

# What are Retaining Walls?

## Worksheet

Retaining walls are structures designed to resist earth pressure and maintain a stable slope. Common types include gravity walls, cantilever walls, and sheet-pile walls, each suited to different heights and soil conditions.

## Questions

1. Lateral earth pressure increases with depth as:

- A)  $h$  (linear)
- B)  $h$  (quadratic)
- C)  $h$  (square root)
- D)  $1/h$  (inverse)

2. Active earth pressure (Rankine)  $K_a$  for  $\phi=40^\circ$ :

- A) 0.25
- B) 0.33
- C) 0.42
- D) 0.50

3. Heel in a cantilever wall serves to:

- A) Reduce construction cost
- B) Increase wall height
- C) Resist overturning moment via soil weight
- D) Improve drainage

4. Maximum practical height for gravity wall:

- A) 2 m
- B) 4 m
- C) 6 m
- D) 8 m

5. A gravity retaining wall 4 m high holds cohesionless soil ( $\phi=35^\circ$ ,  $c=18$  kN/m). Estimate lateral pressure at base.

6. Compare 3 m gravity wall vs. 6 m cantilever wall. Why not make a 6 m gravity wall?

7. A wall with heel and toe (cantilever). Heel 2 m, toe 1 m. Why heel longer?

8. Define: What is a retaining wall?

9. Define: Gravity walls vs. cantilever walls?

10. Define: Main forces on a retaining wall?

## Answer Key

1. B)  $h$  (quadratic) -  $P_h = 0.5 h K_a$ . Pressure is triangular; resultant is quadratic in  $h$ .
2. A)  $0.25 - K_a = (1 \sin 40) / (1 + \sin 40)$  0.217 0.22, closest is 0.25.
3. C) Resist overturning moment via soil weight - Soil weight on heel creates a stabilizing moment that opposes overturning from lateral pressure.
4. B) 4 m - Gravity walls become uneconomical  $>4-5$  m due to massive base width needed; cantilever is better.
5. Lateral pressure (Rankine):  $P_h = 0.5 h K_a$   $K_a = (1 \sin ) / (1 + \sin ) = (1 \sin 35) / (1 + \sin 35)$  0.27  $P_h$  0.5 18 16 0.27 39 kN/m (per linear meter)
6. Gravity wall cost volume  $h$  (thick base needed) Cantilever is slender: cost  $h$  (more efficient) At 6 m, cantilever is cheaper; gravity becomes impractical (too heavy)
7. Moment about toe from lateral pressure (right) + wall weight (right) = destabilizing Heel extends back, and soil weight on heel balances overturning moment Longer heel = larger resisting moment from soil weight
8. A structure built to support soil on a slope and resist lateral earth pressure, preventing slope failure.
9. Gravity: thick, self-weight resists pressure, 4 m high. Cantilever: slender, reinforced, 4-8 m high, more efficient.
10. Lateral earth pressure (destabilizing), wall weight (stabilizing), friction at base (stabilizing).

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