SIMPLE, FAST, COST EFFECTIVE METHODS OF FOAM BOARD JOINT SEALING FOR AIR BARRIER ASSEMBLIES IN COMMERCIAL CONSTRUCTION

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Air Barriers
Test Design
Flashing Tape Joint Seal
Foam Sealant Joint Seal
Test Results
Installation Practicality
Conclusions
The Situation

Effects of air infiltration on energy consumption:

- School buildings: 29%
- Houses: 40%
- Tall buildings (commercial): 22-46%
- High-rise residential: 40%

*National Research Council of Canada report*
DESIGN HISTORY & BACKGROUND
Energy Loss = Money Loss
DESIGN HISTORY & BACKGROUND

Slow Energy Loss
DESIGN HISTORY & BACKGROUND

Air Infiltration
Air Barrier
DESIGN HISTORY & BACKGROUND

Air Barrier
Two Steps:
- Time Consuming
- Expensive
SIMPLIFIED DESIGN: CAVITY WALLS

Joint Sealant

XPS Insulation
SIMPLIFIED DESIGN: CAVITY WALLS

Joint Sealant

- Not New Concept
Simplified Design: Cavity Walls

Joint Sealant

- Not New Concept

Expensive!
Foam Sealant

- Fast
- Easy
- Inexpensive
Validation Plan

- Small scale
  - Board-to-board
  - Board-to-block

- Full Scale
  - Assembly

- Real scale
  - Field Installation
Small Scale: Laboratory Adhesion Data

Board-to-Board

Board failed before foam sealant (Cohesive Failure)
Small Scale: Laboratory Adhesion Data

Board-to-Block

Board failed before foam sealant (cohesive failure)
Full Scale: Assembly Testing

Test Method: ASTM E2357:
“Standard Test Method for Determining air Leakage of Air Barrier Assemblies”

Air barrier assembly test comprised of the following:

- Air leakage baseline
- Wind pressure conditioning
  - Sustained at 600 Pa 1 hour (+/- pressure)
  - Cyclic, 2000 cycles (+/- pressure) with deformation
  - Gust wind of 1200 Pa (+/-) with deformation
- Air leakage post-conditioning
- Structural wind load of 1440 Pa (+/- pressure) with deflection
Wall Design
Wall Design: Insulation

Thin

Thick
Wall Design: Insulation

Thin

Thick
Wall Design: Substrate
Wall Design: Substrate
Wall Design: Joints and Fasteners
Wall Construction

- Steel stud (18 gauge)
- Gypsum exterior sheathing (1/2”)
- Extruded polystyrene insulation in 16” width
  - 16” oc horizontal
  - 8” oc vertical
- Butt edge
- Pos-I-Tie self-tapping brick ties (2” barrel)
## Joint Sealing

### ASTM E2357 Test Matrix

<table>
<thead>
<tr>
<th>Opaque wall</th>
<th>Penetrated wall</th>
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</thead>
<tbody>
<tr>
<td>Wall #1a</td>
<td>Wall #1b</td>
</tr>
<tr>
<td>Wall #2a</td>
<td>Wall #2b</td>
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</table>

- Tape
- Foam sealant
Test Wall #1: Flashing Tape Joints
Test Wall #2: Expanding Foam Sealant Joints
Air Leakage Results
Test Wall #1: Flashing Tape Joints

Baseline Air Leakage Rate (L/sm2)
Post-Conditioned Air Leakage Rate (L/sm2)

L/sm² at 75 Pa

Opaque Wall
Negative: 0.0055
Positive: 0.0068

Penetrated Wall
Negative: 0.0087
Positive: 0.0051
Air Leakage Results
Test Wall #2: Expanding Foam Sealant Joints

Baseline Air Leakage Rate (L/sm²)
Post Conditioning Air Leakage Rate (L/sm²)

L/sm² at 75 Pa

- Negative: Opaque Wall
  - 0.0808
- Positive: Opaque Wall
  - 0.0688
- Negative: Penetrated Wall
  - 0.0032
- Positive: Penetrated Wall
  - 0.0087
Conclusions

Flashing tape and foam sealant PASS ASTM E2357 as joint materials
Conclusions

Taped joints more difficult to install in brick/block walls in field practicality
THANK YOU!!!!!