Introduction

This section provides guidance on meeting the performance requirements for raft foundations. For the purposes of Warranty, a raft foundation may be defined as a reinforced concrete slab, whose thickness and stiffness are designed to spread the applied wall and column loads over a large area and reduce differential settlement gradients.

3.3.1 Compliance

Raft foundations shall meet the performance requirements of this section.

3.3.2 Information to be provided

The Designer shall provide sufficient design details to demonstrate it meets the requirements of this section. This may include:

A full set of design drawings, calculations and specifications should be made available to the Warranty provider and all other interested parties prior to the associated works starting on site. This may include:

1. Phase 1 Desk Study Report and Phase 2 Geotechnical Site Investigation Reports including site-specific recommendations for raft foundations (and allowable bearing pressures) to ensure long term settlement does not exceed 25mm or 1/500 (differential).
2. Structural drawings:
    a. GA and RC drawings, including a drawing register sheet.
    b. Details of internal and external thickening to cater for loadings and the effects of frost.
    c. Details of any insulation beneath the raft.
3. Structural calculations:
    a. Demonstrating that the ground bearing pressure does not exceed the allowable value specified in the Site investigation report. Localised areas of higher bearing pressures (e.g. beneath load-bearing walls, thickening or point loads) should be considered.
    b. Demonstrating that the raft (i.e. the thickening, slab and beams) can span a 3.0 metre ‘soft spot’ and cantilever 1.5 metres.
    c. Demonstrating the adequacy of any insulation beneath the raft (in relation to loadings, creep and groundwater). The insulation must have an appropriate third party product conformity certificate and compressive creep must be limited to a maximum 2% reduction for a 50/60 year period.
4. Plans and details of the proposed raft showing reinforcing positions and a bar schedule, to be used by the reinforcing steel supplier and installer.
5. Confirmation that all made ground and organic matter beneath the foundation has been or shall be removed/replaced with appropriate material, or treated.
6. Details of engineered granular fill below the raft (including its depth and lateral extent, ensuring a 45º spread from the edge), along with its compaction specification, testing and Geotechnical Engineer’s validation. Where Manual for Highway Works (MHW) specification for engineered granular fill is indicated, details shall conform with MHW Volume 1 Series 600 Earthworks Cl:610 ‘Fill to Structures’.
7. Calculations demonstrating how the depth of granular fill has been determined to cater for the effects of heave and shrinkage (if shrinkable soils are present).
8. Details of any ground treatment (e.g. vibro treatment, cement-lime stabilisation etc.).

Please note: if there are queries with regard to anything not covered or it is intended to deviate from the above guidance, then please contact the Warranty surveyor for agreement prior to commencement. Following acceptance of the proposals, please refer back to the Warranty surveyor if anything is subsequently discovered on site, which affects the design and/or construction of the raft.

The Warranty surveyor, at their discretion, may also request supporting information that demonstrates suitability for use of any materials or systems contained within the above.

3.3.3 Materials

All materials shall be suitable for their intended purpose.

Concrete

Concrete should be of a suitable mix design to achieve the required strength, and resistance to chemical and frost attack. For further guidance, please refer to ‘Appendix C - Materials, Products, and Building Systems’ section.

Bricks and blocks below ground

The selected bricks should be appropriately durable against saturation. For further guidance, please refer to ‘Appendix C - Materials, Products, and Building Systems’ section.

If there are sulphates in the ground and/or there is ground water present, confirmation by the manufacturer that the brick or block is suitable for use below ground should be provided.

3.3.4 Ground conditions

The site specific ground conditions shall be taken into account for the raft foundation design.

Raft foundations are usually designed for sites with variable ground conditions with low ground bearing capacities. It is therefore important to complete a suitable Site Investigation to meet the requirements of the 'Ground Conditions' section and ascertain the bearing capacity and suitability of the ground.

Heave and shrinkage

Rafts are not considered an accepted method of foundations where the ground conditions are susceptible to heave or shrinkage (e.g. where trees are present or have been removed) unless appropriate measures have been taken to mitigate the effects of heave or shrinkage. For further clarification, please refer to the 'Foundations - Trees and Clay' section.

3.3.5 Structural design

The raft foundation shall be appropriately designed to safely transfer loads from the superstructure to the ground without causing excessive long term total and differential settlement.

Structural calculations should be provided by an Engineer, confirming that the raft design is suitable for bearing onto the ground and that the ground bearing capacity safely supports the structure and it will limit long term total and differential settlements to acceptable levels.

The raft foundations shall be designed to clearly demonstrate that the rafts, insulation and any treated ground are capable of supporting and transferring the foundation design loads safely to known soil strata that are, in turn, capable of supporting the loads, using the appropriate soil properties obtained from geotechnical testing and contained in the appropriate Site Investigation report.

Settlement

The rafts shall be designed in accordance with BS 8004:2015 and shall ensure that long term settlement does not exceed 25mm or 1:500 (differential), unless more stringent criteria are required by the Engineer.

Allowance for movement joints

Where required by the Engineer, movement joints should be provided and constructed in accordance with the design using appropriate materials.

3.3.6 Damp prevention

Damp proof courses and damp proof membranes incorporated in the raft design shall be suitable for their intended purpose and be provided to prevent moisture rising or entering the home.

The raft foundation and the junction with the wall should be appropriately constructed to resist ground moisture penetration.

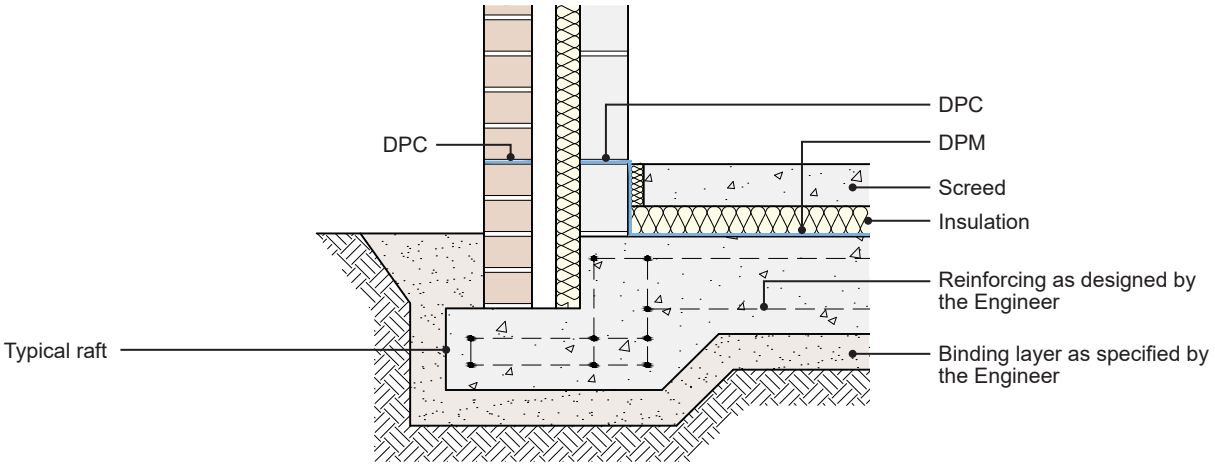
A DPM should be provided beneath all ground-supported slabs or cast in-situ reinforced slabs. DPM's should be linked to the DPC and be a minimum 1200g polythene. Other DPM's may be considered if they have an appropriate third party product conformity certificate and are installed in accordance with the manufacturer's instructions.

A DPM can be placed beneath the raft, wrapped around the external toe and lapped into the internal DPC. However, this detail can be difficult to implement on-site, and puncturing of the membrane can commonly occur when placing reinforcing. The preferred method is to place the DPM on top of the raft slab beneath the floor insulation or screed.

Prior to concreting, any water or debris that may have collected on top of the DPM should be removed.

DPM should be continuous where floors are stepped, a waterproof specialist must select an approved waterproof membrane to meet the requirements of BS 8120 to provide a continuous barrier that is compatible with the floor DPM/DPC.

Typical damp proof membrane linked with damp proof course



Cavity trays

For guidance on cavity trays, please refer to the 'External Walls' section.

3.3.7 Thermal insulation products below the structural raft

Thermal insulation shall be specified to be:

- Suitable for the intended purpose.
- Avoid damp and interstitial condensation.
- Demonstrate the insulation is structurally adequate to be used under the raft.

Where thermal insulation products are used below the structural raft they should:

- Meet the requirements of BS EN 1606 Thermal insulation products for building applications.
- Meet BS EN 13163 (for EPS insulation).
- Meet BS EN 13164 (for XPS insulation).
- The Engineer should ensure that the design limits 'compressive creep' to a maximum 2% reduction for a 50/60 year period.
- The insulation product must have a third party product conformity certificate for use below a structural raft foundation (including below external walls).

3.3.8 Ducts and sleeving

Any service penetrations that pass through the raft shall be appropriately designed in respect to:

- Structural integrity of the raft being maintained.
- Prevention of damp entering the building.
- Preventing thermal loss.
- Prevent the entry of any hazardous substances.

The specification of service penetrations through a raft slab should be appropriately designed by to maintain the integrity of the raft.

Any service penetrations that pass through the raft should be appropriately sleeved to protect the service duct. Service duct positions should be planned and indicated on drawings to prevent reinforcing bars from being cut, unless the structural design has catered for this.

Reference documents

- BS EN 1997-1 - Eurocode 7: Geotechnical design (EC7)
- BS 8004 - Code of practice for foundations and Eurocode
- BS EN 1997-2 - Ground investigation and testing
- BS 5930 - Code of practice for ground investigations
- Manual for Highway Works Volume 1 Series 600 Earthworks