REPORT OF SUBSURFACE EXPLORATION AND FOUNDATION EVALUATION

AT

PROPOSED BRIDGE REPLACEMENT
CUY-INNERBELT CURVE
SUPERIOR AVENUE
CUYAHOGA COUNTY, OHIO
TASK ORDER NUMBER: 11973-8C
PID NUMBER 77413

PREPARED FOR

OHIO DEPARTMENT OF TRANSPORTATION
5500 TRANSPORTATION BOULEVARD
GARFIELD HEIGHTS, OHIO 44125-5396

PREPARED BY

PROFESSIONAL SERVICE INDUSTRIES, INC.
5555 CANAL ROAD
CLEVELAND, OHIO 44125

PSI FILE NUMBER: 142-55031-6

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July 29, 2005

Ohio Department of Transportation - District 12
5500 Transportation Boulevard
Garfield Heights, Ohio 44125-5396

Attention: Mr. Ben Kruse
Consultant Contract Manager

Re: District 12 GES Pavement and Subsurface Investigation
Proposed Superior Avenue Bridge Replacement
CUY-Innerbelt Curve
Cuyahoga County, Ohio
PID Number: 77413
Task Order Number: 11973-8C
PSI Project Number: 142-55031-6

Dear Mr. Kruse:

In compliance with your instructions, we have conducted a geotechnical subsurface exploration and foundation evaluation for the above-referenced project. The results of this exploration, together with our recommendations, are to be found in the accompanying report, three (3) copies of which are being transmitted herewith.

After the plans and specifications are complete, PSI should review the final design drawings and specifications in order to verify that the recommendations are properly interpreted and implemented. It is also considered imperative that the geotechnical engineer or its representative be present during earthwork operations, and foundation and pavement installations to observe field conditions with respect to the design assumptions and specifications.

Should you have any questions regarding the contents of this submittal, please do not hesitate to contact us at 216-447-1335.

Respectfully submitted,

PROFESSIONAL SERVICE INDUSTRIES, INC.

Nathaniel Artman
Staff Engineer

A. Veeramani, P.E.
District Manager

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PROJECT INFORMATION

Project Authorization

This report presents the results of a geotechnical subsurface exploration and foundation evaluation, conducted for the Ohio Department of Transportation, in connection with the proposed bridge replacement on Superior Avenue, in the City of Cleveland, Cuyahoga County, Ohio. PSI's services for this project were performed in accordance with PSI Proposal No. 142-550028, dated February 3, 2005 and revised March 11, 2005. Authorization to perform this exploration and analysis was in the form of an email transmitted to PSI on March 24, 2005, prepared by Mr. Ben Kruse of the Ohio Department of Transportation.

Project Description

Based on the project information provided by Mr. Ben Kruse and Mr. David Lastovka of the Ohio Department of Transportation, it is understood that the proposed project will include replacement of the existing bridge on Superior Avenue over IR-90, as well as new approach slabs. The existing bridge structure is a 3 span, supported by 12-inch cast-in-place piles with effective pile length of about 52 to 63 feet below the surface grades. Specific information for the proposed bridge structure was not available at the time of this report. When specific information becomes available, please inform PSI so that the recommendations presented in this report can be reviewed and amended, if appropriate.

Purpose and Scope of Services

The purpose of this exploration was to evaluate the soil and groundwater conditions at the site to provide recommendations, from a geotechnical engineering viewpoint, for foundation design and construction, site preparation and other construction considerations. The scope of the exploration and analysis included a reconnaissance of the project site, drilling 4 test borings to depths of about 100 feet below the existing roadway surface grades, a laboratory testing program, and an engineering analysis and evaluation of the subsurface materials. The scope of services also included pavement coring at each of the boring location.

The scope of services did not include an environmental assessment for the presence or absence of wetlands or hazardous or toxic materials in the soil, surface water, groundwater, or air, on or below or around this site. Any statements in this report or on the boring logs regarding odors, colors or unusual or suspicious items or conditions are strictly for the information of the client.

SITE AND SUBSURFACE CONDITIONS

Site Location and Description

The subject bridge (CUY/00006/1672) is located on Superior Avenue over IR-90, in the City of Cleveland, Cuyahoga County, Ohio.

The existing structure spans in the east-west direction over IR-90, which runs in the north-south direction in this area of Cleveland. The surface of Superior Avenue is covered with asphalt concrete, underlain by a layer of concrete pavement. The surface elevations provided on the boring location plan indicates that the surface of St. Clair Avenue is gently sloping and exhibits a change in elevation of less than 1 foot (637.0 to 636.9±' MSL).

The elevational difference between the roadway surface of the St. Clair Avenue bridge structure and the top of IR-90 is approximately 19.5 feet (637.0 to 617.6±' MSL). Roadway embankments in the vicinity of the bridge are covered with grass, trees and brush. Surface drainage was good at the time of the field drilling operations. We recommend that all utility lines be located prior to construction activities.

Subsurface Conditions

As discussed in the purpose and scope of services section, the area's subsurface soils were explored with 4 test borings. The test borings were drilled to a depth of approximately 100 feet below the existing surface/pavement grades utilizing conventional truck-mounted drilling equipment. The locations of the test borings were selected and field located by representatives of PSI utilizing conventional taping procedures. However, the stations, offsets and ground surface elevations at the test boring locations were surveyed by Burgess and Niple, Inc. and are provided on the boring logs included in the Appendix.

Field and laboratory testing were accomplished in general accordance with applicable ASTM standards. The soil types encountered in the test borings have been visually classified. Included on the boring logs in the Appendix are the results of the visual classifications, Standard Penetration tests, moisture contents, grain size analyses, unconfined compression tests, Atterberg Limit determinations, hand penetrometer tests and water level observations. Representative samples of the soils were placed in sample jars, and are now stored in the laboratory for further analysis, if requested. Unless notified to the contrary, all samples will be disposed of after 60 days from the date of this report.

Test borings SB-1, SB-3 and SB-4 were drilled on Superior Avenue outside of the existing abutments and test boring SB-2 was drilled on the inside shoulder of IR-90 in the westbound direction. The pavement components on Superior Avenue consist of 3 inches of asphalt concrete underlain by 4.5 to 13.5 inches of concrete. The pavement components on the shoulder of IR-90 consist of 4.5 inches of asphalt underlain by 9 inches of concrete.

The pavement sections were underlain by natural soils consisting of coarse and fine sand, silt, clay, sandy silt, silty clay and silt and clay, containing varying degrees of stone fragments. The natural soils were encountered to the terminal depths at all test boring locations. The natural granular soils exhibited a moisture content ranging from about 10 to 24 percent and a loose to medium dense relative density, based on the Standard Penetration tests. The natural cohesive soils exhibited a moisture content ranging from about 15 to 35 percent and a soft to very stiff consistency, based on the Standard Penetration tests.

The above subsurface material description is of a generalized nature and is provided to highlight the major strata encountered. The boring logs included in the Appendix of this report should be reviewed for specific information at the individual boring locations. The stratifications shown on the boring logs represent the conditions only at the actual test positions. Variations may occur and should be expected between the boring locations. The stratifications represent the approximate boundary between the subsurface materials, and the transition may be gradual or not clearly defined.

Groundwater Conditions

No groundwater was encountered during the drilling operations at the boring locations. However, groundwater levels fluctuate seasonally as a function of precipitation and other hydrogeological factors. Therefore, at a time of year different from the time of drilling, there may be a considerable change in the water table or the occurrence of water where not previously encountered. Furthermore, the water levels in the boreholes often are not representative of the actual groundwater level, because the boreholes remain open for a relatively short time. Therefore, we recommend that the contractor determine the actual groundwater levels at the time of construction to evaluate groundwater impact on the construction procedures.

EVALUATION AND RECOMMENDATIONS

Site Preparation and Earthwork Operations

Prior to the initiation of any earthwork operations, general site area clearing should be employed. All grass, brush, asphalt concrete, concrete, soft/loose and excessively wet soils and other objectionable materials, are to be completely removed from the proposed construction areas.

Careful visual control of clearing and stripping operations should be maintained to assure that all deleterious materials are removed. The required extent to which deleterious materials are removed should be determined in the field following visual observation of the exposed subgrades. Subsequent to the site area clearing and stripping, all structural subgrade sectors should be subjected to critical proof-rolling operations and careful observation of subgrade reactions until the grades offer a relatively unyielding surface. Any sectors that exhibit instability are to be undercut to such depths as may be necessary to assure satisfactory supporting properties. These undercut areas shall be backfilled with approved fill materials, placed and compacted under carefully controlled procedures as described below.

All those areas, which are to receive structural fill, should be filled on a critically controlled, lift-by-lift basis employing select, clean, organically free materials. All structural fill should be approved by the project's geotechnical engineer prior to placement. Individual fill lifts are to be of maximum 8-inch loose measure thickness and each individual lift is to be adjusted in moisture content to within plus or minus two 2 percent of the optimum moisture content as determined in accordance with ASTM standard Proctor method D-698. The fill materials are to be systematically compacted such that an in-place density of at least 98 percent of the maximum laboratory density as determined in accordance with the above-referenced ASTM method is achieved. For backfill against the abutments and wingwalls, the thickness of the lifts should be significantly reduced so that lighter compaction equipment can be used to achieve the recommended densities. Careful moisture control will be required during compaction operations for all fill materials. Careful attention will be required in fine-grading the subgrade surfaces in order to eliminate undulations and depressions that would tend to collect water. The pavement subgrade surface should be graded in a manner such that positive drainage towards the pavement edges and/or drainage systems will be insured.

Cut excavations required at the bridge abutments will not be stable on a vertical slope. As such, it is recommended that the sides of the cut be properly sloped away from the excavation area, as conditions require for the safety of the workers. Further, applicable provisions for excavation slope support required by OSHA and pertinent construction codes should be followed.

It must be recognized that climatic conditions, surcharge loads at the top of the excavation, and water seepage from cut faces of the slopes, as well as the length of time for which the excavation remains open, will adversely affect the excavation slope stability.

Regardless of the initial slope configurations adopted, careful observation of the construction slopes should be maintained throughout excavation and construction. Throughout the course of the earthwork operations, surface grades are to be maintained to facilitate positive drainage within the construction area and to prevent inundation of either the existing subgrade or new fill material. No water should be allowed to impound on the subgrade surfaces during this time.

All slopes affected by the construction activity should be protected by suitable means per guidelines of the Ohio Department of Transportation to minimize erosion, water infiltration and subsequent saturation.

Backfilling against the bridge abutments and wingwalls, protection of any and all utilities, and all other details in connection with the design and installation of the bridge should conform to specifications of: (a) the State of Ohio Department of Transportation, Construction and Materials' Specifications, Columbus, Ohio, (b) the Ohio Department of Transportation, Division of Highways, Bureau of Location and Design publication "Standard Construction Drawings", and (c) the Ohio Department of Transportation Bridge Design Manual.

Bridge Foundation

Based on the test boring and laboratory test results, proposed construction and evaluation of the subsurface conditions, it is recommended that concrete filled driven closed end pipe piles or cast-in-place concrete piles be used to support the abutments and piers in connection with the proposed bridge structure. The tip elevation of the piles should be established at a depth of at least 55 feet (Elev. 562±' MSL) below the existing IR-90 roadway surface grades. Design factors for the design of the individual piles as a function of penetration are as follows:

Penetration Depth (Feet)	Allowable Factors "F"	Allowable Factors "E"
55' (Elev. 562±' MSL)	10.4	2.7
60' (Elev. 557±' MSL)	12.0	2.7
65' (Elev. 552±' MSL)	13.4	2.7
70' (Elev. 547±' MSL)	14.0	1.1
80' (Elev. 537±' MSL)	15.3	1.1
90' (Elev. 527±' MSL)	16.5	2.7
100' (Elev. 517±' MSL)	19.2	2.7

Allowable pile capacity is defined by the following relationships:

$$Q_c = PF + AE$$
$$Q_t = PF$$

Where, Q_c = Allowable Compression Capacity, Tons
Q_t = Allowable Tension Capacity, Tons
P = Pile Perimeter, Feet
A = Pile Tip Area, Square Feet
F = Friction Factor
E = End Bearing Factor

The maximum allowable design load of the individual piles should be limited to the following values:

12-inch diameter piles	-	50 tons
14-inch diameter piles	-	70 tons
16-inch diameter piles	-	90 tons

The structural capacity of the piles should be checked for downward axial loads, tension forces and lateral forces. Also, piles in a group should be spaced a distance of at least three (3) pile diameters apart from one another. It must be recognized that failure to meet this criteria will result in a significant reduction in pile supporting capacity.

Driven piles frequently have a tendency to "freeze" in place when the pile driving operations are halted. Therefore, each pile should be driven to the desired tip elevation and driving resistance without interruptions in the driving operations. Driving the center piles of a cluster first will facilitate the driving operations. Accurate records of the final tip elevations and driving resistance should be obtained during the pile driving operations. These records should be provided to the geotechnical engineer, for review, prior to acceptance of the piles. Steel piles may be subject to corrosion due to the conductivity of the soils. The possibility of excessive corrosion taking place should be reviewed by an engineer specializing in corrosion control.

Lateral loads should be handled by battering some pile members, as required. In the design of the batter piles, two (2) criteria must be satisfied:

a. The axial load in any batter pile must not exceed safe load per pile.
b. The sum of horizontal components of forces in batter piles must be equal the horizontal forces to be carried.

Bridge Abutments and Wingwalls

The bridge abutments and wingwalls will be expected to retain backfill materials to some height. In addition to the lateral earth pressures, the abutments will be expected to resist the reaction of the superstructure of the bridge and the increase in earth pressures due to wheel loads on the backfill adjacent to the abutments. Consideration should be given to the following factors in connection with the design of the abutments and wingwalls:

The abutment walls should be designed for at-rest loading conditions assuming triangular load distribution and an equivalent fluid pressure 60 pounds per square foot (psf) per foot of abutment depth. In the event provisions are made in the design of the superstructure of the bridge to permit sufficient lateral movement of the abutment to develop active earth pressure conditions, then an equivalent fluid pressure of 40 psf per foot of abutment depth may be employed. The wingwalls are to be designed for active earth pressure condition.

The influence of the wheel loads should be considered in the design of the abutments by representing them as an additional 24-inch layer of backfill. For the at-rest condition, an equivalent fluid pressure of 120 psf per foot of abutment depth should be utilized. For the active condition, the equivalent pressure can be reduced to 80 psf per foot of wall depth. Since this pressure is assumed to be uniformly distributed, the resultant force should be assumed at mid-height of the abutment wall.

The abutments and wingwalls should include an adequate drainage system in the form of weep holes and/or perforated drainpipes to preclude the possibility of any water buildup against the backface of these members. A well-graded granular material is to be employed as backfill around tile members or weep holes to avoid any clogging and to ensure positive drainage. A non-woven geotextile wrap for the pipe or a portion of the granular fill can also be utilized. It is further recommended that free draining materials or proprietary wall drain panels be placed against the entire face of the walls along their full length. The drainage blanket should have a minimum thickness of 18 inches and is to terminate approximately 24 inches below the finish subgrade elevation for the approach slabs or surface grades. A cohesive fill cap is recommended for the top 24 inches in order to prevent direct surface water infiltration.

During high water periods the backfill behind the abutments and wingwalls may become saturated by water. This will result in additional lateral pressures on the retaining structures during the period of receding water and until the drainage of the granular backfill is accomplished. Therefore, in addition to the previously discussed lateral earth pressures, the unbalanced water pressure should also be considered in the retaining wall design.

The appropriate safety factors should be considered in the stability analysis assuming that the earth pressures, water pressures, and highway surcharge loads could occur coincidently.

Once the abutments and wingwalls are in place, overcompaction of the materials against these structures should be avoided under all circumstances so as to prevent undue lateral earth pressures. Further, it is recommended that backfilling of cut excavations at the bridge abutments be undertaken only subsequent to installation of structural members of the new superstructure.

Pavement Structures

Pavement design for the approach slabs will include proper preparation of subgrade sectors, careful design of the pavement area drainage systems and utilization of an aggregate base course with an asphalt concrete or concrete surface course.

Once final subgrade elevations have been achieved employing procedures outlined in the *Site Preparation and Earthwork Construction* section of this report, it is recommended that the subgrade surface be compacted to an extent that a minimum of 24 inches of materials underlying the final subgrade surface achieve a minimum in-place density of 98 percent of the maximum laboratory density as determined in accordance with ASTM Proctor D-698.

Based on the subsurface formations encountered at the test boring locations, an average CBR value of 6 can be used for the design of the proposed pavement structures, provided that the subgrade materials consist of the compacted structural fill.

Inclusion of adequate surface and subsurface drainage systems along and below the roadway is considered imperative in order to maintain the compacted subgrades as close to optimum moisture conditions as possible. A subsurface drainage system consisting of perforated drain pipes bedded in and backfilled with suitable filter materials should be installed along either side of the roadway at an elevation such that groundwater will be maintained a minimum of 3 feet below the top of the pavement structures. The filter around the drainage members is to terminate in direct contact with the aggregate base course for the pavements. All subgrade sectors should be graded to direct water by gravity toward the drainage lines. At all low points and at regular intervals, lateral underdrain lines connected to suitably located outlet points are to be provided.

Site surface grades should be such that no pavement sectors are allowed to impound water. All surface and subsurface water is to be directed to the existing or new storm sewer line or drainage ditches.

Excavations

In Federal Register, Volume 54, No. 209 (October, 1989), the United States Department of Labor, Occupational Safety and Health Administration (OSHA) amended its "Construction Standards for Excavations, 29 CFR, Part 1926, Subpart P." This document was issued to better insure the safety of workers entering trenches or excavations. It is mandated by this federal regulation that all excavations, whether they be utility trenches, basement excavations or foundation excavations, be constructed in accordance with the new OSHA guidelines. It is PSI's understanding that these regulations are being strictly enforced. If they are not followed closely, the owner and the contractor could be liable for substantial penalties.

The contractor is solely responsible for designing and constructing stable, temporary excavations and should shore, slope, or bench the sides of the excavations as required to maintain stability of both the excavation sides and bottom. The contractor's "responsible person" as defined in "CFR Part 1926," should evaluate the soil exposed in the excavations as part of the contractor's safety procedures. In no case should slope height, slope inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, state, and federal safety regulations.

Materials removed from the excavation should not be stockpiled immediately adjacent to the excavation, inasmuch as this load may cause a sudden collapse of the embankment.

PSI is providing this information solely as a service to the client. PSI is not assuming responsibility for construction site safety or the contractor's activities; such responsibility is not being implied and should not be inferred.

REPORT LIMITATIONS

The recommendations submitted in this report are based on the available subsurface information developed by PSI and on the design information furnished by Mr. Ben Kruse of the Ohio Department of Transportation for the proposed project. If there are any revisions to the plans for the proposed project, or if deviations from the subsurface conditions noted in this report are encountered during construction, PSI should be retained to determine if changes in the recommendations are required. If PSI is not retained to perform these functions, PSI will not be responsible for the impact of those conditions on the geotechnical recommendations for the project.

The Geotechnical Engineer warrants that the findings, recommendations, specifications, or professional advice contained herein, have been presented after being prepared in accordance with generally accepted professional engineering practice in the fields of foundation engineering, soil mechanics and engineering geology. No other warranties are implied or expressed.

After the plans and specifications are complete, it is recommended that PSI be provided the opportunity to review the final design drawings and specifications, in order to verify that the earthwork and foundation recommendations are properly interpreted and implemented. At that time, it may be necessary to submit supplementary recommendations. This report has been prepared for the exclusive use of the Ohio Department of Transportation, for the specific application to the proposed Superior Avenue bridge replacement project (CUY-Innerbelt Curve), in the City of Cleveland, Cuyahoga County, Ohio.

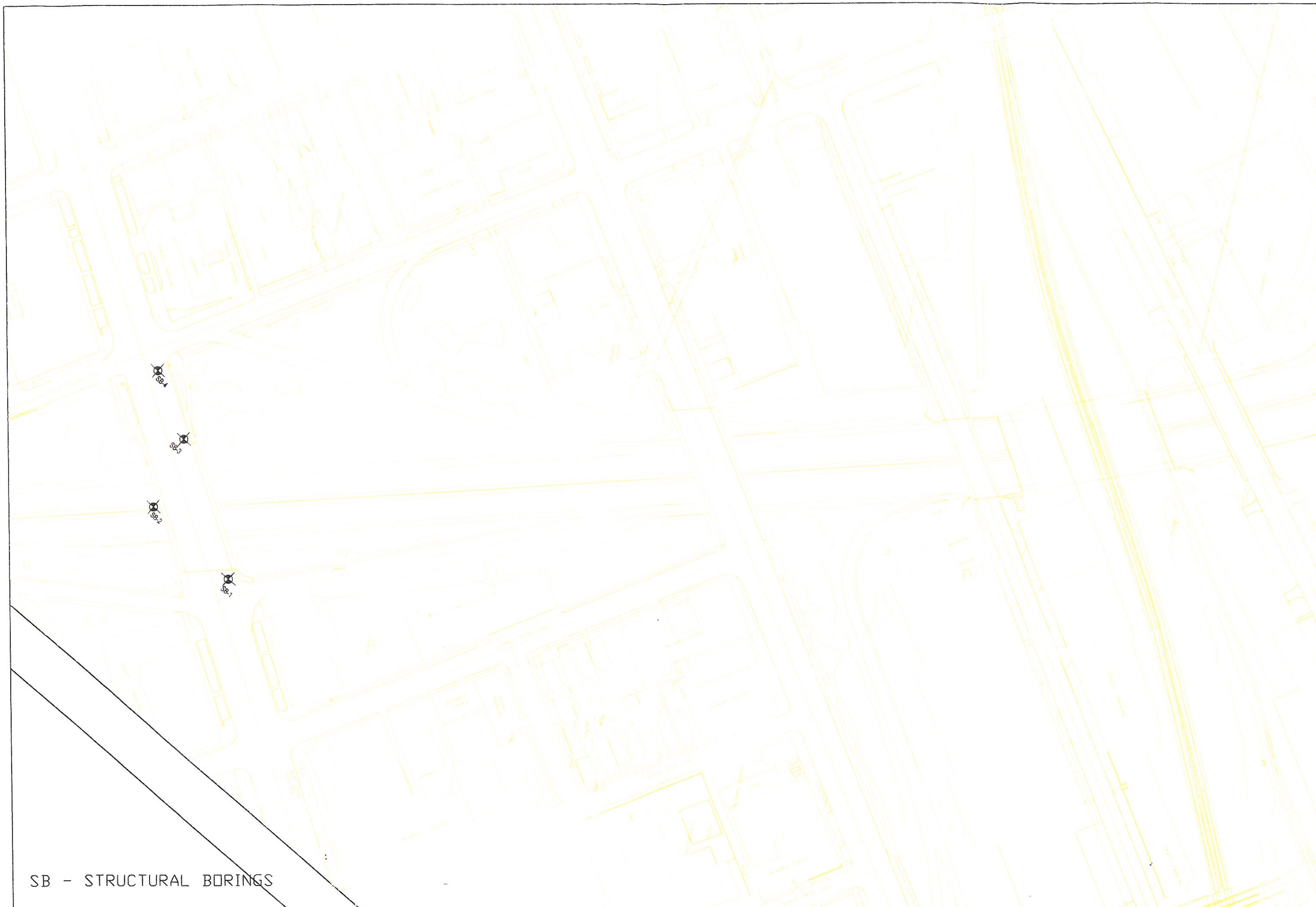
APPENDIX

Boring Location Plan

Boring Logs SB-1, SB-2, SB-3 and SB-4

Pavement Core Logs

General Notes



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DRAWN BY:	REVIEWED BY:	DATE:
SMP	NA	5/26/05

BORING LOCATION PLAN

CUY-INNERBELT CURVE

1/1

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Project I.D.	142-55031
Date Started	07/19/2005
Dated Completed	07/19/2005

Boring No.	SB-1
Station & Offset	STA 1025+20.21; 50.2' RT

Sampler Type	SS	Dia.	2.0"
Casing Type	AU	Dia.	3.25"
Water Encountered	None		
Water on Completion	None		
Surface Elevation	637.0± MSL		

Elev. Ft.	Std. Pen. Test	Description	Depth(ft)	Sample Number	% Agg.	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	Q_p (TSF)	ODOT Class
637.0		Surface												
635.6	--	3" Asphalt CONCRETE; 13.5" Concrete		CORE-1										
	--	Loose to Medium Dense, Moist, Brown Becoming Gray @ 8.5', Sandy SILT, Trace Clay and Stone Fragments		AU-2								10	--	
	4-2-5		5	SS-3								24	--	A-4a*
	5-6-7			SS-4								13	--	
	7-10-8		10	SS-5								19	--	
624.0		Stiff to Very Stiff, Moist, Gray, SILT, Some to and Clay, Trace Sand												
	5-5-6		15	SS-6								17	3.0	
	4-4-5		20	SS-7								17	2.5	
	14-12-10		25	SS-8								16	3.5	A-4b*
	16-14-8		30	SS-9								21	3.0	
	5-9-8		35	SS-10	0	0	1	55	44	27	6	22	2.5	A-4b
599.0		Medium Stiff/Stiff, Wet, Gray, SILT, and Clay, Trace Sand and Stone Fragments												
	3-3-4		40	SS-11								28	0.5	
	3-5-5		45	SS-12								25	0.5	A-6a*
		(Continued on Next Page)	50											

* ODOT Classification Based on Visual Description

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Dated Completed	07/19/2005

Boring No.	SB-1
Station & Offset	STA 1025+20.21; 50.2' RT

Sampler Type	SS	Dia.	2.0"
Casing Type	AU	Dia.	3.25"
Water Encountered	None		
Water on Completion	None		
Surface Elevation	637.0± ' MSL		

Elev. Ft.	Std. Pen. Test	Description	Depth(ft)	Sample Number	% Agg.	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	Q_p (TSF)	ODOT Class
		Continued From Previous Page												
	2-4-5		50	SS-13								27	1.0	A-6a*
	2-2-3		55	SS-14	0	0	0	45	65	35	13	29	1.0	A-6a
579.0		Stiff, Wet, Gray, SILT, and Clay												
	2-5-6		60	SS-15								26	0.5	
	--	Qu = 0.2	65	ST-16								28	–	A-4b*
	5-5-6		70	SS-17								27	0.5	
560.0	4-5-7		75	SS-18	0	0	0	56	44	32	10	25	0.5	A-4b
		Stiff/Soft, Wet, Gray, CLAY, Some Silt, Trace Sand												
	3-6-7		80	SS-19								29	0.25	
	–	Qu = 0.2	85	ST-20								24	–	A-7-6*
	2-2-2		90	SS-21								29	0.5	
	2-2-2		95	SS-22	0	2	1	32	65	41	18	28	0.25	A-7-6
535.6	7-7-7		100	SS-23								32	0.25	
		End of Boring - 101.4'												

* ODOT Classification Based on Visual Description

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Project I.D.	142-55031
Date Started	05/25/2005
Dated Completed	05/25/2005

Boring No.	SB-2
Station & Offset	1023+99.54; 86.3' LT

Sampler Type	SS	Dia.	2.0"
Casing Type	AU	Dia.	3.25"
Water Encountered	None		
Water on Completion	None		
Surface Elevation	617.6± ' MSL		

Elev. Ft.	Std. Pen. Test	Description	Depth(ft)	Sample Number	% Agg.	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	Q_p (TSF)	ODOT Class
617.6		Surface												
616.5	--	4.5" Asphalt CONCRETE; 9" Concrete		CORE-1										
	--	Wet, Brown, Coarse and Fine SAND, Little Silt and Clay, Trace Stone Fragments		AU-2								15	--	A-3a*
614.1	7-7-6	Stiff, Moist, Gray, SILT, Some Clay, Trace Sand	5	SS-3								17	3.0	A-4b*
	6-7-7			SS-4								17	--	
609.1	3-3-3	Medium Stiff, Moist, Gray, SILT and CLAY, Trace Sand	10	SS-5								16	1.0	
	2-3-4		15	SS-6								26	4.0	
	2-2-3		20	SS-7								29	1.5	A-6a*
	2-2-3		25	SS-8								31	0.75	
	2-3-4		30	SS-9								26	1	
585.6		Medium Stiff, Moist, Gray, Silty CLAY												A-6b*
	2-2-3		35	SS-10								30	1	
	2-3-4		40	SS-11	0	0	0	42	58	37	16	28	1.5	A-6b
574.6		Stiff to Medium Stiff, Moist, Gray, SILT and CLAY												
	4-4-6		45	SS-12								23	2.5	
														A-6a*
	5-8-9	(Continued on Next Page)	50	SS-13								23	2.5	

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Boring No.	SB-2
Station & Offset	1023+99.54; 86.3' LT

Sampler Type	SS	Dia.	2.0"
Casing Type	AU	Dia.	3.25"
Water Encountered	None		
Water on Completion	None		
Surface Elevation	617.6± ' MSL		

Elev. Ft.	Std. Pen. Test	Description	Depth(ft)	Sample Number	% Agg.	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	Q_p (TSF)	ODOT Class
		Continued From Previous Page												
	4-4-5		55	SS-14								25	3.0	A-6a*
	--	Qu = 1.7	60	ST-15	0	0	0	45	55	35	15	26	--	A-6a
	2-2-3		65	SS-16								23	1.0	A-6a*
549.6	2-2-2	Soft to Stiff, Wet, Gray, Silty CLAY, Trace Sand and Stone Fragments	70	SS-17								29	0.25	A-6b*
	2-3-3		75	SS-18	2	1	2	31	64	40	18	29	0.5	A-6b
	--	No Recovery	80	ST-19								--	--	
	2-2-3		85	SS-20								33	0.5	A-6b*
	3-4-5		90	SS-21								31	1.0	
	3-4-4		95	SS-22								31	0.5	
519.6		Very Stiff, Moist, Gray, SILT and CLAY												
516.5	5-8-9		100	SS-23	0	0	0	45	55	34	13	24	2.5	A-6a
		End of Boring - 101.1'												

* ODOT Classification Based on Visual Description

Information To Build On
Engineering • Consulting • Testing

Project I.D.	142-55031
Date Started	07/21/2005
Dated Completed	07/21/2005

Boring No.	SB-3
Station & Offset	1024+59.16; 202.2' LT

Sampler Type	SS	Dia.	2.0"
Casing Type	AU	Dia.	3.25"
Water Encountered	None		
Water on Completion	None		
Surface Elevation	636.9± ' MSL		

Elev. Ft.	Std. Pen. Test	Description	Depth(ft)	Sample Number	% Agg.	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	Q_p (TSF)	ODOT Class
636.9		Surface												
635.7	--	3" ASPHALT; 11.5" Concrete		CORE-1										
	--	Loose, Moist, Brown, Coarse and Fine SAND, Trace Silt and Stone Fragments		AU-2								12	--	A-3a*
	5-3-5		5	SS-3								16	--	
630.4	4-4-5	Loose to Medium Dense, Moist, Brown Becoming Gray @ 9.5', Sandy SILT, Trace Clay		SS-4								23	--	A-4a*
	7-7-8		10	SS-5								23	--	
623.9	3-6-7	Stiff to Very Stiff, Moist, Gray, SILT, Some Clay, Trace Sand and Stone Fragments	15	SS-6								15	2.5	
	8-8-7		20	SS-7								18	3.0	A-4b*
	9-13-12		25	SS-8								17	3.0	
608.9	3-4-5	Stiff/Medium Stiff, Moist/Wet, Gray, SILT and CLAY, Trace Sand	30	SS-9	0	0	1	33	66	34	12	33	0.25	A-6a
	3-3-3		35	SS-10								25	1.25	
	3-2-3		40	SS-11								31	0.25	A-6a*
	3-4-4		45	SS-12								27	1.0	
589.9	3-4-4	Medium Stiff, Moist, Gray, Sandy SILT (Continued on Next Page)	50	SS-13	0	0	0	34	66	31	8	27	1.0	A-4a

* ODOT Classification Based on Visual Description

psi Information To Build On
Engineering • Consulting • Testing

Project I.D.	142-55031
Date Started	07/21/2005
Dated Completed	07/21/2005

Boring No.	SB-3
Station & Offset	1024+59.16; 202.2' LT

Sampler Type	SS	Dia.	2.0"
Casing Type	AU	Dia.	3.25"
Water Encountered	None		
Water on Completion	None		
Surface Elevation	636.9±' MSL		

Elev. Ft.	Std. Pen. Test	Description	Depth(ft)	Sample Number	% Agg.	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	Q_p (TSF)	ODOT Class
		Continued From Previous Page												
585.90														
	--	Qu = 0.7	55	ST-14								28	--	
		Stiff to Very Stiff, Moist, Gray, SILT and CLAY												
	4-4-6		60	SS-15								25	0.75	A-6a*
	7-8-11		65	SS-16								24	1.5	
569.9		Very Stiff to Soft, Moist/Wet, Silty CLAY, Trace Sand and Stone Fragments												
	8-8-11		70	SS-17	2	3	2	25	68	40	17	25	1.25	A-6b
	--	QU = 0.5	75	ST-18								30	--	
														A-6b*
	2-2-2		80	SS-19								26	0.50	
553.9		Very Stiff, Moist, Gray, SILT and CLAY, Trace Sand												
	6-6-8		85	SS-20								24	0.5	A-6a*
	5-6-5		90	SS-21	0	1	1	33	65	30	12	29	0.5	A-6a
542.9		Medium Stiff, Wet, Gray, CLAY, Some Silt												
	2-3-3		95	SS-22								26	0.5	
														A-7-6
535.8	2-2-4		100	SS-23								35	0.25	
		End of Boring - 101.1'												

* ODOT Classification Based on Visual Description

psi Information To Build On
Engineering • Consulting • Testing

Project I.D.	142-55031
Date Started	07/25/2005
Dated Completed	07/25/2005

Boring No.	SB-4
Station & Offset	1024+33.81; 296.9' LT

Sampler Type	SS	Dia.	2.0"
Casing Type	AU	Dia.	3.25"
Water Encountered	None		
Water on Completion	None		
Surface Elevation	636.7± ' MSL		

Elev. Ft.	Std. Pen. Test	Description	Depth(ft)	Sample Number	% Agg.	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	Q_p (TSF)	ODOT Class
636.9		Surface												
636.3	--	3" Asphall CONCRETE; 4.5 inches Concrete		CORE-1										
	--	Loose, Moist, Brown, Becoming Gray @ 9.0', Sandy SILT, Trace Clay and Stone Fragments		AU-2								11	--	
	3-4-4			SS-3								10	--	
	5-4-4		5	SS-4								13	--	A-4a*
	4-4-4		10	SS-5								23	--	
624.7		Stiff to Very Stiff, Moist, Gray, SILT, Some Clay												
	9-5-8		15	SS-6								17	2.5	
	7-10-15		20	SS-7								16	2.0	A-4b*
	6-8-11		25	SS-8								16	2.5	
608.7		Soft to Medium Stiff, Moist, Gray, SILT and CLAY												
	2-2-3		30	SS-9								23	0.5	
	2-2-2		35	SS-10	0	0	0	53	47	35	14	17	0.5	A-6a
	2-2-2		40	SS-11								27	0.5	
	3-2-3		45	SS-12								29	0.25	A-6a*
586.7	--	(Continued on Next Page)	50	SS-13								23	0.25	

* ODOT Classification Based on Visual Description

PSI Information To Build On
Engineering • Consulting • Testing

Project I.D.	142-55031
Date Started	07/25/2005
Dated Completed	07/25/2005

Boring No.	SB-4
Station & Offset	1024+33.81; 296.9' LT

Sampler Type	SS	Dia.	2.0"
Casing Type	AU	Dia.	3.25"
Water Encountered	None		
Water on Completion	None		
Surface Elevation	636.7± ' MSL		

Elev. Ft.	Std. Pen. Test	Description	Depth(ft)	Sample Number	% Agg.	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	Q_p (TSF)	ODOT Class
		Continued From Previous Page												
		Medium Stiff, Moist, Gray, SILT, and Clay, Trace Sand	55	SS-14	0	1	1	57	41	30	10	28	0.5	A-4b
579.7		Very Stiff, Moist, Gray, SILT and Clay Qu = 1.8	60	ST-15								30	--	
			65	SS-16								25	2.0	A-6a*
		Qu = 2.0	70	ST-17								24	--	
564.7		Medium Stiff, Moist, Gray, Silty CLAY, Trace Sand	75	SS-18	0	1	0	43	56	38	16	25	1.0	A-6b
			80	SS-19								24	0.75	A-6b*
554.7		Soft to Medium Stiff, Wet, Gray, CLAY, Some Silt, Trace Sand	85	SS-20								33	0.25	A-7-6*
			90	SS-21								30	0.25	
			95	SS-22	0	1	1	29	69	41	17	23	0.25	A-7-6
536.1			100	SS-23								28	0.25	A-7-6*
		End of Boring - 100.6'												

* ODOT Classification Based on Visual Description

PSI Information To Build On
Engineering • Consulting • Testing

Project I.D.	142-55031
Date Started	07/25/2005
Dated Completed	07/25/2005

Boring No.	SB-4
Station & Offset	1024+33.81; 296.9' LT

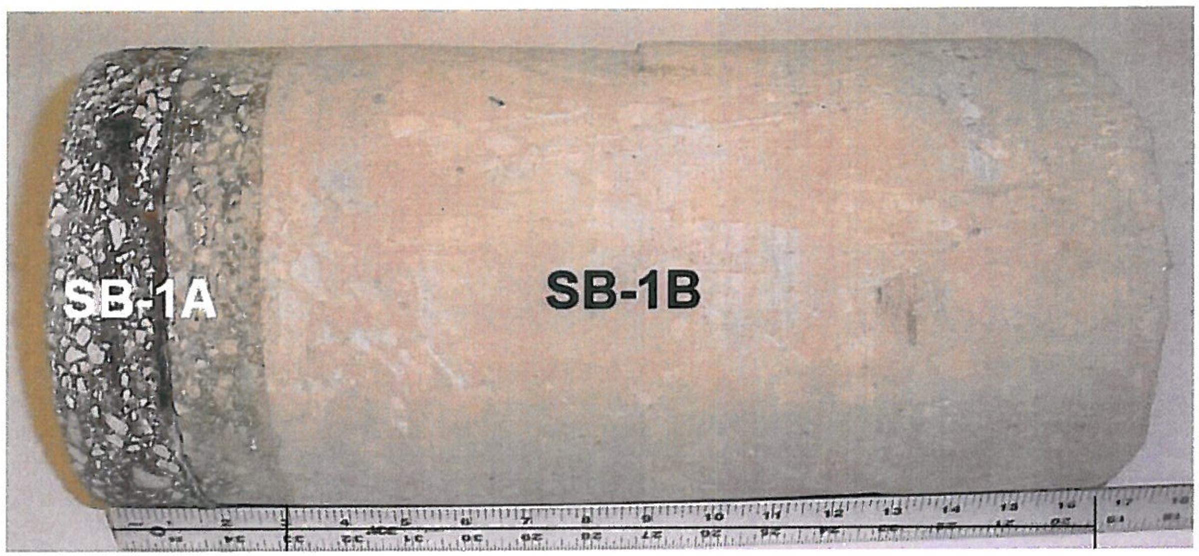
Sampler Type	SS	Dia.	2.0"
Casing Type	AU	Dia.	3.25"
Water Encountered	None		
Water on Completion	None		
Surface Elevation	636.7±' MSL		

Elev. Ft.	Std. Pen. Test	Description	Depth(ft)	Sample Number	% Agg.	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	Q_p (TSF)	ODOT Class
		Continued From Previous Page												
	3-3-3	Medium Stiff, Moist, Gray, SILT, and Clay, Trace Sand	55	SS-14	0	1	1	57	41	30	10	28	0.5	A-4b
579.7	--	Very Stiff, Moist, Gray, SILT and Clay Qu = 1.8	60	ST-15								30	--	
	3-5-7		65	SS-16								25	2.0	A-6a*
	--	Qu = 2.0	70	ST-17								24	--	
564.7	2-3-3	Medium Stiff, Moist, Gray, Silty CLAY, Trace Sand	75	SS-18	0	1	0	43	56	38	16	25	1.0	A-6b
	3-3-4		80	SS-19								24	0.75	A-6b*
554.7	2-2-2	Soft to Medium Stiff, Wet, Gray, CLAY, Some Silt, Trace Sand	85	SS-20								33	0.25	A-7-6*
	2-2-3		90	SS-21								30	0.25	
	2-3-3		95	SS-22	0	1	1	29	69	41	17	23	0.25	A-7-6
536.1	3-3-3		100	SS-23								28	0.25	A-7-6*
		End of Boring - 100.6'												

* ODOT Classification Based on Visual Description

CORE – SB-1

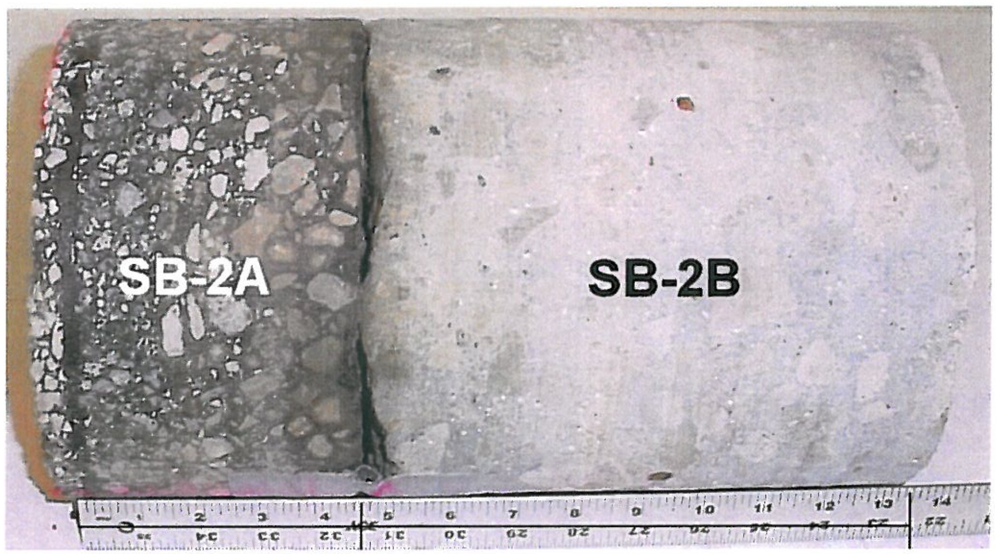
Station and Offset – 1025+20.21; 50.2' RT



3" Asphalt Concrete; 13.5" CONCRETE

CORE – SB-2

Station and Offset – 1023+99.54; 86.3' LT



4.5" Asphalt Concrete; 9" CONCRETE

CORE – SB-3

Station and Offset – 1024+59.16; 202.2' LT

3" Asphalt Concrete; 11.5" CONCRETE

CORE – SB-4

Station and Offset – 1024+33.81; 296.9' LT

3" Asphalt Concrete; 4.5" CONCRETE

GENERAL NOTES

SAMPLE IDENTIFICATION

The Unified Soil Classification System is used to identify the soil unless otherwise noted.

SOIL PROPERTY SYMBOLS

N: Standard "N" penetration: Blows per foot of a 140 pound hammer falling 30 inches on a 2 inch O.D. split-spoon.

Qu: Unconfined compressive strength, tsf.

Qp: Penetrometer value, index value of unconfined compressive strength, tsf.

Mc: Water content, %.

PL: Plastic limit, %.

LL: Liquid Limit, %.

PI: Plasticity Index.

γd: Natural dry density, pcf.

▼: Groundwater level observed at time noted after completion of boring.

DRILLING AND SAMPLING SYMBOLS

SS: Split-Spoon – 1 3/8" I.D., 2" O.D., except where noted.
ST: Shelby Tube – 3" O.D., except where noted.
AU: Auger Sample.
DB: Diamond Bit.
CB: Carbide Bit.
WS: Washed Sample.

RELATIVE DENSITY AND CONSISTENCY CLASSIFICATION (Terzaghi & Peck, 1948)

TERM (COHESIONLESS SOILS)	STANDARD PENETRATION RESISTANCE
Very Loose	0 – 4
Loose	4 – 10
Medium	10 – 30
Dense	30 – 50
Very Dense	Over 50

TERM (COHESIVE SOILS)	Qu – (TSF)
Very Soft	0 – 0.25
Soft	0.25 – 0.50
Medium	0.50 – 1.00
Stiff	1.00 – 2.00
Very Stiff	2.00 – 4.00
Hard	4.00+

PARTICLE SIZE (ASTM D2487 AND D422)

Boulders	≥ 12 in. (300mm)
Cobbles	< 12 in.(300mm) to 3 in. (75mm)
Gravel	< 3 in. (75mm) to 4.75mm (#4 sieve)
Coarse Sand	<4.75mm (#4 sieve) to 2mm (#10 sieve)
Medium Sand	<2mm (10 sieve) to 425μm (#40 sieve)
Fine Sand	<425μm (#40 sieve) to 75μm (#200 sieve)
Silt	<75μm (#200 sieve) to 5μm
Clay	<5μm