Listing and Technical Evaluation Report™

A Duly Authenticated Report from an Approved Agency

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OX-IS™, SI-Strong, IsoRED Ci®, and ThermoPLY® "Portal Frame with Hold-Down" (12" to 24" CI PFH)

Trade Secret Report Holder:

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CSI Designations:

DIVISION: 06 00 00 - WOOD, PLASTICS AND COMPOSITES

Section: 06 11 00 - Wood Framing

Section: 06 12 19 - Shear Wall Panels

1 Innovative Products Evaluated[1]

1.1 OX-IS, SI-Strong, IsoRED Ci, and ThermoPLY

1.1.1 OX-IS is formerly known as SI-Strong.

2 Product Description and Materials

2.1 OX-IS, SI-Strong, IsoRED Ci, and ThermoPLY Portal Frame with Hold-Down (PFH) assemblies differ from the PFH details in the IBC and IRC in that the intent is to allow the use of these sheathing materials in place of the Wood Structural Panels (WSP) shown in the code prescribed details to facilitate use of continuous insulation or carry through the proprietary sheathing materials without the need to change the sheathing thickness at the portal frame.

2.1.1 OX-IS and SI-Strong are Structural Insulated Sheathing (SIS) products consisting of a proprietary fibrous sheathing board laminated to one side of a proprietary rigid, closed-cell polyisocyanurate (polyiso) foam plastic insulating sheathing.

2.1.1.1 The sheathing is made of specially treated plies that are pressure-laminated with a water-resistant adhesive.

2.1.1.2 The surface finish consists of a non-reflective facer on one or both sides.

2.1.2 IsoRED Ci is an ASTM C1289 Type 1, Class 1 compliant rigid polyiso insulation.

2.1.2.1 The closed-cell polyiso foam core is bonded to water-resistant foil facers on both sides.

2.1.3 ThermoPLY is a proprietary fibrous sheathing board, composed of pressure-laminated plies consisting of high-strength cellulosic fibers.

2.1.3.1 These fibers are specially treated to be water resistant and are bonded with a proprietary water resistive adhesive.

2.2 Details of the construction of PFH utilizing OX-IS, SI-Strong, IsoRED Ci, and ThermoPLY are as follows:

2.2.1 *Piers:*

2.2.1.1 The piers are made up of $^{7}/_{16}$" Oriented Strand Board (OSB) sandwiched between nominal 2 x 4 studs installed flatwise with additional 2 x 4 studs framing the outside corner (see **Figure 3**). This pier is then attached to the adjoining full-height studs and the opening header.

2.2.2 *Header:*

2.2.2.1 The header is comprised of a minimum of two 2 x 12 dimensional lumber with a $^{7}/_{16}$" OSB spacer or an equivalent engineered wood beam.

2.2.2.2 The header extends over the top of the pier(s) and is fastened to the pier(s) using straps, plates, and fasteners, as shown in **Figure 1**, **Figure 2**, and **Figure 3**.

2.2.2.3 The maximum PFH height is 10'.

2.2.2.3.1 Where needed, a pony wall may be built above the header to extend the framing to a maximum of 12'.

2.2.3 *Sheathing Options:*

2.2.3.1 *OX-IS or SI-Strong Structural Insulation:*

2.2.3.1.1 For other sheathing performance characteristics that may be required in an exterior wall assembly, please refer to Report Number 0804-01.

2.2.3.2 *IsoRED Ci Polyiso Insulation:*

2.2.3.2.1 For other sheathing performance characteristics that may be required in an exterior wall assembly, please refer to Report Number 1306-02.

2.2.3.3 *ThermoPLY Structural Sheathing – Green, Red, or Blue Grade:*

2.2.3.3.1 For other sheathing performance characteristics that may be required in an exterior wall assembly, please refer to one of the following:

2.2.3.3.1.1 ThermoPLY Red Report Number 1004-01.

2.2.3.3.1.2 ThermoPLY Blue Report Number 1004-02.

2.2.3.3.1.3 ThermoPLY Green Report Number 1004-03.

2.3 As needed, review material properties for design in **Section 6** and the regulatory evaluation in **Section 8**.

3 Definitions[2]

3.1 New Materials[3] are defined as building materials, equipment, appliances, systems, or methods of construction, not provided for by prescriptive and/or legislatively adopted regulations, known as alternative materials.[4] The design strength and permissible stresses shall be established by tests[5] and/or engineering analysis.[6]

3.2 Duly authenticated reports[7] and research reports[8] are test reports and related engineering evaluations that are written by an approved agency[9] and/or an approved source.[10]

3.2.1 These reports utilize intellectual property and/or trade secrets to create public domain material properties for commercial end-use.

3.2.1.1 This report protects confidential Intellectual Property and trade secrets under the regulation, 18.US.Code.90, also known as Defend Trade Secrets Act of 2016 (DTSA).[11]

3.3 An approved agency is *"approved"* when it is ANAB ISO/IEC 17065 accredited. DrJ Engineering, LLC (DrJ) is accredited and listed in the ANAB directory.

3.4 An approved source is *"approved"* when a professional engineer (i.e., Registered Design Professional, hereinafter RDP) is properly licensed to transact engineering commerce. The regulatory authority governing approved sources is the state legislature via its professional engineering regulations.[12]

3.5 Testing and/or inspections conducted for this duly authenticated report were performed by an ISO/IEC 17025 accredited testing laboratory, an ISO/IEC 17020 accredited inspection body, and/or a licensed RDP.

3.5.1 The Center for Building Innovation (CBI) is ANAB[13] ISO/IEC 17025 and ISO/IEC 17020 accredited.

3.6 The regulatory authority shall enforce[14] the specific provisions of each legislatively adopted regulation. If there is a non-conformance, the specific regulatory section and language of the non-conformance shall be provided in writing[15] stating the nonconformance and the path to its cure.

3.7 The regulatory authority shall accept duly authenticated reports from an approved agency and/or an approved source with respect to the quality and manner of use of new materials or assemblies as provided for in regulations regarding the use of alternative materials, designs, or methods of construction.[16]

3.8 ANAB is an International Accreditation Forum (IAF) Multilateral Recognition Arrangement (MLA) signatory. Therefore, recognition of certificates and validation statements issued by conformity assessment bodies accredited by all other signatories of the IAF MLA with the appropriate scope shall be approved.[17] Thus, all ANAB ISO/IEC 17065 duly authenticated reports are approval equivalent,[18] and can be used in any country that is an MLA signatory found at this link: https://iaf.nu/en/recognised-abs/

3.9 Approval equity is a fundamental commercial and legal principle.[19]

4 Applicable Local, State, and Federal Approvals; Standards; Regulations[20]

4.1 *Local, State, and Federal*

4.1.1 Approved in all local jurisdictions pursuant to ISO/IEC 17065 duly authenticated report use, which includes, but is not limited to, the following featured local jurisdictions: Austin, Baltimore, Broward County, Chicago, Clark County, Dade County, Dallas, Detroit, Denver, DuPage County, Fort Worth, Houston, Kansas City, King County, Knoxville, Las Vegas, Los Angeles City, Los Angeles County, Miami, Nashville, New York City, Omaha, Philadelphia, Phoenix, Portland, San Antonio, San Diego, San Jose, San Francisco, Seattle, Sioux Falls, South Holland, St. Louis County, Texas Department of Insurance, and Wichita.[21]

4.1.2 Approved in all state jurisdictions pursuant to ISO/IEC 17065 duly authenticated report use, which includes, but is not limited to, the following featured states: California, Florida, New Jersey, Oregon, New York, Texas, Washington, and Wisconsin.[22]

4.1.3 Approved by the Code of Federal Regulations Manufactured Home Construction: Pursuant to Title 24, Subtitle B, Chapter XX, Part 3282.14[23] and Part 3280[24] pursuant to the use of ISO/IEC 17065 duly authenticated reports.

4.1.4 Approved means complying with the requirements of local, state, or federal legislation.

4.2 *Regulations*

4.2.1 *IBC – 18, 21, 24: International Building Code®*

4.2.2 *IRC – 18, 21, 24: International Residential Code®*

4.2.3 *CBC – 22, 25: California Building Code[25] (Title 24, Part 2)*

4.2.4 *CRC – 22, 25: California Residential Code[25] (Title 24, Part 2.5)*

4.3 *Standards*

4.3.1 *ANSI/AWC SDPWS: Special Design Provisions for Wind and Seismic*

4.3.2 *ASCE/SEI 7: Minimum Design Loads and Associated Criteria for Buildings and Other Structures*

4.3.3 *ASTM E72: Standard Test Methods of Conducting Strength Tests of Panels for Building Construction*

4.3.4 *ASTM E564: Standard Practice for Static Load Test for Shear Resistance of Framed Walls for Buildings*

4.3.5 *ASTM E2126: Standard Test Methods for Cyclic (Reversed) Load Test for Shear Resistance of Vertical Elements of the Lateral Force Resisting Systems for Buildings*

4.4 Structural performance for shear wall assemblies used as lateral force resisting systems in Seismic Design Categories A through F have been tested and evaluated in accordance with the following standards:

4.4.1 ASCE/SEI 7: Minimum Design Loads and Associated Criteria for Buildings and Other Structures

4.4.2 ASTM D7989: Standard Practice for Demonstrating Equivalent In-Plane Lateral Seismic Performance to Wood-Frame Shear Walls Sheathed with Wood Structural Panels

4.4.2.1 ASTM D7989 is accepted engineering practice used to establish Seismic Design Coefficients (SDC).

4.4.2.2 Tested data generated by ISO/IEC 17025 approved agencies and/or professional engineers, which use ASTM D7989 as their basis, are defined as intellectual property and/or trade secrets.

4.4.2.3 All professional engineering evaluations are defined as an independent design review (i.e., listings, certified reports, duly authenticated reports from approved agencies, and/or research reports, are prepared independently by approved agencies and/or approved sources, when signed and sealed by licensed professional engineer pursuant to registration law.

4.4.3 ASTM E564: Standard Practice for Static Load Test for Shear Resistance of Framed Walls for Buildings

4.4.4 ASTM E2126: Standard Test Methods for Cyclic (Reversed) Load Test for Shear Resistance of Vertical Elements of the Lateral Force Resisting Systems for Buildings

5 Listed[26]

5.1 Equipment, materials, products, or services included in a List published by a nationally recognized testing laboratory (e.g., CBI), an approved agency (e.g., CBI and DrJ), and/or and approved source (e.g., DrJ), or other organization(s) concerned with product evaluation (e.g., DrJ), that maintains periodic inspection (e.g., CBI) of production of listed equipment or materials, and whose listing states either that the equipment or material meets nationally recognized standards or has been tested and found suitable for use in a specified manner.

6 Tabulated Properties Generated from Nationally Recognized Standards

6.1 *IBC/IRC Method WSP*

6.1.1 To establish the baseline for equivalency, a full scale 12' x 30' building was constructed in accordance with the minimum requirements of the IRC and IBC.

6.1.2 In the first series of tests, two 4' Braced Wall Panels (BWP) were placed in each of the 30' walls.

6.1.3 Each BWP was placed 6' from each end of each braced wall line.

6.1.4 Anchor bolts were placed every 4' along the base of the wall.

6.1.4.1 No other hold-down devices were used, as they are not required by the IRC or the prescriptive provisions of the IBC.

6.1.5 The roof of the structure was constructed with trusses. Dead loads were applied to simulate typical dead loads on a single story roof.

6.1.6 All other wall construction details are per IRC Table R602.3(1).

6.1.7 Walls were evaluated in accordance with the provisions of ASTM E564.

6.1.8 Testing with the OSB in various positions in the wall was assessed, in addition to fully sheathed walls and walls with window and door openings.

6.1.9 23' walls were constructed and evaluated in accordance with ASTM E2126 to understand the performance of these walls under cyclic loading conditions.

6.1.10 The results of the testing were then compared to the capacity of the OSB sheathing as defined in the provisions of the IBC and IRC, and an equivalent capacity was derived so that comparisons can be made on an equivalency basis.

6.2 *Alternate PFH Portal Frame*

6.2.1 An alternate PFH Portal Frame was developed to determine if an equivalent replacement of the 4' x 8' Method WSP Braced Wall Panel could be achieved (see **Figure 1**, **Figure 2**, and **Figure 3**).

6.2.2 Two 23' braced wall lines were framed using standard code-complying framing techniques with Spruce Pine-Fir (SPF) top plate, sill plate, and studs from stud grade lumber.

6.2.3 The assembly was constructed with $^{7}/_{16}$" thick OSB sheathing ($10^{1}/_{2}$" wide for the 12" PFH and $22^{1}/_{2}$" wide for the 24" PFH) fastened between four (4) flatwise SPF 2 x 4s attached to a SPF king stud.

6.2.4 Bottom plate is treated Southern Pine (SP) 2 x 4s. Single or double bottom plates may be used.

6.2.4.1 In addition to the embedded straps shown in **Figure 1** and **Figure 2**, one sill plate anchor in accordance with IBC Section 2308.7,[27] IRC Section R403.1.6, and IRC Section R602.11.1 (where applicable) per pier is required.

6.2.5 Interior gypsum was not applied.

6.2.6 The portal frames were evaluated in accordance with ASTM E2126 testing procedures. Testing determined their lateral resistance within an identical braced wall line so that a direct performance comparison could be made with respect to the tests performed on the isolated braced wall panel assemblies.

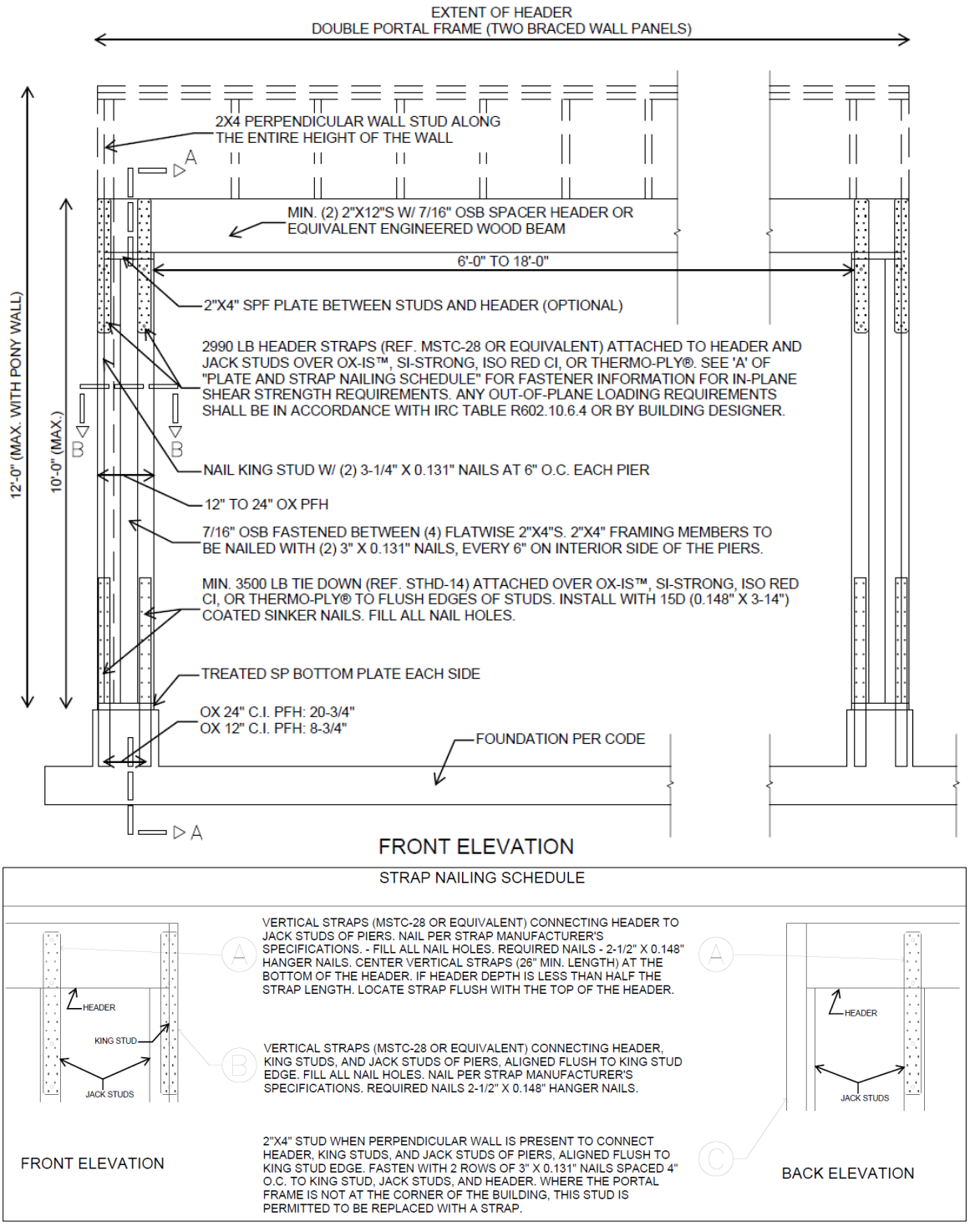

Figure 1. Construction Details of OX-IS, SI-Strong, IsoRED Ci, and ThermoPLY 12" to 24" Continuous Insulation (CI) PFH

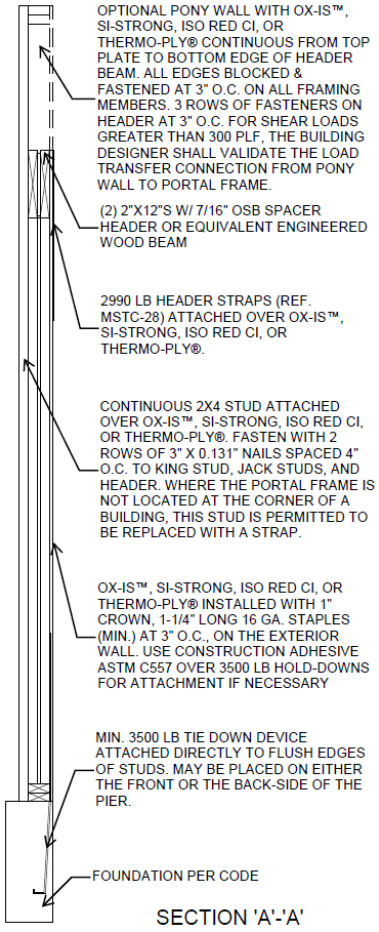

Figure 2. PFH Section A-A

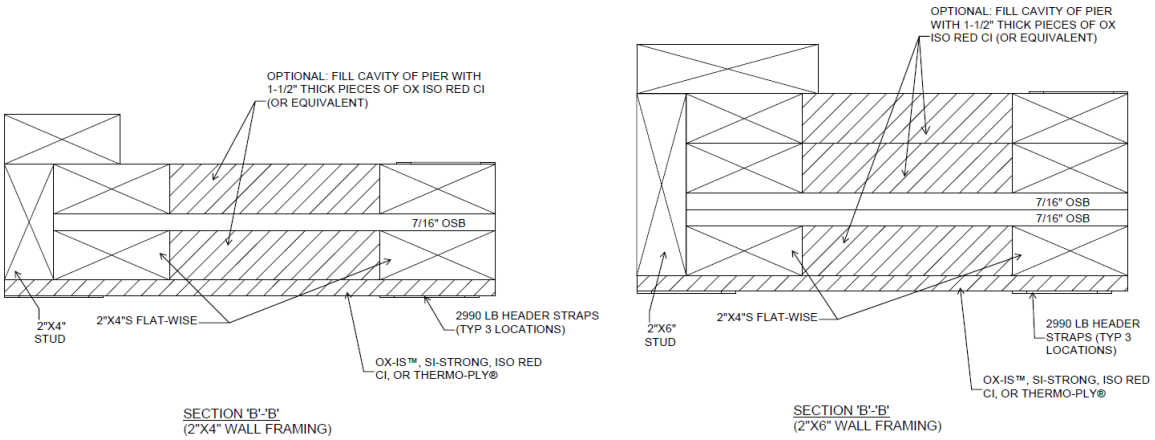

Figure 3. PFH Section B-B

6.3 *Equivalency Results*

6.3.1 A comparison of the 3/8" WSP braced wall lines and the OX-IS, SI-Strong, IsoRED Ci, and ThermoPLY 12" CI PFH and 24" CI PFH is shown in **Table 1**.

6.3.2 The test data, and subsequent engineering analysis, provides confirmation that the performance of OX-IS, SI-Strong, IsoRED Ci, and ThermoPLY 12" CI PFH and 24" CI PFH provide comparable equivalence to the BWP sheathed with 3/8" WSP (OSB was used).

Table 1. Portal Frame Design Values[1,2,3]

Test Name	Sheathing Material	Fastener Size and Spacing	Total Bracing Width (in)	Maximum Wall Height (ft)	Design Value per Panel/Pier[4,5] (lbs)
IBC/IRC Benchmark	3/8" OSB, Isolated 4' x 8' panels, 6' from corners	2 3/8" x 0.113" nails, 6:12 spacing	96	Up to 10	700
12" CI PFH	OX-IS, SI-Strong, IsoRED Ci, and ThermoPLY (Green, Red or Blue Grade)	See **Figure 1**	12	8	1,280
				10	960
24" CI PFH	OX-IS, SI-Strong, IsoRED Ci, and ThermoPLY (Green, Red or Blue Grade)	See **Figure 1**	24	8	2,560
				10	1,920

SI: 1 in. = 25.4 mm, 1 ft = 0.305 m, 1 lb. = 4.45 N

1. Capacity derived from multiple full-scale tests, as well as testing from other labs, showing the capacity of OSB sheathing in buildings constructed in accordance with the minimum requirements of the IRC.
2. The PFH bracing type in the IRC/IBC is defined as equivalent to a 4' BWP using 3/8" WSP. Equivalent capacity is based on comparison testing of the PFH and 3/8" OSB as compared to the published capacities as defined in the IBC and SDPWS.
3. For seismic design, reduce capacities by a factor of 1.4.
4. Interpolation between the wall heights and pier widths for the 12" CI PFH & 24" CI PFH is permitted.
5. 10' high wall design values are provided here that use a seventy-five percent (75%) factor to reduce the 8' high wall design values generated by test data.

6.3.3 Based on the test results using the equivalency principle as defined in IBC Section 104.2.3[28] and IRC Section R104.2.2,[29] the IsoRED Ci and ThermoPLY 12" to 24" CI PFH are assigned the recommended design values for designs controlled by wind or gravity loading conditions as provided in **Table 2**.

6.3.4 The design values for the OX-IS, SI-Strong, IsoRED Ci, and ThermoPLY 12" to 24" CI PFH are based on testing and the evaluation of the test data compared to $^{3}/_{8}$" OSB braced wall panel test data using Method WSP.

6.3.5 As detailed in **Figure 1** through **Figure 3**, the maximum allowable compressive strength of the OX 12" to 24" CI PFH is 11,156 lbs per pier. Additional compressive capacity may be engineered into each pier.

6.3.6 The design values in **Table 2** show that the OX-IS, SI-Strong, IsoRED Ci, and ThermoPLY PFH provide equivalent or better shear resistance to the code-compliant benchmark (IBC/IRC $^{3}/_{8}$" OSB).

6.4 Alternative techniques shall be permitted in accordance with accepted engineering practice and experience. These provisions for the use of alternative materials, designs, and methods of construction are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed herein. This includes, but is not limited to, the following areas of engineering: mechanics of materials, structures, building science, and fire science.

7 Certified Performance[30]

7.1 All construction methods shall conform to accepted engineering practices to ensure durable, livable, and safe construction and shall demonstrate acceptable workmanship reflecting journeyman quality of work of the various trades.[31]

7.2 The strength and rigidity of the component parts and/or the integrated structure shall be determined by engineering analysis or by suitable load tests to simulate the actual loads and conditions of application that occur.[32]

8 Regulatory Evaluation and Accepted Engineering Practice

8.1 OX-IS, SI-Strong, IsoRED Ci, and ThermoPLY comply with the following legislatively adopted regulations and/or accepted engineering practice for the following reasons:

8.1.1 OX-IS, SI-Strong, IsoRED Ci, and ThermoPLY PFH were tested and evaluated for pier widths between 12" and 24" for equivalency to the following IBC requirement:

> 2308.10.5 **Alternative bracing**. An alternate braced wall (ABW) or a portal frame with hold-downs (PFH) described in this section is permitted to substitute for a 48-inch (1219 mm) braced wall panel of Method DWB, WSP, SFB, PBS, PCP or HPS. For Method GB, each 96-inch (2438 mm) section (applied to one face) or 48-inch (1219 mm) section (applied to both faces) or portion thereof required by Table 2308.10.1 is permitted to be replaced by one panel constructed in accordance with Method ABW or PFH.

8.2 The portal frame that is directly referenced in the code is shown in **Figure 4** and adopted into the code in IBC Section 2308.10.5.2[33] as follows:

> 2308.10.5.2 **Portal frame with hold-downs (PFH)**. A PFH shall be constructed in accordance with this section and IBC Figure 2308.10.5.2. The adjacent door or window opening shall have a full-length header…[34]

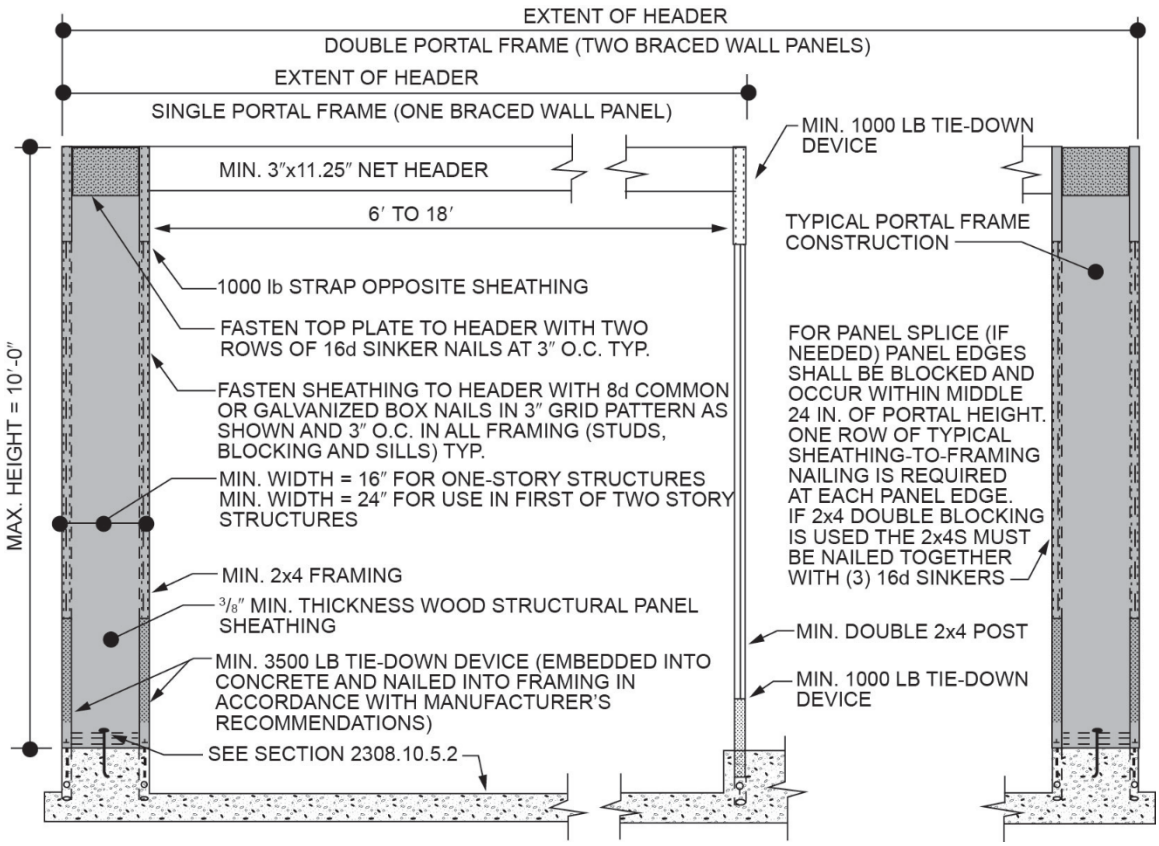

Figure 4. Portal Frame with Hold-Downs as Depicted in IBC Figure 2308.10.5.2[35]

8.3 The IRC defines the PFH detail in IRC Figure R602.10.6.2 (see **Figure 5**) and identifies it as an equivalent replacement to the capacity of a 4' x 8' sheet of 3/8" WSP sheathing in IRC Table R602.10.5 (see **Table 2**) through the use of the following language of IRC Section R602.10.6.2:

> **R602.10.6.2 Method PFH: Portal frame with hold-downs**. Method PFH braced wall panels shall be constructed in accordance with Figure R602.10.6.2.

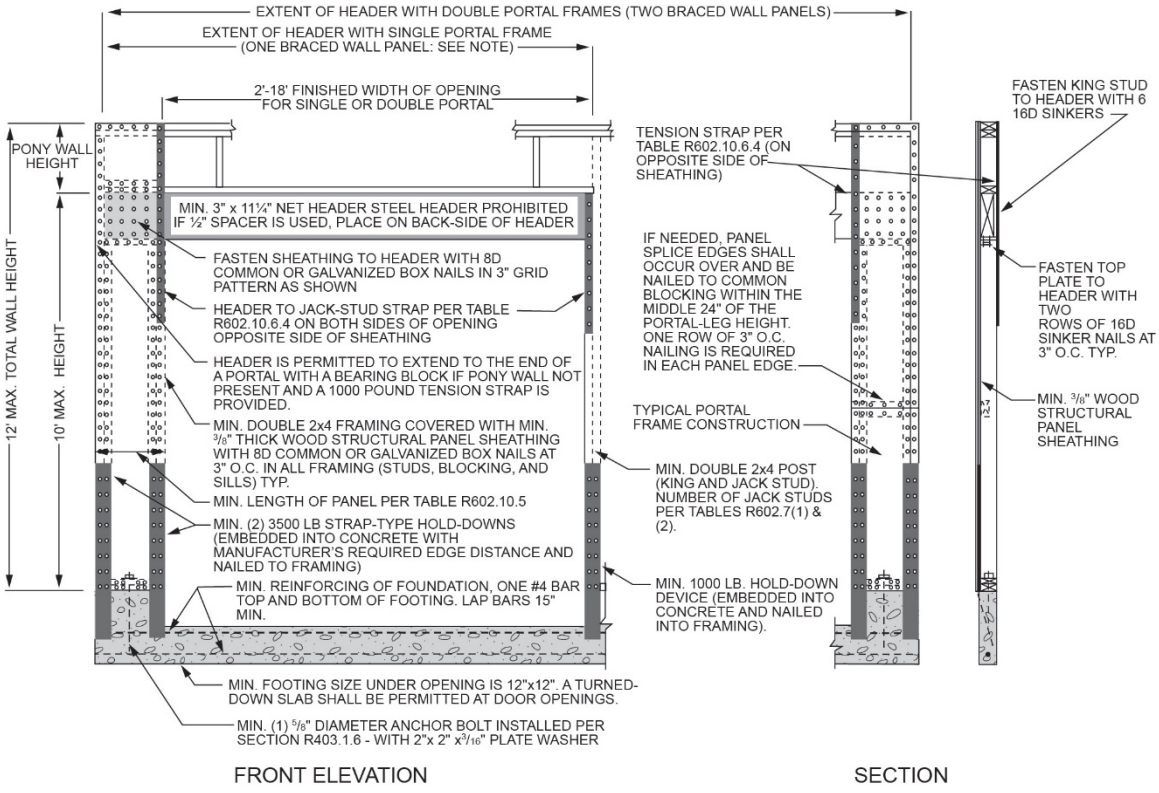

Figure 5. Method PFH—Portal Frame with Hold-Downs as Depicted in IRC Figure R602.10.6.2

Table 2. Minimum Length of Braced Wall Panels, Method PFH, as Depicted in IRC Table R602.10.5

Method (See IRC Table R602.10.4)		Minimum Length (in)					Contributing Length (in)
		Portal Header Height					
		8 Feet	9 Feet	10 Feet	11 Feet	12 Feet	
PFH	Supporting Roof Only	16	16	16	See Note 1 Below	See Note 1 Below	48
	Supporting One Story and Roof	24	24	24	See Note 1 Below	See Note 1 Below	48

SI: 1 in = 25.4 mm, 1 ft = 0.305 m

1. Maximum header height for PFH is 10 feet in accordance with IRC Figure R602.10.6.2 (**Figure 5**), but wall height shall be permitted to be increased to 12 feet with a pony wall.

8.4 Per IRC Figure R602.10.6.2, *"Header is permitted to extend to the end of a portal with a bearing block if pony wall is not present and a 1,000 lb. tension strap is provided."* Installations utilizing a continuous header spanning multiple portal frames must be supported by an engineered design or specific test data approved by the building official.

8.5 While the PFH referenced in the code is one alternate method of compliance, other methods of compliance are permissible, provided they can show equivalence to the code in accordance with IBC Section 104.2.3[36] and IRC Section R104.2.2.[37]

8.6 It is clear from IBC Section 2308.10.5.2[38] and IRC Figure R602.10.6.2 that the performance requirement is to be an equivalent replacement to the capacity of a 4' x 8' sheet of $^{3}/_{8}$" WSP sheathing.

8.7 Testing conducted to compare the performance of an alternative PFH to replace a 4' x 8' Method WSP braced wall panel using $^{3}/_{8}$" WSP sheathing.

8.7.1 Since deflection limits are neither a consideration of the IRC nor a consideration of the light-frame provisions of the IBC, they are not a consideration of this assessment.

8.8 Any building code, regulation and/or accepted engineering evaluations (i.e., research reports, duly authenticated reports, etc.) that are conducted for this Listing were performed by DrJ, which is an ISO/IEC 17065 accredited certification body and a professional engineering company operated by RDP or approved sources. DrJ is qualified[39] to practice product and regulatory compliance services within its scope of accreditation and engineering expertise,[40] respectively.

8.9 Engineering evaluations are conducted with DrJ's ANAB accredited ICS code scope of expertise, which is also its areas of professional engineering competence.

9 Installation

9.1 Installation shall comply with the approved construction documents, the manufacturer installation instructions, this report, and the applicable building code.

9.2 In the event of a conflict between the manufacturer installation instructions and this report, contact the manufacturer for counsel on the proper installation method.

9.3 *General Applications*

9.3.1 OX-IS, SI-Strong, IsoRED Ci, and ThermoPLY shall be installed in accordance with the manufacturer installation instructions and this report, as defined in **Figure 1**, **Figure 2**, and **Figure 3**.

9.3.1.1 In addition to the embedded straps shown in **Figure 1** and **Figure 2**, one sill plate anchor in accordance with IBC Section 2308.7,[41] IRC Section R403.1.6, and IRC Section R602.11.1 (where applicable) per pier is required.

9.3.1.1.1 To accommodate the sill plate anchor, the OSB sheathing and/or cavity insulation, when used, may be notched no larger than necessary to secure the anchor (nut and washer).

9.4 *Orientation*

9.4.1 *OX-IS, SI-Strong, and IsoRED Ci:*

9.4.1.1 OX-IS, SI-Strong, and IsoRED Ci may be installed vertically or horizontally over studs with framing that has a nominal thickness of not less than 2" (51 mm) and spaced a maximum of 24" (610 mm) o.c.

9.4.1.2 Sheathing joints must be butted at framing members, and all panel edges shall be blocked with framing that has a nominal thickness of not less than 2" (51 mm) and spaced a maximum of 24" (610 mm) o.c. A single row of fasteners must be applied to each panel edge into the stud or blocking below.

9.4.1.3 Do not tack product to framing, but fasten each panel completely after fastening begins.

9.4.2 *ThermoPLY:*

9.4.2.1 ThermoPLY may be installed in either the vertical or the horizontal orientation.

9.4.2.2 To be recognized for the structural values listed in this report, or as a water or air barrier, all joints must be backed by studs, plates or blocks, and fastened.

9.5 *Fastener Type*

9.5.1 *OX-IS, SI-Strong, IsoRED Ci, and ThermoPLY:*

9.5.1.1 Minimum $^{15}/_{16}$" crown, 16-gauge staples or minimum 0.120" x galvanized roofing nail.

9.5.1.1.1 Length of fastener to provide 1" embedment into framing.

9.5.1.2 Fasteners shall be installed with a nominal edge distance of $^{3}/_{8}$" (9.5 mm).

9.5.1.3 Always fasten staples parallel to the framing member wherever used.

9.5.1.4 Fasteners for ThermoPLY shall be driven so that the head of the fastener is in contact with the surface of the sheathing. Do not overdrive fasteners.

9.6 *Treatment of Joints*

9.6.1 *OX-IS, SI-Strong, and IsoRED Ci:*

9.6.1.1 OX-IS, SI-Strong, and IsoRED Ci sheathing joints must be butted at framing members and a single row of fasteners must be applied to each panel edge into the stud below. Run staples parallel to framing.

9.6.2 *ThermoPLY:*

9.6.2.1 Lapped joints shall be overlapped $^{3}/_{4}$" (19 mm) nominal, and fastened with a single row of fasteners. Always run staples parallel with framing.

9.6.2.2 Butt joints shall be placed over framing members and fastened with a single row of fasteners at each panel edge and shall be installed with a small gap ($^{1}/_{16}$" to $^{1}/_{8}$") between panels.

9.7 *Structural Applications*

9.7.1 Where the application exceeds the limitations set forth herein, design shall be permitted in accordance with accepted engineering procedures, experience, and technical judgment.

10 Substantiating Data

10.1 Testing has been performed under the supervision of a professional engineer and/or under the requirements of ISO/IEC 17025 as follows:

10.1.1 PFH Double Portal Frame lateral resistance testing braced at 12" and 24" in a 23' wall in accordance with ASTM E2126

10.1.2 PFH Double Portal Frame lateral resistance testing braced at 12" and 24" in a 12' x 30' Full Scale Building in accordance with ASTM E564

10.1.3 Comparison Braced Wall Panel lateral resistance testing using Method WSP with $^{3}/_{8}$" OSB in accordance with ASTM E2126

10.1.4 Comparison Portal Frames lateral resistance testing using Southern Pine Bottom Plates in accordance with ASTM E2126

10.2 Information contained herein may include the result of testing and/or data analysis by sources that are approved agencies, approved sources, and/or an RDP. Accuracy of external test data and resulting analysis is relied upon.

10.3 Where applicable, testing and/or engineering analysis are based upon provisions that have been codified into law through state or local adoption of regulations and standards. The developers of these regulations and standards are responsible for the reliability of published content. DrJ's engineering practice may use a regulation-adopted provision as the control. A regulation-endorsed control versus a simulation of the conditions of application to occur establishes a new material as being equivalent to the regulatory provision in terms of quality, strength, effectiveness, fire resistance, durability, and safety.

10.4 The accuracy of the provisions provided herein may be reliant upon the published properties of raw materials, which are defined by the grade mark, grade stamp, mill certificate, or duly authenticated reports from approved agencies and/or approved sources provided by the supplier. These are presumed to be minimum properties and relied upon to be accurate. The reliability of DrJ's engineering practice, as contained in this duly authenticated report, may be dependent upon published design properties by others.

10.5 *Testing and Engineering Analysis*

10.5.1 The strength, rigidity, and/or general performance of component parts and/or the integrated structure are determined by suitable tests that simulate the actual conditions of application that occur and/or by accepted engineering practice and experience.[42]

10.6 Where additional condition of use and/or regulatory compliance information is required, please search for OX-IS, SI-Strong, IsoRED Ci, and ThermoPLY on the DrJ Certification website.

11 Findings

11.1 As outlined in **Section 6**, OX-IS, SI-Strong, IsoRED Ci, and ThermoPLY have performance characteristics that were tested and/or meet applicable regulations. In addition, they are suitable for use pursuant to its specified purpose.

11.2 When used and installed in accordance with this duly authenticated report and the manufacturer installation instructions, OX-IS, SI-Strong, IsoRED Ci, and ThermoPLY shall be approved for the following applications:

11.2.1 The testing and generally accepted engineering analysis performed provides the basis for the use of the OX-IS, SI-Strong, IsoRED Ci, and ThermoPLY 12" to 24" CI PFH as a substitution for a 4' braced wall panel using $^{3}/_{8}$" OSB, fastened 6:12 with $2^{3}/_{8}$" x 0.113" diameter nails, and have the relative performance as defined in **Table 1**.

11.2.2 The testing and engineering analysis performed provides the basis for the use of the OX-IS, SI-Strong, IsoRED Ci, and ThermoPLY 12" to 24" CI PFH in all locations that require the use of a 4' BWP within the IBC and IRC.

11.3 Unless exempt by state statute, when OX-IS, SI-Strong, IsoRED Ci, and ThermoPLY are to be used as a structural and/or building envelope component in the design of a specific building, the design shall be performed by an RDP.

11.4 Any application specific issues not addressed herein can be engineered by an RDP. Assistance with engineering is available from Amrize Building Envelope, LLC.

11.5 IBC Section 104.2.3[43] (IRC Section R104.2.2[44] and IFC Section 104.2.3[45] are similar) in pertinent part state:

> **104.2.3 Alternative Materials, Design and Methods of Construction and Equipment.** The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative is not specifically prohibited by this code and has been approved.

11.6 **Approved:**[46] Building regulations require that the building official shall accept duly authenticated reports.[47]

11.6.1 An approved agency is *"approved"* when it is ANAB ISO/IEC 17065 accredited.

11.6.2 An approved source is *"approved"* when an RDP is properly licensed to transact engineering commerce.

11.6.3 Federal law, Title 18 US Code Section 242, requires that, where the alternative product, material, service, design, assembly, and/or method of construction is not approved, the building official shall respond in writing, stating the reasons why the alternative was not approved. Denial without written reason deprives a protected right to free and fair competition in the marketplace.

11.7 DrJ is a licensed engineering company, employs licensed RDPs and is an ANAB Accredited Product Certification Body – Accreditation #1131.

11.8 Through the IAF Multilateral Arrangement (MLA), this duly authenticated report can be used to obtain product approval in any jurisdiction or country because all ANAB ISO/IEC 17065 duly authenticated reports are equivalent.[48]

12 Conditions of Use

12.1 As defined in **Section 6**, where material and/or engineering mechanics properties are created for load resisting design purposes, the resistance to the applied load shall not exceed the ability of the defined properties to resist those loads using the principles of accepted engineering practice.

12.2 The OX-IS, SI-Strong, IsoRED Ci, and ThermoPLY 12" to 24" CI PFH described in this report comply with, or are suitable alternatives to, the applicable sections of the IBC and the IRC listed in **Section 4**, and are subject to the following conditions:

12.2.1 This report and the installation instructions, when required by a code official, shall be submitted at the time of permit application.

12.2.2 Where required by the statutes of the jurisdiction where the building is to be constructed, the design drawings shall be prepared by an RDP licensed in the jurisdiction.

12.2.3 Sheathing material located on the exterior side of the portal frame shall be one of the following:

12.2.3.1 $^1/_2$" minimum OX-IS, SI-Strong or IsoRED Ci

12.2.3.2 ThermoPLY Green, Red, or Blue grade

12.3 Each portal frame may replace 4' of braced wall panel. All other braced wall provisions shall be followed per the applicable code.

12.4 When required by adopted legislation and enforced by the building official, also known as the Authority Having Jurisdiction (AHJ) in which the project is to be constructed:

12.4.1 Any calculations incorporated into the construction documents shall conform to accepted engineering practice and, when prepared by an approved source, shall be approved when signed and sealed.

12.4.2 This report and the installation instructions shall be submitted at the time of permit application.

12.4.3 These innovative products have an internal quality control program and a third-party quality assurance program.

12.4.4 At a minimum, these innovative products shall be installed per **Section 9**.

12.4.5 The review of this report by the AHJ shall comply with IBC Section 104.2.3.2 and IBC Section 105.3.1.

12.4.6 These innovative products have an internal quality control program and a third party quality assurance program in accordance with IBC Section 104.7.2, IBC Section 110.4, IBC Section 1703, IRC Section R104.7.2, and IRC Section R109.2.

12.4.7 The application of these innovative products in the context of this report is dependent upon the accuracy of the construction documents, implementation of installation instructions, inspection as required by IBC Section 110.3, IRC Section R109.2, and any other regulatory requirements that may apply.

12.5 The approval of this report by the AHJ shall comply with IBC Section 1707.1, where legislation states in part, *"the building official shall make, or cause to be made, the necessary tests and investigations; or the building official shall accept duly authenticated reports from approved agencies in respect to the quality and manner of use of new materials or assemblies as provided for in Section 104.2.3"*, all of IBC Section 104, and IBC Section 105.3.

12.6 Design loads shall be determined in accordance with the regulations adopted by the jurisdiction in which the project is to be constructed and/or by the building designer (i.e., owner or RDP).

12.7 The actual design, suitability, and use of this report for any particular building, is the responsibility of the owner or the authorized agent of the owner.

13 Identification

13.1 OX-IS, SI-Strong, IsoRED Ci, and ThermoPLY, as listed in **Section 1.1**, are identified by a label on the board or packaging material bearing the manufacturer name, product name, this report number, and other information to confirm code compliance.

13.2 Additional technical information can be found at www.oxengineeredproducts.com.

14 Review Schedule

14.1 This report is subject to periodic review and revision. For the latest version, visit www.drjcertification.org.

14.2 For information on the status of this report, please contact DrJ Certification.

Issue Date: January 22, 2026
Subject to Renewal: April 1, 2027

CBC and CRC Supplement to Report Number 1101-01

REPORT HOLDER: Amrize Building Envelope, LLC

1 Evaluation Subject

1.1 OX-IS, SI-Strong, IsoRED Ci, and ThermoPLY

2 Purpose and Scope

2.1 Purpose

2.1.1 The purpose of this Report Supplement is to show OX-IS, SI-Strong, IsoRED Ci, and ThermoPLY, recognized in Report Number 1101-01 have also been evaluated for compliance with the codes listed below.

2.2 *Applicable Code Editions*

2.2.1 *CBC — 22, 25: California Building Code (Title 24, Part 2)*

2.2.2 *CRC — 22, 25: California Residential Code (Title 24, Part 2.5)*

3 Conclusions

3.1 OX-IS, SI-Strong, IsoRED Ci, and ThermoPLY, described in Report Number 1101-01, comply with the CBC and CRC and are subject to the conditions of use described in this supplement.

3.2 Where there are variations between the IBC and IRC and the CBC and CRC applicable to this report, they are listed here:

3.2.1 CBC Section 104.6 replaces IBC Section 104.4.

3.2.2 CBC Section 104.2.2 replaces IBC Section 104.2.2.

3.2.3 CBC Section 104.2.3 replaces IBC Section 104.2.3.

3.2.4 CBC Section 1707.1 replaces IBC Section 1707.1.

3.2.5 CBC Section 2306.3 replaces IBC Section 2306.3.

3.2.6 CRC Section R104.6 replaces IBC Section R104.4.

3.2.7 CRC Section R104.11 replaces IRC Section R104.2.2.

4 Conditions of Use

4.1 OX-IS, SI-Strong, IsoRED Ci, and ThermoPLY, described in Report Number 1101-01, must comply with all of the following conditions:

4.1.1 All applicable sections in Report Number 1101-01.

4.1.2 The design, installation, and inspections are in accordance with additional requirements of CBC and CRC, as applicable.

Notes

1 For more information, visit drjcertification.org or call us at 608-310-6748.

2 Capitalized terms and responsibilities are defined pursuant to the applicable building code, applicable reference standards, the latest edition of TPI 1, the NDS, AISI S202, US professional engineering law, Canadian building code, Canada professional engineering law, Qualtim External Appendix A: Definitions/Commentary, Qualtim External Appendix B: Project/Deliverables, Qualtim External Appendix C: Intellectual Property and Trade Secrets, definitions created within Design Drawings and/or definitions within Reference Sheets. Beyond this, terms not defined shall have ordinarily accepted meanings as the context implies. Words used in the present tense include the future; words stated in the masculine gender include the feminine and neuter; the singular number includes the plural and the plural, the singular.

3 https://up.codes/viewer/mississippi/ibc-2024/chapter/17/special-inspections-and-tests#1702

4 Alternative Materials, Design and Methods of Construction and Equipment: The provisions of any regulation code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by a regulation. Please review https://www.justice.gov/atr/mission and https://up.codes/viewer/mississippi/ibc-2024/chapter/1/scope-and-administration#104.2.3

5 https://up.codes/viewer/mississippi/ibc-2024/chapter/17/special-inspections-and-tests#1706.2:~:text=the%20design%20strengths%20and%20permissible%20stresses%20shall%20be%20established%20by%20tests

6 The design strengths and permissible stresses of any structural material shall conform to the specifications and methods of design of accepted engineering practice. https://up.codes/viewer/mississippi/ibc-2024/chapter/17/special-inspections-and-tests#1706.1:~:text=Conformance%20to%20Standards-,The%20design%20strengths%20and%20permissible%20stresses,-of%20any%20structural

7 https://up.codes/viewer/mississippi/ibc-2024/chapter/17/special-inspections-and-tests#1707.1:~:text=the%20building%20official%20shall%20make%2C%20or%20cause%20to%20be%20made%2C%20the%20necessary%20tests%20and%20investigations%3B%20or%20the%20building%20official%20shall%20accept%20duly%20authenticated%20reports%20from%20approved%20agencies%20in%20respect%20to%20the%20quality%20and%20manner%20of%20use%20of%20new%20materials%20or%20assemblies%20as%20provided%20for%20in%20Section%20104.2.3.

8 https://up.codes/viewer/mississippi/ibc-2024/chapter/17/special-inspections-and-tests#1703.4.2

9 https://up.codes/viewer/mississippi/ibc-2024/chapter/2/definitions#approved_agency

10 https://up.codes/viewer/mississippi/ibc-2024/chapter/2/definitions#approved_source

11 https://www.law.cornell.edu/uscode/text/18/1832 (b) Any organization that commits any offense described in subsection (a) shall be fined not more than the greater of $5,000,000 or 3 times the value of the stolen trade secret to the organization, including expenses for research and design and other costs of reproducing the trade secret that the organization has thereby avoided. The federal government and each state have a public records act. To follow DTSA and comply state public records and trade secret legislation requires approval through ANAB ISO/IEC 17065 accredited certification bodies or approved sources. For more information, please review this website: Intellectual Property and Trade Secrets.

12 https://www.nspe.org/resources/issues-and-advocacy/professional-policies-and-position-statements/regulation-professional AND https://apassociation.org/list-of-engineering-boards-in-each-state-archive/

13 https://www.cbitest.com/accreditation/

14 https://up.codes/viewer/mississippi/ibc-2024/chapter/1/scope-and-administration#104.1:~:text=directed%20to%20enforce%20the%20provisions%20of%20this%20code

15 https://up.codes/viewer/mississippi/ibc-2024/chapter/1/scope-and-administration#104.2.3 AND https://up.codes/viewer/mississippi/ibc-2024/chapter/1/scope-and-administration#105.3.1

16 https://up.codes/viewer/mississippi/ibc-2024/chapter/17/special-inspections-and-tests#1707.1

17 https://iaf.nu/en/about-iaf-mla/#:~:text=Once%20an%20accreditation%20body%20is%20a%20signatory%20of%20the%20IAF%20MLA%2C%20it%20is%20required%20to%20recognise%20certificates%20and%20validation%20and%20verification%20statements%20issued%20by%20conformity%20assessment%20bodies%20accredited%20by%20all%20other%20signatories%20of%20the%20IAF%20MLA%2C%20with%20the%20appropriate%20scope

18 True for all ANAB accredited product evaluation agencies and all International Trade Agreements.

19 https://www.justice.gov/crt/deprivation-rights-under-color-law AND https://www.justice.gov/atr/mission

20 Unless otherwise noted, the links referenced herein use un-amended versions of the 2024 International Code Council (ICC) 2024 International Code Council (ICC) model codes as foundation references. Mississippi versions of the IBC 2024 and the IRC 2024 are un-amended. This material, product, design, service and/or method of construction also complies with the 2000-2012 versions of the referenced codes and the standards referenced therein. As pertinent to this technical and code compliance evaluation, CBI and/or DrJ staff have reviewed any state or local regulatory amendments to assure this report is in compliance.

21 See Adoptions by Publisher for the latest adoption of a non-amended or amended model code by the local jurisdiction. https://up.codes/codes/general

22 See Adoptions by Publisher for the latest adoption of a non-amended or amended model code by state. https://up.codes/codes/general

23 https://www.ecfr.gov/current/title-24/subtitle-B/chapter-XX/part-3282/subpart-A/section-3282.14

24 https://www.ecfr.gov/current/title-24/subtitle-B/chapter-XX/part-3280

25 All references to the CBC and CRC are the same as the 2024 IBC and 2024 IRC unless otherwise noted in the CBC and CRC Supplement at the end of this report.

26 https://www.ecfr.gov/current/title-24/subtitle-B/chapter-XX/part-3280#p-3280.2(Listed%20or%20certified); https://up.codes/viewer/mississippi/ibc-2024/chapter/2/definitions#listed AND https://up.codes/viewer/mississippi/ibc-2024/chapter/2/definitions#labeled

27 2021 IBC Section 2308.3

28 2021 IBC Section 104.11

29 2021 IRC Section R104.11

30 https://up.codes/viewer/mississippi/ibc-2024/chapter/17/special-inspections-and-tests#1703.4

31 https://www.ecfr.gov/current/title-24/subtitle-B/chapter-XX/part-3280#:~:text=All%20construction%20methods%20shall%20be%20in%20conformance%20with%20accepted%20engineering%20practices%20to%20insure%20durable%2C%20livable%2C%20and%20safe%20housing%20and%20shall%20demonstrate%20acceptable%20workmanship%20reflecting%20journeyman%20quality%20of%20work%20of%20the%20various%20trades

[32] https://www.ecfr.gov/current/title-24/subtitle-B/chapter-XX/part-3280#:~:text=The%20strength%20and%20rigidity%20of%20the%20component%20parts%20and/or%20the%20integrated%20structure%20shall%20be%20determined%20by%20engineering%20analysis%20or%20by%20suitable%20load%20tests%20to%20simulate%20the%20actual%20loads%20and%20conditions%20of%20application%20that%20occur

[33] 2021 IBC Section 2308.6.5.2

[34] Wood structural panel sheathing with a thickness not less than 3/8" (9.5 mm) for 16" (406 mm) or 24" (610 mm) stud spacing in accordance with Table 2308.10.3(2) and 2308.10.3(3).

[35] 2021 IBC Figure 2308.6.5.2

[36] 2021 IBC Section 104.11

[37] 2021 IRC Section R104.11

[38] 2021 IBC Section 2308.6.5.2

[39] Qualification is performed by a legislatively defined Accreditation Body. ANSI National Accreditation Board (ANAB) is the largest independent accreditation body in North America and provides services in more than 75 countries. DrJ is an ANAB accredited product certification body.

[40] https://anabpd.ansi.org/Accreditation/product-certification/AllDirectoryDetails?prgID=1&orgID=2125&statusID=4#:~:text=Bill%20Payment%20Date-,Accredited%20Scopes,-13%20ENVIRONMENT.%20HEALTH

[41] 2021 IBC Section 2308.3

[42] See Code of Federal Regulations (CFR) Title 24 Subtitle B Chapter XX Part 3280 for definition: https://www.ecfr.gov/current/title-24/subtitle-B/chapter-XX/part-3280

[43] 2021 IBC Section 104.11

[44] 2021 IRC Section R104.11

[45] 2018: https://up.codes/viewer/wyoming/ifc-2018/chapter/1/scope-and-administration#104.9 AND 2021: https://up.codes/viewer/wyoming/ibc-2021/chapter/1/scope-and-administration#104.11

[46] Approved is an adjective that modifies the noun after it. For example, Approved Agency means that the Agency is accepted officially as being suitable in a particular situation. This example conforms to IBC/IRC/IFC Section 201.4 (https://up.codes/viewer/mississippi/ibc-2024/chapter/2/definitions#201.4) where the building code authorizes sentences to have an ordinarily accepted meaning such as the context implies.

[47] https://up.codes/viewer/mississippi/ibc-2024/chapter/17/special-inspections-and-tests#1707.1

[48] Multilateral approval is true for all ANAB accredited product evaluation agencies and all International Trade Agreements.