Bin Supports — A Caution to Designers

JAY P. MOORE

Methods of supporting bins are based on factors such as bin geometry, available space, foundation requirements, fabricators' and designers' preferences and the need to support adjacent equipment and structures along with the bin. Support types include columns attached directly to the bin, skirts extending from the bin to the foundation and beam supports. This note calls attention to a combination of support conditions which can lead to overloading.

The bin support framing plan shown in Fig. 1 consists of a combination of four directly loaded columns and four beam supports. This combination needs to be red-flagged because of the alternating rigid and relatively flexible vertical supports. The bin will tend to span directly between the directly attached columns. If the vertical stiffness of the bin wall is great enough, only four supports will be effective, rather than eight, as intended.

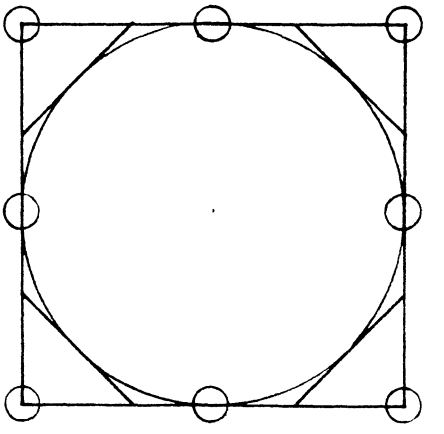

Figure 1

It is convenient to use the straight beam of Fig. 2 to provide an uncomplicated illustration of the principle involved. The beam is rigidly supported at A and C, and spring-supported at B. The deflection at B is equal to the deflection due to the uniform load w minus the deflection due to the upward reaction R_B and is also equal to $K R_B$ where K is the spring constant at B.

$$\frac{5wL^4}{384EI} - \frac{R_B L^3}{48EI} = KR_B \qquad (1)$$

Solving Eq. 1 for R_B yields

$$R_B = \frac{5wL^4}{(384EIK + 8L^3)} \qquad (2)$$

Equation 2 indicates R_B decreases as I increases. The reactions at rigid supports A and C will increase accordingly.

Considering the large vertical stiffness associated with bins it is to be expected that in the case of support systems as shown in Fig. 1, the rigid supports will receive most, if not all, of the load. Combinations of rigid and flexible bin supports should be avoided.

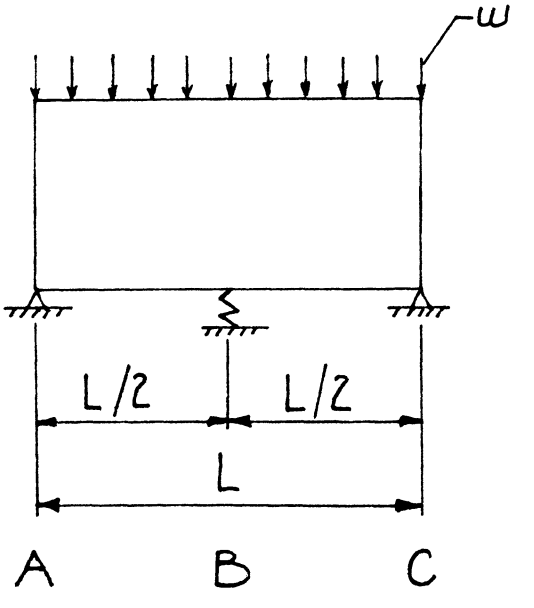

Figure 2

Jay P. Moore is a Consulting Engineer in Conifer, Colorado.