

Types of retaining walls

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Retaining wall: is a structure designed and constructed to resist the lateral pressure of soil, when there is a desired change in ground elevation that exceeds the angle of repose of the soil. Retaining walls are used for supporting soil laterally so that it can be retained at different levels on the two sides. Retaining walls are structures designed to restrain soil to a slope that it would not naturally keep to (typically a steep, near-vertical or vertical slope). They are used to bound soils between two different elevations often in areas of terrain possessing undesirable slopes or in areas where the landscape needs to be shaped severely and engineered for more specific purposes like hillside farming or roadway overpasses.



Retaining wall design consideration

Retaining walls are vertical or near-vertical structures designed to retain material on one side, preventing it from collapsing or slipping or preventing erosion. They provide support to terrain where the soil's angle of repose is exceeded and it would otherwise collapse into a more natural form. The principal characteristic of a retaining wall is being able to withstand the pressure exerted by the retained material, which is usually soil.

The most important consideration in proper design and installation of retaining walls is to recognize and counteract the tendency of the retained material to move downslope due to gravity. This creates lateral earth pressure behind the wall which depends on the angle of internal friction (ϕ) and the cohesive strength (c) of the retained material, as well as the direction and magnitude of movement the retaining structure undergoes.

Lateral earth pressures are zero at the top of the wall and – in homogenous ground – increase proportionally to a maximum value at the lowest depth. Earth pressures will push the wall forward or overturn it if not properly addressed. Also, any groundwater behind the wall that is not dissipated by a drainage system causes hydrostatic pressure on the wall. The total pressure or thrust may be assumed to act at one-third from the lowest depth for lengthwise stretches of uniform height.

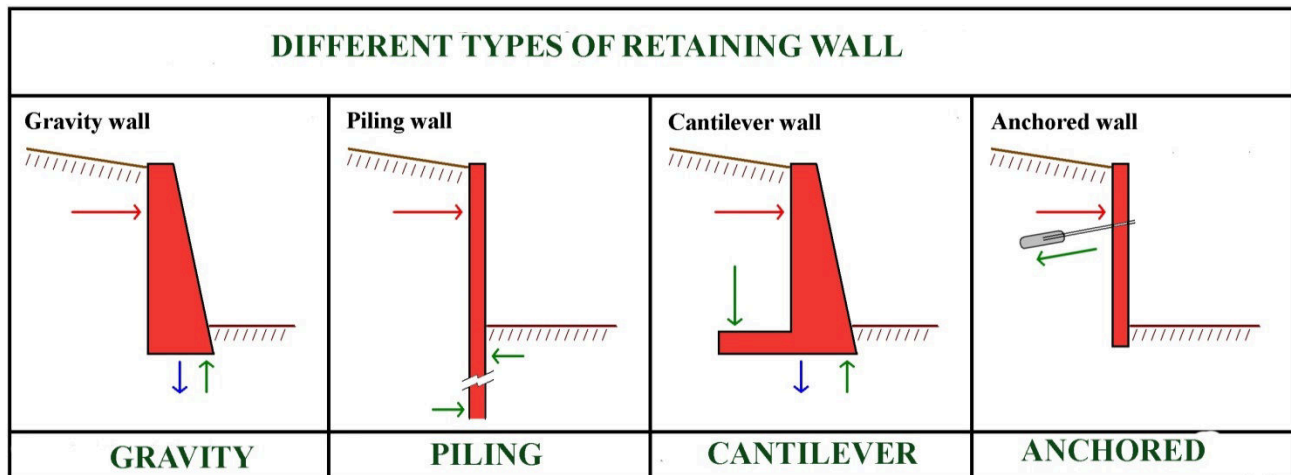
It is important to have proper drainage behind the wall in order to limit the pressure to the wall's design value. Drainage materials will reduce or eliminate the hydrostatic pressure and improve the stability of the material behind the wall. Drystone retaining walls are normally self-draining. As an example, the International Building Code requires retaining walls to be designed to ensure stability against overturning, sliding, excessive foundation pressure and water uplift; and that they be designed for a safety factor of 1.5 against lateral sliding and overturning.



On site of retaining wall construction

Types of retaining walls

There are several types of retaining walls, some of the popular ones are discussed below.



Gravity wall

Gravity walls depend on their mass (stone, concrete or other heavy material) to resist pressure from behind and may have a 'batter' setback to improve stability by leaning back toward the retained soil. For short landscaping walls, they are often made from mortarless stone or segment concrete units (masonry units). Dry-stacked gravity walls are somewhat flexible and do not require a rigid footing. Today, taller retaining walls are increasingly built as composite gravity walls such as: geosynthetics such as geocell cellular confinement earth retention or with precast facing; gabions (stacked steel wire baskets filled with rocks); crib walls (cells built up log cabin style from [precast concrete](#) or timber and filled with granular material).



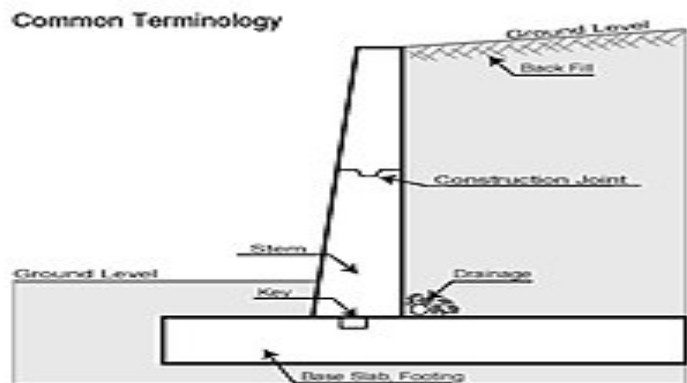
Reinforced Retaining Wall

Reinforced concrete and reinforced masonry walls on spread foundations are gravity structures in which the stability against overturning is provided by the weight of the wall and reinforcement bars in the wall. The following are the main types of wall:



Concrete Cantilever retaining wall

A cantilever retaining wall is one that consists of a wall which is connected to foundation. A cantilevered wall holds back a significant amount of soil, so it must be well engineered. They are the most common type used as retaining walls. The Cantilevered wall rests on a slab foundation. This slab foundation is also loaded by back-fill and thus the weight of the back-fill and surcharge also stabilizes the wall against overturning and sliding.



Counter-fort / Buttressed retaining wall

Counterfort walls are cantilever walls strengthened with counter forts monolithic with the back of the wall slab and base slab. The counter-forts act as tension stiffeners and connect the wall slab and the base to reduce the bending and shearing stresses. To reduce the bending moments in vertical walls of great height, counterforts are used, spaced at distances from each other equal to or slightly larger than one-half of the height. Counter forts are used for high walls with heights greater than 8 to 12 m.



Cantilevered wall

Cantilevered retaining walls are made from an internal stem of steel-reinforced, cast-in-place concrete or mortared masonry (often in the shape of an inverted T). These walls cantilever loads (like a beam) to a large, structural footing, converting horizontal pressures from behind the wall to vertical pressures on the ground below. Sometimes cantilevered walls are buttressed on the front, or include a counterfort on the back, to improve their strength resisting high loads. Buttresses are short wing walls at right angles to the main trend of the wall. These walls require rigid concrete footings below seasonal frost depth. This type of wall uses much less material than a traditional gravity wall.



Reinforced Soil Retaining Wall

Mechanically stabilized earth walls are those structures which are made using steel or **GeoTextiles** soil reinforcements which are placed in layers within a controlled granular fill. Reinforced soils can also be used as retaining walls, if they are built as an integral part of the design and to act as an alternative to the use of reinforced concrete or other solutions on the grounds of economy or as a result of the ground conditions.



Soil nailed wall

Constructing a soil nailed wall involves reinforcing the soil as work progresses in the area being excavated by the introduction of bars which essentially work in tension, called Passive Bars. These are usually parallel to one another and slightly inclined downward. These bars can also work partially in bending and in shear. The skin friction between the soil and the nails puts the nails in tension.



Soil nailing wall

Soil nailing may be a technique that will not reinforce and strengthen existing ground. It consists of putting in closely spaced bars into a slope or excavation as construction income from the highest down. Soil nailing is an efficient and economical methodology of constructing a wall for excavation support, support of hill cuts, bridge abutments, and high ways in which. This method is effective in cohesive soil, broken rock, sedimentary rock or fixed face conditions. This kind of wall to Stabilization of railroad and road cut slopes and excavation retentive structures in urban areas for high-rise building and underground facilities. It is conjointly useful in tunnel portals in steep and unstable stratified slopes. The development and retrofitting of bridge abutments with advanced boundaries involving wall support underneath heaped-up foundations.



Anchored wall

An anchored retaining wall can be constructed in any of the aforementioned styles but also includes additional strength using cables or other stays anchored in the rock or soil behind it. Usually driven into the material with boring, anchors are then expanded at the end of the cable, either by mechanical means or often by injecting pressurized concrete, which expands to form a bulb in the soil. Technically complex, this method is very useful where high loads are expected, or where the wall itself has to be slender and would otherwise be too weak.



Sheet Piled wall

Piling is earth retention and excavation support technique that retains soil, victimization sheet sections with interlocking edges. Pile acts as a temporary certificate wall that has been driven into a slope or excavation to support the soft soils collapse from higher ground to lower ground. It provides high resistance to driving stresses and helps to lightweight. Sheet piles will be reused on many comes and long service life above or below water with modest protection. Simple to adapt the pile length by either attachment or bolting and joints square measure less apt to deform throughout driving.



Pile wall (secant piles, tangent piles)

These walls square measure shaped by the intersection of individual concrete piles. These piles square measure designed by victimization lubricator and augering. The secant piles overlap by concerning three inches. Another is that the tangent pile walls, wherever the piles do not have any overlap. These piles square measure made flush with one another. The important advantage of secant and tangent walls is that the exaggerated alignment flexibility. The walls conjointly might have exaggerated stiffness, and therefore the construction method is a smaller amount abuzz. Among the disadvantages square measure that waterproofing is troublesome to get at the joints, their higher price, which vertical tolerances square measure arduous to attain for the deeper piles.



Berliner wall (soldier pile)

This kind of wall was proverbial to Roman military engineers and was used for deep excavations. It is a comparatively cheap system, simple and quick to construct. It is primarily restricted to temporary construction, and can't be employed in high formation conditions while not in-depth dewatering and expense. It is not as stiff as different styles of retentive walls.



Bored pile wall

Bored pile retaining walls are built by assembling a sequence of bored piles, preceded by excavating away the excess soil. Depending on the project, the bored pile retaining wall may include a series of earth anchors, reinforcing beams, soil improvement operations and shotcrete reinforcement layer. This construction technique tends to be employed in scenarios where sheet piling is a valid construction solution, but where the vibration or noise levels generated by a pile driver are not acceptable.



Mechanical stabilisation wall

Mechanically stabilised earth (MSE) walls are walls that can tolerate some differential movement. The wall face is infilled with granular soil whilst retaining the backfill soil. The advantage of MSE walls is the ease of construction, as they do not require formwork or curing. The use of soil nailing in MSE walls, involves introducing slender steel reinforcing bars to the soil, placed parallel to one another on a slight incline and grouted into place. Anchored earth walls



Crib wall

Where timber, steel or concrete cages or boxes are interlocking, this may be described as a crib wall.



Green retaining walls

Green retaining walls can be used to retain more gentle slopes. A geocellular structure such as a series of 'honeycomb' cells can be embedded into the surface of the slope to stabilise it, and the individual cells can then be planted.



Gabion meshes *Main article: [Gabion](#)*

This type of soil strengthening, often also used without an outside wall, consists of [wire mesh](#) "boxes", which are filled with roughly cut stone or other material. The mesh cages reduce some internal movement and forces, and also reduce erosive forces. Gabion walls are free-draining retaining structures and as such are often built in locations where ground water is present. However, management and control of the ground water in and around all retaining walls is important.



Conclusion

The main uses of retaining walls are to help prevent soil erosion, create usable beds out of steep terrain and to provide decorative or functional landscaping features. They may be independent structures, or may be part of a wider construction work, such as a building. Planning permission is required if the wall is to be over 1-metre high and next to a road or pathway; or over 2-metres high elsewhere. Independent, freestanding retaining walls may not require building regulation approval; however, any structures must be structurally sound and well maintained.

References

*Google search

*Image Source: vikonprecast.com.au, reconwalls.com, islandblock.com.au, equipment4all.blogspot.com, aarsleff.co.uk, martellopiling.com, acro-btp.fr, oil-nailing.com, volkergroundengineering.co.uk, reinforcedearth.com, retainingsolutions.com.au, igmbag.com, acp-concrete.co.uk, pinnacleddesignbuild.com, designingbuildings.co.uk, structville.com, sobindustry.shikunbinui.com