Objective
In this lecture we will learn about different types of retaining walls, their advantages and disadvantages and how they are designed.

Introduction
In the previous lecture we learned about lateral earth pressures. These are the horizontal soil stresses that are applied to retaining walls and must be calculated to design retaining walls.

We will learn about the three most common types of retaining wall. Their design basically involves calculating the earth pressures acting on the wall and checking that it will not fail due to these earth pressures in the ways shown below.

Gravity wall
This is the most simple retaining wall. It can be made from concrete or masonry (anything heavy and hard-wearing). Its stability comes from its weight (hence the name gravity wall). They are suitable for wall heights up to about 5m.

A sub-type of gravity wall is the reinforced concrete cantilever wall – usually some sort of 'L' or 'U' shape – where the stabilising weight comes from the weight of soil on the 'heel' of the wall. The vertical 'stem' of the wall acts like a cantilever structure to support the lateral earth pressure on the back of the wall. They are suitable for walls up to about 6m high.

Advantages:
1) Cheap and simple to build – no specialised equipment is needed for construction.
2) The reinforced concrete wall takes up little space.
3) The gravity wall can look attractive if built from natural stone.

Disadvantages:
1) Limited height.
2) Space needed behind wall for construction and backfilling.
3) Not suitable for soft soils due bearing failure.
4) The reinforced concrete wall is prone to sliding failure – often requires key and propping.

Reinforced soil walls
These walls are composed of vertical (usually concrete) facing panels attached to metal or plastic reinforcement (in the form of strips) in the soil behind the wall. Lateral earth pressures in the soil try to push the facing panels forward but any movement is resisted by the reinforcement. The reinforcement is anchored by friction between the soil and the reinforcement and the weight of soil. Some movement of the wall is necessary in order to mobilise tension and resistance in the reinforcement, so these types of walls are OK for applications where some wall movement can be accommodated. They are often used in highway embankments where a vertical slope is needed, e.g. at a grade-separated junction. There is no theoretical restriction on the height of these walls.
Failure modes of reinforced soil walls

![Failure modes](image)

Embedded cantilever walls

Embedded cantilever walls also support lateral earth pressures by acting as cantilever structures. But instead of fixity for the cantilever coming from a rigid base, it comes from the passive lateral earth pressure in front of the wall.

They are quick to install and can be installed in difficult site conditions, such as on soft ground or under water. They are installed in flat ground before excavation in front of the wall. They require special equipment for installation which can make them expensive. However, when prop or anchor supports are provided, there is theoretically no limit to the height of embedded cantilever walls. (Props are external structural supports to a wall and anchors are installed in the soil behind the wall).

The walls can be constructed of driven steel sheet piles, reinforced concrete bored piles or reinforced concrete diaphragm walls.

Prop or anchor support required for walls higher than about 6m (depending on soil).

Embedded cantilever wall

Advantages:

i) Narrow walls which take up little space.

ii) Can be installed up to the site boundary with little or no space required behind the wall for construction – this is particularly advantageous in built-up areas.

iii) Installed quickly and early in construction and wall can form both temporary and permanent support to excavation.

iv) No restriction on height of wall.

v) Can be installed in weak ground.

Disadvantages:

i) Expensive option (for short walls).

ii) Specialised skills and equipment are required for their installation.

Failure modes of embedded cantilever walls

![Failure modes](image)