FORT BEECH DRIVE PAVEMENT DISTRESS REPORT

CONSULTING SERVICES
FORT BEECH DRIVE PAVEMENT DISTRESS
SOUTHGATE, KENTUCKY

Prepared for:

CITY OF SOUTHGATE
SOUTHGATE, KENTUCKY

Prepared by:

GEOTECHNOLOGY, INC.
ERLANGER, KENTUCKY

Date:

DECEMBER 14, 2018

Geotechnology Project No.:

J033230.01

SAFETY
QUALITY
INTEGRITY
PARTNERSHIP
OPPORTUNITY
RESPONSIVENESS

GEOTECHNOLOGY INC
FROM THE GROUND UP

December 14, 2018

Mr. Arvil Bowman
City of Southgate
122 Electric Avenue
Southgate, Kentucky 41071

Re: Consulting Services
Fort Beech Drive Pavement Distress
Southgate, Kentucky
Geotechnology Project No. J033230.01

Dear Mr. Bowman:

Presented in this report are the results of our geotechnical exploration completed for the Fort Beech Road Pavement Distress Project in Southgate, Kentucky. Our services were performed in general accordance with our Proposal P033230.01, which was dated October 3, 2018, and authorized on October 5, 2018.

We appreciate the opportunity to provide the geotechnical services for this project. If you have any questions regarding this report, or if we may be of any additional service to you, please do not hesitate to contact us.

Respectfully submitted,
GEOTECHNOLOGY, INC.

Andrew C. Casto, PE
Senior Project Manager

STATE OF KENTUCKY
ANDREW C. CASTO
21997
LICENSED
PROFESSIONAL ENGINEER

Joseph D. Hauber, PE
Senior Project Manager

ACC/JDH:acc/tmk

Copies submitted: Client (email)

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GEOTECHNOLOGY INC
FROM THE GROUND UP

CONSULTING SERVICES
FORT BEECH DRIVE PAVEMENT DISTRESS
SOUTHGATE, KENTUCKY
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1.0 INTRODUCTION

Geotechnology, Inc. (Geotechnology) prepared this geotechnical exploration report for the City of Southgate for the Fort Beech Road Pavement Distress Project located between addresses 121 and 128 Fort Beech Road, Southgate, Kentucky. Our services documented in this report were provided in general accordance with the scope of services described in our Proposal P033230.01, which was dated October 3, 2018, and authorized on October 5, 2018.

The purposes of our services were to drill three test borings at the site and develop geotechnical recommendations for full-depth repair of the distressed pavement areas. Our scope of services included a site reconnaissance, geotechnical borings, laboratory testing, engineering analyses, and preparation of this report.

2.0 PROJECT INFORMATION

The following project information was derived from a site meeting with Mr. Arvil Bowman with the City of Southgate and Mr. James Shumate, PE with CT Consultants, Inc. on October 2, 2018.

During the site meeting on October 2, 2018, three areas of distress in Fort Beech Road were observed, and Mr. Bowman requested that each be explored and recommendations for full-depth remediation be provided. They were:

- Moderate to severe rutting of both lanes at address 121;
- Severe alligator cracking and moderate rutting of the west bound lane at address 126; and
- Severe alligator cracking and moderate rutting of the west bound lane at address 128.

3.0 SUBSURFACE EXPLORATION

The subsurface exploration consisted of three borings (numbered B-1 through B-3). The boring locations were selected and marked in the field by us. The ground surface elevations at the boring locations were estimated from topography obtained from linkgis.org. The locations of the borings are shown on our Boring Plan, which is included in Appendix B.

The borings were drilled on October 26, 2018, with a truck-mounted drill rig advancing hollow-stem augers, as indicated on the boring logs presented in Appendix C. Sampling of the overburden soils was accomplished ahead of the augers at the depths indicated on the boring logs, with either 2-inch-outside-diameter (O.D.) split-spoons or 3-inch-O.D., thin-walled Shelby tube samplers in general accordance with the procedures outlined by ASTM D1586 and ASTM D1587, respectively. Standard Penetration Tests (SPTs) were performed on the split-spoon samples to obtain the standard penetration resistance or N-value[1] of the sampled material.

Observations for groundwater were made in the borings during drilling and at the completion of drilling before backfilling the boring holes.

As each boring was advanced, the Drilling Foreman kept a field log of the subsurface profile noting the soil and bedrock types and stratifications, groundwater, SPT results, and other pertinent data.

Representative portions of the split-spoon samples were placed in glass jars with lids to preserve the in-situ moisture contents of the samples. The Shelby tubes were capped and taped at their ends to preserve the in-situ moisture contents and densities of the samples, and the tubes were transported and stored in an upright position. The glass jars and Shelby tubes were marked and labeled in the field for identification when returned to our laboratory.

4.0 LABORATORY REVIEW

Upon completion of the fieldwork, the samples recovered from the borings were transported to our Soil Mechanics Laboratory, where they were visually reviewed by the Project Geotechnical Engineer.

Laboratory testing was performed on selected soil samples to estimate engineering and index properties. Laboratory testing of the selected soil samples included moisture content and Atterberg limits. The results of these tests are summarized in the Tabulation of Laboratory Tests in Appendix D.

The boring logs, which are included in Appendix C, were prepared by the Project Geotechnical Engineer on the basis of the field logs, the visual classification of the soil samples in the laboratory, and the laboratory test results. A Soil Classification Sheet is also included in Appendix C, which describes the terms and symbols used on the boring logs. The dashed lines on the boring logs indicate an approximate change in strata as estimated between samples, whereas a solid line indicates that the change in strata occurred within a sample where a more precise measurement could be made. Furthermore, the transition between strata can be abrupt or gradual.

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[1] The standard penetration resistance, or N-value, is defined as the number of blows required to drive the split-spoon sampler 12 inches with a 140-pound hammer falling 30 inches. Since the split spoon sampler is driven 18 inches or until refusal, the blows for the first 6 inches are for seating the sampler, and the number of blows for the final 12 inches is the N-value. Additionally, "refusal" of the split-spoon sampler occurs when the sampler is driven less than 6 inches with 50 blows of the hammer.

5.0 SUBSURFACE CONDITIONS

5.1 Stratification

Generally, at the boring locations the existing pavement section was underlain by soft to stiff fill. More specific descriptions of the subsurface strata are provided below, and the boring logs containing detailed material descriptions are located in Appendix C.

5.1.1 Existing Pavement

Each boring was advance through the existing asphalt pavement, which measured 6 inches thick at each of the three boring locations. At the location of Boring B-2, the asphalt was underlain by 1.5 inches of dense graded aggregate (DGA).

5.1.2 Fill

Existing fill was encountered beneath the pavement and DGA base in the borings. The fill was 3.5 feet thick in Boring B-3, and was encountered to the boring termination depths of 5.5 and 5.6 feet in Borings B-1 and B-2, respectively. The fill was described as a lean to fat clay with trace amounts of shale and limestone fragments. Overall the consistency of the fill ranged from soft to stiff, but was primarily soft to medium stiff in Borings B- 2 and B-3, and within the upper 2.5 feet of Boring B-1.

Atterberg limits testing of selected samples of the fill indicated liquid limits of 42 and 44 percent with corresponding plasticity indices of 19 and 23 percent, which classify these two samples as CL according to the Unified Soil Classification System (USCS). Results of two moisture content tests were both 21 percent.

5.1.3 Native Soils

Native soils were encountered beneath the fill in Boring B-3 at a depth of 4 feet to the boring termination depth of 5.5 feet. The native soil was described as a stiff lean clay with traces of shale and limestone fragments.

5.2 Groundwater Conditions

As mentioned in Section 3.0, groundwater observations were made in the borings during drilling and at the completion of drilling before backfilling the boreholes. Groundwater was noted in Boring B-2 at a depth of 2 feet during drilling. Accumulated groundwater was not observed in the boreholes at the completion of drilling before backfilling.

6.0 CONCLUSIONS AND RECOMMENDATIONS

The borings completed for this project encountered poor subgrade conditions consisting of soft to medium stiff clayey fill. Soft to medium stiff soils will not provide adequate support for the replacement pavement, as indicated by the existing failures, and should be improved. We recommend that the replacement pavement section include a granular base reinforced with a geogrid to stabilize the poor subgrade conditions encountered. The thickness of the base will remove the uppermost soft zone of existing subgrade and will also act as a drain, collecting subsurface water from beneath the pavement. A trench drain should be utilized along the downslope edge of the replacement section, if the granular base cannot be connected to an existing edge drain. The trench drain should be sloped to gravity drain into a rigid perforated Schedule 40 PVC pipe over the lowest 5 feet of the trench. The perforated pipe should transition to a solid Schedule 40 PVC pipe at the end of the trench, and the solid pipe should be sloped to gravity flow into the existing storm sewer system. Our recommended pavement section and drain detail are shown on Sheet 2 included in Appendix B.

7.0 RECOMMENDED ADDITIONAL SERVICES

The conclusions and recommendations given in this report are based on: Geotechnology's understanding of the proposed project, as outlined in this report; site observations; interpretation of the exploration data; and our experience. Since the intent of the design recommendations is best understood by Geotechnology, we recommend that Geotechnology be included in the final design and construction process, and be retained to review the project plans and specifications to confirm that the recommendations given in this report have been correctly implemented. We recommend that Geotechnology be retained to participate in prebid and preconstruction conferences to reduce the risk of misinterpretation of the conclusions and recommendations in this report relative to the proposed construction of the subject project.

We recommend that Geotechnology be retained to provide construction observation services as a continuation of the design process to confirm the recommendations in this report and to revise them accordingly to accommodate differing subsurface conditions. Construction observation is intended to enhance compliance with project plans and specifications. It is not insurance, nor does it constitute a warranty or guarantee of any type. Regardless of construction observation, contractors, suppliers, and others are solely responsible for the quality of their work and for adhering to plans and specifications.

8.0 LIMITATIONS

This report has been prepared on behalf of, and for the exclusive use of, the client for specific application to the named project as described herein. If this report is provided to other parties, it should be provided in its entirety with all supplementary information. In addition, the client should make it clear that the information is provided for factual data only, and not as a warranty of subsurface conditions presented in this report.

Geotechnology has attempted to conduct the services reported herein in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality and under similar conditions. The recommendations and conclusions contained in this report are professional opinions. The report is not a bidding document and should not be used for that purpose.

The analyses, conclusions, and recommendations contained in this report are based on the data obtained from the subsurface exploration. The field exploration methods used indicate subsurface conditions only at the specific locations where samples were obtained, only at the time they were obtained, and only to the depths penetrated. Consequently, subsurface conditions may vary gradually, abruptly, and/or nonlinearly between sample locations and/or intervals.

The conclusions or recommendations presented in this report should not be used without Geotechnology's review and assessment if the nature, design, or location of the facilities is changed, if there is a substantial lapse in time between the submittal of this report and the start of work at the site, or if there is a substantial interruption or delay during work at the site. If changes are contemplated or delays occur, Geotechnology must be allowed to review them to assess their impact on the findings, conclusions, and/or design recommendations given in this report. Geotechnology will not be responsible for any claims, damages, or liability associated with any other party's interpretations of the subsurface data or with reuse of the subsurface data or engineering analyses in this report.

A copy of "Important Information about This Geotechnical-Engineering Report" that is published by the Geotechnical Business Council (GBC) of the Geoprofessional Business Association (GBA) is included in Appendix A for your review. The publication discusses some other limitations, as well as ways to manage risk associated with subsurface conditions.

APPENDIX A – IMPORTANT INFORMATION ABOUT THIS GEOTECHNICAL-ENGINEERING REPORT

Important Information about This

Geotechnical-Engineering Report

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.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a civil engineer may not fulfill the needs of a constructor — a construction contractor — or even another civil engineer. Because each geotechnical- engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. No one except you should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply this report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical-engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

Geotechnical Engineers Base Each Report on a Unique Set of Project-Specific Factors

Geotechnical engineers consider many unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk-management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical-engineering report that was:

- not prepared for you;
- not prepared for your project;
- not prepared for the specific site explored; or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical-engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical-engineering report is based on conditions that existed at the time the geotechnical engineer performed the study. *Do not rely on a geotechnical-engineering report whose adequacy may have been affected by*: the passage of time; man-made events, such as construction on or adjacent to the site; or natural events, such as floods, droughts, earthquakes, or groundwater fluctuations. *Contact the geotechnical engineer before applying this report to determine if it is still reliable.* A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ — sometimes significantly — from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide geotechnical-construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are Not Final

Do not overrely on the confirmation-dependent recommendations included in your report. *Confirmation-dependent recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations *only* by observing actual subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's confirmation-dependent recommendations if that engineer does not perform the geotechnical-construction observation required to confirm the recommendations' applicability.*

A Geotechnical-Engineering Report Is Subject to Misinterpretation

Other design-team members' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Constructors can also misinterpret a geotechnical-engineering report. Confront that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing geotechnical construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical-engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make constructors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give constructors the complete geotechnical-engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise constructors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure constructors have sufficient time* to perform additional study. Only then might you be in a position to give constructors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and constructors fail to recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Environmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform an *environmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own environmental 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, many mold- prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical- engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; *none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.*

Rely, on Your GBC-Member Geotechnical Engineer for Additional Assistance

Membership in the Geotechnical Business Council of the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project. Confer with you GBC-Member geotechnical engineer for more information.

GBC GEOTECHNICAL BUSINESS COUNCIL *of the Geoprofessional Business Association*

8811 Colesville Road/Suite G106, Silver Spring, MD 20910
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APPENDIX B – PLANS

Boring Plan, Sheet No. 1

Replacement Pavement Section, Sheet No. 2

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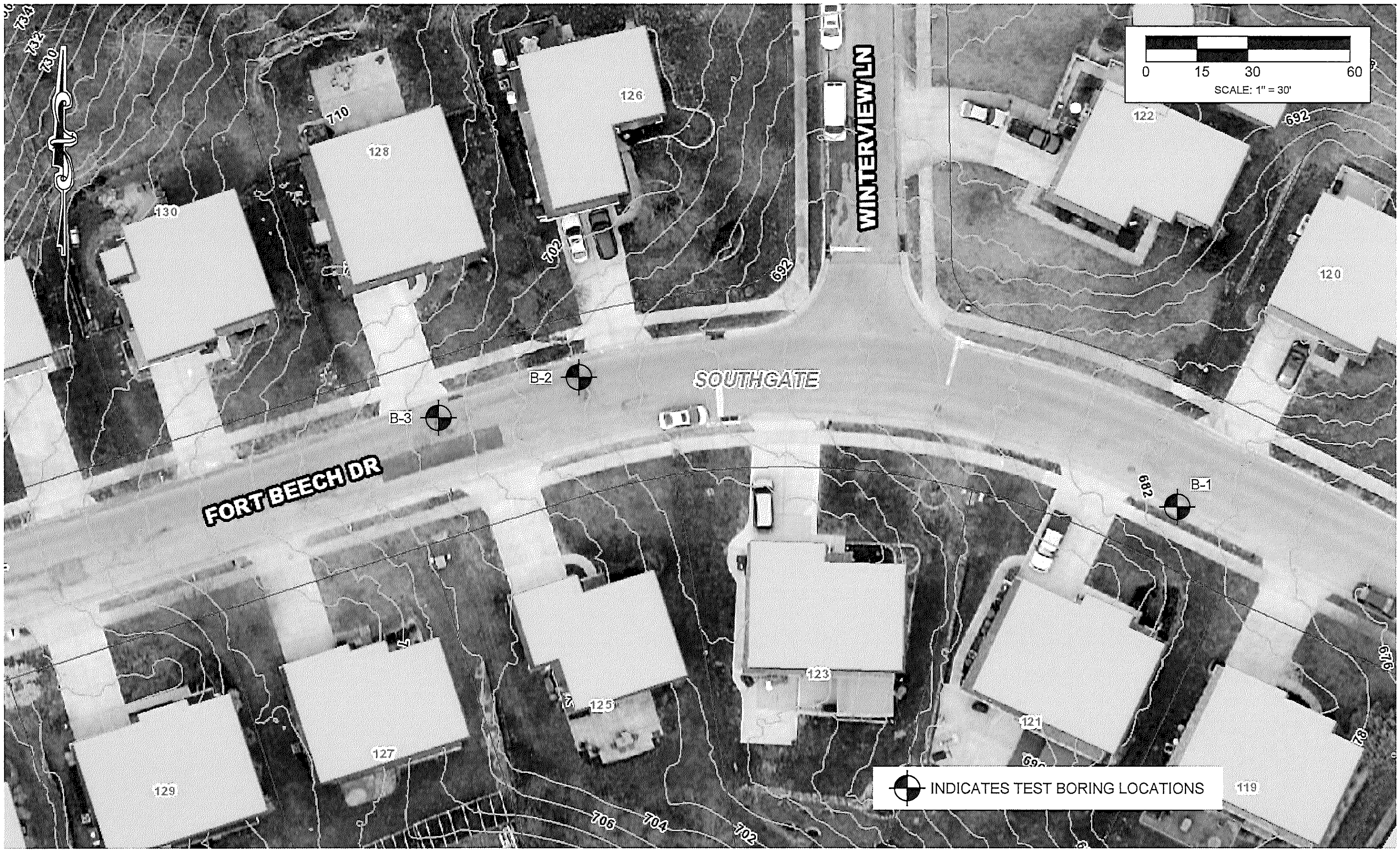

NOTE: BASE MAP OBTAINED FROM LINKGIS.ORG.

Revisions	

GEOTECHNOLOGY INC
FROM THE GROUND UP

Title: BORING PLAN	Project: Fort Beech Road Distress	Date: 12/14/2018
Client: City of Southgate	Location: Southgate, Kentucky	Project No.: J033230.01
		Sheet No.: 1

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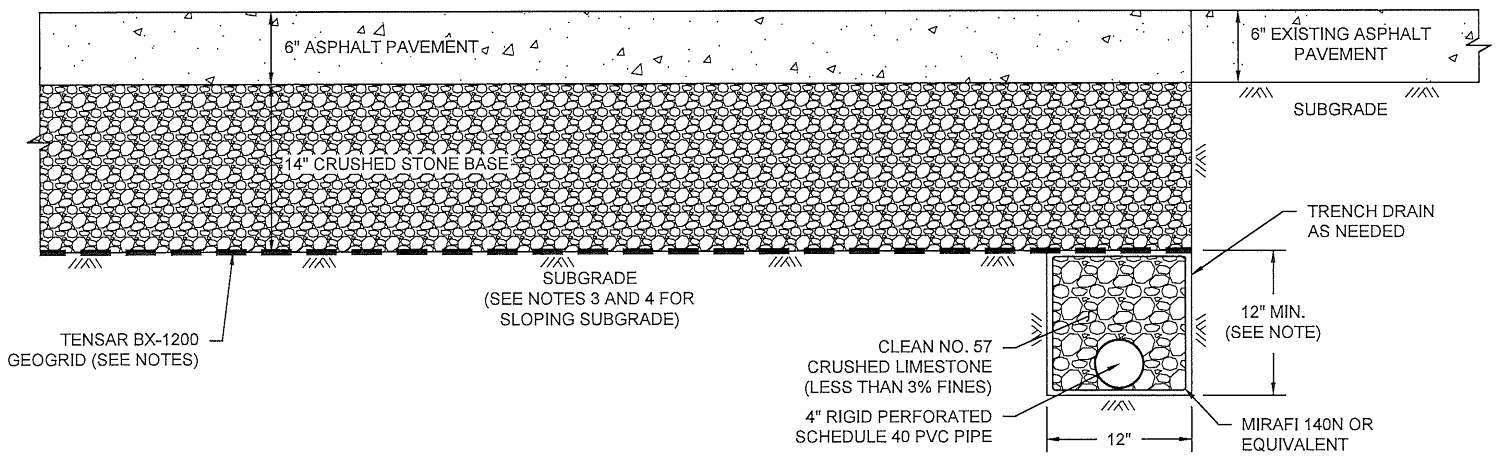

NOTES

1. ALL ASPHALT AND GRANULAR BASE MATERIALS AND THEIR CONSTRUCTION ARE TO BE IN ACCORDANCE WITH THE KENTUCKY TRANSPORTATION CABINET 2012 STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION, UNLESS NOTED OTHERWISE.
2. THE LIMITS OF THE PAVEMENT REPLACEMENT AREA SHALL BE AT LEAST 24 INCHES LARGER ON ALL SIDES THAN THE FAILED AREA.
3. THE SUBGRADE SHALL BE TRIMMED SMOOTH AND UNIFORM AND SLOPED TO DRAIN TO AN EXISTING EDGE DRAIN, IF APPLICABLE, OR TOWARD A NEW TRENCH DRAIN.
4. IF AN EXISTING EDGE DRAIN THAT THE SUBGRADE CAN DRAIN TOWARD IS NOT PRESENT, A TRENCH DRAIN SHALL BE INSTALLED ALONG THE LOWEST EDGE OF THE REPLACEMENT SECTION AS SHOWN. THE BOTTOM OF THE TRENCH DRAIN SHALL BE AT LEAST 12 INCHES DEEP RELATIVE TO THE SUBGRADE. THE BOTTOM OF THE EXCAVATION FOR THE TRENCH DRAIN SHALL SLOPE TO DRAIN AT A MINIMUM OF 2 PERCENT TO TIE INTO THE EXISTING STORM SEWER SYSTEM.
5. PRIOR TO PLACEMENT OF THE CRUSHED STONE BASE (CSB) THE ENTIRE SUBGRADE SHALL BE COVERED WITH TENSAR BX-1200 GEOGRID. THE GEOGRID SHALL BE PLACED IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS AND SHALL BE PLACED SMOOTH AND TAUT. OVERLAPS SHALL BE AT LEAST 18 INCHES.
6. THE CSB SHALL BE COMPACTED TO 98 PERCENT OF THE MAXIMUM DRY DENSITY, AS DETERMINED BY THE STANDARD PROCTOR MOISTURE-DENSITY TEST, ASTM D698.
7. THE CLEAN NO. 57 CRUSHED STONE SHALL CONTAIN LESS THAN 3 PERCENT FINES AND BE COMPACTED TO 80 PERCENT RELATIVE DENSITY, AS DETERMINED BY ASTM D4253 AND D4254.
8. THE CLEAN NO. 57 CRUSHED STONE SHALL BE WRAPPED WITH AN APPROVED NON-WOVEN GEOTEXTILE (E.G., MIRAFI 140N), AND SHALL BE LAPPED A MINIMUM OF 6 INCHES.
9. THE 4-INCH DIAMETER RIGID PERFORATED SCHEDULE 40 PVC PIPE SHALL BE LOCATED WITHIN THE LOWEST 5 FEET OF THE TRENCH. THE PIPE SHALL BE SLOPED TO DRAIN AT A MINIMUM OF 2 PERCENT AND SHALL BE CONNECTED TO A SUITABLE GRAVITY OUTLET, SUCH AS A CATCH BASIN, USING A RIGID SOLID SCHEDULE 40 PVC PIPE THAT IS SLOPED TO DRAIN AT A MINIMUM OF 2 PERCENT.

Revisions	

GEOTECHNOLOGY INC
FROM THE GROUND UP

Title: REPLACEMENT PAVEMENT SECTION	Project: Fort Beech Road Distress	Date: 12/14/2018
Client: City of Southgate	Location: Southgate, Kentucky	Project No.: J033230.01
		Sheet No.: 2

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APPENDIX C – BORING INFORMATION

Boring Logs

Soil Classification Sheet

GEOTECHNOLOGY INC
FROM THE GROUND UP

LOG OF TEST BORING

CLIENT: City of Southgate

BORING #: B-1

PROJECT: Fort Beech Drive Distress
Southgate, Kentucky

PROJECT #: J033230.01

LOCATION OF BORING: As shown on Boring Plan, Sheet No. 1

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Depth Scale (feet)	Sample Condition	Sample Number	Sample Type	SPT* Blows/6" / Rock Core RQD (%)	Recovery (in.)	Recovery (%)
681.0	Ground Surface	0.0	0						
680.5	ASPHALT (6 inches)	0.5							
678.5	Mixed brown, trace gray moist medium stiff FILL, lean clay, trace shale and limestone fragments (CL).	2.5		U	1	PT		17	71
677.0	Mixed gray moist stiff FILL, lean clay, trace shale and limestone fragments.	4.0		I	2	DS	3-3-5	12	67
675.5	Mixed brown and gray moist stiff FILL, lean clay, trace shale and limestone fragments.	5.5		I	3	DS	4-29-50	8	44
	Bottom of test boring at 5.5 feet.		10						

Datum: NAVD 88
Hammer Weight: 140 lb.
Hole Diameter: 8 in.
Drill Rig: CME-55 TD-5
Surface Elevation: 681.0 ft.
Hammer Drop: 30 in.
Rock Core Diameter: --
Foreman: N. Hudson
Date Started: 10/26/2018
Pipe Size: 2 in. O.D.
Boring Method: HSA-3.25
Engineer: Andrew C. Casto
Date Completed: 10/26/2018

BORING METHOD
HSA = Hollow Stem Augers
CFA = Continuous Flight Augers
DC = Driving Casing
MD = Mud Drilling

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
DS = Driven Split Spoon
PT = Pressed Shelby Tube
RC = Rock Core

SAMPLE CONDITIONS
D = Disintegrated
I = Intact
U = Undisturbed
L = Lost

GROUNDWATER DEPTH
First Noted: None
At Completion: Dry
After: --
Backfilled: Immediately

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

GEOTECHNOLOGY INC
FROM THE GROUND UP

LOG OF TEST BORING

CLIENT: City of Southgate **BORING #:** B-2
PROJECT: Fort Beech Drive Distress **PROJECT #:** J033230.01
Southgate, Kentucky **PAGE #:** 1 of 1
LOCATION OF BORING: As shown on Boring Plan, Sheet No. 1

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Depth Scale (feet)	Sample Condition	Sample Number	Sample Type	SPT* Blows/6" / Rock Core RQD (%)	Recovery (in.)	Recovery (%)
698.0	Ground Surface	0.0	0						
697.5	ASPHALT (6 inches)	0.5							
697.4	DGA (1.5 inches)	0.6							
695.4	Mixed brown, trace gray moist medium stiff FILL, lean clay, trace shale and limestone fragments.	2.6	1–2	U	1	PT		13	54
692.4	Mixed brown moist medium stiff FILL, fat clay, trace shale and limestone fragments.	5.6	3	I	2	DS	3-3-3	6	33
			4–5	I	3	DS	3-10-9	8	44
	Bottom of test boring at 5.6 feet.		6–10						

Datum: NAVD 88 | Hammer Weight: 140 lb. | Hole Diameter: 8 in. | Drill Rig: CME-55 TD-5
Surface Elevation: 698.0 ft. | Hammer Drop: 30 in. | Rock Core Diameter: -- | Foreman: N. Hudson
Date Started: 10/26/2018 | Pipe Size: 2 in. O.D. | Boring Method: HSA-3.25 | Engineer: Andrew C. Casto
Date Completed: 10/26/2018

BORING METHOD
HSA = Hollow Stem Augers
CFA = Continuous Flight Augers
DC = Driving Casing
MD = Mud Drilling

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
DS = Driven Split Spoon
PT = Pressed Shelby Tube
RC = Rock Core

SAMPLE CONDITIONS
D = Disintegrated
I = Intact
U = Undisturbed
L = Lost

GROUNDWATER DEPTH
First Noted: 2.0 ft.
At Completion: Dry
After: --
Backfilled: Immediately

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

GEOTECHNOLOGY INC
FROM THE GROUND UP

LOG OF TEST BORING

CLIENT: City of Southgate
BORING #: B-3
PROJECT: Fort Beech Drive Distress, Southgate, Kentucky
PROJECT #: J033230.01
PAGE #: 1 of 1
LOCATION OF BORING: As shown on Boring Plan, Sheet No. 1

ELEV.	COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS DESCRIPTION	Strata Depth (feet)	Depth Scale (feet)	Sample Condition	Sample Number	Sample Type	SPT* Blows/6" / Rock Core RQD (%)	Recovery (in.)	Recovery (%)
703.0	Ground Surface	0.0	0						
702.5	ASPHALT (6 inches)	0.5							
702.2	Mixed brown moist soft FILL, lean clay, trace shale and limestone fragments (CL).	0.8							
700.5	Mixed brown moist medium stiff FILL, lean clay, trace shale and limestone fragments.	2.5	1, 2	U	1	PT		13	54
699.0	Mixed brown moist medium stiff FILL, fat clay, trace limestone fragments.	4.0	3	I	2	DS	8-8-3	5	28
697.5	Brown moist stiff LEAN CLAY, trace shale and limestone fragments.	5.5	4, 5	I	3	DS	5-21-5	8	44
	Bottom of test boring at 5.5 feet.		6–10						

Datum: NAVD 88
Hammer Weight: 140 lb.
Hole Diameter: 8 in.
Drill Rig: CME-55 TD-5
Surface Elevation: 703.0 ft.
Hammer Drop: 30 in.
Rock Core Diameter: --
Foreman: N. Hudson
Date Started: 10/26/2018
Pipe Size: 2 in. O.D.
Boring Method: HSA-3.25
Engineer: Andrew C. Casto
Date Completed: 10/26/2018

BORING METHOD
HSA = Hollow Stem Augers
CFA = Continuous Flight Augers
DC = Driving Casing
MD = Mud Drilling

SAMPLE TYPE
PC = Pavement Core
CA = Continuous Flight Auger
DS = Driven Split Spoon
PT = Pressed Shelby Tube
RC = Rock Core

SAMPLE CONDITIONS
D = Disintegrated
I = Intact
U = Undisturbed
L = Lost

GROUNDWATER DEPTH
First Noted: None
At Completion: Dry
After: --
Backfilled: Immediately

* SPT = Standard Penetration Test - Driving 2" O.D. Sampler 18" with 140-Pound Hammer Falling 30"; Count Made at 6" Intervals

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FROM THE GROUND UP

SOIL CLASSIFICATION SHEET

NON COHESIVE SOILS
(Silt, Sand, Gravel and Combinations)

Density

Very Loose	- 5 blows/ft. or less
Loose	- 6 to 10 blows/ft.
Medium Dense	- 11 to 30 blows/ft.
Dense	- 31 to 50 blows/ft.
Very Dense	- 51 blows/ft. or more

Relative Properties

Descriptive Term	Percent
Trace	1 – 10
Little	11 – 20
Some	21 – 35
And	36 – 50

Particle Size Identification

Boulders	- 8 inch diameter or more	
Cobbles	- 3 to 8 inch diameter	
Gravel	- Coarse	- 3/4 to 3 inches
	- Fine	- 3/16 to 3/4 inches
Sand	- Coarse	- 2mm to 5mm (dia. of pencil lead)
	- Medium	- 0.45mm to 2mm (dia. of broom straw)
	- Fine	- 0.075mm to 0.45mm (dia. of human hair)
Silt		- 0.005mm to 0.075mm (Cannot see particles)

COHESIVE SOILS
(Clay, Silt and Combinations)

Consistency	Field Identification	Unconfined Compressive Strength (tons/sq. ft.)
Very Soft	Easily penetrated several inches by fist	Less than 0.25
Soft	Easily penetrated several inches by thumb	0.25 – 0.5
Medium Stiff	Can be penetrated several inches by thumb with moderate effort	0.5 – 1.0
Stiff	Readily indented by thumb but penetrated only with great effort	1.0 – 2.0
Very Stiff	Readily indented by thumbnail	2.0 – 4.0
Hard	Indented with difficulty by thumbnail	Over 4.0

Classification on logs are made by visual inspection.

Standard Penetration Test – Driving a 2.0" O.D., 1 3/8" I.D., sampler a distance of 1.0 foot into undisturbed soil with a 140 pound hammer free falling a distance of 30 inches. It is customary to drive the spoon 6 inches to seat into undisturbed soil, then perform the test. The number of hammer blows for seating the spoon and making the tests are recorded for each 6 inches of penetration on the drill log (Example – 6/8/9). The standard penetration test results can be obtained by adding the last two figures (i.e. 8+9=17 blows/ft.). Refusal is defined as greater than 50 blows for 6 inches or less penetration.

Strata Changes – In the column "Soil Descriptions" on the drill log, the horizontal lines represent strata changes. A solid line (————) represents an actually observed change; a dashed line (— — — —) represents an estimated change.

Groundwater observations were made at the times indicated. Porosity of soil strata, weather conditions, site topography, etc., may cause changes in the water levels indicated on the logs.

APPENDIX D – LABORATORY TEST DATA

Tabulation of Laboratory Tests

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CITY OF SOUTHGATE
FORT BEECH DRIVE DISTRESS
SOUTHGATE, KENTUCKY
J033230.01

TABULATION OF LABORATORY TESTS

Boring No.	Sample No.	Depth (ft.)		Moisture Content (%)	Atterberg Limits (%)			USCS Classification
		From	To		LL	PL	PI	
B-1	PT-1	0.0	2.0	21.0	42	23	19	CL
B-3	PT-1	0.0	2.0	21.0	44	21	23	CL