



## **Bridge Foundation Investigation**

**Project Number: CSNHS-0008-00(256)  
P.I. Number: 0008256  
I-575 Bridge over Towne Lake Parkway  
Cherokee County, Georgia**

**Prepared for:  
Georgia Transportation Partners  
Atlanta, Georgia**

**Document No: ATL-171-3099I  
Revision: 1  
Issue Date: August 22, 2008  
Document Status: Issued For Use**

**Subconsultant to:  
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3772 Pleasantdale Road, Suite 165  
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**BRIDGE FOUNDATION INVESTIGATION REPORT**  
**I-575 over Towne Lake Parkway**  
**Northwest Corridor Project**  
GDOT Project No. CSNHS-0008-00(256), PI No. 0008256  
Cherokee County, Georgia

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Document No.: ATL-171-30991  
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Issue Date: August 22, 2008  
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Prepared For

**GEORGIA TRANSPORTATION PARTNERS**  
Atlanta, Georgia

Prepared By

**PROFESSIONAL SERVICE INDUSTRIES, INC.**  
95 Chastain Road  
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Subconsultant To

**WILLMER ENGINEERING INC.**  
3772 Pleasantdale Road  
Suite 165  
Atlanta, Georgia 30340-4270

770.939.0089

August 22, 2008

VIA COURIER

Pete M. McMahon, PE  
Georgia Transportation Partners  
c/o PBS&J, Inc.  
5665 New Northside Drive  
Suite 400  
Atlanta, Georgia 30328

**SUBJECT: Bridge Foundation Investigation Report  
I-575 over Towne Lake Parkway  
Northwest Corridor Project**  
GDOT Project No. CSNHS -0008-00(256), PI No. 0008256  
Cherokee County, Georgia  
Willmer Project No. ATL-171-3099I

Dear Mr. McMahon:

Willmer Engineering Inc. (Willmer) is pleased to provide this Bridge Foundation Investigation (BFI) report for the proposed widening of I-575 bridge over Towne Lake Parkway in Cherokee County, Georgia. This report was prepared by Professional Service Industries, Inc. (PSI) under a Subconsulting Services Agreement with Willmer, dated December 19, 2006, and in general accordance with our contract with Georgia Transportation Partners (GTP), dated May 12, 2007. The objective of this investigation was to gather sufficient geotechnical information to support the costing plans to be developed by GTP. Additional borings will be performed in the design/build phase of the project to provide additional information as required. This report was prepared in general accordance with Georgia Department of Transportation (GDOT) guidance documents for bridge foundation investigation. This report was revised to incorporate GTP comments dated December 18, 2007, and GDOT comments dated July 18, 2008.

The attached summary presents the site and subsurface conditions along the proposed bridge alignment, and our geotechnical recommendations related to bridge foundation design and construction.

We appreciate the opportunity to be of service to you on this project and look forward to a continuing relationship. Please contact us if you have any questions concerning this report or require further assistance.

Sincerely,

**WILLMER ENGINEERING INC.**

  
Sujit K. Bhowmik, PhD, PE  
Chief Engineer

  
for James L. Willmer, PE  
Executive Vice President/Principal Consultant

SKB/JLW:kas

H:\Sujit Bhowmik\Northwest Corridor Project\I-575\WEI Report Cover for PSI Report - 171-3099 I (Towne Lake Parkway) - 082208.doc

Attachments: **Bridge Foundation Investigation**

**Figures**

Figure 1	Site Location Plan
Figure 2	Boring Location Plan
Figure 3	Generalized Subsurface Profile A-A'
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Figure 5	Generalized Subsurface Profile C-C'

**Appendix I**

New Boring Logs – BD-1 through BD-4  
Laboratory Test Results  
Test Procedures

**Appendix II**

Existing BFI Report Boring Logs – B-1 through B-8

Revision History:

<b><u>Revision</u></b>	<b><u>Issue Date</u></b>	<b><u>Document Status</u></b>
A	December 12, 2007	Issued for Review
0	January 7, 2008	Issued for Use
1	August 22, 2008	Issued for Use

<b>BRIDGE FOUNDATION INVESTIGATION</b>	
<b>GDOT Project Number</b>	CSNHS-0008-00(256)
<b>Project P.I. Number</b>	0008256
<b>Location</b>	I-575 Bridge over Towne Lake Parkway, Cherokee County, Georgia (see Figure 1)
<b>GENERAL INFORMATION</b>	
<b>Project Description</b>	<p>Current bridge foundation investigation was performed for the proposed widening of I-575 Bridge Over Towne Lake Parkway. The widening involves adding three new parallel bridges, one in the center median and one each on the left and right sides of the existing bridges. The bridges will be three-span, 183 feet long reinforced concrete structures. The design lengths for the three spans from south to north are approximately 42, 88 and 53 feet, respectively.</p> <p>The existing bridges are supported on H-pile bents at the end bents and H-pile footings at the intermediate bents. The existing BFI report and pile driving data dated March 26, 1980 was provided by GDOT. Eight old and four new borings were performed in the existing and current BFI studies, respectively. The subsurface information from the existing borings was incorporated in the current BFI report and recommendations.</p>
<b>Geologic Information</b>	The project alignment is geologically sited within the Piedmont Physiographic Province of Georgia, and is underlain by Biotite Gneiss, Mica Schist, and Amphibolite Formation.
<b>Subsurface Features</b>	<p>Subsurface information for this bridge was obtained from four borings (BD-1 through BD-4) as part of the present study and eight borings (B-1 through B-8) performed by GDOT in year 1980 for the existing bridges.</p> <p>The subsurface condition of the present study generally comprised of silty and clayey sand, and silty clay fill underlain by residuum consisting of silty and clayey sand. The residuum is underlain by hard and partially weathered rock.</p> <p>Groundwater was encountered from Elevations 862 to 880 in the current borings BD-1 through BD-4 performed in October, 2007. Groundwater was encountered from Elevations 883 to 886 in the existing borings B-1 through B-8 performed in March, 1980.</p>

<b>PWR AND AUGER REFUSAL ELEVATIONS (feet)</b>				
<b>Bridge</b>	<b>Bent No.</b>	<b>Reference Boring No.</b>	<b>Top of PWR</b>	<b>Auger Refusal</b>
Left	1	BD-2	867	866
	2	B-3	853	849
	3	B-5	---	861
	4	B-7	863	860
Center	1	BD-1	850	838
	2	B-3	853	849
	3	B-5	---	861
	4	B-8	---	848
Right	1	B-2	---	839
	2	B-4	862	836
	3	B-6	---	855
	4	BD-3	---	861

<b>MAXIMUM PILE DESIGN LOADS</b>			
<b>Pile Type</b>	<b>Load Transfer (%)</b>		<b>Design Load</b>
	<b>Friction</b>	<b>End Bearing</b>	
H-Piles	20	80	10 BP 42 = 55 Tons
			12 BP 53 = 70 Tons
			14 BP 73 = 96 Tons
			14 BP 89 = 117 Tons

<b>FOUNDATION RECOMMENDATIONS</b>			
<b>Bridge</b>	<b>Bent No.</b>	<b>Pile FTG (Type)</b>	<b>Pile Bent (Type)</b>
Left	1	---	Steel H
	2	Steel H	---
	3	Steel H	---
	4	---	Steel H
Center	1	---	Steel H
	2	Steel H	---
	3	Steel H	---
	4	---	Steel H
Right	1	---	Steel H
	2	Steel H	---
	3	Steel H	---
	4	---	Steel H

PILE TIP ELEVATIONS (feet)				
Bridge	Bent No.	Reference Boring No.	H-Pile Tip Elevations	
			Minimum Tip	Estimated Tip
Left	1	BD-2	866±	866±
	2	B-3	852±	843±
	3	B-5	868±	865±
	4	B-7	868±	859±
Center	1	BD-1	853±	850±
	2	B-3	852±	849±
	3	B-5	868±	865±
	4	B-8	858±	857±
Right	1	B-2	855±	844±
	2	B-4	861±	853±
	3	B-6	859±	854±
	4	BD-3	861±	857±

NOTES: GENERAL	
<b>As-built Information</b>	As-built information should be forwarded to the Geotechnical Engineering Bureau upon completion of the foundation system.
<b>NOTES</b>	
<b>PDO</b>	Driving resistance after Minimum Tip Elevations are achieved.
<b>Waiting Period</b>	We recommend a minimum of 60 days waiting period between the completion of fill placement and beginning of pile installation at Bents 1 and 4 of the left and right bridges where significant amount of fill will be placed for the embankment. Settlement of the embankment should be monitored, and length of waiting period may be increased or decreased based on the settlement monitoring data, at discretion of the project Geotechnical Engineer.
<b>Groundwater</b>	Due to high groundwater elevations near the footing elevations, we recommend that 12 inches of Type II Foundation Backfill Material be set up for use in the footing areas for Bents 2 and 3. The use of this material should be at the direction of the Engineer and may be eliminated on construction if the footing area is dry.
<b>Special Problems</b>	Erratic pile lengths can be expected.

<b>Prepared By</b>	 Lauren F. Hill, E.I.T.
<b>Senior Review By</b>	 Karl E. Suter, P.E.



# FIGURES

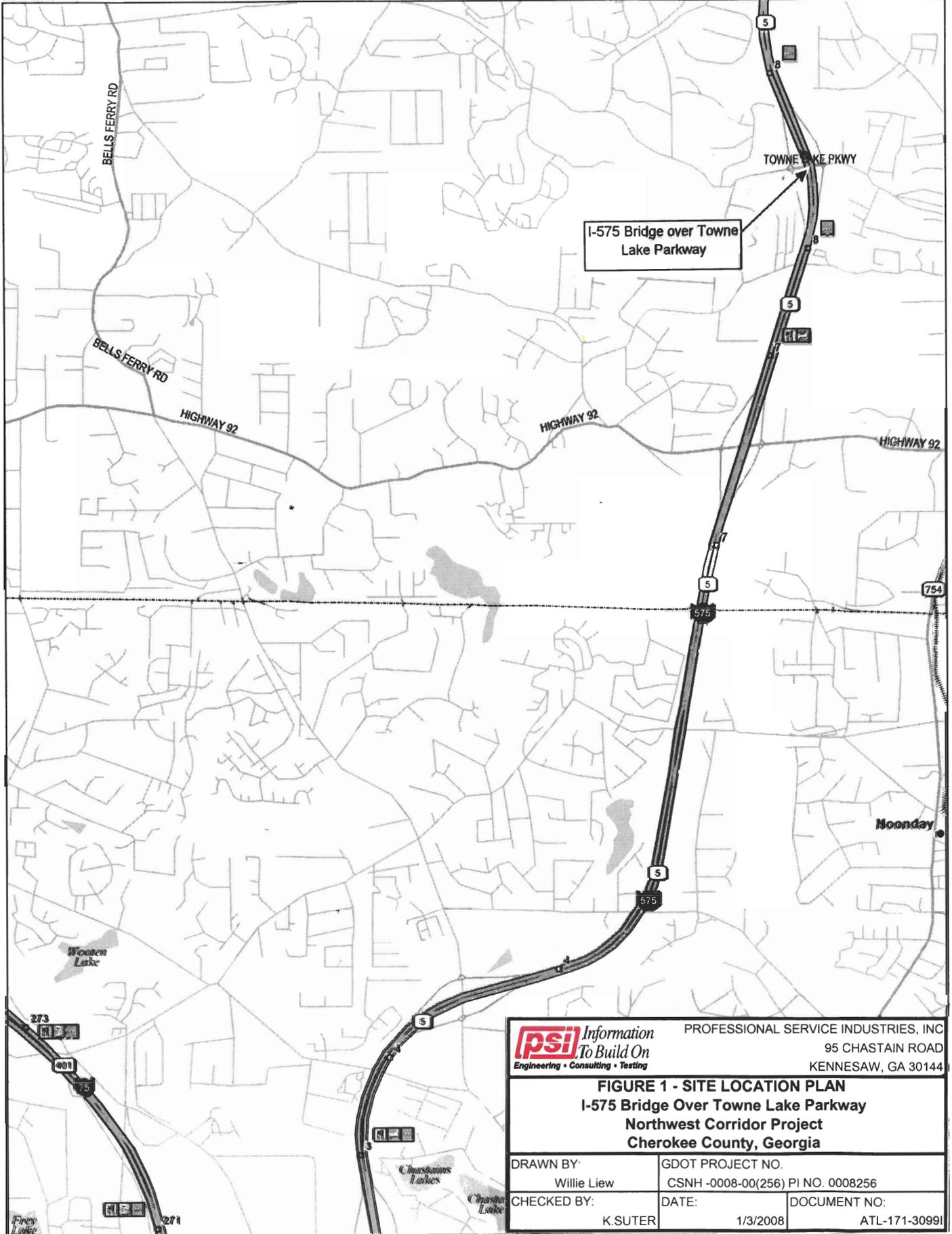
Site Location Plan

Boring Location Plan

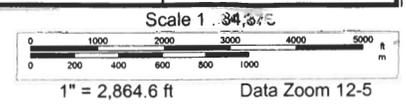
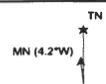
Generalized Subsurface Profile A-A'

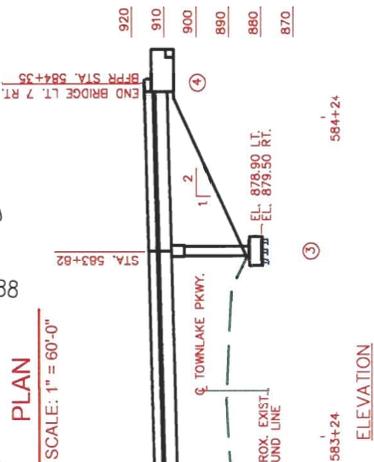
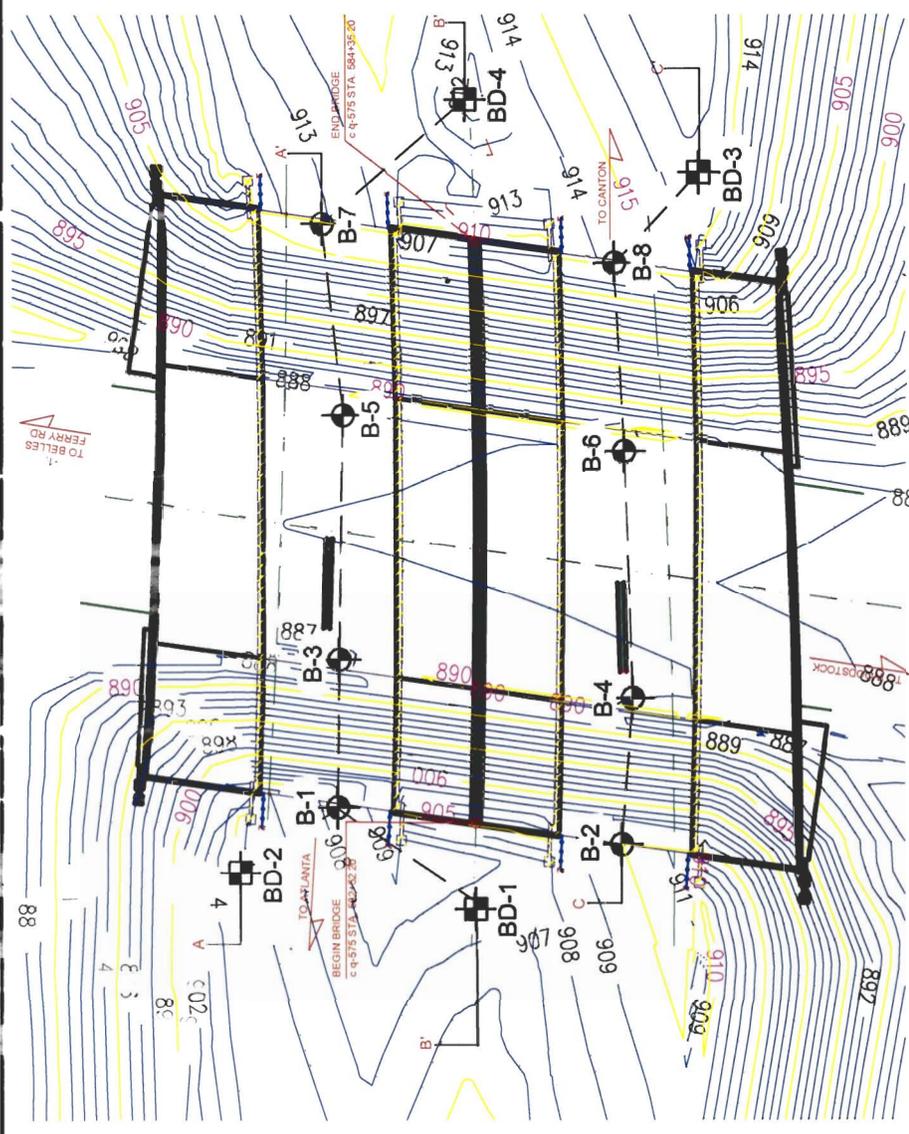
Generalized Subsurface Profile B-B'

Generalized Subsurface Profile C-C'



		PROFESSIONAL SERVICE INDUSTRIES, INC 95 CHASTAIN ROAD KENNESAW, GA 30144	
<b>FIGURE 1 - SITE LOCATION PLAN</b> <b>I-575 Bridge Over Towne Lake Parkway</b> <b>Northwest Corridor Project</b> <b>Cherokee County, Georgia</b>			
DRAWN BY:		GDOT PROJECT NO.	
Willie Liew		CSNH -0008-00(256) PI NO. 0008256	
CHECKED BY:		DATE:	DOCUMENT NO:
K.SUTER		1/3/2008	ATL-171-30991





PLAN  
SCALE: 1" = 60'-0"

**LEGEND:**  
 B-1 EXISTING GDOT BFI BORINGS  
 BD-1 NEW BORING LOCATION

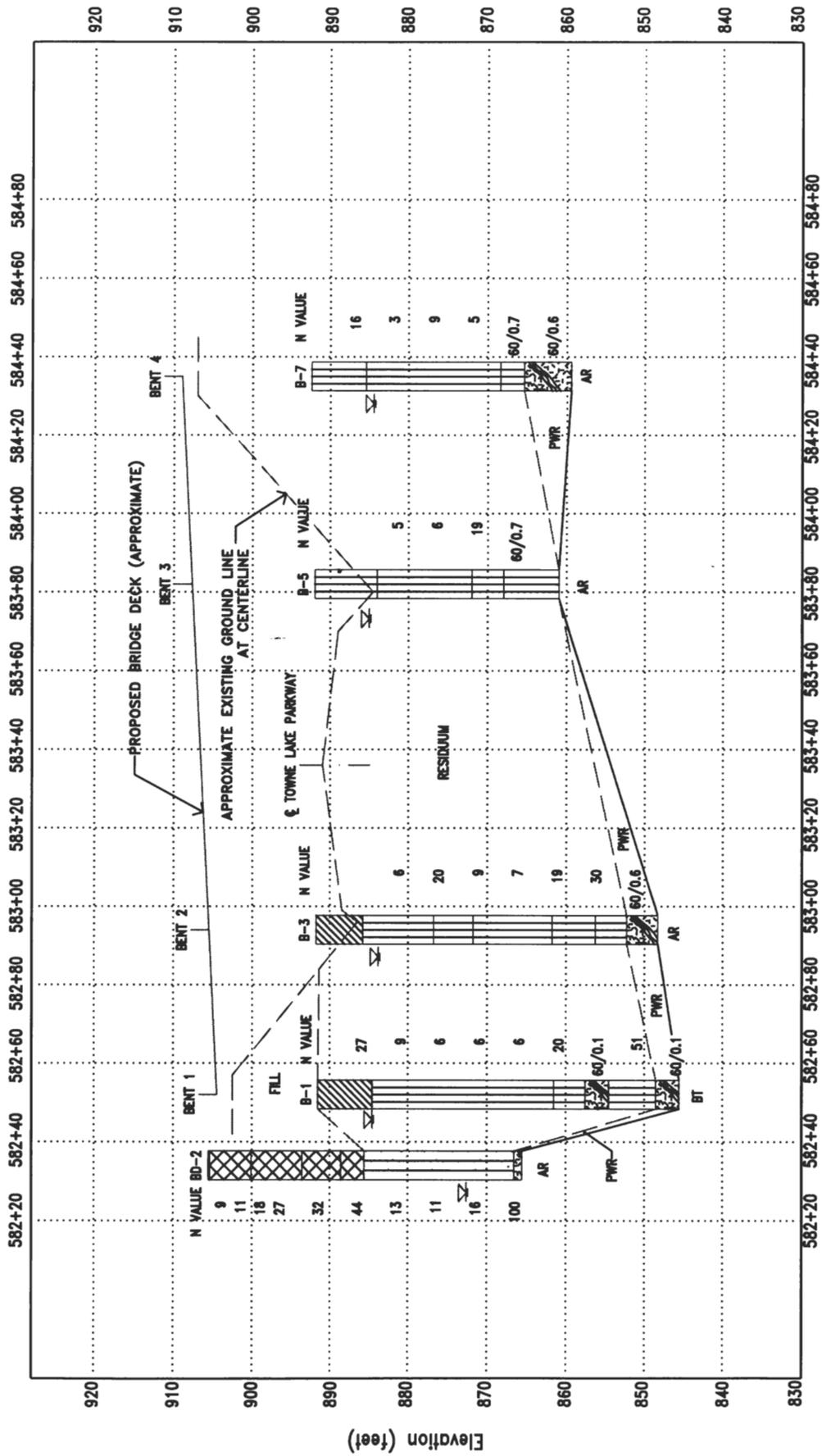
SCALE: 1" = 60'  
 DOC. No.: ATL-171-30991  
 DATE: 1/3/2008  
 DRAWN BY: WL  
 REVIEWED BY: KS

**Information To Build On**  
 Engineering • Consulting • Testing

PROFESSIONAL SERVICE INDUSTRIES, INC.  
 95 CHASTAIN ROAD  
 KENNESAW, GA 30144

FIGURE 2  
 BORING LOCATION PLAN  
 I-575 OVER TOWNLAKE PARKWAY  
 NORTHWEST CORRIDOR PROJECT  
 CHEROKEE COUNTY, GEORGIA  
 PSI PROJECT No. 476-65003

GDOT PROJECT NUMBER  
 CSNHS-0008-00(256)  
 PI No. 0008256



Station (feet)

**ps** Information  
 To Build On  
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 95 CHASTAIN ROAD  
 KENNESAW, GA 30144

**FIGURE 3 - GENERALIZED SUBSURFACE PROFILE A-A**  
 I-575 Bridge Over Towne Lake Parkway  
 Northwest Corridor Project  
 Cherokee County, Georgia

DRAWN BY: Willie Liew  
 CHECKED BY: K. SUTER

DATE: 1/3/2008

DOCUMENT NO.: ATL-171-3099I

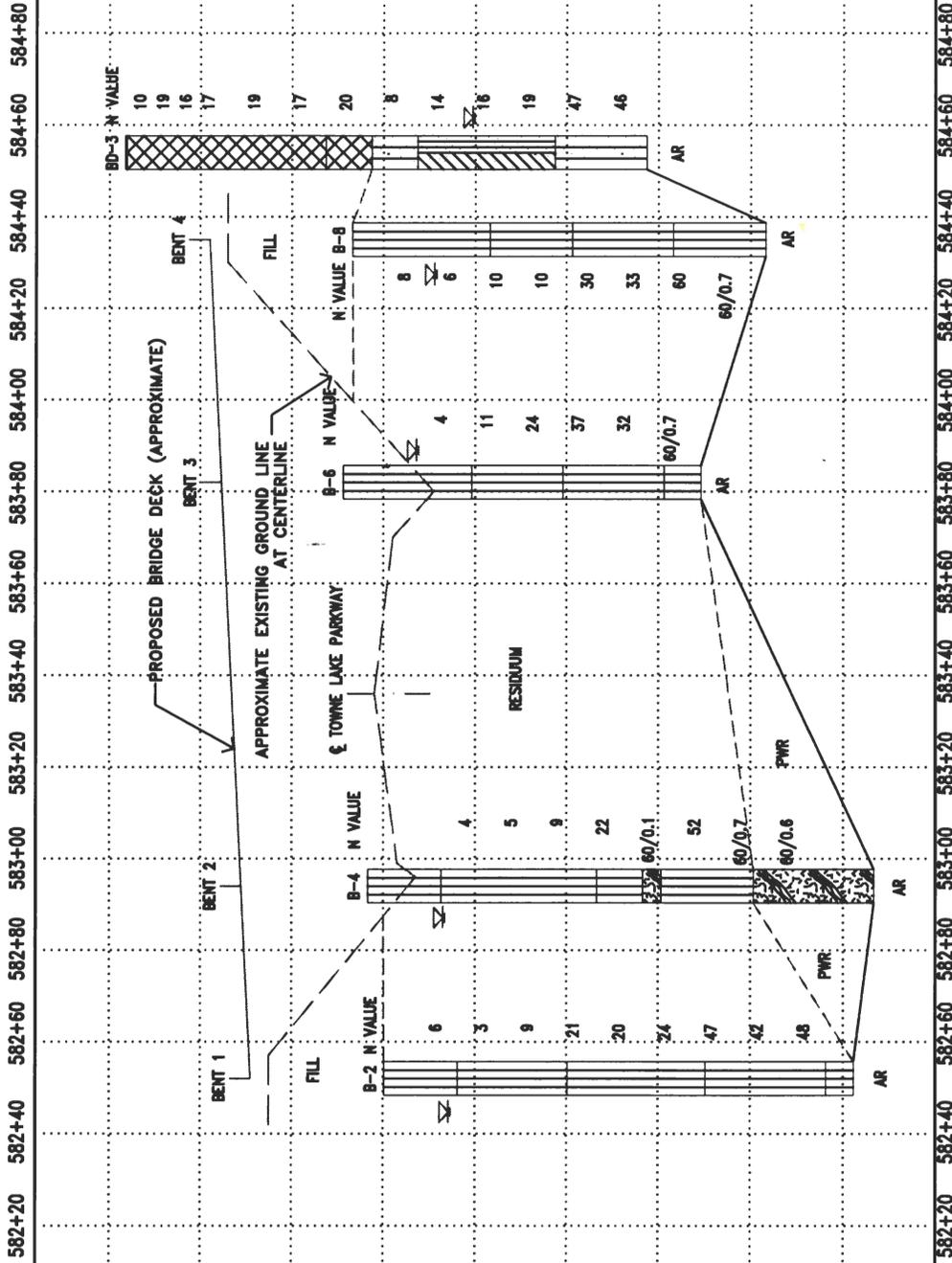
NOTE: BORINGS B-1, B-3, B-5 AND B-7 WERE PERFORMED BY GDOT IN 1980.

LEGEND:

- GROUNDWATER TABLE AT TIME OF BORING
- AUGER REFUSAL
- BORING TERMINATED
- PARTIALLY WEATHERED ROCK

SCALE: 1 INCH = 20' (VERTICAL)  
 1 INCH = 40' (HORIZONTAL)





Station (feet)

**Information**  
**PSI** To Build On  
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 95 CHASTAIN ROAD  
 KENNESAW, GA 30144

**FIGURE 5 - GENERALIZED SUBSURFACE PROFILE C-C'**  
 I-575 Bridge Over Towne Lake Parkway  
 Northwest Corridor Project  
 Cherokee County, Georgia

DRAWN BY: Willie Liew  
 CHECKED BY: K. SUTER  
 GDOT PROJECT NO. CSNH-0008-00(256) P.I.N.O. 0008256  
 DATE: 1/3/2008  
 DOCUMENT NO. ATL-171-3099I

NOTE: BORINGS B-2, B-4, B-6 AND B-8 WERE PERFORMED BY GDOT IN 1980.

- LEGEND:**
- GROUNDWATER TABLE AT TIME OF BORING
  - AR AUGER REFUSAL
  - BT BORING TERMINATED
  - PWR PARTIALLY WEATHERED ROCK

SCALE: 1 INCH = 20' (VERTICAL)  
 1 INCH = 40' (HORIZONTAL)

# APPENDIX I

New Boring Logs – BD-1 through BD-4  
Laboratory Test Results  
Test Procedures

# BORING LOG



PSI No.: 476-65003 (Document No. ATL-171-30991)

Client: Willmer Engineering/Georgia Transportation Partners - GDOT Project No.: CSNHS-0008-00(256) PI No.: 0008256

Project: I-575 Bridge Over Towne Lake Parkway Cherokee County, Georgia

Boring No.: BD-1 (1 of 1) Total Depth 72.0' Elev: 910± Location: Sta. 582+29 at CL

Type of Boring: Hollow Stem Auger Started: 10/9/07 Completed: 10/9/07 Driller: Gable Drilling

Elevation	Depth	DESCRIPTION OF MATERIALS (Classification)	* Sample Blows	Sample Depth (Feet)	N VALUE (bpf)			N
			REC/RQD		PL	%MC	LL	
909.4	0.2	Topsoil Thickness = 2 inches						
		FILL: Medium Dense Tan/Brown Moist Silty SAND (SM)	5-7-7	1.0				14
				3.5	●			
			7-8-9	5.0	●			17
				6.0				
			5-5-7	7.5	●			12
				8.5				
			5-8-8	10.0	●			16
897.6	12.0	FILL: Loose Brown/Red Moist Silty SAND (SM), with rock fragments (Non-Plastic)						
			3-3-3	13.5	●			6
892.6	17.0	FILL: Very Stiff Red/Tan Moist Sandy Silty CLAY (CL)						
			4-8-12	18.5	●			20
				20.0				
887.6	22.0	RESIDUUM: Loose to Medium Dense Orange Moist Silty Clayey SAND (SC-SM)						
			5-2-5	23.5	●			7
				25.0				
				28.5				
			3-6-10	30.0	●			16
				33.5				
			7-9-11	35.0	●			20
872.6	37.0	Medium Dense Gray/White Moist Silty SAND (SM)						
			7-9-10	38.5	●			19
				40.0				
867.6	42.0	Medium Dense to Very Dense Gray/White Wet Silty Clayey SAND (SC-SM)						
			6-8-13	43.5	●			21
				45.0				
				48.5				
			15-18-43	50.0			●	61
857.6	52.0	Dense Red/Black/White Wet Silty SAND (SM)						
			10-17-23	53.5		●		40
				55.0				
				58.5				
			22-32-50/5	60.0				100
847.6	62.0	PARTIALLY WEATHERED ROCK: Sampled as Very Dense Gray Wet Silty SAND (SM)						
		Very Dense Wet Gray Silty SAND (SM)	19-28-41	63.5			●	69
				65.0				
841.6	68.0	PARTIALLY WEATHERED ROCK: Sampled as Very Dense Gray Wet Silty SAND (SM)						
		Auger Refusal at 72 feet	50/3	68.5				100
				70.0				
837.6	72.0	Groundwater at Time of Drilling = 48 feet						

BL STD 47665003.GPJ PSI CORP GDT 1/17/08

\*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the last two increments of penetration is termed the standard penetration resistance, N.

# BORING LOG



PSI No.: 476-65003 (Document No. ATL-171-30991)

Client: Willmer Engineering/Georgia Transportation Partners - GDOT Project No.: CSNHS-0008-00(256) PI No.: 0008256

Project: I-575 Bridge Over Towne Lake Parkway Cherokee County, Georgia

Boring No.: BD-2 (1 of 1) Total Depth 40.0' Elev: 906 ± Location: Sta. 582+34, 75' LT CL

Type of Boring: Hollow Stem Auger Started: 10/9/07 Completed: 10/9/07 Driller: Gable Drilling

Elevation	Depth	DESCRIPTION OF MATERIALS (Classification)	* Sample Blows	Sample Depth (Feet)	N VALUE (bpf)			N	
			REC/RQD		PL	%MC	LL		
905.4	0.2	Topsoil Thickness = 2 inches		1.0					
		FILL: Loose to Medium Dense Reddish Brown Moist Silty Clayey SAND (SC-SM)	4-4-5	2.5	●			9	
				3.5					
900.1	5.5			5-5-6	5.0	●			11
		FILL: Medium Dense Tan Moist Micaceous Silty SAND (SM)		6.0					
				7-9-9	7.5	●			18
				11-12-15	10.0		●		27
893.6	12.0	FILL: Dense Brown Moist Micaceous Silty Clayey SAND (SC-SM)		13.5					
				8-13-19	15.0		●		32
888.6	17.0	FILL: Hard Tan Moist Silty Sandy CLAY (CL)		18.5					
885.6	20.0			12-17-27	20.0		●		44
		RESIDUUM: Medium Dense Light Brown/Black Wet Silty SAND (SM) (Non-Plastic)		23.5					
				3-6-7	25.0	●			13
					28.5				
				3-4-7	30.0	●			11
					33.5				
			5-7-9	35.0	●			16	
866.6	39.0	PARTIALLY WEATHERED ROCK: Sampled as Very Dense Black/Orange Wet Silty SAND (SM) Auger Refusal at 40 feet	7-50/5	38.5					
865.6	40.0				40.0				100

Groundwater at Time of Drilling = 33 feet

BL STD 47665003 GPJ PSI CORP GDT 1/4/08

\*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the last two increments of penetration is termed the standard penetration resistance, N.

# BORING LOG



PSI No.: 476-65003 (Document No. ATL-171-3099I)

Client: Willmer Engineering/Georgia Transportation Partners - GDOT Project No.: CSNHS-0008-00(256) PI No.: 0008256

Project: I-575 Bridge Over Towne Lake Parkway Cherokee County, Georgia

Boring No.: BD-3 (1 of 1) Total Depth 57.0' Elev: 918± Location: Sta. 584+54, 75' RT CL

Type of Boring: Hollow Stem Auger Started: 10/9/07 Completed: 10/9/07 Driller: Gable Drilling

Elevation	Depth	DESCRIPTION OF MATERIALS (Classification)	* Sample Blows	Sample Depth (Feet)	N VALUE (bpf)			N
			REC/RQD		PL	%MC	LL	
918.1	0.2	Topsoil Thickness = 2 inches FILL: Loose to Medium Dense Tan Moist Silty SAND (SM)		1.0				
			4-5-5	2.5	●			10
				3.5				
			5-9-10	5.0		●		19
				6.0				
			5-8-8	7.5	●			16
				8.5				
			5-7-10	10.0		●		17
				13.5				
			6-8-11	15.0		●		19
				18.5				
			8-7-10	20.0		●		17
896.3	22.0	FILL: Very Stiff Reddish Tan Moist Silty Sandy CLAY (CL)						
				23.5				
			5-8-12	25.0		●		20
891.3	27.0	RESIDUUM: Loose Black/Gold Moist Micaceous Silty SAND (SM)						
				28.5				
			3-3-5	30.0	●			8
886.3	32.0	Medium Dense Black/Gold/Orange Moist Micaceous Silty Clayey SAND (SC-SM)						
				33.5				
			5-7-7	35.0		●		14
				38.5				
			5-7-9	40.0		●		16
				43.5				
			7-9-10	45.0		●		19
871.3	47.0	Dense Brown/White Moist Micaceous Silty SAND (SM)						
				48.5				
			17-21-26	50.0			●	47
				53.5				
			13-19-27	55.0			●	46
861.3	57.0	Auger Refusal at 57 feet Groundwater at Time of Drilling = 38 feet						

BL STD 47665003.GPJ PSI\_CORP.GDT 1/4/08

\*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the last two increments of penetration is termed the standard penetration resistance, N.

# BORING LOG



PSI No.: 476-65003 (Document No. ATL-171-30991)

Client: Willmer Engineering/Georgia Transportation Partners - GDOT Project No.: CSNHS-0008-00(256) PI No.: 0008256

Project: I-575 Bridge Over Towne Lake Parkway Cherokee County, Georgia

Boring No.: BD-4 (1 of 1) Total Depth 52.0' Elev: 914± Location: Sta. 584+84 at CL

Type of Boring: Hollow Stem Auger Started: 10/9/07 Completed: 10/9/07 Driller: Gable Drilling

Elevation	Depth	DESCRIPTION OF MATERIALS (Classification)	* Sample Blows	Sample Depth (Feet)	N VALUE (bpf)			N
			REC/RQD		PL	%MC	LL	
914.2	0.2	Topsoil Thickness = 2 inches FILL: Medium Dense Tan Moist Silty SAND (SM)		1.0				
			7-7-8	2.5	●			15
				3.5				
			9-8-9	5.0	●			17
				6.0				
			5-7-9	7.5	●			16
				8.5				
			6-10-10	10.0	●			20
				13.5				
			6-8-10	15.0	●			18
				18.5				
			7-6-8	20.0	●			14
892.4	22.0	RESIDUUM: Dense Tan/Black Moist Silty SAND (SM)		23.5				
			13-15-20	25.0		●		35
887.4	27.0	Medium Dense Reddish Brown Moist Silty SAND (SM)		28.5				
			3-9-9	30.0	●			18
882.4	32.0	Medium Dense Gray/Gold Moist Micaceous Silty SAND (SM) (Non-Plastic)		33.5				
			4-6-8	35.0	●	▲		14
				38.5				
			8-8-10	40.0	●			18
				43.5				
			9-11-13	45.0	●			24
866.4	48.0	PARTIALLY WEATHERED ROCK: Sampled as Very Dense Gray/Gold Moist Micaceous Silty SAND (SM)		48.5				
		Auger Refusal at 52 feet	50/2	50.0				100
862.4	52.0	Groundwater at Time of Drilling = 38 feet						

BL STD 47665003.GPJ PSI\_CORP.GDT 1/4/08

\*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the last two increments of penetration is termed the standard penetration resistance, N.

LIQUID AND PLASTIC LIMIT TEST DATA

**Client:** Willmer Engineering/Georgia Transportation Partners  
**Project:** Northwest Corridor Metro Atlanta: GDOT Project #:CSNHS-0008-00(256); PI #:0008256; Document #:ATL-171-30991  
**Project Number:** (PSI Inc.): 476-65003

Sample Data

**Source:**

**Sample No.:** B-1/S-5

**Elev. or Depth:** 13.5-15.0'

**Sample Length(in./cm.):**

**Location:** I-575 over Towne Lake pkwy

**Description:** Gray Silty SAND

**Water Content:** NA

**USCS:** SM

**AASHTO:**

**Testing Remarks:** % Passing Sieve #200 = 19.3

Liquid Limit= \_\_\_\_\_

Plastic Limit= NP

Plasticity Index= NP

LIQUID AND PLASTIC LIMIT TEST DATA

**Client:** Willmer Engineering/Georgia Transportation Partners  
**Project:** Northwest Corridor Metro Atlanta: GDOT Project #:CSNHS-0008-00(256); PI #:0008256; Document #:ATL-171-30991  
**Project Number:** (PSI Inc.): 476-65003

Sample Data

**Source:**

**Sample No.:** B-2/S-7

**Elev. or Depth:** 23.5-25.0'

**Sample Length(in./cm.):**

**Location:** I-575 over Towne Lake Pkwy

**Description:** Tan Silty SAND

**Water Content:** NA

**USCS:** SM

**AASHTO:**

**Testing Remarks:** % Passing Sieve #200 = 25.9

Liquid Limit= \_\_\_\_\_

Plastic Limit= NP

Plasticity Index= NP

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**Project Number:** (PSI Inc.): 476-65003

Sample Data

**Source:**

**Sample No.:** B-4/S-9

**Elev. or Depth:** 33.5-35.0'

**Sample Length(in./cm.):**

**Location:** I-575 over Towne Lake Pkwy

**Description:** Brown micaceous Silty SAND

**Water Content:** NA

**USCS:** SM

**AASHTO:**

**Testing Remarks:** % Pssing Sieve #200 = 18.4

Liquid Limit= \_\_\_\_\_

Plastic Limit= NP

Plasticity Index= NP

## TEST PROCEDURES

The general field procedures employed by Professional Service Industries, Inc. (PSI) are summarized in the American Society for Testing and Materials (ASTM) Standard D420 which is entitled "Investigating and Sampling Soil and Rock". This recommended practice lists recognized methods for determining soil and rock distribution and groundwater conditions. These methods include geophysical and in-situ methods as well as borings.

### Standard Drilling Techniques

To obtain subsurface samples, borings are drilled using one of several alternate techniques depending upon the subsurface conditions. Some of these techniques are:

#### In Soils:

- a) Continuous hollow stem augers.
- b) Rotary borings using roller cone bits or drag bits, and water or drilling mud to flush the hole.
- c) "Hand" augers.

#### In Rock:

- a) Core drilling with diamond-faced, double or triple tube core barrels.
- b) Core boring with roller cone bits.

The drilling method used during this exploration is presented in the following paragraph.

Hollow Stem Augering: A hollow stem auger consists of a hollow steel tube with a continuous exterior spiral flange termed a flight. The auger is turned into the ground, returning the cuttings along the flights. The hollow center permits a variety of sampling and testing tools to be used without removing the auger.

### Sampling and Testing in Boreholes

Several techniques are used to obtain samples and data in soils in the field; however the most common methods in this area are:

- a) Standard Penetrating Testing
- b) Undisturbed Sampling
- c) Dynamic Cone Penetrometer Testing
- d) Water Level Readings

The procedures utilized for this project are presented below.

Standard Penetration Testing: At regular intervals, the drilling tools are removed and soil samples obtained with a standard 2 inch diameter split tube sampler connected to an A or N-size rod. The sampler is first seated 6 inches to penetrate any loose cuttings, and then driven an additional 12 inches with blows of a 140 pound safety hammer falling 30 inches. Generally, the number of hammer blows required to drive the sampler the final 12 inches is designated the "penetration resistance" or "N" value, in blows per foot (bpf).

The split barrel sampler is designed to retain the soil penetrated, so that it may be returned to the surface for observation. Representative portions of the soil samples obtained from each split barrel sample are placed in jars, sealed and transported to our laboratory.

The standard penetration test, when properly evaluated, provides an indication of the soil strength and compressibility. The tests are conducted according to ASTM Standard D1586. The depths and N-values of standard penetration tests are shown on the Boring Logs. Split barrel samples are suitable for visual observation and classification tests but are not sufficiently intact for quantitative laboratory testing.

Water Level Readings: Water table readings are normally taken in the borings and are recorded on the Boring Logs. In sandy soils, these readings indicate the approximate location of the hydrostatic water table at the time of our field exploration. In clayey soils, the rate of water seepage into the borings is low and it is generally not possible to establish the location of the hydrostatic water table through short term water level readings. Also, fluctuation in the water table should be expected with variations in precipitation, surface run-off, evaporation, and other factors. For long-term monitoring of water levels, it is necessary to install piezometers.

The water levels reported on the Boring Logs are determined by field crews immediately after the drilling tools are removed, and several hours after the borings are completed, if possible. The time lag is intended to permit stabilization of the groundwater table which may have been disrupted by the drilling operation.

Occasionally the borings will cave-in, preventing water level readings from being obtained or trapping drilling water above the cave-in zone. The cave-in depth is measured and recorded on the Boring Logs.

## **BORING LOGS**

The subsurface conditions encountered during drilling are reported on a field boring log prepared by the Driller. The log contains information concerning the boring method, samples attempted and recovered, indications of the presence of coarse gravel, cobbles, etc., and observations of groundwater. It also contains the driller's interpretation of the soil conditions between samples. Therefore, these boring records contain both factual and interpretive information. The field boring records are kept on file in our office.

After the drilling is completed, a geotechnical professional classifies the soil samples and prepares the final Boring Logs which are the basis for our evaluations and recommendations.

## **SOIL CLASSIFICATION**

Soil classifications provide a general guide to the engineering properties of various soil types and enable the engineer to apply his past experience to current problems. In our investigations, samples obtained during drilling operations are examined in our laboratory and visually classified by an engineer. The soils are classified according to consistency (based on number of blows from standard penetration tests), color and texture. These classification descriptions are included on our Boring Logs.

The classification system discussed above is primarily qualitative and for detailed soil classification two laboratory tests are necessary; grain size tests and plasticity tests. Using these test results the soil can be classified according to the AASHTO or Unified Classification Systems (ASTM D-2487). Each of these

classification systems and the in-place physical soil properties provides an index for estimating the soil's behavior. The soil classification and physical properties are presented in this report.

The table below presents criteria that are typically utilized in the classification and description of soil and rock samples for preparation of the Boring Logs.

Relative Density of Cohesionless Soils From Standard Penetration Test		Consistency of Cohesive Soils	
Very Loose	≤ 4 bpf	Very Soft	≤ 2 bpf
Loose	5 - 10 bpf	Soft	3 - 4 bpf
Medium Dense	11 - 30 bpf	Medium Stiff	5 - 8 bpf
Dense	31 - 50 bpf	Stiff	9 - 15 bpf
Very Dense	> 50 bpf	Very Stiff	16 - 30 bpf
		Hard	31 - 50 bpf
		Very Hard	> 50 bpf
(bpf = blows per foot, ASTM D 1586)			
Relative Hardness of Rock		Particle Size Identification	
Very Soft	Hard Rock disintegrates or easily compresses to touch; can be hard to very hard soil.	Boulders	Larger than 12"
Soft	May be broken with fingers.	Cobbles	3" - 12"
		Gravel	
		Coarse	3/4" - 3"
Moderately Soft	May be scratched with a nail, Corners and edges may be broken with fingers.	Fine	4.76mm - 3/4"
		Sand	
		Coarse	2.0 - 4.76 mm
Moderately Hard	Light blow of hammer required to break samples.	Medium	0.42 - 2.00 mm
		Fine	0.42 - 0.074 mm
Hard	Hard blow of hammer required to break sample.	Fines (Silt or Clay)	Smaller than 0.074 mm
Rock Continuity		Relative Quality of Rocks	
<b>RECOVERY</b> = $\frac{\text{Total Length of Core}}{\text{Length of Core Run}} \times 100\%$		<b>RQD</b> = $\frac{\text{Total core, counting only pieces } > 4" \text{ long}}{\text{Length of Core Run}} \times 100\%$	
<u>Description</u>	<u>Core Recovery %</u>	<u>Description</u>	<u>RQD %</u>
Incompetent	Less than 40	Very Poor	0 - 25 %
Competent	40 - 70	Poor	26 - 50 %
Fairly Continuous	71 - 90	Fair	51 - 75 %
Continuous	91 -100	Good	76 - 90 %
		Excellent	91 - 100 %

## APPENDIX II

Existing BFI Report Boring Logs – B-1 through B-8















