# Cost Impact of 2017 FBC-EB § 707.3.2 Roof Diaphragm Reroofing Requirements

RINKER-CR-2018-105

**Interim Report**

15 March 2018

**Submitted to**

Mo Madani

Department of Business and Professional Regulation
1940 North Monroe Street
Tallahassee, FL 32399


**Authors**

R. Raymond Issa, PhD Civil Eng., JD, PE, F ASCE, API (University of Florida)
R.N. Sailappan, PE, Quest Engineering & Testing, Inc., Pompano Beach, FL





**CACIM**
**Rinker School**
**University of Florida**
**Box 115703**
**Gainesville, FL 32611-5703**
**www.bcn.ufl.edu/cacim**

# Overview

This research provides an assessment of the cost impact of the of 2017 Florida Building Code (FBC) - Existing Building (EB) § 707.3.2 Roof Diaphragm Reroofing Requirements under the provisions that require that the whole roof be replaced or strengthened where more than 50 percent of the roof diaphragm is removed in zones where the ultimate design wind speed exceeds 115 mph and the diaphragms and connections in their existing condition are not capable of resisting at least 75 percent of those wind loads. The goal shall be to determine the practical feasibility of this code compliance requirement for roof repair. Figure 1 shows the general process used to conduct this research.

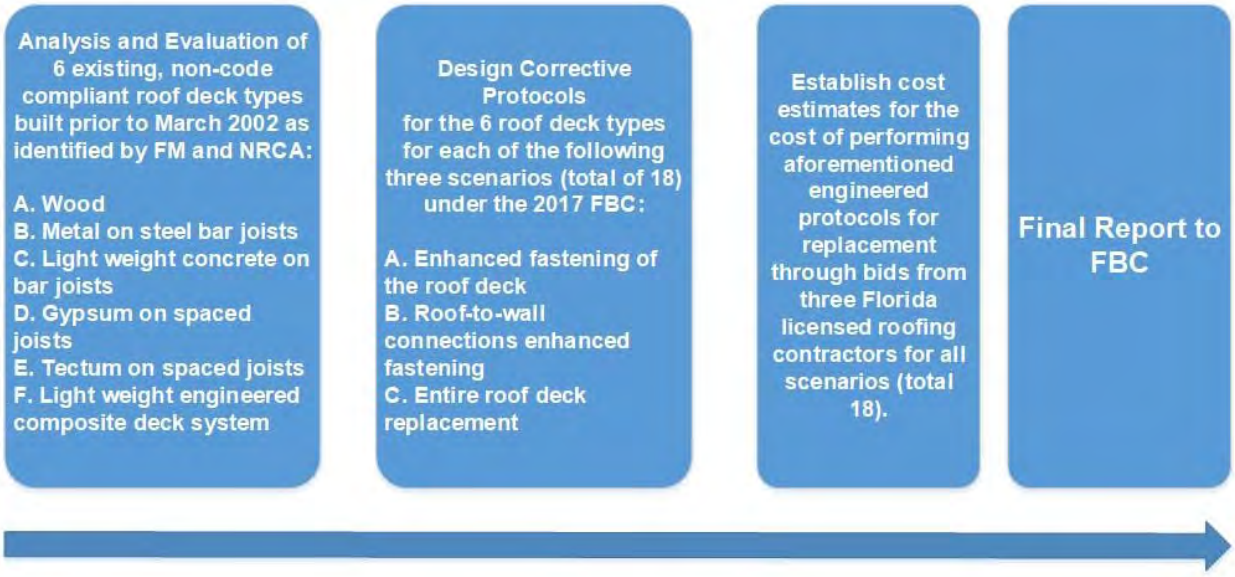


Figure 1. Research Plan

## Relevant Sections of the 2017 FBC-EB (and related documents)

- 2017 FBC-EB § 707.3.2 Roof Diaphragm Reroofing Requirements:

> **[BS] 707.3.2 Roof diaphragms resisting wind loads in high-wind regions.** Where roofing materials are removed from more than 50 percent of the roof diaphragm or section of a building located where the ultimate design wind speed, $V_{ult}$, determined in accordance with Figure 1609.3(1) of the *Florida Building Code, Building,* is greater than 115 mph (51 m/s), as defined in Section 1609 (the High-Velocity Hurricane Zone shall comply with Section 1620) of the *Florida Building Code, Building*, roof diaphragms, connections of the roof diaphragm to roof framing members, and roof-to-wall connections shall be evaluated for the wind loads specified in the *Florida Building Code, Building*, including wind uplift. If the diaphragms and connections in their current condition are not capable of resisting at least 75 percent of those wind loads, they shall be replaced or strengthened in accordance with the loads specified in the *Florida Building Code, Building.*
> **Exceptions:**
> 1. This section does not apply to buildings permitted subject to the *Florida Building Code.*
> 2. This section does not apply to buildings permitted subject to the 1991 *Standard Building Code*, or later edition, or designed to the wind loading requirements of the ASCE 7-88 or later editions, where an evaluation is performed by a registered design professional to confirm the roof diaphragm, connections of the roof diaphragm to roof framing members, and roof-to-wall connections are in compliance with the wind loading requirements of either of these standards or later editions.
> 3. Buildings with steel or concrete moment resisting frames shall only be required to have the roof diaphragm panels and diaphragm connections to framing members evaluated for wind uplift.
> 4. This section does not apply to site-built single family dwellings. Site-built single-family dwellings shall comply with Sections 706.7 and 706.8.
> 5. This section does not apply to buildings permitted within the HVHZ after January 1, 1994 subject to the 1994 *South Florida Building Code,* or later editions, or where the building's wind design is based on the wind loading requirements of ASCE 7-88 or later editions.

# Scope of Work

**Task**

1 Analysis and Evaluation of existing, non-code compliant roof deck types built prior to the year March 1, 2002 as identified by Factory Mutual (FM) and the National Roofing Contractor Association (NRCA) for this research:

A. Wood – common

B. Metal on steel bar joists - common

C. Light weight concrete on bar joists – some cases

D. Gypsum on spaced joists - old

E. Tectum on spaced joists – old

F. Light weight engineered composite deck system

2 Design corrective protocols for the six roof deck types as selected under Task 1 for each of the following three scenarios each (total of 18) under the 2017 FBC:

A. Enhanced fastening of the roof deck

B. Roof-to-wall connections enhanced fastening

C. Entire roof deck replacement

3 Establish cost estimates for the cost of performing aforementioned engineered protocols for replacement through bids from three Florida licensed roofing contractors for all scenarios (total 18).

# Progress to Date

Work completed on the project at this point includes reaching a consensus with all stakeholders on the process and procedures used to evaluate the 6 roof types. Figure 2 highlights research tasks that have been completed or are in progress at the compilation of this interim report.

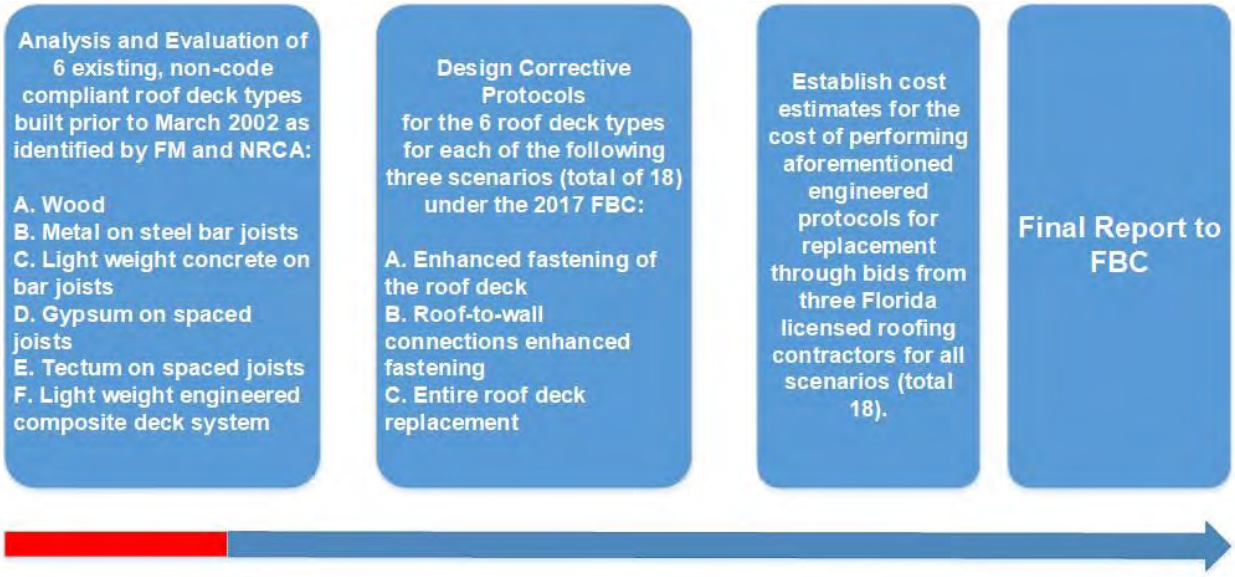


Figure 2. Research progress to date.

Appendix A shows the consensus document generated for ***light weight concrete on bar joists*** roof deck type which will be used for collecting cost estimates for all roof deck types.

# APPENDIX A

## *LIGHT WEIGHT CONCRETE ON BAR JOISTS* ROOF DECK TYPE PROTOCOL

**BID PACKAGE**

for

**RE-ROOF INSTALLATION**

at

**AMERICANA WAREHOUSE BUILDING**
**123 WASHINGTON AVENUE**
**ANYTOWN, FL - 33000**

*Prepared for*

**University of Florida**
**College of Design, Construction & Planning**
**P. O. Box 115701**
**Gainesville, FL 32611-5701**

**April 9, 2018**

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## INTRODUCTION

The subject property comprises of a warehouse building that was built in 1974. This 1-story warehouse building has a flat roof with lightweight concrete over a structural steel deck. The main flat roof is at an elevation of about 16 feet. The total roof area is approximately 10,000 sf. The main roof has a Modified Bitumen roof system over the lightweight concrete deck. This specification addresses the removal of the existing roof down to the lightweight concrete deck and the installation of a new CertainTeed Modified Bitumen roof system.

Quest Engineering Services & Testing, Inc. (QuEST) has prepared the following bid package for the new roof installation at the subject site. The new roof proposed is a CertainTeed Modified Bitumen SBS Roof System over Lightweight Concrete Decks. This roof system's Miami-Dade Notice of Acceptance No. is 14-0529.01 (Page 29 of 34, System Design Pressure -52.5 psf with Limitation #7). This system comprises of a mechanically attached Base Sheet, self-adhered Flintlastic Ply Sheet and a torched down Flintlastic Cap Sheet.

## SCOPE OF PROJECT

The scope of this project is to remove the existing roof down to the lightweight concrete deck, inspect, clean (and repair if necessary) the existing roof deck and then install the new roof system in accordance with the Florida Building Code (2017). Prior to commencement of the re-roofing contractor shall verify existing steel deck attachment and joist anchoring. Damaged deck areas will need to be repaired and/or replaced. As a part of the new roof installation, the membrane should be draped up and over the parapet walls and a new coping cap installed. The owner reserves the right to request post-installation bell chamber tests (TAS-124) to assure that roof system has been installed in an acceptable manner. Failing areas will need to be repaired and retested at contractor's expense, before acceptance.

Overlay walk pads should be installed around all AC Unit clusters as well as around the roof hatch and high traffic areas. This project's work scope also includes raising all roof top AC units and mounting them on approved Aluminum stands. In addition to removing and disposing off the existing equipment curbs, this may include replacing, raising and reconnecting all electrical junction boxes. The new stands should be capable of supporting multiple AC units and be secured to withstand wind loads as required by the Florida Building Code.

This contractor must install CertainTeed and FBC approved flashing around all roof penetrations and equipment stands. We recommend verifying that the existing lightweight concrete deck is sloped adequately to achieve positive drainage. As indicated in the attached drainage evaluation, the existing primary drains and emergency overflow scuppers are adequate. Ensure that these scuppers are positioned such that their bottoms are no more than 2" above roof level. Care should be taken to ensure that ponding water in excess of 5" does not occur at any time at any portion of the roof.

The information provided in these specifications is for general informational purposes only. It is incumbent upon the bidders to visit the site and verify all dimensions and field conditions, prior to submitting their bids. The contractor is responsible for obtaining a re-roofing permit and coordinating with the Building Department for all necessary in-progress and final inspections. All testing and engineering necessary to obtain a permit and complete this job are the also the contractor's responsibility.

**The roof contractor must be certified by CertainTeed Corp to install this roof system. The contractor must provide a 20-year NDL warranty on labor and materials, including puncture warranty.** All work should be done in accordance with the Florida Building Code (2017), including applicable HVHZ protocols. All installation, product and safety guidelines of the roof system manufacturer, along with OSHA mandated safety guidelines should be followed. In case of conflicts, the more stringent standard should be followed.

**Safety and Clean-Up**

The contractor, its employees, representatives, agents and sub-contractors should observe all safety precautions as required by OSHA during the entire duration of this project. The contractor should also clean-up on a daily basis. This is an occupied facility and contractor must maintain the site in a presentable fashion at all times.

**Insurance Requirements**

The roofing contractor must maintain all necessary licenses and insurance certificates throughout the duration of the job.

**Bid Bonds**

Bid bonds may be required at the discretion of the owner.

**Mail Sealed Bids**:

University of Florida
College of Design, Construction & Planning
P. O. Box 115701
Gainesville, FL 32611-5701

Ph (352) 222 6147 Fax (561) 245 4447

**Deadline:** Bid Packages must be received by **5:00 PM on April 20, 2018.**

**All technical questions** concerning this bid package may be addressed directly to Quest Engineering Services & Testing, Inc. If there are any technical questions, please contact:

**R. N. Sailappan, P.E.**, *Quest Engineering Services & Testing, Inc.*, **Ph (954) 582 9800**

## REROOFING SPECIFICATIONS

This section outlines the general guidelines for the bidding and reproofing at the subject site. The guidelines under the general sub-section apply to the entire project.

### General

1. Only those bidders on the invited bidders list are eligible to bid on this project.

2. All bidders must be licensed in the State of Florida and have a minimum of 5 years of experience providing such services.

3. All bids should include 3 project references and reference contact information. The bid should also identify the bidder's contact person and contact information.

4. All bidders should maintain appropriate licenses and insurance requirements during the entire project duration. The liability insurance policy should name AMPCO as additional insured. The minimum insurance requirements are as follow:

| | | |
|---|---|---|
| Workman's Compensation | - | Statutory Limits |
| General Liability & Property Damage | - | $1,000,000.00 |

5. The bids should also indicate the lead-time required for commencement of work after contract is signed.

6. The bids should also indicate the time duration required to complete the reproofing operations.

7. We strongly encourage all contractors to visit the site and familiarize themselves with the project conditions, prior to submitting the bids. Please contact TRAK Property Management Group for an appointment to visit the site. They can be reached at (561) 245 4444.

8. The bid packages should include the following:

   a) Letter of Interest
   b) Bidder's Contact Information
   c) Statement of Qualifications
   d) Project Experience
   e) Project References
   f) Copies of Licenses
   g) Copies of Insurance Certificates
   h) Filled out Bid Form with Cost Proposal for Roof Replacement with breakdowns for all 3 facets, namely:
      Deck Re-fastening to satisfy new diaphragm shear enhancements
      Enhance Edge Connections to satisfy new diaphragm shear enhancements
      Deck Replacement to satisfy new diaphragm shear enhancements

## REQUIRED SUBMITTALS BY SELECTED CONTRACTOR

A. Prior to starting work, the roofing contractor must submit the following:

1. Shop drawings showing layout, details of construction and identification of materials.

2. A sample of the manufacturer's Membrane System Warranty.

3. Submit a letter of certification from the manufacturer which certifies the roofing contractor is authorized to install the manufacturer's roofing system and lists foremen who have received training from the manufacturer along with the dates training was received.

4. Certification of the manufacturer's warranty reserve.

B. Upon completion of the installed work, submit copies of the manufacturer's final inspection to the specifier prior to the issuance of the manufacturer's warranty.

# BID FORM

Contractor:

Date till which Price is Valid:

Cost Proposal:

1. Base Bid for Roof Replacement $ _____

2. Fee for Investigating Deck Attachment to Joist Supports $ _____
   Cut and expose LWC on top side of deck at 4 locations
   (4' x 4' opening) to verify deck fastening

3. Fee for Deck Re-fastening (where required) – Two #12 TEK
   screws per flute; screwed from joist top chord to deck underside $ _____
   Joists are spaced at 5' o.c. (i.e.) 31 Joists & 2 Bays

4. Fee for Investigating Deck Edge Attachment $ _____
   Cut and expose Drywall/drop-down ceiling along roof perimeter
   to verify deck edge fastening and Joist anchoring

5. Additional Cost for Enhanced Edge and Support Connections $ _____
   434 linear feet of perimeter; 124 Joist Bearing Points
   Install 3" x 3" x ¼" deck ledger angle all along roof deck perimeter
   secured to wall with Ø ½" expansion anchor bolts at 24" o.c.
   (bolts to have minimum 4" embedment into filled cell of wall) and
   to each joist with two Ø 3/8" bolts and nuts.

6. Additional Cost for Deck Replacement $ _____
   Removal of existing lightweight concrete and disposal
   Removal and disposal of metal decks
   Grinding of welds/removal of screws
   Replacement deck to be 22 ga. and match the profile of existing deck
   Replacement sheets should span minimum 15 feet (3 joist spacings)
   Deck to be secured to joists in 36/7 pattern with #12 TEK screws
   Deck sidelaps to be fastened with #10 screws at 12" o.c. (4 screws per span)
   Install tapered ISO insulation to match LWC system thickness

7. Associated Engineering Cost $ _____

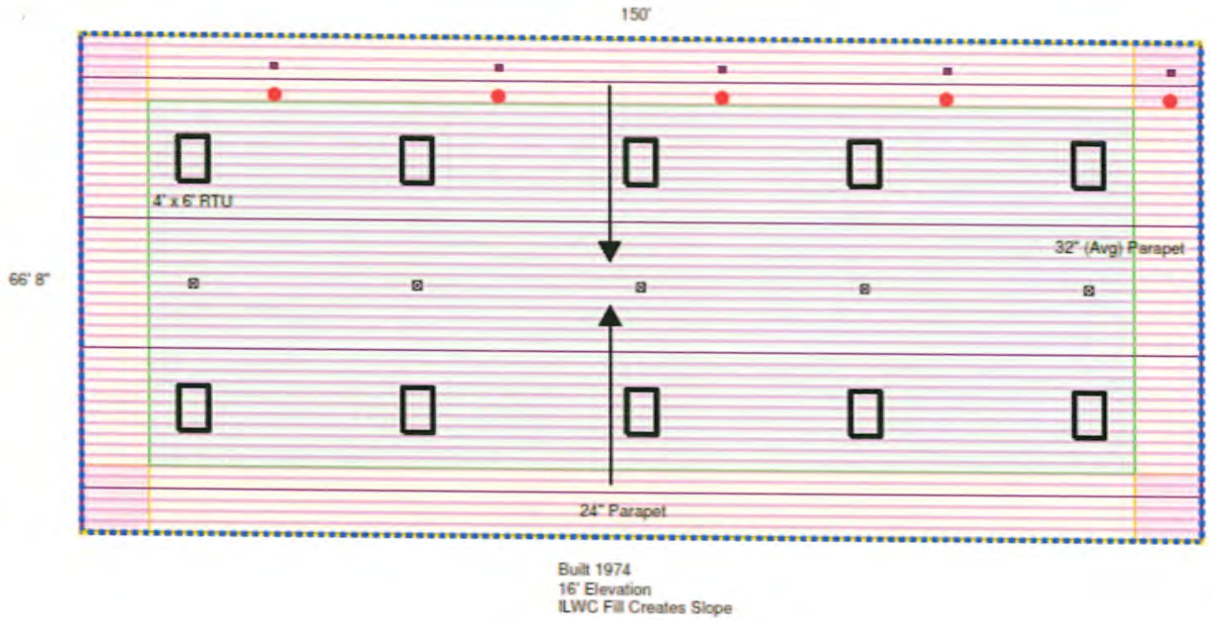
All work will be done by licensed personnel after obtaining relevant permits, in accordance with the Florida Building Code (2017)

Signature: _____

Name: _____

Firm Name: _____

Date: _____




N

| Legend | Pitch | Description |
|---|---|---|
| | <none> | Perimeter |
| | 0.25/12 | Remove Mod Bit |
| | 0.25/12 | Glass Base Nld (ILWC) |
| | 0.25/12 | Glass Base Nld (ILWC) |
| | 0.25/12 | Glass Base Nld (ILWC) |
| | 0.25/12 | Mod Bit, Ply Bs, GMS (Bs Sht) |
| | <none> | 1/2 Sht Flsh & Cant @ Curbs |
| | <none> | Flsh & Cant (ms) 24" HIgh Wall |
| | <none> | Flsh & Cant (ms) 33" (Avg) HIgh Wall |
| ⊠ | 0.25/12 | Roof Drain Flashing |
| ● | 0.25/12 | VTR Flashing w/ 3" Lead Boot |
| ■ | 0.25/12 | Vent 10" GRV |
| | <none> | Coping Cap @ Parapet |
| | 0.25/12 | Coping Miter |

**QuEST**

**Quest Engineering Services & Testing, Inc.**
**2737 NW 19th Street**
**Pompano Beach, FL – 33069**

**Ph (954) 582 9800** **Fax (954) 582 9836**

| | |
|---|---|
| **Title:** | **ROOF PLAN** |
| **Project:** | **Americana Building**<br>**123 Washington Avenue**<br>**Anytown, FL - 30000** |
| **Client:** | **UF College of Design, Construction & Planning** |

Dimensions indicated are approximate. Contractor must field verify before bidding.

Scale: NTS

| Project No. | Drawn | Sheet No. | Revision No. | Revision Date |
|---|---|---|---|---|
| J-17284 | RNS | 1 of 1 | | |

## BASE SHEET ATTACHMENT CALCULATIONS

**Project Name** Americana Warehouse Building
**Project Address** 123 Washington Avenue, Anytown, FL - 30000
**Report No.:** J-17284.002

| | | | |
|---|---|---|---|
| Deck Substrate | Lightweight Concrete over Steel | Mean Roof Height | 16.0 Feet |
| Configuration | Low Slope | Roof Area (Approx.) | 10000 Sq.Ft. |
| Category | II | Roof Width | 66.7 Feet |
| Exposure Condition | C | Perimeter Width | 6.4 Feet |
| Building Type | Enclosed | Parapet Height | 2.0 Feet |
| Base Wind Speed | 170 mph | Corner Zones | 6.4' x 6.4' Each |

Slope V 0.0 Slope H 12.0 Slope Angle° 0.00

**Uplift Pressures** $q_z = 0.00256\ K_z\ K_{zt}\ K_d\ V^2$ $P = q_z\ (GC_p - GC_{pi})$

| $q_z$ | $K_z$ | $K_{zt}$ | $K_d$ | V | $GC_p$ | $GC_{pi}$ | |
|---|---|---|---|---|---|---|---|
| 54.384 | 0.860 | 1.005 | 0.85 | 170 | -1.00 | 0.18 | Field |
| | | | | | -1.80 | 0.18 | Perimeter |
| | | | | | -2.80 | 0.18 | Corner |

| | | | | |
|---|---|---|---|---|
| Field | $P_{1\ ult.}$ | -64.17 psf | $P_{1\ asd}$ | -38.50 psf |
| Perimeter | $P_{2\ ult.}$ | -107.68 psf | $P_{2\ asd}$ | -64.61 psf |
| Corner | $P_{3\ ult.}$ | -162.06 psf | $P_{3\ asd}$ | -97.24 psf |

Proposed System: CertainTeed Modified Bitumen Roof System over Lightweight Concrete Decks
Product Approval No.: 14-0529.01 (Page 29 of 34)
System Design Pressure: -52.5 psf

Fasteners: Approved FM-90 Base Sheet Fasteners

| | | | | | |
|---|---|---|---|---|---|
| Base Sheet Width | 39 inches | Side Lap | 4 inches | Net Width | 35 inches |
| Fastener Spacing in | Lap of Base Sheet | 7 inches | | # Rows | 1 |
| Fastener Spacing in | Field of Base Sheet | 7 inches | | # Rows | 2 |

Min. Characteristic Resistance Force: -29.77 lbf — Verify with TAS-105 Tests

Fastener Spacing: {(MCRF/$P_i$) x 144}/Row Spacing

| No. of Rows of Fasteners | 3 | 4 | 5 | 6 |
|---|---|---|---|---|
| Field Fastener Spacing | 9.54 | 12.73 | 15.91 | 19.09 |
| Perimeter Fastener Spacing | 5.69 | 7.58 | 9.48 | 11.38 |
| Corner Fastener Spacing | 3.78 | 5.04 | 6.30 | 7.56 |

### RECOMMENDED BASE SHEET ATTACHMENT PATTERN

| | | |
|---|---|---|
| **Field** | 1 row in the laps at 7 inches o.c. | 2 rows in the center of the sheet at 7" o.c. |
| **Perimeter** | 1 row in the laps at 7 inches o.c. | 3 rows in the center of the sheet at 7" o.c. |
| **Corner** | 1 row in the laps at 6 inches o.c. | 4 rows in the center of the sheet at 6" o.c. |

These calculations have been done in accordance with ASCE 7-10, based on the information provided by the contractor. The roof system must be installed in accordance with the FBC & manufacturer's recommendations. We recommend TAS-105 Tests to verify that above MCRF may be realized, before installing new roof.

Sincerely
Quest Engineering Services & Testing, Inc.

DRAFT

R. N. Sailappan, P.E.
Principal
Florida Registration No. 46696

## DRAINAGE EVALUATION

**Project Name** Americana Warehouse Building
**Project Address** 123 Washington Avenue
Anytown, FL - 33000

**Report No.:** J-17284.002

The following values are from the Florida Building Code (2010), Plumbing Code, for a 5" per hour rainfall rate

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Vertical Leaders | Pipe Ø | 2" | 3" | 4" | 5" | 6" | 8" | |
| Table 1106.2(1) | Roof Area | 575 | 1760 | 3680 | 6920 | 10800 | 23200 | |
| Horizontal Piping | Pipe Ø | | 3" | 4" | 5" | 6" | 8" | 10" |
| Table 1106.3 | Roof Area | | 657 | 1504 | 2672 | 4280 | 9200 | 16580 |
| Table 1106.7 | Length | 4" | 6" | 8" | 12" | 16" | 20" | 24" |
| Weirs (4" Head) | Roof Area | 1794 | 2692 | 3589 | 5384 | 7179 | 8974 | 10769 |
| Weirs (3" Head) | Roof Area | 1153 | 1730 | 2307 | 3461 | 4615 | 5769 | 6923 |

**ROOF DETAILS**

Mean Roof Height 16.0 Feet
Slope V 1/8" : 12

Roof Area (Approx.) 10000 Sq.Ft.
Tributary Roofs 0 Sq.Ft.

| | | Length (ft) | Height (ft) |
|---|---|---|---|
| Side Walls | 1 | 0 | 0 |
| | 2 | 0 | 0 |
| | 3 | 0 | 0 |

| | | Length (ft) | Height (ft) |
|---|---|---|---|
| Parapets | 1 | 434 | 2 |
| | 2 | 0 | 0 |
| | 3 | 0 | 0 |

Effective Roof Area for Drainage purposes 10434 $ft^2$

| PRIMARY | VERTICAL DRAINS Size Ø | Area | # Drains | Drainage Cap. ($ft^2$) |
|---|---|---|---|---|
| Type 1 | 3.50 | 9.62 | 5 | 11975 |
| Type 2 | | | | |
| Type 3 | | | | |

| | THROUGH-WALL SCUPPERS (WEIRS) Height (in) | Length (in) | # Drains | Drainage Cap. ($ft^2$) |
|---|---|---|---|---|
| Type 1 | | | | |
| Type 2 | | | | |
| Type 3 | | | | |

| SECONDARY | VERTICAL Size Ø | Area | # Drains | Drainage Cap. ($ft^2$) |
|---|---|---|---|---|
| Type 1 | | | | |
| Type 2 | | | | |
| Type 3 | | | | |

| | THROUGH-WALL SCUPPERS (WEIRS) Height (in) | Length (in) | # Drains | Drainage Cap. ($ft^2$) |
|---|---|---|---|---|
| Type 1 | 4 | 12.00 | 4 | 13844 |
| Type 2 | | | | |
| Type 3 | | | | |

Total Primary Drain Capacity of Existing Drains 11975 $ft^2$ Adequate

Total Secondary Drain Capacity of Existing Scuppers 13844 $ft^2$ Adequate

These calculations have been done in accordance with FBC (2017), based on the information provided by the contractor. Position drainage elements such that no more than 5" of ponding occurs anywhere on roof at any time.

Sincerely
Quest Engineering Services & Testing, Inc.

DRAFT

R. N. Sailappan, P.E.
Principal
Florida Registration No. 46696

MIAMI-DADE COUNTY
PRODUCT CONTROL SECTION
11805 SW 26 Street, Room 208
Miami, Florida 33175-2474
T (786)315-2590 F (786) 31525-99
www.miamidade.gov/economy

DEPARTMENT OF REGULATORY AND ECONOMIC RESOURCES (RER)
BOARD AND CODE ADMINISTRATION DIVISION

# NOTICE OF ACCEPTANCE (NOA)

**CertainTeed Corporation**
**18 Moores Road**
**Malvern, PA 19355**

## SCOPE:

This NOA is being issued under the applicable rules and regulations governing the use of construction materials. The documentation submitted has been reviewed and accepted by Miami-Dade County RER - Product Control Section to be used in Miami Dade County and other areas where allowed by the Authority Having Jurisdiction (AHJ).

This NOA shall not be valid after the expiration date stated below. The Miami-Dade County Product Control Section (In Miami Dade County) and/or the AHJ (in areas other than Miami Dade County) reserve the right to have this product or material tested for quality assurance purposes. If this product or material fails to perform in the accepted manner, the manufacturer will incur the expense of such testing and the AHJ may immediately revoke, modify, or suspend the use of such product or material within their jurisdiction. RER reserves the right to revoke this acceptance, if it is determined by Miami-Dade County Product Control Section that this product or material fails to meet the requirements of the applicable building code.

This product is approved as described herein, and has been designed to comply with the Florida Building Code including the High Velocity Hurricane Zone of the Florida Building Code.

**DESCRIPTION: CertainTeed Modified Bitumen System over Lightweight Concrete Decks.**

**LABELING:** Each unit shall bear a permanent label with the manufacturer's name or logo, city, state and following statement: "Miami-Dade County Product Control Approved", unless otherwise noted herein.

**RENEWAL** of this NOA shall be considered after a renewal application has been filed and there has been no change in the applicable building code negatively affecting the performance of this product.

**TERMINATION** of this NOA will occur after the expiration date or if there has been a revision or change in the materials, use, and/or manufacture of the product or process. Misuse of this NOA as an endorsement of any product, for sales, advertising or any other purposes shall automatically terminate this NOA. Failure to comply with any section of this NOA shall be cause for termination and removal of NOA.

**ADVERTISEMENT:** The NOA number preceded by the words Miami-Dade County, Florida, and followed by the expiration date may be displayed in advertising literature. If any portion of the NOA is displayed, then it shall be done in its entirety.

**INSPECTION:** A copy of this entire NOA shall be provided to the user by the manufacturer or its distributors and shall be available for inspection at the job site at the request of the Building Official.

This NOA revises NOA No. 14-0224.02 and consists of pages 1 through 34.
The submitted documentation was reviewed by Alex Tigera.

## TRADE NAMES OF PRODUCTS MANUFACTURED OR LABELED BY APPLICANT:

**TABLE 1**

| Product | Dimensions | Test Specification | Product Description |
|---|---|---|---|
| Flintlastic GMS | 39 3/8" x 32'10"; Roll weight: 94 lbs. (1 square) | ASTM D 6164, Grade G, Type I | Granule surfaced SBS Modified Bitumen membrane with non-woven polyester mat reinforcement for mop application. |
| Flintlastic Premium GMS | 39 3/8" x 32' 10"; Roll weight: 101 lbs. (1 square) | ASTM D 6164, Grade G, Type II | Granule surfaced SBS Modified Bitumen membrane with non-woven polyester mat reinforcement for mop application. |
| Flintlastic FR-P | 39 3/8" x 32'10"; Roll weight: 101 lbs. (1 square) | ASTM D 6164, Grade G, Type I | Fire resistant, granule surfaced SBS Modified Bitumen Membrane with non-woven polyester mat reinforcement for mop application. |
| Flintlastic Premium FR-P | 39 3/8" x 32'10"; Roll weight: 101 lbs. (1 square) | ASTM D 6164, Grade G, Type II | Fire resistant, granule surfaced SBS Modified Bitumen Membrane with non-woven polyester mat reinforcement for mop application. |
| Flintlastic FR Dual Cap | 39 3/8" x 32' 10"; Roll weight: 103 lbs. (1 square) | ASTM D 6162, Grade G, Type I | Granule surfaced SBS modified bitumen membrane with a nonwoven polyester/fiberglass composite mat reinforcement for use in cold or mop applications. |
| Flintlastic FR Cap 30 | 39 3/8" x 32'10"; Roll weight: 86 lbs. (1 square) | ASTM D 6163, Grade G, Type I | Fire resistant, granule surfaced SBS Modified Bitumen membrane with fiberglass mat reinforcement for mop applications. |
| Flintlastic FR Cap 30 T | 39 3/8" x 32'10"; Roll weight: 100 lbs. (1 square) | ASTM D 6163, Grade G, Type I | Granule surfaced SBS Modified Bitumen membrane with fiberglass mat reinforcement for torch application. |
| Flintlastic Base 20 T | 39 3/8" x 33'; Roll Weight: 81lbs. (1 square) | ASTM D 6163, Grade S, Type I | Modified Bitumen, coated fiberglass base sheet for torch application. |
| Flintlastic FR Cap 30 CoolStar | 39 3/8" x 32'10"; Roll weight: 88 lbs. (1 square) | ASTM D 6163, Grade G, Type I | Fire resistant, granule surfaced SBS Modified Bitumen membrane with fiberglass mat reinforcement for mop applications. Covered with reflective CoolStar Coating. |

## TRADE NAMES OF PRODUCTS MANUFACTURED OR LABELED BY APPLICANT:

TABLE 1

| Product | Dimensions | Test Specification | Product Description |
|---|---|---|---|
| Glasbase Base Sheet | 39 3/8" x 98'9"; Roll weight: 75 lbs. (3 squares) | ASTM D 4601, Type II UL Type G2 | Asphalt coated, fiberglass base sheet. |
| Flintlastic Poly SMS Base Sheet | 39 3/8" x 64' 3"; Roll weight: 90 lbs. (2 squares) | ASTM D 4601, Grade S, Type II UL Type G2 | Modified Bitumen coated polyester base sheet. |
| Yosemite Venting Base Sheet | 39 3/8" x 32'10"; Roll weight: 85 lbs. (1 square) | ASTM D 3909 ASTM D 4897, Type II UL G3 | Mineral Surfaced fiberglass reinforced buffer sheet. |
| Flintlastic APP Base T | 39 3/8" x 65' 4"; Roll weight: 100 lbs. (2 squares) | ASTM D6509 | Modified Bitumen coated fiberglass base sheet. |

## APPROVED INSULATIONS:

TABLE 2

| Product Name | Product Description | Manufacturer (With Current NOA) |
|---|---|---|
| FlintBoard ISO | Polyisocyanurate foam insulation | CertainTeed Corp. |
| FlintBoard$_H$ ISO, FlintBoard$_H$ ISO Cold | Polyisocyanurate foam insulation | CertainTeed Corp. |
| ACFoam-II, ACFoam-IV | Polyisocyanurate foam insulation | Atlas Roofing Corp. |
| High Density Wood Fiberboard | Wood fiber insulation board | Generic |
| Perlite Insulation | Perlite insulation board | Generic |
| DensDeck, DensDeck Prime | Water resistant gypsum board | Georgia Pacific Gypsum LLC |
| H-Shield, H-Shield CG | Polyisocyanurate foam insulation | Hunter Panels LLC |
| ENRGY 3, ENRGY 3 25 PSI | Polyisocyanurate foam insulation | Johns Manville Corp. |
| Multi-Max FA-3 | Polyisocyanurate roof insulation | RMax Operating, LCC |
| Insulfoam EPS | Expanded Polystyrene | Insulfoam, a Div. of Carlisle Const. Materials |

## EVIDENCE SUBMITTED:

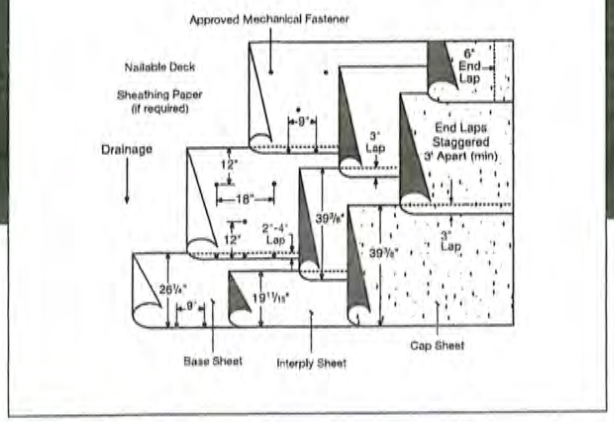
| Test Agency/Identifier | Name | Report | Date |
|---|---|---|---|
| Factory Mutual Research Corp. | FM 4470 | 0D3A3.AM | 04/04/97 |
| | FM 4470 | 2D0A0.AM | 12/23/98 |
| | FM 4470 | 1D7A4.AM | 11/09/98 |
| | FM 4470 | 3048520 | 09/19/13 |
| | FM 4470 | 3039046 | 06/15/10 |
| Underwriters Laboratories, Inc. | UL 790 | R11656 | 01/11/13 |
| United States Testing Company | ASTM D 5147 | 97457-4 | 06/03/88 |
| | ASTM D 5147 | 97-457-2R | 12/02/87 |
| Momentum Technologies, Inc. | ASTM D 4601 | AX31G8D | 09/05/08 |
| | ASTM D6164 | AX31G8F | 06/05/09 |
| | ASTM D6222 | AX31G8G | 06/05/09 |
| | ASTM D 3909/ D 4897 | AX31G8C | 09/05/08 |
| Trinity\|ERD | TAS 114(J) | 3504.06.01-1 | 06/05/01 |
| | TAS 117 (B) | 3503.10.06 | 10/10/06 |
| | TAS 117 (B) | O6490.04.07-R1 | 06/27/07 |
| | TAS 114 (H) | Letter | 04/05/06 |
| | TAS 114 | 3533.01.06 | 01/06/06 |
| | TAS 114 | 3521.07.04 | 07/29/04 |
| | TAS 117 (B)/ ASTM D 6862 | C8500SC.11.07 | 11/30/07 |
| | TAS 114 | C8370.08.08 | 08/19/08 |
| | ASTM Physical Properties | C10080.09.08-R4 | 03/25/10 |
| | ASTM D6164/D4798 | C31410.01.11-2 | 01/10/11 |
| | ASTM D4601 | C40050.09.12-1 | 09/28/12 |
| | ASTM D1970 | C40050.09.12-2 | 09/28/12 |
| | ASTM D5147/D4798 | C31410.10.10-R1 | 11/01/12 |
| | ASTM D5147/D4798 | C31410.01.11-1-R1 | 11/01/12 |
| | TAS 117 B | C35500.02.11 | 02/09/11 |
| | FM 4470/TAS 114 | C33980.12.10 | 12/22/10 |
| | TAS 117 & TAS 114 | C30560.03.10 | 03/18/10 |
| | TAS 117 & TAS 114 | C30560.06.10 | 06/10/10 |
| | FM 4470/TAS 114 | C37830.07.12 | 07/26/12 |
| | ASTM D1876 | C35460.05.11-R1 | 05/20/15 |
| | ASTM D1876, TAS 114 (H), TAS 117 (B) | C42110.08.12 | 08/13/12 |
| | ASTM D1876, TAS 114 (H), FM 4474 | C47320.03.14 | 03/26/14 |
| | ASTM D4798 | C31410.01.11-2A-R1 | 02/21/13 |
| | ASTM D4798 | C31410.12.13 | 12/05/13 |
| | ASTM D6222 | C40050.12.13-R1 | 12/31/13 |
| PRI Construction Materials Technologies LLC | ASTM D6163 | CTC-032-02-01 | 01/22/08 |
| | ASTM D6163 | CTC-066-02-01 | 08/09/11 |

| | |
|---|---|
| **Membrane Type:** | SBS Modified |
| **Deck Type 4:** | Lightweight Concrete, Non-insulated |
| **Deck Description:** | Min. 200 psi. Mearlcrete or min. 160 psi Elastizell Cellular Lightweight Concrete |
| **System Type E(5):** | Base sheet mechanically fastened. |
| **Deck:** | Structural concrete or min. 22ga., type BW slotted steel deck attached to steel supports spaced maximum 5ft. o.c.with 5/8" puddle welds or with 3/8" welding washers spaced maximum 6" o.c. (at each flute). Steel deck side laps are attached 18" o.c. with Traxx/1 fasteners or #10 self-tapping screws. Mearlcrete cast at 40 pcf wet density or Range II Elastizell is applied with an 1/8" slurry coat followed by optional min. 2" thick Star-R-Foam Gripper EPS board or min. 1" thick Apache Corrugated Holey Board or Mearl Corrugated EPS Insulation. A min. 2" thick cap of Mearlcrete or Elastizell is placed over the insulation |

**All General and System limitations apply.**

| | |
|---|---|
| **Base Sheet:** | One or more plies of All weather/Empire Base Sheet, Glasbase Base Sheet or Yosemite Venting Base Sheet* mechanically attached to the deck using OMG CR Assembled Base Sheet Fasteners, or FM-90 Fasteners spaced 7" o.c. in the 4" side lap and 7" o.c. in two evenly divided, staggered rows in the center of the sheet.<br>**Only with FM-90* |
| **Ply Sheet: (Optional)** | One or more plies of All Weather/Empire Base Sheet, Glasbase Base Sheet, Flexiglas Base Sheet, Flintlastic Base 20, Flintlastic Poly SMS Base Sheet, Flintlastic Ultra Poly SMS Base Sheet, Flintglas Ply Sheet Type IV or Flintglas Premium Ply Sheet Type V adhered in a full mopping of approved asphalt applied within the EVT range at a rate of 20-40lbs./sq. or one ply of Flintlastic Ultra Poly SMS Base Sheet torch applied or one ply of Black Diamond Base Sheet or Flintlastic Ultra Glass SA self adhered. |
| **Membrane:** | One or more plies Flintlastic GMS, Flintlastic GMS CoolStar, Flintlastic Premium GMS, Flintlastic Premium GMS CoolStar, Flintlastic FR Dual Cap, Flintlastic FR-P, Flintlastic FR-P CoolStar, Flintlastic Premium FR-P, Flintlastic Premium FR-P CoolStar, Flintlastic FR Cap 30, Flintlastic FR Cap 30 CoolStar adhered to ply sheet with approved mopping of asphalt applied within the EVT range and at a rate of 20-40 lbs./sq. or Flintlastic FR Cap 30 T or Flintlastic FR Cap 30 T CoolStar torch adhered to ply sheet. |
| **Surfacing: (Optional)** | Any of the approved surfacing/coating options listed in Table 4. |
| **Maximum Design Pressure:** | -52.5 psf (See General Limitation #7) |

# SBS-N-3-A




**Base sheet, one interply sheet and an SBS modified cap sheet**

## SUBSTRATE:
- Nailable (mechanically attached, Sec. 3.0)
- Re-cover (Sec. 5.0)

## MAXIMUM SLOPE:
Up to 6" : 12" (Sec. 15.3)

## ROOF ASSEMBLY:
Approved base sheet, mechanically attached to approved substrate (Sec. 15.0).

Approved interply sheet set in hot asphalt (Sec. 7.0) or self-adhered (Sec. 10.2).

Approved cap sheet, mopped in hot asphalt (Sec. 7.0).

## SUMMARY OF MATERIALS:
- Base sheet (1 ply)
- Interply sheet (1 ply)
- Cap sheet (1 ply)
- ASTM D 312 asphalt (two moppings) (One mopping if interply is self-adhered)

## APPROVED BASE SHEETS:
(one of the following)
- All Weather/Empire® Base Sheet
- Flexiglas® Base Sheet
- Flintlastic Base 20
- Flintlastic Poly SMS
- Flintlastic Ultra Poly SMS
- Glasbase™ Base Sheet
- Yosemite® Venting Base Sheet

## APPROVED INTERPLY SHEETS:
(one of the following)
- All Weather/ Empire Base Sheet
- Black Diamond® Base Sheet (self-adhered)
- Flexiglas Base Sheet
- Flintlastic Base 20
- Flintglas® Ply 4
- Flintglas Premium Ply 6
- Flintlastic Poly SMS
- Flintlastic Ultra Glass SA (self-adhered)
- Flintlastic Ultra Poly SMS

## APPROVED CAP SHEETS:
(one of the following)
- Flintlastic FR Cap 30*
- Flintlastic FR-P*
- Flintlastic GMS*
- Flintlastic Premium FR-P*

## FINAL SURFACING:
For optional surfacing see Section 14.0.

## FLASHING ASSEMBLY:
- **Standard.** Over a base sheet or bonded to a primed substrate. One ply Flintlastic modified cap sheet, per CT detail.
- **Premium.** Over a base sheet or bonded to a primed substrate. One smooth and one granulated modified membrane flashing, per CT detail.
- **Premium Alternate.** Over a base sheet or bonded to a primed substrate. One smooth modified membrane and CT SmartFlash®, per CT detail.

**Asphalt:** Type III or Type IV (Sec. 7.0).

**Cants:** In angles of roof deck and vertical surfaces, the roofing contractor shall furnish and install an approved cant strip with a minimum 3" face.

**Available with CoolStar® reflective granules*

WARRANTY DURATIONS FOR THIS SPECIFICATION VARY BASED ON ROLL MATERIAL SELECTION; SEE WARRANTY MATRIX.

Applicable local building code may require more stringent installation requirements such as, but not limited to, increased fastener or adhesive densities to meet required wind uplift pressures. Consult local building code and uplift requirements prior to any application of CertainTeed roofing materials. CertainTeed is not responsible for failure to install roofing products per applicable local building codes.

*Consult CertainTeed General Recommendations for noted section references.*

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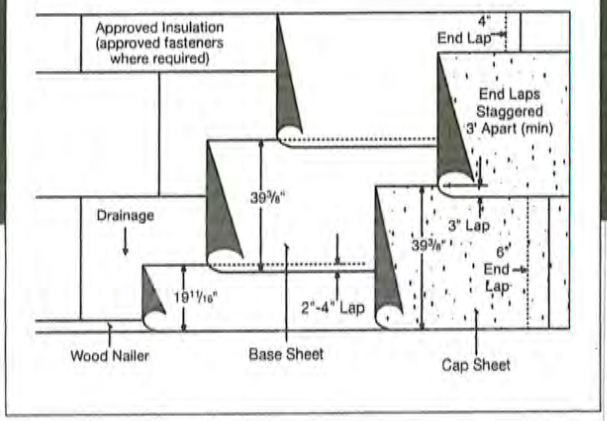
SAINT-GOBAIN
Commercial Roofing

# SBS-I-2-A

**Insulated substrates: base sheet and an SBS modified cap sheet**




## SUBSTRATE:
- Steel and nailable (mechanically attached, Sec. 15.4)
- Non-nailable (adhered, Sec. 4.0)
- Insulation (Sec. 4.0)
- Re-cover (Sec. 5.0)

## MAXIMUM SLOPE:
Up to 6" : 12" (Sec. 15.3)

## ROOF ASSEMBLY:
One or more layers of approved insulation and/or coverboard:
- Base layer mechanically attached and additional layers mechanically attached or adhered in hot asphalt or approved adhesive.
- Base layer and additional layers adhered in hot asphalt or approved adhesive.
- Vapor retarder/anchor sheets (Sec. 4.7).

Approved base sheet, set in hot asphalt (Sec. 7.0) or self-adhered (Sec. 10.2).

Approved cap sheet, mopped in hot asphalt (Sec. 7.0).

## SUMMARY OF MATERIALS:
- One or more layers of insulation and/ or coverboard
- Base sheet (1 ply)
- Cap sheet (1 ply)
- ASTM D 312 asphalt (two moppings) (One mopping if base sheet is self-adhered)

## APPROVED BASE SHEETS:
(one of the following)
- All Weather/Empire® Base Sheet
- Black Diamond® Base Sheet (self-adhered)
- Flexiglas® Base Sheet
- Flintlastic Base 20
- Flintlastic Poly SMS
- Flintlastic Ultra Glass SA (self-adhered)
- Flintlastic Ultra Poly SMS
- Glasbase™ Base Sheet
- Yosemite® Venting Base Sheet

## APPROVED CAP SHEETS:
(one of the following)
- Flintlastic FR Cap 30*
- Flintlastic FR-P*
- Flintlastic GMS*
- Flintlastic Premium FR-P*

## FINAL SURFACING:
For optional surfacing see Section 14.0.

## FLASHING ASSEMBLY:
- **Standard.** Over a base sheet or bonded to a primed substrate. One ply Flintlastic modified cap sheet, per CT detail.
- **Premium.** Over a base sheet or bonded to a primed substrate. One smooth and one granulated modified membrane flashing, per CT detail.
- **Premium Alternate.** Over a base sheet or bonded to a primed substrate. One smooth modified membrane and CT SmartFlash®, per CT detail.

**Asphalt:** Type III or Type IV (Sec. 7.0).

**Cants:** In angles of roof deck and vertical surfaces, the roofing contractor shall furnish and install an approved cant strip with a minimum 3" face.

**Available with CoolStar® reflective granules*

WARRANTY DURATIONS FOR THIS SPECIFICATION VARY BASED ON ROLL MATERIAL SELECTION; SEE WARRANTY MATRIX.

Applicable local building code may require more stringent installation requirements such as, but not limited to, increased fastener or adhesive densities to meet required wind uplift pressures. Consult local building code and uplift requirements prior to any application of CertainTeed roofing materials. CertainTeed is not responsible for failure to install roofing products per applicable local building codes.

*Consult CertainTeed General Recommendations for noted section references.*

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