

Seismic Design Parameters for Smart Components®
Lateral Load Resisting Panels & Portals

TER No. 0811-01

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DIVISION: 06 00 00 – WOOD, PLASTICS AND COMPOSITES

Section: 06 12 19 – Shear Wall Panels

1. Product Evaluated:

- 1.1. Smart Components® Lateral Load Resisting Panels and Portals
- 1.2. For the most recent version of this Technical Evaluation Report (TER), visit drjengineering.org. For more detailed state professional engineering and code compliance legal requirements and references, visit drjengineering.org/statelaw. DrJ is fully compliant with all state professional engineering and code compliance laws.
- 1.3. This TER can be used to obtain product approval in any country that is an IAF MLA Signatory (all countries found [here](#)) and covered by an [IAF MLA Evaluation](#) per the [Purpose of the MLA](#) (as an example, see [letter to ANSI](#) from the Standards Council of Canada). Manufacturers can go to jurisdictions in the U.S., Canada and other [IAF MLA Signatory Countries](#) and have their products readily approved by authorities having jurisdiction using [DrJ's ANSI accreditation](#).
- 1.4. Building code regulations require that evaluation reports are provided by an approved agency meeting specific requirements, such as those found in [IBC Section 1703](#). Any agency accredited in accordance with ANSI ISO/IEC 17065 meets this requirement within ANSI's scope of accreditation. For a list of accredited agencies, visit ANSI's [website](#). For more information, see drjcertification.org.

DrJ is a Professional Engineering Approved Source

 **Learn more about DrJ's Accreditation**

- DrJ is an ISO/IEC 17065 accredited product certification body through ANSI Accreditation Services.
- DrJ provides certified evaluations that are signed and sealed by a P.E.
- DrJ's work is backed up by professional liability insurance.
- DrJ is fully compliant with IBC Section 1703.

Technical Evaluation Report (TER)

- 1.5. Requiring an evaluation report from a specific private company (i.e. ICC-ES, IAPMO, CCMC, DrJ, etc.) can be viewed as discriminatory and is a violation of international, federal, state, provincial and local anti-trust and free trade regulations.
- 1.6. DrJ's code compliance work:
 - 1.6.1. Conforms to code language adopted into law by individual states and any relevant consensus based standard such as an ANSI or ASTM standard.
 - 1.6.2. Complies with accepted engineering practice, all professional engineering laws and by providing an engineer's seal DrJ takes professional responsibility for its specified scope of work.

2. Applicable Codes and Standards:¹

- 2.1. 2012, 2015 and 2018 International Building Code (IBC)
- 2.2. 2012, 2015 and 2018 International Residential Code (IRC)
- 2.3. 2010, 2013 and 2016 California Building Code (CBC)
- 2.4. AISI – American Iron and Steel Institute North American Standards for Cold-Formed Steel Framing – General Provisions
- 2.5. ANSI/TPI 1 – National Design Standard for Metal Plate Connected Wood Truss Construction
- 2.6. ASCE/SEI 7 – Minimum Design Loads for Buildings and Other Structures
- 2.7. ASTM E2126 – Standard Test Methods for Cyclic (Reversed) Load Test for Shear Resistance of Vertical Elements of the Lateral Resisting Systems for Buildings
- 2.8. AWC/NDS – American Wood Council National Design Specification for Wood Construction
- 2.9. AWC/SDPWS – American Wood Council Special Design Provisions for Wind & Seismic
- 2.10. IFI-128 – Hex Coupling Nuts

3. Performance Evaluation:

- 3.1. This TER examines test data and related generally accepted engineering analysis that support the development of seismic design parameters (SDPs) for Smart Components®. The SDPs are used in evaluating the ductility and resistance of Smart Components® as lateral seismic loads are applied.
- 3.2. Smart Components® lateral load resisting panels and portals comply with [IBC Section 1613](#) and ASCE/SEI 7 Section 12.2.
 - 3.2.1. [Table 1](#) provides SDPs and factors that conform to the requirements in ASCE/SEI 7-10 Section 12.2.1 and Table 12.2-1 for design of wall assemblies in buildings that require seismic design in accordance with ASCE/SEI 7 (i.e., all seismic design categories).
 - 3.2.2. The basis for equivalency testing is outlined in ASCE 7 Section 12.2.1:

Seismic force-resisting systems not contained in Table 12.2-1 are permitted provided analytical and test data are submitted to the authority having jurisdiction for approval that establish their dynamic characteristics and demonstrate their lateral force resistance and energy dissipation capacity to be equivalent to the structural systems listed in Table 12.2-1 for equivalent values of response modification coefficient, R, overstrength factor, Ω_o , and deflection amplification factor, C_d.
 - 3.2.3. The Smart Components® SDP evaluation uses the approach found in the document entitled “Establishing Seismic Equivalency for Proprietary Prefabricated Shear Panels”² and “Seismic Design Coefficients: How they are determined for light-frame components”³ using code defined accepted engineering procedures, experience, and good technical judgment.

¹ Unless otherwise noted, all references in this code compliant technical evaluation report (TER) are from the 2018 version of the codes and the standards referenced therein, including, but not limited to, ASCE 7, SDPWS and WFCM. This product also complies with the 2000-2015 versions of the IBC and IRC and the standards referenced therein. As required by law, where this TER is not approved, the building official shall respond in writing, stating the reasons this TER was not approved. For variations in state and local codes, if any see [Section 8](#).

² <http://www.structuremag.org/wp-content/uploads/2014/08/C-StructuralPerformance-Nelson-Aug081.pdf>

³ <http://www.sbcmag.info/article/2014/seismic-design-coefficients-how-they-are-determined-light-frame-components>

Technical Evaluation Report (TER)

- 3.3. The load resistance capacity of Smart Components® is outside the scope of this TER.
- 3.3.1. The design of Smart Components® is performed in accordance with standard metal connector plate design methods as defined in [IBC Section 2303.4](#) and *ANSI/TPI 1*.
- 3.3.2. Each Smart Components® is uniquely designed to resist the seismic design specifications and loading conditions provided by the Building Designer (i.e., Registered Design Professional) for the construction project. Smart Components® design drawings (SCDD) are created that provide all the design information and details needed to meet the resistance to seismic loading conditions and deflection (a.k.a. drift) criteria. This design process follows accepted engineering practice and, therefore, is compliant with any relevant provisions of *ASCE 7*, *AWC/SDPWS*, *IRC*, *IBC*, and *ANSI/TPI 1*.
- 3.4. Any code compliance issues not specifically addressed in this TER are outside the scope of this evaluation.

4. Product Description and Materials:

- 4.1. Smart Components® are prefabricated, metal plate connected, wood trusses that are used to resist lateral loads in braced wall panel and portal applications. See [Figure 1](#). Smart Components® are placed within braced wall lines and used in conventional light-frame construction.
- 4.2. The three types of Smart Components® recognized in this TER are:
- 4.2.1. Portal frame as shown in [Figure 2](#) and portal frame with sill as shown in [Figure 3](#).
- 4.2.2. Narrow panel (single-panel) vertical trusses as shown in [Figure 4](#).
- 4.2.3. Multi-segmented panels composed of multiple single-panel vertical trusses adjacent to each other and interconnected in one wall plane as shown in [Figure 4](#).
- 4.3. Materials
- 4.3.1. Framing Members
- 4.3.1.1. Visually and mechanically graded, solid-sawn lumber and engineered lumber is defined and shall be used in accordance with engineering principles defined in *AWC/NDS* and *ANSI/TPI 1*.
- 4.3.1.2. Minimum nominal member sizes must be 2".
- 4.3.1.2.1. Post members must not have knots larger than ½" in diameter at the hold-down through-bolt location.
- 4.3.1.2.2. Lumber must be of the species and grades as defined in the code compliance reports of the hold-down devices, metal connector plates and any related connecting devices.
- 4.3.1.2.3. Lumber design values correspond with the grade noted on the SCDD and are derived through ASTM consensus standards administered by lumber rules-writing agencies and approved by the American Lumber Standard Committee.
- 4.3.1.3. Preservative-treated and fire-resistant lumber can be used with Smart Components®, where the lumber design values, metal connector plate design values and conditions of use in trusses are provided by the preservative-treated and fire-resistant lumber manufacturer through an ISO/IEC 17065 code compliance report and in concert with *ANSI/TPI 1*.
- 4.3.1.4. Engineered wood members can be used with Smart Components®, where the engineered wood design values, metal connector plate design values and conditions of use in trusses are provided by the preservative-treated and fire-resistant lumber manufacturer through an ISO/IEC 17065 code compliance report and in concert with *ANSI/TPI 1*.
- 4.3.2. Concentric Hold-Down Devices
- 4.3.2.1. Concentric hold-down devices shall be Hardy Frame Z4 T2 Connectors or equivalent, and shall be in accordance with the product's code evaluation report.
- 4.3.2.2. It is the responsibility of the Building Designer to ensure that all displacements are accounted for, including, but not limited to:
- 4.3.2.2.1. Hold-down device
- 4.3.2.2.2. Wood shrinkage

Technical Evaluation Report (TER)

4.3.2.2.3. Fastener slip

4.3.2.2.4. Anchor bolt or threaded rod elongation

4.3.2.3. Total displacement calculations shall be computed in accordance with *AWC/SDPWS* Equation 4.3-1.

4.3.3. Anchor-Rods

4.3.3.1. Steel anchor rods and their design properties shall be in accordance with the standards referenced by [IBC Chapter 35](#).

4.3.3.2. Nuts must meet minimum grade and style specified for the anchor rod grade used. Couplers must comply with IFI 128 and also meet the same specification as the nut for the proof stresses of the anchor rod.

4.3.4. Shrinkage Compensating Device

4.3.4.1. Optional shrinkage compensating devices shall be approved where the Building Official finds that the proposed design is satisfactory and complies with the intent of the codes noted in [Section 2](#).

4.3.4.2. The design properties, performance and installation requirements shall be in accordance with an ISO/IEC 17065 code compliance report.

4.3.5. Metal Plate Connectors

4.3.5.1. The Smart Components® design uses metal plate connector manufacturer published design values, which have been incorporated into the referenced metal plate connector manufacturer's design software program.

4.3.5.1.1. Metal plate connector design properties shall be developed in accordance with *ANSI/TPI 1*.

4.3.5.1.2. Metal plate connector design properties, engineering performance and calibration of engineering performance to design software results shall be in accordance with an ISO/IEC 17065 code compliance report and *ANSI/TPI 1*.

4.3.5.1.3. Metal plate connector installation shall be in accordance with *ANSI/TPI 1* Chapter 3.

4.3.6. Bottom Plates, Sheet Metal Sill Tracks and Shear Connectors

4.3.6.1. Bottom plates shall be in accordance with *AWC/NDS*, [IBC Section 2308.6.7.1](#)⁴ and [IRC Section 602.11](#).

4.3.6.2. Sheet metal sill tracks are used for placement of anchorage, installation and separation of the Smart Components® from concrete foundations. The specification of sheet metal bottom tracks shall be in accordance with *AISI S200* and *S201*.

4.3.6.3. Base shear connector design properties and base shear connection design shall be specified by the Building Designer. This design shall be approved where the Building Official finds that the proposed design is satisfactory and complies with the intent of the codes listed in [Section 2](#) and any appropriate ISO/IEC 17065 code compliance reports.

4.3.7. Bearing Plates

4.3.7.1. Steel bearing plates shall be designed and supplied in accordance with the standards referenced in the applicable building code.

⁴ [2012 IBC Section 2308.3.2.1](#)

Technical Evaluation Report (TER)

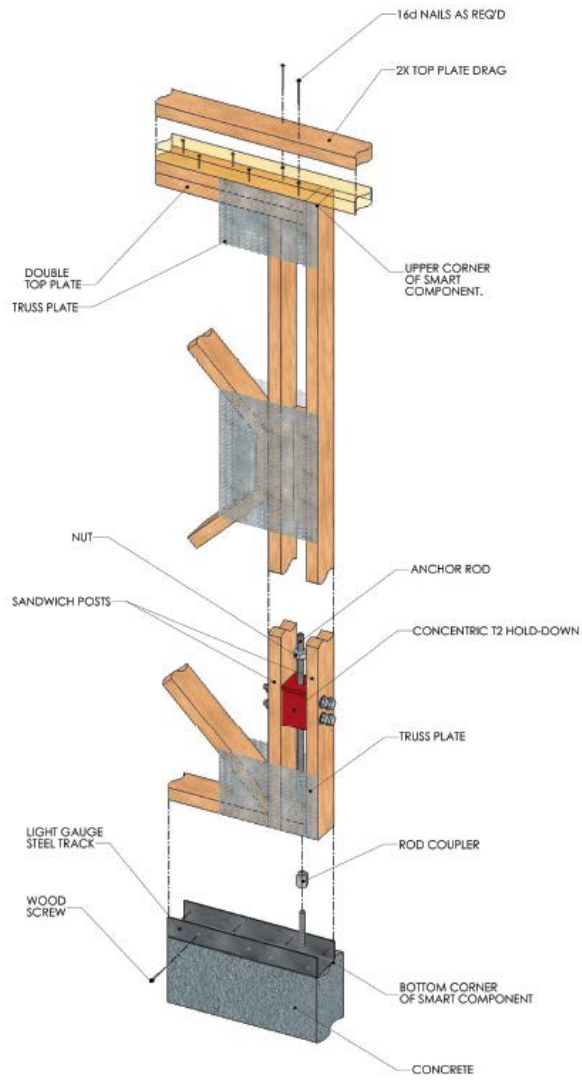


Figure 1: Smart Components® Design Detail

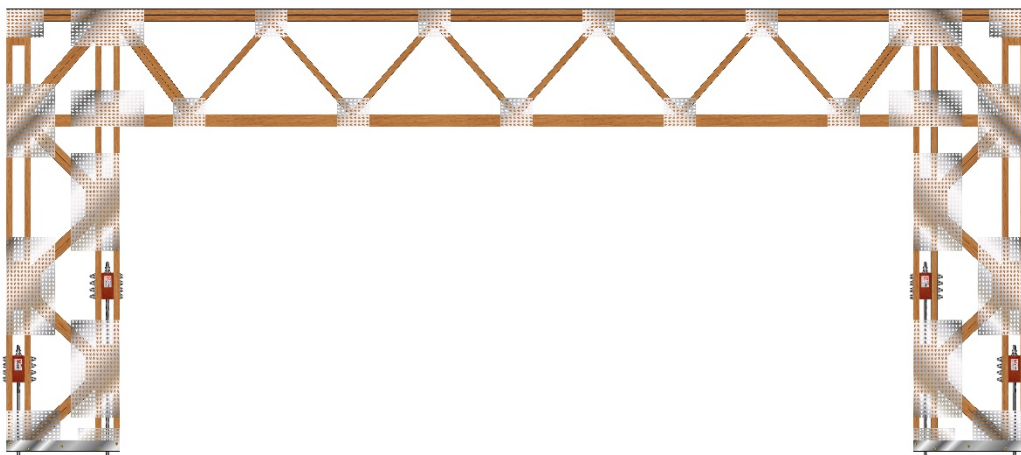


Figure 2: Smart Components® Portal Frame

Technical Evaluation Report (TER)

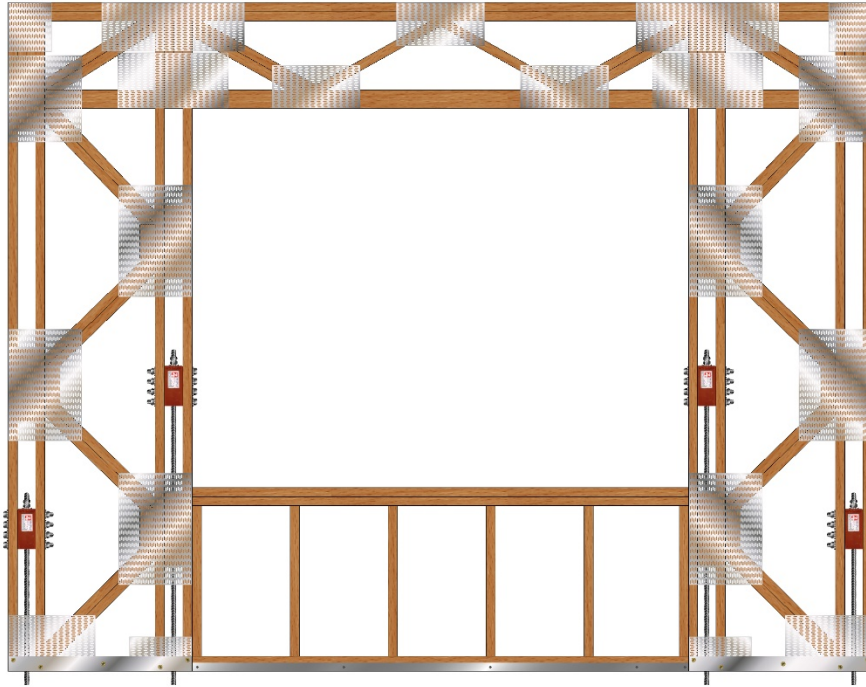


Figure 3: Smart Components® Portal Frame with Sill

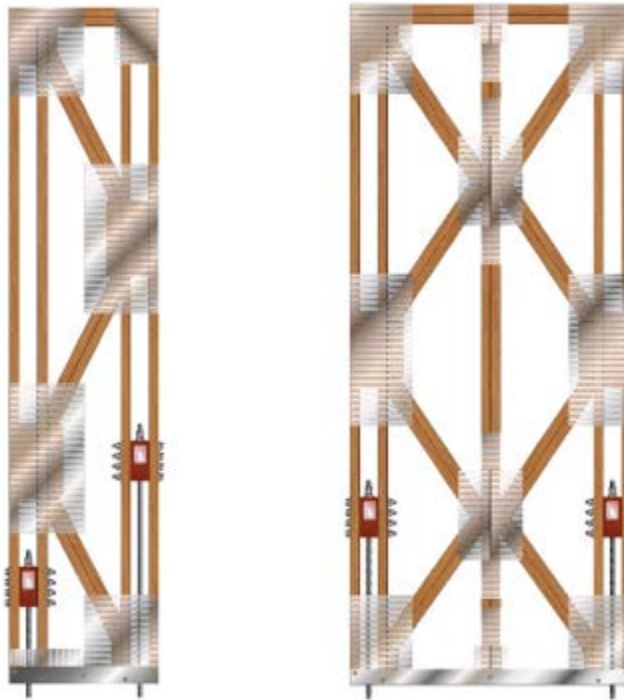


Figure 4: Smart Components® Narrow & Multi-Segmented Wall Panels

Technical Evaluation Report (TER)

5. Applications:

5.1. Seismic Design Parameters

- 5.1.1. Smart Components® may be used in accordance with the SDPs set forth in *ASCE/SEI 7* Table 12.2.1. Smart Components® SDPs – R , Ω_0 , and C_d – are equivalent to those listed in *ASCE/SEI 7* Table 12.2-1 per Section 12.2.1 for light-framed wood walls sheathed with wood structural panels rated for shear resistance.
- 5.1.2. Smart Components® SDPs are listed in [Table 1](#), which have been verified through accredited third-party testing and analysis for use when the braced wall panel or portal is designed and manufactured in accordance with the provisions of [Section 3](#), [Section 5.2](#) and [Section 5.3](#).

SEISMIC DESIGN PARAMETERS (SDPs)	<i>ASCE/SEI 7</i>
Response Modification Coefficient, R	6.5
System Overstrength Factor; Ω_0	3
Deflection Amplification Factor, C_d	4

Table 1: Smart Components® Seismic Design Parameters

- 5.1.2.1. Building height for Seismic Design Categories C, D, E, and F are limited to 65 feet or less as defined in [IBC Section 503](#) and *ASCE-SEI 7* as appropriate.
- 5.1.2.2. For Seismic Design Categories A, B and C building heights, [IBC Section 503](#) applies generally.
- 5.1.2.3. Smart Components lateral load resisting structural elements/systems redundancy factor shall be in accordance with *ASCE/SEI 7* Section 12.3.4.2 and is considered equivalent to shear walls or wall piers with height-to-length ratios of greater than 1.0 per *ASCE/SEI 7* Table 12.3-3.

5.2. Smart Components Design

- 5.2.1. Smart Components® are designed in accordance with [IBC Section 104.11](#), [IRC Section R104.11](#) and [IRC Section R301](#), specifically [R301.1.1](#) and [R301.1.3](#).
- 5.2.2. Smart Components® are used as vertical and lateral load resisting structural elements/shear walls in accordance with [IBC Section 2305.3](#).
- 5.2.3. Smart Components® are used as alternatives to braced wall panels, braced wall lines and continuously sheathed braced walls in conventional light-frame construction in accordance with [IBC Section 2308.6](#)⁵ and [IRC Section R602](#).
- 5.2.4. All applicable project lateral and vertical loads are defined by the Building Designer for each floor level of the structure. The loads supplied provide an individual project's lateral in-plane and out-of-plane wind and earthquake loads.
- 5.2.5. Each Smart Components® is uniquely designed to resist the seismic design specifications and loading conditions provided by the Building Designer for the construction project.
- 5.2.6. The Truss Designer designs Smart Components® for the project's horizontal and vertical demand loads using *ANSI/TPI 1* design methods using standard truss industry engineering practice. Additional considerations include, but are not limited to:
- 5.2.6.1. The truss joints (metal plate connectors) being the primary yield mechanism to achieve seismic resistance ductility.
- 5.2.6.1.1. At locations expected to have ductile and yielding performance, the Joint Stress Index must be greater than the Combined Stress Index.
- 5.2.6.1.2. Calculations for individual members are available upon request.
- 5.2.6.2. Portal header bottom chord must be in accordance with unbraced length requirements of *ANSI/TPI 1*.

⁵ [2012 IBC Section 2308.3](#)

Technical Evaluation Report (TER)

5.2.6.3. Weak and Strong axis buckling calculations must be in accordance with *AWC/NDS* and *ANSI/TPI 1*.

5.2.6.4. Sandwich post vertical boundary members must be designed to carry tension and compression loads in accordance with *AWC/NDS* and *AWC/SDPWS* design specifications.

5.2.7. ASD capacity checks are also made for concentric hold-down connections, lumber net section tension capacity and lumber compression capacity both perpendicular and parallel to grain.

5.2.8. Threaded anchor rod capacity is also analyzed to determine if the rods control the lateral design capacity of the Smart Components®.

5.2.9. The Component Designer calculates the Smart Components® lateral load based drift/deflection.

5.2.10. Contributions from hold-down rod elongation, shrinkage and wood deformation are added to the calculated deflections found on the SCDD.

5.2.11. Seismic drift limits are checked and the Smart Components® stiffness is adjusted to maintain acceptable overall drift/deflection performance.

5.2.12. Smart Components® may have shear wall aspect ratios greater than those specified in *AWC/SDPWS* Section 4.3.4 or [IBC Section 2305](#) and any implied aspect ratios of [IRC Section R602.10](#). See [Section 5.3.7](#) of this TER.

5.2.13. Deflections resulting from out-of-plane loads must comply with [IBC Section 1604.3.1](#) or [IRC Section R301.7](#).

5.3. Building Design Requirements

5.3.1. The design of structures encompassing Smart Components® Panels and Portals must be in accordance with accepted building design, truss design (see [Section 5.2](#)) and general engineering practice.

5.3.2. Building design that utilizes the unique lateral load resistance attributes of Smart Components® shall include but is not limited to, seismic design and detailing requirements associated with relevant *IBC*, *IRC*, *AWC/NDS*, *SDPWS*, and *ANSI/TPI 1* sections.

5.3.3. The Building Designer shall specify the type of Smart Components® to be used. Typical examples are shown in [Section 4.2](#) and [Section 4.3](#).

5.3.4. Building design and engineering considerations shall include, and are not limited to the following.

5.3.4.1. Lateral and vertical loads shall be defined and demand loads must consider:

5.3.4.1.1. Gravity

5.3.4.1.2. Tension or uplift due to wind

5.3.4.1.3. Vertical load impact on seismic loads

5.3.4.1.4. Horizontal in-plane or out-of-plane lateral seismic and/or wind loads

5.3.4.1.5. Distribution of lateral loads to shear-resisting elements and the specification of installation conditions including connections to the surrounding structure to provide a continuous load path, location restrictions, and size limitations

5.3.4.1.6. External to the Smart Components® design, ASD capacities must be evaluated for the effects of:

5.3.4.1.6.1. Concentric anchoring systems

5.3.4.1.6.2. Hold-down device attachment capacities

5.3.4.1.6.3. Related lumber attachments and their net section tension capacity

5.3.4.1.6.4. Related lumber attachments and compression capacity for both perpendicular and parallel-to-grain directions

5.3.4.1.6.5. Threaded anchor rod to the anchoring system and other related connections

5.3.4.1.6.6. Review of the effects of connections to the rest of the supported structure including foundation

Technical Evaluation Report (TER)

5.3.4.1.6.7. Placement of other panels or portals

5.3.4.1.6.8. Overturning strength demands and overturning stiffness as defined by the building design overall

5.3.4.2. Smart Components® shall be designed in accordance with *ANSI/TPI 1*, [IBC Section 1604.4](#), and [IRC Section R301.1.3](#) using Smart Components® proprietary design software.

5.3.4.3. SCDDs and any related engineered details must be signed and sealed by a RDP authorized by Trussed, Inc. and responsible for the Smart Components® design.

5.3.4.4. The Building Designer shall ensure that the overall drift/deflection performance do not exceed values specified in *ASCE/SEI 7* Table 12.12-1 and [IBC Section 1604.3](#).

5.3.4.5. Story drifts due to wind loads at ASD levels must not exceed $h/180$, where h equals the story height. More restrictive story drifts may need to be considered where brittle wall finishes are installed or when specified by the RDP.

5.3.5. Each project must have a design for each panel or portal in order to accommodate site-specific lateral wind and earthquake loads and installation conditions. Continuous load paths must be provided by the RDP in accordance with *ASCE/SEI 7* Section 12.1.3.

5.3.6. Where the stability against overturning resulting from lateral loads in accordance with allowable stress design load combinations in [IBC Section 1605.3](#) or [IRC Section R301](#) is not sufficient to prevent tension or uplift, the connection of the anchoring system described in [Section 4.3](#) must be designed by the Building Designer.

5.3.7. Smart Components® may have shear wall aspect ratios greater than those specified in *AWC/SDPWS* Section 4.3.4 or [IBC Section 2305](#) and any implied aspect ratios of [IRC Section R602.10](#) as follows;

5.3.7.1. Maximum aspect ratio for narrow panels is 6:1

5.3.7.2. Maximum aspect ratio for multi-segmented panels is 5:1

5.3.7.3. Maximum aspect ratio for portal frame legs is 4.9:1

5.3.8. Deflections resulting from out-of-plane loads must comply with [IBC Section 1604.3.1](#) or [IRC Section R301.7](#).

5.4. Anchorage

5.4.1. Adequate embedment length and anchorage details must be determined by a RDP in accordance with [IBC Section 1908](#) and [Section 1909](#), or [Chapter 21](#), and [IRC Chapter 3](#), [Chapter 4](#) or [Chapter 6](#) as applicable.

5.5. Connections

5.5.1. Connections of Smart Components® panels and/or portals to the surrounding structure must be designed to resist all lateral, tension and compression loads in accordance with [IBC Section 2308](#) and [IRC Section R602](#).

5.6. Structural Applications

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

6. Installation:

6.1. Installation shall comply with the manufacturer's installation instructions and this TER. In the event of a conflict between the manufacturer's installation instructions and this TER, the more restrictive shall govern.

6.2. Smart Components® may be supported on concrete or masonry foundations, wood floor framing members, or steel beams.

6.3. Smart Components® shall be installed in accordance with the manufacturer's instructions and the building plans approved by the Building Official.

Technical Evaluation Report (TER)

6.4. Step-by-step instructions

6.4.1. General

6.4.1.1. Secure steel sill track to wood floor framing, steel beams, concrete or masonry foundations as required. Steel sill tracks are optional when Smart Components® are installed on wood floor framing members.

6.4.1.2. If an additional (third) anchor bolt is required, locate and drill hole in portal sill plate.

6.4.2. Sill Track on Concrete

6.4.2.1. (1) Thread coupler on to embedded rod

6.4.2.2. (2) Insert panel/column into sill track

6.4.2.3. (3) Thread ATR into coupler

6.4.2.4. (4) Tighten T2 nut to fully seat component into sill track

6.4.2.5. (5) Fasten sill track to panel/column with furnished screws

6.4.2.6. (6) Do not use nut/washer with drift pins

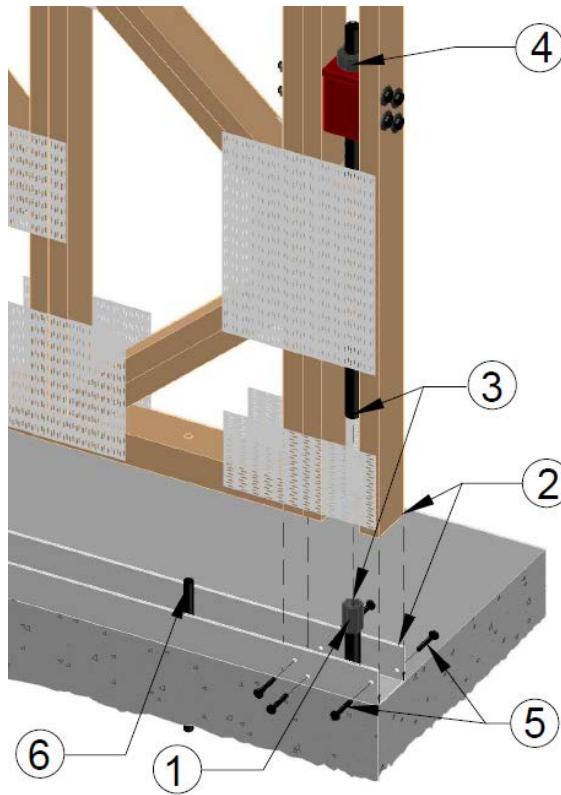


Figure 5: Installation on Concrete

Technical Evaluation Report (TER)

6.4.3. Sill Track Attached to Smart Components

- 6.4.3.1. (1) Remove sill track
- 6.4.3.2. (2) Thread coupler to ATR (within structural panel)
- 6.4.3.3. (3) Fully seat and fasten sill track to panel/column with furnished screws
- 6.4.3.4. (4) Place Smart Components® over embedded rod
- 6.4.3.5. (5) Thread coupler (at bottom of ATR) on to embedded rod
- 6.4.3.6. (6) Tighten T2 nut
- 6.4.3.7. (7) Do not use nut/washer with drift pins

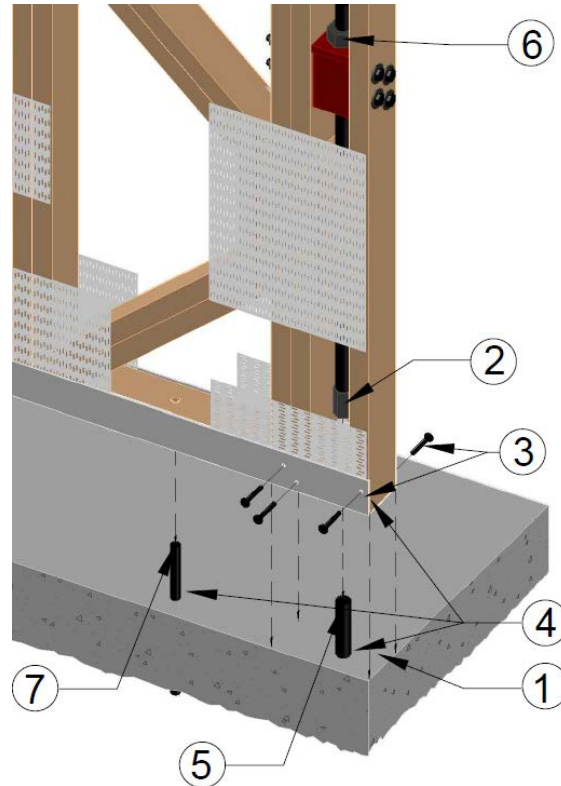


Figure 6: Installation of Sill Plate Attached to Smart Components®

6.4.4. NOTE: In both installation processes, ensure Smart Components® is plumb and braced once it is stood up and sill track is secured to the floor.

7. Test and Engineering Substantiating Data:

- 7.1. Smart Components Equivalency Testing in accordance with *ASTM E2126*, performed by CEL Consulting, Lab #J1025-1068 and Project #50-51996J.
- 7.2. Smart Components Testing in accordance with *ASTM E2126*, performed by CEL Consulting, Project #50-52753C.
- 7.3. DrJ engineering analysis of CEL test data. DrJ engineering analysis of SDP calculations. DrJ engineering comparative engineering analysis of SDPs to wood structural panel SDP derivations.
- 7.4. Grundahl, K., and Lawless, D., May 2014, "Seismic Design Coefficients: How they are determined for light-frame components," *SBC Magazine*, pp. 18-22.
- 7.5. The product(s) evaluated by this TER fall within the scope of one or more of the model, state or local building codes for building construction. The testing and/or substantiating data used in this TER is limited to buildings, structures, building elements, construction materials and civil engineering related specifically to buildings.

Technical Evaluation Report (TER)

- 7.6. The provisions of model, state or local building codes for building construction do not intend to prevent the installation of any material or to prohibit any design or method of construction. Alternatives shall use consensus standards, performance-based design methods or other engineering mechanics based means of compliance. This TER assesses compliance with defined standards, accepted engineering analysis, performance-based design methods, etc. in the context of the pertinent building code requirements.
- 7.7. Some information contained herein is the result of testing and/or data analysis by other sources, which DrJ relies on to be accurate, as it undertakes its engineering analysis.
- 7.8. DrJ has reviewed and found the data provided by other professional sources are credible. The information in this TER conforms with DrJ's procedure for acceptance of data from approved sources.
- 7.9. DrJ's responsibility for data provided by approved sources conforms with [IBC Section 1703](#) and any relevant professional engineering law.
- 7.10. Where appropriate, DrJ relies on the derivation of design values, which have been codified into law through codes and standards (e.g., *IRC, WFCM, IBC, SDPWS, NDS, ACI, AISI, PS-20, PS-2*, etc.). This includes review of code provisions and any related test data that aids in comparative analysis or provides support for equivalency to an intended end-use application. Where the accuracy of design values provided herein is reliant upon the published properties of commodity materials (e.g. lumber, steel, concrete, etc), DrJ relies upon grade/properties provided by the raw material supplier to be accurate and conforming to the mechanical properties defined in the relevant material standard.

8. Findings:

- 8.1. When installed in accordance with the manufacturer's installation instructions and this TER, Smart Components® provide equivalency and are suitable alternatives to light-framed wood walls sheathed with wood structural panels rated for shear resistance and comply with the applicable sections of the codes listed in [Section 2](#) for the following design and application needs.
 - 8.1.1. SDPs in accordance with *ASCE/SEI 7-10*.
 - 8.1.2. Performance as lateral load resisting structural elements/shear walls in Types III and V construction in accordance with [IBC Section 2305.3](#).
 - 8.1.3. Performance as an alternative to braced wall panels, braced wall lines and continuously sheathed braced walls in conventional light-frame construction and buildings of Types III and V construction in accordance with [IBC Section 2308.6](#) and [IRC Section R602.10.4](#).
- 8.2. [IBC Section 104.11](#) ([IRC Section R104.11](#) and [IFC Section 104.9](#) are similar) states:

104.11 **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 has been *approved*. An alternative material, design or method of construction shall be *approved* where the *building official* finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, not less than the equivalent of that prescribed in this code. ... Where the alternative material, design or method of construction is not *approved*, the *building official* shall respond in writing, stating the reasons the alternative was not *approved*.
- 8.3. This product has been evaluated to the codes listed in [Section 2](#), and is compliant with all known state and local building codes. Where there are known variations in state or local codes that are applicable to this evaluation, they are listed here:
 - 8.3.1. No known variations
- 8.4. This TER uses professional engineering law, the building code, ANSI/ASTM consensus standards and generally accepted engineering practice as its criteria for all testing and engineering analysis. DrJ's professional engineering work falls under the jurisdiction of each state Board of Professional Engineers, when signed and sealed.

9. Conditions of Use:

- 9.1. Where required by the authority having jurisdiction (AHJ) in which the project is to be constructed, this TER and the installation instructions shall be submitted at the time of permit application.

Technical Evaluation Report (TER)

- 9.2.** Any generally accepted engineering calculations needed to show compliance with this TER shall be submitted to the code official for review and approval.
- 9.3.** Design loads shall be determined in accordance with the building code adopted by the jurisdiction in which the project is to be constructed and/or by the Building Designer (e.g., Owner, Registered Design Professional, etc.).
- 9.4.** The Smart Components® described in this report shall comply with, or are suitable alternatives to, what is specified in those codes listed in [Section 2](#), subject to the following conditions:
- 9.4.1.** This TER applies to only those Smart Components® panels and portals constructed as is described in [Section 4.2](#) and [Section 4.3](#) using the materials described in [Section 4.3](#), designed in accordance with [Section 5](#), and installed in accordance with [Section 6](#).
- 9.4.2.** The capacity of Smart Components® shall conform to accepted engineering practice and *ANSI/TPI 1* design methods following standard truss industry engineering practice.
- 9.4.2.1.** Smart Components® are designed for a specific project's horizontal and vertical demand loads using *ANSI/TPI 1*.
- 9.4.2.2.** The configuration and design of an individual Smart Components® is determined based upon the project design loads and related requirements and specifications as provided by the Building Designer.
- 9.4.3.** Story drifts due to earthquake loads shall not exceed those specified in *ASCE/SEI 7* Table 12.12-1.
- 9.4.3.1.** In applications where Smart Components® are stacked on multiple levels, the building design shall consider the effect of floor framing on the overall story drift. One method to accomplish this is to increase the drift of any one component by the ratio of the component height plus the depth of the floor above to the specific height of the component at the level (i.e., story) being designed.
- 9.4.4.** Calculations and details justifying that the design stresses in all members are within code allowable limits shall comply with the local building code requirements or be submitted to the code official for approval upon request.
- 9.4.5.** Design of the structural members (concrete or masonry foundations or steel or wood beams) supporting the Smart Components® is the responsibility of the Building Designer and is outside of the scope of this report.
- 9.4.6.** Smart Components® are manufactured by a Trussed Inc. licensed fabricator who has a current and valid certification by:
- 9.4.6.1.** An approved third-party quality assurance/inspection agency that certifies the level of quality meets or exceeds the minimum requirements of *ANSI/TPI 1*.
- 9.4.6.2.** In the absence of certification:
- 9.4.6.2.1.** Truss design drawings, details and specifications are prepared in accordance with [IBC Section 2303.4](#) through [Section 2303.4.7](#) and signed and sealed by a RDP.
- 9.4.7.** Metal connector plates must have a current and valid ISO/IEC 17065 code compliance report that is in compliance with the requirements of *ANSI/TPI 1*.
- 9.4.8.** Smart Components® must be protected with weather-resisting cladding cover on all exterior walls of the building envelope.
- 9.5.** Smart Components® do not require special inspection. Periodic field special inspections of anchorage attachments and fastening of components within seismic-force-resisting systems must be in accordance with [IBC Section 1704](#). Where special inspection or testing is required by [IBC Section 1705](#), the RDP in responsible charge shall prepare a statement of special inspections in accordance with [Section 1704.3.1](#) for submittal by the applicant in accordance with [Section 1704.2.3](#).
- 9.6.** Design
- 9.6.1.** Building Designer Responsibility
- 9.6.1.1.** Unless the AHJ allows otherwise, the Construction Documents shall be prepared by a Building Designer for the Building and shall be in accordance with [IRC Section R106](#) and [IBC Section 107](#).

Technical Evaluation Report (TER)

9.6.1.2. The Construction Documents shall be accurate and reliable and shall provide the location, direction and magnitude of all applied loads and shall be in accordance with [IRC Section R301](#) and [IBC Section 1603](#).

9.6.2. Construction Documents

9.6.2.1. Construction Documents shall be submitted to the Building Official for approval and shall contain the plans, specifications and details needed for the Building Official to approve such documents.

9.7. Responsibilities

9.7.1. The information contained herein is a product, material, detail, design and/or application TER evaluated in accordance with the referenced building codes, testing and/or analysis through the use of accepted engineering practice, experience and technical judgment.

9.7.2. DrJ TERs provide an assessment of only those attributes specifically addressed in the Products Evaluated or Code Compliance Process Evaluated sections.

9.7.3. The engineering evaluation was performed on the dates provided in this TER, within DrJ's professional scope of work.

9.7.4. This product is manufactured under a third-party quality control program in accordance with [IRC Section R104.4](#) and [R109.2](#) and [IBC Section 104.4](#) and [110.4](#).

9.7.5. The actual design, suitability and use of this TER, for any particular building, is the responsibility of the Owner or the Owner's authorized agent, and the TER shall be reviewed for code compliance by the Building Official.

9.7.6. The use of this TER is dependent on the manufacturer's in-plant QC, the ISO/IEC 17020 third-party quality assurance program and procedures, proper installation per the manufacturer's instructions, the Building Official's inspection and any other code requirements that may apply to demonstrate and verify compliance with the applicable building code.

10. Identification:

10.1. Smart Components® described in this TER are identified by a label on the board or packaging material bearing the manufacturer's name, product name, TER number, and other information to confirm code compliance.

10.2. Additional technical information can be found at smartcomponents.us.

11. Review Schedule:

11.1. This TER is subject to periodic review and revision. For the most recent version of this TER, visit drjengineering.org.

11.2. For information on the current status of this TER, contact [DrJ Engineering](#).



- [Mission and Professional Responsibilities](#)
- [Product Evaluation Policies](#)
- [Product Approval – Building Code, Administrative Law and P.E. Law](#)