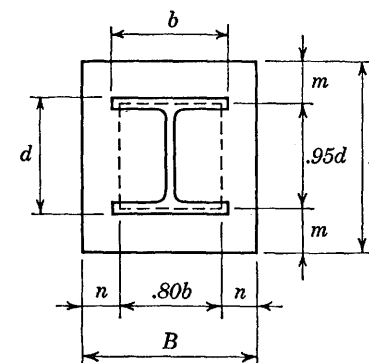


COLUMN BASE PLATES

Design procedure

Steel base plates are generally used under columns for distributing the column loads over a sufficient area of concrete support. The method of design, immediately following, was employed in preparing the tables of column base plate sizes and is recommended for use when a given load and column combination is not covered by the tables.

The following method of design is recommended:



- P = Total column load, kips
 $A = B \times N$ = Area of plate, square inches
 F_b = Allowable bending stress in base plate, ksi
 F_p = Allowable bearing pressure on support, ksi
 f_p = Actual bearing pressure
 f'_c = Compressive strength of concrete, ksi or psi
 t = Thickness of plate, inches

The column load, P , is assumed to be uniformly distributed over the base plate within a rectangle whose dimensions are $.95d$ and $.80b$. The base plate is assumed to distribute this load uniformly to the concrete support. The allowable bearing strength, F_p , of the concrete depends on f'_c and the percent of support area occupied by the base plate. From AISC Specification, Sect. 1.5.5, $F_p = .25f'_c$ when the entire area of a concrete support is covered, and $F_p = .375f'_c$ when only one third of the area is covered.

1. Establish bearing value of concrete, F_p , ksi
2. Determine the required area, $A = P/F_p$
3. Establish B and N , preferably rounded to full inches, so that m and n are approximately equal, and $B \times N \geq A$
4. Determine $m = (N - .95d)/2$ and $n = (B - .80b)/2$
5. Determine actual bearing pressure on concrete, $f_p = P/(B \times N)$
6. Use the larger of the values, m or n , to solve for t by whichever is the applicable formula:

$$t = \sqrt{\frac{3f_p m^2}{F_b}} \quad \text{or} \quad t = \sqrt{\frac{3f_p n^2}{F_b}}$$

EXAMPLE

A W14 \times 95 column ($d = 14.12$; $b = 14.545$) has a reaction of 480 kips, and rests on a base plate fully covering a concrete support. f'_c of the concrete is specified to be 3000 psi at 28 days. Using $F_y = 36.0$ ksi material with $F_b = 27.0$ ksi, (AISC Spec. Sect. 1.5.1.4.3), design a base plate for this column.

$$F_p (\text{allow.}) = .25 \times 3000 \text{ psi} = .750 \text{ ksi} \quad f_p (\text{actual}) = 480 / (25 \times 26) = .738 \text{ ksi}$$

$$A (\text{req.}) = 480 / .750 = 640 \text{ sq. in.}$$

$$\text{Assume } N = 26 \text{ in.; then } B = 640 / 26 = 24.62 \text{ in.; use } 25 \text{ in.}$$

$$m = [26 - (.95 \times 14.12)] / 2 = 6.3 \text{ in.}$$

$$n = [25 - (.80 \times 14.545)] / 2 = 6.7 \text{ in. (use)} \quad \text{Use: Base plate } 25 \times 2 \times 2'-2$$

$$t = \sqrt{(3 \times .738 \times 6.7^2) / 27.0} = 1.92 \text{ in.; use } 2 \text{ in.}$$