# steel quiz

This month's Steel Quiz takes a look at the recommended design procedure for column base plates subjected to axial compression, as covered in Part 14 of the AISC 14th Edition *Steel Construction Manual*.

1 Consider the base plate configuration shown in Figure 1. Match the following four expressions based on Equation 14-7 of the AISC 14th Edition *Steel Construction Manual* with the correct limit states shown in Figure 2 through 5.

$t_{min} = m\sqrt{\frac{2P_u}{0.9F_yBN}}$ checks the flexural strength of the shaded portion of the base plate shown in Figure _____.

$t_{min} = n\sqrt{\frac{2P_u}{0.9F_yBN}}$ checks the flexural strength of the shaded portion of the base plate shown in Figure _____.

$t_{min} = \lambda n'\sqrt{\frac{2P_u}{0.9F_yBN}}$, where $\lambda = 1$, checks the flexural strength of the shaded portion of the base plate shown in Figure _____.

$t_{min} = \lambda n'\sqrt{\frac{2P_u}{0.9F_yBN}}$, where $\lambda < 1$, checks the flexural strength of the shaded portion of the base plate shown in Figure _____.

Figure 1

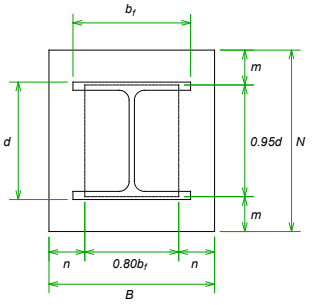



Figure 2

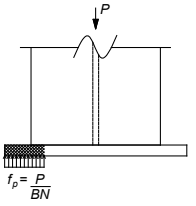



Figure 3

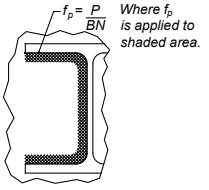



Figure 4

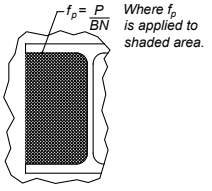
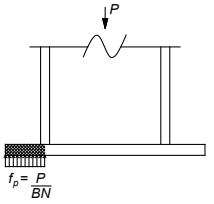



Figure 5




2 True or False: λ used in Equation 14-7 in the AISC 14th Edition *Steel Construction Manual* can always be taken conservatively as 1.

3 True or False: The most economical base plate thickness usually occurs when *m* and *n*, shown in Figure 1, are equal.

4 Derive the formula shown in Equation 14-7a (LRFD) provided in the AISC 14th Edition *Steel Construction Manual* (also shown below).

$$t_{min} = l\sqrt{\frac{2P_u}{0.9F_yBN}} \qquad (14\text{-}7a)$$

TURN PAGE FOR ANSWERS

# steel quiz ANSWERS

1 Figure 5, Figure 2, Figure 4, Figure 3.

2 True. λ helps identify whether a column base plate is lightly loaded or not. If so, the base plate material within the hatched line area shown in Figure 1 can be checked as shown in Figure 3. If λ = 1, then this same area is checked using the approach shown in Figure 4. Conservatively setting λ = 1 means that you are always checking the base plate, even those that would qualify as lightly loaded, using the approach shown in Figure 4, which would yield a conservative base plate thickness relative to the thickness obtained using the approach shown in Figure 3 for lightly loaded columns.

3 True. Setting *m* and *n* equal to one another will generate the same flexural demand on the base plate for the cases shown in Figures 2 and 5.

4 The equation for a cantilevered beam that is uniformly loaded, per unit width, is equal to:

$$M_u = f_p \frac{l^2}{2} = \frac{P_u}{BN} \frac{l^2}{2}$$

The available flexural strength of a plate, per unit width, based on the yielding limit state (see Section F11 in the AISC *Specification*) is:

$$\phi M_n = \phi F_y Z = 0.9 F_y \frac{t^2}{4}$$

Set $M_u = \phi M_n$ and solve for *t*. The resulting value is $t_{min}$.

Steel SolutionsCenter

Everyone is welcome to submit questions and answers for Steel Quiz. If you are interested in submitting one question or an entire quiz, contact AISC's Steel Solutions Center at 866.ASK.AISC or at **solutions@aisc.org**.