Earthworks

Each construction project has a specific earthwork which classified to two types:

1. Excavations
2. Earth filling

The objective of earthworks is to reach the required level as shown in the drawings. This level is required to start latter item such as foundations, floors, sewer…etc.

1. Excavations:

Excavation works include foundations, basements, trenches…etc.

Excavation down by hand or mechanically or both together depend on many factors such as soil conditions, shape of cut section, ground water and time required to complete the job.

1.1 Hand excavation:

It’s done by using simple tools. This type of excavation can be used for small job such as continuous wall foundation, isolated foundation, short trenches, and shallow combined foundation and also to complete the excavation done mechanically to reach the proper level.

Hand excavations don’t used with rock soil. The soil carted away to a tip. If the soil is inert it could be spread over low levels on the site, while the big quantities carry out of the site. During excavation, a path of 70-100cm wide between sides of pits and removal soil must be left to allow the concrete works to be easy done.

Sides of trenches and pits are important to be stable to keep the workers and concrete safe and these depend on:

a. Type of soil
b. Water ground and its movement
c. Deep of excavation
d. Loads

In loose, wet or sandy soils, the sides of trenches sometimes may be supported by open timbering, close-boarded timbering or sheeting as shown in Fig. 2-1.
Fig. 2-1 Timbering to trench

For the high cost of timber in Iraq and it’s difficult to be reused for several times and it’s hard maintained, prefer to replace timber by vertical sheeting. The supports used for narrow trench and excavation only, while for wide excavation, open cut method shall be used because it’s more economic, although it needs more quantity of refill.

1.2 Mechanical excavation:
This type of excavation used for big quantity and when all soil carries away from the site and when the time plays important role to complete the job.

A popular machine is the industrial tractor with shovel, backacter or blade attachment. This can deal with most earthmoving operations on site and bucket sizes can be changed at will. Care must be taken not to over-excavate as the earth will have to be replaced with weak concrete.

Removal of ground water:
The control of ground water during excavation is essential in some sites. An indication of the way this should be done can often be gained from the site investigation report on trial pits. The popular methods are:
a. Direct remove:
It’s the cheaper one and done by making trenches at lowest level of excavated pits and their sides and leave the water to accumulate by slopes away from the pits.

b. Pumping remove:
The method of pumping and discharge must be considered carefully, because continuous pumping from an excavation could cause settlement to adjoining buildings. Also, some authorities will not permit muddy water to be discharged direct into their road gullies. However on open sites the problem is not serious.
Ground water normally lowered by pumping from open sumps within the excavation, the sumps being sheet-piled or close-timbered. They should be deep enough to drain the excavation. It is important that they be cleaned and dredged regularly so that they do not clog. Some form of filter may have to be provided to prevent excessive mud and grit from being sucked up. This normally takes the form of a strainer at the end of suction pipe.

c. Well points system remove:
For heavy work this system is used. It consists of group of metal pipe with 40mm diameter and about 4.5m length around the site with filter and valve at the end. These pipes pilled vertically at the required depth. All pipes joining together with horizontal pipe ended with lift and force diaphragm pump which suck the water to the system and pump it away. This system has the following facilities:
1. Ability to use more than one cycle of pipe discharge around the excavated area to control the water removes.
2. Ability to locate the space between the pipes and their depth.
3. Ability to lower the water within the excavation.
4. This system is very expensive compare with other methods.
5. This system prefers to be used in sandy soil and never used in rock soil.

2. Earth filling:
All buildings need refilling to refill for example sides of foundations, trenches and floor to reach proper level. This involves demolition, if any, the removal of rubbish and waste to 15cm depth of topsoil to reach the good and clean soil. All filling shall be deposited in layers, not exceeding 20 cm. loose depths. In the general, the contractor shall mix fertilizer into the top layer and then sow the grass seed and lightly compact. For landscaping and planting only grass plants, bushes and trees which are known to thrive in the soil and climatic conditions of the site are to be used. The planting is to be carried out in well prepared ground, watering,
rolling, racking, fertilizing, protection, etc.. is to be carried out where necessary to ensure that the landscaping scheme is successful. For roads yards and parking areas, all filling up to underside of the Sub-base shall be of a material suitable for rolling compaction and have as low capillary pressure as possible. Filling shall be in layers not exceeding 20cm. If the work is of lesser extent lighter rollers may be permitted if the thickness of the layers is brought down. All timbering and rubbish shall be removed from the excavation prior to back filling and no soft clay or mud will be permitted as filling. Backfilling shall not commence without the approval of the Engineer. Backfilling shall generally consist of excavated material excluding upper layers of top soil. Back-fill shall be placed and compacted in 0.20m. Horizontal layers to achieve a proper field dry density. Mechanical tamping may be necessary to achieve the required density but no extra will be paid to the contractor on this account. Material for refilling around buildings and other zones may consist of excavated material but no rubbish material to be permitted. Refilling for ground floor slabs shall be compacted. Material which is either classified as unsuitable or not required shall be used as directly by the engineer or where shown on drawings.

Reference:
1. انشاء المباني – آرتين ليفون – زهير ساكو
2. Construction Technology, Level Two Part 1, by R.L.Fullerton