## Managing Condensation, Water Intrusion & Energy Efficiency in the **Real World**

Paul Grahovac, LEED AP **R-GUARD Air and Water Barrier Technical Director.** International Code Council, Air Barrier Association of America Technical, Flashing, and Whole-Building Testing Committees, **National Concrete Masonry Association's Air Barrier Task** Force, ASTM Committees on building performance / vapor permeability / window installation, RCI Industry Advisory **Council, the following National Institute of Building Sciences Councils: Building Enclosure Technology and Environmental Council (BETEC Building Enclosure Integration Committee) and** the Council on Finance, Insurance and Real Estate, Passive House Alliance, and Passive House Institute Builders Training.

Presented by PROSOCO Inc.



Phone: 800-255-4255 Fax: 800-877-2700 **PROSOCO** is a Registered Provider with the American Institute of Architects Continuing Education Systems. Credit earned upon completion of this program will be reported to CES Records for AIA members. Certificates of Completion for non-AIA members are available on 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 brands, methods and services will be addressed at the conclusion of this presentation.

PROSOCO is a Registered Provider with RCI. Credit earned upon completion of this program will be reported to RCI for registered RCI members. Certificates of Completion for non-RCI members are available on request.

This program is registered with the RCI 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 RCI of any material of construction or any method or manner of handling, using, distributing or dealing in any material or product. Questions related to branded materials, methods and services will be addressed at the conclusion of this presentation.



1. Explain why job-site conditions and building performance should be used as systems engineering requirements in construction product development.

2. Describe advanced sealant / coatings technology -- STPE.

3. Describe the multi-step weatherproofing process of conventional window installation and how such installations fare in real-world testing conditions.

4. Explain new window weatherproofing techniques using liquid flashing membranes.

- 5. Explain building remediation using STPE technology.
- 6. Discuss test chambers for design verification testing.

#### Learning Objectives



**U.S EPA's BASE study** of 100 randomly selected U.S. office buildings found that 43% of the buildings had current water leaks, and 85% experienced previous water leaks.



## High-end custom homes

## Extreme energy efficiency

#### Passive House Institute US



 Find a Certified Passive House Consultant (CPHC) in Your Area New! Find a PHIUS Certified Builder!

- CPHC Training-Become a Certified Passive House Consultant!
- New! Design/Build business workshops led by Adam Cohen (Philly and Golden)





PHIUS Training Programs

PHIUS+ Project Certification



About PHIUS



 Builders Training-- Feb 12-15, Philadelphia FULL-waiting list only; April 3-6, Golden, Co. still open

PHIUS+ Rater Training-- Feb 25-25, Orlando



News and Events



Projects



Passive House Institute US

**Bulletin Board** 

Articles

FAQ

Links

Contact Us

**Passive House** Alliance US

# **US Army Corps** of Engineers

200-year home



























ALL IN

# 21.25 cuft test chamber



# Air Changes per Hour @ 50 Pascals = 20mph wind

Energy Star IECC Passive House Sheetwrap/Peel&Stick Fluid applied 4.0 ACH (Zone 6)
3.0 ACH
0.6 ACH
7.01 ACH
0.17 ACH



#### From D+D, October 2010

By Gary Henry

Mini-B is a tiny little thing.

The name stands for "Mini-Bungalow." It's a prototype, 300 square-foot "Detached Accessory Dwelling Unit." In the Seattle area, you can plunk it down in your back yard for a guest house, or for grown-up kids who need to stay with Mom and Pop for a while.

Though small, it has a kitchenette, three-quarters bath (shower but no tub), living/dining room, bed loft, closet, equipment loft with storage, solar hot water collector, and vaulted ceiling.



SSPC Pocket Guide To Coating Information

Informatio

A handy reference to charts, standards and calculations used during surface preparation & coating application. This book is a great addition to your tool kit.

#### Recent Conversation

J Ahern on Blister Fix: Finding a Cause and Solution to a Common Defect No mention of adhesion testing

#### "Mini-B meets passive house standards of .60 air changes per hour"

### **Karuna Passive House**

#### 0.42 ACH BEFORE air sealing completed

Hammer &



#### First commercial Passive House retrofit – restaurant & apartment – Hammer & Hand



## Malcolm Rosenberg Hillel Center Virginia Tech – Passive House

## Emory & Henry College, Emory, VA Nation's Largest Passive House Project



The Passive House dorm Hickory Hall will use 74% less energy than a code-built building, and, at just \$118.75/SF, cost less to build than its conventionally-built twin dorm, Elm Hall.

#### **Passive House**

- Super energy-efficient for minimum utility bills
- Water-tight
- Draft-free, uniform temperature
- Very quiet
- Allergen-proofed
- Government financial incentives
- Environmental leadership
- Increased market value
- Most Durable, Highest-Quality Construction

Architecture Week

Only Passive House buildings are required to perform today at the energy efficiency levels that we can expect for all buildings sometime around 2050 — in less than 40 years.

Putting it another way, nearly every new building that is built today to less than Passive House standards can readily be predicted to become obsolete, in terms of energy performance, in less than 40 years.

http://www.architectureweek.com/2012/0111/index.html

## Department of Energy partnership:

"On Monday, August 20, the U.S. Department of Energy (DOE) announced a new partnership between the DOE Challenge Home program and the Passive House Institute US to cooperate on the promotion of various levels of high-performance buildings on the path to zero net-energy.

This news is a huge development for the passive house community and for PHIUS. The endorsement of PHIUS+ passive house certification through the DOE instantly makes Passive House the most energy efficient option for builders, designers and developers who want to achieve a zero energy building.

# This recognition will go a long way toward making passive house mainstream."

http://passivehouse.us/blog/?p=430

David Boyer, President of PROSOCO, Inc., holds a degree in Architecture and served as the company's Technical Director for 18 years.

He sees Passive House as "thought leaders" of the construction industry.

"They design in the air barrier from the outset -- instead of trying to make a design airtight."


























Net Zero Energy

The Bullitt Center

"Greenest Commercial Building in the World"

Living Building Challenge





# Managing Condensation, Water Intrusion & Energy Efficiency in the Real World



# Managing Condensation, Water Intrusion & Energy Efficiency in the Real World

# Silyl Terminated Poly Ether STPE

#### Liquid detailing membrane

#### Managing Condensation, Water Intrusion & Energy Efficiency in the Real World



# Managing Condensation, Water Intrusion & Energy Efficiency in the Real World



Property	STPE	Urethane	Silicone
Environmental friendliness	10	5	9
Non-bubbling	10	6	10
Low temperature gunnability	10	8	10
Slump resistance	10	10	10
Quick cure	10	7	10
Storage stability	10	7	9
Body (tooling)	8	10	8
Weather resistance	8	6	10
Adhesion to various substrates	10	5	8
Mechanical properties	10	10	10
Heat resistance, mechanical stability	9	8	10
Non-dirt pickup	10	10	5
Stain resistance	8	8	5
Paintability with water-based paint	10	10	3
Scale: 10 – excellent; 1 – very poor	133	110	117

#### **Adhesives & Sealants Council**

"In addition to their high performance properties, these sealants are achieving popularity due to their formulation versatility that allows the customization of viscosity and early strength development for various applications."

#### Liquid detailing membrane

- Silyl terminated poly ether STPE sealant chemistry.
- Combines the advantages of silicone and urethane.

#### Managing Condensation, Water Intrusion & Energy Efficiency in the Real World

- Silyl terminated poly ether STPE
- Combines the advantages of silicone and urethane.
- The leading construction sealant and adhesive in Japan for over 30 years in -- gaining popularity across Asia, and in Europe and North and South America.

### Managing Condensation, Water Intrusion & Energy Efficiency in the Real World

- Silyl terminated poly ether STPE
- Combines the advantages of silicone and urethane.
- The leading construction sealant and adhesive in Japan for over 30 years in -- gaining popularity across Asia, and in Europe and North and South America.
- Contractor in-house spreadable version in use since 2005.

## Managing Condensation, Water Intrusion & Energy Efficiency in the Real World

The second

# Managing Condensation, Water Intrusion & Energy Efficiency in the Real World 53

### Building paper

Self-Adhered Flashing

Liquid detailing membrane

#### **Corroded Fasteners**

# Decayed Sheathing & Structural Members

55

Liquid detailing membrane



Age: 3 years

#### **Project Owner**

Seattle Heights Homeowner's Association

#### **Project Architect:** Simpson Gumpertz & Heger Inc.

56

Project Size: \$9,500,000 Exterior \$2,500,000 Interior

#### Liquid detailing membrane



# Managing Condensation, Water Intrusion & Energy Efficiency in the Real World



# Managing Condensation, Water Intrusion & Energy Efficiency in the Real World

# Lawrence Chamber LDVTC - Fixed Chamber - Lawrence, KS

7' x 7' test wall

59



#### Liquid detailing membrane



# Managing Condensation, Water Intrusion & Energy Efficiency in the Real World

#### Tests Performed in the Transportable Verification Chamber

- •ASTM E-2357 Style WRB and Building Detail Test.
- ASTM E-283 Air Leakage.
- •ASTM E-783 Air Leakage.
- •ASTM E-330 Structural.
- AC212 Style Racking Test.
- •AC212 Style WRB Test.
- •ASTM E-1677 Air Retarder.
- •ASTM E2178 Air Permanence.

#### Liquid detailing membrane

# Managing Condensation, Water Intrusion & Energy Efficiency in the Real World

# **Laser Pointer**

TP.

2ERO

THE

00000

EM150

0 mph wind speed

62

Liquid detailing membrane

00000



## Managing Condensation, Water Intrusion & Energy Efficiency in the Real World

# **ASTM E 2178** 1.57 lbs/sqft = 75 Pascals = 25mph

# **ASTM E 2357** 1.57 lbs/sqft = 75 Pascals = 25mph

Liquid detailing membrane

#### Managing Condensation, Water Intrusion & Energy Efficiency in the Real World

- Products on the market found lacking when tested to roughweather levels of simulated winddriven rain
- Developed STPE products in response

### Managing Condensation, Water Intrusion & Energy Efficiency in the Real World

**ASTM E 2178** 1.57 lbs/sqft = **75** Pascals = **25**mph

**ASTM E 2357** 1.57 lbs/sqft = **75** Pascals = **25**mph

# 2,880 Pascals 155mph wind-driven rain Category 5 Hurricane

Liquid detailing membrane

Managing Condensation, Water Intrusion & Energy Efficiency in the Real World

# Air Changes per Hour @ 50 Pascals = 20mph wind

**Energy Star 4.0** ACH (Zone 6) **IECC** 3.0 ACH **Passive House** 0.6 ACH 7.01 ACH Sheetwrap/Peel&Stick Fluid applied 0.17 ACH Liquid Applied at 2,880 Pascals = 155mph wind Category V hurricane 0.53 ACH

Product Wish List

✓ Fluid applied Bonds to wet surfaces ✓ Adheres without a primer ✓ 100% solids to avoid shrinkage ✓VOC Compliant – minimal odor Immediately waterproof – withstands rain Opaque when target thickness is achieved Can be exposed for up to 6 months ✓ Paintable / compatible ✓Vapor permeable ✓ Reduces steps/saves time Easily repaired Self seals around fasteners

68

Liquid detailing membrane

#### Edge Water Miramar Beach, Florida



#### Pinnacle Point Panama City Beach, Florida



#### Carillon Point Panama City Beach, Florida



Red Fish Village Grayton Beach, Florida


#### Smiling Fish Santa Rosa Beach, Florida



#### Perdido Key Alabama



74

#### Perdido Key Alabama



75

#### Two City Plaza Baton Rouge,LA



76

#### Two City Plaza Baton Rouge,LA



77

#### One Water Place Destin, Florida



78

#### Grand Dunes Miramar Beach, Florida

#### Lake Chelan Resort Eastern Washington



80









### **Common specification**

"For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in **ASTM E 2112.**"

#### Managing Condensation, Water Intrusion & Energy Efficiency in the Real World

82



Designation: E2112 07

Standard Practice for Installation of Exterior Windows, Doors and Skylights<sup>1</sup>

# *"Instructions for complete integration of external wall components."*

#### Managing Condensation, Water Intrusion & Energy Efficiency in the Real World

83























91







92







93







94



Building paper installation first layer fourth row.



#### Managing Condensation, Water Intrusion & Energy Efficiency in the Real World

95







97







98





99





Building paper installation second layer fourth row











Lift second layer fifth row at window to prepare for peel-n-stick.









#### ASTM E-2112 Window Flashing & Installation

## Tested per AAMA 502-90 @55 mph wind – driven rain

Window masked out to eliminate leakage through window assembly

Time

0:00

Pressure 1.44 In. W/C 7.55 psf

Wind Speed 54.5 mph



**START** air + water

Time

0:37

Pressure 1.44 In. W/C 7.55 psf

Wind Speed 54.5 mph



Failure at window/ through- wall interface

Time

0:57

Pressure 1.44 In. W/C 7.55 psf

Wind Speed 54.5 mph


Failure at window/ through- wall interface

Time

2:17

Pressure 1.44 In. W/C 7.55 psf

Wind Speed 54.5 mph



Failure at window/ through- wall interface

Time

3:02

Pressure 1.44 In. W/C 7.55 psf

Wind Speed 54.5 mph



Failure at window/ through- wall interface

Time

5:07

Pressure 1.44 In. W/C 7.55 psf

Wind Speed 54.5 mph







#### Raising the Bar



#### Raising the Bar



#### Raising the Bar



#### Raising the Bar



Raising the Bar





Raising the Bar



















Building paper installation second layer fifth row

#### Raising the Bar