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PRODUCT EVALUATION REPORT

Report No. NA16001
June 30, 2004

Section 04200 □ Aerated Concrete (AC) FomeStone™ Panel

Report Holder:
FlexCrete Building Systems, LC
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This report is limited to the specific product data and tests reports submitted by the applicant in its application requesting this report. No independent tests were performed by Travis Design Associates, PC nor does Travis Design Associates, PC make any warranty, either expressed or implied, as to any finding or other matter in this report or as to any product covered by this report. This disclaimer includes, but is not limited to, merchantability. This report is also subject to the limitation listed herein.

1.0 SUBJECT

FlexCrete Aerated Concrete FomeStone™ Panels and Thin-bed Mortar

2.0 PROPERTY FOR WHICH EVALUATION IS SOUGHT

- 2.1 Structural
- 2.2 Thermal Insulation

3.0 DESCRIPTION

3.1 General

FlexCrete AC FomeStone™ Panels (Thin Unreinforced Panels) are pre-cast noncombustible building units manufactured of FlexCrete aerated concrete.

The FomeStone™ System is an aerated concrete product manufactured by FlexCrete Building Systems, LC licensees, a subsidiary of Headwaters Construction Materials, Inc., one of the largest manufacturers of construction materials in the nation. Headwaters Construction Materials is headquartered in South Jordan, Utah, with manufacturing facilities located throughout the U.S. with a national distribution network.

FomeStone™ is a fiber reinforced aerated concrete panel that provides many advantages over other traditional concrete construction alternatives. FlexCrete is produced primarily from fly ash, a 100% recovered resource that is in abundant supply wherever coal is burned for generating electricity or other industrial uses. In contrast with traditional aerated concrete, and thanks to the important physical properties of fly ash, FlexCrete can be cured at low temperatures and ambient pressures that do not require the use of an energy intensive autoclave.

The FomeStone™ System provides a durable, semi-rigid skin suitable for commercial, industrial and residential applications. The aerated concrete is a lightweight concrete of a uniform cellular structure. It is produced from Portland cement, fly ash, water and an expanding agent. The batched raw materials are thoroughly mixed together with water and an expanding agent and then cast into steel molds. Due to the chemical reactions that take place, air voids are generated in the slurry mix causing it to expand and form non-connecting air cells. After curing (within 24 hours), the mass is machine cut into the various sizes of the FomeStone™ System. The FomeStone™ panels are produced in two thicknesses in varying widths as summarized in Table 1 at the end of this report.

The FlexCrete AC FomeStone™ Panels are attached to the underlying wall structure using approved fasteners and mortared together with the use of FlexCrete thin-bed mortar (type 05) which is a premixed mortar made of Portland cement or blended Portland cements. The proprietary mortar is considered as equivalent to ASTM C 270, Type M or Type N mortar as far as durability is concerned. The specified minimum 28-day compressive strength after dry storage is 1450 psi (10 MPa).

3.2 Uses

FlexCrete AC FomeStone™ Panels with FlexCrete thin-bed mortar are used over steel or wood frames as an exterior sheathing or cladding. The panels are also used as a sheathing material as a component of exterior nonbearing curtain walls. See Section 4.0 of this report for allowable wind pressures, allowable racking shear values, fastener schedules, and installation requirements.

The 3-inch (76.2 mm) thick panels are permitted for use in interior partitions as noted in Section 4.2.3 of this report.

Thermal properties for the FlexCrete AC FomeStone™ Panel, based on testing conducted in accordance with ASTM C 518, are outlined in Table 1 at the end of this report.

4.0 **INSTALLATION**

4.1 General

FomeStone™ is ideal for use in areas prone to earthquakes, hurricanes and other extreme conditions. Its unique properties also provide opportunities for other specialty applications, such as fire walls, sound walls, and collision sacrifice structures.

FlexCrete products, including the FomeStone™ System panels, are installed by trained authorized installers. FomeStone™ authorized installers have completed extensive training and are equipped to provide the highest level of quality, efficiency and safety for the installation of the FomeStone™ panels.

The FomeStone™ system is composed of 2” or 3” Thin Unreinforced Panels (TUPs) attached to either wood or light-gauge metal studs and can be used for a variety of applications, including:

- Exterior Wall Sheathing
- Interior Walls
- Structural Wall Systems with Studs
- Retrofit Walls
- Fire Resistant Cladding
- EIFS Replacement
- Shaft Walls and Fire-Proofing of Steel Columns.

Moisture protection barriers required by applicable code are not required over the framing prior to installation of any FomeStone™ panels in exterior wall applications providing coatings meeting the requirements of Section 7.2 of this report are applied over the exterior surface of the FomeStone™ panels.

In exterior applications, FomeStone™ panels are installed horizontally directly over steel or wood framing, mechanically fastened to steel or wood wall framing using approved fasteners (screws and washers). Alternatively, the 3-inch (76.2) thick FomeStone™ panels may be installed vertically, mechanically fastened to steel sections which are installed horizontally over the steel or wood wall framing. FlexCrete thin-bed mortar is applied to panel edges such that all vertical and horizontal joints between the panels are

filled with the mortar, the panel ends and edges being closely butted but not forced together. The mortar shall be distributed uniformly over the entire surface such that the joint created is not less than 0.04 inches (1 mm) and not more than 0.12 inches (3 mm) thick.

In interior partition applications, 3-inch (76.2) thick FomeStone™ panels shall be installed with their long dimension in the vertical direction, with no horizontal joints being permitted. FlexCrete thin-bed mortar is applied to panel edges such that all vertical joints between the panels are filled with the mortar, the panel edges being closely butted but not forced together. The mortar shall be distributed uniformly over the entire surface such that the joint created is not less than 0.04 inches (1 mm) and not more than 0.12 inches (3 mm) thick.

Where applicable, calculations considering temperature effects and deformations of the wall shall be provided, specifically in long walls. Physical properties to assist in calculating the temperature effects and deformation of the wall construction are given in Table 1 at the end of this report.

The installation instructions within this report shall govern when conflicts occur with the manufacturer's instructions. The manufacturer's published installation instruction and this report shall be strictly adhered to and a copy of these instructions shall be available at all times on the job site during installation. Additionally, drawings and/or specifications shall supplement the manufacturer's instructions, showing detailed information concerning how the FlexCrete products covered by this report shall be integrated into the building under construction.

4.2 Structural

4.2.1 *Transverse Wind Capacity*

Allowable transverse wind capacity for horizontal application of FlexCrete AC FomeStone™ Panels and their attachment to the wall framing are specified in Table 2 at the end of this report. Panel location, panel fastening schedule, and framing requirements for wall assemblies shall be determined by engineering analysis using wind loads specified in the applicable code and the allowable wind pressures noted in Table 2. Stud spacing and design related fastening requirements shall also meet all the requirements of applicable building codes.

Allowable transverse wind capacity for vertical application of 3-inch (76.2 mm) thick FomeStone™ Panels and their attachment to horizontally installed steel sections applied over the wall framing are specified in Table 3 at the end of this report. Panel location, panel fastening schedule, steel section requirements, and framing requirements for wall assemblies shall be determined by engineering analysis using wind loads specified in the applicable code and the allowable wind pressures noted in Table 3. Design of the wall framing, the horizontal steel sections and the related attachments shall also meet all the requirements of applicable building codes.

4.2.2 *Bracing of Exterior Stud Walls (Racking Shear Capacity)*

Allowable shear capacity, specified in Table 4 at the end of this report, for horizontally installed FlexCrete FomeStone™ Panels is applicable to shear walls resisting shear forces acting on the assembly due to wind and seismic forces. Panel location, extent, orientation, fastening schedule, and framing requirements for wall assembly used as bracing (shear wall) shall be determined by engineering analysis using the loads specified by the applicable code and the allowable racking shear values in Table 4 of this report. Stud spacing, design and gage shall also meet the requirements of the applicable building code.

4.2.3 *Interior Partitions*

Use of 3-inch thick FomeStone™ Panels used in interior partition applications shall be installed with their long dimension in the vertical direction, with no horizontal joints being permitted. FlexCrete thin-bed mortar is applied to panel edges such that all vertical joints between the panels are filled with the mortar. Panel lengths shall not exceed 9 feet (2740 mm) and the top and bottoms of the panels shall be adequately supported against horizontal loads.

5.0 IDENTIFICATION

All packages of FlexCrete AC FomeStone™ Panels and thin-bed mortar covered by this report shall bear the manufacturer's name and/or trademark, a code that indicates the production plant, the production time, the product type, and the Omega Point Labs (OPL) classification certificate and the number of this report for field identification.

6.0 EVIDENCE SUBMITTED

- 6.1 Manufacturer's descriptive literature.
- 6.2 ICC Evaluation Service, Inc. Legacy Report ER-5766, dated March 1, 2004.
- 6.3 Application for Changes to ICC Evaluation Service, Inc. Legacy Report ER-5766 dated December 30, 2003 and signed by Samuel Aroni, Ph.D.
- 6.4 Results of ISG FlexCrete Type 1 and Type 2 Block Testing, Construction Technology Laboratories, Inc. Project No. 390091, dated November 10, 2003 signed by W. Morrison.
- 6.5 Final Report of The University of Utah, Department of Civil and Environmental Engineering, Testing of Reinforced Panels, dated December 2003 and prepared by Pedro Romero, Ph.D., P.E. and Sravan Paladagu.
- 6.6 OPL report of tests performed in accordance with ASTM E119-00a, Fire Tests of Building Construction and Materials, 24" x 8" x 8" FlexCrete Aerated Concrete Masonry Units, Project No. 16614-112035, dated September 9, 2002.

- 6.7 FlexCrete Building Systems, LC; FlexCrete™ Fiber Reinforced Aerated Concrete Building Units Quality Control Manual, Revision A, dated March 25, 2004, prepared by Omega Point Laboratories, Inc. and signed by Ryan Creamer, Vice President of FlexCrete Building Systems, LC on 4/14/04.

7.0 CONDITIONS OF USE

Travis Design Associates, P.C. finds that the FlexCrete FomeStone™ Panels and FlexCrete Thin-Bed Mortar as described in this report are suitable alternative materials, products or methods of construction to those specified in the 1999 BOCA National Building Code, the 1999 Standard Building Code, the 1997 Uniform Building Code, the 2000 International Building Code, the 2000 International Residential Code for One and Two Family Dwellings, the 2002 Accumulative Supplement to the International Codes and the 1998 International One and Two Family Dwelling Code, subject to the following:

- 7.1 Design calculations and details for specific applications shall be furnished to the code official verifying compliance with this report and the adopted code. The individual preparing such documents shall possess the necessary credentials regarding competency and qualifications as required by the applicable code and the professional registration laws of the state where construction is undertaken.
- 7.2 Exterior walls and other building elements exposed to weather and/or outside moisture shall have weather protective coatings or coverings which prevent penetration of moisture into the AC materials from the exterior and allow moisture to migrate from the building. Approved coatings or coverings shall be applied in accordance with the manufacturer's instructions. Approved coating documentation/testing shall provide specifications demonstrating that the coating meets FlexCrete specifications as follows: a water vapor permeance equal to or greater than 3 as determined by ASTM E 96, a compressive strength no less than 350 psi (2.42 MPa) and no greater than 1000 psi (6.89 MPa) according to ASTM C 270, meet ASTM C 67 requirements for freeze-thaw resistance and pass a moisture penetration test such as ASTM E 514.
- 7.3 This report does not include an evaluation for use of FlexCrete products in corrosive environments or other severe exposure conditions, as outlined in ACI 318 Section 7.7.5.
- 7.4 Cutting of FlexCrete FomeStone™ Panels is permissible since reinforcing provided is fiber reinforcing only.
- 7.5 Inspection of the installation of FlexCrete AC FomeStone™ Panels shall be comparable to that required by the code for structural sheathing.
- 7.6 This report is subject to periodic re-examination. For information on the current status of this report, contact Travis Design Associates, P.C.

Table 1

ITEM	2" PANEL	3" PANEL
THICKNESS (INS)	2	3
WIDTH (INS)	24	24
LENGTH (FT)	8	10
DRY DENSITY (PCF)	35	35
WEIGHT (PSF)	5.8	8.5
COMPRESSIVE STRENGTH (PSI)	450	450
MODULUS OF ELASTICITY (PSI)	250,000	250,000
COEFF. OF THERMAL EXPANSION (IN/IN/°F)	4.5 X 10 ⁻⁴	4.5 X 10 ⁻⁴
STATIC R-VALUE (HR FT ² °F / BTU)	2.2	3.3

Table 2
 Allowable Transverse Wind Loads for Horizontally Installed
 FlexCrete AC FomeStone™ Panels

FRAMING TYPE	GAUGE NO.	STUD SPACING (MAX.)	PANEL THICKNESS (INCHES)	SCREW TYPE, LOCATION AND SPACING, PANEL ORIENTATION AND LAYOUT ¹	ALLOWABLE WIND PRESSURE, PSF ²
Steel Stud	20	16	2 or 3	See Fig. 1	22.8
Steel Stud	18	24	2 or 3	See Fig. 1	26.4
Steel Stud	16	24	2 or 3	See Fig. 1	32.8
Wood Stud	See Note 2	16	2 or 3	See Fig. 1	24

Notes to Table 2:

1. Panels shall be installed with the long dimension oriented horizontally with all vertical edges of panels backed by framing. Additionally, all joints between panels (head and bed joints) shall be mortared using FlexCrete thin-bed mortar.
2. Wood framing members shall have a specific gravity equal to or greater than 0.49 (such as Southern Pine).
3. Allowable wind pressure shall also be limited by the allowable load of the wall studs or the lead which produces a deflection equal to h/155, where h is the height of the wall in inches.
4. Allowable wind pressures are based on the use of 3 fasteners per panel per framing member (8 inches on center vertically) is permitted provided the allowable wind loads are multiplied by a factor of 2/3.

Table 3
Allowable Transverse Wind Loads for Vertically Installed
FlexCrete AC FomeStone™ Panels

FRAMING TYPE AND SPACING	GAUGE NO. OF HORIZONTAL STEEL SECTIONS	MAX. SPACING OF HORIZONTAL STEEL SECTION ¹	PANEL THICKNESS (INCHES)	SCREW TYPE, LOCATION AND SPACING, PANEL ORIENTATION AND LAYOUT ²	ALLOWABLE WIND PRESSURE, PSF
Steel or Wood	18	4'-4"	3	See Fig. 1	25.0

Notes to Table 3:

- Wall framing, the horizontal steel sections and related attachments shall be designed to meet all the requirements of the applicable building code. Gauge of horizontal steel sections is the minimum required based on FomeStone™ Panel fastening requirements. Maximum spacing of steel sections is the maximum allowed based on FomeStone™ Panel design.
- Panels shall be installed with the long dimension oriented vertically. Additionally, all joint between panels shall be mortared using FlexCrete Thin-bed mortar.

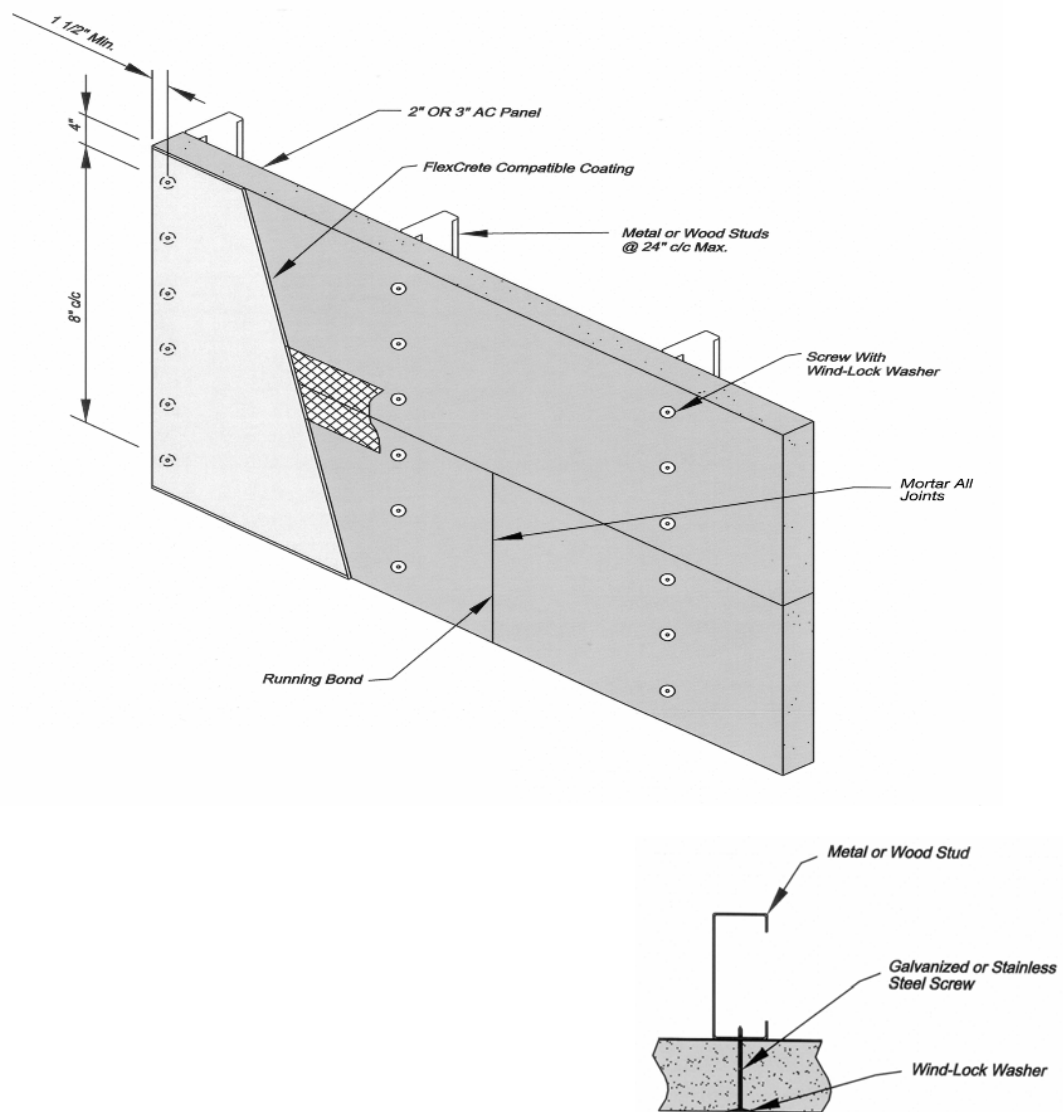
Table 4
Allowable Racking Shear Capacity for Horizontally Installed
FlexCrete AC FomeStone™ Panels^{1,2,3}

FRAMING TYPE	GAUGE NO.	STUD SPACING (INCHES ON CENTER – MAXIMUM)	PANEL THICKNESS (INCHES)	SCREW TYPE, LOCATION AND SPACING, PANEL ORIENTATION AND LAYOUT ²	ALLOWABLE RACKING SHEAR (LB/FT)
Steel Stud	20	16	2 or 3	See Fig. 1	63
Steel Stud	18	24	2 or 3	See Fig. 1	78
Steel Stud	16	24	2 or 3	See Fig. 1	88
Wood Stud	See Note 6	16	2 or 3	See Fig. 1	78

Notes to Table 4:

- Allowable racking shear capacity noted in Table 4 is applicable for wind and seismic loads. For buildings assigned to Seismic Performance Category C, the allowable racking shear shall be multiplied by a factor of 0.5. The allowable racking shear value for buildings assigned to Seismic Performance Categories D and E, shall be taken as zero.
- Maximum height to length ratio of shear wall shall be 2 to 1.
- Walls employing FlexCrete AC FomeStone™ Panels shall not be used to resist horizontal forces from concrete or masonry walls.
- Cumulative allowable shear values for walls having interior finishes that contribute to racking shear capacity have not been evaluated.
- Panels shall be installed with the long dimension oriented horizontally with all vertical edges of panels backed by framing. Additionally, all joints between panels (head and bed joints) shall be mortared using FlexCrete Thin-bed mortar.
- Wood framing members shall have a specific gravity equal to or greater than 0.49 (such as Southern Pine).

Figure 1



Note: The following SI conversions are applicable to Tables 1 through 4:

1 in=25.4mm

1ft=0.3048m

1psf=47.88Pa

1lb/ft=14.59N/m

1 ft-lb/ft=4.448 N m/m

1 psi=0.0069 Mpa

1pcf=16.02 kg/m³

1Btu in/hr ft² °F=0.144 W/m k