Solution:

1. Check the shear capacity of 2-1/2″ deep section:
   The maximum shear capacity = $V_R = F_v t_w h$
   $F_v = 0.4F_y = 14.4$ ksi
   $t_w = 0.275$ inches; $h = 2.5$ inches
   $V_R = (14.4)(0.275)(2.5) = 9.9$ kips
   9 kips < 9.9 kips **o.k.**

2. Reinforce the section for bending:
   M = RL

   Based on the triangular stress distribution shown in Fig. 5.2.7 the reaction is located one inch from the end of the seat, thus L = 7 inches.
   M= 9(7) = 63 in.-kips.
   Try adding a 4″ wide plate to the T section. (See Fig. 5.2.8.)

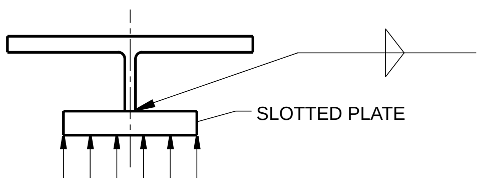

Fig. 5.2.8

Determine the required plate thickness. The thickness is based on cantilever bending of the plate.

The average bearing stress = (9)/[(4)(3)]= 0.75 ksi.

The length of the cantilever equals the clear distance from the edge of the beam fillet weld to the edge of the plate. Estimate this dimension as 1.7 inches. The required thickness is determined by solving the equation $M_x = S_x F_b$ for the plate thickness.

Where:

$M_x = (0.75)(1.7)^2/2 = 1.08$ in.-kips
$S_x = bt^2/6 = (1)(t_{reqd})^2/6$
$F_b = 0.75F_y = 27$ ksi

$$\therefore \quad t_{reqd} = \sqrt{\frac{(1.08)(6)}{27}} = 0.49\text{inches}$$

Use a 1/2″ plate.

The section properties for the composite cantilever section are:

$A = 4.93$ in.^{2}
$I_x = 4.67$ in.^{4}
$S_{x\ top} = 4.12$ in.^{3}
$S_{x\ bottom} = 3.42$ in.^{3}
$y_{bottom} = 1.36$ in.

Check the bending stress in the cantilever.

$$f_b = \frac{M}{S_{bottom}} = \frac{63}{3.42} = 18.4 \text{ ksi}$$

$F_b = 0.6F_y = 22$ ksi
$f_b < F_b \quad \therefore$ **o.k.**

3. Determine the weld required to connect the plate to the beam web.

   The weld must resist the shear flow (v), where;

   v = VQ/I
   V = Shear at the critical section.
   I = Moment of inertia
   Q = The first moment of area of the added material.

$$v = \frac{(9)(1.36 - 0.25)(0.5)(4)}{4.67} = 4.3\text{kips/in.}$$

   Using a 3/16″ fillet weld near side and far side (ns/fs).

   Weld stress = v ÷ weld area

   $f_v = 4.3/(0.707)(0.1875)(2) = 16.22$ ksi
   $f_v \leq 21$ ksi **o.k.**

   Evaluate the weld required to anchor the plate:
   Plate force:
   P = MQ/I

$$P = \frac{(63)(1.36 - 0.25)(0.5)(4)}{4.67} = 29.9 \text{ kips.}$$

   Length of 3/16 fillet weld ns/fs required:

   Allowable weld force per inch
   = (0.707)(70)(0.3)(0.1875) = 2.8 kips/in. for one 3/16 in. fillet weld.

   L = 29.9/(2)(2.8) = 5.3 inches.

∴ Extend the plate 6″ beyond the cope and weld with 3/16 fillet weld ns/fs. See Fig. 5.2.9 for final configuration.

Conveyors

The proper design of joist systems for the suspension of conveyor equipment is analogous to the design of joist systems supporting cranes, and many of the same basic considerations apply. The joists must provide support that is sufficiently rigid so that the function of the conveyor is not impeded. Also, the performance of the roof or floor that is also supported by these joists should not be compromised. The key to successfully supporting a conveyor from a joist system is careful coordination with the conveyor supplier. The systems provided by the various conveyor manufacturers are often proprietary and the support requirements vary from project to project.

There are many different types of conveyors. Most conveyors may be grouped under three major headings: