Guide to Foundation Maintenance For Reactive Sites

Preface: This document is No. 7 of a series of Practice Notes produced by the Foundation & Footings Society (Vic) (FFSV), with the aim of setting a bar for the standard of professional practice of its members and other like practitioners in the industry. Equally important to the standard of professional practice, is the responsibility of the home-owner toward maintenance of the footings after the builder has handed the project over to him or her. The home-owner must be aware that he or she is responsible for the maintenance of the footings, as prescribed in the Building Code of Australia.

1 INTRODUCTION

1.1 Buildings rest on footings, footings rest on the ground, the ground under the footings is the foundation soil. If the foundation soil is *reactive* it can move if the soil moisture changes.

1.2 All clay soils are reactive to some degree. The movement of reactive clay soils is generally seasonal, with shrinkage in summer caused by drying and volume reduction, and swelling in winter caused by wetting up and volume increase. Your footing system is designed to tolerate normal seasonal moisture changes.

1.3 However clay movement can also be caused by artificial moisture changes. If adequate maintenance is not carried out unusual or abnormal soil movements, additional to seasonal movement, could take place.

1.4 This Guide explains how excessive moisture variations can occur, and provides recommendations to assist in the prevention of excessive slab and footing movements that could lead to cracking of your walls.

2 SITE CLASSIFICATION

2.1 All house sites are "classified" before construction of the house. The classification is generally based on the geologic origin and thickness of clay present in the soil profile. Climatic conditions are also considered.

2.2 Reactive clay sites are classified as CLASS M (medium), CLASS H (high), or CLASS E (extreme) and the letters represent increasing levels of reactivity. The site classification for your house must be indicated on the slab and footing design drawings.

2.3 Sometimes, and usually because of the presence of Filling on your site, or because abnormal soil moisture conditions have been identified, the site classification may be CLASS P. However either your soil report, or special notes on the slab design drawings , will indicate the basic level of soil profile reactivity.

2.4 The purpose of good foundation maintenance is to keep the moisture content of the clay reasonably constant. A CLASS H site will generally require more attention than a CLASS M site and CLASS E sites require even more diligence.

2.5 Some minor cracking of masonry walls is almost inevitable despite proper design, construction, and maintenance. Very slight cracks up to 1mm wide could be expected in most houses, and cracking of up to 5mm may occur in some houses, and neither affect the structural performance nor be considered a defect.

3 HOME OWNERS RESPONSIBILITIES

3.1 In the Australian Standard that regulates house footings, the "Owner" is defined as the person or organization responsible for maintenance of the building and the site. The Owner should be familiar with the performance and maintenance recommendations… (such as these)

3.2 On a reactive clay site there are some restrictions on the way the Owner can develop the garden around the house. These restrictions consist of: restrictions on trees and shrubs, requirement for drainage, limitations on gardens, and requirement for repair of all leaks. These are discussed in more detail in the sections following.

3.3 In general houses clad with timber (or other sheet) are more flexible than brick veneer and are better able to withstand soil and footing movements. Thus the requirement for foundation maintenance is less stringent, but nonetheless advisable.

4 PREVENTING EXCESSIVE SOIL WETTING

Water on the surface of the ground

4.1 Ponded water can cause localised heave or swell of the soil and uplift of the footing. Because the uplift is highly localised, the difference in level between the heaved soil and the non-affected soil can cause cracking in plaster walls and around window and doors. In severe cases, brickwork can crack.

4.2 The Owner is expected to prevent water from ponding underneath or against the sides of the houses. To achieve this, the ground adjacent to the house should be kept clear, and graded with a fall away from the house of about 50mm per metre. Ideally all runoff should be collected and via a silt pit to a legal point of discharge.

4.3 On sloping sites, a cut off drain should be provided on the high side such that any groundwater flowing toward the house is intercepted and drained into the storm water drain. An aggie(subsurface) drain system or manufactured "strip drain" system may be used to achieve this.

4.4 On a cut site, the cut-off drain shall be installed at the toe of the cut. In addition the ground surface immediately next to the perimeter footings should be graded away at approximately 1:20 within at least 1500mm and water directed to the legal point of discharge.

4.5 The Owner should ensure that all surface drains are fully maintained in working order. They should be kept free of debris and tall grass that may hinder rapid and free flowing drainage.

Water below the ground

4.6 Soils in depressions which are natural water courses have greater exposure to moisture than soil on surrounding sites. Intercepting drains may be needed if not already installed. On reactive sites these should take the form of surface rather than buried drains as all too often the latter become blocked and feed moisture into the soil, magnifying the problem. If possible buried drains should be kept well away from houses and be provided with numerous inspection points.

4.7 The Owner should ensure that all subsoil drains are fully maintained in working order; outlets are to be kept clear to allow free drainage. An opening should be provided at the high end of the drain to enable it to be flushed out.

Water from the roof

4.8 Pipe all roof water away from the house so that it doesn’t pond adjacent to the footings or cause erosion at any time.

4.9 During construction of new houses or extensions to existing houses, measures should be taken to temporarily divert all roof water from the perimeter of the house. These measures should be implemented as soon as the roof is installed, and maintained until the roof drains are connected permanently into the storm water system.

Leaks and overflows

4.10 All drainage, sewer, and water supply pipes should be checked regularly for leakage, and repaired when necessary.

4.11 The overflow from the hot water service should be directed into a legal point of discharge.

4.12 Plumbing leaks should be repaired immediately.

4.13 The Owner can easily check the water reticulation system for leaks by turning off all taps and observing the response of the water meter.

4.14 Leaks in sewerage or stormwater pipes close to or beneath a house can cause serious localised moisture concentrations. Such leaks in covered pipes are difficult to trace and repair, but the most common indicator is a zone of moist or wet ground , not associated with rainfall. Another indicator is a local zone of dampness of mould on a floor slab. If such zones are noticed, then some exploration for leaking pipes should be made in the moist area.

Removing trees or old houses with timber floors

4.15 If trees are lopped or cut down, or significant vegetation removed, a previously existing means of moisture absorption (tree roots) is removed. The soil in the previous “zone of tree drying” now has more soil moisture to absorb, and can swell and lift the footing, causing distress in the walls.

4.16 When a large tree is removed and a new house or extension built over its position, it is important to allow sufficient time to elapse (at least one wet season) prior to commencement of construction, to enable the soil moisture to return to a natural equilibrium.

4.17 Houses more than 35 years old typically have timber floors, and the ground beneath them is exceedingly dry, similar to tree associated dry ground. Similarly, to avoid future swelling of the ground and building distress, it is important to allow sufficient time to elapse (at least one wet season) prior to commencement of construction. This will help the soil moisture to return to a natural equilibrium.

Adding floor slabs or pavements

4.18 When ground that has previously been exposed to the elements is covered by concrete or paving, then a previously normal means of soil moisture removal (the sun) is prevented. Any moisture that finds its way under the slab or paving is trapped, and accumulates with time, leading to soil swell, footing uplift, and building distress.

4.19 To minimize future swelling of the foundation, it is important to allow sufficient time to elapse (at least one dry season) prior to commencement of construction.

5 PREVENTING SOIL DRYING

Paving

5.1 Construct an impervious apron, such as a concrete path at least one metre wide, around the house. Slope the path away from the walls houses with a fall away from the house of about 50mm per metre.

5.2 Seal joints and gaps to prevent water penetrating between the path and the building. Ideally all runoff should be collected and via a silt pit to a legal point of discharge.

5.3 Paved pergola areas should be graded to ensure that water drains away from the house to an edge drain.

Trees and Gardens

5.4 Tree roots cause problems by drying the soil in a zone around the tree. This "zone of tree drying" increases as the tree grows. Generally trees and large shrubs should not be planted or allowed to exist within a distance from the house equal to the zone of tree drying. This distance is estimated to be *the expected mature height of the tree.* Where there is a group of trees, the distance away should be increased by 50%

5.5 Do not have garden beds which require heavy watering adjacent the house. The introduction of topsoil to the garden will interfere with effective site drainage patterns, and if the garden plot is over watered it can cause local heave of underlying reactive soils at the edge of the house.

5.6 Alternatives to a garden beds around the house are; tan bark or gravel over plastic sheeting, small shrubs in buried pots, or footpaths.

5.7 Do not over-water your garden or lawn, by leaving sprinklers on too long. It is better to use a regulated drip irrigation system.

6 LANDSCAPING

6.1 Excavation replaced by fill with different drainage characteristics may cause greater wetting and drying of adjacent soil. After any excavation the hole should be backfilled with impervious (where possible) excavated material, to minimize water penetration from the surface.

6.2 Before fill is placed on a site any surface water lying in depressions should be removed. Indeed if a depression is a natural catchment arrangements should be made to provide a subsoil drainage trench so that ground water will not concentrate there even after filling.

6.3 Stabilize all cuts and batters by retaining or stone pitching

6.4 On cut and fill sites cut slopes need to be protected if the soils are erodible. If material regularly washes down from the face of the cut and blocks the toe drain, another drain at the head of the cut should be provided.

7 YOUR NEIGHBOURS ACTIVITY

7.1 If your neighbour plants trees that will clearly become high enough to affect the soil moisture under your house, it is prudent to let them know of possible future damage the trees may cause, not only to your house, but to their own. Passing on a copy of this leaflet would be a start.

7.2 If your neighbour is upslope of you and has paving in the yard, there could be substantial stormwater runoff onto your property. His water should be captured by a drain and diverted away before it reaches your property.

7.3 Notify your neighbour if you notice any leaking taps or moist patches of ground on his property.