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ESR-2974

Reissued 07/2017
This report is subject to renewal 07/2018.

DIVISION: 06 00 00—WOOD, PLASTICS AND COMPOSITES
SECTION: 06 17 33—WOOD I-JOISTS

REPORT HOLDER:

SWEET’S JOISTS, INC.

118 BOROVEC ROAD
CHEHALIS, WASHINGTON 98532-8714

EVALUATION SUBJECT:

WEB-i® WOOD I-JOISTS



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DIVISION: 06 00 00—WOOD, PLASTICS AND COMPOSITES

Section: 06 17 33—Wood I-joists

REPORT HOLDER:

SWEET'S JOISTS, INC.
118 BOROVEC ROAD
CHEHALIS, WASHINGTON 98532-8714
(360) 748-9376

www.webjoist.com
Bruce@Webjoist.com

ADDITIONAL LISTEE:

WEB JOIST NORTHWEST CORP.
118 BOROVEC ROAD
CHEHALIS, WASHINGTON 98532
(360) 748-1173

EVALUATION SUBJECT:

WEB-i® WOOD I-JOISTS

1.0 EVALUATION SCOPE

1.1 Compliance with the following codes:

- 2012 and 2009 *International Building Code*® (IBC)
- 2012 and 2009 *International Residential Code*® (IRC)
- 2013 *Abu Dhabi International Building Code* (ADIBC)†

†The ADIBC is based on the 2009 IBC. 2009 IBC code sections referenced in this report are the same sections in the ADIBC.

Properties evaluated:

- Structural
- Fire resistance

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

The WEB-i wood I-joists described in this report are used as structural framing members in floor and roof

assemblies. The structural capacities and design provisions of the WEB-i wood I-joists comply with IBC Section 2303.1.2 for allowable stress design, and IRC Section R502.1.4.

3.0 DESCRIPTION

3.1 General:

The WEB-i joists are prefabricated wood I-joists with lumber flanges and oriented strand board (OSB) webs. The flanges are solid-sawn lumber with glued finger-joints, which are manufactured and tested daily in accordance with the manufacturer's quality control manual, to form continuous flanges. The face grain of the OSB web is oriented vertically, and the web-to-flange and web-to-web connections are proprietary, glued, tongue-and-groove joints. Joist depths vary from 11⁷/₈ to 28 inches (302 to 711 mm). See Table 1 and Figure 1 for joist descriptions.

The attributes of the wood I-joists have been verified as conforming to the provisions of (i) CALGreen Sections A4.404.3 for efficient framing techniques; (ii) ICC 700-2015 Section 608.1(b), 11.608.1(b) and 12.1(A)608.1(b) (iii) ICC 700-2012 Section 608.1(2), 11.608.1(2) and 12(A).608.1 for resource-efficient materials; and (iv) 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.

3.2 Materials:

3.2.1 Flanges: Flange material is 1¹/₂-by-3¹/₂-inch (38 by 89 mm) machine-stress-rated (MSR) lumber meeting the grading rules specified in Table No. 4C of the *National Design Specification for Wood Construction*® (NDS) *Supplement* and in the manufacturer's quality control manual. Lumber species are Douglas fir–larch, hem-fir, spruce-pine-fir, Engelmann spruce/lodgepole pine or lodgepole pine.

3.2.2 Webs: Webs are 3/₈- or 1/₂-inch-thick (9.5 or 12.7 mm) OSB panels conforming with Structural I, Exposure I, performance-rated panel requirements as noted in U.S. Department of Commerce Product Standard PS-2 and the manufacturer's quality control manual.

3.2.3 Adhesive: The adhesive is an exterior-type adhesive complying with ASTM D2559 and Section 5.3.3 of ASTM D5055-09.

4.0 DESIGN AND INSTALLATION

4.1 Installation:

Installation of the WEB-i wood I-joists described in this report must comply with the applicable code requirements, this report and manufacturer's published installation instructions. The manufacturer's published installation instructions must be available at the jobsite at all times during installation.

4.2 Design:

The WEB-i wood I-joists must be designed using accepted joist design principles and this report.

4.2.1 Allowable Capacity: Table 2 specifies allowable moments, shears, and stiffnesses (EI) for the WEB-i wood I-joists.

4.2.2 Web Stiffeners: Both sides of the web of joists that are 16 inches (406 mm) and deeper must have web stiffeners installed at all supports. Table 4 specifies web stiffener requirements. At locations where concentrated loads exceed 1,500 pounds (6.67 kN), both sides of the web require stiffeners for all joist depths. See Figure 2.

4.2.3 Lateral Support: The compression flange requires continuous lateral support, and the joist ends require restraint to prevent rollover.

4.2.4 Holes: Figure 3 shows allowable hole size and location of holes in the joist webs.

4.2.5 Duration of Load: Adjustments for duration of load according to Sections 7.3.2 and 10.3.2 of the NDS apply to the WEB-i wood I-joists and their fastenings, respectively.

4.2.6 In-service Moisture Conditions: The WEB-i wood I-joists must be installed in dry, covered conditions, where the in-service moisture content is less than 16 percent.

4.2.7 Repetitive-member Use: The repetitive member factor for WEB-i wood I-joists shall be taken as 1.0.

4.2.8 Beam Span: Beam span must comply with the code. Vertical shear calculations must include all loads within the span from centerline to centerline of bearing supports.

4.2.9 Deflection: Deflection of uniformly loaded, simple-span joists and joists with a concentrated load at mid-span are determined with the deflection formulae in Footnote 1 of Table 2.

4.2.10 Blocking Panels: WEB-i wood I-joists under bearing walls that are perpendicular to the joists must have full-depth solid blocking.

4.2.11 Bearing Length: Table 3 provides equations that determine allowable shear based on bearing length of the I-joists at simple-span end supports.

4.3 One-hour Fire-resistance-rated Roof and Floor-ceiling Assemblies:

WEB-i I-joists used in one-hour fire-resistance-rated roof and floor-ceiling assemblies must be installed in

accordance with Section 4.2.2.4 of [ESR-1338](#), or IBC Table 721.1(3) Item Nos. 21-1.1, and 23-1.1 through 28-1.1 (Table 720.1(3) Item Nos. 21-1.1 and 23-1.1 through 28-1.1 of the 2009 IBC).

5.0 CONDITIONS OF USE

The WEB-i wood I-joists 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 Installation complies with this report, the manufacturer's published installation instructions and the applicable code. In the event of conflicts between the manufacturer's published installation instructions and this report, this report governs.

5.2 Structural design information for the use of the joists must be indicated on the construction documents submitted with the permit application. The construction documents and the design configurations must be consistent with this report, and 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 Cutting of the flanges of the joists is not permitted. Web openings in wood I-joists must conform to the requirements as specified in Section 4.2.4 of this report. Web opening conditions not covered in Section 4.2.4 of this report are outside the scope of this report.

5.4 Evaluation of the trusses and joists is limited to interior dry-use conditions. Dry conditions of use are those conditions of use represented by moisture content that is less than 16 percent in the wood I-joists.

5.5 The joists are manufactured by Web Joist Northwest Corp. in Chehalis, Washington, under a quality-control program with inspections by ICC-ES and PFS Corporation (AA-652).

6.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for Prefabricated Wood I-joists (AC14), dated October 2013 (editorially revised February 2014).

7.0 IDENTIFICATION

Each WEB-i wood I-joist bears a stamped identification label with the product name (WEB-i Joist), manufacturer's name (Web Joist Northwest Corp.), manufacturer's city and state (Chehalis, WA), evaluation report number (ESR-2974), and name of the inspection agency (PFS Corporation). In addition, the flanges of the I-joists are labeled with the applicable lumber grade stamp.

TABLE 1—WEB-i JOIST DESCRIPTION^{1,2,3}

| Series Code Number | Flange Grade | Web Thickness (inches) | Depth Range (inches) |
|--------------------|----------------|------------------------|----------------------|
| 4212 | MSR 1650f-1.5E | $\frac{3}{8}$ | 11 $\frac{7}{8}$ -24 |
| 4312 | MSR 1800f-1.6E | $\frac{3}{8}$ | 11 $\frac{7}{8}$ -24 |
| 4412 | MSR 2100f-1.8E | $\frac{3}{8}$ | 11 $\frac{7}{8}$ -24 |
| 4512 | MSR 2400f-2.0E | $\frac{3}{8}$ | 11 $\frac{7}{8}$ -24 |
| 4612 | MSR 2700f-2.2E | $\frac{3}{8}$ | 11 $\frac{7}{8}$ -24 |
| 4712 | MSR 2850f-2.3E | $\frac{3}{8}$ | 11 $\frac{7}{8}$ -24 |
| 4232 | MSR 1650f-1.5E | $\frac{1}{2}$ | 16-28 |
| 4332 | MSR 1800f-1.6E | $\frac{1}{2}$ | 16-28 |
| 4432 | MSR 2100f-1.8E | $\frac{1}{2}$ | 16-28 |
| 4532 | MSR 2400f-2.0E | $\frac{1}{2}$ | 16-28 |
| 4632 | MSR 2700f-2.2E | $\frac{1}{2}$ | 16-28 |
| 4732 | MSR 2850f-2.3E | $\frac{1}{2}$ | 16-28 |

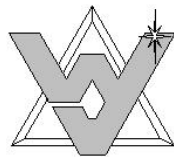
For SI: 1 in = 25.4 mm.

¹ Flange size is 2x4 (1.50" x 3.50")

² Web is Structural I OSB

³ Series code numbers: 1st digit = Flange size, 2nd digit = Flange grade, 3rd digit = Web thickness and 4th digit = Web material.

⁴ Flanges are labeled with applicable grade stamp.



WEB-i[®] All wood I-Joist

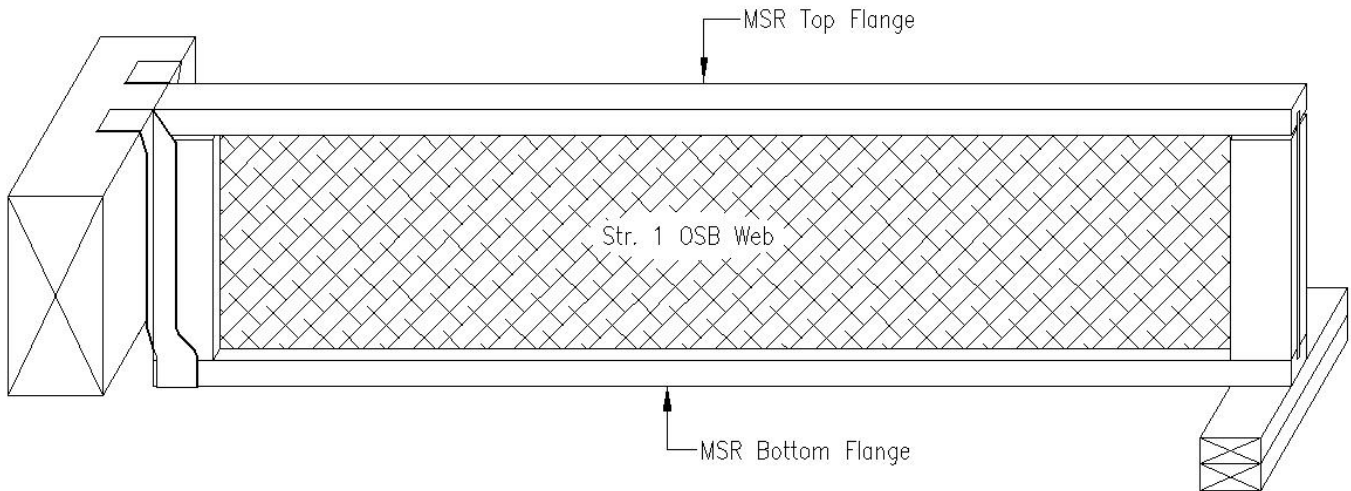


FIGURE 1—WEB-i COMPONENTS

TABLE 2—WEB-I JOIST PROPERTIES^{1,2,3,4}

| Depth (in.) | Weight (plf) | Shear (lbs.) | Moment (Ft.-lbs.) | EIx10 ⁶ (lbs.-in. ²) | Kx10 ⁶ (lbs.) | Depth (in.) | Weight (plf) | Shear (lbs.) | Moment (Ft.-lbs.) | EIx10 ⁶ (lbs.-in. ²) | Kx10 ⁶ (lbs.) |
|--|--------------|--------------|-------------------|---|--------------------------|--|--------------|--------------|-------------------|---|--------------------------|
| WEB-i 4212 (2x4 1650f-1.5E Flange & ³ / ₈ " OSB Web) | | | | | | WEB-i 4232 (2x4 1650f-1.5E Flange & ¹ / ₂ " OSB Web) | | | | | |
| 11 ⁷ / ₈ | 3.6 | 1,929 | 4,482 | 443 | 5.64 | 16 | 4.5 | 2,995 | 6,168 | 899 | 10.13 |
| 14 | 3.8 | 2,147 | 5,398 | 649 | 6.65 | 18 | 4.8 | 3,187 | 7,017 | 1,180 | 11.40 |
| 16 | 4.0 | 2,351 | 6,259 | 882 | 7.60 | 20 | 5.1 | 3,379 | 7,865 | 1,504 | 12.67 |
| 18 | 4.2 | 2,556 | 7,120 | 1,154 | 8.55 | 22 | 5.3 | 3,572 | 8,713 | 1,872 | 13.93 |
| 20 | 4.4 | 2,760 | 7,982 | 1,466 | 9.50 | 24 | 5.6 | 3,764 | 9,561 | 2,286 | 15.20 |
| 22 | 4.6 | 2,965 | 8,843 | 1,818 | 10.45 | 26 | 5.9 | 3,957 | 10,391 | 2,747 | 16.47 |
| 24 | 4.8 | 3,169 | 9,704 | 2,213 | 11.40 | 28 | 6.2 | 4,149 | 11,139 | 3,256 | 17.73 |
| WEB-i 4312 (2x4 1800f-1.6E Flange & ³ / ₈ " OSB Web) | | | | | | WEB-i 4332 (2x4 1800f-1.6E Flange & ¹ / ₂ " OSB Web) | | | | | |
| 11 ⁷ / ₈ | 3.6 | 1,929 | 5,164 | 473 | 5.64 | 16 | 4.5 | 2,995 | 7,106 | 959 | 10.13 |
| 14 | 3.8 | 2,147 | 6,218 | 693 | 6.65 | 18 | 4.8 | 3,187 | 8,083 | 1,259 | 11.40 |
| 16 | 4.0 | 2,351 | 7,210 | 941 | 7.60 | 20 | 5.1 | 3,379 | 9,060 | 1,604 | 12.67 |
| 18 | 4.2 | 2,556 | 8,202 | 1,231 | 8.55 | 22 | 5.3 | 3,572 | 10,037 | 1,997 | 13.93 |
| 20 | 4.4 | 2,760 | 9,195 | 1,563 | 9.50 | 24 | 5.6 | 3,764 | 11,014 | 2,438 | 15.20 |
| 22 | 4.6 | 2,965 | 10,187 | 1,940 | 10.45 | 26 | 5.9 | 3,957 | 11,970 | 2,930 | 16.47 |
| 24 | 4.8 | 3,169 | 11,179 | 2,361 | 11.40 | 28 | 6.2 | 4,149 | 12,831 | 3,473 | 17.73 |
| WEB-i 4412 (2x4 2100f-1.8E Flange & ³ / ₈ " OSB Web) | | | | | | WEB-i 4432 (2x4 2100f-1.8E Flange & ¹ / ₂ " OSB Web) | | | | | |
| 11 ⁷ / ₈ | 3.6 | 1,929 | 6,921 | 532 | 5.64 | 16 | 4.5 | 2,995 | 9,525 | 1,079 | 10.13 |
| 14 | 3.8 | 2,147 | 8,335 | 779 | 6.65 | 18 | 4.8 | 3,187 | 10,834 | 1,416 | 11.40 |
| 16 | 4.0 | 2,351 | 9,665 | 1,059 | 7.60 | 20 | 5.1 | 3,379 | 12,144 | 1,805 | 12.67 |
| 18 | 4.2 | 2,556 | 10,995 | 1,385 | 8.55 | 22 | 5.3 | 3,572 | 13,453 | 2,246 | 13.93 |
| 20 | 4.4 | 2,760 | 12,325 | 1,759 | 9.50 | 24 | 5.6 | 3,764 | 14,763 | 2,743 | 15.20 |
| 22 | 4.6 | 2,965 | 13,655 | 2,182 | 10.45 | 26 | 5.9 | 3,957 | 16,045 | 3,296 | 16.47 |
| 24 | 4.8 | 3,169 | 14,985 | 2,656 | 11.40 | 28 | 6.2 | 4,149 | 17,199 | 3,908 | 17.73 |
| WEB-i 4512 (2x4 2400f-2.0E Flange & ³ / ₈ " OSB Web) | | | | | | WEB-i 4532 (2x4 2400f-2.0E Flange & ¹ / ₂ " OSB Web) | | | | | |
| 11 ⁷ / ₈ | 3.6 | 1,929 | 8,459 | 591 | 5.64 | 16 | 4.5 | 2,995 | 11,641 | 1,199 | 10.13 |
| 14 | 3.8 | 2,147 | 10,187 | 866 | 6.65 | 18 | 4.8 | 3,187 | 13,242 | 1,574 | 11.40 |
| 16 | 4.0 | 2,351 | 11,812 | 1,176 | 7.60 | 20 | 5.1 | 3,379 | 14,843 | 2,005 | 12.67 |
| 18 | 4.2 | 2,556 | 13,438 | 1,539 | 8.55 | 22 | 5.3 | 3,572 | 16,443 | 2,496 | 13.93 |
| 20 | 4.4 | 2,760 | 15,063 | 1,954 | 9.50 | 24 | 5.6 | 3,764 | 18,044 | 3,048 | 15.20 |
| 22 | 4.6 | 2,965 | 16,689 | 2,425 | 10.45 | 26 | 5.9 | 3,957 | 19,611 | 3,662 | 16.47 |
| 24 | 4.8 | 3,169 | 18,315 | 2,951 | 11.40 | 28 | 6.2 | 4,149 | 21,021 | 4,342 | 17.73 |
| WEB-i 4612 (2x4 2700f-2.2E Flange & ³ / ₈ " OSB Web) | | | | | | WEB-i 4632 (2x4 2700f-2.2E Flange & ¹ / ₂ " OSB Web) | | | | | |
| 11 ⁷ / ₈ | 3.6 | 1,929 | 9,448 | 650 | 5.64 | 16 | 4.5 | 2,995 | 13,002 | 1,319 | 10.13 |
| 14 | 3.8 | 2,147 | 11,377 | 952 | 6.65 | 18 | 4.8 | 3,187 | 14,790 | 1,731 | 11.40 |
| 16 | 4.0 | 2,351 | 13,193 | 1,294 | 7.60 | 20 | 5.1 | 3,379 | 16,577 | 2,206 | 12.67 |
| 18 | 4.2 | 2,556 | 15,008 | 1,693 | 8.55 | 22 | 5.3 | 3,572 | 18,365 | 2,746 | 13.93 |
| 20 | 4.4 | 2,760 | 16,824 | 2,150 | 9.50 | 24 | 5.6 | 3,764 | 20,153 | 3,352 | 15.20 |
| 22 | 4.6 | 2,965 | 18,640 | 2,667 | 10.45 | 26 | 5.9 | 3,957 | 21,903 | 4,028 | 16.47 |
| 24 | 4.8 | 3,169 | 20,455 | 3,246 | 11.40 | 28 | 6.2 | 4,149 | 23,478 | 4,776 | 17.73 |
| WEB-i 4712 (2x4 2850f-2.3E Flange & ³ / ₈ " OSB Web) | | | | | | WEB-i 4732 (2x4 2850f-2.3E Flange & ¹ / ₂ " OSB Web) | | | | | |
| 11 ⁷ / ₈ | 3.6 | 1,929 | 10,107 | 680 | 5.64 | 16 | 4.5 | 2,995 | 13,909 | 1,379 | 10.13 |
| 14 | 3.8 | 2,147 | 12,171 | 996 | 6.65 | 18 | 4.8 | 3,187 | 15,822 | 1,810 | 11.40 |
| 16 | 4.0 | 2,351 | 14,113 | 1,353 | 7.60 | 20 | 5.1 | 3,379 | 17,734 | 2,306 | 12.67 |
| 18 | 4.2 | 2,556 | 16,056 | 1,770 | 8.55 | 22 | 5.3 | 3,572 | 19,646 | 2,870 | 13.93 |
| 20 | 4.4 | 2,760 | 17,998 | 2,247 | 9.50 | 24 | 5.6 | 3,764 | 21,559 | 3,505 | 15.20 |
| 22 | 4.6 | 2,965 | 19,940 | 2,788 | 10.45 | 26 | 5.9 | 3,957 | 23,431 | 4,212 | 16.47 |
| 24 | 4.8 | 3,169 | 21,882 | 3,394 | 11.40 | 28 | 6.2 | 4,149 | 25,116 | 4,993 | 17.73 |

For SI: 1 in = 25.4 mm, 1 lbf = 4.448 N, 1 pli = 0.124 kg/m, 1 plf = 1.488 kg/m, 1 Ft-lbf = 1.3558 N-m, 1 lbf-in² = 292.64 kg-mm².

¹ Calculate bending and shear deflection as follows:
 Uniformly distributed load: Defl.(in.) = (5WL⁴ / 384EI)+(WL² /K)
 Concentrated load at centerline: Defl.(in.) = (PL³ /48EI)+(2PL/K)
 Where: W = Uniform load (pli) L = Span length (in.) EI = MOE times I (pounds-inches² x 10⁶)
 K = Shear defl. constant (pounds x 10⁶)
 P = Concentrated load (pounds).
² Allowable shear is lower of above value or bearing length value from equations in Table 3.
³ See Table 4 for web stiffener requirements.
⁴ Straight line interpolation may be made between depths.

TABLE 3—ALLOWABLE SHEAR FOR BEARING LENGTH¹

| | |
|---|--------------------------------|
| For $\frac{3}{8}$ " Web no Web Stiffeners | $V = 723.4 + 45.876D\sqrt{B}$ |
| For $\frac{3}{8}$ " Web with Web Stiffeners | $V = 1353.8 + 39.672D\sqrt{B}$ |
| For $\frac{1}{2}$ " Web with Web Stiffeners | $V = 1741.8 + 42.812D\sqrt{B}$ |

For **SI**: 1 in = 25.4 mm, 1 lbf = 4.448 N.

Where:

V = Allowable shear (Lb.)

D = Out-to-out depth of joist (in.)

B = Bearing length (in.) (B is not to be less than 1.50")

¹The allowable shear for bearing length is for normal duration of loading and may be increased for duration of loading in accordance with Section 7.3.2 of NDS.

TABLE 4—WEB STIFFENERS NAILING^{1,2,3}

| Joist Depth (inches) | Total nails per stiffener location | | | |
|----------------------|------------------------------------|---------------------|---------------------|---------------------|
| | Simple Span | | Continuous Span | |
| | $\frac{3}{8}$ " Web | $\frac{1}{2}$ " Web | $\frac{3}{8}$ " Web | $\frac{1}{2}$ " Web |
| | (Box) | (Com.) | (Box) | (Com.) |
| 11 $\frac{7}{8}$ | 3-10d* | — | 4-10d | — |
| 14 | 4-10d* | — | 6-10d | — |
| 16 | 4-10d | 4-10d | 6-10d | 6-10d |
| 18 | 5-10d | 5-10d | 7-10d | 7-10d |
| 20 | 6-10d | 6-10d | 9-10d | 9-10d |
| 22 | 6-10d | 6-10d | 9-10d | 9-10d |
| 24 | 7-10d | 7-10d | 10-10d | 10-10d |
| 26 | — | 8-10d | — | 12-10d |
| 28 | — | 8-10d | — | 12-10d |

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

¹Web stiffeners are No. 2 or better. Use 2x4's at simple spans and 2x6's at continuous spans. Install nails from both sides.

²May substitute 14 Ga. staples for 10d Box nail and 13 Ga. staples for 10d Common nail. Staples Min. are $\frac{7}{16}$ " crown and 3" leg.

³Web stiffeners not required for 11 $\frac{7}{8}$ " & 14" deep $\frac{3}{8}$ " web simple span ends but may be needed for bearing length requirements.

**U"-type hanger may require web stiffeners to comply with nailing requirements through side plates of hanger.

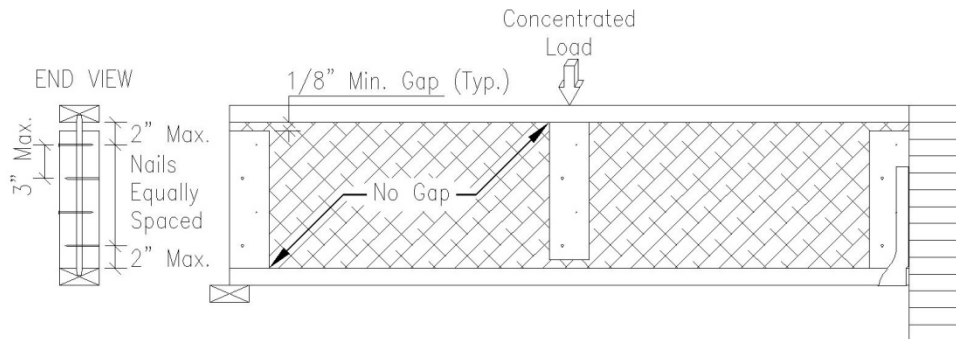
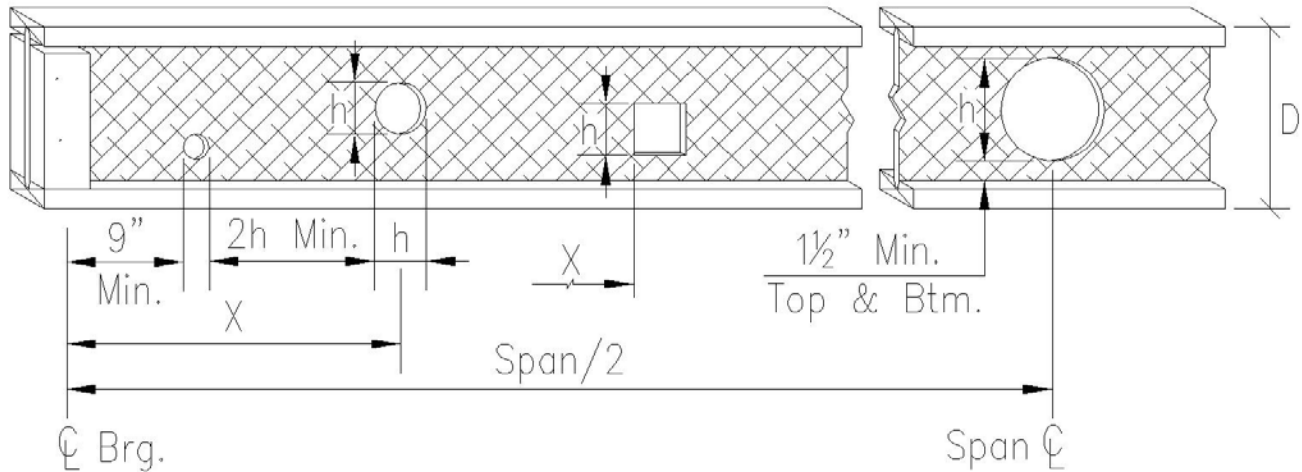


FIGURE 2—WEB STIFFENERS

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



For simple spans and uniform load, the following formulas may be used to determine minimum distance to hole.

$$X = (V - V_H) / W \qquad V = WL / 2 \qquad V_H = V_A (D_E / D_W)$$

Where:

X = Minimum distance in feet from centerline of support to centerline of round hole or edge of square hole.

V = Shear at bearing in pounds.

W = Uniform loading in pounds per lineal foot.

L = Span in feet from centerline of support to centerline of support.

V_H = Allowable shear at hole in pounds.

V_A = Allowable shear in pounds from Table 8.

D_E = Effective depth at hole in inches (D_E cannot be < 0.5").

@ Round hole D_E = D_W - h

@ Square hole D_E = D_W - (h/0.75)

@ Rectangular hole D_E = D_W - (h/0.6667)

D_W = Depth of web in inches = D - 1.75".

h = Height of hole in inches (h_{max.} to be the lower of D-6" or a value that results in D_E being ≥ 0.5").

D = Out-to-out depth of joist in inches.

NOTES:

1. Do not cut the web within nine inches of the support centerline, otherwise, a two inch hole can be cut in the web anywhere. The top and bottom flanges are never to be cut.
2. Where more than one hole is desired, the length of the web between edges of holes must be equal or exceed twice the height of the largest hole.

FIGURE 3—HOLE SIZE AND LOCATION

For SI: 1 in = 25.4 mm, 1 lbf = 4.448 N, 1 lbf/ft = 1.488 kg/m.