



Office of Education and Data Management  
Fall 2018 Career Development Seminar

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## Roofing, Flashing and Related Materials

*Presented by*

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## Roofing Types

- Low Slope
- Steep Slope
  - Metal Roofing
  - Asphalt Shingles
  - Slate
  - Tile
  - Wood Shakes and Shingles



## Low Slope

- Minimum slope listed is ¼” per 12”.
  - 1/8” per 12” is allowed if the material is warranted/ guaranteed by the roofing manufacturer and the installer and
  - The Registered design professional responsible for the design of the structure certifies that the structure will support all loads including any additional loads due to the reduced slope

## Roof Drainage

**[P] 1503.4.1 Secondary (emergency overflow) drains or scuppers.** Where roof drains are required, secondary (emergency overflow) roof drains or scuppers shall be provided where the roof perimeter construction extends above the roof in such a manner that water will be entrapped if the primary drains allow buildup for any reason. The installation and sizing of secondary emergency overflow drains, leaders and conductors shall comply with Sections 1106 and 1108, as applicable, of the *International Plumbing Code*.



## Roof Drainage

**1503.4.2 Scuppers.** When scuppers are used for secondary (emergency overflow) roof drainage, the quantity, size, location and inlet elevation of the scuppers shall be sized to prevent the depth of ponding water from exceeding that for which the roof was designed as determined by Section 1611.1. Scuppers shall not have an opening dimension of less than 4 inches (102 mm). The flow through the primary system shall not be considered when locating and sizing scuppers.

## Low Slope

### Membrane

#### Elastomeric Membrane Roofing

- Ethylene Propylene Diene Monomer (EPDM)

#### Thermoplastic Membrane Roofing

- Polyvinyl Chloride (PVC)
- Thermoplastic Polyolefin (TPO)

#### Spray Foam

#### Liquid Applied



# Low Slope

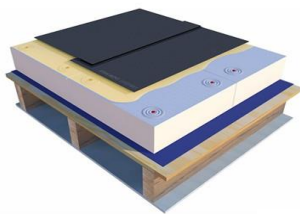
## Membrane

EPDM, PVC, TPO

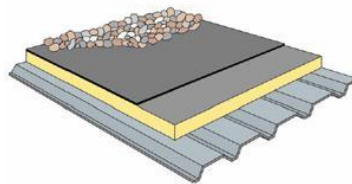
1. *Fully Adhered*
2. *Mechanically Fastened*
3. *Ballasted*
4. *Perimeter securement similar for all three styles.*
5. Metal Fascia or Coping at perimeter securing the roofing

# Roofing Systems

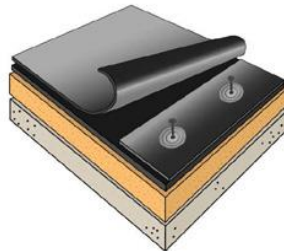
**Fully Adhered**



**Ballasted Roofing Systems**



**Mechanically Fastened**



# Low Slope - Membrane

## **1. Fully Adhered**

- a. *Insulation layers screwed down or adhesively secured to substrate.*
  - i. Fastening or adhesive density dependant on wind resistance requirements.



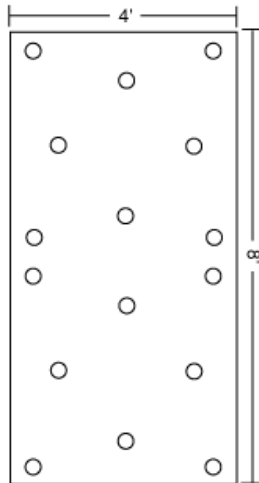






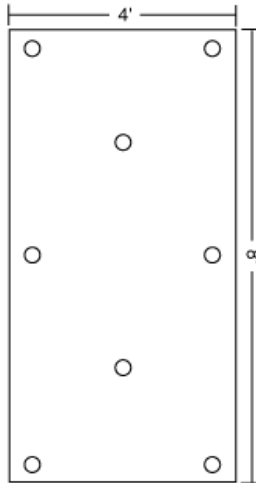
16 Fasteners /  
4'x8' Board

MINIMUM 8' PERIMETER  
FASTENER PATTERN



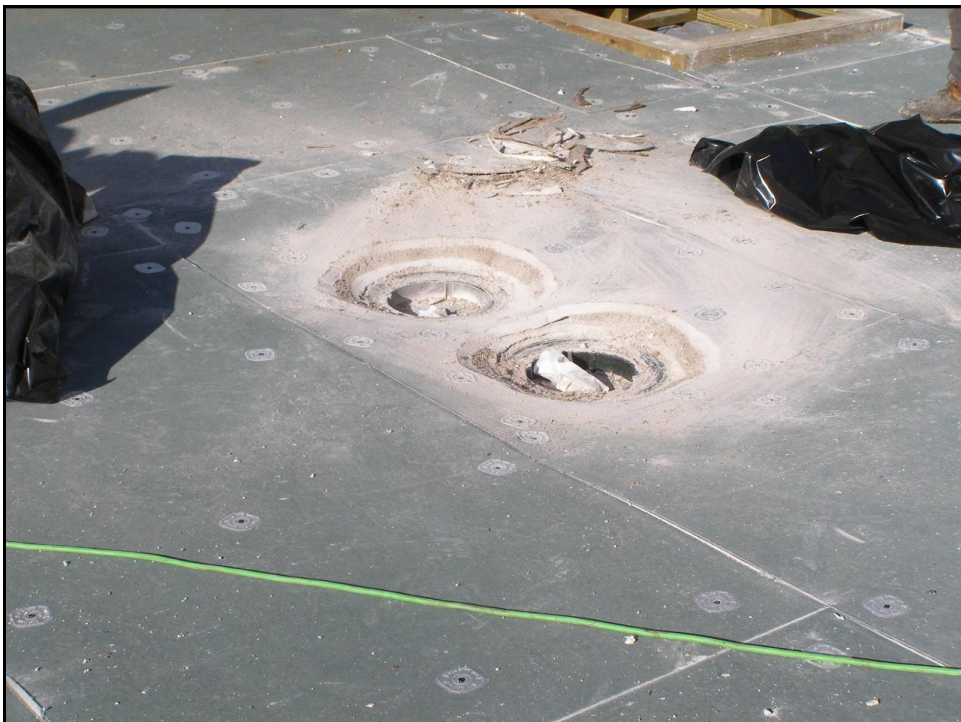
8 Fasteners /  
4'x8' Board

MINIMUM FIELD  
FASTENER PATTERN





# Multipurpose Fastener





## Low Slope - Membrane

### **2. Mechanically Fastened**

#### **a. Insulation Layers screwed down**

- i. High wind areas require air barrier below insulation on air permeable decks, wood, steel
  1. Increased fastening required with air barrier so insulation layers take most of load from air leakage from building interior.
- ii. Concrete, Gypsum, and Tectum deck do not require the air barrier due to monolithic installation.

# EPDM Roofing Systems

**Fully adhered and mechanically fastened**



## Low Slope - Membrane

### **3. Ballasted**

- a. *Insulation layers normally not fastened, and are loose laid*
  - i. Increased ballast required with air barrier so insulation layers take most of load from air leakage from building interior. This is typically at perimeters and corners up to 12' width dependent on building height or width of roof.
- b. *Membrane loose laid and secured with ballast rocks.*
  - i. Average weight around 12# in field of roof 15# at perimeters and 20# in corners
    1. Not allowed along the coast for buildings over 15' in height 120 mph wind zone.



**TABLE 1504.8  
 MAXIMUM ALLOWABLE MEAN ROOF HEIGHT  
 PERMITTED FOR BUILDINGS WITH AGGREGATE ON THE  
 ROOF IN AREAS OUTSIDE A HURRICANE-PRONE REGION**

NOMINAL DESIGN WIND SPEED, $V_{nd}$ (mph) <sup>b, c</sup>	MAXIMUM MEAN ROOF HEIGHT (ft) <sup>a, e</sup>		
	Exposure category		
	B	C	D
85	170	60	30
90	110	35	15
95	75	20	NP
100	55	15	NP
105	40	NP	NP
110	30	NP	NP
115	20	NP	NP
120	15	NP	NP
Greater than 120	NP	NP	NP

## Low Slope - Membrane

### **4. Perimeter securement similar for all three styles.**

- a. Membrane is secured along perimeter parapets.
  - i. Securement of an underlying reinforced strip of membrane to the structure and then adhering or welding the membrane to the strip
  - ii. Fastening of the perimeter of the membrane to the structure with screws/ anchors and plates
    1. Membrane flashing overlaps past the securement locations and is sealed to the field membrane and up the parapet.



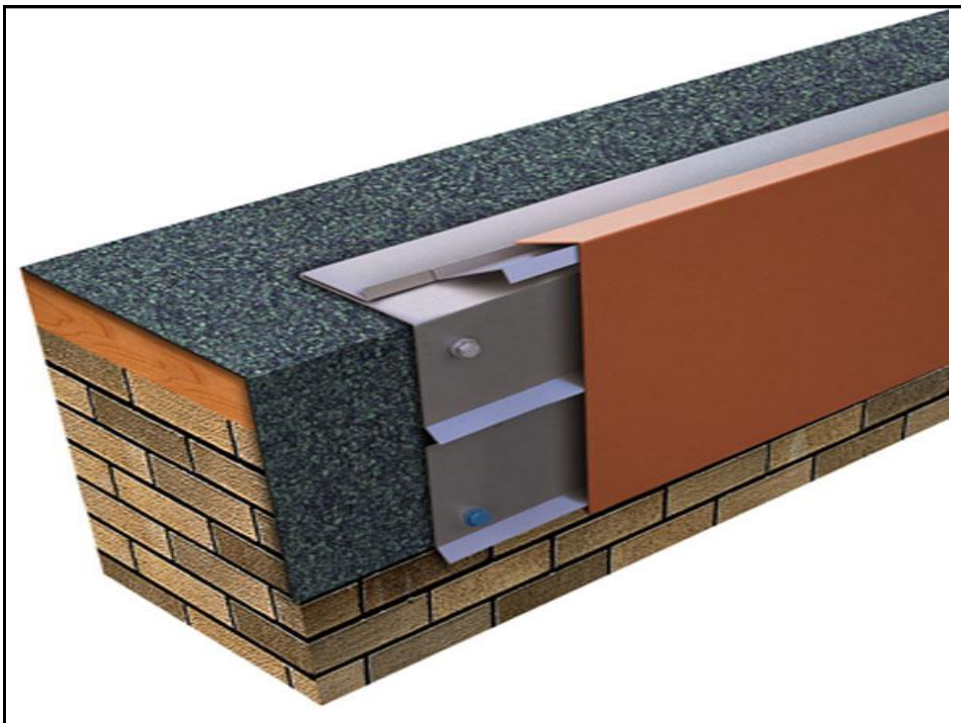
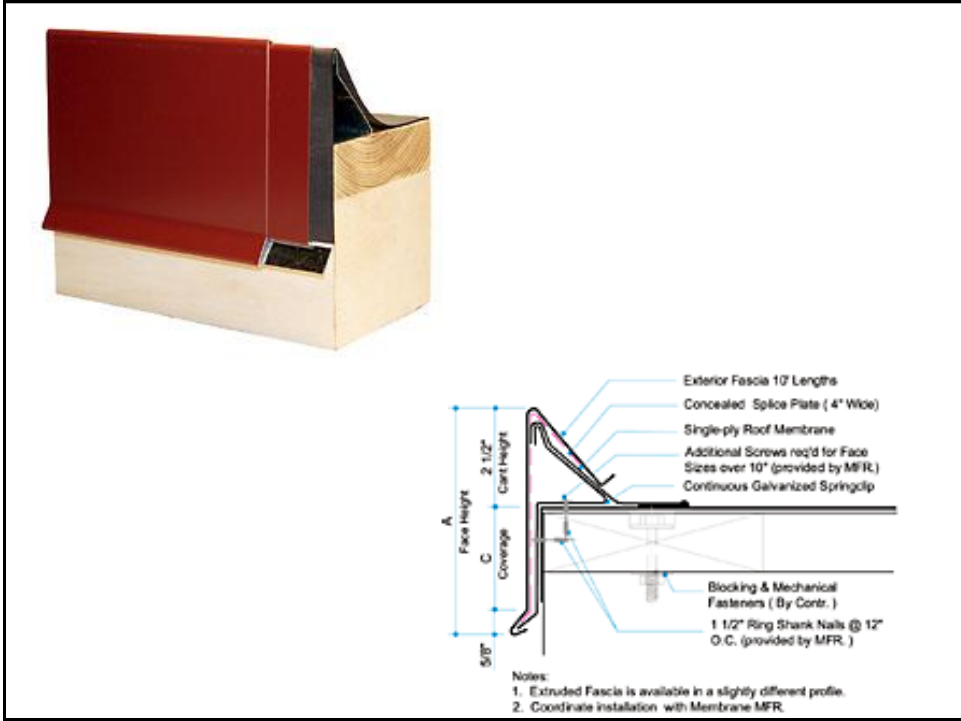


## Low Slope - Membrane

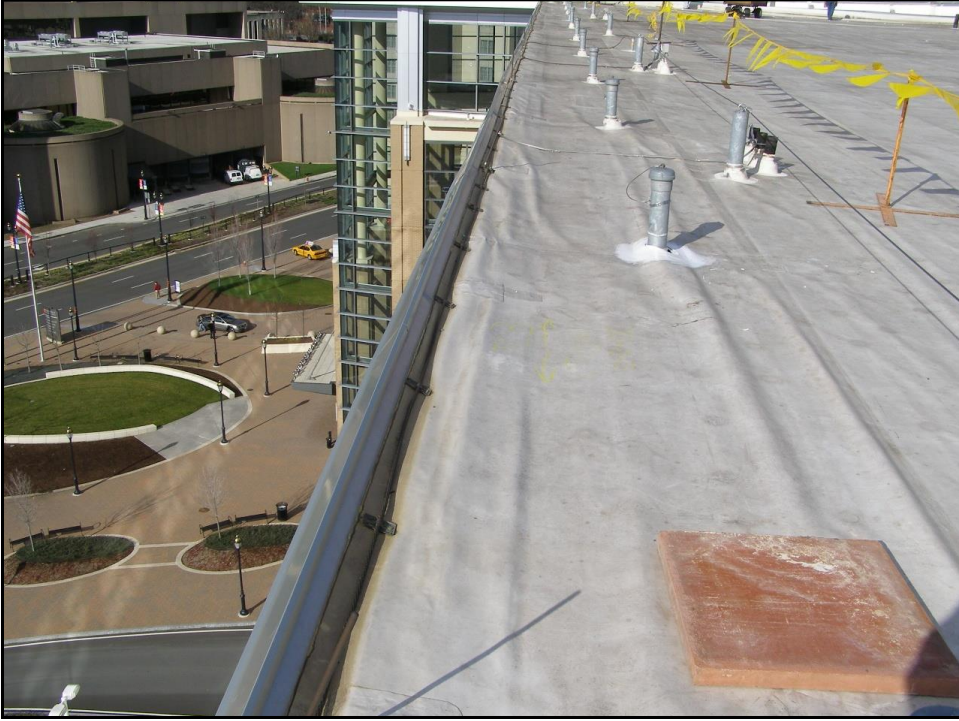
### **5. Metal Fascia at perimeter securing the roofing**

- a. Fascia materials to comply with ANSI ES-1.
  - i. Usually a prefabricated and tested assembly.
- b. Contractor brake metal does not normally comply unless the sheet metal shop has been certified by a testing laboratory
- c. Not required for sloped roof where the water drains off the edge.









# EPDM Roofing Systems

Ethylene Propylene Diene Monomer (EPDM)



# EPDM Roofing Systems

## Factory-Applied Tape







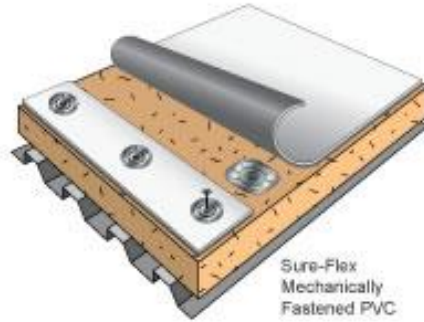
# PVC Roofing Systems

**Polyvinyl Chloride (PVC) Roofing**



# PVC Roofing Systems

**Mechanically fastened and fully adhered PVC roofing systems**







# TPO Roofing Systems

Thermoplastic Polyolefin (TPO) Roofing



# TPO Roofing Systems

**Mechanically fastened and fully adhered TPO roofing systems**



## Low Slope – Built Up Roofing

### ii. Built Up Roofing

1. *Insulation layers adhered with asphalt or low rise foam on concrete decks or secured with screws on steel or wood decks.*
2. *Installed over nailed ply of fiberglass base sheet on nailable decks without insulation.*
3. *Layers of fiberglass or organic felts laminated with asphalt or coal tar.*



## Low Slope – Built Up Roofing

- 1. Insulation layers adhered with asphalt on concrete decks or secured with screws on steel or wood decks.***

## Low Slope – Built Up Roofing

- 2. Installed over nailed ply of fiberglass base sheet on nailable decks without insulation.***



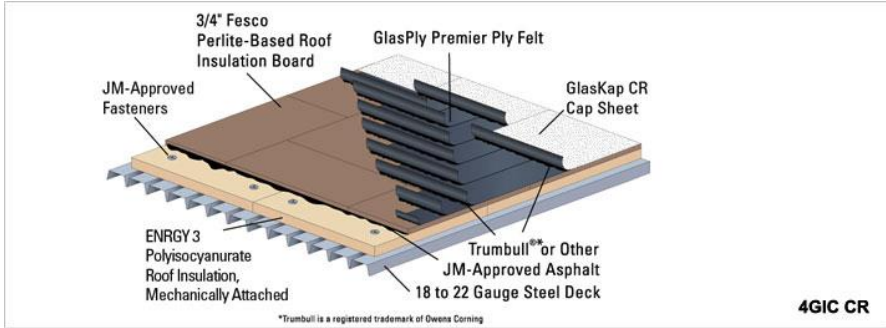
## Low Slope – Built Up Roofing

### **3. Layers of fiberglass or organic felts laminated with asphalt or coal tar.**

- a. Felts to be broomed in place while tar is still hot.
- b. Surfaced with gravel set in hot bitumen or coated over with asphalt or other coating
  - i. Asphalt emulsions
  - ii. Aluminum coating
  - iii. Acrylics
- c. Hybrid system surface the built up membrane with a modified bitumen granule surfaced cap sheet.



# Built Up Roofing System



## Low Slope – Modified Bitumen

### iii. Modified Bitumen

- 1. Insulation layers adhered with asphalt or adhesive on concrete, or secured with screws on steel or wood decks.*
- 2. Installed over nailed ply of fiberglass base sheet on nailable decks without insulation.*
- 3. Membrane installed in one or two layers  
Installation in hot asphalt, cold adhesives or by torch.*

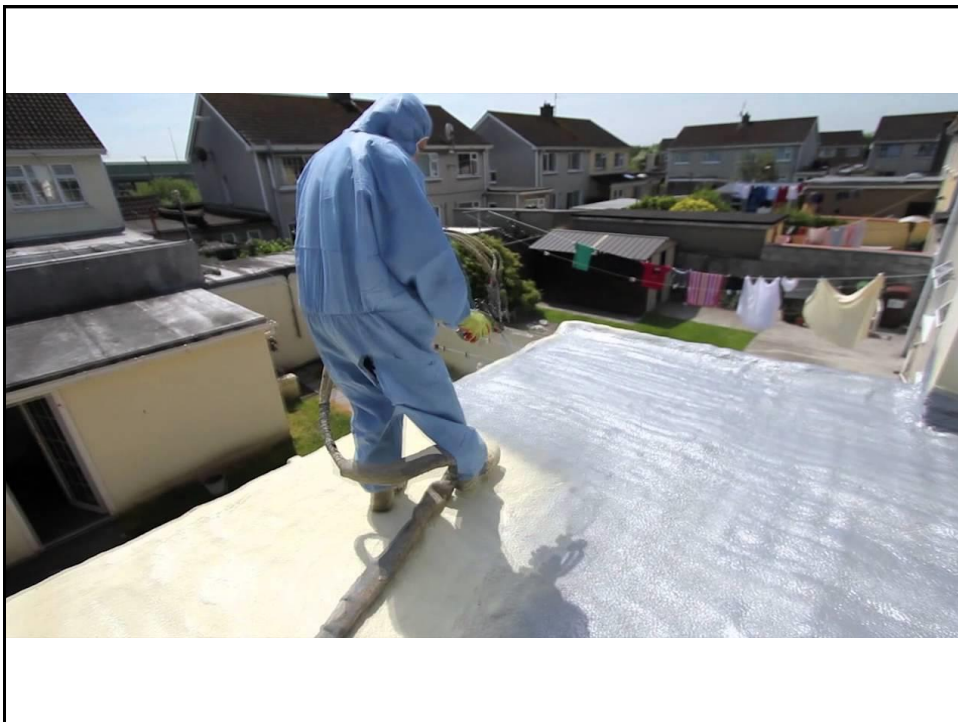






## Spray Polyurethane Foam

- Spray foam is a two part material composed of Isocyanurate and Polyol.
- The two components are mixed at the spray gun and react to create a foam.
- The foam can be sloped to improve drainage





## Low Slope and Code

### **2015 International Building Code/Connecticut**

#### **Chapter 15 – Roof Assemblies & Roof Top Structures**

1504 Performance Requirements

1507.10 Built-up roofs

1507.11 Modified bitumen roofing

1507.12 Thermoset single-ply roofing

1507.13 Thermoplastic single-ply roofing

1507.14 Sprayed polyurethane foam roofing

1507.15 Liquid-applied coatings

### **2015 International Residential Code/CT**

R905 Requirements for Roof Coverings

R905.9 Built Up roofs



## Low Slope - Continued

### *c. Surface burning to be Class A, B, or C*

#### **Section 1505 – Fire Classification**

**Class A** roof assemblies are effective against severe fire test exposure.

**Class B** roof assemblies are effective against moderate fire-test exposure

**Class C** roof assemblies are effective against light fire-test exposure.

## Low Slope - Continued

### *d. Interior Fire Resistance dependant on Building classification*



## Low Slope – Wind Loads

*e. Wind resistance to comply with basic wind speed as listed in Chapter 16*

- i. mph at coast
- ii. mph for remainder of state

IBC Code References:

Section 1609 Wind Loads

Appendix N – Municipality – Specific  
Structural Design Parameters

(Snow Loads, Wind Speeds and MCE Spectral Accelerations)

## Green Roofing

- Roofing with plantings, planters, and or paving.







# Liquid Applied Roofing





## Steep Slope

### ***a. Asphalt Shingles***

- i. Fastening dependent on Basic Wind Speed and Shingle Manufacturer directions. Some require 4 nails, some 6 nails*
- ii. Nails and fasteners shall be corrosion resistant.*
- iii. Ice Dam Materials 24" in side building wall.*

**TABLE 1504.1.1  
CLASSIFICATION OF ASPHALT SHINGLES**

MAXIMUM BASIC WIND SPEED, $V_{ref}$ FROM FIGURE 1609A, B, C OR ASCE 7	MAXIMUM BASIC WIND SPEED, $V_{ref}$ FROM TABLE 1609.3.1	ASTM D 7158 <sup>a</sup> CLASSIFICATION	ASTM D 3161 CLASSIFICATION
110	85	D, G or H	A, D or F
116	90	D, G or H	A, D or F
129	100	G or H	A, D or F
142	110	G or H	F
155	120	G or H	F
168	130	H	F
181	140	H	F
194	150	H	F

For SI: 1 foot = 304.8 mm; 1 mph = 0.447 m/s.  
 a. The standard calculations contained in ASTM D 7158 assume Exposure Category B or C and building height of 60 feet or less. Additional calculations are required for conditions outside of these assumptions.

## Steep Slope - Asphalt Shingles

- i. **Fastening** with 4-6 nails is dependant on Basic Wind speed in town of installation, for standard installation
  - 1. *Steep roof over 21" / 12 usually requires 6 nails or as listed by shingle manufacturer.*
    - a. *Steep roofs also require hand sealing of the shingles due to lack of weight of shingle against seal strips.*
  - 2. *Comply with pattern listed on Manufacturers directions.*
  - 3. *Nailing locations are marked on the shingles*





## **Steep Slope - Asphalt Shingles**

### ***ii. Nails shall be corrosion resistant.***

1. *Galvanized, Aluminum, Copper, or stainless nails listed as acceptable*
  - a. Plated nails not listed therefore not acceptable.
2. Manufacturers of shingles have a double line between which the nails are to be placed. Some are wider than others.

3. Nails must be placed in the nailing locations identified on the shingles.
  - A. Nails to be set flush to the surface of the shingles. Overdriven, underdriven, or installed on an angle are not acceptable.









## **Steep Slope - Asphalt Shingles**

### **iii. Ice Dam Materials**

1. Code requires ice dam material to extend 24" horizontally inside the building wall as a minimum.
2. Standard felt underlayment required for remainder of field of roof.
3. Low slope (<math><4\text{'}/12\text{'}</math> down to ) underlayment requires 2 ply of underlayment felt or full coverage with ice dam material.
4. Ventilation required below the substrate to which the shingles are installed above the insulation.
  - a. Ventilation to be balanced 50% at ridge/ gable end, 50% at soffit.
  - b. No ventilation required if rafter space filled with spray foam.
5. Fiberglass shingles carry a class A fire rating
  - a. Organic shingles have class C rating



## Steep Slope – Asphalt Shingles

### ***Code Reference***

### ***Section 1507 - Requirements for Roof Coverings***

*1507.2 Asphalt Shingles*

*1507.2.6 Fasteners*

*1507.2.7 Attachment*

*1507.2.8.2 Ice Dam Membrane*

## Metal Roofing

### ***3. Metal Roofing***

a. Architectural and Structural standing seam

i. *Architectural generally from 2”in 12” and steeper*

ii. *Structural System*



## Metal Roofing

### ***i. Architectural - Generally from 2" in 12" and steeper***

1. *Usually standing or batten seam.*
2. *Seams locked and folded or snap on.*
  - a. *Below 4" in 12" 2 ply of underlayment or ice dam full coverage required*
  - b. *Above 4" in 12" ice dam required at eaves for 24" inside building wall.*
3. *Seam heights vary from 1" to 2" plus.*
4. *Require a structural deck*
5. *Require wind rating usually a UL 90 listing in CT.*





# Metal Roofing

## **ii. Structural System**

1. No deck required, attached to structural purlins or ,“C”, “Z” shapes attached to structure.
2. Most have integral sealant in the seam as well as capillary breaks to prevent water siphoning through seam into building.
3. Slopes as low as  $\frac{1}{4}$ " in 12" allowed by Manufacturers.
4. Require wind rating usually a UL 90 listing in CT.
5. Metal systems have a class A fire rating.





## Metal Roofing

### ***Code Reference***

### ***Section 1507 - Requirements for Roof Coverings***

#### ***1507.4 Metal Roof Panels***

***1507.4.1 Deck requirements***

***1507.4.4 Attachment***

#### ***1507.5 Metal Roof Shingles***

***1507.5.1 Deck requirements***

***1507.5.6 Attachment***

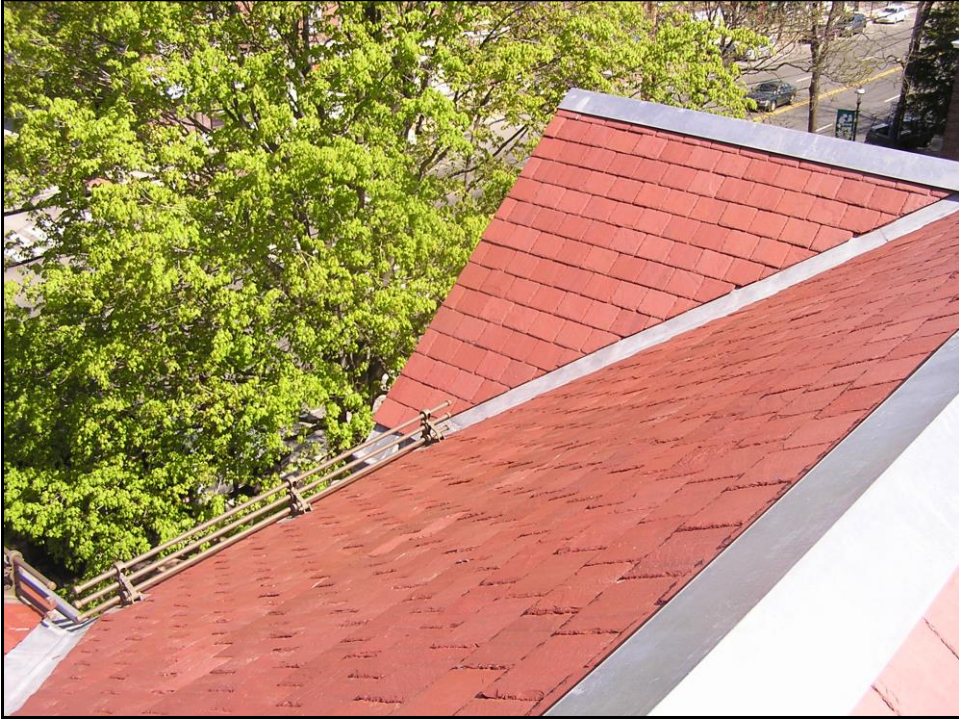




## Slate Roofing

- Slate to comply with ASTM C406
  - Grade S1 = 100 years
  - Grade S2 = 75 years
  - Grade S3 = 50 years





### Imitation Slate



- Slate fastened with 2 nails per slate for nominal  $\frac{1}{4}$ " thick materials.
  - Nails normally are copper .
  - Slates over  $\frac{3}{4}$ " thick and 20" in length require 4 nails
- Slate can be ordered in several thickness's.
  - $\frac{1}{4}$ " is most common but can be provided in  $\frac{3}{8}$ ",  $\frac{1}{2}$ "  $\frac{5}{8}$ ",  $\frac{3}{4}$ ", and 1"

## Clay Tile Roofing

- Required to comply with ASTM C1167
  - Key test in this specification is resistance to freeze thaw for use in northern climates.
- There are many styles to chose from
  - S style
  - Barrel
  - Flat interlocking
  - Slab, which are installed similar to slate

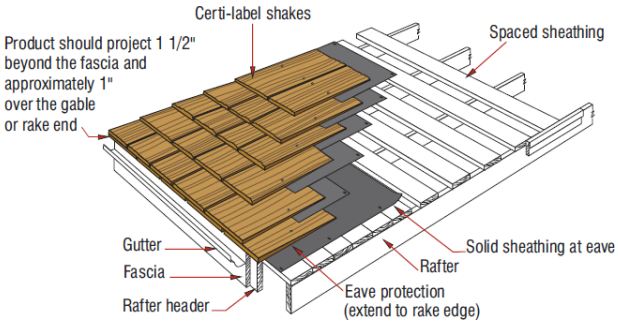




# Wood Roofing



# Wood Shakes

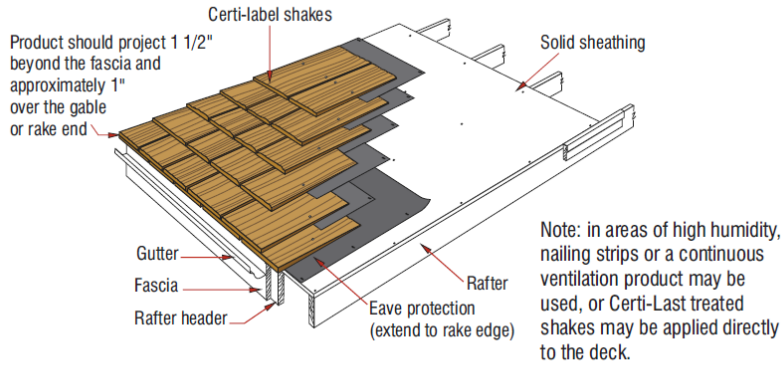


**Figure 1: Spaced Sheathing**

For applications using varied exposures, the center of the sheathing board should be equal to the distance of the exposure.

Cedar Shingle and Shake Manual

# Wood Shakes



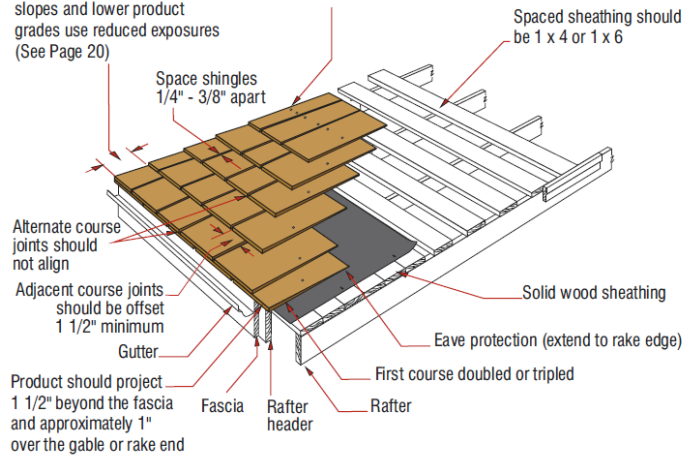
**Figure 2: Solid Sheathing**

Cedar Shingle and Shake Manual

# Wood Shingles

For 4:12 slope and steeper, use Number 1 Grade shingles at 5", 5 1/2" and 7 1/2" exposures at 16", 18" and 24" shingles respectively. For lower roof slopes and lower product grades use reduced exposures (See Page 20)

Two nails (only) for each shingle approximately 3/4" from edge and approximately 1 1/2" above exposure line.



Cedar Shingle and Shake Manual

**TABLE 1507.9.6  
WOOD SHAKE MATERIAL REQUIREMENTS**

MATERIAL	MINIMUM GRADES	APPLICABLE GRADING RULES
Wood shakes of naturally durable wood	1	CSSB
Taper sawn shakes of naturally durable wood	1 or 2	CSSB
Preservative-treated shakes and shingles of naturally durable wood	1	CSSB
Fire-retardant-treated shakes and shingles of naturally durable wood	1	CSSB
Preservative-treated taper sawn shakes of Southern pine treated in accordance with AWPA U1 (Commodity Specification A, Use Category 3B and Section 5.6)	1 or 2	TFS

CSSB = Cedar Shake and Shingle Bureau.

TFS = Forest Products Laboratory of the Texas Forest Services.







Thank You!

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