

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

Industry Collaborative Effort

Client: CCMC

Consortium Members

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

Consultants

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



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

www.CAN-BEST.com

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



www.can-best.com

© CAN-BEST 2006

Canadian Building Envelope Science and Technology
SCC & AAMA 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

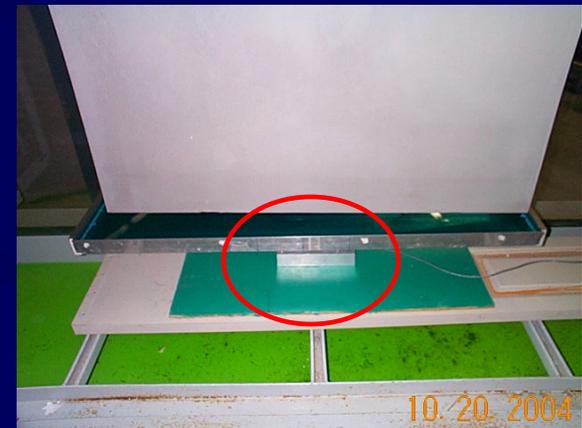
- **Not Appropriate**

Does not address Drying Capability

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**
$$= (W_{\text{Drained}} / W_{\text{Total}}) \times 100$$

ASTM Method



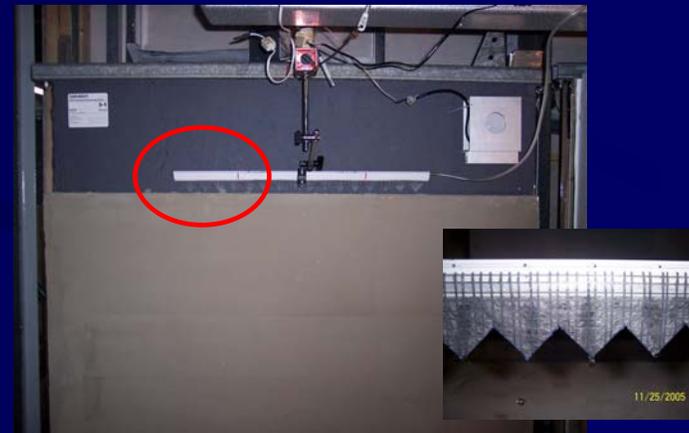
ASTM Method

- Wetting 75 min
- Drainage 60 min



CCMC Method

- Wetting 60 min
- Drainage 60 min
- Drying 48 hrs



CCMC Method

- Continuous Mass Monitoring
- Trickle Wetting of Drainage Cavity



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/m²**

(based on the projected drainage area)

= width of slot fault x its height

CCMC Method – Drying Phase

- **Allow panel to dry for 48 hours**
- **Drying Unit-Retained < 15 g/m²**
(based on the projected drainage area)
= width of slot fault x its height

Project Description

- **6 Companies**

(7 Systems, minimum 3 panels per system)



- **OSB Preparation**

(Special frames mounted on skids for ease of handling)



OSB Substrate

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



WPB *(Water Penetration Barrier)*

- **Two-Coats**
(CCMC requirement)



- **Application**
WPB applied by trowel or roller.



- **Ready for next step**



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.



Insulation

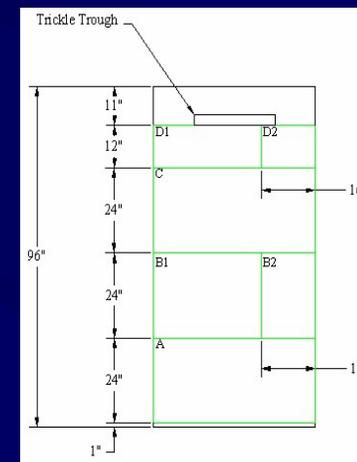
- **Adhered System**

Adhesive is used to adhere insulation board to WPB.



- **Application**

2'x4' boards applied 7' high in running bond pattern.



Lamina *(Base Coat/Finish Coat)*

- **Base Coat**

Trowel-applied, fibreglass reinforcing mesh embedded in base coat.

- **Finish Coat**
(Not Required)



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**

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.



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*





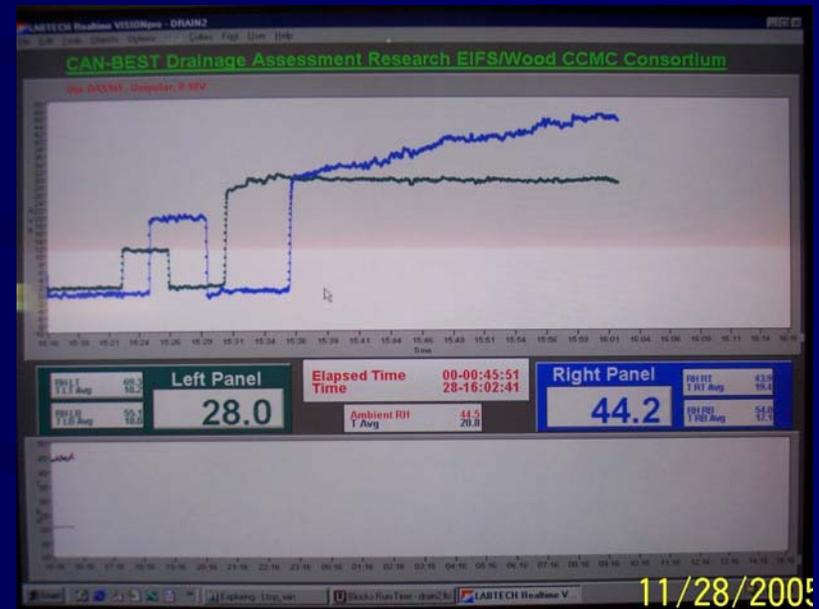
3-1

12/12/2005

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*



Example Log

Microsoft Excel - EIFS CAN-BEST Water Retention Comparison 48 hr (version 1) [Recover...]

File Edit View Insert Format Tools Data Window Help Adobe PDF

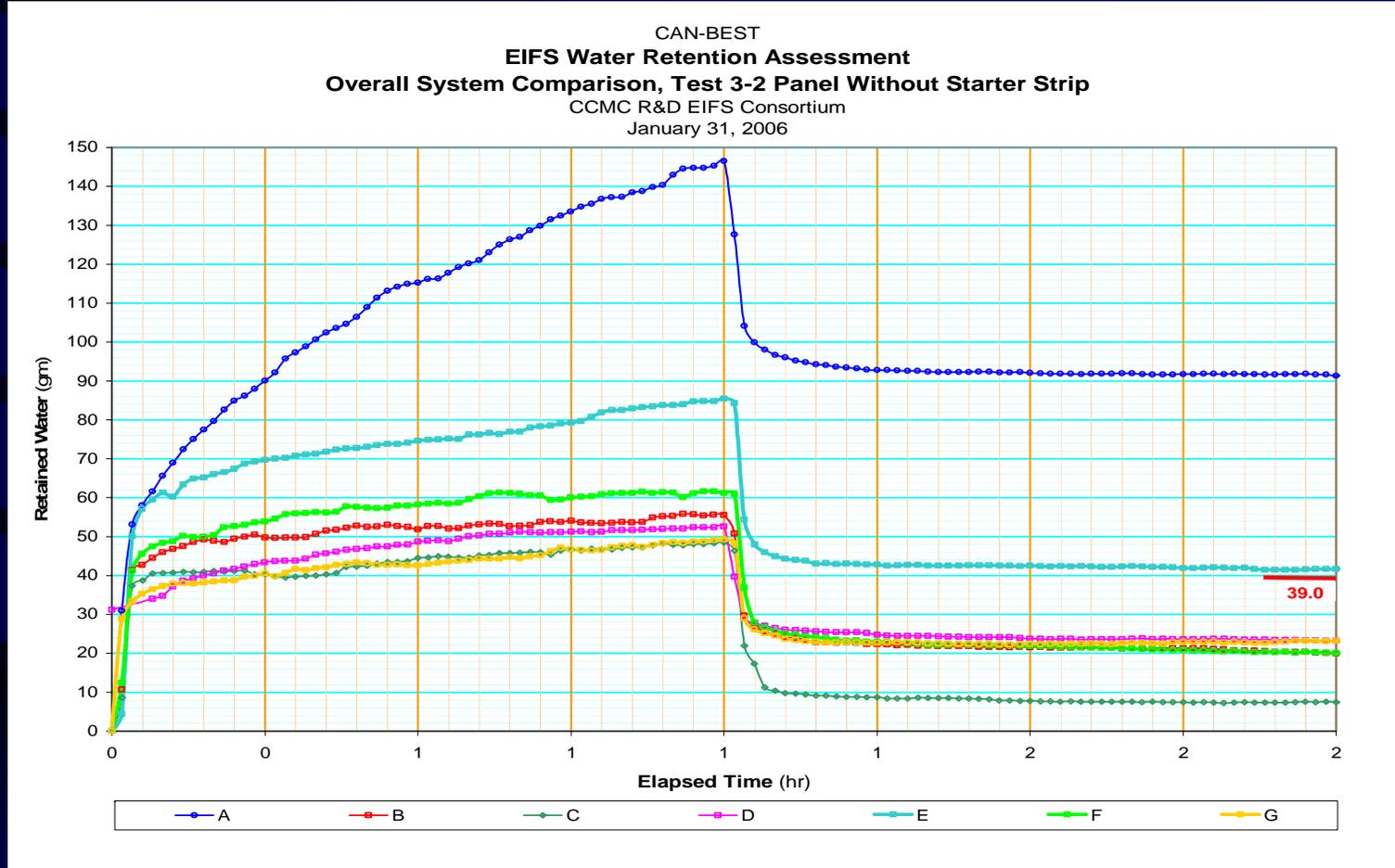
P1 fx

	B	C	D	E	F	G	H	I	M	
1	CAN-BEST per min. Log, 100 s/s									
2	EIFS/Wood CCMC Drainage Left Pnl									
3	Time is 17:30:30.95.									
4	Date is 1-11-2006.									
5	Time	Retained	T amb	RH amb	T top	RH top	T Bot	RH Bot	Retained	
6	DD:HH:MM	Gross	C	%	C	%	C	%	Net (g)	
31	11:17:54	834.26	20.6	46.7	19.1	46.4	17.9	52.6	0.0	
32	11:17:55	865.84	20.6	46.7	19.1	46.5	18	52.8	30.9	
33	11:17:56	888.43	20.6	46.8	19.2	47.7	18	53.5	53.1	
34	11:17:57	893.56	20.6	46.9	19.2	47.3	18	53.9	58.1	
35	11:17:58	897.1	20.6	47.3	19.2	47.1	17.9	53.9	61.6	
36	11:17:59	901.27	20.6	46.8	19.2	46.9	17.9	54.1	65.7	
37	11:18:00	904.65	20.6	47.1	19.2	46.4	17.9	54.2	69.0	
38	11:18:01	908.2	20.6	47.1	19.2	46.6	18	53.8	72.4	
39	11:18:02	910.89	20.6	46.9	19.2	46.9	18	53.8	75.1	
40	11:18:03	913.29	20.6	46.6	19.2	46.9	18	53.6	77.4	
41	11:18:04	915.56	20.6	46.5	19.2	46.4	18	54	79.7	
42	11:18:05	918.57	20.6	46.5	19.2	46.3	18	53.9	82.6	
43	11:18:06	920.96	20.6	46.6	19.2	46.3	18	54.5	84.9	
44	11:18:07	922.24	20.6	46.6	19.2	46.3	18	54.7	86.2	
45	11:18:08	924.02	20.6	46.7	19.1	46.2	17.9	55.8	87.9	
46	11:18:09	926.14	20.6	46.7	19.1	46.3	17.9	55.2	90.0	
47	11:18:10	928.3	20.6	46.7	19.1	46.2	17.9	54.9	92.1	
48	11:18:11	931.98	20.6	46.7	19.1	46.2	17.9	54.5	95.7	
49	11:18:12	933.53	20.6	46.5	19.1	46.2	17.9	54.1	97.3	

System 3-2 / System 3-3 / A3-2M / B3-2M / C3-2M / D3-2M / E3-2M

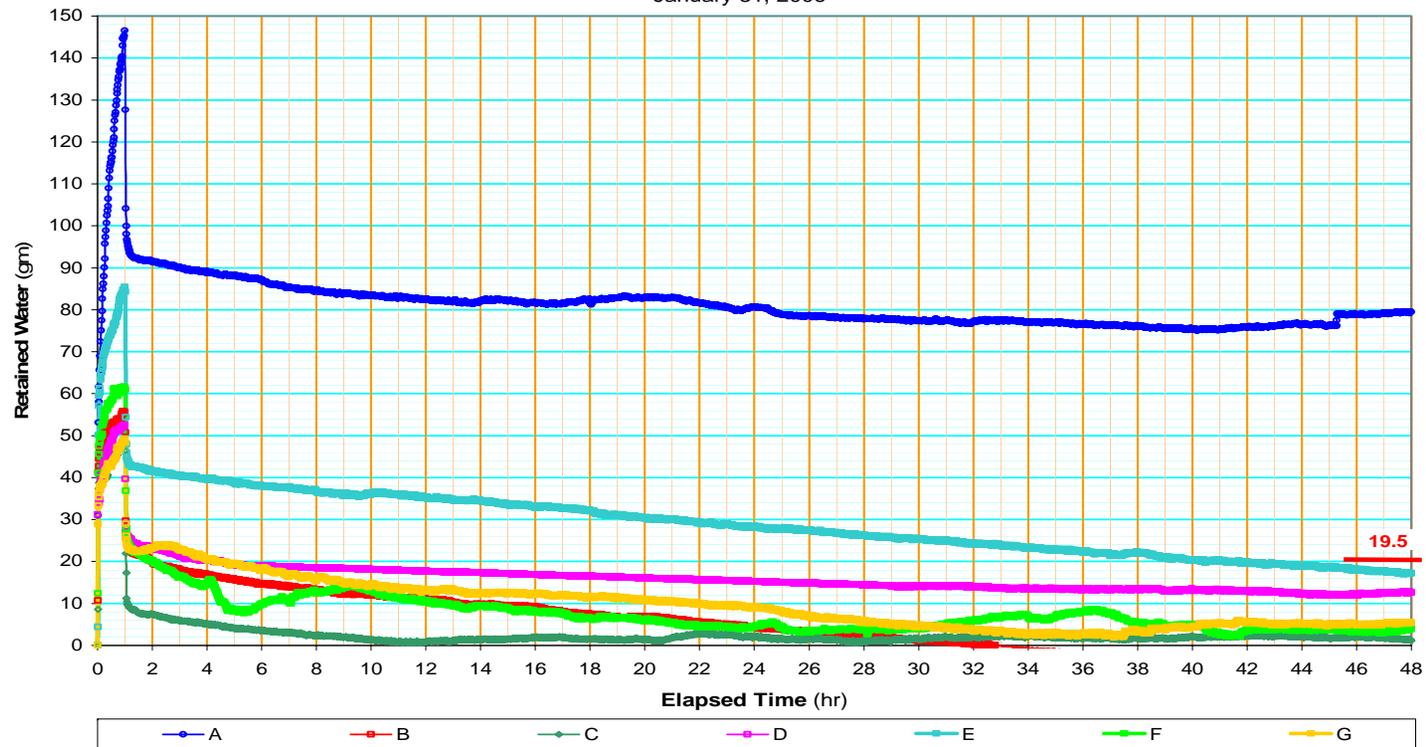
Ready NUM

Test Results - Drainage



Test Results - Drying

CAN-BEST
EIFS Water Retention Assessment
Overall System Comparison, Test 3-2 Panel Without Starter Strip
CCMC R&D EIFS Consortium
January 31, 2006

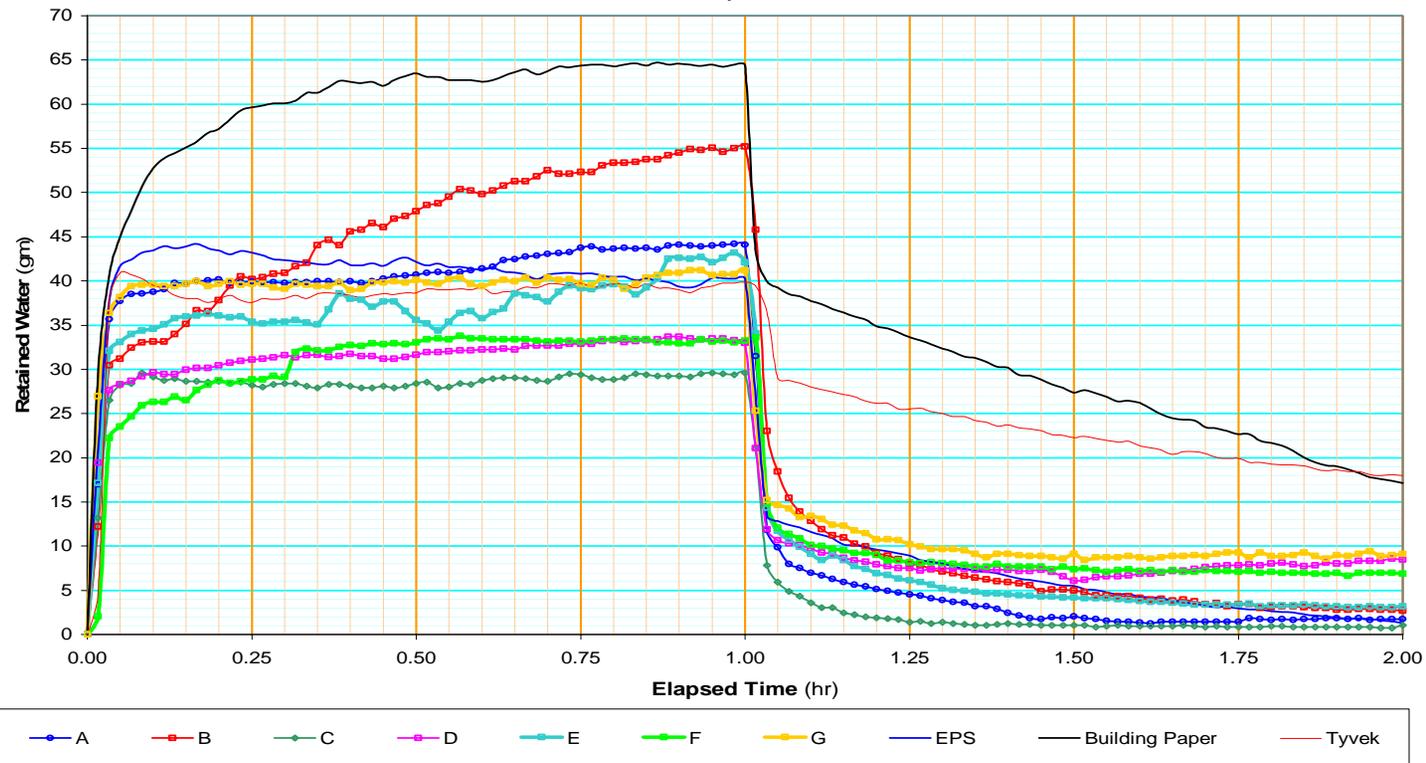


WPB Performance



Test Results - WPB

CAN-BEST
EIFS Water Retention Assessment
LA-WRB Comparison, Test 1-1
CCMC R&D EIFS Consortium
February 10, 2006



Building Paper Performance



Adhesive Performance

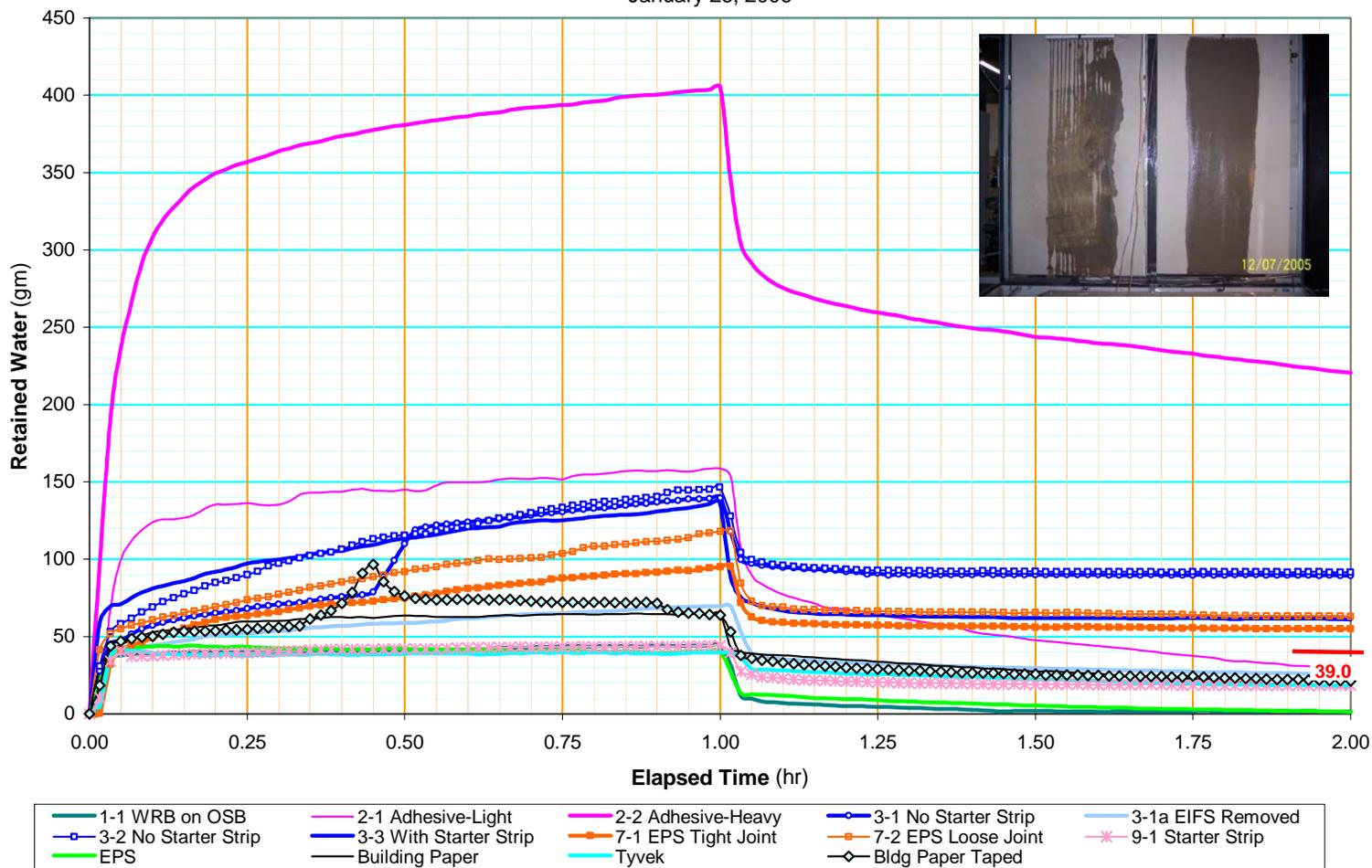
(Thin vs. thick layer application)

High Absorbing



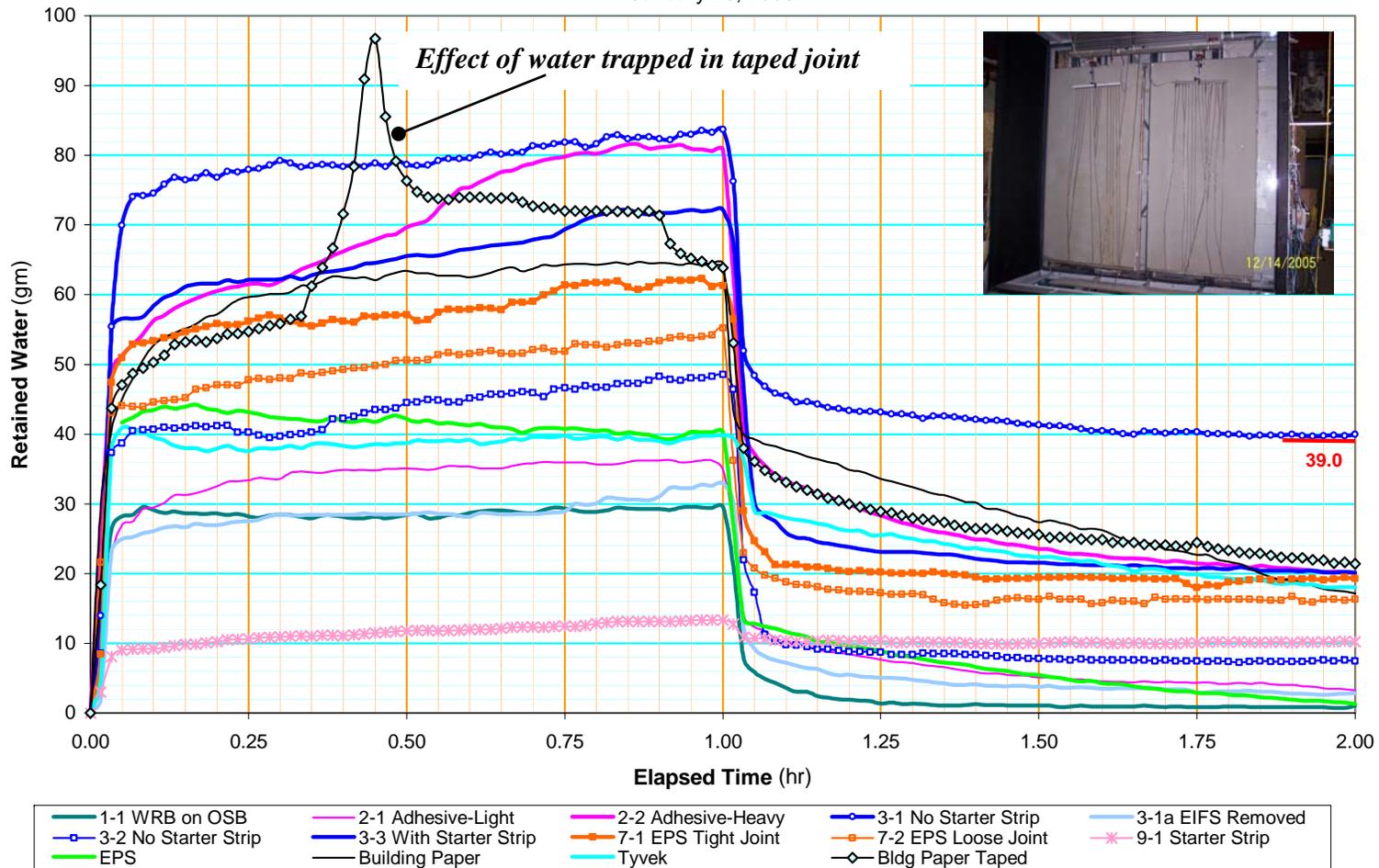
Low Absorbing

CAN-BEST
EIFS Water Retention Assessment
Sample A
 CCMC R&D EIFS Consortium
 January 26, 2006



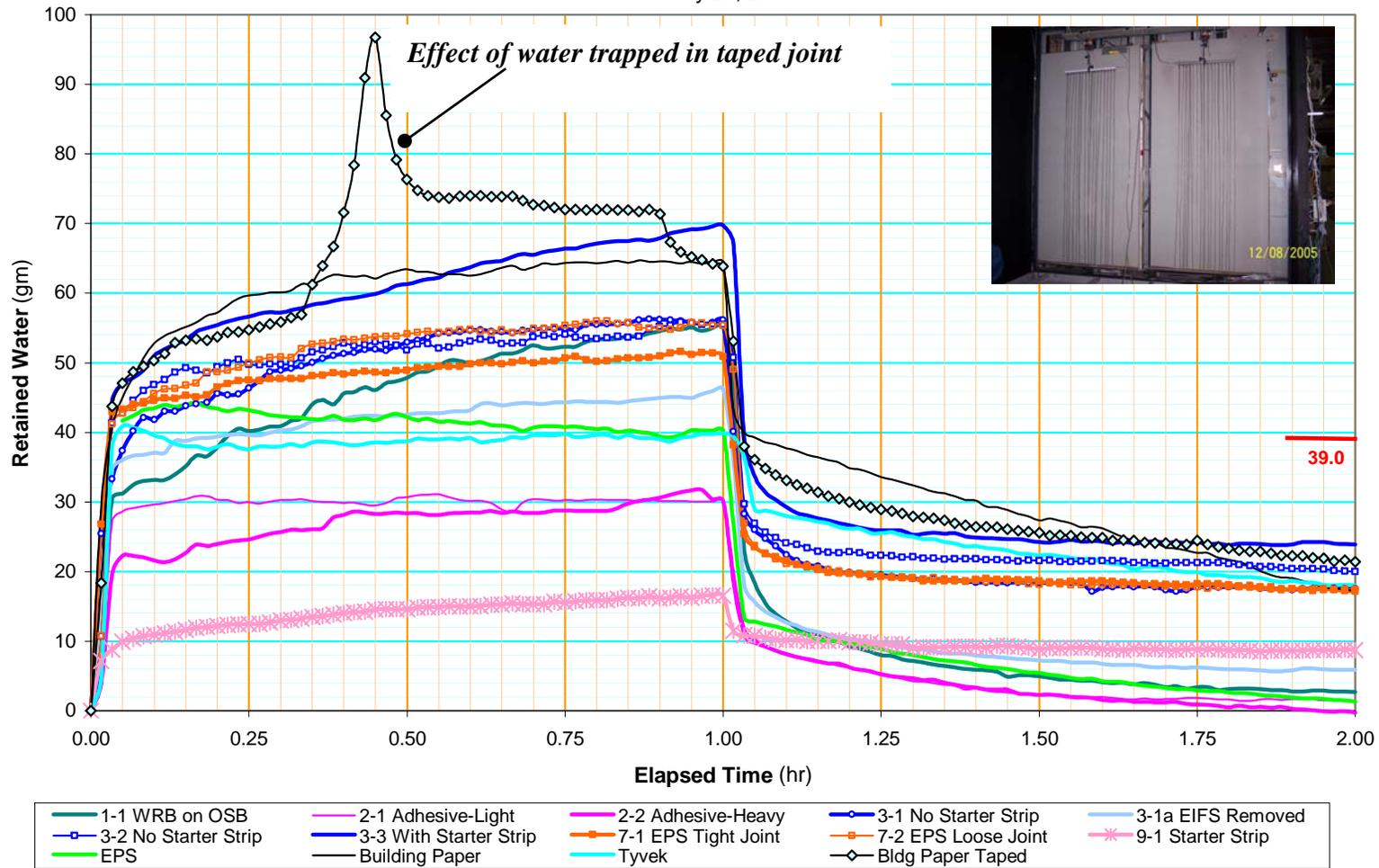
CAN-BEST
EIFS Water Retention Assessment
Sample C

CCMC R&D EIFS Consortium
January 26, 2006

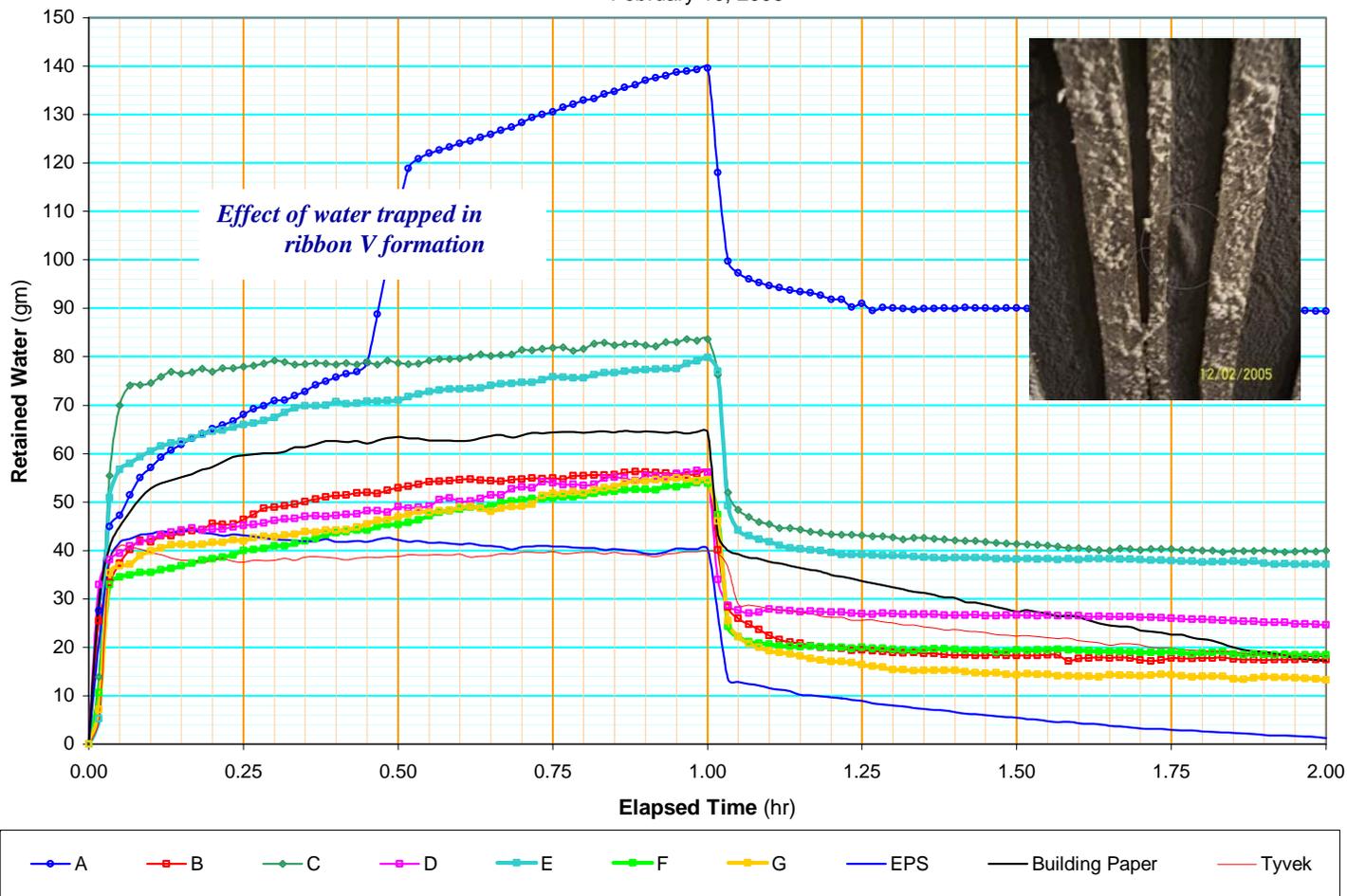


CAN-BEST
EIFS Water Retention Assessment
Sample B

CCMC R&D EIFS Consortium
January 26, 2006



CAN-BEST
EIFS Water Retention Assessment
Overall System Comparison, Test 3-1
 CCMC R&D EIFS Consortium
 February 10, 2006

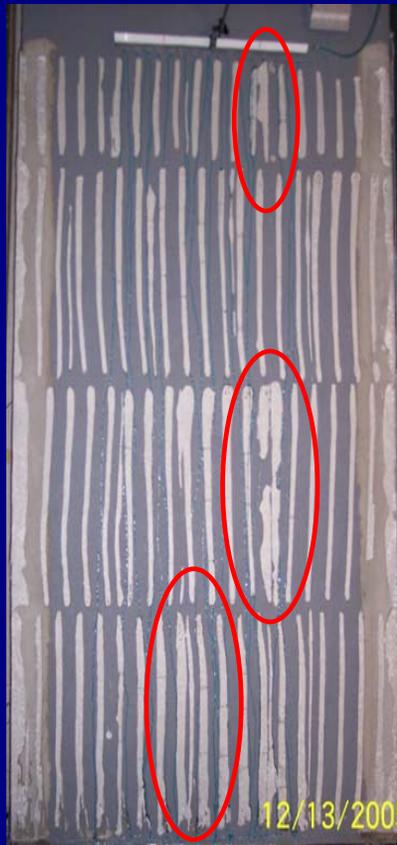


Ribbons *(Before and after board application)*

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



Final



Initial (wet)



Enhanced Ribbon Geometry

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



Aligned Ribbons

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



Pointing Fingers? *No more*



Thank You

www.can-best.com

© CAN-BEST 2006

Canadian Building Envelope Science and Technology
SCC & AAMA Accredited Laboratory, ISO 17025

