

2021 Virginia Construction Code
CHAPTER 18 SOILS AND FOUNDATIONS
SECTION 1803
GEOTECHNICAL INVESTIGATIONS

1803.1 General.

Geotechnical investigations shall be conducted in accordance with [Section 1803.2](#) and reported in accordance with [Section 1803.6](#). Where required by the *building official* or where geotechnical investigations involve in-situ testing, laboratory testing or engineering calculations, such investigations shall be conducted by a *registered design professional*.

1803.2 Investigations required.

Geotechnical investigations shall be conducted in accordance with [Sections 1803.3](#) through [1803.5](#).

Exception: The *building official* shall be permitted to waive the requirement for a geotechnical investigation where satisfactory data from adjacent areas is available that demonstrates an investigation is not necessary for any of the conditions in [Sections 1803.5.1](#) through [1803.5.6](#) and [Sections 1803.5.10](#) and [1803.5.11](#).

1803.3 Basis of investigation.

Soil classification shall be based on observation and any necessary tests of the materials disclosed by borings, test pits or other subsurface exploration made in appropriate locations. Additional studies shall be made as necessary to evaluate slope stability, soil strength, position and adequacy of load-bearing soils, the effect of moisture variation on soil-bearing capacity, compressibility, liquefaction and expansiveness.

1803.3.1 Scope of investigation.

The scope of the geotechnical investigation including the number and types of borings or soundings, the equipment used to drill or sample, the in-situ testing equipment and the laboratory testing program shall be determined by a *registered design professional*.

1803.4 Qualified representative.

The investigation procedure and apparatus shall be in accordance with generally accepted engineering practice. The *registered design professional* shall have a fully qualified representative on site during all boring or sampling operations.

1803.5 Investigated conditions.

Geotechnical investigations shall be conducted as indicated in [Sections 1803.5.1](#) through [1803.5.12](#).

1803.5.1 Classification.

Soil materials shall be classified in accordance with [ASTM D2487](#).

1803.5.2 Questionable soil.

Where the classification, strength or compressibility of the soil is in doubt or where a load-bearing value superior to that specified in this code is claimed, the *building official* shall be permitted to require that a geotechnical investigation be conducted.

1803.5.3 Expansive soil.

In areas likely to have expansive soil, the *building official* shall require soil tests to determine where such soils do exist.

Soils meeting all four of the following provisions shall be considered to be 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 D4318](#).
2. More than 10 percent of the soil particles pass a No.200 sieve (75 µm), determined in accordance with [ASTM D422](#).
3. More than 10 percent of the soil particles are less than 5 micrometers in size, determined in accordance with [ASTM D422](#).
4. Expansion index greater than 20, determined in accordance with [ASTM D4829](#).

1803.5.4 Ground-water table.

A subsurface soil investigation shall be performed to determine whether the existing ground-water table is above or within 5 feet (1524 mm) below the elevation of the *lowest floor* level where such floor is located below the finished ground level adjacent to the foundation.

Exception: A subsurface soil investigation to determine the location of the ground-water table shall not be required where waterproofing is provided in accordance with [Section 1805](#).

1803.5.5 Deep foundations.

Where *deep foundations* will be used, a geotechnical investigation shall be conducted and shall include all of the

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following, unless sufficient data on which to base the design and installation is otherwise available:

1. Recommended *deep foundation* types and installed capacities.
2. Recommended center-to-center spacing of *deep foundation* elements.
3. Driving criteria.
4. Installation procedures.
5. Field inspection and reporting procedures (to include procedures for verification of the installed bearing capacity where required).
6. Load test requirements.
7. Suitability of *deep foundation* materials for the intended environment.
8. Designation of bearing stratum or strata.
9. Reductions for group action, where necessary.

1803.5.6 Rock strata.

Where subsurface explorations at the project site indicate variations in the structure of rock on which foundations are to be constructed, a sufficient number of borings shall be drilled to sufficient depths to assess the competency of the rock and its load-bearing capacity.

1803.5.7 Excavation near foundations.

Where excavation will reduce support from any foundation, a *registered design professional* shall prepare an assessment of the structure as determined from examination of the structure, available design documents, [available subsurface data](#), and, if necessary, excavation of test pits. The *registered design professional* shall determine the requirements for [support](#) and protection [of any existing foundation](#) and prepare site-specific plans, details and sequence of work for submission. Such support shall be provided by under-pinning, bracing, [excavation retention systems](#), or by other means acceptable to the *building official*.

1803.5.8 Compacted fill material.

Where *shallow foundations* will bear on compacted fill material more than 12 inches (305 mm) in depth, a geotechnical investigation shall be conducted and shall include all of the following:

1. Specifications for the preparation of the site prior to placement of compacted fill material.
2. Specifications for material to be used as compacted fill.
3. Test methods to be used to determine the maximum dry density and optimum moisture content of the material to be used as compacted fill.
4. Maximum allowable thickness of each lift of compacted fill material.
5. Field test method for determining the in-place dry density of the compacted fill.
6. Minimum acceptable in-place dry density expressed as a percentage of the maximum dry density determined in accordance with Item 3.
7. Number and frequency of field tests required to determine compliance with Item 6.

1803.5.9 Controlled low-strength material (CLSM).

Where *shallow foundations* will bear on *controlled low-strength material (CLSM)*, a geotechnical investigation shall be conducted and shall include all of the following:

1. Specifications for the preparation of the site prior to placement of the *CLSM*.
2. Specifications for the *CLSM*.
3. Laboratory or field test method(s) to be used to determine the compressive strength or bearing capacity of the *CLSM*.
4. Test methods for determining the acceptance of the *CLSM* in the field.
5. Number and frequency of field tests required to determine compliance with Item 4.

1803.5.10 Alternate setback and clearance.

Where setbacks or clearances other than those required in [Section 1808.7](#) are desired, the *building official* shall be permitted to require a geotechnical investigation by a *registered design professional* to demonstrate that the intent of [Section 1808.7](#) would be satisfied. Such an investigation shall include consideration of material, height of slope, slope gradient, *load* intensity and erosion characteristics of slope material.

1803.5.11 Seismic Design Categories C through F.

For structures assigned to *Seismic Design Category C, D, E or F*, a geotechnical investigation shall be conducted, and shall include an evaluation of all of the following potential geologic and seismic hazards:

1. Slope instability.
2. Liquefaction.

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3. Total and differential settlement.
4. Surface displacement due to faulting or seismically induced lateral spreading or lateral flow.

1803.5.12 Seismic Design Categories D through F.

For structures assigned to *Seismic Design Category* D, E or F, the geotechnical investigation required by [Section 1803.5.11](#) shall include all of the following as applicable:

1. The determination of dynamic seismic lateral earth pressures on foundation walls and retaining walls supporting more than 6 feet (1.83 m) of backfill height due to *design earthquake ground motions*.
2. The potential for liquefaction and soil strength loss evaluated for site peak ground acceleration, earthquake magnitude and source characteristics consistent with the maximum considered earthquake ground motions. Peak ground acceleration shall be determined based on one of the following:
 - 2.1. A site-specific study in accordance with Chapter 21 of [ASCE 7](#).
 - 2.2. In accordance with Section 11.8.3 of [ASCE 7](#).
3. An assessment of potential consequences of liquefaction and soil strength loss including, but not limited to, the following:
 - 3.1. Estimation of total and differential settlement.
 - 3.2. Lateral soil movement.
 - 3.3. Lateral soil *loads* on foundations.
 - 3.4. Reduction in foundation soil-bearing capacity and lateral soil reaction.
 - 3.5. Soil downdrag and reduction in axial and lateral soil reaction for pile foundations.
 - 3.6. Increases in soil lateral pressures on retaining walls.
 - 3.7. Flotation of buried structures.
4. Discussion of mitigation measures such as, but not limited to, the following:
 - 4.1. Selection of appropriate foundation type and depths.
 - 4.2. Selection of appropriate structural systems to accommodate anticipated displacements and forces.
 - 4.3. Ground stabilization.
 - 4.4. Any combination of these measures and how they shall be considered in the design of the structure.

1803.6 Reporting.

Where geotechnical investigations are required, a written report of the investigations shall be submitted to the *building official* by the permit applicant at the time of permit application. This geotechnical report shall include, but need not be limited to, the following information:

1. A plot showing the location of the soil investigations.
2. A complete record of the soil boring and penetration test logs and soil samples.
3. A record of the soil profile.
4. Elevation of the water table, if encountered.
5. Recommendations for foundation type and design criteria, including but not limited to: bearing capacity of natural or compacted soil; provisions to mitigate the effects of expansive soils; mitigation of the effects of liquefaction, differential settlement and varying soil strength; and the effects of adjacent *loads*.
6. Expected total and differential settlement.
7. *Deep foundation* information in accordance with [Section 1803.5.5](#).
8. Special design and construction provisions for foundations of structures founded on expansive soils, as necessary.
9. Compacted fill material properties and testing in accordance with [Section 1803.5.8](#).
10. *Controlled low-strength material* properties and testing in accordance with [Section 1803.5.9](#).