

1.051 Structural Engineering Design

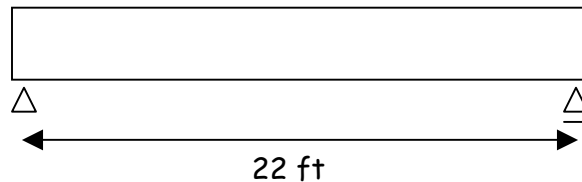
Problem Set 3

(Assigned: 10/15; Due: 10/22)

Shear in beams

1. A simply supported beam has a clear span $l_n = 22$ ft and is subjected to an external uniform service dead load $w_D = 1200$ lb/ft (including own weight) and live load $w_L = 900$ lb/ft. Determine the maximum factored vertical shear V_u at the critical section. Given:

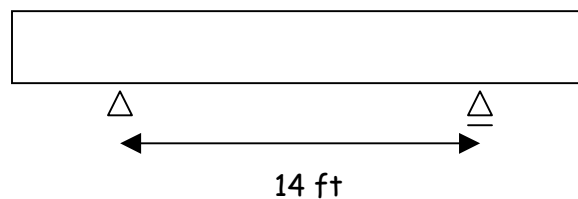
$$\begin{aligned} b_w &= 12 \text{ in.} \\ d &= 17 \text{ in.} \\ h &= 20 \text{ in.} \\ A_s &= 6.0 \text{ in}^2 \\ f'_c &= 4000 \text{ psi} \\ f_y &= 60,000 \text{ psi} \end{aligned}$$



Design the size and spacing of the shear reinforcement.

- (a) Using the approximate value of V_c given by Eq. 4.12b in the textbook
 - (b) Using the more accurate value of V_c given by Eq. 4.12a in the textbook
- Assume no torsion exists.

2. For the beam in question 1, assume that the following support configuration is adopted in order to decrease the shear and moment in the section,



Redesign the shear reinforcement using both approximate and accurate values of V_c and discuss the effects of changing support configuration for both procedures. Assume $A_s' = A_s$.

Bond and Anchorage

3. Solve Problem 5.1 in the textbook.