

ICC-ES Evaluation Report

ESR-2421

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DIVISION: 03 00 00—CONCRETE**Section: 03 11 19—Insulating Concrete Forming****REPORT HOLDER:****POLYCRETE INTERNATIONAL INCORPORATED****355 RUE DES RECOLLETS****MONTREAL, QUEBEC H2Y 1V9****CANADA****(450) 670-7624**www.polycrete.com**EVALUATION SUBJECT:****POLYCRETE BIG BLOCK 1600 AND POLYCRETE FLEX 850 INSULATING CONCRETE FORMS****1.0 EVALUATION SCOPE****Compliance with the following codes:**

- 2009 *International Building Code*® (IBC)
- 2009 *International Residential Code*® (IRC)

Properties evaluated:

- Structural
- Surface burning characteristics
- Attic and crawl space fire evaluation
- Fire-resistance-rated construction

2.0 USES

Polycrete Big Block 1600 and Flex 850 insulating concrete forms (ICFs) are used as stay-in-place formwork for structural concrete, load-bearing and nonload-bearing, below-grade and above-grade walls. The ICFs are used in construction of plain and reinforced concrete beams, lintels, exterior and interior walls, and foundation and retaining walls. The forms remain in place after placement and curing of concrete and must be covered with approved interior and exterior finish materials. For use in fire-resistance-rated construction, installation must be in accordance with Section 4.3.

3.0 DESCRIPTION**3.1 General:**

The Polycrete Big Block 1600 and Flex 850 ICFs are classified as flat ICF wall systems in accordance with IRC Section R611.3.1.

3.2 Polycrete Big Block 1600 ICFs:

The Polycrete Big Block 1600 ICFs consist of two expanded polystyrene (EPS) foam plastic panels separated by steel mesh cross-ties whose flanges are embedded in the EPS foam plastic panels during the molding process. The foam plastic panels are 96 inches (2438 mm) long by either 12 inches (305 mm) or

24 inches (610 mm) high, by 2.5 inches (64 mm) thick. The ICFs are supplied with the cross-tie webs installed and spaced 8.375 inches (213 mm) apart, which maintains the EPS foam plastic panel facings at a clear distance of 5⁵/₈, 7⁵/₈, 9⁵/₈ and 11⁵/₈ inches (143, 194, 244 and 295 mm) for, respectively, the 6-, 8-, 10- and 12-inch (152, 203, 254 and 305 mm) nominal core sizes. See Figure 1 for Big Block ICF drawings.

3.3 Polycrete Flex 850:

Polycrete Flex 850 ICFs consist of two expanded EPS foam plastic panels that have recesses along the top and bottom edges to accept PVC flange sections, which are installed between panels during assembly. The foam plastic panels are 96 inches (2438 mm) long by 12 inches (305 mm) high by 2.5 inches (64 mm) thick. The panels are separated by steel cross-tie webs that are connected to the PVC flange sections, which maintains the EPS foam plastic panel facings at a clear distance of 5⁵/₈, 7⁵/₈, 9⁵/₈ and 11⁵/₈ inches (143, 194, 244 and 295 mm) for, respectively, the 6-, 8-, 10- and 12-inch (152, 203, 254 and 305 mm) nominal core sizes. See Figure 2 for Flex 850 ICF drawings.

3.4 Materials:**3.4.1 Polycrete Big Block 1600 ICFs:**

3.4.1.1 Foam Plastic: The panels are manufactured by injecting and expanding polystyrene beads into molds. The resulting EPS foam plastic complies with ASTM C578 as Type II, with a nominal density of 1.5 pcf (24.1 kg/m³). The EPS foam plastic has a flame-spread index of 25 or less and a maximum smoke developed index of 450 when tested in accordance with ASTM E84.

3.4.1.2 Cross-ties: The steel cross-ties consist of a welded steel wire mesh flange section that is partially embedded into each foam plastic panel; and welded steel wire web sections that are spaced at 8³/₈ inches (213 mm) on center and hooked into the exposed portion of the flange section. The embedded flange section includes two 1.4-inch-high-by-94-inch-long-by-0.03-inch-thick (35 mm by 2388 mm by 0.76 mm) fastening strips, spaced 12 inches (305 mm) on center, that are welded to the mesh flange section. The steel wire web sections are used as support points for steel reinforcing bars. The steel cross-ties consist of longitudinal and transverse galvanized steel wire, welded in a rectangular grid pattern; and a horizontal galvanized steel fastening strip. All factory-applied cross-tie welds are resistance welds in accordance with AWS C1.3. The wire complies with ASTM A641, medium temper with a Class 1 zinc coating (galvanized), and has a minimum diameter of 0.160-inch (4.06 mm) and a minimum tensile strength of 80 ksi (552 MPa). The steel flanges comply with ASTM

A653, CS Type B designation, and have a minimum base-metal thickness of 0.030 inch (0.76 mm) and a minimum yield strength of 41 ksi (283 MPa). The steel strip is zinc-iron alloy coated (galvannealed) by the hot-dip process and has a minimum G60 galvanized coating designation in accordance with ASTM ACL 653 and ASTM ACL 924. The fastening strips are recessed $1\frac{1}{8}$ inches (28.6 mm) below the outer EPS surface and are used for attachment of interior and exterior finish materials.

3.4.2 Polycrete Flex 850 ICFs:

3.4.2.1 Foam Plastic: The panels are manufactured by injecting and expanding polystyrene beads into molds. The resulting EPS foam plastic complies with ASTM C578 as Type IX, with a nominal density of 2 pcf (32 kg/m³). The EPS foam plastic has a flame-spread index of 25 or less and a maximum smoke developed index of 450 when tested in accordance with ASTM E84.

3.4.2.2 Cross-ties: The cross-ties are provided as separate components and consist of a T-shaped PVC flange section and a C-shaped, 0.187-inch-diameter (4.75 mm) steel wire web section. The wire complies with ASTM A641, medium temper with a Class 1 designation, and has a minimum tensile strength of 80 ksi (552 MPa). The cross-tie components are used to assemble the ICF at the jobsite by fitting the PVC flange along the top edge of opposing foam plastic panels, and placing wire webs set at 8 inches (203 mm) on center into holes along opposing PVC flange sections in order to connect the two foam plastic panels at a fixed clear distance. The steel wire webs are used as support points for steel reinforcing bars. The assembled ICFs have the PVC flanges running horizontally along the wall, spaced 12 inches on center (305 mm) vertically up the wall. The flange is recessed $\frac{1}{2}$ inches (12.7 mm) below the outer EPS surface and is used for attachment of interior and exterior finish materials. The fastening portion of the T-shaped PVC flange is 2.75 inches (70 mm) high by 0.125 inch thick (3.2 mm); and the stem of the T-shaped PVC flange is 1.625 inches (41 mm) deep by 0.175 inch thick (4.4 mm).

3.4.3 Concrete: Concrete must be normal-weight concrete complying with the applicable code, having a maximum aggregate size of $\frac{3}{4}$ inch (19 mm) and a minimum compressive strength of 2,500 psi (17 MPa) at 28 days, except as noted in Section 4.3 for fire-resistance-rated construction. Under the IRC, concrete must comply with IRC Sections R404.1 and R611.5.1, as applicable.

3.4.4 Reinforcement: Deformed steel reinforcement bars must have a minimum specified yield stress of either 40 ksi (275 MPa) or 60 ksi (413 MPa), depending on the structural design, and must comply with Section 3.5.3.1 of ACI 318 and IBC Section 1903. Under the IRC, reinforcement must comply with IRC Sections R404.1.2.3.7 and R611.5.2, as applicable.

3.4.5 Other Components: Wood members in contact with concrete for plates of window and door framing must be naturally durable wood or treated with an approved wood preservative, and must be attached with hot-dipped galvanized steel fasteners complying with IBC Section 2304.9.5 or IRC Section R317.3, as applicable.

4.0 DESIGN AND INSTALLATION

4.1 Design:

4.1.1 IBC Design, Including Alternative IBC Wind Design in Accordance with ICC 600-2008: Concrete walls formed by Polycrete Big Block 1600 or Flex 850

ICFs must be designed and constructed in accordance with IBC Chapters 16 and 19, as applicable. Footings and foundations must be designed and constructed in accordance with IBC Chapter 18.

Solid concrete walls formed by flat ICFs may be designed and constructed in accordance with the prescriptive provisions of Section 209 of the ICC Standard for Residential Construction in High Wind Regions (ICC-600), subject to the limitations found in Exception 1 of IBC Sections 1609.1.1 and 1609.1.1.1. Design and construction under the provisions of ICC 600-2008 are limited to resistance to wind forces.

4.1.2 IRC Method: Insulating concrete walls formed by Polycrete Big Block 1600 or Flex 850 ICFs must be designed and constructed in accordance with IRC Sections R404.1.2 and R611, for flat wall systems.

4.1.3 Alternate IRC Design Method: When Polycrete Big Block 1600 or Flex 850 ICFs are used to construct buildings that do not conform to the applicability limits of IRC Sections R404.1.2 and R611.2, construction must be in accordance with the prescriptive provisions of the 2007 Prescriptive Design of Exterior Concrete Walls (PCA 100), or the structural analysis and design of the concrete must be in accordance with ACI 318 and IBC Chapters 16, 18 and 19, as applicable.

4.2 Installation:

4.2.1 General: Installation of ICFs must comply with this report, the Polycrete published installation instructions and the applicable code. Polycrete published installation instructions and this report must be strictly adhered to, and a copy of the Polycrete published installation instructions must be available at the jobsite at all times during installation.

The Polycrete ICFs and resulting concrete walls must be supported on concrete footings complying with IBC Chapters 18 and 19 and IRC Chapter 4, as applicable. Vertical reinforcement embedded in the footing must extend into the base of the wall system the minimum development length necessary for compliance with Chapter 12 of ACI 318 (IBC) or IRC Section 611.5.4, as applicable. Additional reinforcement around doors and windows must be described in the approved construction documents. Concrete quality, mixing and placement must comply with IBC Section 1905 or IRC Sections R404.1.2.3 and R611.5.1, as applicable. Window and door openings must be built into the form units, prior to the placement of the concrete, with wood, steel bucks, or polyvinyl chloride plastic frames of the same dimensions as the "rough stud opening" specified by the window or door manufacturer. Connections of concrete walls to footings, floors, ceilings and roofs must be in accordance with IRC Section R611.9, or be engineered in accordance with the IBC, whichever code is applicable. Anchor bolts used to connect wood ledgers, plates and framing for wall openings to the concrete must be cast in place, with the bolts sized and spaced, as required by the design and the applicable code. Details must be prepared to accommodate the specific job situation, in accordance with the applicable code and the requirements of this report, subject to the approval of the code official.

4.2.2 Interior Finish Requirements:

4.2.2.1 General: The installation details in this section (Section 4.2.2) address compliance with the thermal barrier and interior finish requirements of the codes. The building interior side of the ICFs must be covered with a thermal barrier consisting of minimum $\frac{1}{2}$ -inch thick (12.7 mm) gypsum wallboard complying with ASTM C36 or ASTM C1396, placed vertically. For the Big Block

1600 ICFs, the gypsum wallboard must be attached to the metal fastening strips with 3-inch-long (76 mm), No. 8, stainless steel construction screws spaced 16 inches (406 mm) on center horizontally and 12 inches (305 mm) on center vertically. For the Flex 850 ICFs, the gypsum wallboard must be attached to the PVC flanges with 3-inch-long (76 mm), No. 8, stainless steel construction screws spaced 16 inches (406 mm) on center horizontally and 12 inches (305 mm) on center vertically. The screws comply with ASTM C954 or ASTM C1002; and must be long enough to penetrate through the cross-tie flange at least $\frac{1}{4}$ inch (6.4 mm). Gypsum wallboard joints must be taped and filled with joint compound in accordance with GA-216 or ASTM C840. See Section 4.2.2.2 for installation details when Polycrete Big Block 1600 ICFs are used as walls of attics or crawl spaces without a covering on the interior face.

4.2.2.2 Attic and Crawl Space Installations: When the Polycrete Big Block 1600 ICFs described in this report are used as walls of crawl spaces and no ignition barrier for the foam plastic is applied to the attic or crawl space side, all of the following conditions must be met:

- Entry to the attic or crawl space is only to service utilities, and no storage is permitted.
- There are no interconnected attic or basement areas.
- Air in the attic or crawl space is not circulated to other parts of the building.
- Attic ventilation is provided when required by IBC Section 1203.2 or IRC Section R806, as applicable.
- Under-floor (crawl space) ventilation is provided when required by IBC Section 1203.3 or IRC Section R408.1, as applicable.
- Combustion air is provided in accordance with IMC (*International Mechanical Code*[®]) Section 701.
- The Big Block 1600 ICFs are labeled as described in Section 7.2.

4.2.3 Exterior Finish:

4.2.3.1 Above Grade: An approved exterior wall covering must be designed and installed in accordance with the applicable code or a current ICC-ES evaluation report. Under the IRC, the walls must be flashed in accordance with IRC Section R703.8. Approved exterior wall coverings must be attached to the cross-tie flanges with the fasteners described in Table 2. The fasteners must be corrosion-resistant and have sufficient length to penetrate the cross-tie flange at least $\frac{1}{4}$ inch (6.4 mm). The fasteners have allowable withdrawal and lateral capacities as shown in Table 2. The fastener spacing must be designed to support the gravity loads of the wall covering and resist the negative wind pressures. The negative wind pressure capacity of the exterior finish material must be the same as that recognized in the applicable code for generic materials, or that recognized in a current ICC-ES evaluation report for proprietary materials.

4.2.3.2 Below Grade: Materials used to damp-proof or waterproof basement walls must be specified by Polycrete International Incorporated and must comply with the applicable code or a current ICC-ES evaluation report. The material must be compatible with the ICF foam plastic units, and be free of solvents, hydrocarbons, ketones, and esters that could adversely affect the EPS foam plastic panels. Damp-proofing and waterproofing requirements are in IBC Section 1805 and IRC Section R406, as applicable. Foundation drainage must be provided in accordance with IBC Section 1805.4

or IRC Section R405.1, as applicable. No backfill may be applied against the wall until the complete floor system is in place, unless the wall is designed as a freestanding wall that does not rely on the floor system for structural support.

4.2.4 Foundation Walls: The ICFs may be used as a foundation stem wall when the walls are used to support wood-framed or concrete construction and when the structure is supported on concrete footings complying with the applicable code. Design and installation of Polycrete ICFs as foundation stem walls must comply with IBC Section 1807.1.5 or IRC Sections R404 and R404.1.2, as applicable. For concrete foundation walls under the IRC, vertical reinforcement size and spacing must be in accordance with IRC Table R404.1.2(2), R404.1.2(3), R404.1.2(4), or R404.1.2(8). For concrete foundation walls under the IBC, vertical reinforcement size and spacing must be in accordance with IBC Table 1807.1.6.2. Alternative design and construction may be in accordance with ACI 318, ACI 332 or PCA 100 (see IRC Section R404.1.2) for buildings under the IRC.

4.2.5 Retaining Walls: Polycrete Big Block 1600 and Flex 850 ICF systems, with reinforcement designed in accordance with accepted engineering principles, Section 4.1.1 of this report, and the applicable code, may be used as retaining walls.

4.2.6 Protection against Termites: Where the probability of termite infestation is defined as "very heavy" by the code official, the foam plastic must be installed in accordance with IBC Section 2603.8 or IRC Section R318.4, as applicable. Areas of very heavy termite infestation must be determined in accordance with IBC Figure 2603.8 or IRC Figure R301.2(6), as applicable.

4.3 Fire-resistance-rated Construction:

Polycrete Big Block 1600 and Flex 850 ICFs may be used to construct limited load-bearing and nonload-bearing fire-resistance-rated wall assemblies as shown in Table 1. The normal-weight concrete must have a maximum aggregate size of $\frac{3}{8}$ inch (10 mm) and a minimum compressive strength of 4,000 psi (28 MPa) at 28 days.

4.4 Special Inspection:

4.4.1 IBC: Special inspection is required in accordance with IBC Section 1704 for placement of reinforcing steel and concrete, and for concrete cylinder testing. Special inspection in accordance with IBC Sections 1704.1 and 1704.14 is required when an EIFS wall covering is applied. Duties of the special inspector include verifying field preparation of materials, expiration dates, installation of components, curing of components, treatment of joints and application of sealants.

4.4.2 IRC: For walls constructed in accordance with Section 4.1.2 or PCA 100 as described in Section 4.1.3, special inspection is not required. For walls designed for use under the IRC, in accordance with the IBC as described in Sections 4.1.1 and 4.1.3, special inspection in accordance with Section 4.4.1 is required.

5.0 CONDITIONS OF USE

The Polycrete Big Block 1600 and Polycrete 850 ICFs described in this report comply with, or are suitable alternatives to what is specified in, those codes listed in Section 1.0 of this report, subject to the following conditions:

5.1 The ICFs are manufactured, identified and installed in accordance with this report and the Polycrete International Incorporated published installation

instructions. If there is a conflict between Polycrete International published installation instructions and this report, this report governs.

- 5.2 Polycrete Big Block 1600 ICFs must be separated from the building interior with an approved 15-minute thermal barrier, except for ICFs installed as detailed in Section 4.2.2.2 and labeled in accordance with Section 7.2.
- 5.3 Polycrete Flex 850 ICFs must be separated from the building interior with an approved 15-minute thermal barrier as detailed in Section 4.2.2.1.
- 5.4 When use is as part of a fire-resistance-rated assembly, Section 4.3 applies.
- 5.5 Concrete walls formed by the ICFs are limited to buildings of combustible construction as defined in IBC Chapter 6, and to construction in accordance with the IRC.
- 5.6 When required by the code official, calculations showing compliance with the general design requirements of Section 4.1.1 of this report must be submitted to the code official for approval, except that calculations are not required when the building design is based on the prescriptive provisions in Sections 4.1.2 and 4.1.3, or when foundation design is based on the prescriptive provisions in Section 4.2.4. The calculations and details must be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed.
- 5.7 Concrete quality, mixing and placement must comply with IBC Section 1905 or IRC Sections R404.1.2.3 and R611.5.1, as applicable.
- 5.8 Special inspection must be provided as required by, and in accordance with, Section 4.4.
- 5.9 In areas where the probability of termite infestation is defined as “very heavy” and when insulation boards are used with wood construction, the foam

plastic must be installed in accordance with Section 4.2.6.

- 5.10 When required by the code official, calculations showing compliance with IRC Sections R611.5.3 and R404.1.2.3.6 must be submitted to the code official for approval. The calculations and details, establishing that the ICFs provide sufficient strength to contain concrete during placement and that the cross-ties are capable of resisting the forces created by fluid pressure of fresh concrete, must be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed.
- 5.11 Polycrete Big Block 1600 and Flex 850 ICFs are manufactured by Polycrete in Trois-Rivières, Québec, Canada, under a quality control program with inspections conducted by Intertek Testing Services NA Ltd. (AA-691).

6.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for Stay-in-place, Foam Plastic Insulating Concrete Form (ICF) Systems for Solid Concrete Walls (AC353), dated October 2010.

7.0 IDENTIFICATION

- 7.1 Each package or pallet of Polycrete Big Block 1600 ICFs and Flex 850 ICFs must be labeled with the company name (Polycrete), country of manufacture (Canada), production traceability code, name of the inspection agency (Intertek Testing Services NA Ltd.), and the evaluation report number (ESR-2421).
- 7.2 Big Block 1600 ICFs recognized for use in attics and crawl spaces without a covering applied to the attic or crawl space side are labeled on the exposed, inside face with the evaluation report number (ESR-2421) and the phrase “Acceptable for use in attics and crawl spaces.”

TABLE 1—FIRE-RESISTANCE-RATED WALL ASSEMBLIES

ICF	FIRE-RESISTANCE RATING	CONCRETE CORE NOMINAL WIDTH ¹	INTERIOR WALL FINISH ²	STEEL REINFORCEMENT ³
Big Block 1600⁴: Max allowable axial compressive load: 10,000 lbs/ft	4 hours	6, 8, 10	Not required for fire-resistance-rated wall. See Section 4.2.2 for applicable requirements.	Vertical - #5 at 24 inches on center, in center of wall Horizontal - #5 at 24 inches on center, alternating on either side of vertical bar from row to row
Flex 850^{4,5}: Max allowable axial compressive load: 10,000 lbs/ft	3 hours	6, 8, 10	Not required for fire-resistance-rated wall. See Section 4.2.2 for applicable requirements.	Vertical - #4 at 16 inches on center, in center of wall Horizontal - #4 at 12 inches on center, alternating on either side of vertical bar from row to row.

For SI: 1 inch = 25.4 mm, 1 lbf/ft = 14.59 N/m.

¹Concrete must be normal-weight concrete with a maximum aggregate size of 3/8 inch (10 mm) and a minimum compressive strength of 4,000 psi (28 MPa) at 28 days.

²The wall assembly may be used as either an interior or exterior wall. When use is as an interior wall, the interior sides of the form must be protected by an approved thermal barrier, with the exception of attic and crawl space applications for the Big Block 1600 ICF described in Section 4.2.2.2.

³Steel reinforcement must be spaced as required by ACI 318, at a minimum.

⁴Maximum allowable axial compressive loads are based on 10-foot wall heights.

⁵Flex 850 ICFs must have cross-ties webs spaced 8 inches on center.

TABLE 2—ALLOWABLE CAPACITIES OF FASTENERS IN CROSS-TIE FLANGES

ICF	FASTENER	ALLOWABLE LOAD CAPACITY (lbf)	
		Lateral	Withdrawal
Big Block 1600	No. 8 stainless steel construction screw by 3 inches	52	46
Flex 850 ²	No. 8 stainless steel construction screw by 3 inches	42	23

For SI: 1 inch = 25.4 mm, 1 lbf/ft = 14.59 N/m.

¹Fasteners must be of sufficient length to penetrate through the cross-tie flange a minimum of 1/4 inch (6.4 mm).

²Cross-ties webs installed at 8-inch spacing.

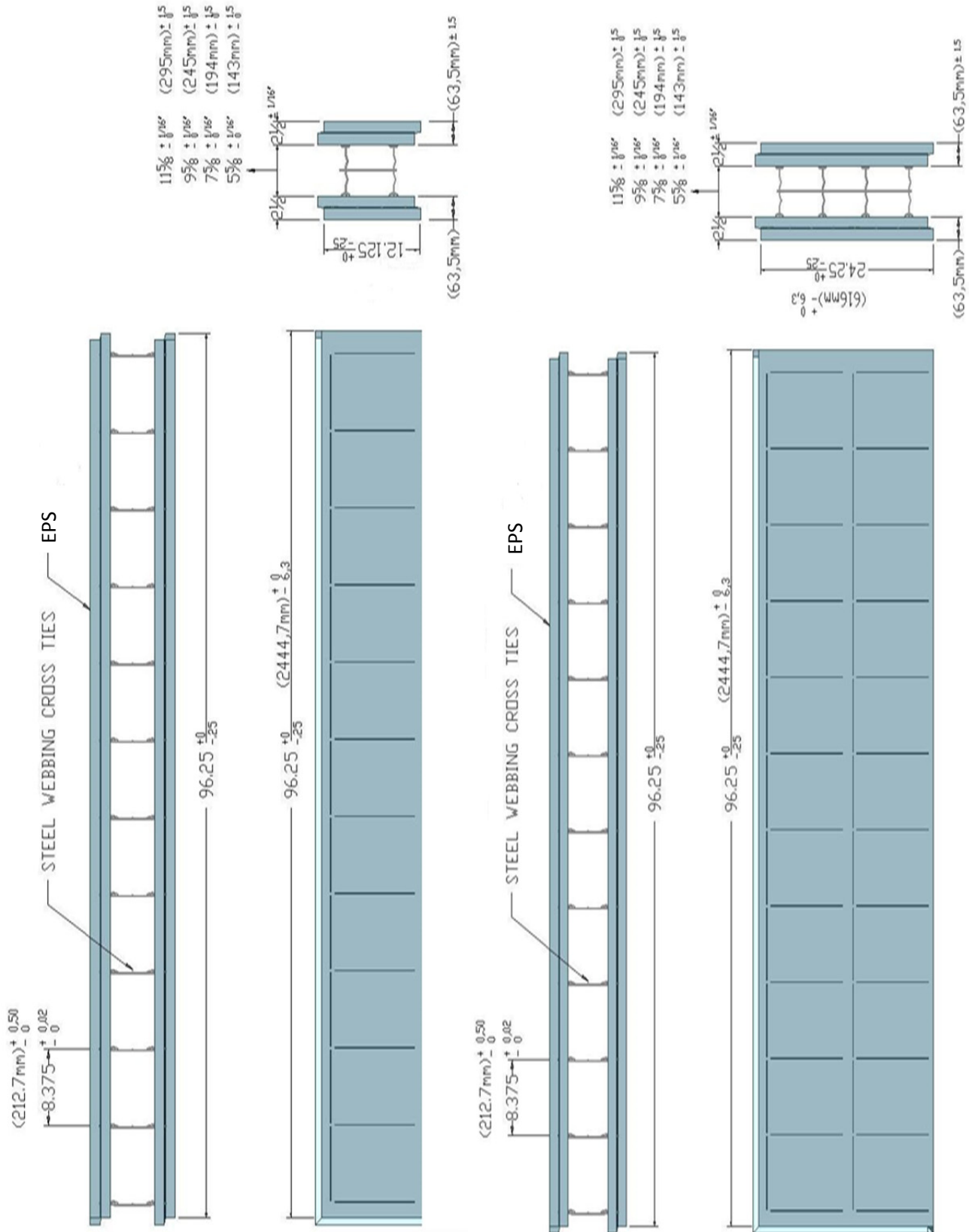


FIGURE 1

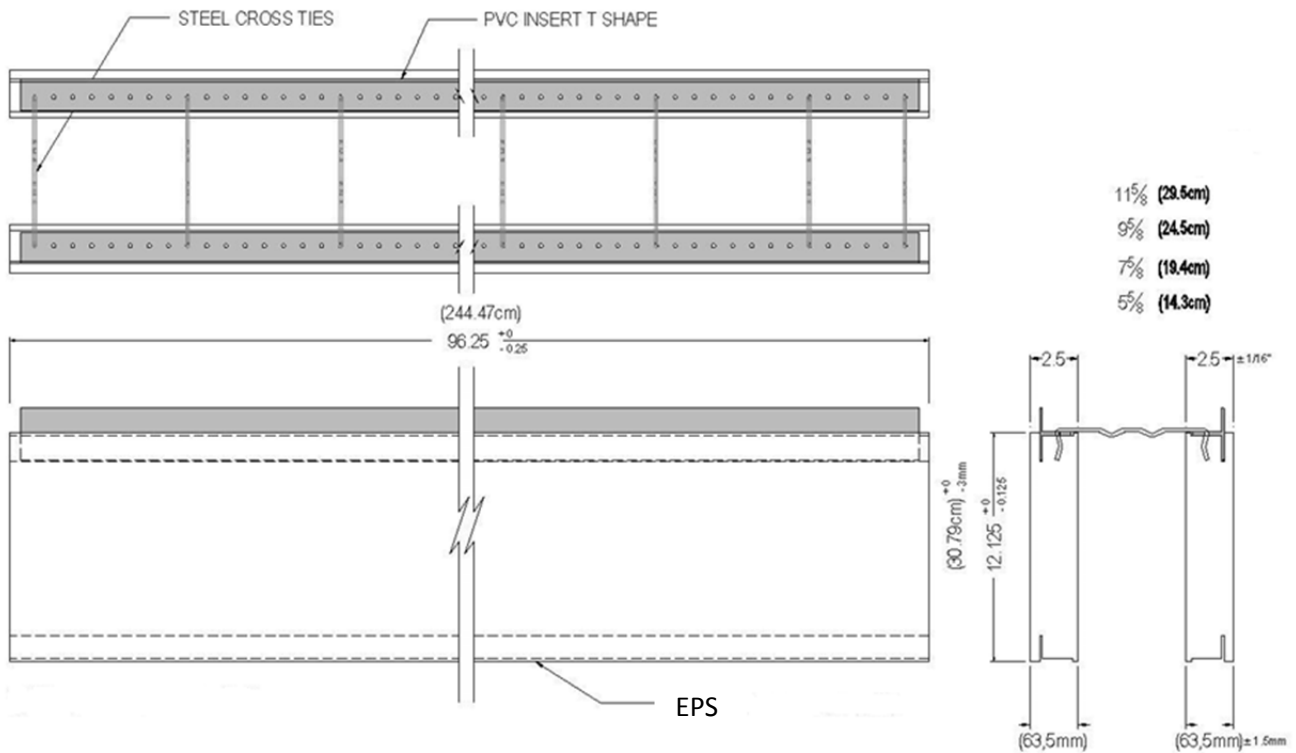


FIGURE 2