

ESTIMATION OF A RETAINING WALL

1. Retaining wall.

A retaining wall is a structure designed and constructed to resist the lateral pressure of soil. Generally used to protect embankment of roads, hills etc.

2. Types of Retaining wall.

- a. Gravity
- b. Cantilever
- c. Sheet piling
- d. Anchored
- e. Counterfort



Figure 1: Typical Retaining wall

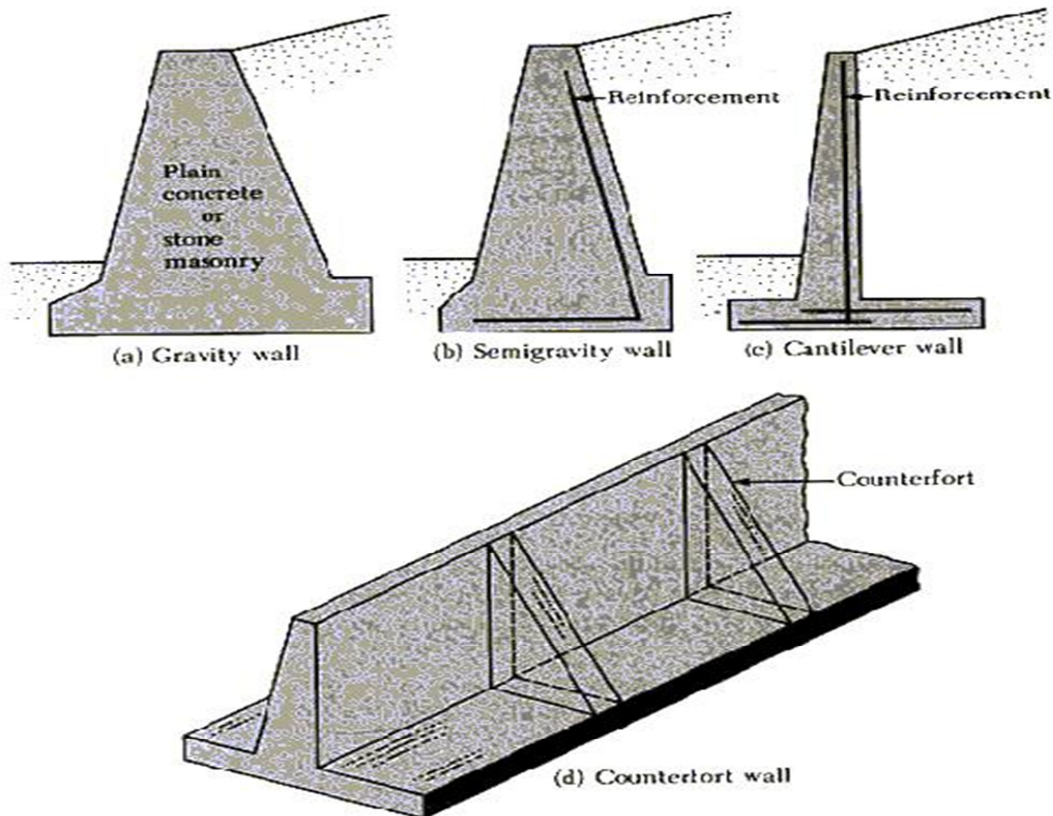


Figure 2: Different Types of Retaining Wall

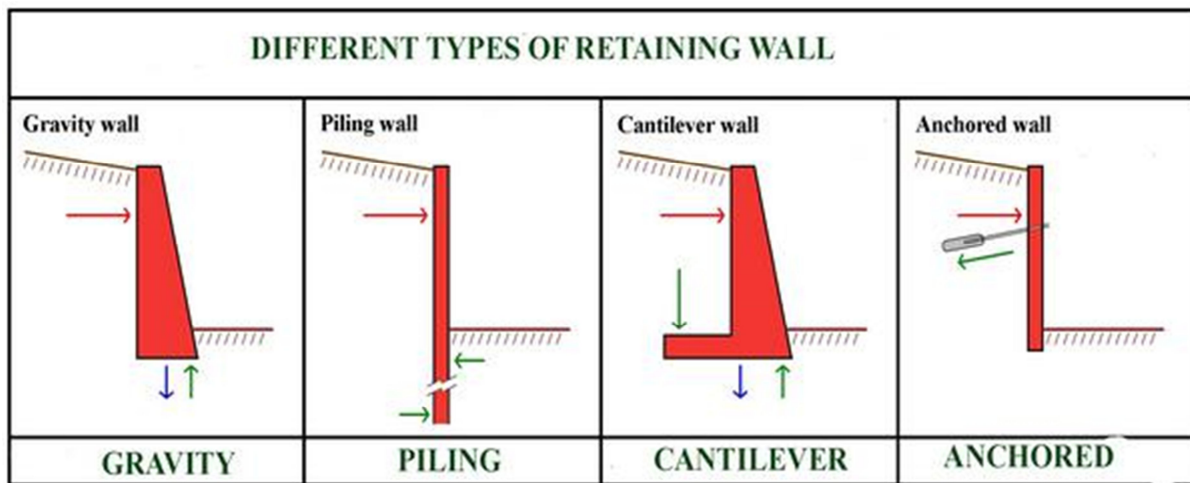


Figure 3: Different Types of Retaining Wall

3. Components of a typical RCC retaining wall.

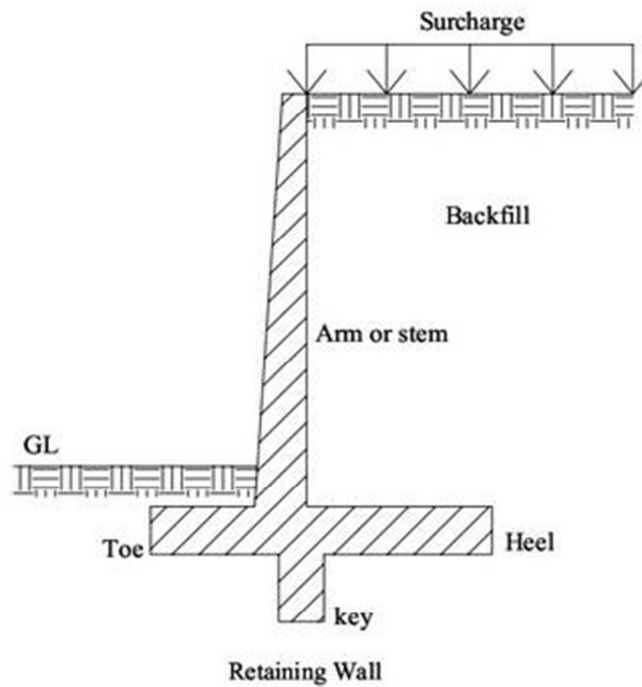


Figure 4: Components of a Typical Cantilever Retaining Wall

4. Worked Out Problem.

Calculate the quantity of the materials required for the construction of the following retaining wall.

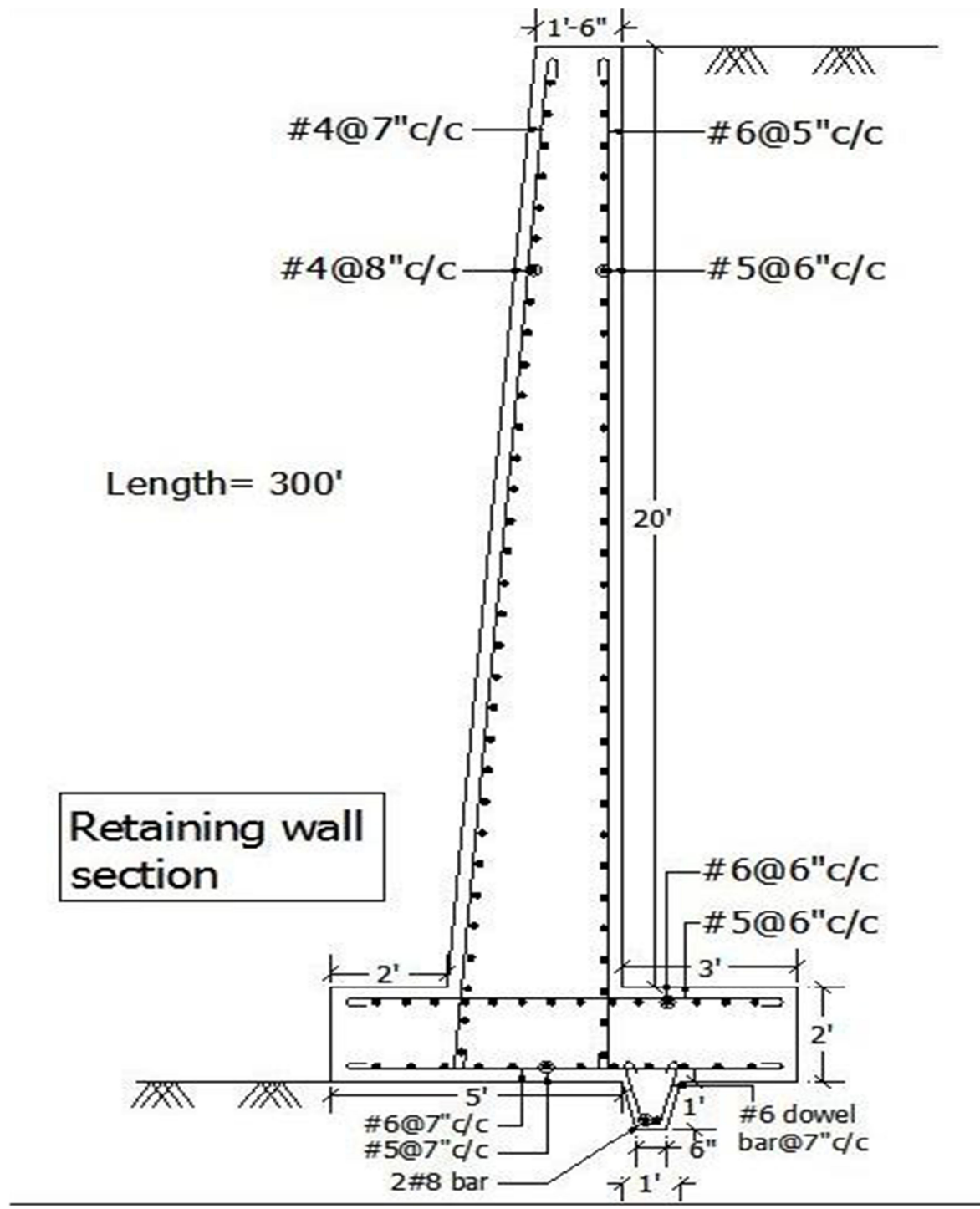


Figure 5: Section of a Retaining Wall

Length of wall = 300 ft

Cover for all sides = 3 in

Estimation of concrete (1:2:4)

$$\text{Volume of wall} = \frac{1}{2} \times (1.5' + 3') \times 20' \times 300' = 13500 \text{ cft}$$

$$\text{Volume of base} = 8' \times 2' \times 300' = 4800 \text{ cft}$$

$$\text{Volume of key} = \frac{1}{2} \times (0.5' + 1') \times 1' \times 300' = 225 \text{ cft}$$

$$\text{Total volume of concrete} = 18525 \text{ cft}$$

$$\text{Total volume of wet concrete} = 1.5 \times 18525 = 27787.5 \text{ cft}$$

Table 1: Summary of Materials

Materials	Volume (cft)	Quantity
Cement	$\frac{1 \times 27787.5}{7} = 3969.6$	3176 bags
Fine Aggregate(sand)	$\frac{2 \times 27787.5}{7} = 7939.3$	7939.3 cft
Coarse Aggregate (brick chips)	$\frac{4 \times 27787.5}{7} = 15875.6$	450 Nos.

Estimation of Reinforcement

a. Reinforcement in wall

Inside vertical reinforcement (# 6 @ 5" c/c)

$$= \left(\frac{300' \times 12 - 3'' - 3''}{5''} + 1 \right) \times (20' \times 12 + 2' \times 12 - 3'' - 3'' + 2 \times 9.5 \times \frac{6}{8} ") / 12 = 16330.5 \text{ f}$$

Outside vertical reinforcement (# 4 @ 7" c/c)

From figure

$$\frac{20.05'}{20'} = \frac{21.75}{21.8'} \Rightarrow L = 21.8'$$

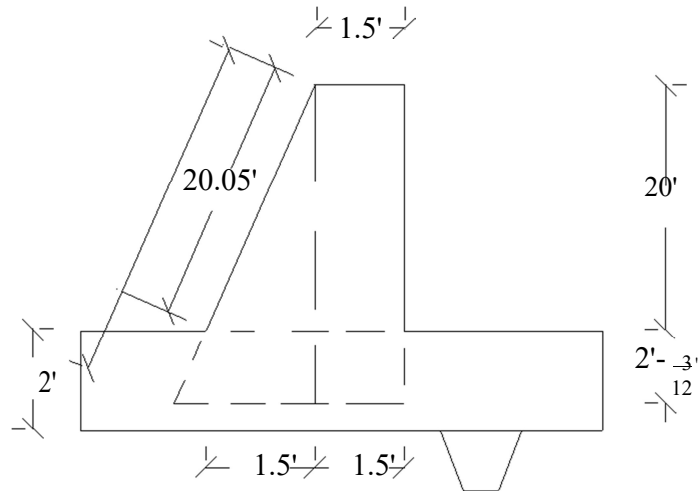


Figure 6: Calculation of Inclined Length of Outside Vertical Reinforcement

$$= \left(\frac{300' \times 12 - 3'' - 3''}{7''} + 1 \right) \times (21.8' \times 12 - 3'' + 2 \times 9.5 \times \frac{4}{8} ") / 12 = 11493.2 \text{ ft}$$

Inside horizontal reinforcement (# 5 @ 6" c/c)

$$= \left(\frac{22' \times 12 - 3'' - 3''}{6''} + 1 \right) \times (300' \times 12 - 3'' - 3'' + 2 \times 9.5 \times \frac{5}{8} ") / 12 = 13221.5 \text{ ft}$$

Outside horizontal reinforcement (# 4 @ 8" c/c)

$$= \left(\frac{21.8' \times 12 - 3''}{8''} + 1 \right) \times (300' \times 12 - 3'' - 3'' + 2 \times 9.5 \times \frac{4}{8} ") / 12 = 10007.2 \text{ ft}$$

b. Reinforcement in base

Along length of wall (Top) (# 6 @ 6" c/c)

$$= \left(\frac{8' \times 12 - 3'' - 3''}{6''} + 1 \right) \times (300' \times 12 - 3'' - 3'' + 2 \times 9.5 \times \frac{6}{8} ") / 12 = 4811 \text{ ft}$$

Along length of wall (Bottom) (# 5 @ 7"c/c)

$$= \left(\frac{8' \times 12 - 3'' - 3''}{7''} + 1 \right) \times (300' \times 12 - 3'' - 3'' + 2 \times 9.5 \times \frac{5}{8} ") / 12 = 4163.9 \text{ ft}$$

Along width of wall (Top) (# 5 @ 6"c/c)

$$= \left(\frac{300' \times 12 - 3'' - 3''}{6''} + 1 \right) \times (8' \times 12 - 3'' - 3'' + 2 \times 9.5 \times \frac{5}{8} ") / 12 = 5093.8 \text{ ft}$$

Along width of wall (Bottom) (# 6 @ 7"c/c)

$$= \left(\frac{300' \times 12 - 3'' - 3''}{7''} + 1 \right) \times (8' \times 12 - 3'' - 3'' + 2 \times 9.5 \times \frac{6}{8} ") / 12 = 4469.1 \text{ ft}$$

c. **Reinforcement in key**

From figure

$$\frac{3}{12} = \frac{X}{15} \Rightarrow X = 3.75''$$

Along length of wall (2#8 bar)

$$= 2 \times (300' \times 12 - 3'' - 3'' + 2 \times 9.5 \times \frac{8}{8} ") / 12 = 602.2 \text{ ft}$$

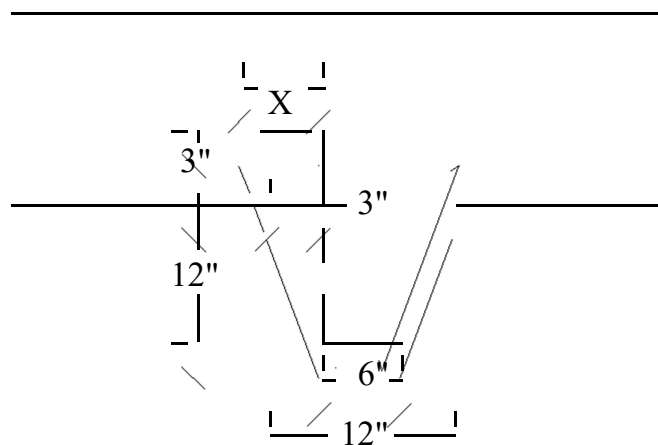


Figure 4-7: Reinforcement in Key

Dowel bar (# 6 @ 7"c/c)

$$= 2 \times \left(\frac{300' \times 12 - 3'' - 3''}{7''} + 1 \right) \times (\sqrt{(15^2 + 3.75^2)} - 3'' + 2 \times 9.5 \times \frac{6}{8} ") / 12 = 2290.2 \text{ ft}$$

Table 2: Calculation of Weight of Reinforcement

Bar	Total length (ft)	Weight/ length (lb/ft)	Weight (lb)
#4 bar	11493.2 + 10007.2 = 21501	0.668	14363
#5 bar	13221.5 + 4163.9 + 5093.8 = 22480	1.043	23447
#6 bar	16330.5 + 4811 + 4469.1 + 2290.2 = 27901	1.502	41908
#8 bar	603	2.670	1611