

# ICC-ES Evaluation Report

**ESR-2295**

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**DIVISION: 06 00 00—WOOD, PLASTICS, AND  
COMPOSITES**
**Section: 06 05 23—Wood, Plastic, and Composite  
Fastenings**
**REPORT HOLDER:**

**EZ STAIRS, INC.**  
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**EVALUATION SUBJECT:**
**EZ-STAIRS® BRACKET**
**1.0 EVALUATION SCOPE**
**Compliance with the following codes:**

- 2009 and 2006 *International Building Code*® (IBC)
- 2009 and 2006 *International Residential Code*® (IRC)

**Property evaluated:**

Structural

**2.0 USES**

The EZ-Stairs® bracket is a connector in accordance with Section 2304.9.3 of the IBC, used to construct straight-run stairs using wood stringers, treads, and risers. The brackets may be used in structures where the IBC or IRC has been adopted, when an engineered design is submitted. Alternatively, the brackets may be used to construct stairs in accordance with the tables at the end of this report for recognition under the IBC and IRC.

The bracket may be used as part of the base connection for a guard post when installed with bolts and cast-iron washers as described in Section 4.2.3.

**3.0 DESCRIPTION**

EZ-Stairs® brackets are cold formed from 14 gage sheet steel into connectors that are fastened to the sides of stair stringers through screw holes stamped into the bracket. The connectors have horizontal flanges, to which treads are fastened, and vertical flanges, to which risers are fastened, through additional screw holes stamped into the flanges. Two  $\frac{3}{8}$ -inch bolt holes are stamped into each bracket for the alternate use of the EZ-Stairs bracket as part of a guard post base connector. Refer to Figure 1 for bracket details.

The brackets are fabricated from steel conforming to JIS G 3302-98 (Japanese Industrial Standard for Hot-Dip Zinc-Coated Steel Sheets and Coils), Class SGH340, having a minimum yield strength of 35.5 ksi, and a minimum tensile strength of 49.3 ksi. The minimum base-metal thickness of the EZ-Stairs brackets is 0.0788 inch. The metal has a G90 zinc coating conforming to ASTM A 653, and a powder coating that provides resistance to weathering.

**4.0 DESIGN AND INSTALLATION**
**4.1 Design:**

Stairs may be designed in accordance with this report using the EZ-Stairs bracket to support treads and risers. Connected wood members must be designed for load-carrying capacity at the connection in accordance with National Design Specification for Wood Construction (NDS) Section 10.1.2. The allowable gravity load for the EZ-Stairs bracket connected for use with stairs is 610 lbf. The maximum allowable load for short duration (10 minutes), based on the load duration factor,  $C_D = 1.60$ , in accordance with Section 10.3.2 of the NDS, is 640 lbf. This load is based on allowable stress design and its use must comply with all applicable requirements and conditions specified in this report. The load is for connections in wood with specific gravity,  $G = 0.50$  or greater, seasoned to a moisture content of 19 percent (16 percent for engineered wood products) or less, and used under continuously dry conditions and where sustained temperatures are limited to 100°F (37.8°C) or less. When connectors are installed in wood having a moisture content greater than 19 percent (16 percent for engineered wood products), or where the in-service moisture content is expected to exceed this value, the applicable wet service factor,  $C_m$ , must be applied. The wet service factor is as specified in the NDS for lateral loading of dowel-type fasteners. For connectors installed with bolts, minimum edge distances and end distances within the wood members, as specified in the NDS, must be met.

In lieu of using the design approach, stairs may be constructed using materials for stringers, treads and risers as tabulated in Tables 1, 2, 3, and 4 for the corresponding allowable stairway widths. These stairs must be installed as described in Section 4.2.

**4.2 Installation:**

Installation of the EZ-Stairs brackets must be in accordance with this evaluation report and the manufacturer's published installation instructions.

**4.2.1 For Design Applications:** To achieve the maximum gravity load capacity for the EZ-Stairs bracket specified in Section 4.1, the stringers must be nominally

2-inch-thick lumber of the species and grade shown in Tables 3 and 4. Alternatively, glued-laminated lumber or engineered lumber having a minimum equivalent specific gravity of 0.50 may be used. The brackets must be connected to the stringers using nine No. 8 by 1<sup>1</sup>/<sub>4</sub>-inch-long wood screws installed in accordance with NDS Section 11.1.4.

**4.2.2 For Tabulated Stair Configurations:** Stairs built and installed in accordance with the specifications outlined in Tables 1, 2, 3, and 4 are recognized as meeting the requirements of IBC Table 1607.1 for stairs. The tabulated stair configurations were designed to support a 100 psf uniform load and a 300-pound concentrated load; except that treads made from particleboard or MDF are for residential loads only. The stairs must be built in accordance with the footnotes to the tables and the details in Figures 2 and 3. Wood screws used to build the stairs must meet ANSI/ASME Standard B18.6.1 specifications. Self-drilling sheet metal screws must meet ANSI/ASME Standard B18.6.4 specifications and must be installed in accordance with NDS Section 11.1.4. Connectors and fasteners used in contact with preservative-treated or fire-retardant-treated wood must comply with IBC Section 2304.9.5 or 2009 IRC Section R317.3 (2006 IRC Section R319.3), as applicable. The lumber treatment manufacturer or the holder of this report (EZ-Stairs, Inc.), or both, should be contacted for recommendations on the appropriate level of corrosion resistance to specify for the connectors and fasteners, as well as the connection capacities of the fasteners used with the specific proprietary preservative-treated or fire-retardant-treated lumber.

**4.2.3 Use of EZ-Stairs Brackets as Guard Post Base Connectors:** EZ-Stair brackets may be used as part of the base connection for guard posts under the following conditions: The posts must be minimum No. 2 Southern pine, or equivalent, and the stringers, treads, risers, and posts must have a minimum specific gravity of 0.50. Guard posts must be nominally 4-by-4 standard dressed sawn lumber, the posts must be a maximum of 48 inches on center horizontally, and the guardrail must be a maximum of 42 inches above the stair treads.

The guard posts and stringers must be predrilled for two <sup>3</sup>/<sub>8</sub>-inch-diameter bolts using the bolt holes in the bracket as a positioning guide. Two <sup>3</sup>/<sub>8</sub>-inch SAE Grade 5, hot-dip galvanized steel bolts with flat washers must be inserted through the bracket, the stringer, and the base of the 4-by-4 post. Malleable iron washers or Ogee washers cast in accordance with ASTM A 47 Grade 32510, 2<sup>1</sup>/<sub>2</sub> inches in diameter, of the type used for heavy timber connections, and sized for <sup>3</sup>/<sub>8</sub>-inch-diameter bolts, must be installed to increase the wood bearing surface area to prevent crushing of the wood post. The bolts must be installed in accordance with NDS Section 11.1.2. The bottom bolt must be located 3 inches from the bottom end of the guard post, and the bolts must be centered in the guard post thickness. The lumber treater or the holder of this report (EZ-Stairs, Inc.), or both, should be contacted for recommendations on the appropriate level of corrosion resistance to specify for the connectors and fasteners, as well as the connection capacities of the fasteners used with the specific proprietary preservative-treated or fire-retardant-treated lumber.

**4.2.3.1 Stacked Stringers:** EZ-Stairs brackets may be used as part of the base connection for guard posts in stairs built with stacked stringers. For use with stacked stringers, the stairs must be built in accordance with the details associated with Table 1 (see Figure 3).

**4.2.3.2 Saw-Tooth-Cut Stringers:** EZ-Stairs brackets may be used as part of the base connection for guard posts in stairs built with saw-tooth-cut stringers. For this application, the bracket must be installed facing backward. A stiffening member, of nominally 2-by-6 lumber, must be installed vertically, spanning between the stringers, beneath the back of the tread, adjacent to the post installation. The treads must be fastened to the stringers and to the stiffening members using No. 9 by 3-inch-long deck screws at 9 inches on center. The brackets must be connected to the stiffening members using five No. 8 by 1<sup>1</sup>/<sub>4</sub>-inch-long wood screws; and to the stair treads using three No. 8 by 1<sup>1</sup>/<sub>4</sub>-inch-long wood screws if installed from the bottom, or three No. 12 by 2-inch-long self-drilling sheet metal screws if installed from the top. See Figure 3 for details. Design of saw-tooth-cut stringers (allowable lengths) must be documented to the satisfaction of the code official.

## 5.0 CONDITIONS OF USE

- 5.1** The connectors are manufactured, identified and installed in accordance with this report and the manufacturer's published installation instructions. A copy of the manufacturer's published installation instructions must be available at the jobsite at all times during installation. In the event of a conflict between this report and the manufacturer's published installation instructions, this report governs.
- 5.2** Where calculations are required by Section 4.1, calculations showing compliance with this report must be submitted to the code official. The calculations must be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed.
- 5.3** When using the alternative stair systems described in Section 4.0 and in the tables and figures at the end of this report, evidence must be submitted to the code official, demonstrating that the materials meet or exceed the material standards and grades, and that the stairs comply with all requirements and limitations specified in this report. The materials must be certified and grade marked by an approved independent inspection agency.
- 5.4** Particleboard or MDF stair treads are limited to interior use and to support residential loads only.
- 5.5** Stairways and stair configurations must be in accordance with the applicable building code.

## 6.0 EVIDENCE SUBMITTED

- 6.1** Data in accordance with the ICC-ES Acceptance Criteria for Joist Hangers and Similar Devices (AC13), dated October 2010.
- 6.2** Stair framing calculations based on recognized principles of engineering mechanics, using recognized material properties in accordance with the code and the material properties of particleboard and MDF for the grades specified in the standards in accordance with Table 2.

## 7.0 IDENTIFICATION

The brackets are identified by a die stamp specifying the name of the company (EZ-Stairs, Inc.), the product name, the batch number, and the evaluation report number (ESR-2295).

TABLE 1—WIDE STAIRS<sup>5,8</sup>—MAXIMUM ALLOWABLE STAIRWAY WIDTH

WOOD STAIR TREADS <sup>7</sup> AND RISERS <sup>1,2,6</sup>				MAXIMUM ALLOWABLE STAIRWAY WIDTH (inches)	
Species	Grade	Specific Gravity	Thickness (inches)	Interior <sup>4</sup>	Exterior <sup>4</sup>
Red oak	No. 2	0.67	1.5	108	108
Mixed maple	No. 2	0.58	1.5	108	108
Douglas fir–larch	No. 2	0.50	1.5	108	108
Southern pine	No. 2	0.55	1.5	108	108
Hem–fir	No. 2	0.46	1.5	108	96
Spruce-pine-fir	No. 2	0.42	1.5	108	96
Spruce-pine-fir (South)	No. 2	0.36	1.5	108	84
Redwood	No. 2, open grain	0.37	1.5	108	84
Western cedar	No. 2	0.36	1.5	96	84
Plywood <sup>3</sup>	Structural 1	N/A	1 <sup>1</sup> / <sub>8</sub>	60	60

For **SI**: See Table 5.

Stairs must comply with the following conditions when using Table 1:

1. Stairs must be constructed with treads consisting of minimum nominally 2-inch-thick sawn lumber having a species and grade tabulated above or 1<sup>1</sup>/<sub>8</sub>-inch-thick plywood complying with Product Standard PS-1. Maximum tread width is 12 inches and treads must be one piece. The tabulated allowable stairway widths are based on the design assumption that the stair treads distribute the code-prescribed 100 psf uniform load and the 300-pound concentrated load to adjacent risers by direct bearing on the stair riser at the front edge of the tread and through the tread-to-riser connection at the back edge of the tread.
2. Stairs must be constructed with risers consisting of minimum nominally 2-by-8 sawn lumber having a species and grade tabulated above, or with 1<sup>1</sup>/<sub>8</sub>-inch-thick plywood complying with Product Standard PS-1. The allowable interior and exterior stairway widths shown are based on the 2-by-8 stair risers acting as joists, spanning between the EZ-Stairs brackets that carry the applied loads without exceeding the allowable design values specified in the applicable code and without exceeding the code-specified deflection limit of  $\frac{1}{240}$ .
3. Maximum allowable stairway width is 5 feet when plywood risers are used.
4. An interior stair condition refers to lumber having a moisture content of 19 percent or less at time of bracket installation and having in-service moisture content less than 19 percent. An exterior stair condition refers to lumber having a moisture content of 19 percent or more at time of bracket installation, or lumber having in-service moisture content greater than 19 percent, or both.
5. Each bracket must be connected to wood stair stringers using nine No. 8 by 1<sup>1</sup>/<sub>4</sub>-inch-long wood screws. Each stringer must be a stacked double stringer consisting of 2—2-by-6 or 2—2-by-8 sawn lumber as shown in the *Stacked Stringer Installation* detail in Figure 3. The bracket must be connected to one 2-by member with four screws, and the other with five screws. Allowable unsupported stringer lengths for interior and exterior conditions are shown in Tables 3 and 4, respectively.
6. The sawn lumber stair risers must be connected to the bracket with five No. 8 by 1<sup>1</sup>/<sub>4</sub>-inch-long wood screws. One-inch-long wood screws must be used with plywood.
7. The stair treads must be connected to the stair risers with No. 8 by 2<sup>1</sup>/<sub>2</sub>-inch-long wood screws spaced a maximum of 9 inches on center as shown in Figure 2, *Tread to Riser* detail.
8. The sawn-lumber stair treads must be connected to the bracket with three No. 8 by 1<sup>1</sup>/<sub>4</sub>-inch-long wood screws from the bottom (1-inch-long wood screws must be used with plywood) or with three No. 12 by 2-inch-long self-drilling sheet metal screws from the top.

TABLE 2—STANDARD STAIRS<sup>4,6,9</sup>—MAXIMUM ALLOWABLE STAIRWAY WIDTH

WOOD AND COMPOSITE STAIR TREADS <sup>2,8</sup> AND RISERS <sup>3,7</sup>				MAXIMUM ALLOWABLE STAIRWAY WIDTH (inches)	
Species	Grade	Specific Gravity	Min. Nominal Thickness (inches)	Interior <sup>5</sup>	Exterior
Douglas fir–larch	No. 2 SRB <sup>1</sup>	0.50	5/4, 1	42	N/A <sup>5</sup>
Mixed oak		0.68			
Yellow poplar		0.43			
Southern pine		0.55			
Plywood	Structural 1	N/A	23/32, 3/4		
OSB	Single Floor				
Particleboard (treads only) <sup>10</sup>	Grade M-3 <sup>2</sup>		1 1/16		
MDF (treads only) <sup>10</sup>	Grade 155 <sup>2</sup>				

SI: See Table 5.

Stairs must comply with the following conditions when using Table 2 (standard stairs are maximum 42 inches wide and for interior use only):

1. Nominally 5/4-inch-thick and nominally 1-inch-thick boards must be marked SRB to denote that they are stress-rated boards.
2. Stairs must be constructed with treads consisting of nominally 2-inch-thick lumber, nominally 5/4-inch-thick SRB boards, or nominally 1-inch-thick SRB boards having a species and grade tabulated above; nominally 23/32- or 3/4-inch-thick plywood or OSB complying with Product Standard PS-1 or PS-2, respectively; nominally 1 1/16-inch-thick particleboard conforming to ANSI A208.1-2009 as Grade M-3 particleboard; or nominally 1 1/16-inch-thick MDF conforming to ANSI A208.2-2009 as Grade 155 MDF. Maximum tread width is 12 inches and treads must be one piece. The tabulated allowable stairway widths are based on the design assumption that the stair treads distribute the code-prescribed 100 psf uniform load and the 300-pound concentrated load to adjacent risers by direct bearing at the top of the riser and the tread to riser connection at the bottom of the riser.
3. Stairs must be constructed with risers consisting of 2-inch-thick lumber, nominally 5/4-inch-thick SRB boards, or nominally 1-inch-thick SRB boards having a species and grade tabulated above; or nominally 3/4-inch plywood or OSB complying with Product Standard PS-1 or PS-2, respectively.
4. Each stringer must be a stacked double stringer consisting of nominally 2— 2-by-6 or 2— 2-by-8 sawn lumber members as shown in Figure 3, *Stacked Stringer Installation*. Stacked double stringers consisting of nominally 2— 5/4-by-6, 2— 5/4-by-8, 2— 1-by-6 or 2— 1-by-8, if used, must be supported at 16 inches on center (minimum), measured horizontally, or must be fastened to supporting framing at a maximum of 16 inches on center.
5. Standard stairs must be used for interior conditions only. An interior stair condition refers to lumber having a moisture content of 19 percent or less at time of bracket installation and having in-service moisture content less than 19 percent.
6. Each bracket must be connected to wood stair stringers with nine No. 8 by 3/4-inch-long sheet metal screws. The bracket must be connected to one member with four screws, and the other with five screws.
7. The stair risers must be connected to the brackets with five No. 8 by 3/4-inch-long sheet metal screws.
8. The stair treads must be connected to the brackets with three No. 8 by 3/4-inch-long sheet metal screws (from the bottom) or with three No. 12 by 2-inch-long self-drilling sheet metal screws (from the top).
9. The stair treads must be connected to the risers as follows:
  - a. For nominally 2-inch-thick main or holding members - fasten treads and risers with 8d common nails at 6 inches on center.
  - b. For nominally 5/4-inch-thick and nominally 1-inch-thick main or holding members - fasten treads and risers with 8d common nails at 6 inches on center.
  - c. Fasten plywood or OSB treads to risers using 8d common nails at 6 inches on center as shown in the *Ledger Detail* in Figure 2.
10. Particleboard and MDF are for use as treads only and use is limited to the following conditions:
  - a. The treads are for covered, interior use only in stairways subject to normal design loads for one- and two-family residences.
  - b. The treads must be installed using structural adhesives and must be fastened at the front to the minimum 3/4-inch-thick riser using 8d finish nails at maximum 12 inches on center, and at the back as shown in the *Ledger Detail* in Figure 2.
  - c. The treads must be kept dry at all times before, during, and after installation; and must be acclimatized to their surroundings for 24 hours prior to installation. Where subject to possible wetting, the treads must be protected with a suitable moisture resistant coating.
  - d. Each particleboard or MDF tread must bear a certification label showing the applicable standard and the grade mark (see Footnote 2 of this table (Table 2)), as well as the manufacturer's name, location, and mill number; and the words "*Interior use only: Install in sheltered buildings*". The particleboard and MDF must be produced, by the particleboard and MDF manufacturer, explicitly for use as stair treads.  
 "*Interior use only: Install in sheltered buildings*". The particleboard and MDF must be produced, by the particleboard and MDF manufacturer, explicitly for use as stair treads.

**TABLE 3—MAXIMUM ALLOWABLE UNSUPPORTED STACKED STRINGER LENGTH FOR INTERIOR CONDITIONS<sup>1,2,3,4</sup>**

STAIR WIDTH (inches)	STAIR STRINGER WOOD SPECIES AND GRADE									
	Douglas Fir–Larch No. 2 Southern Pine No. 2		Hem-Fir No. 2		Spruce-Pine-Fir No. 2		Redwood No. 2 Open Grain		Western Cedars No. 2	
	Stair Stringer Size									
	2-2x6	2-2x8	2-2x6	2-2x8	2-2x6	2-2x8	2-2x6	2-2x8	2-2x6	2-2x8
Allowable Unsupported Stringer Length (inches)										
36	103	130	96	126	98	129	88	116	88	116
48	89	112	87	111	88	112	80	102	79	100
60	79	100	75	99	70	93	72	91	71	90
72	72	92	63	83	59	77	66	83	63	82
84	67	85	54	71	50	66	57	76	54	71
96	60	79	47	62	44	58	50	66	47	62
108	53	70	42	55	39	52	45	59	-	-

SI: See Table 5.

<sup>1</sup>Interior stair condition refers to lumber having an in-service moisture content of 19 percent or less.

<sup>2</sup>Maximum stringer length is measured diagonally, parallel to the slope of the stairway.

<sup>3</sup>Each EZ-Stairs bracket must be connected to wood stair stringers with nine No. 8 by 1<sup>1</sup>/<sub>4</sub>-inch-long wood screws.

<sup>4</sup>Each stringer consists of 2— 2-by-6 or 2— 2-by-8 solid-sawn lumber members. The bracket must be connected to one 2-by member with four screws, and to the other with five screws.

**TABLE 4—MAXIMUM ALLOWABLE UNSUPPORTED STACKED STRINGER LENGTH FOR EXTERIOR CONDITIONS<sup>1,2,3,4</sup>**

STAIR WIDTH (inches)	STAIR STRINGER WOOD SPECIES AND GRADE									
	Douglas Fir–Larch No. 2 Southern Pine No.2		Hem-Fir No.2		Spruce-Pine-Fir No. 2		Redwood No. 2, Open Grain		Western Cedars No. 2	
	Stair Stringer Size									
	2-2x6	2-2x8	2-2x6	2-2x8	2-2x6	2-2x8	2-2x6	2-2x8	2-2x6	2-2x8
Allowable Unsupported Stringer Length (inches)										
36	103	130	96	126	98	129	88	116	88	116
48	89	112	87	111	85	112	80	102	79	100
60	79	100	73	97	68	90	72	91	71	90
72	72	92	61	81	57	75	65	83	61	81
84	66	85	52	69	49	64	56	74	52	69
96	58	76	46	60	44	56	-	-	-	-
108	51	68	-	-	-	-	-	-	-	-

SI: See Table 5.

<sup>1</sup>Exterior stair condition refers to lumber having an in-service moisture content of 19 percent or more.

<sup>2</sup>Maximum stringer length is measured diagonally, parallel to the slope of the stairway.

<sup>3</sup> Each EZ-Stairs bracket must be connected to wood stair stringers with nine No. 8 by 1<sup>1</sup>/<sub>4</sub>-inch-long wood screws.

<sup>4</sup> Each stringer consists of 2— 2-by-6 or 2— 2-by-8 solid-sawn lumber members. The bracket must be connected to one 2-by member with four screws, and to the other with five screws

**TABLE 5—S.I. UNIT CONVERSIONS**

1 inch	=	25.4 mm
1 psf	=	47.9 N/m <sup>2</sup>
1 lbf	=	4.4 N
1 ksi	=	6895 kPa

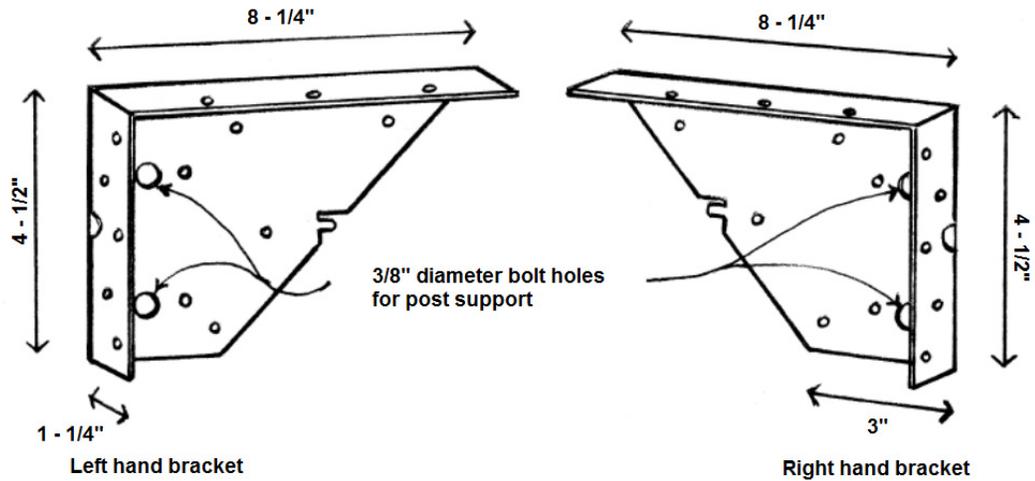


FIGURE 1 - EZ-STAIR BRACKET

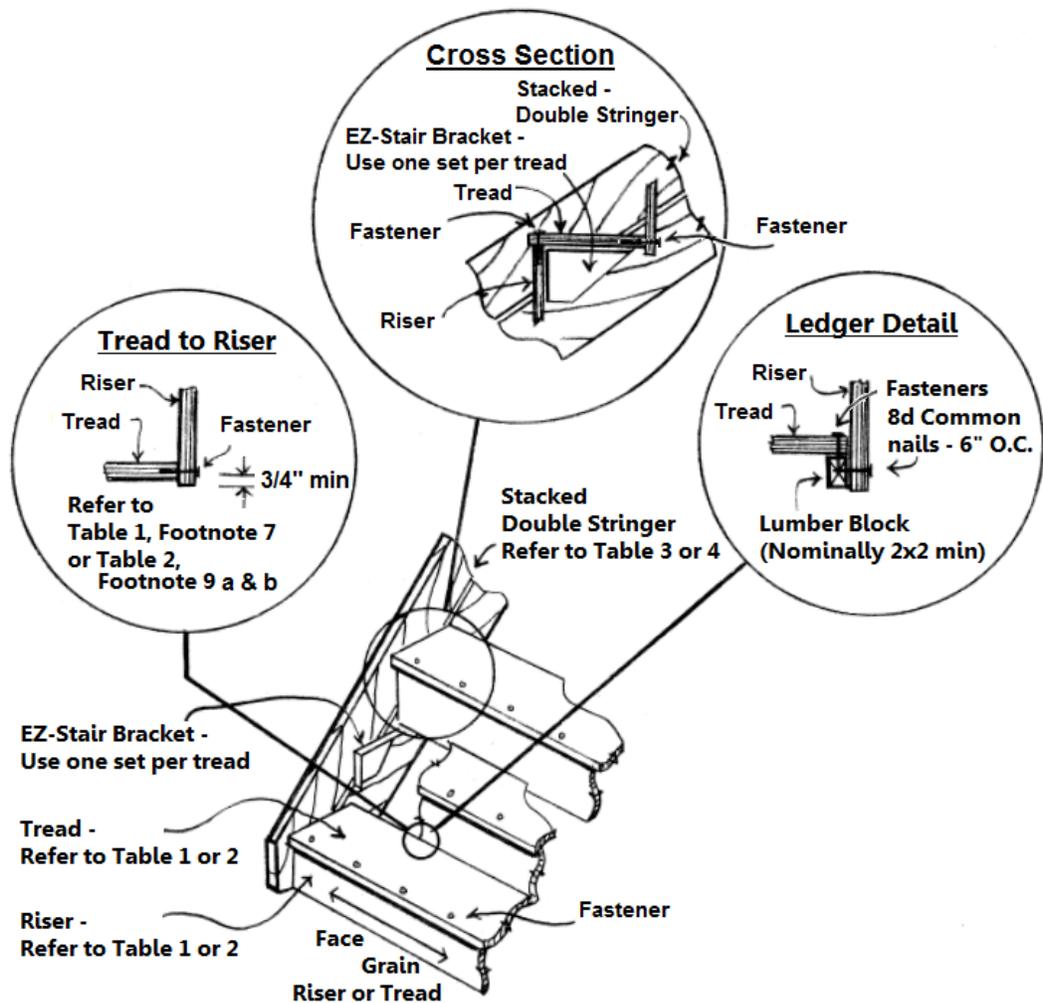


FIGURE 2 - TREAD TO RISER CONNECTION

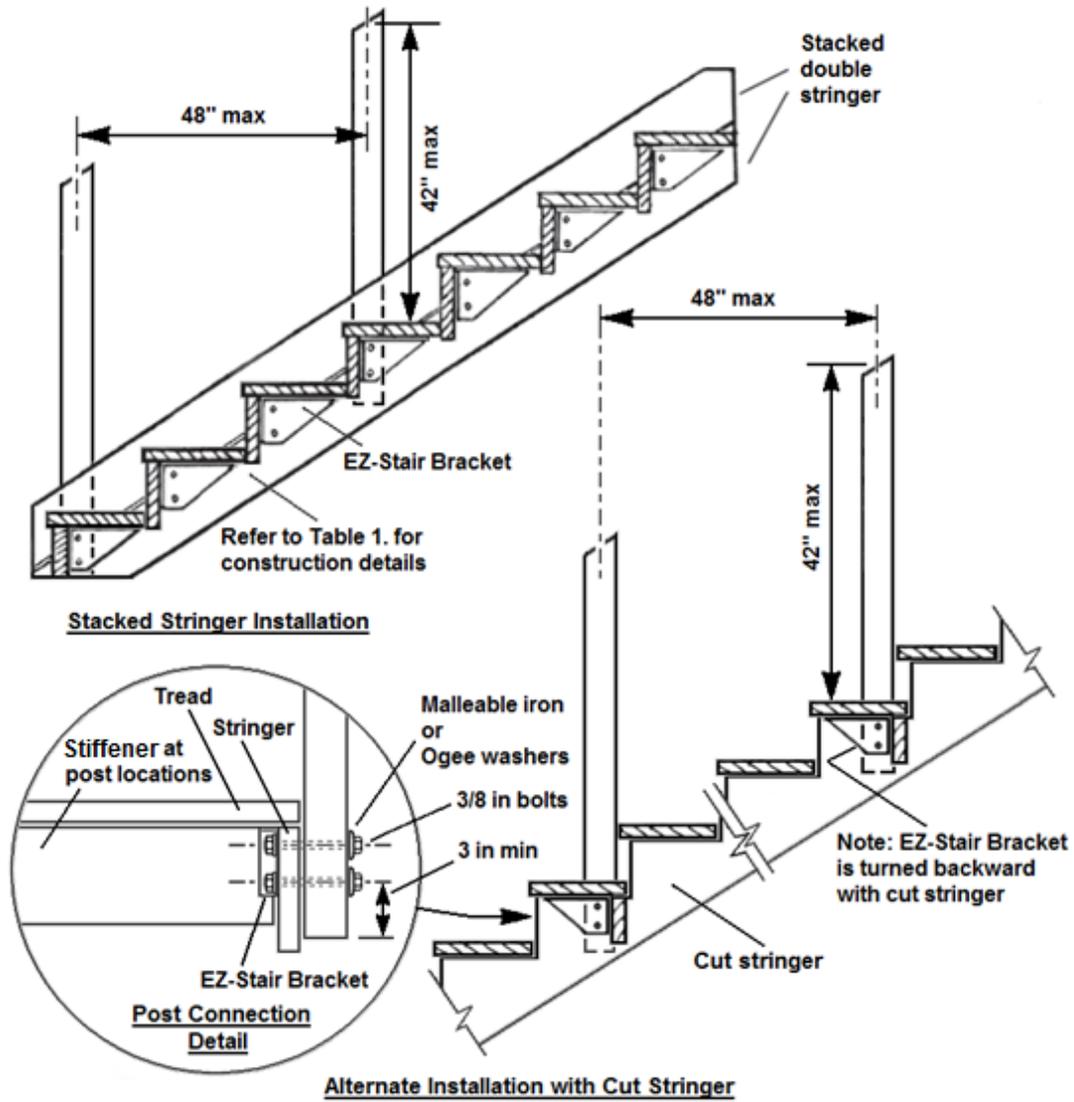


FIGURE 3 - BRACKET INSTALLATION for GUARD POST CONNECTION