

*and Drying*

## Drainage Capacity Evaluation of EIFS / Wood Substrate

By  
Elie Alkhoury, M.Eng. (Building Science), P.Eng.

BECOR Presentation, CMHC Ottawa  
December 13 2006

---

Copy of this presentation may be downloaded at [www.CAN-BEST.com](http://www.CAN-BEST.com)

www.can-best.com Canadian Building Envelope Science and Technology  
© CAN-BEST 2006 SOC & AMMA Accredited Laboratory, ISO 17025

## Industry Collaborative Effort

**Client: CCMC**  
**Consortium Members**

- Adex
- BASF
- Dryvit
- Durabond
- Durock
- Sto

**Consultants**

- Elie Alkhoury, CAN-BEST
- Don Onysko, DMO Associates



12/08/2005

*CAN-BEST wishes to thank all consortium members, CCMC and DMO for their support and constructive comments.*

www.can-best.com Canadian Building Envelope Science and Technology  
© CAN-BEST 2006 SOC & AMMA Accredited Laboratory, ISO 17025

www.CAN-BEST.com

*This research program was carried out at CAN-BEST's laboratory in Brampton, Ontario (SCC accredited).*



www.can-best.com Canadian Building Envelope Science and Technology  
© CAN-BEST 2006 SOC & AMMA Accredited Laboratory, ISO 17025

## 2004 State-of-the-Art

**ASTM E 2273-03 "Standard Test Method for Determining the Drainage Efficiency of Exterior Insulation and Finish Systems (EIFS) Clad Wall Assemblies".**

- **Generic Test**  
*Wood substrates require special attention*
- **Not Appropriate**  
*Does not address Drying Capability*

www.can-best.com Canadian Building Envelope Science and Technology  
© CAN-BEST 2006 SOC & AMMA Accredited Laboratory, ISO 17025

## ASTM Method

- **Spray Water into Fault Slot**  
*at rate of 106 to 116 g/min for 75 minutes*
- **Collect and Weigh drained water**  
*for 60 minutes*
- **Calculate % Drainage Efficiency**  
$$= (W_{\text{Drained}} / W_{\text{Total}}) \times 100$$



www.can-best.com Canadian Building Envelope Science and Technology  
© CAN-BEST 2006 SOC & AMMA Accredited Laboratory, ISO 17025

## ASTM Method



www.can-best.com Canadian Building Envelope Science and Technology  
© CAN-BEST 2006 SOC & AMMA Accredited Laboratory, ISO 17025



<h3>ASTM Method</h3> <ul style="list-style-type: none"> <li>• Wetting 75 min</li> <li>• Drainage 60 min</li> </ul>	<h3>CCMC Method</h3> <ul style="list-style-type: none"> <li>• Wetting 60 min</li> <li>• Drainage 60 min</li> <li>• Drying 48 hrs</li> </ul>
--	---

[www.can-best.com](http://www.can-best.com) Canadian Building Envelope Science and Technology  
 © CAN-BEST 2006 SOC & AMMA Accredited Laboratory, ISO 17025

### CCMC Method

- Continuous Mass Monitoring
- Trickle Wetting of Drainage Cavity

[www.can-best.com](http://www.can-best.com) Canadian Building Envelope Science and Technology  
 © CAN-BEST 2006 SOC & AMMA Accredited Laboratory, ISO 17025

### CCMC Method – Drainage Phase

- Trickle Water onto WPB  
*at rate of 133 ml/min (8.0 l/hr) for 60 minutes*
- Allow panel to drain for 60 min
- Drainage Unit-Retained < 30 g/m<sup>2</sup>  
*(based on the projected drainage area)  
= width of slot fault x its height*

[www.can-best.com](http://www.can-best.com) Canadian Building Envelope Science and Technology  
 © CAN-BEST 2006 SOC & AMMA Accredited Laboratory, ISO 17025

### CCMC Method – Drying Phase

- Allow panel to dry for 48 hours
- Drying Unit-Retained < 15 g/m<sup>2</sup>  
*(based on the projected drainage area)  
= width of slot fault x its height*

[www.can-best.com](http://www.can-best.com) Canadian Building Envelope Science and Technology  
 © CAN-BEST 2006 SOC & AMMA Accredited Laboratory, ISO 17025

### Project Description



- 6 Companies  
*(7 Systems, minimum 3 panels per system)*
- OSB Preparation  
*(Special frames mounted on skids for ease of handling)*




[www.can-best.com](http://www.can-best.com) Canadian Building Envelope Science and Technology  
 © CAN-BEST 2006 SOC & AMMA Accredited Laboratory, ISO 17025

### OSB Substrate


- Horizontal Joint  
*3.2 mm wide horizontal joint located at panel's mid-height.*
- Joint Preparation  
*Joint treated prior to WPB application.*

[www.can-best.com](http://www.can-best.com) Canadian Building Envelope Science and Technology  
 © CAN-BEST 2006 SOC & AMMA Accredited Laboratory, ISO 17025

### WPB (Water Penetration Barrier)

- **Two-Coats**  
*(CCMC requirement)*
- **Application**  
*WPB applied by trowel or roller.*
- **Ready for next step**



www.can-best.com  
© CAN-BEST 2006

Canadian Building Envelope Science and Technology  
SIC & AMMA Accredited Laboratory, ISO 17025

### Drainage Cavity

- **Adhesive Ribbon**  
*Drainage cavity controlled by the final thickness of adhesive ribbon (2-3 mm).*
- **Geometrically-Defined**  
*(Not covered in this presentation)*  
*Channels or other shapes carved in backside of insulation board.*




www.can-best.com  
© CAN-BEST 2006

Canadian Building Envelope Science and Technology  
SIC & AMMA Accredited Laboratory, ISO 17025

### Insulation

- **Adhered System**  
*Adhesive is used to adhere insulation board to WPB.*
- **Application**  
*2'x4' boards applied 7' high in running bond pattern.*



www.can-best.com  
© CAN-BEST 2006

Canadian Building Envelope Science and Technology  
SIC & AMMA Accredited Laboratory, ISO 17025

### Lamina (Base Coat/Finish Coat)

- **Base Coat**  
*Trowel-applied, fibreglass reinforcing mesh embedded in base coat.*
- **Finish Coat**  
*(Not Required)*



www.can-best.com  
© CAN-BEST 2006

Canadian Building Envelope Science and Technology  
SIC & AMMA Accredited Laboratory, ISO 17025

### Curing & Conditioning


- **Curing**  
*Test panels allowed to cure at lab conditions for a minimum period of 7 days.*
- **Conditioning**  
*Optional water pre-conditioning of drainage cavity.*
- **Ready for testing**

www.can-best.com  
© CAN-BEST 2006

Canadian Building Envelope Science and Technology  
SIC & AMMA Accredited Laboratory, ISO 17025

### Test Set-Up

- **Master Test Frames**  
*A pair of master frames, suspended from specially designed weighing system were used.*
- **Test panels**  
*Test panels mounted on Master frames, instrumented, and ready for water introduction.*




www.can-best.com  
© CAN-BEST 2006

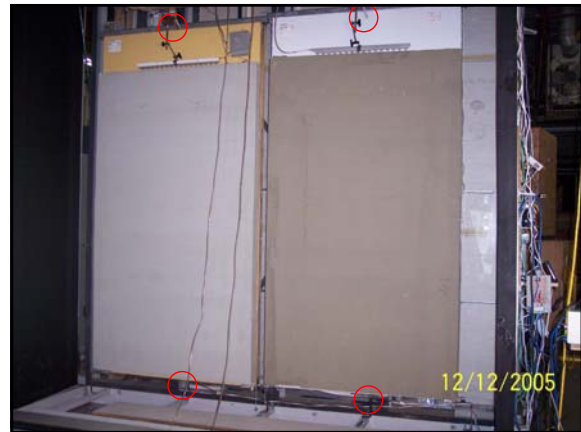
Canadian Building Envelope Science and Technology  
SIC & AMMA Accredited Laboratory, ISO 17025

### Instrumentation - Measurement

- Mass Change Detection**  
*A pair of specialized weighing systems were used to detect minute changes in panel's mass with 0.01 g resolution.*
- Temperature & RH**
  - Ambient
  - Top of drainage cavity
  - Bottom of drainage cavity




www.can-best.com Canadian Building Envelope Science and Technology  
© CAN-BEST 2006 SOC & AMMA Accredited Laboratory, ISO 17025



### Instrumentation - Data Acquisition

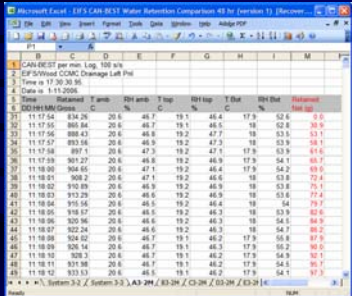
**Monitor all instruments continuously**

- Scan data 100 times per second
- Log data:
  - once per second in first two hours, and
  - once per minute for entire duration of test

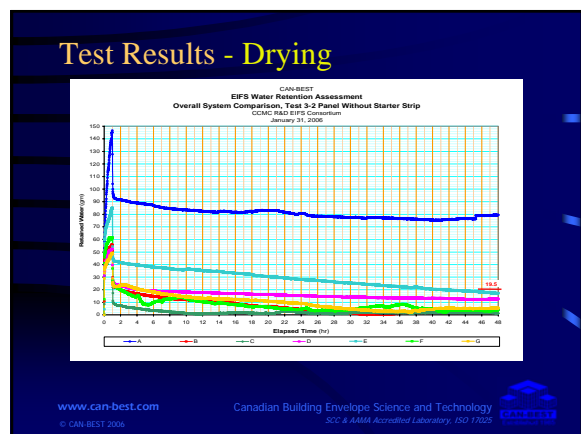
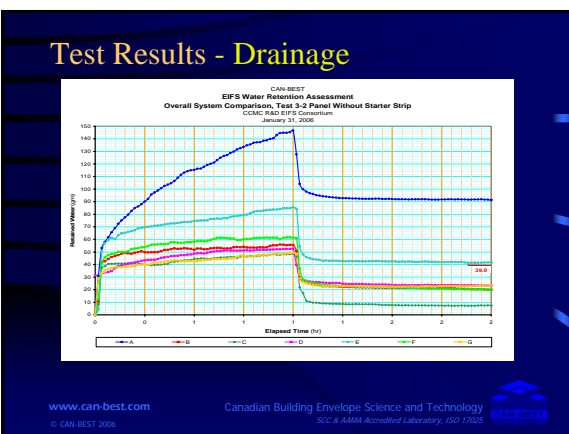


www.can-best.com Canadian Building Envelope Science and Technology  
© CAN-BEST 2006 SOC & AMMA Accredited Laboratory, ISO 17025

### Example Log

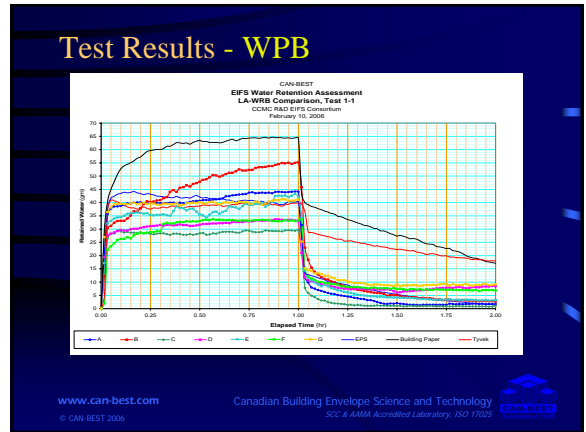


www.can-best.com Canadian Building Envelope Science and Technology  
© CAN-BEST 2006 SOC & AMMA Accredited Laboratory, ISO 17025



### WPB Performance

www.can-best.com  
Canadian Building Envelope Science and Technology  
SOC & AMMA Accredited Laboratory, ISO 17025



### Building Paper Performance

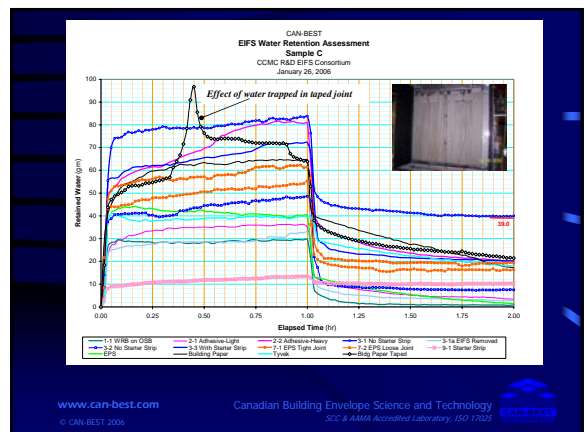
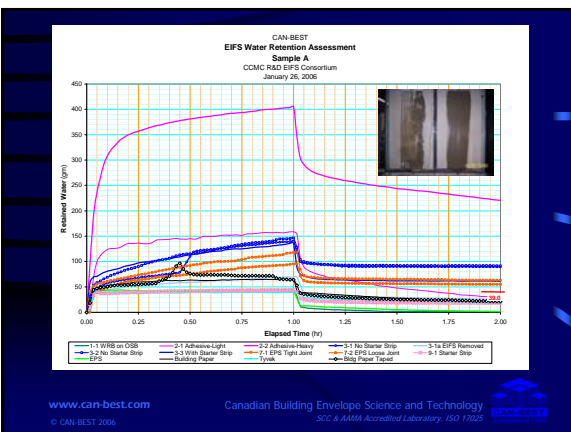
www.can-best.com  
Canadian Building Envelope Science and Technology  
SOC & AMMA Accredited Laboratory, ISO 17025

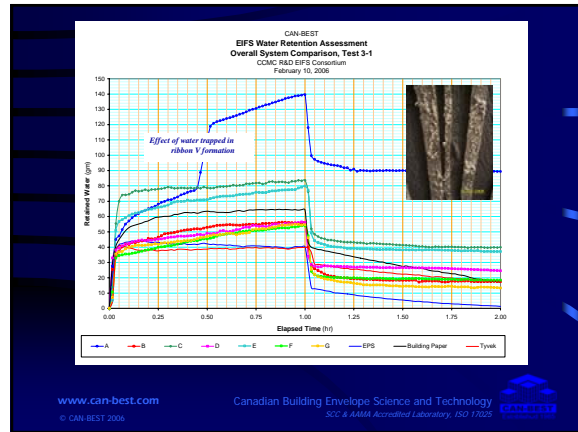
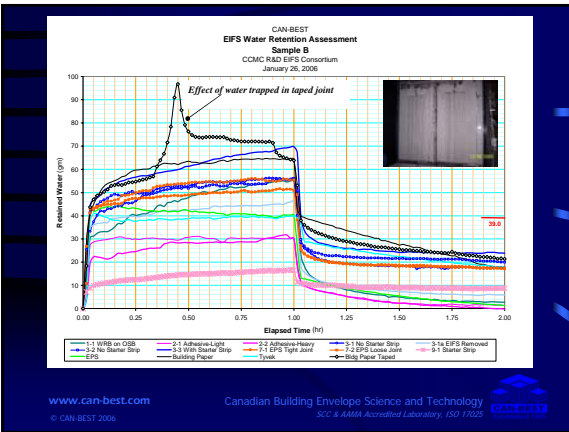
### Adhesive Performance (Thin vs. thick layer application)

**High Absorbing**

**Low Absorbing**

www.can-best.com  
Canadian Building Envelope Science and Technology  
SOC & AMMA Accredited Laboratory, ISO 17025





### Ribbons (Before and after board application)

Potential for water entrapment in cluttered ribbon formation, particularly at edge of insulation board.

Final Initial (wet)

www.can-best.com  
Canadian Building Envelope Science and Technology  
SIC & AMMA Accredited Laboratory, ISO 17025

### Enhanced Ribbon Geometry

What was learned – Keep ribbon geometry clean and aligned to minimize water absorption and entrapment.

www.can-best.com  
Canadian Building Envelope Science and Technology  
SIC & AMMA Accredited Laboratory, ISO 17025

### Aligned Ribbons

Aligned ribbons facilitate drainage and minimize water absorption in adhesive due to lesser wetted surface area.

www.can-best.com  
Canadian Building Envelope Science and Technology  
SIC & AMMA Accredited Laboratory, ISO 17025

### Pointing Fingers? No more

Thank You

www.can-best.com  
Canadian Building Envelope Science and Technology  
SIC & AMMA Accredited Laboratory, ISO 17025