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MATERIALS INSPECTION & TESTING, INC.

PHONE (260) 489-1567 3807 GOSHEN ROAD. FORT WAYNE, INDIANA 46818

August 26, 2019

Brooks Construction
Mr. Rodney Firmi
6525 Ardmore Avenue
Fort Wayne, Indiana 46899

Re: Subsurface Soils Exploration
Toll Road; Parking Plaza
Mile Marker 108

Gentlemen:

We have performed a geotechnical soils investigation at the above referenced property. The purpose of this investigation was to determine the various soil profile components, the engineering characteristics of the foundation materials, and to provide information why the existing parking plaza is rutting.

SOIL INVESTIGATION

The field investigation to determine the engineering characteristics of the foundation soils included a reconnaissance of the project site, drilling of three (3) soil borings located generally as noted on the enclosed rough sketch with two (2) borings being conducted on the north parking plaza and one at the south parking plaza.

The soil borings were performed with a drilling rig equipped with a rotary head. Conventional hollow-stem augers were used to advance the holes. Soil samples were taken at intervals noted on the individual boring logs. As noted, the samples were taken by the Standard Penetration Test Method (ASTM D1586), which involves driving a 2 inch diameter split-spoon sampler into the soil with a 140 pound weight falling 30 inches. The sampler is generally driven in three successive six-inch increments, with the number of blows for each increment recorded. The number of blows required to advance the sampler in the last 12 inches is termed the Standard Penetration Resistance (N). The results of the SPT indicate the relative density and comparative consistency of the soils, thereby providing a basis for estimating the relative strength and compressibility of the soil profile.

The soil samples obtained with the spilt-barrel sampler were sealed in glass containers and transported to our laboratory for further classification and testing. These samples will be stored in our laboratory for a period of 30 days. The stratification shown on the boring logs represents the soil conditions at the actual test locations. Variation may occur between these locations. Additionally, the stratigraphic lines represent the approximate boundary between soil types; however, the transition from one soil type to another may be more gradual than that which is shown.

LABORATORY TESTING

In addition to the field investigation, a supplemental laboratory investigation was conducted to ascertain additional pertinent engineering characteristics of the foundation soils. All phases of the laboratory investigation were conducted in general accordance with ASTM and applicable specifications.

The laboratory testing for this project included visual classification and moisture content on all samples. All soils were classified in accordance with the Unified Soil Classification System. Results of all laboratory tests are presented on the soil boring logs included with this report.

SUBSURFACE CONDITIONS

The stratification depths shown on the boring log is intended to indicate a zone of transition from one soil type to another. It is not intended to indicate exact depths of soil change. Subsurface conditions encountered at the time of construction may vary considerably from one area to another and from the conditions encountered at the soil boring locations.

B-1 (North Parking Plaza)

Approximately +/-16.0" of asphalt, consisting of 4.0" of 9mm wearing surface placed in May 2019 is underlain by 3.0" of previous overlay followed by 9.0" of 5D or 5 base. The 5D/5 base appears to be the original construction of the parking plaza. Beneath the asphalt layers very dense, dense to firm fine brown sand, little fine gravel was encountered and extended throughout the explored depths of the soil boring.

B-2 (North Parking Plaza)

Approximately +/-16.0" of asphalt, consisting of 4.0" of 9mm wearing surface placed in May 2019 is underlain by 3.0" of previous overlay followed by 9.0" of 5D or 5 base. The 5D/5 base appears to be the original construction of the parking plaza. Beneath the asphalt layers very dense, dense to firm fine brown sand, little fine gravel was present and continued throughout the explored depths of the soil boring.

B-3 (South Parking Plaza)

Approximately +/-16.0" of asphalt is underlain by very dense, dense to firm fine brown sand, little fine gravel and continued throughout the explored depths of the soil boring.

No groundwater was recorded upon completion of the drilling operations.

The cause of the rutting from parked truck traffic is the deterioration of the existing 5D or 5 base asphalt. The deterioration of the asphalt could be seen by this investigation where crumbling of asphalt mixed within the dense granular soils, along with the flexing of these materials.

When over the road trucks are parked for a period along with the possible vibration from the trucks this is considered to be a dead load causing the rutting. The areas outside truck parking have minimal rutting conditions.

The sub-grade soils encountered in this exploration are mostly dense granular soils, with moisture contents ranging from 2.9% to 10.5% and are adequate for pavement support in their present condition.

It is recommended all asphalt be removed. Upon completion a thorough proof-roll should be performed on the resulting sub-grade. Any soft, yielding or unsuitable soils that remain should be removed and replaced with approved structural fill. Some reconsolidations of the granular soils may be required. Any new fill placement to develop final grade should be placed and compacted per the enclosed specifications. Some soil modification such as cement stabilization or a geogrid sub-grade enhancing system may be required, depending on the time of year the project is built. This decision should be made on site at the time this work is being completed. The time of year the construction is being performed could greatly affect the final procedure required to provide an adequate sub-grade for the pavement areas.

With proper site preparation and close field inspections and observations, based on anticipated soil types available at the site, we recommend a CBR value of 5 percent be used in design of the all pavement sections.

Based on the above assumptions and our experience with similar projects, we recommend using the following flexible pavement section:

Recommended Flexible Pavement Sections

Material	Light Duty (in)	Heavy Duty (in)
Asphalt Wearing Surface	1.0	1.5
Binder Course	3.0	8.0

Pavement materials and procedures should conform to applicable sections of the Indiana Department of Transportation latest addition.

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Experience has shown that most asphalt pavement failures are caused by localized soft spots in the subgrade or inadequate drainage. Proof rolling by the geotechnical engineer will greatly reduce the incidence of weak spots in the subgrade, as discussed earlier. However, the civil design must include proper drainage to reduce softening of the subgrade, frost damage, heaving, soil migration, and pumping failures. The pavement surface and subgrade should have a minimum slope of 2 percent. Water infiltrating the mineral aggregate base should be designed to drain into catch basins (through weep holes), out slope areas, or drainage trenches. It may also be advisable to construct a concrete pad around interior catch basins to accommodate the problems associated with the frequent saturation of the pavement system in low areas.

Maintenance is essential to good long-term performance of both concrete and asphalt pavements. Any distressed areas should be promptly repaired to prevent the failure from spreading due to loading and water infiltration. Cracks and joints should be sealed annually with a heavy duty sealer. Additionally, a seal should be applied in the second or third year of service for asphalt pavements. The seal will retard the asphalt from becoming brittle and seal small cracks that cannot be repaired otherwise.

GENERAL COMMENTS

In general, the performance of the subgrade soils on this site is dependent on the various factors that have been discussed. Potential load responsive settlements should remain within tolerable limits if suggested design and construction criteria are followed.

This company is not responsible for the independent conclusions; opinions or recommendations made by others based on the field exploration and laboratory test data presented in this report.

This geotechnical study has been conducted in a manner consistent with that level of care ordinarily exercised by members of the profession currently practicing in the same locality under similar conditions. The findings, recommendations, and opinions contained herein have been promulgated in accordance with generally accepted practice in the fields of foundation engineering, soils mechanics, and engineering geology. No other representations, expressed or implied, and no warranty or guarantee is included or intended in this report.

If there are any questions about this report, or if we can be of further assistance to you in any respect, please contact this office. We appreciate the opportunity to have been of service to you on this project.

Respectfully,
Materials Inspection & Testing, Inc.

Tim Reams

Tim Reams,
President

Jason Olin Lougheed, P.E.
Staff Engineer

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RECORD OF
SOIL EXPLORATION

MATERIALS INSPECTION & TESTING
3807 GOSHEN ROAD
FORT WAYNE, INDIANA 46818
PH: 260-489-1567
FAX: 260-489-1993

PROJECT: *TOLL ROAD*
PARKING PLAZA
MILE MARKER 108

DATE: *8/21/2019* *WATER:* *DRY*
ELE:+/- *N/A* *MIT JOB#:* *2019-450*
DEPTH: *10.0'*
CREW: **M. I .T.** **BORING #: B-1**

SOIL DESCRIPTION	DEPTH	Sample Number	N"	Qu	Qp	Mc	Dry Density	Remarks
4.0" Asphalt, Brooks 2019 3.0" Asphalt, Previous Overlay 9.0" 5 Base Original	SUR-FACE	1SS				4.3%		
Dense Moist Brown Sand, Little Fine Gravel.	2.5'	2SS	35			2.9%		
	5.0'	3SS	35			5.2%		
	7.5'	4SS	45			10.4%		
Firm Quite Moist Fine Brown Sand, Little Fine Gravel. EOB	10.0'	5SS	21			10.5%		

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ELE:+/- *N/A* *MIT JOB#:* *2019-450*
DEPTH: *10.0'*
CREW: **M. I .T.** **BORING #: B-2**

SOIL DESCRIPTION	DEPTH	Sample Number	N"	Qu	Qp	Mc	Dry Density	Remarks
4.0" Asphalt, Brooks 2019 3.0" Asphalt, Previous Overlay 9.0" 5 Base Original	SUR-FACE	1SS	42			5.0%		
Dense To Very Dense Moist Fine Brown Sand, Little Fine Gravel.	2.5'	2SS	55			3.8%		
	5.0'	3SS	34			4.8%		
	7.5'	4SS	54			4.8%		
EOB	10.0'	5SS	61			8.8%		

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SOIL EXPLORATION

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PROJECT: *TOLL ROAD*
PARKING PLAZA
MILE MARKER 108

DATE: *8/21/2019* *WATER:* *DRY*
ELE:+/- *N/A* *MIT JOB#:* *2019-450*
DEPTH: *10.0'*
CREW: M. I .T. BORING #: B-3

SOIL DESCRIPTION	DEPTH	Sample Number	N"	Qu	Qp	Mc	Dry Density	Remarks
16.0" Asphalt.	SUR-FACE	1SS	45			4.0%		
Dense To Firm Moist Fine Brown Sand, Little Fine Gravel.	2.5'	2SS	49			4.2%		
	5.0'	3SS	33			3.1%		
	7.5'	4SS	18			4.5%		
EOB	10.0'	5SS	24			3.3%		


Truck Rest Area
+/- Mile Post 107
Indiana Toll Road
Elkhart County / York Township
Legend
1
2
3
4
Indiana Toll Rd (toll road)
80
Google Earth
© 2018 Google
600 ft
N

MATERIALS INSPECTION & TESTING, INC.
M. I. T., INC.
FIELD CLASSIFICATION SYSTEM FOR SOIL EXPLORATION

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

Density	
Very Loose	< 5 blows/ft or less
Loose	> 6 to 10 blows/ft. >
Firm	11 to 30 blows/ft. >
Dense	31 to 50 blows/ft. >
Very Dense	51 plus blows/ft.

Relative Proportions:	
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 in diameter
Gravel:	Coarse 1 to 3 inch
	Medium 1/2 to 1 inch
	Fine 1/4 to 1/2 inch
Sand	Coarse 2.00mm to 1/4 inch (Dia. of a pencil lead)
	Medium 0.42 to 2.00mm (Dia. of a broom straw)
	Fine 0.074 to 0.42mm (Dia. of a human hair)
Silt	0.0074 to 0.002mm (Cannot see particles)

COHESIVE SOILS
(Clay, Silt and Combinations)

Consistency	
Very Soft	0.25 and Below
Soft	0.25------0.50
Medium	0.50------1.00
Stiff	1.00------2.00
Very Stiff	2.00------4.00
Hard	4.00------8.00
Very Hard	Over 8.00

Plasticity	
Degree of Plasticity	Plasticity Index
None to Slight	0-4
Slight	5-7
Medium	8-22
High to Very High	over 22

Classifications on logs are made by visual inspection of samples.

Standard Penetration Test: Driving a 2.0" O. D., 13/8" 1. D., sampler a distance of 1.0 foot into undisturbed soil with a 140 pound hammer free falling a distance of 30.0 inches. It is customary for split spoon to be driven 6.0" to seat into undisturbed soil, then perform the test. The number of hammer blows for seating the spoon and making the test are recorded for each 6.0 inches of penetration on the drill log (Example- 6/7/8). The standard penetration test result can be obtained by adding the last two figures (i. e. 7 + 8 = 15 blows/ft.). (ASTM D 1586-67)

Ground Water: Observations of ground water 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 boring logs.

MIX ANALYSIS FORM

Version Number: 2019.2

Sample Date:	08/29/19	Technician Initials:	ESP
Plant# :	7	Tonnage:	
Size:		Mix Type:	
Purpose:		Category/Type:	
Private Mix Type:			
Contract:		Route:	Toll Road
DMF:			

☑	I certify that all testing was performed in accodance with AASHTO, ASTM, or ITM specifications, so therefore, this test should be used as a statistical reference.

Lot Info:

Lot:	
Sublot:	
Source:	
Weight of Boxes:	
Station Marking:	

Maximum Specific Gravity (T209 / D 2041 = A/(A-C) **C=(E-D)

Water Bath Temp	A	Dry Weight of Mix	
	D	Calibrated Pycnometer with Water	
	E	Mix and Water in Pycnometer	
	GMM	Maximum Specific Gravity	

Moisture Content (T255 / C566):

Start Weight:	Without Moisture:	Moisture %:

Bulk Specific Gravity (ITM 590)

	Total Gsb:			
	Fine Agg 1	Fine Agg 2	Coarse Agg	
Dry+Pan:			Oven Dry:	
Pan Wt:			SSD:	
Flask:			In Water:	
Agg+Flask:			Coarse Gsb:	
SSD:				
Fine Gsb:				

Binder Content (T164 / D2726):

Dry Sample Wt:	1747.8
Filter & Fines Wt:	20.8
Filter Wt:	19.2
Cup & Fines Wt:	270.4
Clean Cup Wt:	266.0
Dry Aggregate Before Decant:	1616.7
Aggregate Wt. w/Fines Added:	1622.7
Binder content:	7.16%
Dry Agg Wt. After Decant:	
% Loss from Decant:	
Binder Content Req'd:	
Dust / Binder Ratio:	
GSE:	

Analysis of Compacted Superpave Specimens @ Ndes (T166)

Heights	Dry Wt. A	SSD WT. B	In Water Wt. C	GMB Bulk D

Avg GMB	
Air Voids (GMB/GMM) X 100	

Gsb (for calculations)	
Vbe	
VMA	

Sieve Analysis (T27/C136)

Sieve Size Inch/MM	Weight Retained	Weight Passing	% Passing	Spec	DMF	Validity (<0.2%)
1.5	0	1622.7	100.0%			0.0%
1	0	1622.7	100.0%			
3/4	74.9	1547.8	95.4%			
1/2	91.6	1456.2	89.7%			
3/8	108.1	1348.1	83.1%			
#4	389.7	958.4	59.1%			
#8	205.1	753.3	46.4%			
#16	159.5	593.8	36.6%			
#30	155.1	438.7	27.0%			
#50	178.5	260.2	16.0%			
#100	105.2	155	9.6%			
#200	45.7	109.3	6.7%			
Pan Wt.	103.3	6.0	0.4%			

Comments

1. Composition Limits for Base Mixtures.

Sieve Size	Percent of Aggregates Passing Sieves			
	Mixture			
	2	5	5C	5D*
63 mm (2 1/2 in.)	100			
37.5 mm (1 1/2 in.)	45-75	100	100	100
25.0 mm (1 in.)	30-60	80-99	70-98	80-99
19.0 mm (3/4 in.)	20-50	67-90	50-85	68-90
12.5 mm (1/2 in.)	15-40	42-74	28-62	54-76
9.5 mm (3/8 in.)	10-35	33-60	15-50	45-67
4.75 mm (No. 4)	15±5	30±5	15±5	40±5
2.36 mm (No. 8)	3-20	12-34	3-20	20-45
1.18 mm (No. 16)	2-15	7-28	2-15	12-36
600 μm (No. 30)	1-10	4-22	1-10	7-28
300 μm (No. 50)	0-7	1-16	0-7	3-18
150 μm (No. 100)	0-6	0-10	0-6	1-12
75 μm (No. 200)	0-4	0-4	0-4	0-5
Percent of Bitumen	2.5-3.5	4.0-5.1	3.0-4.5	4.0-5.1
Percent of Moisture, Max.	0.5	0.5	0.5	0.5

*Base 5D mixture shall be used for the bottom layer of full depth bituminous pavement and may be used in the construction of shoulders, medians, or other areas not subject to traffic.