

**HOMEOWNER'S GUIDE TO
OVERCOMING PROBLEMS WITH
MARINE CLAY-MARUMSCO SOILS
IN FAIRFAX COUNTY**



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WHY IS MARINE CLAY A PROBLEM?

The Marine Clays,¹ also referred to as Marumsco soils, have been a source of difficulties for property owners for many years. They occur in parts of Virginia, Washington D. C., and Maryland. In Fairfax County, the Marine Clays occur on steep hilly land in the southeast of the county, mainly in widespread areas east of Interstates 95 and 395. The clays can cause problems in several ways, ranging from major structural damage in houses to poor drainage in yards. Fortunately, most types of structural damage can be repaired. In addition, homeowners can eliminate some causes of potential problems in Marine Clay.

Some types of damage are much more common than others. The various types of damage can occur singly or in combination with each other. House problems usually develop slowly at first and then become more serious as years go by. For example, minor cracks in a basement wall of a ten-year old house may progressively worsen over the next five years, eventually resulting in wall failure. Damage has been noted to occur in less than five years to greater than 30 years after construction.

Although the types of damage caused by Marine Clay can be grouped into a few categories, no two houses are alike. Building and foundation design, age of the house, soil characteristics, yard grading, vegetative plantings, and homeowner maintenance history make each diagnosis of the problem unique. Correctly identifying the problems usually requires a thorough investigation of the soil and structural conditions by a qualified professional. Repairs should be based on a careful analysis of the soil conditions under and around the building.

***... HOMEOWNERS CAN
ELIMINATE SOME CAUSES OF
POTENTIAL PROBLEMS IN
MARINE CLAY.***

As some homeowners have discovered, an incomplete or improper repair will likely result in recurring problems in the future. For this reason, consult a qualified engineer experienced in soil and foundation investigations for design and inspection of difficult repairs.

Why are the Marine Clays such a problem? The main reason is that they contain a type of clay, montmorillonite, which shrinks and swells during natural changes in soil moisture. The clays shrink during dry periods of the year and swell during wet periods. Slight changes in moisture content are sufficient to cause detrimental shrinking and swelling. The pressures that the clays exert upon swelling can far exceed the strength of basement walls and even the weight of a

¹ The Marine Clays consist of a variety of clayey and silty soils that were deposited by rivers flowing into the ancient Atlantic Ocean millions of years ago. The colors of the soils range from bluish gray to red and yellow. Marine Clays occur as discontinuous layers of silts and clays, often with scattered thin sand layers. The Marine Clays are part of a geologic formation known as the Cretaceous-age Potomac Group Sediments that occur within the Coastal Plain Physiographic Province. Although the term *Marine Clay* has gained wide local usage, geologists think that the sediments were deposited near the shoreline in fresh or brackish water rather than in a true marine (ocean) environment.

house's wall and footing. Uneven settling can cause cracking and warping of the foundation and frame.

Problems tend to be more common in some Marine Clay areas than others. The Marine Clays contain a variable mixture of fine-textured soils – clay and silt – with frequent discontinuous sand layers. The most troublesome areas occur on steeper slopes and where the content of clay and silt is much higher than other soil types.

Many houses located within Marine Clay may never have problems, while others will undergo foundation distress at some time in the life of the structure. Surface drainage is often a problem since water percolates very slowly through the clays and does not drain well from level yard areas.

THE DAMAGE CAUSED BY MARINE CLAY

Some of the problems encountered by homeowners in the Marine Clay-Marumscos soil areas of Northern Virginia are as follows:

Damage To Foundation Footings

The most common problem in Marine Clay-Marumscos areas is the settlement and heave of foundation footings. Foundation footings support the house and distribute the load to the underlying soils. The footings are located below the ground surface and are usually constructed of concrete 16 to 24 inches wide and about eight inches thick. During dry periods, especially the summer months, the soil loses moisture. This causes the clays to shrink, leaving a void, or gap, under the footings. Bearing support for the footings is lost. The buildings settle, usually in an uneven fashion, resulting in broken footings, cracked masonry walls, interior cracks in plaster, and warped door and window frames (Figure 1).

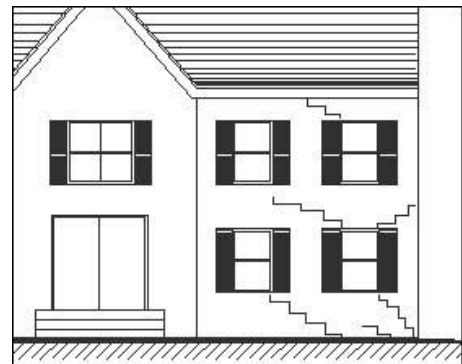


Figure 1: Typical foundation settlement cracks in marine clay

The amount of settlement depends on the type of soil under the footings, the design and depth of the footings, and the moisture content of the soil. Building settlement caused by high shrink-swell clays is most noticeable in dry seasons of the year and is especially troublesome during prolonged dry periods. The average annual rainfall in Fairfax County is about 40 inches. We have seen severe house settlement problems occur when rainfall is less than five inches below normal. It is generally not feasible, however, to define a critical rainfall level since the soil moisture at any specific site depends on the rainfall intensity and the time of year the rain fell, the depth of the water table, and even the characteristics of the soil. Deeply-rooted vegetation such as trees often contribute to the problem. Trees draw water from the soil through many small roots that extend below and well beyond the farthest-reaching branches, drying out the soil and causing shrinkage. Saplings that were planted ten or twenty years ago have grown into trees with an extensive network of roots. Tree roots have been observed as deep as 15 feet in the Marine Clays and can extend well underneath a house and its' foundation.

The moisture in the soil changes rapidly near the ground surface as evaporation and plant uptake deplete soil water. The water content increases and becomes more constant with depth nearer the water table, which is typically at 15 to 30 feet. Deeper foundations, such as those with in-ground basements, are less susceptible to extreme seasonal moisture changes. Many of the houses with settlement problems have relatively shallow foundations (frequently less than three feet deep).

Foundations that have settled during dry periods will often return to near the original position after rainfall replenishes the soil moisture, causing the soils to swell again. After several cycles, however, the rebound of the foundation may be progressively less, resulting in larger and larger cracks.

This type of damage can usually be minimized in new construction by placing foundation footings deeper below ground. Fairfax County requires that all footings placed in marine clay be at minimum 4 feet deep, with the ultimate depth determined by the results of a detailed investigation of the soils. Trees should be planted at least 20 feet away from residential structures to minimize drying of the soils by the root system, which can become quite extensive as trees mature.

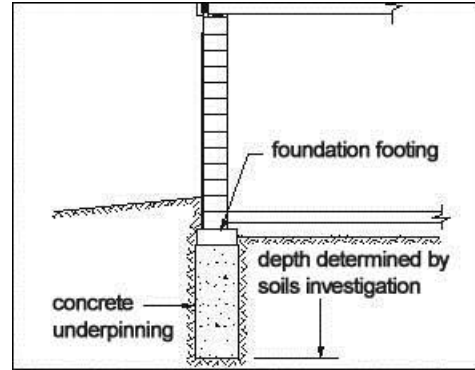


Figure 2: A typical foundation underpinning method in marine clays

Remedial underpinning construction is often necessary to reinforce a foundation that has been damaged by settlement. One method of underpinning a house is to construct new footings that extend some depth below the original footings throughout the damaged area (Figure 2). Another method requires the installation of drilled piers. A drilled pier foundation can consist of long steel beams drilled or rammed into the ground and bolted to the footing with a metal bracket, or a deep auger boring, typically six to twelve inches in diameter, that is filled with concrete after placement of vertical reinforcing steel bars.

The purpose of both methods is to extend the bearing support for the house to deeper soils that are more stable. The Marine Clays occur in an area of Fairfax County that has very diverse bands of sediments. Below the Marine Clay bands, there are often more stable soil layers with increased density, little risk of shrinking and swelling and less susceptibility to seasonal moisture changes. A thorough investigation should be conducted to determine the proper underpinning design and depth, since each house has different soil and foundation conditions.

Damage To Foundation Walls

Damage to foundation walls in Marine Clay-Marumsco soils often occurs when high shrink-swell clays are placed in the backfill against basement foundation walls and retaining walls. While this practice is expressly prohibited by Fairfax County, it was a common procedure in houses built before changes to the Fairfax County Code in 1975², and may still occur where the builder is uninformed or careless. The potential swelling pressures of the Marine Clays far exceed the design strengths of typical house foundation walls and have resulted in damage to many homes in Northern Virginia.

BUILDING SETTLEMENT CAUSED BY HIGH SHRINK-SWELL CLAYS IS MOST NOTICEABLE IN DRY SEASONS OF THE YEAR. . . .

² The Problem Soil Ordinance (Chapter 107 of the Fairfax County Code) was adopted in 1975 by the Board of Supervisors. One purpose of the Problem Soil Ordinance was to insure that new homes and roads constructed in problem soil areas would have the same degree of stability as homes constructed in more stable soils.

Damage from the pressure of swelling Marine Clays in backfill does not normally occur immediately after construction. The clay must often go through several yearly cycles of shrinking and swelling before the detrimental effects of the soils are revealed through cracked or failed walls. The clays in the backfill gradually settle under their own weight as years pass, increasing in density and exerting more stresses against walls. In addition, soil particles fall into the surface cracks formed in the clay backfill during dry periods of the year and cause an increase in pressure against the wall when swelling again occurs.

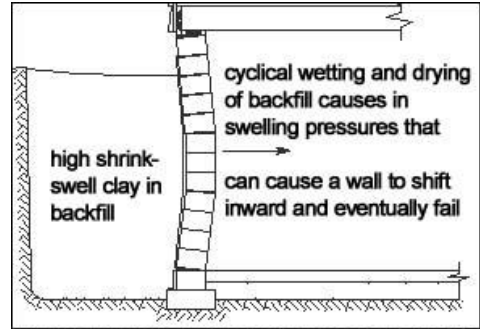


Figure 3: Foundation wall damage caused by high shrink-swell clay in backfill

Surface water can accumulate against foundation walls where the backfill has settled. The excess water then infiltrates into the backfill, increasing the soil moisture and swelling pressure of the soil. The result is accelerated deterioration of the basement wall, which may fail within a single season (Figure 3). Failing walls can exert damaging forces on nearby sewer, water, and gas pipes.

Based on application submissions and project reviews, the most successful repair method for foundation walls damaged from Marine Clay backfill is to remove and replace the clay with soils consisting predominantly of sandy or gravelly materials and to place waterproofing material along the outside of the wall and a foundation drain at the footing level on the outside of the house (Figure 4). Depending on the extent of damage, some walls will need to be replaced, while others can be repaired.

Marine Clay should never be placed in the backfill behind foundation or retaining walls. Present engineering standards for new construction require that the backfill soils consist of coarse-textured soils which contain more than 50 percent sand and gravel materials.

Foundation walls that have been damaged by the swelling pressure of clays will sometimes rebound to the original position after the clays are removed. The engineer or contractor must determine if the wall can be repaired or must be totally replaced.

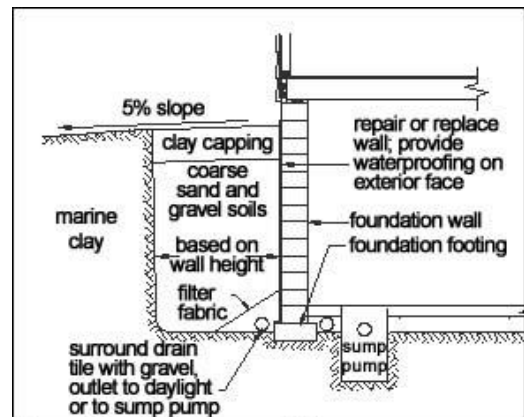


Figure 4: Repair or replacement of a damaged foundation wall

There are several steps that should be carefully followed in the repair of a damaged foundation wall:

- The load-bearing sections of the house near the repair area should be supported with temporary shoring if the foundation walls are severely damaged or are to be replaced. Your engineer or contractor should determine if temporary shoring is necessary and complete this phase of the work prior to earth-moving activities.

- After the underground utilities are marked and located, the Marine Clays should be excavated from behind the foundation wall and trucked to a landfill or other area. A four to eight-foot separation distance should be maintained between the foundation wall and the natural soils to prevent the future effects of soil swelling pressures against the wall. The separation distance should be approximately equal to the depth of the footings below the ground surface.
- The exterior side of the wall should be waterproofed after the wall is repaired or replaced.
- Foundation drains should be placed at the footing level on the outside of the house and encased in gravel. The foundation drains should lead to an outlet on a slope away from the house or to a sump pump.
- The new backfill soils should consist predominantly of coarse-grained sandy soils in order to minimize soil pressures against the walls and to allow good drainage.
- Finally, a one to two-foot thick capping layer of low shrink-swell silty or clayey soils should be placed at the ground surface and thoroughly compacted to reduce the infiltration of surface water. On top of the compacted layer, a few inches of top soil can be placed to encourage the growth of vegetation. The slope next to the house should be at least five percent (a six-inch drop for each ten feet in distance away from the house) (Figure 4).

In addition, you should ensure that individuals do not go near vertical embankments that are temporarily open during construction. Steep embankments in Marine Clays, as well as any other soils, present a safety hazard unless they are adequately sloped or protected by shoring. Slopes should not be steeper than 45 degrees (one-foot drop for each horizontal foot) unless they are braced with shoring. Your contractor is responsible for maintaining safe working conditions in accordance with Occupational Safety and Health Administration (OSHA) guidelines administered by the Federal Government and the State of Virginia.

Damage To Building and Yards Caused By Landslides

Damage to structures from landslides in Marine Clay-Marumsco soils can be dramatic. Slope failures have jeopardized buildings or utilities and made parts of yards unusable. Fortunately, only a few houses in Fairfax County have experienced this problem. Where houses are involved in landslides, movement is usually very slow (fractions of an inch per year) and can be corrected, although at a significant expense. Landslides have occurred during construction in the past, resulting in abandonment of the specific site or project.

Landslides are more common in landscaped yards and undeveloped areas, especially if they are highly sloped. In landscaped areas, landslides often occur in clay fills that were placed at the time of original construction. Slope failures occur most commonly during wet periods of the year when the soil moisture is at a maximum.

Most of the slides are relatively shallow, less than one or two feet in depth, and are more of a lawn maintenance problem than a hazard to a house. The shallow slides often can be corrected by flattening the slope or replacing the clays with stable soil materials containing less clay. Deeper landslides have occasionally occurred, requiring costly stabilization measures. Slides, shallow or deep, can damage underground utilities; especially rigid pipes such as gas, water, and sewer service.

The Fairfax County Code requires that a qualified geotechnical engineer prepare a report with a slope stability analysis for any new proposed construction in Marine Clay and for some repair projects³. The report must address the stability of the construction site and possible effects on any adjacent houses or land.

Damage To Floor Slabs and Roadways

Damage to floor slabs and roadways occurs when underlying clays shrink and swell. Road surfaces may deteriorate prematurely. Curbs and gutters may settle excessively. Swelling pressures under floor slabs can cause a damaging uplift of the floor, sometimes requiring replacement of the floor slab. Damage can be minimized by removing high shrink-swell clays under floor slabs and roadways to some depth, usually one to two feet, and replacing the clays with compacted non-swelling soils.

Yard Drainage Problems

Yard drainage problems occur in Marine Clay-Marumscos soils because water percolates very slowly through the clays and collects in flat yard areas. Establishing and maintaining lawns and shrubs can be a problem because of poor soil drainage. It is important to maintain positive drainage away from houses and throughout yard areas. Positive grades slope away from a house and help prevent water from soaking into the ground next to the house and causing potential foundation problems. Rainfall runoff may stand for long periods in areas that do not have at least a two percent slope.

The Marine Clays frequently have sand layers that carry groundwater. If the sand layers occur near the ground surface, the water can appear as springs during wet periods of the year. Severe wet basement problems can occur if the layers occur below the ground near a basement. These seepage areas can be drained with the proper design and placement of an underground drainage system.

³ The geotechnical engineering report for new construction must include adequate analysis, recommendations, and advice concerning foundation and pavement design, earth work, site grading and drainage, slope stabilization, and construction procedures. The analysis must consider short- and long- term stability of existing and planned slopes, as well as an evaluation of potential adverse effects to nearby properties. These analyses must use acceptable engineering methods

YOUR HOUSE LOCATION AND MARINE CLAY

Most of the Marine Clay-Marumsco soils in Fairfax County occur in Lee and Mount Vernon Districts, although Mason District has a few small areas. Marine Clay areas are shown in the current County Soils Map and labeled as either “Marumsco Soils” or “Previously Mapped Marine Clay.” The maps of Marine Clay are based on field surveys conducted by soil scientists and geologists during years of site investigations for building development and mapping programs. The Marumsco soils represent the extent of Marine Clays found during an update to the soils maps from the mid-2000s, while the “Previously Mapped Marine Clay” layer represents the extent of these soils in older mapping efforts. Damaging shrinking-swelling clays could be found in either area. The current soil maps can be accessed online: <http://www.fairfaxcounty.gov/gis/DMV/Default.aspx>

The Marine Clays-Marumsco soils underlie much of the land area east of Interstate 95, yet may have no effect on buildings, since they are often covered with up to 30 feet of overlying stable soils. The overlying soils consist of mixtures of clay, silt, sand, and gravel. They present potential problems only when near the ground surface (Figure 5).

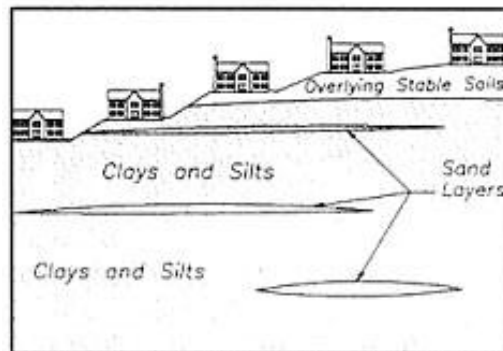


Figure 5. Marine Clay Soils Containing Clays, Silts, and Frequent Sand Layers

The location of the clays should not be scaled directly from the maps because of the difficulty of accurately mapping the soils, the variability of the soils, and the transition from one soil type to another. The only way to definitively tell if your house is located in, or is having problems due to Marine Clay, is to have someone experienced in soils conduct a field investigation and make test borings.

A house located in Marine Clay may never have a soil-related problem. The house may either be properly constructed to withstand the soil conditions or be located in an area of more stable soils within the Marine Clay. We have found that house footings do not necessarily have to be in contact with Marine Clay to develop problems; some houses have experienced settlement due to desiccation under the footings even though the clays are one to three feet below the bottom of the footings.

Marine Clays are not the only soils in Fairfax County with high shrink-swell clays that can cause problems. Several other soil types have potential for causing some similar problems, although usually to a lesser degree. Some of these soils occur east of Interstate 95 while others can be found in the western part of Fairfax County. Fairfax County Soils Map shows the location of most of these soils.

DIAGNOSING THE PROBLEM

Diagnosing a Marine Clay-Marumsco soils problem and designing repair measures usually requires an individual experienced in soils and engineering. As a homeowner, however, your observations and records of problems over the years can help evaluate the problem, as well as the suitability of a particular construction proposal, or even the need for repairs.

If you see foundation wall cracks, note when they first appeared and how extensive they are. Small settlement cracks (smaller than 1/16 inch) are not uncommon in new construction. They usually appear and stabilize during construction or within the first year. Settlement cracks often appear in houses located in the most stable soils in Fairfax County. However, cracks that appear abruptly after five, ten, or thirty years are likely caused by soil problems. Measure and keep a record of the width and extent of the cracks and the time of the year that you made the recordings. The appearance of foundation wall cracks does not necessarily mean that you have a structural problem, or even that your house is constructed on Marine Clay. A structural problem, affecting your house can develop, however, if soil-related damage is allowed to progress unchecked for long periods.

If the cracks open up during the summer months, especially during very dry years, and close up during the moist winter months, they are probably caused by shrinking and swelling of clays below the footings. Note the location of trees with respect to damage in the walls, since trees remove a lot of moisture from soil and are often a contributing factor to foundation problems in Marine Clay. Cracks that extend through masonry walls and follow block and brick mortar lines may indicate advanced settlement due to shrink-swell clays (Figure 1). Foundation underpinning to an adequate depth may be required to correct the problem.

***THE APPEARANCE OF
FOUNDATION WALL CRACKS
DOES NOT NECESSARILY MEAN
THAT YOU HAVE A
STRUCTURAL PROBLEM***

If one or more basement walls are cracked and bowing inward, you may have high shrink-swell clays in the backfill behind the basement wall (Figure 3). Concrete block walls that are bowing inward usually have one or more horizontal cracks about mid-height on the wall. Vertical cracks often develop near the corners, since the corners are more rigid and resist inward movement. The walls may exert pressure against sewer, water, and natural gas pipes. Call the gas company immediately if you think that your natural gas pipe or gas meter is under pressure from a damaged wall, since an explosion could occur from a leaking pipe.

Check the soil next to your basement wall. If there is a gap one-half to one inch in width between the wall and soil backfill during the summer months, then you may have high shrink-swell clays, at least near the ground surface. The only way to confirm if you have clays throughout the backfill is to excavate or bore down to the footings with an auger.

Houses involved in a landslide will usually show actual lateral movement and misalignment of the foundation walls and footings. As previously mentioned, very few houses are directly affected structurally by landslides. Shallow slides in sloping yard areas are more common,

however, and appear as uneven, hummocky areas. Trees within slides will sometimes have curved trunks near the base caused by a combination of slope movement and the natural tendency of the tree to grow upward.

HOMEOWNER PREVENTATIVE MAINTENANCE

There are several steps you can take if you think that your house is located in Marine Clay-Marumscos soils, or even after you start to see some damage. Some of these steps are beneficial regardless of where your house is located in Fairfax County. They may be critical if you happen to be in a problem area of Marine Clay. The steps require maintaining good drainage around the house and keeping the soils under the footings and in the basement wall backfill at stable moisture levels:

- First, make sure that you have positive grades sloping away from the house to help remove rainfall runoff. Backfill next to basement walls normally settles after several years, leaving depressional areas for water to collect. Use a silty or clayey soil rather than sand, gravel, or mulch to increase the grade to at least five percent (a six-inch drop in ten feet) to turn surface water away from the house.
- Make sure that your landscaping does not trap water above the backfill next to the basement wall. Regrading of a yard is sometimes necessary to carry surface water away. Make sure the gutters and downspouts are in good condition and that they carry all roof water beyond the backfill or at least ten feet away from the house on splash blocks or through non-perforated pipe.
- Large trees should be at least 20 feet away from the house. Tree roots can extend well beyond the farthest reaching branches. The fine roots that you can barely see, not the large ones, extract the water from the ground. If you think a tree may be causing foundation problems, removal may be necessary to help stabilize the moisture in the soil.
- Foundation footings on older houses may be shallow, especially those with a walkout basement, crawl space, or slab-on-grade construction. Increase the slope next to the house foundation as much as practical by adding a layer of silty or clayey soils. This helps to create a more constant moisture environment for the soils below the footings.
- If you have a swimming pool, make sure that there are no leaks. Excessive leakage from a swimming pool into the soils around a house can cause foundation problems by weakening the foundation soils or increasing swelling pressures against the foundation walls. Excessive watering of plants next to the house may create similar problems.
- Sometimes springs or seepage areas occur near a house, or even below-ground next to the basement area. Subsurface drainage (drain pipe) may be needed to remove the water. Basement sump pumps, if required to maintain a dry basement, should be in good working condition.
- Shallow slides or slope creep may not present a threat to your house, but can be a nuisance in maintaining a yard. Possible methods of stabilizing the creeping slopes include replacing the slide areas with more stable soil materials containing less clay or regrading to a flatter slope. Clay areas that have moved because of slope creep can often be stabilized by regrading the slope to 20 percent (a one-foot drop in five feet of distance) or flatter.

Some homeowners with foundation problems add water around the house during dry periods to help increase soil moisture and reduce soil shrinkage under the footings. This might work in theory. We do not generally recommend this practice, however, since uncontrolled addition of water can create more problems than it solves. The addition of too much water can damage foundation walls.

GETTING ASSISTANCE FROM FAIRFAX COUNTY

The following agencies and offices can be contacted for further information and assistance:

Information	Agency/Office	Contact
Soil Information and Technical Assistance <i>(Problem identification)</i>	Northern Virginia Soil & Water Conservation District http://www.fairfaxcounty.gov/nvswcd/	703-324-1460 TTY 711
Home Improvement Loan Assistance <i>(Temporarily Closed to New Applicants)</i>	Department of Housing and Community Development http://www.fairfaxcounty.gov/rha/hilp.htm	703-246-5155 TTY 703-385-3578
County Requirements of the Contractor <i>(Licensing Information)</i>	Permit Application Center http://www.fairfaxcounty.gov/dpwes/navbar/faqs/contractorlic.htm	703-222-0801 TTY 711
Consumer Information and Complaints <i>(evaluating private contractors-performance and disputes)</i>	Department of Consumer Affairs http://www.fairfaxcounty.gov/consumer/	703-222-8435 TTY 711
Location of Underground Utilities <i>(Before soil testing or excavating)</i>	Miss Utility	811 (in Virginia) or 1-800-552-7001
Building and Construction Information, Permit Requirements <i>(Before beginning repairs)</i>	Permit Application Center http://www.fairfaxcounty.gov/dpwes/construction/whenapermitisrequired.htm	703-222-0801 TTY 711

SELECTING AN ENGINEERING FIRM

A geotechnical engineer — one experienced in soils and foundation engineering - has the technical expertise to evaluate and design repairs for Marine Clay-Marumsco damage. The Fairfax County Code requires that a soils report be prepared by a qualified engineer for all new construction and grading work in Marine Clay. As a matter of practice, a geotechnical engineering report is required for repair work, unless the homeowner or contractor prepares adequate recommendations and plans.

The geotechnical engineer should provide a thorough investigation of the soils under and around your house as part of the analysis and report. Soil borings or test pits should be located in the problem area to determine the soil characteristics. The engineer should make observations on the stability of the surrounding slopes. If foundation settlement has occurred, the engineer should investigate the soils to a depth of at least ten feet below the bottom of the footings. If the problem is confined only to foundation wall damage due to swelling clays, several auger samples taken throughout the depth of the existing backfill may provide a satisfactory basis for preparing a report.

The recommendations in the engineer's report should be based on the preliminary findings. It is critical, however, that the engineer inspects the soils at the bottom of footings during underpinning construction because of possible variation of the soils. It is also critical that the engineer inspect new backfill soils that are to be placed behind basement walls. The most thorough investigation and highest quality plans can be for naught unless the work is completed properly.

The engineer should note and make a record of all evidence of damage to the house. If there is significant structural damage to the house, the geotechnical engineer should advise you if a structural engineer should be retained for further analysis. A structural engineer is one who specializes in the design and stability of building structures.

Fairfax County does not currently maintain a list of engineers capable of providing geotechnical engineering services, nor recommend one engineering firm superior to another. Lists of engineering firms can be found on the internet or in the Yellow Pages (Engineers – Geotechnical, Consulting, Foundation, Soil, Structural). In obtaining the services of a professional engineer, contact several engineers (at least three) and compare the services offered.

Only licensed, professional engineers are allowed to perform engineering work in Fairfax County. Ask for proof of licensing, or look up license records on Virginia's Department of Professional and Occupational Regulation website: <http://www.dpor.virginia.gov/LicenseLookup/>. Ask the engineer for qualifications such as training and experience in soil and foundation engineering, and especially about experience with Marine Clay. Ask for business and professional references and follow up on these. Contact the Department of Consumer Affairs to see if any complaints have been filed against the engineer and how these were resolved.

SELECTING A CONTRACTOR

Fairfax County does not currently maintain a list of contractors who are available to work in Marine day areas, nor recommend one contractor preferable to another.

Construction and home repair contractors may advertise their services through a variety of means. When selecting a contractor for your repair work, you should always contact several contractors (at least three) and compare the costs and services offered. Costs and quality of work can vary substantially.

... JUST BECAUSE A CONTRACTOR HAS COMPLETED A PROJECT IN MARINE CLAY DOES NOT MEAN THAT HE OR SHE IS QUALIFIED TO REPAIR YOUR HOUSE.

Some contractors may have experience in house repairs in Marine Clay. However, just because a contractor has completed a project in a Marine Clay area does not mean that he or she is qualified to repair your home. Ask contractors for their qualifications. Is the contractor licensed to work in Fairfax County? How long have they been doing home repairs? How many projects have they completed in Marine Clay? Ask for business and professional references and follow up on these.

A contractor must be licensed either by Fairfax County or by the State Regulation Board for Contractors. They must also have Fairfax County Business, Professional and Occupational License from the Office of Assessments. Any salesperson representing the contractor who goes door-to-door attempting to sell services must have a solicitor's license issued by the Fairfax County Department of Consumer Affairs. You should not deal with an unlicensed contractor.

Find out how reliable the contractor has been in the past. Is the work completed in a timely fashion? Are cost overruns typical? Does the completed project look like it was completed by a professional? Are the homeowners satisfied with the quality of the work? You can contact the Department of Consumer Affairs to see if any complaints have been filed against the contractor and how these complaints were resolved.

Ask for a written estimate of the work to be done, including separate statements for materials and labor. Since repair designs will often be prepared by a professional engineer, the contractor will be basing the estimate on the engineering design. Be sure that the contractor understands the scope of the work completely. Make sure that there is complete understanding between the contractor and any of his or her subcontractors regarding the design and extent of the work.

Monitor the progress of the construction from start to finish. The recommendations and drawings prepared by the engineer or contractor should be clearly understandable. Do not hesitate to ask questions about the design and construction. Make sure that you are getting the service and product for which you are paying.

PREPARING THE CONTRACT

For your protection, a contract for repairing your house damage should be carefully prepared. It should meet all the requirements of the Home Improvement Code (Chapter 61, Article 3) of the Fairfax County Code. You may want to have the contract reviewed by your attorney.

The Contracts section of Article 3 of the Home Improvement Code is exhibited in the appendix of this Homeowner's Guide. The entire Fairfax County Code can be viewed online (<http://library.municode.com/HTML/10051/level1/FACOCO.html>) or in Fairfax County Regional and Community Libraries.

Briefly, the Home Improvement Code states that all home improvement contracts shall be in writing with copies for the homeowner and contractor. The contract should list the entire agreement of the parties. The Home Improvement Code specifies that the contractor is prohibited from accepting payment until all blanks in the contract are filled in.

According to the Home Improvement Code, all contracts shall include: identification of the contractor; specifications or written description of the work to be completed; terms of payment; and approximate dates for starting and finishing the project.

There are several supplemental terms you may want to include in the contract:

- A fixed-price contract, not an open-ended one, is preferable. The contractor should have enough information from the geotechnical report to develop cost estimates for his or her work. If not, the geotechnical report is probably incomplete and does not address the problems thoroughly. Any change orders to the contract should also have a fixed price.
- The contract should provide for your acceptance of the geotechnical report and the proposed drawings of repairs. The geotechnical engineer should have reviewed these drawings if they are prepared by the contractor, stamped them with his or her license seal, and signed his name. You are entitled to a copy of the report and drawings under the contract requirements of the Home Improvement Code.
- A requirement that the bulk of contract payment will be made upon completion of the work, not in advance, will help ensure completion of the project. Consider withholding some portion, for example, one-third, of the payment until all required inspections by the engineer and Fairfax County have been completed and approved. The contract should specify that you are not required to make final payment until given proof that the contractor has paid for labor, supplies and equipment that he used to complete the contract. You might be subject to mechanic's liens against your property by subcontractors or material suppliers if the contractor fails to pay them.
- Consider a provision that spells out the responsibility of the homeowner and contractor for insurance coverage. Generally, the contractor should have liability and workman's compensation insurance to cover accidental damage to your home and injury to employees

on your property. Ask for the name of the contractor's insurance carrier and the name of the agent who can verify the policy.

- The contract should specify that the soils report is prepared in accordance with all applicable Codes and guidelines of Fairfax County and those inspections and certifications are included in the services provided by the engineer. Any guarantees made by the engineer should be included in the contract. Any warranties and guarantees made by the contractor should also be included in the contract. The contract should specify that the contractor is responsible for obtaining any building permits.

GETTING THE BUILDING PERMIT

A building permit is required in Fairfax County prior to any foundation repair work either on the interior or exterior of a house. The purpose of the permit is to ensure that the construction is in accordance with applicable building codes and good engineering practice. Although it is the homeowner's obligation to obtain and post the building permit, the contract should specify the contractor as responsible for obtaining the necessary permits in his or her name. By doing so, the contractor, rather than the homeowner, is responsible for ensuring compliance with County and State Codes.

The building permit for repair of Marine Clay-Marumscos damage may be a valuable document when you sell your house because it shows that building codes were followed in correction of the problem. Building permits are obtained through the Permit Application Center. The building permit, along with construction drawings and any engineering reports, must be reviewed and approved by Fairfax County staff. Fairfax County staff may visit the site as part of the review.

***THE BUILDING PERMIT FOR
REPAIR OF MARINE CLAY
DAMAGE MAY BE A VALUABLE
DOCUMENT WHEN YOU SELL
YOUR HOUSE . . .***

Don't forget that underground utilities - water, sewer, electricity, gas, cable, telephone, and any others — should be marked before the engineer or contractor begins any earthwork. If they are not marked, you run the risk of disrupted service, or worse, a safety hazard. There is a single agency, "Miss Utility" that you can call to have utility lines marked at no cost (Phone: 811 from a landline in Virginia or 1-800-552-7001 from a cell phone or from out of state). Your call is routed to all utility companies who are participating members of the service. Your engineer or contractor may make the necessary call. The path of the utility will be identified by staking or marking on the ground; when no utilities exist, you will be notified accordingly. Calls should be placed at least 48 hours before any work is to start. Remember: It's the law in Virginia to call Miss Utility before excavating near utility lines.

SOME QUESTIONS AND ANSWERS ABOUT MARINE CLAY

This section includes some of the typical questions that you, as a homeowner, may have about Marine Clay. These questions and answers summarize some of the information that has already been presented in this guide.

What is Marine Clay?

Marine Clay, also referred to as Marumsco soil, is a type of soil found in Fairfax County that contains clays that swell upon wetting and shrink upon drying. Potential problems associated with these soils include land slippage and slope instability, shrinking and swelling of clays, poor foundation support, and poor drainage.

Where is Marine Clay found?

Marine Clay occurs in an area of Fairfax County known as the Coastal Plain, an area located primarily east of Interstate 95. Fairfax County maintains detailed soil maps for the County, which are available online: <http://www.fairfaxcounty.gov/gis/DMV/Default.aspx>. For help in using the maps, contact the Northern Virginia Soil and Water Conservation District at 703-324-1460.

How can Marine Clay affect my house?

Pressures exerted by Marine Clays upon swelling can crack and damage below-ground walls and ground floor slabs. Shrinking and swelling of soils underneath the foundation footing can reduce the bearing support, damaging foundation walls. Land slippage and slope movement can also undermine the foundation support and, in some rare cases, can cause walls or sections of the house to separate or break apart.

Are all cracks in a house due to Marine Clay?

No. Many hairline cracks may be due to natural settlement of a house and may not represent severe structural damage. Settlement of improperly compacted non-clay fill under a foundation, pressures exerted by water collecting next to the house, and substandard building construction can also result in cracks in walls and floor slabs and in foundation damage.

How can I be sure that my problem is due to Marine Clay?

First, look at the soils maps to see if Marine Clay or Marumsco soils are mapped on or near your property. If you live far from any mapped deposits, your problems are likely due to some other soil type of something else entirely. If you live on or near a Marine Clay/Marumsco deposit, weather patterns can provide clues to identify if the damage is caused by Marine Clay. For instance, foundations may settle during extended dry periods which cause the clays to shrink; wet periods may increase swelling pressures on walls; slope movement typically occurs during wet periods of the year. Cracks caused by Marine Clays tend to open and close with changing

moisture conditions. Often, several houses will be affected in areas which are experiencing are experiencing Marine Clay problems. Check to see if any of your neighbors are experiencing similar problems.

The Northern Virginia Soil and Water Conservation District can help you survey the extent and cause of the damage. Such assistance will *not* take the place of engineering evaluations and designs, but can help you understand the cause of the damage, determine the need for further action, and evaluate potential solutions to the problem.

What should I do to repair damages caused by Marine Clay?

Most types of structural damage resulting from Marine Clay can be repaired. You will need to obtain a building permit before any repair work is undertaken. The Fairfax County Code (Chapter 107 - Problem Soils Ordinance) currently requires a soil report prepared by a qualified geotechnical engineer for all new construction and grading work in Marine Clay areas. As a matter of practice, an engineering report is required for repair work unless the homeowner or contractor prepares adequate recommendations and plans. Engineering designs should be submitted with the application for a building permit. When the County approves your designs, you will receive a building permit. The engineer who prepared the repair designs must inspect the repair work and certify that the designs are properly implemented.

Why do I need an engineer?

An inadequate repair can often result in no repair at all - the damage may resurface after some time. An experienced geotechnical engineer can help identify the source of the damage and ensure that the proposed designs adequately address the problem. While the causes of some types of damage are relatively easy to diagnose, the causes of others can be baffling. An engineer can also make sure that the repairs themselves will not create more damage to the house and potentially result in further problems.

Why can't I just patch the cracks in the walls?

Patching wall, ceiling, or floor cracks caused by Marine Clay is only a cosmetic repair and is not a solution to the problem. Patching does not address the source of the problem. Damage may reappear, resulting in more extensive and costly repairs. If you patch up cracks and later sell your house without disclosing the damage, you may be sued by the purchaser.

Will every house built in Marine Clays have problems?

Not every house that has been built in Marine Clay is or will be experiencing problems. The house may be properly constructed to withstand the soil conditions, especially if constructed after the 1975 adoption of County Codes regulating construction in problem soils, or may be in an area of more stable soils. While no design can provide a 100 percent guarantee that problems will not occur, certain safeguards can be taken to reduce the potential for damage by Marine Clay. Engineering designs that have been properly incorporated into new house construction or

in repairs to existing houses minimize the potential for later damage by Marine Clay. Homeowner maintenance directed toward preventing moisture changes that could trigger Marine Clay damage can also minimize future problems.

What can I do to prevent Marine Clay damage from occurring?

As a homeowner, you can take certain steps to reduce the potential for future Marine Clay damage. These steps lessen changes in moisture that can lead to the shrinking and swelling of clays that cause foundation and wall damage. Maintain a positive grade, or slope, away from the house. This encourages surface water to run off away from the house rather than to soak into the ground next to the house. Similarly, make sure that gutters are in good repair and divert all downspouts away from the house. Do not leave outside water faucets or hoses running unattended, which can add large quantities of water to the soil next to the house.

Keep all deeply-rooted trees and shrubs away from the house. Roots growing around and underneath the foundation can take up large amounts of soil moisture during the growing season, dry out the clays, and lead to soil shrinkage and loss of foundation support.

What kind of County assistance is available?

Fairfax County can help the homeowner determine the source and severity of damages that may be caused by Marine Clay. Contact the Northern Virginia Soil and Water Conservation District for technical help. Consumer information helpful in selecting an engineering firm or a contractor to repair damages can be obtained by contacting the Department of Consumer Affairs. Contact the Permit Application Center for information on building permits. In certain cases, low interest loans may be available for repair work. For availability and criteria, contact the Department of Housing and Community Development. See the table on page 16 for a listing of these County agencies.

APPENDIX

SECTION 3: HOME IMPROVEMENT CODE-GENERAL (Part of the Fairfax County Code)

Section 61-3-2. Contracts-General

All home improvement contracts shall be in writing, shall be executed in duplicate with 1 copy to the owner of the property and 1 copy to the contractor, and shall fully and completely set forth the agreement of the parties. The demand for or the receipt of any payments prior to the execution of such a contract with all blanks filled in is hereby specifically prohibited. A copy of the contract form customarily used by the contractor for the performance of home improvement work shall be filed with the application for a home improvement contractor's license required by this Chapter. (45-03-61.)

Section 61-3-3. Contracts — Contents.

All contracts for home improvement work shall include, but not be limited to the following:

- (1) A date on which work is to begin and the estimated completion date.
- (2) A statement of the total cost of the contract and the amounts and schedule for progress payments including a specific statement on the amount of the down payment.
- (3) A listing of specified materials and work to be performed which is specifically requested by the consumer.
- (4) A "plain-language" exculpatory clause concerning events beyond the control of the contractor and a statement explaining that delays caused by such events do not constitute abandonment and are not included in calculating time frames for payment or performance.
- (5) A statement of assurance that the contractor will comply with all state and local requirements for building permits, inspections, and zoning.
- (6) Disclosure of the cancellation rights of the parties.
- (7) For contracts resulting from door to door solicitations, a signed acknowledgement by the consumer that he has been provided with and has read the Department of Professional and Occupational Regulation's statement of protections available to him through the Board for Contractors.
- (8) The contractor's name, address, office telephone number, license/certificate number, expiration date, class of license/certificate and license classifications or specialty services.
- (9) Statement providing that any modification to the contract, which changes the cost, materials, work to be performed, or estimated completion date must be in writing and signed by all parties. (9-84-61; 13-95-61; 45-03-61.)