INTERIM SUPPLEMENTAL INSTRUCTIONS FOR HIP AND RIDGE ATTACHMENT SECTIONS OF THE FRSA/RTI "CONCRETE AND CLAY ROOF TILE INSTALLATION MANUAL" Third Edition

FOR USE BY AUTHORITIES HAVING JURISDICTION

Submitted by the FRSA/TRI (Formerly the RTI) TILE COMMITTEE

REVISED: April 29, 2005

Foreword

These recommendations were developed after surveying the recent hurricanes and with input from the code, roofing and tile manufacturing community. They are designed to further clarify the current installation procedures as they pertain to the specific roof tile systems (Mechanically fastened, Adhesive-set or Mortar-set).

The following recommendations provide for only products approved by the FBC (Florida Building Code), tested according to SSTD-11 and verified by third party independent FBC approved laboratories, to determine the wind uplift limitations of the various hip and ridge attachment methods or by installation methods currently recognized in the HVHZ (High Velocity Hurricane Zone) section of the FBC.

A joint sub-committee consisting of members from the FRSA (Florida Roofing, Sheet Metal and Air Conditioning Contractors Association, Inc) and the TRI (Tile Roofing Institute) drafted these recommendations and they were approved by consensus by the FRSA Roof Tile Committee.

Table of Contents

1. Introduction

1.1. Purpose

1.1.1. This document is to be used as a supplement to the FRSA/RTI "Concrete and Clay Roof Tile Installation Manual" - Third Edition, specifically the sections of Systems 1, 2, 3 and 4, pertaining to hip and ridge attachment. Recent wind events have established the need to provide greater attention to hip and ridge attachment systems. In order to prevent similar occurrences, all hip and ridge attachment systems must be tested to show compliance to the wind loads set forth by the FBC. The test results will establish the mean roof height limitations for each of the hip and ridge attachment systems. The prescriptive method of hip and ridge applications will no longer be accepted.

1.2 Scope

1.2.1 These recommendations set the requirements for the hip and ridge attachment for Systems 1, 2, 3 and 4 of the FRSA/RTI "Concrete and Clay Roof Tile Installation Manual" - Third Edition.

1.2.2 These recommendations and any other newly developed recommendation shall be tested under laboratory conditions according to SSTD-11 to determine the wind uplift resistance of the specific hip and ridge attachment system. An additional tile factor of 2-to-1 above that specified in SSTD-11 or TAS 101 shall be applied in determining the 'allowable overturning moment' or 'attachment resistance expressed as a moment (Mf)' to account for any interdependence hip and ridge attachment methods used.

1.2.3 The wind resistance performance of the hip and ridge system depends in part on its ability to resist the uplift forces at the perimeter edge and the attachment of the adjoining field tile.

1.2.4 These recommendations are not intended to determine which hip and ridge system is more or less suitable for the user of the product. Conditions, under which the hip and ridge attachment system is used, vary widely. It is the ability of the manufacturer and the user to determine the suitability of the hip and ridge system for the intended job location.

1.2.5 These recommendations are not intended to determine which hip and ridge system is more or less suitable as a weather blocking system or the system's ability to restrict or prevent the infiltration of air or water into the tile system. It is the responsibility of the user to determine the most effective weather blocking system for the intended job location.

1.3 Basis for Requirements

1.3.1 These recommendations are based on experience, research and testing and/or the standards of other organizations. The advice of manufacturers, users, and trade associations was also considered.

1.3.2 These recommendations prohibit component substitution without proper laboratory testing and a FBC Product Approval.

1.3.3 The recommendations reflect tests and practices used to examine characteristics of hip and ridge attachment. These recommendations are intended as guides and strict conformity is not always mandatory. Hip and ridge attachment systems having characteristics not anticipated by these recommendations may be satisfactory if performance equal or superior to that required by these recommendations is demonstrated.

1.4 Applicable Documents

1.4.1 FRSA/RTI 'Concrete and Clay Roof Tile Installation Manual' – Third Edition

1.4.2 (FBC) Florida Building Code

1.4.3 Chapter 9B-72 - Department of Community Affairs – Florida Building Commission

1.4.4 SSTD-11 – 'SBCCI Test Standard for Determining Wind Resistance of Concrete or Clay Roof Tiles'

1.4.5 (TAS) Testing Application Standard 101 – 95 – 'Test Procedure for Static Uplift Resistance of Mortar or Adhesive Set Tile Systems'

1.5 Acronyms, Definitions and General Assumptions

1.5.1 FBC – Florida Building Code.

1.5.2 HVHZ – High Velocity Hurricane Zone of the FBC.

1.5.3 FRSA – Florida Roofing, Sheet Metal and Air Conditioning Contractors Association, Inc.

1.5.4 TRI - Tile Roofing Institute, formally the (RTI) Roof Tile Institute and the (NTRMA) National Tile Roofing Manufacturers Association.

1.5.5 Code Approved – Any product that has FBC Product Approval for that specific application.

1.5.6 Structural support – Any (wood, metal, or other code approved) product used as a means to transfer the loads of an attached hip and ridge tile to the substrate.

1.5.7 Job-site mix – Any non pre-bagged mortar meeting ASTM C-270 for cement, sand and proportioning mixed at a job site and not bagged under the quality control of the mortar manufacture.

1.5.8 Pre-bagged Mortar – Any mortar where the proportions are mixed and bagged under the quality control of the mortar manufacturer and has been issued a FBC Product Approval, tested to SSTD-11.

1.5.9 FRSA/RTI Manual – The FRSA/RTI 'Concrete and Clay Roof Tile Installation Manual' – Third Edition.

1.5.10 Roof Tile Adhesive – A roof tile adhesive product that has been issued FBC Product Approval, tested to SSTD-11.

1.5.11 2" x (H) - a nominal 2" wide by any height necessary to accommodate and properly install the attachment of the hip and ridge tiles. The height of the structural support will vary due to tile profile and the pitch of the roof.

2. General Information

2.1. Hip and Ridge Attachment System Information

2.1.1. Hip and ridge attachment systems are used for weather blocking at the terminations of two adjoining roof planes. Experience has shown that adequate attachment of the hip and ridge tile systems is extremely important to maintaining weather blocking and to minimize ancillary missiles from being created which may occur when hip and ridge tiles impact the field roof tile. Adequately secured field tiles may be vulnerable to wind damage if the hip and ridge tile system is improperly installed. To achieve the specified wind uplift results, follow the hip and ridge application procedures, which shall be representative of the tested assembly.

2.1.2. Hip and ridge attachment system failures occur when wind uplift or pressure exerts forces beyond the resistance strength of the hip and ridge attachment and/or of the structural support to the substrate. When the hip and ridge tile and/or the adjoining field tile are not properly secured, the resulting prying action and uplift forces may cause the hip and ridge attachment to fail. When this occurs the roof tile system becomes vulnerable and may cause ancillary damage and may subject the building to additional rain and/or additional roof tile securement damage.

2.1.3. Hip and ridge tile systems must adequately terminate the adjoining planes. There are three basic types of weather blocking methods used in Florida, foil-faced self-adhered membrane, adhesive and mortar:

Foil-faced self-adhered Membrane System is typically used when a wood hip and ridge frame has been secured to the substrate, the foiled backed membrane is applied in a step fashion sealing to both sides of the adjoining field tile planes prior to the mechanically attachment to the wood frame. It can also be used on a metal hip and ridge frame where mechanical attachment of the hip and ridge tile is an acceptable attachment method. Can be used with all roof tile systems.

Adhesive is used to weather block the entire cavity of the adjoining planes of field tile to the sides of the structural support. Can be used with all roof tile systems.

Mortar (pre-bagged or job-site mix) is used to weather block the longitudinal edges of the hip and ridge tiles to the adjoining field tile roof planes. Can be used with all tile systems.

2.1.4 Hip and Ridge tiles must be adequately attached to transfer the loads to the substrate. **There are three basic attachment methods of the hip and ridge tiles** used in Florida, mechanical attachment, adhesive-set and mortar- set attachment systems:

Mechanical Attachment is the securement of the hip/ridge tiles with nails or screws at the head of the tile in addition to a FBC approved adhesive at the hip/ridge tile overlaps.

Adhesive-set is the securement of the hip/ridge tiles to a structural support with a full bed of adhesive or other FBC approved paddy method.

Mortar-set is the securement of the hip/ridge tiles along both longitudinal edges of the adjoining planes of field tile embedded in a full bed of **pre-bagged FBC approved mortar only.**

2.1.5 Hip and Ridge tile attachment methods are also categorized by whether or not the attachment system is an independent attachment system or an interdependent attachment system. An example of an independent attachment is when the hip/ridge tile is attached in a full bed of adhesive or mortar. An interdependent attachment system is when the load is being applied to more than one tile. An example is a mechanical fastener used at the head of the hip/ridge tile and adhesive used at the overlap joining both tiles together. When the load is being applied to the hip/ridge tile, the resistance is shared with the nail installed at the head of the tile and the adhesive at the hip/ridge tile overlap, which is transferring the load to the nail of the previously installed hip tile.

2.2. Approval Ratings and Limitations

2.2.1. The uplift resistance values achieved from the laboratory testing shall determine the mean roof height limitation of the hip and ridge attachment system.

2.2.2. The resistance values for mechanical fasteners shall be posted in the roof tile manufacturers FBC Product Approval.

2.2.3. The resistance values for adhesive-set system shall be posted in the roof tile adhesive manufacturers FBC Product Approval.

2.2.4. The resistance values for mortar-set system shall be posted in the roof tile mortar manufacturers FBC Product Approval.

3. General Requirements

3.1. Review of Documents

3.1.1. The hip and ridge attachment system shall be installed according to these recommendations and confirmed by test data and/or manufacturers installation recommendation if the system test indicates otherwise or installed according to the HVHZ.

3.1.2. All hip and ridge attachment systems, with uplift resistance values and limitations shall be included in the FBC Product Approval or installed according to the HVHZ, with the same limitations applied.

3.2 Markings

3.2.1 The packaging for the hip and ridge attachment products shall bear the manufacturer's name, model number or trade name and the FBC Product Approval number.

3.3 Manufacturer's Installation Instructions

3.3.1 The manufacturer shall provide all the necessary application instructions, printed materials, and other assistance to the installer to ensure proper installation as required to produce the performance as tested for the FBC Product Approval. These instructions shall include uplift resistance values and clearly state any limitations required.

3.4 Qualified Applicator Program

3.4.1 The adhesive-set and mortar-set manufacturers shall provide a joint qualified applicator program.

4. Hip and Ridge Tile Attachment Systems

NOTE: This document was written for projects utilizing hip and ridge tile. For mitered hip and ridge applications refer to the tile manufacturers recommendations.

4.1 Hip and Ridge Tile Attachment Descriptions

4.1.1 There are four roof tile installation systems currently listed in FRSA/RTI 'Concrete and Clay Roof Tile Installation Manual, System One, System Two, System Three and System Four 'A' & 'B'. **Only System Three and System Four 'B' allows for the use of a FBC approved pre-bagged mortar to attach hip and ridge tiles without the use of a wood, metal or other structural support.**

The three (3) most common methods for installing hip and ridge tile are mechanically fastened, Adhesive-set and mortar-set attachment systems:

1) **Mechanically Fastened Hip and Ridge Attachment System** - This attachment system consists of installing typically a wood hip and ridge frame (or other structural support equal to or superior to resist the pullout of mechanical fastener) secured to the substrate according to the FRSA/RTI Concrete and Clay Roof Tile Installation Manual or the requirements of the HVHZ requirements of the (FBC) Florida Building Code, or having a FBC product approval meeting the requirements of the FBC, specifically rule 9B-72. The weather blocking mechanism is either accomplished with adhesive tested for a weather block, pre-bagged or job site mix mortar or with a step flashing using a foil-faced self-adhered membrane. The hip/ridge tiles are mechanically attached to the structural support with mechanical fasteners and a FBC code-approved roof tile adhesive at the hip/ridge tile overlaps.

2) **Adhesive-set Hip and Ridge Attachment System** - This attachment system consists of installing a wood or metal hip and ridge frame (or other structural support) secured to the substrate according to the FRSA/RTI Concrete and Clay Roof Tile Installation Manual or to the requirements of the HVHZ requirements of the (FBC) Florida Building Code, or having a FBC product approval meeting the requirements of the FBC, specifically rule 9B-72. The weather blocking mechanism is either accomplished with mortar or with a FBC code-approved roof tile adhesive or other FBC code-approved weather blocking material, designed and tested specifically for roof tile weather blocking applications. The hip/ridge tiles are attached to the structural support with a FBC approved adhesive according to the adhesive manufacturers recommendations based on the FBC approved independent laboratory testing or according to the requirements of the HVHZ requirements of the FBC.

3) **Mortar-set Hip and Ridge Attachment System** - This attachment system consists of installing hip and ridge tiles into a bed of FBC approved mortar tested specifically for hip and ridge tile applications and meet the requirements of the (FBC) Florida Building Code, specifically rule 9B-72. The mortar is used as the attachment and waterproofing mechanism.

4.2 Field Cut Roof Tile Requirements

4.2.1 All field cut tiles (two tiles on each side of hip) and the top course of ridge must be attached to the substrate with code-approved adhesive, code-approved mortar or mechanical fasteners and adhesive. **(See Drawings 1 and 2)**. In situations where the ridge course of tile has been cut, the field cut tile and the full tile course below the cut tile must be attached to the substrate as well. This requirement is designed to minimize any dynamic movement of the field cut tiles, at the most stringent zones of the roof, which may occur during a high wind event such as hurricanes. **(See Drawings 3)**.

4.2.2 The minimum head lap when installing the hip and ridge tiles is ~~1~~ 2", as stated in the FRSA/RTI manual. It may be necessary to increase the head lap to cover exposed hip/ridge tile fastening holes or adhesive. Cover exposed fasteners with a UV resistant sealant.

4.3 Hip and Ridge/Field Tile System Limitations

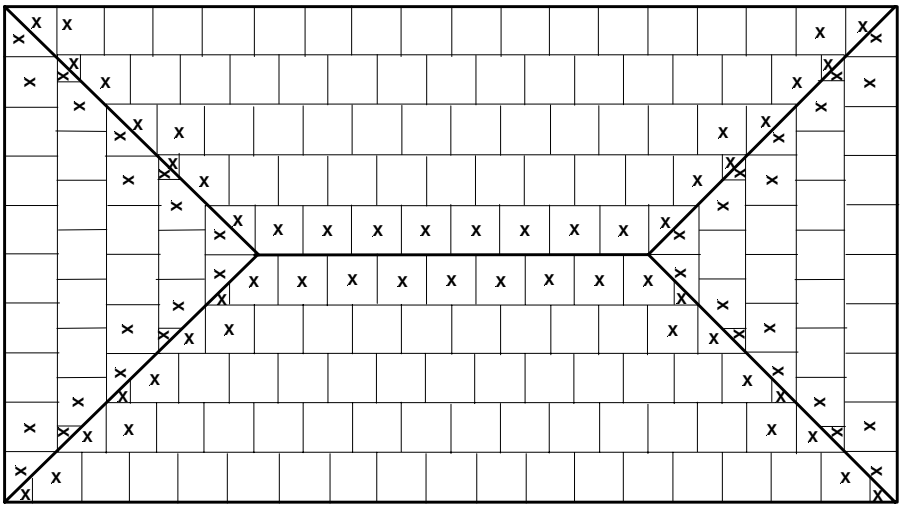
4.3.1 There are three attachment methods for securing hip and ridge tile, mechanically attached, adhesive attached, and Mortar attached. These methods can only be used on field tile attachment systems as follows:

Mechanically Attached Hip and Ridge Tiles - Can be used on field tile attachment Systems One, Two, Three and Four, as listed in the FRSA/RTI Manual.

Adhesive-set Hip and Ridge Tiles - Can be used on field tile attachment Systems One, Two, Three and Four, as listed in the FRSA/RTI Manual.

Mortar-set Hip and Ridge Tiles - Can be used on field tile attachment Systems Three and Four 'B' only, as listed in the FRSA/RTI Manual.

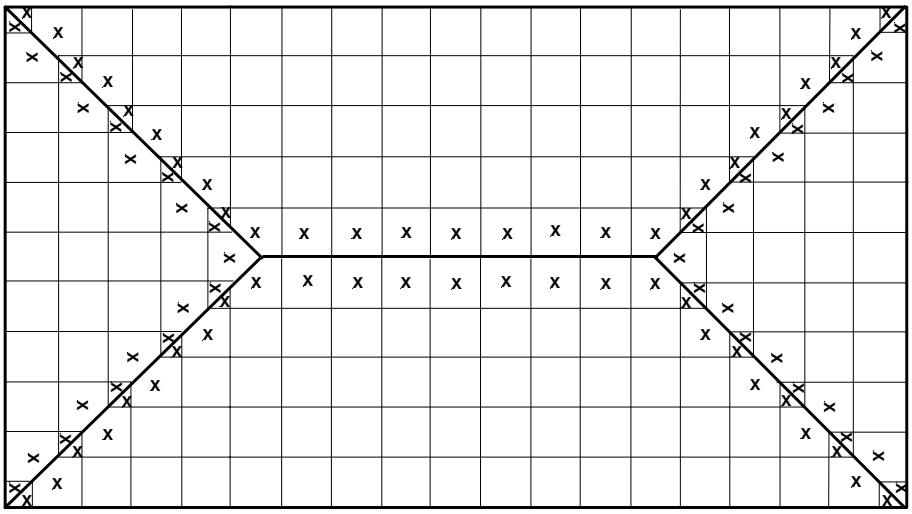
NOTE: Use only the hip/ridge attachment system that will meet or exceed the tile/wind loads set forth by the FBC.



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.

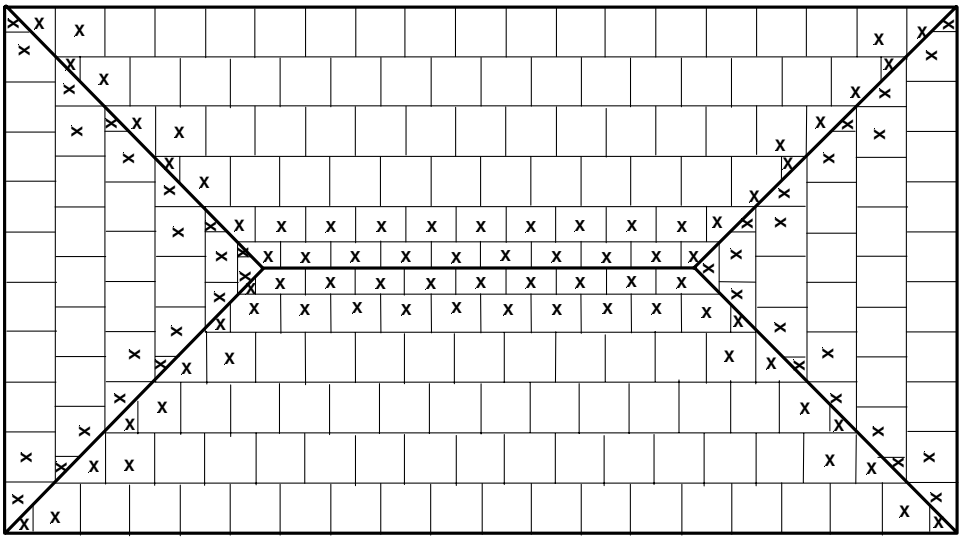
Drawing 1



High Profile Tile or Straight Bond Tile Application

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.

Drawing 2



Cut Pieces at Ridge Line

Where field cut tiles are used at the ridge, attach the cut tile and full tile each side of 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 the tile to the underlayment the underlayment must be approved for adhesive-set or mortar-set applications.

Drawing 3

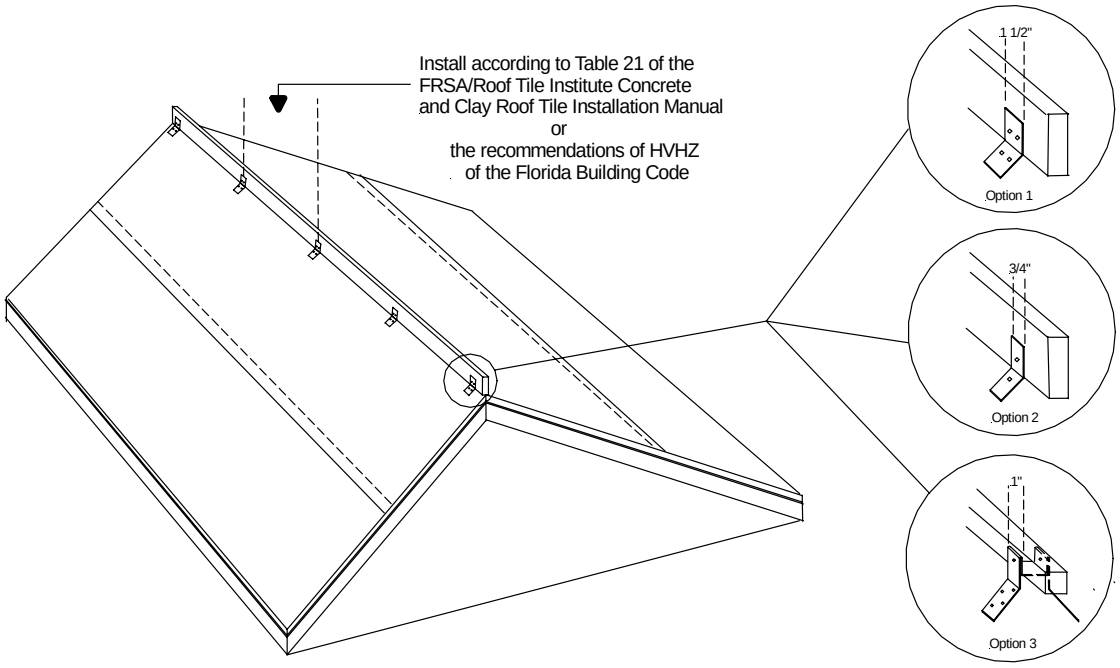
5. Mechanically Attached Hip and Ridge Tile

5.1. Mechanically Attached Hip and Ridge Tile - Structural Support Options

5.1.1. Determine how you want to attach the structural support to the substrate. The three most common methods to attach the structural support (typically wood) to the substrate are:

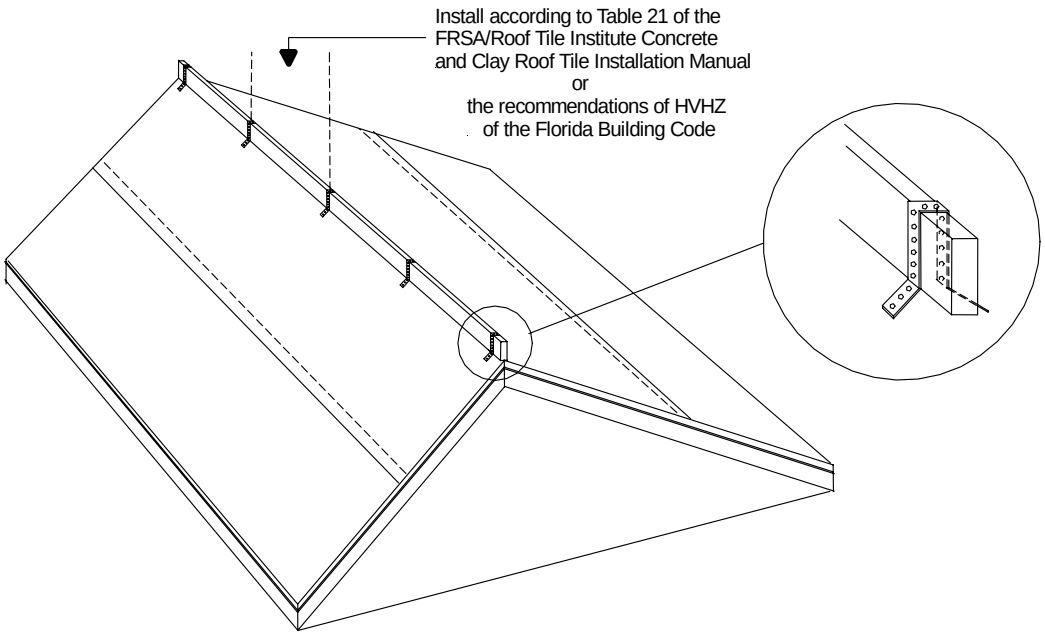
1) Metal Brackets – **See Drawing 4**
2) Metal Straps – **See Drawing 5**
3) Code-approved Adhesive – **See Drawing 6**

5.1.2 Attachment of the wood hip and ridge frame to the substrate must be according to Table 21 of the FRSA/RTI Concrete and Clay Roof Tile Installation Manual or according to the HVHZ requirements of the FBC. See Appendix A for copy of the FRSA/RTI Manual Table 21.



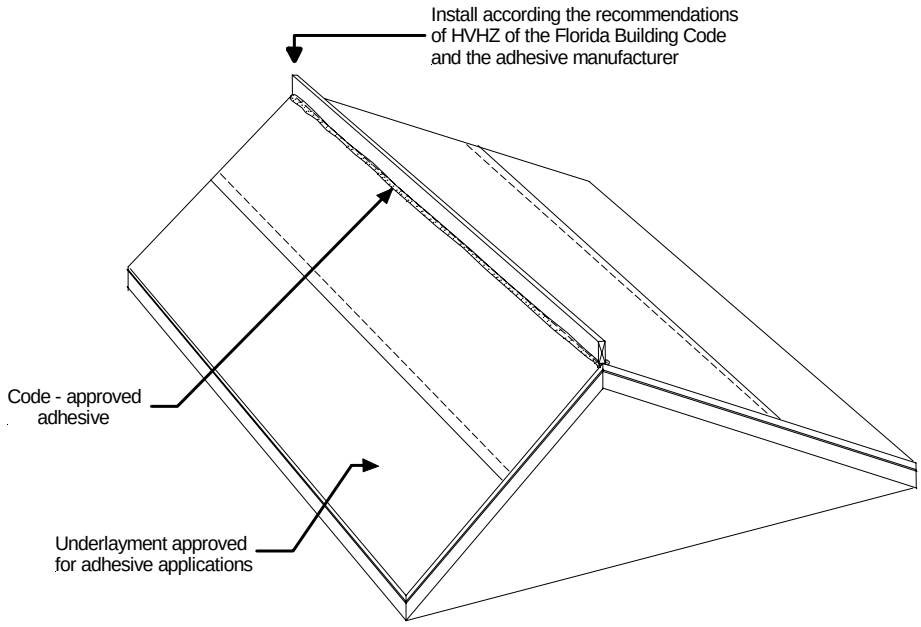
Mechanically Attached Wood Hip and Ridge Board Using Metal Brackets.

Drawing 4



Mechanically Attached Wood Hip and Ridge Board using Strapping Method

Drawing 5



Wood Hip and Ridge Board
Attached with Code-approved adhesive

Drawing 6

5.2 Weather Blocking Options

5.2.1. After completion of the structural support attachment choose the desired weather blocking method for the specific attachment system. The three most common weather blocking methods are:

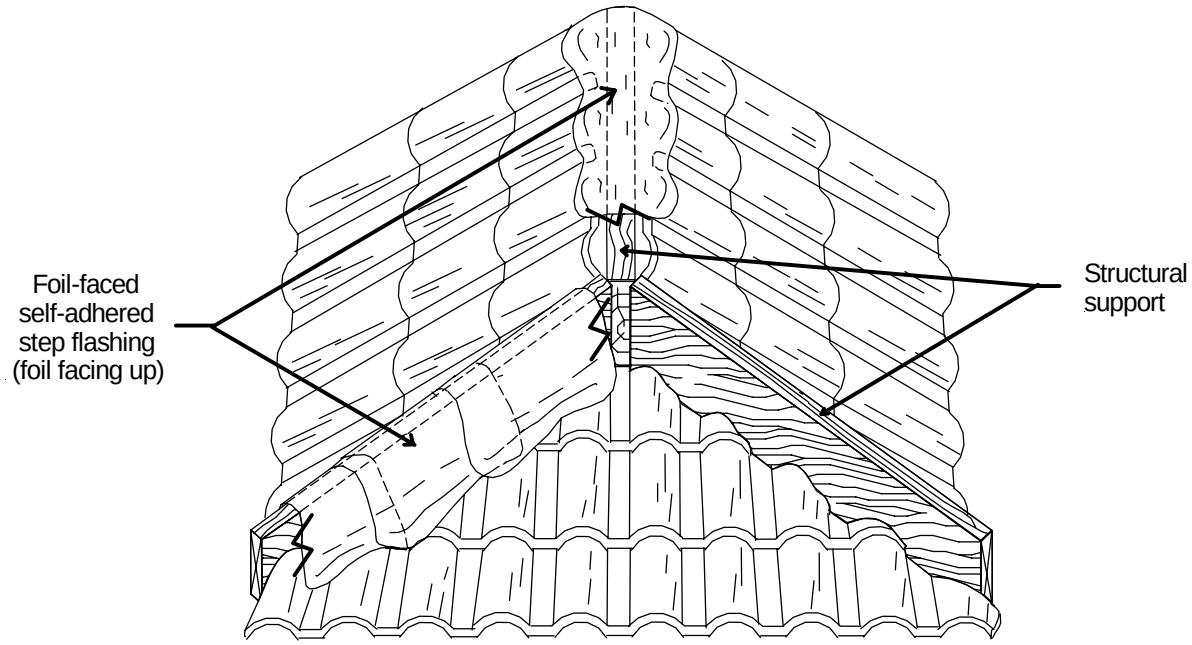
1) Foil-faced Self-adhered Membrane Weather Blocking System
2) FBC Approved Adhesive Tested as a Weather Blocking System
3) (Pre-bagged or Jobsite Mix) Mortar Hip/Ridge Weather Blocking System

5.2.2. Foil-faced Self-adhered Membrane as a Weather Block.

5.2.2.1. This system uses self-adhered membrane as weather block. No mortar is used along the longitudinal edges of the tile. Mortar can be used at the hip/ridge, hip/valley, ridge/valley, and ridge/gable (etc) junctions as a weather block.

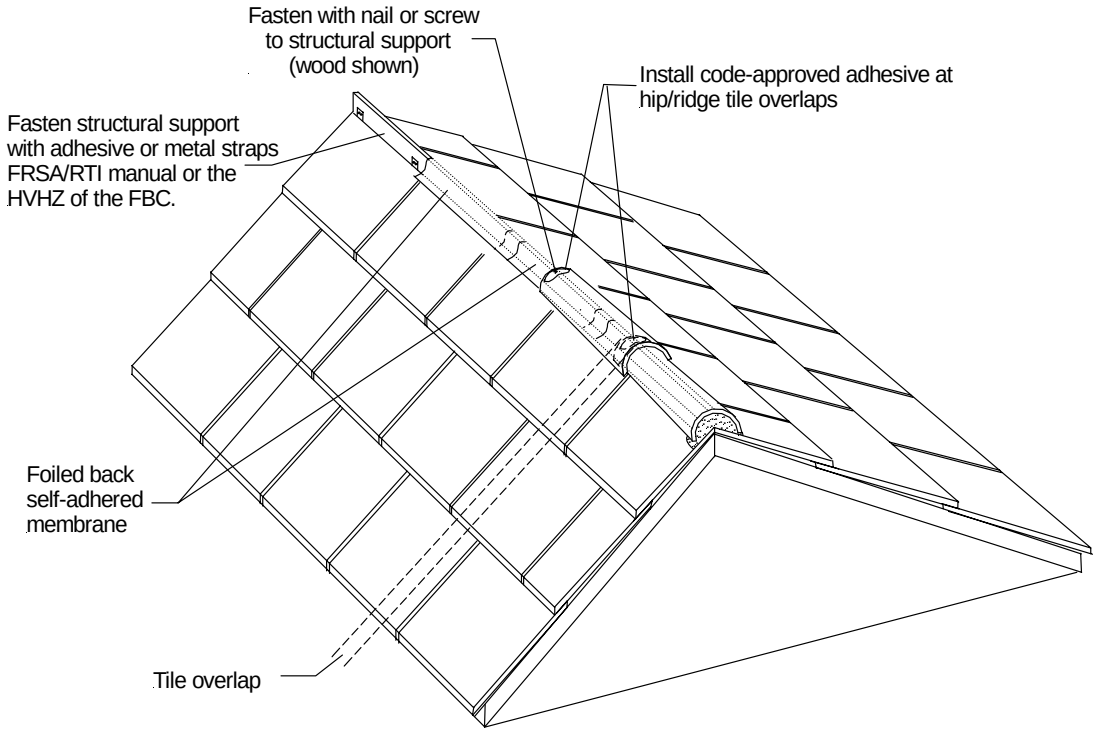
5.2.2.2. Install foil-faced self-adhered membrane over hip/ridge frame (foil side up) in a step flashing method per membrane manufacturer's recommendations and seal to field tile. **(See Drawings 7 & 8)**

5.2.2.3. Care should be taken to ensure the self-adhered membrane is sealed to the tile surface. Ensure hip/ridge, ridge/gable, ridge/valley and hip/eave junctions are sealed to prevent water entry of those areas.



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

Drawing 7



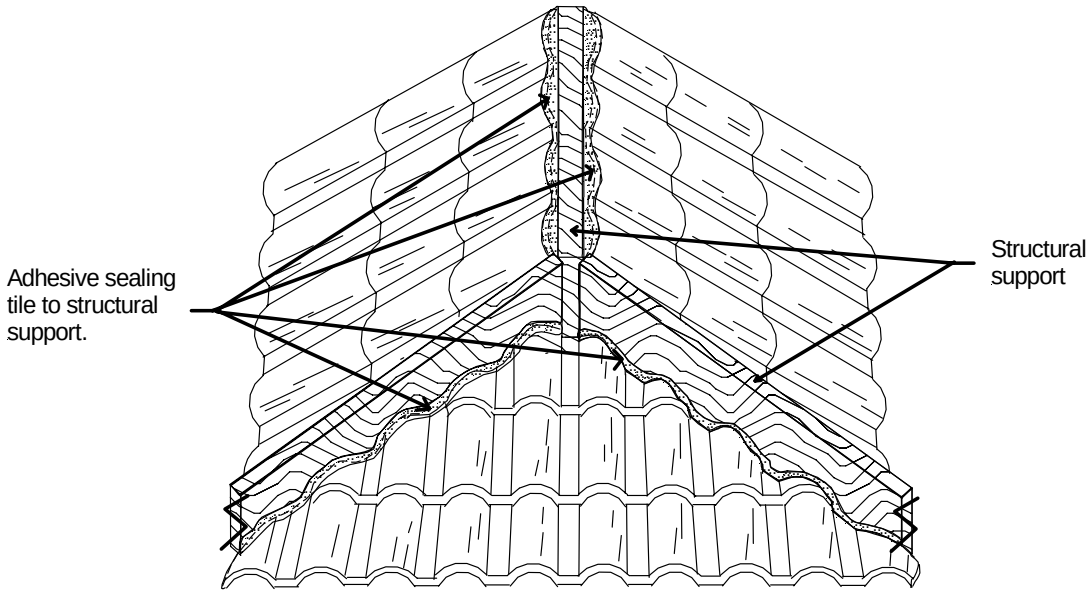
Foil-faced Self-adhered Membrane Used as a Weather Block

Drawing 8

5.2.3 Adhesive Used as a Weather Block

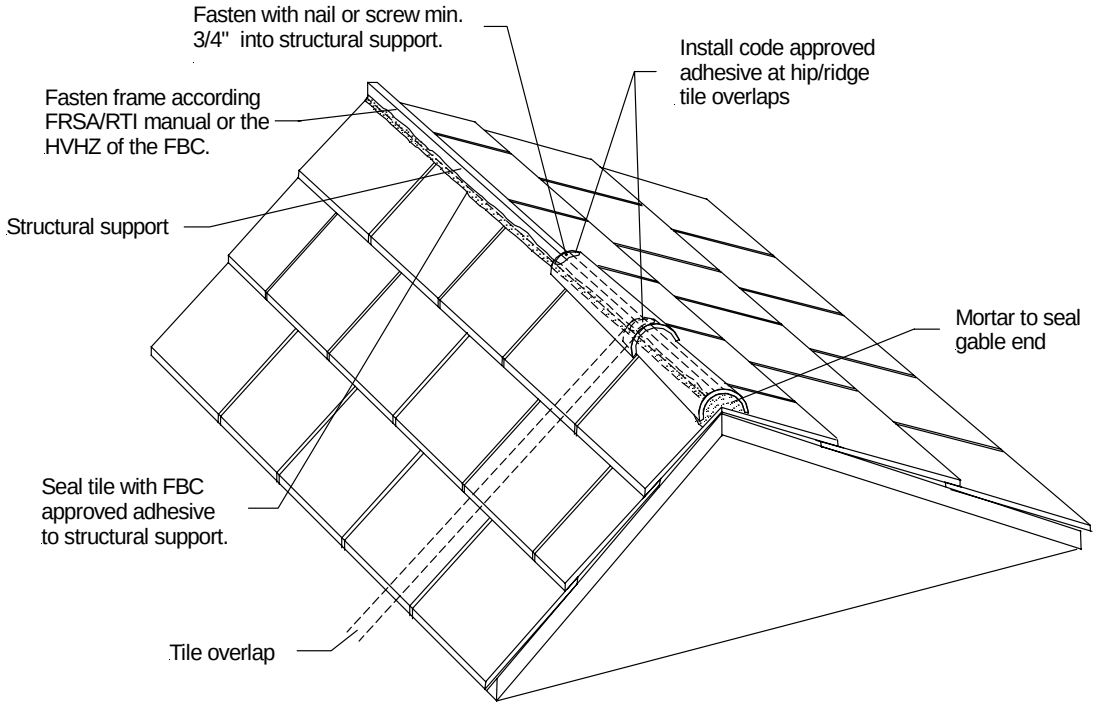
5.2.3.1 This system uses adhesive as weather blocking system. There is no mortar placed along the longitudinal edges of the hip and ridge tile. Adhesive is placed where the field tile abuts to the structural support. A bead of adhesive is placed parallel to the hip and/or ridge board tile junction to act as a weather block and is applied prior to the attachment of the hip and ridge tile.

5.2.3.2 Install adhesive to seal all voids between the tile and the structural support according to the adhesive manufacturers recommendations. Care should be taken to ensure all areas are sealed with adhesive to prevent water entry. **(See Drawings 9 & 10)**



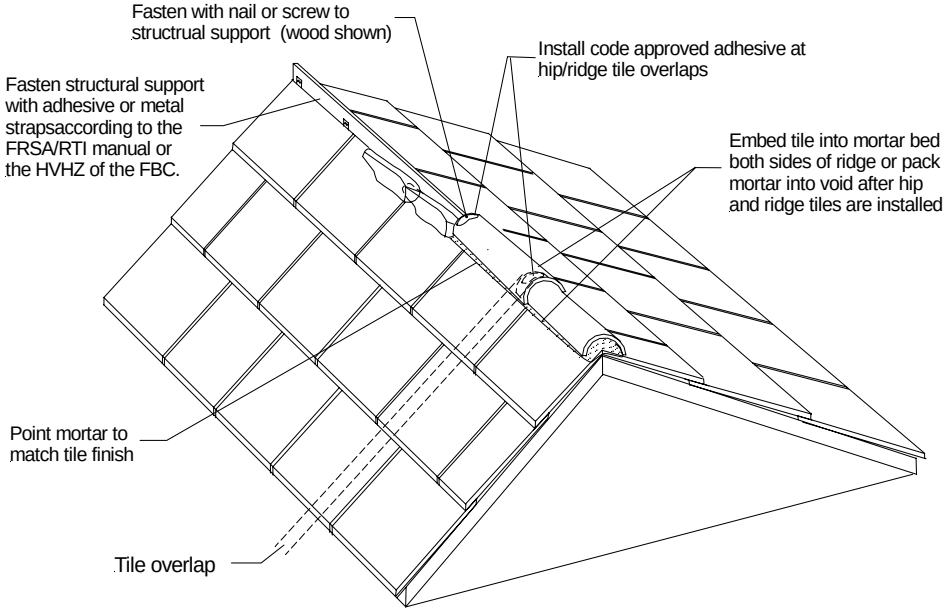
Adhesive used as weather blocking

Drawing 9



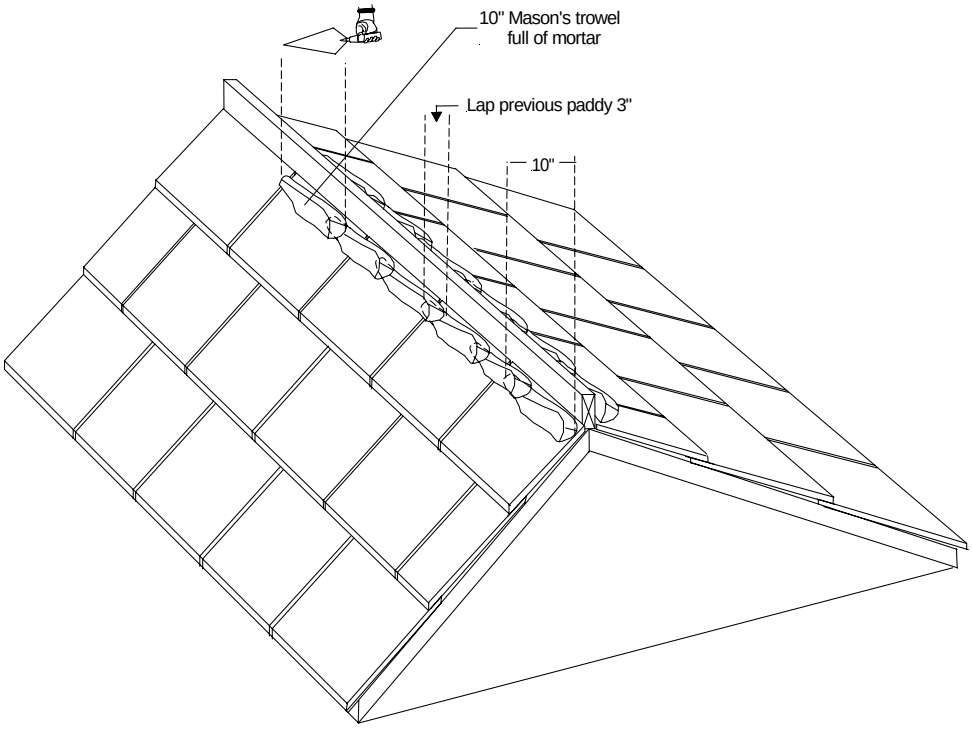
Hip/Ridge Tile Attachment Using Adhesive as Weather Block

Drawing 10



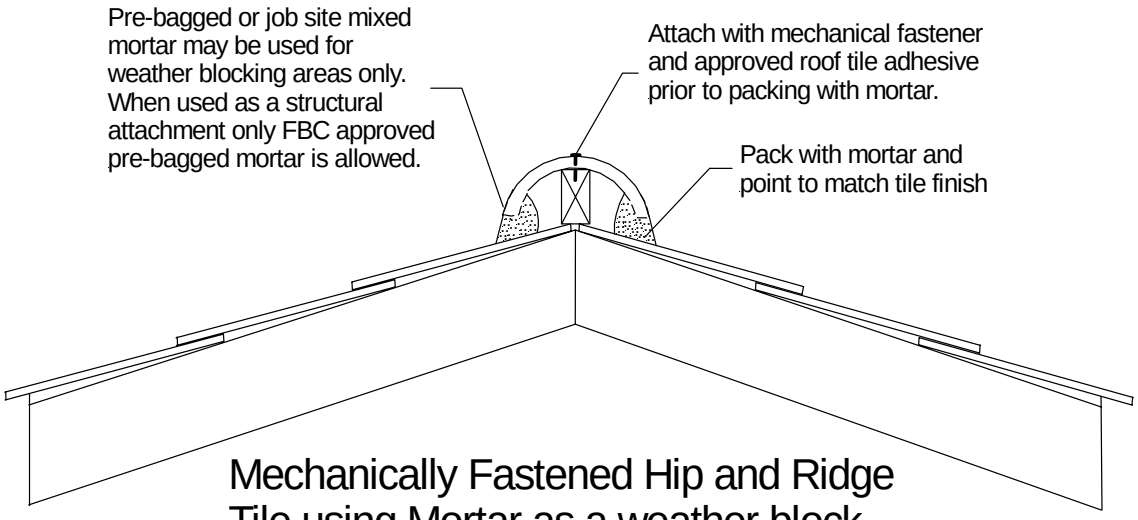
Attaching Hip/Ridge tile using Mortar as Weather Blocking

Drawing 11



Mortar Hip and Ridge Weather Blocking System.

Drawing 12



Mechanically Fastened Hip and Ridge Tile using Mortar as a weather block

Drawing 13

5.3. Hip and/or Ridge Starter Tile Attachment

5.3.1 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 FRSA/RTI Concrete and Clay Roof Tile Installation Manual.

5.3.2 Care must be taken to properly secure the first (starting) hip and ridge tile of the hip/ridge attachment system. Additional securement 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.

5.3.3 Typically the structural support is kept 6" to 12" back from the eave to allow for the aesthetic placement of mortar used as a weather block and closing off the hip end at the eave. It may be necessary to extend or cantilever the structural support toward the eave to ensure adequate support for the hip tile attachment. (**See Drawing 24)** All hip or ridge starter tile must be secured at the both ends of the tile either with mechanical fasteners or adhesive. Although this section mentions hip starter tiles, the same is true for the starting ridge tile. Some options are listed below:

1) Drill a 3/16"hole within lower one-third of the 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 ¾". 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.

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 manufacturers installation instructions. Secure the head of the tile with mechanical fastener embedding into structural support, a minimum of ¾".

3) Prior to installing the hip starter tile, place a full bed of **only FBC code-approved pre-bagged mortar** according to the mortar manufacturers installations 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 ¾". 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.**

5.4 Hip and Ridge Tiles Mechanically Attached to Structural Support

5.4.1 Prior to installing subsequent hip/ridge tiles place a minimum 4" to 5" bead of FBC approved roof tile adhesive along the head of the hip starter tile. Install the next hip tile, centering over the wood frame and lapping the starter tile a minimum of ~~1~~ 2". (See Drawing 8). If the overlap is restricted by product design, refer to the tile manufacturers installation instructions. Continue in same manner working from the lowest point toward the highest point of the roof. At intersecting junctions (i.e. hip/ridge, ridge/gable, ridge/valley) cut tile to form a solid fit and ensure the first and the last hip/ridge tile is securely fastened. Any exposed fasteners must be sealed with a UV resistant sealant.

5.4.2 Optional: Prior to installing the tiles at these adjoining junctions, place a full bed (filling entire cavity) of FBC approved pre-bagged mortar under the entire adjoining hip/ridge tile. Embed the entire hip/ridge tile into the solid bed of mortar. Point mortar to desired finish. Fasten as mentioned above. Use the three methods under Note [5] above as guidelines and/or options at these junctions.

6.0 Adhesive-set Hip and Ridge Attachment System

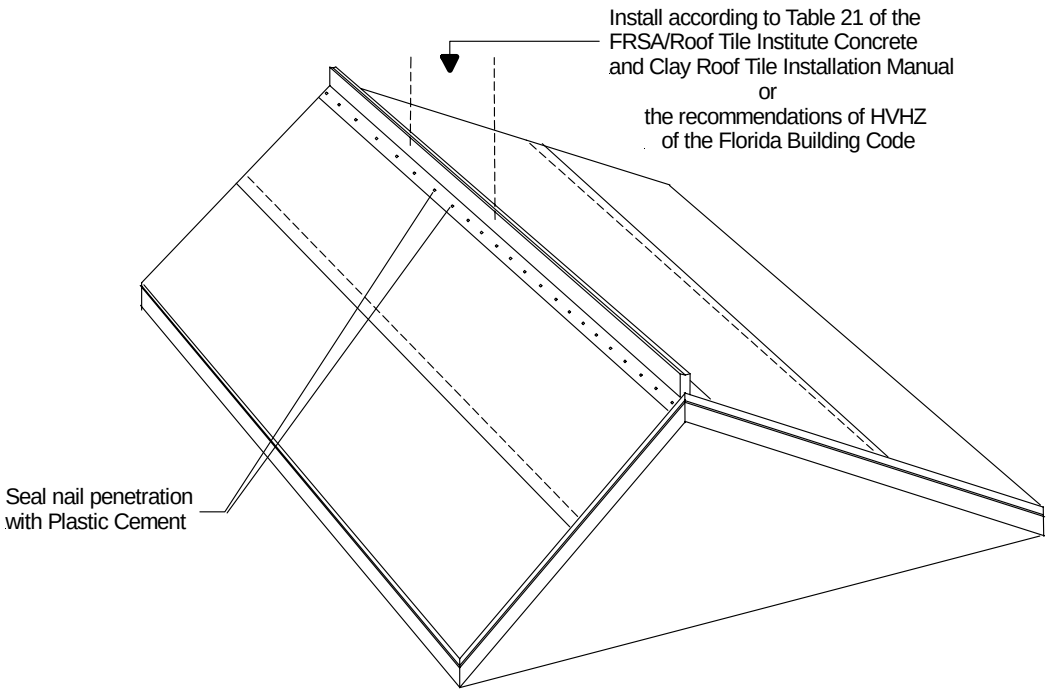
6.1. Adhesive-set Hip and Ridge Attachment System – Structural Support Options

6.1.1 Adhesive-set hip and ridge tiles can be installed directly to a structural support. The most common structural supports are:

1) Wood Hip and Ridge Frame **(See Drawings 4, 5, & 6)**
2) Metal Hip and Ridge Frame (Metal Channel) **(See Drawing 14)**

6.1.2. Determine how you want to attach the wood hip and ridge frame to the substrate. The three most common methods to attach the wood hip and ridge frame to the substrate are:
1) Metal Brackets – **See Drawing 4**
2) Metal Straps – **See Drawing 5**
3) FBC approved Adhesive – **See Drawings 15 & 17**

6.1.3. Attachment of the wood or metal hip and ridge frame to the substrate must be according to Table 21 of the FRSA/RTI Concrete and Clay Roof Tile Installation Manual or according to the HVHZ requirements of the FBC. See Appendix A for a copy of the FRSA/RTI Table 21.



Metal Hip and Ridge Frame

Drawing 14

6.2 Adhesive Weather Blocking System Options

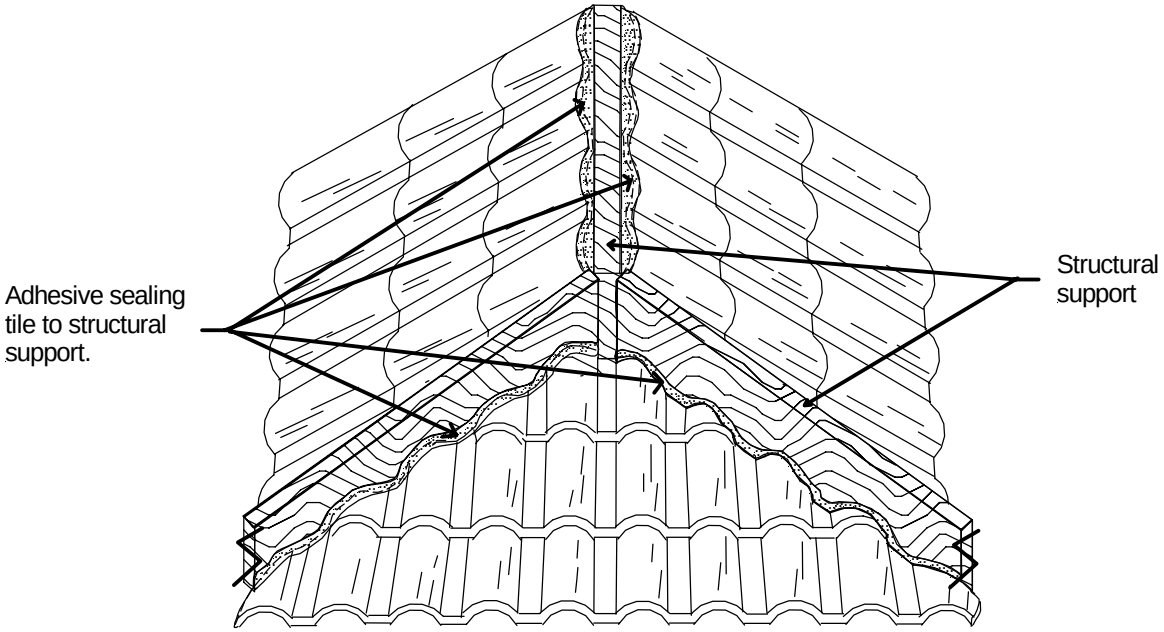
6.2.1 Once the attachment method has been completed a choice has to be made on the weather blocking method. The two most common methods are:

1) FBC Approved Adhesive Tested as a Weather Blocking System –**(See Drawings 15 and 17)**
2) (Pre-bagged or Jobsite Mix) Mortar Weather Blocking System – **(See Drawings 11,12 and 13)**

6.2.2. Adhesive Used as a Weather Block

6.2.2.1. This system uses adhesive as weather blocking system. There is no mortar placed along the longitudinal edges of the hip and ridge tile. Adhesive is placed where the field tile abuts to the structural support. A bead of adhesive is placed parallel to the hip and/or ridge board tile junction to act as a weather block and is applied prior to the attachment of the hip and ridge tile.

6.2.2.2. Install adhesive to seal all voids between the field tile and the structural support according to the adhesive manufacturers recommendations. Care should be taken to ensure all areas are sealed with adhesive to prevent water entry. **(See Drawing 15)**



Adhesive used as weather blocking

Drawing 15

6.2.3 Mortar Used as a Weather Block

6.2.3.1 This system uses mortar as weather blocking system and for aesthetics. A full bed of mortar is placed along the longitudinal edges of the hip and ridge tile either during the application of the hip and ridge tiles or may be packed in after the hip and ridge tiles are installed and the adhesive has cured. The hip and ridge tiles are adhesive-set to the structural support in addition to the mortar.

6.2.3.2 Install mortar to seal all voids between the field tile and the hip/ridge tile according to the mortar manufacturers recommendations. Care should be taken to ensure enough mortar is used, to create a wedge, to eliminate the potential of the mortar from dislodging from the hip/ridge and field tile junction. Ensure areas are sealed to prevent water entry. After mortar is packed into place point mortar to desired finish. **(See Drawings 11, 12 & 13)**

6.3. Adhesive-set Hip and Ridge Starter Tile Attachment

6.3.1 Starting at the eave, and prior to installing the hip starter, place a bead or paddy of FBC approved roof tile adhesive parallel to and on top of the wood or metal frame according to the adhesive manufacturer's instructions. An alternate method is to place the adhesive in the center of the underside of the hip/ridge tile, turn hip/ridge tile over and carefully place and center the tile over the structural support. The method of the paddy placement location must be representative of how the adhesive manufacturer tested the hip and ridge attachment method.

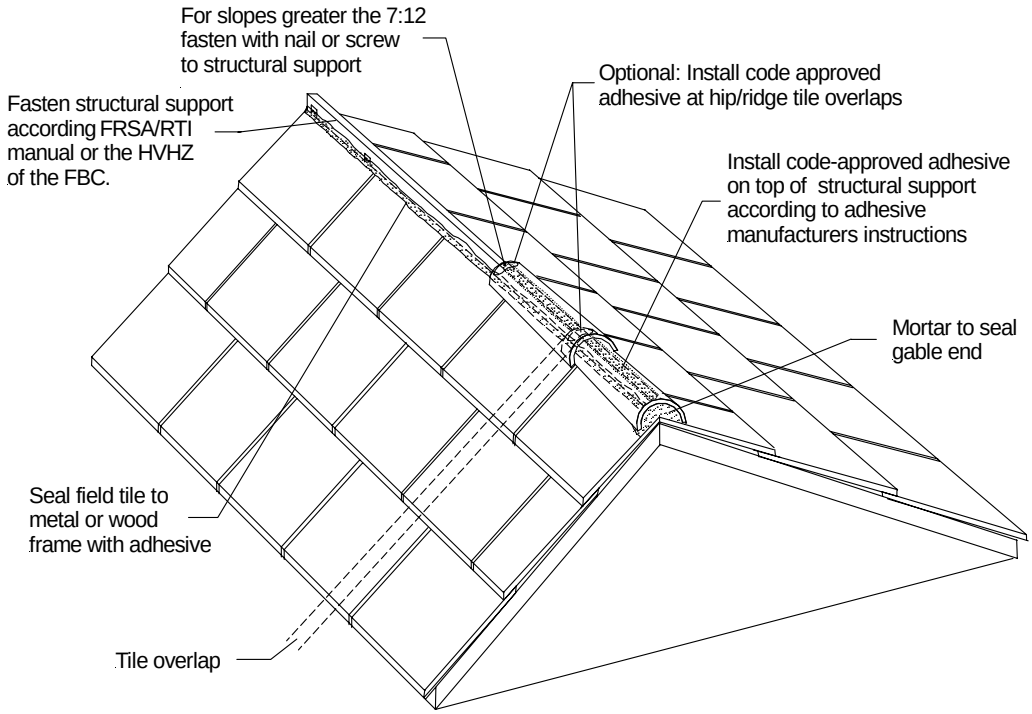
6.3.2 At the eave, place first hip (starter) tile over the metal or wood hip frame, positioning the tile in the center of the frame. Install the hip starter tile over the adhesive paddy or bead. Fasten hip tiles when the roof slope is greater than 7:12. The fasteners hold the tiles in place until the adhesive can cure.

6.3.3 Optional: Prior to installing subsequent hip tiles, Place a minimum 4" bead of code-approved roof tile adhesive along the head of the hip starter tile.

6.4 Adhesive-set Hip and Ridge Tile Attachment

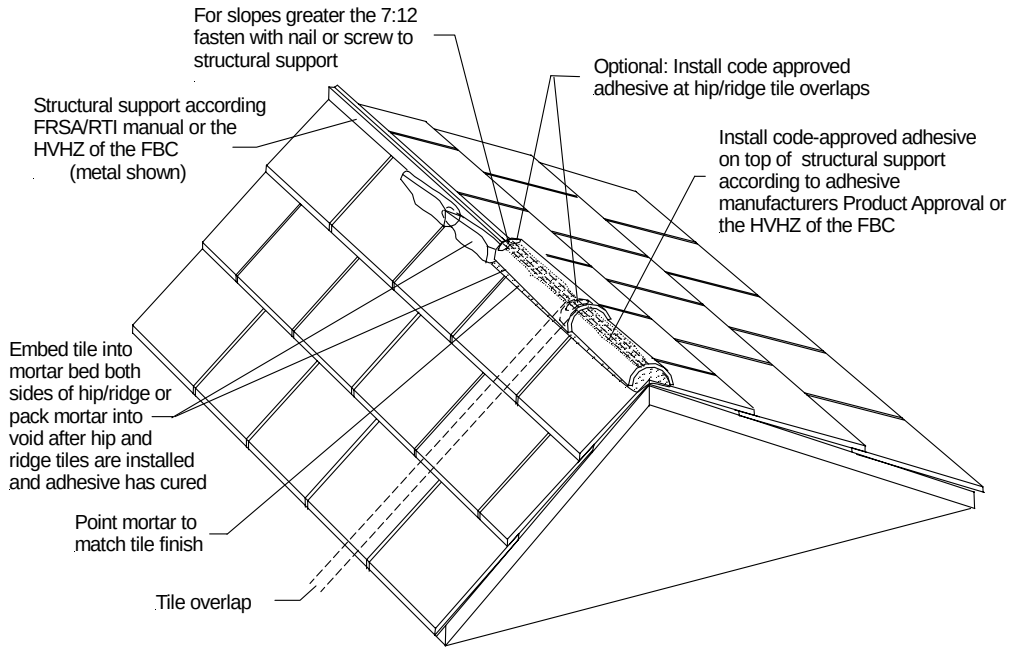
6.4.1 Install the next hip tile, centering over the frame and lapping the starter tile a minimum of ~~1~~ 2". **(See Drawings 16, 17 & 18).** If the overlap is restricted by product design, refer to the tile manufacturers installation instructions. Continue in same manner working from the lowest point toward the highest point of the roof. At intersecting junctions (i.e. hip/ridge, ridge/gable, ridge/valley) cut tile to form a solid fit and ensure the first and the last hip/ridge tile is securely fastened. Any exposed fasteners must be sealed with a UV resistant sealant.

6.4.2 Optional: Prior to installing the tiles at these adjoining junctions, **place a full bed (filling entire cavity) of FBC approved pre-bagged mortar** under the entire adjoining hip/ridge tile. Embed the entire hip/ridge tile into the solid bed of mortar. Point mortar to desired finish. Fasten as mentioned above. Use the three methods under section 5.3.3 above as guidelines and/or options at these junctions.



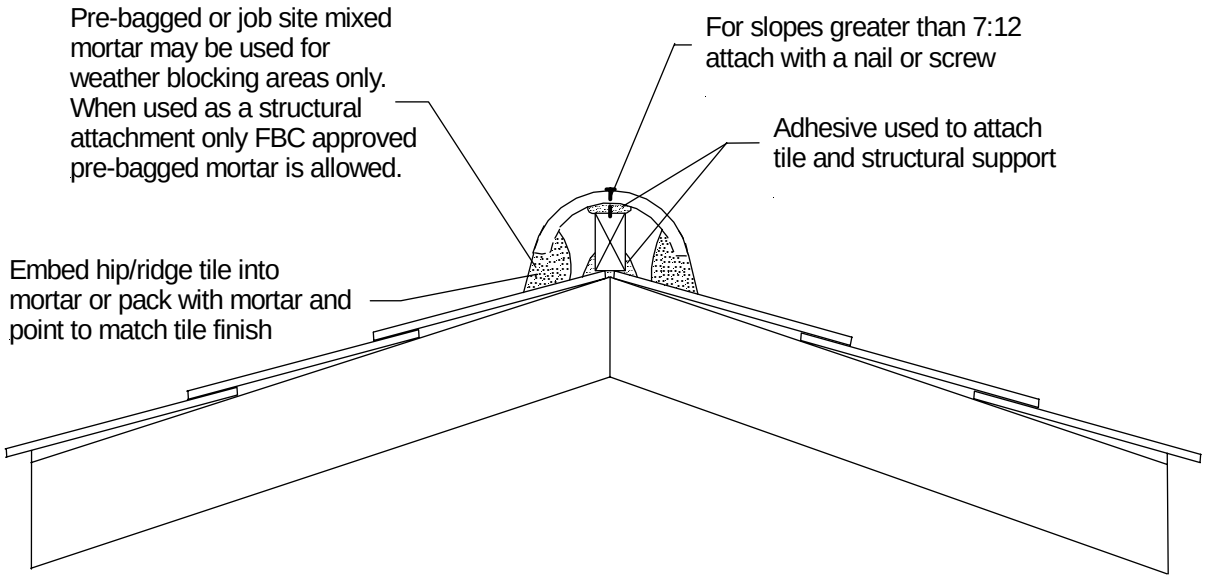
Adhesive-set Hip/Ridge Tile Using Adhesive as Weather Blocking

Drawing 16



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

Drawing 17



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

Drawing 18

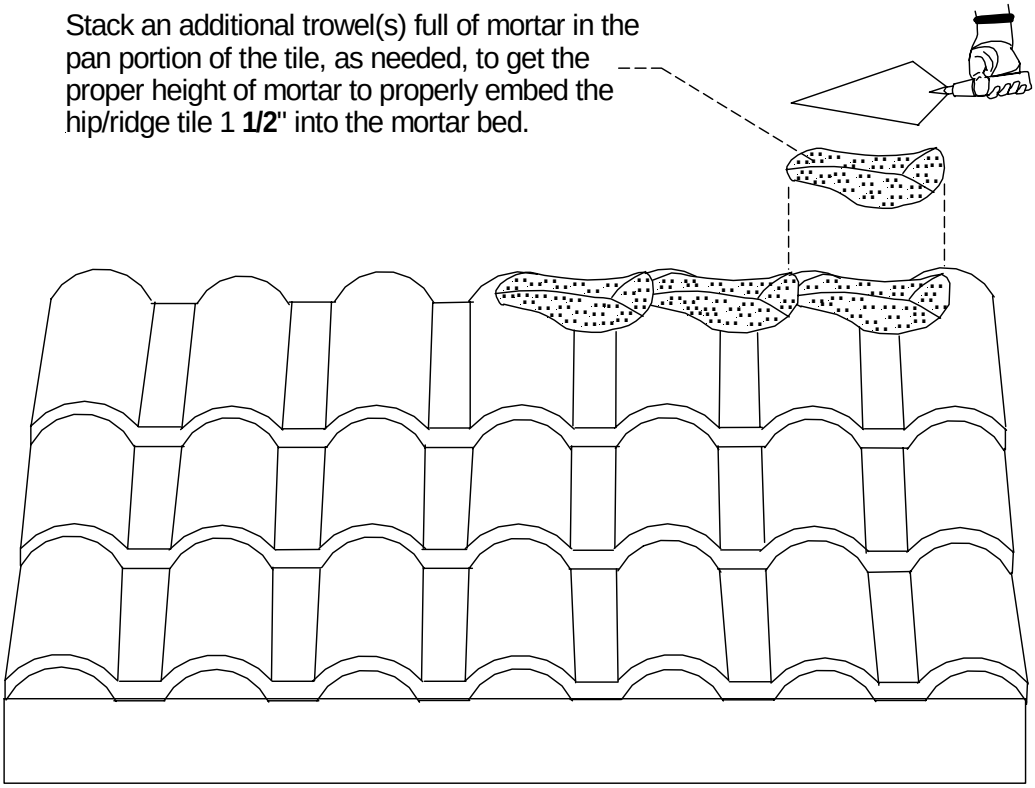
7. Mortar-set Hip and Ridge Tile Attachment System

7.1. Mortar-set Hip and Ridge Tile Attachment limitations

7.1.1 Mortar-set Hip and Ridge Tile Attachment System can only be used with field tile attachment Systems Three and Four 'B' and can only be installed with pre-bagged FBC approved (specifically according to Rule 9B-72) mortar tested to determine the limitations of the product application.

7.2. Mortar-set Hip and Ridge Starter Tile Attachment

7.2.1 Prior to installing any hip/ridge tile, a full solid bed of mortar is placed at the eave end of the hip or ridge starter tile and parallel to the hip and/or ridge structural support under where the longitudinal edge of the hip/ridge tile is to be placed. **(See Drawings 19, 20, 21, 22, 23 & 24) For Medium, High or Two-piece Barrel profiled tiles,** it will be necessary to stack 10" trowel full of mortar on top of each other in the pan portions of the tile, to get the proper height of the mortar to properly embed the hip/ridge tile 1 ½" into the mortar bed. **(See Drawing 22)**



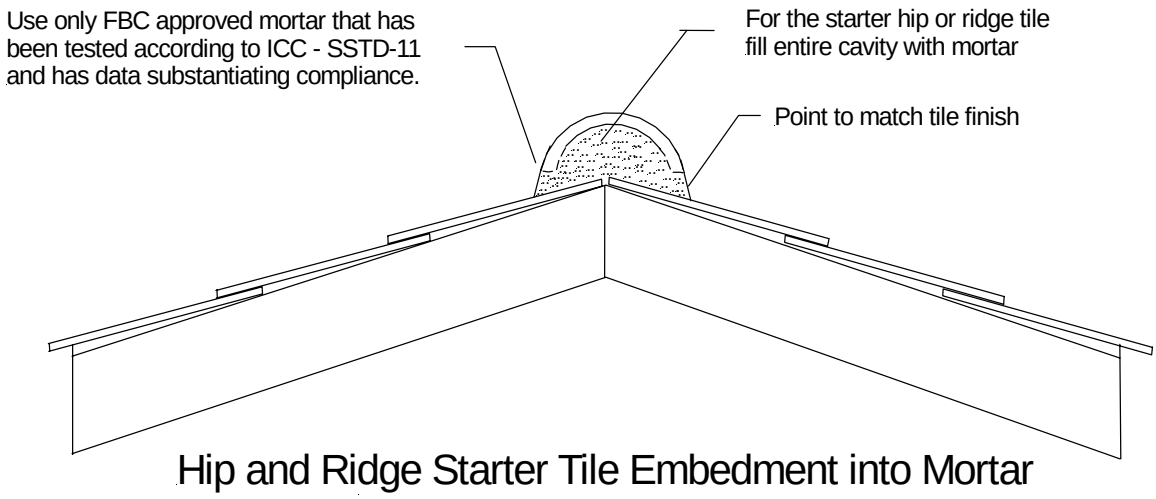
Proper Height of Mortar Bed

Drawing 19

7.2.2. Apply enough FBC approved mortar to fill the entire hip/ridge starter tile cavity with mortar. Apply the remaining hip/ridge tile per mortar manufacturer's instructions. Care should be made to minimize the placing of mortar too far in front of laying tile to minimize mortar dehydration.

7.2.3. Position hip starter tile over the center of the hip junction. Embed the hip starter tile into the full bed of mortar. Some mortar will be forced out of the cavity. Remove excess mortar and point to desired finish.

7.2.4. Care must be taken to embed the tile into the mortar a minimum of 1 ½". (Do not just fill the voids of the tile edges with mortar). The packing of mortar into the cavities between the hip/ridge tiles and the field tile are not allow for the structural attachment of the hip and ridge tiles. The tile must be embedded into the mortar.



Hip and Ridge Starter Tile Embedment into Mortar

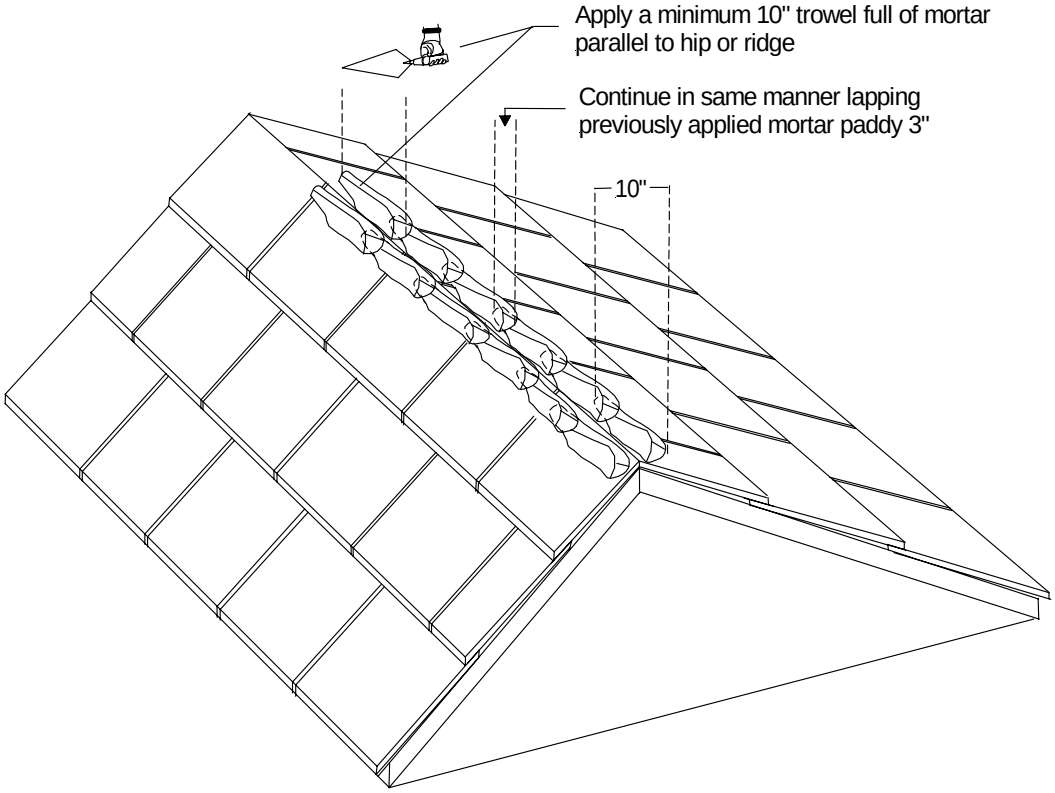
Drawing 20

7.3 Mortar-set Hip and Ridge Tile Attachment

7.3.1 Position and install the next hip tile, centering over the hip junction and lapping the starter tile a minimum of ~~1~~ 2". Embed the tile into the mortar bed a minimum of 1 ½". **(See Drawing 22).** If the overlap is restricted by product design, refer to the tile manufacturers installation instructions. Continue in same manner working from the lowest point toward the highest point of the roof. At intersecting junctions (i.e. hip/ridge, ridge/gable, ridge/valley) cut tile to form a solid fit and ensure the first and the last hip/ridge tile is securely fastened. Any exposed fasteners must be sealed with a UV resistant sealant.

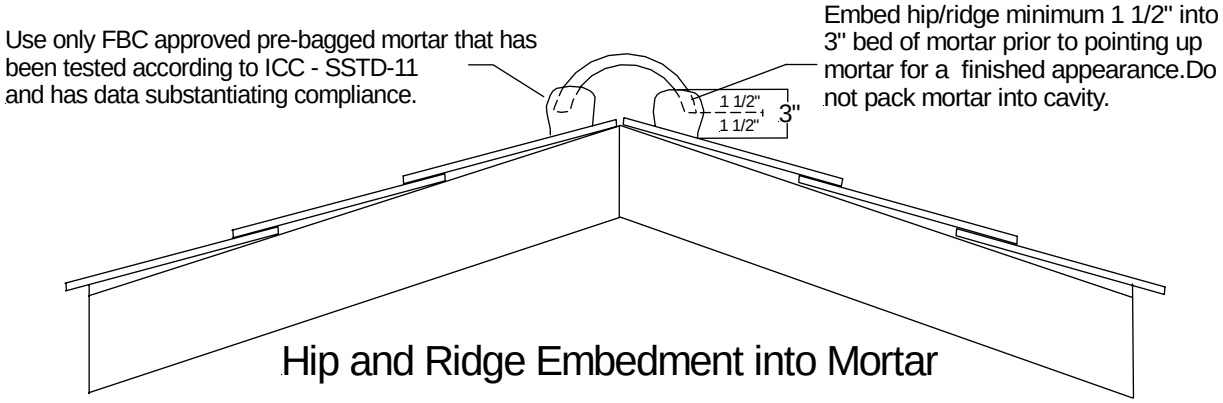
7.3.2 At all junctions (i.e. hip/ridge, ridge/gable, ridge/valley etc.) fill all voids with mortar. Prior to installing the junction tiles a bed of mortar must be placed to minimize any cracking of the mortar. These cut or mitered tile must be embedded into the mortar. Point mortar to desired finish.

7.3.3 Optional: The entire cavity of the hip and ridge tile may be filled a bed of mortar in lieu of longitudinal beads placed parallel to the hip and ridge junction. **(See Drawing 21)**



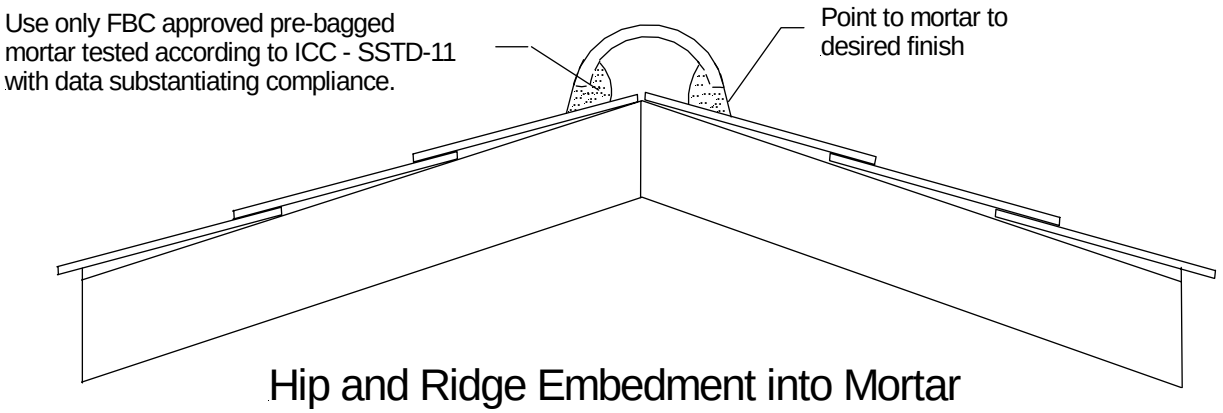
Mortar-set Hip and Ridge Attachment

Drawing 21



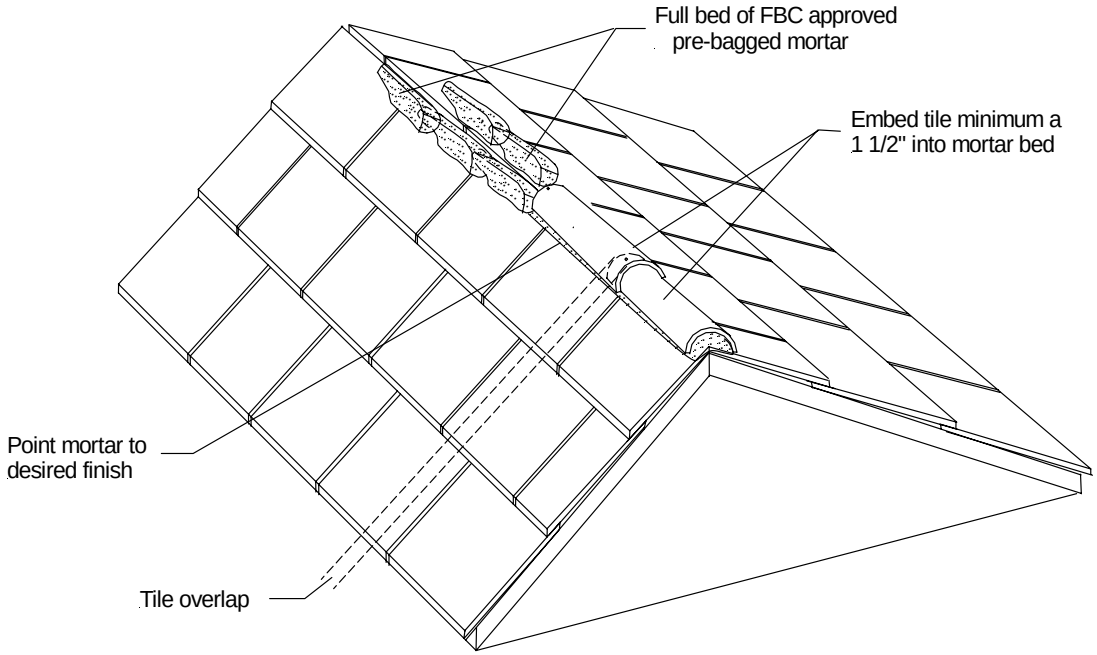
Hip and Ridge Embedment into Mortar

Drawing 22



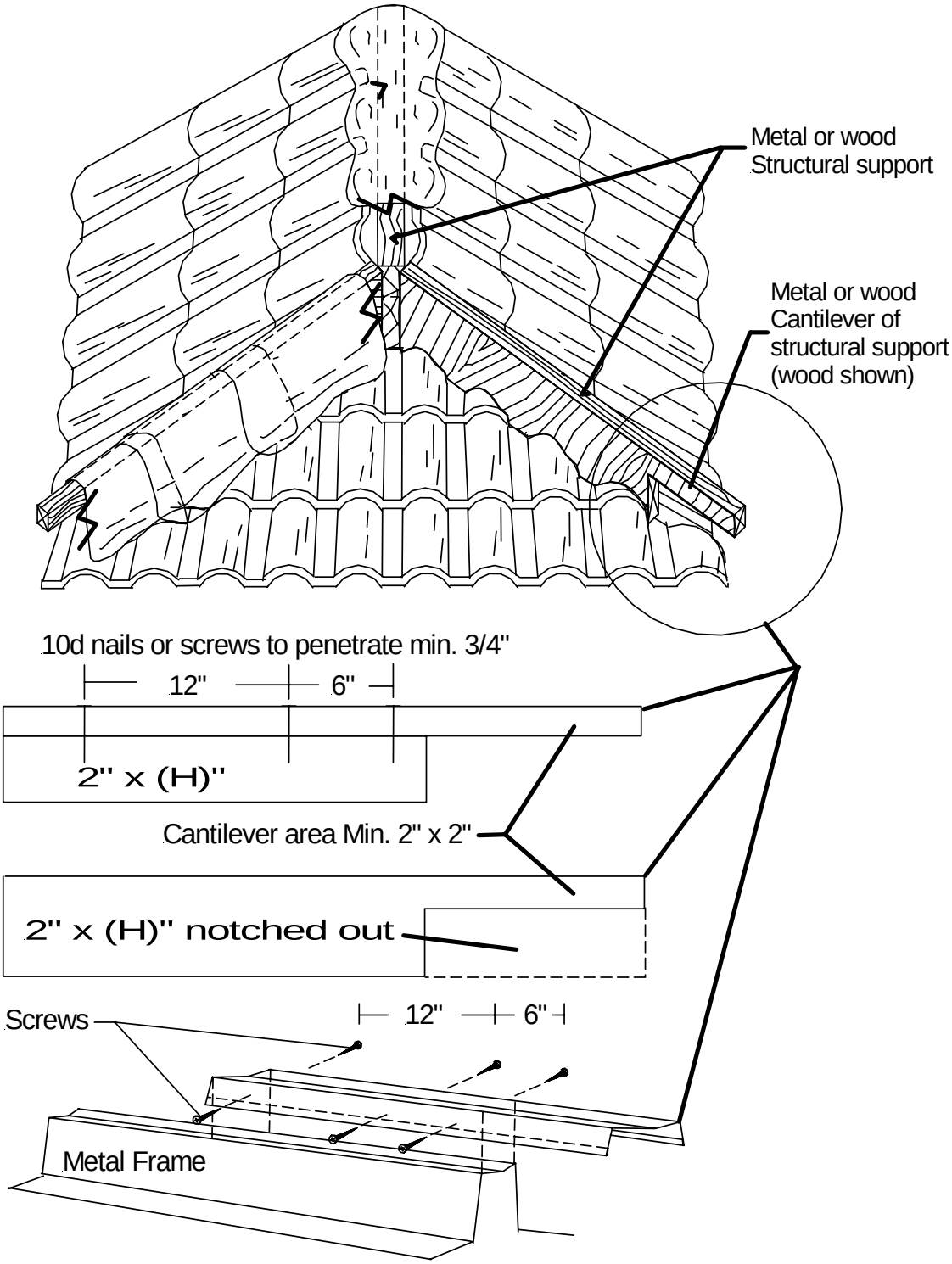
Hip and Ridge Embedment into Mortar

Drawing 23



Attaching Hip/Ridge Tile with FBC Product Approved Mortar Only

Drawing 24



Hip End Cantilever Options

]

Drawing 25

Appendix A

Hip and Ridge Board Attachment Instructions

How to use Table 21:

1. Determine the Exposure Category (See ASCE 7)
2. Determine the thickness of the roof sheathing.
3. Determine the basic wind speed.
4. Follow the rows to the right, based on the information gathered from numbers 1, 2, and 3 above. Under the basic wind speed columns, are the center-to-center spacing based on either a ¾" or a 1-1/2" wide 26 gauge strap.

Roof Tile - Table 21

Hip and Ridge Board Attachment Recommendations

Category II Buildings

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"	32	27	22	19	16	14
		2 - #8	1-1/2"	56	46	39	33	28	25
	C	1 - #8	3/4"	24	20	17	14	12	11
		2 - #8	1-1/2"	42	34	29	25	21	19
19/32"	B	1 - #8	3/4"	35	29	24	21	18	15
		2 - #8	1-1/2"	56	46	39	33	28	25
	C	1 - #8	3/4"	26	22	18	15	13	12
		2 - #8	1-1/2"	42	34	29	25	21	19

NOTES:

1. These measurements were based on actual center-to-center spacing.
2. Minimum thickness of roof sheathing shall be 15/32".
3. Steel straps shall have a minimum tensile strength (Fu) for cold-rolled steel of 42 ksi and a Minimum design yield strength (fy) for cold-rolled steel of 25 ksi conforming to one of the following standards:
   ASTM A 606, ASTM A 607, ASTM A 611, ASTM A 653, ASTM A715, and ASTM A 792.
4. Minimum thickness of steel straps shall be 26 gauge (0.0179") before application of corrosion resistance protection.
5. #8 wood screws are to conform to ASME/ANSI B18.6.1.
6. #8 wood screws shall have a minimum end distance, an edge distance and a minimum distance between screws of ½". The distance is to be measured to the center of the screw.
7. Table 21 is for Category II Buildings with a mean roof height of 60' or less.
8. The building is not located on isolated hills, ridges, or escarpments, constituting abrupt changes in general topography, which creates wind speed-up effects.