

The diagram shows a trapezoidal dam cross-section with a total width of 2.75 m at the base. The upstream face is on the left, and the downstream face is on the right. The water level is indicated by a horizontal line at the top left. The dam is divided into three vertical sections: I (right), II (middle), and III (left). The horizontal dimensions are 0.5 m for section III, 1 m for section II, and 0.15 m for section I. The vertical dimensions are 550 mm for the top width and 400 mm for the bottom width. The water level is 6.8 m above the base. The internal force distributions are shown as follows:

- Section III: A vertical line with a value of 462 kN at the top and a value of 0.25 + 6.55 at the base. A dashed line indicates a value of 130 mm.
- Section II: A vertical line with a value of 712 kN at the top and a value of 270 mm at the base. A dashed line indicates a value of 130 mm.
- Section I: A vertical line with a value of 327.6 kN at the top and a value of 0.15 m at the base.

 The total width of the dam is 2.75 m. The water level is 6.8 m above the base. The internal force distributions are shown as follows:

$$\phi V_c = \phi 0.17 \sqrt{f'_c} b_w d = 0.75 \times 6.7 \times \sqrt{28} \times 400 \times 550 = 148426.6 \text{ N} = 148.4 \text{ kN}$$

$$\phi N_k = 148.4 \text{ kN} \quad \frac{\phi V_k}{2} = 74.2 \text{ kN} \rightarrow x_1 = 0.45 \text{ m}$$

Region II: max spacing

$$V_s = \frac{V_{\text{out}} - V_L}{\phi} = 239 \text{ kN}$$

$$2V_c = 0.33 \sqrt{f'_c} b_w d = 384.2 \text{ kN} > V_s$$

4V_k

$S_{\max} = \min \left\{ \frac{A_{ufy}}{a = 62 \sqrt{f_k} b_w}, \frac{A_{ufy}}{0.35 b_w} \right\}$

$d/2$

600

275

426 mm

$$S_{\max} = 275 \text{ mm}$$

$$\therefore A_{ul} f_{yd} = 0.75 \times 142 \times 420 \times 550 = 98.4 \text{ kN}$$

$$\phi V_{s(max)} = \frac{\phi A_v f_y d}{S_{max}} = \frac{0.75 \times 142 \times 420 \times 550}{275} = 98.4 \text{ kN}$$

$$\phi V_{n} = \phi V_{s(max)} + \phi V_c = 98.4 + 148.4 = \underline{246.8 \text{ kN}}$$

$$X_2 = 1 \text{ m}$$

Region III:

$$S = \frac{A_v f_y d}{V_s} = 137.24 \text{ mm} \sim 130 \text{ mm}$$

$$V_s = \frac{V_{ud} - \phi V_c}{\phi} = \frac{239 \text{ kN}}{1} = 239 \text{ kN}$$

$$\# \text{ stirrups} = 2 \left(\frac{X_1}{0.13} + \frac{X_2}{0.27} + 1 \right) = 18 \text{ stirrups}$$



