steel quiz

This month's Steel Quiz takes a look at how to use Tables 3-22b and 3-22c in the 14th Edition AISC *Manual* to perform a quick analysis for continuous and cantilevered beams.

1 Using Table 3-22c, calculate the maximum positive and negative moments and the maximum shear (LRFD) for each span shown in Figure 1. The beam is continuous, and you should assume 1.2D + 1.6L is the controlling load combination for the loading shown.

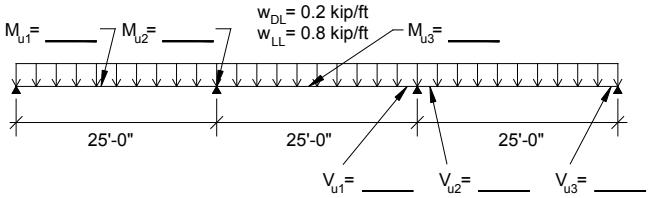

Figure 1

2 Using the maximum required flexural strength from the analysis in question 1, select the lightest size from the following shapes: W14×22, W12×26, W16×31 or W18×35. Assume that C_b = 1.0, that w_{DL} accounts for the self-weight of the beam and that the unbraced length is equal to 12 ft, 6 in.

3 Use Table 3-22b to calculate the maximum positive and negative moments (LRFD) for each span and the reaction shown in Figure 2. The beams on the exterior bays cantilever over the interior supports.

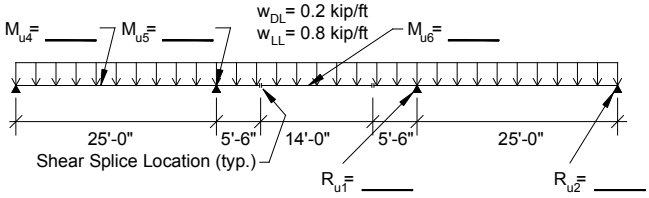

Figure 2

4 Repeat question 2 based on the results from Figure 2 and using the same assumptions.

TURN PAGE FOR ANSWERS

steel quiz ANSWERS

1 The maximum required flexural strength is equal to 95 kip-ft (see calculations and Figure 3 below). To save space, only the maximum load calculation is shown.

$w_u = 1.2(0.20 \text{ kip-ft}) + 1.6(0.8 \text{ kip-ft}) = 1.52 \text{ kip-ft}$

Per the coefficients in Table 3-22c:

$M_{u2} = -0.10(1.52 \text{ kip-ft} \times (25 \text{ ft})^2) = -95.0 \text{ kip-ft}$

$V_{u2} = \frac{6}{10}(1.52 \text{ kip-ft} \times 25 \text{ ft}) = 22.8 \text{ kip}$

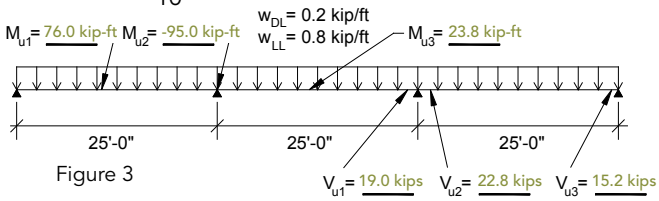

Figure 3

2 Use Table 6-1 in the 14th Edition AISC *Manual* to determine the available strength.

W14×22, $\phi R_n = \phi M_n = 56.1 < 95$ kip-ft (NG)
W12×26, $\phi R_n = \phi M_n = 101 > 95$ kip-ft (OK)

Select a W12×26. Shear check OK by inspection.

3 The maximum required flexural strength is equal to 81.7 kip-ft (see calculations and Figure 4). To save space, only the maximum load calculation is shown.

Per the coefficients in Table 3-22b:

$P = w_u \times L = 1.52 \text{ kip-ft} \times 25 \text{ ft} = 38.0 \text{ kips}$

$M_{u4} = M_{u5} = 0.086 \times PL = 0.086(38.0 \text{ kips} \times 25 \text{ ft}) = 81.7 \text{ kip-ft}$

$R_{u1} = 1.086 \times P = 1.086 \times 38.0 \text{ kips} = 41.3 \text{ kips}$

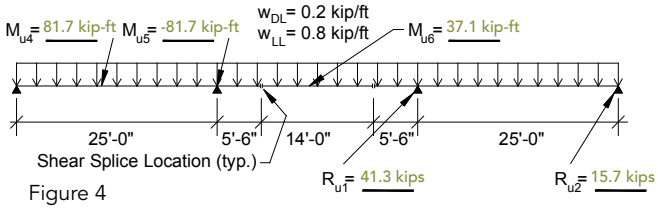

Figure 4

4 Use Table 6-1 in the 14th Edition AISC *Manual* to determine the available strength.

W14×22, $\phi R_n = \phi M_n = 56.1 < 81.7$ kip-ft (NG)
W12×26, $\phi R_n = \phi M_n = 101 > 81.7$ kip-ft (OK)

Select a W12×26. Shear check ok by inspection.