TEST REPORT

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EVALUATION CENTER
Intertek
6225 Kenway Drive
Mississauga, Ontario L5T 2L3

RENDERED TO

NATIONAL GYPSUM COMPANY
2001 Rexford Road
Charlotte, North Carolina 06524-3423

and

LATICRETE INTERNATIONAL INC.
One Laticrete Park North, 91 Amity Road
Bethany, Connecticut 06524-3423

PRODUCT EVALUATED: Wall Assembly Test Frames
EVALUATION PROPERTY: Structural Performance

Report for National Gypsum Company of assembly and test witnessing of test frames for structural performance conducted in accordance with a modified ASTM E330-02, *"Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference"*

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2 Introduction

Intertek has witnessed the installation and structural (wind load) testing of various wall assemblies. A total of eighteen wall assemblies were assembled and tested (3 different types of cladding materials, 2 different structural systems, 3 samples of each). The wall components were sampled at various manufacturing locations and then shipped to NGC Testing Services in Buffalo, NY for assembly and testing.

Structural testing of the assemblies was conducted in accordance with the methods of a modified ASTM E330-02, *"Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference"* and evaluated against International Building Code sections 1405.9 (2006) and 1405.10 (2009).The sampling, assembly and test witnessing dates are outlined below.

3 Material Sampling and Assembly and Test Witnessing

Task	Product / Test	Inspector	Date	Location
Material Sampling	PermaBase Cement Board	Jeffrey Patterson	February 17, 2010	Unifix, Bromont, QC
Material Sampling	Laticrete Masonry Pointing Mortar	David Obedzinski	March 25, 2010	Laticrete, Intl Inc., Bethany, CT
Material Sampling	Laticrete Masonry Veneer Mortar	David Obedzinski	March 25, 2010	Laticrete, Intl Inc., Bethany, CT
Material Sampling	Laticrete Hydro Ban	David Obedzinski	March 25, 2010	Laticrete, Intl Inc., Bethany, CT
Assembly Witnessing	Witness assembly of masonry on test walls	Claudio Sacilotto	April 19, 20, May 14, 2010	NGC, Buffalo, NY
Test Witnessing	Structural test on wall assemblies	Claudio Sacilotto	May 10, 11, 12, 14, 28, 2010	NGC, Buffalo, NY

4 Sampled Materials

4.1. CEMENT BOARD

- PermaBase® Cement Board 1/2″×4′×8′
- Manufacturer – National Gypsum Company
- Lot/Serial No. BRO 02-17-10 09:06

4.2. WATERPROOFING MEMBRANE

- Laticrete Hydro Ban™
- Manufacturer – Laticrete International Inc.
- Lot/Serial No. 372931

4.3. MASONRY ADHESIVE

- Laticrete Masonry Veneer Mortar
- Manufacturer – Laticrete International Inc.
- Lot/Serial No. 371788-001 MFG 03/10
    - 373157-005

4.4. MASONRY GROUT

4.4.1. Laticrete Masonry Pointing Mortar - Gray

- Manufacturer – Laticrete International Inc.
- Lot/Serial No. 372655-001 MFG 03/10

4.4.2. Laticrete Masonry Pointing Mortar – Almond

- Manufacturer – Laticrete International Inc.
- Lot/Serial No. 367073 4 MFG 11/09

5 Other Notable Materials

5.1. FIBERGLASS-COATED GYPSUM SHEATHING

- 5/8″ thick

5.2. CDX PLYWOOD

- 1/2″ thick

5.3. GYPSUM BOARD

- 5/8″ Type X Gypsum Board

5.4. CEMENT BOARD FIBERGLASS TAPE

- 4″×150′

5.5. GALVANIZED STEEL STUDS

- Generic Manufacturer – 6″ wide 18 Ga

5.6. MASONRY VENEER UNITS

5.6.1 Manufactured Stone

5.6.2 Natural Stone

5.6.3 Thin Brick

6 Test Sample Assembly

6.1. ASSEMBLY OF BED BASE on WOOD FRAMES

The bed base on wood frames was constructed in the following manner:

- 1/2″ thick CDX plywood nailed to 2×4 wood stud frame (16″ spacing) with 6d common nails. 6 mil polyethylene sheet was applied between the plywood and studs. The polyethylene sheet overhung the perimeter approximately 12″. Nails were spaced 6″ around perimeter and 12″ on intermediate studs
- 1″ thick rimboard was affixed to each end of the test assembly with six #10 screws
- 1/2″ thick PermaBase® cement board was screwed onto CDX plywood with 2-1/4″ corrosion-resistant screws. Screws were spaced 6″ around the perimeter and along intermediate studs. At 8′ mark, a second sheet of PermaBase® cement board was butt joined next to full sheet. The joint was treated with veneer mortar (about 1/16″ thick) and 4″ wide cement board fibreglass tape.
- Two coats of Hydro Ban™ were rolled on covering the PermaBase® cement board and fibreglass tape (0.030″ total wet thickness)
- 5/8″ gypsum board was placed on back of the assembly and screwed to the studs with 1-1/4″ screws and spaced 12″ throughout.

6.2. ASSEMBLY OF BED BASE on METAL FRAMES

The bed base on steel frames was constructed in the following manner:

- 5/8″ thick fibreglass-coated gypsum sheathing was screwed into 6″ 18Ga galvanized steel stud frame (16″ spacing) with 1-1/4″ screws. 6 mil polyethylene sheet was applied between the fibreglass-coated gypsum sheathing and studs. The polyethylene sheet overhung the perimeter approximately 12″. Screws were spaced 12″ around the perimeter and on intermediate studs.
- 1″ thick rimboard was affixed to each end of the test assembly with six #10 screws
- 1/2″ thick PermaBase® cement board was screwed onto plywood with 2-1/4″ corrosion-resistant screws. Screws were spaced 6″ throughout. At 8′ mark, a second sheet of PermaBase® cement board was butt joined next to full sheet. The joint was treated with veneer mortar (about 1/16″ thick) and 4″ wide cement board fibreglass tape.
- Two coats of Hydro Ban™ were rolled on covering the PermaBase® cement board and fibreglass tape (0.030″ total wet thickness).
- 5/8″ gypsum board was placed on back of the assembly and screwed to the studs with 1-1/4″ screws and spaced 12″ throughout.

6.3. ASSEMBLY OF MASONRY VENEER UNITS AND GROUTING

Three different types of masonry veneer units were applied to the test frames (natural stone, manufactured stone and thin brick.):

6.3.1. MIXING OF MORTAR

The mortar was mixed as per the instructions on the bag. 6.25 quarts (5.9 ℓ) of water was added per 40 lbs bag. The mixture was thoroughly mixed and then allowed to slake for approximately 5 minutes and then mixed again.

The grout was also mixed as per the instructions on the bag. 4 quarts (3.8 ℓ) of water was added to each 50 lbs bag).

6.3.2. ASSEMBLY OF MASONRY VENEER UNITS AND GROUTING

The masonry veneer units were brushed on the back to remove excessive dust and loose stones. Laticrete Masonry Veneer Mortar was applied to the bed with a square notch trowel (1/2″ × 1/2″ × 1/2″). The masonry veneer units were laid on the test bed. A spacing of 3/16″ separated each masonry unit. Once the veneer mortar cured, the test samples were grouted. The grouting process was conducted with a grout bag and small amounts of water were added as required to wet the grout and ease the grouting process.

7 Testing and Evaluation Methods

7.1 DEVIATION FROM ASTM E330-02

Structural performance testing was conducted in one direction only (negative wind load direction). Deviation from the standard procedure was based on the reasonable assumption that negative wind load testing would be the weakest direction, and therefore positive wind load testing was not evaluated. Because of this, the preload pressure (one-half of the test pressure) was not applied prior to the application of the test pressure.

7.2 STRUCTURAL PERFORMANCE (UNIFORM LOAD TESTS)

A modified Uniform Load Deflection test was conducted in accordance with ASTM E-330-02 *"Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference,"* Procedure A. The test sample was installed into NGC's Structural Performance Test Frame apparatus. The NGC Structural Performance Test Frame apparatus is set up such that the ends of the sample are fixed against the apparatus. Only one deflection point (at the center of the test sample) is set up at the center. (An assumption is made to ensure that there are no net deflections at the ends of the specimen).

The sample was sealed to the test apparatus. A negative wind load test pressure was applied to the sample until a deflection outlined below was achieved. The test pressure was measured after maintaining the load for 10 seconds. The test sample was observed (through the portholes) and inspected for cracking of the mortar or deterioration of the test sample.

Test span:120 inches	Deflection	
1.	Span/960	0.125″
2.	Span/840	0.143″
3.	Span/720	0.167″
4.	Span/600	0.200″
5.	Span/480	0.250″
6.	Span/360	0.333″

After two minutes with the pressure released, the residual deflection of the test sample assembly was recorded. Once complete, the samples were subjected to a pressure that corresponded to the next deflection level.

The deflection measurement of the test sample was measured on the interior side of the gypsum board. Simultaneous measurements of the sample were also recorded at the back of the fibreglass-coated gypsum sheathing/plywood on the exterior side of the steel/wood studs.

8 Testing and Evaluation Results

MANUFACTURED STONE ON METAL STUDS

Test	Manufactured Stone
1	Steel Studs

Frame ID	Span
4	120"

Test Date	Temp (°F)	Humidity
12-May-10	61.7	49%

	y Load Applied			x Assembly Deflection			Assembly Residual Defl.		Back of Panel Deflection		Back of Panel Residual Defl.	
	" WC	psf	Pa	L/	inches	mm	inches	mm	inches	mm	inches	mm
	5.0	26.0	1245	960	0.125	3.18	0.033	0.83	0.145	3.68	0.042	1.07
	5.4	28.1	1345	840	0.143	3.63	0.038	0.98	0.162	4.11	0.047	1.19
	6.4	33.3	1594	720	0.167	4.24	0.048	1.22	0.185	4.70	0.054	1.37
	7.8	40.6	1943	600	0.200	5.08	0.057	1.45	0.218	5.54	0.062	1.57
	10.1	52.5	2516	480	0.250	6.35	0.073	1.85	0.274	6.96	0.070	1.78
	14.0	72.8	3487	360	0.333	8.46	0.085	2.17	0.360	9.14	0.085	2.16
Failure									**Comments:** no failures observed			
Max	26.8	139.4	6676									

Test	Manufactured Stone
2	Steel Studs

Frame ID	Span
3	120"

Test Date	Temp (°F)	Humidity
12-May-10	61.7	49%

	Load Applied			Assembly Deflection			Assembly Residual Defl.		Back of Panel Deflection		Back of Panel Residual Defl.	
	" WC	psf	Pa	L/	inches	mm	inches	mm	inches	mm	inches	mm
	3.5	18.2	872	960	0.125	3.18	0.046	1.17	0.138	3.51	0.056	1.42
	4.2	21.8	1046	840	0.143	3.63	0.054	1.38	0.159	4.04	0.066	1.68
	5.5	28.6	1370	720	0.167	4.24	0.066	1.68	0.187	4.75	0.077	1.96
	6.2	32.3	1544	600	0.200	5.08	0.079	2.00	0.216	5.49	0.085	2.16
	8.0	41.6	1993	480	0.250	6.35	0.097	2.46	0.286	7.26	0.098	2.49
	11.8	61.4	2939	360	0.333	8.46	0.118	3.00	0.346	8.79	0.118	3.00
Failure									**Comments:** lost suction due to plastic tear; no failures observed			
Max	24.5	127.5	6103		0.650	16.51						

Test	Manufactured Stone
3	Steel Studs

Frame ID	Span
2	120"

Test Date	Temp (°F)	Humidity
12-May-10	61.7	49%

	Load Applied			Assembly Deflection			Assembly Residual Defl.		Back of Panel Deflection		Back of Panel Residual Defl.	
	" WC	psf	Pa	L/	inches	mm	inches	mm	inches	mm	inches	mm
	4.3	22.4	1071	960	0.125	3.18	0.006	0.16	0.130	3.30	0.007	0.18
	4.8	25.0	1196	840	0.143	3.63	0.010	0.25	0.146	3.71	0.009	0.23
	6.0	31.2	1495	720	0.167	4.24	0.014	0.36	0.171	4.34	0.014	0.36
	7.9	41.1	1968	600	0.200	5.08	0.019	0.49	0.207	5.26	0.018	0.46
	10.7	55.7	2665	480	0.250	6.35	0.029	0.74	0.265	6.73	0.029	0.74
	15.0	78.0	3736	360	0.333	8.46	0.046	1.18	0.360	9.14	0.048	1.22
Failure									**Comments:** no catastrophic failure			
Max	29.2	151.9	7273		0.701	17.81						

MANUFACTURED STONE ON WOOD STUDS

Test	Manufactured Stone
1	Wood Studs

Frame ID	Span
1	120"

Test Date	Temp (°F)	Humidity
10-May-10	62.1	49%

	Load Applied			Assembly Deflection			Assembly Residual Defl.		Back of Panel Deflection		Back of Panel Residual Defl.	
	" WC	psf	Pa	L/	inches	mm	inches	mm	inches	mm	inches	mm
	3.2	16.6	797	960	0.125	3.18	0.010	0.25	N/A	N/A	0.012	0.30
	3.4	17.7	847	840	0.143	3.63	0.014	0.36	0.150	3.81	0.017	0.43
	3.8	19.8	947	720	0.167	4.24	0.018	0.45	0.175	4.45	0.020	0.51
	4.3	22.4	1071	600	0.200	5.08	0.022	0.56	0.220	5.59	0.025	0.64
	5.4	28.1	1345	480	0.250	6.35	0.032	0.81	0.260	6.60	0.036	0.91
	6.6	34.3	1644	360	0.333	8.46	0.044	1.13	0.350	8.89	0.050	1.27
Failure	18.6	96.8	4633						**Comments:** cracking of mortar joint at 18.6 "WC; no catastrophic failure. No defl recorded at L/960			
Max	29.7	154.5	7398									

Test	Manufactured Stone
2	Wood Studs

Frame ID	Span
3	120"

Test Date	Temp (°F)	Humidity
10-May-10	62.1	49%

	Load Applied			Assembly Deflection			Assembly Residual Defl.		Back of Panel Deflection		Back of Panel Residual Defl.	
	" WC	psf	Pa	L/	inches	mm	inches	mm	inches	mm	inches	mm
	2.8	14.6	697	960	0.125	3.18	0.009	0.24	0.145	3.68	0.013	0.33
	3.0	15.6	747	840	0.143	3.63	0.013	0.33	0.160	4.06	0.017	0.43
	3.5	18.2	872	720	0.167	4.24	0.018	0.45	0.184	4.67	0.022	0.56
	4.2	21.8	1046	600	0.200	5.08	0.024	0.61	0.214	5.44	0.030	0.76
	5.0	26.0	1245	480	0.250	6.35	0.052	1.33	0.230	5.84	0.051	1.30
	5.8	30.2	1445	360	0.333	8.46	0.084	2.14	0.330	8.38	0.075	1.91
Failure	19.6	102.0	4882		0.160	4.06			**Comments:** cracking of mortar joint at 19.6 "WC; no catastrophic failure			
Max	29.8	155.0	7423									

Test	Manufactured Stone
3	Wood Studs

Frame ID	Span
3	120"

Test Date	Temp (°F)	Humidity
10-May-10	62.1	49%

	Load Applied			Assembly Deflection			Assembly Residual Defl.		Back of Panel Deflection		Back of Panel Residual Defl.	
	" WC	psf	Pa	L/	inches	mm	inches	mm	inches	mm	inches	mm
	3.2	16.6	797	960	0.125	3.18	0.013	0.32	0.145	3.68	0.021	0.53
	3.5	18.2	872	840	0.143	3.63	0.015	0.39	0.157	3.99	0.025	0.64
	3.8	19.8	947	720	0.167	4.24	0.018	0.47	0.180	4.57	0.028	0.71
	4.5	23.4	1121	600	0.200	5.08	0.024	0.60	0.215	5.46	0.034	0.86
	5.5	28.6	1370	480	0.250	6.35	0.033	0.83	0.272	6.91	0.045	1.14
	6.8	35.4	1694	360	0.333	8.46	0.046	1.16	0.360	9.14	0.058	1.47
Failure	12.9	67.1	3213		1.400	35.56			**Comments:** cracking of mortar joint at 12.9 "WC; no catastrophic failure			
Max	30.2	157.1	7522									

THIN BRICK ON STEEL STUDS

Test	Thin Brick
1	Steel Studs

Frame ID	Span
6	120"

Test Date	Temp (°F)	Humidity
28-May-10	73.9	58%

	Load Applied		
	" WC	psf	Pa
	4.5	23.4	1121
	4.8	25.0	1196
	5.5	28.6	1370
	6.3	32.8	1569
	7.5	39.0	1868
	11.6	60.3	2889
Failure			
Max	18.4	95.7	4583

Assembly Deflection			Assembly Residual Defl.	
L/	inches	mm	inches	mm
960	0.125	3.18	0.006	0.14
840	0.143	3.63	0.038	0.97
720	0.167	4.24	0.050	1.26
600	0.200	5.08	0.071	1.79
480	0.250	6.35	0.083	2.11
360	0.333	8.46	0.099	2.52
	0.520	13.21		

Back of Panel Deflection		Back of Panel Residual Defl.	
inches	mm	inches	mm
0.152	3.86	0.016	0.41
0.179	4.55	0.058	1.47
0.208	5.28	0.074	1.88
0.251	6.38	0.098	2.49
0.310	7.87	0.116	2.95
0.412	10.46	0.135	3.43

Comments: no failures observed

Test	Thin Brick
2	Steel Studs

Frame ID	Span
1	120"

Test Date	Temp (°F)	Humidity
28-May-10	73.9	58%

	Load Applied		
	" WC	psf	Pa
	6.6	34.3	1644
	7.5	39.0	1868
	8.6	44.7	2142
	10.0	52.0	2491
	12.0	62.4	2989
	15.9	82.7	3961
Failure			
Max	25.6	133.2	6377

Assembly Deflection			Assembly Residual Defl.	
L/	inches	mm	inches	mm
960	0.125	3.18	0.006	0.14
840	0.143	3.63	0.009	0.22
720	0.167	4.24	0.012	0.31
600	0.200	5.08	0.017	0.42
480	0.250	6.35	0.022	0.57
360	0.333	8.46	0.034	0.86
	0.620	15.75		

Back of Panel Deflection		Back of Panel Residual Defl.	
inches	mm	inches	mm
0.148	3.76	0.018	0.46
0.167	4.24	0.022	0.56
0.193	4.90	0.027	0.69
0.230	5.84	0.032	0.81
0.286	7.26	0.040	1.02
0.385	9.78	0.056	1.42

Comments: no failures observed

Test	Thin Brick
3	Steel Studs

Frame ID	Span
5	120"

Test Date	Temp (°F)	Humidity
28-May-10	73.9	58%

	Load Applied		
	" WC	psf	Pa
	7.9	41.1	1968
	7.8	40.6	1943
	8.0	41.6	1993
	9.4	48.9	2341
	12.2	63.5	3039
	15.4	80.1	3836
Failure	29.5	153.5	7348
Max			

Assembly Deflection			Assembly Residual Defl.	
L/	inches	mm	inches	mm
960	0.125	3.18	0.001	0.02
840	0.143	3.63	0.003	0.08
720	0.167	4.24	0.002	0.04
600	0.200	5.08	0.004	0.10
480	0.250	6.35	0.015	0.37
360	0.333	8.46	0.030	0.75
	0.780	19.81		

Back of Panel Deflection		Back of Panel Residual Defl.	
inches	mm	inches	mm
0.169	4.29	0.022	0.56
0.185	4.70	0.027	0.69
0.206	5.23	0.027	0.69
0.242	6.15	0.032	0.81
0.300	7.62	0.043	1.09
0.390	9.91	0.061	1.55

Comments: Top screw at base sheared off

THIN BRICK ON WOOD STUDS

Test	Thin Brick
1	Wood Studs

Frame ID	Span
5	120"

Test Date	Temp (°F)	Humidity
10-May-10	64.3	46%

	Load Applied		
	" WC	psf	Pa
	2.2	11.4	548
	2.5	13.0	623
	2.9	15.1	722
	3.2	16.6	797
	4.1	21.3	1021
	5.0	26.0	1245
Failure	22.6	117.6	5629
Max	25.8	134.2	6426

Assembly Deflection			Assembly Residual Defl.	
L/	inches	mm	inches	mm
960	0.125	3.18	0.011	0.28
840	0.143	3.63	0.017	0.42
720	0.167	4.24	0.023	0.58
600	0.200	5.08	0.030	0.77
480	0.250	6.35	0.057	1.45
360	0.333	8.46	0.076	1.93
	2.000	50.80		

Back of Panel Deflection		Back of Panel Residual Defl.	
inches	mm	inches	mm
0.110	2.79	0.016	0.41
0.132	3.35	0.024	0.61
0.150	3.81	0.032	0.81
0.195	4.95	0.040	1.02
0.240	6.10	0.068	1.73
0.331	8.41	0.086	2.18

Comments: Top screw at base sheared off

Test	Thin Brick
2	Wood Studs

Frame ID	Span
4	120"

Test Date	Temp (°F)	Humidity
11-May-10	61.4	48%

	Load Applied		
	" WC	psf	Pa
	2.4	12.5	598
	2.9	15.1	722
	3.3	17.2	822
	3.8	19.8	947
	4.8	25.0	1196
	6.0	31.2	1495
Failure	15.9	82.7	3961
Max	26.7	138.9	6651

Assembly Deflection			Assembly Residual Defl.	
L/	inches	mm	inches	mm
960	0.125	3.18	0.006	0.15
840	0.143	3.63	0.008	0.21
720	0.167	4.24	0.011	0.27
600	0.200	5.08	0.015	0.37
480	0.250	6.35	0.021	0.52
360	0.333	8.46	0.032	0.82

Back of Panel Deflection		Back of Panel Residual Defl.	
inches	mm	inches	mm
0.125	3.18	0.009	0.23
0.145	3.68	0.011	0.28
0.167	4.24	0.014	0.36
0.200	5.08	0.017	0.43
0.250	6.35	0.024	0.61
0.330	8.38	0.035	0.89

Comments: cracking of mortar joint at 15.9 "WC; no catastrophic failure

Test	Thin Brick
3	Wood Studs

Frame ID	Span
7	120"

Test Date	Temp (°F)	Humidity
11-May-10	61.4	48%

	Load Applied		
	" WC	psf	Pa
	2.4	12.5	598
	2.6	13.5	648
	2.9	15.1	722
	3.5	18.2	872
	4.1	21.3	1021
	5.4	28.1	1345
Failure			
Max	28.8	149.8	7174

Assembly Deflection			Assembly Residual Defl.	
L/	inches	mm	inches	mm
960	0.125	3.18	0.006	0.14
840	0.143	3.63	0.009	0.22
720	0.167	4.24	0.010	0.25
600	0.200	5.08	0.014	0.36
480	0.250	6.35	0.022	0.55
360	0.333	8.46	0.038	0.97

Back of Panel Deflection		Back of Panel Residual Defl.	
inches	mm	inches	mm
0.125	3.18	0.012	0.30
0.143	3.63	0.016	0.41
0.170	4.32	0.018	0.46
0.203	5.16	0.023	0.59
0.252	6.40	0.031	0.79
0.340	8.64	0.046	1.17

Comments: no failures observed

NATURAL STONE ON METAL STUDS

Test	Natural Stone (Granite)
1	Metal Studs

Frame ID	Span
9	120"

Test Date	Temp (°F)	Humidity
14-May-10	61.9	60%

Load Applied		
" WC	psf	Pa
7.1	36.9	1769
7.7	40.1	1918
9.1	47.3	2267
10.2	53.1	2541
12.4	64.5	3089
15.9	82.7	3961
Failure		
Max	31.5	163.9	7846

Assembly Deflection			Assembly Residual Defl.	
L/	inches	mm	inches	mm
960	0.125	3.18	0.015	0.38
840	0.143	3.63	0.018	0.46
720	0.167	4.24	0.021	0.54
600	0.200	5.08	0.025	0.65
480	0.250	6.35	0.031	0.79
360	0.333	8.46	0.041	1.04
	0.835			

Back of Panel Deflection		Back of Panel Residual Defl.	
inches	mm	inches	mm
0.142	3.61	0.022	0.56
0.165	4.19	0.026	0.66
0.195	4.95	0.030	0.76
0.238	6.05	0.036	0.91
0.304	7.72	0.044	1.12
0.402	10.21	0.054	1.37

Comments: no failures observed

Test	Natural Stone (Granite)
2	Metal Studs

Frame ID	Span
7	120"

Test Date	Temp (°F)	Humidity
14-May-10	61.9	60%

Load Applied		
" WC	psf	Pa
5.2	27.1	1295
5.4	28.1	1345
6.2	32.3	1544
7.0	36.4	1744
10.1	52.5	2516
13.6	70.8	3388
Failure		
Max	29.2	151.9	7273

Assembly Deflection			Assembly Residual Defl.	
L/	inches	mm	inches	mm
960	0.125	3.18	0.025	0.64
840	0.143	3.63	0.031	0.78
720	0.167	4.24	0.035	0.88
600	0.200	5.08	0.040	1.00
480	0.250	6.35	0.049	1.23
360	0.333	8.46	0.063	1.60
	0.820			

Back of Panel Deflection		Back of Panel Residual Defl.	
inches	mm	inches	mm
0.145	3.68	0.032	0.81
0.171	4.34	0.039	0.99
0.197	5.00	0.043	1.09
0.237	6.02	0.049	1.24
0.295	7.49	0.060	1.52
0.400	10.16	0.078	1.98

Comments: no failures observed

Test	Natural Stone (Granite)
3	Metal Studs

Frame ID	Span
8	120"

Test Date	Temp (°F)	Humidity
14-May-10	61.9	60%

Load Applied		
" WC	psf	Pa
6.8	35.4	1694
7.8	40.6	1943
9.2	47.9	2292
11.0	57.2	2740
12.7	66.1	3163
15.9	82.7	3961
Failure	29.2	151.9	7273
Max			

Assembly Deflection			Assembly Residual Defl.	
L/	inches	mm	inches	mm
960	0.125	3.18	0.000	0.00
840	0.143	3.63	0.000	0.00
720	0.167	4.24	0.000	0.01
600	0.200	5.08	0.001	0.03
480	0.250	6.35	0.007	0.19
360	0.333	8.46	0.023	0.58
	0.640	16.26		

Back of Panel Deflection		Back of Panel Residual Defl.	
inches	mm	inches	mm
0.148	3.76	0.006	0.15
0.169	4.29	0.008	0.20
0.196	4.98	0.009	0.23
0.235	5.97	0.015	0.38
0.300	7.62	0.019	0.48
0.405	10.29	0.037	0.94

Comments: Top screws at base sheared off

NATURAL STONE ON WOOD STUDS

Test	Natural Stone (Granite)
1	Wood Studs

Frame ID	Span
6	120"

Test Date	Temp (°F)	Humidity
11-May-10	60.4	48%

Load Applied		
" WC	psf	Pa
2.7	14.0	673
2.9	15.1	722
3.3	17.2	822
3.2	16.6	797
3.2	16.6	797
4.5	23.4	1121
Failure	16.0	83.2	3985
Max	25.8	134.2	6426

Assembly Deflection			Assembly Residual Defl.	
L/	inches	mm	inches	mm
960	0.125	3.18	0.006	0.14
840	0.143	3.63	0.011	0.27
720	0.167	4.24	0.050	1.26
600	0.200	5.08	0.057	1.44
480	0.250	6.35	0.083	2.11
360	0.333	8.46	0.124	3.16
	1.350	34.29		

Back of Panel Deflection		Back of Panel Residual Defl.	
inches	mm	inches	mm
0.130	3.30	0.001	0.03
0.147	3.73	0.005	0.13
0.180	4.57	0.031	0.79
0.193	4.90	0.037	0.94
0.238	6.05	0.054	1.37
0.310	7.87	0.084	2.13

Comments: cracking of mortar joint at 16.0 "WC; no catastrophic failure

Test	Natural Stone (Granite)
2	Wood Studs

Frame ID	Span
9	120"

Test Date	Temp (°F)	Humidity
11-May-10	60.4	48%

Load Applied		
" WC	psf	Pa
2.2	11.4	548
2.5	13.0	623
2.6	13.5	648
3.2	16.6	797
3.8	19.8	947
4.9	25.5	1221
Failure	19.0	98.8	4733
Max	28.1	146.2	6999

Assembly Deflection			Assembly Residual Defl.	
L/	inches	mm	inches	mm
960	0.125	3.18	0.003	0.08
840	0.143	3.63	0.005	0.13
720	0.167	4.24	0.008	0.19
600	0.200	5.08	0.014	0.36
480	0.250	6.35	0.026	0.66
360	0.333	8.46	0.049	1.24
	1.650	41.91		

Back of Panel Deflection		Back of Panel Residual Defl.	
inches	mm	inches	mm
0.032	0.81	0.007	0.18
0.051	1.30	0.009	0.23
0.076	1.93	0.013	0.33
0.112	2.84	0.020	0.51
0.170	4.32	0.034	0.86
0.265	6.73	0.061	1.55

Comments: cracking of mortar joint at 19.0 "WC; no catastrophic failure

Test	Natural Stone (Granite)
3	Wood Studs

Frame ID	Span
8	120"

Test Date	Temp (°F)	Humidity
11-May-10	60.4	48%

Load Applied		
" WC	psf	Pa
2.7	14.0	673
3.0	15.6	747
3.4	17.7	847
3.9	20.3	971
4.6	23.9	1146
5.8	30.2	1445
Failure		0.0	0
Max	26.4	137.3	6576

Assembly Deflection			Assembly Residual Defl.	
L/	inches	mm	inches	mm
960	0.125	3.18	0.007	0.18
840	0.143	3.63	0.011	0.27
720	0.167	4.24	0.015	0.38
600	0.200	5.08	0.021	0.54
480	0.250	6.35	0.031	0.78
360	0.333	8.46	0.044	1.12

Back of Panel Deflection		Back of Panel Residual Defl.	
inches	mm	inches	mm
0.125	3.18	0.008	0.20
0.145	3.68	0.012	0.30
0.172	4.37	0.018	0.46
0.209	5.31	0.025	0.64
0.262	6.65	0.035	0.89
0.352	8.94	0.050	1.27

Comments: no failures observed

9 Summarized Results

Negative Wind Load Pressure Test

Masonry Veneer	Sheathing material	Stud wall construction	Ultimate Load (psf)		
			Test 1	Test 2	Test 3
Manufactured Stone	CDX Plywood	2×4 Wood studs	96.8	102.0	67.1
Natural Stone	CDX Plywood	2×4 Wood studs	83.2	98.8	*137.3**
Thin Brick	CDX Plywood	2×4 Wood studs	117.6	82.7	*149.8**
Manufactured Stone	Fiberglass-coated gypsum sheathing	16 Ga steel studs	*139.4**	*127.5**	*151.9**
Natural Stone	Fiberglass-coated gypsum sheathing	16 Ga steel studs	*163.9**	*151.9**	151.9
Thin Brick	Fiberglass-coated gypsum sheathing	16 Ga steel studs	*95.7**	*133.2**	153.5

**includes a maximum obtainable load in which failure was not reached*

10 Conclusion

A total of 18 test walls were witnessed for installation and subsequent structural testing. All observations and test results are reported herein.

At the deflection of L/600, there were no mortar cracks, no mortar failures or any wall system failures observed. The wall assemblies were also tested to a more rigorous deflection of L/360 at which there were no mortar cracks, no mortar failures or any wall system failures observed.

All tested wall assemblies witnessed by Intertek and reported herein were tested to meet the standard range of wall deflections, including a deflection of L/600 which is required for adhered masonry veneer installations per International Building Code sections 1405.9 (2006) and 1405.10 (2009).

INTERTEK

Components verified, construction witnessed, test supervised and reported by:

Claudio Sacilotto
Physical Testing Services

Reviewed by:

Ryan Huynh
Physical Testing Services

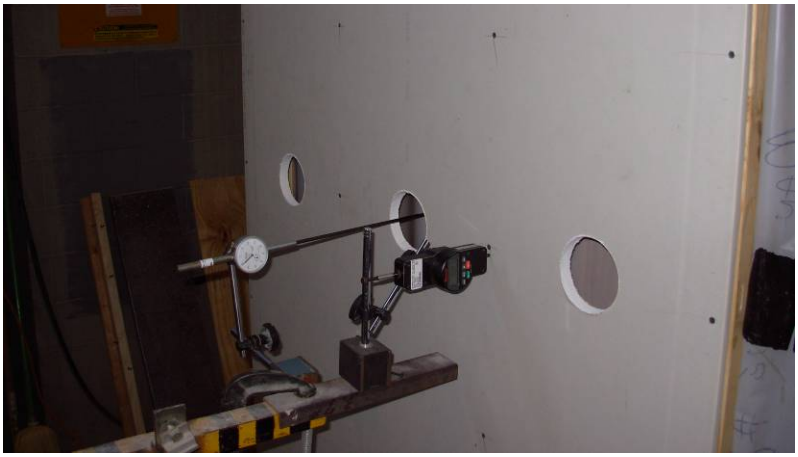
Appendix A – Photos

(Photos – 2 Pages)

Masonry application on to test frame

Grouting of masonry units

Structural performance test frame with wall assembly installed



Gage locations on test wall assembly. One gage on back of wall assembly and one gage on back of plywood/eXP® sheathing