Building Approval - Foundations

Foundations to meet Swale's soil conditions

Introduction

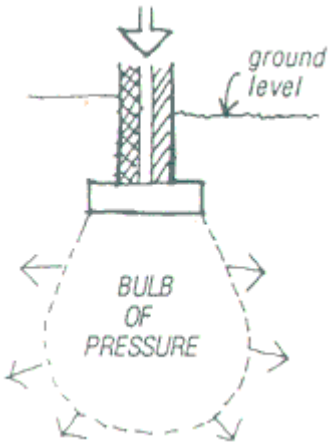
The information contained in this leaflet has been simplified to provide easy reference and guidance primarily for domestic works.

It does not give a definitive interpretation of Building regulations, and you are advised to consult with professionals before submitting plans.

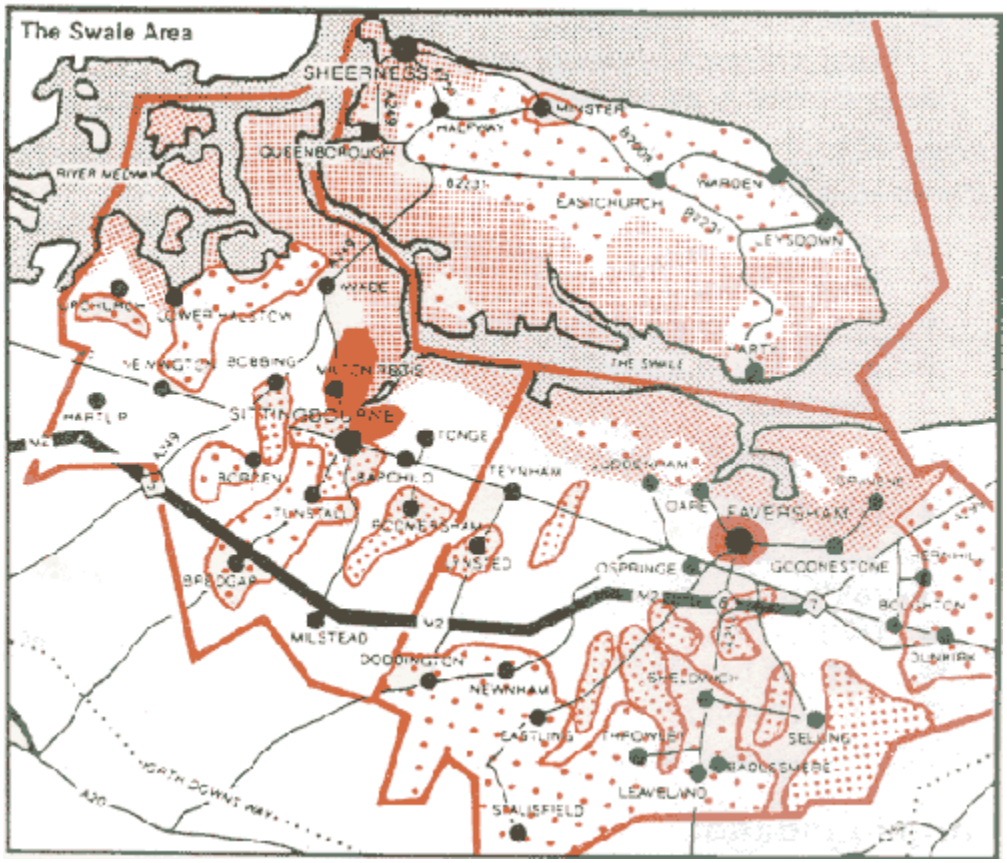
All building materials and products used should conform to the appropriate British Standards or hold a current Certificate issued by the British Board of Agrement (BBA) or European equivalent.

Why Provide Foundations?

Foundations are the part of the building which is in direct contact with the ground. They transmit to the soil all the load from the building in such a way that settlement is limited and failure of the underlying soil is avoided



Ground Conditions in Swale



Clay
Clay with Flints

Alluvium

Chalk

Sands
Head Brickearth
Gravels

Likelihood of filled ground

Inspection by Local Authority

Before any foundations are concreted, it is necessary to notify your local Building Services office for an inspection of he excavation.

Site Investigations

An investigation of the site is needed when any building work is likely to be affected by conditions below ground level.

The subsoil strata may be examined by means of trial pits or bore holes which provide a picture of below ground conditions.

Swale building Services vision can provide information on local and general conditions in the area. However, with new building projects it will be necessary to obtain site investigation/soil analysis reports, from a suitably qualified engineer.

Types of Foundations

The type of foundation used is usually decided by the following factors:

- type of soil;
- size of building;
- economics;
- use, design and position of loadbearing elements (eg, columns or piers); and
- influence such as water tables and gravel contours.

Other factors can affect foundation design. These can be easily identified on the site survey, and are:

- drains and inspection chambers;
- trees and shrubs;
- old excavations, wells etc; and
- possibility of land slip or subsidence (expert advice required).

The main types of foundation are:

- strip foundation;
- trench fill;
- rafts*;
- piles*;
- pad and beams*;
- underpinning*.

*Generally by specialist design only (and therefore omitted from this leaflet)

Strip foundations

Strip foundations are the most common type on domestic works.

The width is dependent on the soil type, but as general guide:

- single storey - 450mm wide;
- two storey - 600mm wide;

Both may have thickness of 200mm or more.

Further details of minimum excavation depths are included under **types of sub soil**.

Trench fill foundations

Trench fill is the term used when the trench is filled with concrete exceeding 500mm in depth. It is recommended that the concrete infill is finished to a minimum of 150mm below ground level. This ensures the sides to the top section are kept vertical and do not form a mushroom head. In cases where heave may be expected, lining of the trench sides may be required.

Trench fill can reduce labour costs below ground level and also tends to simplify operations generally.

Setting out

It is important to set out accurately so the wall will be centrally placed on foundation. With wallls two story's high and above, more than 25mm off the centre line can cause eccentric loads on the foundations; specialist design would then be required.

Before concreting the foundation, it is recommended that steel pins are driven into the sites of the trench to accurately establish the finished level of concrete.

Steps in level

It is often necessary on slopping sites to step foundations as both the bottom and top of the foundation concrete need to be level (as in figure 1)

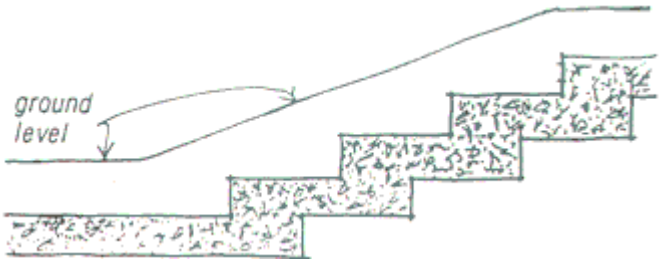


figure 1: stepping foundations

Design of the step

The height of the step (h) should not be greater than the concrete thickness (t)

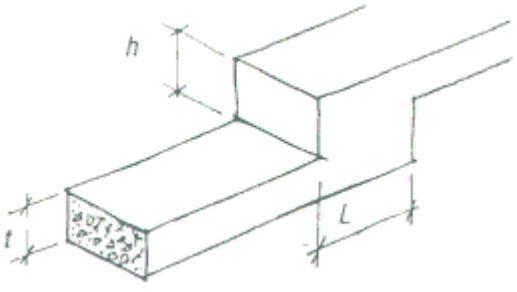


figure 2: step design

The lap of the strip foundation (L) should be at least equal to the concrete thickness (t) or a minimum of

300mm, whichever is greater (as in figure 2)

For trench fill 500mm deep or more, the step should not be greater than the concrete thickness (t). The length of lap at the step should be at least 1m or twice the step high (h) whichever is greater (as in figure 3)

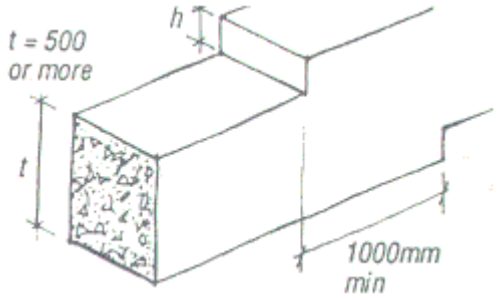


figure 3: trench fill design

Abutting existing foundations

Where new foundations abut footing which are sited at a higher level, it is necessary to ensure no permanent undermining occurs. This is overcome by raising the depth of the foundation concrete to the underside of the existing foundation (see figure 4)

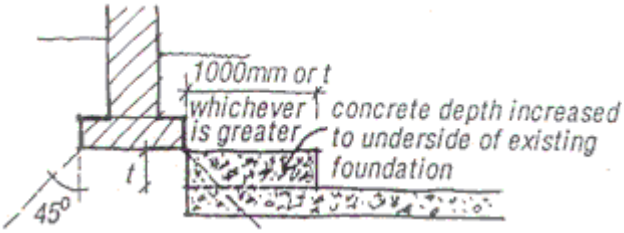


figure 4: abutting existing foundations

Drains

It is normally necessary where drains pass through foundations to keep the two totally separate. This allows for different settlement (see figure 5a, 5b and 5c)

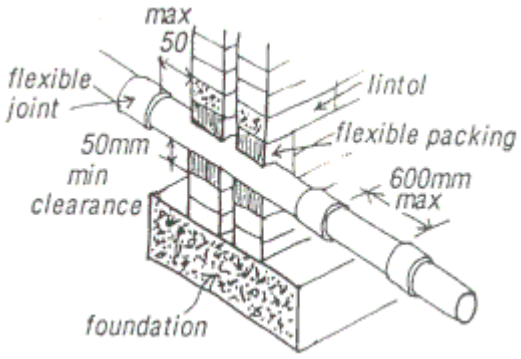


figure 5a: Strip foundations

With trench fill (in figure 5b), a pipe duct or box is fitted into the trench before concrete is placed. The duct should be sensibly larger than the drain or service to be installed and positioned with reasonable accuracy. Reinforcement can be placed within the concrete above the duct to form an 'insitu' intel

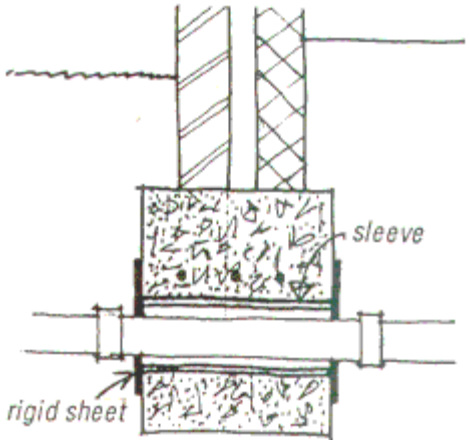


figure 5b: trench fill drain

Foundations should be excavated to a depth so that loads are not transferred through the subsoil to drains below or adjacent to the foundations.

As shown in figure 5c, the depth (d) should be great enough for the distance (L) to exceed the difference in height (h) of the drain and the foundation

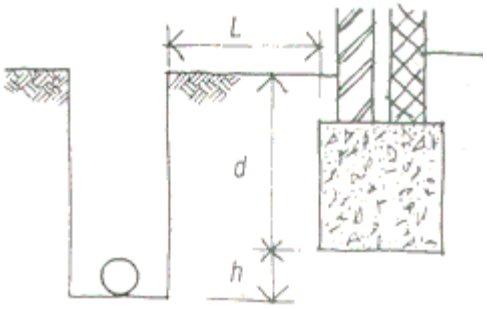


figure 5c: drainage dimensions

Safety

Remember the safety code for excavation work. Provide support to the excavation sides, especially to trenches over 1.2 metres deep.

Type of Soil

1. clay soils

Clay soils contain very fine mineral particles, silt and sand. The proportions of each determine how "shrinkable" the clay might be.

1.1 The effect of trees and vegetation

Problems arise when clay shrinks or swells due to seasonal changes in weather or by trees, hedges, or shrubs that extract moisture from the clay. The hot summer of 1976, 1989 and 1990 have resulted in numerous cases of subsidence (see figure 6).

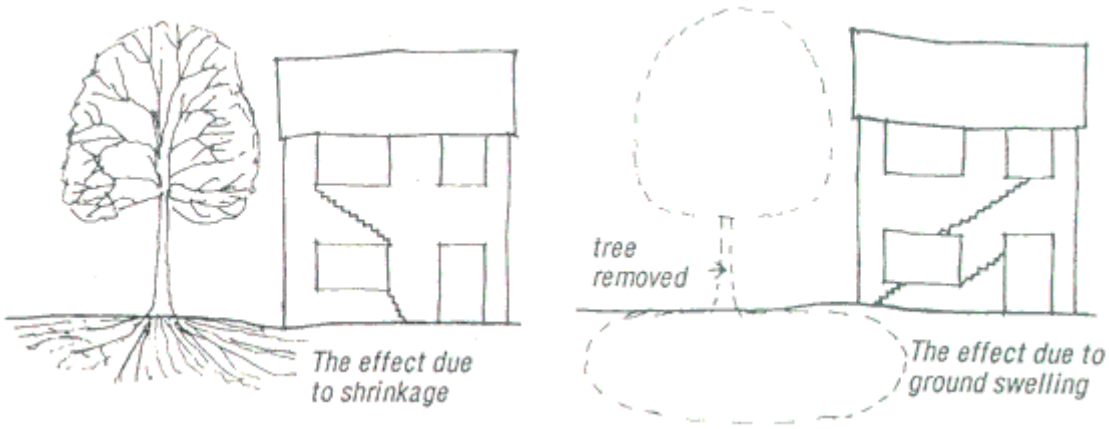


figure 6: effects of subsidence and heave

To prevent future damage to buildings, it is generally necessary to excavate foundations to a depth where the moisture content of the clay remains stable. British Standard 8004 recommends a minimum depth of one metre for foundations. However, if trees or vegetation have been removed, are remaining, or are proposed, depths of up to three metres may be necessary. This occurs mainly in highly "shrinkable" clay such as that found on Sheppey and at Iwade, Lower Halstow and Dunkirk. These areas are indicated on the borough map overleaf.

In addition, if clay is desiccated (ie dried out), allowance for swelling of the clay against the sides of the foundation may needed to be catered for by placing a compressible layer against the trench sides prior to concerning. This has become common practice in the areas stated above.

Where trees or shrubs exist within 35 metres of proposed buildings, they can seriously affect the design and cost of any foundation. You are strongly advised to consult your local Building Services office.

1.2 Firm Clay over Soft Clay

In areas such as Sheerness, parts of Queenborough and areas adjacent to the rivers, a thin clay crust (possibly 1 or 2m thick) overlies a very soft clay.

A traditional strip foundation can sometimes be used in this ground but it is important not to overdig the excavation as this may increase a higher stress on the softer soil beneath. This can lead to excessive, it is often necessary.

to extend trench widths (sometimes up to one metre) and provide reinforcement within the concrete

In certain instances where the clay is very soft, there is little alternative other than to seek a specialist foundation designed by an engineer

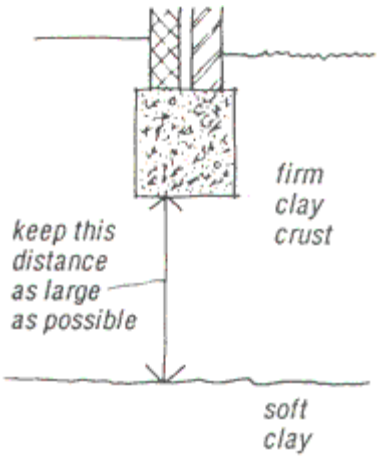


figure 7

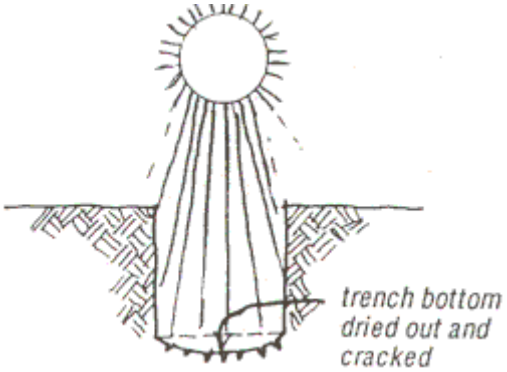
1.3 Effects of weather

Foundation in a clay soil should be concreted as soon as possible after it is excavated and inspected - preferably on the same day.

If delay in concreting the excavation occurred (e.g trenches left open overnight) and the clay has dried out of become wet, the trench must be "bottomed out" (ie excavated a further 50-100mm or as necessary to get back to clay of original moisture content). the trench bottoms should then be concreted as soon as possible.

"Bottoming out" may also be necessary to remove any loose spoil that has fallen in the trench or has been loosened by a bucket of a mechanical excavator.

A foundation placed on a dried out trench bottom may suffer heave when the clay takes up moisture and swells



A wet trench bottom may cause the clay to swell which will cause settlement later when it compresses under load (see figure 8)

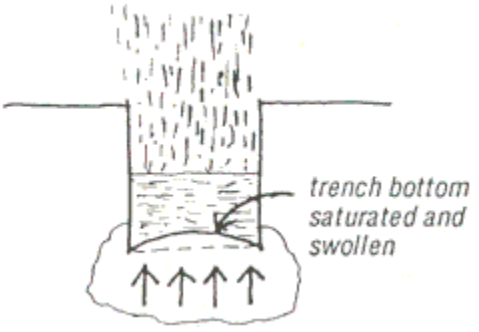


figure 8: effects of weather

2. Sandy or gravel soils

Strip foundations are commonly used in this type of ground. It is not necessary to excavate to a one metre depth in these soils unless adjacent drains, trees or filled ground dictates. Generally a depth of 700mm is satisfactory, as ong as the ground has adequate bearing capacity.

Problems arise in these soils where foundations are placed near or below ground water levels. In these situations, it is important to keep foundations as high as possible because the bearing capacity of the ground can be as little as half when water is present.

3. Chalk

A chalk foundation is commonly used in chalk, its width being dependent on the type of chalk found.

Providing the chalk is not to crumbly, widths of 450mm for low rise buildings are generally acceptable.

The depth of the foundation must be below any frost action (700mm) but will again be subject to the depth of adjacent drains or filled ground. Any spoil of softening of the chalk due to water or mechanical disturbance will need to be removed prior to concreting foundations.

4. Filled ground

some excavations particularly in town centres, such as Faversham, encounter small areas of filled ground. These may be in the form of soakaways, cesspools, old footings or wells, found within or adjacent to the excavation. It is generally necessary to found beneath the area of the fill. Where practical, the filled ground should be removed completely and back filled with lean mix concrete, after inspection. Localised reinforcement may be necessary over any areas affected. Also suspended floors are often required in these situations.

If it is not practical to remove the isolated fill, or all of the site is made-up ground, a specialist engineer's foundation design and site investigation will be necessary.

Your local Building Services Office can advice you in these matters.

5. Contaminated ground

If any signs of possible contaminants are present within the ground, the Environmental Health Officer should be notified at once. Swale Borough Council will be pleased to advise further on the recommended relevant action required.

6. Structure below ground

6.1 grades of concrete

Concrete for foundations and floor slabs can either be ready-mixed or, where a small quantity is required, mixed by hand or cement mixer.

In certain situations, sulphates may be present within the ground. If there is any doubt about the presence of sulphates, sulphate-resisting cement should be used. Guidance is given by Building research Station Digest 174 to the types of cement appropriate to specific concentrations of sulphates.

6.2 Wall below d.p.c

Walls below d.p.c. level are vulnerable to frost action and sulphate attack, particularly within 150mm of ground level. In these situations, brickwork having frost resistant qualities is advisable.

Mortar mixes for use below d.p.c evel can vary. (For general purposes proportions of 1 part of cement: 3 or 4 parts of sand (with plasticiser); or 1 of cement 1/2 of lime: 4 of sand are acceptable.

If sulphates are present within the ground, sulphate-resisting cement must be used.

In some situations it may be preferable to use blockwork below ground.

As there are a large variety of different types of blocks available, you are advised to consult manufactures details to determine which product is suitable for your intended use. 'Lightweight' blocks are not generally recommended where sulphates are present within the ground, and/or where conditions of a current British Board of Agrement Certificate cannot be met.

References

Building Regulations 1991.
BRE Defect Action Sheet no 96 "foundations on Shrinkable Clay;

Avoiding Damage Due to trees.
BRE Digest 298 "The Influence of Trees on House Foundations in Clay Soils".

British Standard - 8004 Code of Practice for Foundations.
BRE Digest 240 & 241 Low-Rise Buildings on Shrinkable Clay Soils Part 1 & 2.