

By summing the moments about the resulting bolt force and solving as a quadratic function, the following expression can be determined for calculating the bearing distance,  $A$ :

$$A = \frac{f' \pm \sqrt{f'^2 - 4 \left( \frac{f_p B}{6} \right) (PA' + M)}}{\frac{f_p B}{3}}$$

where

$$f' = f_p BN' / 2$$

$$P = P_u \text{ for LRFD, } P_a \text{ for ASD}$$

$$M = M_u \text{ for LRFD, } M_a \text{ for ASD}$$

The resulting tensile force in the anchor rods is then

$$T = \frac{f_p AB}{2} - P$$

where  $T = T_u$  for LRFD,  $T_a$  for ASD, and  $P = P_u$  for LRFD,  $P_a$  for ASD.

The design procedure is as follows:

1. Determine the available bearing strength,  $\phi P_p$  or  $P_p / \Omega$  with

$$P_p = 0.85 f'_c A_1 \sqrt{A_2 / A_1} \leq 1.7 f'_c A_1$$

$$\phi = 0.90 \quad \Omega = 1.67$$

2. Choose trial base plate sizes ( $B$  and  $N$ ) based on geom-

6. Determine the plate thickness based on the required flexural strength per inch of plate:

LRFD	ASD
$t_p = \sqrt{\frac{4M_{upl}}{\phi F_y}}$	$t_p = \sqrt{\frac{4M_{apl}\Omega}{F_y}}$

### B.5 Example: Small Moment Base Plate Design, Triangular Pressure Distribution Approach

Design a base plate for axial dead and live loads equal to 100 and 160 kips, respectively, and moments from the dead and live loads equal to 250 and 400 kip-in., respectively. Bending is about the strong axis for the wide flange column W12×96 with  $d = 12.7$  in. and  $b_f = 12.2$  in. The ratio of the concrete to base plate area is unity;  $F_y$  of the base plate is 36 ksi and  $f'_c$  of the concrete is 4 ksi.

1. Choose trial base plate sizes ( $B$  and  $N$ ) based on geometry of column and 4-anchor requirements.

$$N > d + (2 \times 3.0 \text{ in.}) = 12.7 + 6 = 18.7 \text{ in.}$$

$$B > b_f + (2 \times 3.0 \text{ in.}) = 12.2 + 6 = 18.2 \text{ in.}$$

$$\text{Try } N = 19 \text{ in., } B = 19 \text{ in.}$$

2. Determine plate cantilever dimension,  $m$  or  $n$ , in direction of applied moment.

$$m = \frac{(N - 0.95d)}{2} = \frac{19.0 - 0.95(12.7 \text{ in.})}{2} = 3.47 \text{ in.}$$