

<p style="text-align: center;"><b>DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT</b> Housing - Federal Housing Commissioner</p> <p><b>TO: DIRECTORS, SINGLE FAMILY HOCs</b> <b>DIRECTORS, MULTIFAMILY HUBs</b></p>	<p><b>STRUCTURAL ENGINEERING BULLETIN NO. 689 Rev. 9</b> (Supersedes issue dated February 13, 2002)</p>				
	<p><b>ISSUE DATE</b> February 18, 2004</p>				
	<p><b>REVIEW DATE</b> February 18, 2007</p>				
<p><b>SUBJECT:</b></p> <table border="0" style="width: 100%;"> <tr> <td style="width: 15%;"><b>1. Item Description</b></td> <td>TJI® Prefabricated Wood I-Joists</td> </tr> <tr> <td><b>2. Name and address of Manufacturer</b></td> <td>Trus Joist A Weyerhaeuser Business PO Box 8449 Boise, ID 83707</td> </tr> </table>		<b>1. Item Description</b>	TJI® Prefabricated Wood I-Joists	<b>2. Name and address of Manufacturer</b>	Trus Joist A Weyerhaeuser Business PO Box 8449 Boise, ID 83707
<b>1. Item Description</b>	TJI® Prefabricated Wood I-Joists				
<b>2. Name and address of Manufacturer</b>	Trus Joist A Weyerhaeuser Business PO Box 8449 Boise, ID 83707				

This Structural Engineering Bulletin (SEB) should be filed with other SEBs and related Bulletins on materials or products as required by prescribed procedures.

**The technical description, requirements and limitations expressed herein do not constitute an endorsement or approval by the Department of Housing and Urban Development (HUD) of the subject matter, and any statement or representation, however made, indicating approval or endorsement by HUD is unauthorized and false, and will be considered a violation of the United States Criminal Code, 18 U.S.C. 709.**

**NOTICE: THIS BULLETIN APPLIES TO DWELLING UNITS BUILT UNDER HUD HOUSING PROGRAMS. NON-HUD-INSURED UNITS MAY OR MAY NOT BE IN CONFORMINTY WITH THE REQUIREMENTS OF THE HUD MINIMUM PROPERTY STANDARDS.**

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1. General:

This Bulletin sets forth specific requirements under the Technical Suitability of Products Program for determining the eligibility of housing to be constructed under HUD mortgage insurance, or other HUD housing programs.

2. Scope:

This Bulletin applies only to the structural features of this method of construction. Final determination of eligibility is made by the appropriate HUD Field Office. Other factors considered will be valuation, location, architectural planning and appeal, mechanical equipment, thermal characteristics, and market acceptance. Consideration is also necessary to determine whether a specific property will qualify under the specific HUD program, when constructed according to the method outlined in this Bulletin, and where the structure is to be located.

3. Minimum Property Standards (MPS):

Compliance with HUD MPS will be determined by the HUD Field Office or Homeownership Center on the same basis as the submissions involving conventional construction, except for the special features described in this bulletin.

4. Inspection:

Field compliance inspections covering conventional items of construction and any special features covered in this bulletin shall be made in accordance with prescribed procedures.

The appropriate HUD Field Office or Homeownership Center shall furnish a copy of a HUD field inspection report to Headquarters, Office of Manufactured Housing Programs, when there is:

- a. Evidence of non-compliance with any portion of the system of construction described in this bulletin.
- b. Faulty shop fabrication, including significant surface defects.
- c. Damage to shop fabricated items or materials due to improper transportation, storage, handling, or assembly.
- d. Unsatisfactory field workmanship or performance of the product or system.
- e. Any significant degradation or deterioration of the product or evidence of lack of durability or performance.

Periodic plant inspections will be made by HUD Field Office, Homeownership Center, or a HUD designated representative in accordance with their prescribed procedures. Factory inspection reports shall be submitted to HUD Headquarters, upon request.

5. Certification:

The manufacturer named in this bulletin shall furnish the builder with written certification that the product has been manufactured in compliance with the HUD Minimum Property Standards (MPS), except as modified by this bulletin. The builder shall endorse the certification with a statement that the product has been installed in compliance with HUD MPS, except as modified by this bulletin, and that the manufacturer's certification does not relieve the builder, in any way, of responsibility under the terms of the Builder's Warranty required by the National Housing Act, or under any provisions applicable to any other housing program. This certification shall be furnished to the HUD Field Office upon completion of the property.

## **OUTLINE DESCRIPTION, CATEGORY II CONSTRUCTION**

### **GENERAL**

This bulletin provides for the use of all TJI Prefabricated Wood I-Joists, manufactured by Trus Joist for floor and roof spans up to 46 feet.

### **PRODUCT DESCRIPTION**

TJI joists are prefabricated wood I-joists having wood-based flanges and proprietary oriented strand board (OSB) webs. Either the top and bottom flanges are parallel, forming a constant-depth joist; or the top flange has a single taper, forming a variable-depth joist. The web panels have the face grain oriented vertically and the web-to-web connection is either butt jointed or serrated and glued to form a continuous web. The web-to-flange connection is a proprietary tongue-and-groove joint. Refer to Table 1 for TJI joist series and material descriptions.

Flange material is either Microllam<sup>R</sup> laminated veneer lumber (LVL) or TimberStrand<sup>R</sup> laminated strand lumber (LSL), which has been qualified as flange stock material and meets the requirements noted in the approved quality control manual that contains Trus Joist manufacturing standards. Table 1 specifies flange widths and depths. Flange material and grades are as specified in the approved quality control manual that contains Trus Joist manufacturing standards.

Web material is Performance Plus<sup>R</sup> OSB conforming to DOC Voluntary Product Standard PS 2-92, Exposure 1, along with further requirements set forth in the approved quality control manual that contains Trus Joist manufacturing standards. Web material thickness requirements are noted in Table 1.

Adhesives shall be of the types specified in the approved quality control manual that contains Trus Joist manufacturing standards.

TJI Joists are produced in a continuous fabrication process, and are cut to the desired length after fabrication.

### **DESIGN AND INSTALLATION**

The design and installation of TJI joists shall comply with the requirements of this bulletin. Design of TJI joists is governed by the applicable code and ANSI/AF&PA NDS-97 *National Design Specification for Wood Construction* (NDS).

**ALLOWABLE CAPACITY**

Table 2 specifies allowable moments, reactions, shears, and joist stiffness (*EI*). Maximum allowable reactions are based on minimum and maximum bearing lengths of 1-3/4 inches, 2-1/2 inches and 3-1/2 inches at end supports; and 3-1/2, 5-1/4 and 7 inches at intermediate supports of continuous spans. When joists are used as multiple span members, the calculated shear used for design at the intermediate support may be reduced by the percentage determined from the following formula and limited to the depths shown in the table that appears after the formula:

$$R = W \div K \leq 18\%$$

where:

$$K = V_{12} \div 100.$$

*R* = The percent reduction.

*V*<sub>12</sub> = The allowable shear for a 12-inch or 11 7/8-inch deep joist (pounds).

*W* = The uniform load (plf).

TJI JOIST SERIES	TJI JOIST DEPTH (inches)	<i>V</i> <sub>12</sub>	<i>K</i>
TJI 110	≤ 14	1,560	15.60
TJI 210, TJI 230	≤ 16	1,655	16.55
TJI 360	≤ 16	1,705	17.05
TJI 560	≤ 20	2,050	20.50
TJI/L45	≤ 16	1,420	14.20
TJI/L65, TJI/L90, TJI/H90	≤ 24	1,925	19.25
TJI/HD90, TJI/HS90	≤ 24	2,320	23.20

For other joist depths, the design shear is the calculated shear at the interior face of support.

The allowable design shear at the interior supports of multiple-span-member TJI joists up to 12 inches deep, used in residential floor construction is permitted to be increased an additional 10 percent. This increase of allowable design shear does not apply to the design shear at the ends of the joists.

**FASTENERS**

Allowable capacities and spacing of nails in Microllam<sup>®</sup> LVL and TimberStrand<sup>®</sup> LSL flanges shall comply with this bulletin and the applicable code. Nails installed perpendicular to the glue lines or strands on the wide face shall be installed in accordance with the applicable code.

The lateral nail capacity and nail withdrawal of nails installed on the wide face perpendicular to the glue lines of Microllam<sup>®</sup> LVL or strands of TimberStrand<sup>®</sup> LSL flanges shall be as provided in the applicable code for Douglas fir-larch (minimum specific gravity *SG* = 0.50).

**WEB STIFFENERS**

Table 2 and Figure 1 show web stiffener requirements for reactions and concentrated loads.

### **LATERAL SUPPORT**

TJI joist compression flanges with widths less than 2.30 inches require lateral support every 18 inches on center. TJI joist compression flanges with widths equal to or greater than 2.30 inches require lateral support every 24 inches on center. Each connection shall be capable of transmitting a 75-pound horizontal load. All TJI joist ends require restraint to prevent rollover. Code-approved methods of lateral restraint specified for sawn lumber are acceptable. Bridging is not required for TJI joist floor and roof applications.

### **HOLES IN TJI JOIST WEB**

The tables in Figures 2 and 3 specify allowable sizes and location of round, square, and rectangular holes in the TJI joist webs.

### **DURATION OF LOAD**

Adjustments for duration of load, as permitted by the applicable code, apply to the TJI joists and their fastenings.

### **IN-SERVICE MOISTURE CONDITIONS**

TJI joist properties and allowable loads in this bulletin are limited to covered installations with dry conditions of use. Dry conditions of use are those environmental conditions represented by sawn lumber in which the moisture content is less than 16 percent.

### **REPETITIVE-MEMBER USE**

The repetitive-member use factor applicable to the resistive moment capacities listed in Table 2 is 1.0.

### **MEMBER SPANS**

The span of TJI joists shall be taken as distance from face to face of supports, plus one-half the required bearing length at each end, except that for cantilever and continuous spans, the span shall be taken as the distance between centers of bearings on supports over which the joist is continuous.

### **DEFLECTION**

Deflection of simple span TJI joists with either uniform load or a concentrated load at midspan is determined using the formulas in the footnotes to Table 2.

**BLOCKING PANELS**

Bearing walls perpendicular to and supported by TJI joists at the end or intermediate supports, or both, require full-depth blocking. TJI joists up to 16 inches in depth, when used as blocking panels, have a maximum vertical load transfer capacity of 2,100 plf. TJI joists over 16 inches and up to 20 inches in depth, when used as blocking panels, have a minimum vertical load transfer capacity of 1,550 plf.

**TJI RIM JOISTS**

TJI joists used as rim joists, having depths of up to 16 inches have a maximum vertical load transfer capacity of 2,100 plf. TJI joists used as rim joists, having depths of up to 16 inches, are permitted to be used as boundary members of horizontal wood structural diaphragms. The allowable shear values in pounds per foot specified in the code for horizontal wood structural panel diaphragms with framing of nominal 2-inch thick Douglas fir-larch or southern pine are applicable to TJI joists used as rim joists, in unblocked and blocked diaphragm applications. The TJI joists used as rim joists shall be laterally supported at the top and continuously supported at the bottom, and the gravity loads shall be uniformly applied along the top. Other loading or support conditions shall be investigated and approved by the design professional.

**CANTILEVERED TJI JOISTS**

TJI joists are permitted to be installed with cantilevers, provided the cantilevers have a maximum length equal to one-third of the adjacent span and support uniform loads only. Otherwise cantilever applications require design by a design professional.

**TABLE 1 –TJI JOIST DESCRIPTION**

TJI Joist Series	Flange Size Depth x Width (inches)	Web Thickness (inches)	Range of Joist Depths (inches)
TJI <sup>®</sup> 110	1.375 x 1.75	3/8	9 1/2 - 14
TJI <sup>®</sup> 210	1.375 x 2.08	3/8	9 1/2 - 16
TJI <sup>®</sup> 230	1.375 x 2.3	3/8	9 1/2 - 16
TJI <sup>®</sup> 360	1.375 x 2.3	3/8	9 1/2 - 20
TJI <sup>®</sup> 560	1.375 x 3.5	7/16	9 1/2 - 20
TJI <sup>®</sup> /L45	1.5 x 1.75	3/8	8 - 20 Taper only
TJI <sup>®</sup> /L65	1.5 x 2.5	7/16	9 1/2 - 30 (9 1/2 - 30 Taper)
TJI <sup>®</sup> /L90	1.5 x 3.5	7/16	11 7/8 - 30 (9 1/2 – 30 Taper)
TJI <sup>®</sup> /H90	1.75 x 3.5	7/16	11 7/8 - 30
TJI <sup>®</sup> /HD90	2.125 x 3.5	1/2	11 7/8 - 32
TJI <sup>®</sup> /HS90	2.5 x 3.5	1/2	11 7/8 - 32

**TABLE 2 – PROPERTIES FOR TJI JOISTS**

BASIC PROPERTIES						REACTION PROPERTIES									
Joist Depth (in.)	Joist Weight (plf)	Resistive Moment (ft.-lbs.) (10)	Vert. Shear (lbs.)	EI x 10 <sup>6</sup> lbs.-in. <sup>2</sup>	K	END REACTION (lbs.)					INTERMEDIATE REACTION (lbs.)				
						1-3/4" 2-1/2" (9) Bearing Length		3-1/2" Bearing Length		Nails Req'd.	3-1/2" 5-1/4" (7) Bearing Length		5-1/4" 7" (7) Bearing Length		Nails Req'd
						Web Stiffeners		Web Stiffeners			Web Stiffeners		Web Stiffeners		
						NO	YES	NO	YES	NO	YES	NO	YES	NO	YES
TJI 110															
9-1/2	2.3	2380	1220	140	4.5	885	NA	1220	NA	NA	1935	NA	2350	NA	NA
11-7/8	2.5	3015	1560	238	4.5	885	1225	1350	1560	3-8d	1935	2295	2350	2705	3-8d
14	2.8	3565	1860	351	4.5	885	1225	1350	1705	3-8d	1935	2295	2350	2705	3-8d
TJI 210															
9-1/2	2.6	2860	1330	167	4.5	980	NA	1330	NA	NA	2145	NA	2565	NA	NA
11-7/8	2.8	3620	1655	283	4.5	980	1340	1435	1655	3-8d	2145	2505	2565	2925	3-8d
14	3.1	4280	1945	415	4.5	980	1340	1435	1790	3-8d	2145	2505	2565	2925	3-8d
16	3.3	4895	2190	566	4.5	980	1340	1435	1790	3-8d	2145	2505	2565	2925	3-8d
TJI 230															
9-1/2	2.7	3175	1330	183	4.5	1035	NA	1330	NA	NA	2410	NA	2790	NA	NA
11-7/8	3.0	4015	1655	310	4.5	1035	1395	1460	1655	3-8d	2410	2765	2790	3150	3-8d
14	3.3	4755	1945	454	4.5	1035	1395	1460	1815	3-8d	2410	2765	2790	3150	3-8d
16	3.5	5440	2190	618	4.5	1035	1395	1460	1815	3-8d	2410	2765	2790	3150	3-8d
TJI 360															
9-1/2	2.7	4790	1425	249	4.5	1080	NA	1425	NA	NA	2460	NA	3000	NA	NA
11-7/8	3.0	6180	1705	419	4.5	1080	1440	1505	1705	3-8d	2460	2815	3000	3360	3-8d
14	3.3	7335	1955	612	4.5	1080	1440	1505	1865	3-8d	2460	2815	3000	3360	3-8d
16	3.5	8405	2190	830	4.5	1080	1440	1505	1865	3-8d	2460	2815	3000	3360	3-8d
18	3.7	9465	2425	1085	4.5	1080	1440	1505	1865	3-8d	2460	2815	3000	3360	3-8d
20	4.0	10515	2660	1376	4.5	1080	1440	1505	1865	3-8d	2460	2815	3000	3360	3-8d
TJI 560															
9-1/2	3.6	7355	1670	378	5.3	1265	NA	1670	NA	NA	3000	NA	3455	NA	NA
11-7/8	4.0	9500	2050	636	5.3	1265	1740	1725	2050	3-16d	3000	3475	3455	3930	3-16d
14	4.2	11275	2390	926	5.3	1265	1740	1725	2200	3-16d	3000	3475	3455	3930	3-16d
16	4.5	12925	2710	1252	5.3	1265	1740	1725	2200	3-16d	3000	3475	3455	3930	3-16d
18	4.8	14550	3030	1631	5.3	1265	1740	1725	2200	3-16d	3000	3475	3455	3930	3-16d
20	5.1	16165	3345	2064	5.3	1265	1740	1725	2200	3-16d	3000	3475	3455	3930	3-16d
TJI/L45															
7-1/2	2.0	2720	860	103	4.5	860	NA	860	NA	NA	2025	NA	2025	NA	NA
9-1/2	2.2	3620	1120	185	4.5	1015	NA	1120	NA	NA	2025	NA	2575	NA	NA
11-7/8	2.5	4685	1420	319	4.5	1015	1225	1420	1420	3-8d	2025	2385	2575	2930	3-8d
14	2.8	5570	1710	474	4.5	1015	1225	1560	1710	3-8d	2025	2385	2575	2930	3-8d
16	3.0	6385	1970	653	4.5	1015	1225	1560	1915	3-8d	2025	2385	2575	2930	3-8d
18	3.2	7200	2155	865	4.5	1015	1225	1560	1915	3-8d	2025	2385	2575	2930	3-8d
20	3.5	8000	2165	1113	4.5	1015	1225	1560	1915	3-8d	2025	2385	2575	2930	3-8d

See notes at the end of the table.

**TABLE 2 – CONTINUED**

BASIC PROPERTIES						REACTION PROPERTIES									
Joist Depth (in.)	Joist Weight (plf)	Resistive Moment (ft.-lbs.) (10)	Vert. Shear (lbs.)	EI x 10 <sup>6</sup> lbs.-in. <sup>2</sup>	K	END REACTION (lbs.)					INTERMEDIATE REACTION (lbs.)				
						1-3/4" 2-1/2" (9) Bearing Length		3-1/2" Bearing Length		Nails Req'd.	3-1/2" 5-1/4" (7) Bearing Length		5-1/4" 7" (7) Bearing Length		Nails Req'd
						Web Stiffeners		Web Stiffeners			Web Stiffeners		Web Stiffeners		
						NO	YES	NO	YES		NO	YES	NO	YES	
TJI/L65															
9-1/2	3.0	5215	1675	263	5.3	1375	NA	1675	NA	NA	2745	NA	3365	NA	NA
11-7/8	3.3	6750	1925	450	5.3	1375	1745	1885	1925	3-8d	2745	3120	3365	3735	3-8d
14	3.6	8030	2125	666	5.3	1375	1750	1885	2125	5-8d	2745	3365	3365	3985	5-8d
16	3.9	9210	2330	913	5.3	1375	1750	1885	2330	6-8d	2745	3490	3365	4105	6-8d
18	4.2	10380	2535	1205	5.3	1375	1750	1885	2535	7-8d	2745	3615	3365	4230	7-8d
20	4.4	11540	2740	1545	5.3	NA	1750	NA	2740	8-8d	NA	3740	NA	4355	8-8d
22	4.7	12690	2935	1934	5.3	NA	1750	NA	2935	9-8d	NA	3860	NA	4480	9-8d
24	5.0	13830	3060	2374	5.3	NA	1750	NA	3060	10-8d	NA	3875	NA	4605	10-8d
26	5.3	14960	2900	2868	5.3	NA	1750	NA	2900	11-8d	NA (7)	4725(7)	NA (7)	5345(7)	11-8d
28	5.5	16085	2900	3417	5.3	NA	1750	NA	2900	12-8d	NA (7)	4850(7)	NA (7)	5470(7)	12-8d
30	5.8	17205	2900	4025	5.3	NA	1750	NA	2900	13-8d	NA (7)	4975(7)	NA (7)	5590(7)	13-8d
TJI/L90															
9 1/2	3.8	7415	1675	365	5.3	1400	NA	1675	NA	NA	3350	NA	3965	NA	NA
11-7/8	4.2	9605	1925	621	5.3	1400	1715	1885	1925	2-16d	3350	3665	3965	4285	2-16d
14	4.5	11430	2125	913	5.3	1400	1875	1885	2125	3-16d	3350	3825	3965	4440	3-16d
16	4.7	13115	2330	1246	5.3	1400	2030	1885	2330	4-16d	3350	3980	3965	4600	4-16d
18	5.0	14785	2535	1635	5.3	1400	2030	1885	2515	4-16d	3350	3980	3965	4600	4-16d
20	5.3	16435	2740	2085	5.3	NA	2190	NA	2675	5-16d	NA	4140	NA	4755	5-16d
22	5.6	18075	2935	2597	5.3	NA	2345	NA	2830	6-16d	NA	5090	NA	5705	11-16d
24	5.8	19700	3060	3172	5.3	NA	2345	NA	2830	6-16d	NA	5405	NA	6020	13-16d
26	6.1	21315	2900	3814	5.3	NA	2450	NA	2900	7-16d	NA (7)	5800(7)	NA (7)	5800(7)	14-16d
28	6.4	22915	2900	4525	5.3	NA	2450	NA	2900	8-16d	NA (7)	5800(7)	NA (7)	5800(7)	15-16d
30	6.6	24510	2900	5306	5.3	NA	2450	NA	2900	8-16d	NA (7)	5800(7)	NA (7)	5800(7)	17-16d
TJI/H90															
11-7/8	4.6	10960	1925	687	5.3	1400	1715	1885	1925	2-16d	3495	3810	4100	4420	2-16d
14	4.9	13090	2125	1015	5.3	1400	1875	1885	2125	3-16d	3495	3970	4100	4575	3-16d
16	5.2	15065	2330	1389	5.3	1400	2030	1885	2330	4-16d	3495	4130	4100	4735	4-16d
18	5.4	17010	2535	1827	5.3	1400	2030	1885	2515	4-16d	3495	4130	4100	4735	4-16d
20	5.7	18945	2740	2331	5.3	NA	2190	NA	2675	5-16d	NA	4285	NA	4890	5-16d
22	6.0	20855	2935	2904	5.3	NA	2345	NA	2830	6-16d	NA	5235	NA	5840	11-16d
24	6.3	22755	3060	3549	5.3	NA	2345	NA	2830	6-16d	NA	5425	NA	6155	13-16d
26	6.5	24645	2900	4266	5.3	NA	2450	NA	2900	7-16d	NA (7)	5800(7)	NA (7)	5800(7)	14-16d
28	6.8	26520	2900	5059	5.3	NA	2450	NA	2900	8-16d	NA (7)	5800(7)	NA (7)	5800(7)	15-16d
30	7.1	28380	2900	5930	5.3	NA	2450	NA	2900	8-16d	NA (7)	5800(7)	NA (7)	5800(7)	17-16d

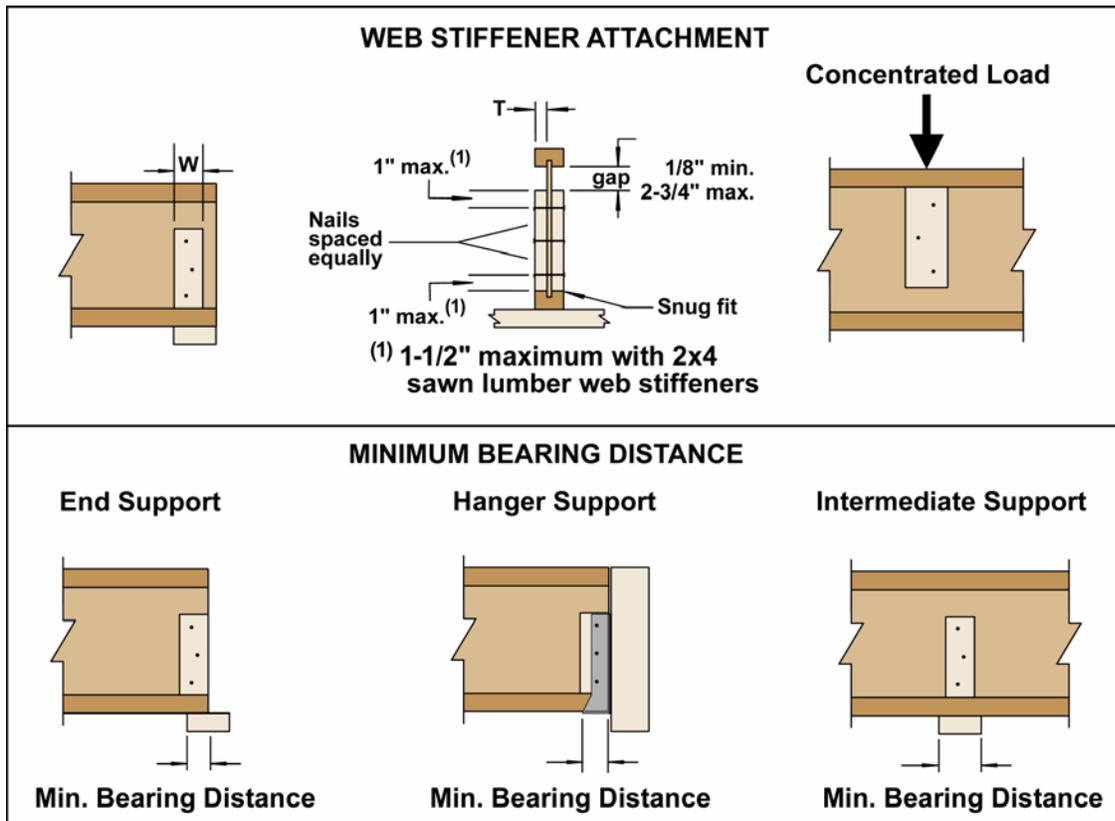
See notes at the end of the table.



**FOOTNOTES FOR TABLE 2 – CONTINUED**

3. The stated allowable design properties are for loads of normal duration. Adjustments to the allowable design values shall be in accordance with the applicable code, with the exception noted in footnote 10 below.
4. Interpolation between bearing lengths and joist depths is permitted for allowable design reactions.
5. The minimum bearing length is permitted to be reduced for joists supported by hangers if supplemental nail attachment is provided to the web stiffener.
6. Allowable bearing lengths have been determined based on Trus Joist products. Allowable bearing on supporting members shall be checked.
7. Allowable bearing reactions for 5-1/4-inch and 7-inch bearing lengths at intermediate supports.
8. Joist weights shown are calculated on a rational basis, are based on the heavier of eastern or western species products and are suitable for dead load calculation. Contact the producing plant for shipping weight information if needed.
9. Applicable to TJI/HD90 and TJI/HS90 joists only. Areas indicate allowable bearing reactions of 1600 lbs. without web stiffeners for depths up to and including 18 inches; with web stiffeners the allowable reaction is 2255 lbs. for the 11-7/8 inch depth and 2450 lbs. for all other depths.
10. The resistive moment capacities listed in Table 2 may not be increased by any code allowed repetitive-member use factor.
11. Applicable to TJI/HD90 and TJI/HS90 joists only. Reaction capacities at a 3-inch bearing length (interpolated as per note 4 above) may be increased 510 lbs. when supported by Simpson Strong-Tie Co. HWI or WPU joist hangers with a minimum of 4 10d common nails installed through the joist hanger stirrups and into the joist web stiffener and web.

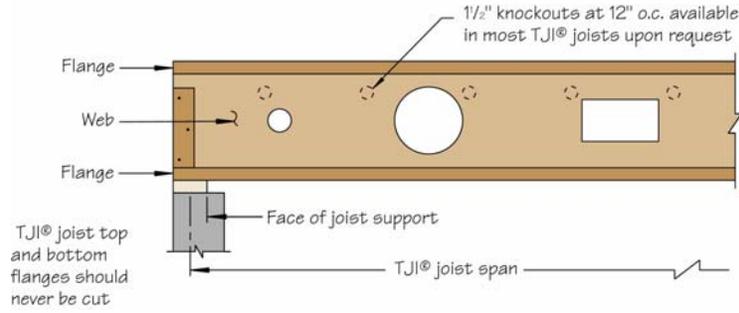
**FIGURE 1 – WEB STIFFENER NOTES AND DETAILS**



1. Web stiffeners shall be installed at bearing points as required in Table 2.
2. Web stiffeners shall be installed at points of concentrated loads greater than 1500 pounds and are to be nailed in accordance with the intermediate reaction schedule in Table 2.
3. Web stiffeners shall be installed on each side of the web as shown, with nails equally spaced vertically.
4. A gap shall be left at the top of web stiffeners as shown at all bearing conditions. In the case of concentrated loads, web stiffeners are required as shown and the gap shall be at the bottom.
5. Web stiffener material shall be sheathing meeting the requirements of PS-1 or PS-2 with the face grain parallel to the long axis.
6. Some hangers require web stiffeners to comply with nailing requirements through side plates.
7. If web stiffeners are not used in hanger support, the side of the hanger shall extend up to laterally support the top flange.

Web stiffener specifications are as follows:

TJI Joist Series	Minimum Dimensions		Grade
	"W" (Inches)	"T" (Inches)	
TJI 110, TJI/L45	2 5/16	5/8	See Note 5
TJI 210	2 5/16	23/32	See Note 5
TJI 230, TJI 360, TJI/L65	2 5/16	7/8	See Note 5
TJI 560, TJI/L90, TJI/H90	3 1/2	1 1/2	Construction Grade 2x4
TJI/HD90, TJI/HS90	3 1/2	1 1/2	1.3E minimum grade TimberStrand LSL



**FIGURE 2. Allowable Hole Size and Location for the TJI/L45, TJI/L65, TJI/L90, TJI/H90, TJI/HD90 and TJI/HS90 Joists ONLY.**

**Hole Factors and Locations Chart**

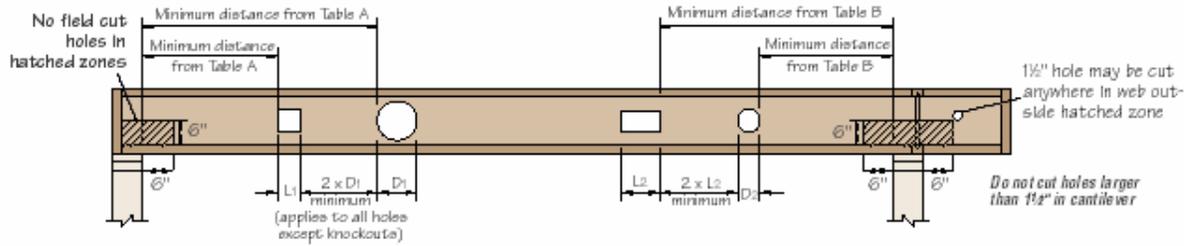
Round Hole Size (inches)	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
Rectangular Hole Size (inches)	1¼	1¾	2¼	3	3½	4	4¾	5¼	6	6½	7	7¾	8¼	9	9½	10	10¾	11¼	12	
Joist depth (inches)	11½	A	A	B	C	E														
	14	A	A	B	C	C	D	E												
	16	A	A	A	B	C	C	D	E	E										
	18	4"	1'-3"	A	A	B	C	C	D	E	E									
	20	4"	1'-3"	A	A	B	B	C	C	D	D	E	E							
	22	4"	1'-3"	1'-3"	A	A	B	B	C	C	D	D	E	E						
	24	4"	4"	1'-3"	A	A	A	B	B	C	C	D	D	E	E	E				
	26	4"	4"	1'-3"	A	A	A	B	B	B	C	C	D	D	D	E	E			
	28	4"	4"	1'-3"	1'-3"	A	A	A	B	B	B	C	C	D	D	D	E	E	E	E
30	4"	4"	4"	1'-3"	1'-3"	A	A	A	B	B	B	C	C	C	D	D	E	E	E	

**Hole Locations Chart**

Joist Span (center to center of support, feet)	Hole Factor				
	A	B	C	D	E
14	1'-3"	2'-0"	2'-6"	3'-9"	5'-0"
15	1'-3"	2'-0"	3'-0"	4'-0"	5'-3"
16	1'-3"	2'-3"	3'-3"	4'-6"	5'-9"
17	1'-6"	2'-9"	3'-9"	5'-0"	6'-3"
18	1'-6"	3'-0"	4'-3"	5'-6"	6'-9"
19	1'-9"	3'-0"	4'-3"	5'-6"	7'-0"
20	1'-9"	3'-0"	4'-3"	5'-6"	7'-0"
21	2'-0"	3'-0"	4'-3"	5'-9"	7'-3"
22	2'-0"	3'-0"	4'-3"	5'-9"	7'-3"
23	2'-0"	3'-3"	4'-3"	5'-9"	7'-6"
24	2'-3"	3'-3"	4'-6"	5'-9"	7'-6"
25	2'-3"	3'-6"	4'-9"	5'-9"	7'-9"
26	2'-3"	3'-9"	4'-9"	6'-0"	7'-9"
27	2'-6"	3'-9"	5'-0"	6'-3"	7'-9"
28	2'-6"	4'-0"	5'-3"	6'-6"	8'-0"
29	2'-6"	4'-0"	5'-6"	6'-9"	8'-3"
30	2'-9"	4'-3"	5'-9"	7'-0"	8'-6"
31	3'-0"	4'-3"	5'-9"	7'-3"	8'-9"
32	3'-0"	4'-6"	6'-0"	7'-6"	9'-3"
33	3'-0"	4'-9"	6'-3"	7'-9"	9'-6"
34	3'-0"	5'-0"	6'-6"	8'-0"	9'-9"
35	3'-3"	5'-0"	6'-6"	8'-3"	10'-0"
36	3'-3"	5'-0"	6'-9"	8'-6"	10'-3"

**Notes to Figure 2:**

1. Charts are based on simple spans and uniform load applications or applicable building code provisions for concentrated loads (2000 lbs. Over 2.5 square feet) with 25 psf dead load and 20 psf partition load.
2. For uniformly loaded multiple span applications holes shall be located 1.0 inch farther from the support for each foot of joist span, than the values indicated in the Charts.
3. Holes are not allowed in cantilever areas unless specifically designed by a qualified design professional.
4. Where more than one hole is to be cut in the web, the clear distance between holes shall be twice the length of the longest dimension of the largest adjacent hole.
5. Hole sizes shown are hole sizes, not duct sizes.
6. Rectangular hole sizes are based on measurement of the longest side.



**FIGURE 3. ALLOWABLE HOLE SIZE AND LOCATION FOR THE TJI 110, TJI 210, TJI 230, TJI 360 AND TJI 560 JOISTS**

**Table A – End Support**

Minimum Distance From Edge of Hole to Inside Face of Nearest End Support

Joist Depth (inches)	TJI Joist Series	Round Hole Size (inches)							Square or Rectangular Hole Size (inches)						
		2	3	4	6 1/2	8 7/8	11	13	2	3	4	6 1/2	8 7/8	11	13
9 1/2	TJI 110	1'-0"	1'-6"	2'-0"	5'-0"				1'-0"	1'-6"	2'-6"	4'-6"			
	TJI 210	1'-0"	1'-6"	2'-0"	5'-0"				1'-0"	2'-0"	2'-6"	5'-0"			
	TJI 230	1'-0"	2'-0"	2'-6"	5'-6"				1'-0"	2'-0"	3'-0"	5'-0"			
11 1/8	TJI 110	1'-0"	1'-0"	1'-0"	2'-6"	5'-0"			1'-0"	1'-0"	1'-6"	4'-6"	6'-0"		
	TJI 210	1'-0"	1'-0"	1'-0"	2'-6"	5'-6"			1'-0"	1'-0"	2'-0"	5'-0"	6'-6"		
	TJI 230	1'-0"	1'-0"	1'-0"	3'-0"	6'-0"			1'-0"	1'-0"	2'-0"	5'-6"	7'-0"		
	TJI 360	1'-0"	1'-0"	1'-6"	4'-6"	7'-0"			1'-0"	1'-0"	2'-6"	6'-6"	7'-6"		
	TJI 560	1'-0"	1'-0"	1'-6"	5'-0"	8'-0"			1'-0"	2'-0"	3'-6"	7'-0"	8'-0"		
14	TJI 110	1'-0"	1'-0"	1'-0"	1'-0"	2'-6"	5'-0"		1'-0"	1'-0"	1'-0"	3'-6"	6'-0"	8'-0"	
	TJI 210	1'-0"	1'-0"	1'-0"	1'-0"	3'-0"	6'-0"		1'-0"	1'-0"	1'-0"	4'-0"	6'-6"	8'-6"	
	TJI 230	1'-0"	1'-0"	1'-0"	1'-6"	3'-6"	6'-6"		1'-0"	1'-0"	1'-0"	4'-0"	7'-0"	9'-0"	
	TJI 360	1'-0"	1'-0"	1'-0"	2'-6"	5'-6"	8'-0"		1'-0"	1'-0"	1'-0"	5'-6"	8'-0"	9'-6"	
	TJI 560	1'-0"	1'-0"	1'-0"	2'-6"	6'-0"	9'-0"		1'-0"	1'-0"	1'-6"	6'-6"	9'-0"	10'-0"	
16	TJI 210	1'-0"	1'-0"	1'-0"	1'-0"	1'-6"	3'-6"	6'-0"	1'-0"	1'-0"	1'-0"	2'-6"	6'-6"	8'-0"	10'-6"
	TJI 230	1'-0"	1'-0"	1'-0"	1'-0"	2'-0"	4'-0"	6'-6"	1'-0"	1'-0"	1'-0"	3'-0"	7'-0"	9'-0"	11'-0"
	TJI 360	1'-0"	1'-0"	1'-0"	1'-0"	3'-0"	6'-0"	9'-0"	1'-0"	1'-0"	1'-0"	4'-0"	9'-0"	10'-0"	11'-6"
	TJI 560	1'-0"	1'-0"	1'-0"	1'-0"	3'-0"	6'-6"	10'-0"	1'-0"	1'-0"	1'-0"	5'-0"	10'-0"	11'-0"	12'-0"

See notes below Table B.

**Table B – Intermediate or Cantilever Support**

Minimum Distance from Edge of Hole to Inside Face of Nearest Intermediate or Cantilever Support

Joist Depth (inches)	TJI Joist Series	Round Hole Size (inches)							Square or Rectangular Hole Size (inches)						
		2	3	4	6½	8⅞	11	13	2	3	4	6½	8⅞	11	13
9½	TJI 110	1'-6"	2'-6"	3'-0"	7'-6"				1'-6"	2'-6"	3'-6"	6'-6"			
	TJI 210	2'-0"	2'-6"	3'-6"	7'-6"				2'-0"	3'-0"	4'-0"	7'-0"			
	TJI 230	2'-6"	3'-0"	4'-0"	8'-0"				2'-6"	3'-0"	4'-6"	7'-6"			
11⅞	TJI 110	1'-0"	1'-0"	1'-6"	4'-0"	8'-0"			1'-0"	1'-6"	2'-6"	6'-6"	9'-0"		
	TJI 210	1'-0"	1'-0"	2'-0"	4'-6"	9'-0"			1'-0"	2'-0"	3'-0"	7'-6"	10'-0"		
	TJI 230	1'-0"	2'-0"	2'-6"	5'-0"	9'-6"			1'-0"	2'-6"	3'-6"	8'-0"	10'-0"		
	TJI 360	2'-0"	3'-0"	4'-0"	7'-0"	11'-0"			2'-0"	3'-6"	5'-0"	9'-6"	11'-0"		
	TJI 560	1'-6"	3'-0"	4'-6"	8'-0"	12'-0"			3'-0"	4'-6"	6'-0"	10'-6"	12'-0"		
14	TJI 110	1'-0"	1'-0"	1'-0"	2'-0"	4'-6"	8'-0"		1'-0"	1'-0"	1'-0"	5'-0"	9'-0"	12'-0"	
	TJI 210	1'-0"	1'-0"	1'-0"	2'-6"	5'-0"	9'-0"		1'-0"	1'-0"	2'-0"	6'-0"	10'-0"	12'-6"	
	TJI 230	1'-0"	1'-0"	1'-0"	3'-0"	5'-6"	10'-0"		1'-0"	1'-0"	2'-6"	6'-0"	10'-6"	13'-0"	
	TJI 360	1'-0"	1'-0"	2'-0"	5'-6"	8'-6"	12'-6"		1'-0"	2'-0"	4'-0"	9'-0"	12'-0"	14'-0"	
	TJI 560	1'-0"	1'-0"	1'-6"	5'-6"	9'-6"	13'-6"		1'-0"	3'-0"	5'-0"	10'-0"	13'-6"	15'-0"	
16	TJI 210	1'-0"	1'-0"	1'-0"	1'-0"	3'-0"	5'-6"	9'-6"	1'-0"	1'-0"	1'-0"	4'-6"	9'-6"	12'-6"	15'-6"
	TJI 230	1'-0"	1'-0"	1'-0"	1'-6"	4'-0"	6'-6"	10'-6"	1'-0"	1'-0"	1'-0"	5'-0"	10'-6"	13'-0"	16'-0"
	TJI 360	1'-0"	1'-0"	1'-0"	3'-0"	6'-6"	10'-0"	13'-6"	1'-0"	1'-0"	2'-0"	7'-6"	13'-0"	14'-6"	17'-0"
	TJI 560	1'-0"	1'-0"	1'-0"	2'-6"	7'-0"	11'-0"	15'-0"	1'-0"	1'-0"	3'-6"	9'-0"	14'-6"	16'-0"	18'-0"

1. The clear distance between multiple holes shall be twice the longest dimension of the largest hole.
2. Holes may be located vertically anywhere within the web. Leave 1/8 inch of web minimum at top and bottom of hole.
3. Tables A and B are based on uniform load applications, within the limitations of the applicable Trus Joist literature.
4. TJI Joists are manufactured with 1 1/2 inch diameter perforated knockouts in the web at approximately 12 inches on center along the length of the joist.
5. For simple span (5 foot minimum) uniformly loaded joists one maximum size hole may be located in the web at the center of the joist span provided no other holes occur in the joist.

**MANUFACTURING PLANTS**

TJI Joists covered by this bulletin shall be produced at the following locations:

Trus Joist  
2345 Deschutes Drive  
P. O. Box 60  
Stayton, OR 97383

Trus Joist  
Hanger 5  
Claresholm Industrial Airport  
P. O. Box 1060  
Claresholm, Alberta T0L0T0

Trus Joist  
410 Clay Road  
Valdosta, GA 31601

Trus Joist  
162 N. Jackson Street.  
Hwy 31 S  
P. O. Box 368  
Castleberry, AL 36432

Trus Joist  
610 Trus Joist Lane  
Chavies, KY 41727

Trus Joist  
195 N. Bertelsen Road  
Eugene, OR 97402

Trus Joist  
234 Industrial Avenue  
Natchitoches, LA 71457

The appropriate HUD Field Office or Homeownership Center in whose jurisdiction the manufacturing plant is located, or HUD designated representative will inspect this plant in accordance with prescribed procedures.

## **QUALITY CONTROL**

The appropriate HUD Field Office or HUD designated representative, or Homeownership Center in whose jurisdiction the manufacturing plant is located, shall review and approve plant fabrication procedures and quality control program, and shall report to Headquarters in accordance with outstanding instructions.

## **IDENTIFICATION**

TJI Joists are identified by a stamp indicating the product designation, the number of this bulletin (HUD 689), manufacturer's name (Trus Joist) or logo, plant number, and production date.

SAMPLE STAMP:

The sample stamp consists of several elements: a Trus Joist logo (a stylized house with a joist), the text "Trus Joist" in a script font, a circled number "15", two "PFS" logos, a stylized joist logo, and the text "ICC ESR1153 • HUD 689 • CCMC 13132-R 08-31-03-1".

## **RECORD OF PROPERTIES**

The manufacturer shall provide HUD a list of the first ten properties in which the component or system described in this bulletin is used. The list shall include the complete address, or description of location, and the approximate date of installation or erection. Failure of the manufacturer to provide HUD with the above information may result in cancellation of this bulletin.

## **NOTICE OF CHANGES:**

The manufacturer shall inform HUD in advance of changes in production facilities, transportation, field erection procedures, design, or materials used in this product. Further, the manufacturer shall inform HUD of revision to corporate structure, change of address or change in name or affiliation of the prime manufacturer. Failure of the manufacturer to notify HUD of any of the above changes may result in cancellation of this bulletin.

## **EVALUATION:**

This SEB shall be valid for a period of three years from the date of initial issuance or most recent renewal or revision, whichever is later. The holder of this bulletin shall apply for renewal or revision 90 days prior to the review date printed on this bulletin.

Submittals for renewal or revision shall be sent to:

U. S. Department of Housing and Urban Development  
FHA Standards, Office of Manufactured Housing Programs  
451 Seventh Street, SW, Room 9168  
Washington, DC 20410-8000

Appropriate User Fee shall be sent to:

U. S. Department of Housing and Urban Development  
Miscellaneous Income - Technical Suitability of Products Fees  
Bank of America  
P. O. Box 198762  
Atlanta, GA 30384-8762

The holder of this SEB may apply for revision at any time prior to the review date. Minor revisions may be in the form of a supplement.

If the Department determines that a proposed renewal or supplement constitutes a revision, the appropriate User Fee for a revision will need to be submitted in accordance with Code of Federal Regulations 24 CFR 200.934, "User Fee System for the Technical Suitability of Products Program," and current User Fee Schedule.

**CANCELLATION:**

Failure to apply for a renewal or revision shall constitute a basis for cancellation of the bulletin. HUD will notify the manufacturer that the bulletin may be cancelled when:

1. conditions under which the document was issued have changed so as to affect production of, or to compromise the integrity of the accepted material, product, or system,
2. the manufacturer has changed its organizational form without notifying HUD, or
3. the manufacturer has not complied with responsibilities it assumed as a condition of HUD's acceptance.

However, before cancellation, HUD will give the manufacturer a written notice of the specific reasons for cancellation, and the opportunity to present views on why the SEB should not be cancelled. No refund of fees will be made on a canceled document.

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