

County of Spotsylvania
Founded 1721

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Service, Integrity, Pride

SPOTSYLVANIA COUNTY RESIDENTIAL FOUNDATIONS POLICY

Effective: February 1, 2007

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1. SOIL TESTING REQUIREMENTS

The 2012 edition of the **Virginia Uniform Statewide Building Code, section R401.4**, states the following regarding soil tests: “Where quantifiable data created by sound science methodologies indicate expansive, compressible, shifting or unknown soil characteristics are likely to be present, the building official shall determine whether to require a soil test to determine the soil’s characteristics at a particular location. This test shall be made by an approved agency using an approved method”.

Past development has indicated that soils having either a high or moderate shrink swell potential exist throughout various areas of the county. This potential for shrink swell soils has also been confirmed through the Soil Survey of Spotsylvania County, Virginia issued in August, 1985, a survey made by the Soil Conservation Service in cooperation with the Virginia Polytechnic Institute and State University. These expansive soils have the characteristics of absorbing water and swelling, or shrinking and cracking when drying. The significant volume changes brought about by expansion/shrinking can cause serious damage to buildings and other structures.

Prior to issuance of a building permit for certain structures, Spotsylvania County Building Safety Dept. requires a soil test to be performed to determine the shrink/swell potential of the soil.

A soil test is required for the following:

1. All new single family dwellings
2. All additions where the floor slab is four (4) feet or more below the existing grade (on any side)
3. Building additions with a footprint of four hundred (400) square feet or larger
4. Any project, which does not fit into the above categories, as deemed appropriate by the building official

Note: At the discretion of the building official, an existing soil report that was prepared for the original dwelling shall be adequate for an addition.

A soils report **shall not be required** for:

1. Decks (open, covered or screened)
2. Detached storage sheds
3. Detached garage without habitable space above
4. Swimming pools
5. Stoops and/or porches (open or covered)
6. Manufactured homes (as defined in Chapter 2 of the Virginia Uniform Statewide Building Code) installed on piers with tie downs.

Note: If questionable soils are encountered by Spotsylvania County Building Safety Dept., or by an approved third party inspection agency, during construction, the building official reserves the right to issue a stop work order and require a soil test be performed, prior to proceeding with construction.

If a soil test is required, such testing shall be performed by a Virginia licensed professional engineer or a Virginia certified soil scientist.

Soil Sample Requirements:

1. A minimum of two (2) soil borings per site shall be taken which shall be located at opposite outside corners of the proposed structure.
2. Test borings shall extend a minimum depth of two (2) feet below the recommended footing depth or to a depth of five (5) feet, whichever is greater, or until auger refusal is encountered.
3. A sample which exhibits the "poorest" observed soil quality from each boring within a zone from grade to two (2) feet below the proposed bottom of footing, shall be taken to the laboratory for testing.

The soils professional shall determine the appropriate test(s) to be performed in all cases based on the soil characteristics and any other known factors relating to the site and the proposed construction. ASTM Unified Soil Classification is not acceptable as a test standard for the purposes of this policy. Laboratory test procedures shall, at a minimum, contain one set of index parameters which are performed using ASTM test procedures or a County approved methodology. All laboratory tests must be performed in an Approved laboratory that is accredited in the ASTM test method being performed. If FHA PVC tests are performed in lieu of ASTM test methods, the laboratory must be accredited to perform a least one ASTM test method.

Soil Reports.

When a soil test is required, a written report of the investigation shall be submitted that includes, but need not be limited to, the following information:

1. A plot showing the location of test borings and/or excavations
2. A complete record of the soil samples, including existing fill material
3. A record of the soil profiles, including identification of soil types
4. Elevation of the water table, if encountered
5. Special design and construction provisions for footings, foundations or slabs, as necessary
6. Shrink-swell potential of soil, including swell pressure
7. Design load bearing capacity of the soil
8. Certify that the laboratory test procedures, at a minimum, contain one set of index parameters which are performed using ASTM test procedures
9. Original signature(s) and professional seal(s) of the soil professional(s) who performed and/or supervised the soil sampling, conducted the laboratory testing and/or evaluation, and prepared the report
10. Reason for auger refusal during sampling, if applicable

When a soil is identified, through laboratory testing, as having a **zero or low potential** to shrink swell:

- There are no foundation requirements for construction outside the minimum requirements of the building code. (based upon the soil types identified within the soil report). The building designer shall supply the soil type, per soil report, and the foundation type, per code tables, on the submittal drawings.
- All subgrade inspections (i.e., footing, wall slab, backfill) shall be performed by the county, or an approved third party inspection agency.

When a soil is identified, through laboratory testing, as having a **moderate potential or high potential** to shrink swell, a foundation design is required.

- The foundation shall be designed by a Virginia licensed professional engineer, or a Virginia licensed architect.
- All subgrade inspections (i.e., footing, wall, slab, backfill) shall be performed by the county, or an approved third party inspection agency.
- If soil characteristics other than those referenced in the soil report are encountered during field inspections, the owner may be required to obtain the services of a soils professional to perform additional analysis, at the discretion of the building official.

2. FOUNDATION DESIGN REQUIREMENTS

For all projects not requiring a soil investigation, and for projects found to contain soils having a zero or low potential to shrink swell through laboratory testing:

The foundation shall be designed and constructed in accordance with the minimum requirements of the building code.

When a foundation requires a design by a Virginia licensed professional engineer or architect, such design shall be based upon **Virginia Residential Code section R403.1.8**. During the design, consideration shall be given to, but not limited to the following:

- Design of the footing, wall, backfill and slab
- Lateral pressure on foundation and/or piers
- Uplift on foundation and/or piers
- Uplift on slab
- Soil swell pressures on foundation
- Soil swell pressures on piers
- Soil swell pressures on slab
- Hydrostatic pressure from groundwater
- Surcharge loads (garage adjacent to foundation, etc.)
- Depth of footing
- Type of soil to be used as backfill material
- Use of existing soil as backfill material
- Isolation of foundation from expansive soil
- Isolation of pier from expansive soil
- Isolation of slab from expansive soil
- Removal of existing soil. Amount of cut required under the slab and/or adjacent to the foundation
- Special slab drainage
- All recommendations of the soil report
- Requirements other than section R401.3, if any, to ensure proper surface drainage away from the foundation
- Requirements other than section R801.3, if any, to ensure proper roof drainage away from the foundation

All foundation designs submitted to Spotsylvania County Building Safety Dept. for review and approval must possess the lot or parcel number for which the design is applicable, the date of the design and the seal and original signature of the design professional responsible for the design.

R403.1.8 Foundations on expansive soils. Foundation and floor slabs for buildings located on expansive soils shall be designed in accordance with **Section 1808.6** of the **International Building Code**.

R403.1.8.1 Expansive soils classifications. Soils meeting all four of the following provisions shall be considered expansive, except that tests to show compliance with Items 1,2 and 3 shall not be required if the test prescribed in Item 4 is conducted:

1. Plasticity Index (PI) of 15 or greater, determined in accordance with ASTM D 4318.
2. More than 10 percent of the soil particles pass a No. 200 sieve (75 mm), determined in accordance with ASTM D 422.
3. More than 10 percent of the soil particles are less than 5 micrometers in size, determined in accordance with ASTM D 422.
4. Expansion Index greater than 20, determined in accordance with ASTM D 4829.

IBC 1808.6 Design for expansive soils. Footings or foundations for buildings and structures founded on expansive soils shall be designed in accordance with Section 1808.6.1 or 1808.6.2.

Exception: Foundation design need not comply with Section 1808.6.1 or 1808.6.2 where one of the following conditions is satisfied:

1. The soil is removed in accordance with Section 1808.6.3; or
2. The building official approves stabilization of the soil in accordance with Section 1808.6.4.

IBC 1808.6.1 Foundations. Foundations placed on or within the active zone of expansive soils shall be designed to resist differential volume changes and to prevent structural damage to the supported structure. Deflection and racking of the supported structure shall be limited to that which will not interfere with the usability and serviceability of the structure.

Foundations placed below where volume change occurs or below expansive soil shall comply with the following provisions:

1. Foundations extending into or penetrating expansive soils shall be designed to prevent uplift of the supported structure.
2. Foundations penetrating expansive soils shall be designed to resist forces exerted on the foundation due to soil volume changes or shall be isolated from the expansive soil.

IBC 1808.6.2 Slab-on-ground foundations. Moments, shears and deflections for use in designing slab-on-ground, mat or raft foundations on expansive soils shall be determined in accordance with *WRI/CRSI Design of Slab-on-Ground Foundations* or *PTI Standard Requirements for Analysis of Shallow Concrete Foundations on*

Expansive Soils. Using the moments, shears and deflections determined above, nonprestressed slabs-on-ground, mat or raft foundations on expansive soils shall be designed in accordance with *WRI/CRSI Design of Slab-on-Ground Foundations* and post-tensioned slab-on-ground, mat or raft foundations on expansive soils shall be designed in accordance with *PTI Standard Requirements for Design of Shallow Post-Tensioned Concrete Foundations on Expansive Soils*. It shall be permitted to analyze and design such slabs by other methods that account for soil-structure interaction, the deformed shape of the soil support, the plate or stiffened plate action of the slab as well as both center lift and edge lift conditions. Such alternative methods shall be rational and the basis for all aspects and parameters of the method shall be available for peer review.

IBC 1808.6.3 Removal of expansive soil. Where expansive soil is removed in lieu of designing footings or foundations in accordance with Section 1808.6.1 or 1808.6.2, the soil shall be removed to a depth sufficient to ensure a constant moisture content in the remaining soil. Fill material shall not contain expansive soils and shall comply with Section 1804.5 or 1804.6.

Exception: Expansive soil need not be removed to the depth of constant moisture, provided the confining pressure in the expansive soil created by the fill and supported structure exceeds the swell pressure.

IBC 1808.6.4 Stabilization. Where the active zone of expansive soils is stabilized in lieu of designing footings or foundations in accordance with Section 1808.6.1 or 1808.6.2, the soil shall be stabilized by chemical, dewatering, presaturation or equivalent techniques.

3. FOUNDATION CONSTRUCTION

All footings, foundation walls and slabs shall be constructed in accordance with the approved construction documents. Any county approved foundation designs submitted by a Virginia licensed professional engineer or architect, shall be available to the inspector as part of the county approved construction documents. If, at any time during the construction process, the existing soils are found to be of a questionable nature, the owner may be required to obtain the services of a soils professional to perform additional analysis in order to identify the characteristics of the soil in question. The soil investigation shall be at the discretion of the building official.

4. FOOTING CONSTRUCTION

Minimum footing requirements:

- Frost depth to the bottom of the footing shall be a minimum of 18 inches
- Footings shall be supported on undisturbed natural soils or engineered fill.
- Thickness of the footing shall be the minimum per section R403.1.1 of the code
- Width of the footing shall be the minimum per table R403.1 of the code

- Footings shall be continuous per section R403.1 of the code
- Footings shall be stepped where it is necessary to change the elevation of the top surface of the footings or where the slope of the bottom surface of the footings will exceed one unit vertical in ten units horizontal, per section R403.1.5
- The overlap at all footing steps shall be a minimum of 2 times the footing thickness.
- The height of a single footing step shall not exceed $\frac{3}{4}$ of the horizontal dimension of the previous higher elevated footing , up to a maximum height of 32 inches

The use of slag lintels between two discontinuous footings will not be approved by Spotsylvania County. Crawl space or garage footings, are to be stepped down to adjacent basement footings. As an alternative, a design and calculation packet may be submitted by a Virginia licensed professional engineer or architect utilizing the concrete stem wall to span between two discontinuous footings.

5. BRICK LEDGES

Brick ledges that recess into the required wall thickness must be detailed on the approved drawings. The height of the reduced foundation wall thickness shall not exceed 24 inches, unless designed and sealed by a Virginia licensed professional engineer or architect.

6. FOUNDATION DRAINAGE

Drains shall be provided around all concrete and masonry foundations that retain earth and enclose habitable or usable spaces located below grade, per section R405.1 of the code. These drains shall discharge by gravity or mechanical means into an approved drainage system. **If the foundation drain is to be installed to a sump crock, the sump crock shall be installed at the time of the plumbing groundwork inspection.** In addition, the builder must demonstrate that the sump pump is operating properly during the final inspection.

The foundation drainage system inspection conducted by approved Third Party Inspectors prior to the placement of backfill shall be documented through the Third Party Inspection Program.

7. AREAWAY DRAINS

Areaway drains shall be a solid pipe, not less than 3 inches in diameter and shall be provided with a removable strainer with an open area of at least two-thirds of the cross-sectional area of the drain line to which it connects. Areaway drains shall discharge by gravity or mechanical means into an approved drainage system.

The installation of the areaway drain shall be in place at the time of the plumbing groundwork inspection. **If the areaway drain is to be installed to a sump crock, the sump crock shall be installed at the time of the plumbing groundwork inspection.** In addition, the builder must demonstrate that the sump pump is operating properly during the final inspection.

Periodic maintenance must be provided by the homeowner in an effort to keep the strainer clean of debris. A clogged strainer can lead to water backing up within the areaway and potentially into the basement.

8. SPECIAL SLAB DRAINAGE

If the foundation is required to be designed by a Virginia licensed professional engineer or architect, such design may require the installation of a special slab drainage system. If a slab drainage system is required, this drainage system shall discharge by gravity or mechanical means into an approved drainage system per design requirements.

The installation of special slab drains shall be in place at the time of the plumbing groundwork inspection. **If the slab drain system is to be installed to a sump crock, the sump crock shall be installed at the time of the plumbing groundwork inspection.** In addition, the builder must demonstrate that the sump pump is operating properly during the final inspection.

9. BASEMENT ROUGH-IN PLUMBING

The installation of all basement rough-in plumbing, and the sewage ejector crock it is installed to, shall be in place at the time of the plumbing groundwork inspection. In addition, if fixtures are installed, the builder must demonstrate that the sewage ejector pump is operating properly during the final inspection.

10. WATERPROOFING

Waterproofing, installed in accordance with the 2012 Edition of the **Virginia Residential Code, Section R406.2**, is required on all exterior foundation walls that retain earth and enclose habitable or usable spaces located below grade. This includes all prefabricated foundation systems, such as "Superior Wall". **Dampproofing is not permitted in Spotsylvania County on basement walls.** All waterproofed foundations shall have an approved waterproofing certification prior to inspection.

11. BACKFILL

The 2012 Edition of the **Virginia Residential Code, Section R404.1.7**, states the following regarding backfill placement: "Backfill shall not be placed against the wall until

the wall has sufficient strength and has been anchored to the floor above, or has been sufficiently braced to prevent damage by the backfill”.

According to the American Concrete Institute, the number of curing days required for plain concrete walls to obtain sufficient strength is dependent upon the average daily temperature. Prior to placement of backfill material, the builder shall verify that the foundation wall has obtained adequate strength through the curing process.

If temporary bracing is used in lieu of being anchored to the floor above, the temporary bracing must be detailed on the approved construction documents. Walls supporting less than 4 feet of unbalanced backfill are not required to be braced prior to placement of backfill.

The foundation wall design, and the type of material to be used as non-expansive backfill material on the foundation wall, shall correspond to the minimum code requirements as set forth in tables R404.1.1(1) through R404.1.1(5) and R404.1.2(1) through R404.1.2(9) of the code. The wall design and backfill material shall be specified on the approved construction documents. If a foundation design was required to be submitted by a Virginia licensed professional engineer or architect, the design shall specify the type of material to be used for backfilling the foundation walls.

All material to be used as backfill shall be free of organic material, construction debris, cobbles and boulders, trash and roots. If the backfill material is found to be of a questionable nature, the owner may be required to obtain the services of a soils professional to perform additional analysis in order to identify the characteristics of the soil in question. The soil investigation shall be at the discretion of the building official.

When a building lot is found to contain soils which cannot be re-used as backfill material, a backfill inspection will be required prior to placement of the backfill material. Also, if a foundation design specifies that the existing on-site soil is to be mixed with an outside soil source, in order to obtain a “blended backfill” suitable for placement against the foundation wall, then the design professional shall be responsible for the inspection of such “blending of soils” as well as the placement of the backfill.

This inspection shall be conducted by a Virginia licensed professional engineer, a Virginia certified soil scientist or an individual who works directly under and is supervised by the registered design professional, who is certified by WACEL, or an equivalent organization approved by the Building Official. All laboratories from which Spotsylvania County receives soil testing results shall be accredited by WACEL or an equivalent organization approved by the Building Official.

The registered design professional performing the inspection shall notify the Building Safety Dept. by fax (540-507-7283) at least two hours prior to performing the backfill inspection. The fax shall indicate the type of inspection, permit number, location, time and date of the inspection in addition to the agency conducting the inspection. All information shall be submitted to the Building Safety Dept. using the Spotsylvania County Backfill Certification Form and shall be forwarded within five (5) days of performing the inspection.

12. SURFACE DRAINAGE

“Lots shall be graded so as to drain surface water away from foundation walls. The grade away from foundation walls shall fall a minimum of 6 inches within the first 10 feet”, (see exception) per the 2012 Edition of the **Virginia Residential Code, Section R401.3**.

The builder must verify that proper fall away from the foundation has been achieved prior to scheduling the final inspection.

13. ROOF DRAINAGE

In areas where expansive soils are known to exist, the 2012 edition of the **Virginia Residential Code, Section R801.3** states that “All dwellings shall have a controlled method of water disposal from roofs that will collect and discharge all roof drainage to the ground surface at least 5 feet from foundation walls or to an approved drainage system”,

Spotsylvania County recognizes gutters, downspouts and downspout extensions as acceptable means of satisfying this code requirement. All methods of water disposal from roofs shall be inspected. Please note, the above referenced provision does not apply to slab on grade foundations.

ALL BELOW GRADE PIPING INSTALLED TO ACCOMMODATE ROOF DRAINAGE SHALL BE INSPECTED AND APPROVED PRIOR TO CONCEALMENT.