Geotechnical Engineering Report

Taco Bell W Plane St, Bethel
Bethel, Clermont, OH
February 22, 2022
Terracon Project No. N1215409

Prepared for:
Ampler Development, LLC
Oklahoma City, OK

Prepared by:
Terracon Consultants, Inc.
Cincinnati, Ohio

February 22, 2022

Ampler Development, LLC
P. O. Box 721888
Oklahoma City, OK 73172

Attn: Ms. Amy Cannon
P: (812) 989 8896
E: acannon@amplergroup.com

Re: Geotechnical Engineering Report
Taco Bell W Plane St, Bethel
644 West Plane Street
Bethel, Clermont, OH
Terracon Project No. N1215409

Dear Ms. Cannon:

We have completed the Geotechnical Engineering services for the above-referenced project. This study was performed in general accordance with Terracon Proposal No. PN1215409 dated December 16, 2021. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design and construction of foundations and floor slabs 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 OHIO
CRAIG M. DAVIS E-65462
REGISTERED PROFESSIONAL ENGINEER
2/22/2022

Ayanda T. Ncube
Staff Engineer

Craig M. Davis, P.E., CPESC
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REPORT TOPICS

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 that 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

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

Geotechnical Engineering Report

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644 West Plane Street
Bethel, Clermont, OH
Terracon Project No. N1215409
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INTRODUCTION

This report presents the results of our subsurface exploration and geotechnical engineering services performed for the proposed Taco Bell restaurant to be located at 644 West Plane Street in Bethel, Clermont, OH. The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

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

The geotechnical engineering Scope of Services for this project included the advancement of seven (7) test borings to depths ranging from approximately 6 to 15 feet below existing site grades.

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/or as separate graphs in the **Exploration Results** section.

SITE CONDITIONS

The following description of site conditions is derived from our site visit in association with the field exploration and our review of publicly available geologic and topographic maps.

Item	Description
Parcel Information	■ The project is located at 644 West Plane Street, Bethel, Clermont, OH. ■ Latitude/Longitude 38.9655, -84.0923 (approximate) (See **Site Location**
Existing Improvements	One existing residential building, two stories with a basement. The driveway consists of gravel..

Item	Description
Current Ground Cover	Heavily vegetated with grasses, bushes, and trees. A portion of the parcel consists of a maintained lawn.
Existing Topography (from GPS Unit Zeno2)	Grades on site vary from about 873 feet to 876 feet, MSL.
Geology	According to the USDA Soil Survey, the overburden soils were formed in the Illinoian age loess-capped till plains and belong to the Jonesboro and Hickory soil series. Based on the review of published geologic literature, the bedrock at the site belongs to the Ordovician Age Grant Lake Limestone and Fairview Formations consisting of interbedded 40 to 50% limestone and 60 to 50% shale. Bedrock is mapped at an elevation of approximately 850 feet.

PROJECT DESCRIPTION

Our initial understanding of the project was provided in our proposal and was discussed during project planning. A period of collaboration has transpired since the project was initiated, and our final understanding of the project conditions is as follows:

Item	Description
Information Provided	Site sketch overlying aerial image dated 11-3-2021; provided by AmplerDevelopment LLC on 12-10-2021.
Project Description	New Taco Bell Restaurant with drive-thru window to be constructed in Bethel, Ohio.
Proposed Structure	The project includes a single-story building with a footprint of about 2000 square feet.
Building Construction	Lightly loaded, slab-on-grade, wood-framed structure with reinforced concrete foundation walls supported on shallow footings.
Finished Floor Elevation	Anticipated to be at or near existing site grades, approximately El. 875 feet.
Maximum Loads	■ Columns: 75 to 100 kips ■ Walls: <4 kips per linear foot (klf) ■ Slabs: 100 pounds per square foot (psf)
Grading/Slopes	Grades anticipated to be at or near existing levels.
Below-Grade Structures	None
Pavements	Traffic loads not available at the time of this proposal, anticipated as follows: ■ Autos/light trucks: 1,000 vehicles per day ■ Light delivery and trash collection vehicles: 10 vehicles per week ■ Tractor-trailer trucks: <3 vehicles per week The pavement design period is 20 years.

Item	Description
Estimated Start of Construction	Summer 2022

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
1	**Cohesive Fill**	Brown and gray lean clay, with root hairs, trace sand and gravel.
2	**Granular Fill**	Brown and black sand with gravel, concrete and trace clay seams.
3	**Lean Clay**	Brown, stiff to very stiff, trace root hairs, sand and gravel.
4	**Fat Clay**	Brown, stiff to very stiff, trace sand and gravel.
5	**Glacial Till**	Gray, lean clay, hard, with gravel, trace sand.

Groundwater

The boreholes were observed while drilling and immediately after completion for the presence and level of short-term groundwater levels. No long-term groundwater monitoring was performed.

Groundwater was not observed in any of the borings during drilling or for the short duration that the borings were allowed to remain open. However, this doesn't necessarily mean the borings terminated above the groundwater table. Due to the low permeability of the soils (native cohesive soils) encountered in the borings, a relatively long period may be necessary for a groundwater level to develop and stabilize in a borehole. Long-term observations in piezometers, or observation wells sealed from the influence of surface water, are often required to define groundwater levels in materials of this type.

From experience, trapped/perched groundwater is commonly encountered within existing fill and along the fill/natural soil interface. Cohesive soils of glacial origin were encountered in the borings. It is also common in glacial till soils to have seams, layers or pockets of sand, silt or gravel between the lower permeability silty clay or lean clay soils.

Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff, and other factors not evident at the time that the 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 boring logs. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

GEOTECHNICAL OVERVIEW

This report provides information on the data collected and recommendations related to geotechnical aspects of the project including subsurface conditions, earthwork, and foundations for the canopy. Our geotechnical exploration included a total of 7 borings drilled to depths between 6 feet and 15 feet below the existing ground surface. The borings, designated B-1 through B-3, were drilled in the proposed building area. Boring D-1 was drilled in the proposed dumpster area. Borings P-1 through P-3 were drilled in the proposed parking/driveway areas. The structural borings were terminated in cohesive, hard, glacial till soil consisting of an unsorted glacial sediment mix of lean clay, sand and gravel. The pavement borings were terminated in cohesive, stiff to very stiff native soil consisting of lean to slightly fat clay.

In general, the upper 3 to 4 feet of the soil profile was described as medium-stiff (or fill). This is common due to the seasonal weathering process. The fill was likely a derivative of the construction of the residence or the backfill of underground utilities or septic systems. We also expect heavy root concentrations in the vicinity of the mature trees. Where the existing fill or shallow native soils are weak/yielding, as identified by a proof roll, an undercut of the material should be made to expose firm/unyielding soil. The undercut should then be replaced with new structural fill placed and compacted as recommended in this report. The fill may remain in paved areas pending review and acceptance by Terracon (visual inspection, test pits, and/or proof rolls). In lieu of a complete undercut of the fill beneath the structure, the bearing elements could be deepened to expose at-least-stiff native soils. The remaining building pad area can be undercut to a depth of 3 feet below the design subgrade level and replaced with structural fill (described later in this report).

Existing fill soil was encountered in two borings, P-2 and D-1, to depths of about 0.2 to 6 feet below the existing grade. The existing fill consists of both cohesive (clay) and granular (sand and gravel) materials. Based upon the low relative stiffness of the cohesive soils and the low density of the granular soils (by N-value), it appears that the fill was not engineered/controlled during its placement and is not considered suitable for direct support of the building foundations or pavement.

If weather and schedule permit, we anticipate that the undercut materials can be air-dried and recompacted as engineered fill to backfill the undercuts. Additional site preparation recommendations, including subgrade improvement and fill placement, are provided in the **Earthwork** section. The **Floor Slabs** section addresses slab-on-grade support of the building. The **Pavements** section addresses the design of pavement systems.

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

EARTHWORK

Earthwork is anticipated to include the demolition of the existing building on site, clearing and grubbing, excavations, and fill placement (backfill of excavations and undercuts). 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

Prior to placing fill, existing vegetation and root mat should be removed. Complete stripping of the topsoil should be performed in the proposed building, dumpster and parking/driveway areas. Depending upon the Owner's acceptance of risk, the project site may be undercut to a depth of 3 feet and replaced with engineered fill or proof-rolled to identify deficient subgrade support areas and thereby limited undercuts. Proof rolling of subgrades should be performed with a minimum 20-ton tandem-axle dump truck or similarly loaded equipment that represents the heaviest construction or service load.

We recommend proof rolling be performed in the presence of a Terracon representative in order to aid in evaluating unstable subgrade areas and identifying appropriate remedial measures. If weather and schedule permit, we anticipate that the undercut materials can be air-dried and re-compacted as engineered fill to backfill the undercuts.

Existing Fill

As noted in **Geotechnical Characterization**, Borings P-2 and D-1 encountered existing fill to depths ranging from about 0.2 to 6 feet, but we have no records to indicate the degree of control during placement. Support of footings, floor slabs, and pavements, on or above existing fill soils, is discussed in this report. However, even with the recommended construction procedures, there is an inherent risk for the owner that compressible fill or unsuitable material, within or buried by the fill will, not be discovered. This risk of unforeseen conditions cannot be eliminated without completely removing the existing fill but can be reduced by following the recommendations contained in this report.

Fill Material Types

Earthen materials used for engineered fill should meet the following material property requirements:

Soil Type [1]	USCS Classification	Acceptable Parameters (for Structural Fill)
Lean Clay	CL (LL<45)	All locations and elevations
Well Graded Granular	GW, GW-GM, SW, SW-SM	All locations and elevations. The material should have less than 5% fines to be considered free-draining.
On-Site Soils	Varies	The on-site clay soils typically appear suitable for use as fill; however, thorough mixing and moisture conditioning (drying) will be needed to create a uniform, compactable material. Some moderately to highly plastic clay layers were encountered. We recommend that any fat clays be mixed with lean clays to create a uniformly low-plasticity fill material.

1. Engineered 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.

Fill Compaction Requirements

Engineered fill should meet the following compaction requirements.

Item	Structural 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
Minimum Compaction Requirements [1, 2]	98% of the materials Standard Proctor maximum dry density (ASTM D 698)
Water Content Range [1]	■ Within -2% to +3% of optimum moisture content (OMC) as determined by the Standard Proctor test at the time of placement and compaction (Low Plasticity Cohesive Soil) ■ Within -3% to +3% of OMC/within workable moisture levels to achieve firm unyielding conditions (granular Material)

1. Maximum density and optimum water content as determined by the standard Proctor test (ASTM D 698).
2. If the granular material is coarse sand or gravel, of a uniform size with a low fines content, compaction comparison to relative density may be more appropriate. In this case, granular materials should be compacted to at least 80% 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 deflection greater than that discussed in this report. These movements can result in detrimental cracking of slabs and walls, and potentially roof leaks or other water infiltration.

The final ground surface should be sloped and maintained at a minimum 5% away from the building over lawns and 2% over pavement, 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 the 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.

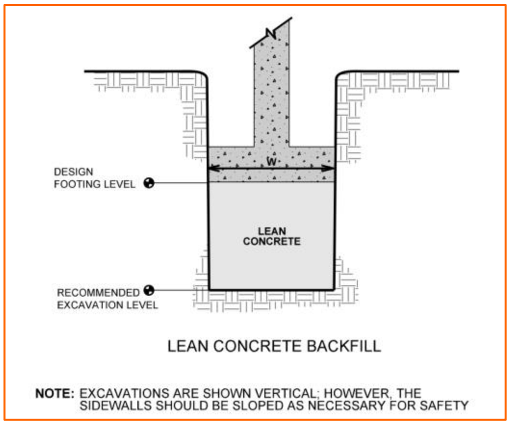
In addition to the documentation of the essential parameters necessary for construction, the continuation of the Geotechnical Engineer into the construction phase of the project provides the continuity to maintain the Geotechnical Engineer’s evaluation of subsurface conditions, including assessing variations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

SHALLOW FOUNDATIONS

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.



Ground Improvement

Based on settlement analyses, total settlements greater than 1 inch may occur if the proposed building is supported on conventional spread footings. A ground improvement process of aggregate piers could be installed to provide adequate capacity for the support of the proposed structure on conventional spread footings. In our opinion, and based upon discussion with the Client on other projects, the cost of these systems is cost-prohibitive. If you wish to discuss this option further, please contact us.

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 D**. Subsurface explorations at this site were extended to a maximum depth of 15 feet. The site properties below the boring depth to 30 feet were estimated based on our experience and knowledge of the 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

The floor slab subgrade should be prepared as described in the Earthwork section of this report. All floor slab subgrade areas should be moisture conditioned and properly compacted to the recommendations in this report immediately prior to the placement of the aggregate base and concrete.

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]	Presence of existing fill, special subgrade preparation is required. See Geotechnical Overview and **Earthwork** sections of this report.
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.

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 waterproof, 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 the use of sufficient control joints, appropriate reinforcing, or other means.

Settlement of floor slabs supported on existing fill materials cannot be accurately predicted but could be larger than normal and result in some cracking. Mitigation measures, as noted in **Earthwork**, are critical to the performance of floor slabs. In addition to the mitigation measures, the floor slab can be stiffened by adding steel reinforcement, grade beams, and/or post-tensioned elements.

Floor Slab Construction Considerations

The 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

General Pavement Comments

Specific traffic loads for the Bethel, Ohio, Taco Bell were not available at the time of this report. Minimum pavement section designs are provided for the estimated traffic conditions and pavement life conditions as noted in **Project Description** and 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.

Support characteristics of subgrade for pavement design do not account for shrink/swell movements of an expansive clay subgrade, such as soils encountered on this project. Thus, the pavement may be adequate from a structural standpoint, yet still, experience cracking and deformation due to a shrink/swell-related movement of the subgrade.

Pavement Design Parameters

For subgrade prepared as recommended in this report, a subgrade CBR of 3 has been used for the AC pavement designs and a modulus of subgrade reaction of 100 pci for the PCC pavement designs. The values were empirically derived based upon our experience with the sandy lean clay 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:

Typical Pavement Section Thickness (inches)						
Traffic Area [3]	**Pavement Type**	**Asphalt Concrete Surface Course**	**Asphalt Concrete Base Course**	**Portland Cement Concrete**[1]	**Aggregate Base Course**[2]	**Total Thickness**
Light Duty	PCC	-	-	5	5	10
	AC	1.5	2.5	-	8	12
Heavy Duty	PCC	-	-	6	6	12
	AC	2.5	2.5	-	10	15
Dumpster [4] Pad	PCC	-	-	7	5	12

1. 4,000 psi at 28 days, 4-inch maximum slump, up to 5 to 7 percent air entrainment, 6-sack minimum mix. PCC pavements are recommended for the dumpster pads and at all other locations subject to heavy wheel loads and/or turning traffic.
2. ODOT Item 304 crushed limestone base material
3. In accordance with assumed traffic loads (See **Project Description**)
4. The dumpster pad minimum dimensions should accommodate the dumpster container and the tipping axle of the trash collection truck.

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. Appropriate sub-drainage or connection to a suitable daylight outlet should be provided to remove water from the granular subbase.

Based on the possibility of shallow and/or perched groundwater, we recommend installing a pavement subdrain system to control groundwater, improve stability, and improve long-term pavement performance.

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, cultural, or biological 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 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.

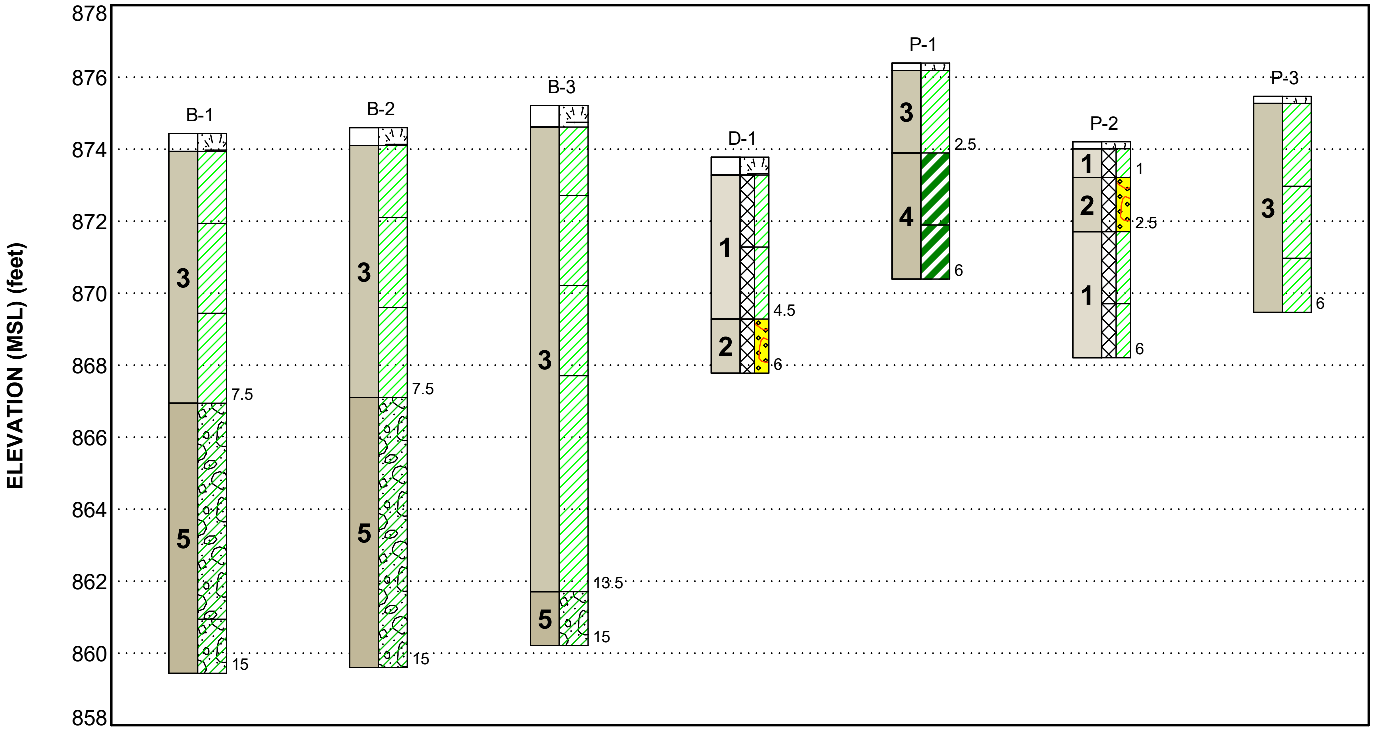
FIGURES

Contents:

GeoModel

GEOMODEL

Taco Bell W Plane St, Bethel ■ Bethel, OH
Terracon Project No. N1215409



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	Cohesive Fill	Brown and gray lean clay, with root hairs, trace sand and gravel
2	Granular Fill	Brown and black sand with gravel, concrete and trace clay seams
3	Lean Clay	Brown, stiff to very stiff, trace root hairs, sand and gravel
4	Fat Clay	Brown, stiff to very stiff, trace sand and gravel
5	Glacial Till	Gray, lean clay, hard, with gravel,trace sand

LEGEND

Topsoil

Lean Clay

Glacial Till

Gravel w/sand

Fat Clay

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)	Drilled Location
3	15	Planned building area
3	6	Planned parking/driveway area
1	6	Dumpster area

Boring Layout and Elevations: Terracon personnel provided the boring layout. Coordinates were obtained with a survey-grade handheld GPS unit with an estimated horizontal accuracy of about ±1 foot. Ground surface elevations were determined with the survey-grade handheld GPS.

Subsurface Exploration Procedures: We advanced the borings with a track-mounted rotary drill rig using continuous-flight hollow stem augers. Four samples were obtained in the upper 10 feet of each boring and at intervals of 5 feet thereafter. 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. For safety purposes, all borings were backfilled with auger cuttings after their completion. Pavements were patched with cold-mix asphalt and/or pre-mixed concrete, as appropriate.

The sampling depths, penetration distances, and other sampling information was 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 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.

SITE LOCATION AND EXPLORATION PLANS

Contents:

Note: All attachments are one page unless noted above.

SITE LOCATION

Taco Bell W Plane St, Bethel ■ Bethel, Clermont, OH

February 22, 2022 ■ Terracon Project No. N1215409

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

MAP PROVIDED BY MICROSOFT BING MAPS

EXPLORATION PLAN

Taco Bell W Plane St, Bethel ■ Bethel, Clermont, OH
February 22, 2022 ■ Terracon Project No. N1215409

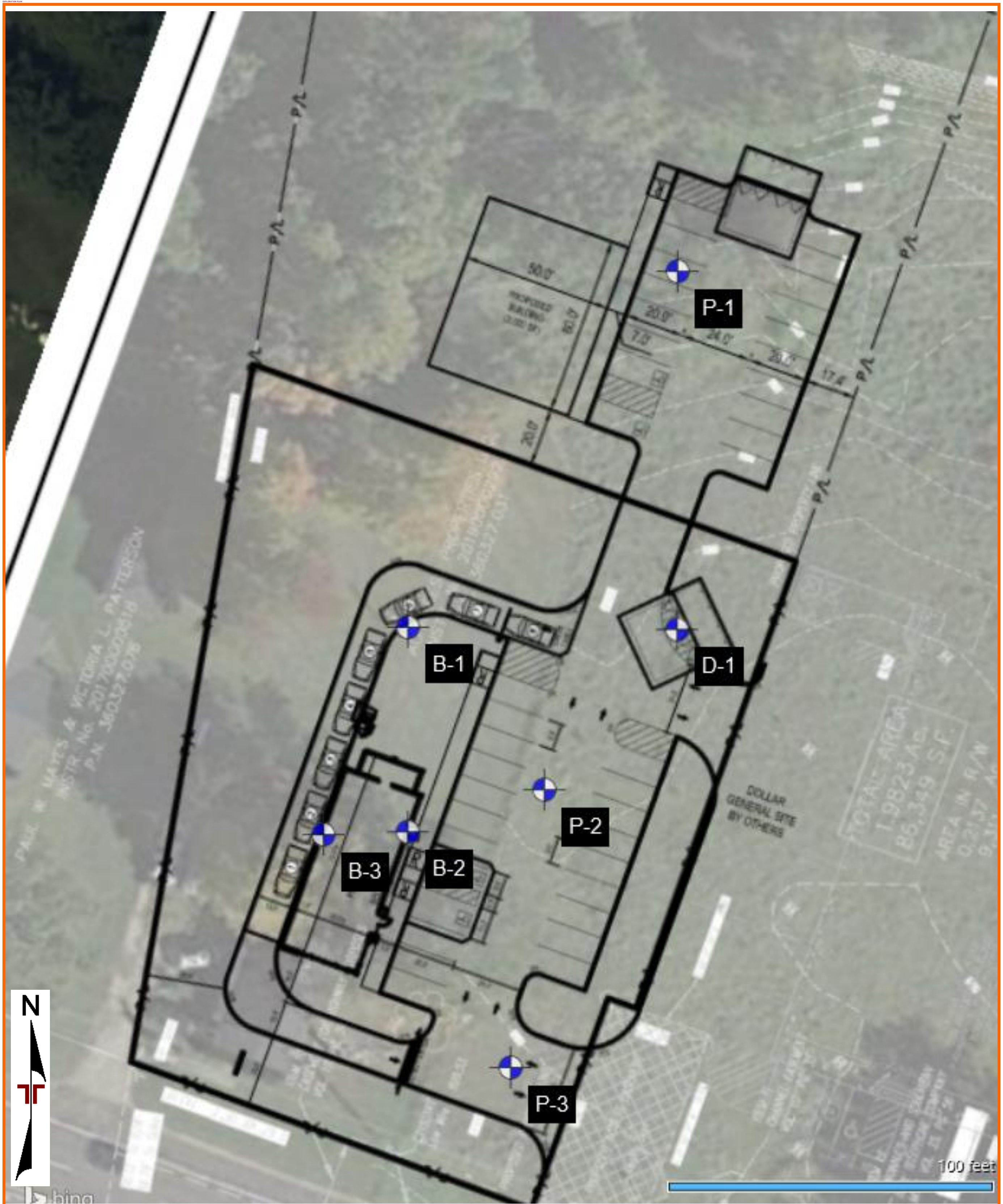


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

EXPLORATION RESULTS

Contents:

Note: All attachments are one page unless noted above.

BORING LOG NO. B-1

PROJECT: Taco Bell W Plane St, Bethel

**CLIENT: Ampler Development, LLC
Oklahoma City, OK**

**SITE: 644 West Plane Street
Bethel, OH**

LOCATION See Exploration Plan

Latitude: 38.965813° Longitude: -84.092279°

Surface Elev.: 874.4389764 (Ft.)

MODEL LAYER	DEPTH	DESCRIPTION	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY ()	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI
	0.5	**TOPSOIL (6")**	874								
3	2.5	**LEAN CLAY (CL)**, with root hairs, brown to dark brown, soft	872			X	100	6-2-2 N=4	0.5 (HP)	43.6	44-24-20
3	5.0	**LEAN CLAY (CL)**, trace sand, brown, medium stiff to stiff	869.5			X	100	3-2-2 N=4	2.75 (HP)	18.7	
3	7.5	**LEAN CLAY (CL)**, trace sand, brown and gray, stiff to very stiff	867	5		X	100	6-6-8 N=14	2.5 (HP)		
5	13.5	**GLACIAL TILL**, with lean clay, trace gravel and sand, dark brown and gray, hard	861	10	Cave-in at 12'	X	100	8-12-18 N=30	4.0 (HP)	8.7	
5	15.0	**GLACIAL TILL**, with lean clay, gravel and trace sand, gray, hard	859.5	15		X	100	9-16-23 N=39			

Boring Terminated at 15 Feet

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

Hammer Type: Automatic

Advancement Method:
3.25-inch Continuous-Flight Hollow-Stem Augers
2-inch Split-Barrel Sampler

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

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.

Notes:

WATER LEVEL OBSERVATIONS

No water observed during drilling

No water observed after drilling

Cave-in encountered at 12'

Terracon
611 Lunken Park Dr
Cincinnati, OH

Boring Started: 01-25-2022	Boring Completed: 01-25-2022
Drill Rig: Geoprobe CPT	Driller: Caleb Knisley
Project No.: N1215409	

BORING LOG NO. B-2

PROJECT: Taco Bell W Plane St, Bethel

CLIENT: Ampler Development, LLC
Oklahoma City, OK

SITE: 644 West Plane Street
Bethel, OH

LOCATION See Exploration Plan

Latitude: 38.965641° Longitude: -84.092279°

Surface Elev.: 874.5997375 (Ft.)

MODEL LAYER	DEPTH	MATERIAL DESCRIPTION	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY ()	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI
	0.5	**TOPSOIL (6")**	874								
3	2.5	**LEAN CLAY (CL)**, with root hairs, brown to dark brown, medium stiff	872			X	100	2-1-2 N=3	1.0 (HP)	21.4	
3	5.0	**LEAN CLAY (CL)**, trace sand, brown, soft to medium stiff	869.5			X	83	0-1-4 N=5		25.6	
3	7.5	**LEAN CLAY (CL)**, brown and gray, stiff to very stiff	867	5		X	100	3-4-6 N=10	3.0 (HP)	17.6	35-15-20
5		**GLACIAL TILL**, with lean clay, gravel and trace sand, gray, hard				X	100	15-22-30 N=52			
5				10	Cave-in (11.5')						
5	15.0		859.5	15		X	100	15-21-27 N=48			

Boring Terminated at 15 Feet

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

Hammer Type: Automatic

Advancement Method:
3.25-inch Continuous-Flight Hollow-Stem Augers
2-inch Split-Barrel Sampler

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

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.

Notes:
Offset 5' East due to PVC pipes at 3.5'-4'
Cones left on original boring

WATER LEVEL OBSERVATIONS

No water observed during drilling
No water observed after drilling
Cave-in encountered at 11.5'

Terracon
611 Lunken Park Dr
Cincinnati, OH

Boring Started: 01-25-2022	Boring Completed: 01-25-2022
Drill Rig: Geoprobe CPT	Driller: Caleb Knisley
Project No.: N1215409	

BORING LOG NO. B-3

PROJECT: Taco Bell W Plane St, Bethel

CLIENT: Ampler Development, LLC
Oklahoma City, OK

SITE: 644 West Plane Street
Bethel, OH

LOCATION See Exploration Plan

Latitude: 38.965639° Longitude: -84.092370°

Surface Elev.: 875.2099738 (Ft.)

MODEL LAYER	DEPTH	DESCRIPTION	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY ()	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI
	0.6	**TOPSOIL (7")**	874.5								
3	2.5	**LEAN CLAY (CL)**, with root hairs, brown to dark brown, medium stiff to stiff	872.5			X	100	2-2-2 N=4	1.25 (HP)		
3	5.0	**LEAN CLAY (CL)**, trace sand and root hairs, brown and gray, stiff to very stiff	870	5		X	100	3-4-5 N=9	3.0 (HP)	19.9	44-19-25
3	7.5	**LEAN CLAY (CL)**, trace sand, brown and gray, stiff to very stiff	867.5			X	100	4-5-6 N=11	2.5 (HP)	21.5	
3	13.5	**LEAN CLAY (CL)**, trace sand and gravel, brown and gray, medium stiff	861.5	10	Cave-in at 13'	X	100	2-2-3 N=5	0.75 (HP)	21.0	
5	15.0	**GLACIAL TILL**, with lean clay, gravel and trace sand, gray, hard	860	15		X	100	13-15-22 N=37	4.0 (HP)		

Boring Terminated at 15 Feet

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

Hammer Type: Automatic

Advancement Method:
3.25-inch Continuous-Flight Hollow-Stem Augers
2-inch Split-Barrel Sampler

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

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.

Notes:

WATER LEVEL OBSERVATIONS

No water observed during drilling

No water observed after drilling

Cave-in encountered at 13'

Terracon
611 Lunken Park Dr
Cincinnati, OH

Boring Started: 01-25-2022	Boring Completed: 01-25-2022
Drill Rig: Geoprobe CPT	Driller: Caleb Knisley
Project No.: N1215409	

BORING LOG NO. D-1

PROJECT: Taco Bell W Plane St, Bethel

CLIENT: Ampler Development, LLC
Oklahoma City, OK

SITE: 644 West Plane Street
Bethel, OH

LOCATION See Exploration Plan

Latitude: 38.965811° Longitude: -84.091988°

Surface Elev.: 873.7795276 (Ft.)

MODEL LAYER	DEPTH	DESCRIPTION	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY ()	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI
	0.5	**TOPSOIL (6")**	873.5								
1	2.5	**FILL - LEAN CLAY**, with root hairs and trace sand, brown	871.5			X	100	2-2-4 N=6	3.0 (HP)	18.6	
1	4.5	**FILL - LEAN CLAY**, trace sand, brown	869.5		Cave-in	X	100	3-3-3 N=6	1.0 (HP)	24.5	29-19-10
2	6.0	**FILL - GRAVEL WITH SAND**, with concrete fragments and clay seams, brown	868	5		X	83	11-9-18 N=27			

Boring Terminated at 6 Feet

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

Hammer Type: Automatic

Advancement Method:
3.25-inch Continuous-Flight Hollow-Stem Augers
2-inch Split-Barrel Sampler

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

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.

Notes:

WATER LEVEL OBSERVATIONS

No water observed during drilling

No water observed after drilling

Cave-in encountered at 4.2'

Terracon
611 Lunken Park Dr
Cincinnati, OH

Boring Started: 01-26-2022	Boring Completed: 01-26-2022
Drill Rig: Geoprobe CPT	Driller: Caleb Knisley
Project No.: N1215409	

BORING LOG NO. P-1

PROJECT: Taco Bell W Plane St, Bethel

CLIENT: Ampler Development, LLC
Oklahoma City, OK

SITE: 644 West Plane Street
Bethel, OH

LOCATION See Exploration Plan

Latitude: 38.966112° Longitude: -84.091987°

Surface Elev.: 876.3910761 (Ft.)

MODEL LAYER	DEPTH	MATERIAL DESCRIPTION	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY ()	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI
	0.2	**TOPSOIL (2")**	876								
3		**LEAN CLAY (CL)**, with root hairs, brown, medium stiff				X	11	3-3-4 N=7			
	2.5		874								
4		**FAT CLAY (CH)**, trace sand, brown, stiff to very stiff			Cave-in	X	100	4-4-7 N=11	4.0 (HP)	18.7	51-18-33
	4.5		872								
		FAT CLAY (CH), trace sand and gravel, brown, stiff to very stiff		5		X	100	4-5-5 N=10	3.25 (HP)	17.5	
	6.0		870.5								
		Boring Terminated at 6 Feet									

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

Hammer Type: Automatic

Advancement Method:
3.25-inch Continuous-Flight Hollow-Stem Augers
2-inch Split-Barrel Sampler

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

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.

Notes:

WATER LEVEL OBSERVATIONS

No water observed during drilling

No water observed after drilling

Cave-in encountered at 4'

Terracon
611 Lunken Park Dr
Cincinnati, OH

Boring Started: 01-26-2022	Boring Completed: 01-26-2022
Drill Rig: Geoprobe CPT	Driller: Caleb Knisley
Project No.: N1215409	

BORING LOG NO. P-2

PROJECT: Taco Bell W Plane St, Bethel

CLIENT: Ampler Development, LLC
Oklahoma City, OK

SITE: 644 West Plane Street
Bethel, OH

LOCATION See Exploration Plan

Latitude: 38.965676° Longitude: -84.092131°

Surface Elev.: 874.2060367 (Ft.)

MODEL LAYER	GRAPHIC LOG	DEPTH	DESCRIPTION	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY ()	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI
		0.2	**TOPSOIL (2")**	874								
1		1.0	**FILL - LEAN CLAY**, with root hairs and trace gravel, brown	873			X	100	4-4-5 N=9	1.0 (HP)		
2		2.5	**FILL - GRAVEL WITH SAND**, trace clay seams, brown and black	871.5								
1		4.5	**FILL - LEAN CLAY**, trace sand and gravel, brown and gray	869.5		Cave-in	X	100	1-3-3 N=6	2.5 (HP)	24.2	
1		6.0	**FILL - LEAN CLAY**, trace sand, brown and gray	868	5		X	100	4-4-6 N=10	4.0 (HP)	17.8	

Boring Terminated at 6 Feet

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

Hammer Type: Automatic

Advancement Method:
3.25-inch Continuous-Flight Hollow-Stem Augers
2-inch Split-Barrel Sampler

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

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.

Notes:

WATER LEVEL OBSERVATIONS

No water observed during drilling

No water observed after drilling

Cave-in encountered at 4.4'

Terracon
611 Lunken Park Dr
Cincinnati, OH

Boring Started: 01-26-2022	Boring Completed: 01-26-2022
Drill Rig: Geoprobe CPT	Driller: Caleb Knisley
Project No.: N1215409	

BORING LOG NO. P-3

PROJECT: Taco Bell W Plane St, Bethel

CLIENT: Ampler Development, LLC
Oklahoma City, OK

SITE: 644 West Plane Street
Bethel, OH

LOCATION See Exploration Plan

Latitude: 38.965443° Longitude: -84.092168°

Surface Elev.: 875.4691601 (Ft.)

MODEL LAYER	GRAPHIC LOG	DEPTH	DESCRIPTION	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY ()	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI
3		0.2	**TOPSOIL (2")**	875.5								
			LEAN CLAY (CL), trace root hairs and sand, brown, medium stiff to stiff				X	100	1-1-2 N=3	2.75 (HP)	27.1	
		2.5		873								
			LEAN CLAY (CL), trace sand, brown, very stiff				X	100	5-7-9 N=16	3.5 (HP)	19.6	44-16-28
		4.5		871		Cave-in						
			LEAN CLAY (CL), trace sand, brown, stiff to very stiff		5		X	100	4-4-8 N=12	4.0 (HP)	21.8	
		6.0		869.5								

Boring Terminated at 6 Feet

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

Hammer Type: Automatic

Advancement Method:
3.25-inch Continuous-Flight Hollow-Stem Augers
2-inch Split-Barrel Sampler

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

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.

Notes:

WATER LEVEL OBSERVATIONS

No water observed during drilling

No water observed after drilling

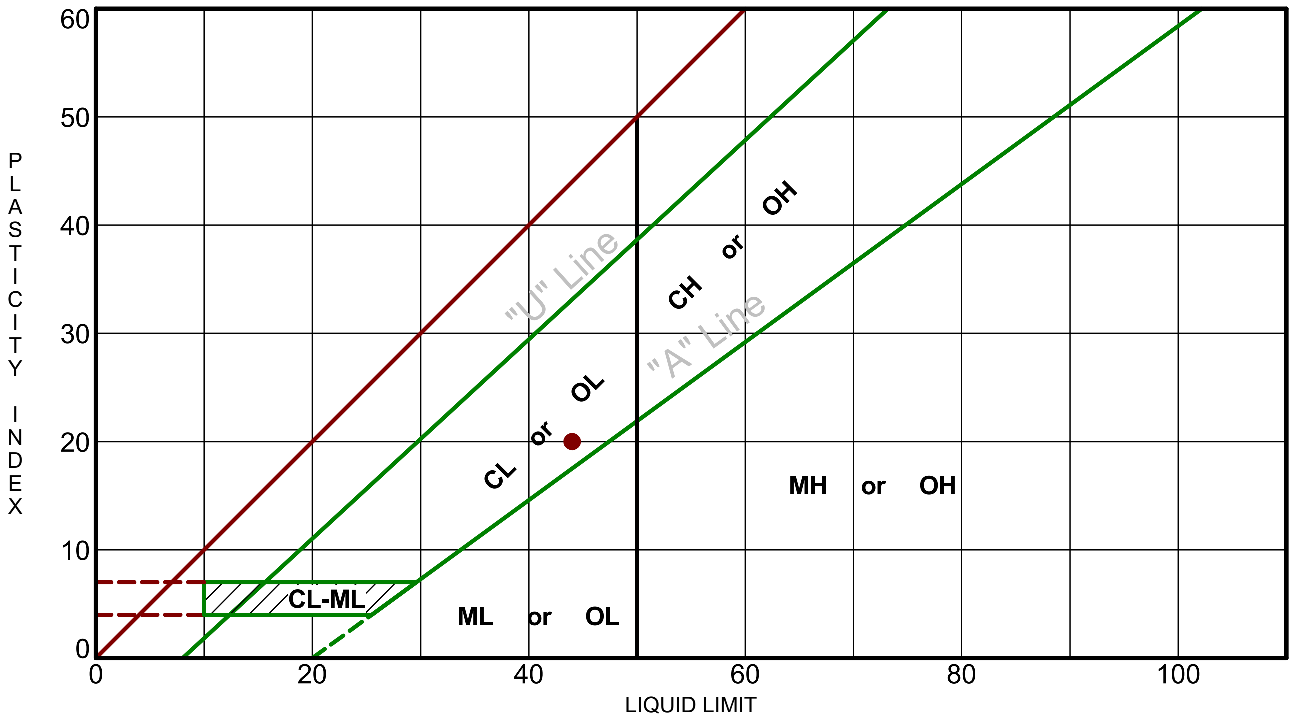
Cave-in encountered at 4.2'

Terracon
611 Lunken Park Dr
Cincinnati, OH

Boring Started: 01-26-2022	Boring Completed: 01-26-2022
Drill Rig: Geoprobe CPT	Driller: Caleb Knisley
Project No.: N1215409	

ATTERBERG LIMITS RESULTS

ASTM D4318



	Boring ID	Depth	LL	PL	PI	Fines	USCS	Description
●	B-1	0 - 1.5	44	24	20		CL	Dark Brown Lean Clay

PROJECT: Taco Bell W Plane St, Bethel

SITE: 644 West Plane Street
Bethel, OH

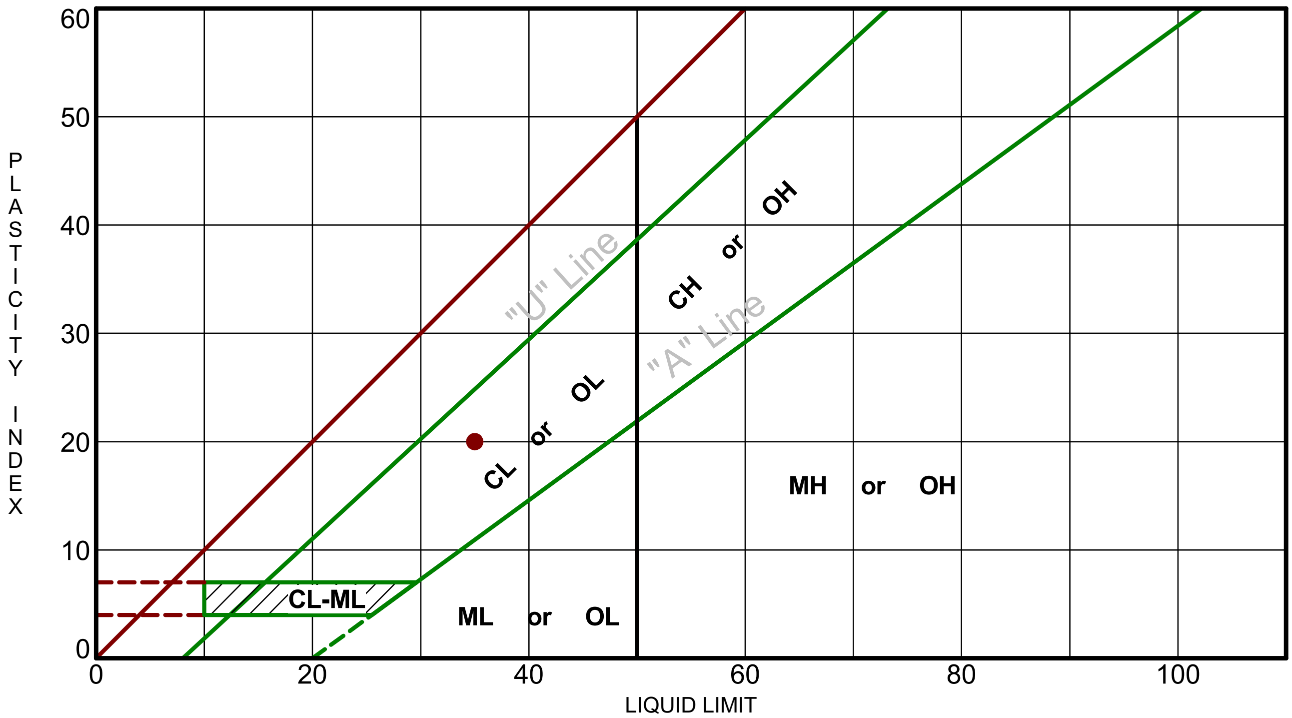
Terracon
611 Lunken Park Dr
Cincinnati, OH

PROJECT NUMBER: N1215409

CLIENT: Ampler Development, LLC
Oklahoma City, OK

ATTERBERG LIMITS RESULTS

ASTM D4318

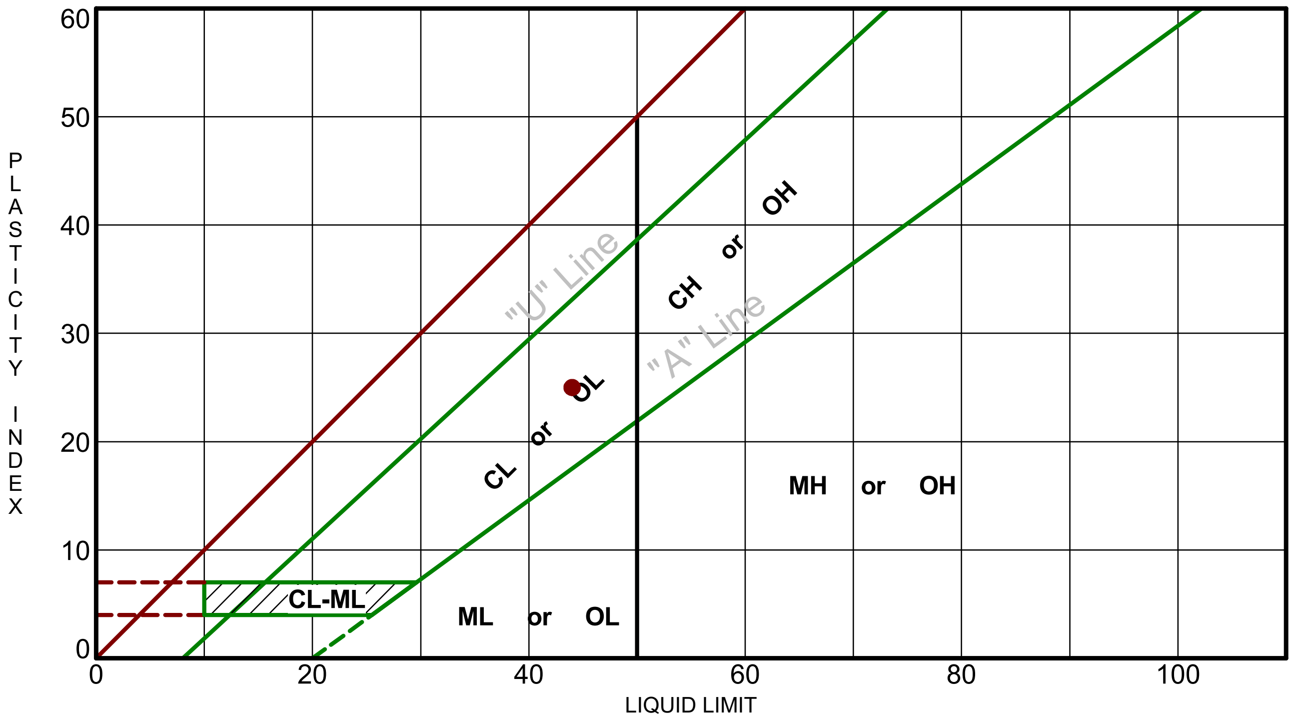


	Boring ID	Depth	LL	PL	PI	Fines	USCS	Description
●	B-2	5 - 6.5	35	15	20		CL	Brown and Gray Lean Clay

PROJECT: Taco Bell W Plane St, Bethel	Terracon 611 Lunken Park Dr Cincinnati, OH	PROJECT NUMBER: N1215409
SITE: 644 West Plane Street Bethel, OH		CLIENT: Ampler Development, LLC Oklahoma City, OK

ATTERBERG LIMITS RESULTS

ASTM D4318



	Boring ID	Depth	LL	PL	PI	Fines	USCS	Description
●	B-3	2.5 - 4	44	19	25		CL	Brown and Gray Lean Clay

PROJECT: Taco Bell W Plane St, Bethel

SITE: 644 West Plane Street
Bethel, OH

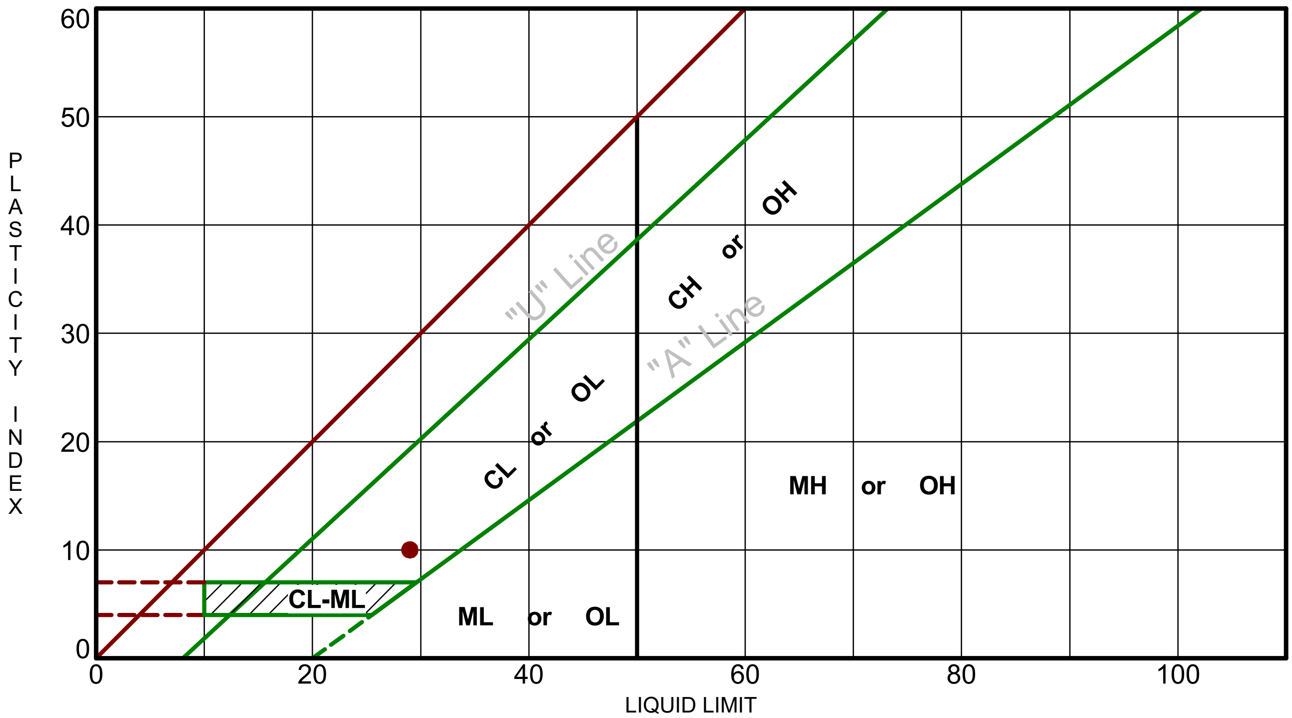
Terracon
611 Lunken Park Dr
Cincinnati, OH

PROJECT NUMBER: N1215409

CLIENT: Ampler Development, LLC
Oklahoma City, OK

ATTERBERG LIMITS RESULTS

ASTM D4318



Boring ID		Depth	LL	PL	PI	Fines	USCS	Description
●	D-1	2.5 - 4	29	19	10		CL	Brown Lean Clay

PROJECT: Taco Bell W Plane St, Bethel

SITE: 644 West Plane Street
Bethel, OH

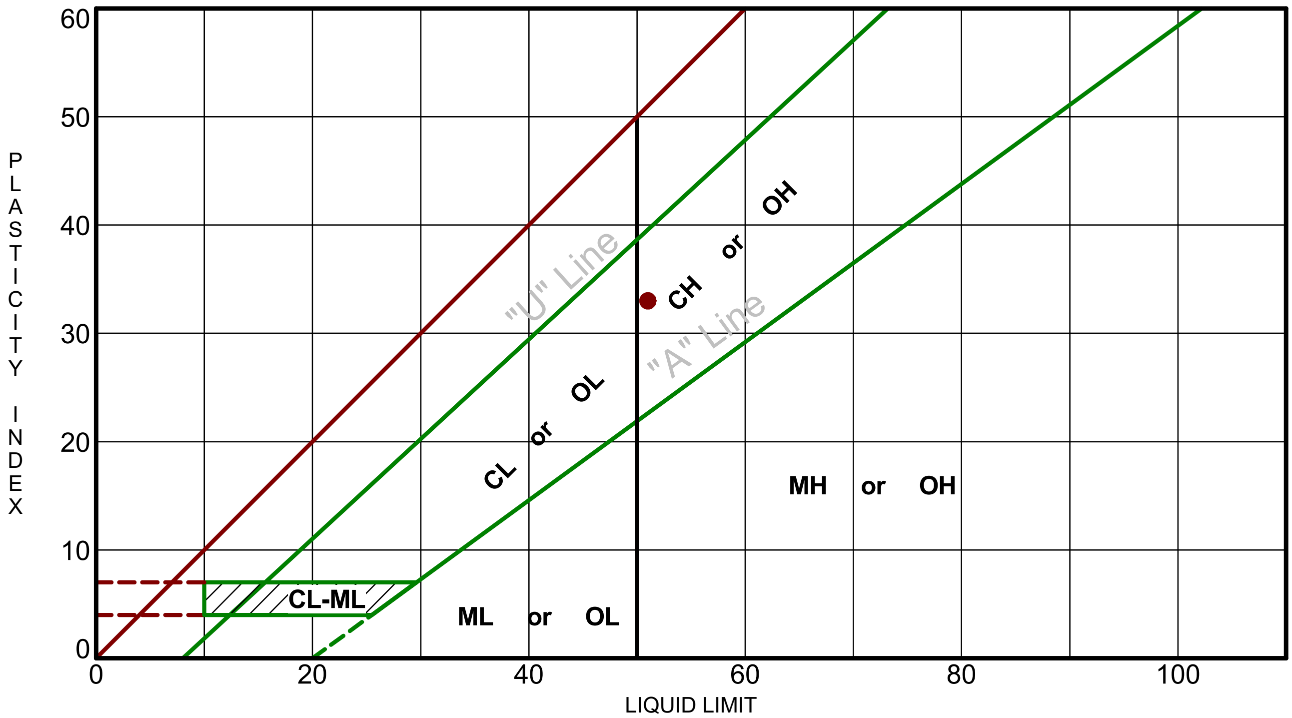
Terracon
611 Lunken Park Dr
Cincinnati, OH

PROJECT NUMBER: N1215409

CLIENT: Ampler Development, LLC
Oklahoma City, OK

ATTERBERG LIMITS RESULTS

ASTM D4318



	Boring ID	Depth	LL	PL	PI	Fines	USCS	Description
●	P-1	2.5 - 4	51	18	33		CH	Brown Fat Clay

PROJECT: Taco Bell W Plane St, Bethel

SITE: 644 West Plane Street
Bethel, OH

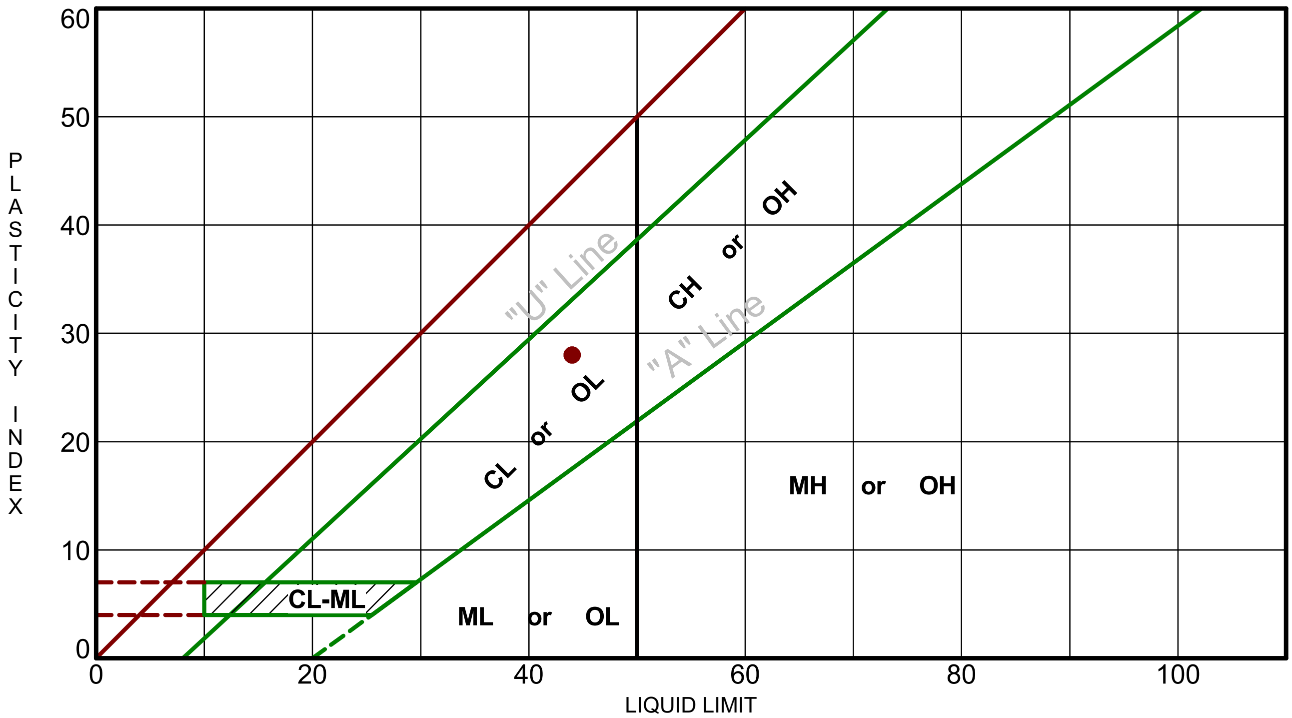
Terracon
611 Lunken Park Dr
Cincinnati, OH

PROJECT NUMBER: N1215409

CLIENT: Ampler Development, LLC
Oklahoma City, OK

ATTERBERG LIMITS RESULTS

ASTM D4318



Boring ID	Depth	LL	PL	PI	Fines	USCS	Description
● P-3	2.5 - 4	44	16	28		CL	Brown Lean Clay

PROJECT: Taco Bell W Plane St, Bethel

SITE: 644 West Plane Street
Bethel, OH

Terracon
611 Lunken Park Dr
Cincinnati, OH

PROJECT NUMBER: N1215409

CLIENT: Ampler Development, LLC
Oklahoma City, OK

SUPPORTING INFORMATION

Contents:

Note: All attachments are one page unless noted above.

GENERAL NOTES

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

Taco Bell W Plane St, Bethel ■ Bethel, OH

Terracon Project No. N1215409

SAMPLING	WATER LEVEL	FIELD TESTS
Standard Penetration Test	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.	**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	**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]	$Cu \geq 4$ and $1 \leq Cc \leq 3$ [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]	$Cu \geq 6$ and $1 \leq Cc \leq 3$ [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] $Cu = D_{60}/D_{10} \qquad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$

[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.