



QUEST[®] CEN

CRASH CUSHION

ANCHORING GUIDELINES

PN 603698

REVISION A FEBRUARY 2023

QUEST® CEN Anchoring Guidelines

QUEST® CEN Anchoring Guidelines

The purpose of this document is to provide guidance for new installations of the QUEST® CEN system. It is critical that the crash cushion is suitably anchored to the foundation in order to assure maximum impact performance. The following pages outline acceptable installation methods for both concrete and asphalt foundations that meet the anchorage test parameters set out in the Installation Manual.

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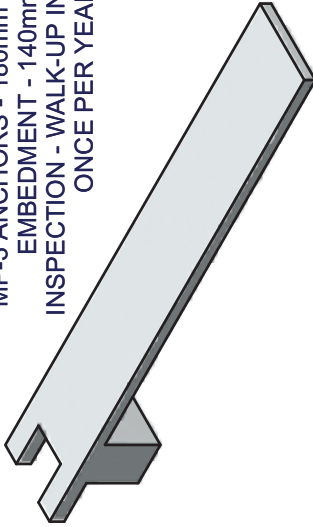
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QUEST® CEN Anchoring Guidelines

QUEST CMB FOUNDATIONS

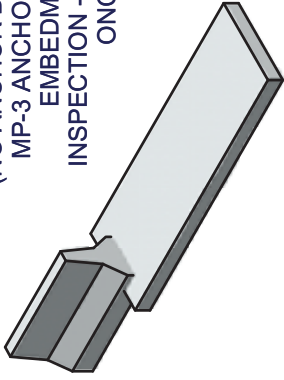
6" REINFORCED CONCRETE PAD

MP-3 ANCHORS - 180mm [7"] STUDS
EMBEDMENT - 140mm [5.5"]
INSPECTION - WALK-UP INSPECTION
ONCE PER YEAR



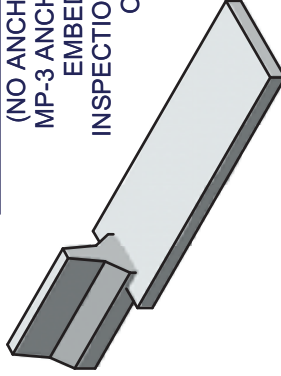
8" NON-REINFORCED CONCRETE PAD

(NO ANCHOR BLOCK, SEE NOTES 1 & 3)
MP-3 ANCHORS - 180mm [7"] STUDS
EMBEDMENT - 140mm [5.5"]
INSPECTION - WALK-UP INSPECTION
ONCE PER YEAR



8" REINFORCED CONCRETE PAD

(NO ANCHOR BLOCK, SEE NOTE 1)
MP-3 ANCHORS - 180mm [7"] STUDS
EMBEDMENT - 140mm [5.5"]
INSPECTION - WALK-UP INSPECTION
ONCE PER YEAR

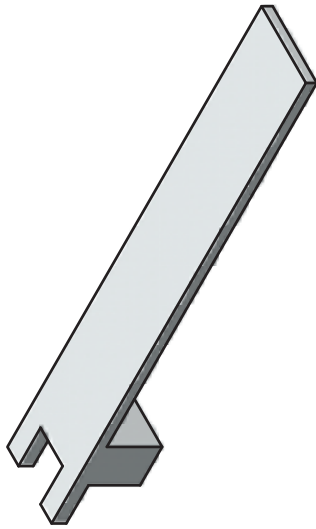


LIMITATIONS AND WARNINGS:

1. CONCRETE PADS WITHOUT REINFORCEMENT MAY CRACK WHEN PLACED IN ENVIRONMENTS WITH DRAMATIC TEMPERATURE CHANGES. TO PREVENT CRACKING, REINFORCE PAD AS NECESSARY.
2. OTHER OPTIONS MAY BE POSSIBLE DEPENDING ON THE SITE. PLEASE CONTACT CUSTOMER SERVICE WITH SPECIAL NEEDS.
3. PROVISIONS SHALL BE MADE FOR REAR RAILS TO SLIDE UPON IMPACT 1.52 M [5' - 0"]

QUEST® CEN Anchoring Guidelines

QUEST GUARDRAIL FOUNDATIONS

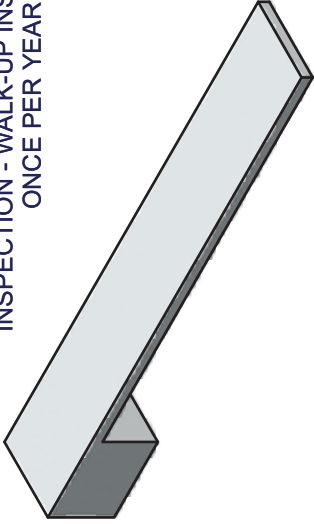


6" REINFORCED CONCRETE PAD

MP-3 ANCHORS - 180mm [7"] STUDS
EMBEDMENT - 140mm [5.5"]
INSPECTION - WALK-UP INSPECTION
ONCE PER YEAR

6" REINFORCED CONCRETE PAD

MP-3 ANCHORS - 180mm [7"] STUDS
EMBEDMENT - 140mm [5.5"]
INSPECTION - WALK-UP INSPECTION
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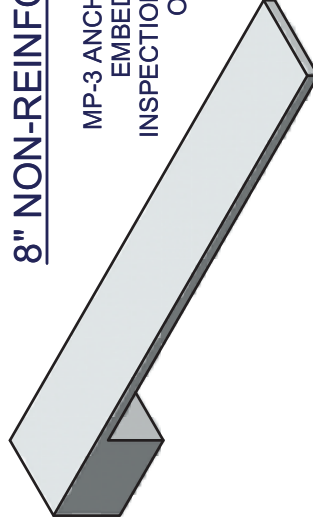


6" REINFORCED CONCRETE PAD

MP-3 ANCHORS - 180mm [7"] STUDS
EMBEDMENT - 140mm [5.5"]
INSPECTION - WALK-UP INSPECTION
ONCE PER YEAR

8" NON-REINFORCED CONCRETE PAD

(SEE NOTE 3)
MP-3 ANCHORS - 180mm [7"] STUDS
EMBEDMENT - 140mm [5.5"]
INSPECTION - WALK-UP INSPECTION
ONCE PER YEAR



LIMITATIONS AND WARNINGS:

1. CONCRETE PADS WITHOUT REINFORCEMENT MAY CRACK WHEN PLACED IN ENVIRONMENTS WITH DRAMATIC TEMPERATURE CHANGES. TO PREVENT CRACKING, REINFORCE PAD AS NECESSARY.
2. OTHER OPTIONS MAY BE POSSIBLE DEPENDING ON THE SITE. PLEASE CONTACT CUSTOMER SERVICE WITH SPECIAL NEEDS.
3. PROVISIONS SHALL BE MADE FOR REAR RAILS TO SLIDE UPON IMPACT 1.52 M [5' - 0"]

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QUEST ROADWAY FOUNDATIONS

(IF THE EXISTING ROADWAY IS ONE OF THE FOUNDATIONS SHOWN, THE SYSTEM MAY BE ANCHORED DIRECTLY TO THE FOUNDATION. NO PAD IS NECESSARY, SEE NOTE 4)



8" NON-REINFORCED CONCRETE ROADWAY

(12FT WIDE X 50FT LONG, MINIMUM)
MP-3 ANCHORS - 180mm [7"] STUDS
EMBEDMENT - 140mm [5.5"]
INSPECTION - WALK-UP INSPECTION
ONCE PER YEAR



6" ASPHALT CONCRETE ROADWAY OVER 6" COMPACTED SUBBASE

(SEE NOTE 2)
MP-3 ANCHORS - 460mm [18"] STUDS
EMBEDMENT - 420mm [16.5"]
INSPECTION - WALK-UP INSPECTION
EVERY SIX MONTHS



3" ASPHALT CONCRETE ROADWAY OVER 3" P.C. CONCRETE ROADWAY

(SEE NOTE 2)
MP-3 ANCHORS - 460mm [18"] STUDS
EMBEDMENT - 420mm [16.5"]
INSPECTION - WALK-UP INSPECTION
EVERY SIX MONTHS



8" ASPHALT CONCRETE ROADWAY

(SEE NOTE 2)
MP-3 ANCHORS - 460mm [18"] STUDS
EMBEDMENT - 420mm [16.5"]
INSPECTION - WALK-UP INSPECTION
EVERY SIX MONTHS

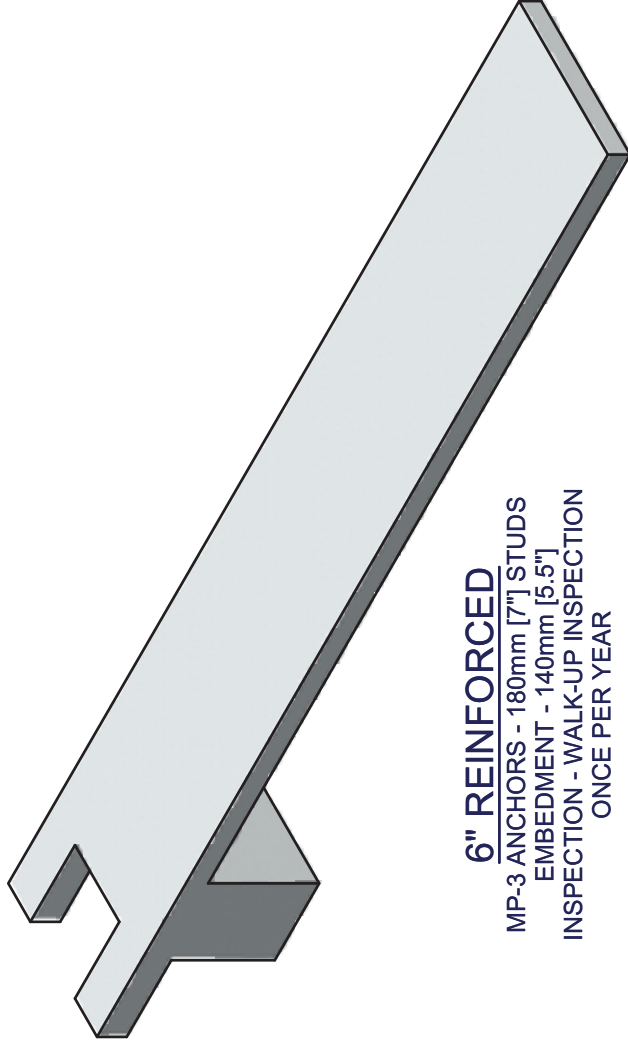
LIMITATIONS AND WARNINGS:

1. SYSTEMS INSTALLED ON ASPHALT SHOULD BE INSPECTED EVERY 6 MONTHS AND FOLLOWING EACH IMPACT TO ENSURE THE ANCHORS ARE STILL PROPERLY SET. RE-ANCHOR AS NECESSARY
2. OTHER OPTIONS MAY BE POSSIBLE DEPENDING ON THE SITE. PLEASE CONTACT CUSTOMER SERVICE WITH SPECIAL NEEDS.
3. PROVISIONS SHALL BE MADE FOR REAR RAILS TO SLIDE UPON IMPACT 1.52 M [5' - 0"]

QUEST® CEN Anchoring Guidelines

QUEST SELF-SUPPORTING FOUNDATION

(SEE NOTE 4)



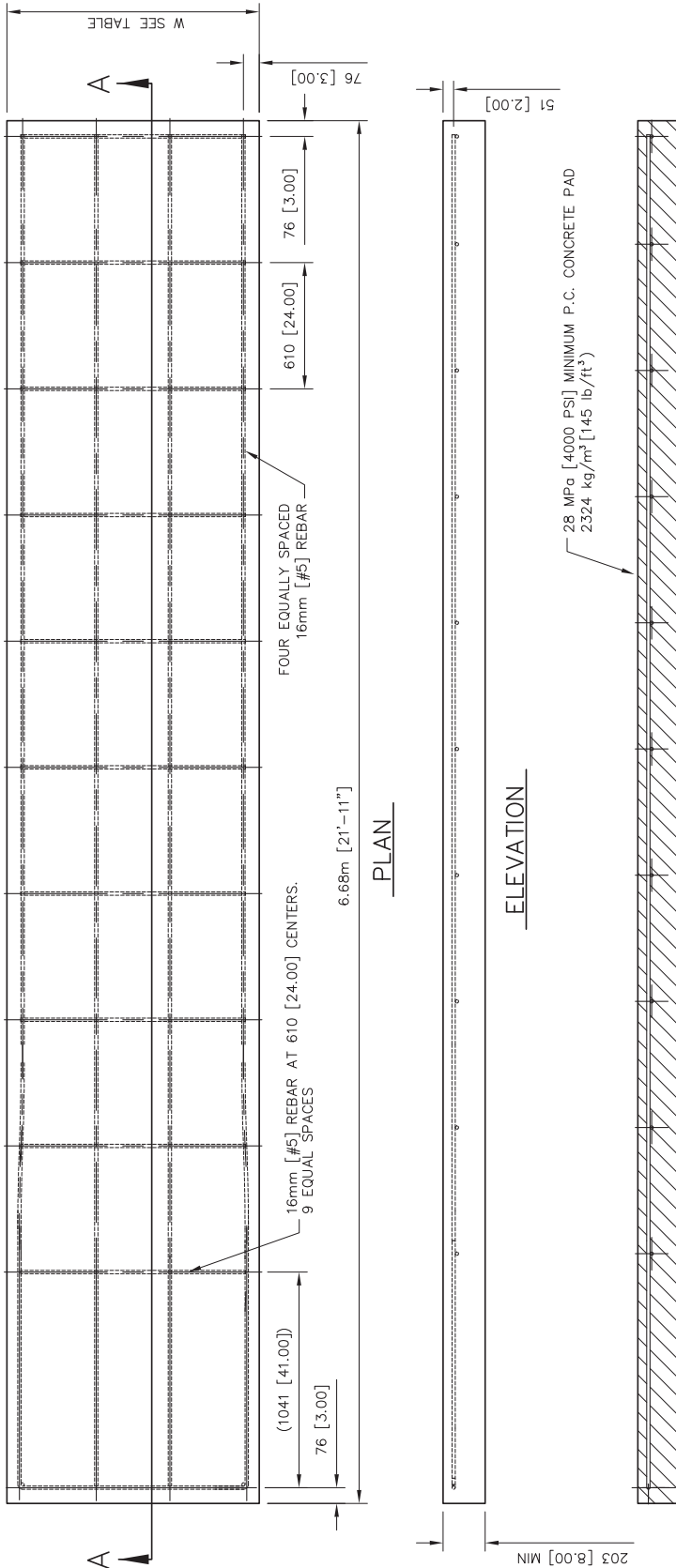
6" REINFORCED

MP-3 ANCHORS - 180mm [7"] STUDS
EMBEDMENT - 140mm [5.5"]
INSPECTION - WALK-UP INSPECTION
ONCE PER YEAR

LIMITATIONS AND WARNINGS:

1. OTHER OPTIONS MAY BE POSSIBLE DEPENDING ON THE SITE. PLEASE CONTACT CUSTOMER SERVICE WITH SPECIAL NEEDS.
2. PROVISIONS SHALL BE MADE FOR REAR RAILS TO SLIDE UPON IMPACT 1.52 M [5' -0"]

QUEST® CEN Anchoring Guidelines



TABLE

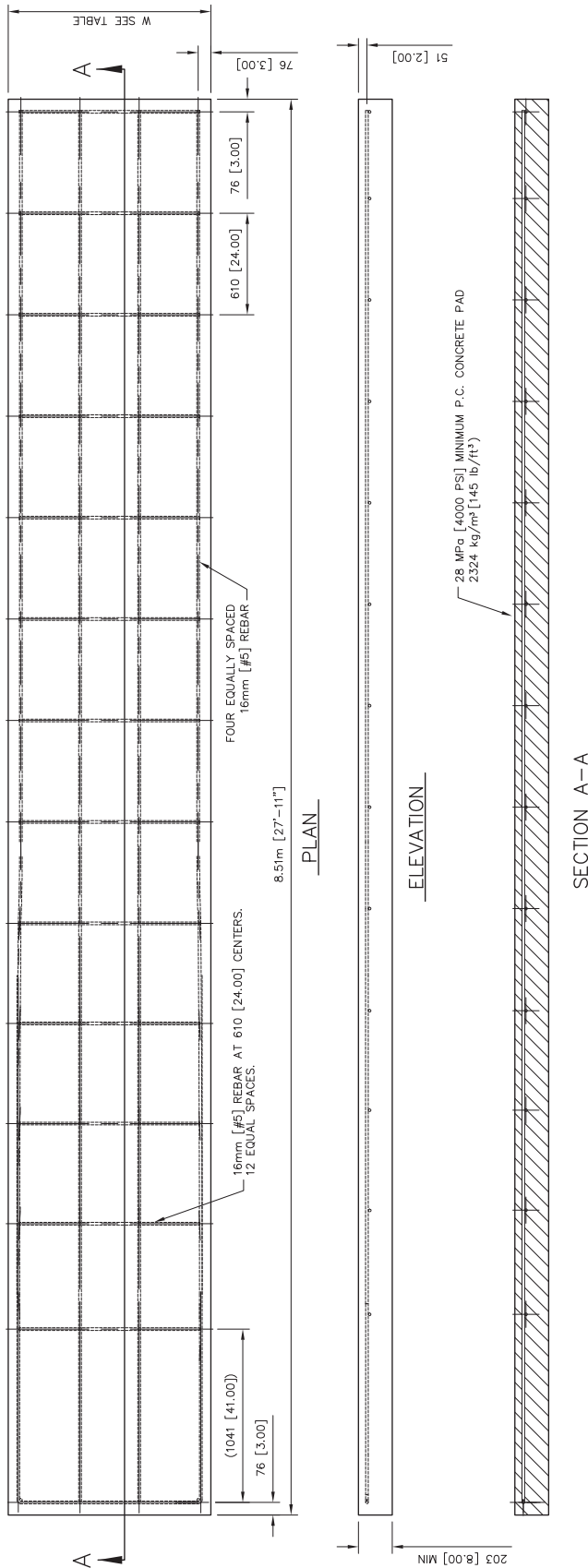
SYSTEM WIDTH	DESIGN SPEED	W	PC CONCRETE 28MPa [4000 PSI]	REBAR REQ.
610 [24.00]	70 kph & 80 kph	1220 [48]	1.62 m³	37.29m
762 [30.00]	70 kph & 80 kph	1372 [54]	1.83 m³	36.81m
914 [36.00]	70 kph & 80 kph	1524 [60]	2.03 m³	40.33m
1100 [42.00]	70 kph & 80 kph	1702 [67]	2.27 m³	42.11m

NOTES:

1. CROSS SLOPE OF PAD SHALL NOT EXCEED 8% AND NOT VARY MORE THAN 2% FROM FRONT TO BACK.
2. UNITS OF MEASUREMENT ARE MILLIMETERS [INCHES] UNLESS OTHERWISE NOTED.

QUEST 70/80 SYSTEMS, 8" CONCRETE PAD (SEE DWG. 3562121-1000)

QUEST® CEN Anchoring Guidelines



TABLE

SYSTEM WIDTH	DESIGN SPEED	W	PC CONCRETE 28MPa [4000 PSI]	REBAR REQ.
610 [24.00]	100 kph & 110 kph	1220 [48]	2.07 m³	47.81m
762 [30.00]	100 kph & 110 kph	1372 [54]	2.33 m³	49.38m
914 [36.00]	100 kph & 110 kph	1524 [60]	2.59 m³	51.75m
1100 [42.00]	100 kph & 110 kph	1702 [67]	2.89 m³	54.07m

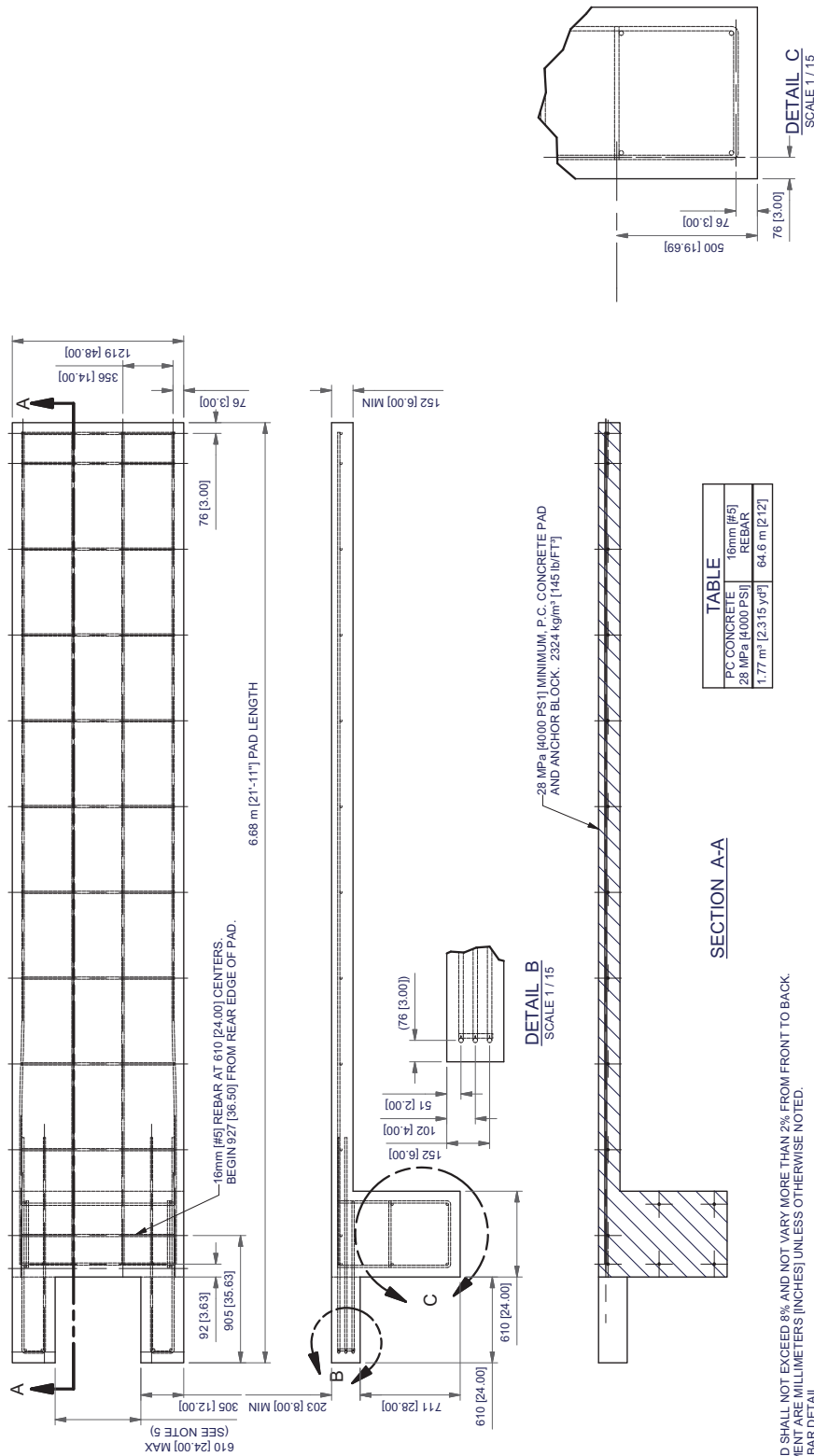
- NOTES:
- CROSS SLOPE OF PAD SHALL NOT EXCEED 8% AND NOT VARY MORE THAN 2% FROM FRONT TO BACK.
 - UNITS OF MEASUREMENT ARE MILLIMETERS [INCHES] UNLESS OTHERWISE NOTED.

QUEST 100/110 SYSTEMS, 8" CONCRETE PAD (SEE DWG. 3562121-2000)

QUEST[®] CEN Anchoring Guidelines

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QUEST® CEN Anchoring Guidelines

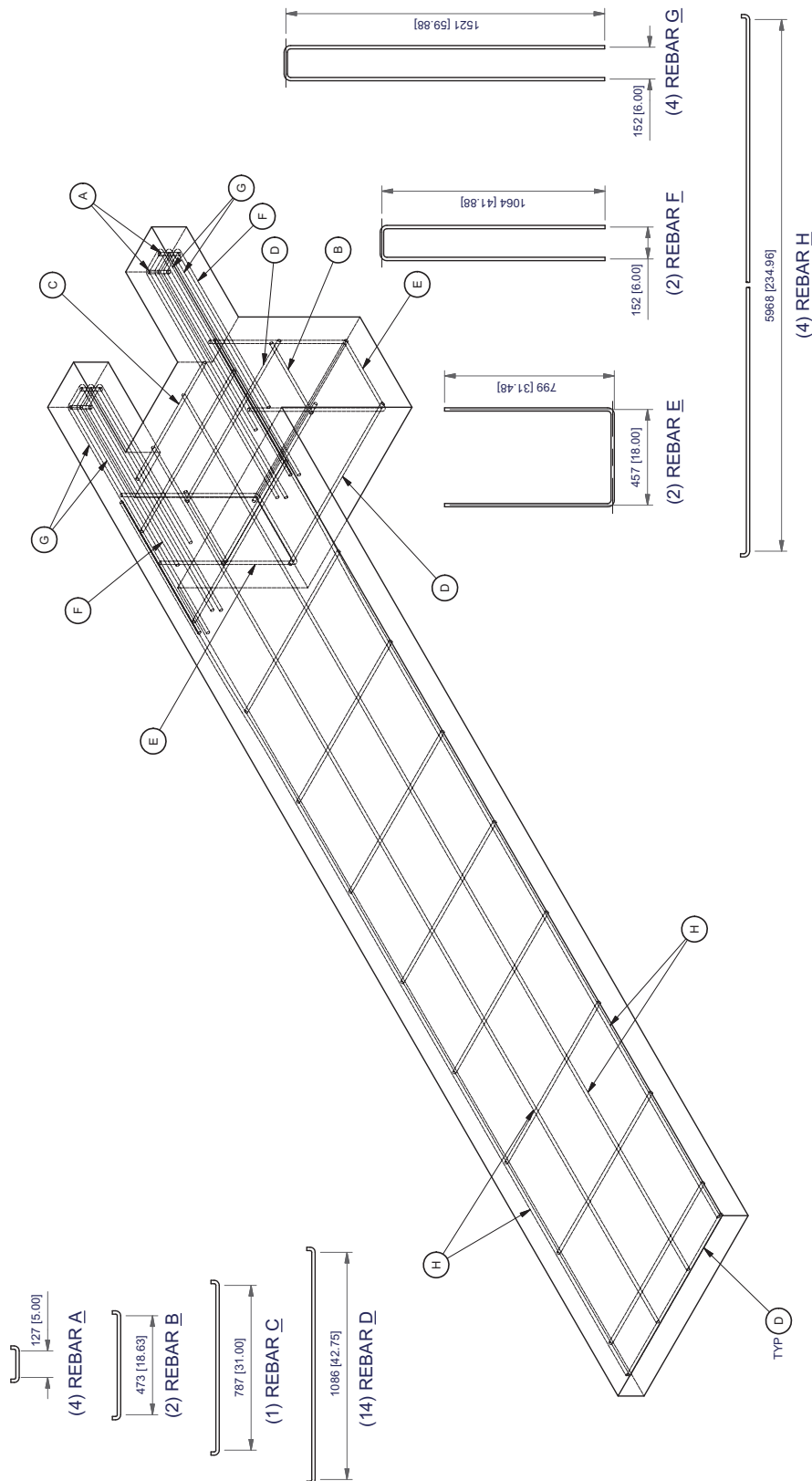


- NOTES:
1. CROSS SLOPE OF PAD SHALL NOT EXCEED 8% AND NOT VARY MORE THAN 2% FROM FRONT TO BACK.
 2. ALL DIMENSIONS ARE IN MILLIMETERS [INCHES] UNLESS OTHERWISE NOTED.
 3. SEE SHEET 2 FOR REBAR.
 4. THE CONCRETE PAD SHOWN IS DESIGNED TO NEST AROUND HAZARDS 610 [24.00] IN WIDTH OR LESS. MAKE PREPARATIONS TO POUR THE REAR PORTION OF THE PAD AROUND THE HAZARD.

- NOTES:
1. CROSS SLOPE OF PAD SHALL NOT EXCEED 8% AND NOT VARY MORE THAN 2% FROM FRONT TO BACK.
 2. UNITS OF MEASUREMENT ARE MILLIMETERS [INCHES] UNLESS OTHERWISE NOTED.
 3. SEE SHEET 2 FOR REBAR DETAIL.
 4. THE CONCRETE PAD SHOWN IS DESIGNED TO NEST AROUND HAZARDS 610 [24.00] IN WIDTH OR LESS. MAKE PREPARATIONS TO POUR THE REAR PORTION OF THE PAD AROUND THE HAZARD.

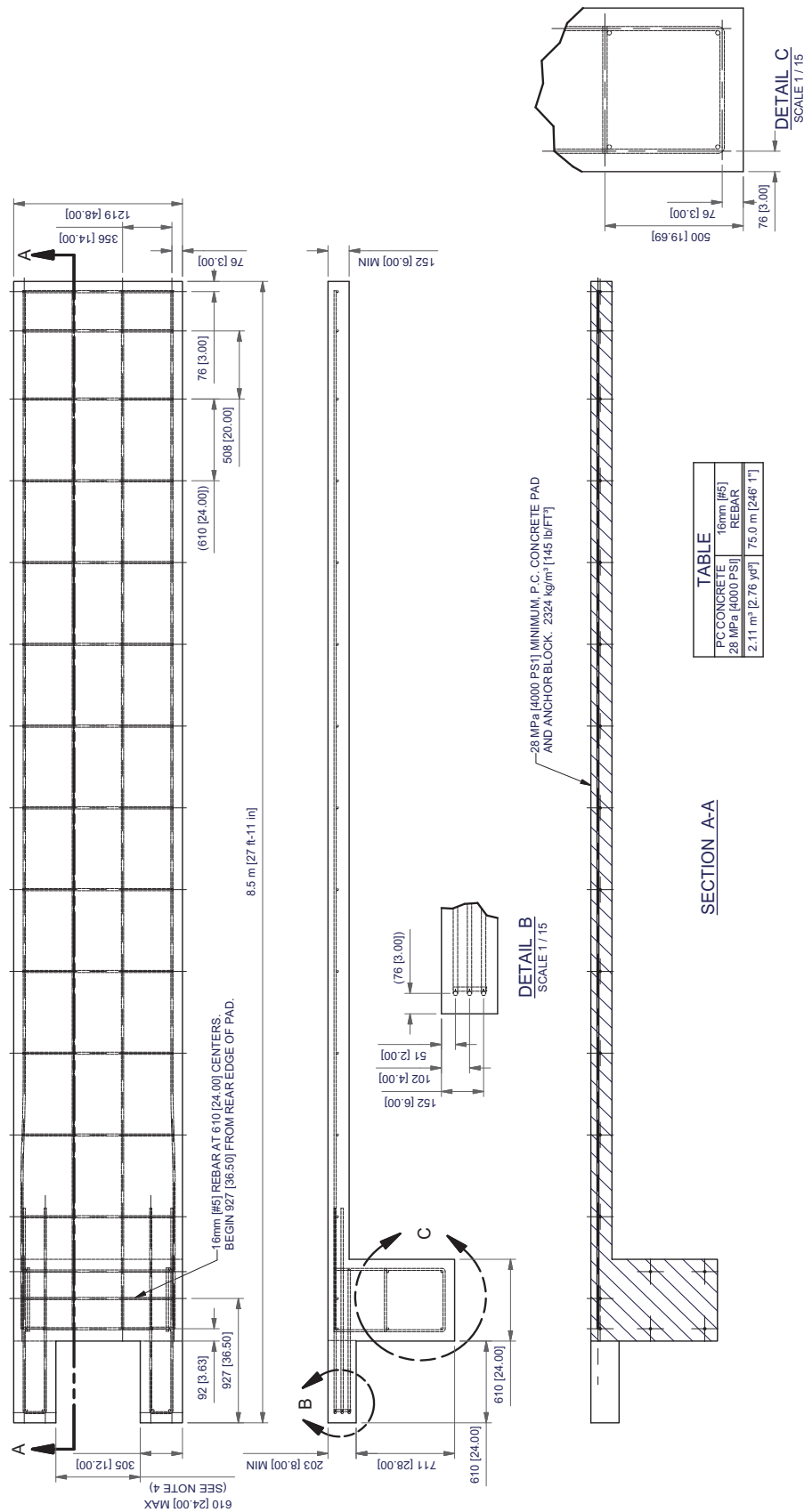
QUEST TL-2 (24") & QUEST CEN 80 CONCRETE PAD (SEE DWG. 3562018-0000, SH. 1)

QUEST® CEN Anchoring Guidelines



QUEST TL-2 (24") & QUEST CEN 80 CONCRETE PAD (SEE DWG. 3562018-0000, SH. 2)

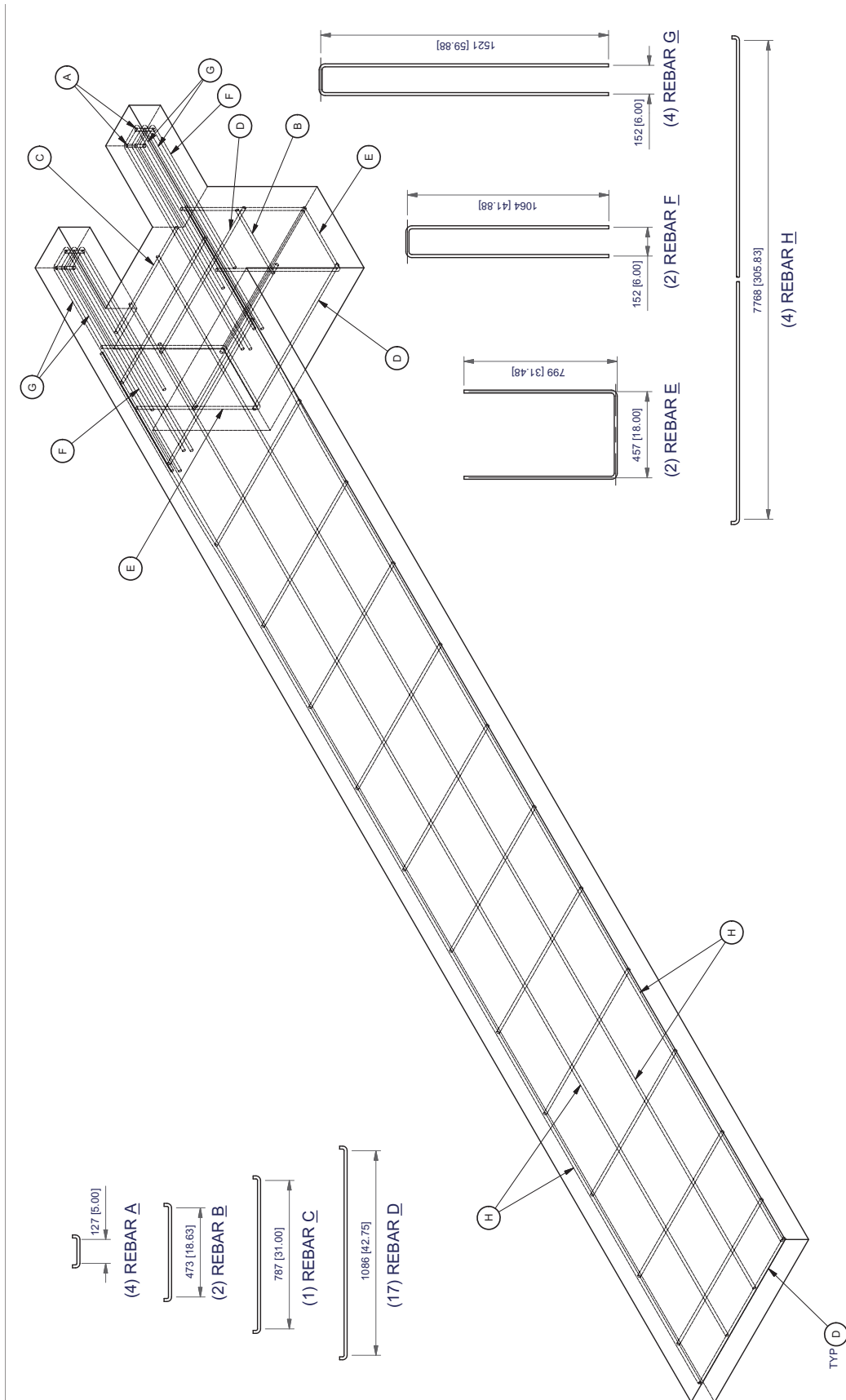
QUEST® CEN Anchoring Guidelines



- NOTES:
1. CROSS SLOPE OF PAD SHALL NOT EXCEED 8% AND NOT VARY MORE THAN 2% FROM FRONT TO BACK.
 2. UNITS OF MEASUREMENT ARE MILLIMETERS [INCHES] UNLESS OTHERWISE NOTED.
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 4. THE CONCRETE PAD SHOWN IS DESIGNED TO NEST AROUND HAZARDS 610 [24.00] IN WIDTH OR LESS. MAKE PREPARATIONS TO POUR THE REAR PORTION OF THE PAD AROUND THE HAZARD.

QUEST TL-3 (24") & QUEST CEN 100/110 CONCRETE PAD (SEE DWG. 3562015-0000, SH. 1)

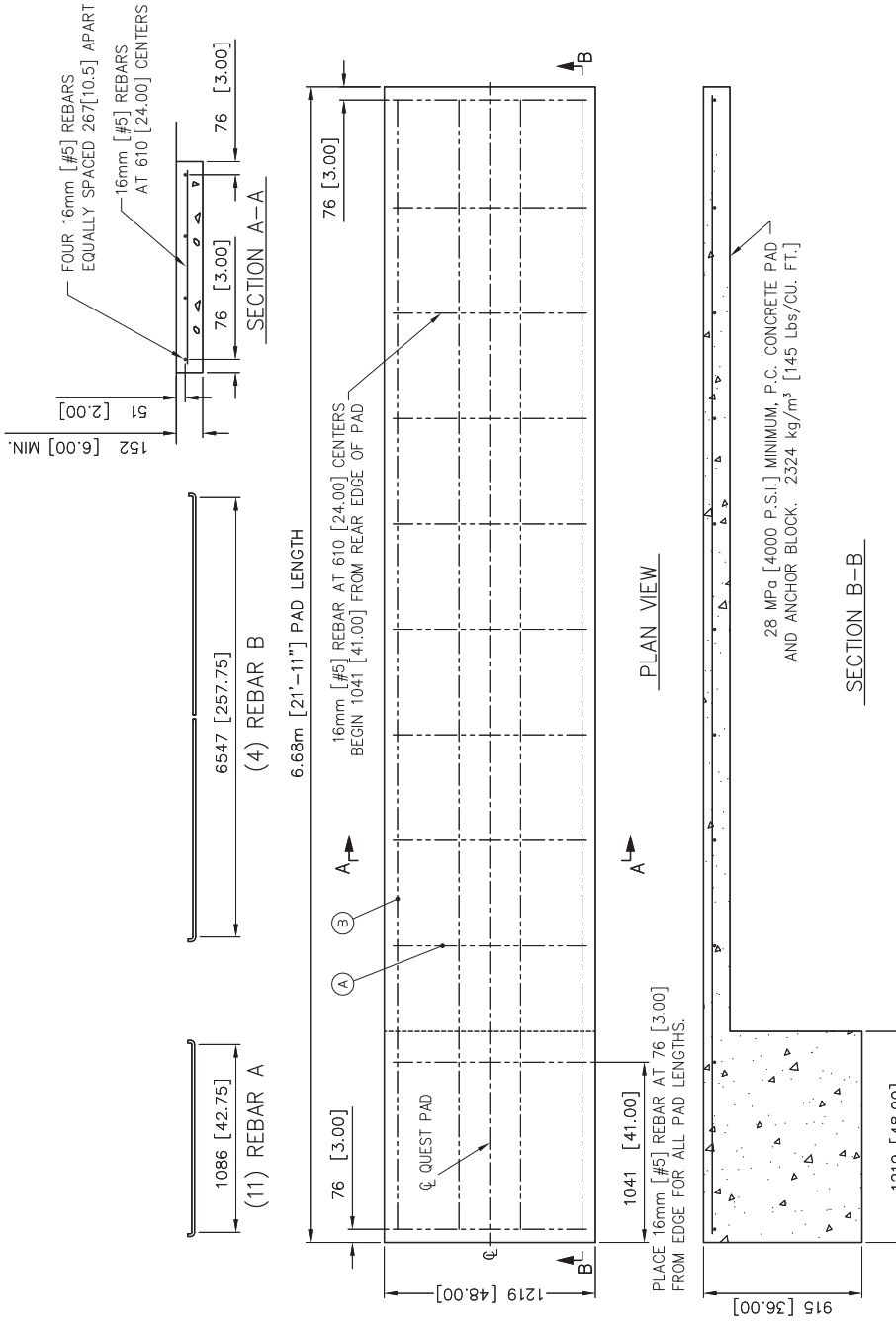
QUEST® CEN Anchoring Guidelines



QUEST TL-3 (24") & QUEST CEN 100/110 CONCRETE PAD (SEE DWG. 3562015-0000, SH. 2)

QUEST® CEN Anchoring Guidelines

REBAR REQUIRED		CONCRETE IN PAD	
[m]	[ft-in]	[m ³]	[yards ³]
45.6	[149'-6"]	2.30	[3.0]



NOTES:
 1. CROSS SLOPE OF PAD SHALL NOT EXCEED 8% AND NOT VARY MORE THAN 2% FROM FRONT TO BACK.
 2. UNITS OF MEASUREMENT ARE MILLIMETERS [INCHES] UNLESS OTHERWISE NOTED.

QUEST TL-2 (24") & QUEST CEN 80 ALTERNATE CONCRETE PAD (SEE DWG. 3562045-0000)

QUEST® CEN Anchoring Guidelines

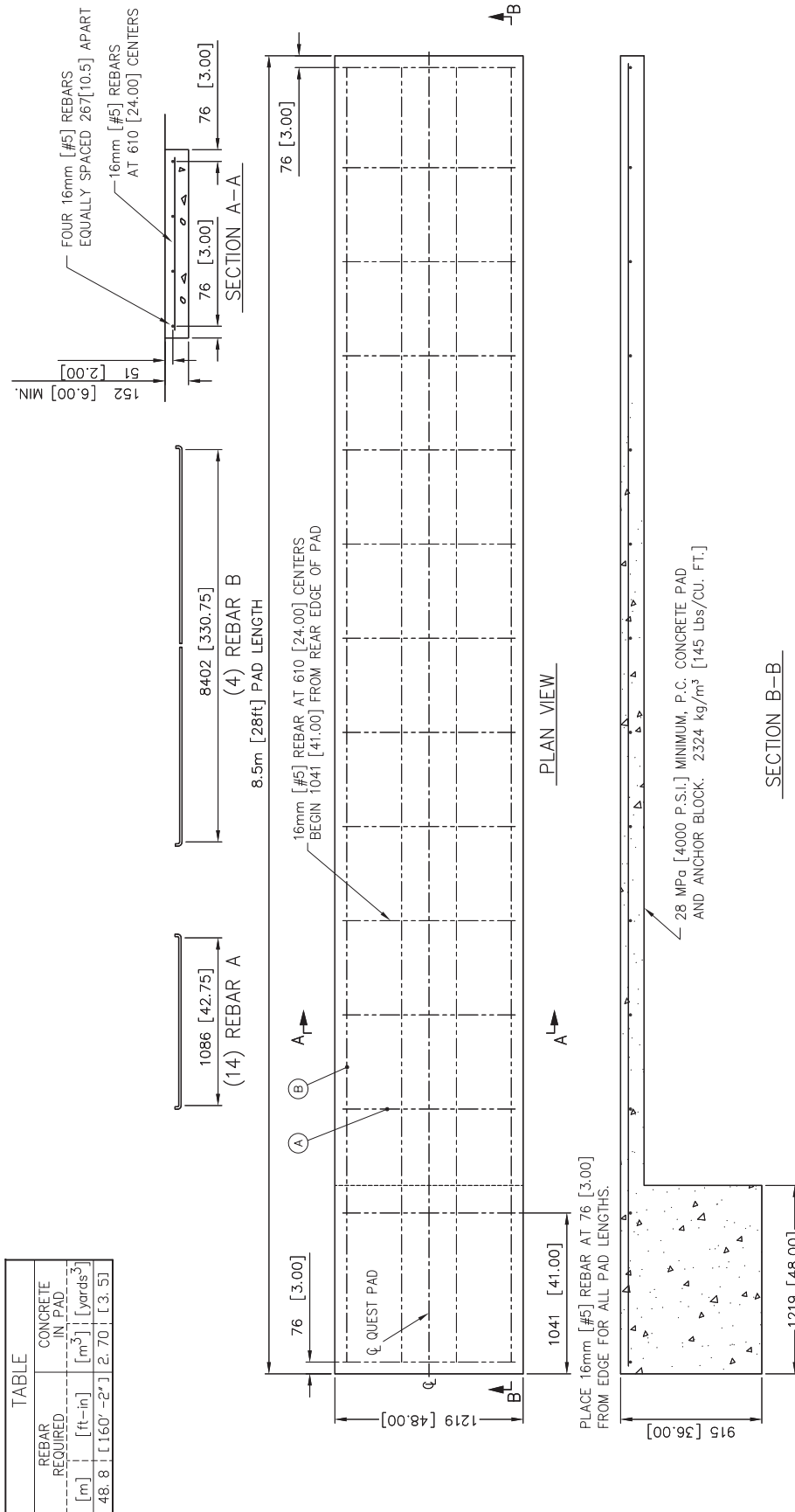


TABLE		CONCRETE REQUIRED IN PAD	
REBAR REQUIRED		[m ³]	[yards ³]
48.8	[1.160' - 2']	2.70	[3.5]

- NOTES:
- CROSS SLOPE OF PAD SHALL NOT EXCEED 8% AND NOT VARY MORE THAN 2% FROM FRONT TO BACK.
 - UNITS OF MEASUREMENT ARE MILLIMETERS [INCHES] UNLESS OTHERWISE NOTED.

QUEST TL-3 (24") & QUEST CEN 100/110 ALTERNATE CONCRETE PAD (SEE DWG. 3562046-0000)

QUEST® CEN Anchoring Guidelines

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Alternative Reinforced Concrete Option Using Wire Mesh

To avoid the possibility of encountering rebar while drilling anchor holes into the foundation, wire mesh is an acceptable alternative concrete reinforcement method. The wire mesh is significantly easier to drill through as compared to rebar.

Based on our research, the following non-exclusive list of wire mesh options are deemed as acceptable for this application:

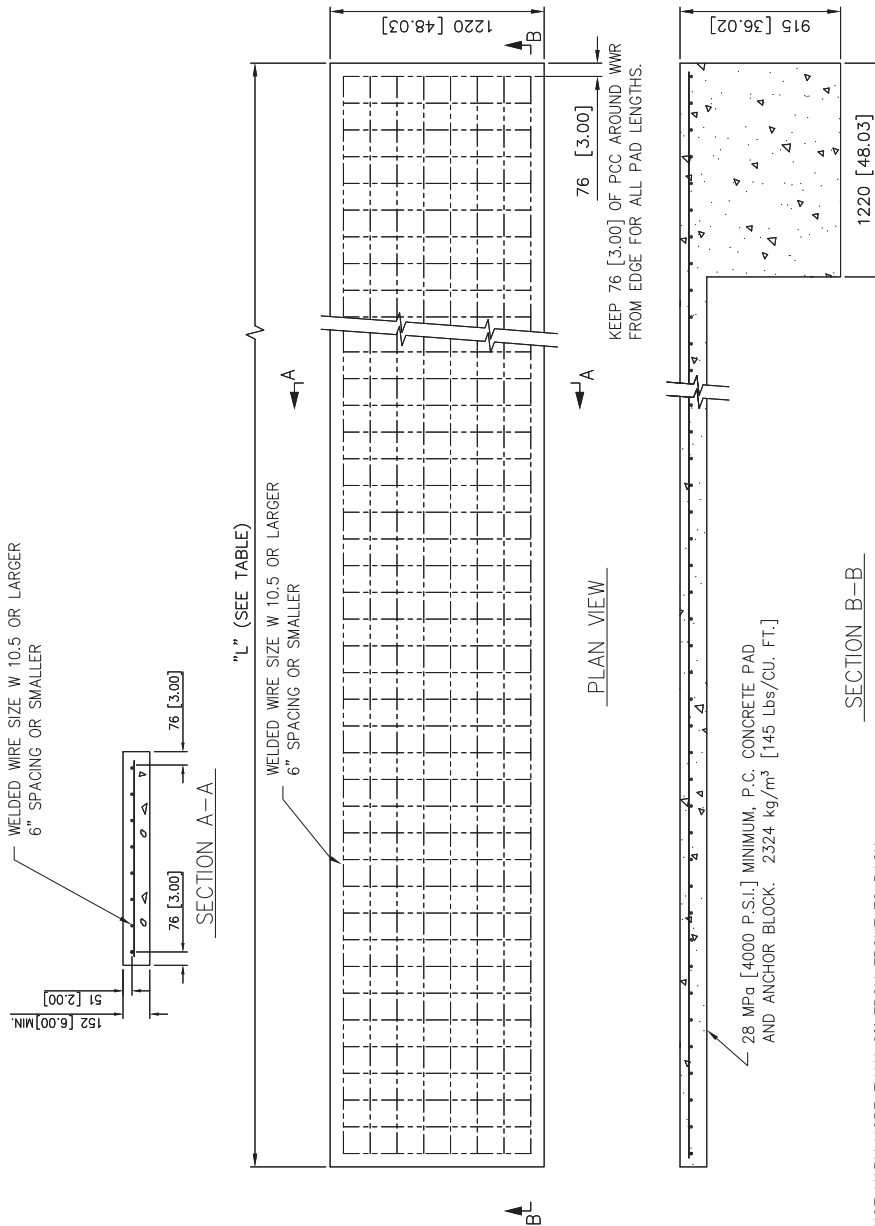
BS503

BS505



QUEST® CEN Anchoring Guidelines

DESIGN SPEED [km/hr]	TABLE		YARDS OF CONCRETE IN PAD m ³ [YARDS ³]
	"L" (PAD LENGTH) [m]	"L" (PAD LENGTH) [ft-in]	
80	6.68 [21'-11"]	2.30 [3.01]	
100/110	8.51 [27'-11"]	2.70 [3.51]	



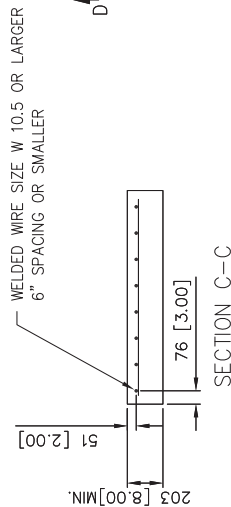
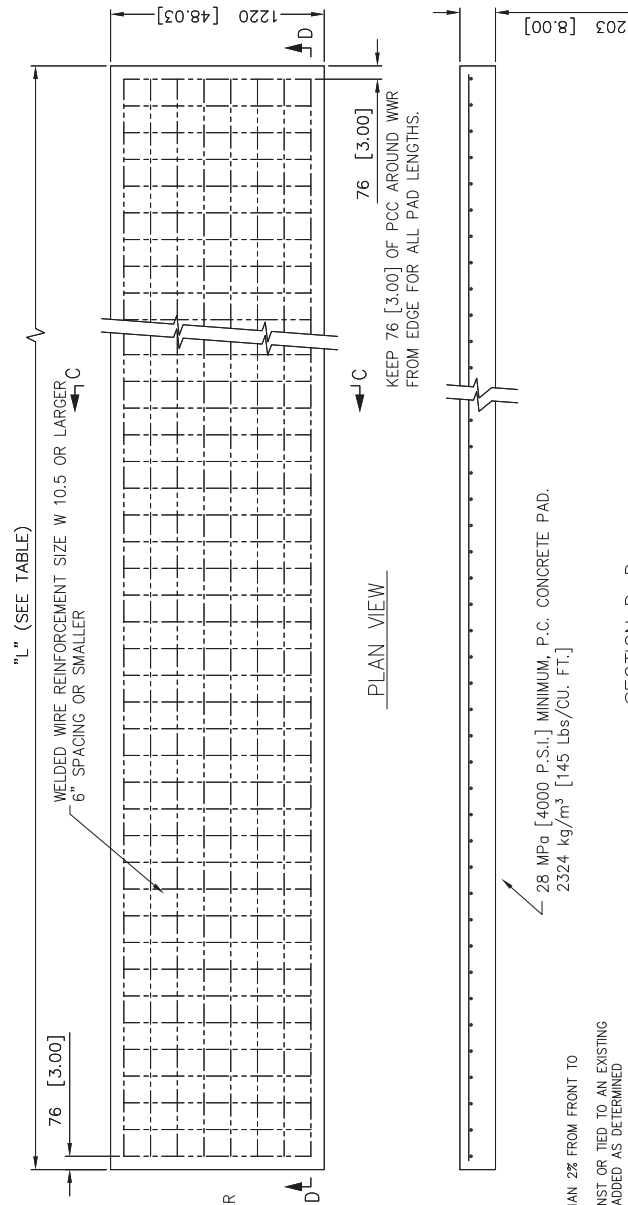
NOTES:

1. CROSS SLOPE OF PAD SHALL NOT EXCEED 8% AND NOT VARY MORE THAN 2% FROM FRONT TO BACK.
2. UNITS OF MEASUREMENT ARE MILLIMETERS [INCHES] UNLESS OTHERWISE NOTED.

QUEST CEN 80/100/110 CONCRETE PAD w/WWR (SEE DWG. 3562049-0000, SH. 1)

QUEST® CEN Anchoring Guidelines

TABLE		YARDS OF CONCRETE IN PAD
DESIGN SPEED [km/hr]	"L" (PAD LENGTH) [m] [ft-in]	m ³ [YARDS ³]
80	6.68 [21'-11"] 1.62 [2.1]	
100/110	8.51 [27'-11"] 2.07 [2.7]	

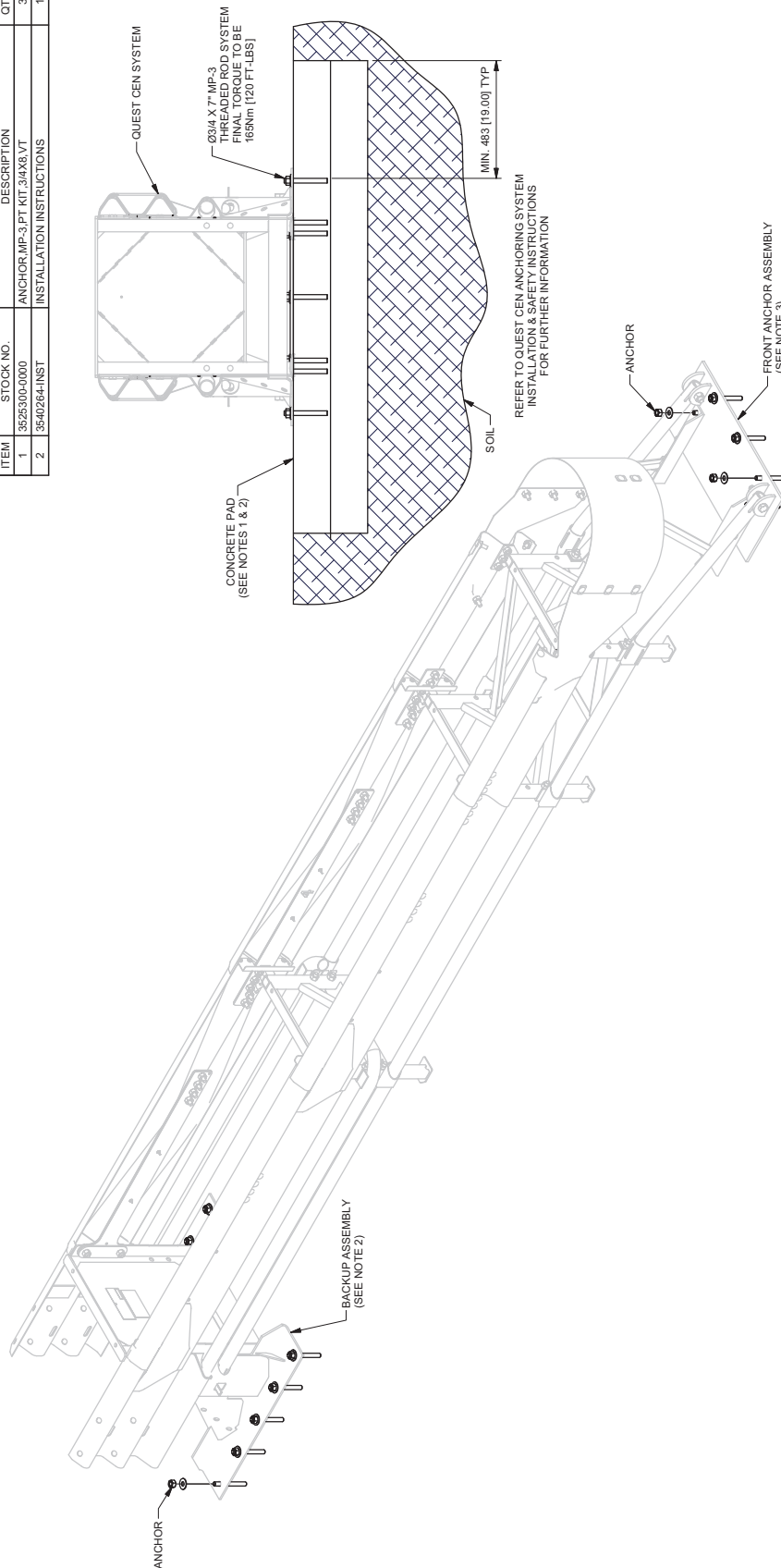


- NOTES:
- CROSS SLOPE OF PAD SHALL NOT EXCEED 8%, AND NOT VARY MORE THAN 2% FROM FRONT TO BACK.
 - TO PREVENT SLIDING DURING AN IMPACT, PAD MUST BE INSTALLED AGAINST OR TIED TO AN EXISTING STRUCTURE. OTHERWISE, ADDITIONAL BELOW GRADE SUPPORTS MUST BE ADDED AS DETERMINED NECESSARY BY THE PROJECT ENGINEER.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

QUEST CEN 80/100/110 OPTIONAL 8" CONCRETE PAD w/WWR (SEE DWG. 3562049-0000, SH. 1)

QUEST® CEN Anchoring Guidelines

PARTS LIST			
ITEM	STOCK NO.	DESCRIPTION	QTY.
1	3526300-0000	ANCHOR, MP-3, PT. KIT, 3/4X8, VT	3
2	3540264-INST	INSTALLATION INSTRUCTIONS	1



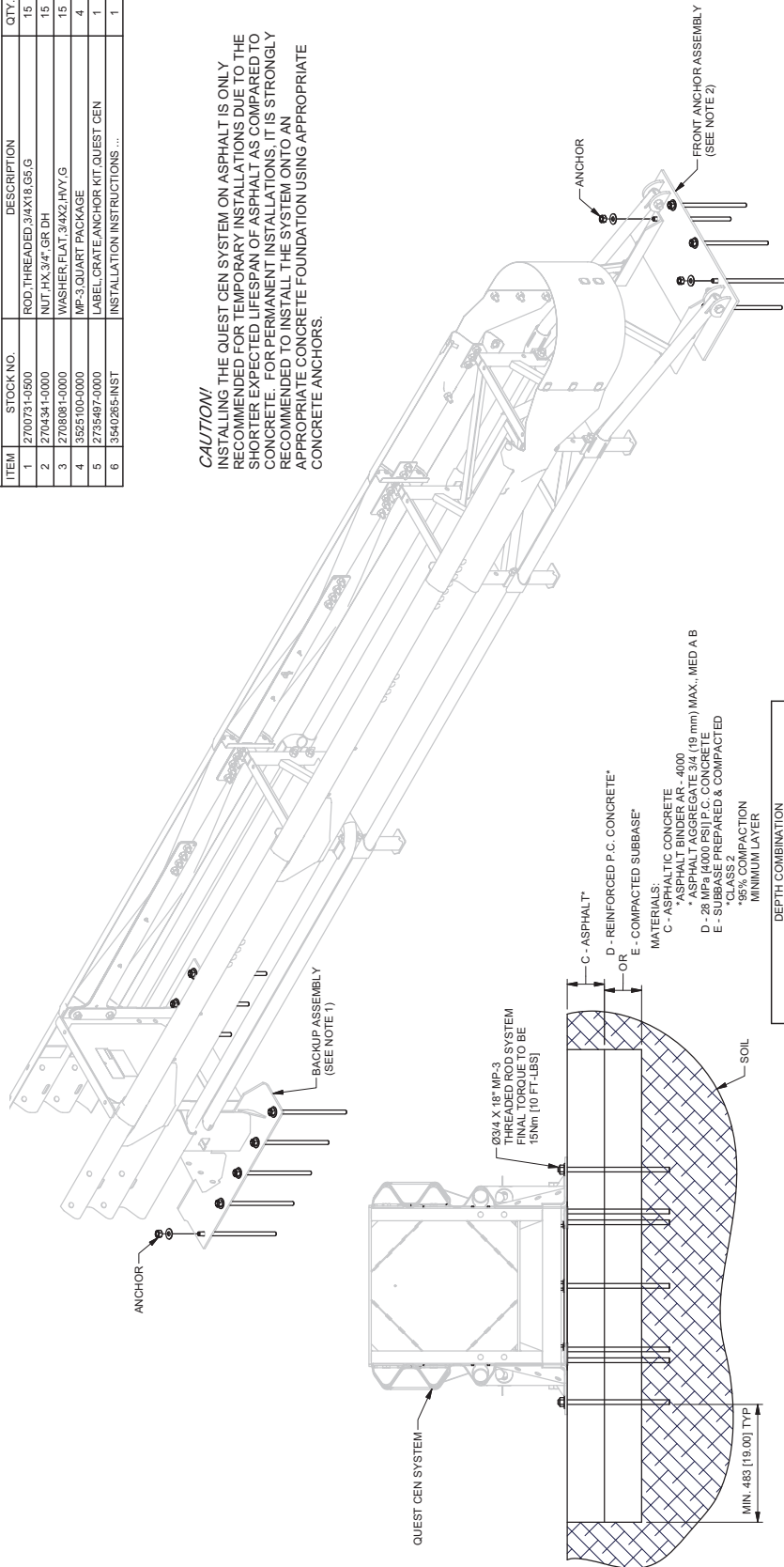
- NOTES:
- 150mm (6.00in) MIN. REINFORCED 28MPa [4000PSI] P.C. CONCRETE PAD, OR 170mm (7.00in) MIN. REINFORCED 28MPa [4000PSI] CONCRETE DECK STRUCTURE, OR 203mm (8.00in) MIN. NON-REINFORCED 28MPa [4000PSI] P.C. CONCRETE ROADWAY MEASURING AT LEAST 3.66m [12ft-0in] WIDE BY 15.24m [50ft-0in] LONG. IF REBAR IS ENCOUNTERED ON A DECK STRUCTURE, CONSULT THE PROJECT ENGINEER FOR DIRECTION.
 - THE BACKUP ASSEMBLY REQUIRES 10 ANCHORS TOTAL (5 ANCHORS PER SIDE).
 - THE FRONT ANCHOR ASSEMBLY REQUIRES 5 ANCHORS.

ANCHORING KIT, MP-3, QUEST CEN (CONCRETE) (SEE DWG. 3540264-0000)

QUEST® CEN Anchoring Guidelines

PARTS LIST			
ITEM	STOCK NO.	DESCRIPTION	QTY
1	2700731-0300	ROD, THREADED, 3/4X18, 65.G	15
2	2704341-0000	NUT, HEX, 3/4", GR, DH	15
3	2706081-0000	WASHER, FLAT, 3/4X2, HVY, G	15
4	3525100-0000	MP-3 QUART PACKAGE	4
5	2735497-0000	LABEL, GRATE, ANCHOR KIT QUEST CEN	1
6	3540265-INST	INSTALLATION INSTRUCTIONS...	1

CAUTION!
 INSTALLING THE QUEST CEN SYSTEM ON ASPHALT IS ONLY RECOMMENDED FOR TEMPORARY INSTALLATIONS DUE TO THE SHORTER EXPECTED LIFESPAN OF ASPHALT AS COMPARED TO CONCRETE. FOR PERMANENT INSTALLATIONS, IT IS STRONGLY RECOMMENDED TO INSTALL THE SYSTEM ONTO AN APPROPRIATE CONCRETE FOUNDATION USING APPROPRIATE CONCRETE ANCHORS.



- NOTES:
1. THE BACKUP ASSEMBLY REQUIRES 10 ANCHORS TOTAL (5 ANCHORS PER SIDE).
 2. THE FRONT ANCHOR ASSEMBLY REQUIRES 5 ANCHORS TOTAL.

ANCHORING KIT, MP-3, QUEST CEN (ASPHALT) (SEE DWG. 3540265-0000)

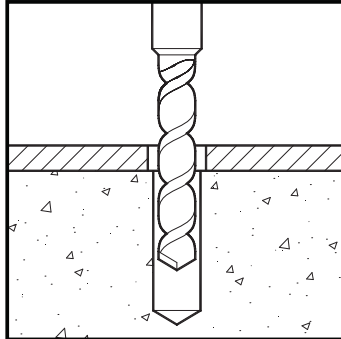
QUEST® CEN Anchoring Guidelines

MP-3
POLYESTER
ANCHORING
SYSTEM

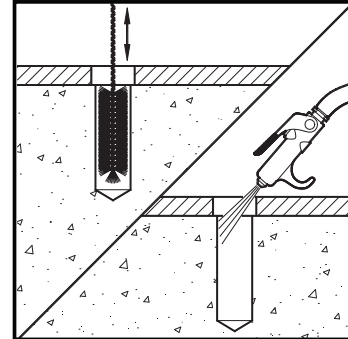
INSTALLATION AND SAFETY INSTRUCTIONS



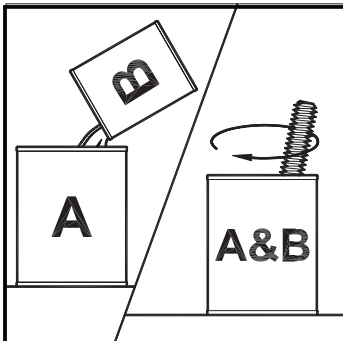
1 Do not allow contact with skin or eyes. Use only in a well-ventilated area. Do not use near open flame.



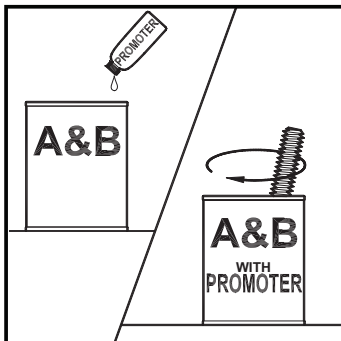
2 Wear safety goggles. If possible, use the part to be anchored as a drilling template. Drill the holes 1/8" larger than the stud diameter to the recommended depth, using a two fluted rotary percussive drill. Full strength will not be achieved if a diamond drill is used. Check to be sure all holes are drilled to the proper depth and aligned with the part to be anchored.



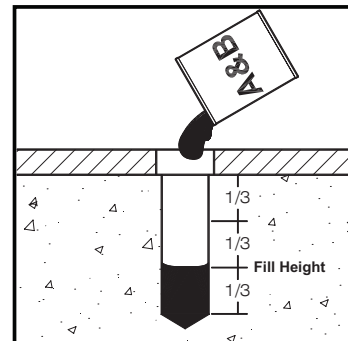
3 While wearing safety glasses, blow the concrete dust from the hole, using oil-free compressed air. Thoroughly clean it with a stiff-bristled brush, and then blow it out again. If the hole is wet, completely flush it with water while brushing. Then blow it clean using oil-free compressed air.



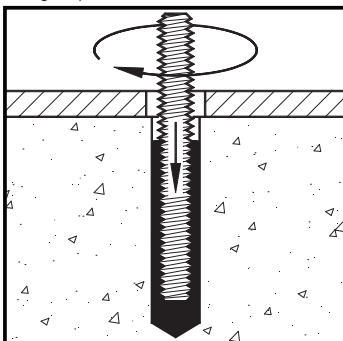
4 While wearing gloves and safety goggles, remove the lids from the MP-3 Part A-Resin and Part B-Hardener containers. Pour Part B into Part A and mix vigorously for 30 seconds to form MP-3 grout. (An anchor stud may serve as a stirring rod.)



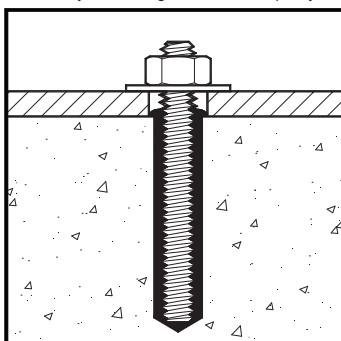
5 For faster hardening in cold weather, Promoter may be used. **Do not use Promoter when the temperature is above 60°F.** Add the entire contents of the Promoter container to the MP-3 grout and mix for an additional 30 seconds. Use immediately, the MP-3 grout will thicken quickly.



6 Position the part to be anchored over the clean holes. Crimp the mouth of the can to form a spout and pour the MP-3 grout mixture down into the hole through the part. Fill 1/3 of the hole. Do not over- or under-fill the hole.



7 Push the stud down through the part to be anchored and into the hole. Leave enough of the stud exposed to attach the nut and washer. Twist the stud several turns in the grout to wet the threads.



8 Place a flat washer onto the stud and thread a nut on until it is flush with the top of the stud or seated against the part. Do not disturb or load the stud until the material has hardened.

Hardening Times (Hours)		
Temp. (°F)	No Promoter	With Promoter
>80	1/2	N/R*
70-79	1	N/R
60-69	2	N/R
50-59	4	3/4
40-49	8	1
30-39	N/R	1 1/2
<30	N/R	N/R
* Not Recommended		

9 Once the grout has hardened, torque the nut to the recommended values.

Valtir, LLC expressly disclaims liability for injury to persons or damage to property resulting from failure to follow instructions or improper application of the MP-3 Polyester Anchoring System. Valtir, LLC EXPRESSLY DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY OF ANY KIND IN CONNECTION WITH THE USE OF THE MP-3 POLYESTER ANCHORING SYSTEM.

Document No. 2735041-0000, Sheet 1/2

QUEST[®] CEN Anchoring Guidelines

To Whom it May Concern:

This is to inform you that in order to comply with the US Department of Labor Hazard Communication - 1910.1200, Material Safety Data Sheets are available upon request.

Valtir, LLC is committed to meeting our customer's requirements and to supplying high quality, safe products for use on the nation's highways. If you have any questions, please contact our Customer Service Department at 888-356-2363.

IMPORTANT: Read all instructions and materials thoroughly before proceeding.

QUEST® CEN Anchoring Guidelines

Alternative Anchor Options

There are numerous manufacturers of anchors that provided a product that will successfully anchor the Quest CEN System to the foundation. Valtir, LLC has performed anchor performance tests on several of these alternative anchors. The following list states which anchors have satisfactorily passed our minimum requirements (i.e. min. pull out strength of 82.3kN [18,500lbs] and min. shear strength of 109kN [24,500lbs]).

Caution!

All anchors must be installed strictly per the each anchor manufacturer's specific requirements. It is recommended that the anchor manufacturer is consulted to discuss your specific installation site conditions prior to finalizing your anchor selection.

Concrete:



<http://www.hilti.com>

Models [Epoxy-based anchoring systems]:

- HVU M20 x 170
- HY 150
- RE 500

Asphalt:



<http://www.kelken.com>

Model [Epoxy-based anchoring system]:

- N/A Kelken "Lefty" anchor coated with Kelislip bond release agent and anchored with Keligrout epoxy
 - Kelken "Lefty" anchors (¾ inch diameter x 18 inch long)
 - ¾-10 threads at top 2 inches of anchor, ¾ inch "Lefty" removable thread for remaining anchor length (~16 inches)
 - Material per ASTM A449 Type 1 or ASTM A193 Grade B7 or SAE J429 Grade 5
 - Galvanized for corrosion resistance
 - Includes ¾ inch galvanized washers and ¾-10 galvanized nuts
 - 1KS12Q (Kelislip bond release agent)
 - 1KG101T (Keligrout epoxy)

QUEST® CEN Anchoring Guidelines



<http://www.simpsonanchors.com>

Model [Mechanical anchoring systems]:

THD75812HMG (3/4 inch diameter x 8.5 inches long; mechanically galvanized)

THD75100HMG (3/4 inch diameter x 10 inches long; mechanically galvanized)



<http://toge-road.de>

Model [Epoxy-based anchoring system]:

TSM B 22 X 155 IM 16 ASPHALT

For permanent applications on asphalt, using alternative anchor options (like Toge), Valtir recommends that the system be inspected according to the guidelines set forth in the Maintenance and Repair section in the Product Manual, with the following additions:

1. Increase the frequency of Walk-Up Inspections to once every six months (instead of once every 12 months for *concrete* applications).
2. After each impact, check to see that all Anchor Bolts are not damaged and have remained firmly anchored in the roadway surface. Damaged anchor bolts are those found to be loose, broken, or showing signs of pull out and are to be replaced. If the system is anchored to asphalt, then up to 20% of the total anchors may be replaced if damaged. If more than 20% of the anchors are damaged, then the system shall be relocated and reinstalled onto new and undisturbed asphalt.

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Notes:



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Notes:





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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.