BRIDGE FOUNDATION INVESTIGATION (LRFD)

McGinnis Ferry Road over Big Creek
Forsyth and Fulton Counties, Georgia

PI NO. 0004634

Initial Submittal, May 24, 2020
Revision #1, October, 23, 2021

PREPARED BY:
Atlas Technical Consultants, LLC
2450 Commerce Avenue
Suite 100
Duluth, Georgia 30096

Atlas Project No. FOR095

Bridge Foundation Investigation (LRFD)

McGinnis Ferry Road over Big Creek
PI 0004634, Forsyth and Fulton Counties
Revision No. 1
October 23, 2021

LOCATION (See Map) McGinnis Ferry Road over Big Creek, Forsyth Co.

GENERAL INFORMATION

GEOLOGIC FORMATION This project will be geologically sited in the Biotitic Gneiss / Mica Schist / Amphibolite Formation of the Georgia Piedmont Region.

SUBSURFACE FEATURES Subsurface soils consist of loose to medium dense silty sand over hard rock at depths which vary from elevations 951 to 984, and groundwater was encountered from 980 to 986. For additional information see the boring layout and boring logs.

SITE CLASSIFICATION We recommend a site class of "D" per AASHTO LRFD 3.10.3.1. based on the most representative boring data.

1.0 -- FOUNDATION RECOMMENDATIONS

Bents	Pile Footing (Type)	Pile Bent (Type)
1, 2, 5 and 6		HP
3 and 4	HP	

1.1 -- Pile Properties

Pile Type	Pile Size (in)	Nominal Compression Stress (ksi)	Nominal Tension Stress (ksi)	Maximum Factored Structural Resistance (kips)
HP (36 ksi)	14 x 73	32.4	32.4	385
HP (36 ksi)	14 x 102	32.4	32.4	540

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)
1 and 6	234.6	157.5	-
2 and 5	220.4	147.5	-
3 and 4	308.2	251.1	-

2.0 -- FOUNDATION LOADS

2.1 -- PILE FOUNDATION LOADS

Bents	Pile Type	Size (in)	Down Drag *** (kips)	Scour (Kips)	Driving Resistance * (kips)
1 Lt	HP	14x73	-	-	361
1 Rt	HP	14x73	-	-	361
2 Lt	HP	14x73	-	-	339
2 Rt	HP	14x73	-	-	339
3 Lt	HP	14x102	-	-	474
3 Rt	HP	14x102	-	-	474
4 Lt	HP	14x102	-	-	474
4 Rt	HP	14x102	-	-	474
5 Lt	HP	14x73	-	15.8	355
5 Rt	HP	14x73	-	-	339
6 Lt	HP	14x73	-	-	361
6 Rt	HP	14x73	-	-	361

3.0 -- FOUNDATION ELEVATIONS

Bents	Minimum Tip (ft)	Estimated Tip (ft)
1 Lt	986	983
1 Rt	967	967
2 Lt	974	974
2 Rt	965	965
3 Lt	968	968
3 Rt	952	952
4 Lt	953	953
4 Rt	958	958
5 Lt	968	959
5 Rt	967	967
6 Lt	968	960
6 Rt	968	968

4.0 -- GENERAL NOTES

Elevations All elevations are based on an Elevation 1001.02 of a rebar set into the ground at station 131+46.46, 4.94' Lt.

Waiting Period A waiting period of 45 days will be required before the driving of HP piles at the end bents 1Rt and 6 Rt to allow for the settlement of the soft underlying soils.

Theoretical Scour The theoretical scour line may be raised to elevations 984 at bent 2Lt and 978 at bent 3Lt respectively, because of the presence of scour resistant rock that was encountered during our subsurface investigations.

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 GDOT Standard Specification 520.3.05.D.2 and Special Provision 523 Dynamic Pile Testing. Perform one PDA test at bents 1Lt, 5Lt, and 6 Lt.

*** Nominal Bearing Resistance of Single Pile** Driving resistance is based on the following field verification method and resistance factor φ_{dyn} 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

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 above mentioned piles to their respective estimated tips with a diesel hammer ICE-60-S, the calculated maximum driving stresses are within allowable limits

Pilot Holes Pilot Holes should be set up for H-piles due to the required embedment in rock. Drill 24" diameter pilot holes and set up to the following minimum elevations:

Bent	Elevations
Bent 1 Rt	967
Bent 2 Lt	974
Bent 2 Rt	965
Bent 3 Lt	968
Bent 3 Rt	952
Bent 4 Lt	953
Bent 4 Rt	958
Bent 5 Rt	967
Bent 6 Rt	968

The pilot hole must be clean and free of debris. Seat the pile at the bottom of the pilot hole by striking it with a warm pile hammer. The pile is seated when you observe .25" of movement or less in 5 blows. Back-fill each pilot hole with class A concrete to the top of rock. Ensure a minimum install depth of 5' into sound rock for each pilot hole.

Points Pile points are recommended for each pile to be driven at bent 1 Lt & bent 6Lt to insure adequate penetration into very dense weathered rock.

Temporary Shoring Shoring may be required to construct the pile footings at bents 3 and 4 due to groundwater that was encountered near the footing elevations, dewatering of the excavations may also be required.

Pile Footings Due to the high groundwater elevations near the footing elevations, we recommend that 12 inches of Type II Foundation Backfill Material be set up for use in the footing area. The use of this material should be at the direction of the Engineer and may be eliminated on construction if the footing area is dry.

5.0 – QA / QC

Prepared By: Jay Shah, Staff Engineer

Signature: _____

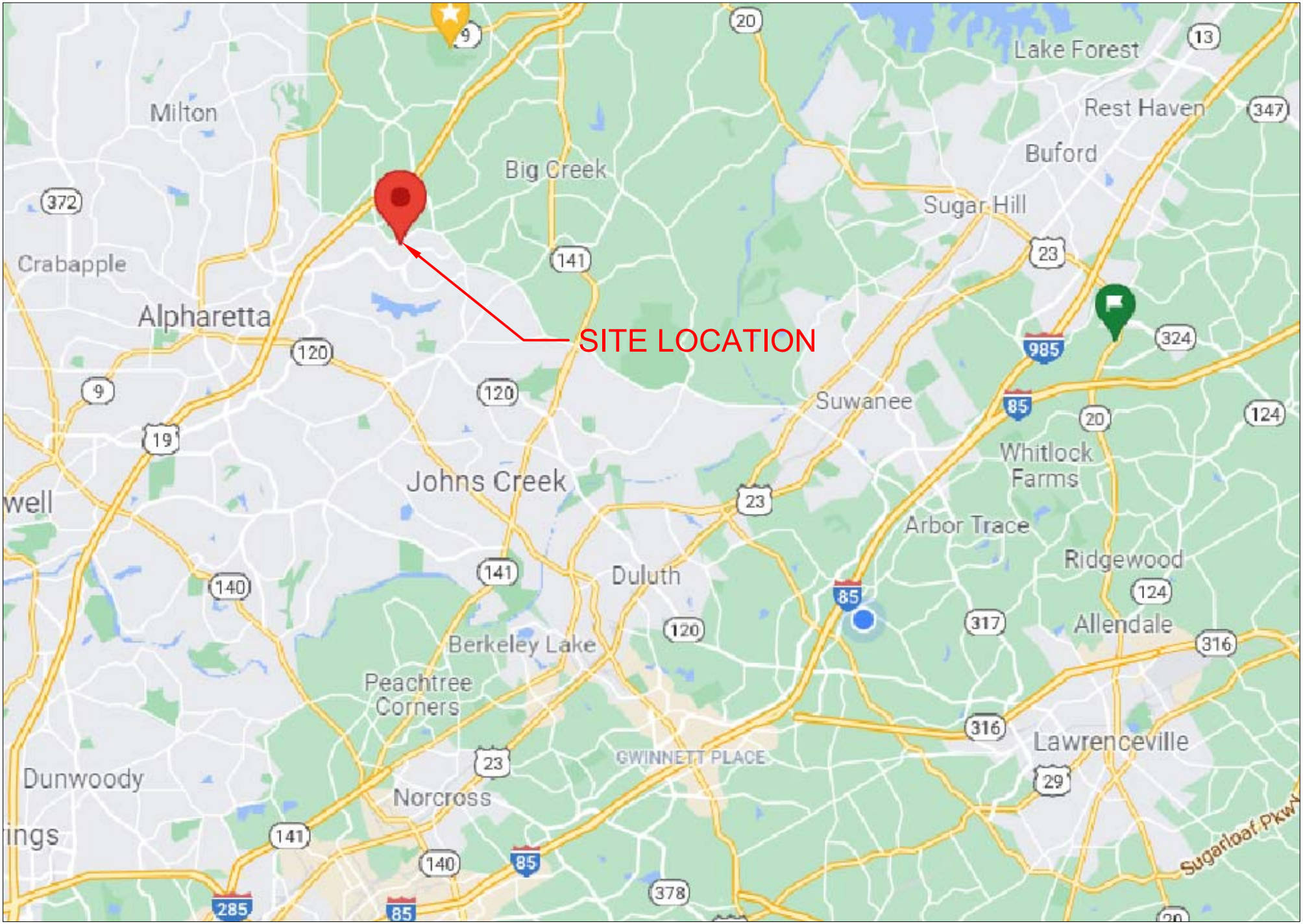
Reviewed By: Yong Shao, PhD, PE.

Signature: _____

GEORGIA REGISTERED No. 26340 PROFESSIONAL ENGINEER YONG C. SHAO

INDEX OF APPENDIX

Appendix A – Site Location Map and Bridge Layout



TITLE: SITE LOCATION MAP	PROJECT NO: FOR095	ATLAS	ATLAS TECHNICAL CONSULTANTS
PROJECT: MCGINNIS FERRY ROAD OVER BIG CREEK FORSYTH/FULTON COUNTIES, GEORGIA	DRAWN BY: YCS DATE: 1/13/2021		2450 COMMERCE AVE, SUITE 100 DULUTH, GEORGIA 30096 TEL: 770-2635945; FAX: 770-2635954

12/20/2018
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GRMCOV

GDOT

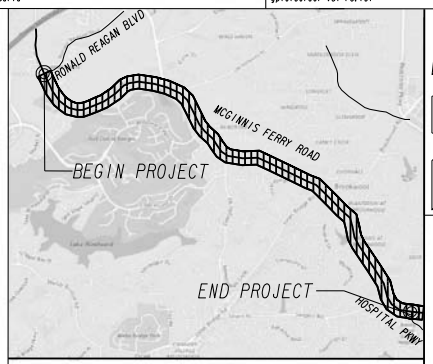
P. I. No.
0004634

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

PLAN AND PROFILE OF PROPOSED

MCGINNIS FERRY ROAD WIDENING

FROM RONALD REAGAN BLVD/UNION HILL RD TO HOSPITAL PARKWAY
FORSYTH AND FULTON COUNTIES



LOCATION SKETCH

DESIGN DATA:
TRAFFIC A.D.T.: 26,200 (2020)
TRAFFIC A.D.T.: 37,700 (2040)
TRAFFIC D.H.V.: 3580 (2040)
DIRECTIONAL DIST: 51/49
% TRUCKS: 2%
24 HR.TRUCKS %: 4%
SPEED DESIGN: 45 mph

LOCATION & DESIGN APPROVAL DATE:

FUNCTIONAL CLASS:
URBAN ARTERIAL

THIS PROJECT IS 50 % IN FULTON COUNTY NO.006, AND IS 50 % IN FORSYTH COUNTY CONG. DIST.NO. 007

PROJECT DESIGNATION: EXEMPT

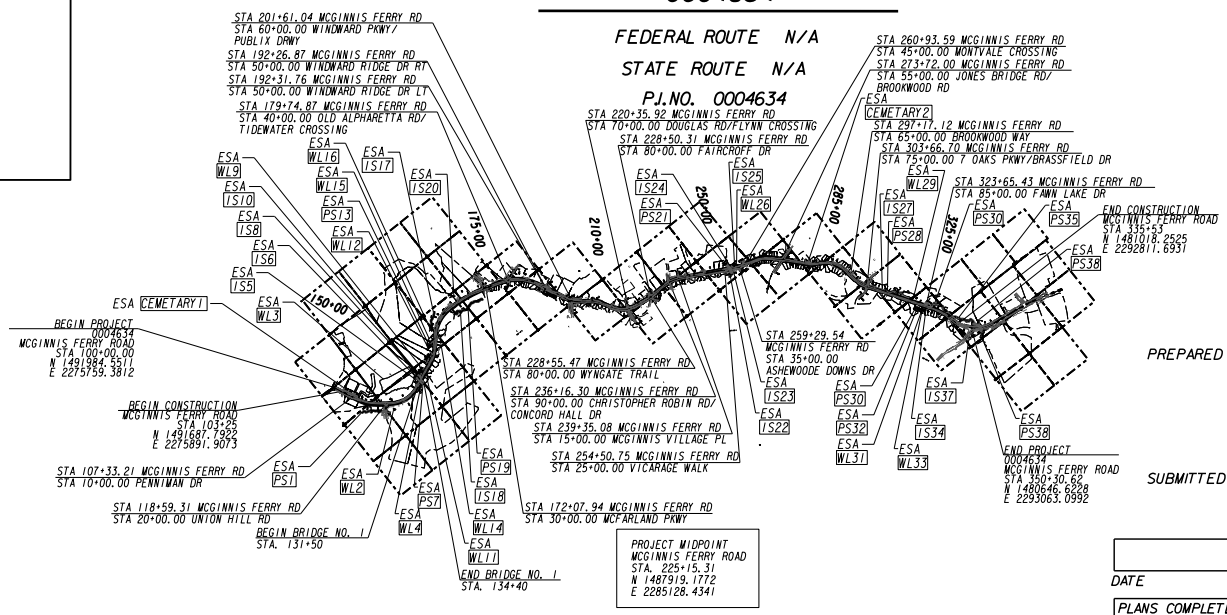
THIS PROJECT HAS BEEN PREPARED USING THE HORIZONTAL GEORGIA COORDINATE SYSTEM OF 1984 (NAD 1983)/94 WEST ZONE, AND THE NORTH AMERICAN VERTICAL DATUM (NAVD) OF 1988.

0004634

FEDERAL ROUTE N/A

STATE ROUTE N/A

P.I.NO. 0004634



PROJECT MIDPOINT
MCGINNIS FERRY ROAD
STA. 225+15.31
N 1487919.1772
E 2285128.4341

SCALE IN FEET
0 2000 4000 8000

LENGTH OF PROJECT	COUNTY No. 121 AND 117 Project No. 0004634
	MILES
NET LENGTH OF ROADWAY	4.686
NET LENGTH OF BRIDGES	0.055
NET LENGTH OF PROJECT	4.741
NET LENGTH OF EXCEPTIONS	N/A
GROSS LENGTH OF PROJECT	4.741

NOTE :
ALL REFERENCES IN THIS DOCUMENT, WHICH INCLUDES ALL PAPERS, WRITINGS, DOCUMENTS, DRAWINGS, OR PHOTOGRAPHS USED, OR TO BE USED IN CONNECTION WITH THIS DOCUMENT, TO "STATE HIGHWAY DEPARTMENT OF GEORGIA", "STATE HIGHWAY DEPARTMENT", GEORGIA STATE HIGHWAY DEPARTMENT", "HIGHWAY DEPARTMENT", OR "DEPARTMENT" WHEN THE CONTEXT THEREOF MEANS THE STATE HIGHWAY DEPARTMENT OF GEORGIA, AND SHALL BE DEEMED TO MEAN THE DEPARTMENT OF TRANSPORTATION.

PE STAMP

MORELAND ALTOBELLI
AN ATLAS COMPANY
2450 Commerce Avenue
Suite 100
Duluth, Georgia 30096
770.263.5945

PREPARED BY: _____
DESIGN

SUBMITTED BY: _____
STATE PROGRAM DELIVERY ADMINISTRATOR

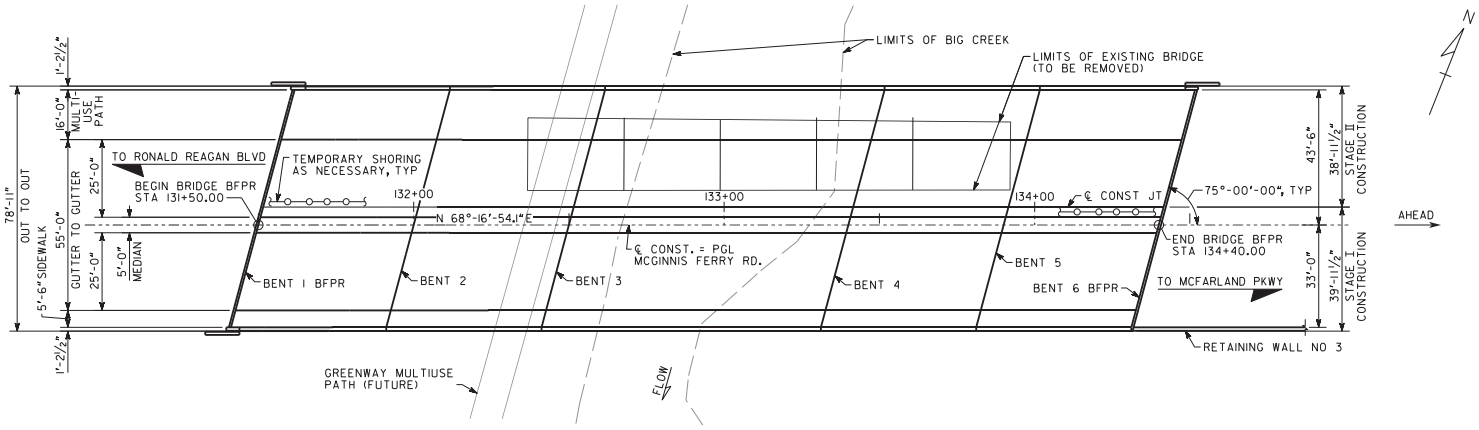
DATE CHIEF ENGINEER

PLANS COMPLETED	- -
REVISIONS	

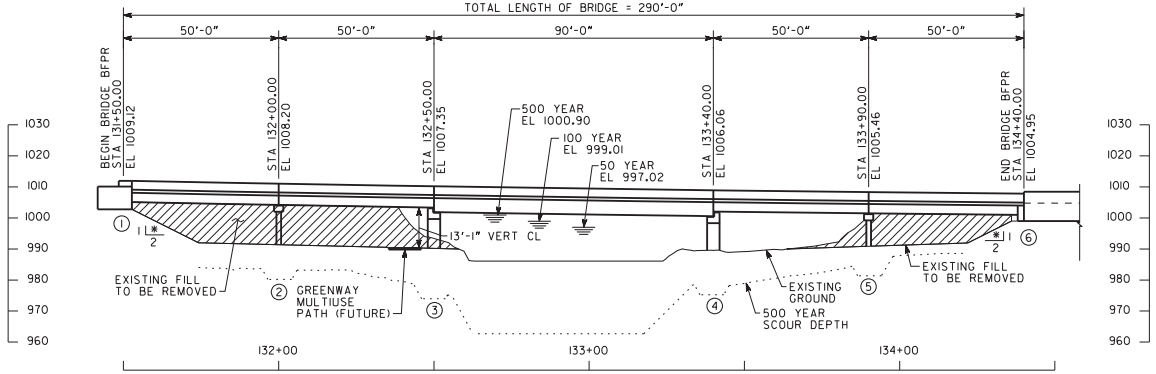
THE DATA, TOGETHER WITH ALL OTHER INFORMATION SHOWN ON THESE PLANS OR IN ANYWAY INDICATED THEREBY, WHETHER BY DRAWINGS OR NOTES, OR IN ANY OTHER MANNER, ARE BASED UPON FIELD INVESTIGATIONS AND ARE BELIEVED TO BE INDICATIVE OF ACTUAL CONDITIONS. HOWEVER, THE SAME ARE SHOWN AS INFORMATION ONLY, ARE NOT GUARANTEED, AND DO NOT BIND THE DEPARTMENT OF TRANSPORTATION IN ANY WAY. THE ATTENTION OF BIDDER IS SPECIFICALLY DIRECTED TO SUBSECTIONS 102.04, 102.05, AND 104.03 OF THE SPECIFICATIONS.

DRAWING No.
01-0001

P.I. NO.
0004634



PLAN



ELEVATION

PROPOSED BRIDGE CONSISTS OF

4 - 50'-0" TYPE II, PSC BEAM SPANS ---------- SPECIAL DESIGN
1 - 90'-0" BULB TEE, 54 IN. PSC BEAM SPAN ---------- SPECIAL DESIGN
2 - PILE END BENTS ---------- SPECIAL DESIGN
2 - PILE INTERMEDIATE BENTS ---------- SPECIAL DESIGN
2 - CONCRETE INTERMEDIATE BENTS ---------- SPECIAL DESIGN
24" TYPE I RIPRAP

DESIGN DATA

SPECIFICATION ---------- AASHTO LRFD 7TH EDITION, 2014
DESIGN VEHICLE LIVE LOAD ---------- HL-93
FUTURE PAVING ALLOWANCE ---------- 30 LBS PER SQ FT

TRAFFIC DATA

TRAFFIC ---------- ADT = 26,200 (2020)
ADT = 37,700 (2040)
DESIGN SPEED ---------- 45 MPH
TRUCKS ---------- 2%
24-HR TRUCKS ---------- 4%
DIRECTIONAL ---------- 51/49%

EXISTING UTILITIES

4 - 4 IN. DIAMETER TELEPHONE CONDUITS (TO BE RELOCATED) ---------- AT&T
UNDERGROUND ELECTRICAL (TO BE RELOCATED) ---------- GA POWER
12 IN. DIAMETER WATER LINE (TO BE RELOCATED) ---------- FORSYTH COUNTY
SANITARY SEWER LINE (TO BE RELOCATED) ---------- FORSYTH COUNTY

PROPOSED UTILITIES

NO UTILITIES ON BRIDGE

DRAINAGE DATA

DRAINAGE AREA ---------- 53.1 SQ MI

FLOOD FREQUENCY	TOTAL DISCHARGE	MEAN VELOCITY	AREA OF OPENING UNDER FLOODSTAGE	BACKWATER
50 YEAR	7,454 CFS	3.68 FPS	2,027.0 SQ FT	0.50 FT
100 YEAR	8,570 CFS	3.37 FPS	2,546.0 SQ FT	0.51 FT
500 YEAR	12,753 CFS	4.27 FPS	2,986.0 SQ FT	0.79 FT

BENCHMARK DATA

REBAR SET INTO THE GROUND
AT THE FOLLOWING LOCATION:
N: 1490314.11
E: 2277971.86
EL. 1001.02
STA 131+46.46 4.94' LT

THEORETICAL SCOUR DEPTHS (FT)

BENT LOCATION	100 YEAR STORM			500 YEAR STORM		
	GENERAL	LOCAL	TOTAL	GENERAL	LOCAL	TOTAL
BENT 2	1.6	4.9	6.5	5.9	5.3	11.2
BENT 3	1.6	9.3	10.9	5.9	10.1	16.0
BENT 4	2.2	9.3	11.5	4.2	10.1	14.3
BENT 5	2.2	4.9	7.1	4.2	5.3	9.5

NOTE: THE 500 YEAR SCOUR IN THE CREEK IS 23.4 FT

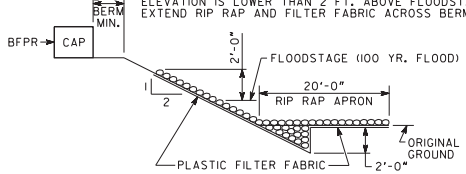
BERM ELEVATIONS

END BENT	ELEVATIONS
1 LT	1001.73
1 RT	1002.28
6 LT	997.89
6 RT	997.80

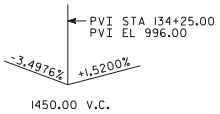
(FOR BRIDGE ENDROLL STAKING PURPOSES ONLY)

EXISTING BRIDGE SERIAL NO. 121-0286-0
EXISTING BRIDGE I.D. NO. 121-02564F-003.10E
PROJECT P.I. NO. 0004634
BRIDGE NO. 1

PLACE RIP RAP AND FILTER FABRIC FROM 2 FT. BELOW ORIGINAL GROUND TO 2 FT. ABOVE FLOODSTAGE. EXTEND RIP RAP AND FILTER FABRIC 20 FT. BEYOND END OF WINGWALLS UNLESS OTHERWISE NOTED. WHERE BERM ELEVATION IS LOWER THAN 2 FT. ABOVE FLOODSTAGE, EXTEND RIP RAP AND FILTER FABRIC ACROSS BERM.



RIP RAP DETAIL
NO SCALE



PROPOSED VERTICAL CURVE DATA

NOTES:

1. THE PROPOSED BRIDGE DECK IS TO BE BUILT ON A NORMAL CROWN OF 2.0%.
2. MINIMUM BOTTOM OF BEAM ELEVATION FOR PROPOSED BRIDGE SHALL BE NO LOWER THAN ELEV. 999.02. APPROXIMATE PROPOSED BOTTOM OF BEAM ELEVATION IS 999.69.
3. ALL BENTS ARE PARALLEL.
4. END BENT PILES NOT SHOWN.
5. * 2:1 SLOPE NORMAL TO END BENTS.
6. ** STATIONS AND ELEVATIONS ARE AT THE INTERSECTIONS OF THE PGL & BFPR OR ℄ BENT.
7. REMOVE EXISTING BRIDGE. REMOVE EXISTING SUBSTRUCTURE PER THE SPECIFICATIONS.
8. DECK DRAIN SYSTEM REQUIRED.
9. CR 3717 (MCGINNIS FERRY RD) TO BE MAINTAINED BY STAGE CONSTRUCTION SEE CONSTRUCTION SEQUENCE FOR DETAILS.

MORELAND ALTOBELLI ASSOCIATES LLC
2450 Commerce Avenue Suite 100
Duluth, Georgia 30096-8910
Tel.: (770) 263-5945

GEORGIA
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION-OFFICE OF BRIDGES AND STRUCTURES

REVISIONS | DATE

PRELIMINARY LAYOUT
CR 3717 (MCGINNIS FERRY ROAD)
OVER BIG CREEK

FORSYTH/FULTON COUNTIES 0004634

SCALE: 1" = 20'-0" (UNLESS NOTED OTHERWISE) JANUARY 2019

DRAWING NO. 35-0001
BRIDGE SHEET 1 OF 3

BY	X		
DESIGNED KFD	CHECKED BLB	REVIEWED DLC/SKG
DRAWN JJK	DESIGN GROUP STB	APPROVED WMD

1 INCH WHEN PRINTED FULL SIZE

Appendix B – Special Provisions

Revised January 24, 2008

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

SPECIAL PROVISION

P.I. NO. 0004634, Forsyth and Fulton Counties

SECTION 520—PILING

Delete Sub-Section 520.3.05.B and substitute the following:

520.3.05.B. Drill Pilot Holes
When pilot holes are required, drill them to the diameter and approximate depth specified on the Plans.

Backfill voids and holes with Class A or better concrete. Furnishing and placing backfill concrete is an incidental part of the work.

The following are not considered pilot holes:

- Holes created by spudding (punching)
- Holes dug to drive piling that is too long to fit leads
- Holes dug to replace a template (if permitted)

Where pilot holes are required in granular material and the material cannot be sealed off using "mudding" drilling methods, drill the pilot hole as follows:

1. Place a casing pipe with a large enough diameter around the boring device.
2. Hold the casing in position until the pilot hole is completed and the pile driving progresses deep enough into the hard material to keep loose material out of the pilot hole.

The use of casing is incidental to the work.

Office of Materials and Testing

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

SPECIAL PROVISION

P.I. NO. 0004634, Forsyth and Fulton Counties

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:

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

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

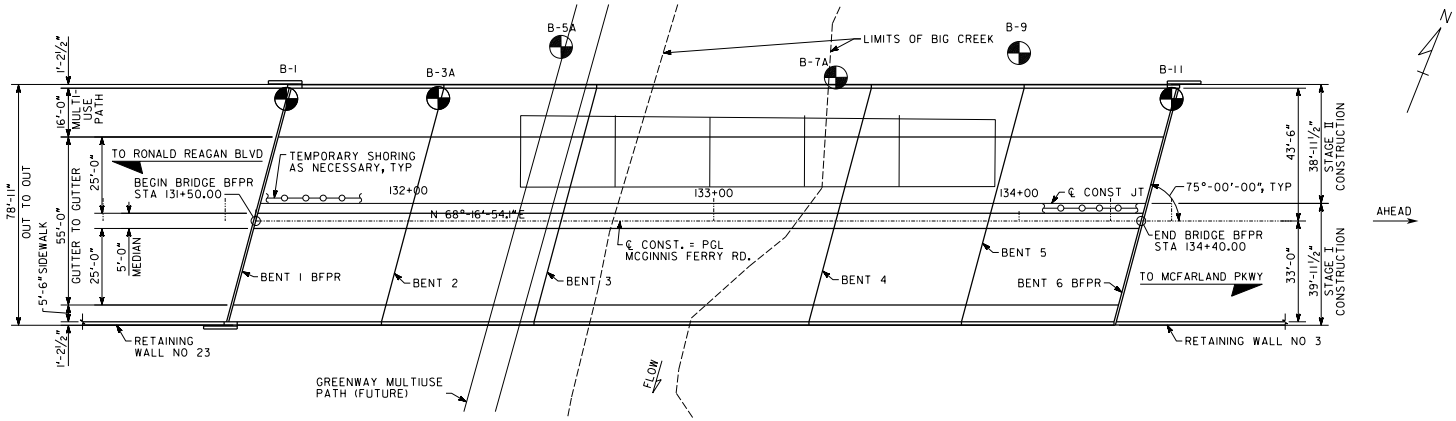
The Dynamic Pile Test completed and accepted will be paid for at the Contract unit Price. This payment will be full compensation for all costs of complying with this specification, including incidentals, additional work, and any delays incurred in conjunction therewith.

Payment will be made under:

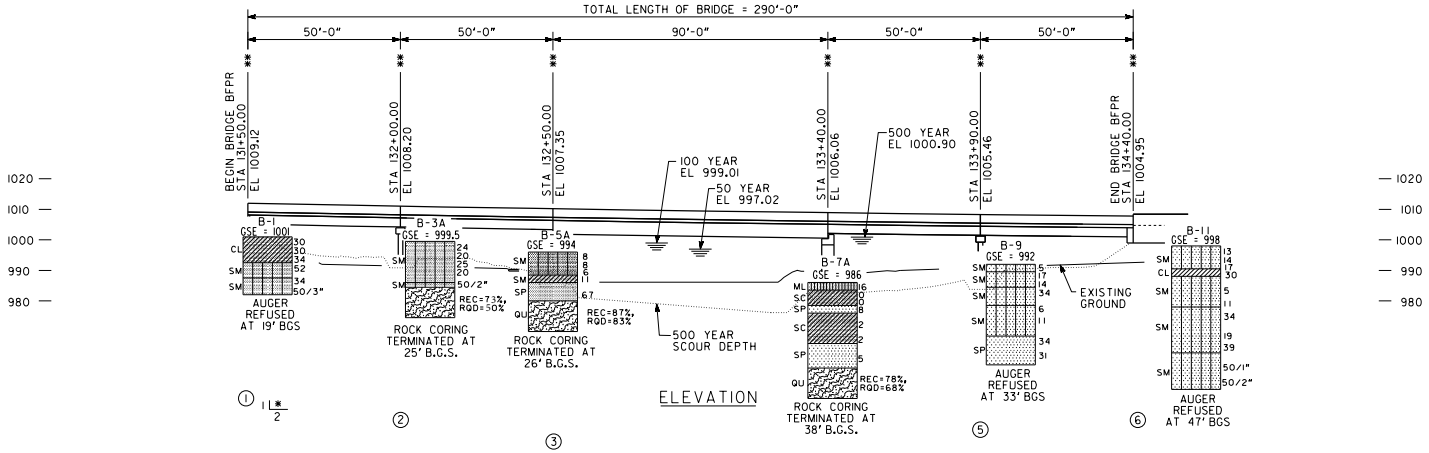
Item No. 523. Dynamic Pile Test_____ . . . . . Per Each

Appendix C – Boring locations and boring logs

P.J. NO. --



PLAN



ELEVATION

NOTES:

1. ALL BENTS ARE PARALLEL.
2. END BENT PILES NOT SHOWN.
3. * 2:1 SLOPE NORMAL TO END BENTS.
4. ** STATIONS AND ELEVATIONS ARE AT THE INTERSECTIONS OF THE PGL & BFPR OR ℄ BENT.
5. REMOVE EXISTING BRIDGE. REMOVE EXISTING SUBSTRUCTURE PER THE SPECIFICATIONS.
6. DECK DRAIN SYSTEM REQUIRED.
7. CR 3717 (MCGINNIS FERRY RD) TO BE MAINTAINED BY STAGE CONSTRUCTION SEE CONSTRUCTION SEQUENCE FOR DETAILS.

P.J. NO. 0004634

BRIDGE NO. 1

GEORGIA
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION-OFFICE OF BRIDGES AND STRUCTURES

GEOTECH BORINGS - LEFT
CR 3717 (MCGINNIS FERRY ROAD)
OVER BIG CREEK
FORSYTH/FULTON COUNTIES 0004634

SCALE: 1" = 20'-0", UNLESS NOTED OTHERWISE FEBRAUARY 2021

DRAWING NO. 35-0002

BRIDGE SHEET 2 OF 2

DATE | REVISIONS | BY

DESIGNED KFD | CHECKED BLB | REVIEWED DLC/SKG
DRAWN JJK | DESIGN GROUP STB | APPROVED WMD

1 INCH WHEN PRINTED FULL SIZE

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GEOTECH_BORINGS.dgn

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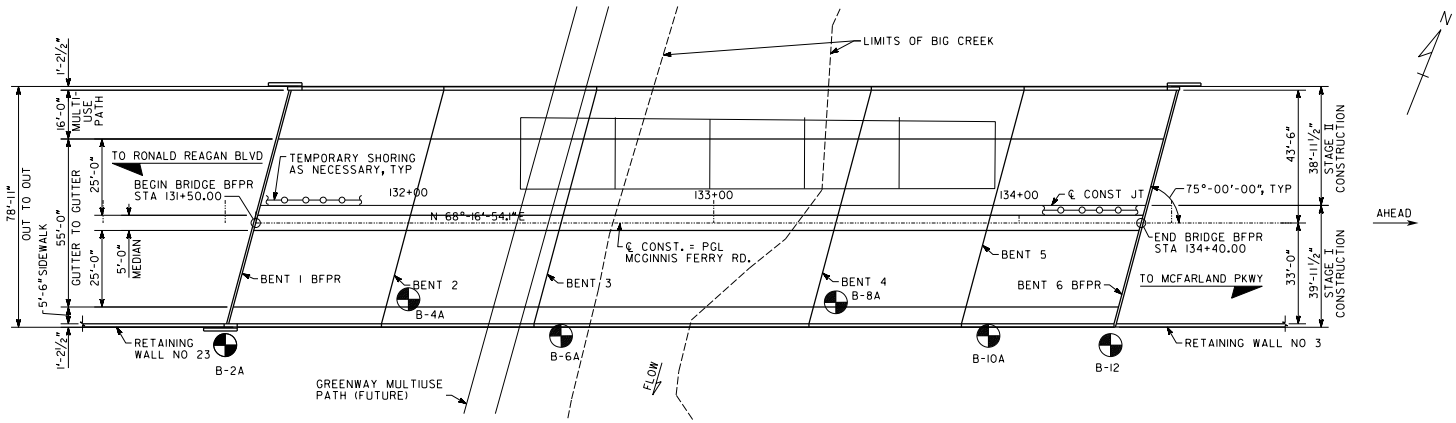

PLAN

N

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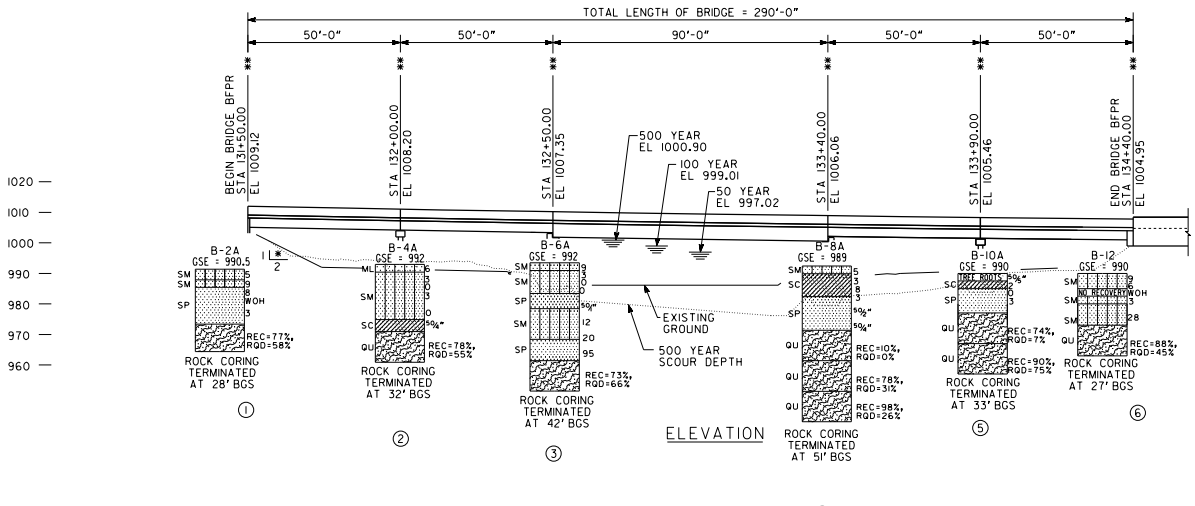
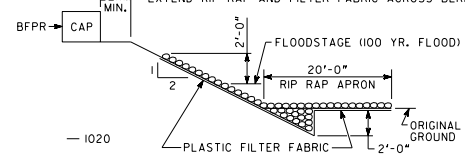


ELEVATION

PLACE RIP RAP AND FILTER FABRIC FROM 2 FT. BELOW ORIGINAL GROUND TO 2 FT. ABOVE FLOODSTAGE. EXTEND RIP RAP AND FILTER FABRIC 20 FT. BEYOND END OF WINGWALLS UNLESS OTHERWISE NOTED. WHERE BERM ELEVATION IS LOWER THAN 2 FT. ABOVE FLOODSTAGE, EXTEND RIP RAP AND FILTER FABRIC ACROSS BERM.



RIP RAP DETAIL
NO SCALE

P.I. NO. 0004634

BRIDGE NO. 1

ATLAS

GEORGIA
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION-OFFICE OF BRIDGES AND STRUCTURES

GEOTECH BORINGS - RIGHT
CR 3717 (MCGINNIS FERRY ROAD)
OVER BIG CREEK
FORSYTH/FULTON COUNTIES 0004634

SCALE: 1" = 20'-0", UNLESS NOTED OTHERWISE FEBRUARY 2021

DRAWING NO. 35-0001

BRIDGE SHEET 1 OF 2

DATE | REVISIONS | BY

DESIGNED KFD | CHECKED BLB | REVIEWED DLC/SKG
DRAWN JJK | DESIGN GROUP STB | APPROVED WMD

1 INCH WHEN PRINTED FULL SIZE

$FILEL$ jaime.mandujano 10/22/2021 2:37:20 PM GEOTECH_BORINGS.dgn

ATLAS
TECHNICAL CONSULTANTS
2450 Commerce Avenue, STE 100, Duluth, GA 30096
(770)-2635945

B-1: Sta.131+60, 40' Lt (Bent 1 Left)

McGinnis Ferry Road over Big Creek
Forsyth/Fulton Counties

PI No. 0004634

ATLAS Proj. No.: FOR095

DATE COMPLETED	: 9/19/2019	SURFACE ELE.	: 1001'
ENERGY RATING	: 94%	DEPTH OF BORING	: 19'
DRILL RIG	: CME 550 (SN 380)	DEPTH TO WATER	: 15'
DRILLING METHOD	: HSA + SPT	LOGGED BY	: Jay
DRILLER	: Drilling Solutions	BOTTOM OF CAP	: 1001.73'

Sample Condition: Remoulded; Undisturbed; Lost; Rock Core

Sampler Type: SS Split Spoon; ST Shelby Tube; PS Piston Sampler; DC Diamond Core Bar.

Depth in Feet	Surf. Elev. 1001	USCS	DESCRIPTION	Blow count	SPT-N60 Value	Sampler Type	Sample
0–8	1000–992	CL	Brown, micaceous, SANDY CLAY, very stiff	8-10-9	30	SS	☒
				10-8-11	30	SS	☒
				4-10-12	34	SS	☒
8–14	992–988	SM	Orange/brown, SILTY SAND, very dense	9-16-17	52	SS	☒
14–18	988–982	SM	Grey, SILTY SAND, dense	8-10-12	34	SS	☒
18	982			50/3"	50/3"	SS	☒

Auger refused at depth of 19' B.G.S

N60 Value Graph: 0, 50, 100

Moist, %

Water Level

NOTE: SPT N-Values have been corrected with 94% Energy Rating

ATLAS
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2450 Commerce Avenue, STE 100, Duluth, GA 30096
(770)-2635945

B-2A : Sta.131+40, 40' Rt (Bent 1 Right)

McGinnis Ferry Road over Big Creek
Forsyth/Fulton Counties

PI No. 0004634

ATLAS Proj. No.: FOR095

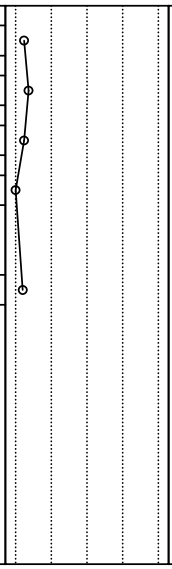
DATE COMPLETED	: 12/19/2020	SURFACE ELE.	: 990.5'
ENERGY RATING	: 94%	DEPTH OF BORING	: 18'
DRILL RIG	: CME 550 (SN 380)	DEPTH TO WATER	: 10'
DRILLING METHOD	: HSA + SPT	LOGGED BY	: Jay
DRILLER	: Drilling Solutions	BOTTOM OF CAP	: 1002.28'

Sample Condition: Remoulded; Undisturbed; Lost; Rock Core

Sampler Type: SS Split Spoon; ST Shelby Tube; PS Piston Sampler; DC Diamond Core Bar.

Depth in Feet	Surf. Elev. 990.5	USCS	DESCRIPTION	Blow count	SPT-N60 Value	Sampler Type	Sample
0	990	SM	Brown, micaceous, SILTY SAND, loose	1-2-1	5	SS	
2	988						
4	986	SM	Brown/orange, SILTY SAND, loose	2-3-3	9	SS	
6	984	SP	Grey, SAND, loose, alluvial	2-2-3	8	SS	
8	982						
10	980			WOH	WOH	SS	
12	978						
14	976			WOH-1-1	3	SS	
16	974						
18	972	RC	Auger refused at depth of 18ft B.G.S. Rock coring from 18' to 28' Grey to off-white biotite gneiss, hard REC=77%; RQD=58% UCS=4,050 psi			DC	
20	970						
22	968						
24	966						
26	964						
28	962		Rock coring terminated at depth of 28' B.G.S.				
30	960						
32	958						
34	956						
36	954						
38	952						
40	950						
42	948						
44	946						
46	944						
48	942						
50	940						
52	938						
54	936						
56	934						
58	932						
60							

N60 Value Graph



Moist, %

Water Level

NOTE: SPT N-Values have been corrected with 94% Energy Rating

Rock Core From Boring B-2A
(Depth 18’ – 28’)
REC = 77%, RQD = 58%

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(770)-2635945

B-3A: Sta. 132+10, 40' Lt (Bent 2 Left)

McGinnis Ferry Road over Big Creek
Forsyth/Fulton Counties

PI No. 0004634

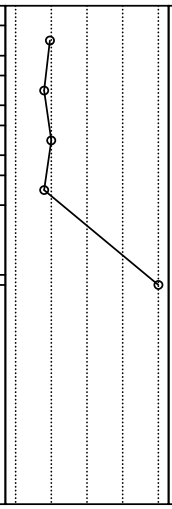
ATLAS Proj. No.: FOR095

DATE COMPLETED	: 12/19/2020	SURFACE ELE.	: 999.5'
ENERGY RATING	: 94%	DEPTH OF BORING	: 25'
DRILL RIG	: CME 550 (SN 380)	DEPTH TO WATER	: Not Encountered
DRILLING METHOD	: HSA + SPT	LOGGED BY	: Jay
DRILLER	: Drilling Solutions	BOTTOM OF CAP	: 1001.01'

Sample Condition: Remoulded; Undisturbed; Lost; Rock Core

Sampler Type: SS Split Spoon; ST Shelby Tube; PS Piston Sampler; DC Diamond Core Bar.

Depth in Feet	Surf. Elev. 999.5	USCS	DESCRIPTION	Blow count	SPT-N60 Value	Sampler Type	Sample
0							
2	998	SM	Brown, SILTY SAND, Medium dense	10-8-7	24	SS	
4	996			5-5-8	20	SS	
6	994			5-8-8	25	SS	
8	992						
10	990		Bottom of Excavation	4-6-7	20	SS	
12	988						
14	986	SM	Brown, SILTY SAND, very dense (PWR)	50/2"	50/2"	SS	
16	984	RC	Auger refused at depth of 15' B.G.S. Rock coring from 15' to 25' Grey to off-white biotite gneiss, hard REC = 73% RQD = 50% UCS = 6,950 psi			DC	
18	982						
20	980						
22	978						
24	976						
26	974		Rock coring terminated at depth of 25' BGS				
28	972						
30	970						
32	968						
34	966						
36	964						
38	962						
40	960						
42	958						
44	956						
46	954						
48	952						
50	950						
52	948						
54	946						
56	944						
58	942						
60	940						



Moist, %

Water Level

NOTE: SPT N-Values have been corrected with 94% Energy Rating

Rock Core From Boring B-3A
(Depth 15’ – 25’)
REC = 73%, RQD = 50%

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B-4A: Sta. 132+00, 25' Rt (Bent 2 Right)

McGinnis Ferry Road over Big Creek
Forsyth/Fulton Counties, Georgia

PI No. 0004634

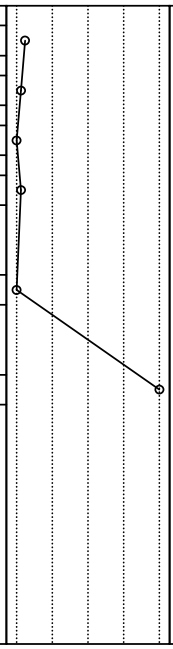
ATLAS Proj. No.: FOR095

DATE COMPLETED	: 1/6/2021	GROUND SURF. ELE.	: 992'
DRILL RIG	: CME 550 (SN 380)	DEPTH OF BORING	: 32'
DRILLING METHOD	: Mud Rotary / Auto Hammer	DEPTH OF WATER	: 7'
ENERGY EFFICIENCY	: 94%	LOGGED BY	: Jay Shah
DRILLER	: Drilling Solutions	BOTTOM OF CAP	: 1001.56'

Sample Condition: Remoulded; Undisturbed; Lost; Rock Core

Sampler Type: SS Split Spoon; ST Shelby Tube; PS Piston Sampler; DC Diamond Core Bar.

Depth in Feet	Surf. Elev. 992	USCS	DESCRIPTION	Blow count	SPT-N60 Value	Sampler Type	Sample
0	992	ML	Grey, SANDY SILT, firm				
2	990		Bottom of Excavation	2-2-2	6	SS	
4	988	SC	Brown, CLAYEY SAND, very loose	1-1-1	3	SS	
6	986			1-WOH	0	SS	
8	984						
10	982			1-1-1	3	SS	
12	980						
14	978			WOH-WOH	0	SS	
16	976						
18	974	SC	Grey, CLAYEY SAND, very dense				
20	972			7-50/4"	50/4"	SS	
22	970	RC	Auger refused at depth of 22' B.G.S. Rock coring from 22' to 32' Dark grey to off-white biotite gneiss, hard REC=78%: RQD=55% UCS = 7,020 psi			DC	
24	968						
26	966						
28	964						
30	962						
32	960		Rock coring terminated at depth of 32' B.G.S.				
34	958						
36	956						
38	954						
40	952						
42	950						
44	948						
46	946						
48	944						
50	942						
52	940						
54	938						
56	936						
58	934						
60							



Moist, %

Water Level

NOTE: SPT-N Values have been corrected with 94% ER

Rock Core From Boring B-4A
(Depth 22’ – 32’)
REC = 93%, RQD = 91%

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(770)-2635945

B-5A: Sta. 132+50, 57' Lt (Bent 3 Left)

McGinnis Ferry Road over Big Creek
Forsyth/Fulton Counties, Georgia

PI No. 0004634

ATLAS Proj. No.: FOR095

DATE COMPLETED	: 1/6/2021	GROUND SURF. ELE.	: 994'
DRILL RIG	: CME (SN 380)	DEPTH OF BORING	: 26'
DRILLING METHOD	: Mud Rotary / Auto Hammer	DEPTH OF WATER	: 7'
ENERGY EFFICIENCY	: 94%	LOGGED BY	: Jay Shah
DRILLER	: Drilling Solutions	BOTTOM OF FTG	: 985'+/-

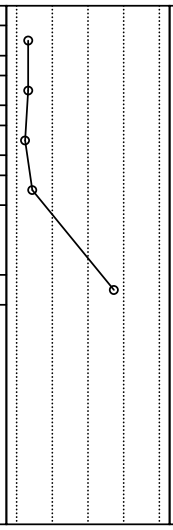
Sample Condition: Remoulded; Undisturbed; Lost; Rock Core

Sampler Type: SS Split Spoon; ST Shelby Tube; PS Piston Sampler; DC Diamond Core Bar.

Depth in Feet	Surf. Elev. 994	USCS	DESCRIPTION	Blow count	SPT-N60 Value	Sampler Type	Sample
0	994	SC	Brown, CLAYEY SAND, loose	2-2-3	8	SS	
2	992						
4	990			2-3-2	8	SS	
6	988			WOH-4	6	SS	
8	986	SC	Brown/tan, CLAYEY SAND, medium dense	3-4-3	11	SS	
10	984	SP	Grey, SAND, Poorly Graded, with weather rock, very dense				
12	982						
14	980			23-24-19	67	SS	
16	978	RC	Auger refused at depth of 16' B.G.S. Rock coring from 16' to 26' Dark grey to off-white biotite geiness, hard REC=87%, RQD=83% UCS = 15,210 psi			DC	
18	976						
20	974						
22	972						
24	970						
26	968		Rock coring terminated at depth of 26' B.G.S.				
28	966						
30	964						
32	962						
34	960						
36	958						
38	956						
40	954						
42	952						
44	950						
46	948						
48	946						
50	944						
52	942						
54	940						
56	938						
58	936						
60							

Btm of Ftg.

N60 Value Graph



Moist, %

Water Level

NOTE: SPT-N Values have been corrected with 94% ER

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Rock Core From Boring B-5A
(Depth 16’ – 26’)
REC = 87%, RQD = 83%

ATLAS TECHNICAL CONSULTANTS
2450 Commerce Avenue, STE 100, Duluth, GA 30096
(770)-2635945

B-6A: Sta. 132+50, 37' Rt (Bent 3 Right)

McGinnis Ferry Road over Big Creek
Forsyth/Fulton Counties, Georgia

PI No. 0004634

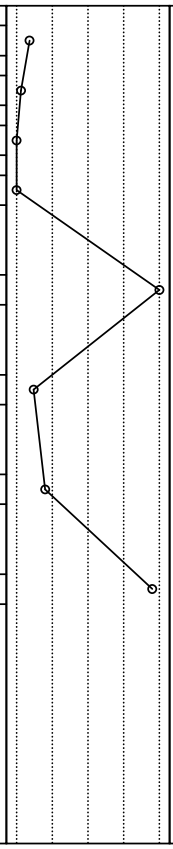
ATLAS Proj. No.: FOR095

DATE COMPLETED	: 1/6/2021	GROUND SURF. ELE.	: 992'
DRILL RIG	: CME550 (SN 380)	DEPTH OF BORING	: 42'
DRILLING METHOD	: Mud Rotary / Auto Hammer	DEPTH OF WATER	: 7'
ENERGY EFFICIENCY	: 94%	LOGGED BY	: Jay Shah
DRILLER	: Drilling Solutions	BOTTOM OF FTG	: 985'+/-

Sample Condition: Remoulded; Undisturbed; Lost; Rock Core

Sampler Type: SS Split Spoon; ST Shelby Tube; PS Piston Sampler; DC Diamond Core Bar.

Depth in Feet	Surf. Elev. 992	USCS	DESCRIPTION	Blow count	SPT-N60 Value	Sampler Type	Sample
0	992	SM	Brown SILTY SAND, loose	3-3-3	9	SS	
2	990						
4	988	SM	Brown, SILTY SAND, very loose	1-1-1	3	SS	
6	986		Bottom of Footing	WOH	0	SS	
8	984			WOH	0	SS	
10	982	SP	Grey, coarse SAND, with rock fragments,very dense				
12	980						
14	978			50/1"	50/1"	SS	
16	976	SM	Grey, SILTY SAND, medium dense				
18	974						
20	972			2-3-5	12	SS	
22	970						
24	968			4-6-7	20	SS	
26	966	SP	White/grey, medium to coarse SAND, very dense				
28	964						
30	962			11-24-37	95	SS	
32	960	RC	Auger refused at depth of 32' B.G.S. Dark grey to off-white biotite gneiss, hard Rock coring from 32' to 42' REC=73%, RQD=66% UCS = 4,390 psi			DC	
34	958						
36	956						
38	954						
40	952						
42	950		Rock coring terminated at depth of 42' B.G.S.				
44	948						
46	946						
48	944						
50	942						
52	940						
54	938						
56	936						
58	934						
60							



Moist, %

Water Level

NOTE: SPT-N Values have been corrected with 94% ER

Rock Core From Boring B-6A
(Depth 32’ – 42’)
REC = 73%, RQD = 66%

ATLAS
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B-7A: Sta. 133+40, 47' Lt (Bent 4 Left)

McGinnis Ferry Road over Big Creek
Forsyth/Fulton Counties, Georgia

PI No. 0004634

ATLAS Proj. No.: FOR095

DATE COMPLETED	: 1/6/2021	GROUND SURF. ELE.	: 986'
DRILL RIG	: CME 550 (SN 380)	DEPTH OF BORING	: 38'
DRILLING METHOD	: Mud Rotary / Auto Hammer	DEPTH OF WATER	: 4'
ENERGY EFFICIENCY	: 94%	LOGGED BY	: Jay Shah
DRILLER	: Drilling Solutions	BOTTOM OF FTG	: 984'+/-

Sample Condition: Remoulded; Undisturbed; Lost; Rock Core

Sampler Type: SS Split Spoon; ST Shelby Tube; PS Piston Sampler; DC Diamond Core Bar.

Btm of Ftg. 984

Depth in Feet	Surf. Elev. 986	USCS	DESCRIPTION	Blow count	SPT-N60 Value	Sampler Type	Sample
0–2	986–984	ML	Brown, SANDY SILT, with rock fragments, stiff	3-5-5	16	SS	☒
4	982	SC	Grey, CLAYEY SAND, very loose	1-WOH	0	SS	☒
6	980			1-WOH	0	SS	☒
8	978	SP	Grey,medium to fine SAND, loose	WOH-2-3	8	SS	☒
12	974	SC	Dark grey, CLAYEY SAND, very loose				
14	972			WOH-1	2	SS	☒
18	968						
20	966			WOH-1	2	SS	☒
22	964	SP	Grey, coarse SAND, loose				
24	962			1-1-2	5	SS	☒
28	958	RC	Auger refused at depth of 28' B.G.S. Rock coring from 28' to 38' Dark grey to off-white biotite gneiss, hard REC= 78%, RQD=68% UCS = 7,170 psi			DC	▩
38	948		Rock coring terminated at depth of 38' B.G.S.				

N60 Value Graph: 0, 50, 100

Moist, %

Water Level ▼

NOTE: SPT-N Values have been corrected with 94% ER

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Rock Core From Boring B-7A
(Depth 28’ – 38’)
REC = 78%, RQD = 68%

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B-8A: Sta. 133+40, 26' Rt (Bent 4 Right)

McGinnis Ferry Road over Big Creek
Forsyth/Fulton Counties, Georgia

PI No. 0004634

ATLAS Proj. No.: FOR095

DATE COMPLETED	: 1/6/2021	GROUND SURF. ELE.	: 989'
DRILL RIG	: CME 550 (SN 380)	DEPTH OF BORING	: 56'
DRILLING METHOD	: Mud Rotary / Auto Hammer	DEPTH OF WATER	: 5'
ENERGY EFFICIENCY	: 94%	LOGGED BY	: Jay Shah
DRILLER	: Drilling Solutions	PILE CAP ELE.	: 984'+/-

Sample Condition: Remoulded; Undisturbed; Lost; Rock Core

Sampler Type: SS Split Spoon; ST Shelby Tube; PS Piston Sampler; DC Diamond Core Bar.

Depth in Feet	Surf. Elev. 989	USCS	GRAPHIC	DESCRIPTION	Blow count	SPT-N60 Value	N60 Value Graph (0 – 50 – 100)	Sampler Type	Sample	Moist, %	Water Level
0	988	SM		Brown,SILTY SAND, loose	2-1-1	5		SS			
2	986			Grey, CLAYEY SAND, very loose	1-1-1	3		SS			
4	984			Btm of Ftg.							
6	982	SC			WOH-2-3	8		SS			
8	980				WOH-1-1	3		SS			
10	978			Grey,medium to coarse SAND, with rock fragments,very dense							
12	976										
14	974	SP			17-50/2"	50/2"		SS			
16	972										
18	970				50/4"	50/4"		SS			
20	968										
22	966	RC1		Auger refused at depth of 21' B.G.S. Rock coring from 21' to 31' (first run) Poor recovery, dark grey to off-white biotite gneiss, moderately soft REC=10%, RQD= 0%				Dc			
24	964										
26	962										
28	960										
30	958	RC2		Rock coring from 31' to 41' (2nd run) Dark grey to off-white biotite gneiss Moderately soft to moderately hard REC=78%, RQD= 31% UCS = 8,550 psi				DC			
32	956										
34	954										
36	952										
38	950										
40	948	RC3		Rock coring from 41' to 51' (3rd run) Dark grey to off-white biotite gneiss, hard REC= 98%, RQD=26% UCS = 11,340 psi				DC			
42	946										
44	944										
46	942										
48	940										
50	938	RC4		Rock coring from 51' to 56' (4th run) Grey to off-white biotite gneiss, hard REC=100%, RQD=80% UCS = 7,960 psi				DC			
52	936										
54	934										
56	932			Rock coring terminated at depth of 56' B.G.S.							
58	930										
60											

NOTE: SPT-N Values have been corrected with 94% ER

Rock Core From Boring B-8A
(Depth 21' – 41')
REC = 10%, RQD = 0% for depth of 21' to 31'
REC = 78%, RQD = 31% for depth of 31' to 41'

Rock Core From Boring B-8A
(Depth 41’ – 51’)
REC = 98%, RQD = 26%

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B-9 : Sta.134+00, 55' Lt (Bent 5 Left)

McGinnis Ferry Road over Big Creek
Forsyth/Fulton Counties

PI No. 0004634

ATLAS Proj. No.: FOR095

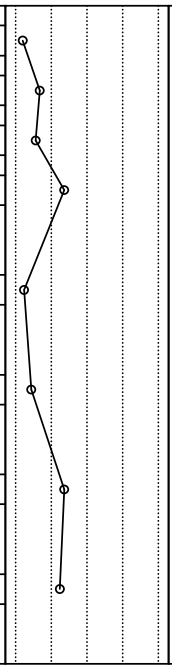
DATE COMPLETED	: 9/18/2019	SURFACE ELE.	: 992'
ENERGY RATING	: 94%	DEPTH OF BORING	: 33'
DRILL RIG	: CME 550 (SN 380)	DEPTH TO WATER	: 10'
DRILLING METHOD	: HSA + SPT	LOGGED BY	: Jay
DRILLER	: Drilling Solutions	BOTTOM OF CAP	: 998.39'

Sample Condition: Remoulded; Undisturbed; Lost; Rock Core

Sampler Type: SS Split Spoon; ST Shelby Tube; PS Piston Sampler; DC Diamond Core Bar.

Depth in Feet	Surf. Elev. 992	USCS	DESCRIPTION	Blow count	SPT-N Value	Sampler Type	Sample
0	992						
2	990	SM	Brown, SILTY SAND, loose — Bottom of Excavation	2-2-1	5	SS	☒
4	988	SM	Brown, SILTY SAND, medium dense	4-6-5	17	SS	☒
6	986			3-3-6	14	SS	☒
8	984	SM	Brown, SILTY SAND, dense	8-8-14	34	SS	☒
10	982						
12	980						
14	978	SM	Dark grey, SILTY coarse SAND, loose to medium dense	2-2-2	6	SS	☒
16	976						
18	974						
20	972			2-3-4	11	SS	☒
22	970						
24	968	SP	Dark grey, coarse SAND, dense	11-9-13	34	SS	☒
26	966						
28	964						
30	962			6-8-12	31	SS	☒
32	960						
34	958		Auger refused at depth of 33' B.G.S.				
36	956						
38	954						
40	952						
42	950						
44	948						
46	946						
48	944						
50	942						
52	940						
54	938						
56	936						
58	934						
60							

N Value Graph



Moist, %

Water Level

NOTE: SPT N-Values have been corrected with 94% energy rating

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(770)-2635945

B-10A: Sta. 133+90, 37' Rt (Bent 5 Right)

McGinnis Ferry Road over Big Creek
Forsyth/Fulton Counties, Georgia

PI No. 0004634

ATLAS Proj. No.: FOR095

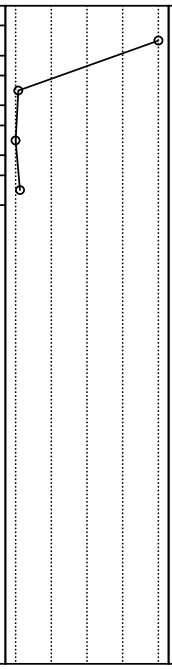
DATE COMPLETED	: 1/6/2021	GROUND SURF. ELE.	: 990'
DRILL RIG	: CME 550 (SN 380)	DEPTH OF BORING	: 33'
DRILLING METHOD	: Mud Rotary / Auto Hammer	DEPTH OF WATER	: 6.5'
ENERGY EFFICIENCY	: 94%	LOGGED BY	: Jay Shah
DRILLER	: Drilling Solutions	BOTTOM OF CAP	: 998.81'

Sample Condition: Remoulded; Undisturbed; Lost; Rock Core

Sampler Type: SS Split Spoon; ST Shelby Tube; PS Piston Sampler; DC Diamond Core Bar.

Depth in Feet	Surf. Elev. 990	USCS	DESCRIPTION	Blow count	SPT-N60 Value	Sampler Type	Sample
0	990						
2	988		Tree roots	50/5"	50/5"	SS	Remoulded
4	986	SC	Brown/grey, CLAYEY SAND, very loose	1-1-WOH	2	SS	Remoulded
6	984	SP	Grey, fine SAND, very loose	1-WOH	0	SS	Remoulded
8	982						
10	980			1-1-1	3	SS	Remoulded
12	978						
14	976	RC1	Auger refused at depth of 23' B.G.S. Rock coring from 13' to 23' (1st run) Dark grey to off-white biotite gneiss Moderately hard REC=74%, RQD= 7%			DC	Rock Core
16	974						
18	972						
20	970						
22	968						
24	966	RC2	Start third 5' rock coring from 23' to 33' Dark grey to off-white biotite gneiss Moderately hard to hard REC=90%, RQD= 75% UCS = 8,390 psi			DC	Rock Core
26	964						
28	962						
30	960						
32	958						
34	956		Rock coring terminated at depth of 33' B.G.S.				
36	954						
38	952						
40	950						
42	948						
44	946						
46	944						
48	942						
50	940						
52	938						
54	936						
56	934						
58	932						
60							

N60 Value Graph



Moist, %

Water Level

NOTE: SPT-N Values have been corrected with 94% ER

Rock Core From Boring B-10A
(Depth 13’ – 23’)
REC = 74%, RQD = 7%

Rock Core From Boring B-10A
(Depth 23’ – 33’)
REC = 90%, RQD = 75%

H

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(770)-2635945

B-11 : Sta.134+50, 40' Lt (Bent 6 Left)

McGinnis Ferry Road over Big Creek
Forsyth/Fulton Counties

PI No. 0004634

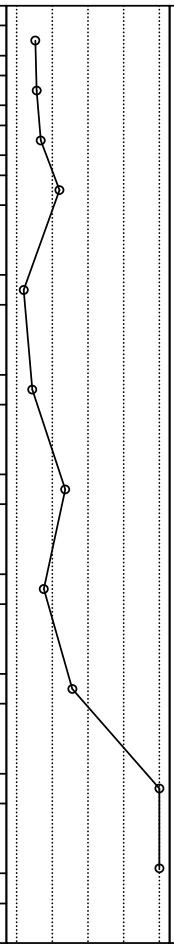
ATLAS Proj. No.: FOR095

DATE COMPLETED	: 9/18/2019	SURFACE ELE.	: 998'
ENERGY RATING	: 94%	DEPTH OF BORING	: 47'
DRILL RIG	: CME 550 (SN 380)	DEPTH TO WATER	: 14'
DRILLING METHOD	: HSA + SPT	LOGGED BY	: Jay Shah
DRILLER	: Drilling Solutions	BOTTOM OF CAP	: 997.89'

Sample Condition: Remoulded; Undisturbed; Lost; Rock Core

Sampler Type: SS Split Spoon; ST Shelby Tube; PS Piston Sampler; DC Diamond Core Bar.

Depth in Feet	Surf. Elev. 998	USCS	DESCRIPTION	Blow count	SPT-N60 Value	Sampler Type	Sample
0	998						
2	996	SM	Brown,SILTY SAND, medium dense	3-4-4	13	SS	☒
4	994			6-5-4	14	SS	☒
6	992			5-5-6	17	SS	☒
8	990	CL	Grey, SANDY CLAY, stiff	7-10-9	30	SS	☒
10	988	SM	Dark grey, SILTY SAND, , loose to medium dense				
12	986						
14	984			WOH-2-1	5	SS	☒
16	982						
18	980						
20	978			2-3-4	11	SS	☒
22	976	SM	Dark grey, SILTY SAND, medium dense to dense				
24	974			15-11-11	34	SS	☒
26	972						
28	970						
30	968			5-5-7	19	SS	☒
32	966	SM	Dark grey, SILTY SAND, Dense				
34	964			10-11-14	39	SS	☒
36	962	SM	Grey/yelow, micaceous, SILTY SAND, with rock fragments, very dense (PWR)				
38	960						
40	958			50/1"	50/1"	SS	☒
42	956						
44	954			50/2"	50/2"	SS	☒
46	952						
48	950		Auger refused at depth of 47' B.G.S.				
50	948						
52	946						
54	944						
56	942						
58	940						
60							



Moist, %

Water Level

NOTE: SPT N-Values have been corrected with 94% energy rating

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TECHNICAL CONSULTANTS
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(770)-2635945

B-12A: Sta.134+30, 40' Rt (Bent 6 Right)

McGinnis Ferry Road over Big Creek
Forsyth/Fulton Counties

PI No. 0004634

ATLAS Proj. No.: FOR095

DATE COMPLETED	: 9/20/2019	SURFACE ELE.	: 990'
ENERGY RATING	: 94%	DEPTH OF BORING	: 17'
DRILL RIG	: CME 550 (SN 380)	DEPTH TO WATER	: 5'
DRILLING METHOD	: HSA + SPT	LOGGED BY	: Jay Shah
DRILLER	: Drilling Solutions	BOTTOM OF CAP	: 997.80'

Sample Condition: Remoulded; Undisturbed; Lost; Rock Core

Sampler Type: SS Split Spoon; ST Shelby Tube; PS Piston Sampler; DC Diamond Core Bar.

Depth in Feet	Surf. Elev. 990	USCS	GRAPHIC	DESCRIPTION	Blow count	SPT-N Value	N Value Graph (0 50 100)	Sampler Type	Sample	Moist, %	Water Level
0	990										
2	988	SM		Brown, SILTY SAND, loose	4-3-3	9		SS			
4	986				2-2-2	6		SS			▼
6	984			No recovery except some roots	WOH	WOH		SS			
8	982	SM		Grey, SILTY SAND, very loose	2-1-1	3		SS			
10	980										
12	978	SM		Dark grey, SILTY coarse SAND, medium dense							
14	976				4-5-13	28		SS			
16	974										
18	972	RC		Auger Refusal at depth of 17ft B.G.S. Rock coring from 17 to 27' Dark grey to off-white biotite gneiss, hard REC=88%; RQD=45% UCS=5,540psi				DC			
20	970										
22	968										
24	966										
26	964										
28	962			Rock coring terminated at depth of 27' B.G.S.							
30	960										
32	958										
34	956										
36	954										
38	952										
40	950										
42	948										
44	946										
46	944										
48	942										
50	940										
52	938										
54	936										
56	934										
58	932										
60											

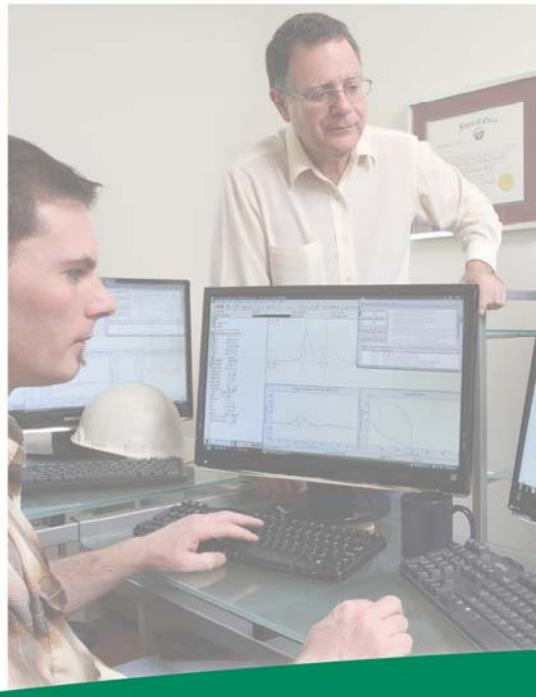
NOTE: SPT N-values have been corrected with 94% energy rating

Rock Core From Boring B-12A
(Depth 17’ – 27’)
REC = 88%, RQD = 45%

Appendix D – Drilling Calibration Report








GRL engineers, inc.

Dynamic Measurements and Analyses

Job No. 179031-1

Report on: Standard Penetration Test Energy Measurements
Jonesboro, GA

Prepared for Drilling Solutions

By Thomas G. Hyatt, P.E. and Joel S. Webster, E.I.

June 20, 2018

www.GRLengineers.com info@GRLengineers.com

June 20, 2018

Tony Trettel
Drilling Solutions, LLC
180 Gateway Dr.
Canton, GA 30115

Re: Standard Penetration Test Energy Measurements
Jonesboro, GA GRL Job No. 179031-1

Dear Mr. Trettel,

This report presents results of energy measurements obtained on June 8, 2019 during Standard Penetration Tests (SPT) sampling. Two automatic hammers mounted on two separate CME550 dill rigs that were tested generally following ASTM D4633-10 standards. All dynamic tests were performed on AWJ drill rods. GRL Engineers, Inc. obtained the dynamic measurements with an instrumented AW subsection that had AWJ adapters and a Model 8G Pile Driving Analyzer®. This report describes the testing procedures and summarizes the test results. Appendix A describes our measurement and analysis methods, Appendix B contains calibration information for the gages and equipment used, and Appendix C is a summary of the field data.

PURPOSE AND SCOPE OF WORK

At the request of Drilling Solutions, LLC., GRL conducted SPT energy measurements in Jonesboro, GA according to ASTM D4633-10. Specifically, we recorded SPT energy measurements at five-foot sample intervals between 18.5 and 43.5 feet below the existing ground surface. SPT samples were taken every five feet from the ground surface until a boring depth of about 43.5 feet was reached. All SPT samples were driven for a total of 3 six-inch increments, or 1.5 feet.

EQUIPMENT

Drilling and SPT Hammer Equipment

CME-550 (Serial # 380)

SPT energy measurements were made on an automatic hammer mounted on a CME-550 drill rig. The drilling method used to advance the boring was hollow stem auger. Energy measurements for this drill rig were collected at a borehole located in Jonesboro, GA. SPT energy measurements were performed at 5-foot sampling intervals between 18.5 and 40.0 feet. A total of five energy measurement events were performed for this drill rig.

CME-550 (Serial # 404)

SPT energy measurements were made on an automatic hammer mounted on a CME-550 drill rig. The drilling method used to advance the boring was hollow stem auger. Energy measurements for this drill rig were collected at a borehole located in Jonesboro, GA. SPT energy measurements were performed at 5-foot sampling intervals between 18.5 and 43.5 feet. A total of six energy measurement events were performed for this drill rig. The SPT energy measurements performed from 33.5 to 40 feet did not meet the ASTM D4633-10 specifications for blow counts and were not considered in the calibration of this drill rig.

Instrumentation

A Model 8G Pile Driving Analyzer (PDA) data acquisition system (SN# 4613LE) was used to collect and process the dynamic measurements of force and velocity. The data was collected using a two foot long section of AW rod subsection (SN# 246AW) with a cross sectional area of 1.21 square inches and instrumented with two full bridge foil resistance strain gages and two piezoresistive accelerometers mounted in the midpoint location of the instrumented rod. Couplings were used to convert the threads from the AW rod subsection to the AWJ rod string.

Analog signals from the strain gages and accelerometers were conditioned, digitized, stored and processed with the PDA. The sampling frequency used during the SPT testing was 50 kHz. Selected output from the PDA for each recorded impact included the energy transfer ratio (ETR), maximum rod top velocity (VMX), maximum energy transfer (EFV), maximum rod top force (FMX), and the hammer operating rate (BPM).

MEASUREMENTS AND CALCULATIONS

FV Method (EFV)

Energy transfer to the PDA gage location, EFV, was computed by the PDA using force, F(t), and velocity, v(t), records as follows:

$$EFV = \int_a^b F(t) \cdot v(t) dt$$

The time "a" corresponds to the start of the record when the energy transfer begins, and "b" is the time at which energy transferred to the rod reaches a maximum value. The FV Method is currently recognized in ASTM D4633-10, and is the theoretically correct result; therefore, no other energy calculation methods are reported.

Corrected SPT number (N_{60})

While the primary purpose of SPT energy testing is to calculate the maximum transferred energy (ETR) of each hammer blow, the overall average EFV value can be used to calculate the corrected SPT number (N_{60}). To adjust the SPT N-values for hammer performance, the following correction as suggested by Seed for N-value adjustment to 60% transfer efficiency (e.g. 210 ft-pounds) was used:

Where:

N_{60} = Corrected N-value
E_m = overall average measured energy transfer (EFV)
N_m =number of blows for last 12 inches of sampler penetration

A general introduction to dynamic SPT testing methods is included in this report as Appendix A. References for more detailed descriptions of our testing and analysis methods are available upon request.

Any cross-sectional area difference between the GRL rod subsection and the drill rods, any loose connections or changes in area at section joints, or any cross-sectional area differences between the individual drill rod sections will result in stress wave reflections that can potentially influence the energy transfer. The EFV transferred energy calculation method, utilizing both force and velocity records, is theoretically correct and gives energy transfer results that are not adversely affected by cross-sectional area changes or loose connectors. The EFV results are included in Appendix C for all records collected and accepted after checking them for consistency.

RESULTS

Upon return to the office, the records collected by the PDA were checked for consistency and accuracy. For example, records from very weak startup or final impacts were not included in average results. Appendix C contains a representative plot of force and normalized velocity versus time, as well as tables of PDA results for all hammer blows at each dynamically monitored sampling depth. The results include the EFV (transferred energy by the FV method, as recommended by ASTM D4633-10), ETR (energy transfer efficiency for the EFV method), BPM (hammer operating rate), FMX (maximum rod top force) and VMX (maximum rod top velocity). The tables show statistical summaries for the final two 6 inch increments over which the SPT N value is calculated. At the end of each table is a statistical evaluation of these results which include the average and standard deviation.

$$N_{60} = \left(\frac{E_m}{210}\right) N_m$$

The table below and the summary tables in Appendix C summarize the average transferred energy values calculated by the EFV method. The records consist of averaged hammer blows from the last 12 inches (i.e. N value) at each dynamically monitored sampling depth. The "energy transfer ratio" (ETR) is defined as the ratio of maximum transferred energy EFV divided by the theoretical hammer potential energy of 350 ft-lbs (i.e., computed per the 140 lb SPT hammer and the standard 30 inch drop as specified by ASTM D1586-08). The average hammer operating rate is reported in blows per minute (BPM). A summary of the dynamic measurements of the energy transfer to the drill rods using the EFV equation is provided in the table below.

Drill Rig	Avg. EFV (ft-lbs)	Avg ETR (%)	Range of EFV (ft-lbs)	Range of ETR (%)
CME-550 SN 380	330	94	309 – 367	88 – 105
CME-550 SN 404	325	78	302 – 343	66 – 88

CONCLUSIONS

Based upon the dynamic test data obtained, the following conclusions are presented:

1. Loose connections in the drill string were sometimes observed in the force and velocity records. However, energy transfer values calculated using the EFV equation are not adversely affected by the connectors and therefore are considered a better indication of transferred energy.

2. Dynamic measurements of the transferred energy to the drill rods using the EFV equation ranged from 309 to 367 ft-lbs for the CME-550, SN 380 drill rig. This corresponds to a transfer efficiency ranging from 88 to 105% of the SPT hammer energy of 350 ft-lbs.

3. Dynamic measurements of the transferred energy to the drill rods using the EFV equation ranged from 302 to 343 ft-lbs for the CME-550, SN 404 drill rig. This corresponds to a transfer efficiency ranging from 66 to 88% of the SPT hammer energy of 350 ft-lbs.

4. The average transferred energy (EFV) and energy transfer ratio (ETR) for the CME-550 drill rigs tested was as follows:

   CME-550, SN 380: Average EFV = 330 ft-lbs; Average ETR = 94%

   CME-550, SN 404: Average EFV = 325 ft-lbs; Average ETR = 78%

Please review both ASTM D4633-10 and ASTM D1586-08 prior to applying these test results. The energy calibrations reported herein are valid for the same hammer/drill rig, with the same drill operator, same anvil dimensions, and same drilling methods.

We appreciate the opportunity to be of assistance to you on this project. Please contact our office should you have any questions regarding this submittal, require additional information, or if we may be of further service.

Sincerely,

GRL Engineers, Inc.

GEORGIA
REGISTERED
No. PE041302
PROFESSIONAL
ENGINEER
THOMAS GEORGE HYATT

Thomas G. Hyatt, P.E.

Joel S. Webster, E.I.

TGH:JSW:dms

Appendix E – Laboratory tests

2450 Commerce Avenue
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Soil Classification

Project Name:	*McGinnis Ferry Road/ Phase-2*			P I No.:	*0004634*
Sample Location:	*Bridge at Big Creek*	Sample Number:	B-4A	Sample Depth:	*13.5-15'*
Date Sampled:		Sampled By:		*Lab No.:*	
Date Tested:	*1/19/2021*	Tested By:	*Jay*	*Atlas Project Number:*	*FOR095*
Sample Description:	*Brown clayey sand*				

Sieve Analysis

US Sieve Size	Sieve Opening		% Passing
	(inch)	(mm)	
3 Inch	3.0000	76.2	
1.5 Inch	1.5000	38.1	
1 Inch	1.0000	25.4	
No.4	1.8701	4.75	*100.0*
No.10	0.7874	2.00	*100.0*
No.20	0.3346	0.85	*100.0*
No.40	0.1673	0.425	*99.0*
No.60	0.0984	0.25	*92.8*
No.100	0.0591	0.15	*42.6*
No.200	0.0295	0.075	*17.8*
% Clay	0.0079	0.02	16.2

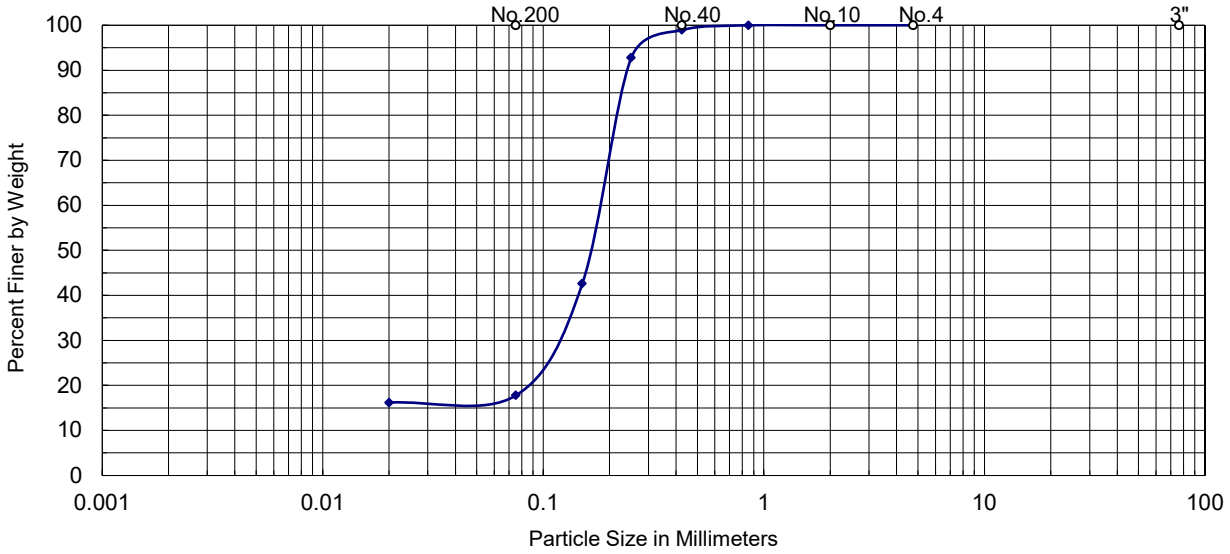
Atterberg Limits

Liquid limit (LL)	*40*
Plastic Limit (PL)	*15*
Plasticity Index (PI)	*25*

D_{10} (mm) =	0.0000
D_{30} (mm) =	0.0000
D_{75} (mm) =	0.209
Coefficient of Uniformity, C_u =	1000.00
Coefficient of ccurvature, C_c =	1000.00

Organic Content, %	0
Maximum Dry Density,pcf	
Volume Change, %	

Grain size distribution



Soil Classification

AASHTO	
USCS	SC - Clayey sand
GDOT	

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Fax: 770-263-0166

Soil Classification

Project Name:	*McGinnis Ferry Road*			P I No.:	*0004634*
Sample Location:	*Bridge at Big Creek*	Sample Number:	B-5A	Sample Depth:	*3.5-5'*
Date Sampled:		Sampled By:		*Lab No.:*	
Date Tested:	*1/19/2021*	Tested By:	*Jay*	*Atlas Project Number:*	*FOR095*
Sample Description:	*Brown clayey sand*				

Sieve Analysis

US Sieve Size	Sieve Opening		% Passing
	(inch)	(mm)	
3 Inch	3.0000	76.2	
1.5 Inch	1.5000	38.1	
1 Inch	1.0000	25.4	
No.4	1.8701	4.75	*100.0*
No.10	0.7874	2.00	*100.0*
No.20	0.3346	0.85	*97.2*
No.40	0.1673	0.425	*92.6*
No.60	0.0984	0.25	*90.0*
No.100	0.0591	0.15	*67.0*
No.200	0.0295	0.075	*48.2*
% Clay	0.0079	0.02	47.0

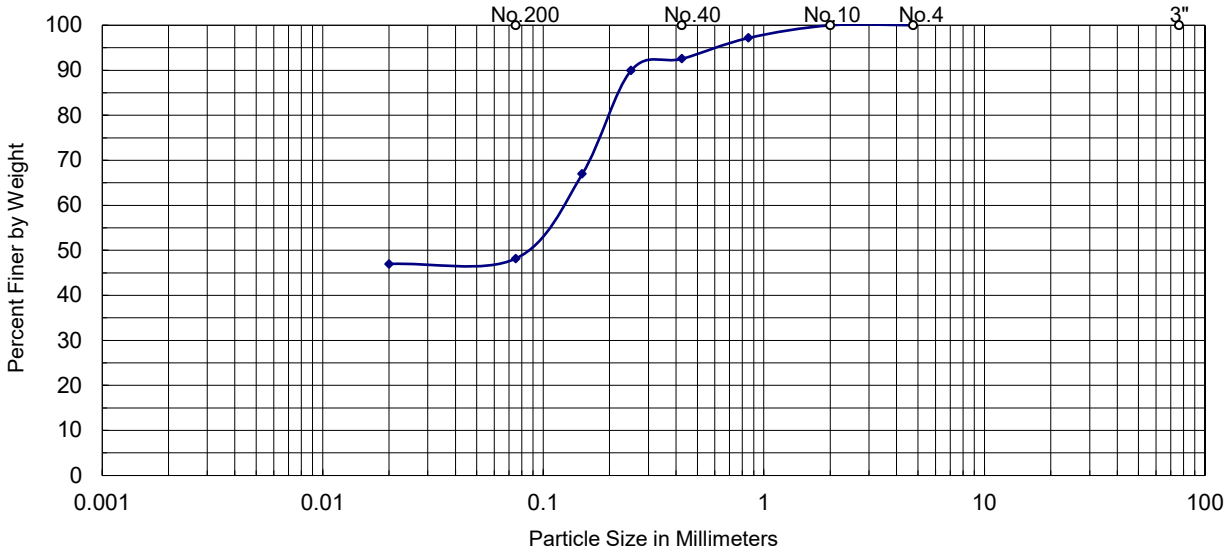
Atterberg Limits

Liquid limit (LL)	*39*
Plastic Limit (PL)	*17*
Plasticity Index (PI)	*22*

D_{10} (mm) =	0.0000
D_{30} (mm) =	0.0000
D_{75} (mm) =	0.179
Coefficient of Uniformity, C_u =	1000.00
Coefficient of ccurvature, C_c =	1000.00

Organic Content, %	0
Maximum Dry Density,pcf	108.7
Volume Change, %	14.2

Grain size distribution



Soil Classification

AASHTO	
USCS	SC - Clayey sand
GDOT	

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Fax: 770-263-0166

Soil Classification

Project Name:	*McGinnis Ferry Road/ Phase-2*			P I No.:	*0004634*
Sample Location:	*Bridge at Big Creek*	Sample Number:	B-5A	Sample Depth:	*8.5'-10'*
Date Sampled:		Sampled By:		*Lab No.:*	
Date Tested:	*1/19/2021*	Tested By:	*Jay*	*Atlas Project Number:*	*FOR095*
Sample Description:	*Brown/tan clayey sand*				

Sieve Analysis

US Sieve Size	Sieve Opening		% Passing
	(inch)	(mm)	
3 Inch	3.0000	76.2	
1.5 Inch	1.5000	38.1	
1 Inch	1.0000	25.4	
No.4	1.8701	4.75	*100.0*
No.10	0.7874	2.00	*100.0*
No.20	0.3346	0.85	*99.6*
No.40	0.1673	0.425	*99.0*
No.60	0.0984	0.25	*97.2*
No.100	0.0591	0.15	*67.6*
No.200	0.0295	0.075	*39.6*
% Clay	0.0079	0.02	37.6

Atterberg Limits

Liquid limit (LL)	*35*
Plastic Limit (PL)	*16*
Plasticity Index (PI)	*19*

D_{10} (mm) =	0.0000
D_{30} (mm) =	0.0000
D_{75} (mm) =	0.170
Coefficient of Uniformity, C_u =	1000.00
Coefficient of ccurvature, C_c =	1000.00

Organic Content, %	0
Maximum Dry Density,pcf	
Volume Change, %	

Grain size distribution

Soil Classification

AASHTO	
USCS	SC - Clayey sand
GDOT	

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Fax: 770-263-0166

Soil Classification

Project Name:	*McGinnis Ferry Road/ Phase-2*			P I No.:	*0004634*
Sample Location:	*Bridge at Big Creek*	Sample Number:	B-6A	Sample Depth:	*6-7.5'*
Date Sampled:		Sampled By:		*Lab No.:*	
Date Tested:	*1/19/2021*	Tested By:	*Jay*	*Atlas Project Number:*	*FOR095*
Sample Description:	*Brown silty sand*				

Sieve Analysis

US Sieve Size	Sieve Opening		% Passing
	(inch)	(mm)	
3 Inch	3.0000	76.2	
1.5 Inch	1.5000	38.1	
1 Inch	1.0000	25.4	
No.4	1.8701	4.75	*100.0*
No.10	0.7874	2.00	*100.0*
No.20	0.3346	0.85	*100.0*
No.40	0.1673	0.425	*99.6*
No.60	0.0984	0.25	*97.2*
No.100	0.0591	0.15	*50.2*
No.200	0.0295	0.075	*23.4*
% Clay	0.0079	0.02	22.0

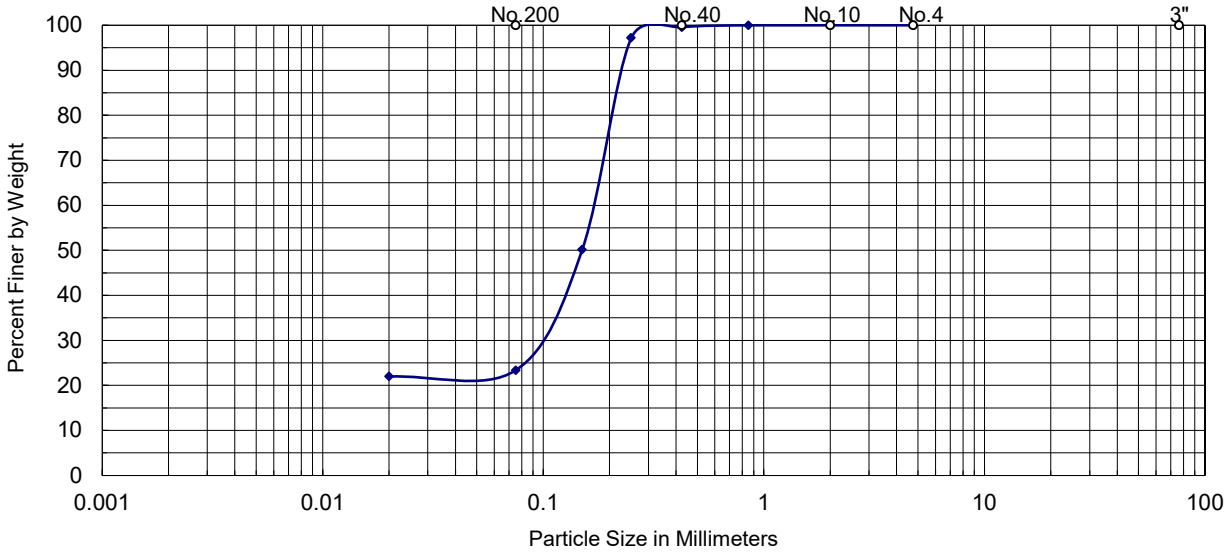
Atterberg Limits

Liquid limit (LL)	*50*
Plastic Limit (PL)	*31*
Plasticity Index (PI)	*19*

D_{10} (mm) =	0.0000
D_{30} (mm) =	0.0000
D_{75} (mm) =	0.196
Coefficient of Uniformity, C_u =	1000.00
Coefficient of ccurvature, C_c =	1000.00

Organic Content, %	0
Maximum Dry Density,pcf	
Volume Change, %	

Grain size distribution



Soil Classification

AASHTO	
USCS	SM - Silty sand
GDOT	

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Duluth, Georgia 30096
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Fax: 770-263-0166

Soil Classification

Project Name:	*McGinnis Ferry Road/ Phase-2*			P I No.:	*0004634*
Sample Location:	*Bridge at Big Creek*	Sample Number:	B-7A	Sample Depth:	*13.5-15'*
Date Sampled:		Sampled By:		*Lab No.:*	
Date Tested:	*1/19/2021*	Tested By:	*Jay*	*Atlas Project Number:*	*FOR095*
Sample Description:	*Dark grey clayey sand*				

Sieve Analysis

US Sieve Size	Sieve Opening		% Passing
	(inch)	(mm)	
3 Inch	3.0000	76.2	
1.5 Inch	1.5000	38.1	
1 Inch	1.0000	25.4	
No.4	1.8701	4.75	*100.0*
No.10	0.7874	2.00	*100.0*
No.20	0.3346	0.85	*80.8*
No.40	0.1673	0.425	*67.0*
No.60	0.0984	0.25	*60.4*
No.100	0.0591	0.15	*46.0*
No.200	0.0295	0.075	*29.8*
% Clay	0.0079	0.02	25.8

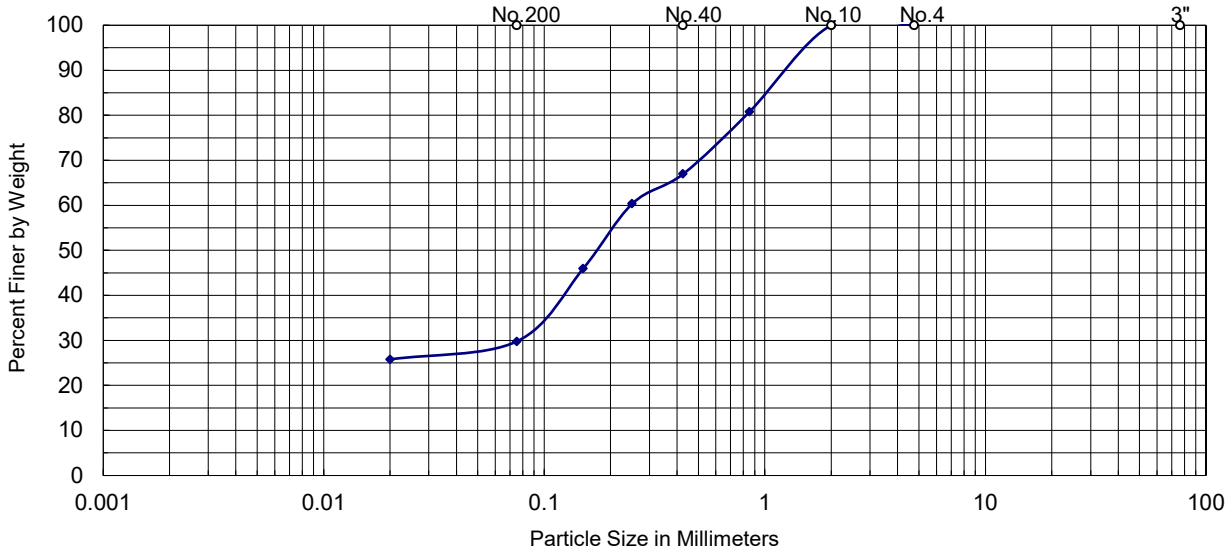
Atterberg Limits

Liquid limit (LL)	*39*
Plastic Limit (PL)	*17*
Plasticity Index (PI)	*22*

D_{10} (mm) =	0.0000
D_{30} (mm) =	0.0000
D_{75} (mm) =	0.635
Coefficient of Uniformity, C_u =	1000.00
Coefficient of ccurvature, C_c =	1000.00

Organic Content, %	0
Maximum Dry Density,pcf	
Volume Change, %	

Grain size distribution



Soil Classification

AASHTO	
USCS	SC - Clayey sand
GDOT	

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Soil Classification

Project Name:	*McGinnis Ferry Road/ Phase-2*			P I No.:	*0004634*
Sample Location:	*Bridge at Big Creek*	Sample Number:	B-7A	Sample Depth:	*18.5-20'*
Date Sampled:		Sampled By:		*Lab No.:*	
Date Tested:	*1/19/2021*	Tested By:	*Jay*	*Atlas Project Number:*	*FOR095*
Sample Description:	*Grey clayey sand*				

Sieve Analysis

US Sieve Size	Sieve Opening		% Passing
	(inch)	(mm)	
3 Inch	3.0000	76.2	
1.5 Inch	1.5000	38.1	
1 Inch	1.0000	25.4	
No.4	1.8701	4.75	*100.0*
No.10	0.7874	2.00	*100.0*
No.20	0.3346	0.85	*86.4*
No.40	0.1673	0.425	*69.6*
No.60	0.0984	0.25	*62.4*
No.100	0.0591	0.15	*43.6*
No.200	0.0295	0.075	*30.4*
% Clay	0.0079	0.02	28.2

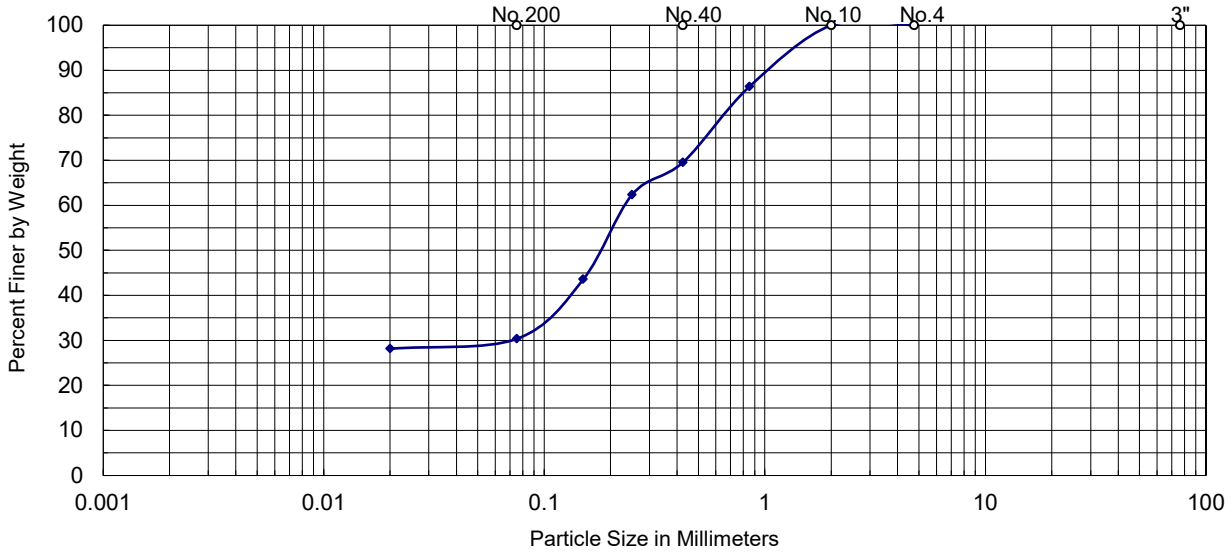
Atterberg Limits

Liquid limit (LL)	*30*
Plastic Limit (PL)	*20*
Plasticity Index (PI)	*10*

D_{10} (mm) =	0.0000
D_{30} (mm) =	0.0000
D_{75} (mm) =	0.531
Coefficient of Uniformity, C_u =	1000.00
Coefficient of ccurvature, C_c =	1000.00

Organic Content, %	0
Maximum Dry Density,pcf	
Volume Change, %	

Grain size distribution



Soil Classification

AASHTO	
USCS	SC - Clayey sand
GDOT	

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Soil Classification

Project Name:	*McGinnis Ferry Road/ Phase-2*			P I No.:	*0004634*
Sample Location:	*Bridge at Big Creek*	Sample Number:	B-8A	Sample Depth:	*13.5-15'*
Date Sampled:		Sampled By:		*Lab No.:*	
Date Tested:	*1/19/2021*	Tested By:	*Jay*	*Atlas Project Number:*	*FOR095*
Sample Description:	*Grey medium to coarse sand*				

Sieve Analysis

US Sieve Size	Sieve Opening		% Passing
	(inch)	(mm)	
3 Inch	3.0000	76.2	
1.5 Inch	1.5000	38.1	
1 Inch	1.0000	25.4	
No.4	1.8701	4.75	*100.0*
No.10	0.7874	2.00	*100.0*
No.20	0.3346	0.85	*98.0*
No.40	0.1673	0.425	*88.2*
No.60	0.0984	0.25	*61.0*
No.100	0.0591	0.15	*15.8*
No.200	0.0295	0.075	*4.2*
% Clay	0.0079	0.02	3.8

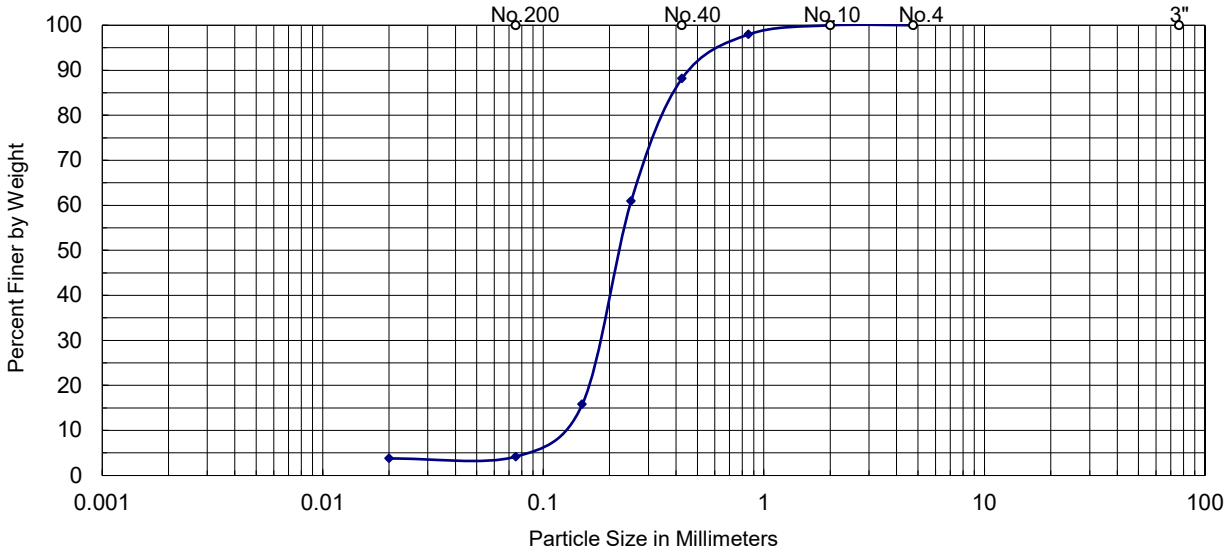
Atterberg Limits

Liquid limit (LL)	
Plastic Limit (PL)	
Plasticity Index (PI)	*0*

D_{10} (mm) =	0.0000
D_{30} (mm) =	0.0000
D_{75} (mm) =	0.329
Coefficient of Uniformity, C_u =	1000.00
Coefficient of ccurvature, C_c =	1000.00

Organic Content, %	0
Maximum Dry Density,pcf	
Volume Change, %	

Grain size distribution



Soil Classification

AASHTO	
USCS	SP - Poorly graded sand
GDOT	

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Soil Classification

Project Name:	*McGinnis Ferry Road/ Phase-2*			P I No.:	*0004634*
Sample Location:	*Bridge at Big Creek*	Sample Number:	B-10A	Sample Depth:	*3.5-5'*
Date Sampled:		Sampled By:		*Lab No.:*	
Date Tested:	*1/19/2021*	Tested By:	*Jay*	*Atlas Project Number:*	*FOR095*
Sample Description:	*Brown/grey clayey sand*				

Sieve Analysis

US Sieve Size	Sieve Opening		% Passing
	(inch)	(mm)	
3 Inch	3.0000	76.2	
1.5 Inch	1.5000	38.1	
1 Inch	1.0000	25.4	
No.4	1.8701	4.75	*100.0*
No.10	0.7874	2.00	*97.8*
No.20	0.3346	0.85	*93.8*
No.40	0.1673	0.425	*85.6*
No.60	0.0984	0.25	*82.8*
No.100	0.0591	0.15	*57.8*
No.200	0.0295	0.075	*42.6*
% Clay	0.0079	0.02	40.2

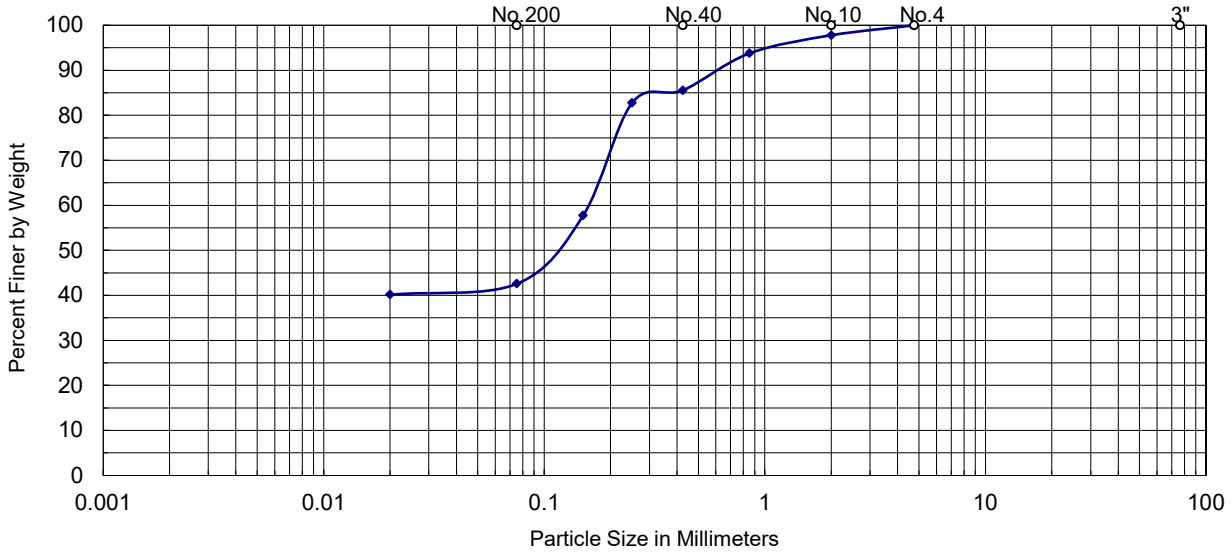
Atterberg Limits

Liquid limit (LL)	*40*
Plastic Limit (PL)	*20*
Plasticity Index (PI)	*20*

D_{10} (mm) =	0.0000
D_{30} (mm) =	0.0000
D_{75} (mm) =	0.213
Coefficient of Uniformity, C_u =	1000.00
Coefficient of ccurvature, C_c =	1000.00

Organic Content, %	0
Maximum Dry Density,pcf	
Volume Change, %	

Grain size distribution



Soil Classification

AASHTO	
USCS	SC - Clayey sand
GDOT	

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Summary of Unconfined Compressive Strength Test of Rock Cores

(ASTM D7012 Method C)

Project Name:	**McGinnis Ferry Road Widening (from Ronald Reagan Blvd/Union Hill Road to Hospital Pkwy)**							
GDOT Project No.:	**N/A**							
GDOT P.I. No.:	**0004634**							
Atlas Project No.:	**FOR095**							
Sample location:	Bent 1 Rt	Bent 2 Lt	Bent 2 Rt	Bent 2 Rt	Bent 3 Lt	Bent 3 Lt	Bent 3 Rt	Bent 3 Rt
Station no.:	131+40	132+00	132+00	132+00	132+50	132+50	132+50	132+50
Offset:	40' Rt	40' Lt	25' Rt	25' Rt	57' Lt	57' Lt	37' Rt	37' Rt
Boring No.:	B-2A	B-3A	B-4A	B-4A	B-5A	B-5A	B-6A	B-6A
Sample depth:	18' to 23'	20' to 25'	22' to 27'	27' to 32'	16' to 21'	21' to 26'	32' to 37'	37' to 42'
Date sampled:	1/7/2021	1/7/2021	1/7/2021	1/7/2021	1/6/2021	1/6/2021	1/7/2021	1/7/2021
Date tested:	1/22/2021	1/22/2021	1/22/2021	1/22/2021	1/22/2021	1/22/2021	1/22/2021	1/22/2021
Diameter, in	1.989	1.989	1.989	1.989	1.989	1.989	1.989	1.989
Height, in	3.93	3.97	4.03	3.94	3.96	3.84	3.96	3.91
Area, sq.in	3.11	3.11	3.11	3.11	3.11	3.11	3.11	3.11
Volume, cu.in	12.21	12.34	12.52	12.24	12.30	11.93	12.30	12.15
Weight of core, lbs	1.218	1.222	1.253	1.222	1.204	1.194	1.198	1.203
Unit weight of rock	172.4	171.2	172.9	172.5	169.1	172.9	168.2	171.1
Max. load, lbs	12596	21605	32996	21799	57609	47246	13628	5471
Strength, psi	4050	6950	10620	7020	18540	15210	4390	1760
Strength, ksf	583	1001	1529	1011	2670	2190	632	253

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Summary of Unconfined Compressive Strength Test of Rock Cores

(ASTM D7012 Method C)

Project Name:	**McGinnis Ferry Road Widening (from Ronald Reagan Blvd/Union Hill Road to Hospital Pkwy)**							
GDOT Project No.:	**N/A**							
GDOT P.I. No.:	**0004634**							
Atlas Project No.:	**FOR095**							
Sample location:	Bent 4 Lt	Bent 4 Lt	Bent 4 Rt	Bent 4 Rt	Bent 4 Rt	Bent 4 Rt	Bent 4 Rt	Bent 5 Rt
Station no.:	133+40	133+40	133+40	133+40	133+40	133+40	133+40	133+90
Offset:	47' Lt	47' Lt	26' Rt	26' Rt	26' Rt	26' Rt	26' Rt	77' Rt
Boring No.:	B-7A	B-7A	B-8	B-8	B-8	B-8	B-8	B-10
Sample depth:	28' to 33'	33' to 38'	31' to 36'	36' to 41'	41' to 46'	46' to 51'	51' to 56'	23' to 28'
Date sampled:	1/6/2021	1/6/2021	1/6/2021	1/6/2021	1/6/2021	1/6/2021	1/6/2021	1/6/2021
Date tested:	1/22/2021	1/22/2021	1/25/2021	1/25/2021	1/25/2021	1/25/2021	1/25/2021	1/25/2021
Diameter, in	1.989	1.989	1.989	1.989	1.989	1.989	1.989	1.989
Height, in	3.89	3.95	3.97	3.92	3.99	3.87	3.98	3.14
Area, sq.in	3.11	3.11	3.11	3.11	3.11	3.11	3.11	3.11
Volume, cu.in	12.09	12.27	12.34	12.18	12.40	12.02	12.37	9.76
Weight of core, lbs	1.239	1.228	1.173	1.220	1.241	1.252	1.250	0.979
Unit weight of rock	177.1	172.9	164.3	173.1	173.0	179.9	174.7	173.4
Max. load, lbs	22266	34933	33816	26577	35229	44617	23906	26068
Strength, psi	7170	11240	10880	8550	11340	14360	7690	8390
Strength, ksf	1032	1619	1567	1231	1633	2068	1107	1208

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Summary of Unconfined Compressive Strength Test of Rock Cores

(ASTM D7012 Method C)

Project Name:	**McGinnis Ferry Road Widening (from Ronald Reagan Blvd/Union Hill Road to Hospital Pkwy)**							
GDOT Project No.:	**N/A**							
GDOT P.I. No.:	**0004634**							
Atlas Project No.:	**FOR095**							
Sample location:	Bent 5 Rt	Bent 6 Rt						
Station no.:	133+90	134+30						
Offset:	77' Rt	40' Rt						
Boring No.:	B-10	B-12A						
Sample depth:	28' to 33'	17' to 22'						
Date sampled:	1/6/2021	1/6/2021						
Date tested:	1/25/2021	1/22/2021						
Diameter, in	1.989	1.989						
Height, in	3.95	3.90						
Area, sq.in	3.11	3.11						
Volume, cu.in	12.27	12.12						
Weight of core, lbs	1.252	1.228						
Unit weight of rock	176.3	175.1						
Max. load, lbs	35102	17229						
Strength, psi	11300	5540						
Strength, ksf	1627	798						

Appendix F – Seismic site class determination

McGinnis Ferry Road over Big Creek - PI 0004634, Forsyth Co.

Table 3.10.3.1-1—Site Class Definitions

Site Class	Soil Type and Profile
A	Hard rock with measured shear wave velocity, $\bar{v}_s > 5{,}000$ ft/s
B	Rock with 2,500 ft/sec $< \bar{v}_s < 5{,}000$ ft/s
C	Very dense soil and soil rock with 1,200 ft/sec $< \bar{v}_s < 2{,}500$ ft/s, or with either $\bar{N} > 50$ blows/ft, or $\bar{s}_u > 2.0$ ksf
D	Stiff soil with 600 ft/s $< \bar{v}_s < 1{,}200$ ft/s, or with either $15 < \bar{N} < 50$ blows/ft, or $1.0 < \bar{s}_u < 2.0$ ksf
E	Soil profile with $\bar{v}_s < 600$ ft/s or with either $\bar{N} < 15$ blows/ft or $\bar{s}_u < 1.0$ ksf, or any profile with more than 10.0 ft of soft clay defined as soil with $PI > 20$, $w > 40$ percent and $\bar{s}_u < 0.5$ ksf
F	Soils requiring site-specific evaluations, such as: • Peats or highly organic clays ($H > 10.0$ ft of peat or highly organic clay where H = thickness of soil) • Very high plasticity clays ($H > 25.0$ ft with $PI > 75$) • Very thick soft/medium stiff clays ($H > 120$ ft)

Boring B-1

Sample	di	N	di/N
1	2.5	30	0.0833
2	2.5	30	0.0833
3	2.5	34	0.0735
4	2.5	52	0.0481
5	5	34	0.1471
6	5	100	0.0500
7	5	100	0.0500
8	5	100	0.0500
9	5	100	0.0500
10	5	100	0.0500
11	5	100	0.0500
12	5	100	0.0500
13	5	100	0.0500
14	5	100	0.0500
15	5	100	0.0500
16	5	100	0.0500
17	5	100	0.0500
18	5	100	0.0500
19	5	100	0.0500
20	5	100	0.0500
21	5	100	0.0500
22	5	100	0.0500
∑di=	100	∑di/N=	1.2853

Average N= 77.8

Site Class = C

Boring B-2

Sample	di	N	di/N
1	2.5	5	0.5000
2	2.5	9	0.2778
3	2.5	8	0.3125
4	2.5	1	2.5000
5	5	3	1.6667
6	5	100	0.0500
7	5	100	0.0500
8	5	100	0.0500
9	5	100	0.0500
10	5	100	0.0500
11	5	100	0.0500
12	5	100	0.0500
13	5	100	0.0500
14	5	100	0.0500
15	5	100	0.0500
16	5	100	0.0500
17	5	100	0.0500
18	5	100	0.0500
19	5	100	0.0500
20	5	100	0.0500
21	5	100	0.0500
22	5	100	0.0500
∑di=	100	∑di/N=	6.1069

Average N= 16.4

Site Class = D

McGinnis Ferry Road over Big Creek - PI 0004634, Forsyth Co.

Table 3.10.3.1-1—Site Class Definitions

Site Class	Soil Type and Profile
A	Hard rock with measured shear wave velocity, $\bar{v}_s > 5{,}000$ ft/s
B	Rock with 2,500 ft/sec $< \bar{v}_s < 5{,}000$ ft/s
C	Very dense soil and soil rock with 1,200 ft/sec $< \bar{v}_s < 2{,}500$ ft/s, or with either $\bar{N} > 50$ blows/ft, or $\bar{s}_u > 2.0$ ksf
D	Stiff soil with 600 ft/s $< \bar{v}_s < 1{,}200$ ft/s, or with either $15 < \bar{N} < 50$ blows/ft, or $1.0 < \bar{s}_u < 2.0$ ksf
E	Soil profile with $\bar{v}_s < 600$ ft/s or with either $\bar{N} < 15$ blows/ft or $\bar{s}_u < 1.0$ ksf, or any profile with more than 10.0 ft of soft clay defined as soil with $PI > 20$, $w > 40$ percent and $\bar{s}_u < 0.5$ ksf
F	Soils requiring site-specific evaluations, such as: • Peats or highly organic clays ($H > 10.0$ ft of peat or highly organic clay where H = thickness of soil) • Very high plasticity clays ($H > 25.0$ ft with $PI > 75$) • Very thick soft/medium stiff clays ($H > 120$ ft)

Boring B-3

Sample	di	N	di/N
1	2.5	24	0.1042
2	2.5	20	0.1250
3	2.5	25	0.1000
4	2.5	20	0.1250
5	5	100	0.0500
6	5	100	0.0500
7	5	100	0.0500
8	5	100	0.0500
9	5	100	0.0500
10	5	100	0.0500
11	5	100	0.0500
12	5	100	0.0500
13	5	100	0.0500
14	5	100	0.0500
15	5	100	0.0500
16	5	100	0.0500
17	5	100	0.0500
18	5	100	0.0500
19	5	100	0.0500
20	5	100	0.0500
21	5	100	0.0500
22	5	100	0.0500
∑di=	100	∑di/N=	1.3542

Average N= 73.8

Site Class = C

Boring B-4

Sample	di	N	di/N
1	2.5	6	0.4167
2	2.5	3	0.8333
3	2.5	1	2.5000
4	2.5	3	0.8333
5	5	1	5.0000
6	5	100	0.0500
7	5	100	0.0500
8	5	100	0.0500
9	5	100	0.0500
10	5	100	0.0500
11	5	100	0.0500
12	5	100	0.0500
13	5	100	0.0500
14	5	100	0.0500
15	5	100	0.0500
16	5	100	0.0500
17	5	100	0.0500
18	5	100	0.0500
19	5	100	0.0500
20	5	100	0.0500
21	5	100	0.0500
22	5	100	0.0500
∑di=	100	∑di/N=	10.4333

Average N= 9.6

Site Class = E

McGinnis Ferry Road over Big Creek - PI 0004634, Forsyth Co.

Table 3.10.3.1-1—Site Class Definitions

Site Class	Soil Type and Profile
A	Hard rock with measured shear wave velocity, $\bar{v}_s > 5{,}000$ ft/s
B	Rock with 2,500 ft/sec $< \bar{v}_s < 5{,}000$ ft/s
C	Very dense soil and soil rock with 1,200 ft/sec $< \bar{v}_s < 2{,}500$ ft/s, or with either $\bar{N} > 50$ blows/ft, or $\bar{s}_u > 2.0$ ksf
D	Stiff soil with 600 ft/s $< \bar{v}_s < 1{,}200$ ft/s, or with either $15 < \bar{N} < 50$ blows/ft, or $1.0 < \bar{s}_u < 2.0$ ksf
E	Soil profile with $\bar{v}_s < 600$ ft/s or with either $\bar{N} < 15$ blows/ft or $\bar{s}_u < 1.0$ ksf, or any profile with more than 10.0 ft of soft clay defined as soil with $PI > 20$, $w > 40$ percent and $\bar{s}_u < 0.5$ ksf
F	Soils requiring site-specific evaluations, such as: • Peats or highly organic clays ($H > 10.0$ ft of peat or highly organic clay where H = thickness of soil) • Very high plasticity clays ($H > 25.0$ ft with $PI > 75$) • Very thick soft/medium stiff clays ($H > 120$ ft)

Boring B-5

Sample	di	N	di/N
1	2.5	8	0.3125
2	2.5	8	0.3125
3	2.5	6	0.4167
4	2.5	11	0.2273
5	5	67	0.0746
6	5	100	0.0500
7	5	100	0.0500
8	5	100	0.0500
9	5	100	0.0500
10	5	100	0.0500
11	5	100	0.0500
12	5	100	0.0500
13	5	100	0.0500
14	5	100	0.0500
15	5	100	0.0500
16	5	100	0.0500
17	5	100	0.0500
18	5	100	0.0500
19	5	100	0.0500
20	5	100	0.0500
21	5	100	0.0500
22	5	100	0.0500
∑di=	100	∑di/N=	2.1936

Average N= 45.6

Site Class = D

Boring B-6

Sample	di	N	di/N
1	2.5	9	0.2778
2	2.5	3	0.8333
3	2.5	1	2.5000
4	2.5	1	2.5000
5	5	100	0.0500
6	5	12	0.4167
7	5	20	0.2500
8	5	95	0.0526
9	5	100	0.0500
10	5	100	0.0500
11	5	100	0.0500
12	5	100	0.0500
13	5	100	0.0500
14	5	100	0.0500
15	5	100	0.0500
16	5	100	0.0500
17	5	100	0.0500
18	5	100	0.0500
19	5	100	0.0500
20	5	100	0.0500
21	5	100	0.0500
22	5	100	0.0500
∑di=	100	∑di/N=	7.5804

Average N= 13.2

Site Class = E

McGinnis Ferry Road over Big Creek - PI 0004634, Forsyth Co.

Table 3.10.3.1-1—Site Class Definitions

Site Class	Soil Type and Profile
A	Hard rock with measured shear wave velocity, $\bar{v}_s > 5{,}000$ ft/s
B	Rock with 2,500 ft/sec $< \bar{v}_s < 5{,}000$ ft/s
C	Very dense soil and soil rock with 1,200 ft/sec $< \bar{v}_s < 2{,}500$ ft/s, or with either $\bar{N} > 50$ blows/ft, or $\bar{s}_u > 2.0$ ksf
D	Stiff soil with 600 ft/s $< \bar{v}_s < 1{,}200$ ft/s, or with either $15 < \bar{N} < 50$ blows/ft, or $1.0 < \bar{s}_u < 2.0$ ksf
E	Soil profile with $\bar{v}_s < 600$ ft/s or with either $\bar{N} < 15$ blows/ft or $\bar{s}_u < 1.0$ ksf, or any profile with more than 10.0 ft of soft clay defined as soil with $PI > 20$, $w > 40$ percent and $\bar{s}_u < 0.5$ ksf
F	Soils requiring site-specific evaluations, such as: • Peats or highly organic clays ($H > 10.0$ ft of peat or highly organic clay where H = thickness of soil) • Very high plasticity clays ($H > 25.0$ ft with $PI > 75$) • Very thick soft/medium stiff clays ($H > 120$ ft)

Boring B-7

Sample	di	N	di/N
1	2.5	16	0.1563
2	2.5	1	2.5000
3	2.5	1	2.5000
4	2.5	8	0.3125
5	5	2	2.5000
6	5	2	2.5000
7	5	5	1.0000
8	5	100	0.0500
9	5	100	0.0500
10	5	100	0.0500
11	5	100	0.0500
12	5	100	0.0500
13	5	100	0.0500
14	5	100	0.0500
15	5	100	0.0500
16	5	100	0.0500
17	5	100	0.0500
18	5	100	0.0500
19	5	100	0.0500
20	5	100	0.0500
21	5	100	0.0500
22	5	100	0.0500
∑di=	100	∑di/N=	12.2188

Average N= 8.2

Site Class = E

Boring B-8

Sample	di	N	di/N
1	2.5	5	0.5000
2	2.5	3	0.8333
3	2.5	8	0.3125
4	2.5	3	0.8333
5	5	100	0.0500
6	5	100	0.0500
7	5	100	0.0500
8	5	100	0.0500
9	5	100	0.0500
10	5	100	0.0500
11	5	100	0.0500
12	5	100	0.0500
13	5	100	0.0500
14	5	100	0.0500
15	5	100	0.0500
16	5	100	0.0500
17	5	100	0.0500
18	5	100	0.0500
19	5	100	0.0500
20	5	100	0.0500
21	5	100	0.0500
22	5	100	0.0500
∑di=	100	∑di/N=	3.3792

Average N= 29.6

Site Class = D

McGinnis Ferry Road over Big Creek - PI 0004634, Forsyth Co.

Table 3.10.3.1-1—Site Class Definitions

Site Class	Soil Type and Profile
A	Hard rock with measured shear wave velocity, $\bar{v}_s > 5{,}000$ ft/s
B	Rock with 2,500 ft/sec $< \bar{v}_s < 5{,}000$ ft/s
C	Very dense soil and soil rock with 1,200 ft/sec $< \bar{v}_s < 2{,}500$ ft/s, or with either $\bar{N} > 50$ blows/ft, or $\bar{s}_u > 2.0$ ksf
D	Stiff soil with 600 ft/s $< \bar{v}_s < 1{,}200$ ft/s, or with either $15 < \bar{N} < 50$ blows/ft, or $1.0 < \bar{s}_u < 2.0$ ksf
E	Soil profile with $\bar{v}_s < 600$ ft/s or with either $\bar{N} < 15$ blows/ft or $\bar{s}_u < 1.0$ ksf, or any profile with more than 10.0 ft of soft clay defined as soil with $PI > 20$, $w > 40$ percent and $\bar{s}_u < 0.5$ ksf
F	Soils requiring site-specific evaluations, such as: • Peats or highly organic clays ($H > 10.0$ ft of peat or highly organic clay where H = thickness of soil) • Very high plasticity clays ($H > 25.0$ ft with $PI > 75$) • Very thick soft/medium stiff clays ($H > 120$ ft)

Boring B-9

Sample	di	N	di/N
1	2.5	5	0.5000
2	2.5	17	0.1471
3	2.5	14	0.1786
4	2.5	34	0.0735
5	5	6	0.8333
6	5	11	0.4545
7	5	34	0.1471
8	5	31	0.1613
9	5	100	0.0500
10	5	100	0.0500
11	5	100	0.0500
12	5	100	0.0500
13	5	100	0.0500
14	5	100	0.0500
15	5	100	0.0500
16	5	100	0.0500
17	5	100	0.0500
18	5	100	0.0500
19	5	100	0.0500
20	5	100	0.0500
21	5	100	0.0500
22	5	100	0.0500
∑di=	100	∑di/N=	3.1954

Average N= 31.3

Site Class = D

Boring B-10

Sample	di	N	di/N
1	2.5	3	0.8333
2	2.5	2	1.2500
3	2.5	1	2.5000
4	2.5	3	0.8333
5	5	100	0.0500
6	5	100	0.0500
7	5	100	0.0500
8	5	100	0.0500
9	5	100	0.0500
10	5	100	0.0500
11	5	100	0.0500
12	5	100	0.0500
13	5	100	0.0500
14	5	100	0.0500
15	5	100	0.0500
16	5	100	0.0500
17	5	100	0.0500
18	5	100	0.0500
19	5	100	0.0500
20	5	100	0.0500
21	5	100	0.0500
22	5	100	0.0500
∑di=	100	∑di/N=	6.3167

Average N= 15.8

Site Class = D

McGinnis Ferry Road over Big Creek - PI 0004634, Forsyth Co.

Table 3.10.3.1-1—Site Class Definitions

Site Class	Soil Type and Profile
A	Hard rock with measured shear wave velocity, $\bar{v}_s > 5{,}000$ ft/s
B	Rock with 2,500 ft/sec $< \bar{v}_s < 5{,}000$ ft/s
C	Very dense soil and soil rock with 1,200 ft/sec $< \bar{v}_s < 2{,}500$ ft/s, or with either $\bar{N} > 50$ blows/ft, or $\bar{s}_u > 2.0$ ksf
D	Stiff soil with 600 ft/s $< \bar{v}_s < 1{,}200$ ft/s, or with either $15 < \bar{N} < 50$ blows/ft, or $1.0 < \bar{s}_u < 2.0$ ksf
E	Soil profile with $\bar{v}_s < 600$ ft/s or with either $\bar{N} < 15$ blows/ft or $\bar{s}_u < 1.0$ ksf, or any profile with more than 10.0 ft of soft clay defined as soil with $PI > 20$, $w > 40$ percent and $\bar{s}_u < 0.5$ ksf
F	Soils requiring site-specific evaluations, such as: • Peats or highly organic clays ($H > 10.0$ ft of peat or highly organic clay where H = thickness of soil) • Very high plasticity clays ($H > 25.0$ ft with $PI > 75$) • Very thick soft/medium stiff clays ($H > 120$ ft)

Boring B-11

Sample	di	N	di/N
1	2.5	13	0.1923
2	2.5	14	0.1786
3	2.5	17	0.1471
4	2.5	30	0.0833
5	5	5	1.0000
6	5	11	0.4545
7	5	34	0.1471
8	5	19	0.2632
9	5	39	0.1282
10	5	100	0.0500
11	5	100	0.0500
12	5	100	0.0500
13	5	100	0.0500
14	5	100	0.0500
15	5	100	0.0500
16	5	100	0.0500
17	5	100	0.0500
18	5	100	0.0500
19	5	100	0.0500
20	5	100	0.0500
21	5	100	0.0500
22	5	100	0.0500
∑di=	100	∑di/N=	3.2442

Average N= 30.8

Site Class = D

Boring B-12

Sample	di	N	di/N
1	2.5	9	0.2778
2	2.5	6	0.4167
3	2.5	1	2.5000
4	2.5	3	0.8333
5	5	28	0.1786
6	5	100	0.0500
7	5	100	0.0500
8	5	100	0.0500
9	5	100	0.0500
10	5	100	0.0500
11	5	100	0.0500
12	5	100	0.0500
13	5	100	0.0500
14	5	100	0.0500
15	5	100	0.0500
16	5	100	0.0500
17	5	100	0.0500
18	5	100	0.0500
19	5	100	0.0500
20	5	100	0.0500
21	5	100	0.0500
22	5	100	0.0500
∑di=	100	∑di/N=	5.0563

Average N= 19.8

Site Class = D

Appendix G – Foundation design data

DESIGNER: ATLAS
DATE: September 23, 2021
PI NUMBER: 0004634
PROJECT: CR 3717 McGinnis Ferry Road Over Big Creek
FROM: Jaime Mandujano, EIT, Bridge Engineer, Atlas Technical Consultants, LLC
TO: Yong Shao, Ph.D. PE Atlas Technical Consultants, LLC

SUBJECT: **BRIDGE FOUNDATION DESIGN DATA (LRFD)**

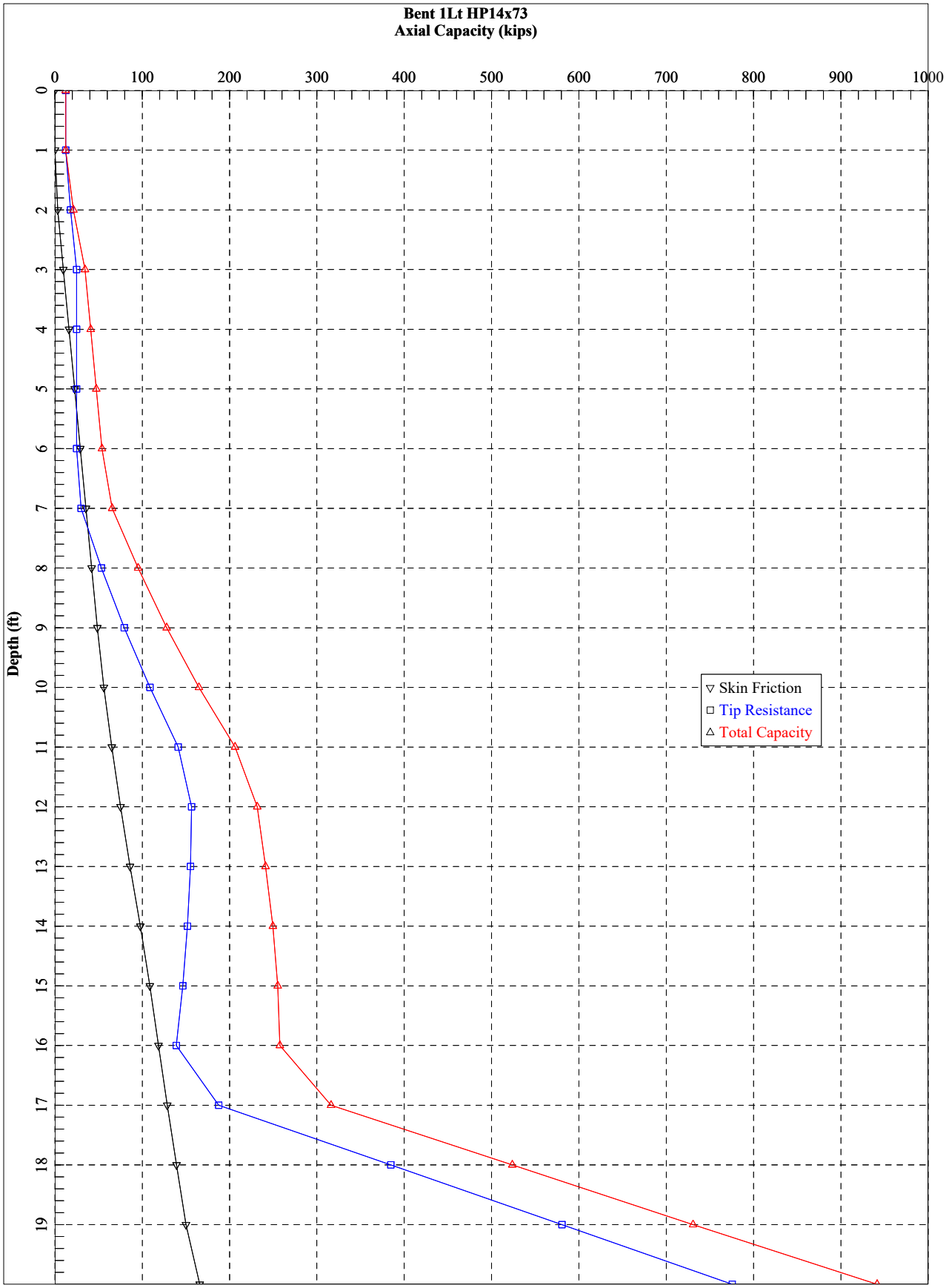
The following design information has been calculated for the above listed structures. Please use the provided values to complete the Bridge Foundation Investigation report for this project.

	DESIGN LOADS:			DRIVABILITY:		PILE DESIGN LOAD:
				Stress limits = σ_d		(Structural Capacity)
Bent(s):	**Maximum Factored Load (kips)**	**Service Load (kips)**	**Pile Size:**	**Comp. (ksi)**	**Tens. (ksi)**	**P_R (kips)**
1 and 6	234.6	157.5	HP14x73	32.4	32.4	385
2 and 5	220.4	147.48	HP14x73	32.4	32.4	385
3 and 4	308.2	251.1	HP14x102	32.4	32.4	540

Bent(s):	**Bottom of Footing Elevation (Ft)**
3	985.00
4	984.00

If you have any questions, please contact Jaime Mandujano or Atlas at 770-263-5945 or Jaime.Mandujano@oneatlas.com

Appendix H – Pile capacity static analysis, APILE output


Bent 1Lt HP14x73
Axial Capacity (kips)
0
100
200
300
400
500
600
700
800
900
1000
Depth (ft)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
Skin Friction
Tip Resistance
Total Capacity

```
=========================================================================

                 APILE for Windows, Version 2015.7.5

                  Serial Number :  139694124

                  A Program for Analyzing the Axial Capacity
                  and Short-term Settlement of Driven Piles
                            under Axial Loading.
                (c) Copyright ENSOFT, Inc., 1987-2015
                      All Rights Reserved

=========================================================================


This program is licensed to :

Moreland Altobelli Associates
Duluth, GA

Path to file locations      : C:\Users\yshao\Desktop\Yong Shao GDOT\TEMP\McGinnis Ferry\BFI\APILE\
Name of input data file     : Bent1Lt.ap7d
Name of output file         : Bent1Lt.ap7o
Name of plot output file    : Bent1Lt.ap7p

-------------------------------------------------------------------------
                     Time and Date of Analysis
-------------------------------------------------------------------------

          Date:  October 21, 2021     Time:  21:38:30



1
     *********************
     * INPUT INFORMATION *
     *********************



     Bent 1 Lt: HP14x73

     DESIGNER   : YCS

     JOB NUMBER : PI 0004634


     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)
     - API RP 2A (American Petroleum Institute)


     TYPE OF LOADING :
     - COMPRESSION


     PILE TYPE :

     H-Pile/Steel Pile
```

```
DATA FOR AXIAL STIFFNESS :

- MODULUS OF ELASTICITY     = 0.290E+08 PSI
- CROSS SECTION AREA        =    198.50 IN2


NONCIRCULAR PILE PROPERTIES :

- TOTAL PILE LENGTH, TL     =     20.00 FT.
- PILE STICKUP LENGTH, PSL  =      0.00 FT.
- ZERO FRICTION LENGTH, ZFL =      0.00 FT.
- PERIMETER OF PILE         =     56.40 IN.
- TIP AREA OF PILE          =    198.50 IN2
- INCREMENT OF PILE LENGTH
  USED IN COMPUTATION       =      1.00 FT.



SOIL INFORMATIONS :



                  LATERAL    EFFECTIVE    FRICTION   BEARING
          SOIL    EARTH      UNIT         ANGLE      CAPACITY
 DEPTH    TYPE    PRESSURE   WEIGHT       DEGREES    FACTOR
  FT.                        LB/CF
   0.00   CLAY      0.00       120.00         0.00      0.00
   8.50   CLAY      0.00       120.00         0.00      0.00
   8.50   SAND      0.00       125.00        38.00      0.00
  13.50   SAND      0.00       125.00        38.00      0.00
  13.50   SAND      0.00        62.60        36.00      0.00
  19.00   SAND      0.00        62.60        36.00      0.00
  19.00   SAND      0.00        62.60        45.00      0.00
  29.00   SAND      0.00        62.60        45.00      0.00



MAXIMUM   MAXIMUM   UNDISTURB  REMOLDED
UNIT      UNIT      SHEAR      SHEAR     BLOW   UNIT SKIN  UNIT END
FRICTION  BEARING   STRENGTH   STRENGTH  COUNT  FRICTION   BEARING
  KSF       KSF        KSF        KSF              KSF        KSF
0.10E+08* 0.10E+08*       2.00      0.00   0.00       0.00      0.00
0.10E+08* 0.10E+08*       2.00      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

* 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.



         LRFD FACTOR  LRFD FACTOR
          ON UNIT      ON UNIT
 DEPTH    FRICTION     BEARING
  FT.
   0.00    1.000       1.000
   8.50    1.000       1.000
   8.50    1.000       1.000
  13.50    1.000       1.000
  13.50    1.000       1.000
  19.00    1.000       1.000
  19.00    1.000       1.000
  29.00    1.000       1.000
```

DEPTH FT.	PLASTIC INDEX PI %	YIELD STRESS RATIO	Qc FROM CPT KSF
0.00	0.00	0.00	0.000E+00
8.50	0.00	0.00	0.000E+00
8.50	0.00	0.00	0.000E+00
13.50	0.00	0.00	0.000E+00
13.50	0.00	0.00	0.000E+00
19.00	0.00	0.00	0.000E+00
19.00	0.00	0.00	0.000E+00
29.00	0.00	0.00	0.000E+00

1

```
**********************
* COMPUTATION RESULT *
**********************
```

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

	PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
Ele. 1001' →	0.00	0.0	12.4	12.4
	1.00	0.0	12.4	12.4
	2.00	3.2	17.9	21.2
	3.00	9.7	24.8	34.5
	4.00	16.2	24.8	41.0
	5.00	22.6	24.8	47.4
	6.00	29.1	24.8	53.9
	7.00	35.6	30.0	65.6
	8.00	42.1	53.2	95.3
	9.00	48.6	79.4	128.0
	10.00	56.1	108.8	164.9
	11.00	65.2	141.1	206.3
	12.00	75.2	156.5	231.7
	13.00	86.1	155.2	241.2
	14.00	97.8	151.8	249.6
Min. Tip 986' →	15.00	108.7	146.4	255.2
	16.00	118.6	139.0	257.6
	17.00	128.7	187.5	316.3
Est. Tip 983' →	18.00	139.3	384.6	523.8
	19.00	150.1	580.6	730.7
	20.00	165.9	775.6	941.5

Rndr = 234.6 kips / 0.65 = 361 kips

```
**********************
*  API RP-2A (1994)  *
**********************
```

PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	12.4	12.4
1.00	2.3	12.4	14.7
2.00	4.9	17.9	22.8
3.00	7.8	24.8	32.6
4.00	11.0	24.8	35.8
5.00	14.3	24.8	39.2

6.00	17.9	24.8	42.7
7.00	21.6	23.5	45.1
8.00	25.5	17.9	43.4
9.00	29.4	12.4	41.8
10.00	31.5	6.9	38.3
11.00	31.5	1.3	32.8
12.00	31.5	0.0	31.5
13.00	31.5	0.0	31.5
14.00	31.5	0.0	31.5
15.00	31.5	0.0	31.5
16.00	31.5	0.0	31.5
17.00	31.5	0.0	31.5
18.00	31.5	0.0	31.5
19.00	31.5	0.0	31.5
20.00	31.5	0.0	31.5

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
			0.1433E+01	0.2872E-01
			0.2389E+01	0.5565E-01
			0.3583E+01	0.1023E+00
			0.4300E+01	0.1436E+00
			0.4778E+01	0.1795E+00
			0.4300E+01	0.3591E+00
			0.4300E+01	0.5386E+00
			0.4300E+01	0.8976E+00
			0.4300E+01	0.3591E+01
2	10	0.4275E+01		
			0.0000E+00	0.0000E+00
			0.2867E+01	0.2872E-01
			0.4778E+01	0.5565E-01
			0.7167E+01	0.1023E+00
			0.8600E+01	0.1436E+00
			0.9556E+01	0.1795E+00
			0.8600E+01	0.3591E+00
			0.8600E+01	0.5386E+00
			0.8600E+01	0.8976E+00
			0.8600E+01	0.3591E+01
3	10	0.8458E+01		
			0.0000E+00	0.0000E+00
			0.3116E+01	0.2872E-01
			0.5194E+01	0.5565E-01
			0.7790E+01	0.1023E+00
			0.9348E+01	0.1436E+00
			0.1039E+02	0.1795E+00
			0.9348E+01	0.3591E+00
			0.9348E+01	0.5386E+00
			0.9348E+01	0.8976E+00
			0.9348E+01	0.3591E+01
4	10	0.8500E+01		
			0.0000E+00	0.0000E+00
			0.1039E+01	0.1000E-01

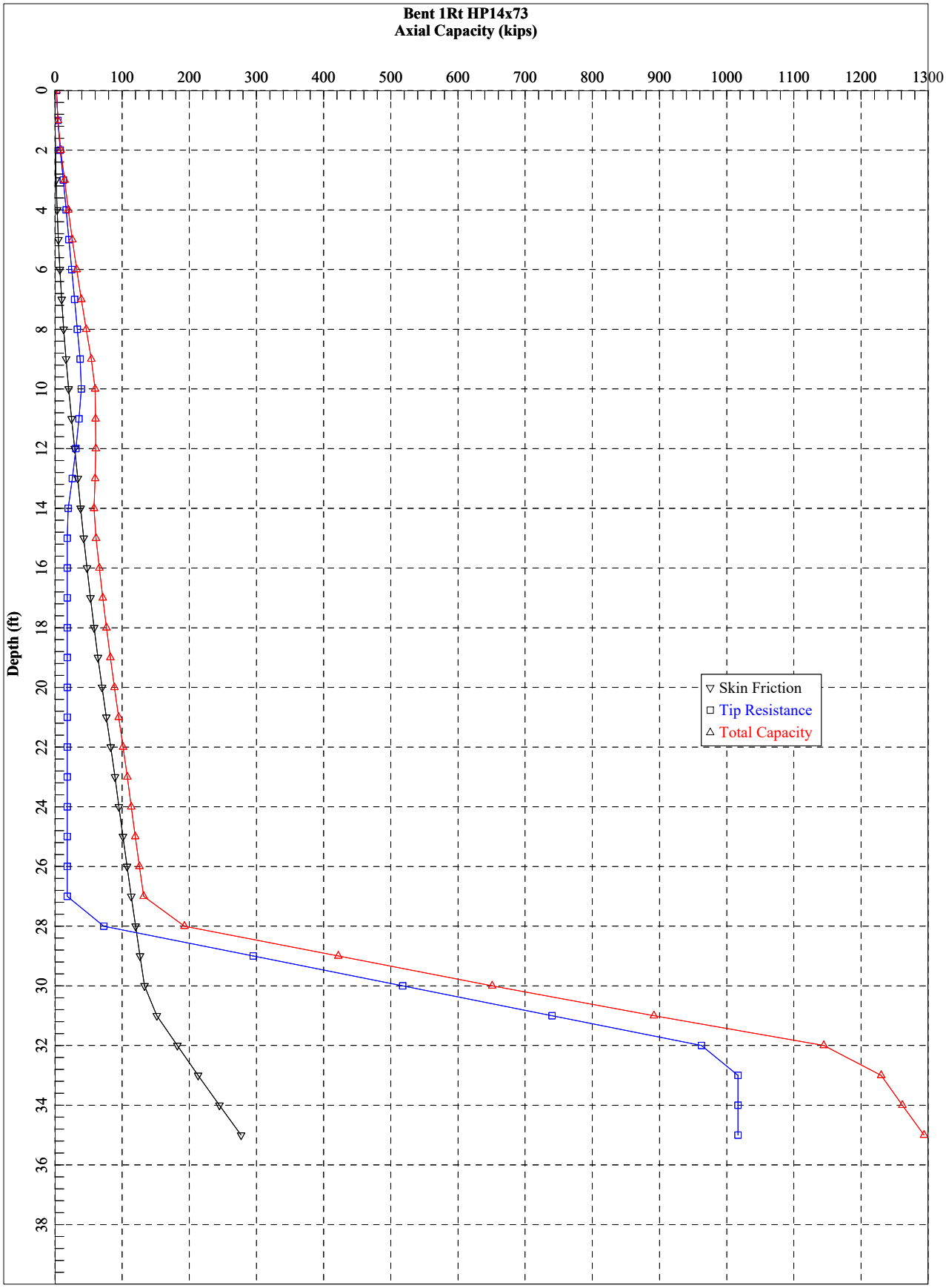
			0.2077E+01	0.2000E-01
			0.4155E+01	0.4000E-01
			0.6232E+01	0.6000E-01
			0.8310E+01	0.8000E-01
			0.9348E+01	0.9000E-01
			0.1039E+02	0.1000E+00
			0.1039E+02	0.5000E+00
			0.1039E+02	0.2000E+01
5	10	0.1103E+02		
			0.0000E+00	0.0000E+00
			0.1539E+01	0.1000E-01
			0.3079E+01	0.2000E-01
			0.6157E+01	0.4000E-01
			0.9236E+01	0.6000E-01
			0.1231E+02	0.8000E-01
			0.1385E+02	0.9000E-01
			0.1539E+02	0.1000E+00
			0.1539E+02	0.5000E+00
			0.1539E+02	0.2000E+01
6	10	0.1346E+02		
			0.0000E+00	0.0000E+00
			0.1677E+01	0.1000E-01
			0.3353E+01	0.2000E-01
			0.6706E+01	0.4000E-01
			0.1006E+02	0.6000E-01
			0.1341E+02	0.8000E-01
			0.1509E+02	0.9000E-01
			0.1677E+02	0.1000E+00
			0.1677E+02	0.5000E+00
			0.1677E+02	0.2000E+01
7	10	0.1350E+02		
			0.0000E+00	0.0000E+00
			0.1677E+01	0.1000E-01
			0.3353E+01	0.2000E-01
			0.6706E+01	0.4000E-01
			0.1006E+02	0.6000E-01
			0.1341E+02	0.8000E-01
			0.1509E+02	0.9000E-01
			0.1677E+02	0.1000E+00
			0.1677E+02	0.5000E+00
			0.1677E+02	0.2000E+01
8	10	0.1628E+02		
			0.0000E+00	0.0000E+00
			0.1528E+01	0.1000E-01
			0.3056E+01	0.2000E-01
			0.6112E+01	0.4000E-01
			0.9169E+01	0.6000E-01
			0.1222E+02	0.8000E-01
			0.1375E+02	0.9000E-01
			0.1528E+02	0.1000E+00
			0.1528E+02	0.5000E+00
			0.1528E+02	0.2000E+01
9	10	0.1896E+02		
			0.0000E+00	0.0000E+00
			0.1965E+01	0.1000E-01
			0.3930E+01	0.2000E-01
			0.7859E+01	0.4000E-01
			0.1179E+02	0.6000E-01
			0.1572E+02	0.8000E-01
			0.1768E+02	0.9000E-01
			0.1965E+02	0.1000E+00
			0.1965E+02	0.5000E+00
			0.1965E+02	0.2000E+01
10	10	0.1900E+02		
			0.0000E+00	0.0000E+00
			0.2326E+01	0.1000E-01
			0.4652E+01	0.2000E-01
			0.9303E+01	0.4000E-01
			0.1395E+02	0.6000E-01

			0.1861E+02	0.8000E-01
			0.2093E+02	0.9000E-01
			0.2326E+02	0.1000E+00
			0.2326E+02	0.5000E+00
			0.2326E+02	0.2000E+01
11	10	0.2403E+02		
			0.0000E+00	0.0000E+00
			0.2326E+01	0.1000E-01
			0.4652E+01	0.2000E-01
			0.9303E+01	0.4000E-01
			0.1395E+02	0.6000E-01
			0.1861E+02	0.8000E-01
			0.2093E+02	0.9000E-01
			0.2326E+02	0.1000E+00
			0.2326E+02	0.5000E+00
			0.2326E+02	0.2000E+01
12	10	0.2896E+02		
			0.0000E+00	0.0000E+00
			0.2326E+01	0.1000E-01
			0.4652E+01	0.2000E-01
			0.9303E+01	0.4000E-01
			0.1395E+02	0.6000E-01
			0.1861E+02	0.8000E-01
			0.2093E+02	0.9000E-01
			0.2326E+02	0.1000E+00
			0.2326E+02	0.5000E+00
			0.2326E+02	0.2000E+01

TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00
0.4848E+02	0.8976E-02
0.9695E+02	0.1795E-01
0.1939E+03	0.3591E-01
0.3878E+03	0.2334E+00
0.5817E+03	0.7540E+00
0.6980E+03	0.1311E+01
0.7756E+03	0.1795E+01
0.7756E+03	0.2693E+01
0.7756E+03	0.3591E+01

LOAD VERSUS SETTLEMENT CURVE
****

TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.7361E+00	0.1272E-03	0.5400E+00	0.1000E-03
0.7361E+01	0.1272E-02	0.5400E+01	0.1000E-02
0.3680E+02	0.6360E-02	0.2700E+02	0.5000E-02
0.7361E+02	0.1272E-01	0.5400E+02	0.1000E-01
0.2998E+03	0.6094E-01	0.2077E+03	0.5000E-01
0.4223E+03	0.1150E+00	0.2568E+03	0.1000E+00
0.6585E+03	0.5246E+00	0.4871E+03	0.5000E+00
0.8045E+03	0.1031E+01	0.6331E+03	0.1000E+01
0.9470E+03	0.2037E+01	0.7756E+03	0.2000E+01


Bent 1Rt HP14x73
Axial Capacity (kips)
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
Depth (ft)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
Skin Friction
Tip Resistance
Total Capacity

```
=========================================================================

                 APILE for Windows, Version 2015.7.5

                  Serial Number :  139694124

                  A Program for Analyzing the Axial Capacity
                  and Short-term Settlement of Driven Piles
                            under Axial Loading.
                (c) Copyright ENSOFT, Inc., 1987-2015
                      All Rights Reserved

=========================================================================


This program is licensed to :

Moreland Altobelli Associates
Duluth, GA

Path to file locations      : C:\Users\yshao\Desktop\Yong Shao GDOT\TEMP\McGinnis Ferry\BFI\APILE\
Name of input data file     : Bent1Rt.ap7d
Name of output file         : Bent1Rt.ap7o
Name of plot output file    : Bent1Rt.ap7p

-------------------------------------------------------------------------
                     Time and Date of Analysis
-------------------------------------------------------------------------

          Date:  October 21, 2021     Time:  22:26:06



1
     *********************
     * INPUT INFORMATION *
     *********************



     Bent 1 Rt: HP14x73

     DESIGNER   : YCS

     JOB NUMBER : PI 0004634


     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)
     - API RP 2A (American Petroleum Institute)


     TYPE OF LOADING :
     - COMPRESSION


     PILE TYPE :

     H-Pile/Steel Pile
```

```
DATA FOR AXIAL STIFFNESS :

- MODULUS OF ELASTICITY     = 0.290E+08 PSI
- CROSS SECTION AREA        =    198.50 IN2


NONCIRCULAR PILE PROPERTIES :

- TOTAL PILE LENGTH, TL     =     35.00 FT.
- PILE STICKUP LENGTH, PSL  =      0.00 FT.
- ZERO FRICTION LENGTH, ZFL =      0.00 FT.
- PERIMETER OF PILE         =     56.40 IN.
- TIP AREA OF PILE          =    198.50 IN2
- INCREMENT OF PILE LENGTH
  USED IN COMPUTATION       =      1.00 FT.



SOIL INFORMATIONS :



                  LATERAL    EFFECTIVE    FRICTION   BEARING
          SOIL    EARTH      UNIT         ANGLE      CAPACITY
 DEPTH    TYPE    PRESSURE   WEIGHT       DEGREES    FACTOR
  FT.                        LB/CF
   0.00   SAND      0.00       120.00       32.00      0.00
  11.50   SAND      0.00       120.00       32.00      0.00
  11.50   SAND      0.00       110.00       30.00      0.00
  21.50   SAND      0.00       110.00       30.00      0.00
  21.50   SAND      0.00        57.60       28.00      0.00
  29.50   SAND      0.00        57.60       28.00      0.00
  29.50   SAND      0.00        62.60       45.00      0.00
  38.00   SAND      0.00        62.60       45.00      0.00



MAXIMUM   MAXIMUM   UNDISTURB  REMOLDED
UNIT      UNIT      SHEAR      SHEAR     BLOW   UNIT SKIN  UNIT END
FRICTION  BEARING   STRENGTH   STRENGTH  COUNT  FRICTION   BEARING
  KSF       KSF        KSF       KSF               KSF       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

* 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.



         LRFD FACTOR  LRFD FACTOR
          ON UNIT      ON UNIT
 DEPTH    FRICTION     BEARING
  FT.
   0.00    1.000       1.000
  11.50    1.000       1.000
  11.50    1.000       1.000
  21.50    1.000       1.000
  21.50    1.000       1.000
  29.50    1.000       1.000
  29.50    1.000       1.000
  38.00    1.000       1.000
```

DEPTH FT.	PLASTIC INDEX PI %	YIELD STRESS RATIO	Qc FROM CPT KSF
0.00	0.00	0.00	0.000E+00
11.50	0.00	0.00	0.000E+00
11.50	0.00	0.00	0.000E+00
21.50	0.00	0.00	0.000E+00
21.50	0.00	0.00	0.000E+00
29.50	0.00	0.00	0.000E+00
29.50	0.00	0.00	0.000E+00
38.00	0.00	0.00	0.000E+00

1

```
**********************
* COMPUTATION RESULT *
**********************
```

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

	PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP	
Btm of Cap Ele. 1002' →	0.00	0.0	2.3	2.3	
	1.00	0.2	4.4	4.6	
	2.00	0.8	7.9	8.7	
	3.00	1.8	12.5	14.4	
	4.00	3.3	16.7	20.0	
	5.00	5.1	20.9	26.0	
	6.00	7.4	25.1	32.5	
	7.00	10.1	29.3	39.3	
	8.00	13.1	33.4	46.6	
	9.00	16.6	37.5	54.1	
	10.00	20.5	39.4	59.9	
	11.00	24.8	35.8	60.6	
	12.00	29.5	31.3	60.8	
	13.00	34.1	25.9	59.9	
	14.00	38.3	19.8	58.2	
	15.00	42.9	18.4	61.3	
	16.00	47.8	18.4	66.1	
	17.00	52.9	18.4	71.3	
	18.00	58.4	18.4	76.8	
	19.00	64.1	18.4	82.5	
	20.00	70.2	18.4	88.5	
	21.00	76.5	18.4	94.9	
	22.00	83.1	18.4	101.5	
	23.00	89.4	18.4	107.8	
	24.00	95.3	18.4	113.7	
	25.00	101.3	18.4	119.7	
	26.00	107.5	18.4	125.8	
	27.00	113.7	18.4	132.1	
	28.00	120.1	72.7	192.8	
	29.00	126.7	295.1	421.8	
	30.00	133.3	517.6	650.9	
	31.00	151.8	740.0	891.8	Rndr = 234.6kips / 0.65 = 361 kips
	32.00	182.2	962.5	1144.6	
	33.00	213.2	1016.8	1230.0	
	34.00	244.9	1016.8	1261.6	
Min. & Est. Tip 967' →	35.00	277.1	1016.8	1293.9	Pilot hole is needed

```
                    **********************
                    *  API RP-2A (1994)  *
                    **********************
```

PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	0.0	0.0
1.00	0.0	0.0	0.0
2.00	0.0	0.0	0.0
3.00	0.0	0.0	0.0
4.00	0.0	0.0	0.0
5.00	0.0	0.0	0.0
6.00	0.0	0.0	0.0
7.00	0.0	0.0	0.0
8.00	0.0	0.0	0.0
9.00	0.0	0.0	0.0
10.00	0.0	0.0	0.0
11.00	0.0	0.0	0.0
12.00	0.0	0.0	0.0
13.00	0.0	0.0	0.0
14.00	0.0	0.0	0.0
15.00	0.0	0.0	0.0
16.00	0.0	0.0	0.0
17.00	0.0	0.0	0.0
18.00	0.0	0.0	0.0
19.00	0.0	0.0	0.0
20.00	0.0	0.0	0.0
21.00	0.0	0.0	0.0
22.00	0.0	0.0	0.0
23.00	0.0	0.0	0.0
24.00	0.0	0.0	0.0
25.00	0.0	0.0	0.0
26.00	0.0	0.0	0.0
27.00	0.0	0.0	0.0
28.00	0.0	0.0	0.0
29.00	0.0	0.0	0.0
30.00	0.0	0.0	0.0
31.00	0.0	0.0	0.0
32.00	0.0	0.0	0.0
33.00	0.0	0.0	0.0
34.00	0.0	0.0	0.0
35.00	0.0	0.0	0.0

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
			0.9093E-01	0.1000E-01
			0.1819E+00	0.2000E-01
			0.3637E+00	0.4000E-01
			0.5456E+00	0.6000E-01

			0.7274E+00	0.8000E-01
			0.8184E+00	0.9000E-01
			0.9093E+00	0.1000E+00
			0.9093E+00	0.5000E+00
			0.9093E+00	0.2000E+01
2	10	0.5775E+01		
			0.0000E+00	0.0000E+00
			0.3637E+00	0.1000E-01
			0.7274E+00	0.2000E-01
			0.1455E+01	0.4000E-01
			0.2182E+01	0.6000E-01
			0.2910E+01	0.8000E-01
			0.3273E+01	0.9000E-01
			0.3637E+01	0.1000E+00
			0.3637E+01	0.5000E+00
			0.3637E+01	0.2000E+01
3	10	0.1146E+02		
			0.0000E+00	0.0000E+00
			0.6831E+00	0.1000E-01
			0.1366E+01	0.2000E-01
			0.2732E+01	0.4000E-01
			0.4098E+01	0.6000E-01
			0.5465E+01	0.8000E-01
			0.6148E+01	0.9000E-01
			0.6831E+01	0.1000E+00
			0.6831E+01	0.5000E+00
			0.6831E+01	0.2000E+01
4	10	0.1150E+02		
			0.0000E+00	0.0000E+00
			0.6831E+00	0.1000E-01
			0.1366E+01	0.2000E-01
			0.2732E+01	0.4000E-01
			0.4098E+01	0.6000E-01
			0.5465E+01	0.8000E-01
			0.6148E+01	0.9000E-01
			0.6831E+01	0.1000E+00
			0.6831E+01	0.5000E+00
			0.6831E+01	0.2000E+01
5	10	0.1653E+02		
			0.0000E+00	0.0000E+00
			0.7840E+00	0.1000E-01
			0.1568E+01	0.2000E-01
			0.3136E+01	0.4000E-01
			0.4704E+01	0.6000E-01
			0.6272E+01	0.8000E-01
			0.7056E+01	0.9000E-01
			0.7840E+01	0.1000E+00
			0.7840E+01	0.5000E+00
			0.7840E+01	0.2000E+01
6	10	0.2146E+02		
			0.0000E+00	0.0000E+00
			0.9546E+00	0.1000E-01
			0.1909E+01	0.2000E-01
			0.3818E+01	0.4000E-01
			0.5728E+01	0.6000E-01
			0.7637E+01	0.8000E-01
			0.8592E+01	0.9000E-01
			0.9546E+01	0.1000E+00
			0.9546E+01	0.5000E+00
			0.9546E+01	0.2000E+01
7	10	0.2150E+02		
			0.0000E+00	0.0000E+00
			0.9546E+00	0.1000E-01
			0.1909E+01	0.2000E-01
			0.3818E+01	0.4000E-01
			0.5728E+01	0.6000E-01
			0.7637E+01	0.8000E-01
			0.8592E+01	0.9000E-01
			0.9546E+01	0.1000E+00

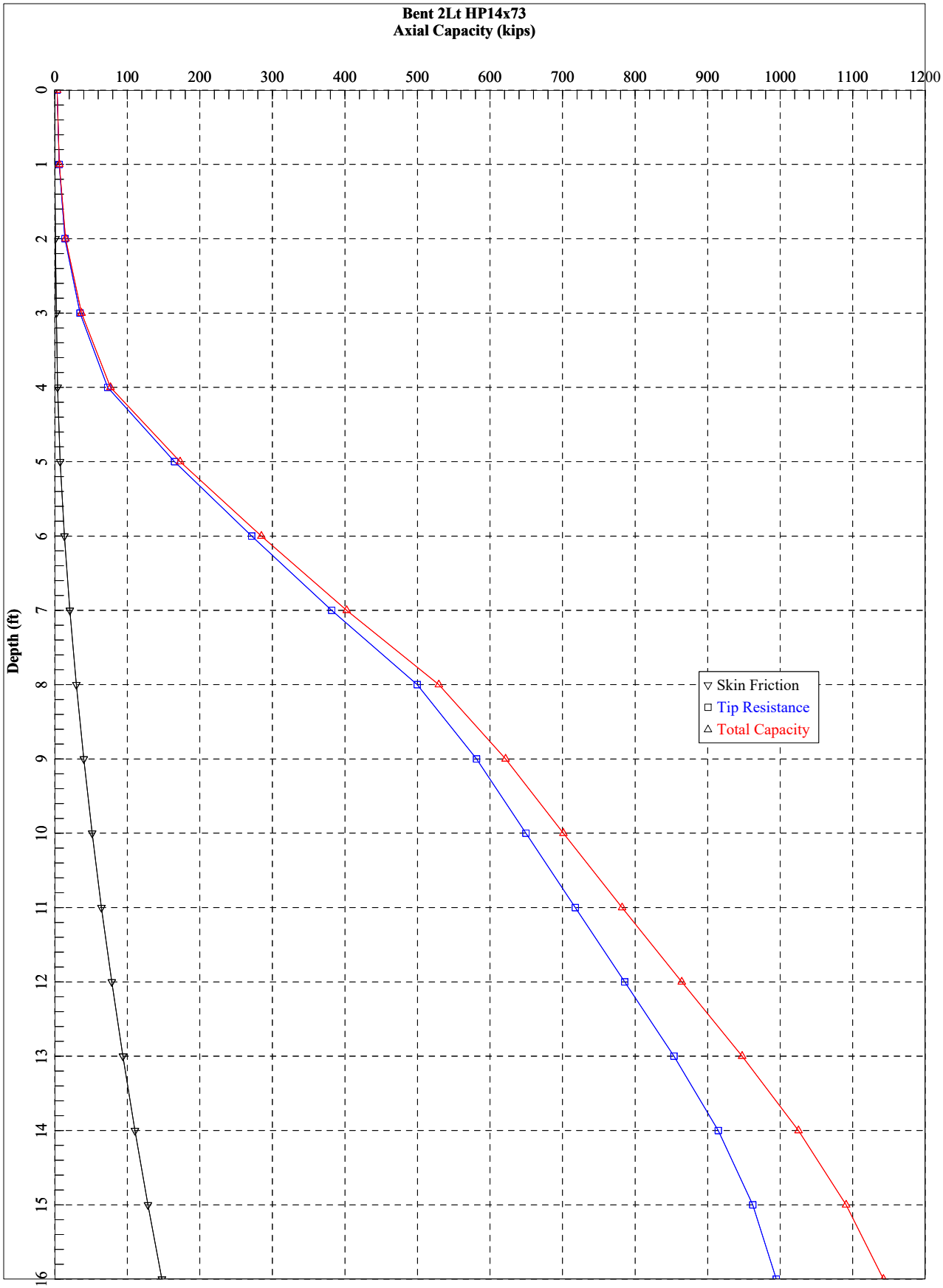
			0.9546E+01	0.5000E+00
			0.9546E+01	0.2000E+01
8	10	0.2553E+02		
			0.0000E+00	0.0000E+00
			0.9170E+00	0.1000E-01
			0.1834E+01	0.2000E-01
			0.3668E+01	0.4000E-01
			0.5502E+01	0.6000E-01
			0.7336E+01	0.8000E-01
			0.8253E+01	0.9000E-01
			0.9170E+01	0.1000E+00
			0.9170E+01	0.5000E+00
			0.9170E+01	0.2000E+01
9	10	0.2946E+02		
			0.0000E+00	0.0000E+00
			0.1853E+01	0.1000E-01
			0.3705E+01	0.2000E-01
			0.7411E+01	0.4000E-01
			0.1112E+02	0.6000E-01
			0.1482E+02	0.8000E-01
			0.1667E+02	0.9000E-01
			0.1853E+02	0.1000E+00
			0.1853E+02	0.5000E+00
			0.1853E+02	0.2000E+01
10	10	0.2950E+02		
			0.0000E+00	0.0000E+00
			0.1853E+01	0.1000E-01
			0.3705E+01	0.2000E-01
			0.7411E+01	0.4000E-01
			0.1112E+02	0.6000E-01
			0.1482E+02	0.8000E-01
			0.1667E+02	0.9000E-01
			0.1853E+02	0.1000E+00
			0.1853E+02	0.5000E+00
			0.1853E+02	0.2000E+01
11	10	0.3378E+02		
			0.0000E+00	0.0000E+00
			0.4723E+01	0.1000E-01
			0.9445E+01	0.2000E-01
			0.1889E+02	0.4000E-01
			0.2834E+02	0.6000E-01
			0.3778E+02	0.8000E-01
			0.4250E+02	0.9000E-01
			0.4723E+02	0.1000E+00
			0.4723E+02	0.5000E+00
			0.4723E+02	0.2000E+01
12	10	0.3796E+02		
			0.0000E+00	0.0000E+00
			0.4768E+01	0.1000E-01
			0.9536E+01	0.2000E-01
			0.1907E+02	0.4000E-01
			0.2861E+02	0.6000E-01
			0.3815E+02	0.8000E-01
			0.4291E+02	0.9000E-01
			0.4768E+02	0.1000E+00
			0.4768E+02	0.5000E+00
			0.4768E+02	0.2000E+01

TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00
0.6355E+02	0.8976E-02
0.1271E+03	0.1795E-01
0.2542E+03	0.3591E-01
0.5084E+03	0.2334E+00
0.7626E+03	0.7540E+00

0.9151E+03	0.1311E+01
0.1017E+04	0.1795E+01
0.1017E+04	0.2693E+01
0.1017E+04	0.3591E+01

LOAD VERSUS SETTLEMENT CURVE
****

TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.1034E+01	0.1681E-03	0.7079E+00	0.1000E-03
0.1034E+02	0.1681E-02	0.7079E+01	0.1000E-02
0.5170E+02	0.8404E-02	0.3540E+02	0.5000E-02
0.1034E+03	0.1681E-01	0.7079E+02	0.1000E-01
0.4320E+03	0.7798E-01	0.2723E+03	0.5000E-01
0.6173E+03	0.1395E+00	0.3367E+03	0.1000E+00
0.9191E+03	0.5615E+00	0.6386E+03	0.5000E+00
0.1111E+04	0.1075E+01	0.8300E+03	0.1000E+01
0.1297E+04	0.2089E+01	0.1017E+04	0.2000E+01


Bent 2Lt HP14x73
Axial Capacity (kips)
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
Depth (ft)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
Skin Friction
Tip Resistance
Total Capacity

```
=========================================================================

                 APILE for Windows, Version 2015.7.5

                  Serial Number :  139694124

                  A Program for Analyzing the Axial Capacity
                  and Short-term Settlement of Driven Piles
                            under Axial Loading.
                (c) Copyright ENSOFT, Inc., 1987-2015
                      All Rights Reserved

=========================================================================


This program is licensed to :

Moreland Altobelli Associates
Duluth, GA

Path to file locations      : C:\Users\yshao\Desktop\Yong Shao GDOT\TEMP\McGinnis Ferry\BFI\APILE\
Name of input data file     : Bent2Lt.ap7d
Name of output file         : Bent2Lt.ap7o
Name of plot output file    : Bent2Lt.ap7p

-------------------------------------------------------------------------
                     Time and Date of Analysis
-------------------------------------------------------------------------

          Date:  October 21, 2021     Time:  22:47:29



1
     *********************
     * INPUT INFORMATION *
     *********************



     Bent 2 Lt: HP14x73

     DESIGNER   : YCS

     JOB NUMBER : PI 0004634


     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)
     - API RP 2A (American Petroleum Institute)


     TYPE OF LOADING :
     - COMPRESSION


     PILE TYPE :

     H-Pile/Steel Pile
```

```
DATA FOR AXIAL STIFFNESS :

- MODULUS OF ELASTICITY     = 0.290E+08 PSI
- CROSS SECTION AREA        =    198.50 IN2


NONCIRCULAR PILE PROPERTIES :

- TOTAL PILE LENGTH, TL     =     27.00 FT.
- PILE STICKUP LENGTH, PSL  =     10.50 FT.
- ZERO FRICTION LENGTH, ZFL =      0.00 FT.
- PERIMETER OF PILE         =     56.40 IN.
- TIP AREA OF PILE          =    198.50 IN2
- INCREMENT OF PILE LENGTH
  USED IN COMPUTATION       =      1.00 FT.



SOIL INFORMATIONS :



                  LATERAL    EFFECTIVE    FRICTION   BEARING
          SOIL    EARTH      UNIT         ANGLE      CAPACITY
 DEPTH    TYPE    PRESSURE   WEIGHT       DEGREES    FACTOR
  FT.                        LB/CF
   0.00   SAND      0.00       115.00        34.00      0.00
   3.50   SAND      0.00       115.00        34.00      0.00
   3.50   SAND      0.00       130.00        40.00      0.00
   5.50   SAND      0.00       130.00        40.00      0.00
   5.50   SAND      0.00       130.00        45.00      0.00
  20.00   SAND      0.00       130.00        45.00      0.00



MAXIMUM   MAXIMUM   UNDISTURB  REMOLDED
UNIT      UNIT      SHEAR      SHEAR     BLOW   UNIT SKIN  UNIT END
FRICTION  BEARING   STRENGTH   STRENGTH  COUNT  FRICTION   BEARING
  KSF       KSF        KSF       KSF               KSF       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

* 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.



         LRFD FACTOR  LRFD FACTOR
          ON UNIT      ON UNIT
 DEPTH    FRICTION     BEARING
  FT.
   0.00    1.000       1.000
   3.50    1.000       1.000
   3.50    1.000       1.000
   5.50    1.000       1.000
   5.50    1.000       1.000
  20.00    1.000       1.000




        PLASTIC    YIELD      Qc
         INDEX    STRESS     FROM
 DEPTH     PI      RATIO     CPT
```

FT.	%		KSF
0.00	0.00	0.00	0.000E+00
3.50	0.00	0.00	0.000E+00
3.50	0.00	0.00	0.000E+00
5.50	0.00	0.00	0.000E+00
5.50	0.00	0.00	0.000E+00
20.00	0.00	0.00	0.000E+00

1

```
**********************
* COMPUTATION RESULT *
**********************
```

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

	PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP	
Btm of Cut Ele. 990' →	0.00	0.0	3.3	3.3	
	1.00	0.2	6.2	6.4	
	2.00	1.0	14.0	15.0	
	3.00	2.2	34.8	37.0	
	4.00	3.9	72.9	76.8	
	5.00	7.5	165.2	172.8	
Scour line Ele. 984' →	6.00	13.4	271.5	284.9	Rscour = 13.4 kips
	7.00	20.8	381.8	402.5	
	8.00	29.8	499.6	529.4	
	9.00	40.1	581.4	621.5	
	10.00	51.6	649.5	701.2	
	11.00	64.4	717.6	782.1	
	12.00	78.6	785.7	864.3	
	13.00	93.9	853.6	947.5	
	14.00	110.6	914.6	1025.2	Rndr = 220.4kips / 0.65 = 339 kips
	15.00	128.5	962.2	1090.8	
Min. & Est. Tip 974' →	16.00	147.8	994.6	1142.4	Pilot hole is needed

```
**********************
*  API RP-2A (1994)  *
**********************
```

PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	0.0	0.0
1.00	0.0	0.0	0.0
2.00	0.0	0.0	0.0
3.00	0.0	0.0	0.0
4.00	0.0	0.0	0.0
5.00	0.0	0.0	0.0
6.00	0.0	0.0	0.0
7.00	0.0	0.0	0.0
8.00	0.0	0.0	0.0
9.00	0.0	0.0	0.0
10.00	0.0	0.0	0.0
11.00	0.0	0.0	0.0
12.00	0.0	0.0	0.0
13.00	0.0	0.0	0.0
14.00	0.0	0.0	0.0
15.00	0.0	0.0	0.0
16.00	0.0	0.0	0.0

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                      *
**************************************************
```

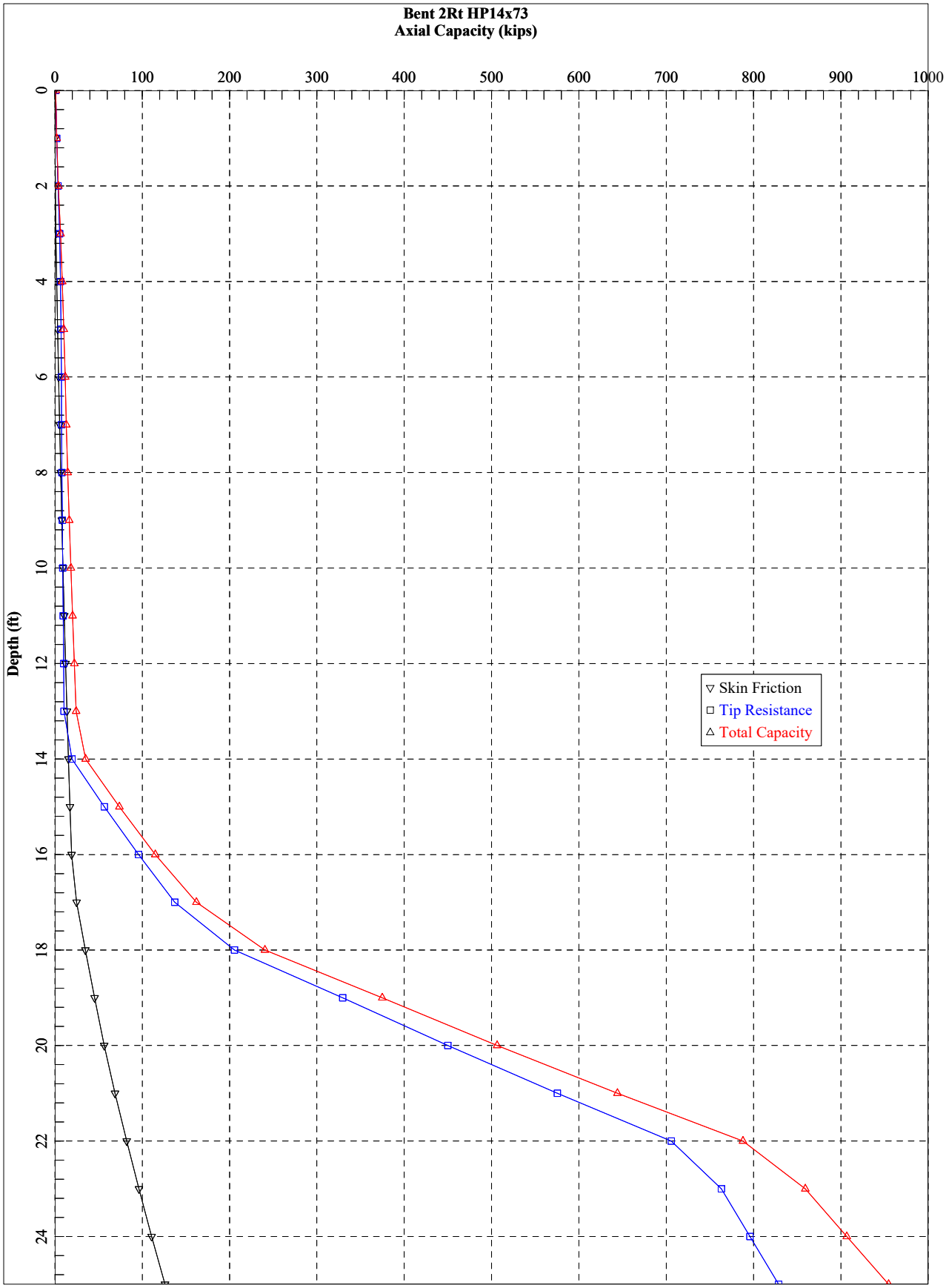
T-Z CURVE NO.	NO. OF POINTS	DEPTH TO CURVE FT.	LOAD TRANSFER PSI	PILE MOVEMENT IN.
1	10	0.0000E+00		
			0.0000E+00	0.0000E+00
			0.1079E+00	0.1000E-01
			0.2158E+00	0.2000E-01
			0.4315E+00	0.4000E-01
			0.6473E+00	0.6000E-01
			0.8631E+00	0.8000E-01
			0.9709E+00	0.9000E-01
			0.1079E+01	0.1000E+00
			0.1079E+01	0.5000E+00
			0.1079E+01	0.2000E+01
2	10	0.1775E+01		
			0.0000E+00	0.0000E+00
			0.1438E+00	0.1000E-01
			0.2877E+00	0.2000E-01
			0.5754E+00	0.4000E-01
			0.8631E+00	0.6000E-01
			0.1151E+01	0.8000E-01
			0.1295E+01	0.9000E-01
			0.1438E+01	0.1000E+00
			0.1438E+01	0.5000E+00
			0.1438E+01	0.2000E+01
3	10	0.3458E+01		
			0.0000E+00	0.0000E+00
			0.3933E+00	0.1000E-01
			0.7865E+00	0.2000E-01
			0.1573E+01	0.4000E-01
			0.2360E+01	0.6000E-01
			0.3146E+01	0.8000E-01
			0.3539E+01	0.9000E-01
			0.3933E+01	0.1000E+00
			0.3933E+01	0.5000E+00
			0.3933E+01	0.2000E+01
4	10	0.3500E+01		
			0.0000E+00	0.0000E+00
			0.3933E+00	0.1000E-01
			0.7865E+00	0.2000E-01
			0.1573E+01	0.4000E-01
			0.2360E+01	0.6000E-01
			0.3146E+01	0.8000E-01
			0.3539E+01	0.9000E-01
			0.3933E+01	0.1000E+00
			0.3933E+01	0.5000E+00
			0.3933E+01	0.2000E+01
5	10	0.4525E+01		
			0.0000E+00	0.0000E+00
			0.7014E+00	0.1000E-01
			0.1403E+01	0.2000E-01
			0.2806E+01	0.4000E-01
			0.4209E+01	0.6000E-01
			0.5612E+01	0.8000E-01
			0.6313E+01	0.9000E-01

			0.7014E+01	0.1000E+00
			0.7014E+01	0.5000E+00
			0.7014E+01	0.2000E+01
6	10	0.5458E+01		
			0.0000E+00	0.0000E+00
			0.9813E+00	0.1000E-01
			0.1963E+01	0.2000E-01
			0.3925E+01	0.4000E-01
			0.5888E+01	0.6000E-01
			0.7850E+01	0.8000E-01
			0.8831E+01	0.9000E-01
			0.9813E+01	0.1000E+00
			0.9813E+01	0.5000E+00
			0.9813E+01	0.2000E+01
7	10	0.5500E+01		
			0.0000E+00	0.0000E+00
			0.9813E+00	0.1000E-01
			0.1963E+01	0.2000E-01
			0.3925E+01	0.4000E-01
			0.5888E+01	0.6000E-01
			0.7850E+01	0.8000E-01
			0.8831E+01	0.9000E-01
			0.9813E+01	0.1000E+00
			0.9813E+01	0.5000E+00
			0.9813E+01	0.2000E+01
8	10	0.1278E+02		
			0.0000E+00	0.0000E+00
			0.2368E+01	0.1000E-01
			0.4736E+01	0.2000E-01
			0.9471E+01	0.4000E-01
			0.1421E+02	0.6000E-01
			0.1894E+02	0.8000E-01
			0.2131E+02	0.9000E-01
			0.2368E+02	0.1000E+00
			0.2368E+02	0.5000E+00
			0.2368E+02	0.2000E+01
9	10	0.1996E+02		
			0.0000E+00	0.0000E+00
			0.2840E+01	0.1000E-01
			0.5680E+01	0.2000E-01
			0.1136E+02	0.4000E-01
			0.1704E+02	0.6000E-01
			0.2272E+02	0.8000E-01
			0.2556E+02	0.9000E-01
			0.2840E+02	0.1000E+00
			0.2840E+02	0.5000E+00
			0.2840E+02	0.2000E+01

TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00
0.6216E+02	0.8976E-02
0.1243E+03	0.1795E-01
0.2487E+03	0.3591E-01
0.4973E+03	0.2334E+00
0.7460E+03	0.7540E+00
0.8952E+03	0.1311E+01
0.9946E+03	0.1795E+01
0.9946E+03	0.2693E+01
0.9946E+03	0.3591E+01

LOAD VERSUS SETTLEMENT CURVE
****

TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.8628E+00	0.1466E-03	0.6925E+00	0.1000E-03
0.8628E+01	0.1466E-02	0.6925E+01	0.1000E-02
0.4314E+02	0.7329E-02	0.3463E+02	0.5000E-02
0.8648E+02	0.1467E-01	0.6925E+02	0.1000E-01
0.3511E+03	0.6878E-01	0.2664E+03	0.5000E-01
0.4882E+03	0.1257E+00	0.3294E+03	0.1000E+00
0.7835E+03	0.5423E+00	0.6247E+03	0.5000E+00
0.9708E+03	0.1053E+01	0.8119E+03	0.1000E+01
0.1153E+04	0.2063E+01	0.9946E+03	0.2000E+01


Bent 2Rt HP14x73
Axial Capacity (kips)
0
100
200
300
400
500
600
700
800
900
1000
Depth (ft)
0
2
4
6
8
10
12
14
16
18
20
22
24
Skin Friction
Tip Resistance
Total Capacity

```
=========================================================================

                 APILE for Windows, Version 2015.7.5

                  Serial Number :  139694124

                  A Program for Analyzing the Axial Capacity
                  and Short-term Settlement of Driven Piles
                            under Axial Loading.
                (c) Copyright ENSOFT, Inc., 1987-2015
                      All Rights Reserved

=========================================================================


This program is licensed to :

Moreland Altobelli Associates
Duluth, GA

Path to file locations      : C:\Users\yshao\Desktop\Yong Shao GDOT\TEMP\McGinnis Ferry\BFI\APILE\
Name of input data file     : Bent2Rt.ap7d
Name of output file         : Bent2Rt.ap7o
Name of plot output file    : Bent2Rt.ap7p

-------------------------------------------------------------------------
                     Time and Date of Analysis
-------------------------------------------------------------------------

          Date:  October 21, 2021     Time:  23:12:00



1
     *********************
     * INPUT INFORMATION *
     *********************



     Bent 2 Rt: HP14x73

     DESIGNER   : YCS

     JOB NUMBER : PI 0004634


     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)
     - API RP 2A (American Petroleum Institute)


     TYPE OF LOADING :
     - COMPRESSION


     PILE TYPE :

     H-Pile/Steel Pile
```

```
DATA FOR AXIAL STIFFNESS :

- MODULUS OF ELASTICITY     = 0.290E+08 PSI
- CROSS SECTION AREA        =    198.50 IN2


NONCIRCULAR PILE PROPERTIES :

- TOTAL PILE LENGTH, TL     =     36.50 FT.
- PILE STICKUP LENGTH, PSL  =     11.50 FT.
- ZERO FRICTION LENGTH, ZFL =      0.00 FT.
- PERIMETER OF PILE         =     56.40 IN.
- TIP AREA OF PILE          =    198.50 IN2
- INCREMENT OF PILE LENGTH
  USED IN COMPUTATION       =      1.00 FT.



SOIL INFORMATIONS :



                  LATERAL    EFFECTIVE    FRICTION   BEARING
          SOIL    EARTH      UNIT         ANGLE      CAPACITY
 DEPTH    TYPE    PRESSURE   WEIGHT       DEGREES    FACTOR
  FT.                        LB/CF
   0.00   SAND      0.00       110.00        28.00      0.00
   5.00   SAND      0.00       110.00        28.00      0.00
   5.00   SAND      0.00        42.60        26.00      0.00
  16.00   SAND      0.00        42.60        26.00      0.00
  16.00   SAND      0.00        62.60        40.00      0.00
  20.00   SAND      0.00        62.60        40.00      0.00
  20.00   SAND      0.00        62.60        45.00      0.00
  30.00   SAND      0.00        62.60        45.00      0.00



MAXIMUM   MAXIMUM   UNDISTURB  REMOLDED
UNIT      UNIT      SHEAR      SHEAR     BLOW   UNIT SKIN  UNIT END
FRICTION  BEARING   STRENGTH   STRENGTH  COUNT  FRICTION   BEARING
 KSF        KSF        KSF        KSF              KSF        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

* 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.



         LRFD FACTOR  LRFD FACTOR
          ON UNIT      ON UNIT
 DEPTH    FRICTION     BEARING
  FT.
   0.00    1.000       1.000
   5.00    1.000       1.000
   5.00    1.000       1.000
  16.00    1.000       1.000
  16.00    1.000       1.000
  20.00    1.000       1.000
  20.00    1.000       1.000
  30.00    1.000       1.000
```

DEPTH FT.	PLASTIC INDEX PI %	YIELD STRESS RATIO	Qc FROM CPT KSF
0.00	0.00	0.00	0.000E+00
5.00	0.00	0.00	0.000E+00
5.00	0.00	0.00	0.000E+00
16.00	0.00	0.00	0.000E+00
16.00	0.00	0.00	0.000E+00
20.00	0.00	0.00	0.000E+00
20.00	0.00	0.00	0.000E+00
30.00	0.00	0.00	0.000E+00

1

```
**********************
* COMPUTATION RESULT *
**********************
```

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

	PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP	
Btm of Cut Ele. 990' →	0.00	0.0	1.0	1.0	
	1.00	0.1	2.0	2.1	
	2.00	0.5	3.5	4.0	
	3.00	1.1	5.4	6.5	
	4.00	2.0	6.4	8.4	
	5.00	3.1	7.1	10.2	
	6.00	4.2	7.5	11.8	
	7.00	5.4	7.6	13.0	
	8.00	6.6	8.0	14.6	
	9.00	7.9	8.5	16.4	
Scour line Ele. 980' →	10.00	9.2	9.0	18.3	Rscour = 9.2 kips
	11.00	10.7	9.5	20.2	
	12.00	12.2	10.0	22.2	
	13.00	13.8	10.5	24.3	
	14.00	15.5	19.6	35.1	
	15.00	17.3	56.6	73.9	
	16.00	19.1	95.8	114.9	
	17.00	24.9	137.2	162.1	
	18.00	34.9	205.6	240.5	
	19.00	45.4	329.5	374.9	
	20.00	56.5	449.9	506.4	
	21.00	68.8	575.3	644.1	
	22.00	82.2	705.7	787.9	Rndr = 220.4 kips / 0.65 = 339 kips
	23.00	96.2	763.1	859.3	
	24.00	110.8	795.9	906.7	
Min. & Est. Tip 965' →	25.00	126.1	828.7	954.7	Pilot hole needed

```
**********************
*  API RP-2A (1994)  *
**********************
```

PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	0.0	0.0

1.00	0.0	0.0	0.0
2.00	0.0	0.0	0.0
3.00	0.0	0.0	0.0
4.00	0.0	0.0	0.0
5.00	0.0	0.0	0.0
6.00	0.0	0.0	0.0
7.00	0.0	0.0	0.0
8.00	0.0	0.0	0.0
9.00	0.0	0.0	0.0
10.00	0.0	0.0	0.0
11.00	0.0	0.0	0.0
12.00	0.0	0.0	0.0
13.00	0.0	0.0	0.0
14.00	0.0	0.0	0.0
15.00	0.0	0.0	0.0
16.00	0.0	0.0	0.0
17.00	0.0	0.0	0.0
18.00	0.0	0.0	0.0
19.00	0.0	0.0	0.0
20.00	0.0	0.0	0.0
21.00	0.0	0.0	0.0
22.00	0.0	0.0	0.0
23.00	0.0	0.0	0.0
24.00	0.0	0.0	0.0
25.00	0.0	0.0	0.0

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
			0.5462E-01	0.1000E-01
			0.1092E+00	0.2000E-01
			0.2185E+00	0.4000E-01
			0.3277E+00	0.6000E-01
			0.4369E+00	0.8000E-01
			0.4916E+00	0.9000E-01
			0.5462E+00	0.1000E+00
			0.5462E+00	0.5000E+00
			0.5462E+00	0.2000E+01
2	10	0.2525E+01		
			0.0000E+00	0.0000E+00
			0.1092E+00	0.1000E-01
			0.2185E+00	0.2000E-01
			0.4369E+00	0.4000E-01
			0.6554E+00	0.6000E-01
			0.8739E+00	0.8000E-01
			0.9831E+00	0.9000E-01
			0.1092E+01	0.1000E+00
			0.1092E+01	0.5000E+00
			0.1092E+01	0.2000E+01
3	10	0.4958E+01		
			0.0000E+00	0.0000E+00
			0.1678E+00	0.1000E-01
			0.3357E+00	0.2000E-01

			0.6714E+00	0.4000E-01
			0.1007E+01	0.6000E-01
			0.1343E+01	0.8000E-01
			0.1511E+01	0.9000E-01
			0.1678E+01	0.1000E+00
			0.1678E+01	0.5000E+00
			0.1678E+01	0.2000E+01
4	10	0.5000E+01		
			0.0000E+00	0.0000E+00
			0.1696E+00	0.1000E-01
			0.3393E+00	0.2000E-01
			0.6786E+00	0.4000E-01
			0.1018E+01	0.6000E-01
			0.1357E+01	0.8000E-01
			0.1527E+01	0.9000E-01
			0.1696E+01	0.1000E+00
			0.1696E+01	0.5000E+00
			0.1696E+01	0.2000E+01
5	10	0.1053E+02		
			0.0000E+00	0.0000E+00
			0.2197E+00	0.1000E-01
			0.4395E+00	0.2000E-01
			0.8789E+00	0.4000E-01
			0.1318E+01	0.6000E-01
			0.1758E+01	0.8000E-01
			0.1978E+01	0.9000E-01
			0.2197E+01	0.1000E+00
			0.2197E+01	0.5000E+00
			0.2197E+01	0.2000E+01
6	10	0.1596E+02		
			0.0000E+00	0.0000E+00
			0.5637E+00	0.1000E-01
			0.1127E+01	0.2000E-01
			0.2255E+01	0.4000E-01
			0.3382E+01	0.6000E-01
			0.4510E+01	0.8000E-01
			0.5073E+01	0.9000E-01
			0.5637E+01	0.1000E+00
			0.5637E+01	0.5000E+00
			0.5637E+01	0.2000E+01
7	10	0.1600E+02		
			0.0000E+00	0.0000E+00
			0.1165E+01	0.1000E-01
			0.2330E+01	0.2000E-01
			0.4660E+01	0.4000E-01
			0.6989E+01	0.6000E-01
			0.9319E+01	0.8000E-01
			0.1048E+02	0.9000E-01
			0.1165E+02	0.1000E+00
			0.1165E+02	0.5000E+00
			0.1165E+02	0.2000E+01
8	10	0.1803E+02		
			0.0000E+00	0.0000E+00
			0.1599E+01	0.1000E-01
			0.3198E+01	0.2000E-01
			0.6395E+01	0.4000E-01
			0.9593E+01	0.6000E-01
			0.1279E+02	0.8000E-01
			0.1439E+02	0.9000E-01
			0.1599E+02	0.1000E+00
			0.1599E+02	0.5000E+00
			0.1599E+02	0.2000E+01
9	10	0.1996E+02		
			0.0000E+00	0.0000E+00
			0.1724E+01	0.1000E-01
			0.3448E+01	0.2000E-01
			0.6897E+01	0.4000E-01
			0.1035E+02	0.6000E-01
			0.1379E+02	0.8000E-01

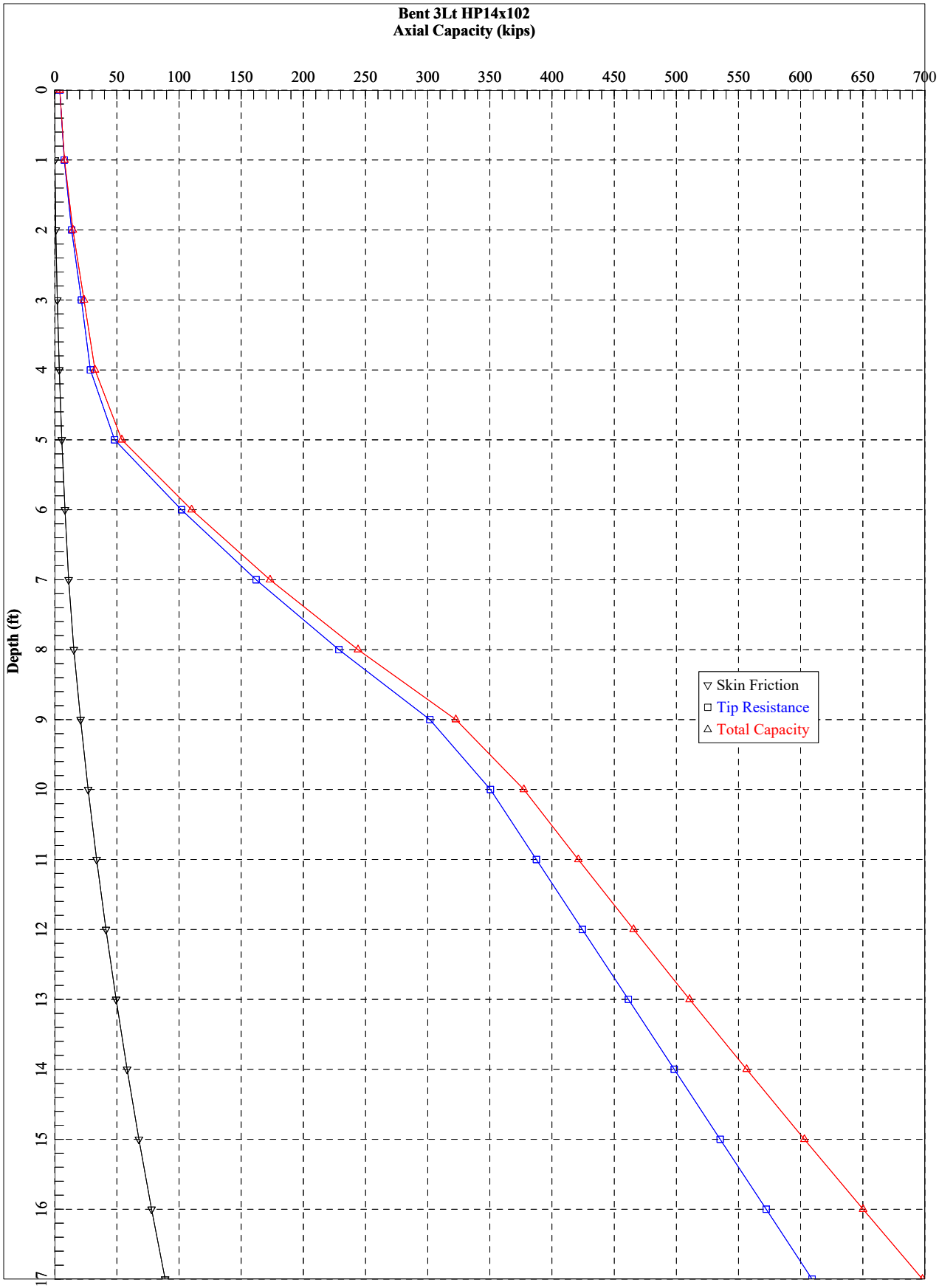
			0.1552E+02	0.9000E-01
			0.1724E+02	0.1000E+00
			0.1724E+02	0.5000E+00
			0.1724E+02	0.2000E+01
10	10	0.2000E+02		
			0.0000E+00	0.0000E+00
			0.1894E+01	0.1000E-01
			0.3788E+01	0.2000E-01
			0.7576E+01	0.4000E-01
			0.1136E+02	0.6000E-01
			0.1515E+02	0.8000E-01
			0.1705E+02	0.9000E-01
			0.1894E+02	0.1000E+00
			0.1894E+02	0.5000E+00
			0.1894E+02	0.2000E+01
11	10	0.2503E+02		
			0.0000E+00	0.0000E+00
			0.2253E+01	0.1000E-01
			0.4505E+01	0.2000E-01
			0.9010E+01	0.4000E-01
			0.1352E+02	0.6000E-01
			0.1802E+02	0.8000E-01
			0.2027E+02	0.9000E-01
			0.2253E+02	0.1000E+00
			0.2253E+02	0.5000E+00
			0.2253E+02	0.2000E+01
12	10	0.2996E+02		
			0.0000E+00	0.0000E+00
			0.2253E+01	0.1000E-01
			0.4505E+01	0.2000E-01
			0.9010E+01	0.4000E-01
			0.1352E+02	0.6000E-01
			0.1802E+02	0.8000E-01
			0.2027E+02	0.9000E-01
			0.2253E+02	0.1000E+00
			0.2253E+02	0.5000E+00
			0.2253E+02	0.2000E+01

TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00
0.5179E+02	0.8976E-02
0.1036E+03	0.1795E-01
0.2072E+03	0.3591E-01
0.4143E+03	0.2334E+00
0.6215E+03	0.7540E+00
0.7458E+03	0.1311E+01
0.8287E+03	0.1795E+01
0.8287E+03	0.2693E+01
0.8287E+03	0.3591E+01

LOAD VERSUS SETTLEMENT CURVE
****

TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.7216E+00	0.1530E-03	0.5770E+00	0.1000E-03
0.7216E+01	0.1530E-02	0.5770E+01	0.1000E-02
0.3608E+02	0.7650E-02	0.2885E+02	0.5000E-02
0.7219E+02	0.1530E-01	0.5770E+02	0.1000E-01
0.2938E+03	0.7141E-01	0.2220E+03	0.5000E-01
0.4095E+03	0.1295E+00	0.2744E+03	0.1000E+00

0.6555E+03	0.5482E+00	0.5204E+03	0.5000E+00
0.8116E+03	0.1060E+01	0.6765E+03	0.1000E+01
0.9638E+03	0.2072E+01	0.8287E+03	0.2000E+01


Bent 3Lt HP14x102
Axial Capacity (kips)
0
50
100
150
200
250
300
350
400
450
500
550
600
650
700
Depth (ft)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
Skin Friction
Tip Resistance
Total Capacity

```
=========================================================================

                 APILE for Windows, Version 2015.7.5

                  Serial Number :  139694124

                  A Program for Analyzing the Axial Capacity
                  and Short-term Settlement of Driven Piles
                            under Axial Loading.
                (c) Copyright ENSOFT, Inc., 1987-2015
                      All Rights Reserved

=========================================================================


This program is licensed to :

Moreland Altobelli Associates
Duluth, GA

Path to file locations      : C:\Users\yshao\Desktop\Yong Shao GDOT\TEMP\McGinnis Ferry\BFI\APILE\
Name of input data file     : Bent3Lt.ap7d
Name of output file         : Bent3Lt.ap7o
Name of plot output file    : Bent3Lt.ap7p

-------------------------------------------------------------------------
                     Time and Date of Analysis
-------------------------------------------------------------------------

          Date:  October 21, 2021     Time:  23:31:51



1
     *********************
     * INPUT INFORMATION *
     *********************



     Bent 3 Lt: HP14x102

     DESIGNER   : YCS

     JOB NUMBER : PI 0004634


     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)
     - API RP 2A (American Petroleum Institute)


     TYPE OF LOADING :
     - COMPRESSION


     PILE TYPE :

     H-Pile/Steel Pile
```

DATA FOR AXIAL STIFFNESS :

- MODULUS OF ELASTICITY = 0.290E+08 PSI
- CROSS SECTION AREA = 207.20 IN2

NONCIRCULAR PILE PROPERTIES :

- TOTAL PILE LENGTH, TL = 17.00 FT.
- PILE STICKUP LENGTH, PSL = 0.00 FT.
- ZERO FRICTION LENGTH, ZFL = 0.00 FT.
- PERIMETER OF PILE = 57.60 IN.
- TIP AREA OF PILE = 207.20 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	62.60	38.00	0.00
7.00	SAND	0.00	62.60	38.00	0.00
7.00	SAND	0.00	67.60	45.00	0.00
22.00	SAND	0.00	67.60	45.00	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

* 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
7.00	1.000	1.000
7.00	1.000	1.000
22.00	1.000	1.000

DEPTH FT.	PLASTIC INDEX PI %	YIELD STRESS RATIO	Qc FROM CPT KSF
0.00	0.00	0.00	0.000E+00
7.00	0.00	0.00	0.000E+00
7.00	0.00	0.00	0.000E+00
22.00	0.00	0.00	0.000E+00

1

```
**********************
* COMPUTATION RESULT *
**********************
```

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

	PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP	
Btm of Ftg Ele. 985'	0.00	0.0	4.1	4.1	
	1.00	0.2	7.7	7.9	
	2.00	0.9	13.6	14.6	
	3.00	2.1	21.5	23.6	
	4.00	3.7	28.7	32.4	
	5.00	5.7	48.2	54.0	
	6.00	8.3	101.9	110.1	
Scour line Ele. 978'	7.00	11.2	162.0	173.2	Rscour = 11.2 kips
	8.00	15.4	228.6	244.0	
	9.00	20.8	301.7	322.6	
	10.00	26.9	350.5	377.4	
	11.00	33.7	387.4	421.2	
	12.00	41.2	424.4	465.6	
	13.00	49.4	461.4	510.7	Rndr = 308.2kips / 0.65 = 474 kips
	14.00	58.2	498.3	556.5	
	15.00	67.7	535.3	603.0	
	16.00	77.9	572.3	650.2	
Min. & Est. Tip 968'	17.00	88.8	609.2	698.0	Pilot hole needed

```
**********************
*  API RP-2A (1994)  *
**********************
```

PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	0.0	0.0
1.00	0.0	0.0	0.0
2.00	0.0	0.0	0.0
3.00	0.0	0.0	0.0
4.00	0.0	0.0	0.0
5.00	0.0	0.0	0.0
6.00	0.0	0.0	0.0
7.00	0.0	0.0	0.0
8.00	0.0	0.0	0.0
9.00	0.0	0.0	0.0
10.00	0.0	0.0	0.0
11.00	0.0	0.0	0.0
12.00	0.0	0.0	0.0
13.00	0.0	0.0	0.0
14.00	0.0	0.0	0.0
15.00	0.0	0.0	0.0
16.00	0.0	0.0	0.0
17.00	0.0	0.0	0.0

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                      *
**************************************************
```

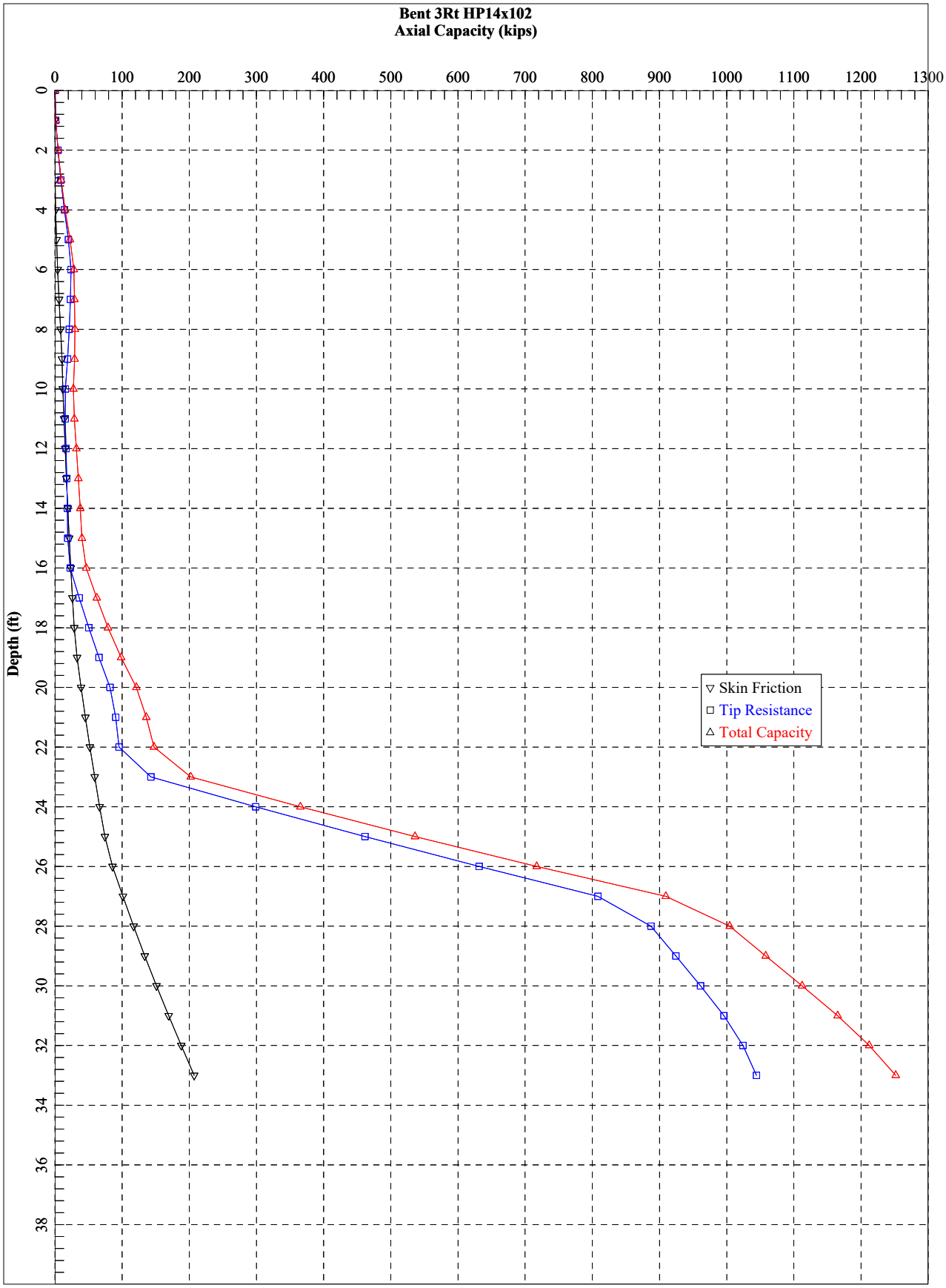
T-Z CURVE NO.	NO. OF POINTS	DEPTH TO CURVE FT.	LOAD TRANSFER PSI	PILE MOVEMENT IN.
1	10	0.0000E+00		
			0.0000E+00	0.0000E+00
			0.9961E-01	0.1000E-01
			0.1992E+00	0.2000E-01
			0.3984E+00	0.4000E-01
			0.5977E+00	0.6000E-01
			0.7969E+00	0.8000E-01
			0.8965E+00	0.9000E-01
			0.9961E+00	0.1000E+00
			0.9961E+00	0.5000E+00
			0.9961E+00	0.2000E+01
2	10	0.3525E+01		
			0.0000E+00	0.0000E+00
			0.2656E+00	0.1000E-01
			0.5312E+00	0.2000E-01
			0.1062E+01	0.4000E-01
			0.1594E+01	0.6000E-01
			0.2125E+01	0.8000E-01
			0.2391E+01	0.9000E-01
			0.2656E+01	0.1000E+00
			0.2656E+01	0.5000E+00
			0.2656E+01	0.2000E+01
3	10	0.6958E+01		
			0.0000E+00	0.0000E+00
			0.5162E+00	0.1000E-01
			0.1032E+01	0.2000E-01
			0.2065E+01	0.4000E-01
			0.3097E+01	0.6000E-01
			0.4130E+01	0.8000E-01
			0.4646E+01	0.9000E-01
			0.5162E+01	0.1000E+00
			0.5162E+01	0.5000E+00
			0.5162E+01	0.2000E+01
4	10	0.7000E+01		
			0.0000E+00	0.0000E+00
			0.6935E+00	0.1000E-01
			0.1387E+01	0.2000E-01
			0.2774E+01	0.4000E-01
			0.4161E+01	0.6000E-01
			0.5548E+01	0.8000E-01
			0.6241E+01	0.9000E-01
			0.6935E+01	0.1000E+00
			0.6935E+01	0.5000E+00
			0.6935E+01	0.2000E+01
5	10	0.1453E+02		
			0.0000E+00	0.0000E+00
			0.1426E+01	0.1000E-01
			0.2852E+01	0.2000E-01
			0.5705E+01	0.4000E-01
			0.8557E+01	0.6000E-01
			0.1141E+02	0.8000E-01
			0.1284E+02	0.9000E-01
			0.1426E+02	0.1000E+00
			0.1426E+02	0.5000E+00
			0.1426E+02	0.2000E+01
6	10	0.2196E+02		
			0.0000E+00	0.0000E+00
			0.1574E+01	0.1000E-01

0.3148E+01	0.2000E-01
0.6296E+01	0.4000E-01
0.9443E+01	0.6000E-01
0.1259E+02	0.8000E-01
0.1416E+02	0.9000E-01
0.1574E+02	0.1000E+00
0.1574E+02	0.5000E+00
0.1574E+02	0.2000E+01

TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00
0.3808E+02	0.9167E-02
0.7615E+02	0.1833E-01
0.1523E+03	0.3667E-01
0.3046E+03	0.2383E+00
0.4569E+03	0.7701E+00
0.5483E+03	0.1338E+01
0.6092E+03	0.1833E+01
0.6092E+03	0.2750E+01
0.6092E+03	0.3667E+01

LOAD VERSUS SETTLEMENT CURVE
****

TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.5141E+00	0.1163E-03	0.4153E+00	0.1000E-03
0.5141E+01	0.1163E-02	0.4153E+01	0.1000E-02
0.2570E+02	0.5816E-02	0.2077E+02	0.5000E-02
0.5141E+02	0.1163E-01	0.4153E+02	0.1000E-01
0.2114E+03	0.5662E-01	0.1624E+03	0.5000E-01
0.2944E+03	0.1089E+00	0.2001E+03	0.1000E+00
0.4739E+03	0.5150E+00	0.3796E+03	0.5000E+00
0.5882E+03	0.1019E+01	0.4939E+03	0.1000E+01
0.7035E+03	0.2023E+01	0.6092E+03	0.2000E+01


Bent 3Rt HP14x102
Axial Capacity (kips)
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
Depth (ft)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
Skin Friction
Tip Resistance
Total Capacity

```
=========================================================================

                 APILE for Windows, Version 2015.7.5

                  Serial Number :  139694124

                  A Program for Analyzing the Axial Capacity
                  and Short-term Settlement of Driven Piles
                            under Axial Loading.
                (c) Copyright ENSOFT, Inc., 1987-2015
                      All Rights Reserved

=========================================================================


This program is licensed to :

Moreland Altobelli Associates
Duluth, GA

Path to file locations      : C:\Users\yshao\Desktop\Yong Shao GDOT\TEMP\McGinnis Ferry\BFI\APILE\
Name of input data file     : Bent3Rt.ap7d
Name of output file         : Bent3Rt.ap7o
Name of plot output file    : Bent3Rt.ap7p

-------------------------------------------------------------------------
                     Time and Date of Analysis
-------------------------------------------------------------------------

          Date:  October 21, 2021     Time:  23:49:56



1
     *********************
     * INPUT INFORMATION *
     *********************



     Bent 3 Rt: HP14x102

     DESIGNER   : YCS

     JOB NUMBER : PI 0004634


     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)
     - API RP 2A (American Petroleum Institute)


     TYPE OF LOADING :
     - COMPRESSION


     PILE TYPE :

     H-Pile/Steel Pile
```

```
DATA FOR AXIAL STIFFNESS :

- MODULUS OF ELASTICITY     = 0.290E+08 PSI
- CROSS SECTION AREA        =    207.20 IN2


NONCIRCULAR PILE PROPERTIES :

- TOTAL PILE LENGTH, TL     =     33.00 FT.
- PILE STICKUP LENGTH, PSL  =      0.00 FT.
- ZERO FRICTION LENGTH, ZFL =      0.00 FT.
- PERIMETER OF PILE         =     57.60 IN.
- TIP AREA OF PILE          =    207.20 IN2
- INCREMENT OF PILE LENGTH
  USED IN COMPUTATION       =      1.00 FT.



SOIL INFORMATIONS :



                  LATERAL    EFFECTIVE    FRICTION   BEARING
          SOIL    EARTH      UNIT         ANGLE      CAPACITY
 DEPTH    TYPE    PRESSURE   WEIGHT       DEGREES    FACTOR
  FT.                        LB/CF
   0.00   SAND      0.00        47.60        26.00      0.00
   3.00   SAND      0.00        47.60        26.00      0.00
   3.00   SAND      0.00        62.60        36.00      0.00
   8.00   SAND      0.00        62.60        36.00      0.00
   8.00   SAND      0.00        52.60        30.00      0.00
  18.00   SAND      0.00        52.60        30.00      0.00
  18.00   SAND      0.00        62.60        36.00      0.00
  25.00   SAND      0.00        62.60        36.00      0.00
  25.00   SAND      0.00        67.60        45.00      0.00
  40.00   SAND      0.00        67.60        45.00      0.00



MAXIMUM   MAXIMUM   UNDISTURB  REMOLDED
UNIT      UNIT      SHEAR      SHEAR     BLOW   UNIT SKIN  UNIT END
FRICTION  BEARING   STRENGTH   STRENGTH  COUNT  FRICTION   BEARING
  KSF       KSF        KSF       KSF                KSF       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   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.



         LRFD FACTOR  LRFD FACTOR
          ON UNIT      ON UNIT
 DEPTH    FRICTION     BEARING
  FT.
   0.00    1.000       1.000
   3.00    1.000       1.000
   3.00    1.000       1.000
   8.00    1.000       1.000
   8.00    1.000       1.000
```

18.00	1.000	1.000
18.00	1.000	1.000
25.00	1.000	1.000
25.00	1.000	1.000
40.00	1.000	1.000

DEPTH FT.	PLASTIC INDEX PI %	YIELD STRESS RATIO	Qc FROM CPT KSF
0.00	0.00	0.00	0.000E+00
3.00	0.00	0.00	0.000E+00
3.00	0.00	0.00	0.000E+00
8.00	0.00	0.00	0.000E+00
8.00	0.00	0.00	0.000E+00
18.00	0.00	0.00	0.000E+00
18.00	0.00	0.00	0.000E+00
25.00	0.00	0.00	0.000E+00
25.00	0.00	0.00	0.000E+00
40.00	0.00	0.00	0.000E+00

1

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

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

	PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP	
Btm of Ftg. Ele. 985'	0.00	0.0	0.3	0.3	
	1.00	0.0	1.3	1.3	
	2.00	0.2	4.5	4.7	
	3.00	0.4	8.8	9.3	
	4.00	1.1	14.1	15.2	
	5.00	2.4	20.2	22.6	
	6.00	4.1	24.0	28.2	
	7.00	6.1	23.1	29.2	
	8.00	8.5	21.3	29.8	
	9.00	10.5	18.8	29.3	
	10.00	11.9	15.5	27.5	
	11.00	13.5	15.4	28.9	
	12.00	15.3	16.6	31.9	
	13.00	17.2	17.7	34.9	
	14.00	19.2	18.5	37.7	
	15.00	21.4	19.0	40.3	
	16.00	23.7	22.8	46.5	
	17.00	26.2	36.1	62.2	
	18.00	28.8	50.4	79.1	
	19.00	33.0	65.7	98.7	
	20.00	39.0	82.1	121.2	
	21.00	45.4	90.5	136.0	
	22.00	52.1	95.4	147.5	
Scour line Ele. 962'	23.00	59.2	143.0	202.2	Rscour = 59.2 kips
	24.00	66.6	298.8	365.4	
	25.00	74.4	461.6	536.0	
	26.00	85.8	631.4	717.2	
	27.00	101.2	808.2	909.4	
	28.00	117.2	887.3	1004.5	

	29.00	133.8	924.3	1058.1
	30.00	151.2	961.1	1112.3
	31.00	169.3	996.0	1165.2
	32.00	188.0	1024.2	1212.2
Min. & Est. Tip 952' →	33.00	207.4	1044.4	1251.7

Rndr = 308.2kips / 0.65 = 474 kips

Pilot hole needed.

```
**********************
*  API RP-2A (1994)  *
**********************
```

PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	0.0	0.0
1.00	0.0	0.0	0.0
2.00	0.0	0.0	0.0
3.00	0.0	0.0	0.0
4.00	0.0	0.0	0.0
5.00	0.0	0.0	0.0
6.00	0.0	0.0	0.0
7.00	0.0	0.0	0.0
8.00	0.0	0.0	0.0
9.00	0.0	0.0	0.0
10.00	0.0	0.0	0.0
11.00	0.0	0.0	0.0
12.00	0.0	0.0	0.0
13.00	0.0	0.0	0.0
14.00	0.0	0.0	0.0
15.00	0.0	0.0	0.0
16.00	0.0	0.0	0.0
17.00	0.0	0.0	0.0
18.00	0.0	0.0	0.0
19.00	0.0	0.0	0.0
20.00	0.0	0.0	0.0
21.00	0.0	0.0	0.0
22.00	0.0	0.0	0.0
23.00	0.0	0.0	0.0
24.00	0.0	0.0	0.0
25.00	0.0	0.0	0.0
26.00	0.0	0.0	0.0
27.00	0.0	0.0	0.0
28.00	0.0	0.0	0.0
29.00	0.0	0.0	0.0
30.00	0.0	0.0	0.0
31.00	0.0	0.0	0.0
32.00	0.0	0.0	0.0
33.00	0.0	0.0	0.0

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

			0.1950E-01	0.1000E-01
			0.3900E-01	0.2000E-01
			0.7800E-01	0.4000E-01
			0.1170E+00	0.6000E-01
			0.1560E+00	0.8000E-01
			0.1755E+00	0.9000E-01
			0.1950E+00	0.1000E+00
			0.1950E+00	0.5000E+00
			0.1950E+00	0.2000E+01
2	10	0.1525E+01		
			0.0000E+00	0.0000E+00
			0.2600E-01	0.1000E-01
			0.5200E-01	0.2000E-01
			0.1040E+00	0.4000E-01
			0.1560E+00	0.6000E-01
			0.2080E+00	0.8000E-01
			0.2340E+00	0.9000E-01
			0.2600E+00	0.1000E+00
			0.2600E+00	0.5000E+00
			0.2600E+00	0.2000E+01
3	10	0.2958E+01		
			0.0000E+00	0.0000E+00
			0.6756E-01	0.1000E-01
			0.1351E+00	0.2000E-01
			0.2702E+00	0.4000E-01
			0.4053E+00	0.6000E-01
			0.5405E+00	0.8000E-01
			0.6080E+00	0.9000E-01
			0.6756E+00	0.1000E+00
			0.6756E+00	0.5000E+00
			0.6756E+00	0.2000E+01
4	10	0.3000E+01		
			0.0000E+00	0.0000E+00
			0.1471E+00	0.1000E-01
			0.2942E+00	0.2000E-01
			0.5884E+00	0.4000E-01
			0.8825E+00	0.6000E-01
			0.1177E+01	0.8000E-01
			0.1324E+01	0.9000E-01
			0.1471E+01	0.1000E+00
			0.1471E+01	0.5000E+00
			0.1471E+01	0.2000E+01
5	10	0.5525E+01		
			0.0000E+00	0.0000E+00
			0.2676E+00	0.1000E-01
			0.5351E+00	0.2000E-01
			0.1070E+01	0.4000E-01
			0.1605E+01	0.6000E-01
			0.2140E+01	0.8000E-01
			0.2408E+01	0.9000E-01
			0.2676E+01	0.1000E+00
			0.2676E+01	0.5000E+00
			0.2676E+01	0.2000E+01
6	10	0.7958E+01		
			0.0000E+00	0.0000E+00
			0.3142E+00	0.1000E-01
			0.6283E+00	0.2000E-01
			0.1257E+01	0.4000E-01
			0.1885E+01	0.6000E-01
			0.2513E+01	0.8000E-01
			0.2827E+01	0.9000E-01
			0.3142E+01	0.1000E+00
			0.3142E+01	0.5000E+00
			0.3142E+01	0.2000E+01
7	10	0.8000E+01		
			0.0000E+00	0.0000E+00
			0.2479E+00	0.1000E-01
			0.4958E+00	0.2000E-01
			0.9916E+00	0.4000E-01

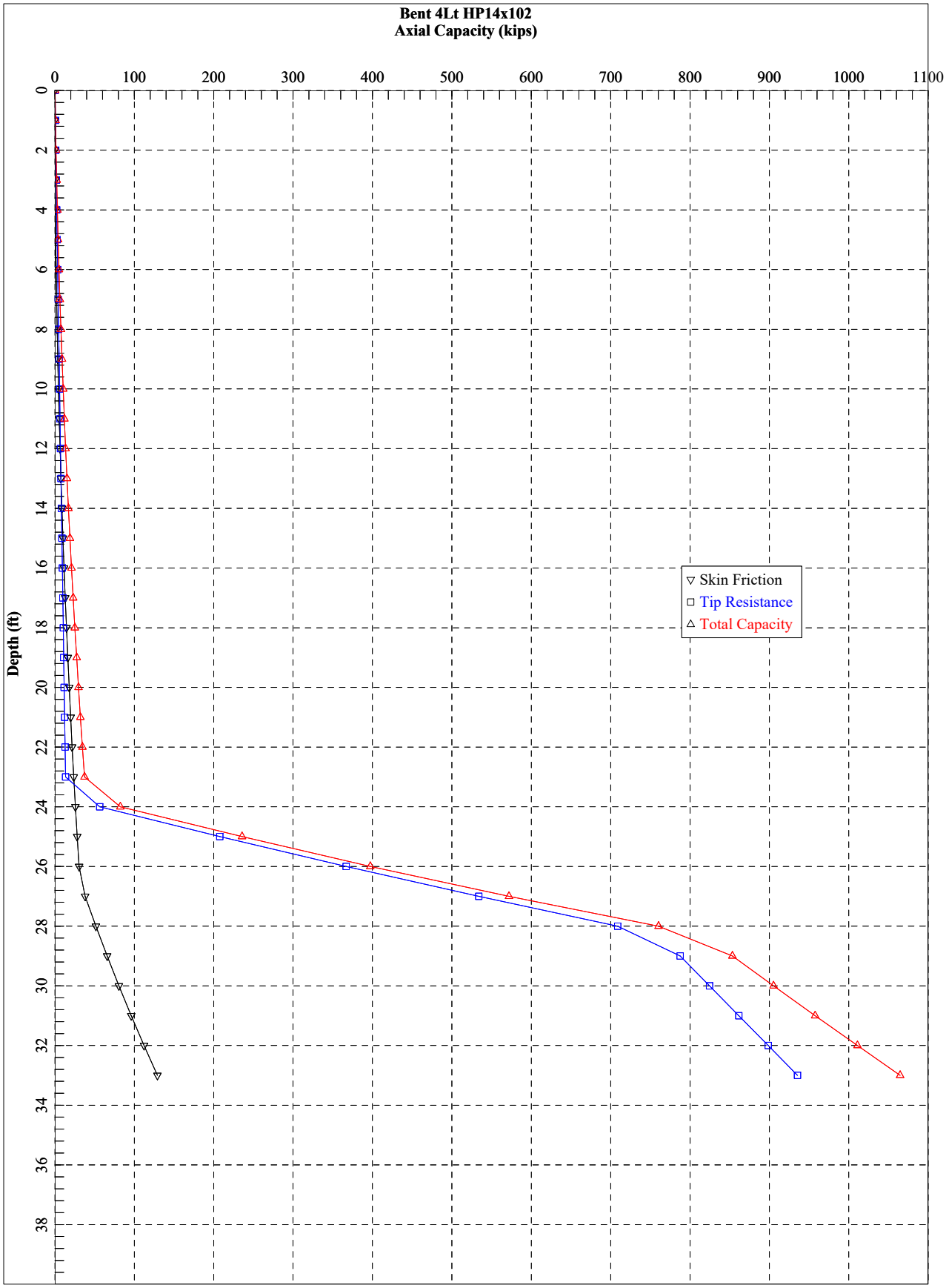
			0.1487E+01	0.6000E-01
			0.1983E+01	0.8000E-01
			0.2231E+01	0.9000E-01
			0.2479E+01	0.1000E+00
			0.2479E+01	0.5000E+00
			0.2479E+01	0.2000E+01
8	10	0.1303E+02		
			0.0000E+00	0.0000E+00
			0.3044E+00	0.1000E-01
			0.6089E+00	0.2000E-01
			0.1218E+01	0.4000E-01
			0.1827E+01	0.6000E-01
			0.2435E+01	0.8000E-01
			0.2740E+01	0.9000E-01
			0.3044E+01	0.1000E+00
			0.3044E+01	0.5000E+00
			0.3044E+01	0.2000E+01
9	10	0.1796E+02		
			0.0000E+00	0.0000E+00
			0.4967E+00	0.1000E-01
			0.9934E+00	0.2000E-01
			0.1987E+01	0.4000E-01
			0.2980E+01	0.6000E-01
			0.3974E+01	0.8000E-01
			0.4470E+01	0.9000E-01
			0.4967E+01	0.1000E+00
			0.4967E+01	0.5000E+00
			0.4967E+01	0.2000E+01
10	10	0.1800E+02		
			0.0000E+00	0.0000E+00
			0.7435E+00	0.1000E-01
			0.1487E+01	0.2000E-01
			0.2974E+01	0.4000E-01
			0.4461E+01	0.6000E-01
			0.5948E+01	0.8000E-01
			0.6691E+01	0.9000E-01
			0.7435E+01	0.1000E+00
			0.7435E+01	0.5000E+00
			0.7435E+01	0.2000E+01
11	10	0.2153E+02		
			0.0000E+00	0.0000E+00
			0.9972E+00	0.1000E-01
			0.1994E+01	0.2000E-01
			0.3989E+01	0.4000E-01
			0.5983E+01	0.6000E-01
			0.7978E+01	0.8000E-01
			0.8975E+01	0.9000E-01
			0.9972E+01	0.1000E+00
			0.9972E+01	0.5000E+00
			0.9972E+01	0.2000E+01
12	10	0.2496E+02		
			0.0000E+00	0.0000E+00
			0.1391E+01	0.1000E-01
			0.2782E+01	0.2000E-01
			0.5564E+01	0.4000E-01
			0.8346E+01	0.6000E-01
			0.1113E+02	0.8000E-01
			0.1252E+02	0.9000E-01
			0.1391E+02	0.1000E+00
			0.1391E+02	0.5000E+00
			0.1391E+02	0.2000E+01
13	10	0.2500E+02		
			0.0000E+00	0.0000E+00
			0.1937E+01	0.1000E-01
			0.3874E+01	0.2000E-01
			0.7749E+01	0.4000E-01
			0.1162E+02	0.6000E-01
			0.1550E+02	0.8000E-01
			0.1744E+02	0.9000E-01

			0.1937E+02	0.1000E+00
			0.1937E+02	0.5000E+00
			0.1937E+02	0.2000E+01
14	10	0.3253E+02		
			0.0000E+00	0.0000E+00
			0.2807E+01	0.1000E-01
			0.5614E+01	0.2000E-01
			0.1123E+02	0.4000E-01
			0.1684E+02	0.6000E-01
			0.2246E+02	0.8000E-01
			0.2526E+02	0.9000E-01
			0.2807E+02	0.1000E+00
			0.2807E+02	0.5000E+00
			0.2807E+02	0.2000E+01
15	10	0.3996E+02		
			0.0000E+00	0.0000E+00
			0.2807E+01	0.1000E-01
			0.5614E+01	0.2000E-01
			0.1123E+02	0.4000E-01
			0.1684E+02	0.6000E-01
			0.2246E+02	0.8000E-01
			0.2526E+02	0.9000E-01
			0.2807E+02	0.1000E+00
			0.2807E+02	0.5000E+00
			0.2807E+02	0.2000E+01

TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00
0.6527E+02	0.9167E-02
0.1305E+03	0.1833E-01
0.2611E+03	0.3667E-01
0.5222E+03	0.2383E+00
0.7833E+03	0.7701E+00
0.9399E+03	0.1338E+01
0.1044E+04	0.1833E+01
0.1044E+04	0.2750E+01
0.1044E+04	0.3667E+01

LOAD VERSUS SETTLEMENT CURVE
****

TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.9523E+00	0.1585E-03	0.7120E+00	0.1000E-03
0.9523E+01	0.1585E-02	0.7120E+01	0.1000E-02
0.4762E+02	0.7924E-02	0.3560E+02	0.5000E-02
0.9523E+02	0.1585E-01	0.7120E+02	0.1000E-01
0.3966E+03	0.7406E-01	0.2783E+03	0.5000E-01
0.5567E+03	0.1332E+00	0.3431E+03	0.1000E+00
0.8643E+03	0.5535E+00	0.6507E+03	0.5000E+00
0.1060E+04	0.1066E+01	0.8467E+03	0.1000E+01
0.1258E+04	0.2079E+01	0.1044E+04	0.2000E+01


Bent 4Lt HP14x102
Axial Capacity (kips)
0
100
200
300
400
500
600
700
800
900
1000
1100
Depth (ft)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
Skin Friction
Tip Resistance
Total Capacity

```
=========================================================================

                 APILE for Windows, Version 2015.7.5

                  Serial Number :  139694124

                  A Program for Analyzing the Axial Capacity
                  and Short-term Settlement of Driven Piles
                            under Axial Loading.
                (c) Copyright ENSOFT, Inc., 1987-2015
                      All Rights Reserved

=========================================================================


This program is licensed to :

Moreland Altobelli Associates
Duluth, GA

Path to file locations      : C:\Users\yshao\Desktop\Yong Shao GDOT\TEMP\McGinnis Ferry\BFI\APILE\
Name of input data file     : Bent4Lt.ap7d
Name of output file         : Bent4Lt.ap7o
Name of plot output file    : Bent4Lt.ap7p

-------------------------------------------------------------------------
                     Time and Date of Analysis
-------------------------------------------------------------------------

          Date:  October 21, 2021     Time:  23:59:51



1
     *********************
     * INPUT INFORMATION *
     *********************



     Bent 4 Lt: HP14x102

     DESIGNER   : YCS

     JOB NUMBER : PI 0004634


     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)
     - API RP 2A (American Petroleum Institute)


     TYPE OF LOADING :
     - COMPRESSION


     PILE TYPE :

     H-Pile/Steel Pile
```

DATA FOR AXIAL STIFFNESS :

- MODULUS OF ELASTICITY = 0.290E+08 PSI
- CROSS SECTION AREA = 207.20 IN2

NONCIRCULAR PILE PROPERTIES :

- TOTAL PILE LENGTH, TL = 33.00 FT.
- PILE STICKUP LENGTH, PSL = 0.00 FT.
- ZERO FRICTION LENGTH, ZFL = 0.00 FT.
- PERIMETER OF PILE = 57.60 IN.
- TIP AREA OF PILE = 207.20 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	47.60	26.00	0.00
26.00	SAND	0.00	47.60	26.00	0.00
26.00	SAND	0.00	67.60	45.00	0.00
38.00	SAND	0.00	67.60	45.00	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

* 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
26.00	1.000	1.000
26.00	1.000	1.000
38.00	1.000	1.000

DEPTH FT.	PLASTIC INDEX PI %	YIELD STRESS RATIO	Qc FROM CPT KSF
0.00	0.00	0.00	0.000E+00
26.00	0.00	0.00	0.000E+00
26.00	0.00	0.00	0.000E+00
38.00	0.00	0.00	0.000E+00

1

```
**********************
* COMPUTATION RESULT *
**********************
```

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

	PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP	
Btm of Ftg. Ele. 984' →	0.00	0.0	0.3	0.3	
	1.00	0.0	0.6	0.7	
	2.00	0.2	1.1	1.3	
	3.00	0.4	1.8	2.2	
	4.00	0.7	2.3	3.1	
	5.00	1.1	2.9	4.1	
	6.00	1.6	3.5	5.1	
	7.00	2.2	4.1	6.3	
	8.00	2.9	4.7	7.6	
	9.00	3.6	5.3	8.9	
	10.00	4.5	5.9	10.4	
	11.00	5.4	6.4	11.9	
	12.00	6.5	7.0	13.5	
	13.00	7.6	7.6	15.2	
	14.00	8.8	8.2	17.0	
	15.00	10.1	8.8	18.9	
	16.00	11.5	9.4	20.9	
	17.00	13.0	10.0	23.0	
	18.00	14.6	10.6	25.1	
	19.00	16.2	11.1	27.4	
	20.00	18.0	11.7	29.7	
	21.00	19.8	12.3	32.1	
Scour line Ele. 962' →	22.00	21.7	12.9	34.6	Rscour = 21.7 kips
	23.00	23.8	13.5	37.3	
	24.00	25.9	56.5	82.4	
	25.00	28.1	207.7	235.8	
	26.00	30.4	366.8	397.2	
	27.00	38.1	533.9	572.0	
	28.00	51.6	708.8	760.4	Rndr = 308.2kips / 0.65 = 474 kips
	29.00	65.8	787.6	853.3	
	30.00	80.6	824.5	905.1	
Min. & Est. Tip 953' →	31.00	96.1	861.5	957.6	
	32.00	112.3	898.5	1010.8	
	33.00	129.2	935.4	1064.6	Pilot hole needed

```
**********************
*  API RP-2A (1994)  *
**********************
```

PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	0.0	0.0
1.00	0.0	0.0	0.0
2.00	0.0	0.0	0.0
3.00	0.0	0.0	0.0
4.00	0.0	0.0	0.0
5.00	0.0	0.0	0.0
6.00	0.0	0.0	0.0
7.00	0.0	0.0	0.0
8.00	0.0	0.0	0.0

9.00	0.0	0.0	0.0
10.00	0.0	0.0	0.0
11.00	0.0	0.0	0.0
12.00	0.0	0.0	0.0
13.00	0.0	0.0	0.0
14.00	0.0	0.0	0.0
15.00	0.0	0.0	0.0
16.00	0.0	0.0	0.0
17.00	0.0	0.0	0.0
18.00	0.0	0.0	0.0
19.00	0.0	0.0	0.0
20.00	0.0	0.0	0.0
21.00	0.0	0.0	0.0
22.00	0.0	0.0	0.0
23.00	0.0	0.0	0.0
24.00	0.0	0.0	0.0
25.00	0.0	0.0	0.0
26.00	0.0	0.0	0.0
27.00	0.0	0.0	0.0
28.00	0.0	0.0	0.0
29.00	0.0	0.0	0.0
30.00	0.0	0.0	0.0
31.00	0.0	0.0	0.0
32.00	0.0	0.0	0.0
33.00	0.0	0.0	0.0

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
			0.1950E-01	0.1000E-01
			0.3900E-01	0.2000E-01
			0.7800E-01	0.4000E-01
			0.1170E+00	0.6000E-01
			0.1560E+00	0.8000E-01
			0.1755E+00	0.9000E-01
			0.1950E+00	0.1000E+00
			0.1950E+00	0.5000E+00
			0.1950E+00	0.2000E+01
2	10	0.1303E+02		
			0.0000E+00	0.0000E+00
			0.1820E+00	0.1000E-01
			0.3640E+00	0.2000E-01
			0.7280E+00	0.4000E-01
			0.1092E+01	0.6000E-01
			0.1456E+01	0.8000E-01
			0.1638E+01	0.9000E-01
			0.1820E+01	0.1000E+00
			0.1820E+01	0.5000E+00
			0.1820E+01	0.2000E+01
3	10	0.2596E+02		
			0.0000E+00	0.0000E+00
			0.7256E+00	0.1000E-01
			0.1451E+01	0.2000E-01

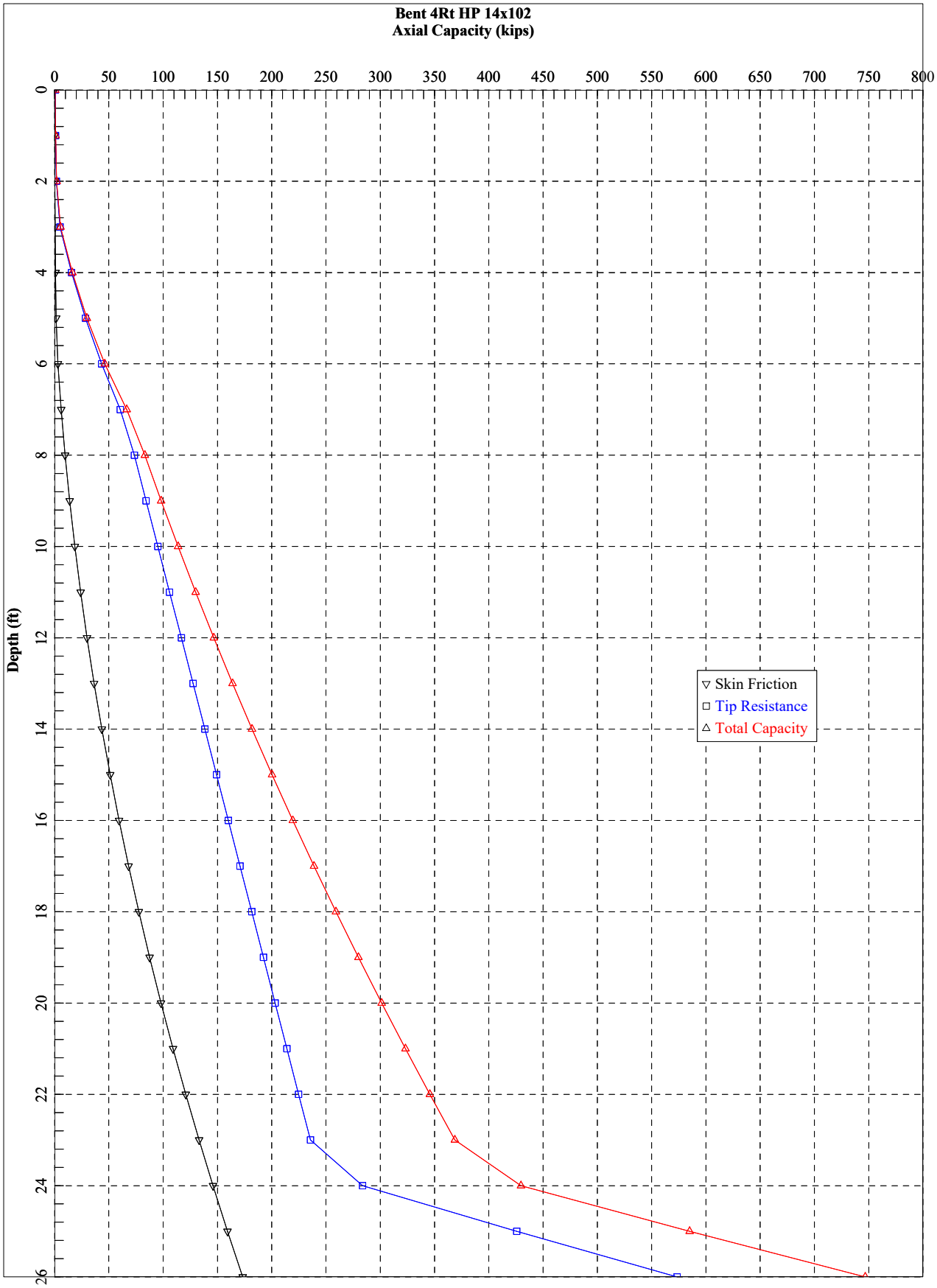
			0.2902E+01	0.4000E-01
			0.4354E+01	0.6000E-01
			0.5805E+01	0.8000E-01
			0.6530E+01	0.9000E-01
			0.7256E+01	0.1000E+00
			0.7256E+01	0.5000E+00
			0.7256E+01	0.2000E+01
4	10	0.2600E+02		
			0.0000E+00	0.0000E+00
			0.1535E+01	0.1000E-01
			0.3070E+01	0.2000E-01
			0.6141E+01	0.4000E-01
			0.9211E+01	0.6000E-01
			0.1228E+02	0.8000E-01
			0.1382E+02	0.9000E-01
			0.1535E+02	0.1000E+00
			0.1535E+02	0.5000E+00
			0.1535E+02	0.2000E+01
5	10	0.3203E+02		
			0.0000E+00	0.0000E+00
			0.2443E+01	0.1000E-01
			0.4886E+01	0.2000E-01
			0.9772E+01	0.4000E-01
			0.1466E+02	0.6000E-01
			0.1954E+02	0.8000E-01
			0.2199E+02	0.9000E-01
			0.2443E+02	0.1000E+00
			0.2443E+02	0.5000E+00
			0.2443E+02	0.2000E+01
6	10	0.3796E+02		
			0.0000E+00	0.0000E+00
			0.2443E+01	0.1000E-01
			0.4886E+01	0.2000E-01
			0.9772E+01	0.4000E-01
			0.1466E+02	0.6000E-01
			0.1954E+02	0.8000E-01
			0.2199E+02	0.9000E-01
			0.2443E+02	0.1000E+00
			0.2443E+02	0.5000E+00
			0.2443E+02	0.2000E+01

TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00
0.5846E+02	0.9167E-02
0.1169E+03	0.1833E-01
0.2339E+03	0.3667E-01
0.4677E+03	0.2383E+00
0.7016E+03	0.7701E+00
0.8419E+03	0.1338E+01
0.9354E+03	0.1833E+01
0.9354E+03	0.2750E+01
0.9354E+03	0.3667E+01

LOAD VERSUS SETTLEMENT CURVE
****

TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.7994E+00	0.1502E-03	0.6377E+00	0.1000E-03
0.7994E+01	0.1502E-02	0.6377E+01	0.1000E-02
0.3997E+02	0.7512E-02	0.3189E+02	0.5000E-02

0.7994E+02	0.1502E-01	0.6377E+02	0.1000E-01
0.3292E+03	0.7050E-01	0.2493E+03	0.5000E-01
0.4553E+03	0.1279E+00	0.3073E+03	0.1000E+00
0.7308E+03	0.5461E+00	0.5828E+03	0.5000E+00
0.9063E+03	0.1058E+01	0.7583E+03	0.1000E+01
0.1083E+04	0.2069E+01	0.9354E+03	0.2000E+01


Bent 4Rt HP 14x102
Axial Capacity (kips)
0
50
100
150
200
250
300
350
400
450
500
550
600
650
700
750
800
Depth (ft)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
Skin Friction
Tip Resistance
Total Capacity

```
=========================================================================

                 APILE for Windows, Version 2015.7.5

                  Serial Number :  139694124

                  A Program for Analyzing the Axial Capacity
                  and Short-term Settlement of Driven Piles
                            under Axial Loading.
                (c) Copyright ENSOFT, Inc., 1987-2015
                      All Rights Reserved

=========================================================================


This program is licensed to :

Moreland Altobelli Associates
Duluth, GA

Path to file locations      : C:\Users\yshao\Desktop\Yong Shao GDOT\TEMP\McGinnis Ferry\BFI\APILE\
Name of input data file     : Bent4Rt.ap7d
Name of output file         : Bent4Rt.ap7o
Name of plot output file    : Bent4Rt.ap7p

-------------------------------------------------------------------------
                     Time and Date of Analysis
-------------------------------------------------------------------------

          Date:  October 22, 2021     Time:  00:13:22



1
     *********************
     * INPUT INFORMATION *
     *********************



     Bent 4 Rt: HP14x102

     DESIGNER   : YCS

     JOB NUMBER : PI 0004634


     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)
     - API RP 2A (American Petroleum Institute)


     TYPE OF LOADING :
     - COMPRESSION


     PILE TYPE :

     H-Pile/Steel Pile
```

```
DATA FOR AXIAL STIFFNESS :

- MODULUS OF ELASTICITY     = 0.290E+08 PSI
- CROSS SECTION AREA        =    207.20 IN2


NONCIRCULAR PILE PROPERTIES :

- TOTAL PILE LENGTH, TL     =     26.00 FT.
- PILE STICKUP LENGTH, PSL  =      0.00 FT.
- ZERO FRICTION LENGTH, ZFL =      0.00 FT.
- PERIMETER OF PILE         =     57.60 IN.
- TIP AREA OF PILE          =    207.20 IN2
- INCREMENT OF PILE LENGTH
  USED IN COMPUTATION       =      1.00 FT.



SOIL INFORMATIONS :



                  LATERAL    EFFECTIVE    FRICTION   BEARING
          SOIL    EARTH      UNIT         ANGLE      CAPACITY
 DEPTH    TYPE    PRESSURE   WEIGHT       DEGREES    FACTOR
  FT.                        LB/CF
   0.00   SAND      0.00        47.60        28.00      0.00
   5.00   SAND      0.00        47.60        28.00      0.00
   5.00   SAND      0.00        62.60        40.00      0.00
  16.00   SAND      0.00        62.60        40.00      0.00
  16.00   SAND      0.00        62.60        40.00      0.00
  26.00   SAND      0.00        62.60        40.00      0.00
  26.00   SAND      0.00        67.60        45.00      0.00
  51.00   SAND      0.00        67.60        45.00      0.00



MAXIMUM   MAXIMUM   UNDISTURB  REMOLDED
UNIT      UNIT      SHEAR      SHEAR     BLOW   UNIT SKIN  UNIT END
FRICTION  BEARING   STRENGTH   STRENGTH  COUNT  FRICTION   BEARING
 KSF        KSF        KSF        KSF                KSF       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

* 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.



         LRFD FACTOR  LRFD FACTOR
          ON UNIT      ON UNIT
 DEPTH    FRICTION     BEARING
  FT.
   0.00    1.000       1.000
   5.00    1.000       1.000
   5.00    1.000       1.000
  16.00    1.000       1.000
  16.00    1.000       1.000
  26.00    1.000       1.000
  26.00    1.000       1.000
  51.00    1.000       1.000
```

DEPTH FT.	PLASTIC INDEX PI %	YIELD STRESS RATIO	Qc FROM CPT KSF
0.00	0.00	0.00	0.000E+00
5.00	0.00	0.00	0.000E+00
5.00	0.00	0.00	0.000E+00
16.00	0.00	0.00	0.000E+00
16.00	0.00	0.00	0.000E+00
26.00	0.00	0.00	0.000E+00
26.00	0.00	0.00	0.000E+00
51.00	0.00	0.00	0.000E+00

1

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

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

	PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP	
Btm of Ftg 984'	0.00	0.0	0.5	0.5	
	1.00	0.1	0.9	1.0	
	2.00	0.2	1.6	1.8	
	3.00	0.5	5.0	5.4	
	4.00	0.9	15.6	16.4	
	5.00	1.4	28.4	29.7	
	6.00	3.0	43.3	46.3	
	7.00	6.1	60.5	66.5	
	8.00	9.7	73.5	83.2	
	9.00	13.9	84.3	98.2	
	10.00	18.7	95.1	113.8	
	11.00	24.0	105.9	130.0	
	12.00	29.9	116.8	146.7	
	13.00	36.4	127.6	164.0	
	14.00	43.5	138.4	181.9	
	15.00	51.2	149.2	200.3	
Scour line Ele. 968'	16.00	59.4	160.0	219.4	Rscour = 59.4 kips
	17.00	68.2	170.8	239.0	
	18.00	77.6	181.6	259.2	
	19.00	87.5	192.4	279.9	
	20.00	98.0	203.2	301.3	
	21.00	109.1	214.0	323.2	
	22.00	120.8	224.8	345.7	
	23.00	133.1	235.7	368.7	Rndr = 308.2 kips / 0.65 = 474 kips
	24.00	145.9	283.7	429.6	
	25.00	159.3	425.7	585.0	
Min. & Est. Tip 958'	26.00	173.3	573.5	746.8	Pilot hole needed

****
* API RP-2A (1994) *
****

PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP

0.00	0.0	0.0	0.0
1.00	0.0	0.0	0.0
2.00	0.0	0.0	0.0
3.00	0.0	0.0	0.0
4.00	0.0	0.0	0.0
5.00	0.0	0.0	0.0
6.00	0.0	0.0	0.0
7.00	0.0	0.0	0.0
8.00	0.0	0.0	0.0
9.00	0.0	0.0	0.0
10.00	0.0	0.0	0.0
11.00	0.0	0.0	0.0
12.00	0.0	0.0	0.0
13.00	0.0	0.0	0.0
14.00	0.0	0.0	0.0
15.00	0.0	0.0	0.0
16.00	0.0	0.0	0.0
17.00	0.0	0.0	0.0
18.00	0.0	0.0	0.0
19.00	0.0	0.0	0.0
20.00	0.0	0.0	0.0
21.00	0.0	0.0	0.0
22.00	0.0	0.0	0.0
23.00	0.0	0.0	0.0
24.00	0.0	0.0	0.0
25.00	0.0	0.0	0.0
26.00	0.0	0.0	0.0

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
			0.2367E-01	0.1000E-01
			0.4734E-01	0.2000E-01
			0.9468E-01	0.4000E-01
			0.1420E+00	0.6000E-01
			0.1894E+00	0.8000E-01
			0.2130E+00	0.9000E-01
			0.2367E+00	0.1000E+00
			0.2367E+00	0.5000E+00
			0.2367E+00	0.2000E+01
2	10	0.2525E+01		
			0.0000E+00	0.0000E+00
			0.4734E-01	0.1000E-01
			0.9468E-01	0.2000E-01
			0.1894E+00	0.4000E-01
			0.2841E+00	0.6000E-01
			0.3787E+00	0.8000E-01
			0.4261E+00	0.9000E-01
			0.4734E+00	0.1000E+00
			0.4734E+00	0.5000E+00
			0.4734E+00	0.2000E+01
3	10	0.4958E+01		
			0.0000E+00	0.0000E+00

			0.1551E+00	0.1000E-01
			0.3102E+00	0.2000E-01
			0.6205E+00	0.4000E-01
			0.9307E+00	0.6000E-01
			0.1241E+01	0.8000E-01
			0.1396E+01	0.9000E-01
			0.1551E+01	0.1000E+00
			0.1551E+01	0.5000E+00
			0.1551E+01	0.2000E+01
4	10	0.5000E+01		
			0.0000E+00	0.0000E+00
			0.3402E+00	0.1000E-01
			0.6803E+00	0.2000E-01
			0.1361E+01	0.4000E-01
			0.2041E+01	0.6000E-01
			0.2721E+01	0.8000E-01
			0.3062E+01	0.9000E-01
			0.3402E+01	0.1000E+00
			0.3402E+01	0.5000E+00
			0.3402E+01	0.2000E+01
5	10	0.1053E+02		
			0.0000E+00	0.0000E+00
			0.8155E+00	0.1000E-01
			0.1631E+01	0.2000E-01
			0.3262E+01	0.4000E-01
			0.4893E+01	0.6000E-01
			0.6524E+01	0.8000E-01
			0.7340E+01	0.9000E-01
			0.8155E+01	0.1000E+00
			0.8155E+01	0.5000E+00
			0.8155E+01	0.2000E+01
6	10	0.1596E+02		
			0.0000E+00	0.0000E+00
			0.1232E+01	0.1000E-01
			0.2463E+01	0.2000E-01
			0.4926E+01	0.4000E-01
			0.7389E+01	0.6000E-01
			0.9852E+01	0.8000E-01
			0.1108E+02	0.9000E-01
			0.1232E+02	0.1000E+00
			0.1232E+02	0.5000E+00
			0.1232E+02	0.2000E+01
7	10	0.1600E+02		
			0.0000E+00	0.0000E+00
			0.1315E+01	0.1000E-01
			0.2629E+01	0.2000E-01
			0.5259E+01	0.4000E-01
			0.7888E+01	0.6000E-01
			0.1052E+02	0.8000E-01
			0.1183E+02	0.9000E-01
			0.1315E+02	0.1000E+00
			0.1315E+02	0.5000E+00
			0.1315E+02	0.2000E+01
8	10	0.2103E+02		
			0.0000E+00	0.0000E+00
			0.1731E+01	0.1000E-01
			0.3461E+01	0.2000E-01
			0.6923E+01	0.4000E-01
			0.1038E+02	0.6000E-01
			0.1385E+02	0.8000E-01
			0.1558E+02	0.9000E-01
			0.1731E+02	0.1000E+00
			0.1731E+02	0.5000E+00
			0.1731E+02	0.2000E+01
9	10	0.2596E+02		
			0.0000E+00	0.0000E+00
			0.2022E+01	0.1000E-01
			0.4044E+01	0.2000E-01
			0.8088E+01	0.4000E-01

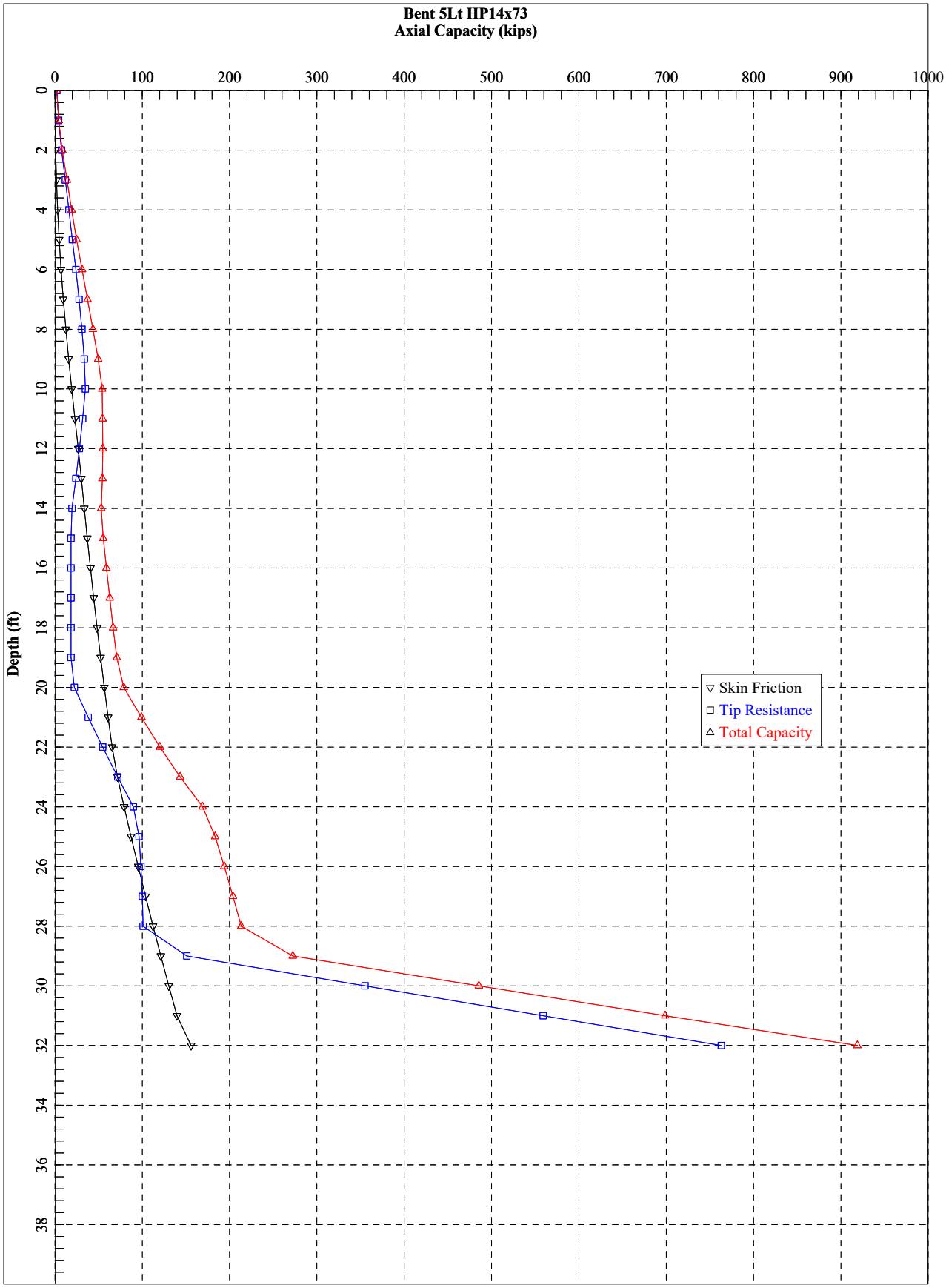
			0.1213E+02	0.6000E-01
			0.1618E+02	0.8000E-01
			0.1820E+02	0.9000E-01
			0.2022E+02	0.1000E+00
			0.2022E+02	0.5000E+00
			0.2022E+02	0.2000E+01
10	10	0.2600E+02		
			0.0000E+00	0.0000E+00
			0.2022E+01	0.1000E-01
			0.4044E+01	0.2000E-01
			0.8088E+01	0.4000E-01
			0.1213E+02	0.6000E-01
			0.1618E+02	0.8000E-01
			0.1820E+02	0.9000E-01
			0.2022E+02	0.1000E+00
			0.2022E+02	0.5000E+00
			0.2022E+02	0.2000E+01
11	10	0.3853E+02		
			0.0000E+00	0.0000E+00
			0.2022E+01	0.1000E-01
			0.4044E+01	0.2000E-01
			0.8088E+01	0.4000E-01
			0.1213E+02	0.6000E-01
			0.1618E+02	0.8000E-01
			0.1820E+02	0.9000E-01
			0.2022E+02	0.1000E+00
			0.2022E+02	0.5000E+00
			0.2022E+02	0.2000E+01
12	10	0.5096E+02		
			0.0000E+00	0.0000E+00
			0.2022E+01	0.1000E-01
			0.4044E+01	0.2000E-01
			0.8088E+01	0.4000E-01
			0.1213E+02	0.6000E-01
			0.1618E+02	0.8000E-01
			0.1820E+02	0.9000E-01
			0.2022E+02	0.1000E+00
			0.2022E+02	0.5000E+00
			0.2022E+02	0.2000E+01

TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00
0.3584E+02	0.9167E-02
0.7169E+02	0.1833E-01
0.1434E+03	0.3667E-01
0.2867E+03	0.2383E+00
0.4301E+03	0.7701E+00
0.5161E+03	0.1338E+01
0.5735E+03	0.1833E+01
0.5735E+03	0.2750E+01
0.5735E+03	0.3667E+01

LOAD VERSUS SETTLEMENT CURVE
****

TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.5846E+00	0.1271E-03	0.3910E+00	0.1000E-03
0.5846E+01	0.1271E-02	0.3910E+01	0.1000E-02
0.2923E+02	0.6353E-02	0.1955E+02	0.5000E-02
0.5846E+02	0.1271E-01	0.3910E+02	0.1000E-01

0.2488E+03	0.6130E-01	0.1528E+03	0.5000E-01
0.3691E+03	0.1162E+00	0.1884E+03	0.1000E+00
0.5380E+03	0.5250E+00	0.3573E+03	0.5000E+00
0.6456E+03	0.1031E+01	0.4649E+03	0.1000E+01
0.7542E+03	0.2036E+01	0.5735E+03	0.2000E+01


Bent 5Lt HP14x73
Axial Capacity (kips)
0
100
200
300
400
500
600
700
800
900
1000
Depth (ft)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
Skin Friction
Tip Resistance
Total Capacity

```
=========================================================================

                 APILE for Windows, Version 2015.7.5

                  Serial Number :  139694124

                  A Program for Analyzing the Axial Capacity
                  and Short-term Settlement of Driven Piles
                            under Axial Loading.
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Moreland Altobelli Associates
Duluth, GA

Path to file locations      : C:\Users\yshao\Desktop\Yong Shao GDOT\TEMP\McGinnis Ferry\BFI\APILE\
Name of input data file     : Bent5Lt.ap7d
Name of output file         : Bent5Lt.ap7o
Name of plot output file    : Bent5Lt.ap7p

-------------------------------------------------------------------------
                     Time and Date of Analysis
-------------------------------------------------------------------------

          Date:  October 22, 2021     Time:  10:09:36



1
     *********************
     * INPUT INFORMATION *
     *********************



     Bent 5 Lt: HP14x73

     DESIGNER   : YCS

     JOB NUMBER : PI 0004634


     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)
     - API RP 2A (American Petroleum Institute)


     TYPE OF LOADING :
     - COMPRESSION


     PILE TYPE :

     H-Pile/Steel Pile
```

```
DATA FOR AXIAL STIFFNESS :

- MODULUS OF ELASTICITY     = 0.290E+08 PSI
- CROSS SECTION AREA        =    198.50 IN2


NONCIRCULAR PILE PROPERTIES :

- TOTAL PILE LENGTH, TL     =     40.00 FT.
- PILE STICKUP LENGTH, PSL  =      8.00 FT.
- ZERO FRICTION LENGTH, ZFL =      0.00 FT.
- PERIMETER OF PILE         =     56.40 IN.
- TIP AREA OF PILE          =    198.50 IN2
- INCREMENT OF PILE LENGTH
  USED IN COMPUTATION       =      1.00 FT.



SOIL INFORMATIONS :



                  LATERAL    EFFECTIVE    FRICTION   BEARING
          SOIL    EARTH      UNIT         ANGLE      CAPACITY
 DEPTH    TYPE    PRESSURE   WEIGHT       DEGREES    FACTOR
  FT.                        LB/CF
   0.00   SAND      0.00       115.00        32.00      0.00
   8.00   SAND      0.00       115.00        32.00      0.00
   8.00   SAND      0.00        57.60        32.00      0.00
  12.00   SAND      0.00        57.60        32.00      0.00
  12.00   SAND      0.00        57.60        30.00      0.00
  22.00   SAND      0.00        57.60        30.00      0.00
  22.00   SAND      0.00        57.60        34.00      0.00
  31.00   SAND      0.00        57.60        34.00      0.00
  31.00   SAND      0.00        67.60        45.00      0.00
  40.00   SAND      0.00        67.60        45.00      0.00



MAXIMUM   MAXIMUM   UNDISTURB  REMOLDED
UNIT      UNIT      SHEAR      SHEAR     BLOW   UNIT SKIN  UNIT END
FRICTION  BEARING   STRENGTH   STRENGTH  COUNT  FRICTION   BEARING
  KSF       KSF        KSF       KSF               KSF       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   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.



         LRFD FACTOR  LRFD FACTOR
          ON UNIT      ON UNIT
 DEPTH    FRICTION     BEARING
  FT.
   0.00    1.000       1.000
   8.00    1.000       1.000
   8.00    1.000       1.000
  12.00    1.000       1.000
  12.00    1.000       1.000
```

22.00	1.000	1.000
22.00	1.000	1.000
31.00	1.000	1.000
31.00	1.000	1.000
40.00	1.000	1.000

DEPTH FT.	PLASTIC INDEX PI %	YIELD STRESS RATIO	Qc FROM CPT KSF
0.00	0.00	0.00	0.000E+00
8.00	0.00	0.00	0.000E+00
8.00	0.00	0.00	0.000E+00
12.00	0.00	0.00	0.000E+00
12.00	0.00	0.00	0.000E+00
22.00	0.00	0.00	0.000E+00
22.00	0.00	0.00	0.000E+00
31.00	0.00	0.00	0.000E+00
31.00	0.00	0.00	0.000E+00
40.00	0.00	0.00	0.000E+00

1

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

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

	PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP	
Btm of Cut Ele. 990' →	0.00	0.0	2.2	2.2	
	1.00	0.2	4.3	4.4	
	2.00	0.8	7.6	8.4	
	3.00	1.8	12.0	13.8	
	4.00	3.1	16.0	19.2	
	5.00	4.9	20.0	24.9	
	6.00	7.1	24.0	31.1	
	7.00	9.6	27.7	37.3	
	8.00	12.6	30.9	43.5	
Scour line Ele. 981' →	9.00	15.8	33.7	49.5	Rscour = 15.8 kips
	10.00	19.3	34.9	54.1	
	11.00	22.9	31.7	54.6	
	12.00	26.7	28.1	54.8	
	13.00	30.3	24.0	54.4	
	14.00	33.6	19.5	53.1	
	15.00	37.1	18.4	55.4	
	16.00	40.7	18.4	59.0	
	17.00	44.4	18.4	62.8	
	18.00	48.3	18.4	66.7	
	19.00	52.4	18.4	70.8	
	20.00	56.6	22.2	78.8	
	21.00	61.0	38.1	99.1	
Min. Tip Ele. 968' →	22.00	65.5	54.7	120.2	
	23.00	71.6	71.9	143.5	
	24.00	79.3	89.8	169.1	
	25.00	87.2	96.3	183.5	
	26.00	95.4	98.5	193.9	
	27.00	103.8	100.1	203.8	
	28.00	112.4	101.0	213.4	

Est. Tip Ele. 959'

Rndr = 220.4kips / 0.65 = 339 kips

29.00	121.3	151.1	272.4
30.00	130.4	355.1	485.5
31.00	139.8	559.1	698.9
32.00	155.9	763.0	918.9

```
**********************
*  API RP-2A (1994)  *
**********************
```

PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	0.0	0.0
1.00	0.0	0.0	0.0
2.00	0.0	0.0	0.0
3.00	0.0	0.0	0.0
4.00	0.0	0.0	0.0
5.00	0.0	0.0	0.0
6.00	0.0	0.0	0.0
7.00	0.0	0.0	0.0
8.00	0.0	0.0	0.0
9.00	0.0	0.0	0.0
10.00	0.0	0.0	0.0
11.00	0.0	0.0	0.0
12.00	0.0	0.0	0.0
13.00	0.0	0.0	0.0
14.00	0.0	0.0	0.0
15.00	0.0	0.0	0.0
16.00	0.0	0.0	0.0
17.00	0.0	0.0	0.0
18.00	0.0	0.0	0.0
19.00	0.0	0.0	0.0
20.00	0.0	0.0	0.0
21.00	0.0	0.0	0.0
22.00	0.0	0.0	0.0
23.00	0.0	0.0	0.0
24.00	0.0	0.0	0.0
25.00	0.0	0.0	0.0
26.00	0.0	0.0	0.0
27.00	0.0	0.0	0.0
28.00	0.0	0.0	0.0
29.00	0.0	0.0	0.0
30.00	0.0	0.0	0.0
31.00	0.0	0.0	0.0
32.00	0.0	0.0	0.0

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
			0.8714E-01	0.1000E-01
			0.1743E+00	0.2000E-01

```
                                        0.3486E+00      0.4000E-01
                                        0.5228E+00      0.6000E-01
                                        0.6971E+00      0.8000E-01
                                        0.7843E+00      0.9000E-01
                                        0.8714E+00      0.1000E+00
                                        0.8714E+00      0.5000E+00
                                        0.8714E+00      0.2000E+01
2          10      0.4025E+01
                                        0.0000E+00      0.0000E+00
                                        0.2905E+00      0.1000E-01
                                        0.5809E+00      0.2000E-01
                                        0.1162E+01      0.4000E-01
                                        0.1743E+01      0.6000E-01
                                        0.2324E+01      0.8000E-01
                                        0.2614E+01      0.9000E-01
                                        0.2905E+01      0.1000E+00
                                        0.2905E+01      0.5000E+00
                                        0.2905E+01      0.2000E+01
3          10      0.7958E+01
                                        0.0000E+00      0.0000E+00
                                        0.4575E+00      0.1000E-01
                                        0.9150E+00      0.2000E-01
                                        0.1830E+01      0.4000E-01
                                        0.2745E+01      0.6000E-01
                                        0.3660E+01      0.8000E-01
                                        0.4118E+01      0.9000E-01
                                        0.4575E+01      0.1000E+00
                                        0.4575E+01      0.5000E+00
                                        0.4575E+01      0.2000E+01
4          10      0.8000E+01
                                        0.0000E+00      0.0000E+00
                                        0.4938E+00      0.1000E-01
                                        0.9877E+00      0.2000E-01
                                        0.1975E+01      0.4000E-01
                                        0.2963E+01      0.6000E-01
                                        0.3951E+01      0.8000E-01
                                        0.4445E+01      0.9000E-01
                                        0.4938E+01      0.1000E+00
                                        0.4938E+01      0.5000E+00
                                        0.4938E+01      0.2000E+01
5          10      0.1003E+02
                                        0.0000E+00      0.0000E+00
                                        0.5520E+00      0.1000E-01
                                        0.1104E+01      0.2000E-01
                                        0.2208E+01      0.4000E-01
                                        0.3312E+01      0.6000E-01
                                        0.4416E+01      0.8000E-01
                                        0.4968E+01      0.9000E-01
                                        0.5520E+01      0.1000E+00
                                        0.5520E+01      0.5000E+00
                                        0.5520E+01      0.2000E+01
6          10      0.1196E+02
                                        0.0000E+00      0.0000E+00
                                        0.5476E+00      0.1000E-01
                                        0.1095E+01      0.2000E-01
                                        0.2190E+01      0.4000E-01
                                        0.3285E+01      0.6000E-01
                                        0.4380E+01      0.8000E-01
                                        0.4928E+01      0.9000E-01
                                        0.5476E+01      0.1000E+00
                                        0.5476E+01      0.5000E+00
                                        0.5476E+01      0.2000E+01
7          10      0.1200E+02
                                        0.0000E+00      0.0000E+00
                                        0.5079E+00      0.1000E-01
                                        0.1016E+01      0.2000E-01
                                        0.2032E+01      0.4000E-01
                                        0.3047E+01      0.6000E-01
                                        0.4063E+01      0.8000E-01
```

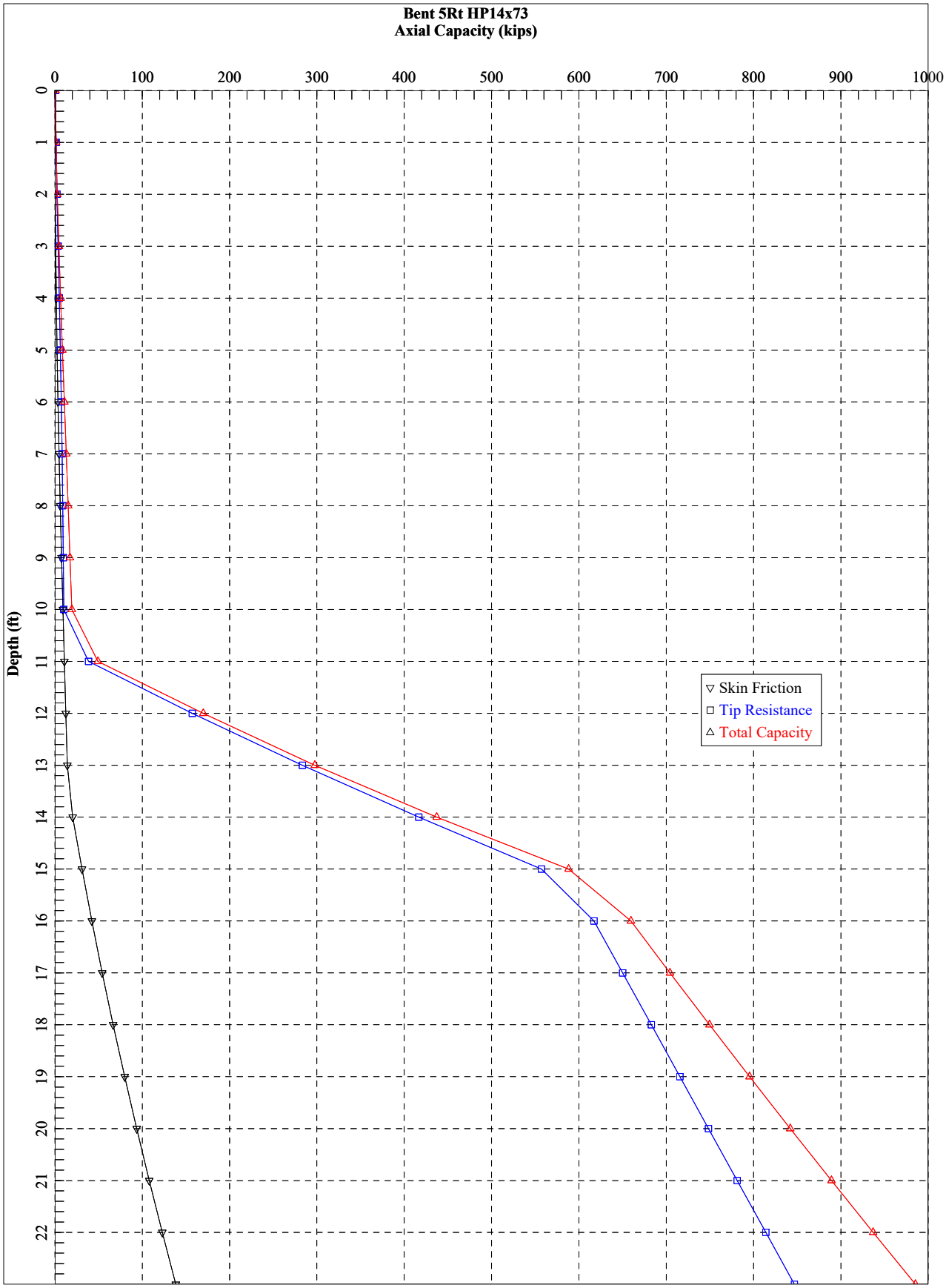
			0.4571E+01	0.9000E-01
			0.5079E+01	0.1000E+00
			0.5079E+01	0.5000E+00
			0.5079E+01	0.2000E+01
8	10	0.1703E+02		
			0.0000E+00	0.0000E+00
			0.5894E+00	0.1000E-01
			0.1179E+01	0.2000E-01
			0.2357E+01	0.4000E-01
			0.3536E+01	0.6000E-01
			0.4715E+01	0.8000E-01
			0.5304E+01	0.9000E-01
			0.5894E+01	0.1000E+00
			0.5894E+01	0.5000E+00
			0.5894E+01	0.2000E+01
9	10	0.2196E+02		
			0.0000E+00	0.0000E+00
			0.7834E+00	0.1000E-01
			0.1567E+01	0.2000E-01
			0.3133E+01	0.4000E-01
			0.4700E+01	0.6000E-01
			0.6267E+01	0.8000E-01
			0.7050E+01	0.9000E-01
			0.7834E+01	0.1000E+00
			0.7834E+01	0.5000E+00
			0.7834E+01	0.2000E+01
10	10	0.2200E+02		
			0.0000E+00	0.0000E+00
			0.1016E+01	0.1000E-01
			0.2032E+01	0.2000E-01
			0.4063E+01	0.4000E-01
			0.6095E+01	0.6000E-01
			0.8127E+01	0.8000E-01
			0.9143E+01	0.9000E-01
			0.1016E+02	0.1000E+00
			0.1016E+02	0.5000E+00
			0.1016E+02	0.2000E+01
11	10	0.2653E+02		
			0.0000E+00	0.0000E+00
			0.1260E+01	0.1000E-01
			0.2520E+01	0.2000E-01
			0.5039E+01	0.4000E-01
			0.7559E+01	0.6000E-01
			0.1008E+02	0.8000E-01
			0.1134E+02	0.9000E-01
			0.1260E+02	0.1000E+00
			0.1260E+02	0.5000E+00
			0.1260E+02	0.2000E+01
12	10	0.3096E+02		
			0.0000E+00	0.0000E+00
			0.1884E+01	0.1000E-01
			0.3767E+01	0.2000E-01
			0.7535E+01	0.4000E-01
			0.1130E+02	0.6000E-01
			0.1507E+02	0.8000E-01
			0.1695E+02	0.9000E-01
			0.1884E+02	0.1000E+00
			0.1884E+02	0.5000E+00
			0.1884E+02	0.2000E+01
13	10	0.3100E+02		
			0.0000E+00	0.0000E+00
			0.2381E+01	0.1000E-01
			0.4763E+01	0.2000E-01
			0.9526E+01	0.4000E-01
			0.1429E+02	0.6000E-01
			0.1905E+02	0.8000E-01
			0.2143E+02	0.9000E-01
			0.2381E+02	0.1000E+00
			0.2381E+02	0.5000E+00

			0.2381E+02	0.2000E+01
14	10	0.3553E+02		
			0.0000E+00	0.0000E+00
			0.2381E+01	0.1000E-01
			0.4763E+01	0.2000E-01
			0.9526E+01	0.4000E-01
			0.1429E+02	0.6000E-01
			0.1905E+02	0.8000E-01
			0.2143E+02	0.9000E-01
			0.2381E+02	0.1000E+00
			0.2381E+02	0.5000E+00
			0.2381E+02	0.2000E+01
15	10	0.3996E+02		
			0.0000E+00	0.0000E+00
			0.2381E+01	0.1000E-01
			0.4763E+01	0.2000E-01
			0.9526E+01	0.4000E-01
			0.1429E+02	0.6000E-01
			0.1905E+02	0.8000E-01
			0.2143E+02	0.9000E-01
			0.2381E+02	0.1000E+00
			0.2381E+02	0.5000E+00
			0.2381E+02	0.2000E+01

TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00
0.4769E+02	0.8976E-02
0.9538E+02	0.1795E-01
0.1908E+03	0.3591E-01
0.3815E+03	0.2334E+00
0.5723E+03	0.7540E+00
0.6867E+03	0.1311E+01
0.7630E+03	0.1795E+01
0.7630E+03	0.2693E+01
0.7630E+03	0.3591E+01

LOAD VERSUS SETTLEMENT CURVE
****

TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.7221E+00	0.1558E-03	0.5313E+00	0.1000E-03
0.7221E+01	0.1558E-02	0.5313E+01	0.1000E-02
0.3611E+02	0.7789E-02	0.2656E+02	0.5000E-02
0.7221E+02	0.1558E-01	0.5313E+02	0.1000E-01
0.2982E+03	0.7272E-01	0.2044E+03	0.5000E-01
0.4225E+03	0.1316E+00	0.2527E+03	0.1000E+00
0.6491E+03	0.5505E+00	0.4792E+03	0.5000E+00
0.7927E+03	0.1062E+01	0.6229E+03	0.1000E+01
0.9329E+03	0.2074E+01	0.7630E+03	0.2000E+01


Bent 5Rt HP14x73
Axial Capacity (kips)
0
100
200
300
400
500
600
700
800
900
1000
Depth (ft)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
Skin Friction
Tip Resistance
Total Capacity

```
=========================================================================

                 APILE for Windows, Version 2015.7.5

                  Serial Number :  139694124

                  A Program for Analyzing the Axial Capacity
                  and Short-term Settlement of Driven Piles
                            under Axial Loading.
                (c) Copyright ENSOFT, Inc., 1987-2015
                      All Rights Reserved

=========================================================================


This program is licensed to :

Moreland Altobelli Associates
Duluth, GA

Path to file locations      : C:\Users\yshao\Desktop\Yong Shao GDOT\TEMP\McGinnis Ferry\BFI\APILE\
Name of input data file     : Bent5Rt.ap7d
Name of output file         : Bent5Rt.ap7o
Name of plot output file    : Bent5Rt.ap7p

-------------------------------------------------------------------------
                     Time and Date of Analysis
-------------------------------------------------------------------------

          Date:  October 22, 2021     Time:  11:47:47



1
     *********************
     * INPUT INFORMATION *
     *********************



     Bent 5 Rt: HP14x73

     DESIGNER   : YCS

     JOB NUMBER : PI 0004634


     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)
     - API RP 2A (American Petroleum Institute)


     TYPE OF LOADING :
     - COMPRESSION


     PILE TYPE :

     H-Pile/Steel Pile
```

```
DATA FOR AXIAL STIFFNESS :

- MODULUS OF ELASTICITY     = 0.290E+08 PSI
- CROSS SECTION AREA        =    198.50 IN2


NONCIRCULAR PILE PROPERTIES :

- TOTAL PILE LENGTH, TL     =     31.00 FT.
- PILE STICKUP LENGTH, PSL  =      8.00 FT.
- ZERO FRICTION LENGTH, ZFL =      0.00 FT.
- PERIMETER OF PILE         =     56.40 IN.
- TIP AREA OF PILE          =    198.50 IN2
- INCREMENT OF PILE LENGTH
  USED IN COMPUTATION       =      1.00 FT.



SOIL INFORMATIONS :



                  LATERAL    EFFECTIVE    FRICTION   BEARING
          SOIL    EARTH      UNIT         ANGLE      CAPACITY
 DEPTH    TYPE    PRESSURE   WEIGHT       DEGREES    FACTOR
  FT.                        LB/CF
   0.00   SAND      0.00       105.00        26.00      0.00
   6.50   SAND      0.00       105.00        26.00      0.00
   6.50   SAND      0.00        42.60        26.00      0.00
  13.00   SAND      0.00        42.60        26.00      0.00
  13.00   SAND      0.00        62.60        45.00      0.00
  33.00   SAND      0.00        62.60        45.00      0.00



MAXIMUM   MAXIMUM   UNDISTURB  REMOLDED
UNIT      UNIT      SHEAR      SHEAR     BLOW   UNIT SKIN  UNIT END
FRICTION  BEARING   STRENGTH   STRENGTH  COUNT  FRICTION   BEARING
  KSF       KSF        KSF       KSF               KSF       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

* 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.



         LRFD FACTOR  LRFD FACTOR
          ON UNIT      ON UNIT
 DEPTH    FRICTION     BEARING
  FT.
   0.00    1.000       1.000
   6.50    1.000       1.000
   6.50    1.000       1.000
  13.00    1.000       1.000
  13.00    1.000       1.000
  33.00    1.000       1.000




        PLASTIC    YIELD      Qc
         INDEX    STRESS     FROM
 DEPTH     PI      RATIO     CPT
```

FT.	%		KSF
0.00	0.00	0.00	0.000E+00
6.50	0.00	0.00	0.000E+00
6.50	0.00	0.00	0.000E+00
13.00	0.00	0.00	0.000E+00
13.00	0.00	0.00	0.000E+00
33.00	0.00	0.00	0.000E+00

1

```
**********************
* COMPUTATION RESULT *
**********************
```

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

	PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP	
Btm of Cut Ele. 990'	0.00	0.0	0.7	0.7	
	1.00	0.1	1.3	1.4	
	2.00	0.4	2.3	2.7	
	3.00	0.9	3.7	4.6	
	4.00	1.6	5.0	6.5	
	5.00	2.4	6.2	8.6	
	6.00	3.5	7.3	10.8	
	7.00	4.7	8.3	13.0	
	8.00	6.1	9.0	15.2	
Scour line Ele. 981'	9.00	7.6	9.7	17.3	Rscour = 7.6 kips
	10.00	9.2	10.2	19.4	
	11.00	10.8	38.5	49.3	
	12.00	12.5	157.3	169.9	
	13.00	14.3	283.4	297.7	
	14.00	20.4	416.7	437.1	Rndr = 220.4kips / 0.65 = 339 kips
	15.00	31.1	557.1	588.2	
	16.00	42.3	617.3	659.6	
	17.00	54.2	650.1	704.3	
	18.00	66.7	682.9	749.6	
	19.00	79.9	715.6	795.5	
	20.00	93.6	748.4	842.0	
	21.00	108.0	781.2	889.2	
	22.00	122.9	814.0	936.9	Pilot hole needed
Min. & Est. Tip 967'	23.00	138.5	846.8	985.3	

```
**********************
*  API RP-2A (1994)  *
**********************
```

PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	0.0	0.0
1.00	0.0	0.0	0.0
2.00	0.0	0.0	0.0
3.00	0.0	0.0	0.0
4.00	0.0	0.0	0.0
5.00	0.0	0.0	0.0
6.00	0.0	0.0	0.0
7.00	0.0	0.0	0.0
8.00	0.0	0.0	0.0
9.00	0.0	0.0	0.0
10.00	0.0	0.0	0.0

11.00	0.0	0.0	0.0
12.00	0.0	0.0	0.0
13.00	0.0	0.0	0.0
14.00	0.0	0.0	0.0
15.00	0.0	0.0	0.0
16.00	0.0	0.0	0.0
17.00	0.0	0.0	0.0
18.00	0.0	0.0	0.0
19.00	0.0	0.0	0.0
20.00	0.0	0.0	0.0
21.00	0.0	0.0	0.0
22.00	0.0	0.0	0.0
23.00	0.0	0.0	0.0

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
			0.4296E-01	0.1000E-01
			0.8592E-01	0.2000E-01
			0.1718E+00	0.4000E-01
			0.2577E+00	0.6000E-01
			0.3437E+00	0.8000E-01
			0.3866E+00	0.9000E-01
			0.4296E+00	0.1000E+00
			0.4296E+00	0.5000E+00
			0.4296E+00	0.2000E+01
2	10	0.3275E+01		
			0.0000E+00	0.0000E+00
			0.1146E+00	0.1000E-01
			0.2291E+00	0.2000E-01
			0.4582E+00	0.4000E-01
			0.6873E+00	0.6000E-01
			0.9164E+00	0.8000E-01
			0.1031E+01	0.9000E-01
			0.1146E+01	0.1000E+00
			0.1146E+01	0.5000E+00
			0.1146E+01	0.2000E+01
3	10	0.6458E+01		
			0.0000E+00	0.0000E+00
			0.1962E+00	0.1000E-01
			0.3924E+00	0.2000E-01
			0.7849E+00	0.4000E-01
			0.1177E+01	0.6000E-01
			0.1570E+01	0.8000E-01
			0.1766E+01	0.9000E-01
			0.1962E+01	0.1000E+00
			0.1962E+01	0.5000E+00
			0.1962E+01	0.2000E+01
4	10	0.6500E+01		
			0.0000E+00	0.0000E+00
			0.1962E+00	0.1000E-01
			0.3924E+00	0.2000E-01
			0.7849E+00	0.4000E-01

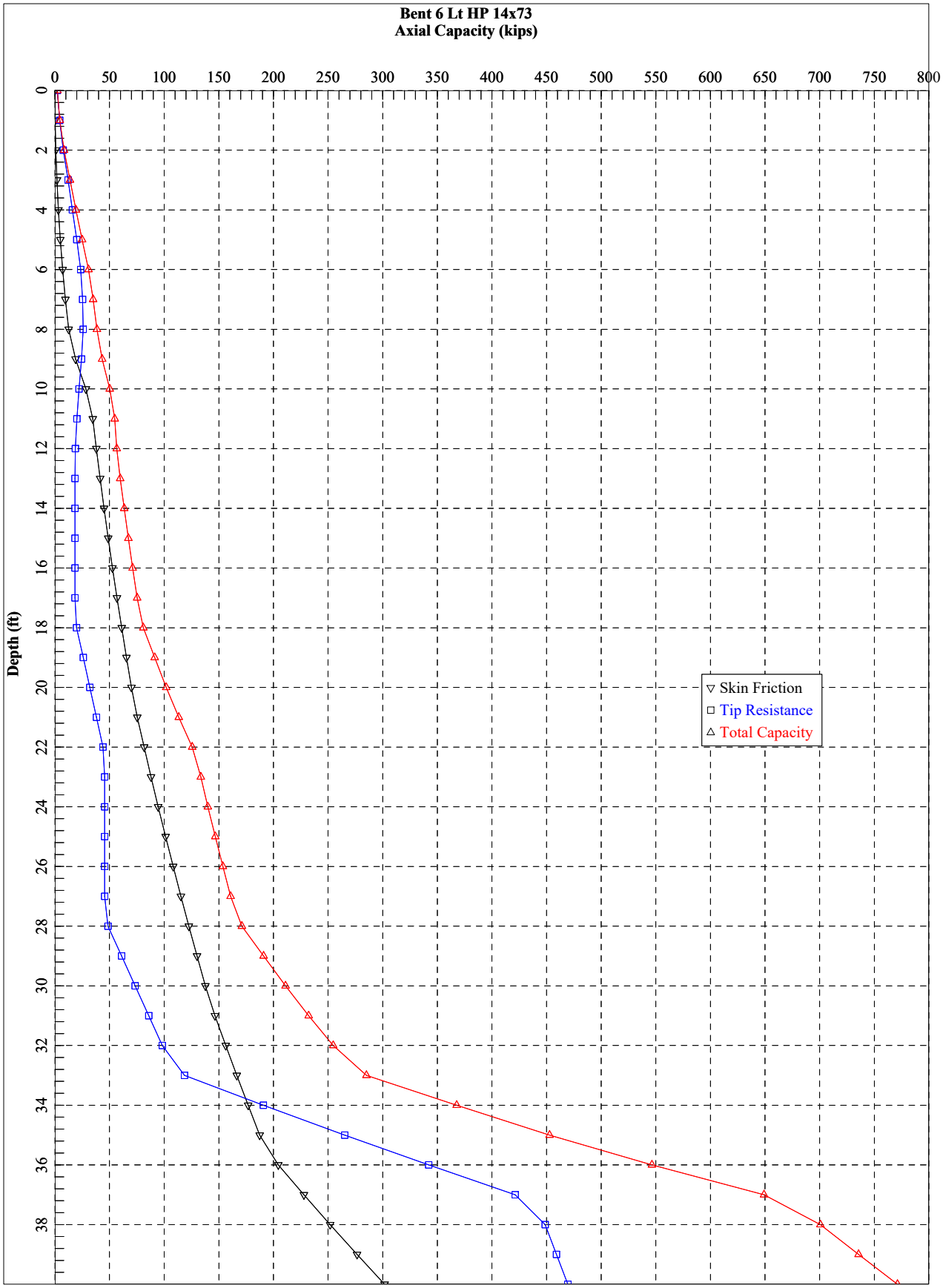
			0.1177E+01	0.6000E-01
			0.1570E+01	0.8000E-01
			0.1766E+01	0.9000E-01
			0.1962E+01	0.1000E+00
			0.1962E+01	0.5000E+00
			0.1962E+01	0.2000E+01
5	10	0.9775E+01		
			0.0000E+00	0.0000E+00
			0.2353E+00	0.1000E-01
			0.4707E+00	0.2000E-01
			0.9413E+00	0.4000E-01
			0.1412E+01	0.6000E-01
			0.1883E+01	0.8000E-01
			0.2118E+01	0.9000E-01
			0.2353E+01	0.1000E+00
			0.2353E+01	0.5000E+00
			0.2353E+01	0.2000E+01
6	10	0.1296E+02		
			0.0000E+00	0.0000E+00
			0.5822E+00	0.1000E-01
			0.1164E+01	0.2000E-01
			0.2329E+01	0.4000E-01
			0.3493E+01	0.6000E-01
			0.4658E+01	0.8000E-01
			0.5240E+01	0.9000E-01
			0.5822E+01	0.1000E+00
			0.5822E+01	0.5000E+00
			0.5822E+01	0.2000E+01
7	10	0.1300E+02		
			0.0000E+00	0.0000E+00
			0.1238E+01	0.1000E-01
			0.2475E+01	0.2000E-01
			0.4951E+01	0.4000E-01
			0.7426E+01	0.6000E-01
			0.9902E+01	0.8000E-01
			0.1114E+02	0.9000E-01
			0.1238E+02	0.1000E+00
			0.1238E+02	0.5000E+00
			0.1238E+02	0.2000E+01
8	10	0.2303E+02		
			0.0000E+00	0.0000E+00
			0.2303E+01	0.1000E-01
			0.4606E+01	0.2000E-01
			0.9211E+01	0.4000E-01
			0.1382E+02	0.6000E-01
			0.1842E+02	0.8000E-01
			0.2073E+02	0.9000E-01
			0.2303E+02	0.1000E+00
			0.2303E+02	0.5000E+00
			0.2303E+02	0.2000E+01
9	10	0.3296E+02		
			0.0000E+00	0.0000E+00
			0.2303E+01	0.1000E-01
			0.4606E+01	0.2000E-01
			0.9211E+01	0.4000E-01
			0.1382E+02	0.6000E-01
			0.1842E+02	0.8000E-01
			0.2073E+02	0.9000E-01
			0.2303E+02	0.1000E+00
			0.2303E+02	0.5000E+00
			0.2303E+02	0.2000E+01

TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00
0.5293E+02	0.8976E-02

0.1059E+03	0.1795E-01
0.2117E+03	0.3591E-01
0.4234E+03	0.2334E+00
0.6351E+03	0.7540E+00
0.7621E+03	0.1311E+01
0.8468E+03	0.1795E+01
0.8468E+03	0.2693E+01
0.8468E+03	0.3591E+01

LOAD VERSUS SETTLEMENT CURVE
****

TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.7397E+00	0.1459E-03	0.5896E+00	0.1000E-03
0.7397E+01	0.1459E-02	0.5896E+01	0.1000E-02
0.3698E+02	0.7294E-02	0.2948E+02	0.5000E-02
0.7397E+02	0.1459E-01	0.5896E+02	0.1000E-01
0.3013E+03	0.6852E-01	0.2268E+03	0.5000E-01
0.4205E+03	0.1255E+00	0.2804E+03	0.1000E+00
0.6719E+03	0.5417E+00	0.5318E+03	0.5000E+00
0.8314E+03	0.1052E+01	0.6912E+03	0.1000E+01
0.9869E+03	0.2062E+01	0.8468E+03	0.2000E+01


Bent 6 Lt HP 14x73
Axial Capacity (kips)
0
50
100
150
200
250
300
350
400
450
500
550
600
650
700
750
800
Depth (ft)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
Skin Friction
Tip Resistance
Total Capacity

```
=========================================================================

                 APILE for Windows, Version 2015.7.5

                  Serial Number :  139694124

                  A Program for Analyzing the Axial Capacity
                  and Short-term Settlement of Driven Piles
                            under Axial Loading.
                (c) Copyright ENSOFT, Inc., 1987-2015
                      All Rights Reserved

=========================================================================


This program is licensed to :

Moreland Altobelli Associates
Duluth, GA

Path to file locations      : C:\Users\yshao\Desktop\Yong Shao GDOT\TEMP\McGinnis Ferry\BFI\APILE\
Name of input data file     : Bent6Lt.ap7d
Name of output file         : Bent6Lt.ap7o
Name of plot output file    : Bent6Lt.ap7p

-------------------------------------------------------------------------
                     Time and Date of Analysis
-------------------------------------------------------------------------

          Date:  October 22, 2021     Time:  12:46:10



1
     *********************
     * INPUT INFORMATION *
     *********************



     Bent 6 Lt: HP14x73

     DESIGNER   : YCS

     JOB NUMBER : PI 0004634


     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)
     - API RP 2A (American Petroleum Institute)


     TYPE OF LOADING :
     - COMPRESSION


     PILE TYPE :

     H-Pile/Steel Pile
```

```
DATA FOR AXIAL STIFFNESS :

- MODULUS OF ELASTICITY     = 0.290E+08 PSI
- CROSS SECTION AREA        =    198.50 IN2


NONCIRCULAR PILE PROPERTIES :

- TOTAL PILE LENGTH, TL     =     40.00 FT.
- PILE STICKUP LENGTH, PSL  =      0.00 FT.
- ZERO FRICTION LENGTH, ZFL =      0.00 FT.
- PERIMETER OF PILE         =     56.40 IN.
- TIP AREA OF PILE          =    198.50 IN2
- INCREMENT OF PILE LENGTH
  USED IN COMPUTATION       =      1.00 FT.



SOIL INFORMATIONS :



                  LATERAL    EFFECTIVE    FRICTION   BEARING
          SOIL    EARTH      UNIT         ANGLE      CAPACITY
 DEPTH    TYPE    PRESSURE   WEIGHT       DEGREES    FACTOR
  FT.                        LB/CF
   0.00   SAND      0.00       115.00        32.00      0.00
   8.00   SAND      0.00       115.00        32.00      0.00
   8.00   CLAY      0.00       120.00         0.00      0.00
  10.00   CLAY      0.00       120.00         0.00      0.00
  10.00   SAND      0.00        57.60        30.00      0.00
  20.00   SAND      0.00        57.60        30.00      0.00
  20.00   SAND      0.00        52.60        32.00      0.00
  30.00   SAND      0.00        52.60        32.00      0.00
  30.00   SAND      0.00        52.60        34.00      0.00
  35.00   SAND      0.00        52.60        34.00      0.00
  35.00   SAND      0.00        62.60        40.00      0.00
  47.00   SAND      0.00        62.60        40.00      0.00
  47.00   SAND      0.00        62.60        45.00      0.00
  50.00   SAND      0.00        62.60        45.00      0.00



MAXIMUM   MAXIMUM   UNDISTURB  REMOLDED
UNIT      UNIT      SHEAR      SHEAR     BLOW   UNIT SKIN  UNIT END
FRICTION  BEARING   STRENGTH   STRENGTH  COUNT  FRICTION   BEARING
  KSF       KSF        KSF       KSF               KSF       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*       2.00      0.00   0.00       0.00      0.00
0.10E+08* 0.10E+08*       2.00      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   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.



         LRFD FACTOR  LRFD FACTOR
```

DEPTH FT.	ON UNIT FRICTION	ON UNIT BEARING
0.00	1.000	1.000
8.00	1.000	1.000
8.00	1.000	1.000
10.00	1.000	1.000
10.00	1.000	1.000
20.00	1.000	1.000
20.00	1.000	1.000
30.00	1.000	1.000
30.00	1.000	1.000
35.00	1.000	1.000
35.00	1.000	1.000
47.00	1.000	1.000
47.00	1.000	1.000
50.00	1.000	1.000

DEPTH FT.	PLASTIC INDEX PI %	YIELD STRESS RATIO	Qc FROM CPT KSF
0.00	0.00	0.00	0.000E+00
8.00	0.00	0.00	0.000E+00
8.00	0.00	0.00	0.000E+00
10.00	0.00	0.00	0.000E+00
10.00	0.00	0.00	0.000E+00
20.00	0.00	0.00	0.000E+00
20.00	0.00	0.00	0.000E+00
30.00	0.00	0.00	0.000E+00
30.00	0.00	0.00	0.000E+00
35.00	0.00	0.00	0.000E+00
35.00	0.00	0.00	0.000E+00
47.00	0.00	0.00	0.000E+00
47.00	0.00	0.00	0.000E+00
50.00	0.00	0.00	0.000E+00

1

```
**********************
* COMPUTATION RESULT *
**********************
```

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

Btm of Cap Ele. 998'

PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	2.2	2.2
1.00	0.2	4.3	4.4
2.00	0.8	7.6	8.4
3.00	1.8	12.0	13.8
4.00	3.1	16.0	19.2
5.00	4.9	20.0	24.9
6.00	7.1	23.6	30.7
7.00	9.6	25.3	35.0
8.00	12.6	25.8	38.4
9.00	18.9	24.3	43.2
10.00	28.3	22.0	50.2
11.00	34.6	20.1	54.7
12.00	37.9	18.7	56.6

	13.00	41.4	18.4	59.7
	14.00	45.0	18.4	63.4
	15.00	48.8	18.4	67.2
	16.00	52.7	18.4	71.1
	17.00	56.8	18.4	75.2
	18.00	61.1	19.8	80.9
	19.00	65.5	25.9	91.3
	20.00	70.0	31.9	101.9
	21.00	75.4	38.0	113.4
	22.00	81.6	44.0	125.6
	23.00	88.0	45.5	133.5
	24.00	94.5	45.5	140.0
	25.00	101.3	45.5	146.8
	26.00	108.2	45.5	153.7
	27.00	115.3	45.5	160.8
	28.00	122.6	48.5	171.1
	29.00	130.1	61.0	191.0
Min. Tip Ele. 968' →	30.00	137.7	73.4	211.1
	31.00	146.5	85.9	232.3
	32.00	156.4	98.3	254.7
	33.00	166.5	118.6	285.1
Est. Tip Ele. 964' →	34.00	176.9	190.8	367.7
	35.00	187.4	265.3	452.8
	36.00	204.4	342.1	546.5
	37.00	227.9	421.3	649.1
	38.00	251.9	448.7	700.7
	39.00	276.5	459.1	735.6
	40.00	301.7	469.5	771.2

Rndr = 234.6kips / 0.65 = 361 kips

```
**********************
*  API RP-2A (1994)  *
**********************
```

PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	0.0	0.0
1.00	0.0	0.0	0.0
2.00	0.0	0.0	0.0
3.00	0.0	0.0	0.0
4.00	0.0	0.0	0.0
5.00	0.0	0.0	0.0
6.00	0.0	1.3	1.3
7.00	0.0	6.9	6.9
8.00	0.0	11.1	11.1
9.00	2.0	11.1	13.1
10.00	6.0	11.1	17.1
11.00	8.1	6.9	15.0
12.00	8.1	1.3	9.4
13.00	8.1	0.0	8.1
14.00	8.1	0.0	8.1
15.00	8.1	0.0	8.1
16.00	8.1	0.0	8.1
17.00	8.1	0.0	8.1
18.00	8.1	0.0	8.1
19.00	8.1	0.0	8.1
20.00	8.1	0.0	8.1
21.00	8.1	0.0	8.1
22.00	8.1	0.0	8.1
23.00	8.1	0.0	8.1
24.00	8.1	0.0	8.1
25.00	8.1	0.0	8.1
26.00	8.1	0.0	8.1
27.00	8.1	0.0	8.1
28.00	8.1	0.0	8.1
29.00	8.1	0.0	8.1
30.00	8.1	0.0	8.1

31.00	8.1	0.0	8.1
32.00	8.1	0.0	8.1
33.00	8.1	0.0	8.1
34.00	8.1	0.0	8.1
35.00	8.1	0.0	8.1
36.00	8.1	0.0	8.1
37.00	8.1	0.0	8.1
38.00	8.1	0.0	8.1
39.00	8.1	0.0	8.1
40.00	8.1	0.0	8.1

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
			0.8714E-01	0.1000E-01
			0.1743E+00	0.2000E-01
			0.3486E+00	0.4000E-01
			0.5228E+00	0.6000E-01
			0.6971E+00	0.8000E-01
			0.7843E+00	0.9000E-01
			0.8714E+00	0.1000E+00
			0.8714E+00	0.5000E+00
			0.8714E+00	0.2000E+01
2	10	0.4025E+01		
			0.0000E+00	0.0000E+00
			0.2905E+00	0.1000E-01
			0.5809E+00	0.2000E-01
			0.1162E+01	0.4000E-01
			0.1743E+01	0.6000E-01
			0.2324E+01	0.8000E-01
			0.2614E+01	0.9000E-01
			0.2905E+01	0.1000E+00
			0.2905E+01	0.5000E+00
			0.2905E+01	0.2000E+01
3	10	0.7958E+01		
			0.0000E+00	0.0000E+00
			0.6813E+00	0.1000E-01
			0.1363E+01	0.2000E-01
			0.2725E+01	0.4000E-01
			0.4088E+01	0.6000E-01
			0.5450E+01	0.8000E-01
			0.6131E+01	0.9000E-01
			0.6813E+01	0.1000E+00
			0.6813E+01	0.5000E+00
			0.6813E+01	0.2000E+01
4	10	0.8000E+01		
			0.0000E+00	0.0000E+00
			0.3474E+01	0.2872E-01
			0.5789E+01	0.5565E-01
			0.8684E+01	0.1023E+00
			0.1042E+02	0.1436E+00
			0.1158E+02	0.1795E+00
			0.1042E+02	0.3591E+00

```
                                        0.1042E+02      0.5386E+00
                                        0.1042E+02      0.8976E+00
                                        0.1042E+02      0.3591E+01
  5         10      0.9025E+01
                                        0.0000E+00      0.0000E+00
                                        0.3485E+01      0.2872E-01
                                        0.5808E+01      0.5565E-01
                                        0.8712E+01      0.1023E+00
                                        0.1045E+02      0.1436E+00
                                        0.1162E+02      0.1795E+00
                                        0.1045E+02      0.3591E+00
                                        0.1045E+02      0.5386E+00
                                        0.1045E+02      0.8976E+00
                                        0.1045E+02      0.3591E+01
  6         10      0.9958E+01
                                        0.0000E+00      0.0000E+00
                                        0.3485E+01      0.2872E-01
                                        0.5808E+01      0.5565E-01
                                        0.8712E+01      0.1023E+00
                                        0.1045E+02      0.1436E+00
                                        0.1162E+02      0.1795E+00
                                        0.1045E+02      0.3591E+00
                                        0.1045E+02      0.5386E+00
                                        0.1045E+02      0.8976E+00
                                        0.1045E+02      0.3591E+01
  7         10      0.1000E+02
                                        0.0000E+00      0.0000E+00
                                        0.7127E+00      0.1000E-01
                                        0.1425E+01      0.2000E-01
                                        0.2851E+01      0.4000E-01
                                        0.4276E+01      0.6000E-01
                                        0.5701E+01      0.8000E-01
                                        0.6414E+01      0.9000E-01
                                        0.7127E+01      0.1000E+00
                                        0.7127E+01      0.5000E+00
                                        0.7127E+01      0.2000E+01
  8         10      0.1503E+02
                                        0.0000E+00      0.0000E+00
                                        0.5932E+00      0.1000E-01
                                        0.1186E+01      0.2000E-01
                                        0.2373E+01      0.4000E-01
                                        0.3559E+01      0.6000E-01
                                        0.4745E+01      0.8000E-01
                                        0.5338E+01      0.9000E-01
                                        0.5932E+01      0.1000E+00
                                        0.5932E+01      0.5000E+00
                                        0.5932E+01      0.2000E+01
  9         10      0.1996E+02
                                        0.0000E+00      0.0000E+00
                                        0.7332E+00      0.1000E-01
                                        0.1466E+01      0.2000E-01
                                        0.2933E+01      0.4000E-01
                                        0.4399E+01      0.6000E-01
                                        0.5865E+01      0.8000E-01
                                        0.6598E+01      0.9000E-01
                                        0.7332E+01      0.1000E+00
                                        0.7332E+01      0.5000E+00
                                        0.7332E+01      0.2000E+01
 10         10      0.2000E+02
                                        0.0000E+00      0.0000E+00
                                        0.8553E+00      0.1000E-01
                                        0.1711E+01      0.2000E-01
                                        0.3421E+01      0.4000E-01
                                        0.5132E+01      0.6000E-01
                                        0.6842E+01      0.8000E-01
                                        0.7697E+01      0.9000E-01
                                        0.8553E+01      0.1000E+00
                                        0.8553E+01      0.5000E+00
                                        0.8553E+01      0.2000E+01
```

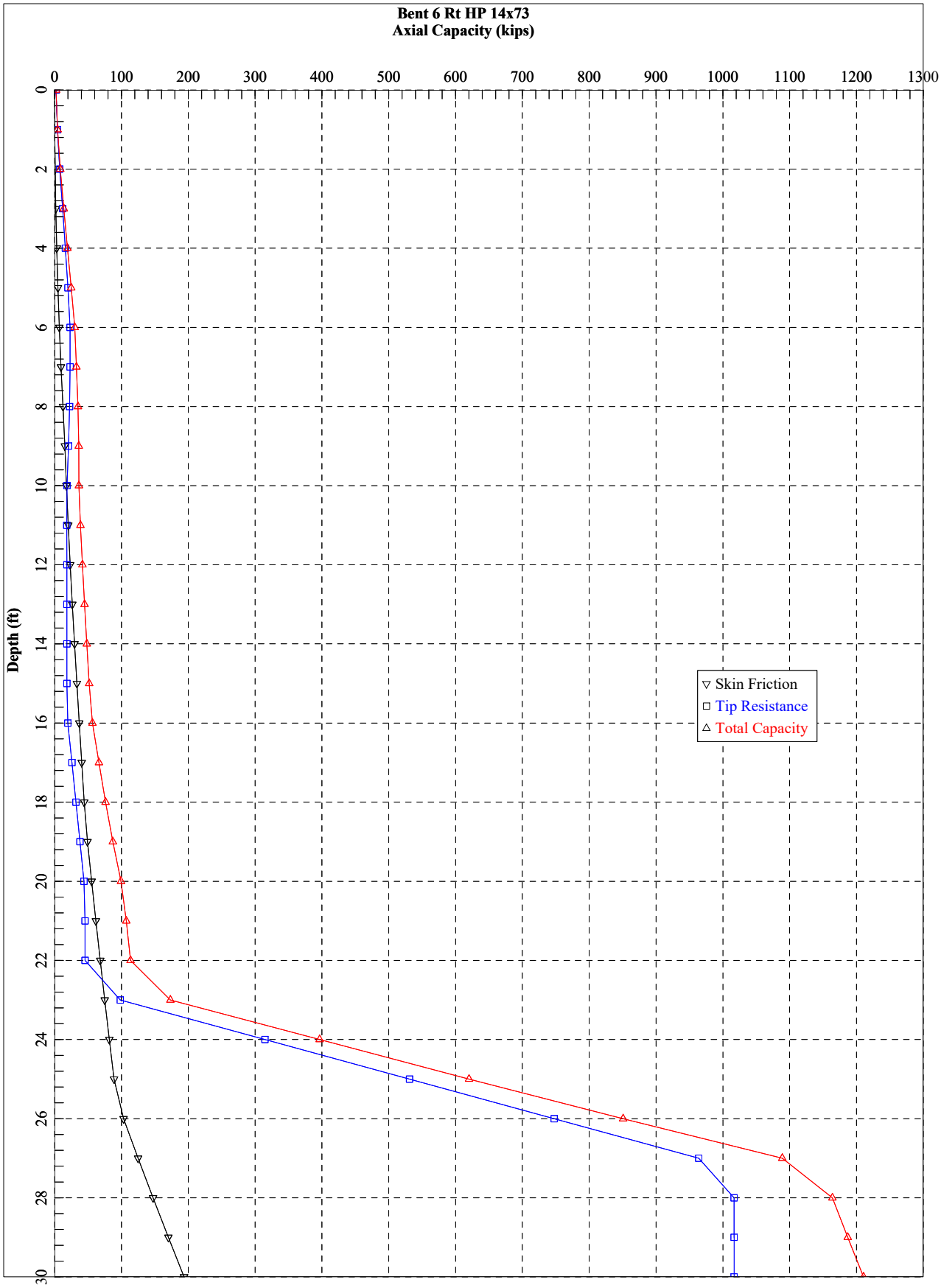
11	10	0.2503E+02		
			0.0000E+00	0.0000E+00
			0.1036E+01	0.1000E-01
			0.2073E+01	0.2000E-01
			0.4146E+01	0.4000E-01
			0.6218E+01	0.6000E-01
			0.8291E+01	0.8000E-01
			0.9328E+01	0.9000E-01
			0.1036E+02	0.1000E+00
			0.1036E+02	0.5000E+00
			0.1036E+02	0.2000E+01
12	10	0.2996E+02		
			0.0000E+00	0.0000E+00
			0.1212E+01	0.1000E-01
			0.2425E+01	0.2000E-01
			0.4849E+01	0.4000E-01
			0.7274E+01	0.6000E-01
			0.9698E+01	0.8000E-01
			0.1091E+02	0.9000E-01
			0.1212E+02	0.1000E+00
			0.1212E+02	0.5000E+00
			0.1212E+02	0.2000E+01
13	10	0.3000E+02		
			0.0000E+00	0.0000E+00
			0.1380E+01	0.1000E-01
			0.2759E+01	0.2000E-01
			0.5518E+01	0.4000E-01
			0.8277E+01	0.6000E-01
			0.1104E+02	0.8000E-01
			0.1242E+02	0.9000E-01
			0.1380E+02	0.1000E+00
			0.1380E+02	0.5000E+00
			0.1380E+02	0.2000E+01
14	10	0.3253E+02		
			0.0000E+00	0.0000E+00
			0.1513E+01	0.1000E-01
			0.3027E+01	0.2000E-01
			0.6053E+01	0.4000E-01
			0.9080E+01	0.6000E-01
			0.1211E+02	0.8000E-01
			0.1362E+02	0.9000E-01
			0.1513E+02	0.1000E+00
			0.1513E+02	0.5000E+00
			0.1513E+02	0.2000E+01
15	10	0.3496E+02		
			0.0000E+00	0.0000E+00
			0.2033E+01	0.1000E-01
			0.4067E+01	0.2000E-01
			0.8134E+01	0.4000E-01
			0.1220E+02	0.6000E-01
			0.1627E+02	0.8000E-01
			0.1830E+02	0.9000E-01
			0.2033E+02	0.1000E+00
			0.2033E+02	0.5000E+00
			0.2033E+02	0.2000E+01
16	10	0.3500E+02		
			0.0000E+00	0.0000E+00
			0.2988E+01	0.1000E-01
			0.5975E+01	0.2000E-01
			0.1195E+02	0.4000E-01
			0.1793E+02	0.6000E-01
			0.2390E+02	0.8000E-01
			0.2689E+02	0.9000E-01
			0.2988E+02	0.1000E+00
			0.2988E+02	0.5000E+00
			0.2988E+02	0.2000E+01
17	10	0.4103E+02		
			0.0000E+00	0.0000E+00
			0.3720E+01	0.1000E-01

			0.7439E+01	0.2000E-01
			0.1488E+02	0.4000E-01
			0.2232E+02	0.6000E-01
			0.2976E+02	0.8000E-01
			0.3348E+02	0.9000E-01
			0.3720E+02	0.1000E+00
			0.3720E+02	0.5000E+00
			0.3720E+02	0.2000E+01
18	10	0.4696E+02		
			0.0000E+00	0.0000E+00
			0.3720E+01	0.1000E-01
			0.7439E+01	0.2000E-01
			0.1488E+02	0.4000E-01
			0.2232E+02	0.6000E-01
			0.2976E+02	0.8000E-01
			0.3348E+02	0.9000E-01
			0.3720E+02	0.1000E+00
			0.3720E+02	0.5000E+00
			0.3720E+02	0.2000E+01
19	10	0.4700E+02		
			0.0000E+00	0.0000E+00
			0.3720E+01	0.1000E-01
			0.7439E+01	0.2000E-01
			0.1488E+02	0.4000E-01
			0.2232E+02	0.6000E-01
			0.2976E+02	0.8000E-01
			0.3348E+02	0.9000E-01
			0.3720E+02	0.1000E+00
			0.3720E+02	0.5000E+00
			0.3720E+02	0.2000E+01
20	10	0.4853E+02		
			0.0000E+00	0.0000E+00
			0.3720E+01	0.1000E-01
			0.7439E+01	0.2000E-01
			0.1488E+02	0.4000E-01
			0.2232E+02	0.6000E-01
			0.2976E+02	0.8000E-01
			0.3348E+02	0.9000E-01
			0.3720E+02	0.1000E+00
			0.3720E+02	0.5000E+00
			0.3720E+02	0.2000E+01
21	10	0.4996E+02		
			0.0000E+00	0.0000E+00
			0.3720E+01	0.1000E-01
			0.7439E+01	0.2000E-01
			0.1488E+02	0.4000E-01
			0.2232E+02	0.6000E-01
			0.2976E+02	0.8000E-01
			0.3348E+02	0.9000E-01
			0.3720E+02	0.1000E+00
			0.3720E+02	0.5000E+00
			0.3720E+02	0.2000E+01

TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00
0.2934E+02	0.8976E-02
0.5868E+02	0.1795E-01
0.1174E+03	0.3591E-01
0.2347E+03	0.2334E+00
0.3521E+03	0.7540E+00
0.4225E+03	0.1311E+01
0.4695E+03	0.1795E+01
0.4695E+03	0.2693E+01
0.4695E+03	0.3591E+01

LOAD VERSUS SETTLEMENT CURVE
****

TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.6794E+00	0.1466E-03	0.3269E+00	0.1000E-03
0.6794E+01	0.1466E-02	0.3269E+01	0.1000E-02
0.3397E+02	0.7328E-02	0.1634E+02	0.5000E-02
0.6794E+02	0.1466E-01	0.3269E+02	0.1000E-01
0.2977E+03	0.7002E-01	0.1257E+03	0.5000E-01
0.4664E+03	0.1309E+00	0.1555E+03	0.1000E+00
0.6069E+03	0.5425E+00	0.2948E+03	0.5000E+00
0.6953E+03	0.1050E+01	0.3832E+03	0.1000E+01
0.7815E+03	0.2057E+01	0.4695E+03	0.2000E+01


Bent 6 Rt HP 14x73
Axial Capacity (kips)
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
Depth (ft)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
Skin Friction
Tip Resistance
Total Capacity

```
=========================================================================

                 APILE for Windows, Version 2015.7.5

                  Serial Number :  139694124

                  A Program for Analyzing the Axial Capacity
                  and Short-term Settlement of Driven Piles
                            under Axial Loading.
                (c) Copyright ENSOFT, Inc., 1987-2015
                      All Rights Reserved

=========================================================================


This program is licensed to :

Moreland Altobelli Associates
Duluth, GA

Path to file locations      : C:\Users\yshao\Desktop\Yong Shao GDOT\TEMP\McGinnis Ferry\BFI\APILE\
Name of input data file     : Bent6Rt.ap7d
Name of output file         : Bent6Rt.ap7o
Name of plot output file    : Bent6Rt.ap7p

-------------------------------------------------------------------------
                     Time and Date of Analysis
-------------------------------------------------------------------------

          Date:  October 22, 2021     Time:  13:20:42



1
     *********************
     * INPUT INFORMATION *
     *********************



     Bent 6 Rt: HP14x73

     DESIGNER   : YCS

     JOB NUMBER : PI 0004634


     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)
     - API RP 2A (American Petroleum Institute)


     TYPE OF LOADING :
     - COMPRESSION


     PILE TYPE :

     H-Pile/Steel Pile
```

```
DATA FOR AXIAL STIFFNESS :

- MODULUS OF ELASTICITY     = 0.290E+08 PSI
- CROSS SECTION AREA        =    198.50 IN2


NONCIRCULAR PILE PROPERTIES :

- TOTAL PILE LENGTH, TL     =     30.00 FT.
- PILE STICKUP LENGTH, PSL  =      0.00 FT.
- ZERO FRICTION LENGTH, ZFL =      0.00 FT.
- PERIMETER OF PILE         =     56.40 IN.
- TIP AREA OF PILE          =    198.50 IN2
- INCREMENT OF PILE LENGTH
  USED IN COMPUTATION       =      1.00 FT.



SOIL INFORMATIONS :



                  LATERAL    EFFECTIVE    FRICTION   BEARING
          SOIL    EARTH      UNIT         ANGLE      CAPACITY
 DEPTH    TYPE    PRESSURE   WEIGHT       DEGREES    FACTOR
  FT.                        LB/CF
   0.00   SAND      0.00       115.00        32.00      0.00
   7.80   SAND      0.00       115.00        32.00      0.00
   7.80   SAND      0.00       110.00        28.00      0.00
  12.80   SAND      0.00       110.00        28.00      0.00
  12.80   SAND      0.00        47.60        28.00      0.00
  17.80   SAND      0.00        47.60        28.00      0.00
  17.80   SAND      0.00        57.60        32.00      0.00
  24.80   SAND      0.00        57.60        32.00      0.00
  24.80   SAND      0.00        62.60        45.00      0.00
  34.00   SAND      0.00        62.60        45.00      0.00



MAXIMUM   MAXIMUM   UNDISTURB  REMOLDED
UNIT      UNIT      SHEAR      SHEAR     BLOW   UNIT SKIN  UNIT END
FRICTION  BEARING   STRENGTH   STRENGTH  COUNT  FRICTION   BEARING
  KSF       KSF        KSF       KSF                KSF       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   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.



         LRFD FACTOR  LRFD FACTOR
          ON UNIT      ON UNIT
 DEPTH    FRICTION     BEARING
  FT.
   0.00    1.000       1.000
   7.80    1.000       1.000
   7.80    1.000       1.000
  12.80    1.000       1.000
  12.80    1.000       1.000
```

17.80	1.000	1.000
17.80	1.000	1.000
24.80	1.000	1.000
24.80	1.000	1.000
34.00	1.000	1.000

DEPTH FT.	PLASTIC INDEX PI %	YIELD STRESS RATIO	Qc FROM CPT KSF
0.00	0.00	0.00	0.000E+00
7.80	0.00	0.00	0.000E+00
7.80	0.00	0.00	0.000E+00
12.80	0.00	0.00	0.000E+00
12.80	0.00	0.00	0.000E+00
17.80	0.00	0.00	0.000E+00
17.80	0.00	0.00	0.000E+00
24.80	0.00	0.00	0.000E+00
24.80	0.00	0.00	0.000E+00
34.00	0.00	0.00	0.000E+00

1

```
**********************
* COMPUTATION RESULT *
**********************
```

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

Btm of Cap Ele. 998'

PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	2.2	2.2
1.00	0.2	4.3	4.4
2.00	0.8	7.6	8.4
3.00	1.8	12.0	13.8
4.00	3.1	16.0	19.2
5.00	4.9	20.0	24.9
6.00	7.1	23.1	30.2
7.00	9.6	23.1	32.7
8.00	12.6	22.4	35.0
9.00	15.3	20.9	36.2
10.00	17.7	18.5	36.3
11.00	20.4	18.2	38.6
12.00	23.3	18.4	41.7
13.00	26.5	18.4	44.9
14.00	29.9	18.4	48.2
15.00	33.3	18.4	51.7
16.00	36.9	19.8	56.7
17.00	40.5	25.9	66.4
18.00	44.3	31.9	76.2
19.00	49.2	38.0	87.2
20.00	55.4	44.0	99.4
21.00	61.7	45.5	107.2
22.00	68.2	45.5	113.7
23.00	75.0	98.3	173.3
24.00	81.9	314.7	396.6
25.00	89.0	531.1	620.1
26.00	103.3	747.5	850.8
27.00	125.0	963.9	1088.9
28.00	147.3	1016.8	1164.0

Min. & Est. Tip 968'

Rndr = 234.6kips / 0.65 = 361 kips

Pilot hole needed.

29.00	170.2	1016.8	1186.9
30.00	193.7	1016.8	1210.5

```
**********************
*  API RP-2A (1994)  *
**********************
```

PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	0.0	0.0
1.00	0.0	0.0	0.0
2.00	0.0	0.0	0.0
3.00	0.0	0.0	0.0
4.00	0.0	0.0	0.0
5.00	0.0	0.0	0.0
6.00	0.0	0.0	0.0
7.00	0.0	0.0	0.0
8.00	0.0	0.0	0.0
9.00	0.0	0.0	0.0
10.00	0.0	0.0	0.0
11.00	0.0	0.0	0.0
12.00	0.0	0.0	0.0
13.00	0.0	0.0	0.0
14.00	0.0	0.0	0.0
15.00	0.0	0.0	0.0
16.00	0.0	0.0	0.0
17.00	0.0	0.0	0.0
18.00	0.0	0.0	0.0
19.00	0.0	0.0	0.0
20.00	0.0	0.0	0.0
21.00	0.0	0.0	0.0
22.00	0.0	0.0	0.0
23.00	0.0	0.0	0.0
24.00	0.0	0.0	0.0
25.00	0.0	0.0	0.0
26.00	0.0	0.0	0.0
27.00	0.0	0.0	0.0
28.00	0.0	0.0	0.0
29.00	0.0	0.0	0.0
30.00	0.0	0.0	0.0

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
			0.8714E-01	0.1000E-01
			0.1743E+00	0.2000E-01
			0.3486E+00	0.4000E-01
			0.5228E+00	0.6000E-01
			0.6971E+00	0.8000E-01
			0.7843E+00	0.9000E-01

			0.8714E+00	0.1000E+00
			0.8714E+00	0.5000E+00
			0.8714E+00	0.2000E+01
2	10	0.3925E+01		
			0.0000E+00	0.0000E+00
			0.2324E+00	0.1000E-01
			0.4648E+00	0.2000E-01
			0.9295E+00	0.4000E-01
			0.1394E+01	0.6000E-01
			0.1859E+01	0.8000E-01
			0.2091E+01	0.9000E-01
			0.2324E+01	0.1000E+00
			0.2324E+01	0.5000E+00
			0.2324E+01	0.2000E+01
3	10	0.7758E+01		
			0.0000E+00	0.0000E+00
			0.4193E+00	0.1000E-01
			0.8386E+00	0.2000E-01
			0.1677E+01	0.4000E-01
			0.2516E+01	0.6000E-01
			0.3354E+01	0.8000E-01
			0.3773E+01	0.9000E-01
			0.4193E+01	0.1000E+00
			0.4193E+01	0.5000E+00
			0.4193E+01	0.2000E+01
4	10	0.7800E+01		
			0.0000E+00	0.0000E+00
			0.4193E+00	0.1000E-01
			0.8386E+00	0.2000E-01
			0.1677E+01	0.4000E-01
			0.2516E+01	0.6000E-01
			0.3354E+01	0.8000E-01
			0.3773E+01	0.9000E-01
			0.4193E+01	0.1000E+00
			0.4193E+01	0.5000E+00
			0.4193E+01	0.2000E+01
5	10	0.1033E+02		
			0.0000E+00	0.0000E+00
			0.4138E+00	0.1000E-01
			0.8275E+00	0.2000E-01
			0.1655E+01	0.4000E-01
			0.2483E+01	0.6000E-01
			0.3310E+01	0.8000E-01
			0.3724E+01	0.9000E-01
			0.4138E+01	0.1000E+00
			0.4138E+01	0.5000E+00
			0.4138E+01	0.2000E+01
6	10	0.1276E+02		
			0.0000E+00	0.0000E+00
			0.4814E+00	0.1000E-01
			0.9628E+00	0.2000E-01
			0.1926E+01	0.4000E-01
			0.2889E+01	0.6000E-01
			0.3851E+01	0.8000E-01
			0.4333E+01	0.9000E-01
			0.4814E+01	0.1000E+00
			0.4814E+01	0.5000E+00
			0.4814E+01	0.2000E+01
7	10	0.1280E+02		
			0.0000E+00	0.0000E+00
			0.4814E+00	0.1000E-01
			0.9628E+00	0.2000E-01
			0.1926E+01	0.4000E-01
			0.2889E+01	0.6000E-01
			0.3851E+01	0.8000E-01
			0.4333E+01	0.9000E-01
			0.4814E+01	0.1000E+00
			0.4814E+01	0.5000E+00
			0.4814E+01	0.2000E+01

8	10	0.1533E+02		
			0.0000E+00	0.0000E+00
			0.5339E+00	0.1000E-01
			0.1068E+01	0.2000E-01
			0.2135E+01	0.4000E-01
			0.3203E+01	0.6000E-01
			0.4271E+01	0.8000E-01
			0.4805E+01	0.9000E-01
			0.5339E+01	0.1000E+00
			0.5339E+01	0.5000E+00
			0.5339E+01	0.2000E+01
9	10	0.1776E+02		
			0.0000E+00	0.0000E+00
			0.6431E+00	0.1000E-01
			0.1286E+01	0.2000E-01
			0.2572E+01	0.4000E-01
			0.3858E+01	0.6000E-01
			0.5145E+01	0.8000E-01
			0.5788E+01	0.9000E-01
			0.6431E+01	0.1000E+00
			0.6431E+01	0.5000E+00
			0.6431E+01	0.2000E+01
10	10	0.1780E+02		
			0.0000E+00	0.0000E+00
			0.6431E+00	0.1000E-01
			0.1286E+01	0.2000E-01
			0.2572E+01	0.4000E-01
			0.3858E+01	0.6000E-01
			0.5145E+01	0.8000E-01
			0.5788E+01	0.9000E-01
			0.6431E+01	0.1000E+00
			0.6431E+01	0.5000E+00
			0.6431E+01	0.2000E+01
11	10	0.2133E+02		
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			0.9792E+00	0.1000E-01
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			0.3917E+01	0.4000E-01
			0.5875E+01	0.6000E-01
			0.7834E+01	0.8000E-01
			0.8813E+01	0.9000E-01
			0.9792E+01	0.1000E+00
			0.9792E+01	0.5000E+00
			0.9792E+01	0.2000E+01
12	10	0.2476E+02		
			0.0000E+00	0.0000E+00
			0.1582E+01	0.1000E-01
			0.3164E+01	0.2000E-01
			0.6328E+01	0.4000E-01
			0.9492E+01	0.6000E-01
			0.1266E+02	0.8000E-01
			0.1424E+02	0.9000E-01
			0.1582E+02	0.1000E+00
			0.1582E+02	0.5000E+00
			0.1582E+02	0.2000E+01
13	10	0.2480E+02		
			0.0000E+00	0.0000E+00
			0.1582E+01	0.1000E-01
			0.3164E+01	0.2000E-01
			0.6328E+01	0.4000E-01
			0.9492E+01	0.6000E-01
			0.1266E+02	0.8000E-01
			0.1424E+02	0.9000E-01
			0.1582E+02	0.1000E+00
			0.1582E+02	0.5000E+00
			0.1582E+02	0.2000E+01
14	10	0.2943E+02		
			0.0000E+00	0.0000E+00
			0.3476E+01	0.1000E-01

```
                                        0.6952E+01      0.2000E-01
                                        0.1390E+02      0.4000E-01
                                        0.2086E+02      0.6000E-01
                                        0.2781E+02      0.8000E-01
                                        0.3128E+02      0.9000E-01
                                        0.3476E+02      0.1000E+00
                                        0.3476E+02      0.5000E+00
                                        0.3476E+02      0.2000E+01
   15         10      0.3396E+02
                                        0.0000E+00      0.0000E+00
                                        0.3476E+01      0.1000E-01
                                        0.6952E+01      0.2000E-01
                                        0.1390E+02      0.4000E-01
                                        0.2086E+02      0.6000E-01
                                        0.2781E+02      0.8000E-01
                                        0.3128E+02      0.9000E-01
                                        0.3476E+02      0.1000E+00
                                        0.3476E+02      0.5000E+00
                                        0.3476E+02      0.2000E+01
```

TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00
0.6355E+02	0.8976E-02
0.1271E+03	0.1795E-01
0.2542E+03	0.3591E-01
0.5084E+03	0.2334E+00
0.7626E+03	0.7540E+00
0.9151E+03	0.1311E+01
0.1017E+04	0.1795E+01
0.1017E+04	0.2693E+01
0.1017E+04	0.3591E+01

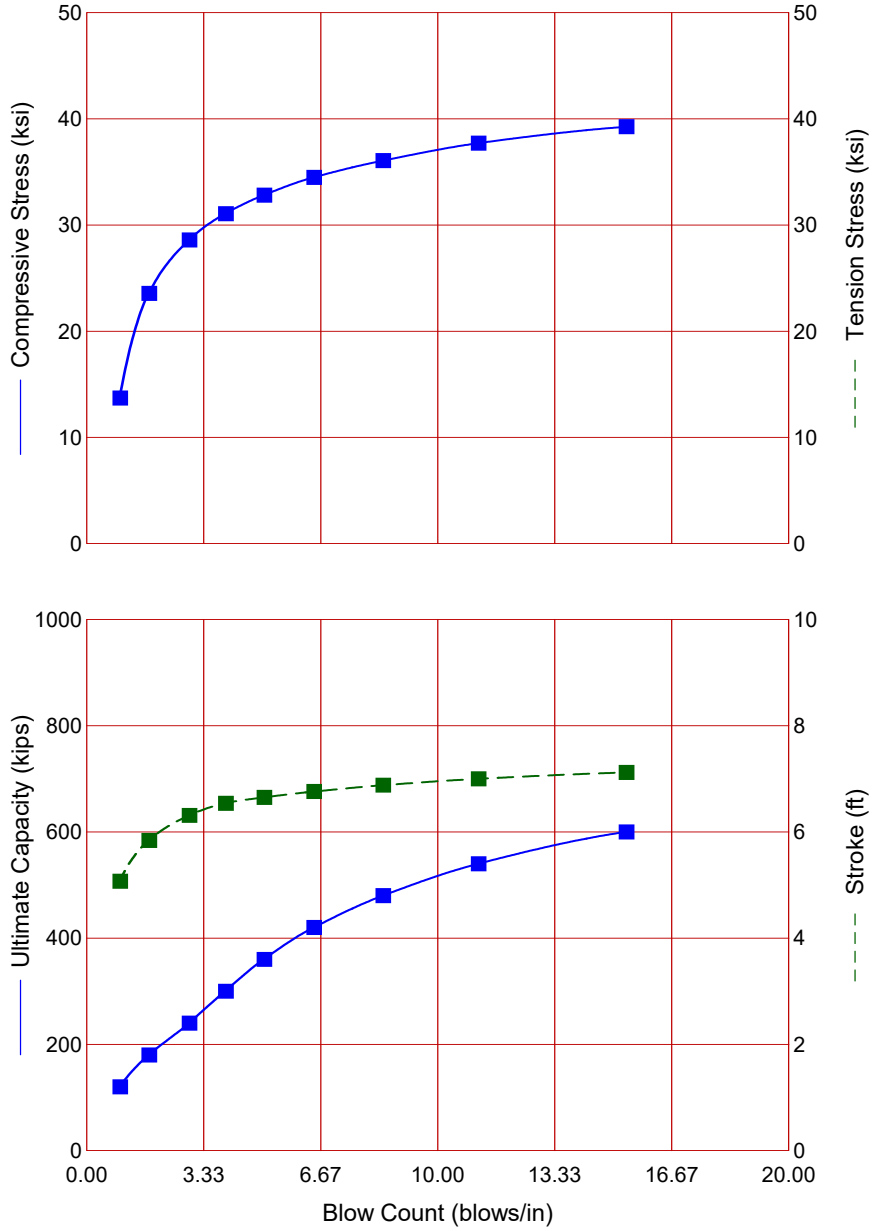
LOAD VERSUS SETTLEMENT CURVE
****

TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.9199E+00	0.1536E-03	0.7079E+00	0.1000E-03
0.9199E+01	0.1536E-02	0.7079E+01	0.1000E-02
0.4599E+02	0.7682E-02	0.3540E+02	0.5000E-02
0.9199E+02	0.1536E-01	0.7079E+02	0.1000E-01
0.3765E+03	0.7167E-01	0.2723E+03	0.5000E-01
0.5250E+03	0.1297E+00	0.3367E+03	0.1000E+00
0.8269E+03	0.5486E+00	0.6386E+03	0.5000E+00
0.1018E+04	0.1061E+01	0.8300E+03	0.1000E+01
0.1205E+04	0.2072E+01	0.1017E+04	0.2000E+01

Appendix I – Drivability Analysis, WEAP output

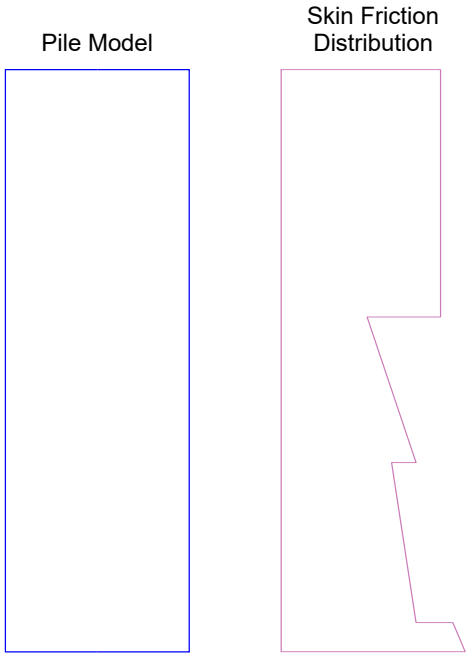
Moreland Altobelli Associates Inc.
PI No. 0004634, Bent 1 Lt 14x73

21-Oct-2021
GRLWEAP Version 2010



ICE 60-S

Ram Weight	7.00	kips
Efficiency	0.800	
Pressure	920 (80%)	psi
Helmet Weight	2.09	kips
Hammer Cushion	34825	kips/in
COR of H.C.	0.920	
Skin Quake	0.100	in
Toe Quake	0.100	in
Skin Damping	0.120	s/ft
Toe Damping	0.150	s/ft
Pile Length	20.00	ft
Pile Penetration	20.00	ft
Pile Top Area	21.40	in2



Res. Shaft = 51 %
(Proportional)

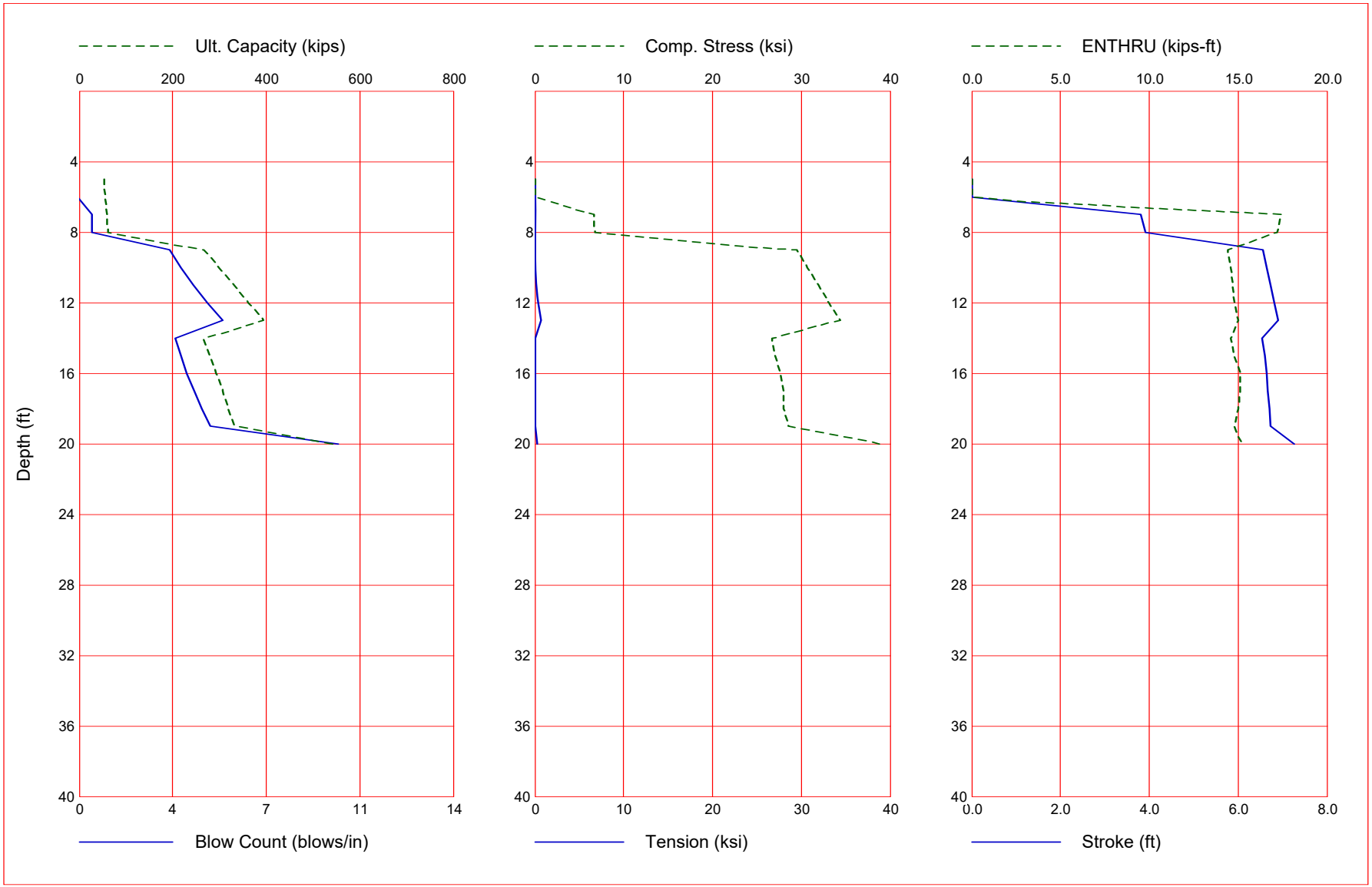
Moreland Altobelli Associates Inc. 21-Oct-2021
PI No. 0004634, Bent 1 Lt 14x73 GRLWEAP Version 2010

Ultimate Capacity kips	Maximum Compression Stress ksi	Maximum Tension Stress ksi	Blow Count blows/in	Stroke ft	Energy kips-ft
120.0	13.71	0.00	1.0	5.07	13.92
180.0	23.56	0.00	1.8	5.84	13.69
240.0	28.58	0.00	2.9	6.31	13.43
300.0	31.05	0.00	4.0	6.54	13.54
360.0	32.81	0.00	5.1	6.65	13.44
420.0	34.48	0.00	6.5	6.76	13.38
480.0	36.06	0.00	8.4	6.88	13.33
540.0	37.70	0.00	11.2	7.00	13.62
600.0	39.25	0.00	15.4	7.12	13.93

Moreland Altobelli Associates Inc.
PI No. 0004634, Bent 1 Lt 14x73

Oct 21 2021
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.500 / 1.000



Moreland Altobelli Associates Inc.
PI No. 0004634, Bent 1 Lt 14x73

Oct 21 2021
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.500 / 1.000

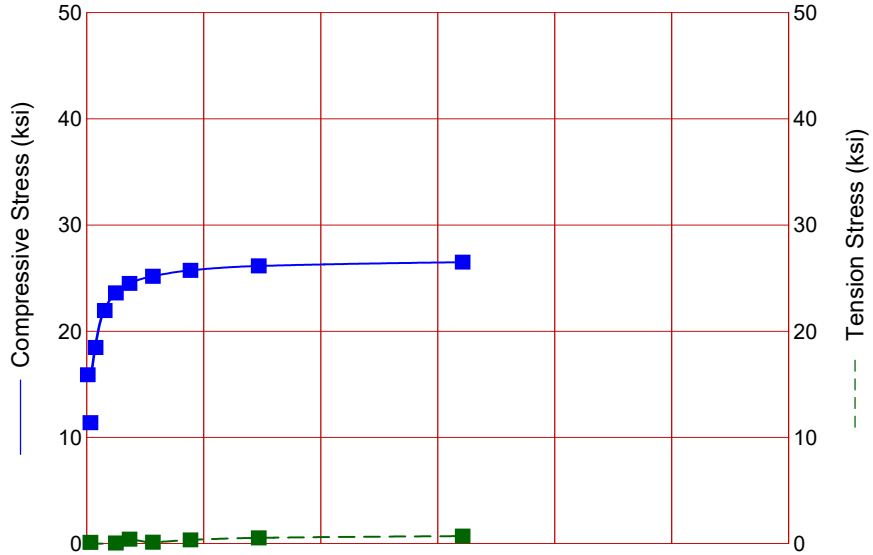
Zero depth elevation = 1001'

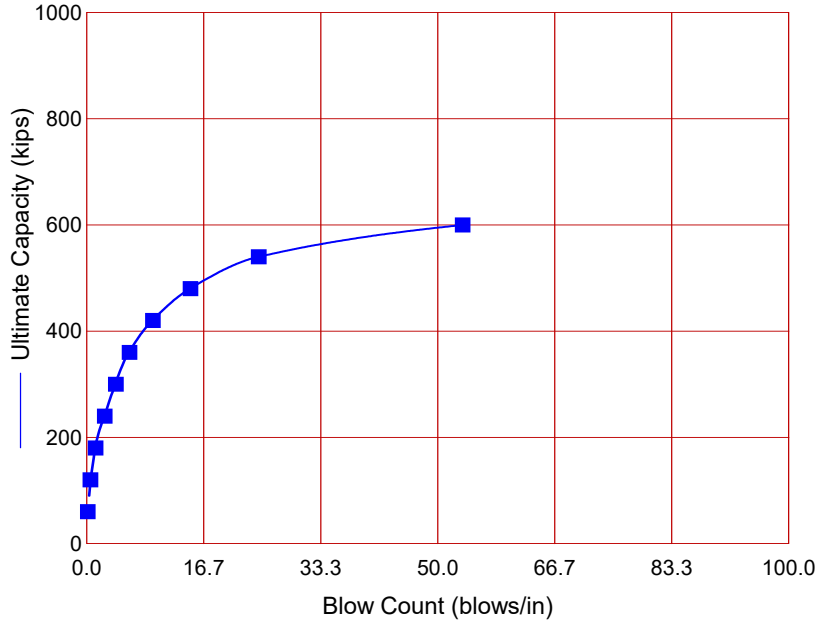
	Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/in	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
	5.0	53.1	15.7	37.4	-0.1	0.000	0.000	0.00	0.0
	6.0	56.3	18.8	37.4	-0.1	0.000	0.000	0.00	0.0
	7.0	59.4	22.0	37.4	0.5	6.618	0.000	3.81	17.4
	8.0	62.6	25.1	37.4	0.5	6.795	0.000	3.91	17.2
	9.0	267.1	28.1	239.0	3.4	29.440	0.000	6.56	14.4
	10.0	298.5	31.2	267.3	3.8	30.702	0.000	6.65	14.6
	11.0	330.3	34.6	295.7	4.3	31.916	-0.114	6.74	14.7
	12.0	362.4	38.3	324.1	4.8	33.099	-0.414	6.82	14.8
	13.0	394.9	42.4	352.5	5.4	34.422	-0.657	6.90	15.0
	14.0	265.7	46.4	219.4	3.6	26.671	0.000	6.54	14.6
Min. Tip Ele. 986'	15.0	279.0	49.9	229.1	3.8	27.056	0.000	6.61	14.8
	16.0	292.5	53.7	238.8	4.0	27.636	0.000	6.65	15.1
	17.0	306.1	57.6	248.5	4.3	27.972	0.000	6.67	15.1
Est. Tip Ele. 983'	18.0	319.8	61.6	258.2	4.6	28.032	0.000	6.71	15.0
	19.0	333.7	65.8	267.9	4.9	28.540	0.000	6.74	14.8
	20.0	545.0	71.4	473.5	9.7	38.883	-0.279	7.26	15.2

Total Continuous Driving Time 14.00 minutes; Total Number of Blows 633 (starting at penetration 5.0 ft)

Moreland Altobelli Associates Inc.
PI No. 0004634, Bent 5 Lt HP14x73

22-Oct-2021
GRLWEAP Version 2010

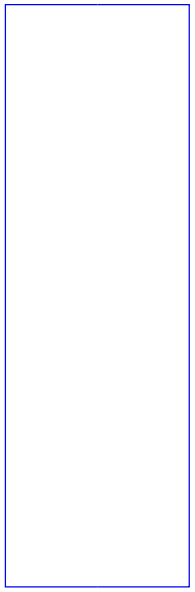




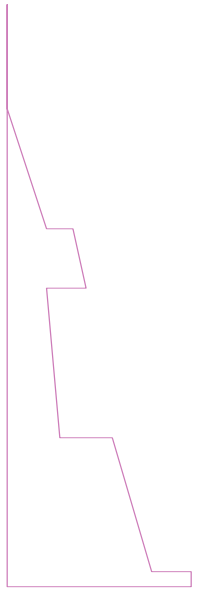
ICE 60-S

Stroke	6.00	ft
Ram Weight	7.00	kips
Efficiency	0.800	
Pressure	Variable	
Helmet Weight	2.09	kips
Hammer Cushion	34825	kips/in
COR of H.C.	0.920	
Skin Quake	0.100	in
Toe Quake	0.234	in
Skin Damping	0.050	s/ft
Toe Damping	0.150	s/ft
Pile Length	39.00	ft
Pile Penetration	32.00	ft
Pile Top Area	21.40	in2

Pile Model



Skin Friction Distribution



Res. Shaft = 51 %
(Proportional)

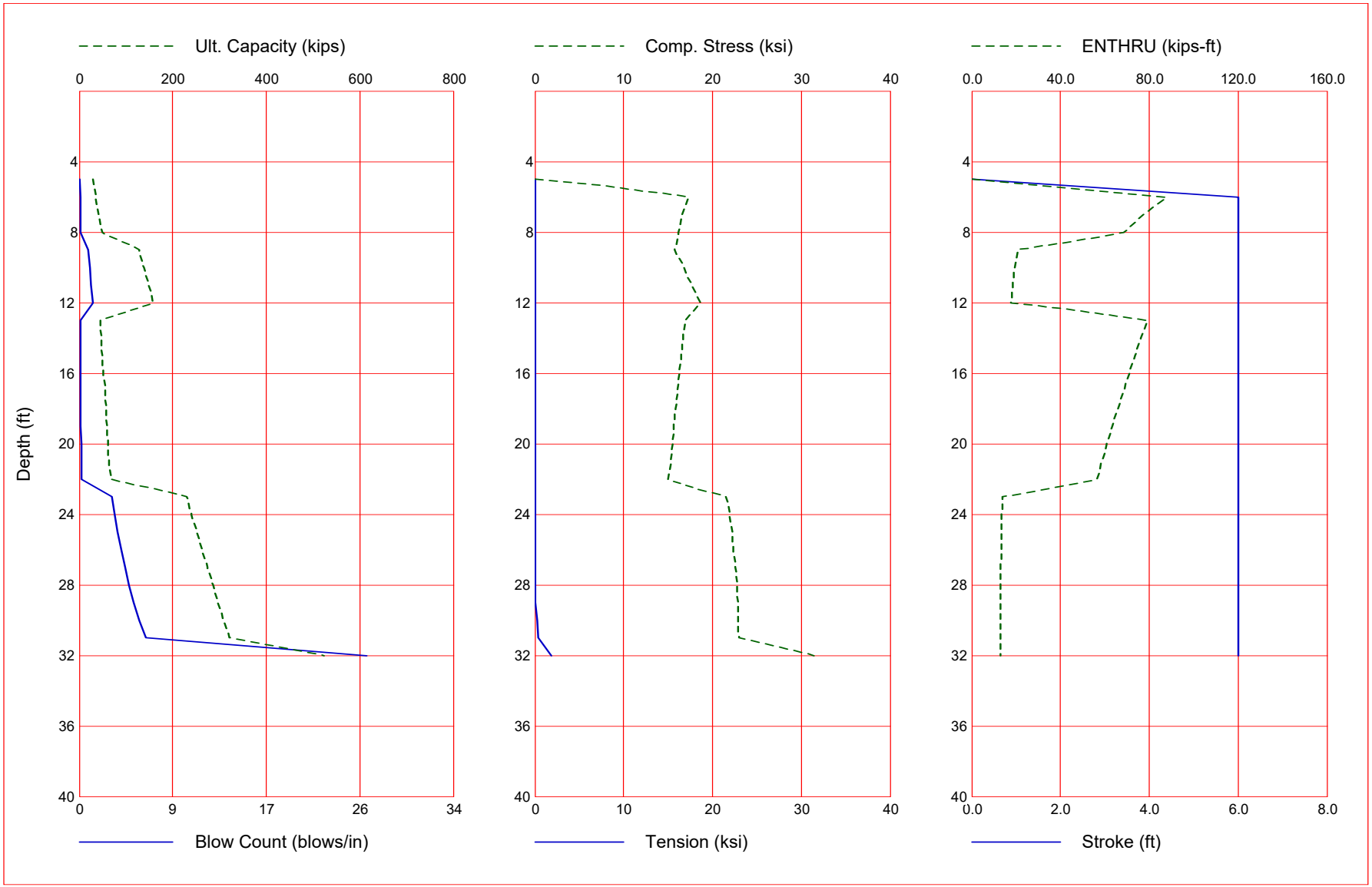
Moreland Altobelli Associates Inc. 22-Oct-2021
PI No. 0004634, Bent 5 Lt HP14x73 GRLWEAP Version 2010

Ultimate Capacity kips	Maximum Compression Stress ksi	Maximum Tension Stress ksi	Blow Count blows/in	Stroke ft	Energy kips-ft
60.0	15.90	0.00	0.1	6.00	67.10
120.0	11.38	0.13	0.5	6.00	24.97
180.0	18.47	0.00	1.3	6.00	18.18
240.0	21.95	0.00	2.6	6.00	14.24
300.0	23.60	0.06	4.2	6.00	13.05
360.0	24.50	0.43	6.1	6.00	12.82
420.0	25.17	0.14	9.4	6.00	12.70
480.0	25.73	0.36	14.8	6.00	12.75
540.0	26.15	0.55	24.5	6.00	12.58
600.0	26.50	0.72	53.6	6.00	12.49

Moreland Altobelli Associates Inc.
PI No. 0004634, Bent 5 Lt HP14x73

Oct 22 2021
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.833 / 1.000



Moreland Altobelli Associates Inc.
PI No. 0004634, Bent 5 Lt HP14x73

Oct 22 2021
GRLWEAP Version 2010

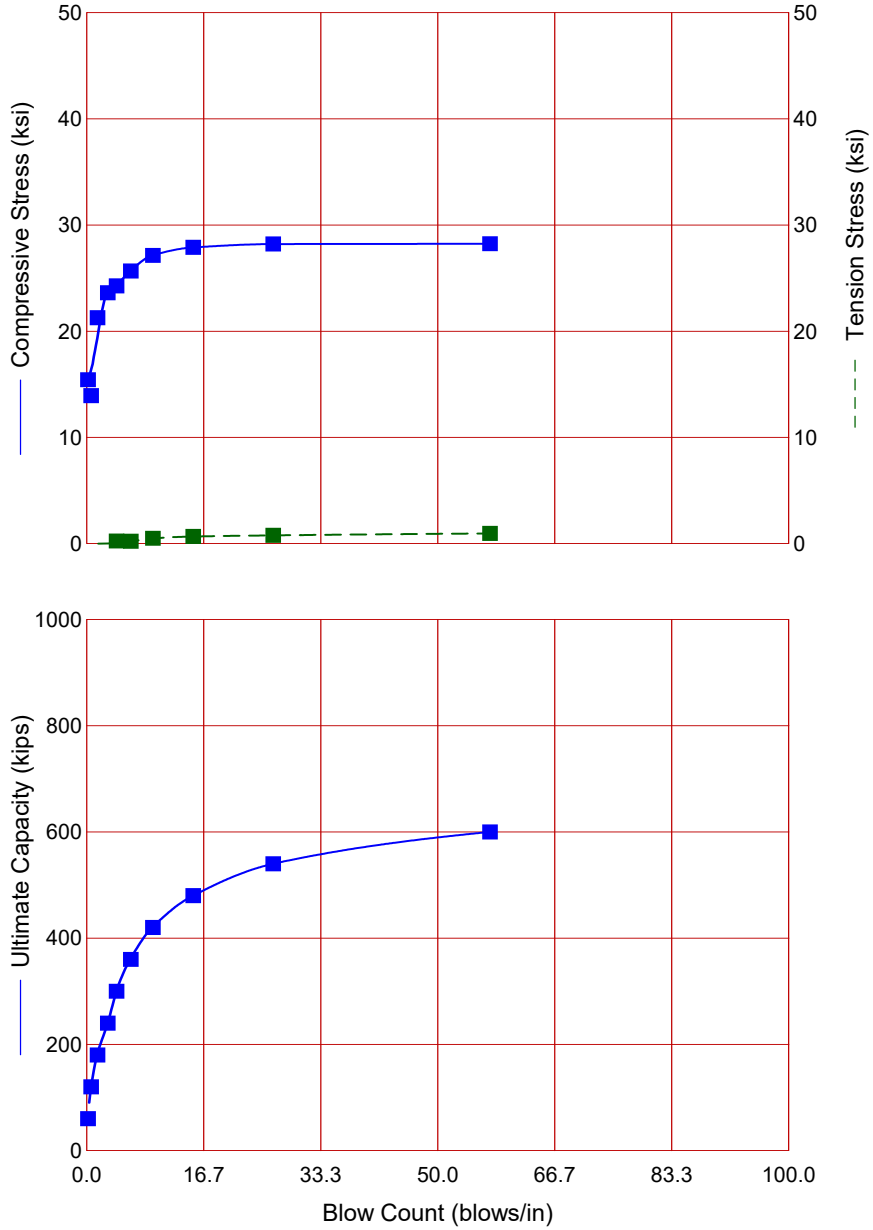
Gain/Loss 1 at Shaft and Toe 0.833 / 1.000

	Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/in	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
Zero depth Ele. 990'									
	5.0	29.5	1.9	27.7	-0.1	0.000	0.000	0.00	0.0
	6.0	35.9	2.7	33.2	0.1	17.320	0.000	6.00	87.8
	7.0	42.4	3.6	38.7	0.1	16.621	0.000	6.00	77.6
	8.0	49.0	4.7	44.3	0.1	16.127	0.000	6.00	68.5
	9.0	129.0	6.6	122.4	0.8	15.759	-0.044	6.00	20.7
	10.0	138.7	8.6	130.1	1.0	16.754	0.000	6.00	19.5
	11.0	148.6	10.8	137.8	1.1	17.632	0.000	6.00	18.4
	12.0	158.5	13.0	145.5	1.3	18.615	0.000	6.00	17.5
	13.0	45.8	14.2	31.6	0.1	16.878	0.000	6.00	79.0
	14.0	48.0	15.4	32.6	0.1	16.671	0.000	6.00	76.2
	15.0	50.3	16.7	33.6	0.1	16.435	0.000	6.00	73.5
	16.0	52.5	18.0	34.6	0.1	16.245	0.000	6.00	71.2
	17.0	54.9	19.3	35.5	0.1	16.037	0.000	6.00	68.6
	18.0	57.2	20.7	36.5	0.2	15.795	0.000	6.00	66.0
	19.0	59.6	22.1	37.5	0.2	15.625	0.000	6.00	63.3
	20.0	62.0	23.5	38.5	0.2	15.471	0.000	6.00	60.9
	21.0	64.5	25.0	39.5	0.2	15.255	0.000	6.00	58.5
Min. Tip 968'	22.0	67.0	26.5	40.5	0.2	15.022	0.000	6.00	56.4
	23.0	229.6	29.7	200.0	3.0	21.606	0.000	6.00	13.7
	24.0	240.6	32.9	207.7	3.2	21.884	0.000	6.00	13.6
	25.0	251.6	36.3	215.4	3.5	22.267	0.000	6.00	13.5
	26.0	262.8	39.8	223.1	3.8	22.386	0.000	6.00	13.3
	27.0	274.1	43.4	230.7	4.2	22.565	0.000	6.00	13.2
	28.0	285.6	47.1	238.4	4.5	22.801	0.000	6.00	13.2
	29.0	297.1	51.0	246.1	5.0	22.829	-0.047	6.00	13.1
	30.0	308.8	55.0	253.8	5.4	22.922	-0.272	6.00	13.0
Est. Tip 959'	31.0	320.6	59.1	261.5	6.0	23.029	-0.376	6.00	12.9
	32.0	523.2	64.6	458.6	26.1	31.433	-1.859	6.00	12.8

Total Continuous Driving Time 15.00 minutes; Total Number of Blows 692 (starting at penetration 5.0 ft)

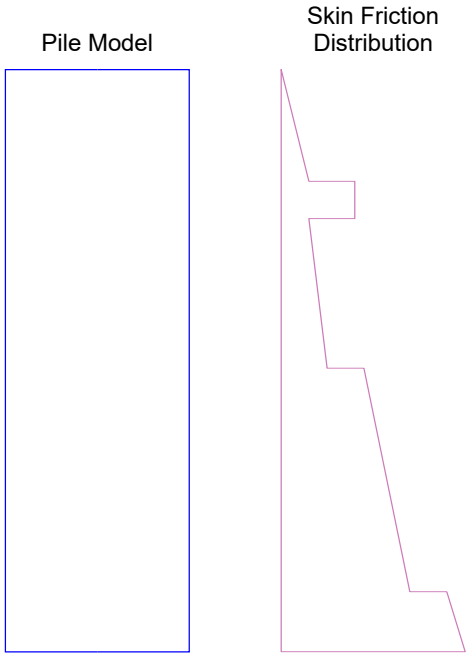
Moreland Altobelli Associates Inc.
PI No. 0004634, Bent 6 Lt 14x73

22-Oct-2021
GRLWEAP Version 2010



ICE 60-S

Stroke	6.00	ft
Ram Weight	7.00	kips
Efficiency	0.800	
Pressure	Variable	
Helmet Weight	2.09	kips
Hammer Cushion	34825	kips/in
COR of H.C.	0.920	
Skin Quake	0.100	in
Toe Quake	0.100	in
Skin Damping	0.059	s/ft
Toe Damping	0.150	s/ft
Pile Length	39.00	ft
Pile Penetration	39.00	ft
Pile Top Area	21.40	in2



Res. Shaft = 26 %
(Proportional)

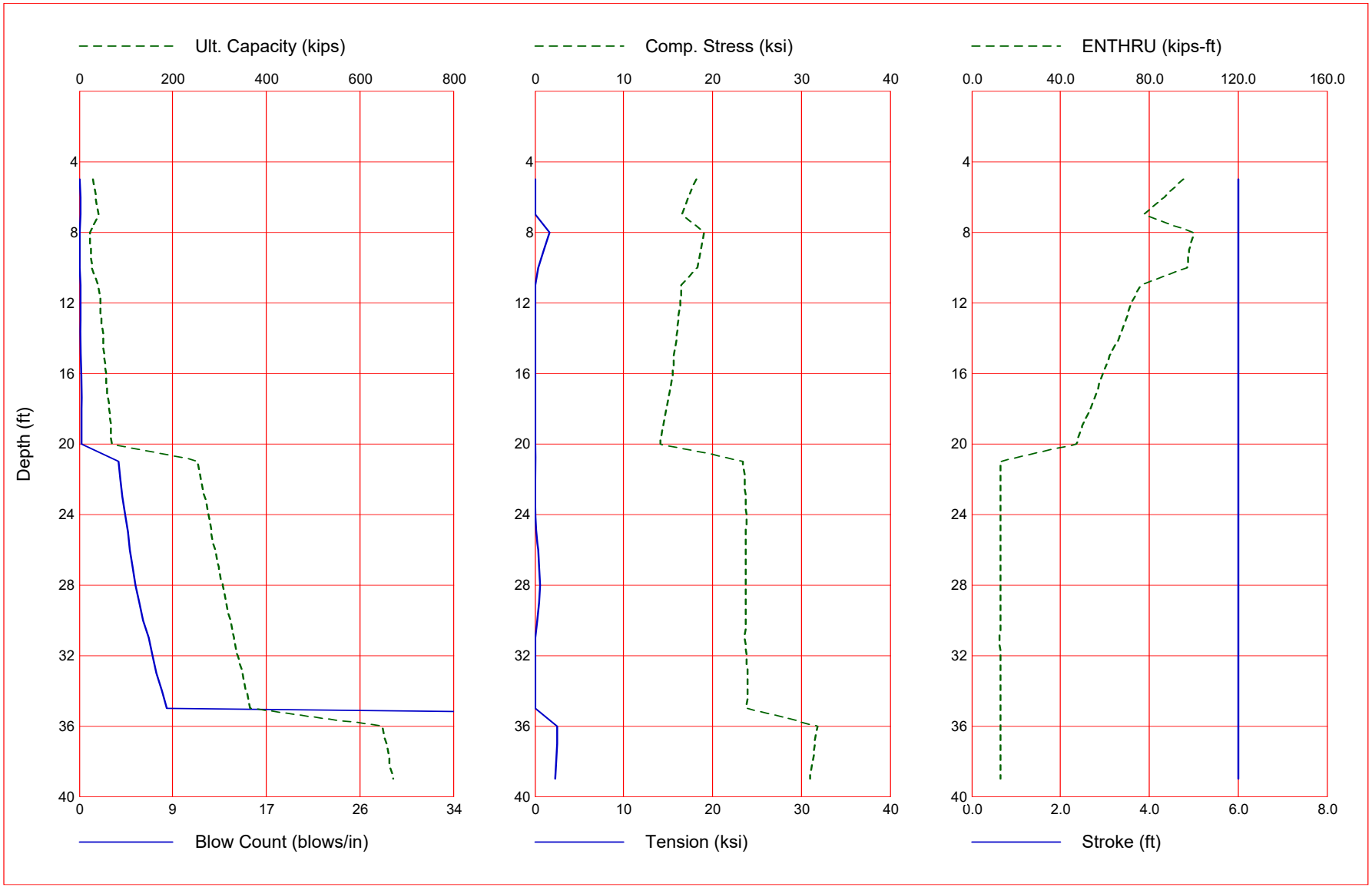
Moreland Altobelli Associates Inc. 22-Oct-2021
PI No. 0004634, Bent 6 Lt 14x73 GRLWEAP Version 2010

Ultimate Capacity kips	Maximum Compression Stress ksi	Maximum Tension Stress ksi	Blow Count blows/in	Stroke ft	Energy kips-ft
60.0	15.43	0.00	0.2	6.00	57.10
120.0	13.94	0.00	0.6	6.00	23.44
180.0	21.26	0.00	1.6	6.00	15.88
240.0	23.63	0.00	3.0	6.00	13.00
300.0	24.26	0.25	4.3	6.00	12.53
360.0	25.67	0.24	6.3	6.00	12.53
420.0	27.14	0.50	9.4	6.00	12.63
480.0	27.89	0.68	15.2	6.00	12.63
540.0	28.21	0.79	26.6	6.00	12.63
600.0	28.24	0.96	57.5	6.00	12.63

Moreland Altobelli Associates Inc.
PI No. 0004634, Bent 6 Lt 14x73

Oct 22 2021
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.500 / 1.000



Moreland Altobelli Associates Inc.
PI No. 0004634, Bent 6 Lt 14x73

Oct 22 2021
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.500 / 1.000

	Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/in	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
Zero depth Ele. 998'									
	5.0	29.5	1.9	27.7	0.1	18.140	-0.055	6.00	95.3
	6.0	35.9	2.7	33.2	0.1	17.226	0.000	6.00	87.0
	7.0	42.4	3.6	38.8	0.1	16.547	0.000	6.00	77.3
	8.0	23.8	5.1	18.7	0.1	19.030	-1.641	6.00	100.0
	9.0	25.8	7.0	18.7	0.1	18.684	-1.036	6.00	98.1
	10.0	27.7	9.0	18.7	0.1	18.333	-0.421	6.00	97.1
	11.0	42.5	10.2	32.4	0.1	16.523	0.000	6.00	76.0
	12.0	45.4	11.4	34.0	0.1	16.384	0.000	6.00	72.1
	13.0	48.3	12.7	35.6	0.1	16.179	0.000	6.00	69.2
	14.0	51.3	14.1	37.2	0.1	15.933	0.000	6.00	66.3
	15.0	54.4	15.6	38.8	0.2	15.650	0.000	6.00	61.9
	16.0	57.5	17.1	40.4	0.2	15.486	0.000	6.00	59.2
	17.0	60.6	18.6	42.0	0.2	15.170	0.000	6.00	56.7
	18.0	63.9	20.2	43.6	0.2	14.794	0.000	6.00	53.4
	19.0	67.2	21.9	45.2	0.2	14.459	0.000	6.00	49.6
	20.0	70.5	23.7	46.8	0.2	14.090	0.000	6.00	47.3
	21.0	253.4	27.3	226.1	3.6	23.431	0.000	6.00	13.2
	22.0	260.7	31.0	229.7	3.8	23.607	0.000	6.00	13.2
	23.0	268.1	34.9	233.2	4.0	23.774	0.000	6.00	13.1
	24.0	275.6	38.9	236.7	4.2	23.799	0.000	6.00	13.0
	25.0	283.3	43.0	240.3	4.4	23.734	-0.142	6.00	12.9
	26.0	291.0	47.2	243.8	4.6	23.775	-0.343	6.00	12.9
	27.0	298.9	51.5	247.4	4.9	23.718	-0.509	6.00	12.8
	28.0	306.9	56.0	250.9	5.2	23.716	-0.598	6.00	12.9
	29.0	315.1	60.6	254.4	5.5	23.696	-0.469	6.00	12.9
Min. Tip 968'	30.0	323.3	65.3	258.0	5.8	23.753	-0.291	6.00	12.8
	31.0	331.7	70.2	261.5	6.3	23.675	-0.032	6.00	12.7
	32.0	340.2	75.1	265.1	6.7	23.821	0.000	6.00	12.8
	33.0	348.8	80.2	268.6	7.0	23.947	0.000	6.00	12.9
Est. Tip 964'	34.0	357.6	85.4	272.1	7.5	23.913	0.000	6.00	12.8
	35.0	366.4	90.8	275.7	8.0	23.847	0.000	6.00	12.9
	36.0	649.2	97.9	551.4	158.0	31.799	-2.509	6.00	12.9
	37.0	656.5	105.1	551.4	209.1	31.482	-2.488	6.00	12.8
	38.0	664.0	112.6	551.4	289.7	31.256	-2.396	6.00	12.9
	39.0	671.7	120.3	551.4	463.9	30.934	-2.256	6.00	12.8

Total Continuous Driving Time 244.00 minutes; Total Number of Blows 11673 (starting at penetration 5.0 ft)