Geotechnical Engineering Report

Zips Car Wash
Louisville, Jefferson County, Kentucky
November 17, 2022
Terracon Project No. 57225048

Prepared for:
Zips Car Wash, LLC
Plano, TX

Prepared by:
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Louisville, Kentucky

November 17, 2022

Terracon GeoReport

Zips Car Wash, LLC
8400 Belleview Drive, Suite 210
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Attn: Mr. Michael Corey – Chief Development Officer
P: (214) 906-1846
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Re: Geotechnical Engineering Report
Zips Car Wash
9500 Preston Highway
Louisville, Jefferson County, Kentucky
Terracon Project No. 57225048

Dear Mr. Corey:

We have completed the Geotechnical Engineering services for the above referenced project. This study was performed in general accordance with Terracon Proposal No. P57225048 dated April 4, 2022. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design and construction of foundations, floor slabs, and pavement for the proposed project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report or if we may be of further service, please contact us.

Sincerely,
Terracon Consultants, Inc.

STATE OF KENTUCKY
KYLE P. STOLTE
33670
LICENSED PROFESSIONAL ENGINEER

Kyle Stolte, P.E.
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Note: This report was originally delivered in a web-based format. **Orange Bold** text in the report indicates a referenced section heading. The PDF version also includes hyperlinks which direct the reader to that section and clicking on the ***GeoReport*** logo will bring you back to this page. For more interactive features, please view your project online at client.terracon.com.

ATTACHMENTS

EXPLORATION AND TESTING PROCEDURES
PHOTOGRAPHY LOG
SITE LOCATION AND EXPLORATION PLANS
EXPLORATION RESULTS
SUPPORTING INFORMATION

Note: Refer to each individual Attachment for a listing of contents.

Geotechnical Engineering Report

Zips Car Wash
9500 Preston Highway
Louisville, Jefferson County, Kentucky

Terracon Project No. 57225048
November 17, 2022

INTRODUCTION

This report presents the results of our subsurface exploration and geotechnical engineering services performed for the proposed Zips Car Wash to be located at 9500 Preston Highway in Louisville, Jefferson County, Kentucky. The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- Subsurface soil conditions
- Groundwater conditions
- Site preparation and earthwork
- Pavement design and construction
- Foundation design and construction
- Floor slab design and construction
- Seismic site classification per IBC

The geotechnical engineering Scope of Services for this project included the advancement of eight test borings to depths ranging from approximately 1.4 to 3.1 feet below existing site grades, where auger refusal (presumed top of rock) was encountered.

Maps showing the site and boring locations are shown in the **Site Location** and **Exploration Plan** sections, respectively. The results of the laboratory testing performed on soil samples obtained from the site during the field exploration are included on the boring logs and as separate graphs in the **Exploration Results** section.

SITE CONDITIONS

The following description of site conditions was derived from our field exploration and our review of publicly available geologic and topographic maps.

Item	Description
Parcel Information	The project site is located at 9500 Preston Highway in Louisville, Jefferson County, Kentucky. Approximate Latitude, Longitude: 38.11376°N, 85.6781°W. See **Site Location**
Existing Improvements	Asphalt parking for Meijer supercenter.

Item	Description
Current Ground Cover	Existing pavement and grassed landscape areas
Existing Topography (Google Earth PRO™)	Relatively level with site grades ranging from elevation 517 to 521 feet.
Geology	Review of geologic maps indicates subsurface conditions will likely consist of clayey residuum overlying limestone bedrock of the Louisville Limestone formation at relatively shallow depths. Our explorations showed subsurface consists of clayey residuum mixed with limestone fragments with shallow limestone bedrock (1.4 to 3.1 ft.). The Louisville Limestone is reported by the Kentucky Geological Survey (KGS) to have an "intense" karst potential with sinkholes mapped in the vicinity, including at the Meijer site.

Representative photos are provided in our **Photography Log**.

PROJECT DESCRIPTION

Our final understanding of the project conditions is as follows:

Item	Description
Information Provided	E-mail RFP from Greg McGahey with UCR Development March 31, 2022 including site plan with exploration locations prepared by Spangenberg Phillips Tice (SPT) Architecture dated March 28, 2022.
Project Description	Proposed carwash including building with a footprint of about 4,500 square feet and associated paved parking and drive areas.
Proposed Structures	Car wash facility with associated parking and drive lanes.
Finished Floor Elevation	Not available at the time of this report.
Maximum Loads	The maximum column loads are not expected to exceed 50 kips for columns and 2 to 3 kips for strip footings.
Grading/Slopes	Site grading plans were not provided at the time of this proposal. Based on existing site grades, we anticipate grading will be limited to +/- 2-feet of cut/fill. Additional excavation may be required if a sediment pit is constructed.
Pavements	Paved driveway and parking will be constructed around the proposed building. We assume both rigid (concrete) and flexible (asphalt) pavement sections should be considered. We anticipated less than 30,000 ESALs based on assumed traffic loading: ■ Autos/light trucks: 400 vehicles per day ■ Light delivery and trash collection vehicles: 2 vehicles per week ■ Tractor-trailer trucks: <1 vehicle per week The pavement design period is 20 years.

GEOTECHNICAL CHARACTERIZATION

We have developed a general characterization of the subsurface conditions based upon our review of the subsurface exploration, laboratory data, geologic setting and our understanding of the project. This characterization, termed GeoModel, forms the basis of our geotechnical calculations and evaluation of site preparation and foundation options. Conditions encountered at each exploration point are indicated on the individual logs. The individual logs can be found in the **Exploration Results** section and the GeoModel can be found in the **Figures** section of this report.

As part of our analyses, we identified the following model layers within the subsurface profile. For a more detailed view of the model layer depths at each boring location, refer to the GeoModel.

Model Layer	Layer Name	General Description
01	**Surface Material**	Asphalt/Crushed Aggregate/Topsoil
02	**Lean Clay**	Lean clay with silt and limestone rock fragments, brown, stiff to hard
03	**Weathered Rock**	Weathered Limestone, light brown, completely weathered

Groundwater Considerations

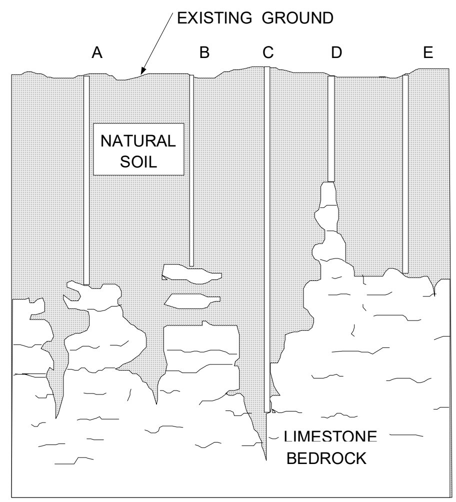
The boreholes were observed while drilling and after completion for the presence and level of groundwater. No water was encountered while drilling or observed after drilling operations were completed in the borings. For safety reasons, all boring locations were backfilled with auger cutting on conclusion.

Groundwater level fluctuations should be expected to occur due to seasonal variations in rainfall, runoff and other factors not evident at the time the test borings were performed. Therefore, groundwater levels during construction or at other times in the life of the structure may be higher or lower than the levels indicated on the attached test boring logs. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

Karst Considerations

According to the Kentucky Geological Survey (KGS), this site has “intense” karst potential. Karst features, including clay seams, caverns, sinkholes, and highly irregular rock surfaces, are common features within carbonate rocks like those encountered in this exploration. As previously discussed, there are no mapped sinkholes within the footprint of this site however, two sinkholes are mapped approximately 800 feet south of the project site (within the Meijer parking lot footprint).

AUGER REFUSAL ILLUSTRATION



THIS FIGURE IS FOR ILLUSTRATIVE PURPOSES ONLY AND DOES NOT NECESSARILY DEPICT THE SPECIFIC BEDROCK CONDITIONS AT THIS SITE

To determine in more detail the likelihood of karst activity at the site, additional studies would need to be undertaken. Further assessment of specific, unusual features may include additional exploration and/or geophysical analysis (i.e., resistivity study) to better understand the risk and to aid in generating informed decisions. Because this project lies in a commercially-developed area, it is possible that documentation exists regarding the extent of existing depressions and sinkholes in the surrounding area and the risk these depressions pose to present infrastructure within the vicinity of the project area. If this documentation is available, it should be provided to Terracon so that we may reassess and revise our recommendations, if necessary.

Specific conditions encountered at the exploration locations are indicated by the **Exploration Results**. Stratification boundaries on the boring log represent the approximate location of changes in soil types; in-situ, the transition between materials may be gradual.

GEOTECHNICAL OVERVIEW

The near surface, cohesive soils 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, although given the relatively shallow depth to bedrock across the project site, mitigation by simply removing the soft/saturated material may prove an economical option compared to other mitigation options. Additional site preparation recommendations, including subgrade improvement and fill placement, are provided in the **Earthwork** section.

Evidence of fill was not encountered in the borings. However, it is likely that some fill was used as part of grading operations during construction of the existing parking lot.

Limestone bedrock was encountered at this site at shallow depths (1.4 to 3.1 feet). Excavation into existing rock may be required in some areas to accommodate the construction of foundations and floor slabs and to accommodate the installation of underground utilities (water, storm sewer, sanitary sewer, and electrical lines, depending on cut/fill requirements. Terracon should be contacted to review and revise recommendations presented in this report, once grading plans become available.

Weathered bedrock can typically be excavated using conventional excavation equipment equipped with rock removal tools. However, the earthwork contractor should be prepared to use methods such as pneumatic hammering to reach design floor slab subgrade and footing elevations as well as to install deeper utilities. It may be advantageous to provide earthwork contractors the opportunity to perform independent rock cores prior to bidding for their own evaluation of excavatable rock across the site. Blasting may be considered, however, given the developed nature of the area, not likely feasible.

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

EARTHWORK

Earthwork is anticipated to include demolition of existing asphalt pavement, clearing and grubbing, rock excavation 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 following presents general recommendations for site preparation, excavation, and fill placement. Special considerations will be needed where site grading may expose unstable soils. Our recommendations presented for design and construction of earth supported elements (i.e., foundations, slabs, etc.) are contingent upon following the recommendations outlined in this section.

The proposed development footprint lies primarily on existing asphalt pavement. We anticipate that as part of the initial site grading preparation, all existing construction debris (pavements, concrete curbs, underground utilities, etc.), as well as any other existing deleterious materials encountered within the proposed construction limits will be completely removed. We would anticipate removal and relocation, or re-routing, of any existing utilities which currently exist within the footprint of the proposed development area that would interfere with new construction. Any abandoned underground pipes, left in place, should be fully grouted. The stability of existing backfill above pipes left in place should be evaluated in the presence of geotechnical personnel by such means as proofrolling, in-place density testing and hand-augering. Excavations created due to utility relocations or demolition activities should be backfilled with structural fill materials, placed and compacted in accordance with the recommendations provided in the following paragraphs or with lean concrete or flowable fill. If lean concrete is used as backfill, the contractor should refer to all of the new build Mechanical-Electrical-Plumbing (MEP) and foundation drawings to confirm that the concrete backfill materials will not conflict with any new item installations or construction.

Although not observed in the borings performed for this project, given the developed nature of the site, the presence of fill cannot be discounted. If encountered, any existing fill soils and to eliminate the risk of bearing floor slabs and pavements directly on or over existing fills, it is recommended that subgrade in the floor slab and pavement areas where fill is encountered be completely undercut, removed, and replaced with properly compacted structural fill back to design subgrade elevation. The structural fill should meet the requirements of the **Fill Material Types** section of this report and should be free of deleterious materials.

After undercutting is complete (and prior to placement of structural fill), the exposed subgrade should be carefully proof-rolled with an adequately loaded vehicle such as a fully-loaded tandem-axle dump truck in areas of the floor slabs, pavement, and any areas to receive structural fill. The proof-rolling program should consist of a minimum of 3 passes by the proof-rolling equipment and should be performed under the close direction of the geotechnical personnel. Any soft areas or areas excessively deflecting under the proof-roll should be undercut. Excessively wet or dry material should either be removed or moisture conditioned and recompacted. If areas of intact bedrock are exposed beneath the removed surface layer (as expected), proofrolling will not be applicable.

If bedrock is exposed at floor slab subgrade elevation in this area, we recommend a 12-inch buffer of compacted structural fill meeting requirements in the **Fill Material Types** section of this report be provided between floor slab base elevation and exposed bedrock to allow for a more-uniform bearing material beneath the floor slab. The floor slab base layer can be included as part of this buffer. Where rock is encountered at or just below slab subgrade elevation, an alternative to this 12-inch buffer of structural fill can include a 2-inch-thick mud mat at slab subgrade elevation that can be used to provide a uniform bearing layer and reduce potential high-stress points between the floor slab and bedrock subgrade.

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 10 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 [1]	USCS Classification	Acceptable Location for Placement
Low Plasticity Cohesive (Low Volume Change Material)	CL, CL-ML (LL<40 & PI<15)	All locations and elevations
Granular (Low Volume Change Material) [3]	SW, GW	All locations and elevations
On-Site Soils	CL	Onsite soils could be used as structural, provided they conform to the structural fill recommendations provided in this report. Any rock fragments greater than 3-inches should be removed prior to placing fill.

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.
2. Not recommended in structural areas
3. Well graded granular fill shall be similar to KYTC's Dense Graded Aggregate or crushed limestone aggregate. If frost heave is not a concern, limestone screenings or granular material such as sand, gravel, or crushed stone may also be used. Material should be approved by the Geotechnical Engineer.

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 4 to 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 [1, 2, 3]	98% 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 [1]	Low plasticity cohesive: -2% to +3% of optimum Granular: -3% to +3% 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. High plasticity cohesive fill should not be compacted to more than 100% of standard Proctor maximum dry density.
3. 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 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

Excavation into existing rock may be required in some areas to accommodate the construction of underground utilities (water, storm sewer, sanitary sewer and electrical lines) or to reach foundation bearing or structural fill subgrade elevation (depending on final grades). The uppermost rock may be rippable using a large dozer or track-type excavator equipped with either a single tine or multiple tine ripper. However, contractors should be prepared to use hard rock excavation techniques such as the use of rock chisels and hammers or other methods to penetrate below the topmost portion of the limestone rock layer.

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.

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.

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 5,000 square feet 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.

SHALLOW FOUNDATIONS

If the site has been prepared in accordance with the requirements noted in **Earthwork**, the following design parameters are applicable for shallow foundations.

Design Parameters – Compressive Loads

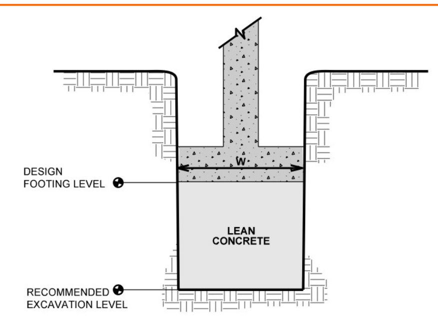
Item	Description
Maximum Net Allowable Bearing pressure [1, 2]	3,000 psf (foundation bearing on weathered or intact limestone bedrock, or engineered fill)
Required Bearing Stratum [3]	Competent (intact) limestone bedrock or engineered fill
Minimum Foundation Dimensions	Columns: 30 inches Continuous: 18 inches
Ultimate Passive Resistance [4] **(equivalent fluid pressures)**	240 pcf (cohesive backfill)
Ultimate Coefficient of Sliding Friction [5]	0.5 (bedrock)
Minimum Embedment below Finished Grade [6]	For foundations bearing on competent intact limestone bedrock (where encountered at proposed foundation bearing elevation), a minimum embedment depth of 12 inches is acceptable for frost protection purposes. For foundations bearing on native clay or structural fill (where water can infiltrate and cause the material to be susceptible to frost heave), a minimum 24-inch embedment depth should be implemented for frost protection purposes.
Estimated Total Settlement from Structural Loads [2]	Less than about 1 inch
Estimated Differential Settlement [2, 7]	About 1/2 of total settlement

Item	Description
1.	The maximum net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. An appropriate factor of safety has been applied. Values assume that exterior grades are no steeper than 20% within 10 feet of structure.
2.	Values provided are for maximum loads noted in **Project Description**.
3.	Unsuitable or soft soils should be over-excavated and replaced per the recommendations presented in the **Earthwork**.
4.	Use of passive earth pressures require the sides of the excavation for the spread footing foundation to be nearly vertical and the concrete placed neat against these vertical faces or that the footing forms be removed and compacted structural fill be placed against the vertical footing face.
5.	Can be used to compute sliding resistance where foundations are placed on suitable soil/materials. Should be neglected for foundations subject to net uplift conditions.
6.	Embedment necessary to minimize the effects of frost and/or seasonal water content variations. For sloping ground, maintain depth below the lowest adjacent exterior grade within 5 horizontal feet of the structure.
7.	Differential settlements are as measured over a span of 50 feet.

Foundation Construction Considerations

As noted in **Earthwork**, the footing excavations should be evaluated under the direction of the Geotechnical Engineer. The base of all foundation excavations should be free of water and loose soil, prior to placing concrete. Concrete should be placed soon after excavating to reduce bearing soil disturbance. Care should be taken to prevent wetting or drying of the bearing materials during construction. Excessively wet or dry material or any loose/disturbed material in the bottom of the footing excavations should be removed/reconditioned before foundation concrete is placed.

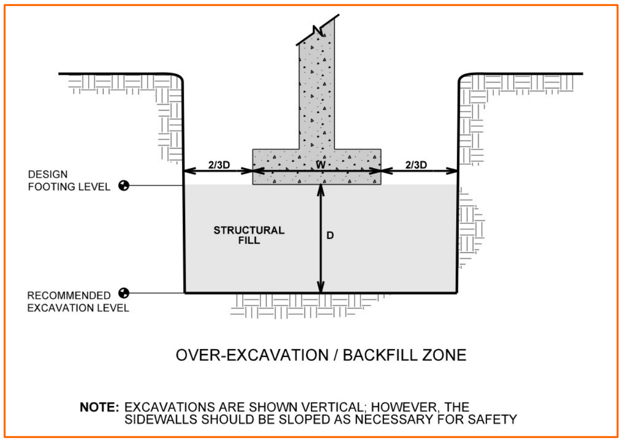
If unsuitable bearing soils are encountered at the base of the planned footing excavation, the excavation should be extended deeper to suitable soils, and the footings could bear directly on these soils at the lower level or on lean concrete backfill placed in the excavations. This is illustrated on the sketch below.



LEAN CONCRETE BACKFILL

NOTE: EXCAVATIONS ARE SHOWN VERTICAL; HOWEVER, THE SIDEWALLS SHOULD BE SLOPED AS NECESSARY FOR SAFETY

Over-excavation for structural fill placement below footings should be conducted as shown below. The over-excavation should be backfilled up to the footing base elevation, with suitable engineered fill as described in Fill Material Type,, as recommended in the **Earthwork** section.



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 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 B**. Subsurface explorations at this site were extended to a maximum depth of 3.1 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.

FLOOR SLABS

If bedrock is encountered at floor slab subgrade elevation, and to allow for a more uniform bearing material beneath the subgrade, a 12-inch buffer of structural fill should lie between base slab elevation and bedrock, as stated in our **Earthwork** section. The granular base layer can be included as a part of this structural fill buffer. Where rock is encountered at or just below subgrade elevation, an alternative can include placement of a 2-inch mud mat between slab subgrade elevation and bedrock to account for high stress points and provide for a level, uniform bearing surface.

Design parameters for floor slabs assume the requirements for **Earthwork** have been followed. Specific attention should be given to positive drainage away from the structure and positive drainage of the aggregate base beneath the floor slab.

Floor Slab Design Parameters

Item	Description
Floor Slab Support [1]	Minimum 6 inches of free-draining (less than 6% passing the U.S. No. 200 sieve) crushed aggregate compacted to at least 95% of ASTM D 698 [2, 3] At least 18 inches of low plasticity cohesive or granular soils with at least 18% passing the U.S. No. 200 sieve material should be present below floor slabs where lean to fat clay or fat clay soils are present
Estimated Modulus of Subgrade Reaction [2]	100 pounds per square inch per inch (psi/in) for point loads

1. Floor slabs should be structurally independent of building footings or walls to reduce the possibility of floor slab cracking caused by differential movements between the slab and foundation.
2. Modulus of subgrade reaction is an estimated value based upon our experience with the subgrade condition, the requirements noted in **Earthwork**, and the floor slab support as noted in this table. It is provided for point loads. For large area loads the modulus of subgrade reaction would be lower.
3. Free-draining granular material should have less than 6% fines (material passing the No. 200 sieve). Other design considerations such as cold temperatures and condensation development could warrant more extensive design provisions.

The use of a vapor retarder should be considered beneath concrete slabs on grade covered with wood, tile, carpet, or other moisture sensitive or impervious coverings, or when the slab will support equipment sensitive to moisture. When conditions warrant the use of a vapor retarder, the slab designer should refer to ACI 302 and/or ACI 360 for procedures and cautions regarding the use and placement of a vapor retarder.

Saw-cut control joints should be placed in the slab to help control the location and extent of cracking. For additional recommendations refer to the ACI Design Manual. Joints or cracks should be sealed with a water-proof, non-extruding compressible compound specifically recommended for heavy duty concrete pavement and wet environments.

Where floor slabs are tied to perimeter walls or turn-down slabs to meet structural or other construction objectives, our experience indicates differential movement between the walls and slabs will likely be observed in adjacent slab expansion joints or floor slab cracks beyond the length of the structural dowels. The Structural Engineer should account for potential differential settlement through use of sufficient control joints, appropriate reinforcing or other means.

Floor Slab Construction Considerations

Finished subgrade, within and for at least 10 feet beyond the floor slab, should be protected from traffic, rutting, or other disturbance and maintained in a relatively moist condition until floor slabs are constructed. If the subgrade should become damaged or desiccated prior to construction of floor slabs, the affected material should be removed and structural fill should be added to replace the resulting excavation. Final conditioning of the finished subgrade should be performed immediately prior to placement of the floor slab support course.

The Geotechnical Engineer should approve the condition of the floor slab subgrades immediately prior to placement of the floor slab support course, reinforcing steel, and concrete. Attention should be paid to high traffic areas that were rutted and disturbed earlier, and to areas where backfilled trenches are located.

PAVEMENTS

Design parameters for pavements assume the requirements for **Earthwork** have been followed.

General Pavement Comments

Pavement designs are provided for the traffic conditions and pavement life conditions as noted in **Project Description** and in the following sections of this report. A critical aspect of pavement performance is site preparation. Pavement designs noted in this section must be applied to the site which has been prepared as recommended in the **Earthwork** section.

While not anticipated, if excavation into bedrock prior to reaching proposed pavement subgrade elevation is required or if bedrock is encountered at proposed pavement subgrade elevation, overexcavation of bedrock to a depth of 2 feet below subgrade elevation should occur in transition areas where subgrade material changes over from bedrock to soils. This 2-foot undercut should extend about 5 feet laterally into the bedrock subgrade. The undercut should then be backfilled to proposed pavement subgrade elevation with properly compacted structural fill following recommendations stated in the **Fill Material Types** and **Fill Compaction Requirements** sections of this report.

Pavement Design Parameters

Design of Asphaltic Concrete (AC) pavements is based on the procedures outlined in the National Asphalt Pavement Association (NAPA) Information Series 109 (IS-109). Design of Portland Cement Concrete (PCC) pavements is based upon American Concrete Institute (ACI) 330: Guide for Design and Construction of Concrete Parking Lots.

A subgrade California Bearing Ratio (CBR) of 3 was used for the AC pavement designs, and a modulus of subgrade reaction of 100 pci was used for the PCC pavement designs. The values were empirically derived based upon our experience with the low plasticity cohesive subgrade soils and our understanding of the quality of the subgrade as prescribed by the **Site Preparation** conditions as outlined in **Earthwork**. A modulus of rupture of 600 psi was used for pavement concrete.

Pavement Section Thicknesses

The following table provides options for AC and PCC Sections:

Minimum Recommended Pavement Section Thickness (inches)						
Traffic Area	Pavement Type	Asphalt Concrete Couse		Portland Cement Concrete [1]	Aggregate Base [2]	Total Thickness
		Surface	Base			
Pavement	AC	1.5	2.5	–	6	10
	PCC	–	–	6	6	11
Dumpster Pad	PCC	--	--	7	6	13

1. 4,000 psi compressive strength at 28 days, air entrained mix.
2. KYTC crushed limestone dense graded aggregate

Pavement Drainage

Pavements should be sloped to provide rapid drainage of surface water. Water allowed to pond on or adjacent to the pavements could saturate the subgrade and contribute to premature pavement deterioration. In addition, the pavement subgrade should be graded to provide positive drainage within the granular base section.

Subdrainage should be a primary consideration in the proposed pavement areas to prevent water from accumulating within the aggregate base course and causing softening of the subgrade, shrink/swell volume change, or frost heave. To this end, we recommend the installation of pipe underdrains (finger drains) radiating from all catch basins within the pavement. Where surrounded by pavement, the finger drains should be installed on all four sides of the catch basins. At catch basins located along the edge of the pavement, the finger drains should be installed on the sides that abut pavement. Subgrade surfaces should be fine graded so that water seepage under the pavements will flow to the underdrains or to other suitable drainage outlets. Establishing subgrade slopes during site grading to promote rapid surface and base course drainage away from the pavement will extend its useful life.

Pavement Maintenance

The pavement sections represent minimum recommended thicknesses and, as such, periodic maintenance should be anticipated. Therefore, preventive maintenance should be planned and provided for through an on-going pavement management program. Maintenance activities are intended to slow the rate of pavement deterioration and to preserve the pavement investment. Maintenance consists of both localized maintenance (e.g., crack and joint sealing and patching) and global maintenance (e.g., surface sealing). Preventive maintenance is usually the priority when implementing a pavement maintenance program. Additional engineering observation is recommended to determine the type and extent of a cost-effective program. Even with periodic maintenance, some movements and related cracking may still occur and repairs may be required.

Pavement performance is affected by its surroundings. In addition to providing preventive maintenance, the civil engineer should consider the following recommendations in the design and layout of pavements:

- Final grade adjacent to paved areas should slope down from the edges at a minimum 2%.
- Subgrade and pavement surfaces should have a minimum 2% slope to promote proper surface drainage.
- Install below pavement drainage systems surrounding areas anticipated for frequent wetting.
- Install joint sealant and seal cracks immediately.
- Seal all landscaped areas in or adjacent to pavements to reduce moisture migration to subgrade soils.
- Place compacted, low permeability backfill against the exterior side of curb and gutter.
- Place curb, gutter and/or sidewalk directly on clay subgrade soils rather than on unbound granular base course materials.

GENERAL COMMENTS

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Natural variations will occur between exploration point locations or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. Terracon should be retained as the Geotechnical Engineer, where noted in this report, to provide observation and testing services during pertinent construction phases. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our Scope of Services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence or collaboration through this system are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third-party beneficiaries intended. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client, and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly impact excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety, and cost estimating including, excavation support, and dewatering requirements/design are the responsibility of others. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

FIGURES

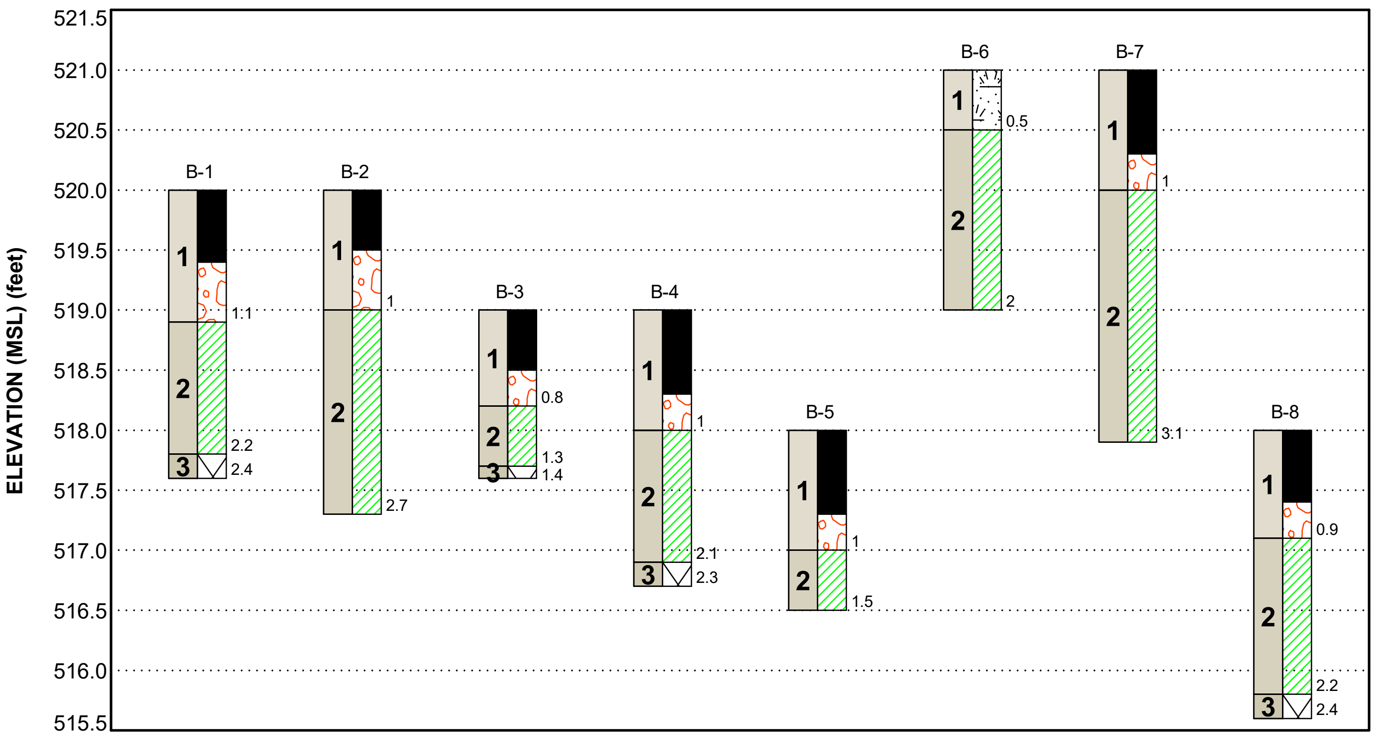
Contents:

GeoModel

GEOMODEL

Zips Car Wash ■ Louisville, KY
Terracon Project No. 57225048

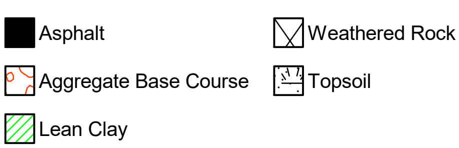
Terracon GeoReport



This is not a cross section. This is intended to display the Geotechnical Model only. See individual logs for more detailed conditions.

Model Layer	Layer Name	General Description
1	Surface Material	Asphalt/Crushed Aggregate/Topsoil
2	Lean Clay	Lean clay with silt and limestone rock fragments, brown, stiff to hard
3	Weathered Rock	Weathered Limestone, light brown, completely weathered

LEGEND



NOTES:
Layering shown on this figure has been developed by the geotechnical engineer for purposes of modeling the subsurface conditions as required for the subsequent geotechnical engineering for this project. Numbers adjacent to soil column indicate depth below ground surface.

ATTACHMENTS

EXPLORATION AND TESTING PROCEDURES

Field Exploration

Number of Borings	Boring Depth (feet)	Planned Location
5	1.4 to 2.7	Building area
3	2.0 to 3.1	Pavement area

Boring Layout and Elevations: Unless otherwise noted, Terracon personnel provided the boring layout. Coordinates were obtained with a handheld GPS unit (estimated horizontal accuracy of about ±10 feet) and approximate elevations were obtained by Google Earth Pro. If more precise boring elevations are desired, we recommend the as-drilled boring locations be surveyed.

Subsurface Exploration Procedures: We advanced the borings with a track-mounted drill rig using direct push drilling methods. In the split-barrel sampling procedure, a standard 2-inch outer diameter split-barrel sampling spoon was driven into the ground by a 140-pound automatic hammer falling a distance of 30 inches. The number of blows required to advance the sampling spoon the last 12 inches of a normal 18-inch penetration is recorded as the Standard Penetration Test (SPT) resistance value. The SPT resistance values, also referred to as N-values, are indicated on the boring logs at the test depths. We observed and recorded groundwater levels during drilling and sampling.

The sampling depths, penetration distances, and other sampling information were recorded on the field boring logs. The samples were placed in appropriate containers and taken to our soil laboratory for testing and classification by a Geotechnical Engineer. Our exploration team prepared field boring logs as part of the drilling operations. These field logs included visual classifications of the materials encountered during drilling and our interpretation of the subsurface conditions between samples. Final boring logs were prepared from the field logs. The final boring logs represent the Geotechnical Engineer's interpretation of the field logs and include modifications based on observations and tests of the samples in our laboratory.

Laboratory Testing

The project engineer reviewed the field data and assigned laboratory tests to understand the engineering properties of the various soil strata, as necessary, for this project. Procedural standards noted below are for reference to methodology in general. In some cases, variations to methods were applied because of local practice or professional judgment. Standards noted below include reference to other, related standards. Such references are not necessarily applicable to describe the specific test performed.

- ASTM D2216 Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
- ASTM D4318 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

The laboratory testing program often included examination of soil samples by an engineer. Based on the material's texture and plasticity, we described and classified the soil samples in accordance with the Unified Soil Classification System.

Of note, two Atterberg limits tests were conducted on soils samples. However, the weathered rock content of the soil samples prevented valid Plastic Limit values from being obtained. The Liquid Limits (32 and 43) were indicative of Lean Clay (CL). Therefore, the native clay soils is best classified as Lean Clay with silt and weathered rock.

PHOTOGRAPHY LOG

Zips Car Wash Proposed Location (Looking North)

Zips Car Wash Proposed Location (Looking South)

SITE LOCATION AND EXPLORATION PLANS

Contents:

Site Location Plan
Exploration Plan

Note: All attachments are one page unless noted above.

SITE LOCATION

Zips Car Wash ■ Louisville, Jefferson County, Kentucky
November 17, 2022 ■ Terracon Project No. 57225048

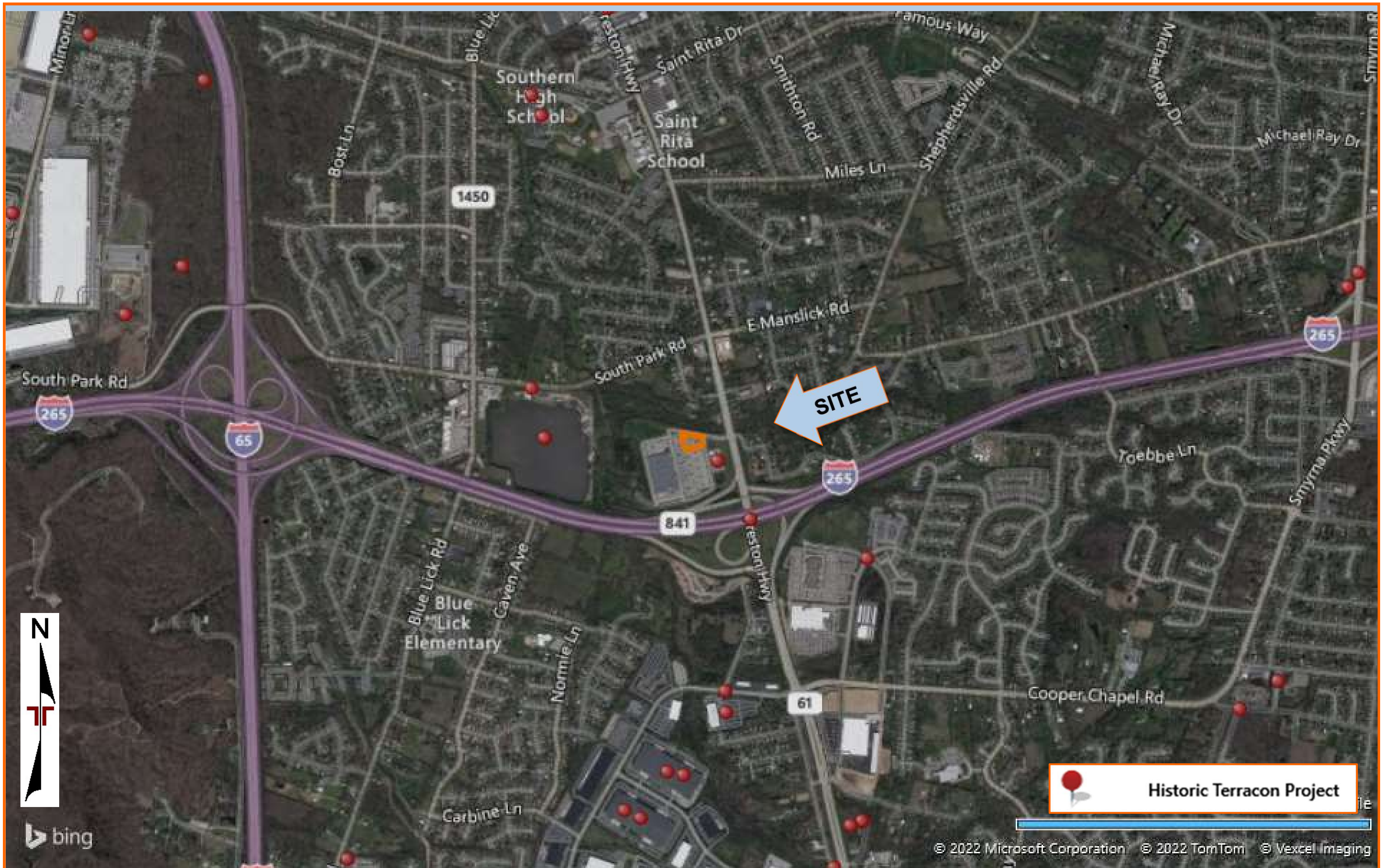


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

EXPLORATION PLAN

Zips Car Wash ■ Louisville, Jefferson County, Kentucky

November 17, 2022 ■ Terracon Project No. 57225048

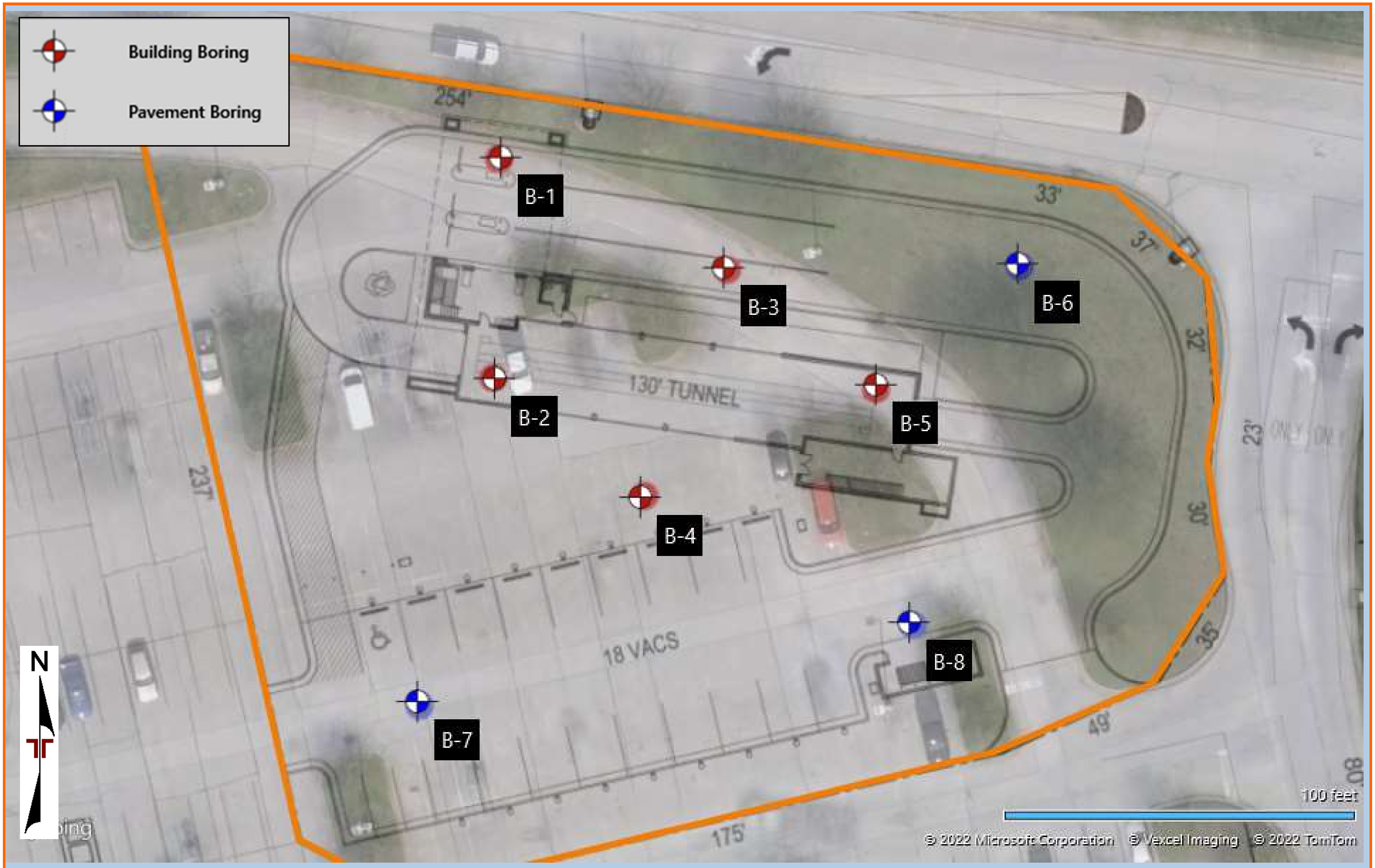


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

EXPLORATION RESULTS

Contents:

Boring Logs (B-1 through B-8)
Atterberg Limits

Note: All attachments are one page unless noted above.

BORING LOG NO. B-1

PROJECT: Zips Car Wash

CLIENT: Zips Car Wash, LLC
Plano, TX

SITE: 9500 Preston Highway
Louisville, KY

LOCATION See Exploration Plan

Latitude: 38.1140° Longitude: -85.6783°

Approximate Surface Elev.: 520 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	DESCRIPTION	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)
1		0.6	**ASPHALT**	519.4+/-					
1		1.1	**AGGREGATE BASE COURSE**	518.9+/-	1				
2		2.2	**LEAN CLAY (CL)**, with silt, brown, stiff, with limestone fragments	517.8+/-	2		X	12-8-50/5"	20.8
3		2.4	**LIMESTONE**, light brown, completely weathered	517.6+/-					
			Boring Refusal at 2.4 Feet						

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Direct Push

Abandonment Method:
Boring backfilled with Auger Cuttings
Surface capped with asphalt

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations estimated from Google Earth PRO

Notes:

Terracon
13050 Eastgate Park Way Ste 101
Louisville, KY

Boring Started: 09-26-2022	Boring Completed: 09-26-2022
Drill Rig: Geoprobe 7822DT	Driller: M. Reynolds
Project No.: 57225048	

BORING LOG NO. B-2

PROJECT: Zips Car Wash

CLIENT: Zips Car Wash, LLC
Plano, TX

SITE: 9500 Preston Highway
Louisville, KY

LOCATION See Exploration Plan

Latitude: 38.1138° Longitude: -85.6783°

Approximate Surface Elev.: 520 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)
1		**ASPHALT**						
		0.5	519.5+/-					
		AGGREGATE BASE COURSE						
		1.0	519+/-	1				
2		**LEAN CLAY (CL)**, with silt, brown, very stiff, with limestone fragments		2		X	5-6-7 N=13	43.5
		2.7	517.3+/-					
		Boring Refusal at 2.7 Feet						

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Direct Push

Abandonment Method:
Boring backfilled with Auger Cuttings
Surface capped with asphalt

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations estimated from Google Earth PRO

Notes:

Terracon
13050 Eastgate Park Way Ste 101
Louisville, KY

Boring Started: 09-26-2022

Boring Completed: 09-26-2022

Drill Rig: Geoprobe 7822DT

Driller: M. Reynolds

Project No.: 57225048

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. 26195013B-CUSTOM 57225048 ZIPS CAR WASH.GPJ TERRACON_DATATEMPLATE.GDT 11/17/22

BORING LOG NO. B-3

PROJECT: Zips Car Wash

CLIENT: Zips Car Wash, LLC
Plano, TX

SITE: 9500 Preston Highway
Louisville, KY

LOCATION See Exploration Plan

Latitude: 38.1139° Longitude: -85.6780°

Approximate Surface Elev.: 519 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	DESCRIPTION	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)
1		0.5	**ASPHALT**	518.5+/-					
		0.8	**AGGREGATE BASE COURSE**	518.2+/-					
2		1.3	**LEAN CLAY (CL)**, with silt, brown, stiff, with limestone fragments	517.7+/-	1			50/5"	16.7
3		1.4	**LIMESTONE**, light brown, completely weathered	517.6+/-					
			Boring Refusal at 1.4 Feet						

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Direct Push

Abandonment Method:
Boring backfilled with Auger Cuttings
Surface capped with asphalt

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations estimated from Google Earth PRO

Notes:

Terracon
13050 Eastgate Park Way Ste 101
Louisville, KY

Boring Started: 09-26-2022	Boring Completed: 09-26-2022
Drill Rig: Geoprobe 7822DT	Driller: M. Reynolds
Project No.: 57225048	

BORING LOG NO. B-4

PROJECT: Zips Car Wash

CLIENT: Zips Car Wash, LLC
Plano, TX

SITE: 9500 Preston Highway
Louisville, KY

LOCATION See Exploration Plan

Latitude: 38.1137° Longitude: -85.6781°

Approximate Surface Elev.: 519 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	DESCRIPTION	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)
1		0.7	**ASPHALT**	518.3+/-					
1		1.0	**AGGREGATE BASE COURSE**	518+/-	1				
2		2.1	**LEAN CLAY (CL)**, with silt, brown, hard, with limestone fragments	516.9+/-	2		X	33-25-50/4"	17.7
3		2.3	**LIMESTONE**, light brown, completely weathered	516.7+/-					
			Boring Refusal at 2.3 Feet						

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Direct Push

Abandonment Method:
Boring backfilled with Auger Cuttings
Surface capped with asphalt

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations estimated from Google Earth PRO

Notes:

Terracon
13050 Eastgate Park Way Ste 101
Louisville, KY

Boring Started: 09-26-2022	Boring Completed: 09-26-2022
Drill Rig: Geoprobe 7822DT	Driller: M. Reynolds
Project No.: 57225048	

BORING LOG NO. B-5

PROJECT: Zips Car Wash

CLIENT: Zips Car Wash, LLC
Plano, TX

SITE: 9500 Preston Highway
Louisville, KY

LOCATION See Exploration Plan

Latitude: 38.1138° Longitude: -85.6779°

Approximate Surface Elev.: 518 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)
1		**ASPHALT** — 0.7	517.3+/-					
1		**AGGREGATE BASE COURSE** — 1.0	517+/-	1				
2		**LEAN CLAY (CL)**, with silt, brown, hard, with limestone fragments — 1.5	516.5+/-			X	13-50/0"	14.9

Boring Refusal at 1.5 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Direct Push

Abandonment Method:
Boring backfilled with Auger Cuttings
Surface capped with asphalt

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations estimated from Google Earth PRO

Notes:

Terracon
13050 Eastgate Park Way Ste 101
Louisville, KY

Boring Started: 09-26-2022	Boring Completed: 09-26-2022
Drill Rig: Geoprobe 7822DT	Driller: M. Reynolds
Project No.: 57225048	

BORING LOG NO. B-6

PROJECT: Zips Car Wash

CLIENT: Zips Car Wash, LLC
Plano, TX

SITE: 9500 Preston Highway
Louisville, KY

LOCATION See Exploration Plan

Latitude: 38.1139° Longitude: -85.6778°

Approximate Surface Elev.: 521 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	DESCRIPTION	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)
1		0.5	**TOPSOIL**	520.5+/-					
2		2.0	**LEAN CLAY (CL)**, with silt, brown, very stiff, with limestone fragments	519+/-	1–2		X	6-9-50/0"	14.9
			Boring Refusal at 2 Feet						

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Direct Push

Abandonment Method:
Boring backfilled with Auger Cuttings
Surface capped with asphalt

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations estimated from Google Earth PRO

Notes:

Terracon
13050 Eastgate Park Way Ste 101
Louisville, KY

Boring Started: 09-26-2022

Boring Completed: 09-26-2022

Drill Rig: Geoprobe 7822DT

Driller: M. Reynolds

Project No.: 57225048

BORING LOG NO. B-7

PROJECT: Zips Car Wash

CLIENT: Zips Car Wash, LLC
Plano, TX

SITE: 9500 Preston Highway
Louisville, KY

LOCATION See Exploration Plan

Latitude: 38.1136° Longitude: -85.6783°

Approximate Surface Elev.: 521 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	Description	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)
1		0.7	**ASPHALT**	520.3+/-					
		1.0	**AGGREGATE BASE COURSE**	520+/-	1				
2		3.1	**LEAN CLAY (CL)**, with silt, brown, stiff, with limestone fragments	517.9+/-	2, 3		X	8-5-6 N=11	21.4
			Boring Refusal at 3.1 Feet						

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Direct Push

Abandonment Method:
Boring backfilled with Auger Cuttings
Surface capped with asphalt

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations estimated from Google Earth PRO

Notes:

Terracon
13050 Eastgate Park Way Ste 101
Louisville, KY

Boring Started: 09-26-2022

Boring Completed: 09-26-2022

Drill Rig: Geoprobe 7822DT

Driller: M. Reynolds

Project No.: 57225048

BORING LOG NO. B-8

PROJECT: Zips Car Wash

CLIENT: Zips Car Wash, LLC
Plano, TX

SITE: 9500 Preston Highway
Louisville, KY

LOCATION See Exploration Plan

Latitude: 38.1136° Longitude: -85.6779°

Approximate Surface Elev.: 518 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	DESCRIPTION	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)
1		0.6	**ASPHALT**	517.4+/-					
		0.9	**AGGREGATE BASE COURSE**	517.1+/-					
2		2.2	**LEAN CLAY (CL)**, with silt, brown, hard, with limestone fragments	515.8+/-	1 – 2		X	18-50/5"	28.1
3		2.4	**LIMESTONE**, light brown, completely weathered	515.6+/-					

Boring Refusal at 2.4 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Direct Push

Abandonment Method:
Boring backfilled with Auger Cuttings
Surface capped with asphalt

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations estimated from Google Earth PRO

Notes:

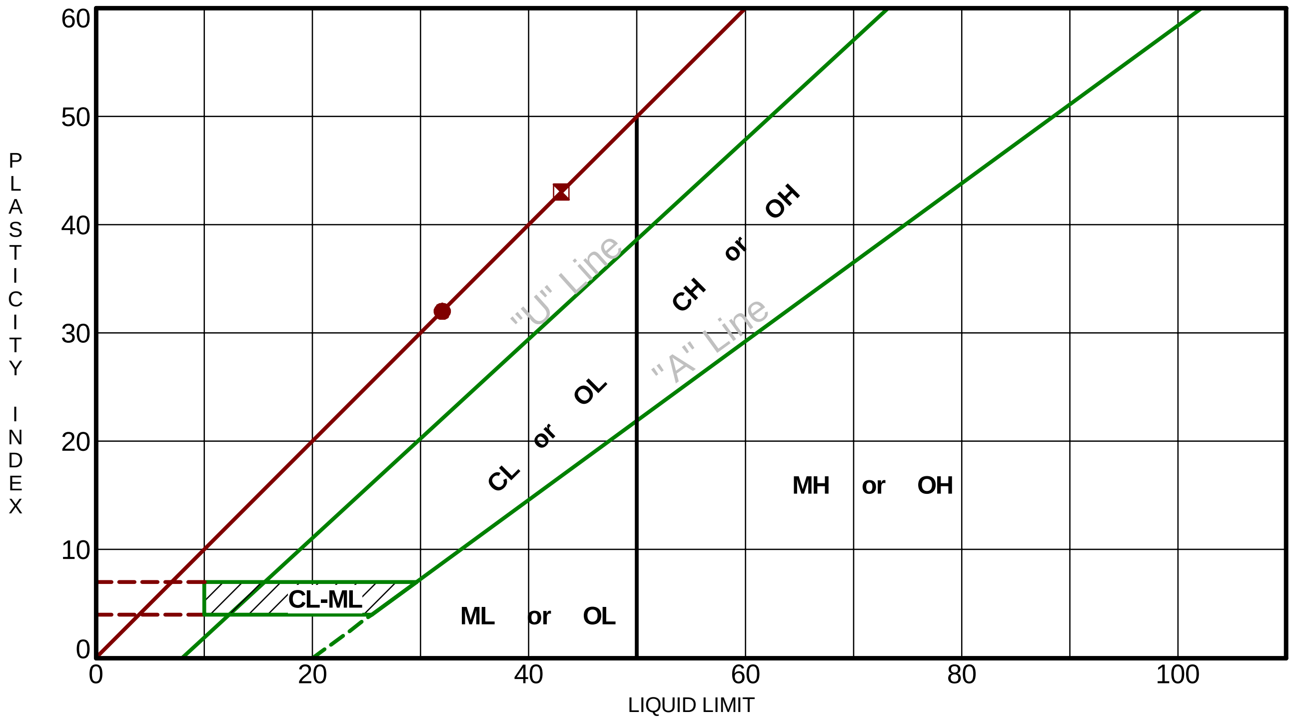
Terracon
13050 Eastgate Park Way Ste 101
Louisville, KY

Boring Started: 09-26-2022	Boring Completed: 09-26-2022
Drill Rig: Geoprobe 7822DT	Driller: M. Reynolds
Project No.: 57225048	

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. 26195013B-CUSTOM 57225048 ZIPS CAR WASH.GPJ TERRACON_DATATEMPLATE.GDT 11/17/22

ATTERBERG LIMITS RESULTS

ASTM D4318



	Boring ID	Depth	LL	PL	PI	Fines	USCS	Description
●	B-1	1 - 2.4	32	NP	32			
⊠	B-2	1 - 2.5	43	NP	43			

PROJECT: Zips Car Wash

SITE: 9500 Preston Highway
Louisville, KY

Terracon
13050 Eastgate Park Way Ste 101
Louisville, KY

PROJECT NUMBER: 57225048

CLIENT: Zips Car Wash, LLC
Plano, TX

April 18, 2023 Planning and Design 23-DDP-0007

SUPPORTING INFORMATION

Contents:

General Notes
Unified Soil Classification System

Note: All attachments are one page unless noted above.

GENERAL NOTES

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

Zips Cars Wash ■ Louisville, KY

Terracon Project No. 57225048

Terracon GeoReport

SAMPLING

Grab Sample

Standard Penetration Test

WATER LEVEL

Water Initially Encountered

Water Level After a Specified Period of Time

Water Level After a Specified Period of Time

Cave In Encountered

Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.

FIELD TESTS

N	**Standard Penetration Test Resistance (Blows/Ft.)**
(HP)	**Hand Penetrometer**
(T)	**Torvane**
(DCP)	**Dynamic Cone Penetrometer**
UC	**Unconfined Compressive Strength**
(PID)	**Photo-Ionization Detector**
(OVA)	**Organic Vapor Analyzer**

DESCRIPTIVE SOIL CLASSIFICATION

Soil classification as noted on the soil boring logs is based Unified Soil Classification System. Where sufficient laboratory data exist to classify the soils consistent with ASTM D2487 "Classification of Soils for Engineering Purposes" this procedure is used. ASTM D2488 "Description and Identification of Soils (Visual-Manual Procedure)" is also used to classify the soils, particularly where insufficient laboratory data exist to classify the soils in accordance with ASTM D2487. In addition to USCS classification, coarse grained soils are classified on the basis of their in-place relative density, and fine-grained soils are classified on the basis of their consistency. See "Strength Terms" table below for details. The ASTM standards noted above are for reference to methodology in general. In some cases, variations to methods are applied as a result of local practice or professional judgment.

LOCATION AND ELEVATION NOTES

Exploration point locations as shown on the Exploration Plan and as noted on the soil boring logs in the form of Latitude and Longitude are approximate. See Exploration and Testing Procedures in the report for the methods used to locate the exploration points for this project. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

STRENGTH TERMS

RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance		**CONSISTENCY OF FINE-GRAINED SOILS** (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance		
Descriptive Term (Density)	**Standard Penetration or N-Value Blows/Ft.**	**Descriptive Term (Consistency)**	**Unconfined Compressive Strength Qu, (tsf)**	**Standard Penetration or N-Value Blows/Ft.**
Very Loose	0 - 3	Very Soft	less than 0.25	0 - 1
Loose	4 - 9	Soft	0.25 to 0.50	2 - 4
Medium Dense	10 - 29	Medium Stiff	0.50 to 1.00	4 - 8
Dense	30 - 50	Stiff	1.00 to 2.00	8 - 15
Very Dense	> 50	Very Stiff	2.00 to 4.00	15 - 30
		Hard	> 4.00	> 30

RELEVANCE OF SOIL BORING LOG

The soil boring logs contained within this document are intended for application to the project as described in this document. Use of these soil boring logs for any other purpose may not be appropriate.

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests[A]				Soil Classification: Group Symbol	Soil Classification: Group Name[B]
Coarse-Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines[C]	Cu ≥ 4 and 1 ≤ Cc ≤ 3[E]	GW	Well-graded gravel[F]
			Cu < 4 and/or [Cc<1 or Cc>3.0][E]	GP	Poorly graded gravel[F]
		Gravels with Fines: More than 12% fines[C]	Fines classify as ML or MH	GM	Silty gravel[F, G, H]
			Fines classify as CL or CH	GC	Clayey gravel[F, G, H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines[D]	Cu ≥ 6 and 1 ≤ Cc ≤ 3[E]	SW	Well-graded sand[I]
			Cu < 6 and/or [Cc<1 or Cc>3.0][E]	SP	Poorly graded sand[I]
		Sands with Fines: More than 12% fines[D]	Fines classify as ML or MH	SM	Silty sand[G, H, I]
			Fines classify as CL or CH	SC	Clayey sand[G, H, I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	PI > 7 and plots on or above "A" line	CL	Lean clay[K, L, M]
			PI < 4 or plots below "A" line[J]	ML	Silt[K, L, M]
		Organic:	Liquid limit - oven dried / Liquid limit - not dried < 0.75	OL	Organic clay[K, L, M, N]
					Organic silt[K, L, M, O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line	CH	Fat clay[K, L, M]
			PI plots below "A" line	MH	Elastic Silt[K, L, M]
		Organic:	Liquid limit - oven dried / Liquid limit - not dried < 0.75	OH	Organic clay[K, L, M, P]
					Organic silt[K, L, M, Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor			PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve.

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] PI ≥ 4 and plots on or above "A" line.

[O] PI < 4 or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.