

TERRACON CONSULTANTS, INC.  
4899 PRINCE WILLIAM PARKWAY WOODBRIDGE VA 22192

PANDA EXPRESS RESTAURANT (S8-19-D5335)  
PROJECT NO. EV195001  
PWC CASE NO. SPR2020-00196-S01 GC#1  
February 26, 2020

GEOTECHNICAL SITE CONSTRUCTION RECOMMENDATIONS

Weathered rock was encountered at depths as shallow as 3 feet in test boring P-3, and was typically encountered at about 5 feet depth. Excavations extending into the rock will be difficult and may require special excavation procedures. Based on the proposed grading, we do not expect mass excavations will extend into the weathered rock; however, utility trenches and foundations may encounter weathered rock. Additional site preparation recommendations are provided in the **Earthwork** section.

Highly plastic, FAT CLAY (CH) soils were encountered in test borings B-4 and P-4 at depths ranging from 0.3 feet to 3.5 feet below existing grade. Such soils are commonly referred to as "expansive" or "swelling" soils because they expand or swell as their moisture contents increase. However, these soils also "contract" or "shrink" as their moisture contents decrease. Footings, floor slabs and pavements supported on expansive soils will experience cycles of upward and downward movement that will result in distortion, possibly causing cracking or structural damage to the structure. Specific recommendations are provided in the **Earthwork** section.

The near surface, very soft to very stiff medium plasticity lean clay and high plasticity fat clay could become unstable with typical earthwork and construction traffic, especially after precipitation events. The effective drainage should be completed early in the construction sequence and maintained after construction to avoid potential issues. If possible, the grading should be performed during the warmer and drier times of the year. If grading is performed during the winter months, an increased risk for possible undercutting and replacement of unstable subgrade will persist. Additional site preparation recommendations, including subgrade improvement and fill placement, are provided in the **Earthwork** section.

The **Shallow Foundations** section addresses support of the building bearing on native, loose granular soils or structural fill. The **Floor Slabs** section addresses slab-on-grade support of the building.

The **Pavements** section addresses the design of pavement systems.

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Soil Type <sup>1</sup>	USCS Classification	Acceptable Parameters
On-Site Soils	CL, ML, SC, GC, GP-GC	Liquid Limit less than 40, Plasticity index less than 15
1. Structural and general fill should consist of approved materials free of organic matter and debris. Frozen material should not be used, and fill should not be placed on a frozen subgrade. A sample of each material type should be submitted to the Geotechnical Engineer for evaluation prior to use on this site.		

In addition, weathered rock materials excavated by ripping or blasting could also be considered for re-use as structural fill but are likely to include oversized pieces. These materials can be used as fill but should be blended with soil to allow complete filling of the voids between the pieces. Pieces larger than 3 inches in maximum dimension should not be used in any fills.

The size limitation is recommended to allow more uniform compaction, to improve infilling of voids between larger pieces, and to develop more uniform bearing support for foundations and slabs. The use of an on-site crusher and screens should be considered as a means of preparing the excavated rock material for reuse as fill.

Fill Compaction Requirements

Structural and general fill should meet the following compaction requirements.

Item	Structural Fill	General Fill
Maximum Lift Thickness	8 inches or less in loose thickness when heavy, self-propelled compaction equipment is used 6 inches in loose thickness when hand-guided equipment (i.e. jumping jack or plate compactor) is used	Same as Structural fill
Minimum Compaction Requirements <sup>1, 2</sup>	100% of max. below foundations and within 1 foot of finished pavement subgrade 95% of max. above foundations, below floor slabs, and more than 1 foot below finished pavement subgrade	92% of max.
Water Content Range <sup>1</sup>	Low plasticity cohesive: -2% to +2% of optimum Granular: -2% to +2% of optimum	As required to achieve min. compaction requirements
1. Maximum density and optimum water content as determined by the standard Proctor test (ASTM D 698). 2. If the granular material is a coarse sand or gravel, or of a uniform size, or has a low fines content, compaction comparison to relative density may be more appropriate. In this case, granular materials should be compacted to at least 70% relative density (ASTM D 4253 and D 4254).		

Utility Trench Backfill

For low permeability subgrades, utility trenches are a common source of water infiltration and migration. Utility trenches penetrating beneath the building should be effectively sealed to restrict

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The **General Comments** section provides an understanding of the report limitations.

EARTHWORK

Earthwork is anticipated to include clearing and grubbing, excavations, and fill placement. The following sections provide recommendations for use in the preparation of specifications for the work. Recommendations include critical quality criteria, as necessary, to render the site in the state considered in our geotechnical engineering evaluation for foundations, floor slabs, and pavements.

Site Preparation

The site includes an existing pavement, and underground utility lines. We recommend that all existing topsoil, pavement, structures, foundations and utilities be removed and/or properly abandoned in accordance with local, state and federal regulations.

The subgrade should be proofrolled with an adequately loaded vehicle such as a fully-loaded, tandem-axle dump truck weighing at least 10 tons. The proofrolling should be performed under the direction of the Geotechnical Engineer. Areas excessively deflecting under the proofroll should be delineated and subsequently addressed by the Geotechnical Engineer. These unsuitable materials should be undercut and replaced by structural fill. Excessively wet or dry material should either be removed, or moisture conditioned and recompacted.

Shallow Rock

Weathered rock was recorded in test borings B-1 through B-6 and P-3, at depths ranging between 3 and 8 feet below existing grades. Auger refusal on bedrock was encountered between approximately 6 and 10 feet below existing grades. Depending on the proposed utility inverts, difficult excavations or hoe ramming or blasting may be required to permit installation of utilities planned below these depths.

Rock can generally be excavated an additional 2 to 3 feet below the recorded auger refusal depths, as noted in the boring logs, utilizing single tooth rippers or hoe rams operating in open excavations. Special considerations shall be implemented if blasting is required for this project. Chipping, pneumatic hammering, and rock saw excavation are the alternatives to blasting operations.

Expansive Soils

According to the 2018 International Building Code (IBC), Section 1803.5.3 - Expansive Soils Classifications, soils meeting all four of the following provisions below shall be considered

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water intrusion and flow through the trenches, which could migrate below the building. The trench should provide an effective trench plug that extends at least 5 feet from the face of the building exterior. The plug material should consist of cementitious flowable fill or low permeability clay. The trench plug material should be placed to surround the utility line. If used, the clay trench plug material should be placed and compacted to comply with the water content and compaction recommendations for structural fill stated previously in this report.

Grading and Drainage

All grades must provide effective drainage away from the building during and after construction and should be maintained throughout the life of the structure. Water retained next to the building can result in soil movements greater than those discussed in this report. Greater movements can result in unacceptable differential floor slab and/or foundation movements, cracked slabs and walls, and roof leaks. The roof should have gutters/drains with downspouts that discharge onto splash blocks at a distance of at least 10 feet from the building.

Exposed ground should be sloped and maintained at a minimum 5% away from the building for at least 10 feet beyond the perimeter of the building. Locally, flatter grades may be necessary to transition ADA access requirements for flatwork. After building construction and landscaping have been completed, final grades should be verified to document effective drainage has been achieved. Grades around the structure should also be periodically inspected and adjusted, as necessary, as part of the structure's maintenance program. Where paving or flatwork abuts the structure, a maintenance program should be established to effectively seal and maintain joints and prevent surface water infiltration.

Earthwork Construction Considerations

Shallow excavations for the proposed structure are anticipated to be accomplished with conventional construction equipment. Upon completion of filling and grading, care should be taken to maintain the subgrade water content prior to construction of floor slabs. Construction traffic over the completed subgrades should be avoided. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. Water collecting over or adjacent to construction areas should be removed. If the subgrade freezes, desiccates, saturates, or is disturbed, the affected material should be removed, or the materials should be scarified, moisture conditioned, and recompacted prior to floor slab construction.

The groundwater table could affect over-excavation efforts, especially for over-excavation and replacement of lower strength soils. A temporary dewatering system consisting of sumps with pumps could be necessary to achieve the necessary depth of over-excavation.

As a minimum, excavations should be performed in accordance with OSHA 29 CFR, Part 1926, Subpart P, "Excavations" and its appendices, and in accordance with any applicable local, and/or state regulations.

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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:

- Plasticity Index (PI) of 15 or greater, determined in accordance with ASTM D 4318.
- More than 10 percent of the soil particles pass a No. 200 sieve (0.75 µm), determined in accordance with ASTM D 6913.
- More than 10 percent of the soil particles are less than 5 micrometers in size, determined in accordance with ASTM D 6913.
- Expansion Index greater than 20, determined in accordance with ASTM D4829

These soils are considered **unsuitable** for use as compacted structural fill and for the support of building foundations and pavements in the Active Zone. The Active Zone or Zone of Seasonal Fluctuation is the zone under and around a structure where the soil's moisture content is appreciably affected by climatic conditions and environmental factors. For buildings foundations the Active Zone extends up to a minimum of 4 feet below the external finished grade, or 2 feet below the bottom of footing, whichever is deeper. For proposed roadways, the Active Zone extends up to a minimum of 2 feet below proposed subgrade.

Unsuitable material such as high plasticity fat clay (CH) were encountered in test borings B-4 and P-4. Therefore, if encountered during site grading at proposed subgrades for buildings foundations and pavements, these high plasticity materials should be sampled and tested to determine their expansiveness based on criteria discussed above; and if classified as expansive they shall be completely removed, within the active zone of buildings and pavements, and replaced with structural fill material meeting requirements stated in **Fill Material Types** section below. For building foundations, in lieu of complete removal and replacement, footings can be extended beyond the active zone. Additional recommendations are included in the **Shallow Foundations** and **Floor Slabs** sections of this report.

Fill Material Types

Fill required to achieve design grade should be classified as structural fill and general fill. Structural fill is material used below, or within 4 feet of structures, pavements or constructed slopes. General fill is material used to achieve grade outside of these areas. Earthen materials used for structural and general fill should meet the following material property requirements:

Soil Type <sup>1</sup>	USCS Classification	Acceptable Parameters
Low Plasticity Cohesive	CL, CL-ML, SC	Liquid Limit less than 40, Plasticity index less than 15 Less than 25% retained on No. 200 sieve
Granular	GW, GP, GM, GC, SW, SP, SM, SC	Less than 10% Passing No. 200 sieve

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Construction site safety is the sole responsibility of the contractor who controls the means, methods, and sequencing of construction operations. Under no circumstances shall the information provided herein be interpreted to mean Terracon is assuming responsibility for construction site safety, or the contractor's activities; such responsibility shall neither be implied nor inferred.

Construction Observation and Testing

The earthwork efforts should be monitored under the direction of the Geotechnical Engineer. Monitoring should include documentation of adequate removal of vegetation and topsoil, proofrolling, and mitigation of areas delineated by the proofroll to require mitigation.

Each lift of compacted fill should be tested, evaluated, and reworked, as necessary, until approved by the Geotechnical Engineer prior to placement of additional lifts. Each lift of fill should be tested for density and water content at a frequency of at least one test for every 2,500 square feet of compacted fill in the building areas and in pavement areas. One density and water content test should be performed for every 50 linear feet of compacted utility trench backfill.

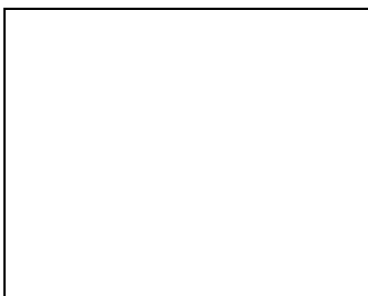
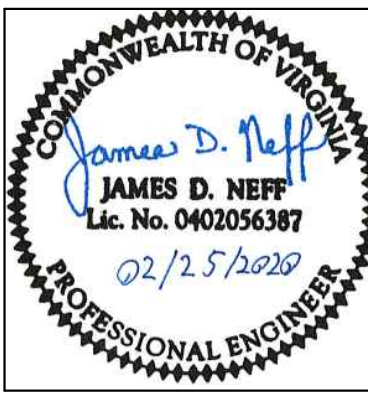
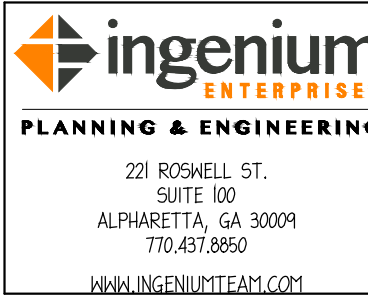
In areas of foundation excavations, the bearing subgrade should be evaluated under the direction of the Geotechnical Engineer. If unanticipated conditions are encountered, the Geotechnical Engineer should prescribe mitigation options.

In addition to the documentation of the essential parameters necessary for construction, the continuation of the Geotechnical Engineer into the construction phase of the project provides the continuity to maintain the Geotechnical Engineer's evaluation of subsurface conditions, including assessing variations and associated design changes.

SEISMIC CONSIDERATIONS

The seismic design requirements for buildings and other structures are based on Seismic Design Category. Site Classification is required to determine the Seismic Design Category for a structure. The Site Classification is based on the upper 100 feet of the site profile defined by a weighted average value of either shear wave velocity, standard penetration resistance, or undrained shear strength in accordance with Section 20.4 of ASCE 7 and the International Building Code (IBC). Based on the soil/bedrock properties encountered at the site and as described on the exploration logs and results, it is our professional opinion that the **Seismic Site Classification is C**. Subsurface explorations at this site were extended to a maximum depth of 10.2 feet. The site properties below the boring depth to 100 feet were estimated based on our experience and knowledge of geologic conditions of the general area. Additional deeper borings or geophysical testing may be performed to confirm the conditions below the current boring depth.

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CFT NV DEVELOPMENTS, LLC  
WELLINGTON ROAD & GATEWAY  
PROVENADE PLACE  
GAINESVILLE, VA 20155

CLIENT:

CFT NV DEVELOPMENTS, LLC  
1120 N. TOWN CENTER DR., SUITE 150  
LAS VEGAS, NV 89144  
PHONE: 626-799-9898

REVISION HISTORY	
1	Initial Issue
2	Revised for comments
3	Revised for comments
4	Revised for comments
5	Revised for comments
6	Revised for comments
7	Revised for comments
8	Revised for comments
9	Revised for comments
10	Revised for comments

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GEOTECHNICAL  
REQUIREMENTS I

C05.2  
SHEET NUMBER

ISSUE FOR PERMIT