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1.0 Subject

Guardrail Systems

- fiberon*[®] *Horizon Deluxe*
- fiberon*[®] *Horizon Flat*
- fiberon*[®] *Horizon Mission*
- fiberon*[®] *Horizon Provincial*
- fiberon*[®] *Horizon Regency*
- Severe Weather Plus Deluxe*
- Severe Weather Plus Flat*
- fiberon*[®] *Professional Washington*
- Portico*[™]

2.0 Research Scope

2.1. Building codes

- 2003 & 2006 International Building Code (IBC)
- 2003 & 2006 International Residential Code (IRC)
- Products and Recognized Codes are summarized in Table 1.

2.2. Properties

- Structural Performance
- Durability
- Surface Burning
- Decay Resistance
- Termite Resistance

3.0 Description

3.1. General – The Fiber Composites, LLC guardrail products identified in Section 1.0 are guards under the definitions of the referenced codes. They are intended for use at or near the open sides of elevated walking areas of buildings and walkways as required by the referenced codes.

3.2. Guard systems include top and bottom rails, vertical balusters, posts, rail-to-post brackets, post mounting brackets, crush blocks, decorative moldings and post caps.

3.2.1. Level guards with heights of 36 inches and/or 42 inches above the floor surface are provided in lengths up to 8 feet (96-inches). See Table 1.

3.2.2. Stair guards are provided in lengths up to 8 feet (96-inches). See Table 1.

4.0 Materials and Processes

Two different material classifications and processes are utilized and identified as HDPE systems and PVC systems.

4.1. HDPE (high density polyethylene) systems consist of rails, balusters and post sleeves manufactured from an extruded wood-plastic composite (WPC) material that is part polyethylene/polypropylene and part wood fiber.

4.1.1. HDPE Guardrail systems include: *fiberon*[®] *Professional Washington* and *Portico*[™]

4.1.2. HDPE Guardrail systems are produced in Gray, Redwood, Brown, Golden Cedar, and Cedar colors.

4.1.3. Rails and balusters are manufactured from extruded HDPE rectangular stock and then cut and milled to finished shapes. HDPE Post sleeves are extruded directly in the finished profile.

4.2. PVC (Poly Vinyl Chloride) systems consist of rails, balusters structural posts and post sleeves manufactured from an extruded wood-plastic composite (WPC) material that is part PVC and part wood fiber with a PVC cap stock applied by a co-extrusion process. Some balusters and post sleeves utilized in the PVC systems are extruded PVC. PVC spindles are injection molded.

4.2.1. PVC Guardrail systems include the *fiberon*[®] *Horizon* series and the *Severe Weather Plus* series.

4.2.2. PVC Guardrail systems are produced in White, Almond, and Gray colors.

5.0 Assembly

5.1. HDPE Guardrail systems – *fiberon*[®] *Professional Washington* and *Portico*[™]:



5.1.1. Guard assemblies consist of a two-part top rail (upper sub-rail and top rail), a single bottom rail and solid balusters mechanically fastened to the top and bottom rails. See Table 2 for fastening.

5.1.2. Railing systems include a bottom rail intermediate support located beneath the bottom rail every 32 inches or less. Support blocks are short pieces of baluster fastened to the bottom rail.

5.1.3. Non-structural 4 inch by 4 inch HDPE post sleeves are available for installation over a conventional 4x4 wood post.

5.1.4. The level top rail assembly and the level bottom rail are attached to sleeved 4x4 wood posts using an "L" shaped steel bracket at each of the four (4) rail-to-post connection points. See Table 4 for bracket fastening and Figure 6 for bracket details.

5.1.5. The stair top rail assembly and the stair bottom rail are attached to sleeved 4x4 wood posts with a hinged bracket at each of the four (4) rail-to-post connection points. See Table 4 for bracket fastening and Figure 6 for bracket details.

5.1.6. A non-structural decorative HDPE post cap and cove molding cap can be assembled over the upper end of the sleeve covered post and around its base.

5.2. PVC Composite Guardrail Systems - *fiberon*[®] *Horizon Deluxe, Flat, Mission, Provincial and Regency and, Severe Weather Plus Deluxe and Flat*

5.2.1. The top rail in each of the PVC systems consists of a single co-extruded PVC/Wood composite with PVC capstock section. All top rails have pre-routed holes of installation of balusters.

5.2.2. The bottom rail in each of the PVC systems consists of a single co-extruded PVC/Wood composite with PVC capstock section. Bottom rails have either pre-routed for baluster installation or pre-cut slotted holes for installation of baluster dagger inserts. See Table 2 for additional details.

5.2.3. PVC Guardrail systems have three baluster options:

1. 1-1/4 inch square co-extruded PVC-Wood composite picket w/PVC cap stock.

2. 1-1/4 inch square extruded PVC picket.

3. 1-1/4 inch injection molded PVC Colonial spindles.

See Table 2 for additional baluster information and Figure 4 for details.

5.2.4. Supports – PVC Railing systems can be attached to conventional wood supports or a structural WPC post with railing system allowable heights in accordance with Table 3.

5.2.4.1. Non-structural PVC or WPC post sleeves can be utilized as a cladding over conventional 4x4 wood posts.

5.2.4.2. Structural WPC posts are supported by a *fiberon*[®] Post Mount system for surface mount installations or can be installed in a wood deck with steel joist-mount brackets ("Standard Mount" or "Pro Mount").

5.2.4.3. "Standard Mount" brackets are manufactured from 14 gauge galvanized steel and are limited to use with 36 inch height railing systems.

5.2.4.4. "Pro Mount" brackets are manufactured from 11 gauge galvanized steel and may be used with railing system heights up to 42 inches.

5.2.5. Level railing systems include a bottom rail intermediate support ("Crush Block") located beneath the rail at mid-span. The crush block is a 3 inch long section of WPC "Flat" rail or WPC square picket or PVC picket. The Crush Block is secured to the bottom rail with water resistant PVC adhesive.

6.0 Performance Characteristics

6.1. The *Fiber Composite, Inc.* guard systems described in this report have demonstrated the capacity to resist the design loadings specified in Chapter 16 of the IBC, and Section R301 of IRC, when tested in accordance with ICC-ES AC174.

6.2. Structural performance has been demonstrated for a temperature range from -20°F to 125°F.

6.3. Materials used are deemed equivalent to preservative treated or naturally durable wood for resistance to weathering effects, decay, and attack from termites.



6.4. The referenced criteria within AC174, requires a flame spread index not exceeding 200 when tested in accordance with ASTM E84. Materials utilized in the referenced guard assembly components have a flame spread indexes as follows;

The HDPE material has flame spread index of 115 when tested according to ASTM E84.

The PVC/wood composite material with co-extruded PVC capstock has a flame spread index of 35 when tested according to ASTM E84.

The PVC material has a flame spread index of 45 when tested according to ASTM E84.

7.0 Installation

Installation shall be in accordance with the manufacturer's installation instructions and this report. Where differences occur between this report and the manufacturer's installation instructions, this report shall govern.

7.1. Assembly of railing systems (rails and balusters) shall be in accordance with Table 2.

7.2. Attachment of railing systems to supports shall be in accordance with Table 4 using connector brackets shown in Figures 6 - 9.

7.3. Railing systems may be attached to conventional wood posts or other suitable wood support structure. Wood in the supporting structure shall have a specific gravity of 0.50 or greater (Southern Yellow Pine or better) and a minimum thickness to allow full penetration of the bracket mounting screws. Conventional wood posts or other wood supports are not within the scope of this report.

7.4. The *fiberon*[®] Post Mount may be mounted to a wood deck in accordance with the manufacturers installation instructions and Figure 12.

7.5. The *fiberon*[®] Post Mount may be mounted to concrete and/or steel with approved anchors. Post mount anchors used in concrete or steel installation are not within the scope of this report and are subject to evaluation and approval by the building official. Anchors must satisfy the design load requirements specified in Chapter 16 of the building code and must meet the following minimum requirements.

7.5.1. A minimum of four anchor bolts must be used and located in the four pre-drilled holes in the post base plate.

7.5.2. The anchors must be stainless steel, galvanized steel or other approved material compatible with the steel post mount system.

7.5.3. The anchors must have a minimum diameter equal to 5/16 inch.

7.5.4. Where required by the building official, engineering calculations and details shall be provided. The calculations shall verify that the anchorage complies with the building code for the type and condition of the supporting construction.

7.6. Joist-Mount post brackets are bolted to structural wood members (joists or headers) with four (4) 3/8 inch diameter bolts. The supporting structure (wood framing) is not within the scope of this report.

7.7. Post caps shall be installed over the exposed ends of WPC posts and sleeved 4x4 wood posts.

7.8. Crush Blocks shall be installed between the deck surface and the guardrail.

8.0 Supporting Evidence

8.1. Drawings and installation instructions submitted by the manufacturer.

8.2. The reports of testing and engineering analysis demonstrating compliance with the performance requirements of ICC-ES Acceptance Criteria for Deck Board Span ratings and Guardrail Systems (Guards and Handrails), AC174 effective March 1, 2007.

8.3. A quality control manual that is in accordance with the ICC-ES AC10, "Acceptance Criteria for Quality Documentation" effective March 1, 2007.

9.0 Conditions of Use

The guard assemblies identified in this report are deemed to comply with the intent of the provisions of the referenced building codes subject to the following conditions.

9.1. Guards are limited to exterior use in residential use groups R-3 and R-4 of the IBC or One- and Two-Family Dwellings (IRC). See Table 1.



9.2. Conventional wood supports and supporting structure for guards are not within the scope of this report and are subject to evaluation and approval by the building official. Supports must satisfy the design load requirements specified in Chapter 16 of the IBC and must provide suitable material for anchorage of the rail brackets. Where required by the building official, engineering calculations and details shall be provided.

9.3. Compatibility of fasteners, post mount brackets, and other metallic components with the supporting structure, including chemically treated wood, is not within the scope of this report.

9.4. The use of the referenced guard systems in handrail applications is outside the scope of this report.

9.5. Fiber Composites, LLC Guard Systems are manufactured in New London, North Carolina in accordance with the manufacturer's approved quality control system with inspections by PFS, Corp. (AA-652).

10.0 Identification

The composite guard assemblies produced by Fiber Composites, LLC identified in this report, shall be identified with labeling on the individual components or the packaging and include the following;

10.1. Name and/or trademark of the manufacturer and the manufacturers address.

10.2. Identifying mark of the independent inspection agency, PFS Corporation (AA-652).

10.3. ATI Code Compliance Research Report Number (CCRR-0112).

11.0 Code Compliance Research Report Use

11.1. Approval of building products and/or materials can only be granted by a building official having legal authority in the specific jurisdiction where approval is sought.

11.2. Code Compliance Research Reports shall not be used in any manner that implies an endorsement of the product by ATI.

11.3. Reference to the Architectural Testing internet web site address at www.archtest.com is recommended to ascertain the current version and status of this report.

Table 1 – Railing System Size and Code Recognition¹

Railing System	Code Recognition	
	IBC ²	IRC
fiberon® Professional Washington (HDPE)	N.A.	8' x 36" Level 8-ft. Stair
Portico™ (HDPE)	N.A.	8' x 36" Level 8-ft. Stair
Mission, Provincial and Regency	8' x 42" Level 8-ft. Stair	8' x 36" Level 8-ft. Stair
Deluxe	6' x 42" Level 6-ft. Stair	6' x 36" Level 6-ft. Stair
Flat ³	8' x 42" Level	8' x 36" Level

¹ Railing lengths are the maximum clear length between supports. Railing height is the minimum installed height from walking surface to top of top rail.

² Code recognition for the IBC is limited to Residential use groups R-3 and R-4

³ The Flat rail style is not provided in a stair rail configuration.



Table 2 – Railing System Descriptions

Railing System	Rail/Baluster Assembly	Balusters
<u>HDPE Systems:</u> fiberon® Professional Washington Portico™	Top sub-rail and bottom rail are attached to balusters with a single #10 by 1-3/4 inch pan-head wood screw in each end. Screws are inserted through predrilled holes in the upper and lower rails and into each end of the baluster. Double top rail members are fastened together with #10 by 1-3/8 inch screws spaced approx. 12 inches. Bottom rail is attached to intermediate support blocks with a single #10 by 1-3/4 inch screw.	1-1/4 inch square picket with beveled corners HDPE composite
<u>PVC Systems:</u> Mission Provincial	Balusters are inserted into top rail via pre-routed holes in the rail member. Balusters are attached to the bottom rail with molded plastic "Dagger" inserts. Dagger inserts are fitted into precut slotted holes in the upper surface of the bottom rail. The baluster is then pushed down over the dagger on the bottom rail.	1-1/4 inch square picket PVC/Wood Composite 1-1/4 inch Square Picket Extruded PVC
<u>PVC Systems:</u> Regency Deluxe Flat	Balusters are inserted into top and bottom rails via pre-routed holes in the rail member.	1-1/4 inch colonial spindle Injection molded PVC ¹

¹ PVC Spindles are used only in 36" height railing systems.

Table 3 – Post Mounting Information

Guard System	Post Mount System	Post	Max. Rail Height
<u>HDPE Systems</u> fiberon® Professional Washington Portico™	Conventional 4 inch by 4 inch wood posts (Southern Pine or Eq.)	4 inch by 4 inch HDPE post sleeve	36"
<u>PVC Systems</u> fiberon® Horizon and Severe Weather Plus Mission Provincial Regency Deluxe Flat	Conventional 4 inch by 4 inch wood posts (Southern Pine or Equiv.)	PVC Post Sleeve –or- PVC-Composite Post Sleeve	36"
	fiberon® Post Mount - Surface of wood deck -or- Concrete surface See Fig. 12	Structural PVC Composite Post	42"
	"Standard Mount" – Joist mount post bracket	Structural PVC Composite Post	36"
	"Pro Mount" – Joist mount post bracket	Structural PVC Composite Post	42"

Table 4 – Rail Bracket Fastening Schedule ¹

Rail – Bracket Combination		Bracket to Post	Bracket to Rail
<u>HDPE Systems:</u> fiberon® Professional Washington Portico™	In –line Bracket	<u>Top and Bot. Rail:</u> (4) #10 by 2 inch long screws.	Top Rail: (4) #10 by 1-3/8 inch long screws. Bot Rail: (4) #10 by 3/4 inch long screws
	Stair Bracket	<u>Top and Bot. Rail:</u> (4) #10 by 2 inch long screws.	Top Rail: (4) #10 by 1-3/8 inch long screws. Bot Rail: (4) #10 by 3/4 inch long screws
<u>PVC Systems:</u> Mission Provincial Regency	In –line Bracket	<u>Structural PVC Posts:</u> Top Rail: (2) #12 by 3/4 inch long screws Bot. Rail: (2) #10 by 3/4 inch long screws	<u>Top Rail:</u> (3) #12 by 3/4 inch long screws <u>Bot. Rail:</u> (3) #10 by 3/4 inch screws
		<u>Conventional 4x4 Wood Post (sleeved):</u> Top Rail: (2) #12 by 2 inch long screws Bot. Rail: (2) #10 by 2 inch long screws	
	Stair Bracket	<u>Structural PVC Posts:</u> Top and Bot. Rail: (2) #12 by 3/4 inch long screws	<u>Top and Bot. Rail:</u> (3) #12 by 3/4 inch long screws
		<u>Conventional 4x4 Wood Post (sleeved):</u> Top and Bot. Rail: (2) #12 by 2 inch long screws	
<u>PVC Systems:</u> Deluxe Flat ³	In –line Bracket	<u>Structural PVC Posts:</u> Top Rail: (2) #12 by 3/4 inch long screws Bot Rail: (2) #10 by 3/4 inch long screws	<u>Top Rail:</u> (2) #12 by 1-1/4 inch long screws Bot Rail: N/A
		<u>Conventional 4x4 Wood Post (sleeved):</u> Top Rail: (2) #12 by 2 inch long screws Bot Rail: (2) #10 by 2 inch long screws	
	Stair Bracket ²	<u>Structural PVC Posts:</u> Top and Bot Rail: (2) #12 by 3 inch long screws ²	N.A.
		<u>Conventional 4x4 Wood Post (sleeved):</u> Top and Bot Rail: (2) #12 by 3 inch long screws ²	N.A.

¹ All fasteners and metal brackets are stainless steel.

² Deluxe rail stair brackets must be field cut according to the slope of the stair for a flush fit to the supporting surface and must provide at least 1 inch of fastener penetration into wood supports or full thickness penetration in Structural PVC Posts. See Figure 18 and 19.

³ The *Flat* rail style is not provided in a stair rail configuration.

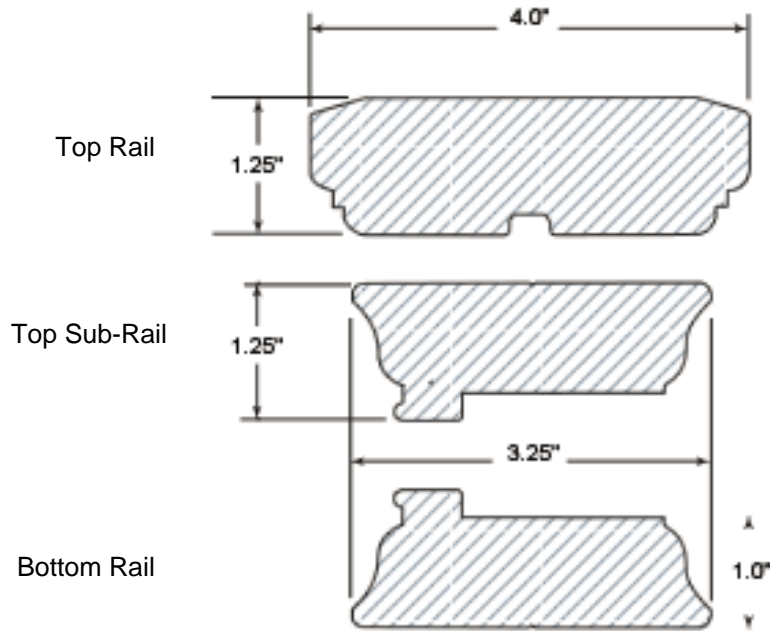


Figure 1 – Rail Profiles
fiberon[®] Professional Washington

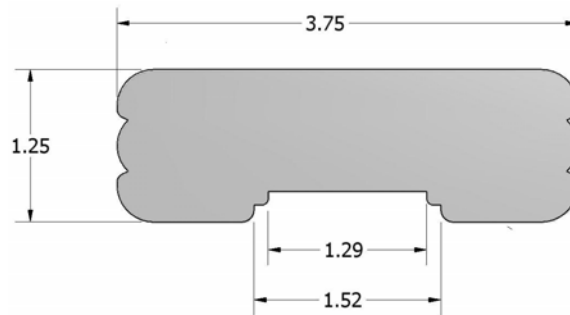
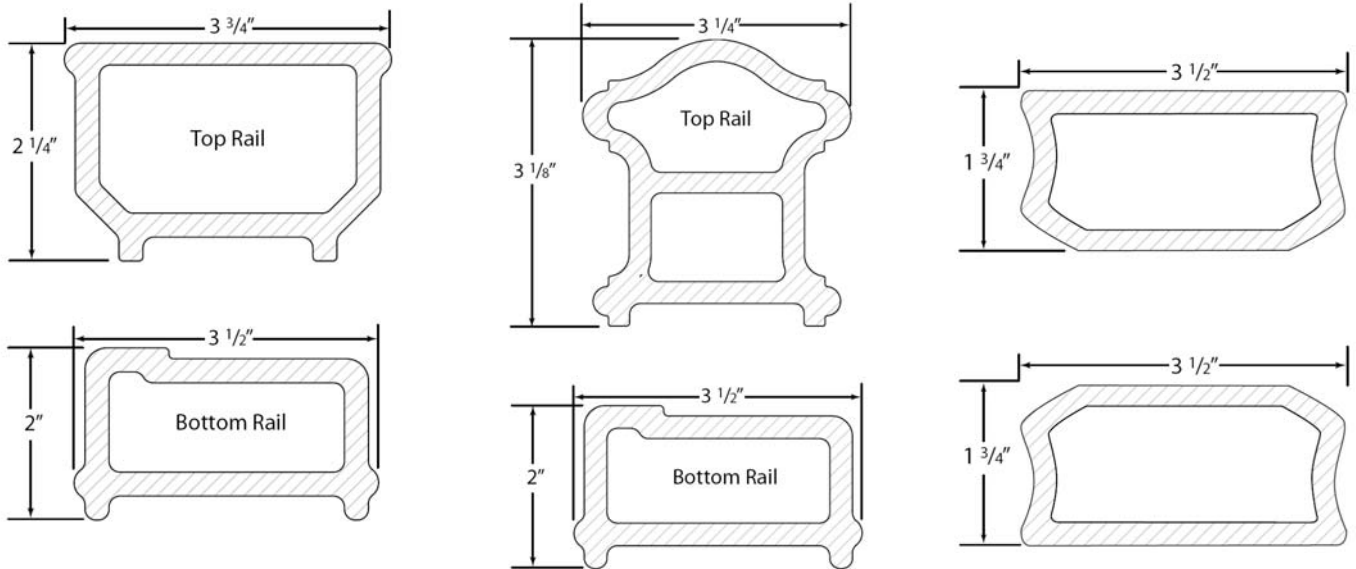


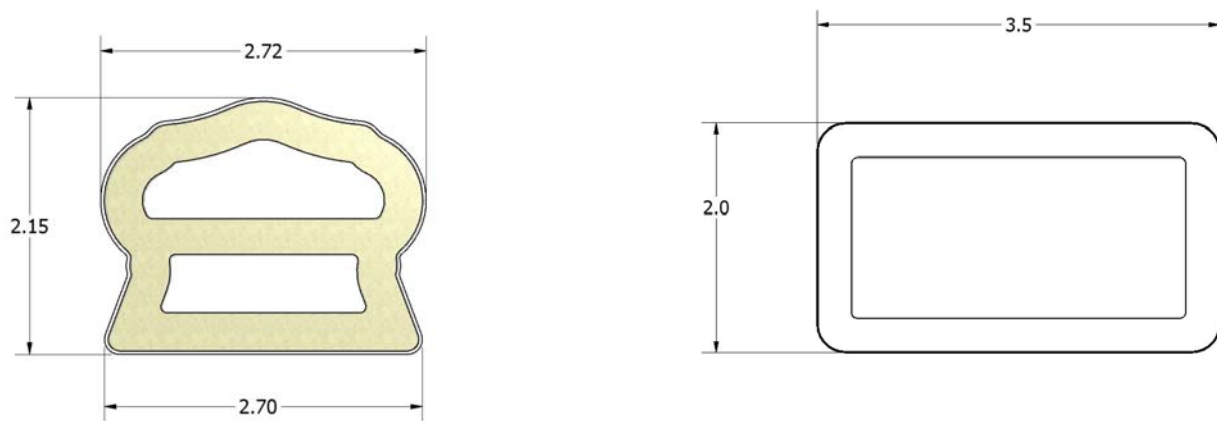
Figure 2 – Rail (Top, Sub and Bottom) Profiles
Portico[™]



Mission

Provincial

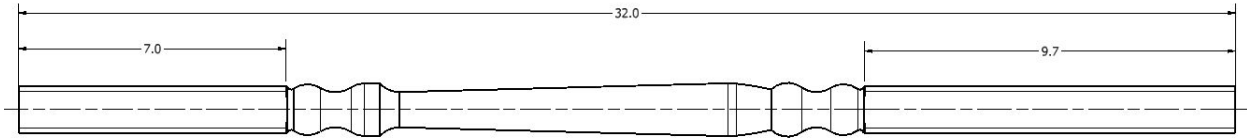
Regency



Deluxe

Flat

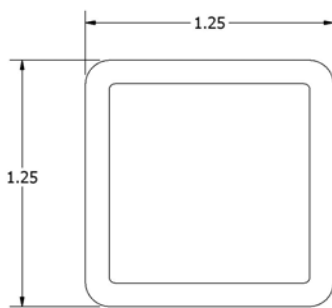
Figure 3 – Rail Profiles



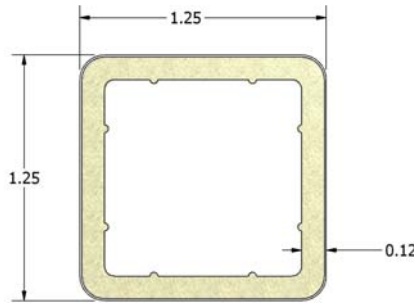
PVC Colonial Spindle

32" Length Shown (*Mission, Provincial, Deluxe and Flat*)

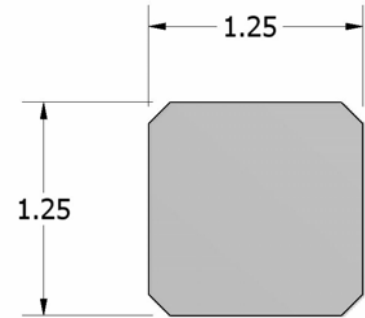
34" Length (*Regency*)



Square PVC extruded
Baluster
(0.08" Wall)

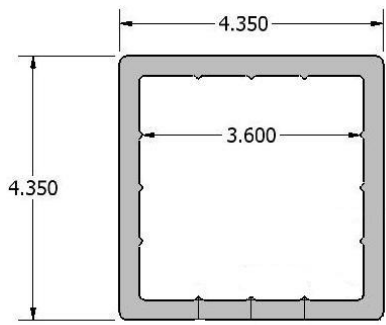


Square PVC/wood
composite Baluster
(0.125" Wall)

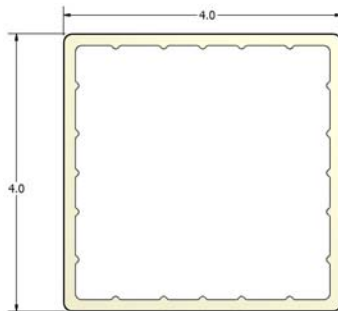


Square HDPE Baluster
(solid)

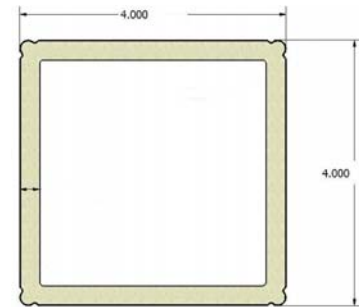
Figure 4 – Baluster Profiles



HDPE Post Sleeve
(0.325" Wall)



PVC Composite Post Sleeve
(0.175" Wall)



PVC Composite Post (Structural)
(0.30" Wall)

Figure 5 – Composite Posts and Sleeves

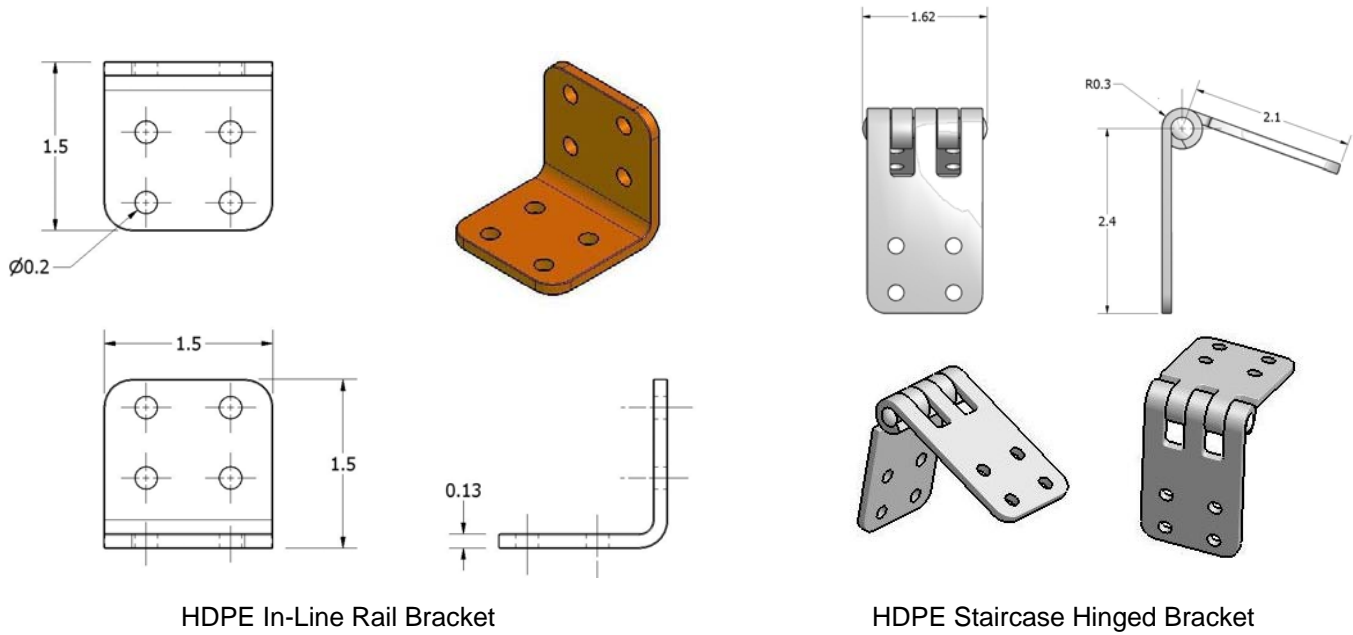


Figure 6 – Attachment Brackets for HDPE Systems

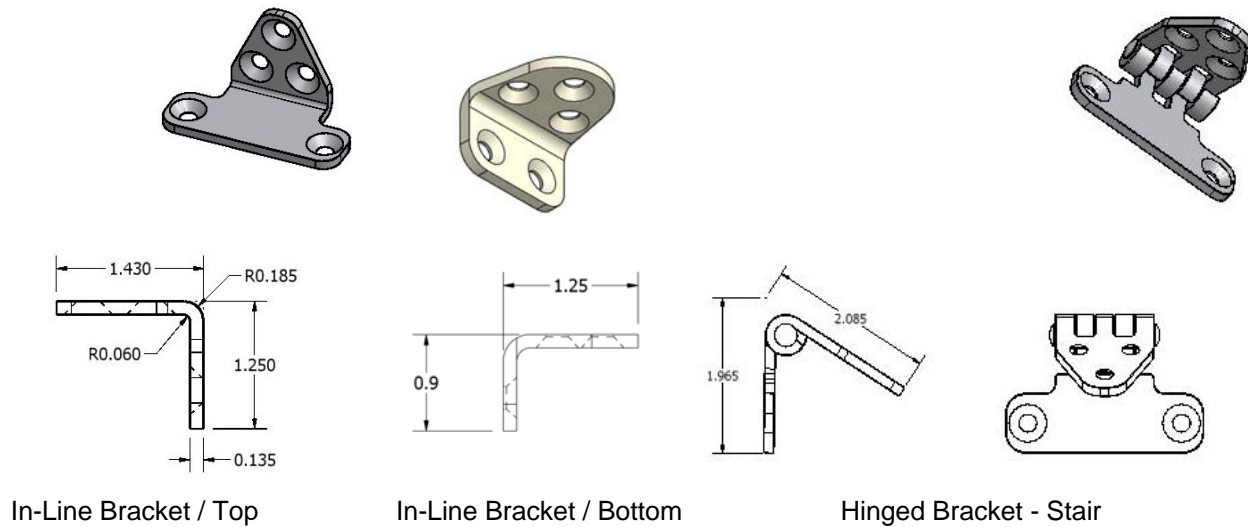
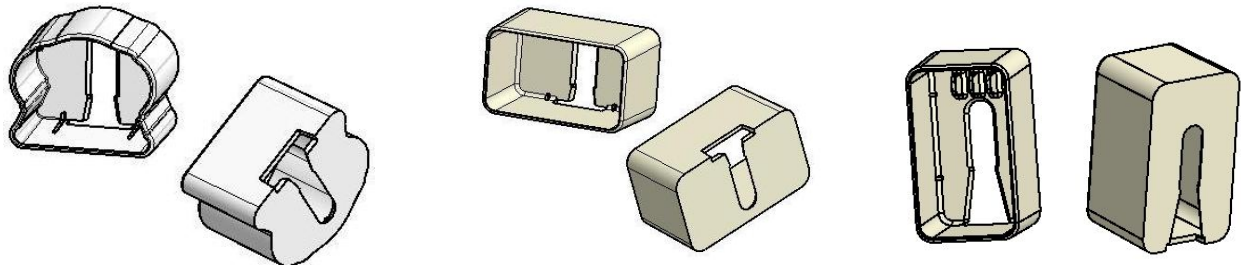


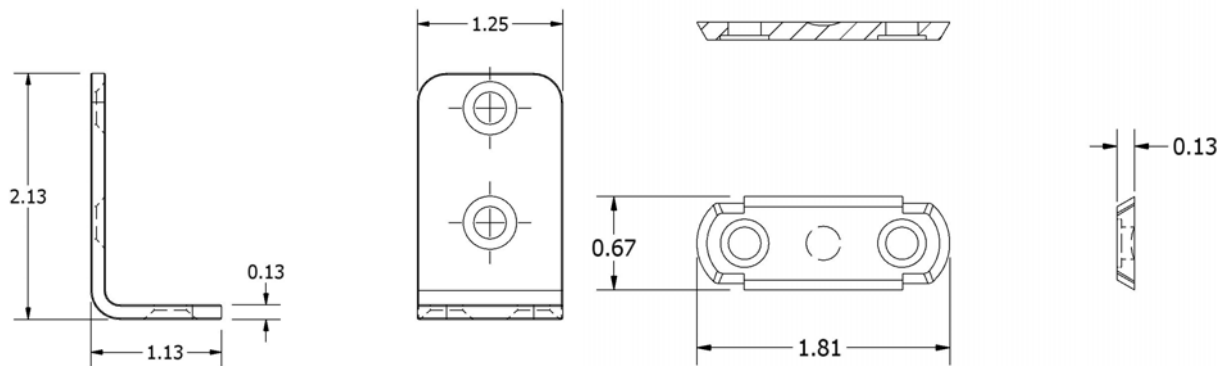
Figure 7 – Attachment Brackets for PVC Systems
 Mission, Provincial and Regency



Deluxe Top Rail
PVC Bracket

Flat Rail
PVC Bracket

Bottom Rail - Edge
PVC Bracket



Top Rail Stainless Steel L-Clip
(Deluxe and Flat Top Rail Brackets)

PVC Dovetail Clip
(Deluxe, Flat and Edge Brackets)

Figure 8 – Attachment Brackets for PVC Systems
Deluxe and Flat Level Rails

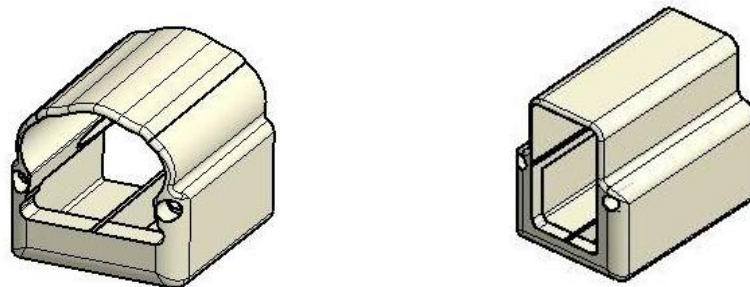


Figure 9 – Attachment Brackets for PVC Systems
Deluxe Stair Rails

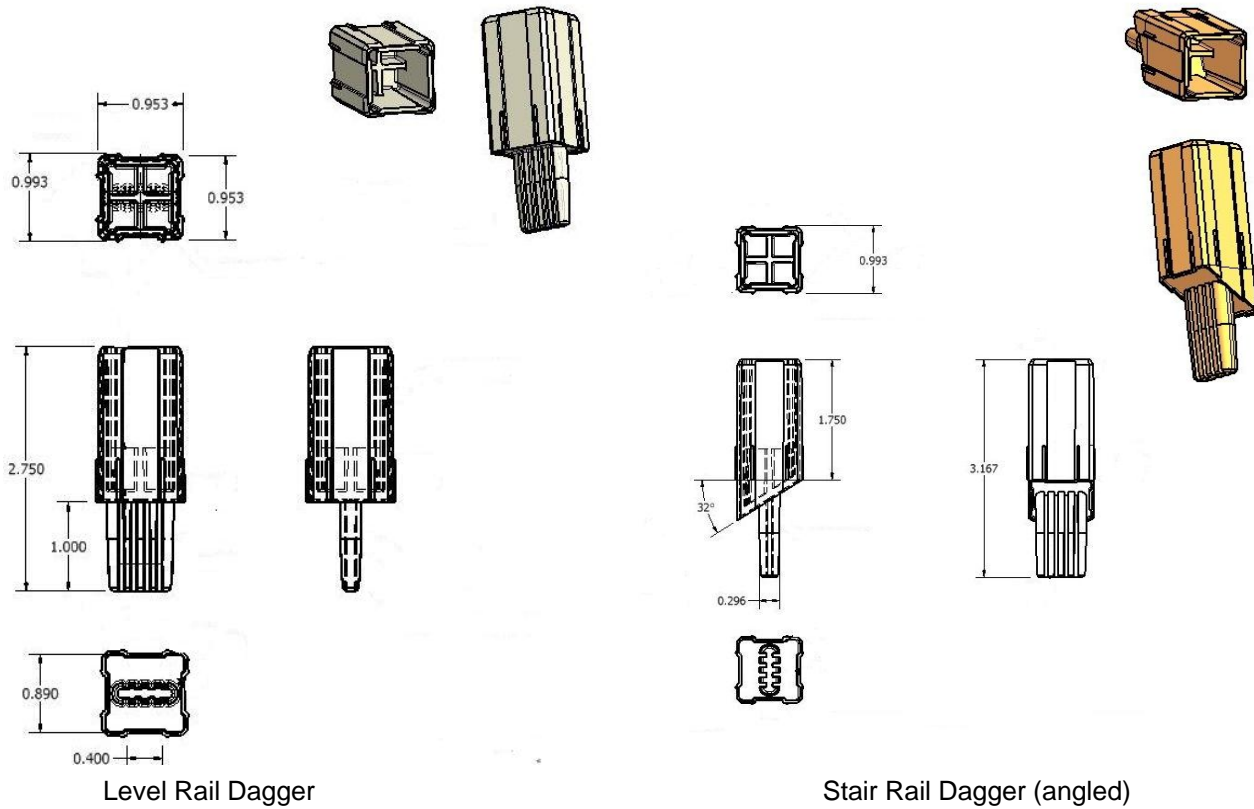


Figure 10 – Baluster Dagger Inserts
 Mission and Provincial baluster attachment to bottom rail

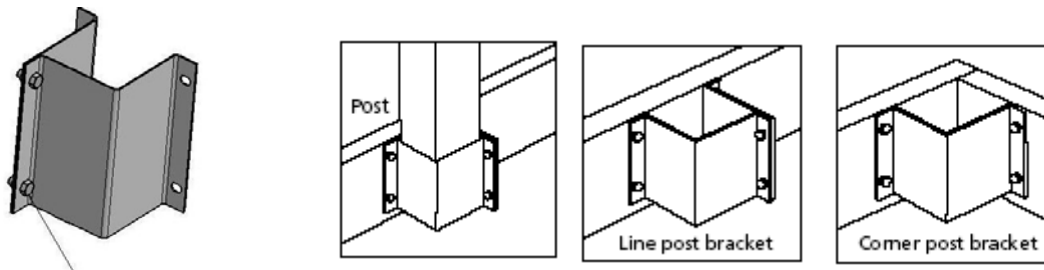


Figure 11 – Joist-Mount Brackets
 Standard Mount (14 gage steel)
 Pro Mount (11 gage steel)

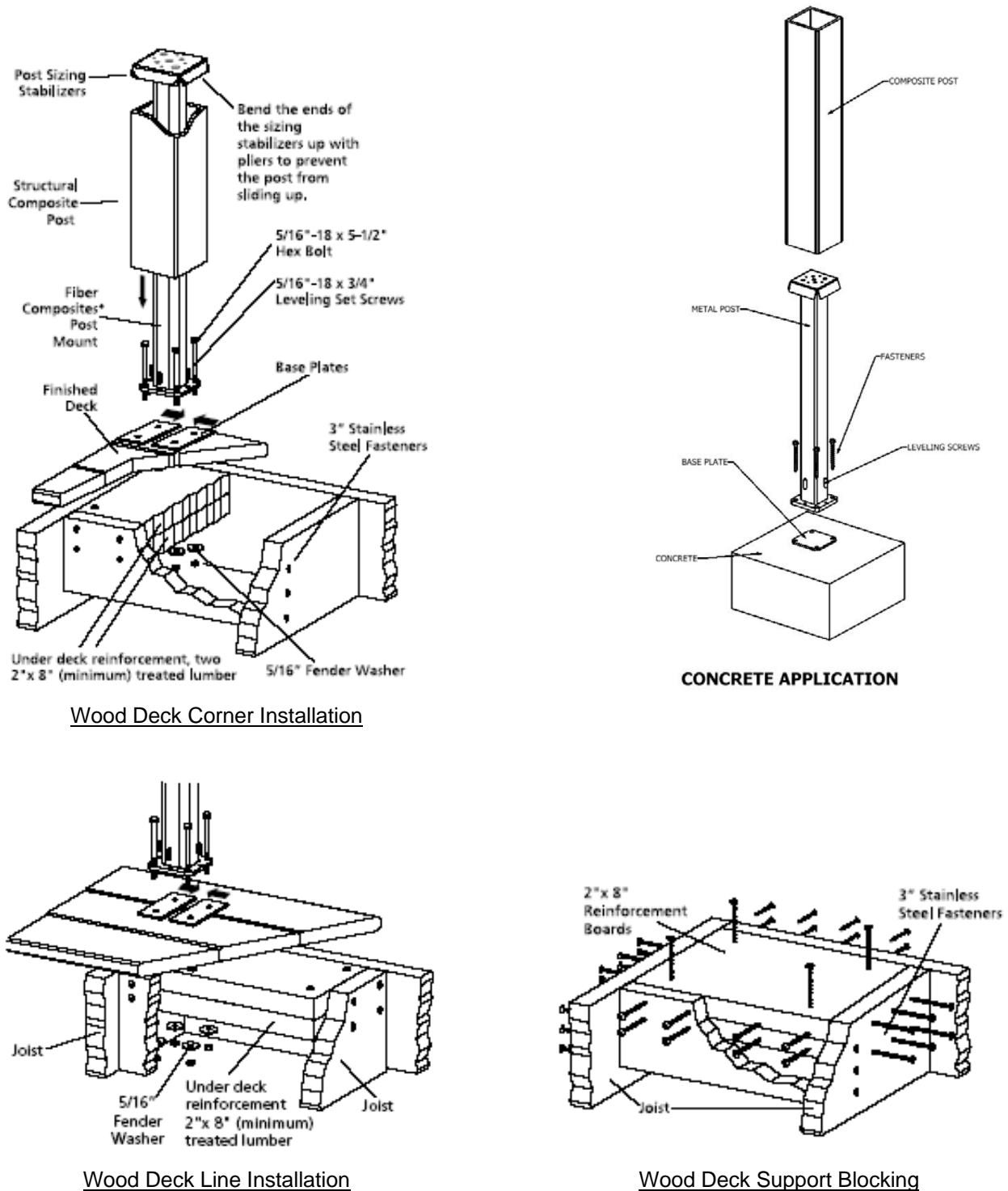


Figure 12 – fiberon® Post Mount

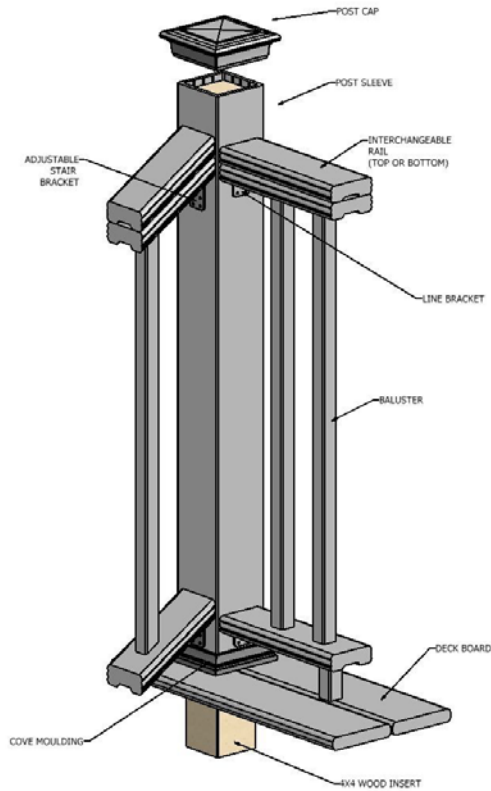


Figure 13 – Portico

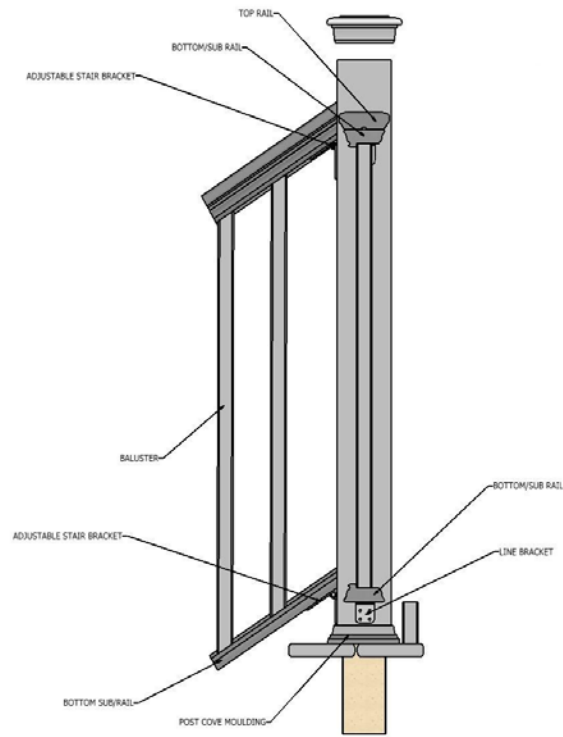


Figure 14 – Professional Washington

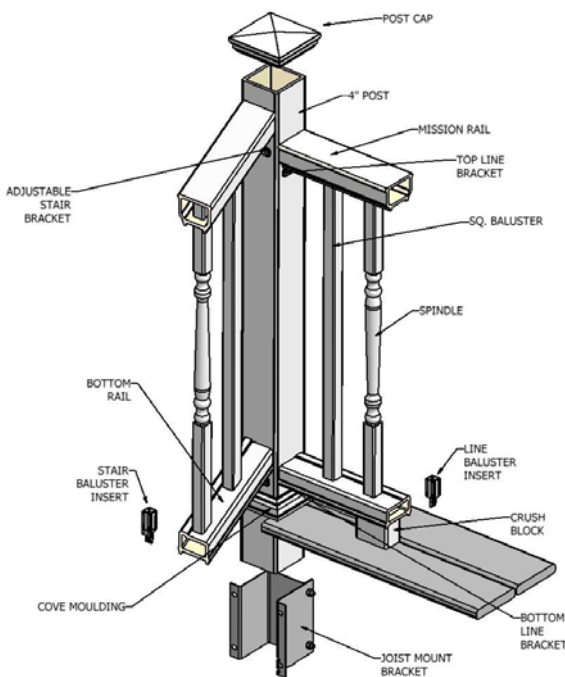


Figure 15 – Mission

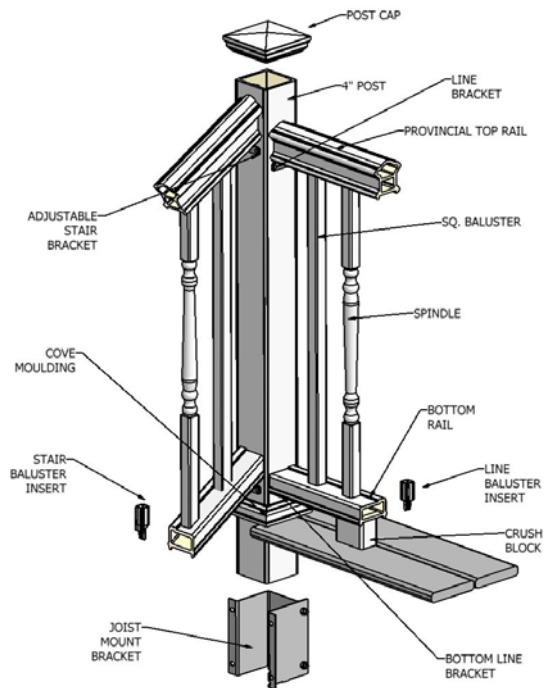


Figure 16 – Provincial

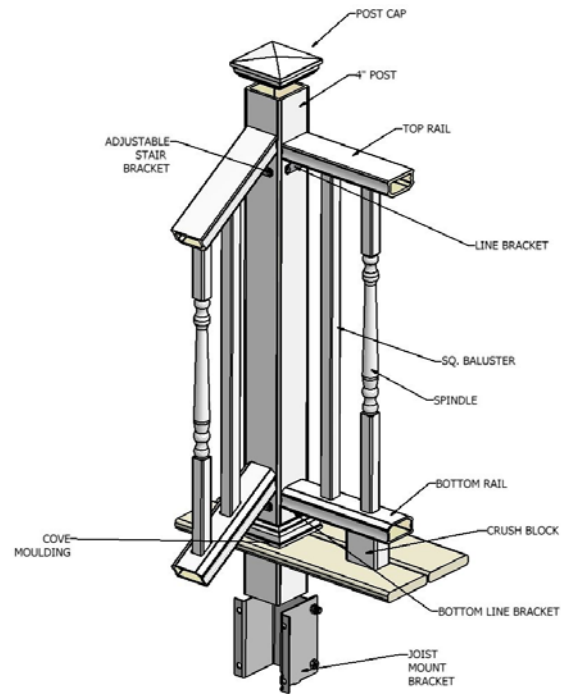


Figure 17 – Regency

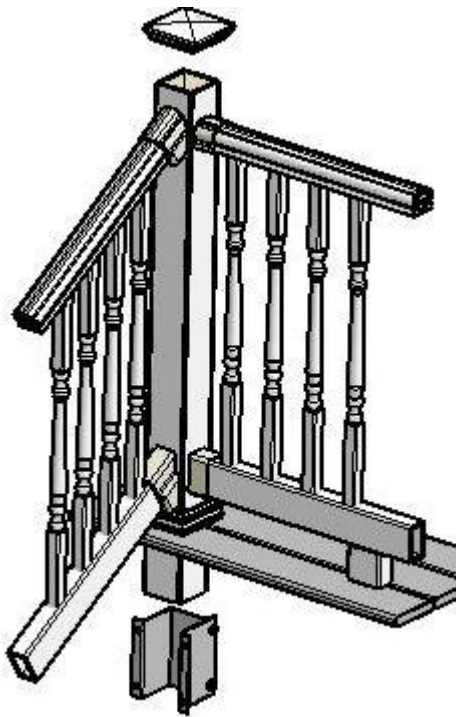


Figure 18 – Deluxe

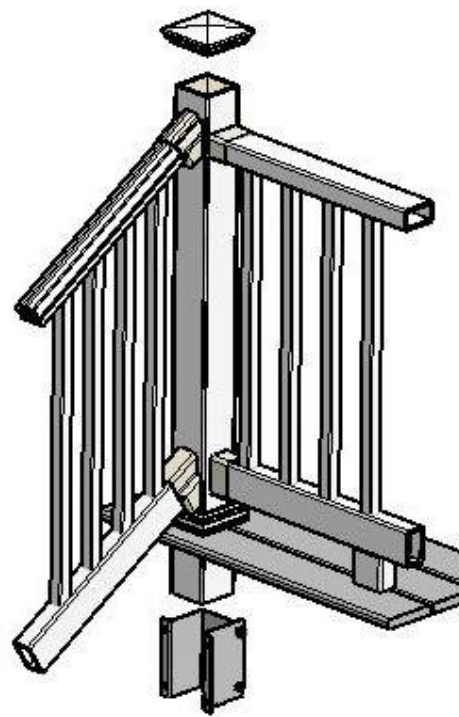


Figure 19 – Flat