

This technical update provides additional guidance on heave: ground recovery following tree removal. It is important that all workmanship carried out during construction is completed in accordance with the relevant tolerances.

Background

Heave, the reverse of shrinkage, became particularly evident in the recovery of soils after the removal of dead elm trees during the 1970's Dutch elm disease outbreak.

Tree removal can cause significant swelling in low permeability soils and it is often difficult to know how long it may take the ground to recover following tree/vegetation removal.

Details

The amount of heave following the removal of a tree depends:

- a.) On the maturity of the tree
- b.) On the permeability of the soil
- c.) The availability of free water

When a tree is removed, water will return slowly to the soil causing it to swell, and the process will continue until the pore water suction that desiccation induces returns to a state of equilibrium.

For example, if a tree pre-dates the house, then removing the tree may cause the soil to uplift to a greater volume than when the property was built.

The recovery of the ground can take years and in some extreme circumstances up to 25 years, though most recover fully in a max of 10-15 years. In more permeable soils, the recovery could occur over the winter months.

Heave is particularly likely to occur if the removed tree was mature and had a high water demand, such as oak, poplar, willow and common varieties of cypress conifers.

Recommendations

Allowance must be made for the probability that any existing tree is likely to die sometime during the life of the building. If the tree has dried the soil prior to the foundations being laid, when it dies (or becomes over mature or is removed) the soil will rehydrate and swell, causing upward or lateral heave movement of the foundations. Severing roots within the footprint of a building foundation will allow the soil to rehydrate.

If trees have been removed prior to construction, precautions must be taken against potential rehydration and swelling of the soil and the design should be drawn up as if the tree was still present.

- If the height of the former trees is known, the foundation depth should be determined using actual height.
- If the identity is not known, it should be assumed the trees were of high water demand, and if actual height is not known, it should be assumed to be 20m.
- Heave protection should be provided as per the guidance where trees remain.

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Alternatively, the foundations and heave protection should be designed by a suitably qualified structural engineer, taking into account the recommendations of this guidance, the site investigation report conclusions and recommendations incorporated from both a registered arboriculturist and geotechnical consultant reports. The design should be submitted before work commences on site.

More specific guidance can be found in our [Technical Manual in Foundations, trees and clay section](#) which will also include recommendations for avoiding the effects of heave to the ground floor constructions.

Every care was taken to ensure the information in this article was correct at the time of publication. Guidance provided does not replace the reader's professional judgement and any construction project should comply with the relevant Building Regulations or applicable technical standards. For the most up to date Premier Guarantee technical guidance please refer to your Risk Management Surveyor and the latest version of the [Premier Guarantee Technical Manual](#).