
TECHNICAL INFORMATION NOTE NO 10

Foundation Design, Clay Soils and Trees

SH/A/4

Introduction

It has long been known that trees cause clay soils to shrink by withdrawing water through their roots in summer.

Changes in the moisture content of clay soils causes shrinkage or swelling, commonly known as heave, which in turn can cause cracking and movement of foundations, floor slabs and hence damage to whole structures.

Clay shrinkage is caused during dry spells, generally from water abstraction by vegetation, clay heave is often caused by the removal of trees and hedgerows or alternatively due to substantial wetting after prolonged dry spells. The extent of movement may be determined from a number of factors (e.g. clay type, tree type, distance of trees from a foundation excavation and geological location).

Climatic effects

High rainfall replaces moisture deficits caused by trees and hedgerows, and cool damp weather reduces the rate of water loss to the tree, thus reducing the risk of soil movement. As the driest and hottest conditions usually prevail in Southeast England, the greatest risks occur in that area and diminish with distance north and west.

Identifying clay types

Clay can be recognised as being smooth and silky to touch with no grains visible to the naked eye. It may also contain silt-sized particles barely visible to the naked eye) together with sand (which will be visible and would give a more gritty feel).

In general the finer the soil the greater its shrinkage potential, (more clay particles and less silt or sand).

Assessing foundation depths

The presence of trees and other vegetation in close proximity to the proposed building (or extension) can affect moisture content considerably. When necessary a designer, owner or builder should obtain advice on a foundation design from a suitably qualified and experienced expert.

The degree to which soil will change in volume will depend greatly on the amount of moisture, which is drawn from and returned to it.

Different trees have different water demands and it is important to determine the particular tree type.

It is also important to consider and identify trees on adjacent sites as trees up to 30m away may still abstract moisture from the soil at the proposed building location.

In certain circumstances multiple trees can extract moisture to a greater depth than a single tree of the same species. Particular caution is advised for rows of closely spaced trees of the Poplar and Cypress species.

The design of foundations should take account of the potential for soil desiccation by trees:

□ *When no trees are present*

The minimum depth for a foundation where no trees are present or where trees have been removed within the last 3 years is usually 900mm, this is the minimum depth required to ensure that the natural climatic effects (i.e. drying out and frost) will not affect the stability of the foundation.

□ *When trees have been removed*

Where trees have been removed from clay soils the moisture abstracted by the tree will find its way back into the soil resulting in the soil swelling. Since there is no longer a moisture demand by trees assessing a minimum depth of foundation should take account of soil recovery.

□ *When trees are present*

Predicting a safe depth at which to construct the foundation when trees are present requires account to be taken of a number of major factors such as:

- Soil type,
- Shrinkage potential of the clay soil,
- Potential water demand of the tree(s),
- Potential mature height of the tree(s),
- Distance of trees from the proposed foundation,
- Geological location.

Root growth damage

Provided there is room for trunks and roots to grow, there is little risk of them exerting pressure sufficient to displace foundations.

However, foundations of light structures such as porches, garages and conservatories can be damaged by the growth of major roots.

Protection of trees and hedgerows

Planning conditions, conservation area restrictions or tree preservation orders may mean that trees are protected and must be retained. This should be checked with the local planning authority.

Guidance available

Guidance on foundations in clay soils is available in;

- Zurich Insurance, Building Guarantees Technical Manual,
- NHBC Standards; Chapter 4.2 (Building near trees),
- BS 8004; Code of practice for foundations,
- BS 5837; Code of practice for trees in relation to construction,
- BRE Digests; 240, 241, 242, 251 and 298,

The Local Authority endeavour to give the best advice but no responsibility is accepted for its completeness or applicability. The recommendations contained in this guidance note are supplied in good faith but without liability and their use shall be entirely at the risk of the user.