1.054/1.541 Mechanics and Design of Concrete Structures (3-0-9)

Homework #4

Assigned: Thursday, April 8, 2004   **Due:** Thursday, April 15, 2004

Shear and Torsion

Introduction

Architectural and clearance requirements call for the use of a transfer girder (shown in Fig. 1) spanning 28 ft between supporting column faces. The girder carries a concentrated load of 25 kips at midspan, applied with eccentricity of 25 in. from the girder centerline (considering load factors and including girder self weight). Dimensions of the member are $x = 10$ in., $y = 22$ in., $x_1 = 6$ in., $y_1 = 17$ in., and $d = 19$ in. Assuming supporting columns provide full torsional rigidity. Flexural rigidity at the ends of the span may also be assumed to develop 40 percent of the maximum moment that would be obtained if the girder were simply supported. Material strengths are

Concrete

Uniaxial compressive strength: $f_c' = 5000$ psi;
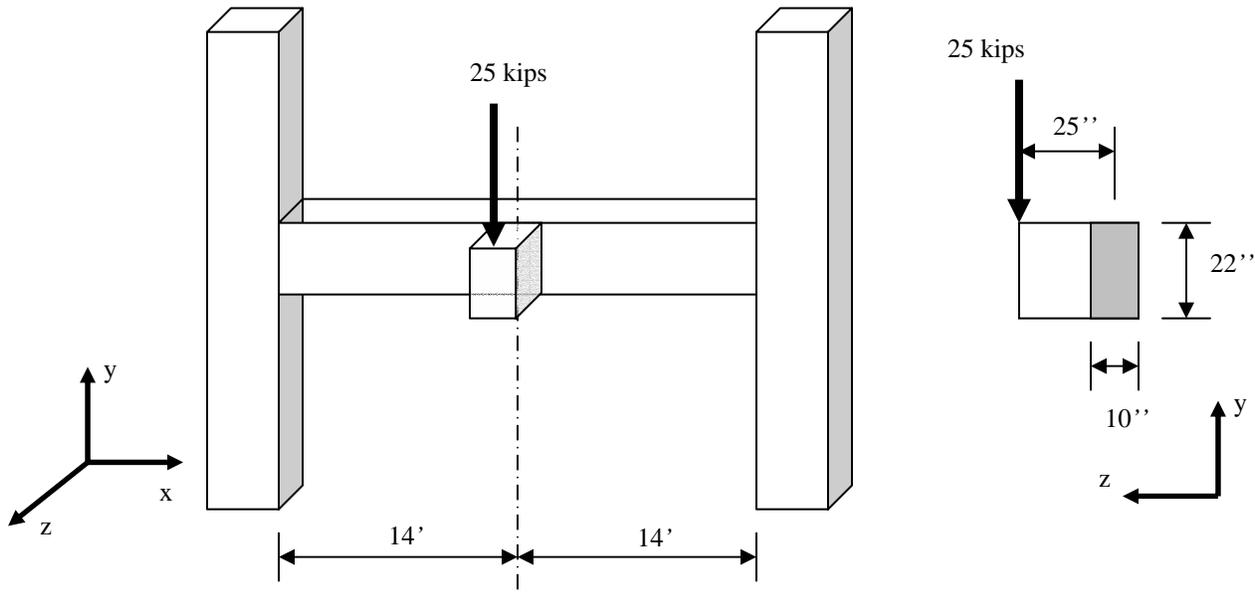
Steel

Yield stress: $f_y = 40$ ksi;

Figure 1. Transfer girder and its dimensions

Question

Design both transverse and longitudinal steel for the girder.