

GEOTECHNICAL CONSIDERATIONS FOR PROPER SITE PREPARATION PROVIDED BY GEO HYDRO ENGINEERS

To manage the marginal fill materials and mitigate the risk of excessive foundation settlement, we suggest a partial excavation and replacement approach to remove some of the existing fill within each building pad and replace the excavated materials with new structural fill or the fill excavated from the pads. The new or reused fill would be adjusted for moisture content and properly placed and compacted. We recommend extending the remedial excavation to a depth of 8 feet below planned subgrade elevation, and roughly 10 feet laterally beyond the building limits.

After proper preparation of the building pads (undercut/replace) and thorough evaluation of foundation excavations, it is our opinion that the planned buildings can be supported using a monolithic reinforced concrete floor system with foundation turndown. Conventional shallow foundations and slab-on-grade floors are also feasible, but considering the depth and variability of the fill that will be left in place under the new building pads, a monolithic floor with foundation turndowns is a better match for the site conditions.

EXISTING FILL MATERIALS:

There are a few important facts that should be considered regarding existing fill materials and the limitations of subsurface exploration.

- The quality of existing fill materials can be highly variable, and test borings are often not able to detect all of the zones or layers of poor quality fill materials.
- Layers of poor quality fill materials that are less than about 2.5 to 5 feet thick may often remain undetected by soil test borings due to the discrete-interval sampling method used in this exploration.
- The interface between existing fill materials and the original ground surface may include a layer of organic material that was not properly stripped off during the original grading. Depending on its relationship to site hardscapes or pavements, an organic layer might adversely affect support of the site features. If such organic layers are encountered during construction, it may be necessary to "chase out"the organic layer by excavating the layer along with the overlaying soils.
- Subsurface exploration is simply not capable of disclosing all conditions that may require remediation.

GENERAL SITE PREPARATION:

Vegetation, topsoil, trash, pavements, demolition debris, and other deleterious materials should be removed from the proposed construction area. All existing utilities should be excavated and removed unless they are to be incorporated into the new construction. Additionally, site clearing, grubbing, and stripping should be performed only during dry weather conditions. Operation of heavy equipment on the site during wet conditions could result in excessive rutting and mixing of topsoil and debris with underlying soils. All excavations resulting from rerouting of underground utilities and demolition of foundation and other below-grade structures should be backfilled in accordance with the Structural Fill section of this report.

We recommend that areas to receive structural fill be proofrolled prior to placement of structural fill. Areas of proposed excavation should be proofrolled after rough finished subgrade is achieved. Proofrolling should be performed with multiple passes in at least two directions using a fully loaded tandem axle dump truck weighing at least 18 tons. Proofrolling must be avoided within 10 feet of rights-of-way, utility easements, or any hardscapes to remain. If low consistency soils are encountered that cannot be adequately densified in place, such soils should be removed and replaced with well compacted fill material placed in accordance with the Structural Fill section of this report. Proofrolling should be observed by Geo-Hydro to determine if remedial measures are necessary.

BUILDING PADS – PARTIAL EXCAVATION AND REPLACEMENT OF FILL MATERIALS:

The following describes the excavation and replacement approach to allow conventional shallow foundation support.

- Excavate the approximate area of the proposed building footprints to a depth of 8 feet below planned subgrade elevation or until residual soils are encountered, whichever occurs first. The test borings show varying fill depths within the building footprints ranging from about 3 to 18 feet below current grades. It is unlikely that the bottom of the resulting remedial excavations will be flat Temporary excavation slopes should have a gradient no steeper than 1.5H:1V. Depending on conditions at the time of excavation, a flatter slope gradient may be necessary to maintain safe working conditions.
 - The resulting excavation bottom should be stabilized as necessary by placing a Tensar HX5.5 or TX-140 geogrid (or approved equivalent) and about 6 to 12 inches of #57 stone to provide a relatively unyielding working surface on which to place new structural fill. Please refer to the Structural Fill section of this report for recommendations regarding the nature, placement, and compaction of backfill materials.
- After proper preparation of the building pads (undercut/replace) and thorough evaluation of foundation excavations, it is our opinion that the planned buildings can be supported using a monolithic reinforced concrete floor system with foundation turndown. Conventional shallow foundations and slab-on-grade floors are also feasible, but considering the depth and variability of the fill that will be left in place under the new building pads, a monolithic floor with foundation turndowns is a better match for the site conditions. During site preparation, burn pits or trash pits may be encountered. Any buried debris or trash found during the construction operation should be thoroughly excavated and removed from the site.

ROCK:

For construction bidding and field verification purposes it is common to provide a verifiable definition of rock in the project specifications. The following are typical definitions of mass rock and trench rock:

Mass Rock: Material which cannot be excavated with a single-tooth ripper drawn by a crawler tractor having a minimum draw bar pull rated at 56,000 pounds (Caterpillar D-8K or equivalent) and occupying an original volume of at least one cubic yard.

Trench Rock: Material occupying an original volume of at least one-half cubic yard which cannot be excavated with a hydraulic excavator having a minimum flywheel power rating of 123 kW (165 hp); such as a Caterpillar 322C L, John Deere 230C LC, or a Komatsu PC220LC-7; equipped with a short tip radius bucket not wider than 42 inches.

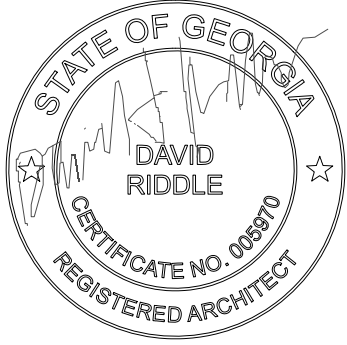
The foregoing definitions are based on large equipment typically utilized for mass grading. Retail excavations for building foundations, retaining walls, and underground utilities are often performed with smaller equipment such as rubber-tired backhoe/loaders or even mini-excavators. Contractors will often request additional payment for mobilizing larger equipment than that which was anticipated during preparation of their construction bid. The amount of additional compensation, if any, and the minimum equipment size necessary to qualify for any additional compensation should be defined before the start of construction.

REUSE OF EXCAVATED MATERIALS:

Based on the results of the soil test borings, residual soils should be reusable as structural fill. Whether excavated fill materials can be reused will depend on the composition of the fill. Organic debris and other refuse may render some excavated materials unsuitable if the debris cannot be segregated. Additionally, organic materials in excess of about 5 to 6 percent by weight (ASTM D2974) will also make excavated materials unsuitable for reuse. Soft, unstable fill soils free of deleterious materials may be reusable after routine moisture adjustment. Routine adjustment of moisture content will be required to facilitate the reuse of excavated fill and residual soils. It is important to establish as part of the construction contract whether soils having elevated moisture contentwill be considered suitable for reuse. We often find this issue to be a point of contention and a source of delays and change orders. From a technical standpoint, soils with moisture contents wet of optimum as determined by the standard Proctor test (ASTM D698) can be reused provided that the moisture is properly adjusted to within the workable range. From a practical standpoint, wet soils can be very difficult to dry in small or congested sites, and such difficulties should be considered during planning and budgeting. A clear understanding by the general contractor and grading subcontractor regarding the reuse of excavated soils will be important to avoid delays and unexpected cost overruns.

STRUCTURAL FILL:

Materials selected for use as structural fill should be free of organic debris, waste construction debris, and other deleterious materials. The material should not contain rocks having a diameter over 4 inches. It is our opinion that the following soils represented by their USCS group symbols will typically be suitable for use as structural fill and are usually found in abundance in the Piedmont: (SM), (ML), and (CL). The following soil types are typically suitable but are not abundant in the Piedmont: (SW), (SP), (SC), (SP-SM), and (SP-SC). The following soil types are considered unsuitable: (MH), (CH), (OL), (OH), and (Pt). Laboratory Proctor compaction tests and classification tests should be performed on representative samples obtained from the proposed borrow material to provide data necessary to determine acceptability and for quality control. The moisture content of suitable borrow soils should generally be no more than 3 percentage points below or above optimum at the time of compaction. Tighter moisture limits may be necessary with certain soils. Suitable fill material should be placed in thin lifts. Lift thickness depends on the type of compaction equipment, but a maximum loose-lift thickness of 8 inches is generally recommended. The soil should be compacted by a self-propelled sheepsfoot roller. Within small excavations such as in utility trenches, around manholes, above foundations, or behind retaining walls, we recommend the use of "wacker packers" or "Rammax" compactors to achieve the specified compaction. Loose lift thicknesses of 4 to 6 inches are recommended in small area fills. We recommend that structural fill be compacted to at least 95 percent of the standard Proctor maximum dry density (ASTM D698). The upper 12 inches of floor slab subgrade soils should be compacted to at least 98 percent of the standard Proctor maximum dry density. The upper 12 inches of pavement subgrades should be compacted in accordance with Georgia DOT requirements to at least 100 percent of the standard Proctor maximum dry density (ASTM D698). Additionally, the maximum dry density of structural fill should be no less than 90 pcf. Geo-Hydro should perform density tests during fill placement.



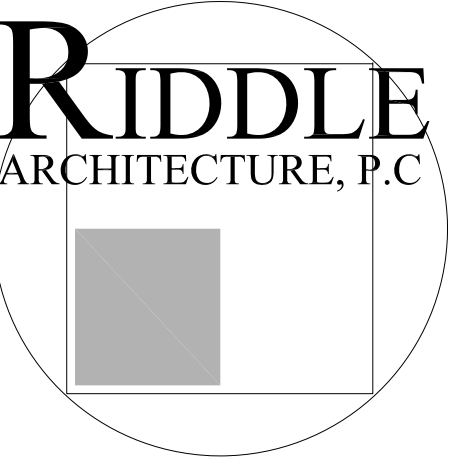
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