04	[29'–8"]	9.14	[30'–0"]	△115 [71]	4	6
10	QS2410*	QS3010*	QS3610*	10.40	[34'–1"]	9.96	[32'–8"]	10.06	[33'–0"]	△120 [75]	5	6
11	QS2411*	QS3011*	QS3611*	11.32	[37'–1"]	10.87	[35'–8"]	10.97	[36'–0"]	△120 [75]	5	7
12	QS2412*	QS3012*	QS3612*	12.23	[40'–1"]	11.79	[38'–8"]	11.89	[39'–0"]	△120 [75]	5	8

KEY
① QUADGUARD CARTRIDGE
② DIAPHRAGM
③ FENDER PANEL
④ MONORAIL
⑤ NOSE ASSEMBLY
⑥ BACKUP

Revisions	Date	Rev.	By	Ckd	App
AASHTO WAS 1996	12/01/03	I	SDC	STT	ACF
CHANGED NOTES 4,5 & 7	12/15/04	J	RGC	STT	ACF
REVISED NOTE 3	9/25/07	H	DSW	STT	SPT

REFERENCES

SERIAL#	607113
DIAPHRAGM ASSY.	35–40–50
SALES ORDER#	608236
NOSE ASSY.	
EH PROJECT#	SEE CHART ABOVE
FENDER PANEL ASSY.	35–40–03
DESIGN SPEED	
BACKUP ASSY.	35–40–06
NOSE COLOR	
MONORAIL ASSY.	35–40–11
CONCRETE PAD	
NUMBER OF UNITS	
TRANSITION ASSY.	N/A
WHEEL DEFLECTOR ASSY.	N/A

DRAWN	S. LEWIS	DATE 03/21/96
DESIGNED	JMV/MHO	DATE 03/21/96
CHECKED	S. TRAGESER	DATE 6/07/96
APPROVED	J. MACHADO	DATE 6/07/96
CAD FILE	QSTSCVR–U.dwg	

ENERGY ABSORPTION SYSTEMS, INC.
ENGINEERING AND RESEARCH DEPARTMENT

QUADGUARD® SYSTEM
w/ TENSION STRUT BACKUP

SCALE 1=40 | DWG QSTSCVR–U | SHT 1 OF 1 | REV J

QuadGuard® w/ Tension Strut Backup

DWG QSTSCVR-U

BAYS	610[24] WIDTH MODEL#	762[30] WIDTH MODEL#	915[36] WIDTH	SYSTEM LENGTH m	SYSTEM LENGTH ft-in	EFFECTIVE LENGTH m	EFFECTIVE LENGTH ft-in	PAD LENGTH m	PAD LENGTH ft-in	MAX DESIGN SPEED km/h [MPH]	# OF CARTRIDGES TYPE I	# OF CARTRIDGES TYPE II
1	QS2401*	QS3001*	QS3601*	2.59	[8'-6"]	1.73	[5'-8"]	1.68	[5'-6"]	40 [25]	2	0
2	QS2402*	QS3002*	QS3602*	3.51	[11'-6"]	2.64	[8'-8"]	2.59	[8'-6"]	60 [37]	2	1
3	QS2403*	QS3003*	QS3603*	4.42	[14'-6"]	3.56	[11'-8"]	3.51	[11'-6"]	70 [44]	3	1
4	QS2404*	QS3004*	QS3604*	5.33	[17'-6"]	4.47	[14'-8"]	4.42	[14'-6"]	80 [50]	3	2
5	QS2405*	QS3005*	QS3605*	6.25	[20'-6"]	5.38	[17'-8"]	5.33	[17'-6"]	90 [56]	4	2
6	QS2406*	QS3006*	QS3606*	7.16	[23'-6"]	6.30	[20'-8"]	6.25	[20'-6"]	△100 [62]	4	3
7	QS2407*	QS3007*	QS3607*	8.08	[26'-6"]	7.21	[23'-8"]	7.16	[23'-6"]	△105 [65]	4	4
8	QS2408*	QS3008*	QS3608*	8.99	[29'-6"]	8.13	[26'-8"]	8.08	[26'-6"]	△110 [68]	4	5
9	QS2409*	QS3009*	QS3609*	9.91	[32'-6"]	9.04	[29'-8"]	8.99	[29'-6"]	△115 [71]	4	6
10	QS2410*	QS3010*	QS3610*	10.82	[35'-6"]	9.96	[32'-8"]	9.91	[32'-6"]	△120 [75]	5	6
11	QS2411*	QS3011*	QS3611*	11.73	[38'-6"]	10.87	[35'-8"]	10.82	[35'-6"]	△120 [75]	5	7
12	QS2412*	QS3012*	QS3612*	12.65	[41'-6"]	11.79	[38'-8"]	11.74	[38'-6"]	△120 [75]	5	8

Revisions	Date	Rev.	By	Ckd.	App
AASHTO WAS 1996	11/25/03	J	SDC	STT	ACF
CHANGES WITH NOTES 4,5 & 7	12/15/04	K	RGC	STT	ACF
REVISED NOTE 3	2/14/02	I	DDW	STT	SPT

DRAWN	T. BUSSE	DATE	8/08/96
DESIGNED	JVM/MHO	DATE	3/01/96
CHECKED	BB	DATE	8/13/96
APPROVED	J. MACHADO	DATE	8/13/96
CAD FILE	QSCBCVR-U.dwg		

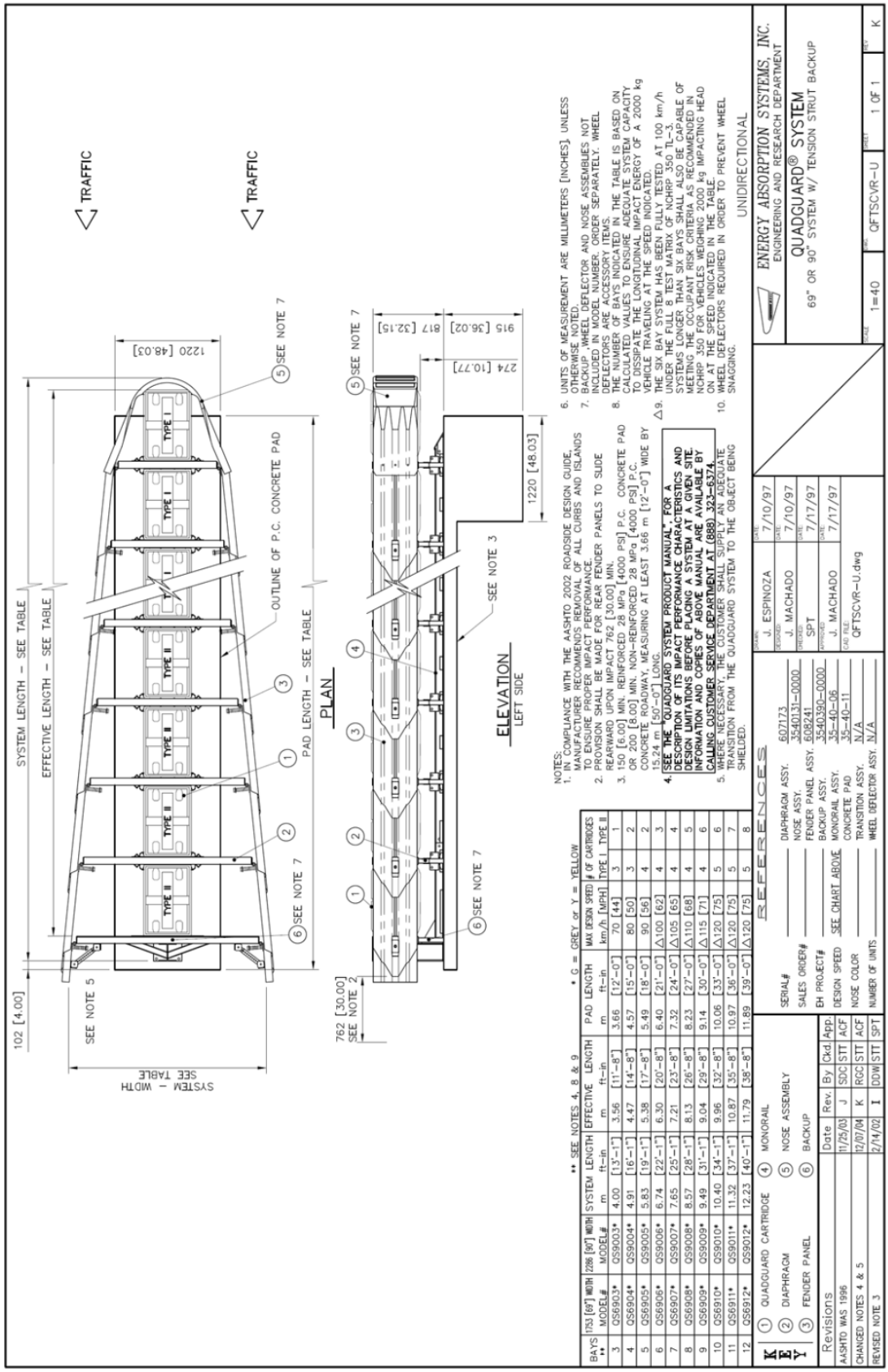
ENERGY ABSORPTION SYSTEMS, INC.
ENGINEERING AND RESEARCH DEPARTMENT

QUADGUARD® SYSTEM
w/ CONCRETE BACKUP

SCALE	1=40	DWG	QSCBCVR-U	SHEET	1 OF 1	REV	K

QuadGuard® w/ Concrete Backup

DWG QSCBCVR-U



** SEE NOTES 4, 8 & 9 * G = GREY or Y = YELLOW

BAYS **	1753 [69"] WIDTH	2286 [90"] WIDTH	SYSTEM LENGTH		EFFECTIVE LENGTH		PAD LENGTH		MAX DESIGN SPEED	# OF CARTRIDGES	
	MODEL#	MODEL#	m	ft–in	m	ft–in	m	ft–in	km/h [MPH]	TYPE I	TYPE II
3	QS9003*	QS9003*	4.00	[13'–1"]	3.56	[11'–8"]	3.66	[12'–0"]	70 [44]	3	1
4	QS9004*	QS9004*	4.91	[16'–1"]	4.47	[14'–8"]	4.57	[15'–0"]	80 [50]	3	2
5	QS9005*	QS9005*	5.83	[19'–1"]	5.38	[17'–8"]	5.49	[18'–0"]	90 [56]	4	2
6	QS9006*	QS9006*	6.74	[22'–1"]	6.30	[20'–8"]	6.40	[21'–0"]	△100 [62]	4	3
7	QS9007*	QS9007*	7.65	[25'–1"]	7.21	[23'–8"]	7.32	[24'–0"]	△105 [65]	4	4
8	QS9008*	QS9008*	8.57	[28'–1"]	8.13	[26'–8"]	8.23	[27'–0"]	△110 [68]	4	5
9	QS9009*	QS9009*	9.49	[31'–1"]	9.04	[29'–8"]	9.14	[30'–0"]	△115 [71]	4	6
10	QS9010*	QS9010*	10.40	[34'–1"]	9.96	[32'–8"]	10.06	[33'–0"]	△120 [75]	5	6
11	QS9011*	QS9011*	11.32	[37'–1"]	10.87	[35'–8"]	10.97	[36'–0"]	△120 [75]	5	7
12	QS9012*	QS9012*	12.23	[40'–1"]	11.79	[38'–8"]	11.89	[39'–0"]	△120 [75]	5	8

NOTES:
1. IN COMPLIANCE WITH THE AASHTO 2002 ROADSIDE DESIGN GUIDE, MANUFACTURER RECOMMENDS REMOVAL OF ALL CURBS AND ISLANDS TO ENSURE PROPER IMPACT PERFORMANCE.
2. PROVISION SHALL BE MADE FOR REAR FENDER PANELS TO SLIDE REARWARD UPON IMPACT. 762 [30.00] MIN.
3. 150 [6.00] MIN. REINFORCED 28 MPa [4000 PSI] P.C. CONCRETE PAD OR 200 [8.00] MIN. NON-REINFORCED 28 MPa [4000 PSI] P.C. CONCRETE ROADWAY, MEASURING AT LEAST 3.66 m [12'–0"] WIDE BY 15.24 m [50'–0"] LONG.
4. **SEE THE "QUADGUARD SYSTEM PRODUCT MANUAL" FOR A DESCRIPTION OF ITS IMPACT PERFORMANCE CHARACTERISTICS AND DESIGN LIMITATIONS BEFORE PLACING A SYSTEM AT A GIVEN SITE. INFORMATION AND COPIES OF ABOVE MANUAL ARE AVAILABLE BY CALLING CUSTOMER SERVICE DEPARTMENT AT (888) 323–6374.**
5. WHERE NECESSARY, THE CUSTOMER SHALL SUPPLY AN ADEQUATE TRANSITION FROM THE QUADGUARD SYSTEM TO THE OBJECT BEING SHIELDED.
6. UNITS OF MEASUREMENT ARE MILLIMETERS [INCHES], UNLESS OTHERWISE NOTED.
7. BACKUP, WHEEL DEFLECTOR AND NOSE ASSEMBLIES NOT INCLUDED IN MODEL NUMBER. ORDER SEPARATELY. WHEEL DEFLECTORS ARE ACCESSORY ITEMS.
8. THE NUMBER OF BAYS INDICATED IN THE TABLE IS BASED ON CALCULATED VALUES TO ENSURE ADEQUATE SYSTEM CAPACITY TO DISSIPATE THE LONGITUDINAL IMPACT ENERGY OF A 2000 kg VEHICLE TRAVELING AT THE SPEED INDICATED.
9. △ THE SIX BAY SYSTEM HAS BEEN FULLY TESTED AT 100 km/h UNDER THE TEST LEVEL 3 CRITERIA OF NCHRP 350. THIS SYSTEM IS LONGER THAN SIX BAYS SHALL ALSO BE CAPABLE OF MEETING THE OCCUPANT RISK CRITERIA AS RECOMMENDED IN NCHRP 350 FOR VEHICLES WEIGHING 2000 kg IMPACTING HEAD ON AT THE SPEED INDICATED IN THE TABLE.
10. WHEEL DEFLECTORS REQUIRED IN ORDER TO PREVENT WHEEL SNAGGING.

UNIDIRECTIONAL

KEY
① QUADGUARD CARTRIDGE
② DIAPHRAGM
③ FENDER PANEL
④ MONORAIL
⑤ NOSE ASSEMBLY
⑥ BACKUP

REFERENCES

SERIAL#	607173
SALES ORDER#	3540131–0000
EH PROJECT#	608241
DIAPHRAGM ASSY.	3540131–0000
NOSE ASSY.	3540390–0000
FENDER PANEL ASSY.	3540390–0000
BACKUP ASSY.	3540390–0000
DESIGN SPEED	SEE CHART ABOVE
MONORAIL ASSY.	35–40–06
NOSE COLOR	35–40–11
CONCRETE PAD	N/A
TRANSITION ASSY.	N/A
NUMBER OF UNITS	N/A
WHEEL DEFLECTOR ASSY.	N/A

DRAWN	J. ESPINOZA	DATE	7/10/97
DESIGNED	J. MACHADO	DATE	7/10/97
CHECKED	SPT	DATE	7/17/97
APPROVED	J. MACHADO	DATE	7/17/97
CAD FILE	QFTSCVR–U.dwg		

Revisions	Date	Rev.	By	Ckd.	App.
AASHTO WAS 1996	11/25/03	J	SDC	STT	ACF
CHANGED NOTES 4 & 5	12/07/04	K	RGC	STT	ACF
REVISED NOTE 3	2/14/02	I	DDW	STT	SPT

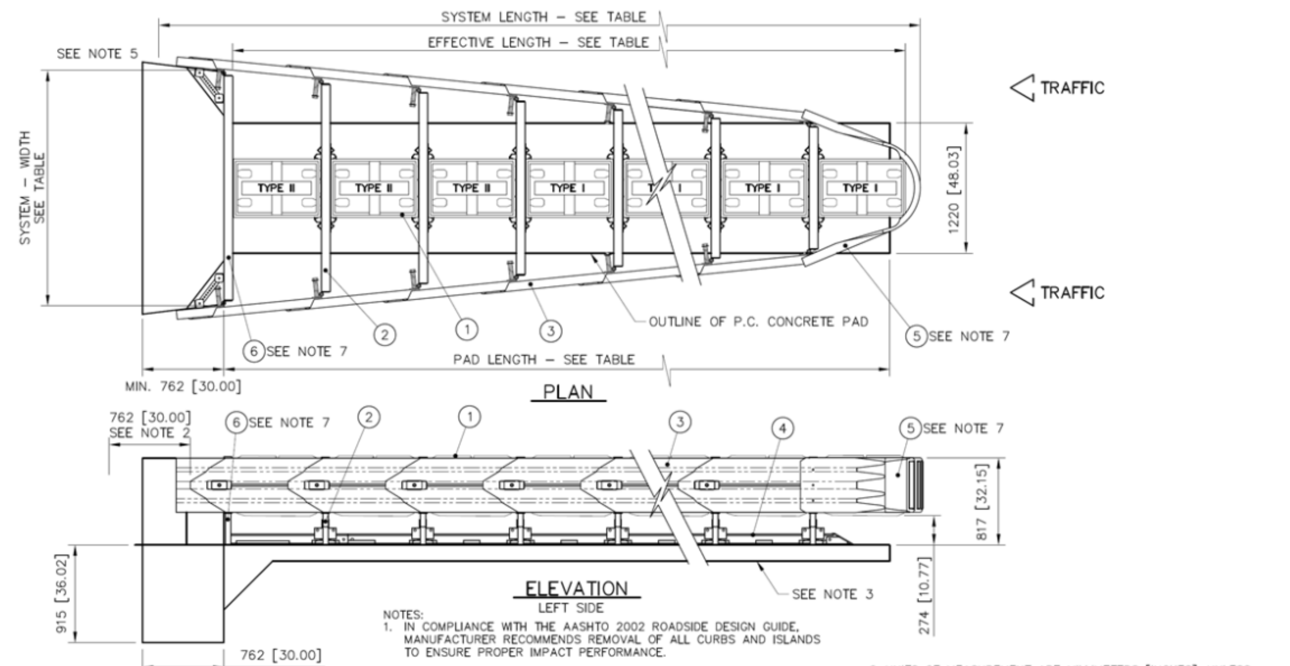
ENERGY ABSORPTION SYSTEMS, INC.
ENGINEERING AND RESEARCH DEPARTMENT

QUADGUARD® SYSTEM
69" OR 90" SYSTEM W/ TENSION STRUT BACKUP

SCALE 1=40 | DWG QFTSCVR–U | SHEET 1 OF 1 | REV K

QuadGuard® 69" or 90" System w/ Tension Strut Backup

DWG QFTSCVR-U



NOTES:
1. IN COMPLIANCE WITH THE AASHTO 2002 ROADSIDE DESIGN GUIDE, MANUFACTURER RECOMMENDS REMOVAL OF ALL CURBS AND ISLANDS TO ENSURE PROPER IMPACT PERFORMANCE.
2. PROVISION SHALL BE MADE FOR REAR FENDER PANELS TO SLIDE REARWARD UPON IMPACT 762 [30.00] MIN.
3. 150 [6.00] MIN. REINFORCED 28 MPa [4000 PSI] P.C. CONCRETE PAD OR 200 [8.00] MIN. NON-REINFORCED 28 MPa [4000 PSI] P.C. CONCRETE ROADWAY, MEASURING AT LEAST 3.66 m [12'-0"] WIDE BY 15.24 m [50'-0"] LONG.
4. **SEE THE "QUADGUARD SYSTEM PRODUCT MANUAL" CODED ENE 820-796, FOR A DESCRIPTION OF ITS IMPACT PERFORMANCE CHARACTERISTICS AND DESIGN LIMITATIONS BEFORE PLACING A SYSTEM AT A GIVEN SITE. INFORMATION AND COPIES OF ABOVE MANUAL ARE AVAILABLE BY CALLING CUSTOMER SERVICE DEPARTMENT AT (888) 323-6374.**
5. WHERE NECESSARY, THE CUSTOMER SHALL SUPPLY AN ADEQUATE TRANSITION FROM THE QUADGUARD SYSTEM TO THE OBJECT BEING SHIELDED.
6. UNITS OF MEASUREMENT ARE MILLIMETERS [INCHES], UNLESS OTHERWISE NOTED.
7. BACKUP AND NOSE ASSEMBLIES NOT INCLUDED IN MODEL NUMBER, ORDER SEPARATELY.
8. THE BAY LENGTHS INDICATED IN THE TABLE ARE BASED UPON CALCULATED VALUES TO ENSURE ADEQUATE SYSTEM CAPACITY TO DISSIPATE LONGITUDINAL IMPACT ENERGY OF 2000kg VEHICLES TRAVELING AT SPEEDS INDICATED.
△9. THE SIX BAY SYSTEM HAS BEEN FULLY TESTED AT 100 km/h UNDER THE FULL 8 TEST MATRIX OF NCHRP 350 TL-3. SYSTEMS LONGER THAN SIX BAYS SHALL ALSO BE CAPABLE OF MEETING THE OCCUPANT RISK CRITERIA AS RECOMMENDED IN NCHRP 350 FOR VEHICLES WEIGHING 2000 kg IMPACTING HEAD ON AT THE SPEED INDICATED IN THE TABLE.

UNIDIRECTIONAL

** SEE NOTES 4,8 & 9 • G = GREY or Y = YELLOW

BAYS **	1753[69"] WIDTH MODEL#	2286[90"] WIDTH MODEL#	SYSTEM LENGTH m	SYSTEM LENGTH ft-in	EFFECTIVE LENGTH m	EFFECTIVE LENGTH ft-in	PAD LENGTH m	PAD LENGTH ft-in	MAX DESIGN SPEED km/h [MPH]	# OF CARTRIDGES TYPE I	# OF CARTRIDGES TYPE II
3	QS6903•	QS9003•	4.57	[15'-0"]	3.56	[11'-8"]	3.51	[11'-6"]	70 [44]	3	1
4	QS6904•	QS9004•	5.49	[18'-0"]	4.47	[14'-8"]	4.42	[14'-6"]	80 [50]	3	2
5	QS6905•	QS9005•	6.40	[21'-0"]	5.38	[17'-8"]	5.33	[17'-6"]	90 [56]	4	2
6	QS6906•	QS9006•	7.31	[24'-0"]	6.30	[20'-8"]	6.25	[20'-6"]	△100 [62]	4	3
7	QS6907•	QS9007•	8.23	[27'-0"]	7.21	[23'-8"]	7.16	[23'-6"]	△105 [65]	4	4
8	QS6908•	QS9008•	9.14	[30'-0"]	8.13	[26'-8"]	8.08	[26'-6"]	△110 [68]	4	5
9	QS6909•	QS9009•	10.06	[33'-0"]	9.04	[29'-8"]	8.99	[29'-6"]	△115 [71]	4	6
10	QS6910•	QS9010•	10.97	[36'-0"]	9.96	[32'-8"]	9.91	[32'-6"]	△120 [75]	5	6
11	QS6911•	QS9011•	11.89	[39'-0"]	10.87	[35'-8"]	10.82	[35'-6"]	△120 [75]	5	7
12	QS6912•	QS9012•	12.80	[42'-0"]	11.79	[38'-8"]	11.74	[38'-6"]	△120 [75]	5	8

KEY
① QUADGUARD CARTRIDGE
② DIAPHRAGM
③ FENDER PANEL
④ MONORAIL
⑤ NOSE ASSEMBLY
⑥ BACKUP

Revisions	Date	Rev.	By	Ckd.	App.
AASHTO WAS 1996	11/25/03	I	SDC	STT	ACF
CHANGED NOTES 4 &5	12/17/04	J	RGC	STT	ACF
UPDATED TABLE, CONC. BACKUP WAS 24"	05/28/08	K	RGC	STT	RCB

REFERENCES

SERIAL# ____
SALES ORDER# ____
EH PROJECT# ____
DESIGN SPEED SEE CHART ABOVE
NOSE COLOR ____
NUMBER OF UNITS ____

DIAPHRAGM ASSY. 3540340-0000
NOSE ASSY. 3540131-0000
FENDER PANEL ASSY. 608241
BACKUP ASSY. 3540400-0000
MONORAIL ASSY. 35-40-06
CONCRETE PAD 3540411-0000
TRANSITION ASSY. N/A
WHEEL DEFLECTOR ASSY. N/A

DRAWN: J. ESPINOZA DATE: 7/11/97
DESIGNED: J. MACHADO DATE: 7/10/97
CHECKED: SPT DATE: 7/17/97
APPROVED: J. MACHADO DATE: 7/17/97
CAD FILE: QFCBCVR-U.dwg

ENERGY ABSORPTION SYSTEMS, INC.
ENGINEERING AND RESEARCH DEPARTMENT

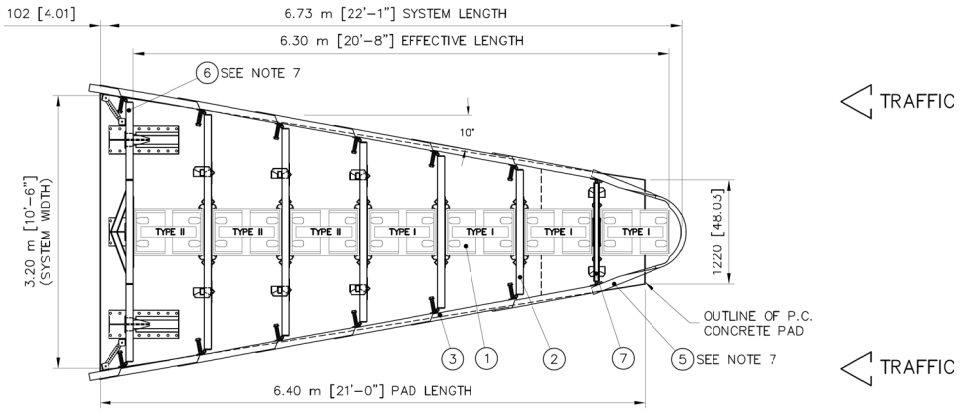
QUADGUARD® SYSTEM
69" OR 90" SYSTEM W/CONCRETE BACKUP

SCALE 1=40 DWG. QFCBCVR-U SHEET 1 OF 1 REV K

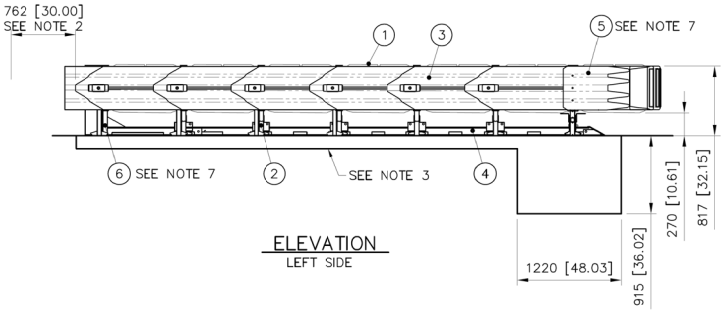
QuadGuard® 69" or 90" System w/ Concrete Backup

DWG QFCBCVR-U

DWG Q10TECVR-U



PLAN



ELEVATION
LEFT SIDE

NOTES:
1. IN COMPLIANCE WITH THE AASHTO 2002 ROADSIDE DESIGN GUIDE, MANUFACTURER RECOMMENDS REMOVAL OF ALL CURBS AND ISLANDS TO ENSURE PROPER IMPACT PERFORMANCE.
2. PROVISION SHALL BE MADE FOR REAR FENDER PANELS TO SLIDE REARWARD UPON IMPACT 762 [30.00] MIN.
3. 150 [6.00] MIN. REINFORCED 28 MPa [4000 PSI] P.C. CONCRETE PAD OR 200 [8.00] MIN. NON-REINFORCED 28 MPa [4000 PSI] P.C. CONCRETE ROADWAY, MEASURING AT LEAST 3.66 m [12'-0"] WIDE BY 15.24 m [50'-0"] LONG.
4. **SEE THE "QUADGUARD SYSTEM PRODUCT MANUAL" FOR A DESCRIPTION OF ITS IMPACT PERFORMANCE CHARACTERISTICS AND DESIGN LIMITATIONS BEFORE PLACING A SYSTEM AT A GIVEN SITE. INFORMATION AND COPIES OF CURRENT MANUAL ARE AVAILABLE BY CALLING CUSTOMER SERVICE DEPARTMENT AT (888) 323-6374.**
5. WHERE NECESSARY, THE CUSTOMER SHALL SUPPLY AN ADEQUATE TRANSITION FROM THE QUADGUARD SYSTEM TO THE OBJECT BEING SHIELDED.
6. UNITS OF MEASUREMENT ARE MILLIMETERS [INCHES], UNLESS OTHERWISE NOTED.
7. BACKUP & NOSE ASSEMBLY NOT INCLUDED IN MODEL NUMBER. ORDER SEPARATELY.
8. FINAL ALIGNMENT OF THE QUADGUARD SYSTEM RELATIVE TO ROADWAY TO BE DETERMINED BY PROJECT ENGINEER.

UNIDIRECTIONAL
MODEL NO. QN12606

KEY
1 QUADGUARD CARTRIDGE
2 DIAPHRAGM
3 FENDER PANEL
4 MONORAIL
5 NOSE ASSEMBLY
6 BACKUP
7 EXTRA WIDE DIAPHRAGM

Revisions	Date	Rev.	By	Ckd.	App.

REFERENCES

SERIAL#		DIAPHRAGM ASSY.	60-22-32 Sh02
SALES ORDER#		NOSE ASSY.	3540131-0000
EH PROJECT#		FENDER PANEL ASSY.	608241
DESIGN SPEED	100 km/h [62 mph]	BACKUP ASSY.	60-22-32 Sh03
NOSE COLOR		RAIL ASSY.	60-22-32 Sh04
NUMBER OF UNITS		CONCRETE PAD	60-22-32 Sh05
		EXTRAWIDE DIAPHRAGM	607179

DRAWN: W. LEDDINGTON	DATE: 7/19/05	
DESIGNED:	DATE:	
CHECKED: A. FRANKLIN	DATE: 7/25/05	
APPROVED: F.J. POWELL	DATE: 7/25/05	
CAD FILE: Q10TSCVR-U.dwg		

ENERGY ABSORPTION SYSTEMS
ENGINEERING AND RESEARCH DEPARTMENT

QUADGUARD® SYSTEM
W/120" TENSION STRUT BACKUP

SCALE	DWG	SHEET	REV
1=50	Q10TSCVR-U	1 of 1	

QuadGuard® 120" System w/ Tension Strut Backup

QuadGuard® CZ for Construction Zones

NOTES:

1. IN COMPLIANCE WITH THE AASHTO 2002 ROADSIDE DESIGN GUIDE, MANUFACTURER RECOMMENDS REMOVAL OF ALL CURBS AND ISLANDS TO ENSURE PROPER IMPACT PERFORMANCE.
2. PROVISION SHALL BE MADE FOR REAR FENDER PANELS TO SLIDE REARWARD UPON IMPACT 760 [30.00] MIN.
3. **CAUTION: THE QUADGUARD C.Z. MUST BE CORRECTLY ANCHORED FOR PROPER IMPACT PERFORMANCE.** ATTACH SYSTEM USING ONE OF THE FOLLOWING:
   - 7" STUDS MAY BE USED TO ATTACH SYSTEM TO 28 MPa[4000 PSI] MIN. P.C. CONCRETE PER THE FOLLOWING MINIMUMS:**
     a) 150[6.00] NON REINFORCED ROADWAY OR PAD
     b) 200[8.00] REINFORCED **PORTABLE** PAD PER THE REFERENCE DETAIL
     c) 180[7.00] DECK STRUCTURE
   - 18" THREADED RODS MAY BE USED TO INSTALL SYSTEM ON ASPHALT.**
   - **REFER TO THE QUADGUARD CZ MP-3 ANCHORING SYSTEM INSTALLATION INSTRUCTIONS FOR SPECIFICATIONS.
4. **SEE THE "QUADGUARD SYSTEM PRODUCT MANUAL", FOR A DESCRIPTION OF ITS IMPACT PERFORMANCE CHARACTERISTICS AND DESIGN LIMITATIONS BEFORE PLACING A SYSTEM AT A GIVEN SITE. INFORMATION AND COPIES OF ABOVE MANUAL ARE AVAILABLE BY CALLING CUSTOMER SERVICE DEPARTMENT AT (888) 323-6374.**
5. WHERE NECESSARY, THE CUSTOMER SHALL SUPPLY A TRANSITION FROM THE QUADGUARD SYSTEM TO THE OBJECT BEING SHIELDED.
6. UNITS OF MEASUREMENT ARE MILLIMETERS [INCHES] UNLESS OTHERWISE NOTED.
7. THE NUMBER OF BAYS INDICATED IN THE TABLE IS BASED ON CALCULATED VALUES TO ENSURE ADEQUATE SYSTEM CAPACITY TO DISSIPATE THE LONGITUDINAL IMPACT ENERGY OF A 2000 kg VEHICLE TRAVELING AT THE SPEED INDICATED.
8. △ THE SIX BAY SYSTEM HAS BEEN FULLY TESTED AT 100 km/h UNDER THE FULL TEST MATRIX OF NCHRP 350 TL-3. SYSTEMS LONGER THAN SIX BAYS SHALL ALSO BE CAPABLE OF MEETING THE OCCUPANT RISK CRITERIA AS RECOMMENDED IN NCHRP 350 FOR VEHICLES WEIGHING 2000 kg IMPACTING HEAD ON AT THE SPEED INDICATED IN THE TABLE.
9. NOSE ASSEMBLY NOT INCLUDED IN MODEL NUMBER. ORDER SEPARATELY.

UNIDIRECTIONAL

* G = GREY or Y = YELLOW

BAYS	610[24] WIDTH MODEL#	760[30] WIDTH MODEL#	914[36] WIDTH MODEL#	SYSTEM LENGTH m	SYSTEM LENGTH ft-in	EFFECTIVE LENGTH m	EFFECTIVE LENGTH ft-in	PAD LENGTH m	PAD LENGTH ft-in	MAX DESIGN SPEED km/h [MPH]	# OF CARTRIDGES TYPE I	# OF CARTRIDGES TYPE II
3	QZ2403*	QZ3003*	QZ3603*	4.00	[13'-1"]	3.56	[11'-8"]	4.57	[15'-0"]	70 [44]	3	1
4	QZ2404*	QZ3004*	QZ3604*	4.90	[16'-1"]	4.47	[14'-8"]	4.57	[15'-0"]	80 [50]	3	2
5	QZ2405*	QZ3005*	QZ3605*	5.82	[19'-1"]	5.38	[17'-8"]	5.49	[18'-0"]	90 [56]	4	2
6	QZ2406*	QZ3006*	QZ3606*	6.74	[22'-1"]	6.30	[20'-8"]	6.40	[21'-0"]	100 [62]	4	3
7	QZ2407*	QZ3007*	QZ3607*	7.65	[25'-1"]	7.21	[23'-8"]	7.32	[24'-0"]	△105 [65]	4	4
8	QZ2408*	QZ3008*	QZ3608*	8.56	[28'-1"]	8.13	[26'-8"]	8.23	[27'-0"]	△110 [68]	4	5
9	QZ2409*	QZ3009*	QZ3609*	9.48	[31'-1"]	9.04	[29'-8"]	9.14	[30'-0"]	△115 [71]	4	6

KEY
① QUADGUARD CARTRIDGE ④ MONORAIL
② DIAPHRAGM ⑤ NOSE ASSEMBLY
③ FENDER PANEL ⑥ C.Z. BACKUP

Revisions	Date	Rev.	By	Ckd.	App
ITEM 5 "DOT" WAS IN WRONG PLACE	7/25/00	N	STT	KM	BB
REVISED TO SHOW NOSE BELT	5/14/99	L	DLS	BB	SPT
ADDED NOTES 8 AND 9.	12/3/99	M	DK	DO	SPT

REFERENCES

SERIAL#	PORTABLE CONCRETE PAD 35-40-10
	DIAPHRAGM ASSY. 607113
SALES ORDER#	NOSE ASSY. 35-40-05Z
	FENDER PANEL ASSY. 608236
EH PROJECT#	RAIL ASSY. 35-40-06
See Chart Above	C.Z. BACKUP ASSY. 35-40-16
	C.Z. KIT 35-40-24
NOSE COLOR	TRANSITION PANEL ASSY. N/A
NUMBER OF UNITS	PORTABLE BARRIER ANCHOR 612006

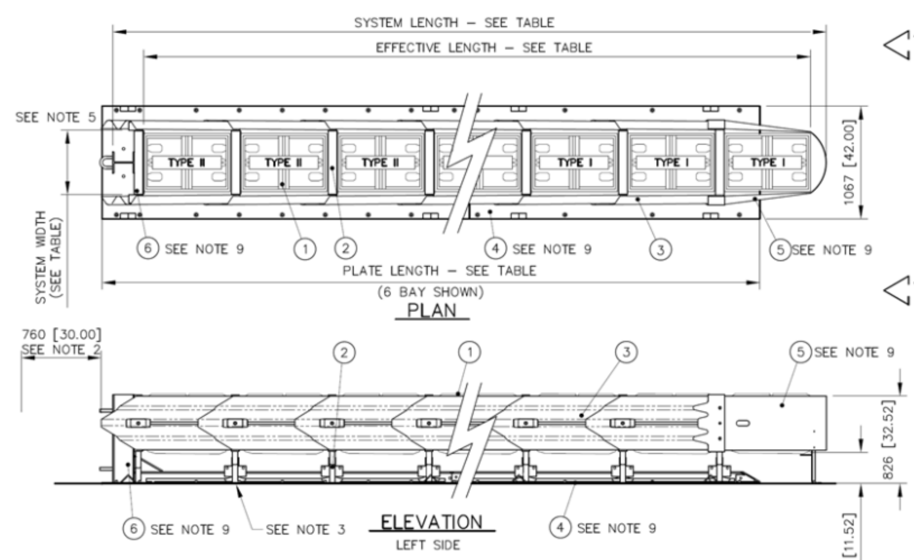
	NAME	DATE
DRAWN	S. TRAGESER	06/14/96
DESIGNED	JVM/MHO	03/01/96
CHECKED	KRM	06/17/96
APPROVED	J. MACHADO	06/17/96
CAD FILE:	QSCZCVR-U.dwg	

ENERGY ABSORPTION SYSTEMS
ENGINEERING AND RESEARCH DEPARTMENT

QUADGUARD® c.z. SYSTEM
FOR CONSTRUCTION ZONES

SCALE	DWG	SHEET	REV
1=40	QSCZCVR-U	1 OF 1	N

DWG QSCZCVR



NOTES:

1. IN COMPLIANCE WITH THE AASHTO 2002 ROADSIDE DESIGN GUIDE, MANUFACTURER RECOMMENDS REMOVAL OF ALL CURBS AND ISLANDS TO ENSURE PROPER IMPACT PERFORMANCE.
2. PROVISION SHALL BE MADE FOR REAR FENDER PANELS TO SLIDE REARWARD UPON IMPACT 760 [30.00] MIN.
3. **CAUTION: THE QUADGUARD C.Z. MUST BE CORRECTLY ANCHORED FOR PROPER IMPACT PERFORMANCE.** ATTACH SYSTEM USING ONE OF THE FOLLOWING:
   — 7" STUDS MAY BE USED TO ATTACH SYSTEM TO 28 MPa[4000 PSI] MIN. P.C. CONCRETE PER THE FOLLOWING MINIMUMS: **
   a) 150[6.00] NON REINFORCED ROADWAY OR PAD
   b) 180[7.00] DECK STRUCTURE
   — 18" THREADED RODS MAY BE USED TO INSTALL SYSTEM ON ASPHALT.**
   **REFER TO THE QUADGUARD CZ MP-3 ANCHORING SYSTEM SECTION OF THE "QUADGUARD INSTALLATION MANUAL".
4. **SEE THE "QUADGUARD SYSTEM PRODUCT MANUAL", FOR A DESCRIPTION OF ITS IMPACT PERFORMANCE CHARACTERISTICS AND DESIGN LIMITATIONS BEFORE PLACING A SYSTEM AT A GIVEN SITE. INFORMATION AND COPIES OF ABOVE MANUAL ARE AVAILABLE BY CALLING CUSTOMER SERVICE DEPARTMENT AT (888) 323-6374.**
5. WHERE NECESSARY, THE CUSTOMER SHALL SUPPLY AN ADEQUATE TRANSITION FROM THE QUADGUARD SYSTEM TO THE OBJECT BEING SHIELDED.
6. UNITS OF MEASUREMENT ARE MILLIMETERS [INCHES] UNLESS OTHERWISE NOTED.
7. THE NUMBER OF BAYS INDICATED IN THE TABLE IS BASED ON CALCULATED VALUES TO ENSURE ADEQUATE SYSTEM CAPACITY TO DISSIPATE THE LONGITUDINAL IMPACT ENERGY OF A 2000 kg VEHICLE TRAVELING AT THE SPEED INDICATED.
8. (△) THE SIX BAY SYSTEM HAS BEEN FULLY TESTED AT 100 km/h UNDER THE FULL 8 TEST MATRIX OF NCHRP 350 TL-3. SYSTEMS LONGER THAN SIX BAYS SHALL ALSO BE CAPABLE OF MEETING THE OCCUPANT RISK CRITERIA AS RECOMMENDED IN NCHRP 350 FOR VEHICLES WEIGHING 2000 kg IMPACTING HEAD ON AT THE SPEED INDICATED IN THE TABLE.
9. NOSE AND ANCHOR ASSEMBLIES NOT INCLUDED IN MODEL NUMBER. ORDER SEPARATELY.

UNIDIRECTIONAL
MODEL NO. SEE TABLE

* G = GREY or Y = YELLOW

BAYS	610[24] WIDTH MODEL#	762[30] WIDTH MODEL#	914[36] WIDTH MODEL#	SYSTEM LENGTH m	SYSTEM LENGTH ft-in	EFFECTIVE LENGTH m	EFFECTIVE LENGTH ft-in	PLATE LENGTH m	PLATE LENGTH ft-in	MAX DESIGN SPEED km/h [MPH]	# OF CARTRIDGES TYPE I	# OF CARTRIDGES TYPE II
3	QZ2403P*	QZ3003P*	QZ3603P*	4.00	[13'-1"]	3.56	[11'-8"]	3.47	[11'-5"]	70 [44]	3	1
4	QZ2404P*	QZ3004P*	QZ3604P*	4.90	[16'-1"]	4.47	[14'-8"]	4.39	[14'-5"]	80 [50]	3	2
5	QZ2405P*	QZ3005P*	QZ3605P*	5.82	[19'-1"]	5.38	[17'-8"]	5.30	[17'-5"]	90 [56]	4	2
6	QZ2406P*	QZ3006P*	QZ3606P*	6.74	[22'-1"]	6.30	[20'-8"]	6.21	[20'-5"]	100 [62]	4	3
7	QZ2407P*	QZ3007P*	QZ3607P*	7.65	[25'-1"]	7.21	[23'-8"]	7.13	[23'-5"]	△105 [65]	4	4
8	QZ2408P*	QZ3008P*	QZ3608P*	8.56	[28'-1"]	8.13	[26'-8"]	8.05	[26'-5"]	△110 [68]	4	5
9	QZ2409P*	QZ3009P*	QZ3609P*	9.48	[31'-1"]	9.04	[29'-8"]	8.96	[29'-5"]	△115 [71]	4	6

KEY
1. QUADGUARD CARTRIDGE
2. DIAPHRAGM
3. FENDER PANEL
4. C.Z. PLATE W/MONORAIL
5. NOSE ASSEMBLY
6. C.Z. BACKUP

Revisions	Date	Rev.	By	Ckd.	App.
PCN 1908, UPDATED PLATE	10/13/04	F	RGC	STT	ACF
REVISED NOTE 9	8/23/05	G	RGC	JME	ACF
CHANGED PLATE LENGTH (ECO 3071)	1/28/11	H	WWL	JME	RCB

REFERENCES

SERIAL# ______
SALES ORDER# ______
EH PROJECT# ______
DESIGN SPEED △See Chart Above
NOSE COLOR ______
NUMBER OF UNITS ______

DIAPHRAGM ASSY.	35-40-07
NOSE ASSY.	35-40-49
FENDER PANEL ASSY.	35-40-04
C.Z. BACKUP/PLATE ASSY.	35-40-28
LIFTING KIT	35-40-23
ANCHOR	35-40-64
PORTABLE BARRIER ANCHOR	612006

DRAWN:	L. Corker	03/26/03
DESIGNED:	R. Brougher	12/19/01
CHECKED:	K. Mortensen	03/31/03
APPROVED:	R. Brougher	03/31/03
CAD FILE:	QPCZCVR-U.dwg	

ENERGY ABSORPTION SYSTEMS, INC.
ENGINEERING AND RESEARCH DEPARTMENT

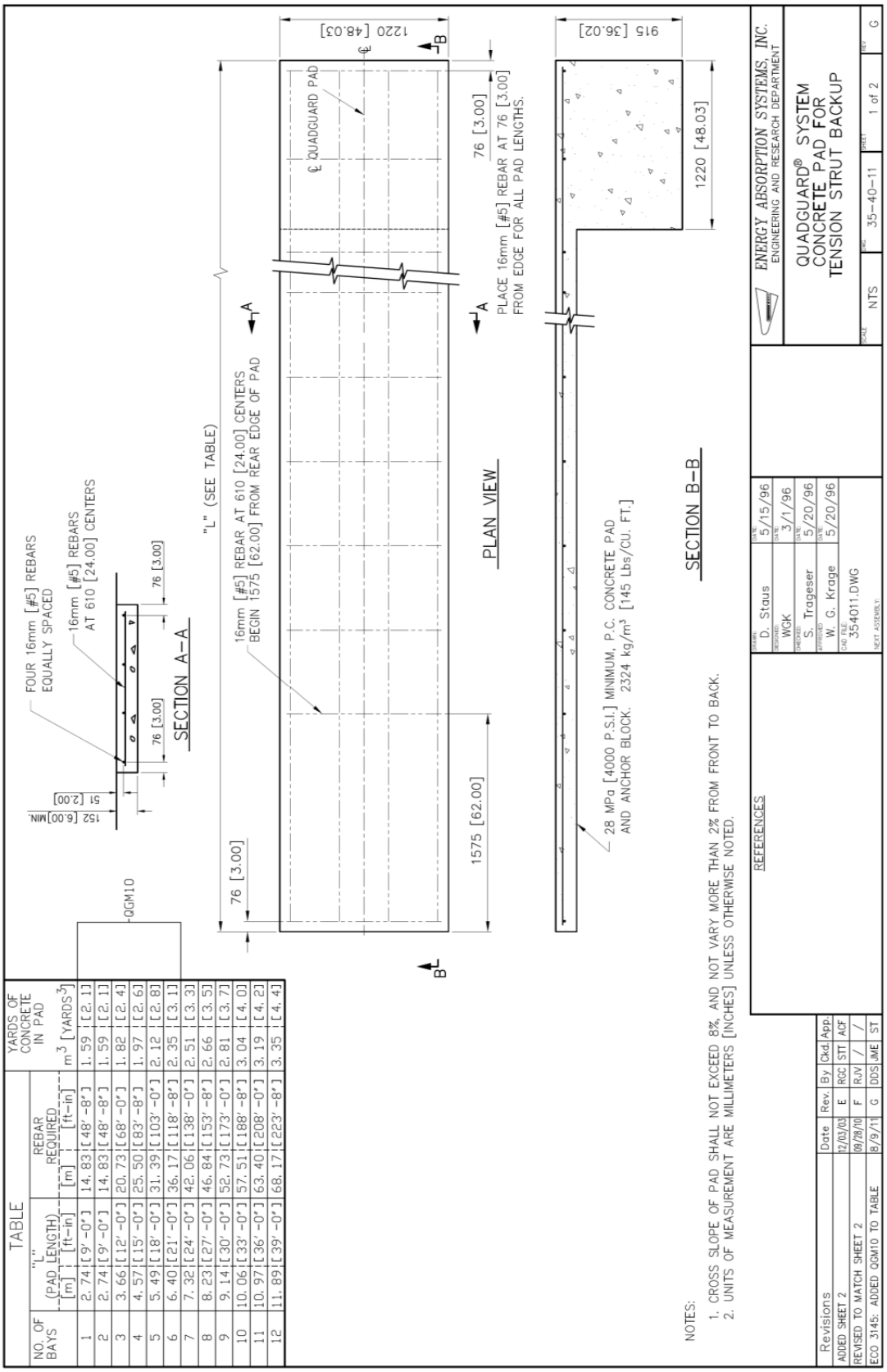
QUADGUARD® c.z. SYSTEM ON A PLATE
FOR CONSTRUCTION ZONES

SCALE 1:40 | DWG QPCZCVR-U | SHEET 1 of 1 | REV H

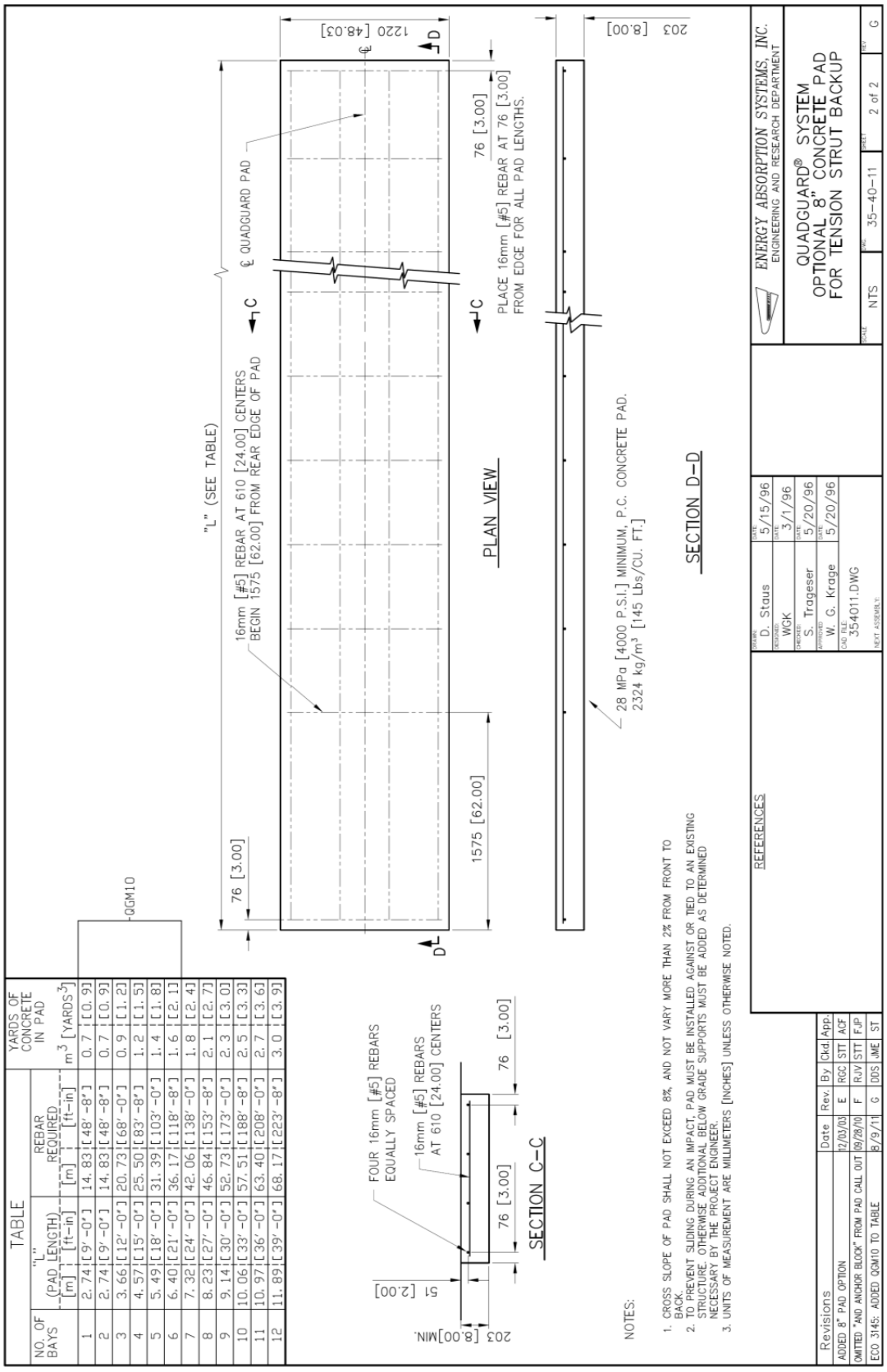
QuadGuard® CZ System on a Plate

DWG QPCZCVR-U

QuadGuard® Concrete Pad for Tension Strut Backup

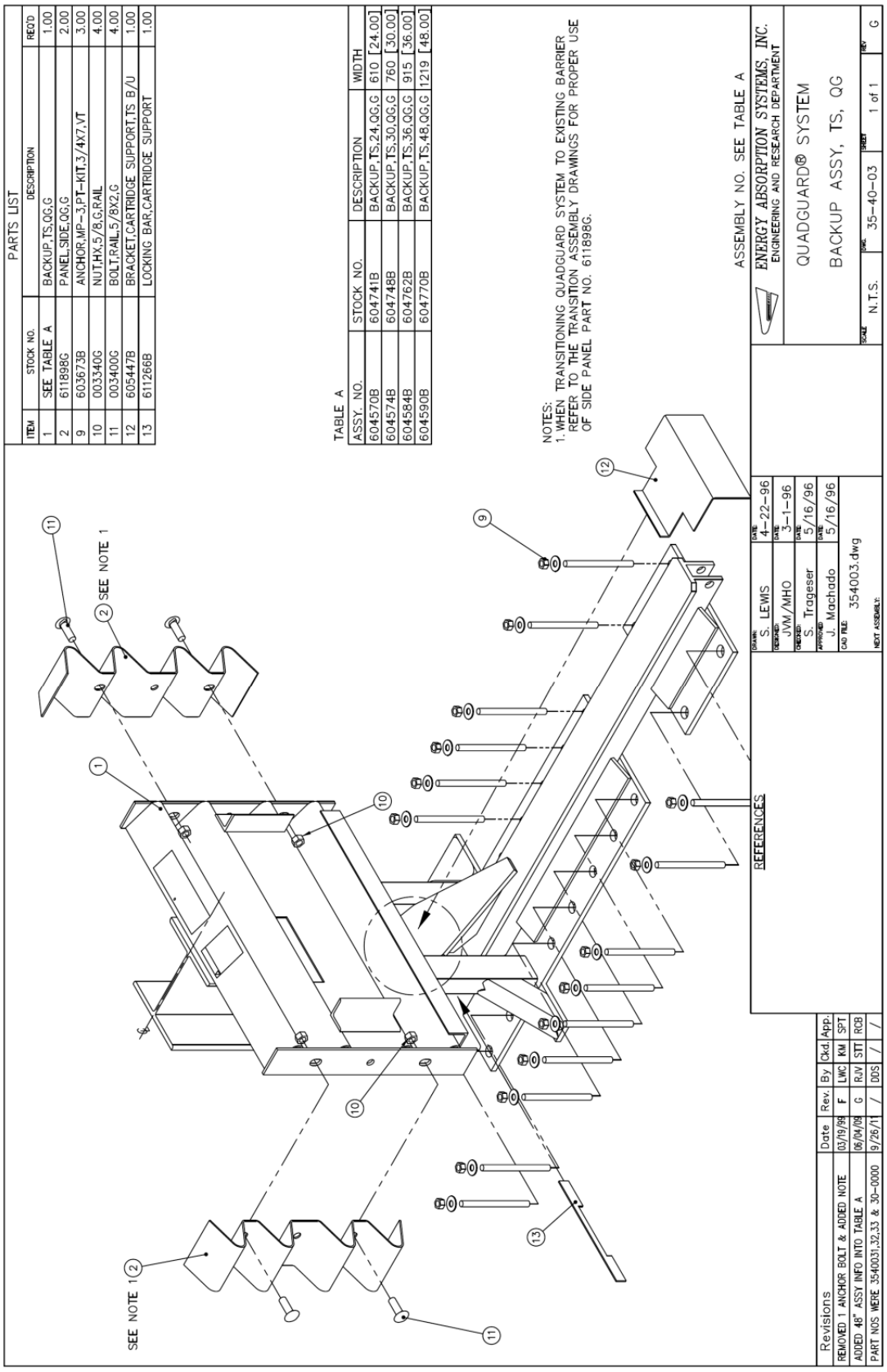


DWG 354011 Sheet 1 of 2

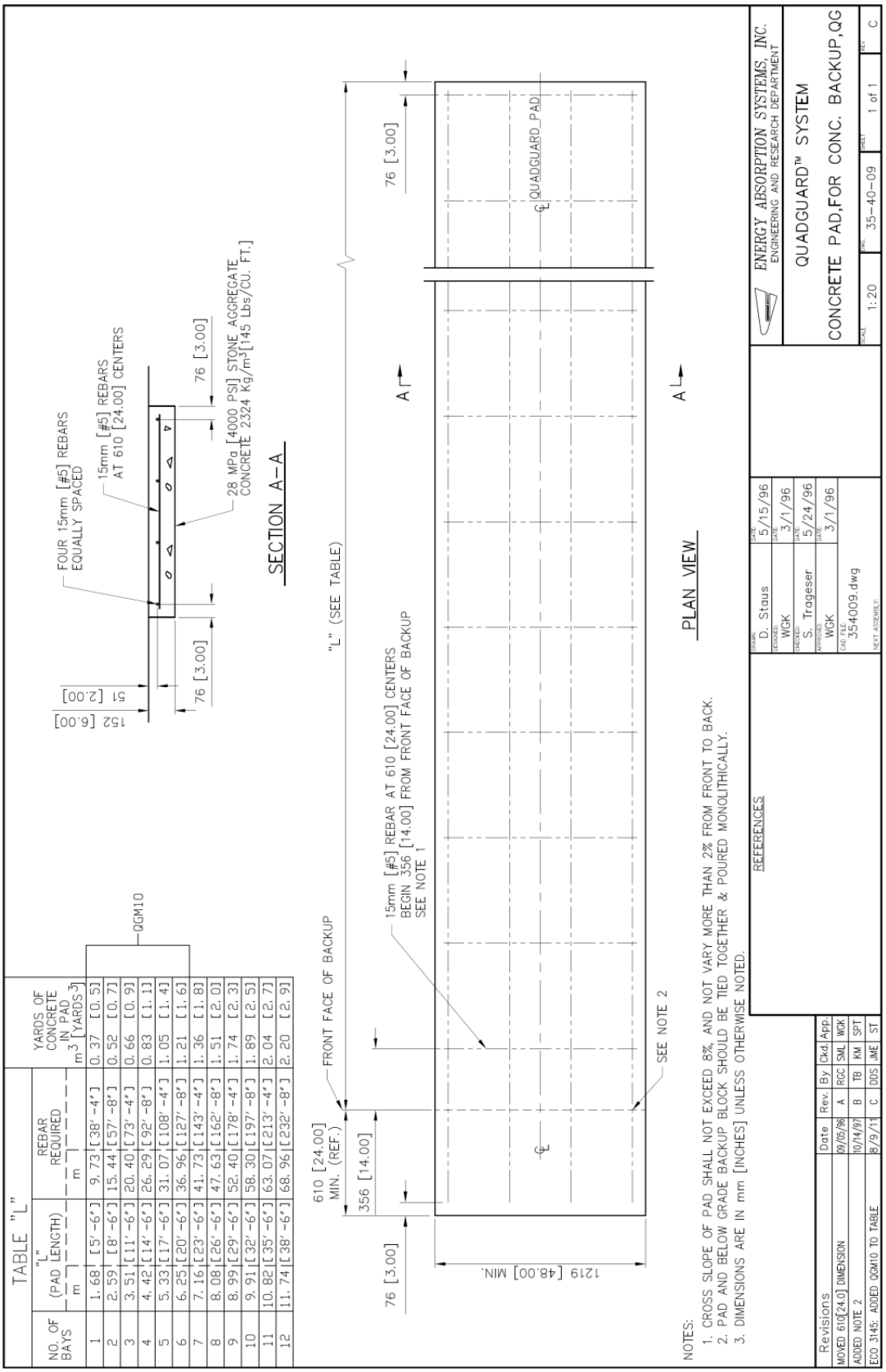


QuadGuard® Optional 8" Concrete Pad for Tension Strut Backup

DWG 354011 Sheet 2 of 2

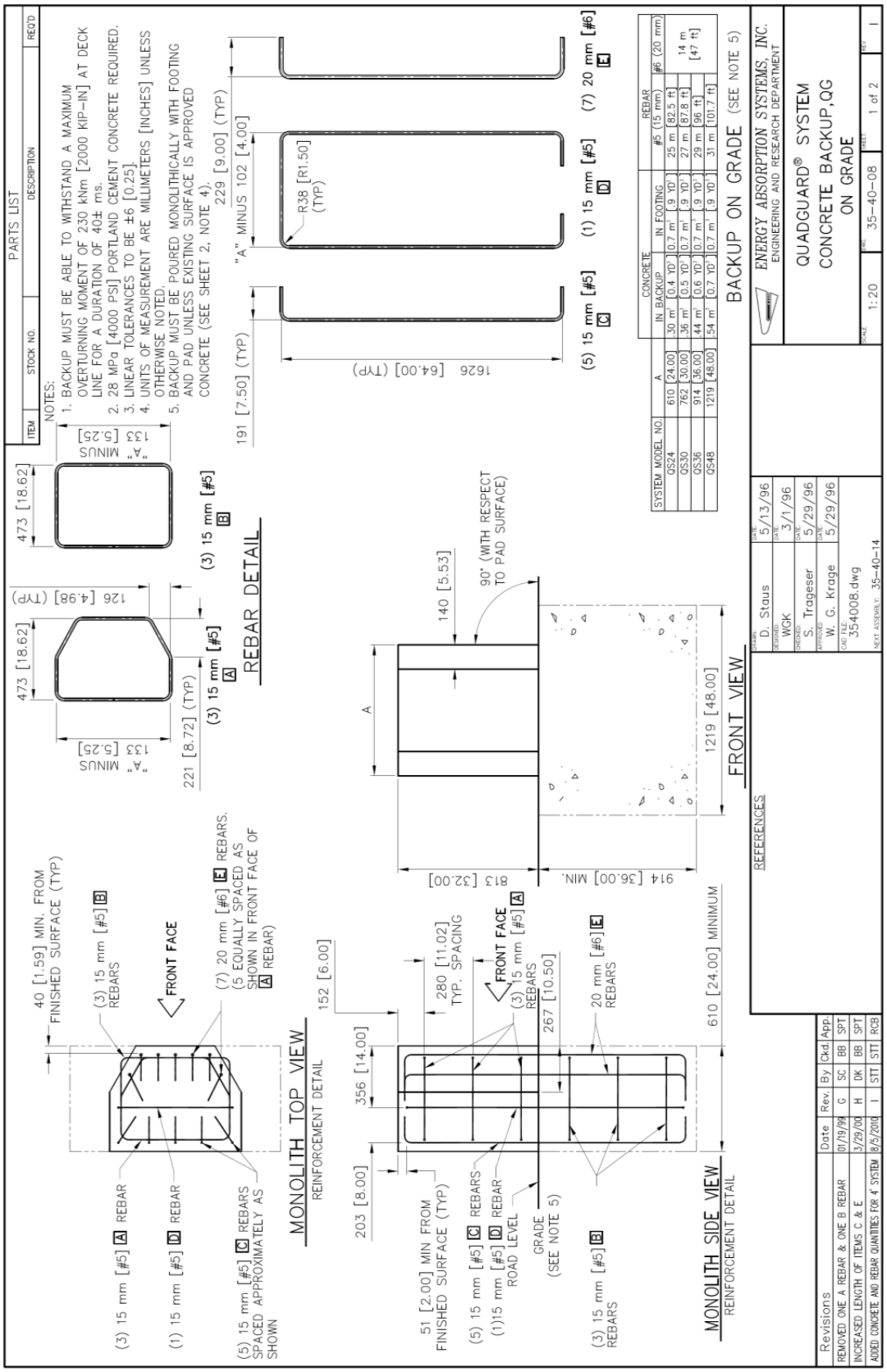


DWG 354003



QuadGuard® Concrete Pad for Concrete Backup

DWG 354009

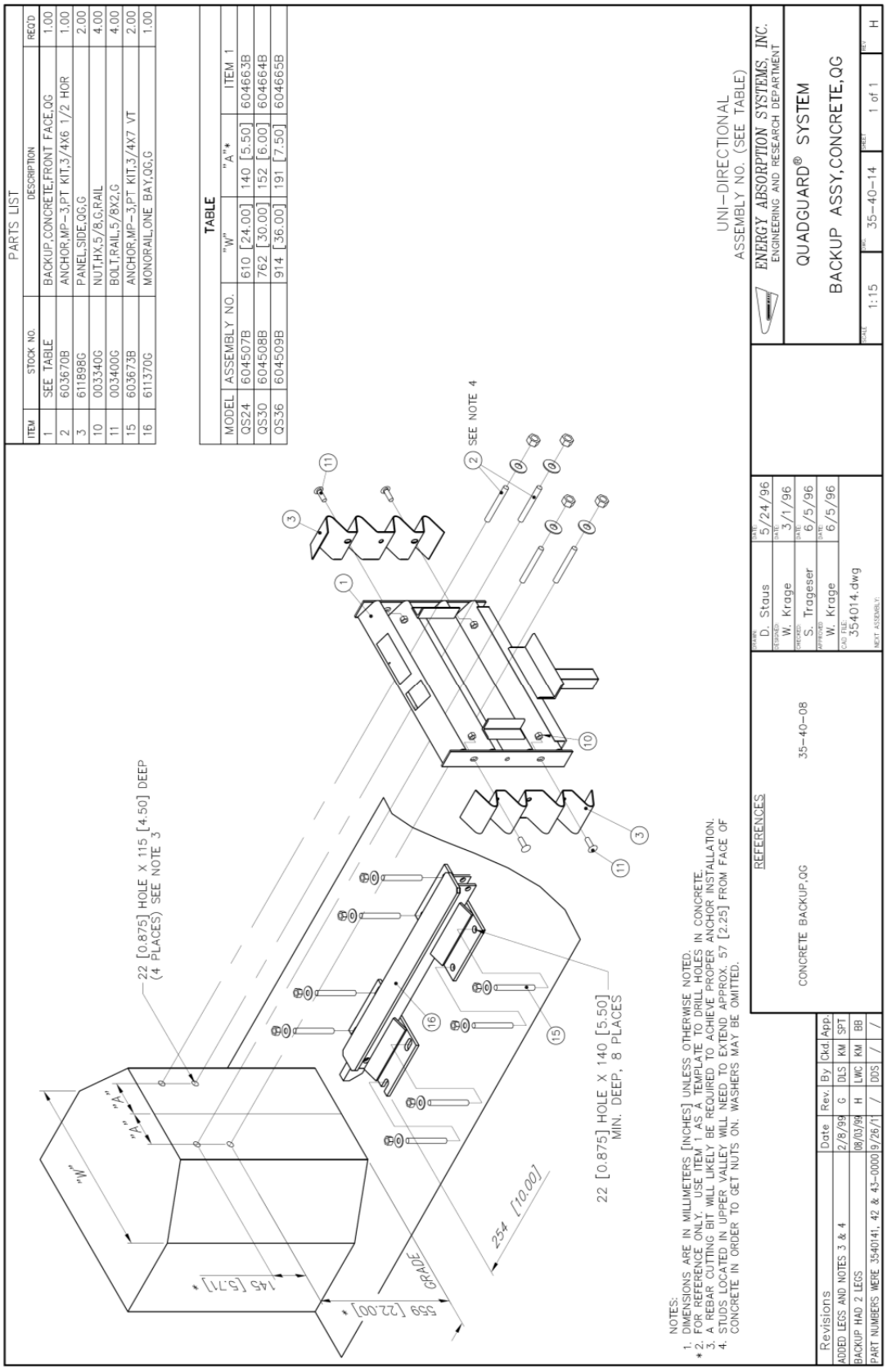


QuadGuard® Concrete Backup on Grade

DWG 354008 Sheet 1 of 2

QuadGuard® Concrete Backup on Existing Concrete Structure

DWG 354008 Sheet 2 of 2

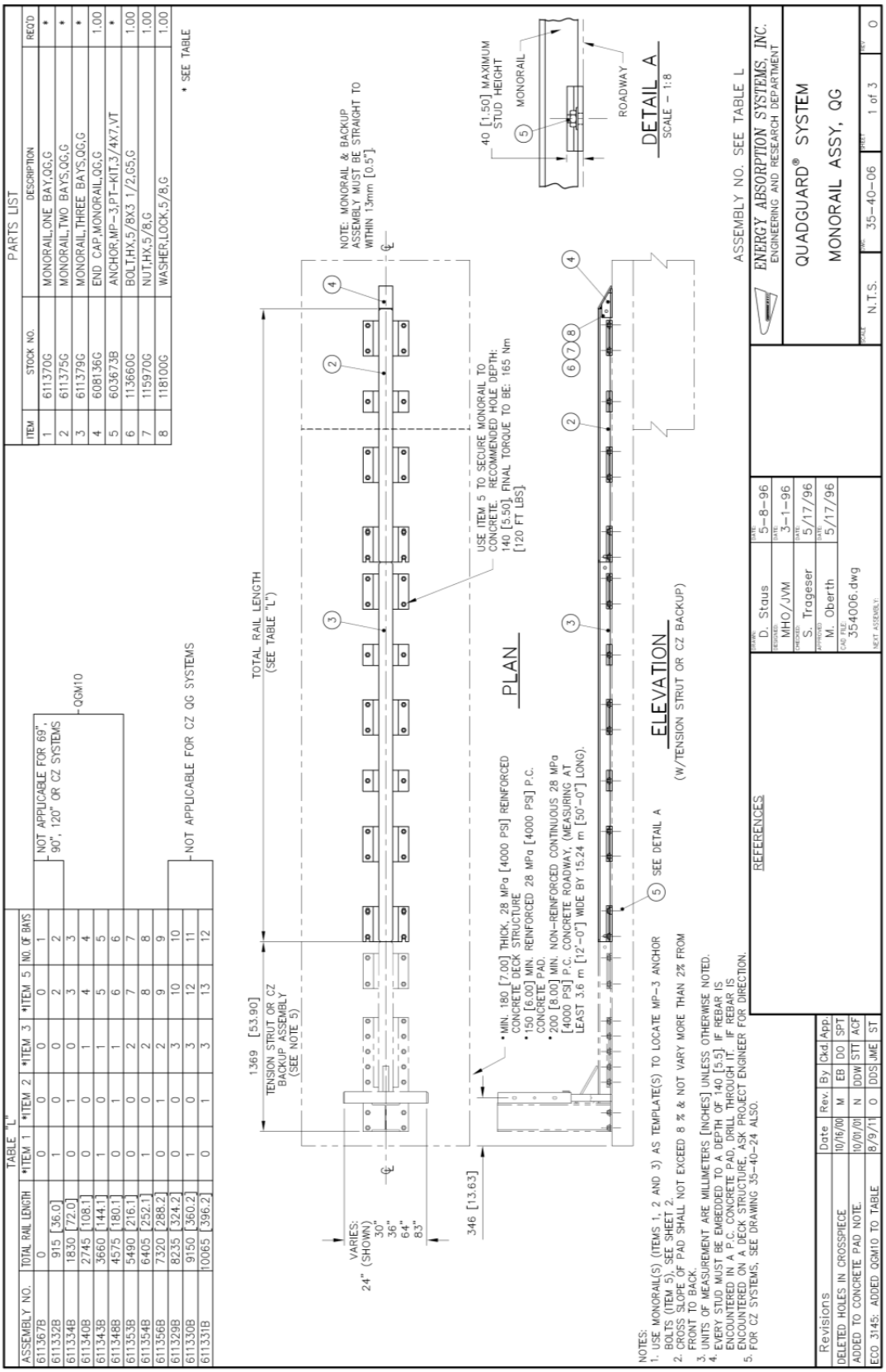


QuadGuard® Backup Assembly, Concrete

DWG 354014

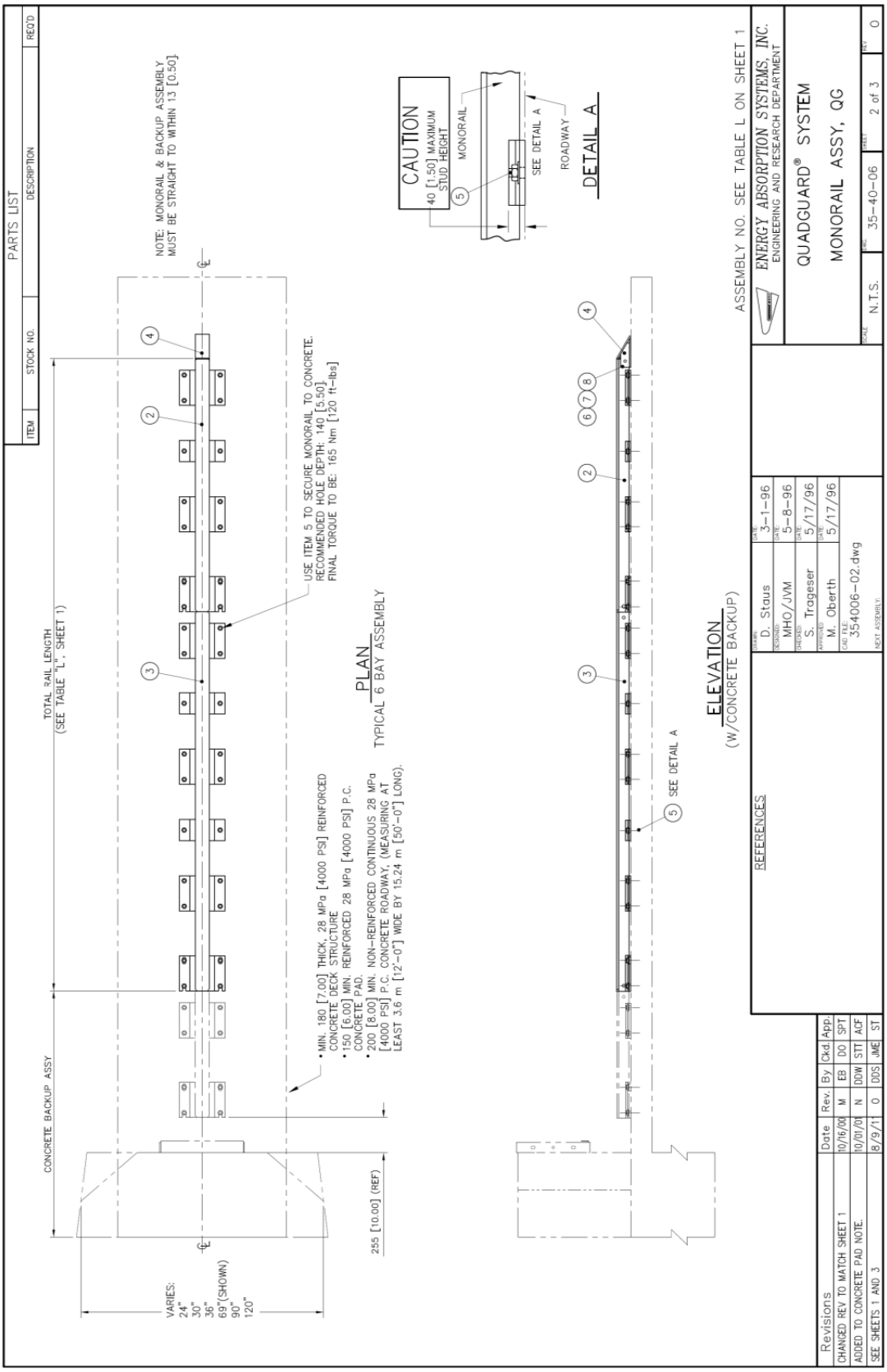
QuadGuard® Concrete Pad, CZ

DWG 354010

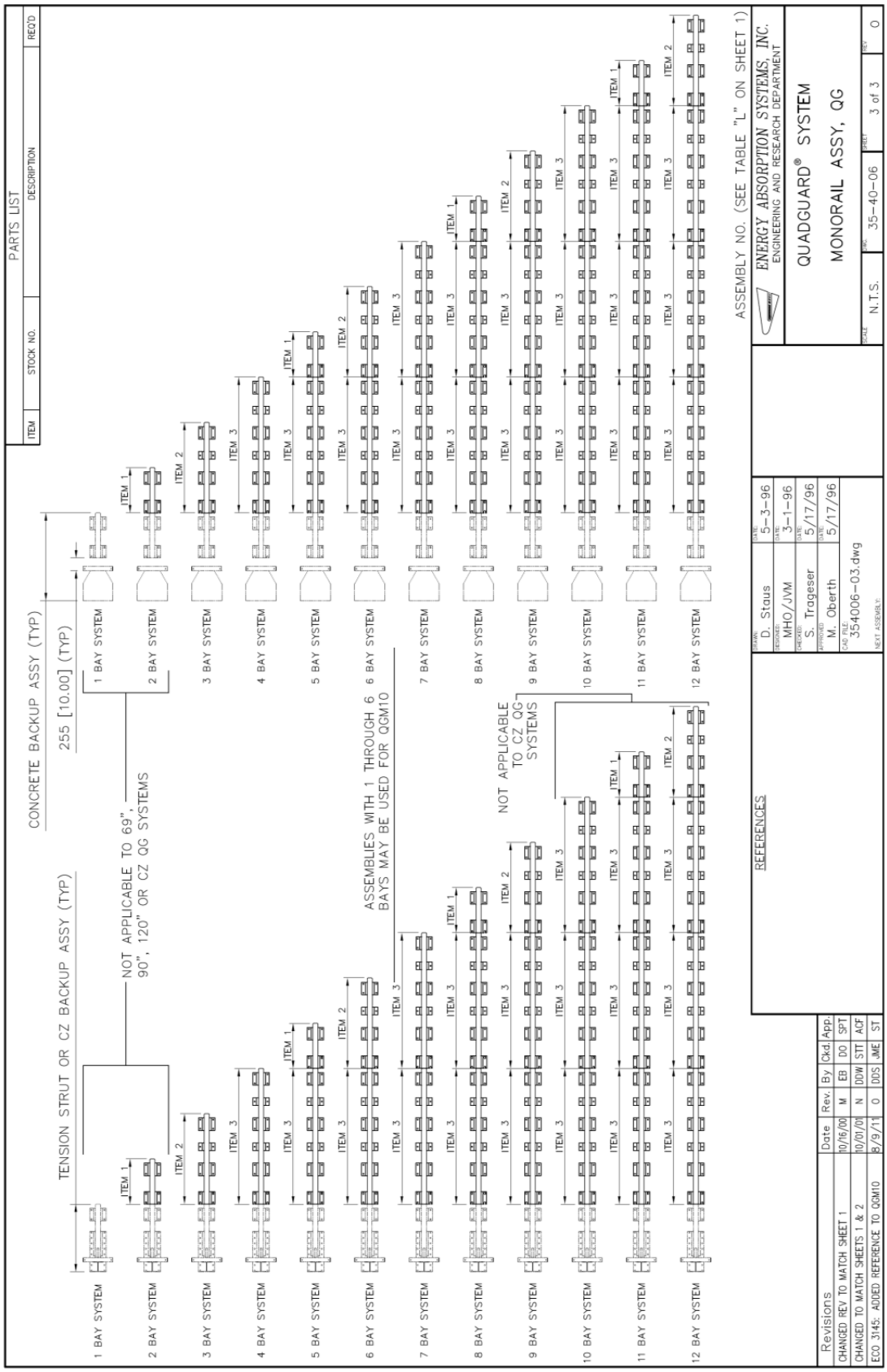


QuadGuard® Monorail Assembly

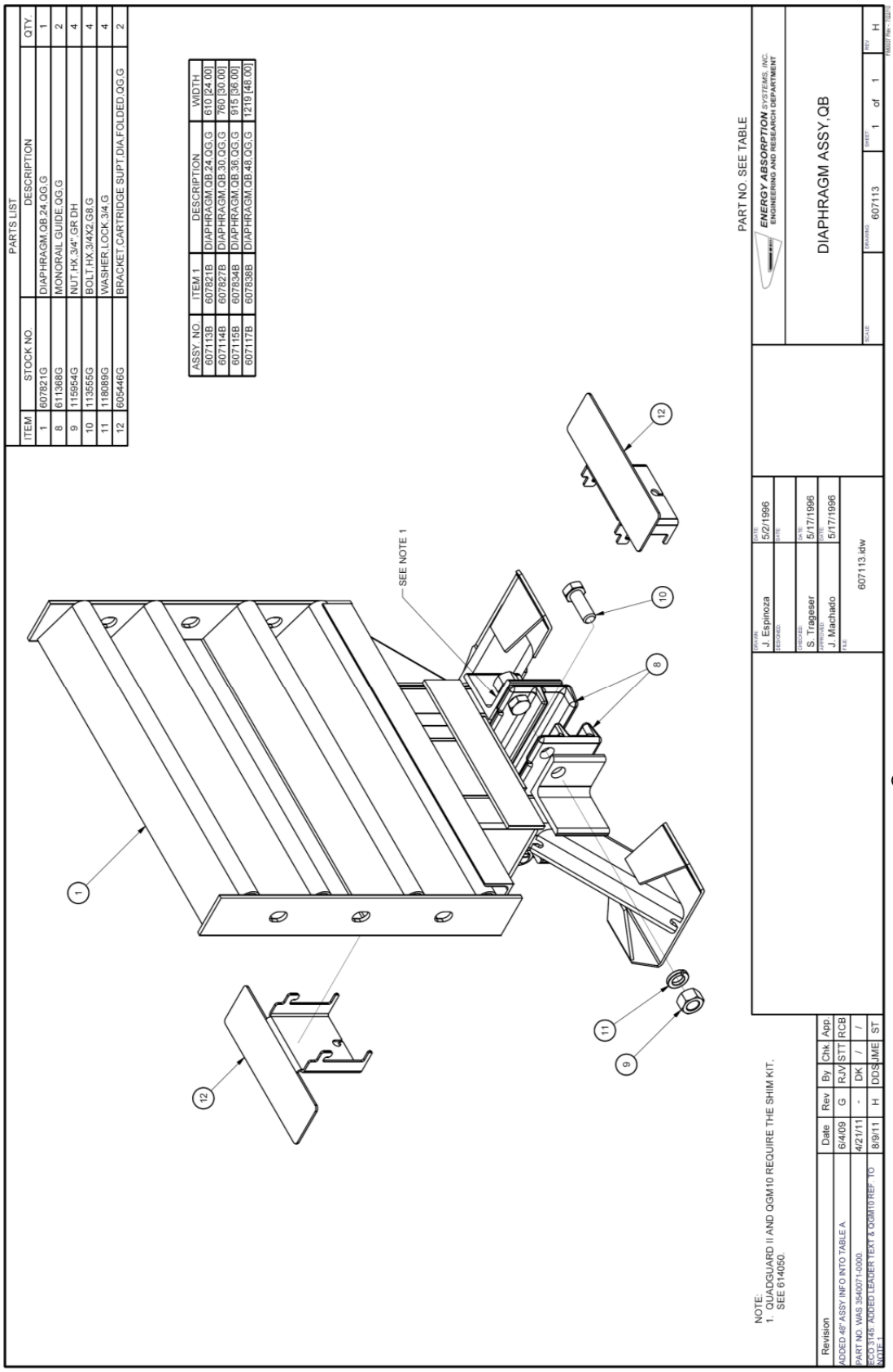
DWG 354006 Sheet 1 of 3



DWG 354006 Sheet 2 of 3

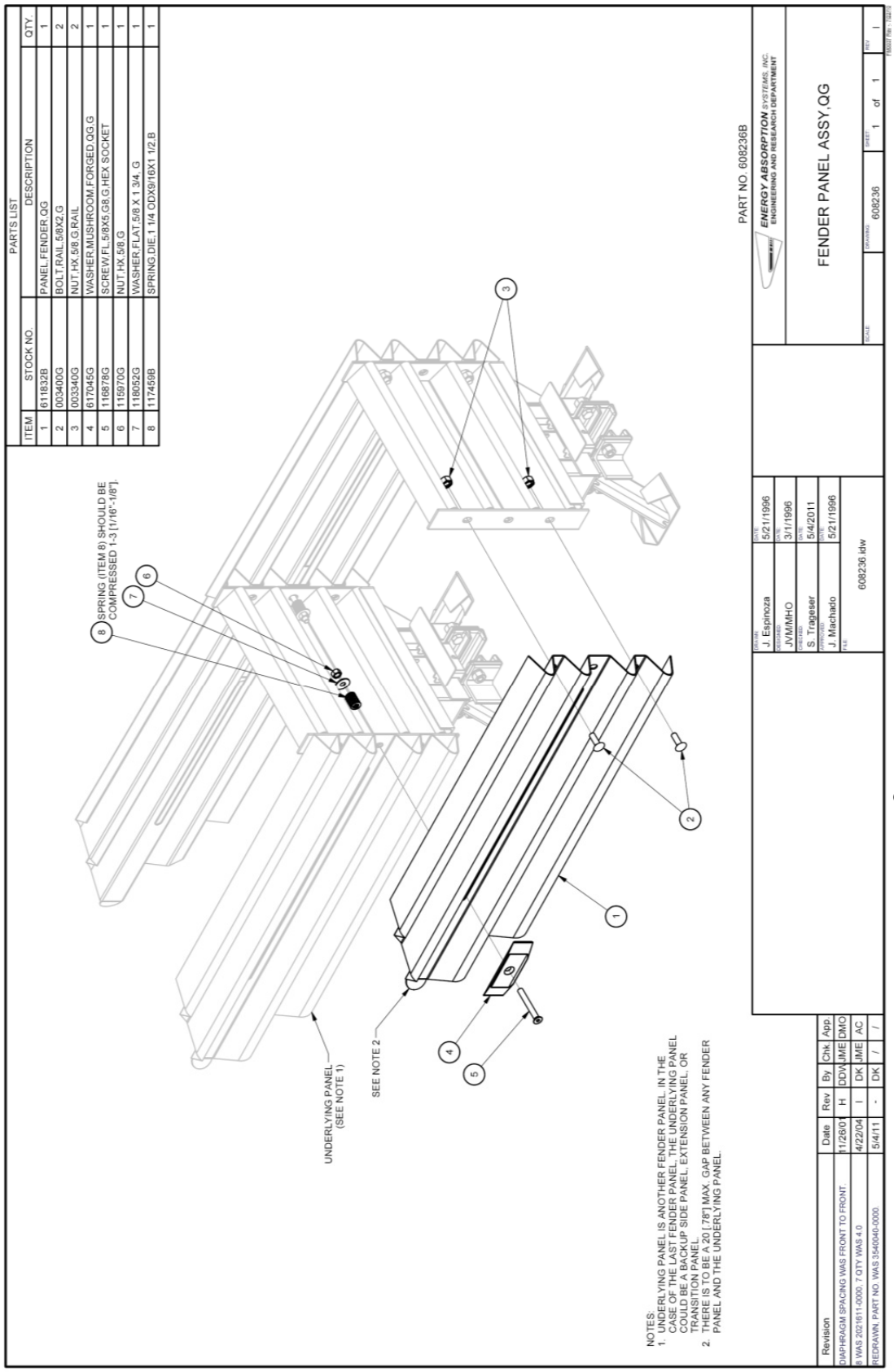


DWG 354006 Sheet 3 of 3



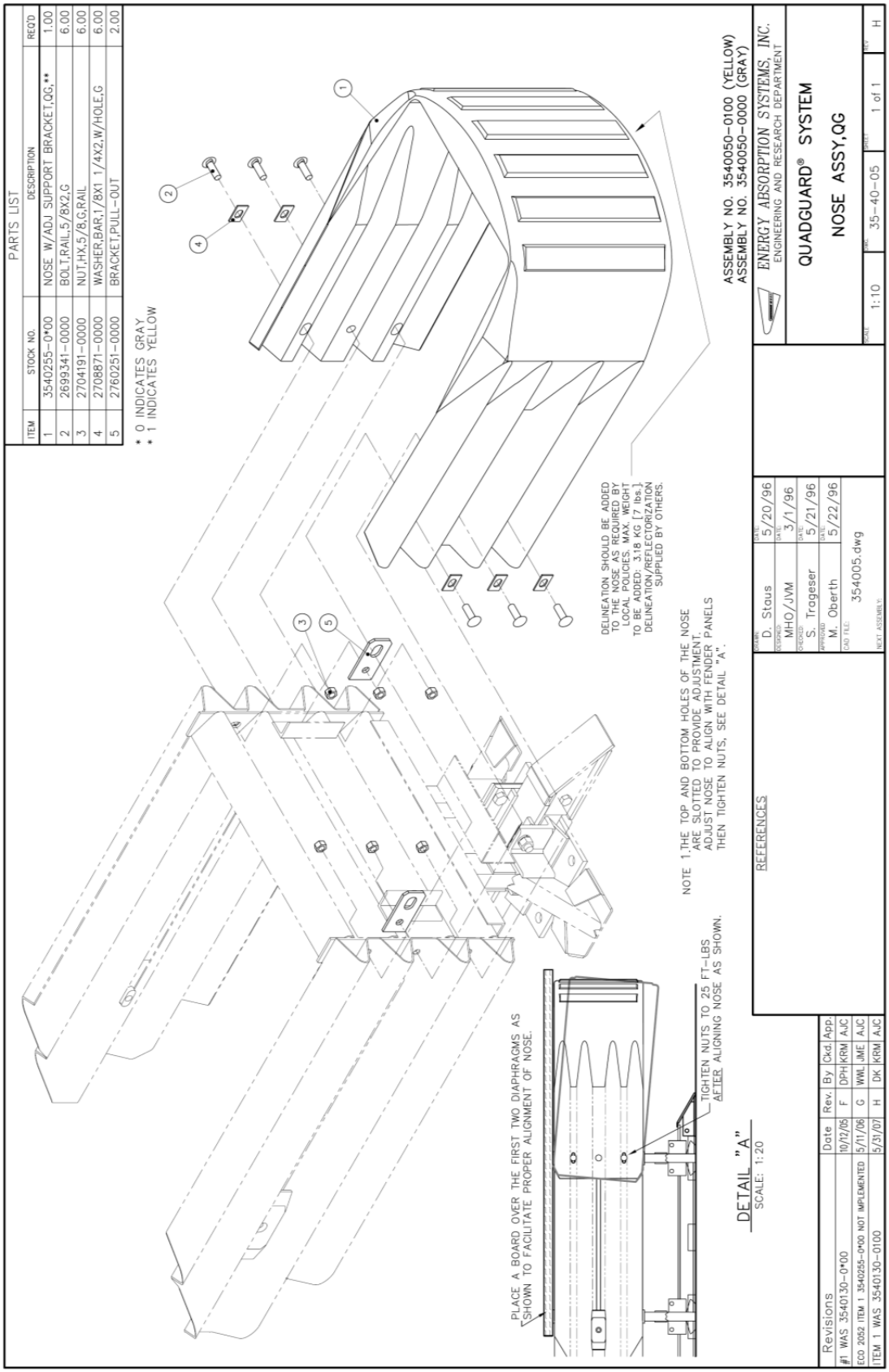
QuadGuard® Diaphragm Assembly

DWG 607113



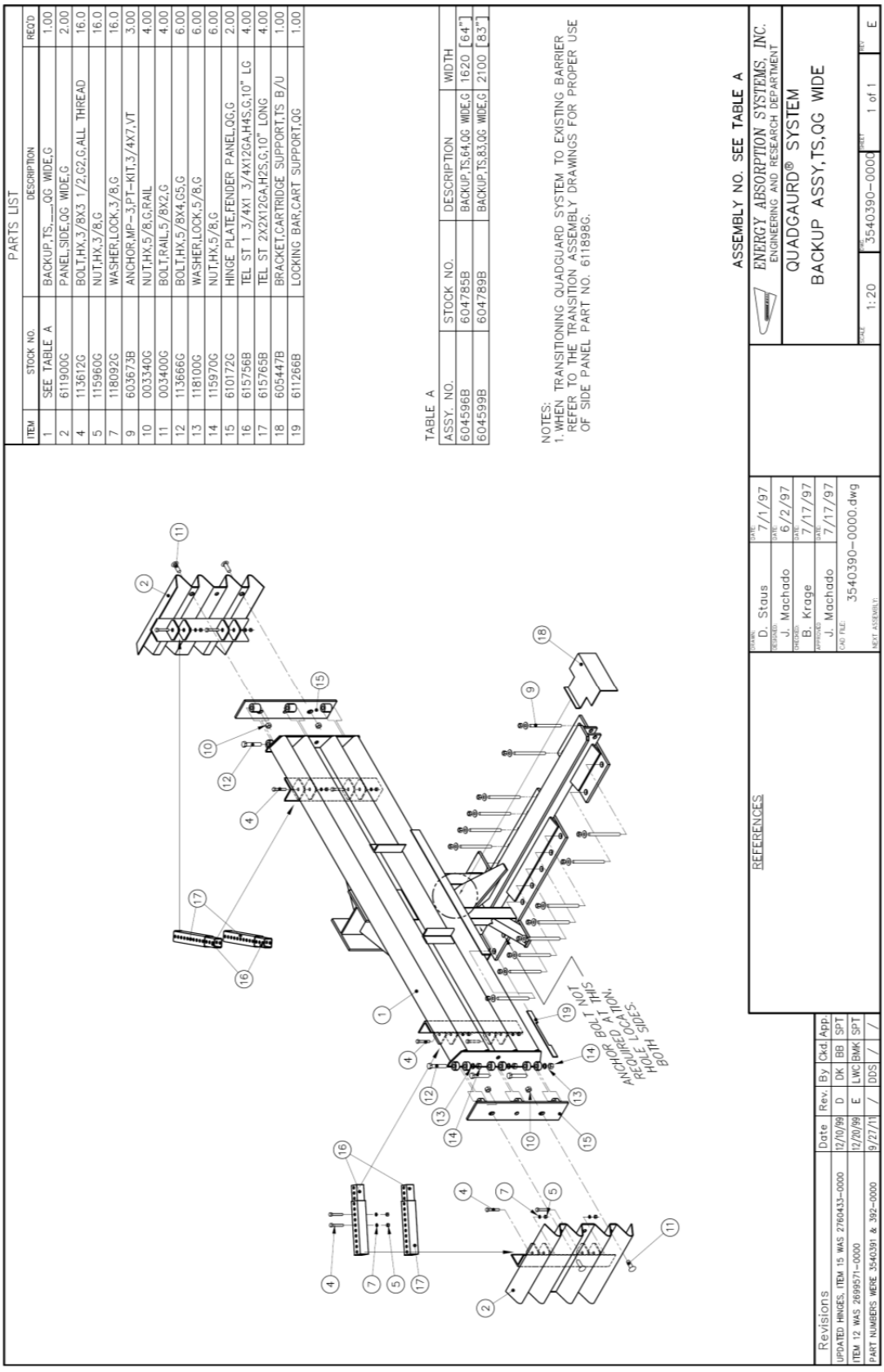
DWG 608236

QuadGuard® Fender Panel Assembly



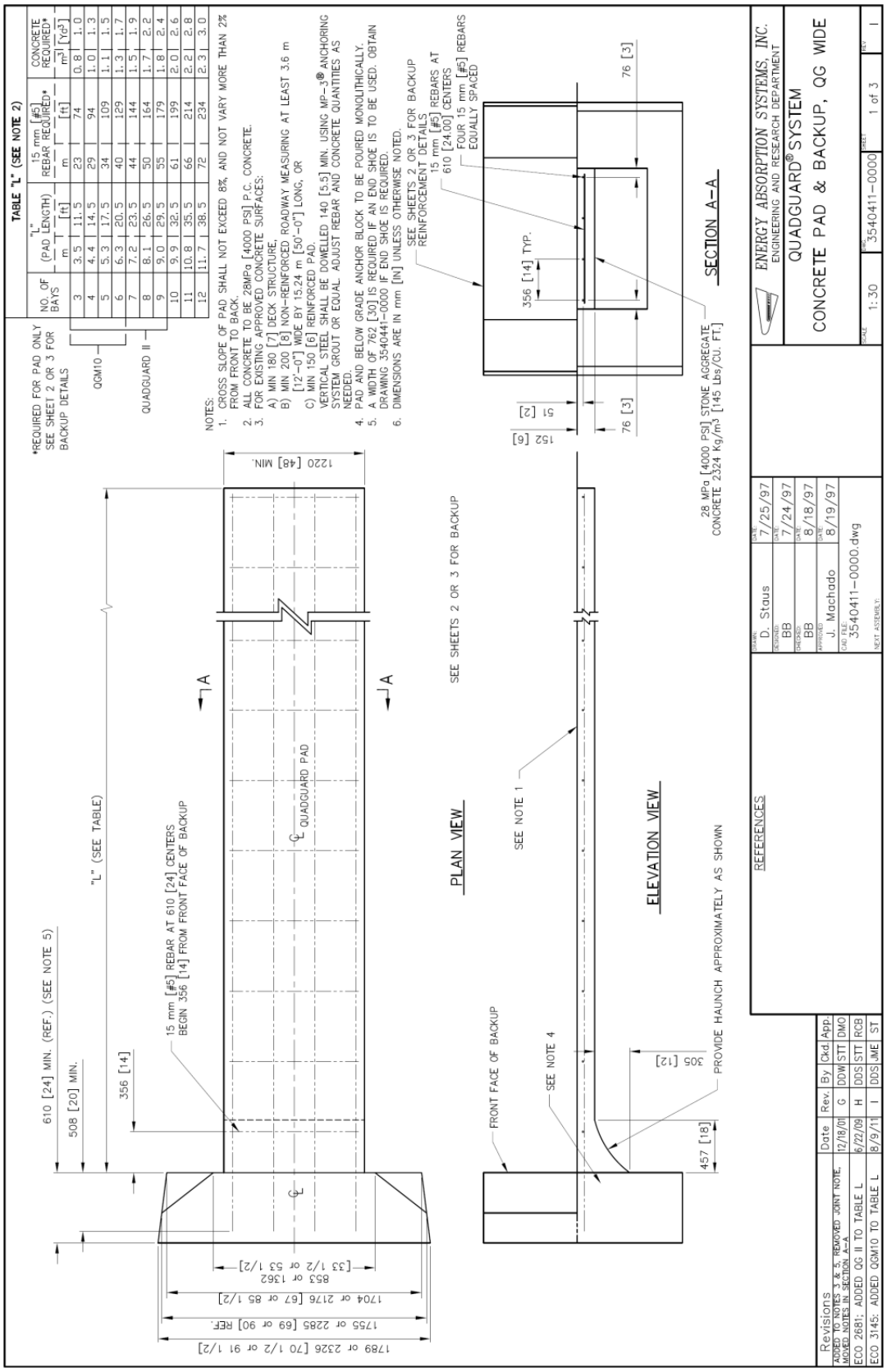
QuadGuard® System Nose Assembly

DWG 3540050-0000



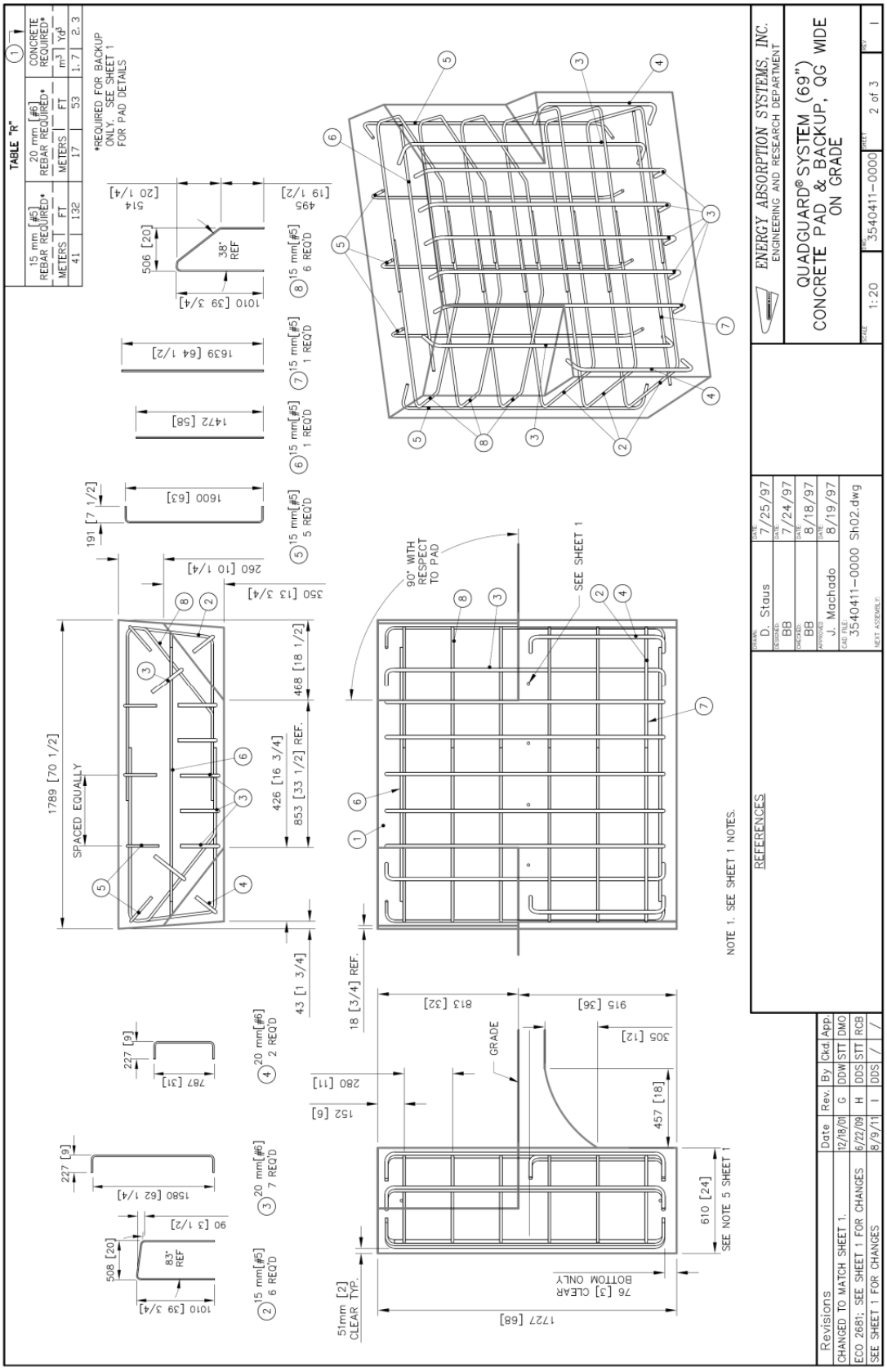
QuadGuard® Tension Strut Backup Assembly (Wide)

DWG 3540390-0000



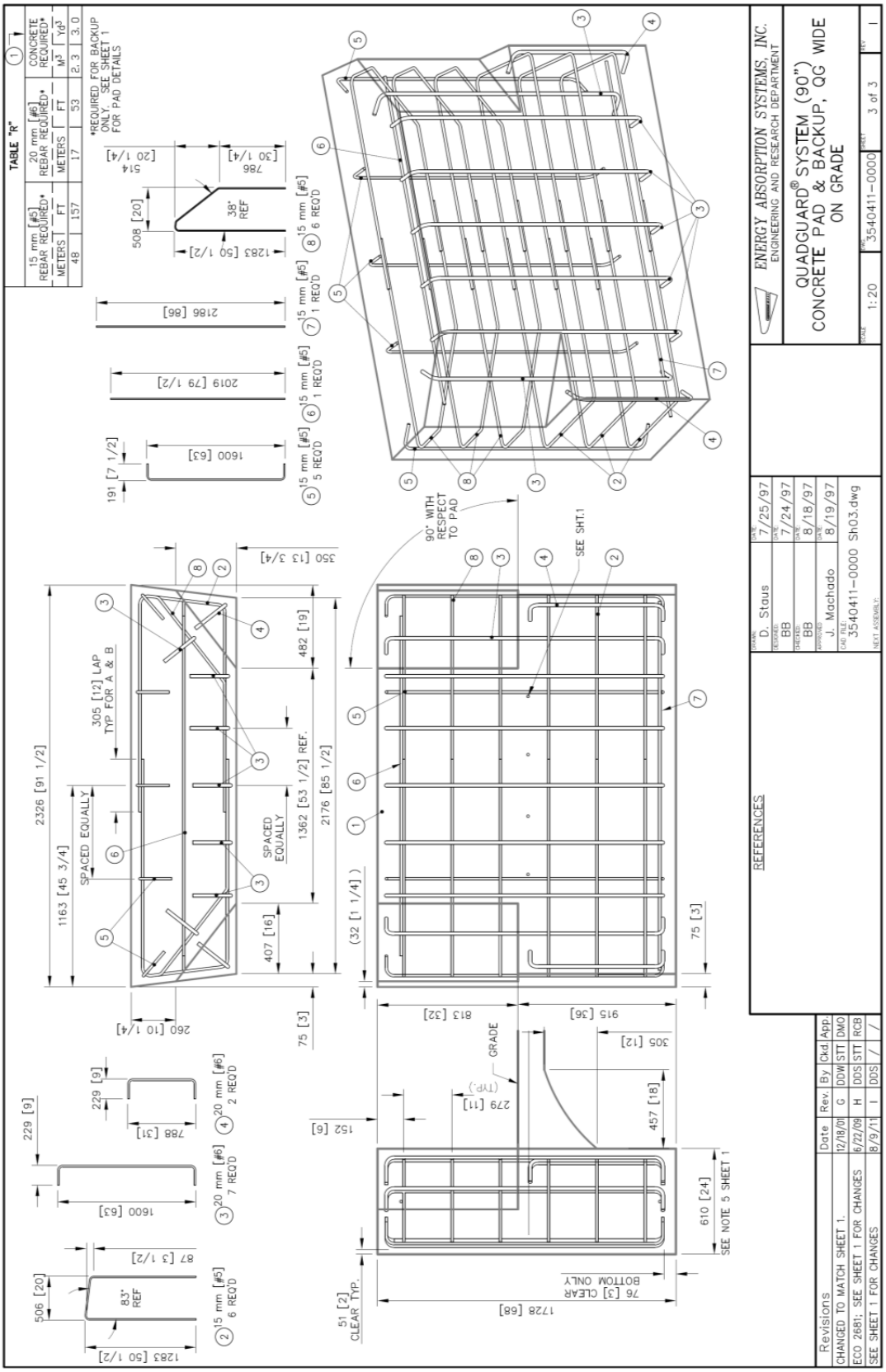
QuadGuard® Concrete Pad & Backup (Wide)

DWG 3540411-0000 Sheet 1 of 3



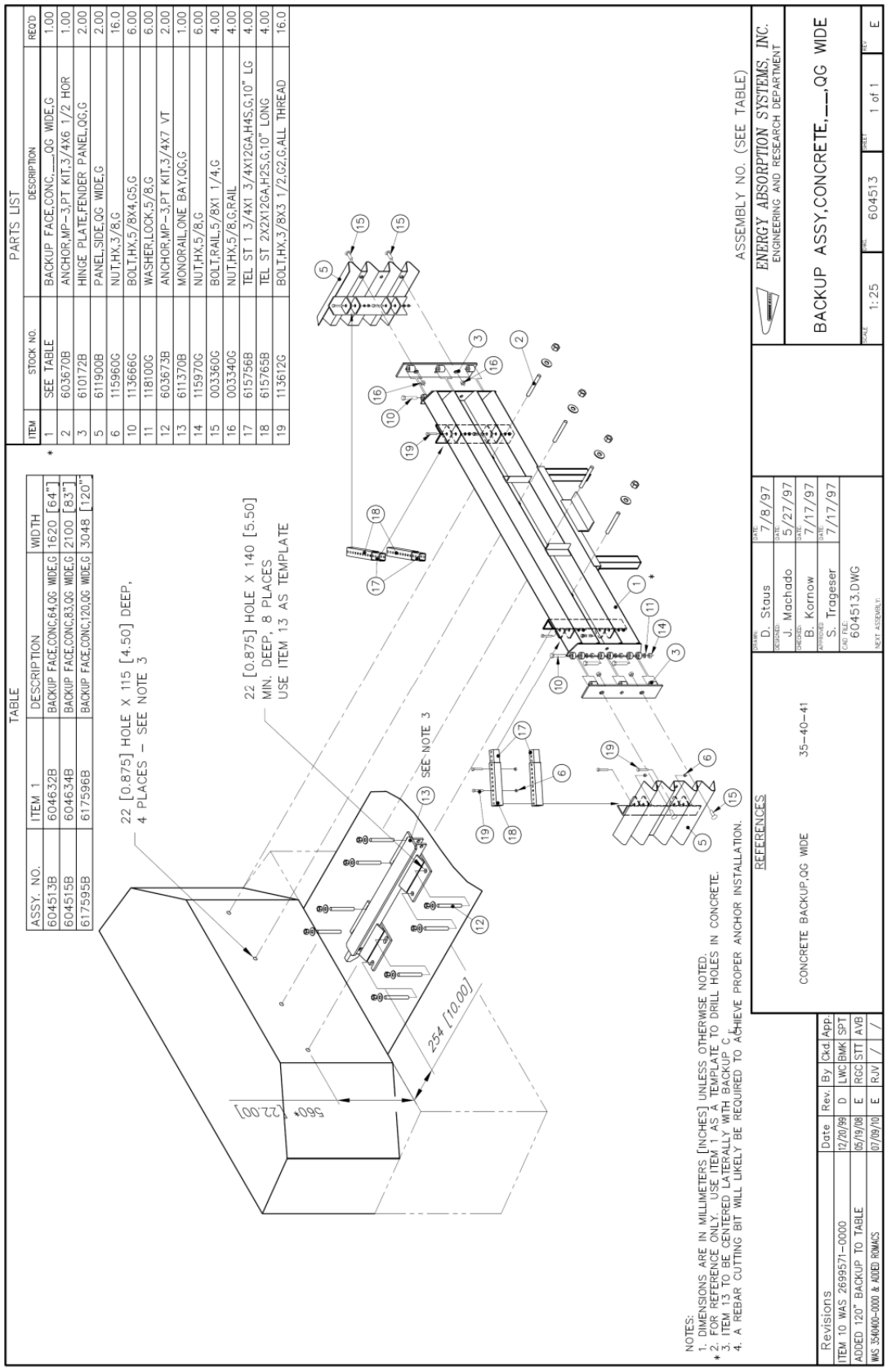
QuadGuard® Concrete Pad & Backup on Grade (69")

DWG 3540411-0000 Sheet 2 of 3



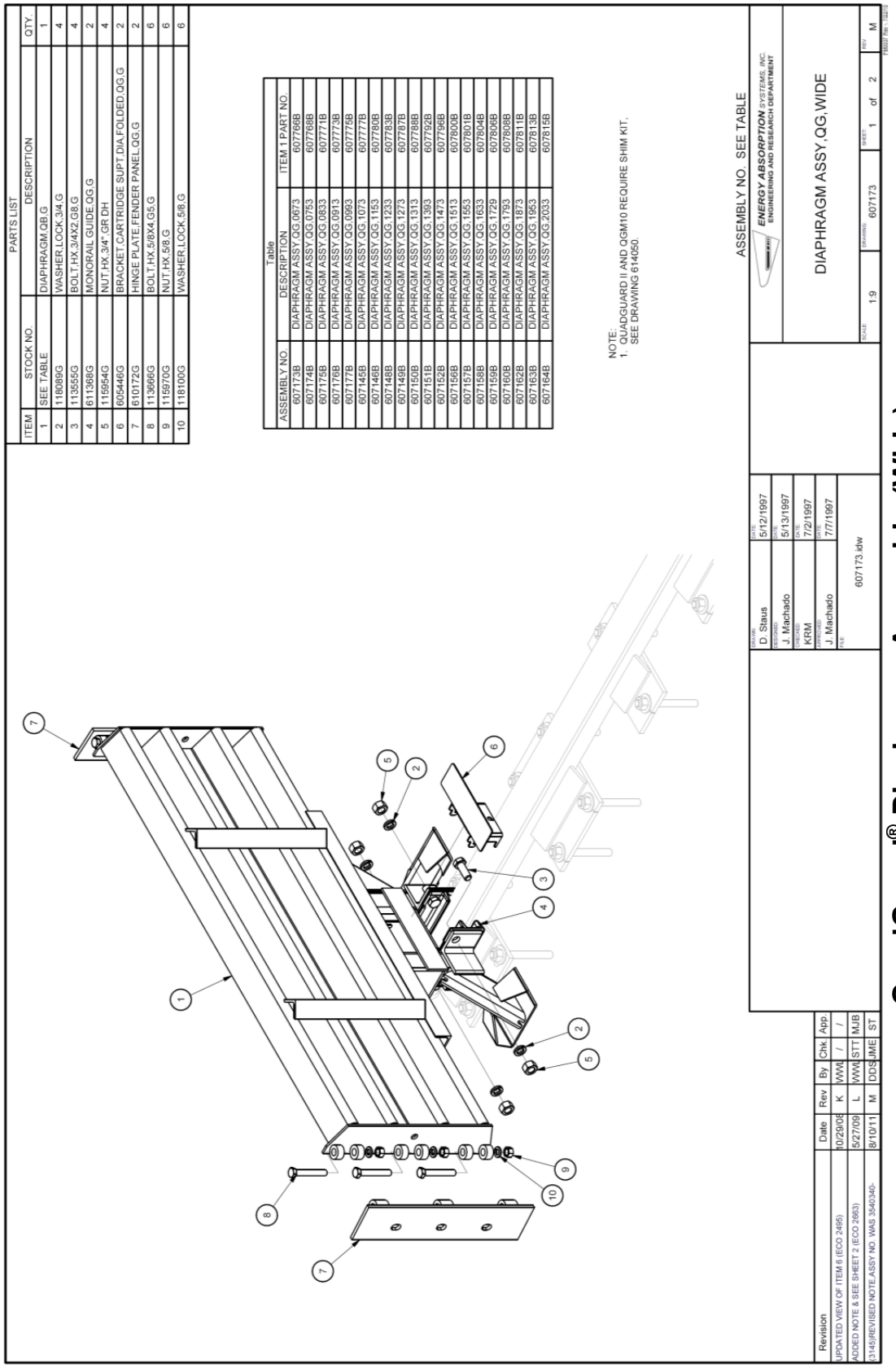
QuadGuard® Concrete Pad & Backup on Grade (90")

DWG 3540411-0000 Sheet 3 of 3



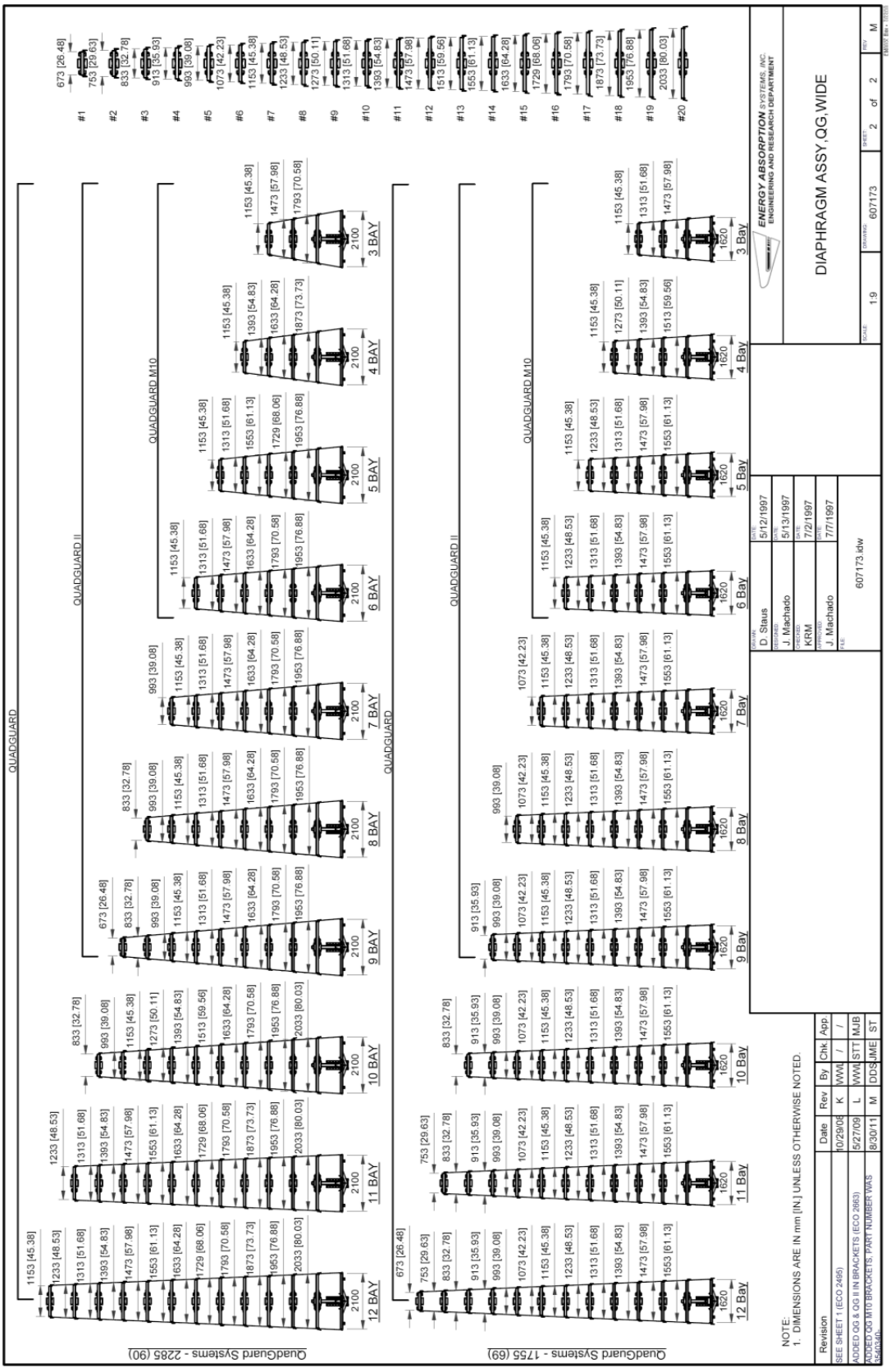
QuadGuard® Backup Assembly, Concrete (Wide)

DWG 604513



QuadGuard® Diaphragm Assembly (Wide)

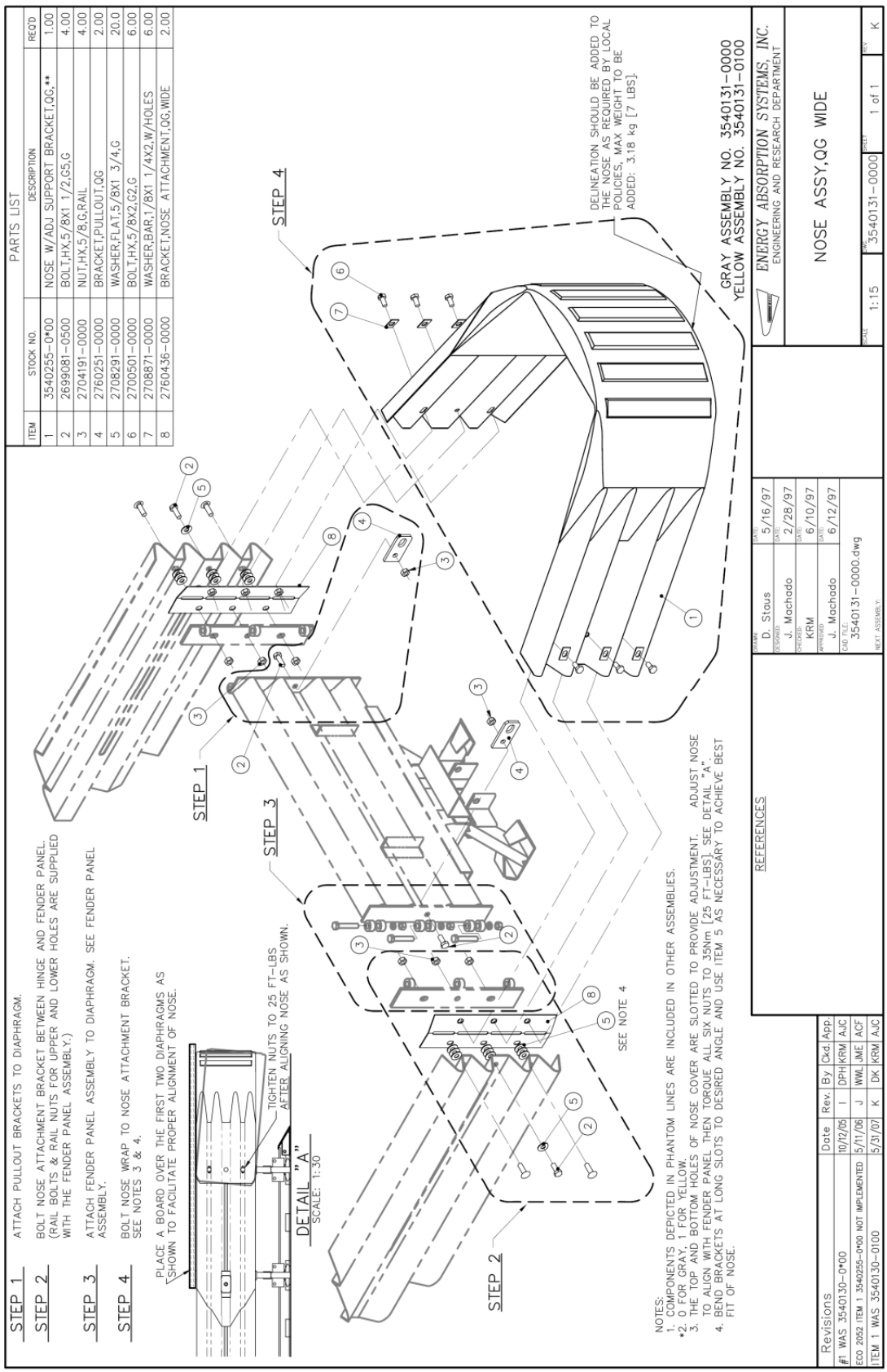
DWG 607173 Sheet 1 of 2



DWG 607173 Sheet 2 of 2

QuadGuard® Fender Panel Assembly (Wide)

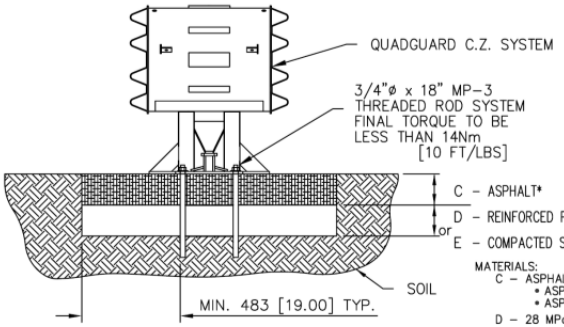
DWG 608241



QuadGuard® Nose Assembly (Wide)

DWG 3540131-0000

NEXT ASSEMBLY: QSCZCVR



SECTION A-A

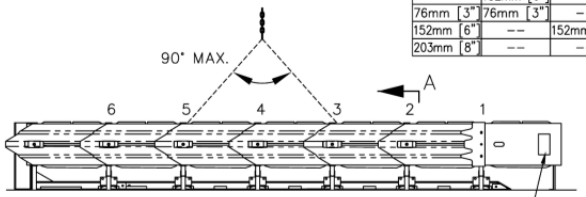
REFER TO QUADGUARD CZ ANCHORING SYSTEM INSTALLATION & SAFETY INSTRUCTIONS FOR FURTHER INFORMATION

MATERIALS:
C - ASPHALTIC CONCRETE
- ASPHALT BINDER AR-4000
- ASPHALT AGGREGATE 3/4"(19mm) MAX., MED A B

D - 28 MPa [4000 PSI] P. C. CONCRETE
E - SUBBASE, PREPARED & COMPACTED
- CLASS 2
- 95% COMPACTION
MINIMUM LAYER

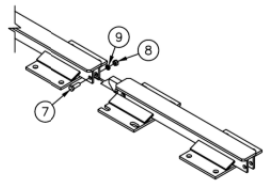
DEPTH COMBINATION

"C"	"D"	"E"	REQ'D STUD LENGTH
--	152mm [6"]	--	180mm [7"]
76mm [3"]	76mm [3"]	--	460mm [18"]
152mm [6"]	--	152mm [6"]	460mm [18"]
203mm [8"]	--	--	460mm [18"]



EXAMPLE:
6 BAY QUADGUARD cz
SCALE - 1:50

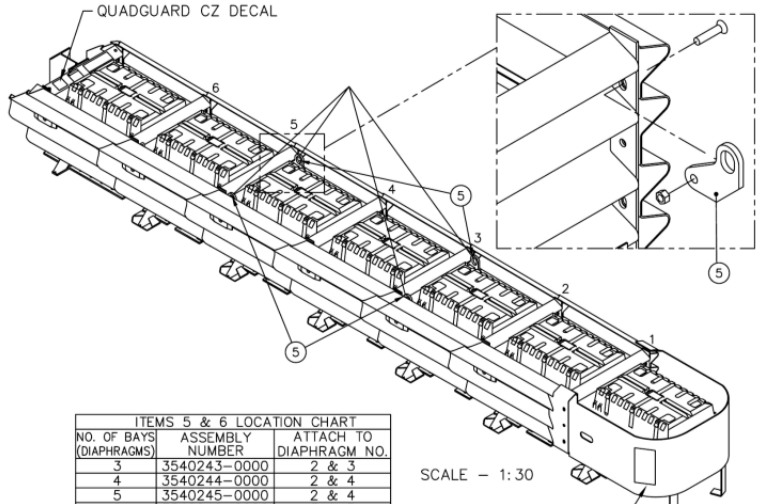
QUADGUARD CZ CAUTION DECAL



MONORAIL ATTACHMENT
SCALE - 1:25

PARTS LIST

ITEM	STOCK NO.	DESCRIPTION	REQ'D						
		BAYS →	3	4	5	6	7	8	9
1	2700731-0500	ROD,THREADED,3/4x18,G5,G	32	38	46	52	58	66	72
2	2704341-0000	NUT,HX,3/4,G,GR DH	32	38	46	52	58	66	72
3	2708081-0000	WASHER,FLAT,3/4X2,HVY,G	32	38	46	52	58	66	72
4	3525100-0000	MP-3,QUART PACKAGE	8	10	12	13	15	17	18
5	2760231-0000	BRACKET,LIFTING,QG,CZ	4	4	4	4	4	4	4
6	DELETED		–	–	–	–	–	–	–
7	2699571-0000	BOLT,HX,5/8X3 1/2,G5,G	1	1	2	2	2	3	3
8	2704141-0000	NUT,HX,5/8,G	1	1	2	2	2	3	3
9	2708231-0000	WASHER,LOCK,5/8,G	1	1	2	2	2	3	3
10	354024Z-0000	INST.,QG CZ ANCHOR/LIFT KIT	1	1	1	1	1	1	1
11	2735492-0000	LABEL,CRATE,QG CZ,LIFT KIT	1	1	1	1	1	1	1



ITEMS 5 & 6 LOCATION CHART

NO. OF BAYS (DIAPHRAGMS)	ASSEMBLY NUMBER	ATTACH TO DIAPHRAGM NO.
3	3540243-0000	2 & 3
4	3540244-0000	2 & 4
5	3540245-0000	2 & 4
6	3540246-0000	3 & 5
7	3540247-0000	3 & 6
8	3540248-0000	3 & 6
9	3540249-0000	4 & 7

ASSY NO. 354024*-0000

TO MOVE SYSTEM:

1. Verify monorail sections are bolted together.
2. Attach two lifting brackets each on diaphragms listed (four brackets total). See example.
3. Minimum sling length 3 meters (9 ft). Use fixed equal length slings.
4. Free unit from anchor bolts & grout prior to lifting the system. To accomplish this, start at the nose of the system and use pry bars to gradually raise the system off of the studs. Place blocks such as 2X4's under the monorail and work down the length of unit until the unit is completely free of the studs.
5. Lift the system to new location and re-anchor.
6. ANCHOR SYSTEM FOR PROPER IMPACT PERFORMANCE. Use MP-3® polyester anchor system, supplied by Energy Absorption Systems, or approved equal. QuadGuard cz Systems installed on asphalt must be inspected to ensure the anchors are still properly set following each impact. Re-anchor as necessary. See drawing 35-40-06.

Revisions	Date	Rev.	By	Ckd.	App.	Q.C.
ITEM 4 WAS 3525210-0000	10/07/97	G	RGC	KRM	SPT	STT
REVISED TO SHOW NOSE BELT	5/17/99	H	DLS	BB	SPT	JMT

DRAWN: D. Staus	DATE: 10/7/96
DESIGNED: B. Burgess	DATE: 10/15/96
CHECKED: K. Mortensen	DATE: 10/14/96
APPROVED: S. Turner	DATE: 10/15/96
Q.C.	DATE:
CAD FILE: 354024.dwg	

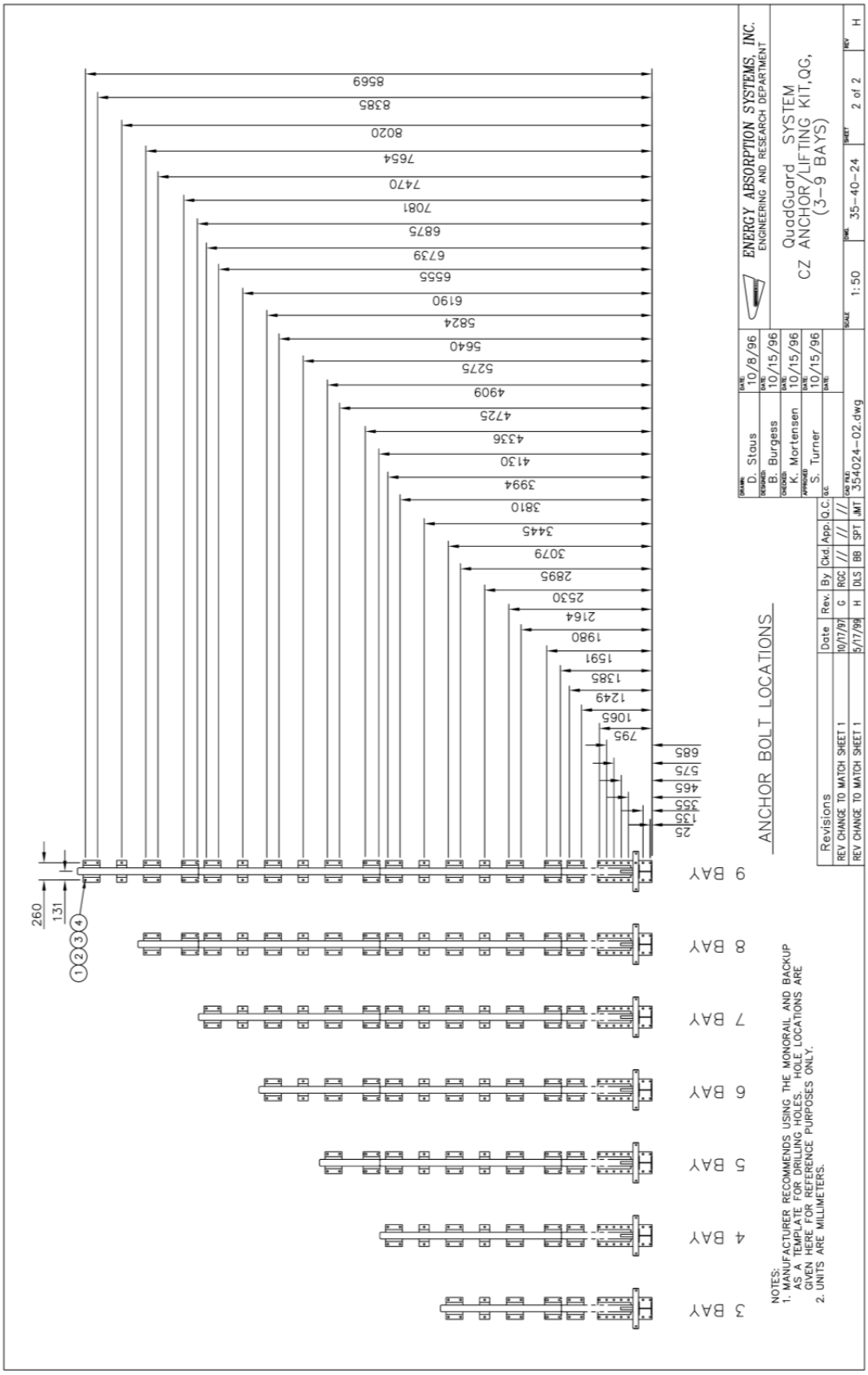
ENERGY ABSORPTION SYSTEMS, INC.
ENGINEERING AND RESEARCH DEPARTMENT

QuadGuard® SYSTEM
CZ ANCHOR/LIFTING KIT,QG,
(3-9 BAYS)

Instruction No. 354024Z-0000

SCALE: AS NOTED | DWG: 35-40-24 | SHEET: 1 of 2 | REV: H

QuadGuard® CZ Anchor/Lifting Kit (3-9 Bays)



DWG 3540243-0000 Sheet 2 of 2

QuadGuard® PCMB Anchor Assembly

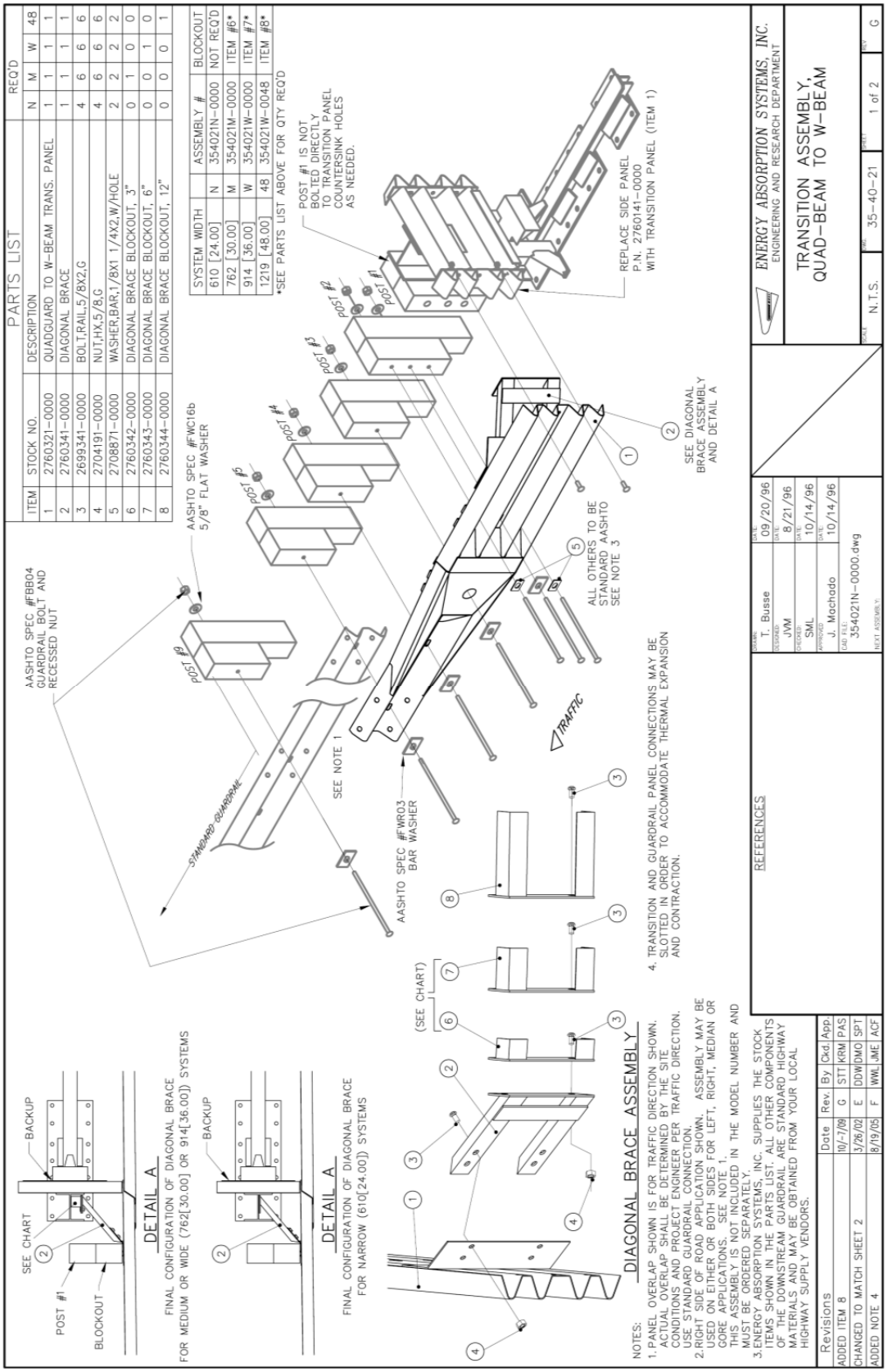
DWG 612006

QuadGuard® End Shoe Assembly

DWG 608105

QuadGuard® 4" Offset Transition Assembly

DWG 354018L-0000



QuadGuard® Quad-Beam to W-Beam Transition Assembly

DWG 354021N-0000

QuadGuard® Quad-Beam to Thrie-Beam Transition Assembly

DWG 354022N0000

Notes:

Notes:

2525 Stemmons Freeway
Dallas, Texas 75207
888-323-6374 (USA only)
214-589-8140 (Outside USA)
www.energyabsorption.com
www.highwayguardrail.com