

The Geotechnical Report

What the designer needs to know

BY JOSEPH A. AMON

A geotechnical report is the written summary of a geotechnical investigation—the process of boring, sampling, and testing to establish subsurface profiles and the relative strength, compressibility, and other characteristics of the various strata encountered within depths likely to have an influence on the design of the constructed environment.

BEFORE THE INVESTIGATION

A geotechnical report can include soil classification, bearing capacity, lateral pressures, and the elevation of the groundwater table. The report will also include recommendations on possible foundation designs suitable for the site and on the geotechnical aspects of site preparation.

The reporting process begins with a meeting between the Geotechnical Engineer and the Designer (the Architect or Engineer) before the investigation to discuss the proposed structural configuration, loads, special conditions or needs, and size of the boring program. The better the information the Geotechnical Engineer has, the better the basis for the site exploration and the report that follows from it.

WHAT SHOULD BE REPORTED

General

When the report arrives, the Designer should first verify the site location and description (borings are sometimes drilled on the wrong property). The Designer should also review the report to verify that the Geotechnical Engineer understood the structural requirements and to determine what field and laboratory techniques were used for the study.

The heart of the report will describe geotechnical conditions, providing an understanding of the type of soil or rock that the structure will be built on or in. The report will also include conclusions based on the geotechnical conditions, including site seismic

classification and sinkhole risk assessment. Seismic data will include acceleration coefficients needed for design. For a project in a high-risk sinkhole environment, the report will present an estimate of the size of open chasms the foundation system will need to span.

Foundations

The Geotechnical Engineer will recommend one or more foundation types with allowable unit or maximum loads, for example, spread footing bearing on clay at 3000 lb/ft² (145 kPa); concrete piles driven to a gravel layer for 100 tons (90 tonnes) working compressive capacity with 30 tons (27 tonnes) lateral capacity; or a 36 in. (900 mm) diameter drilled shaft bearing on limestone bedrock at 50 tons/ft² (490 tonnes/m²) bearing capacity. The Designer should expect to see detailed descriptions for foundation types, including discussion of potential construction difficulties for each type of foundation.

It is important that the Geotechnical Engineer provide the Structural Designer with estimates of foundation performance. As a minimum, estimates of settlement should be presented along with a discussion of predictions regarding the timing and magnitude of differential settlements. While a large footing uniformly settling 1.5 in. (38 mm) may not be a problem, for example, the rotation from a 1 in. (25 mm) settlement of one side of a small footing could induce excessive moment into the column resting on the footing.

Cautions

In certain areas, corrosive soil is a concern. If so, it should be plainly stated, along with recommendations for protection of the steel and concrete, including cement type. Similarly, in the Great Plains states and the Canadian Prairie provinces among other places, sulfate-bearing soils can cause deterioration of the concrete in contact with them. In these locations, the soil should be analyzed in accordance with ASTM C1580, “Standard Test

Method for Water-Soluble Sulfate in Soil.” Based on the results, the Geotechnical Engineer will recommend the appropriate cementitious material(s) and water-cementitious material ratio for the concrete from Table 4.3.1 of ACI 318, based on the exposure class determined from Table 4.2.1. In other regions, a governing agency such as the Department of Transportation may have different test standards and evaluation criteria. This should be presented in the report.

Effects

For structures supporting soil, such as basement walls and retaining walls, lateral earth pressures should be presented. The Designer should be given active and at-rest pressure coefficients, passive pressure coefficients, and coefficient of sliding friction. The unit weight of the soil and the location of groundwater are both important, so if they are not clearly spelled out in the report, the Designer should request that the Geotechnical Engineer provide a load distribution diagram for soil loads on the walls.

For slab-on-ground designs, the report should specify a modulus of subgrade reaction (*k*-value) for each subgrade soil type. The need for a vapor retarder under the slab should be discussed along with recommendations of type and configuration.

Construction requirements

Construction compaction requirements should be presented for all fills and backfills with specific values listed for each structure, pavement, utility, and landscaping area. The Designer and Contractor should be able to find the required compaction and density standard (for example, Modified or Standard Proctor, or relative density) that are necessary to achieve the geotechnical recommendations. A discussion as to the appropriate type and size compaction equipment is always helpful to the construction team.

If any of the information is confusing or missing, the Designer should contact the Geotechnical Engineer for guidance.

Note: Additional information on the ASTM standards discussed in this article can be found at www.astm.org.

Selected for reader interest by the editors.



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