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The Subcommittee on Evaluation has reviewed the data submitted for compliance with the *Standard Building Code*®, the *SBCCI Standard for Hurricane Resistant Residential Construction*® SSTD 10-99, and the International One and Two Family Dwelling Code and submits to the Building Official or other authority having jurisdiction the following report. The Subcommittee on Evaluation, ICC-ES and its staff are not responsible for any errors or omissions to any documents, calculations, drawings, specifications, tests or summaries prepared and submitted by the design professional or preparer of record that are listed in the Substantiating Data Section of this report. Portions of this report were previously included in SBCCI PST & ESI Evaluation Reports #9955 and #9955A.

REPORT NO.: 9955B

EXPIRES: See the current EVALUATION REPORT INDEX

CATEGORY: FLOOR, WALL, AND ROOF SYSTEMS

SUBMITTED BY:

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1. PRODUCT TRADE NAME

RASTRA Wall Panel System

2. SCOPE OF EVALUATION

- 2.1 Formwork for structural concrete
- 2.2 Surface burning characteristics
- 2.3 Crawl space fire evaluation
- 2.4 Thermal barrier
- 2.5 Fire resistive wall assembly
- 2.6 Structural

3. USES

RASTRA Wall Panel Systems forms are used as permanent formwork for structural concrete walls in buildings of any type construction.

4. DESCRIPTION

4.1 General

RASTRA Wall Panel System forms are hollow core forms of lightweight material Thastyron™, a mixture of recycled polystyrene beads, Portland cement, admixtures and water. Thastyron contains approximately 85% by volume of expanded polystyrene beads or recycled polystyrene and has a density between 20 and 24 pcf (320 and 380 kg/m³). The forms may be stacked horizontally or vertically. The forms are available in standard thicknesses of 8.5, 10, 12, and 14 inches (216, 254, 305, and 356 mm) and standard widths of 7-1/2, 15, and 30 inches (191, 381, and 762 mm). Standard lengths are 7.5 and 10 feet (2286 and 3048 mm). The cores of the forms are filled with concrete and reinforcing steel to construct a concrete wall with vertical and horizontal members. The concrete wall consists of steel reinforced vertical and horizontal members spaced 15 inches on center (380 mm). The forms remain in place after setting of concrete and are covered with an approved exterior finish material.

Alternate: RASTRA forms are similar to Screen-Grid ICF wall systems described in section 1916.5 of the *Standard Building Code*®, except the spacing of horizontal and vertical cores in the RASTRA forms are 15 or 16 inches (381 or 406 mm) on center, the Screen-Grid ICF forms core spacings are 12 inches (381 mm) on center. RASTRA forms must be designed in accordance with Section 5.6 of this report.

4.2 Materials

4.2.1 Thastyron™: flamespread index (FSI) of 25 or less and a maximum smoke development index (SDI) of 450 or less when tested under ASTM E 84.

4.2.2 Concrete: normal weight concrete with 3/4 inch (19 mm) maximum aggregate size and a minimum compressive strength of 2,500 psi (17.2 Mpa) at 28 days.

4.2.3 Reinforcement: deformed steel reinforcement bars with a minimum yield strength of 40 ksi (275 MPa) complying with ASTM A 615.

4.3 Standard and Accessory Forms

Standard Element (15 inches wide)
Twin Element (30 inches wide)
End Element (7-1/2 inches wide)

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4.4 Surface Burning Characteristics

The Thastyron polystyrene concrete used in the manufacture of the RASTRA Wall Panel Systems forms was tested for surface burning characteristics under ASTM E 84 and demonstrated a flamespread index FSI of 25 or less and a maximum smoke development index SDI of 450 or less.

The numerical flamespread ratings are not intended to reflect hazards presented by these or any other materials under actual fire conditions.

5. INSTALLATION

5.1 General

RASTRA Wall Panel System forms are installed in accordance with the manufacturer's published installation instructions and this report.

RASTRA Wall Panel System forms are installed as formwork for foundation and basement load bearing walls and exterior load bearing walls for residential and commercial construction. The panels are laid horizontally or vertically. If panels are stacked horizontally, walers can be used. Without the use of walers or if the panels are set vertically, either an approved high-yield expansive foam, such as Rastra R-Foam or clamps may be used. A 1/4 inch (6.4 mm) non-continuous bead of foam is applied to one surface. The panels are pressed together or held by mechanical means until the adhesive has cured. If clamps are used no adhesive is required. Clamps remain in place until the concrete has dried. Structural analysis and design of the concrete is prepared in accordance with the manufacturer's recommended design procedure, ACI 318 and the *Standard Building Code*®.

RASTRA forms have a Class A interior finish rating and may be installed exposed to the interior of the building without a wall covering or a thermal barrier, see section 5.2.

The exterior of Rastra forms may be left unfinished or finished with an approved exterior wall covering.

The manufacturer's published installation instructions 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.

The instructions within this report govern if there are any conflicts between the manufacturer's instructions and this report.

5.2 Thermal Barriers

RASTRA Wall Panel System may be exposed to the interior without a thermal barrier. All horizontal and vertical cores of the RASTRA form must be filled with normal weight concrete.

5.3 Crawl Space Installation

RASTRA Wall Panel System forms may be installed exposed in a crawl space without a thermal barrier under the following conditions:

- entry to the crawl space is limited to service of utilities;
- there are no interconnected basement areas;
- air in the crawl space is not circulated to other parts of the building;
- ventilation of the crawl space is provided in accordance with the Code.

5.4 Wood Construction in Areas of Very Heavy Termite Infestation

Where RASTRA Wall Panel Systems forms are used with wood construction, the forms shall be installed in accordance with Section 2603.3 of the *Standard Building Code*®.

5.5 Fire Restive Rated Wall Assembly

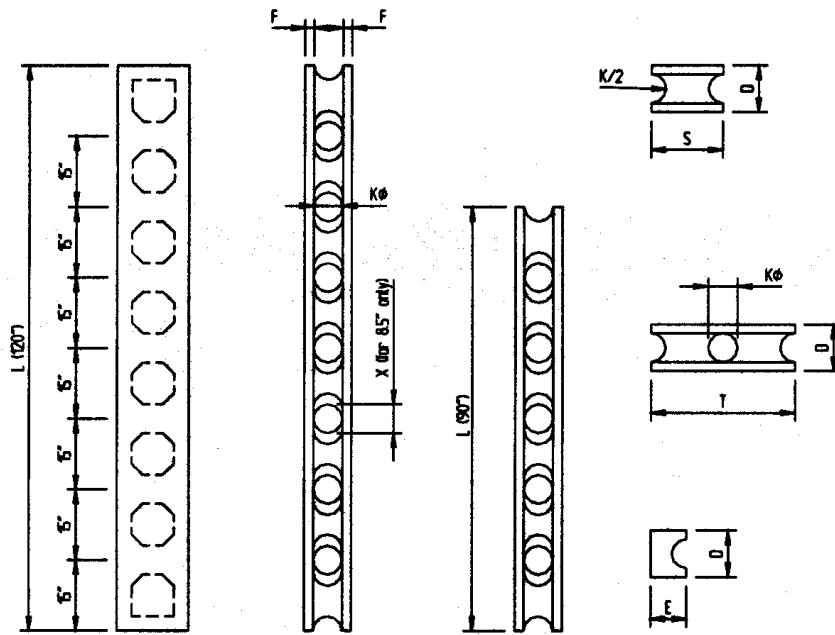
Fire Resistive 4 hour Load Bearing or Non-Load Bearing Wall Assembly: RASTRA Wall Panels minimum 10 inch thickness (254 mm) and assembled in accordance with this report, filled with normal weight concrete and reinforced.

5.6 Structural Design

The RASTRA Wall Panel System forms are installed as formwork for concrete foundation and basement load bearing walls and exterior load bearing walls and lintels for residential and commercial construction.

The RASTRA Wall Panel System shall be designed and analyzed in accordance with the RASTRA Engineering Guide, Copyright © 1998, ACI 318 and the *Standard Building Code*®.

Engineering calculations shall be submitted to the building official when applying for a permit. The engineering calculations shall be signed and sealed by a registered professional engineer when required by the Code.



DIMENSIONS - ins (mm)

D	K	F	L	S	T	E	X
8.5" (215)	5" (127)	1.75" (45)	90"(2286)	15"(380)	30"(760)	7½"(190)	5.25"(135)
10" (250)	6" (152)	2" (50)	90"(2286)				N.A.
12" (305)	6" (152)	3" (76)	or				
14" (355)	6" (152)	4" (100)	120"(3050)				

VOLUMES and WEIGHTS

Thickness ins(cm)	Length ins(cm)	Standard Element cuft(dm³)			End Elem.	Weight Std.E. ≤ lbs(kg)
		Outside	Cavity	Net	Net	
8.5"(21.5)	90"(228)	6.64 (188)	1.97 (56)	4.67 (132)	-	112 (51)
10"(25)	120"(305)	10.42 (294)	3.67 (104)	6.75 (190)	4.22 (119)	158 (72)
	90"(228)	7.81 (221)	2.73 (77)	5.08 (144)	3.17 (90)	120 (54)
12"(30.5)	120"(305)	12.5 (354)	3.67 (104)	8.83 (250)	5.26 (149)	197 (90)
	90"(228)	9.37 (265)	2.73 (77)	6.64 (188)	3.95 (112)	148 (68)
14"(35.5)	120"(305)	14.58 (412)	3.67 (104)	10.91 (308)	6.31 (178)	243 (110)
	90"(228)	10.94 (309)	2.73 (77)	8.21 (232)	4.73 (134)	183 (83)

FIGURE 1 – Configuration and Dimensions of RASTRA® Panels

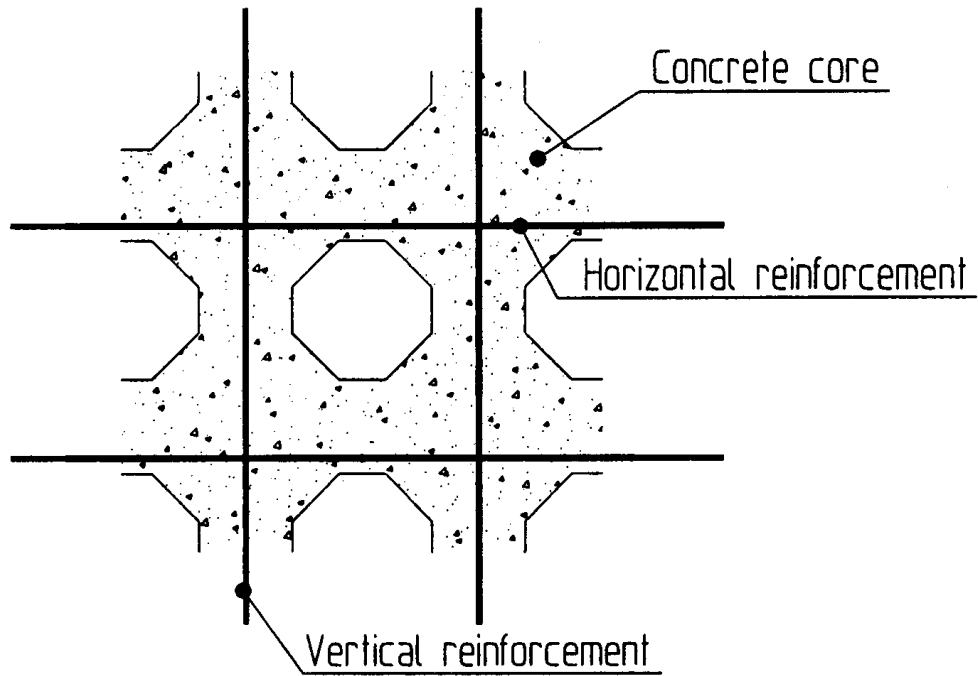


Figure 2: Placement of Reinforcement within the Wall

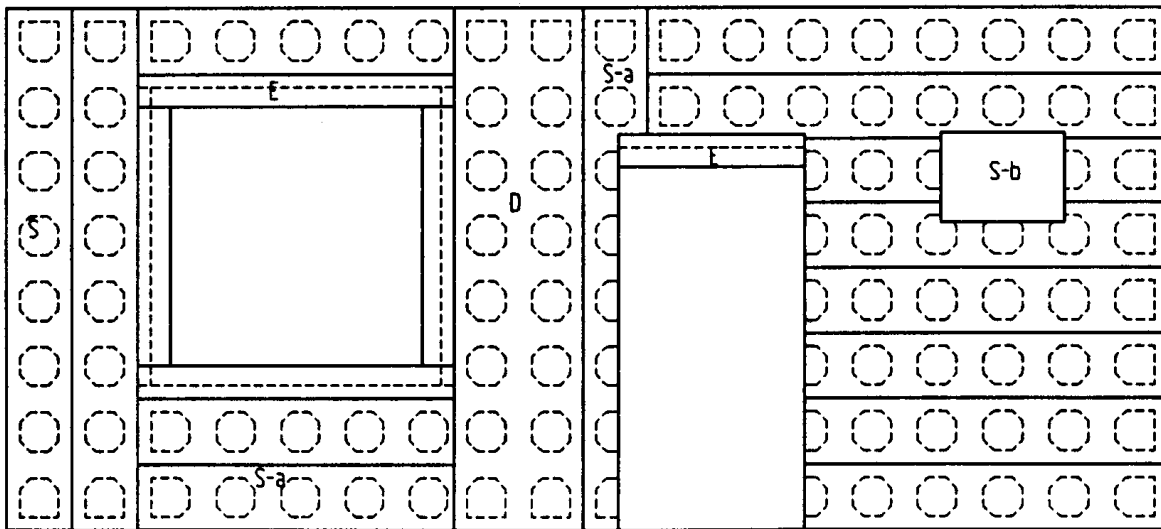


Figure 3: Example of a RASTRA® Wall Panel Layout Schedule

- S Standard Panel
- E End Panel
- D Double Panel
- S-a Standard Panel cut to fit
- S-b Smaller openings cut out before concrete is poured

6. SUBSTANTIATING DATA

- 6.1 RASTRA product reference and informational material:
- 6.1.1 Manufacturer's descriptive literature, Copyright© 1999.
- 6.1.2 Technical Data Reference Guide, 5/99.
- 6.1.3 RASTRA Installation Guide, Copyright© 1998.
- 6.1.4 RASTRA Selection of Architectural Details, 6/99.
- 6.1.5 Specifications, Section 031356, Insulated Concrete Forms - RASTRA, June 16, 1999.
- 6.1.6 RASTRA Engineering Guide, Copyright© 1998, signed, sealed and dated by Nader Namdar, P.E., 6/25/99.
- 6.2 Test reports on structural load testing, UCI University of California, Irvine, Department of Civil and Environmental Engineering, signed by Carla V. Yland, MSCE, and Medhat A. Haroun, Ph.D., P.E.:
- 6.2.1 Slender Wall Report, flexural monotonic loading of full-scale slender walls combined with constant eccentric axial load, Report No. RAL-23940-SW, October 1997 - Rev.1, witnessed by Omega Point Laboratories, Inc., signed by David Neugebauer.
- 6.2.2 In-Plane Cyclic Loading of Full-Scale Walls, out-of-Plane Monotonic Loading of Full-Scale Walls, Flexural Monotonic Loading of Full-Scale Lintels, Report No. RAL-20177, November 1996.
- 6.2.3 In-Plane cyclic Shear Wall Tests RASTRA R10 and R5 Walls, Report No. RAL #20177-IP, September 1996, Third Party Witness Braun Intertec, signed by Paul Irish, P.E.
- 6.2.4 Narrow Shear Wall Report, In-plane cyclic loading of full-scale shear walls combined with constant axial load, Report No. RAL-25683-NSW, November 1998, witnessed by Namdar Structural Engineering, Inc., signed by Nader Namdar, P.E.
- 6.2.5 Flexural Tests of RASTRA Lintels L5 and L10 Sets, Report No. RAL #20177-L, September 1996, third Party Witness Braun Intertec, signed by Paul Irish, P.E.
- 6.2.6 Out-Of-Plane Flexural Tests RASTRA Walls, Report No. RAL #20177-OP, September 1996, Third Party Witness Braun Intertec, signed by Paul Irish, P.E.
- 6.2.7 A Comparative Study of Experimental and Analytical Results of Full-Scale RASTRA Tests at UCI, Carla V. Yland, MSCE, and Hussein Elsanadedy, MSCE.
- 6.3 Test report on loadbearing fire resistive rate wall assembly under ASTM E 119, Design No. U915, Underwriters Laboratories Inc., File R14366, Project 91NK6768, September 24, 1991, signed by Thomas J. Michalski and Richard N. Walke. Letter report, Underwriters Laboratories Inc., increase fire resistance rating of U915 to 4 hours, January 20, 1999, signed by Shawn Q. Marshal and Daniel J. Kaiser.
- 6.4 Test report on loadbearing fire restive rated wall assembly under ASTM E 119, Braun Intertec Corporation, Project EASX-96-0174, Report 07-106-2147, October 8, 1996, signed by Paul Irish.
- 6.5 Test report on room corner fire tests without 15 minute thermal barrier, Omega Point Laboratories, Project No. 15715-101808, September 29, 1997, signed by Javier O. Trevino and Deggary N. Priest.
- 6.6 Test report on surface burning characteristics under ASTM E 84, SGS U.S. Testing Company, Inc., Report No. 113924, 9/10/98, signed by Brian Ortega and Michael S. Elliott
- 6.7 Test report on noncombustibility under ASTM E 136, United States Testing Company, Inc., No. LA 31602, 10-17-83, signed by T. Naughton and Patrick V. McCullen.
- 6.8 Test report on water infiltration of wall assembly under ASTM E 331, Architectural Testing, Inc., Report No. 03-

30070.01, 12-18-98, signed by Leaton Kirk and Anthony Avalos.

- 6.9 Test report on water penetration and leakage under ASTM E 514, Architectural Testing, Inc., Report No. 03-30305.01, 12-18-98, signed by Leaton Kirk and Anthony Avalos.
- 6.10 Quality Control Manual for RASTRA Building System, Issued by: Rastra of the Americas, LLC; Facility: Rastra New Mexico Corporation, Albuquerque, NM; Listing Agency: Underwriters Laboratories, Inc.; Issued 01/2002, Revision 00, signed by Robert Montoya, 5/17/02, and Karl Holik, 5/2/02, for Rastra, and signed by John Pabian of Underwriters Laboratories Inc., 4/3/02.
- 6.11 Quality Control Manual for RASTRA Building System, Issued by: Rastra of the Americas, LLC; Facility: Eterna Building Systems, Inc., Pima, AZ; Listing Agency: Underwriters Laboratories, Inc.; Issued 09/2001, Revision 00, signed by Grady A. John, 8-30-01, and Karl Holik, 8-30-01, for Rastra, and signed by David Clary of Underwriters Laboratories Inc., 11-29-01.

7. CODE REFERENCES

Standard Building Code© - 1999 Edition

Section 103.7	Alternate Materials and Methods
Chapter 6	Construction Types
Chapter 16	Structural Loads
Section 1804.6	Foundation Walls
Section 1804.6.2	Insulated Concrete Form Foundation Walls
Section 1804.6.3	Openings - Ventilation Crawl Spaces
Chapter 19	Concrete
Section 1907	Form Work, Embedded Pipers, and Construction Joints
Section 1916	Insulated Concrete Form Wall Construction
Section 2304.1.4	Foam Plastics
Figure 2304.1.4	Termite Infestation Probability Map
Section 2304.3	Crawl Space Construction
Section 2309.7	Ventilation of Attic Spaces
Section 2603	Foam Plastic Insulation

SBCCI Standard for Hurricane Resistant Residential Construction© SSTD 10-99

Section 101.4	Alternate Materials and Methods
Chapter 2	Buildings with Concrete or Masonry Exterior Walls
Section 206	Insulated Concrete Form (ICF) Walls
Chapter 4	Combined Concrete, Masonry, or ICF and Wood Exterior Wall Construction

International One and Two Family Dwelling Code - 1998 Edition

Section 108	Alternate Materials and Systems
Section 317	Foam Plastic
Section 318	Flame Spread and Smoke Density
Section 323.4	Protection Against Termites - Foam Plastic Protection
Section 404	Foundation Walls
Section 409	Crawl Space
Chapter 6	Wall Construction
Chapter 7	Wall Covering

8. COMMITTEE FINDINGS

The Subcommittee on Evaluation in review of the data submitted finds that, in their opinion, the RASTRA Wall Panel System forms as described in this report conform with or are suitable alternates to that specified in the *Standard Building Code*®, the *SBCCI Standard for Hurricane Resistant Residential Construction*©SSTD 10-99, and the International One and Two Family Dwelling Code or Supplements thereto.

9. LIMITATIONS

- 9.1 This Legacy Evaluation Report and the installation instructions, when required by the building official, shall be submitted at the time of permit application.
- 9.2 Engineering calculations for the structural concrete in accordance with the manufacturer's recommended design procedure, ACI 318, and the *Code* shall be submitted to the building official when applying for a permit. The engineering calculations shall be signed and sealed by a registered professional engineer when required by the *Code*. See Section 5.6 of this report.
- 9.3 When the RASTRA Wall Panel Systems forms are used with wood construction, see Section 5.4 of this report.
- 9.4 When a fire resistive rated wall assembly is required, see Section 5.5 of this report.

10. IDENTIFICATION

Each shipment of RASTRA Wall Panel System forms covered by this report shall have a certificate of compliance with the manufacturer's name, the Rastra trademark, the SBCCI Public Safety Testing and Evaluation Services Inc. Seal or initials (SBCCI PST & ESI), the number of this report, and at least 5% of the RASTRA Wall Panels will be imprinted with the trademark "RASTRA" for field identification.

11. PERIOD OF ISSUANCE

SEE THE CURRENT EVALUATION REPORT INDEX FOR STATUS OF THIS LEGACY EVALUATION REPORT.

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