Guidelines for the Engineer & Designer

FRP Grating, Guardrail, Handrail, Ladders & Structural Shapes

SI Units

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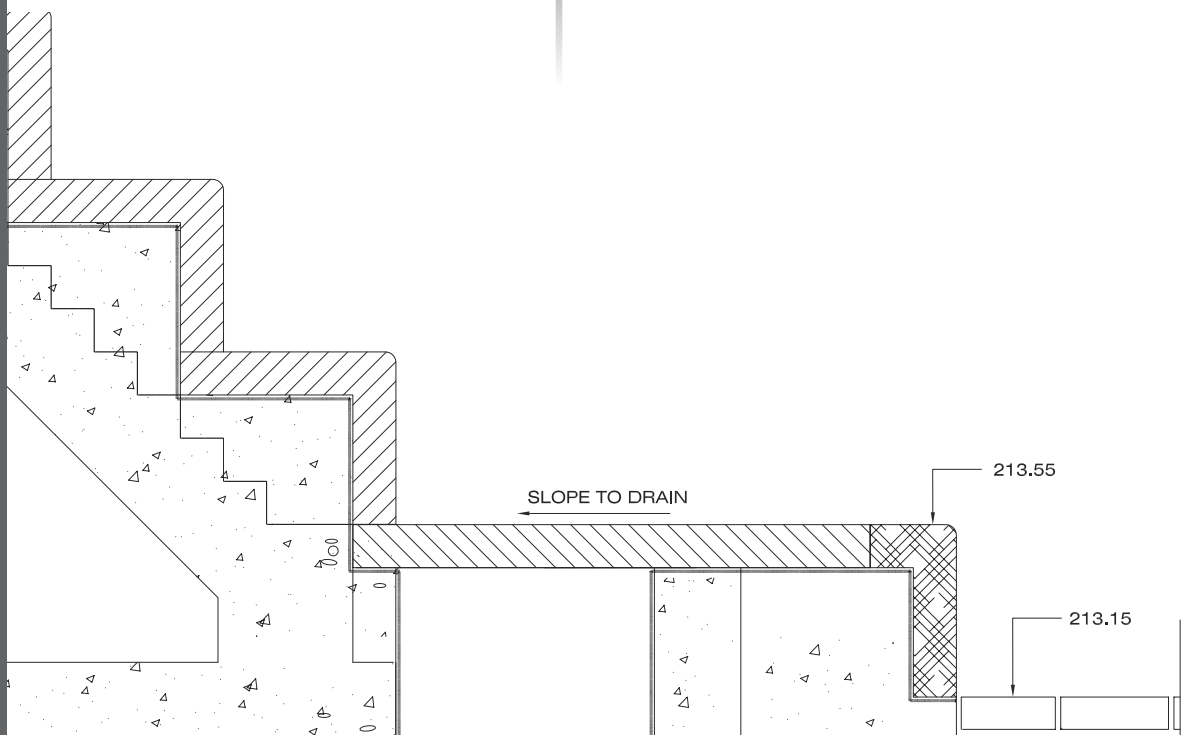

1.0 GENERAL

1.1 The purpose of this guideline is to assist the engineer/designer in designing FRP (Fiberglass Reinforced Plastic) pedestrian walkways utilizing molded and pultruded gratings, railing systems, ladder systems, and structural members. The guideline includes recommended sizes and configurations, recommended design criteria, and referenced standards, where applicable.

1.2 Drawing details of the FRP systems described in this guideline are also available electronically.

2.0 FRP GRATINGS AS PEDESTRIAN WALKWAYS

2.1 Gratings

2.1.1 Fibergrate Composite Structures, Inc. FRP gratings are manufactured by open molding or pultrusion processes. Molded gratings are available in a variety of stock panel sizes (i.e. 0.9m x 3.1m, 1.2m x 2.4m, 1.5m x 3.1m, and 1.2m x 3.7m for 38mm deep, 38mm square mesh gratings). The designer should consider these sizes at the early stages of structure layout to efficiently utilize the material and minimize installation costs.

Molded gratings are available in a variety of resin systems and colors to meet specific project requirements. Detailed descriptions of the resin systems available are included in the Fibergrate Molded Product brochures.

Pultruded gratings are available in two resin systems and two colors. Detailed descriptions of these are given in the *Safe-T-Span® Fiberglass Pultruded Grating* brochure.

2.2 Minimum Grating Design Criteria

Pedestrian Loads*	
Uniform Live Load	2.4 kN/m^2 - 3.1 kN/m^2
Concentrated Load	113 kg
Dead Load	0.2 kN/m^2
Maximum Deflection	Span L/120 or 9.5mm (whichever is less)

*Note that these design criteria are minimums, but exceed general building code requirements for office space. Other criteria are commonly used in specifications. For pedestrian walkways in industrial applications, the above are sufficient and are recommended to prevent excessive cost.

2.3 Application Notes: Molded FRP Gratings

2.3.1 Molded grating spans should be kept to 914mm or 1219mm from center to center of supporting members to most efficiently utilize grating panels. Typically, 25mm deep molded gratings have acceptable deflections at spans up to 914mm. 38mm deep molded gratings are acceptable for spans from 914mm to 1067mm, and 51mm deep molded gratings are acceptable for spans from 1219mm to 1372mm.

2.3.2 Grating panels installed over multiple spans will further reduce deflections. The deflection of the grating can be determined using standard AISC beam formulas and grating properties provided in the Fibergrate Molded Product brochures.

2.3.3 Molded gratings may be cantilevered as required to a maximum distance of 152mm (for 25mm deep gratings) and up to 305mm (for 51mm deep gratings) from the centerline of the last supporting member. Gratings used in this way must be held down to a minimum of two supports and have a minimum of three hold downs clips at each interior support to prevent overturning of the grating panel.

2.3.4 Hold Down Clips: Gratings must be mechanically fastened in place to prevent sliding. Each grating panel should be fastened to each supporting structure using a minimum of four "M" style hold down clips. For larger panels, 6 to 8 hold down clips are recommended. Gratings installed in trenches where they are captive in an embedment angle do not require hold down clips unless bearing surfaces are uneven and the grating panels would tend to rock.

2.3.5 Covered Gratings: Due to the nature of the manufacturing process, covered gratings are often slightly warped. As a result of this, covered gratings will rock and pose a trip hazard if they are not secured with the appropriate hold down clips. It is Fibergrate policy to recommend hold down clips for all covered grating applications. In fact, Fibergrate includes "W" type hold down clips with each covered grating stock panel order.

2.3.6 Abutting edges of molded grating panels should be supported by structural members or fastened together using "F" style clips at a maximum spacing of 610mm on center. This will prevent differential deflection when one of the abutting gratings is loaded.

2.3.7 Due to the bi-directional nature of square mesh molded gratings, unsupported holes of limited size may be cut into the edges or interior of the panels without the use of additional supports. This is very useful for applications which involve pipe penetrations. As a rule of thumb, as long as no more than 1/3 of the individual grating panel width is removed by such a hole, no additional support will be required.

2.3.8 Edge Banding: Unlike steel and aluminum gratings it is not necessary to edge band molded gratings for structural reasons. As FRP cannot be welded, edge banding will not transmit load to the grating. Fibergrate only recommends edge banding where personnel may be passing through the grating to prevent injury from stub bars.

2.3.9 Molded Grating Details: The attached drawings (A and B) give details of the "M" style hold down clip and the "F" style abutment clip.

2.4 Application Notes: Pultruded Gratings

2.4.1 As with molded gratings, pultruded gratings may also be used on multiple spans to reduce deflections. AISC beam formulas and grating design procedures apply.

2.4.2 Like molded gratings, edge banding is not required for pultruded gratings. Due to the construction of this type of grating, it is very difficult to install banding.

2.4.3 Pultruded Grating Details: The attached drawings (G and H) give details of the “M” and “FC” style hold down clip. Gratings must be mechanically fastened in place to prevent sliding.

3.0 DYNARAIL® FRP GUARDRAIL AND HANDRAIL SYSTEMS

3.1 Railing Arrangement & Dimensions

3.1.1 The Fibergrate Composite Structures' Dynarail® guardrail system consists of a 54mm x 4.8mm thick square tube post with two 44mm x 3.2mm thick square tube rails. The mid-rail passes through the post at a routed square hole and is riveted and bonded in place. The top rail is fitted into a u-shaped routed slot in the top of the post and is riveted and bonded in place. The system includes a 102mm FRP toe-plate mounted at each post using a self tapping screw. The height of the top rail is 1067 above the walking surface. Fibergrate's Dynarail handrail system (the offset rail that attaches to guardrails or walls) consists of 38mm x 6.4mm wall round tube, connectors and brackets. Recommended handrail installation height is 864mm above walking surface or leading edge of stair tread. Railing systems are available in vinyl ester and polyester fire-retardant resin formulations in a safety yellow color.

3.2 Design Criteria

3.2.1 The railing systems are designed to meet the loading requirements of OSHA 1910.23 and latest IBC, a concentrated load of 0.9 kN applied in any direction at any point on the rail or a uniform load of 0.7 kN/m applied in any direction on the rail. Loads are assumed not to act concurrently.

3.3 UV Protective Coatings

3.3.1 For applications where the railing system is to be used outdoors, a polyurethane based UV protective coating is recommended to preserve the long-term appearance of the railings.

3.4 Layout Guidelines

3.4.1 The following guidelines should be used in railing layout to most economically utilize this system and to maximize performance.

3.4.2 Post and offset handrail supports spacing: Post and offset handrail supports spacing must not exceed 1829mm to meet OSHA and IBC loading requirements.

3.4.3 Inside or Outside Corners: Posts cannot be placed at corners. At interior or exterior corners, two posts should be placed within 305mm of the corner, on both sides.

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3.4.4 Post Location With Respect to Structure: For side-mounted posts attaching to fiberglass structures, the post should be placed as close as practical but no more than 152mm to an element which torsionally fixes the element to which the post is attached. This will prevent excessive rotation of the structural element when the posts are under load.

3.4.5 Number of Posts Per Section: A minimum of two posts per straight guardrail section are recommended to improve durability in shipping and erection.

3.5 Guardrail and Handrail System Details

3.5.1 Refer to the attached drawings for railing assembly details, splicing, and post base mountings.

4.0 DYNARAIL® FRP LADDER SYSTEM

4.1 Ladder Arrangement & Dimensions

4.1.1 The Fibergrate Composite Structures Dynarail® ladder system consists of 44mm x 6.4mm thick square tube rails and 32mm diameter x 6.4mm thick fluted rungs. There is a clear horizontal distance of 457mm between the inside of the rails and a center to center distance between rungs of 305. Ladders are available in vinyl ester and polyester fire-retardant resin formulations in a safety yellow color. The designer is referred to the *Dynarail® Fiberglass Guardrail, Handrail & Safety Ladders* brochure for further description of this system.

4.2 Loading Requirements

4.2.1 This ladder system is designed to meet the loading requirements of OSHA 1910.27, "Fixed Ladders." The ladders are designed to meet the OSHA minimum live load requirement of a 0.9 kN concentrated load at the mid-point of the rung.

4.3 Support Requirements

4.3.1 Ladders will require support back to a wall or solid structure at intervals not to exceed 1829mm. Exceeding this spacing will result in a ladder installation that is too flexible for comfort or safety. Ladders are required to be base supported to structure or back to a wall or solid structure. All ladders are to include a minimum of one base support. The standard ladder wall mount bracket is not capable of supporting a vertical load. Ladders that cannot be base supported should include one pair of bottom wall brackets engineered to support design loads.

4.4 Cages and Rest Platforms

4.4.1 The designer is referred to OSHA 1910.27, "Fixed Ladders" for ladders requiring cages and rest platforms. These units are available in FRP as part of the ladder system. Generally, cages are required for ladders of more than 6.1m in length to a maximum unbroken length of 9.2m. Ladders with a length of more than 6.1m will require a cage and an intermediate rest platform at 9.2m and for every 9.2m thereafter. Cages are required to start at a minimum of 2.1m and a maximum of 2.4 above the platform. They are required to extend 1067mm above the landing at the top of the ladder.

4.5 Ladder System Details

4.5.1 Refer to the attached drawings for ladder system splicing, and mounting details.

5.0 DYNAFORM® FRP STRUCTURAL MEMBERS

5.1 Availability

5.1.1 Dynaform® structural shapes are available in FRP in the common structural shapes: angle, channel, square and round tubes, I-sections and W-sections. These are available in fire retardant vinyl ester (beige), fire retardant polyester (dark gray) and non-fire retardant polyester (green).

5.2 Design Criteria

5.2.1 The following design criteria is recommended for use in FRP structural members used as beams for supporting live loads plus the dead load of the FRP structure. Higher safety factors and deflection ratios may be needed for other conditions.

FRP Structural Shapes*	
Maximum Deflection	L/180
Allowable Bending Stress	*68.9 MPa (F.S. = 3)
Allowable Shear Stress	10.3 MPa (F.S. = 3)
Allowable Bearing Stress	68.9 MPa (F.S. = 3)

*Assumes adequate lateral bracing of compression flange, see 5.6 and a b/t ≤ 12 (flange width-to-flange thickness ratio. Using a column failure analogy, we refer you to the *Dynaform® Fiberglass Structural Shapes Design Guide*.

5.3 Preferred Sizes

5.3.1 The table below gives a list of preferred sizes for FRP structural members. These sizes are available from stock without the added cost and delay of a mill run. Members are stocked in 6.1m lengths.

FRP Structural Shapes	
Shape Name	**Shape Size (mm)**
Equal Leg Angles	76 x 6.4, 76 x 9.5, 102 x 6.4, 102 x 9.5, 102 x 13
Channels	152 x 43 x 6.4, 203 x 56 x 9.5, 254 x 70 x 13
I - Sections	203 x 102 x 9.5, 305 x 152 x 13
Wide Flange Sections	102 x 102 x 6.4, 152 x 152 x 6.4, 152 x 152 x 9.5, 203 x 203 x 9.5

5.4 Beam and Column Selection Tables

5.4.1 The *Dynaform® Fiberglass Structural Shapes Design Guide* provides tables for selecting the common sizes of FRP structural members used as columns and beams. Note that these tables are based on adequate lateral support of the compression flange of bending members (see Section 5.6, Lateral Support Requirements). The Design Guide also provides information on corrosion resistance, section dimensions and properties, mechanical and physical properties, and thermal effects.

5.5 Availability of Other Shapes and Mill Run Quantities

5.5.1 Non-stock shapes can be obtained in mill run quantities. Consult Customer Service for availability. These members may be used economically if they are ordered in these quantities.

5.6 Lateral Support Requirements

5.6.1 The table below gives the maximum lateral support spacing required to produce the full bending capacity of these members.

Lateral Support Requirements - FRP Structural Shapes

Member	Lateral Support Spacing	Member	Lateral Support Spacing
C6" x 1/4" (152mm x 6.4mm)	1219mm	W4" x 1/4" (102mm x 6.4mm)	1524mm
C8" x 3/8" (203mm x 9.5mm)	1524mm	W6" x 1/4" (152mm x 6.4mm)	2134mm
C10" x 1/2" (254mm x 13mm)	1524mm	W6" x 3/8" (152mm x 9.5mm)	2438mm
I4" x 1/4" (102mm x 6.4mm)	610mm	W8" x 3/8" (203mm x 9.5mm)	2743mm
I6" x 1/4" (152mm x 6.4mm)	914mm	W10" x 3/8" (254mm x 9.5mm)	3962mm
I8" x 3/8" (203mm x 9.5mm)	1219mm	W12" x 1/2" (305mm x 13mm)	4267mm
I10" x 3/8" (254mm x 9.5mm)	1524mm		
I12" x 1/2" (305mm x 13mm)	2134mm		

5.7 Connection Details

5.7.1 The attached drawings include example connection details for use with fiberglass structural shapes used as beams and columns. Note that these details are examples only and that Fibergrate Composite Structures will perform the detailed design needed to meet the loading requirements. Fibergrate Composite Structures can provide standard connection details designed to exceed the ultimate capacity of all standard FRP beams available.

5.72 The following tables outline allowables and requirements that should be considered when designing and detailing connections.

STRUCTURAL CONNECTIONS

BEARING ON FRP **Bolt Allowable (MPa) for Given FRP Plate Thickness (1)**

Material Thickness	Bolt Diameter				
	3/8" (9.5mm)	1/2" (13mm)	5/8" (16mm)	3/4" (19mm)	1" (25mm)
3.2mm	3.23	4.31	5.38	6.47	8.62
6.4mm	6.47	8.62	10.78	12.93	17.24
9.5mm	9.69	12.93	16.16	19.39	25.86
13mm	12.93	17.24	21.55	25.86	34.47
19mm	19.39	25.86	32.32	38.78	51.71
25mm	25.86	34.47	43.09	51.71	68.95

(1) BEARING on FRP plate or web controls (Factor of Safety = 3.0; Fp=68.95 MPa).
The designer must confirm that no other component of connection controls.

BOLT SHEAR **Bolt Allowable (MPa) for Given Bolt Diameter (2)**

Bolt Type & Application	Bolt Diameter				
	3/8" (9.5mm)	1/2" (13mm)	5/8" (16mm)	3/4" (19mm)	1" (25mm)
316SS - Single Shear (3)	9.71	17.26	26.97	38.84	69.04
316SS - Double Shear	19.42	34.52	53.94	77.67	138.08
FRP Threaded Rod (4) Single Shear	2.07	4.14	6.21	6.89	14.13
FRP Threaded Rod Double Shear	4.14	8.27	12.41	13.79	28.27

(2) The designer must confirm that no other component of connection controls.
*(3) SHEAR of bolt controls. Fv = 0.17*FU = 0.17*517.1 MPa = 87.91 MPa*
(4) SHEAR of FRP threaded rod controls (Factor of Safety = 4.0).
Ultimate values from Dynaform® Fiberglass Structural Shapes Design Guide

RATIO OF EDGE DISTANCE TO FASTENER DIAMETER *(* - "cl" is centerline)*

	RANGE	RECOMMENDED
Edge Distance - cl* bolt to END	2.0-4.0	3.0
Edge Distance - cl* bolt to SIDE	1.5-3.5	2.5
Bolt Pitch - cl* to cl*	4.0-5.0	5.0

6.0 FRP STAIR SYSTEMS

6.1 Stair System Components

6.1.1 FRP structural shapes and special FRP gratings can be used in combination to create FRP stairs. The stair treads are typically made using 38mm deep, 38mm x 152mm mesh molded Fibertred® grating panels with an integral reinforced, gritted nosing. These stair treads are available in the same resin systems and colors as molded grating. Fibertred® panels are manufactured in a 565mm wide x 3048mm long panel and a 641mm wide x 3658mm long panel with solid nosing along the 3048mm and 3658mm sides. These panels can be best utilized if stair tread widths are kept to 610mm, 762mm, 914mm or 1067mm with depths of 286mm or less. Pultruded grating stair treads are also available in the Safe-T-Span® product line. These are manufactured using standard pultruded gratings with a stiffened nosing. The nosing bars are painted a contrasting color.

6.2 Design Criteria

6.2.1 The designer is referred to OSHA 1910.24, "Fixed Industrial Stairs" for guidelines in the design of stair systems in general. The stair should be designed for a moving live load of 4.45 kN (2.22 kN/stair stringer).

6.3 Tread Deflections

6.3.1 Tread deflections are typically limited to L/150 or less. The table below gives the load-deflection performance of Fibertred® for spans up to 1067mm. Spans greater than 1067mm will require a stiffened nosing or intermediate support to reduce deflections. The deflections are based on 1 kN and 2 kN point loads applied over a 102mm wide x 152mm deep load plate starting at the nosing edge to simulate the landing of a foot.

Load / Deflection Table: 38mm Deep Fibertred®

Load (kN)	Span (mm)			
	600	800	1000	1200
1	1.1mm	2.4mm	4.7mm	8.8mm
2	2.2mm	5.0mm	9.5mm	---

*Load deflection tables for pultruded stair treads are available in the *Safe-T-Span® Fiberglass Pultruded Grating* brochure.

6.4 FRP Stair Design Notes

6.4.1 Most stairs can be satisfactorily designed using up to 203mm or 254mm channels as stringers with the flanges outward. The stringer must be designed to meet the loading requirements given in section 6.3.1. The individual stair treads are supported by 51mm x 51mm x 6.4mm angles bolted to the stringers with two 3/8" (9.5mm) diameter bolts.

6.4.2 The stair railings are manufactured using a system identical to the one described in section 3.0 for FRP Guardrails and Handrails. These are typically side-mounted to the channel stringers using a detail similar to Drawing K. Note that on OSHA compliant stairs the top of rail used as handrail is 762mm to 864mm above the leading edge of the nosing, while the offset rail used as handrail on IBC compliant stairs is 864mm to 965mm above the leading edge of the nosing or top of walkway surface.

6.4.3 Long stair runs may require intermediate support using columns and may require bracing to prevent excessive side sway. (See Charts)

Stringer Design Table - OSHA Design Criteria

Notes: 1. Slope range is 30 to 50 degrees.
2. OSHA does not limit the maximum rise.
3. Design is for a 4.45 kN stair load, 2.22 kN point load/ stringer L/D ≥180.
4. C8 = C 8" x 2-3/16" x 3/8"; C10 = C 10" x 2-3/4" x 1/2" (203mm x 56mm x 9.5mm; 254mm x 70mm x 13mm).

Vertical Rise in Meters	Horizontal Run in Meters																			
	0.3	0.6	0.9	1.2	1.5	1.8	2.1	2.4	2.7	3.0	3.4	3.7	4.0	4.3	4.6	4.9	5.2	5.5	5.8	6.1	6.4
0.3	C8																				
0.6		C8	C8																		
0.9			C8	C8	C8																
1.2				C8	C8	C8															
1.5					C8	C8	C8	C8													
1.8						C8	C8	C8	C8	C8				**Stringers below double lines require lateral bracing. See detail.**							
2.1						C8	C8	C8	C8	C8	C8	C8									
2.4							C8	C8	C8	C8	C8	C8	C8								
2.7								C8	C8	C8	C8	C8	C8	C8	C8						
3.0									C8	C8	C8	C8	C8	C8	C8	C8					
3.4										C8	C8	C8	C8	C8	C8	C10	C10	C10	C10		
3.7											C8	C8	C8	C8	C8	C10	C10	C10	C10	C10	
4.0											C8	C8	C8	C8	C10	C10	C10	C10	C10	C10	C10
4.3												C8	C8	C10	C10	C10	C10	C10	C10	C10	C10
4.6													C10	C10	C10	C10	C10	C10	C10	C10	C10
4.9						**Stringers below heavy black lines are longer than 6.1m. These require a splice or pull to length.**								C10	C10	C10	C10	C10	C10	C10	C10
5.2															C10	C10	C10	C10	C10	C10	C10
5.5																C10	C10	C10	C10	C10	C10

Stringer Design Table - IBC Design Criteria (914mm Wide Stair Only)

Notes: 1. Slope range is 20 to 32.5 degrees.
2. Landings are required every 3.7m of rise.
3. Design is for a 4.8 kN/m² uniform load, L/D ≥ 180.
4. C8 = C 8" x 2-3/16" x 3/8"; C10 = C 10" x 2-3/4" x 1/2" (203mm x 56mm x 9.5mm; 254mm x 70mm x 13mm).

Vertical Rise in Meters	Horizontal Run in Meters																		
	0.3	0.6	0.9	1.2	1.5	1.8	2.1	2.4	2.7	3.0	3.4	3.7	4.0	4.3	4.6	4.9	5.2	5.5	5.8
0.3		C8																	
0.6			C8	C8	C8								Stringers below heavy black lines are longer than 6.1m.						
0.9					C8	C8	C8	C8											
1.2							C8	C8	C8	C8	C8								
1.5								C8	C8	C8	C8	C10	C10						
1.8										C8	C8	C10	C10	C10	C10	C8*			
2.1											C10	C10	C10	C10	C10	C8*	C8*	C8*	C8*
2.4													C10	C10	C10	C8*	C8*	C8*	C8*
2.7															C8*	C8*	C8*	C8*	C8*
3.0					Stringers below double lines require lateral bracing. See detail.											C8*	C8*	C8*	C8*
3.4																		C8*	C8*
3.7																			C8*

*Indicates that C8 stringers can be used if columns are installed at midspan of stringer. C10 will not work.

Stringer Design Table - IBC Design Criteria (1219mm Wide Stair Only)

Notes: 1. Slope range is 20 to 32.5 degrees.
2. Landings are required every 3.7m of rise.
3. Design is for a 4.8 kN psf uniform load, L/D ≥ 180.
4. C8 = C 8" x 2-3/16" x 3/8"; C10 = C 10" x 2-3/4" x 1/2" (203mm x 56mm x 9.5mm; 254mm x 70mm x 13mm).

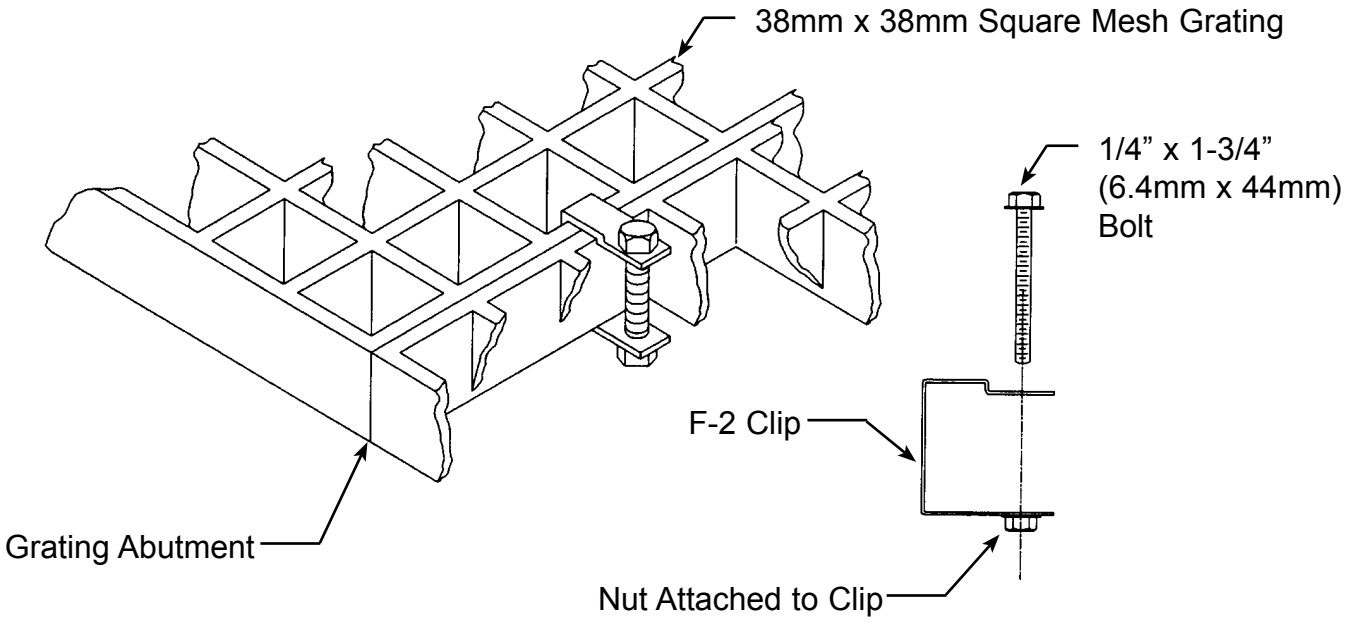
Vertical Rise in Meters	Horizontal Run in Meters																		
	0.3	0.6	0.9	1.2	1.5	1.8	2.1	2.4	2.7	3.0	3.4	3.7	4.0	4.3	4.6	4.9	5.2	5.5	5.8
0.3		C8																	
0.6			C8	C8	C8								Stringers below heavy black lines are longer than 6.1m.						
0.9					C8	C8	C8	C8											
1.2							C8	C8	C8	C8	C10								
1.5								C8	C8	C8	C10	C10	C10						
1.8										C10	C10	C10	C10	C10	C8*	C8*			
2.1											C10	C10	C10	C8*	C8*	C8*	C8*	C8*	C8*
2.4													C10	C8*	C8*	C8*	C8*	C8*	C8*
2.7															C8*	C8*	C8*	C8*	C8*
3.0					Stringers below double lines require lateral bracing. See detail.											C8*	C8*	C8*	C8*
3.4																		C8*	C8*
3.7																			C8*

*Indicates that C8 stringers can be used if columns are installed at midspan of stringer. C10 will not work.

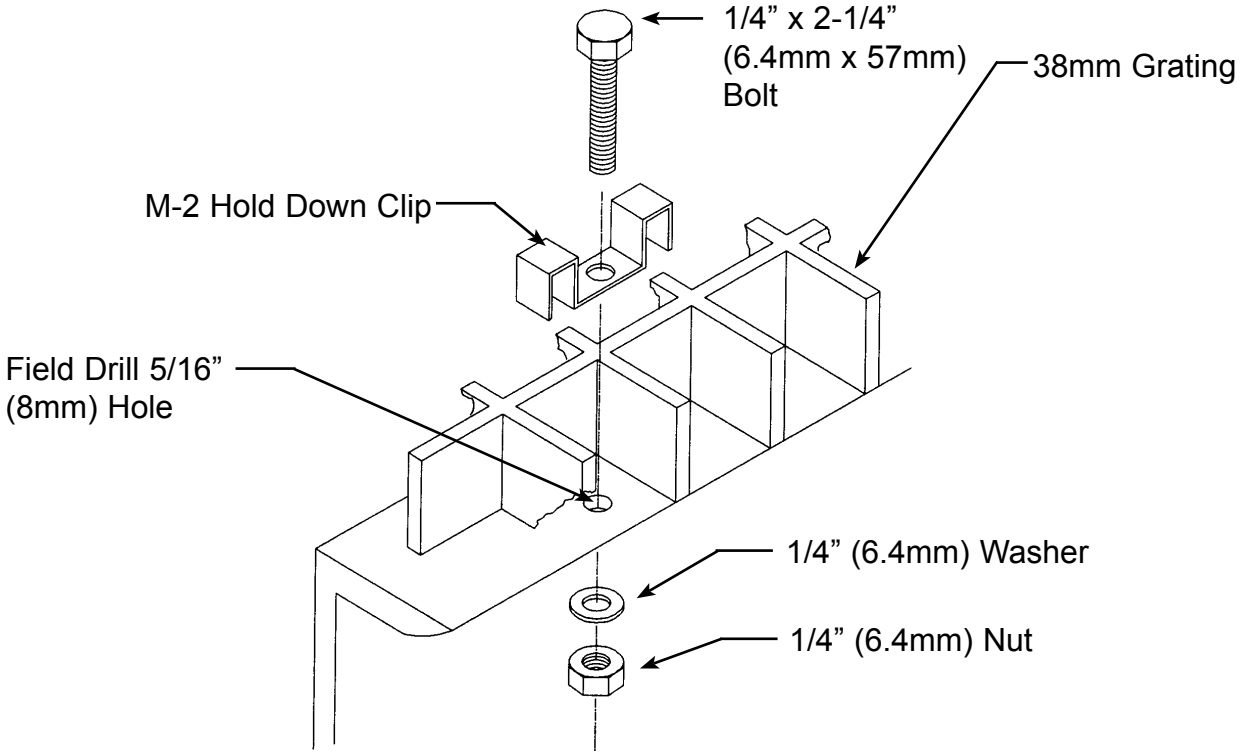
6.5 FRP Stair Details

6.5.1 The attached drawings provide typical details of stair systems using channel stringers.

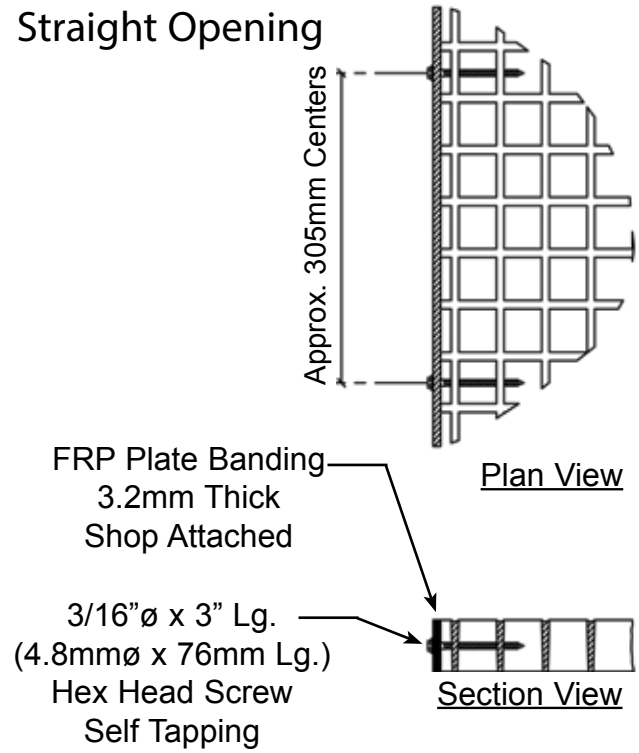
DRAWING A: F CLIP ASSEMBLY



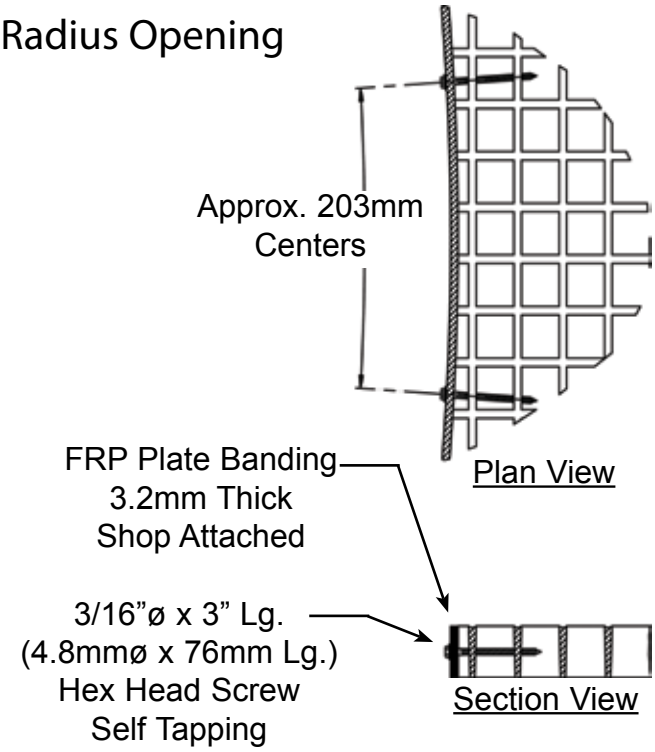
DRAWING B: M CLIP ASSEMBLY



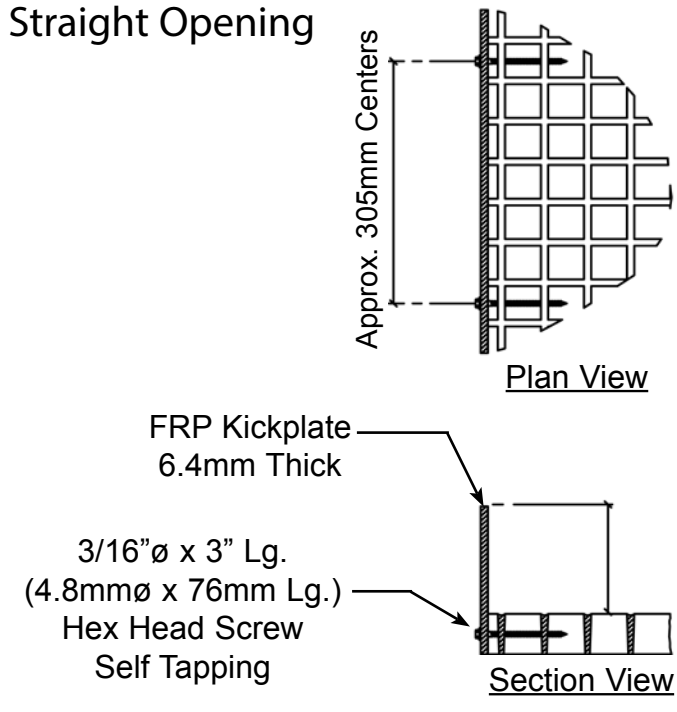
DRAWING C:
FRP EDGEBANDING
Straight Opening



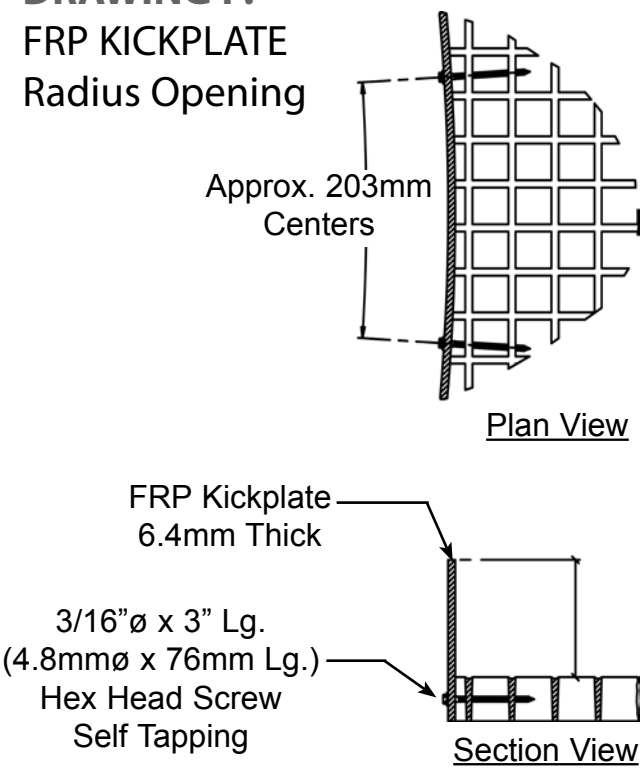
DRAWING D:
FRP EDGEBANDING
Radius Opening



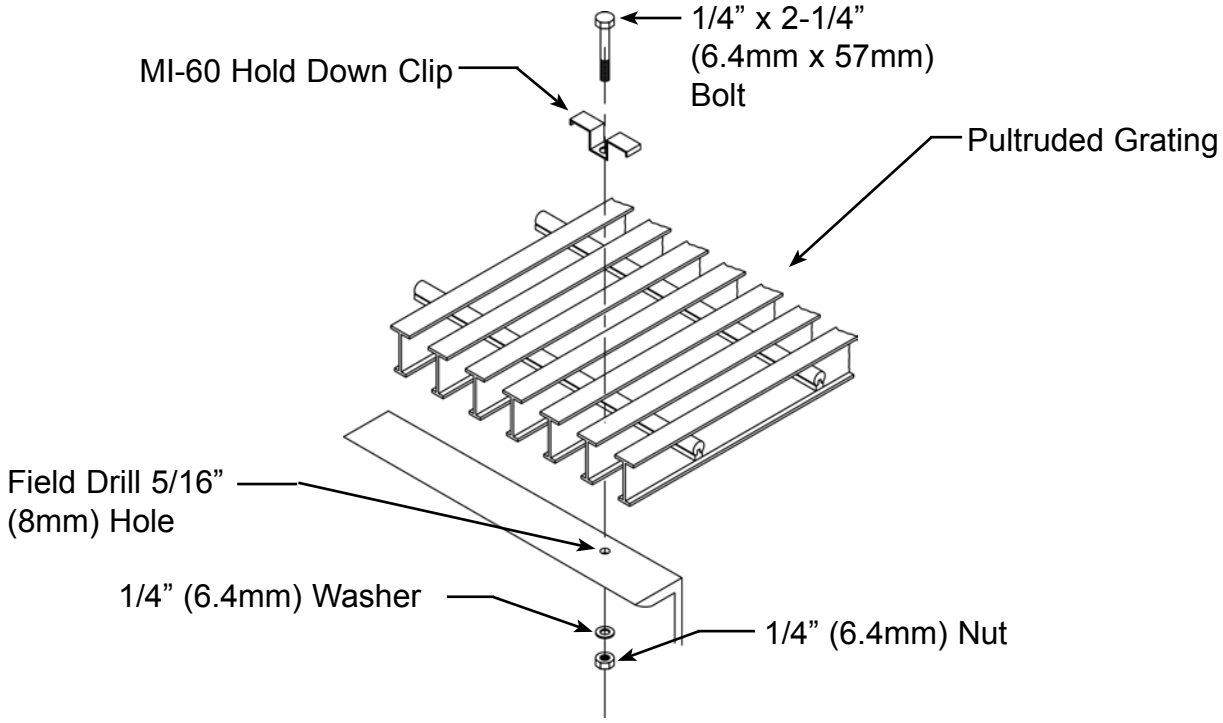
DRAWING E:
FRP KICKPLATE
Straight Opening



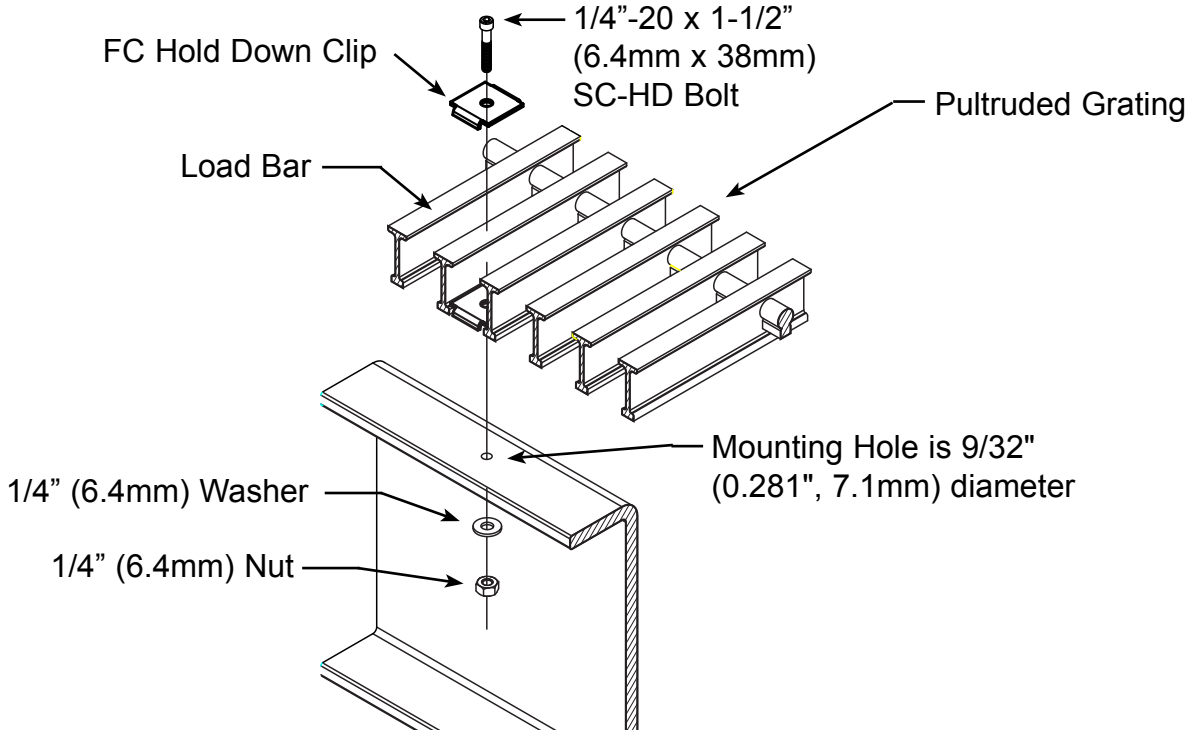
DRAWING F:
FRP KICKPLATE
Radius Opening



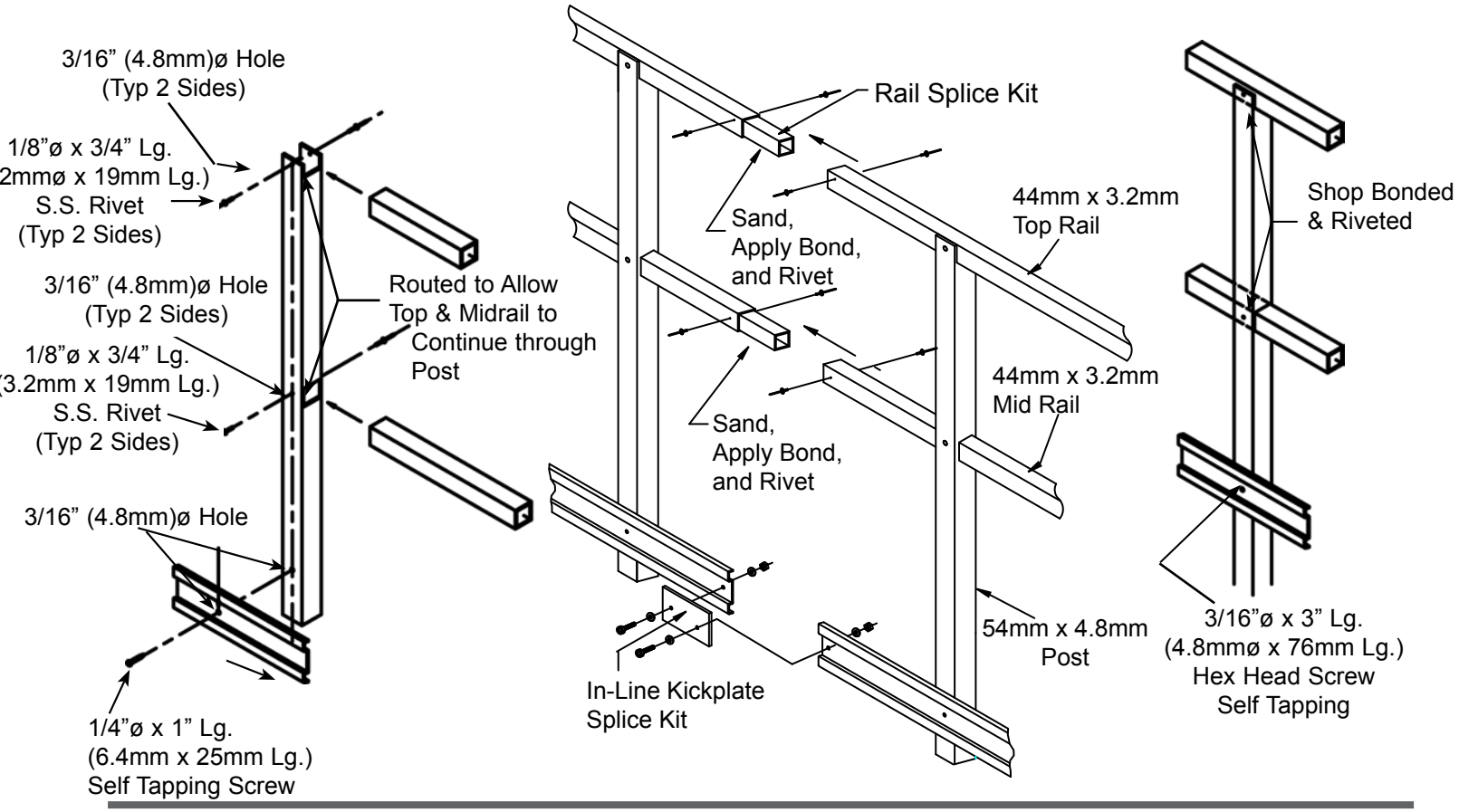
DRAWING G: MI-60 CLIP ASSEMBLY



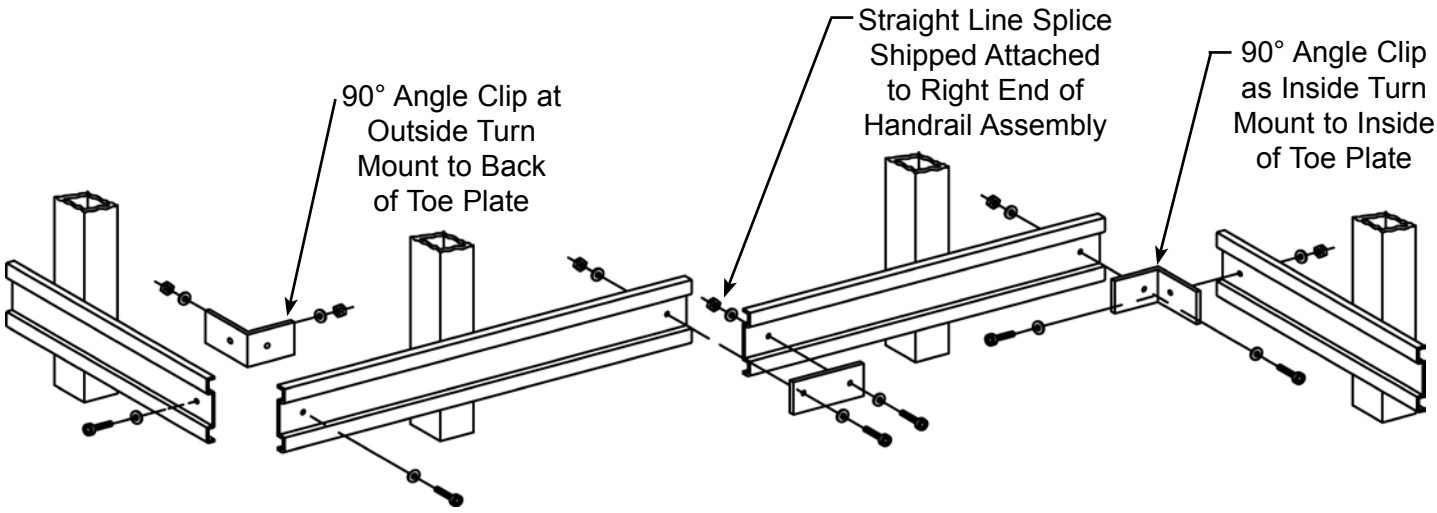
DRAWING H: FC CLIP ASSEMBLY



DRAWING I: FRP GUARDRAIL CONNECTIONS

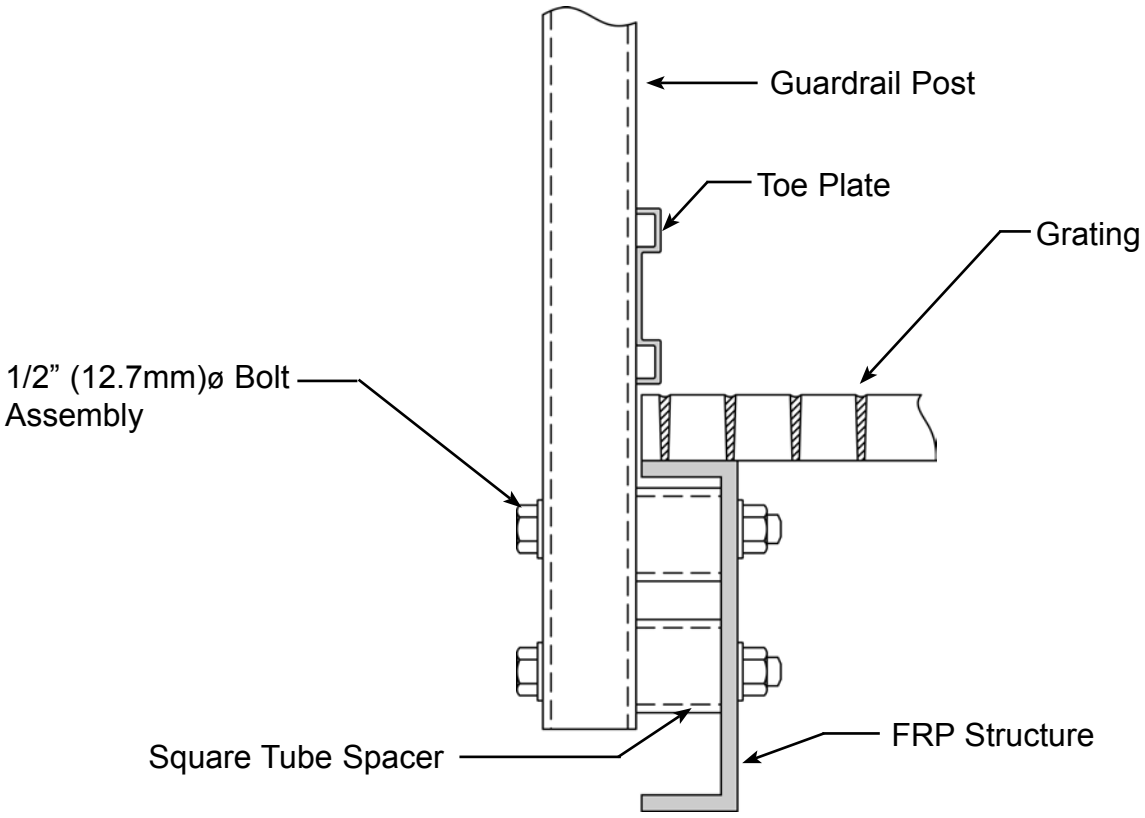


DRAWING J: TOE PLATE SPLICE CONDITIONS

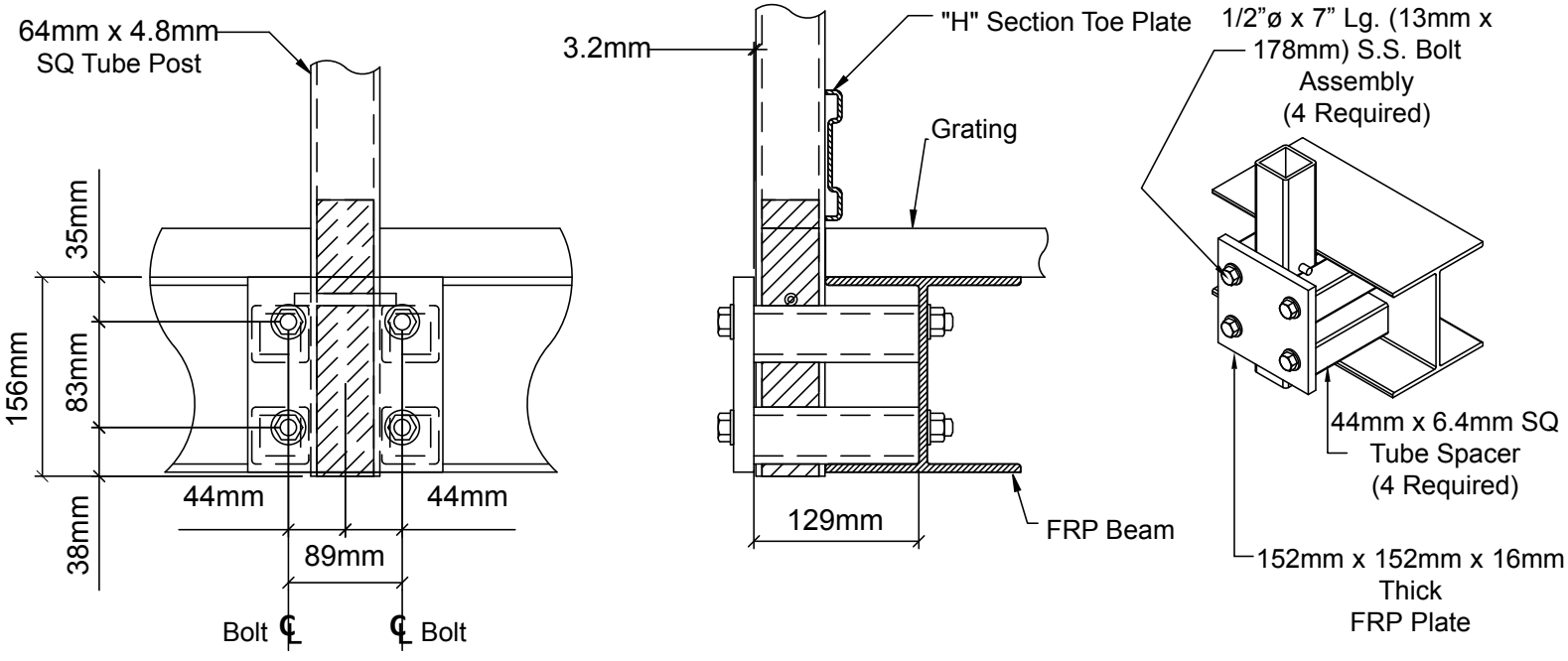


Outside Turn | Straight Line | Inside Turn

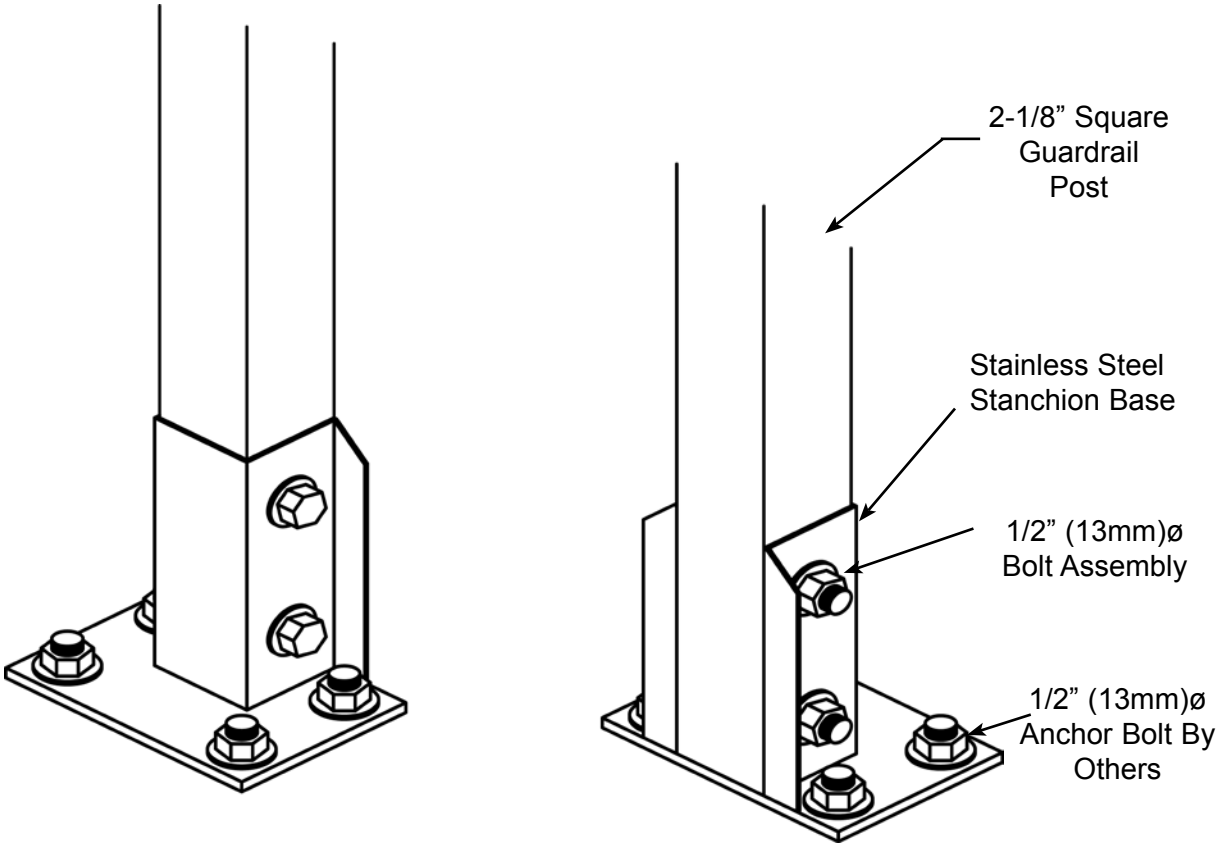
DRAWING K: GUARDRAIL POST TO FRP STRUCTURE CONNECTION



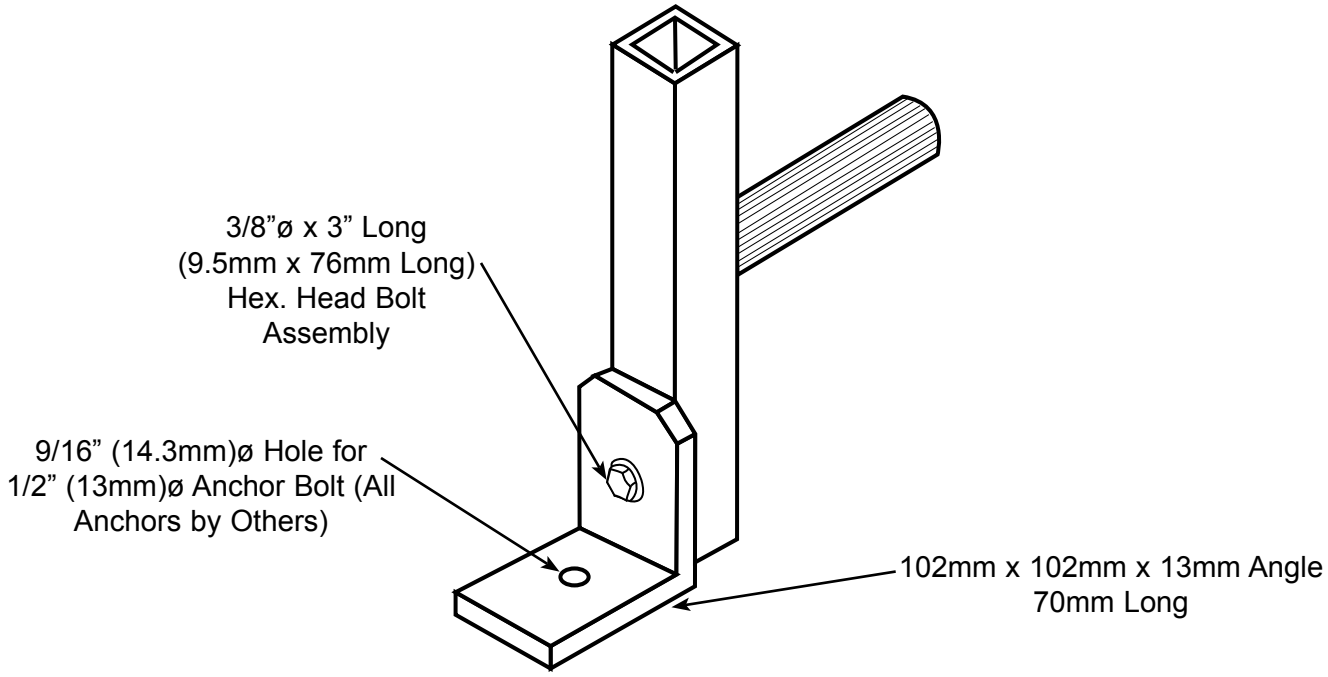
DRAWING L: REMOVEABLE GUARDRAIL CONNECTION



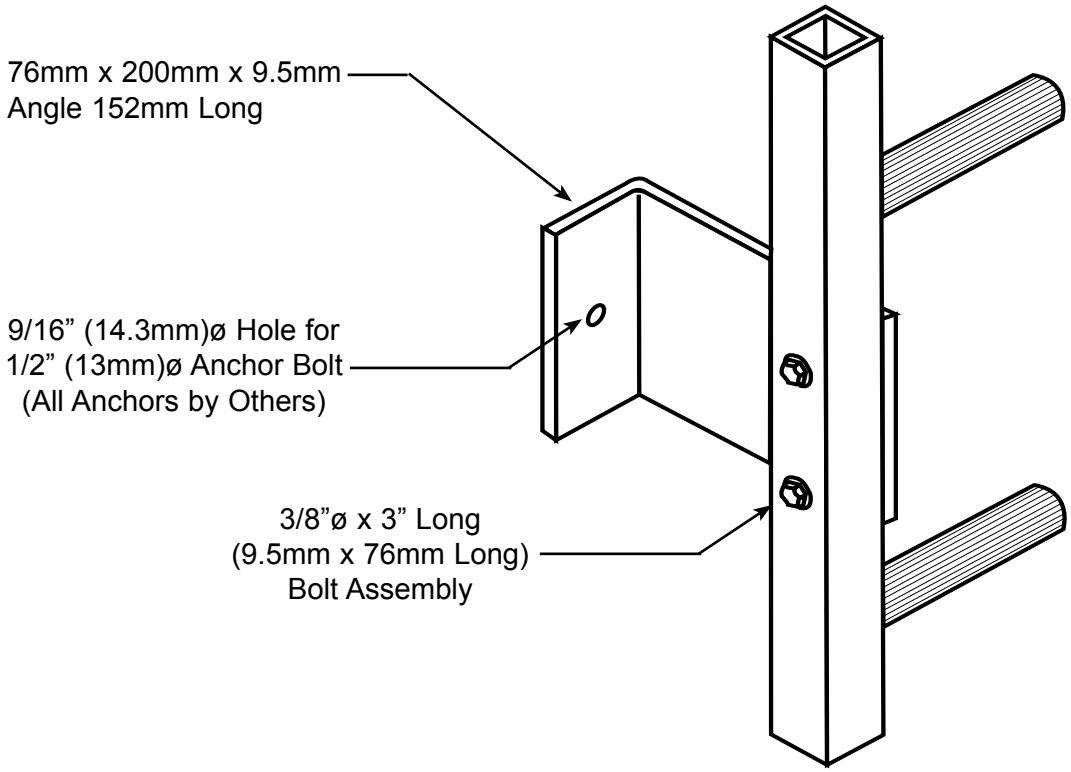
DRAWING M: STANCHION BASE



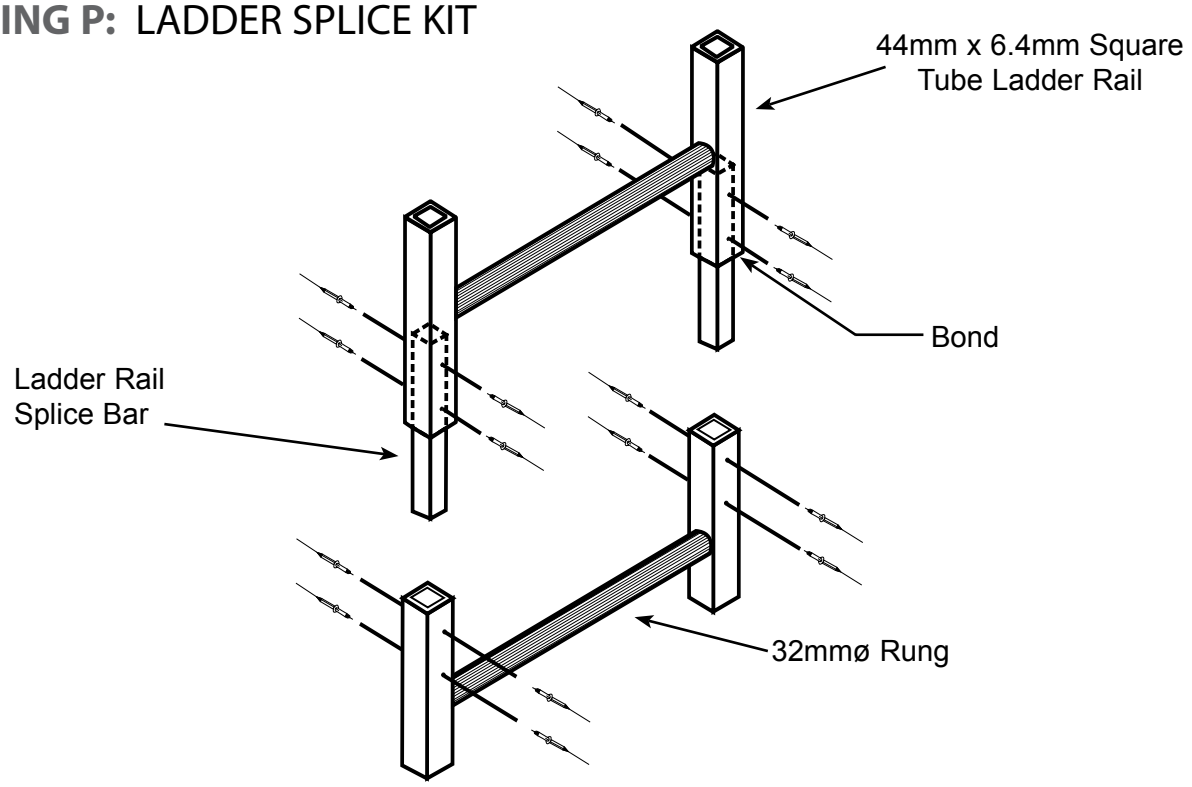
DRAWING N: LADDER FLOOR MOUNT KIT



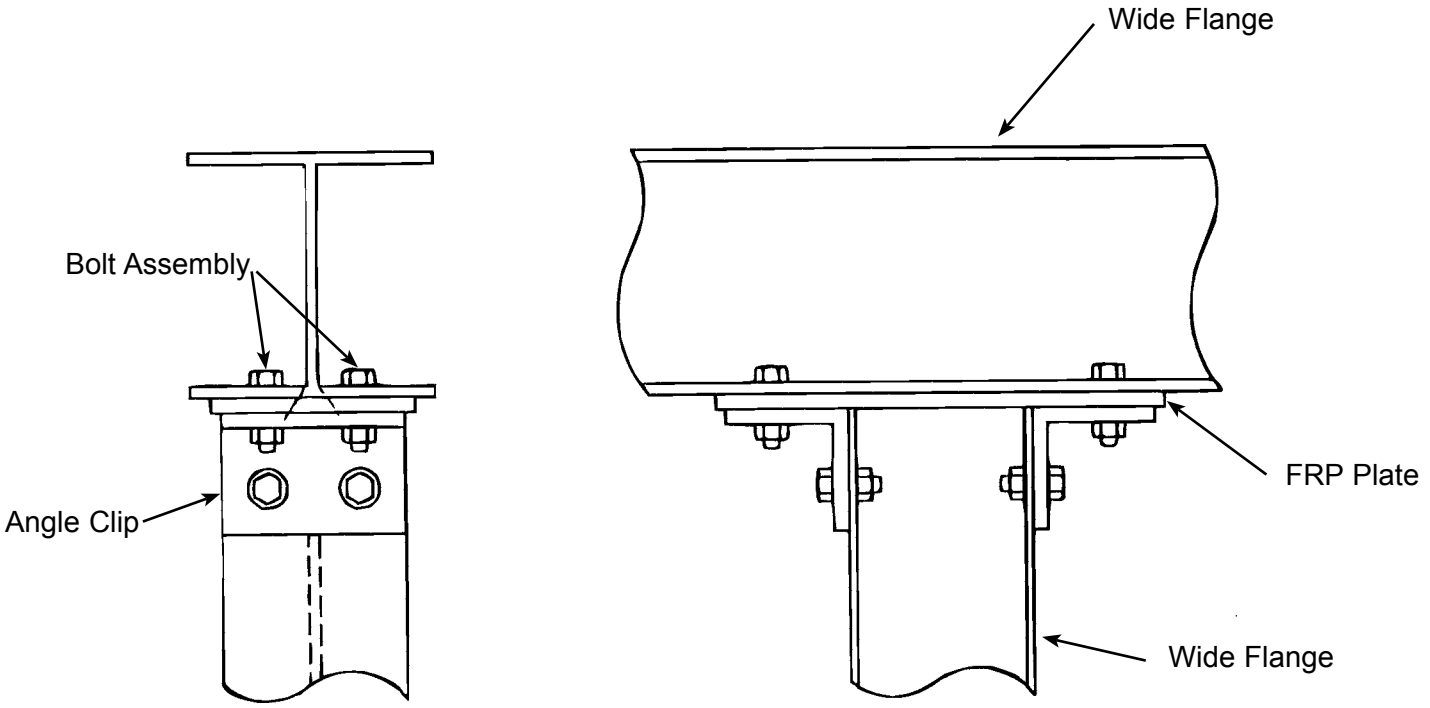
DRAWING O: LADDER WALL MOUNT KIT



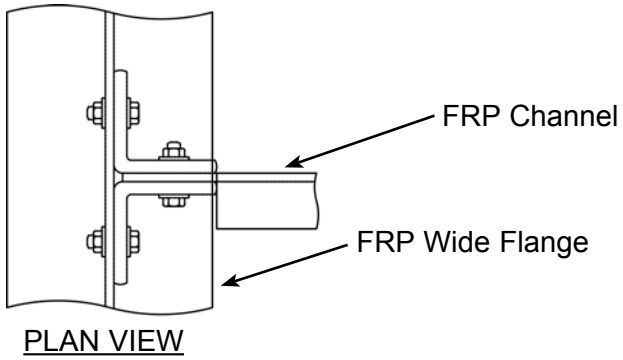
DRAWING P: LADDER SPLICE KIT

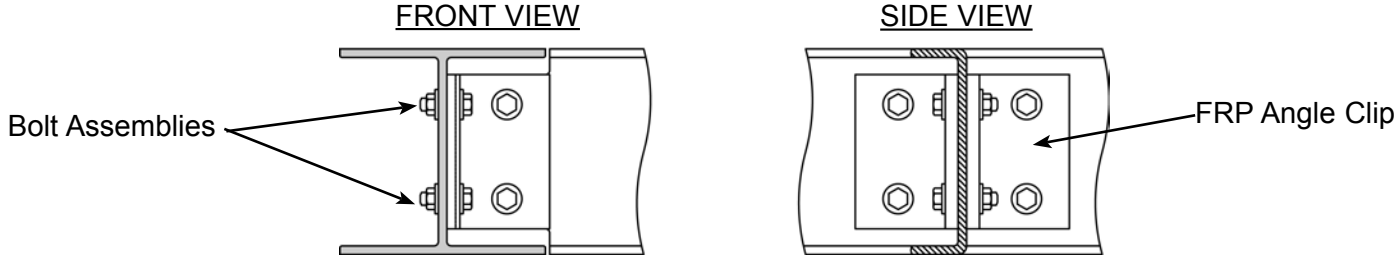


DRAWING Q: WIDE FLANGE COLUMN TOP

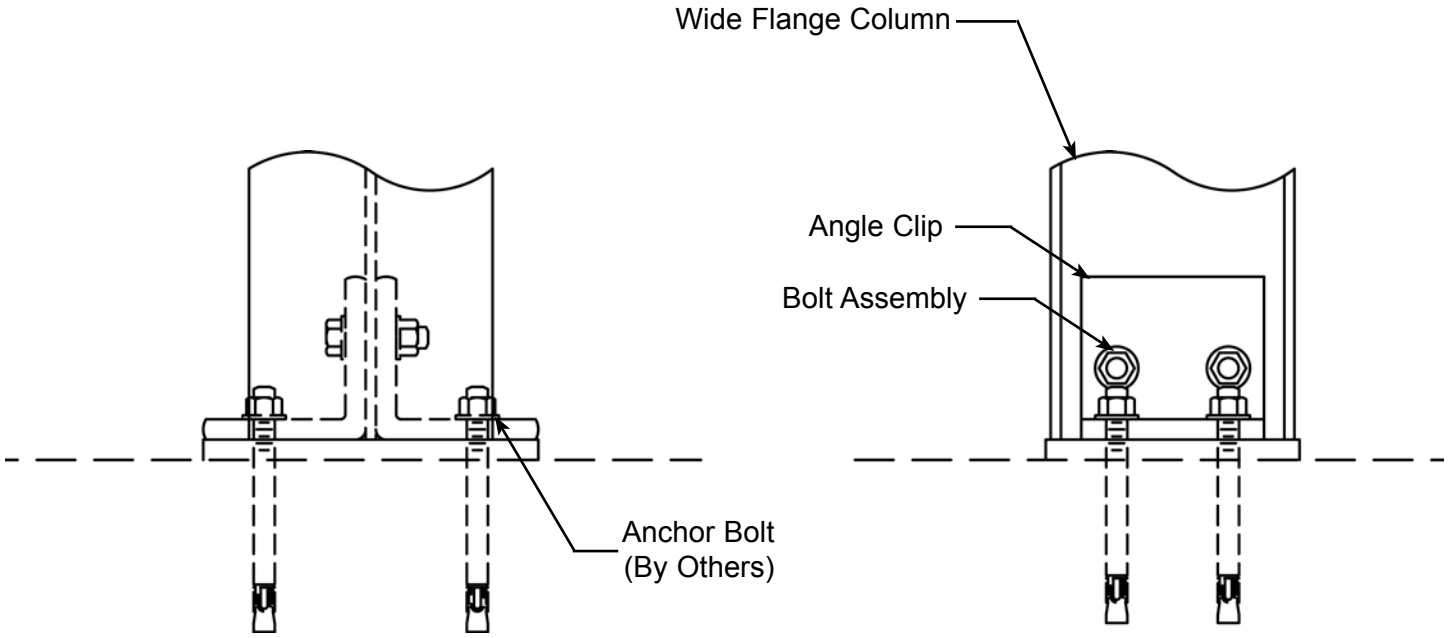


DRAWING R: WIDE FLANGE TO CHANNEL CONNECTION

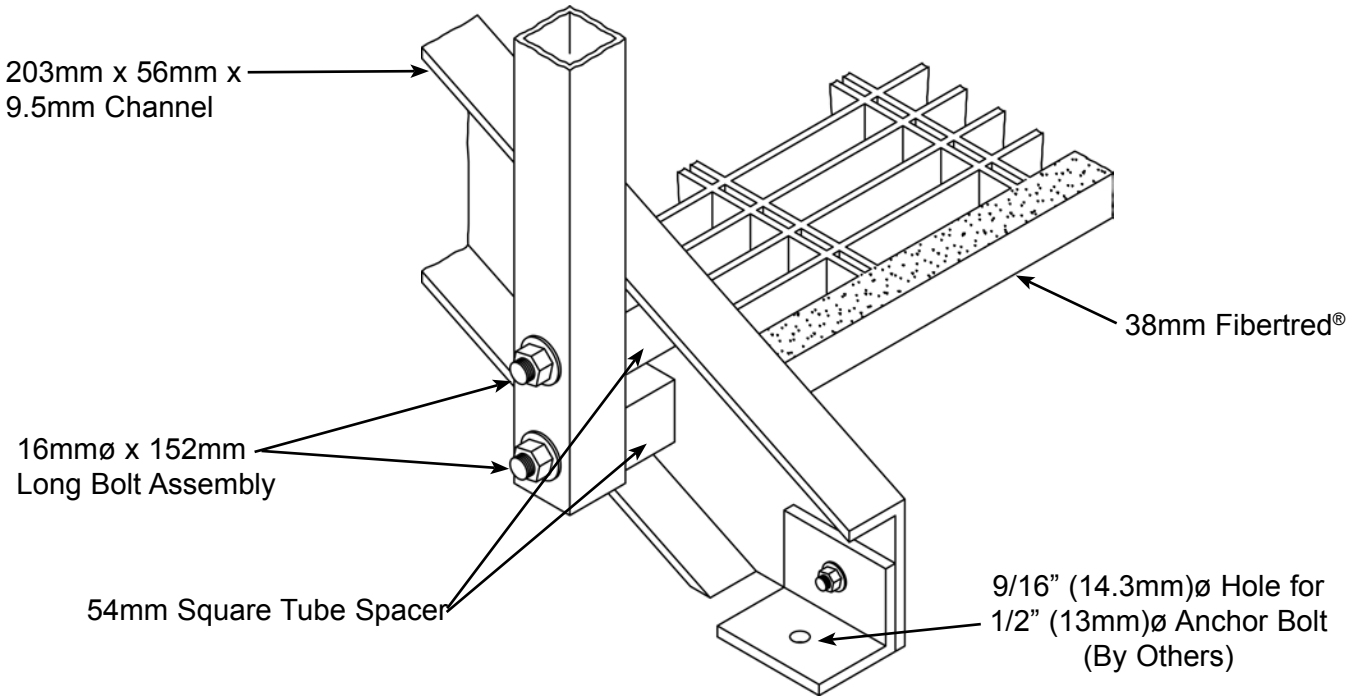




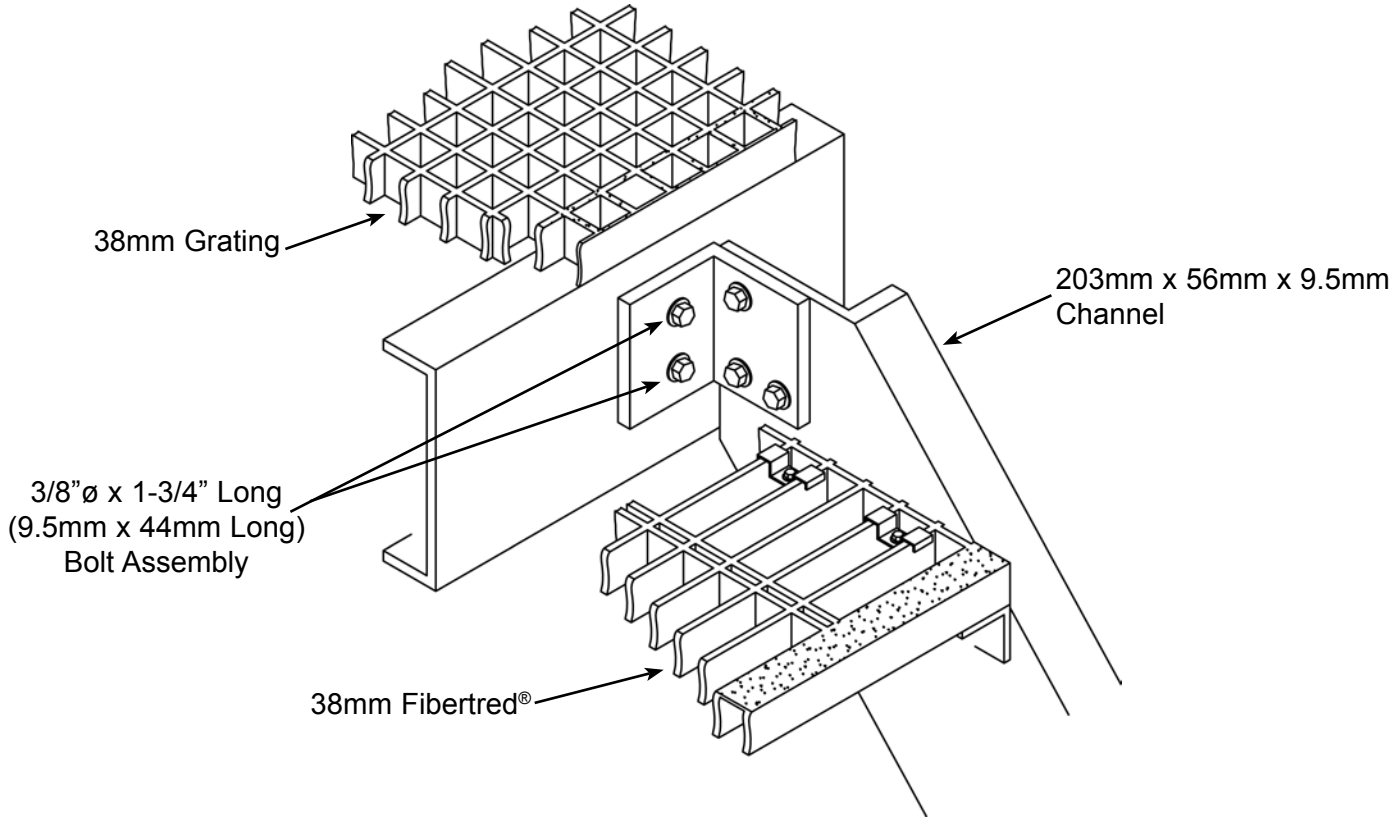
DRAWING S: WIDE FLANGE COLUMN BASE



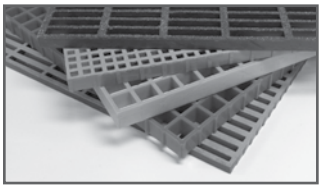
DRAWING T: BOTTOM STAIR STRINGER MOUNT



DRAWING U: TOP STAIR STRINGER MOUNT



Fibergrate Products & Services

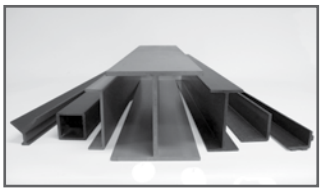


Fibergrate® Molded Grating

Fibergrate molded gratings are designed to provide the ultimate in reliable performance, even in the most demanding conditions. Fibergrate offers the widest selection in the market with multiple resins and more than twenty grating configurations available in many panel sizes and surfaces.

Safe-T-Span® Pultruded Industrial and Pedestrian Gratings

Combining corrosion resistance, long-life and low maintenance, Safe-T-Span® provides unidirectional strength for industrial and pedestrian pultruded grating applications.

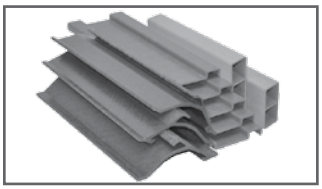


Dynaform® Structural Shapes

Fibergrate offers a wide range of standard Dynaform pultruded structural profiles for industrial and commercial use, including I-beams, wide flange beams, round and square tubes, bars, rods, channels, leg angles and plate.

Dynarail® & DynaRound™ Guardrail, Handrail & Ladder

Easily assembled from durable components or engineered and prefabricated to your specifications, Dynarail square tube and DynaRound round tube railing systems and Dynarail safety ladder systems meet or exceed OSHA and strict building code requirements for safety and design.



Custom Composite Solutions

Combining Fibergrate's design, manufacturing and fabrication services allows Fibergrate to offer custom composite solutions to meet our client's specific requirements. Either through unique pultruded profiles or custom open molding, Fibergrate can help bring your vision to reality.

Design & Fabrication Services

Combining engineering expertise with an understanding of fiberglass applications, Fibergrate provides turnkey design and fabrication of fiberglass structures, including platforms, catwalks, stairways, railings and equipment support structures.

Worldwide Sales & Distribution Network

Whether a customer requires a platform in a mine in South Africa to grating on an oil rig in the North Sea, or walkways in a Wisconsin cheese plant to railing at a water treatment facility in Brazil; Fibergrate has sales and service locations throughout the world to meet the needs and exceed the expectations of any customer.

[Heavy Metal] SAFE
Arsenic Barium Cadmium Chromium Lead Mercury Nickel Selenium Silver

QUALITY CERTIFIED ISO 9001-2008 FACILITIES

Fibergrate Composite Structures

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