

MASS CONCRETE UNDERPINNING

DESCRIPTION

The mass concrete (or 'traditional') method of underpinning is an established technique, suitable for relatively shallow depths of underpinning. The method is often used for partial underpinning of sections of a building. This is probably the most common form of underpinning undertaken for residential properties. The method can be used in cohesive or granular soils, but is widely used in shrinkable clays. It can be used to prevent movement due to subsidence and heave, and is often used to assist in retro-fit basement construction.

TECHNIQUE

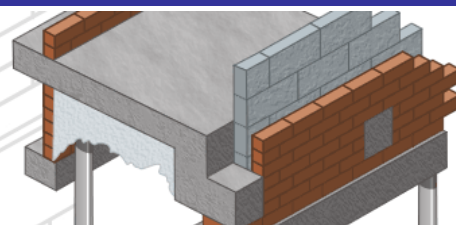
The technique involves the construction of a new foundation beneath a failing section of a building by extending the existing footings down to a greater depth where stable soil of suitable bearing capacity exists. This is achieved by excavating individual bases in short lengths (usually not exceeding 1200mm) in a pre-determined sequence to a designed depth in a suitable stratum. The depth of the bases may vary depending upon the profile of the stratum selected. Once each base is excavated to the appropriate depth, and before concreting, supervisory staff and local authority officers inspect the excavation to check that the correct stratum has been reached and that the ground is free from soft spots, tree roots etc. Once the excavation has been approved, shutters are set in position and the base is backfilled with concrete of a specified mix. The concrete is usually cast to leave a narrow gap between the top of the base and the underside of the footing. When the concrete has cured sufficiently to reduce initial shrinkage and to support the applied load, a sand and cement 'dry-pack' is rammed into this gap to transfer the building load to the new foundation. Alternatively under some circumstances, the concrete may be flooded up to the underside of the existing footing and well vibrated to ensure that any trapped air pockets are removed.

Base construction is repeated sequentially until the whole length of wall where underpinning is required has been supported. Bases will generally be linked together using 'joggle' joints to provide a key between adjacent bases. Reinforcement cages can be introduced using couplers to provide continuity between the bases. When specifying reinforcement for underpinning bases, it is important to consider the health and safety implications for the operatives. Anti-heave precautions consisting of polythene sheeting and/or low density polystyrene are usually installed when underpinning is constructed in shrinkable clay.

ADVANTAGES AND DISADVANTAGES

The main advantages of mass concrete underpinning are:

- Bases are usually constructed from one side of a wall only, and it is therefore often possible to construct all underpinning from outside without disturbing the inside of the building and possibly necessitating a building to be vacated.
- Soil conditions can be examined at close quarters, tested for strength using hand penetrometers or vane testers, and the presence of tree roots or soft spots easily identified.
- The method is not technically complex and operatives can be relatively easily trained to achieve competence.
- Excavations can often be undertaken using minimal amounts of plant and machinery.
- Acts as a root barrier which may help prevent damage to other parts of the building.



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- It can be designed to act as a retaining structure to assist in retro-fit basement construction.
- By increasing the base width, it is possible to reduce imposed stresses by spreading the load in weak soil

Disadvantages of this system include:

- There are large amounts of excavated material to be disposed of.
- There are large amounts of concrete to be imported to construct the bases.
- Excavations and bases are difficult to construct in unstable or water-logged ground.
- Base depths in excess of 3.0 metres are generally uneconomic and create a number of health and safety issues.
- Mass concrete underpinning generally requires good site access due to the amount of spoil to be removed and concrete imported. If access is difficult, the technique is more difficult and may prove costly.

HEALTH AND SAFETY

Briefly, the main health and safety considerations are:

- The locations of services must be clearly identified prior to excavations being undertaken, and they should be exposed by hand digging and suitably marked and supported or diverted as necessary.
- The stability of the existing structure should be assessed prior to excavations being undertaken and any necessary propping or preliminary repairs carried out to ensure stability during construction of the underpinning.
- Excavations must be properly shored and strutted during construction in a manner suitable to the prevailing soil conditions.
- The stability of the existing footings should be assessed once they are exposed as old clinker or brick spreader footings can often be unstable once they are undermined.
- The presence of contaminated soil or water must be considered both prior to commencement and during construction should unexpected soil conditions be encountered.
- As excavations will be open during the construction of the underpinning, the working area must be properly isolated during working hours and excavations properly covered outside working hours to prevent access by others.

For detailed Health and Safety information, see ASUCplus 'Guidelines on safe and efficient underpinning and mini-piling operations'

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