

CAHILL INSPECTION SERVICES, INC

(972) 491-9919

MAINTENANCE OF SLAB-ON-GRADE FOUNDATIONS BUILT ON EXPANSIVE CLAY BASED SOILS

Many foundation movement problems in areas with expansive clay based soils are moisture related.¹ Active clay soils will shrink when dry and swell when wet. Foundation movement can result when wet expanding soils cause upheaval and dry soils cause settlement. Minimizing the risks of foundation movement caused by these geological conditions requires you to assist in maintaining uniform consistent moisture levels in the soil surrounding the foundation. Foundation problems can result without proper maintenance on the homeowner's part. Maintenance can be accomplished by doing three things:

- Provide good drainage away from the foundation.
- Water the soils surrounding the foundation on an as needed basis.
- Be aware of the potential for adverse affects caused by trees and shrubbery.

Perhaps the most important part of foundation maintenance is providing proper drainage and soil level heights around the home. Water should always drain away from the home and ponding conditions near the grade beam should be avoided. Recommendations can vary, but generally it is wise to avoid letting water pond within 6 feet of the grade beam. Soil height below the top of the slab or brick ledge should generally be 4 to 6 inches. Again, this specification can vary from house to house and the particulars of each foundation will determine the best soil height. Soils that are above the bottom of the foundation edge are too high and are conducive to water and insect entry into the home. Soils that are too low can promote quicker dehydration of underlying supporting soils. Generally the soil should be 4 to 6 inches below the top of the slab.

What is "good slope" for adequate drainage? Various guidelines can be found in Codebooks, Government specifications or Engineering publications and some minor variations between these groups may exist. However, for the sake of this article, 1/2 inch of slope per 1 linear foot should be provided around the foundation. This slope should extend 2 to 6 feet away from the home and from there properly drain off the property site.² Contouring the home site may require construction of swales, that is, wide shallow sloped depressions constructed to channel water flow. Specific recommendations will vary from site to site.

Areas that are difficult to properly grade may require special provisions. For example, an interceptor drain consisting of a solid pipe placed underground and routed to a proper discharge point may be required. In cases where sub-surface water flow must be controlled, specially designed French drains are used. Sometimes water cannot be discharged by means of gravity flow and in such special situations pumps are required.

Areas of slow drainage or soil erosion resulting from roof runoff can often be improved by using gutters. Generally, if good drainage exists and erosion is not a problem then gutters are not necessary. However, when conditions warrant, gutters can reduce excessive water accumulation. It is important that gutter downspouts direct water away from the foundation and that they not allow water to simply collect at the downspout discharge point. If necessary, use extended downspouts to direct and control water flow. In some cases, connecting the gutters to underground drains may be required. Gutter downspout discharge erosion can be controlled with properly placed splash blocks. Garden edging and fences can sometimes cause problems because they prevent water flow. Pay attention to these conditions and provide outlets or drains where needed.

All of the aforementioned efforts contribute to controlling excessive moisture. Remember, excessive moisture makes clay-based soils expand, swell and uplift. Once soils around the home are contoured and shaped to provide good drainage, then preventing excessive dehydration becomes the goal.

Soil dehydration results from lack of rain; hot outdoor temperatures and surrounding plant life. You can assist Mother Nature by replenishing water in the soil on an "as needed" basis. This is best accomplished by watering slowly, consistently and uniformly around the perimeter of the home when conditions warrant. Special cases can affect final watering decisions, for example:

- Water more frequently in the hot dry months of summer than in the cooler months of winter.
- The south and west sides of the home are more likely to experience hot sunny exposure and thus may require more water than the shady north and east sides.
- The gabled end of a house may need more water because it receives less runoff from the roof.
- If the neighbors' lot drains toward your site, then that side of the house may require less watering.

Methods of applying water vary from the use of soaker hoses to automatic sprinkler systems. Automatic sprinklers are certainly more convenient but soaker hoses can do just as good a job. During droughts soaker hoses may be required to supplement sprinkler systems.

How much water and when to water is the next consideration. Just setting the automatic control and forgetting it is probably not going to work. Perhaps the important thing to remember is that clay-based soils absorb water slowly and obtaining ideal moisture levels takes time. Applying a lot of water over a short

period of time will result in wasted runoff or in dry conditions possible foundation movement. Slow regular watering periods are needed in order to allow moisture to penetrate the deeper soil particles.

Generally, about 1 to 2 inches of water per week in the summer, 1 to 2 inches of water every two weeks during spring and fall and 1 to 2 inches of water per month during the winter will be needed in order to maintain most plant life.³ This same scale can be used to maintain moisture in the soil. Simply water until 1/2 to 1 inch of water is distributed, or until water runoff happens, whichever ever occurs first. Generally, we find that automatic sprinklers, which run three times a week and 10 minutes per zone during hot summer periods, will meet this recommendation. Steeper sites may require more frequent watering over shorter durations. Remember, watering frequency decreases in the winter and increases in the summer. If you see the soil shrinking, cracking and pulling away from the foundation it is a good indication that moisture is needed. You will become a good judge of when its time to water.

There may be a time when you discover the soil has become very dry. You might find large 1/2 to 1 inch wide cracks in the soil. When this happens, it is very important to remember that slow, consistent and uniform watering is the guideline to follow. Do not place a hose into a large soil crack and try to fill it up. The water distribution will not be uniform and you may cause foundation movement to occur. In excessively dry conditions remember; water slowly, consistently and uniformly.

We have now discussed proper drainage and watering concerns. That leaves us with the third consideration, plant life and trees. Trees and shrubbery can cause problems by speeding the removal of moisture from the soil. Large trees require large amounts of water and they can remove enough moisture from the soil under the foundation to cause settlement. Large shrubbery can compete for moisture in a similar fashion. Over a long period of time, large tree roots can cause uplifting of the foundation edge. Ideally, trees should be planted far enough away from the home so that the drip line of the outermost branches will not be over the home when the tree reaches maturity.

Avoid planting trees and large shrubs that will grow up to become a problem. Avoid certain types of trees known for their aggressive root system and need for water. Fast growing trees are generally the type to avoid. Two such trees are the Cottonwood and Weeping Willow.

If small immature trees are found close to the foundation it is probably best to remove them now. However, what does one do when mature trees are found nearby? This is a tricky question and there are variables to consider. Trees are wondrous plants and are aesthetically desirable. Most people do not want to cut them down. Additionally, one must ask, will cutting down a large nearby tree promote root rot and termites in the supporting soils under a home? There are options to tree removal, such as root shearing, and these should be discussed with your engineer and arborist. Remember, modifying existing landscape foliage deserves case-by-case consideration and the final decision always depends on what you are willing to accept. Some people may find foundation movement preferable to cutting down a 50-year-old oak tree.

Many of these maintenance considerations apply to pier and beam foundations as well. While there are variables to consider on each home, remember the 3 basics:

- Proper drainage
- Consistent, slow and uniform watering
- Plant life management

If your home already shows signs of foundation movement then it is important to remember that the 3 maintenance requirements should be considered before spending money on structural repair. Failure to do so may prove to be a waste of repair funds.

Soil maintenance on silt, sandy loam or sand has similar but different concerns. Good drainage is still important but watering must be very carefully considered as a different set of problems, such as erosion, can be encountered on these types of soils if too much water is applied. Whenever you have doubts, you should have a drainage specialist survey the home site and prescribe corrective action options. In obvious problem areas these surveys can be visually accomplished, however in subjective areas a transit or water level survey of the topography is usually required.

In conclusion, maintenance of clay-based soils requires a common sense approach to controlling moisture. The measures discussed in this article will help reduce risk but will not eliminate such. Whenever you compete against the forces of nature, there are times when your best efforts will not work. We recommend you stick with the basics, obtain professional help when needed and hope for the best.

1 Soil movement can be caused by other factors such as compaction, rebound, retaining wall configuration, fill decay or other considerations and such discussion is beyond the scope of this article.
2 Final drainage termination point allowances may vary from city to city and one should consult local officials for final requirements.
3 Neil Sperry's Complete Guide to Texas Gardening, Second edition. Such provides guidelines for landscape foliage watering but does not provide engineering information regarding soil-stabilizing techniques.