# Minimising foundation movement and damage to your house

Once you have taken ownership of your new home, there are several things you should do to help protect it from cracks and associated damage caused by excessive foundation movement. This guide provides you with advice about maintaining your home to reduce the risk of damage caused by foundation movement.

## Understanding soil conditions

Before building your new home, your builder, draftsperson or architect would have arranged for a soil test to classify your soil type and determine how 'reactive' it is. The reactivity of the soil determines to what extent the soil shrinks and swells with changes in moisture content. Excessive changes in moisture conditions around the perimeter of your home can cause the footings to move, potentially causing damage to your home.

The soil test will classify the reactivity of your soil from:

A – Non-reactive

S – Slight

M, M-D – Moderate

H1, H1-D – High

H2, H2-D – Very High

E, E-D – Extreme.

**Reactivity levels**

The greater the reactivity, the greater the possibility of excessive movement. If you do not have a copy of the soil report for your property, ask your builder for a copy or contact your local council.

Once the soil has been classified, the designer and/or engineer will design your house footings to ensure they can cope with the classification of the soil and likely movement. The builder will then build your home on footings designed under engineering principals to suit the soil on your land.

### Responsibilities of the builder

When building your house, the builder must comply with the relevant building legislation and Australian Standards, and they must build your home's footings according to the engineer's designs and specifications approved by the building surveyor when they issued the building permit. This will mean that your home and its footings are designed and built to suit the soil condition and will minimise movement of the footings, as long as the soil condition doesn't change. For more details of the builders responsibilities refer to page 4.

### Movement of footings

Some movement of footings is normal and within design tolerances. When your footing lifts excessively (i.e. heaves) in one section of your house and not another, your walls will usually develop cracks.

Cracks in walls less than 1mm wide that are caused by movement of the footings are generally considered part of the normal movement that a house may experience and within the accepted range. This movement and consequential wall damage may not be due to a serious problem with your house footings. As the owner, you are responsible for any repairs you wish to undertake.

If your home is showing signs of significant damage, the potential cause and extent of excessive footing movement should be investigated. If your home is less than 10 years old you should contact your builder for advice in the first instance.

For cracks in walls between 1mm and 5mm wide, the cracking should be monitored during all weather conditions over a 12-month period. If the cracks are attributed to the actions of the builder, they may be considered defective.

In moderate or severe cases, the cracking can be more significant and require substantial repair work. Cracks more than 5mm wide are considered significant and outside the tolerances for footing movement. This could also appear as noticeable bulging of walls, and windows and doors that stick and/or distort. The cause of this excessive movement should be further investigated by a registered civil/structural engineer. If defective work is determined and it can be attributed to the actions of your builder, then they will be responsible for any necessary remedial works and repairs.

For more information about what is considered to be within the acceptable standards of building, visit the Victorian Building Authority's website at www.vba.vic.gov.au to download the *Guide to Standards and Tolerances*. Please note that there are different versions of the guide and the guide that is applicable for your home will depend on the date you entered into your domestic building contract with your builder.

You can also find more information about your rights from Building Advice and Conciliation Victoria at www.consumer.vic.gov.au

## Responsibilities of the homeowner

Once your home has been built and you have taken possession of it, you will need to ensure that the foundation soil is not subject to significant moisture changes.

If the conditions of the foundation are not properly maintained, it can cause or contribute to the cracking of walls and floors due to movement. If the damage is attributed to the actions taken by you as the owner, it can diminish the builder's liability, potentially leaving you responsible for some or all of the repair costs.

## Maintaining your home

When carrying out work around your home and garden, you need to make sure you don't change the moisture conditions of the foundation. It is also important that the foundation that supports the edges of your footing is not exposed to excess moisture, such as water ponding against footings or walls.

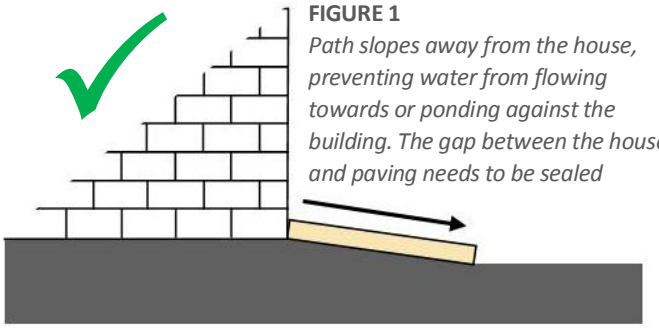


**FIGURE 1**
*Path slopes away from the house, preventing water from flowing towards or ponding against the building. The gap between the house and paving needs to be sealed*

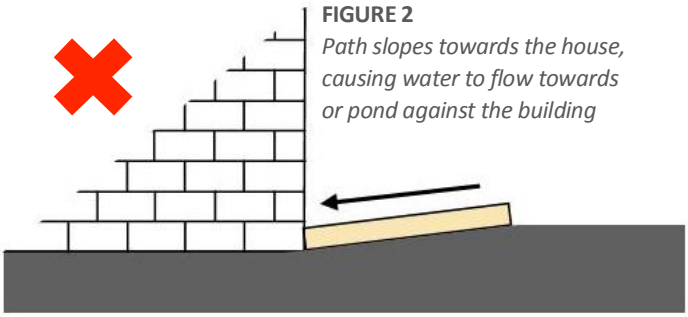


**FIGURE 2**
*Path slopes towards the house, causing water to flow towards or pond against the building*

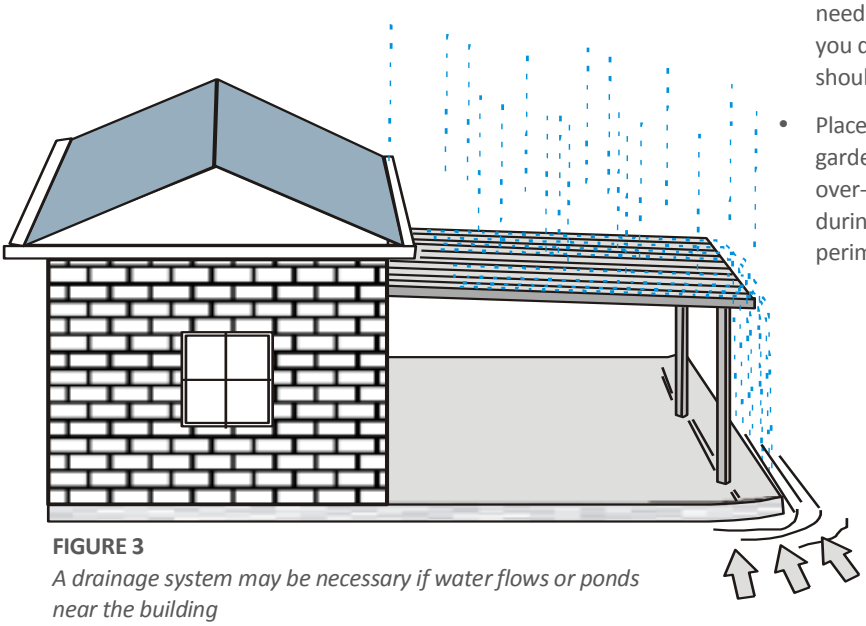


**FIGURE 3**
*A drainage system may be necessary if water flows or ponds near the building*

Below are some useful tips to help you protect your home from damage caused by excessive movement of the footings.

### DO

- Prevent water flowing towards your home's foundations by sloping the soil, paths and garden beds away from the building (Figure 1). As a rule, the more reactive the soil, the steeper the slope needs to be.
- If it is not possible for the surfaces surrounding your home to drain away from the building, you will need to install garden drainage systems or drains against your external walls to remove excess moisture to your stormwater system. You should seek professional advice about any drainage work.
- Ensure you properly maintain any drainage installed by your builder.
- Make sure the roof of any garden shed adjacent to your home has gutters draining to your stormwater system.
- Ensure there is a minimum slope of 70mm for the first metre away from the house in very reactive soils.

### DON'T

- Install sheds or outdoor roofed areas without connecting the roof drainage to stormwater systems.
- Lay paving around the building without sufficient slope away from the building (Figure 2). In large paved areas a drain and stormwater collection pit may be necessary.
- Run machinery over shallow drain pipes. This may break or squash the pipes, which can cause leaks and subsequent movement of the foundation.
- Excavate close to building footings, where possible. If you do need to carry out excavations next to your house, make sure you don't excavate deeper than the base of the footing. You should ensure you don't undermine the footing.
- Place garden beds alongside the house, where possible. If garden beds must be next to the house, make sure not to over-water them. Footings constructed in reactive soil during dry conditions may experience damage if the perimeter of the house is watered unevenly or excessively.

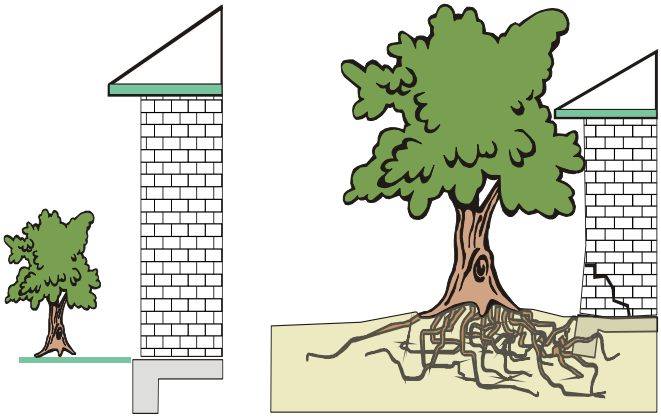


**FIGURE 4**
*Plant trees away from your house to allow for tree and root growth*

## Landscaping and trees

Trees can significantly impact the house's foundation and damage can occur even months after a tree has been removed. If trees do not receive sufficient water while alive, their roots will dry the soil near buildings or under pavements. Generally, the larger the root system of the tree the more it will dry the soil.

If you want to grow, keep or remove trees near your house, you should let your builder know before you sign the building contract. The builder will then advise the engineer, who will take this into account when designing your home's footings.

The type and grouping of trees or shrubs have varying impacts on their surrounding soil moisture conditions. After your house is built, you should seek professional advice before planting to ensure that the trees or shrubs chosen, as well as their distance from the house, will not damage or affect the footings in the future.

If you plan to remove nearby trees after your house is built, you should consult an expert arboriculturist or a registered civil/structural engineer who is familiar with footing movement.

Most modern allotments with clay-type soils are too small to safely grow large trees without special footings.

Foundation problems in clay sites may also be caused by:

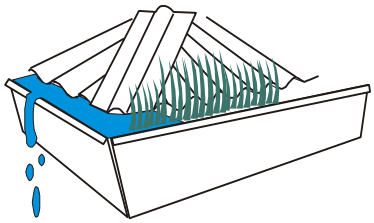
- excessive watering of gardens
- watering systems that are overused or discharge water too close to building walls
- constructing waterproof decks, verandahs and retaining walls without appropriate drainage.

Tree roots in sandy areas are less likely to cause damage to your home. Sand does not shrink or swell with changes in moisture, however, if the root ball or large root is very close to a building it can grow and lift the footings of a structure causing damage.

## Poor site maintenance

The greatest cause of building damage by far is an excessive change of moisture in foundation soil around the perimeter of a house. Changes to drainage or watering of gardens in adjoining properties can also create problems.

To help prevent damage, all possible water leaks and sources of excessive water should be repaired immediately, such as:



- leaking or blocked roof gutters, which cause water to overflow near the external walls of a building (right)
- hot water system relief valve pipes (Figure 5). If the discharge changes the moisture of the soil, the pipes should be connected to the stormwater drainage system
- air conditioners and heat pumps to hot water systems. These should not discharge water near the building footings, as it may change the soil moisture conditions. They should be connected to a stormwater drainage system
- leaking or overflowing water tanks near building footings
- land or paving that slopes towards the house, causing rain water to flow or pond near the building
- plumbing leaks, leaky taps or hoses
- water from regularly washing cars near the house
- water flowing near the house (even from neighbouring properties), which must be diverted away from the footings or collected via a drainage system.

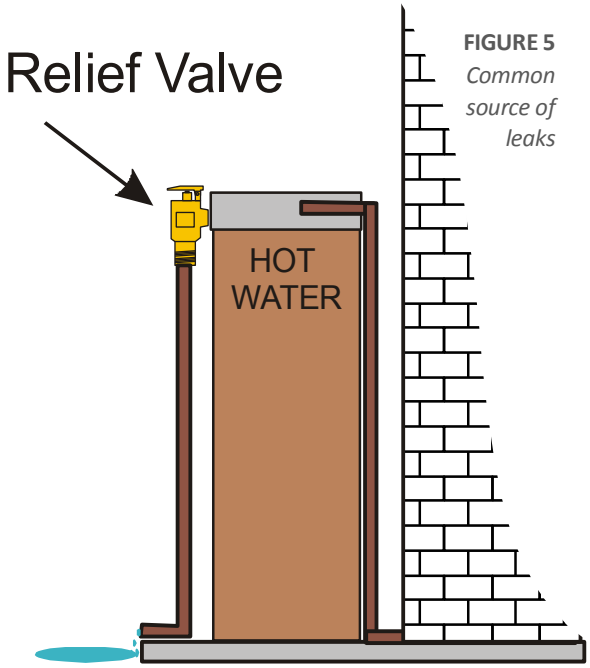



**FIGURE 5**
*Common source of leaks*

## Responsibilities of the builder

When building your house, the builder needs to comply with the Building Code of Australia, relevant Australian Standards, approved designs, specifications and contract documents.

Builders need to address the following important aspects:

- Make sure there are well-drained foundation conditions which will create 'normal' soil moisture and maintain adequate bearing capacity of the footings as soon as work begins at the site.
- Where abnormal moisture conditions exist or are anticipated, the footings will need to be designed by a structural engineer to suit these conditions.
- Ensure that the floor level allows for proper drainage around the outside of the house, and that the property is protected from any adjoining water flows (Figure 8).
- Slope the soil and paths away from the building by the minimum amount required by the Building Code of Australia to prevent water flowing towards the house's foundations.
- Special considerations may be needed if any excavations are to be dug near adjoining structures (i.e. when installing a swimming pool).
- Construct subsoil drains or moisture barriers on sloping sites to your engineer's requirements, in order to prevent stormwater affecting the building's foundations.

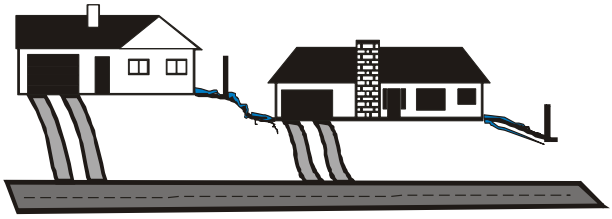


**FIGURE 6**
*Ensure that the property is protected from water flowing from adjoining properties*

- In sites with highly or extremely reactive soil, *AS 2870 – Residential slabs and footings* requires mechanical flexible couplings for sub-surface drainage pipes and for above-ground connections from the downpipe to the stormwater and sewerage drains (Figure 7). These allow for the movement of the soil and minimise the risk of pipe joints breaking and leaking.
- Ensure owners understand that failure to maintain adequate drainage may result in damage to the structure.

Builders are also encouraged to provide owners with a plan showing the location of all 'as installed' sewer pipes, stormwater drains, water and gas lines. This will help with any future modifications or repairs.

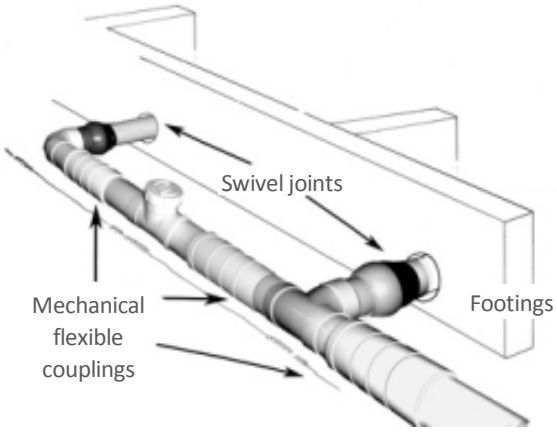



**FIGURE 7**
*Mechanical flexible couplings reduce the potential of broken pipes in highly or extremely reactive soil*

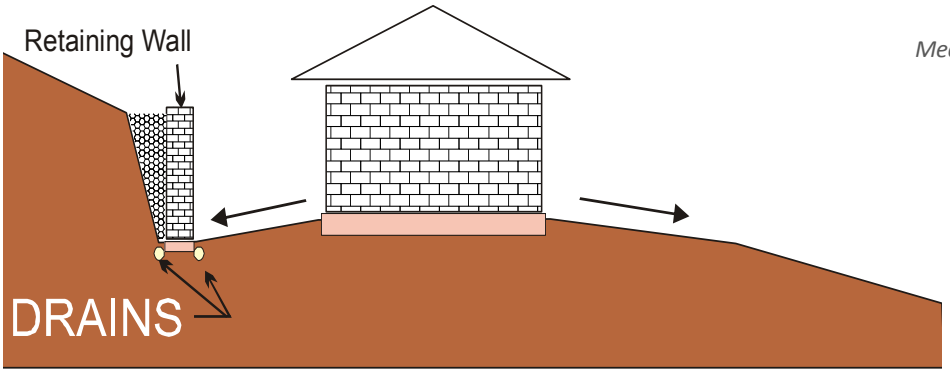



**FIGURE 8**
*A well-drained site*

## Explanations

**Footings** (often incorrectly called foundations) are usually constructed of reinforced concrete that supports the building. They are commonly comprised of concrete strips, stumps with pads, stiffened raft or waffle slabs (Figures 9, 10 and 11).

**Foundation** is the soil or rock supporting the footings.

**Reactive clay foundations** are those that shrink and swell with changing moisture and cause the building and paving to sink or lift.

**Reverse slope** is one that slopes towards the building.

**Sand foundations** do not shrink or swell but if they are loose they can cause the building to move.

**The Australian Standard** for building footing construction permits minor wall and floor movements. If the foundation conditions are changed after construction, the floor and walls may move more than these standards allow for. The designs for building footings in *Australian Standard 2870 – Residential slabs and footings* will perform adequately, provided the building site and surrounds have 'normal' foundation conditions that are maintained. If the building site and surrounds have 'abnormal' moisture conditions, special provisions must be followed by the design engineer, builder and owners (refer to AS 2870 for a description and examples of 'abnormal' moisture conditions).

## Typical footing system used for dwellings

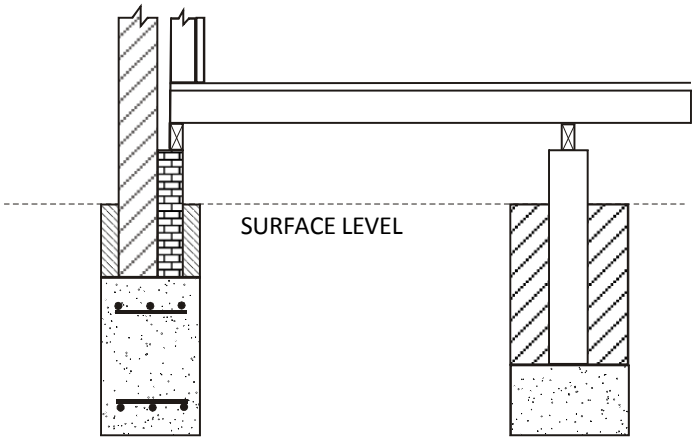



**FIGURE 9**
*Strip and stump footing system*

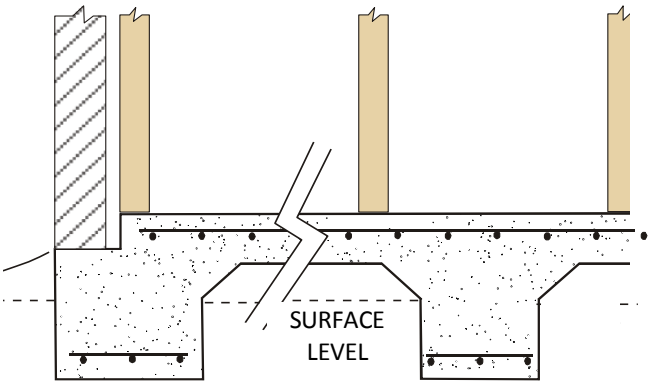



**FIGURE 10**
*Stiffened raft*

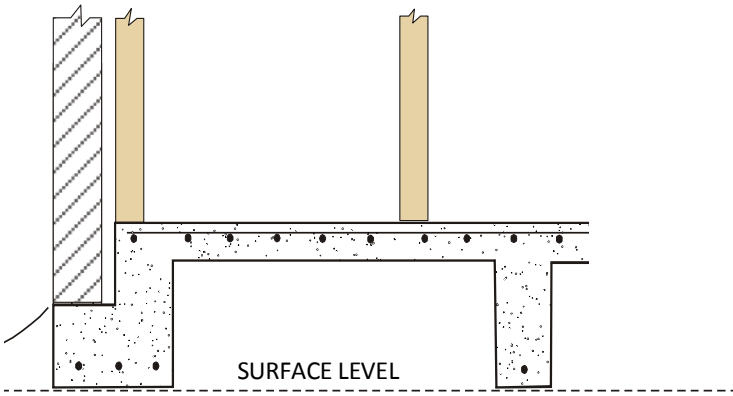



**FIGURE 11**
*Waffle slab*

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