Steel Joist Institute
Technical Digest 12
Third Edition

First Printing – March 2023

This document containing the errata to the Steel Joist Institute Technical Digest 12 may be periodically updated as needed and posted on the SJI website at www.steeljoist.org. The errata are organized by date in descending order (most recent to furthest past) hence regular users of this document need only review the errata posted since their previous use.

First Errata Posted on June 19, 2023

Example 2.2 Load Distribution for Rooftop Units (page 19)

This example illustrates how load distribution between several joists can be used to eliminate the need for strengthening a joist system or minimizing the amount of reinforcing required. The example also illustrates how to design a truss system within the depth of the joists so that the headroom below the joists is not reduced.

Given:

A new rooftop unit will be located on top of the existing 30H8 joists. The building was erected in 1975. The joists span 40 feet and are 5 ft. on center. A sketch indicating the location of the loads from the rooftop unit is shown in Figure 2.2. The reactions from the unit and the curbing are also shown in the figure. Figure 2.3 shows the location and suggested geometry of the transfer truss.

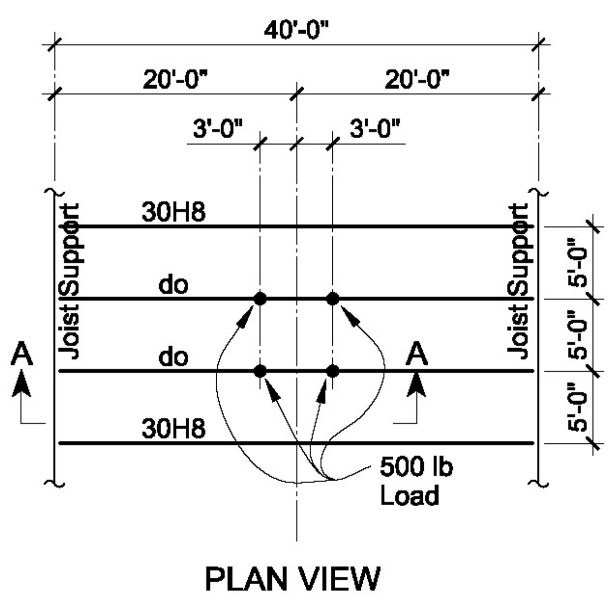

Fig. 2.2 RTU Loads

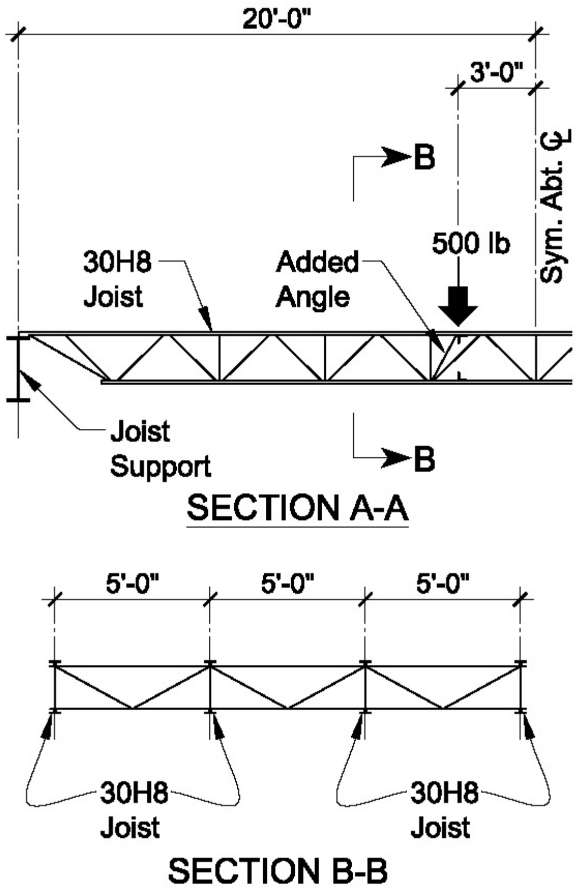

Fig. 2.3 Transfer Truss

Solution:

1. Determine the stiffness of the joists:

$$I_j = 26.767(W)(L^3)(10^{-6})$$

From the 1974 H-Series Load Table (SJI 2018), the live load deflection for a 30H8 joist with a 40 ft. span is,

W = 262 plf

$$I_j = 26.767(262\text{ plf})(39.67\text{ ft})^3(10^{-6}) = 438\text{ in.}^4$$

2. Divide I_j by 1.15 to account for shear deflection.

$$I_{j,eff} = \frac{438\text{ in.}^4}{1.15} = 381\text{ in.}^4$$

$$K = \frac{P}{\Delta} = \frac{P}{\dfrac{Pa^2b^2}{3EI_{j,eff}L}} = \frac{3EI_{j,eff}L}{a^2b^2}$$

$$K = \frac{3(29{,}000\text{ ksi})(381\text{ in.}^4)(39.67\text{ ft})(12\text{vin./ft})}{[(17\text{ ft})(12\text{ in./ft})]^2[(23\text{ ft})(12\text{ in./ft})]^2} = 4.98\text{ kips/in.}$$

Determine the moment of inertia of the transfer truss necessary to distribute the load to the four joists:

Try a 3 x 3 x 1/4 in. angle for the top and bottom chords of the transfer truss.

In the calculation below, the top and bottom chords of the 30H8 joists are assumed to be 2 inch angles.

$$I_x = 2Ad^2 = (2)(1.44 \text{ in.}^2)(15 \text{ in.} - 2 \text{ in.} - 0.836 \text{ in.})^2 = 426 \text{ in.}^4$$

$$I_{eff} \approx \frac{426 \text{ in.}^4}{1.15} = 370 \text{ in.}^4$$

$$\beta = \sqrt[4]{\frac{(K/S)}{(4EI)}} = \sqrt[4]{\frac{4.98 \text{ kips/in.}/60 \text{ in.}}{(4)(29{,}000 \text{ ksi})(370 \text{ in.}^4)}} = 0.0066 \text{ in.}^{-1}$$

Check if spacing, $S < \frac{\pi}{4\beta} = 118.4 \text{ in.}$

S = 60 in. < 118.4 in. Therefore, **OK**

As Printed:

Check the length of the truss < 1/β

L = 18 ft. = 216 in.
1/β = 1/0.0066 = 151 in.
216 in. > 151 in. Therefore, **NG**

Try a 6 x 6 x 1/2 in. angle for the top and bottom chords of the transfer truss.

$$I_x = 2Ad^2 = (2)(5.77 \text{ in.}^2)(15 \text{ in.} - 2 \text{ in.} - 1.67 \text{ in.})^2 = 1{,}481 \text{ in.}^4$$

$$I_{eff} \approx \frac{1481 \text{ in.}^4}{1.15} = 1{,}288 \text{ in.}^4$$ Ignoring I_x of the individual angles

$$\beta = \sqrt[4]{\frac{4.98 \text{ kips/in.}/60 \text{ in.}}{(4)(29{,}000 \text{ ksi})(1{,}288 \text{ in.}^4)}} = 0.0049 \text{ in.}^{-1}$$

Check if spacing, $S < \frac{\pi}{4\beta} = 161.8 \text{ in.}$

S = 60 in. < 161.8 in. Therefore, **OK**

Check the length of truss < 1/β

L = 18 ft. = 216 in.
1/β = 1/0.0049 = 204 in.
216 in. > 204 in. Therefore, still **NG**

By inspection, use a L6 x 6 x 5/8 in. angle for the transfer truss chords.

3. Solve for the reaction at each joist:

Since the truss can be considered rigid, each joist must support 250 pounds and be located 3 feet from each side of the joist centerline. Each transfer truss must be designed to support the two 500-pound loads.

As Corrected:

Check the length of the truss < 1/β

L = 15 ft. = 180 in.
1/β = 1/0.0066 = 151 in.
180 in. > 151 in.   Therefore, **NG**

Try a 6 x 6 x 1/2 in. angle for the top and bottom chords of the transfer truss.

$$I_x = 2Ad^2 = (2)\left(5.77\text{ in.}^2\right)(15\text{ in.} - 2\text{ in.} - 1.67\text{ in.})^2 = 1{,}481\text{ in.}^4$$

$$I_{eff} \approx \frac{1481\text{ in.}^4}{1.15} = 1{,}288\text{ in.}^4 \qquad \text{Ignoring } I_x \text{ of the individual angles}$$

$$\beta = \sqrt[4]{\frac{4.98\text{ kips/in.}/60\text{ in.}}{(4)(29{,}000\text{ ksi})\left(1{,}288\text{ in.}^4\right)}} = 0.0049\text{ in.}^{-1}$$

Check if spacing, $S < \dfrac{\pi}{4\beta} = 161.8\text{ in.}$

S = 60 in. < 161.8 in.   Therefore, **OK**

Check the length of truss < 1/β

L = 15 ft. = 180 in.
1/β = 1/0.0049 = 204 in.
180 in. < 204 in.   Therefore, still **OK**

3. Solve for the reaction at each joist:

   Since the truss can be considered rigid, each joist must support 250 pounds and be located 3 feet from each side of the joist centerline. Each transfer truss must be designed to support the two 500-pound loads.