

Code Compliance Research Report

CCRR-0194

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Page 1 of 12

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1.0 Subject

Marquee™ Railing System

2.0 Research Scope

2.1 Building Codes:

2009, 2012 International Building Code (IBC)

2009, 2012 International Residential Code (IRC)

2014 Florida Building Code (FBC), Building and Residential
(Excluding the High Velocity Hurricane Zone)

2.2 Properties:

Structural Performance

Durability

Surface Burning

Decay Resistance

Termite Resistance

3.0 Description

3.1 General – The *Marquee™ Railing System* is a guardrail or guard under the definitions of the referenced codes intended for use on elevated walking areas of buildings and walkways as required by the codes.

3.2 Guard Assemblies – Guard systems are provided as level guards for level walking areas such as decks, balconies and porches, and sloped guards for open sides of stairways. See Table 1 for qualified lengths and configurations.

3.2.1 Level guards are provided with rail lengths up to 91 inches in length (measured between the inside of support posts) and an installed height of up to 42 inches.

3.2.2 Stair guards are provided with rail lengths up to 68 inches in length (measured sloping length of rail between support posts) and an installed height of up to 42 inches.

3.3 Materials and Processes – The *Marquee™ Railing System* is an assemblage of co-extruded components utilizing Poly Vinyl Chloride (PVC) and Wood-Plastic Composite (WPC) materials. PVC components are provided in five colors: Burgundy Wood, Cappuccino, Dark Walnut, Shadow Grey, and White.

3.4 The guard system includes a top rail, a bottom rail, 1-1/4 inch hollow square balusters, 5 inch square post sleeves, metal brackets, decorative moldings, and post caps.

3.4.1 The top and bottom rails are co-extruded PVC with a PVC capstock, dimensions 3-3/8 inch wide and 1.8 inches tall. See Figure 1.

3.4.2 The infill area consists of 1-1/4 inch square, hollow, co-extruded PVC balusters with a PVC capstock. See Figure 2.

3.5 The *Marquee™ Railing System* is supported with 5" square PVC post sleeves installed over a *Marquee™* post mount (wood deck or concrete supporting structure) or conventional wood post. Code compliance assessment of conventional wood posts is not within the scope of this report. See Section 7, Conditions of Use, for further limitations.

3.5.1 *Marquee™* post sleeves utilize *Marquee™ Wood Post Spacers* when installed over conventional 4x4 wood posts. Spacers consist of PVC and are installed at both the top and bottom rail connections per the manufacturer's installation instructions. See Figure 5.

3.5.2 The *Marquee™* post mount system is comprised of a 2" square steel tube welded to a 0.650" thick base plate for anchorage. Two molded PVC spacer/mounting (guide) blocks provide for attachment of rail brackets.

3.5.2.1 For attachment of the *Marquee™* post mount system to wood composite decking systems, additional components are provided and includes a steel leveling plate, a steel back plate and hardware. See Figure 9.

3.5.2.2 For attachment of the *Marquee™* post mount system to concrete, the system is provided with an additional 5 1/2" square, 0.551" thick steel surface plate, 3/8" diameter stainless steel

anchor rods and associated hardware. See Figure 6 thru 8.

4.0 Performance Characteristics

4.1 The *Marquee™ Railing System* described in this report has demonstrated the capacity to resist the design loads specified in Chapter 16 of the IBC and Section R301 of the IRC when tested in accordance with ICC-ES AC174 and ASTM D 7032.

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

4.3 Materials used to produce the *Marquee™ Railing System* are deemed equivalent to preservative treated or naturally durable wood for resistance to weathering effects, decay, and attack from termites, including Formosan termites.

4.4 The *Marquee™* concrete post mount system and adhesive anchor design was evaluated in accordance with AC174 Section 5.1 and ACI 318-11, respectively.

4.5 PVC materials used have a flame spread index less than 200 when tested in accordance with ASTM E 84.

5.0 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.

5.1 The top and bottom rails are attached to structural supports utilizing metal brackets shown in Figure 4.

5.1.1 See Table 2 for fastening schedule.

5.1.2 Rail brackets for stair and straight level railing systems are attached to the bottom surface of the top and bottom rails. Rail brackets for 45 degree level railing systems are attached to the top or bottom surface of the top rails and bottom surface of the bottom rails.

5.2 Railing assemblies consist of top and bottom rails with pre-routed holes to receive balusters.

5.3 The *Marquee™* concrete post mount system must be installed in accordance with the post mount instructions for concrete application supplied by the manufacturer, within the

limitations outlined in Section 7.0 of this CCRR and the requirements of the adhesive anchoring systems evaluation reports. See Table 3 and, Figure 6 and Figure 7.

5.3.1 Special installation instructions are outlined in Section 7.6.

6.0 Supporting Evidence

6.1 Manufacturer's drawings and installation instructions.

6.2 Reports of testing demonstrating compliance with ICC-ES AC174, Acceptance Criteria for Deck Board Span Ratings and Guardrail Systems (Guards and Handrails), approved January 2012.

6.3 Reports of testing and engineering analysis demonstrating compliance with the performance requirements of ASTM D 7032-08, Standard Specification for Establishing Performance Ratings for Wood-Plastic Composite Deck Boards and Guardrail Systems (Guards or Handrails).

6.4 Within the scope of this report, the following versions of referenced standards are deemed equivalent.

Standard	Version(s)	
ASTM D7032	07	08
ASTM E84	07	09

6.5 Quality control manual in accordance with ICC-ES AC10, Acceptance Criteria for Quality Documentation, dated June 2014.

7.0 Conditions of Use

The guardrail 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:

7.1 Guardrail systems recognized in this report shall be limited to exterior use in all construction types where wood is permitted in accordance with Section 1406.3 of the IBC and FBC and in One- and Two-Family Dwellings regulated by the IRC. 36-inch high guards are further limited to use in One- and Two-Family Dwellings (IRC).

7.2 Conventional wood supports for guards, including posts, 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 FBC and must provide suitable material for anchorage of the rail brackets. Where required by the building official, engineering calculations and details shall be provided.

7.3 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. Compatibility of the supporting construction materials with all fasteners, metal post mount components, and other hardware components are subject to approval by the code official.

7.4 Only those types of fasteners and fastening methods described in this report have been evaluated for the installation of the *Marquee™ Railing System*; other methods of attachment are outside the scope of this report.

7.5 For wood composite decking systems, anchors and anchoring systems for use with the *Marquee™* post mount system 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 anchor bolts must have a minimum diameter of 3/8" and utilize flat washers. The type and length of the anchor bolts is dependent upon the material and condition of the supporting structure and is not within the scope of this report.

7.5.4 When the supporting structure is a wood framed deck, installation must include anchorage to suitable structural framing. Decking is not considered structural framing and anchorage to decking alone is not an approved installation method.

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

7.6 For installations utilizing the *Marquee™* concrete post mount system, the following conditions must be met in order to be within the scope of this report.

7.6.1 Installation of the concrete post mount system requires the use of Hilti HIT-RE 500-SD, Simpson Strong Tie Set-XP or the Simpson Strong Tie AT-XP Adhesive Anchoring System as described in their respective evaluation report.

Adhesive Anchor System	Evaluation Report
Hilti HIT-RE 500-SD	ICC-ES ESR-2322
Simpson Strong Tie Set-XP	ICC-ES ESR-2508
Simpson Strong Tie AT-XP	IAPMO UES ER-263

7.6.2 The recognition of the adhesive anchoring systems as an approved element of the *Marquee™* Concrete Post Mount installation is contingent on maintaining the relevant evaluation report listed in the table above.

7.6.3 Installation of adhesive anchors must comply with the conditions of use in the respective evaluation report, unless stated otherwise in this report

7.6.4 Periodic Special Inspection and Jobsite Quality Assurance must be provided in accordance with each respective evaluation report.

7.6.5 Only those fasteners and anchors included with the *Marquee™* Post Mount Kits and bearing the CCRR-0194 label shall be used in the installation. The installation must utilize the 5.5" square concrete adapter plates provided with the concrete mounting kit. See Figure 8.

7.6.6 The scope of this CCRR is limited to Installation in dry, cracked and uncracked, normal weight concrete with specified compressive strength of 2,500 to 8,500 psi.

7.6.7 In service concrete temperature must be in accordance with the anchor system evaluation report and Table 3.

7.6.8 Bored holes for installation of the adhesive anchoring systems and 3/8" diameter anchor rods must meet the following requirements.

7.6.8.1 Holes shall be located to assure a minimum distance of 4.25" from the edge of the mounting plate to any edge of the concrete. See Figure 6.

7.6.8.2 Holes shall be prepared and cleaned as described in each anchor's evaluation report prior to installation of the anchoring system.

7.6.8.3 Holes shall be drilled using the specified equipment and drill bits as indicated in the respective evaluation report.

7.6.8.4 See Table 3 for the required adhesive anchor embedment depth and uniform concrete base material thickness.

7.6.8.5 The minimum concrete thickness specified for anchor installation in 7.6.8.4 refers to a uniform concrete slab and is not applicable to thickness of concrete on a metal deck.

7.6.9 Preparation, application and curing of the adhesive anchoring systems shall be as described in the respective evaluation report before installing the *Marquee*™ Post Mount concrete adapter plate.

7.6.10 The applied torques to the installed and cured concrete anchors shall not exceed limits specified in Table 3 and the respective product evaluation report.

7.6.11 Upon installation of the *Marquee*™ Post Mount, the 3/8" x 2" hex bolts shall be tightened in accordance with the anchoring system evaluation report (See Table 3).

7.6.12 Installation must be in structures assigned to Seismic Design Categories A and B as defined in the referenced codes.

7.6.13 Installations shall not be subject to fatigue or shock loading.

7.7 For installations not consistent with the requirements and limitations noted above and in this report, calculations and details demonstrating compliance must be prepared by a licensed Professional Engineer and submitted to the building official having jurisdiction in that

area. Otherwise, the installation could be improper and create a safety hazard.

7.8 The *Marquee*™ *Railing* System is manufactured in Lamar, Missouri in accordance with the manufacturer's approved quality control system with inspections by PFS (IAS AA-652).

8.0 Identification

The *Marquee*™ *Railing* System produced in accordance with this report shall be identified with labeling on the individual components or the packaging that includes the following information:

8.1 Name and/or trademark of the manufacturer and the manufacturer's address.

8.2 The following statement: "ASTM D 7032 Compliant."

8.3 The following statement: "See CCRR-0194 at www.ati-es.com for uses and performance levels."

8.4 The mark of the independent inspection agency, PFS (IAS AA-652).

8.5 The Architectural Testing Code Compliance Research Report mark and number (CCRR-0194)

9.0 Code Compliance Research Report Use

9.1 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.

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

9.3 Reference to the Architectural Testing internet web site address at www.ati-es.com is recommended to ascertain the current version and status of this report.

Table 1 – Guardrail Systems and Use Categories

Maximum Guardrail System Dimensions ⁽¹⁾	Type	Support Post	Code Occupancy Classification
91 in. by 42 in.	Level / Straight	Conventional wood posts -or- <i>Marquee™</i> post mount system for wood/composite decks, with PVC guides and post sleeves	IBC – All Use Groups IRC – One & Two Family Dwellings FBC – Excluding High Velocity Hurricane Zone (HVHZ)
91 in. by 42 in.	Level / 0° - 45° Application	Conventional wood posts	
72 in. by 42 in.	Level	<i>Marquee™</i> concrete post mounts, with PVC guides and post sleeves	
68 in. by 42 in.	Stair	Conventional wood posts	

⁽¹⁾ Guardrails are qualified up to and including the listed maximum guardrail system dimensions for use in the reference Code Occupancy Classification. Lengths are clear space between supports for level rails and sloping length of rail between supports for stair rails. Height is from the deck surface to the top of the top rail.

Table 2 – Fastening Schedule

Connection	Fastener	Quantity
Rail Bracket to Sleeved Wood Post	#10 x 2" (0.129 in minor diameter), bugle head, type 17 point, stainless steel screw	2
Rail Bracket to <i>Marquee™</i> Post Mount	#12 x 1-1/4" (0.154 in minor diameter), trim head, stainless steel screw	2
Rail Bracket to Rail	#10 x 1" (0.133 in minor diameter), trim head, self-starting, stainless steel screw	2
Foot Block to Bottom Rail	#10 x 3/4" (0.127 in minor diameter), pan head, stainless steel screw	1

Table 3 – Adhesive Anchoring Systems

	Min Concrete thickness		Minimum Threaded Rod Embedment		Max Anchor Torque (ft-lbs)	Service Concrete Temperatures	
	38" Post Mount System	44" Post Mount System	38" Post Mount System	44" Post Mount System		Max Short Term	Max Long Term
Hilti HIT-RE 500-SD	4-3/4"	5-1/4"	3-1/2"	4"	33 ¹	130° F ¹	110° F ¹
Simpson Strong-Tie Set-XP	5-3/4"	7-1/4"	3-3/4"	5-1/4"	10 ²	150° F ²	110° F ²
Simpson Strong-Tie AT-XP	5"	5-1/2"	3-1/2"	4"	10 ³	180° F ³	110° F ³

¹ Per Hilti HIT-RE 500-SD ESR-2232.

² Per Simpson Strong Tie Set-XP ESR-2508.

³ Per Simpson Strong Tie AT-XP ER-0263

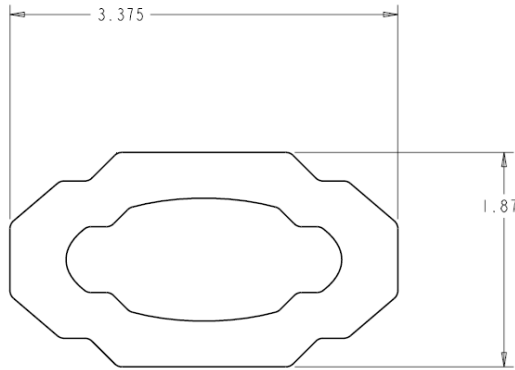


Figure 1 – Railing Profile

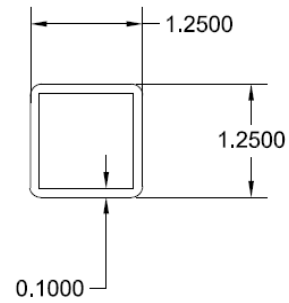


Figure 2 – Square Baluster 1-1/4 inch

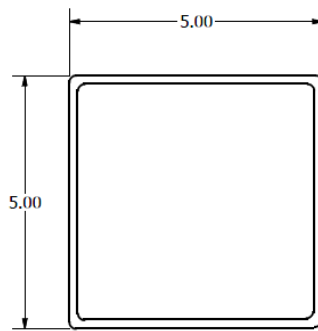
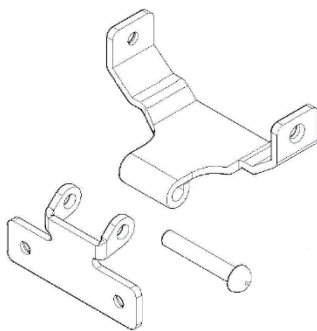
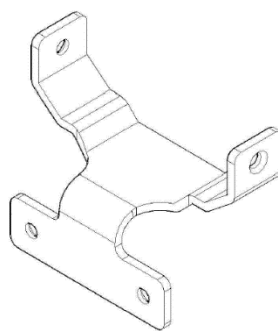


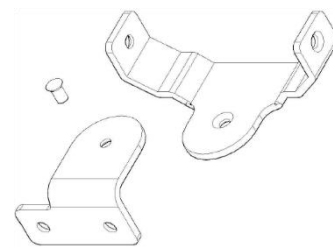
Figure 3 – 5 inch Square Post Sleeve



Stair Rail Bracket

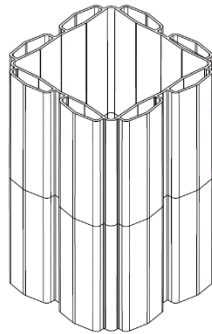


Level Rail Bracket



45° Level Rail Bracket

Figure 4 – Rail Metal Brackets



**Figure 5 – Marquee™ Wood Post Spacer
(for use with conventional 4x4 wood posts)**

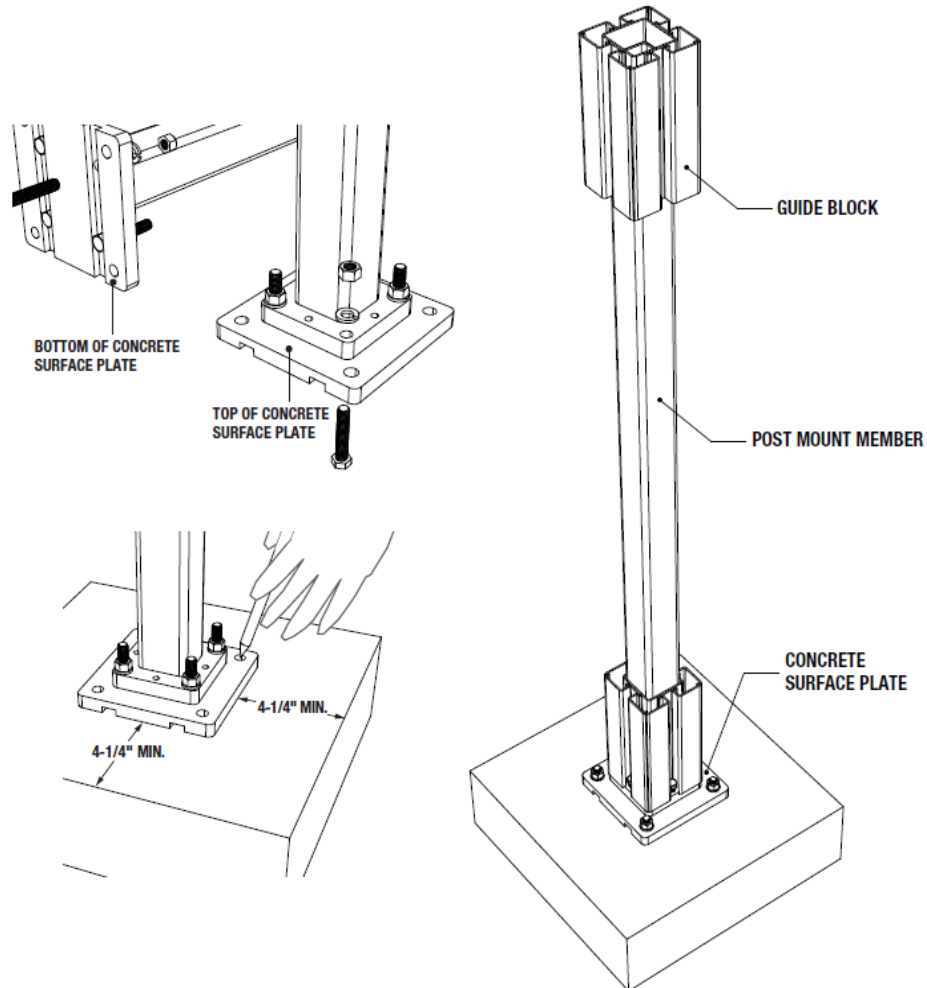


Figure 6 – Marquee™ Concrete Post Mount System with PVC Guides

Note: Supporting structure (wood deck or concrete) is not within the scope of this report and must be designed and constructed in accordance with Chapter 16 of the IBC and FBC. Refer to Section 7.5.

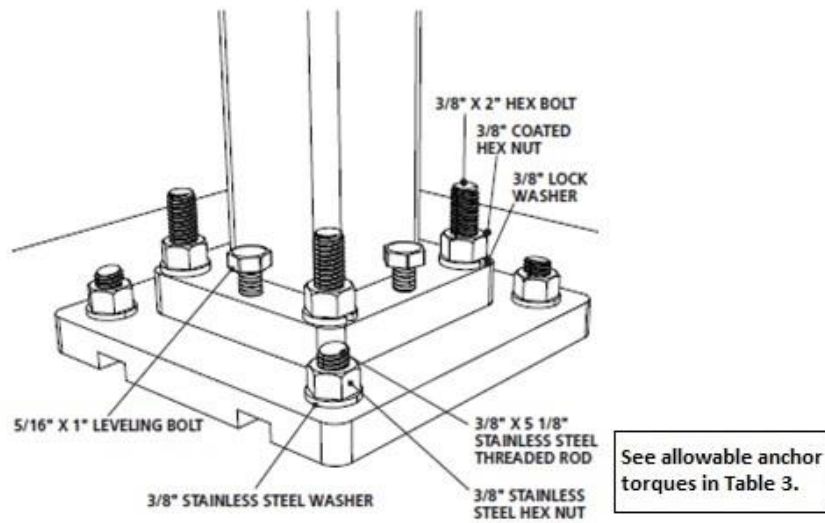


Figure 7 – Marquee™ Concrete Surface Plate Fasteners

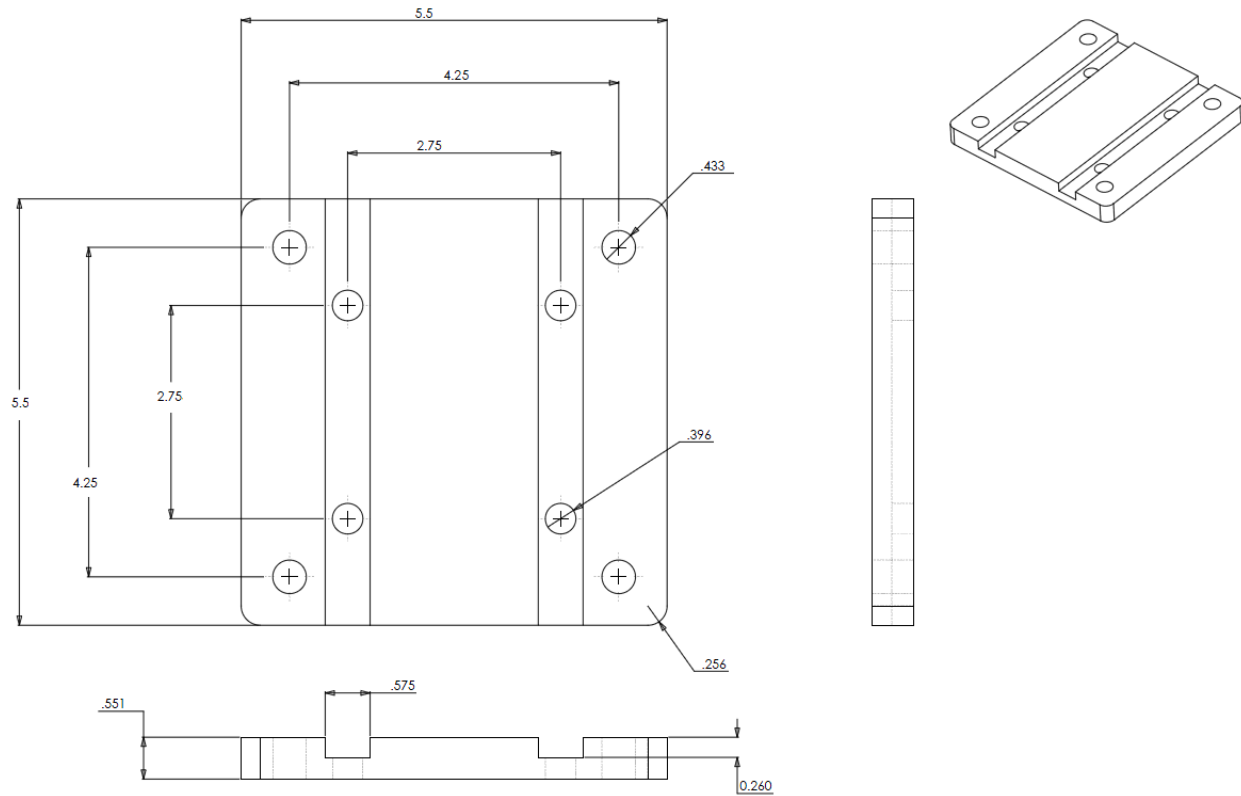


Figure 8 – Marquee™ Concrete Surface Plate

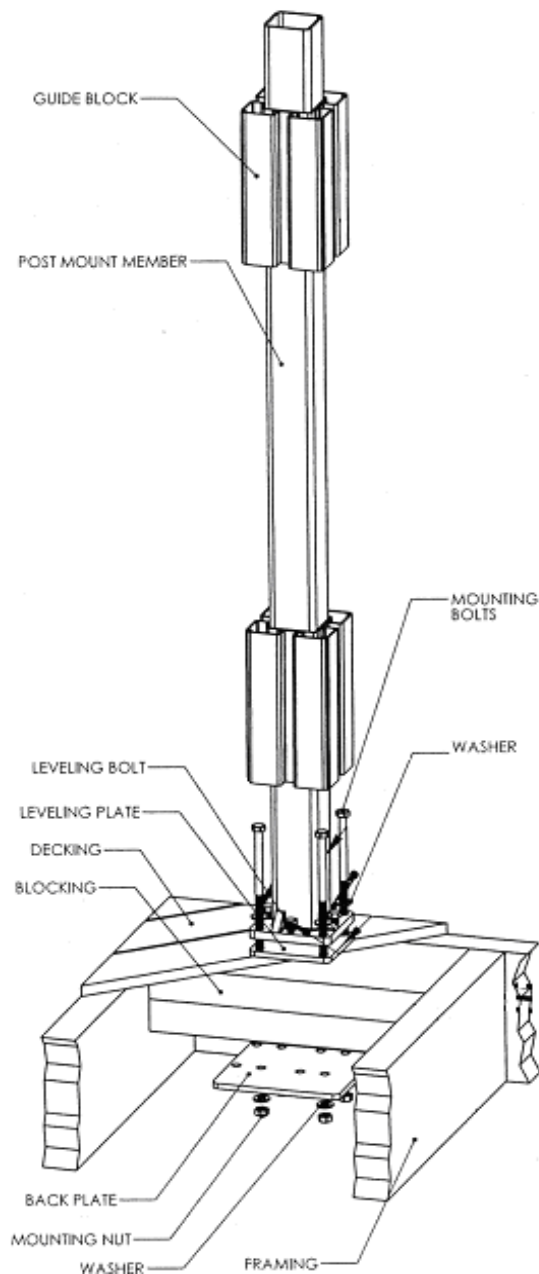
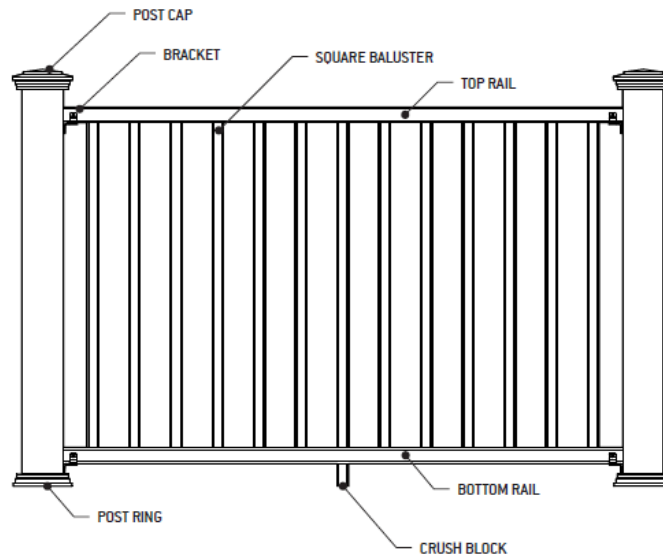
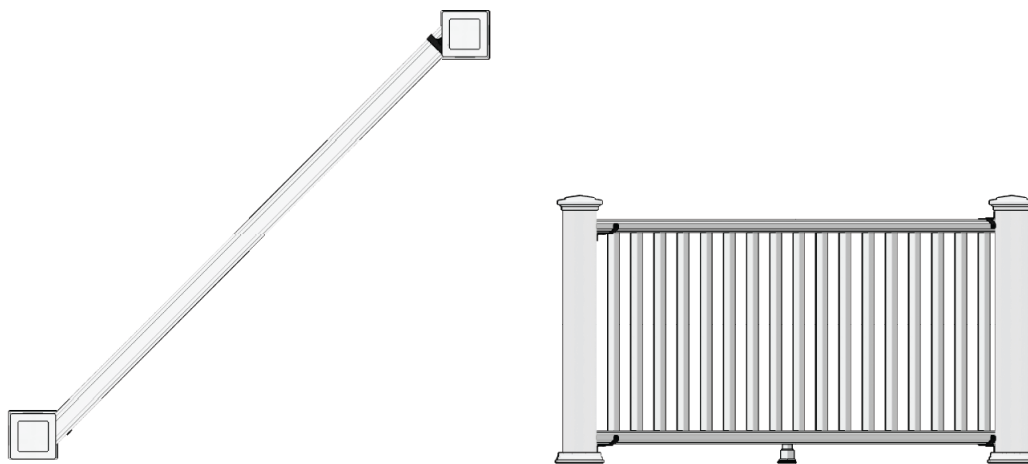


Figure 9 – Marquee™ Post Mount System with PVC Guides Wood/Composite Deck Installation

Note: Supporting structure (wood deck or concrete) is not within the scope of this report and must be designed and constructed in accordance with Chapter 16 of the IBC and FBC. Refer to Section 7.5.



Straight Level Rail



0° - 45° Level Rail

Figure 10 – *Marquee*™ Level Railing Systems

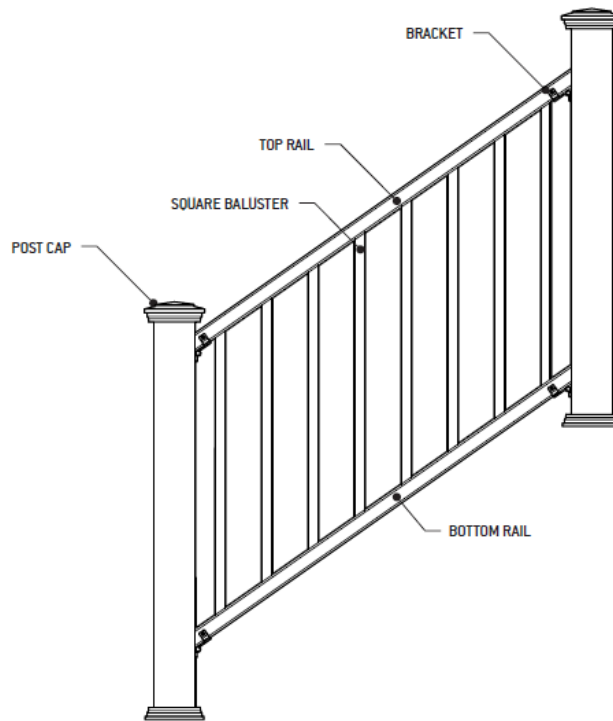


Figure 11 – Marquee™ Stair Railing Systems