



ICC-ES Evaluation Report

ESR-5053

Reissued August 2023

Revised December 2023

This report is subject to renewal August 2024

DIVISION: 06 00 00—WOOD, PLASTICS AND COMPOSITES

Section: 06 17 19—Cross-laminated Timber

REPORT HOLDER:

STERLING SITE ACCESS SOLUTIONS, LLC

EVALUATION SUBJECT:

TERRALAM® CROSS-LAMINATED TIMBER PANELS

1.0 EVALUATION SCOPE

Compliance with the following codes and standard:

- 2021, 2018 and 2015 *International Building Code*® (IBC)
- 2021, 2018 and 2015 *International Residential Code*® (IRC)
- ANSI/APA PRG 320-2019 Standard for Performance-Rated Cross-Laminated Timber

For evaluation for compliance with codes adopted by the California Office of Statewide Health Planning and Development (OSHPD) AKA: California Department of Health Care Access and Information (HCAI) and Division of State Architects (DSA), see ESR-5053 CBC and CRC Supplement.

Property evaluated:

- Structural
- Fire Resistance

2.0 USES

Sterling’s TerraLam cross-laminated timber (CLT) panels are certified engineered wood product. When installed under the 2021, 2018 and 2015 IBC, TerraLam CLT panels can be used as components in floors, roofs and interior walls in Type III construction; as floors, roofs, interior and exterior walls in Type IV and V Construction; and in Type I and II Construction as allowed by IBC Section 603. When installed under earlier editions of the IBC, TerraLam CLT panels can be used as components in roofs in Type I and II Construction; in floors, roofs and interior walls in Type III and IV construction; and anywhere in Type V Construction.

When the TerraLam CLT panels are installed in construction regulated under the IRC, an engineered design is required in accordance with IRC Section R301.1.3.

3.0 DESCRIPTION

3.1 General:

The TerraLam CLT panels described in this evaluation report comply with Section 2303.1.4 of the 2021, 2018 and 2015 IBC. Design must be in accordance with 2021 and 2018 IBC Section 2302.1(1) or (2) [2015 IBC Section 2301.2(1) or (2)]. The panels are fabricated with at least three planed sawn lumber laminations with adjacent laminations glued together at an angle of 90°, as shown in Table 2. The TerraLam CLT panels are fabricated with nominal widths up to 8 feet (2438 mm), thicknesses of 4¹/₈ to 9⁵/₈ inches (105 to 244 mm), and lengths up to 18 feet (5486 mm). The TerraLam CLT panels are fabricated by face-bonding each layer of laminations using a structural adhesive, complying with Section 3.2.2 of this evaluation report. The layers are placed in a press to form a dimensionally stable structural element. Refer to Table 2 for TerraLam CLT panel layouts.

3.2 Material:

3.2.1 Wood Laminations: Wood laminations used in fabricating TerraLam CLT panels must be in accordance with the approved in-plant manufacturing standard and are No. 2 Southern Pine (SP) sawn lumber having an assigned specific gravity of 0.55, No. 2 Spruce-Pine-Fir (South) (SPF-S) sawn lumber having an assigned specific gravity of 0.36, or No. 2 Eastern Hemlock-Tamarack (EH-T) sawn lumber having an assigned specific gravity of 0.41 and the reference design values provided in Table 1.

3.2.2 Adhesives: Adhesive used to face-bond layers of TerraLam CLT panels and adhesive used for finger-joints of wood laminations are non-formaldehyde, one-component polyurethane based, exterior-type structural adhesives, conforming to ANSI/APA PRG 320-2019 and the product specifications in the approved quality documentation.

4.0 DESIGN AND INSTALLATION

4.1 General:

Design and installation of TerraLam CLT panels must be in accordance with this evaluation report, the applicable code provisions and the manufacturer’s published design and installation instructions. The manufacturer’s design and installation instructions must be available at the jobsite at all times during installation. Design must be in accordance with 2021 and 2018 IBC Section 2302.1(1) for Allowable Stress

Design (ASD) or Section 2302.1(2) for Load and Resistance Factor Design (LRFD), respectively, [2015 IBC Section 2301.2(1) and (2)], and Chapter 10 of the 2018 or 2015 *National Design Specification® for Wood Construction* (NDS), as applicable.

4.2 Reference Design Values:

Table 1 provides reference design values of laminations used to fabricate the TerraLam CLT panels. The design values shall be used in conjunction with the section properties analytically derived using the equations outlined in the ANSI/APA PRG 320-2019 based on the actual layouts used in manufacturing the CLT panels in Table 2.

Table 3 provides the reference design values for bending and shear capacities of TerraLam CLT panels for Allowable Stress Design (ASD). For the Load and Resistance Factor Design (LRFD), the reference design values must be adjusted using the adjustment factors specified in Table 10.3.1 of the 2018 or 2015 NDS. In addition, the reference design values must be adjusted in accordance with Section 4.3 of this evaluation report.

4.3 Adjustment Factors:

The reference design values in Table 3 must be adjusted in accordance with Table 10.3.1 of the 2018 or 2015 NDS to determine the allowable stress (ASD) or design stress (LRFD), and must not be increased for the lumber flat use or lumber size adjustment factor in accordance with the NDS. The time dependent deformation (creep) factor, K_{cr} , of 2.0, specified in Section 3.5.2 of the NDS, must be used to calculate the total deflection due to long-term loading for TerraLam CLT panels used as components in floor and roof decks under dry service condition such as in most covered structures, where the moisture content in lumber in service is less than 16 percent, as specified in Section 10.1.5 of the 2018 or 2015 NDS.

4.4 Shear Wall: For installations under the 2021 IBC, the nominal unit shear capacity of CLT shear wall systems must be determined in accordance with Section 4.6.3 and Appendix B with the deflection of the shear wall systems determined in accordance with Sections 4.6.1 and 4.6.2 of the 2021 AWC *Special Design Provisions for Wind and Seismic* (SDPWS) with Commentary. The ASD and LRFD capacity for wind or seismic design must be determined in accordance with Section 4.1.4 of the SDPWS. The seismic design coefficients and structural height limits must be limited to the values in ASCE 7-22.

4.5 Fire Resistance:

4.5.1 Under the 2021 IBC: When fire performance is required, the fire resistance rating of exposed TerraLam CLT panels may be determined in accordance with Chapter 16 of the NDS. Additionally, the Heavy Timber construction provisions of IBC Section 602.4 are applicable to TerraLam CLT panels. As an alternate to these provisions, TerraLam CLT panels must be tested in accordance with ASTM E119 with a fire resistance rating in accordance with the test results and the conditions of such tests.

4.5.2 Under Earlier Editions of the IBC: Procedures specified in Chapter 16 of the 2018 or 2015 NDS may be used in designing TerraLam CLT panels for a fire exposure up to 2 hours. Alternatively, TerraLam CLT panels can be used in 2-hour fire-resistance-rated construction, when qualified in accordance with ASTM E119.

5.0 CONDITIONS OF USE

The TerraLam CLT panels described in this report comply with, or are suitable alternatives to what is specified in, those codes listed in Section 1.0 of this report, subject to the following conditions:

- 5.1** Fabrication, design, and installation of TerraLam CLT panels must comply with this evaluation report and the manufacturer's published design and installation instructions. In the event of a conflict between the manufacturer's published design and installation instructions and this evaluation report, the more restrictive requirements govern.
- 5.2** Use of TerraLam CLT panels must be limited to dry service conditions where the equilibrium moisture content in lumber in service is less than 16 percent, as in most covered structures.
- 5.3** Calculations and drawings demonstrating compliance with this evaluation report must be submitted to the code official. The calculations and drawings must be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed.
- 5.4** Connections between wall panels and roof/floor panels, and other support members shall be accompanied by complete detailing and design that are satisfactory to the code official. Fasteners and connectors must be properly specified, including size, length, dimension, fastener bearing length and location. Connections must be designed in accordance with the mechanical connection provisions in the NDS or in accordance with provisions for proprietary connectors and fasteners addressed in a current ICC-ES evaluation report.
- 5.5** Cutting, drilling, and notching of TerraLam CLT panels when used as components in floor and roof decks have not been evaluated and are outside the scope of this evaluation report.
- 5.6** TerraLam CLT panels used to resist gravity or out-of-plane transverse forces in walls must be accompanied by complete detailing and wall design that are acceptable to the code official.
- 5.7** Use of TerraLam CLT panels to resist in-plane shear forces in shear walls must be accompanied by detailing to complete load path(s) for shear wall design in accordance with Appendix B of the 2021 SDPWS.
- 5.8** TerraLam CLT panel roofs must be covered with approved roof coverings secured to the building or structure in accordance with applicable provisions of IBC Chapter 15.
- 5.9** The exterior surface of TerraLam CLT panel exterior walls must be protected by a weather-resistant exterior wall envelope in accordance with IBC Chapter 14.
- 5.10** The exterior surface of TerraLam CLT panel exterior walls in Type IV Construction must be protected against fire by one of the methods described in 2021 IBC Section 602.4.4.2 or in accordance with 2018 and 2015 IBC Section 602.4.2, as applicable.
- 5.11** Special inspection must be conducted in accordance with the applicable requirements of Sections 1704 and 1705 of the IBC.

5.12 TerraLam CLT panels are fabricated at the Sterling Structural’s facility located in Phoenix, Illinois, under an approved quality control program with inspections by ICC-ES.

6.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for Cross-laminated Timber Panels for Use as Components in Walls, Floors, and Roofs (AC455), dated October 2022.

7.0 IDENTIFICATION

7.1 The ICC-ES mark of conformity, electronic labeling, or the evaluation report number (ICC-ES ESR-5053) along with the name, registered trademark, or

registered logo of the report holder must be included in the product label.

7.2 In addition, TerraLam CLT panels are identified with a product label noting the panel grade and layup, the production lot number, “ANSI PRG 320”.

7.3 The report holder’s contact information is the following:

STERLING SITE ACCESS SOLUTIONS, LLC
501 EAST 151 STREET
PHOENIX, ILLINOIS 60426
(708) 388-2223
www.sterlingstructural.com

TABLE 1—REFERENCE DESIGN VALUES FOR LUMBER LAMINATIONS USED IN TERRALAM CLT PANELS¹

CLT GRADE	MAJOR STRENGTH DIRECTION						MINOR STRENGTH DIRECTION					
	f _{b,0} (psi)	E (10 ⁶ psi)	f _{t,0} (psi)	f _{c,0} (psi)	f _{v,0} (psi)	f _{s,0} (psi)	f _{b,90} (psi)	E (10 ⁶ psi)	f _{t,90} (psi)	f _{c,90} (psi)	f _{v,90} (psi)	f _{s,90} (psi)
V3+	925	1.4	550	1350	175	55	925	1.4	550	1350	175	55
V4+	775	1.1	350	1,000	135	45	775	1.1	350	1,000	135	45
EH-T	575	1.1	275	825	170	55	575	1.1	275	825	170	55

For SI: 1 psi = 6,895 Pa

¹Tabulated tabulated values are allowable design values and not permitted to be increased for the lumber flat use or size factor in accordance with the NDS. The design values shall be used in conjunction with the section properties analytically derived using the equations outlined in the ANSI/APA PRG 32-2019 based on the actual layup used in manufacturing the CLT panel (see Table 2).

TABLE 2—TERRALAM CLT PANEL LAYUPS

CLT GRADE	LAYUP ¹	THICKNESS t _p ² (in.)	LAMINATION ACTUAL THICKNESS ³ (in.)						
				⊥		⊥		⊥	
V3+	TL300S	4 ¹ / ₈	1 ³ / ₈	1 ³ / ₈	1 ³ / ₈	-	-	-	-
	TL500S	6 ⁷ / ₈	1 ³ / ₈	1 ³ / ₈	1 ³ / ₈	1 ³ / ₈	1 ³ / ₈	-	-
	TL700S	9 ⁵ / ₈	1 ³ / ₈	1 ³ / ₈	1 ³ / ₈	1 ³ / ₈	1 ³ / ₈	1 ³ / ₈	1 ³ / ₈
V4+	TL300S	4 ¹ / ₈	1 ³ / ₈	1 ³ / ₈	1 ³ / ₈	-	-	-	-
	TL500S	6 ⁷ / ₈	1 ³ / ₈	1 ³ / ₈	1 ³ / ₈	1 ³ / ₈	1 ³ / ₈	-	-
	TL700S	9 ⁵ / ₈	1 ³ / ₈	1 ³ / ₈	1 ³ / ₈	1 ³ / ₈	1 ³ / ₈	1 ³ / ₈	1 ³ / ₈
EH-T	TL300S	4 ¹ / ₈	1 ³ / ₈	1 ³ / ₈	1 ³ / ₈	-	-	-	-
	TL500S	6 ⁷ / ₈	1 ³ / ₈	1 ³ / ₈	1 ³ / ₈	1 ³ / ₈	1 ³ / ₈	-	-
	TL700S	9 ⁵ / ₈	1 ³ / ₈	1 ³ / ₈	1 ³ / ₈	1 ³ / ₈	1 ³ / ₈	1 ³ / ₈	1 ³ / ₈

For SI: 1 in. = 25.4 mm

¹The panel layups are developed based on the ANSI/APA PRG 320-2019, using visually graded sawn lumber described in Section 3.2.1. The layup designation refers to the number of layers and the layup series.

²Gross thickness of CLT panels.

³Actual thickness of lamination after planing. “||”: Face laminations are oriented parallel to the major strength direction and “⊥”: Face laminations are oriented perpendicular to the major strength direction.

TABLE 3—REFERENCE DESIGN VALUES FOR TERRALAM CLT PANELS^{1,4}

CLT GRADE	LAYUP ²	THICKNESS t_p ³ (in.)	MAJOR STRENGTH DIRECTION				MINOR STRENGTH DIRECTION			
			$(F_b S)_{eff.f,0}$ (lb _r -ft/ft)	$(EI)_{eff.f,0}$ ($\times 10^6$ lb _r -in. ² /ft)	$(GA)_{eff.f,0}$ ($\times 10^6$ lb _r /ft)	$V_{s,0}$ (lb _r /ft)	$(F_b S)_{eff.f,90}$ (lb _r -ft/ft)	$(EI)_{eff.f,90}$ ($\times 10^6$ lb _r -in. ² /ft)	$(GA)_{eff.f,90}$ ($\times 10^6$ lb _r /ft)	$V_{s,90}$ (lb _r /ft)
V3+	TL300S	4 ¹ / ₈	2,150	95	0.53	1,820	290	3.6	0.53	605
	TL500S	6 ⁷ / ₈	4,950	363	1.05	3,025	2,525	95	1.05	1,820
	TL700S	9 ⁵ / ₈	8,750	900	1.58	4,225	5,825	363	1.58	3,025
V4+	TL300S	4 ¹ / ₈	1,800	74	0.41	1,490	245	2.9	0.41	495
	TL500S	6 ⁷ / ₈	4,150	286	0.83	2,480	2,120	74	0.83	1,490
	TL700S	9 ⁵ / ₈	7,325	707	1.20	3,475	4,875	283	1.20	2,480
EH-T	TL300S	4 ¹ / ₈	1,340	74	0.41	1,820	180	2.9	0.41	605
	TL500S	6 ⁷ / ₈	3,075	286	0.83	3,025	1,570	74	0.83	1,820
	TL700S	9 ⁵ / ₈	5,450	707	1.20	3,575	3,575	283	1.20	3,025

For SI: 1 in. = 25.4 mm; 1 ft. = 305 mm; 1 lb_r = 4.45 N

¹The tabulated values are reference design values intended for Allowable Stress Design (ASD) and must be adjusted in accordance with Section 4.3. For LRFD, the reference design values must be adjusted using the adjustment factors specified in Table 10.3.1 of the 2018 or 2015 NDS.

²The CLT layups are developed based on the ANSI/APA PRG 320-2019, using visually graded sawn lumber noted in Section 3.2.1 of the evaluation report. The layup designation refers to the number of layers of CLT panels.

³Gross thickness of CLT panels.



FIGURE 1—COMPANY LOGO FOR STERLING SITE ACCESS SOLUTIONS, LLC

DIVISION: 06 00 00—WOOD, PLASTICS AND COMPOSITES
Section: 06 17 19—Cross-laminated Timber

REPORT HOLDER:

STERLING SITE ACCESS SOLUTIONS, LLC

EVALUATION SUBJECT:

TERRALAM® CROSS-LAMINATED TIMBER PANELS

1.0 REPORT PURPOSE AND SCOPE**Purpose:**

The purpose of this evaluation report supplement is to indicate that the TerraLam Cross Laminated Timber (CLT) panels, described in ICC-ES evaluation report ESR-5053, have also been evaluated for compliance with the Chicago Construction Codes (Title 14 of the Chicago Municipal Code) as noted below.

Applicable code edition:

- 2019 *Chicago Building Code* (Title 14B)

2.0 CONCLUSIONS

The TerraLam CLT panels, described in Sections 2.0 through 7.0 of the evaluation report ESR-5053, comply with Chapters 6 and 23 of Title 14B, and are subject to the conditions of use described in this supplement.

3.0 CONDITIONS OF USE

The TerraLam CLT panels, described in this evaluation report supplement must comply with all of the following conditions:

- All applicable sections in the evaluation report ESR-5053.
- The design, installation, conditions of use and identification of the TerraLam CLT panels are in accordance with the 2018 *International Building Code*® (IBC) provisions noted in the evaluation report ESR-5053, except that the use of TerraLam CLT panels in exterior walls is limited in Type V construction in accordance with Chapter 6 of Title 14B.
- The design, installation and inspection are in accordance with additional requirements of Chapters 16 and 17 of Title 14B, as applicable.

This supplement expires concurrently with the evaluation report, reissued August 2023 and revised December 2023.

DIVISION: 06 00 00—WOOD, PLASTICS AND COMPOSITES

Section: 06 17 19—Cross-laminated Timber

REPORT HOLDER:

STERLING SITE ACCESS SOLUTIONS, LLC

EVALUATION SUBJECT:

TERRALAM® CROSS-LAMINATED TIMBER PANELS

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that the TerraLam Cross Laminated Timber (CLT) panels, described in the ICC-ES evaluation report ESR-5053, have also been evaluated for compliance with the codes noted below.

Applicable code editions:

- 2022 California Building Code (CBC)

For evaluation of applicable chapters adopted by the California Office of Statewide Health Planning and Development (OSHPD) AKA: California Department of Health Care Access and Information (HCAI) and Division of State Architect (DSA), see Sections 2.1.1 and 2.1.2 below.

- 2022 California Residential Code (CRC)

2.0 CONCLUSIONS

2.1 CBC:

The TerraLam CLT panels, described in Sections 2.0 through 7.0 of the evaluation report ESR-5053, comply with CBC Chapters 6 and 23, provided the design and installation are in accordance with the 2021 *International Building Code*® (IBC) provisions noted in the evaluation report ESR-5053 and the additional requirements of CBC Chapters 6, 16, 17, and 23, as applicable.

2.1.1 OSHPD:

The TerraLam CLT panels, described in Sections 2.0 through 7.0 of the evaluation report ESR-5053 comply with requirements of CBC amended Chapters 16, 17 and 23 and Chapters 16A and 17A provided the design and installation are in accordance with the 2021 *International Building Code*® (IBC) provisions noted in the evaluation report ESR-5053, and the additional requirements in Sections 2.1.1.1 and 2.1.1.2 of this supplement.

2.1.1.1 Conditions of Use:

1. All loads applied to the TerraLam CLT panels shall be determined by the registered design professional and shall comply with applicable loads and load combinations from CBC Chapter 16 and amendments [OSHPD 1R, 2, 3 & 5] and Chapter 16A [OSHPD 1 & 4].
2. Seismic Design Category shall be in accordance with CBC amended Section 1613.1, Exception 6 [OSHPD 1R, 2 & 5].
3. The TerraLam CLT panels are prohibited from use as part of the seismic force-resisting system, unless approved as an alternative system in accordance with CBC Section 104.11 [OSHPD 1, 1R, 2, 4 & 5].

2.1.1.2 Special Inspection Requirement: Special inspection of wood structural elements is required in accordance with CBC amended Section 1705A.5.3 [OSHPD 1 & 4].

2.1.2 DSA:

The TerraLam CLT panels, described in Sections 2.0 through 7.0 of the evaluation report ESR-5053 comply with the CBC amended Chapters 16 and 23, and Chapters 16A and 17A provided the design and installation are in accordance with the 2021 *International Building Code*[®] (IBC) provisions noted in the evaluation report ESR-5053, and the additional requirements in Sections 2.1.2.1 and 2.1.2.2 of this supplement.

2.1.2.1 Conditions of Use:

1. All loads applied to the TerraLam CLT panels shall be determined by the registered design professional and shall comply with applicable loads and load combinations from CBC amended sections in Chapter 16 [DSA-SS/CC] and Chapter 16A [DSA-SS].
2. The TerraLam CLT panels are prohibited from use as part of the seismic force-resisting system, unless approved as an alternative system in accordance with CBC Section 104.11 [DSA-SS & DSA-SS/CC].

2.1.2.2 Special Inspection Requirement: Special inspection of wood structural elements is required in accordance with the CBC amended Section 1705A.5.3 [DSA-SS & DSA-SS/CC].

2.2 CRC:

The TerraLam CLT panels described in Sections 2.0 through 7.0 of the evaluation report ESR-5053, complies with CRC Chapters 5, 6 and 8, provided the design and installation are in accordance with the 2021 *International Residential Code*[®] (IRC) provisions noted in the evaluation report and the additional requirements of CRC Chapter 3, as applicable.

This supplement expires concurrently with the evaluation report, reissued August 2023 and revised December 2023.