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TO: LATICRETE Technical Sales Representatives

RE: LATICRETE® Masonry Veneer Installation SystemTM (MVIS) Test Report

LATICRETE is pleased to announce another industry first. Attached you will find an independent test report confirming that LATICRETE® MVIS™ performs equally to code approved conventional lath and plaster installation systems for adhered masonry veneers.

Part one of the report (Intertek report # 3196773TOR-009) describes the testing of various thin bed LATICRETE MVIS assemblies. All 18 assemblies, tested in accordance with ASTM E-330-02, met and exceeded the standard range of wall deflections; including the 2009 International Building Code prescribed standard of L/600 (sections 1405.9 [2006] and 1405.10 [2009]).

Part two of the report (NGC-WL -1003) describes the testing of conventional lath and plaster adhered manufactured stone and thin brick assemblies. Both assemblies were tested in accordance with ASTM E330-02 and met the same performance requirements described above.

The testing confirms that the performance of the LATICRETE MVIS assemblies performed equal to existing code approved conventional lath and plaster systems.

LATICRETE has developed adhered masonry veneer installation systems that are permanent, high strength, freeze/ thaw stable and protected from water intrusion. Backed by the LATICRETE® 25 Year System Warranty*, LATICRETE MVIS allows for increased productivity of adhered masonry veneers.

In the very near future, LATICRETE International, Inc. will secure an International Code Council Evaluation Service Report (ICC-ES) for LATICRETE MVIS. We hope that the attached LATICRETE MVIS test report helps you to secure additional specifications and sales.

Feel free to contact us with any questions or concerns.

Regards,

Arthur Mintie CSI, CDT Director, Technical Services LATICRETE International. Inc.

Cc LATICRETE Sales Representatives

Jether Mille

Letter # AM/am 045 - LATICRETE MVIS Test Report Cover Letter [20 October 2010]

* Please refer to LATICRETE International, Inc. warranty data sheet 025.0 for complete details



TEST REPORT

REPORT NUMBER: 3196773TOR-009

ISSUE DATE: October 15, 2010

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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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"



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**

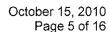
4.4. MASONRY GROUT

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.



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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 $(3.8 \ \ell)$ 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 ($1/2" \times 1/2" \times 1/2"$). 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.



Testing and Evaluation Results 8

MANUFACTURED STONE ON METAL STUDS

			У		
Test	Manufactured	Stone	Los	id App	ed
1	Steel Studs		"WC	psi	Pa
			5.0	26.0	1245
	Frame ID	Span	5.4	28.1	1345
	4	120"	6.4	33.3	1594
			7.8	40.6	1943
Test Date	Temp (°F)	Humidity	10.1	52.5	2516
12-May-10	61.7	49%	14.0	72.8	3487
		Fakur	е		
		Ma	x 26.8	139.4	6676

U	inches	mm	inches	mm
960	0.125	3.18	0.033	0.83
840	0.143	3.63	0.038	0.98
720	0.167	4.24	0.048	1.22
600	0.200	5.08	0.057	1.45
480	0.250	6.35	0.073	1.85
360	0.333	8.46	0.085	2.17

inches	mm		
		inches	Section 1980 (Section 1980)
0.145	3.68	0.042	1.07
0.162	4.11	0.047	1.19
0.185	4.70	0.054	1.37
0.218	5.54	0.062	1.57
0.274	6.96	0.070	1.78
0.360	9.14	0.085	2.16

Test	Manufacture	d Stone
2	Steel Studs	
,		
1	Frame ID	[Span
I	3	120"
7	7055	
1 est Date	Temp ('r)	Humiday
12-May-10	Temp (°F) 61.7	49%
		Failu

08	d App	lied	Asse	mbly Defle	ection	Assembly R	esidual D
>	psf	¹Pa ∵		inches	mm	inches	mm
	18.2	872	960	0.125	3.18	0.046	1.17
_	21.8	1046	840	0.143	3.63	0.054	1.38
	28.6	1370	720	0.167	4.24	0.066	1.68
_	32.3	1544	600	0.200	5.08	0.079	2.00
_	41.6	1993	480	0.250	6.35	0.097	2.46
3	61.4	2939	360	0.333	8.46	0.118	3.00
,	127.5	6103		0.650	16.51		

inches	mm	inches	mm
0.138	3.51	0.056	1.42
0.159	4.04	0.066	1.68
0.187	4.75	0.077	1.96
0.216	5.49	0.085	2.16
0.286	7.26	0.098	2.49
0.346	8.79 -	0.118	3.00

Test	Manufactured	Stone	Lo	ad App	lied
3	Steel Studs		*WC	psf	Pa
			4.3	22.4	1071
	Frame ID	Span	4.8	25.0	1196
	2	120"	6.0	31.2	1495
			7.9	41.1	1968
Test Date	Temp (°F)	Humidity	10.7	55.7	2665
12-May-10	61.7	49%	15.0	78.0	3736
,,		Failu	re		
		Ma	29.2	151 9	7273

"WC	psf	Pa
4.3	22.4	1071
4.8	25.0	1196
6.0	31.2	1495
7.9	41.1	1968
10.7	55.7	2665
15.0	78.0	3736
29.2	151.9	7273

Asse	Assembly Deflection			esidual Defl.
U	inches	mm	inches	mm
960	0.125	3.18	0.006	0.16
840	0.143	3.63	0.010	0.25
720	0.167	4.24	0.014	0.36
600	0.200	5.08	0.019	0.49
480	0.250	6.35	0.029	0.74
360	0.333	8.46	0.046	1.18
	0.701	17.81		

	el Detiection	Back of Panel	
inches	mm	inches	mm
0.130	3.30	0.007	0.18
0.146	3.71	0.009	0.23
0.171	4.34	0.014	0.36
0.207	5.26	0.018	0.46
0.265	6.73	0.029	0.74
0.360	9.14	0.048	1,22

MANUFACTURED STONE ON WOOD STUDS

Test	Manufactured	Stone
1	Wood Studs	
	g	
	Frame ID	120"
	Temp ("F)	Humidity
10-May-10	62.1	49% Failure
		railure May

	Load Applied			
"WC		Pa		
3.2	16.6	797		
3.4	17.7	847		
3.8	19.8	947		
4.3	22.4	1071		
5.4	28.1	1345		
6.6	34.3	1644		
18.6	96.8	4633		
29.7	154.5	7398		

Asse	Assembly Deflection			esidual Defl.
U.∴	inches	mm	inches	mm
960	0.125	3.18	0.010	0.25
840	0.143	3.63	0.014	0.36
720	0.167	4.24	0.018	0.45
600	0.200	5.08	0.022	0.56
480	0.250	6.35	0.032	0.81
360	0.333	8.46	0.044	1.13

Back of Panel Deflection		Back of Pane	l Residual Dell.
inches	No mm 1885	inches	mm
N/A	N/A	0.012	0.30
0,150	3.81	0.017	0.43
0.175	4.45	0.020	0,51
0.220	5.59	0.025	0.64
0.260	6.60	0.036	0.91
0.350	8.89	0.050	1.27
Comments:		ortar joint at 18.6 ' silure. No defi rec	

1001	Manutactoro	Cione	
2	Wood Studs		
	······································	ψ	
	Frame ID		
	3	120"	
Test Date	Temp (°F)	Humiday	
10-May-10	62.1	49%	
		Failt	
		M	

d App	ed ·	Asse	mbly Defi	ection	Assembly R	esidual D
psf	Pa	W.	inches	mm :	inches	mm
14.6	697	960	0.125	3.18	0.009	0.24
15.6	747	840	0.143	3.63	0.013	0.33
18.2	872	720	0.167	4.24	0.018	0.45
21.8	1046	600	0.200	5.08	0.024	0.61
26.0	1245	480	0.250	6.35	0.052	1.33
30.2	1445	360	0.333	8.46	0.084	2.14
102.0	4882		0.160	4.06		
155.0	7423					
	PSI 14.6 15.6 18.2 21.8 26.0 30.2 102.0	14.6 697 15.6 747 18.2 872 21.8 1046 26.0 1245 30.2 1445	Pa U 960 14.6 697 840 18.2 872 720 21.8 1046 600 26.0 1245 480 360 102.0 4882	P8 U Inches 14.6 697 860 0.125 15.6 747 840 0.143 18.2 872 720 0.167 21.8 1046 600 0.200 26.0 1245 480 0.250 30.2 1445 360 0.333 102.0 4882 0.160	P8	P8 P8 U Inches mm Inches

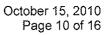
Back of Par	el Deflection	Back of Panel Residual Defl.		
inches	mm	inches	N. A. mm	
0.145	3.68	0.013	0.33	
0.160	4.06	0.017	0.43	
0.184	4.67	0.022	0.56	
0.214	5.44	0.030	0.76	
0.230	5.84	0.051	1.30	
0.330	8.38	0.075	1.91	
Comments:	cracking of m catastrophic f	ortar joint at 19.6 "\ aiture	WC; no	

COLUMN TO STATE OF	iwan ora crorec	i Sione
3	Wood Studs	
	Frame ID	Span
	3	120"
Test Date	Temp (°F)	
10-May-10	62.1	49%
		Failur

1					
	1.08	d App	ied i		
	*WC	psf	Pa		
	3.2	16.6	797		96
1	3.5	18.2	872		84
1	3.8	19.8	947	1	72
1	4.5	23.4	1121		60
1	5.5	28.6	1370		48
1	6.8	35.4	1694		36
э	12.9	67.1	3213		
×	30.2	157.1	7522		

Asse	Assembly Deflection			esidual Defi.
%- 1 /-∞	inches	mm	inches	mm
960	0.125	3.18	0.013	0.32
840	0.143	3.63	0.015	0.39
720	0.167	4.24	0.018	0.47
600	0.200	5.08	0.024	0.60
480	0.250	6.35	0.033	0.83
360	0.333	8.46	0.046	1.16
	1.400	35.56		

inches	mm	inches	mm
0.145	3.68	0.021	0.53
0.157	3.99	0.025	0.64
0.180	4.57	0.028	0.71
0.215	5.46	0.034	0.86
0.272	6.91	0.045	1.14
0.360	9.14	0.058	1.47





THIN BRICK ON STEEL STUDS

Test	Thin Brick		ľ	Loa	id App	lied 💠
1	Steel Studs			"WC	· psf	Pa
	-		1	4.5	23.4	1121
	Frame ID	Span	l	4.8	25.0	1196
	6	120"	1	5.5	28.6	1370
,			1	6.3	32.8	1569
Test Date:	Temp (°F)	Humidity		7.5	39.0	1868
28-May-10	73.9	58%		11.6	60.3	2889
		Failu	re			
		M:	ax[18.4	95.7	4583

Asse	mbly Defi	ection	Assembly R	esidual Defl.
<i>U</i>	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		i .

0.152 3.8 0.179 4.5 0.208 5.2	6 0.016	
0.179 4.5		
*11.1	5 0.056	1 1 1 7
0.208 5.2		> { 1.447
	8 0.074	4 1.88
0.251 6.3	8 0.096	8 2.49
0.310 7.8	7 0.116	6 2.95
0.412 10.4	16 0.135	5 3.43

Test	Thin Brick	
2	Steel Studs	
	Frame ID	Span
	1	120"
	Temp (°F)	Humidity :
28-May-10	73.9	58%
		Failure
		11.

LO	od Appl	ed .
"WC	psi	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
25.6	133.2	6377

	mbiy Defi	ection	Assembly R	esidual Defl.
U	inches	mm	inches	i mm K
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		

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

Test	Thin Brick	
3	Steel Studs	
	Frame ID	Span
	5	120"
Test Date	Temp (°F)	Humidity
28-May-10	73.9	58%

	LUC	iu App	100
	".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
é	29.5	153.5	7348
×			

Assembly Deflection			Assembly Residual Defi.			
U	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 Pan	el Deflection	Back of Panel	Residual Deff.
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

THIN BRICK ON WOOD STUDS

Test	Thin Brick			Los	d App	ied
1	Wood Studs			"WC	psf	Pa
Lancing Control	•		٠	2.2	11.4	548
	Frame ID	Span	П	2.5	13.0	623
	5	120"	Н	2.9	15.1	722
				3.2	16.6	797
Test Date	Temp (°F)	Humidity	П	4.1	21.3	1021
10-May-10	64.3	46%	П	5.0	26.0	1245
		Fail	ire	22.6	117.6	5629
		M	ax	25.8	134.2	6426

	 100	առբբ	LUC
ं	Pa	psf	"WC
	548	11.4	2.2
	623	13.0	2.5
	722	15.1	2.9
	797	16.6	3.2
	1021	21.3	4.1
	1245	26.0	5.0
	5629		22.6
	6426	134.2	25.8

Assembly Deflection		Assembly Residual D		
IJ	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 Def		
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	

Test	Thin Brick	I
2	Wood Studs	
	Frame ID	
	4	120"
Test Date	Temp (°F)	Humidity :
11-May-10	61.4	48%
		Failur
		Ma

	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
15.9	82.7	3961
26.7	138.9	6651
	2.4 2.9 3.3 3.8 4.8 6.0 15.9	2.4 12.5 2.9 15.1 3.3 17.2 3.8 19.8 4.8 25.0 6.0 31.2 15.9 82.7

Load Applied

Assembly Deflection			Assembly Residual De		
ಾ⊍್	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	

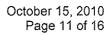
Back of Pan	el Deflection	Back of Panel	Residual Defl.
inches	mm	inches	mm
0.125	3.18	0.009	0.23
0.145	3.68	0.011	0.28
0.167	4.24	0.014	0.36
0.200	5.08	0.017	0.43
0.250	6.35	0.024	0.61
0.330	8.38	0.035	0.89
Comments:	cracking of mi catastrophic fa	ortar joint at 15.9 "\ aiture	WC; no

Test	Thin Brick	
3	Wood Studs	
	Frame ID	
	7	120"
Test Date	Temp (°F)	Humidity
11-May-10	61.4	48%
		Failur
		Ma

Ŧ	100	id App	hai
1	LO		
l	. AAC	psf	Pa
1	2.4	12.5	598
1	2.6	13.5	648
1	2.9	15.1	722
I	3.5	18.2	872
I	4.1	21.3	1021
1	5.4	28.1	1345
ı			
I	28.8	149.8	7174
-			

Assembly Deflection			Assembly R	esidual Defl.
$-\mathbf{U}$	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

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





NATURAL STONE ON METAL STUDS

Test	Natural Stone (Granite)			Los	1
1	Metal Studs			#WC	
				7.1	Γ
	Frame ID	Span		7.7	Γ
	9	120"		9.1	Γ
				10.2	Γ
	Temp (°F)	Humidity		12.4	Γ
14-May-10	61.9	60%		15.9	Γ

Los	id App	ied	Ι.	
. WC	psf	Pa		
7.1	36.9	1769		
7.7	40.1	1918		
9.1	47.3	2267		Г
10.2	53.1	2541		Г
12.4	64.5	3089		
15.9	82.7	3961		Г
31.5	163.9	7846		

Asse	Assembly Deflection			esidual Defi.
ಾಟ್ ಾ	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 Deff.		
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	
	no failures ob		7.07	

Test	Natural Stoné (Granite)		
2	Metal Studs		ı
	Frame ID	Span	ı
	7	120"	ı
			•
Test Date	Temp (°F)	Humidity	ı
14-May-10	61.9	60%	ı
		Faiu	ı re

	Load Applied			
	"WC	psf	a a.	
	5.2	27.1	1295	
1	5.4	28.1	1345	
1	6.2	32.3	1544	
1	7.0	36.4	1744	
1	10.1	52.5	2516	
1	13.6	70.8	3388	
9				
×	29.2	151.9	7273	

	Assembly Deflection			Assembly Residual Defl	
∵.U.	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				

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

Test	Natural Stone (Granite)
3	Metal Studs

•	Frame (D	Span	Г
I	8	120"	ľ
			Γ
	Temp (°F)	Humidity	
14-May-10	61.9	60%	
		Failu	re
		M:	ax

pst	⊢a
35.4	1694
40.6	1943
47.9	2292
57.2	2740
66.1	3163
82.7	3961
151.9	7273
	35.4 40.6 47.9 57.2 66.1 82.7

Load Applied

Assembly Deflection			Assembly R	esidual Defl.
U	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		
		1		

inches	ាខារា	inches	mm
0.148	3.76	0.006	0.15
0.169	4.29	800.0	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

NATURAL STONE ON WOOD STUDS

/ood Studs	
rame ID	Span
6	120"
	ame ID

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

	3.3	17.2	822	
	3.2	16.6	797	
ty:	3.2	16.6	797	ı
	4.5	23.4	1121	İ
ailure	16.0	83.2	3985	
Max	25.8	134.2	6426	

"WC psf Pa 2.7 14.0 673 2.9 15.1 722

Assembly Deflection			Assembly R	esidual Defi.
U	inches	លាភា	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 Pan	el 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 me catastrophic fa	ortar joint at 16.0 "\ eiture	NC; no

Test	Natural Stone (Granite)
2	Wood Studs

	Frame ID	Span
	9	120"
Test Date	:Temp (°F)	Humidity
11-May-10	60.4	48%

lumidity		L
48%		
Failu	re	Γ
		r

					_
Load Applied				Asse	mbly
	psf	Pa		U	incl
2.2	11.4	548		960	0.1
2.5	13.0	623	1	840	0.1
2.6	13.5	648		720	0.1
3.2	16.6	797		600	0.2
3.8	19.8	947		480	0.2
4.9	25.5	1221		360	0.3
9.0	98.8	4733			1.6
8.1	146.2	6999			

Asse	Assembly Deflection			esidual Defl.
U	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		

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 mo	ortar joint at 19.0 "\ ailure	NC; no

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	ı	
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		
	0.0	0		
26.4	137.3	6576		

u	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 Pan	el 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



9 Summarized Results

Negative Wind Load Pressure Test

Masonry Veneer	Sheathing	Stud wall	Ultimate Load (psf)			
Masomy veneer	material	construction	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



October 15, 2010 Page 13 of 16

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)





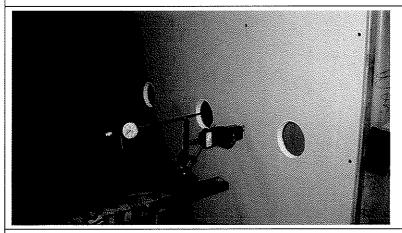
Masonry application on to test frame



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



Structural Testing Laboratory



TEST REPORT

Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure – ASTM E 330-02 Procedure B

Test Date: May 27, 2010

Report Issue Date: June 16, 2010

Reissued Date: October 22, 2010

Report Number: WL-1002 Project Number: J-131-N

Prepared For:
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Charlotte, North Carolina 28211-3498

And

Laticrete International Incorporated One Laticrete Park North, 91 Amity Road Bethany, Connecticut 06524-3423

Prepared By:
NGC Testing ServicesTM
1650 Military Road
Buffalo, New York 14150

The results reported in this document apply to specific samples submitted for measurement. No responsibility is assumed for performance of any other specimen.

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3.	DESCRIPTION OF WALL ASSEMBLY	PAGE	4
4.	TEST PROCEDURE	PAGE	5
5.	DESCRIPTION OF TEST RESULTS	PAGE	5
6.	TEST DATA PAGES	PAGE	7
7.	PHOTOGRAPHS	PAGE	8



1. INTRODUCTION

On May 27, 2010, NGC Testing Services ™ conducted vertical negative load tests for National Gypsum Company of Charlotte, NC. Panel assemblies were constructed with 2 in. by 4 in. nominal wood framing members, 16 in. on centers. A single layer of 1/2 in. CDX plywood was nailed onto the framing members. A double layer of 15 lb. felt paper was stapled to the face of the plywood. Metal lath was then nailed over the felt paper. A scratch coat of Type S mortar was applied over the lath. A layer of either, manufactured stone, natural stone or tin brick was applied over the scratch coat with Laticrete masonry veneer mortar. The joints were finished with Laticrete pointing mortar. The panel assemblies measured 4 ft wide by 10 ft long. The panels were tested in accordance to ASTM E 330 – 02 Standard Test Method. The total loads achieved for each specimen is detailed in the data pages.

Construction of all framing and panel assemblies was performed by NGC Testing Services TM personnel on site. All Stone work was performed by Buffalo Tile employees. Stone work was witnessed by Greg Sherwood, a representative of Laticrete. Testing was performed on three like wall panel assemblies.

Testing was conducted by Steven Armenia, Test Technician, and Andrew Heuer, Test and Quality Engineer, both of NGC Testing Services TM.

2. TEST APPARATUS

The test apparatus utilized met the criteria outlined in test standard ASTM E 330 – 02 for negative wind load testing. The test chamber has one open side from which to mount and seal the test specimen. A pressure tap is mounted into back of chamber to measure the pressure difference across the test specimen. The air supply inlet is located such that it does not impinge on the test specimen directly with any significant velocity. A window is placed on the side of the test chamber to make viewing of the exposed side of the sample possible. The test chamber can accommodate samples up to 4 feet wide and up to 16 feet long. Air was exhausted from the chamber with a Variac controlled 6.5 HP vacuum and pressure readings were measured utilizing a differential pressure transmitter with a digital meter. Lateral deflections were recorded at the test sample horizontal and vertical center lines via a dial indicator and at the vertical centerline at a framing member via a digital indicator.



3. DESCRIPTION OF WALL ASSEMBLIES

Three like test specimens consisted of nominal 2 in. x 4 in. SPF wood studs spaced 16 inches on center. The studs were attached to nominal 2 in. x 4 in. wooden plates. The studs were nailed in to the plates with two (2) 16d common nails. There was no center stud. A single layer of 15/32 in. CDX plywood was nailed onto the framing members with 8d common nails. The nail spacing was 6 in. on center around the perimeter and 12 in. on center along the intermediate studs. A double layer of 15 Lb. felt paper was stapled onto the plywood, with an overlap between the layers. Each layer was stapled 12 in. on center. 3.4 Lb. Metal lath was nailed over the felt paper. A 1 in. overlap was used at every occurring overlap. The lath was nailed 6 in. on center with 1-1/2 in. roofing nails. A scratch coat of Type S mortar was applied over the metal lath, nominally 3/8 in. thick. A single layer of 5/8 in. gypsum wallboard was attached to the back side of the assembly to prevent stud twisting during testing. The gypsum was attached with 1-1/4 in. coarse thread bugle headed screws 12 in. on center. The samples were 48 in. wide x 120 in. high. Average specimen weight was found to be 270 pounds without the stone toppings applied. A continuous sheet of 4 mil polyethylene was placed over the entire assembly and sealed to the test frame to aid in creating an airtight chamber and to ensure uniform application of test loads. A single test panel was made with one of the three possible coverings; manufacture stone, natural stone or thin brick. One of each was tested, for a total of three assemblies.

- A layer of natural stone was applied over the scratch coat with Laticrete masonry veneer mortar. Each tile was back buttered around the perimeter and placed into a wet mortar bed. The tiles measured 12 in. x 12 in. by 3/8 in. thick. Sample weight was 6.9 PSF.
- A layer of manufactured stone was applied over the scratch coat with Laticrete
 masonry veneer mortar. Each stone was back buttered around the perimeter and
 placed into a wet mortar bed. The stones were of various lengths and widths and
 depths. Sample weight varied due to sizes and shapes of stones.
- A layer of thin red brick was applied over the scratch coat with Laticrete masonry veneer mortar. Each brick was back buttered around the perimeter and placed into a wet mortar bed. The bricks measured 2-1/4 in. x 7 in. by 5/8 in. thick. Sample weight was 6.0 PSF.



4. TEST PROCEDURE

Testing was conducted in accordance to ASTM E 330 - 02 procedure B. Any construction material that was not to be used or installed in or on a building unit was removed prior to testing. The specimens were inserted into the test frame and seated. The specimens were secured to a top plate only via a 2 in. by 10 in. wooden board and six (6) 2-1/4 in. long coarse threaded bugle head screws. The sample was taped to the outside of the test frame to create an air tight chamber. The poly sheeting was bunched so that it would not restrict the sample from reaching maximum deflection during testing. Six incremental deflections were tested. Increments were; L/960, L/840, L/720, L/600, L/480 and L/360. At the correct decimal reading, the timer was started and held for a ten second period and the pressure was recorded then released. The system was then allowed to stabilize for two minutes prior to the next load in the program.

A dial indicator was placed at wall vertical and horizontal center points to measure the lateral deflection of the specimen under live load and the set after the release of the load. A separate digital indicator was placed at the vertical centerline on a framing member to record the lateral deflection of the entire assembly. Both indicators were detached from the test frame. A small pre-load of (-1) in. of water was applied to the assembly, and then the load was released, allowing the assembly to rest until all set deflections stabilized. The indicators were again zeroed and the test commenced.

A total of three tests for each assembly type was conducted in according to the above mentioned procedure.

5. DESCRIPTION OF TEST RESULTS

The failure mode for all wall panel assemblies tested was not definitively determined. The test assemblies held up throughout the above mentioned testing protocol. The assembly failure could not be determined since the test frame itself was becoming the limiting factor. The tests were stopped before ultimate failure occurred to assemblies to prevent any further damage to the test chamber itself. The values reached are not the ultimate failure values, but rather a stopping point of the test due to the tester's discretion.



Tested and witnessed by:

Steven M. Armenia

Test Technician

Andrew Heuer

Test and Quality Engineer

Attachments:

Reviewed by:

Robert J. Menchetti

Director NGC Testing Services



6. Test Data Pages

Summary of ASTM E-330 Test Data						
				L-Value, In.	Height, in.	Deflection, in.
				120	960	0.125
Assignment No.	J-131-N	Assembly	Lath and Scratch Coat	120	840	0.143
Date	3/14/1900		PormaBase, Plywood	120	720	0.107
Temperature, DegF	59		Wood Stude	120	000	0.200
Humidity, % R.H.	68%		Manufactured Stone	120	400	0.260
				120	380	0.333

			Start			Set		
Assembly		Dollacti	on (inches)	Inches of Water	Deliction (inches)			
Number	Deflection, In.							
		Assembly	Sack of Panel	Lond Applied	Assembly	Back of Panel		
lanufactured	0.125	0.134	0.140	2.8	0.005	0.009		
Stone	0.143	D,150	0.160	3.1	0.011	0.025		
	0.167	0.170	0.105	35	0.015	0.010		
	0.200	0,214	0.222	42	0 021	0.028		
[
Ė	0.250	6.257	0.265	40	0.031	0.036		
		0.257 0.354	0.265 0.363	4 B 6.5	0.049	0.036 0.054		

Comments

A small initial prolocit was applied to the assembly to check for teaks and propor setting of panels in lest chamber.

The Load was applied and held for 10 seconds, randings taken, then load was released. Readings taken again after a 2 minute set period

Failure of topping No visible failure

Calastrophic Failure

Assignment No.	J-131-N
Date	5/27/2010
Temperature, DegF	76.6
Humidity, % R.H.	60%

Assembly	Lath and Scratch Coat
	PermaBase, Plywood
	Wood Studs
	Natural Stone

			Start			Sel
Assambly		Deflect	on (inches)		Opflecti	on (inches)
Number	Deliaction. In.					T
		Assembly	Back of Panel	Load Applied	Assembly	Back of Panel
Natural	0.125	0.122	0.054	2.5	0.000	0.000
Stone	0143	0.144	0.125	2.6	0.000	0.000
	0 107	0.172	0.195	2.8	0.000	0.002
	0 200	0.221	8,241	3.0	0.020	0.000
	0.250	Ð.310	0.338	3,6	0.023	0.000
	0 333	0.354	0.200	4.5	0.035	0.045
	Fallure					1

Comments

Entere of topping No visible failure	
Colostrophic Follure	

Assignment No.	J-131-N
Date	5/27/2010
Tomporature, DegF	77.5
Humidity, % R.H.	58%

Assombly	Lath and Scratch Coat
	PormaBaso, Plywood
	Wood Studs
	Thin Red Brick

			Start	Got Dollacijan (inches)		
Assembly	Deflection, in.	Dellection (inches)				
Number			!			1
		Assembly	Back of Panel	Lond Applied	Assembly	Bock of Panel
Thin	0.125	0.138	0.155	2.3	0.017	0.002
Brick	0.143	0.151	0.137	2.7	0.021	0.078
	0 167	0.105	0.200	2.0	0.020	0.072
	0.200	0.215	0.275	3.2	0.035	0.060
	0 250	0.290	0.285	37	0.093	0.103
	0.333	0.361	0.360	4.2		
	Falluro		1		***************************************	·•

Fallute of topping No visible failure
Colostrophic Fallure



7. PHOTOGRAPHS

PHOTO #1 Typical Test Assembly Setup

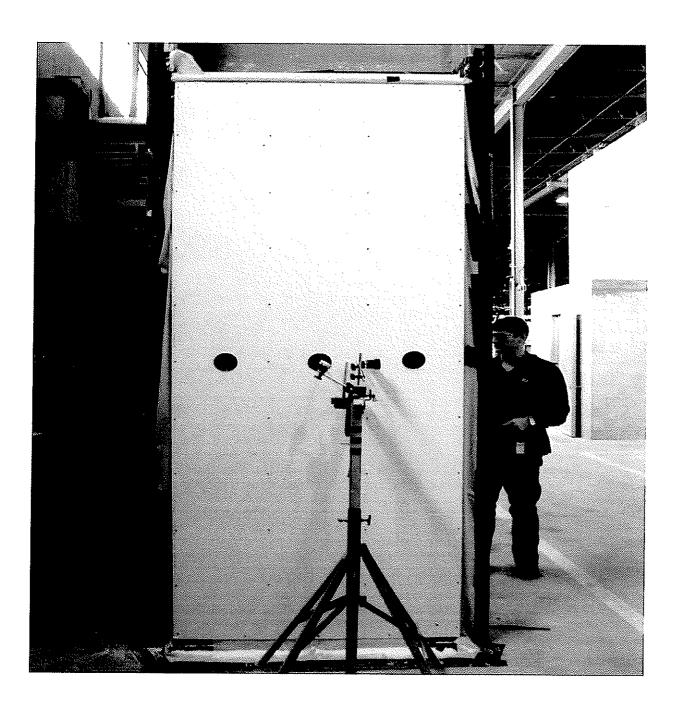




PHOTO #2 Manufactured Stone Assembly





PHOTO #3 Thin Brick Stone Assembly

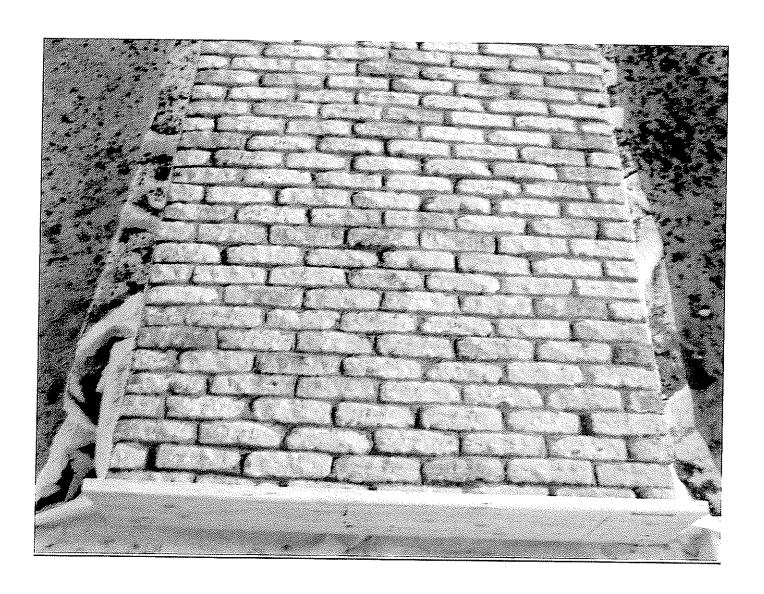




PHOTO #4 Natural Stone Assembly

