

EVALUATION OF CONCRETE MASONRY UNITS PREFACED WITH SPECTRA GLAZE II MATERIAL

Project No. 18-257
May 21, 2018

Conducted For:



CONDUCTED BY:



ACCREDITED BY:



RESEARCH AND DEVELOPMENT LABORATORY

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Research and Development Laboratory Staff

Douglas H. Ross, *Manager, Research and Development Laboratory*
Tim Jones, *Senior Laboratory Technician*
Amber Edmonds, *Materials Research Assistant*
Zach O’Bruba, *Laboratory Technician*

NCMA Technical Staff

Jason J. Thompson, *Vice President of Engineering*
Monika Nain, *Structural Hardscapes Manager*
Brian Roye, *Engineering Projects Manager – Structural*

National Concrete Masonry Association
Research and Development Laboratory
13750 Sunrise Valley Drive
Herndon, Virginia 20171
(703) 713-1900
www.ncma.org

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Douglas H. Ross, Manager, Research and Development Laboratory

5/21/2018



Jason J. Thompson, Vice President of Engineering

5/21/2018

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Evaluation of Concrete Masonry Units Prefaced with Spectra Glaze II Material

1. INTRODUCTION

This report covers the testing of concrete masonry units that have a proprietary material applied to the face of the units. The trade name of this facing material is “Spectra Glaze II.” Units supplied to the Laboratory for evaluation had one face on which this facing material was applied. These units were evaluated for compliance with both ASTM C90-16a, *Standard Specification for Loadbearing Concrete Masonry Units* (Ref. 1), as well as ASTM C744-16, *Standard Specification for Prefaced Concrete and Calcium-Silicate Masonry Units* (Ref. 2).

2. MATERIALS

2.1 Concrete Masonry Units

The concrete masonry units provided had nominal dimensions of 4 x 8 x 16 in. (102 x 203 x 406 mm) and were tested in accordance with ASTM C140-17b, *Standard Specification for Concrete Masonry Units and Related Units* (Ref. 3). A summary of the ASTM C140-17b test results is provided in Table 1 with detailed results provided in Appendix A. Units without the facing material were not evaluated in this project, therefore, compliance with ASTM C90-16a prior to application of the facing material could not be determined. However, the tested units with the facing material did comply with the compressive strength, absorption, and dimensional tolerance requirements of ASTM C90-16a.

Tested Property	Average Test Results
Width, in. (mm)	3.66 (93)
Height, in. (mm)	6.82 (173.2)
Length, in. (mm)	15.55 (395)
Minimum Face Shell Thickness, in. (mm)	1.04 (26.4)
Minimum Web Thickness, in. (mm)	1.04 (26.4)
Compressive Strength, psi (MPa)	3,060 (21.1)
Density, lb/ft ³ (kg/m ³)	95.2 (1525)
Absorption, lb/ft ³ (kg/m ³)	12.8 (205)
Percent Solid, %	85.0

2.2 Prefaced Material

The concrete masonry units were provided to the Laboratory with the facing material already applied. The trade name of the facing material is “Spectra Glaze II”, a concrete masonry unit with the “Spectra Glaze II” material is shown in Figure 1 as received by the Laboratory.



Figure 1 – As-received Concrete Masonry Unit with “Spectra Glaze II” Material

3. C744-16 TESTING PROCEDURES

3.1 Adhesion of Facing

The facing material was tested for adhesion to the concrete masonry unit in accordance with Section 7.4 of ASTM C744-16. During compressive strength testing, the units were inspected for visible failure of adhesion of the facing material without magnification.

3.2 Resistance to Crazeing, Cracking, and Spalling

The resistance to crazing, cracking, and spalling of the facing material was evaluated in accordance with Section 7.2 of C744-16. Following oven-drying of the units during the absorption procedure of ASTM C140-17b, the units were cooled to room temperature and then resaturated for a period of 24 hours. The units were then removed from the water tank and immediately inspected for crazing, cracking, or spalling of the facing material.

3.3 Resistance to Chemicals

Nine different chemicals were used on the facing material to determine resistance to chemicals in accordance with Section 7.3 of ASTM C744-16. The chemicals were left on the units for the period of time defined in ASTM C744-16. The chemicals were then wiped with a clean cloth and the test area was inspected for any change in appearance. The chemicals used and the duration of the test is shown in Table 2.

Table 2 – Resistance to Chemicals Test	
Chemical	Test Duration, hr
Acetic Acid (CH ₃ COOH) (5%)	24 hr
Hydrochloric Acid (HCL) (10%)	3 hr
Potassium Hydroxide (KOH) (10%)	3 hr
Trisodium Phosphate (Na ₃ PO ₄) (5%)	24 hr
Hydrogen Peroxide (H ₂ O ₂) (3%)	24 hr
Household Detergent (10%)	24 hr
Vegetable Oil	24 hr
Blue-Black Ink	1 hr
Ethyl Alcohol, Industrial Denatured (95%)	3 hr

An example of chemical application is shown in Figure 2 and the removal of the chemical is shown in Figure 3.

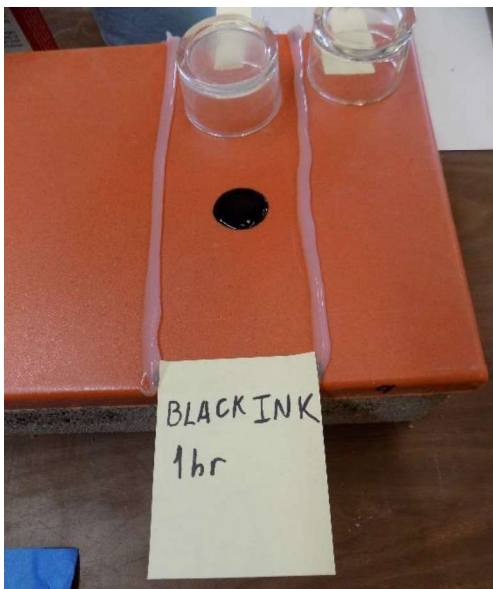


FIGURE 2 – BLACK INK APPLICATION



FIGURE 3 – REMOVAL OF BLACK INK

3.4 Soiling and Cleansability

The soiling and cleansability of the facing material was evaluated using both staining and spotting media in accordance with ASTM C744-16. The staining media used was a mixture of 0.5 g (0.001 lb) of oil-soluble dye, 1.0 g (0.002 lb) of lanolin, and 5.0 g (0.011 lb) of SAE 10 oil. Four spotting media were used, No. 2 writing pencil, magic marker, lanolin, and carbon paper. Each was applied in accordance with ASTM C744-16 and cleaned using the procedure outlined in ASTM C744-16 and ASTM D2486-17, *Standard Test Methods for Scrub Resistance of Wall Paints* (Ref. 4). Table 3 shows the application method, cleaning media, and number of scrub cycles for these tests.

Table 3 – Soiling and Cleansability Test			
Media	Application	Cleaning Media	Number of Scrub Cycles
Mix of:0.5 g oil-soluble dye, 1.0 g lanolin 5.0 g SAE 10 oil (staining)	½ inch diameter spot for four days	Industrial-grade cleaning agent	80
No. 2 Writing Pencil (spotting)	Single line along CMU using 500 g (1.10 lb) applicator	Industrial-grade cleaning agent	10
Magic Marker (spotting)	Single line along CMU using 500 g (1.10 lb) applicator	100% Isopropyl Alcohol	150
Lanolin (spotting)	Single line along CMU with artist's brush	Industrial-grade cleaning agent	60
Carbon Paper (spotting)	Single stroke of 500 g (1.10 lb) weight on 1 in. ² (645.2 mm ²) of paper	Industrial-grade cleaning agent	60

An example of the application of spotting media using the 500 g (1.10 lb) applicator is shown in Figure 4. The use of the scrubbing brush is shown in Figure 5.

After the appropriate number of scrubbing cycles, the units were examined at a distance of 10 ft (3 m) and categorized by the following intensity scale:

- A – Stain completely removed
- B – Trace
- C – Evident
- D – Pronounced
- E – Very Pronounced



Figure 4 – Application of Magic Marker Spotting Media

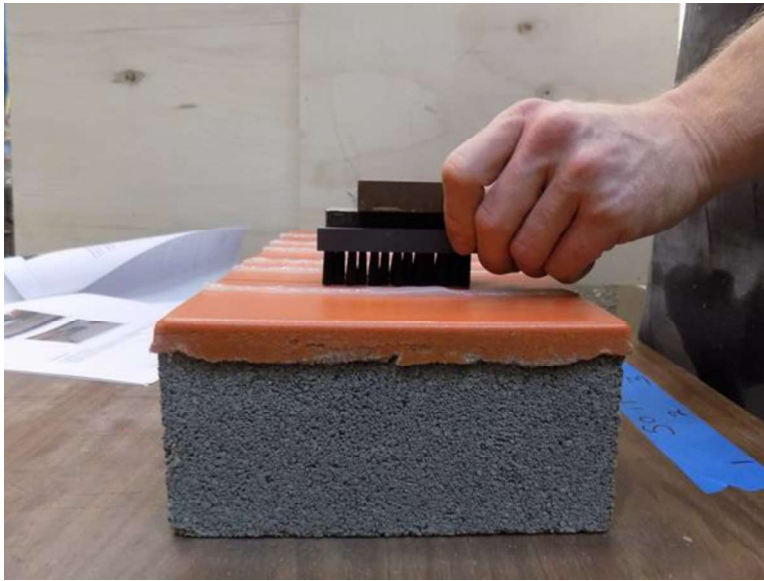


Figure 5 – Scrubbing of Staining and Spotting Media

4. RESULTS

4.1 Adhesion of Facing

At the time of compressive test failure, there was no visible failure of the adhesion of the facing material. Figure 6 shows the post-failure surface of one of the units. While cracking was seen throughout the unit, the facing material remained intact and adhered to the unit.



Figure 6 – Post Compression Testing Unit Face

4.2 Resistance to Crazeing, Cracking, and Spalling

After the resaturation, the facing material was inspected, and no visible crazeing, cracking or spalling was observed on any of the units. Figure 7 shows post saturation of one unit.



FIGURE 7 – UNIT AFTER RESATURATION

4.3 Resistance to Chemicals

Table 4 provides the results of the resistance to chemicals test for each of the units evaluated.

Table 4 – Resistance to Chemicals Results	
Chemical	Unit 1
Acetic Acid	No change
Hydrochloric Acid	No change
Potassium Hydroxide	No change
Trisodium Phosphate	No change
Hydrogen Peroxide	No change
Household Detergent	No change
Vegetable Oil	No change
Blue-Black Ink	No change
Ethyl Alcohol, Industrial Denatured	No change

As seen above, there was no change observed on any of the units. Figure 8 is a close up of the unit after application and removal of chemicals.



Figure 8 – CMU after Exposure to Chemicals

4.4 Soiling and Cleansability

Table 5 provides the results of the soiling and cleansability testing for each of the units tested.

Table 5 – Resistance to Chemicals Results¹	
Media	Unit 1
Mix of: 0.5 g oil-soluble dye, 1.0 g lanolin, 5.0 g SAE 10 oil (staining)	A
No. 2 Writing Pencil (spotting)	A
Magic Marker (spotting)	A
Lanolin (spotting)	A
Carbon Paper (spotting)	A

¹Results based on intensity scale from Section 3.4

Based on these results, there was no visible stain left after scrubbing from the staining media. Figure 9 is a close up of the unit after application and removal of staining media.



Figure 9 – Close-Up of the Unit after Application and Removal of Staining Media

5. SUMMARY

Concrete masonry units prefaced with “Spectra Glaze II” material were evaluated for compliance with both ASTM C90-16a and ASTM C744-16. The units with the facing material adhered to one face complied with the compressive strength, absorption, and dimensional requirements of ASTM C90-16a. Units without facing material were not evaluated as part of this project. The facing material complied with the requirements for adhesion and resistance to crazing, cracking, and spalling. When exposed to chemicals, the units resisted all applied chemicals. For the soiling and cleansability tests, the units were found to have no evidence of staining when exposed to the staining media (mix of oil—soluble dye, lanolin, and SAE 10 oil), and no evidence of spotting when exposed to writing pencil, lanolin, and carbon paper. Abrasion, surface burning, and color change were not evaluated as part of this project.

6. REFERENCES

1. ASTM Standard C90-16a, 2016, “Standard Specification for Loadbearing Concrete Masonry Units”, ASTM International, West Conshohocken, PA, www.astm.org.
2. ASTM Standard C744-16, 2016, “Standard Specification for Prefaced Concrete and Calcium Silicate Masonry Units”, ASTM International, West Conshohocken, PA, www.astm.org.
3. ASTM Standard C140/C140M-17b, 2017, “Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units”, ASTM International, West Conshohocken, PA, www.astm.org.
4. ASTM Standard D2486-17, 2017, “Standard Test Methods for Scrub Resistance of Wall Paints”, ASTM International, West Conshohocken, PA, www.astm.org.

APPENDIX

In the appendix, the values presented are in inch-pound units. The following conversions to SI units can be used:

$$1 \text{ in} = 25.4 \text{ mm}$$

$$1 \text{ lb/ft}^3 = 16.0 \text{ kg/m}^3$$

$$1 \text{ lb (mass)} = 0.4536 \text{ kg}$$

$$1 \text{ lb (force)} = 4.45 \text{ N}$$

$$1 \text{ psi} = 6.895 \text{ kPa}$$

Appendix A – ASTM C140-17b Results

ASTM C140/C140M-17b Test Report Sampling and Testing Concrete Masonry Units and Related Units

Job No.: 18-257
Report Date: 3/27/2018

Client: Texas Building Products
Address: 3261 Hwy 108
Strawn, TX 76475

Testing Agency: National Concrete Masonry Association
Address: Research and Development Laboratory
13750 Sunrise Valley Drive
Herndon, VA 20171-4662

Standard Specification: ASTM C90-16a

Sampling Party: Texas Building Products

Unit Description: 4 x 8 x 16 inch Concrete Masonry Unit
Mark: 'Spectra Glaze'

Date Samples Received: 2/7/2018

Summary of Test Results

Physical Property	ASTM C90-16a Specified Values		Average Test Results	Physical Property	ASTM C90-16a Specified Values		Average Test Results
	Values	Results			Values	Results	
Net Compressive Strength	2000 min	3060	psi	Min. Faceshell Thickness (t_{fs})	0.75 min	1.04	in.
Gross Compressive Strength	****	2600	psi	Min. Web Thickness (t_w)	0.75 min	1.04	in.
Density	****	95.2	pcf	Equivalent Web Thickness	****	3.20	in.
Absorption	18 max	12.8	pcf	Normalized Web Area (A_{wn})	6.5 min	35.5	in. ² /ft ²
Percent Solid	****	85.0	%	Equivalent Thickness	****	3.11	in.
Net Cross-Sectional Area	****	48.39	in. ²	Max. Var. from Spec. Dimensions	.125 max	0.045	in.
Gross Cross-Sectional Area	****	56.93	in. ²				

Individual Unit Test Results

Compression Units	Specimen No.	Received		Cross-Sectional Area *		Max. Load lb	Compressive Strength	
		Weight lb	Gross in ²	Net in ²	Gross psi		Net psi	
	#1	16.72	56.93	48.39	154990	2720	3200	
	#2	16.78	56.93	48.39	156150	2740	3230	
	#3	16.42	56.93	48.39	133420	2340	2760	
Date Tested: 3/15/2018	Average	16.64	56.93	48.39	148190	2600	3060	

* Unit areas determined as the average of the three absorption units and are assumed to be the same as those units tested in compression.

Absorption Units	Specimen No.	Avg Width in.	Avg Height in.	Avg Length in.	Minimum Web Height in.	Avg./Min.		Minimum Web Area in. ²	Normalized Web Area in. ² /ft ²
						Face Shell Thickness in.	Min. Web Thickness in.		
	#4	3.67	6.83	15.56	6.83	1.03	1.04	28.33	35.6
	#5	3.65	6.81	15.52	6.81	1.05	1.03	28.06	35.3
	#6	3.67	6.82	15.56	6.82	1.05	1.04	28.35	35.7
Date Tested: 2/28/2018	Average	3.66	6.82	15.55	6.82	1.04	1.04	28.25	35.5

**Where the thinnest points of opposite face shells differ in thickness by less than 0.125 inches, their measurements are averaged.

Date Tested: 2/21/2018 to 2/23/2018	Specimen No.	Received Weight lb	Immersed Weight lb	Saturated Weight lb	Oven-Dry Weight lb	Absorption pcf	Density pcf	Net Volume ft ³	Percent Solid %
	#4	18.34	8.67	20.50	18.08	12.8	95.4	0.1896	84.2
	#5	18.58	8.77	20.80	18.30	13.0	94.9	0.1928	86.4
	#6	18.38	8.68	20.56	18.12	12.8	95.2	0.1904	84.5
	Average	18.43	8.71	20.62	18.17	12.8	95.2	0.1909	85.0

Client: Mr. John P. Orsina
Address: Westbrook Concrete Block Co., Inc.
PO Box 700
Westbrook CT 06498

Project Name: Westbrook Concrete Block Lab Tests

Date Received: February 3, 2016

Date of Compression Testing: February 25, 2016

Unit Specification: ASTM C90

Unit Designation and Description: Concrete Masonry Unit
4x8x16" Regular Light Weight

Laboratory Number: 10- 137747

Summary of Test Results

Physical Property	Specification Values	Average Test Results	Physical Property	Specification Values	Average Test Results
Net Compressive Strength (min.)	2000	3840 <i>psi</i>	Min. Faceshell Thickness (FST)	0.75	1.04 <i>in.</i>
Gross Compressive Strength		2850 <i>psi</i>	Min. Web Thickness (WT)	0.750	1.07 <i>in.</i>
Density		105.1 <i>pcf</i>	Equivalent Web Thickness		2.46 <i>in.</i>
Absorption (max.)	15	12.7 <i>pcf</i>	Equivalent Thickness		2.70 <i>in.</i>
Percent Solid		74.2 %	Normalized Web Area	6.5	39.4 <i>in.²/ft.²</i>
Net Cross-Sectional Area		42.02 <i>in.²</i>	Max. Var. From Spec. Dimensions		<i>in.</i>
Gross Cross-Sectional Area		56.68 <i>in.²</i>	Moisture Content		%

Individual Unit Test Results

Specimen No.	Received Wt, W _R <i>lb.</i>	Cross-Sectional Area		Max. Load <i>lb</i>	Compressive Strength		
		Gross <i>in.²</i>	Net* <i>in.²</i>		Gross <i>psi</i>	Net <i>psi</i>	
Compression Units	4	21.20	57.14	42.02	128215	2240	3050
	5	21.59	56.60	42.07	179865	3170	4270
	6	20.81	56.30	41.96	177420	3150	4220
	Average	21.20	56.68	42.02	161830	2850	3840


* Net area determined from absorption specimens unless solid units are used.

Specimen No.	Average Width	Average Height	Average Length	Average Min. FST	Average Min. WT	Normalized Web Area	
	<i>in.</i>	<i>in.</i>	<i>in.</i>	<i>in.</i>	<i>in.</i>	<i>In.²/ft.²</i>	
Absorption Units	1	3.63	7.63	15.60	1.04	1.03	38.1
	2	3.64	7.55	15.59	1.06	1.12	41.5
	3	3.64	7.66	15.65	1.04	1.05	38.7
	Average	3.64	7.61	15.61	1.04	1.07	39.4

Specimen No.	Received Wt, W _R **	Immersed Wt, W _I	Saturated Wt, W _S	Oven-Dry Wt, W _O	Absorption		Density	Net Volume	Net Area	Percent Solid	Moisture Content**
	<i>lb</i>	<i>lb</i>	<i>lb</i>	<i>lb</i>	<i>pcf</i>	%	<i>pcf</i>	<i>ft³</i>	<i>in²</i>	%	% of total absorption
1	21.43	10.57	22.19	19.97	11.9	11.1	107.2	0.1862	41.99	74.4	
2	20.13	9.76	21.21	18.66	13.9	13.7	101.7	0.1834	42.43	74.0	
3	21.34	10.53	22.17	19.86	12.4	11.6	106.5	0.1865	41.85	74.0	
Average	20.97	10.29	21.86	19.50	12.7	12.1	105.1	0.1854	42.09	74.2	

**Received weight determined at the time of unit delivery to the job site or from units sampled at that time and delivered to the laboratory in sealed containers for moisture content determination.

Remarks: The units were tested according to ASTM C140. This set meets the absorption and compressive strength requirements of ASTM C90


Chas M. Snyder, PE
Laboratory Manager