DESIGN OF AXIALLY LOADED BASE PLATES

Design Procedure

The method recommended for the design of axially loaded base plates, those assumed to be pinned at the base, is given in the AISC Manual of Steel Construction (AISC 1986, 1989a). The design case is shown in Fig. 2(a). It is assumed that the wide flange column is centered on the plate and that the plate is then centered on the concrete foundation. The AISC method is a two step approach. The required plate area is first determined, based on an assumed uniform allowable bearing stress defined in Section J9 in the AISC Specification (AISC 1989, 1986a). The allowable bearing stress F_p is a function of the concrete strength and the ratio of the concrete to plate areas, as follows:

$$F_p = 0.35 f_c' \sqrt{\frac{A_2}{A_1}} \leq 0.70 f_c'$$

where

f_c' = concrete compressive strength
A_1 = area of the base plate
A_2 = area of the supporting concrete foundation that is geometrically similar to the plate.

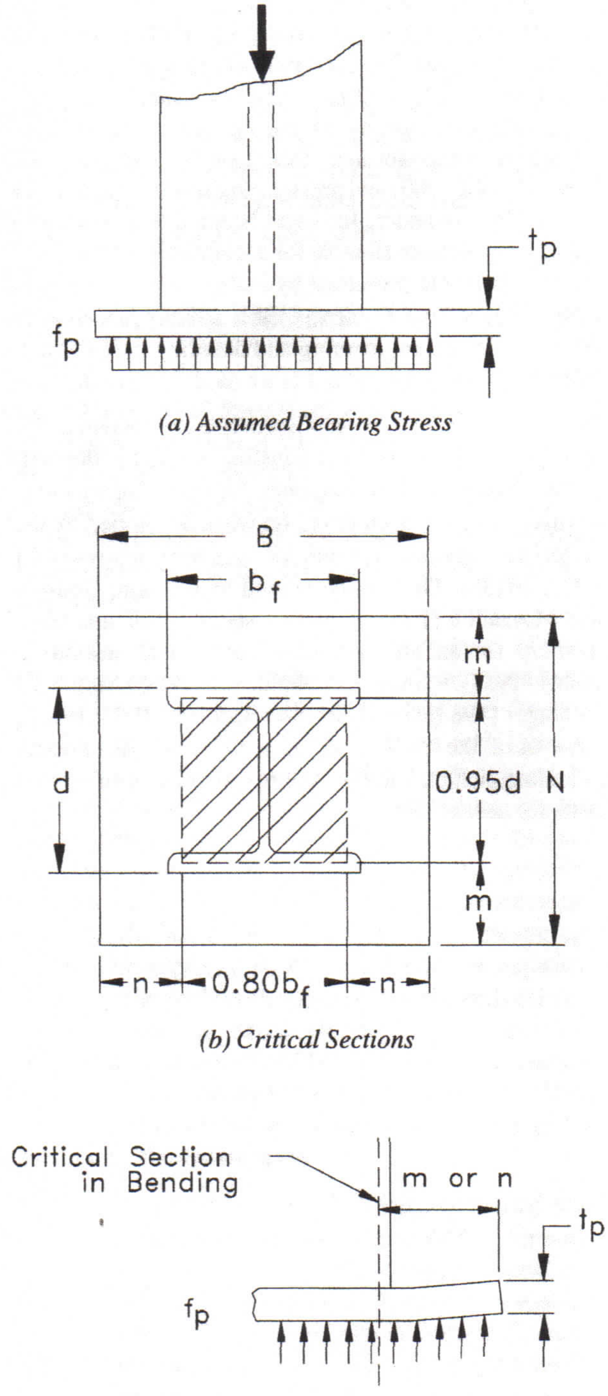
The increase in the allowable bearing stress when the concrete area is greater than the plate area accounts for the beneficial effects of confinement. The highest value then occurs when this ratio is equal to or greater than 4.0, and this results in the smallest plate. The full plate area is used to determine the plan dimensions. The loss of area due to anchor bolt holes, even though oversized, and due to holes used for the placement of grout is normally ignored.

In LRFD format, the factored load on the column P_u should be governed by the following:

$$P_u = \varphi_c P_p = 0.85\, \varphi_c f_c' A_1 \sqrt{\frac{A_2}{A_1}} \leq \varphi_c\, 1.7 f_c' A_1$$

where

φ_c = resistance factor for bearing on concrete, equal to 0.60
P_p = limit state capacity of the concrete in bearing.



(a) Assumed Bearing Stress

(b) Critical Sections

(c) Determination of Moment

Fig. 2. Design of Plate with Axial Load