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CLIENT: **COMPOSITE BUILDING SYSTEMS INC.**
938 South-Orange Grove BLVD, Unit A
Pasadena, CA 91105

Evaluation No: T1382	Date: August 30, 2019

Product ID: Non-load bearing exterior wall of 1-hour fire resistance rating, composed of precast lightweight concrete panel façade over proprietary composite steel stud framed wall assembly constructed at Orlando Health Imaging Center, Orlando, FL.

For a more detailed description please see Page 2 and Appendix A.

AUTHORIZATION: Authorized by Mr. Paul Clark, Jr. President of Composite Building Systems Inc. on August 27, 2019 per QAI proposal 19JL08273.

EVALUATION REQUESTED: Engineering evaluation of a nonload-bearing exterior wall constructed of 2 ½ inch concrete façade, anchored to composite steel studs as detailed on Page 2 and Appendix A of this report, to the following methods:

- ASTM E119-19 *Standard Test Methods for Fire Tests of Building Construction and Materials* (ASTM E119).
- CAN/ULC-S101-07 *Standard Methods of Fire Endurance Tests of Building Construction and Materials* (CAN/ULC-S101).

CONCLUSIONS: It is the opinion of QAI that the constructed wall assembly detailed on Page 2 and Appendix A of this report, would maintain a 1-hour nonload-bearing fire-resistance rating for both orientations of wall, when evaluated to ASTM E119.

TABLE 1. 1-hour Nonload-Bearing Proprietary Steel Stud Assembly Details Evaluated by QAI

CLADDING / SHEATHING	Joint Sealant	STUDS	INSULATION	INTERIOR FINISH
2.5 inches thick light weight concrete of 5,000 psi compressive strength at 28 days cure, reinforced with 6 in. x 6 in. x 2.9mm diameter welded wire mesh.	Joints of maximum ½ inch width. Finished with mineral wool backer rod of minimum 1 inch depth. STI Specseal® SIL300 applied at minimum ½ inch depth over backer rod, flush to façade face.	Steel studs of minimum 16 Gauge thickness, 6-inch depth and 1-1/2 inch width, spaced 16 inch on center. Studs are to comply with ASTM A653 specifications for strength and corrosion resistance. Shear Transfer Strip provides ½ inch air gap between insulation and concrete façade.	Minimum 3-1/2 inch fiberglass insulation, or Icynene Spray-applied polyurethane foam plastic insulation with current ICC-ES ESR report showing compliance with ICC AC 377.	Minimum 5/8-inch thickness Type X gypsum board complying with ASTM C1396.

Prepared By:

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Director of Engineering

Signed for and on behalf of QAI Laboratories Ltd.:

Kent Adamson
President

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EVALUATION PURPOSE:

QAI has evaluated an exterior wall assembly outlined in Product Description below and Appendix A of this report, for determination if the constructed wall assembly maintains a 1-hour nonload-bearing fire-resistance rating from both wall orientations, when evaluated to ASTM E119 *Standard Test Methods for Fire Tests of Building Construction and Materials*.

Compliance of the detailed wall assembly for use in Types I-IV construction (non-combustible construction) is outside the scope of this evaluation.

PRODUCT DESCRIPTION:

Proposed Wall Assembly:

- Framing:
  - Type: Steel
  - Size: 16 Gauge C-channel, with Composite Building Systems Shear Transfer Strip.
    6-inches depth
    1-1/2 inches width
  - Spacing: 16 inches on center (OC)

- Stud Cavity Insulation:

  Type 1: Fiberglass or Mineral Wool Insulation:
  - Type: Fiberglass insulation complying with ASTM C665 or Mineral wool compliant with ASTM C612.
  - Thickness: Minimum 3.5 inches. Minimum ½-inch air gap maintained between insulation and back side of façade.
  - Density: 2.8 lbs/ft^3 minimum

  Or

  Type 2: Icynene Insulation:
  - Type: Spray-Applied Polyurethane Foam Plastic Insulation complying with ICC-ES AC377 *Acceptance Criteria for Spray-applied Polyurethane Foam Plastic Insulation*.
  - Thickness: Minimum 3.5 inches. Minimum ½-inch air gap maintained between insulation and back side of façade.
  - Type: Product covered by ICC-ES report of polyurethane foam plastic.

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- Interior Sheathing:
  - Type: Type X drywall board, ASTM C1396 compliant
  - Thickness: 5/8 inch
  - Joint Treatment: Multi-purpose joint compound and 2" paper joint tape
  - Fastener Detail: Sheathing mounted vertically with #6, 1-1/4 inches length, self-tapping drywall screws located 8 inches on center around perimeter and 12 inches on center in the field. Screw heads are taped and mudded.

- Exterior Façade / Sheathing:
  - Type: Lightweight concrete panels of 5,000 psi compressive strength at 28 days cure, installed with ½ inch expansion gaps. Concreate panels are reinforced with 6 in. x 6 in. x 2.9mm diameter welded wire mesh.
  - Thickness: 2.5 inch thick minimum, concrete.
  - Joint Treatment: Mineral wool backer rod is placed in each joint with minimum 1-inch depth and the joint finished with STI Specseal SIL 300 silicone firestop sealant at minimum ½ inch depth over backer rod and flush to façade face. STI Specseal SIL 300 silicone firestop sealant is listed by Underwriters Laboratories (UL) for formulation consistency, UL listing # BW-S-0003.
  - Fastening Detail: Mechanical connection of concrete façade to Composite Building Systems proprietary 18 Gauge Shear Transfer Strip outlined in ICC-ES ESR-2511. Connection includes steel to concrete interface to retain position of concrete façade after placement.

REFERENCED STANDARDS AND REPORTS:

1. ASTM E119-12a/19 *Standard Test Methods for Fire Tests of Building Construction and Materials.*
2. CAN/ULC-S101-07 *Standard Methods of Fire Endurance Tests of Building Construction and Materials.*
3. 2018 / 2015 International Building Code (IBC).
4. ICC-ES ESR-2511.
5. ICC-ES AC377 *Acceptance Criteria for Spray-applied Polyurethane Foam Plastic Insulation.*
6. Underwriters Laboratories STI Specseal ® Listing BW-S-0003.

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ENGINEERING EVALUATION:

QAI has conducted this evaluation by considering the materials used in construction of the noted wall assembly detailed in Appendix A. This includes the following critical components of the complete wall assembly:

1. Precast lightweight concrete façade panels of 2.5 inch thickness, of minimum 5,000 psi compressive strength at 28 days cure, reinforced with 6 in. x 6 in. x 2.9 mm diameter welded wire mesh. Concrete panel joints are to be filled with mineral wool backer rod at 1-inch depth, finished with STI Specseal® SIL 300 weather resistant firestop sealant installed per STI and UL approved installation at minimum ½ inch depth filling joint, with surface spread to match flush with concrete façade face finish. STI Specseal® SIL300 is for use in joint installations (see UL Listing BW-S-0003 in Appendix B). Precast concrete façade panels are mechanically secured to Composite Building System Inc.'s proprietary Shear Transfer Striop..
2. Steel studs of minimum 16 Gauge thickness, 6 inch depth with 1-1/2-inch leg width, spaced at maximum 16 inches on center spacing. Studs provide a ½-inch air gap between insulation and exterior concrete façade.
3. 5/8-in thick Type X gypsum board complying with ASTM C1396, and listed by an *Approved Agency* as defined per Section 202 of the IBC. Gypsum is oriented vertically, with joints taped and mudded. Gypsum board to be installed in accordance with IBC

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Review was conducted by QAI considering each fire orientation regarding the components used to construct the wall assembly outlined in Appendix A.

ORIENTATION #1: EXTERIOR CEMENTITIOUS FAÇADE ORIENTED TO FIRE

Per Section 722.2.1 of IBC, Table 722.2.1.1, precast *lightweight concrete walls* in both loadbearing, and nonload-bearing conditions maintain a 1 hour fire resistance rating from both directions at 2.5 inches thickness. The 1-hour fire-resistance-rating represents the *precast lightweight concrete* panel ability to resist the passage of flames and heat along areas of where the panel is continuous. The precast concrete panels are connected via an integrated steel leg system to the underlying steel studs. This connection is not expected to be compromised during testing to ASTM E119, as temperatures sufficient to cause this connection to fail will not be achieved. As such, the precast panels are expected to remain in plane for the 1-hour fire exposure period.

At panel joints, the gaps are limited to maximum ½-inch width (see Appendix A), with the joints filled with mineral wool backer rod of 1-inch depth and finished with minimum ½ inch depth Specseal® SIL300 firestopping joint sealant. Per UL design listing BW-S-0003, Specseal® SIL300 product maintains a 2 hour rating when 1 layer of Specseal® is applied at ½ inch thickness, without backer rod, is applied to each assembly surface (this is noted for a 2 layer gypsum wall board assembly, however, the installation of STI Specseal® SIL300 remains unchanged between a 2 hour fire-resistance application and 1 hour fire-resistance application). This UL specification outlines Specseal® attachment to gypsum wallboard, which is known to calcify and deteriorate during the fire exposure. Anchoring of the Specseal® SIL300 to concrete provides a stable surface with greater temperature stability. This installation in the precast concrete joint will provide an estimated 1-hour fire resistance to passage of heat and flames into the wall cavity, as only 1 layer of Specseal® SIL300 is applied to the assembly for Composite Building Systems proposed assembly. Temperatures in the Composite Building Systems cavity housing the insulation, are expected below mean 350^{0}F for 1-hour time, which is noted below the ignition point of both Icynene insulation, and fiberglass insulation. It is noted, the air gap in the detailed assembly provides further protection to ignition potential of underlying insulation materials as there is no contact for conductive heat flow.

After estimated 1-hour time, the insulation may ignite due to temperature rise, or failure of the firestopping and backer rod. However, inclusion of insulation introduces a layer of low thermal conductivity, reducing the heat flow across the wall assembly, providing protection to the underlying steel studs and gypsum wallboard. Any combustion of this insulation that increases temperatures during evaluation to ASTM E119, would result in the furnace temperature being reduced to follow ASTM E119 time temperature curve requirements, as such, introduction of combustible materials is not considered to negatively impact the fire resistance.

It is noted, that 5/8 inch Type X gypsum wallboard installed in accordance with the IBC, is expected to provide additional resistance to passage of heat and flame to above noted assembly that already provided a 1-hour fire-resistance rating by the 2.5 inch thickness concrete façade with STI Specseal® SIL300 fire stopping and insulation materials, when used in load bearing or non-load bearing steel stud applications. The 5/8 inch thick, type X gypsum membrane would be of sufficient rigidity to resist the passage of hose stream following the ASTM E119 exposure testing for a 1 hour

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duration based on the contribution of fire resistance provided by the exterior precast concrete façade with STI Specseal® SIL300 at ½ inch depth, and the wall insulation noted.

Based on the additive resistances of the components noted above, the Composite Building System Inc. load-bearing proprietary steel stud construction outlined in Appendix A of this evaluation, is considered to meet the requirements for 1-hour fire-resistance rating when evaluated to ASTM E119.

ORINETATION #2: INTERIOR 5/8 Type X GYPSUM FACING FIRE

Per IBC Table 721.1(2) Item Number 13-1.1, a wall assembly constructed of 25 Gauge steel studs spaced at maximum 24 inches on center, covered on each side with 5/8 inch Type X gypsum wall board oriented vertically, anchored with No. 6 drywall screws spaced at 8 inches on center around perimeter and 12 inches in the field, with joints taped and mudded, provides a 1-hour nonload-bearing fire-resistance rating for studs 1-5/8 inches depth, for total wall thickness of 2-7/8 inches.

The wall assembly outlined in this report (see diagram in Appendix A), includes one face of 5/8 inch thick Type X gypsum wall board, anchored with #6 self tapping drywall screws at 8 inches on center around perimeter and 12 inches on center in the field. This assembly includes insulation, which further resists the transmission of heat and flames to the non-fire side, and additionally includes as an exterior surface façade of 2.5 inch thick precast *lightweight concrete* with joints finished with 1-inch depth backer rod of mineral wool, and ½-inch depth STI Specseal® SIL300 firestopping. This exterior precast *lightweight concrete* façade with joint assembly is considered to provide additional resistance to the prescribed 5/8 inch gypsum wallboard per Item Number 13-1.1 of IBC Table 721.1(2).

As such, when the assembly is oriented such that the interior gypsum finish is facing the fire, the wall assembly outlined in Appendix A of this report is considered to provide a minimum 1-hour nonload-bearing fire-resistance rating when evaluated to ASTM E119.

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CONCLUSIONS:

It is the opinion of QAI that the wall assembly outlined in this report, see table 2 below, would provide a 1-hour nonload-bearing fire-resistance rating from both orientations, in accordance with ASTM E119-12a and CAN/ULC S101-07.

TABLE 2. Composite Building Systems Inc. 1-hour Nonload-Bearing Proprietary Steel Stud Assembly

CLADDING / SHEATHING	Joint Sealant	STUDS	INSULATION	INTERIOR FINISH
2.5 inch thick light weight concrete of 5,000 psi compressive strength at 28 days cure, reinforced with 6 in. x 6 in. x 2.9 mm diameter welded wire mesh.	Joints of maximum ½ inch width. Finished with mineral wool backer rod of minimum 1 inch depth. STI Specseal® SIL300 applied at minimum ½ inch depth over backer rod, flush to façade face.	Steel studs of minimum 16 Gauge thickness, 6-inch depth and 1-1/2 inch width, spaced 16 inch on center. Studs are to comply with ASTM A653 specifications for strength and corrosion resistance. Shear Transfer Strip provides ½ inch air gap between insulation and concrete façade.	Minimum 3-1/2 inch thick fiberglass insulation, or Icynene Spray-applied polyurethane foam plastic insulation with current ICC-ES ESR report demonstrating compliance with ICC AC 377..	Minimum 5/8-inch thickness Type X gypsum board complying with ASTM C1396.

This report relates only to the items specified. Test results in this report may not be reproducible in the field.

Attachments:

Appendix A – Composite Building Systems Inc. Wall Assembly Details
Appendix B – STI Specseal® SIL300 BW-W-0003 UL Listing Details

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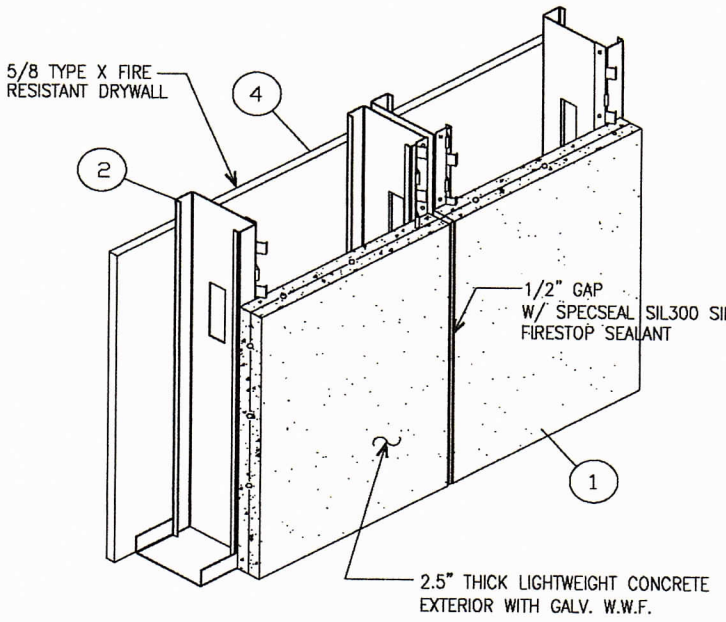
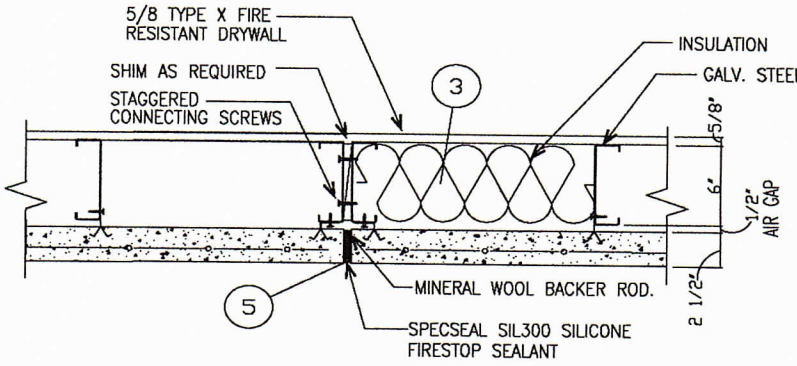
Appendix A – Composite Building Systems Inc. Wall Assembly Details

Metal Stud Crete® Composite System





THE FOLLOWING EXTERIOR WALL DESIGN USING COMPOSITE BUILDING SYSTEMS INCORPORATED CONCRETE/STEEL STUD WALL SYSTEM WILL PROVIDE A ONE HOUR FIRE RESISTANCE RATING, LOAD BEARING, IN ACCORDANCE WITH ASTM E–119 AND THE UNIFORM BUILDING CODE REQUIREMENTS.

1. EXTERIOR LIGHTWEIGHT CONCRETE –MINIMUM 2.5 IN. CONCRETE (5000 PSI @ 28 DAYS) REINFORCED WITH 6 IN. BY 6 IN., 2.9 BY 2.9 WELDED WIRE FABRIC MESH.

2. COMPOSITE STEEL STUDS – MINIMUM 16 GAUGE, 6 IN. DEPTH OR LARGER GALVANIZED STEEL STUDS AND PROPRIETARY COMPOSITE CONNECTORS LOCATED 16 IN. ON CENTRES MAXIMUM.

3. INSULATION –FIBREGLASS BATT INSULATION OR ICYNENE SPRAY INSULATION.

4. GYPSUM WALLBOARD –5/8 IN. TYPE X GYPSUM WALLBOARD, INSTALLED VERTICALLY AND FASTENED WITH 1–1/4 IN. SCREWS LOCATED 8 IN. ON CENTRES. ALL JOINTS AND SCREW HEADS TO BE TAPED AND FILLED.

5. SPECSEAL SIL300 FIRESTOP SEALANT, APPLIED AT ½" THICKNESS AND ½" DEPTH MINIMUM.

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