SUBGRADE EXPLORATION

LAK – STEVENS BOULEVARD
EASTLAKE, OHIO

SME Project Number: 080888.00
April 1, 2019

SME

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April 1, 2019

Mr. William D. Baker, Jr., P.E.
Principal
CT Consultants, Inc.
8150 Sterling Court
Mentor, Ohio 44060

Via Email: bbaker@ctconsultants.com (PDF file)

RE: Subgrade Exploration Report
LAK – Stevens Boulevard
Eastlake, Ohio
SME Project No. 080888.00

Dear Mr. Baker:

We have completed the subgrade exploration report for the planned reconstruction of Stevens Boulevard in Eastlake, Ohio. The attached report presents the results of our subsurface investigation, and our recommendations for subgrade preparation.

We appreciate the opportunity to work with you on this project. If you have questions, please call.

Sincerely,

SME

Brendan P. Lieske, PE
Project Engineer/Manager

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EXECUTIVE SUMMARY

SME completed a subgrade exploration and soil analysis for Stevens Boulevard in Eastlake, Lake County, Ohio. The project area includes Stevens Boulevard from its intersection with S.O.M. Center Road (SR 91) to its intersection with Lakeshore Boulevard (SR 283). Our exploration and analysis were conducted in general accordance with ODOT's Specifications for Geotechnical Engineering (SGE), and Geotechnical Bulletin 1 (GB1).

We cored the existing pavement, sampled the base material, and continuously sampled Standard Penetration Test (SPT) borings at eighteen locations designated B-001 through B-018. The borings were drilled and sampled to 6 feet below the top of subgrade elevation.

The exploration encountered a pavement section that varied depending on the general location within the project. The pavement section consisted of concrete with an asphalt overlay between S.O.M Center Road and East 337th Street, and in some locations north of the intersection with Jakse Drive. The pavement section in the remainder of the project consisted of concrete. The pavement thicknesses ranged from 6¾ inches to 9½ inches. Base material was encountered at each location consisting of coarse to fine slag. Location B-010 had a pavement section that differed from the other locations; we encountered 3 inches of asphalt over 3½ inches of concrete over about 2 feet of slag base. Not including B-010, the total pavement and base thicknesses ranged from 8¼ inches to 19 inches, with an average of 15¼ inches. We encountered fill at two locations, B-010 and B-017. Groundwater was not encountered during the time that the boreholes were open for observation.

The pavement cores, base samples, and soil samples were delivered to our laboratory for testing. All soil samples were classified either based on the results of laboratory tests or by visual-manual methods. We entered the field and laboratory data into ODOT's GB1 Subgrade Analysis spreadsheet.

The results of the GB1 analysis suggested subgrade treatments for various sections of the project where weak soil or soils with higher moisture contents are present. Based on the boring data, the spreadsheet states that approximately 53% of the project has unstable or potentially unstable subgrade soil. However, the spreadsheet recommends undercutting and replacing at only three of the eighteen boring locations, or approximately 18% of the project area.

The GB1 spreadsheet listed global chemical stabilization a viable option. However, sulfate concentrations over 3,000 ppm were encountered at two locations, and the likely presence of shallow utilities would make chemical stabilization difficult.

Due to the potential drawbacks of chemical stabilization, and small proportion of the project that requires subgrade improvement, a practical approach would be to proofroll to delineate areas requiring subgrade improvement, and to complete spot undercuts in unstable areas. The GB1 analysis suggests that the project could be divided into seven segments based on N_{60L} values and stabilization recommendations. There are three segments that require subgrade stabilization:

- In the area around B-001, undercut 12 inches, place geotextile at the bottom of the undercut, and backfill with ODOT Item 204, Granular Material, Type B.
- In the area including B-012 and B-013, undercut 12 inches, place geogrid at the bottom of the excavation and backfill with ODOT Item 204, Granular Material, Type B.
- In the area around B-017, undercut 12 inches, place geogrid at the bottom of the excavation and backfill with ODOT Item 204, Granular Material, Type B.

Additional borings would be required to better define areas of instability. Alternately, the limits and depths of undercuts should be determined in the field by proofrolling to evaluate the subgrade.

The ODOT GB1 spreadsheet suggests using a CBR of 6 for pavement design. The results of CBR testing on bulk subgrade samples suggest that a CBR of 1 should be used.

The results of our exploration and testing program are presented in the project plan and profile sheets provided by CT Consultants and in this report.

1. INTRODUCTION

This report presents the results of our subgrade exploration for the reconstruction of Stevens Boulevard from S.O.M. Center Road to Lakeshore Boulevard, in Eastlake, Lake County, Ohio. We performed this work in general accordance with our proposal dated November December 21, 2018. SME was authorized to perform the work by Bill Baker of CT Consultants, Inc. on January 30, 2019.

1.1 SITE LOCATION AND PROJECT DESCRIPTION

Stevens Boulevard is bounded by S.O.M Center Road on the east and Lakeshore Boulevard on the northwest. Stevens Boulevard is an east to west trending road from S.O.M. Center Road to the intersection with Jakse Drive, and is generally a southeast to northwest tending road from Jakse Drive to Lakeshore Boulevard. Longfellow Elementary School is located on the south side of Stevens just west of the intersection with S.O.M. Center Road, and North High School is located about 1,700 feet west of S.O.M Center Road. The traffic along Stevens is moderate to heavy, with periods of heavy traffic during the beginning and end of the school days. Both S.O.M Center Road and Lakeshore Boulevard are major arterial streets, and each contributes traffic to Stevens Boulevard.

We understand that the City plans to replace the pavement within the project limits, and that the project does not include widening, significant grade changes, or re-alignment of the roadway.

Subgrade and pavement conditions were identified by a field exploration program consisting of eighteen Standard Penetration Test (SPT) borings. Thicknesses of the existing pavement were measured, and representative subgrade samples were tested in our laboratory. The field and laboratory test results were interpreted in accordance with ODOT Standards and use to develop recommendations for subgrade preparation.

1.2 HISTORIC BORINGS

There are three historical borings located along Stevens Boulevard within or close enough to the project limits to be considered representative of the conditions in the roadway. The borings were completed in 1975 as part of a subsurface exploration entitled *Report of Soil Profile Investigation Lak-Stevens Boulevard-Willowick Drive*. The investigation included areas along Stevens Boulevard and Willowick Drive, near the intersection of the two streets. The borings were designated by station; the center of the intersection with Willowick Drive was designated station 10+00. The borings were located at station 6+10, 15 feet right of centerline, station 14+60, 5 feet right of centerline, and station 18+50, 20 feet left of centerline. For the purpose of this report, the historical borings will be designated S-001-0-75 through S-003-0-75 in order of increasing station.

The soil profiles encountered at the historic borings is generally similar to the profiles encountered in our subgrade exploration. The subsurface profile encountered at these borings generally consisted of medium dense sandy silt (A-4a) over very stiff silt and clay (A-6a) or layers of very stiff silt and clay (A-6a) or silty clay (A-6b) soil over medium dense sandy silt (A-4a) or alternating layers of medium dense sandy silt or medium dense fine to coarse sand (A-3a). Although groundwater levels are not reported on the logs, a transition from brown to gray was noted at 7½ feet below the ground surface at S-001-0-75, 8½ feet below the surface at S-002-0-75, and 7 feet below the surface at S-003-0-75. The log from S-003-0-75 indicates that the sand in the layer between 9 and 11 feet was wet, suggesting an encounter with groundwater at 9 feet. The transition from brown to gray in the historic borings suggests that the long term ground water level is about 7 to 8 ½ feet below the ground surface. A copies of the historic boring logs and associated soil profile are included in Appendix C.

2. GEOLOGY AND FIELD OBSERVATIONS

The project site is located in the glaciated portion of Ohio within the Lake Erie Plain. According to *The Glacial Geology of Lake County,* Ohio, the project is in a lacustrine plain with deposits consisting of silt, fine sand, silty clay and clay over glacial till. The USDA Web Soil Survey indicates that the soil within the project limits consists of Conneaut silt loam. According to the USDA Web Soil Survey, the Conneaut silt loam is typically found in lake planes, classified as a silty clay loam within the depth of our soil borings, and is poorly drained.

The existing pavement between S.O.M. Center Road and East 337th Street is in fair condition. The pavement section in this area consists of an asphalt overlay on concrete. Transverse joint-reflective cracks were observed throughout this area, with secondary cracks observed along many of the transverse cracks. Longitudinal cracks were observed along the centerline. Longitudinal cracks were observed along the wheel-paths in a few locations. "Alligator" cracks were observed along the curbs and near catch basins in some locations.

The existing pavement between East 337th Street and Jaske Drive consists of concrete. The pavement in this area is in poor to fair condition. Patching, longitudinal cracks, corner breaks, and standing water were observed in this area.

The pavement north of Jakse Drive primarily consisted of concrete. There are asphalt overlays in some locations between Jakse Drive and Willowick Drive. The asphalt overlays are in poor condition; potholes, and transverse, longitudinal, and "alligator" cracks were observed. The concrete pavements in areas without overlays is in fair condition. Mid panel transverse and longitudinal cracks were observed, as well patching, and some deterioration along joints

The traffic along Stevens is moderate to heavy, with periods of heavy traffic during the beginning and end of the school days. Both S.O.M Center Road and Lakeshore Boulevard are major arterial streets, and each contributes traffic to Stevens Boulevard

3. FIELD EXPLORATION AND LABORATORY TESTING

3.1 FIELD EXPLORATION

The subsurface conditions with the project limits were identified by a field exploration program consisting of pavement cores and Standard Penetration Test (SPT) borings at eighteen locations, designated B-001 through B-018, spaced at approximately 400 foot intervals between S.O.M Center Road and Lakeshore Boulevard. The boring locations were selected by SME and were generally staggered right and left of centerline. The locations were selected to provide representative coverage of the pavement conditions, while avoiding intersections, and underground and overhead utilities. The approximate test locations are shown on the attached *Boring Location Plan*.

SME visited the site on February 18th and 19th to complete the pavement cores and SPT borings. At each test location, we cored through the existing pavement with a 6 inch nominal diameter diamond-tipped core bit and collected asphalt and concrete cores. The base material, if encountered was sampled and the thicknesses of the pavement materials were measured. SPT samples were collected continuously at 1.5 foot intervals in general accordance with ODOT Specifications for Geotechnical Exploration (SGE). A bulk sample of the subgrade was collected from the upper 1.5 to 3 feet of subgrade at locations B-007 through B-018. The boreholes were checked for the presence of groundwater during drilling and after removing the drill augers. At completion, the boreholes were backfilled with soil cuttings, and bagged, pre-mixed concrete and the pavement was patched with cold-mix asphalt.

The field-measured blow counts are corrected to N_{60} based on energy measurements obtained from hammer calibration. The energy-corrected blow counts are reported on the boring logs and in the GB1 spreadsheet.

3.2 LABORATORY TESTING

The cores, bulk samples of the base material, bulk subgrade samples, and soil from the borings were taken to our laboratory. The cores were measured and photographed. The base materials were classified. The soil samples were examined and classified in accordance with Sections 602 and 603 of the ODOT Specifications for Geotechnical Explorations (SGE), updated July 2018. The soil samples were visually inspected for gypsum. A representative portion from each split-barrel sample was tested for water content as an indication of subgrade consistency, strength, and compressibility. Two samples from each boring location were tested for their Atterberg limits and particle size in accordance with ASTM D4318 and ASTM D422, respectively. One sample from the upper 1.5 feet of subgrade at each boring was tested for its sulfate content in accordance with ODOT Supplement 1122 (2018). A sample of the upper 3 feet of subgrade from B-013 and a composite of the upper 1.5 feet of subgrade from locations B-007 and B-009 were tested for their California Bearing Ratio (CBR).

The results of our field exploration are presented on the enclosed boring logs. The laboratory test results are reported on the boring logs and the attached laboratory test reports.

4. FINDINGS

4.1 SUBSURFACE CONDITIONS

4.1.1 PAVEMENT MATERIALS

The subsurface profile generally consists of concrete, over slag base, over silty clay or clay subgrade with varying amounts of sand and gravel. An asphalt overlay is present between S.O.M Center Road and about 100 feet east of East 337th Street, and in some locations north of the intersection with Jakse Drive.

The pavement section from S.O.M. Center Road to about 100 feet west of East 337th Street consists of asphalt over concrete. Asphalt thicknesses in this area range from 1¼ to 3½ inches, averaging about 2 inches and concrete thicknesses range from 4 to 8 inches, averaging 7 inches. The combined asphalt and concrete thicknesses between S.O.M. Center Road and East 337th Street ranged from 7½ inches 9½ inches, with an average of 9 inches. Base material thicknesses from B-001 through B-007 range from 4½ inches to 9½ inches, averaging 6¾ inches. The base material in this area generally consisted of fine to coarse slag, with a particle size distribution similar to ODOT #304. Clay was observed in the slag base from location B-002. Total pavement material thicknesses ranged from 8¼ inches to 17, with an average of 14¼ inches.

The pavement from East 337th Street to the intersection with Jakse Drive and from Jakse Drive north to Lakeshore Boulevard generally consists of concrete. There are asphalt overlays in some locations between Jakse Drive and Willowick Drive. With the exception of location B-010, concrete thicknesses ranged from 6¾ to 8¼ inches, with an average of 7½ inches. A ½ inch asphalt overlay was present at location B-009. With the exception of B-010, base thicknesses ranged from 5 to 11 inches, with an average of 7½ inches. The pavement material thicknesses at B-010 differed greatly from those of the other locations; we encountered 3 inches of asphalt, over 3½ inches of concrete, over 23½ inches of slag base. This location may be in a utility trench or in an area where the subgrade was undercut. With the exception of B-010 the total pavement material thicknesses in this area ranged from 13¼ to 19 inches with an average of 16 inches.

Photos of the pavement cores, material descriptions, and material descriptions are included on the attached core photo logs.

4.1.2 SUBGRADE

The subgrade along the project generally consists of stiff to hard brown lean clay with varying amounts of sand and gravel according to the USCS method. Slag, lean to fat clay, sandy clay, and sand were also encountered. Soils that classified as A-1-b, A-2-4, A-4a, A-6a, A-6b, and A-7-6 as defined by the Modified AASHTO method were encountered, with A-6a being the most predominant.

The subgrade at the majority of the boring locations between S.O.M. Center Road and the intersection with Jakse Drive consisted of very stiff to hard silt and clay (A-6a) with little sand and trace gravel. Exceptions in this area include the subgrade at B-001, which consisted of stiff to very stiff clay (A-7-6) with some silt, little sand and trace gravel, and at B-008, which consist of hard silty clay (A-7-6) over very hard silt and clay (A-6a) , each with some sand and little gravel.

The subgrade between the intersection with Jakse Drive and Lakeshore Boulevard is more variable. The subgrade at locations B-009, B-012, B-014, B-015, and B-016 generally consisted of very stiff to hard brown silt and clay (A-6a) or silty clay (A-6b) with trace to some sand and gravel.

The soil profile at B-017 included of multiple layers of fill to about 2.5 feet; the fill consisted of a 6 inch layer of loose brown clay (A-7-6) with sand, gravel, slag, and asphalt fragments, over loose brown fine to coarse sand with trace gravel, slag, and brick fragments (A-2-4). The remaining soil profile at B-017 consisted of very stiff brown silt and clay (A-6a) with little sand and trace gravel.

Soils that classified as clay were encountered at multiple locations between Jakse Drive and Lakeshore Boulevard. The soil profile at B-013 consisted of stiff to very stiff brown clay (A-7-6) with little silt and sand and trace gravel, with the upper approximate 1½ feet consisting of lean to fat clay. The soil profile at locations B-011 of very stiff brown clay (A-7-6) with little silt, sand, and trace gravel to about 4 feet over very stiff silty clay (A-6b), each with little sand and trace gravel.

The subsurface profile at B-010 and B-018 differed from other locations; at B-010, fine to coarse slag was encountered to about 2½ feet below the pavement surface. The remaining subgrade at B-010 consisted of very stiff sandy lean clay with trace gravel; the upper layer classified as silt and clay (A-6a) and the lower layer classified as a sandy silt (A-4a). The difference in classifications was due to variation in clay content. The profile at B-018 consisted of a layer of very stiff brown clay fill to about 2½ feet, over medium dense crushed limestone to about 4½ feet. The remainder of the profile at B-018 consists of hard silt and clay (A-6a) with little sand and trace gravel.

The soil classifications and data from the SPT, Atterberg limits, and grainsize tests were entered into the ODOT GB1 spreadsheet. The stations, offsets, and elevations, provided by CT Consultants, were entered into the spreadsheet. Since the planned subgrade elevation is not known, the existing subgrade elevation was entered into the proposed subgrade elevations cells in the spreadsheet. A copy of the spreadsheet is attached.

The results of our field exploration are presented on the enclosed boring logs and the plan and profile drawings. The laboratory test results are reported on the boring logs and the attached laboratory test reports. Data for the subgrade soils is also summarized on the plan sheets

4.1.3 GROUNDWATER CONDITIONS

Groundwater was not encountered during drilling at the boring locations. The long term depth of groundwater cannot be assessed based on the borings because a clear transition from brown to gray soils was not observed in the soil samples. The groundwater conditions indicated by the borings represent conditions at the time the readings were taken. The groundwater levels at the time of construction may vary from those conditions noted on the boring logs.

Subsurface conditions at other times and locations on the site may differ from those found at our test locations. If different conditions are encountered during pavement reconstruction, we should be contacted and given the opportunity to review our recommendations.

4.2 SULFATE TEST RESULTS

Sulfate contents in the subgrade samples ranged from 406 parts per million (ppm) at B-012 to 4,022 ppm at B-017. Gypsum was not visually evident in any of the subgrade samples. The material at the estimated top of subgrade elevation at B-010 consisted of slag base having a sulfate content of 13,409, which is likely part of a utility trench or undercut and is not representative of the soils within the project. The upper subgrade from B-017 had a sulfate concentration above 3,000 ppm. The risk of sulfate-induced heave becomes significant above 3,000 ppm when calcium-based stabilizers are used. GB1 indicates that chemical stabilization should not be considered if any samples have a sulfate concentration above 5,000 ppm. The results of our sulfate testing are presented in Table 1.

TABLE 1. SULFATE CONCENTRATIONS IN SUBGRADE SAMPLES.

Boring	Sulfate Concentration, ppm
B-001	771
B-002	2,325
B-003	2,846
B-004	788
B-005	1,008
B-006	833
B-007	2,832
B-008	879
B-009	564
B-0010	13,409
B-0011	554
B-0012	406
B-0013	684
B-0014	663
B-0015	663
B-0016	925
B-0017	4,220
B-0018	2,745

4.3 CALIFORNIA BEARING RATIO TEST RESULTS

The results of the CBR testing indicate that the subgrade sample from B-013 had a CBR of 4 and the subgrade sample from locations B-007 and B-009 had a CBR of 1. The results of the CBR testing are shown on the attached data sheets.

5. ANALYSIS AND RECOMMENDATIONS

5.1 GB1 SUBGRADE ANALYSIS

The ODOT GB1 spreadsheet analysis, based on field and laboratory testing, indicates that about 53% of the project area has unstable soil. This percentage is based on N_{60L} values (lowest N60 value at each boring). Based on the N_{60} value and moisture contents in the upper 1½ feet of the subgrade at each boring, the spreadsheet indicates that 18% of the locations would require stabilization. Soils that are considered unsuitable per GB1 were not encountered.

Table 2 summarizes the project-wide parameters estimated by the GB1 spreadsheet.

TABLE 2. PROJECT-WIDE PARAMETERS PER THE GB1 ANALYSIS.

Project-Wide Average N_{60L} = 13

Project-Wide Average PI = 15

Average Design CBR = 6

It should be noted that the design CBR is an average based on based on the index properties of the soil, and may not be representative of the actual CBR of the subgrade. The CBR results indicated the subgrade from locations B-007 and B-009 have a CBR as low as 1. **Based on these results, and the fact that soils with similar index properties are located within the project, a CBR of 1 should be used for pavement design.**

The GB1 spreadsheet suggests that the project could be divided into seven segments, based on N_{60L} values and GB1's recommendations. Table 3 summarizes the findings and analysis from the GB1 spreadsheet.

TABLE 3. RECOMMENDED DIVISION OF SUBGRADE AREAS BASED ON N_{60L} VALUES.

Segment	Approximate location (Associated Boring Locations)	Approximate Length, ft	Subgrade Soil	Average N_{60L}
1	S.O.M Center Road to Station 73+36 (B-001)	360	A-7-6	9
2	73+36 to 42+95 (B-001 through B-009)	3,041	A-6a	15
3	42+95 to 34+90 (B-010 and B-011)	805	A-1-b, A-4a, A-6a, A-6b, A-7-6	8
5	34+90 to 26+95 (B-012 and B-013)	795	A-6b, A-7-6	9
5	26+95 to 16+92 (B-014 through B-016)	1,003	A-6a, A-6b	17
6	16+92 to 13+70 (B-017)	322	A-2-4, A-6a	9
7	13+70 to Lakeshore Boulevard (B-018)	360	A-6a, A-7-6	15

5.2 SUBGRADE STABILIZATION ALTERNATIVES

The spreadsheet indicates that rubblize and roll, global chemical stabilization, and global stabilization by excavation and replacement are viable options for subgrade improvement. It should be noted that this global recommendation is based on the average of the N_{60L} values from the entire project, and that the conditions at individual boring locations should be considered when specifying a subgrade improvement alternative.

5.2.1 RUBBLIZE AND ROLL

The GB1 spreadsheet lists rubblize and roll as a potential stabilization option. This option is not recommended, as it would be difficult to maintain the existing pavement elevations if the rubblized material is kept in place and overlayed with asphalt. Rubblizing and rolling would not allow the opportunity to shape the subgrade to promote drainage. Further, GB1 states that rubblize and roll should not be completed in a "piecemeal" fashion. Since only 53% of the project requires stabilization, rubblizing and rolling would not be an appropriate alternative.

5.2.2 CEMENT STABILIZATION

The GB1 spreadsheet indicates that global cement stabilization to 12 inches is an option. Deducting the areas around B-0010 and B-0017, where chemical stabilization cannot be performed due to high sulfate contents, about 47% of the project subgrade requires and is suitable for chemical stabilization. This is over the 30% threshold at which ODOT GB1 states that consideration should be given to global subgrade stabilization. The areas around B-010 and B-017 could be chemically stabilized if the material that is high in sulfates is excavated and replaced with material that is compatible with cement stabilization. It should be noted that trench or undercut backfill with high sulfate contents may be present in other locations.

However, cement stabilization is not recommended due to a number of factors that may reduce its cost effectiveness. The possible presence of shallow utilities throughout the project may make chemical stabilization difficult. The depths to utilities would have to be verified and shallow utilities within or near the depth of stabilization would have to be lowered or relocated. Stabilization would likely have to be completed in phases so that traffic and access to residences can be maintained, and so that trucks and busses do not have to traverse the stabilized subgrade during the cure period. These, coupled with the need to undercut areas with high sulfate content material, will likely increase the cost and duration of cement stabilization. There is also a possibility of causing dust complaints from residents and the adjacent schools.

5.2.3 UNDERCUT AND REPLACE

The GB1 spreadsheet indicates that a global excavate and replace would be a viable reconstruction alternative. The spreadsheet specifies a global undercut depth of 12 inches. However, the global recommendations are based on average N_{60L} values, and the spreadsheet indicates that undercut depths should vary depending on the location. Undercutting would be required at 6 of the 18 boring locations. However, due to the presence of elevated moisture contents at many locations, the spreadsheet suggests that there could be other localized areas with unstable subgrade that may require undercutting and replacement.

Spot stabilization with excavation and replacement of unstable soil would be a more practical approach than global excavation and replacement. The entire project should be proofrolled to identify areas that require subgrade improvement. Unstable areas should be undercut and replaced with suitable material, or scarified, dried and re-compacted. Based on the results of the SPT borings and laboratory tests, areas where unstable soil, requiring subgrade treatment may be grouped by segment.

Table 4 Summarizes the recommended undercut locations and depths shown on the GB1 spreadsheet, grouped by project segment.

TABLE 4: RECOMMENDED SUBGRADE IMPROVEMENTS BASED ON GB1 ANALYSIS

Segment	Start and End Stations	Condition	Depth of Cut	Stabilization Method
1	S.O.M Center Road to Station 73+36 (B-001)	Unstable Subgrade	12 inches	Geotextile at bottom of cut
2	73+36 to 42+95 (B-001 through B-009)	Stable Subgrade	None	None
3	42+95 to 34+90 (B-010 and B-011)	Stable Subgrade	None	None
4	34+90 to 26+95 (B-012 and B-013)	Unstable Subgrade	12 inches	Geotextile at bottom of cut
5	26+95 to 16+92 (B-014 through B-016)	Stable Subgrade	None	None
6	16+92 to 13+70 (B-017)	Unstable Subgrade	12 inches	Geotextile at bottom of cut
7	13+70 to Lakeshore Boulevard (B-018)	Stable Subgrade	None	None

The N_{60L} value and moisture contents at B-001 indicate that stabilization is required in Segment 1. GB1 would require excavating to 12 inches, lining with geotextile, and replacing with ODOT 204 Type D granular material.

The N_{60L} values at B-002 through B-009 indicate that no stabilization is required in Segment 2. However, the presence of soil with moisture contents that are 3 percent or more above optimum moisture at some locations within the segment suggests that there could be areas with unstable subgrade that would need improvement. The subgrade in Segment 2 should be proofrolled to further evaluate the subgrade and identify any areas that may require improvement. Unstable areas should either be scarified, dried and re-compacted, or undercut and replaced.

The GB1 spreadsheet does not recommend stabilization in Segment 3. Although the N_{60L} values and moisture contents would suggest that stabilization is required. Stabilization is not required due to the presence of A-1-b material in the upper layer of B-010 and the higher blow counts in the upper layer of B-011. Nonetheless, subgrade in Segment 3 should be proofrolled to further evaluate the subgrade and identify any areas that may require improvement. Unstable areas should either be scarified, dried and re-compacted, or undercut and replaced

The N_{60} values and moisture contents at B-012 and B-013 indicate that stabilization is required in Segment 4. The GB1 spreadsheet recommends a 12 inch undercut and lining the undercut with geotextile.

The GB1 spreadsheet does not recommend subgrade improvements in Segment 6, which includes locations B-014 through B-016. The spreadsheet does indicate that the moisture contents of the upper 1½ feet of subgrade at locations B-015 and B-016 are 3 percent or more above the estimated optimum

moisture for those soils. The presence of the higher moisture contents suggests that there may be isolated areas of instability, which may require subgrade improvement. The subgrade in Segment 5 should be proofrolled to further evaluate the subgrade and identify any areas that may require scarifying, air drying, and re-compaction, or localized undercut and replacement.

GB1 indicates that the subgrade in Segment 6, which includes B-017, requires stabilization. The GB1 spreadsheet recommends a 12 inch undercut, lined with geotextile.

Based on the N_{60} values at B-018, GB1 does not recommend stabilization in Segment 7. However, unstable areas may be present in this segment, therefore, the subgrade in this segment should be proofrolled to further evaluate the subgrade and identify any areas that may require improvement.

We recommend that contingency quantities be included to address areas of instability in the segments where undercuts are not specified by GB1. Enough contingency funding should be set aside to undercut and replace the subgrade in about 15% of the area in segments where the GB1 spreadsheet does not specify stabilization.

Proofrolling should be completed in accordance with ODOT Item 204.06. Unsuitable materials such as silty soils, organic soils, tree roots, unsuitable fill, and other undesirable materials, if encountered, should be undercut and replaced. All excavations should be backfilled in accordance with ODOT Item 204, Granular Material Type B, with the modifications indicated below. Materials acceptable under Item 204 are specified in Section 703.16 of the ODOT Construction and Material Specifications. We recommend using a free draining crushed limestone that is often marketed as 'Modified #304", as discussed in Section 5.3 of this report. Slag, slag products, recycled concrete, and shale which are allowed by ODOT 703.16 should not be used. All fill should be clean material free of organic or other contamination. The plan documents should include ODOT Plan Note G122, which lists specifications for subgrade compaction and proofrolling.

Geogrid should be furnished and placed in conformance with ODOT Supplemental Specification 861. Geotextile should conform to the specifications in Item 712.09, Type D (Subgrade-Base Separation or Stabilization) and should be placed in accordance with Item 204. Consideration should be given to lining the undercuts with geogrid instead of geotextile, as geogrid is a more effective stabilization method.

Areas with instability in the upper 12 inches may be scarified, dried and re-compacted, provided that the existing subgrade consists of suitable material. The subgrade should be compacted in accordance with ODOT Item 204.03.

Positive drainage should be provided to all undercuts and consideration should be given to installing drains throughout the project. For the drains to function properly, it is necessary for the aggregate base course to be free draining.

Adjustments to the areas where we recommend stabilization may be required due to varying field conditions. We recommend that a senior engineering technician from our firm be on-site to observe proofrolling, to verify that all unstable material is undercut, that geotextile and/or geogrid is properly placed, and to test compaction of the backfill.

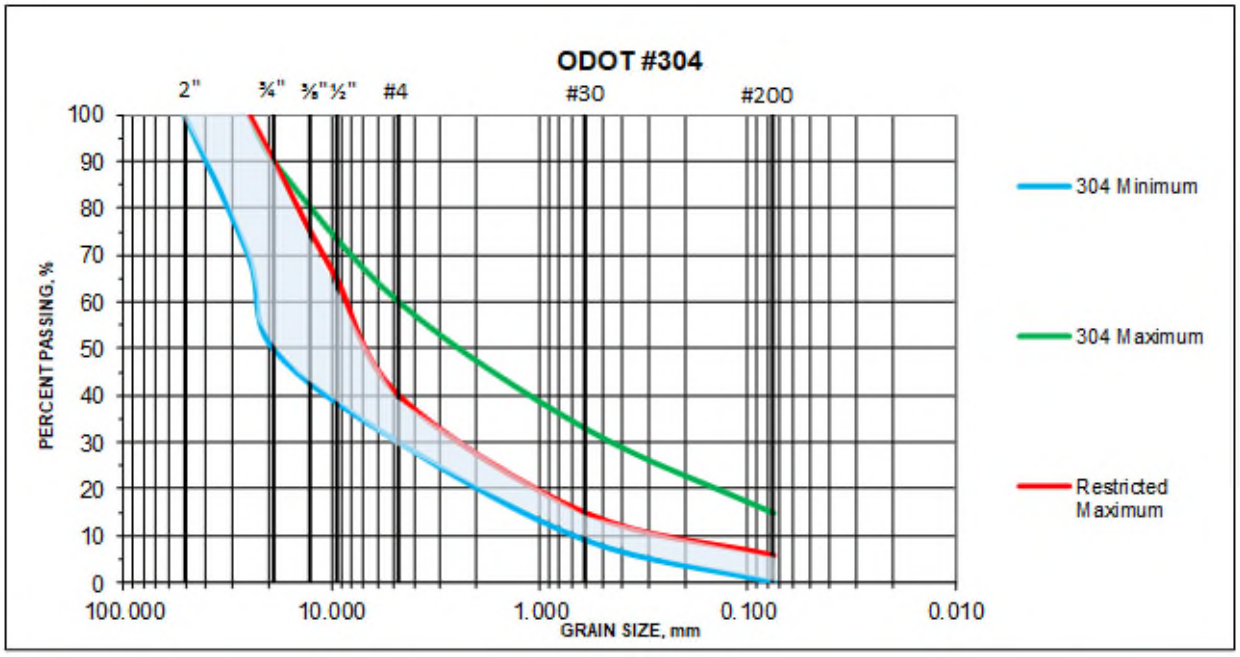
5.3 AGGREGATE BASE MATERIAL RECOMMENDATIONS

For improved subsurface drainage, it is necessary for the aggregate base beneath the pavements to be free draining. This is not the case with virtually all of the locally available ODOT item #304 crushed aggregate because of the high percentages of fine size particles allowed by the specification. We recommend that a restricted blend of 304 base material be used which is marketed as "modified 304" in order to provide the required permeability. The final blend used will fall within the broader ODOT #304 specification but restricts or limits the sizes used to produce a more drainable 304. The gradation of the base used should fall between the "Restricted Maximum" and the standard "304 Minimum" as shown in

Table 5 and the following graph. Before any pavement base materials are delivered to the jobsite, they should be sampled at the source and the material approved in advance by the geotechnical engineer.

Table 5: Restricted ODOT #304 Crushed Aggregate Base

SIEVE	SIZE, mm	ODOT ITEM #304 SPECIFICATION		RESTRICTED ODOT ITEM #304 MAX
		MIN	MAX	
2”	50.80	100	--	--
1”	25.00	70	100	**100**
¾”	19.00	50	90	**90**
½”	12.70	--	--	**75**
3/8”	9.50	--	--	**65**
No. 4	4.75	30	60	**40**
No. 30	0.60	9	33	**15**
No. 200	0.075	0	15	**6.0**



6. CLOSING COMMENTS

BASIS OF THE GEOTECHNICAL REPORT

This report has been prepared in accordance with generally accepted geotechnical engineering practices to assist in the design of this project. If the project plans, design criteria, and other project information referenced in this report and utilized by SME to prepare our recommendations are changed, the conclusions and recommendations contained in this report are not considered valid unless the changes are reviewed, and the conclusions and recommendations of this report are modified or approved in writing by SME.

The discussions and recommendations submitted in this report are based on the available project information described in this report, and the geotechnical data obtained from the field exploration at the locations indicated in the report. Variations in the soil and groundwater conditions commonly occur between or away from sampling locations. The nature and extent of the variations may not become

evident until the time of construction. If significant variations are observed during construction, SME should be contacted to reevaluate the recommendations of this report. This exploration was not intended to identify hazardous waste or other hazardous materials and its results should not be used to surmise the presence or absence of subsurface contamination

Report Prepared by:

Shawn H. Smith, PE
Staff Engineer

Report Reviewed by:

John E. Dingeldein, PE
Principal Consultant

APPENDIX A

ODOT GB1 SPREADSHEET
LABORATORY TEST DATA SHEETS
BORING LOGS
CORE PHOTO LOGS
BORING LOG TERMINOLOGY

OHIO DEPARTMENT OF TRANSPORTATION

OFFICE OF GEOTECHNICAL ENGINEERING

PLAN SUBGRADES
Geotechnical Bulletin GB1

LAK - Stevens Boulevard

Stevens Boulevard from S.O.M. Center Road to Lakeshore Boulevard, Eastlake, Ohio

SME

Prepared By: Shawn Smith, PE
Date prepared: 3/28/2019

Shawn Smith, PE
SME
9375 Chillicothe Road
Kirtland, Ohio 44094
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NO. OF BORINGS: 18

#	Boring ID	Alignment	Station	Offset	Dir	Drill Rig	ER	Boring EL.	Proposed Subgrade EL	Cut Fill
1	B-001	Mainline	75+26	8	Left	293-CME 55 Truck	81	624.2	623.1	1.1 C
2	B-002	Mainline	71+45	10	Right	293-CME 55 Truck	81	624.9	623.9	1.0 C
3	B-003	Mainline	66+96	7	Left	293-CME 55 Truck	81	624.7	623.4	1.3 C
4	B-004	Mainline	63+41	8	Right	293-CME 55 Truck	81	623.7	622.7	1.0 C
5	B-005	Mainline	59+27	8	Left	293-CME 55 Truck	81	623.2	622.0	1.2 C
6	B-006	Mainline	55+12	7	Right	293-CME 55 Truck	81	621.2	620.2	1.0 C
7	B-007	Mainline	51+10	9	Left	293-CME 55 Truck	81	621.0	619.6	1.4 C
8	B-008	Mainline	47+44	7	Left	293-CME 55 Truck	81	620.6	619.3	1.3 C
9	B-009	Mainline	44+93	6	Left	293-CME 55 Truck	81	619.4	618.0	1.4 C
10	B-010	Mainline	40+97	6	Right	293-CME 55 Truck	81	618.3	617.0	1.3 C
11	B-011	Mainline	36+67	7	Left	293-CME 55 Truck	81	618.9	617.8	1.1 C
12	B-012	Mainline	33+13	10	Right	293-CME 55 Truck	81	618.5	617.2	1.3 C
13	B-013	Mainline	28+84	11	Left	293-CME 55 Truck	81	619.5	618.2	1.3 C
14	B-014	Mainline	25+50	8	Right	293-CME 55 Truck	81	620.1	618.5	1.6 C
15	B-015	Mainline	20+92	8	Left	293-CME 55 Truck	81	616.8	615.4	1.4 C
16	B-016	Mainline	18+59	8	Left	293-CME 55 Truck	81	615.8	614.7	1.1 C
17	B-017	Mainline	15+25	8	Right	293-CME 55 Truck	81	615.2	613.9	1.3 C
18	B-018	Mainline	12+16	9	Left	293-CME 55 Truck	81	614.1	612.8	1.3 C

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.2 1/23/2018

#	Boring	Sample	Sample Depth		Subgrade Depth		Standard Penetration		HP (tsf)	Physical Characteristics						Moisture		Ohio DOT		Sulfate Content (ppm)	Problem		Excavate and Replace (Item 204)		Recommendation
			From	To	From	To	N_{60}	N_{60L}		LL	PL	PI	% Silt	% Clay	P200	M_C	M_{OPT}	Class	GI		Unsuitable	Unstable	Unsuitable	Unstable	
1	B	SB1	1.1	2.6	0.0	1.5	9		3	44	23	21	32.8	49.9	82.7	23	20	A-7-6	13	711		N_{60} & Mc		12"	Geotextile Option:
	001	SB2	2.6	3.1	1.5	2.0	11		3.5							18	18	A-7-6	16			N_{60}			12"
		SB3	3.1	5.6	2.0	4.5	11		1	41	21	20	38.4	48.9	87.3	28	18	A-7-6	12						
		SB4	5.6	6.1	4.5	5.0	19	9	4.5							16	18	A-7-6	16						
2	B	SB1	1.0	2.5	0.0	1.5	15		3.5	35	20	15	37.7	44.1	81.8	18	15	A-6a	10	2325		Mc			
	002	SB2	2.5	4.0	1.5	3.0	15		4	32	20	12	39.9	39.6	79.5	18	15	A-6a	9			Mc			
		SB3	4.0	5.5	3.0	4.5	23		4.5							19	14	A-6a	10						
		SB4	5.5	7.0	4.5	6.0	28	15	4							18	14	A-6a	10						
3	B	SB1	1.3	2.9	0.0	1.6	14		18	35	21	14	36.2	47.1	83.3	18	16	A-6a	10	2846					
	003	SB2	2.9	4.4	1.6	3.1	15		17	32	20	12	34.9	40.1	75	17	15	A-6a	9						
		SB3	4.4	5.9	3.1	4.6	12		18							18	14	A-6a	10						
		SB4	5.9	7.4	4.6	6.1	14	12	17							17	14	A-6a	10						
4	B	SB1	1.2	2.7	0.2	1.7	16		4.5	35	21	14	37.7	44.2	81.9	17	16	A-6a	10	788					
	004	SB2	2.7	4.2	1.7	3.2	19		4.5	31	19	12	39.2	40.7	79.9	18	14	A-6a	9			Mc			
		SB3	4.2	5.7	3.2	4.7	22		4.5							17	14	A-6a	10						
		SB4	5.7	7.2	4.7	6.2	32	16	4.5							17	14	A-6a	10						
5	B	SB1	1.2	2.7	0.0	1.5	18		4	34	20	14	36.3	42.8	79.1	16	15	A-6a	10	1008					
	005	SB2	2.7	4.2	1.5	3.0	22		4.5							18	14	A-6a	10			Mc			
		SB3	4.2	5.7	3.0	4.5	24		4.5	33	20	13	38.5	38.9	77.4	18	15	A-6a	9						
		SB4	5.7	7.2	4.5	6.0	41	18	4.5							17	14	A-6a	10						
6	B	SB1	1.0	2.5	0.0	1.5	16		4.5	34	21	13	35.8	44.4	80.2	17	16	A-6a	9	833					
	006	SB2	2.5	4.0	1.5	3.0	22		4.5	33	21	12	33.9	41.3	75.2	18	16	A-6a	9						
		SB3	4.0	5.5	3.0	4.5	24		4.5							17	14	A-6a	10						
		SB4	5.5	7.0	4.5	6.0	32	16	4.5							18	14	A-6a	10						
7	B	SB1	1.4	2.9	0.0	1.5	24		4.5	33	19	14	35.2	45.8	81	16	14	A-6a	10	2832					
	007	SB2	2.9	4.4	1.5	3.0	23		4.5	33	21	12	33.3	41.7	75	18	16	A-6a	9						
		SB3	4.4	5.9	3.0	4.5	24		4.5							18	14	A-6a	10						
		SB4	5.9	7.4	4.5	6.0	19	19	4.5							16	14	A-6a	10						
8	B	SB1	1.3	2.8	0.0	1.5	14		4	37	21	16	34.4	46.3	80.7	18	16	A-6b	10	879					
	008	SB2	2.8	4.3	1.5	3.0	15		4.5							17	14	A-6a	10			Mc			
		SB3	4.3	5.8	3.0	4.5	19		4.5							17	14	A-6a	10						
		SB4	5.8	7.3	4.5	6.0	22	14	4.5	34	20	14	36.1	42.2	78.3	17	15	A-6a	10						
9	B	SB1	1.4	2.9	0.0	1.5	19		4.5	34	20	14	35	46.2	81.2	17	15	A-6a	10	564					
	009	SB2	2.9	4.4	1.5	3.0	18		4.5	33	20	13	36.5	43.7	80.2	18	15	A-6a	9			Mc			
		SB3	4.4	5.9	3.0	4.5	12		4.5							17	14	A-6a	10						
		SB4	5.9	7.4	4.5	6.0	19	12	4.5							18	14	A-6a	10						

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.2 1/23/2018

#	Boring	Sample	Sample Depth		Subgrade Depth		Standard Penetration		HP (tsf)	Physical Characteristics						Moisture		Ohio DOT		Sulfate Content (ppm)	Problem		Excavate and Replace (Item 204)		Recommendation
			From	To	From	To	N_{60}	N_{60L}		LL	PL	PI	% Silt	% Clay	P200	M_C	M_{OPT}	Class	GI		Unsuitable	Unstable	Unsuitable	Unstable	
10	B	SB1	1.3	2.8	0.0	1.5	12		-							12	6	A-1-b	0	13409					
	010	SB2	2.8	4.3	1.5	3.0	8		1.5	28	17	11	37.4	33.7	71.1	20	14	A-6a	8			HP & Mc			
		SB3	4.3	5.8	3.0	4.5	14		3.5	26	17	9	39.4	30.1	69.5	16	12	A-4a	7						
		SB4	5.8	7.3	4.5	6.0	16	8	4.5							17	10	A-4a	8						
11	B	SB1	1.1	2.6	0.0	1.5	16		3	44	21	23	32.8	51.3	84.1	22	18	A-7-6	14	554		Mc			
	011	SB2	2.6	4.1	1.5	3.0	12		2.5							20	18	A-7-6	16						
		SB3	4.1	5.6	3.0	4.5	9		2.5	37	19	18	33.4	45.7	79.1	23	16	A-6b	11						
		SB4	5.6	7.1	4.5	6.0	14	9	4.5							18	16	A-6b	16						
12	B	SB1	1.3	2.8	0.0	1.5	11		2.5	40	20	20	36.3	45.8	82.1	19	16	A-6b	12	406		N_{60} & Mc		12"	Geotextile Option:
	012	SB2	2.8	4.3	1.5	3.0	9		1.5	39	21	18	34.8	52.6	87.4	24	16	A-6b	11			HP & Mc			12"
		SB3	4.3	5.8	3.0	4.5	11		2							23	16	A-6b	16						
		SB4	5.8	7.3	4.5	6.0	14	9	4.5							18	16	A-6b	16						
13	B	SB1	1.3	2.8	0.0	1.5	14		4	49	23	26	28.7	55.8	84.5	25	20	A-7-6	16	684		N_{60} & Mc		12"	Geotextile Option:
	013	SB2	2.8	4.3	1.5	3.0	11		2.5	41	21	20	36.6	52.6	89.2	24	18	A-7-6	12			N_{60} & Mc			12"
		SB3	4.3	5.8	3.0	4.5	12		2.75							24	18	A-7-6	16						
		SB4	5.8	7.3	4.5	6.0	9	9	4							20	18	A-7-6	16						
14	B	SB1	1.6	3.1	0.0	1.5	16		3.5	37	20	17	34.9	51.1	86	14	16	A-6b	11	663					
	014	SB2	3.1	4.6	1.5	3.0	18		3.5	28	17	11	29.2	27.3	56.5	10	14	A-6a	5						
		SB3	4.6	6.1	3.0	4.5	24		4.5							13	14	A-6a	10						
		SB4	6.1	7.6	4.5	6.0	23	16	4.5							15	14	A-6a	10						
15	B	SB1	1.4	2.9	0.0	1.5	18		4.5	37	21	16	35	46.1	81.1	20	16	A-6b	10	663		Mc			
	015	SB2	2.9	4.4	1.5	3.0	18		4.5							18	16	A-6b	16						
		SB3	4.4	5.9	3.0	4.5	20		4	36	19	17	29.1	35.8	64.9	18	16	A-6b	9						
		SB4	5.9	7.4	4.5	6.0	23	18	3.5							17	14	A-6a	10						
16	B	SB1	1.1	2.6	0.0	1.5	16		4	39	22	17	35.3	49.8	85.1	20	17	A-6b	11	925		Mc			
	016	SB2	2.6	3.1	1.5	2.0	16		4.5	39	21	18	36.1	44.3	80.4	17	16	A-6b	11						
		SB3	3.1	5.6	2.0	4.5	16		3							17	14	A-6a	10						
		SB4	5.6	6.1	4.5	5.0	16	16	3.5							16	14	A-6a	10						
17	B	SB1	1.3	2.8	0.0	1.5	9		-	23	16	7	9	4	13	5	10	A-2-4	0	4220		N_{60}		12"	Geotextile Option:
	017	SB2	2.8	4.3	1.5	3.0	14		4.5							18	10	A-2-4	0			N_{60} & Mc			12"
		SB3	4.3	5.8	3.0	4.5	19		4.5	31	19	12	38.3	40.6	78.9	16	14	A-6a	9						
		SB4	5.8	7.3	4.5	6.0	16	9	4.5							8	14	A-6a	10						
18	B	SB1	1.3	2.8	0.0	1.5	18		2.25	42	22	20	39	33.7	72.7	23	19	A-7-6	12			Mc			
	018	SB2	2.8	4.3	1.5	3.0	15									5	6	A-1-b	0						
		SB3	4.3	5.8	3.0	4.5	19		4.5	30	19	11	38.5	39.1	77.6	17	14	A-6a	8						
		SB4	5.8	7.3	4.5	6.0	23	15	4.5							17	14	A-6a	10						

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.2 1/23/2018

PID:

County-Route-Section: LAK - Stevens Boulevard
No. of Borings: 18

Geotechnical Consultant: SME
Prepared By: Shawn Smith, PE
Date prepared: 3/28/2019

Chemical Stabilization Options		
320	Rubblize & Roll	Option
206	Cement Stabilization	Option
	Lime Stabilization	No
206	Depth	12"

Excavate and Replace Stabilization Options	
Global Geotextile Override(N60L):	12"
Override(HP):	12"
Global Geogrid Override(N60L):	0"
Override(HP):	0"

Design CBR	6

% Samples within 6 feet of subgrade			
$N_{60} \leq 5$	0%	HP ≤ 0.5	0%
$N_{60} < 12$	15%	0.5 < HP ≤ 1	1%
$12 \leq N_{60} < 15$	18%	1 < HP ≤ 2	4%
$N_{60} \geq 20$	26%	HP > 2	90%
M+	24%		
Rock	0%		
Unsuitable	0%		

Excavate and Replace at Surface	
Average	12"
Maximum	12"
Minimum	12"

% Proposed Subgrade Surface	
Unstable & Unsuitable	50%
Unstable	50%
Unsuitable	0%

	N_{60}	N_{60L}	HP	LL	PL	PI	Silt	Clay	P 200	M_C	M_{OPT}	GI
Average	17	13	4.68	35	20	15	35	42	77	18	15	10
Maximum	41	19	18.00	49	23	26	40	56	89	28	20	16
Minimum	8	8	1.00	23	16	7	9	4	13	5	6	0

Classification Counts by Sample

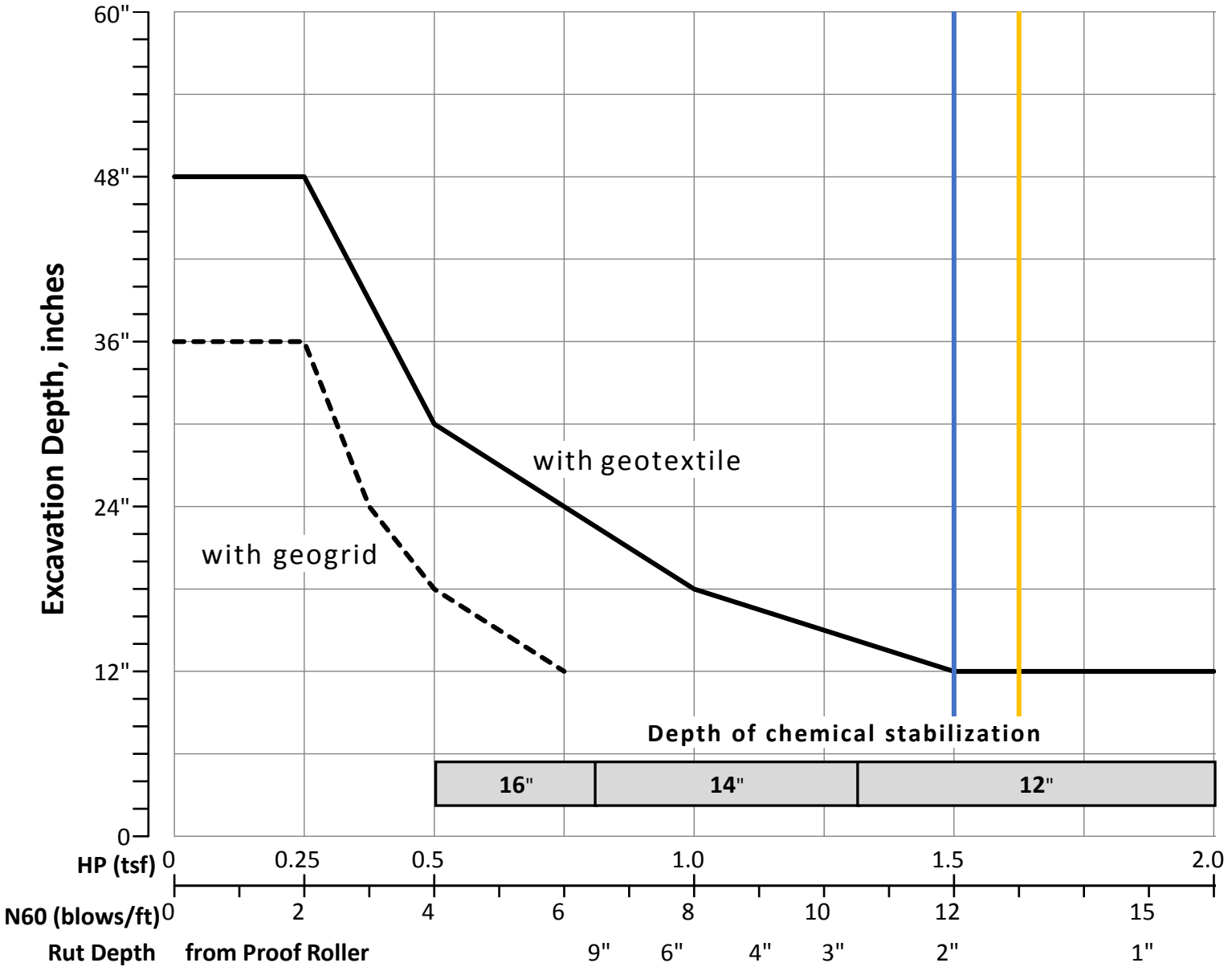
ODOT Class	Rock	A-1-a	A-1-b	A-2-4	A-2-5	A-2-6	A-2-7	A-3	A-3a	A-4a	A-4b	A-5	A-6a	A-6b	A-7-5	A-7-6	A-8a	A-8b	Totals
Count	0	0	2	2	0	0	0	0	0	2	0	0	42	13	0	11	0	0	72
Percent	0%	0%	3%	3%	0%	0%	0%	0%	0%	3%	0%	0%	58%	18%	0%	15%	0%	0%	100%
% Rock|Cohesive|Granular	0%	8%									92%								100%
Surface Class Count	0	0	2	2	0	0	0	0	0	0	0	0	18	8	0	8	0	0	38
Surface Class Percent	0%	0%	5%	5%	0%	0%	0%	0%	0%	0%	0%	0%	47%	21%	0%	21%	0%	0%	100%

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.2 1/23/2018

GB1 Figure B – Subgrade Stabilization



OVERRIDE TABLE

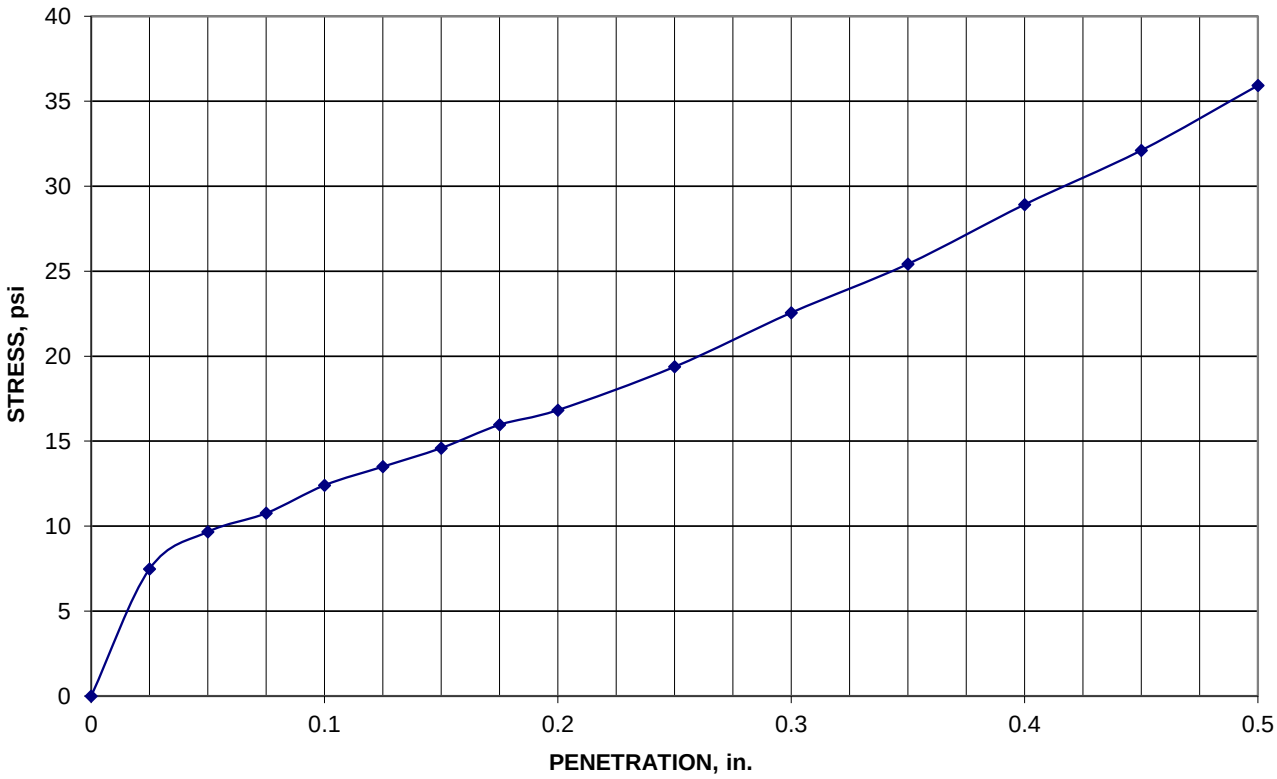
Calculated Average	New Values	Check to Override
4.68	1.50	☑ HP
13.33	13.00	☑ N60L

Average HP

Average N_{60L}

CALIFORNIA BEARING RATIO
ASTM D1883

PROJECT INFORMATION		SAMPLE INFORMATION	
Project:	LAK- Stevens Blvd	***Sample Description:***	Brown SILT and CLAY, Little Sand, Trace Gravel (A-6a)
Location:	Eastlake, Ohio		
Project #:	080888.00	***Sample #:***	Composite sample
Date:	3/22/2019	***Sample Location:***	B-007-0-19 and B-009-0-19; 0 - 3 feet



SAMPLE SET UP
Compaction method used: ASTM D698
Conditioning: Soaked
Surcharge mass (lbs): 10
Soaking period: 96 hours

CBR RESULTS
CBR value 0.1 in: 1.2
CBR value 0.2 in: 1.1
Swell (%): 3.89
Offset: ---

MOISTURE CONTENTS (%)
As compacted: 13.8
Top 1-inch, after soak: 22.3
Total sample, after soak: 17.6

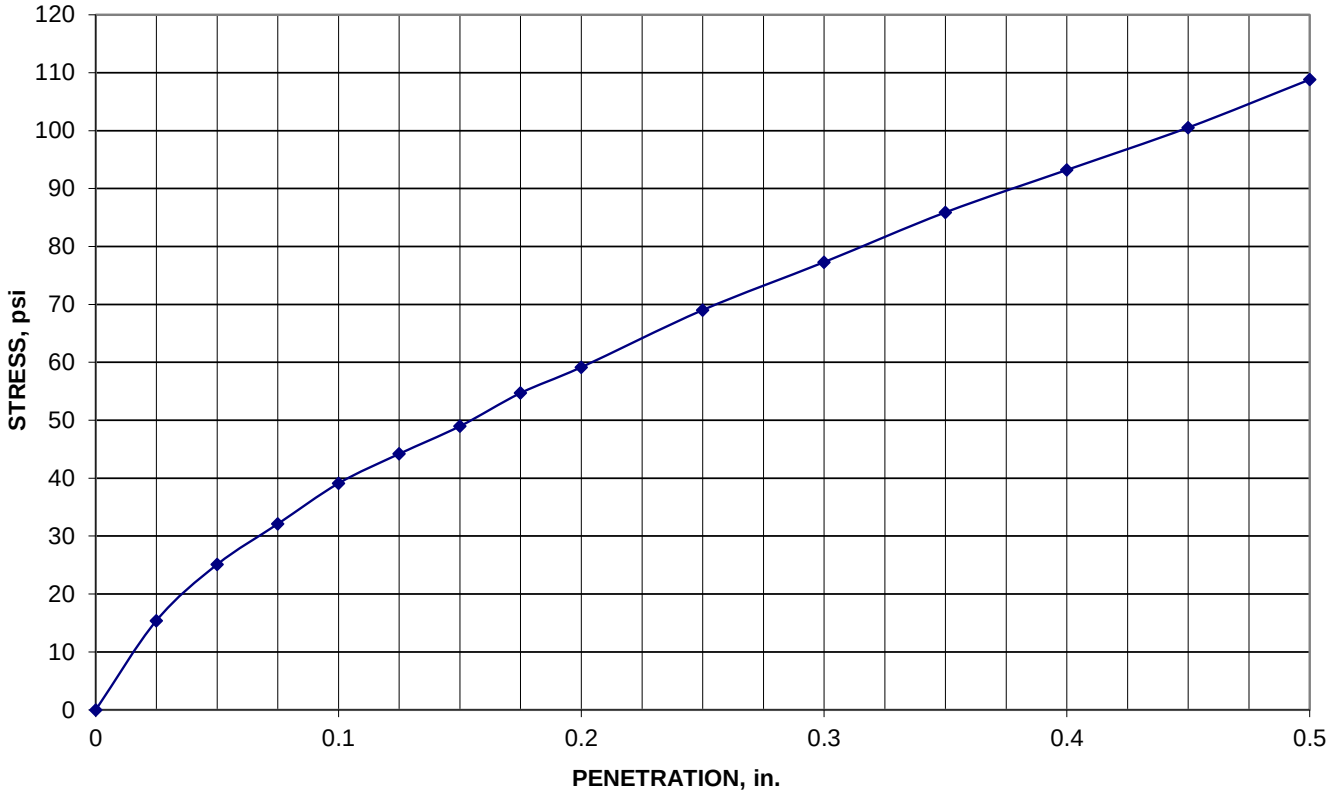
DRY DENSITIES (PCF)
As compacted: 113.6
After soak: 109.9

REMARKS:
Optimum density obtained by running a one-point proctor test and compared to the "ODOT Typical Moisture Density Curves" g
Material follows Curve "L": 114.6 PCF dry density at 14.6% optimum moisture content.

LAB-12 (12)

CALIFORNIA BEARING RATIO
ASTM D1883

PROJECT INFORMATION		SAMPLE INFORMATION	
Project:	LAK- Stevens Blvd	***Sample Description:***	Brown CLAY, Little Silt, Little Sand, Trace Gravel (A-7-6)
Location:	Eastlake, Ohio		
Project #:	080888.00	***Sample #:***	Bulk
Date:	3/22/2019	***Sample Location:***	B-013-0-19; 0 - 3 feet



SAMPLE SET UP

Compaction method used: ASTM D698
Conditioning: Soaked
Surcharge mass (lbs): 10
Soaking period: 96 hours

MOISTURE CONTENTS (%)

As compacted: 19.1
Top 1-inch, after soak: 22.0
Total sample, after soak: 19.6

CBR RESULTS

CBR value 0.1 in: 3.9
CBR value 0.2 in: 3.9
Swell (%): 1.33
Offset: ---

DRY DENSITIES (PCF)

As compacted: 109.4
After soak: 108.9

REMARKS:
Optimum density obtained by running a one-point proctor test and compared to the "ODOT Typical Moisture Density Curves" gra
Material follows Curve "N": 109.6 PCF dry density at 16.9% optimum moisture content.

LAB-12 (12)

PROJECT: LAK-STEVENS BLVD.-	DRILLING FIRM / OPERATOR: SME / RH/DL	DRILL RIG: CME 55 TRUCK 293	STATION / OFFSET: 75+26, 8' LT.
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: SME / JF	HAMMER: CME AUTOMATIC	ALIGNMENT: CL CONSTRUCTION
PID: SFN:	DRILLING METHOD: 4" SSA	CALIBRATION DATE: N/A	ELEVATION: 624.2 (MSL) EOB: 7.42 ft.
START: 2/18/19 END: 2/18/19	SAMPLING METHOD: SPT	ENERGY RATIO (%): 81	LAT / LONG: 41.649153, -81.438641

EXPLORATION ID B-001-0-19

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 624.2	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
3.5" ASPHALT, 4" CONCRETE, AND 9.5" COARSE TO FINE SLAG BASE (DRILLERS DESCRIPTION)	622.8																		
STIFF TO VERY STIFF, BROWN, **CLAY**, SOME SILT, LITTLE SAND, TRACE GRAVEL, DAMP TO MOIST		1																	
		2	3 3 4	9	89	SS-1	3.00	2	5	10	33	50	44	23	21	23	A-7-6 (13)	710	
		3	4 4 4	11	100	SS-2	3.50	2	2	9	38	49	41	21	20	18	A-7-6 (12)	-	
		4																	
		5	3 4 4	11	100	SS-3	1.00	-	-	-	-	-	-	-	-	28	A-7-6 (V)	-	
		6																	
	616.8	7	3 6 8	19	100	SS-4	4.50	-	-	-	-	-	-	-	-	16	A-7-6 (V)	-	
		EOB																	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: ASPHALT PATCH; AUGER CUTTINGS MIXED WITH BENTONITE CHIPS

PROJECT: LAK-STEVENS BLVD.-	DRILLING FIRM / OPERATOR: SME / RH/DL	DRILL RIG: CME 55 TRUCK 293	STATION / OFFSET: 71+45, 10' RT.
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: SME / JF	HAMMER: CME AUTOMATIC	ALIGNMENT: CL CONSTRUCTION
PID: SFN:	DRILLING METHOD: 4" SSA	CALIBRATION DATE: N/A	ELEVATION: 624.9 (MSL) EOB: 7.33 ft.
START: 2/18/19 END: 2/18/19	SAMPLING METHOD: SPT	ENERGY RATIO (%): 81	LAT / LONG: 41.649350, -81.440013

EXPLORATION ID B-002-0-19

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 624.9	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
2" ASPHALT, 7.25" CONCRETE, AND 4.75" COARSE TO FINE SLAG BASE (DRILLERS DESCRIPTION)	623.6	1																	
VERY STIFF, BROWN, **SILT AND CLAY**, LITTLE SAND, TRACE GRAVEL, DAMP		2	3 5 6	15	100	SS-1	3.50	4	5	9	19	63	35	20	15	18	A-6a (10)	2300	
		3	3 5 6	15	100	SS-2	4.00	5	5	10	19	61	32	20	12	18	A-6a (9)	-	
		4 5	8 8 9	23	100	SS-3	4.50	-	-	-	-	-	-	-	-	19	A-6a (V)	-	
	617.6	6 7 EOB	8 9 12	28	100	SS-4	4.00	-	-	-	-	-	-	-	-	18	A-6a (V)	-	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: ASPHALT PATCH; AUGER CUTTINGS MIXED WITH BENTONITE CHIPS

PROJECT: LAK-STEVENS BLVD.-	DRILLING FIRM / OPERATOR: SME / RH/DL	DRILL RIG: CME 55 TRUCK 293	STATION / OFFSET: 66+96, 7' LT.
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: SME / JF	HAMMER: CME AUTOMATIC	ALIGNMENT: CL CONSTRUCTION
PID: SFN:	DRILLING METHOD: 4" SSA	CALIBRATION DATE: N/A	ELEVATION: 624.7 (MSL) EOB: 7.42 ft.
START: 2/18/19 END: 2/18/19	SAMPLING METHOD: SPT	ENERGY RATIO (%): 81	LAT / LONG: 41.649681, -81.441597

EXPLORATION ID B-003-0-19

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 624.7	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
1.5" ASPHALT, 8" CONCRETE, AND 7.5" COARSE TO FINE SLAG BASE (DRILLERS DESCRIPTION)	623.2	1																	
HARD, BROWN, **SILT AND CLAY**, LITTLE SAND, TRACE GRAVEL, DAMP		2	3 4 6	14	67	SS-1	4.50	3	5	9	18	65	35	21	14	18	A-6a (10)	2800	
		3	5 5 6	15	100	SS-2	4.50	9	6	10	19	56	32	20	12	17	A-6a (9)	-	
		4																	
		5	3 4 5	12	100	SS-3	4.00	-	-	-	-	-	-	-	-	18	A-6a (V)	-	
		6	5 5 5	14	100	SS-4	4.50	-	-	-	-	-	-	-	-	17	A-6a (V)	-	
	617.2	7 EOB																	

NOTES: BORING CAVED AT 7.4 FT.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: ASPHALT PATCH; AUGER CUTTINGS MIXED WITH BENTONITE CHIPS

PROJECT: LAK-STEVENS BLVD.-	DRILLING FIRM / OPERATOR: SME / RH/DL	DRILL RIG: CME 55 TRUCK 293	STATION / OFFSET: 63+41, 8' RT.	EXPLORATION ID B-004-0-19
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: SME / JF	HAMMER: CME AUTOMATIC	ALIGNMENT: CL CONSTRUCTION	
PID: SFN:	DRILLING METHOD: 4" SSA	CALIBRATION DATE: N/A	ELEVATION: 623.7 (MSL) EOB: 7.17 ft.	PAGE 1 OF 1
START: 2/18/19 END: 2/18/19	SAMPLING METHOD: SPT	ENERGY RATIO (%): 81	LAT / LONG: 41.649867, -81.442870	

MATERIAL DESCRIPTION AND NOTES	ELEV. 623.7	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
1.5" ASPHALT, 7.5" CONCRETE, AND 5" OF COARSE TO FINE SLAG BASE (DRILLERS DESCRIPTION)	622.6																		
HARD, BROWN, **SILT AND CLAY**, LITTLE SAND, AND TRACE GRAVEL, DAMP		1	3 5 7	16	100	SS-1	4.50	5	5	10	19	61	35	21	14	17	A-6a (10)	790	
		2	6 7 7	19	100	SS-2	4.50	5	5	10	19	61	31	19	12	18	A-6a (9)	-	
		3	7 7 9	22	100	SS-3	4.50	-	-	-	-	-	-	-	-	17	A-6a (V)	-	
		4	9 12 12	32	100	SS-4	4.50	-	-	-	-	-	-	-	-	17	A-6a (V)	-	
	616.6	5 EOB																	
		6																	
		7																	

NOTES: BORING CAVED AT 7.2 FT.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: ASPHALT PATCH; AUGER CUTTINGS MIXED WITH BENTONITE CHIPS

PROJECT: LAK-STEVENS BLVD.-	DRILLING FIRM / OPERATOR: SME / RH/DL	DRILL RIG: CME 55 TRUCK 293	STATION / OFFSET: 59+27, 8' LT.
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: SME / JF	HAMMER: CME AUTOMATIC	ALIGNMENT: CL CONSTRUCTION
PID: SFN:	DRILLING METHOD: 4" SSA	CALIBRATION DATE: N/A	ELEVATION: 623.2 (MSL) EOB: 7.33 ft.
START: 2/18/19 END: 2/18/19	SAMPLING METHOD: SPT	ENERGY RATIO (%): 81	LAT / LONG: 41.649987, -81.444373

EXPLORATION ID B-005-0-19

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MATERIAL DESCRIPTION AND NOTES	ELEV. 623.2	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
1.25" ASPHALT, 7.5" CONCRETE, AND 7.25" COARSE TO FINE SLAG BASE (DRILLERS DESCRIPTION)	621.8	1																	
HARD, BROWN, **SILT AND CLAY**, LITTE SAND, TRACE GRAVEL, DAMP		2	4 5 8	18	89	SS-1	4.00	5	6	10	13	66	34	20	14	16	A-6a (10)	1000	
		3	6 7 9	22	100	SS-2	4.50	-	-	-	-	-	-	-	-	18	A-6a (V)	-	
		4	6 8 10	24	100	SS-3	4.50	6	6	11	19	58	33	20	13	18	A-6a (9)	-	
		5	11 14 16	41	100	SS-4	4.50	-	-	-	-	-	-	-	-	17	A-6a (V)	-	
	615.8	6 EOB																	
		7																	

NOTES: BORING CAVED AT 7.3 FT.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: ASPHALT PATCH; AUGER CUTTINGS MIXED WITH BENTONITE CHIPS

PROJECT: LAK-STEVENS BLVD.-	DRILLING FIRM / OPERATOR: SME / RH/DL	DRILL RIG: CME 55 TRUCK 293	STATION / OFFSET: 55+12, 7' RT.
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: SME / JF	HAMMER: CME AUTOMATIC	ALIGNMENT: CL CONSTRUCTION
PID: SFN:	DRILLING METHOD: 4" SSA	CALIBRATION DATE: N/A	ELEVATION: 621.2 (MSL) EOB: 7.17 ft.
START: 2/18/19 END: 2/18/19	SAMPLING METHOD: SPT	ENERGY RATIO (%): 81	LAT / LONG: 41.650007, -81.445893

EXPLORATION ID B-006-0-19

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 621.2	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
2 " ASPHALT, 7.5" CONCRETE, AND 4.5" COARSE TO FINE SLAG BASE (DRILLERS DESCRIPTION)	620.0																		
HARD, BROWN, **SILT AND CLAY**, LITTLE SAND, TRACE GRAVEL, DAMP		1	3 6 6	16	100	SS-1	4.50	4	6	10	16	64	34	21	13	17	A-6a (9)	830	
		2	6 6 10	22	100	SS-2	4.50	10	6	9	18	57	33	21	12	18	A-6a (9)	-	
		3	7 10 8	24	100	SS-3	4.50	-	-	-	-	-	-	-	-	17	A-6a (V)	-	
		4	8 12 12	32	33	SS-4	4.50	-	-	-	-	-	-	-	-	18	A-6a (V)	-	
	614.0	5																	
		6																	
		7 EOB																	

NOTES: BORING CAVED AT 7.2 FT.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: ASPHALT PATCH; AUGER CUTTINGS MIXED WITH BENTONITE CHIPS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 4/1/19 15:59 - \\SME-INC\PZ\WIP\080888.00\PROJECT DATA\GINT\LAK-STEVENS.GPJ

PROJECT: LAK-STEVENS BLVD.-	DRILLING FIRM / OPERATOR: SME / RH/DL	DRILL RIG: CME 55 TRUCK 293	STATION / OFFSET: 51+10, 9' LT.
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: SME / JF	HAMMER: CME AUTOMATIC	ALIGNMENT: CL CONSTRUCTION
PID: SFN:	DRILLING METHOD: 4" SSA	CALIBRATION DATE: N/A	ELEVATION: 621.0 (MSL) EOB: 6.69 ft.
START: 2/19/19 END: 2/19/19	SAMPLING METHOD: SPT	ENERGY RATIO (%): 81	LAT / LONG: 41.650109, -81.447357

EXPLORATION ID B-007-0-19

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 621.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
1.75" ASPHALT AND 6.5" CONCRETE (DRILLERS DESCRIPTION)	620.3																		
HARD, BROWN, **SILT AND CLAY**, LITTLE SAND, TRACE TO LITTLE GRAVEL, DAMP		1	4 9 9	24	100	1	4.50	5	5	9	18	63	33	19	14	17	A-6a (10)	2800	
		2																	
		3	6 8 9	23	100	2	4.50	12	8	5	12	63	33	21	12	18	A-6a (9)	-	
		4	6 8 10	24	100	SS-3	4.50	-	-	-	-	-	-	-	-	18	A-6a (V)	-	
		5																	
		6	5 7 7	19	100	SS-4	4.50	-	-	-	-	-	-	-	-	16	A-6a (V)	-	
	614.3	EOB																	

NOTES: BORING CAVED AT 6.7 FT.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: ASPHALT PATCH; AUGER CUTTINGS MIXED WITH BENTONITE CHIPS

PROJECT: LAK-STEVENS BLVD.-	DRILLING FIRM / OPERATOR: SME / RH/DL	DRILL RIG: CME 55 TRUCK 293	STATION / OFFSET: 47+44, 7' LT.
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: SME / JF	HAMMER: CME AUTOMATIC	ALIGNMENT: CL CONSTRUCTION
PID: SFN:	DRILLING METHOD: 4" SSA	CALIBRATION DATE: N/A	ELEVATION: 620.6 (MSL) EOB: 7.29 ft.
START: 2/19/19 END: 2/19/19	SAMPLING METHOD: SPT	ENERGY RATIO (%): 81	LAT / LONG: 41.650156, -81.448695

EXPLORATION ID B-008-0-19

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 620.6	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
7.75" CONCRETE AND 7.75" COARSE TO FINE SLAG BASE (DRILLERS DESCRIPTION)	619.3	1																	
HARD, BROWN, **SILTY CLAY**, LITTLE SAND, TRACE GRAVEL, DAMP	616.3	2	3 4 6	14	94	SS-1	4.00	7	6	9	16	62	37	21	16	18	A-6b (10)	880	
		3	3 5 6	15	33	SS-2	4.50	-	-	-	-	-	-	-	-	17	A-6b (V)	-	
		4																	
HARD, BROWN, **SILT AND CLAY**, LITTLE SAND, TRACE GRAVEL, DAMP		5	5 6 8	19	89	SS-3	4.50	-	-	-	-	-	-	-	-	17	A-6a (V)	-	
	613.3	6	5 7 9	22	100	SS-4	4.50	7	6	9	16	62	34	20	14	17	A-6a (10)	-	
		7 EOB																	

NOTES: BORING CAVED AT 7.3 FT.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: ASPHALT PATCH; AUGER CUTTINGS MIXED WITH BENTONITE CHIPS

PROJECT: LAK-STEVENS BLVD.-	DRILLING FIRM / OPERATOR: SME / RH/DL	DRILL RIG: CME 55 TRUCK 293	STATION / OFFSET: 44+93, 6' LT.
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: SME / JF	HAMMER: CME AUTOMATIC	ALIGNMENT: CL CONSTRUCTION
PID: SFN:	DRILLING METHOD: 4" SSA	CALIBRATION DATE: N/A	ELEVATION: 619.4 (MSL) EOB: 7.42 ft.
START: 2/19/19 END: 2/19/19	SAMPLING METHOD: SPT	ENERGY RATIO (%): 81	LAT / LONG: 41.650560, -81.449053

EXPLORATION ID B-009-0-19

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 619.4	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.5" ASPHALT, 7.5" CONCRETE, AND 9" COARSE TO FINE SLAG BASE (DRILLERS DESCRIPTION)	617.9																		
HARD, BROWN, **SILT AND CLAY**, LITTLE SAND, TRACE GRAVEL, DAMP		2	3 6 8	19	100	SS-1	4.50	5	5	9	17	64	34	20	14	17	A-6a (10)	560	
		3 4	4 6 7	18	50	SS-2	4.50	4	6	10	17	63	33	20	13	18	A-6a (9)	-	
		5	3 4 5	12	89	SS-3	4.50	-	-	-	-	-	-	-	-	17	A-6a (V)	-	
	611.9	7 EOB	6 6 8	19	100	SS-4	4.50	-	-	-	-	-	-	-	-	18	A-6a (V)	-	

NOTES: BORING CAVED AT 7.4 FT.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: ASPHALT PATCH; AUGER CUTTINGS MIXED WITH BENTONITE CHIPS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 4/1/19 15:59 - \\SME-INC\PZ\WIP\080888.00\PROJECT DATA\GINT\LAK-STEVENS.GPJ

PROJECT: LAK-STEVENS BLVD.-	DRILLING FIRM / OPERATOR: SME / RH/DL	DRILL RIG: CME 55 TRUCK 293	STATION / OFFSET: 40+97, 6' RT.	EXPLORATION ID B-010-0-19
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: SME / JF	HAMMER: CME AUTOMATIC	ALIGNMENT: CL CONSTRUCTION	
PID: SFN:	DRILLING METHOD: 4" SSA	CALIBRATION DATE: N/A	ELEVATION: 618.3 (MSL) EOB: 6.54 ft.	PAGE 1 OF 1
START: 2/19/19 END: 2/19/19	SAMPLING METHOD: SPT	ENERGY RATIO (%): 81	LAT / LONG: 41.651648, -81.449113	

MATERIAL DESCRIPTION AND NOTES	ELEV. 618.3	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
3" ASPHALT, 3.5" CONCRETE WITH REBAR (DRILLERS DESCRIPTION)	617.8																		
23.5" COARSE TO FINE SLAG BASE (DRILLERS DESCRIPTION)	615.8	1	7 5 4	12	67	SS-1	-	-	-	-	-	-	-	-	-	12	UCF (V)	>8000	
						SS-2A	-	-	-	-	-	-	-	-	-	-	UCF (V)	-	
STIFF, BROWN, **SILT AND CLAY**, SOME SAND, TRACE GRAVEL, MOIST	614.8	2 3	5 3 3	8	67	SS-2B	1.50	6	6	17	28	43	28	17	11	20	A-6a (8)	-	
VERY STIFF TO HARD, BROWN, **SANDY SILT**, AND CLAY, SOME SAND, TRACE GRAVEL, DAMP	611.8	4 5	4 5 5	14	100	SS-3	3.50	6	7	17	29	41	26	17	9	16	A-4a (7)	-	
		6 EOB	5 6 6	16	100	SS-4	4.50	-	-	-	-	-	-	-	-	17	A-4a (V)	-	

NOTES: BORING CAVED AT 6.5 FT.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: ASPHALT PATCH; AUGER CUTTINGS MIXED WITH BENTONITE CHIPS

PROJECT: LAK-STEVENS BLVD.-	DRILLING FIRM / OPERATOR: SME / RH/DL	DRILL RIG: CME 55 TRUCK 293	STATION / OFFSET: 36+67, 7' LT.
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: SME / JF	HAMMER: CME AUTOMATIC	ALIGNMENT: CL CONSTRUCTION
PID: SFN:	DRILLING METHOD: 4" SSA	CALIBRATION DATE: N/A	ELEVATION: 618.9 (MSL) EOB: 7.1 ft.
START: 2/19/19 END: 2/19/19	SAMPLING METHOD: SPT	ENERGY RATIO (%): 81	LAT / LONG: 41.652806, -81.449100

EXPLORATION ID B-011-0-19

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 618.9	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
8.25" CONCRETE AND 5" FINE SLAG BAS (DRILLERS DESCRIPTION)	617.8																		
VERY STIFF, BROWN, **CLAY**, LITTLE SILT, LITTLE SAND, TRACE GRAVEL, MOIST	614.8	1	4 6 6	16	78	SS-1	3.00	3	4	9	15	69	44	21	23	22	A-7-6 (14)	550	
		2																	
		3	4 4 5	12	67	SS-2	2.50	-	-	-	-	-	-	-	-	20	A-7-6 (V)	-	
VERY STIFF, BROWN, **SILTY CLAY**, LITTLE SAND, TRACE GRAVEL, MOIST	611.8	4	2 3 4	9	56	SS-3	2.50	4	7	10	17	62	37	19	18	23	A-6b (11)	-	
		5																	
		6	4 5 5	14	100	SS-4	4.50	-	-	-	-	-	-	-	-	18	A-6b (V)	-	
		EOB 7																	

NOTES: BORING CAVED AT 7.1 FT.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: ASPHALT PATCH; AUGER CUTTINGS MIXED WITH BENTONITE CHIPS

PROJECT: LAK-STEVENS BLVD.-	DRILLING FIRM / OPERATOR: SME / RH/DL	DRILL RIG: CME 55 TRUCK 293	STATION / OFFSET: 33+13, 10' RT.
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: SME / JF	HAMMER: CME AUTOMATIC	ALIGNMENT: CL CONSTRUCTION
PID: SFN:	DRILLING METHOD: 4" SSA	CALIBRATION DATE: N/A	ELEVATION: 618.5 (MSL) EOB: 7.33 ft.
START: 2/19/19 END: 2/19/19	SAMPLING METHOD: SPT	ENERGY RATIO (%): 81	LAT / LONG: 41.653590, -81.449827

EXPLORATION ID B-012-0-19

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MATERIAL DESCRIPTION AND NOTES	ELEV. 618.5	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
7.75" CONCRETE AND 8.25" FINE SLAG BASE (DRILLERS DESCRIPTION)	617.2	1																	
VERY STIFF, BROWN AND GRAY, **SILTY CLAY**, LITTLE SAND, TRACE GRAVEL, DAMP TO MOIST		2	3 4 4	11	100	SS-1	2.50	3	5	10	18	64	40	20	20	19	A-6b (12)	410	
		3	2 3 4	9	56	SS-2	1.50	2	3	8	17	70	39	21	18	24	A-6b (11)	-	
		4 5	3 4 4	11	67	SS-3	2.00	-	-	-	-	-	-	-	-	23	A-6b (V)	-	
		6	2 4 6	14	100	SS-4	4.50	-	-	-	-	-	-	-	-	18	A-6b (V)	-	
	611.2	7 EOB																	

NOTES: BORING CAVED AT 7.3 FT.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: ASPHALT PATCH; AUGER CUTTINGS MIXED WITH BENTONITE CHIPS

PROJECT: LAK-STEVENS BLVD.-	DRILLING FIRM / OPERATOR: SME / RH/DL	DRILL RIG: CME 55 TRUCK 293	STATION / OFFSET: 28+84, 11' LT.
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: SME / JF	HAMMER: CME AUTOMATIC	ALIGNMENT: CL CONSTRUCTION
PID: SFN:	DRILLING METHOD: 4" SSA	CALIBRATION DATE: N/A	ELEVATION: 619.5 (MSL) EOB: 7.33 ft.
START: 2/19/19 END: 2/19/19	SAMPLING METHOD: SPT	ENERGY RATIO (%): 81	LAT / LONG: 41.654483, -81.450851

EXPLORATION ID B-013-0-19

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 619.5	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
8" CONCRETE, AND 8" COARSE TO FINE SLAG BASE (DRILLERS DESCRIPTION)	618.2	1																	
VERY STIFF, BROWN, **CLAY**, LITTLE SILT, LITTLE SAND, TRACE GRAVEL, MOIST		2	4 4 6	14	83	SS-1	4.00	4	4	7	14	71	49	23	26	25	A-7-6 (16)	-	
		3	3 4 4	11	78	SS-2	2.50	2	2	7	18	71	41	21	20	24	A-7-6 (12)	-	
		4 5	4 4 5	12	44	SS-3	2.75	-	-	-	-	-	-	-	-	24	A-7-6 (V)	-	
		6	2 3 4	9	89	SS-4	4.00	-	-	-	-	-	-	-	-	20	A-7-6 (V)	-	
	612.2	7 EOB																	

NOTES: BORING CAVED AT 7.3 FT.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: ASPHALT PATCH; AUGER CUTTINGS MIXED WITH BENTONITE CHIPS

PROJECT: LAK-STEVENS BLVD.-	DRILLING FIRM / OPERATOR: SME / RH/DL	DRILL RIG: CME 55 TRUCK 293	STATION / OFFSET: 25+05, 8' RT.
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: SME / JF	HAMMER: CME AUTOMATIC	ALIGNMENT: CL CONSTRUCTION
PID: SFN:	DRILLING METHOD: 4" SSA	CALIBRATION DATE: N/A	ELEVATION: 620.1 (MSL) EOB: 7.58 ft.
START: 2/19/19 END: 2/19/19	SAMPLING METHOD: SPT	ENERGY RATIO (%): 81	LAT / LONG: 41.655202, -81.451855

EXPLORATION ID B-014-0-19

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 620.1	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
8" CONCRETE AND 11" COARSE TO FINE SLAG BASE (DRILLERS DESCRIPTION)	618.6																		
VERY STIFF, BROWN, **SILTY CLAY**, LITTLE SAND, TRACE GRAVEL, DAMP	617.1		4 6 6	16	83	SS-1	3.50	2	4	8	15	71	37	20	17	14	A-6b (11)	660	
VERY STIFF, BROWN, **SILT AND CLAY**, SOME SAND, LITTLE GRAVEL, DAMP	612.6	EOB	4 6 7	18	67	SS-2	3.50	13	14	16	23	34	28	17	11	10	A-6a (5)	-	
			4 9 9	24	89	SS-3	4.50	-	-	-	-	-	-	-	-	13	A-6a (V)	-	
			4 7 10	23	100	SS-4	4.50	-	-	-	-	-	-	-	-	15	A-6a (V)	-	

NOTES: BORING CAVED AT 7.66 FT.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: ASPHALT PATCH; AUGER CUTTINGS MIXED WITH BENTONITE CHIPS

PROJECT: LAK-STEVENS BLVD.-	DRILLING FIRM / OPERATOR: SME / RH/DL	DRILL RIG: CME 55 TRUCK 293	STATION / OFFSET: 20+92, 8' LT.
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: SME / JF	HAMMER: CME AUTOMATIC	ALIGNMENT: CL CONSTRUCTION
PID: SFN:	DRILLING METHOD: 4" SSA	CALIBRATION DATE: N/A	ELEVATION: 616.8 (MSL) EOB: 7.38 ft.
START: 2/19/19 END: 2/19/19	SAMPLING METHOD: SPT	ENERGY RATIO (%): 81	LAT / LONG: 41.656055, -81.452854

EXPLORATION ID B-015-0-19

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 616.8	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
7.75" CONCRETE AND 8.75 COARSE TO FINE SLAG BASE (DRILLERS DESCRIPTION)	615.4	1																	
VERY STIFF TO HARD, BROWN, **SILTY CLAY**, LITTLE TO SOME SANS, TRACE TO LITTLE GRAVEL, DAMP		2	5 7 6	18	100	SS-1	4.50	4	5	10	18	63	37	21	16	20	A-6b (10)	660	
		3	4 6 7	18	50	SS-2	4.50	-	-	-	-	-	-	-	-	18	A-6b (V)	-	
		4	6 6 9	20	100	SS-3	4.00	15	8	12	17	48	36	19	17	18	A-6b (9)	-	
		5	4 7 10	23	100	SS-4	3.50	-	-	-	-	-	-	-	-	17	A-6b (V)	-	
	609.4	6 EOB																	
		7																	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: ASPHALT PATCH; AUGER CUTTINGS MIXED WITH BENTONITE CHIPS

PROJECT: LAK-STEVENS BLVD.-	DRILLING FIRM / OPERATOR: SME / RH/DL	DRILL RIG: CME 55 TRUCK 293	STATION / OFFSET: 18+59, 8' LT.
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: SME / JF	HAMMER: CME AUTOMATIC	ALIGNMENT: CL CONSTRUCTION
PID: SFN:	DRILLING METHOD: 4" SSA	CALIBRATION DATE: N/A	ELEVATION: 615.8 (MSL) EOB: 7.17 ft.
START: 2/19/19 END: 2/19/19	SAMPLING METHOD: SPT	ENERGY RATIO (%): 81	LAT / LONG: 41.656518, -81.453439

EXPLORATION ID B-016-0-19

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 615.8	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
7" CONCRETE AND 7" COARSE TO FINE SLAG BASE (DRILLERS DESCRIPTION)	614.7																		
VERY STIFF TO HARD, BROWN, **SILTY CLAY**, LITTLE SAND, TRACE GRAVEL, DAMP		1	5 6 6	16	100	SS-1	4.00	2	4	9	17	68	39	22	17	20	A-6b (11)	930	
		2																	
		3	4 4 8	16	78	SS-2	4.50	5	5	10	16	64	39	21	18	17	A-6b (11)	-	
		4																	
		5	4 5 7	16	100	SS-3	3.00	-	-	-	-	-	-	-	-	17	A-6b (V)	-	
		6	4 5 7	16	100	SS-4	3.50	-	-	-	-	-	-	-	-	17	A-6b (V)	-	
	608.7	7 EOB																	

NOTES: BORING CAVED AT 7.2 FT.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: ASPHALT PATCH; AUGER CUTTINGS MIXED WITH BENTONITE CHIPS

PROJECT: LAK-STEVENS BLVD.-	DRILLING FIRM / OPERATOR: SME / RH/DL	DRILL RIG: CME 55 TRUCK 293	STATION / OFFSET: 15+25, 8' RT.
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: SME / JF	HAMMER: CME AUTOMATIC	ALIGNMENT: CL CONSTRUCTION
PID: SFN:	DRILLING METHOD: 4" SSA	CALIBRATION DATE: N/A	ELEVATION: 615.2 (MSL) EOB: 7.33 ft.
START: 2/19/19 END: 2/19/19	SAMPLING METHOD: SPT	ENERGY RATIO (%): 81	LAT / LONG: 41.657156, -81.454324

EXPLORATION ID B-017-0-19

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 615.2	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
7" CONCRETE AND 9" COARSE TO FINE SLAG BASE (DRILLERS DESCRIPTION)	613.9																		
BROWN, CLAY, SOME SAND, SOME GRAVEL, SLAG, ASPHALT FRAGMENTS, DAMP, **FILL**	613.4					SS-1A	-	-	-	-	-	-	-	-	-	-	UCF (V)	-	
LOOSE, BROWN, **GRAVEL AND STONE FRAGMENTS WITH SAND AND SILT**, TRACE CLAY, DAMP	611.4		6 4 3	9	67	SS-1B	-	33	21	33	9	4	23	16	7	5	A-2-4 (0)	4200	
			3 4 6	14	100	SS-2A	-	-	-	-	-	-	-	-	-	18	A-2-4 (V)	-	
HARD, BROWN, **SILT AND CLAY**, LITTLE SAND, TRACE GRAVEL, DAMP						SS-2B	4.50	-	-	-	-	-	-	-	-	-	A-6a (V)	-	
			4 6 8	19	100	SS-3	4.50	4	6	11	18	61	31	19	12	16	A-6a (9)	-	
	607.9	EOB	4 5 7	16	100	SS-4	4.50	-	-	-	-	-	-	-	-	8	A-6a (V)	-	

NOTES: BORING CAVED AT 7.3 FT.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: ASPHALT PATCH; AUGER CUTTINGS MIXED WITH BENTONITE CHIPS

PROJECT: LAK-STEVENS BLVD.-	DRILLING FIRM / OPERATOR: SME / RH/DL	DRILL RIG: CME 55 TRUCK 293	STATION / OFFSET: 12+16, 9' LT.
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: SME / JF	HAMMER: CME AUTOMATIC	ALIGNMENT: CL CONSTRUCTION
PID: SFN:	DRILLING METHOD: 4" SSA	CALIBRATION DATE: N/A	ELEVATION: 614.1 (MSL) EOB: 7.33 ft.
START: 2/19/19 END: 2/19/19	SAMPLING METHOD: SPT	ENERGY RATIO (%): 81	LAT / LONG: 41.657803, -81.455057

EXPLORATION ID B-018-0-19

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 614.1	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
6.75" CONCRETE AND 9.25" COARSE TO FINE SLAG BASE (DRILLERS DESCRIPTION)	612.8	1																	
VERY STIFF, BROWN, **CLAY**, LITTLE SILT, LITTLE SAND, LITTLE GRAVEL, **FILL**, MOIST	611.3	2	3 7 6	18	44	SS-1	2.25	13	5	9	14	59	42	22	20	23	A-7-6 (12)	2700	
MEDIUM DENSE, BROWN, FINE TO COARSE CRUSHED LIMESTONE, DRY, **FILL**	609.3	3 4	3 5 6	15	28	SS-2	-	-	-	-	-	-	-	-	-	5	UCF (V)	-	
			5			SS-3A	-	-	-	-	-	-	-	-	-	-	UCF (V)	-	
HARD, BROWN, **SILT AND CLAY**, LITTLE SAND, TRACE GRAVEL, DAMP	606.8	5 6 7	6 8	19	89	SS-3B	4.50	4	7	11	18	60	30	19	11	17	A-6a (8)	-	
			5 7 10	23	100	SS-4	4.50	-	-	-	-	-	-	-	-	17	A-6a (V)	-	
		EOB																	

NOTES: BORING CAVED AT 7.3 FT.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: ASPHALT PATCH; AUGER CUTTINGS MIXED WITH BENTONITE CHIPS

Project Name: LAK- Stevens Blvd.
Project Location: Eastlake, Ohio
SME Project No.: 080888.00

	 Reinforcing Steel	 Reinforcing Steel	 Reinforcing Steel	 Reinforcing Steel
CORE LOCATION	B-001	B-002	B-003	B-004
ASPHALT, in	3½	2	1¾	1½
CONCRETE, in	4	7½	7½	7¼
BASE, in	9½	4¾	7½	5
BASE DESCRIPTION	Coarse to Fine SLAG	Coarse to Fine SLAG with Clay	Coarse to Fine SLAG	Coarse to Fine SLAG
TOTAL PAVEMENT THICKNESS, in.	17	14¼	16¾	13¾
SUBGRADE CLASSIFICATION	Stiff Brown CLAY, Some Silt, Little Sand, Trace Gravel (A-7-6)	Very Stiff Brown SILT and CLAY, Little Sand, Trace Gravel (A-6a)	Brown SILT and CLAY, Little Sand, Trace Gravel (A-6a)	Brown SILT and CLAY, Little Sand, Trace Gravel (A-6a)
Notes	Moderate voids were observed at bottom of 2” of asphalt			

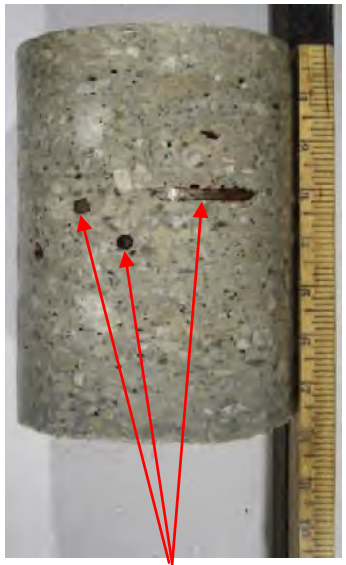
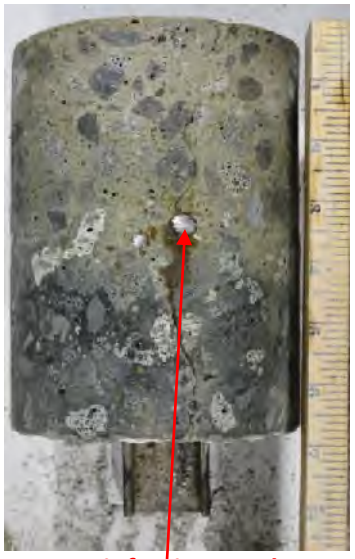
Project Name: LAK- Stevens Blvd.
Project Location: Eastlake, Ohio
SME Project No.: 080888.00

	 Reinforcing steel	 Reinforcing steel	 Reinforcing steel	 Reinforcing steel
CORE LOCATION	B-005	B-006	B-007	B-008
ASPHALT, in	1¼	2	1¾	Not Encountered
CONCRETE, in	7½	7½	6½	7½
BASE, in	7¼	4½	8	7¾
BASE DESCRIPTION	Coarse to Fine SLAG	Coarse to Fine SLAG	Coarse to Fine SLAG	Coarse to Fine SLAG
TOTAL PAVEMENT, in.	16	14	16¼	15¼
SUBGRADE CLASSIFICATION	Hard Brown SILT and CLAY, Little Sand, Trace Gravel (A-6a)	Hard Brown SILT and CLAY, Little Sand, Trace Gravel (A-6a)	Hard Brown SILT and CLAY, Little Sand, Trace Gravel (A-6a)	Hard Brown SILTY CLAY, Little Sand, Trace Gravel (A-6b)
Notes				

Project Name: LAK- Stevens Blvd.
Project Location: Eastlake, Ohio
SME Project No.: 080888.00

	 Reinforcing steel		 Reinforcing steel	 Reinforcing steel
CORE LOCATION	B-009	B-010	B-011	B-012
ASPHALT, in	¾	2¾	Not Encountered	Not Encountered
CONCRETE, in	7½	3½	8¼	8
BASE, in	9	23½	5	8¼
BASE DESCRIPTION	Coarse to Fine SLAG	Coarse to Fine SLAG	Fine SLAG	Fine SLAG
TOTAL PAVEMENT, in.	17¼	29¾	13¼	16¼
SUBGRADE CLASSIFICATION	Hard Brown SILT and CLAY, Little Sand, Trace Gravel (A-6a)	Stiff Brown SILT and CLAY, Some Sand, Trace Gravel (A-6a)	Very Stiff Brown CLAY, Little Silt, Little Sand, Trace Gravel (A-7-6)	Very Stiff Brown SILTY CLAY, Little Sand, Trace Gravel(A-6b)
Notes		Dowels were present at the bottom of the concrete		

Project Name: LAK- Stevens Blvd.
Project Location: Eastlake, Ohio
SME Project No.: 080888.00

	 Reinforcing Steel	 Reinforcing Steel	 Reinforcing Steel	 Reinforcing Steel
CORE LOCATION	B-013	B-014	B-015	B-016
ASPHALT, in	Not Encountered	Not Encountered	Not Encountered	Not Encountered
CONCRETE, in	8	8½	7¾	7
BASE, in	8	11	8¾	7
BASE DESCRIPTION	Fine SLAG	Coarse to Fine SLAG	Coarse to Fine SLAG	Coarse to Fine SLAG
TOTAL PAVEMENT, in.	16	19 ½	16 ½	14
SUBGRADE CLASSIFICATION	Very Stiff Brown CLAY, Little Silt, Little Sand, Trace Gravel (A-7-6)	Very Stiff Brown SILTY CLAY, Little Sand, Trace Gravel(A-6b)	Very Stiff Brown SILTY CLAY, Little to Some Sand, Trace to Little Gravel (A-6b)	Very Stiff Brown SILTY CLAY, Little to Some Sand, Trace to Little Gravel (A-6b)
Notes				

Project Name: LAK- Stevens Blvd.
Project Location: Eastlake, Ohio
SME Project No.: 080888.00

	 Reinforcing Steel	 Reinforcing Steel		
CORE LOCATION	B-017	B-018		
ASPHALT, in	Not Encountered	Not Encountered		
CONCRETE, in	7¼	7		
BASE, in	9	9¼		
BASE DESCRIPTION	Coarse to Fine SLAG	Coarse to Fine SLAG		
TOTAL PAVEMENT, in.	16¼	16¼		
SUBGRADE CLASSIFICATION (Visual)	Brown CLAY, Some Sand, Some Gravel, Slag, Asphalt Fragments (UCF)	FILL: Brown CLAY, Little Silt, Little Sand, Little Gravel (A-7-6)		
Notes				

BORING LOG TERMINOLOGY

UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART

COARSE-GRAINED SOIL (more than 50% of material is larger than No. 200 sieve size.)			
GRAVEL More than 50% of coarse fraction larger than No. 4 sieve size	Clean Gravel (Less than 5% fines)	GW	Well-graded gravel; gravel-sand mixtures, little or no fines
		GP	Poorly-graded gravel; gravel-sand mixtures, little or no fines
	Gravel with fines (More than 12% fines)	GM	Silty gravel; gravel-sand-silt mixtures
		GC	Clayey gravel; gravel-sand-clay mixtures
SAND 50% or more of coarse fraction smaller than No. 4 sieve size	Clean Sand (Less than 5% fines)	SW	Well-graded sand; sand-gravel mixtures, little or no fines
		SP	Poorly graded sand; sand-gravel mixtures, little or no fines
	Sand with fines (More than 12% fines)	SM	Silty sand; sand-silt-gravel mixtures
		SC	Clayey sand; sand–clay-gravel mixtures
FINE-GRAINED SOIL (50% or more of material is smaller than No. 200 sieve size)			
SILT AND CLAY Liquid limit less than 50%		ML	Inorganic silt; sandy silt or gravelly silt with slight plasticity
		CL	Inorganic clay of low plasticity; lean clay, sandy clay, gravelly clay
		OL	Organic silt and organic clay of low plasticity
SILT AND CLAY Liquid limit 50% or greater		MH	Inorganic silt of high plasticity, elastic silt
		CH	Inorganic clay of high plasticity, fat clay
		OH	Organic silt and organic clay of high plasticity
HIGHLY ORGANIC SOIL		PT	Peat and other highly organic soil

OTHER MATERIAL SYMBOLS

Topsoil, Void, Sandstone, Asphalt, Glacial Till, Siltstone, Base, Coal, Limestone, Concrete, Shale, Fill

LABORATORY CLASSIFICATION CRITERIA

GW	$C_U = \frac{D_{60}}{D_{10}}$ greater than 4; $C_C = \frac{D_{30}^2}{D_{10} \times D_{60}}$ between 1 and 3	
GP	Not meeting all gradation requirements for GW	
GM	Atterberg limits below "A" line or PI less than 4	Above "A" line with PI between 4 and 7 are borderline cases requiring use of dual symbols
GC	Atterberg limits above "A" line with PI greater than 7	
SW	$C_U = \frac{D_{60}}{D_{10}}$ greater than 6; $C_C = \frac{D_{30}^2}{D_{10} \times D_{60}}$ between 1 and 3	
SP	Not meeting all gradation requirements for SW	
SM	Atterberg limits below "A" line or PI less than 4	Above "A" line with PI between 4 and 7 are borderline cases requiring use of dual symbols
SC	Atterberg limits above "A" line with PI greater than 7	

Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:

Less than 5 percent……..GW, GP, SW, SP
More than 12 percent……GM, GC, SM, SC
5 to 12 percent……..Cases requiring dual symbols

- SP-SM or SW-SM (SAND with Silt or SAND with Silt and Gravel)
- SP-SC or SW-SC (SAND with Clay or SAND with Clay and Gravel)
- GP-GM or GW-GM (GRAVEL with Silt or GRAVEL with Silt and Sand)
- GP-GC or GW-GC (GRAVEL with Clay or GRAVEL with Clay and Sand)

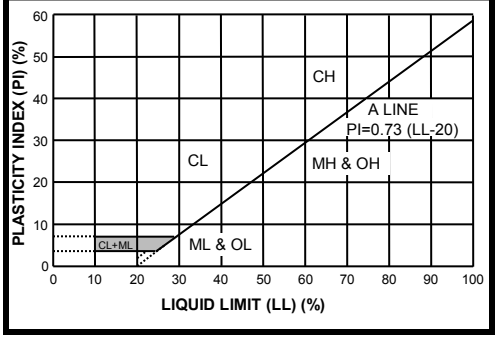
If the fines are CL-ML:

- SC-SM (SILTY CLAYEY SAND or SILTY CLAYEY SAND with Gravel)
- SM-SC (CLAYEY SILTY SAND or CLAYEY SILTY SAND with Gravel)
- GC-GM (SILTY CLAYEY GRAVEL or SILTY CLAYEY GRAVEL with Sand)
- GM-GC (CLAYEY SILTY GRAVEL or CLAYEY SILTY GRAVEL with Sand)

PARTICLE SIZES

Boulders	-	Greater than 12 inches
Cobbles	-	3 inches to 12 inches
Gravel- Coarse	-	3/4 inches to 3 inches
Fine	-	No. 4 to 3/4 inches
Sand- Coarse	-	No. 10 to No. 4
Medium	-	No. 40 to No. 10
Fine	-	No. 200 to No. 40
Silt and Clay	-	Less than (0.0074 mm)

PLASTICITY CHART



VISUAL MANUAL PROCEDURE

When laboratory tests are not performed to confirm the classification of soils exhibiting borderline classifications, the two possible classifications would be separated with a slash, as follows:

For soils where it is difficult to distinguish if it is a coarse or fine-grained soil:

- SC/CL (CLAYEY SAND to Sandy LEAN CLAY)
- SM/ML (SILTY SAND to SANDY SILT)
- GC/CL (CLAYEY GRAVEL to Gravelly LEAN CLAY)
- GM/ML (SILTY GRAVEL to Gravelly SILT)

For soils where it is difficult to distinguish if it is sand or gravel, poorly or well-graded sand or gravel; silt or clay; or plastic or non-plastic silt or clay:

- SP/GP or SW/GW (SAND with Gravel to GRAVEL with Sand)
- SC/GC (CLAYEY SAND with Gravel to CLAYEY GRAVEL with Sand)
- SM/GM (SILTY SAND with Gravel to SILTY GRAVEL with Sand)
- SW/SP (SAND or SAND with Gravel)
- GP/GW (GRAVEL or GRAVEL with Sand)
- SC/SM (CLAYEY to SILTY SAND)
- GM/GC (SILTY to CLAYEY GRAVEL)
- CL/ML (SILTY CLAY)
- ML/CL (CLAYEY SILT)
- CH/MH (FAT CLAY to ELASTIC SILT)
- CL/CH (LEAN to FAT CLAY)
- MH/ML (ELASTIC SILT to SILT)
- OL/OH (ORGANIC SILT or ORGANIC CLAY)

DRILLING AND SAMPLING ABBREVIATIONS

2ST	–	Shelby Tube – 2" O.D.
3ST	–	Shelby Tube – 3" O.D.
AS	–	Auger Sample
GS	–	Grab Sample
LS	–	Liner Sample
NR	–	No Recovery
PM	–	Pressure Meter
RC	–	Rock Core diamond bit. NX size, except where noted
SB	–	Split Barrel Sample 1-3/8" I.D., 2" O.D., except where noted
VS	–	Vane Shear
WS	–	Wash Sample

OTHER ABBREVIATIONS

WOH	–	Weight of Hammer
WOR	–	Weight of Rods
SP	–	Soil Probe
PID	–	Photo Ionization Device
FID	–	Flame Ionization Device

DEPOSITIONAL FEATURES

Parting	–	as much as 1/16 inch thick
Seam	–	1/16 inch to 1/2 inch thick
Layer	–	1/2 inch to 12 inches thick
Stratum	–	greater than 12 inches thick
Pocket	–	deposit of limited lateral extent
Lens	–	lenticular deposit
Hardpan/Till	–	an unstratified, consolidated or cemented mixture of clay, silt, sand and/or gravel, the size/shape of the constituents vary widely
Lacustrine	–	soil deposited by lake water
Mottled	–	soil irregularly marked with spots of different colors that vary in number and size
Varved	–	alternating partings or seams of silt and/or clay
Occasional	–	one or less per foot of thickness
Frequent	–	more than one per foot of thickness
Interbedded	–	strata of soil or beds of rock lying between or alternating with other strata of a different nature

CLASSIFICATION TERMINOLOGY AND CORRELATIONS

Cohesionless Soils

Relative Density	N-Value (Blows per foot)
Very Loose	0 to 4
Loose	4 to 10
Medium Dense	10 to 30
Dense	30 to 50
Very Dense	50 to 80
Extremely Dense	Over 80

Cohesive Soils

Consistency	N-Value (Blows per foot)	Undrained Shear Strength (kips/ft^2)
Very Soft	0 - 2	0.25 or less
Soft	2 - 4	0.25 to 0.50
Medium	4 - 8	0.50 to 1.0
Stiff	8 - 15	1.0 to 2.0
Very Stiff	15 - 30	2.0 to 4.0
Hard	> 30	4.0 or greater

Standard Penetration 'N-Value' = Blows per foot of a 140-pound hammer falling 30 inches on a 2-inch O.D. split barrel sampler, except where noted.

APPENDIX B
HISTORICAL BORING LOGS

90376 FIELD BORING LOG 90399

Project Code: 0569 | Project Identification: LAK. WILLOWICK STEVENS BLVD | Co., Rt., Sec. No.

Station: 6+10, | Offset: 15 R | Order Code: 01

Crew: J.G., E.K., A.B. | Date: 5-7-75

Equipment: T.R.

Surface Elev. 83 | Water Elev.

Depth Feet	Field Number	Description
0.0		BERM MAT'L
4a 2.0	11	MOIST BR. SANDY SILT CLAY W/ STONE
5		MOIST BR SANDY SILT CLAY
6a 7.5	16 2	
4a 10	13	MOIST GRAY SILT CLAY
12.0	3	
15		Stevens Boulevard
20		
25		
30		

MAY 14 1975

Use reverse side of this sheet for additional notes.

Form TE-133

FIELD BORING LOG

Project Code: 0569

Project Identification: LAK WILLOWICK-STEVENS BLVD

Co., Rt., Sec. No.

Station: 14+60, Offset: 05R

Order Code: 01

Crew: J.G. F.K. A.B. Date: 5-7-75

Equipment: T.R.

Surface Elev: (2) Water Elev.

Depth Feet	Field Number	Description
0.0-0.3		SOD
6b	20	MOIST MOTTLED SILTCLAY
5.5	8	
6a	18	MOIST BR. SILT CLAY
8.5	7	
10		
4a	16	MOIST GRAY SILTCLAY
13.0	10	
15		
		Stevens Boulevard
20		
25		
30		

Use reverse side of this sheet for additional notes.

FIELD BORING LOG

Project Code: 05 6 B

Project Identification: LAK WILLOWICK - STEVENS BLVD

Co., Rt., Sec. No.:

Station: 18+50, Offset: 20L

Order Code: 01

Crew: J.G. J.K. A.B. Date: 5-7-75

Equipment: T.A.

Surface Elev: -1' Water Elev.:

Depth Feet	Field Number	Description
0.0		BERM MAT'L WASHED IN
0.6	25	MOIST MOTTLED SILT CLAY
2.0	11	
5		
4a 2.0	12	MOIST BR. SILT CLAY
4a 5.0	14	MOIST GRAY SILT CLAY
5.0	13	W/ SMALL STONE FRAGS
3a 10 9.0	16	WET SILTY SAND
4a 13.0	15	MOIST GRAG SILT CLAY
15		Stevens Boulevard
20		
25		
30		

Use reverse side of this sheet for additional notes.

Form TE-133

O.C.

FORM 6413

SUMMARY OF SOIL TEST DATA

NOTE - NP SHOWN IN LIQUID LIMIT AND PLASTICITY COLUMNS INDICATES A NON-PLASTIC MATERIAL

LAB NO	STATION & OFFSET	DEPTH FROM	DEPTH TO	AGG	CS	FS	SILT	CLAY	LL	PI	WC	OHIO CLASS	COMP CLASS	MST
						STEVENS	BOULEVARD							
90376	6+10,015 R	00.3	02.0	23	9	16	37	15	24	5	11	A-4A	A-4A	*
90377		02.0	07.5	5	5	10	41	39	29	11	16	A-6A	A-6A	*
90378		07.5	12.0	9	6	10	39	36	25	8	13	A-4A	A-4A	
90379	8+95,043 L	00.5	06.0	0	2	10	35	53	40	19	23	A-6B	A-6B	*
90380		06.0	07.5	9	5	10	40	36	29	11	17	A-6A	A-6A	
90381		07.5	12.0	0	6	11	41	42	26	9	13	A-4A	A-4A	
90382		12.0	15.0	0	6	11	46	37	26	10	15	A-4A	A-4A	
90383	14+60,005 R	00.3	05.5	0	2	7	40	51	38	17	20	A-6B	A-6B	*
90384		05.5	08.5	4	6	10	40	40	30	11	18	A-6A	A-6A	
90385		08.5	13.0	7	6	9	35	43	26	8	16	A-4A	A-4A	
90386	18+50,020 L	00.2	04.0	0	2	7	41	50	37	17	25	A-6B	A-6B	*
90387		04.0	07.0	0	6	10	44	40	28	10	17	A-4A	A-4A	
90388		07.0	09.0	9	6	10	41	34	25	8	14	A-4A	A-4A	
90389		09.0	11.0	6	21	40	20	13	NP	NP	17	A-3A	A-3A	
90390		11.0	13.0	6	7	11	40	36	24	8	15	A-4A	A-4A	

APPENDIX C
IMPORTANT INFORMATION ABOUT THIS GEOTECHNICAL ENGINEERING REPORT
GENERAL COMMENTS

Important Information about This

Geotechnical Engineering Proposal

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

Participate in Development of the Subsurface Exploration Plan

Geotechnical engineering begins with the creation of an effective subsurface exploration plan. This proposal starts the process by presenting an initial plan. While that plan may consider the unique physical attributes of the site and the improvements you have in mind, it probably does not consider your unique goals, objectives, and risk management preferences. Subsurface exploration plans that are finalized without considering such factors presuppose that clients' needs are unimportant, or that all clients have the same needs. *Avoid the problems that can stem from such assumptions* by finalizing the plan and other scope elements directly with the geotechnical engineer you feel is best qualified for the project, along with the other project professionals whose plans are affected by the geotechnical engineer's findings and recommendations. If you have been told that this step is unnecessary; that client preferences do not influence the scope of geotechnical engineering service or that someone else can articulate your needs as well as you, you have been told wrong. No one else can discuss your geotechnical options better than an experienced geotechnical engineer, and no one else can provide the input you can. Thus, while you certainly are at liberty to accept a proposed scope "as is," recognize that it could be a unilateral scope developed without direct client/engineer discussion; that authorizing a unilateral scope will force the geotechnical engineer to accept all assumptions it contains; that assumptions create risk. *Manage your risk. Get involved.*

Expect the Unexpected

The nature of geotechnical engineering is such that planning needs to *anticipate the unexpected*. During the design phase of a project, more or deeper borings may be required, additional tests may become necessary, or someone associated with your organization may request a service that was not included in the final scope. During the construction phase, additional services may be needed to respond quickly to unanticipated conditions. In the past, geotechnical engineers commonly did whatever was required to oblige their clients' representatives and safeguard their clients' interests, taking it on faith that their clients wanted them to do so. But some, evidently, did not, and refused to pay for legitimate extras on the ground that the engineer proceeded without proper authorization, or failed to submit notice in a timely manner, or failed to provide proper documentation. *What are your preferences? Who is permitted to authorize additional geotechnical services on your project? What type of documentation do you require? To whom should it be sent? When? How?* By addressing these and similar issues sooner rather than later, you and your geotechnical engineer will be prepared for the unexpected, to help prevent molehills from growing into mountains.

Have Realistic Expectations; Apply Appropriate Preventives

The recommendations included in a geotechnical engineering report are *not final*, because they are based on opinions that can be verified only during construction. For that reason, most geotechnical engineering proposals offer the construction observation services that permit the geotechnical engineer of record to confirm that subsurface conditions are what they were expected to be, or to modify recommendations when actual conditions were not anticipated. *An offer to provide construction observation*

is an offer to better manage your risk. Clients who do not take advantage of such an offer; clients who retain a second firm to observe construction, can create a high-risk "Catch-22" situation for themselves. *The geotechnical engineer of record cannot assume responsibility or liability for a report's recommendations when another firm performs the services needed to evaluate the recommendations' adequacy*. The second firm is also likely to disavow liability for the recommendations, because of the substantial and possibly uninsurable risk of assuming responsibility for services it did not perform. Recognize, too, that no firm other than the geotechnical engineer of record can possibly have as intimate an understanding of your project's geotechnical issues. As such, reliance on a second firm to perform construction observation can elevate risk still more, because its personnel may not have the wherewithal to recognize subtle, but sometimes critically important unanticipated conditions, or to respond to them in a manner consistent with your goals, objectives, and risk management preferences.

Realize That Geoenvironmental Issues Have Not Been Covered

The equipment, techniques, and personnel used to perform a geoenvironmental study differ significantly from those used to perform a geotechnical study. *Geoenvironmental services are not being offered in this proposal. The report that results will not relate any geoenvironmental findings, conclusions, or recommendations*. Unanticipated environmental problems have led to numerous project failures. If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the express purpose of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may be addressed as part of the geotechnical engineering study described in this proposal, the geotechnical engineer who would lead this project ***is not*** a mold prevention consultant; ***none of the services being offered have been designed or proposed for the purpose of mold prevention.***

Have the Geotechnical Engineer Work with Other Design Professionals and Constructors

Other design team members' misinterpretation of a geotechnical engineering report has resulted in costly problems. Manage that risk by having your geotechnical engineer confer with appropriate members of the design team before finalizing the scope of geotechnical service (as suggested above), and, again, after submitting the report. *Also retain your geotechnical engineer to review pertinent elements of the design team members' plans and specifications.*

Reduce the risk of unanticipated conditions claims that can occur when constructors misinterpret or misunderstand the purposes of a geotechnical engineering report. Use appropriate language in your contract documents. Retain your geotechnical engineer to participate in prebid and preconstruction conferences, and to perform construction observation.

Read Responsibility Provisions Closely

Clients, design professionals, and constructors who do not recognize that geotechnical engineering is far less exact than other engineering disciplines can develop unrealistic expectations. Unrealistic expectations can lead to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their proposals. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks, thus to encourage more effective scopes of service. *Read this proposal's provisions closely*. Ask questions. Your geotechnical engineer should respond fully and frankly.

Rely on Your Geotechnical Engineer for Additional Assistance

Membership in the Geoprofessional Business Association (GBA) exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit to everyone involved with a construction project. Confer with a GBA-member geotechnical engineer for more information. Confirm a firm's membership in GBA by contacting GBA directly or at its website.

8811 Colesville Road/Suite G106, Silver Spring, MD 20910
Telephone: 301/565-2733 Facsimile: 301/589-2017
e-mail: info@geoprofessional.org www.geoprofessional.org

GENERAL COMMENTS

BASIS OF GEOTECHNICAL REPORT

This report has been prepared in accordance with generally accepted geotechnical engineering practices to assist in the design and/or evaluation of this project. If the project plans, design criteria, and other project information referenced in this report and utilized by SME to prepare our recommendations are changed, the conclusions and recommendations contained in this report are not considered valid unless the changes are reviewed, and the conclusions and recommendations of this report are modified or approved in writing by our office.

The discussions and recommendations submitted in this report are based on the available project information, described in this report, and the geotechnical data obtained from the field exploration at the locations indicated in the report. Variations in the soil and groundwater conditions commonly occur between or away from sampling locations. The nature and extent of the variations may not become evident until the time of construction. If significant variations are observed during construction, SME should be contacted to reevaluate the recommendations of this report. SME should be retained to continue our services through construction to observe and evaluate the actual subsurface conditions relative to the recommendations made in this report.

In the process of obtaining and testing samples and preparing this report, procedures are followed that represent reasonable and accepted practice in the field of soil and foundation engineering. Specifically, field logs are prepared during the field exploration that describe field occurrences, sampling locations, and other information. Samples obtained in the field are frequently subjected to additional testing and reclassification in the laboratory and differences may exist between the field logs and the report logs. The engineer preparing the report reviews the field logs, laboratory classifications, and test data and then prepares the report logs. Our recommendations are based on the contents of the report logs and the information contained therein.

REVIEW OF DESIGN DETAILS, PLANS, AND SPECIFICATIONS

SME should be retained to review the design details, project plans, and specifications to verify those documents are consistent with the recommendations contained in this report.

REVIEW OF REPORT INFORMATION WITH PROJECT TEAM

Implementation of our recommendations may affect the design, construction, and performance of the proposed improvements, along with the potential inherent risks involved with the proposed construction. The client and key members of the design team, including SME, should discuss the issues covered in this report so that the issues are understood and applied in a manner consistent with the owner's budget, tolerance of risk, and expectations for performance and maintenance.

FIELD VERIFICATION OF GEOTECHNICAL CONDITIONS

SME should be retained to verify the recommendations of this report are properly implemented during construction. This may avoid misinterpretation of our recommendations by other parties and will allow us to review and modify our recommendations if variations in the site subsurface conditions are encountered.

PROJECT INFORMATION FOR CONTRACTOR

This report and any future addenda or other reports regarding this site should be made available to prospective contractors prior to submitting their proposals for their information only and to supply them with facts relative to the subsurface evaluation and laboratory test results. If the selected contractor encounters subsurface conditions during construction, which differ from those presented in this report, the contractor should promptly describe the nature and extent of the differing conditions in writing and SME should be notified so that we can verify those conditions. The construction contract should include provisions for dealing with differing conditions and contingency funds should be reserved for potential problems during earthwork and foundation construction. We would be pleased to assist you in developing the contract provisions based on our experience.

The contractor should be prepared to handle environmental conditions encountered at this site, which may affect the excavation, removal, or disposal of soil; dewatering of excavations; and health and safety of workers. Any Environmental Assessment reports prepared for this site should be made available for review by bidders and the successful contractor.

THIRD PARTY RELIANCE/REUSE OF THIS REPORT

This report has been prepared solely for the use of our Client for the project specifically described in this report. This report cannot be relied upon by other parties not involved in the project, unless specifically allowed by SME in writing. SME also is not responsible for the interpretation by other parties of the geotechnical data and the recommendations provided herein.

Passionate People Building
and Revitalizing our World

SME