

## BEAM AND BASE UNDERPINNING

### DESCRIPTION

Beam and base underpinning is a designed system of underpinning combining the simplicity of excavated (or 'traditional') techniques with the introduction of beams spanning between discrete bases. Generally used to partially underpin failing structures, the technique can be applied to entire buildings when appropriate to do so. This system is suitable in situations where the structure loads are not particularly high and large a quantity of excavating work is not acceptable.

### TECHNIQUE

Beam and base underpinning involves the design and installation of a replacement foundation system extending the building loads down onto competent bearing strata or through desiccated ground. Initial design involves a load assessment of the area of the building to be underpinned and of the ground conditions. Individual bases will be designed to carry the building loads imposed directly and via the beams. The size of each base will then be determined taking into account the load and the bearing capacity of the ground at varying depths to give the most economical solution, ie plan size against depth of excavation.

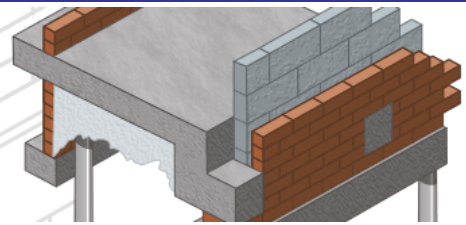
The initial construction involves the excavation of bases at specified positions. Upon completion of the excavation, the base dimensions and the founding strata will be checked to confirm compliance with the design. Where required, the sides of the base will be lined with an anti-heave material such as claymaster. The open side(s) of the base will be shuttered and the base will be concreted using a specified mix. The concrete will be placed and compacted to a level allowing the installation of the beams.

The beams can be cut into the walls, installed below or replace the existing footings. Temporary support jacks are positioned systematically as the wall or footing is cut out or excavated below. The spacing of the jacks will often be determined by the condition of the structure but will generally be no more than 1m. When ground or foundations conditions dictate, the jacks will be placed on concrete padstones to provide the necessary temporary support. The underside of the wall/ footing will be cleaned of any unstable or weak masonry or soils. When required, an appropriate anti-heave material will be placed at the rear and to the soffit of the beam. The reinforcement cage will be fabricated in-situ around the jacks and fixed with spacer blocks to ensure that the specified cover is maintained. Shuttering will be placed to construct the beam to the correct size and secured to prevent movement during concreting. The concrete will be placed and compacted to ensure homogeneity and full connection with the reinforcement. Where the concrete is to be 'flooded' up to the wall or footing, air pockets will be provided at the rear of the wall/ footing and the shuttering will be sufficiently high to allow a 'head' of concrete. If flooding is not appropriate or possible, a sand-cement 'dry-pack' mix will be rammed into the gap between the underside of the structure and the top of the beam. This will only take place once the concrete has cured sufficiently. Where anti-heave measures have been specified, the connection between the ground and the jacks is removed. It is essential that all of the jack supports are removed and that continuity of anti-heave protection is provided.

As an alternative to reinforced concrete beams, consideration could be given to reinforcing the existing brickwork to become the structural member between the bases.

### ADVANTAGES AND DISADVANTAGES

The main advantages of beam and base underpinning are:



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- This is an efficient alternative system to deep excavated underpinning.
- The load bearing bases can be positioned and designed to best suit the loading conditions of the structure.
- Using a smaller number of bases, the volumes of spoil and concrete will be reduced.
- Schemes can be designed to avoid services.
- The installation of beams will reduce the impact on existing root systems and will minimise potential disruption to ground water.
- Reduces the volume of deep access excavations on structures with deep footings.
- The ground conditions can be visually checked and the bearing capacity of the founding strata can be tested in-situ.
- Can be used for sites where space, local or environmental constraints prevent piling being a viable option.
- For external walls, the underpinning can be constructed from the outside, minimising disruption to the occupants and reducing the need to vacate the property.

Disadvantages of this system include:-

- Although less than for excavated underpinning, there can still be large volumes of spoil and concrete to be moved from and to the site. This can cause problems if access is difficult or there are long barrow runs involved.
- Excavations and bases can be difficult to construct in unstable or water bearing ground.
- Base depths in excess of 3m can create health and safety issues.
- Poor quality or unstable brickwork requires experienced operatives to ensure that damage to the building is avoided.

### 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.



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- 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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