



PILED RAFT UNDERPINNING

DESCRIPTION

Piled raft underpinning is a well established technique generally used for whole houses or buildings. It can deal with deep seated foundation problems and the technique is suitable for dealing with both subsidence and heave.

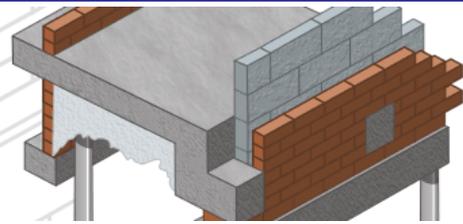
This system of underpinning can deal with all ground types ie. cohesive or granular, and can carry the loads of the building through significant thicknesses of unsuitable material, such as backfilled tips, to a suitable bearing strata at a greater depth.

TECHNIQUE

The technique involves the construction of a designed piled reinforced concrete slab extending into or under the existing walls/ footings to provide a replacement foundation. Initial works involve reducing levels sufficiently within the property to allow space for the new structural raft construction, any necessary anti-heave requirements and the reinstatement of floor finishes above. Piles appropriate to the prevailing ground conditions are installed internally using specialist mini piling equipment. In some cases, it may be necessary, in order to support a particularly heavy structural element on an external wall eg. a large chimney, to install some piles outside the building and to extend the raft slab to bear on these.

Once the piles are installed, it is necessary to ensure the stability of the internal and external walls of the building while the reinforced concrete raft slab is constructed. There are many ways of achieving this depending upon whether or not anti-heave precautions are required and the usual methods of working of individual contractors. Generally speaking, if no anti-heave precautions are required then it is often possible to support the walls on individual reinforced concrete nibs protruding from the main raft slab installed in pockets broken out in the walls. Factors such as very heavy wall loadings or the condition of the existing wall may result in a decision being made to construct the raft slab continuously beneath the walls in which case appropriate temporary propping works will be required. A requirement for anti heave precautions will mean that the anti-heave void must be continuous and uninterrupted for the entire extent of the raft slab. This will either mean bridging between isolated needles and providing a gap beneath the bridging elements or completely removing any temporary props to ensure that there is no possibility for any upward movement of the underlying clay being transmitted to the building ie. that this movement takes place within the anti-heave void. The appropriate size of the anti-heave void should be determined from adequate site investigation information which would also be required for the purpose of correct pile selection and economic pile design.

The final transfer of the load of the building onto the new raft slab is achieved either by dry packing or flooding the new raft concrete up beneath the existing walls or footings. The exact details of this load transfer will be dependent upon such factors as the condition of the existing brickwork walls, the levels of existing footings, external ground and finished floor levels. Clearly this load transfer process cannot take place until the reinforced concrete raft slab has gained adequate strength. In the case of an anti-heave scheme involving continuous slab edge and temporary propping, this will result in there being an appropriate hold period on site between the concreting of the slab and the subsequent removal of the temporary props.



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Depending upon the size and condition of the property, the requirements for anti-heave precautions and the particular method of temporary support chosen, the raft slab may be completed in a number of separate concrete pours. The decision as to the number of pours and the location of the construction joints is a matter of judgment and experience and must take into account the amount of concrete which can be properly placed in the time available, the need to ensure that an excessively large proportion of a property is not supported on temporary props at any one time, access considerations and, at certain times of the year, the weather. It goes without saying that the whole of a detached building should not be supported on temporary props at any one time.

ADVANTAGES AND DISADVANTAGES

The main advantages of piled raft underpinning are:

- Once a decision has been made to underpin the whole of a building piled raft underpinning is generally a cost effective solution.
- As the whole building is constructed on one continuous concrete slab the building is effectively tied together horizontally at ground level.
- The technique provides a new suspended structural floor slab throughout the property as an integral part of the scheme.
- The technique can deal with very deep seated ground problems.
- A piled raft is particularly good at providing comprehensive anti-heave precautions throughout the property.
- The use of a piled raft means that any requirement to relocate piles as a result of unforeseen ground or construction details can usually be easily accommodated.

The main disadvantages of the system are:

- Major internal strip out and enabling works are required which almost always renders the property uninhabitable.
- Unusually bad access conditions will make it very difficult to gain access for the necessary plant and equipment.
- If part of a structure only is to be underpinned ie. one of a terrace of houses it is difficult to engineer transition zones from underpinned to non-underpinned parts of the structure.

HEALTH AND SAFETY

- The works inevitably require the use of relatively complex piling equipment in restricted spaces.
- Significant parts of the subject building are likely to be supported on temporary props or to have their original level of support significantly reduced during the course of the works. This requires proper engineering consideration and the exercise of considerable expertise and experience on the part of the operatives on site.
- Considerable amounts of surplus materials of various sorts are often generated during the reduced level excavation and piling for the raft slab construction, all of which must be removed from site in a safe manner.



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- Access conditions can be particularly difficult, invariably using existing doorways. On occasions access may require craneage/hoisting of piling equipment and the use of hoists and conveyors to remove surplus material all of which will need proper planning, risk assessments and method statements.
- Significant excavations and piling within existing inhabited properties are always likely to encounter services. All appropriate desk studies, enquiries from facilities providers and both invasive and non-invasive investigations on site must be carried out to identify existing services. Services must be either disconnected by the appropriate authorities or qualified tradesmen or risk assessments and method statements must be drawn up to clearly mark, protect and work around existing services as appropriate. Permits To Dig should be obtained from main contractors.
- Notwithstanding the apparent adequacy of site investigation information there is always the possibility of encountering either unforeseen ground conditions or structural details within the subject building. Work must stop in these circumstances while properly engineered solutions are developed.

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

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