CITY OF PARKVILLE • 8880 Clark Avenue • Parkville, MO 64152 • (816) 741-7676 • FAX (816) 741-0013

ADDENDUM NO. 2

Wednesday, May 5, 2021

Route 9 Improvements

This addendum is to provide additional information not originally included in the bid package. This addendum is hereby made a part of the **Invitation to Bid.**

Please attach this addendum to the documents in your possession, and confirm receipt of Addendum No. 2 in your proposal.

1. Pre-Bid Meeting Agenda with Minutes – Attached

2. Pre-Bid Meeting Sign-In Sheet – Attached

3. Following the pre-bid meeting, the following information was requested:

   a. Geotech Report – Attached is the Geotechnical report that includes information about the existing pavement section along Route 9.

   b. Commercial Entrance Detail – Attached is an updated Commercial Entrance Detail. The original Commercial Entrance Detail (shown on Page 66 of the approved plans) shows aggregate under the commercial entrances. The aggregate base has been removed in the updated Commercial Entrance Detail for clarification. This clarification does not affect the quantities.

   c. The poles and arms shown on the plans are the decorative Sternberg fixtures. They do not provide the base plate and foundation information for their poles. Bidders will need to work with Sternberg or equalivalent vendor in order to determine the necessary hardware and foundation requirements for the pole configurations.

   d. The dimensions of the lighting bases can be found in Section O of the JSPs. For the purposes of bidding, you may use the Overland Park standard based on the pole height. The geotechnical report is included in this addenda to provide information regarding the soil and site conditions to the manufacturer per Section M of the JSPs. The bolt patterns and base dimensions can be found in Section O of the JSPs.

e. There is no aggregate required under the trail / sidewalk.

f. Flowable fill backfill is required for storm sewer under sidewalk, in accordance with Page 74 of the approved plans.

g. The concrete pavement and entrances should follow the specifications with regard to reinforcement.

h. Cut sheets for the assembled pole, arm and head of the light poles is included in Section O of the JSPs.

Additional questions should be addressed to:
Alysen Abel, Public Works Director
816-741-7676

***

AGENDA

CITY OF PARKVILLE
Route 9 Improvements
From Hwy 45 to Lakeview Dr

PRE-BID CONFERENCE
Parkville City Hall
April 28, 2021 @ 10:00 a.m.

Pre-Bid Conference Agenda:

1. Introductions:

City of Parkville:

- Alysen Abel, Public Works Director – City of Parkville – aabel@parkvillemo.gov – 816-741-7676
- Alan Schank, Director of Operations – City of Parkville – aschank@parkvillemo.gov – 816-741-7676
- Kevin Blair, Construction Inspector – City of Parkville – kblair@parkvillemo.gov – 816-741-7676
- Bonnie Buckmaster – City of Parkville – bbuckmaster@parkvillemo.gov – 816-741-7676

MoDOT:

- Sean Partain, Senior Transportation Planner – sean.partain@modot.mo.gov – 816-607-2147

Design Engineer (GBA):

- Matt Graviett, Project Engineer – mgraviett@gbateam.com – 913-577-8368
- Brian Blizzard, Associate – bblizzard@gbateam.com – 913-577-8206

2. Project Overview

Scope of Project – STP-3400(442)

- Improvements to Route 9 between Hwy 45 and Lakeview Dr including mill and overlay, pavement widening, curb and gutter, storm sewer, sidewalk, retaining wall, signals, decorative street lighting and some landscaping.

DBE Goal is 9%

3. Right-of-Way Status

- All Easements and Right-of-Way obtained

4. Utility Relocation Status

- All utility relocations will be complete prior to roadway construction NTP.

5. Construction Schedule / Staging / Traffic Control

- Schedule – Anticipated Notice to Proceed in late June or earlyJulyProject Manual states November 19th completion. There may be some flexibility for landscaping or signal pole/streetlighting pole manufacturing delays out of the contractor's control.

- Staging Area – The City owns the property in the southeast corner of 62nd Street, next to the Pinecrest subdivision. This area can be used for a construction trailer and equipment. It is advised to put up a temporary fence for securing equipment. The area should be returned to previous condition.

- Traffic Control – The goal is to maintain the traffic through Route 9. This is a major traffic way. There is a detailed traffic control plan in the plans with notes to keep traffic flowing. Contractors may submit alternative traffic control plan for review.

- Access to commercial and residential entrances must be maintained at all times through construction.

6. Job Special Provisions

This project is a federally funded project and will have the standard MoDOT / FHWA requirements, such as Buy America and Prevailing Wage.

7. Contractor Questions

Are there any known permit fees to be included on project?

- City will obtain the Land Disturbance Permit from MDNR. The contractor will be responsible for contacting MoDOT directly to obtain a state permit.

Are there any work hour restrictions?

- There is a City noise ordinance, however, City projects are exempt. Standard work hours shall apply. If working evening or weekend hours, this will require City and State approval.

Who will perform SWPPP inspections?

- The City of Parkville will employ City employees and on-call resources to perform inspections on erosion and sediment control devices on regular intervals, and after significant rainfall events.

Materials testing? Who's responsible? City or Contractor?

- The City will have a third-party company to perform materials testing at regular intervals in accordance with the specifications.

Bid Opening – May 11th at 10:00 a.m. – There is a lot of road construction around the city, allow plenty of travel time for possible delays. Look at the checklist in the bid documents for all bid requirements.

There will be a Pre-Construction meeting once the contract is awarded.

RT. 9 IMPROVEMENTS
PRE-BID MEETING
WEDNESDAY, APRIL 28, 2021 @ 10:00 A.M.
CITY OF PARKVILLE – CITY HALL BOARDROOM

NAME	COMPANY	EMAIL	PHONE
Ryan Bingaman	Black & McDonald	rbingaman@blackandmcdonald.com	816-596-0458
Jimmy Peeler	MegaKC	megabids@megakc.com	816-472-8722
Jerry Baker	Jerry Baker Construction	jerryb@gunterkc.com	913-680-8062
Bryan Blizzard	GBA	bblizzard@gbateam.com	913-577-8206
Shawn Berkey	Miles Excavating		
Matt Graviett	GBA	mgraviett@gbateam.com	913-577-8368
Ben Cummings	Radmacher		
Alysen Abel, Public Works Director	City of Parkville	aabel@parkvillemo.gov	816-741-7676
Alan Schank, Director of Operations	City of Parkville	aschand@parkvillemo.gov	816-741-7676
Kevin Blair, Construction Inspector	City of Parkville	kblair@parkvillemo.gov	816-741-7676
Bonnie Buckmaster, Public Works Assistant	City of Parkville	bbuckmaster@parkvillemo.gov	816-741-7676

Terracon GeoReport

Geotechnical Engineering Report

Route 9 Improvements

Parkville, Missouri

March 14, 2018

Terracon Project No. 02175280

Prepared for:

GBA

Lenexa, Kansas

Prepared by:

Terracon Consultants, Inc.

Lenexa, Kansas

March 14, 2018

GBA
9801 Renner Boulevard
Lenexa, Kansas 66219

Attn: Mr. Cory Clark, P.E.

Re: Geotechnical Engineering Report
Route 9 Improvements
Lewis Street to Lakeview Drive
Parkville, Missouri
Terracon Project No. 02175280

Dear Mr. Clark:

We have completed a geotechnical exploration for the above referenced project. This study was performed in general accordance with Terracon Proposal No. P02175280.R1 dated November 16, 2017 and the supplemental agreement for services dated February 16, 2018. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork, pavements, and the design and construction of a retaining wall 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.

Kevin D. Friedrichs, P.E.
Project Engineer
Missouri: PE 2013010325

Kole C. Berg, P.E.
Senior Engineer
Missouri: PE 2002016417

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 which direct the reader to that section and clicking on the Terracon 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
SITE LOCATION AND EXPLORATION PLANS
EXPLORATION RESULTS (Boring Logs and Laboratory Data)
GLOBAL STABILITY ANALYSIS
SUPPORTING INFORMATION (General Notes, USCS, and Description of Rock Properties)

Geotechnical Engineering Report

Route 9 Improvements
Lewis Street to Lakeview Drive
Parkville, Missouri

Terracon Project No. 02175280
March 14, 2018

INTRODUCTION

This report presents the results of our subsurface exploration and geotechnical engineering evaluation performed for the proposed Route 9 Improvements from Lewis Street to Lakeview Drive in Parkville, Missouri. Twelve exploratory borings were performed along the project alignment to depths ranging from approximately ½ to 6½ feet below existing site grades. This report describes the subsurface conditions encountered at the boring locations, presents the test data, and provides geotechnical recommendations for the following items:

- earthwork
- retaining wall
- pavements

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 in the **Exploration Results** section of this report.

PROJECT DESCRIPTION

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

Item	Description
Proposed Improvements	Improvements to Route 9 include new pavements, curb and gutters, sidewalks, shoulders, and a retaining wall.
Grading/Slopes	Minimal grading is expected along the street centerline to develop final grades. Some additional cuts and/or fills up to about 12 feet will be required at certain areas along the east and west edges of the alignment due to planned shoulder improvements. Final slope angles of 3H:1V (Horizontal: Vertical) or flatter are expected.

Item	Description
Free-Standing Retaining Walls	One new retaining wall (Retaining Wall 1) is planned along the east edge of the roadway from Station 106+75.00 to 111+50.00. The maximum height of the retaining wall will be approximately 5 feet at Station 108+25.00. We understand the wall will be a cast-in-place reinforced concrete cantilever wall.
Pavements	Existing pavements will likely be milled and overlaid. Some areas of new pavements will be constructed where the road will be widened.

GEOTECHNICAL CHARACTERIZATION

Subsurface Profile

We have developed a general characterization of the subsurface soil and groundwater conditions based upon our review of the data and our understanding of the geologic setting and planned construction. The following table provides our geotechnical characterization.

The geotechnical characterization forms the basis of our geotechnical calculations and evaluation of site preparation, foundation options and pavement options. As noted in **General Comments**, the characterization is based upon widely spaced borings across the site, and variations are likely.

Stratum	Approximate Depth to Bottom of Stratum	Material Description	Consistency/Density
1	4 to 6½ inches asphalt over 5½ to 10 inches concrete	Pavement (asphalt over concrete)	N/A
2	3½ to 5 feet at RW-1 to RW-4 Undetermined: Borings P-1 to P-7 terminated within this stratum at a planned depth of 5 feet.	Fat Clay (CH) and Lean Clay (CL)	Medium stiff to very stiff
3	Undetermined: Borings RW-1 to RW-5 terminated within this stratum at auger refusal.	Limestone	Highly weathered

Conditions encountered at each boring location are indicated on the individual boring logs shown in the **Exploration Results** section and are attached to this report. Stratification boundaries on the boring logs represent the approximate location of changes in native soil types; in situ, the transition between materials may be gradual.

Groundwater Conditions

The boreholes were observed during drilling for the presence and level of groundwater. Groundwater was not observed in the boreholes during our subsurface exploration. Long-term

observations in piezometers or observation wells, sealed from the influence of surface water, would be needed to develop more detailed groundwater information. Groundwater level fluctuations occur due to variations in rainfall, runoff, and other factors not evident at the time we performed the borings. The potential for groundwater level fluctuations should be considered when developing the design and construction plans for the project.

EARTHWORK

Site preparation, excavation, subgrade preparation and placement of engineered fills should conform to recommendations provided in the latest version of the *Missouri Standard Specifications for Highway Construction.* We recommend earthwork on this project be observed and evaluated by Terracon. The evaluation of earthwork should include observation and testing of subgrade preparation, foundation bearing soils for the retaining wall, engineered fill, and other geotechnical conditions exposed during the construction of the project.

Site Preparation

Clearing and grubbing operations should comply with Section 201 of the *Missouri Standard Specifications for Highway Construction*. Tree root systems should be thoroughly grubbed to remove roots larger than ½ inch in diameter. Surface vegetation should be stripped and all organic topsoil should be removed from planned borrow source areas, cut areas, and areas to be filled. Existing fill should be undercut where encountered.

Topsoil materials removed during stripping operations could be used as select fill for final site grading along ditches and embankment slopes. *Select fill*, as used in the context of this report, refers to soils capable of supporting vegetation, with proper fertilization. These materials should be carefully separated to avoid incorporation of organic matter in controlled engineered fill sections.

Following initial stripping, the exposed soils in new pavement areas should be proofrolled, where practical. A Terracon representative should observe the proofrolling. Proofrolling can be accomplished using a loaded tandem-axle dump truck with a gross weight of at least 20 tons, or similarly loaded equipment. Areas that display excessive deflection (pumping) or rutting during proofroll operations should be improved by scarification/compaction or by removal and replacement with engineered fill. When proofrolling is not practical due to equipment access limitations, a Terracon representative should observe and probe the exposed subgrade.

Fill Materials and Compaction Requirements

Materials that will be used as engineered fill to support pavements and other features that are settlement sensitive should consist of approved materials as outlined in Section 203 of the *Missouri Standard Specifications for Highway Construction*. Approved materials should be free

of organic matter and debris. Frozen materials should not be used, and fill should not be placed on a frozen subgrade.

Engineered fill materials used to support settlement sensitive features should be compacted and moisture conditioned as outlined in Section 203 of the *Missouri Standard Specifications for Highway Construction.*

Terracon should observe the placement of engineered fill and test the density and moisture content of each lift during fill placement. If the results of the in-place density tests indicate the specified moisture or compaction limits have not been met, the area represented by the test should be reworked and retested as required until the specified moisture and compaction requirements are achieved.

Grading and Drainage

During construction, grades should be developed to direct surface water flow away from or around the site. Exposed subgrades should be sloped to provide positive drainage so that saturation of subgrades is avoided. Surface water should not be permitted to accumulate on the site. Final surrounding grades should promote rapid surface drainage away from the structures. Accumulation of water adjacent to the structure could contribute to significant moisture increases in the subgrade soils and subsequent softening/settlement or expansion/heave.

After construction of the structures and pavements have been completed, we recommend verifying final grades to document that effective drainage has been achieved. Grades around the structures should also be periodically inspected and adjusted as necessary, as part of the structure's maintenance program.

Earthwork Construction Considerations

Terracon should be retained during the construction phase of the project to observe earthwork and to perform necessary tests and observations during subgrade preparation, proofrolling, placement and compaction of controlled compacted fills, backfilling of excavations into completed subgrades, and just prior to construction of the retaining wall and pavements.

Care should be taken to avoid disturbance of prepared subgrades. Unstable subgrade conditions can develop during general construction operations, particularly if the soils are wetted and/or subjected to repetitive construction traffic. If unstable subgrade conditions develop, stabilization measures will need to be employed. Construction traffic over the completed subgrade should be avoided to the extent practical. If the subgrade becomes frozen, desiccated, saturated, or disturbed, the affected materials should be removed or these materials should be scarified, moisture conditioned, and compacted 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, state, and federal safety regulations. The contractor should be aware that slope height, slope inclination, and excavation depth should in no instance exceed those specified by these safety regulations. Flatter slopes than those dictated by these regulations may be required depending upon the soil conditions encountered and other external factors. These regulations are strictly enforced and if they are not followed, the owner, contractor, and/or earthwork and utility subcontractor could be liable and subject to substantial penalties. Under no circumstances should the information provided in this report be interpreted to mean that Terracon is responsible for construction site safety or the contractor's activities. Construction site safety is the sole responsibility of the contractor who shall also be solely responsible for the means, methods, and sequencing of the construction operations.

PAVEMENTS

Pavement Subgrade Preparation

Pavement subgrades are expected to consist of on-site native clay soils. If soft or otherwise unsuitable areas are observed, additional over-excavation and replacement will be needed.

Grading and paving are commonly performed by separate contractors and there is often a time lapse between the end of grading operations and the commencement of paving. Subgrades prepared early in the construction process may become disturbed by construction traffic. Non-uniform subgrades often result in poor pavement performance and local failures relatively soon after pavements are constructed. Depending on the paving equipment used by the contractor, measures may be required to improve subgrade strength to greater depths for support of heavily loaded concrete/asphalt trucks.

We recommend the moisture content and density of the subgrade be evaluated and the pavement subgrades be proofrolled (using a loaded tandem-axle dump truck with a minimum gross weight of 20 tons or similarly loaded rubber-tire equipment) within two days prior to commencement of actual paving operations. Areas not in compliance with the required ranges of moisture or density should be scarified, moisture conditioned, and compacted. Particular attention should be paid to high traffic areas that were rutted and disturbed earlier and to areas where backfilled trenches are located. Areas where unsuitable conditions are located should be repaired by removing and replacing the materials with properly compacted fills. The subgrade should be in its finished form at the time of the final review.

Mill and Overlay

Mill and overlay rehabilitation of the existing pavements can be performed. In our opinion, a pavement section with 3-inch-thick mill and overlay of asphalt concrete will meet traffic criteria for

a design period of about 20 years in these areas. Once the surface has been milled, the underlying pavement should be observed for areas of excessive deterioration. The asphalt base in these areas should be completely removed to the top of concrete (observed in all core locations) and replaced with a base course asphalt mix prior to overlay operations.

BELOW-GRADE STRUCTURES

Retaining Wall 1

We understand that a cast-in-place reinforced concrete cantilever retaining wall is planned along the east edge of the roadway from Station 106+75 to 111+50. The maximum height of the retaining wall will be approximately 5 feet at Station 108+25.

Global stability of the wall at Station 109+00 was analyzed by Terracon. Design parameters and recommendations for the retaining wall are included in this section.

Design Parameters

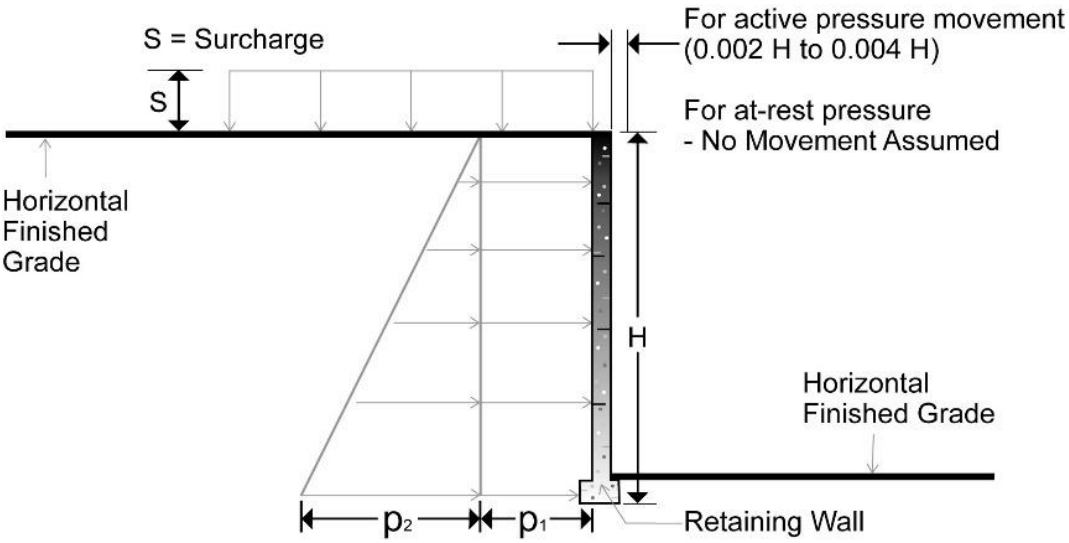
The retaining wall can be supported on a combination of limestone and/or newly placed aggregate fill consisting of crushed limestone aggregate (MoDoT Type 5 or similar gradation) extending to limestone bedrock. Design parameters for wall foundations are provided in the following sections. Our design parameters were estimated based on the results of our field and laboratory test results and our experience with similar subsurface conditions.

Description	Value
Maximum net allowable bearing pressure [1]	**Aggregate Fill** 2,500 psf **Limestone** 4,000 psf
Minimum embedment below finished grade for frost protection	3 feet
Estimated total settlement [2]	1 inch or less
Estimated differential settlement [2]	½ inch over 40 feet

1. The recommended net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the wall base elevation. This pressure assumes that any soils, if encountered at the foundation level, will be undercut and replaced with aggregate fill.
2. The wall settlement will depend upon the variations within the subsurface soil profile, the structural loading conditions, the embedment depth, the thickness of engineered fill below the wall, and the quality of the earthwork operations.

To evaluate that suitable bearing materials are encountered, we recommend the base of the wall excavations be observed and evaluated by the geotechnical engineer. Where unsuitable bearing soils are encountered at the wall foundation excavations, the excavations should be extended deeper to limestone bedrock and backfilled with crushed limestone aggregate (MoDOT Type 5 or similar).

The retaining wall should be designed for at-rest earth pressures at least equal to those indicated in the following table. The recommended design lateral earth pressures do not include a factor of safety and do not provide for possible hydrostatic pressure on the walls.



Lateral Earth Pressure Parameters

Earth Pressure Conditions	Coefficient for Backfill Type	Equivalent Fluid Unit Weight (pcf)	Surcharge Pressure, p_1 (psf)	Earth Pressure, p_2 (psf)
Active (K_a)	Granular - 0.3 Clay - 0.42	40 50	(0.3)S (0.42)S	(40)H (50)H
At-Rest (K_o)	Granular - 0.47 Clay - 0.60	60 70	(0.47)S (0.60)S	(60)H (70)H
Passive (K_p)	Granular - 3.3 Clay - 2.4	420 290	--- ---	--- ---

Applicable conditions to the above include:

- For active earth pressure, wall must rotate about base, with top lateral movements of about 0.002 H to 0.004 H, where H is wall height
- For passive earth pressure to develop, wall must move horizontally to mobilize resistance
- Uniform surcharge, where S is surcharge pressure
- Clay soil backfill: unit weight = 120 pcf (maximum), and ϕ = 24 degrees (minimum)

- Granular material backfill: unit weight = 130 pcf (maximum), and ϕ = 32 degrees (minimum)
- Horizontal backfill, compacted as recommended in the report
- Loading from heavy compaction equipment not included
- No hydrostatic pressures acting on wall
- No loading from nearby footing or slabs
- No dynamic loading
- No safety factor included in soil parameters
- Ignore passive pressure in frost zone

Backfill placed against the wall should consist of granular soils or low plasticity cohesive soils. For the granular values to be valid, the granular backfill must extend out and up from the base of the wall at an angle of at least 45 degrees from vertical for the active and at-rest cases, and at an angle of 60 degrees from vertical for the passive case. To calculate the resistance to sliding, a value of 0.3 should be used as the ultimate coefficient of friction where the footing bears on engineered fill, and a value of 0.5 should be used where the footing bears on limestone.

Drainage Recommendations

To reduce the potential for the build-up of hydrostatic pressure behind the retaining wall, we recommend that a drain line be installed along the back of the wall. The drain line should be positively sloped to drain to a suitable discharge point. The drain line should consist of a perforated plastic pipe with appropriate slot sizes. The pipe should be surrounded by free-draining, granular material, and the granular material should be encapsulated with an approved geotextile filter fabric. The granular material should extend from the drainage pipe to within 2 feet of final grade and should be capped with a cohesive (clay) fill material to reduce surface water infiltration.

Global Stability Analysis

We performed a global stability analysis for retaining wall 1. The analysis was completed based on the provided wall geometry at Station 109+00. The toe condition at the base of the wall is generally sloping away from the wall at a slope of approximately 3H:1V or flatter. The head condition at the top of the wall is generally horizontal with traffic loading. The exposed height of the wall is approximately 5 feet. The section used in the analysis was chosen based on wall height and presence of engineered fill beneath the wall.

Analysis of the retaining wall for global stability followed limit equilibrium allowable stress design (ASD) analysis procedures using the computer program SLOPE/W developed by Geo-Slope International. The global stability analysis was based on the rigid body method, only considering failure surfaces outside the retaining wall mass. Parameters for the retaining wall mass were selected to restrict failure surfaces from passing through it. Compound stability of failure surfaces passing through the retaining wall mass were not considered. We considered a minimum factor of

safety (FOS) of 1.3 for the global stability analysis. The factor of safety may be generally defined as the ratio of the resisting forces (the strength of the soil) to the driving forces (the weight of soil mass and other externally applied loads).

The soil stratigraphy for the global stability analysis was inferred from our borings for long-term conditions. The shear strength parameters for the material types used in our analyses were derived from laboratory test data, established engineering correlations, and our past experience with similar materials in the Kansas City area. A summary of the identified materials and their corresponding shear strength parameters are shown in the table below.

		Effective Stress Shear Strength Parameters	
Material Type or Zone	**Minimum Total Unit Weight (pcf)**	**Minimum Friction Angle (degrees)**	**Cohesion, c' (psf)**
Engineered fill (MODOT Type 5)	130	32	0
Engineered fill (Clay)	120	27	0
Native Fat Clay Soils	120	27	0
Weathered Limestone Bedrock	135	22	150
Limestone Bedrock	135	24	250

Based on our analysis, the planned retaining wall section will meet a minimum FOS of 1.3, provided the wall is founded on limestone bedrock, or MoDOT Type 5 aggregate extending to limestone bedrock. An exhibit showing the results of our global stability analysis is attached to this report.

If wall construction varies from that assumed in the design, or materials used in wall construction vary from that identified in this report, Terracon should be consulted to review and update the enclosed recommendations.

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 boring 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 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.

ATTACHMENTS

EXPLORATION AND TESTING PROCEDURES

Field Exploration

The borings were located in the field by Terracon personnel using a hand-held GPS unit with a horizontal accuracy of ±20 feet. Ground surface elevations indicated on the boring logs were provided by the project surveyor.

The borings were drilled with a truck-mounted, rotary drill rig using solid-stem, continuous flight augers to advance most of the boreholes. RW-5 was drilled with a hand auger. Samples of the soil encountered in the borings were obtained using thin-walled tube and split-barrel sampling procedures. In the thin-walled tube sampling procedure, a thin-walled, seamless steel tube with a sharp cutting edge is pushed hydraulically into the soil to obtain a relatively undisturbed sample. In the split-barrel sampling procedure, a standard 2-inch outside diameter split-barrel sampling spoon is 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.

The samples were tagged for identification, sealed to reduce moisture loss, and taken to our laboratory for further examination, testing, and classification. The drill crew backfilled the borings with auger cuttings after completion of drilling/sampling and prior to leaving the site.

The drill crew prepared a field log of each boring to record data including visual classifications of the materials encountered during drilling as well as the driller's interpretation of the subsurface conditions between samples. The final boring logs included with this report represent the engineer's interpretation of the subsurface conditions at the borings based on field and laboratory data and observation of the samples.

Laboratory Testing

Representative soil samples were tested in the laboratory to measure their natural water content, dry unit weight, and Atterberg limits. A pocket penetrometer was used to estimate the consistency of selected cohesive samples. The test results are provided on the boring logs included in **Exploration Results**.

The soil samples were classified in the laboratory based on visual observation, texture, plasticity, and the laboratory testing described above. The soil descriptions presented on the boring logs are in accordance with the enclosed General Notes and Unified Soil Classification System (USCS). The estimated USCS group symbols for native soils are shown on the boring logs, and a brief description of the USCS is included in this report.

The bedrock materials encountered in the borings were described in accordance with the appended Description of Rock Properties on the basis of drilling characteristics and visual classification of disturbed auger cuttings. Petrographic analysis and rock core may indicate other rock types.

SITE LOCATION AND EXPLORATION PLANS

SITE LOCATION

Parkville Route 9 Improvements ■ Parkville, MO
February 28, 2018 ■ Terracon Project No. 02175280

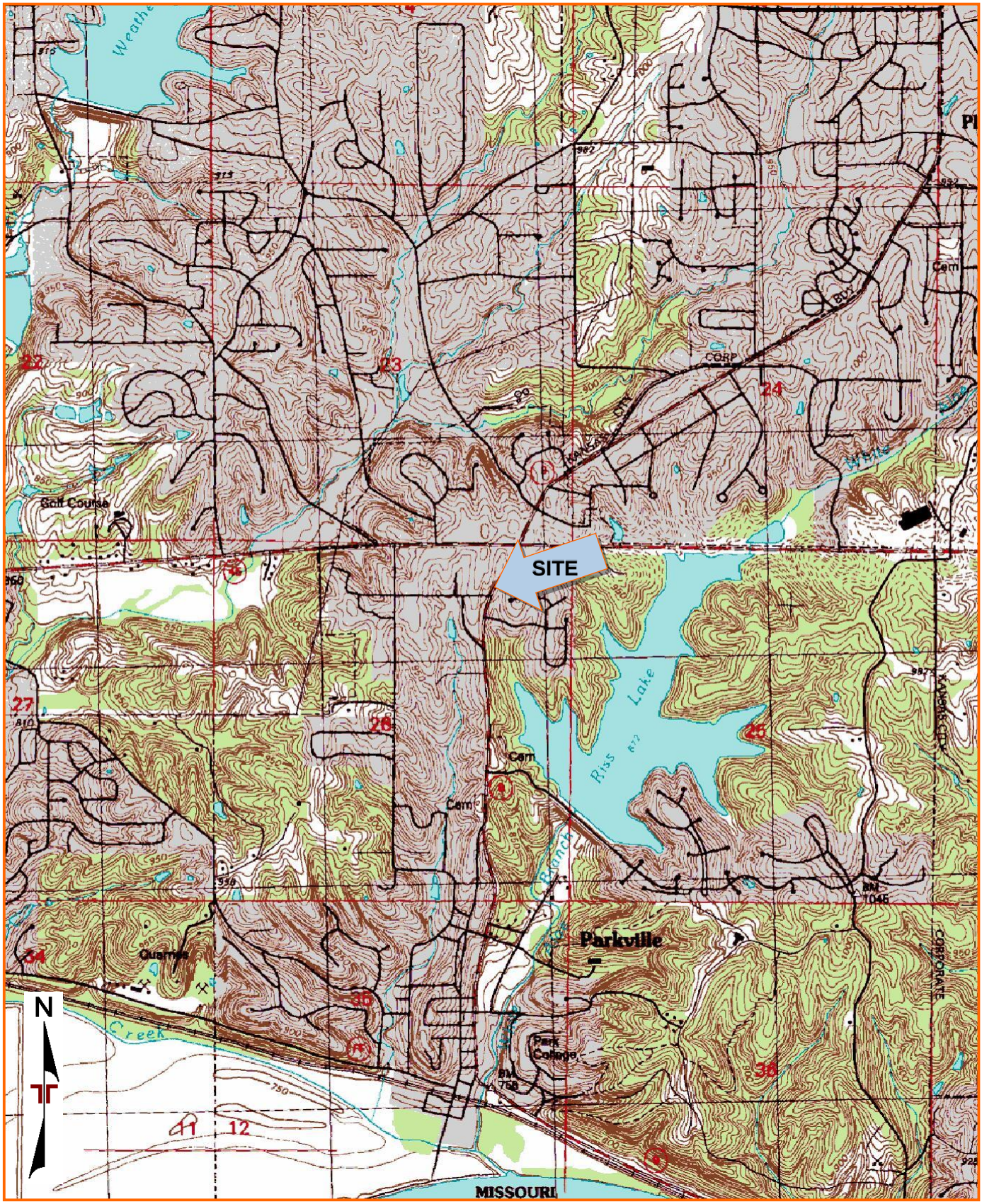


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

TOPOGRAPHIC MAP IMAGE COURTESY OF THE U.S. GEOLOGICAL SURVEY
QUADRANGLES INCLUDE: PARKVILLE, MO (1/1/1996).

EXPLORATION PLAN

Parkville Route 9 Improvements ■ Parkville, MO
February 28, 2018 ■ Terracon Project No. 02175280

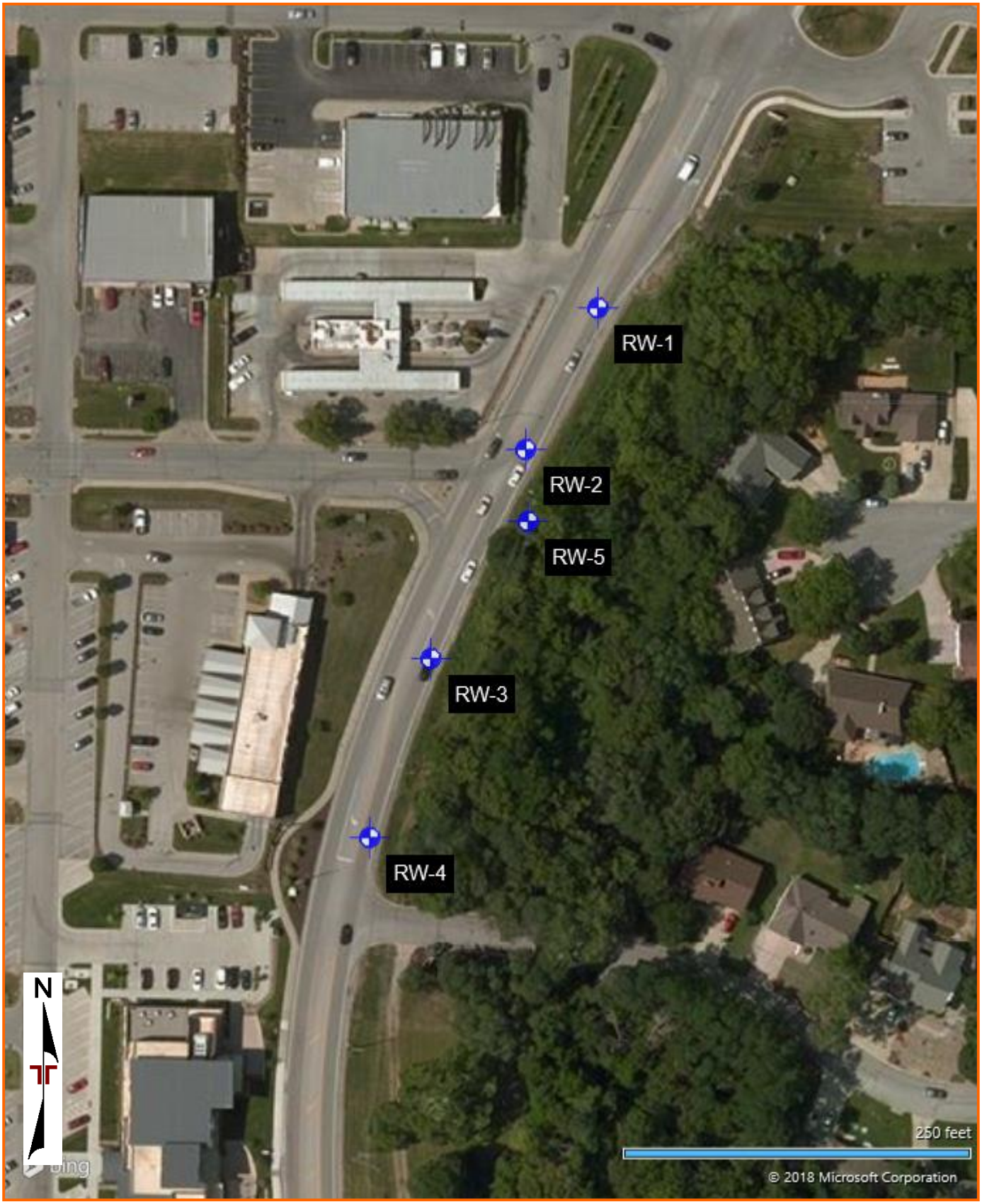


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

AERIAL PHOTOGRAPHY PROVIDED BY MICROSOFT BING MAPS

EXPLORATION PLAN

Parkville Route 9 Improvements ■ Parkville, MO
February 28, 2018 ■ Terracon Project No. 02175280

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

AERIAL PHOTOGRAPHY PROVIDED BY MICROSOFT BING MAPS

EXPLORATION RESULTS

BORING LOG NO. RW-1

PROJECT: Parkville Route 9 Improvements

CLIENT: GBA Inc
Lenexa, KS

SITE: Route 9
Parkville, MO

LOCATION See Exploration Plan

Latitude: 39.209° Longitude: -94.6819°

Surface Elev.: 949.39 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	HAND PENETROMETER (tsf)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI
		6" ASPHALT									
	0.5	949				10.6					
		4.5" CONCRETE									
	0.9	948.5									
		FAT CLAY (CH), gray and brown, medium stiff to stiff									
						14	2-3-4 N=7		24		64-20-44
	3.5	946				6		1.75	27	94	
		LIMESTONE, gray, highly weathered									
	4.5	945									
		Auger Refusal at 4.5 Feet									

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

Hammer Type: Automatic

Advancement Method:
Continuous Flight Auger

Abandonment Method:
Boring backfilled with bentonite
Surface capped with concrete

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 were provided by others.

Notes:

WATER LEVEL OBSERVATIONS

Terracon
13910 W 96th Ter
Lenexa, KS

Boring Started: 01-29-2018 | Boring Completed: 01-29-2018

Drill Rig: 988 | Driller: SF

Project No.: 02175280

BORING LOG NO. RW-2

PROJECT: Parkville Route 9 Improvements

CLIENT: GBA Inc
Lenexa, KS

SITE: Route 9
Parkville, MO

LOCATION See Exploration Plan

Latitude: 39.2088° Longitude: -94.6821°

Surface Elev.: 947.77 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	HAND PENETROMETER (tsf)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI
5.5" ASPHALT									
0.5	947.5			11.3					
7" CONCRETE									
1.0	946.5								
FAT CLAY (CH), gray and brown, stiff				14	2-3-7 N=10		24		
				21		2.0	26	95	
5.0	943	5							
LIMESTONE, gray, highly weathered									
6.0	942								
Auger Refusal at 6 Feet									

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

Hammer Type: Automatic

Advancement Method:
Continuous Flight Auger

Abandonment Method:
Boring backfilled with bentonite
Surface capped with concrete

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 were provided by others.

Notes:

WATER LEVEL OBSERVATIONS

Terracon
13910 W 96th Ter
Lenexa, KS

Boring Started: 01-29-2018 | Boring Completed: 01-29-2018

Drill Rig: 988 | Driller: SF

Project No.: 02175280

BORING LOG NO. RW-3

PROJECT: Parkville Route 9 Improvements

CLIENT: GBA Inc
Lenexa, KS

SITE: Route 9
Parkville, MO

LOCATION See Exploration Plan

Latitude: 39.2083° Longitude: -94.6823°

Surface Elev.: 946.18 (Ft.)

DEPTH	ELEVATION (Ft.)	Description
0.5	945.5	**6" ASPHALT**
1.0	945	**5.5" CONCRETE**
3.0	943	**LEAN CLAY (CL)**, gray and brown, stiff
4.5	941.5	**FAT CLAY (CH)**, gray and brown, stiff
6.0	940	**LIMESTONE**, gray, highly weathered
		Auger Refusal at 6 Feet

DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	HAND PENETROMETER (tsf)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI
		12.3					
		12	2-4-5 N=9		24		42-17-25
		7		0.75	28		
5							

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

Hammer Type: Automatic

Advancement Method:
Continuous Flight Auger

Abandonment Method:
Boring backfilled with bentonite
Surface capped with concrete

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 were provided by others.

Notes:

WATER LEVEL OBSERVATIONS

Terracon
13910 W 96th Ter
Lenexa, KS

Boring Started: 01-29-2018 | Boring Completed: 01-29-2018

Drill Rig: 988 | Driller: SF

Project No.: 02175280

BORING LOG NO. RW-4

PROJECT: Parkville Route 9 Improvements

CLIENT: GBA Inc
Lenexa, KS

SITE: Route 9
Parkville, MO

LOCATION See Exploration Plan

Latitude: 39.208° Longitude: -94.6825°

Surface Elev.: 946.76 (Ft.)

DEPTH	ELEVATION (Ft.)	Description
0.5	946.5	**6" ASPHALT**
1.3	945.5	**10" CONCRETE**
5.0	942	**FAT CLAY (CH)**, gray and brown, stiff to very stiff
6.5	940.5	**LIMESTONE**, gray, highly weathered
		Auger Refusal at 6.5 Feet

DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	HAND PENETROMETER (tsf)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI
			14.6					
			12	3-4-4 N=8		26		
			24		2.25	37	81	
5								

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

Hammer Type: Automatic

Advancement Method:
Continuous Flight Auger

Abandonment Method:
Boring backfilled with bentonite
Surface capped with concrete

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 were provided by others.

Notes:

WATER LEVEL OBSERVATIONS

Terracon
13910 W 96th Ter
Lenexa, KS

Boring Started: 01-29-2018 | Boring Completed: 01-29-2018

Drill Rig: 988 | Driller: SF

Project No.: 02175280

BORING LOG NO. RW-5

PROJECT: Parkville Route 9 Improvements

CLIENT: GBA Inc
Lenexa, KS

SITE: Route 9
Parkville, MO

LOCATION See Exploration Plan

Latitude: 39.2086° Longitude: -94.682°

Surface Elev.: 935.93 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	HAND PENETROMETER (tsf)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI
		5" Root Zone									
	0.5	935.5									
	0.5	**LIMESTONE**, light brown									
		Auger Refusal at 0.5 Foot									

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

Advancement Method:
Hand Auger

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.

Elevations were provided by others.

Notes:

WATER LEVEL OBSERVATIONS

Terracon
13910 W 96th Ter
Lenexa, KS

Boring Started: 02-09-2018	Boring Completed: 02-09-2018
Drill Rig: 988	Driller: SF
Project No.: 02175280	

BORING LOG NO. P-1

PROJECT: Parkville Route 9 Improvements

CLIENT: GBA Inc
Lenexa, KS

SITE: Route 9
Parkville, MO

LOCATION See Exploration Plan

Latitude: 39.2072° Longitude: -94.6826°

Surface Elev.: 953.84 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	HAND PENETROMETER (tsf)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI
	6.5" ASPHALT										
	0.5	953.5				13.2					
	7" CONCRETE										
	1.1	952.5									
	FAT CLAY (CH), brown, stiff										
						18	3-3-5 N=8		23		
						18	3-4-7 N=11		23		
	5.0	949	5								
	Boring Terminated at 5 Feet										

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

Hammer Type: Automatic

Advancement Method:
Continuous Flight Auger

Abandonment Method:
Boring backfilled with bentonite
Surface capped with concrete

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 were provided by others.

Notes:

WATER LEVEL OBSERVATIONS

Terracon
13910 W 96th Ter
Lenexa, KS

Boring Started: 02-09-2018 | Boring Completed: 02-09-2018

Drill Rig: 988 | Driller: SF

Project No.: 02175280

BORING LOG NO. P-2

PROJECT: Parkville Route 9 Improvements

CLIENT: GBA Inc
Lenexa, KS

SITE: Route 9
Parkville, MO

LOCATION See Exploration Plan

Latitude: 39.2063° Longitude: -94.6825°

Surface Elev.: 956.76 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	HAND PENETROMETER (tsf)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI
	6.5" ASPHALT										
	0.5	956				12.5					
	6.5" CONCRETE										
	1.1	955.5									
	FAT CLAY (CH), brown, stiff										
						18	5-5-9 N=14		24		
						14	4-4-7 N=11		24		
	5.0	952	5								
	Boring Terminated at 5 Feet										

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

Hammer Type: Automatic

Advancement Method:
Continuous Flight Auger

Abandonment Method:
Boring backfilled with bentonite
Surface capped with concrete

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 were provided by others.

Notes:

WATER LEVEL OBSERVATIONS

Terracon
13910 W 96th Ter
Lenexa, KS

Boring Started: 02-09-2018 | Boring Completed: 02-09-2018

Drill Rig: 988 | Driller: SF

Project No.: 02175280

BORING LOG NO. P-3

PROJECT: Parkville Route 9 Improvements

CLIENT: GBA Inc
Lenexa, KS

SITE: Route 9
Parkville, MO

LOCATION See Exploration Plan

Latitude: 39.2054° Longitude: -94.6824°

Surface Elev.: 957.47 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	HAND PENETROMETER (tsf)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI
	6" ASPHALT										
	0.5	957				12.5					
	6.5" CONCRETE										
	1.0	956.5									
	FAT CLAY (CH), brown, stiff										
						18	4-5-9 N=14		27		
						18	4-5-8 N=13		27		
	5.0	952.5	5								
	Boring Terminated at 5 Feet										

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

Hammer Type: Automatic

Advancement Method:
Continuous Flight Auger

Abandonment Method:
Boring backfilled with bentonite
Surface capped with concrete

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 were provided by others.

Notes:

WATER LEVEL OBSERVATIONS

Terracon
13910 W 96th Ter
Lenexa, KS

Boring Started: 02-09-2018 | Boring Completed: 02-09-2018

Drill Rig: 988 | Driller: SF

Project No.: 02175280

BORING LOG NO. P-4

PROJECT: Parkville Route 9 Improvements

CLIENT: GBA Inc
Lenexa, KS

SITE: Route 9
Parkville, MO

LOCATION See Exploration Plan

Latitude: 39.2043° Longitude: -94.6822°

Surface Elev.: 953.34 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	HAND PENETROMETER (tsf)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI
	6" ASPHALT										
	0.5	953				11.6					
	5.5" CONCRETE										
	1.0	952.5									
	LEAN CLAY (CL), brown, very stiff										
						18	3-8-10 N=18		15		38-17-21
	3.0	950.5									
	FAT CLAY (CH), brown, very stiff										
						18	5-6-10 N=16		24		
	5.0	948.5	5								
	Boring Terminated at 5 Feet										

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

Hammer Type: Automatic

Advancement Method:
Continuous Flight Auger

Abandonment Method:
Boring backfilled with bentonite
Surface capped with concrete

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 were provided by others.

Notes:

WATER LEVEL OBSERVATIONS

Terracon
13910 W 96th Ter
Lenexa, KS

Boring Started: 02-08-2018 | Boring Completed: 02-08-2018

Drill Rig: 988 | Driller: SF

Project No.: 02175280

BORING LOG NO. P-5

PROJECT: Parkville Route 9 Improvements

CLIENT: GBA Inc
Lenexa, KS

SITE: Route 9
Parkville, MO

LOCATION See Exploration Plan

Latitude: 39.2032° Longitude: -94.6822°

Surface Elev.: 948.64 (Ft.)

DEPTH	ELEVATION (Ft.)	Description
0.5	948	**5.5" ASPHALT**
1.0	947.5	**7" CONCRETE**
3.0	945.5	**LEAN CLAY (CL)**, brown, stiff
5.0	943.5	**FAT CLAY (CH)**, brown, very stiff
		Boring Terminated at 5 Feet

DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)
		13		
		18	3-4-10 N=14	18
5		18	4-9-10 N=19	23

HAND PENETROMETER (tsf) | DRY UNIT WEIGHT (pcf) | ATTERBERG LIMITS LL-PL-PI | WATER LEVEL OBSERVATIONS

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

Hammer Type: Automatic

Advancement Method:
Continuous Flight Auger

Abandonment Method:
Boring backfilled with bentonite
Surface capped with concrete

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 were provided by others.

Notes:

WATER LEVEL OBSERVATIONS

Terracon
13910 W 96th Ter
Lenexa, KS

Boring Started: 02-08-2018 | Boring Completed: 02-08-2018

Drill Rig: 988 | Driller: SF

Project No.: 02175280

BORING LOG NO. P-6

PROJECT: Parkville Route 9 Improvements

CLIENT: GBA Inc
Lenexa, KS

SITE: Route 9
Parkville, MO

LOCATION See Exploration Plan

Latitude: 39.2023° Longitude: -94.6822°

Surface Elev.: 945.10 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	HAND PENETROMETER (tsf)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI
0.5	944.5				11.4					
5.5" ASPHALT										
1.0	944									
6.5" CONCRETE										
FAT CLAY (CH), brown, stiff										
					18	3-4-8 N=12		26		
					18	4-6-10 N=16		29		
5.0	940	5								
Boring Terminated at 5 Feet										

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

Hammer Type: Automatic

Advancement Method:
Continuous Flight Auger

Abandonment Method:
Boring backfilled with bentonite
Surface capped with concrete

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 were provided by others.

Notes:

WATER LEVEL OBSERVATIONS

Terracon
13910 W 96th Ter
Lenexa, KS

Boring Started: 02-08-2018 | Boring Completed: 02-08-2018

Drill Rig: 988 | Driller: SF

Project No.: 02175280

BORING LOG NO. P-7

PROJECT: Parkville Route 9 Improvements

CLIENT: GBA Inc
Lenexa, KS

SITE: Route 9
Parkville, MO

LOCATION See Exploration Plan

Latitude: 39.2013° Longitude: -94.6823°

Surface Elev.: 937.19 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI
0.3	937						
4" ASPHALT				9.3			
0.8	936.5						
FAT CLAY (CH), brown, stiff							
				18	3-4-7 N=11	23	50-19-31
				18	4-4-6 N=10	23	
5.0	932	5					
Boring Terminated at 5 Feet							

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

Hammer Type: Automatic

Advancement Method:
Continuous Flight Auger

Abandonment Method:
Boring backfilled with bentonite
Surface capped with concrete

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 were provided by others.

Notes:

WATER LEVEL OBSERVATIONS

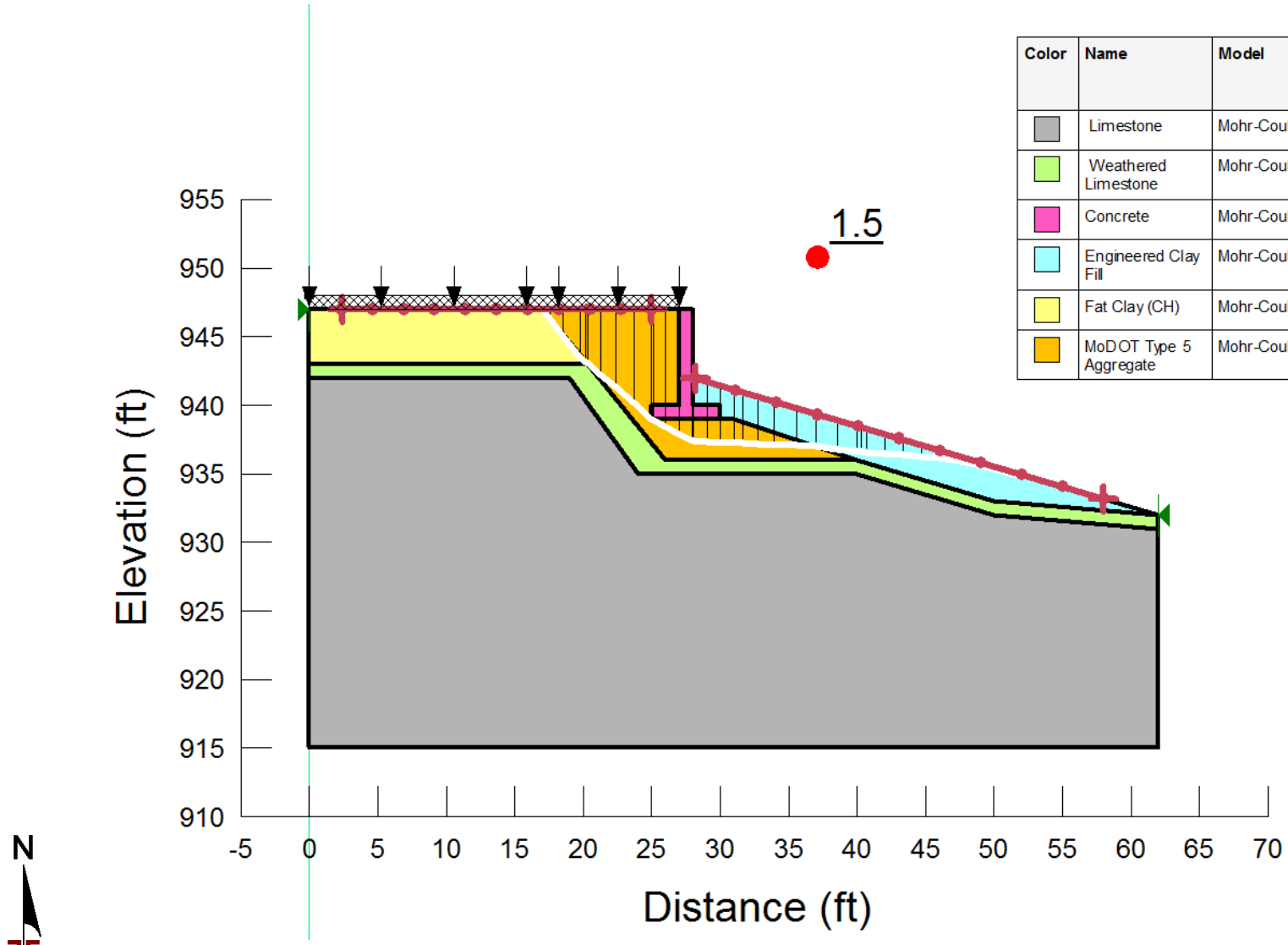
Terracon
13910 W 96th Ter
Lenexa, KS

Boring Started: 02-08-2018 | Boring Completed: 02-08-2018

Drill Rig: 988 | Driller: SF

Project No.: 02175280

GLOBAL STABILTY ANALYSIS



Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Limestone	Mohr-Coulomb	135	250	24
	Weathered Limestone	Mohr-Coulomb	135	150	22
	Concrete	Mohr-Coulomb	145	5,000	45
	Engineered Clay Fill	Mohr-Coulomb	120	0	27
	Fat Clay (CH)	Mohr-Coulomb	120	0	27
	MoDOT Type 5 Aggregate	Mohr-Coulomb	130	0	32

N

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

Project Manager:	KDF
Drawn by:	KDF
Checked by:	KCB
Approved by:	KCB

Project No.	02175280
Scale:	AS SHOWN
File Name:	N/A
Date:	3/12/2018

Terracon
Consulting Engineers & Scientists
13910 W. 96th Terrace Lenexa, Kansas 66215
PH. (913) 492-7777 FAX. (913) 492-7443

GLOBAL STABILITY EXHIBIT

PARKVILLE ROUTE 9 IMPROVEMENTS

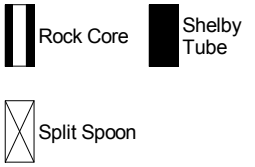
ROUTE 9
PARKVILLE, MISSOURI

SUPPORTING INFORMATION

GENERAL NOTES

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

SAMPLING



WATER LEVEL

Water Initially Encountered

Water Level After a Specified Period of Time

Water Level After a Specified Period of Time

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**
(PID)	**Photo-Ionization Detector**
(OVA)	**Organic Vapor Analyzer**

DESCRIPTIVE SOIL CLASSIFICATION

Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

LOCATION AND ELEVATION NOTES

Unless otherwise noted, Latitude and Longitude are approximately determined using a hand-held GPS device. The accuracy of such devices is variable. 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, (psf)**	**Standard Penetration or N-Value Blows/Ft.**
Very Loose	0 - 3	Very Soft	less than 500	0 - 1
Loose	4 - 9	Soft	500 to 1,000	2 - 4
Medium Dense	10 - 29	Medium Stiff	1,000 to 2,000	4 - 8
Dense	30 - 50	Stiff	2,000 to 4,000	8 - 15
Very Dense	> 50	Very Stiff	4,000 to 8,000	15 - 30
		Hard	> 8,000	> 30

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 15
With	15 - 29
Modifier	> 30

GRAIN SIZE TERMINOLOGY

Major Component of Sample	Particle Size
Boulders	Over 12 in. (300 mm)
Cobbles	12 in. to 3 in. (300mm to 75mm)
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)
Sand	#4 to #200 sieve (4.75mm to 0.075mm
Silt or Clay	Passing #200 sieve (0.075mm)

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 5
With	5 - 12
Modifier	> 12

PLASTICITY DESCRIPTION

Term	Plasticity Index
Non-plastic	0
Low	1 - 10
Medium	11 - 30
High	> 30

Terracon

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 $1 > Cc > 3$ [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 $1 > Cc > 3$ [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 [J]		CL	Lean clay [K,L,M]
			PI < 4 or plots below "A" line [J]		ML	Silt [K,L,M]
		Organic:	Liquid limit - oven dried	< 0.75	OL	Organic clay [K,L,M,N]
			Liquid limit - not dried			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	< 0.75	OH	Organic clay [K,L,M,P]
			Liquid limit - not dried			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] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[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.

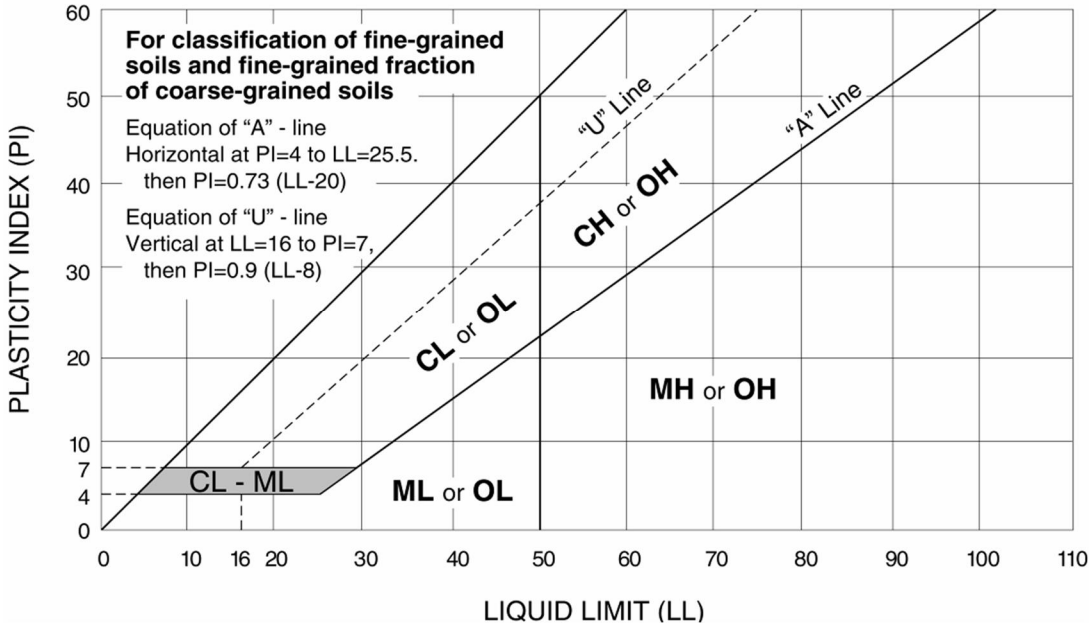
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[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.



Terracon

DESCRIPTION OF ROCK PROPERTIES

WEATHERING	
Term	**Description**
Unweathered	No visible sign of rock material weathering, perhaps slight discoloration on major discontinuity surfaces.
Slightly weathered	Discoloration indicates weathering of rock material and discontinuity surfaces. All the rock material may be discolored by weathering and may be somewhat weaker externally than in its fresh condition.
Moderately weathered	Less than half of the rock material is decomposed and/or disintegrated to a soil. Fresh or discolored rock is present either as a continuous framework or as corestones.
Highly weathered	More than half of the rock material is decomposed and/or disintegrated to a soil. Fresh or discolored rock is present either as a discontinuous framework or as corestones.
Completely weathered	All rock material is decomposed and/or disintegrated to soil. The original mass structure is still largely intact.
Residual soil	All rock material is converted to soil. The mass structure and material fabric are destroyed. There is a large change in volume, but the soil has not been significantly transported.

STRENGTH OR HARDNESS		
Description	**Field Identification**	**Uniaxial Compressive Strength, PSI (MPa)**
Extremely weak	Indented by thumbnail	40-150 (0.3-1)
Very weak	Crumbles under firm blows with point of geological hammer, can be peeled by a pocket knife	150-700 (1-5)
Weak rock	Can be peeled by a pocket knife with difficulty, shallow indentations made by firm blow with point of geological hammer	700-4,000 (5-30)
Medium strong	Cannot be scraped or peeled with a pocket knife, specimen can be fractured with single firm blow of geological hammer	4,000-7,000 (30-50)
Strong rock	Specimen requires more than one blow of geological hammer to fracture it	7,000-15,000 (50-100)
Very strong	Specimen requires many blows of geological hammer to fracture it	15,000-36,000 (100-250)
Extremely strong	Specimen can only be chipped with geological hammer	>36,000 (>250)

DISCONTINUITY DESCRIPTION			
Fracture Spacing (Joints, Faults, Other Fractures)		**Bedding Spacing (May Include Foliation or Banding)**	
Description	**Spacing**	**Description**	**Spacing**
Extremely close	< ¾ in (<19 mm)	**Laminated**	< ½ in (<12 mm)
Very close	¾ in – 2-1/2 in (19 - 60 mm)	**Very thin**	½ in – 2 in (12 – 50 mm)
Close	2-1/2 in – 8 in (60 – 200 mm)	**Thin**	2 in – 1 ft (50 – 300 mm)
Moderate	8 in – 2 ft (200 – 600 mm)	**Medium**	1 ft – 3 ft (300 – 900 mm)
Wide	2 ft – 6 ft (600 mm – 2.0 m)	**Thick**	3 ft – 10 ft (900 mm – 3 m)
Very Wide	6 ft – 20 ft (2.0 – 6 m)	**Massive**	> 10 ft (3 m)

Discontinuity Orientation (Angle): Measure the angle of discontinuity relative to a plane perpendicular to the longitudinal axis of the core. (For most cases, the core axis is vertical; therefore, the plane perpendicular to the core axis is horizontal.) For example, a horizontal bedding plane would have a 0 degree angle.

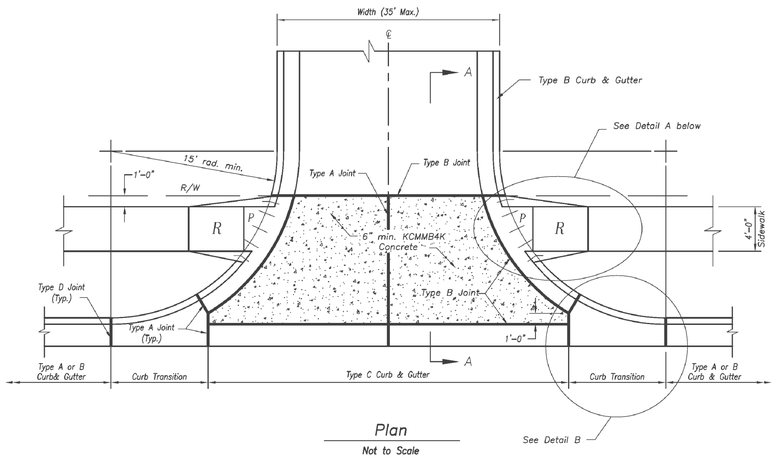
ROCK QUALITY DESIGNATION (RQD*)	
Description	**RQD Value (%)**
Very Poor	0 - 25
Poor	25 – 50
Fair	50 – 75
Good	75 – 90
Excellent	90 - 100

*The combined length of all sound and intact core segments equal to or greater than 4 inches in length, expressed as a percentage of the total core run length.

Reference: U.S. Department of Transportation, Federal Highway Administration, Publication No FHWA-NHI-10-034, December 2009 Technical Manual for Design and Construction of Road Tunnels – Civil Elements

Terracon

OVERLAND PARK STANDARDS ARE INTENDED FOR CONSTRUCTION GUIDANCE. REFERENCES MADE TO OP MAY NOT PERTAIN TO THIS PROJECT.



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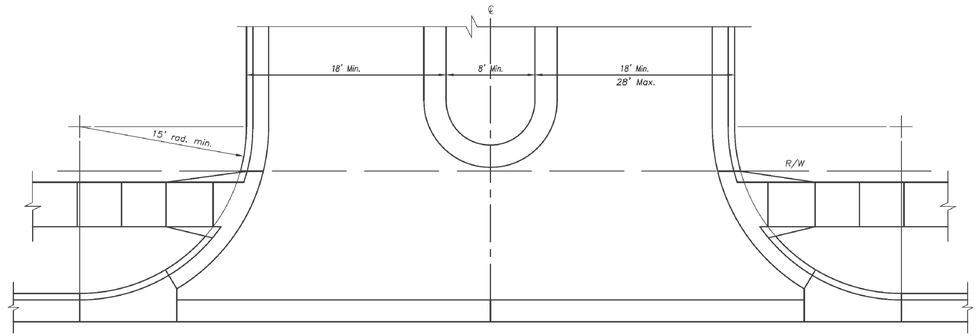

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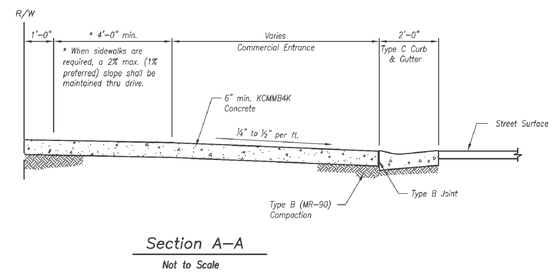
COMMERCIAL ENTRANCE WITH MEDIAN



Section A–A
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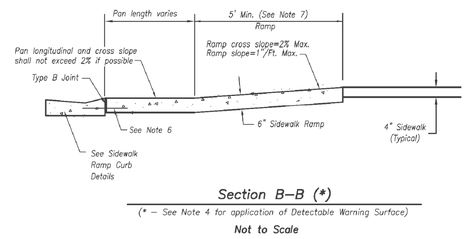

Section B–B (*)
(* – See Note 4 for application of Detectable Warning Surface)
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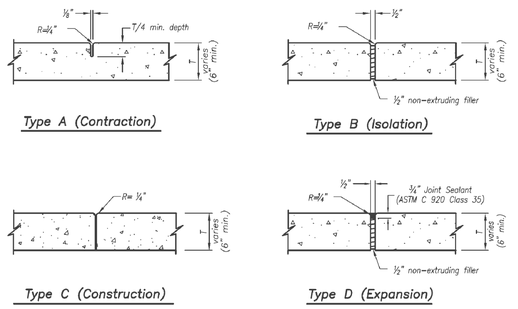

JOINT DETAILS
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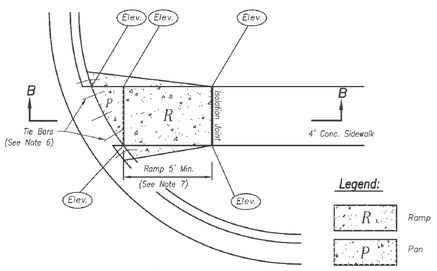
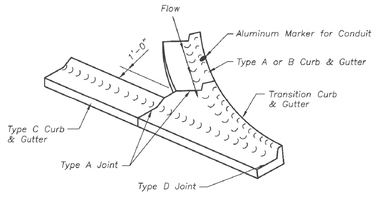


Detail A
Not to Scale



Detail B
Not To Scale

COMMERCIAL ENTRANCE DETAIL

Commercial Drive Notes:

1. Overland Park Municipal Code (OPMC) and Overland Park Design and Construction Standards Manual (OPDCSM) are incorporated, except as otherwise noted.
2. KCMMB4K Concrete shall be used throughout.
3. Concrete pavement shall be jointed with Type A joints. No jointed slab shall exceed 12' x 12'.
4. Detectable warning surfaces are not allowed at non-signalized entrances. For signalized entrances use Type A ramp as shown on "Sidewalk and Sidewalk Ramp Details".
5. ADA compliance will be measured at points labeled (Elev.) .
6. Install 18" tie bars #4 epoxy coated @ 18" o.c. and through wings as shown.
7. Sidewalk Ramp shall be lengthened to provide ADA compliance slope but need not exceed 15'.
8. ADA maximum ramp slope = 1"/Ft.
   ADA maximum cross slope = 2%.
9. Top of curb elevations shall be shown at quarter points and curb returns.
10. Any additional steel reinforcement shall be approved by the City Engineer.
11. See Curb Replacement Detail for additional requirements.

DRAWING NAME: K:\Details_Specs\Detail_Drawings\details_english\revision_17\drive-c.dwg
WEB SITE ADDRESS: http://www.opkansas.org/Doing-Business/Construction-Details

Year 2017 Edition

REVISIONS:	
07/01/03	Concrete Mix Designation;
Jan. 2005	ADA Compliance;
Feb. 2008	Miscellaneous;
Jan. 2009	Joint Locations; Miscellaneous;
RELATED ORDINANCES:	
OPMC Title 13	

OVERLAND PARK
KANSAS
ABOVE AND BEYOND BY DESIGN

DEPARTMENT OF PUBLIC WORKS
STANDARD DETAILS

COMMERCIAL ENTRANCE DETAIL

DATE: 08/10/98 SHEET: 17

THIS SHEET HAS BEEN SIGNED, SEALED AND DATED ELECTRONICALLY.

ROUTE 9 IMPROVEMENTS
CITY OF PARKVILLE, MISSOURI
8880 CLARK AVE, PARKVILLE, MO 64152

GBA
9801 Renner Blvd. Ste. 300
Lenexa, KS 66219
913.492.0400
GBAteam.com

REVISION

PROJECT NUMBER
STP-3400 (442)

GBA PROJECT NUMBER
13813.00

DATE
5/3/2021

DESIGNED:
MLG

DRAWN:
LDR

REVIEWED

SHEET TITLE
CONSTRUCTION DETAIL SHEET 1 OF 15

SHEET NUMBER
66