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Joint Evaluation Report

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ESR-2725

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DIVISION: 06 00 00—WOOD, PLASTICS AND COMPOSITES
SECTION: 06 17 25—LAMINATED STRAND LUMBER

REPORT HOLDER:

TOLKO INDUSTRIES LTD., ATHABASCA DIVISION

EVALUATION SUBJECT:

TOLKO LAMINATED STRAND LUMBER (LSL) AND ZB TREATED LSL

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ESR-2725
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DIVISION: 06 00 00—WOOD, PLASTICS AND COMPOSITES
Section: 06 17 25—Laminated Strand Lumber

REPORT HOLDER:

TOLKO INDUSTRIES LTD., ATHABASCA DIVISION

EVALUATION SUBJECT:

TOLKO LAMINATED STRAND LUMBER (LSL) AND ZB TREATED LSL

1.0 EVALUATION SCOPE

1.1 Compliance with the following codes:

- 2018, 2015, 2012, 2009, and 2006 *International Building Code*® (IBC)
- 2018, 2015, 2012, 2009, and 2006 *International Residential Code*® (IRC)

For evaluation in compliance with codes adopted by the Los Angeles Department of Building and Safety (LADBS), see ESR-2725 LABC and LARC Supplement.

Properties evaluated:

- Structural
- Fire resistance
- Preservative Treatment

1.2 Evaluation to the following green code(s) and/or standards:

- 2016 California Green Building Standards Code (CALGreen), Title 24, Part 11
- 2015, 2012 and 2008 ICC 700 *National Green Building Standard*™ (ICC 700-2015, ICC 700-2012 and ICC 700-2008)

Attributes verified:

See Section 3.1.

2.0 USES

Tolko laminated strand lumber (LSL) and ZB Treated LSL are used for structural applications, such as beams, headers, joists, rafters, columns, and rim board. It is also used as components in built-up structural members, such as flanges for I-joists and chords for trusses. Tolko ZB Treated LSL may be used as sill plates.

3.0 DESCRIPTION

Tolko LSL and ZB Treated LSL described in this report comply with the requirements noted in Section 2303.1.10 of the 2018 and 2015 IBC (Section 2303.1.9 of the 2012, 2009 and 2006 IBC), for allowable stress design in accordance with IBC Section 2301.2(1). They may also be used in structures regulated under the IRC when an engineered design is submitted in accordance with IRC Section R301.1.3.

The attributes of the LSL have been verified as conforming to the provisions of (i) CALGreen Section A4.404.3 for efficient framing techniques; (ii) ICC 700-2015 and ICC 700-2012 Section 608.1(2), 11.608.1(2) and 12(A).608.1 for resource-efficient materials; and (iii) ICC 700-2008 Section 607.1(2) for resource-efficient materials. Note that decisions on compliance for those areas rest with the user of this report. The user is advised of the project-specific provisions that may be contingent upon meeting specific conditions, and the verification of those conditions is outside the scope of this report. These codes or standards often provide supplemental information as guidance.

Tolko LSL consists of wood strands bonded together using an exterior-type structural adhesive. The wood strand properties and species, adhesive, manufacturing parameters and finished product dimensions and tolerances are as specified in the approved quality documentation and manufacturing standard.

Tolko ZB Treated LSL are treated with zinc borate (ZB) for protection against decay and termites, and is limited to interior locations, continuously protected from the weather and not in contact with the ground, but may be subject to dampness (such as in sill plates over concrete footings and slabs) as defined by the American Wood Protection Association (AWPA) Use Category UC2 as defined in AWPA U1. Unless noted otherwise within this report, all design provisions for Tolko LSL apply also to ZB Treated LSL.

4.0 DESIGN AND INSTALLATION

4.1 General:

Design and installation of Tolko LSL and ZB Treated LSL must be in accordance with this report, the applicable code provisions and the manufacturer's published installation instructions. The manufacturer's published installation instructions must be available at the jobsite at all times during installation. The requirements specified for allowable stress design in accordance with IBC Section 2301.2(1), and the design provisions for structural composite lumber in the ANSI/AWC *National Design Specification* (NDS) *for Wood Construction* are applicable to Tolko LSL and ZB Treated LSL, except as modified within this report. Reference design values for each grade of Tolko LSL and ZB Treated LSL are provided in Table 1.

4.2 Connections:

The design of mechanical connections in Tolko LSL and ZB Treated LSL must be in accordance with the NDS. Equivalent specific gravities for the design of nail, bolt and lag screw connections under dry use conditions are provided in Table 2. Minimum nail spacing and end distance requirements are provided in Table 3.

Exception: Lag screw connections between Tolko LSL and ZB Treated LSL rim board and lumber deck ledgers have allowable lateral loads as specified in Table 4, provided all of the following conditions are met:

1. Lag screws must have a minimum diameter of $^1/_2$ inch (12.7 mm), and sufficient length such that the lag screw shank penetrates through the rim board (not including the length of the tapered tip).
2. Deck ledgers must consist of lumber having a minimum thickness of $1^1/_2$ inches (38 mm) and a minimum assigned specific gravity of 0.42.
3. The sheathing between the rim board and the deck ledger must consist of wood structural panels meeting U.S. DOC PS-1 or PS-2, and be attached to the rim board in accordance with the applicable code.
4. One flat washer must be used between the deck ledger and the lag screw head.
5. Edge distances from the center of the lag screw to the edges of the rim board and deck ledger must be 2 inches (51 mm) or greater. End distances must be 4 inches (102 mm) or greater.
6. Adjustment factors in accordance with the NDS must be applied as applicable.
7. Rim board and deck ledgers must be checked for load- carrying capacity at connections in accordance with Section 11.1.2 of the 2018 and 2015 NDS (Section 10.1.2 of the 2012 NDS).

4.3 Rim Board and Blocking:

When used as rim board, Tolko LSL and ZB Treated LSL must be continuously supported across the full width (except as noted in Section 4.3.2), and must be located at the joist elevation either perpendicular to, or parallel to, the joist framing. It must be the full depth of the joist space and be used for any combination of the following:

- To transfer, from above to below, all vertical loads at the rim board location. Allowable vertical loads are given in Table 4.
- To provide diaphragm attachment (sheathing to top edge of rim board).
- To transfer in-plane lateral loads from the diaphragm to the wall plate below. Allowable in-plane lateral loads are given in Table 4.
- To provide lateral support to the joist or rafter (resistance against rotation) through attachment to the joist or rafter.
- To provide closure for ends of joists or rafters.
- To provide an attachment base for siding and/or an exterior deck ledger.

4.3.1 Rim board must be installed in accordance with the prescriptive provisions of the applicable code, and design loads must not exceed those given in Table 4.

4.3.2 Installation of Tolko LSL and ZB Treated LSL rim board over wall openings is permitted, provided the rim board is designed for all applicable stresses in accordance with Sections 4.1 and 4.2 adjusted by the applicable adjustment factors. Joints in the rim board are not allowed within 12 inches (305 mm) of the opening.

4.3.3 Tolko LSL and ZB Treated LSL having minimum thicknesses as given in Table 4 may be used as direct replacements for the nominally 2-inch-thick solid blocking specified in Section 2308.4.2.3 of the 2018 and 2015 IBC (Section 2308.8.2 of the 2012, 2009 and 2006 IBC) and Section R502.7 of the IRC.

4.4 Fire Resistance and Fire Blocking:

4.4.4 Calculated Fire Resistance: The fire resistance of exposed Tolko LSL and ZB Treated LSL may be calculated in accordance with Chapter 16 of the NDS.

4.4.5 Fire-resistance-rated Floor and Roof Systems: Tolko LSL and ZB Treated LSL may be used as direct replacements for non-fire-retardant-treated sawn lumber, of equivalent size, in the prescriptive fire-resistance-rated floor and roof assemblies listed in Table 721.1(3) of the 2018, 2015, and 2012 IBC (Table 720.1(3) of the 2009 and 2006 IBC).

4.4.6 Fire Protection of Floors: Tolko LSL and ZB Treated LSL having a minimum thickness of $1^1/_2$ inches (38 mm) and a minimum depth of $9^1/_4$ inches (235 mm), are considered equivalent to lumber joists in accordance with Exception 4 to Section R302.13 of the 2018 and 2015 IRC (R501.3 of the 2012 IRC).

4.4.7 Fire Blocking: Tolko LSL and ZB Treated LSL are permitted to be used as fire blocking in accordance with Section 718.2.1 of the 2018, 2015, and 2012 IBC (717.2.1 of the 2009 and 2006 IBC) and Section R602.8 of the IRC as follows:

1. Tolko LSL and ZB Treated LSL having a minimum thickness of $1^1/_4$ inches (31.8 mm) are permitted to be used as an alternate to nominally 2-inch lumber fire blocking.
2. Tolko LSL and ZB Treated LSL having a minimum thickness of 1 inch (25.4 mm) are permitted to be used as an alternate to $^{23}/_{32}$ inch (18.3 mm) wood structural panel fire blocking, provided the joints are backed accordingly.

4.4.8 Roof and Ceiling Framing: Tolko LSL and ZB Treated LSL may be used as ceiling joists and rafter framing in conventional light-frame construction in accordance with Section 2308.7 of the 2018 and 2015 IBC (2308.10 of the 2012, 2009 and 2006 IBC) and Section R802 of the IRC.

5.0 CONDITIONS OF USE

Tolko LSL and ZB Treated LSL described in this report comply with, or are suitable alternatives to what is specified in, those codes specifically listed in Section 1.0 of this report, subject to the following conditions:

5.1 Fabrication, design, installation, and connection restrictions must comply with this report and the manufacturer's published installation instructions. In the event of a conflict between the manufacturer's published installation instructions and this report, this report governs.

5.2 Use of Tolko LSL and ZB Treated LSL must be limited to dry, well-ventilated interior applications in which the in-service average moisture content of lumber is less than 16 percent. Use of Tolko LSL and ZB Treated LSL must be limited to interior locations, continuously protected from the weather, and cannot be in contact with the ground, but may be subject to dampness, as defined by the American Wood Protection Association (AWPA) Use Category UC2. Applications of ZB

treated LSL within the building envelop are to be in accordance with 2018 and 2015 IBC Section 2304.12 and 2018 and 2015 IRC Section R317.1.

5.3 Calculations and drawings demonstrating compliance with this 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 Tolko LSL and ZB Treated LSL are produced by the Tolko Industries, Ltd. facility in Slave Lake, Alberta, Canada under a quality control program with inspections by ICC-ES and APA—The Engineered Wood Association (AA-649). The ZB treatment is under a quality control program with inspections by ICC-ES and Timber Products Inspection, Inc. (AA-696).

6.0 EVIDENCE SUBMITTED

6.1 Data in accordance with the ICC-ES Acceptance Criteria for Structural Wood-based Products (AC47), dated June 2017 (editorially revised March 2018).

6.2 Data in accordance with the ICC-ES Acceptance Criteria for Rim Board Products (AC124), dated October 2016 (editorially revised March 2018).

6.3 Data in accordance with the ICC-ES Acceptance Criteria for Zinc Borate (ZB) Preservative Treatment of Structural Composite Wood Products by Non-pressure Processes (AC203), dated August 2017.

7.0 IDENTIFICATION

7.1 Tolko LSL is identified with stamps noting the Tolko Industries, Ltd name or logo, plant number, product designation, grade, production date and shift, evaluation report number (ESR-2725), and the third-party inspection agency (APA—The Engineered Wood Association). Tolko ZB Treated LSL is identified with the designation of "AWPA UC2" with the third-party inspection agency (Timber Products Inspection, Inc.).

7.2 The report holder's contact information is the following:

TOLKO INDUSTRIES LTD., ATHABASCA DIVISION
6 KM EAST MITSUE INDUSTRIAL PARK
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SLAVE LAKE, ALBERTA T0G 2A0
CANADA
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TABLE 1—REFERENCE DESIGN VALUES FOR TOLKO LSL and ZB TREATED LSL [1,2,3]

GRADE	BEAM ORIENTATION					PLANK ORIENTATION					AXIAL	
	Modulus of Elasticity		Bending [6,7]	Shear	Compr. Perp-to-Grain	Modulus of Elasticity		Bending	Shear	Compr. Perp-to-Grain	Compr.	Tension [8]
	E [4] (x10^6 psi)	E_{min} [5] (x10^6 psi)	F_b (psi)	F_v (psi)	$F_{c\perp}$ [9] (psi)	E [4] (x10^6 psi)	E_{min} [5] (x10^6 psi)	F_b (psi)	F_v (psi)	$F_{c\perp}$ [9] (psi)	F_c (psi)	F_t (psi)
1.35E	1.35	0.70	1850 [9]	330	750	1.35	0.70	2060	115	690	1650	1300

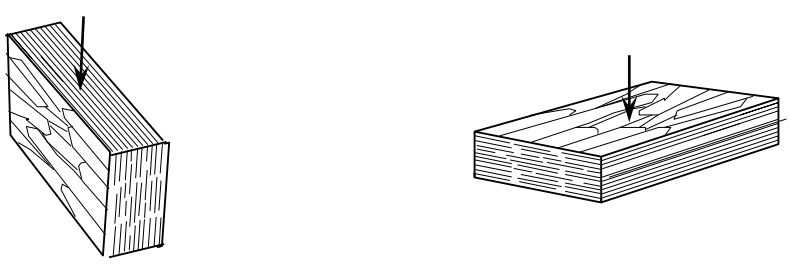
For **SI**: 1 psi = 6.89 kPa, 1 inch = 25.4 mm.

[1]Reference design values apply only to dry, well-ventilated interior applications where the equivalent moisture content in lumber is less than 16 percent.
[2]Reference design values are for normal load duration. Tabulated values must be adjusted by the applicable adjustment factors in accordance with the NDS. Modulus of elasticity and compression perpendicular-to-grain must not be adjusted for duration of load.
[3]Reference design values given for Beam Orientation refer to loads applied parallel to the wide face of the strands (applied to the edge of the member). Plank Orientation refers to loads applied perpendicular to the wide face of the strands (applied to the face of the member). See Figure 1.
[4]The reference E value is the apparent modulus of elasticity and include the effect of shear deformations. For uniformly loaded simple-span beams, deflection is calculated using the tabulated apparent MOE as follows:

$$\delta = \frac{270\ \omega L^4}{Ebd^3}$$

where δ = calculated deflection (in.), ω = uniform load (lbf/ft), L = design span (ft), b = beam width (in.), d = beam depth (in.), and E = apparent modulus of elasticity (psi).

[5]E_{min} is the reference modulus of elasticity for beam stability and column stability calculations.
[6]Reference bending design values in the beam orientation, F_b, may be increased by 4% when the member qualifies as a repetitive member, in accordance with Section 8.3.7 of the NDS.
[7]Reference bending design values in the beam orientation, F_b, are assigned for a standard depth of 12 inches. For other depths greater than $2^1/_2$ inches, multiply F_b by a volume factor of $(12/d)^{0.125}$, where *d* is the depth of the member in inches. For depths $2^1/_2$ inches or less, the factor for the $2^1/_2$-inch depth shall be used.
[8]Reference tension design values, F_t, are assigned for a standard length of 3 feet. For other lengths, the allowable tensile stress shall be modified by $(3/L)^{(1/16)}$, where L = length in feet. For lengths less than 3 feet, use the allowable tension stress in Table 1 unadjusted.
[9] When designing with the tabulated compressive stress perpendicular to grain ($F_{c\perp}$), the Bearing Area Factor (C_b) stipulated in Section 3.10.4 of the NDS shall be permitted to be applied.



Beam Orientation Plank Orientation

FIGURE 1—BEAM AND PLANK ORIENTATION AS NOTED IN TABLE 1

TABLE 2—EQUIVALENT SPECIFIC GRAVITY FOR FASTENER DESIGN [1,2,3]

GRADE	EQUIVALENT SPECIFIC GRAVITY					
	NAILS AND SCREWS				BOLTS AND LAG SCREWS [4, 5]	
	Withdrawal		Dowel Bearing		Dowel Bearing (Installed in Face)	
	Installed in Edge	Installed in Face	Installed in Edge	Installed in Face	Load Applied Parallel to Grain	Load Applied Perpendicular to Grain
1.35E	0.42	0.44	0.47	0.50	0.50	0.50

[1]Fastener types and orientation not specifically described above are outside the scope of this report.
[2]Fastener design values calculated using the tabulated equivalent specific gravities given above must be adjusted by the applicable adjustment factors specified in the NDS for connections.
[3]Minimum nail spacing and end distance must be as specified in Table 3. Minimum spacing, end and edge distances for bolts and lag screws must be as specified in the NDS.
[4]Equivalent specific gravity values apply only to bolts and lag screws installed into the face of the LSL, such that the bolt axis is perpendicular to the wide faces of the strands or veneers.
[5]The allowable lateral loads for lag screw connections between Tolko LSL or ZB Treated LSL rim board and deck ledgers complying with the exception to Section 4.2 are given in Table 4.

TABLE 3—NAIL SPACING REQUIREMENTS FOR TOLKO LSL AND ZB TREATED LSL [1]

MEMBER THICKNESS (in.)	FASTENER ORIENTATION [2]	COMMON NAIL SIZE [3, 4]	MINIMUM END DISTANCE (in.)	MINIMUM NAIL SPACING (in.)	
				Single Row	Multiple Rows [5, 6]
$1^1/_2$ > Thickness ≥ $1^1/_4$	Edge [7]	8d & smaller	2	4	NA [9]
		10d & 12d	2	4	NA [9]
		16d	$2^1/_2$	5	NA [9]
	Face [8]	8d & smaller	$^7/_8$	1	1
		10d & 12d	$^7/_8$	1	1
		16d	$^7/_8$	$1^1/_2$	$1^1/_2$
$3^1/_2$ ≥ Thickness ≥ $1^1/_2$	Edge [7]	8d & smaller	1	2	3
		10d & 12d	2	3	4
		16d	$2^1/_2$	3	4
	Face [8]	8d & smaller	$^1/_2$	1	1
		10d & 12d	$^1/_2$	1	1
		16d	$^7/_8$	$1^1/_2$	$1^1/_2$

For **SI**: 1 inch = 25.4 mm.

[1]Edge distance must be sufficient to prevent splitting.
[2]Face orientation applies to nails driven into the face of the LSL member, such that the long axis of the nail is perpendicular to the wide faces of the strands. Edge orientation applies to nails driven into the edge of the LSL member.
[3]16d sinkers ($3^1/_4$ in. x 0.148 in. diameter) are considered equivalent to 12d common nails for the purpose of this table.
[4]Nails listed are common wire nails. For box nails, the spacing and end distance requirements of the next shorter common nail may be used (e.g., a 16d box nail may be spaced the same as a 10d and 12d common nail). Larger nail sizes and shank types not specifically described above are outside the scope of this report.
[5]For multiple rows of nails, the rows must be offset $^1/_2$ inch or more from each other, and staggered, as shown in Figure 2.
[6]For multiple rows of nails, the rows must be equally spaced about the centerline of the edge or face (whichever applies).
[7]Nail penetration for edge nailing must not exceed 2 inches for 16d common nails ($3^1/_2$ in. by 0.162 in. diameter) and $2^1/_2$ inches for all nails with a smaller shank diameter.
[8]Minimum nail spacing for the face orientation is applicable to nails that are installed in rows that are parallel to the direction of the grain (length) of the LSL. For nails driven into the face in rows that are perpendicular to the direction of the grain (width/depth) of the LSL, the minimum spacing must be sufficient to prevent splitting of the wood.
[8]Not available.

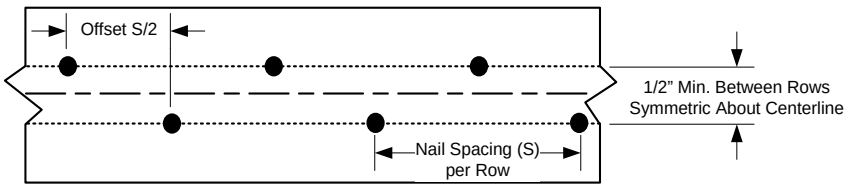


FIGURE 2—SPACING OF MULTIPLE ROWS OF NAILS

TABLE 4—ALLOWABLE DESIGN LOADS FOR TOLKO LSL AND ZB TREATED RIM BOARD [1,2]

GRADE	THICKNESS (in.)	LATERAL LOAD CAPACITY [3, 4, 5] (lbf/ft)	VERTICAL LOAD CAPACITY			1/2-INCH DIA. LAG SCREW CAPACITY FOR DECK LEDGER [7] (lbf)
			Uniform Load [6] (lbf/ft)		Concentrated (lbf)	
			Depth ≤ 16″	16″< Depth ≤ 24″	Depth ≤ 24″	
1.35E	$1^1/_4$	250	5400	4350	3800	610

For **SI**: 1 inch = 25.4 mm, 1 LB. = 4.45 N, 1 lbf/ft = 14.6 N/m.

[1]Allowable design loads in this table cannot be increased for load duration.
[2]See Table 3 for minimum nail spacing requirements.
[3]The lateral load capacity is for seismic design and is permitted to be multiplied by 1.4 for wind load applications. For shear loads of normal or permanent load duration as defined by the NDS, the values in the table shall be multiplied by 0.63 or 0.56, respectively.
[4]Toe-nailed connections are not limited by the 150 lbf/ft lateral load capacity noted for Seismic Design Categories D, E, and F in Section 4.1.7 of the ANSI/AWC *Seismic Design Provisions for Wind & Seismic* (SDPWS) or Section 2305.1.4 of the 2006 IBC.
[5]The nailing schedule for sheathing-to-rim and rim-to-sill plate (toe-nailed) is based on minimum 8d box nails ($2^1/_2$ in x 0.113 in. diameter) at 6 inches on center. Commercial framing connectors fastened to the face of the rim board and wall plates may be used to achieve lateral load capacities exceeding values in this table. Calculations must be based on equivalent specific gravity listed in Table 2, and must not exceed the nail spacing requirements of Table 3.
[6]The allowable vertical uniform load capacity is based on the strength of the rim board, and may need to be reduced based on the bearing capacity of the supporting wall plate.
[7]Lag screw connections between Tolko LSL or ZB treated LSL rim board and deck ledgers have allowable lateral loads as specified in this table, provided the conditions under the exception to Section 4.2 are met.

ICC-ES Evaluation Report

ESR-2725 LABC and LARC Supplement

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DIVISION: 06 00 00—WOOD, PLASTICS AND COMPOSITES
Section: 06 17 25—Laminated Strand Lumber

REPORT HOLDER:

TOLKO INDUSTRIES LTD., ATHABASCA DIVISION

EVALUATION SUBJECT:

TOLKO LAMINATED STRAND LUMBER (LSL) AND ZB TREATED LSL

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that Tolko laminated strand lumber (LSL) and ZB Treated LSL, described in ICC-ES master evaluation report ESR-2725, have also been evaluated for compliance with the codes noted below as adopted by the Los Angeles Department of Building and Safety (LADBS).

Applicable code editions:

- 2017 *City of Los Angeles Building Code* (LABC)
- 2017 *City of Los Angeles Residential Code* (LARC)

2.0 CONCLUSIONS

The Tolko laminated strand lumber (LSL) and ZB Treated LSL, described in Sections 2.0 through 7.0 of the master evaluation report ESR-2725, comply with the LABC Chapter 23, and the LARC, and are subject to the conditions of use described in this supplement.

3.0 CONDITIONS OF USE

The Tolko laminated strand lumber (LSL) and ZB Treated LSL described in this evaluation report supplement must comply with all of the following conditions:

- All applicable sections in the master evaluation report ESR-2725.
- The design, installation, conditions of use and identification are in accordance with the 2015 *International Building Code®* (IBC) provisions noted in the master evaluation report ESR-2725.
- The design, installation and inspection are in accordance with additional requirements of LABC Chapters 16 and 17, as applicable.

This supplement expires concurrently with the master report, issued February 2019 and revised February 7, 2019.

ICC-ES Evaluation Report

ESR-2725 FBC Supplement

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1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that Tolko laminated strand lumber (LSL) and ZB Treated LSL, recognized in ICC-ES master report ESR-2725, have also been evaluated for compliance with the codes noted below.

Applicable code editions:

- 2017 *Florida Building Code—Building*
- 2017 *Florida Building Code—Residential*

2.0 CONCLUSIONS

The Tolko laminated strand lumber (LSL) and ZB Treated LSL, described in Sections 2.0 through 7.0 of the master evaluation report ESR-2725, comply with the *Florida Building Code—Building* and the *Florida Building Code—Residential*, provided the design and installation are in accordance with the 2015 *International Building Code®* provisions noted in the master report.

Use of the Tolko laminated strand lumber (LSL) and ZB Treated LSL for compliance with the High-Velocity Hurricane Zone provisions of the *Florida Building Code—Building* and the *Florida Building Code—Residential* has not been evaluated and is outside the scope of this evaluation report.

For products falling under Florida Rule 9N-3, verification that the report holder's quality assurance program is audited by a quality assurance entity approved by the Florida Building Commission for the type of inspections being conducted is the responsibility of an approved validation entity (or the code official, when the report holder does not possess an approval by the Commission).

This supplement expires concurrently with the master report, issued February 2019 and revised February 7, 2019.