

WHY DID THE WATERPROOFING FAIL?

And How to Make Sure It Doesn't Happen to You



1

Why Did the Waterproofing Fail?



2

AIA CES Disclaimer



- Noble Company is a registered provider with The American Institute of Architects Continuing Education System.
- Credit Earned on the completion of this program will be reported to CES Records for AIA Members. Certificates of Completion for non-AIA members are available upon request.
- This program is registered with the AIA/CES for continuing professional education.
- As such, it does not include content that may be deemed or construed to be an approval or endorsement by the AIA of any material of construction or any method or manner of handling, using, distributing, or dealing in any material or product.
- Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.

3

IDCEC Approved Session



- This CEU is registered with the International Design Continuing Education Council (IDCEC) for continuing education credits. This credit will be accepted by most interior design Associations and State Boards.
- The content included is not deemed or construed to be an approval or endorsement by IDCEC of any material or construction or any method or manner of handling, using, distributing or dealing in any material or product.
- Questions related to specific materials, methods and services should be directed to the instructor or provider of this CEU.
- This program is registered for 1 CEU value.
- Your attendance will be reported to IDCEC by your instructor after this CEU. Please do not share the class-code with anyone who has not attended this CEU.
- Certificates of completion will be issued electronically through your IDCEC account once attendance has been reported for you. Please allow 5 business days for attendance reporting.
- Attendees who do not have a unique IDCEC number will be provided with a paper Certificate of Completion after this CEU.

4

Copyright Materials

This presentation is protected by US and International Copyright laws. Reproduction, distribution, display, and use of the presentation without written permission of the speaker is prohibited.

© Noble Company

5

Session Description

This course evaluates the reasons that lead to failures of waterproofing installations. It examines product attributes that lead to successful installations and identifies the ways to identify necessary characteristics. Also compares installation methods and identifies ways to specify successful installations.

6

Learning Objectives

At the end of this session, participants will be able to:

1. Review common waterproofing products, installation methods, and building code compliance.
2. Understand the relationship of movement in the surface and substrate to waterproofing.
3. Understand reasons for failures in waterproofing installations under tile and the relationship of failed waterproofing to durability and sustainable design.
4. Understand permeation and its impact on creating suitable water and vapor barriers for tile installations and the relationship of permeation to indoor air quality.

7

Learning Objectives

- Understand ANSI A118.12 & WP Choices
- Using all the "Pieces" of the WP "System"
- Explore Solutions for Future WP Success



8

Presentation Outline

- Presentation Objective:
 - Identify the Elements of Failure
- Review Common Methods of W/P
 - Characteristics and Impacts
- Understand the Importance of Permeation
 - There are Significant Variations
- Crack Isolation and Waterproofing?
 - What is the Connection?
- Exploring the Waterproof Installation
 - You Need all the "pieces"

9

Elements of Failure

- Substrate Issues
- Installer Error
- Unclear Specifications/Details
- Unrealistic Project Demands

10

Elements of Failure

- Lack of Substrate Preparation



11

Elements of Failure

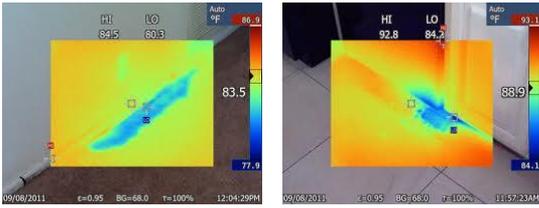
- Installer Error



12

Elements of Failure

- Thermal Images of Shower Pan Leaks at Base



13

Elements of Failure

- Many Failures Occur at Pan/Wall Upturn



14

Elements of Failure

Unclear Specifications/Details

- A. Waterproof/Crack Isolation Membrane:
 1. Type & Manufacture: "Brand X".....does not require the use of fabric; anti-fracture protection of up to 1/2" over shrinkage and non-structural cracks and exceeding ANSI A 118.10 and ANSI 118.12

15

Common Waterproofing Methods

- Fluid Applied
- Trowel Applied
- Sheet Membranes
- "Trays, Pre-Fabricated Pans"

16

Common Waterproofing Methods

- Fluid Applied Product Challenges
- Ensuring uniform coverage
- Ensuring reinforcing fabric is used
- Allowing time for proper curing and additional second/third coat applications
- Movement and Permeation Concerns

17

Common Waterproofing Methods

- Typical Fluid Application Methods



18

Common Waterproofing Methods

- Fluid Applied Product Solutions
- Mandate the Use of a Mil Gauge
- Mandate reinforcing fabric be used
- Plan time for proper curing and additional second/third coat applications
- Match Product Performance to Project Demand

19

Common Waterproofing Methods

- Fluid Applied Seaming & Coverage Issues



20

Common Waterproofing Methods

- Fluid Applied

The use of this simple tool would greatly reduce installer-related error for these type of products



21

Painting Liquid Rubber



Painting Liquid Rubber.MPG

22

Improper Installation

- \$7 Million Dollar Waterproofing Failure... official cause, improper installation.



Project leaked from day one... required removal and replacement of 55K sq. ft. of natural stone

23

Improper Installation

- "Because the membrane wasn't thick enough, it developed lots of little leaks"



"The waterproof membrane turned out to be not the correct thickness... it was an installation issue"

24

Are You Using the Right Waterproof Membrane for Your Project?



25

Common Waterproofing Methods

- Trowel Applied Product Challenges
- Ensuring uniform coverage
- Ensuring reinforcing fabric is used
- Allowing time for proper curing and additional second/third coat applications
- Permeation and Movement Concerns

26

Improper Installation

- WP Membrane was not "Smooth Troweled"



Leaving "too much" WP product on the substrate does not ensure success

27

Common Waterproofing Methods

- Sheet Membrane Product Challenges
- Ensuring uniform bond of sheet to substrate
- Ensuring seams/corners are watertight/correctly sealed
- Allowing time for proper curing of sheet bond coat

28

Improper Installation

- Poor seaming will result in a failure



Properly embedding the seams and using a watertight sealant will eliminate this problem

29

Common Waterproofing Methods

- Sheet Membrane Product Solutions
- Mandate proper adhesive application/bond
- Mandate proper seam/corner sealant methods
- Allow time for curing of sheet bond coat

30

Exterior Applications often Demand Sheet Membranes for Primary WP



31

Common Waterproofing Methods

- “Trays/Pre-Formed Pans” Challenges
- Job-Site Variables vs. Pre-Formed Pan
- Compression Concerns and Tile Size
- Seam/Joint/Penetration Concerns

32

“Trays and Pre-formed Pans”

- Some Pans are Waterproof...others need WP



33

“Trays and Pre-formed Pans”

- There are pre-fab trays that have the membrane pre-installed and can be adjusted in the field



34

Common Waterproofing Methods

- “Trays/Pre-Formed Pans” Solutions
- Be Aware of the Manufacture Variables
- Vett Products for Compression & Tile Size
- Employ a High Level of Q/A-Q/C to seams/joints/penetrations Details

35

Unacceptable Permeation

- What is Permeation
- Different WP Products=Varying Perm
- Project Demands Determine Performance
- Match the Product to the Project

36

Unacceptable Permeation

- The end result of excessive vapor migration into the stud wall cavity of shower Walls



37

Unacceptable Permeation

- The end result of excessive vapor migration into the stud wall cavity of shower



A "low perm" wall membrane would have prevented this from happening

38

Unacceptable Permeation

- Shower walls need low-perm WP membrane



A variety of products are available

39

Moisture Vapor Transmission

Classification / permeation*	Highest perm in classification	Oz of water / hr / sq. ft	Amount of water / week / 100 sq. ft	Amount of water / week / 1000 sq. ft
1 0.1 perm or less	.1 perm =	0.00022 8571	3.84 oz	38.4 oz
2 0.1 ≤ 1.0 perm	1.0 perm =	0.00228 5714	38.4 oz	384 oz (3 gallons)
3 1.0 ≤ 10.0	10 perm =	0.02285 7143	384 oz (3 gallons)	3840 oz (30 gallons)

ASTM E96 CPE rating: .15
PVC rating: .40

40

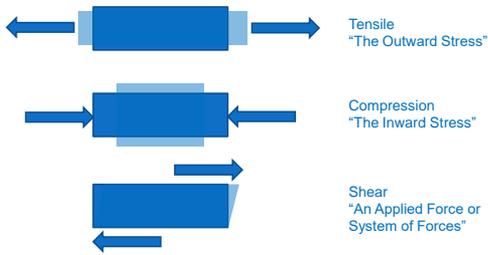
Unacceptable Rates of Movement

- What Are the Movement Forces
- How Do they Impact Waterproofing
- How Do You Prevent Failure



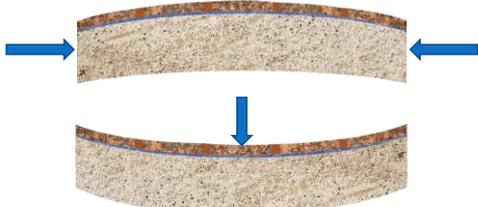
41

Movement Forces



Movement Forces

- Post Tension Pre-Stressed Concrete



Designed for Vertical, Horizontal & Lateral Movements

43

Unacceptable Rates of Movement

- ANSI A118.12
- Products Will Vary with Regard 118.12
- "Standard Performance" vs "High Perf"
- Match the Product to the Project Demands

44

Isolate Opposing Forces

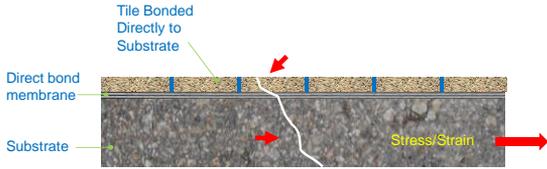
- (Indirect Bond)



45

Unacceptable Rates of Movement

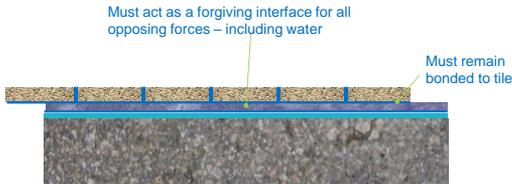
- (Direct Bond Waterproofing)



46

Isolate Opposing Forces

- (Indirect Bond)



47

Isolate Opposing Forces

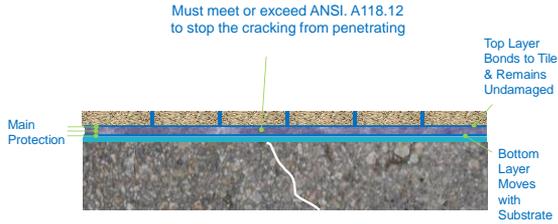
- (Indirect Bond)



48

Isolate Opposing Forces

- (Indirect Bond/Composite Sheet Membrane)



49

Standard Performance vs. High Performance

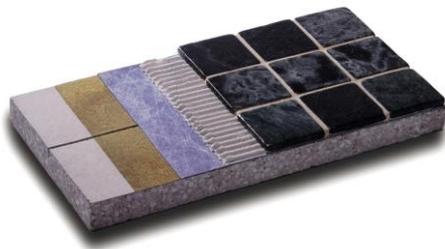
5.4.9 Continue testing at one hour intervals by opening the gap an additional 0.016 in. (theoretical) until one of the following occurs: (A) the specimen gap is 0.062 in. (for standard performance) or 0.125 in. (for high performance) or (B) tile cracks or de-bonds. Report the maximum specimen gap opening before tile failure occurs for each of the three test specimens.

Requirement: Standard performance: Tile failure occurs after 1/16 in. specimen gap opening, but before 1/8 in. gap opening. High Performance: Tile failure does not occur by 1/8 in. specimen gap opening.

END OF ANSI A118.12

50

Does Your Waterproofing Meet ANSI A118.12 for High Performance?



51

Integrating the Components



It's more than just the membrane.

It's the drain, the curb, the niches, and the benches

52

Integrating the Components

- "Membrane Friendly" Linear Drains, and Low-Profile



53

Integrating the Components

Linear Drains now integrate with waterproof membranes



54

Integrating the Components

Waterproof pre-formed products are part of a successful waterproofing



55

Integrating the Components

Waterproof pre-formed products are part of a successful waterproofing



56

Integrating the Components

Waterproof pre-formed curbs eliminate failures like this!!



57

Integrating the Components

Waterproof pre-formed curbs eliminate failures like this!!



58

Integrating the Components

Waterproof foam benches are the solution



59

Improper Installation

- Many failures have several installation short-comings

Incorporation of a Drain/Slope to Drain

To fully evacuate water, shower pan membranes and bonded waterproof membranes must slope to and connect with a drain. Plumbing code typically requires membranes to be sloped a minimum of 1/4" per foot and extend at least 3" above the height of the curb or threshold. Account for the perimeter floor height required to form adequate slopes. Membranes must be installed over other horizontal surfaces in wet areas subject to deterioration, like shower seats. They must be sloped and configured so as to direct water to the membrane connected to the drain.

When water cannot migrate to the drain, it flows to areas where other installation errors can lead to a failure

60

Improper Installation

- Many failures have several installation short-comings



When water cannot migrate to the drain, it flows to areas where other installation errors can lead to a failure

61

Improper Installation

- Many failures have several installation short-comings



When water migrates to the back wall, and the detail does not have fabric reinforcement and/or minimal mil coverage.... failure is likely

62

Improper Installation

- Failure of membrane detail at drain attachment resulted in a waterproofing failure



Using a mil gauge and/or a drain flashing would correct this problem

63

Improper Installation

- Failure to install WP membrane correctly around the drain resulted in a failure



Incorrect "Slope to Drain" and plugged weep holes can both cause this condition

64

Improper Installation - Solution

- A variety of manufacturers provide drain flashings to ensure watertight drain details



These can be used in both sheet membrane and fluid applied systems

65

Improper Installation - Solution

- Even the best waterproofing installation can unravel if you don't use all the "parts & pieces"

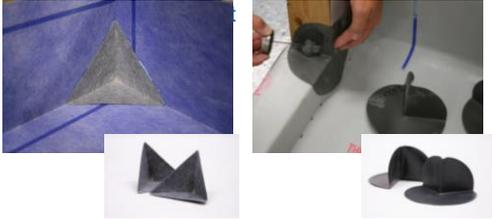


Inattention to curb corner details was the undoing of this shower

66

Improper Installation - Solution

- Pre-fabricated inside and outside corners ensure the



67

Waterproofing

- Insist that a flood test be done!



68

Waterproofing

- Insist that a flood test be done!



69

Waterproofing

- Water is just drained....and the abuse starts



70

Waterproofing

- Waterproofing is not a wearing surface



71

Typical Shower Pan View



- Where waterproofing meets tile or stone... these are the wettest places on earth
- Successful installations rely on a "systems" approach
- Durable components and Q/A-Q/C installations ensure waterproofing success

72

Summary

• Conclusions

- Improper Installation is a Common Theme
- Permeation Rates play a Part
- ANSI A118.12 Performance is a Factor
- Successful Waterproofing is more than the Membrane, it is all the Components As Well

73

Summary

• Solutions

- Quality Assurance and Quality Control Have to be Built into the Installation Sequence
- Q/A-Q/C can be performed by the sub, GC or an independent "third party"
- Q/A-Q/C must have "veto power"

74

Why leave it to just anyone?

"Because tile is a permanent finish, the lowest bid should not be the driving factor, but rather who is the most qualified to perform the scope of the work specified."

- TCNA Handbook



The Tile Council of North America urges design professionals to include language in specifications to secure qualified contractors and installers. The following nonprofit programs are well-established and recognized by the Handbook Committee:

- Advanced Certifications for Tile Installers (ACT)
- Ceramic Tile Education Foundation (CTEF) Certified Tile Installer Program
- International Masonry Institute (IMI) Contractor College
- Journeyman Tile Layer Apprenticeship Programs
- Natural Stone Institute (NSI) Accreditation for Natural Stone Tile Installation
- National Tile Contractors Association (NTCA) Five Star Contractor Program
- Tile Contractors Association of America (TCAA) Trowel of Excellence Program



75



Advanced Certifications for Tile Installers
tilecertifications.com



Ceramic Tile Education Foundation
ceramictilefoundation.org
info@ceramictilefoundation.org



National Tile Contractors Association / Five Star
Contractor Group
tile-assn.com
NTCAqualifiedlabor@tile-assn.com



Tile Contractors' Association of America
tcaainc.org
info@tcaainc.org



Tile Council of North America, Inc.
TCNAtile.com/find-qualified
info@tcnatile.com

79

ANY QUESTIONS?

This concludes our program.
Please feel free to contact me for additional information.

Dean Moilanen
Director of Architectural Services – Noble Company,
AIA Las Vegas Allied Member, CSI, CTEF, IIBEC, NTCA Ambassador

702-604-5366
dean@noblecompany.com

THANK YOU!



80
