

Moisture Intrusion

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INSTRUCTOR:

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Background:

Building Contractor - 1984 to present
Building Inspector Technician - 1997 - 2 years
Field Inspector - 1997 - 2020
Residential Plans Examiner - 1997 - to present
Code Development Committee - started 2001
Instructor - 1998 - present
Code Consultant - 2005 to present
Program Manager - Short Stint3

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2

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3

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4

POLLING QUESTION

- If I were to categorize my experience with review or inspections of International Residential Code efficiency, I would be:
 - Groot (I have limited exposure)
 - Rocket Raccoon
 - Black Widow
 - Captain America
 - Iron Man (I could teach this course)



5

Definition -Sustainability

- "development which meets the needs of the present without compromising the ability of future generations to meet their own needs."

A commonly used definition from the report entitled *Our Common Future (The Brundtland Report)* issued by the World Commission on Environment and Development (Mrs. Gro Harlem Brundtland, Prime Minister of Norway, Chairperson), 1987:

6

Definition -Sustainability

- A mathematically precise definition of a sustainable process is based on “life” considerations (no life => sustainability is moot)

Louise F. Goldberg, PhD (Eng)
Senior Research Associate and Director
Energy Systems Design Program
College of Design
University of Minnesota

7

Definition -Net Zero Energy

$$\frac{(\text{Life Cycle Net Energy Generation})}{(\text{Life Cycle Embodied Energy}) + (\text{Life Cycle Operating Energy})} \geq 1$$

(Energy generation) = (No. of years of occupation) x (Average annual generation)

(Operating energy) = (No. of years of occupation) x (Average annual consumption)

(Embodied energy) = (Materials used) + (Materials used transport) + (Materials wasted) + (Materials wasted transport)

Therefore:

- Maximize generation
- Minimize consumption
- Maximize life of building
- Minimize waste

by Louise F. Goldberg, PhD (Eng)

8

Durability Design Criteria

Purpose

- Maximize life of building
- Minimize waste

by Louise F. Goldberg, PhD (Eng)

9

Learning Objective

To provide fundamental information of *International Residential Code (IRC) exterior weather barrier provisions* (walls and roof) related to moisture intrusion from a permit and inspection perspective.

- Roofing assembly components
- Exterior wall envelope weather-barrier components
- Foundation

10

Moisture Barrier

- The International Residential Code (IRC), beginning in 2009, requires a moisture barrier consisting of one layer of 15# asphalt felt or equivalent material behind most exterior wall coverings. The felt must be applied horizontally, with horizontal seams lapped at least two inches and vertical seams lapped at least six inches. The primary exception is for stucco and adhered veneer such as artificial stone. These wall coverings require one or two layers of Grade D paper or equivalent material. Note that asphalt felt and Grade D paper **are not** equivalent and may not be substituted for each other.

11

R703.7.3.1 Dry Climates

Moisture Barrier

- A moisture barrier (also called a weather-resistive barrier) stops the flow of liquid water. Moisture barriers primarily are used to control the flow of liquid water from the exterior into the home's interior. Asphalt felt (often called 15# and 30# roofing felt), Grade D paper, and some types of house wraps are common forms of moisture barriers.

12

Moisture Barrier

- Now, here is where things get interesting. Some materials perform multiple functions and don't perform others. Polyethylene sheeting and sealants such as caulk perform all three functions. Kraft paper is a vapor retarder and is an air barrier if correctly installed, but it is not a moisture barrier. Asphalt felt, Grade D paper and house wraps such as Tyvek® are moisture barriers and are air barriers if correctly installed, but they are not vapor retarders.

13

Vapor Retarder

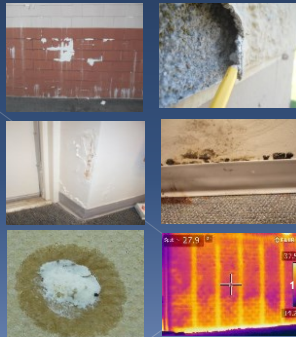


- Insulation between joists or wall studs by stapling facing flanges to the inside framing. Place the vapor retarder toward the warm-in-winter side of living area of the house in heating climates

14

Damaging Effects of Moisture Intrusion

- Block and Mortar Deterioration
- Drywall Deterioration
- Mold
- Damp Insulation
- Reduced Energy Efficiency



Conduction Heat Transfer Equation

$$Q = U \times A \times \Delta T$$

- Q – Btu/hr
- U – Overall Heat Transfer Coefficient (Btu/hr/ft²/°F)
- A – Surface Area (ft²)
- ΔT – (T_{inside} – T_{outside})

16

Example - Walls

- U – R-20 wall and $U=1/R$, so...
- $U=1/20 = .05$ Btu/hr/ft²/°F
- A – Wall 40' x 8' = 320 ft²
 - Assume 20% of wall area is window (64 ft²)
- ΔT – 72°F – 22 °F
- $Q = .05 \times 256 \times (72 - 22) = 640$ Btu/hr
- Now, we need to look at that window

17

Example - Windows

- $U_{\text{win}} = 0.65$ Btu/hr/ft²/°F
- T - Same weather conditions so...
- $Q = 0.65 \times 65 \times (72 - 22) = 2080$ Btu/hr !!

18

Why Use Good Windows?

- Total loss for the wall is
 - > $2,080 + 640 = 2,720$ Btu/hr

So, 76.5% of total energy loss is through 20% of the assembly!!

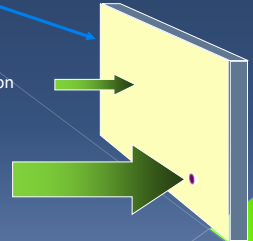
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Annual Water Vapor Transport

100 sq ft Wall with no Vapor Barrier

Vapor Diffusion:
2/3 pint per heating season

Air Leakage (1/2" hole):
50 pints of water



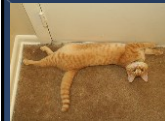
20

Air Leakage



21

KEY TERM



- **Draft Stop:** A material, device or construction installed to restrict the movement of air within open spaces of concealed areas of building components such as crawl spaces, floor-ceiling assemblies, roof-ceiling assemblies and attics.

22

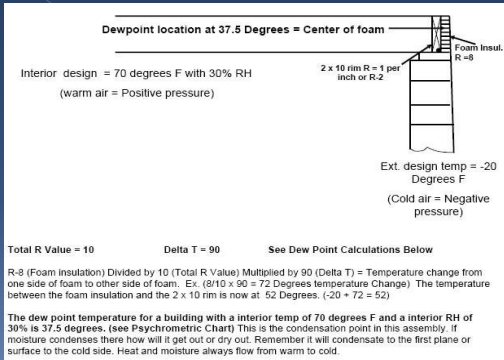


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24

Identifying Dew-point



25

Relative Humidity

Abstract:

- What relative humidity should I have in my home? Seems like a simple enough question. However, the answer can sometimes be difficult to understand.
- Elevated relative humidity at a surface - 70 percent or higher - can lead to problems with mold, corrosion, decay and other moisture related deterioration. When relative humidity reaches 100 percent, condensation can occur on surfaces leading to a whole host of additional problems. An elevated relative humidity in carpet and within fabrics can lead to dust mite infestation and mildew (mildew is mold growing on fabrics).

Joseph Lstiburek
Research Report - 0203

26

Exterior Covering



27

Coverings



R609, R703.8, R903.2, R905

28

Slope/Pitch



... Distortions in the underlayment shall not interfere with the ability of the shingles to seal. table

29

R905.2.2, Table R905.1.1(2) Underlayment Application



30

Ice Barrier

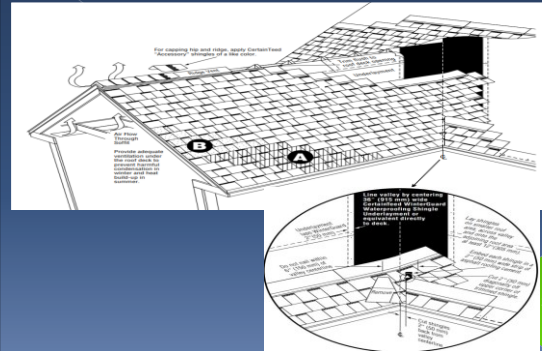
...or a self-adhering polymer modified bitumen sheet...and extend...to a point at least 24 inches inside the exterior wall line.



R905.2.7.1 & R905.2.8.2

31

Moisture Intrusion



32

What is Moisture Intrusion?

- Moisture that penetration the exterior water-resistive barrier system that includes the roof, walls and foundation.



R903 Weather Protection

33

Ceiling / Attic / Top Plate

- Missing Wind Wash



34

N1102.2.3 (R402.2.3) Eave Baffle

Ceiling / Attic / Top Plate

Wind wash barriers to extend to within 1" of roof deck.



35

R806.3 & N1102.2.3

(Wind Wash) Air Barrier

The wind wash barrier needs to be continuous and sealed at rim joist areas and cantilevers, etc...

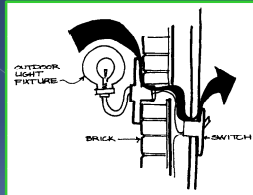


R703, Table N1102.4.1.1, and Manufacturer's Requirements

36

(Wind Wash) - Air Barrier SHEATHING PENETRATIONS

- All penetrations through the (wind wash) - air barrier must be sealed.
- Illustration: unsealed wind wash barrier allows air leaks



37

Table N1102.4.1.1 (R402.4.1.1) General

What is Moisture Intrusion?

- Moisture that penetration the exterior water-resistive barrier system that includes the roof, walls and foundation.



38

R703.2 Water-resistive barrier

Wood Framed Components Exterior Wall Corners

Framing must be constructed so that insulation can be installed after exterior sheathing is installed.



39

Table N1102.4.1.1, (R402.4.1.1)

Joints, Seams and Penetrations

- The opening between the framing and jambs of windows and doors must be sealed or gasketed



40

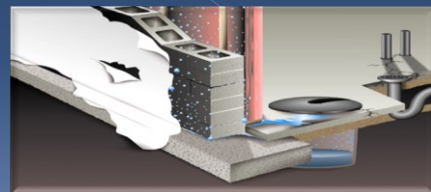
Table N1102.4.1.1 (R402.4.1.1)



41

What is Moisture Intrusion?

- Moisture that penetration the exterior water-resistive barrier system that includes the roof, walls and foundation & slab.



42

R506.2.3 Vapor retarder

What is Moisture Intrusion?

- Moisture that penetration the exterior water-resistive barrier system that includes the roof, walls and foundation & slab.



R506.2.3 Vapor retarder

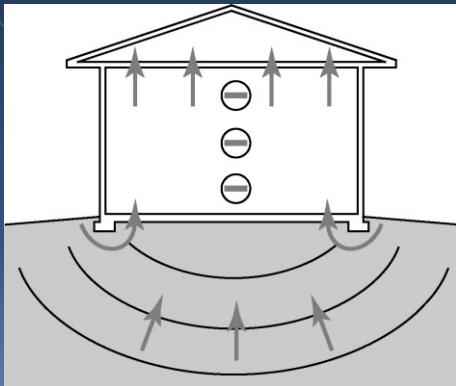
43

Moisture Diffusion Through Basements

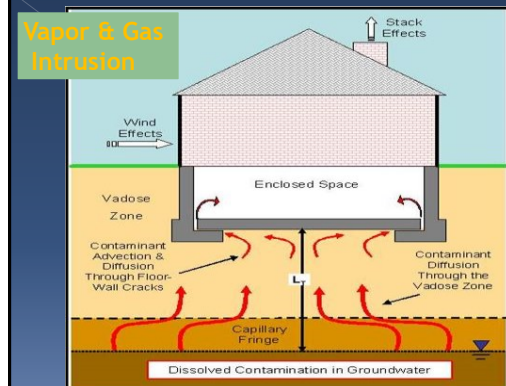
- Surface Water
- Deep Ground Water



44



45



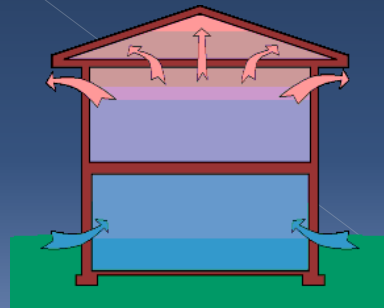
46

Entry routes



47

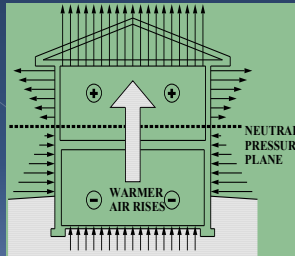
New Emphasis on Air Barrier The Main Reason: Stack Effect



48

The Stack Effect

- Positive (outward) pressure is created above the neutral pressure plane
- Negative (inward) pressure is created below the neutral pressure plane
- Outward flow above the plane = Inward flow below the plane

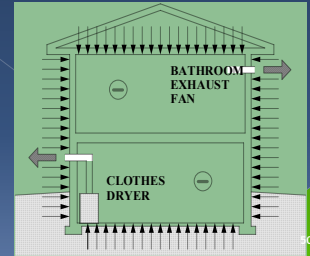


49

Exhausting Devices create negative (inward) pressure in the building

Clothes dryers
Bath and kitchen
fans

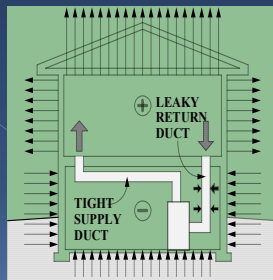
Combustion
appliances



50

Leaky ducts in the basement

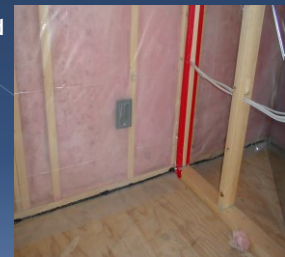
- Leaky return ducts cause the basement to be depressurized



51

Interior Air Barrier - in Cold

- Continuously sealed
- Installed on warm-in-winter side of insulation
- Air leakage points to be caulked, gasketed, weatherstripped or sealed



52

Foundation Concrete R402.2 Materials

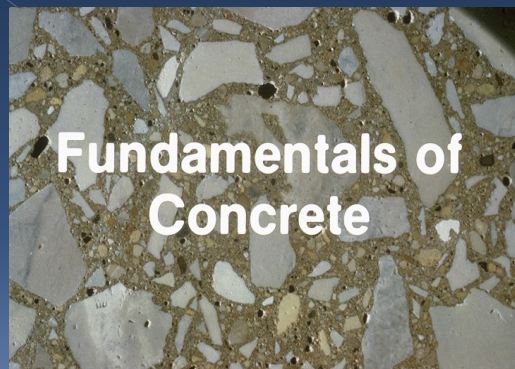
- Trip ticket to identify concrete mix proportions (Minimum Compressive Strength per IRC table R402.2 ... 2,500 psi typical).
- Air entrainment (if required, ... 5 to 7 percent).
- Travel time and drum rotation (1 1/2 hours and 300 revolutions maximum).



53

American Concrete Institute 332R-84

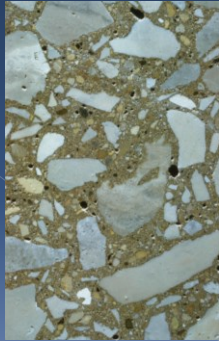
Fundamentals of Concrete



54

Concrete should be made up of :

- 10% cement
- 20% water
- 30% sand
- 40% gravel



55

Water / Cement Ratio

Strength Losses

Add 20 gallons to a 10 yard load and we can lose 400 to 500 psi
True or False



56

Water / Cement Ratio

Permeability

- After concrete cures, those capillary voids let water and vapor move through finished slabs and walls.



57

What is Moisture Intrusion?

Damp foundations can allow mold to grow and permit excess moisture to enter the home



58

Evaporation

- 32 gallons of water per yard of concrete
- Including footings, walls and slab about 400 to 700 gallons of water vapor will enter the house within a 3 year period



59

Foundation Damp-proofing/Waterproofing

- Dampproofing, waterproofing, or water repellent material applied to exposed above grade foundation R406



60

Exterior insulation

- Concrete wall warm, can dry to the interior low likelihood to mold
- Basement floor slab can dry to the interior
- Protective membrane to UV resistant

61

Exterior insulation

- Draining rigid fiberglass also acts as capillary break
- Concrete wall warm, can dry to interior and exterior
- Basement floor slab can dry to interior

62



63

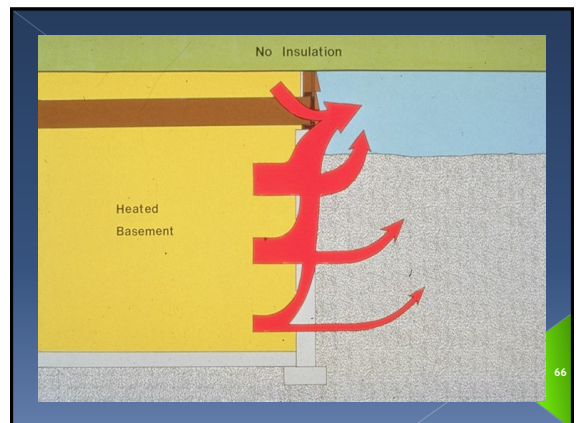


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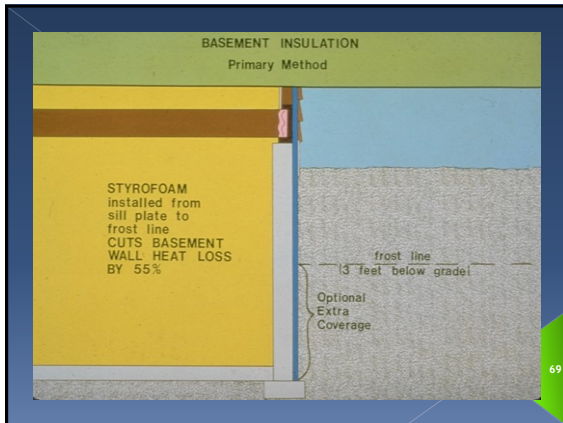
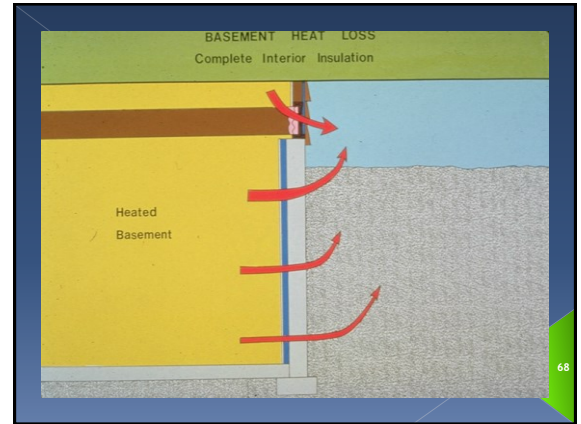
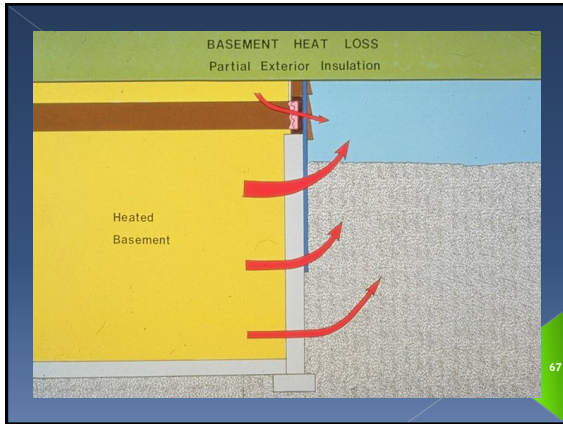
Interior insulation

- Cold concrete wall must be protected from interior moisture-laden air in the winter and summer
- Concrete wall cold, cannot dry to interior; drying only possible to exterior at above grade portion of wall
- Rigid insulation should not be installed until concrete wall has dried substantially

65



66



What is Moisture Intrusion?



71

Air Tight



72

N1101.6, Def. ... of Air Barrier

What is Moisture Intrusion?

Sometimes it occurs because of scheduling issues.



73

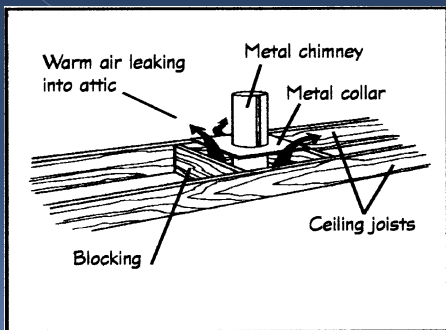
What is Moisture Intrusion?

Sometimes it occurs because of lack of proper flashing or normal wear and tear.



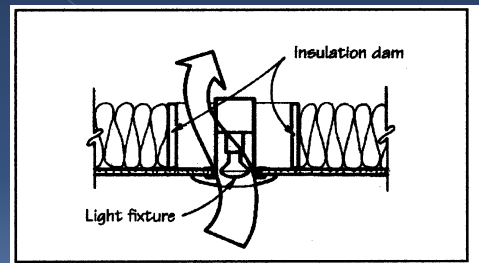
74

Attic Bypass



75

Attic Bypass



76

Attic Bypass



77

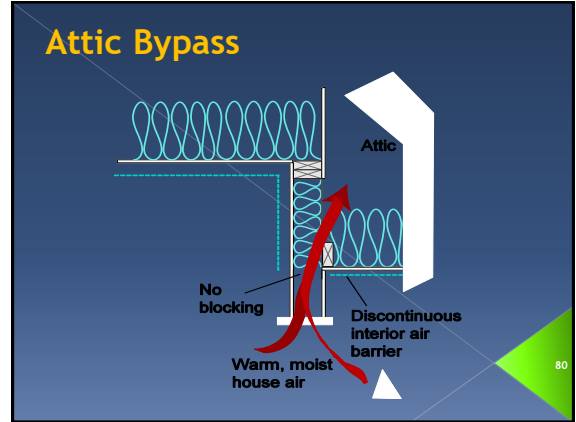
Attic Bypass



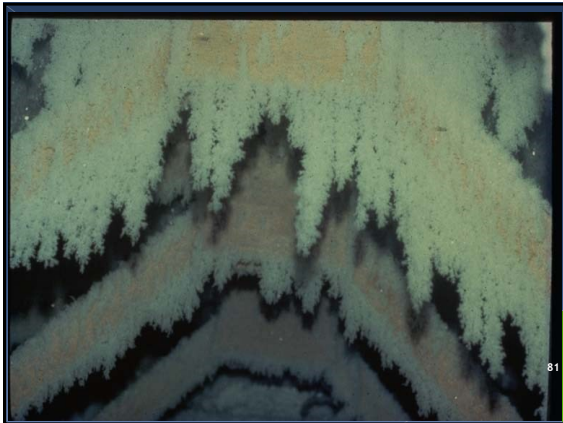
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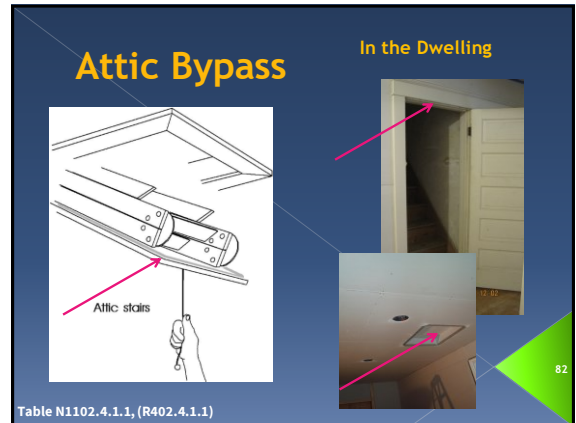
79



80



81



82

What is Moisture Intrusion?

Sometimes it occurs because of lack of protection from the weather during construction.



83

What can prevent Moisture Intrusion?

The roof assembly and exterior wall envelope are to be designed and constructed in such a manner that they prevent water penetration of the roof assembly and prevent the accumulation of water within the wall assembly.



84

Plan Review Considerations

Weather-barrier materials for walls and roofs are typically included in the building plan for new structures.



85

Inspection - R109

- Framing inspection allows for the verification of proper application of exterior wall sheathing, such as for an addition, prior to the application of house sheathing paper and/or exterior cladding (siding, stucco, etc.) or roofing.



86

Inspections - R109

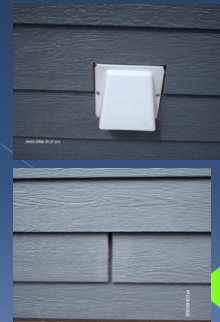
- Jurisdictions can require an inspection of the house sheathing paper. This inspection should be noted on the permit card.



87

Inspections - R109

- Final Inspection



88

First, a Clarification ...

- The exterior cladding material, such as the siding, exterior plaster (stucco), stone, brick, and adhered veneer, are not designed to serve as the exterior water-resistive barrier material.
- The primary exterior water-resistive barrier material is the approved felt, sheathing paper or exterior foam sheathing behind the exterior cladding material.

89

IRC Section R703

Vapor Barrier



The Word's today are vapor barrier (more accurately called a vapor retarder) and its cousins, air barrier and moisture barrier. These words can be confusing because the materials that perform these functions may appear similar and because some materials can perform multiple functions.

- A vapor retarder reduces the flow of water vapor contained in the air. A vapor retarder is required when warm, moisture-laden air may travel by convection into a cooler area such as the attic or a wall cavity. There, the water vapor may condense into liquid water and cause damage. Polyethylene sheeting is a common form of a Class I vapor retarder. Asphalt-saturated Kraft paper found on fiberglass batt insulation is a common form of a Class II vapor retarder. Latex and enamel paints are common forms of a Class III vapor retarder.

90

Water-Resistive Barriers

Not fewer than one layer of *water-resistive barrier* shall be applied over studs or sheathing of all exterior walls with flashing as indicated in [Section R703.4](#), in such a manner as to provide a continuous water-resistive barrier behind the exterior wall veneer. The water-resistive barrier material shall be continuous to the top of walls and terminated at penetrations and building appendages in a manner to meet the requirements of the exterior wall envelope as described in [Section R703.1](#). Water-resistive barrier materials shall comply with one of the following:

1. No. 15 felt complying with [ASTM D226](#), Type 1.
2. [ASTM E2556](#), Type 1 or 2.
3. [ASTM E331](#) in accordance with [Section R703.1.1](#).
4. Other approved materials in accordance with the manufacturer's installation instructions.

No. 15 asphalt felt and *water-resistive barriers* complying with [ASTM E2556](#) shall be applied horizontally, with the upper layer lapped over the lower layer not less than 2", and where joints occur, shall be lapped not less than 6".

IRC Section R703.2

91

Water-Resistive Barriers

R703.7.3 - Water-resistive barriers shall be installed as required in [Section R703.2](#) and, where applied over wood-based sheathing, shall comply with [Section R703.7.3.1](#) or [R703.7.3.2](#).

R703.7.3.1 Dry climates.

In Dry (B) climate zones indicated in [Figure N1101.7](#), *water-resistive barriers* shall comply with one of the following:

1. The *water-resistive barrier* shall be two layers of 10-minute Grade D paper or have a water resistance equal to or greater than two layers of a water-resistive barrier complying with [ASTM E2556](#), Type I. The individual layers shall be installed independently such that each layer provides a separate continuous plane. Flashing installed in accordance with [Section R703.4](#) and intended to drain to the *water-resistive barrier* shall be directed between the layers.
2. The *water-resistive barrier* shall be 60-minute Grade D paper or have a water resistance equal to or greater than one layer of a *water-resistive barrier* complying with [ASTM E2556](#), Type II. The *water-resistive barrier* shall be separated from the stucco by a layer of foam plastic *insulating sheathing* or other non-water-absorbing layer, or a designed drainage space.

92

Exterior Wall Water - Resistive Barrier

- The code requires the installation of one layer of No. 15 felt paper complying with ASTM D 226 for Type I felt.
- The code requires ASTM E2556, Type 1 or 2
- One layer 60 min or Two layers 10 minutes
- (This information should also be verified during the permit process)



IRC Section R703.7.3

93

Your local resource for stucco information



Stucco Manufacturers Association – YouTube

<http://www.tlpcpa.org>

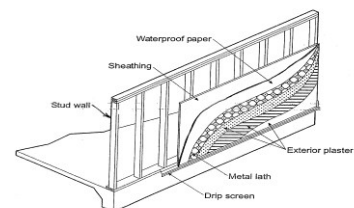
94

Pre-Certification / Pre-Permit



95

Exterior Plaster - R703



96



ICC Acceptance Criteria AC # 38

Grade D Requirements

Dry Tensile Strength	20lbs both machine and cross direction
Water Resistance	10 minutes
Water Vapor Transmission	
Maximum	no limit
Minimum	35 grams

103

Applications

- Weather-resistive barriers are used behind:
 - Three-Coat Portland Cement Plaster (Stucco)
 - One Coat EIFS



104

Water-Resistive Barrier

- The one layer of Type I, No. 15 felt
- paper is to be installed continuous,
- lapped 2 inches horizontally, and
- 6 inches vertically.



105

IRC Section R703

Water-Resistive Barrier

- ... Lapped 2 inches horizontally, and 6 inches vertically. What if it is applied vertically?

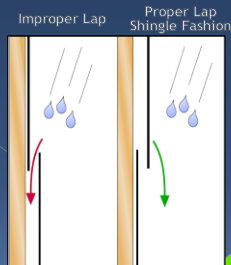


106

IRC Section R703

Application

- Weather barriers must be installed in shingle lap fashion



107

Application

- Water-resistive barriers are also used behind:
 - Other exterior cladding such as Stucco Brick, Hardboard Siding, Vinyl, Aluminum, Fiber Cement and Wood Siding

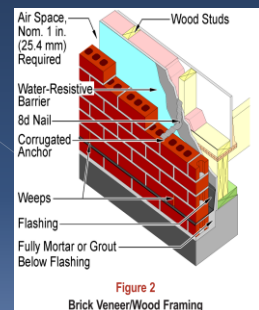


Figure 2
Brick Veneer/Wood Framing

108

Water-Resistive Barrier

- Brick veneer requires one layer of No. 15 felt.



109

IRC Section R703

Water-Resistive Barrier

- Exterior plaster (aka stucco) needs two layers of Type I, Grade D, No. 15 felt, or one layer plus an approved drainage plane system.



110

IRC Section R703.2 & R703.7.3.1

System Requirements

- The success of system depends on all of the components in the building envelopes performing equally well.



111



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Architecture and Building Science

- Building paper swelled when wet and shrank when dry creating natural drainage channels in stucco
- 2 layers of building paper create an airspace behind stucco providing drainage

112

Water-Resistive Barrier

- Adhered veneer shall meet R703.7.3.1 Options: item 1 or 2.
- One or two layers, Type I or Type 2, Grade D, etc., or
- one layer plus an approved drainage plane system.



113

IRC Section R703.12, R703.2 & R703.7.3

Alternative Materials

- What procedures can be taken for a proponent to have a material or method of installation, such as for a water resistive barrier, be approved by the Building Official as an alternate to the specific requirement noted in the code?



114

IRC Section R104

Attaching Through Foam

- Cladding attachment over foam sheathing shall comply [Section 703.3](#), [Table R703.3\(1\)](#) with the additional requirements and limitations of [Sections R703.15](#) through [R703.17](#).



R703.3, R703.17 Cladding attachment over foam sheathing to masonry or concrete wall construction

115

Alternative Materials

- What documentation can verify that a proposed product is equivalent to the Type I, No. 15 that is needed?



IRC Section R104

116

Alternative Materials

- For determining equivalency to the Type I paper, or the Type I, Grade D paper for exterior plaster, data should be submitted to the Building Official that shows that the proposed material is equivalent to that prescribed in the code.



IRC Section R104

117

What do you see????



118

Alternative Materials

- This data could be:
 - Manufacturer's specifications
 - Independent third-party testing
 - An Evaluation Service Report from the International Code Council Evaluation Service (www.icc-es.org)
 - Information from some other source
 - This data would need to be approved by the Building Official.

(continued)

IRC Section R104

119

Alternative Materials

- www.icc-es.org
- The ICC-Evaluation Service (ICC-ES) reports for Water-Resistive Barriers are based on (Acceptance Criteria) AC-38, which establishes criteria for recognition of water-resistive barriers based on the provisions contained in the I-Codes.

(air leakage, vapor transmission, surface-burning characteristics, Drainage capability, etc.)



IRC Section R104

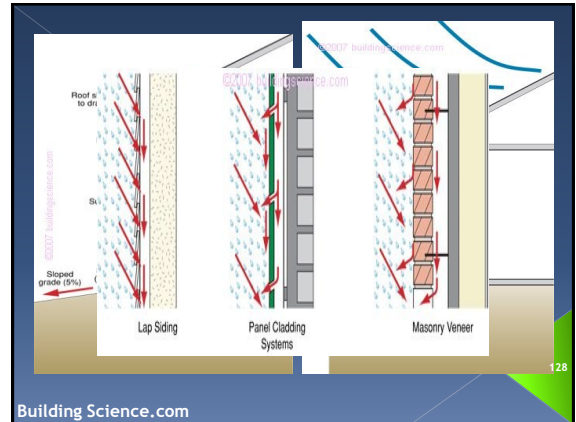
120

Exterior Barrier Components

- Window flashing/sealing method.



127



Building Science.com

128

Exterior Barrier Components

- Sill flashing / Pan flashing.



129

R609

Exterior Barrier Components

- Insulated Concrete Form (ICF) Foundation Wall Deck Attachment.



IRC Section R703

130

Flashing approved for use with ACQ treated lumber.

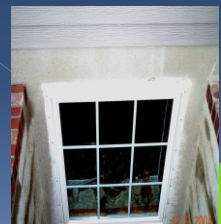


131

R317

Exterior Barrier Components

- Stay-in-Place Form (Insulated Concrete Form (ICF) Foundation Walls



132

IRC Section R703 & R703.4

Roofing

- The following slides will address some of the components that are typically addressed related to roofing weather barrier components, such as underlayment, ice barriers, drip edge, penetrations and flashing.

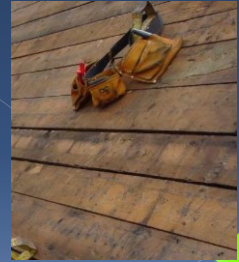


IRC Section R905

133

Roof Boards

- Does this old roof boards meet the provisions in the code today and comply with the manufacturer's installation requirements?

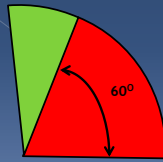


IRC Section R803

134

Design Consideration

- Paper based products allowed for "Walls" within 30° of vertical
- Paper based products are not allowed on "Roofs" with a slope of less than 60° from horizontal



135

Severe Climate Underlayment

- Ice barrier protection at eaves in areas subject to ice buildup.

The Building Official is to make a determination if his or her jurisdiction is in an area subject to ice-build-up.



IRC Section R905

136

Underlayment

- Underlayment to comply with ASTM D 226, Type I or ASTM D4869, Type I or II.



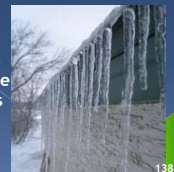
IRC Section R905

137

Drip Edge for Roofing

Although not required in earlier editions of the IRC, a drip-edge is now required at eaves and gables of all shingled roofs.

- Extend at least ¼ inch below sheathing
- Extend up the roof deck at least 2 inches
- Underlayment to be placed over drip edge at eaves and under the drip edge at gables
- Shingles are permitted to be flush with drip edge



IRC Section R905

138

Gutters and Down spouts

- In areas where expansive or collapsible soils are known to exist...



R801.3 Roof drainage

139

Flashing

- Valley flashing and/or type of valley flashing method.

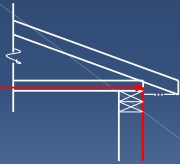


IRC R905.2.8.2

140

703.2 Water-Resistive Barrier

The felt or other approved material shall be continuous to the top of walls and terminated at penetrations and building Appendages...



IRC R703.2

141

Flashing - R703.8 Item 6

- At wall and roof intersections.



142

Kick-out Flashing

- Step flashing and kick-out flashing



IRC Section R905

143

Special Flashing For Solar Systems

- Flashing method for bracket supports and electrical junction



IRC Section R905

144

Application/ Application



145

703.2 Water-Resistive Barrier

Flashing shall be installed in shingle-fashion and must extend to the surface of the exterior wall finish or to the water-resistive barrier.



146

Lath - R703

The lath shall be attached with 1 1/2" long, 11-gage nails having a 7/16" head, or 7/8" long, 16-gage staples, spaced not more than 7" o.c. along framing members or furring and not more than 24" o.c. between framing members or furring, or as otherwise approved.

Additional fastening between wood framing members shall not be prohibited.



147

R703.7.1

Weep Screeds - R703

The weather-resistant barrier shall lap the attachment flange and the exterior lath shall cover and terminate on the attachment flange of the weep screed.



148

R703.7.2.1

Code Language

R317.1 Location required.

Protection of wood and wood-based products from decay shall be provided in the following locations by ... naturally durable wood or PTW... with AWPA U1.

5. Wood siding, sheathing and wall framing on the exterior of a building having a clearance of less than 6" from the ground or less than 2" measured vertically from concrete steps, porch slabs, patio slabs and similar horizontal surfaces exposed to the weather.

R703.7.2.1 Weep screeds.

...The weep screed shall be placed not less than 4" above the earth or 2" above paved areas and shall be of a type that will allow trapped water to drain to the exterior of the building...

149

Base - Application



150

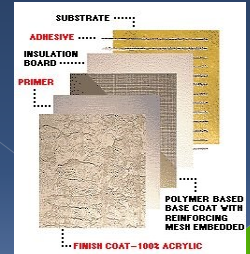




EIFS

Exterior Insulation Finish Systems (EIFS)

- › Synthetic stucco cladding systems typically consisting of five layers:
 - Adhesive
 - Insulation board
 - Base Coat
 - Embedded fiberglass reinforcing mesh
 - Finish coat in the desired color



Flashing

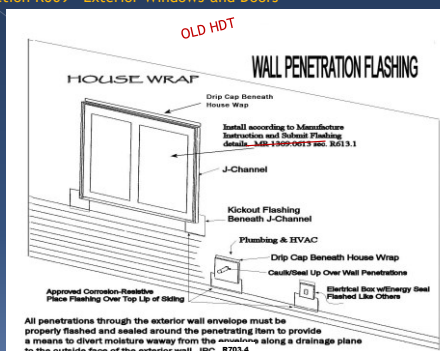
Approved corrosion-resistant material provided in such a manner as to deflect and resist entry of water into the construction assembly.



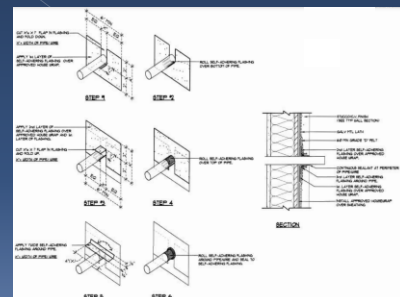
R703.4



Section R609 - Exterior Windows and Doors



Flashing - Examples





The Rules of Building Performance

- Moisture moves from more to less
- Moisture move from warm to cold
- Heat flows from warm to cold
- CFM (air) out equals CFM (air) in
- Drain the rain



Control Liquid Flow through the Building Envelope

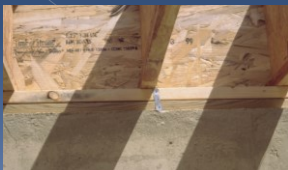
- Flashing systems
- Weather barriers
- Rain screens
- Foundation drainage system
- Capillary breaks or non-porous materials

Air Pressure in Buildings

- Natural forces
 - Stack Effect
 - Temperature difference drives air flow
 - Pressure planes establish directional flows (in/out)

Rim Joist

- Concentrated joints
- Perimeter of the building
- Attachment to concrete
- Near to grade



Rim Joist/Band Joist

Products used

- Sheathing
- Sill plate
- Rim board
- Joist system
- Insulation
- Vapor and air barrier

The Rim Joist



169

The Rim Joist



170

The Sill Plate



171

Rim Joist/Band Joist

- Assembly
 - Rim joist closure
 - Set-back rim joist
 - Floor truss rim closure
 - Floor truss with spray foam

172

Sill Plate/Sill Sill

- Interior Air Barrier.
- Between bottom plate and foundation wall.



173

Table N1102.4.1.1(R402.4.1.1)

Rim Joist/Band Joist



174

Table N1102.4.1.1(R402.4.1.1)



Rim Joist/Band Joist

- The use of gaskets, sealants and caulks can easily provide a tight rim section

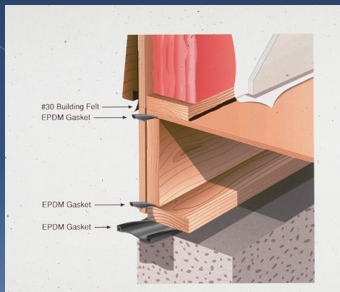


Table N1102.4.1.1(R402.4.1.1)

Rim Joist/Band Joist

- Air barrier and vapor retarder

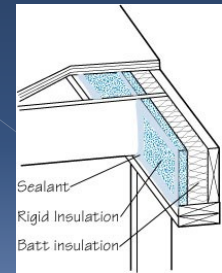
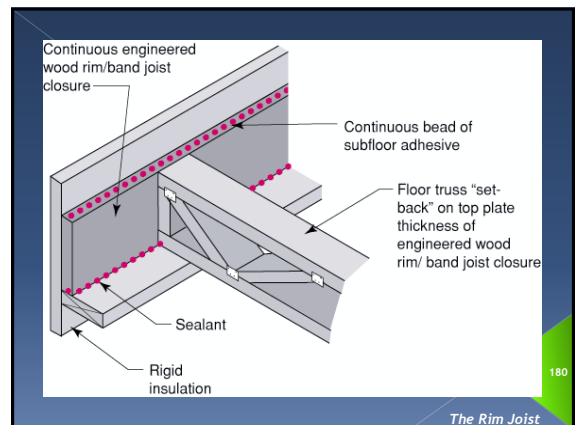


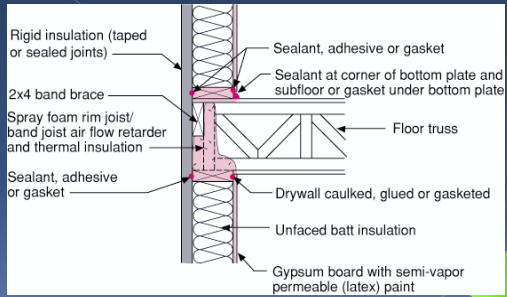
Table N1102.4.1.1(R402.4.1.1)

The Rim Joist



The Rim Joist

Rim Joist/Band Joist



R316.5.11 Sill plates and headers.

181



R316.5.11 Sill plates and headers.

Table N1102.4.1.1(R402.4.1.1), Table N 1102.1.2

182



R316.5.11 Sill plates and headers.

183



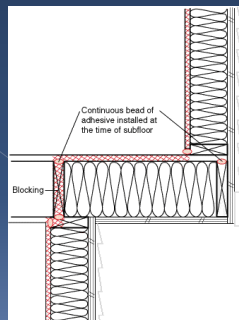
R302.10.2 Loose-fill insulation.

The Rim Joist

184

Rim Joist/Band Joist

- Interior air and vapor barrier

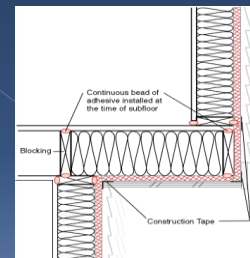


185

Table N1102.4.1.1(R402.4.1.1), Table N 1102.1.2

Rim Joist/Band Joist

- Exterior wind wash barrier



186

Sealed

2018 International Residential Code (IRC) Part IV—Energy Conservation CHAPTER 11 [RE] —SECTION N1102 (R402) BUILDING THERMAL ENVELOPE 1... 0
 inches (153 mm) and be sealed in lap. The edges of
 the air barrier shall be sealed. Air permeable insulation shall not
 2018 International Residential Code (IRC) Part IV—Energy Conservation CHAPTER 11 [RE] | SECTION N1102 (R402) BUILDING THERMAL ENVELOPE 1... 0
 gaps in the air barrier shall be sealed. The insulation in any dropped...
 and all joints shall be sealed.
 of exterior walls shall be sealed.
 Knee walls shall be sealed. Joints within corners and headers
 windows and doors, shall be sealed. Rim joists rim joists shall
 or unconditioned space shall be sealed. Narrow cavities — Batts to be
 building thermal envelope shall be sealed to the finished surface. (Recessed...
 and communication boxes. Alternatively, air seals shall be installed. — HVAC...
 building thermal envelope shall be sealed to the surface, wall covering,
 sprinklers. Where required to be sealed, concealed fire sprinklers shall only be sealed in a manner that is
 2018 International Residential Code (IRC) Part IV—Energy Conservation CHAPTER 11 [RE] | SECTION N1102 (R402) BUILDING THERMAL ENVELOPE 1... 0
 shall be sealed, but not sealed beyond the finished wall/ceiling/floor.
 2018 International Residential Code (IRC) Part IV—Energy Conservation CHAPTER 11 [RE] | SECTION N1102 (R402) BUILDING THERMAL ENVELOPE 1... 0
 shall be closed, but not sealed beyond the finished wall/ceiling/floor.
 2018 International Residential Code (IRC) Part IV—Energy Conservation CHAPTER 11 [RE] | SECTION N1102 (R402) BUILDING THERMAL ENVELOPE 1... 0
 continuous ventilation systems shall be sealed.
 2018 International Residential Code (IRC) Part IV—Energy Conservation CHAPTER 11 [RE] | SECTION N1102 (R402) BUILDING THERMAL ENVELOPE 1... 0
 envelope. Such rooms shall be sealed and insulated in accordance with...
 building thermal envelope shall be sealed to limit air leakage between...
 (a). Recessed luminaires shall be sealed with a gasket or caulked.
 2018 International Residential Code (IRC) Part IV—Energy Conservation CHAPTER 11 [RE] | SECTION N1103 (R403) SYSTEMS N1103.3 (R403.3) Duct... 0
 and filter boxes shall be sealed. Joints and seams shall comply...
 2018 International Residential Code (IRC) Part IV—Energy Conservation CHAPTER 11 [RE] | SECTION N1103 (R403) SYSTEMS N1103.3 (R403.3) Duct... 0
 N1103.3.2 (R403.3.2) [RE] — Header
 2018 International Residential Code (IRC) Part IV—Energy Conservation CHAPTER 11 [RE] | SECTION N1103 (R403) SYSTEMS N1103.3 (R403.3) Duct... 0
 shall be sealed or otherwise sealed during the test.
 2018 International Residential Code (IRC) Part IV—Energy Conservation CHAPTER 11 [RE] | SECTION N1103 (R403) SYSTEMS N1103.3 (R403.3) Duct... 0
 shall be sealed or otherwise sealed during the test.

Foundation

- Keep the groundwater out
- Keep the soil gas out
- Keep the water vapor out
- Keep the heat in during the winter



Adequate drainage is a key aspect of good water management



R405.1 Concrete or masonry foundations.

Exterior Covering

Weather-resistant barrier.

"The exterior wall envelope shall be designed and constructed in a manner that prevents the accumulation of water within the wall assembly by providing a water-resistant barrier behind the exterior veneer... and a means of draining water that enter the assembly to the exterior."



IRC section R703.1

Exterior Covering

A minimum of one layer of No. 15 asphalt felt...or other weather-resistant material shall be applied over sheathing of all exterior walls...



R703.2 Water-resistant barrier

Exterior Covering

Weather-resistant barrier.

"... or other approved weather-resistant material shall be applied over sheathing of all exterior walls..."



Exterior Covering



DuPont Tyvek DrainWrap vs. GreenGuard RainDrop

TECH TALK

www.green-guard.com

LISTEE:
Owens Corning
One Owens Corning Parkway
Toledo, Ohio 43660

GreenGuard® Classic Wrap Housewrap is also sold by Owens Corning as PINKWRAP® Housewrap and Lowe's Home Improvement Warehouse as Lowe's Housewrap. GreenGuard® Classic Wrap Housewrap is green in color. PINKWRAP® Housewrap is pink in color, and Lowe's Housewrap is white in color.

193

Big Picture



194

Exterior Covering

Weather-resistant barrier.

"Flashing at exterior window and door openings shall extend to the surface the exterior wall finish or to the water-resistant barrier for subsequent drainage."



195

Exterior Covering

Vinyl siding must be installed per the manufacturers installation instructions.



196

Permit Required????



197

Fasteners Shall Penetrate Framing



198





205

Ancora imparo (I'm still learning)

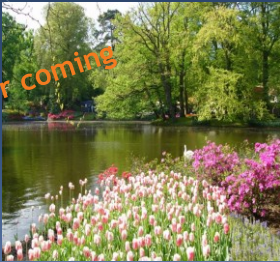
Michelangelo, 1562 ,age 87



206

Questions???

Thanks for coming



207

Short Cut

Learn from the mistakes of others.
You can never live long enough
to make them all yourself.

208

- Verify all code requirements.
 - Call one another with your questions.
 - ...And remember: "Life is good."
- (Brent Snyder 2006)



209