

# FRSA/TRI Concrete and Clay Roof Tile Installation Manual – Fourth Edition

# HIP AND RIDGE ATTACHMENT RECOMMENDATIONS

OF THE  
FRSA/TRI CONCRETE AND CLAY ROOF TILE  
INSTALLATION MANUAL  
FOURTH EDITION

FRSA 2006 Annual Convention – Seminar #11

# Outline

- Changes/Updates to Manual
- Hip and Ridge Attachment Section
  - Support Member Attachment
  - Trim Attachment Options to Support Member
  - Starter Tile Attachment
  - Weather Blocking
  - Deficiencies Noted after Wilma
  - Hip and Ridge Design Pressures and Resistance Values
- Fastening Table Changes
  - Comparison with Third Edition

# Changes to Manual

- Corrected text typos
- Corrected drawings and drawing text errors
- Changed wind standard calculations from ASCE 7-98 to ASCE 7-02
- Included hip and ridge design pressures
- Added monoslope roofs wind loading requirements
- Put hip and ridge attachment guidelines in back of Manual for all systems



07-01-06

Hip and Ridge Attachment

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# Industry Proposed Changes

- Systems 1 and 2
  - Structural supports required for hip and ridge attachment; no mortar-only
- System 3
  - Field tile approved mortar formulations only or structural supports for hip and ridge attachment
- System 4
  - Hip and ridge attachment same as System 3

## Hip and Ridge System Design Considerations – Transferring the Wind Loads to the Structure

- Mechanically Fastened Systems
  - Wood frame attached with straps or metal brackets or adhesive
    - Hip and ridge tiles installed with
      - nails and code-approved adhesive
      - code-approved adhesive
  - Metal frame – attached with nails or screws
    - Hip and ridge tiles installed with
      - code-approved adhesive
- Adhesive or Mortar-Set Systems
  - Same options as above
  - Mortar



# Future Enforcement

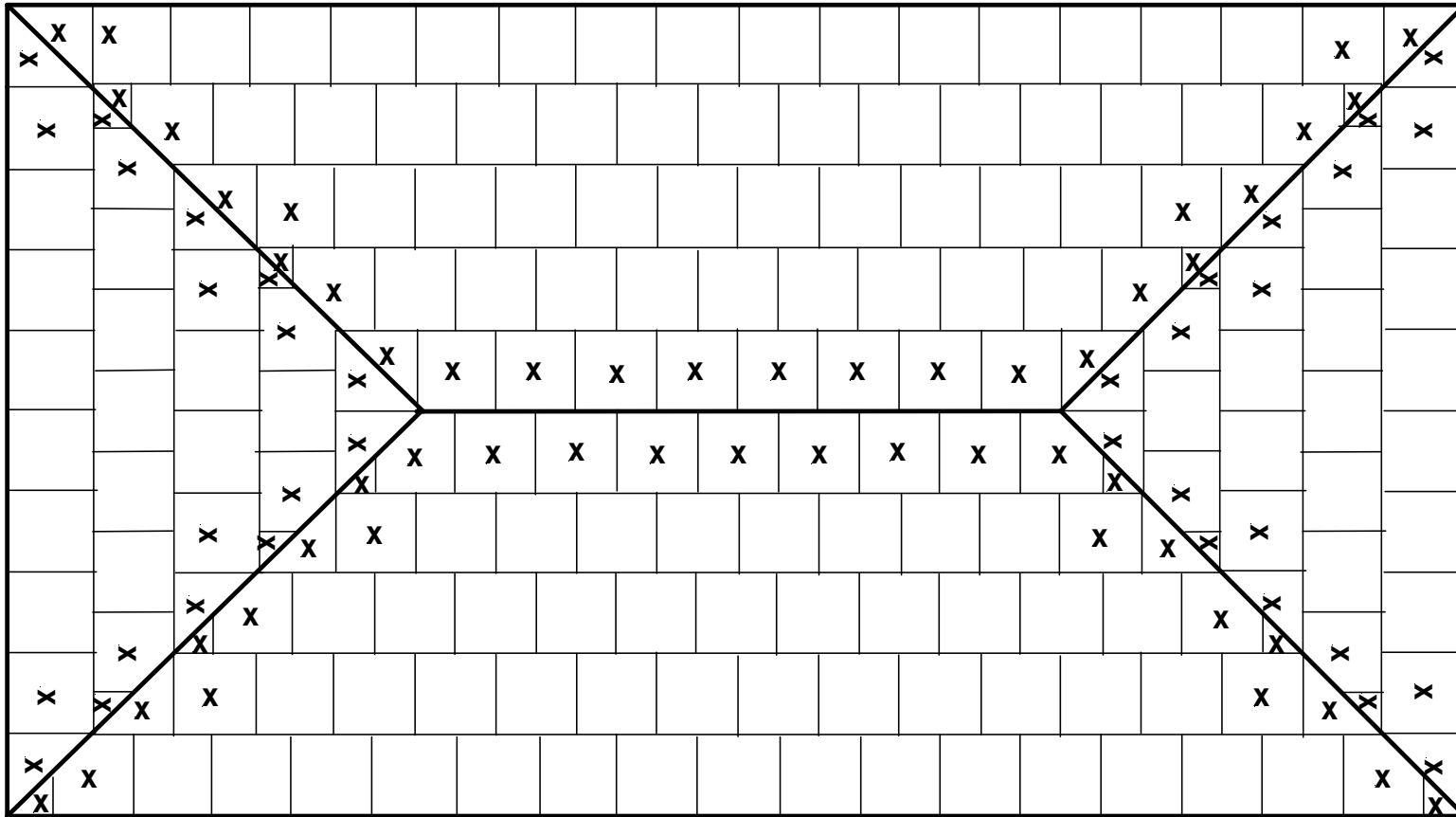
- Each municipality will issue their own requirement time period. Generally, permits pulled after December 12, 2005 will require hip and ridge attachment changes.
- Revisions are included in the reprinting of FRSA/TRI Manual – Fourth Edition just released.

# Hip and Ridge Attachment

- Mortar-only attachment no longer an option for Systems 1 and 2
- Fastening options for support member follow Table 11 in the Manual
- Follow hip and ridge requirement Tables 2A-2D & 3A-3D for hip and ridge for design pressures

# Cut Field Tile Attachment Requirements

- All field tiles (two tiles on each side of hip) and the top course of the ridge must be attached to the substrate. Code approved:
  - Adhesive
  - Mortar
  - Mechanical fasteners and adhesive
- Minimum head lap of trim tiles 2 inches



## Flat/Low, Medium or Crossbond Tile Applications

Attach two tile each side of hip and one top ridge course to the underlayment with code approved roof tile adhesive, code approved mortar or mechanically attach with fasteners and code approved adhesive at the tile overlaps. When using adhesive or mortar to attach tile to the underlayment the underlayment must be approved for adhesive-set or mortar-set applications.

# Cut Tile Attachment



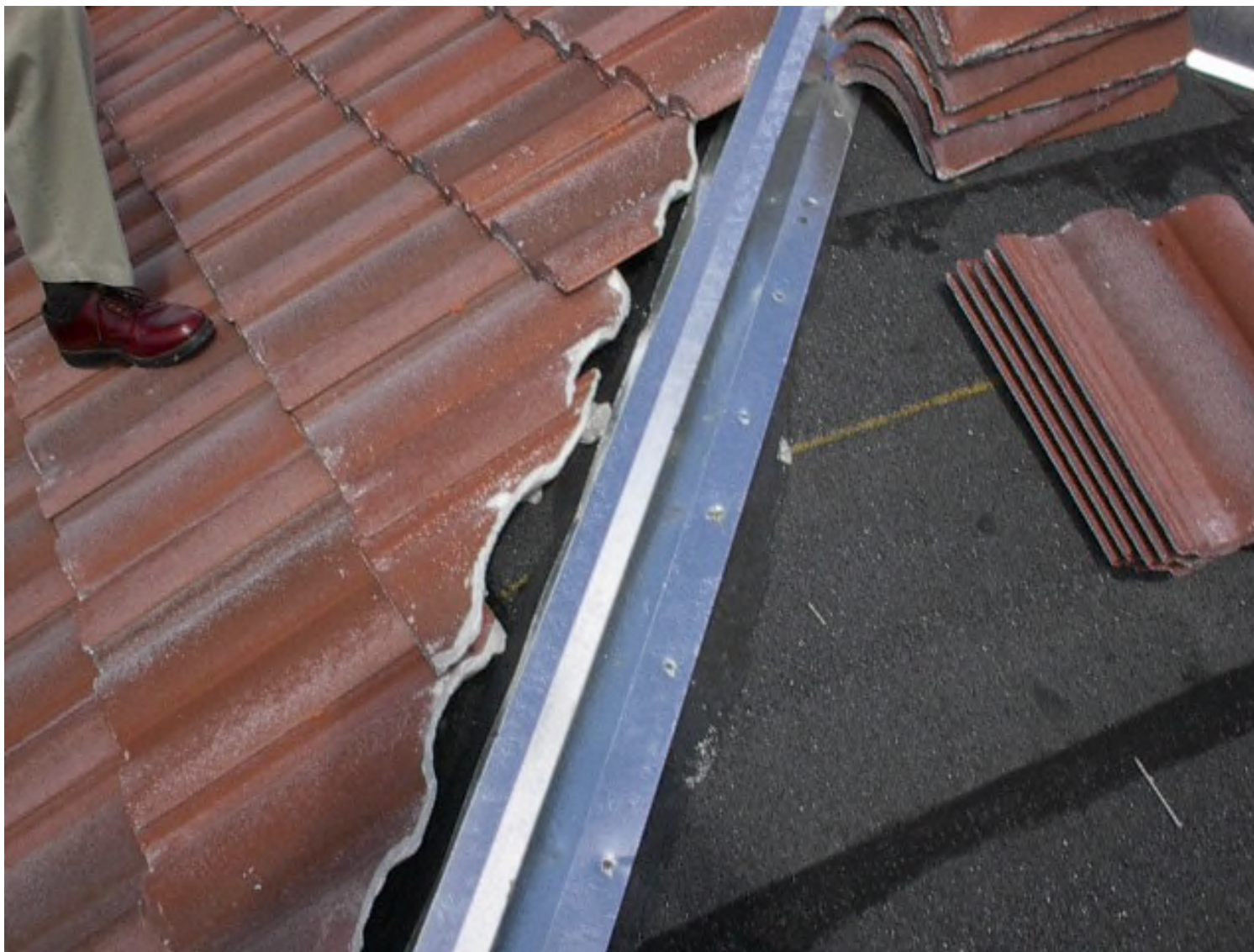
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Hip and Ridge Attachment

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## Metal Support Fastening



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Hip and Ridge Attachment

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## 2" x (H) Wood Support Member



Two #8 Screws  
130 MPH Wind Zone  
36 Inches O.C.

# Hip and Ridge Bracket



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Hip and Ridge Attachment

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# FRSA/TRI Table 11

**Table 11**

## Category II Buildings

### Hip and Ridge Support Member Attachment Recommendations

Roof Sheathing (inches)	Exposure	Number of Fasteners on each side of Ridge Board	Strap Width	Basic Wind Speeds, V (mph)					
				100	110	120	130	140	150
				Center to Center Spacing (inches)					
15/32"	B	1 - #8	3/4"	36	29	25	21	18	16
		2 - #8	1-1/2"	48	48	43	36	31	27
	C	1 - #8	3/4"	27	22	18	16	13	12
		2 - #8	1-1/2"	46	38	32	27	23	20
19/32"	B	1 - #8	3/4"	38	32	24	22	19	17
		2 - #8	1-1/2"	48	48	43	36	31	27
	C	1 - #8	3/4"	29	24	20	17	14	12
		2 - #8	1-1/2"	46	38	32	27	23	20

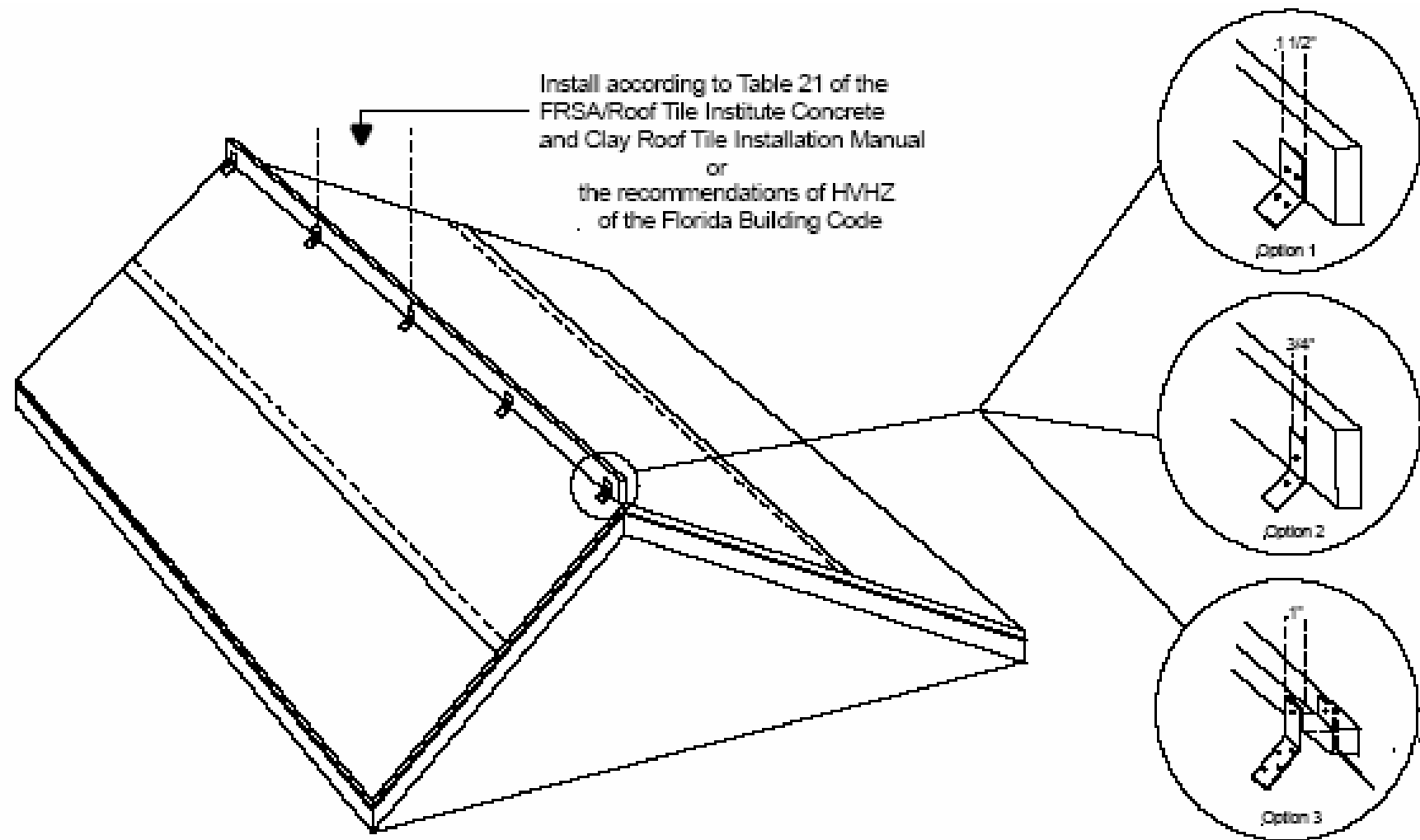
Note<sup>1</sup>: For Building Category Definition See Page 104.

Note<sup>2</sup>: For Exposure Categories See Page 105.

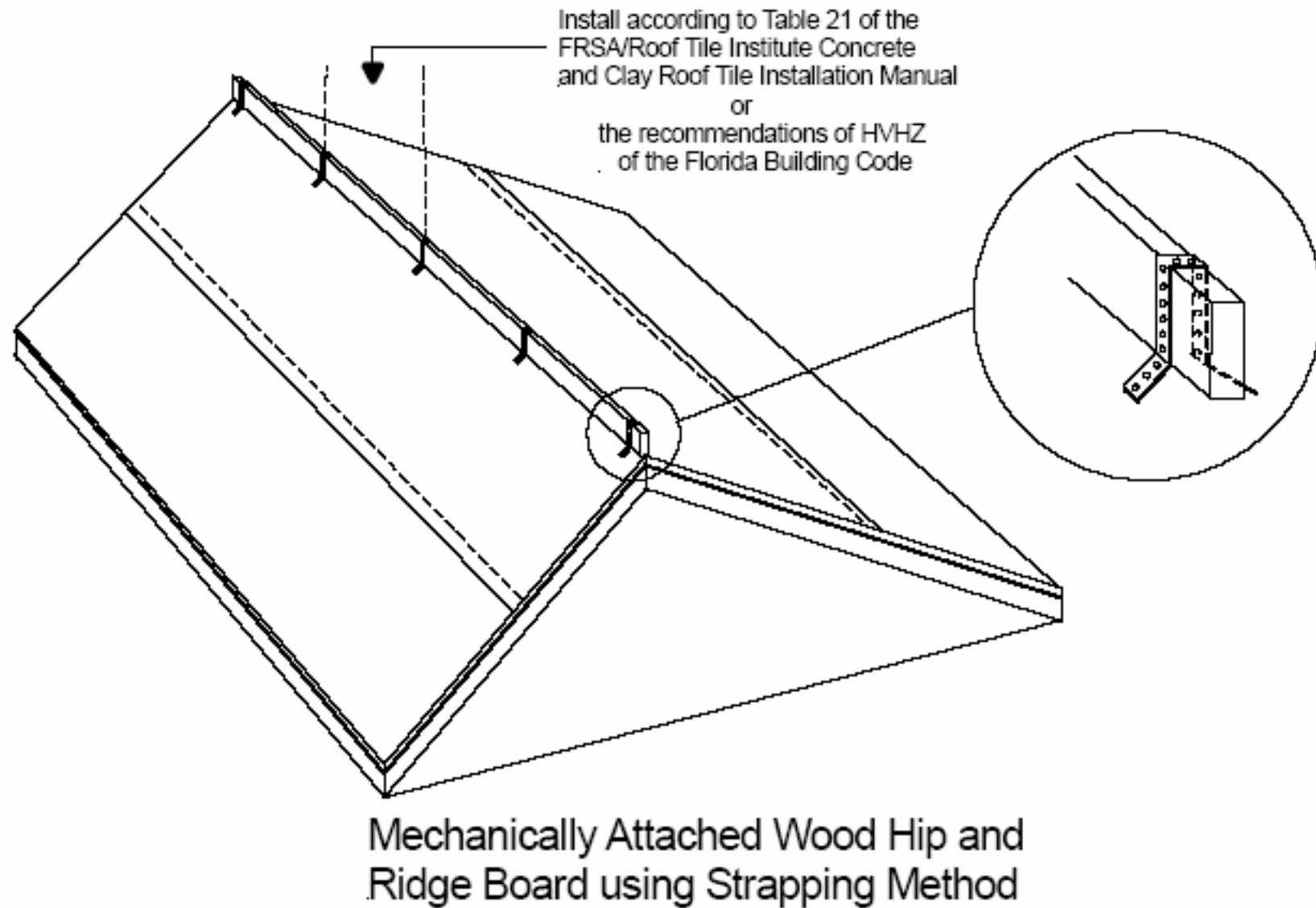
Note<sup>3</sup>: Table conforms to ASCE 7-02. Essential or Hazardous Facilities having an Importance Factor of 1.15

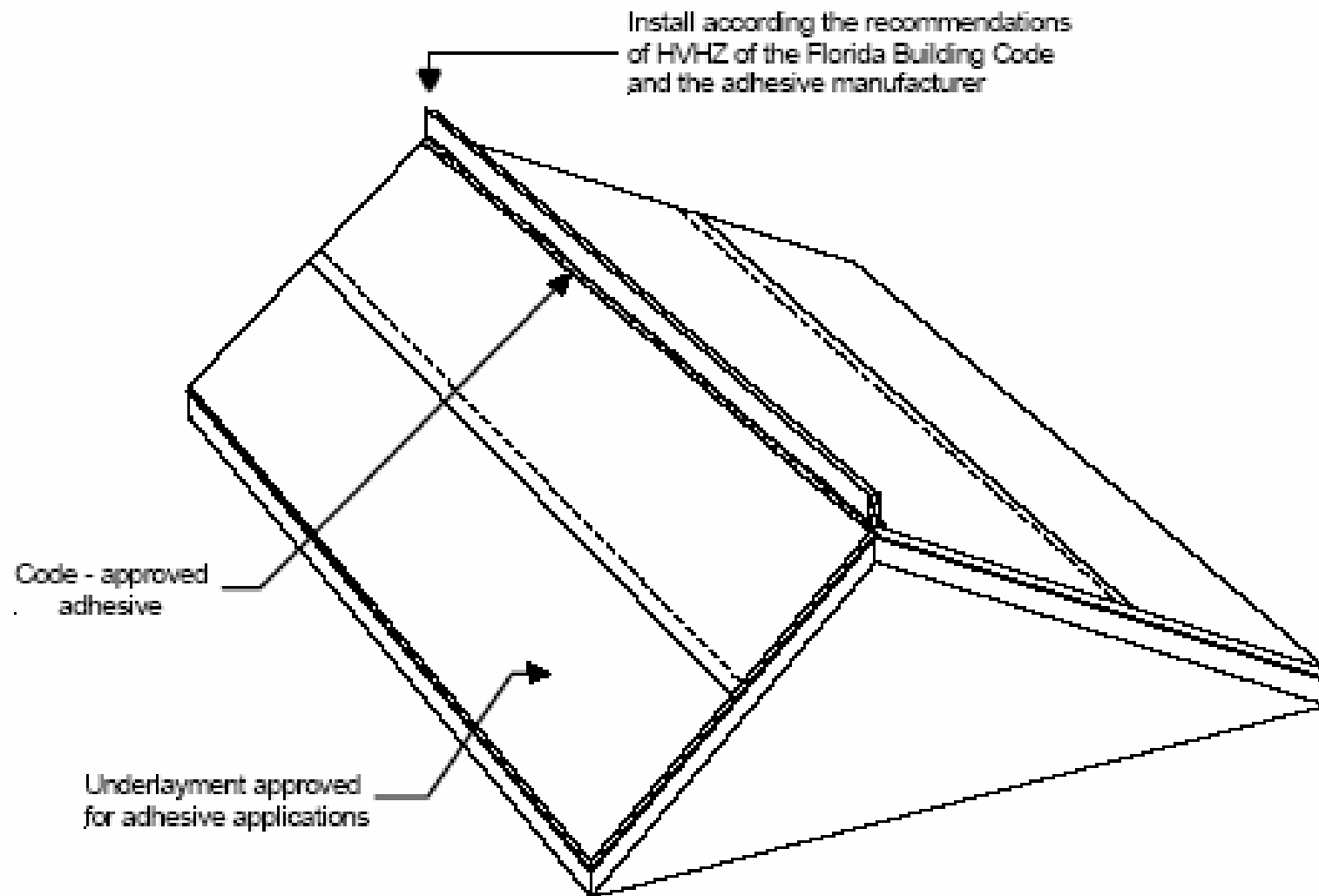
Note<sup>4</sup>: Table is good for Gable and Hip Roofs for Roof Slopes  $2:12 < \Theta \leq 12:12$ . Monoslope roof slopes are not addressed.

Note<sup>5</sup>: For mean roof heights over 60 feet, engineering calculations must be submitted for permitting.



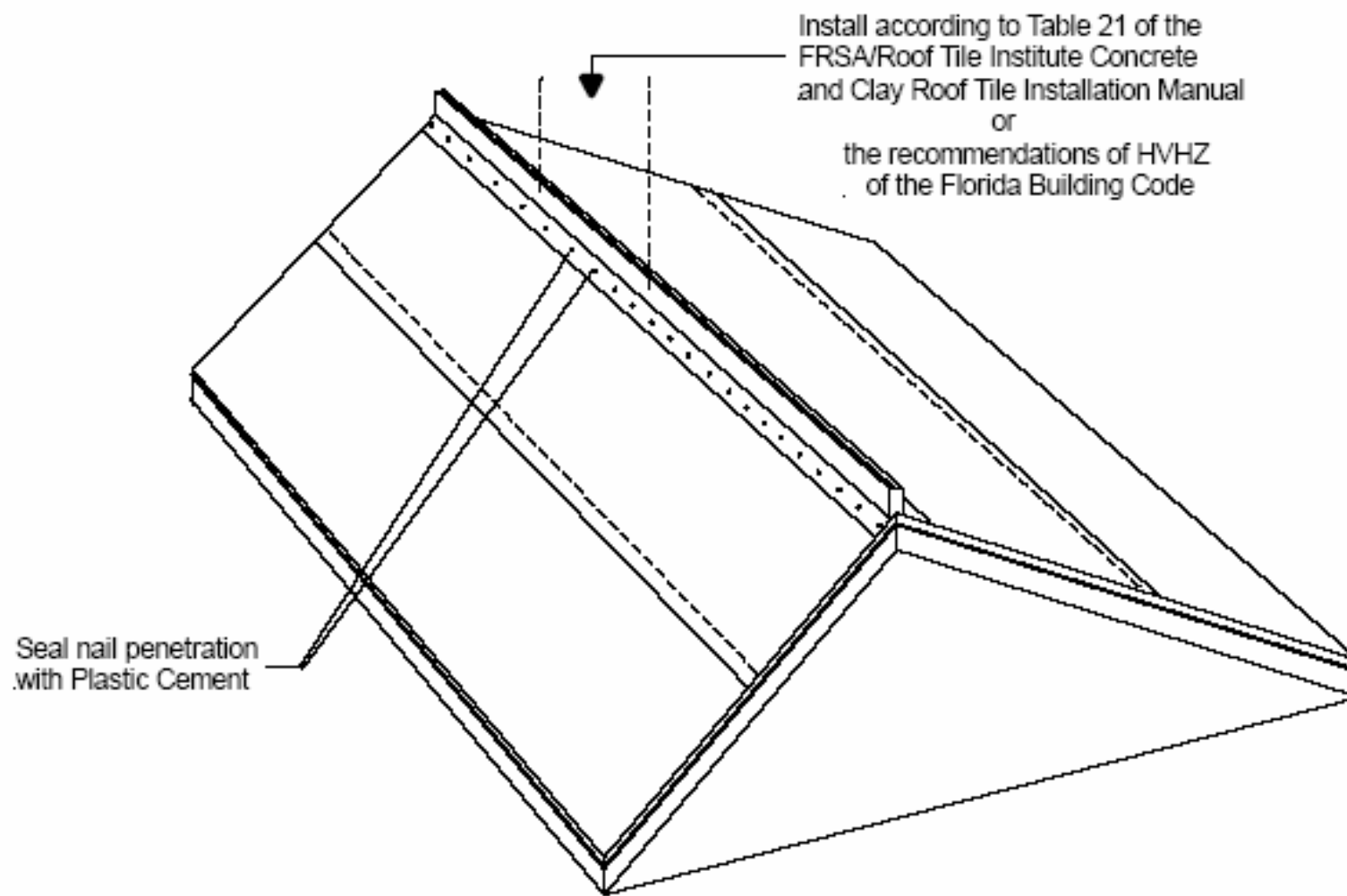
Mechanically Attached Wood Hip and  
Ridge Board Using Metal Brackets.





Wood Hip and Ridge Board  
Attached with Code-approved adhesive



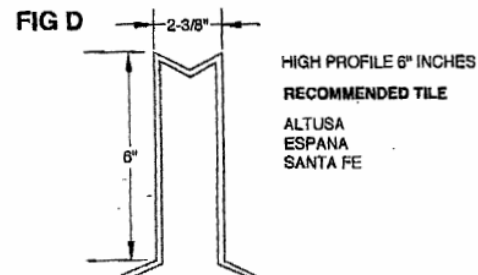
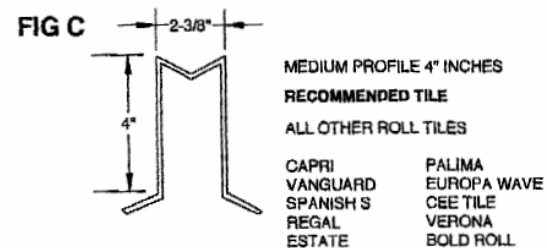
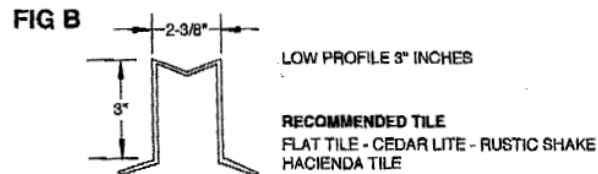
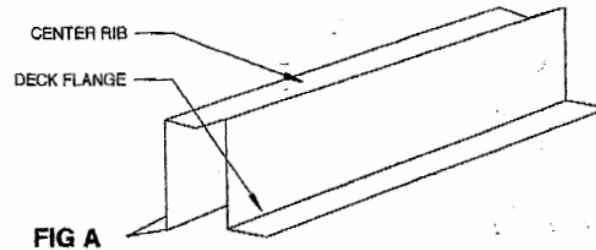


Install according to Table 21 of the  
FRSA/Roof Tile Institute Concrete  
and Clay Roof Tile Installation Manual  
or  
the recommendations of HVHZ  
of the Florida Building Code

Seal nail penetration  
with Plastic Cement

Metal Hip and Ridge Frame

# Metal Support Member Height Options



## DETAILS AND SPECIFICATIONS

**LENGTH:**  
APPROXIMATE 10' L(FT)

**CENTER RIB:**  
FIG A - APPROXIMATE 2 3/8" INCHES

**DECKFLANGE:**  
FIG A - APPROXIMATE 2" INCHES

**HEIGHT:**  
FIG B - LOW PROFILE 3" INCHES  
FIG C - MEDIUM PROFILE 4" INCHES  
FIG D - LARGE PROFILE 6" INCHES


**GAUGE:**  
28 GAUGE GALVANIZED/ GALVALUME

**INSTALLATION TIPS**  
CHOOSE THE RIGHT PROFILE  
HEIGHT DEPENDING ON THE  
TILE HEIGHT.

FOR MORE INSTALLATION DETAIL  
PLEASE REFER TO YOUR LOCAL  
COUNTY CODES

**NOTES:**  
FOR MORE INFORMATION  
PLEASE CONTACT THE  
EAST COAST METALS SALES  
DEPARTMENT AT 1-800-579-0944

PATENT: PATENT PENDING

 <p><b>EAST COAST METALS</b> 2301 WEST 8 LANE, HIALEAH FL 33010 TEL: 3058859001 FAX: 3058859008 WWW.EASTCOAST-METALS.COM</p>	<p><b>HIP &amp; RIDGE - CHANNEL METAL</b> <b>RECOMMENDED PROFILE</b></p>	<p>NOT DRAWN TO SCALE</p>
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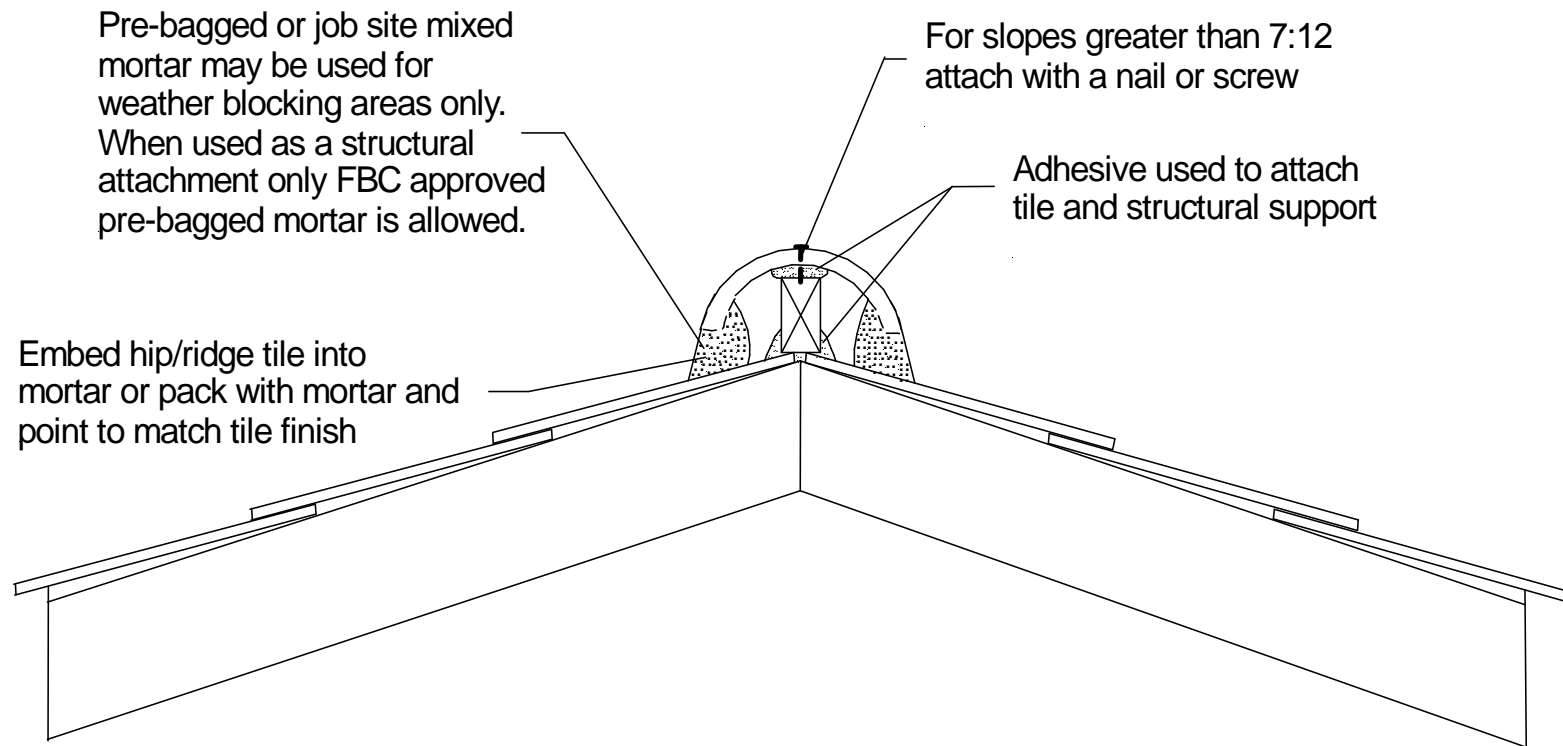
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# Adhesive Support Member Height Requirements

- The head of the hip or ridge tile must touch the support member to get the yield and contact area to the underside of the tile.
- If the head of the hip and ridge tile does not touch the support member, more material must be applied to make contact with the underside of the tile.

Head of tile must be in contact with or within a maximum  
1/2" of support member



Adhesive-set Hip and Ridge Tile using Mortar as a Weather Block

# Insufficient Support Member Height



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Hip and Ridge Attachment

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Hip and Ridge Attachment

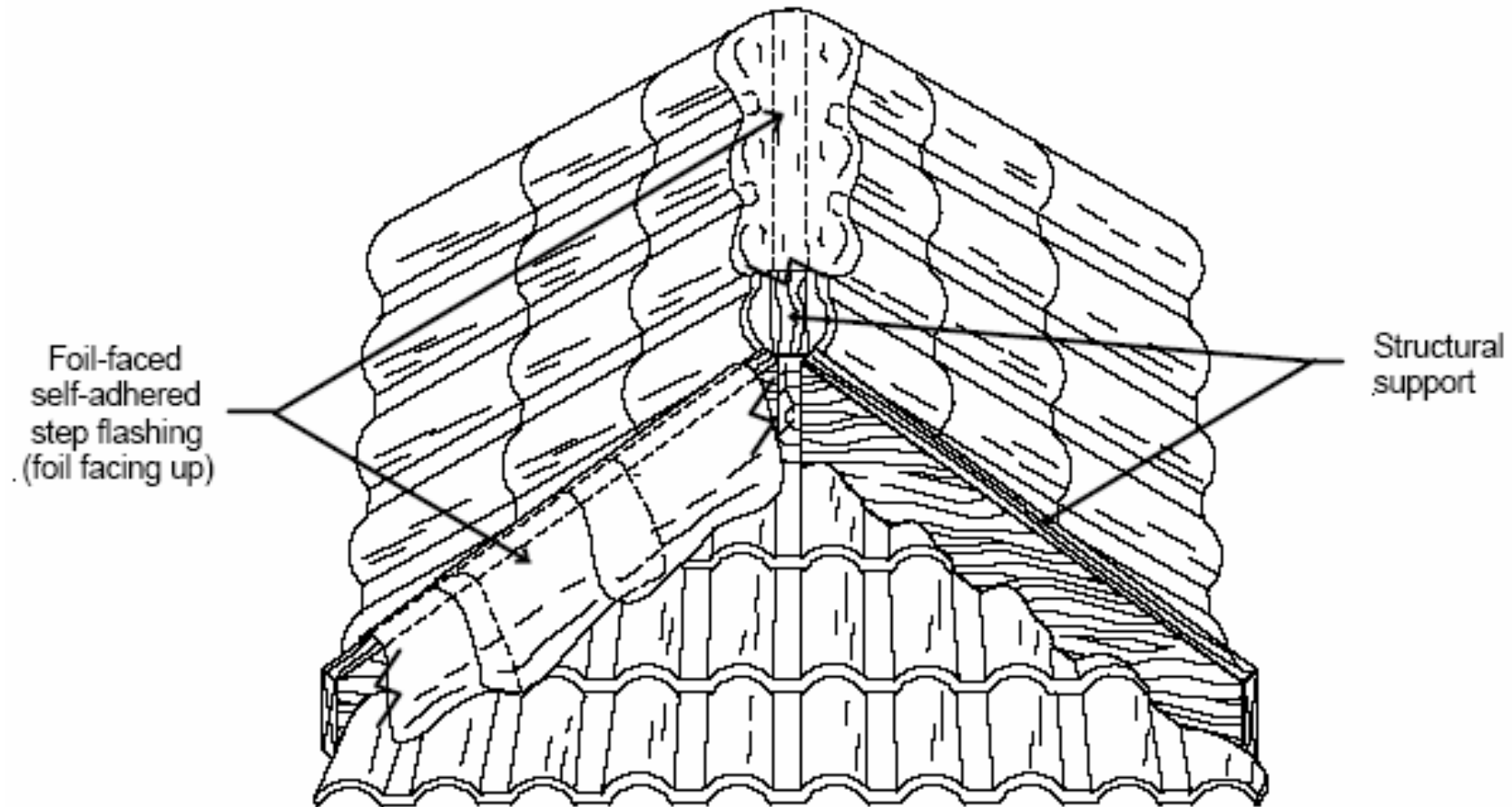
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# Weather Blocking Options

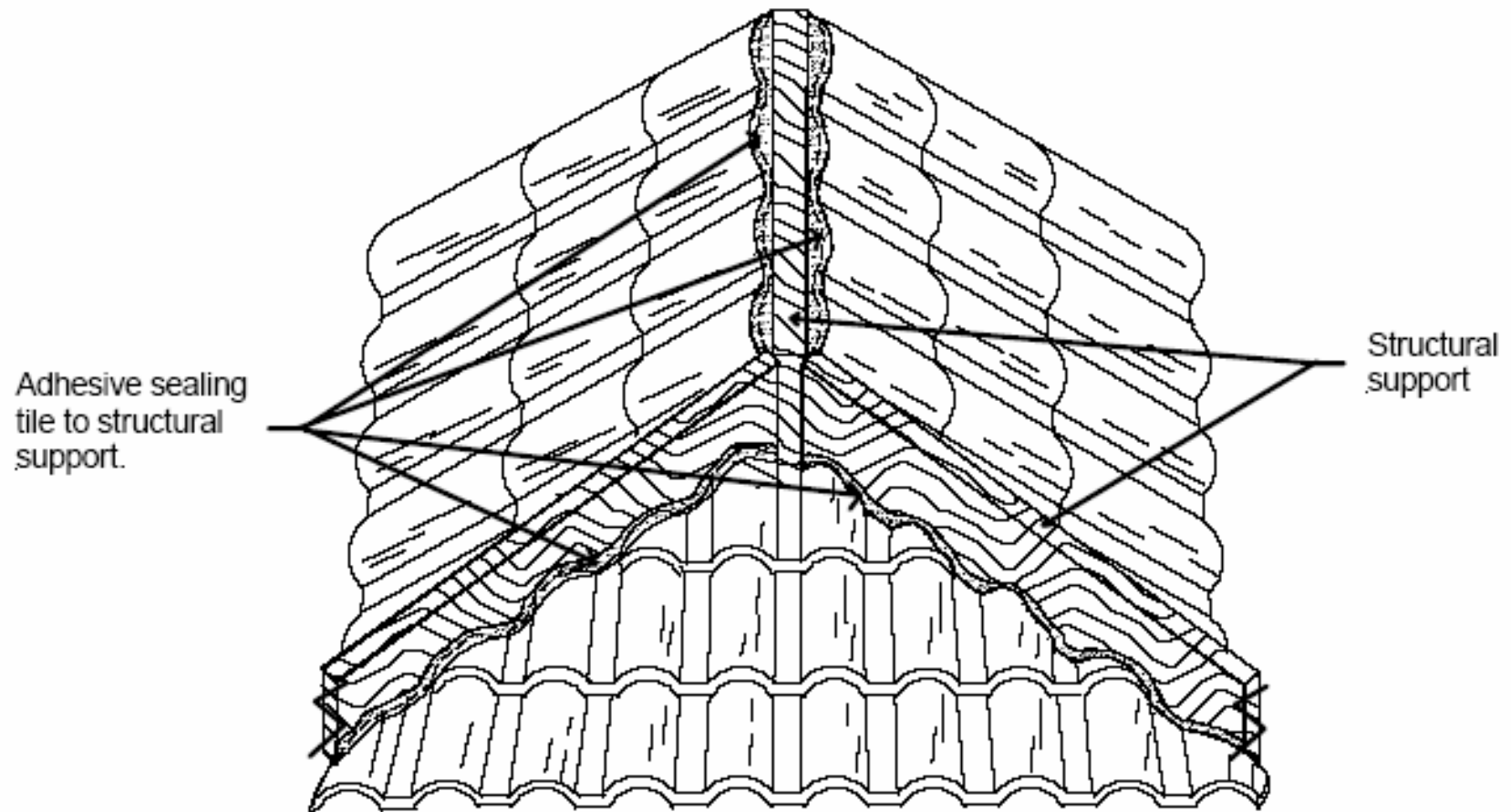
- Mortar Point-Up
- Hip and Ridge Sealer – foil faced or wind tested sealer
- Adhesive (open hip and ridge line) (Dry Ridge)
- Mortar (open hip and ridge line) (Dry Ridge)

## Foil –Faced Membrane

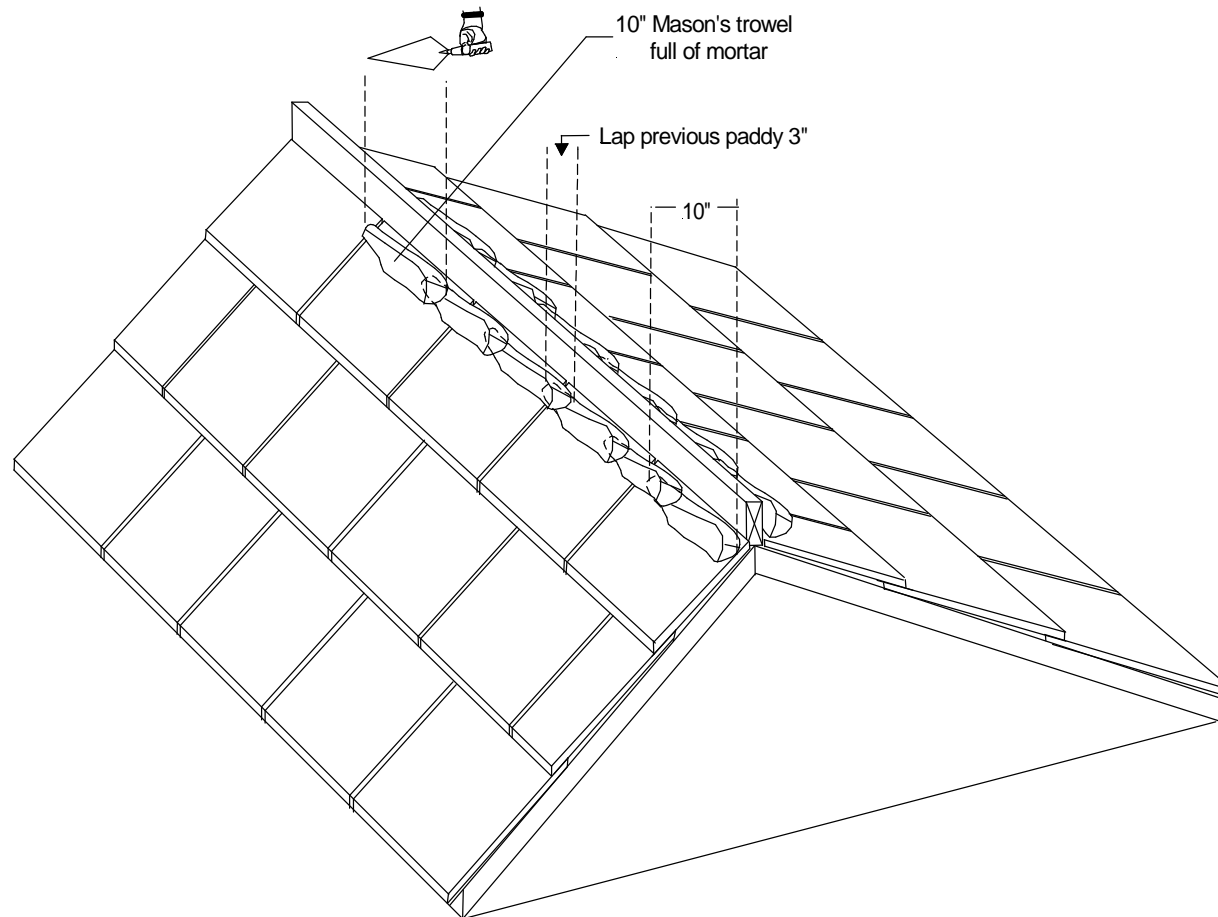


Foil-faced Self-adhered Membrane Used as a Weather Block

## Adhesive Tested as a Weather Block



# Mortar



Mortar Hip and Ridge Weather Blocking System.

# Hip and/or Ridge Starter Tile Attachment

- Starting at the eave, place hip starter tile over wood hip frame, positioning in the center of the structural support. Secure the head of the starter tile to the structural support with a mechanical fastener conforming to the Manual.
- Care must be taken to properly secure the first (starting) hip and ridge tile of the hip/ridge attachment system. Additional securing at the hip starter tile installed at the eave and at the starting ridge tile installed at either the ridge/hip or ridge/gable junctions are necessary to prevent the tile from overturning during a high wind event.



# Hip and/or Ridge Starter Tile Attachment

- Structural support kept 6-12 inches from eave
- All hip and ridge starter tiles secured at both ends, either mechanically or with adhesive

## Metal Support Member - Typical Eave Detail

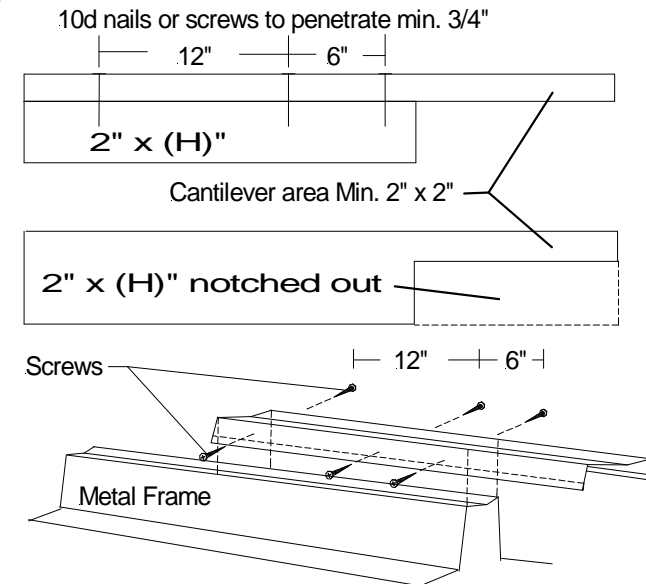
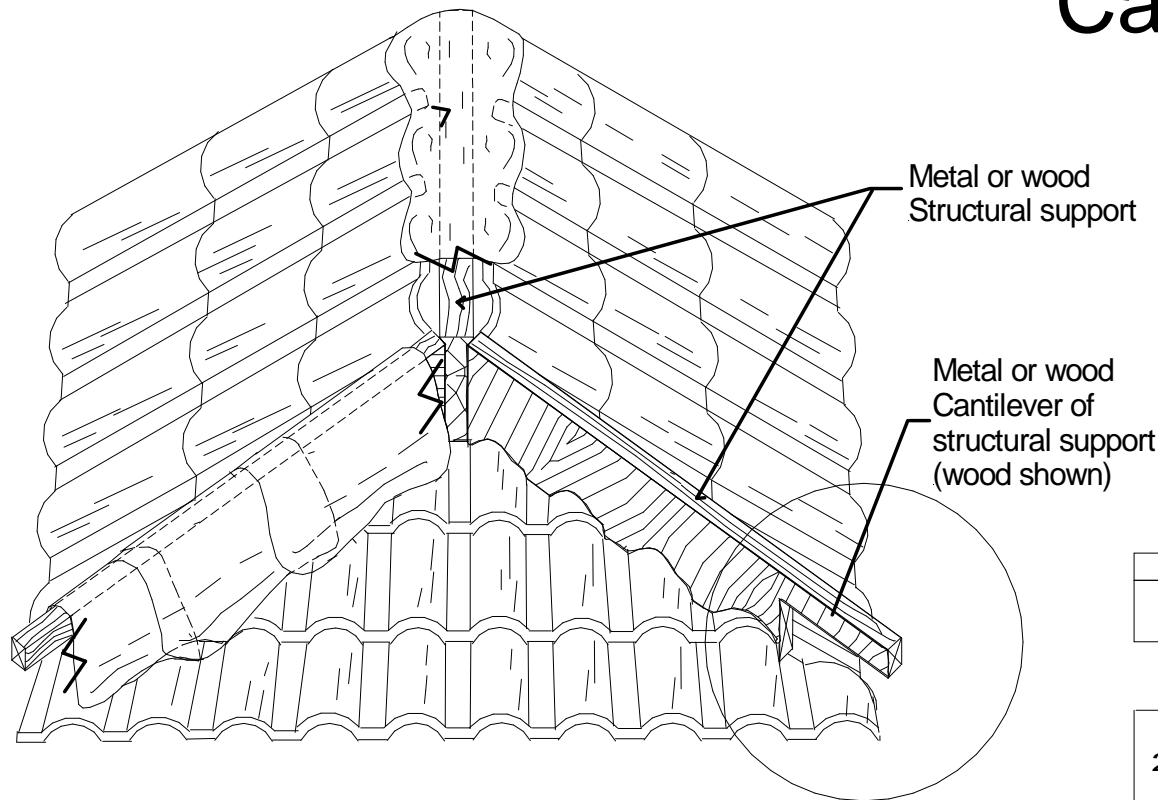


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Hip and Ridge Attachment

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# Cantilever Options



Hip End Cantilever Options

# Starter Hip/Ridge Tile – Option 1

- Drill a 3/16 inch hole within lower 1/3 of tile length, from the eave end of the hip starter tile. Secure the eave end of the starter tile with a mechanical fastener, embedding into the structural support a minimum of 3/4 inch. Seal the head of the fastener with a UV resistant sealant. Adhesive may also be used in lieu of a fastener at the starting end of the tile as long as the structural member has been cantilevered to provide a base for adhesive attachment.

## Starter Hip/Ridge Tile – Option 2

- Prior to installing the hip starter tile, apply a code-approved roof tile adhesive along the entire length of the hip starter tile according to the adhesive manufacturer's installation instructions. Secure the head of the tile with mechanical fastener, embedding into structural support a minimum of 3/4 inch.



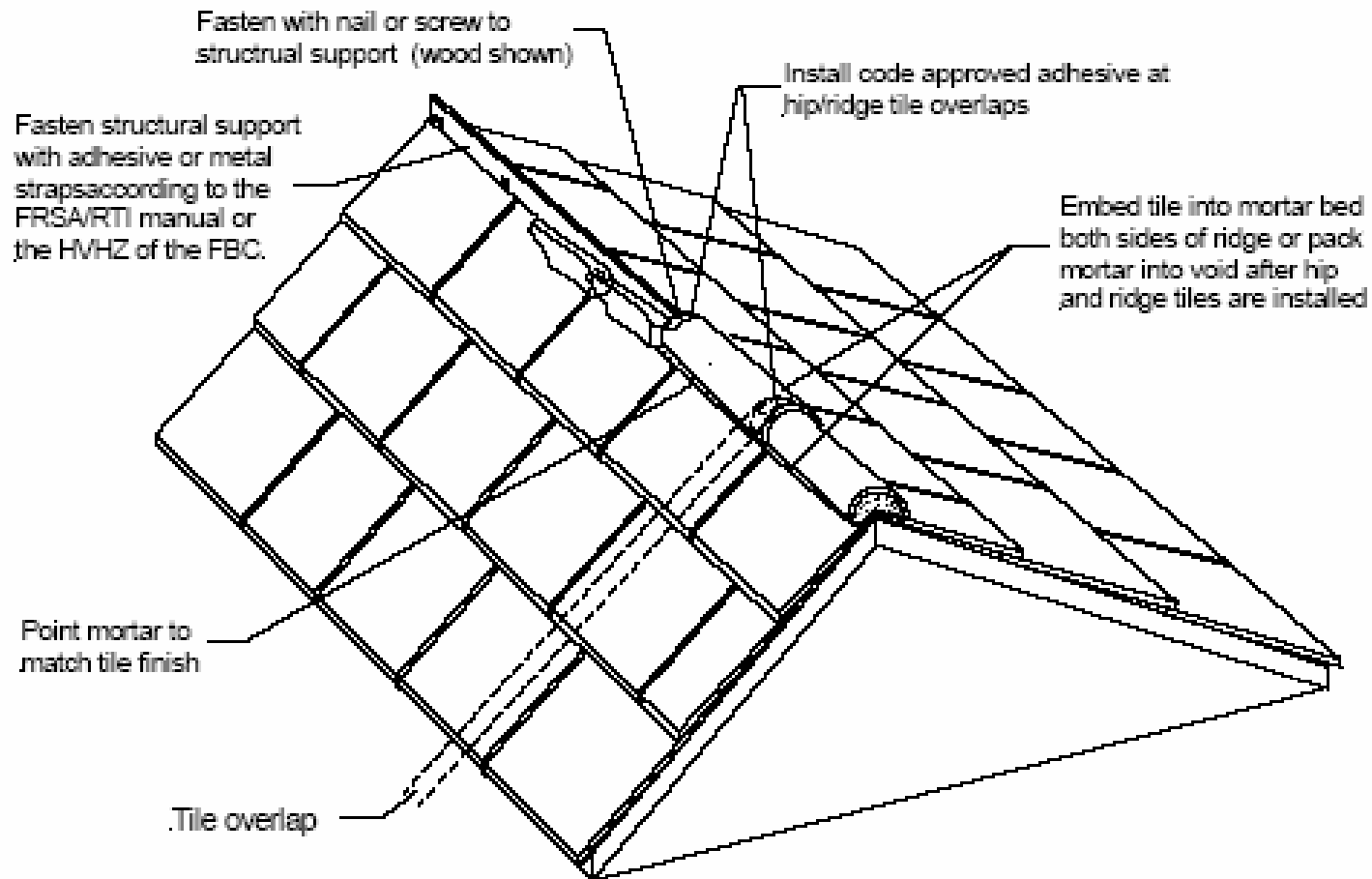
# Starter Hip/Ridge Tile – Option 3

- Prior to installing the hip starter tile, place a full bed of only FBC code-approved pre-bagged mortar according to the manufacturer's installation instructions, under the entire hip starter tile. Within 2 minutes of placing the bed of mortar, embed the entire hip starter into the solid bed of mortar. Secure the head of the tile with mechanical fastener, embedding into structural support a minimum of 3/4 inch. Point mortar to desired finish.
- When using this mortar method for securing the starter hip tile, ensure underlayment is approved for use with mortar-set applications.

# Hip and Ridge Attachment

- Mechanical
  - Screw or nail into wood nailer with code approved adhesive at laps as tested
- Adhesive
  - Apply code approved adhesive on top of structural support as tested
- Mortar (System 3 and 4)
  - 10 inch trowel full of tested mortar formulation every 7 inches as tested
  - Embed into pliable mortar paddy approximately 1-1/2 inches

# Mechanical Attachment



Attaching Hip/Ridge tile using Mortar as Weather Blocking

# Screw into Metal

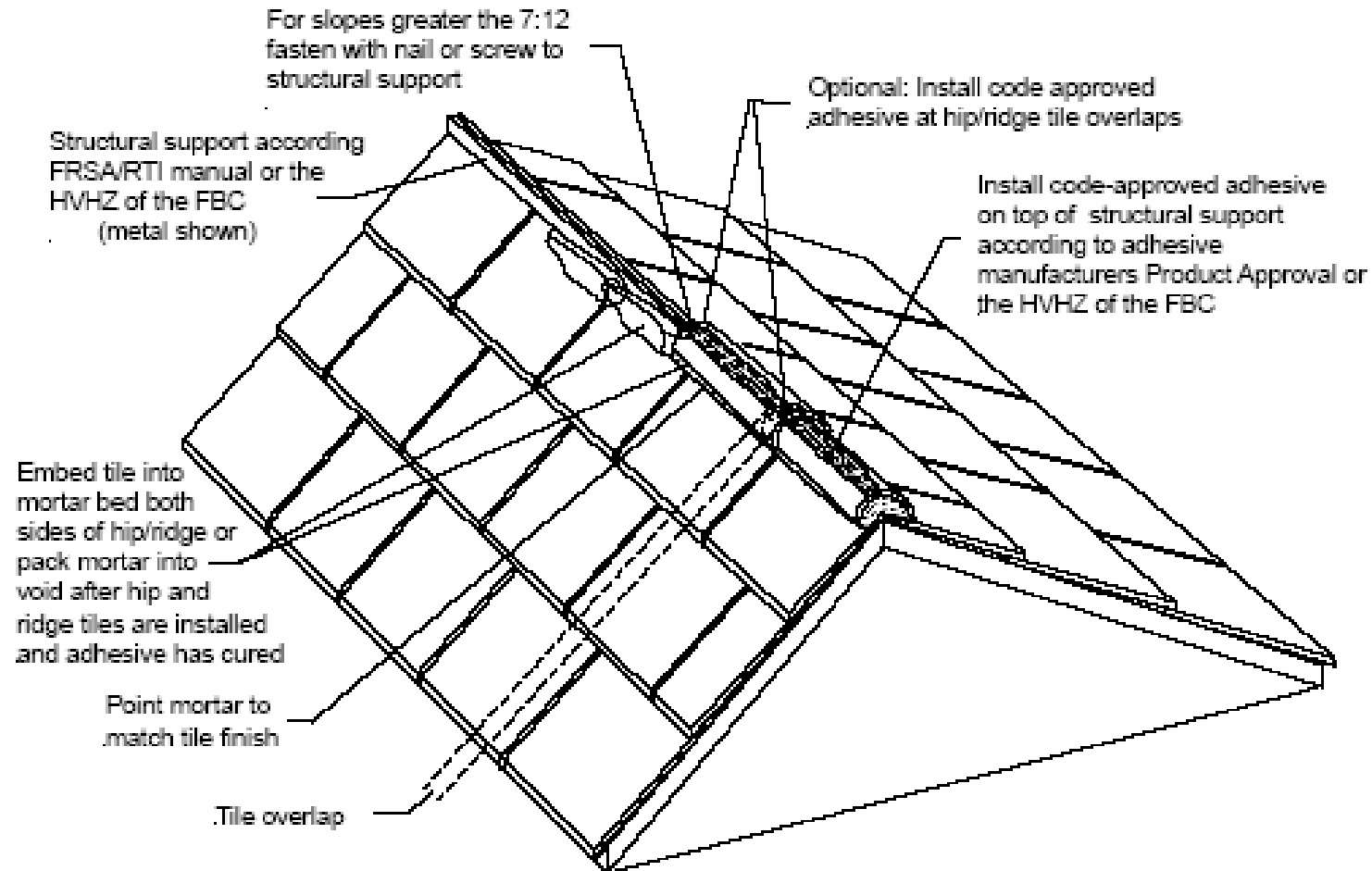


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Hip and Ridge Attachment

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# Adhesive Attachment



## Attaching Hip/Ridge Tile with Adhesive Using Mortar as Weather Blocking



## Two Component - Continuous Bead



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Hip and Ridge Attachment

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## Two Component – Individual Paddy



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Hip and Ridge Attachment

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Hip and Ridge Attachment

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# One Component Adhesive



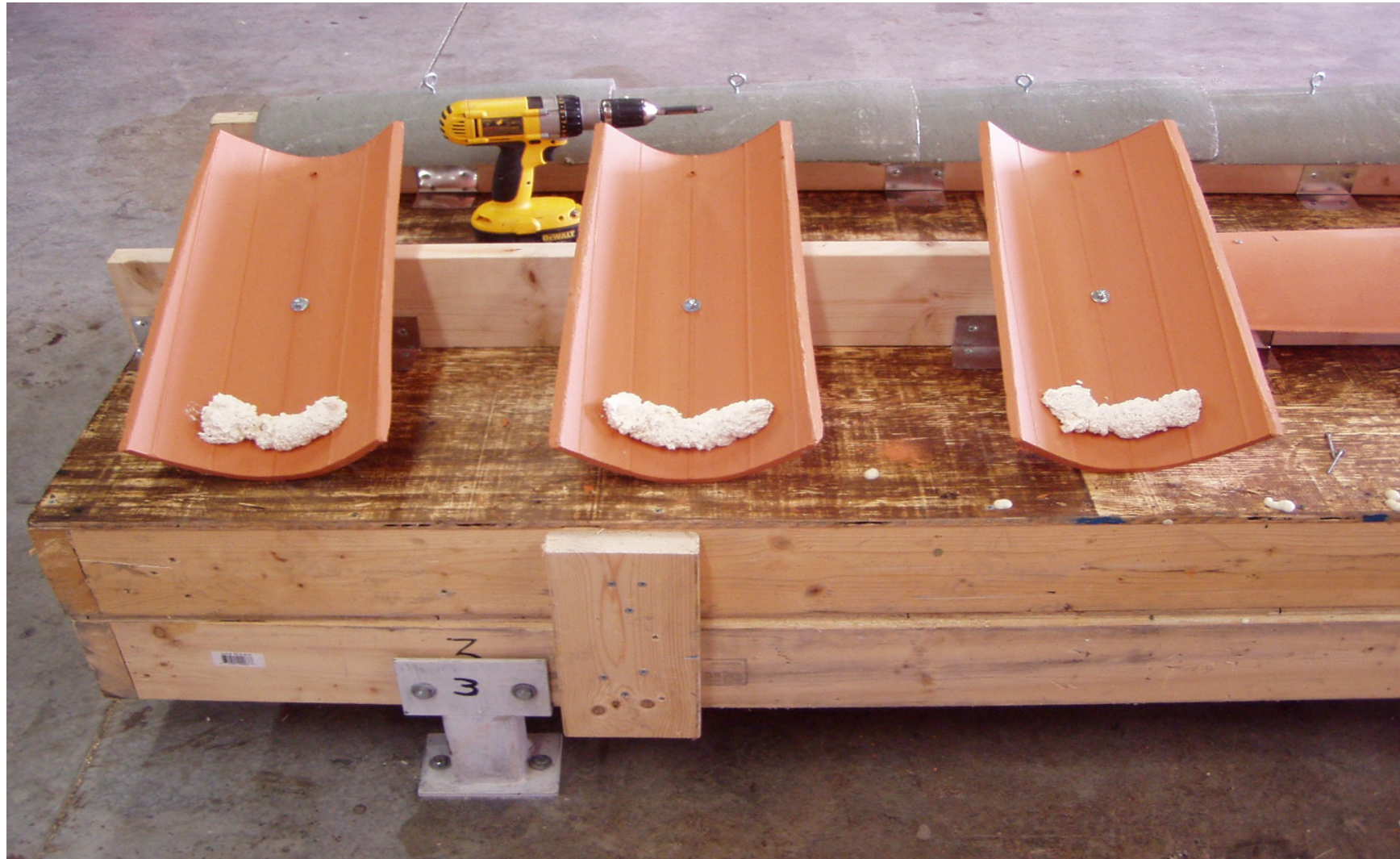
Paddy Placement on Ridge Board  
and Ridge Overlap

## Actual Contact Area to Ridge Tile





# Screw and Adhesive



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Hip and Ridge Attachment

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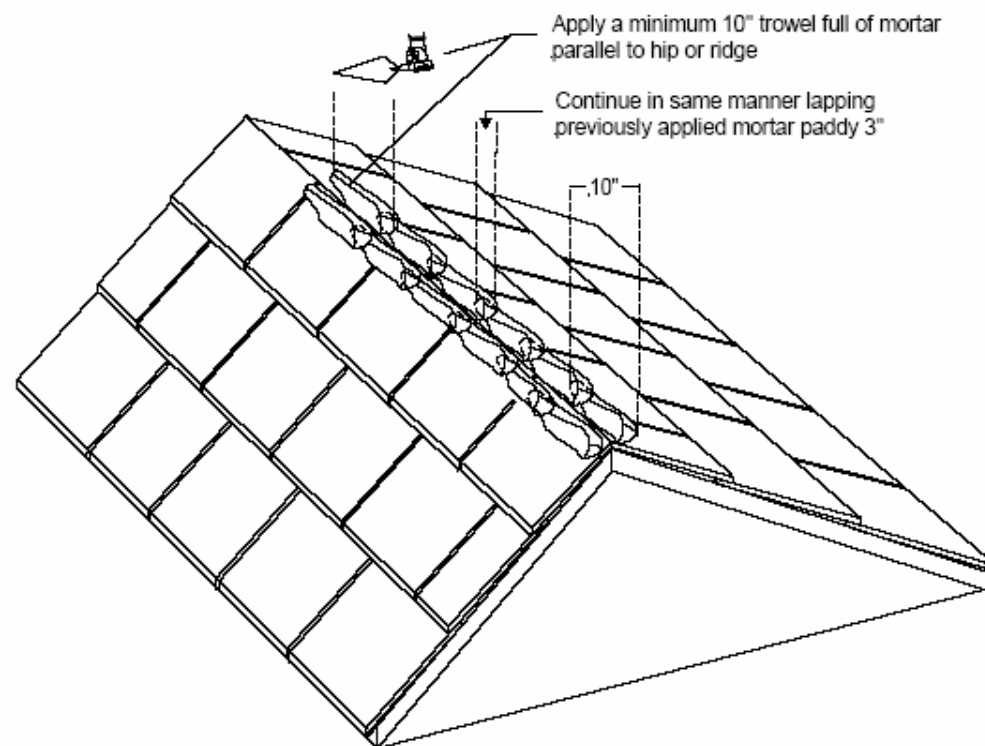
Hip and Ridge Attachment

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# One vs. Two Component Adhesive (Foam)

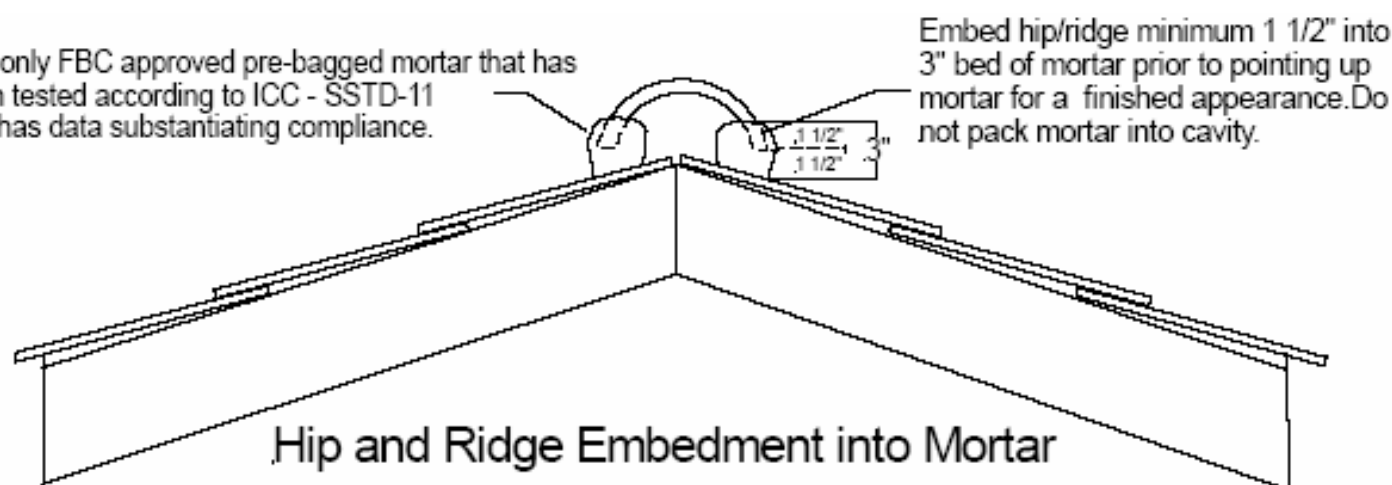
- One component depends on compression to establish secure contact. This includes non-expanding products like RT-600<sup>R</sup> and one component roof tile adhesives like Tile Bond<sup>R</sup> and POLYSET One<sup>R</sup>.
- Two component will expand to establish contact area, given enough volume is applied.

## Mortar Set Attachment Systems 3 & 4 Only



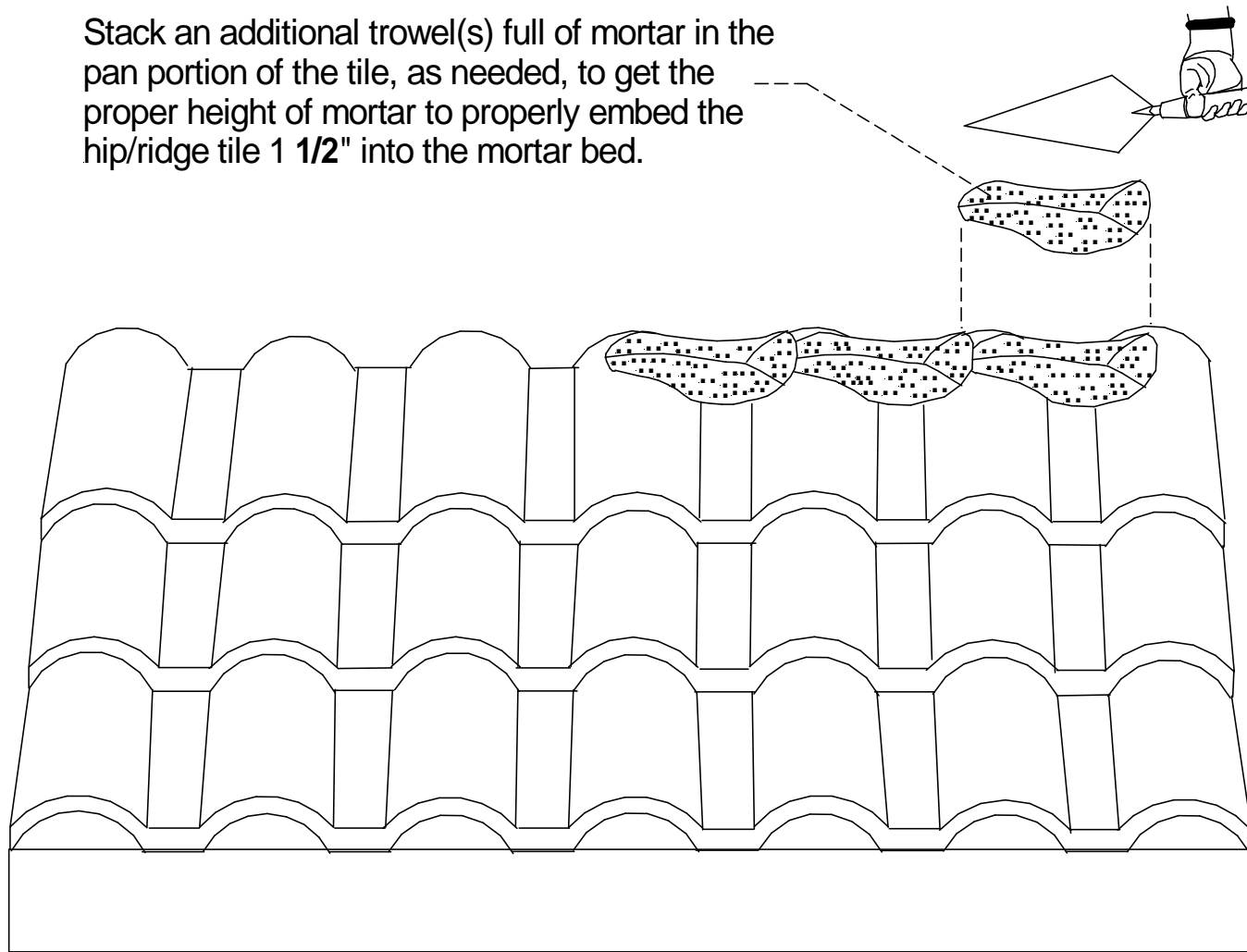
Mortar-set Hip and Ridge Attachment

Use only FBC approved pre-bagged mortar that has been tested according to ICC - SST-D-11 and has data substantiating compliance.



Hip and Ridge Embedment into Mortar

Stack an additional trowel(s) full of mortar in the pan portion of the tile, as needed, to get the proper height of mortar to properly embed the hip/ridge tile 1  $\frac{1}{2}$ " into the mortar bed.



## Proper Height of Mortar Bed

# Hip and Ridge Design Pressures

- All hip and ridge fastening options covered in the Manual have been tested and certified by a third party laboratory.
- To determine actual design pressures of hip and ridge tiles, use underlayment pressures in Tables 2A-2D and 3A-3D of the Manual.

**Table 2A**  
**Category II Buildings**  
**Underlayment Table for Systems 3 & 4 Only**  
**and**  
**Hip and Ridge Design Pressures**

Required Design Pressures, p (psf) Exposure B Gable Roofs ( For Slopes $2:12 < \theta \leq 6:12$ ) Hip Roofs ( For Slopes $5\frac{1}{2}:12 < \theta \leq 6:12$ )										
Height (ft) above ground level, z	Basic Wind Speed, V; (mph)									
	90	100	105	110	120	125	130	140	145	150
<b>Standard or Special Occupancy Structures having an Importance Factor of 1.00</b>										
0 - 30	32.1	39.6	43.7	48.0	57.1	61.9	67.0	77.7	83.3	89.2
40	34.9	43.0	47.4	52.1	62.0	67.2	72.7	84.3	90.5	96.8
50	37.2	45.9	50.6	55.5	66.0	71.7	77.5	89.9	96.4	103.2
60	39.1	48.3	53.3	58.5	69.6	75.5	81.7	94.7	101.6	108.7
<b>Essential or Hazardous Facilities having an Importance Factor of 1.15</b>										
0 - 30	36.9	45.6	50.3	55.2	65.6	71.2	77.0	89.3	95.8	102.6
40	40.1	49.5	54.6	59.9	71.3	77.3	83.6	97.0	104.0	111.3
50	42.7	52.7	58.2	63.8	76.0	82.4	89.1	103.4	110.9	118.7
60	45.0	55.6	61.3	67.2	80.0	86.8	93.9	108.9	116.8	125.0

Note<sup>1</sup>: For Building Category Definition See Page 104.

Note<sup>2</sup>: For Exposure Categories See Page 105.

Note<sup>3</sup>: Table conforms to ASCE 7-02.

Note<sup>4</sup>: For mean roof heights over 60 feet, engineering calculations must be submitted for permitting.

Note<sup>5</sup>: The above design pressure are conservative for any hip/ridge tile with an average exposed width less than 12". To determine the actual hip/ridge design pressure multiply the average exposed width of the tile (b) divided by 12 (inches) times the required design pressure (p).



# Example Calculation

- If the average width of the hip/ridge tile is 10" and the exposed length is 16.5".
  - Hip/ridge area is  $(A) = (W) \times (L)/144$
  - $(A) = 10" \times 16.5"/144$
  - $(A) = 165/144$
  - $(A) = 1.146 \text{ sq. ft}$
- The design pressure according to Table 2A @ 140 mph & 0-30 feet mean roof height is 77.7psf
- $77.7 \times 1.146 = 89.0 \text{ psf}$

# Hip/Ridge Resistance Values



- 4.4 Minimum underlayment shall comply with *FRSA/RTI 07320*.
- 4.5 Tile systems using Polypro® AH160 are limited to installation on projects having an Aerodynamic Uplift Moment ( $M_u$ )<sup>1</sup> or Moment Resistance ( $M_r$ )<sup>2</sup> not greater than the following Allowable Overturning Moment values. Refer to Appendix 1 for Adhesive Paddy Placement details.

Table 1: Maximum Aerodynamic Uplift Moment ( $M_u$ ) or Moment Resistance ( $M_r$ ) Field Tile Installations		
Tile Profile	Adhesive Paddy Placement	Allowable Overturning Moment (ft-lbf)
Clay or Concrete, Flat/Low	Small	36
	Medium	77
	Large	120
	Two	46
	Dual Stacked	59
Clay or Concrete, Medium	Small	25
	Medium	51
	Large	90
	Two	50
	Dual Stacked	43
Clay or Concrete, High	Small	29
	Medium	54
	Large	69
	Two	37
	Dual Stacked	39
Clay, Barrel	Large	182
Concrete, Barrel	Large	127

Table 2: Maximum Aerodynamic Uplift Moment ( $M_u$ ) or Moment Resistance ( $M_r$ ) Hip & Ridge Installations			
Tile Profile	Attachment	Hip / Ridge Material	Allowable Overturning Moment (ft-lbf)
Clay or Concrete, Hip & Ridge	Continuous Paddy, AH160 only	Metal frame w/ 4" flange	165
	8" x 2" Shared Paddy, AH160 only	Metal frame w/ 2" flange (East Coast Metals)	193
	Continuous Paddy, AH160 only	2x6 PT ridge board	196
	One (1) #10 x 2½" SS screw at head with AH160 at tail	2x6 PT ridge board	128

<sup>1</sup> Determined in accordance with 2001 FBC Section 1606.3.3 or 2004 FBC Section 1609.7.3.

<sup>2</sup> Determined in accordance with RAS 127.

# Hip and Ridge Resistance Values

<b>Table 2: Maximum Aerodynamic Uplift Moment (<math>M_u</math>) or Moment Resistance (<math>M_r</math>) Hip &amp; Ridge Installations</b>			
<b>Tile Profile</b>	<b>Attachment</b>	<b>Hip / Ridge Material</b>	<b>Allowable Overturning Moment (ft-lbf)</b>
Clay or Concrete, Hip & Ridge	Continuous Paddy, AH160 only	Metal frame w/ 4" flange	165
	8" x 2" Shared Paddy, AH160 only	Metal frame w/ 2" flange (East Coast Metals)	193
	Continuous Paddy, AH160 only	2x6 PT ridge board	196
	One (1) #10 x 2½" SS screw at head with AH160 at tail	2x6 PT ridge board	128

# Fastening Charts Overview

## Fastening Table Comparisons 1998 vs 2002

- Anchor sheet tables allowable uplift resistance:
  - 1998: 3 tables: One ply, one ply with battens, two ply
  - 2002: Two ply only, with note should single ply values be required
- Anchor sheet tables required uplift resistance:
  - 1998: Gable and hip roofs treated equally
  - 2002: Gable and hip roofs separated

# Fastening Table Comparisons 1998 vs 2002

- Hip and ridge resistance values:
  - 1998: Prescriptive - separated by method
  - 2002: Calculated based on design pressure and tested uplift values
- Monoslope attachment requirement:
  - 1998: Not stipulated (monoslope roofs have higher design pressures)
  - 2002: New monoslope table  $\leq 6-3/4:12$  ( $>6-3/4:12$  not included in ASCE 7-02)



# Fastening Table Comparisons 1998 vs 2002

- Tile fastening tables:
  - 2002: Follows same format as anchor sheet tables with regard to gable and hip requirements
  - 1998: Referenced perimeter and field roof zones
  - 2002: Referenced corner, perimeter, and field roof zones (the corner zones having higher design pressures effectively raises fastening criteria when using “worst case values” for the entire roof)

# Fastening Table Comparisons 1998 vs 2002

- 2002:
  - Eliminated quick reference charts
  - Added essential facilities requirements
  - Hip and ridge tested values required by manufacturer
  - Hip and ridge support member attachment uses the more conservative requirements for essential facilities

# One Screw Limitations

## Western Coast of Florida Where I-75 Determines Boundary

- 130 mph – INLAND – Direct Deck
  - Flat: 60 ft mean roof height
  - Medium: 60 ft mean roof height
  - High: 40 ft mean roof height
- 130 mph – COASTAL – Direct Deck
  - Flat: 40 ft mean roof height
  - Medium: 15 ft mean roof height
  - High: N/A
- Note: Coastal values are marginal for single screw. Suggest two screws in such cases.