Listing and Technical Evaluation Report™

A Duly Authenticated Report from an Approved Agency

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TRX™ Truss Screws

Trade Secret Report Holder:

Western Builders Supply Company dba Big Timber®

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CSI Designations:

DIVISION: 06 00 00 - WOOD, PLASTICS AND COMPOSITES Section: 06 05 23 - Wood, Plastic, and Composite Fastenings

1 Innovative Products Evaluated[1]

1.1 TRX Truss Screws:

1.1.1 $4^1/_2$" TRX Truss Screw

1.1.2 6" TRX Truss Screw

2 Product Description and Materials

2.1 The innovative products evaluated in this report are shown in **Figure 1** and **Figure 2**.



Figure 1. $4^1/_2$" TRX Truss Screw

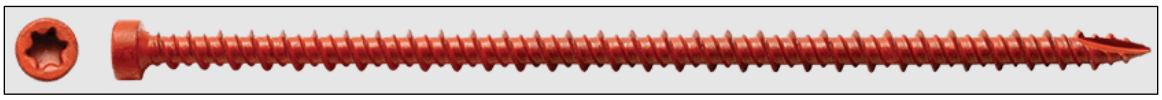


Figure 2. 6" TRX Truss Screw

2.2 *Product Description*

2.2.1 TRX Truss Screws are fully threaded fasteners with a cylindrical, Torx-driven head with a tapered underside.

2.2.2 $4^1/_2$" TRX Truss Screws are available with a bronze-colored coating.

2.2.3 6" TRX Truss Screws are available with an orange-colored coating.

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2.3 *Fastener Material*

2.3.1 TRX Truss Screws are manufactured using a standard cold-formed process followed by a heat-treating process, and then are subsequently coated.

2.3.2 Fasteners are heat-treated and then coated with a proprietary coating.

2.4 *Corrosion Resistance*

2.4.1 TRX Truss Screws are approved for use in chemically treated or untreated lumber where ASTM A153, Class D coatings are approved for use in accordance with IBC Section 2304.10 and IRC Section R304.3.[2]

2.4.1.1 The proprietary coating has been tested and found to exceed the protection provided by code approved hot-dipped galvanized coatings meeting ASTM A153, Class D in accordance with IBC Section 2304.10.6[3] and IRC Section R304.3.[4]

2.4.2 TRX Truss Screws are subject to the limitations of this report.

2.5 *Pressure-Preservative Treated (PPT) Wood Applications*

2.5.1 TRX Truss Screws, with the proprietary coating, are recognized for use in PPT lumber provided the conditions set forth by the PPT lumber manufacturer be met, including appropriate strength reductions.

2.6 *Fire-Retardant Treated (FRT) Wood Applications*

2.6.1 TRX Truss Screws, with the proprietary coating, are recognized for use in FRT lumber provided the conditions set forth by the FRT lumber manufacturer be met, including appropriate strength reductions.

2.7 *Wood Material*

2.7.1 Solid sawn wood main and side members connected using TRX Truss Screws shall consist of lumber species or species combinations having an assigned specific gravity as given in the respective tables of this report.

2.7.2 Structural Composite Lumber, or SCL (e.g., LVL, LSL, PSL, etc.), connected using TRX Truss Screws shall be recognized in evaluation reports having published equivalent specific gravities for dowel-bearing strength and withdrawal resistance.

2.8 *Fastener Specifications*

2.8.1 The fasteners evaluated in this report are specified in **Table 1**.

Table 1. Fastener Specifications[1]

Fastener Designation	Head Geometry				Length[2] (in)		Diameter (in)		Bending Yield Strength,[4] F_{yb} (psi)	Allowable Steel Strength (lbf)	
	Style	Drive System	Diameter (in)	Height (in)	Fastener	Thread[3]	Minor	Major		Tensile	Shear[5]
4 1/2" TRX Truss Screws	Cylinder Head	T30 Star Drive	0.346	0.156	4.6	4.3	0.153	0.235	209,000	1,140	850
6" TRX Truss Screws					6.0	5.8					

SI: 1 in = 25.4 mm, 1-lbf = 4.45 N, 1-psi = 0.00689 MPa

1. Tabulated fastener dimensions are measured on uncoated fasteners. Finished dimensions are larger due to the proprietary coatings added.
2. Fastener length is measured from the topside of the head to the tip.
3. Thread length includes tapered tip.
4. Bending yield strength, or F_{yb}, is determined in accordance with ASTM F1575 using minor thread diameter when fastener is tested in the threaded section.
5. Shear strength is determined in accordance with AISI S904 and tested within the minor thread diameter.

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

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3 Definitions[5]

3.1 New Materials[6] 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.[7] The design strength and permissible stresses shall be established by tests[8] and/or engineering analysis.[9]

3.2 Duly authenticated reports[10] and research reports[11] are test reports and related engineering evaluations that are written by an approved agency[12] and/or an approved source.[13]

3.2.1 This report utilizes 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).[14]

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.[15]

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[16] ISO/IEC 17025 and ISO/IEC 17020 accredited.

3.6 The regulatory authority shall enforce[17] 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[18] 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.[19]

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.[20] Thus, all ANAB ISO/IEC 17065 duly authenticated reports are approval equivalent,[21] 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.[22]

4 Applicable Local, State, and Federal Approvals; Standards; Regulations[23]

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.[24]

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.[25]

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4.1.3 Approved by the Code of Federal Regulations Manufactured Home Construction: Pursuant to Title 24, Subtitle B, Chapter XX, Part 3282.14[26] and Part 3280[27] 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 *Code of Federal Regulations, Title 24, Subtitle B, Chapter XX, Part 3280 and Part 3282*

4.3 *Standards*

4.3.1 *AISI S904: Test Standard for Determining the Tensile and Shear Strengths of Steel Screws*

4.3.2 *ANSI/AWC NDS: National Design Specification (NDS) for Wood Construction*

4.3.3 *ASTM A153: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware*

4.3.4 *ASTM A510: Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel, and Alloy Steel*

4.3.5 *ASTM B117: Standard Practice for Operating Salt Spray (Fog) Apparatus*

4.3.6 *ASTM D1761: Standard Test Methods for Mechanical Fasteners in Wood and Wood-Based Materials*

4.3.7 *ASTM F1575: Standard Test Method for Determining Bending Yield Moment of Nails, Spikes, and Dowel-type Threaded Fasteners*

4.3.8 *ASTM G85: Standard Practice for Modified Salt Spray (Fog) Testing*

4.3.9 *ASTM G198: Standard Test Method for Determining the Relative Corrosion Performance of Driven Fasteners in Contact with Treated Wood*

5 Listed[28]

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 an 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 *General*

6.1.1 TRX Truss Screws are dowel-type threaded and self-drilling screws used for wood-to-wood connections.

6.1.2 Reference design values for TRX Truss Screws are governed by the applicable codes, and the provisions for dowel-type fasteners in the NDS.

6.1.2.1 Tabulated reference design values herein shall be adjusted by all applicable adjustment factors per NDS Table 11.3.1 for Allowable Stress Design (ASD) only.

6.1.3 Unless otherwise noted, adjustment of the design stresses for duration of load shall be in accordance with the applicable code.

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6.2 *Reference Lateral Design Values (Z)*

6.2.1 Reference lateral design values [lb] for shear load perpendicular to grain and parallel to grain for TRX Truss Screws are outlined in **Table 2**.

Table 2. Reference Lateral Design Values (Z) for Connections in Lumber [lbf][1,3,4]

Fastener Designation	Minimum Side Member Thickness (in)	Minimum Main Member Penetration[5] (in)	Wood Species[2] (Specific Gravity)	
			HF/SPF (0.42)	
			$Z_\perp$	$Z_\parallel$
4 1/2" TRX Truss Screws	1.5	3.0	150	150
6" TRX Truss Screws	1.5	3.0	150	150
	3.0	3.0	160	160

SI: 1 in = 25.4 mm, 1-lbf = 4.45 N

1. Reference lateral values apply to two-member single shear connection where both members are of the same specific gravity and the fastener is oriented perpendicular to grain.
2. Tabulated values may also be used for engineered wood products with a corresponding assigned specific gravity equal to or greater than the specific gravity listed in the table.
3. Tabulated lateral design values (Z) shall be adjusted by all applicable adjustment factors per NDS Table 11.3.1 for ASD only.
4. $Z_\perp$ = Lateral Design Values Perpendicular to Grain (lb), $Z_\parallel$ = Lateral Design Values Parallel to Grain (lb)
5. Fastener main member penetration is the length embedded in the main member, including the tip.

6.3 *Reference Withdrawal Design Values (W) and Head Pull-Through Design Values (P)*

6.3.1 Reference withdrawal design values [lb/in] for TRX Truss Screws are specified in **Table 3**.

Table 3. Reference Withdrawal Values (W) – Side Grain Applications, [lbf/in]

Fastener Designation	Penetration[3] (in)	Withdrawal Allowable Design Value,[1,2,4] W
		Wood Species[2] (Specific Gravity)
		HF/SPF (0.42)
4 1/2" and 6" TRX Truss Screws	1	215
	2	235

SI: 1 in = 25.4 mm, 1 lbf/in = 0.175 kN/m

1. Tabulated withdrawal values (W) shall be adjusted by all applicable adjustment factors per NDS Table 11.3.1 for ASD only.
2. Tabulated values may also be used for engineered wood products with a corresponding assigned specific gravity equal to or greater than the specific gravity listed in the table.
3. Minimum fastener penetration into main member of 1" is required. Fastener penetration is the threaded length embedded in the main member, including the tip.
4. Total Allowable Withdrawal Design Value as a function of penetration is determined as follows:
   a. For penetration ≤1":
      W_{total} *[lbf]* = W_1" *(p)*
   b. For penetration >1":
      W_{total} *[lbf]* = W_1"*(1)* + *(2*W_2"-W_1"*)(p - 1)*
   c. where:
      W_1" = value for withdrawal resistance at 1" penetration from this table [lb/in]
      W_2" = value for withdrawal resistance at 2" penetration from this table [lb/in]
      p = penetration [in], value shall be limited to the threaded length if penetration into substrate exceeds fastener thread length.

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6.3.2 Reference head pull-through design values (lbf) for TRX Truss Screws are given in **Table 4**.

Table 4. Reference Head Pull-Through Allowable Design Values (P), [lbf]

Fastener Designation	Wood Side Member Thickness (in)	Head Pull-Through Allowable Design Value,[1] P
		Wood Species[2] (Specific Gravity)
		HF/SPF (0.42)
4 1/2" and 6" TRX Truss Screws	1.5	450

SI: 1 in = 25.4 mm, 1-lbf = 4.45 N

1. Tabulated head pull-through values (P) shall be adjusted by all applicable adjustment factors per NDS Table 11.3.1 for ASD only.
2. Tabulated values may also be used for engineered wood products with a corresponding assigned specific gravity equal to or greater than the specific gravity listed in the table.

6.4 *Structural Connections*

6.4.1 TRX Truss Screws may be used in the construction of walls meeting the requirements of IBC Section 2308 or IRC Section R602 for the following applications:

6.4.1.1 TRX Truss Screws may be used to attach minimum 1 1/2" thick wood trusses, rafters, floor joists, or floor trusses to wood walls.

6.4.1.1.1 See **Section 6.5** for allowable design loads for top plate to roof truss/rafter/joist connections.

6.4.1.1.2 See **Section 6.6** for allowable design loads for top plate to gable end truss connections.

6.4.1.2 TRX Truss Screws may be used to attach studs to top plates or bottom plates see **Section 6.7** and **Section 6.8**, respectively, for allowable design loads.

6.4.1.3 TRX Truss Screws may be used to attach bottom plates to rim boards in the construction of walls, see **Section 6.9** for allowable design loads.

6.4.2 Allowable design loads are applicable to fasteners installed in accordance with **Section 9**.

6.4.3 At a minimum, walls shall consist of a double top plate installed in accordance with IBC Section 2308.9.3.2[29] or IRC Section R602.3.2.

6.4.3.1 A single top plate is permitted to be used as an alternative to a double top plate, provided the provisions specified in IBC Section 2308.9.3.2[30] or IRC Section R602.3.2 be met.

6.4.4 TRX Truss Screws may be used in buildings or structures requiring structural design for wind loads in accordance with IBC Section 1609, or wind design in accordance with IRC Section R301.2.1.

6.4.5 TRX Truss Screws may be used in buildings or structures requiring structural design for earthquake loads in accordance with IBC Section 1613, or seismic design in accordance with IRC Section R301.2.2.

6.4.6 To maintain a continuous uplift load path, connections in the same area must be stacked on the same side of the wall (i.e., rafter to top plate connection and top plate to stud connection).

6.4.7 Where these tabulated ASD values are based upon the NDS concepts and calculations, the ASD value is based on, and dependent upon, the specific gravity value specified and certified by the NDS Supplement.

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6.5 *Allowable Design Loads – Roof Truss/Rafter/Joist to Top Plate Connection*

6.5.1 Allowable design loads for uplift and lateral resistance for truss, rafter, and joist to top plate connections are provided in **Table 5**, using a load duration factor, C_D, of 1.0.

6.5.1.1 Per NDS Section 11.3.2, connection design properties may be adjusted by a load duration factor listed in NDS Table 2.3.2. These loads are generally not combined with other loads (e.g., dead, live).

6.5.1.2 Per **Table 1**, when a load duration factor, C_D, is applied to the ASD values for uplift, the resulting ASD value shall not exceed the allowable screw tension design value of 1,140 lbs.

6.5.2 Loads parallel to the wall are labeled F1 and loads perpendicular to the wall are labeled F2. See **Figure 3** for load directions.

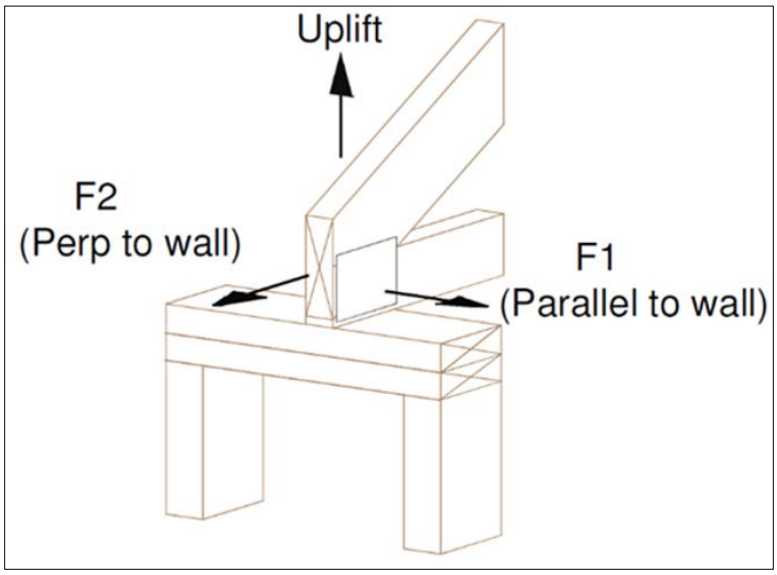


Figure 3. Uplift and Lateral Load Orientations

6.5.3 Allowable design loads are applicable to fasteners installed in accordance with **Section 9** in single and double top plate applications.

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Table 5. Allowable Uplift and Lateral Loads for Fasteners in Truss/Rafter/Joist to Top Plate Connections [lbf]

Fastener	Minimum Penetration into Truss/Rafter/Joist[1] (in)	Top Plate(s)	Fastener Angle to Vertical	ASD Loads Per Fastener[2,3,4,5] (lbf) C_D = 1.0		
				HF/SPF (0.42)		
				Uplift	F1 (Parallel to Wall)	F2 (Perpendicular to Wall)
4 1/2" TRX Truss Screws	2 7/8	Single	22.5°[7]	450	305	265
	3		0°	450	340	300
6" TRX Truss Screws	2 3/4	Double	22.5°[7]	600	245	410
	3		0°	685	255	425

SI: 1 in = 25.4 mm, 1-lbf = 4.45 N

1. Wood truss, rafter, or floor joist members shall be a minimum of 2" nominal thickness. Design of truss, rafter, or floor joist is by others.
2. SCL may be used provided the equivalent specific gravity shall be equal to or greater than the specific gravities provided in this table. Refer to product information from the SCL manufacturer.
3. For applications involving members with different specific gravities, use the allowable load corresponding to the lowest specific gravity. Loads may be adjusted using the adjustment factors (e.g., load duration factor) from NDS Section 11.3, where applicable.
4. See Figure 3 for load directions.
5. Install fastener at an upward angle from the vertical of 20° to 25° (22.5° is optimal) or 0° (See Figure 4 and Figure 5). For installation between 20° and 25°, design values for 22.5° (optimal upward angle) may be used.

6.5.4 Install fastener at an upward angle from the vertical of 20° to 25°; 22.5° is optimal. For installation between 20° and 25°, design values for 22.5° may be used. See **Figure 4**.

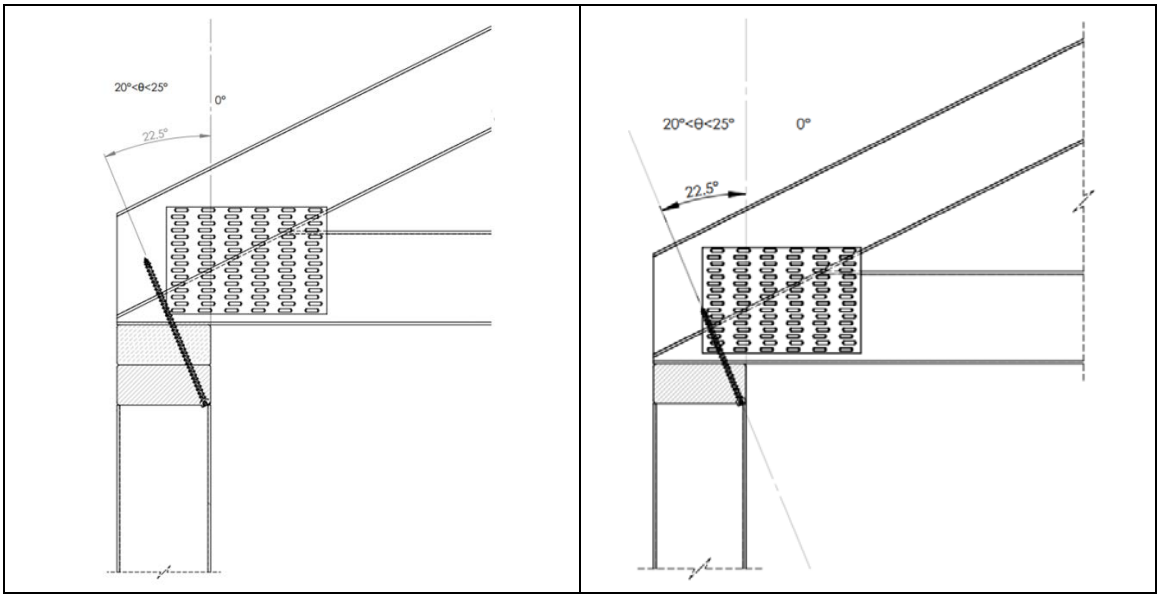


Figure 4. Installation of Fasteners at an Angle in Top Plate to Truss/Rafter/Joist Applications

6.5.5 Install fastener at an upward angle from the vertical of 0°. See **Figure 5**.

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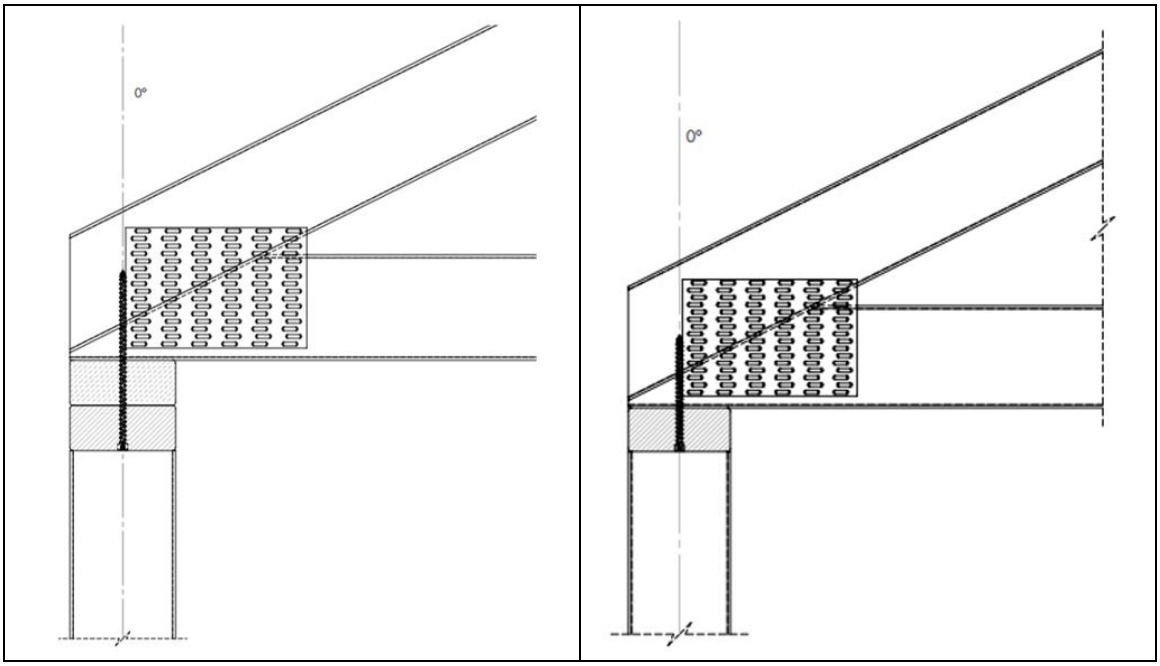


Figure 5. Installation of Fasteners in Top Plate Perpendicular to Truss/Rafter/Joist Applications

6.5.6 To attach minimum $1^1/_2$" thick wood trusses or rafters to the top plates of wood stud walls using two fasteners.

6.5.6.1 Where the truss or rafter is offset from the stud, the fasteners can be installed perpendicularly through the top plates to engage the truss or rafter above. See **Figure 6** for installation details.

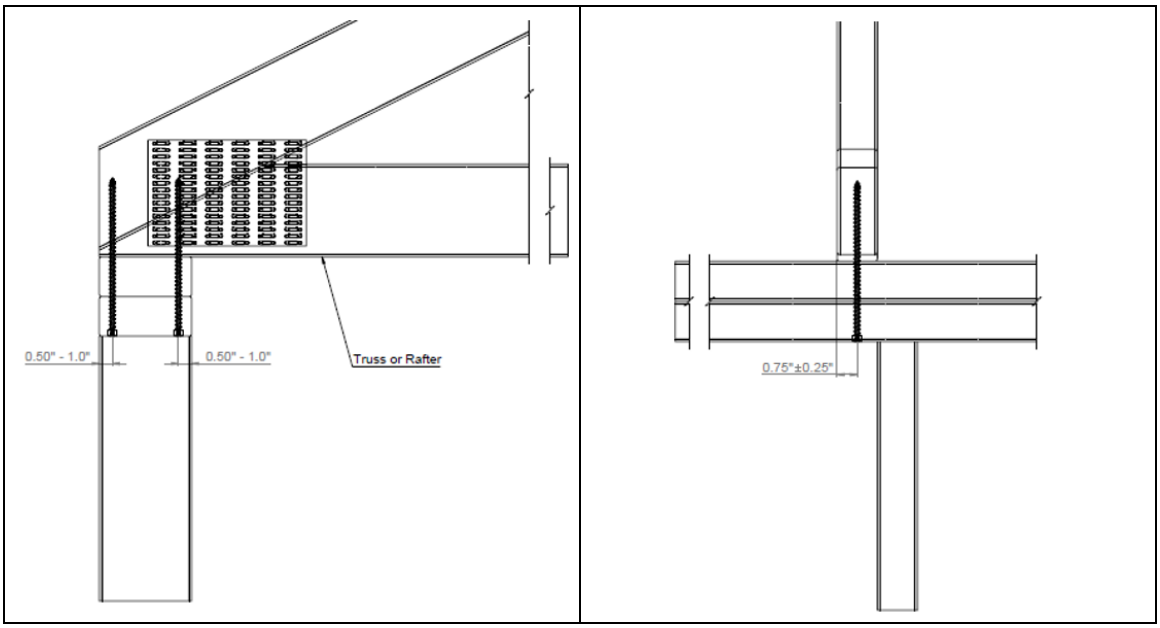


Figure 6. Installation of Two TRX Truss Screws in Truss to Top Plate Connection – Perpendicular

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6.5.6.2 Where the truss or rafter is aligned directly over a stud, the vertical fastener can be installed up to a 14º angle through the top plates to engage the truss or rafter above. See **Figure 7** for installation details.

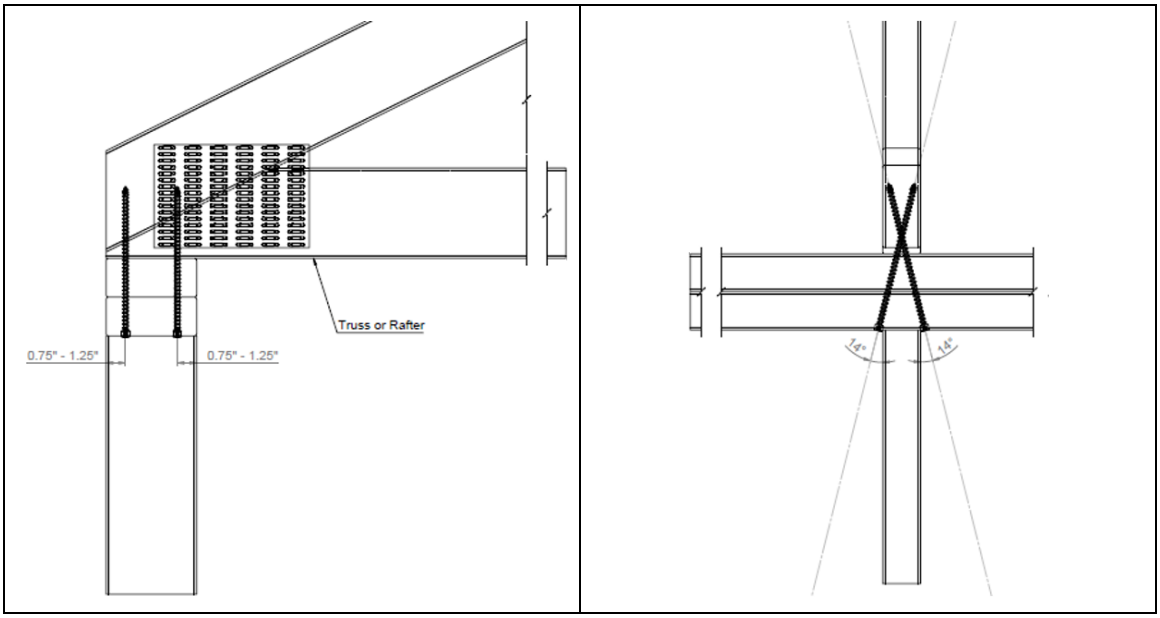


Figure 7. Installation of Two TRX Truss Screws in Truss to Top Plate Connection – Angled

6.5.6.3 Allowable design loads for this application are provided in **Table 6**.

Table 6. Allowable Loads for Uplift and Lateral Resistance for Two TRX Truss Screws Connection [lbf]

Fastener Designation	Minimum Penetration into Truss/Rafter/Joist[1] (in)	Top Plate(s)	Fastener Angle[6] to Vertical	ASD Total Loads Per Connection[2,3,4,5] (lbf) C_D = 1.0		
				HF/SPF (0.42)		
				Uplift	F1 (Parallel to Wall)	F2 (Perpendicular to Wall)
4 1/2" TRX Truss Screws	2 3/4	Single	14°	790	590	435
	3		0°	790	680	510
6" TRX Truss Screws	2 3/4	Double	14°	1,145	490	695
	3		0°	1,205	510	725

SI: 1 in = 25.4 mm, 1 lbf = 4.45 N

1. Wood truss, rafter, or floor joist members shall be a minimum of 2" nominal thickness. Design of truss, rafter, or floor joist is by others.
2. SCL may be used, provided the equivalent specific gravity shall be equal to or greater than the specific gravities provided in this table. Refer to product information from the SCL manufacturer.
3. For applications involving members with different specific gravities, use the allowable load corresponding to the lowest specific gravity. Loads may be adjusted using the adjustment factors (i.e. load duration factor) from NDS Section 11.3, where applicable.
4. Use reduction factor of 0.80 when connecting each ply of multiply trusses to the top plate.
5. See Figure 3 for load directions.
6. Install fastener at an upward angle from the vertical of 4° to 14° or 0° (See Figure 6 and Figure 7). For installation between 4° and 14°, use design values for 14°

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6.6 *Allowable Design Loads – Gable End Truss to Top Plate Connection*

6.6.1 Allowable design loads for uplift and lateral resistance for gable end truss to top plate connections are provided in **Table 7** using a load duration factor, C_D, of 1.0.

6.6.1.1 Per NDS Section 11.3.2, connection design properties may be adjusted by a load duration factor listed in NDS Table 2.3.2. Generally, these loads are not combined with other loads (e.g., dead, live)

6.6.1.2 Per **Table 1**, when a load duration factor, C_D, is applied to the ASD values for uplift, the resulting ASD value shall not exceed the allowable screw tension design value of 1,140 lbs.

Table 7. Allowable Uplift and Lateral Loads for Fasteners in Gable End Truss to Top Plate Connections [lbf]

Fastener	Minimum Penetration into Gable End Truss[1] (in)	Top Plate(s)	Fastener Angle to Vertical	Allowable Loads per Fastener[2,3,4,5] (lbf) C_D = 1.0		
				HF/SPF (0.42)		
				Uplift	F1 (Parallel to Wall)	F2 (Perpendicular to Wall)
4½" TRX Truss Screws	3.0	Single	0°	450	340	300
6" TRX Truss Screws	3.0	Double	0°	685	255	425

SI: 1 in = 25.4 mm, 1-lbf = 4.45 N

1. Gable truss, rafter, or floor joist members shall be a minimum of 2" nominal thickness. Design of gable truss, rafter, or floor joist is by others.
2. SCL may be used, provided that the equivalent specific gravity shall be equal to or greater than the specific gravities provided in this table. Refer to product information from the SCL manufacturer.
3. For applications involving members with different specific gravities, use the allowable load corresponding to the lowest specific gravity.
4. Loads may be adjusted using the adjustment factors (e.g., load duration factor) from NDS Section 11.3, where applicable.
5. See Figure 8 for load directions. See Figure 9 for installation details.

6.6.2 Loads parallel to the wall are labeled F1 and loads perpendicular to the wall are labeled F2. See **Figure 8** for load directions.

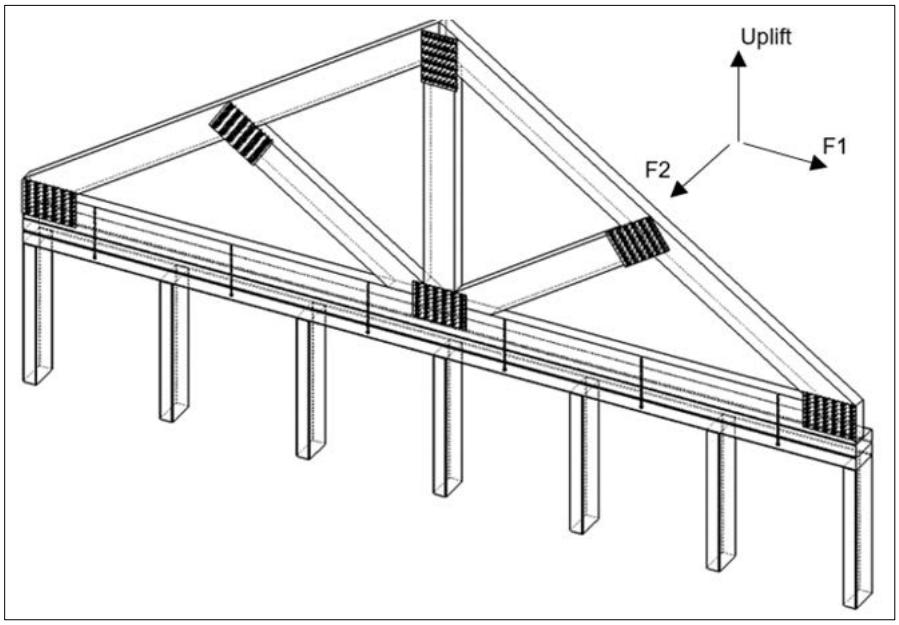


Figure 8. Gable End Truss to Top Plate - Uplift and Lateral Load (F1 and F2) Directions

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6.6.3 Allowable design loads are applicable to fasteners installed in accordance with **Section 9** in single and double top plate applications. See **Figure 9** for installation details.

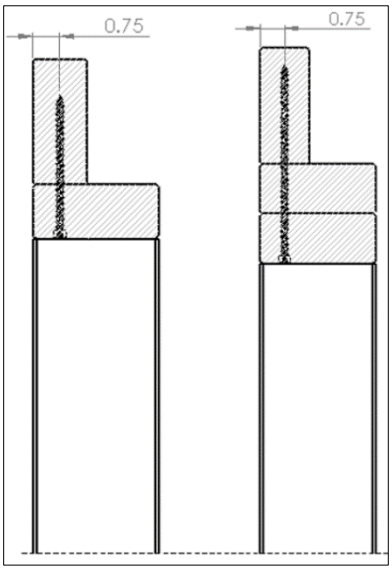


Figure 9. Gable End Truss to Top Plate Installation Configuration

6.7 *Allowable Design Loads Stud to Top Plate Connection*

6.7.1 Allowable design loads for uplift and lateral resistance in stud to top plate connections are presented in **Table 8** using a load duration factor, C_D, of 1.0.

6.7.1.1 Per NDS Section 11.3.2, connection design properties may be adjusted by a load duration factor listed in NDS Table 2.3.2. Generally, these loads are not combined with other loads (e.g., dead, live).

6.7.1.2 Per **Table 1**, when a load duration factor, C_D, is applied to the ASD values for uplift, the resulting ASD value shall not exceed the allowable screw tension design value of 1,140 lbs.

6.7.2 Walls shall consist of a double top plate designed in accordance with IBC Section 2308.9.3.2[31] or IRC Section R602.3.2.

6.7.2.1 A single top plate is permitted to be used as an alternative to a double top plate, provided the additional provisions specified in the IBC Section 2308.9.3.2[32] or IRC Section R602.3.2 be met.

6.7.3 Installation details for stud to top plate connections are shown in **Figure 10** through **Figure 17**.

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Table 8. Allowable Uplift and Lateral Loads for Fasteners in Stud to Top Plate Connections[1] [lbf]

Fastener	Top Plate Configuration	Fastener Angle to Vertical	Number of Fasteners	Allowable Loads[2,3,4,5,6] (lbf) C_D = 1.0	
				HF/SPF (0.42)	
				Uplift	F2
4½" TRX Truss Screws	Single	22.5°[7]	1[7]	260	160
			2[8]	520	320
			3[9]	780	480
		0°[10]	1	340	150
			2	680	300
6" TRX Truss Screws	Double	22.5°[7]	1[7]	315	160
			2[8]	630	320
			3[9]	945	480
		0°[10]	1	450	160
			2	900	320

SI: 1 in = 25.4 mm, 1-lbf = 4.45 N

1. Wood stud and top plate members shall be a minimum of 2" nominal thickness.
2. SCL may be used, provided that the equivalent specific gravity shall be equal to or greater than the specific gravities provided in this table. Refer to product information from the SCL manufacturer.
3. For applications involving members with different specific gravities, use the allowable load corresponding to the lowest specific gravity.
4. Loads may be adjusted using the adjustment factors (e.g., load duration factor) from NDS Section 11.3, where applicable. No further increase allowed.
5. Loads presented are per stud connection.
6. Install fastener at an upward angle from the vertical of 20° to 30° (22.5° is optimal) or 0°. For installation between 20° and 30°, design values for 22.5° may be used.
7. Applicable to installation in the wide face or narrow face of the stud. See **Figure 10** and **Figure 14**.
8. Both fasteners installed in the wide face. See **Figure 11** and **Figure 15**.
9. Two fasteners installed in the wide face, ½" from each edge on one side, and one fastener installed at the center of the wide face on the opposite side (see **Table 11** for additional spacing of fasteners). See **Figure 12** and **Figure 16**.
10. Fastener(s) installed in the wide face of the top plates into the stud. *Note:* End grain factor has been applied. See **Figure 13** and **Figure 17**.

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6.7.3.1 Installation details of single 6" TRX Truss Screws into the wide face or narrow face of the stud is shown in **Figure 10**.

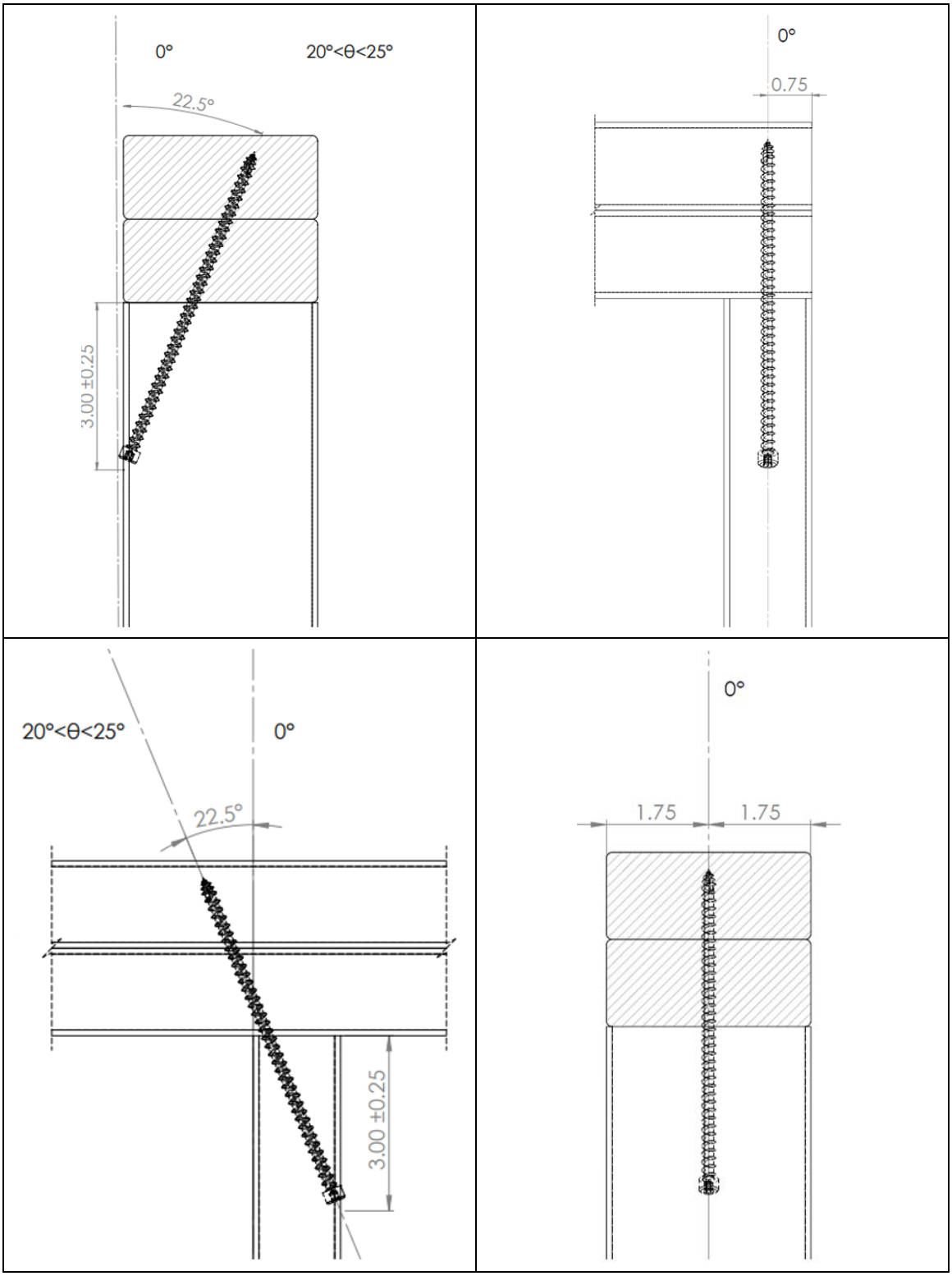


Figure 10. Stud to Top Plate – 22.5° (Angle), One 6" TRX Truss Screw Options

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6.7.3.2 Installation details of two 6" TRX Truss Screws into the wide face of the stud is shown in **Figure 11**.

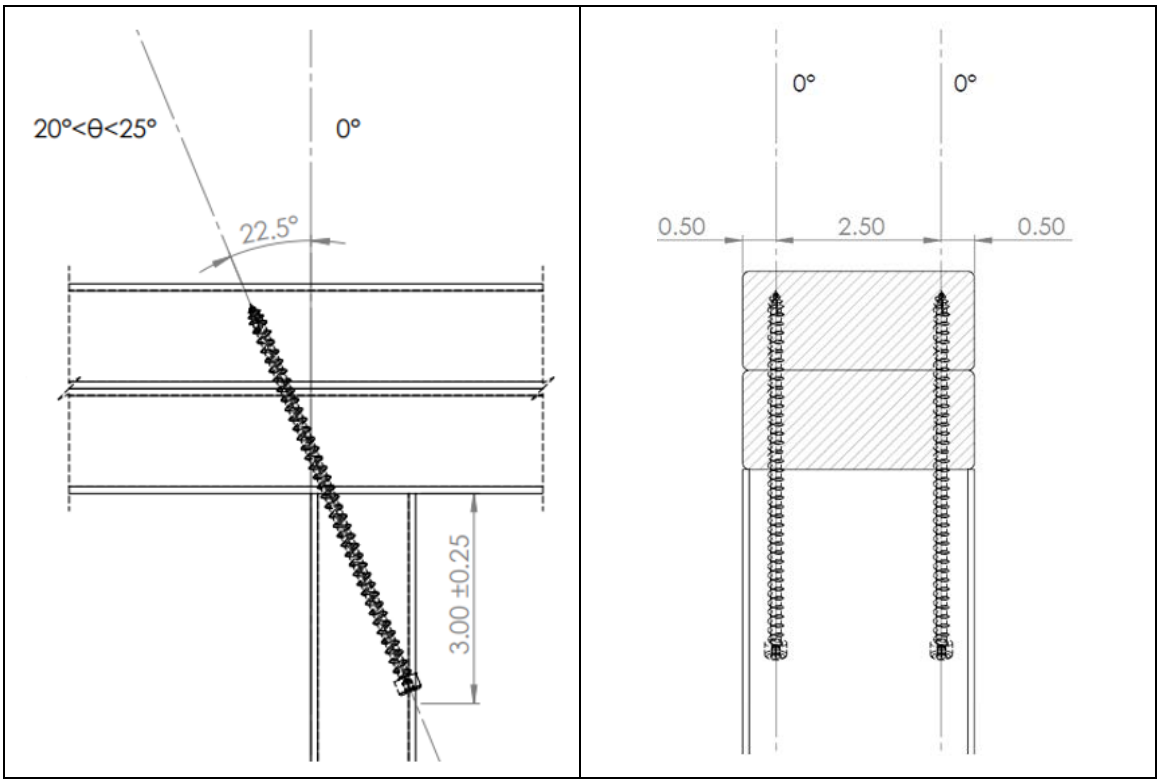


Figure 11. Stud to Top Plate – 22.5° (Angle), Two 6" TRX Truss Screws Install Option

6.7.3.3 Installation details of three 6" TRX Truss Screws into the wide face of the stud is shown in **Figure 12**.

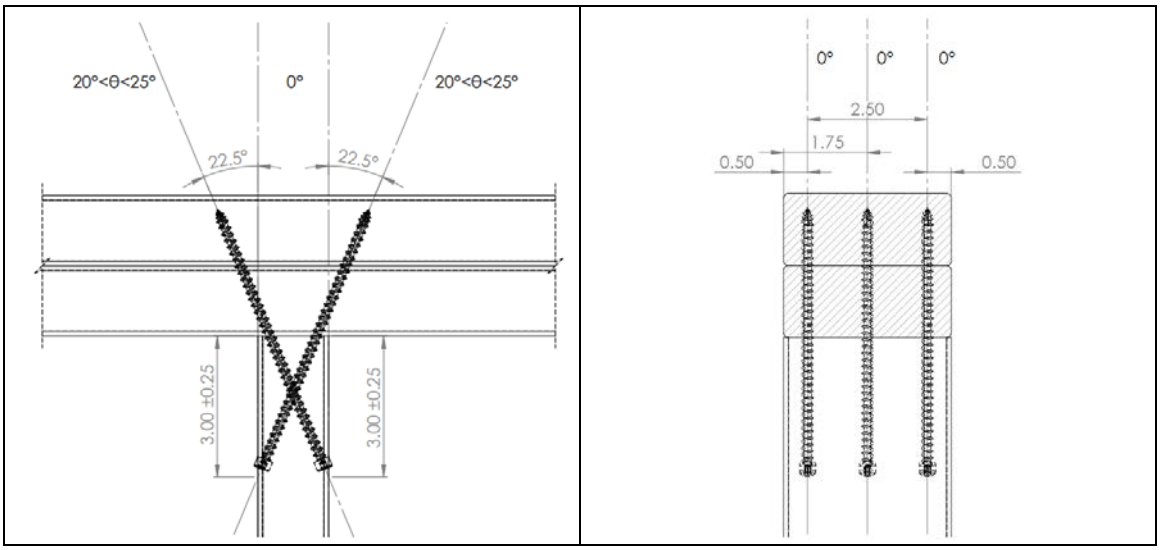


Figure 12. Stud to Top Plate – 22.5° (Angle), Three 6" TRX Truss Screws Install Option

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6.7.3.4 Installation details of 6" TRX Truss Screws into the wide face of the double top plate and into the end grain of the stud is shown in **Figure 13**.

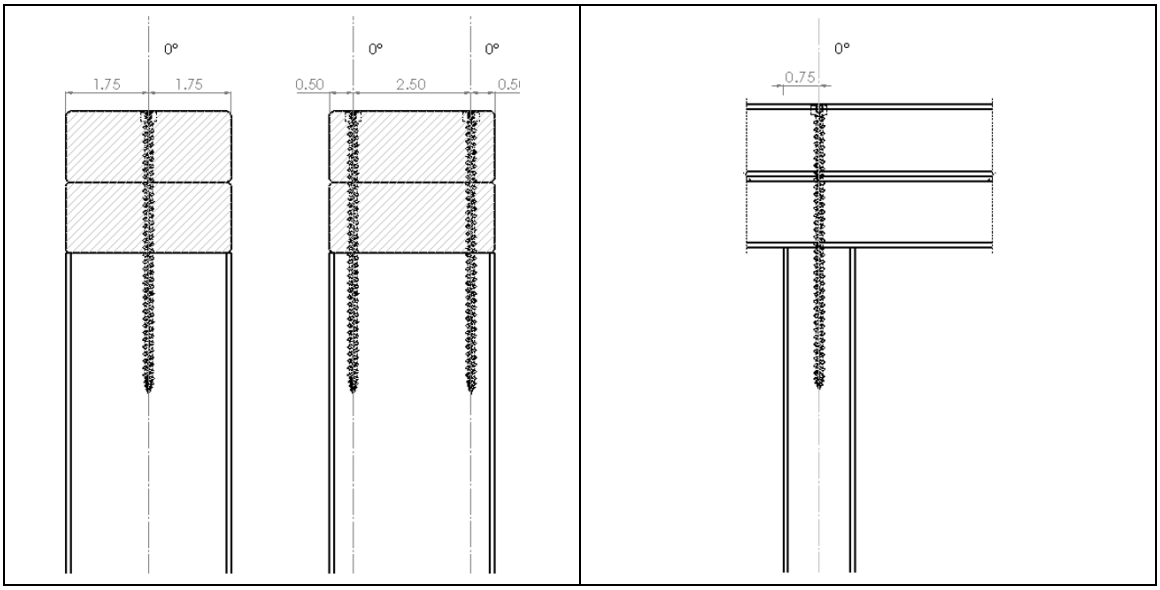


Figure 13. Stud to Top Plate – 0° (Perpendicular) Install Options

6.7.3.5 Installation details of single 4½" TRX Truss Screws into the wide face or narrow face of the stud is shown in **Figure 14**.

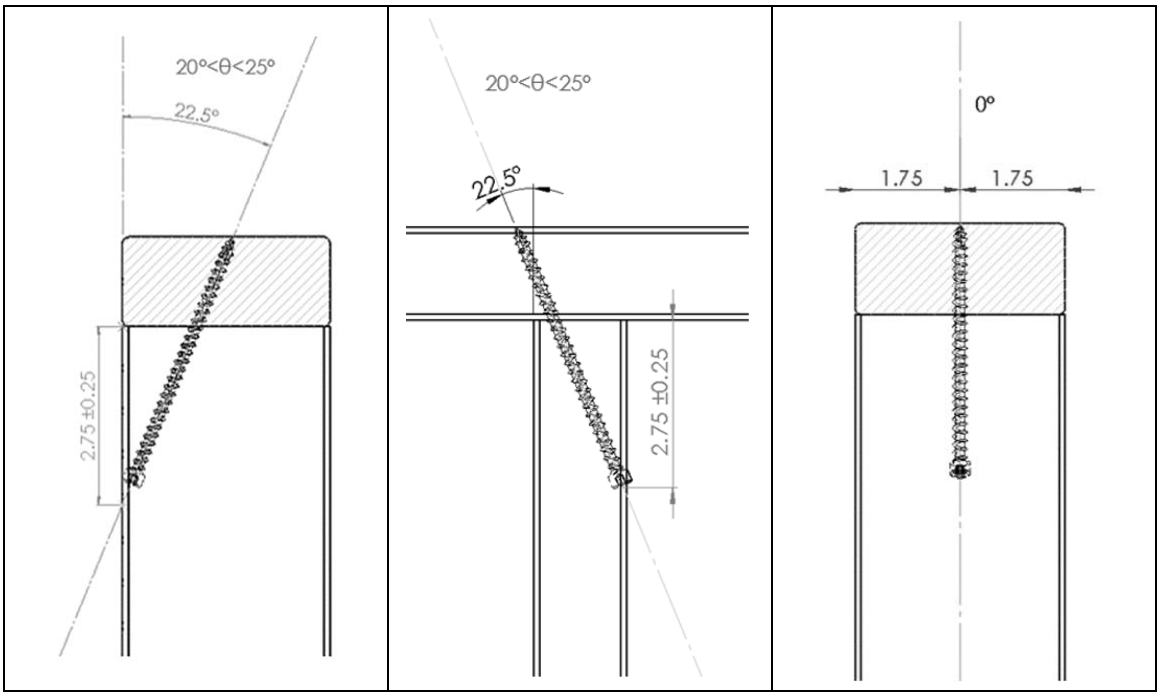


Figure 14. Stud to Top Plate – 22.5° (Angle), One 4½" TRX Truss Screws Options

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6.7.3.6 Installation details of two 4$^1/_2$" TRX Truss Screws into the wide face of the stud is shown in **Figure 15**.

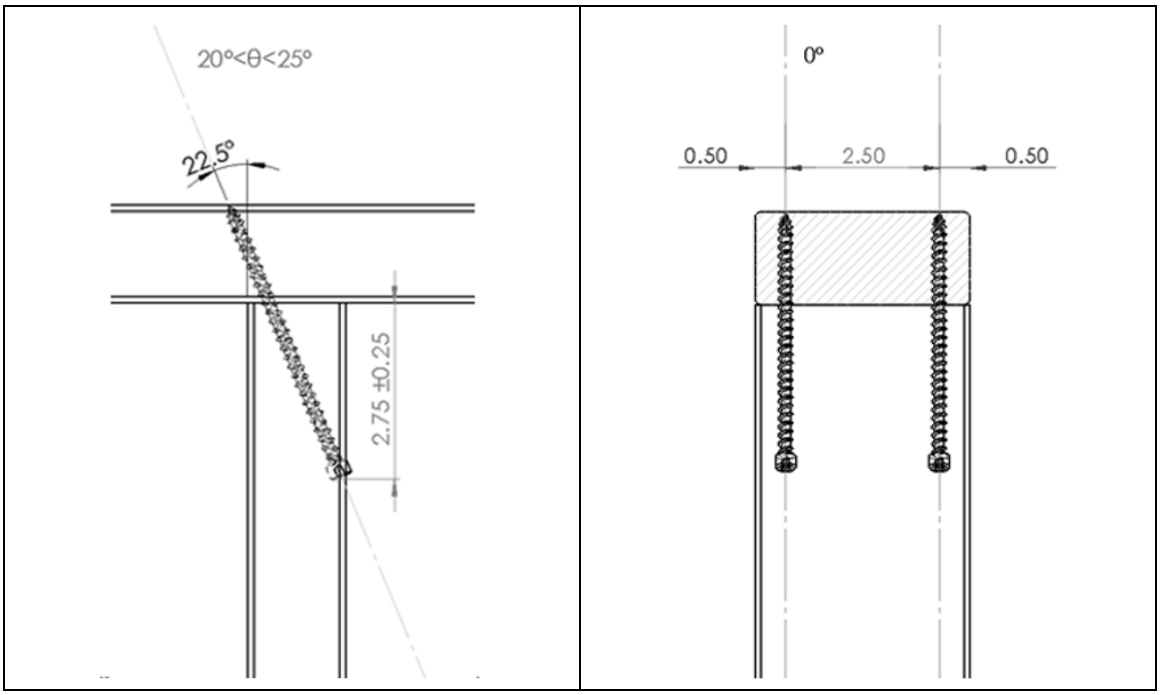


Figure 15. Stud to Top Plate – 22.5° (Angle), Two 4$^1/_2$" TRX Truss Screws Install Option

6.7.3.7 Installation details of three 4$^1/_2$" TRX Truss Screws into the wide face of the stud is demonstrated in **Figure 16**.

6.7.3.8 Two fasteners shall be installed into one side of the wide face of the stud, $^1/_2$" from each edge on one side, and one fastener installed at the center of the wide face on the opposite side.

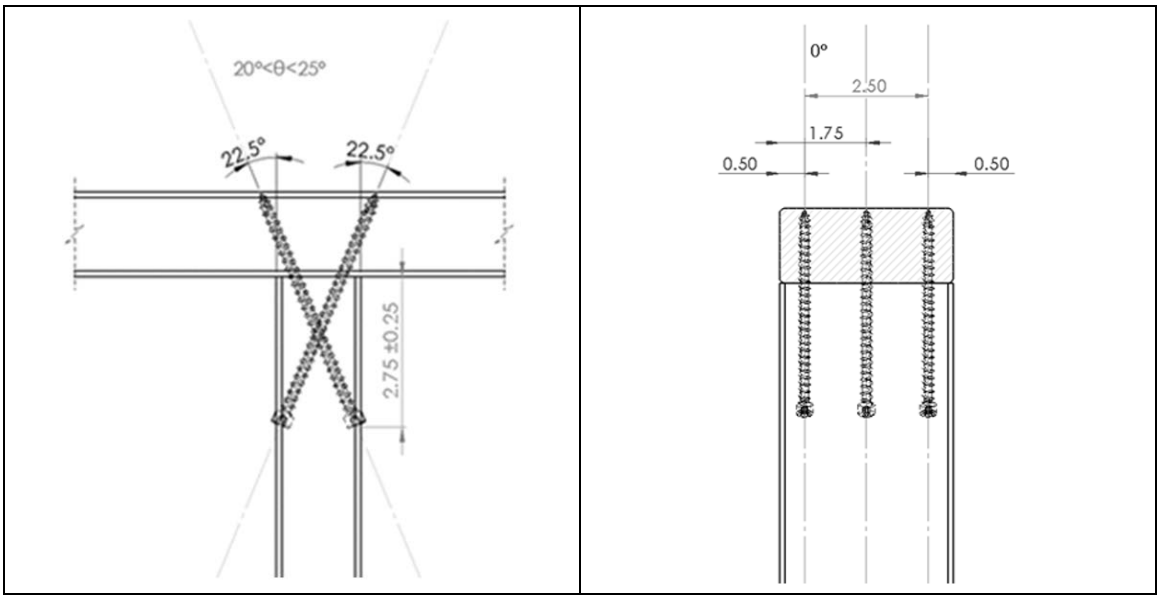


Figure 16. Stud to Top Plate – 22.5° (Angle), Three 4$^1/_2$" TRX Truss Screws Install Option

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6.7.3.9 Installation details of $4^1/_2$" TRX Truss Screws into the wide face of the double top plate and into the end grain of the stud is shown in **Figure 17**.

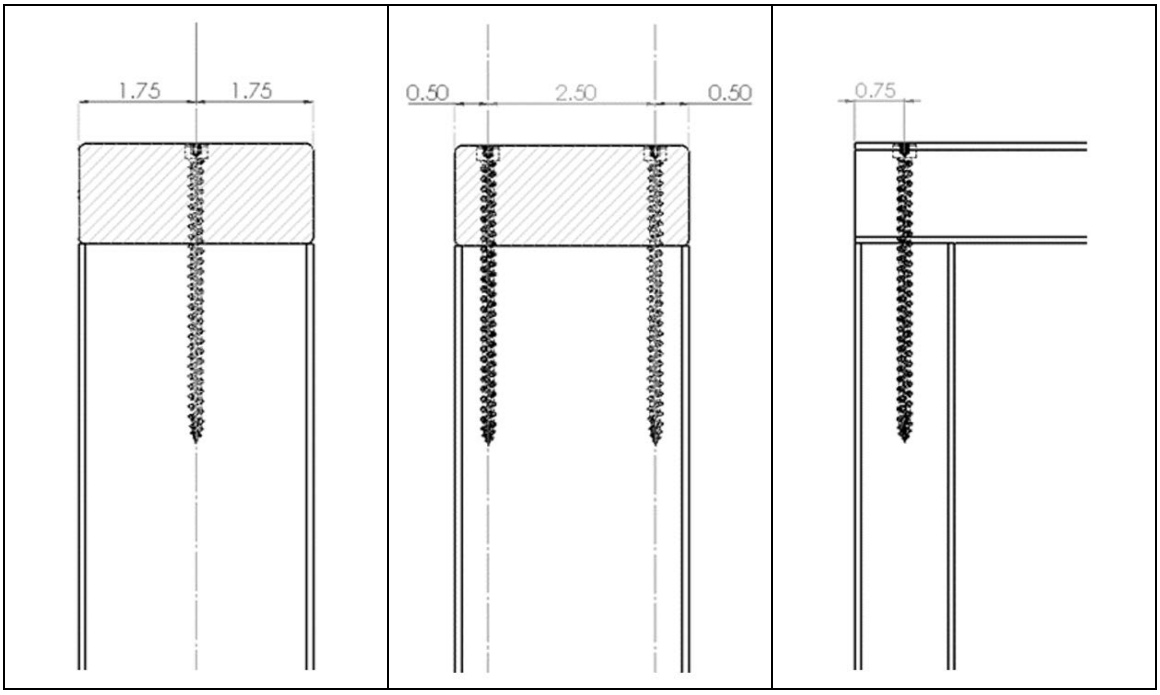


Figure 17. Stud to Top Plate – 0° (Perpendicular) Install Options

6.8 *Allowable Design Loads – Stud to Bottom Plate Connection*

6.8.1 Allowable design loads for uplift and lateral resistance in stud to bottom plate connections are presented in **Table 9** using a load duration factor, C_D, of 1.0.

6.8.1.1 Per NDS Section 11.3.2, connection design properties may be adjusted by a load duration factor listed in NDS Table 2.3.2. Generally, these loads are not combined with other loads (e.g., dead, live).

6.8.1.2 Per **Table 1**, when a load duration factor, C_D, is applied to the ASD values for uplift, the resulting ASD value shall not exceed the allowable screw tension design value of 1,140 lbs.

6.8.2 Walls shall consist of a bottom plate designed in accordance with IBC Section 2308.9.3.1[33] or IRC Section R602.3.4.

6.8.3 Installation details for stud to bottom plate connections are shown in **Figure 18** through **Figure 25**.

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Table 9. Allowable Uplift and Lateral Loads for Fasteners in Stud to Bottom Plate Connections[1] [lbf]

Fastener	Fastener Angle to Vertical	Number of Fasteners	Allowable Loads[2,3,4,5] (lbf) C_D = 1.0	
			HF/SPF (0.42)	
			Uplift	F2
4½" TRX Truss Screws	22.5°	1[12]	260	140
		2[13]	520	280
		3[14]	780	420
	0°[11]	1	255	100
		2	510	200
6" TRX Truss Screws	22.5°[6]	1	295	145
	14°[7]	1[8]	325	150
		2[9]	650	300
		3[10]	975	450
	0°[11]	1	340	100
		2	680	200

SI: 1 in = 25.4 mm, 1-lbf = 4.45 N

1. Wood stud and bottom plate members shall be a minimum of 2" nominal thickness.
2. SCL may be used, provided the equivalent specific gravity shall be equal to or greater than the specific gravities provided in this table. Refer to product information from SCL manufacturer.
3. For applications involving members with different specific gravities, use the allowable load corresponding to the lowest specific gravity.
4. Loads may be adjusted using the adjustment factors (e.g., load duration factor) from NDS Section 11.3, where applicable. No further increase allowed.
5. Loads presented are per stud connection. For connections with more than one screw that will be fastened on the same side of the wood member, fastener spacing listed in Table 11 shall be followed.
6. Install fastener at a downward angle from the vertical of 20° to 30° (22.5° is optimal) into the narrow face of the stud. For installation between 20° and 30°, design values for 22.5° may be used. See Figure 18.
7. Install fastener(s) at a downward angle from the vertical of 4° to 14° into the wide face of the stud.
8. Applicable to installation in the wide face. See Figure 19.
9. Both fasteners installed in the wide face. See Figure 20.
10. Two fasteners installed in the wide face, ½" from each edge on one side and one fastener installed at the center of the wide face on the opposite side. See Figure 21.
11. Fastener(s) installed in the wide face of the bottom plates into the stud. *Note:* End grain factor has been applied. See Figure 22.
12. Applicable to installation in the wide face or narrow face of the stud. Install fastener at a downward angle from the vertical of 20° to 30° (22.5° is optimal) into the narrow face of the stud. For installation between 20° and 30°, design values for 22.5° may be used. See Figure 23.
13. Both fastener installed in the wide face. See Figure 24.
14. Two fasteners installed in the wide face, ½" from each edge on one side, and one fastener installed at the center of the wide face on the opposite side. See Figure 25.

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6.8.3.1 Installation details of a single 6" TRX Truss Screw into the narrow face or wide face of the stud is shown in **Figure 18** and **Figure 19**.

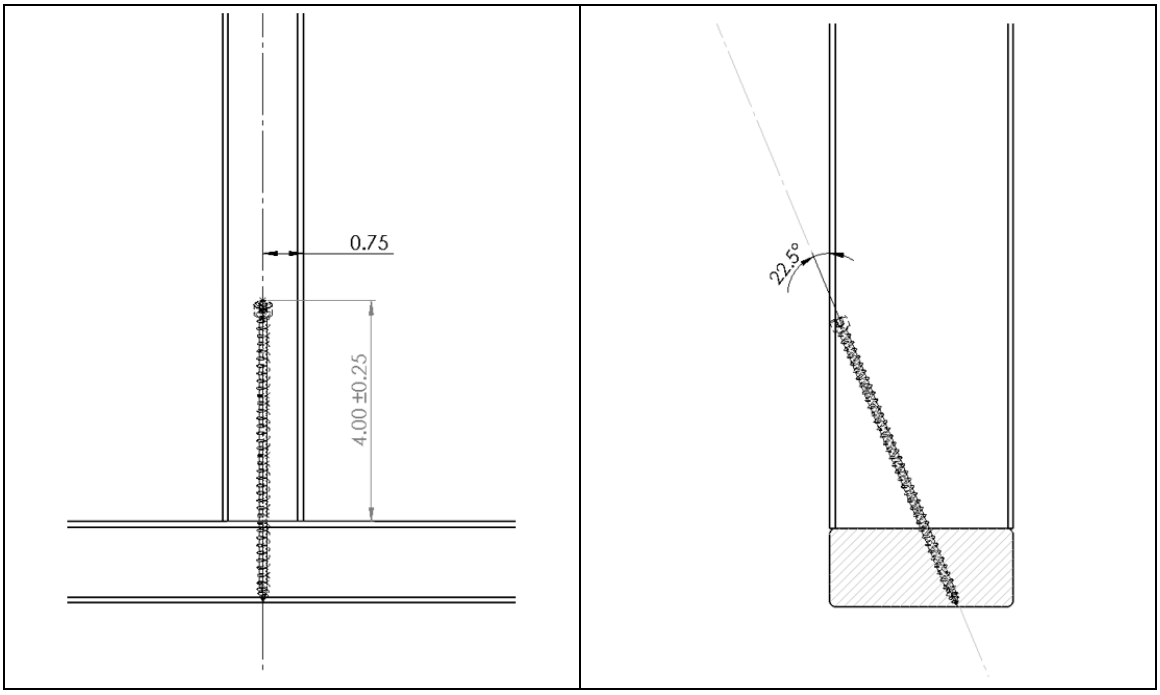


Figure 18. Stud to Bottom Plate – 22.5° (Angle), One 6" TRX Truss Screw Option

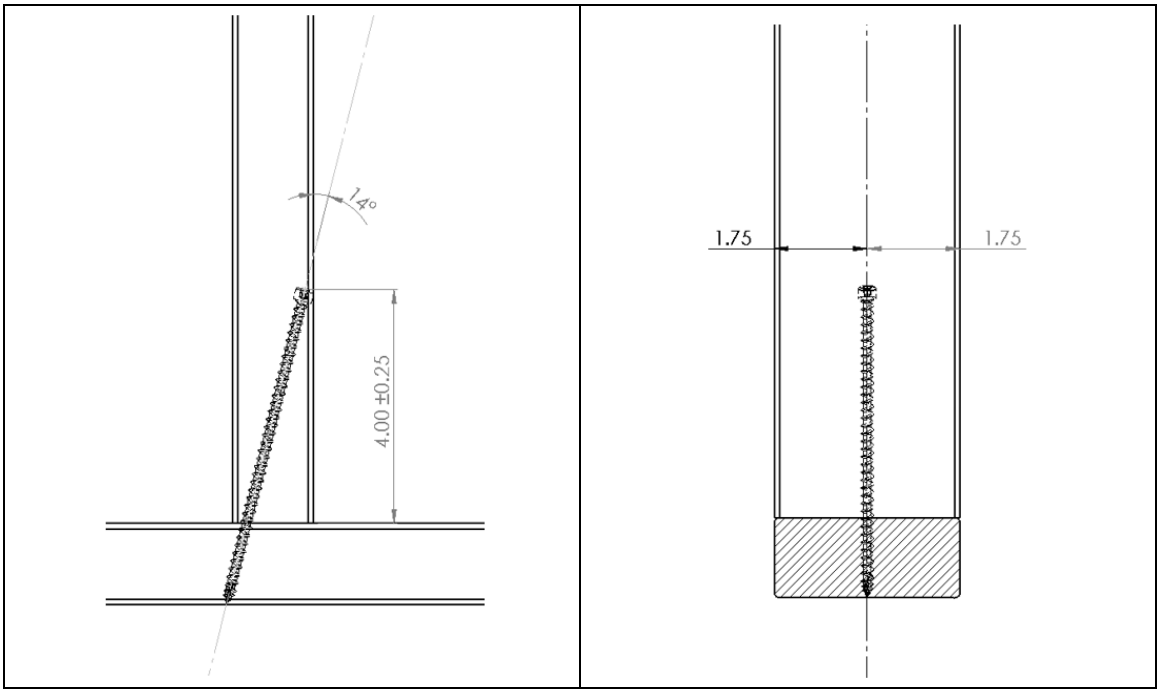


Figure 19. Stud to Bottom Plate – 14° (Angle), One 6" TRX Truss Screw Option

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6.8.3.2 Installation details of two 6" TRX Truss Screws into the wide face of the stud is shown in **Figure 20**.

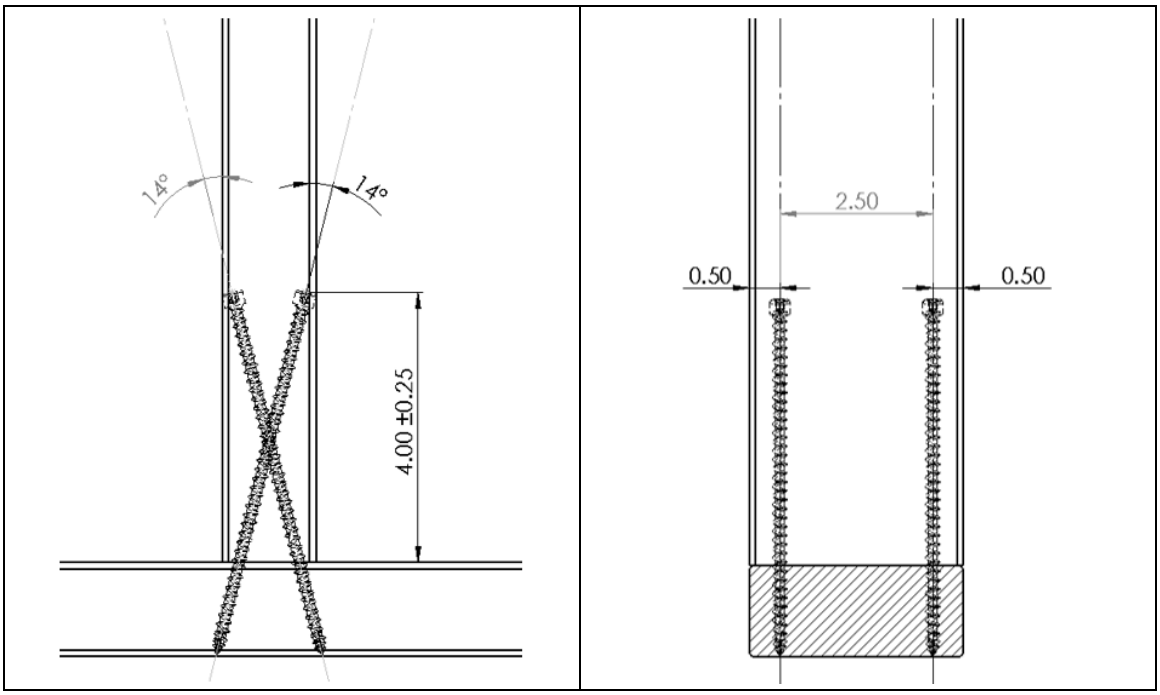


Figure 20. Stud to Bottom Plate – 4°-14° (Angle), Two 6" TRX Truss Screws Install Option

6.8.3.3 Installation details of three 6" TRX Truss Screws into the wide face of the stud is shown in **Figure 21**.

6.8.3.3.1 Two fasteners shall be installed into one side of the wide face of the stud, $^1/_2$" from each edge on one side, and one fastener installed at the center of the wide face on the opposite side.

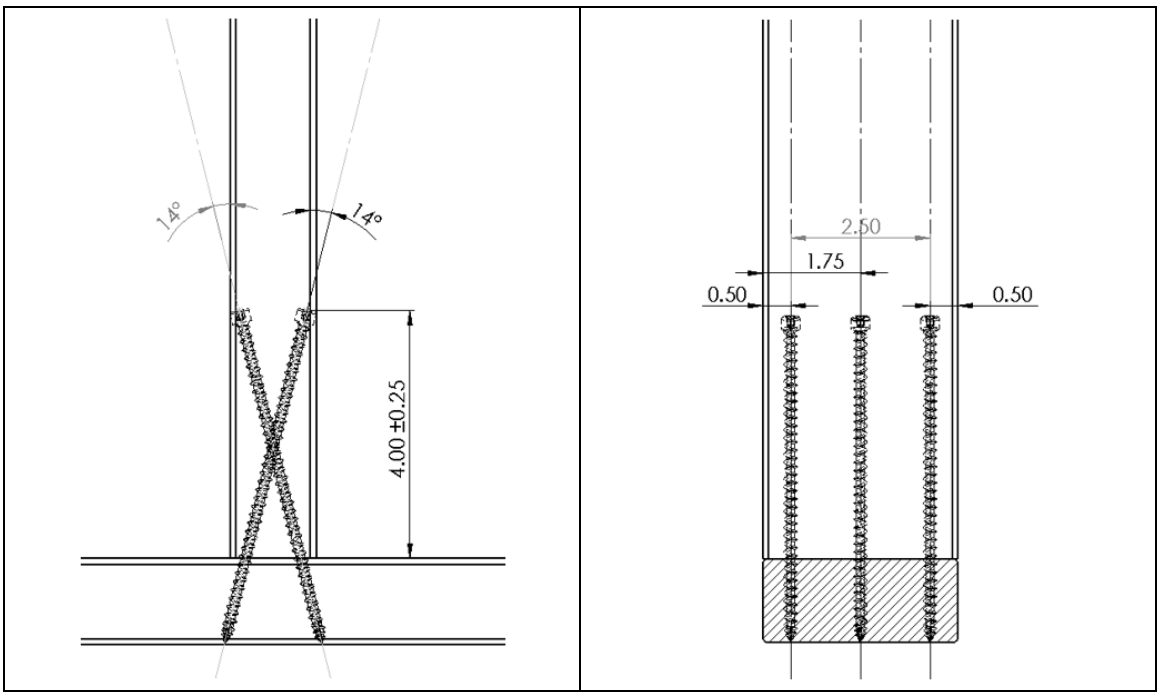


Figure 21. Stud to Bottom Plate – 4°-14° (Angle), Three 6" TRX Truss Screws Install Option

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6.8.3.4 Installation details of 6" TRX Truss Screws into the wide face of the bottom plate and into the end grain of the stud is shown in **Figure 22**.

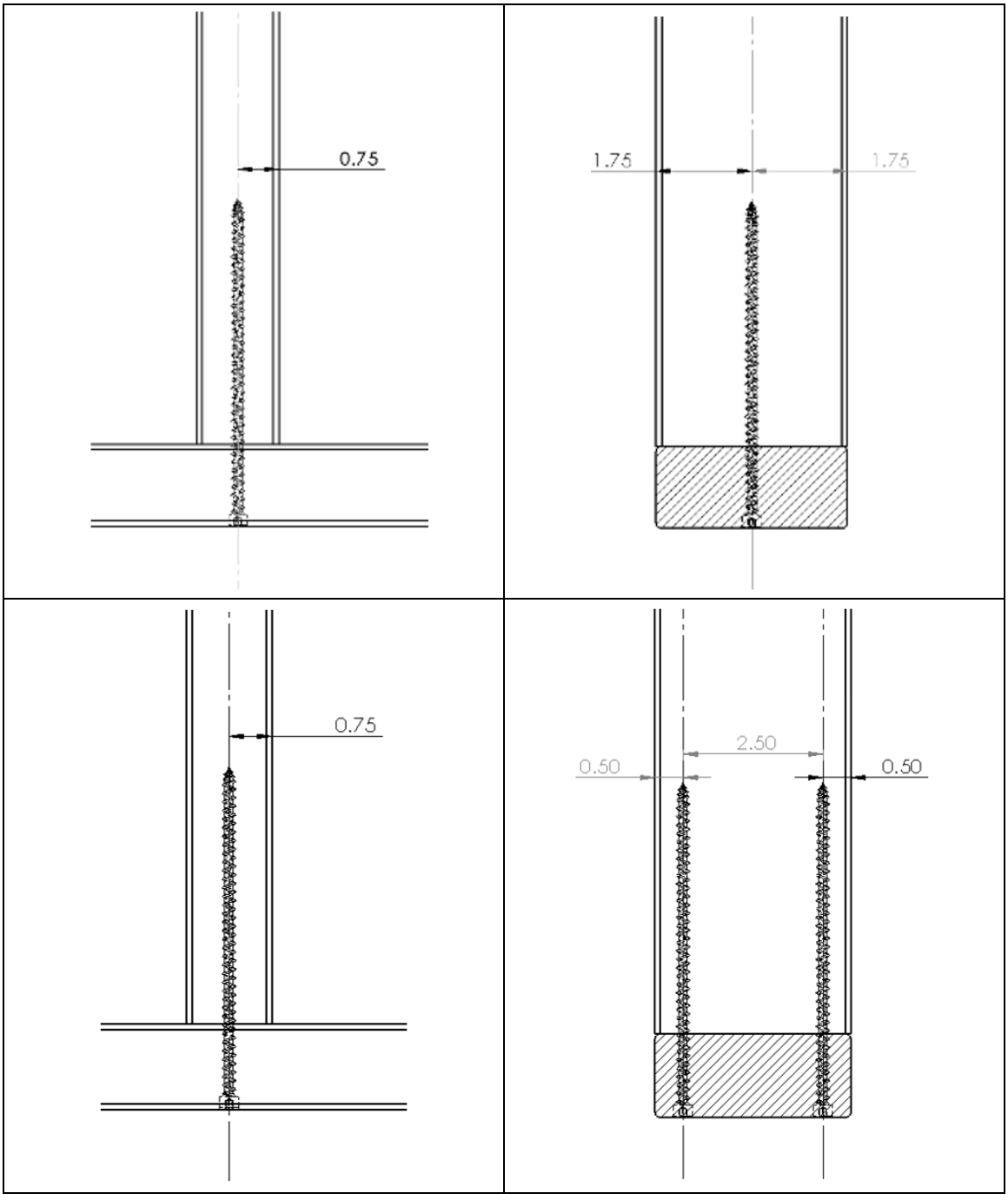


Figure 22. Stud to Bottom Plate – 0° (Perpendicular) Install Options

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6.8.3.5 Installation details of a single 4½" TRX Truss Screw into the narrow face or wide face of the stud is shown in **Figure 23**.

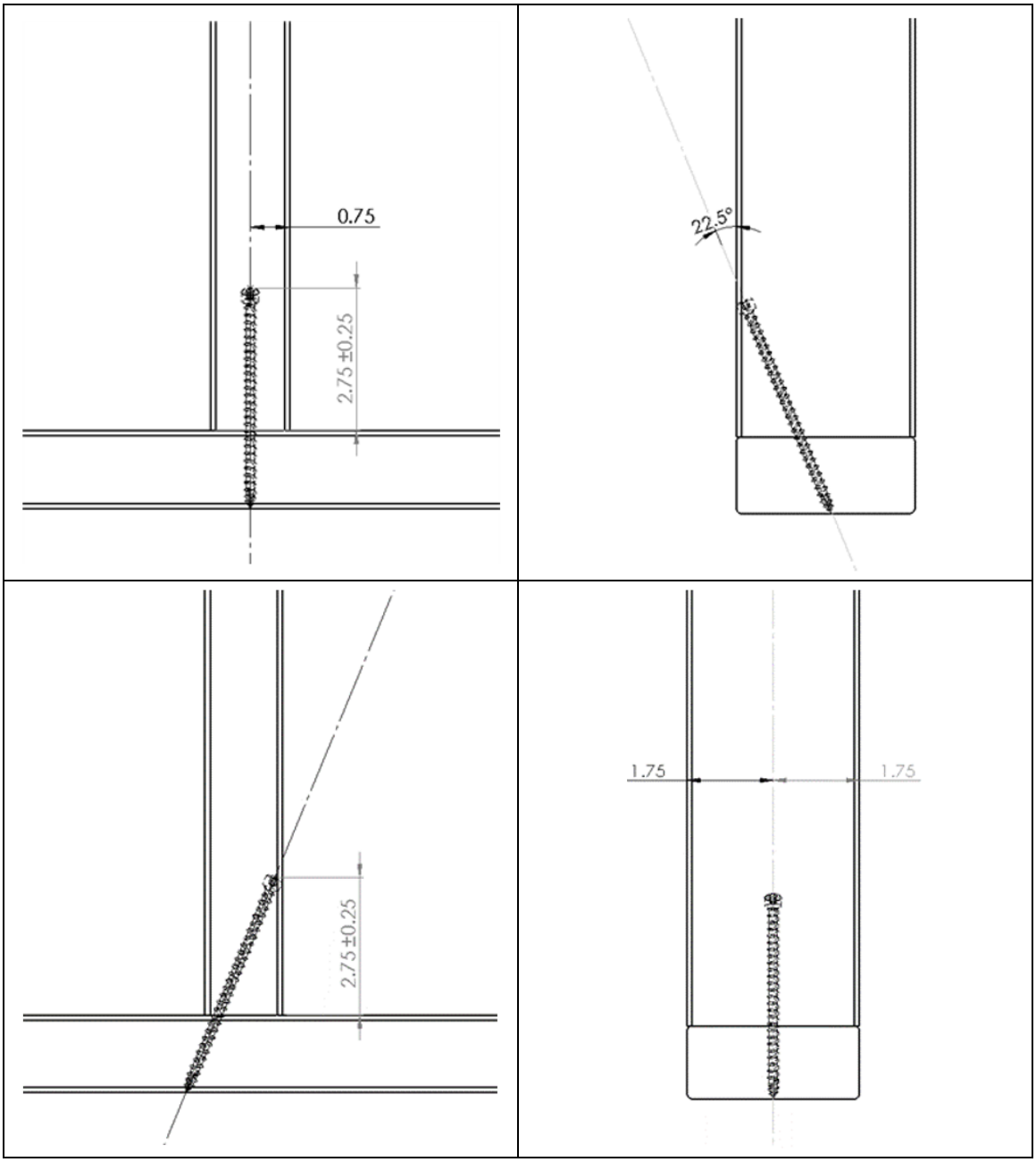


Figure 23. Stud to Bottom Plate – 22.5° (Angle), One 4½" TRX Truss Screw Option

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6.8.3.6 Installation details of two 4$^1/_2$" TRX Truss Screws into the wide face of the stud is shown in **Figure 24**.

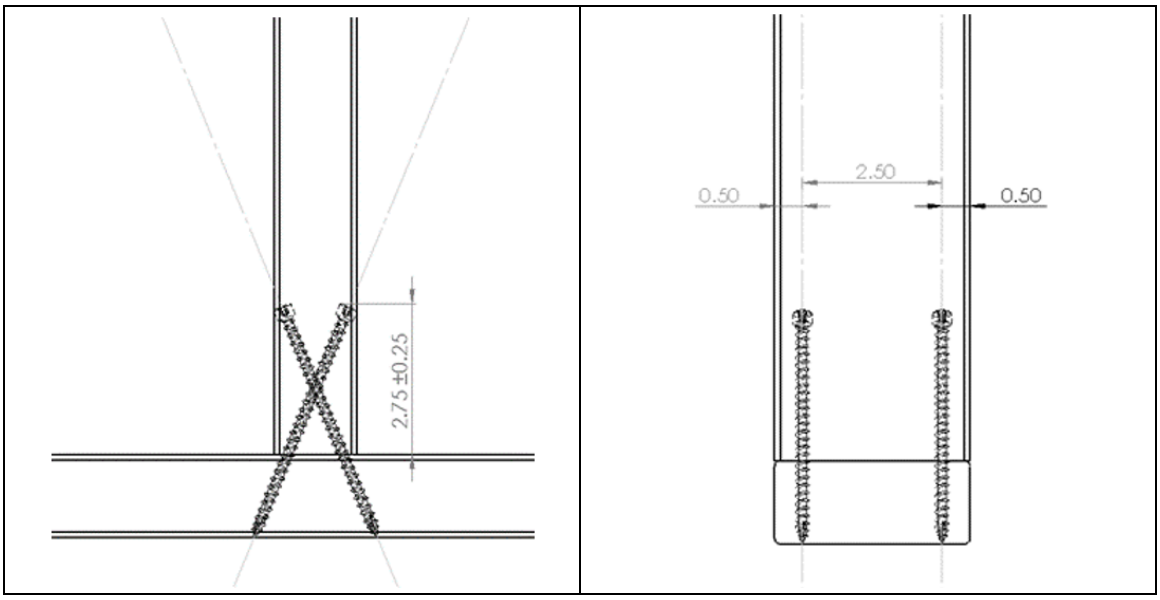


Figure 24. Stud to Bottom Plate – 22.5° (Angle), Two 4$^1/_2$" TRX Truss Screws Install Option

6.8.3.7 Installation details of three 4$^1/_2$" TRX Truss Screws into the wide face of the stud is displayed in **Figure 25**.

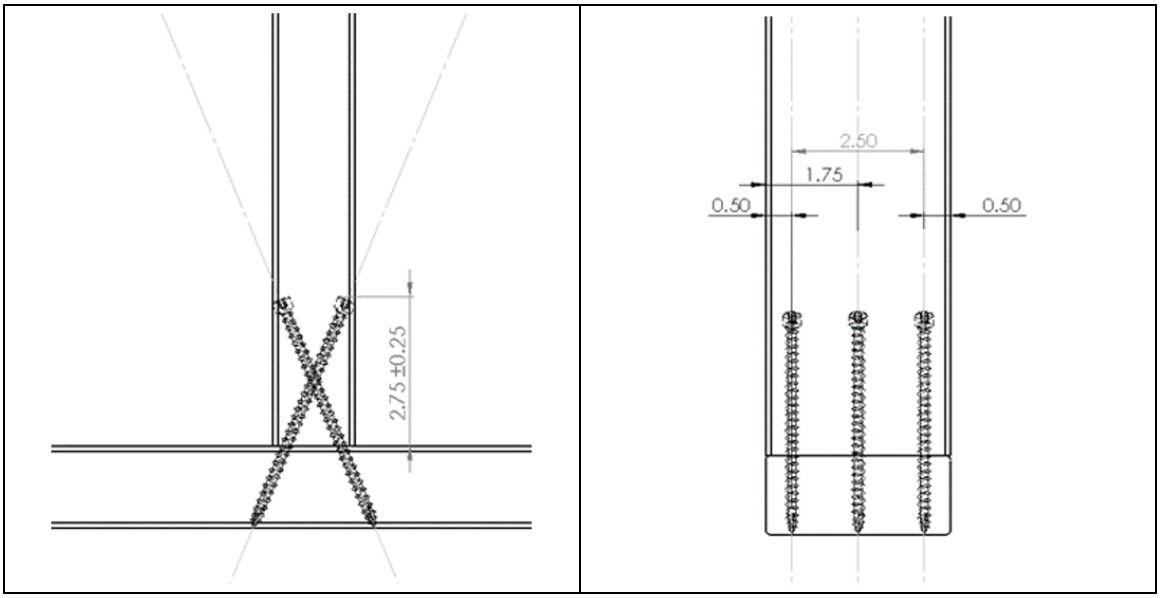


Figure 25. Stud to Bottom Plate – 22.5° (Angle), Three 4$^1/_2$" TRX Truss Screws Install Option

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6.9 *Allowable Design Loads – Bottom Plate to Rim Board/Ribbon Board Connection*

6.9.1 Allowable design loads for lateral resistance parallel to grain in bottom plate to rim board connections are provided in **Table 10** using a load duration factor, C_D, of 1.0.

6.9.1.1 Per NDS Section 11.3.2, connection design properties may be adjusted by a load duration factor listed in NDS Table 2.3.2. These loads are generally not combined with other loads (e.g., dead, live).

6.9.1.2 Per **Table 1**, when a load duration factor, C_D, is applied to the ASD values for uplift, the resulting ASD value shall not exceed the allowable screw tension design value of 1,140 lbs.

6.9.2 The connection configuration is shown in **Figure 26**.

6.9.2.1 A Wood Structural Panel (WSP) up to $1^1/_8$" thick is permitted between the rim board and the bottom plate, so long as it is independently fastened to the rim board per the building code and the minimum screw penetration in **Table 10** be met.

6.9.2.2 Double bottom plates are permitted so long as they are independently fastened per the building code and the minimum screw penetration in **Table 10** be met.

6.9.3 Allowable design loads are applicable to fasteners installed in accordance with **Section 9**.

Table 10. Allowable Shear and Uplift Loads for Bottom Plate to Rim Board Connections[1,2,3] [lbf]

Fastener	Configuration	Minimum Penetration into Rim Board (in)	Rim Board Species and Bottom Plate Species (Specific Gravity)
			2x HF/SPF (0.42)
Allowable Shear Loads per Fastener, Parallel to Grain (lbf)			
$4^1/_2$" TRX Truss Screws	Single Bottom Plate to Rim Board	$1^1/_2$	145
6" TRX Truss Screws		3	150
Allowable Uplift Loads per Fastener (lbf)			
$4^1/_2$" TRX Truss Screws	Single Bottom Plate to Rim Board	$1^1/_2$	335
6" TRX Truss Screws		3	450

SI: 1 in = 25.4 mm, 1-lbf = 4.45 N

1. For applications involving members with different specific gravities, use the allowable load corresponding to the lowest specific gravity.
2. Loads may be adjusted using the adjustment factors (e.g., load duration factor) from NDS Section 11.3, where applicable.
3. See Figure 26 for installation details.

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6.9.4 Installation details of bottom plate to rim board connection using TRX Truss Screws is shown in **Figure 26**.

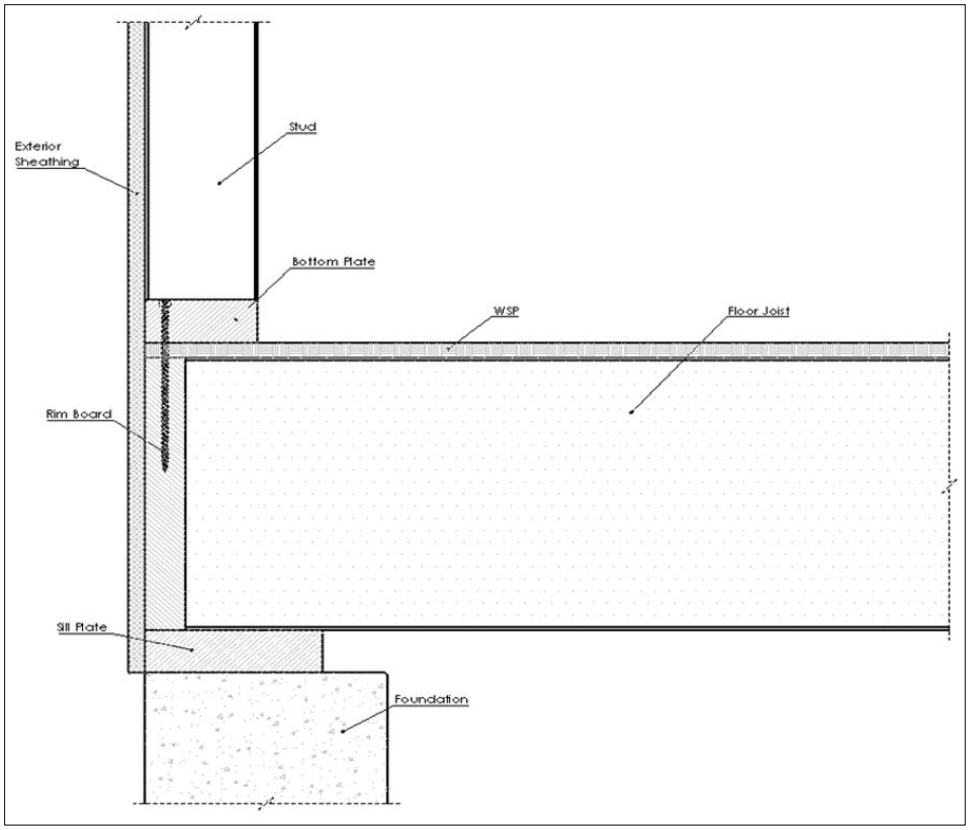


Figure 26. Fastener in Bottom Plate to Rim Board Connection

6.10 Where it is anticipated that loads will be applied to a single fastener simultaneously in more than one direction, additional evaluation is required to account for the combined effect of these loads using accepted engineering practice.

6.11 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[34]

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.[35]

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.[36]

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8 Regulatory Evaluation and Accepted Engineering Practice

8.1 TRX Truss Screws comply with the following legislatively adopted regulations and/or accepted engineering practice for the following reasons:

8.1.1 TRX Truss Screws were tested and evaluated to determine their structural resistance properties, which were used to develop reference design values for Allowable Stress Design (ASD). The following properties were evaluated:

8.1.1.1 Bending yield in accordance with ASTM F1575

8.1.1.2 Shear strength in accordance with AISI S904

8.1.1.3 Tensile strength in accordance with AISI S904

8.1.1.4 Lateral resistance in accordance with ASTM D1761 and the NDS

8.1.1.5 Withdrawal resistance in accordance with ASTM D1761

8.1.1.6 Head pull-through in accordance with ASTM D1761

8.1.2 TRX Truss Screws were evaluated as an alternative means of attaching:

8.1.2.1 Metal plate connected wood trusses, rafters, or floor joists to the tops of walls to provide uplift and lateral load resistance.

8.1.2.2 Metal plate connected wood trusses or floor joists to the bottom of walls to provide uplift and lateral load resistance.

8.1.2.3 Wood studs to wall top/bottom plate to provide uplift and lateral resistance.

8.1.2.4 Wall bottom plates to the rim board/ribbon board to provide uplift and lateral load resistance.

8.1.3 This evaluation consisted of the following:

8.1.3.1 Withdrawal and head pull-through strength for use as an alternative to toenail connections, metal hurricane and seismic clip/straps or nails in tension (uplift) load applications.

8.1.3.2 Shear strength for use as an alternative to toenail connections, hurricane and seismic clip/straps or nails in shear (lateral) load applications, either parallel or perpendicular to wood grain.

8.1.3.3 Shear strength to resist shear (lateral and uplift) loads applied parallel or perpendicular to the wood grain.

8.1.4 TRX Truss Screw connections, other than those addressed in this section, are outside the scope of this report.

8.1.5 Corrosion resistance was evaluated in accordance with ASTM B117, ASTM G85, and ASTM G198.

8.1.5.1 Fasteners were evaluated for freshwater exposure and in chemically treated lumber. Use of fasteners in locations exposed to saltwater or saltwater spray is outside the scope of this report.

8.2 Any building code, regulation and/or accepted engineering evaluations (e.g., 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[37] to practice product and regulatory compliance services within its scope of accreditation and engineering expertise,[38] respectively.

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

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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 Guidelines*

9.3.1 TRX Truss Screws shall be installed with a 1/2" (12.7 mm), low rpm/high torque electric drill (450 rpm).

9.3.2 TRX Truss Screws shall be installed with manufacturer-supplied bits.

9.3.3 TRX Truss Screws shall be installed with the topside of the head flush to the surface of the wood member.

9.3.4 Minimum requirements for fastener spacing, edge distance, and end distance shall be in accordance with **Table 11**.

Table 11. Minimum Spacing, Edge Distance, and End Distance Requirements[1,2]

Connection Geometry	Minimum Spacing/Distance (in)
Edge Distance – Load in any direction	1/2
End Distance – Load parallel to grain, towards end	2 3/8
End Distance – Load parallel to grain, away from end	1 5/8
End Distance – Load perpendicular to grain	1 5/8
Spacing between Fasteners in a Row – Parallel to grain	2 3/8
Spacing between Fasteners in a Row – Perpendicular to grain	1 5/8
Spacing between Rows of Fasteners – In-line	7/8
Spacing between Rows of Fasteners – Staggered	1/2

SI: 1 in = 25.4 mm

1. Edge distances, end distances, and spacing of fasteners shall be sufficient to prevent splitting of the wood or as shown in this table, whichever is the more restrictive.
2. Values for *"Spacing between Rows of Fasteners – Staggered"* apply where the fasteners in adjacent rows are offset by one half of the *"Spacing between Fasteners in a Row"*.

9.4 *Truss/Rafter/Joist to Top Plate Connection*

9.4.1 Install TRX Truss Screws upward through the wall top plates or wood structural framing member at the bottom corner of the top plate(s) and into the center of the wood truss/rafter/joist.

9.4.1.1 The fastener shall be installed at an upward angle from the vertical of 20° to 30° (see **Figure 4**), and shall penetrate the wood truss, rafter or joist within 1/4" of the centerline.

9.4.1.2 Where two fasteners are required at each truss/rafter/joist and top plate(s) location and the truss/rafter/joist is aligned directly over a stud, install TRX Truss Screws at an upward angle from the vertical up to 14°.

9.4.1.2.1 Install the screws through the wall top plates or wood structural framing member at the wide face of the studs and into the center of the wood truss or rafter as shown in **Figure 7**.

9.4.2 Trusses/rafters/joists located between (offset) studs may be installed at a 0° angle, as shown in **Figure 5** and **Figure 6**.

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9.4.3 If the wood truss, rafter, or floor joist is located directly over a top plate splice, offset the fastener 1/4" to one side of the splice. *Note:* the splice may be in either top plate.

9.4.4 Minimum penetration for truss/rafter/joist to top plate connections shall be in accordance with **Table 5**.

9.4.5 Minimum requirements for fastener spacing, edge distance, and end distance shall be in accordance with **Table 11**.

9.5 *Gable End Truss to Top Plate Connection*

9.5.1 Install fasteners upward into the center of the gable end truss through the wall top plates or wood structural framing member. The fastener should be installed perpendicular to the face of the top plate between studs (see **Figure 9**) and should penetrate the gable end truss within 1/4" of the centerline.

9.5.1.1 If the screw location for the gable end truss is located directly over a top plate splice or at a bottom chord splice joint, offset the fastener 1 3/4" to one side of the splice.

9.5.2 Minimum requirements for fastener spacing, edge distance, and end distance shall be in accordance with **Table 11**.

9.6 *Stud to Top Plate Connection*

9.6.1 *Angle (Toenail) Installation:*

9.6.1.1 Install upward through the centerline of wall studs or wood structural framing member at the specified distance from the end of the stud and into the top plate(s).

9.6.1.2 Fastener shall be installed at an upward angle from the vertical of 20° to 30° within 1/4" of the centerline of the stud.

9.6.1.2.1 See **Figure 10**, **Figure 11**, and **Figure 12** for 6" TRX Truss Screws.

9.6.1.2.2 See **Figure 14**, **Figure 15**, and **Figure 16** for 4 1/2" TRX Truss Screws.

9.6.1.3 Starting from the specified end distances shown in **Figure 10** through **Figure 12**, or **Figure 14** through **Figure 16**, drive the fastener until the bottom surface of the fastener head fully bears against stud (see **Figure 27**), at a minimum.

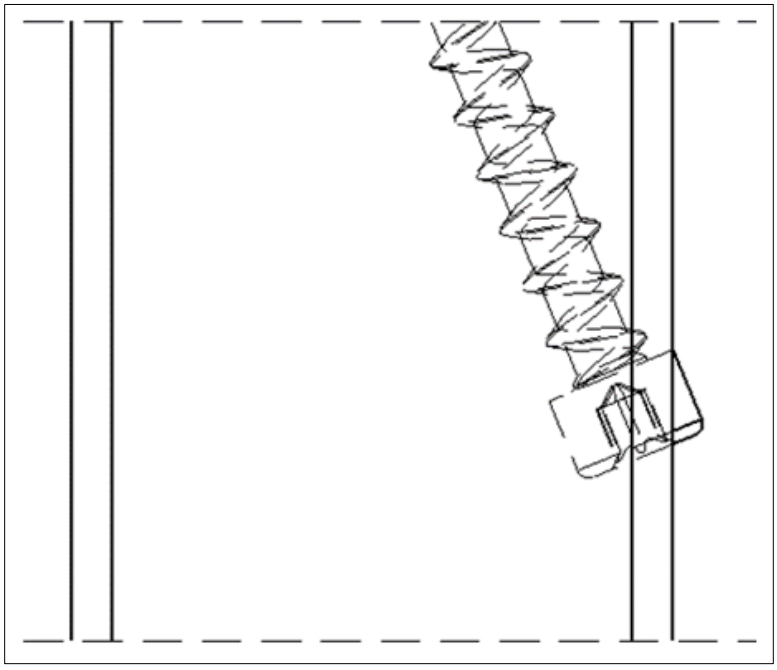


Figure 27. Diagram Showing Fastener Head Fully Bearing Against Stud

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9.6.1.4 Minimum requirements for fastener spacing, edge distance, and end distance shall be in accordance with **Table 11**.

9.6.2 *Perpendicular Installation:*

9.6.2.1 Install TRX Truss Screws downward through the top plate(s) and into the wall studs (see **Figure 13** and **Figure 17**). Fastener shall be within 1/4" of the centerline of the stud.

9.6.2.2 Drive the fastener until the bottom of the head is flush with the surface of the outermost top plate.

9.7 *Stud to Bottom Plate Connection*

9.7.1 *Angle (Toenail) Installation:*

9.7.1.1 Install TRX Truss Screws downward through the centerline of wall stud or wood structural framing member within the specified distances from the end of the stud and into the bottom plate.

9.7.1.2 *For 4 1/2" TRX Truss Screws:*

9.7.1.2.1 Fasteners shall be installed at a downward angle from the vertical of 20° to 30° into the narrow or wide face (**Figure 23**) and within 1/4" of the centerline of the stud.

9.7.1.2.2 For multiple fasteners, the 4 1/2" TRX Truss Screws shall be installed at a downward angle from the vertical of 4° to 14° into the wide face (see **Figure 24** and **Figure 25**) of the stud while upholding the fastener spacing provided in **Table 11**.

9.7.1.2.3 Starting from the specified end distances shown in **Figure 23** through **Figure 25**, at a minimum, drive the fastener until the bottom surface of the fastener head fully bears against stud (see **Figure 27**).

9.7.1.3 *For 6" TRX Truss Screws:*

9.7.1.3.1 Fasteners shall be installed at a downward angle from the vertical of 20° to 30° into the narrow face (see **Figure 18**) and within 1/4" of the centerline of the stud, or shall be installed at a downward angle from the vertical of 4° to 14° into the wide face (see **Figure 19**) and within 1/4" of the centerline of the stud.

9.7.1.3.2 For multiple fasteners, the 6" TRX Truss Screws shall be installed at a downward angle from the vertical of 4° to 14° into the wide face (see **Figure 20** and **Figure 21**) of the stud while upholding the fastener spacing provided in **Table 11**.

9.7.1.3.3 Starting from the specified end distances shown in **Figure 18** through **Figure 21**, at a minimum, drive the fastener until the bottom surface of the fastener head fully bears against stud (see **Figure 27**).

9.7.2 *Perpendicular Installation:*

9.7.2.1 Install TRX Truss Screws upward through the bottom plates and into the wall studs (**Figure 22**).

9.7.2.1.1 Fastener shall be within 1/4" of the centerline of the stud.

9.7.2.1.2 Drive the fastener until the bottom of the head is flush with the surface of the outermost bottom plate.

9.7.2.1.3 Minimum requirements for fastener spacing, edge distance, and end distance shall be in accordance with **Table 11**.

9.8 *Bottom Plate to Rim Board/Ribbon Board Connection*

9.8.1 Install TRX Truss Screws downward and perpendicular to the face of the wall bottom plate, a minimum of 1/2" from the outside face of the wall, through the plate and into the rim board/ribbon board (**Figure 26**).

9.8.2 Minimum penetration into the rim board or ribbon board shall be in accordance with **Table 10**.

9.8.3 Minimum requirements for fastener spacing, edge distance, and end distance shall be in accordance with **Table 11**.

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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 Bending yield testing in accordance with ASTM F1575

10.1.2 Shear strength testing in accordance with AISI S904

10.1.3 Tensile strength testing in accordance with AISI S904

10.1.4 Lateral connection testing in accordance with ASTM D1761

10.1.5 Withdrawal testing in accordance with ASTM D1761

10.1.6 Head pull-through testing in accordance with ASTM D1761

10.1.7 Corrosion resistance testing in accordance with ASTM B117, ASTM G85, and ASTM G198

10.1.8 Uplift and lateral testing of assemblies in accordance with ASTM D1761

10.2 Connection design value calculations by DrJ Engineering, LLC in accordance with the NDS and accepted engineering practices.

10.3 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.

10.4 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.

10.5 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.

10.6 *Testing and Engineering Analysis*

10.6.1 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.[39]

10.7 Where additional condition of use and/or regulatory compliance information is required, please search for TRX Truss Screws on the DrJ Certification website.

11 Findings

11.1 As outlined in **Section 6**, TRX Truss Screws 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, TRX Truss Screws shall be approved for the following applications:

11.2.1 To provide resistance to lateral loads applied to the fastener in a wood-to-wood connection as shown in **Table 2**.

11.2.2 To provide resistance to reference withdrawal loads as shown in **Table 3**.

11.2.3 To provide resistance to head pull-through loads as shown in **Table 4**.

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11.2.4 An acceptable means of attaching metal plate connected wood trusses or floor joists to the top/bottom of walls to provide uplift and lateral load resistance due to wind and seismic forces as provided in **Table 5** through **Table 7**.

11.2.5 An acceptable means of attaching studs to top/bottom plate in accordance with **Table 8** and **Table 9**.

11.2.6 An acceptable means of attaching wall bottom plate to rim board/ribbon board to provide lateral load and uplift resistance parallel to the bottom plate as provided in **Table 10**.

11.3 Unless exempt by state statute, when TRX Truss Screws 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 Western Builders Supply Company.

11.5 IBC Section 104.2.3[40] (IRC Section R104.2.2[41] and IFC Section 104.2.3[42] 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:**[43] Building regulations require that the building official shall accept duly authenticated reports.[44]

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.[45]

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 Allowable loads reflect dry service conditions.

12.2.1 Sawn lumber members shall have a moisture content no greater than nineteen percent (19%) as specified in NDS Section 4.1.4.

12.2.2 SCL members shall have a moisture content no greater than sixteen percent (16%) as specified in NDS Section 8.1.4.

12.2.2.1 Where SCL is specified in this report, the designated SCL product shall have a published equivalent specific gravity that meets or exceeds the specified specific gravity in the relevant tables in **Section 6**.

12.2.3 Use of fasteners in locations exposed to saltwater or saltwater spray is outside the scope of this report.

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12.3 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:

12.3.1 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.

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

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

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

12.3.5 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.

12.3.6 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.

12.4 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.

12.5 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).

12.6 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 TRX Truss Screws, 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.marmonfasteners.com/big-timber-us/product/trx.

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.

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Notes

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

2 2021 IRC Section R317.3

3 2018 IBC Section 2304.10.5

4 2021 IRC Section R317.3

5 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.

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

7 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

8 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

9 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

10 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.

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

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

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

14 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.

15 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/

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

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

18 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

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

20 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

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

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

23 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.

24 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

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

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

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

28 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

29 2021 IBC Section 2308.5.3.2

30 2021 IBC Section 2308.5.3.2

31 2021 IBC Section 2308.5.3.2

32 2021 IBC Section 2308.5.3.2

33 2021 IBC Section 2308.5.3.1

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

[35] 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

[36] 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

[37] 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.

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

[39] 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

[40] 2021 IBC Section 104.11

[41] 2021 IRC Section R104.11

[42] 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

[43] 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.

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

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

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