DEPARTMENT OF TRANSPORTATION

STATE OF GEORGIA

INTERDEPARTMENTAL CORRESPONDENCE

FILE 0012878, Fayette County
PI No. 0012878
West Fayetteville Path from SR 54 to CS 894/Lester Road

OFFICE Materials and Testing
Forest Park, Georgia

DATE October 5, 2017

Monica L. Flournoy P.E.

FROM Monica L. Flournoy, P.E., State Materials Engineer

TO Kimberly Nesbitt, State Program Delivery Administrator
Attn: Ameenah Saleem, Project Manager

SUBJECT **Acceptance of Consultant's Retaining Wall Foundation Investigation Report**

As requested, we have reviewed the Retaining Wall Foundation Investigation Report that was written on February 27, 2017, and revised on September 16, 2017, by ACCURA of Atlanta, Georgia. This Report is acceptable for use. Copies of this Report should be forwarded to the appropriate Offices by the Project Manager.

The consultant should provide a PDF of the accepted Report to this Office.

If additional information is needed, please contact Nicolas Sotolongo of the Geotechnical Bureau at 404-608-4729 (Direct) or 404-608-4720 (Main).

MLF: GEF: NLS

cc: Michael Presley, P.E., District Engineer, Thomaston
David Neighbors, Area Engineer, LaGrange
Larry Mullins, P.E., ACCURA
(lmullins@accura.com)

DEPARTMENT OF TRANSPORTATION

STATE OF GEORGIA

INTERDEPARTMENTAL CORRESPONDENCE

FILE	0012878, Fayette County PI No. 0012878 West Fayetteville Path from SR 54 to CS 894/Lester Road	**OFFICE** **DATE**	Materials and Testing Forest Park, Georgia October 24, 2017

Monica L. Flournoy P.E.

FROM Monica L. Flournoy, P.E., State Materials Engineer

TO Kimberly Nesbitt, P.E., State Program Delivery Administrator
Attn: Ameenah Saleem, Project Manager

SUBJECT **Acceptance of Consultant's Bridge Foundation Investigation Report**

As requested, we have reviewed the Bridge Foundation Investigation Report that was written on February 6, 2017, and revised on October 5, 2017, by ACCURA of Atlanta, Georgia. This Report is acceptable for use. Copies of this Report should be forwarded to the appropriate Offices by the Project Manager.

The consultant should provide a PDF of the accepted Report to this Office.

If additional information is needed, please contact Nicolas Sotolongo of the Geotechnical Bureau at 404-608-4729 (Direct) or 404-608-4720 (Main).

MLF: GEF: NLS

cc: Bill DuVall, P.E., State Bridge and Structural Engineer
Attn: Lyn Clements, P.E., Assistant State Bridge and Structural Engineer
Andy Doyle, State Bridge Maintenance Engineer
Michael Presley, P.E., District Engineer, Thomaston
David Neighbors, Area Engineer, LaGrange
Larry Mullins, P.E. (lmullins@accura.com)

Bridge Foundation Investigation (LRFD)
SR 54 Multi-Use Trail & Bridge, Fayette County
PI No. 0012878
October 5, 2017
Revision No. 2

LOCATION

Georgia Highway 54 West, near street address 1294 and Piedmont Fayette Hospital, Fayetteville, Fayette County, Georgia. The location is approximately midway between Sandy Creek Road to the east and Veterans Parkway to the west.

GENERAL INFORMATION

GEOLOGIC FORMATION

Piedmont Physiographic Province - The Clarkston Formation, described as a sillimanite-garnet-quartz-plagioclase-biotite-muscovite schist interlayered with hornblende-plagioclase amphibolite of Precambrian age underlies the site. The Clarkston Formation is locally intruded in the Tyrone, Peachtree City and Fayetteville area by younger rocks of the Palmetto Granite unit, which is a coarse-grained porphyritic granite.

SUBSURFACE FEATURES

The investigation encountered fill materials, residual soils, partially weathered rock (PWR) and auger refusal material. Please see the enclosed Boring Locations – Mainline Plan Drawing Nos. 13-08 & 13-09 and Soil Test Boring Records for specific subsurface conditions at each boring location.

Below a surfical topsoil or gravel layer, fill was encountered at all boring locations, except B-5, to depths ranging approximately from 3 to 13 feet. The fill was sampled as either loose or medium dense clayey sand.

Residual soils were initially encountered below the topsoil layer in boring B-5 and from below the fill in the remaining borings. The residual soil profile mainly consists of loose and medium dense silty sand. Some clayey sand was also penetrated in the upper portions of three borings. The residual soils extended to the top of partially weathered rock (PWR) at depths of about 43 and 48 feet, respectively, in borings B-2 and B-3 and to boring termination depths of 20 and 60 feet in the remaining three borings.

Partially weathered rock was encountered from below the residual soils to auger refusal depths of 48 feet at the location of boring B-2 and 52 feet at B-3.

Groundwater was encountered in borings B-2, B-3 and B-4, respectively, at depths of 5, 22 and 27 feet below the ground surface at the time of the field investigation. Groundwater was not observed in boreholes B-1 and B-5 at the time of drilling. No 24-hour groundwater measurements were obtained, since all of the boreholes caved at depths ranging from 7 to 9.5 feet below ground.

SITE CLASSIFICATION

We recommend a site class of D per AASHTO LRFD 3.10.3.1.

1.0 -- FOUNDATION RECOMMENDATIONS

Bents	Pile Bent (Type)
North End Bent 2 (Boring B-4)	HP 14x89 (50 ksi)
South End Bent 1 (Boring B-3)	HP 14x89 (50 ksi)

1.1 -- PILE PROPERTIES

Pile Type	Pile Size (in)	Nominal Compression Stress (ksi)	Nominal Tension Stress (ksi)	Maximum Factored Structural Resistance (kips)
HP (50 ksi)	14 x 89	45.0	45.0	653

1.2 -- DESIGN LOADS

Bents	Maximum Factored Strength Limit State Load (kips)	Maximum Factored Service Limit State Load (kips)	Factored Extreme Event I Limit State Load (kips)
North End Bent 2 (Boring B-4)	250	175	Not Provided
South End Bent 1 (Boring B-3)	250	175	Not Provided

2.0 -- FOUNDATION LOADS

2.1 -- PILE FOUNDATION LOADS

Bents	Pile Type	Size (in)	Down Drag (kips)	Scour (Kips)	Driving Resistance (kips)
North End Bent 2 (Boring B-4)	HP	14x89	N/A	N/A	385
South End Bent 1 (Boring B-3)	HP	14x89	N/A	N/A	385

3.0 -- FOUNDATION ELEVATIONS

Bents	Minimum Tip	Estimated Tip
North End Bent 2 (Boring B-4)	855	836
South End Bent 1 (Boring B-3)	843	840

4.0 -- GENERAL NOTES

Elevations

All foundation elevations are based on the soil test boring elevations as shown on the enclosed Soil Test Boring Records. The boring elevations were established by survey using Control Points D-25 and D-26, as referenced on Drawing No. 13-009 of the project plans.

Waiting Period

An initial waiting period of 30 days is recommended to allow for completion of at least 90 percent of an estimated 6 to 11 inches of settlement (total) beneath the MSE wall end bents. The majority of the settlement should occur during construction of the MSE walls and the amount of settlement remaining after completion of filling should not be significant. We recommend monitoring of MSE wall settlement during construction to confirm the expected performance and determine the final waiting period necessary. Minimal instrumentation to monitor settlement should consist of settlement plates installed at the interface of the wall fill and the existing ground surface.

Staged Construction

Staged construction for pile installation through the end bents is required to prevent possible down-drag loads on the piles from settlement of the in-situ soils under the MSE wall loads. Piles should not be installed until after at least 90 percent of the anticipated settlement has occurred. During MSE wall construction, installation of vertical casing through the reinforced fill is required for subsequent pile installation. Casing will prevent damage to or interference with the MSE wall reinforcement elements.

Obstructions

Due to the erratic weathering of the rocks within this geologic setting, some unexpected obstructions are possible between the borings or in areas not investigated.

As Built Foundation Information

The as built foundation information should be forwarded to the Geotechnical Engineering Bureau upon completion of the foundation system.

4.1 -- PILE FOUNDATION NOTES

PDO

Driving resistance after minimum tip elevations are achieved in conjunction with Special Provision 520 Piling for LRFD and Special Provision 523 Dynamic Pile Testing. Perform one PDA test at Bent 1 (South-Boring B-3) and Bent 2 (North-Boring B-4)

Nominal Bearing Resistance of Single Pile

Driving resistance is based on the following field verification method and resistance factor φ_{dyn} per AASHTO LRFD 2014 (10.5.5.2.3-1):

Resistance Determination Method	Resistance Factor
Driving criteria established by dynamic testing of at least two piles per site condition, but no less than 2% of the production piles.	0.65

Freeze Bearing

Piles should not be overdriven at this site. If dynamic bearing has not been achieved by 2 feet above the estimated tip elevation, pile driving should be stopped for a minimum 24 hours and re-started with a warm hammer to check for "freeze" bearing.

Piles Driven to Hard Rock

The nominal resistance of piles driven to point bearing on hard rock where pile penetration into the rock formation is minimal is controlled by the structural limit state. The Nominal Driving Resistance should not exceed the Factored Structural Resistance. Dynamic pile measurements should be used to monitor for pile damage.

Drivability

A drivability analysis has been completed on the proposed piles to about their respective estimated tips using a DELMAG D 16-32 pile hammer.

Down-drag Protection

To avoid inducing down-drag loads into the piles from potential settlement of compressible layers during construction of the MSE wall, we recommend that piles at Bent 1 (South) and Bent 2 (North) be protected from down-drag by delaying pile installation until after at least 90 percent of the anticipated settlement has occurred.

Pile Casing through MSE Reinforcement Zone

Installation of vertical casing through the MSE reinforced fill is required for subsequent pile installation in order to prevent damage to or interference with the MSE wall reinforcement elements.

5.0 – QA / QC

Prepared By: Larry D. Mullins, P.E.

Attachment A
- Boring Locations – Mainline Plan Drawing Nos. 13-08 & 13-09
- Key to Symbols and Descriptions
- Soil Test Boring Records (B-1 through B-5)
- Laboratory Soil Test Reports

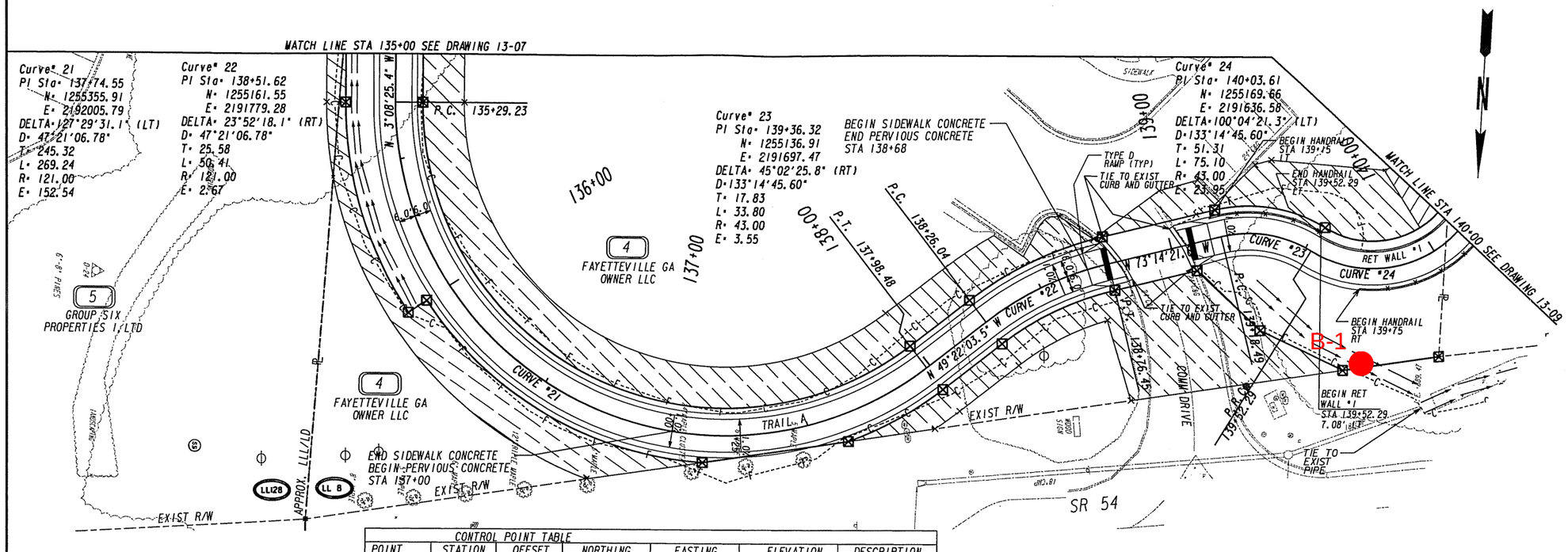
Attachment B
- APILE & GRLWEAP Calculations
  - Bent 2 (South-Boring B-3)

Attachment C
- Special Provision 523 Dynamic Pile Testing
- Special Provision 520 Piling for LRFD

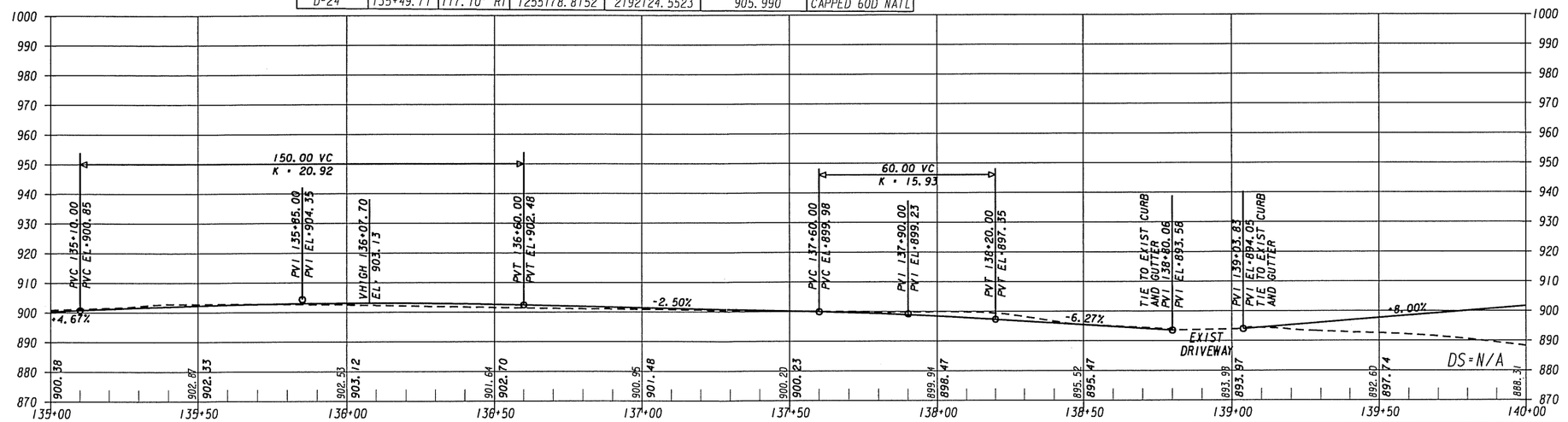
ATTACHMENT A

BORING LOCATIONS – MAINLINE PLAN
DRAWING NOS. 13-08 & 13-09
KEY TO SYMBOLS AND DESCRIPTIONS
SOIL TEST BORING RECORDS (B-1 THROUGH B-5)
LABORATORY SOIL TEST REPORTS

7/11/2017	7:29:09 AM	GPLOT-V8	0012878_13-008.dgn	GDOT	P.I. No.
James. c. lawson		gplotborder-v81-PO. tbl			0012878



CONTROL POINT TABLE						
POINT	STATION	OFFSET	NORTHING	EASTING	ELEVATION	DESCRIPTION
D-24	135+49.71	117.10' RT	1255178.8152	2192124.5523	905.990	CAPPED 60D NAIL



PROPERTY AND EXISTING R/W LINE	—℄—
REQUIRED R/W LINE	
CONSTRUCTION LIMITS	—C— F—
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES	
EASEMENT FOR CONSTR OF SLOPES	
EASEMENT FOR CONSTR OF DRIVES	

BEGIN LIMIT OF ACCESS	BLA
END LIMIT OF ACCESS	ELA
LIMIT OF ACCESS	
REQ'D R/W & LIMIT OF ACCESS	
LIMITS OF MILLING & OVERLAY	
LIMITS OF EXIST. PAVEMENT	

GEORGIA
DEPARTMENT OF TRANSPORTATION

AECOM

SCALE IN FEET
0 20 40 80

REVISION DATES

MAINLINE PLAN

SR 54 MULTI-USE TRAIL & BRIDGE

CHECKED:		DATE:		DRAWING No.
BACKCHECKED:		DATE:		13-008
CORRECTED:		DATE:		
VERIFIED:		DATE:		

T/31/2015 GPLN

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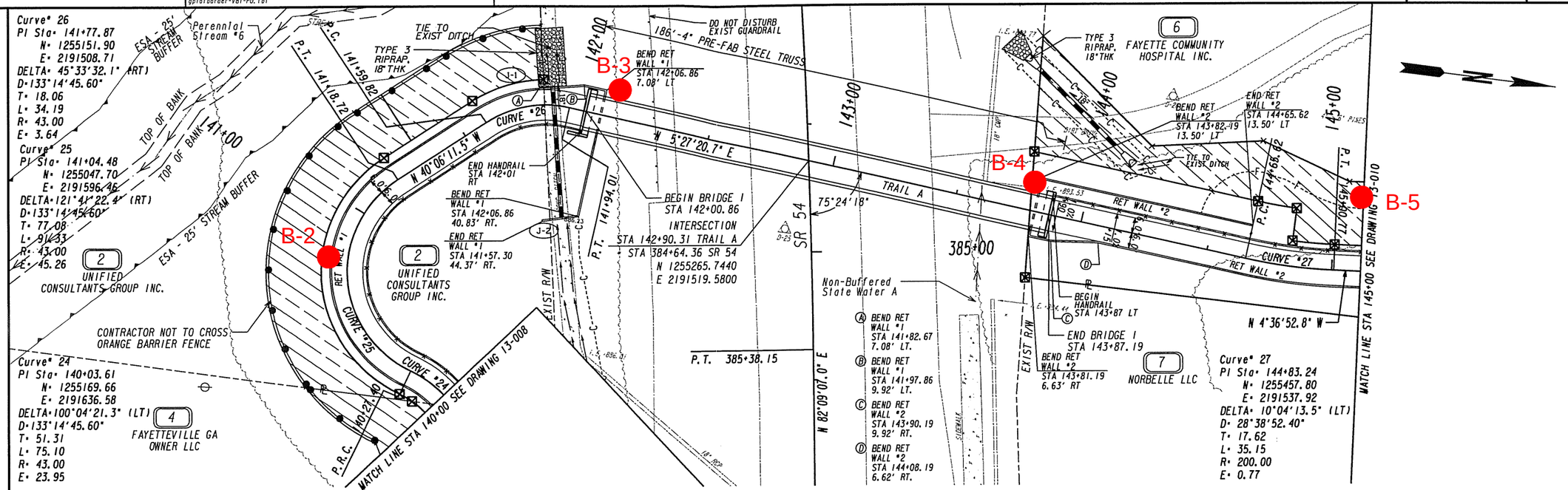
James. c. lawson | gplotborder-v81-PO.tbl

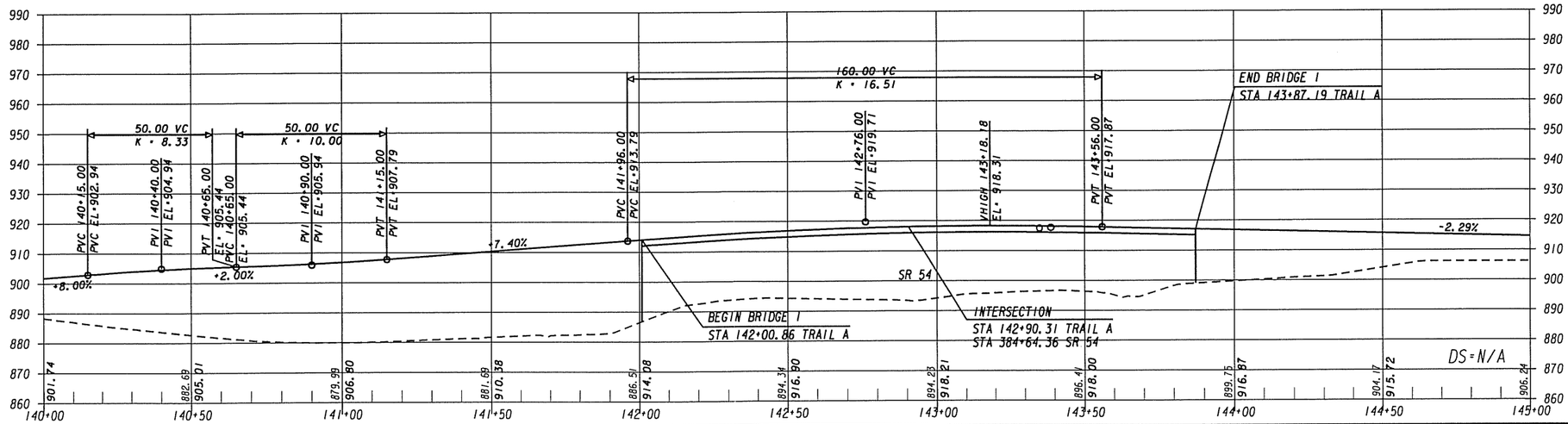
GDOT | P. I. No. 0012878



ESA - SEE ENVIRONMENTAL RESOURCES IMPACT TABLE IN GENERAL NOTES FOR CONSTRUCTION RESTRICTIONS.

CONTROL POINT TABLE

POINT	STATION	OFFSET	NORTHING	EASTING	ELEVATION	DESCRIPTION
D-25	142+75.66	28.02' RT	1255259.8378	2191547.1600	894.599	CAPPED 60D NAIL
D-26	144+12.74	55.85' LT	1255404.2661	2191476.7053	900.708	CAPPED 60D NAIL



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
LIMITS OF MILLING & OVERLAY
LIMITS OF EXIST. PAVEMENT

GEORGIA DEPARTMENT OF TRANSPORTATION

AECOM

SCALE IN FEET 0 20 40 80

REVISION DATES

MAINLINE PLAN

SR 54 MULTI-USE TRAIL & BRIDGE

CHECKED:		DATE:	DRAWING No.
BACKCHECKED:		DATE:	
CORRECTED:		DATE:	13-009
VERIFIED:		DATE:	

7/31/2015 GPLN

MAJOR DIVISIONS			GROUP SYMBOLS		TYPICAL NAMES
COARSE GRAINED SOILS (More than 50% of material is LARGER than No. 200 sieve size)	GRAVELS (More than 50% of coarse fraction is LARGER than the No. 4 sieve size)	CLEAN GRAVELS (Little or no fines)		GW	Well graded gravels, gravel - sand mixtures, little or no fines.
				GP	Poorly graded gravels or grave - sand mixtures, little or no fines.
		GRAVELS WITH FINES (Appreciable amount of fines)		GM	Silty gravels, gravel - sand - silt mixtures.
				GC	Clayey gravels, gravel - sand - clay mixtures.
	SANDS (More than 50% of coarse fraction is SMALLER than the No. 4 Sieve Size)	CLEAN SANDS (Little or no fines)		SW	Well graded sands, gravelly sands, little or no fines.
				SP	Poorly graded sands or gravelly sands, little or no fines.
		SANDS WITH FINES (Appreciable amount of fines)		SM	Silty sands, sand - silt mixtures
				SC	Clayey sands, sand - clay mixtures.
FINE GRAINED SOILS (More than 50% of material is SMALLER than No. 200 sieve size)	SILTS AND CLAYS (Liquid limit LESS than 50)			ML	Inorganic silts and very fine sands, rock flour, silty of clayey fine sands or clayey silts and with slight plasticity.
				CL	Inorganic lays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
				OL	Organic silts and organic silty clays of low plasticity.
	SILTS AND CLAYS (Liquid limit GREATER than 50)			MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
				CH	Inorganic clays of high plasticity, fat clays
				OH	Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS				PT	Peat and other highly organic soils.
FILL					Fill

	Undisturbed Sample		Auger Cuttings
	Standard Penetration Test or Dynamic Cone Penetration Test		Bulk Sample
	Rock Core		Crandall Sampler
	Dilatometer		Pressure Meter
	Packer		No Recovery
	Water Table at time of boring		Water Table after 24 hours

Correlation of Standard Penetration Resistance with Relative Density and Consistency

SAND & GRAVEL		SILT & CLAY	
No. of Blows	Relative Density	No. of Blows	Consistency
0 - 4	Very Loose	0 - 2	Very Soft
5 - 10	Loose	3 - 4	Soft
11 - 30	Medium Dense	5 - 8	Firm
31 - 50	Dense	9 - 15	Stiff
Over 50	Very Dense	16 - 30	Very Stiff
		31 - 50	Hard
		Over 50	Very Hard

Correlation of Dynamic Cone Penetration Resistance with Relative Density and Consistency (Piedmont Residual Soils)

SAND & GRAVEL		SILT & CLAY	
No. of Blows	Relative Density	No. of Blows	Consistency
0 - 4	Very Loose	0 - 2	Very Soft
5 - 15	Loose	3 - 4	Soft
16 - 30	Medium Dense	5 - 10	Firm
		11 - 30	Stiff

BOUNDARY CLASSIFICATIONS: Soils possessing characteristics of two groups are designated by combinations of group symbols.

SILT OR CLAY	SAND			GRAVEL		Cobbles	Boulders
	Fine	Medium	Coarse	Fine	Coarse		

No.200 No.40 No.10 No.4 3/4" 3" 12"

U.S. STANDARD SIEVE SIZE

Reference: The Unified Soil Classification System, Corps of Engineers, U.S. Army Technical Memorandum No 3-357, Vol. 1, March, 1953 (Revised April, 1960)

KEY TO SYMBOLS AND DESCRIPTIONS

ACCURA

Accura Engineering and Consulting Services, Inc.
3200 Presidential Drive
Atlanta, GA 30340
Office: 404.241.8722

BORING LOG

CONTRACTED WITH: GeoSystems Engineering, Inc. BORING NO.: B-1
PROJECT NAME: Fayetteville Pedestrian Bridge DATE: June 25, 2015
JOB NO.: 20014.003.14 DRILLER: Gable Drilling Co. Inc. RIG: CME 550 LOGGED BY: Larry

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	RECOV.	W	NOTES
	TOPSOIL							
	FILL-Medium dense, brown orange red, clayey SAND		1		7-9-8	10		
890		5	2		3-5-6	14		
	RESIDUUM-Loose, brown orange red, clayey SAND		3		3-5-5	12		
BOW=886								
885	Stiff, yellowish red, sandy SILT (MH)	10	4		4-5-7	18	23	LL=57, PL=45, PI=11
	Medium dense, olive gray, silty SAND							
880		15	5		3-5-6	14		
	Loose, olive gray, silty SAND							
875		20	6		3-5-5	12		
	BORING TERMINATED AT 20 FEET							No groundwater encountered at time of boring
870		25						
865		30						
860		35						
855		40						

BOW-Bottom of Wall#1
LL-Liquid Limit
PL-Platic Limit
PI-Plasticity Index

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3200 Presidential Drive
Atlanta, GA 30340
Office: 404.241.8722

BORING LOG

CONTRACTED WITH: GeoSystems Engineering, Inc. BORING NO.: B-2
PROJECT NAME: Fayetteville Pedestrian Bridge DATE: June 25, 2015
JOB NO.: 20014.003.14 DRILLER: Gable Drilling Co. Inc. RIG: CME 550 LOGGED BY: Larry

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	RECOV.	W	NOTES
BOW=878	TOPSOIL							
	FILL-Loose, brown orange red, clayey SAND		1		1-2-3	12		
875	Loose, yellowish brown, clayey SAND							
		5 ▽	2		2-4-6	14		Groundwater encountered at 5 feet at time of boring
			3		2-3-6	12		
870	RESIDUUM-Very loose, brown orange, silty SAND							
		10	4		1-2-2	12		
865	Loose, dark yellowish brown, silty SAND							
		15	5		3-3-4	18		
860								
		20	6		3-4-4	12		
855	Medium dense, brown orange, silty SAND							
		25	7		6-8-8	12		
850								
		30	8		5-10-13	18		
845								
		35	9		7-12-15	18		
840	Medium dense, brown orange red, silty SAND							BOW-Bottom of Wall#1
		40	10		5-6-8	14		

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BORING LOG

CONTRACTED WITH: GeoSystems Engineering, Inc. BORING NO.: B-2
PROJECT NAME: Fayetteville Pedestrian Bridge DATE: June 25, 2015
JOB NO.: 20014.003.14 DRILLER: Gable Drilling Co. Inc. RIG: CME 550 LOGGED BY: Larry

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	RECOV.	W	NOTES
835	PWR-Very dense, black orange red, partially weathered rock	45	11		25-50/5"	12		
830	AUGER REFUSAL AT 48 FEET	50						
825		55						
820		60						
815		65						
810		70						
805		75						
800		80						
795		85						

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BORING LOG

CONTRACTED WITH: GeoSystems Engineering, Inc. BORING NO.: B-3
PROJECT NAME: Fayetteville Pedestrian Bridge DATE: June 25, 2015
JOB NO.: 20014.003.14 DRILLER: Gable Drilling Co. Inc. RIG: CME 550 LOGGED BY: Larry

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	RECOV.	W	NOTES
890	TOPSOIL							
	FILL-Medium dense, reddish brown, clayey SAND		1		3-4-8	12		
		5	2		4-6-6	14		
885			3		5-6-5	12		
BOW=882	Loose, reddish brown, clayey SAND	10	4		2-3-5	14		
880								
	RESIDUUM-Loose, gray orange, silty SAND	15	5		2-2-3	14		
875								
	Loose, brown orange, silty SAND	20	6		2-2-3	12		
870		▽						Groundwater encountered at 22 feet at time of boring
		25	7		4-4-4	12		
865								
	Medium dense, reddish yellow, silty SAND	30	8		4-5-11	18		
860								
	Loose, brown orange silty SAND	35	9		3-5-5	14		
855								BOW-Bottom of Wall#1
	Medium dense, brown orange red, silty SAND	40	10		6-9-11	14		
850								
	Medium dense, brown orange red, silty							

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BORING LOG

CONTRACTED WITH: GeoSystems Engineering, Inc. BORING NO.: B-3
PROJECT NAME: Fayetteville Pedestrian Bridge DATE: June 25, 2015
JOB NO.: 20014.003.14 DRILLER: Gable Drilling Co. Inc. RIG: CME 550 LOGGED BY: Larry

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	RECOV.	W	NOTES
	SAND							
		45	11		3-7-10	12		
845								
	PWR-Very dense, orange brown, partially weathered rock	50	12		20-50/4"	12		
840								
	AUGER REFUSAL AT 52 FEET	55						
835		60						
830		65						
825		70						
820		75						
815		80						
810		85						

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BORING LOG

CONTRACTED WITH: GeoSystems Engineering, Inc. BORING NO.: B-4
PROJECT NAME: Fayetteville Pedestrian Bridge DATE: June 25, 2015
JOB NO.: 20014.003.14 DRILLER: Gable Drilling Co. Inc. RIG: CME 550 LOGGED BY: Larry

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	RECOV.	W	NOTES
BOW=896	FILL-Gravel							
895	FILL-Medium dense, brown orange red, clayey SAND		1		2-5-6	12		
	RESIDUUM-Medium dense, brown orange red, clayey SAND	5	2		5-8-14	14		
890	Stiff, yellowish red, sandy SILT (ML)		3		3-4-6	12		LL=49, PL=41, PI=8
		10	4		3-5-8	18		
885		15	5		3-5-6	14		
880	Loose, olive gray, silty SAND	20	6		2-3-4	12		
875		25	7		2-4-4	12		
870		▽						Groundwater encountered at 27 feet at time of boring
	Medium dense, white brown orange, silty SAND	30	8		4-6-8	18		
865		35	9		3-6-7	18		
860		40	10		3-4-8	14		BOW-Bottom of Wall#2 LL-Liquid Limit PL-Platic Limit PI-Plasticity Index
855								

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Atlanta, GA 30340
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BORING LOG

CONTRACTED WITH: GeoSystems Engineering, Inc. BORING NO.: B-4
PROJECT NAME: Fayetteville Pedestrian Bridge DATE: June 25, 2015
JOB NO.: 20014.003.14 DRILLER: Gable Drilling Co. Inc. RIG: CME 550 LOGGED BY: Larry

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	RECOV.	W	NOTES
	Medium dense, black orange red, silty SAND	45	11		5-8-10	12		
850		50	12		3-4-7	12		
845	Medium dense, light gray, silty SAND	55	13		4-6-7	14		
840		60	14		5-7-7	14		
	BORING TERMINATED at 60 FEET							
835		65						
830		70						
825		75						
820		80						
815		85						

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BORING LOG

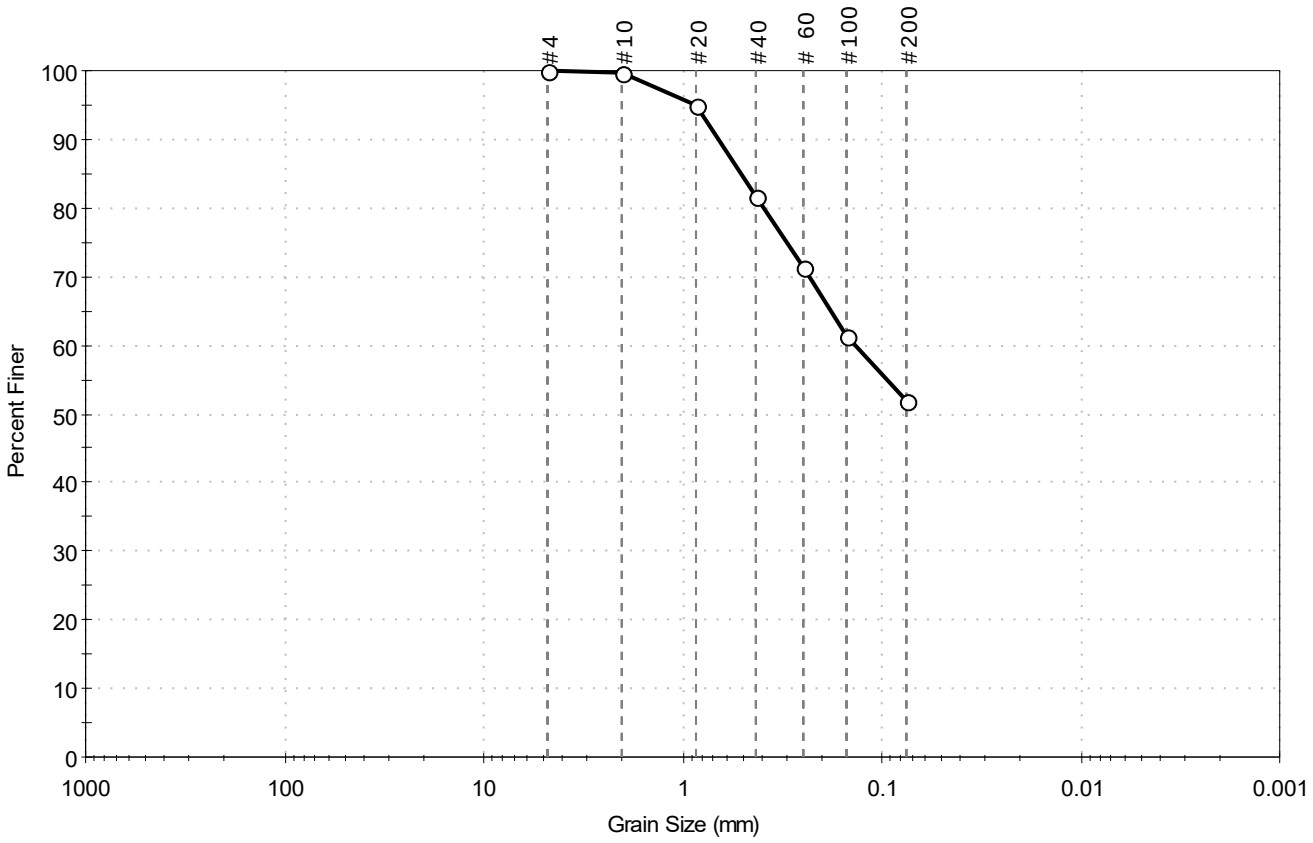
CONTRACTED WITH: GeoSystems Engineering, Inc. BORING NO.: B-5
PROJECT NAME: Fayetteville Pedestrian Bridge DATE: June 25, 2015
JOB NO.: 20014.003.14 DRILLER: Gable Drilling Co. Inc. RIG: CME 550 LOGGED BY: Larry

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	RECOV.	W	NOTES
905	TOPSOIL							
	RESIDUUM-Very stiff to stiff, red, sandy SILT (ML)		1		4-7-16	10		
BOW=904								
		5	2		4-7-8	12	13	LL=48, PL=34, PI=14
900	Medium dense, brown orange red, silty SAND		3		4-8-9	12		
		10	4		3-5-6	18		
895								
		15	5		4-6-7	14		
890								
		20	6		4-4-7	12		
	BORING TERMINATED AT 20 FEET							No groundwater encountered at time of boring
885								
		25						
880								
		30						
875								
		35						
870								
		40						
865								

BOW-Bottom of Wall#2
LL-Liquid Limit
PL-Platic Limit
PI-Plasticity Index

Client:	GeoSystems Engineering, Inc.				
Project:	Fayetteville Pedestrian Bridge/Walking Trail				
Location:	Fayetteville, Georgia			Project No:	GTX-306785
Boring ID:	B-1	Sample Type:	bag	Tested By:	twh
Sample ID:	S-4	Test Date:	08/02/17	Checked By:	MCM
Depth :	9.5 ft	Test Id:	286071		
Test Comment:	---				
Visual Description:	Moist, yellowish red sandy silt				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	48.1	51.9

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	95		
#40	0.42	82		
# 60	0.25	71		
#100	0.15	61		
#200	0.075	52		

Coefficients

D_{85} = 0.5055 mm	D_{30} = N/A
D_{60} = 0.1346 mm	D_{15} = N/A
D_{50} = N/A	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM Sandy Elastic silt (MH)

AASHTO Clayey Soils (A-7-5 (5))

Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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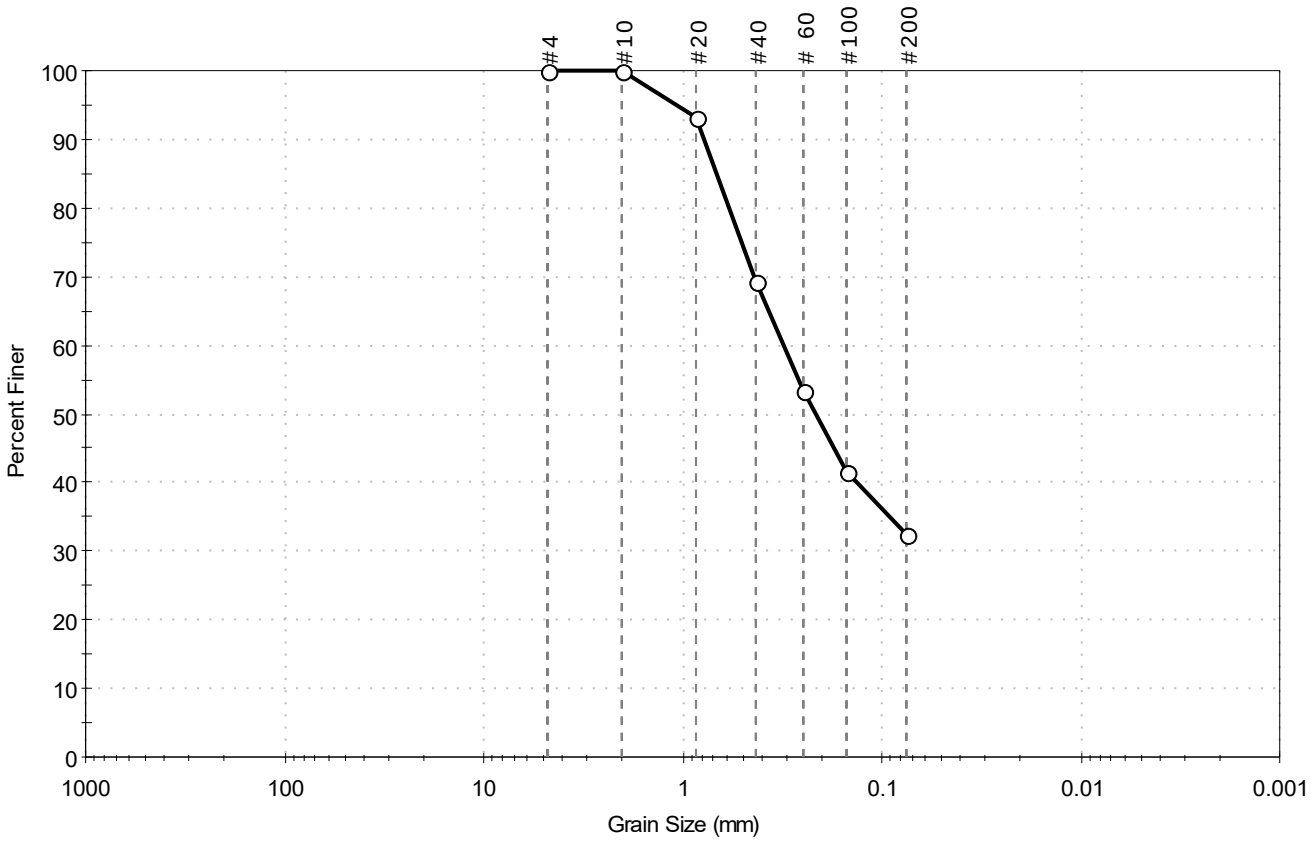
Client:	GeoSystems Engineering, Inc.				
Project:	Fayetteville Pedestrian Bridge/Walking Trail				
Location:	Fayetteville, Georgia			Project No:	GTX-306785
Boring ID:	B-1	Sample Type:	bag	Tested By:	twh
Sample ID:	S-5+S-6 Composite	Test Date:	08/02/17	Checked By:	MCM
Depth :	14.5-19.5 ft	Test Id:	286072		
Test Comment:	---				
Visual Description:	Moist, olive gray silty sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	67.5	32.5

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	93		
#40	0.42	69		
# 60	0.25	53		
#100	0.15	42		
#200	0.075	33		

Coefficients

D_{85} = 0.6691 mm	D_{30} = N/A
D_{60} = 0.3111 mm	D_{15} = N/A
D_{50} = 0.2156 mm	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

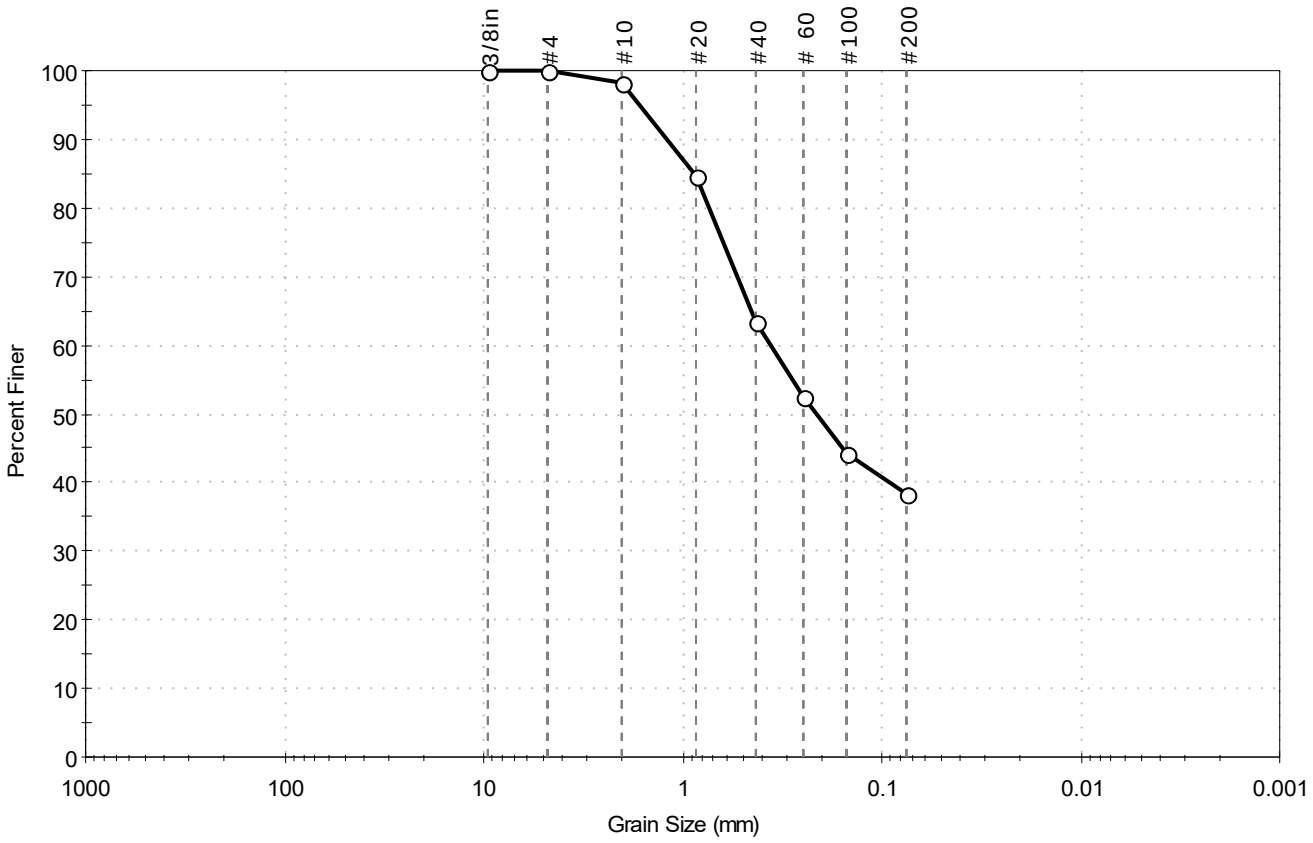
Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

Client:	GeoSystems Engineering, Inc.				
Project:	Fayetteville Pedestrian Bridge/Walking Trail				
Location:	Fayetteville, Georgia			Project No:	GTX-306785
Boring ID:	B-2	Sample Type:	bag	Tested By:	twh
Sample ID:	S-2+S-3 Composite	Test Date:	08/02/17	Checked By:	MCM
Depth :	4.5-7.0 ft	Test Id:	286073		
Test Comment:	---				
Visual Description:	Moist, yellowish brown clayey sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.1	61.5	38.4

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
3/8in	9.50	100		
#4	4.75	100		
#10	2.00	98		
#20	0.85	85		
#40	0.42	64		
# 60	0.25	52		
#100	0.15	44		
#200	0.075	38		

Coefficients

D_{85} = 0.8628 mm	D_{30} = N/A
D_{60} = 0.3593 mm	D_{15} = N/A
D_{50} = 0.2151 mm	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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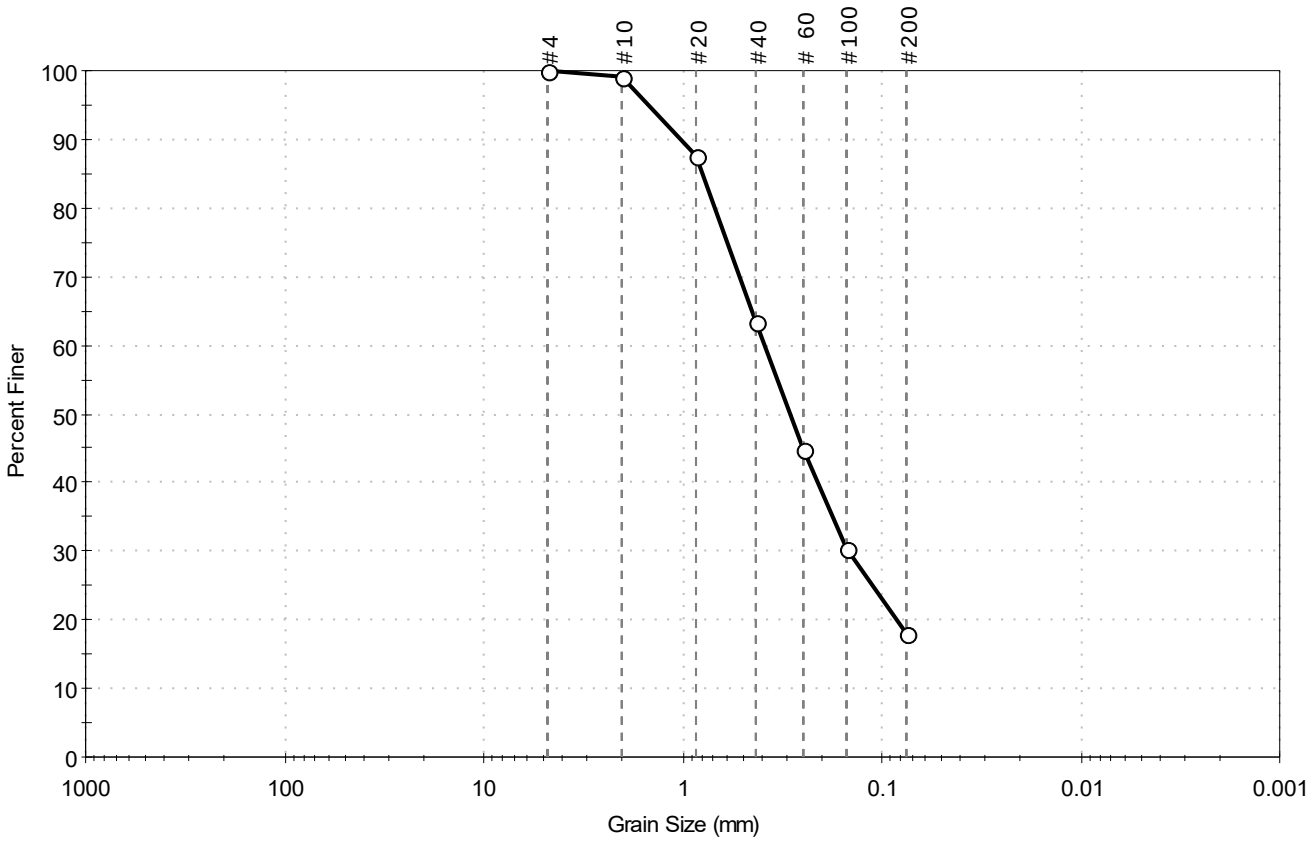
Client:	GeoSystems Engineering, Inc.				
Project:	Fayetteville Pedestrian Bridge/Walking Trail				
Location:	Fayetteville, Georgia			Project No:	GTX-306785
Boring ID:	B-2	Sample Type:	bag	Tested By:	twh
Sample ID:	S-6	Test Date:	08/02/17	Checked By:	MCM
Depth :	19.5 ft	Test Id:	286074		
Test Comment:	---				
Visual Description:	Moist, dark yellowish brown silty sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	81.9	18.1

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	99		
#20	0.85	88		
#40	0.42	63		
# 60	0.25	45		
#100	0.15	30		
#200	0.075	18		

Coefficients

D_{85} = 0.7863 mm	D_{30} = 0.1472 mm
D_{60} = 0.3850 mm	D_{15} = N/A
D_{50} = 0.2894 mm	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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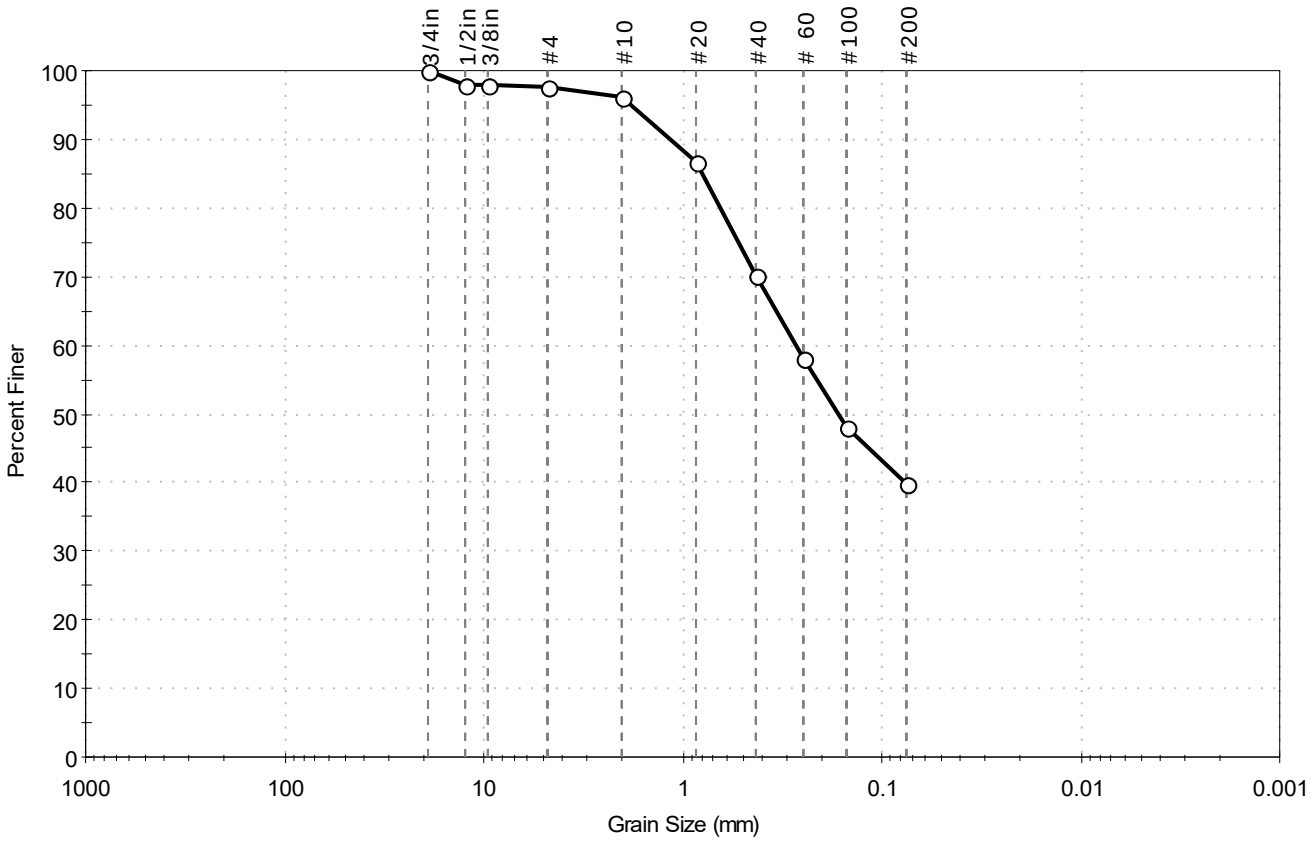
Client:	GeoSystems Engineering, Inc.				
Project:	Fayetteville Pedestrian Bridge/Walking Trail				
Location:	Fayetteville, Georgia			Project No:	GTX-306785
Boring ID:	B-3	Sample Type:	bag	Tested By:	twh
Sample ID:	S-3+S-4 Composite	Test Date:	08/02/17	Checked By:	MCM
Depth :	7.0-9.5 ft	Test Id:	286075		
Test Comment:	---				
Visual Description:	Moist, reddish brown clayey sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	2.4	57.6	40.0

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
3/4in	19.00	100		
1/2in	12.50	98		
3/8in	9.50	98		
#4	4.75	98		
#10	2.00	96		
#20	0.85	87		
#40	0.42	70		
# 60	0.25	58		
#100	0.15	48		
#200	0.075	40		

Coefficients

D_{85} = 0.7948 mm D_{30} = N/A

D_{60} = 0.2715 mm D_{15} = N/A

D_{50} = 0.1647 mm D_{10} = N/A

C_u = N/A C_c = N/A

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

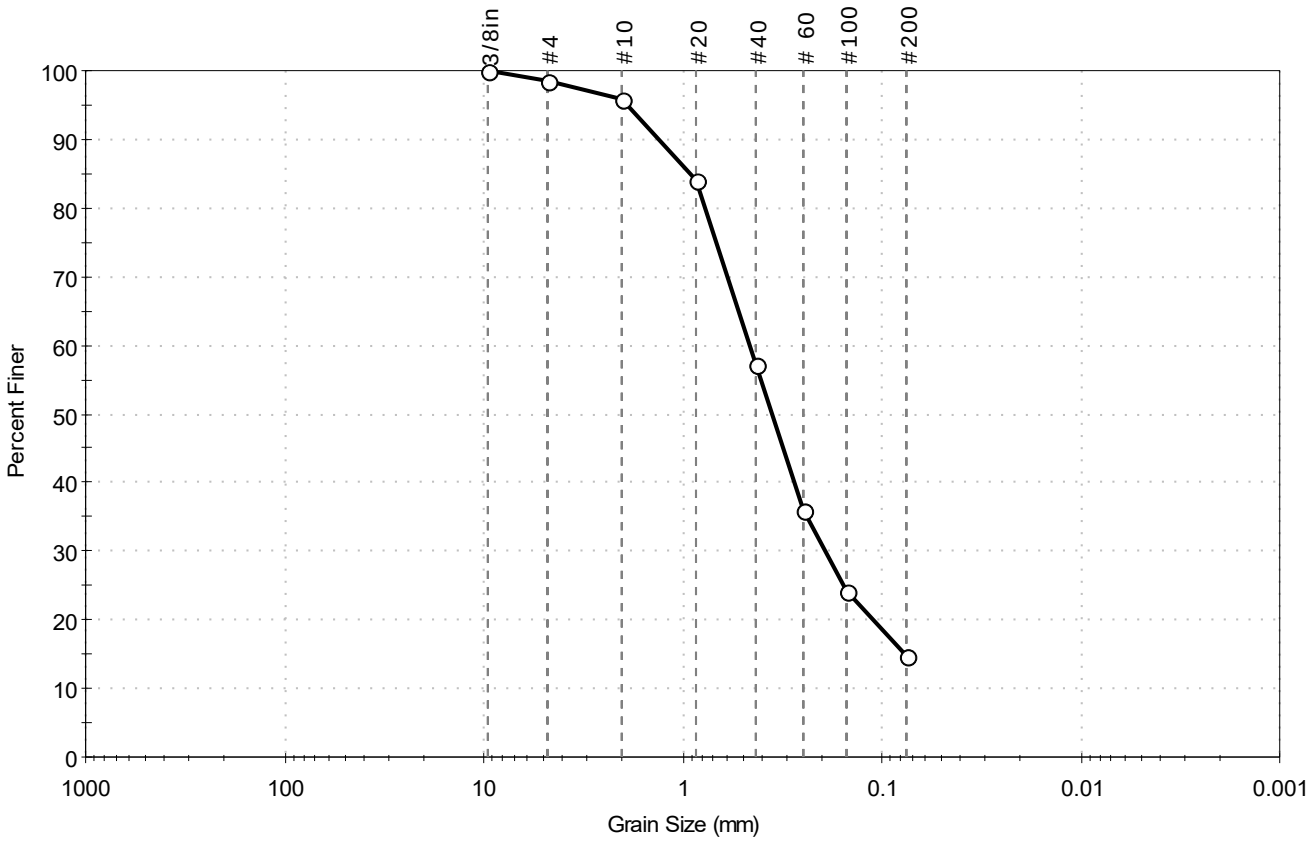
Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

Client:	GeoSystems Engineering, Inc.				
Project:	Fayetteville Pedestrian Bridge/Walking Trail				
Location:	Fayetteville, Georgia			Project No:	GTX-306785
Boring ID:	B-3	Sample Type:	bag	Tested By:	twh
Sample ID:	S-8	Test Date:	08/02/17	Checked By:	MCM
Depth :	29.5 ft	Test Id:	286076		
Test Comment:	---				
Visual Description:	Moist, reddish yellow silty sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	1.6	83.6	14.8

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
3/8in	9.50	100		
#4	4.75	98		
#10	2.00	96		
#20	0.85	84		
#40	0.42	57		
# 60	0.25	36		
#100	0.15	24		
#200	0.075	15		

Coefficients

D_{85} = 0.9104 mm	D_{30} = 0.1935 mm
D_{60} = 0.4570 mm	D_{15} = 0.0761 mm
D_{50} = 0.3554 mm	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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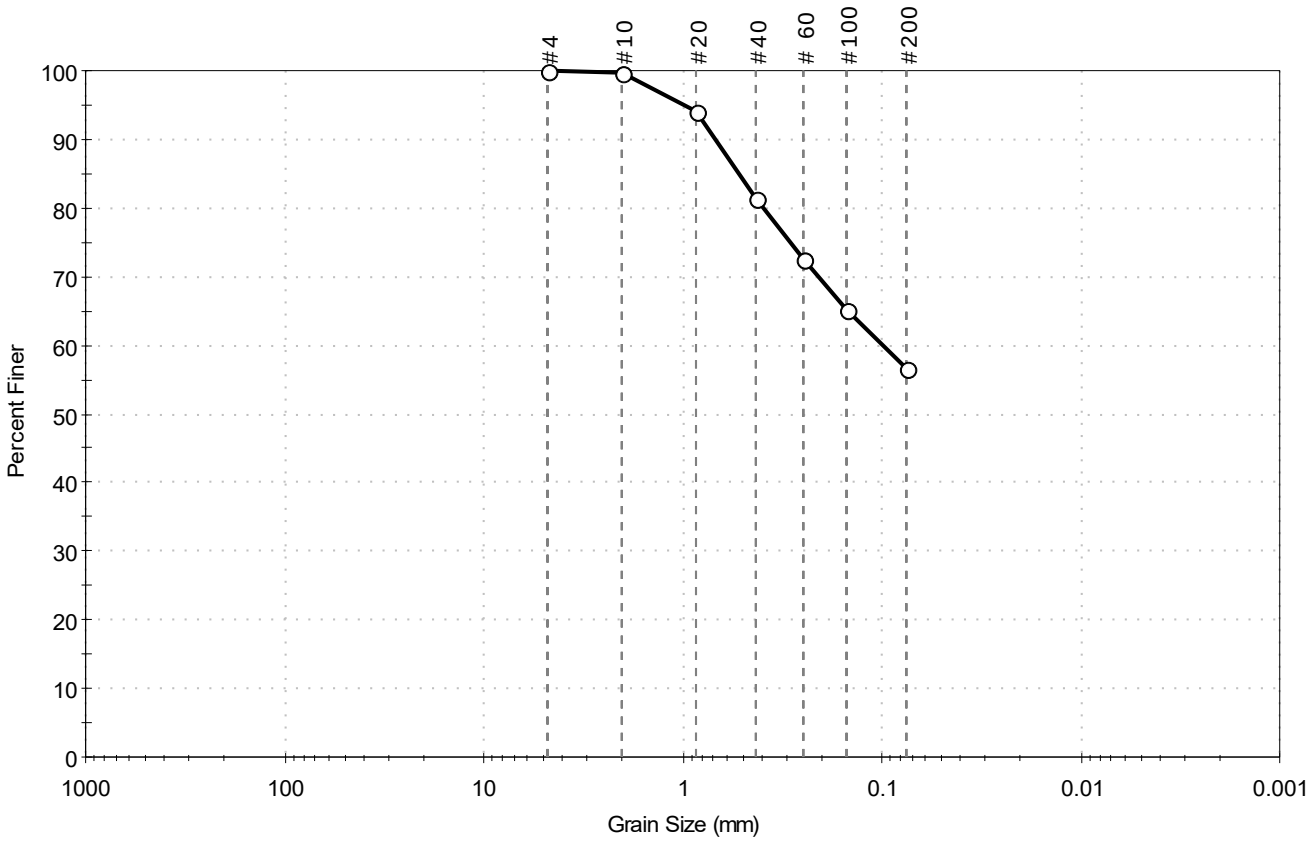
Client:	GeoSystems Engineering, Inc.				
Project:	Fayetteville Pedestrian Bridge/Walking Trail				
Location:	Fayetteville, Georgia			Project No:	GTX-306785
Boring ID:	B-4	Sample Type:	bag	Tested By:	twh
Sample ID:	S-3+S-4 Composite	Test Date:	08/02/17	Checked By:	MCM
Depth :	7.0-9.5 ft	Test Id:	286077		
Test Comment:	---				
Visual Description:	Moist, yellowish red sandy silt				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	43.5	56.5

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	94		
#40	0.42	81		
# 60	0.25	72		
#100	0.15	65		
#200	0.075	56		

Coefficients

D_{85} = 0.5191 mm	D_{30} = N/A
D_{60} = 0.0994 mm	D_{15} = N/A
D_{50} = N/A	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM Sandy Silt (ML)

AASHTO Silty Soils (A-5 (4))

Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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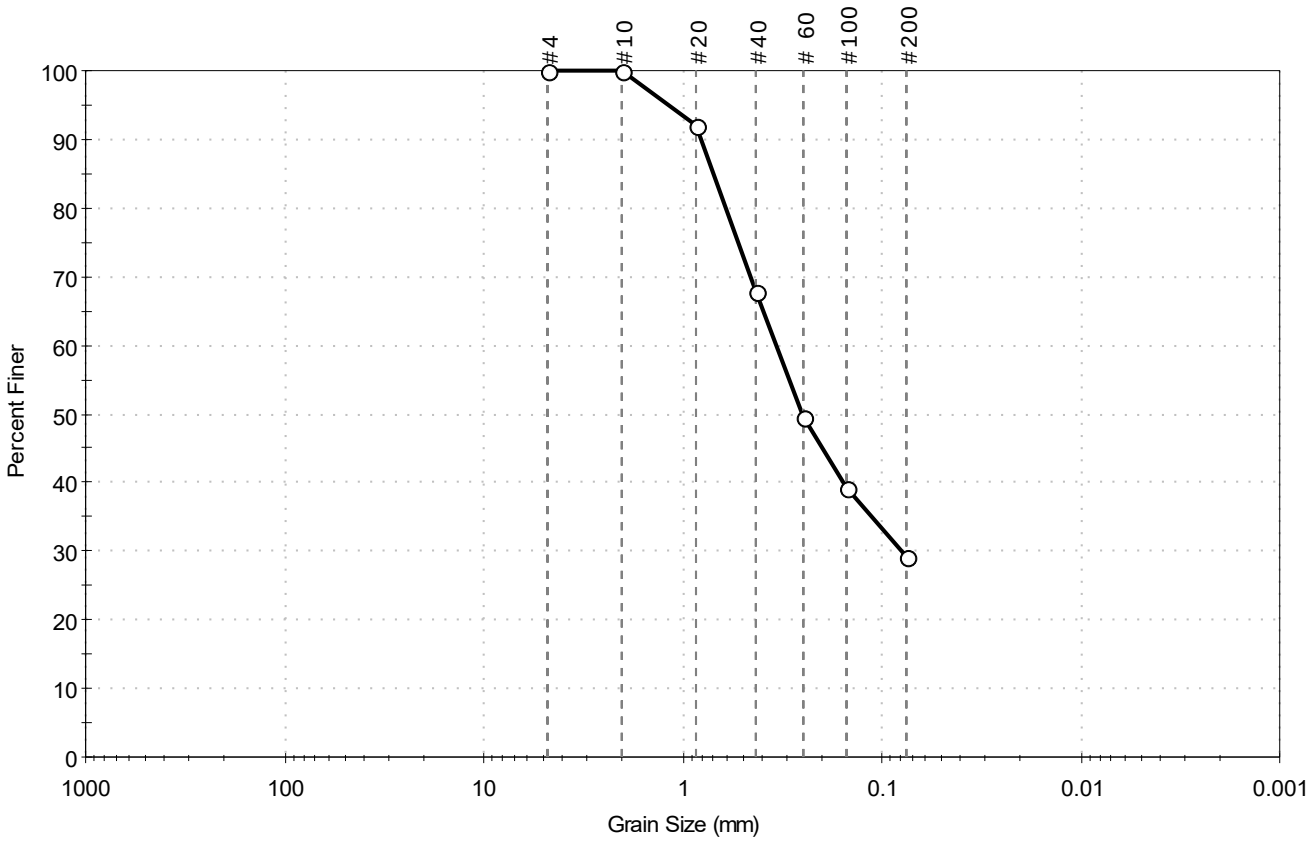
Client:	GeoSystems Engineering, Inc.				
Project:	Fayetteville Pedestrian Bridge/Walking Trail				
Location:	Fayetteville, Georgia			Project No:	GTX-306785
Boring ID:	B-4	Sample Type:	bag	Tested By:	twh
Sample ID:	S-7	Test Date:	08/02/17	Checked By:	MCM
Depth :	24.5 ft	Test Id:	286078		
Test Comment:	---				
Visual Description:	Moist, olive gray silty sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	70.8	29.2

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	92		
#40	0.42	68		
# 60	0.25	50		
#100	0.15	39		
#200	0.075	29		

Coefficients

D_{85} = 0.6957 mm	D_{30} = 0.0792 mm
D_{60} = 0.3388 mm	D_{15} = N/A
D_{50} = 0.2535 mm	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

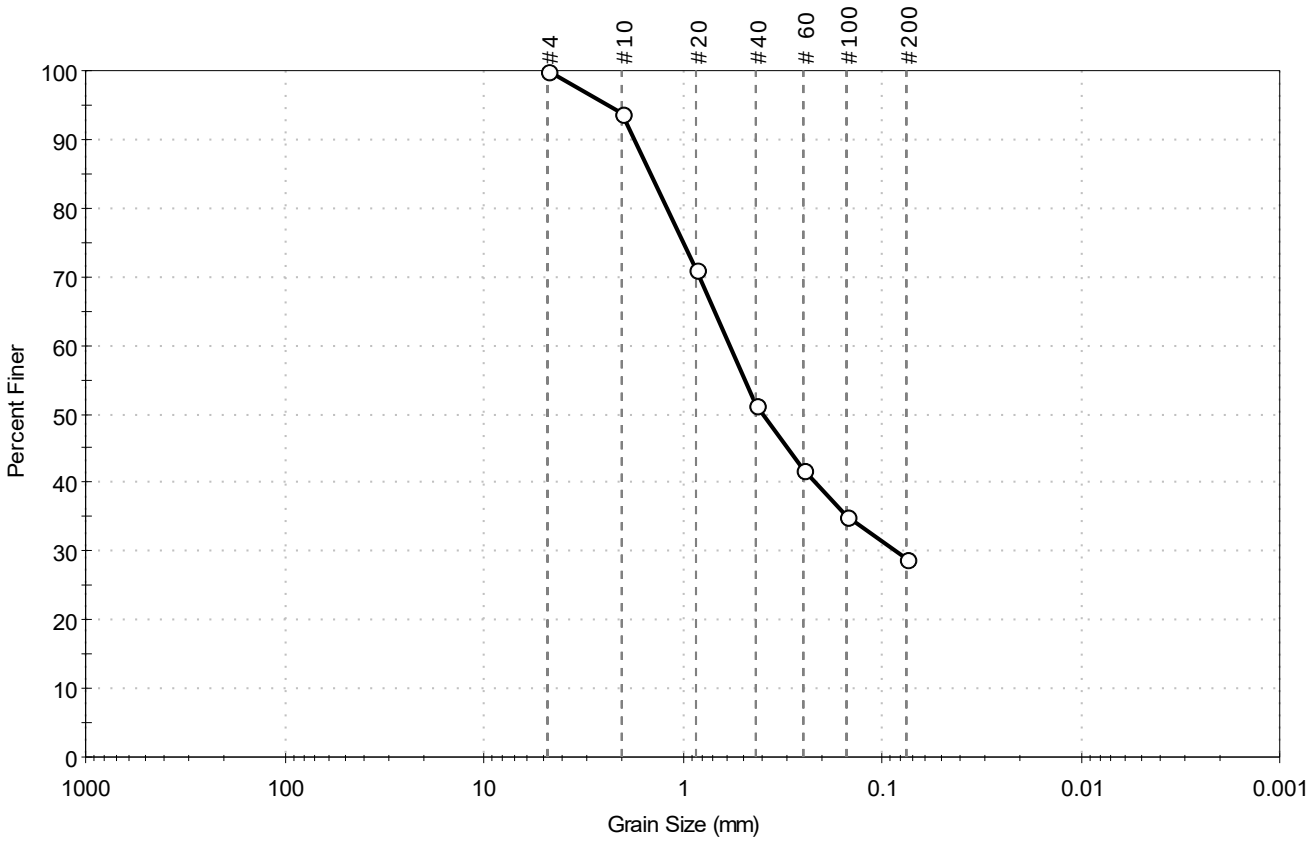
Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

Client:	GeoSystems Engineering, Inc.				
Project:	Fayetteville Pedestrian Bridge/Walking Trail				
Location:	Fayetteville, Georgia			Project No:	GTX-306785
Boring ID:	B-4	Sample Type:	bag	Tested By:	twh
Sample ID:	S-13+S-14 Composite	Test Date:	08/02/17	Checked By:	MCM
Depth :	54.5-59.5 ft	Test Id:	286079		
Test Comment:	---				
Visual Description:	Moist, light gray silty sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	71.1	28.9

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	94		
#20	0.85	71		
#40	0.42	51		
# 60	0.25	42		
#100	0.15	35		
#200	0.075	29		

Coefficients

D_{85} = 1.4299 mm	D_{30} = 0.0847 mm
D_{60} = 0.5754 mm	D_{15} = N/A
D_{50} = 0.3948 mm	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample / Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

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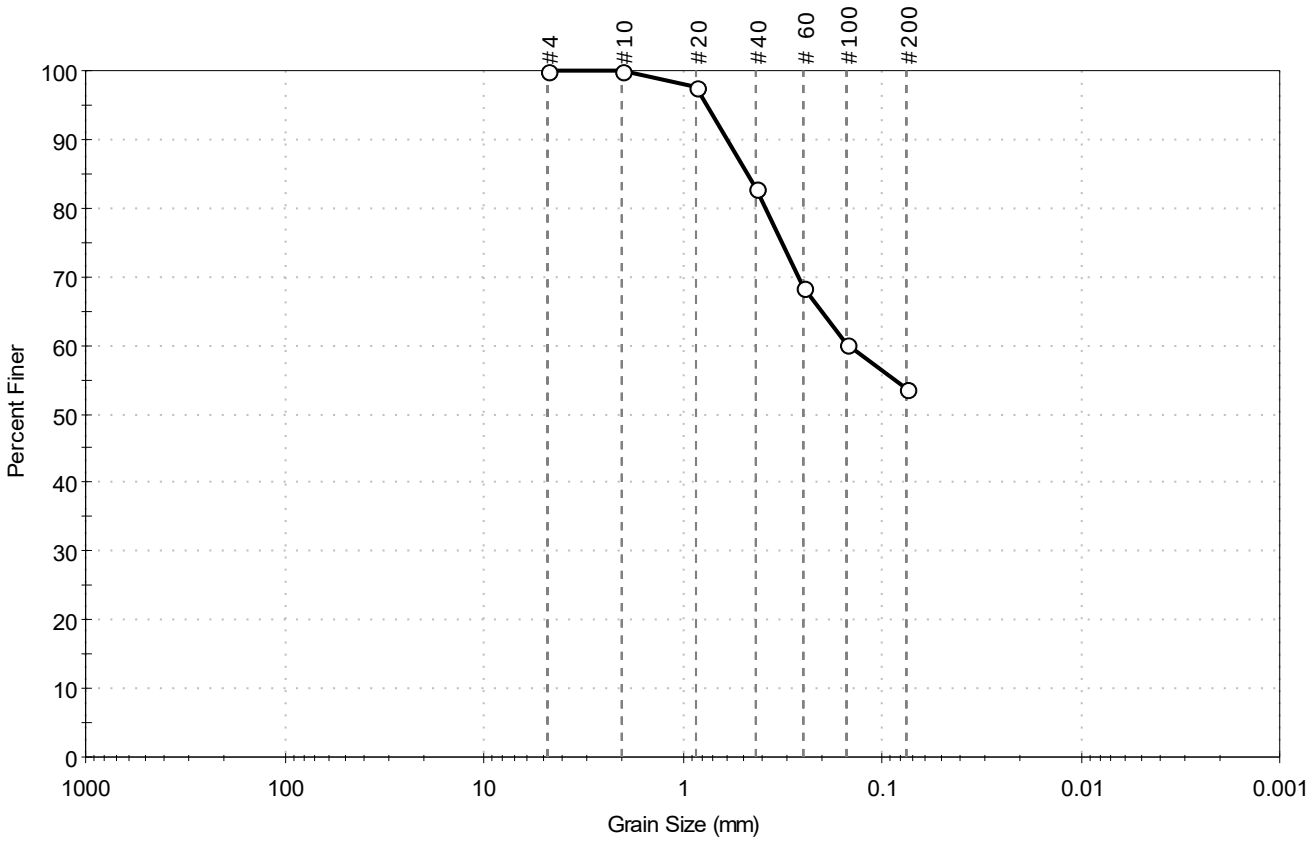
GeoTesting EXPRESS

Client:	GeoSystems Engineering, Inc.				
Project:	Fayetteville Pedestrian Bridge/Walking Trail				
Location:	Fayetteville, Georgia			Project No:	GTX-306785
Boring ID:	B-5	Sample Type:	bag	Tested By:	twh
Sample ID:	S-1+S-2 Composite	Test Date:	08/02/17	Checked By:	MCM
Depth :	1.0-4.5 ft	Test Id:	286080		
Test Comment:	---				
Visual Description:	Moist, red sandy silt				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	46.3	53.7

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	98		
#40	0.42	83		
# 60	0.25	68		
#100	0.15	60		
#200	0.075	54		

Coefficients

D_{85} = 0.4722 mm	D_{30} = N/A
D_{60} = 0.1484 mm	D_{15} = N/A
D_{50} = N/A	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM Sandy Silt (ML)

AASHTO Clayey Soils (A-7-5 (6))

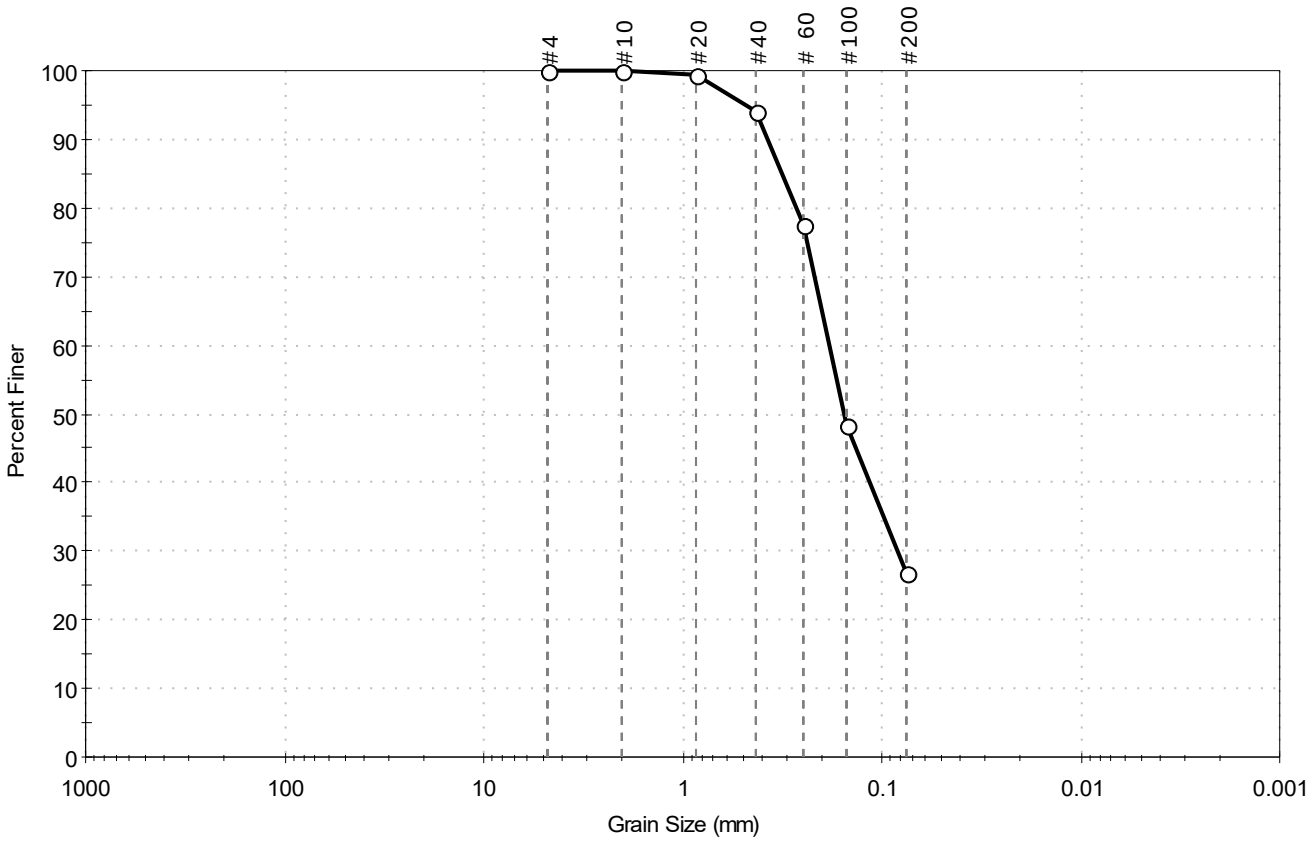
Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

Client:	GeoSystems Engineering, Inc.				
Project:	Fayetteville Pedestrian Bridge/Walking Trail				
Location:	Fayetteville, Georgia			Project No:	GTX-306785
Boring ID:	B-5	Sample Type:	bag	Tested By:	twh
Sample ID:	S-5	Test Date:	08/02/17	Checked By:	MCM
Depth :	14.5	Test Id:	286081		
Test Comment:	---				
Visual Description:	Moist, red silty sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	73.3	26.7

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	100		
#40	0.42	94		
# 60	0.25	78		
#100	0.15	48		
#200	0.075	27		

Coefficients

D_{85} = 0.3169 mm	D_{30} = 0.0832 mm
D_{60} = 0.1835 mm	D_{15} = N/A
D_{50} = 0.1540 mm	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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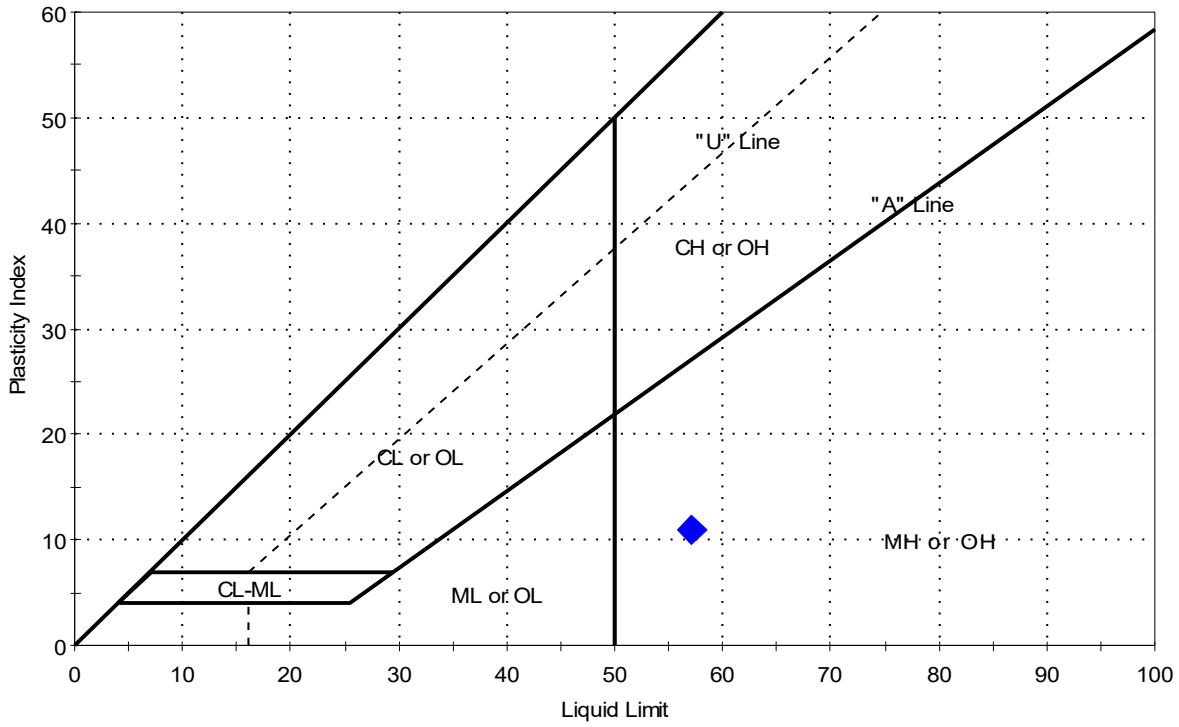
Client:	GeoSystems Engineering, Inc.				
Project:	Fayetteville Pedestrian Bridge/Walking Trail				
Location:	Fayetteville, Georgia			Project No:	GTX-306785
Boring ID:	B-1	Sample Type:	bag	Tested By:	twh
Sample ID:	S-4	Test Date:	08/04/17	Checked By:	MCM
Depth :	9.5 ft	Test Id:	286109		
Test Comment:	---				
Visual Description:	Moist, yellowish red sandy silt				
Sample Comment:	---				

Atterberg Limits - ASTM D4318

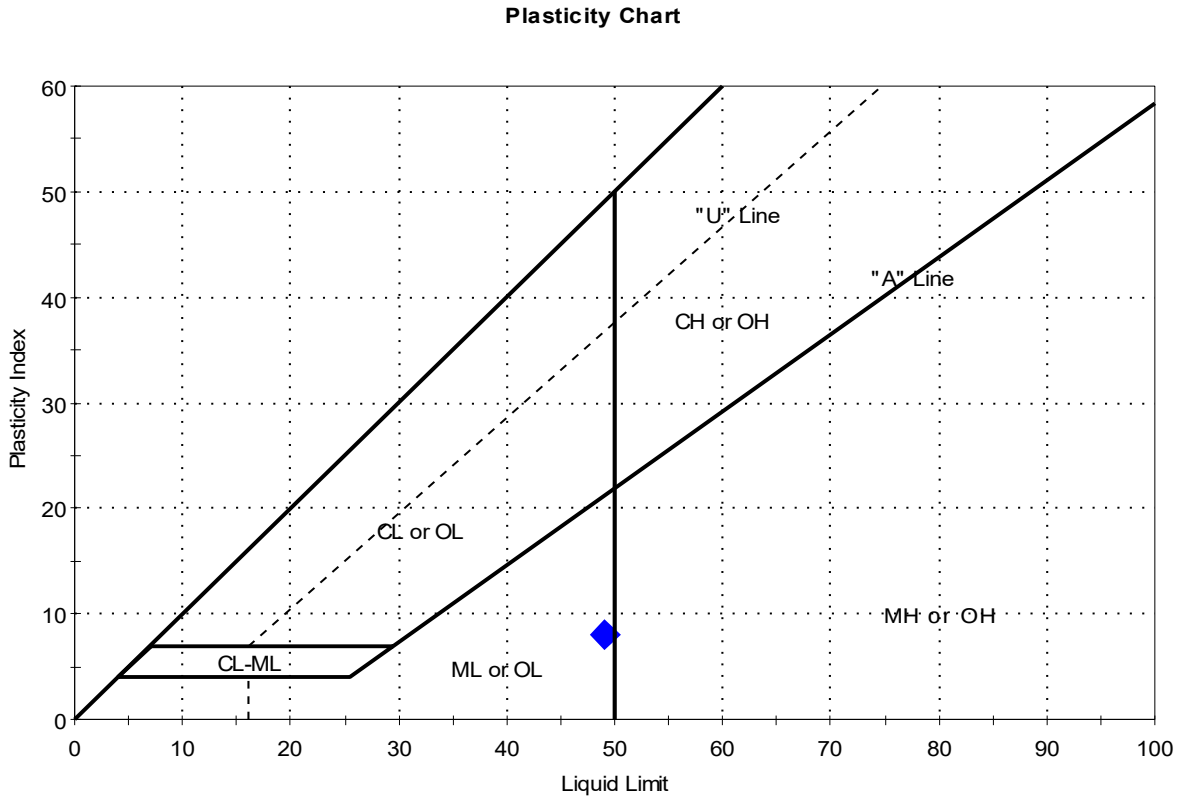


Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	S-4	B-1	9.5 ft	23	57	46	11	-2.1	Sandy Elastic silt (MH)

Sample Prepared using the WET method
18% Retained on #40 Sieve
Dry Strength: MEDIUM
Dilatancy: RAPID
Toughness: LOW

Client:	GeoSystems Engineering, Inc.				
Project:	Fayetteville Pedestrian Bridge/Walking Trail				
Location:	Fayetteville, Georgia			Project No:	GTX-306785
Boring ID:	B-4	Sample Type:	bag	Tested By:	n/a
Sample ID:	S-3+S-4 Composite	Test Date:	08/04/17	Checked By:	MCM
Depth :	7.0-9.5 ft	Test Id:	286112		
Test Comment:	---				
Visual Description:	Moist, yellowish red sandy silt				
Sample Comment:	---				

Atterberg Limits - ASTM D4318



Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	S-3+S-4 Composite	B-4	7.0-9.5 ft	22	49	41	8	-2.4	Sandy Silt (ML)

Sample Prepared using the WET method
19% Retained on #40 Sieve
Dry Strength: MEDIUM
Dilatancy: SLOW
Toughness: LOW

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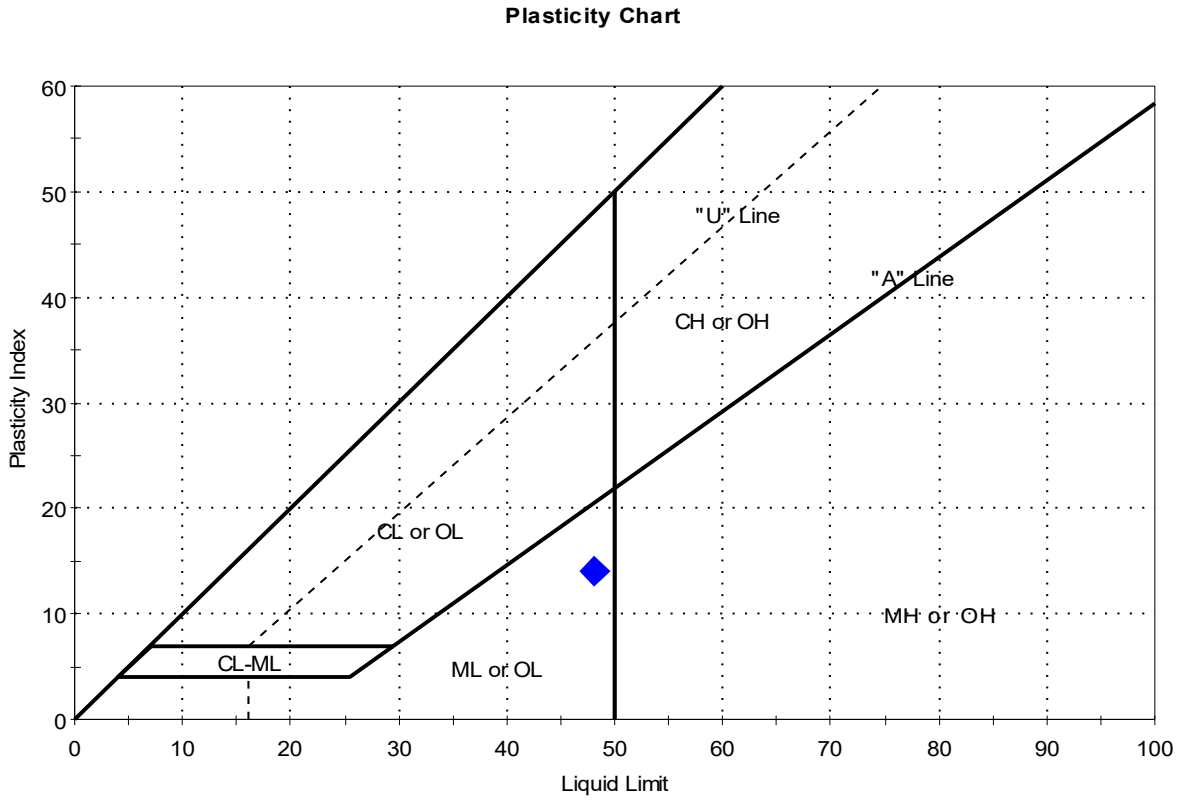
Client:	GeoSystems Engineering, Inc.				
Project:	Fayetteville Pedestrian Bridge/Walking Trail				
Location:	Fayetteville, Georgia			Project No:	GTX-306785
Boring ID:	B-5	Sample Type:	bag	Tested By:	twh
Sample ID:	S-1+S-2 Composite	Test Date:	08/04/17	Checked By:	MCM
Depth :	1.0-4.5 ft	Test Id:	286111		
Test Comment:	---				
Visual Description:	Moist, red sandy silt				
Sample Comment:	---				

Atterberg Limits - ASTM D4318



Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	S-1+S-2 Composite	B-5	1.0-4.5 ft	13	48	34	14	-1.5	Sandy Silt (ML)

Sample Prepared using the WET method

17% Retained on #40 Sieve

Dry Strength: MEDIUM

Dilatancy: SLOW

Toughness: LOW

ATTACHMENT B

APILE & GRLWEAP CALCULATIONS
BENT 1 (NORTH-BORING B-4)
BENT 2 (SOUTH-BORING B-3)

==========

APILE for Windows, Version 2015.7.6

Serial Number : 139304252

A Program for Analyzing the Axial Capacity
and Short-term Settlement of Driven Piles
under Axial Loading.

==========

This program is licensed to :

GeoSystems Engineering, Inc.
Roswell, GA

Path to file locations : C:\Users\lmullins\Documents\Calculations\APILE Data\
Name of input data file : FPB B4-65_FA.4.ap7d
Name of output file : FPB B4-65_FA.4.ap7o
Name of plot output file : FPB B4-65_FA.4.ap7p

Time and Date of Analysis

Date: September 15, 2017 Time: 17:02:11

****
* INPUT INFORMATION *
****

Fayetteville Pedestrian Bridge - North Bent (B-4) HP14x89 at 65 feet

DESIGNER : LDM

JOB NUMBER : GeoSystems 15-2511

METHOD FOR UNIT LOAD TRANSFERS :

- FHWA (Federal Highway Administration)
  Unfactored Unit Side Friction and Unit Side Resistance are used.

COMPUTATION METHOD(S) FOR PILE CAPACITY :

- FHWA (Federal Highway Administration)

TYPE OF LOADING :
- COMPRESSION

PILE TYPE :

H-Pile/Steel Pile

DATA FOR AXIAL STIFFNESS :

- MODULUS OF ELASTICITY = 0.290E+08 PSI
- CROSS SECTION AREA = 203.23 IN2

NONCIRCULAR PILE PROPERTIES :

- TOTAL PILE LENGTH, TL = 65.00 FT.
- PILE STICKUP LENGTH, PSL = 0.00 FT.
- ZERO FRICTION LENGTH, ZFL = 0.00 FT.
- PERIMETER OF PILE = 57.05 IN.
- TIP AREA OF PILE = 203.23 IN2
- INCREMENT OF PILE LENGTH USED IN COMPUTATION = 1.00 FT.

SOIL INFORMATIONS :

DEPTH FT.	SOIL TYPE	LATERAL EARTH PRESSURE	EFFECTIVE UNIT WEIGHT LB/CF	FRICTION ANGLE DEGREES	BEARING CAPACITY FACTOR
0.00	SAND	0.00	115.00	28.00	0.00
6.00	SAND	0.00	115.00	30.00	0.00
6.00	CLAY	0.00	115.00	0.00	0.00
18.00	CLAY	0.00	115.00	0.00	0.00
18.00	SAND	0.00	115.00	28.00	0.00
20.00	SAND	0.00	115.00	28.00	0.00
20.00	SAND	0.00	51.00	28.00	0.00
28.00	SAND	0.00	51.00	28.00	0.00
28.00	SAND	0.00	51.00	30.00	0.00
70.00	SAND	0.00	51.00	30.00	0.00

MAXIMUM UNIT FRICTION KSF	MAXIMUM UNIT BEARING KSF	UNDISTURB SHEAR STRENGTH KSF	REMOLDED SHEAR STRENGTH KSF	BLOW COUNT	UNIT SKIN FRICTION KSF	UNIT END BEARING KSF
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	1.10	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	1.10	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00

* MAXIMUM UNIT FRICTION AND/OR MAXIMUM UNIT BEARING WERE SET TO BE 0.10E+08 BECAUSE THE USER DOES NOT PLAN TO LIMIT THE COMPUTED DATA.

DEPTH FT.	LRFD FACTOR ON UNIT FRICTION	LRFD FACTOR ON UNIT BEARING
0.00	1.000	1.000
6.00	1.000	1.000
6.00	1.000	1.000
18.00	1.000	1.000
18.00	1.000	1.000
20.00	1.000	1.000
20.00	1.000	1.000
28.00	1.000	1.000
28.00	1.000	1.000
70.00	1.000	1.000

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* COMPUTATION RESULT *
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****
* FED. HWY. METHOD *
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PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	1.2	1.2
1.00	0.1	2.5	2.6
2.00	0.5	4.5	5.1
3.00	1.2	7.4	8.7
4.00	2.2	10.2	12.4
5.00	3.6	12.1	15.7
6.00	5.2	13.5	18.7
7.00	8.8	14.1	22.9
8.00	14.0	14.1	28.1
9.00	19.2	14.0	33.2
10.00	24.4	14.0	38.4
11.00	29.7	14.0	43.6
12.00	34.9	14.0	48.9
13.00	40.1	14.0	54.1
14.00	45.4	14.0	59.3
15.00	50.6	14.0	64.6
16.00	55.8	14.3	70.1
17.00	61.0	15.3	76.4
18.00	66.3	16.4	82.7
19.00	71.4	17.4	88.8
20.00	76.5	18.5	95.0
21.00	81.7	18.8	100.5
22.00	87.1	18.8	105.9
23.00	92.6	18.8	111.4
24.00	98.2	18.8	117.0
25.00	104.0	18.8	122.8
26.00	109.8	18.8	128.6
27.00	115.8	18.8	134.6
28.00	121.9	18.8	140.7

29.00	128.7	18.8	147.5
30.00	136.2	18.8	155.0
31.00	143.9	18.8	162.7
32.00	151.6	18.8	170.4
33.00	159.6	18.8	178.4
34.00	167.6	18.8	186.4
35.00	175.9	18.8	194.6
36.00	184.2	18.8	203.0
37.00	192.7	18.8	211.5
38.00	201.3	18.8	220.1
39.00	210.0	18.8	228.8
40.00	218.9	18.8	237.7
41.00	228.0	18.8	246.8
42.00	237.1	18.8	255.9
43.00	246.5	18.8	265.2
44.00	255.9	18.8	274.7
45.00	265.5	18.8	284.3
46.00	275.2	18.8	294.0
47.00	285.1	18.8	303.9
48.00	295.1	18.8	313.8
49.00	305.2	18.8	324.0
50.00	315.5	18.8	334.3
51.00	325.9	18.8	344.7
52.00	336.4	18.8	355.2
53.00	347.1	18.8	365.9
54.00	357.9	18.8	376.7
55.00	368.9	18.8	387.7
56.00	380.0	18.8	398.8
57.00	391.2	18.8	410.0
58.00	402.6	18.8	421.4
59.00	414.1	18.8	432.9
60.00	425.7	18.8	444.5
61.00	437.5	18.8	456.3
62.00	449.4	18.8	468.2
63.00	461.5	18.8	480.3
64.00	473.7	18.8	492.5
65.00	486.0	18.8	504.8

NOTES:
- AN ASTERISK IS PLACED IN THE END-BEARING COLUMN IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.

****
* COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
* CURVES FOR AXIAL LOADING *
****

T-Z CURVE NO.	NO. OF POINTS	DEPTH TO CURVE FT.	LOAD TRANSFER PSI	PILE MOVEMENT IN.
1	10	0.0000E+00		
			0.0000E+00	0.0000E+00
			0.5920E-01	0.1000E-01
			0.1184E+00	0.2000E-01
			0.2368E+00	0.4000E-01
			0.3552E+00	0.6000E-01
			0.4736E+00	0.8000E-01
			0.5328E+00	0.9000E-01

			0.5920E+00	0.1000E+00
			0.5920E+00	0.5000E+00
			0.5920E+00	0.2000E+01
2	10	0.3025E+01		
			0.0000E+00	0.0000E+00
			0.1697E+00	0.1000E-01
			0.3394E+00	0.2000E-01
			0.6787E+00	0.4000E-01
			0.1018E+01	0.6000E-01
			0.1357E+01	0.8000E-01
			0.1527E+01	0.9000E-01
			0.1697E+01	0.1000E+00
			0.1697E+01	0.5000E+00
			0.1697E+01	0.2000E+01
3	10	0.5958E+01		
			0.0000E+00	0.0000E+00
			0.3795E+00	0.1000E-01
			0.7590E+00	0.2000E-01
			0.1518E+01	0.4000E-01
			0.2277E+01	0.6000E-01
			0.3036E+01	0.8000E-01
			0.3416E+01	0.9000E-01
			0.3795E+01	0.1000E+00
			0.3795E+01	0.5000E+00
			0.3795E+01	0.2000E+01
4	10	0.6000E+01		
			0.0000E+00	0.0000E+00
			0.1920E+01	0.2906E-01
			0.3200E+01	0.5629E-01
			0.4800E+01	0.1035E+00
			0.5760E+01	0.1453E+00
			0.6400E+01	0.1816E+00
			0.5760E+01	0.3632E+00
			0.5760E+01	0.5448E+00
			0.5760E+01	0.9080E+00
			0.5760E+01	0.3632E+01
5	10	0.1203E+02		
			0.0000E+00	0.0000E+00
			0.2292E+01	0.2906E-01
			0.3819E+01	0.5629E-01
			0.5729E+01	0.1035E+00
			0.6875E+01	0.1453E+00
			0.7639E+01	0.1816E+00
			0.6875E+01	0.3632E+00
			0.6875E+01	0.5448E+00
			0.6875E+01	0.9080E+00
			0.6875E+01	0.3632E+01
6	10	0.1796E+02		
			0.0000E+00	0.0000E+00
			0.2262E+01	0.2906E-01
			0.3769E+01	0.5629E-01
			0.5654E+01	0.1035E+00
			0.6785E+01	0.1453E+00
			0.7539E+01	0.1816E+00
			0.6785E+01	0.3632E+00
			0.6785E+01	0.5448E+00
			0.6785E+01	0.9080E+00
			0.6785E+01	0.3632E+01
7	10	0.1800E+02		
			0.0000E+00	0.0000E+00
			0.7434E+00	0.1000E-01
			0.1487E+01	0.2000E-01
			0.2974E+01	0.4000E-01

			0.4460E+01	0.6000E-01
			0.5947E+01	0.8000E-01
			0.6691E+01	0.9000E-01
			0.7434E+01	0.1000E+00
			0.7434E+01	0.5000E+00
			0.7434E+01	0.2000E+01
8	10	0.1903E+02		
			0.0000E+00	0.0000E+00
			0.7567E+00	0.1000E-01
			0.1513E+01	0.2000E-01
			0.3027E+01	0.4000E-01
			0.4540E+01	0.6000E-01
			0.6053E+01	0.8000E-01
			0.6810E+01	0.9000E-01
			0.7567E+01	0.1000E+00
			0.7567E+01	0.5000E+00
			0.7567E+01	0.2000E+01
9	10	0.1996E+02		
			0.0000E+00	0.0000E+00
			0.7567E+00	0.1000E-01
			0.1513E+01	0.2000E-01
			0.3027E+01	0.4000E-01
			0.4540E+01	0.6000E-01
			0.6053E+01	0.8000E-01
			0.6810E+01	0.9000E-01
			0.7567E+01	0.1000E+00
			0.7567E+01	0.5000E+00
			0.7567E+01	0.2000E+01
10	10	0.2000E+02		
			0.0000E+00	0.0000E+00
			0.7789E+00	0.1000E-01
			0.1558E+01	0.2000E-01
			0.3115E+01	0.4000E-01
			0.4673E+01	0.6000E-01
			0.6231E+01	0.8000E-01
			0.7010E+01	0.9000E-01
			0.7789E+01	0.1000E+00
			0.7789E+01	0.5000E+00
			0.7789E+01	0.2000E+01
11	10	0.2403E+02		
			0.0000E+00	0.0000E+00
			0.8464E+00	0.1000E-01
			0.1693E+01	0.2000E-01
			0.3386E+01	0.4000E-01
			0.5079E+01	0.6000E-01
			0.6772E+01	0.8000E-01
			0.7618E+01	0.9000E-01
			0.8464E+01	0.1000E+00
			0.8464E+01	0.5000E+00
			0.8464E+01	0.2000E+01
12	10	0.2796E+02		
			0.0000E+00	0.0000E+00
			0.9406E+00	0.1000E-01
			0.1881E+01	0.2000E-01
			0.3762E+01	0.4000E-01
			0.5644E+01	0.6000E-01
			0.7525E+01	0.8000E-01
			0.8466E+01	0.9000E-01
			0.9406E+01	0.1000E+00
			0.9406E+01	0.5000E+00
			0.9406E+01	0.2000E+01
13	10	0.2800E+02		
			0.0000E+00	0.0000E+00

			0.1045E+01	0.1000E-01
			0.2091E+01	0.2000E-01
			0.4181E+01	0.4000E-01
			0.6272E+01	0.6000E-01
			0.8362E+01	0.8000E-01
			0.9408E+01	0.9000E-01
			0.1045E+02	0.1000E+00
			0.1045E+02	0.5000E+00
			0.1045E+02	0.2000E+01
14	10	0.4903E+02		
			0.0000E+00	0.0000E+00
			0.1510E+01	0.1000E-01
			0.3021E+01	0.2000E-01
			0.6041E+01	0.4000E-01
			0.9062E+01	0.6000E-01
			0.1208E+02	0.8000E-01
			0.1359E+02	0.9000E-01
			0.1510E+02	0.1000E+00
			0.1510E+02	0.5000E+00
			0.1510E+02	0.2000E+01
15	10	0.6996E+02		
			0.0000E+00	0.0000E+00
			0.1802E+01	0.1000E-01
			0.3604E+01	0.2000E-01
			0.7208E+01	0.4000E-01
			0.1081E+02	0.6000E-01
			0.1442E+02	0.8000E-01
			0.1622E+02	0.9000E-01
			0.1802E+02	0.1000E+00
			0.1802E+02	0.5000E+00
			0.1802E+02	0.2000E+01

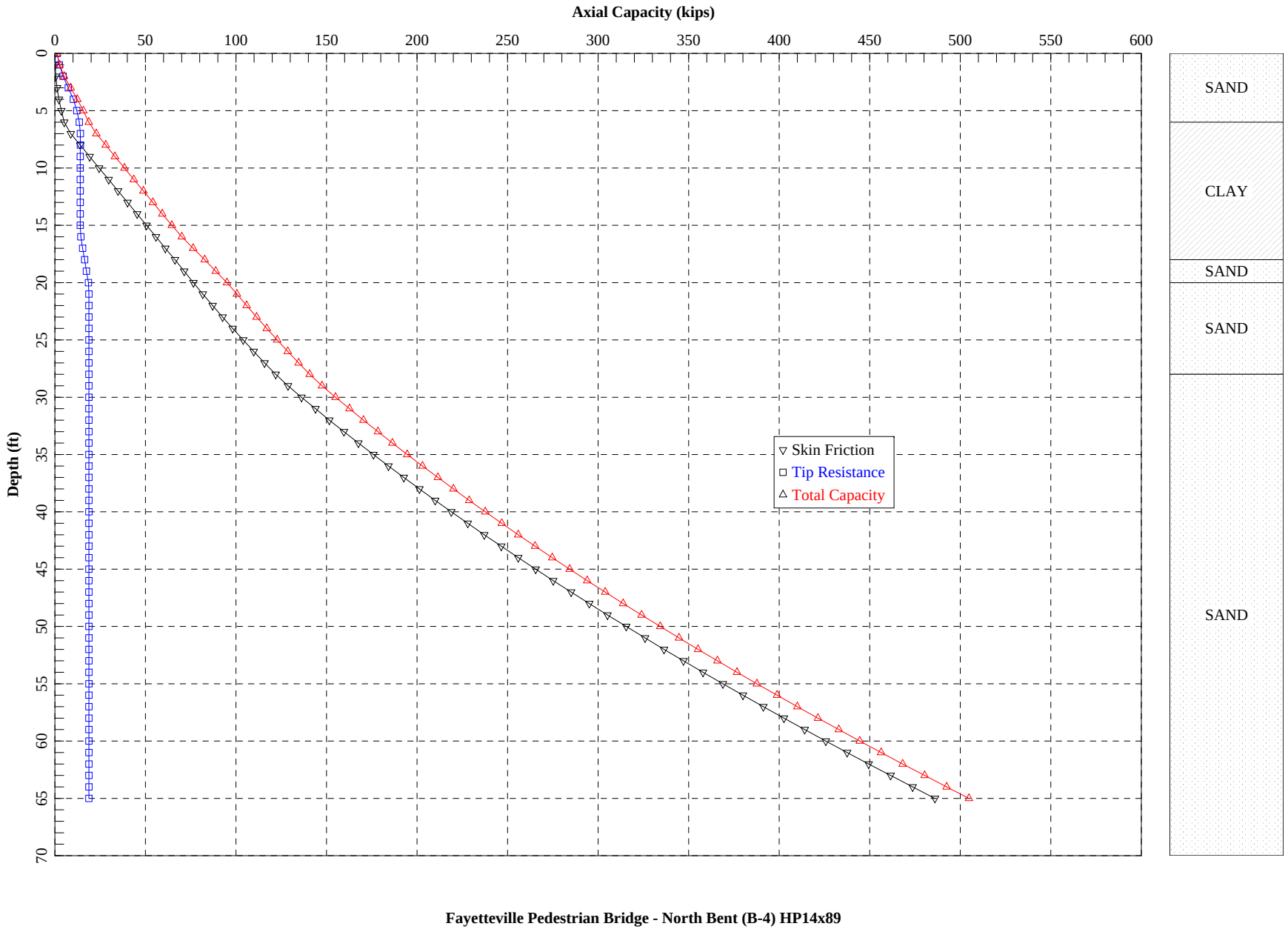
TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00
0.1175E+01	0.9080E-02
0.2350E+01	0.1816E-01
0.4700E+01	0.3632E-01
0.9399E+01	0.2361E+00
0.1410E+02	0.7627E+00
0.1692E+02	0.1326E+01
0.1880E+02	0.1816E+01
0.1880E+02	0.2724E+01
0.1880E+02	0.3632E+01

LOAD VERSUS SETTLEMENT CURVE

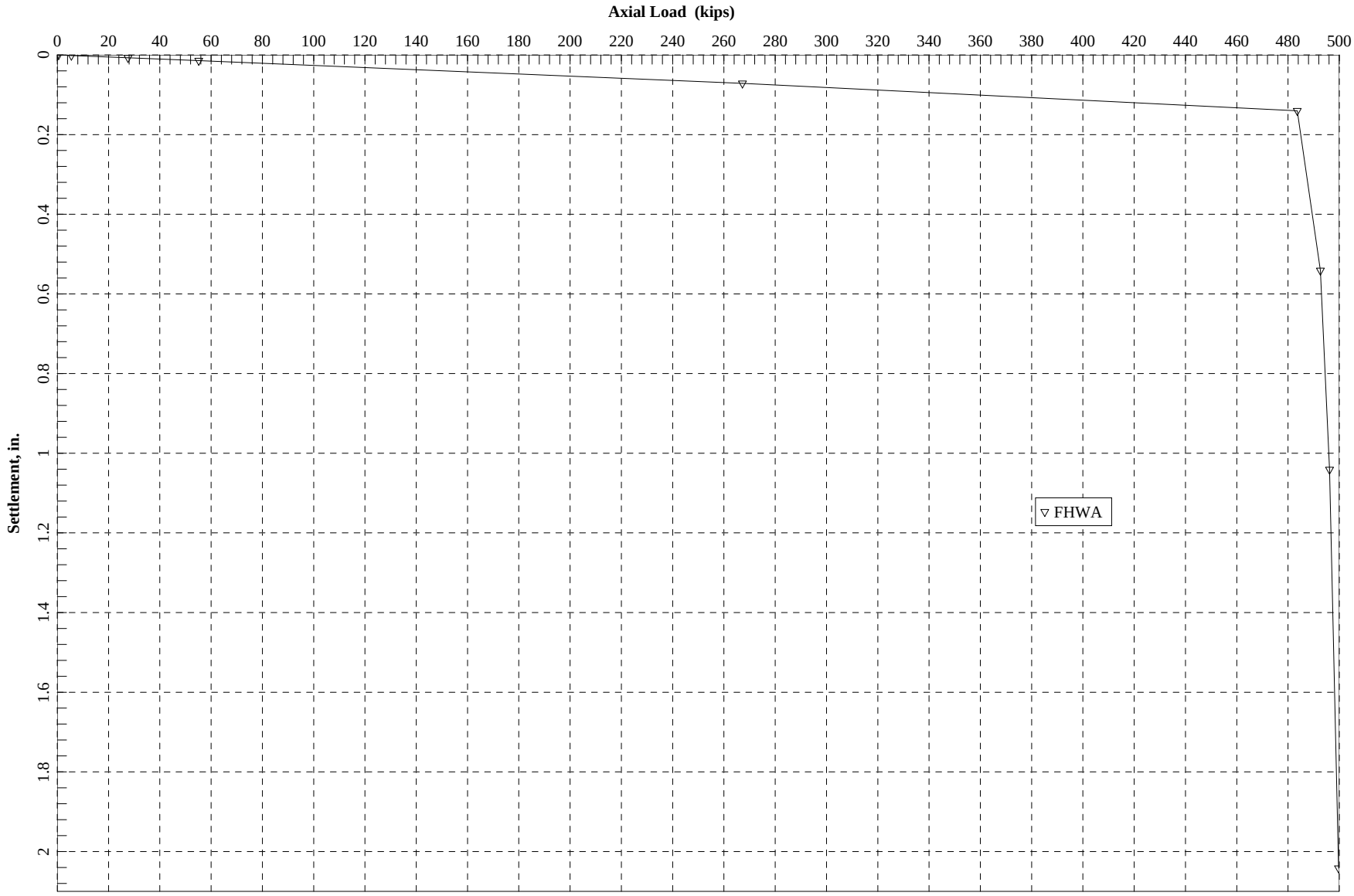
****

TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.5519E+00	0.1437E-03	0.1294E-01	0.1000E-03
0.5519E+01	0.1437E-02	0.1294E+00	0.1000E-02
0.2760E+02	0.7184E-02	0.6470E+00	0.5000E-02
0.5519E+02	0.1437E-01	0.1294E+01	0.1000E-01
0.2672E+03	0.7148E-01	0.5022E+01	0.5000E-01
0.4836E+03	0.1402E+00	0.6198E+01	0.1000E+00

0.4926E+03	0.5410E+00	0.1175E+02	0.5000E+00
0.4962E+03	0.1041E+01	0.1529E+02	0.1000E+01
0.4997E+03	0.2042E+01	0.1880E+02	0.2000E+01



Fayetteville Pedestrian Bridge - North Bent (B-4) HP14x89



Fayetteville Pedestrian Bridge North Bent (B-4) HP14x89

APILE for Windows, Version 2015.7.6

Serial Number : 139304252

A Program for Analyzing the Axial Capacity
and Short-term Settlement of Driven Piles
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This program is licensed to :

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Path to file locations : C:\Users\lmullins\Documents\Calculations\APILE Data\
Name of input data file : FPB B3-55_FA.ap7d
Name of output file : FPB B3-55_FA.ap7o
Name of plot output file : FPB B3-55_FA.ap7p

Time and Date of Analysis

Date: August 10, 2017 Time: 16:50:11

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* INPUT INFORMATION *

Fayetteville Pedestrian Bridge - South Bent (B-3) HP14x89 at 55 feet

DESIGNER : LDM

JOB NUMBER : GeoSystems 15-2511

METHOD FOR UNIT LOAD TRANSFERS :

- FHWA (Federal Highway Administration)
  Unfactored Unit Side Friction and Unit Side Resistance are used.

COMPUTATION METHOD(S) FOR PILE CAPACITY :

- FHWA (Federal Highway Administration)

TYPE OF LOADING :
- COMPRESSION

PILE TYPE :

H-Pile/Steel Pile

DATA FOR AXIAL STIFFNESS :

- MODULUS OF ELASTICITY = 0.290E+08 PSI
- CROSS SECTION AREA = 203.23 IN2

NONCIRCULAR PILE PROPERTIES :

- TOTAL PILE LENGTH, TL = 55.00 FT.
- PILE STICKUP LENGTH, PSL = 0.00 FT.
- ZERO FRICTION LENGTH, ZFL = 0.00 FT.
- PERIMETER OF PILE = 57.05 IN.
- TIP AREA OF PILE = 203.23 IN2
- INCREMENT OF PILE LENGTH USED IN COMPUTATION = 1.00 FT.

SOIL INFORMATIONS :

DEPTH FT.	SOIL TYPE	LATERAL EARTH PRESSURE	EFFECTIVE UNIT WEIGHT LB/CF	FRICTION ANGLE DEGREES	BEARING CAPACITY FACTOR
0.00	SAND	0.00	115.00	30.00	0.00
8.00	SAND	0.00	115.00	30.00	0.00
8.00	SAND	0.00	115.00	28.00	0.00
20.00	SAND	0.00	115.00	28.00	0.00
20.00	SAND	0.00	51.00	30.00	0.00
48.00	SAND	0.00	51.00	30.00	0.00
48.00	SAND	0.00	51.00	45.00	0.00
52.00	SAND	0.00	51.00	45.00	0.00
52.00	SAND	0.00	51.00	0.00	0.00
60.00	SAND	0.00	51.00	0.00	0.00

MAXIMUM UNIT FRICTION KSF	MAXIMUM UNIT BEARING KSF	UNDISTURB SHEAR STRENGTH KSF	REMOLDED SHEAR STRENGTH KSF	BLOW COUNT	UNIT SKIN FRICTION KSF	UNIT END BEARING KSF
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	100.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	100.00	0.00	0.00

* MAXIMUM UNIT FRICTION AND/OR MAXIMUM UNIT BEARING WERE SET TO BE 0.10E+08 BECAUSE THE USER DOES NOT PLAN TO LIMIT THE COMPUTED DATA.

DEPTH FT.	LRFD FACTOR ON UNIT FRICTION	LRFD FACTOR ON UNIT BEARING
0.00	1.000	1.000
8.00	1.000	1.000
8.00	1.000	1.000
20.00	1.000	1.000
20.00	1.000	1.000
48.00	1.000	1.000
48.00	1.000	1.000
52.00	1.000	1.000
52.00	1.000	1.000
60.00	1.000	1.000

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****
* COMPUTATION RESULT *
****

****
* FED. HWY. METHOD *
****

PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	1.6	1.6
1.00	0.2	3.0	3.2
2.00	0.6	5.4	6.0
3.00	1.4	8.5	9.9
4.00	2.5	11.3	13.8
5.00	3.9	13.9	17.8
6.00	5.6	15.9	21.5
7.00	7.6	17.1	24.7
8.00	9.9	17.9	27.9
9.00	12.4	18.3	30.6
10.00	14.8	18.3	33.1
11.00	17.6	18.6	36.2
12.00	20.6	18.8	39.4
13.00	23.8	18.8	42.6
14.00	27.3	18.8	46.1
15.00	31.1	18.8	49.9
16.00	35.2	18.8	54.0
17.00	39.5	18.8	58.3
18.00	44.0	18.8	62.8
19.00	48.9	18.8	67.7
20.00	54.0	18.8	72.7
21.00	59.7	18.8	78.5
22.00	66.1	18.8	84.9
23.00	72.7	18.8	91.5
24.00	79.4	18.8	98.2
25.00	86.2	18.8	105.0
26.00	93.2	18.8	112.0
27.00	100.3	18.8	119.1
28.00	107.5	18.8	126.3

29.00	114.9	18.8	133.7
30.00	122.4	18.8	141.2
31.00	130.1	18.8	148.9
32.00	137.9	18.8	156.7
33.00	145.8	18.8	164.6
34.00	153.9	18.8	172.7
35.00	162.1	18.8	180.9
36.00	170.4	18.8	189.2
37.00	178.9	18.8	197.7
38.00	187.5	18.8	206.3
39.00	196.3	18.8	215.1
40.00	205.2	18.8	224.0
41.00	214.2	18.8	233.0
42.00	223.4	18.8	242.2
43.00	232.7	18.8	251.5
44.00	242.1	18.8	260.9
45.00	251.7	18.8	270.5
46.00	261.4	79.6	341.0
47.00	271.3	304.7	576.0
48.00	281.3	529.9	811.2
49.00	305.1	755.1	1060.2
50.00	343.0	980.2	1323.2
51.00	381.4	1041.0	1422.4
52.00	420.3	1041.0	1461.3
53.00	461.4	1041.0	1502.4
54.00	504.7	1041.0	1545.7
55.00	548.6	1041.0	1589.6

NOTES:
- AN ASTERISK IS PLACED IN THE END-BEARING COLUMN
  IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION
  OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.

****
* COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
* CURVES FOR AXIAL LOADING *
****

T-Z CURVE NO.	NO. OF POINTS	DEPTH TO CURVE FT.	LOAD TRANSFER PSI	PILE MOVEMENT IN.
1	10	0.0000E+00		
			0.0000E+00	0.0000E+00
			0.6802E-01	0.1000E-01
			0.1360E+00	0.2000E-01
			0.2721E+00	0.4000E-01
			0.4081E+00	0.6000E-01
			0.5442E+00	0.8000E-01
			0.6122E+00	0.9000E-01
			0.6802E+00	0.1000E+00
			0.6802E+00	0.5000E+00
			0.6802E+00	0.2000E+01
2	10	0.4025E+01		
			0.0000E+00	0.0000E+00
			0.2267E+00	0.1000E-01
			0.4535E+00	0.2000E-01
			0.9070E+00	0.4000E-01
			0.1360E+01	0.6000E-01
			0.1814E+01	0.8000E-01

			0.2041E+01	0.9000E-01
			0.2267E+01	0.1000E+00
			0.2267E+01	0.5000E+00
			0.2267E+01	0.2000E+01
3	10	0.7958E+01		
			0.0000E+00	0.0000E+00
			0.3465E+00	0.1000E-01
			0.6929E+00	0.2000E-01
			0.1386E+01	0.4000E-01
			0.2079E+01	0.6000E-01
			0.2772E+01	0.8000E-01
			0.3118E+01	0.9000E-01
			0.3465E+01	0.1000E+00
			0.3465E+01	0.5000E+00
			0.3465E+01	0.2000E+01
4	10	0.8000E+01		
			0.0000E+00	0.0000E+00
			0.3574E+00	0.1000E-01
			0.7148E+00	0.2000E-01
			0.1430E+01	0.4000E-01
			0.2144E+01	0.6000E-01
			0.2859E+01	0.8000E-01
			0.3216E+01	0.9000E-01
			0.3574E+01	0.1000E+00
			0.3574E+01	0.5000E+00
			0.3574E+01	0.2000E+01
5	10	0.1403E+02		
			0.0000E+00	0.0000E+00
			0.5715E+00	0.1000E-01
			0.1143E+01	0.2000E-01
			0.2286E+01	0.4000E-01
			0.3429E+01	0.6000E-01
			0.4572E+01	0.8000E-01
			0.5143E+01	0.9000E-01
			0.5715E+01	0.1000E+00
			0.5715E+01	0.5000E+00
			0.5715E+01	0.2000E+01
6	10	0.1996E+02		
			0.0000E+00	0.0000E+00
			0.7937E+00	0.1000E-01
			0.1587E+01	0.2000E-01
			0.3175E+01	0.4000E-01
			0.4762E+01	0.6000E-01
			0.6350E+01	0.8000E-01
			0.7143E+01	0.9000E-01
			0.7937E+01	0.1000E+00
			0.7937E+01	0.5000E+00
			0.7937E+01	0.2000E+01
7	10	0.2000E+02		
			0.0000E+00	0.0000E+00
			0.8908E+00	0.1000E-01
			0.1782E+01	0.2000E-01
			0.3563E+01	0.4000E-01
			0.5345E+01	0.6000E-01
			0.7127E+01	0.8000E-01
			0.8017E+01	0.9000E-01
			0.8908E+01	0.1000E+00
			0.8908E+01	0.5000E+00
			0.8908E+01	0.2000E+01
8	10	0.3403E+02		
			0.0000E+00	0.0000E+00
			0.1209E+01	0.1000E-01
			0.2417E+01	0.2000E-01

			0.4835E+01	0.4000E-01
			0.7252E+01	0.6000E-01
			0.9669E+01	0.8000E-01
			0.1088E+02	0.9000E-01
			0.1209E+02	0.1000E+00
			0.1209E+02	0.5000E+00
			0.1209E+02	0.2000E+01
9	10	0.4796E+02		
			0.0000E+00	0.0000E+00
			0.2472E+01	0.1000E-01
			0.4944E+01	0.2000E-01
			0.9888E+01	0.4000E-01
			0.1483E+02	0.6000E-01
			0.1978E+02	0.8000E-01
			0.2225E+02	0.9000E-01
			0.2472E+02	0.1000E+00
			0.2472E+02	0.5000E+00
			0.2472E+02	0.2000E+01
10	10	0.4800E+02		
			0.0000E+00	0.0000E+00
			0.4510E+01	0.1000E-01
			0.9019E+01	0.2000E-01
			0.1804E+02	0.4000E-01
			0.2706E+02	0.6000E-01
			0.3608E+02	0.8000E-01
			0.4059E+02	0.9000E-01
			0.4510E+02	0.1000E+00
			0.4510E+02	0.5000E+00
			0.4510E+02	0.2000E+01
11	10	0.5003E+02		
			0.0000E+00	0.0000E+00
			0.5646E+01	0.1000E-01
			0.1129E+02	0.2000E-01
			0.2259E+02	0.4000E-01
			0.3388E+02	0.6000E-01
			0.4517E+02	0.8000E-01
			0.5082E+02	0.9000E-01
			0.5646E+02	0.1000E+00
			0.5646E+02	0.5000E+00
			0.5646E+02	0.2000E+01
12	10	0.5196E+02		
			0.0000E+00	0.0000E+00
			0.5843E+01	0.1000E-01
			0.1169E+02	0.2000E-01
			0.2337E+02	0.4000E-01
			0.3506E+02	0.6000E-01
			0.4674E+02	0.8000E-01
			0.5259E+02	0.9000E-01
			0.5843E+02	0.1000E+00
			0.5843E+02	0.5000E+00
			0.5843E+02	0.2000E+01
13	10	0.5200E+02		
			0.0000E+00	0.0000E+00
			0.6164E+01	0.1000E-01
			0.1233E+02	0.2000E-01
			0.2465E+02	0.4000E-01
			0.3698E+02	0.6000E-01
			0.4931E+02	0.8000E-01
			0.5547E+02	0.9000E-01
			0.6164E+02	0.1000E+00
			0.6164E+02	0.5000E+00
			0.6164E+02	0.2000E+01
14	10	0.5603E+02		

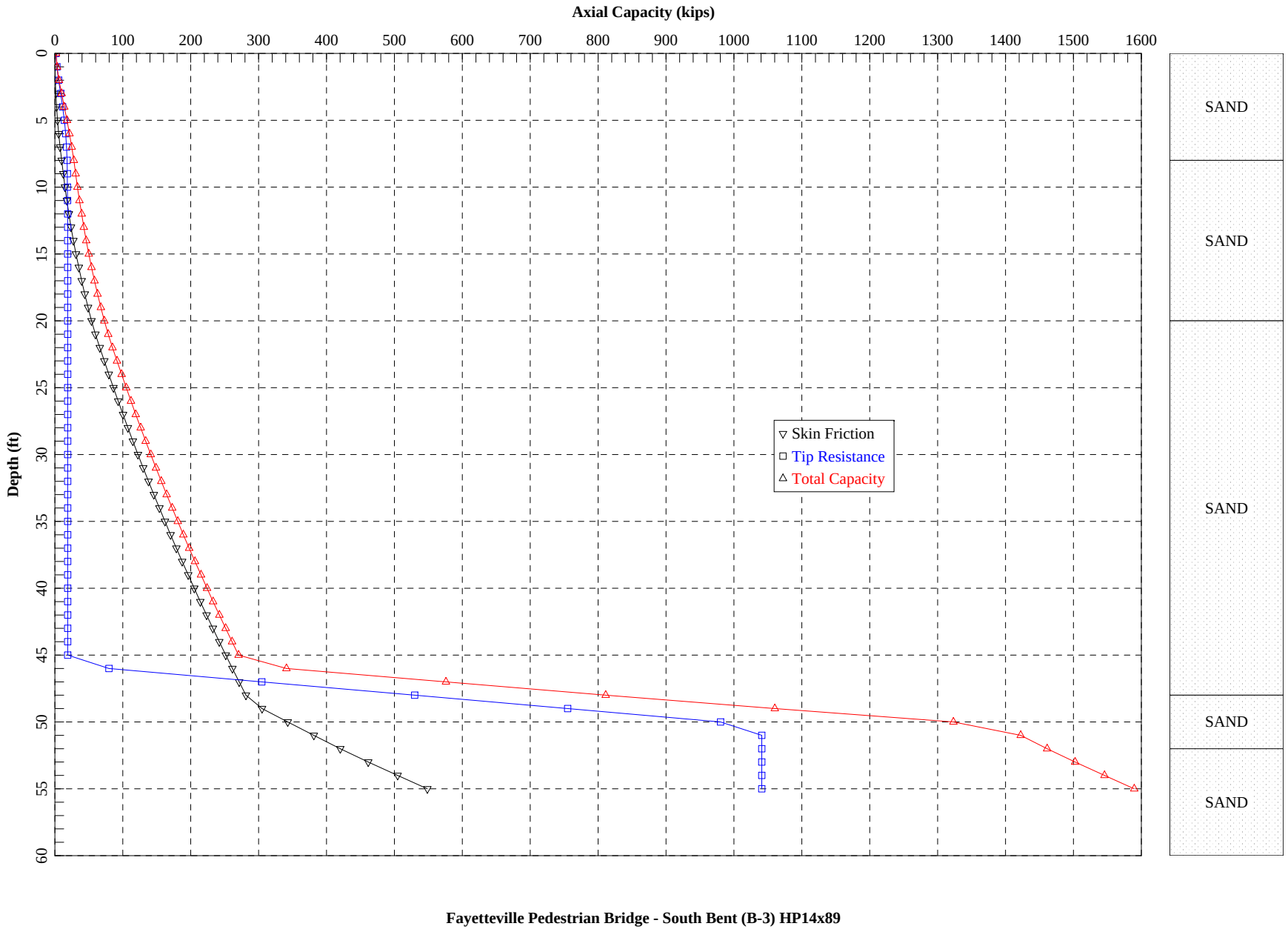
			0.0000E+00	0.0000E+00
			0.6405E+01	0.1000E-01
			0.1281E+02	0.2000E-01
			0.2562E+02	0.4000E-01
			0.3843E+02	0.6000E-01
			0.5124E+02	0.8000E-01
			0.5765E+02	0.9000E-01
			0.6405E+02	0.1000E+00
			0.6405E+02	0.5000E+00
			0.6405E+02	0.2000E+01
15	10	0.5996E+02		
			0.0000E+00	0.0000E+00
			0.6405E+01	0.1000E-01
			0.1281E+02	0.2000E-01
			0.2562E+02	0.4000E-01
			0.3843E+02	0.6000E-01
			0.5124E+02	0.8000E-01
			0.5765E+02	0.9000E-01
			0.6405E+02	0.1000E+00
			0.6405E+02	0.5000E+00
			0.6405E+02	0.2000E+01

TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00
0.6506E+02	0.9080E-02
0.1301E+03	0.1816E-01
0.2602E+03	0.3632E-01
0.5205E+03	0.2361E+00
0.7807E+03	0.7627E+00
0.9369E+03	0.1326E+01
0.1041E+04	0.1816E+01
0.1041E+04	0.2724E+01
0.1041E+04	0.3632E+01

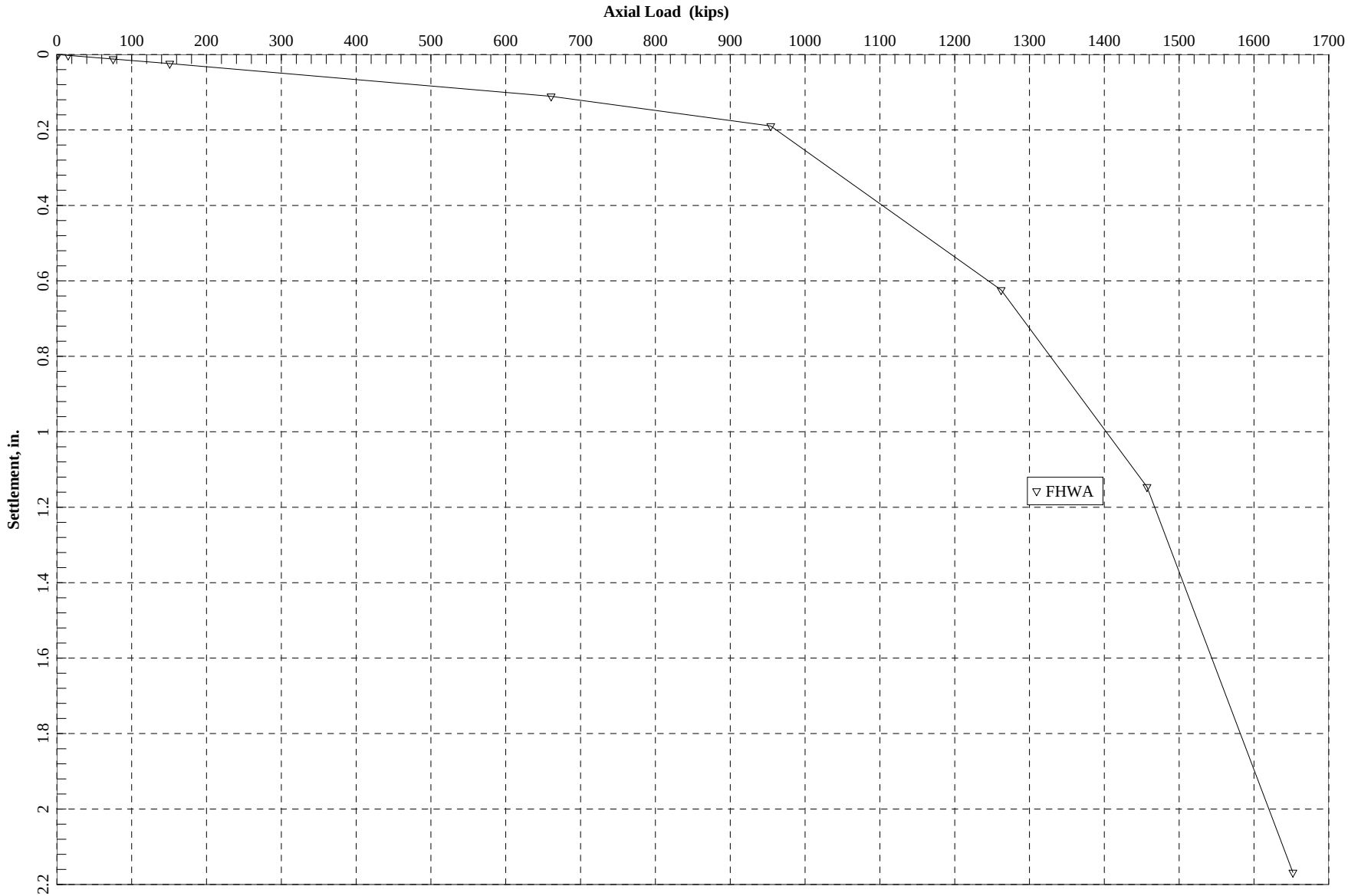
LOAD VERSUS SETTLEMENT CURVE

****

TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.1505E+01	0.2410E-03	0.7166E+00	0.1000E-03
0.1505E+02	0.2410E-02	0.7166E+01	0.1000E-02
0.7523E+02	0.1205E-01	0.3583E+02	0.5000E-02
0.1509E+03	0.2412E-01	0.7166E+02	0.1000E-01
0.6606E+03	0.1109E+00	0.2781E+03	0.5000E-01
0.9541E+03	0.1895E+00	0.3432E+03	0.1000E+00
0.1262E+04	0.6240E+00	0.6509E+03	0.5000E+00
0.1457E+04	0.1146E+01	0.8466E+03	0.1000E+01
0.1652E+04	0.2168E+01	0.1041E+04	0.2000E+01



Fayetteville Pedestrian Bridge - South Bent (B-3) HP14x89



Fayetteville Pedestrian Bridge South Bent (B-3) HP14x89

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03-Oct-2017
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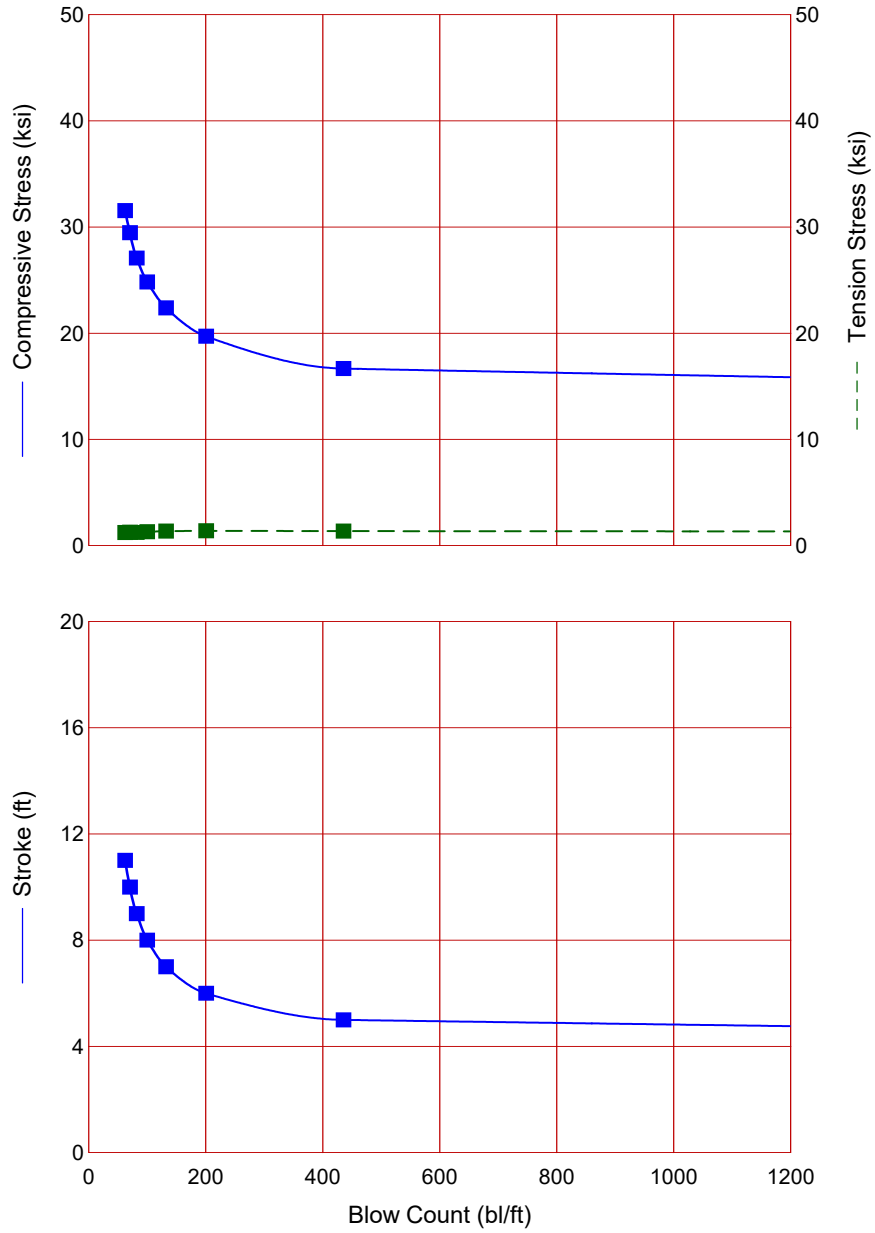
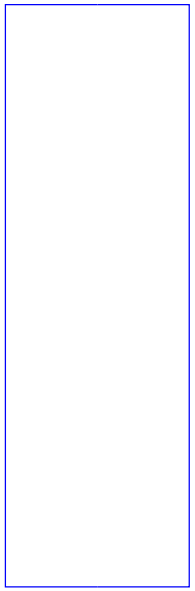


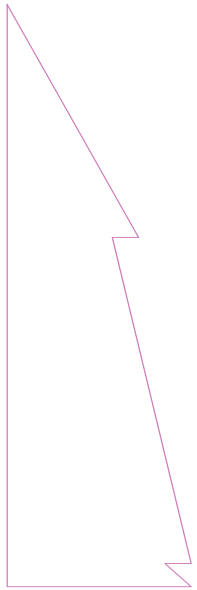
DELMAG D 16-32

Capacity	385.0	kips
Ram Weight	3.52	kips
Efficiency	0.800	
Pressure	1500 (100%)	psi
Helmet Weight	1.90	kips
Hammer Cushion	60155	kips/in
COR of H.C.	0.800	
Skin Quake	0.100	in
Toe Quake	0.122	in
Skin Damping	0.050	s/ft
Toe Damping	0.150	s/ft
Pile Length	50.00	ft
Pile Penetration	50.00	ft
Pile Top Area	26.10	in2

Pile Model



Skin Friction Distribution



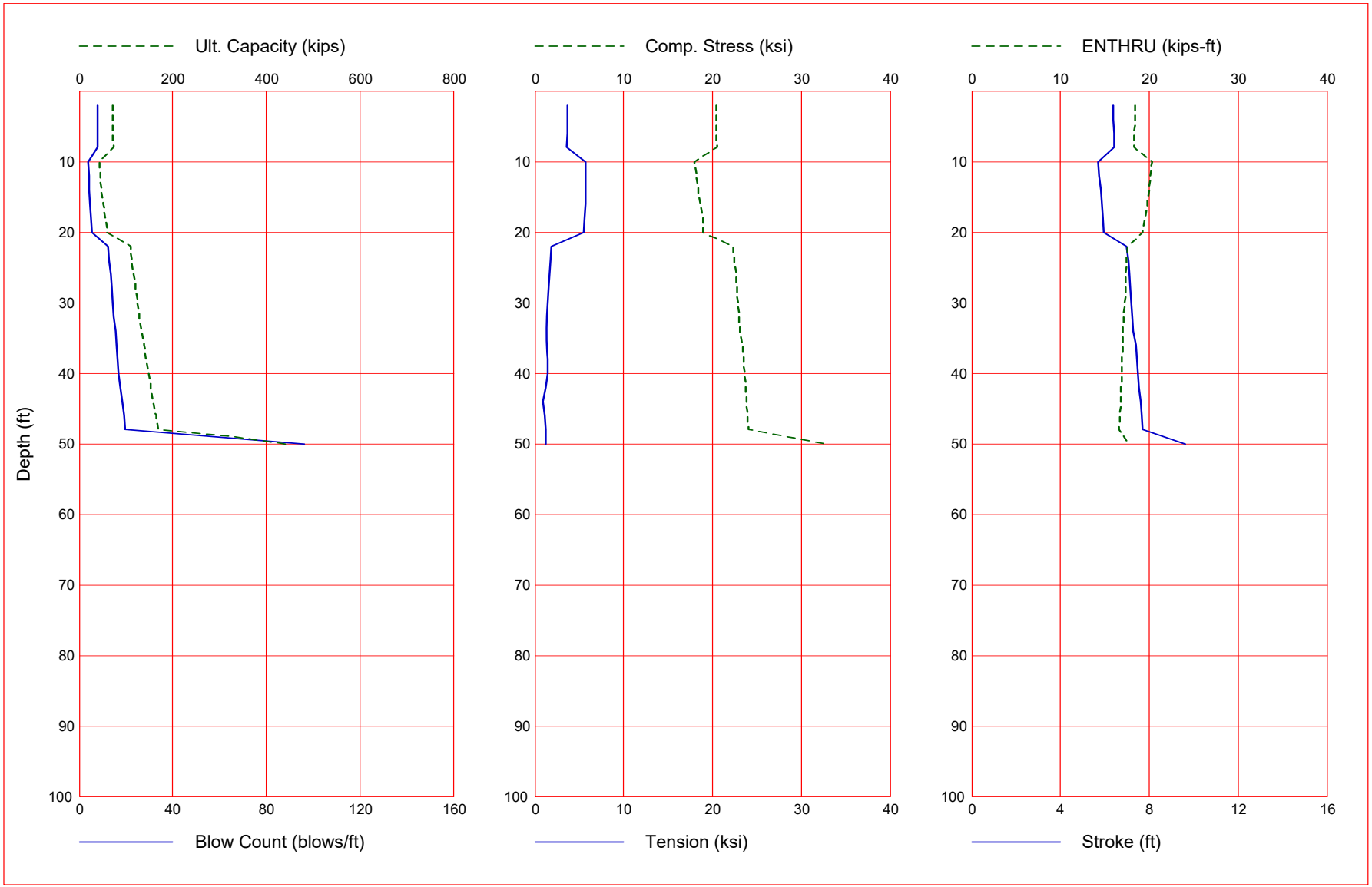
Res. Shaft = 25 %
(Proportional)

Ultimate Capacity kips	Maximum Compression Stress ksi	Maximum Tension Stress ksi	Blow Count bl/ft	Stroke ft	Energy kips-ft
385.0	9.78	1.13	9999.0	3.00	2.79
385.0	13.08	1.51	9999.0	4.00	5.18
385.0	16.68	1.37	435.7	5.00	7.49
385.0	19.71	1.40	200.8	6.00	9.74
385.0	22.38	1.37	132.4	7.00	11.97
385.0	24.83	1.31	100.1	8.00	14.22
385.0	27.07	1.24	82.1	9.00	16.43
385.0	29.47	1.26	70.7	10.00	18.58
385.0	31.54	1.24	62.3	11.00	20.76

Geotechnical & Environmental Consult Inc
Fayetteville Ped Bridge South Bent B-3 R

Oct 03 2017
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.833 / 1.000



Gain/Loss 1 at Shaft and Toe 0.833 / 1.000

Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
2.0	70.9	0.2	70.7	7.8	20.379	-3.725	6.38	18.4
4.0	71.6	0.8	70.7	7.9	20.402	-3.681	6.39	18.4
6.0	72.6	1.9	70.7	8.0	20.464	-3.650	6.40	18.3
8.0	74.1	3.3	70.7	8.1	20.523	-3.605	6.42	18.3
10.0	43.0	5.3	37.7	4.0	17.997	-5.704	5.70	20.3
12.0	45.3	7.6	37.7	4.2	18.166	-5.705	5.75	20.1
14.0	48.1	10.4	37.7	4.4	18.406	-5.698	5.81	20.0
16.0	51.3	13.6	37.7	4.7	18.637	-5.668	5.86	19.8
18.0	55.0	17.2	37.7	5.0	18.884	-5.632	5.92	19.6
20.0	59.0	21.3	37.7	5.4	18.981	-5.459	5.94	19.2
22.0	109.7	24.8	84.9	12.5	22.358	-1.845	6.99	17.5
24.0	113.4	28.5	84.9	12.9	22.503	-1.733	7.04	17.4
26.0	117.2	32.3	84.9	13.4	22.616	-1.654	7.09	17.3
28.0	121.2	36.3	84.9	13.9	22.755	-1.554	7.14	17.3
30.0	125.3	40.4	84.9	14.5	22.869	-1.455	7.19	17.2
32.0	129.6	44.8	84.9	14.9	22.972	-1.357	7.23	17.1
34.0	134.1	49.2	84.9	15.4	23.083	-1.356	7.27	17.0
36.0	138.7	53.8	84.9	15.9	23.371	-1.349	7.39	17.0
38.0	143.5	58.6	84.9	16.4	23.476	-1.412	7.44	16.9
40.0	148.4	63.6	84.9	17.0	23.614	-1.388	7.50	16.9
42.0	153.5	68.6	84.9	17.7	23.711	-1.220	7.55	16.8
44.0	158.8	73.9	84.9	18.4	23.819	-0.931	7.60	16.8
46.0	164.2	79.3	84.9	19.1	23.909	-1.123	7.65	16.7
48.0	169.8	84.9	84.9	19.8	24.001	-1.248	7.70	16.6
50.0	443.7	90.0	353.7	96.0	32.762	-1.232	9.61	17.7

Total Continuous Driving Time 15.00 minutes; Total Number of Blows 649 (starting at penetration 2.0 ft)

ATTACHMENT C

SPECIAL PROVISION 523 DYNAMIC PILE TESTING
SPECIAL PROVISION 520 PILING FOR LRFD

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

SPECIAL PROVISION

SR 54 MULTI-USE TRAIL & BRIDGE, FAYETTE COUNTY
PI NO. 0012878

SECTION 523 - DYNAMIC PILE TESTING

523.1 General Description

The work consists of performing dynamic pile testing using the Pile Driving Analyzer (PDA) to monitor the driving of piles with accelerometer and strain gauges attached to the piles. Piles to be dynamically tested will be identified in the Special Provision or on the Plans. Prior to pile driving, the Engineer will determine production or test piles to be dynamically tested. Perform the dynamic pile testing in accordance with ASTM D4945-12.

Take dynamic measurements during driving of any required piles. Drive the pile as shown in the Special Provisions or on the Plans.

523.2 Materials

Furnish measuring instruments for dynamic pile testing. Attach instruments near the top of the piles with bolts placed in drilled holes. Furnish materials, labor and equipment necessary for installation of the instruments.

523.3 Construction Requirements

Measure wave speed prior to driving piles. Wave speed measurements will not be required for Steel H piles or metal shell piles. When wave speed measurements are performed, place the piles in a horizontal position not in contact with other piles.

Perform dynamic pile testing during driving. Modify the driving to reduce the stress and/or eliminate the damage, should the recommended stress level be exceeded or if damage occurs (determined visually or as indicated by the instrumentation).

Do not exceed the following maximum driving stresses, as determined by the dynamic pile testing:

1. For Steel piles:

   0.9 Fy, where Fy = Yield strength of steel

2. For Prestressed Concrete Piles:

Compression:

$$\sigma_{dr} = (0.85f'_c - f_{pe})$$

Tension in Normal Environments:

$$\sigma_{dr} = \left(0.095\sqrt{f'_c} + f_{pe}\right)$$

Tension in Severe Corrosive Environments:

$$\sigma_{dr} = \varphi_{da} f_{pe}$$

where;
σ_{dr} = maximum allowed driving stress, ksi
$f'c$= specified minimum 28-day compressive strength of concrete, ksi
$f pe$= effective prestress in concrete, ksi, (after all losses) at the time of driving taken as 0.78 times the initial prestress force

Re-drive friction piles that do not obtain bearing after a freeze period of a minimum of 24 hours or for a period designated on the Plans, whichever is longer. Reset the gauges if required. Re-strike the pile with a warm hammer until a maximum penetration of 3 inches (76 mm) or 40 blows is reached, whichever occurs first. The Engineer may modify the Pile Driving Objective based on the results of the PDA work.

Provide two weeks' notice prior to the driving of designated piles and cooperate with the Engineer in connection with the performance of Dynamic Pile Testing.

Provide a complete report consisting of but not limited to PDA field monitoring data, results of CAPWAP computer analyses, and recommendations such as pile lengths, hammer fuel setting, and valid driving criteria. Valid driving criteria is defined as having the required hammer having a hammer set greater than 3 blows per inch and less than 10 blows per inch at the driving resistance for that pile. Submit the report electronically in PDF format and the electronic data files of the PDA analysis and CAPWAP to the Geotechnical Bureau and allow seven (7) calendar days for review and approval before proceeding with driving production piles.

523.4 Measurement

The Dynamic Pile Tests performed in accordance with these Specifications will be counted separately for payment. (Refer to plans summary sheet for the required amount of PDA testing.)

523.5 Payment

The Dynamic Pile Test completed and accepted will be paid for at the Contract unit Price. This payment will be full compensation for all costs of complying with this specification, including incidentals, additional work, and any delays incurred in conjunction therewith.

Payment will be made under:

Item No. 523. Dynamic Pile Test_____ . . . . . Per Each

Office of Materials and Testing

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

SPECIAL PROVISION

SR 54 MULTI-USE TRAIL & BRIDGE, FAYETTE COUNTY
PI NO. 0012878

SECTION 520—PILING

Delete Sub-Section 520.3.05.D.1 and substitute the following:

520.3.05.D.1. Determine Driving Resistance
Drive piles in one continuous operation. Determine the driving resistance of the piling based on the method specified in the plans, which will be one of the following methods (a – c):

a. Upon completion of the dynamic pile testing in accordance with Special Provision Section 523. The pile bearing will be determined by computing the penetration per blow with less than ¼-inch (6-mm) rebound averaged through 12 inches (305 mm) each of penetration. When it is considered necessary by the Engineer, the average penetration per blow may be determined by averaging the penetration per blow through the last 10 to 20 blows of the hammer. In soft material the driving resistance may be determined, at the Engineer's discretion, after delaying driving operations and performing pile re-strikes.

b. Upon completion of the loading test in accordance with Sub-Section 520.3.05.D.2.

c. Shall not be used when driving pile to hard rock. Using FHWA-modified Gates Formula as provided below:

$R_{ndr} = 1.75\ (E_d)^{0.5} \log_{10}(10N_b) - 100$ (kips) U.S units

$R_{ndr} = 7\ (E_d)^{0.5} \log_{10}(10N_b) - 550$ (kN) S.I. units

Where:

R_{ndr} = nominal pile driving resistance measured during pile driving

E_d = developed hammer energy. This is the kinetic energy in the ram at impact for a given blow. If ram velocity is not measured, it may be assumed equal to the potential energy of the ram at the height of the stroke, taken as the ram weight times the actual stroke (ft-lb for U.S units, kN-m for S.I. units)

N_b = Number of hammer blows for 1.0 inch of pile permanent set (blows/in)

These resistance formulas apply only when:

- The hammer has a free fall.
- The head of the pile is not broomed, crushed, spalled, or excessively crimped.
- The penetration rate is reasonably uniform.

Determining driving resistance by formula is not a Pay Item. Provide the facilities for determining driving resistance by formula as an incidental part of the work.

Once the driving resistance has been determined by one of the methods noted above, do not continue to drive piles if the Engineer determines that the piles have reached practical refusal. Practical refusal is defined as 20 blows per inch with the hammer operating at the highest setting or setting determined by the Engineer and less than ¼-inch (6-mm) rebound per blow. The Engineer will generally make this determination within 2 inches (51 mm) of driving. However, the Engineer will not approve the continuation of driving at practical refusal for more than 12 inches (305 mm). When the required pile penetration cannot be achieved by driving without exceeding practical refusal, use other penetration aids such as jetting, spudding, predrilling or other methods approved by the Engineer.

d. Wave Equation: Use the Wave Equation Analysis for Piles (WEAP) program to evaluate the suitability of the proposed driving system chosen from the methods noted above (including the hammer, follower, capblock and pile cushions) as well as to estimate the driving resistance to achieve the pile bearing requirements and to evaluate pile driving stresses. Use the WEAP program to show that the hammer is capable of driving to a driving resistance equal 130% (1.3 times) the driving resistance shown in the Plans without overstressing the piling in compression or tension and without reaching practical refusal.

Perform the WEAP analysis with personnel who are experienced in this type work, and have performed this analysis on a minimum of 15 projects. Provide a list of the qualifications and experience of the personnel to perform the WEAP analysis for this Project.

The Engineer may modify the scour resistance shown in the plans if the dynamic pile test is used to determine the actual soil resistance through the scour zone. Also, the Engineer may make modifications in scour resistance when the Contractor proposes drilling and/or jetting to reduce the soil resistance in the scour zone.

A minimum of two weeks prior to beginning any pile driving operations, submit to the Engineer for evaluation and approval the following information on all of the proposed pile driving system(s) to be used on the Project including but not limited to:

i. Items on Pile Driving Equipment Data Sheet
ii. Other information on the driving system required by the Engineer

iii. A WEAP program output indicating the approximate depth or elevation where the pile will achieve the bearing required
iv. Valid Driving Criteria.

Valid driving criteria is defined as having the required hammer having a hammer set greater than 3 blows per inch and less than 10 blows per inch at the driving resistance for that pile.

If WEAP analyses show that the hammer(s) will overstress the pile, modify the driving system or method of operation as required to prevent overstressing the pile. Resubmit the modified pile driving system information and WEAP program output to the Engineer for re-evaluation. Do not begin pile driving operations until the Engineer has approved the qualifications of the personnel, the WEAP program output, and the pile driving system(s).

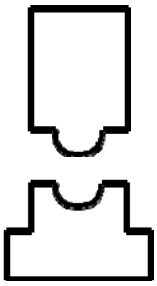
Approval of the pile driving system(s) is also based on satisfactory field trials with dynamic pile testing. Obtain approval from the Engineer for the pile driving system(s) based on satisfactory field performance.

If piles require different hammer sizes, the Contractor may elect to drive with more than one size hammer or with a variable energy hammer, provided that the hammer is properly sized and cushioned, will not damage the pile, and will develop the required resistance.

For penetration of weak soils by concrete piles, use thick cushions and/or reduced stroke to control tension stresses during driving.

Pile Driving Data Form

Contract ID: Structure Name:
PI Number: Structure No.:
County Pile Driving Contractor:



Hammer

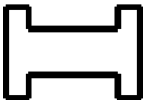
Manufacturer: _____ Model No. _____
Hammer Type: _____ Serial No. _____
Manufacturers Maximum Rated Energy: _____(ft-k)
Stroke at Maximum Rated Energy: _____(ft)
Range in Operating Energy: _____ to _____(ft-k)
Range in Operating Stroke: _____ to _____(ft)
Ram Weight: _____ (kips)
Modifications: _____

Striker Plate

Weight: _____(kips) Diameter: _____(in)
Thickness: _____(in)

Hammer Cushion

Material 1 Material 2
Name: _____ Name: _____
Area: _____(in^2) Area: (in^2)
Thickness/Plate: _____(in) Thickness/Plate:_____(in)
No. of Plates: _____ No. of Plates: _____
Total Thickness of Hammer Cushion: _____(in)

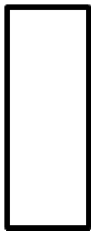


Helmet

Weight including inserts: _____(kips)

Pile Cushion

Material: _____
Area: _____(in^2) Thickness/Sheet: _____(in)
No. of Sheets: _____
Total Thickness of Pile Cushion: _____(in)



Pile

Pile Type: _____
Wall Thickness: _____(in) Taper: _____
Cross Sectional Area: ___(in^2) Weight/Meter: _____
Ordered Length: _____(ft)
Driving Resistance: _____(kips)
Description of Splice: _____
Driving Shoe/Closure Plate Description: _____

Submitted By: _____ Date: _____

Retaining Wall Foundation Investigation Report (ASD)
SR 54 Multi-Use Trail & Bridge, Fayette County
PI No. 0012878
September 16, 2017
Revision No. 2

1. Location

The project is located on Georgia Highway 54 West, near street address 1294 and Piedmont Fayette Hospital, Fayetteville, Fayette County, Georgia. The location is approximately midway between Sandy Creek Road to the east and Veterans Parkway to the west.

2. Geology

The site is located within the Piedmont Physiographic Province of Georgia. Rocks within the Clarkston Formation, described as a sillimanite-garnet-quartz-plagioclase-biotite-muscovite schist interlayered with hornblende-plagioclase amphibolite of Precambrian age underlie the site. The Clarkston Formation is locally intruded in the Tyrone, Peachtree City and Fayetteville area by younger rocks of the Palmetto Granite unit, which is a coarse-grained porphyritic granite.

3. Subsurface Information

The investigation encountered fill materials, residual soils, partially weathered rock (PWR) and auger refusal material. Please see the enclosed Boring Locations – Mainline Plan Drawing Nos. 13-08 & 13-09 and Soil Test Boring Records for specific subsurface conditions at each boring location.

Below a surfical topsoil or gravel layer, fill was encountered at all boring locations, except B-5, to depths ranging approximately from 3 to 13 feet. The fill was sampled as either loose or medium dense clayey sand.

Residual soils were initially encountered below the topsoil layer in boring B-5 and from below the fill in the remaining borings. The residual soil profile mainly consists of loose and medium dense silty sand. Some clayey sand and sandy silt were also penetrated in the upper portions of three borings. The residual soils extend to the top of partially weathered rock (PWR) at depths of about 43 and 48 feet, respectively, in borings B-2 and B-3 and to boring termination depths of 20 and 60 feet in the remaining three borings.

Partially weathered rock was encountered from below the residual soils to auger refusal depths of 48 feet at the location of boring B-2 and 52 feet at B-3.

Groundwater was encountered in borings B-2, B-3 and B-4, respectively, at depths of 5, 22 and 27 feet below the ground surface at the time of the field investigation. Groundwater was not observed in boreholes B-1 and B-5 at the time of drilling. No 24-hour groundwater measurements were obtained, since all of the boreholes caved at depths ranging from 7 to 9.5 feet below ground.

4. Soil Parameters

Mechanically Stabilized Earth (MSE) retaining walls are planned for support of the bridge approach ramps and abutments. MSE wall foundation soils consist of undisturbed residual soils and existing fill. The residual soils were classified as loose and medium dense silty sand (SM) with some stiff to very stiff sandy silt (ML-MH) and medium dense clayey sand (SC). The existing fill is described as loose or medium dense clayey sand (SC).

4. Soil Parameters (Continued)

Undisturbed Residual Soils/Existing Fill. Standard penetration resistance (N) values in the residual soils ranged from a minimum of 4 to a maximum of 27 blows per foot (bpf), with most values between 10 to 15 bpf. In the fill soils, standard penetration resistances ranged from a minimum of 5 bpf to 17 bpf. Based on correlations with SPT N-values and our previous experience with similar conditions, we recommend the following design parameters for the MSE wall foundation soils:

Angle internal soil friction angle (ϕ) = 28 degrees
Cohesion value (c) = 0 psf
Soil Unit Weight (γ) = 115 pcf
Coefficient of Sliding Friction (μ) = 0.53

Wall Backfill. Backfill in the reinforced zone of the MSE walls should be well-graded granular soils free from organic matter, shale, soft particles or other deleterious materials. The reinforced zone backfill should have a maximum particle size of ¾ to 1-inch and conform to the gradation limits of 0 to 60 percent passing the No. 40 sieve and 0 to 15 percent passing the No. 200 sieve. The plasticity index should be less than 6. We assume any retained fill soils in the ramps required beyond the reinforced zone will consist of native silty sand residual soils typical of the Piedmont area. The following soil parameters for the MSE wall backfill in the reinforced zone and retained soils are recommended for design:

Select Reinforced Zone Granular Backfill
Angle internal soil friction angle (ϕ) = 34 degrees
Cohesion value (c) = 0 psf
Soil Unit Weight (γ) = 135 pcf

Retained Fill - Silty Sand (SM) 98% Standard Proctor MDD
Angle internal soil friction angle (ϕ) = 28 degrees
Cohesion value (c) = 0 psf
Soil Unit Weight (γ) = 124 pcf

Retained Fill – Silty Sand (SM) 95% Standard Proctor MDD
Angle internal soil friction angle (ϕ) = 25 degrees
Cohesion value (c) = 0 psf
Soil Unit Weight (γ) = 117 pcf

5. Recommendations

Soil Bearing. Based on local experience and correlations with N-values for loose to medium dense silty sand, loose to medium dense clayey sand and stiff sandy silt, a maximum allowable general soil bearing capacity of 4,000 psf is recommended for preliminary design of the MSE walls on this project. Final wall design requires foundation soil bearing calculations based on the foundation and retained soil parameters listed above, considering site geometry, the wall height and foundation width for each wall. A minimum safety factor of 2.5 against a bearing capacity failure is required per AASHTO for flexible earth reinforced walls.

5. Recommendations (Continued)

The provided Mainline Plan and Cross Sections show the proposed MSE walls vary in height up to a maximum of approximately 28 feet, resulting in relatively high applied foundation loading conditions, estimated to range generally from over 3,000 psf to 5,000 psf. If the MSE wall applied foundation pressure in the final design exceeds the maximum allowable design soil bearing capacity, the wall should be constructed to a height equivalent to the allowable bearing pressure, and installation temporarily halted for 30 days. After the 30 day waiting period, the wall may be completed to its final height.

Type II Foundation Backfill Material. Due to the proximity of the groundwater to the bottom of wall elevation at the location of boring B-2, we recommend a minimum 12-inch thick layer of Type II Foundation Backfill Material be placed below the bottom of the wall in the area of boring B-2.

Settlement. Preliminary settlement calculations were performed for the MSE Retaining Wall #1 at the south bridge abutment at about station 142+00, which represents the apparent worse case foundation loading condition due to the height of the wall. At this location the wall is located on the west side of the trail and is approximately 28 feet in height. A 2.0(H):1.0(V) soil slope down to the existing ground supports the trail on the east side. The approximate magnitude of elastic foundation settlement was calculated using soil modulus values estimated from correlations with corrected standard penetration resistances (N_{60}) for the subsurface profile at the location of boring B-3. Two different foundation loading conditions were utilized, one for an applied bearing pressure at the base of the wall using a unit weight of 135 pcf for the select reinforced zone granular backfill and a second using 135 percent of the backfill weight to represent a possible upper limit for the wall loading. These loading conditions result in foundation contact pressures of 3,780 and 5,040 psf, respectively, at the base of the wall beneath the 28-foot high embankment.

Initial settlement calculations were performed for the embankment loads according to the FHWA EMBANK program manual and elastic solutions developed by Poulos and Davis (1978). The settlement values are taken as the summation of individual layer strains due to added stress from the embankment (MSE wall) loads. Calculations using this method show maximum elastic settlements of 14.1 and 18.8 inches for the two loading conditions. These settlement values likely over estimate the actual amount of settlement since the program cannot exactly model the wall geometry and the values represent settlement calculated along the centerline of a long continuous embankment. Actual settlement should be significantly less at the end abutment.

5. Recommendations (Continued)

Settlement was also calculated using an internal elastic settlement program (MSETT), which allows the wall foundation to be modeled as an individual footing and also is capable of calculating settlement at various points within the foundation footprint. Settlement was calculated for a long embankment by this method using the Westergaard stress distribution and embankment cross section geometry generally equivalent to the MSE wall section at the abutment. Maximum total elastic foundation settlements along the centerline of the embankment were calculated at 10.8 inches for the 3,780 psf load and 14.4 inches for 5,040 psf. Settlement values at the abutment (end of the embankment) were found to be 6.3 and 8.4 inches, respectively.

The settlement calculations noted above are attached for reference. Based on our preliminary analysis, we expect total elastic settlement for MSE Retaining Wall #1 at the south bridge abutment will range approximately from 6 to 11 inches, depending upon the actual loading conditions. Settlement of MSE Retaining Wall #1 at the north abutment should be significantly less, since the maximum wall height is only 17 feet and the foundation footprint is smaller. The elastic settlement should represent the major component of total settlement, since the bearing soils are generally granular and very little consolidation settlement is expected.

Settlement Monitoring. An initial waiting period of 30 days is recommended to allow for completion of at least 90 percent of estimated settlement beneath the MSE wall at the bridge end bents. The majority of the settlement should occur during construction of the MSE walls and the amount of settlement remaining after completion of filling should not be significant. We recommend monitoring of MSE wall settlement during construction to confirm the expected performance and determine the final waiting period necessary. Minimal instrumentation to monitor settlement should consist of settlement plates installed at the interface of the wall fill and the existing ground surface.

Restrictions. During MSE wall construction, installation of vertical casing through the reinforced fill is required for subsequent pile installation at the bridge abutments (end bents). Casing will prevent damage to or interference with the MSE wall reinforcement elements.

Prepared By: Larry D. Mullins, P.E.

Attachments:
- Boring Locations – Mainline Plan Drawing Nos. 13-08 & 13-09
- Key to Symbols and Descriptions
- Soil Test Boring Records (B-1 through B-5)
- Laboratory Soil Test Reports
- Settlement Calculations

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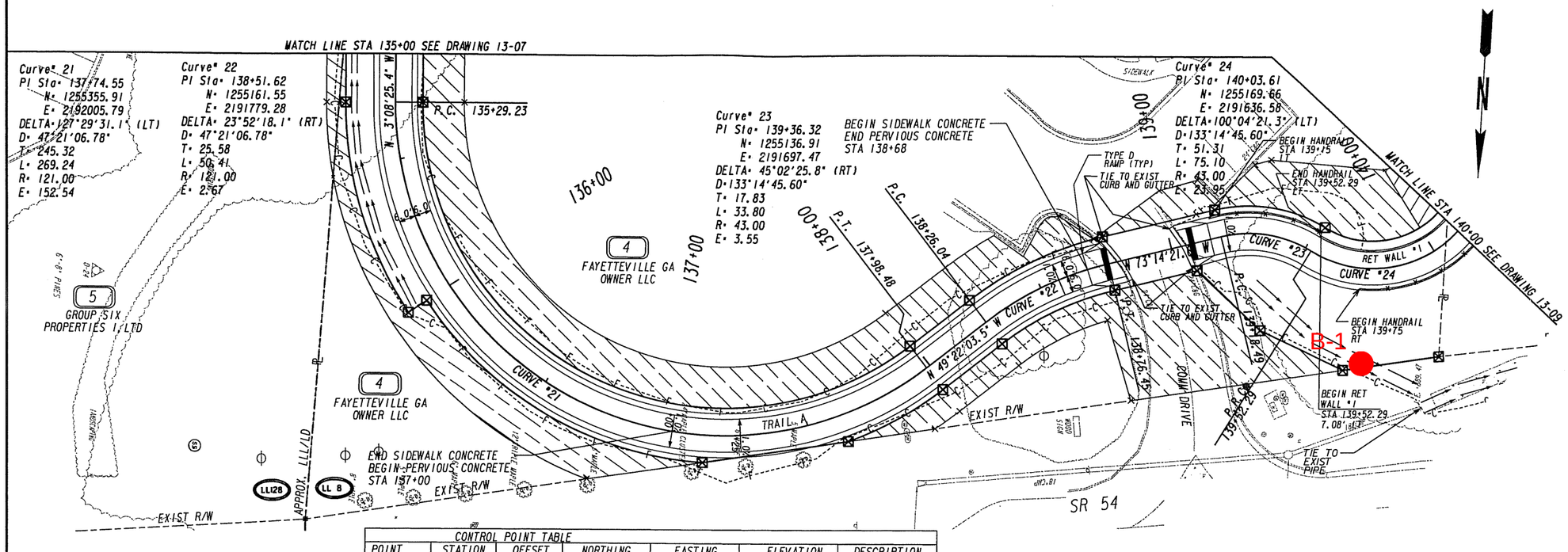
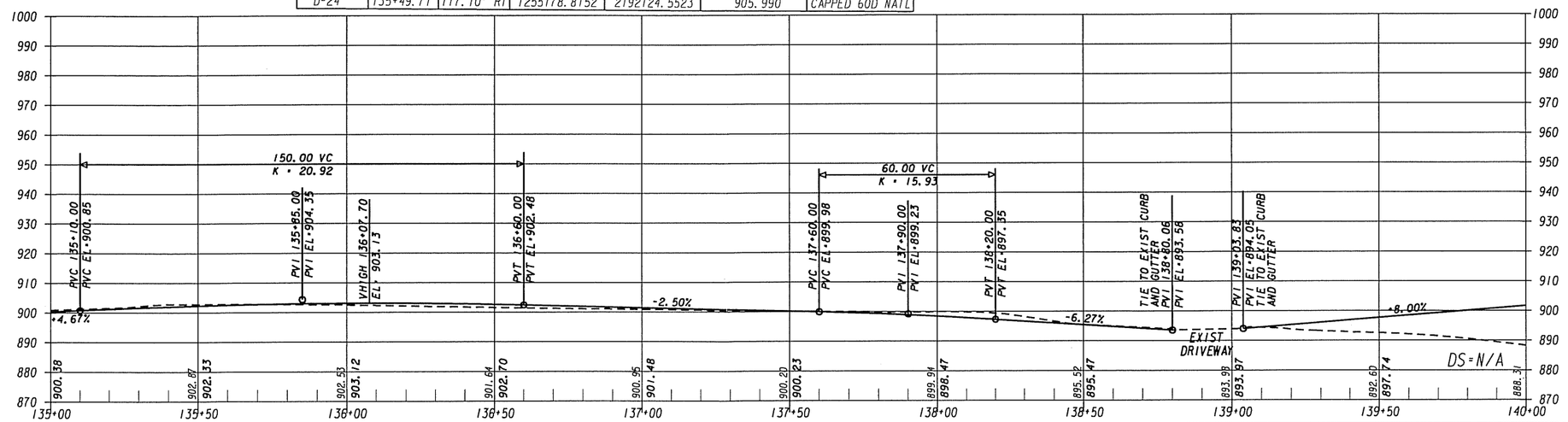
James. c. lawson		gplotborder-v81-PO. tbl			0012878



CONTROL POINT TABLE						
POINT	STATION	OFFSET	NORTHING	EASTING	ELEVATION	DESCRIPTION
D-24	135+49.71	117.10' RT	1255178.8152	2192124.5523	905.990	CAPPED 60D NAIL



PROPERTY AND EXISTING R/W LINE	—℄—
REQUIRED R/W LINE	
CONSTRUCTION LIMITS	—C— F—
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES	
EASEMENT FOR CONSTR OF SLOPES	
EASEMENT FOR CONSTR OF DRIVES	

BEGIN LIMIT OF ACCESS	BLA
END LIMIT OF ACCESS	ELA
LIMIT OF ACCESS	
REQ'D R/W & LIMIT OF ACCESS	
LIMITS OF MILLING & OVERLAY	
LIMITS OF EXIST. PAVEMENT	

GEORGIA
DEPARTMENT OF TRANSPORTATION

AECOM

SCALE IN FEET
0 20 40 80

REVISION DATES

MAINLINE PLAN

SR 54 MULTI-USE TRAIL & BRIDGE

CHECKED:		DATE:		DRAWING No.
BACKCHECKED:		DATE:		13-008
CORRECTED:		DATE:		
VERIFIED:		DATE:		

T/31/2015 GPLN

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James. c. lawson | gplotborder-v81-PO.tbl

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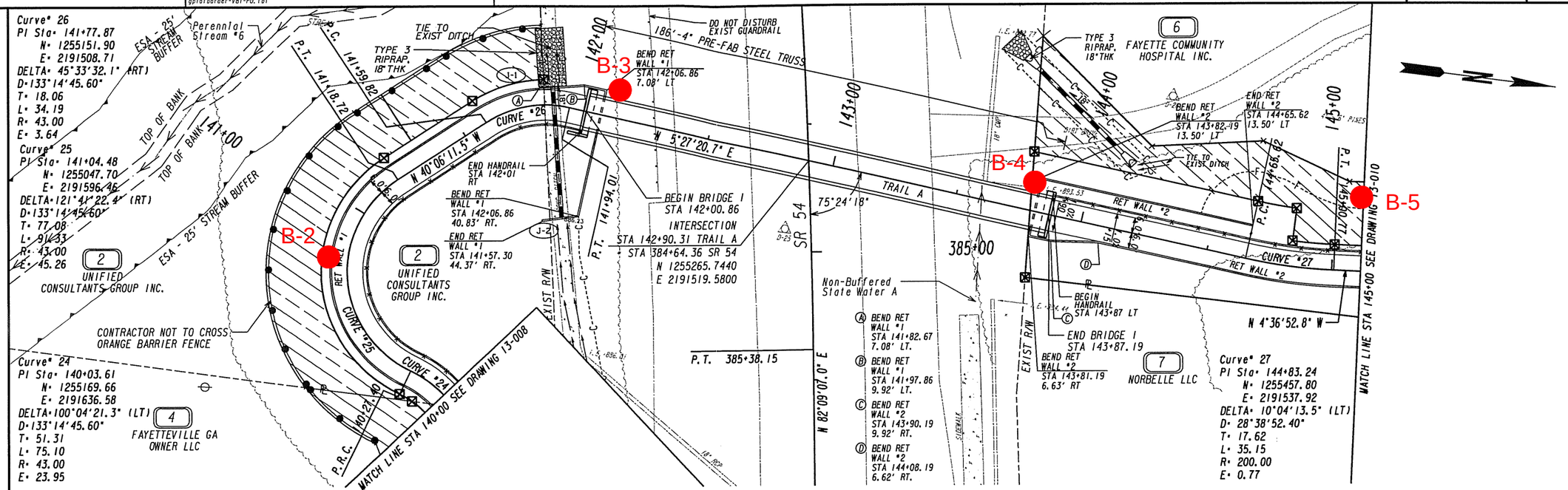
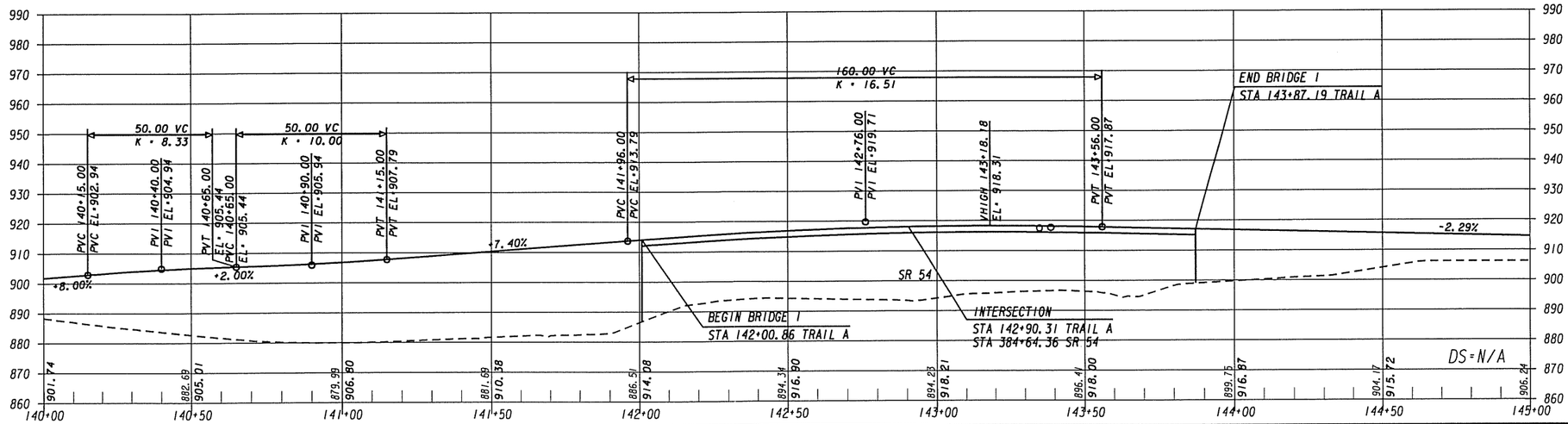


ESA - SEE ENVIRONMENTAL RESOURCES IMPACT TABLE IN GENERAL NOTES FOR CONSTRUCTION RESTRICTIONS.

CONTROL POINT TABLE

POINT	STATION	OFFSET	NORTHING	EASTING	ELEVATION	DESCRIPTION
D-25	142+75.66	28.02' RT	1255259.8378	2191547.1600	894.599	CAPPED 60D NAIL
D-26	144+12.74	55.85' LT	1255404.2661	2191476.7053	900.708	CAPPED 60D NAIL



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
LIMITS OF MILLING & OVERLAY
LIMITS OF EXIST. PAVEMENT

GEORGIA DEPARTMENT OF TRANSPORTATION

AECOM

SCALE IN FEET 0 20 40 80

REVISION DATES

MAINLINE PLAN

SR 54 MULTI-USE TRAIL & BRIDGE

CHECKED:		DATE:	DRAWING No.
BACKCHECKED:		DATE:	
CORRECTED:		DATE:	13-009
VERIFIED:		DATE:	

7/31/2015 GPLN

MAJOR DIVISIONS			GROUP SYMBOLS		TYPICAL NAMES
COARSE GRAINED SOILS (More than 50% of material is LARGER than No. 200 sieve size)	GRAVELS (More than 50% of coarse fraction is LARGER than the No. 4 sieve size)	CLEAN GRAVELS (Little or no fines)		GW	Well graded gravels, gravel - sand mixtures, little or no fines.
				GP	Poorly graded gravels or grave - sand mixtures, little or no fines.
		GRAVELS WITH FINES (Appreciable amount of fines)		GM	Silty gravels, gravel - sand - silt mixtures.
				GC	Clayey gravels, gravel - sand - clay mixtures.
	SANDS (More than 50% of coarse fraction is SMALLER than the No. 4 Sieve Size)	CLEAN SANDS (Little or no fines)		SW	Well graded sands, gravelly sands, little or no fines.
				SP	Poorly graded sands or gravelly sands, little or no fines.
		SANDS WITH FINES (Appreciable amount of fines)		SM	Silty sands, sand - silt mixtures
				SC	Clayey sands, sand - clay mixtures.
FINE GRAINED SOILS (More than 50% of material is SMALLER than No. 200 sieve size)	SILTS AND CLAYS (Liquid limit LESS than 50)			ML	Inorganic silts and very fine sands, rock flour, silty of clayey fine sands or clayey silts and with slight plasticity.
				CL	Inorganic lays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
				OL	Organic silts and organic silty clays of low plasticity.
	SILTS AND CLAYS (Liquid limit GREATER than 50)			MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
				CH	Inorganic clays of high plasticity, fat clays
				OH	Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS				PT	Peat and other highly organic soils.
FILL					Fill

	Undisturbed Sample		Auger Cuttings
	Standard Penetration Test or Dynamic Cone Penetration Test		Bulk Sample
	Rock Core		Crandall Sampler
	Dilatometer		Pressure Meter
	Packer		No Recovery
	Water Table at time of boring		Water Table after 24 hours

Correlation of Standard Penetration Resistance with Relative Density and Consistency

SAND & GRAVEL		SILT & CLAY	
No. of Blows	Relative Density	No. of Blows	Consistency
0 - 4	Very Loose	0 - 2	Very Soft
5 - 10	Loose	3 - 4	Soft
11 - 30	Medium Dense	5 - 8	Firm
31 - 50	Dense	9 - 15	Stiff
Over 50	Very Dense	16 - 30	Very Stiff
		31 - 50	Hard
		Over 50	Very Hard

Correlation of Dynamic Cone Penetration Resistance with Relative Density and Consistency (Piedmont Residual Soils)

SAND & GRAVEL		SILT & CLAY	
No. of Blows	Relative Density	No. of Blows	Consistency
0 - 4	Very Loose	0 - 2	Very Soft
5 - 15	Loose	3 - 4	Soft
16 - 30	Medium Dense	5 - 10	Firm
		11 - 30	Stiff

BOUNDARY CLASSIFICATIONS: Soils possessing characteristics of two groups are designated by combinations of group symbols.

SILT OR CLAY	SAND			GRAVEL		Cobbles	Boulders
	Fine	Medium	Coarse	Fine	Coarse		

No.200 No.40 No.10 No.4 3/4" 3" 12"

U.S. STANDARD SIEVE SIZE

Reference: The Unified Soil Classification System, Corps of Engineers, U.S. Army Technical Memorandum No 3-357, Vol. 1, March, 1953 (Revised April, 1960)

KEY TO SYMBOLS AND DESCRIPTIONS

ACCURA

Accura Engineering and Consulting Services, Inc.
3200 Presidential Drive
Atlanta, GA 30340
Office: 404.241.8722

BORING LOG

CONTRACTED WITH: GeoSystems Engineering, Inc. BORING NO.: B-1
PROJECT NAME: Fayetteville Pedestrian Bridge DATE: June 25, 2015
JOB NO.: 20014.003.14 DRILLER: Gable Drilling Co. Inc. RIG: CME 550 LOGGED BY: Larry

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	RECOV.	W	NOTES
	TOPSOIL							
	FILL-Medium dense, brown orange red, clayey SAND		1		7-9-8	10		
890		5	2		3-5-6	14		
	RESIDUUM-Loose, brown orange red, clayey SAND		3		3-5-5	12		
BOW=886								
885	Stiff, yellowish red, sandy SILT (MH)	10	4		4-5-7	18	23	LL=57, PL=45, PI=11
	Medium dense, olive gray, silty SAND							
880		15	5		3-5-6	14		
	Loose, olive gray, silty SAND							
875		20	6		3-5-5	12		
	BORING TERMINATED AT 20 FEET							No groundwater encountered at time of boring
870		25						
865		30						
860		35						
855		40						

BOW-Bottom of Wall#1
LL-Liquid Limit
PL-Platic Limit
PI-Plasticity Index

Accura Engineering and Consulting Services, Inc.
3200 Presidential Drive
Atlanta, GA 30340
Office: 404.241.8722

BORING LOG

CONTRACTED WITH: GeoSystems Engineering, Inc. BORING NO.: B-2
PROJECT NAME: Fayetteville Pedestrian Bridge DATE: June 25, 2015
JOB NO.: 20014.003.14 DRILLER: Gable Drilling Co. Inc. RIG: CME 550 LOGGED BY: Larry

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	RECOV.	W	NOTES
BOW=878	TOPSOIL							
	FILL-Loose, brown orange red, clayey SAND		1		1-2-3	12		
875	Loose, yellowish brown, clayey SAND							
		5 ▽	2		2-4-6	14		Groundwater encountered at 5 feet at time of boring
			3		2-3-6	12		
870	RESIDUUM-Very loose, brown orange, silty SAND							
		10	4		1-2-2	12		
865	Loose, dark yellowish brown, silty SAND							
		15	5		3-3-4	18		
860								
		20	6		3-4-4	12		
855	Medium dense, brown orange, silty SAND							
		25	7		6-8-8	12		
850								
		30	8		5-10-13	18		
845								
		35	9		7-12-15	18		
840	Medium dense, brown orange red, silty SAND							BOW-Bottom of Wall#1
		40	10		5-6-8	14		

Accura Engineering and Consulting Services, Inc.
3200 Presidential Drive
Atlanta, GA 30340
Office: 404.241.8722

BORING LOG

CONTRACTED WITH: GeoSystems Engineering, Inc. BORING NO.: B-2
PROJECT NAME: Fayetteville Pedestrian Bridge DATE: June 25, 2015
JOB NO.: 20014.003.14 DRILLER: Gable Drilling Co. Inc. RIG: CME 550 LOGGED BY: Larry

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	RECOV.	W	NOTES
835	PWR-Very dense, black orange red, partially weathered rock	45	11		25-50/5"	12		
830	AUGER REFUSAL AT 48 FEET	50						
825		55						
820		60						
815		65						
810		70						
805		75						
800		80						
795		85						

Accura Engineering and Consulting Services, Inc.
3200 Presidential Drive
Atlanta, GA 30340
Office: 404.241.8722

BORING LOG

CONTRACTED WITH: GeoSystems Engineering, Inc. BORING NO.: B-3
PROJECT NAME: Fayetteville Pedestrian Bridge DATE: June 25, 2015
JOB NO.: 20014.003.14 DRILLER: Gable Drilling Co. Inc. RIG: CME 550 LOGGED BY: Larry

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	RECOV.	W	NOTES
890	TOPSOIL							
	FILL-Medium dense, reddish brown, clayey SAND		1		3-4-8	12		
		5	2		4-6-6	14		
885			3		5-6-5	12		
BOW=882	Loose, reddish brown, clayey SAND	10	4		2-3-5	14		
880								
	RESIDUUM-Loose, gray orange, silty SAND	15	5		2-2-3	14		
875								
	Loose, brown orange, silty SAND	20	6		2-2-3	12		
870		▽						Groundwater encountered at 22 feet at time of boring
		25	7		4-4-4	12		
865								
	Medium dense, reddish yellow, silty SAND	30	8		4-5-11	18		
860								
	Loose, brown orange silty SAND	35	9		3-5-5	14		
855								BOW-Bottom of Wall#1
	Medium dense, brown orange red, silty SAND	40	10		6-9-11	14		
850								
	Medium dense, brown orange red, silty							

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BORING LOG

CONTRACTED WITH: GeoSystems Engineering, Inc. BORING NO.: B-3
PROJECT NAME: Fayetteville Pedestrian Bridge DATE: June 25, 2015
JOB NO.: 20014.003.14 DRILLER: Gable Drilling Co. Inc. RIG: CME 550 LOGGED BY: Larry

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	RECOV.	W	NOTES
	SAND							
		45	11		3-7-10	12		
845								
	PWR-Very dense, orange brown, partially weathered rock	50	12		20-50/4"	12		
840								
	AUGER REFUSAL AT 52 FEET	55						
835		60						
830		65						
825		70						
820		75						
815		80						
810		85						

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BORING LOG

CONTRACTED WITH: GeoSystems Engineering, Inc. BORING NO.: B-4
PROJECT NAME: Fayetteville Pedestrian Bridge DATE: June 25, 2015
JOB NO.: 20014.003.14 DRILLER: Gable Drilling Co. Inc. RIG: CME 550 LOGGED BY: Larry

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	RECOV.	W	NOTES
BOW=896	FILL-Gravel							
895	FILL-Medium dense, brown orange red, clayey SAND		1		2-5-6	12		
	RESIDUUM-Medium dense, brown orange red, clayey SAND	5	2		5-8-14	14		
890	Stiff, yellowish red, sandy SILT (ML)		3		3-4-6	12		LL=49, PL=41, PI=8
		10	4		3-5-8	18		
885		15	5		3-5-6	14		
880	Loose, olive gray, silty SAND	20	6		2-3-4	12		
875		25	7		2-4-4	12		
870		▽						Groundwater encountered at 27 feet at time of boring
	Medium dense, white brown orange, silty SAND	30	8		4-6-8	18		
865		35	9		3-6-7	18		
860		40	10		3-4-8	14		BOW-Bottom of Wall#2 LL-Liquid Limit PL-Platic Limit PI-Plasticity Index
855								

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BORING LOG

CONTRACTED WITH: GeoSystems Engineering, Inc. BORING NO.: B-4
PROJECT NAME: Fayetteville Pedestrian Bridge DATE: June 25, 2015
JOB NO.: 20014.003.14 DRILLER: Gable Drilling Co. Inc. RIG: CME 550 LOGGED BY: Larry

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	RECOV.	W	NOTES
	Medium dense, black orange red, silty SAND	45	11		5-8-10	12		
850		50	12		3-4-7	12		
845	Medium dense, light gray, silty SAND	55	13		4-6-7	14		
840		60	14		5-7-7	14		
	BORING TERMINATED at 60 FEET							
835		65						
830		70						
825		75						
820		80						
815		85						

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BORING LOG

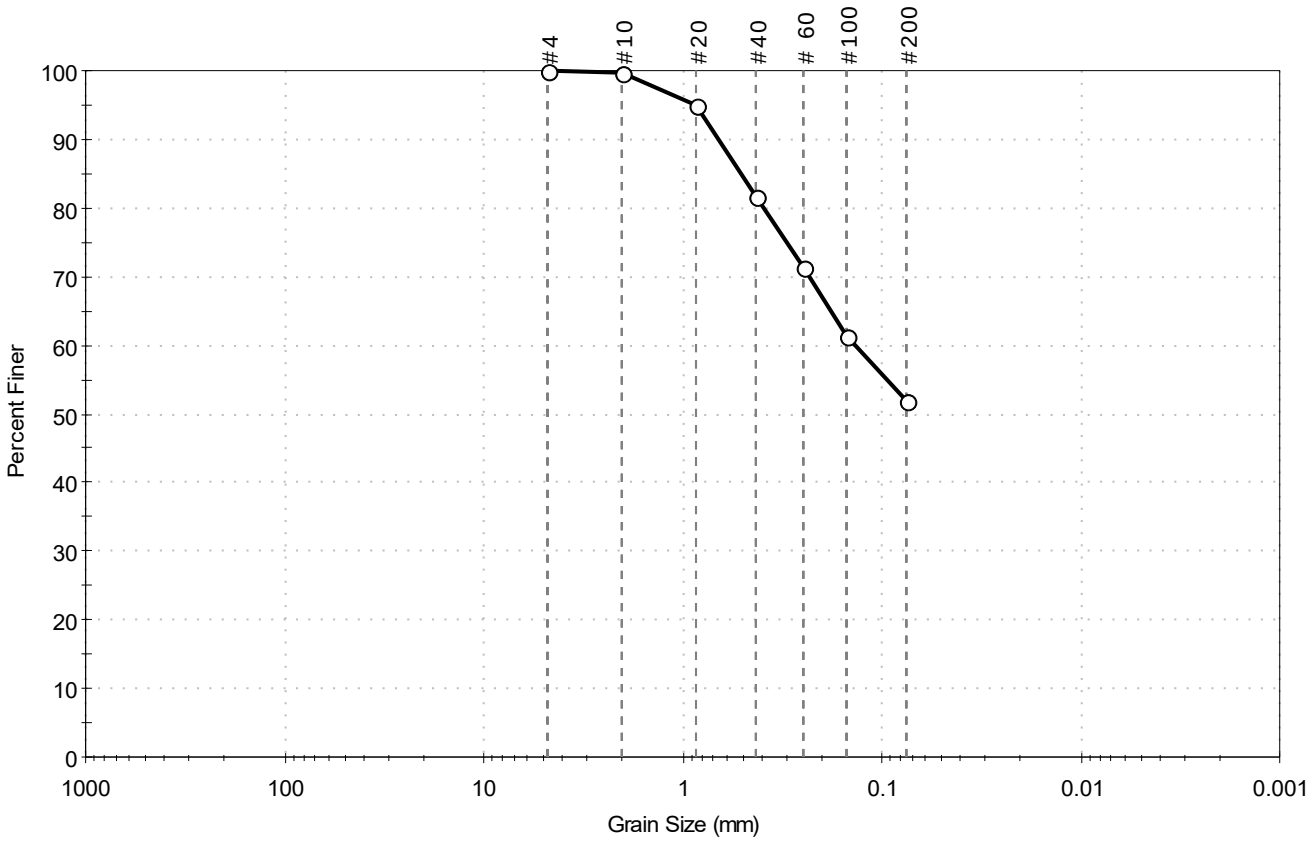
CONTRACTED WITH: GeoSystems Engineering, Inc. BORING NO.: B-5
PROJECT NAME: Fayetteville Pedestrian Bridge DATE: June 25, 2015
JOB NO.: 20014.003.14 DRILLER: Gable Drilling Co. Inc. RIG: CME 550 LOGGED BY: Larry

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	RECOV.	W	NOTES
905	TOPSOIL							
	RESIDUUM-Very stiff to stiff, red, sandy SILT (ML)		1		4-7-16	10		
BOW=904								
		5	2		4-7-8	12	13	LL=48, PL=34, PI=14
900	Medium dense, brown orange red, silty SAND		3		4-8-9	12		
		10	4		3-5-6	18		
895								
		15	5		4-6-7	14		
890								
		20	6		4-4-7	12		
	BORING TERMINATED AT 20 FEET							No groundwater encountered at time of boring
885								
		25						
880								
		30						
875								
		35						
870								
		40						
865								

BOW-Bottom of Wall#2
LL-Liquid Limit
PL-Platic Limit
PI-Plasticity Index

Client:	GeoSystems Engineering, Inc.				
Project:	Fayetteville Pedestrian Bridge/Walking Trail				
Location:	Fayetteville, Georgia			Project No:	GTX-306785
Boring ID:	B-1	Sample Type:	bag	Tested By:	twh
Sample ID:	S-4	Test Date:	08/02/17	Checked By:	MCM
Depth :	9.5 ft	Test Id:	286071		
Test Comment:	---				
Visual Description:	Moist, yellowish red sandy silt				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	48.1	51.9

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	95		
#40	0.42	82		
# 60	0.25	71		
#100	0.15	61		
#200	0.075	52		

Coefficients

D_{85} = 0.5055 mm	D_{30} = N/A
D_{60} = 0.1346 mm	D_{15} = N/A
D_{50} = N/A	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM Sandy Elastic silt (MH)

AASHTO Clayey Soils (A-7-5 (5))

Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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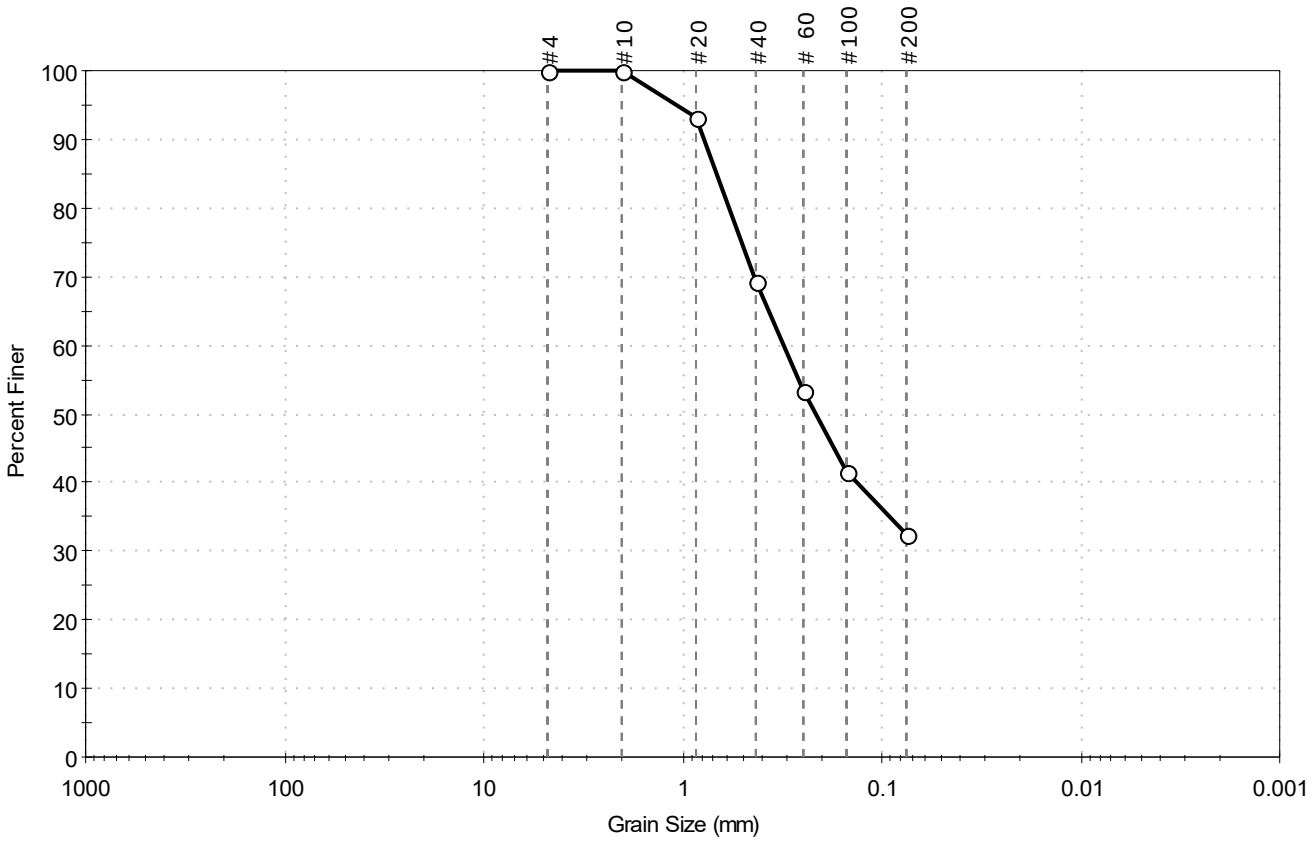
Client:	GeoSystems Engineering, Inc.				
Project:	Fayetteville Pedestrian Bridge/Walking Trail				
Location:	Fayetteville, Georgia			Project No:	GTX-306785
Boring ID:	B-1	Sample Type:	bag	Tested By:	twh
Sample ID:	S-5+S-6 Composite	Test Date:	08/02/17	Checked By:	MCM
Depth :	14.5-19.5 ft	Test Id:	286072		
Test Comment:	---				
Visual Description:	Moist, olive gray silty sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	67.5	32.5

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	93		
#40	0.42	69		
# 60	0.25	53		
#100	0.15	42		
#200	0.075	33		

Coefficients

D_{85} = 0.6691 mm	D_{30} = N/A
D_{60} = 0.3111 mm	D_{15} = N/A
D_{50} = 0.2156 mm	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

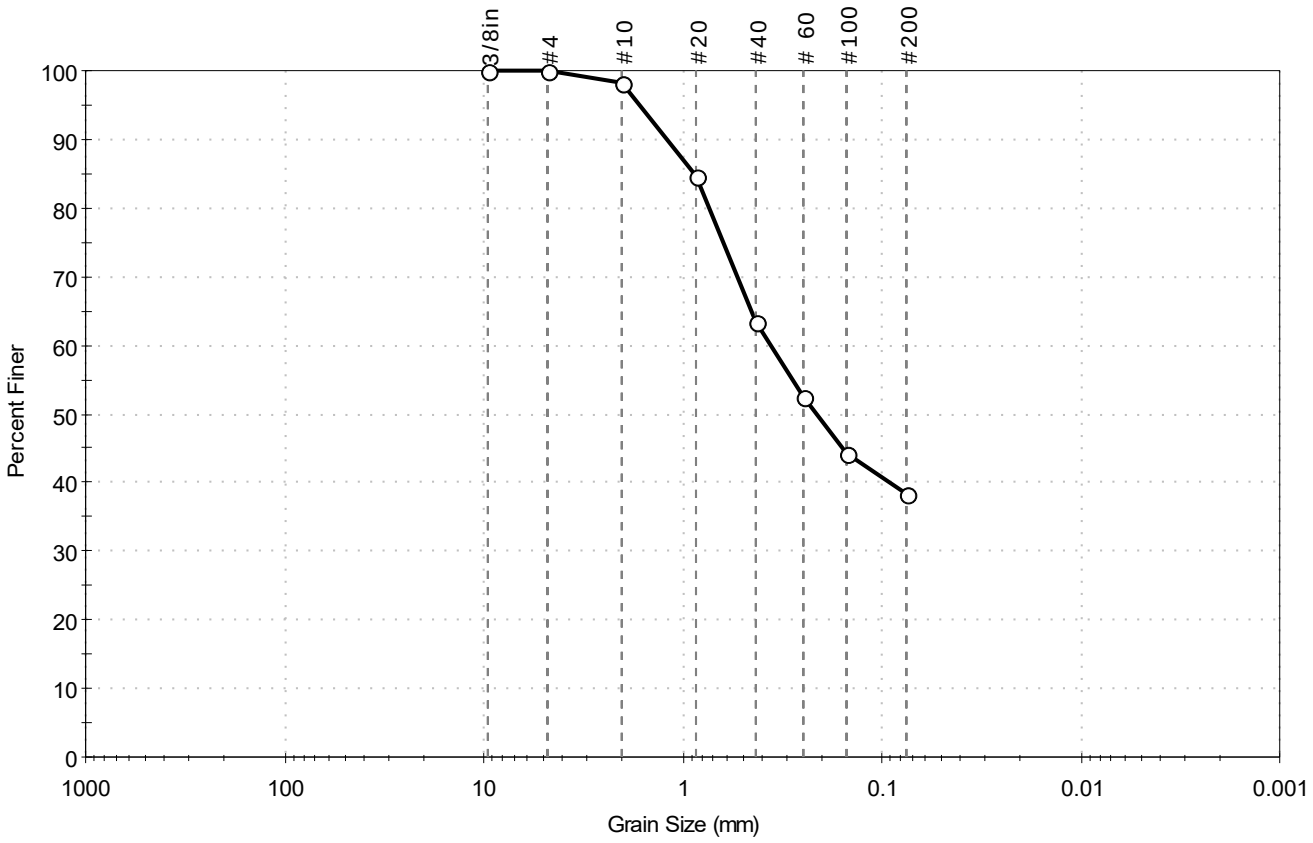
Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

Client:	GeoSystems Engineering, Inc.				
Project:	Fayetteville Pedestrian Bridge/Walking Trail				
Location:	Fayetteville, Georgia			Project No:	GTX-306785
Boring ID:	B-2	Sample Type:	bag	Tested By:	twh
Sample ID:	S-2+S-3 Composite	Test Date:	08/02/17	Checked By:	MCM
Depth :	4.5-7.0 ft	Test Id:	286073		
Test Comment:	---				
Visual Description:	Moist, yellowish brown clayey sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.1	61.5	38.4

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
3/8in	9.50	100		
#4	4.75	100		
#10	2.00	98		
#20	0.85	85		
#40	0.42	64		
# 60	0.25	52		
#100	0.15	44		
#200	0.075	38		

Coefficients

D_{85} = 0.8628 mm	D_{30} = N/A
D_{60} = 0.3593 mm	D_{15} = N/A
D_{50} = 0.2151 mm	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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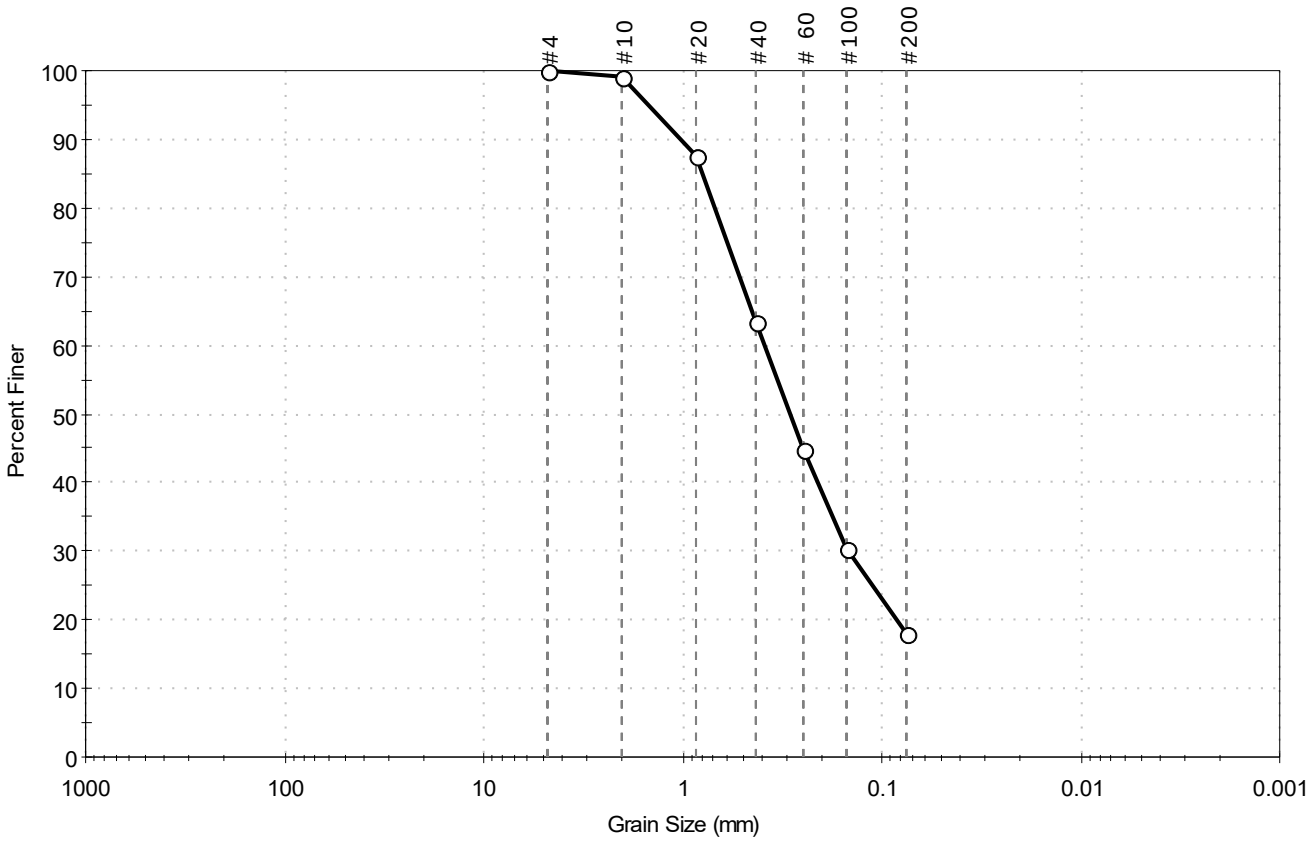
Client:	GeoSystems Engineering, Inc.				
Project:	Fayetteville Pedestrian Bridge/Walking Trail				
Location:	Fayetteville, Georgia			Project No:	GTX-306785
Boring ID:	B-2	Sample Type:	bag	Tested By:	twh
Sample ID:	S-6	Test Date:	08/02/17	Checked By:	MCM
Depth :	19.5 ft	Test Id:	286074		
Test Comment:	---				
Visual Description:	Moist, dark yellowish brown silty sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	81.9	18.1

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	99		
#20	0.85	88		
#40	0.42	63		
# 60	0.25	45		
#100	0.15	30		
#200	0.075	18		

Coefficients

D_{85} = 0.7863 mm	D_{30} = 0.1472 mm
D_{60} = 0.3850 mm	D_{15} = N/A
D_{50} = 0.2894 mm	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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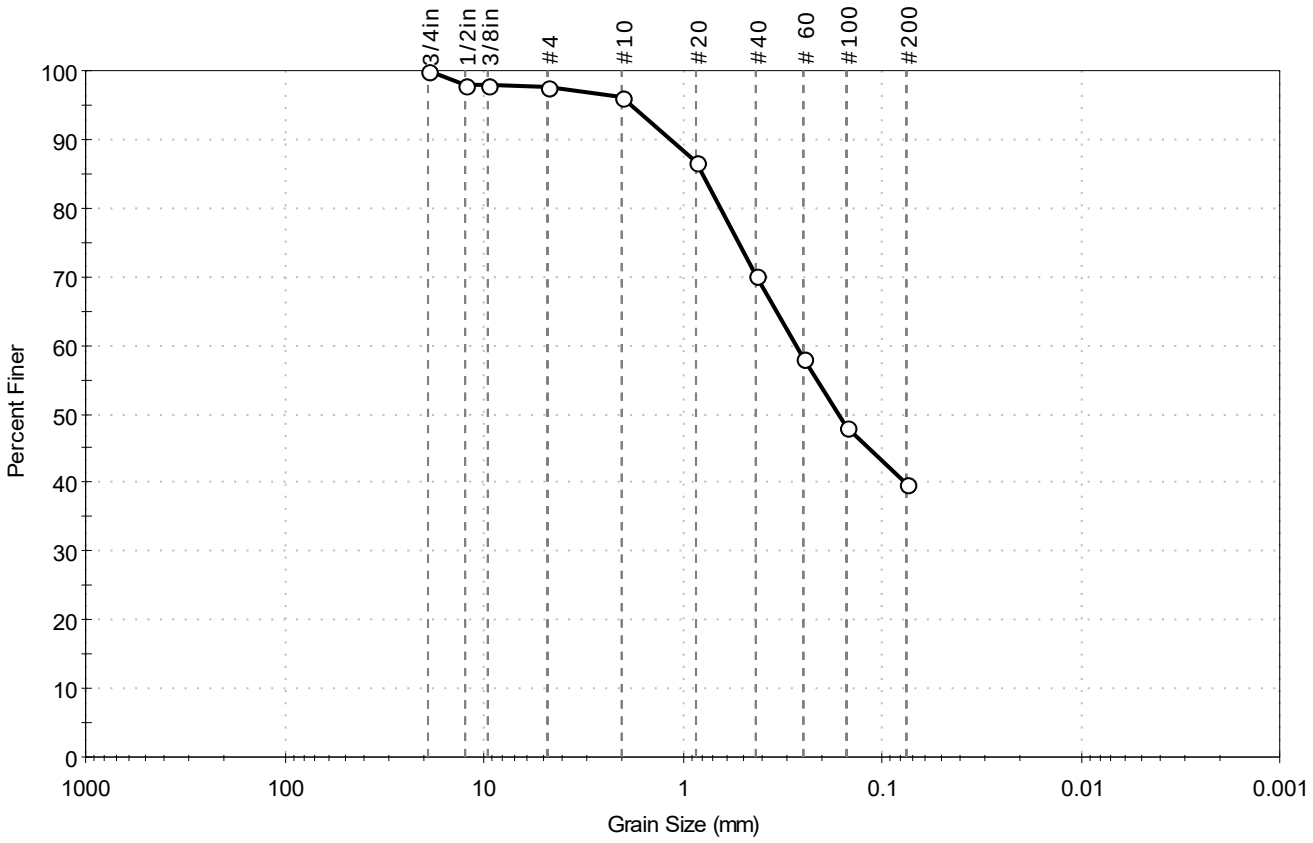
Client:	GeoSystems Engineering, Inc.				
Project:	Fayetteville Pedestrian Bridge/Walking Trail				
Location:	Fayetteville, Georgia			Project No:	GTX-306785
Boring ID:	B-3	Sample Type:	bag	Tested By:	twh
Sample ID:	S-3+S-4 Composite	Test Date:	08/02/17	Checked By:	MCM
Depth :	7.0-9.5 ft	Test Id:	286075		
Test Comment:	---				
Visual Description:	Moist, reddish brown clayey sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	2.4	57.6	40.0

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
3/4in	19.00	100		
1/2in	12.50	98		
3/8in	9.50	98		
#4	4.75	98		
#10	2.00	96		
#20	0.85	87		
#40	0.42	70		
# 60	0.25	58		
#100	0.15	48		
#200	0.075	40		

Coefficients

D_{85} = 0.7948 mm D_{30} = N/A

D_{60} = 0.2715 mm D_{15} = N/A

D_{50} = 0.1647 mm D_{10} = N/A

C_u = N/A C_c = N/A

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

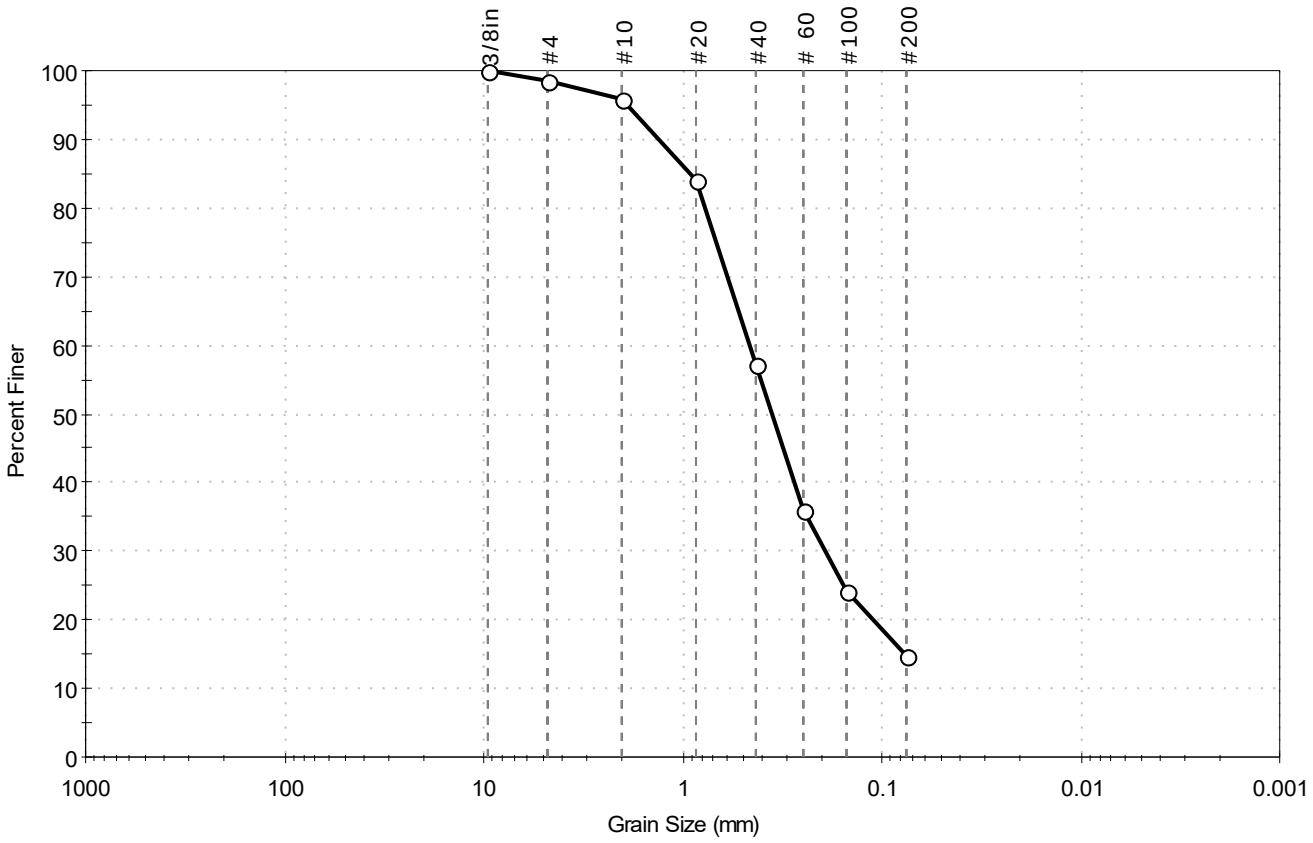
Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

Client:	GeoSystems Engineering, Inc.				
Project:	Fayetteville Pedestrian Bridge/Walking Trail				
Location:	Fayetteville, Georgia			Project No:	GTX-306785
Boring ID:	B-3	Sample Type:	bag	Tested By:	twh
Sample ID:	S-8	Test Date:	08/02/17	Checked By:	MCM
Depth :	29.5 ft	Test Id:	286076		
Test Comment:	---				
Visual Description:	Moist, reddish yellow silty sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	1.6	83.6	14.8

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
3/8in	9.50	100		
#4	4.75	98		
#10	2.00	96		
#20	0.85	84		
#40	0.42	57		
# 60	0.25	36		
#100	0.15	24		
#200	0.075	15		

Coefficients

D_{85} = 0.9104 mm	D_{30} = 0.1935 mm
D_{60} = 0.4570 mm	D_{15} = 0.0761 mm
D_{50} = 0.3554 mm	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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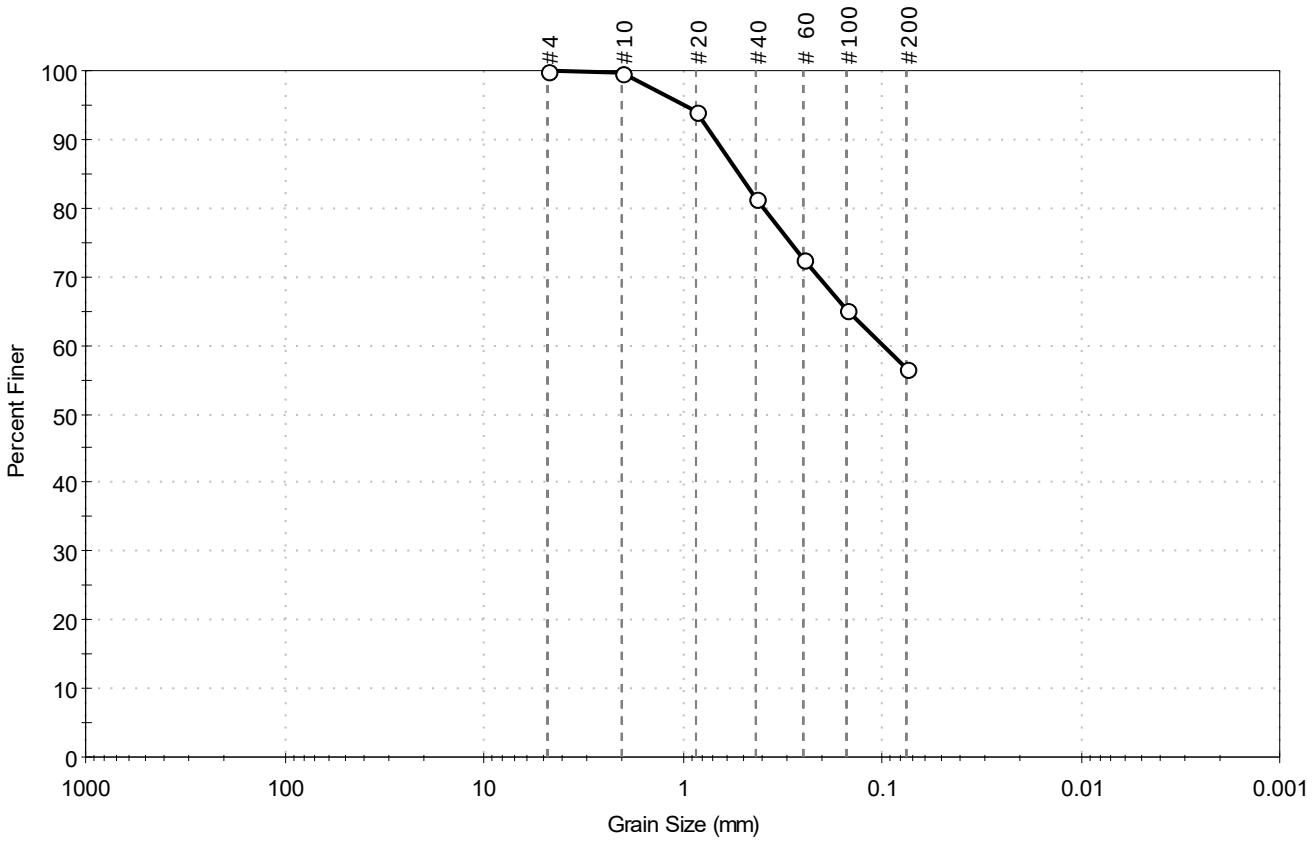
Client:	GeoSystems Engineering, Inc.				
Project:	Fayetteville Pedestrian Bridge/Walking Trail				
Location:	Fayetteville, Georgia			Project No:	GTX-306785
Boring ID:	B-4	Sample Type:	bag	Tested By:	twh
Sample ID:	S-3+S-4 Composite	Test Date:	08/02/17	Checked By:	MCM
Depth :	7.0-9.5 ft	Test Id:	286077		
Test Comment:	---				
Visual Description:	Moist, yellowish red sandy silt				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	43.5	56.5

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	94		
#40	0.42	81		
# 60	0.25	72		
#100	0.15	65		
#200	0.075	56		

Coefficients

D_{85} = 0.5191 mm	D_{30} = N/A
D_{60} = 0.0994 mm	D_{15} = N/A
D_{50} = N/A	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM Sandy Silt (ML)

AASHTO Silty Soils (A-5 (4))

Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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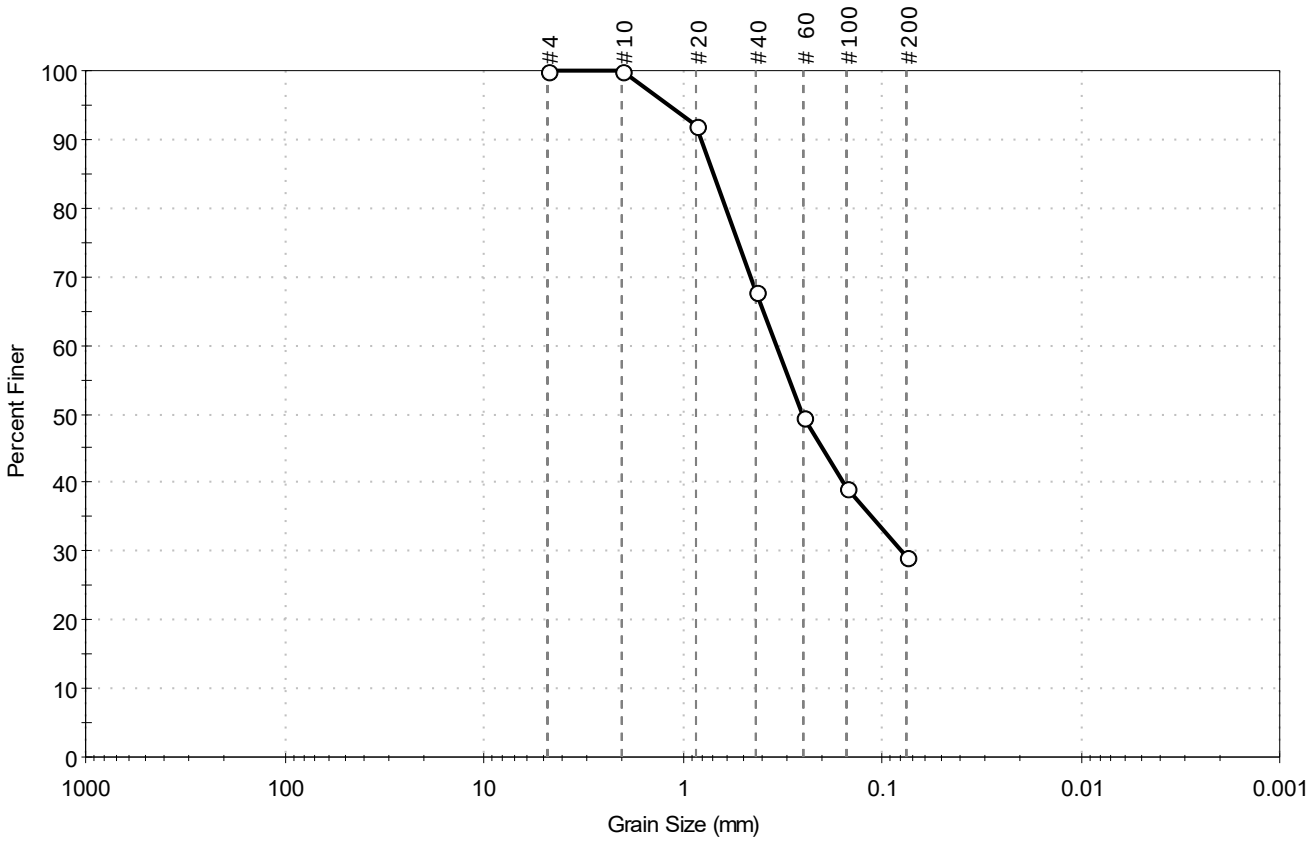
Client:	GeoSystems Engineering, Inc.				
Project:	Fayetteville Pedestrian Bridge/Walking Trail				
Location:	Fayetteville, Georgia			Project No:	GTX-306785
Boring ID:	B-4	Sample Type:	bag	Tested By:	twh
Sample ID:	S-7	Test Date:	08/02/17	Checked By:	MCM
Depth :	24.5 ft	Test Id:	286078		
Test Comment:	---				
Visual Description:	Moist, olive gray silty sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	70.8	29.2

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	92		
#40	0.42	68		
# 60	0.25	50		
#100	0.15	39		
#200	0.075	29		

Coefficients

D_{85} = 0.6957 mm	D_{30} = 0.0792 mm
D_{60} = 0.3388 mm	D_{15} = N/A
D_{50} = 0.2535 mm	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

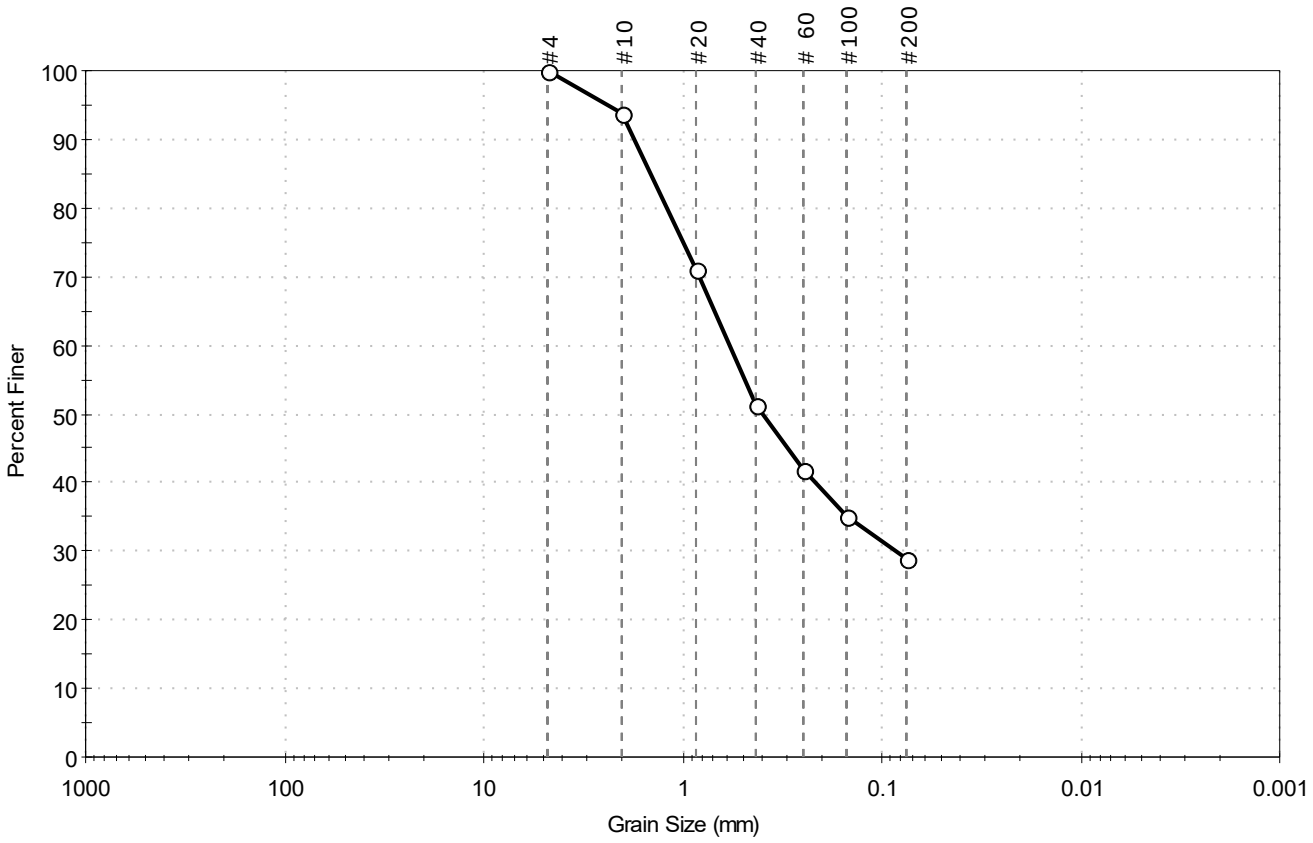
Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

Client:	GeoSystems Engineering, Inc.				
Project:	Fayetteville Pedestrian Bridge/Walking Trail				
Location:	Fayetteville, Georgia			Project No:	GTX-306785
Boring ID:	B-4	Sample Type:	bag	Tested By:	twh
Sample ID:	S-13+S-14 Composite	Test Date:	08/02/17	Checked By:	MCM
Depth :	54.5-59.5 ft	Test Id:	286079		
Test Comment:	---				
Visual Description:	Moist, light gray silty sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	71.1	28.9

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	94		
#20	0.85	71		
#40	0.42	51		
# 60	0.25	42		
#100	0.15	35		
#200	0.075	29		

Coefficients

D_{85} = 1.4299 mm	D_{30} = 0.0847 mm
D_{60} = 0.5754 mm	D_{15} = N/A
D_{50} = 0.3948 mm	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample / Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

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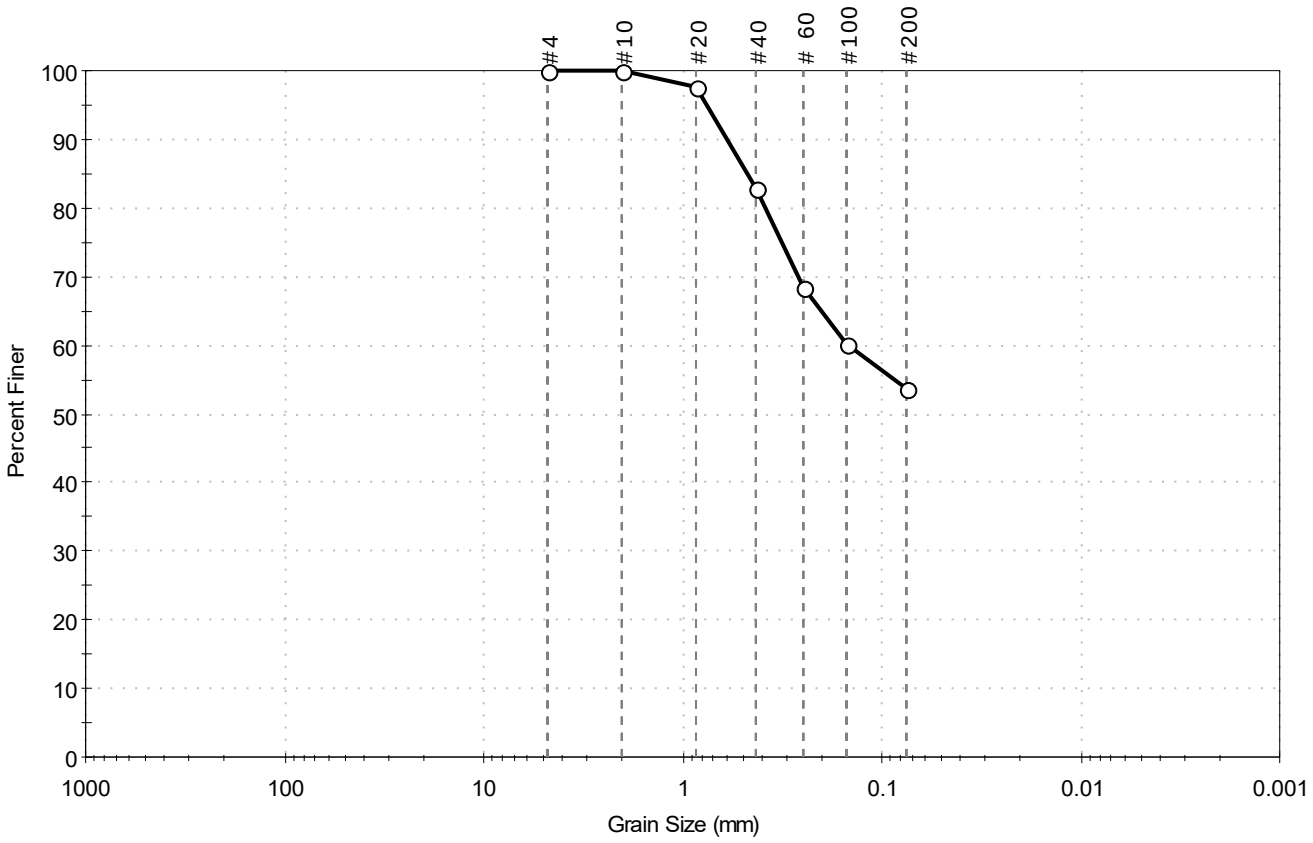
GeoTesting EXPRESS

Client:	GeoSystems Engineering, Inc.				
Project:	Fayetteville Pedestrian Bridge/Walking Trail				
Location:	Fayetteville, Georgia			Project No:	GTX-306785
Boring ID:	B-5	Sample Type:	bag	Tested By:	twh
Sample ID:	S-1+S-2 Composite	Test Date:	08/02/17	Checked By:	MCM
Depth :	1.0-4.5 ft	Test Id:	286080		
Test Comment:	---				
Visual Description:	Moist, red sandy silt				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	46.3	53.7

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	98		
#40	0.42	83		
# 60	0.25	68		
#100	0.15	60		
#200	0.075	54		

Coefficients

D_{85} = 0.4722 mm	D_{30} = N/A
D_{60} = 0.1484 mm	D_{15} = N/A
D_{50} = N/A	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM Sandy Silt (ML)

AASHTO Clayey Soils (A-7-5 (6))

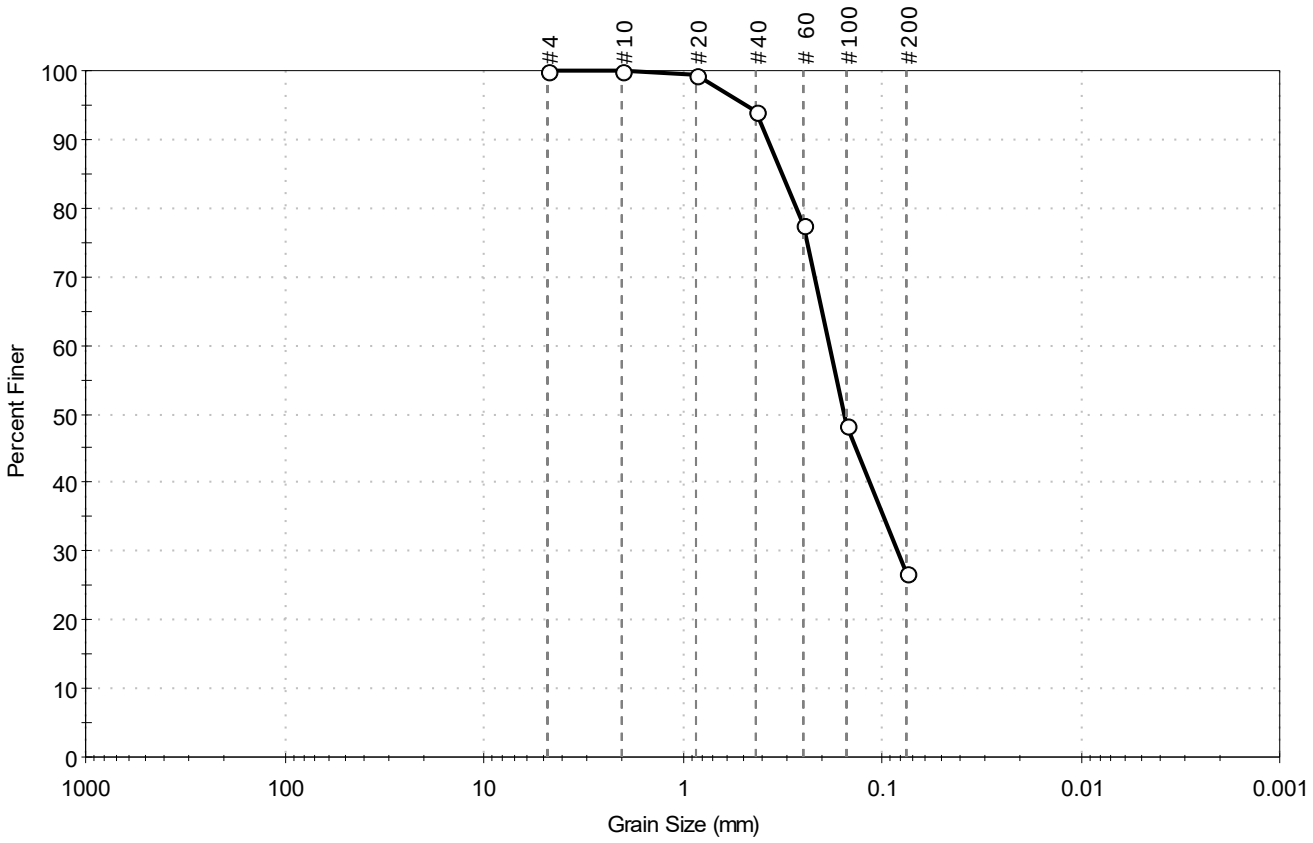
Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

Client:	GeoSystems Engineering, Inc.				
Project:	Fayetteville Pedestrian Bridge/Walking Trail				
Location:	Fayetteville, Georgia			Project No:	GTX-306785
Boring ID:	B-5	Sample Type:	bag	Tested By:	twh
Sample ID:	S-5	Test Date:	08/02/17	Checked By:	MCM
Depth :	14.5	Test Id:	286081		
Test Comment:	---				
Visual Description:	Moist, red silty sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	73.3	26.7

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	100		
#40	0.42	94		
# 60	0.25	78		
#100	0.15	48		
#200	0.075	27		

Coefficients

D_{85} = 0.3169 mm	D_{30} = 0.0832 mm
D_{60} = 0.1835 mm	D_{15} = N/A
D_{50} = 0.1540 mm	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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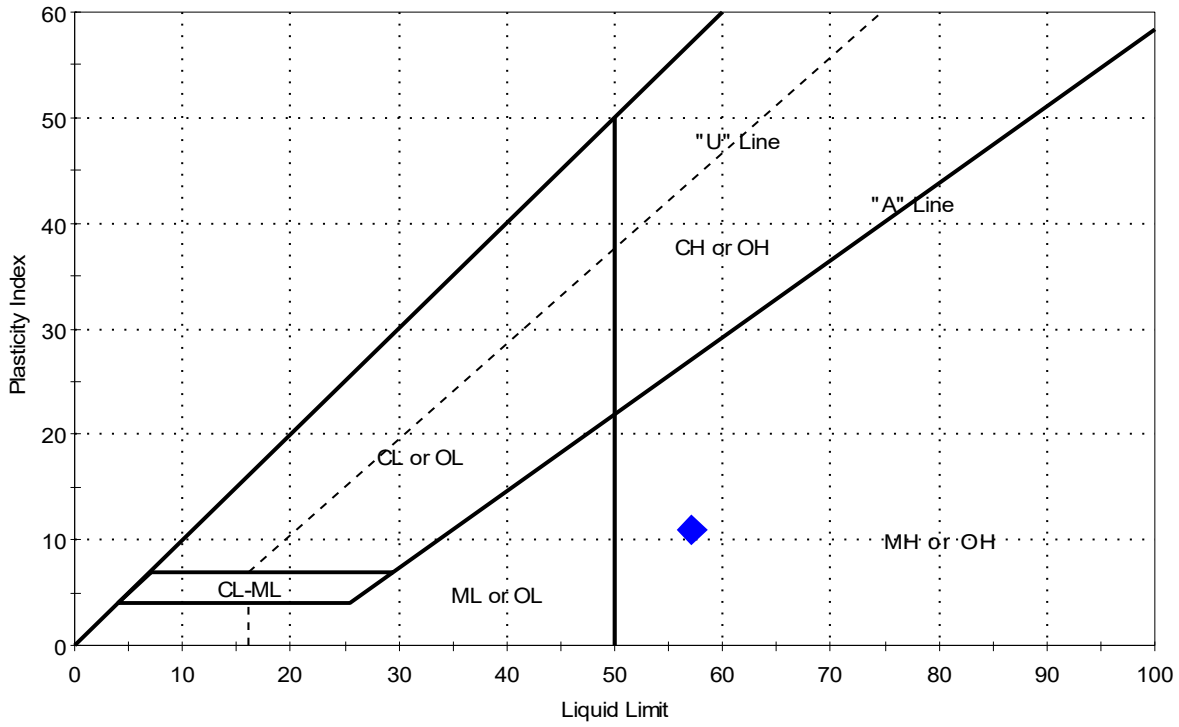
Client:	GeoSystems Engineering, Inc.				
Project:	Fayetteville Pedestrian Bridge/Walking Trail				
Location:	Fayetteville, Georgia			Project No:	GTX-306785
Boring ID:	B-1	Sample Type:	bag	Tested By:	twh
Sample ID:	S-4	Test Date:	08/04/17	Checked By:	MCM
Depth :	9.5 ft	Test Id:	286109		
Test Comment:	---				
Visual Description:	Moist, yellowish red sandy silt				
Sample Comment:	---				

Atterberg Limits - ASTM D4318

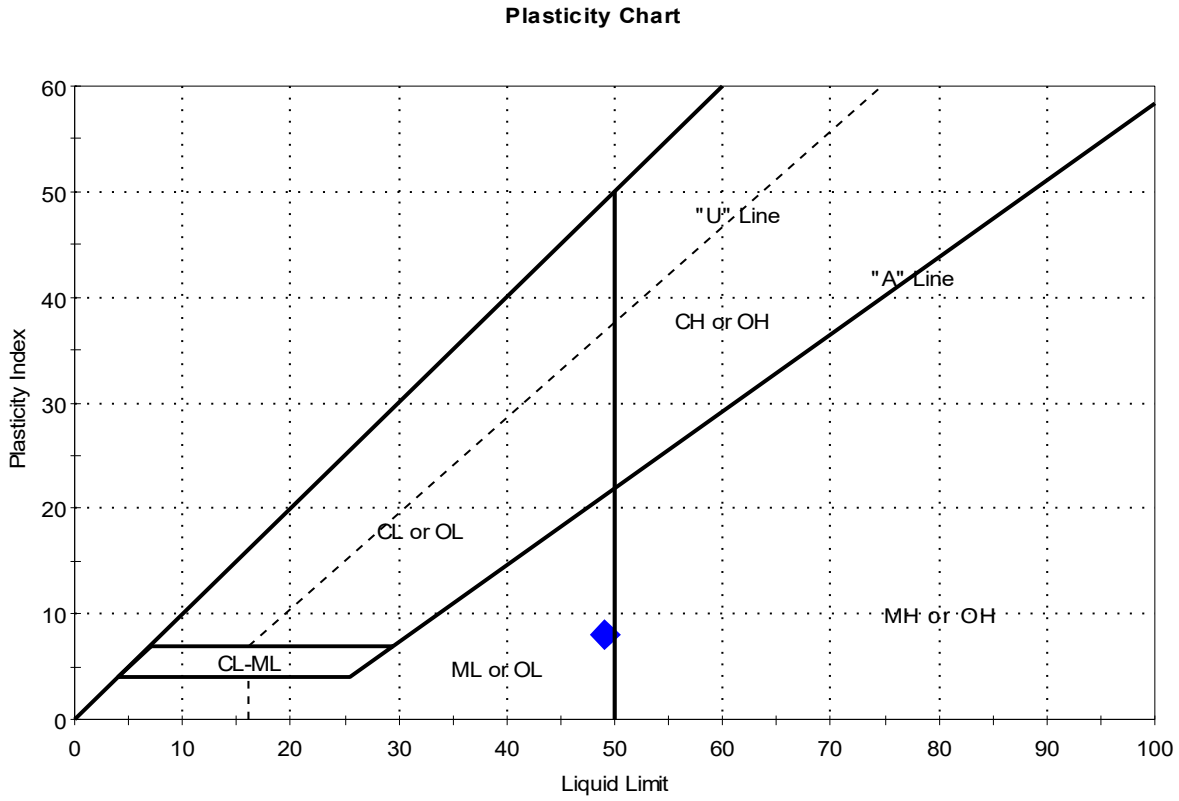


Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	S-4	B-1	9.5 ft	23	57	46	11	-2.1	Sandy Elastic silt (MH)

Sample Prepared using the WET method
18% Retained on #40 Sieve
Dry Strength: MEDIUM
Dilatancy: RAPID
Toughness: LOW

Client:	GeoSystems Engineering, Inc.				
Project:	Fayetteville Pedestrian Bridge/Walking Trail				
Location:	Fayetteville, Georgia			Project No:	GTX-306785
Boring ID:	B-4	Sample Type:	bag	Tested By:	n/a
Sample ID:	S-3+S-4 Composite	Test Date:	08/04/17	Checked By:	MCM
Depth :	7.0-9.5 ft	Test Id:	286112		
Test Comment:	---				
Visual Description:	Moist, yellowish red sandy silt				
Sample Comment:	---				

Atterberg Limits - ASTM D4318



Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	S-3+S-4 Composite	B-4	7.0-9.5 ft	22	49	41	8	-2.4	Sandy Silt (ML)

Sample Prepared using the WET method
19% Retained on #40 Sieve
Dry Strength: MEDIUM
Dilatancy: SLOW
Toughness: LOW

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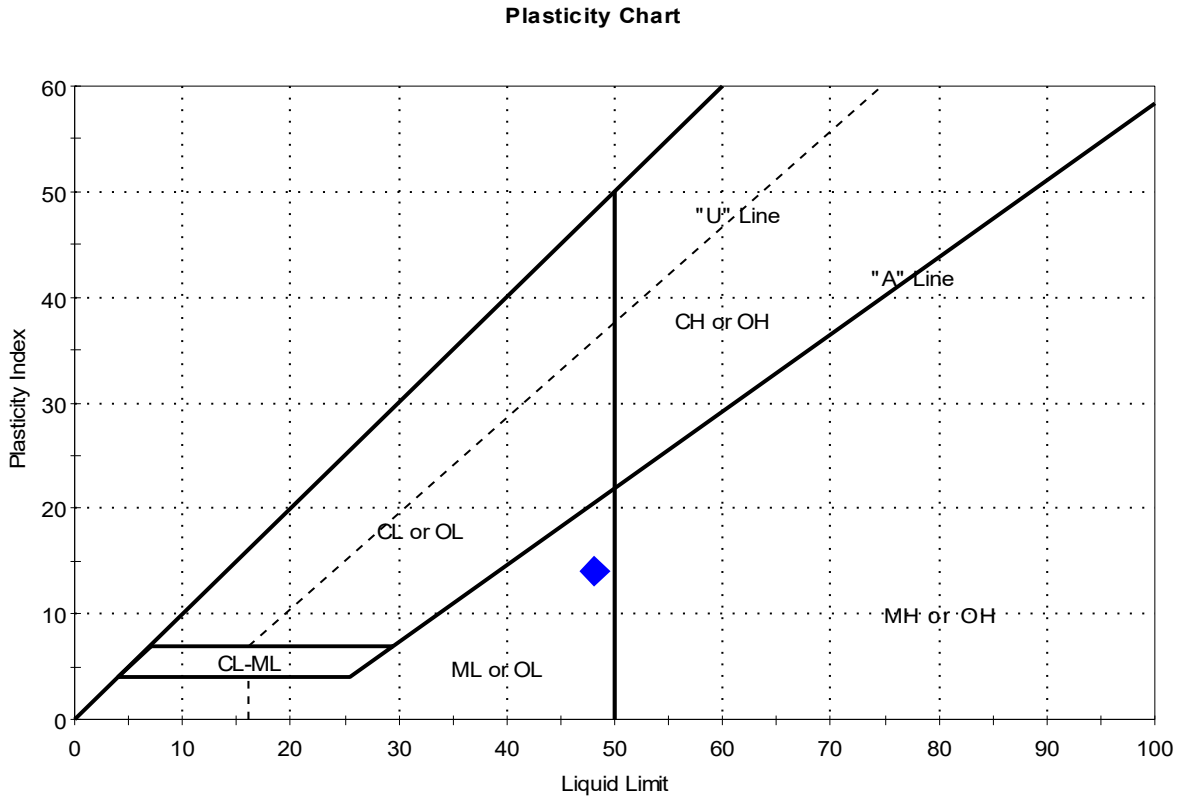
Client:	GeoSystems Engineering, Inc.				
Project:	Fayetteville Pedestrian Bridge/Walking Trail				
Location:	Fayetteville, Georgia			Project No:	GTX-306785
Boring ID:	B-5	Sample Type:	bag	Tested By:	twh
Sample ID:	S-1+S-2 Composite	Test Date:	08/04/17	Checked By:	MCM
Depth :	1.0-4.5 ft	Test Id:	286111		
Test Comment:	---				
Visual Description:	Moist, red sandy silt				
Sample Comment:	---				

Atterberg Limits - ASTM D4318



Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	S-1+S-2 Composite	B-5	1.0-4.5 ft	13	48	34	14	-1.5	Sandy Silt (ML)

Sample Prepared using the WET method

17% Retained on #40 Sieve

Dry Strength: MEDIUM

Dilatancy: SLOW

Toughness: LOW

ELASTIC SETTLEMENT

GEOSYSTEMS ENGINEERING, INC.

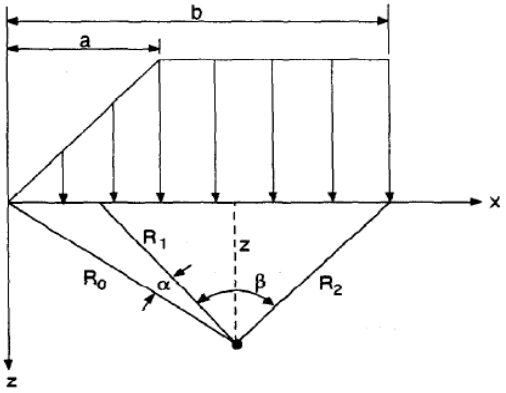
Project:	SR-54 Multi-Use Trail & Bridge	**Date:**	8/11/2017
Location:	Fayette County , Georgia	**Engineer:**	LDM
Analysis:	Elastic settlements		
Description:	Elastic settlements based on moduli interpreted from SPT data from boring B-3		

Calculation performed as outlined in FHWA EMBANK user manual. Principle of supersition is used to combine loads from two halves of embankment. Settlement calculated for ten intervals divided evenly over depth of analysis (as input).

Depth of Analysis = 50 feet

Dimensions

Length, a =	51	feet
Length, b =	57.5	feet
Height, H =	28	feet
Fill, unit weight, γ =	135	pcf
Load, P =	3780	psf



Embankment parameters (Poulos and Davis, 1978).

				Layer displacment, ρ				
Depth, z	Layer thickness, Δz	N60 Value	Elastic moduli E = 12 X N60	X = 0	X = 14.375	X = 28.75	X = 43.125	X = 57.5
(ft)	(ft)	(bpf)	(ksf)	in	in	in	in	in
5	5	12	144	0.788	0.962	1.182	1.404	1.619
10	5	8	96	1.183	1.384	1.702	2.026	2.316
15	5	6	72	1.583	1.785	2.178	2.588	2.922
20	5	6	72	1.590	1.737	2.091	2.469	2.754
25	5	10	120	0.959	1.018	1.204	1.408	1.555
30	5	20	240	0.481	0.498	0.578	0.668	0.731
35	5	13	156	0.741	0.749	0.855	0.975	1.058
40	5	27	324	0.356	0.352	0.395	0.445	0.479
45	5	23	276	0.416	0.404	0.446	0.495	0.530
50	5	100	1200	0.095	0.091	0.099	0.108	0.115
			Cumulative displacement (in):	8.194	8.978	10.730	12.587	14.080

References: FHWA. (2002). Geotechnical Engineering Circular No. 5: Evaluation of Soil and Rock Properties.
FHWA (1993). EMBANK User Manual
Poulos, H.G. and Davis, E.H. (1978). Elastic Solutions for Soil and Rock Mechanics

ELASTIC SETTLEMENT

GEOSYSTEMS ENGINEERING, INC.

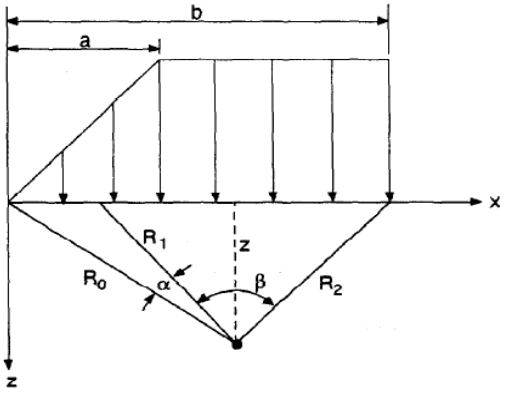
Project:	SR-54 Multi-Use Trail & Bridge	**Date:**	8/11/2017
Location:	Fayette County , Georgia	**Engineer:**	LDM
Analysis:	Elastic settlements		
Description:	Elastic settlements based on moduli interpreted from SPT data from boring B-3		

Calculation performed as outlined in FHWA EMBANK user manual. Principle of supersition is used to combine loads from two halves of embankment. Settlement calculated for ten intervals divided evenly over depth of analysis (as input).

Depth of Analysis = 50 feet

Dimensions

Length, a =	51	feet
Length, b =	57.5	feet
Height, H =	28	feet
Fill, unit weight, γ =	180	pcf
Load, P =	5040	psf



Embankment parameters (Poulos and Davis, 1978).

				Layer displacment, ρ				
Depth, z	Layer thickness, Δz	N60 Value	Elastic moduli E = 12 X N60	X = 0	X = 14.375	X = 28.75	X = 43.125	X = 57.5
(ft)	(ft)	(bpf)	(ksf)	in	in	in	in	in
5	5	12	144	1.050	1.283	1.577	1.872	2.159
10	5	8	96	1.578	1.845	2.270	2.702	3.089
15	5	6	72	2.111	2.379	2.904	3.451	3.896
20	5	6	72	2.121	2.316	2.787	3.292	3.673
25	5	10	120	1.279	1.357	1.606	1.878	2.073
30	5	20	240	0.642	0.663	0.771	0.891	0.975
35	5	13	156	0.989	0.998	1.140	1.300	1.410
40	5	27	324	0.475	0.470	0.527	0.593	0.639
45	5	23	276	0.555	0.539	0.594	0.660	0.707
50	5	100	1200	0.127	0.121	0.131	0.144	0.153
			Cumulative displacement (in):	10.925	11.971	14.307	16.782	18.774

References: FHWA. (2002). Geotechnical Engineering Circular No. 5: Evaluation of Soil and Rock Properties.
FHWA (1993). EMBANK User Manual
Poulos, H.G. and Davis, E.H. (1978). Elastic Solutions for Soil and Rock Mechanics

GEOSYSTEMS ENGINEERING
FOOTING SETTLEMENT PROGRAM

SR-54 MULTI-USE TRAIL & BRIDGE
STA 142+00 WESTERGAARD SETTLEMENT BORING B-3 135PCF

****

STRUCTURAL DATA

FOOTING NUMBER: 1

FOOTING LENGTH: 49.0 FT
FOOTING WIDTH: 100.0 FT
FOOTING DEPTH: 3.0 FT
LOAD: 18522.00 KIPS
SURFACE BEARING PRESSURE: 3780.0 PSF
X COORDINATE OF CENTER: 34.5
Y COORDINATE OF CENTER: 60.0

****

SOIL DATA

NUMBER OF LAYERS: 10
DEPTH TO WATER: 21.0 FT

LAYER NUMBER 1

DEPTH TO BOTTOM OF LAYER: 5.0 FT
THICKNESS: 5.00 FT
MODULUS OF ELASTICITY: 144000. PSF
UNIT WEIGHT: 180.0 PSF

LAYER NUMBER 2

DEPTH TO BOTTOM OF LAYER: 10.0 FT
THICKNESS: 5.00 FT
MODULUS OF ELASTICITY: 96000. PSF
UNIT WEIGHT: 180.0 PSF

LAYER NUMBER 3

DEPTH TO BOTTOM OF LAYER: 15.0 FT
THICKNESS: 5.00 FT
MODULUS OF ELASTICITY: 72000. PSF
UNIT WEIGHT: 180.0 PSF

LAYER NUMBER 4

DEPTH TO BOTTOM OF LAYER: 20.0 FT
THICKNESS: 5.00 FT
MODULUS OF ELASTICITY: 72000. PSF
UNIT WEIGHT: 180.0 PSF

LAYER NUMBER 5

DEPTH TO BOTTOM OF LAYER: 25.0 FT
THICKNESS: 5.00 FT
MODULUS OF ELASTICITY: 120000. PSF
UNIT WEIGHT: 180.0 PSF

LAYER NUMBER 6

DEPTH TO BOTTOM OF LAYER: 30.0 FT
THICKNESS: 5.00 FT
MODULUS OF ELASTICITY: 240000. PSF
UNIT WEIGHT: 180.0 PSF

LAYER NUMBER 7

DEPTH TO BOTTOM OF LAYER: 35.0 FT
THICKNESS: 5.00 FT
MODULUS OF ELASTICITY: 156000. PSF
UNIT WEIGHT: 180.0 PSF

LAYER NUMBER 8

DEPTH TO BOTTOM OF LAYER: 40.0 FT
THICKNESS: 5.00 FT
MODULUS OF ELASTICITY: 324000. PSF
UNIT WEIGHT: 180.0 PSF

LAYER NUMBER 9

DEPTH TO BOTTOM OF LAYER: 45.0 FT
THICKNESS: 5.00 FT
MODULUS OF ELASTICITY: 276000. PSF

UNIT WEIGHT: 180.0 PSF

LAYER NUMBER 10

DEPTH TO BOTTOM OF LAYER: 50.0 FT
THICKNESS: 5.00 FT
MODULUS OF ELASTICITY: 1200000. PSF
UNIT WEIGHT: 180.0 PSF

*****WESTERGAARD STRESS DISTRIBUTION *****

PREDICTED SETTLEMENT, POINT NUMBER 1 COORDINATES: X= 35.
Y= 60.

STANDARD WESTERGAARD
MODIFIED WESTERGAARD

LAYER DEPTH	INITIAL STRESS	FINAL STRESS	SUBLAYER SETTLEMENT	CUMULATIVE SETTLEMENT	FINAL STRESS	SUBLAYER SETTLEMENT	CUMULATIVE SETTLEMENT
(FT)	(PSF)	(PSF)	(IN)	(IN)	(PSF)	(IN)	(IN)
**********	**********	**********	**********	**********	**********	**********	**********
4.9	882.00	4515.19	.061	.617	4511.68	.060	.617
TOTAL LAYER 1 ,CUMULATIVE SETTLEMENT********				.617	********	**********	.617	********	.617
9.7	1755.00	5019.08	.204	2.764	5004.36	.203	2.757
TOTAL LAYER 2 ,CUMULATIVE SETTLEMENT********				2.146	********	**********	2.140	********	2.757
14.7	2655.00	5557.28	.242	5.316	5563.79	.242	5.307
TOTAL LAYER 3 ,CUMULATIVE SETTLEMENT********				2.553	********				

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5.316  ********************  2.550  ********  5.307

  19.8        3555.00       6124.23            .214
7.580       6150.14             .216           7.585

TOTAL LAYER 4 ,CUMULATIVE SETTLEMENT********  2.264  ********
7.580  ********************  2.278  ********  7.585

  24.7        4221.00       6491.08            .114
8.781       6523.58             .115           8.801

TOTAL LAYER 5 ,CUMULATIVE SETTLEMENT********  1.201  ********
8.781  ********************  1.216  ********  8.801

  29.7        4809.00       6814.94            .050
9.311       6853.63             .051           9.341

TOTAL LAYER 6 ,CUMULATIVE SETTLEMENT********   .530  ********
9.311  ********************   .540  ********  9.341

  34.8        5397.00       7172.20            .068
10.033       7214.20             .070          10.078

TOTAL LAYER 7 ,CUMULATIVE SETTLEMENT********   .722  ********
10.033  ********************   .737  ******** 10.078

  39.7        5985.00       7559.80            .029
10.341       7598.83             .030          10.393

TOTAL LAYER 8 ,CUMULATIVE SETTLEMENT********   .308  ********
10.341  ********************   .315  ******** 10.393

  44.8        6573.00       7974.19            .030
10.662       8018.20             .031          10.723

TOTAL LAYER 9 ,CUMULATIVE SETTLEMENT********   .321  ********
10.662  ********************   .330  ******** 10.723

  49.8        7161.00       8411.82            .006
10.728       8415.63             .006          10.790

TOTAL LAYER10 ,CUMULATIVE SETTLEMENT********   .066  ********
10.728  ********************   .067  ******** 10.790



PREDICTED SETTLEMENT, POINT NUMBER   2      COORDINATES: X=   35.
Y=   11.

                                        STANDARD WESTERGAARD

MODIFIED WESTERGAARD
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LAYER CUMULATIVE DEPTH	INITIAL STRESS	FINAL STRESS	SUBLAYER SETTLEMENT	CUMULATIVE SETTLEMENT
	FINAL STRESS	SUBLAYER SETTLEMENT		
(FT)	(PSF)	(PSF)	(IN)	
(IN)	(PSF)	(IN)	(IN)	
**********				
**********				
**********				
4.9	882.00	3472.64	.043	
.510	3457.36	.043	.508	
TOTAL LAYER 1 ,CUMULATIVE SETTLEMENT********			.510	********
.510	**********	.508 ********	.508	
9.7	1755.00	3650.28	.118	
1.842	3636.48	.118	1.831	
TOTAL LAYER 2 ,CUMULATIVE SETTLEMENT********			1.331	********
1.842	**********	1.322 ********	1.831	
14.7	2655.00	4275.82	.135	
3.287	4280.01	.135	3.273	
TOTAL LAYER 3 ,CUMULATIVE SETTLEMENT********			1.445	********
3.287	**********	1.442 ********	3.273	
19.8	3555.00	4977.05	.119	
4.543	4991.68	.120	4.538	
TOTAL LAYER 4 ,CUMULATIVE SETTLEMENT********			1.256	********
4.543	**********	1.265 ********	4.538	
24.7	4221.00	5480.29	.063	
5.208	5497.53	.064	5.211	
TOTAL LAYER 5 ,CUMULATIVE SETTLEMENT********			.665	********
5.208	**********	.673 ********	5.211	
29.7	4809.00	5930.94	.028	
5.504	5950.79	.029	5.512	
TOTAL LAYER 6 ,CUMULATIVE SETTLEMENT********			.295	********
5.504	**********	.300 ********	5.512	
34.8	5397.00	6401.92	.039	
5.910	6423.07	.039	5.926	

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TOTAL LAYER 7 ,CUMULATIVE SETTLEMENT********   .406  ********
5.910  **********************   .414  ********  5.926

  39.7        5985.00       6889.69            .017
6.085       6909.14            .017            6.105

TOTAL LAYER 8 ,CUMULATIVE SETTLEMENT********   .176  ********
6.085  **********************   .179  ********  6.105

  44.8        6573.00       7391.42            .018
6.272       7413.26            .018            6.296

TOTAL LAYER 9 ,CUMULATIVE SETTLEMENT********   .186  ********
6.272  **********************   .191  ********  6.296

  49.8        7161.00       7904.79            .004
6.310       7906.69            .004            6.335

TOTAL LAYER10 ,CUMULATIVE SETTLEMENT********   .039  ********
6.310  **********************   .039  ********  6.335

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GEOSYSTEMS ENGINEERING
FOOTING SETTLEMENT PROGRAM

SR-54 MULTI-USE TRAIL & BRIDGE
STA 142+00 WESTERGAARD SETTLEMENT BORING B-3 180PCF

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STRUCTURAL DATA

FOOTING NUMBER: 1

FOOTING LENGTH: 49.0 FT
FOOTING WIDTH: 100.0 FT
FOOTING DEPTH: 3.0 FT
LOAD: 24696.00 KIPS
SURFACE BEARING PRESSURE: 5040.0 PSF
X COORDINATE OF CENTER: 34.5
Y COORDINATE OF CENTER: 60.0

****

SOIL DATA

NUMBER OF LAYERS: 10
DEPTH TO WATER: 21.0 FT

LAYER NUMBER 1

DEPTH TO BOTTOM OF LAYER: 5.0 FT
THICKNESS: 5.00 FT
MODULUS OF ELASTICITY: 144000. PSF
UNIT WEIGHT: 180.0 PSF

LAYER NUMBER 2

DEPTH TO BOTTOM OF LAYER: 10.0 FT
THICKNESS: 5.00 FT
MODULUS OF ELASTICITY: 96000. PSF
UNIT WEIGHT: 180.0 PSF

LAYER NUMBER 3

DEPTH TO BOTTOM OF LAYER: 15.0 FT
THICKNESS: 5.00 FT
MODULUS OF ELASTICITY: 72000. PSF
UNIT WEIGHT: 180.0 PSF

LAYER NUMBER 4

DEPTH TO BOTTOM OF LAYER: 20.0 FT
THICKNESS: 5.00 FT
MODULUS OF ELASTICITY: 72000. PSF
UNIT WEIGHT: 180.0 PSF

LAYER NUMBER 5

DEPTH TO BOTTOM OF LAYER: 25.0 FT
THICKNESS: 5.00 FT
MODULUS OF ELASTICITY: 120000. PSF
UNIT WEIGHT: 180.0 PSF

LAYER NUMBER 6

DEPTH TO BOTTOM OF LAYER: 30.0 FT
THICKNESS: 5.00 FT
MODULUS OF ELASTICITY: 240000. PSF
UNIT WEIGHT: 180.0 PSF

LAYER NUMBER 7

DEPTH TO BOTTOM OF LAYER: 35.0 FT
THICKNESS: 5.00 FT
MODULUS OF ELASTICITY: 156000. PSF
UNIT WEIGHT: 180.0 PSF

LAYER NUMBER 8

DEPTH TO BOTTOM OF LAYER: 40.0 FT
THICKNESS: 5.00 FT
MODULUS OF ELASTICITY: 324000. PSF
UNIT WEIGHT: 180.0 PSF

LAYER NUMBER 9

DEPTH TO BOTTOM OF LAYER: 45.0 FT
THICKNESS: 5.00 FT
MODULUS OF ELASTICITY: 276000. PSF

UNIT WEIGHT: 180.0 PSF

LAYER NUMBER 10

DEPTH TO BOTTOM OF LAYER: 50.0 FT
THICKNESS: 5.00 FT
MODULUS OF ELASTICITY: 1200000. PSF
UNIT WEIGHT: 180.0 PSF

*****WESTERGAARD STRESS DISTRIBUTION *****

PREDICTED SETTLEMENT, POINT NUMBER 1 COORDINATES: X= 35. Y= 60.

STANDARD WESTERGAARD MODIFIED WESTERGAARD

LAYER DEPTH (FT)	INITIAL STRESS (PSF)	FINAL STRESS (PSF)	SUBLAYER SETTLEMENT (IN)	CUMULATIVE SETTLEMENT (IN)	FINAL STRESS (PSF)	SUBLAYER SETTLEMENT (IN)	CUMULATIVE SETTLEMENT (IN)
4.9	882.00	5726.26	.081	.823	5721.57	.081	.822
TOTAL LAYER 1 ,CUMULATIVE SETTLEMENT********			.823	********		.822	********
9.7	1755.00	6107.10	.272	3.685	6087.47	.271	3.676
TOTAL LAYER 2 ,CUMULATIVE SETTLEMENT********			2.862	********		2.854	********
14.7	2655.00	6524.70	.322	7.088	6533.38	.323	7.076
TOTAL LAYER 3 ,CUMULATIVE SETTLEMENT********			3.403	********			

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7.088  ********************  3.399  ********  7.076

  19.8        3555.00       6980.63            .285
10.106       7015.19            .288          10.114

TOTAL LAYER 4 ,CUMULATIVE SETTLEMENT********  3.018  ********
10.106  ********************  3.038  ******** 10.114

  24.7        4221.00       7247.77            .151
11.708       7291.11            .154          11.735

TOTAL LAYER 5 ,CUMULATIVE SETTLEMENT********  1.601  ********
11.708  ********************  1.621  ******** 11.735

  29.7        4809.00       7483.59            .067
12.415       7535.17            .068          12.454

TOTAL LAYER 6 ,CUMULATIVE SETTLEMENT********   .707  ********
12.415  ********************   .719  ******** 12.454

  34.8        5397.00       7763.93            .091
13.377       7819.94            .093          13.437

TOTAL LAYER 7 ,CUMULATIVE SETTLEMENT********   .962  ********
13.377  ********************   .983  ******** 13.437

  39.7        5985.00       8084.73            .039
13.788       8136.77            .040          13.858

TOTAL LAYER 8 ,CUMULATIVE SETTLEMENT********   .411  ********
13.788  ********************   .421  ******** 13.858

  44.8        6573.00       8441.25            .041
14.216       8499.93            .042          14.298

TOTAL LAYER 9 ,CUMULATIVE SETTLEMENT********   .428  ********
14.216  ********************   .440  ******** 14.298

  49.8        7161.00       8828.76            .008
14.304       8833.85            .008          14.387

TOTAL LAYER10 ,CUMULATIVE SETTLEMENT********   .088  ********
14.304  ********************   .089  ******** 14.387



PREDICTED SETTLEMENT, POINT NUMBER   2      COORDINATES: X=   35.
Y=   11.

                                    STANDARD WESTERGAARD

MODIFIED WESTERGAARD
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LAYER DEPTH (FT)	INITIAL STRESS (PSF)	FINAL STRESS (PSF)	SUBLAYER SETTLEMENT (IN)	CUMULATIVE SETTLEMENT (IN)	FINAL STRESS (PSF)	SUBLAYER SETTLEMENT (IN)	CUMULATIVE SETTLEMENT (IN)
4.9	882.00	4336.19	.058	.680	4315.82	.057	.678
TOTAL LAYER 1 ,CUMULATIVE SETTLEMENT********			.680	********		.678	********
9.7	1755.00	4282.04	.158	2.455	4263.64	.157	2.441
TOTAL LAYER 2 ,CUMULATIVE SETTLEMENT********			1.775	********		1.763	********
14.7	2655.00	4816.09	.180	4.382	4821.69	.181	4.364
TOTAL LAYER 3 ,CUMULATIVE SETTLEMENT********			1.927	********		1.923	********
19.8	3555.00	5451.07	.158	6.057	5470.57	.160	6.051
TOTAL LAYER 4 ,CUMULATIVE SETTLEMENT********			1.675	********		1.687	********
24.7	4221.00	5900.05	.084	6.944	5923.04	.085	6.948
TOTAL LAYER 5 ,CUMULATIVE SETTLEMENT********			.887	********		.898	********
29.7	4809.00	6304.92	.037	7.338	6331.39	.038	7.349
TOTAL LAYER 6 ,CUMULATIVE SETTLEMENT********			.394	********		.400	********
34.8	5397.00	6736.89	.052	7.880	6765.09	.053	7.901

```
TOTAL LAYER 7 ,CUMULATIVE SETTLEMENT********   .542  ********
7.880  **********************   .552  ********  7.901

  39.7        5985.00       7191.25            .022
8.114       7217.18            .023            8.140

TOTAL LAYER 8 ,CUMULATIVE SETTLEMENT********   .234  ********
8.114  **********************   .239  ********  8.140

  44.8        6573.00       7664.23            .024
8.362       7693.35            .024            8.394

TOTAL LAYER 9 ,CUMULATIVE SETTLEMENT********   .248  ********
8.362  **********************   .254  ********  8.394

  49.8        7161.00       8152.72            .005
8.414       8155.25            .005            8.447

TOTAL LAYER10 ,CUMULATIVE SETTLEMENT********   .052  ********
8.414  **********************   .052  ********  8.447

→
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Bridge Foundation Investigation (LRFD)
SR 54 Multi-Use Trail & Bridge, Fayette County
PI No. 0012878
October 5, 2017
Revision No. 2

LOCATION

Georgia Highway 54 West, near street address 1294 and Piedmont Fayette Hospital, Fayetteville, Fayette County, Georgia. The location is approximately midway between Sandy Creek Road to the east and Veterans Parkway to the west.

GENERAL INFORMATION

GEOLOGIC FORMATION

Piedmont Physiographic Province - The Clarkston Formation, described as a sillimanite-garnet-quartz-plagioclase-biotite-muscovite schist interlayered with hornblende-plagioclase amphibolite of Precambrian age underlies the site. The Clarkston Formation is locally intruded in the Tyrone, Peachtree City and Fayetteville area by younger rocks of the Palmetto Granite unit, which is a coarse-grained porphyritic granite.

SUBSURFACE FEATURES

The investigation encountered fill materials, residual soils, partially weathered rock (PWR) and auger refusal material. Please see the enclosed Boring Locations – Mainline Plan Drawing Nos. 13-08 & 13-09 and Soil Test Boring Records for specific subsurface conditions at each boring location.

Below a surfical topsoil or gravel layer, fill was encountered at all boring locations, except B-5, to depths ranging approximately from 3 to 13 feet. The fill was sampled as either loose or medium dense clayey sand.

Residual soils were initially encountered below the topsoil layer in boring B-5 and from below the fill in the remaining borings. The residual soil profile mainly consists of loose and medium dense silty sand. Some clayey sand was also penetrated in the upper portions of three borings. The residual soils extended to the top of partially weathered rock (PWR) at depths of about 43 and 48 feet, respectively, in borings B-2 and B-3 and to boring termination depths of 20 and 60 feet in the remaining three borings.

Partially weathered rock was encountered from below the residual soils to auger refusal depths of 48 feet at the location of boring B-2 and 52 feet at B-3.

Groundwater was encountered in borings B-2, B-3 and B-4, respectively, at depths of 5, 22 and 27 feet below the ground surface at the time of the field investigation. Groundwater was not observed in boreholes B-1 and B-5 at the time of drilling. No 24-hour groundwater measurements were obtained, since all of the boreholes caved at depths ranging from 7 to 9.5 feet below ground.

SITE CLASSIFICATION

We recommend a site class of D per AASHTO LRFD 3.10.3.1.

1.0 -- FOUNDATION RECOMMENDATIONS

Bents	Pile Bent (Type)
North End Bent 2 (Boring B-4)	HP 14x89 (50 ksi)
South End Bent 1 (Boring B-3)	HP 14x89 (50 ksi)

1.1 -- PILE PROPERTIES

Pile Type	Pile Size (in)	Nominal Compression Stress (ksi)	Nominal Tension Stress (ksi)	Maximum Factored Structural Resistance (kips)
HP (50 ksi)	14 x 89	45.0	45.0	653

1.2 -- DESIGN LOADS

Bents	Maximum Factored Strength Limit State Load (kips)	Maximum Factored Service Limit State Load (kips)	Factored Extreme Event I Limit State Load (kips)
North End Bent 2 (Boring B-4)	250	175	Not Provided
South End Bent 1 (Boring B-3)	250	175	Not Provided

2.0 -- FOUNDATION LOADS

2.1 -- PILE FOUNDATION LOADS

Bents	Pile Type	Size (in)	Down Drag (kips)	Scour (Kips)	Driving Resistance (kips)
North End Bent 2 (Boring B-4)	HP	14x89	N/A	N/A	385
South End Bent 1 (Boring B-3)	HP	14x89	N/A	N/A	385

3.0 -- FOUNDATION ELEVATIONS

Bents	Minimum Tip	Estimated Tip
North End Bent 2 (Boring B-4)	855	836
South End Bent 1 (Boring B-3)	843	840

4.0 -- GENERAL NOTES

Elevations

All foundation elevations are based on the soil test boring elevations as shown on the enclosed Soil Test Boring Records. The boring elevations were established by survey using Control Points D-25 and D-26, as referenced on Drawing No. 13-009 of the project plans.

Waiting Period

An initial waiting period of 30 days is recommended to allow for completion of at least 90 percent of an estimated 6 to 11 inches of settlement (total) beneath the MSE wall end bents. The majority of the settlement should occur during construction of the MSE walls and the amount of settlement remaining after completion of filling should not be significant. We recommend monitoring of MSE wall settlement during construction to confirm the expected performance and determine the final waiting period necessary. Minimal instrumentation to monitor settlement should consist of settlement plates installed at the interface of the wall fill and the existing ground surface.

Staged Construction

Staged construction for pile installation through the end bents is required to prevent possible down-drag loads on the piles from settlement of the in-situ soils under the MSE wall loads. Piles should not be installed until after at least 90 percent of the anticipated settlement has occurred. During MSE wall construction, installation of vertical casing through the reinforced fill is required for subsequent pile installation. Casing will prevent damage to or interference with the MSE wall reinforcement elements.

Obstructions

Due to the erratic weathering of the rocks within this geologic setting, some unexpected obstructions are possible between the borings or in areas not investigated.

As Built Foundation Information

The as built foundation information should be forwarded to the Geotechnical Engineering Bureau upon completion of the foundation system.

4.1 -- PILE FOUNDATION NOTES

PDO

Driving resistance after minimum tip elevations are achieved in conjunction with Special Provision 520 Piling for LRFD and Special Provision 523 Dynamic Pile Testing. Perform one PDA test at Bent 1 (South-Boring B-3) and Bent 2 (North-Boring B-4)

Nominal Bearing Resistance of Single Pile

Driving resistance is based on the following field verification method and resistance factor φ_{dyn} per AASHTO LRFD 2014 (10.5.5.2.3-1):

Resistance Determination Method	Resistance Factor
Driving criteria established by dynamic testing of at least two piles per site condition, but no less than 2% of the production piles.	0.65

Freeze Bearing

Piles should not be overdriven at this site. If dynamic bearing has not been achieved by 2 feet above the estimated tip elevation, pile driving should be stopped for a minimum 24 hours and re-started with a warm hammer to check for "freeze" bearing.

Piles Driven to Hard Rock

The nominal resistance of piles driven to point bearing on hard rock where pile penetration into the rock formation is minimal is controlled by the structural limit state. The Nominal Driving Resistance should not exceed the Factored Structural Resistance. Dynamic pile measurements should be used to monitor for pile damage.

Drivability

A drivability analysis has been completed on the proposed piles to about their respective estimated tips using a DELMAG D 16-32 pile hammer.

Down-drag Protection

To avoid inducing down-drag loads into the piles from potential settlement of compressible layers during construction of the MSE wall, we recommend that piles at Bent 1 (South) and Bent 2 (North) be protected from down-drag by delaying pile installation until after at least 90 percent of the anticipated settlement has occurred.

Pile Casing through MSE Reinforcement Zone

Installation of vertical casing through the MSE reinforced fill is required for subsequent pile installation in order to prevent damage to or interference with the MSE wall reinforcement elements.

5.0 – QA / QC

Prepared By: Larry D. Mullins, P.E.

Attachment A
- Boring Locations – Mainline Plan Drawing Nos. 13-08 & 13-09
- Key to Symbols and Descriptions
- Soil Test Boring Records (B-1 through B-5)
- Laboratory Soil Test Reports

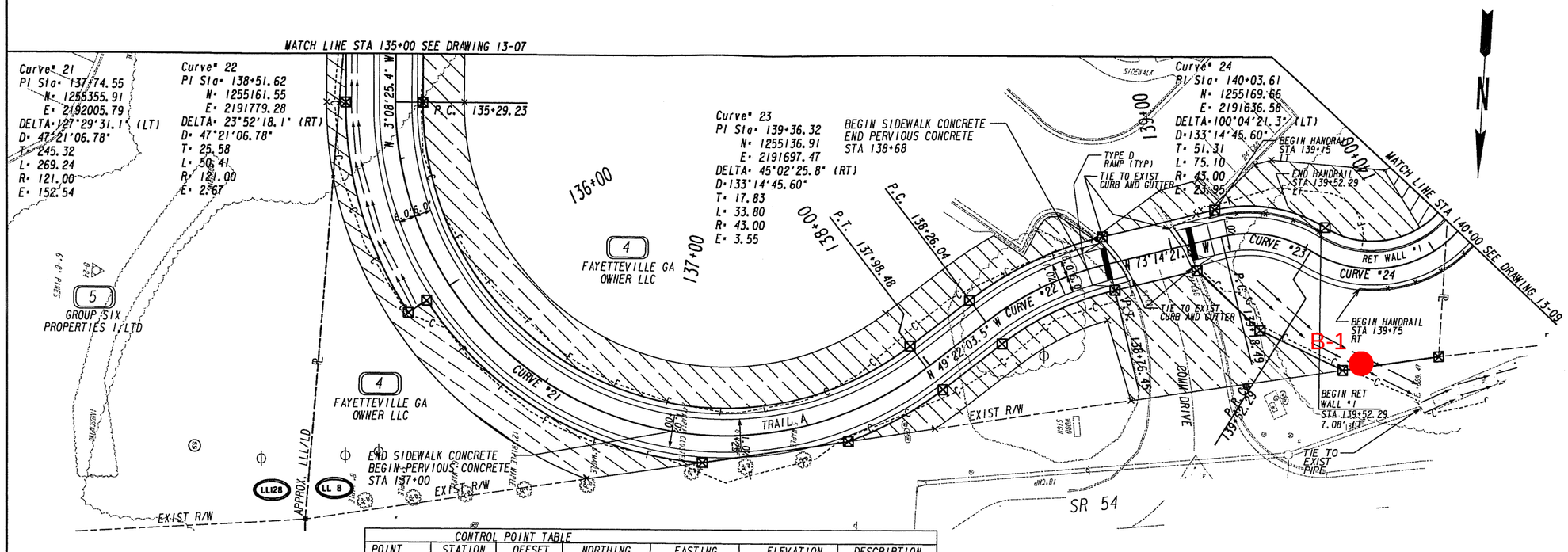
Attachment B
- APILE & GRLWEAP Calculations
  - Bent 2 (South-Boring B-3)

Attachment C
- Special Provision 523 Dynamic Pile Testing
- Special Provision 520 Piling for LRFD

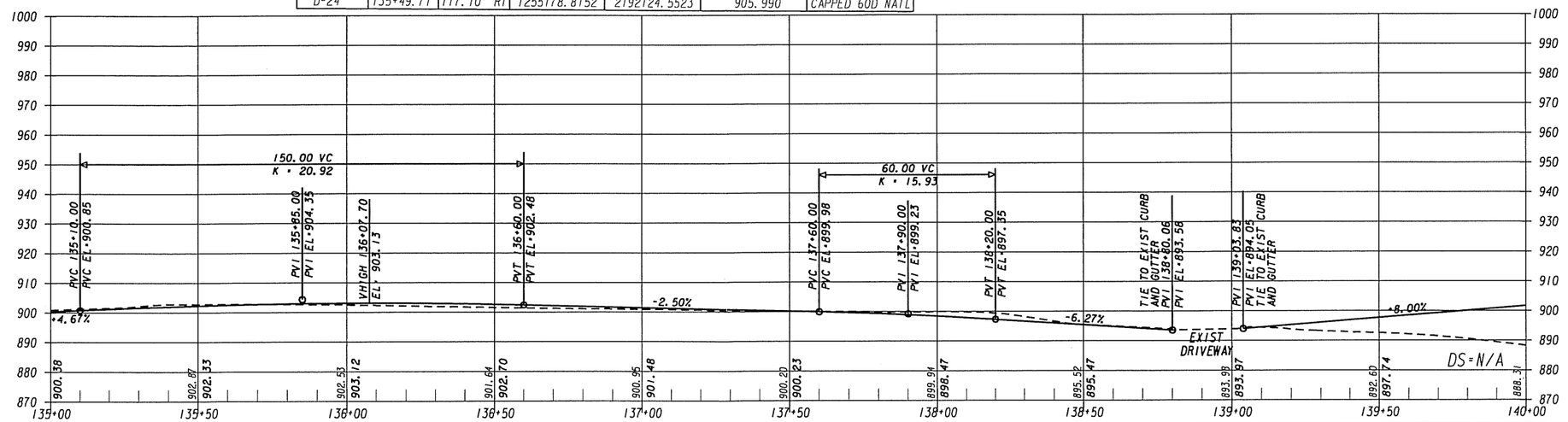
ATTACHMENT A

BORING LOCATIONS – MAINLINE PLAN
DRAWING NOS. 13-08 & 13-09
KEY TO SYMBOLS AND DESCRIPTIONS
SOIL TEST BORING RECORDS (B-1 THROUGH B-5)
LABORATORY SOIL TEST REPORTS

7/11/2017	7:29:09 AM	GPLOT-V8	0012878_13-008.dgn	GDOT	P.I. No.
James. c. lawson		gplotborder-v81-PO. tbl			0012878



CONTROL POINT TABLE						
POINT	STATION	OFFSET	NORTHING	EASTING	ELEVATION	DESCRIPTION
D-24	135+49.71	117.10' RT	1255178.8152	2192124.5523	905.990	CAPPED 60D NAIL



PROPERTY AND EXISTING R/W LINE	—℄—
REQUIRED R/W LINE	
CONSTRUCTION LIMITS	—C— F—
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES	
EASEMENT FOR CONSTR OF SLOPES	
EASEMENT FOR CONSTR OF DRIVES	

BEGIN LIMIT OF ACCESS	BLA
END LIMIT OF ACCESS	ELA
LIMIT OF ACCESS	
REQ'D R/W & LIMIT OF ACCESS	
LIMITS OF MILLING & OVERLAY	
LIMITS OF EXIST. PAVEMENT	

GEORGIA
DEPARTMENT OF TRANSPORTATION

AECOM

SCALE IN FEET
0 20 40 80

REVISION DATES

MAINLINE PLAN

SR 54 MULTI-USE TRAIL & BRIDGE

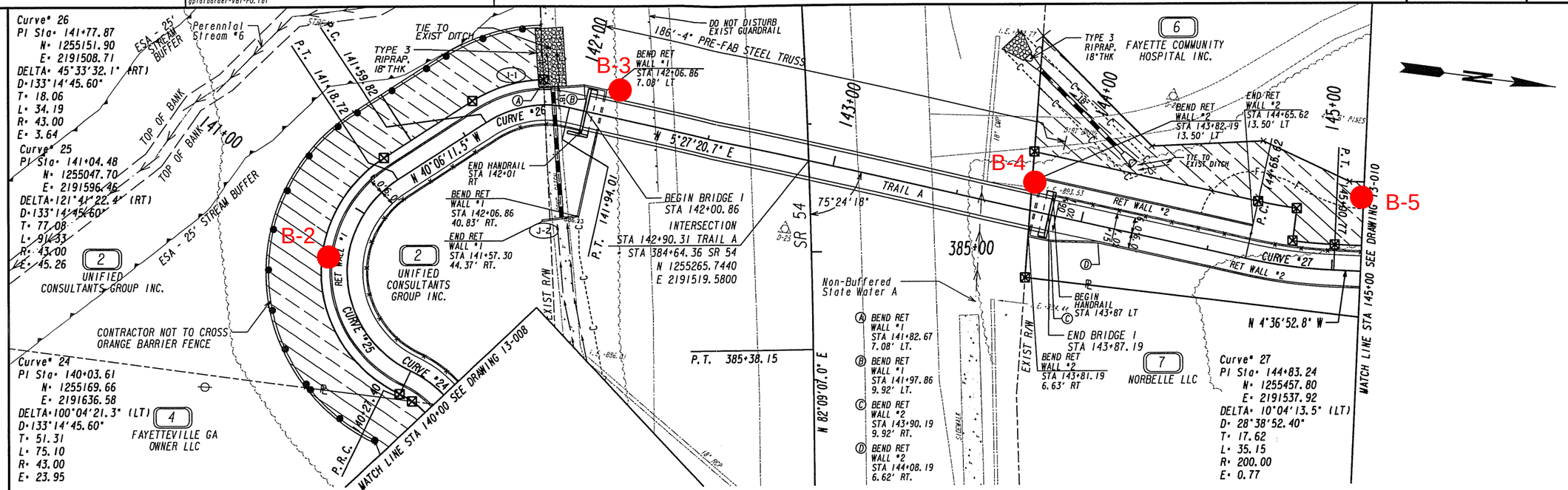
CHECKED:		DATE:		DRAWING No.
BACKCHECKED:		DATE:		13-008
CORRECTED:		DATE:		
VERIFIED:		DATE:		

T/31/2015 GPLN

7/11/2017 7:30:33 AM | GPLOT-V8 | 0012878_13-009.dgn

James. c. lawson | gplotborder-v81-PO.tbl

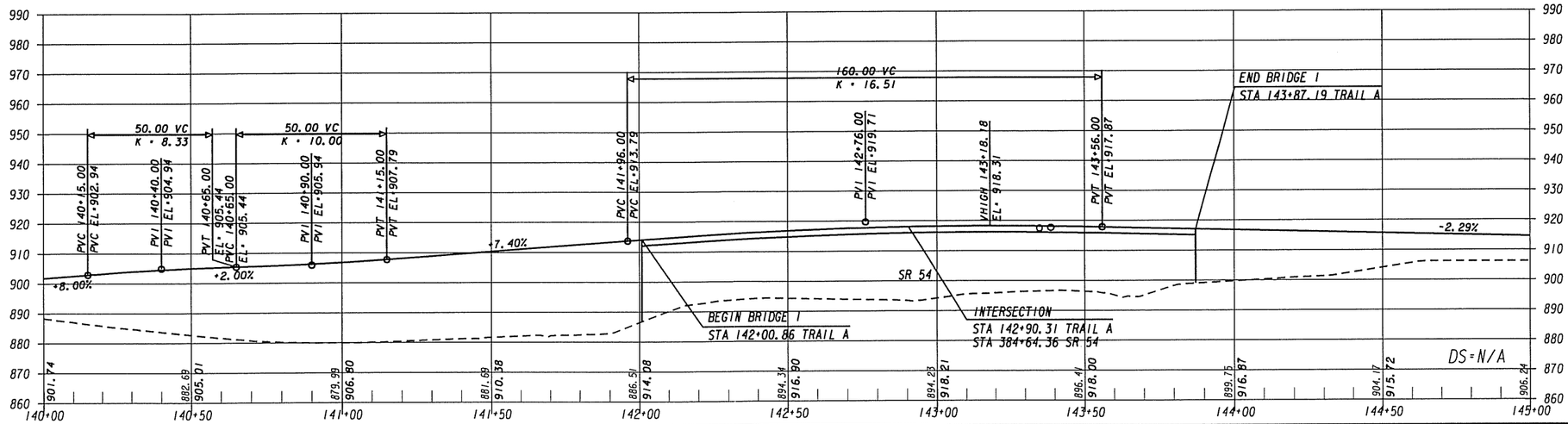
GDOT | P. I. No. 0012878



ESA - SEE ENVIRONMENTAL RESOURCES IMPACT TABLE IN GENERAL NOTES FOR CONSTRUCTION RESTRICTIONS.

CONTROL POINT TABLE

POINT	STATION	OFFSET	NORTHING	EASTING	ELEVATION	DESCRIPTION
D-25	142+75.66	28.02' RT	1255259.8378	2191547.1600	894.599	CAPPED 60D NAIL
D-26	144+12.74	55.85' LT	1255404.2661	2191476.7053	900.708	CAPPED 60D NAIL



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
LIMITS OF MILLING & OVERLAY
LIMITS OF EXIST. PAVEMENT

GEORGIA
DEPARTMENT OF TRANSPORTATION

AECOM

SCALE IN FEET
0 20 40 80

REVISION DATES

MAINLINE PLAN

SR 54 MULTI-USE TRAIL & BRIDGE

CHECKED:		DATE:	DRAWING No.
BACKCHECKED:		DATE:	13-009
CORRECTED:		DATE:	
VERIFIED:		DATE:	

7/31/2015 GPLN

MAJOR DIVISIONS			GROUP SYMBOLS		TYPICAL NAMES
COARSE GRAINED SOILS (More than 50% of material is LARGER than No. 200 sieve size)	GRAVELS (More than 50% of coarse fraction is LARGER than the No. 4 sieve size)	CLEAN GRAVELS (Little or no fines)		GW	Well graded gravels, gravel - sand mixtures, little or no fines.
				GP	Poorly graded gravels or grave - sand mixtures, little or no fines.
		GRAVELS WITH FINES (Appreciable amount of fines)		GM	Silty gravels, gravel - sand - silt mixtures.
				GC	Clayey gravels, gravel - sand - clay mixtures.
	SANDS (More than 50% of coarse fraction is SMALLER than the No. 4 Sieve Size)	CLEAN SANDS (Little or no fines)		SW	Well graded sands, gravelly sands, little or no fines.
				SP	Poorly graded sands or gravelly sands, little or no fines.
		SANDS WITH FINES (Appreciable amount of fines)		SM	Silty sands, sand - silt mixtures
				SC	Clayey sands, sand - clay mixtures.
FINE GRAINED SOILS (More than 50% of material is SMALLER than No. 200 sieve size)	SILTS AND CLAYS (Liquid limit LESS than 50)			ML	Inorganic silts and very fine sands, rock flour, silty of clayey fine sands or clayey silts and with slight plasticity.
				CL	Inorganic lays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
				OL	Organic silts and organic silty clays of low plasticity.
	SILTS AND CLAYS (Liquid limit GREATER than 50)			MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
				CH	Inorganic clays of high plasticity, fat clays
				OH	Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS				PT	Peat and other highly organic soils.
FILL					Fill

	Undisturbed Sample		Auger Cuttings
	Standard Penetration Test or Dynamic Cone Penetration Test		Bulk Sample
	Rock Core		Crandall Sampler
	Dilatometer		Pressure Meter
	Packer		No Recovery
	Water Table at time of boring		Water Table after 24 hours

Correlation of Standard Penetration Resistance with Relative Density and Consistency

SAND & GRAVEL		SILT & CLAY	
No. of Blows	Relative Density	No. of Blows	Consistency
0 - 4	Very Loose	0 - 2	Very Soft
5 - 10	Loose	3 - 4	Soft
11 - 30	Medium Dense	5 - 8	Firm
31 - 50	Dense	9 - 15	Stiff
Over 50	Very Dense	16 - 30	Very Stiff
		31 - 50	Hard
		Over 50	Very Hard

Correlation of Dynamic Cone Penetration Resistance with Relative Density and Consistency (Piedmont Residual Soils)

SAND & GRAVEL		SILT & CLAY	
No. of Blows	Relative Density	No. of Blows	Consistency
0 - 4	Very Loose	0 - 2	Very Soft
5 - 15	Loose	3 - 4	Soft
16 - 30	Medium Dense	5 - 10	Firm
		11 - 30	Stiff

BOUNDARY CLASSIFICATIONS: Soils possessing characteristics of two groups are designated by combinations of group symbols.

SILT OR CLAY	SAND			GRAVEL		Cobbles	Boulders
	Fine	Medium	Coarse	Fine	Coarse		

No.200 No.40 No.10 No.4 3/4" 3" 12"

U.S. STANDARD SIEVE SIZE

Reference: The Unified Soil Classification System, Corps of Engineers, U.S. Army Technical Memorandum No 3-357, Vol. 1, March, 1953 (Revised April, 1960)

KEY TO SYMBOLS AND DESCRIPTIONS

ACCURA

Accura Engineering and Consulting Services, Inc.
3200 Presidential Drive
Atlanta, GA 30340
Office: 404.241.8722

BORING LOG

CONTRACTED WITH: GeoSystems Engineering, Inc. BORING NO.: B-1
PROJECT NAME: Fayetteville Pedestrian Bridge DATE: June 25, 2015
JOB NO.: 20014.003.14 DRILLER: Gable Drilling Co. Inc. RIG: CME 550 LOGGED BY: Larry

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	RECOV.	W	NOTES
	TOPSOIL							
	FILL-Medium dense, brown orange red, clayey SAND		1		7-9-8	10		
890		5	2		3-5-6	14		
	RESIDUUM-Loose, brown orange red, clayey SAND		3		3-5-5	12		
BOW=886								
885	Stiff, yellowish red, sandy SILT (MH)	10	4		4-5-7	18	23	LL=57, PL=45, PI=11
	Medium dense, olive gray, silty SAND							
880		15	5		3-5-6	14		
	Loose, olive gray, silty SAND							
875		20	6		3-5-5	12		
	BORING TERMINATED AT 20 FEET							No groundwater encountered at time of boring
870		25						
865		30						
860		35						
855		40						

BOW-Bottom of Wall#1
LL-Liquid Limit
PL-Platic Limit
PI-Plasticity Index

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BORING LOG

CONTRACTED WITH: GeoSystems Engineering, Inc. BORING NO.: B-2
PROJECT NAME: Fayetteville Pedestrian Bridge DATE: June 25, 2015
JOB NO.: 20014.003.14 DRILLER: Gable Drilling Co. Inc. RIG: CME 550 LOGGED BY: Larry

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	RECOV.	W	NOTES
BOW=878	TOPSOIL							
	FILL-Loose, brown orange red, clayey SAND		1		1-2-3	12		
875	Loose, yellowish brown, clayey SAND							
		5 ▽	2		2-4-6	14		Groundwater encountered at 5 feet at time of boring
			3		2-3-6	12		
870	RESIDUUM-Very loose, brown orange, silty SAND							
		10	4		1-2-2	12		
865	Loose, dark yellowish brown, silty SAND							
		15	5		3-3-4	18		
860								
		20	6		3-4-4	12		
855	Medium dense, brown orange, silty SAND							
		25	7		6-8-8	12		
850								
		30	8		5-10-13	18		
845								
		35	9		7-12-15	18		
840	Medium dense, brown orange red, silty SAND							BOW-Bottom of Wall#1
		40	10		5-6-8	14		

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BORING LOG

CONTRACTED WITH: GeoSystems Engineering, Inc. BORING NO.: B-2
PROJECT NAME: Fayetteville Pedestrian Bridge DATE: June 25, 2015
JOB NO.: 20014.003.14 DRILLER: Gable Drilling Co. Inc. RIG: CME 550 LOGGED BY: Larry

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	RECOV.	W	NOTES
835	PWR-Very dense, black orange red, partially weathered rock	45	11		25-50/5"	12		
830	AUGER REFUSAL AT 48 FEET	50						
825		55						
820		60						
815		65						
810		70						
805		75						
800		80						
795		85						

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BORING LOG

CONTRACTED WITH: GeoSystems Engineering, Inc. BORING NO.: B-3
PROJECT NAME: Fayetteville Pedestrian Bridge DATE: June 25, 2015
JOB NO.: 20014.003.14 DRILLER: Gable Drilling Co. Inc. RIG: CME 550 LOGGED BY: Larry

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	RECOV.	W	NOTES
890	TOPSOIL							
	FILL-Medium dense, reddish brown, clayey SAND		1		3-4-8	12		
		5	2		4-6-6	14		
885			3		5-6-5	12		
BOW=882	Loose, reddish brown, clayey SAND	10	4		2-3-5	14		
880								
	RESIDUUM-Loose, gray orange, silty SAND	15	5		2-2-3	14		
875								
	Loose, brown orange, silty SAND	20	6		2-2-3	12		
870		▽						Groundwater encountered at 22 feet at time of boring
		25	7		4-4-4	12		
865								
	Medium dense, reddish yellow, silty SAND	30	8		4-5-11	18		
860								
	Loose, brown orange silty SAND	35	9		3-5-5	14		
855								BOW-Bottom of Wall#1
	Medium dense, brown orange red, silty SAND	40	10		6-9-11	14		
850								
	Medium dense, brown orange red, silty							

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BORING LOG

CONTRACTED WITH: GeoSystems Engineering, Inc. BORING NO.: B-3
PROJECT NAME: Fayetteville Pedestrian Bridge DATE: June 25, 2015
JOB NO.: 20014.003.14 DRILLER: Gable Drilling Co. Inc. RIG: CME 550 LOGGED BY: Larry

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	RECOV.	W	NOTES
	SAND							
		45	11		3-7-10	12		
845								
	PWR-Very dense, orange brown, partially weathered rock	50	12		20-50/4"	12		
840								
	AUGER REFUSAL AT 52 FEET	55						
835		60						
830		65						
825		70						
820		75						
815		80						
810		85						

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BORING LOG

CONTRACTED WITH: GeoSystems Engineering, Inc. BORING NO.: B-4
PROJECT NAME: Fayetteville Pedestrian Bridge DATE: June 25, 2015
JOB NO.: 20014.003.14 DRILLER: Gable Drilling Co. Inc. RIG: CME 550 LOGGED BY: Larry

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	RECOV.	W	NOTES
BOW=896	FILL-Gravel							
895	FILL-Medium dense, brown orange red, clayey SAND		1		2-5-6	12		
	RESIDUUM-Medium dense, brown orange red, clayey SAND	5	2		5-8-14	14		
890	Stiff, yellowish red, sandy SILT (ML)		3		3-4-6	12		LL=49, PL=41, PI=8
		10	4		3-5-8	18		
885		15	5		3-5-6	14		
880	Loose, olive gray, silty SAND	20	6		2-3-4	12		
875		25	7		2-4-4	12		
870		▽						Groundwater encountered at 27 feet at time of boring
	Medium dense, white brown orange, silty SAND	30	8		4-6-8	18		
865		35	9		3-6-7	18		
860		40	10		3-4-8	14		BOW-Bottom of Wall#2 LL-Liquid Limit PL-Platic Limit PI-Plasticity Index
855								

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BORING LOG

CONTRACTED WITH: GeoSystems Engineering, Inc. BORING NO.: B-4
PROJECT NAME: Fayetteville Pedestrian Bridge DATE: June 25, 2015
JOB NO.: 20014.003.14 DRILLER: Gable Drilling Co. Inc. RIG: CME 550 LOGGED BY: Larry

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	RECOV.	W	NOTES
	Medium dense, black orange red, silty SAND	45	11		5-8-10	12		
850		50	12		3-4-7	12		
845	Medium dense, light gray, silty SAND	55	13		4-6-7	14		
840		60	14		5-7-7	14		
	BORING TERMINATED at 60 FEET							
835		65						
830		70						
825		75						
820		80						
815		85						

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Office: 404.241.8722

BORING LOG

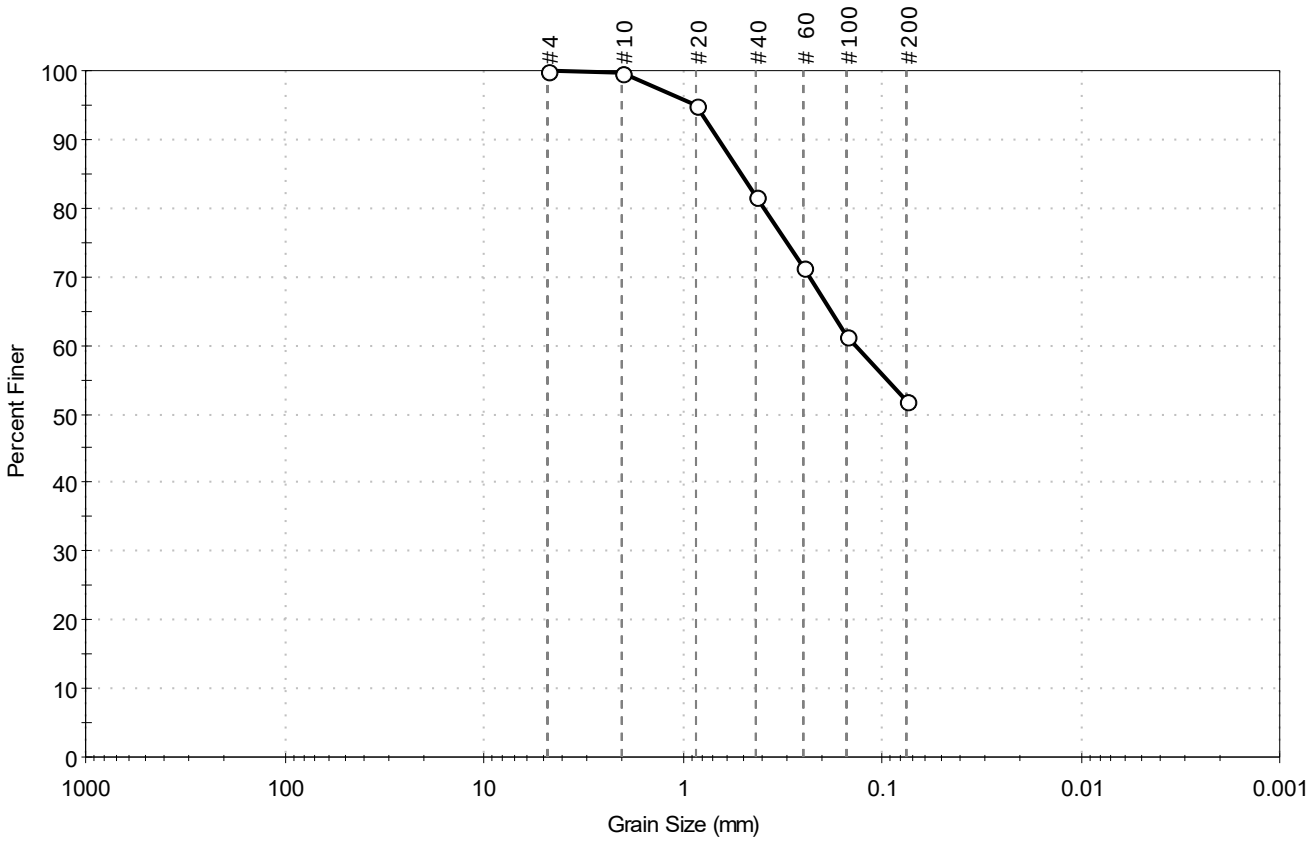
CONTRACTED WITH: GeoSystems Engineering, Inc. BORING NO.: B-5
PROJECT NAME: Fayetteville Pedestrian Bridge DATE: June 25, 2015
JOB NO.: 20014.003.14 DRILLER: Gable Drilling Co. Inc. RIG: CME 550 LOGGED BY: Larry

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	RECOV.	W	NOTES
905	TOPSOIL							
	RESIDUUM-Very stiff to stiff, red, sandy SILT (ML)		1		4-7-16	10		
BOW=904								
		5	2		4-7-8	12	13	LL=48, PL=34, PI=14
900	Medium dense, brown orange red, silty SAND		3		4-8-9	12		
		10	4		3-5-6	18		
895								
		15	5		4-6-7	14		
890								
		20	6		4-4-7	12		
	BORING TERMINATED AT 20 FEET							No groundwater encountered at time of boring
885								
		25						
880								
		30						
875								
		35						
870								
		40						
865								

BOW-Bottom of Wall#2
LL-Liquid Limit
PL-Platic Limit
PI-Plasticity Index

Client:	GeoSystems Engineering, Inc.				
Project:	Fayetteville Pedestrian Bridge/Walking Trail				
Location:	Fayetteville, Georgia			Project No:	GTX-306785
Boring ID:	B-1	Sample Type:	bag	Tested By:	twh
Sample ID:	S-4	Test Date:	08/02/17	Checked By:	MCM
Depth :	9.5 ft	Test Id:	286071		
Test Comment:	---				
Visual Description:	Moist, yellowish red sandy silt				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	48.1	51.9

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	95		
#40	0.42	82		
# 60	0.25	71		
#100	0.15	61		
#200	0.075	52		

Coefficients

D_{85} = 0.5055 mm	D_{30} = N/A
D_{60} = 0.1346 mm	D_{15} = N/A
D_{50} = N/A	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM Sandy Elastic silt (MH)

AASHTO Clayey Soils (A-7-5 (5))

Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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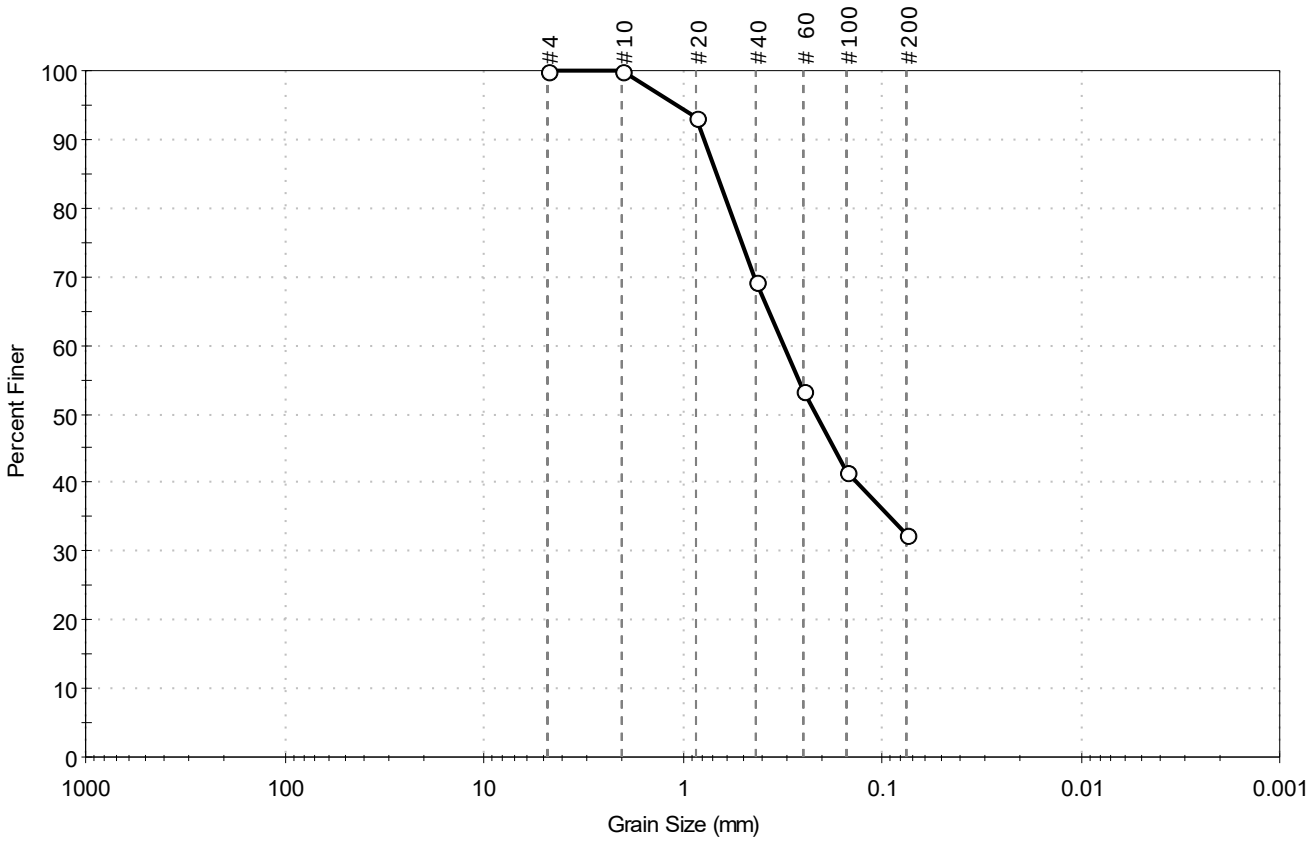
Client:	GeoSystems Engineering, Inc.				
Project:	Fayetteville Pedestrian Bridge/Walking Trail				
Location:	Fayetteville, Georgia			Project No:	GTX-306785
Boring ID:	B-1	Sample Type:	bag	Tested By:	twh
Sample ID:	S-5+S-6 Composite	Test Date:	08/02/17	Checked By:	MCM
Depth :	14.5-19.5 ft	Test Id:	286072		
Test Comment:	---				
Visual Description:	Moist, olive gray silty sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	67.5	32.5

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	93		
#40	0.42	69		
# 60	0.25	53		
#100	0.15	42		
#200	0.075	33		

Coefficients

D_{85} = 0.6691 mm	D_{30} = N/A
D_{60} = 0.3111 mm	D_{15} = N/A
D_{50} = 0.2156 mm	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

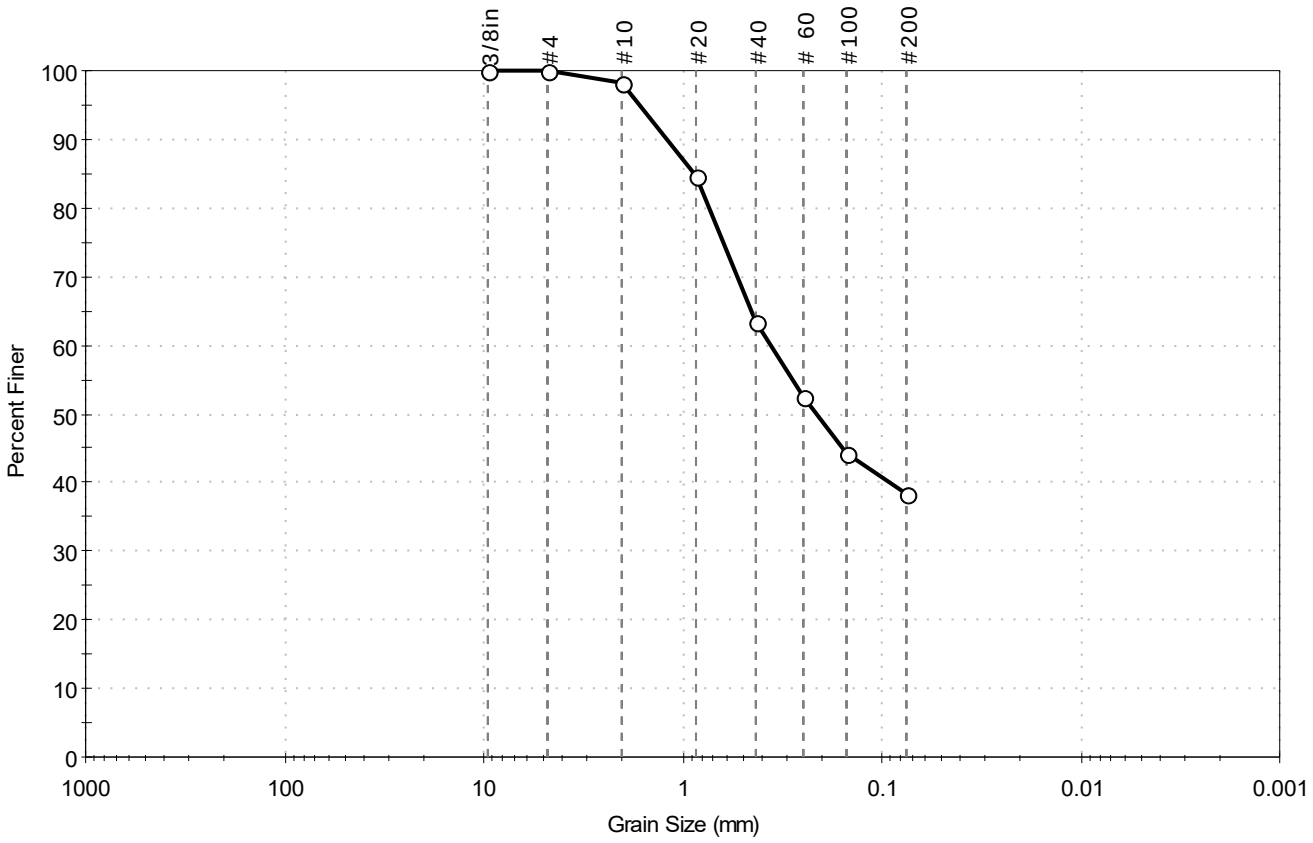
Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

Client:	GeoSystems Engineering, Inc.				
Project:	Fayetteville Pedestrian Bridge/Walking Trail				
Location:	Fayetteville, Georgia			Project No:	GTX-306785
Boring ID:	B-2	Sample Type:	bag	Tested By:	twh
Sample ID:	S-2+S-3 Composite	Test Date:	08/02/17	Checked By:	MCM
Depth :	4.5-7.0 ft	Test Id:	286073		
Test Comment:	---				
Visual Description:	Moist, yellowish brown clayey sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.1	61.5	38.4

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
3/8in	9.50	100		
#4	4.75	100		
#10	2.00	98		
#20	0.85	85		
#40	0.42	64		
# 60	0.25	52		
#100	0.15	44		
#200	0.075	38		

Coefficients

D_{85} = 0.8628 mm	D_{30} = N/A
D_{60} = 0.3593 mm	D_{15} = N/A
D_{50} = 0.2151 mm	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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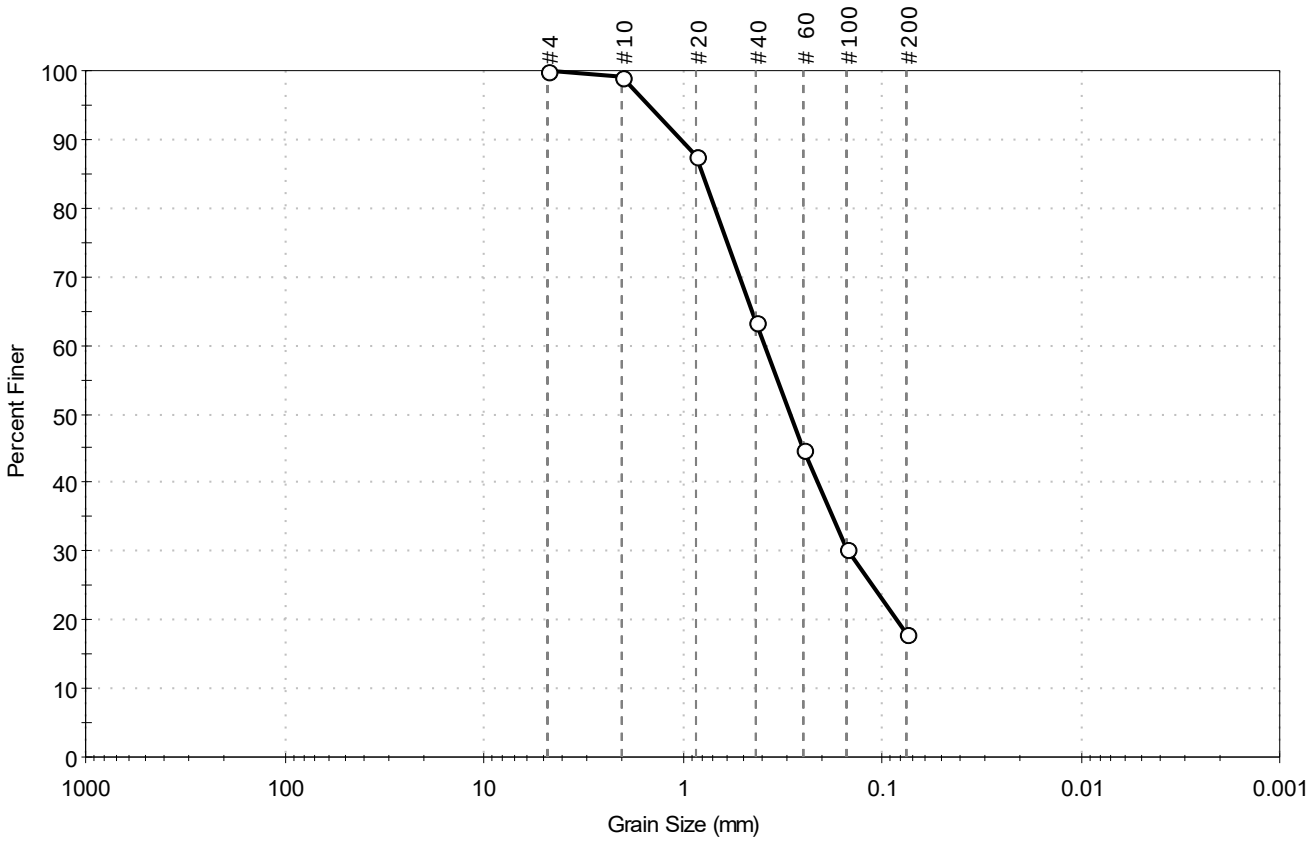
Client:	GeoSystems Engineering, Inc.				
Project:	Fayetteville Pedestrian Bridge/Walking Trail				
Location:	Fayetteville, Georgia			Project No:	GTX-306785
Boring ID:	B-2	Sample Type:	bag	Tested By:	twh
Sample ID:	S-6	Test Date:	08/02/17	Checked By:	MCM
Depth :	19.5 ft	Test Id:	286074		
Test Comment:	---				
Visual Description:	Moist, dark yellowish brown silty sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	81.9	18.1

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	99		
#20	0.85	88		
#40	0.42	63		
# 60	0.25	45		
#100	0.15	30		
#200	0.075	18		

Coefficients

D_{85} = 0.7863 mm	D_{30} = 0.1472 mm
D_{60} = 0.3850 mm	D_{15} = N/A
D_{50} = 0.2894 mm	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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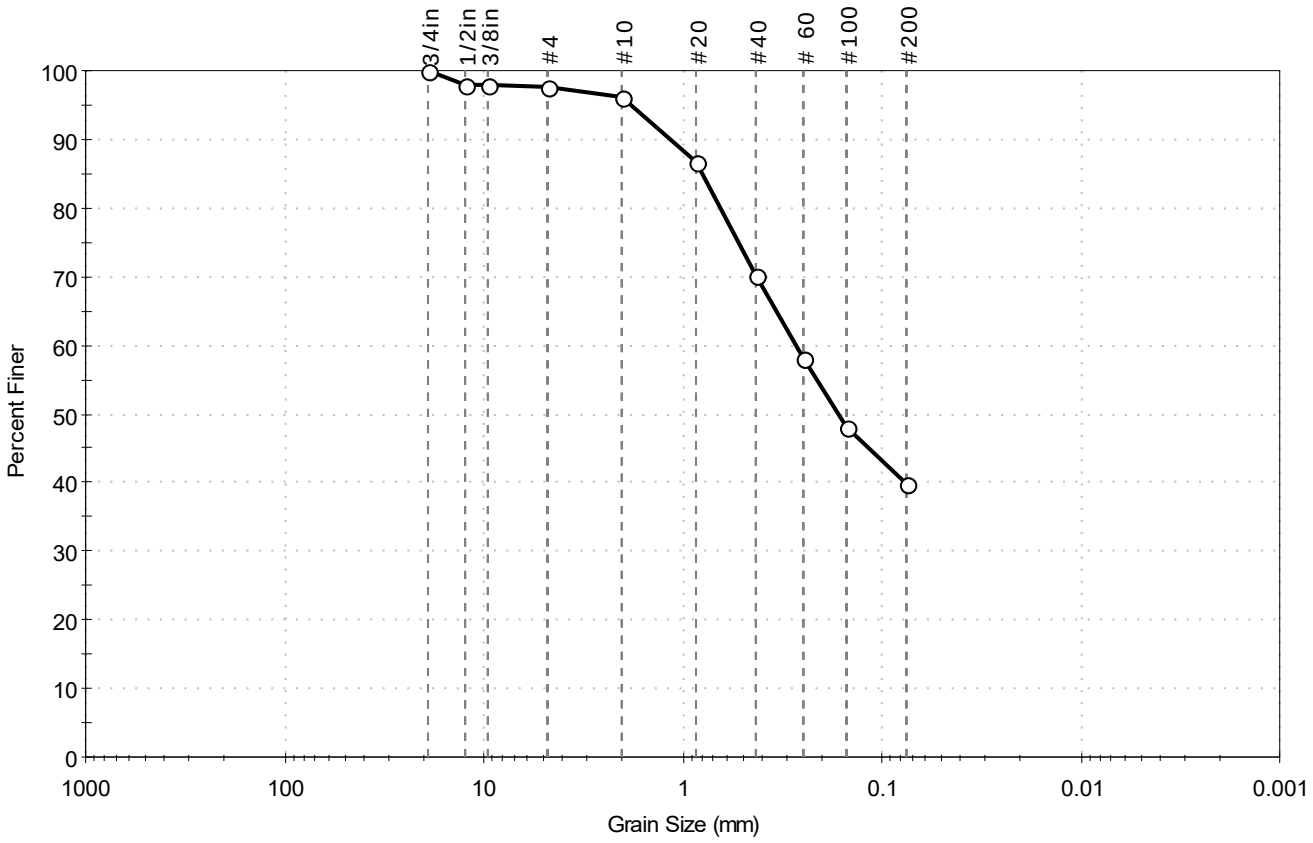
Client:	GeoSystems Engineering, Inc.				
Project:	Fayetteville Pedestrian Bridge/Walking Trail				
Location:	Fayetteville, Georgia			Project No:	GTX-306785
Boring ID:	B-3	Sample Type:	bag	Tested By:	twh
Sample ID:	S-3+S-4 Composite	Test Date:	08/02/17	Checked By:	MCM
Depth :	7.0-9.5 ft	Test Id:	286075		
Test Comment:	---				
Visual Description:	Moist, reddish brown clayey sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	2.4	57.6	40.0

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
3/4in	19.00	100		
1/2in	12.50	98		
3/8in	9.50	98		
#4	4.75	98		
#10	2.00	96		
#20	0.85	87		
#40	0.42	70		
# 60	0.25	58		
#100	0.15	48		
#200	0.075	40		

Coefficients

D_{85} = 0.7948 mm D_{30} = N/A

D_{60} = 0.2715 mm D_{15} = N/A

D_{50} = 0.1647 mm D_{10} = N/A

C_u = N/A C_c = N/A

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

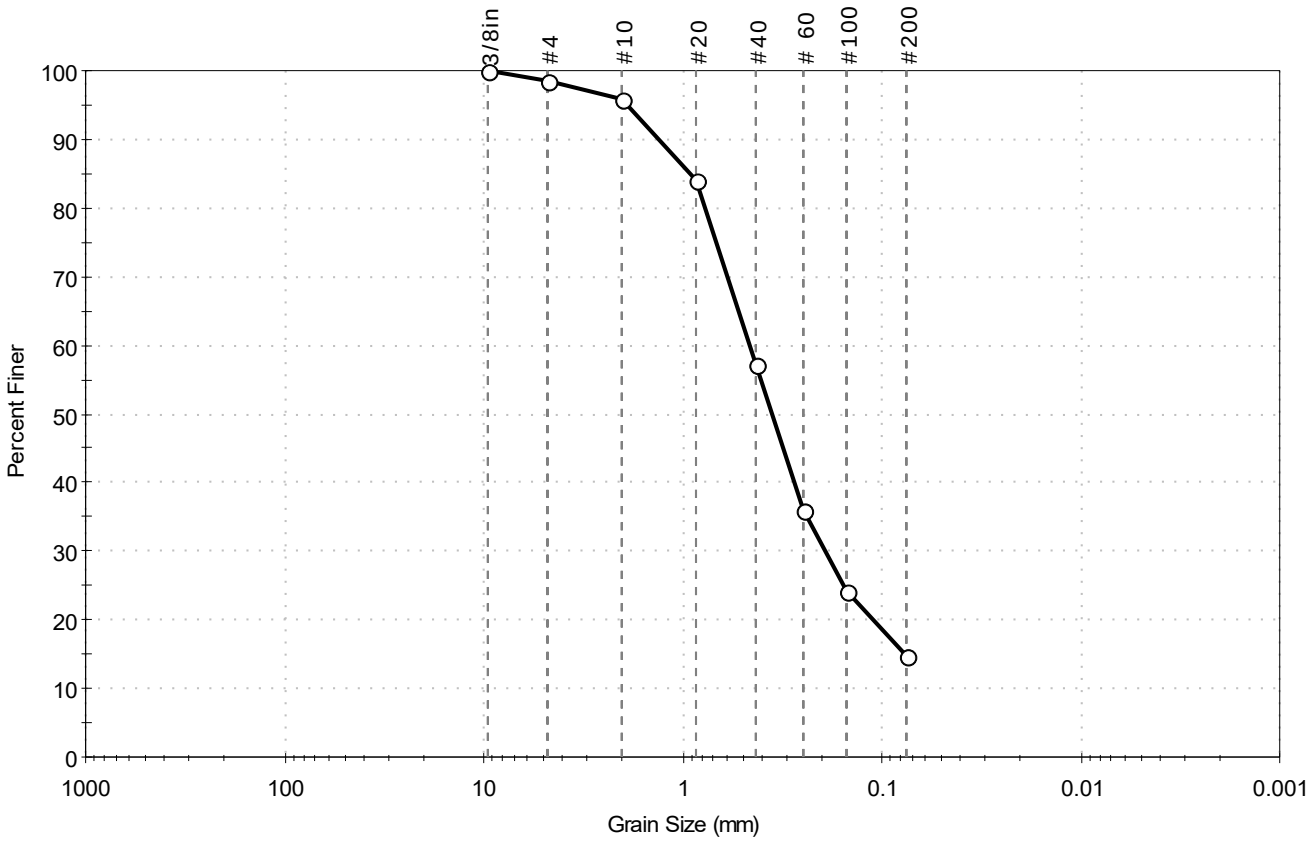
Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

Client:	GeoSystems Engineering, Inc.				
Project:	Fayetteville Pedestrian Bridge/Walking Trail				
Location:	Fayetteville, Georgia			Project No:	GTX-306785
Boring ID:	B-3	Sample Type:	bag	Tested By:	twh
Sample ID:	S-8	Test Date:	08/02/17	Checked By:	MCM
Depth :	29.5 ft	Test Id:	286076		
Test Comment:	---				
Visual Description:	Moist, reddish yellow silty sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	1.6	83.6	14.8

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
3/8in	9.50	100		
#4	4.75	98		
#10	2.00	96		
#20	0.85	84		
#40	0.42	57		
# 60	0.25	36		
#100	0.15	24		
#200	0.075	15		

Coefficients

D_{85} = 0.9104 mm	D_{30} = 0.1935 mm
D_{60} = 0.4570 mm	D_{15} = 0.0761 mm
D_{50} = 0.3554 mm	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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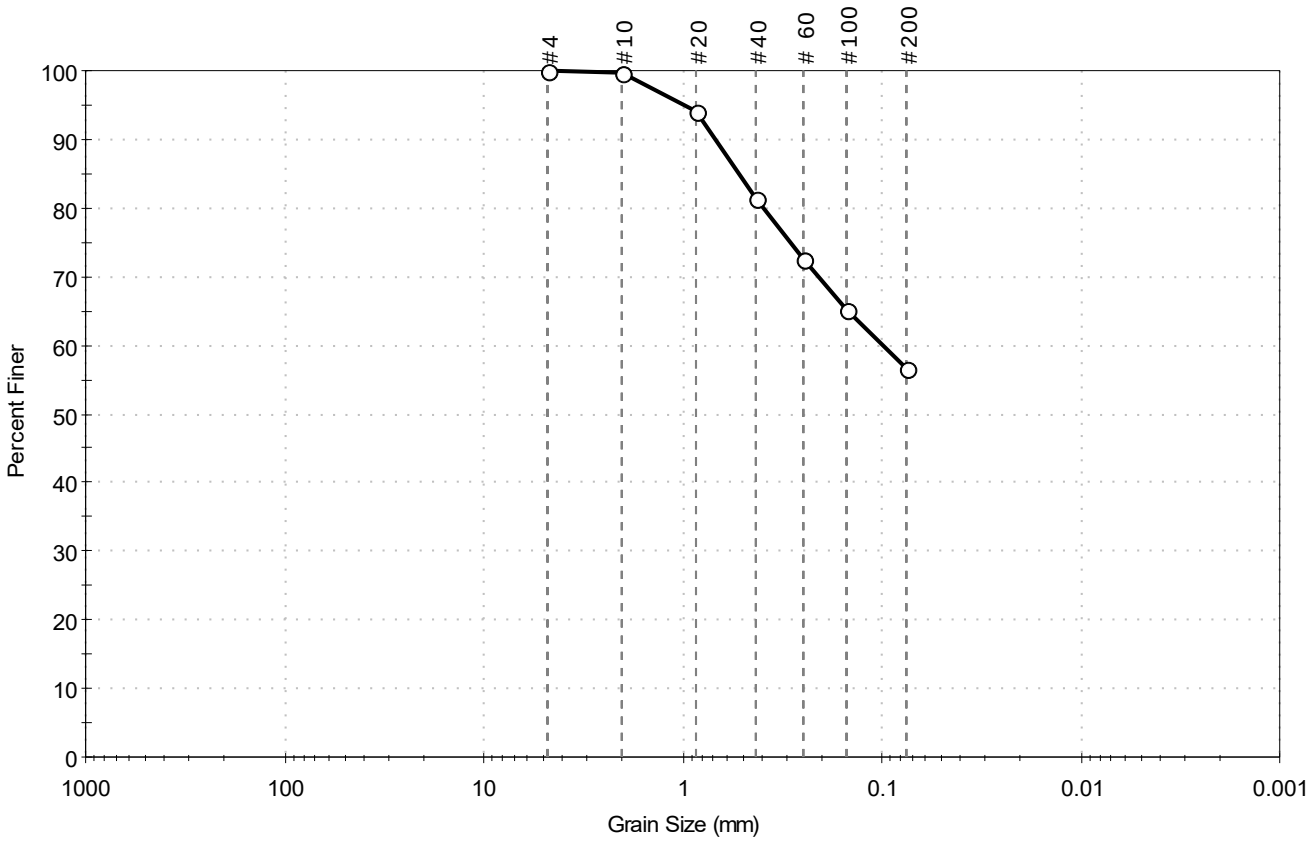
Client:	GeoSystems Engineering, Inc.				
Project:	Fayetteville Pedestrian Bridge/Walking Trail				
Location:	Fayetteville, Georgia			Project No:	GTX-306785
Boring ID:	B-4	Sample Type:	bag	Tested By:	twh
Sample ID:	S-3+S-4 Composite	Test Date:	08/02/17	Checked By:	MCM
Depth :	7.0-9.5 ft	Test Id:	286077		
Test Comment:	---				
Visual Description:	Moist, yellowish red sandy silt				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	43.5	56.5

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	94		
#40	0.42	81		
# 60	0.25	72		
#100	0.15	65		
#200	0.075	56		

Coefficients

D_{85} = 0.5191 mm	D_{30} = N/A
D_{60} = 0.0994 mm	D_{15} = N/A
D_{50} = N/A	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM Sandy Silt (ML)

AASHTO Silty Soils (A-5 (4))

Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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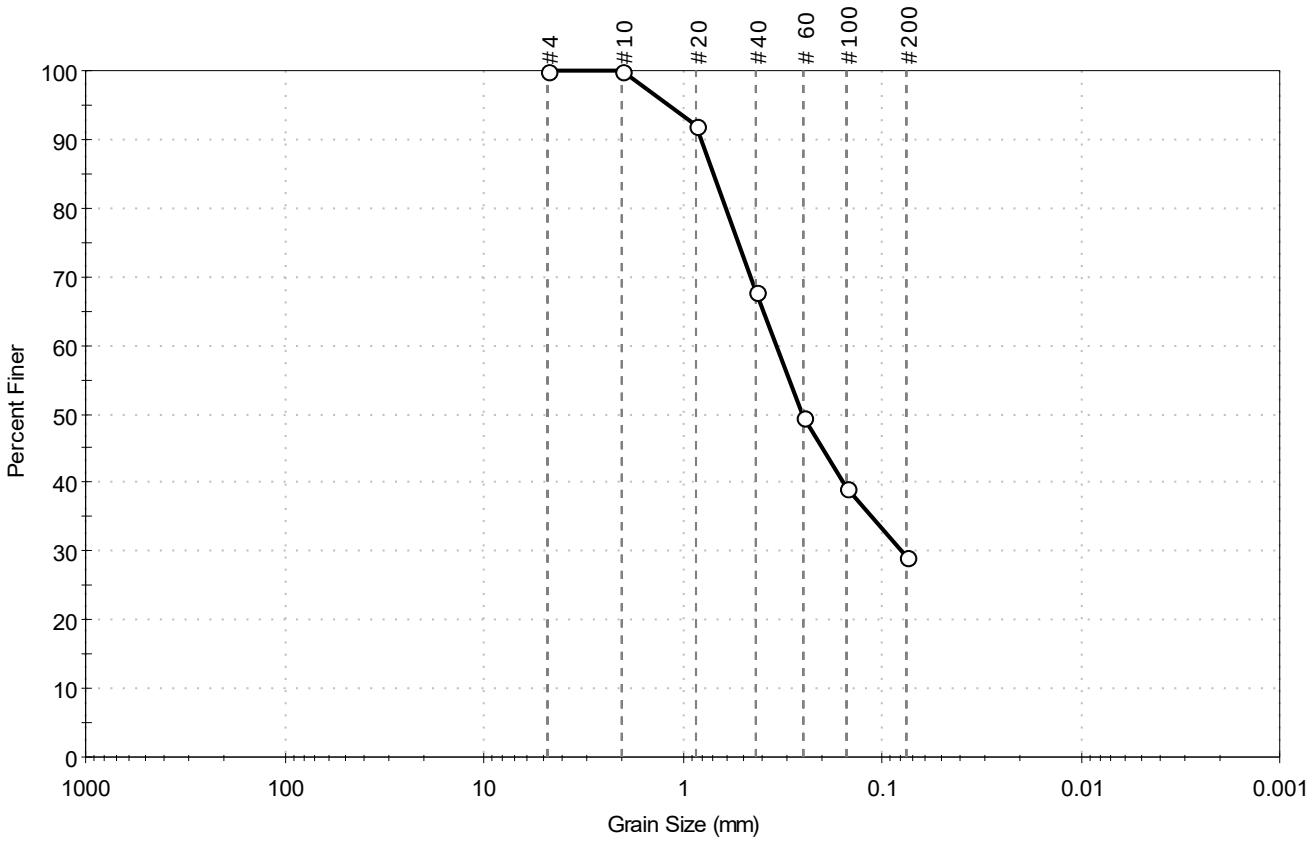
Client:	GeoSystems Engineering, Inc.				
Project:	Fayetteville Pedestrian Bridge/Walking Trail				
Location:	Fayetteville, Georgia			Project No:	GTX-306785
Boring ID:	B-4	Sample Type:	bag	Tested By:	twh
Sample ID:	S-7	Test Date:	08/02/17	Checked By:	MCM
Depth :	24.5 ft	Test Id:	286078		
Test Comment:	---				
Visual Description:	Moist, olive gray silty sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	70.8	29.2

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	92		
#40	0.42	68		
# 60	0.25	50		
#100	0.15	39		
#200	0.075	29		

Coefficients

D_{85} = 0.6957 mm	D_{30} = 0.0792 mm
D_{60} = 0.3388 mm	D_{15} = N/A
D_{50} = 0.2535 mm	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

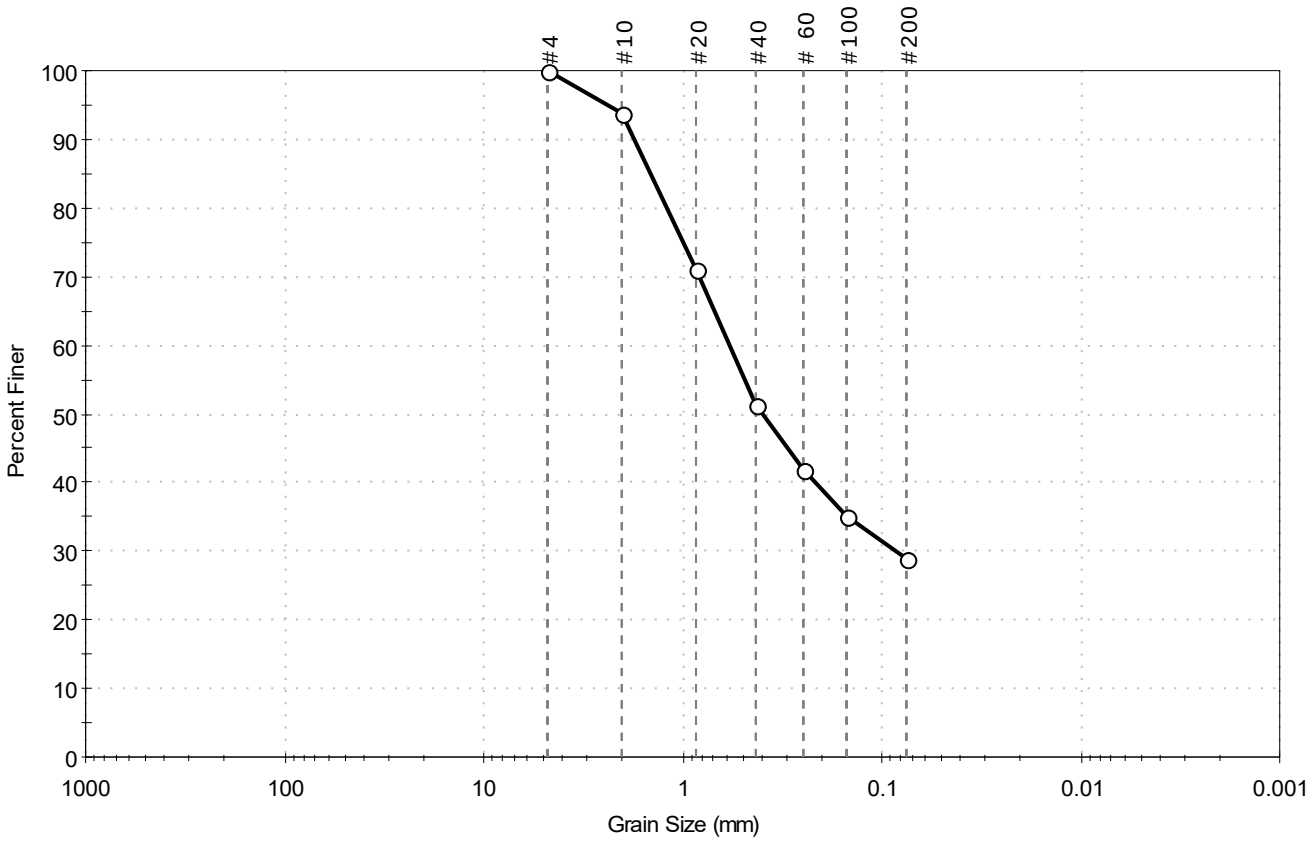
Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

Client:	GeoSystems Engineering, Inc.				
Project:	Fayetteville Pedestrian Bridge/Walking Trail				
Location:	Fayetteville, Georgia			Project No:	GTX-306785
Boring ID:	B-4	Sample Type:	bag	Tested By:	twh
Sample ID:	S-13+S-14 Composite	Test Date:	08/02/17	Checked By:	MCM
Depth :	54.5-59.5 ft	Test Id:	286079		
Test Comment:	---				
Visual Description:	Moist, light gray silty sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	71.1	28.9

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	94		
#20	0.85	71		
#40	0.42	51		
# 60	0.25	42		
#100	0.15	35		
#200	0.075	29		

Coefficients

D_{85} = 1.4299 mm	D_{30} = 0.0847 mm
D_{60} = 0.5754 mm	D_{15} = N/A
D_{50} = 0.3948 mm	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample / Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

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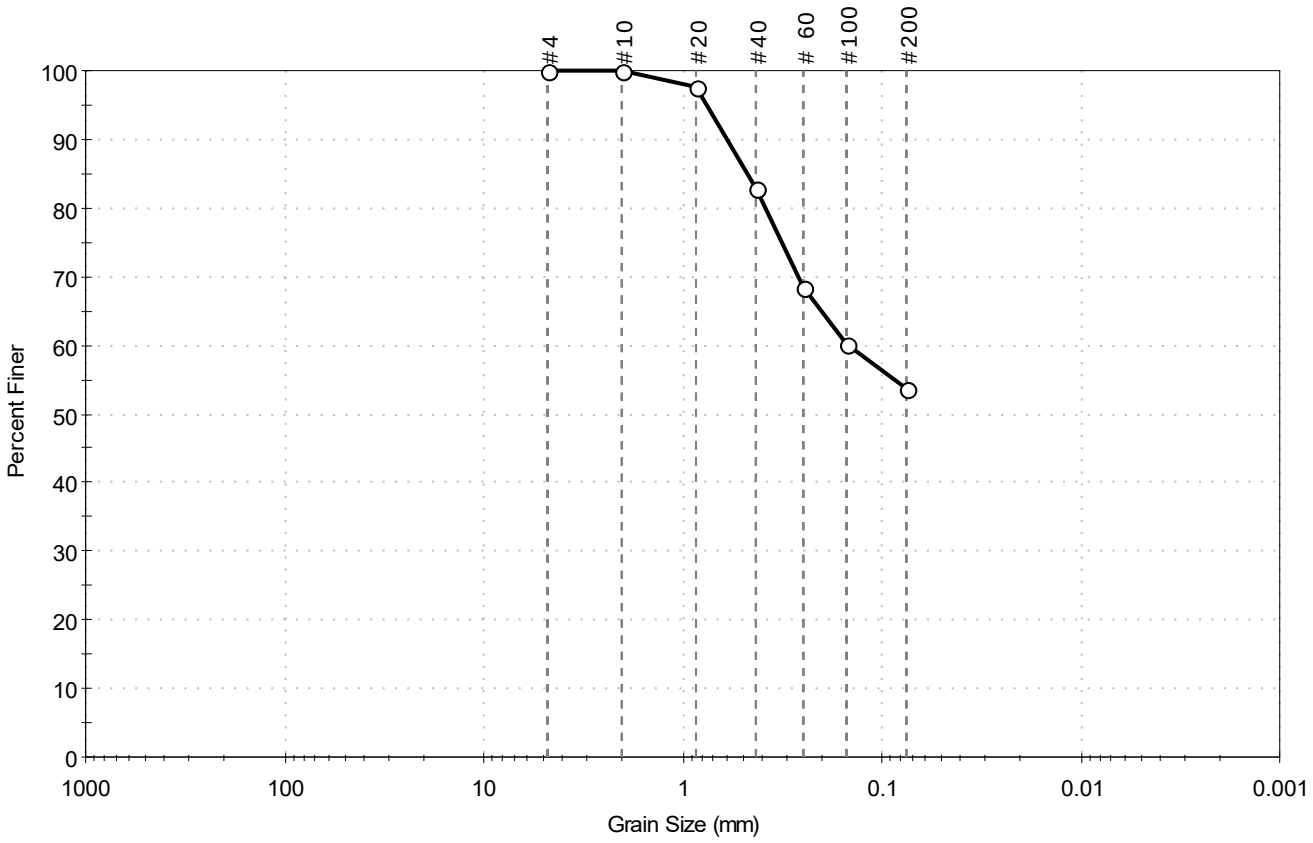
GeoTesting EXPRESS

Client:	GeoSystems Engineering, Inc.				
Project:	Fayetteville Pedestrian Bridge/Walking Trail				
Location:	Fayetteville, Georgia			Project No:	GTX-306785
Boring ID:	B-5	Sample Type:	bag	Tested By:	twh
Sample ID:	S-1+S-2 Composite	Test Date:	08/02/17	Checked By:	MCM
Depth :	1.0-4.5 ft	Test Id:	286080		
Test Comment:	---				
Visual Description:	Moist, red sandy silt				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	46.3	53.7

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	98		
#40	0.42	83		
# 60	0.25	68		
#100	0.15	60		
#200	0.075	54		

Coefficients

D_{85} = 0.4722 mm	D_{30} = N/A
D_{60} = 0.1484 mm	D_{15} = N/A
D_{50} = N/A	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM Sandy Silt (ML)

AASHTO Clayey Soils (A-7-5 (6))

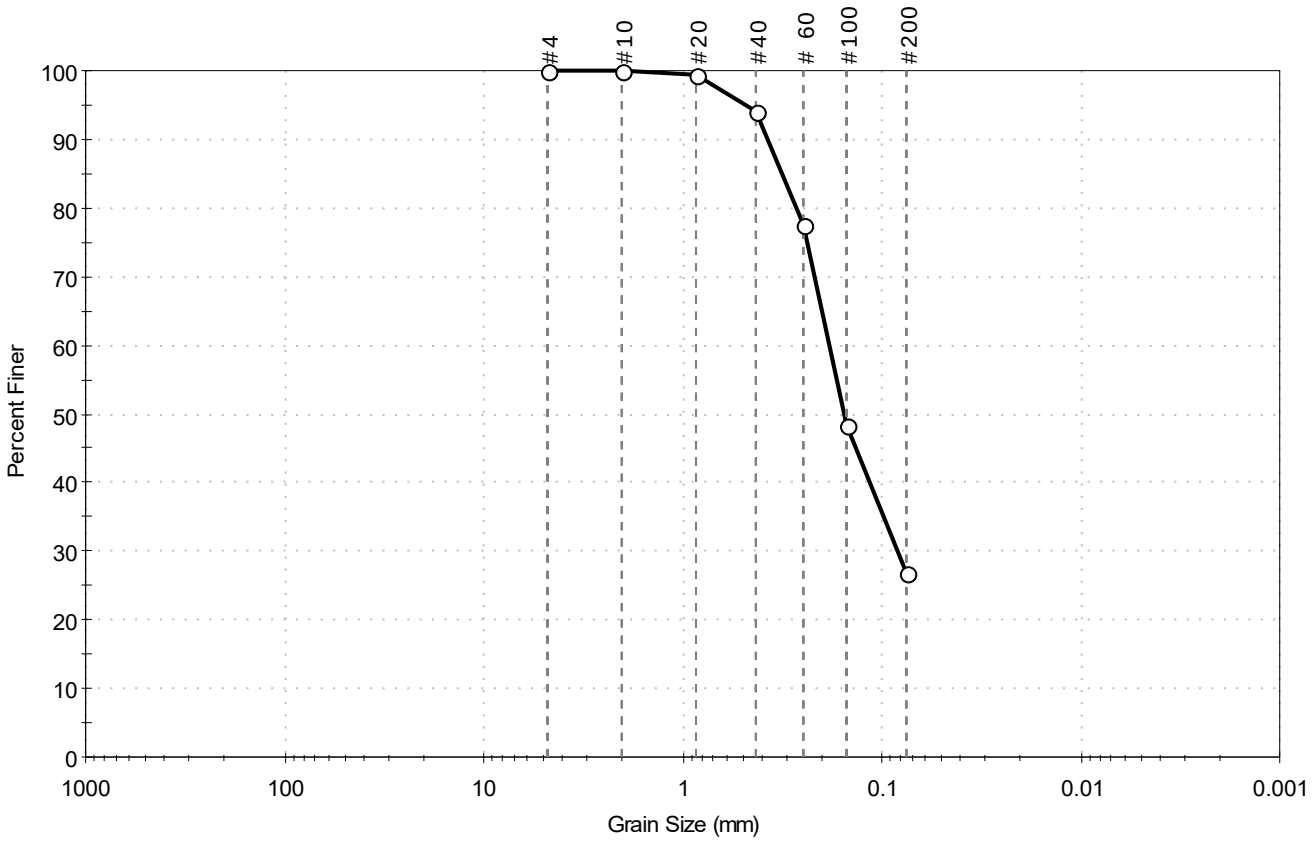
Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

Client:	GeoSystems Engineering, Inc.				
Project:	Fayetteville Pedestrian Bridge/Walking Trail				
Location:	Fayetteville, Georgia			Project No:	GTX-306785
Boring ID:	B-5	Sample Type:	bag	Tested By:	twh
Sample ID:	S-5	Test Date:	08/02/17	Checked By:	MCM
Depth :	14.5	Test Id:	286081		
Test Comment:	---				
Visual Description:	Moist, red silty sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	73.3	26.7

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	100		
#40	0.42	94		
# 60	0.25	78		
#100	0.15	48		
#200	0.075	27		

Coefficients

D_{85} = 0.3169 mm	D_{30} = 0.0832 mm
D_{60} = 0.1835 mm	D_{15} = N/A
D_{50} = 0.1540 mm	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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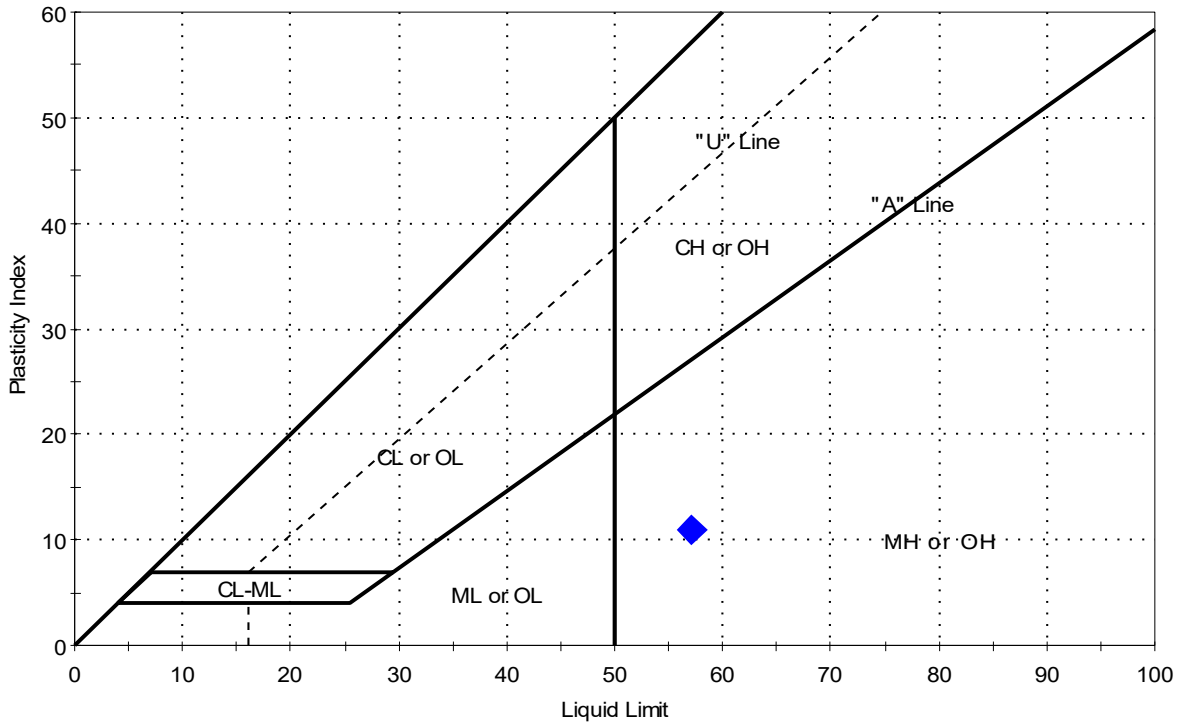
Client:	GeoSystems Engineering, Inc.				
Project:	Fayetteville Pedestrian Bridge/Walking Trail				
Location:	Fayetteville, Georgia			Project No:	GTX-306785
Boring ID:	B-1	Sample Type:	bag	Tested By:	twh
Sample ID:	S-4	Test Date:	08/04/17	Checked By:	MCM
Depth :	9.5 ft	Test Id:	286109		
Test Comment:	---				
Visual Description:	Moist, yellowish red sandy silt				
Sample Comment:	---				

Atterberg Limits - ASTM D4318

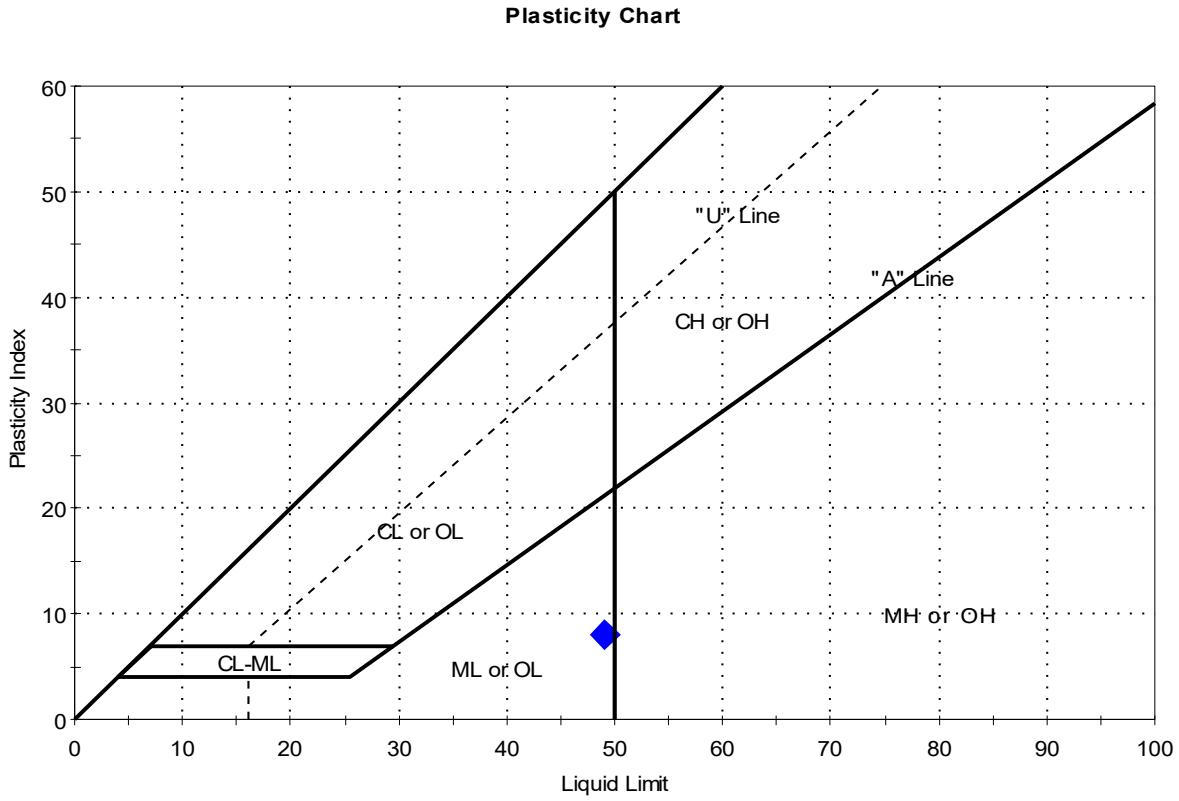


Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	S-4	B-1	9.5 ft	23	57	46	11	-2.1	Sandy Elastic silt (MH)

Sample Prepared using the WET method
18% Retained on #40 Sieve
Dry Strength: MEDIUM
Dilatancy: RAPID
Toughness: LOW

Client:	GeoSystems Engineering, Inc.				
Project:	Fayetteville Pedestrian Bridge/Walking Trail				
Location:	Fayetteville, Georgia			Project No:	GTX-306785
Boring ID:	B-4	Sample Type:	bag	Tested By:	n/a
Sample ID:	S-3+S-4 Composite	Test Date:	08/04/17	Checked By:	MCM
Depth :	7.0-9.5 ft	Test Id:	286112		
Test Comment:	---				
Visual Description:	Moist, yellowish red sandy silt				
Sample Comment:	---				

Atterberg Limits - ASTM D4318



Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	S-3+S-4 Composite	B-4	7.0-9.5 ft	22	49	41	8	-2.4	Sandy Silt (ML)

Sample Prepared using the WET method
19% Retained on #40 Sieve
Dry Strength: MEDIUM
Dilatancy: SLOW
Toughness: LOW

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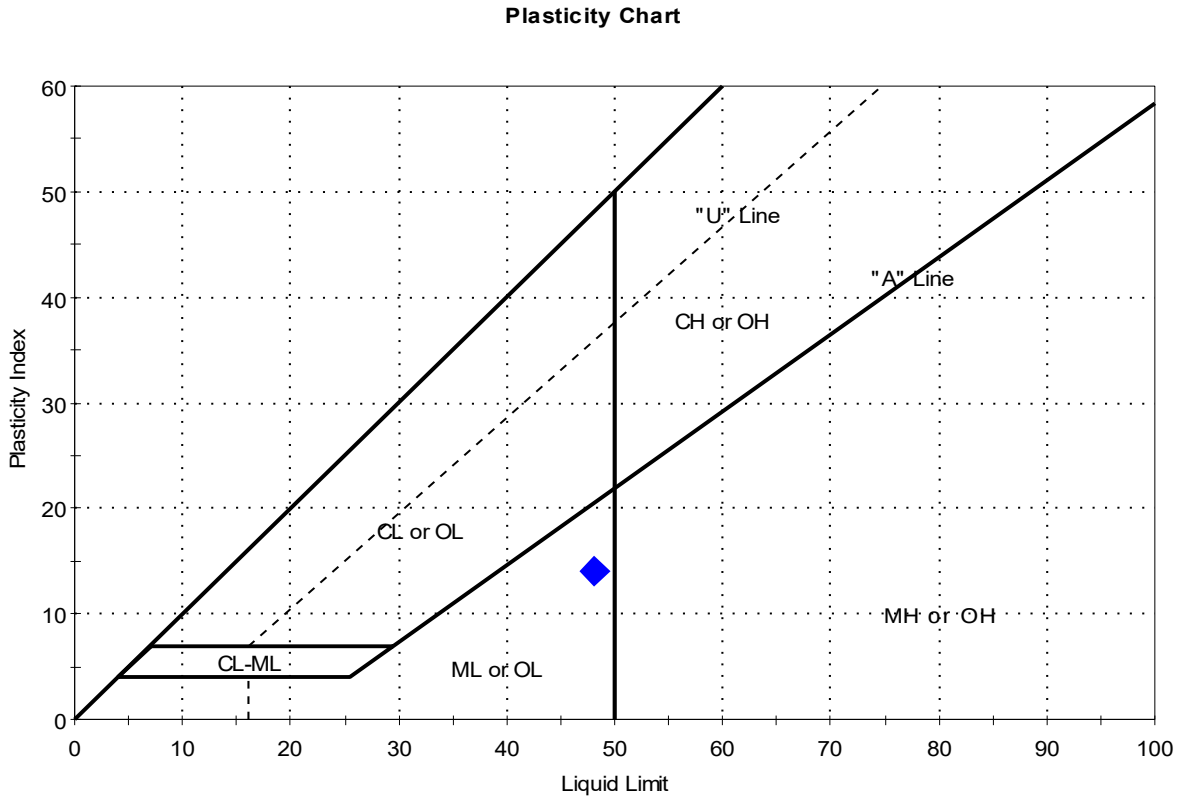
Client:	GeoSystems Engineering, Inc.				
Project:	Fayetteville Pedestrian Bridge/Walking Trail				
Location:	Fayetteville, Georgia			Project No:	GTX-306785
Boring ID:	B-5	Sample Type:	bag	Tested By:	twh
Sample ID:	S-1+S-2 Composite	Test Date:	08/04/17	Checked By:	MCM
Depth :	1.0-4.5 ft	Test Id:	286111		
Test Comment:	---				
Visual Description:	Moist, red sandy silt				
Sample Comment:	---				

Atterberg Limits - ASTM D4318



Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	S-1+S-2 Composite	B-5	1.0-4.5 ft	13	48	34	14	-1.5	Sandy Silt (ML)

Sample Prepared using the WET method

17% Retained on #40 Sieve

Dry Strength: MEDIUM

Dilatancy: SLOW

Toughness: LOW

ATTACHMENT B

APILE & GRLWEAP CALCULATIONS
BENT 1 (NORTH-BORING B-4)
BENT 2 (SOUTH-BORING B-3)

==========

APILE for Windows, Version 2015.7.6

Serial Number : 139304252

A Program for Analyzing the Axial Capacity
and Short-term Settlement of Driven Piles
under Axial Loading.

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This program is licensed to :

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Path to file locations : C:\Users\lmullins\Documents\Calculations\APILE Data\
Name of input data file : FPB B4-65_FA.4.ap7d
Name of output file : FPB B4-65_FA.4.ap7o
Name of plot output file : FPB B4-65_FA.4.ap7p

Time and Date of Analysis

Date: September 15, 2017 Time: 17:02:11

****
* INPUT INFORMATION *
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Fayetteville Pedestrian Bridge - North Bent (B-4) HP14x89 at 65 feet

DESIGNER : LDM

JOB NUMBER : GeoSystems 15-2511

METHOD FOR UNIT LOAD TRANSFERS :

- FHWA (Federal Highway Administration)
  Unfactored Unit Side Friction and Unit Side Resistance are used.

COMPUTATION METHOD(S) FOR PILE CAPACITY :

- FHWA (Federal Highway Administration)

TYPE OF LOADING :
- COMPRESSION

PILE TYPE :

H-Pile/Steel Pile

DATA FOR AXIAL STIFFNESS :

- MODULUS OF ELASTICITY = 0.290E+08 PSI
- CROSS SECTION AREA = 203.23 IN2

NONCIRCULAR PILE PROPERTIES :

- TOTAL PILE LENGTH, TL = 65.00 FT.
- PILE STICKUP LENGTH, PSL = 0.00 FT.
- ZERO FRICTION LENGTH, ZFL = 0.00 FT.
- PERIMETER OF PILE = 57.05 IN.
- TIP AREA OF PILE = 203.23 IN2
- INCREMENT OF PILE LENGTH USED IN COMPUTATION = 1.00 FT.

SOIL INFORMATIONS :

DEPTH FT.	SOIL TYPE	LATERAL EARTH PRESSURE	EFFECTIVE UNIT WEIGHT LB/CF	FRICTION ANGLE DEGREES	BEARING CAPACITY FACTOR
0.00	SAND	0.00	115.00	28.00	0.00
6.00	SAND	0.00	115.00	30.00	0.00
6.00	CLAY	0.00	115.00	0.00	0.00
18.00	CLAY	0.00	115.00	0.00	0.00
18.00	SAND	0.00	115.00	28.00	0.00
20.00	SAND	0.00	115.00	28.00	0.00
20.00	SAND	0.00	51.00	28.00	0.00
28.00	SAND	0.00	51.00	28.00	0.00
28.00	SAND	0.00	51.00	30.00	0.00
70.00	SAND	0.00	51.00	30.00	0.00

MAXIMUM UNIT FRICTION KSF	MAXIMUM UNIT BEARING KSF	UNDISTURB SHEAR STRENGTH KSF	REMOLDED SHEAR STRENGTH KSF	BLOW COUNT	UNIT SKIN FRICTION KSF	UNIT END BEARING KSF
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	1.10	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	1.10	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00

* MAXIMUM UNIT FRICTION AND/OR MAXIMUM UNIT BEARING WERE SET TO BE 0.10E+08 BECAUSE THE USER DOES NOT PLAN TO LIMIT THE COMPUTED DATA.

DEPTH FT.	LRFD FACTOR ON UNIT FRICTION	LRFD FACTOR ON UNIT BEARING
0.00	1.000	1.000
6.00	1.000	1.000
6.00	1.000	1.000
18.00	1.000	1.000
18.00	1.000	1.000
20.00	1.000	1.000
20.00	1.000	1.000
28.00	1.000	1.000
28.00	1.000	1.000
70.00	1.000	1.000

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****
* COMPUTATION RESULT *
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****
* FED. HWY. METHOD *
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PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	1.2	1.2
1.00	0.1	2.5	2.6
2.00	0.5	4.5	5.1
3.00	1.2	7.4	8.7
4.00	2.2	10.2	12.4
5.00	3.6	12.1	15.7
6.00	5.2	13.5	18.7
7.00	8.8	14.1	22.9
8.00	14.0	14.1	28.1
9.00	19.2	14.0	33.2
10.00	24.4	14.0	38.4
11.00	29.7	14.0	43.6
12.00	34.9	14.0	48.9
13.00	40.1	14.0	54.1
14.00	45.4	14.0	59.3
15.00	50.6	14.0	64.6
16.00	55.8	14.3	70.1
17.00	61.0	15.3	76.4
18.00	66.3	16.4	82.7
19.00	71.4	17.4	88.8
20.00	76.5	18.5	95.0
21.00	81.7	18.8	100.5
22.00	87.1	18.8	105.9
23.00	92.6	18.8	111.4
24.00	98.2	18.8	117.0
25.00	104.0	18.8	122.8
26.00	109.8	18.8	128.6
27.00	115.8	18.8	134.6
28.00	121.9	18.8	140.7

29.00	128.7	18.8	147.5
30.00	136.2	18.8	155.0
31.00	143.9	18.8	162.7
32.00	151.6	18.8	170.4
33.00	159.6	18.8	178.4
34.00	167.6	18.8	186.4
35.00	175.9	18.8	194.6
36.00	184.2	18.8	203.0
37.00	192.7	18.8	211.5
38.00	201.3	18.8	220.1
39.00	210.0	18.8	228.8
40.00	218.9	18.8	237.7
41.00	228.0	18.8	246.8
42.00	237.1	18.8	255.9
43.00	246.5	18.8	265.2
44.00	255.9	18.8	274.7
45.00	265.5	18.8	284.3
46.00	275.2	18.8	294.0
47.00	285.1	18.8	303.9
48.00	295.1	18.8	313.8
49.00	305.2	18.8	324.0
50.00	315.5	18.8	334.3
51.00	325.9	18.8	344.7
52.00	336.4	18.8	355.2
53.00	347.1	18.8	365.9
54.00	357.9	18.8	376.7
55.00	368.9	18.8	387.7
56.00	380.0	18.8	398.8
57.00	391.2	18.8	410.0
58.00	402.6	18.8	421.4
59.00	414.1	18.8	432.9
60.00	425.7	18.8	444.5
61.00	437.5	18.8	456.3
62.00	449.4	18.8	468.2
63.00	461.5	18.8	480.3
64.00	473.7	18.8	492.5
65.00	486.0	18.8	504.8

NOTES:
- AN ASTERISK IS PLACED IN THE END-BEARING COLUMN IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.

****
* COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
* CURVES FOR AXIAL LOADING *
****

T-Z CURVE NO.	NO. OF POINTS	DEPTH TO CURVE FT.	LOAD TRANSFER PSI	PILE MOVEMENT IN.
1	10	0.0000E+00		
			0.0000E+00	0.0000E+00
			0.5920E-01	0.1000E-01
			0.1184E+00	0.2000E-01
			0.2368E+00	0.4000E-01
			0.3552E+00	0.6000E-01
			0.4736E+00	0.8000E-01
			0.5328E+00	0.9000E-01

			0.5920E+00	0.1000E+00
			0.5920E+00	0.5000E+00
			0.5920E+00	0.2000E+01
2	10	0.3025E+01		
			0.0000E+00	0.0000E+00
			0.1697E+00	0.1000E-01
			0.3394E+00	0.2000E-01
			0.6787E+00	0.4000E-01
			0.1018E+01	0.6000E-01
			0.1357E+01	0.8000E-01
			0.1527E+01	0.9000E-01
			0.1697E+01	0.1000E+00
			0.1697E+01	0.5000E+00
			0.1697E+01	0.2000E+01
3	10	0.5958E+01		
			0.0000E+00	0.0000E+00
			0.3795E+00	0.1000E-01
			0.7590E+00	0.2000E-01
			0.1518E+01	0.4000E-01
			0.2277E+01	0.6000E-01
			0.3036E+01	0.8000E-01
			0.3416E+01	0.9000E-01
			0.3795E+01	0.1000E+00
			0.3795E+01	0.5000E+00
			0.3795E+01	0.2000E+01
4	10	0.6000E+01		
			0.0000E+00	0.0000E+00
			0.1920E+01	0.2906E-01
			0.3200E+01	0.5629E-01
			0.4800E+01	0.1035E+00
			0.5760E+01	0.1453E+00
			0.6400E+01	0.1816E+00
			0.5760E+01	0.3632E+00
			0.5760E+01	0.5448E+00
			0.5760E+01	0.9080E+00
			0.5760E+01	0.3632E+01
5	10	0.1203E+02		
			0.0000E+00	0.0000E+00
			0.2292E+01	0.2906E-01
			0.3819E+01	0.5629E-01
			0.5729E+01	0.1035E+00
			0.6875E+01	0.1453E+00
			0.7639E+01	0.1816E+00
			0.6875E+01	0.3632E+00
			0.6875E+01	0.5448E+00
			0.6875E+01	0.9080E+00
			0.6875E+01	0.3632E+01
6	10	0.1796E+02		
			0.0000E+00	0.0000E+00
			0.2262E+01	0.2906E-01
			0.3769E+01	0.5629E-01
			0.5654E+01	0.1035E+00
			0.6785E+01	0.1453E+00
			0.7539E+01	0.1816E+00
			0.6785E+01	0.3632E+00
			0.6785E+01	0.5448E+00
			0.6785E+01	0.9080E+00
			0.6785E+01	0.3632E+01
7	10	0.1800E+02		
			0.0000E+00	0.0000E+00
			0.7434E+00	0.1000E-01
			0.1487E+01	0.2000E-01
			0.2974E+01	0.4000E-01

			0.4460E+01	0.6000E-01
			0.5947E+01	0.8000E-01
			0.6691E+01	0.9000E-01
			0.7434E+01	0.1000E+00
			0.7434E+01	0.5000E+00
			0.7434E+01	0.2000E+01
8	10	0.1903E+02		
			0.0000E+00	0.0000E+00
			0.7567E+00	0.1000E-01
			0.1513E+01	0.2000E-01
			0.3027E+01	0.4000E-01
			0.4540E+01	0.6000E-01
			0.6053E+01	0.8000E-01
			0.6810E+01	0.9000E-01
			0.7567E+01	0.1000E+00
			0.7567E+01	0.5000E+00
			0.7567E+01	0.2000E+01
9	10	0.1996E+02		
			0.0000E+00	0.0000E+00
			0.7567E+00	0.1000E-01
			0.1513E+01	0.2000E-01
			0.3027E+01	0.4000E-01
			0.4540E+01	0.6000E-01
			0.6053E+01	0.8000E-01
			0.6810E+01	0.9000E-01
			0.7567E+01	0.1000E+00
			0.7567E+01	0.5000E+00
			0.7567E+01	0.2000E+01
10	10	0.2000E+02		
			0.0000E+00	0.0000E+00
			0.7789E+00	0.1000E-01
			0.1558E+01	0.2000E-01
			0.3115E+01	0.4000E-01
			0.4673E+01	0.6000E-01
			0.6231E+01	0.8000E-01
			0.7010E+01	0.9000E-01
			0.7789E+01	0.1000E+00
			0.7789E+01	0.5000E+00
			0.7789E+01	0.2000E+01
11	10	0.2403E+02		
			0.0000E+00	0.0000E+00
			0.8464E+00	0.1000E-01
			0.1693E+01	0.2000E-01
			0.3386E+01	0.4000E-01
			0.5079E+01	0.6000E-01
			0.6772E+01	0.8000E-01
			0.7618E+01	0.9000E-01
			0.8464E+01	0.1000E+00
			0.8464E+01	0.5000E+00
			0.8464E+01	0.2000E+01
12	10	0.2796E+02		
			0.0000E+00	0.0000E+00
			0.9406E+00	0.1000E-01
			0.1881E+01	0.2000E-01
			0.3762E+01	0.4000E-01
			0.5644E+01	0.6000E-01
			0.7525E+01	0.8000E-01
			0.8466E+01	0.9000E-01
			0.9406E+01	0.1000E+00
			0.9406E+01	0.5000E+00
			0.9406E+01	0.2000E+01
13	10	0.2800E+02		
			0.0000E+00	0.0000E+00

			0.1045E+01	0.1000E-01
			0.2091E+01	0.2000E-01
			0.4181E+01	0.4000E-01
			0.6272E+01	0.6000E-01
			0.8362E+01	0.8000E-01
			0.9408E+01	0.9000E-01
			0.1045E+02	0.1000E+00
			0.1045E+02	0.5000E+00
			0.1045E+02	0.2000E+01
14	10	0.4903E+02		
			0.0000E+00	0.0000E+00
			0.1510E+01	0.1000E-01
			0.3021E+01	0.2000E-01
			0.6041E+01	0.4000E-01
			0.9062E+01	0.6000E-01
			0.1208E+02	0.8000E-01
			0.1359E+02	0.9000E-01
			0.1510E+02	0.1000E+00
			0.1510E+02	0.5000E+00
			0.1510E+02	0.2000E+01
15	10	0.6996E+02		
			0.0000E+00	0.0000E+00
			0.1802E+01	0.1000E-01
			0.3604E+01	0.2000E-01
			0.7208E+01	0.4000E-01
			0.1081E+02	0.6000E-01
			0.1442E+02	0.8000E-01
			0.1622E+02	0.9000E-01
			0.1802E+02	0.1000E+00
			0.1802E+02	0.5000E+00
			0.1802E+02	0.2000E+01

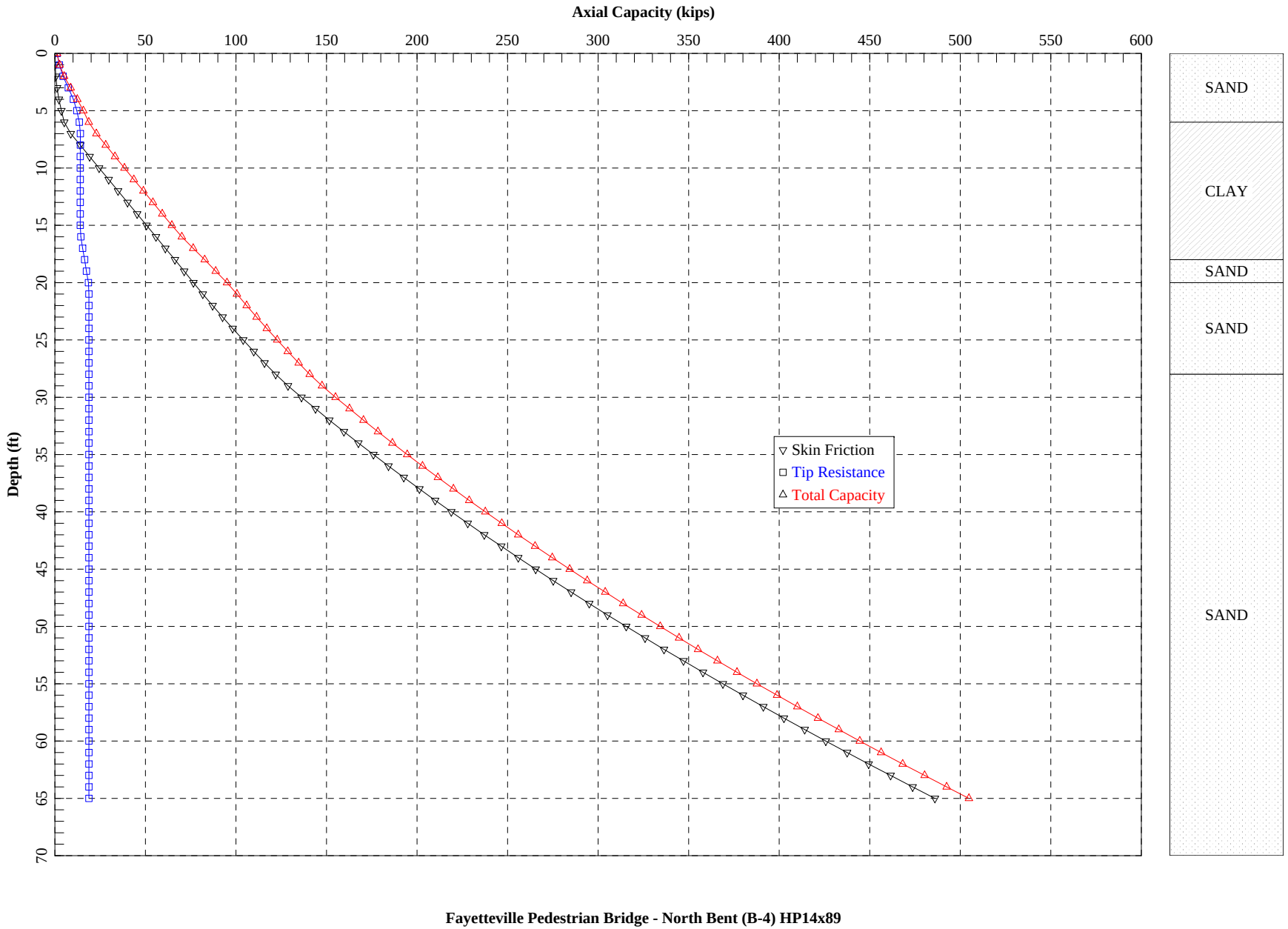
TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00
0.1175E+01	0.9080E-02
0.2350E+01	0.1816E-01
0.4700E+01	0.3632E-01
0.9399E+01	0.2361E+00
0.1410E+02	0.7627E+00
0.1692E+02	0.1326E+01
0.1880E+02	0.1816E+01
0.1880E+02	0.2724E+01
0.1880E+02	0.3632E+01

LOAD VERSUS SETTLEMENT CURVE

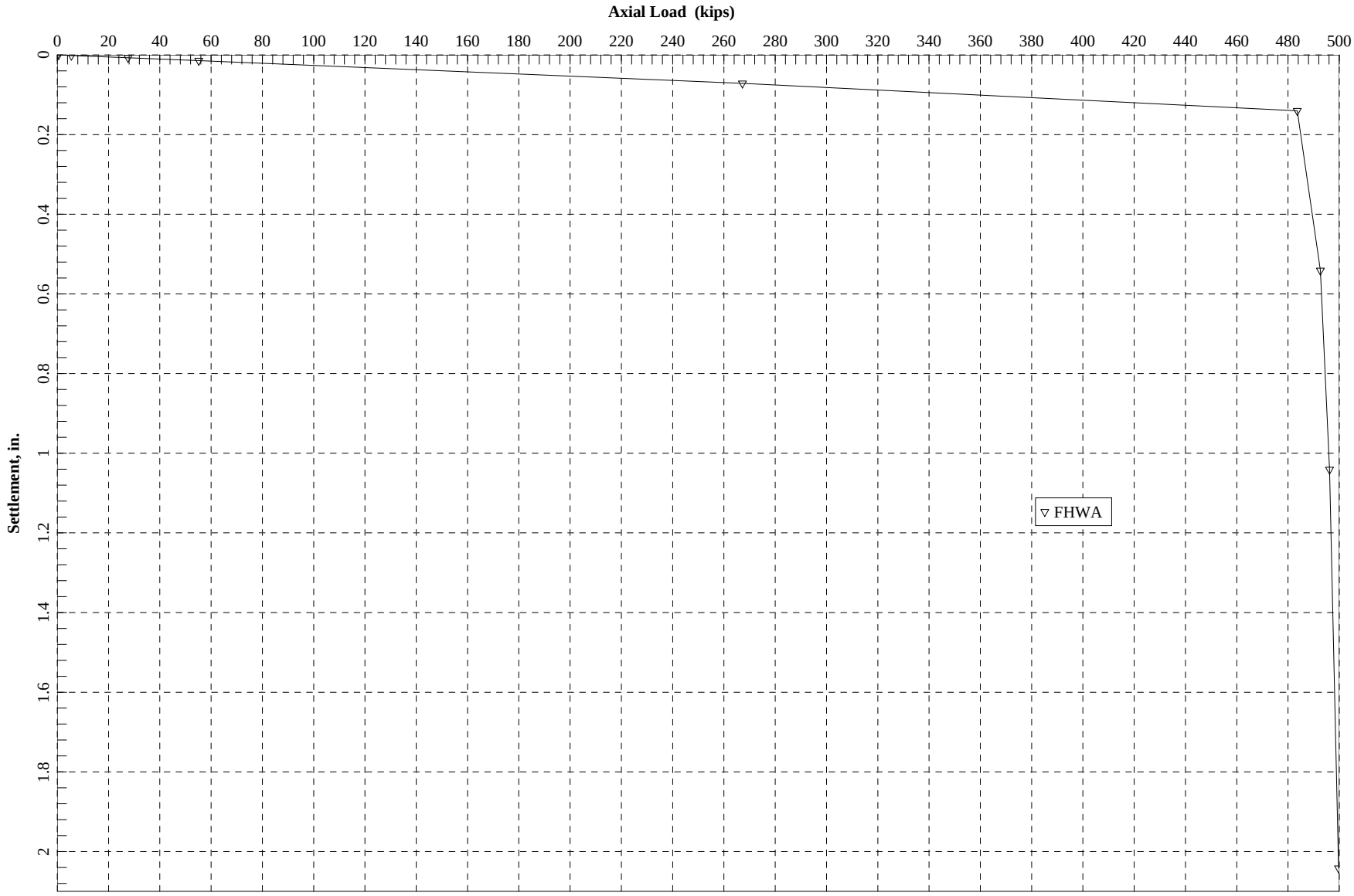
****

TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.5519E+00	0.1437E-03	0.1294E-01	0.1000E-03
0.5519E+01	0.1437E-02	0.1294E+00	0.1000E-02
0.2760E+02	0.7184E-02	0.6470E+00	0.5000E-02
0.5519E+02	0.1437E-01	0.1294E+01	0.1000E-01
0.2672E+03	0.7148E-01	0.5022E+01	0.5000E-01
0.4836E+03	0.1402E+00	0.6198E+01	0.1000E+00

0.4926E+03	0.5410E+00	0.1175E+02	0.5000E+00
0.4962E+03	0.1041E+01	0.1529E+02	0.1000E+01
0.4997E+03	0.2042E+01	0.1880E+02	0.2000E+01



Fayetteville Pedestrian Bridge - North Bent (B-4) HP14x89



Fayetteville Pedestrian Bridge North Bent (B-4) HP14x89

APILE for Windows, Version 2015.7.6

Serial Number : 139304252

A Program for Analyzing the Axial Capacity
and Short-term Settlement of Driven Piles
under Axial Loading.

This program is licensed to :

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Path to file locations : C:\Users\lmullins\Documents\Calculations\APILE Data\
Name of input data file : FPB B3-55_FA.ap7d
Name of output file : FPB B3-55_FA.ap7o
Name of plot output file : FPB B3-55_FA.ap7p

Time and Date of Analysis

Date: August 10, 2017 Time: 16:50:11

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* INPUT INFORMATION *

Fayetteville Pedestrian Bridge - South Bent (B-3) HP14x89 at 55 feet

DESIGNER : LDM

JOB NUMBER : GeoSystems 15-2511

METHOD FOR UNIT LOAD TRANSFERS :

- FHWA (Federal Highway Administration)
  Unfactored Unit Side Friction and Unit Side Resistance are used.

COMPUTATION METHOD(S) FOR PILE CAPACITY :

- FHWA (Federal Highway Administration)

TYPE OF LOADING :
- COMPRESSION

PILE TYPE :

H-Pile/Steel Pile

DATA FOR AXIAL STIFFNESS :

- MODULUS OF ELASTICITY = 0.290E+08 PSI
- CROSS SECTION AREA = 203.23 IN2

NONCIRCULAR PILE PROPERTIES :

- TOTAL PILE LENGTH, TL = 55.00 FT.
- PILE STICKUP LENGTH, PSL = 0.00 FT.
- ZERO FRICTION LENGTH, ZFL = 0.00 FT.
- PERIMETER OF PILE = 57.05 IN.
- TIP AREA OF PILE = 203.23 IN2
- INCREMENT OF PILE LENGTH USED IN COMPUTATION = 1.00 FT.

SOIL INFORMATIONS :

DEPTH FT.	SOIL TYPE	LATERAL EARTH PRESSURE	EFFECTIVE UNIT WEIGHT LB/CF	FRICTION ANGLE DEGREES	BEARING CAPACITY FACTOR
0.00	SAND	0.00	115.00	30.00	0.00
8.00	SAND	0.00	115.00	30.00	0.00
8.00	SAND	0.00	115.00	28.00	0.00
20.00	SAND	0.00	115.00	28.00	0.00
20.00	SAND	0.00	51.00	30.00	0.00
48.00	SAND	0.00	51.00	30.00	0.00
48.00	SAND	0.00	51.00	45.00	0.00
52.00	SAND	0.00	51.00	45.00	0.00
52.00	SAND	0.00	51.00	0.00	0.00
60.00	SAND	0.00	51.00	0.00	0.00

MAXIMUM UNIT FRICTION KSF	MAXIMUM UNIT BEARING KSF	UNDISTURB SHEAR STRENGTH KSF	REMOLDED SHEAR STRENGTH KSF	BLOW COUNT	UNIT SKIN FRICTION KSF	UNIT END BEARING KSF
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	100.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	100.00	0.00	0.00

* MAXIMUM UNIT FRICTION AND/OR MAXIMUM UNIT BEARING WERE SET TO BE 0.10E+08 BECAUSE THE USER DOES NOT PLAN TO LIMIT THE COMPUTED DATA.

DEPTH FT.	LRFD FACTOR ON UNIT FRICTION	LRFD FACTOR ON UNIT BEARING
0.00	1.000	1.000
8.00	1.000	1.000
8.00	1.000	1.000
20.00	1.000	1.000
20.00	1.000	1.000
48.00	1.000	1.000
48.00	1.000	1.000
52.00	1.000	1.000
52.00	1.000	1.000
60.00	1.000	1.000

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****
* COMPUTATION RESULT *
****

****
* FED. HWY. METHOD *
****

PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	1.6	1.6
1.00	0.2	3.0	3.2
2.00	0.6	5.4	6.0
3.00	1.4	8.5	9.9
4.00	2.5	11.3	13.8
5.00	3.9	13.9	17.8
6.00	5.6	15.9	21.5
7.00	7.6	17.1	24.7
8.00	9.9	17.9	27.9
9.00	12.4	18.3	30.6
10.00	14.8	18.3	33.1
11.00	17.6	18.6	36.2
12.00	20.6	18.8	39.4
13.00	23.8	18.8	42.6
14.00	27.3	18.8	46.1
15.00	31.1	18.8	49.9
16.00	35.2	18.8	54.0
17.00	39.5	18.8	58.3
18.00	44.0	18.8	62.8
19.00	48.9	18.8	67.7
20.00	54.0	18.8	72.7
21.00	59.7	18.8	78.5
22.00	66.1	18.8	84.9
23.00	72.7	18.8	91.5
24.00	79.4	18.8	98.2
25.00	86.2	18.8	105.0
26.00	93.2	18.8	112.0
27.00	100.3	18.8	119.1
28.00	107.5	18.8	126.3

29.00	114.9	18.8	133.7
30.00	122.4	18.8	141.2
31.00	130.1	18.8	148.9
32.00	137.9	18.8	156.7
33.00	145.8	18.8	164.6
34.00	153.9	18.8	172.7
35.00	162.1	18.8	180.9
36.00	170.4	18.8	189.2
37.00	178.9	18.8	197.7
38.00	187.5	18.8	206.3
39.00	196.3	18.8	215.1
40.00	205.2	18.8	224.0
41.00	214.2	18.8	233.0
42.00	223.4	18.8	242.2
43.00	232.7	18.8	251.5
44.00	242.1	18.8	260.9
45.00	251.7	18.8	270.5
46.00	261.4	79.6	341.0
47.00	271.3	304.7	576.0
48.00	281.3	529.9	811.2
49.00	305.1	755.1	1060.2
50.00	343.0	980.2	1323.2
51.00	381.4	1041.0	1422.4
52.00	420.3	1041.0	1461.3
53.00	461.4	1041.0	1502.4
54.00	504.7	1041.0	1545.7
55.00	548.6	1041.0	1589.6

NOTES:
- AN ASTERISK IS PLACED IN THE END-BEARING COLUMN
  IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION
  OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.

****
* COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
* CURVES FOR AXIAL LOADING *
****

T-Z CURVE NO.	NO. OF POINTS	DEPTH TO CURVE FT.	LOAD TRANSFER PSI	PILE MOVEMENT IN.
1	10	0.0000E+00		
			0.0000E+00	0.0000E+00
			0.6802E-01	0.1000E-01
			0.1360E+00	0.2000E-01
			0.2721E+00	0.4000E-01
			0.4081E+00	0.6000E-01
			0.5442E+00	0.8000E-01
			0.6122E+00	0.9000E-01
			0.6802E+00	0.1000E+00
			0.6802E+00	0.5000E+00
			0.6802E+00	0.2000E+01
2	10	0.4025E+01		
			0.0000E+00	0.0000E+00
			0.2267E+00	0.1000E-01
			0.4535E+00	0.2000E-01
			0.9070E+00	0.4000E-01
			0.1360E+01	0.6000E-01
			0.1814E+01	0.8000E-01

			0.2041E+01	0.9000E-01
			0.2267E+01	0.1000E+00
			0.2267E+01	0.5000E+00
			0.2267E+01	0.2000E+01
3	10	0.7958E+01		
			0.0000E+00	0.0000E+00
			0.3465E+00	0.1000E-01
			0.6929E+00	0.2000E-01
			0.1386E+01	0.4000E-01
			0.2079E+01	0.6000E-01
			0.2772E+01	0.8000E-01
			0.3118E+01	0.9000E-01
			0.3465E+01	0.1000E+00
			0.3465E+01	0.5000E+00
			0.3465E+01	0.2000E+01
4	10	0.8000E+01		
			0.0000E+00	0.0000E+00
			0.3574E+00	0.1000E-01
			0.7148E+00	0.2000E-01
			0.1430E+01	0.4000E-01
			0.2144E+01	0.6000E-01
			0.2859E+01	0.8000E-01
			0.3216E+01	0.9000E-01
			0.3574E+01	0.1000E+00
			0.3574E+01	0.5000E+00
			0.3574E+01	0.2000E+01
5	10	0.1403E+02		
			0.0000E+00	0.0000E+00
			0.5715E+00	0.1000E-01
			0.1143E+01	0.2000E-01
			0.2286E+01	0.4000E-01
			0.3429E+01	0.6000E-01
			0.4572E+01	0.8000E-01
			0.5143E+01	0.9000E-01
			0.5715E+01	0.1000E+00
			0.5715E+01	0.5000E+00
			0.5715E+01	0.2000E+01
6	10	0.1996E+02		
			0.0000E+00	0.0000E+00
			0.7937E+00	0.1000E-01
			0.1587E+01	0.2000E-01
			0.3175E+01	0.4000E-01
			0.4762E+01	0.6000E-01
			0.6350E+01	0.8000E-01
			0.7143E+01	0.9000E-01
			0.7937E+01	0.1000E+00
			0.7937E+01	0.5000E+00
			0.7937E+01	0.2000E+01
7	10	0.2000E+02		
			0.0000E+00	0.0000E+00
			0.8908E+00	0.1000E-01
			0.1782E+01	0.2000E-01
			0.3563E+01	0.4000E-01
			0.5345E+01	0.6000E-01
			0.7127E+01	0.8000E-01
			0.8017E+01	0.9000E-01
			0.8908E+01	0.1000E+00
			0.8908E+01	0.5000E+00
			0.8908E+01	0.2000E+01
8	10	0.3403E+02		
			0.0000E+00	0.0000E+00
			0.1209E+01	0.1000E-01
			0.2417E+01	0.2000E-01

			0.4835E+01	0.4000E-01
			0.7252E+01	0.6000E-01
			0.9669E+01	0.8000E-01
			0.1088E+02	0.9000E-01
			0.1209E+02	0.1000E+00
			0.1209E+02	0.5000E+00
			0.1209E+02	0.2000E+01
9	10	0.4796E+02		
			0.0000E+00	0.0000E+00
			0.2472E+01	0.1000E-01
			0.4944E+01	0.2000E-01
			0.9888E+01	0.4000E-01
			0.1483E+02	0.6000E-01
			0.1978E+02	0.8000E-01
			0.2225E+02	0.9000E-01
			0.2472E+02	0.1000E+00
			0.2472E+02	0.5000E+00
			0.2472E+02	0.2000E+01
10	10	0.4800E+02		
			0.0000E+00	0.0000E+00
			0.4510E+01	0.1000E-01
			0.9019E+01	0.2000E-01
			0.1804E+02	0.4000E-01
			0.2706E+02	0.6000E-01
			0.3608E+02	0.8000E-01
			0.4059E+02	0.9000E-01
			0.4510E+02	0.1000E+00
			0.4510E+02	0.5000E+00
			0.4510E+02	0.2000E+01
11	10	0.5003E+02		
			0.0000E+00	0.0000E+00
			0.5646E+01	0.1000E-01
			0.1129E+02	0.2000E-01
			0.2259E+02	0.4000E-01
			0.3388E+02	0.6000E-01
			0.4517E+02	0.8000E-01
			0.5082E+02	0.9000E-01
			0.5646E+02	0.1000E+00
			0.5646E+02	0.5000E+00
			0.5646E+02	0.2000E+01
12	10	0.5196E+02		
			0.0000E+00	0.0000E+00
			0.5843E+01	0.1000E-01
			0.1169E+02	0.2000E-01
			0.2337E+02	0.4000E-01
			0.3506E+02	0.6000E-01
			0.4674E+02	0.8000E-01
			0.5259E+02	0.9000E-01
			0.5843E+02	0.1000E+00
			0.5843E+02	0.5000E+00
			0.5843E+02	0.2000E+01
13	10	0.5200E+02		
			0.0000E+00	0.0000E+00
			0.6164E+01	0.1000E-01
			0.1233E+02	0.2000E-01
			0.2465E+02	0.4000E-01
			0.3698E+02	0.6000E-01
			0.4931E+02	0.8000E-01
			0.5547E+02	0.9000E-01
			0.6164E+02	0.1000E+00
			0.6164E+02	0.5000E+00
			0.6164E+02	0.2000E+01
14	10	0.5603E+02		

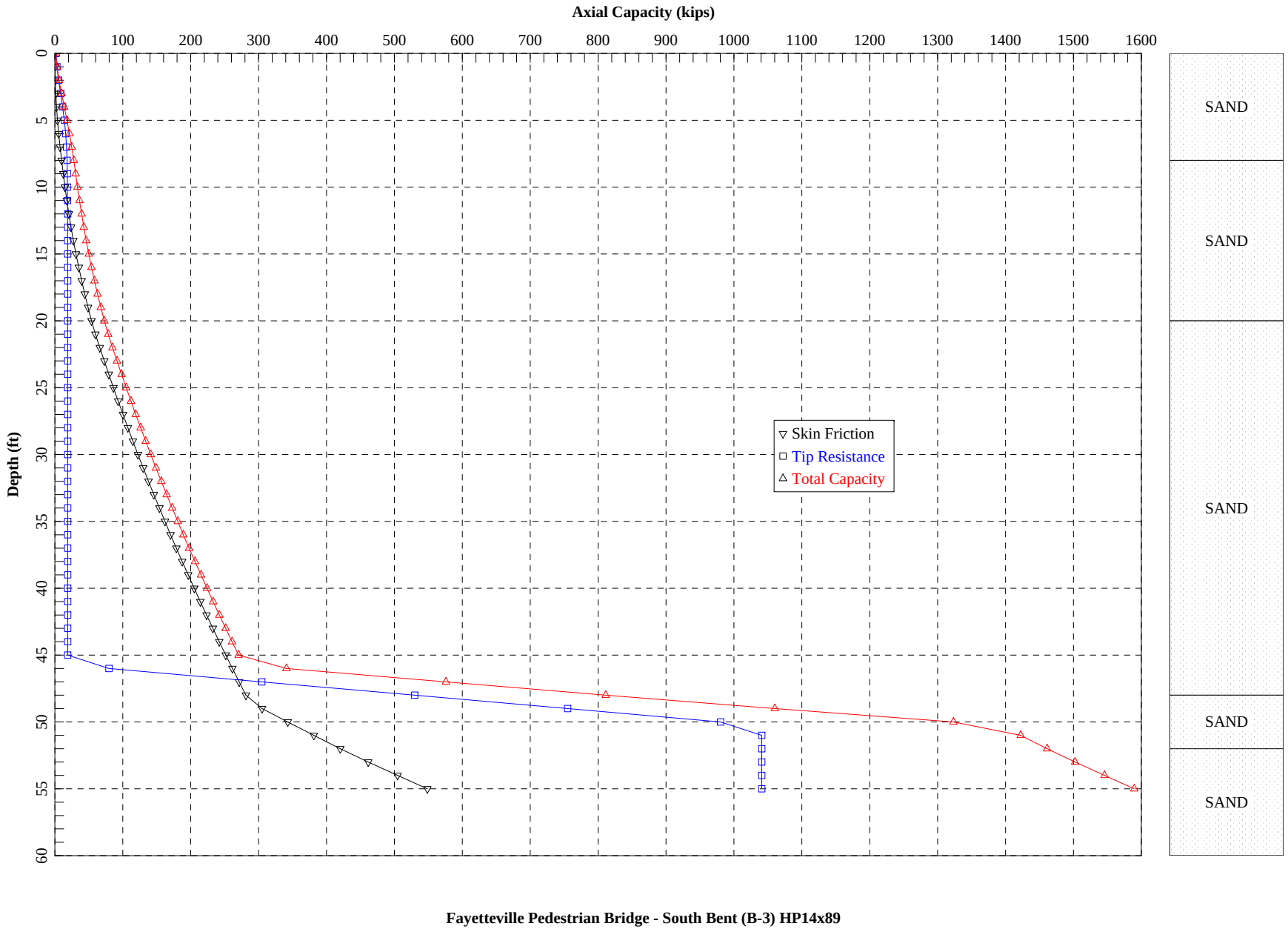
			0.0000E+00	0.0000E+00
			0.6405E+01	0.1000E-01
			0.1281E+02	0.2000E-01
			0.2562E+02	0.4000E-01
			0.3843E+02	0.6000E-01
			0.5124E+02	0.8000E-01
			0.5765E+02	0.9000E-01
			0.6405E+02	0.1000E+00
			0.6405E+02	0.5000E+00
			0.6405E+02	0.2000E+01
15	10	0.5996E+02		
			0.0000E+00	0.0000E+00
			0.6405E+01	0.1000E-01
			0.1281E+02	0.2000E-01
			0.2562E+02	0.4000E-01
			0.3843E+02	0.6000E-01
			0.5124E+02	0.8000E-01
			0.5765E+02	0.9000E-01
			0.6405E+02	0.1000E+00
			0.6405E+02	0.5000E+00
			0.6405E+02	0.2000E+01

TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00
0.6506E+02	0.9080E-02
0.1301E+03	0.1816E-01
0.2602E+03	0.3632E-01
0.5205E+03	0.2361E+00
0.7807E+03	0.7627E+00
0.9369E+03	0.1326E+01
0.1041E+04	0.1816E+01
0.1041E+04	0.2724E+01
0.1041E+04	0.3632E+01

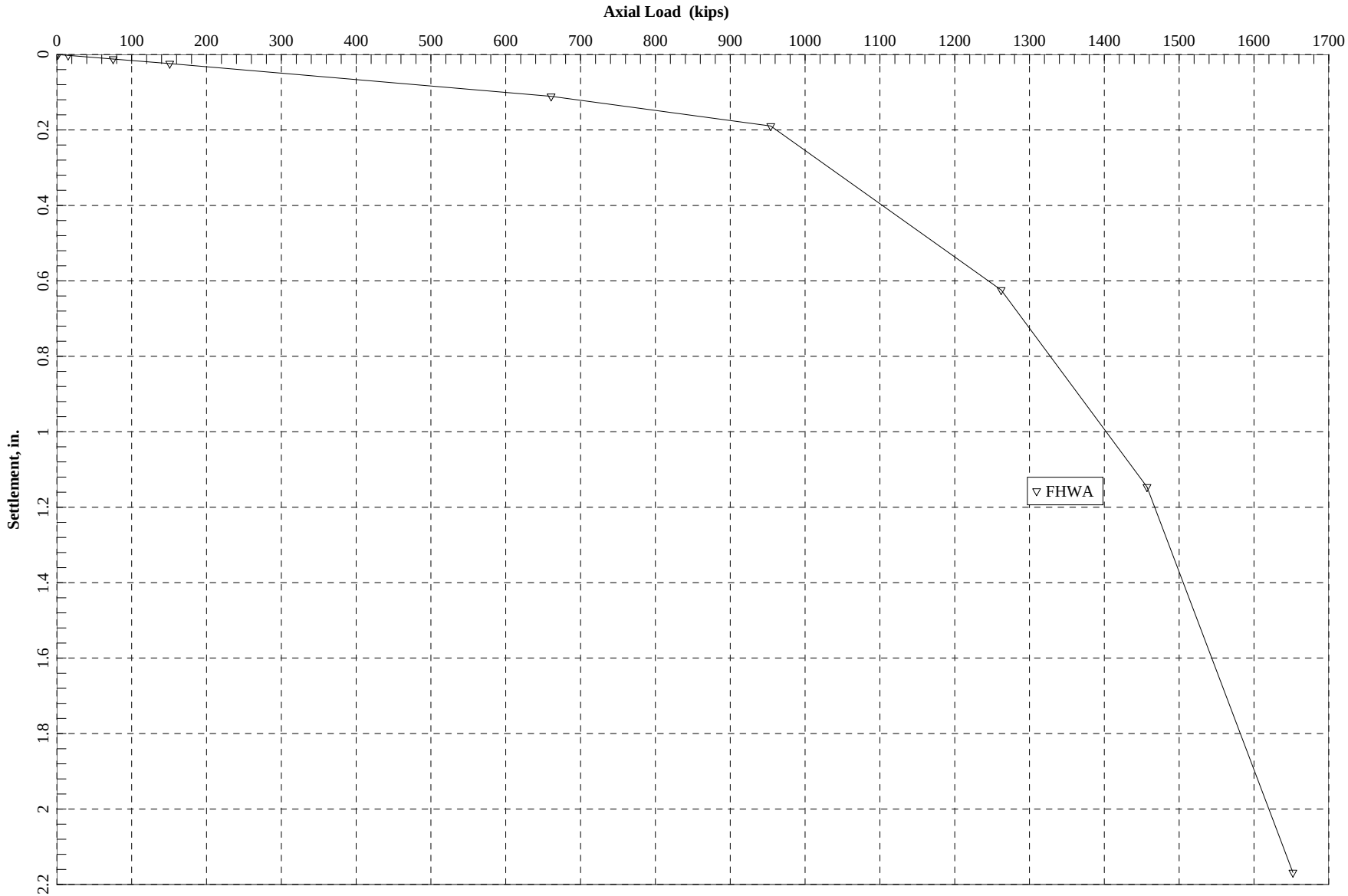
LOAD VERSUS SETTLEMENT CURVE

****

TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.1505E+01	0.2410E-03	0.7166E+00	0.1000E-03
0.1505E+02	0.2410E-02	0.7166E+01	0.1000E-02
0.7523E+02	0.1205E-01	0.3583E+02	0.5000E-02
0.1509E+03	0.2412E-01	0.7166E+02	0.1000E-01
0.6606E+03	0.1109E+00	0.2781E+03	0.5000E-01
0.9541E+03	0.1895E+00	0.3432E+03	0.1000E+00
0.1262E+04	0.6240E+00	0.6509E+03	0.5000E+00
0.1457E+04	0.1146E+01	0.8466E+03	0.1000E+01
0.1652E+04	0.2168E+01	0.1041E+04	0.2000E+01



Fayetteville Pedestrian Bridge - South Bent (B-3) HP14x89



Fayetteville Pedestrian Bridge South Bent (B-3) HP14x89

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03-Oct-2017
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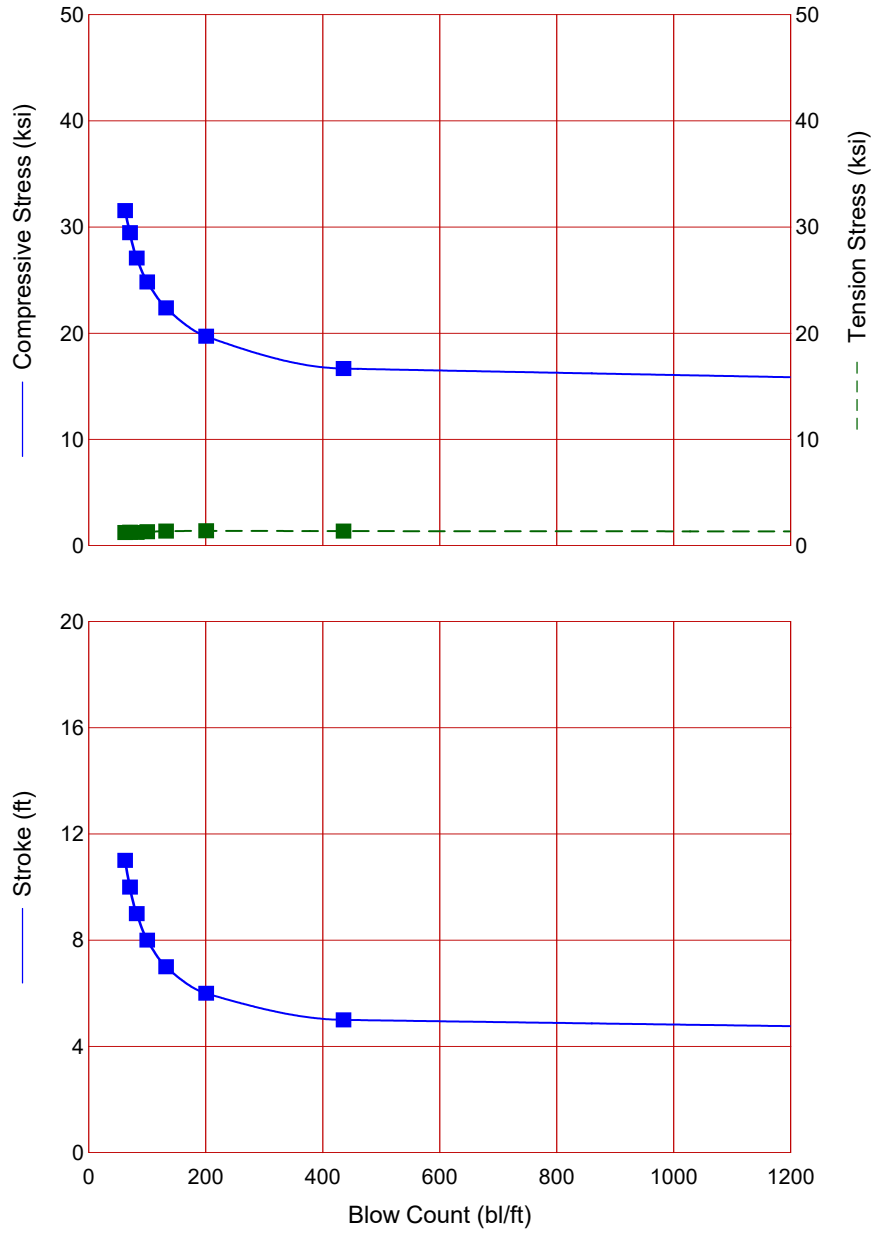
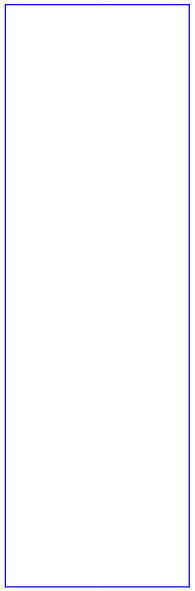


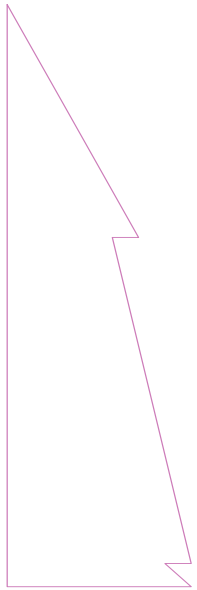
DELMAG D 16-32

Capacity	385.0	kips
Ram Weight	3.52	kips
Efficiency	0.800	
Pressure	1500 (100%)	psi
Helmet Weight	1.90	kips
Hammer Cushion	60155	kips/in
COR of H.C.	0.800	
Skin Quake	0.100	in
Toe Quake	0.122	in
Skin Damping	0.050	s/ft
Toe Damping	0.150	s/ft
Pile Length	50.00	ft
Pile Penetration	50.00	ft
Pile Top Area	26.10	in2

Pile Model



Skin Friction Distribution



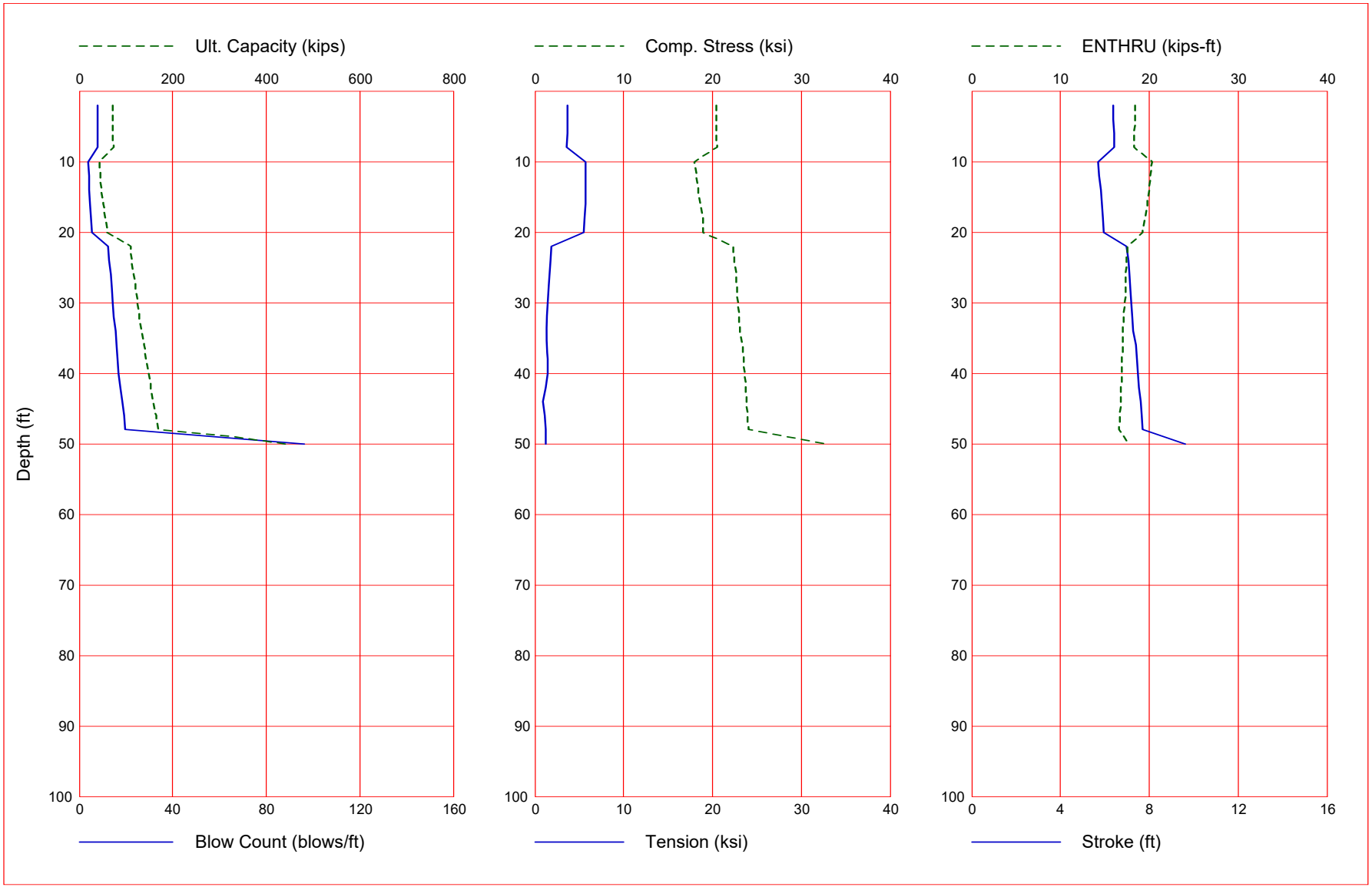
Res. Shaft = 25 %
(Proportional)

Ultimate Capacity kips	Maximum Compression Stress ksi	Maximum Tension Stress ksi	Blow Count bl/ft	Stroke ft	Energy kips-ft
385.0	9.78	1.13	9999.0	3.00	2.79
385.0	13.08	1.51	9999.0	4.00	5.18
385.0	16.68	1.37	435.7	5.00	7.49
385.0	19.71	1.40	200.8	6.00	9.74
385.0	22.38	1.37	132.4	7.00	11.97
385.0	24.83	1.31	100.1	8.00	14.22
385.0	27.07	1.24	82.1	9.00	16.43
385.0	29.47	1.26	70.7	10.00	18.58
385.0	31.54	1.24	62.3	11.00	20.76

Geotechnical & Environmental Consult Inc
Fayetteville Ped Bridge South Bent B-3 R

Oct 03 2017
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.833 / 1.000



Gain/Loss 1 at Shaft and Toe 0.833 / 1.000

Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
2.0	70.9	0.2	70.7	7.8	20.379	-3.725	6.38	18.4
4.0	71.6	0.8	70.7	7.9	20.402	-3.681	6.39	18.4
6.0	72.6	1.9	70.7	8.0	20.464	-3.650	6.40	18.3
8.0	74.1	3.3	70.7	8.1	20.523	-3.605	6.42	18.3
10.0	43.0	5.3	37.7	4.0	17.997	-5.704	5.70	20.3
12.0	45.3	7.6	37.7	4.2	18.166	-5.705	5.75	20.1
14.0	48.1	10.4	37.7	4.4	18.406	-5.698	5.81	20.0
16.0	51.3	13.6	37.7	4.7	18.637	-5.668	5.86	19.8
18.0	55.0	17.2	37.7	5.0	18.884	-5.632	5.92	19.6
20.0	59.0	21.3	37.7	5.4	18.981	-5.459	5.94	19.2
22.0	109.7	24.8	84.9	12.5	22.358	-1.845	6.99	17.5
24.0	113.4	28.5	84.9	12.9	22.503	-1.733	7.04	17.4
26.0	117.2	32.3	84.9	13.4	22.616	-1.654	7.09	17.3
28.0	121.2	36.3	84.9	13.9	22.755	-1.554	7.14	17.3
30.0	125.3	40.4	84.9	14.5	22.869	-1.455	7.19	17.2
32.0	129.6	44.8	84.9	14.9	22.972	-1.357	7.23	17.1
34.0	134.1	49.2	84.9	15.4	23.083	-1.356	7.27	17.0
36.0	138.7	53.8	84.9	15.9	23.371	-1.349	7.39	17.0
38.0	143.5	58.6	84.9	16.4	23.476	-1.412	7.44	16.9
40.0	148.4	63.6	84.9	17.0	23.614	-1.388	7.50	16.9
42.0	153.5	68.6	84.9	17.7	23.711	-1.220	7.55	16.8
44.0	158.8	73.9	84.9	18.4	23.819	-0.931	7.60	16.8
46.0	164.2	79.3	84.9	19.1	23.909	-1.123	7.65	16.7
48.0	169.8	84.9	84.9	19.8	24.001	-1.248	7.70	16.6
50.0	443.7	90.0	353.7	96.0	32.762	-1.232	9.61	17.7

Total Continuous Driving Time 15.00 minutes; Total Number of Blows 649 (starting at penetration 2.0 ft)

ATTACHMENT C

SPECIAL PROVISION 523 DYNAMIC PILE TESTING
SPECIAL PROVISION 520 PILING FOR LRFD

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

SPECIAL PROVISION

SR 54 MULTI-USE TRAIL & BRIDGE, FAYETTE COUNTY
PI NO. 0012878

SECTION 523 - DYNAMIC PILE TESTING

523.1 General Description

The work consists of performing dynamic pile testing using the Pile Driving Analyzer (PDA) to monitor the driving of piles with accelerometer and strain gauges attached to the piles. Piles to be dynamically tested will be identified in the Special Provision or on the Plans. Prior to pile driving, the Engineer will determine production or test piles to be dynamically tested. Perform the dynamic pile testing in accordance with ASTM D4945-12.

Take dynamic measurements during driving of any required piles. Drive the pile as shown in the Special Provisions or on the Plans.

523.2 Materials

Furnish measuring instruments for dynamic pile testing. Attach instruments near the top of the piles with bolts placed in drilled holes. Furnish materials, labor and equipment necessary for installation of the instruments.

523.3 Construction Requirements

Measure wave speed prior to driving piles. Wave speed measurements will not be required for Steel H piles or metal shell piles. When wave speed measurements are performed, place the piles in a horizontal position not in contact with other piles.

Perform dynamic pile testing during driving. Modify the driving to reduce the stress and/or eliminate the damage, should the recommended stress level be exceeded or if damage occurs (determined visually or as indicated by the instrumentation).

Do not exceed the following maximum driving stresses, as determined by the dynamic pile testing:

1. For Steel piles:

   0.9 Fy, where Fy = Yield strength of steel

2. For Prestressed Concrete Piles:

Compression:

$$\sigma_{dr} = (0.85f'_c - f_{pe})$$

Tension in Normal Environments:

$$\sigma_{dr} = \left(0.095\sqrt{f'_c} + f_{pe}\right)$$

Tension in Severe Corrosive Environments:

$$\sigma_{dr} = \varphi_{da} f_{pe}$$

where;
σ_{dr} = maximum allowed driving stress, ksi
$f'c$= specified minimum 28-day compressive strength of concrete, ksi
$f pe$= effective prestress in concrete, ksi, (after all losses) at the time of driving taken as 0.78 times the initial prestress force

Re-drive friction piles that do not obtain bearing after a freeze period of a minimum of 24 hours or for a period designated on the Plans, whichever is longer. Reset the gauges if required. Re-strike the pile with a warm hammer until a maximum penetration of 3 inches (76 mm) or 40 blows is reached, whichever occurs first. The Engineer may modify the Pile Driving Objective based on the results of the PDA work.

Provide two weeks' notice prior to the driving of designated piles and cooperate with the Engineer in connection with the performance of Dynamic Pile Testing.

Provide a complete report consisting of but not limited to PDA field monitoring data, results of CAPWAP computer analyses, and recommendations such as pile lengths, hammer fuel setting, and valid driving criteria. Valid driving criteria is defined as having the required hammer having a hammer set greater than 3 blows per inch and less than 10 blows per inch at the driving resistance for that pile. Submit the report electronically in PDF format and the electronic data files of the PDA analysis and CAPWAP to the Geotechnical Bureau and allow seven (7) calendar days for review and approval before proceeding with driving production piles.

523.4 Measurement

The Dynamic Pile Tests performed in accordance with these Specifications will be counted separately for payment. (Refer to plans summary sheet for the required amount of PDA testing.)

523.5 Payment

The Dynamic Pile Test completed and accepted will be paid for at the Contract unit Price. This payment will be full compensation for all costs of complying with this specification, including incidentals, additional work, and any delays incurred in conjunction therewith.

Payment will be made under:

Item No. 523. Dynamic Pile Test_____ . . . . . Per Each

Office of Materials and Testing

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

SPECIAL PROVISION

SR 54 MULTI-USE TRAIL & BRIDGE, FAYETTE COUNTY
PI NO. 0012878

SECTION 520—PILING

Delete Sub-Section 520.3.05.D.1 and substitute the following:

520.3.05.D.1. Determine Driving Resistance
Drive piles in one continuous operation. Determine the driving resistance of the piling based on the method specified in the plans, which will be one of the following methods (a – c):

a. Upon completion of the dynamic pile testing in accordance with Special Provision Section 523. The pile bearing will be determined by computing the penetration per blow with less than ¼-inch (6-mm) rebound averaged through 12 inches (305 mm) each of penetration. When it is considered necessary by the Engineer, the average penetration per blow may be determined by averaging the penetration per blow through the last 10 to 20 blows of the hammer. In soft material the driving resistance may be determined, at the Engineer's discretion, after delaying driving operations and performing pile re-strikes.

b. Upon completion of the loading test in accordance with Sub-Section 520.3.05.D.2.

c. Shall not be used when driving pile to hard rock. Using FHWA-modified Gates Formula as provided below:

$R_{ndr} = 1.75\ (E_d)^{0.5} \log_{10}(10N_b) - 100$ (kips) U.S units

$R_{ndr} = 7\ (E_d)^{0.5} \log_{10}(10N_b) - 550$ (kN) S.I. units

Where:

R_{ndr} = nominal pile driving resistance measured during pile driving

E_d = developed hammer energy. This is the kinetic energy in the ram at impact for a given blow. If ram velocity is not measured, it may be assumed equal to the potential energy of the ram at the height of the stroke, taken as the ram weight times the actual stroke (ft-lb for U.S units, kN-m for S.I. units)

N_b = Number of hammer blows for 1.0 inch of pile permanent set (blows/in)

These resistance formulas apply only when:

- The hammer has a free fall.
- The head of the pile is not broomed, crushed, spalled, or excessively crimped.
- The penetration rate is reasonably uniform.

Determining driving resistance by formula is not a Pay Item. Provide the facilities for determining driving resistance by formula as an incidental part of the work.

Once the driving resistance has been determined by one of the methods noted above, do not continue to drive piles if the Engineer determines that the piles have reached practical refusal. Practical refusal is defined as 20 blows per inch with the hammer operating at the highest setting or setting determined by the Engineer and less than ¼-inch (6-mm) rebound per blow. The Engineer will generally make this determination within 2 inches (51 mm) of driving. However, the Engineer will not approve the continuation of driving at practical refusal for more than 12 inches (305 mm). When the required pile penetration cannot be achieved by driving without exceeding practical refusal, use other penetration aids such as jetting, spudding, predrilling or other methods approved by the Engineer.

d. Wave Equation: Use the Wave Equation Analysis for Piles (WEAP) program to evaluate the suitability of the proposed driving system chosen from the methods noted above (including the hammer, follower, capblock and pile cushions) as well as to estimate the driving resistance to achieve the pile bearing requirements and to evaluate pile driving stresses. Use the WEAP program to show that the hammer is capable of driving to a driving resistance equal 130% (1.3 times) the driving resistance shown in the Plans without overstressing the piling in compression or tension and without reaching practical refusal.

Perform the WEAP analysis with personnel who are experienced in this type work, and have performed this analysis on a minimum of 15 projects. Provide a list of the qualifications and experience of the personnel to perform the WEAP analysis for this Project.

The Engineer may modify the scour resistance shown in the plans if the dynamic pile test is used to determine the actual soil resistance through the scour zone. Also, the Engineer may make modifications in scour resistance when the Contractor proposes drilling and/or jetting to reduce the soil resistance in the scour zone.

A minimum of two weeks prior to beginning any pile driving operations, submit to the Engineer for evaluation and approval the following information on all of the proposed pile driving system(s) to be used on the Project including but not limited to:

i. Items on Pile Driving Equipment Data Sheet
ii. Other information on the driving system required by the Engineer

iii. A WEAP program output indicating the approximate depth or elevation where the pile will achieve the bearing required
iv. Valid Driving Criteria.

Valid driving criteria is defined as having the required hammer having a hammer set greater than 3 blows per inch and less than 10 blows per inch at the driving resistance for that pile.

If WEAP analyses show that the hammer(s) will overstress the pile, modify the driving system or method of operation as required to prevent overstressing the pile. Resubmit the modified pile driving system information and WEAP program output to the Engineer for re-evaluation. Do not begin pile driving operations until the Engineer has approved the qualifications of the personnel, the WEAP program output, and the pile driving system(s).

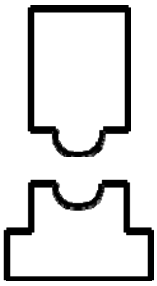
Approval of the pile driving system(s) is also based on satisfactory field trials with dynamic pile testing. Obtain approval from the Engineer for the pile driving system(s) based on satisfactory field performance.

If piles require different hammer sizes, the Contractor may elect to drive with more than one size hammer or with a variable energy hammer, provided that the hammer is properly sized and cushioned, will not damage the pile, and will develop the required resistance.

For penetration of weak soils by concrete piles, use thick cushions and/or reduced stroke to control tension stresses during driving.

Pile Driving Data Form

Contract ID: Structure Name:
PI Number: Structure No.:
County Pile Driving Contractor:



Hammer

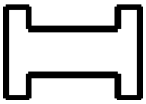
Manufacturer: _____ Model No. _____
Hammer Type: _____ Serial No. _____
Manufacturers Maximum Rated Energy: _____(ft-k)
Stroke at Maximum Rated Energy: _____(ft)
Range in Operating Energy: _____ to _____(ft-k)
Range in Operating Stroke: _____ to _____(ft)
Ram Weight: _____ (kips)
Modifications: _____

Striker Plate

Weight: _____(kips) Diameter: _____(in)
Thickness: _____(in)

Hammer Cushion

Material 1 Material 2
Name: _____ Name: _____
Area: _____(in^2) Area: (in^2)
Thickness/Plate: _____(in) Thickness/Plate:_____(in)
No. of Plates: _____ No. of Plates: _____
Total Thickness of Hammer Cushion: _____(in)

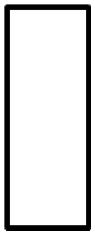


Helmet

Weight including inserts: _____(kips)

Pile Cushion

Material: _____
Area: _____(in^2) Thickness/Sheet: _____(in)
No. of Sheets: _____
Total Thickness of Pile Cushion: _____(in)



Pile

Pile Type: _____
Wall Thickness: _____(in) Taper: _____
Cross Sectional Area: ___(in^2) Weight/Meter: _____
Ordered Length: _____(ft)
Driving Resistance: _____(kips)
Description of Splice: _____
Driving Shoe/Closure Plate Description: _____

Submitted By: _____ Date: _____

Retaining Wall Foundation Investigation Report (ASD)
SR 54 Multi-Use Trail & Bridge, Fayette County
PI No. 0012878
September 16, 2017
Revision No. 2

1. Location

The project is located on Georgia Highway 54 West, near street address 1294 and Piedmont Fayette Hospital, Fayetteville, Fayette County, Georgia. The location is approximately midway between Sandy Creek Road to the east and Veterans Parkway to the west.

2. Geology

The site is located within the Piedmont Physiographic Province of Georgia. Rocks within the Clarkston Formation, described as a sillimanite-garnet-quartz-plagioclase-biotite-muscovite schist interlayered with hornblende-plagioclase amphibolite of Precambrian age underlie the site. The Clarkston Formation is locally intruded in the Tyrone, Peachtree City and Fayetteville area by younger rocks of the Palmetto Granite unit, which is a coarse-grained porphyritic granite.

3. Subsurface Information

The investigation encountered fill materials, residual soils, partially weathered rock (PWR) and auger refusal material. Please see the enclosed Boring Locations – Mainline Plan Drawing Nos. 13-08 & 13-09 and Soil Test Boring Records for specific subsurface conditions at each boring location.

Below a surfical topsoil or gravel layer, fill was encountered at all boring locations, except B-5, to depths ranging approximately from 3 to 13 feet. The fill was sampled as either loose or medium dense clayey sand.

Residual soils were initially encountered below the topsoil layer in boring B-5 and from below the fill in the remaining borings. The residual soil profile mainly consists of loose and medium dense silty sand. Some clayey sand and sandy silt were also penetrated in the upper portions of three borings. The residual soils extend to the top of partially weathered rock (PWR) at depths of about 43 and 48 feet, respectively, in borings B-2 and B-3 and to boring termination depths of 20 and 60 feet in the remaining three borings.

Partially weathered rock was encountered from below the residual soils to auger refusal depths of 48 feet at the location of boring B-2 and 52 feet at B-3.

Groundwater was encountered in borings B-2, B-3 and B-4, respectively, at depths of 5, 22 and 27 feet below the ground surface at the time of the field investigation. Groundwater was not observed in boreholes B-1 and B-5 at the time of drilling. No 24-hour groundwater measurements were obtained, since all of the boreholes caved at depths ranging from 7 to 9.5 feet below ground.

4. Soil Parameters

Mechanically Stabilized Earth (MSE) retaining walls are planned for support of the bridge approach ramps and abutments. MSE wall foundation soils consist of undisturbed residual soils and existing fill. The residual soils were classified as loose and medium dense silty sand (SM) with some stiff to very stiff sandy silt (ML-MH) and medium dense clayey sand (SC). The existing fill is described as loose or medium dense clayey sand (SC).

4. Soil Parameters (Continued)

Undisturbed Residual Soils/Existing Fill. Standard penetration resistance (N) values in the residual soils ranged from a minimum of 4 to a maximum of 27 blows per foot (bpf), with most values between 10 to 15 bpf. In the fill soils, standard penetration resistances ranged from a minimum of 5 bpf to 17 bpf. Based on correlations with SPT N-values and our previous experience with similar conditions, we recommend the following design parameters for the MSE wall foundation soils:

Angle internal soil friction angle (ϕ) = 28 degrees
Cohesion value (c) = 0 psf
Soil Unit Weight (γ) = 115 pcf
Coefficient of Sliding Friction (μ) = 0.53

Wall Backfill. Backfill in the reinforced zone of the MSE walls should be well-graded granular soils free from organic matter, shale, soft particles or other deleterious materials. The reinforced zone backfill should have a maximum particle size of ¾ to 1-inch and conform to the gradation limits of 0 to 60 percent passing the No. 40 sieve and 0 to 15 percent passing the No. 200 sieve. The plasticity index should be less than 6. We assume any retained fill soils in the ramps required beyond the reinforced zone will consist of native silty sand residual soils typical of the Piedmont area. The following soil parameters for the MSE wall backfill in the reinforced zone and retained soils are recommended for design:

Select Reinforced Zone Granular Backfill
Angle internal soil friction angle (ϕ) = 34 degrees
Cohesion value (c) = 0 psf
Soil Unit Weight (γ) = 135 pcf

Retained Fill - Silty Sand (SM) 98% Standard Proctor MDD
Angle internal soil friction angle (ϕ) = 28 degrees
Cohesion value (c) = 0 psf
Soil Unit Weight (γ) = 124 pcf

Retained Fill – Silty Sand (SM) 95% Standard Proctor MDD
Angle internal soil friction angle (ϕ) = 25 degrees
Cohesion value (c) = 0 psf
Soil Unit Weight (γ) = 117 pcf

5. Recommendations

Soil Bearing. Based on local experience and correlations with N-values for loose to medium dense silty sand, loose to medium dense clayey sand and stiff sandy silt, a maximum allowable general soil bearing capacity of 4,000 psf is recommended for preliminary design of the MSE walls on this project. Final wall design requires foundation soil bearing calculations based on the foundation and retained soil parameters listed above, considering site geometry, the wall height and foundation width for each wall. A minimum safety factor of 2.5 against a bearing capacity failure is required per AASHTO for flexible earth reinforced walls.

5. Recommendations (Continued)

The provided Mainline Plan and Cross Sections show the proposed MSE walls vary in height up to a maximum of approximately 28 feet, resulting in relatively high applied foundation loading conditions, estimated to range generally from over 3,000 psf to 5,000 psf. If the MSE wall applied foundation pressure in the final design exceeds the maximum allowable design soil bearing capacity, the wall should be constructed to a height equivalent to the allowable bearing pressure, and installation temporarily halted for 30 days. After the 30 day waiting period, the wall may be completed to its final height.

Type II Foundation Backfill Material. Due to the proximity of the groundwater to the bottom of wall elevation at the location of boring B-2, we recommend a minimum 12-inch thick layer of Type II Foundation Backfill Material be placed below the bottom of the wall in the area of boring B-2.

Settlement. Preliminary settlement calculations were performed for the MSE Retaining Wall #1 at the south bridge abutment at about station 142+00, which represents the apparent worse case foundation loading condition due to the height of the wall. At this location the wall is located on the west side of the trail and is approximately 28 feet in height. A 2.0(H):1.0(V) soil slope down to the existing ground supports the trail on the east side. The approximate magnitude of elastic foundation settlement was calculated using soil modulus values estimated from correlations with corrected standard penetration resistances (N_{60}) for the subsurface profile at the location of boring B-3. Two different foundation loading conditions were utilized, one for an applied bearing pressure at the base of the wall using a unit weight of 135 pcf for the select reinforced zone granular backfill and a second using 135 percent of the backfill weight to represent a possible upper limit for the wall loading. These loading conditions result in foundation contact pressures of 3,780 and 5,040 psf, respectively, at the base of the wall beneath the 28-foot high embankment.

Initial settlement calculations were performed for the embankment loads according to the FHWA EMBANK program manual and elastic solutions developed by Poulos and Davis (1978). The settlement values are taken as the summation of individual layer strains due to added stress from the embankment (MSE wall) loads. Calculations using this method show maximum elastic settlements of 14.1 and 18.8 inches for the two loading conditions. These settlement values likely over estimate the actual amount of settlement since the program cannot exactly model the wall geometry and the values represent settlement calculated along the centerline of a long continuous embankment. Actual settlement should be significantly less at the end abutment.

5. Recommendations (Continued)

Settlement was also calculated using an internal elastic settlement program (MSETT), which allows the wall foundation to be modeled as an individual footing and also is capable of calculating settlement at various points within the foundation footprint. Settlement was calculated for a long embankment by this method using the Westergaard stress distribution and embankment cross section geometry generally equivalent to the MSE wall section at the abutment. Maximum total elastic foundation settlements along the centerline of the embankment were calculated at 10.8 inches for the 3,780 psf load and 14.4 inches for 5,040 psf. Settlement values at the abutment (end of the embankment) were found to be 6.3 and 8.4 inches, respectively.

The settlement calculations noted above are attached for reference. Based on our preliminary analysis, we expect total elastic settlement for MSE Retaining Wall #1 at the south bridge abutment will range approximately from 6 to 11 inches, depending upon the actual loading conditions. Settlement of MSE Retaining Wall #1 at the north abutment should be significantly less, since the maximum wall height is only 17 feet and the foundation footprint is smaller. The elastic settlement should represent the major component of total settlement, since the bearing soils are generally granular and very little consolidation settlement is expected.

Settlement Monitoring. An initial waiting period of 30 days is recommended to allow for completion of at least 90 percent of estimated settlement beneath the MSE wall at the bridge end bents. The majority of the settlement should occur during construction of the MSE walls and the amount of settlement remaining after completion of filling should not be significant. We recommend monitoring of MSE wall settlement during construction to confirm the expected performance and determine the final waiting period necessary. Minimal instrumentation to monitor settlement should consist of settlement plates installed at the interface of the wall fill and the existing ground surface.

Restrictions. During MSE wall construction, installation of vertical casing through the reinforced fill is required for subsequent pile installation at the bridge abutments (end bents). Casing will prevent damage to or interference with the MSE wall reinforcement elements.

Prepared By: Larry D. Mullins, P.E.

Attachments:
- Boring Locations – Mainline Plan Drawing Nos. 13-08 & 13-09
- Key to Symbols and Descriptions
- Soil Test Boring Records (B-1 through B-5)
- Laboratory Soil Test Reports
- Settlement Calculations

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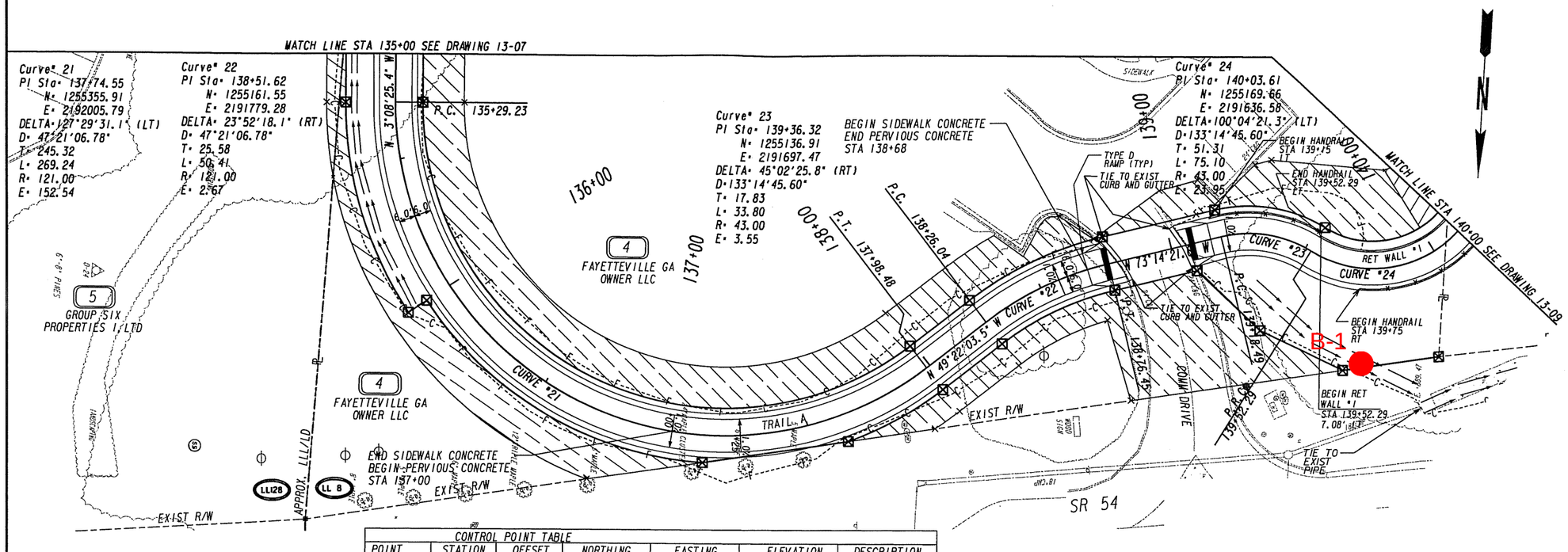
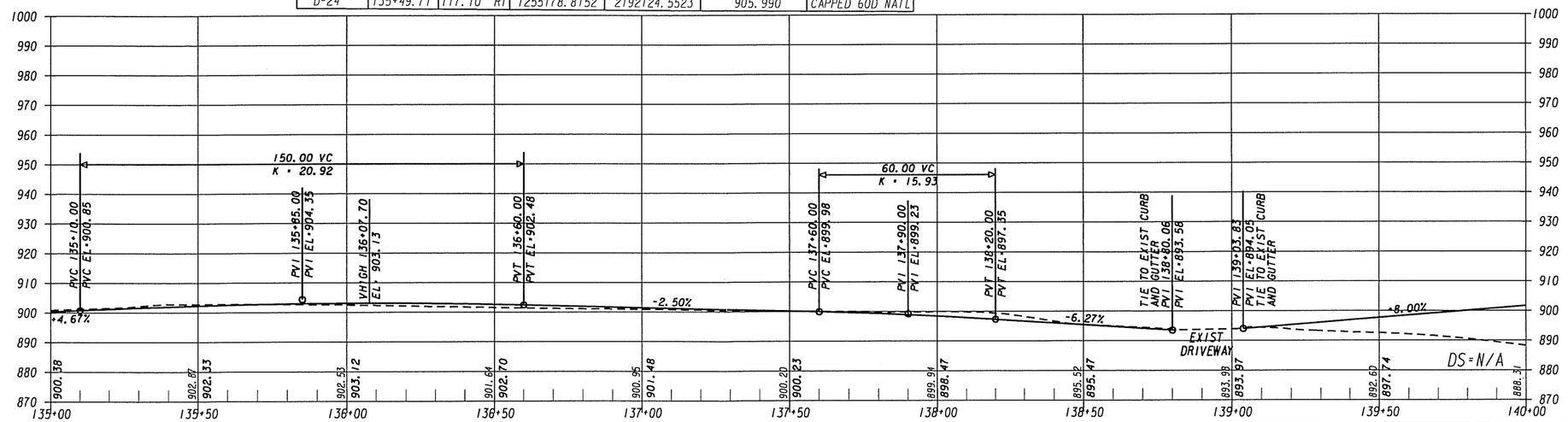
James. c. lawson		gplotborder-v81-PO. tbl			0012878



CONTROL POINT TABLE						
POINT	STATION	OFFSET	NORTHING	EASTING	ELEVATION	DESCRIPTION
D-24	135+49.71	117.10' RT	1255178.8152	2192124.5523	905.990	CAPPED 60D NAIL



PROPERTY AND EXISTING R/W LINE	—℄—
REQUIRED R/W LINE	
CONSTRUCTION LIMITS	—C— F—
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES	
EASEMENT FOR CONSTR OF SLOPES	
EASEMENT FOR CONSTR OF DRIVES	

BEGIN LIMIT OF ACCESS	BLA
END LIMIT OF ACCESS	ELA
LIMIT OF ACCESS	
REQ'D R/W & LIMIT OF ACCESS	
LIMITS OF MILLING & OVERLAY	
LIMITS OF EXIST. PAVEMENT	

GEORGIA
DEPARTMENT OF TRANSPORTATION

AECOM

SCALE IN FEET
0 20 40 80

REVISION DATES

MAINLINE PLAN

SR 54 MULTI-USE TRAIL & BRIDGE

CHECKED:		DATE:		DRAWING No.
BACKCHECKED:		DATE:		13-008
CORRECTED:		DATE:		
VERIFIED:		DATE:		

T/31/2015 GPLN

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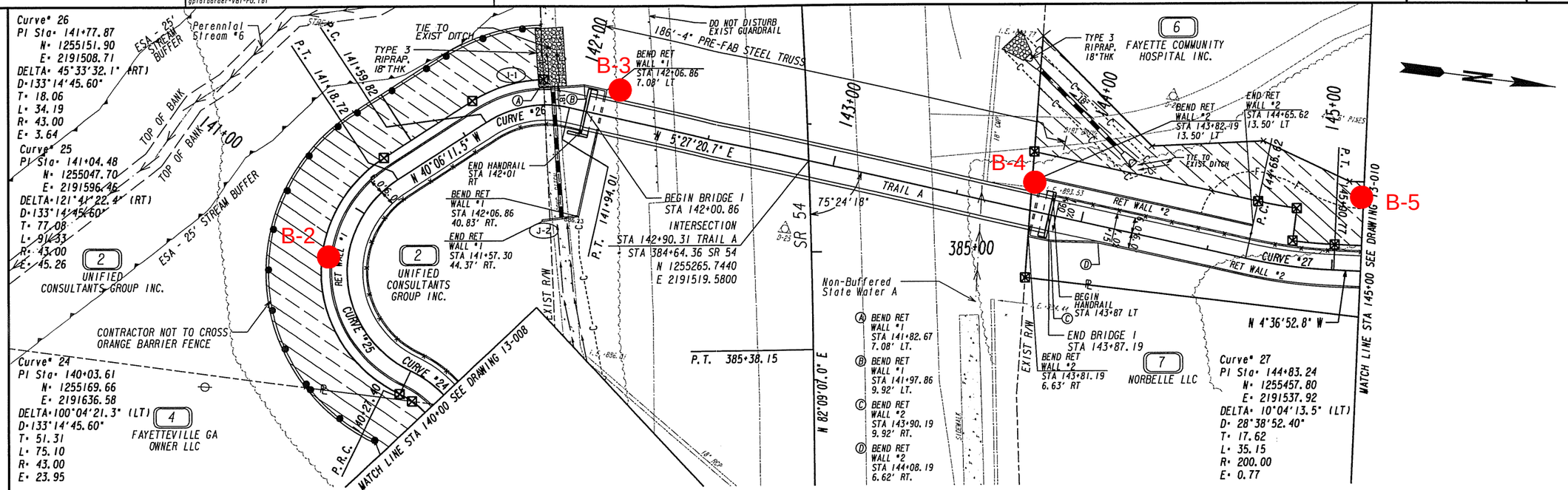
James. c. lawson | gplotborder-v81-PO.tbl

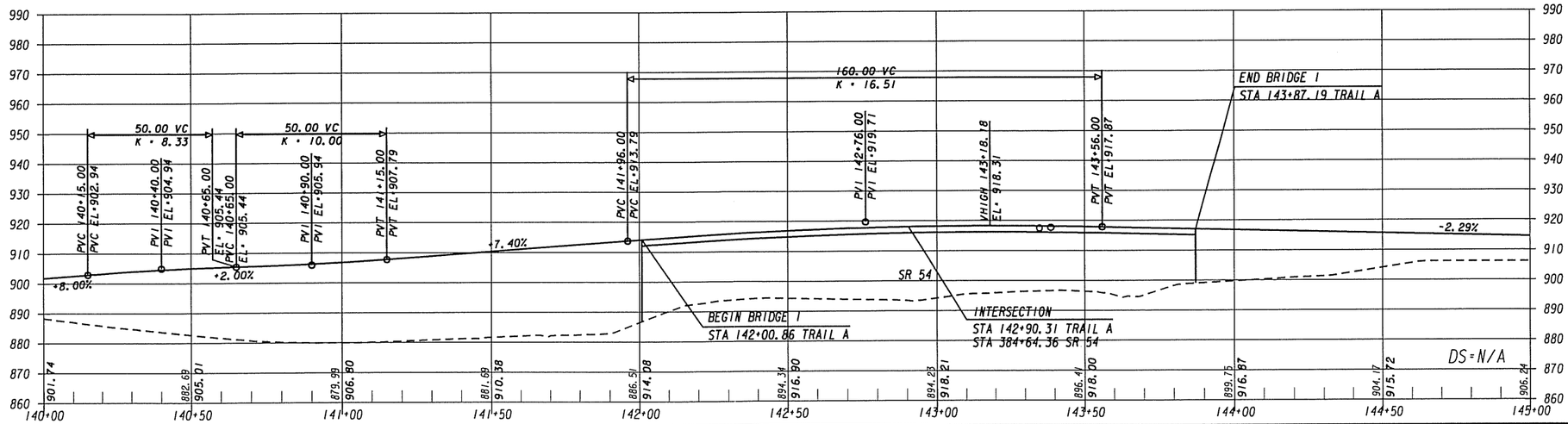
GDOT | P. I. No. 0012878



ESA - SEE ENVIRONMENTAL RESOURCES IMPACT TABLE IN GENERAL NOTES FOR CONSTRUCTION RESTRICTIONS.

CONTROL POINT TABLE

POINT	STATION	OFFSET	NORTHING	EASTING	ELEVATION	DESCRIPTION
D-25	142+75.66	28.02' RT	1255259.8378	2191547.1600	894.599	CAPPED 60D NAIL
D-26	144+12.74	55.85' LT	1255404.2661	2191476.7053	900.708	CAPPED 60D NAIL



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
LIMITS OF MILLING & OVERLAY
LIMITS OF EXIST. PAVEMENT

GEORGIA
DEPARTMENT OF TRANSPORTATION

AECOM

SCALE IN FEET
0 20 40 80

REVISION DATES

MAINLINE PLAN

SR 54 MULTI-USE TRAIL & BRIDGE

CHECKED:		DATE:	DRAWING No.
BACKCHECKED:		DATE:	13-009
CORRECTED:		DATE:	
VERIFIED:		DATE:	

7/31/2015 GPLN

MAJOR DIVISIONS			GROUP SYMBOLS		TYPICAL NAMES
COARSE GRAINED SOILS (More than 50% of material is LARGER than No. 200 sieve size)	GRAVELS (More than 50% of coarse fraction is LARGER than the No. 4 sieve size)	CLEAN GRAVELS (Little or no fines)		GW	Well graded gravels, gravel - sand mixtures, little or no fines.
				GP	Poorly graded gravels or grave - sand mixtures, little or no fines.
		GRAVELS WITH FINES (Appreciable amount of fines)		GM	Silty gravels, gravel - sand - silt mixtures.
				GC	Clayey gravels, gravel - sand - clay mixtures.
	SANDS (More than 50% of coarse fraction is SMALLER than the No. 4 Sieve Size)	CLEAN SANDS (Little or no fines)		SW	Well graded sands, gravelly sands, little or no fines.
				SP	Poorly graded sands or gravelly sands, little or no fines.
		SANDS WITH FINES (Appreciable amount of fines)		SM	Silty sands, sand - silt mixtures
				SC	Clayey sands, sand - clay mixtures.
FINE GRAINED SOILS (More than 50% of material is SMALLER than No. 200 sieve size)	SILTS AND CLAYS (Liquid limit LESS than 50)			ML	Inorganic silts and very fine sands, rock flour, silty of clayey fine sands or clayey silts and with slight plasticity.
				CL	Inorganic lays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
				OL	Organic silts and organic silty clays of low plasticity.
	SILTS AND CLAYS (Liquid limit GREATER than 50)			MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
				CH	Inorganic clays of high plasticity, fat clays
				OH	Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS				PT	Peat and other highly organic soils.
FILL					Fill

	Undisturbed Sample		Auger Cuttings
	Standard Penetration Test or Dynamic Cone Penetration Test		Bulk Sample
	Rock Core		Crandall Sampler
	Dilatometer		Pressure Meter
	Packer		No Recovery
	Water Table at time of boring		Water Table after 24 hours

Correlation of Standard Penetration Resistance with Relative Density and Consistency

SAND & GRAVEL		SILT & CLAY	
No. of Blows	Relative Density	No. of Blows	Consistency
0 - 4	Very Loose	0 - 2	Very Soft
5 - 10	Loose	3 - 4	Soft
11 - 30	Medium Dense	5 - 8	Firm
31 - 50	Dense	9 - 15	Stiff
Over 50	Very Dense	16 - 30	Very Stiff
		31 - 50	Hard
		Over 50	Very Hard

Correlation of Dynamic Cone Penetration Resistance with Relative Density and Consistency (Piedmont Residual Soils)

SAND & GRAVEL		SILT & CLAY	
No. of Blows	Relative Density	No. of Blows	Consistency
0 - 4	Very Loose	0 - 2	Very Soft
5 - 15	Loose	3 - 4	Soft
16 - 30	Medium Dense	5 - 10	Firm
		11 - 30	Stiff

BOUNDARY CLASSIFICATIONS: Soils possessing characteristics of two groups are designated by combinations of group symbols.

SILT OR CLAY	SAND			GRAVEL		Cobbles	Boulders
	Fine	Medium	Coarse	Fine	Coarse		

No.200 No.40 No.10 No.4 3/4" 3" 12"

U.S. STANDARD SIEVE SIZE

Reference: The Unified Soil Classification System, Corps of Engineers, U.S. Army Technical Memorandum No 3-357, Vol. 1, March, 1953 (Revised April, 1960)

KEY TO SYMBOLS AND DESCRIPTIONS

ACCURA

Accura Engineering and Consulting Services, Inc.
3200 Presidential Drive
Atlanta, GA 30340
Office: 404.241.8722

BORING LOG

CONTRACTED WITH: GeoSystems Engineering, Inc. BORING NO.: B-1
PROJECT NAME: Fayetteville Pedestrian Bridge DATE: June 25, 2015
JOB NO.: 20014.003.14 DRILLER: Gable Drilling Co. Inc. RIG: CME 550 LOGGED BY: Larry

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	RECOV.	W	NOTES
	TOPSOIL							
	FILL-Medium dense, brown orange red, clayey SAND		1		7-9-8	10		
890		5	2		3-5-6	14		
	RESIDUUM-Loose, brown orange red, clayey SAND		3		3-5-5	12		
BOW=886								
885	Stiff, yellowish red, sandy SILT (MH)	10	4		4-5-7	18	23	LL=57, PL=45, PI=11
	Medium dense, olive gray, silty SAND							
880		15	5		3-5-6	14		
	Loose, olive gray, silty SAND							
875		20	6		3-5-5	12		
	BORING TERMINATED AT 20 FEET							No groundwater encountered at time of boring
870		25						
865		30						
860		35						
855		40						

BOW-Bottom of Wall#1
LL-Liquid Limit
PL-Platic Limit
PI-Plasticity Index

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3200 Presidential Drive
Atlanta, GA 30340
Office: 404.241.8722

BORING LOG

CONTRACTED WITH: GeoSystems Engineering, Inc. BORING NO.: B-2
PROJECT NAME: Fayetteville Pedestrian Bridge DATE: June 25, 2015
JOB NO.: 20014.003.14 DRILLER: Gable Drilling Co. Inc. RIG: CME 550 LOGGED BY: Larry

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	RECOV.	W	NOTES
BOW=878	TOPSOIL							
	FILL-Loose, brown orange red, clayey SAND		1		1-2-3	12		
875	Loose, yellowish brown, clayey SAND							
		5 ▽	2		2-4-6	14		Groundwater encountered at 5 feet at time of boring
			3		2-3-6	12		
870	RESIDUUM-Very loose, brown orange, silty SAND							
		10	4		1-2-2	12		
865	Loose, dark yellowish brown, silty SAND							
		15	5		3-3-4	18		
860								
		20	6		3-4-4	12		
855	Medium dense, brown orange, silty SAND							
		25	7		6-8-8	12		
850								
		30	8		5-10-13	18		
845								
		35	9		7-12-15	18		
840	Medium dense, brown orange red, silty SAND							BOW-Bottom of Wall#1
		40	10		5-6-8	14		

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3200 Presidential Drive
Atlanta, GA 30340
Office: 404.241.8722

BORING LOG

CONTRACTED WITH: GeoSystems Engineering, Inc. BORING NO.: B-2
PROJECT NAME: Fayetteville Pedestrian Bridge DATE: June 25, 2015
JOB NO.: 20014.003.14 DRILLER: Gable Drilling Co. Inc. RIG: CME 550 LOGGED BY: Larry

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	RECOV.	W	NOTES
835	PWR-Very dense, black orange red, partially weathered rock	45	11		25-50/5"	12		
830	AUGER REFUSAL AT 48 FEET	50						
825		55						
820		60						
815		65						
810		70						
805		75						
800		80						
795		85						

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3200 Presidential Drive
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Office: 404.241.8722

BORING LOG

CONTRACTED WITH: GeoSystems Engineering, Inc. BORING NO.: B-3
PROJECT NAME: Fayetteville Pedestrian Bridge DATE: June 25, 2015
JOB NO.: 20014.003.14 DRILLER: Gable Drilling Co. Inc. RIG: CME 550 LOGGED BY: Larry

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	RECOV.	W	NOTES
890	TOPSOIL							
	FILL-Medium dense, reddish brown, clayey SAND		1		3-4-8	12		
		5	2		4-6-6	14		
885			3		5-6-5	12		
BOW=882	Loose, reddish brown, clayey SAND	10	4		2-3-5	14		
880								
	RESIDUUM-Loose, gray orange, silty SAND	15	5		2-2-3	14		
875								
	Loose, brown orange, silty SAND	20	6		2-2-3	12		
870		▽						Groundwater encountered at 22 feet at time of boring
		25	7		4-4-4	12		
865								
	Medium dense, reddish yellow, silty SAND	30	8		4-5-11	18		
860								
	Loose, brown orange silty SAND	35	9		3-5-5	14		
855								BOW-Bottom of Wall#1
	Medium dense, brown orange red, silty SAND	40	10		6-9-11	14		
850								
	Medium dense, brown orange red, silty							

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3200 Presidential Drive
Atlanta, GA 30340
Office: 404.241.8722

BORING LOG

CONTRACTED WITH: GeoSystems Engineering, Inc. BORING NO.: B-3
PROJECT NAME: Fayetteville Pedestrian Bridge DATE: June 25, 2015
JOB NO.: 20014.003.14 DRILLER: Gable Drilling Co. Inc. RIG: CME 550 LOGGED BY: Larry

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	RECOV.	W	NOTES
	SAND							
		45	11		3-7-10	12		
845								
	PWR-Very dense, orange brown, partially weathered rock	50	12		20-50/4"	12		
840								
	AUGER REFUSAL AT 52 FEET	55						
835		60						
830		65						
825		70						
820		75						
815		80						
810		85						

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3200 Presidential Drive
Atlanta, GA 30340
Office: 404.241.8722

BORING LOG

CONTRACTED WITH: GeoSystems Engineering, Inc. BORING NO.: B-4
PROJECT NAME: Fayetteville Pedestrian Bridge DATE: June 25, 2015
JOB NO.: 20014.003.14 DRILLER: Gable Drilling Co. Inc. RIG: CME 550 LOGGED BY: Larry

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	RECOV.	W	NOTES
BOW=896	FILL-Gravel							
895	FILL-Medium dense, brown orange red, clayey SAND		1		2-5-6	12		
	RESIDUUM-Medium dense, brown orange red, clayey SAND	5	2		5-8-14	14		
890	Stiff, yellowish red, sandy SILT (ML)		3		3-4-6	12		LL=49, PL=41, PI=8
		10	4		3-5-8	18		
885		15	5		3-5-6	14		
880	Loose, olive gray, silty SAND	20	6		2-3-4	12		
875		25	7		2-4-4	12		
870		▽						Groundwater encountered at 27 feet at time of boring
	Medium dense, white brown orange, silty SAND	30	8		4-6-8	18		
865		35	9		3-6-7	18		
860		40	10		3-4-8	14		BOW-Bottom of Wall#2 LL-Liquid Limit PL-Platic Limit PI-Plasticity Index
855								

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3200 Presidential Drive
Atlanta, GA 30340
Office: 404.241.8722

BORING LOG

CONTRACTED WITH: GeoSystems Engineering, Inc. BORING NO.: B-4
PROJECT NAME: Fayetteville Pedestrian Bridge DATE: June 25, 2015
JOB NO.: 20014.003.14 DRILLER: Gable Drilling Co. Inc. RIG: CME 550 LOGGED BY: Larry

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	RECOV.	W	NOTES
	Medium dense, black orange red, silty SAND	45	11		5-8-10	12		
850		50	12		3-4-7	12		
845	Medium dense, light gray, silty SAND	55	13		4-6-7	14		
840		60	14		5-7-7	14		
	BORING TERMINATED at 60 FEET							
835		65						
830		70						
825		75						
820		80						
815		85						

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Office: 404.241.8722

BORING LOG

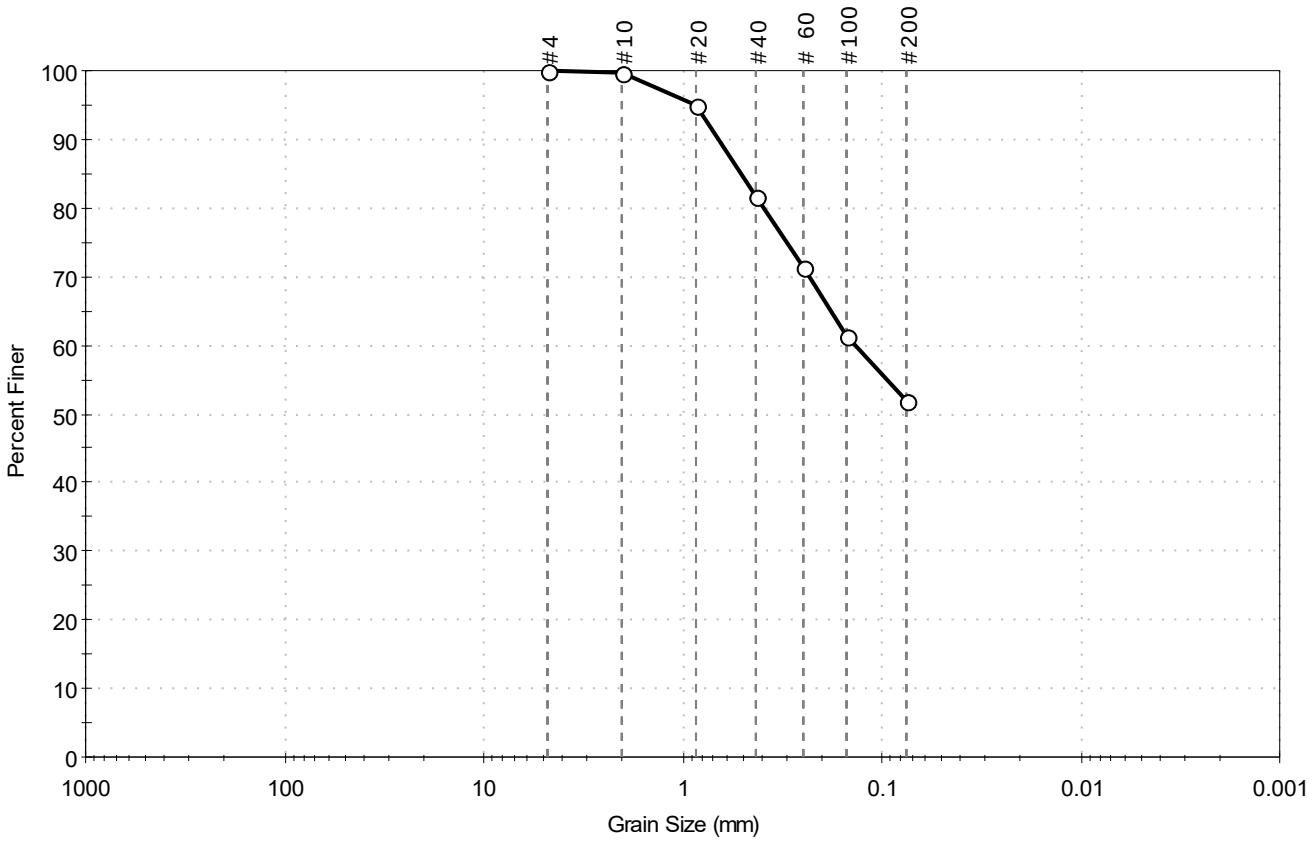
CONTRACTED WITH: GeoSystems Engineering, Inc. BORING NO.: B-5
PROJECT NAME: Fayetteville Pedestrian Bridge DATE: June 25, 2015
JOB NO.: 20014.003.14 DRILLER: Gable Drilling Co. Inc. RIG: CME 550 LOGGED BY: Larry

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	RECOV.	W	NOTES
905	TOPSOIL							
	RESIDUUM-Very stiff to stiff, red, sandy SILT (ML)		1		4-7-16	10		
BOW=904								
		5	2		4-7-8	12	13	LL=48, PL=34, PI=14
900	Medium dense, brown orange red, silty SAND		3		4-8-9	12		
		10	4		3-5-6	18		
895								
		15	5		4-6-7	14		
890								
		20	6		4-4-7	12		
	BORING TERMINATED AT 20 FEET							No groundwater encountered at time of boring
885								
		25						
880								
		30						
875								
		35						
870								
		40						
865								

BOW-Bottom of Wall#2
LL-Liquid Limit
PL-Platic Limit
PI-Plasticity Index

Client:	GeoSystems Engineering, Inc.				
Project:	Fayetteville Pedestrian Bridge/Walking Trail				
Location:	Fayetteville, Georgia			Project No:	GTX-306785
Boring ID:	B-1	Sample Type:	bag	Tested By:	twh
Sample ID:	S-4	Test Date:	08/02/17	Checked By:	MCM
Depth :	9.5 ft	Test Id:	286071		
Test Comment:	---				
Visual Description:	Moist, yellowish red sandy silt				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	48.1	51.9

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	95		
#40	0.42	82		
# 60	0.25	71		
#100	0.15	61		
#200	0.075	52		

Coefficients

D_{85} = 0.5055 mm	D_{30} = N/A
D_{60} = 0.1346 mm	D_{15} = N/A
D_{50} = N/A	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM Sandy Elastic silt (MH)

AASHTO Clayey Soils (A-7-5 (5))

Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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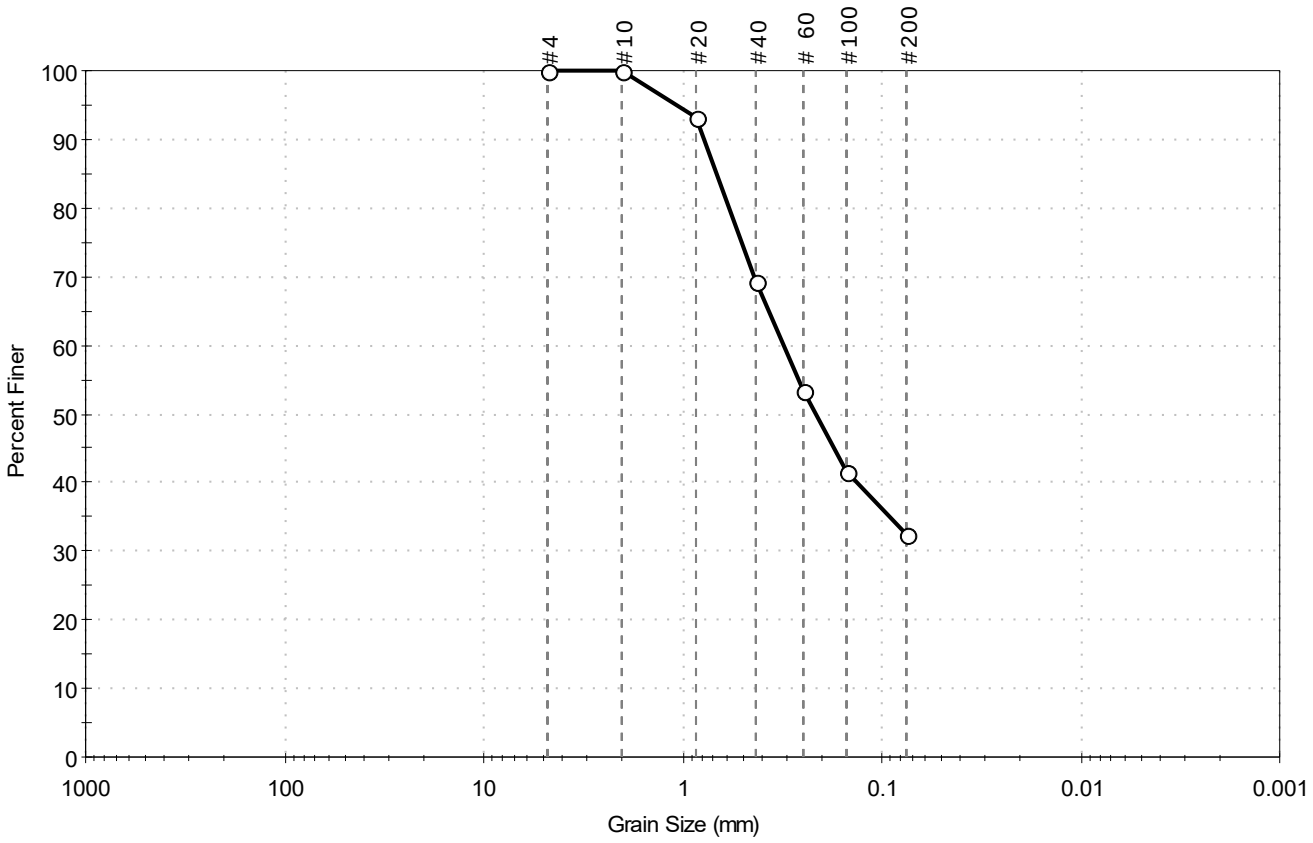
Client:	GeoSystems Engineering, Inc.				
Project:	Fayetteville Pedestrian Bridge/Walking Trail				
Location:	Fayetteville, Georgia			Project No:	GTX-306785
Boring ID:	B-1	Sample Type:	bag	Tested By:	twh
Sample ID:	S-5+S-6 Composite	Test Date:	08/02/17	Checked By:	MCM
Depth :	14.5-19.5 ft	Test Id:	286072		
Test Comment:	---				
Visual Description:	Moist, olive gray silty sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	67.5	32.5

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	93		
#40	0.42	69		
# 60	0.25	53		
#100	0.15	42		
#200	0.075	33		

Coefficients

D_{85} = 0.6691 mm	D_{30} = N/A
D_{60} = 0.3111 mm	D_{15} = N/A
D_{50} = 0.2156 mm	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

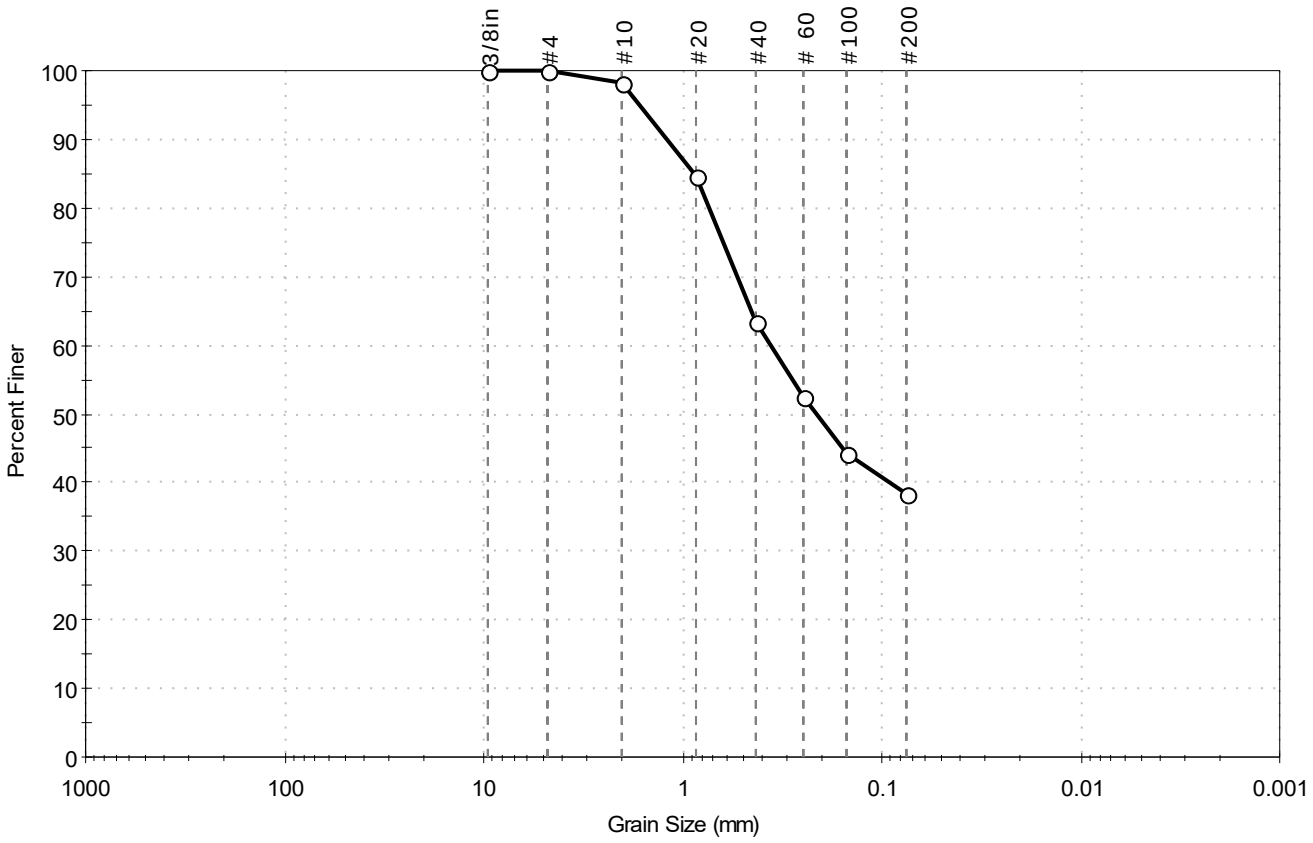
Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

Client:	GeoSystems Engineering, Inc.				
Project:	Fayetteville Pedestrian Bridge/Walking Trail				
Location:	Fayetteville, Georgia			Project No:	GTX-306785
Boring ID:	B-2	Sample Type:	bag	Tested By:	twh
Sample ID:	S-2+S-3 Composite	Test Date:	08/02/17	Checked By:	MCM
Depth :	4.5-7.0 ft	Test Id:	286073		
Test Comment:	---				
Visual Description:	Moist, yellowish brown clayey sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.1	61.5	38.4

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
3/8in	9.50	100		
#4	4.75	100		
#10	2.00	98		
#20	0.85	85		
#40	0.42	64		
# 60	0.25	52		
#100	0.15	44		
#200	0.075	38		

Coefficients

D_{85} = 0.8628 mm	D_{30} = N/A
D_{60} = 0.3593 mm	D_{15} = N/A
D_{50} = 0.2151 mm	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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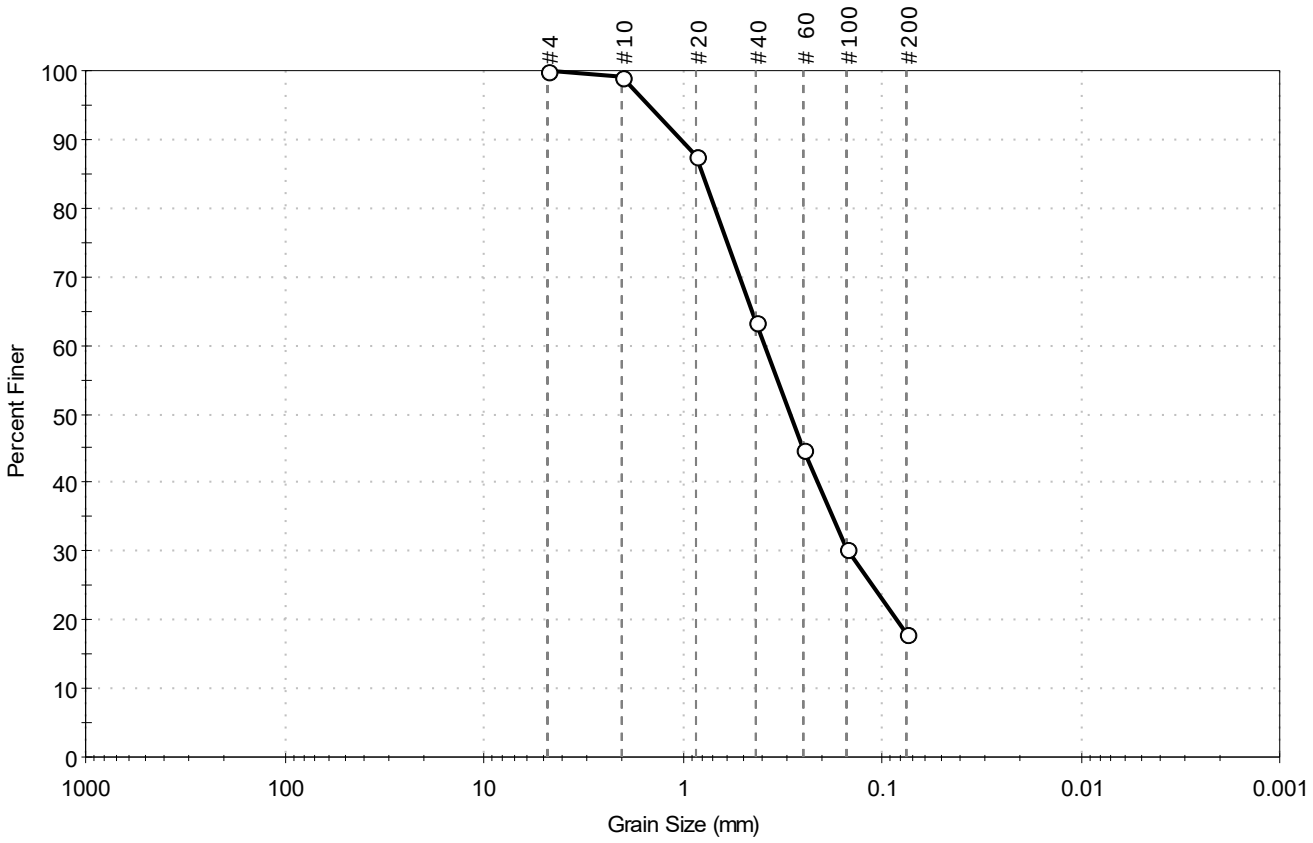
Client:	GeoSystems Engineering, Inc.				
Project:	Fayetteville Pedestrian Bridge/Walking Trail				
Location:	Fayetteville, Georgia			Project No:	GTX-306785
Boring ID:	B-2	Sample Type:	bag	Tested By:	twh
Sample ID:	S-6	Test Date:	08/02/17	Checked By:	MCM
Depth :	19.5 ft	Test Id:	286074		
Test Comment:	---				
Visual Description:	Moist, dark yellowish brown silty sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	81.9	18.1

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	99		
#20	0.85	88		
#40	0.42	63		
# 60	0.25	45		
#100	0.15	30		
#200	0.075	18		

Coefficients

D_{85} = 0.7863 mm	D_{30} = 0.1472 mm
D_{60} = 0.3850 mm	D_{15} = N/A
D_{50} = 0.2894 mm	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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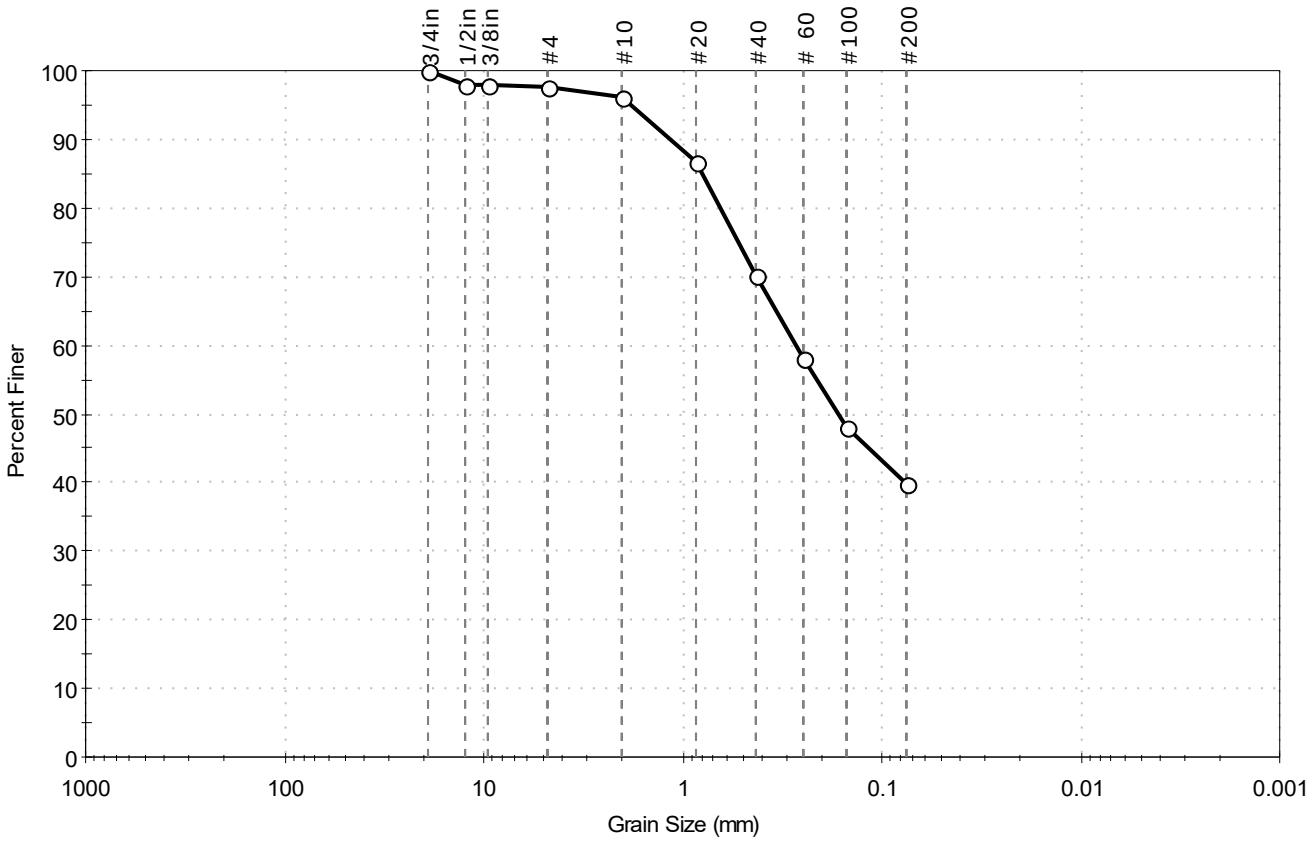
Client:	GeoSystems Engineering, Inc.				
Project:	Fayetteville Pedestrian Bridge/Walking Trail				
Location:	Fayetteville, Georgia			Project No:	GTX-306785
Boring ID:	B-3	Sample Type:	bag	Tested By:	twh
Sample ID:	S-3+S-4 Composite	Test Date:	08/02/17	Checked By:	MCM
Depth :	7.0-9.5 ft	Test Id:	286075		
Test Comment:	---				
Visual Description:	Moist, reddish brown clayey sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	2.4	57.6	40.0

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
3/4in	19.00	100		
1/2in	12.50	98		
3/8in	9.50	98		
#4	4.75	98		
#10	2.00	96		
#20	0.85	87		
#40	0.42	70		
# 60	0.25	58		
#100	0.15	48		
#200	0.075	40		

Coefficients

D_{85} = 0.7948 mm D_{30} = N/A

D_{60} = 0.2715 mm D_{15} = N/A

D_{50} = 0.1647 mm D_{10} = N/A

C_u = N/A C_c = N/A

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

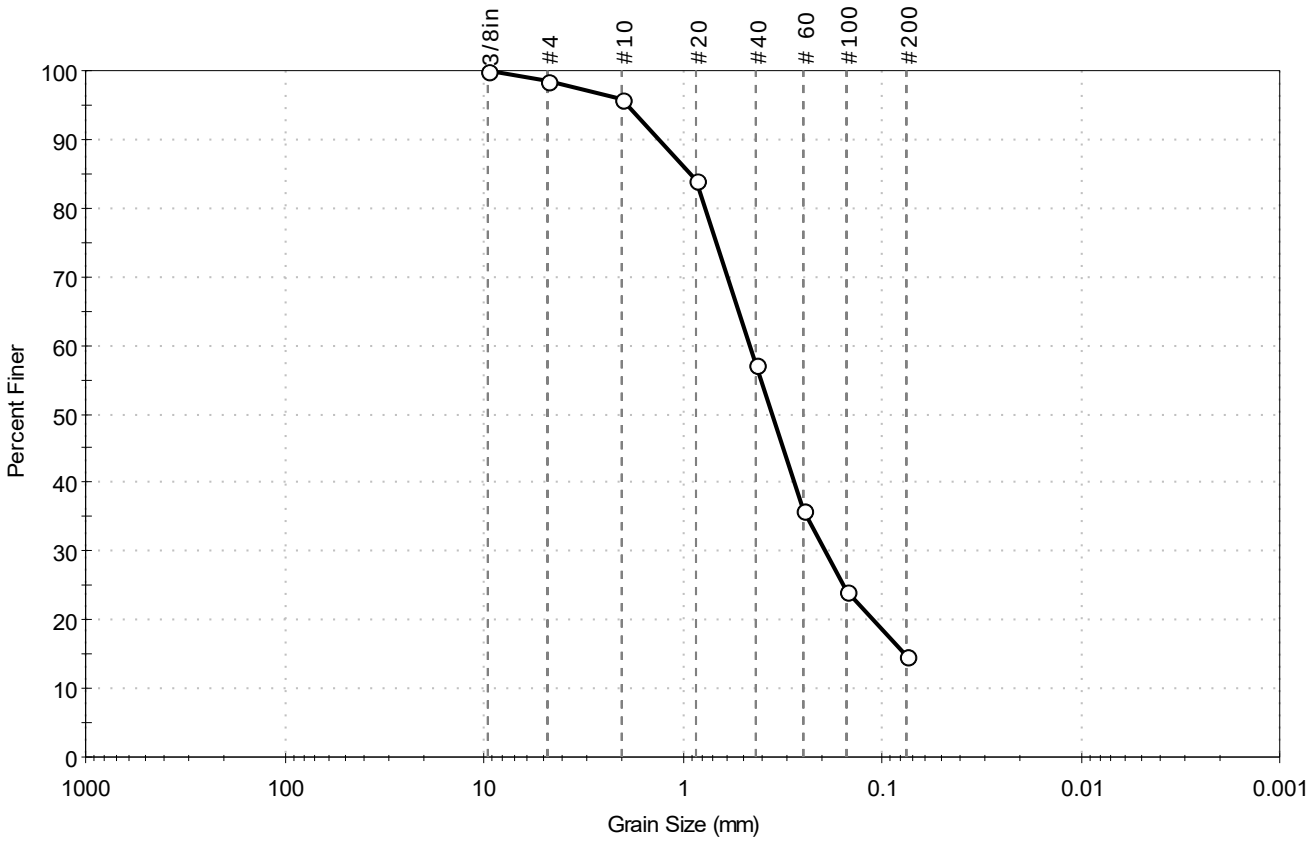
Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

Client:	GeoSystems Engineering, Inc.				
Project:	Fayetteville Pedestrian Bridge/Walking Trail				
Location:	Fayetteville, Georgia			Project No:	GTX-306785
Boring ID:	B-3	Sample Type:	bag	Tested By:	twh
Sample ID:	S-8	Test Date:	08/02/17	Checked By:	MCM
Depth :	29.5 ft	Test Id:	286076		
Test Comment:	---				
Visual Description:	Moist, reddish yellow silty sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	1.6	83.6	14.8

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
3/8in	9.50	100		
#4	4.75	98		
#10	2.00	96		
#20	0.85	84		
#40	0.42	57		
# 60	0.25	36		
#100	0.15	24		
#200	0.075	15		

Coefficients

D_{85} = 0.9104 mm	D_{30} = 0.1935 mm
D_{60} = 0.4570 mm	D_{15} = 0.0761 mm
D_{50} = 0.3554 mm	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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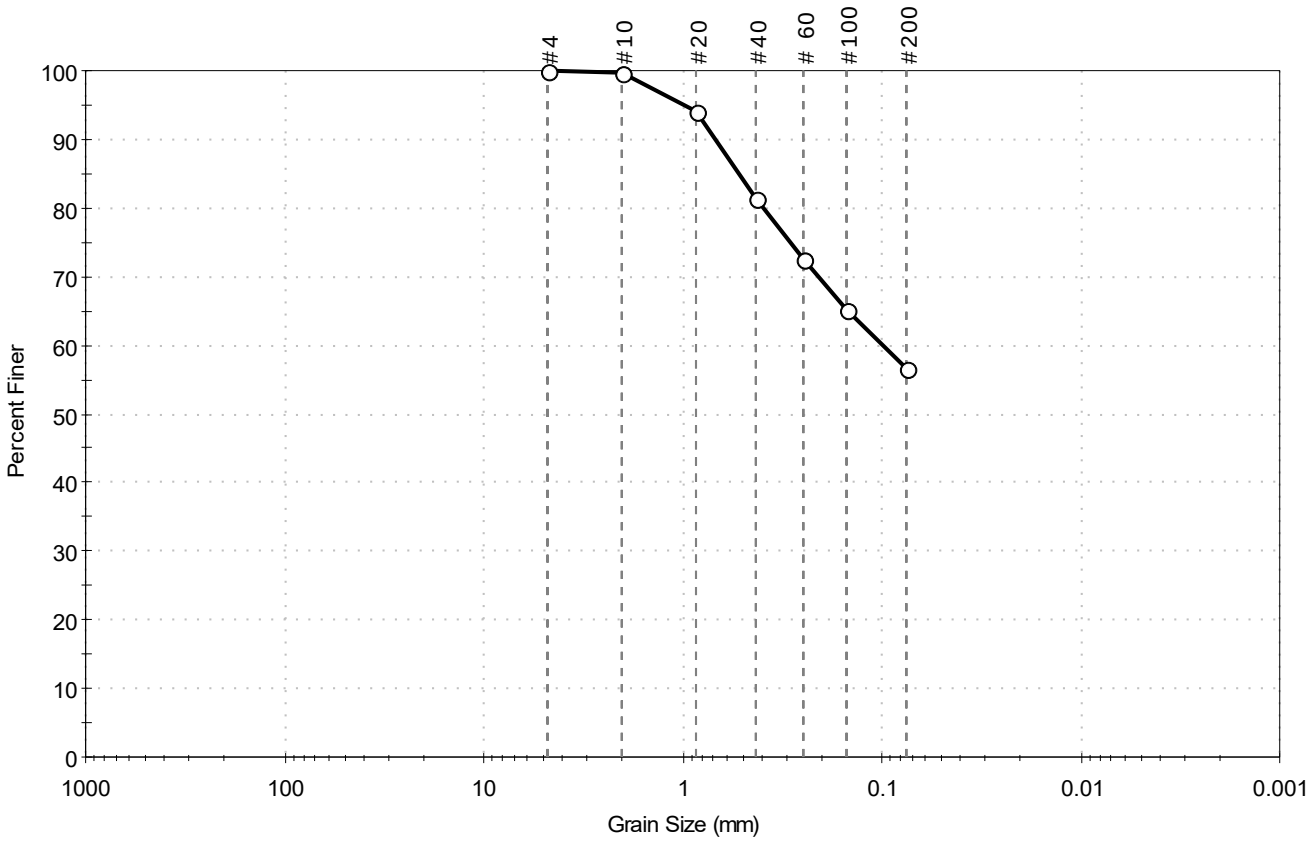
Client:	GeoSystems Engineering, Inc.				
Project:	Fayetteville Pedestrian Bridge/Walking Trail				
Location:	Fayetteville, Georgia			Project No:	GTX-306785
Boring ID:	B-4	Sample Type:	bag	Tested By:	twh
Sample ID:	S-3+S-4 Composite	Test Date:	08/02/17	Checked By:	MCM
Depth :	7.0-9.5 ft	Test Id:	286077		
Test Comment:	---				
Visual Description:	Moist, yellowish red sandy silt				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	43.5	56.5

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	94		
#40	0.42	81		
# 60	0.25	72		
#100	0.15	65		
#200	0.075	56		

Coefficients

D_{85} = 0.5191 mm	D_{30} = N/A
D_{60} = 0.0994 mm	D_{15} = N/A
D_{50} = N/A	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM Sandy Silt (ML)

AASHTO Silty Soils (A-5 (4))

Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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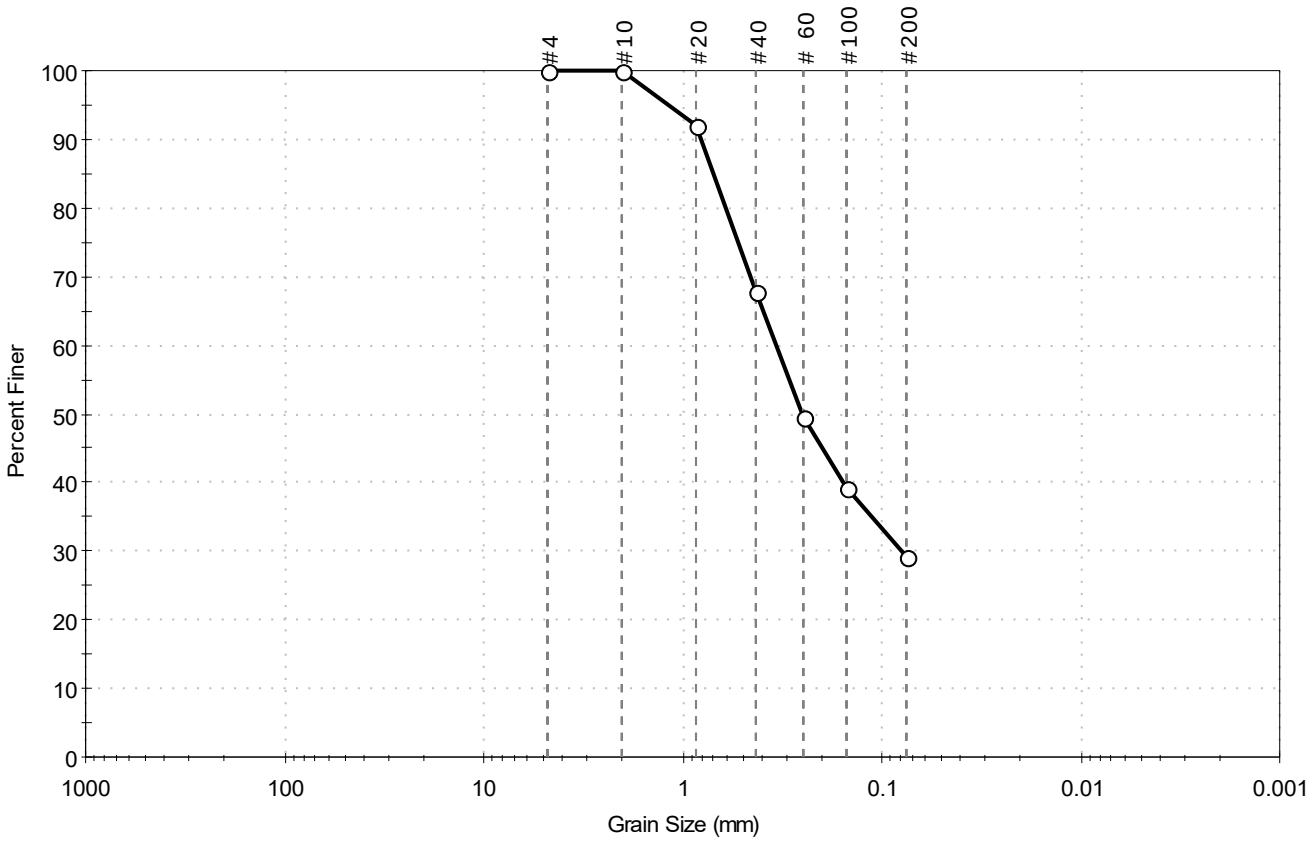
Client:	GeoSystems Engineering, Inc.				
Project:	Fayetteville Pedestrian Bridge/Walking Trail				
Location:	Fayetteville, Georgia			Project No:	GTX-306785
Boring ID:	B-4	Sample Type:	bag	Tested By:	twh
Sample ID:	S-7	Test Date:	08/02/17	Checked By:	MCM
Depth :	24.5 ft	Test Id:	286078		
Test Comment:	---				
Visual Description:	Moist, olive gray silty sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	70.8	29.2

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	92		
#40	0.42	68		
# 60	0.25	50		
#100	0.15	39		
#200	0.075	29		

Coefficients

D_{85} = 0.6957 mm	D_{30} = 0.0792 mm
D_{60} = 0.3388 mm	D_{15} = N/A
D_{50} = 0.2535 mm	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

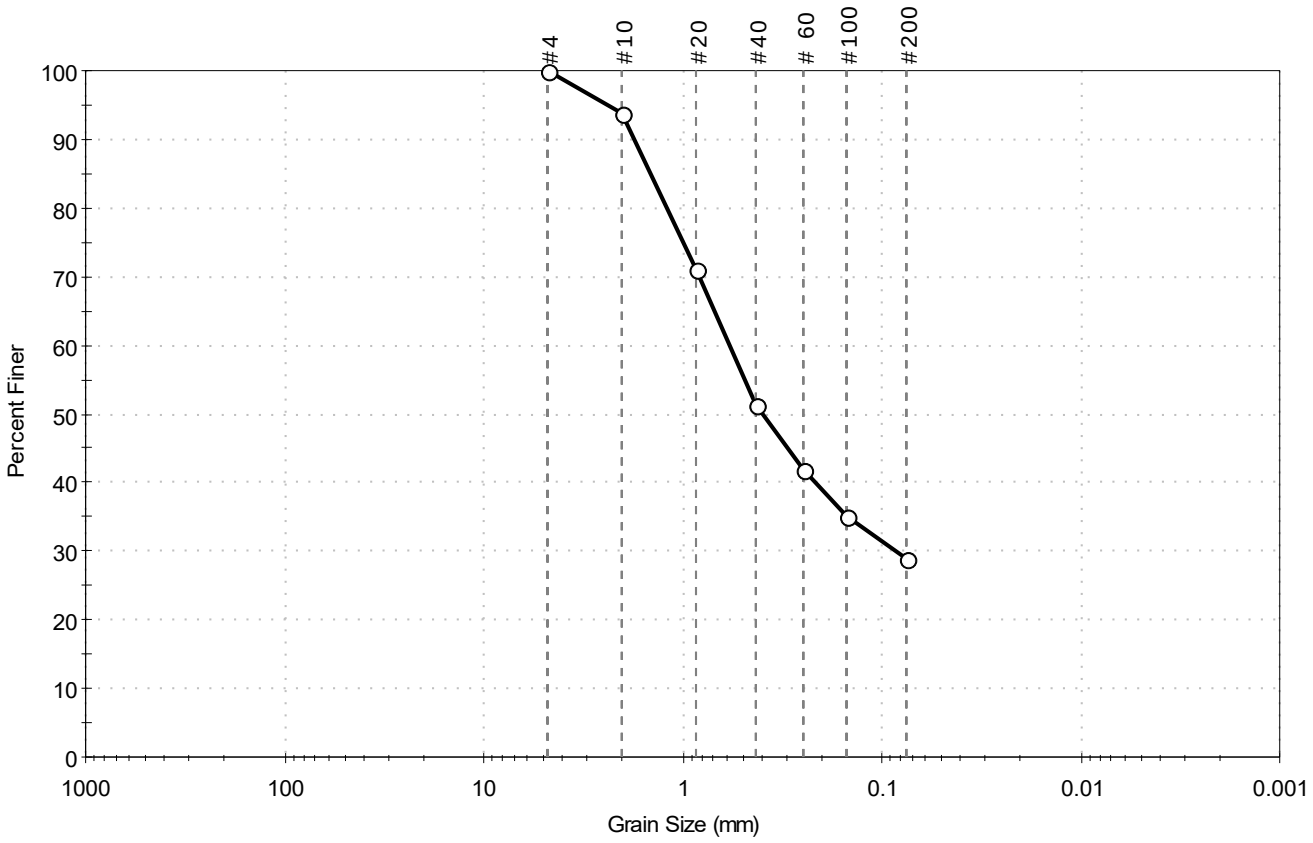
Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

Client:	GeoSystems Engineering, Inc.				
Project:	Fayetteville Pedestrian Bridge/Walking Trail				
Location:	Fayetteville, Georgia			Project No:	GTX-306785
Boring ID:	B-4	Sample Type:	bag	Tested By:	twh
Sample ID:	S-13+S-14 Composite	Test Date:	08/02/17	Checked By:	MCM
Depth :	54.5-59.5 ft	Test Id:	286079		
Test Comment:	---				
Visual Description:	Moist, light gray silty sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	71.1	28.9

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	94		
#20	0.85	71		
#40	0.42	51		
# 60	0.25	42		
#100	0.15	35		
#200	0.075	29		

Coefficients

D_{85} = 1.4299 mm	D_{30} = 0.0847 mm
D_{60} = 0.5754 mm	D_{15} = N/A
D_{50} = 0.3948 mm	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample / Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

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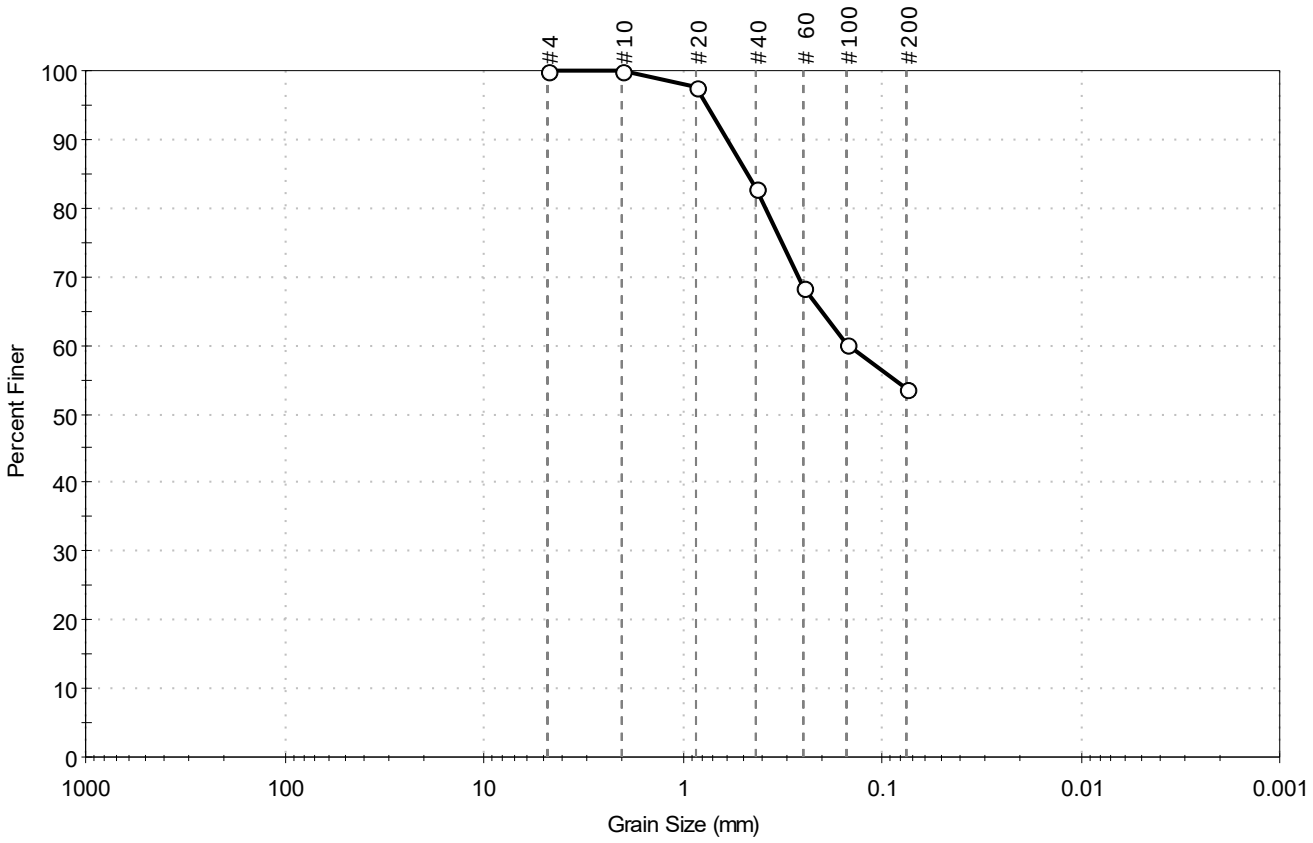
GeoTesting EXPRESS

Client:	GeoSystems Engineering, Inc.				
Project:	Fayetteville Pedestrian Bridge/Walking Trail				
Location:	Fayetteville, Georgia			Project No:	GTX-306785
Boring ID:	B-5	Sample Type:	bag	Tested By:	twh
Sample ID:	S-1+S-2 Composite	Test Date:	08/02/17	Checked By:	MCM
Depth :	1.0-4.5 ft	Test Id:	286080		
Test Comment:	---				
Visual Description:	Moist, red sandy silt				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	46.3	53.7

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	98		
#40	0.42	83		
# 60	0.25	68		
#100	0.15	60		
#200	0.075	54		

Coefficients

D_{85} = 0.4722 mm	D_{30} = N/A
D_{60} = 0.1484 mm	D_{15} = N/A
D_{50} = N/A	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM Sandy Silt (ML)

AASHTO Clayey Soils (A-7-5 (6))

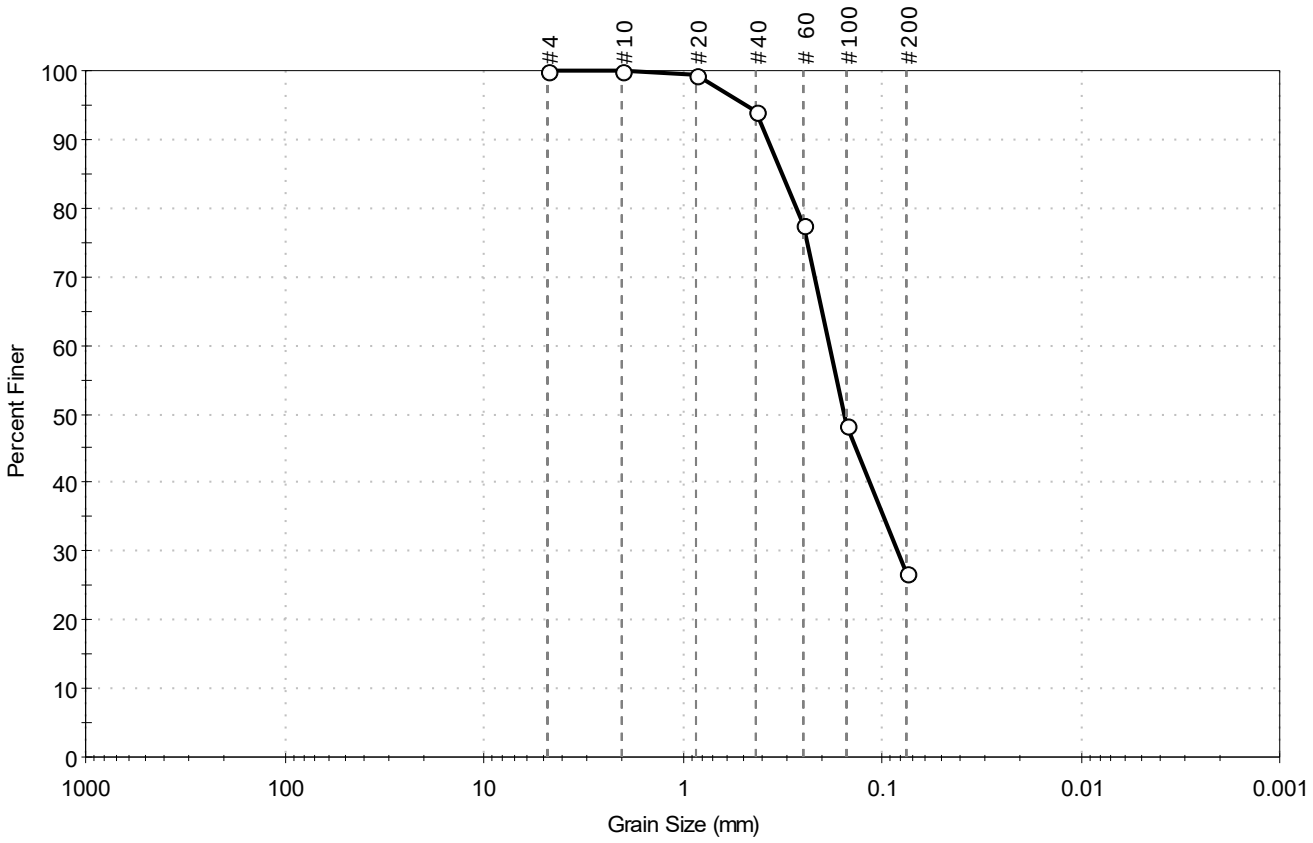
Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

Client:	GeoSystems Engineering, Inc.				
Project:	Fayetteville Pedestrian Bridge/Walking Trail				
Location:	Fayetteville, Georgia			Project No:	GTX-306785
Boring ID:	B-5	Sample Type:	bag	Tested By:	twh
Sample ID:	S-5	Test Date:	08/02/17	Checked By:	MCM
Depth :	14.5	Test Id:	286081		
Test Comment:	---				
Visual Description:	Moist, red silty sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	73.3	26.7

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	100		
#40	0.42	94		
# 60	0.25	78		
#100	0.15	48		
#200	0.075	27		

Coefficients

D_{85} = 0.3169 mm	D_{30} = 0.0832 mm
D_{60} = 0.1835 mm	D_{15} = N/A
D_{50} = 0.1540 mm	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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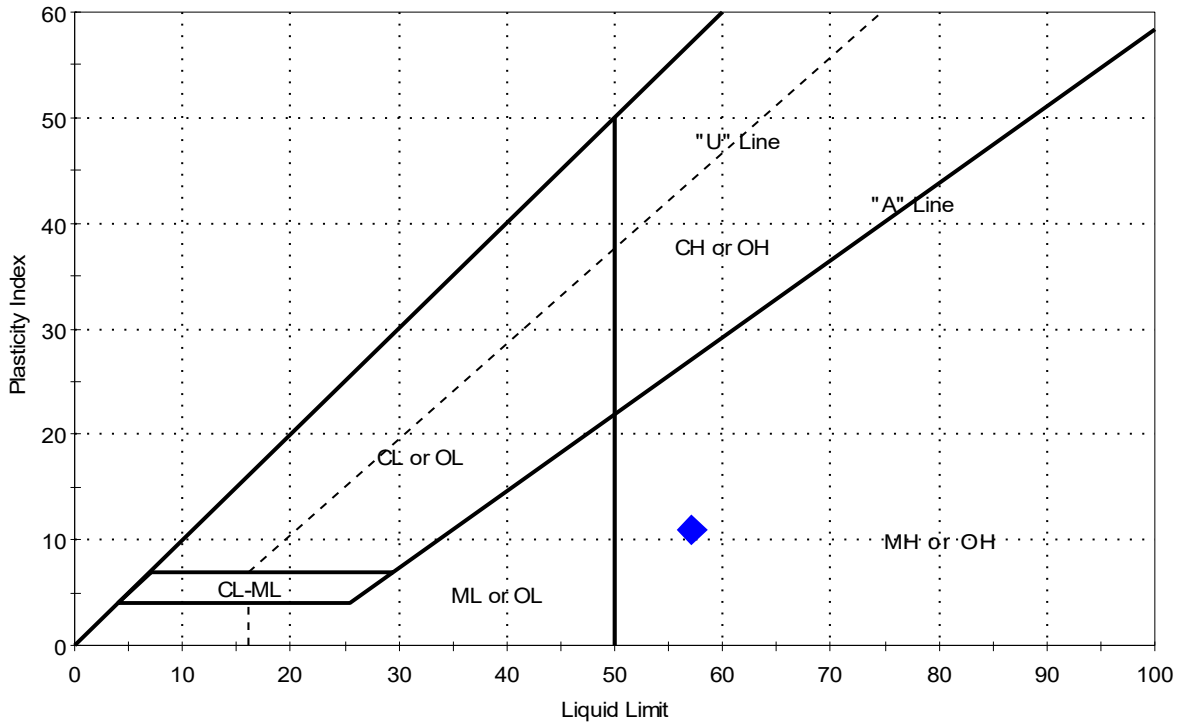
Client:	GeoSystems Engineering, Inc.				
Project:	Fayetteville Pedestrian Bridge/Walking Trail				
Location:	Fayetteville, Georgia			Project No:	GTX-306785
Boring ID:	B-1	Sample Type:	bag	Tested By:	twh
Sample ID:	S-4	Test Date:	08/04/17	Checked By:	MCM
Depth :	9.5 ft	Test Id:	286109		
Test Comment:	---				
Visual Description:	Moist, yellowish red sandy silt				
Sample Comment:	---				

Atterberg Limits - ASTM D4318

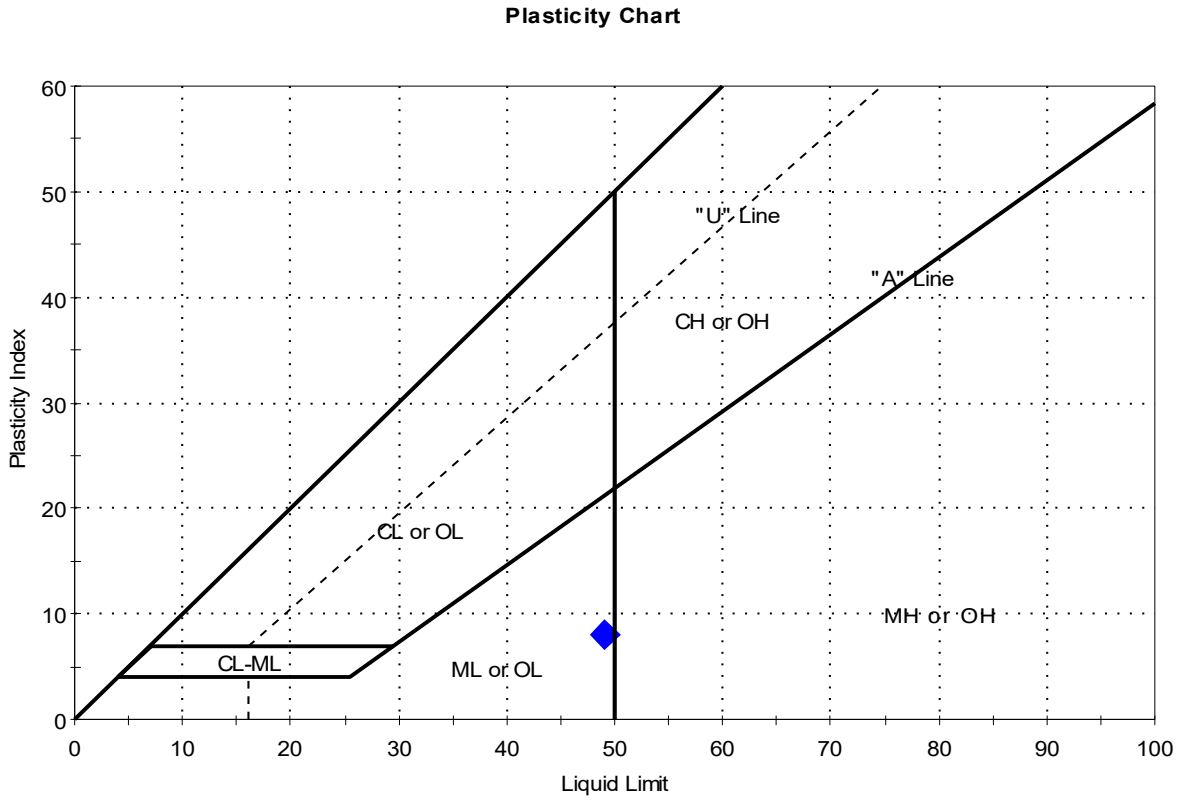


Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	S-4	B-1	9.5 ft	23	57	46	11	-2.1	Sandy Elastic silt (MH)

Sample Prepared using the WET method
18% Retained on #40 Sieve
Dry Strength: MEDIUM
Dilatancy: RAPID
Toughness: LOW

Client:	GeoSystems Engineering, Inc.				
Project:	Fayetteville Pedestrian Bridge/Walking Trail				
Location:	Fayetteville, Georgia			Project No:	GTX-306785
Boring ID:	B-4	Sample Type:	bag	Tested By:	n/a
Sample ID:	S-3+S-4 Composite	Test Date:	08/04/17	Checked By:	MCM
Depth :	7.0-9.5 ft	Test Id:	286112		
Test Comment:	---				
Visual Description:	Moist, yellowish red sandy silt				
Sample Comment:	---				

Atterberg Limits - ASTM D4318



Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	S-3+S-4 Composite	B-4	7.0-9.5 ft	22	49	41	8	-2.4	Sandy Silt (ML)

Sample Prepared using the WET method
19% Retained on #40 Sieve
Dry Strength: MEDIUM
Dilatancy: SLOW
Toughness: LOW

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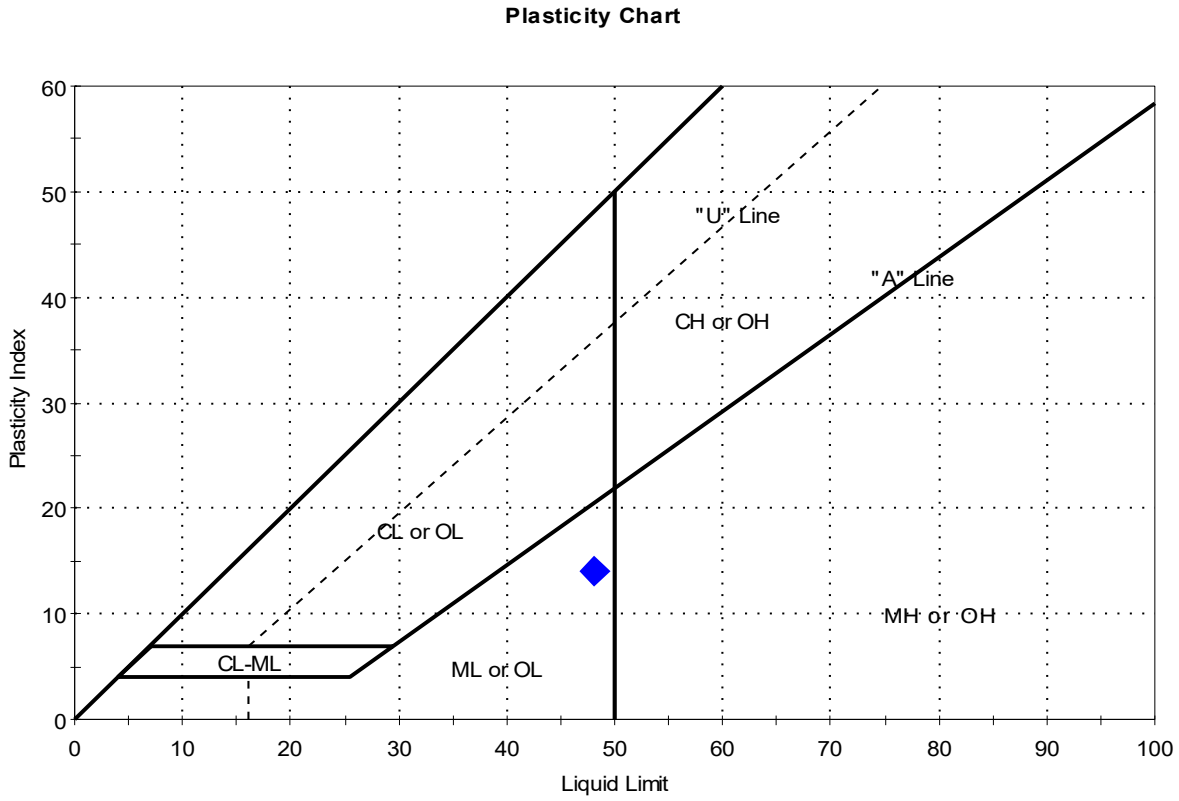
Client:	GeoSystems Engineering, Inc.				
Project:	Fayetteville Pedestrian Bridge/Walking Trail				
Location:	Fayetteville, Georgia			Project No:	GTX-306785
Boring ID:	B-5	Sample Type:	bag	Tested By:	twh
Sample ID:	S-1+S-2 Composite	Test Date:	08/04/17	Checked By:	MCM
Depth :	1.0-4.5 ft	Test Id:	286111		
Test Comment:	---				
Visual Description:	Moist, red sandy silt				
Sample Comment:	---				

Atterberg Limits - ASTM D4318



Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	S-1+S-2 Composite	B-5	1.0-4.5 ft	13	48	34	14	-1.5	Sandy Silt (ML)

Sample Prepared using the WET method

17% Retained on #40 Sieve

Dry Strength: MEDIUM

Dilatancy: SLOW

Toughness: LOW

ELASTIC SETTLEMENT

GEOSYSTEMS ENGINEERING, INC.

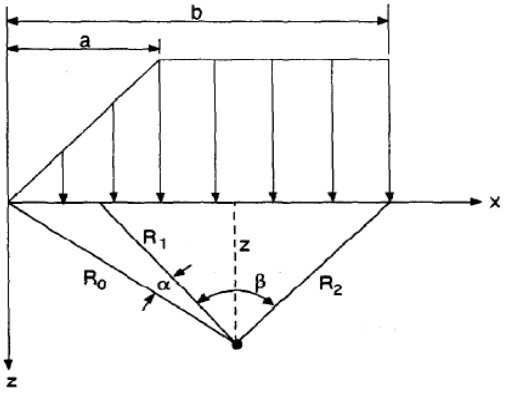
Project:	SR-54 Multi-Use Trail & Bridge	**Date:**	8/11/2017
Location:	Fayette County , Georgia	**Engineer:**	LDM
Analysis:	Elastic settlements		
Description:	Elastic settlements based on moduli interpreted from SPT data from boring B-3		

Calculation performed as outlined in FHWA EMBANK user manual. Principle of supersition is used to combine loads from two halves of embankment. Settlement calculated for ten intervals divided evenly over depth of analysis (as input).

Depth of Analysis = 50 feet

Dimensions

Length, a =	51	feet
Length, b =	57.5	feet
Height, H =	28	feet
Fill, unit weight, γ =	135	pcf
Load, P =	3780	psf



Embankment parameters (Poulos and Davis, 1978).

				Layer displacment, ρ				
Depth, z	Layer thickness, Δz	N60 Value	Elastic moduli E = 12 X N60	X = 0	X = 14.375	X = 28.75	X = 43.125	X = 57.5
(ft)	(ft)	(bpf)	(ksf)	in	in	in	in	in
5	5	12	144	0.788	0.962	1.182	1.404	1.619
10	5	8	96	1.183	1.384	1.702	2.026	2.316
15	5	6	72	1.583	1.785	2.178	2.588	2.922
20	5	6	72	1.590	1.737	2.091	2.469	2.754
25	5	10	120	0.959	1.018	1.204	1.408	1.555
30	5	20	240	0.481	0.498	0.578	0.668	0.731
35	5	13	156	0.741	0.749	0.855	0.975	1.058
40	5	27	324	0.356	0.352	0.395	0.445	0.479
45	5	23	276	0.416	0.404	0.446	0.495	0.530
50	5	100	1200	0.095	0.091	0.099	0.108	0.115
			Cumulative displacement (in):	8.194	8.978	10.730	12.587	14.080

References: FHWA. (2002). Geotechnical Engineering Circular No. 5: Evaluation of Soil and Rock Properties.
FHWA (1993). EMBANK User Manual
Poulos, H.G. and Davis, E.H. (1978). Elastic Solutions for Soil and Rock Mechanics

ELASTIC SETTLEMENT

GEOSYSTEMS ENGINEERING, INC.

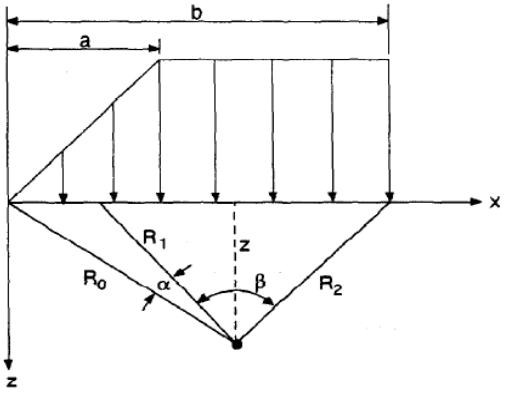
Project:	SR-54 Multi-Use Trail & Bridge	**Date:**	8/11/2017
Location:	Fayette County , Georgia	**Engineer:**	LDM
Analysis:	Elastic settlements		
Description:	Elastic settlements based on moduli interpreted from SPT data from boring B-3		

Calculation performed as outlined in FHWA EMBANK user manual. Principle of supersition is used to combine loads from two halves of embankment. Settlement calculated for ten intervals divided evenly over depth of analysis (as input).

Depth of Analysis = 50 feet

Dimensions

Length, a =	51	feet
Length, b =	57.5	feet
Height, H =	28	feet
Fill, unit weight, γ =	180	pcf
Load, P =	5040	psf



Embankment parameters (Poulos and Davis, 1978).

				Layer displacment, ρ				
Depth, z	Layer thickness, Δz	N60 Value	Elastic moduli E = 12 X N60	X = 0	X = 14.375	X = 28.75	X = 43.125	X = 57.5
(ft)	(ft)	(bpf)	(ksf)	in	in	in	in	in
5	5	12	144	1.050	1.283	1.577	1.872	2.159
10	5	8	96	1.578	1.845	2.270	2.702	3.089
15	5	6	72	2.111	2.379	2.904	3.451	3.896
20	5	6	72	2.121	2.316	2.787	3.292	3.673
25	5	10	120	1.279	1.357	1.606	1.878	2.073
30	5	20	240	0.642	0.663	0.771	0.891	0.975
35	5	13	156	0.989	0.998	1.140	1.300	1.410
40	5	27	324	0.475	0.470	0.527	0.593	0.639
45	5	23	276	0.555	0.539	0.594	0.660	0.707
50	5	100	1200	0.127	0.121	0.131	0.144	0.153
			Cumulative displacement (in):	10.925	11.971	14.307	16.782	18.774

References: FHWA. (2002). Geotechnical Engineering Circular No. 5: Evaluation of Soil and Rock Properties.
FHWA (1993). EMBANK User Manual
Poulos, H.G. and Davis, E.H. (1978). Elastic Solutions for Soil and Rock Mechanics

GEOSYSTEMS ENGINEERING
FOOTING SETTLEMENT PROGRAM

SR-54 MULTI-USE TRAIL & BRIDGE
STA 142+00 WESTERGAARD SETTLEMENT BORING B-3 135PCF

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STRUCTURAL DATA

FOOTING NUMBER: 1

FOOTING LENGTH: 49.0 FT
FOOTING WIDTH: 100.0 FT
FOOTING DEPTH: 3.0 FT
LOAD: 18522.00 KIPS
SURFACE BEARING PRESSURE: 3780.0 PSF
X COORDINATE OF CENTER: 34.5
Y COORDINATE OF CENTER: 60.0

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SOIL DATA

NUMBER OF LAYERS: 10
DEPTH TO WATER: 21.0 FT

LAYER NUMBER 1

DEPTH TO BOTTOM OF LAYER: 5.0 FT
THICKNESS: 5.00 FT
MODULUS OF ELASTICITY: 144000. PSF
UNIT WEIGHT: 180.0 PSF

LAYER NUMBER 2

DEPTH TO BOTTOM OF LAYER: 10.0 FT
THICKNESS: 5.00 FT
MODULUS OF ELASTICITY: 96000. PSF
UNIT WEIGHT: 180.0 PSF

LAYER NUMBER 3

DEPTH TO BOTTOM OF LAYER: 15.0 FT
THICKNESS: 5.00 FT
MODULUS OF ELASTICITY: 72000. PSF
UNIT WEIGHT: 180.0 PSF

LAYER NUMBER 4

DEPTH TO BOTTOM OF LAYER: 20.0 FT
THICKNESS: 5.00 FT
MODULUS OF ELASTICITY: 72000. PSF
UNIT WEIGHT: 180.0 PSF

LAYER NUMBER 5

DEPTH TO BOTTOM OF LAYER: 25.0 FT
THICKNESS: 5.00 FT
MODULUS OF ELASTICITY: 120000. PSF
UNIT WEIGHT: 180.0 PSF

LAYER NUMBER 6

DEPTH TO BOTTOM OF LAYER: 30.0 FT
THICKNESS: 5.00 FT
MODULUS OF ELASTICITY: 240000. PSF
UNIT WEIGHT: 180.0 PSF

LAYER NUMBER 7

DEPTH TO BOTTOM OF LAYER: 35.0 FT
THICKNESS: 5.00 FT
MODULUS OF ELASTICITY: 156000. PSF
UNIT WEIGHT: 180.0 PSF

LAYER NUMBER 8

DEPTH TO BOTTOM OF LAYER: 40.0 FT
THICKNESS: 5.00 FT
MODULUS OF ELASTICITY: 324000. PSF
UNIT WEIGHT: 180.0 PSF

LAYER NUMBER 9

DEPTH TO BOTTOM OF LAYER: 45.0 FT
THICKNESS: 5.00 FT
MODULUS OF ELASTICITY: 276000. PSF

UNIT WEIGHT: 180.0 PSF

LAYER NUMBER 10

DEPTH TO BOTTOM OF LAYER: 50.0 FT
THICKNESS: 5.00 FT
MODULUS OF ELASTICITY: 1200000. PSF
UNIT WEIGHT: 180.0 PSF

*****WESTERGAARD STRESS DISTRIBUTION *****

PREDICTED SETTLEMENT, POINT NUMBER 1 COORDINATES: X= 35.
Y= 60.

STANDARD WESTERGAARD
MODIFIED WESTERGAARD

LAYER DEPTH	INITIAL STRESS	FINAL STRESS	SUBLAYER SETTLEMENT	CUMULATIVE SETTLEMENT	FINAL STRESS	SUBLAYER SETTLEMENT	CUMULATIVE SETTLEMENT
(FT)	(PSF)	(PSF)	(IN)	(IN)	(PSF)	(IN)	(IN)
**********	**********	**********	**********	**********	**********	**********	**********
4.9	882.00	4515.19	.061	.617	4511.68	.060	.617
TOTAL LAYER 1 ,CUMULATIVE SETTLEMENT********				.617	********	**********	.617	********	.617
9.7	1755.00	5019.08	.204	2.764	5004.36	.203	2.757
TOTAL LAYER 2 ,CUMULATIVE SETTLEMENT********				2.146	********	**********	2.140	********	2.757
14.7	2655.00	5557.28	.242	5.316	5563.79	.242	5.307
TOTAL LAYER 3 ,CUMULATIVE SETTLEMENT********				2.553	********				

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5.316  ********************  2.550  ********  5.307

  19.8        3555.00       6124.23            .214
7.580       6150.14             .216           7.585

TOTAL LAYER 4 ,CUMULATIVE SETTLEMENT********  2.264  ********
7.580  ********************  2.278  ********  7.585

  24.7        4221.00       6491.08            .114
8.781       6523.58             .115           8.801

TOTAL LAYER 5 ,CUMULATIVE SETTLEMENT********  1.201  ********
8.781  ********************  1.216  ********  8.801

  29.7        4809.00       6814.94            .050
9.311       6853.63             .051           9.341

TOTAL LAYER 6 ,CUMULATIVE SETTLEMENT********   .530  ********
9.311  ********************   .540  ********  9.341

  34.8        5397.00       7172.20            .068
10.033       7214.20             .070          10.078

TOTAL LAYER 7 ,CUMULATIVE SETTLEMENT********   .722  ********
10.033  ********************   .737  ******** 10.078

  39.7        5985.00       7559.80            .029
10.341       7598.83             .030          10.393

TOTAL LAYER 8 ,CUMULATIVE SETTLEMENT********   .308  ********
10.341  ********************   .315  ******** 10.393

  44.8        6573.00       7974.19            .030
10.662       8018.20             .031          10.723

TOTAL LAYER 9 ,CUMULATIVE SETTLEMENT********   .321  ********
10.662  ********************   .330  ******** 10.723

  49.8        7161.00       8411.82            .006
10.728       8415.63             .006          10.790

TOTAL LAYER10 ,CUMULATIVE SETTLEMENT********   .066  ********
10.728  ********************   .067  ******** 10.790



PREDICTED SETTLEMENT, POINT NUMBER   2      COORDINATES: X=   35.
Y=   11.

                                        STANDARD WESTERGAARD

MODIFIED WESTERGAARD
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 LAYER          INITIAL         FINAL          SUBLAYER
CUMULATIVE          FINAL          SUBLAYER          CUMULATIVE
 DEPTH          STRESS          STRESS        SETTLEMENT
SETTLEMENT          STRESS         SETTLEMENT          SETTLEMENT

  (FT)          (PSF)           (PSF)              (IN)
(IN)            (PSF)           (IN)                (IN)
**********************
******************************************
******************************************


   4.9          882.00        3472.64               .043
.510         3457.36             .043               .508

TOTAL LAYER 1 ,CUMULATIVE SETTLEMENT********    .510   ********
.510  *********************     .508   ********    .508

   9.7          1755.00       3650.28               .118
1.842         3636.48            .118               1.831

TOTAL LAYER 2 ,CUMULATIVE SETTLEMENT********  1.331   ********
1.842  *********************  1.322   ********  1.831

  14.7          2655.00       4275.82               .135
3.287         4280.01            .135               3.273

TOTAL LAYER 3 ,CUMULATIVE SETTLEMENT********  1.445   ********
3.287  *********************  1.442   ********  3.273

  19.8          3555.00       4977.05               .119
4.543         4991.68            .120               4.538

TOTAL LAYER 4 ,CUMULATIVE SETTLEMENT********  1.256   ********
4.543  *********************  1.265   ********  4.538

  24.7          4221.00       5480.29               .063
5.208         5497.53            .064               5.211

TOTAL LAYER 5 ,CUMULATIVE SETTLEMENT********    .665   ********
5.208  *********************    .673   ********  5.211

  29.7          4809.00       5930.94               .028
5.504         5950.79            .029               5.512

TOTAL LAYER 6 ,CUMULATIVE SETTLEMENT********    .295   ********
5.504  *********************    .300   ********  5.512

  34.8          5397.00       6401.92               .039
5.910         6423.07            .039               5.926
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TOTAL LAYER 7 ,CUMULATIVE SETTLEMENT********   .406  ********
5.910  **********************   .414  ********  5.926

  39.7        5985.00       6889.69            .017
6.085       6909.14            .017            6.105

TOTAL LAYER 8 ,CUMULATIVE SETTLEMENT********   .176  ********
6.085  **********************   .179  ********  6.105

  44.8        6573.00       7391.42            .018
6.272       7413.26            .018            6.296

TOTAL LAYER 9 ,CUMULATIVE SETTLEMENT********   .186  ********
6.272  **********************   .191  ********  6.296

  49.8        7161.00       7904.79            .004
6.310       7906.69            .004            6.335

TOTAL LAYER10 ,CUMULATIVE SETTLEMENT********   .039  ********
6.310  **********************   .039  ********  6.335

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GEOSYSTEMS ENGINEERING
FOOTING SETTLEMENT PROGRAM

SR-54 MULTI-USE TRAIL & BRIDGE
STA 142+00 WESTERGAARD SETTLEMENT BORING B-3 180PCF

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STRUCTURAL DATA

FOOTING NUMBER: 1

FOOTING LENGTH: 49.0 FT
FOOTING WIDTH: 100.0 FT
FOOTING DEPTH: 3.0 FT
LOAD: 24696.00 KIPS
SURFACE BEARING PRESSURE: 5040.0 PSF
X COORDINATE OF CENTER: 34.5
Y COORDINATE OF CENTER: 60.0

****

SOIL DATA

NUMBER OF LAYERS: 10
DEPTH TO WATER: 21.0 FT

LAYER NUMBER 1

DEPTH TO BOTTOM OF LAYER: 5.0 FT
THICKNESS: 5.00 FT
MODULUS OF ELASTICITY: 144000. PSF
UNIT WEIGHT: 180.0 PSF

LAYER NUMBER 2

DEPTH TO BOTTOM OF LAYER: 10.0 FT
THICKNESS: 5.00 FT
MODULUS OF ELASTICITY: 96000. PSF
UNIT WEIGHT: 180.0 PSF

LAYER NUMBER 3

DEPTH TO BOTTOM OF LAYER: 15.0 FT
THICKNESS: 5.00 FT
MODULUS OF ELASTICITY: 72000. PSF
UNIT WEIGHT: 180.0 PSF

LAYER NUMBER 4

DEPTH TO BOTTOM OF LAYER: 20.0 FT
THICKNESS: 5.00 FT
MODULUS OF ELASTICITY: 72000. PSF
UNIT WEIGHT: 180.0 PSF

LAYER NUMBER 5

DEPTH TO BOTTOM OF LAYER: 25.0 FT
THICKNESS: 5.00 FT
MODULUS OF ELASTICITY: 120000. PSF
UNIT WEIGHT: 180.0 PSF

LAYER NUMBER 6

DEPTH TO BOTTOM OF LAYER: 30.0 FT
THICKNESS: 5.00 FT
MODULUS OF ELASTICITY: 240000. PSF
UNIT WEIGHT: 180.0 PSF

LAYER NUMBER 7

DEPTH TO BOTTOM OF LAYER: 35.0 FT
THICKNESS: 5.00 FT
MODULUS OF ELASTICITY: 156000. PSF
UNIT WEIGHT: 180.0 PSF

LAYER NUMBER 8

DEPTH TO BOTTOM OF LAYER: 40.0 FT
THICKNESS: 5.00 FT
MODULUS OF ELASTICITY: 324000. PSF
UNIT WEIGHT: 180.0 PSF

LAYER NUMBER 9

DEPTH TO BOTTOM OF LAYER: 45.0 FT
THICKNESS: 5.00 FT
MODULUS OF ELASTICITY: 276000. PSF

UNIT WEIGHT: 180.0 PSF

LAYER NUMBER 10

DEPTH TO BOTTOM OF LAYER: 50.0 FT
THICKNESS: 5.00 FT
MODULUS OF ELASTICITY: 1200000. PSF
UNIT WEIGHT: 180.0 PSF

*****WESTERGAARD STRESS DISTRIBUTION *****

PREDICTED SETTLEMENT, POINT NUMBER 1 COORDINATES: X= 35. Y= 60.

STANDARD WESTERGAARD MODIFIED WESTERGAARD

LAYER DEPTH (FT)	INITIAL STRESS (PSF)	FINAL STRESS (PSF)	SUBLAYER SETTLEMENT (IN)	CUMULATIVE SETTLEMENT (IN)	FINAL STRESS (PSF)	SUBLAYER SETTLEMENT (IN)	CUMULATIVE SETTLEMENT (IN)
4.9	882.00	5726.26	.081	.823	5721.57	.081	.822
TOTAL LAYER 1 ,CUMULATIVE SETTLEMENT********			.823	********		.822	********
9.7	1755.00	6107.10	.272	3.685	6087.47	.271	3.676
TOTAL LAYER 2 ,CUMULATIVE SETTLEMENT********			2.862	********		2.854	********
14.7	2655.00	6524.70	.322	7.088	6533.38	.323	7.076
TOTAL LAYER 3 ,CUMULATIVE SETTLEMENT********			3.403	********			

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7.088  ********************  3.399  ********  7.076

  19.8        3555.00       6980.63            .285
10.106       7015.19            .288          10.114

TOTAL LAYER 4 ,CUMULATIVE SETTLEMENT********  3.018  ********
10.106  ********************  3.038  ******** 10.114

  24.7        4221.00       7247.77            .151
11.708       7291.11            .154          11.735

TOTAL LAYER 5 ,CUMULATIVE SETTLEMENT********  1.601  ********
11.708  ********************  1.621  ******** 11.735

  29.7        4809.00       7483.59            .067
12.415       7535.17            .068          12.454

TOTAL LAYER 6 ,CUMULATIVE SETTLEMENT********   .707  ********
12.415  ********************   .719  ******** 12.454

  34.8        5397.00       7763.93            .091
13.377       7819.94            .093          13.437

TOTAL LAYER 7 ,CUMULATIVE SETTLEMENT********   .962  ********
13.377  ********************   .983  ******** 13.437

  39.7        5985.00       8084.73            .039
13.788       8136.77            .040          13.858

TOTAL LAYER 8 ,CUMULATIVE SETTLEMENT********   .411  ********
13.788  ********************   .421  ******** 13.858

  44.8        6573.00       8441.25            .041
14.216       8499.93            .042          14.298

TOTAL LAYER 9 ,CUMULATIVE SETTLEMENT********   .428  ********
14.216  ********************   .440  ******** 14.298

  49.8        7161.00       8828.76            .008
14.304       8833.85            .008          14.387

TOTAL LAYER10 ,CUMULATIVE SETTLEMENT********   .088  ********
14.304  ********************   .089  ******** 14.387



PREDICTED SETTLEMENT, POINT NUMBER   2      COORDINATES: X=   35.
Y=   11.

                                    STANDARD WESTERGAARD

MODIFIED WESTERGAARD
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LAYER DEPTH (FT)	INITIAL STRESS (PSF)	FINAL STRESS (PSF)	SUBLAYER SETTLEMENT (IN)	CUMULATIVE SETTLEMENT (IN)	FINAL STRESS (PSF)	SUBLAYER SETTLEMENT (IN)	CUMULATIVE SETTLEMENT (IN)
4.9	882.00	4336.19	.058	.680	4315.82	.057	.678
TOTAL LAYER 1 ,CUMULATIVE SETTLEMENT********			.680	********		.678	********
9.7	1755.00	4282.04	.158	2.455	4263.64	.157	2.441
TOTAL LAYER 2 ,CUMULATIVE SETTLEMENT********			1.775	********		1.763	********
14.7	2655.00	4816.09	.180	4.382	4821.69	.181	4.364
TOTAL LAYER 3 ,CUMULATIVE SETTLEMENT********			1.927	********		1.923	********
19.8	3555.00	5451.07	.158	6.057	5470.57	.160	6.051
TOTAL LAYER 4 ,CUMULATIVE SETTLEMENT********			1.675	********		1.687	********
24.7	4221.00	5900.05	.084	6.944	5923.04	.085	6.948
TOTAL LAYER 5 ,CUMULATIVE SETTLEMENT********			.887	********		.898	********
29.7	4809.00	6304.92	.037	7.338	6331.39	.038	7.349
TOTAL LAYER 6 ,CUMULATIVE SETTLEMENT********			.394	********		.400	********
34.8	5397.00	6736.89	.052	7.880	6765.09	.053	7.901

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TOTAL LAYER 7 ,CUMULATIVE SETTLEMENT********   .542  ********
7.880  **********************   .552  ********  7.901

  39.7        5985.00       7191.25            .022
8.114       7217.18            .023            8.140

TOTAL LAYER 8 ,CUMULATIVE SETTLEMENT********   .234  ********
8.114  **********************   .239  ********  8.140

  44.8        6573.00       7664.23            .024
8.362       7693.35            .024            8.394

TOTAL LAYER 9 ,CUMULATIVE SETTLEMENT********   .248  ********
8.362  **********************   .254  ********  8.394

  49.8        7161.00       8152.72            .005
8.414       8155.25            .005            8.447

TOTAL LAYER10 ,CUMULATIVE SETTLEMENT********   .052  ********
8.414  **********************   .052  ********  8.447

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