East Midlands Building Consultancy

Guidance Note – Number 5

Foundations in Clay Soils

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 by several factors. (e.g., clay type, tree type, distance of trees from a foundation excavation, 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 grittier feel). In general, the finer the soil (more clay particle and less silt or sand sized particles) the greater its shrinkage potential.

Assessing Foundation Depths

The presence of trees and other vegetation near the proposed building (or extension) can affect moisture content considerably. When necessary, an owner, builder or designer 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 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. Caution is advised for rows of closely spaced trees of the Popular and Cypress species. The design of foundations should take account of the potential for soil desiccation.

No Trees 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.

Trees 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.

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Trees Present

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

- 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.

Typical Foundation Depths (Based on a Mature Height Tree and Clay of Medium Plasticity)

	Distance from Tree (m)														
Tree (at mature height)	2m	4m	6m	8m	10m	12m	14m	16m	18m	20m	22m	24m	26m	28m	30m
Elm, Oak	2.6	2.6	2.6	2.4	2.3	1.3	1.8	1.8	1.7	1.5	1.4	1.2	1.1	1.1	1.0
Eucalyptus	2.6	2.6	2.4	2.2	1.8	1.7	1.5	1.3	1.2	1.0					
Hawthorne	2.6	2.3	1.8	1.5	1.0										
Poplar	2.6	2.6	2.6	2.6	2.5	2.2	2.0	1.8	1.8	1.7	1.6	1.4	1.3	1.2	1.1
Willow	2.6	2.6	2.6	2.3	2.0	1.9	1.7	1.5	1.4	1.2	1.1	1.0			
Leylandi	2.4	2.4	2.0	1.6	1.3	1.0									
Apple	1.6	1.3	1.0												
Ash, Lime	1.6	1.6	1.6	1.5	1.4	1.2	1.0								
Beech, Maple, Horse Chestnut, Sycamore	1.6	1.6	1.6	1.5	1.3	1.1	1.0								
Blackthorn, Spruce	1.6	1.3	1.0												
Cherry, Laurel	1.6	1.5	1.3	1.0											
Pear, Cedar, Fir, Pine	1.6	1.5	1.1	1.0											
Alder, Sweet Chestnut, Walnut	1.6	1.6	1.6	1.4	1.2	1.0									
Larch	1.5	1.5	1.2	1.0											
Yew	1.5	1.1	1.0												
Birch	1.2	1.2	1.1	1.0											
Hornbeam	1.2	1.2	1.1	1.0											
Elder	1.2	1.0													
Fig	1.1	1.0													
Hazel	1.2	1.1	1.0												
Holly	1.2	1.2	1.0												
Laburnham	1.2	1.1	1.0												
Magnolia	1.2	1.0													
Mulberry	1.2	1.2	1.0												

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If you are unsure whether or not the work you propose requires approval please contact East Midlands Building Consultancy for advice. If you carry out work which requires approval without first submitting an application, you will not benefit from having the work independently inspected and you risk enforcement action. The lack of a completion certificate from the Council may affect the future sale of your home.
Please note that these guidance notes are for advice only and may not cover all situations. It is your responsibility to ensure that they are appropriate for use in your particular circumstance.

For further information contact East Midlands Building Consultancy.