ARKANSAS DEPARTMENT OF TRANSPORTATION

# SUBSURFACE INVESTIGATION

**STATE JOB NO.** 020475

**FEDERAL AID PROJECT NO.** STPSC-9293(9)

**HWY. 83 SPUR – HWY. 278 CONNECTOR (MONTICELLO) (F)**

**STATE HIGHWAY** 83 **SECTION** 1

**IN** DREW **COUNTY**

The information contained herein was obtained by the Department for design and estimating purposes only. It is being furnished with the express understanding that said information does not constitute a part of the Proposal or Contract and represents only the best knowledge of the Department as to the location, character and depth of the materials encountered. The information is only included and made available so that bidders may have access to subsurface information obtained by the Department and is not intended to be a substitute for personal investigation, interpretation and judgment of the bidder. The bidder should be cognizant of the possibility that conditions affecting the cost and/or quantities of work to be performed may differ from those indicated herein.

ARKANSAS DEPARTMENT OF TRANSPORTATION
ArDOT.gov | IDriveArkansas.com | Scott E. Bennett, P.E., Director
MATERIALS DIVISION
11301 West Baseline Road | P.O. Box 2261 | Little Rock, AR 72203-2261 | Phone: 501.569.2185 | Fax: 501.569.2368

July 26, 2019

**TO:** Mr. Trinity Smith, Engineer of Roadway Design

**SUBJECT:** Job No. 020475
Hwy. 83 Spur – Hwy. 278 Connector (Monticello) (S)
Route 83 Section 1
Drew County

Attached is the requested soil survey, strength data, and Resilient Modulus test results for the above referenced job. The project consists of connecting Highway 83 Spur and Highway 278. Samples were taken in the existing travel lanes, ditch line and along the new alignment. The new alignment traverses hay fields.

The subgrade soils consist of moderate to highly plastic sandy clay. The subgrade soils may require stabilization to obtain a stable working platform. If remediation is required, it is recommended that the addition of 4% lime (by dry wt.) mixed to a depth of 16 inches be used for quantity estimation purposes. If the Engineer determines stabilization is required, field trials may dictate a stable working platform can be achieved at a lower lime content.

There are three ponds within the project limits. Two at station 1045+00 150 feet right and 185 feet left of centerline. These ponds may be outside of right of way limits. At station 1083+00 is approximately 10 feet right of centerline.

Geotechnical should be notified when cross sections are available so that undercut and embankment recommendations can be made.

Listed below is the additional information requested for use in developing the plans:

1. The Qualified Products List (QPL) indicates that Aggregate Base Course (Class CL-7) is available from commercial producers located near Sweet Home.

2. Asphalt Concrete Hot Mix

| Type | Asphalt Cement % | Mineral Aggregate % |
|---|---|---|
| Surface Course | 5.2 | 94.8 |
| Binder Course | 4.2 | 95.8 |
| Base Course | 3.5 | 96.5 |

Michael C. Benson
Materials Engineer

MCB:pt:bjj
Attachment
cc: State Constr. Eng. – Master File Copy
District 2 Engineer
System Information and Research Div.
G. C. File

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 ARKANSAS STATE HIGHWAY AND TRANSPORTATION DEPARTMENT - LITTLE ROCK, ARKANSAS
                               MATERIALS DIVISION
                   MICHAEL BENSON, MATERIALS ENGINEER
                    *** SOIL SURVEY STRENGTH TEST REPORT ***

DATE       - 07/10/2019                            SEQUENCE NO.  - 1
JOB NUMBER - 020475                                MATERIAL CODE - SSRV
                                                   SPEC. YEAR    - 2014
                                                   SUPPLIER ID.  - 1
                                                   COUNTY/STATE  - 22
                                                   DISTRICT NO.  - 02
JOB NAME - HWY.83 SPUR - HWY.278 CONNECTOR (MONTICELLO)(S)
******************************************************************************
*                  STATION LIMITS            R-VALUE AT 240 psi                *
******************************************************************************

                 BEGIN JOB - END JOB           LESS THAN 5

                 RESILIENT MODULUS
                 STA. 1035+00                  12297
                 STA. 1094+00                  6890



------------------------------------------------------------------------------
REMARKS -
        -
AASHTO TESTS :  T190
```

## ARKANSAS STATE HIGHWAY AND TRANSPORTATION DEPARTMENT
## MATERIALS DIVISION

### AASHTO T 307-99 - RESILIENT MODULUS OF SUBGRADE SOILS
### RECOMPACTED SAMPLES

| | | | |
|---|---|---|---|
| **Job No.** | 020475 | **Material Code** | SSRVPS |
| **Date Sampled:** | 6/19/19 | **Station No.:** | 1035+00 |
| **Date Tested:** | July 3, 2019 | **Location:** | CL |
| **Name of Project:** | HWY. 83 SPUR - HWY. 278 CONNECTOR (MONTICELLO)(S) | | |
| **County:** | **Code:** 22 **Name:** DREW | | |
| **Sampled By:** | FRAZIER / DICKERSON | **Depth:** | 0-5 |
| **Lab No.:** | 20191826 | **AASHTO Class:** | A-7-6 (33) |
| **Sample ID:** | RV551 | **Material Type (1 or 2):** | 2 |
| **LATITUDE:** | | **LONGITUDE:** | |

---

**1. Testing Information:**

| | |
|---|---|
| Preconditioning - Permanent Strain > 5% (Y=Yes or N= No) | N |
| Testing - Permanent Strain > 5% (Y=Yes or N=No) | N |
| Number of Load Sequences Completed (0-15) | 15 |

**2. Specimen Information:**

| | |
|---|---|
| Specimen Diameter (in): | |
| Top | 3.95 |
| Middle | 3.95 |
| Bottom | 3.95 |
| Average | 3.95 |
| Membrane Thickness (in): | 0.01 |
| Height of Specimen, Cap and Base (in): | 8.02 |
| Height of Cap and Base (in): | 0.00 |
| Initial Length, Lo (in): | 8.02 |
| Initial Area, Ao (sq. in): | 12.18 |
| Initial Volume, AoLo (cu. in): | 97.68 |

**3. Soil Specimen Weight:**

| | |
|---|---|
| Weight of Wet Soil Used (g): | 2912.00 |

**4. Soil Properties:**

| | |
|---|---|
| Optimum Moisture Content (%): | 20.0 |
| Maximum Dry Density (pcf): | 99 |
| 95% of MDD (pcf): | 94.1 |
| In-Situ Moisture Content (%): | N/A |

**5. Specimen Properties:**

| | |
|---|---|
| Wet Weight (g): | 2912.00 |
| Compaction Moisture content (%): | 20.3 |
| Compaction Wet Density (pcf): | 113.59 |
| Compaction Dry Density (pcf): | 94.42 |
| Moisture Content After Mr Test (%): | 20.3 |

**6. Quick Shear Test (Y=Yes, N=No, N/A=Not Applicable):** #VALUE!

**7. Resilient Modulus, Mr:** 12122(Sc)^-0.03603(S3)^0.18592

**8. Comments**

**9. Tested By:** GW **Date:** July 3, 2019

# ARKANSAS STATE HIGHWAY AND TRANSPORTATION DEPARTMENT
# MATERIALS DIVISION

## AASHTO T 307-99 - RESILIENT MODULUS OF SUBGRADE SOILS
## RECOMPACTED SAMPLES

**Job No.** 020475
**Date Sampled:** 6/19/19
**Date Tested:** July 3, 2019
**Name of Project:** HWY. 83 SPUR - HWY. 278 CONNECTOR (MONTICELLO)(S)
**County:** **Code:** 22 **Name:** DREW
**Sampled By:** FRAZIER / DICKERSON
**Lab No.:** 20191826
**Sample ID:** RV551
**LATITUDE:**

**Material Code** SSRVPS
**Station No.:** 1035+00
**Location:** CL
**Depth:** 0-5
**AASHTO Class:** A-7-6 (33)
**Material Type (1 or 2):** 2
**LONGITUDE:**

| PARAMETER | *Chamber Confining Pressure* | *Nominal Maximum Axial Stress* | *Actual Applied Max. Axial Load* | *Actual Applied Cyclic Load* | *Actual Applied Contact Load* | *Actual Applied Max. Axial Stress* | *Actual Applied Cyclic Stress* | *Actual Applied Contact Stress* | *Average Recov Def. LVDT 1 and 2* | *Resilient Strain* | *Resilient Modulus* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| DESIGNATION | $S_3$ | $S_{cyclic}$ | $P_{max}$ | $P_{cyclic}$ | $P_{contact}$ | $S_{max}$ | $S_{cyclic}$ | $S_{contact}$ | $H_{avg}$ | $\varepsilon_r$ | $M_r$ |
| UNIT | psi | psi | lbs | lbs | lbs | psi | psi | psi | in | in/in | psi |
| Sequence 1 | 6.0 | 2.0 | 25.0 | 22.4 | 2.6 | 2.1 | 1.8 | 0.2 | 0.00086 | 0.00011 | 17,189 |
| Sequence 2 | 6.0 | 4.0 | 46.8 | 44.1 | 2.7 | 3.8 | 3.6 | 0.2 | 0.00178 | 0.00022 | 16,352 |
| Sequence 3 | 6.0 | 6.0 | 69.6 | 66.2 | 3.5 | 5.7 | 5.4 | 0.3 | 0.00273 | 0.00034 | 15,952 |
| Sequence 4 | 6.0 | 8.0 | 93.2 | 87.3 | 6.0 | 7.7 | 7.2 | 0.5 | 0.00378 | 0.00047 | 15,211 |
| Sequence 5 | 6.0 | 10.0 | 116.7 | 108.2 | 8.5 | 9.6 | 8.9 | 0.7 | 0.00486 | 0.00061 | 14,656 |
| Sequence 6 | 4.0 | 2.0 | 25.0 | 22.2 | 2.8 | 2.1 | 1.8 | 0.2 | 0.00092 | 0.00011 | 15,875 |
| Sequence 7 | 4.0 | 4.0 | 46.9 | 44.1 | 2.8 | 3.9 | 3.6 | 0.2 | 0.00189 | 0.00024 | 15,336 |
| Sequence 8 | 4.0 | 6.0 | 68.7 | 65.9 | 2.8 | 5.6 | 5.4 | 0.2 | 0.00289 | 0.00036 | 15,022 |
| Sequence 9 | 4.0 | 8.0 | 92.5 | 87.3 | 5.2 | 7.6 | 7.2 | 0.4 | 0.00389 | 0.00048 | 14,791 |
| Sequence 10 | 4.0 | 10.0 | 115.7 | 108.1 | 7.7 | 9.5 | 8.9 | 0.6 | 0.00497 | 0.00062 | 14,304 |
| Sequence 11 | 2.0 | 2.0 | 24.9 | 22.1 | 2.8 | 2.0 | 1.8 | 0.2 | 0.00118 | 0.00015 | 12,297 |
| Sequence 12 | 2.0 | 4.0 | 46.7 | 43.9 | 2.8 | 3.8 | 3.6 | 0.2 | 0.00224 | 0.00028 | 12,934 |
| Sequence 13 | 2.0 | 6.0 | 68.5 | 65.6 | 2.8 | 5.6 | 5.4 | 0.2 | 0.00328 | 0.00041 | 13,157 |
| Sequence 14 | 2.0 | 8.0 | 91.2 | 86.9 | 4.3 | 7.5 | 7.1 | 0.4 | 0.00434 | 0.00054 | 13,189 |
| Sequence 15 | 2.0 | 10.0 | 114.7 | 107.9 | 6.8 | 9.4 | 8.9 | 0.6 | 0.00534 | 0.00067 | 13,313 |

TESTED BY GW DATE July 3, 2019
REVIEWED BY DATE

# ARKANSAS STATE HIGHWAY AND TRANSPORTATION DEPARTMENT
## MATERIALS DIVISION

### AASHTO T 307-99 - RESILIENT MODULUS OF SUBGRADE SOILS
### RECOMPACTED / THINWALL TUBE SAMPLES

| | | | |
|---|---|---|---|
| **Job No.** | 020475 | **Material Code** | SSRVPS |
| **Date Sampled:** | 6/19/19 | **Station No.:** | 1035+00 |
| **Date Tested:** | July 3, 2019 | **Location:** | CL |
| **Name of Project:** | HWY. 83 SPUR - HWY. 278 CONNECTOR (MONTICELLO)(S) | | |
| **County:** | **Code:** 22 **Name:** DREW | | |
| **Sampled By:** | FRAZIER / DICKERSON | **Depth:** | 0-5 |
| **Lab No.:** | 20191826 | **AASHTO Class:** | A-7-6 (33) |
| **Sample ID:** | RV551 | **Material Type (1 or 2):** | 2 |
| **LATITUDE:** | | **LONGITUDE:** | |

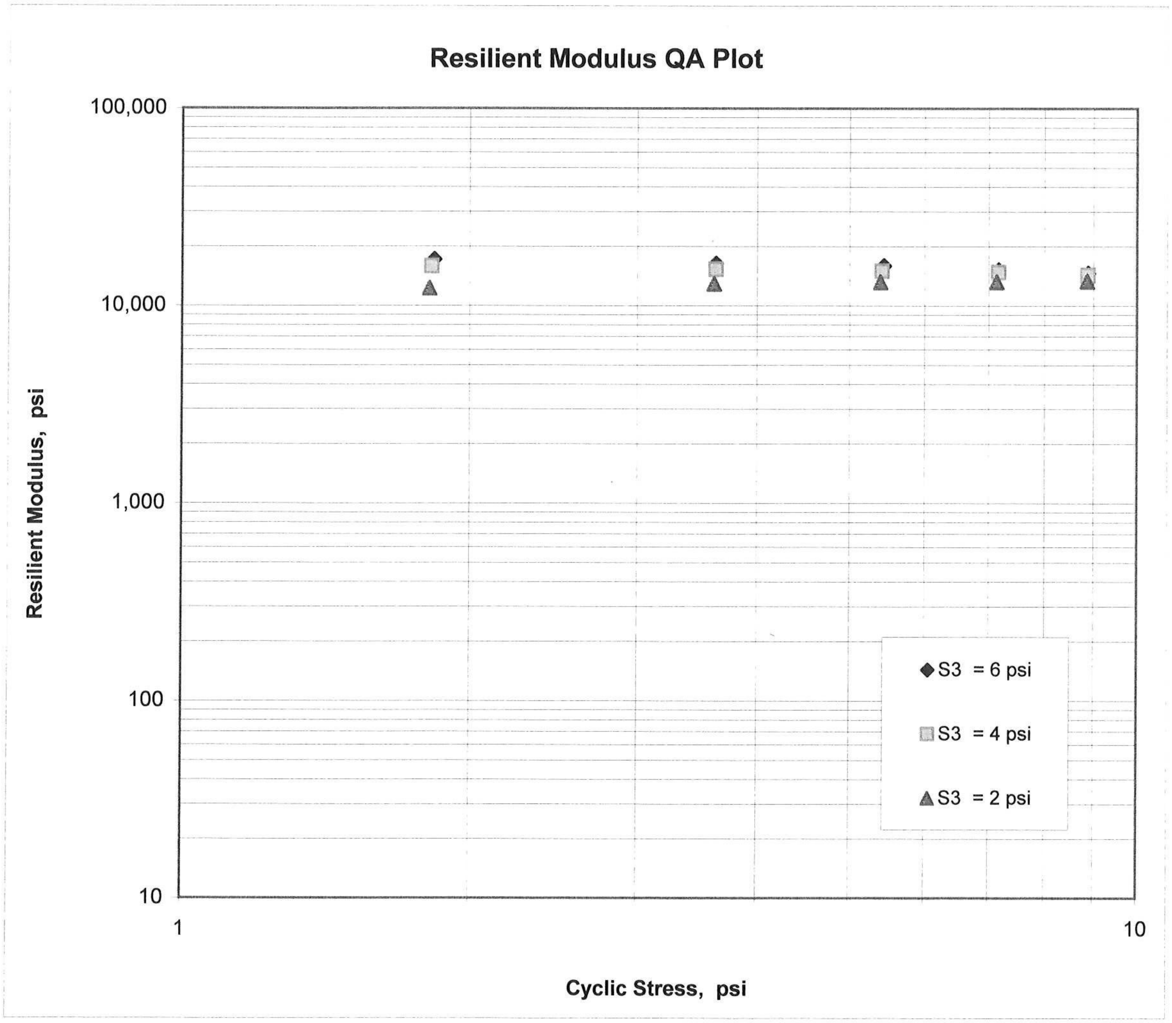
$$M_R = K1\,(S_C)^{K2}\,(S_3)^{K5}$$

$K1 =$ 12,122

$K2 =$ -0.03603

$K5 =$ 0.18592

$R^2 =$ 0.84



## ARKANSAS STATE HIGHWAY AND TRANSPORTATION DEPARTMENT
## MATERIALS DIVISION

### AASHTO T 307-99 - RESILIENT MODULUS OF SUBGRADE SOILS
### RECOMPACTED SAMPLES

| | | | |
|---|---|---|---|
| **Job No.** | 020475 | **Material Code** | SSRVPS |
| **Date Sampled:** | 6/19/19 | **Station No.:** | 1094+00 |
| **Date Tested:** | July 3, 2019 | **Location:** | CL |
| **Name of Project:** | HWY. 83 SPUR - HWY. 278 CONNECTOR (MONTICELLO)(S) | | |
| **County:** | **Code:** 22 **Name:** DREW | | |
| **Sampled By:** | FRAZIER / DICKERSON | **Depth:** | 0-5 |
| **Lab No.:** | 20191827 | **AASHTO Class:** | A-2-4 (0) |
| **Sample ID:** | RV552 | **Material Type (1 or 2):** | 2 |
| **LATITUDE:** | | **LONGITUDE:** | |

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**1. Testing Information:**

| | |
|---|---|
| Preconditioning - Permanent Strain > 5% (Y=Yes or N= No) | N |
| Testing - Permanent Strain > 5% (Y=Yes or N=No) | N |
| Number of Load Sequences Completed (0-15) | 15 |

**2. Specimen Information:**

| | |
|---|---|
| Specimen Diameter (in): | |
| Top | 3.95 |
| Middle | 3.95 |
| Bottom | 3.95 |
| Average | 3.95 |
| Membrane Thickness (in): | 0.01 |
| Height of Specimen, Cap and Base (in): | 8.02 |
| Height of Cap and Base (in): | 0.00 |
| Initial Length, Lo (in): | 8.02 |
| Initial Area, Ao (sq. in): | 12.18 |
| Initial Volume, AoLo (cu. in): | 97.68 |

**3. Soil Specimen Weight:**

| | |
|---|---|
| Weight of Wet Soil Used (g): | 3392.90 |

**4. Soil Properties:**

| | |
|---|---|
| Optimum Moisture Content (%): | 10.4 |
| Maximum Dry Density (pcf): | 122.6 |
| 95% of MDD (pcf): | 116.5 |
| In-Situ Moisture Content (%): | N/A |

**5. Specimen Properties:**

| | |
|---|---|
| Wet Weight (g): | 3392.90 |
| Compaction Moisture content (%): | 10.3 |
| Compaction Wet Density (pcf): | 132.35 |
| Compaction Dry Density (pcf): | 119.99 |
| Moisture Content After Mr Test (%): | 10.1 |

**6. Quick Shear Test (Y=Yes, N=No, N/A=Not Applicable):** #VALUE!

**7. Resilient Modulus, Mr:** 4869(Sc)^0.02867(S3)^0.50818

**8. Comments** ____________________

**9. Tested By:** GW **Date:** July 3, 2019

# ARKANSAS STATE HIGHWAY AND TRANSPORTATION DEPARTMENT
# MATERIALS DIVISION

## AASHTO T 307-99 - RESILIENT MODULUS OF SUBGRADE SOILS
## RECOMPACTED SAMPLES

**Job No.** 020475
**Date Sampled:** 6/19/19
**Date Tested:** July 3, 2019
**Name of Project:** HWY. 83 SPUR - HWY. 278 CONNECTOR (MONTICELLO)(S)
**County:** **Code:** 22 **Name:** DREW
**Sampled By:** FRAZIER / DICKERSON
**Lab No.:** 20191827
**Sample ID:** RV552
**LATITUDE:**

**Material Code** SSRVPS
**Station No.:** 1094+00
**Location:** CL
**Depth:** 0-5
**AASHTO Class:** A-2-4 (0)
**Material Type (1 or 2):** 2
**LONGITUDE:**

| PARAMETER | *Chamber Confining Pressure* | *Nominal Maximum Axial Stress* | *Actual Applied Max. Axial Load* | *Actual Applied Cyclic Load* | *Actual Applied Contact Load* | *Actual Applied Max. Axial Stress* | *Actual Applied Cyclic Stress* | *Actual Applied Contact Stress* | *Average Recov Def. LVDT 1 and 2* | *Resilient Strain* | *Resilient Modulus* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| DESIGNATION | $S_3$ | $S_{cyclic}$ | $P_{max}$ | $P_{cyclic}$ | $P_{contact}$ | $S_{max}$ | $S_{cyclic}$ | $S_{contact}$ | $H_{avg}$ | $\varepsilon_r$ | $M_r$ |
| UNIT | psi | psi | lbs | lbs | lbs | psi | psi | psi | in | in/in | psi |
| Sequence 1 | 6.0 | 2.0 | 25.2 | 22.3 | 2.8 | 2.1 | 1.8 | 0.2 | 0.00113 | 0.00014 | 13,057 |
| Sequence 2 | 6.0 | 4.0 | 47.5 | 44.7 | 2.9 | 3.9 | 3.7 | 0.2 | 0.00229 | 0.00029 | 12,831 |
| Sequence 3 | 6.0 | 6.0 | 70.5 | 66.9 | 3.6 | 5.8 | 5.5 | 0.3 | 0.00349 | 0.00044 | 12,616 |
| Sequence 4 | 6.0 | 8.0 | 95.2 | 89.2 | 6.0 | 7.8 | 7.3 | 0.5 | 0.00462 | 0.00058 | 12,719 |
| Sequence 5 | 6.0 | 10.0 | 119.9 | 111.4 | 8.5 | 9.8 | 9.1 | 0.7 | 0.00580 | 0.00072 | 12,640 |
| Sequence 6 | 4.0 | 2.0 | 24.8 | 21.9 | 2.8 | 2.0 | 1.8 | 0.2 | 0.00143 | 0.00018 | 10,133 |
| Sequence 7 | 4.0 | 4.0 | 46.6 | 43.8 | 2.8 | 3.8 | 3.6 | 0.2 | 0.00292 | 0.00036 | 9,870 |
| Sequence 8 | 4.0 | 6.0 | 68.5 | 65.7 | 2.8 | 5.6 | 5.4 | 0.2 | 0.00437 | 0.00054 | 9,908 |
| Sequence 9 | 4.0 | 8.0 | 92.9 | 87.7 | 5.2 | 7.6 | 7.2 | 0.4 | 0.00563 | 0.00070 | 10,268 |
| Sequence 10 | 4.0 | 10.0 | 117.2 | 109.6 | 7.6 | 9.6 | 9.0 | 0.6 | 0.00683 | 0.00085 | 10,569 |
| Sequence 11 | 2.0 | 2.0 | 23.9 | 21.1 | 2.8 | 2.0 | 1.7 | 0.2 | 0.00201 | 0.00025 | 6,898 |
| Sequence 12 | 2.0 | 4.0 | 44.3 | 41.5 | 2.8 | 3.6 | 3.4 | 0.2 | 0.00397 | 0.00049 | 6,890 |
| Sequence 13 | 2.0 | 6.0 | 65.6 | 62.7 | 2.8 | 5.4 | 5.2 | 0.2 | 0.00579 | 0.00072 | 7,136 |
| Sequence 14 | 2.0 | 8.0 | 88.6 | 84.3 | 4.3 | 7.3 | 6.9 | 0.4 | 0.00738 | 0.00092 | 7,526 |
| Sequence 15 | 2.0 | 10.0 | 111.8 | 105.1 | 6.7 | 9.2 | 8.6 | 0.6 | 0.00871 | 0.00109 | 7,941 |

TESTED BY GW DATE July 3, 2019
REVIEWED BY DATE

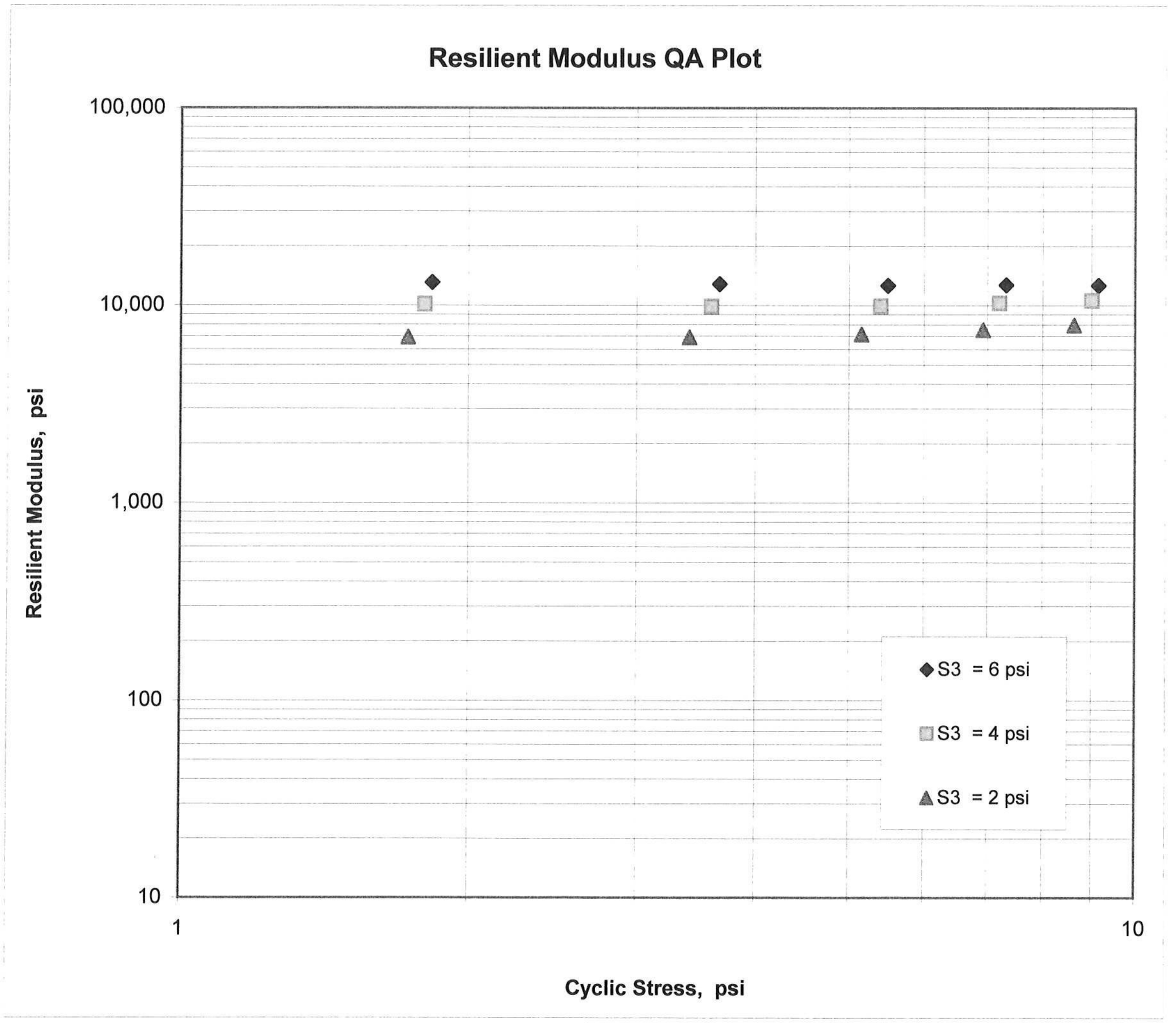
# ARKANSAS STATE HIGHWAY AND TRANSPORTATION DEPARTMENT
## MATERIALS DIVISION

### AASHTO T 307-99 - RESILIENT MODULUS OF SUBGRADE SOILS
### RECOMPACTED / THINWALL TUBE SAMPLES

**Job No.** 020475 **Material Code** SSRVPS
**Date Sampled:** 6/19/19 **Station No.:** 1094+00
**Date Tested:** July 3, 2019 **Location:** CL
**Name of Project:** HWY. 83 SPUR - HWY. 278 CONNECTOR (MONTICELLO)(S)
**County:** **Code:** 22 **Name:** DREW
**Sampled By:** FRAZIER / DICKERSON **Depth:** 0-5
**Lab No.:** 20191827 **AASHTO Class:** A-2-4 (0)
**Sample ID:** RV552 **Material Type (1 or 2):** 2
**LATITUDE:** **LONGITUDE:**

$$M_R = K1\,(S_C)^{K2}\,(S_3)^{K5}$$

$K1 =$ 4,869
$K2 =$ 0.02867
$K5 =$ 0.50818
$R^2 =$ 0.98



**JOB:** 020475

## *Arkansas State Highway Transpiration Department*

*Materials Division*

*Michael Benson, Materials Engineer*

**JOB NAME:** HWY.83 SPUR - HWY.278 CONNECTOR (MONTICELLO)(S)

**COUNTY NO.** 22 **DATE TESTED** 7/10/2019

| STA.# | LOC. | DEPTH | COLOR | #4 | #10 | #40 | #80 | #200 | L.L. | P.I. | SOIL CLASS | LAB #: | %MOISTURE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | SIEVES | | | | | | | | | |
| 1035+00 | CL | 0-5 | BROWN | 100 | | | | 95 | 52 | 32 | A-7-6(33) | RV551 | |
| 1094+80 | CL | 0-5 | RD/BR | 95 | 93 | 66 | 31 | 28 | ND | NP | A-2-4(0) | RV552 | |
| 1011+00 | 06 RT | 0-5 | BROWN | 99 | 99 | 96 | 93 | 80 | 31 | 14 | A-6(10) | S534 | 21.6 |
| 1011+00 | 18 RT | 0-5 | BROWN | 100 | 99 | 98 | 95 | 83 | 36 | 16 | A-6(13) | S535 | 22.4 |
| 1011+00 | 27 RT | 0-5 | BROWN | 92 | 91 | 88 | 86 | 73 | 34 | 17 | A-6(11) | S536 | 21.9 |
| 1019+00 | 06 LT | 0-5 | BR/GR | 99 | 99 | 95 | 89 | 74 | 24 | 7 | A-4(3) | S537 | 20.6 |
| 1019+00 | 18 LT | 0-5 | RD/BR | 98 | 96 | 91 | 87 | 74 | 27 | 11 | A-6(6) | S538 | 23.2 |
| 1027+00 | 06 RT | 0-5 | BR/GR | 98 | 96 | 91 | 84 | 74 | 30 | 14 | A-6(8) | S539 | 21.3 |
| 1027+00 | 18 RT | 0-5 | BR/GR | 97 | 96 | 87 | 80 | 70 | 28 | 11 | A-6(5) | S540 | 17.2 |
| 1035+00 | CL | 0-5 | BROWN | 98 | 96 | 94 | 93 | 88 | 36 | 17 | A-6(15) | S541 | 31.9 |
| 1043+00 | CL | 0-5 | RD/BR | 96 | 95 | 90 | 86 | 64 | 40 | 24 | A-6(13) | S542 | 19.6 |
| 1051+00 | CL | 0-5 | BROWN | 99 | 99 | 97 | 95 | 80 | 33 | 12 | A-6(9) | S543 | 19.5 |
| 1059+00 | CL | 0-5 | BROWN | 100 | 99 | 98 | 97 | 85 | 27 | 7 | A-4(5) | S544 | 23.2 |
| 1067+00 | CL | 0-5 | BROWN | 94 | 93 | 88 | 84 | 67 | 24 | 3 | A-4(0) | S545 | 23.4 |
| 1075+00 | CL | 0-5 | BROWN | 100 | 99 | 98 | 97 | 85 | 33 | 14 | A-6(11) | S546 | 24.2 |
| 1083+00 | CL | 0-5 | BROWN | | 100 | 99 | 99 | 87 | 25 | 7 | A-4(4) | S547 | 14.6 |
| 1091+00 | CL | 0-5 | BROWN | 100 | 98 | 96 | 95 | 82 | ND | NP | A-4(0) | S548 | 24.2 |
| 1094+80 | CL | 0-5 | RD/BR | 99 | 96 | 90 | 85 | 73 | 18 | 4 | A-4(0) | S549 | 22.2 |
| 1095+00 | CL | 0-5 | RD/BR | 99 | 97 | 81 | 54 | 42 | 21 | 8 | A-4(0) | S550 | 20.1 |

***comments:*** W=MULTIPLE LAYERS, X=STRIPPED

*Tuesday, July 16, 2019*

**JOB:** 020475

**JOB NAME:** HWY.83 SPUR - HWY.278 CONNECTOR (MONTICELLO)(S)

**COUNTY NO.** 22

**Arkansas State Highway Transporation Department**
**Materials Division**
**Michael Benson, Materials Engineer**

**DATE TESTED**
7/10/2019

| STA.# | LOC. | PAVEMENT SOUNDINGS | | | |
|---|---|---|---|---|---|
| 1011+00 | 06 RT | ACHMSC | AGG.BASE CRS CL-7 | | |
| | | **6.0WX** | **6.0** | | |
| 1011+00 | 18 RT | ACHMSC | AGG.BASE CRS CL-7 | | |
| | | **4.0WX** | --- | | |
| 1011+00 | 27 RT | ACHMSC | AGG.BASE CRS CL-7 | | |
| | | --- | --- | | |
| 1019+00 | 06 LT | ACHMSC | AGG.BASE CRS CL-7 | | |
| | | **4.5WX** | **6.0** | | |
| 1019+00 | 18 LT | ACHMSC | AGG.BASE CRS CL-7 | | |
| | | --- | --- | | |
| 1027+00 | 06 RT | ACHMSC | AGG.BASE CRS CL-7 | | |
| | | **4.5W** | **6.0** | | |
| 1094+80 | CL | ACHMSC | ACHMBC | CS | AGG.BASE CRS CL-7 |
| | | **5.5W** | **12.5W** | **.125** | **8.0** |
| 1095+00 | CL | ACHMSC | ACHMBC | CS | AGG.BASE CRS CL-7 |
| | | --- | --- | --- | --- |

***comments:*** W=MULTIPLE LAYERS, X=STRIPPED

*Tuesday, July 16, 2019*

ARKANSAS STATE HIGHWAY AND TRANSPORTATION DEPARTMENT - LITTLE ROCK, ARKANSAS
MATERIALS DIVISION
MICHAEL BENSON, MATERIALS ENGINEER

## *** SOIL SURVEY / PAVEMENT SOUNDING TEST REPORT ***

DATE - 07/10/19
JOB NUMBER - 020475
FEDERAL AID NO.- TO BE ASSIGNED
PURPOSE - SOIL SURVEY SAMPLE
SPEC. REMARKS - NO SPECIFICATION CHECK
SUPPLIER NAME - STATE

SEQUENCE NO. - 1
MATERIAL CODE - SSRVPS
SPEC. YEAR - 2014
SUPPLIER ID. - 1
COUNTY/STATE - 22
DISTRICT NO. - 02

NAME OF PROJECT - HWY.83 SPUR - HWY.278 CONNECTOR (MONTICELLO)(S)
PROJECT ENGINEER - NOT APPLICABLE
PIT/QUARRY - ARKANSAS
LOCATION - DREW COUNTY
SAMPLED BY - FRAZIER/DICKERSON
SAMPLE FROM - TEST HOLE
MATERIAL DESC. - SOIL SURVEY - R VALUE- PAVEMENT SOUNDINGS

DATE SAMPLED - 06/10/19
DATE RECEIVED - 06/11/19
DATE TESTED - 07/10/19

| | | | |
|---|---|---|---|
| LAB NUMBER | 20191809 | 20191810 | 20191811 |
| SAMPLE ID | S534 | S535 | S536 |
| TEST STATUS | INFORMATION ONLY | INFORMATION ONLY | INFORMATION ONLY |
| STATION | 1011+00 | 1011+00 | 1011+00 |
| LOCATION | 06 RT | 18 RT | 27 RT |
| DEPTH IN FEET | 0-5 | 0-5 | 0-5 |
| MAT'L COLOR | BROWN | BROWN | BROWN |
| MAT'L TYPE | | | |
| LATITUDE DEG-MIN-SEC | 33 36 31.20 | 33 36 31.20 | 33 36 31.20 |
| LONGITUDE DEG-MIN-SEC | 91 48 54.00 | 91 48 53.90 | 91 48 53.80 |
| % PASSING 2 IN. | | | |
| 1 1/2 IN. | | | |
| 3/4 IN. | | | 100 |
| 3/8 IN. | 100 | | 93 |
| NO. 4 | 99 | 100 | 92 |
| NO. 10 | 99 | 99 | 91 |
| NO. 40 | 96 | 98 | 88 |
| NO. 80 | 93 | 95 | 86 |
| NO. 200 | 80 | 83 | 73 |
| LIQUID LIMIT | 31 | 36 | 34 |
| PLASTICITY INDEX | 14 | 16 | 17 |
| AASHTO SOIL | A-6(10) | A-6(13) | A-6(11) |
| UNIFIED SOIL | | | |
| % MOISTURE CONTENT | 21.6 | 22.4 | 21.9 |
| ACHMSC (IN) | 6.0WX | 4.0WX | --- |
| AGG.BASE CRS CL-7 (IN) | 6.0 | --- | --- |

REMARKS - W=MULTIPLE LAYERS, X=STRIPPED

AASHTO TESTS : T24 T88 T89 T90 T265

ARKANSAS STATE HIGHWAY AND TRANSPORTATION DEPARTMENT - LITTLE ROCK, ARKANSAS
MATERIALS DIVISION
MICHAEL BENSON, MATERIALS ENGINEER

## *** SOIL SURVEY / PAVEMENT SOUNDING TEST REPORT ***

DATE - 07/15/19
JOB NUMBER - 020475
FEDERAL AID NO.- TO BE ASSIGNED
PURPOSE - SOIL SURVEY SAMPLE
SPEC. REMARKS - NO SPECIFICATION CHECK
SUPPLIER NAME - STATE

SEQUENCE NO. - 2
MATERIAL CODE - SSRVPS
SPEC. YEAR - 2014
SUPPLIER ID. - 1
COUNTY/STATE - 22
DISTRICT NO. - 02

NAME OF PROJECT - HWY.83 SPUR - HWY.278 CONNECTOR (MONTICELLO)(S)
PROJECT ENGINEER - NOT APPLICABLE
PIT/QUARRY - ARKANSAS
LOCATION - DREW COUNTY
SAMPLED BY - FRAZIER/DICKERSON
SAMPLE FROM - TEST HOLE

DATE SAMPLED - 06/10/19
DATE RECEIVED - 06/11/19
DATE TESTED - 07/10/19

MATERIAL DESC. - SOIL SURVEY - R VALUE- PAVEMENT SOUNDINGS

| | | | |
|---|---|---|---|
| LAB NUMBER | 20191812 | 20191813 | 20191814 |
| SAMPLE ID | S537 | S538 | S539 |
| TEST STATUS | INFORMATION ONLY | INFORMATION ONLY | INFORMATION ONLY |
| STATION | 1019+00 | 1019+00 | 1027+00 |
| LOCATION | 06 LT | 18 LT | 06 RT |
| DEPTH IN FEET | 0-5 | 0-5 | 0-5 |
| MAT'L COLOR | BR/GR | RD/BR | BR/GR |
| MAT'L TYPE | | | |
| LATITUDE DEG-MIN-SEC | 33 36 39.30 | 33 36 39.30 | 33 36 47.20 |
| LONGITUDE DEG-MIN-SEC | 91 48 54.10 | 91 48 54.20 | 91 48 53.90 |
| % PASSING 2 IN. | | | |
| 1 1/2 IN. | | | |
| 3/4 IN. | | 100 | |
| 3/8 IN. | 100 | 99 | 100 |
| NO. 4 | 99 | 98 | 98 |
| NO. 10 | 99 | 96 | 96 |
| NO. 40 | 95 | 91 | 91 |
| NO. 80 | 89 | 87 | 84 |
| NO. 200 | 74 | 74 | 74 |
| LIQUID LIMIT | 24 | 27 | 30 |
| PLASTICITY INDEX | 7 | 11 | 14 |
| AASHTO SOIL | A-4(3) | A-6(6) | A-6(8) |
| UNIFIED SOIL | | | |
| % MOISTURE CONTENT | 20.6 | 23.2 | 21.3 |
| ACHMSC (IN) | 4.5WX | --- | 4.5W |
| AGG.BASE CRS CL-7 (IN) | 6.0 | --- | 6.0 |

REMARKS - W=MULTIPLE LAYERS, X=STRIPPED

AASHTO TESTS : T24 T88 T89 T90 T265

ARKANSAS STATE HIGHWAY AND TRANSPORTATION DEPARTMENT - LITTLE ROCK, ARKANSAS
MATERIALS DIVISION
MICHAEL BENSON, MATERIALS ENGINEER

# *** SOIL SURVEY / PAVEMENT SOUNDING TEST REPORT ***

DATE - 07/10/19
JOB NUMBER - 020475
FEDERAL AID NO.- TO BE ASSIGNED
PURPOSE - SOIL SURVEY SAMPLE
SPEC. REMARKS - NO SPECIFICATION CHECK
SUPPLIER NAME - STATE

SEQUENCE NO. - 3
MATERIAL CODE - SSRVPS
SPEC. YEAR - 2014
SUPPLIER ID. - 1
COUNTY/STATE - 22
DISTRICT NO. - 02

NAME OF PROJECT - HWY.83 SPUR - HWY.278 CONNECTOR (MONTICELLO)(S)
PROJECT ENGINEER - NOT APPLICABLE
PIT/QUARRY - ARKANSAS
LOCATION - DREW COUNTY
SAMPLED BY - FRAZIER/DICKERSON
SAMPLE FROM - TEST HOLE
MATERIAL DESC. - SOIL SURVEY - R VALUE- PAVEMENT SOUNDINGS

DATE SAMPLED - 06/10/19
DATE RECEIVED - 06/11/19
DATE TESTED - 07/10/19

| | | | |
|---|---|---|---|
| LAB NUMBER | 20191815 | 20191816 | 20191817 |
| SAMPLE ID | S540 | S541 | S542 |
| TEST STATUS | INFORMATION ONLY | INFORMATION ONLY | INFORMATION ONLY |
| STATION | 1027+00 | 1035+00 | 1043+00 |
| LOCATION | 18 RT | CL | CL |
| DEPTH IN FEET | 0-5 | 0-5 | 0-5 |
| MAT'L COLOR | BR/GR | BROWN | RD/BR |
| MAT'L TYPE | | | |
| LATITUDE DEG-MIN-SEC | 33 36 47.20 | 33 36 55.40 | 33 37 2.90 |
| LONGITUDE DEG-MIN-SEC | 91 48 53.70 | 91 48 53.50 | 91 48 53.50 |
| % PASSING 2 IN. | | | |
| 1 1/2 IN. | | | |
| 3/4 IN. | 100 | 100 | 100 |
| 3/8 IN. | 99 | 99 | 98 |
| NO. 4 | 97 | 98 | 96 |
| NO. 10 | 96 | 96 | 95 |
| NO. 40 | 87 | 94 | 90 |
| NO. 80 | 80 | 93 | 86 |
| NO. 200 | 70 | 88 | 64 |
| LIQUID LIMIT | 28 | 36 | 40 |
| PLASTICITY INDEX | 11 | 17 | 24 |
| AASHTO SOIL | A-6(5) | A-6(15) | A-6(13) |
| UNIFIED SOIL | | | |
| % MOISTURE CONTENT | 17.2 | 31.9 | 19.6 |

REMARKS - W=MULTIPLE LAYERS, X=STRIPPED

AASHTO TESTS : T24 T88 T89 T90 T265

ARKANSAS STATE HIGHWAY AND TRANSPORTATION DEPARTMENT - LITTLE ROCK, ARKANSAS
MATERIALS DIVISION
MICHAEL BENSON, MATERIALS ENGINEER

### *** SOIL SURVEY / PAVEMENT SOUNDING TEST REPORT ***

DATE - 07/10/19 SEQUENCE NO. - 4
JOB NUMBER - 020475 MATERIAL CODE - SSRVPS
FEDERAL AID NO.- TO BE ASSIGNED SPEC. YEAR - 2014
PURPOSE - SOIL SURVEY SAMPLE SUPPLIER ID. - 1
SPEC. REMARKS - NO SPECIFICATION CHECK COUNTY/STATE - 22
SUPPLIER NAME - STATE DISTRICT NO. - 02
NAME OF PROJECT - HWY.83 SPUR - HWY.278 CONNECTOR (MONTICELLO)(S)
PROJECT ENGINEER - NOT APPLICABLE
PIT/QUARRY - ARKANSAS
LOCATION - DREW COUNTY DATE SAMPLED - 06/10/19
SAMPLED BY - FRAZIER/DICKERSON DATE RECEIVED - 06/11/19
SAMPLE FROM - TEST HOLE DATE TESTED - 07/10/19
MATERIAL DESC. - SOIL SURVEY - R VALUE- PAVEMENT SOUNDINGS

| | | | |
|---|---|---|---|
| LAB NUMBER | 20191818 | 20191819 | 20191820 |
| SAMPLE ID | S543 | S544 | S545 |
| TEST STATUS | INFORMATION ONLY | INFORMATION ONLY | INFORMATION ONLY |
| STATION | 1051+00 | 1059+00 | 1067+00 |
| LOCATION | CL | CL | CL |
| DEPTH IN FEET | 0-5 | 0-5 | 0-5 |
| MAT'L COLOR | BROWN | BROWN | BROWN |
| MAT'L TYPE | | | |
| LATITUDE DEG-MIN-SEC | 33 37 10.80 | 33 37 18.70 | 33 37 26.60 |
| LONGITUDE DEG-MIN-SEC | 91 48 53.30 | 91 48 53.70 | 91 48 55.80 |
| % PASSING 2 IN. | | | |
| 1 1/2 IN. | | | |
| 3/4 IN. | | | 100 |
| 3/8 IN. | 100 | | 96 |
| NO. 4 | 99 | 100 | 94 |
| NO. 10 | 99 | 99 | 93 |
| NO. 40 | 97 | 98 | 88 |
| NO. 80 | 95 | 97 | 84 |
| NO. 200 | 80 | 85 | 67 |
| LIQUID LIMIT | 33 | 27 | 24 |
| PLASTICITY INDEX | 12 | 7 | 3 |
| AASHTO SOIL | A-6(9) | A-4(5) | A-4(0) |
| UNIFIED SOIL | | | |
| % MOISTURE CONTENT | 19.5 | 23.2 | 23.4 |

REMARKS - W=MULTIPLE LAYERS, X=STRIPPED

AASHTO TESTS : T24 T88 T89 T90 T265

ARKANSAS STATE HIGHWAY AND TRANSPORTATION DEPARTMENT - LITTLE ROCK, ARKANSAS
MATERIALS DIVISION
MICHAEL BENSON, MATERIALS ENGINEER

# *** SOIL SURVEY / PAVEMENT SOUNDING TEST REPORT ***

| | | | |
|---|---|---|---|
| DATE | 07/10/19 | SEQUENCE NO. | 5 |
| JOB NUMBER | 020475 | MATERIAL CODE | SSRVPS |
| FEDERAL AID NO. | TO BE ASSIGNED | SPEC. YEAR | 2014 |
| PURPOSE | SOIL SURVEY SAMPLE | SUPPLIER ID. | 1 |
| SPEC. REMARKS | NO SPECIFICATION CHECK | COUNTY/STATE | 22 |
| SUPPLIER NAME | STATE | DISTRICT NO. | 02 |

NAME OF PROJECT - HWY.83 SPUR - HWY.278 CONNECTOR (MONTICELLO)(S)
PROJECT ENGINEER - NOT APPLICABLE
PIT/QUARRY - ARKANSAS

| | | | |
|---|---|---|---|
| LOCATION | DREW COUNTY | DATE SAMPLED | 06/10/19 |
| SAMPLED BY | FRAZIER/DICKERSON | DATE RECEIVED | 06/11/19 |
| SAMPLE FROM | TEST HOLE | DATE TESTED | 07/10/19 |

MATERIAL DESC. - SOIL SURVEY - R VALUE- PAVEMENT SOUNDINGS

| | | | |
|---|---|---|---|
| LAB NUMBER | 20191821 | 20191822 | 20191823 |
| SAMPLE ID | S546 | S547 | S548 |
| TEST STATUS | INFORMATION ONLY | INFORMATION ONLY | INFORMATION ONLY |
| STATION | 1075+00 | 1083+00 | 1091+00 |
| LOCATION | CL | CL | CL |
| DEPTH IN FEET | 0-5 | 0-5 | 0-5 |
| MAT'L COLOR | BROWN | BROWN | BROWN |
| MAT'L TYPE | | | |
| LATITUDE DEG-MIN-SEC | 33 37 34.10 | 33 37 41.80 | 33 37 49.50 |
| LONGITUDE DEG-MIN-SEC | 91 48 57.70 | 91 48 57.20 | 91 48 54.10 |
| % PASSING 2 IN. | | | |
| 1 1/2 IN. | | | |
| 3/4 IN. | | | |
| 3/8 IN. | | | |
| NO. 4 | 100 | | 100 |
| NO. 10 | 99 | 100 | 98 |
| NO. 40 | 98 | 99 | 96 |
| NO. 80 | 97 | 99 | 95 |
| NO. 200 | 85 | 87 | 82 |
| LIQUID LIMIT | 33 | 25 | ND |
| PLASTICITY INDEX | 14 | 7 | NP |
| AASHTO SOIL | A-6(11) | A-4(4) | A-4(0) |
| UNIFIED SOIL | | | |
| % MOISTURE CONTENT | 24.2 | 14.6 | 24.2 |

REMARKS - W=MULTIPLE LAYERS, X=STRIPPED
-
-
-
-

AASHTO TESTS : T24 T88 T89 T90 T265
:

# ARKANSAS STATE HIGHWAY AND TRANSPORTATION DEPARTMENT - LITTLE ROCK, ARKANSAS
MATERIALS DIVISION
MICHAEL BENSON, MATERIALS ENGINEER

## *** SOIL SURVEY / PAVEMENT SOUNDING TEST REPORT ***

DATE - 07/10/19
JOB NUMBER - 020475
FEDERAL AID NO.- TO BE ASSIGNED
PURPOSE - SOIL SURVEY SAMPLE
SPEC. REMARKS - NO SPECIFICATION CHECK
SUPPLIER NAME - STATE

SEQUENCE NO. - 6
MATERIAL CODE - SSRVPS
SPEC. YEAR - 2014
SUPPLIER ID. - 1
COUNTY/STATE - 22
DISTRICT NO. - 02

NAME OF PROJECT - HWY.83 SPUR - HWY.278 CONNECTOR (MONTICELLO)(S)
PROJECT ENGINEER - NOT APPLICABLE
PIT/QUARRY - ARKANSAS
LOCATION - DREW COUNTY
SAMPLED BY - FRAZIER/DICKERSON
SAMPLE FROM - TEST HOLE

DATE SAMPLED - 06/10/19
DATE RECEIVED - 06/11/19
DATE TESTED - 07/10/19

MATERIAL DESC. - SOIL SURVEY - R VALUE- PAVEMENT SOUNDINGS

| | | |
|---|---|---|
| LAB NUMBER | 20191824 | 20191825 |
| SAMPLE ID | S549 | S550 |
| TEST STATUS | INFORMATION ONLY | INFORMATION ONLY |
| STATION | 1094+80 | 1095+00 |
| LOCATION | CL | CL |
| DEPTH IN FEET | 0-5 | 0-5 |
| MAT'L COLOR | RD/BR | RD/BR |
| MAT'L TYPE | | |
| LATITUDE DEG-MIN-SEC | 33 37 53.00 | 33 37 53.30 |
| LONGITUDE DEG-MIN-SEC | 91 48 52.80 | 91 48 52.70 |
| % PASSING 2 IN. | | |
| 1 1/2 IN. | | |
| 3/4 IN. | | |
| 3/8 IN. | 100 | 100 |
| NO. 4 | 99 | 99 |
| NO. 10 | 96 | 97 |
| NO. 40 | 90 | 81 |
| NO. 80 | 85 | 54 |
| NO. 200 | 73 | 42 |
| LIQUID LIMIT | 18 | 21 |
| PLASTICITY INDEX | 4 | 8 |
| AASHTO SOIL | A-4(0) | A-4(0) |
| UNIFIED SOIL | | |
| % MOISTURE CONTENT | 22.2 | 20.1 |
| ACHMSC (IN) | 5.5W | --- |
| ACHMBC (IN) | 12.5W | --- |
| CS (IN) | .125 | --- |
| AGG.BASE CRS CL-7 (IN) | 8.0 | --- |

REMARKS - W=MULTIPLE LAYERS, X=STRIPPED

AASHTO TESTS : T24 T88 T89 T90 T265

ARKANSAS STATE HIGHWAY AND TRANSPORTATION DEPARTMENT - LITTLE ROCK, ARKANSAS
MATERIALS DIVISION
MICHAEL BENSON, MATERIALS ENGINEER

# *** SOIL SURVEY / PAVEMENT SOUNDING TEST REPORT ***

DATE - 07/10/19
JOB NUMBER - 020475
FEDERAL AID NO.- TO BE ASSIGNED
PURPOSE - SOIL SURVEY SAMPLE
SPEC. REMARKS - NO SPECIFICATION CHECK
SUPPLIER NAME - STATE

SEQUENCE NO. - 1
MATERIAL CODE - RV
SPEC. YEAR - 2014
SUPPLIER ID. - 1
COUNTY/STATE - 22
DISTRICT NO. - 02

NAME OF PROJECT - HWY.83 SPUR - HWY.278 CONNECTOR (MONTICELLO)(S)
PROJECT ENGINEER - NOT APPLICABLE
PIT/QUARRY - ARKANSAS
LOCATION - DREW COUNTY
SAMPLED BY - FRAZIER/DICKERSON
SAMPLE FROM - TEST HOLE

DATE SAMPLED - 06/10/19
DATE RECEIVED - 06/11/19
DATE TESTED - 07/10/19

MATERIAL DESC. - SOIL SURVEY - RESISTANCE R-VALUE ACTUAL RESULTS

| | | | |
|---|---|---|---|
| LAB NUMBER | 20191826 | 20191827 | |
| SAMPLE ID | RV551 | RV552 | |
| TEST STATUS | INFORMATION ONLY | INFORMATION ONLY | |
| STATION | 1035+00 | 1094+80 | |
| LOCATION | CL | CL | |
| DEPTH IN FEET | 0-5 | 0-5 | |
| MAT'L COLOR | BROWN | RD/BR | |
| MAT'L TYPE | | | |
| LATITUDE DEG-MIN-SEC | 33 36 55.40 | 33 37 53.00 | |
| LONGITUDE DEG-MIN-SEC | 91 48 53.50 | 91 48 52.80 | |
| % PASSING 2 IN. | | | |
| 1 1/2 IN. | | | |
| 3/4 IN. | | 100 | |
| 3/8 IN. | | 98 | |
| NO. 4 | 100 | 95 | |
| NO. 10 | | 93 | |
| NO. 40 | | 66 | |
| NO. 80 | | 31 | |
| NO. 200 | 95 | 28 | |
| LIQUID LIMIT | 52 | ND | |
| PLASTICITY INDEX | 32 | NP | |
| AASHTO SOIL | A-7-6(33) | A-2-4(0) | |
| UNIFIED SOIL | | | |
| % MOISTURE CONTENT | | | |

REMARKS - W=MULTIPLE LAYERS, X=STRIPPED

AASHTO TESTS : T24 T88 T89 T90 T265

AR DOT
ARKANSAS DEPARTMENT
OF TRANSPORTATION

ARKANSAS DEPARTMENT OF TRANSPORTATION
ArDOT.gov | IDriveArkansas.com | Lorie H. Tudor, P.E., Director
MATERIALS DIVISION
11301 West Baseline Road | P.O. Box 2261 | Little Rock, AR 72203-2261 | Phone: 501.569.2185 | Fax: 501.569.2368

May 26, 2022

**TO:** Mr. Trinity Smith, Engineer of Roadway Design

**SUBJECT:** Job No. 020475
Hwy. 83 Spur – Hwy. 278 Connector (Monticello) (S)
Route 83 Section 1
Drew County

The Geotechnical section has reviewed the proposed cross sections for 020475 and offers the following comments.

Between stations 1001+00 - 1033+64, 1048+00 – 1053+00 and 1093+40 – 1094+58 the grade line closely matches the existing ground and embankment will encroach into the existing ditches. The soft unstable organic material should be undercut prior to embankment construction. The undercut below existing grade is anticipated to be no more than two feet. The embankment may be constructed with locally available unspecified material.

Embankment height up to 9 feet is proposed between stations 1034+00 – 1042+00, 1044+00 – 1048+00, and 1054+00 to 1058+00. The embankments may be constructed with locally available unspecified material utilizing the 3:1 slope configuration demonstrated in the cross sections.

The proposed 3:1 slope configuration for the 11 feet cut between stations 1059+00 to 1065+00 is acceptable as shown. The subgrade material within the cut limits is highly plastic clay and will not be suitable for fill.

The construction grade line of the roundabouts at Jordan and Old Warren Roads closely matches that of the existing roadways. All soft unstable organic material within the foot print of the roundabout should be undercut prior to embankment construction. The undercut below existing grade is anticipated to be no more than two feet. Locally available unspecified material may be used as backfill.

The bridge approach embankments between stations 1066+00 -1078+34 and 1089+32 – 1093+00 should be constructed in accordance with the recommendations proposed in the Geotechnology subsurface investigation report. As a minimum, the embankment material shall meet the specifications of the attached special provision.

Jonathan A. Annable
Materials Engineer

JAA:yz:bjj
Attachment
cc: State Constr. Eng. – Master File Copy
District 2 Engineer
System Information and Research Div.
G. C. File

# ARKANSAS DEPARTMENT OF TRANSPORTATION

## SPECIAL PROVISION

## JOB NO. 020475

## COMPACTED EMBANKMENT

**Description.** This Special Provision shall be supplementary to Section 210, Excavation and Embankment, of the Standard Specifications, Edition of 2014.

**Materials.** With exception of cohesionless sand and silty sand, soils with AASHTO M 145 general classification "Granular Materials" are acceptable for use in embankment construction. Sandy soils classified as "Granular Materials" shall have a minimum plasticity index of 5.

Soils with AASHTO M 145 general classification "Silt-Clay" are acceptable for use in embankment construction if they have a plasticity index of between 8 and 20 and a maximum 65% passing the #200 sieve. Soils not meeting these requirements shall not be utilized for compacted embankment regardless of the source.

**Construction Requirements.** Prior to embankment construction, all sod and vegetable matter shall be completely removed from the natural ground surface upon which the embankment is to be constructed, regardless of embankment height. In addition, the natural ground surface on which an embankment is to be constructed, shall be adequately compacted in accordance with the compaction requirements specified in Subsection 210.10, regardless of embankment height. These requirements may be modified by the Engineer as conditions justify.

**Quality Control and Acceptance Testing.** Quality control and acceptance sampling and testing shall be performed in accordance with Subsection 210.02 and 210.10 of the Standard Specifications. Tests for plasticity index and gradation shall be performed in accordance with Section 306 of the Standard Specifications, except that the size of the standard lots will be 3000 cubic yards. In addition to the required test, the Engineer may require the Contractor to test any location that, by visual inspection appears different from previously approved material.

**Method of Measurement.** All embankments constructed as described above will be measured as Compacted Embankment in accordance with Section 210 of the Standard Specifications.

**Basis of Payment.** All embankments constructed as described above shall be paid in accordance with Subsection 210.13 of the Standard Specifications and shall also include all labor, material, and equipment necessary to achieve the Compacted Embankment requirements as specified herein.

Payment will be made under:

| **Pay Item** | **Pay Unit** |
|---|---|
| Compacted Embankment | Cubic Yard |

# GEOTECHNICAL REPORT
# HWY. 83 SPUR – HWY. 278 CONNECTOR (MONTICELLO) (S)
# DREW COUNTY, ARKANSAS

**ARKANSAS DEPARTMENT OF TRANSPORTATION**
**STATE PROJECT NO. 020475**

Prepared for:

**ARKANSAS DEPARTMENT OF TRANSPORTATION (ARDOT)**
**LITTLE ROCK, ARKANSAS**

Prepared by:

**GEOTECHNOLOGY, LLC**
**MEMPHIS, TENNESSEE**

Date:

**JULY 5, 2022**

Geotechnology Project No.:

**J037781.01**

SAFETY
QUALITY
INTEGRITY
PARTNERSHIP
OPPORTUNITY
RESPONSIVENESS

GEOTECHNOLOGY
A Universal Engineering Sciences Company

July 5, 2022

Mr. Paul Tinsley, P.E.
Geotechnical Engineering Manager
Arkansas Department of Transportation (ARDOT)
PO Box 2261
Little Rock, Arkansas 72203

Re: Geotechnical Report
Hwy. 83 Spur - Hwy. 278 Connector (Monticello) (S)
Drew County, Arkansas
ARDOT Project No. 020475
Geotechnology Project No. J037781.01

Dear Mr. Tinsley:

Presented in this report are the results of the geotechnical exploration performed by Geotechnology, LLC for the referenced project. The report includes our understanding of the project, observed site conditions, conclusions and/or recommendations, and support data as listed in the Table of Contents.

We appreciate the opportunity to provide geotechnical services for this project. If you have any questions regarding this report, or if we can be of any additional service to you, please do not hesitate to contact us.

Respectfully submitted,

**GEOTECHNOLOGY, LLC**

Jacob Monroe, P.E.
Engineer

Dale M. Smith, P.E.
Geotechnical Manager

No. 17917
Dale M. Smith

7/5/22

JDM/ASE/DMS:jdm

Copies submitted: Client (email)

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# GEOTECHNICAL REPORT
# HWY. 83 SPUR - HWY. 278 CONNECTOR (MONTICELLO) (S)
# DREW COUNTY, ARKANSAS

**July 5, 2022 | Geotechnology Project No. J037781.01**

## 1.0 SCOPE OF SERVICES

Presented in this report are the results of the geotechnical exploration and recommendations for design and constructed of the proposed new Bridge No. 07536 along the proposed Highway 83 (Hwy. 83) Spur – Highway 278 (Hwy. 278) Connector in Drew County, Arkansas. The referenced project includes the construction of a new bridge to cross over the Arkansas Midland Railroad. It is our understanding the anticipated foundation type for support of the new bridge will be driven closed-ended pipe piles at the abutment (exterior bent) and interior bent locations. The project location is shown on Figure 1 included in Appendix B.

The recommendations presented in this report are based on the geology, provided plans and project information, and the results of the geotechnical exploration. Results of the borings, in-situ testing, sampling, and laboratory testing are included in the report. A total of 14 borings were drilled and 10 Cone Penetration Testing (CPT) soundings were performed in the vicinity of the site as shown on Figure 2 included in Appendix B. The boring logs and plots of CPT soundings, along with field and laboratory test results, are enclosed. The collected data have been analyzed and the physical properties of the in-situ soils summarized. General site conditions are discussed, along with recommendations for subgrade preparation. Important information prepared by the Geotechnical Business Council (GBC) of the Geoprofessional Business Association for studies of this type is presented in Appendix A for your review.

## 2.0 GENERAL INFORMATION

### Planned Modifications

The proposed Hwy. 83 Spur – Hwy. 278 Connector over Arkansas Midland Railroad Bridge No. 07536 will be a two-lane, 12-span structure approximately 1,097-foot-long and 42½-foot-wide. The proposed bridge will be constructed in one phase and is part of the overall construction of the proposed Arkansas Job 020475 Hwy. 83 Spur – Hwy. 278 Connector roadway.

Riprap is planned along the abutment slopes based on the provided preliminary plans[1]; abutment slopes are anticipated to be three horizontal units for every vertical unit (3H:1V) at the southern abutment and 2H:1V at the northern abutment and side slopes are anticipated to be 3H:1V. Up to 35½ feet of fill will be required to reach design grades.

### Topography

The proposed Hwy. 83 Spur – Hwy. 278 Connector Bridge No. 07536 is located in Drew County, Arkansas. According to the provided plans, the elevations at the south and north abutments are approximately El 248 and El 226, respectively, with a maximum of 26 feet of relief across the proposed alignment.

### Drainage

The drainage system in the project area consists of the Lower Saline Watershed. The Lower Saline Watershed, in turn, is part of the overall drainage system of the Mississippi River Basin.

### Geology

Drew County is located in southeastern Arkansas, in the Mississippi Embayment. The Mississippi Embayment is a trough-like depression dipping southward along an axis approximately following the Mississippi River. The site geology consists of alluvial deposits of clay and silt underlain by fine-grained sand.

## 3.0 GEOTECHNICAL EXPLORATION

A total of 14 borings were drilled at selected locations near the proposed abutment and interior bent locations along the alignment of the proposed bridge. The borings were drilled to approximate depths ranging from 30 to 100 feet. A total of 10 Cone Penetration Testing (CPT) soundings were performed at selected locations in the proposed abutment and interior bent locations along the alignment of the proposed bridge. The CPT soundings were performed to approximate depths ranging from 60 to 83 feet; CPT soundings were terminated earlier than the originally-scoped 100-foot depths due to overly hard clay layers causing probe refusal at shallower depths. Seismic cone tests were performed in three CPT sounding locations to determine the average shear wave velocity at the locations.

CPT soundings were advanced using a 20-ton, track-mounted Vertek direct-push rig between the dates of August 19 and 20, 2021. The data were collected using a Vertek 15 square-centimeter end area, seismic piezometric cone with a $u_2$ pore pressure location (behind the cone) following the procedures outlined in ASTM D3441 and D5778. Plots of the CPT measurements are presented in Appendix D along with interpreted soil behavior types.

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[1] *Arkansas Department of Transportation Construction Plans for State Highway Hwy. 83 Spur – Hwy. 278 Connector (Monticello) (S) Drew County Route 83 Section 1, Job 020475.* Provided by Arkansas Highway and Transportation Department, dated December 7, 2020.

The borings were drilled on July 7 through 29, September 25 through 27, and October 6 through 19, 2021 using a rotary drill rig (Diedrich D-50 or CME 750X), hollow-stem augers and wet rotary methods. Sampling procedures included Standard Penetration Test (SPT) and thin-wall (Shelby) tube methods. SPT's were conducted at 2.5, 5, and 10-foot depth intervals using automatic hammers. Thin-walled Shelby tube samples were collected in cohesive soils at selected depths. Groundwater observations were made during drilling operations.

The collected samples were visually examined by field staff and transported to our laboratory for further evaluation and testing. The samples were examined in the laboratory by a geotechnical professional who prepared descriptive logs of the materials encountered. The boring logs are presented in Appendix C along with an explanation of the terms and symbols used on the boring logs. Included on each boring log are elevation data estimated from the provided plans. Included in Table 1 are in situ tests and measurements made as part of the fieldwork and recorded on the boring logs.

**Table 1. Field Tests and Measurements**

| Item | Test Method |
|---|---|
| Soil Classification | ASTM D 2488/ D 3282 |
| Standard Penetration Test (SPT) | ASTM D 1586/ AASHTO T206 |
| Thin-Walled (Shelby) Tube Sampling | ASTM D 1587/ AASHTO T207 |

The boring logs and CPT sounding plots represent conditions observed at the time of exploration and have been edited to incorporate results of the laboratory tests. Unless noted on the boring logs, the lines designating the changes between various strata represent approximate boundaries. The transition between materials could be gradual or occur between recovered samples. The stratification given on the boring logs, or described herein, is for use by Geotechnology in its analyses and should not be used as the basis of design or construction cost estimates without realizing that there can be variation from that shown or described.

The boring logs and related information depict subsurface conditions only at the specific locations and times where sampling was conducted. The passage of time could result in changes in conditions, interpreted to exist, at or between the locations where sampling was conducted.

## 4.0 LABORATORY REVIEW AND TESTING

Laboratory testing was performed on soil samples to assess engineering and index properties. Most of the laboratory test results are presented on the boring logs in Appendix C. The Atterberg limits, grain size analyses, unconsolidated-undrained triaxial compression (UU), one-dimension consolidation, direct shear, one-dimensional consolidation, pH, and soil resistivity test results are also provided in Appendix E. The laboratory tests and corresponding test method standards are presented in Table 2.

**Table 2. Summary of Laboratory Tests and Methods.**

| Laboratory Test | ASTM | AASHTO |
|---|---|---|
| Moisture Content | D 2216 | T 265 |
| Atterberg Limits | D 4318 | T 98 |
| Grain Size Analysis | D 422 | T 88 |
| Percent Finer Than No. 200 Sieve | D 1140 | T 11 |
| Unconsolidated-Undrained Triaxial Compression | D 2850 | T 296 |
| One-Dimensional Consolidation | D 2435 | T 216 |
| Consolidated-Undrained Triaxial Compression | D 4767 | T 297 |
| Direct Shear | D 3080 | T 236 |
| pH of Soil | D 4972 | T 289 |
| Soil Electrical Resistivity | G 57 | T 288 |

The boring logs were prepared by a project geotechnical engineer from the field logs, visual classification of the soil samples in the laboratory, and laboratory test results. Terms and symbols used on the boring logs are presented on the Boring Log: Terms and Symbols in Appendix C. Stratification lines on the boring logs indicate approximate changes in strata. The transition between strata could be abrupt or gradual.

## 5.0 SUBSURFACE CONDITIONS

### Subgrade Materials

Borings B-1 through -14 and the CPT soundings were performed in the alignment of the proposed bridge. Borings B-1 through -9 were drilled south of the Arkansas Midland Railroad; and Borings B-10 through -14 were drilled north of the Railroad. CPT soundings CPT-1a, -1b, -2, -4, -6, and -9 were advanced south of the Arkansas Midland Railroad; and CPT soundings CPT-10, -12, and -14 were performed north of the railroad. The soils at the boring locations generally consisted of predominately fine-grained soils at the ground surface that extended to the boring termination depths. However, an interbedded layer of predominately coarse-grained soil was encountered in Boring B-9 from approximately 13.5 to 18.5 feet. The boring logs, with more detailed descriptions are included in Appendix C. Laboratory testing was used to determine the AASHTO classifications as presented in Appendix F.

The fine-grained soils encountered from the ground surface to the boring termination depths at the boring locations were classified as high plasticity “fat” clay (CH), A-7-6, A-7-5; low plasticity “lean” clay (CL), A-6, A-7-5, A-7-6; and elastic silt (MH), A-7-5. The fine-grained soils ranged from soft to hard in consistency.

An interbedded layer of predominately coarse-grained soils was encountered in Boring B-9 from approximately 13.5 feet to 18.5 feet that was classified as clayey gravel (GC), A-2-6. The coarse-grained soil layer was loose in consistency.

### Groundwater

Groundwater was not encountered in the upper 50 feet of the borings during drilling operations; groundwater levels may have been masked due to the use of wet rotary methods. Definitive groundwater levels were not interpreted in the CPT sounding locations; however, we have assumed groundwater depths of approximately 50 feet in the CPT soundings based on pore pressure data recorded in the soundings. Groundwater levels could vary significantly over time due to the effects of seasonal variations in precipitation or other factors not evident at the time of exploration.

## 6.0 ENGINEERING EVALUATION, ANALYSIS, AND RECOMMENDATIONS

### Site Preparation and Earthwork

The following procedures are recommended for site preparation in cut and fill areas. These recommendations do not supersede ARDOT standards and specifications. Site preparation and compaction requirements must conform to the latest ARDOT standards.

Site Preparation. In general, cut areas and areas to receive new fill should be stripped of topsoil, vegetation, and other deleterious materials. Topsoil should be placed in landscape areas or disposed of off-site. Vegetation and tree roots should be over-excavated.

The exposed subgrade should be proof-rolled using a tandem axle dump truck loaded to approximately 20,000 pounds per axle (or equivalent proof-rolling equipment). Soft areas that develop should be over-excavated and backfilled with select fill, which is defined as soil conforming to A-4 or better material, and compacted to the unit weights specified in subsequent paragraphs.

Side Slopes. Existing slopes steeper than 4H:1V should be benched prior to placing new fill. Slope ratios of 3H:1V or flatter are recommended for all cut and fill slopes along the proposed alignment.

Cut Areas. It is our understanding up to 35½ feet of fill will be required to achieve design grade at proposed new bridge abutments, as indicated on the provided plans. Based on the stratigraphy, excavations for pile cap foundations will terminate in fat clay. After excavation, the top 6 inches of the resulting subgrade should be compacted to a minimum of 95% of the maximum dry unit weight as determined by a standard Proctor test (ASTM D 698/AASTHO T 99). Areas supporting pavement should be compacted to 98% of the maximum unit weight as determined by the standard Proctor test.

Fill Materials. Fill material should consist of natural soils classifying as AASHTO A-6 or better[2], and should meet the minimum requirements set forth in ARDOT's Special Provision[3] (SP) dated March 1, 2022. Soils classifying as AASHTO A-4 or better are considered to be select fill. Fine-grained "silt-clay" soils (A-4 through A-6) should have a maximum LL of 45 and a PI between 8 and 20 percent. Coarse-grained "sandy" soils used for embankment fills should have a minimum PI of 5 to

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[2] A-6 soils or better as determined by ARDOT.

[3] Special Provision "Compacted Embankment", developed by ARDOT, dated March 1, 2022.

eliminate potential for erosion and other requirements regarding its angle of internal friction. At the northern abutment (Bent No. 13), select fill with a phi-angle of 32 or greater (AASHTO A-4 or better) should be used for construction of the embankment; this requirement is discussed subsequently in this report. Fill materials should also be free from organic matter, debris, or other deleterious materials, and have a maximum particle size of 2 inches.

Fill and Backfill Placement. Fill and backfill should be placed in level lifts, up to 8 inches in loose thickness. For fill and backfill exhibiting a well-defined moisture-density relationship, each lift should be moisture-conditioned to within ±2% of the optimum moisture content and compacted with a sheepsfoot roller of self-propelled compactor to a minimum of 98% of the maximum dry unit weight as determined by the standard Proctor test. Moisture-conditioning can include: aeration and drying of wetter soils; wetting drier soils; and/or mixing wetter and drier soils into a uniform blend. The upper 3 feet of soil beneath the base of pavement should be compacted to 98% of the maximum unit weight as determined by the standard Proctor test.

For fill and backfill that do not exhibit a well-defined moisture-density relationship, each lift should be compacted to a 70% of the minimum relative density as evaluated from the maximum and minimum index densities measured by ASTM D4253 and D4254, respectively. The upper 3 feet of soil beneath the base of pavement should be compacted to 75% of the minimum relative density.

Fill Placement on Slopes. Certain areas of the project site will require fill to be placed on slopes. Benching of existing slopes should be performed during placement of new fill. Fill on the sloped areas should begin from the toe of the slope and proceed upward, placing new fill on horizontal benches. Bench shelves should be 8 to 10 feet wide, and bench faces should be 1 to 2 feet in height. Fill lifts should be keyed into the slope to reduce the potential of a slip place between the new fill and existing soils. Fill slopes should be constructed by extending the compacted fill beyond the planned profile of the slope and then trimming the slope to the desired configuration.

Moisture Considerations. Maintaining the moisture content of bearing and subgrade soils within the acceptable range is important during and after construction. Silty and clayey subgrade soils should not be allowed to become wet or dry during or after construction, and measures should be taken to hinder water from ponding on these soils. Positive drainage should be established to promote drainage of surface water away from the roadway.

### Seismic Considerations

Earthquake Risk. The project area is located in the vicinity of the New Madrid Seismic Zone (NMSZ). The NMSZ is located in the northern part of the Mississippi Embayment and trends in a northeast to southwest direction from southern Illinois to northeast Arkansas. In December 1811, a series of large magnitude earthquake occurred, which were centered near New Madrid, Missouri. Three strong earthquakes occurred over the next three months and smaller aftershocks continued until at least 1817. According to researchers, the magnitudes of these three events ranged from 7.5 to 8.0.

Earthquake Forces. It is our understanding the bridge and approaches will be designed in accordance with the AASHTO publication "LRFD Bridge Design Specifications", eighth edition (2017), with 2017 interims.

### *AASHTO LRFD 2017 Seismic Site Classification and Seismic Design Parameters*

Seismic Design Parameters. Seismic design parameters based on a seismic hazard with 7% probability of exceedance in 75 years and field and laboratory testing is presented in Table 3.

**Table 3. Seismic Design Parameters (7% Probability of Exceedance in 75 years).**

| Latitude 33.628844°N/Longitude 91.815569°W | | |
|---|---|---|
| Category/ Parameter | Designation/ Value | Reference |
| Seismic Zone | 2 | AASHTO LRFD 2017 Table 3.10.6-1 |
| Seismic Site Class | D | AASHTO LRFD 2017 Table 3.10.3.1-1 |
| $S_S$ | 0.198g | Ground motion parameters obtained from a computer program supplied with the AASHTO Guideline for the Seismic Design of Highway Bridges (2009) using the indicated latitude and coordinates of the project site and the seismic site class based on boring data. |
| $S_1$ | 0.070g | |
| $F_a$ | 1.600 | |
| $F_v$ | 2.400 | |
| $F_{PGA}$ | 1.600 | |
| $t_s$ | 0.533 | |
| $t_0$ | 0.107 | |
| $S_{DS}$ | 0.316g | |
| $S_{D1}$ | 0.169g | |
| PGA | 0.084g | |
| As | 0.135g | |

### *Seismic Site Classification*

A study to determine the seismic site classification was performed for the project site. The process included downhole, seismic-cone testing to measure the shear wave velocity of the soil profile. Data measured using the seismic cone resulted in average shear wave velocities ($V_S$) of 741, 752, and 781 feet per second within the upper 100 feet of CPT-2, -9, and -14, respectively, as shown on Figure 3 (Shear Wave Velocity Profile) in Appendix B.

The results of the seismic study performed at the site indicate that the site is Site Class D, "stiff soil" profile based on an average $V_S$ of approximately 758 feet per second. This site class is based on the average shear wave velocity in the top 100 feet of the three CPT locations located in the alignment of the proposed bridge where seismic data was collected.

### *Liquefaction and Dynamic Settlement*

A study was performed to evaluate the liquefaction and dynamic settlement potential at the site. Both field and laboratory data were used to perform the analysis. The field measurements included the depth of the water table and the SPT N-values. The laboratory data included USCS classification and soil unit weight. An earthquake magnitude ($M_W$) of 7.7 with a probability of exceedance of 7% in 75 years was considered. A site peak ground acceleration of 0.135g was utilized as obtained from the referenced Seismic Design Maps. Groundwater was set at a depth of 50 feet as indicated on the CPT plots in Appendix D.

Subsurface conditions (as characterized by field and laboratory data) and earthquake characteristics were used to estimate the safety factors against liquefaction in each soil layer, as well as the associated dynamic settlement during the design seismic event. Based on the analysis, the potential for liquefaction at the site is relatively low in the upper 50 feet.

Lateral Spreading. Lateral spreading is triggered and sustained by earthquake ground motions. Based on our seismic slope stability analyses, it is our professional opinion the potential for lateral spreading is low at the site.

### Approach Embankment Settlement

Settlement analyses of natural soils were performed to assess fill-induced settlement for the approaches. Based on the provided preliminary plans, up to approximately 35½ feet and 14½ of fill will be required at the southern and northern abutments, respectively, to bring the site to design grade. For settlement analyses, we have assumed cohesive, engineered fill will be used for the fill material. The results of the settlement due to fill placement are shown in Table 4. If grade changes will require the placement of additional fill, Geotechnology should be contacted to perform additional settlement analyses for fill-induced settlement at the approaches.

**Table 4. Summary of Estimated Settlement.**

| Southern Abutment (Exterior Bent No. 1) | | | | Northern Abutment (Exterior Bent No. 13) | | | |
|---|---|---|---|---|---|---|---|
| Max Fill (feet) | Estimated Settlement (inches) | | | Max Fill (feet) | Estimated Settlement (inches) | | |
| | Immediate | Long-Term (Consolidation) | Total | | Immediate | Long-Term (Consolidation) | Total |
| 35½ | 8 | 14 | 22 | 14½ | 3 | 5 | 8 |

The bent numbers presented in Table 4 are in reference to the bent number designations presented in the provided preliminary plans. Based on review of the preliminary plans, the bents are numbered from 1 to 13 such that exterior Bent No. 1 is at the southern abutment. The bents are numbered in succession from south to north along the bridge alignment with exterior Bent No. 13 at the northern abutment of the bridge.

Discussion of Fill-Induced Settlement. The results of the settlement analyses indicate immediate and long-term (primary consolidation) settlement across the site. We anticipate the immediate settlement to occur shortly after fill placement. At exterior Bent No. 13, we anticipate practical completion of consolidation to occur within 2 months after fill placement.

Based on the analyses at exterior Bent No. 1, we anticipate practical completion of consolidation to occur longer than one year after fill placement. Note this estimate is based on the one-dimensional consolidation test performed in our laboratory on a sample recovered in the CH material. The test confines the drainage path during sample loading to one dimension; in the field, drainage may take place in three dimensions. Therefore, it is our professional opinion the estimated settlement will occur in a shorter time period; however, we are not able to accurately estimate the shorter time. Proposed methods of ground improvement and expediting consolidation settlements are presented subsequently in this report.

### Global Stability

Geotechnology performed stability analyses for deep-seated, global failure of bridge abutment slopes using the computer program SLIDE2. Short-term, long-term, and seismic conditions were considered using the Spencer method to compute factors of safety for the proposed slopes.

Calculated minimum factors of safety are summarized in the following table. Minimum required factors of safety for the proposed bridge were based on the ARDOT Minimum Acceptable Factors of Safety as provided by ARDOT using a seismic operational class of “Other”. A pseudo-static seismic acceleration of 0.0675g, corresponding to one-half the peak ground acceleration (per FHWA Publication HI-99-012) was utilized.

Fill material consists of engineered fill as described in the Fill Materials section of this report; a groundwater elevation of deeper than 50 feet, as noted from the borings and CPT soundings, was utilized for the short-term and seismic condition analyses and a groundwater elevation of 212.9, as obtained from the preliminary plans, was used for the long-term condition analyses. Section profiles with critical slip surfaces and utilized soil parameters are presented in Appendix G for the selected analyses. The analysis models did not consider the effect of foundation piles driven at the abutments that would provide additional restraining force to stabilize the slopes. The models include an approximately 18-inch-thick layer of riprap placed on the slope faces as described by ARDOT.

**Table 5. Results of Slope Stability Analyses.**

| Location | Description | Slope Height (ft.) | Calculated Factor of Safety | | |
|---|---|---|---|---|---|
| | | | Short-Term Static[a,c] | Long-Term Static[a,d] | Seismic[b,c] |
| Southern Abutment STA 1078+22 | 3:1<br>35.5' Fill Slope | 37.0 | 1.42 | 1.55 | 1.11 |
| Northern Abutment STA 1089+44 | 2:1<br>14.5' Fill Slope | 14.5 | 3.11 | 1.31 | 2.32 |
| Side Slope STA 1077+55.84 | 3:1<br>35.5' Fill Slope | 35.5 | 1.49 | 1.47 | 1.16 |
| Side Slope STA 1089+45.84 | 3:1<br>14.5' Fill Slope | 14.5 | 3.20 | 1.56 | 2.35 |

[a] Target factor of safety = 1.3, approximately equivalent to a global stability resistance factor = 0.75, as provided by ARDOT.

[b] Target factor of safety = 1.1, approximately equivalent to a global stability resistance factor = 0.9, as provided by ARDOT.

[c] Based on a groundwater elevation of approximately El 159; approximately 50 feet below existing ground surface.

[d] Based on a groundwater elevation of El 212.9 as observed in the preliminary plans provided by ARDOT.

As a minimum, fill material used for construction of the embankments will be required to meet the criteria established in the SP provided by ARDOT. Based on the analyses performed under long term (drained) static conditions, select fill material with a minimum drained angle of internal friction (phi-angle) of 32 degrees will be required to achieve the minimum factor of safety at the northern abutment (Bent No. 13); this corresponds to select fill material classified as AASHTO A-4 or better. Global stability analyses performed using fill material with a drained phi-angle of less than 32 degrees resulted in a factor of safety less than the minimum required under long-term static conditions. The extents of the select embankment fill material should extend a minimum of 5 feet beyond the toe of embankment side slopes; 5 feet beyond the toe of abutment fill slopes; and a minimum of 50 feet behind the toe of the abutment slope along the centerline at Bent No. 13. The friction angle of fill soils should be confirmed by performing consolidated-undrained (CU) or consolidated-drained (CD) testing.

## Deep Foundations

Foundation design recommendations are provided herein based on the AASHTO LRFD Bridge Design Specifications (2017).

Based on information provided by ARDOT, proposed foundation types for the abutments (exterior bents) and interior bents will be driven closed-ended pipe piles; pile diameters of 16-, 18-, and 24-inches have been considered for foundations as provided by ARDOT. Geotechnology should be notified if different foundation sizes, types, or configurations are to be considered. Soil parameters including LPILE lateral load analysis parameters for each bent foundation are included in Appendix H.

Nominal resistance curves showing axial resistance from skin friction and total axial capacity (skin friction + end bearing) for Bent Nos. 1 through 13 are presented in Appendix I. Nominal resistances at each bent location are presented in Table 6 through Table 10. Uplift (tension) capacities may be calculated using the resistance provided by skin friction.

It should be noted the resistance and capacity values presented for Exterior Bent Nos. 1 and 13 are subject to downdrag loads imposed by fill placement at the bents; embedment lengths presented for the piles at the bent locations are in reference to bottom of pile cap elevations of exterior Bent Nos. 1 and 13 of approximately El 240 and El 218, respectively. The embedment depths presented assume piles will be driven through fill placed at the exterior bent locations immediately after abutment fill placement in lieu of waiting for essential completion of consolidation settlement due to fill placement. If essential completion of consolidation settlement is allowed to be reached prior to pile driving, Geotechnology should be contacted to perform additional pile capacity analyses.

**Table 6. Nominal Static Axial Resistance of Driven Closed-Ended Pipe Piles – Exterior Bents 1 and 13.**

| Location | Pile Diameter (inches) | Embedment Length (feet) | Skin Friction[b] (tons) | End Bearing (tons) | Compression Total (tons) | Nominal Drag Loads[c] (tons) |
|---|---|---|---|---|---|---|
| Southern Abutment (Exterior Bent No. 1)[a] (Boring B-2) | 16 | 110 | 169 | 25 | 194 | 169 |
| | | 115 | 200 | 25 | 225 | |
| | | 120 | 231 | 25 | 256 | |
| | 18 | 110 | 190 | 32 | 222 | 190 |
| | | 115 | 225 | 32 | 257 | |
| | | 120 | 260 | 32 | 291 | |
| | 24 | 110 | 254 | 57 | 310 | 254 |
| | | 115 | 300 | 57 | 356 | |
| | | 120 | 346 | 57 | 403 | |
| Northern Abutment (Exterior Bent No. 13)[a] (Boring B-14) | 16 | 50 | 44 | 15 | 59 | 41 |
| | | 60 | 80 | 25 | 105 | |
| | | 70 | 124 | 25 | 149 | |
| | 18 | 50 | 49 | 19 | 68 | 46 |
| | | 60 | 90 | 32 | 122 | |
| | | 70 | 139 | 32 | 171 | |
| | 24 | 50 | 66 | 34 | 100 | 62 |
| | | 60 | 120 | 57 | 176 | |
| | | 70 | 186 | 57 | 242 | |

[a] Embedment length referenced from pile cap elevations of Exterior Bent No. 1 and 13 of approximately El 240 and El 218, respectively, extending through fill material placed at the exterior bent locations.

[b] Skin friction resistances are calculated as the total side friction accounting for downdrag; the drag load is presented in the rightmost column. Drag loads should be subtracted from total resistance.

[c] Drag loads attributed to consolidation settlement due to fill placement.

**Table 7. Nominal Static Axial Resistance of Driven Closed-Ended Pipe Piles – Interior Bents 2 Through 4.**

| Location | Pile Diameter (inches) | Embedment Length (feet) | Skin Friction (tons) | End Bearing (tons) | Compression Total (tons) |
|---|---|---|---|---|---|
| Interior Bent No. 2[a] (Boring B-3) | 16 | 40 | 50 | 15 | 65 |
| | | 50 | 76 | 15 | 91 |
| | | 60 | 104 | 15 | 119 |
| | 18 | 40 | 56 | 19 | 75 |
| | | 50 | 85 | 19 | 104 |
| | | 60 | 117 | 19 | 136 |
| | 24 | 40 | 74 | 34 | 108 |
| | | 50 | 113 | 34 | 147 |
| | | 60 | 156 | 34 | 190 |
| Interior Bent No. 3[a] (Boring B-4) | 16 | 40 | 50 | 15 | 65 |
| | | 50 | 76 | 15 | 91 |
| | | 60 | 105 | 23 | 127 |
| | 18 | 40 | 56 | 19 | 75 |
| | | 50 | 85 | 19 | 104 |
| | | 60 | 118 | 28 | 146 |
| | 24 | 40 | 74 | 34 | 108 |
| | | 50 | 113 | 34 | 147 |
| | | 60 | 157 | 49 | 206 |
| Interior Bent No. 4[a] (Boring B-5) | 16 | 40 | 50 | 15 | 65 |
| | | 50 | 76 | 15 | 91 |
| | | 60 | 110 | 25 | 135 |
| | 18 | 40 | 56 | 19 | 75 |
| | | 50 | 85 | 19 | 104 |
| | | 60 | 124 | 32 | 156 |
| | 24 | 40 | 74 | 34 | 108 |
| | | 50 | 113 | 34 | 147 |
| | | 60 | 165 | 57 | 221 |

[a] Embedment length referenced from approximate ground surface elevations at the boring locations as shown on the soil parameters sheets in Appendix H.

**Table 8. Nominal Static Axial Resistance of Driven Closed-Ended Pipe Piles – Interior Bents 5 Through 7.**

| Location | Pile Diameter (inches) | Embedment Length (feet) | Skin Friction (tons) | End Bearing (tons) | Compression Total (tons) |
|---|---|---|---|---|---|
| Interior Bent No. 5[a] (Boring B-6) | 16 | 40 | 50 | 15 | 65 |
| | | 50 | 76 | 15 | 91 |
| | | 60 | 105 | 23 | 127 |
| | 18 | 40 | 56 | 19 | 75 |
| | | 50 | 85 | 19 | 104 |
| | | 60 | 118 | 28 | 146 |
| | 24 | 40 | 74 | 34 | 108 |
| | | 50 | 113 | 34 | 147 |
| | | 60 | 157 | 49 | 206 |
| Interior Bent No. 6[a] (Boring B-7) | 16 | 40 | 55 | 15 | 70 |
| | | 50 | 81 | 15 | 96 |
| | | 60 | 115 | 25 | 140 |
| | 18 | 40 | 62 | 19 | 81 |
| | | 50 | 91 | 19 | 110 |
| | | 60 | 130 | 32 | 161 |
| | 24 | 40 | 82 | 34 | 116 |
| | | 50 | 121 | 34 | 155 |
| | | 60 | 173 | 57 | 229 |
| Interior Bent No. 7[a] (Boring B-8) | 16 | 40 | 55 | 15 | 70 |
| | | 50 | 81 | 23 | 104 |
| | | 60 | 121 | 25 | 146 |
| | 18 | 40 | 62 | 19 | 81 |
| | | 50 | 91 | 28 | 120 |
| | | 60 | 136 | 32 | 168 |
| | 24 | 40 | 82 | 34 | 116 |
| | | 50 | 122 | 49 | 171 |
| | | 60 | 181 | 57 | 238 |

[a] Embedment length referenced from ground surface elevations at the boring locations as shown on the soil parameter sheets in Appendix H.

**Table 9. Nominal Static Axial Resistance of Driven Closed-Ended Pipe Piles – Interior Bents 8 Through 10.**

| Location | Pile Diameter (inches) | Embedment Length (feet) | Skin Friction (tons) | End Bearing (tons) | Compression Total (tons) |
|---|---|---|---|---|---|
| Interior Bent No. 8[a] (Boring B-9) | 16 | 40 | 50 | 15 | 65 |
| | | 50 | 76 | 23 | 99 |
| | | 60 | 115 | 25 | 141 |
| | 18 | 40 | 56 | 19 | 75 |
| | | 50 | 86 | 28 | 114 |
| | | 60 | 130 | 32 | 162 |
| | 24 | 40 | 74 | 34 | 108 |
| | | 50 | 114 | 49 | 163 |
| | | 60 | 173 | 57 | 230 |
| Interior Bent No. 9[a] (Boring B-10) | 16 | 40 | 64 | 15 | 79 |
| | | 50 | 90 | 15 | 105 |
| | | 60 | 125 | 25 | 150 |
| | 18 | 40 | 72 | 19 | 91 |
| | | 50 | 101 | 19 | 121 |
| | | 60 | 140 | 32 | 172 |
| | 24 | 40 | 96 | 34 | 130 |
| | | 50 | 135 | 34 | 169 |
| | | 60 | 187 | 57 | 244 |
| Interior Bent No. 10[a] (Boring B-11) | 16 | 40 | 55 | 15 | 70 |
| | | 50 | 81 | 15 | 96 |
| | | 60 | 115 | 25 | 140 |
| | 18 | 40 | 73 | 19 | 92 |
| | | 50 | 103 | 28 | 131 |
| | | 60 | 148 | 32 | 179 |
| | 24 | 40 | 98 | 34 | 132 |
| | | 50 | 168 | 49 | 187 |
| | | 60 | 197 | 57 | 253 |

[a] Embedment length referenced from ground surface elevations at the boring locations as shown on the soil parameter sheets in Appendix H.

**Table 10. Nominal Static Axial Resistance of Driven Closed-Ended Pipe Piles – Interior Bents 11 and 12.**

| Location | Pile Diameter (inches) | Embedment Length (feet) | Skin Friction (tons) | End Bearing (tons) | Compression Total (tons) |
|---|---|---|---|---|---|
| Interior Bent No. 11[a] (Boring B-12) | 16 | 40 | 55 | 15 | 70 |
| | | 50 | 81 | 15 | 96 |
| | | 60 | 115 | 25 | 140 |
| | 18 | 40 | 62 | 19 | 81 |
| | | 50 | 91 | 19 | 110 |
| | | 60 | 130 | 32 | 161 |
| | 24 | 40 | 82 | 34 | 116 |
| | | 50 | 121 | 34 | 155 |
| | | 60 | 173 | 57 | 229 |
| Interior Bent No. 12[a] (Boring B-13) | 16 | 40 | 50 | 15 | 65 |
| | | 50 | 76 | 23 | 99 |
| | | 60 | 115 | 25 | 141 |
| | 18 | 40 | 56 | 19 | 75 |
| | | 50 | 86 | 28 | 114 |
| | | 60 | 130 | 32 | 162 |
| | 24 | 40 | 74 | 34 | 108 |
| | | 50 | 113 | 34 | 147 |
| | | 60 | 157 | 49 | 206 |

[a] Embedment length referenced from ground surface elevations at the boring locations as shown on the soil parameter sheets in Appendix H.

Resistance Factors. Resistance factors should be applied to the nominal resistances provided. Based solely on the static analysis methods used to calculate nominal pile resistances, the factors presented in Table 11 may be applied.

**Table 11. Resistance Factors Based on Static Analysis Methods.**

| Deep Foundation and Condition | Clay | | Sand | |
|---|---|---|---|---|
| | Side Resistance | End-Bearing | Side Resistance | End-Bearing |
| Nominal Compressive Resistance of Single Pile | 0.35 | 0.35 | 0.45 | 0.45 |
| Uplift Resistance of Single Pile | 0.25 | -- | 0.35 | -- |

Based on the AASHTO LRFD (2017) Table 10.5.5.2.3-1, a higher resistance factor can be used in accordance with the method of pile testing performed as indicated in Table 12.

**Table 12. Resistance Factors for Driven Piles.**

| Condition/Resistance Determination Method | | Resistance Factor |
|---|---|---|
| Nominal Bearing Resistance of Single Pile – Dynamic Analysis and Static Load Test Methods | Driving criteria established by successful static load test of at least one pile per site condition and dynamic testing of at least two piles per site, but no less than 2% of the production piles* | 0.80 |
| | Driving criteria established by successful static load test of at least one pile per site condition without dynamic testing | 0.75 |
| | Driving criteria established by dynamic testing conducted on 100% of production piles* | 0.75 |
| | Driving criteria established by dynamic testing, quality control by dynamic testing of at least two piles per site condition, but no less than 2% of production piles* | 0.65 |
| | Wave equation analysis, without pile dynamic measurements or load test but with field confirmation of hammer performance | 0.50 |
| | FHWA-modified Gates dynamic pile formula (End of Drive condition only) | 0.40 |
| Uplift Resistance of Single Pile | Dynamic test with signal matching | 0.50 |

* Dynamic testing requires signal matching, and estimates of nominal resistance are made from a restrike. Dynamic tests are calibrated to a static load test, when available.

Pile Group Considerations. The settlement of pile groups should be evaluated as per AASHTO LRFD (2017) section 10.7.2.3. Settlement analysis of the pile groups can be performed when the foundation configurations and service loads are available. AASHTO LRFD (2017) section 10.7.3.9 addresses pile group resistance. Group capacity considerations for different pile groups, center-to-center spacings, and other conditions (cap contact with ground, softness of surface soil etc.) are given in AASHTO LRFD (2017) sections 10.7.3.9 and 10.7.3.11.

Driven Pile Construction Considerations. Minimum hammer energies required to drive the piles were not evaluated for the proposed foundations. If minimum hammer energy evaluations are required, Geotechnology should be contacted to perform analyses for the required minimum hammer energies for driving piles.

Static Pile Load Testing. At least one static pile compression load test should be performed for each bent or abutment location. The testing should be performed in accordance with ASTM D 1143 using the quick loading procedure and AASHTO LRFD (2017) section 10.7.3.8.2. Please refer to the previous Resistance Factors table for additional guidance regarding the minimum number of tests and alternate resistance factors associated with other field methods for determining resistance.

If the piles are to support net uplift loads, at least one tension load test should be performed for each location. The test should be performed in accordance with ASTM D 3689. Piles should be tested to the required nominal uplift resistances.

Load tests are required to verify recommended nominal pile resistance and will not be used to increase the design pile resistance. The piles used in the load tests should not be used for support of any structures. Geotechnology should be consulted regarding the locations of the test piles.

Dynamic Testing of Driven Piles. As an alternative to static pile load testing, high-strain dynamic pile testing can be performed according to AASHTO LRFD (2017)) section 10.7.3.8.3 and the procedures given in ASTM D4945. Different resistance factors correspond to different load testing combinations as illustrated in the previous table. We recommend that the test piles be identified according to AASHTO LRFD (2017) Table 10.5.5.2.3-1 or 2 percent of the production piles, whichever results in a larger number of tests. We recommend that the identified piles be tested at the end of initial drive (EOID) and a restrike performed at a minimum seven days after EOID.

Pile driving monitoring should be performed by an engineer with a minimum 3 years dynamic pile testing and analysis experience and who has achieved Basic or better certification under the High-Strain Dynamic Pile Testing Examination and Certification process of the Pile Driving Contractors Association and Foundation QA. Pile driving modeling and analyses should be performed by an engineer with a minimum five years dynamic pile testing and analysis experience and who has achieved Advanced or better certification under the High-Strain Dynamic Pile Testing Examination and Certification process of the Pile Driving Contractors Association and Foundation QA.

Dynamic tests are required to monitor hammer and drive system performance, assess driving stresses and structural integrity and to evaluate pile resistance, and should not be used to increase design pile resistance. Dynamic tests should be performed on production piles with the lowest driving resistance. Geotechnology will be available to assist with development of specifications for this program and should be on site to perform or observe the testing and establish the pile driving criteria.

Settlement. Settlement of pile foundations depends on the loads applied and the foundation configuration. In general, settlement of deep foundations designed in accordance with the recommendations provided in this report is expected to be less than 1-inch. However, a calculation of the expected settlement of the pile foundations can be performed when the applied service loads and foundation configuration are available.

Uplift Resistance. Uplift forces can be resisted by the effective weight of the piles and caps, and frictional resistance between the piles and surrounding soil. If the anticipated maximum level of groundwater is higher than the tip of the pile then the buoyant unit weight of the pile must be used in computing uplift resistance for pile lengths extending below the design groundwater level.

Lateral Resistance. The lateral resistance of pile foundations depends on the lengths and dimensions of the foundations and the soil characteristics. The lateral resistance of pile foundations can be computed using the computer program LPILE to model the behavior of a single pile or shaft. Soil parameters are provided in Appendix H for the various strata and soil strengths present at the site. Soil parameters are based on field and laboratory test results and empirical correlations with SPT N-values.

The effects of group interaction must be considered when evaluating pile/shaft group horizontal movement. The lateral resistance for individual piles calculated by LPILE must be reduced by the P-multipliers provided in Section 10.7.2.4 of the AASHTO LRFD (2017) to determine lateral resistance of a pile group. Alternatively, the GROUP software can be used to evaluate the lateral resistance of the pile/shaft groups. The resistance factor for lateral resistance of single pile or pile group is 1.0.

### Downdrag

The AASHTO LRFD (2017) suggests that soil settlement relative to a pile of 0.4-inch or greater could produce downdrag on pile foundations. Downdrag occurs as the soil strata moves downward relative to foundations due to settlement of the soil layers. The relative movement of the soil layers versus the shaft depends on the final foundation configuration.

Downdrag Due to Fill-Induced Settlement. Based on settlement analyses performed for the maximum fill placements at the abutments, up to 22 inches of settlement is predicted. The settlement due to fill placement at exterior Bent No. 13 is estimated to occur within 2 months following completion of fill placement. At exterior Bent No. 1, we anticipate consolidation settlement to take longer than one year to achieve essential completion.

Piles driven through the fill embankment at exterior Bent Nos. 1 and 13 could be subject to downdrag as the soil consolidates under the fill load. Nominal (unfactored) drag loads from consolidation settlement at exterior Bent Nos. 1 and 13 are presented in Table 6 based on the cumulative side resistance above the depth where approximately 0.4-inch of consolidation settlement is predicted to occur. Piles placed at exterior Bent Nos. 1 and 13 should be designed to account for drag loads imposed on the piles due to the downward movement of soils.

The following options are presented as methods for accommodating for the fill-induced settlement and downdrag loads on piles placed at exterior Bent Nos. 1 and 13. Options 1, 2, and 3 are presented if piles at the exterior bent locations are to be driven after essential completion of consolidation settlement is achieved; in this case, downdrag will not mobilize and will have minimal effect on piles placed at Bent Nos. 1 and 13. Option 4 is presented if piles at the exterior bent locations are to be driven immediately after fill placement; in this case, downdrag will be exerted on the pile.

1. Driving of piles and continued construction of the abutments can commence as soon as fill-induced settlement at exterior Bent Nos. 1 and 13 is essentially complete (less than 0.4 inches of settlement anticipated). We recommend a settlement monitoring system be implemented and survey data be sent to Geotechnology to estimate when settlement is essentially complete. The recommended settlement monitoring program is discussed subsequently in this report.

2. To accelerate settlement, a prefabricated vertical drain (wick drain) ground improvement system may be installed prior to fill placement. Ground improvement systems are typically installed by specialty firms using a design/build arrangement. A preliminary wick drain ground improvement analysis was performed for Bent Nos. 1 and 13 and is discussed subsequently in this report. A settlement monitoring program will be required along with ground improvement to estimate when settlement is essentially complete.

3. Aggregate pier (AP) ground improvement systems can be used in lieu of or in addition to the wick drain systems discussed in Option 2. AP systems are typically designed and installed by specialty firms on a design/build arrangement. Further discussed of AP ground improvement systems are presented subsequently in this report. A settlement monitoring program will be required with an AP system to estimate when settlement is essentially complete.

4. In lieu of ground improvement alternatives, piles can be driven immediately after fill placement if pile lengths and configurations account for the drag loads imposed by settlement due to fill placement. Drag loads imposed on piles driven at exterior Bent Nos. 1 and 13 prior to essential completion of fill-induced settlement are presented in Table 6.

Downdrag Due to Dynamic Settlement. Based on the low liquefaction potential at the site, liquefaction-induced drag loads were not considered.

### Ground Improvement – Undercut and Backfill

Recommendations for undercut of the in-situ soils at the abutment locations and replacement with coarse-grained engineered fill, referred to as a clean sand blanket, as described in ARDOT's Special Provision[4]. Replacement of the in-situ clayey soils with a clean sand blanket will facilitate drainage of excess pore water pressure at the top of the clayey soils generated by embankment fill placement, as well as reduce the amount of predicted consolidation settlement. Settlement analyses were performed assuming a minimum of 5 feet of in-situ soil is undercut and replaced with a clean sand blanket that extends 2 feet above the ground surface. Presented in Table 13 are the reduced predicted consolidation settlements at Bents 1 and 13.

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[4] Special Provision "Sand Drainage Blanket", developed by ARDOT, dated January 10, 2022.

**Table 13. Reduction of Consolidation Settlement - 5-Foot Undercut.**

| Location | Estimated Consolidation Settlement (inches) | |
|---|---|---|
| | Existing Clayey Soils (No Undercut) | 5 Feet of Undercut Coarse-Grained Engineered Fill |
| Southern Abutment (Exterior Bent No. 1) | 14 | 9 |
| Northern Abutment (Exterior Bent No. 13) | 5 | 3½ |

At Bent Nos. 1 and 13, it is recommended the undercut and backfilled clean sand blanket extend a minimum of 5 feet past the toe of the abutment slope and 5 feet past the toe of side slopes of the abutment. The clean sand blanket should also extend a minimum of 150 feet behind the crest of the abutment slope.

Based on the analyses of estimated consolidation settlement with 5 feet of undercut and replacement of the in-situ clayey soils with a clean sand blanket, the estimated amount of consolidation settlement is reduced at the exterior bent locations. The estimated consolidation settlement at Bent No. 13 is anticipated to be essentially complete within 4 to 8 weeks after placement of fill. The estimated consolidation settlement at Bent No. 1 is anticipated to take longer than 2 months to be essentially complete after placement of fill.

### Ground Improvement – Wick Drains

Preliminary analyses were performed to assess reduced consolidation time with the use of wick drains as a ground improvement technique. Consolidation time using wick drains will vary with drain dimensions and installation configurations. The preliminary wick drain analyses performed was based on a triangular layout with drain dimensions of 98 mm by 4 mm. Vertical and horizontal time-rate coefficients of consolidation ($c_v$ and $c_h$, respectively) of approximately 7 $in^2$/day and 20 $in^2$/day, respectfully, were used in the preliminary analyses. The preliminary analyses for estimated consolidation time with wick drain ground improvement systems at Bent 1, presented in Table 14, were performed to estimate the approximate amount of time required to achieve approximately 0.4 inches of remaining consolidation settlement. Wick drains were assumed extend to a depth of approximately 30 feet below ground surface to accommodate the full depth of the consolidating layer.

**Table 14. Estimated Consolidation Time - Wick Drain Systems.**

| Location | Wick Drain Spacing (feet) | Estimated Consolidation Time[a] (days) |
|---|---|---|
| Southern Abutment (Exterior Bent No. 1) | 3 | 36 |
| | 5 | 122 |
| | 8 | 368 |

[a] Estimated time to achieve 0.4 inches of remaining consolidation settlement.

Wick drain systems are a typically designed by specialty firms using a design/build arrangement; **it should be noted that the presented consolidation times are preliminary and should not be used for design**. A design wick drain ground improvement system should be provided by the design/build contractor. The soils below embankment fill placed at  Bent No. 1 should be undercut and replaced with a clean sand blanket as discussed previously in this report prior to installation of wick drains to facilitate increased drainage of excess pore water pressures generated by embankment fill loading.

### Ground Improvement – Aggregate Piers

Aggregate pier (AP) ground improvement systems can be utilized to stiffen subgrade soils below embankment fill. AP elements can be used to provide drainage paths and accelerate consolidation settlement of soils below embankment fill and can improve stability of embankments in lieu of or in addition to wick drain systems. AP elements should consist of clean aggregate to facilitate drainage of excess pore water pressures generated by embankment fill loading. Class 7 (crushed stone) base material is not recommended for AP element construction. Specifications for AP ground improvement systems and installation methods of AP systems should be prepared by a design/build AP contractor.

The soils below embankment fill placed at Bent No. 1 should be undercut and replaced with a clean sand blanket as discussed previously in this report. It is also recommended a biaxial geogrid load transfer platform be incorporated for distribution of the embankment loading to AP elements and surrounding soil. The geogrid load transfer platform should have a minimum ultimate tensile strength of 4,000 pounds per foot.

The bottom layer of the geogrid should be placed at approximately 6 inches above the bottom of the 5-foot undercut and installed in the clean sand blanket at 9-inch vertical spacing within the height of the clean sand blanket fill. The top layer of the geogrid load transfer platform should be 12 inches below the top of the ground surface.

### Settlement Monitoring

At the locations of Bent Nos. 1 and 13, settlement plates, or other appropriate methods, should be utilized. Settlement plates should be installed approximately 1-foot below the existing ground surface and extend in 5-foot calibrated increments as the height of embankment fill increases. To protect the riser pipes, fill should be hand-compacted within a 4-foot radius of each plate. A typical settlement plate detail is presented in Figure 4 in Appendix B. We recommend settlement plates be placed no further than 50 feet apart, with at least one in the deepest area of fill at the abutments. The project surveyor should be retained to monitor the settlement plate riser pipe. Settlement at the site should be measured twice weekly during fill placement and weekly after filling is completed. Further construction at Bents 1 and 13 should not commence until after the settlement due to embankment fill placement has essentially completed.

If an AP ground improvement system is utilized it is recommended that the settlement plates be installed over the soil matrix as recommended previously. Additionally, at least one settlement plate should be installed at each abutment over an adjacent AP element in the deepest area of fill. To accommodate base plates, holes should be cut in the top layer of geogrid installed for the load transfer platform.

### Corrosion Potential

In addition to laboratory soil classification and strength testing, soil resistivity testing was also conducted. The purpose of soil resistivity testing is to provide soil data for use by a structural engineer for analysis of any necessary protection of the piling, concrete, reinforcing steel, etc. Corrosion and deterioration protection requirements and guidelines for piling are set forth in Section 10.7.5 of the AASHTO LRFD Bridge Design Specifications. The corrosion and deterioration testing results are summarized below and are included in Appendix E.

**Table 15. Results of pH and Soil Resistivity Testing.**

| Boring | Sample No. | Sample Depth (feet) | pH | Soil Resistivity (ohm-cm) |
|---|---|---|---|---|
| B-2 | SS-11 | 43.5 | 8.03 | 495.9 |
| B-5 | SS-11 | 43.5 | 7.55 | 535.8 |
| B-9 | SS-13 | 53.5 | 7.74 | 473.1 |
| B-11 | SS-10 | 38.5 | 7.43 | 404.7 |
| B-14 | SS-13 | 53.5 | 8.02 | 444.6 |

The following soil conditions should be considered as indicative of a potential for steel pile deterioration or corrosion:

- Resistivity values less than 2,000 ohms-cm; or
- pH less than 5.5.

The following soil conditions should be considered as indicative of a potential for steel reinforcement corrosion or deterioration situation:

- Resistivity values less than 3,000 ohms-cm; or
- pH less than 5.5.

Interpretation of the data and corrosion protection of the bridge structural components should be performed by the design team.

## 7.0 RECOMMENDED ADDITIONAL SERVICES

The conclusions and recommendations given in this report are based on: Geotechnology's understanding of the proposed design and construction, as outlined in this report; site observations; interpretation of the exploration data; and our experience. Since the intent of the design recommendations is best understood by Geotechnology, we recommend Geotechnology be included in the final design and construction process, and be retained to review the project plans and specifications to confirm the recommendations given in this report have been correctly implemented. We recommend Geotechnology be retained to participate in pre-bid and preconstruction conferences to reduce the risk of misinterpretation of the conclusions and recommendations in this report relative to the proposed construction of the subject project.

Since actual subsurface conditions between boring locations could vary from those encountered in the borings, our design recommendations are subject to adjustment in the field based on the subsurface conditions encountered during construction. Therefore, we recommend Geotechnology be retained to provide construction observation services as a continuation of the design process to confirm the recommendations in this report and to revise them accordingly to accommodate differing subsurface conditions. Construction observation is intended to enhance compliance with project plans and specifications. It is not insurance, nor does it constitute a warranty or guarantee of any type. Regardless of construction observation, contractors, suppliers, and others are solely responsible for the quality of their work and for adhering to plans and specifications.

## 8.0 LIMITATIONS

This report has been prepared on behalf of, and for the exclusive use of, the client for specific application to the named project as described herein. If this report is provided to other parties, it should be provided in its entirety with all supplementary information. In addition, the client should make it clear the information is provided for factual data only, and not as a warranty of subsurface conditions presented in this report.

Geotechnology has attempted to conduct the services reported herein in a manner consistent with the level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality and under similar conditions. The recommendations and conclusions contained in this report are professional opinions. The report is not a bidding document and should not be used for that purpose.

Our scope for this phase of the project did not include any environmental assessment or investigation for the presence or absence of wetlands or hazardous or toxic materials in the soil, surface water, groundwater, or air, on or below or around this site. Any statements in this report or on the boring logs regarding odors noted or unusual or suspicious items or conditions observed are strictly for the information of our client. Our scope did not include an assessment of the effects of flooding and erosion of creeks or rivers adjacent to or on the project site.

Our scope did not include: any services to investigate or detect the presence of mold or any other biological contaminants (such as spores, fungus, bacteria, viruses, and the by-products of such organisms) on and around the site; or any services, designed or intended, to prevent or lower the risk of the occurrence of an infestation of mold or other biological contaminants.

The analyses, conclusions, and recommendations contained in this report are based on the data obtained from the geotechnical exploration. The field exploration methods used indicate subsurface conditions only at the specific locations where samples were obtained, only at the time they were obtained, and only to the depths penetrated. Consequently, subsurface conditions could vary gradually, abruptly, and/or nonlinearly between sample locations and/or intervals.

The conclusions or recommendations presented in this report should not be used without Geotechnology's review and assessment if the nature, design, or location of the facilities is changed, if there is a lapse in time between the submittal of this report and the start of work at the site, or if there is a substantial interruption or delay during work at the site. If changes are contemplated or delays occur, Geotechnology must be allowed to review them to assess their impact on the findings, conclusions, and/or design recommendations given in this report. Geotechnology will not be responsible for any claims, damages, or liability associated with any other party's interpretations of the subsurface data or with reuse of the subsurface data or engineering analyses in this report.

The recommendations included in this report have been based in part on assumptions about variations in site stratigraphy that can be evaluated further during earthwork and foundation construction. Geotechnology should be retained to perform construction observation and continue its geotechnical engineering service using observational methods. Geotechnology cannot assume liability for the adequacy of its recommendations when they are used in the field without Geotechnology being retained to observe construction.

# APPENDIX A – IMPORTANT INFORMATION ABOUT THIS GEOTECHNICAL-ENGINEERING REPORT

# Important Information about This

# Geotechnical-Engineering Report

**Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.**

**While you cannot eliminate all such risks, you can manage them. The following information is provided to help.**

## Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a civil engineer may not fulfill the needs of a constructor — a construction contractor — or even another civil engineer. Because each geotechnical- engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. No one except you should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply this report for any purpose or project except the one originally contemplated.

## Read the Full Report

Serious problems have occurred because those relying on a geotechnical-engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

## Geotechnical Engineers Base Each Report on a Unique Set of Project-Specific Factors

Geotechnical engineers consider many unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk-management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical-engineering report that was:

- not prepared for you;
- not prepared for your project;
- not prepared for the specific site explored; or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical-engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

## Subsurface Conditions Can Change

A geotechnical-engineering report is based on conditions that existed at the time the geotechnical engineer performed the study. *Do not rely on a geotechnical-engineering report whose adequacy may have been affected by*: the passage of time; man-made events, such as construction on or adjacent to the site; or natural events, such as floods, droughts, earthquakes, or groundwater fluctuations. *Contact the geotechnical engineer before applying this report to determine if it is still reliable.* A minor amount of additional testing or analysis could prevent major problems.

## Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ — sometimes significantly — from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide geotechnical-construction observation is the most effective method of managing the risks associated with unanticipated conditions.

## A Report's Recommendations Are Not Final

Do not overrely on the confirmation-dependent recommendations included in your report. *Confirmation-dependent recommendations are not final*, because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations *only* by observing actual subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's confirmation-dependent recommendations if that engineer does not perform the geotechnical-construction observation required to confirm the recommendations' applicability.*

## A Geotechnical-Engineering Report Is Subject to Misinterpretation

Other design-team members' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Constructors can also misinterpret a geotechnical-engineering report. Confront that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing geotechnical construction observation.

## Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical-engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

## Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make constructors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give constructors the complete geotechnical-engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise constructors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure constructors have sufficient time* to perform additional study. Only then might you be in a position to give constructors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

## Read Responsibility Provisions Closely

Some clients, design professionals, and constructors fail to recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

## Environmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform an *environmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. *Do not rely on an environmental report prepared for someone else.*

## Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold-prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, many mold- prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical- engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; *none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.*

## Rely, on Your GBC-Member Geotechnical Engineer for Additional Assistance

Membership in the Geotechnical Business Council of the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project. Confer with you GBC-Member geotechnical engineer for more information.

GBC GEOTECHNICAL BUSINESS COUNCIL
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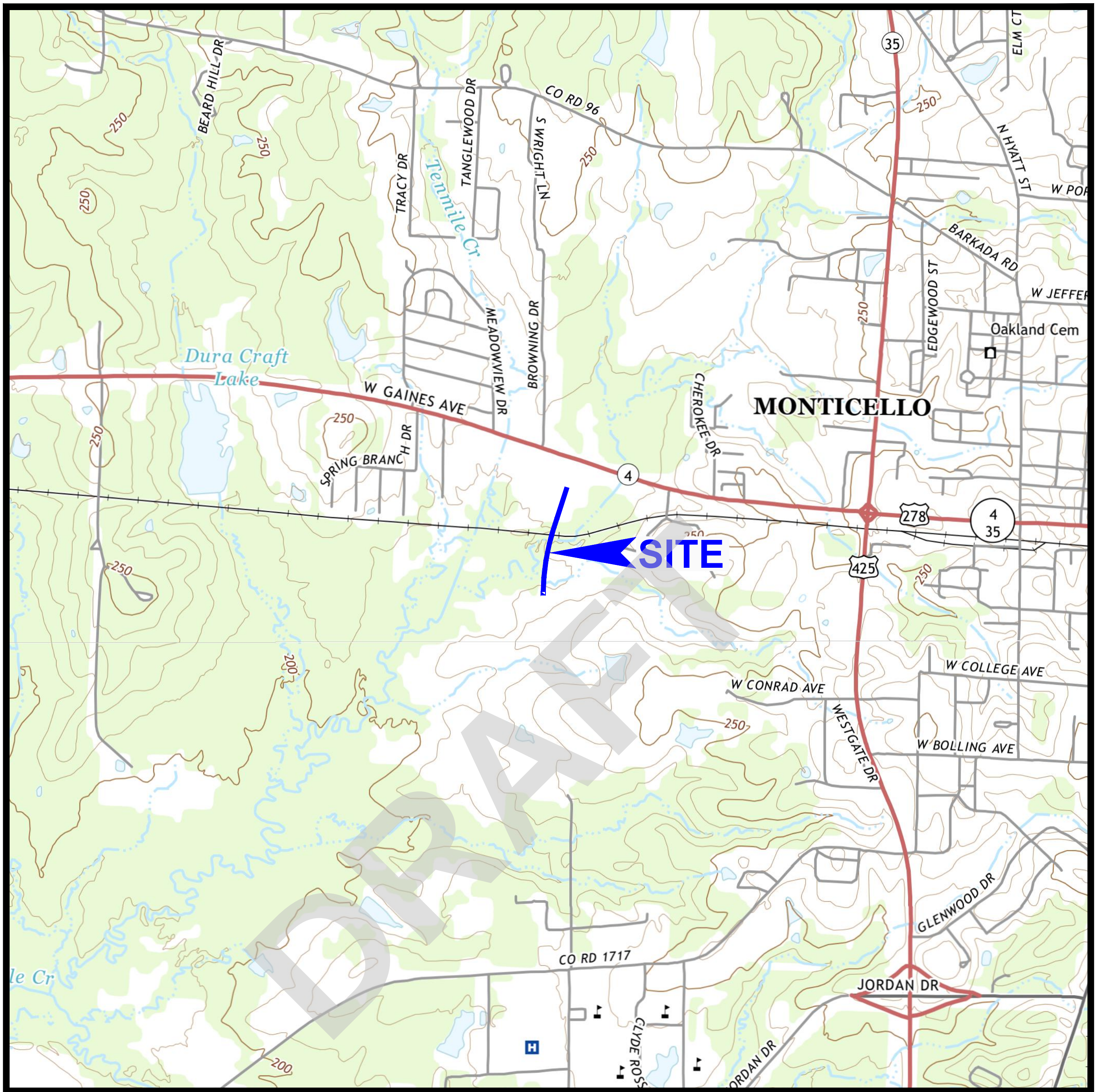
# APPENDIX B – FIGURES

Figure 1 – Site Location and Topography

Figure 2 – Aerial Photograph of Site and Boring Locations

Figure 3 – Shear Wave Velocity Profile

Figure 4 – Settlement Plate Detail



DRAFT

NOTES

1. Plan adapted from 7.5 minute U.S.G.S. maps for Monticello North and Monticello South, Arkansas quadrangles, last revised in 2020.

0 2,000 4,000

SCALE IN FEET

N

| | | |
|---|---|---|
| Drawn By: WAH | Ck'd By: JDM | App'vd By: DMS |
| Date: 10-5-21 | Date: 11-30-21 | Date: 11-30-21 |

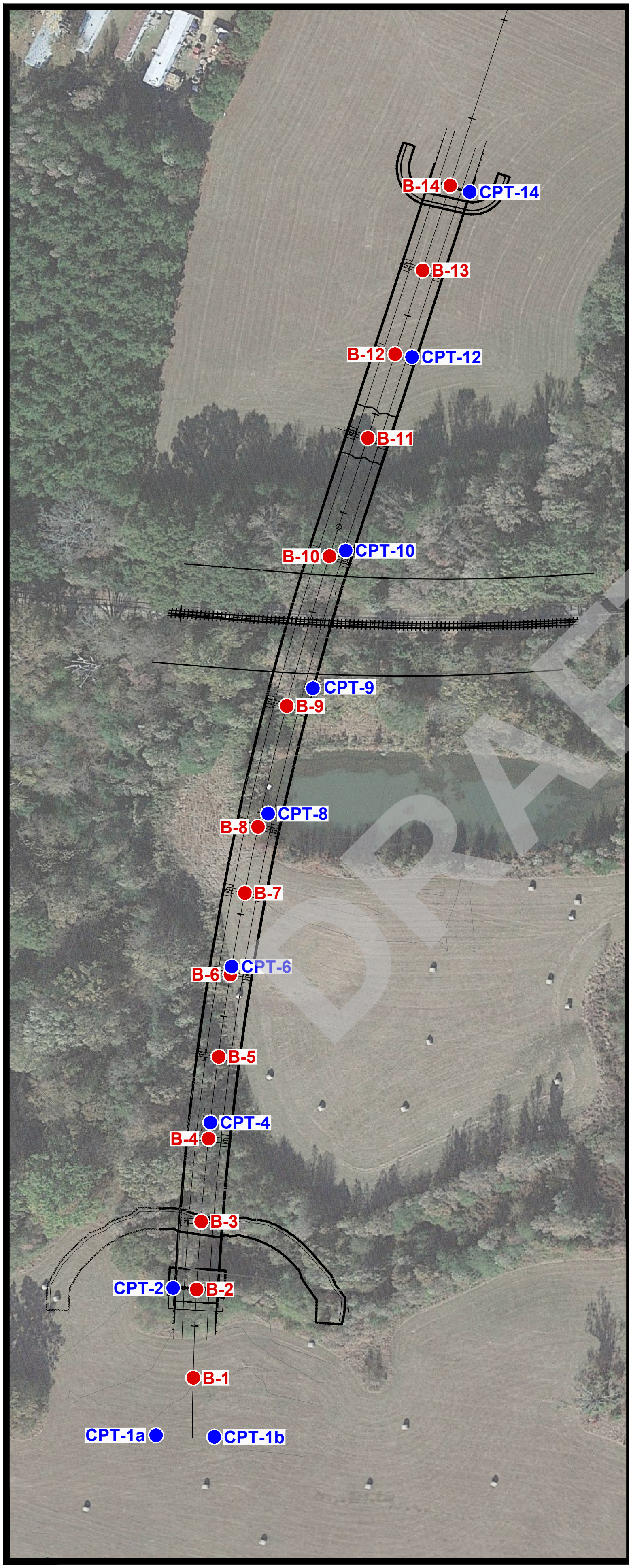
GEOTECHNOLOGY
A Universal Engineering Sciences Company

ARDOT G013, 020475
Hwy. 83 Spur - Hwy. 278 Connector (Monticello) (S)
Drew County, Arkansas

**SITE LOCATION AND TOPOGRAPHY**

Project Number
J037781.01

FIGURE 1



DRAFT

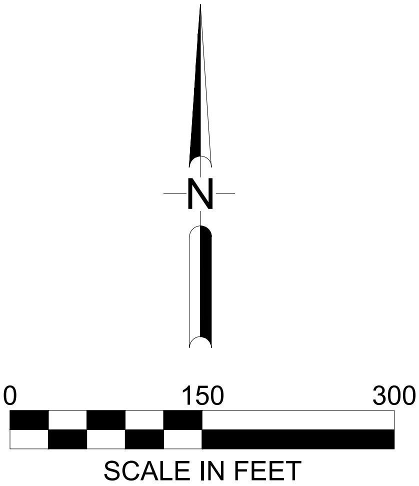
NOTES

1. Plan adapted from a November 14, 2019 aerial photograph courtesy of Google Earth and a drawings dated September 15, 2020, titled "Layout of Bridge", prepared by Arkansas Department of Transportation.

2. SPT Borings and CPT Soundings were located in the field with reference to site features and are shown approximate only.

LEGEND

| | |
|---|---|
| 🔴 | SPT Boring Location |
| 🔵 | CPT Sounding Location |



| | | |
|---|---|---|
| Drawn By: WAH | Ck'd By: JDM | App'vd By: DMS |
| Date: 10-5-21 | Date: 11-30-21 | Date: 11-30-21 |

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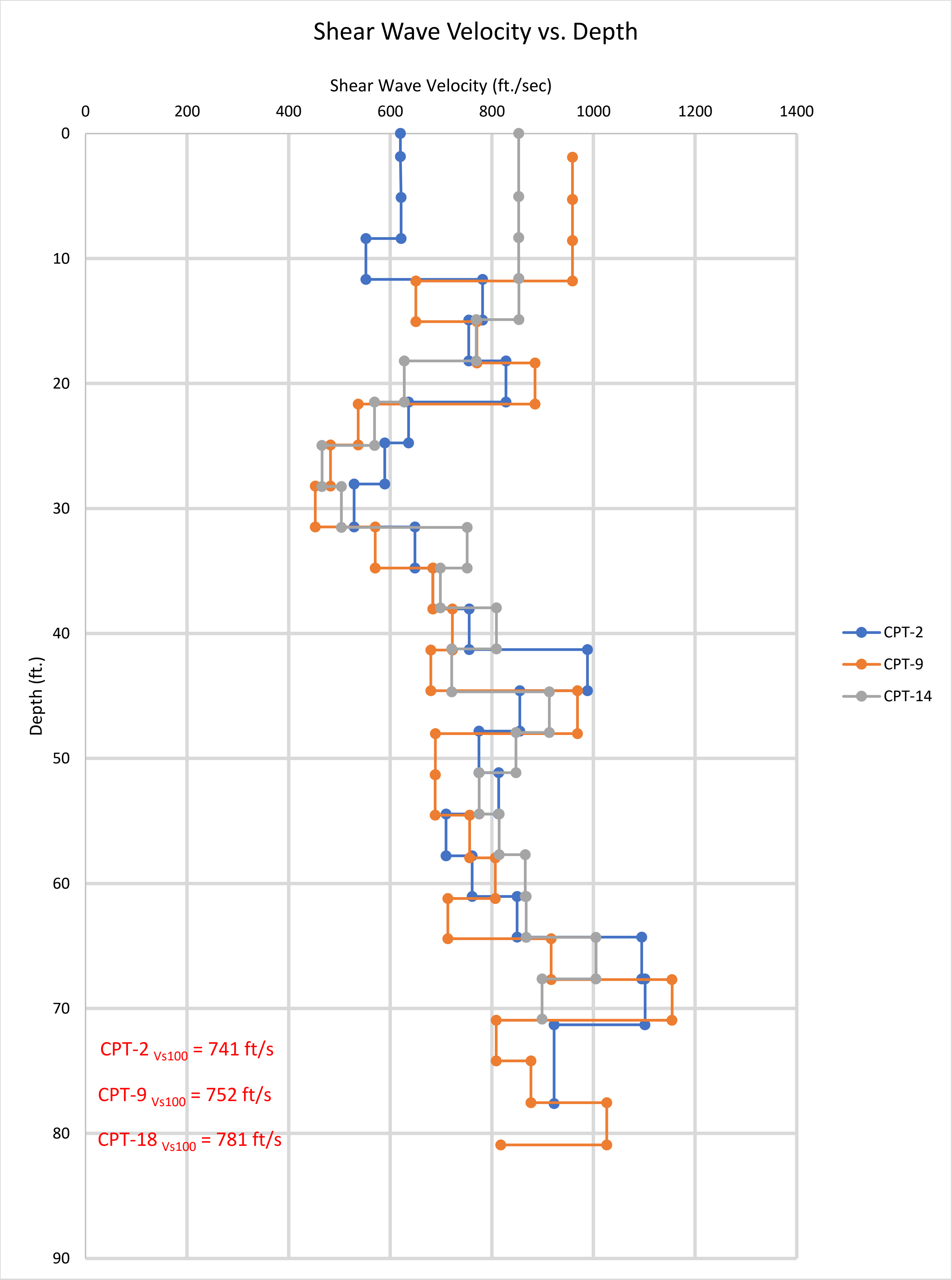
Hwy. 83 Spur - Hwy. 278 Connector (Monticello) (S)
Drew County, Arkansas

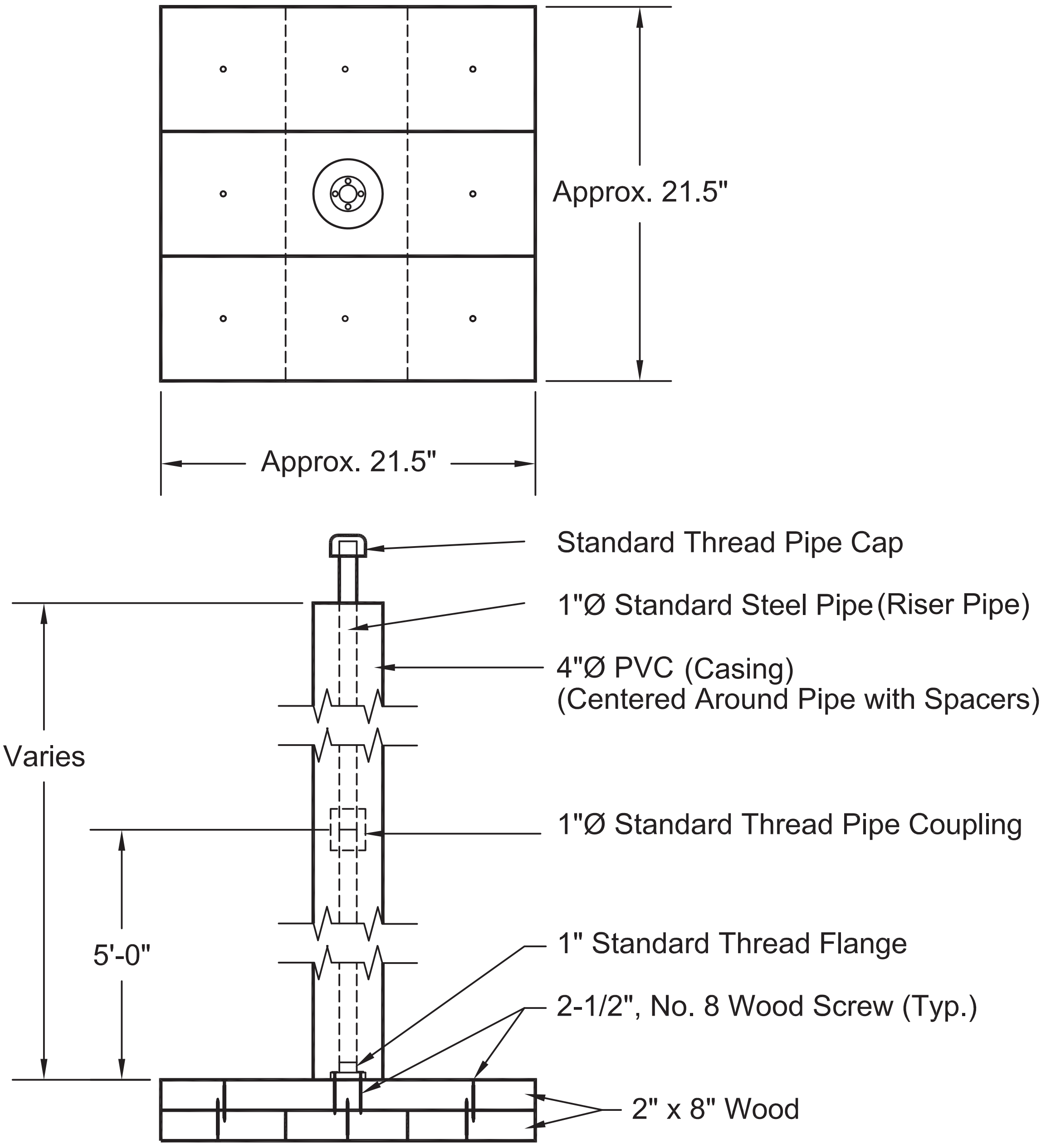
**AERIAL PHOTOGRAPH OF SITE, BORING AND SOUNDING LOCATIONS**

Project Number
J037781.01

FIGURE 2

# Figure 3 - Shear Wave Velocity Profile





NOTES

1. Place plate on level surface, a minimum of 1 foot below ground level and hand compact backfill adjacent to PVC.

| | | |
|---|---|---|
| Drawn By: WAH | Ck'd By: FC | App'vd By: DMS |
| Date: 5/30/2019 | Date: 5/30/2019 | Date: 11/18/2021 |

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ARDOT GO13, 020475
Hwy 83 Spur- Hwy 278 Connector (Monticello)(S)
Drew County, Arkansas

**SETTLEMENT PLATE DETAIL**

Project Number
J037781.01

FIGURE 4

# APPENDIX C – BORING INFORMATION

Boring Logs

Boring Log Terms and Symbols

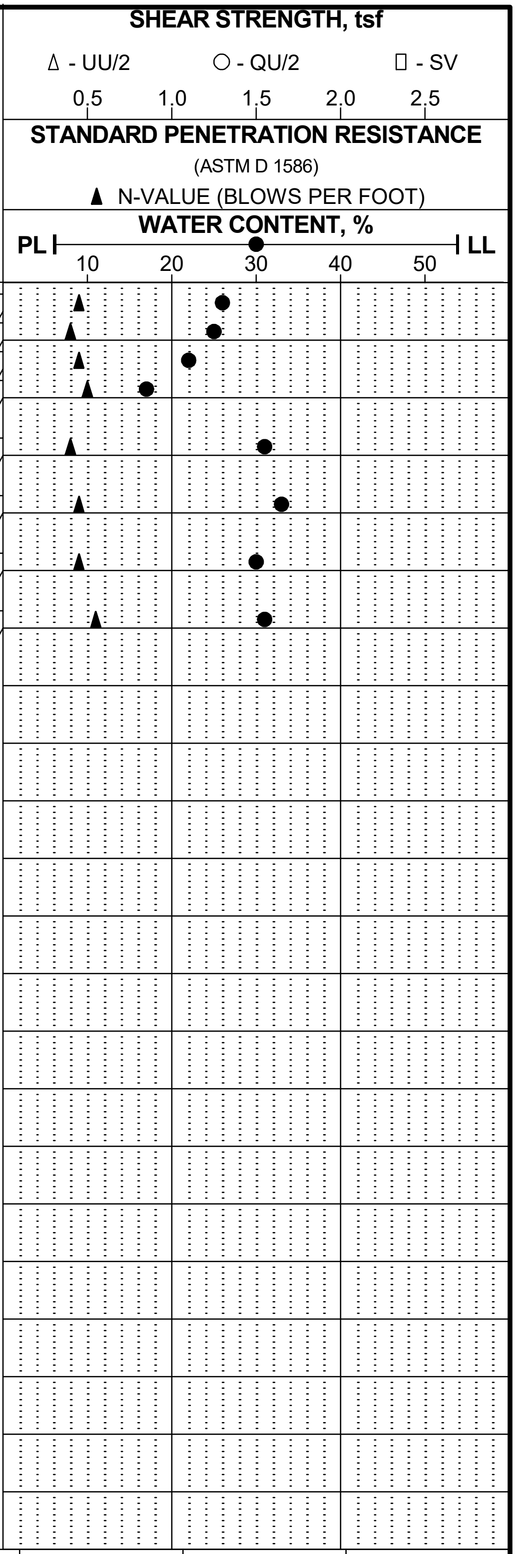
Surface Elevation: 214

Datum NAVD 88

Completion Date: 9/28/21

Station: 1077+50.00

| DEPTH IN FEET | ELEVATION IN FEET | DESCRIPTION OF MATERIAL | GRAPHIC LOG | DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD | SAMPLES |
|---|---|---|---|---|---|
| | | Medium stiff to stiff, brown and gray, FAT CLAY - CH | ▨ | 3-4-5 | SS1 |
| 5 | 209 | | ▨ | 2-3-5 | SS2 |
| | | 88.1% passing No. 200 sieve | ▨ | 3-3-6 | SS3 |
| 10 | 204 | | ▨ | 3-5-5 | SS4 |
| 15 | 199 | trace silt | ▨ | 2-3-5 | SS5 |
| 20 | 194 | trace silt | ▨ | 2-4-5 | SS6 |
| 25 | 189 | | ▨ | 2-4-5 | SS7 |
| 30 | 184 | | ▨ | 4-5-6 | SS8 |
| | | Boring terminated at 30 feet. | | | |
| 35 | 179 | | | | |
| 40 | 174 | | | | |
| 45 | 169 | | | | |
| 50 | 164 | | | | |
| 55 | 159 | | | | |
| 60 | 154 | | | | |
| 65 | 149 | | | | |
| 70 | 144 | | | | |
| 75 | 139 | | | | |
| 80 | 134 | | | | |
| 85 | 129 | | | | |
| 90 | 124 | | | | |
| 95 | 119 | | | | |
| 100 | 114 | | | | |
| 105 | 109 | | | | |



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

**GROUNDWATER DATA**

X FREE WATER NOT ENCOUNTERED DURING DRILLING

**DRILLING DATA**

__ AUGER 3 3/4" HOLLOW STEM

WASHBORING FROM __ FEET

KJB DRILLER LCH LOGGER

CME 750X DRILL RIG

HAMMER TYPE Auto

HAMMER EFFICIENCY 84 %

**REMARKS:**

| Drawn by: SWF | Checked by: JDM | App'vd. by: DMS |
|---|---|---|
| Date: 10/4/21 | Date: 11/30/21 | Date: 11/30/21 |

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**ARDOT G013, 020475**
**Hwy. 83 Spur - Hwy. 278 Connector**
**(Monticello)(S)**
**Drew County, Arkansas**

**LOG OF BORING: B- 1**

**Project No. J037781.01**

Surface Elevation: 207

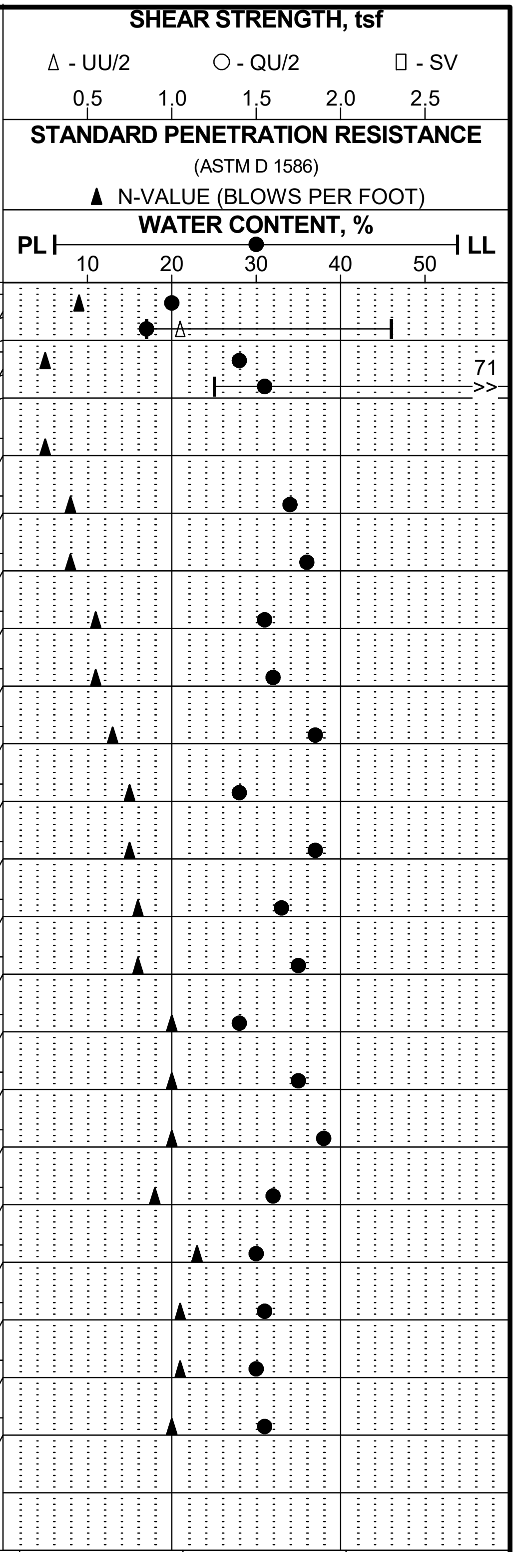
Datum NAVD 88

Completion Date: 9/29/21

Station: 1078+35.00

| DEPTH IN FEET | ELEVATION IN FEET | DESCRIPTION OF MATERIAL | DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD | SAMPLES |
|---|---|---|---|---|
| | | Stiff to very stiff, brown, LEAN CLAY - (CL) | 2-3-6 | SS1 |
| | | 64.2% passing No. 200 sieve | 112 | ST2 |
| 5 | 202 | | | |
| | | Medium stiff to very stiff, brown and gray and tan, FAT CLAY - (CH) | 2-3-2 | SS3 |
| | | | 90 | ST4 |
| 10 | 197 | | | |
| 15 | 192 | | 2-2-3 | SS5 |
| 20 | 187 | | 2-4-4 | SS6 |
| 25 | 182 | | 3-4-4 | SS7 |
| 30 | 177 | | 5-5-6 | SS8 |
| 35 | 172 | | 5-5-6 | SS9 |
| 40 | 167 | | 5-6-7 | SS10 |
| 45 | 162 | | 6-6-9 | SS11 |
| 50 | 157 | | 5-7-8 | SS12 |
| 55 | 152 | | 5-7-9 | SS13 |
| 60 | 147 | | 6-6-10 | SS14 |
| 65 | 142 | | 7-9-11 | SS15 |
| 70 | 137 | | 6-9-11 | SS16 |
| 75 | 132 | | 6-9-11 | SS17 |
| 80 | 127 | | 6-8-10 | SS18 |
| 85 | 122 | | 8-10-13 | SS19 |
| 90 | 117 | | 7-9-12 | SS20 |
| 95 | 112 | | 7-10-11 | SS21 |
| 100 | 107 | | 4-9-11 | SS22 |
| | | Boring terminated at 100 feet. | | |
| 105 | 102 | | | |

GRAPHIC LOG



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

**GROUNDWATER DATA**

X FREE WATER NOT ENCOUNTERED DURING DRILLING

**DRILLING DATA**

__ AUGER 3 3/4" HOLLOW STEM

WASHBORING FROM 20 FEET

KJB DRILLER LCH LOGGER

CME 750X DRILL RIG

HAMMER TYPE Auto

HAMMER EFFICIENCY 84 %

**REMARKS:**

| | | |
|---|---|---|
| Drawn by: SWF | Checked by: JDM | App'vd. by: DMS |
| Date: 10/4/21 | Date: 11/30/21 | Date: 11/30/21 |

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**Hwy. 83 Spur - Hwy. 278 Connector**
**(Monticello)(S)**
**Drew County, Arkansas**

**LOG OF BORING: B- 2**

**Project No. J037781.01**

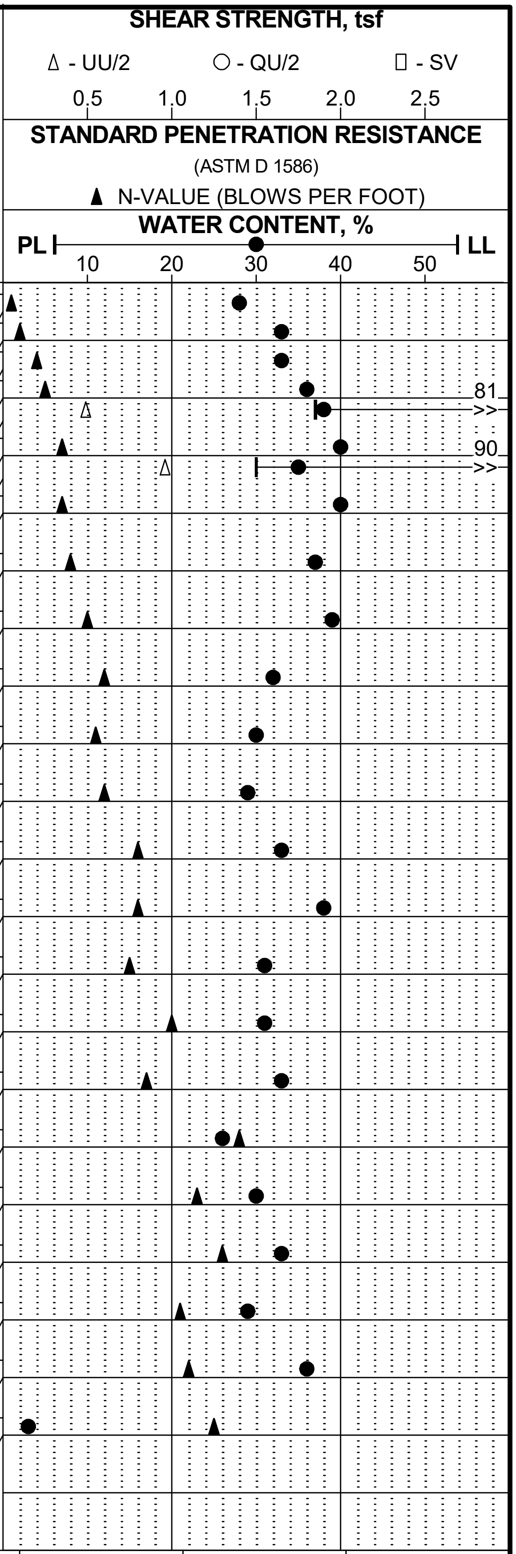
Surface Elevation: 208

Datum NAVD 88

Completion Date: 10/6/21

Station: 1079+01.00

| DEPTH IN FEET | ELEVATION IN FEET | DESCRIPTION OF MATERIAL | GRAPHIC LOG | DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD | SAMPLES |
|---|---|---|---|---|---|
| | | Soft to medium stiff, gray, FAT CLAY - CH | ▨ | 0-0-1 | SS1 |
| 5 | 203 | | ▨ | 0-1-1 | SS2 |
| | | | ▨ | 1-2-2 | SS3 |
| 10 | 198 | | ▨ | 1-2-3 | SS4 |
| | | Medium stiff, gray, ELASTIC SILT - (MH) | ▥ | 83 | ST5 |
| 15 | 193 | Medium stiff to very stiff, brown to brown and gray to gray, FAT CLAY - (CH) | ▨ | 2-3-4 | SS6 |
| | | | ▨ | 87 | ST7 |
| 20 | 188 | | ▨ | 2-3-4 | SS8 |
| 25 | 183 | | ▨ | 4-3-5 | SS9 |
| 30 | 178 | | ▨ | 4-4-6 | SS10 |
| 35 | 173 | | ▨ | 4-5-7 | SS11 |
| 40 | 168 | | ▨ | 9-5-6 | SS12 |
| 45 | 163 | | ▨ | 4-5-7 | SS13 |
| 50 | 158 | | ▨ | 5-8-8 | SS14 |
| 55 | 153 | | ▨ | 5-7-9 | SS15 |
| 60 | 148 | | ▨ | 6-7-8 | SS16 |
| 65 | 143 | | ▨ | 6-9-11 | SS17 |
| 70 | 138 | | ▨ | 7-7-10 | SS18 |
| 75 | 133 | | ▨ | 7-13-15 | SS19 |
| 80 | 128 | | ▨ | 7-9-14 | SS20 |
| 85 | 123 | | ▨ | 8-10-16 | SS21 |
| 90 | 118 | | ▨ | 8-9-12 | SS22 |
| 95 | 113 | | ▨ | 7-10-12 | SS23 |
| 100 | 108 | Boring terminated at 100 feet. | | 8-11-14 | SS24 |
| 105 | 103 | | | | |



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

**GROUNDWATER DATA**

X FREE WATER NOT ENCOUNTERED DURING DRILLING

**DRILLING DATA**

__ AUGER 3 3/4" HOLLOW STEM
WASHBORING FROM 25 FEET
KJB DRILLER LCH LOGGER
CME 750X DRILL RIG
HAMMER TYPE Auto
HAMMER EFFICIENCY 84 %

**REMARKS:**

| Drawn by: LCH | Checked by: JDM | App'vd. by: DMS |
|---|---|---|
| Date: 10/12/21 | Date: 11/30/21 | Date: 11/30/21 |

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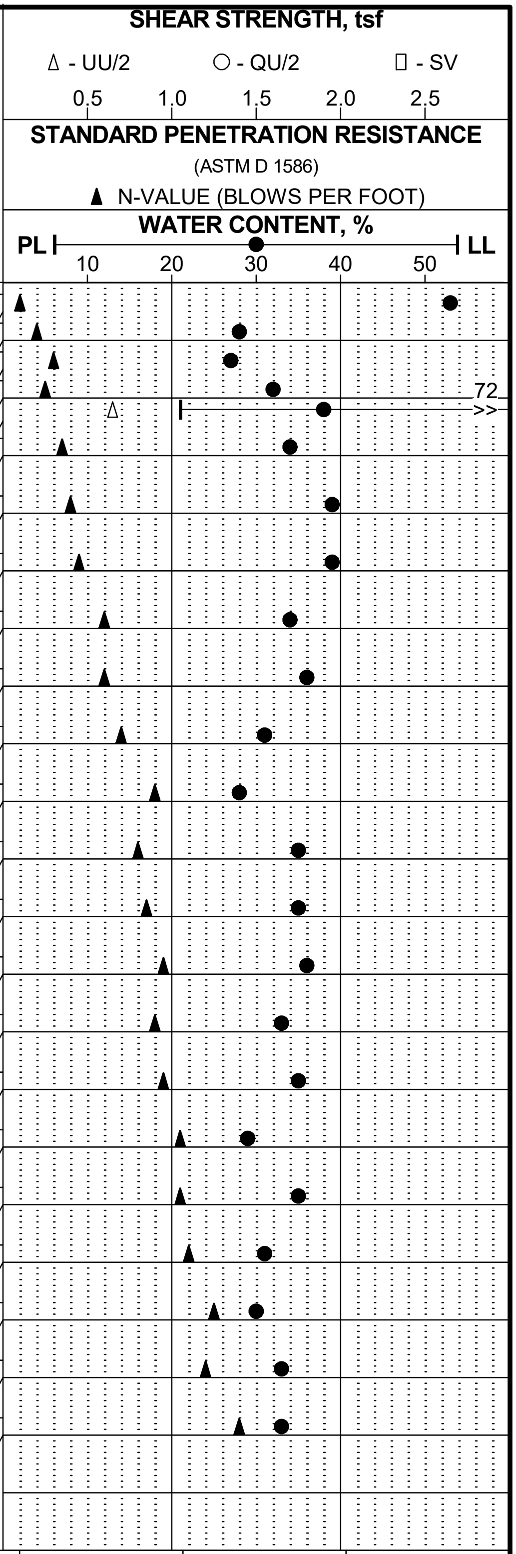
**ARDOT G013, 020475**
**Hwy. 83 Spur - Hwy. 278 Connector**
**(Monticello)(S)**
**Drew County, Arkansas**

**LOG OF BORING: B- 3**

**Project No. J037781.01**

Surface Elevation: 204
Datum NAVD 88
Completion Date: 10/7/21
Station: 1079+81.00

| DEPTH IN FEET | ELEVATION IN FEET | DESCRIPTION OF MATERIAL | GRAPHIC LOG | DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD | SAMPLES |
|---|---|---|---|---|---|
| | | Very soft to very stiff, brown and gray to gray, FAT CLAY - (CH) | ▨ | 0-0-2 | SS1 |
| 5 | 199 | | ▨ | 1-2-2 | SS2 |
| | | | ▨ | 1-2-4 | SS3 |
| 10 | 194 | | ▨ | 3-2-3 | SS4 |
| | | | ▨ | 84 | ST5 |
| 15 | 189 | | ▨ | 1-3-4 | SS6 |
| 20 | 184 | | ▨ | 2-4-4 | SS7 |
| 25 | 179 | | ▨ | 3-4-5 | SS8 |
| 30 | 174 | | ▨ | 4-5-7 | SS9 |
| 35 | 169 | | ▨ | 3-6-6 | SS10 |
| 40 | 164 | | ▨ | 5-6-8 | SS11 |
| 45 | 159 | | ▨ | 5-7-11 | SS12 |
| 50 | 154 | | ▨ | 5-6-10 | SS13 |
| 55 | 149 | | ▨ | 5-7-10 | SS14 |
| 60 | 144 | | ▨ | 6-8-11 | SS15 |
| 65 | 139 | | ▨ | 7-8-10 | SS16 |
| 70 | 134 | | ▨ | 6-9-10 | SS17 |
| 75 | 129 | | ▨ | 8-9-12 | SS18 |
| 80 | 124 | | ▨ | 8-9-12 | SS19 |
| 85 | 119 | | ▨ | 9-9-13 | SS20 |
| 90 | 114 | | ▨ | 8-10-15 | SS21 |
| 95 | 109 | | ▨ | 9-11-13 | SS22 |
| 100 | 104 | Boring terminated at 100 feet. | | 10-12-16 | SS23 |
| 105 | 99 | | | | |



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

**GROUNDWATER DATA**

X FREE WATER NOT ENCOUNTERED DURING DRILLING

**DRILLING DATA**

__ AUGER 3 3/4" HOLLOW STEM
WASHBORING FROM 25 FEET
KJB DRILLER LCH LOGGER
CME 750X DRILL RIG
HAMMER TYPE Auto
HAMMER EFFICIENCY 84 %

**REMARKS:**

| Drawn by: LCH | Checked by: JDM | App'vd. by: DMS |
|---|---|---|
| Date: 10/12/21 | Date: 11/30/21 | Date: 11/30/21 |

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**ARDOT G013, 020475**
**Hwy. 83 Spur - Hwy. 278 Connector**
**(Monticello)(S)**
**Drew County, Arkansas**

**LOG OF BORING: B- 4**

**Project No. J037781.01**

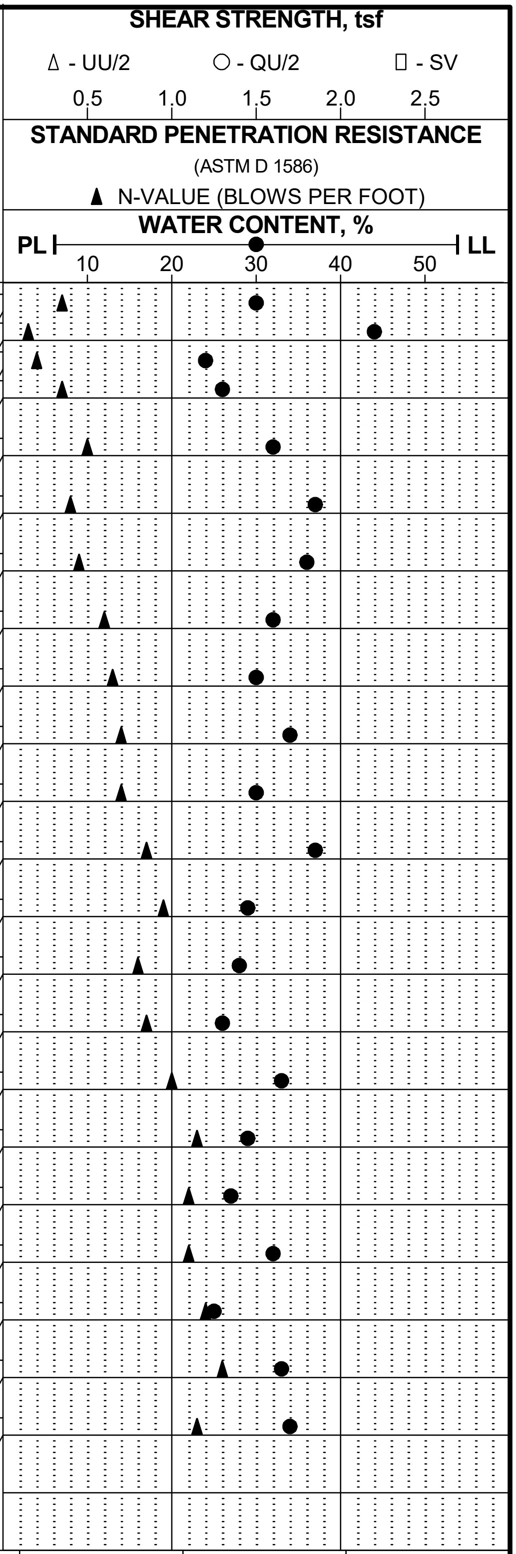
Surface Elevation: 210

Datum NAVD 88

Completion Date: 10/8/21

Station: 1080+61.00

| DEPTH IN FEET | ELEVATION IN FEET | DESCRIPTION OF MATERIAL | GRAPHIC LOG | DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD | SAMPLES |
|---|---|---|---|---|---|
| | | Soft to Very stiff, brown and gray to gray, FAT CLAY - CH | 🟩 | 2-3-4 | SS1 |
| 5 | 205 | | 🟩 | 2-1-2 | SS2 |
| | | | 🟩 | 1-2-2 | SS3 |
| 10 | 200 | | 🟩 | 2-3-4 | SS4 |
| 15 | 195 | | 🟩 | 3-4-6 | SS5 |
| 20 | 190 | | 🟩 | 2-4-4 | SS6 |
| 25 | 185 | | 🟩 | 3-4-5 | SS7 |
| 30 | 180 | | 🟩 | 4-5-7 | SS8 |
| 35 | 175 | trace silt<br>trace organics | 🟩 | 4-7-6 | SS9 |
| 40 | 170 | trace silt | 🟩 | 4-6-8 | SS10 |
| 45 | 165 | trace organics | 🟩 | 4-6-8 | SS11 |
| 50 | 160 | trace organics | 🟩 | 6-7-10 | SS12 |
| 55 | 155 | | 🟩 | 5-8-11 | SS13 |
| 60 | 150 | trace organics | 🟩 | 5-7-9 | SS14 |
| 65 | 145 | | 🟩 | 8-8-9 | SS15 |
| 70 | 140 | | 🟩 | 7-9-11 | SS16 |
| 75 | 135 | | 🟩 | 8-10-13 | SS17 |
| 80 | 130 | | 🟩 | 7-8-14 | SS18 |
| 85 | 125 | | 🟩 | 8-10-12 | SS19 |
| 90 | 120 | | 🟩 | 9-10-14 | SS20 |
| 95 | 115 | | 🟩 | 9-10-16 | SS21 |
| 100 | 110 | Boring terminated at 100 feet. | | 8-11-12 | SS22 |
| 105 | 105 | | | | |



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

## GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

## DRILLING DATA

__ AUGER 3 3/4" HOLLOW STEM

WASHBORING FROM 25 FEET

KJB DRILLER LCH LOGGER

CME 750X DRILL RIG

HAMMER TYPE Auto

HAMMER EFFICIENCY 84 %

**REMARKS:**

| Drawn by: LCH | Checked by: JDM | App'vd. by: DMS |
|---|---|---|
| Date: 10/12/21 | Date: 11/30/21 | Date: 11/30/21 |

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**ARDOT G013, 020475**
**Hwy. 83 Spur - Hwy. 278 Connector**
**(Monticello)(S)**
**Drew County, Arkansas**

**LOG OF BORING: B- 5**

**Project No. J037781.01**

LOG OF BORING 2020 JDM - ELEVATIONS J037781.01.GPJ GTINC 0638301.GPJ 12/6/21

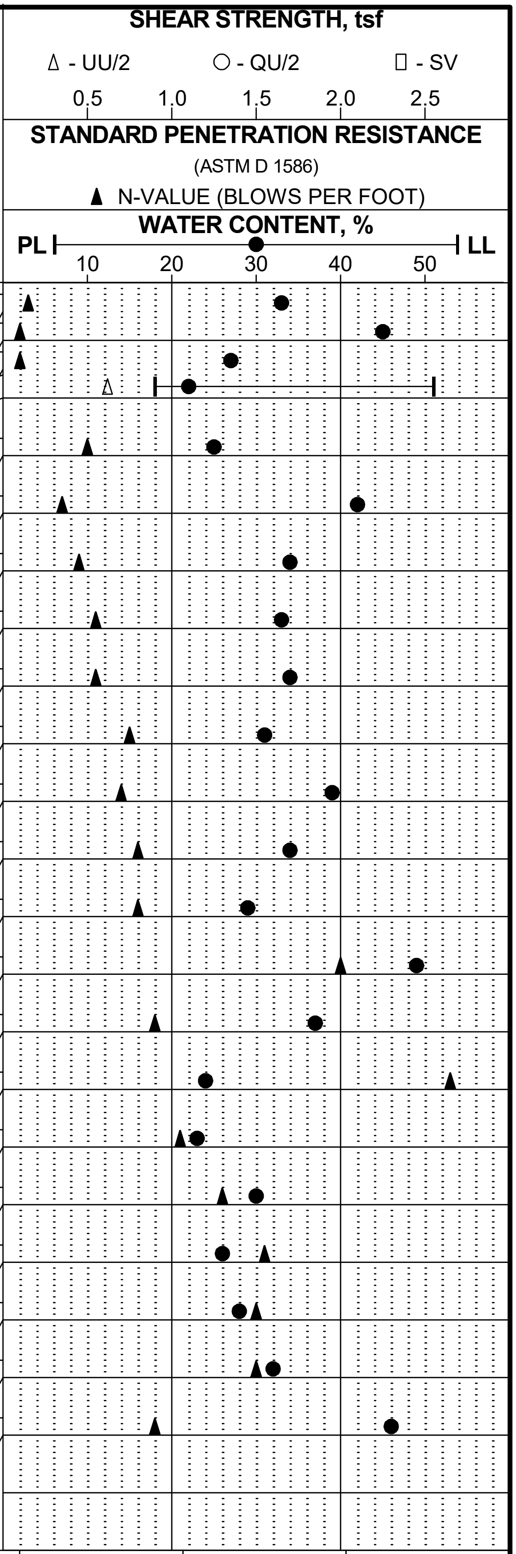
Surface Elevation: 210

Datum NAVD 88

Completion Date: 10/9/21

Station: 1081+41.00

| DEPTH IN FEET | ELEVATION IN FEET | DESCRIPTION OF MATERIAL | GRAPHIC LOG | DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD | SAMPLES |
|---|---|---|---|---|---|
| | | Soft to hard, brown and gray to gray, FAT CALY - (CH) | ▨ | 2-2-1 | SS1 |
| 5 | 205 | | | 1-1-1 | SS2 |
| | | | | 0-1-1 | SS3 |
| 10 | 200 | | | 106 | ST4 |
| 15 | 195 | trace gravel | | 3-5-5 | SS5 |
| 20 | 190 | | | 2-3-4 | SS6 |
| 25 | 185 | | | 2-4-5 | SS7 |
| 30 | 180 | | | 4-5-6 | SS8 |
| 35 | 175 | | | 4-5-6 | SS9 |
| 40 | 170 | | | 5-6-9 | SS10 |
| 45 | 165 | | | 4-5-9 | SS11 |
| 50 | 160 | | | 5-7-9 | SS12 |
| 55 | 155 | | | 6-7-9 | SS13 |
| 60 | 150 | | | 10-16-24 | SS14 |
| 65 | 145 | | | 10-9-9 | SS15 |
| 70 | 140 | | | 11-19-34 | SS16 |
| 75 | 135 | | | 8-9-12 | SS17 |
| 80 | 130 | | | 9-10-16 | SS18 |
| 85 | 125 | | | 9-13-18 | SS19 |
| 90 | 120 | | | 9-13-17 | SS20 |
| 95 | 115 | | | 8-13-17 | SS21 |
| 100 | 110 | Boring terminated at 100 feet. | | 3-6-12 | SS22 |
| 105 | 105 | | | | |



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

**GROUNDWATER DATA**

X FREE WATER NOT ENCOUNTERED DURING DRILLING

**DRILLING DATA**

__ AUGER 3 3/4" HOLLOW STEM

WASHBORING FROM 25 FEET

KJB DRILLER LCH LOGGER

CME 750X DRILL RIG

HAMMER TYPE Auto

HAMMER EFFICIENCY 84 %

**REMARKS:**

| Drawn by: LCH | Checked by: JDM | App'vd. by: DMS |
|---|---|---|
| Date: 10/12/21 | Date: 11/30/21 | Date: 11/30/21 |

GEOTECHNOLOGY
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**ARDOT G013, 020475**
**Hwy. 83 Spur - Hwy. 278 Connector**
**(Monticello)(S)**
**Drew County, Arkansas**

**LOG OF BORING: B- 6**

**Project No. J037781.01**

Surface Elevation: 210

Datum NAVD 88

Completion Date: 10/10/21

Station: 1082+21.00

| DEPTH IN FEET | ELEVATION IN FEET |
|---|---|
| 5 | 205 |
| 10 | 200 |
| 15 | 195 |
| 20 | 190 |
| 25 | 185 |
| 30 | 180 |
| 35 | 175 |
| 40 | 170 |
| 45 | 165 |
| 50 | 160 |
| 55 | 155 |
| 60 | 150 |
| 65 | 145 |
| 70 | 140 |
| 75 | 135 |
| 80 | 130 |
| 85 | 125 |
| 90 | 120 |
| 95 | 115 |
| 100 | 110 |
| 105 | 105 |

**DESCRIPTION OF MATERIAL**

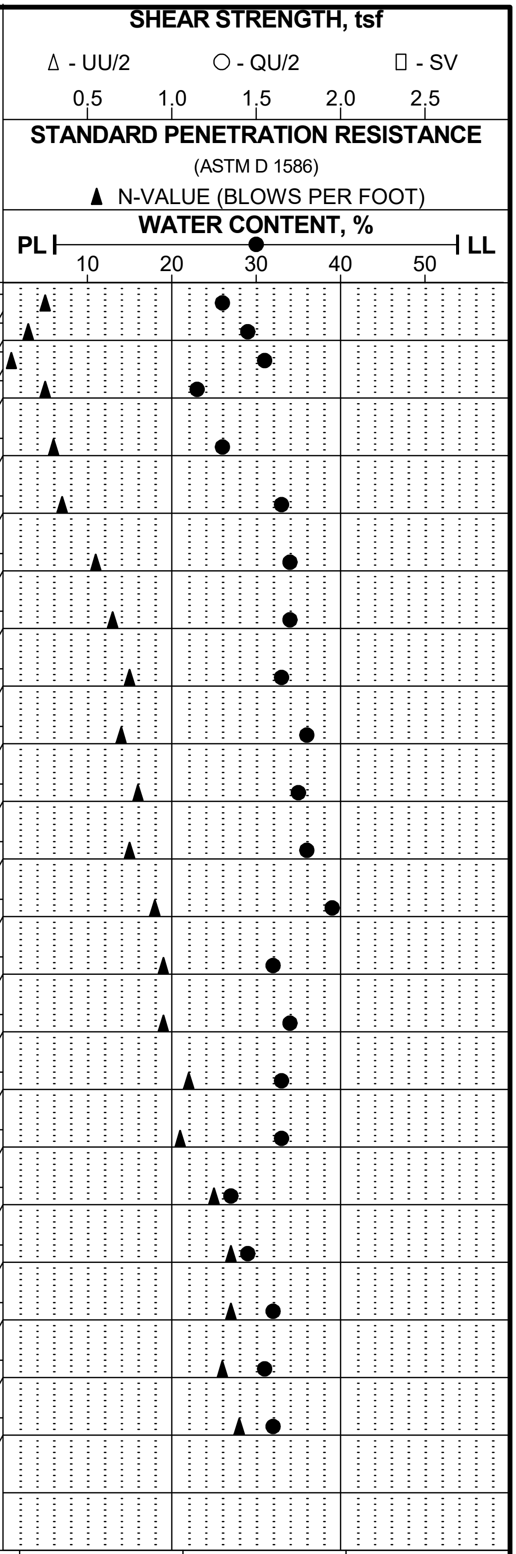
Soft to very stiff, brown and gray to gray, FAT CLAY - CH

trace sand

Boring terminated at 100 feet.

GRAPHIC LOG

| DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD | SAMPLES |
|---|---|
| 2-2-3 | SS1 |
| 1-1-2 | SS2 |
| 0-0-1 | SS3 |
| 0-2-3 | SS4 |
| 2-2-4 | SS5 |
| 2-3-4 | SS6 |
| 3-5-6 | SS7 |
| 4-5-8 | SS8 |
| 4-6-9 | SS9 |
| 5-6-8 | SS10 |
| 5-7-9 | SS11 |
| 6-6-9 | SS12 |
| 6-8-10 | SS13 |
| 6-8-11 | SS14 |
| 6-9-10 | SS15 |
| 7-11-11 | SS16 |
| 8-10-11 | SS17 |
| 8-11-14 | SS18 |
| 9-12-15 | SS19 |
| 10-12-15 | SS20 |
| 9-11-15 | SS21 |
| 9-12-16 | SS22 |



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

**GROUNDWATER DATA**

X FREE WATER NOT ENCOUNTERED DURING DRILLING

**DRILLING DATA**

__ AUGER 3 3/4" HOLLOW STEM

WASHBORING FROM 25 FEET

KJB DRILLER LCH LOGGER

CME 750X DRILL RIG

HAMMER TYPE Auto

HAMMER EFFICIENCY 84 %

**REMARKS:**

| Drawn by: LCH | Checked by: JDM | App'vd. by: DMS |
|---|---|---|
| Date: 10/12/21 | Date: 11/30/21 | Date: 11/30/21 |

GEOTECHNOLOGY
A Universal Engineering Sciences Company

**ARDOT G013, 020475**
**Hwy. 83 Spur - Hwy. 278 Connector**
**(Monticello)(S)**
**Drew County, Arkansas**

**LOG OF BORING: B- 7**

**Project No. J037781.01**

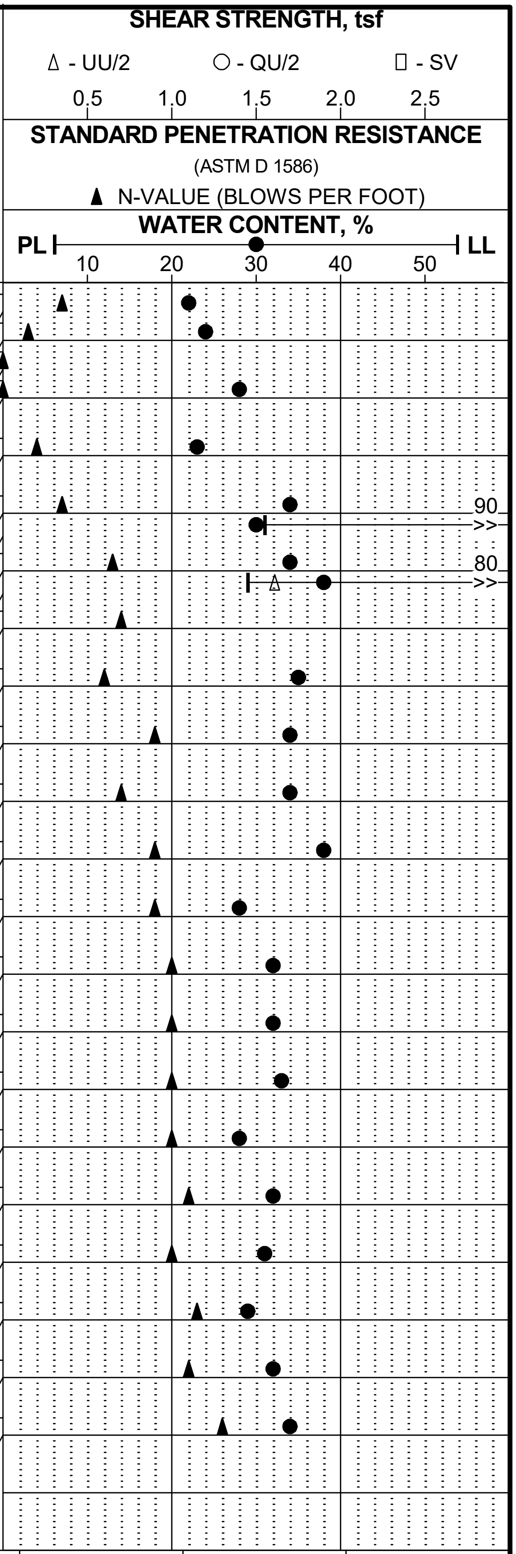
Surface Elevation: 208

Datum NAVD 88

Completion Date: 10/19/21

Station: 1082+86.00

| DEPTH IN FEET | ELEVATION IN FEET | DESCRIPTION OF MATERIAL | DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD | SAMPLES |
|---|---|---|---|---|
| | | Medium stiff, brown, LEAN CLAY - CL | 2-3-4 | SS1 |
| 5 | 203 | Very soft to very stiff, brown and gray to gray, FAT CLAY - (CH) | 1-1-2 | SS2 |
| | | | 0-0-0 | SS3 |
| 10 | 198 | trace gravel | 0-0-0 | SS4 |
| 15 | 193 | | 2-1-3 | SS5 |
| 20 | 188 | | 1-3-4 | SS6 |
| | | | 94 | ST7 |
| 25 | 183 | trace sand | 3-5-8 | SS8 |
| | | | 85 | ST9 |
| 30 | 178 | | 3-6-8 | SS10 |
| 35 | 173 | | 4-5-7 | SS11 |
| 40 | 168 | | 5-6-12 | SS12 |
| 45 | 163 | trace sand | 6-5-9 | SS13 |
| 50 | 158 | trace sand | 6-8-10 | SS14 |
| 55 | 153 | trace sand | 7-8-10 | SS15 |
| 60 | 148 | | 6-9-11 | SS16 |
| 65 | 143 | | 7-9-11 | SS17 |
| 70 | 138 | | 6-9-11 | SS18 |
| 75 | 133 | | 9-11-9 | SS19 |
| 80 | 128 | | 7-10-12 | SS20 |
| 85 | 123 | | 8-10-10 | SS21 |
| 90 | 118 | | 8-12-11 | SS22 |
| 95 | 113 | | 9-11-11 | SS23 |
| 100 | 108 | Boring terminated at 100 feet. | 8-12-14 | SS24 |
| 105 | 103 | | | |



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

**GROUNDWATER DATA**

X FREE WATER NOT ENCOUNTERED DURING DRILLING

**DRILLING DATA**

__ AUGER 3 3/4" HOLLOW STEM
WASHBORING FROM 30 FEET
JCG DRILLER TBB LOGGER
Diedrich D-50 DRILL RIG
HAMMER TYPE Auto
HAMMER EFFICIENCY 93 %

**REMARKS:**

| Drawn by: LCH | Checked by: JDM | App'vd. by: DMS |
|---|---|---|
| Date: 10/21/21 | Date: 11/30/21 | Date: 11/30/21 |

GEOTECHNOLOGY
A Universal Engineering Sciences Company

**ARDOT G013, 020475**
**Hwy. 83 Spur - Hwy. 278 Connector**
**(Monticello)(S)**
**Drew County, Arkansas**

**LOG OF BORING: B- 8**

**Project No. J037781.01**

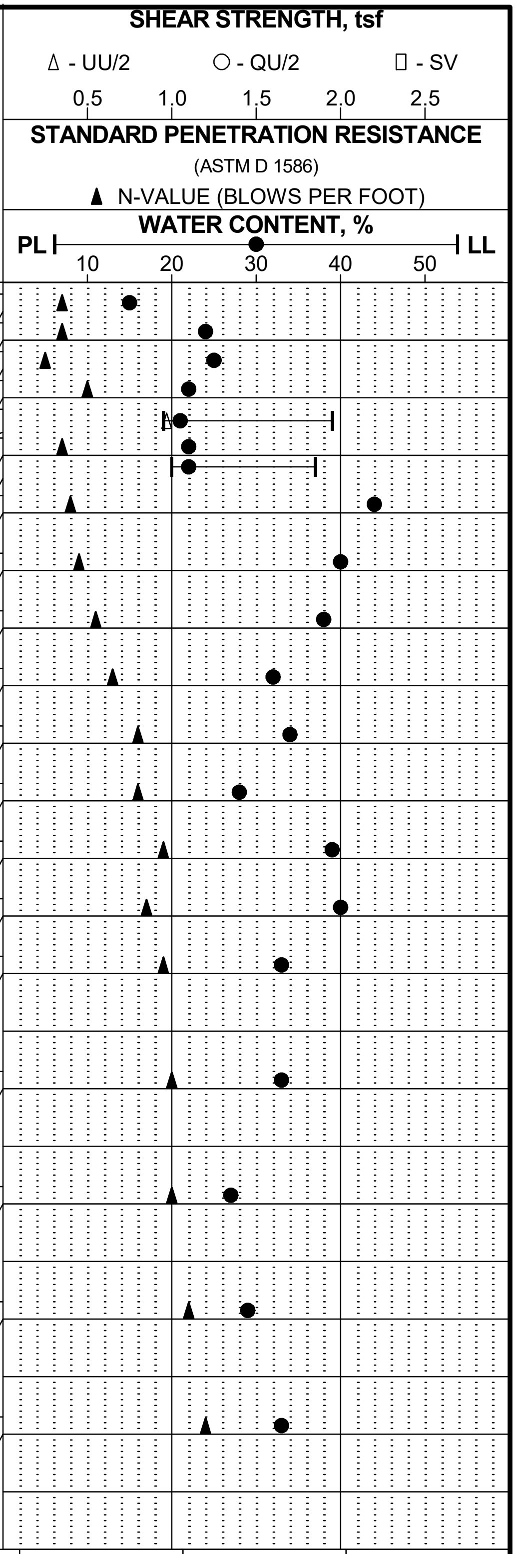
Surface Elevation: 209.5

Datum NAVD 88

Completion Date: 10/19/21

Station: 1084+06.00

| DEPTH IN FEET | ELEVATION IN FEET | DESCRIPTION OF MATERIAL | GRAPHIC LOG | DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD | SAMPLES |
|---|---|---|---|---|---|
| | | Medium stiff to stiff, gray, LEAN CLAY - (CL) | | 4-3-4 | SS1 |
| 5 | 205 | trace sand | | 2-3-4 | SS2 |
| | | | | 2-3-2 | SS3 |
| 10 | 200 | | | 3-4-6 | SS4 |
| | | | | 108 | ST5 |
| 15 | 195 | Loose, gray, CLAYEY GRAVEL, some sand - (GC)<br>25.8% passing No. 200 sieve | | 3-3-4 | SS6 |
| | | | | | ST7 |
| 20 | 190 | Medium stiff to very stiff, brown and gray to gray, FAT CLAY - (CH) | | 3-3-5 | SS8 |
| 25 | 185 | | | 2-3-6 | SS9 |
| 30 | 180 | | | 3-5-6 | SS10 |
| 35 | 175 | trace organics | | 5-6-7 | SS11 |
| 40 | 170 | | | 5-7-9 | SS12 |
| 45 | 165 | | | 5-8-8 | SS13 |
| 50 | 160 | | | 5-8-11 | SS14 |
| 55 | 155 | | | 7-7-10 | SS15 |
| 60 | 150 | | | 6-8-11 | SS16 |
| 65 | 145 | | | | |
| 70 | 140 | | | 7-9-11 | SS17 |
| 75 | 135 | | | | |
| 80 | 130 | trace silt | | 8-9-11 | SS18 |
| 85 | 125 | | | | |
| 90 | 120 | | | 8-10-12 | SS19 |
| 95 | 115 | | | | |
| 100 | 110 | Boring terminated at 100 feet. | | 8-11-13 | SS20 |
| 105 | 105 | | | | |



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

**GROUNDWATER DATA**

X FREE WATER NOT ENCOUNTERED DURING DRILLING

**DRILLING DATA**

__ AUGER 3 3/4" HOLLOW STEM

WASHBORING FROM 20 FEET

JCG DRILLER TBB LOGGER

Diedrich D-50 DRILL RIG

HAMMER TYPE Auto

HAMMER EFFICIENCY 93 %

**REMARKS: Shelby tube sample ST-7 not used for strength testing; sample consisted of granular material.**

| Drawn by: LCH | Checked by: JDM | App'vd. by: DMS |
|---|---|---|
| Date: 10/21/21 | Date: 11/30/21 | Date: 11/30/21 |

GEOTECHNOLOGY
A Universal Engineering Sciences Company

**ARDOT G013, 020475**
**Hwy. 83 Spur - Hwy. 278 Connector**
**(Monticello)(S)**
**Drew County, Arkansas**

**LOG OF BORING: B- 9**

**Project No. J037781.01**

Surface Elevation: 210

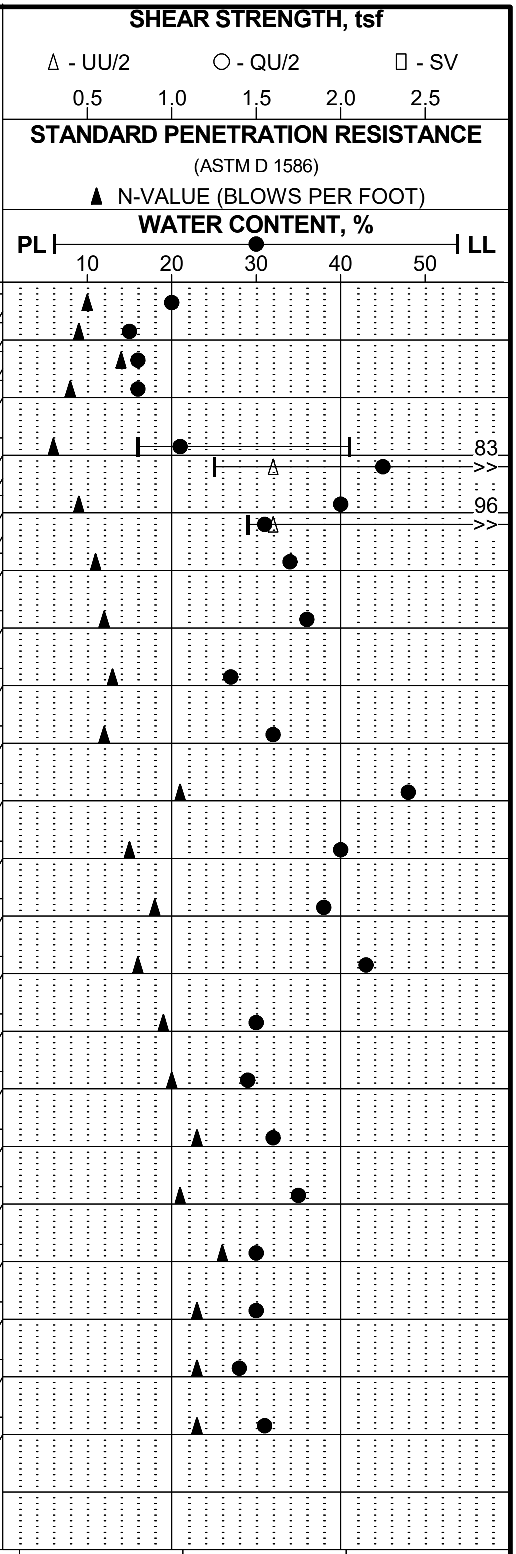
Datum: NAVD 88

Completion Date: 9/27/21

Station: 1085+56.00

| DEPTH IN FEET | ELEVATION IN FEET | DESCRIPTION OF MATERIAL |
|---|---|---|
| 0 | 210 | Stiff to medium stiff, brown and gray, LEAN CLAY - (CL) |
| 15 | 195 | trace gravel |
| 16 | 194 | Very stiff to stiff, gray, FAT CLAY - (CH) |
| 45 | 165 | 84.8% passing No. 200 sieve<br>trace gravel |
| 100 | 110 | Boring terminated at 100 feet. |

| DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD | SAMPLES |
|---|---|
| 3-3-7 | SS1 |
| 4-4-5 | SS2 |
| 4-5-9 | SS3 |
| 4-4-4 | SS4 |
| 4-4-2 | SS5 |
| 76 | ST6 |
| 1-3-6 | SS7 |
| 88 | ST8 |
| 2-5-6 | SS9 |
| 4-5-7 | SS10 |
| 5-6-7 | SS11 |
| 5-5-7 | SS12 |
| 15-10-11 | SS13 |
| 5-7-8 | SS14 |
| 6-7-11 | SS15 |
| 6-7-9 | SS16 |
| 6-9-10 | SS17 |
| 7-9-11 | SS18 |
| 8-10-13 | SS19 |
| 7-10-11 | SS20 |
| 10-10-16 | SS21 |
| 9-11-12 | SS22 |
| 8-10-13 | SS23 |
| 10-10-13 | SS24 |



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

**GROUNDWATER DATA**

X FREE WATER NOT ENCOUNTERED DURING DRILLING

**DRILLING DATA**

__ AUGER 3 3/4" HOLLOW STEM

WASHBORING FROM 25 FEET

KJB DRILLER LCH LOGGER

CME 750X DRILL RIG

HAMMER TYPE Auto

HAMMER EFFICIENCY 84 %

**REMARKS:**

| Drawn by: SWF | Checked by: JDM | App'vd. by: DMS |
|---|---|---|
| Date: 10/4/21 | Date: 11/30/21 | Date: 11/30/21 |

GEOTECHNOLOGY
A Universal Engineering Sciences Company

**ARDOT G013, 020475**
**Hwy. 83 Spur - Hwy. 278 Connector**
**(Monticello)(S)**
**Drew County, Arkansas**

**LOG OF BORING: B-10**

**Project No. J037781.01**

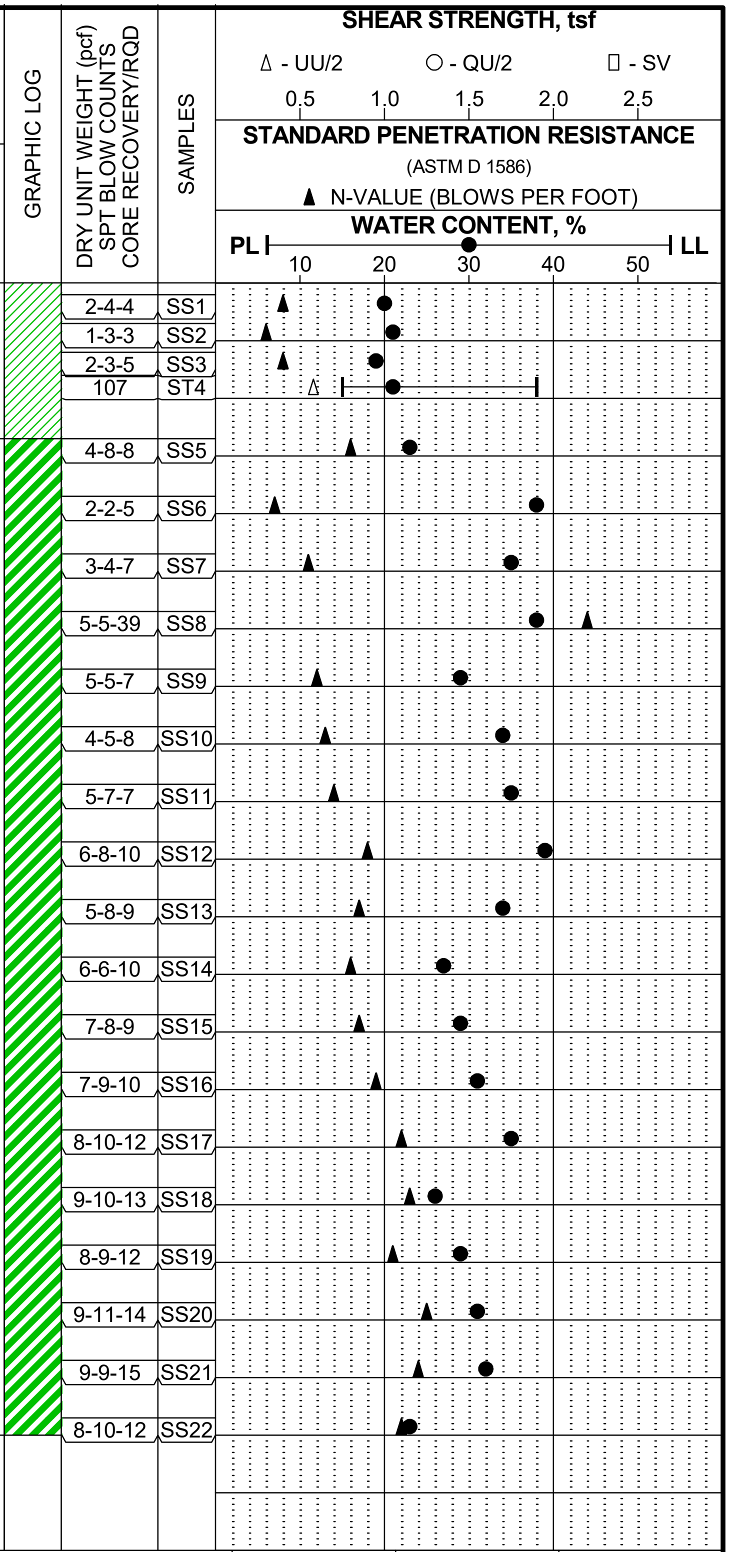
Surface Elevation: 210

Datum: NAVD 88

Completion Date: 9/26/21

Station: 1086+76.00

| DEPTH IN FEET | ELEVATION IN FEET | DESCRIPTION OF MATERIAL | DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD | SAMPLES |
|---|---|---|---|---|
| | | Stiff, brown and gray, LEAN CLAY - (CL) | 2-4-4 | SS1 |
| 5 | 205 | | 1-3-3 | SS2 |
| | | | 2-3-5 | SS3 |
| | | | 107 | ST4 |
| 10 | 200 | | | |
| 15 | 195 | Medium stiff to hard, brown and gray, FAT CLAY - CH<br>little gravel | 4-8-8 | SS5 |
| 20 | 190 | 3 inch gravel seam | 2-2-5 | SS6 |
| 25 | 185 | | 3-4-7 | SS7 |
| 30 | 180 | | 5-5-39 | SS8 |
| 35 | 175 | | 5-5-7 | SS9 |
| 40 | 170 | | 4-5-8 | SS10 |
| 45 | 165 | trace silt<br>trace gravel | 5-7-7 | SS11 |
| 50 | 160 | trace gravel | 6-8-10 | SS12 |
| 55 | 155 | trace gravel | 5-8-9 | SS13 |
| 60 | 150 | trace gravel | 6-6-10 | SS14 |
| 65 | 145 | | 7-8-9 | SS15 |
| 70 | 140 | | 7-9-10 | SS16 |
| 75 | 135 | | 8-10-12 | SS17 |
| 80 | 130 | | 9-10-13 | SS18 |
| 85 | 125 | | 8-9-12 | SS19 |
| 90 | 120 | trace silt | 9-11-14 | SS20 |
| 95 | 115 | | 9-9-15 | SS21 |
| 100 | 110 | Boring terminated at 100 feet. | 8-10-12 | SS22 |
| 105 | 105 | | | |



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

**GROUNDWATER DATA**

X FREE WATER NOT ENCOUNTERED DURING DRILLING

**DRILLING DATA**

__ AUGER 3 3/4" HOLLOW STEM
WASHBORING FROM 15 FEET
KJB DRILLER LCH LOGGER
CME 750X DRILL RIG
HAMMER TYPE Auto
HAMMER EFFICIENCY 84 %

**REMARKS:**

| Drawn by: SWF | Checked by: JDM | App'vd. by: DMS |
|---|---|---|
| Date: 10/4/21 | Date: 11/30/21 | Date: 11/30/21 |

GEOTECHNOLOGY
A Universal Engineering Sciences Company

**ARDOT G013, 020475**
**Hwy. 83 Spur - Hwy. 278 Connector**
**(Monticello)(S)**
**Drew County, Arkansas**

**LOG OF BORING: B-11**

**Project No. J037781.01**

Surface Elevation: 210

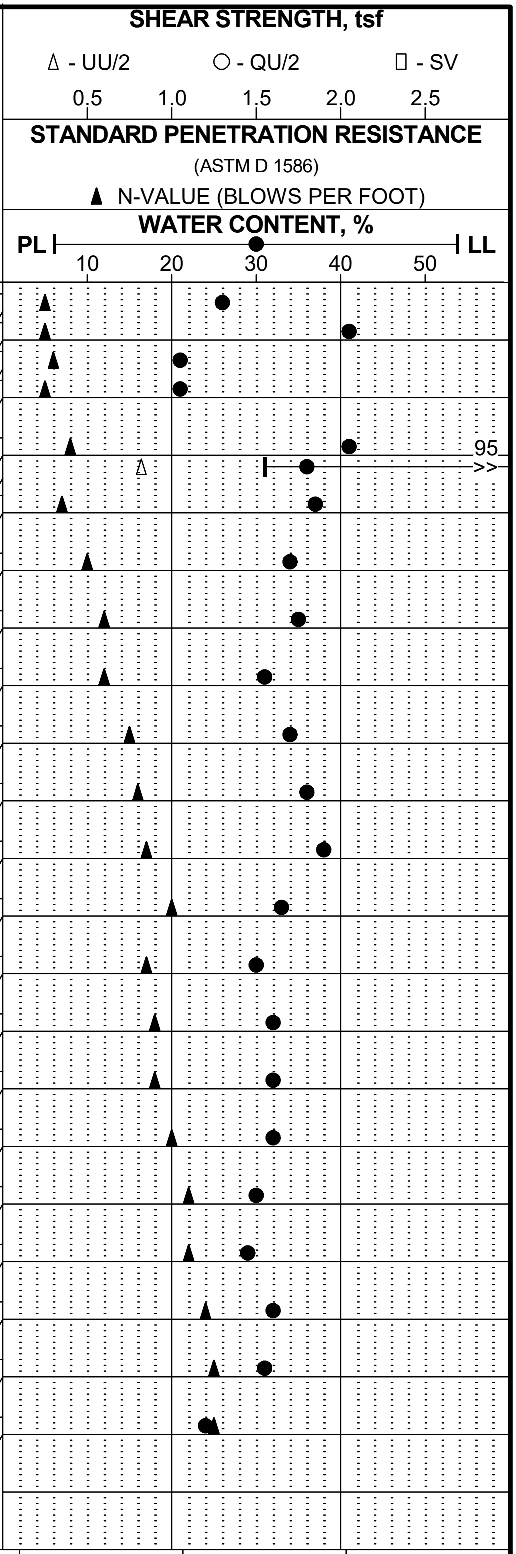
Datum: NAVD 88

Completion Date: 9/25/21

Station: 1087+61.00

| DEPTH IN FEET | ELEVATION IN FEET | DESCRIPTION OF MATERIAL |
|---|---|---|
| | | Medium stiff to very stiff, brown and gray to yellow, FAT CLAY - (CH) |
| 5 | 205 | |
| 10 | 200 | |
| 15 | 195 | little organics |
| 20 | 190 | |
| 25 | 185 | |
| 30 | 180 | |
| 35 | 175 | |
| 40 | 170 | |
| 45 | 165 | |
| 50 | 160 | |
| 55 | 155 | |
| 60 | 150 | |
| 65 | 145 | |
| 70 | 140 | |
| 75 | 135 | |
| 80 | 130 | |
| 85 | 125 | |
| 90 | 120 | |
| 95 | 115 | |
| 100 | 110 | Boring terminated at 100 feet. |
| 105 | 105 | |

| DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD | SAMPLES |
|---|---|
| 1-3-2 | SS1 |
| 1-2-3 | SS2 |
| 1-3-3 | SS3 |
| 1-3-2 | SS4 |
| 2-3-5 | SS5 |
| 84 | ST6 |
| 2-2-5 | SS7 |
| 2-4-6 | SS8 |
| 4-5-7 | SS9 |
| 4-6-6 | SS10 |
| 5-7-8 | SS11 |
| 5-7-9 | SS12 |
| 11-8-9 | SS13 |
| 6-8-12 | SS14 |
| 5-7-10 | SS15 |
| 6-8-10 | SS16 |
| 6-8-10 | SS17 |
| 6-9-11 | SS18 |
| 7-10-12 | SS19 |
| 7-11-11 | SS20 |
| 7-11-13 | SS21 |
| 8-10-15 | SS22 |
| 8-11-14 | SS23 |



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

**GROUNDWATER DATA**

X FREE WATER NOT ENCOUNTERED DURING DRILLING

**DRILLING DATA**

__ AUGER 3 3/4" HOLLOW STEM

WASHBORING FROM 20 FEET

KJB DRILLER LCH LOGGER

CME 750X DRILL RIG

HAMMER TYPE Auto

HAMMER EFFICIENCY 84 %

**REMARKS:**

| Drawn by: SWF | Checked by: JDM | App'vd. by: DMS |
|---|---|---|
| Date: 10/4/21 | Date: 11/30/21 | Date: 11/30/21 |

GEOTECHNOLOGY
A Universal Engineering Sciences Company

**ARDOT G013, 020475**
**Hwy. 83 Spur - Hwy. 278 Connector**
**(Monticello)(S)**
**Drew County, Arkansas**

**LOG OF BORING: B-12**

**Project No. J037781.01**

Surface Elevation: 210

Datum NAVD 88

Completion Date: 9/25/21

Station: 1088+46.00

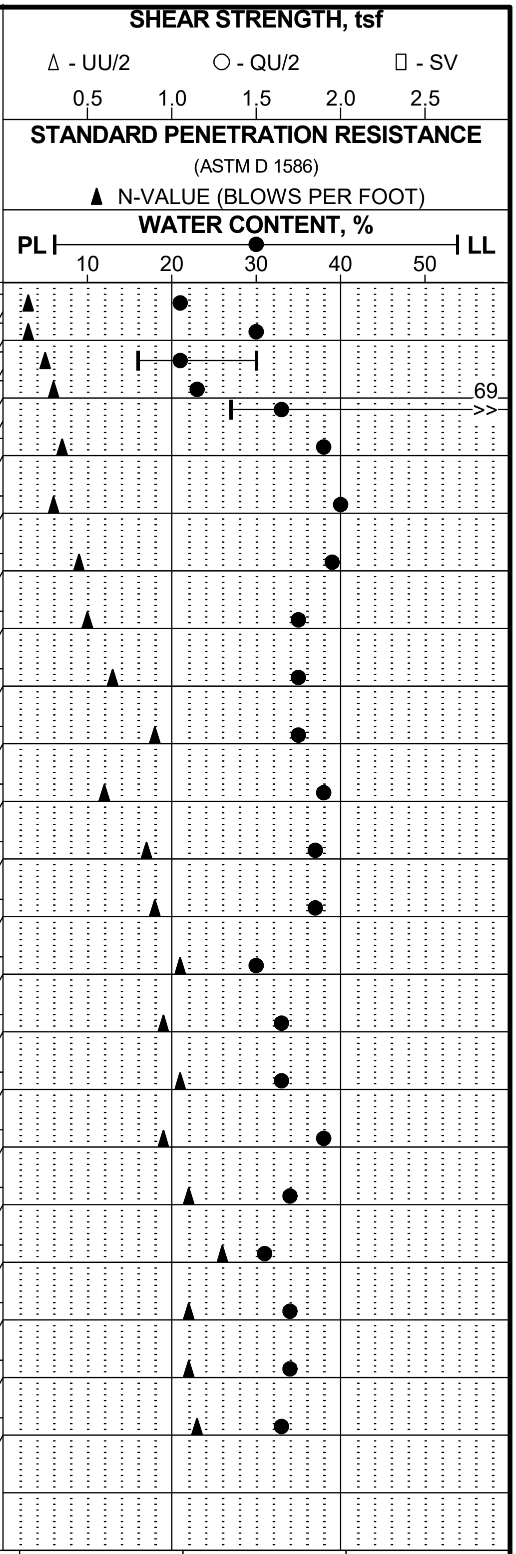
**DESCRIPTION OF MATERIAL**

Soft to medium stiff, brown and gray, LEAN CLAY - (CL)

Medium stiff to very stiff, brown and gray to yellow, FAT CLAY - (CH)

| DEPTH IN FEET | ELEVATION IN FEET | DESCRIPTION OF MATERIAL |
|---|---|---|
| 5 | 205 | |
| 10 | 200 | |
| 15 | 195 | |
| 20 | 190 | |
| 25 | 185 | |
| 30 | 180 | |
| 35 | 175 | |
| 40 | 170 | trace sand |
| 45 | 165 | trace sand |
| 50 | 160 | |
| 55 | 155 | |
| 60 | 150 | |
| 65 | 145 | |
| 70 | 140 | |
| 75 | 135 | |
| 80 | 130 | |
| 85 | 125 | |
| 90 | 120 | |
| 95 | 115 | |
| 100 | 110 | Boring terminated at 100 feet. |
| 105 | 105 | |

| DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD | SAMPLES |
|---|---|
| 1-1-2 | SS1 |
| 0-1-2 | SS2 |
| 1-2-3 | SS3 |
| 1-3-3 | SS4 |
| 88 | ST5 |
| 2-3-4 | SS6 |
| 2-3-3 | SS7 |
| 3-4-5 | SS8 |
| 4-4-6 | SS9 |
| 4-7-6 | SS10 |
| 6-8-10 | SS11 |
| 4-5-7 | SS12 |
| 5-7-10 | SS13 |
| 6-8-10 | SS14 |
| 6-10-11 | SS15 |
| 6-7-12 | SS16 |
| 7-10-11 | SS17 |
| 7-8-11 | SS18 |
| 6-9-13 | SS19 |
| 8-13-13 | SS20 |
| 7-9-13 | SS21 |
| 8-9-13 | SS22 |
| 7-10-13 | SS23 |



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

**GROUNDWATER DATA**

X FREE WATER NOT ENCOUNTERED DURING DRILLING

**DRILLING DATA**

__ AUGER 3 3/4" HOLLOW STEM
WASHBORING FROM 15 FEET
KJB DRILLER LCH LOGGER
CME 750X DRILL RIG
HAMMER TYPE Auto
HAMMER EFFICIENCY 84 %

**REMARKS:**

| Drawn by: SWF | Checked by: JDM | App'vd. by: DMS |
|---|---|---|
| Date: 10/4/21 | Date: 11/30/21 | Date: 11/30/21 |

GEOTECHNOLOGY
A Universal Engineering Sciences Company

**ARDOT G013, 020475**
**Hwy. 83 Spur - Hwy. 278 Connector**
**(Monticello)(S)**
**Drew County, Arkansas**

**LOG OF BORING: B-13**

**Project No. J037781.01**

Surface Elevation: 210

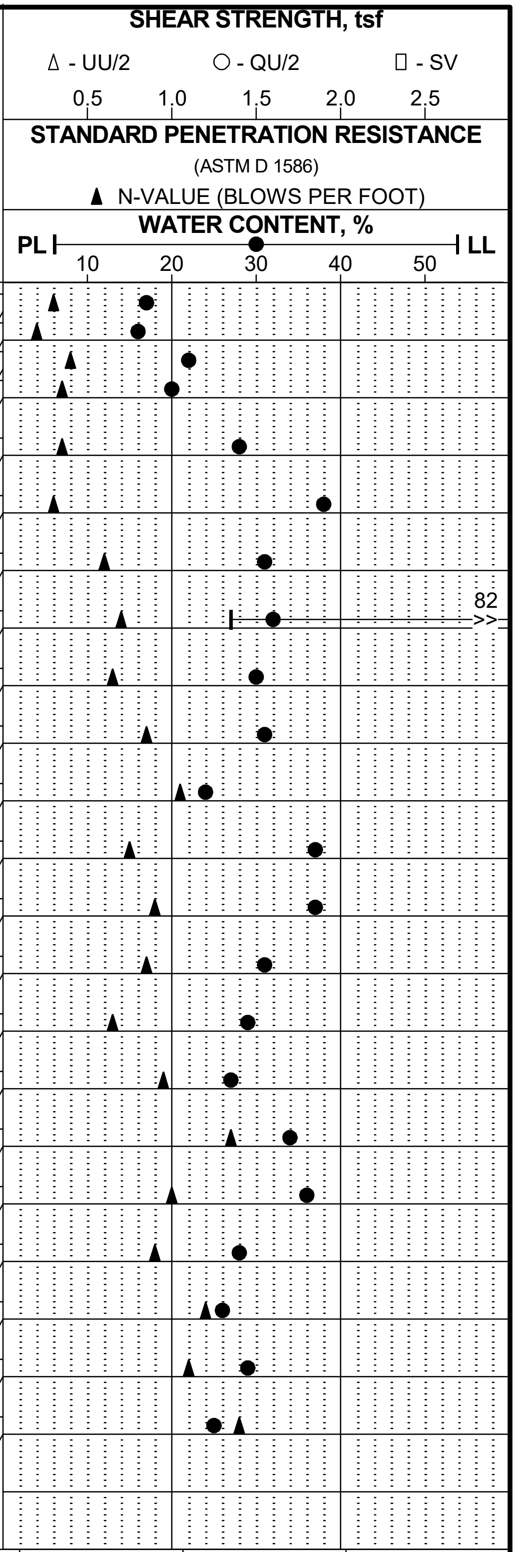
Datum: NAVD 88

Completion Date: 9/25/21

Station: 1089+32.00

| DEPTH IN FEET | ELEVATION IN FEET | DESCRIPTION OF MATERIAL |
|---|---|---|
| | | Soft to very stiff, gray and brown to red, FAT CLAY - (CH) |
| 5 | 205 | 96.7% passing No. 200 sieve |
| 10 | 200 | |
| 15 | 195 | |
| 20 | 190 | trace sand |
| 25 | 185 | |
| 30 | 180 | 97.0% passing No. 200 sieve |
| 35 | 175 | |
| 40 | 170 | 94.5% passing No. 200 sieve |
| 45 | 165 | trace sand<br>trace silt |
| 50 | 160 | |
| 55 | 155 | |
| 60 | 150 | |
| 65 | 145 | |
| 70 | 140 | |
| 75 | 135 | |
| 80 | 130 | |
| 85 | 125 | |
| 90 | 120 | |
| 95 | 115 | |
| 100 | 110 | Boring terminated at 100 feet. |
| 105 | 105 | |

| DRY UNIT WEIGHT (pcf)<br>SPT BLOW COUNTS<br>CORE RECOVERY/RQD | SAMPLES |
|---|---|
| 2-3-3 | SS1 |
| 2-2-2 | SS2 |
| 2-3-5 | SS3 |
| 2-3-4 | SS4 |
| 2-3-4 | SS5 |
| 2-3-3 | SS6 |
| 3-6-6 | SS7 |
| 4-7-7 | SS8 |
| 5-5-8 | SS9 |
| 5-7-10 | SS10 |
| 6-11-10 | SS11 |
| 4-7-8 | SS12 |
| 6-8-10 | SS13 |
| 6-7-10 | SS14 |
| 6-7-6 | SS15 |
| 8-7-12 | SS16 |
| 9-12-15 | SS17 |
| 7-9-11 | SS18 |
| 6-8-10 | SS19 |
| 6-10-14 | SS20 |
| 8-10-12 | SS21 |
| 10-11-17 | SS22 |



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**GROUNDWATER DATA**

X FREE WATER NOT ENCOUNTERED DURING DRILLING

**DRILLING DATA**

__ AUGER 3 3/4" HOLLOW STEM

WASHBORING FROM 50 FEET

KJB DRILLER LCH LOGGER

CME 750X DRILL RIG

HAMMER TYPE Auto

HAMMER EFFICIENCY 84 %

**REMARKS:**

| Drawn by: SWF | Checked by: JDM | App'vd. by: DMS |
|---|---|---|
| Date: 10/4/21 | Date: 11/30/21 | Date: 11/30/21 |

GEOTECHNOLOGY
A Universal Engineering Sciences Company

**ARDOT G013, 020475**
**Hwy. 83 Spur - Hwy. 278 Connector**
**(Monticello)(S)**
**Drew County, Arkansas**

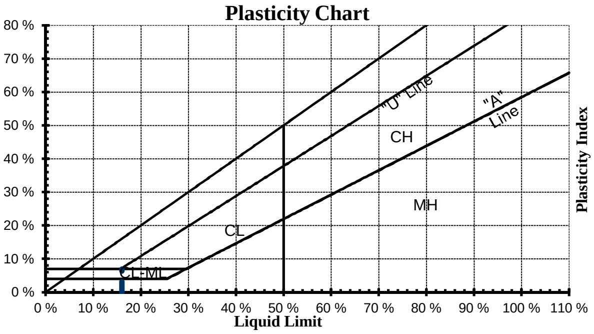
**LOG OF BORING: B-14**

**Project No. J037781.01**

# BORING LOG: TERMS AND SYMBOLS

## LEGEND

| | |
|---|---|
| CS | Continuous Sampler |
| GB | Grab Sample |
| NQ | NQ Rock Core |
| PST | Three-Inch Diameter Piston Tube Sample |
| SS | Split-Spoon Sample (Standard Penetration Test) |
| ST | Three-Inch Diameter Shelby Tube Sample |
| * | Sample Not Recovered |
| PL | Plastic Limit (ASTM D4318) |
| LL | Liquid Limit (ASTM D4318) |
| SV | Shear Strength from Field Vane (ASTM D2573) |
| UU | Shear Strength from Unconsolidated-Undrained Triaxial Compression Test (ASTM D2850) |
| QU | Shear Strength from Unconfined Compression Test (ASTM D2166) |



Plasticity Chart

## SOIL GRAIN SIZE

US STANDARD SIEVE

12" 3" 3/4" 4 10 40 200

| BOULDERS | COBBLES | GRAVEL | | SAND | | | SILT | CLAY |
|---|---|---|---|---|---|---|---|---|
| | | COARSE | FINE | COARSE | MEDIUM | FINE | | |

300 76.2 19.1 4.76 2.00 0.42 0.074 0.005

SOIL GRAIN SIZE IN MILLIMETERS

## UNIFIED SOIL CLASSIFICATION SYSTEM

| ***Major Divisions*** | | | ***Symbol*** | ***Description*** |
|---|---|---|---|---|
| **Coarse-Grained Soils (More than 50% Larger than No. 200 Sieve Size)** | Gravel and Gravelly Soil | Clean Gravels Little or no Fines | GW | Well-Graded Gravel, Gravel- Sand Mixture |
| | | | GP | Poorly-Graded Gravel, Gravel-Sand Mixture |
| | | Gravels with Appreciable Fines | GM | Silty Gravel, Gravel-Sand-Silt Mixture |
| | | | GC | Clayey-Gravel, Gravel-Sand-Clay Mixture |
| | Sand and Sandy Soils | Clean Sands Little or no Fines | SW | Well-Graded Sand, Gravelly Sand |
| | | | SP | Poorly-Graded Sand, Gravelly Sand |
| | | Sands with Appreciable Fines | SM | Silty Sand, Sand-Silt Mixture |
| | | | SC | Clayey-Sand, Sand-Clay Mixture |
| Fine-Grained Soils (More than 50% Smaller than No. 200 Sieve Size) | Silts and Clays | Liquid Limit Less Than 50 | ML | Silt, Sandy Silt, Clayey Silt, Slight Plasticity |
| | | | CL | Lean Clay, Sandy Clay, Silty Clay, Low to Medium Plasticity |
| | | | OL | Organic Silts or Lean Clays, Low Plasticity |
| | Silts and Clays | Liquid Limit Greater Than 50 | MH | Silt, High Plasticity |
| | | | CH | Fat Clay, High Plasticity |
| | | | OH | Organic Clay, Medium to High Plasticity |
| | Highly Organic Soils | | PT | Peat, Humus, Swamp Soil |

## STRENGTH OF COHESIVE SOILS

| ***Consistency*** | ***Undrained Shear Strength (tsf)*** | ***Unconfined Comp. Strength (tsf)*** |
|---|---|---|
| Very Soft | less than 0.125 | less then 0.25 |
| Soft | 0.125 to 0.25 | 0.25 to 0.5 |
| Medium Stiff | 0.25 to 0.5 | 0.5 to 1.0 |
| Stiff | 0.5 to 1.0 | 1.0 to 2.0 |
| Very Stiff | 1.0 to 2.0 | 2.0 to 3.0 |
| Hard | greater than 2.0 | greater than 4.0 |

## DENSITY OF GRANULAR SOILS

| ***Descriptive Term*** | ***Approximate $N_{60}$-Value Range*** |
|---|---|
| Very Loose | 0 to 4 |
| Loose | 5 to 10 |
| Medium Dense | 11 to 30 |
| Dense | 31 to 50 |
| Very Dense | >50 |

N-Value (Blow Count) is the last two, 6-inch drive increments (i.e. 4/7/9, N = 7 + 9 = 16). Values are shown as a summation on the grid plot and shown in the Unit Dry Weight/SPT column.

## RELATIVE COMPOSITION

| | |
|---|---|
| Trace | 0 to 10% |
| Little | 10 to 20% |
| Some | 20 to 35% |
| And | 35 to 50% |

## OTHER TERMS

Layer - Inclusion greater than 3 inches thick.
Seam - Inclusion 1/8-inch to 3 inches thick
Parting - Inclusion less than 1/8-inch thick
Pocket - Inclusion of material that is smaller than sample diameter

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FROM THE GROUND UP

Relative composition and Unified Soil Classification System (USCS) designations are based on visual descriptions and are approximate only. If laboratory tests were performed to classify the soil, the USCS designation is shown in parenthesis.

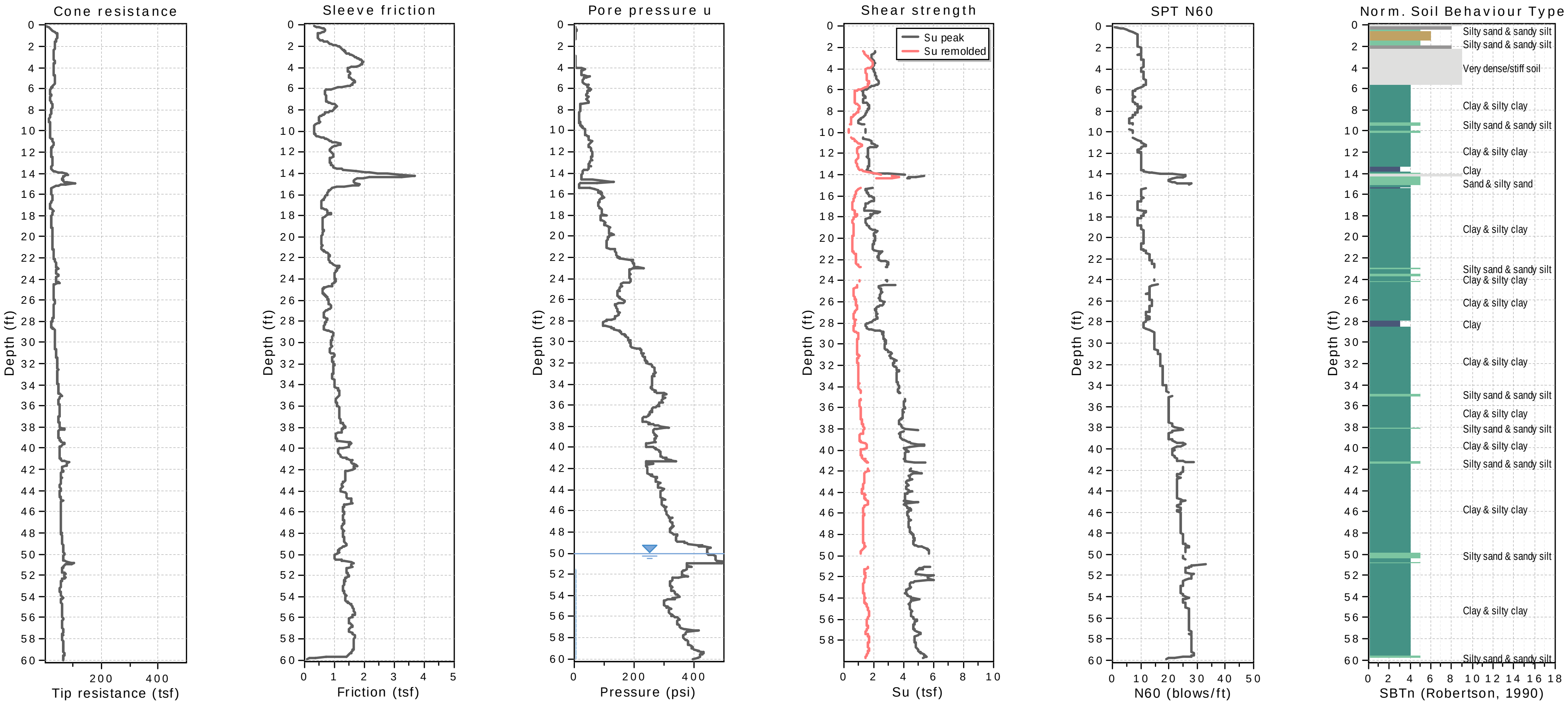
# APPENDIX D – CPT SOUNDING PLOTS

Geotechnology, LLC
11816 Lackland Road
St. Louis, Missouri
http://www.geotechnology.com

Project: ARDOT G013, 020475, Monticello
Location: Monticello, Arkansas

## cpt-1a

Total depth: 60.05 ft
Cone Type: 15cm2
Cone Operator: DWJ



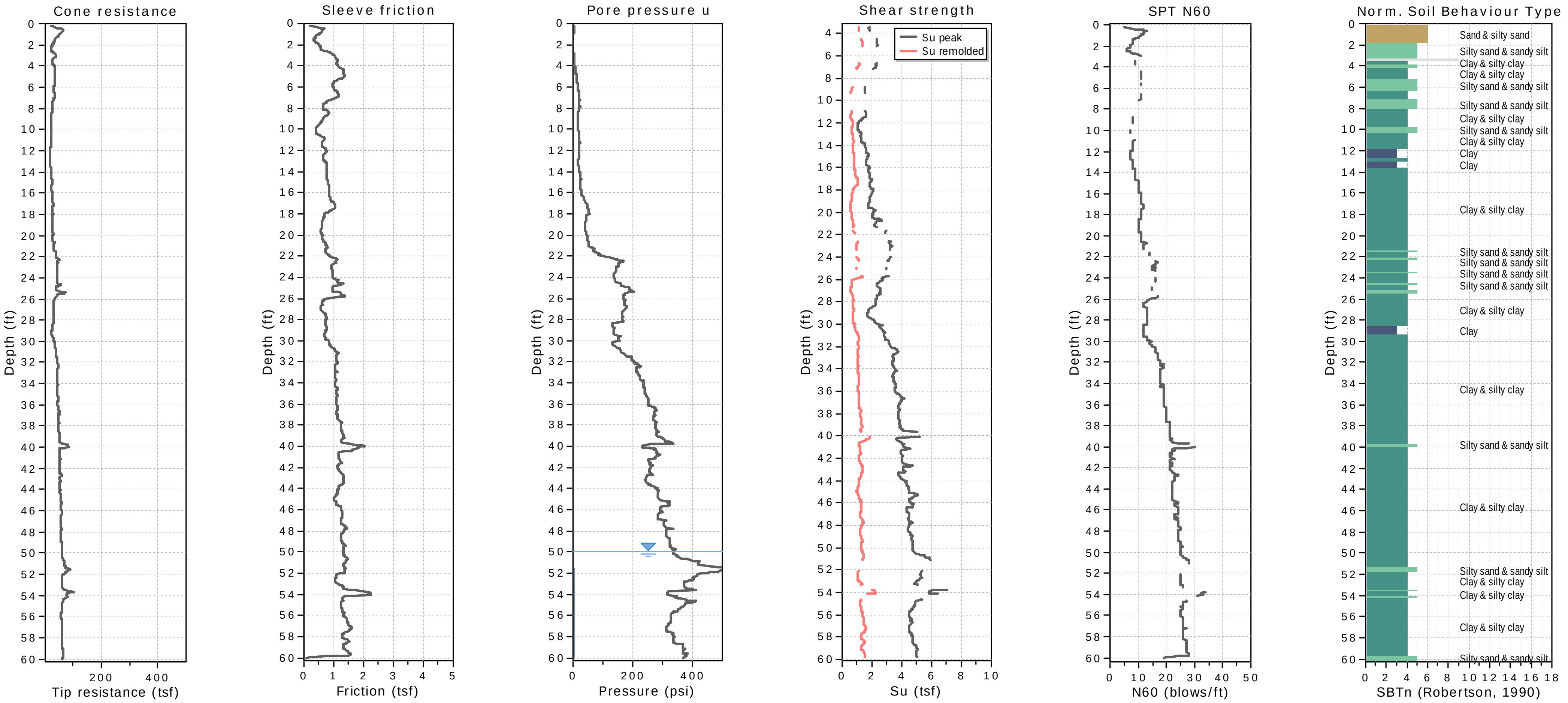
### SBTn legend

- 🟥 1. Sensitive fine grained
- 🟫 2. Organic material
- 🟦 3. Clay to silty clay
- 🟩 4. Clayey silt to silty clay
- 🟩 5. Silty sand to sandy silt
- 🟨 6. Clean sand to silty sand
- 🟧 7. Gravelly sand to sand
- ⬛ 8. Very stiff sand to clayey sand
- ⬜ 9. Very stiff fine grained

**cpt-1b**

Total depth: 60.05 ft
Cone Type: 15cm2
Cone Operator: DWJ

Project: ARDOT G013, 020475, Monticello
Location: Monticello, Arkansas

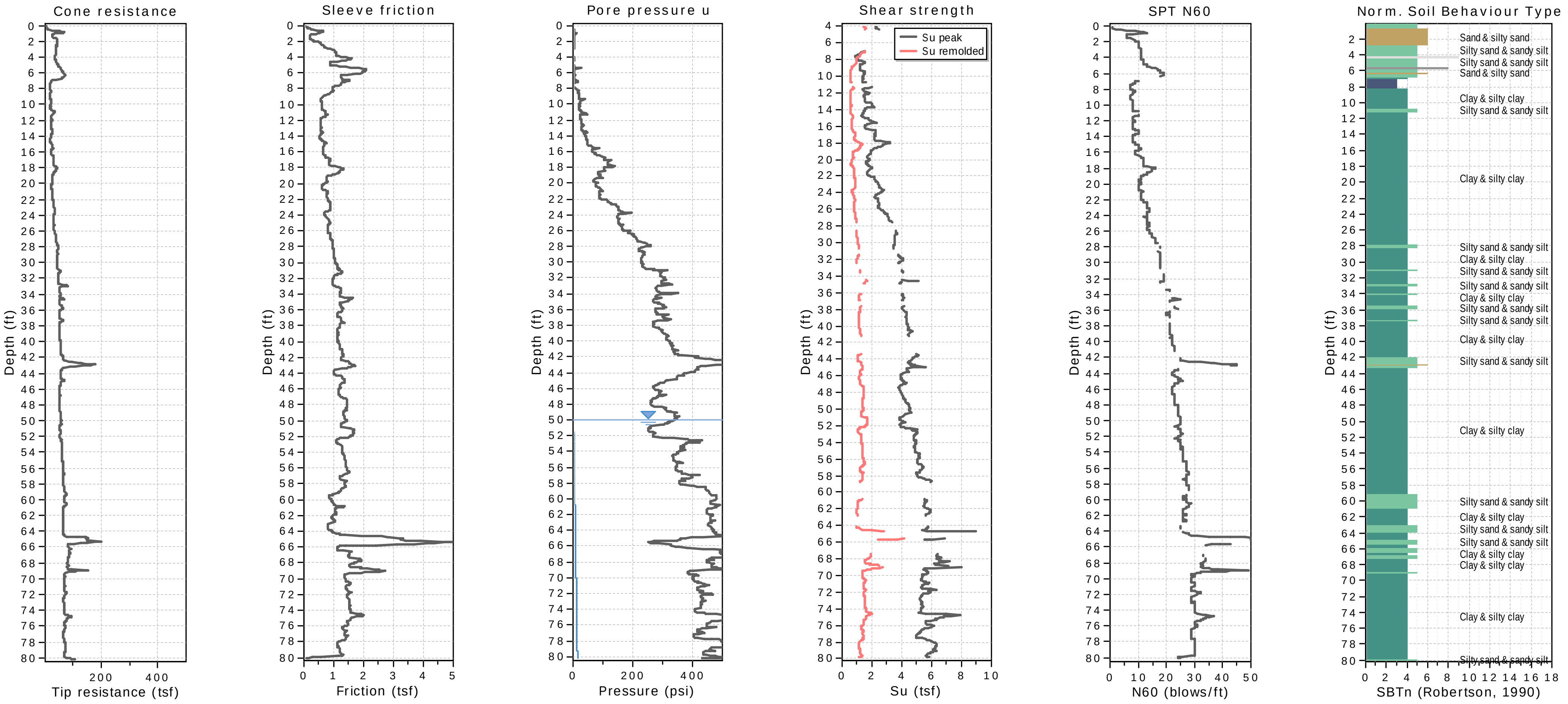


SBTn legend

🟥 1. Sensitive fine grained
🟫 2. Organic material
🟦 3. Clay to silty clay
🟩 4. Clayey silt to silty clay
🟩 5. Silty sand to sandy silt
🟨 6. Clean sand to silty sand
🟧 7. Gravelly sand to sand
⬛ 8. Very stiff sand to clayey sand
⬜ 9. Very stiff fine grained

**Project:** ARDOT G013, 020475, Monticello
**Location:** Monticello, Arkansas

cpt-2
Total depth: 80.19 ft
Cone Type: 15cm2
Cone Operator: DWJ



SBTn legend

| | | |
|---|---|---|
| 🟥 1. Sensitive fine grained | 🟩 4. Clayey silt to silty clay | 🟧 7. Gravelly sand to sand |
| 🟫 2. Organic material | 🟩 5. Silty sand to sandy silt | ⬛ 8. Very stiff sand to clayey sand |
| 🟦 3. Clay to silty clay | 🟨 6. Clean sand to silty sand | ⬜ 9. Very stiff fine grained |

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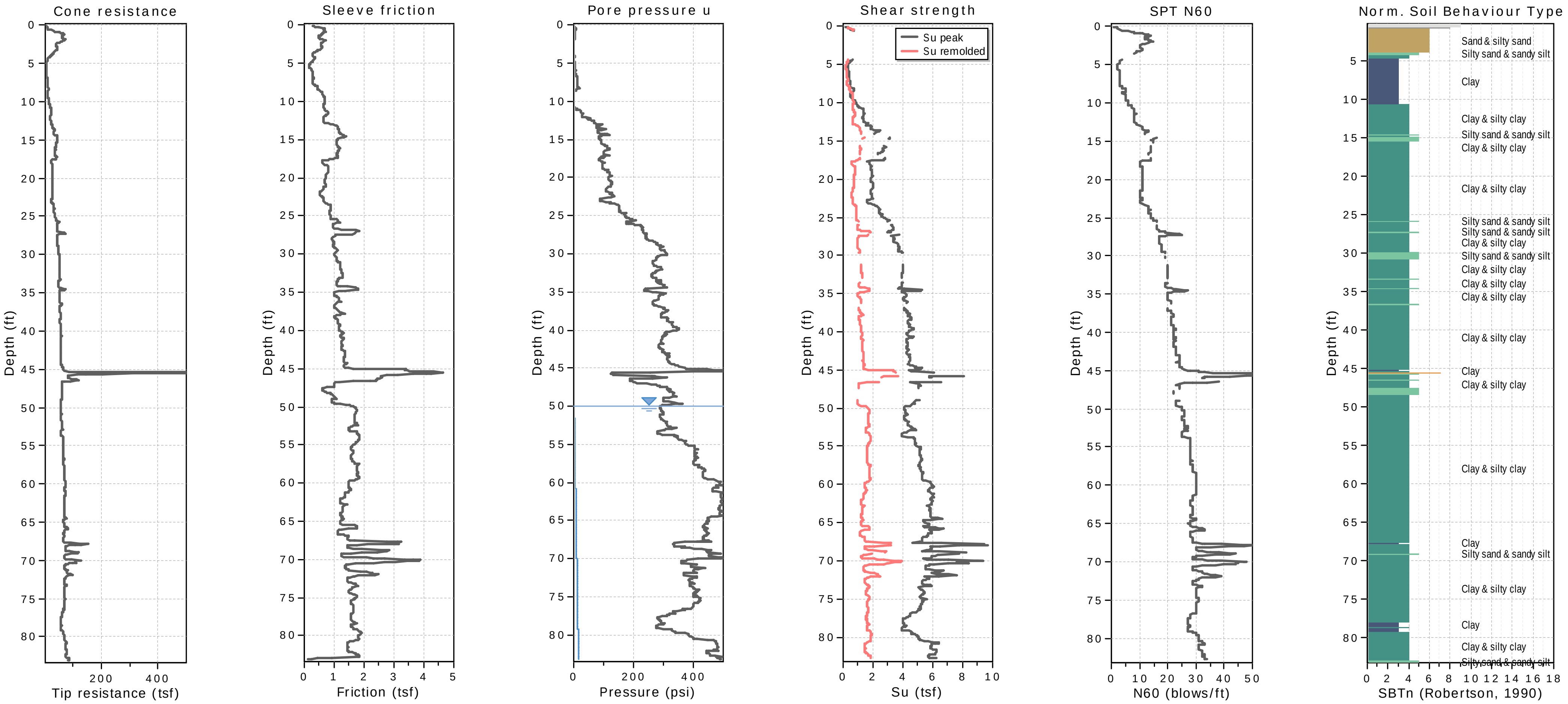
Project: ARDOT G013, 020475, Monticello
Location: Monticello, Arkansas

**cpt-4**
Total depth: 83.21 ft
Cone Type: 15cm2
Cone Operator: DWJ



SBTn legend

| | | |
|---|---|---|
| 🟥 1. Sensitive fine grained | 🟩 4. Clayey silt to silty clay | 🟧 7. Gravelly sand to sand |
| 🟫 2. Organic material | 🟩 5. Silty sand to sandy silt | ▨ 8. Very stiff sand to clayey sand |
| 🟦 3. Clay to silty clay | 🟨 6. Clean sand to silty sand | ☐ 9. Very stiff fine grained |

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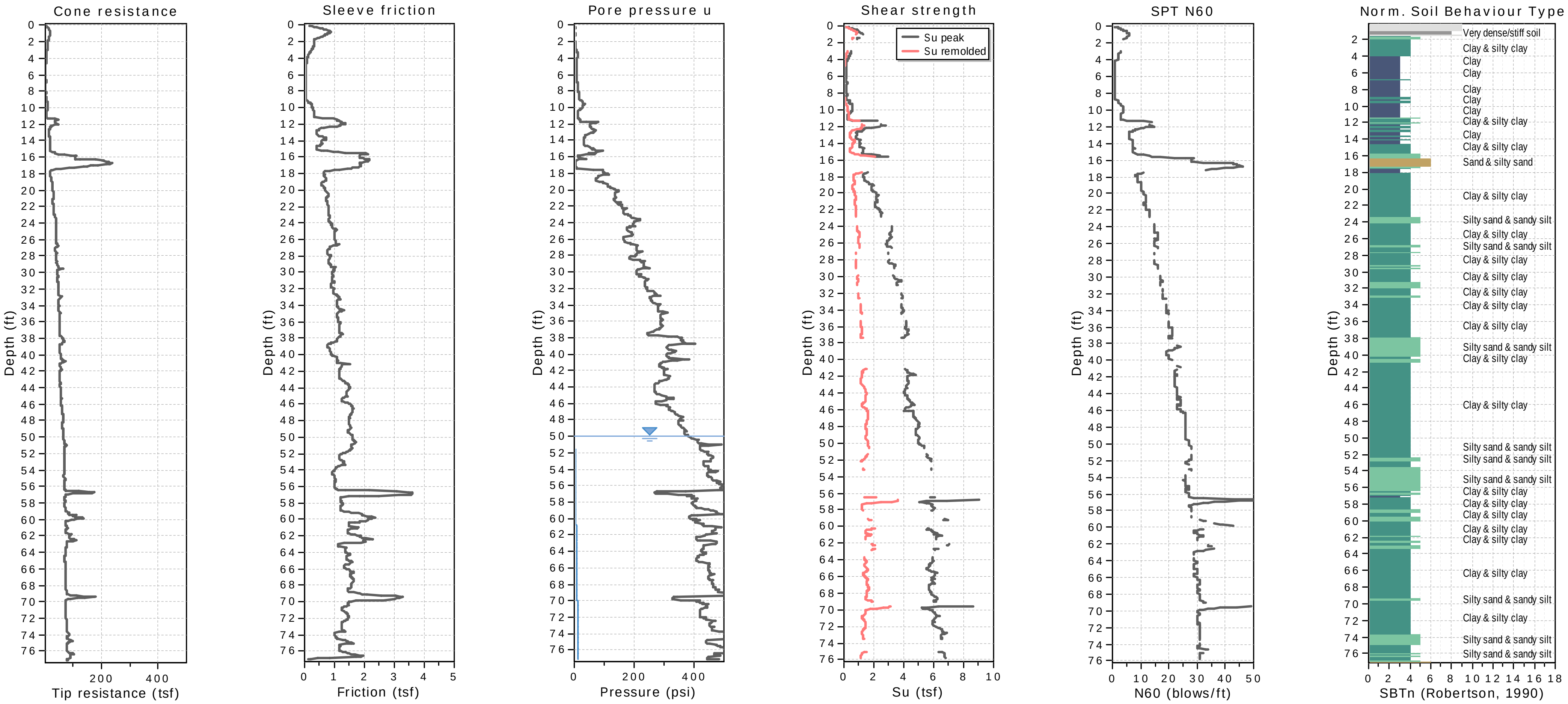
**Project:** ARDOT G013, 020475, Monticello
**Location:** Monticello, Arkansas

## cpt-6

Total depth: 77.11 ft
Cone Type: 15cm2
Cone Operator: DWJ

---



**SBTn legend**

| | | |
|---|---|---|
| 🟥 1. Sensitive fine grained | 🟩 4. Clayey silt to silty clay | 🟧 7. Gravelly sand to sand |
| 🟫 2. Organic material | 🟩 5. Silty sand to sandy silt | ⬛ 8. Very stiff sand to clayey sand |
| 🟦 3. Clay to silty clay | 🟫 6. Clean sand to silty sand | ⬜ 9. Very stiff fine grained |

Geotechnology, LLC
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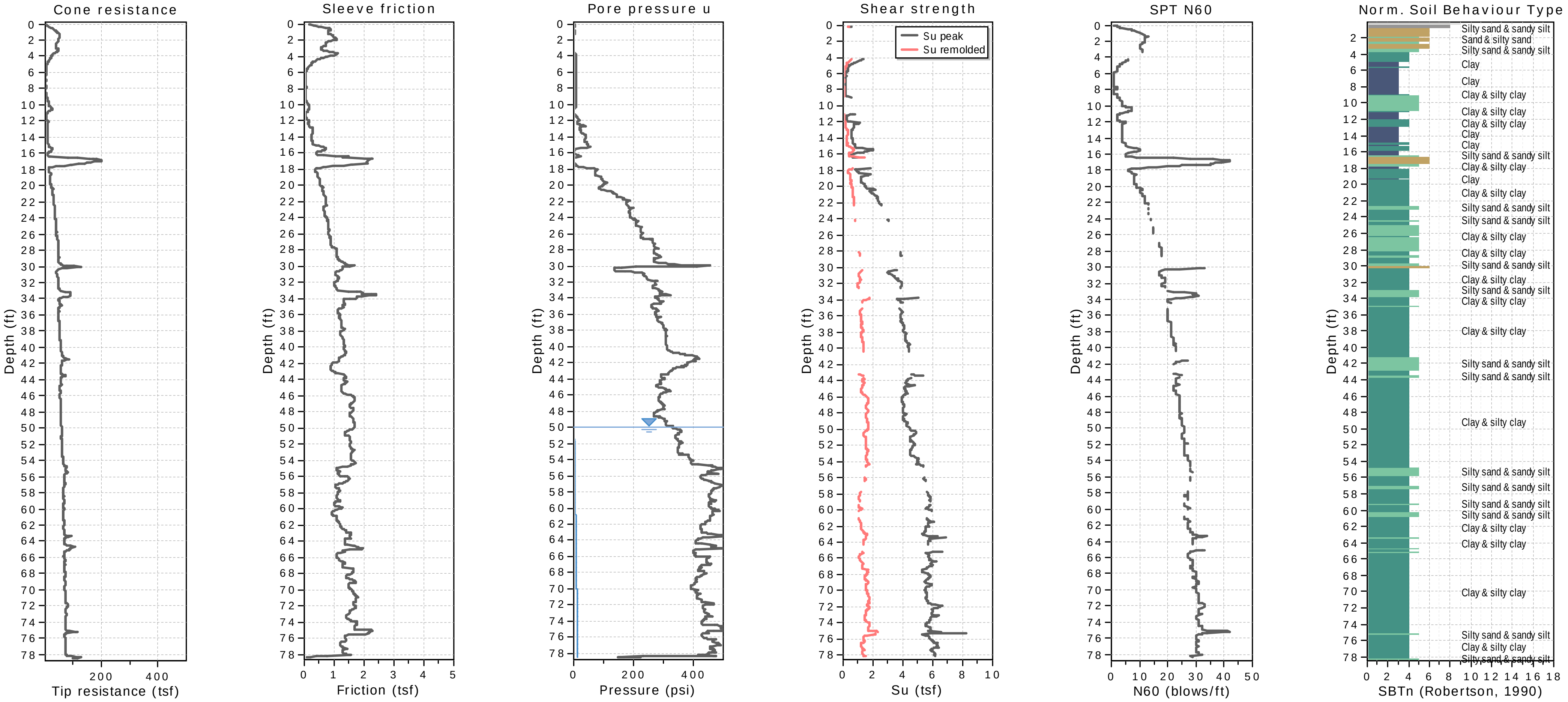
Project: ARDOT G013, 020475, Monticello
Location: Monticello, Arkansas

**cpt-8**
Total depth: 78.48 ft
Cone Type: 15cm2
Cone Operator: DWJ



SBTn legend

- 🟥 1. Sensitive fine grained
- 🟫 2. Organic material
- 🟦 3. Clay to silty clay
- 🟩 4. Clayey silt to silty clay
- 🟩 5. Silty sand to sandy silt
- 🟨 6. Clean sand to silty sand
- 🟧 7. Gravelly sand to sand
- ⬛ 8. Very stiff sand to clayey sand
- ⬜ 9. Very stiff fine grained

Geotechnology, LLC
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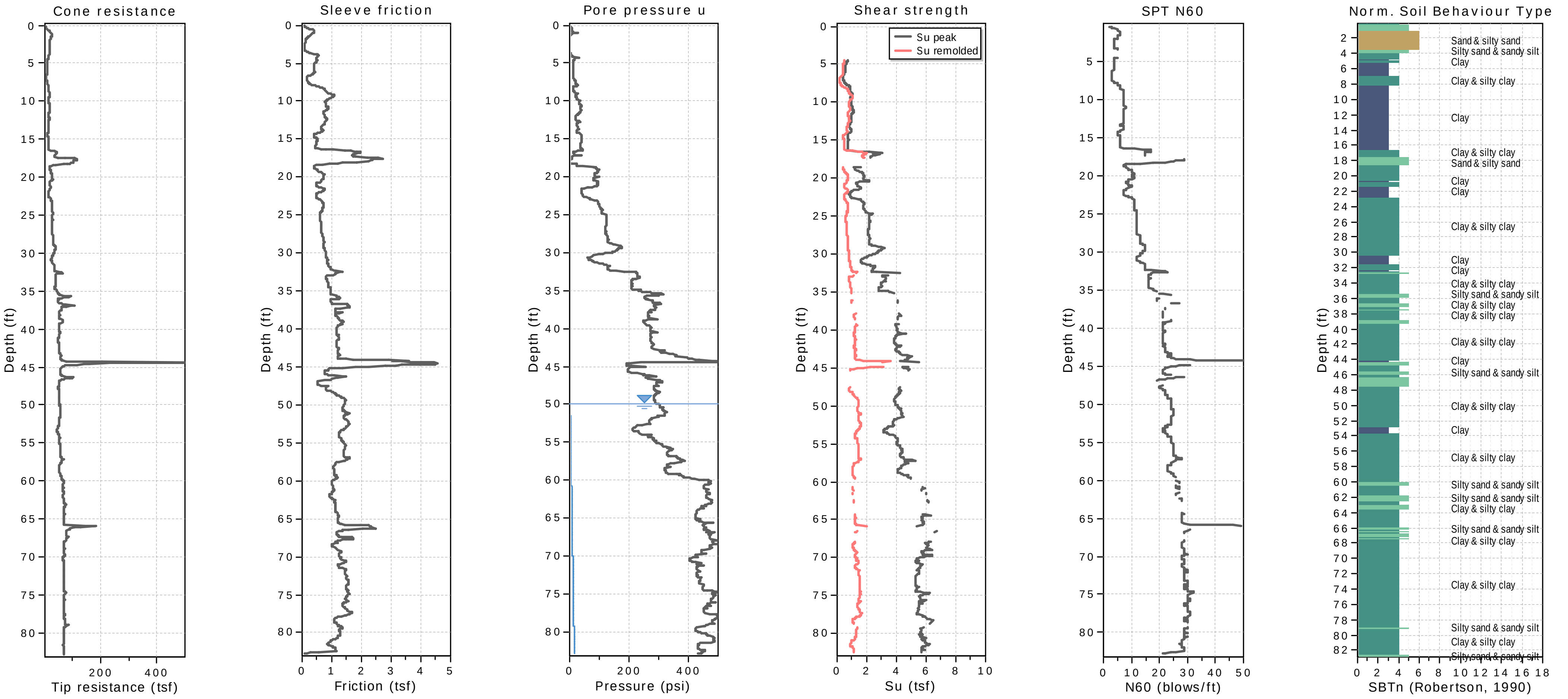
**cpt-9**
Total depth: 82.87 ft
Cone Type: 15cm2
Cone Operator: DWJ

Project: ARDOT G013, 020475, Monticello
Location: Monticello, Arkansas



**SBTn legend**

- 🟥 1. Sensitive fine grained
- 🟫 2. Organic material
- 🟦 3. Clay to silty clay
- 🟩 4. Clayey silt to silty clay
- 🟩 5. Silty sand to sandy silt
- 🟨 6. Clean sand to silty sand
- 🟧 7. Gravelly sand to sand
- ⬛ 8. Very stiff sand to clayey sand
- ⬜ 9. Very stiff fine grained

Geotechnology, LLC
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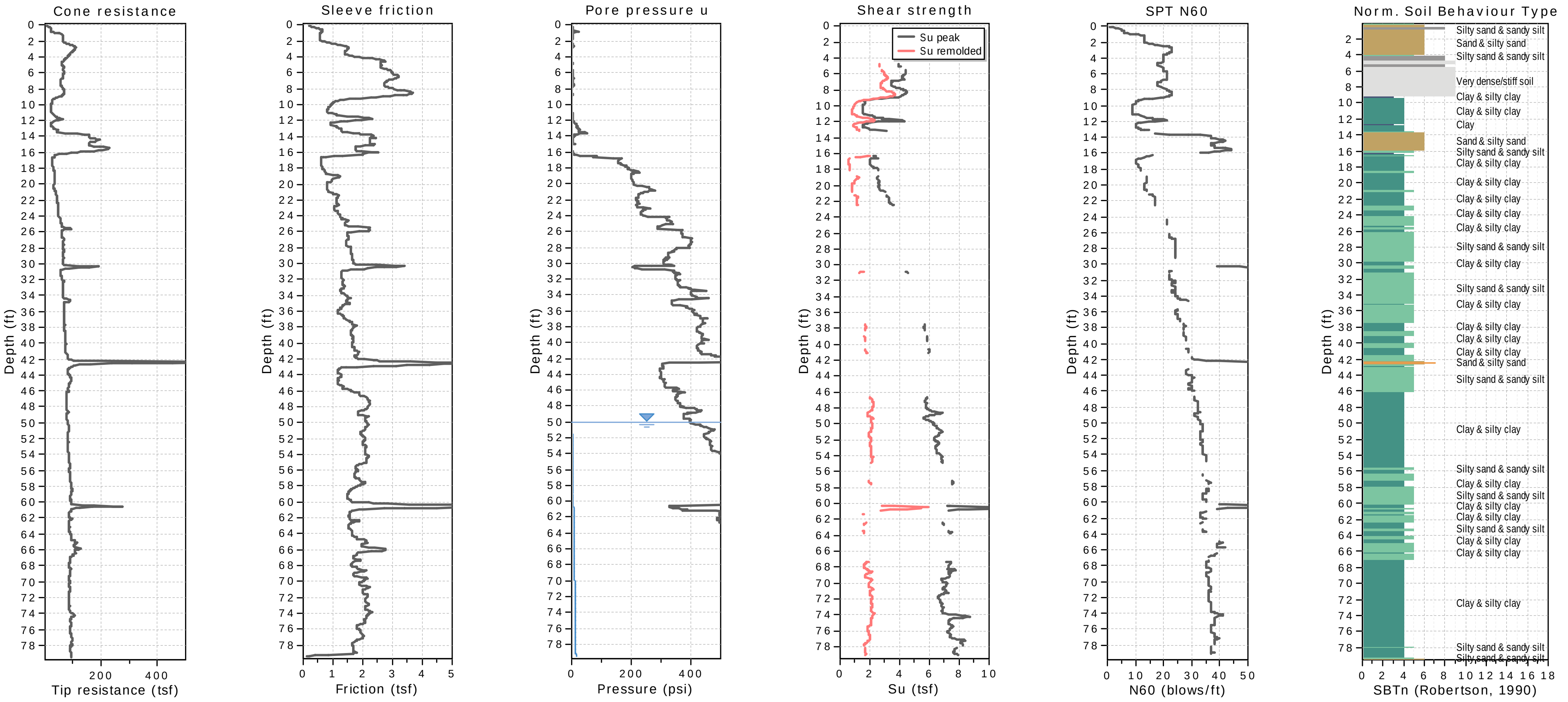
**Project:** ARDOT G013, 020475, Monticello
**Location:** Monticello, Arkansas

## cpt-10

Total depth: 79.53 ft
Cone Type: 15cm2
Cone Operator: DWJ



**SBTn legend**

| | | |
|---|---|---|
| 🟥 1. Sensitive fine grained | 🟩 4. Clayey silt to silty clay | 🟧 7. Gravelly sand to sand |
| 🟫 2. Organic material | 🟩 5. Silty sand to sandy silt | ⬛ 8. Very stiff sand to clayey sand |
| 🟦 3. Clay to silty clay | 🟫 6. Clean sand to silty sand | ⬜ 9. Very stiff fine grained |

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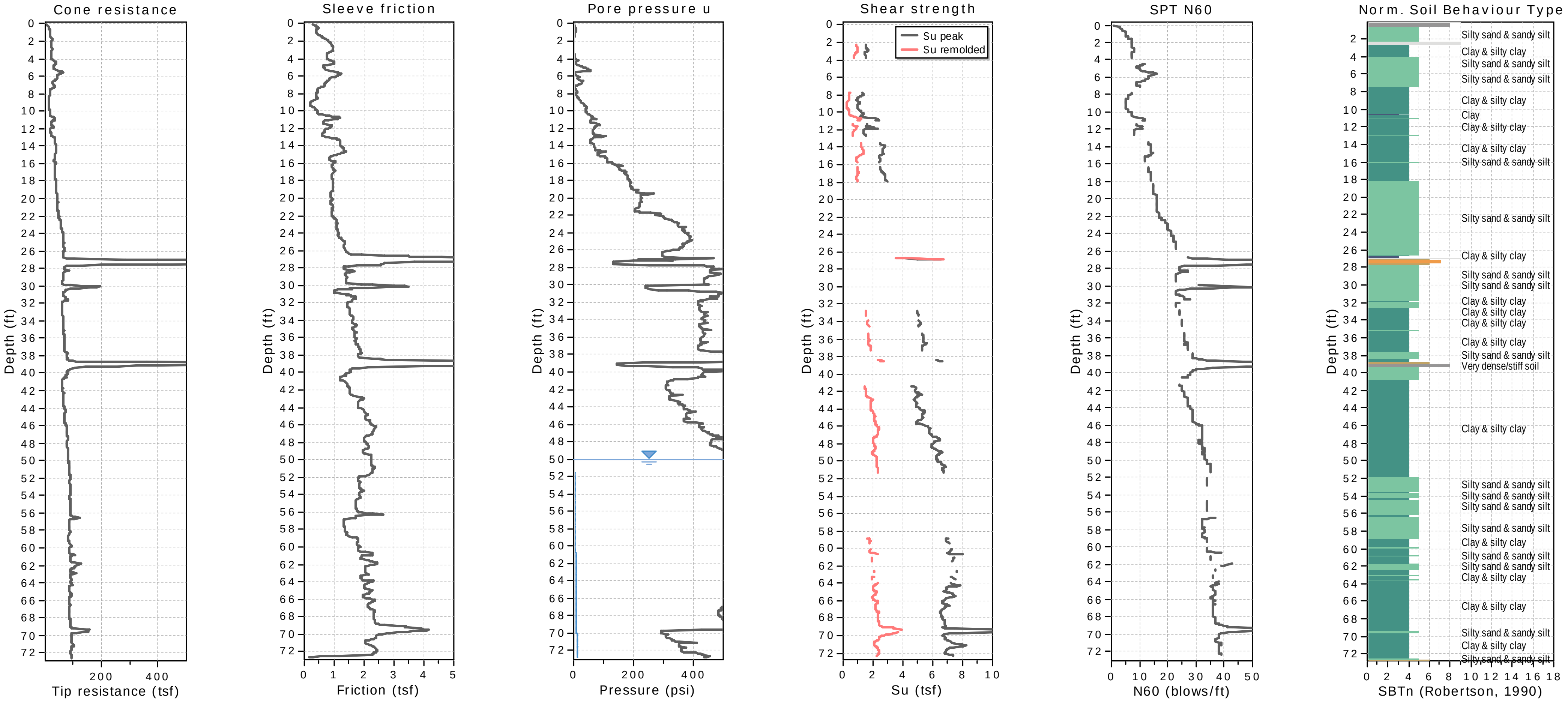
Project: ARDOT G013, 020475, Monticello
Location: Monticello, Arkansas

**cpt-12**
Total depth: 72.78 ft
Cone Type: 15cm2
Cone Operator: DWJ



SBTn legend

- 🟥 1. Sensitive fine grained
- 🟫 2. Organic material
- 🟦 3. Clay to silty clay
- 🟩 4. Clayey silt to silty clay
- 🟩 5. Silty sand to sandy silt
- 🟨 6. Clean sand to silty sand
- 🟧 7. Gravelly sand to sand
- ⬛ 8. Very stiff sand to clayey sand
- ⬜ 9. Very stiff fine grained

Geotechnology, LLC
11816 Lackland Road
St. Louis, Missouri
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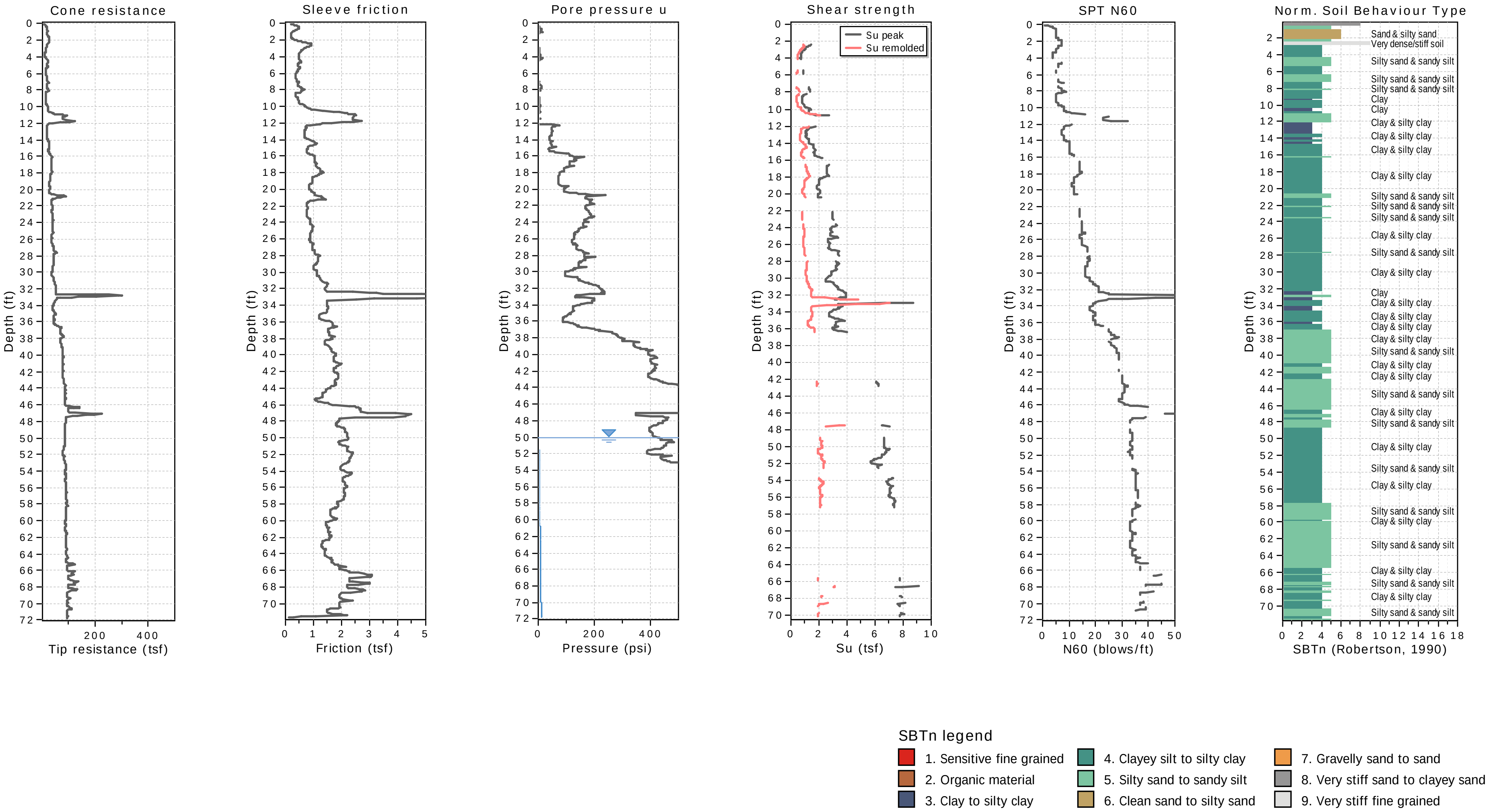
cpt-14
Total depth: 71.80 ft
Cone Type: 15cm2
Cone Operator: DWJ

Project: ARDOT G013, 020475, Monticello
Location: Monticello, Arkansas



Presented below is a list of formulas used for the estimation of various soil properties. The formulas are presented in SI unit system and assume that all components are expressed in the same units.

:: Unit Weight, g (kN/m³) ::

$$g = g_w \cdot \left(0.27 \cdot \log(R_f) + 0.36 \cdot \log(\frac{q_t}{p_a}) + 1.236\right)$$

where $g_w$ = water unit weight

:: Permeability, k (m/s) ::

$I_c < 3.27$ and $I_c > 1.00$ then $k = 10^{0.952-3.04 \cdot I_c}$

$I_c \leq 4.00$ and $I_c > 3.27$ then $k = 10^{-4.52-1.37 \cdot I_c}$

:: $N_{SPT}$ (blows per 30 cm) ::

$$N_{60} = \left(\frac{q_c}{P_a}\right) \cdot \frac{1}{10^{1.1268-0.2817 \cdot I_c}}$$

$$N_{1(60)} = Q_{tn} \cdot \frac{1}{10^{1.1268-0.2817 \cdot I_c}}$$

:: Young's Modulus, Es (MPa) ::

$$(q_t - \sigma_v) \cdot 0.015 \cdot 10^{0.55 \cdot I_c + 1.68}$$

(applicable only to $I_c < I_{c\_cutoff}$)

:: Relative Density, Dr (%) ::

$$100 \cdot \sqrt{\frac{Q_{tn}}{k_{DR}}}$$

(applicable only to $SBT_n$: 5, 6, 7 and 8 or $I_c < I_{c\_cutoff}$)

:: State Parameter, **ψ** ::

$$\psi = 0.56 - 0.33 \cdot \log(Q_{tn,cs})$$

:: Drained Friction Angle, **φ** (°) ::

$$\varphi = \varphi'_{cv} + 15.94 \cdot \log(Q_{tn,cs}) - 26.88$$

(applicable only to $SBT_n$: 5, 6, 7 and 8 or $I_c < I_{c\_cutoff}$)

:: 1-D constrained modulus, M (MPa) ::

If $I_c > 2.20$
$\alpha = 14$ for $Q_{tn} > 14$
$\alpha = Q_{tn}$ for $Q_{tn} \leq 14$
$M_{CPT} = \alpha \cdot (q_t - \sigma_v)$

If $I_c \geq 2.20$

$$M_{CPT} = 0.03 \cdot (q_t - \sigma_v) \cdot 10^{0.55 \cdot I_c + 1.68}$$

:: Small strain shear Modulus, Go (MPa) ::

$$G_0 = (q_t - \sigma_v) \cdot 0.0188 \cdot 10^{0.55 \cdot I_c + 1.68}$$

:: Shear Wave Velocity, Vs (m/s) ::

$$V_s = \left(\frac{G_0}{\rho}\right)^{0.50}$$

:: Undrained peak shear strength, Su (kPa) ::

$N_{kt} = 10.50 + 7 \cdot \log(F_r)$ or user defined

$$S_u = \frac{(q_t - \sigma_v)}{N_{kt}}$$

(applicable only to $SBT_n$: 1, 2, 3, 4 and 9 or $I_c > I_{c\_cutoff}$)

:: Remolded undrained shear strength, Su(rem) (kPa) ::

$S_{u(rem)} = f_s$ (applicable only to $SBT_n$: 1, 2, 3, 4 and 9 or $I_c > I_{c\_cutoff}$)

:: Overconsolidation Ratio, OCR ::

$$k_{OCR} = \left[\frac{Q_{tn}^{0.20}}{0.25 \cdot (10.50 \cdot +7 \cdot \log(F_r))}\right]^{1.25}$$ or user defined

$$OCR = k_{OCR} \cdot Q_{tn}$$

(applicable only to $SBT_n$: 1, 2, 3, 4 and 9 or $I_c > I_{c\_cutoff}$)

:: In situ Stress Ratio, Ko ::

$$K_O = (1 - \sin\varphi') \cdot OCR^{\sin\varphi'}$$

(applicable only to $SBT_n$: 1, 2, 3, 4 and 9 or $I_c > I_{c\_cutoff}$)

:: Soil Sensitivity, $S_t$ ::

$$S_t = \frac{N_S}{F_r}$$

(applicable only to $SBT_n$: 1, 2, 3, 4 and 9 or $I_c > I_{c\_cutoff}$)

:: Peak Friction Angle, **φ'** (°) ::

$$\varphi' = 29.5° \cdot B_q^{0.121} \cdot (0.256 + 0.336 \cdot B_q + \log Q_t)$$

(applicable for $0.10 < B_q < 1.00$)

References

- Robertson, P.K., Cabal K.L., Guide to Cone Penetration Testing for Geotechnical Engineering, Gregg Drilling & Testing, Inc., 5th Edition, November 2012
- Robertson, P.K., Interpretation of Cone Penetration Tests - a unified approach., Can. Geotech. J. 46(11): 1337–1355 (2009)

# APPENDIX E – LABORATORY TEST DATA

Atterberg Limits

Grain Size Distributions

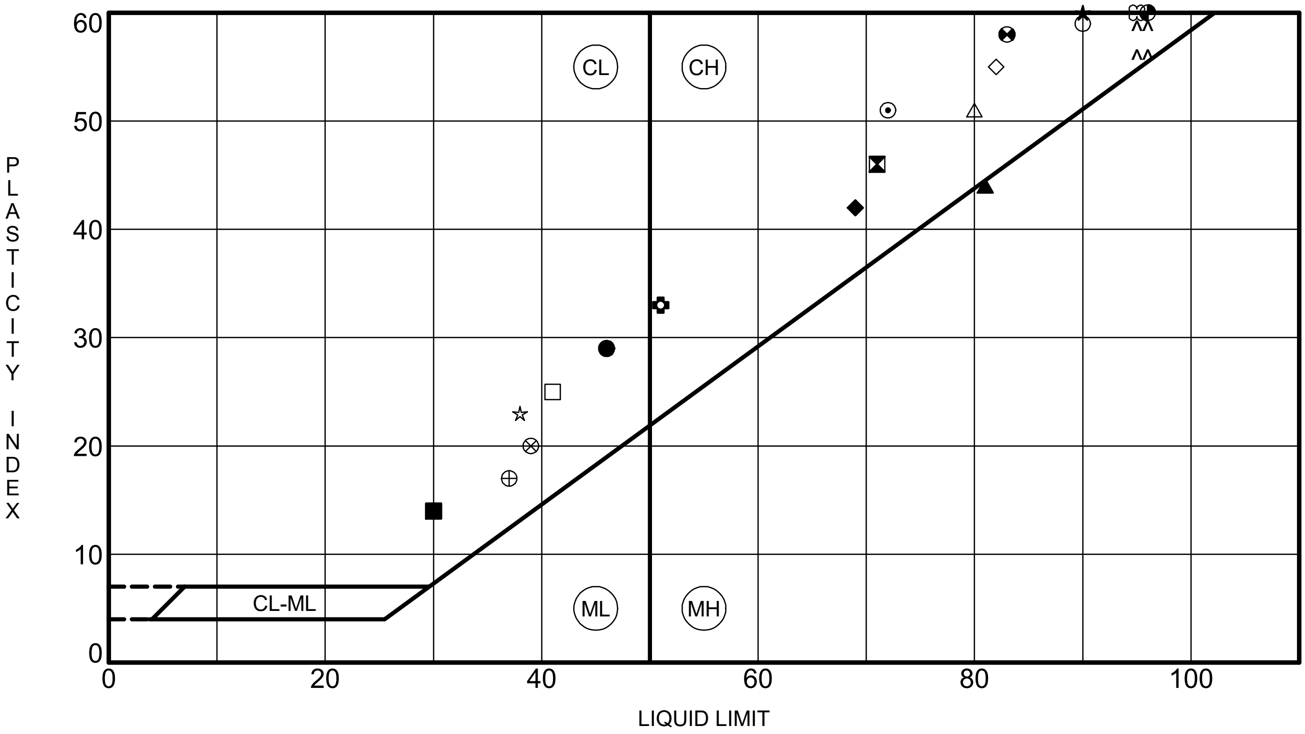
Unconsolidated-Undrained Triaxial Compression

One-Dimensional Consolidation

Direct Shear

Resistivity

pH



| | Specimen Identification | | LL | PL | PI | Fines | Classification |
|---|---|---|---|---|---|---|---|
| ● | B- 2 | 3.0 | 46 | 17 | 29 | | LEAN CLAY(CL), A-7-6 |
| ⧗ | B- 2 | 8.0 | 71 | 25 | 46 | | FAT CLAY(CH), A-7-6 |
| ▲ | B- 3 | 10.0 | 81 | 37 | 44 | | ELASTIC SILT(MH), A-7-5 |
| ★ | B- 3 | 15.0 | 90 | 30 | 60 | | FAT CLAY(CH), A-7-5 |
| ⊙ | B- 4 | 10.0 | 72 | 21 | 51 | | FAT CLAY(CH), A-7-6 |
| ✿ | B- 6 | 8.0 | 51 | 18 | 33 | | FAT CLAY(CH), A-7-6 |
| ○ | B- 8 | 20.0 | 90 | 31 | 59 | | FAT CLAY(CH), A-7-5 |
| △ | B- 8 | 25.0 | 80 | 29 | 51 | | FAT CLAY(CH), A-7-6 |
| ⊗ | B- 9 | 11.0 | 39 | 19 | 20 | | LEAN CLAY(CL), A-6 |
| ⊕ | B- 9 | 15.0 | 37 | 20 | 17 | 26 | CLAYEY GRAVEL(GC), A-2-6 (1) |
| □ | B-10 | 13.5 | 41 | 16 | 25 | | LEAN CLAY(CL), A-7-6 |
| ◉ | B-10 | 15.0 | 83 | 25 | 58 | | FAT CLAY(CH), A-7-6 |
| ◕ | B-10 | 20.0 | 96 | 29 | 67 | | FAT CLAY(CH), A-7-6 |
| ☆ | B-11 | 8.0 | 38 | 15 | 23 | | LEAN CLAY(CL), A-6 |
| ✣ | B-12 | 15.0 | 95 | 31 | 64 | | FAT CLAY(CH), A-7-5 |
| ■ | B-13 | 6.0 | 30 | 16 | 14 | | LEAN CLAY(CL), A-6 |
| ◆ | B-13 | 10.0 | 69 | 27 | 42 | | FAT CLAY(CH), A-7-6 |
| ◇ | B-14 | 28.5 | 82 | 27 | 55 | 97 | FAT CLAY(CH), A-7-6 (62) |
| | | | | | | | |
| | | | | | | | |

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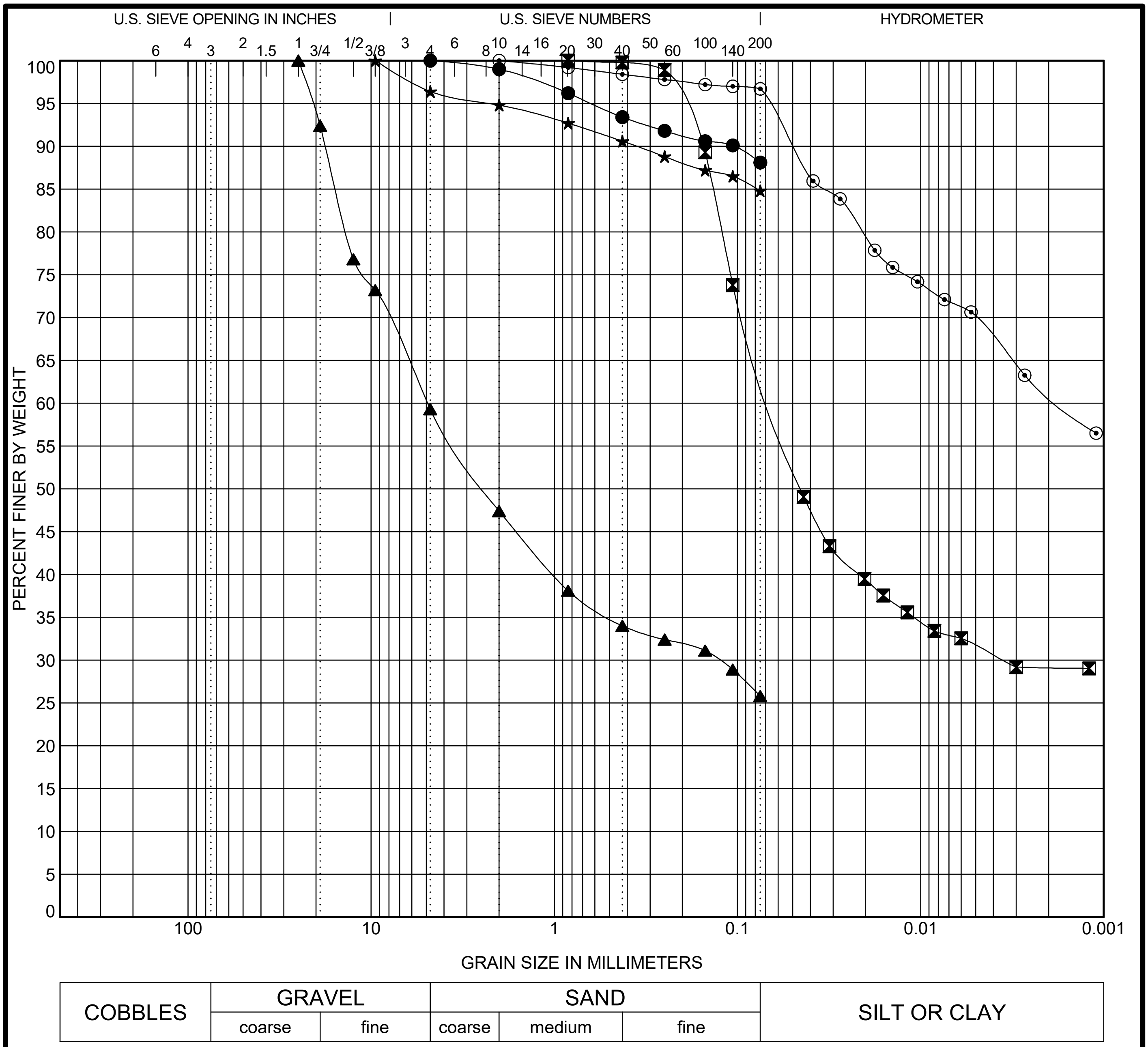
# ATTERBERG LIMITS RESULTS

**ARDOT G013, 020475**
**Hwy. 83 Spur - Hwy. 278 Connector**
**(Monticello)(S)**
**Drew County, Arkansas**
**J037781.01**

US ATTERBERG LIMITS J037781.01.GPJ US LAB.GDT 12/6/21



| Specimen Identification | | | Classification | LL | PL | PI | Cc | Cu |
|---|---|---|---|---|---|---|---|---|
| ● | **B- 1** | **6.0** | **FAT CLAY(CH), A-7-6** | | | | | |
| ⧗ | **B- 2** | **3.0** | **LEAN CLAY(CL), A-7-6** | **46** | **17** | **29** | | |
| ▲ | **B- 9** | **15.0** | **CLAYEY GRAVEL(GC), A-2-6 (1)** | **37** | **20** | **17** | | |
| ★ | **B-10** | **43.5** | **FAT CLAY(CH), A-7-5** | | | | | |
| ⊙ | **B-14** | **6.0** | **FAT CLAY(CH), A-7-6** | | | | | |

| Specimen Identification | | | D100 | D60 | D30 | D10 | %Gravel | %Sand | %Silt | %Clay |
|---|---|---|---|---|---|---|---|---|---|---|
| ● | **B- 1** | **6.0** | **4.75** | | | | **0.0** | **11.9** | **88.1** | |
| ⧗ | **B- 2** | **3.0** | **0.84** | **0.064** | **0.004** | | **0.0** | **35.8** | **32.5** | **31.7** |
| ▲ | **B- 9** | **15.0** | **25** | **4.919** | **0.126** | | **40.7** | **33.5** | **25.8** | |
| ★ | **B-10** | **43.5** | **9.5** | | | | **3.6** | **11.6** | **84.8** | |
| ⊙ | **B-14** | **6.0** | **2** | **0.002** | | | **0.0** | **3.3** | **26.7** | **70.0** |

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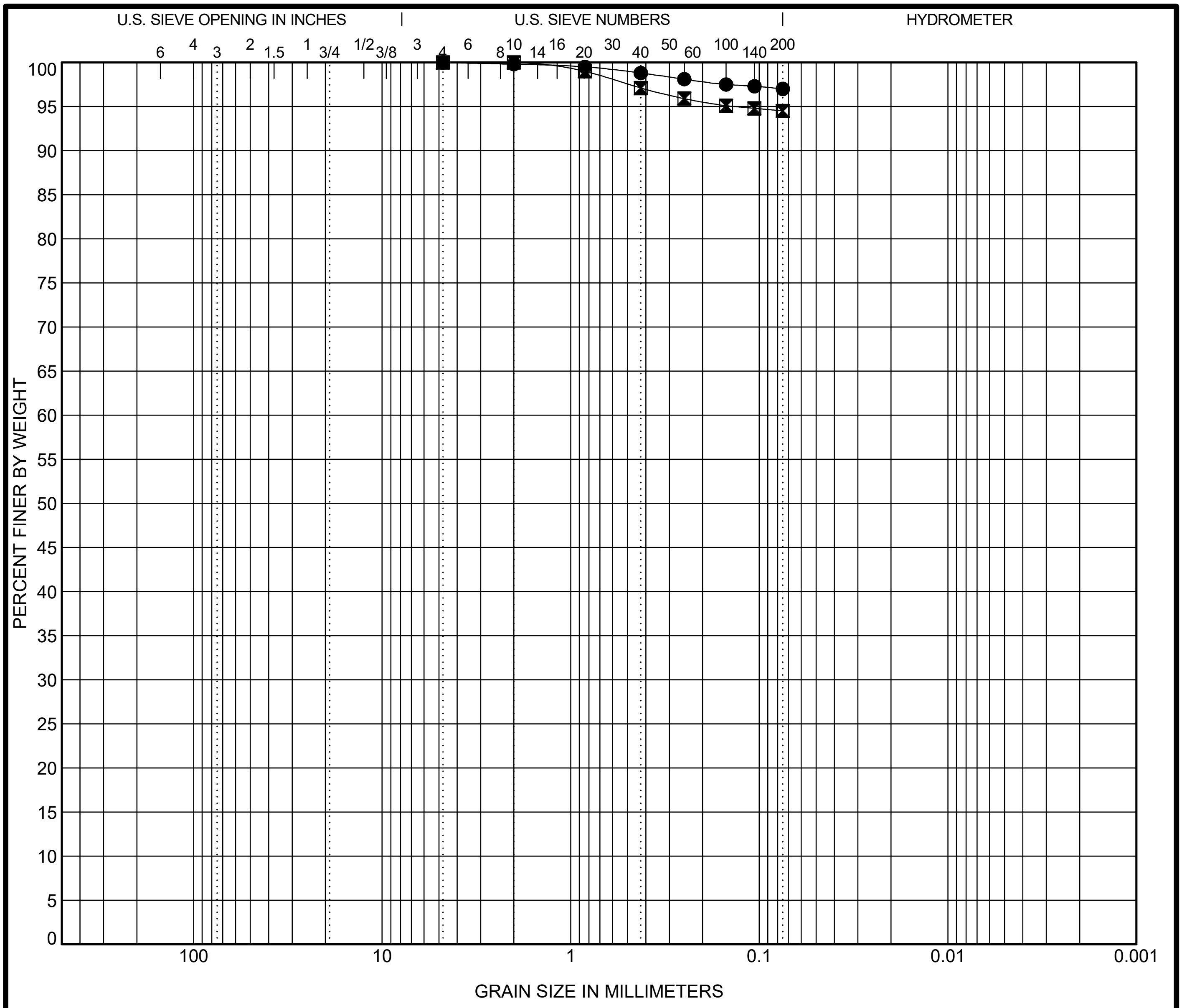
# GRAIN SIZE DISTRIBUTION

**ARDOT G013, 020475**
**Hwy. 83 Spur - Hwy. 278 Connector**
**(Monticello)(S)**
**Drew County, Arkansas**
**J037781.01**

US GRAIN SIZE J037781.01.GPJ US LAB.GDT 12/6/21



| COBBLES | GRAVEL | | SAND | | | SILT OR CLAY |
|---|---|---|---|---|---|---|
| | coarse | fine | coarse | medium | fine | |

| Specimen Identification | | | Classification | LL | PL | PI | Cc | Cu |
|---|---|---|---|---|---|---|---|---|
| ● | **B-14** | **28.5** | **FAT CLAY(CH), A-7-6 (62)** | **82** | **27** | **55** | | |
| ☒ | **B-14** | **38.5** | **FAT CLAY(CH), A-7-5** | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

| Specimen Identification | | | D100 | D60 | D30 | D10 | %Gravel | %Sand | %Silt | %Clay |
|---|---|---|---|---|---|---|---|---|---|---|
| ● | **B-14** | **28.5** | **4.75** | | | | **0.0** | **3.0** | **97.0** | |
| ☒ | **B-14** | **38.5** | **4.75** | | | | **0.0** | **5.5** | **94.5** | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

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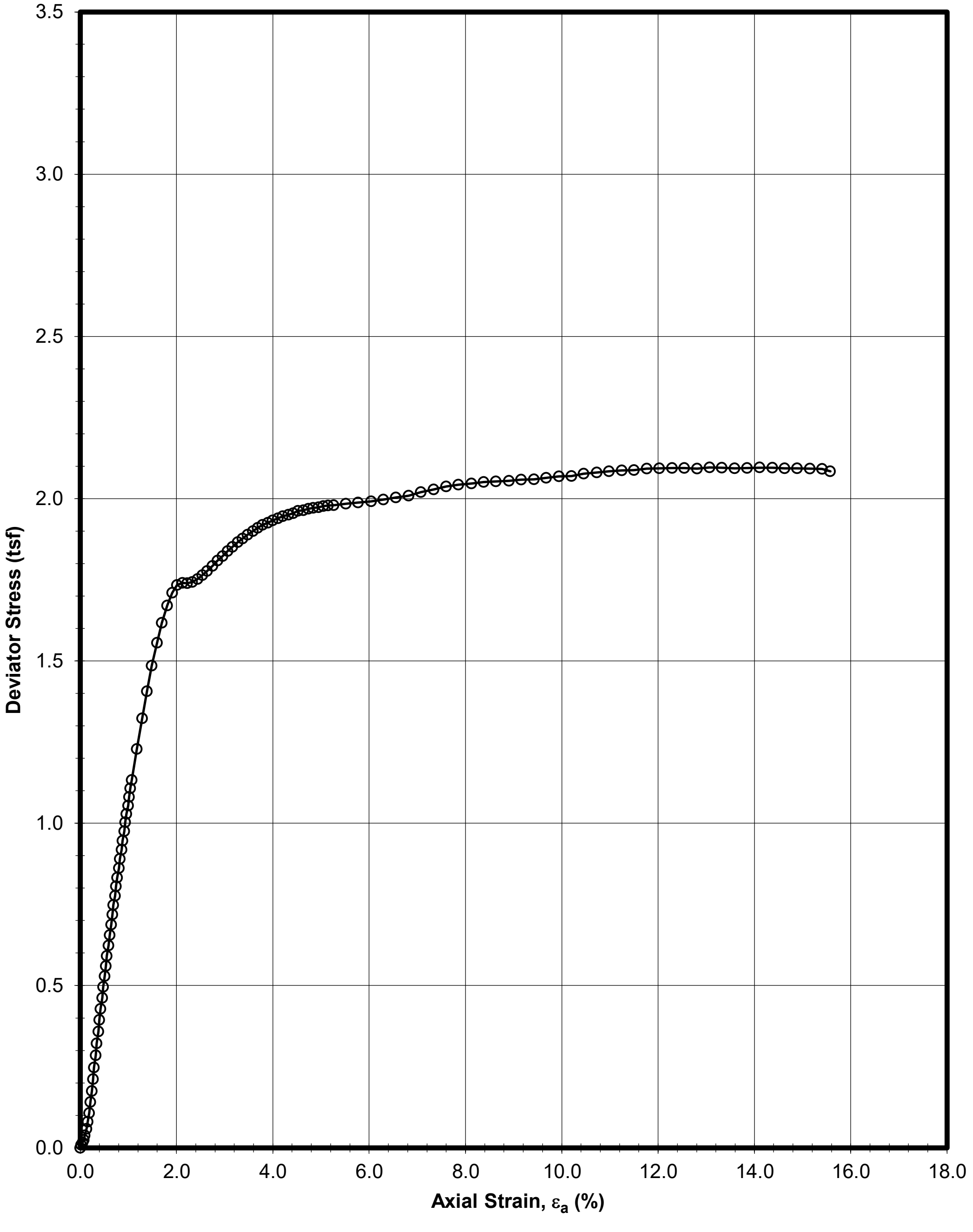
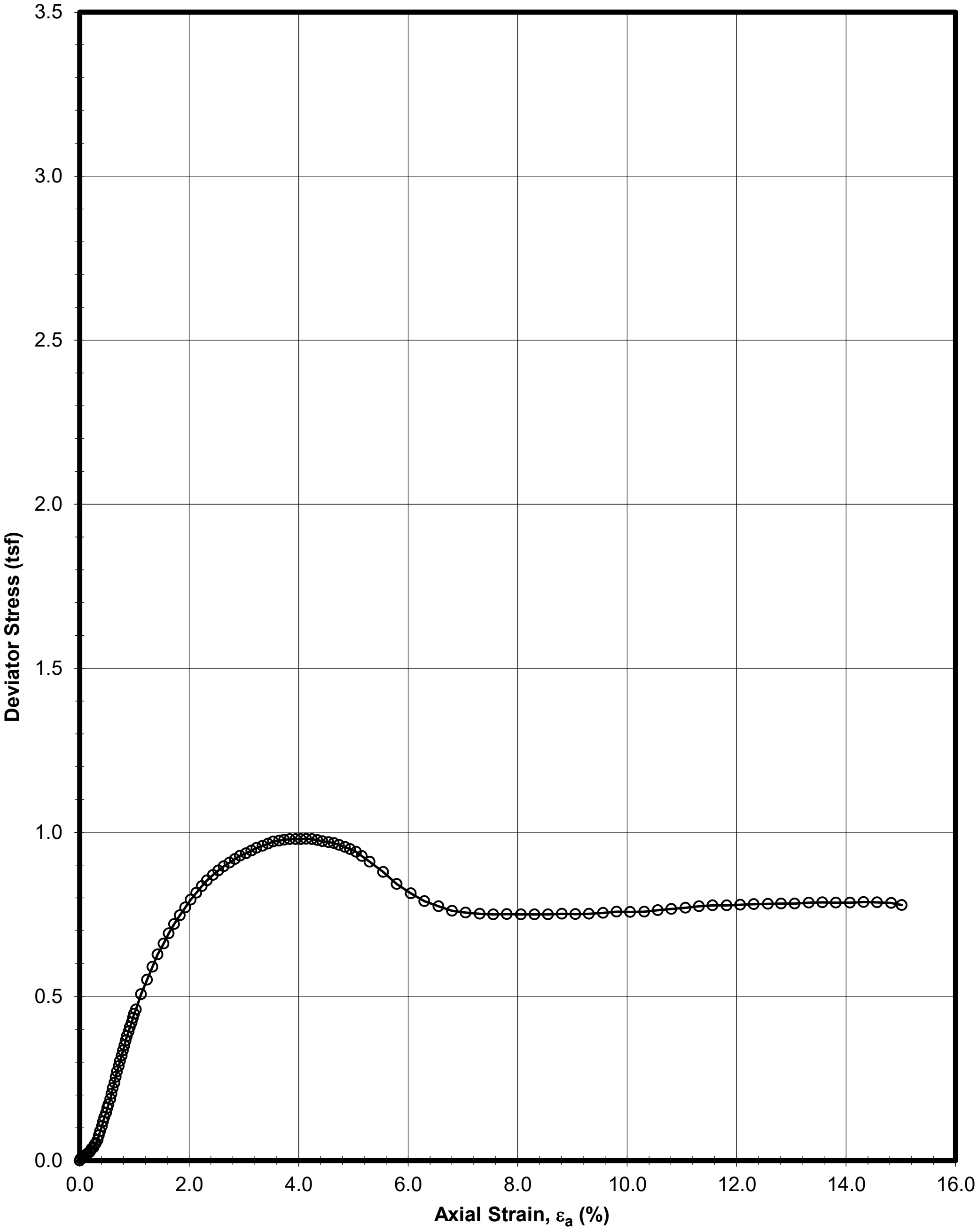
## GRAIN SIZE DISTRIBUTION

**ARDOT G013, 020475**
**Hwy. 83 Spur - Hwy. 278 Connector**
**(Monticello)(S)**
**Drew County, Arkansas**
**J037781.01**



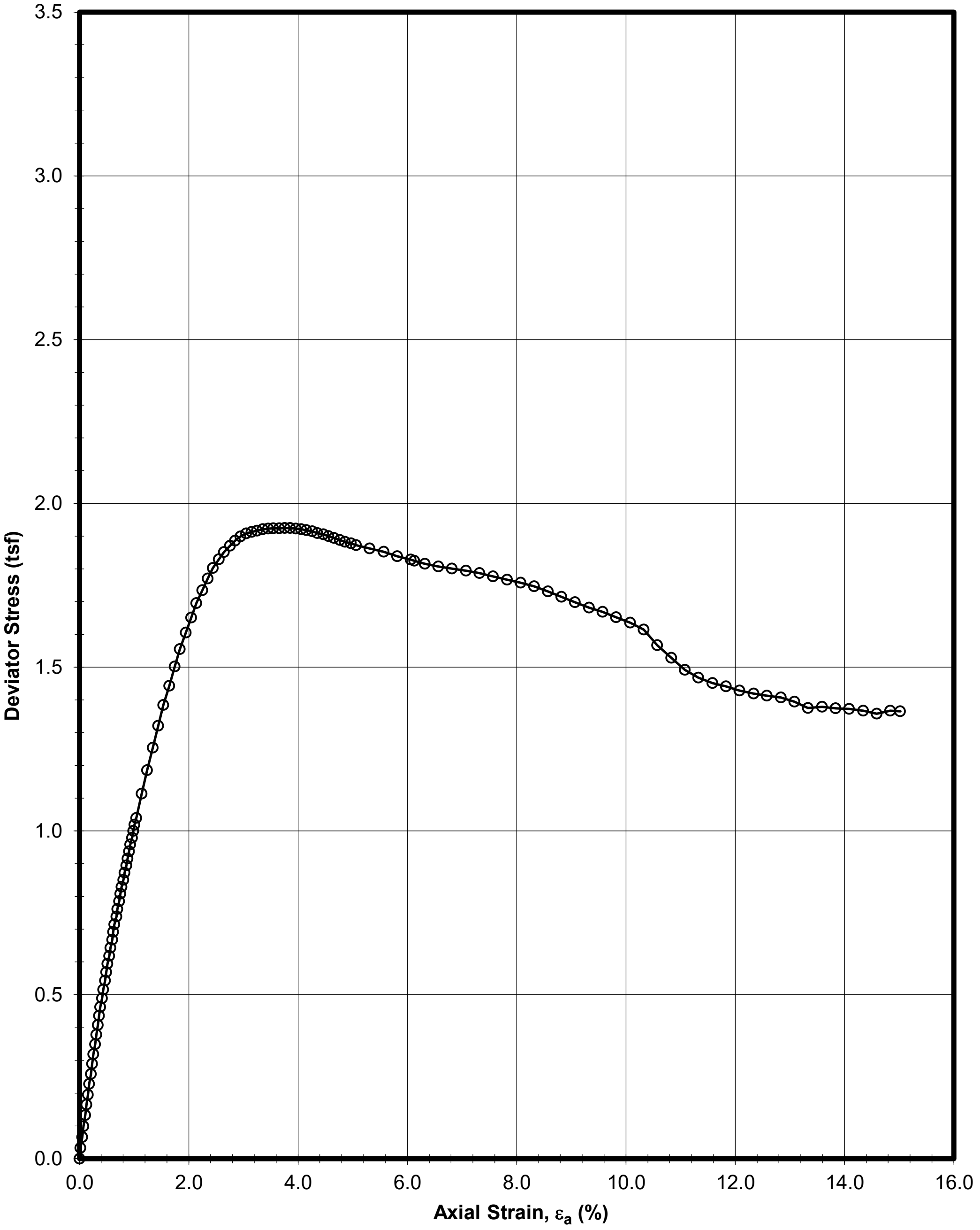
## UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST

ASTM D 2850
Project No.: J037781.01
Boring: B-2
Sample: ST-2 - Depth: 3 ft.



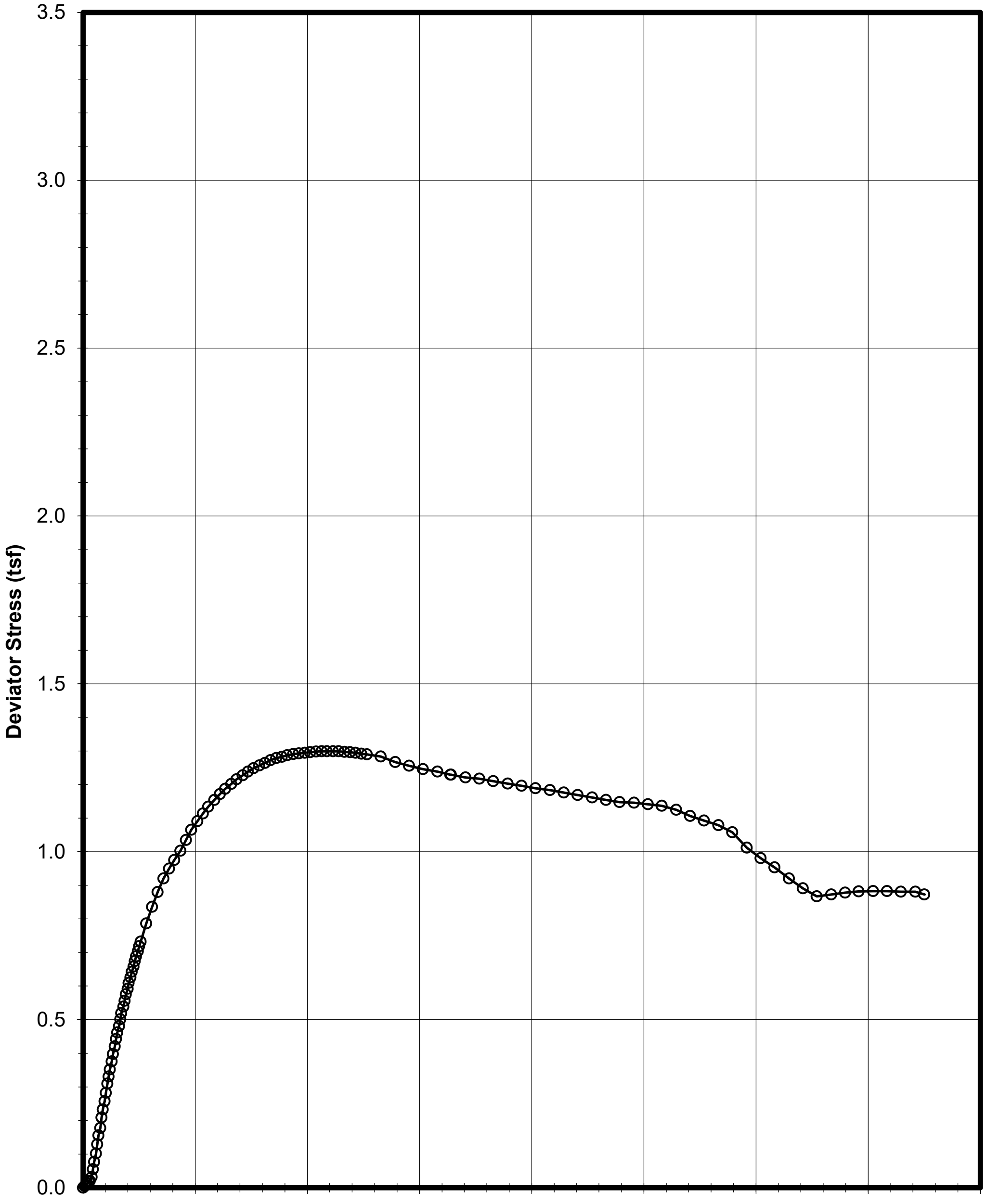
## UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST

ASTM D 2850
Project No.: J037781.01
Boring: B-3
Sample:  ST-5  - Depth: 10  ft.



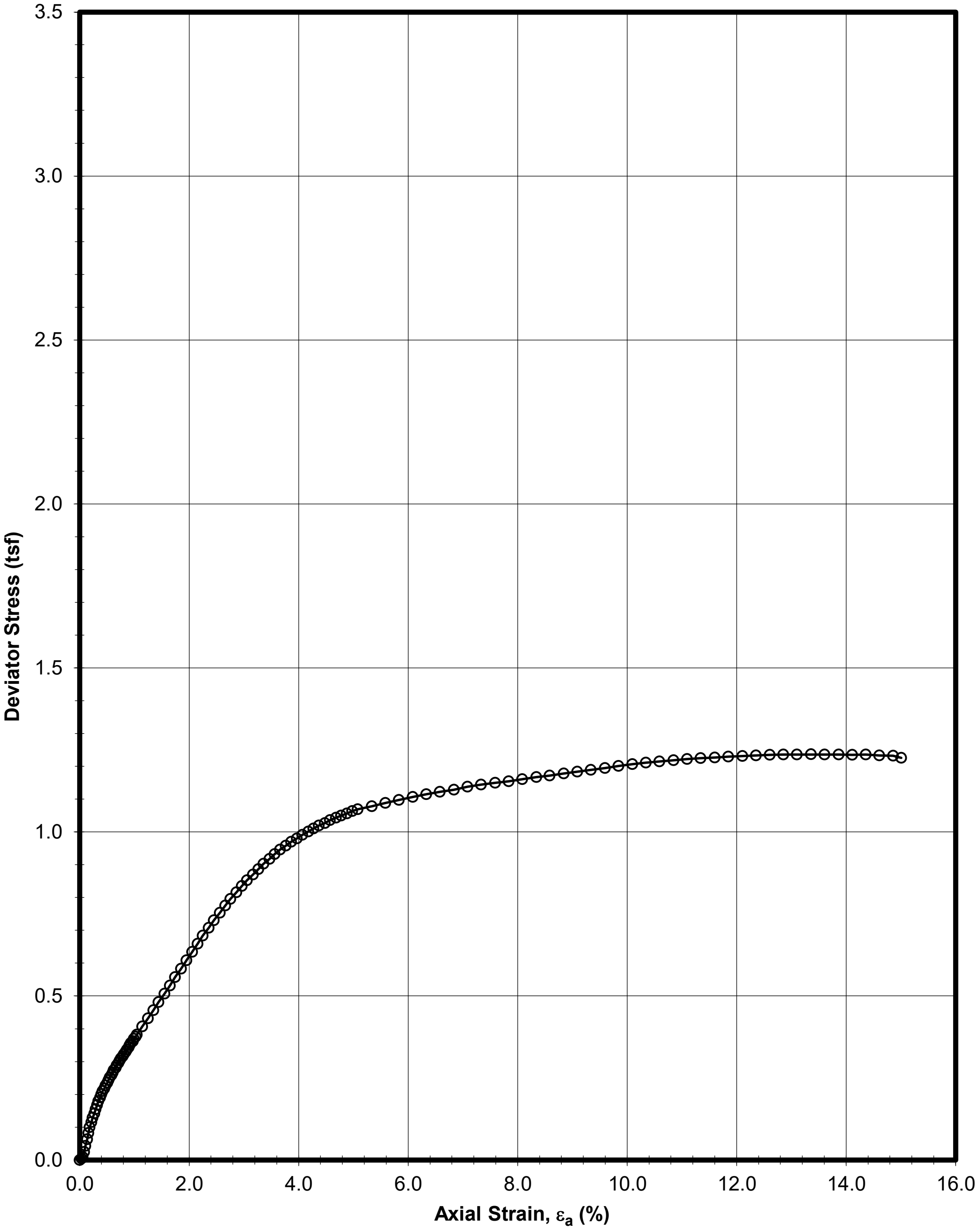
**UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST**

ASTM D 2850
Project No.: J037781.01
Boring: B-3
Sample: ST7 - Depth: 15 ft.



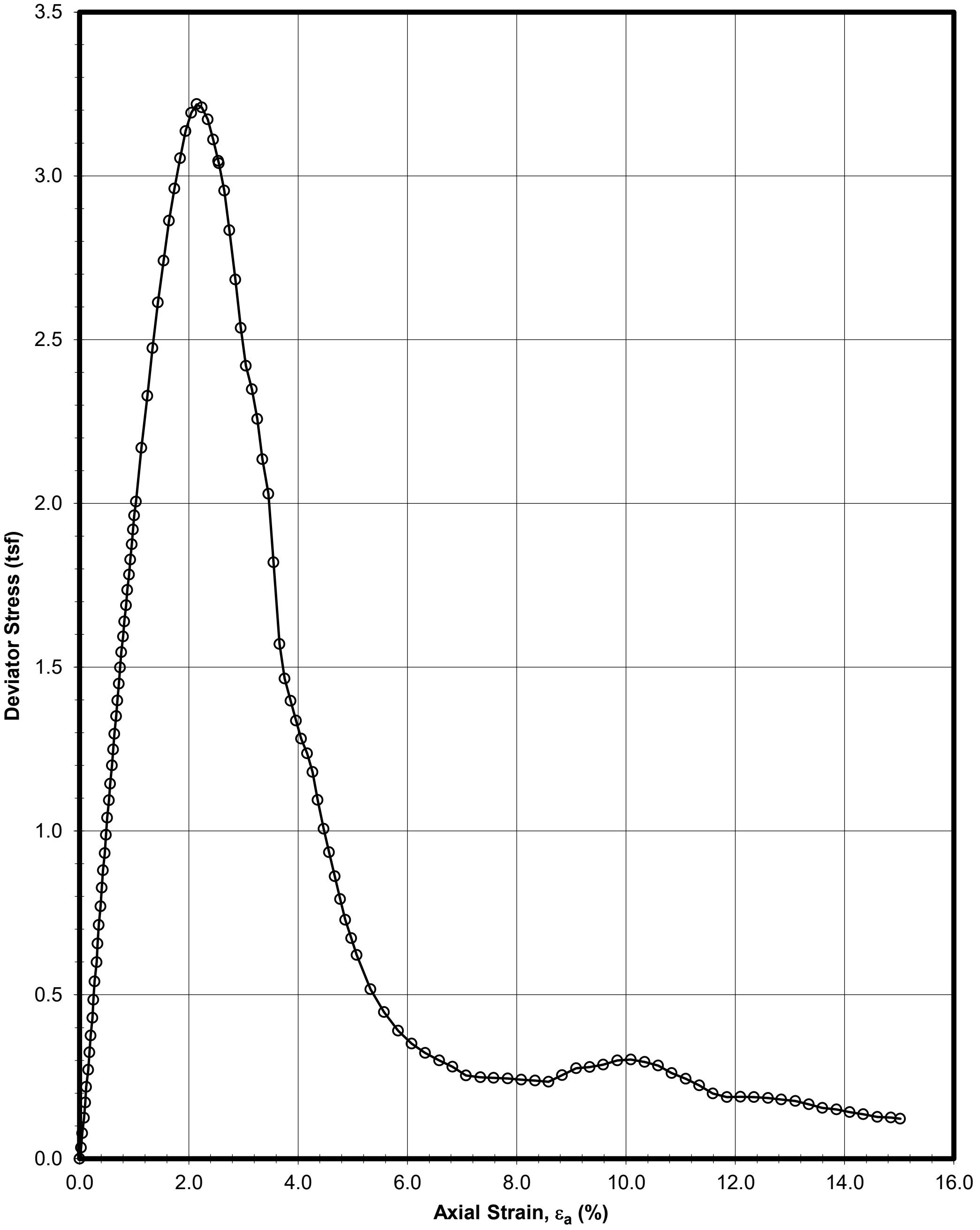
## UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST

ASTM D 2850
Project No.: J037781.01
Boring: B-4
Sample: ST-5 - Depth: 10 ft.



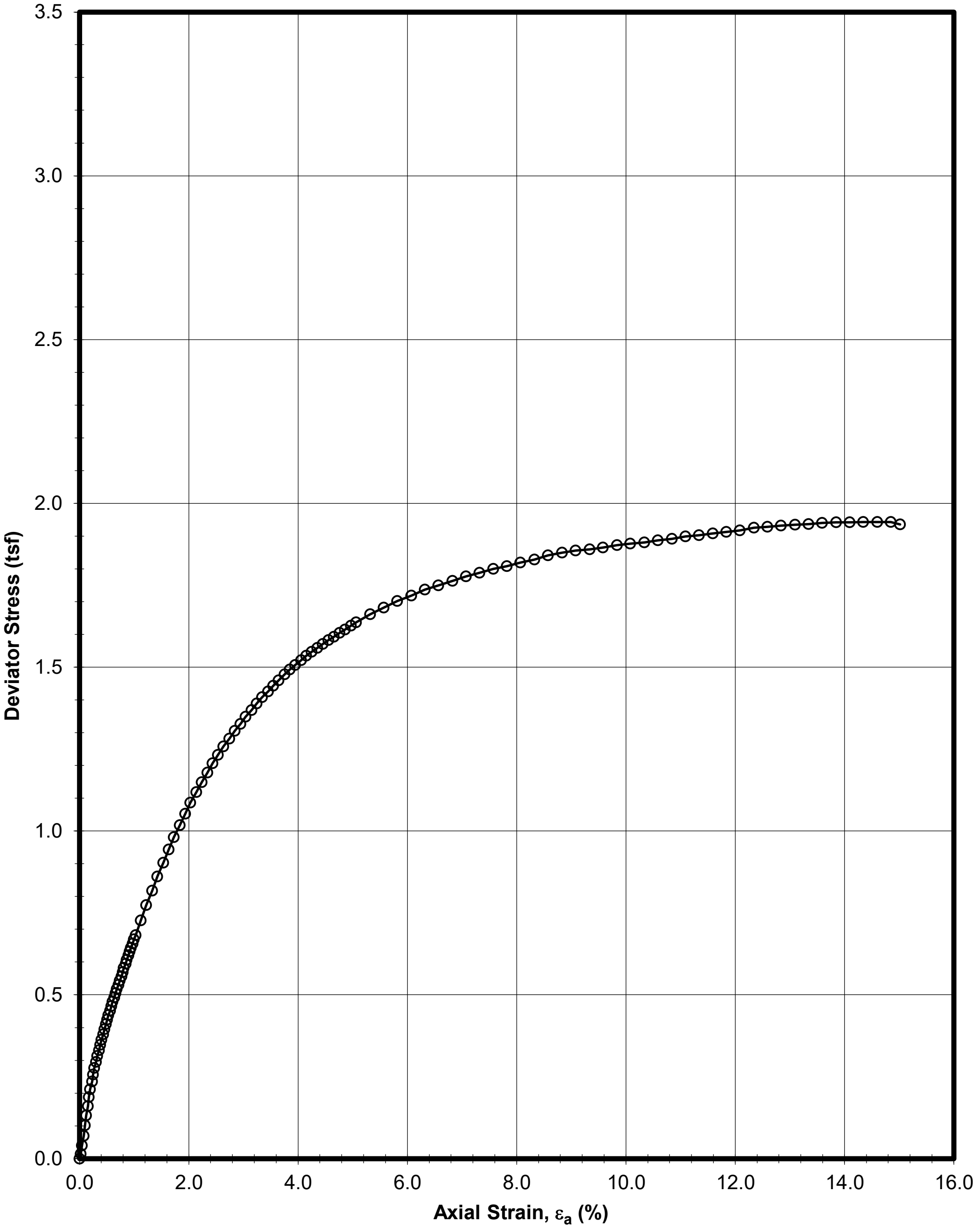
## UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST

ASTM D 2850
Project No.: J037781.01
Boring: B-6
Sample: ST-4 - Depth: 8 ft.



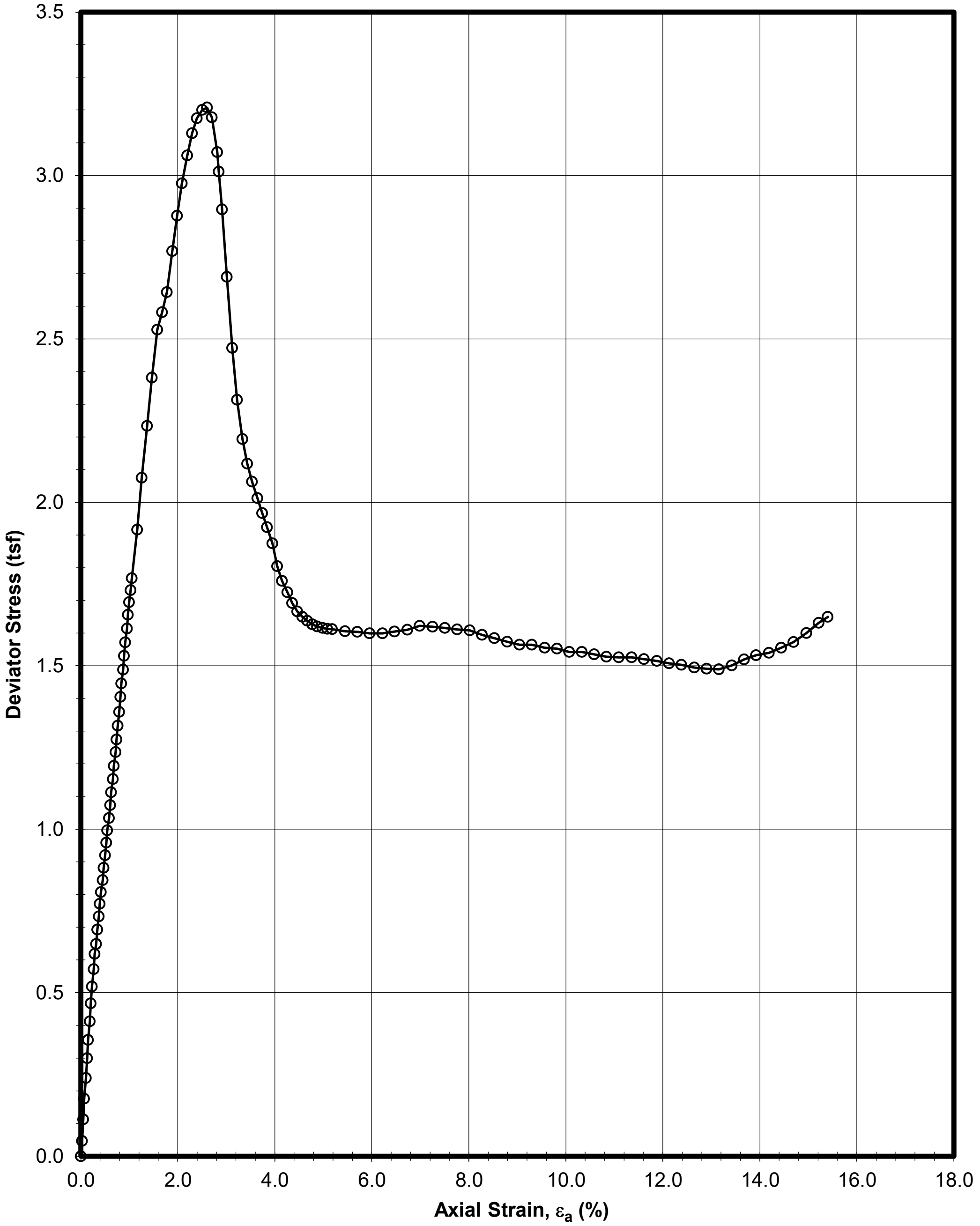
## UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST

ASTM D 2850
Project No.: J037781.01
Boring: B-8
Sample: ST-9 - Depth: 25 ft.



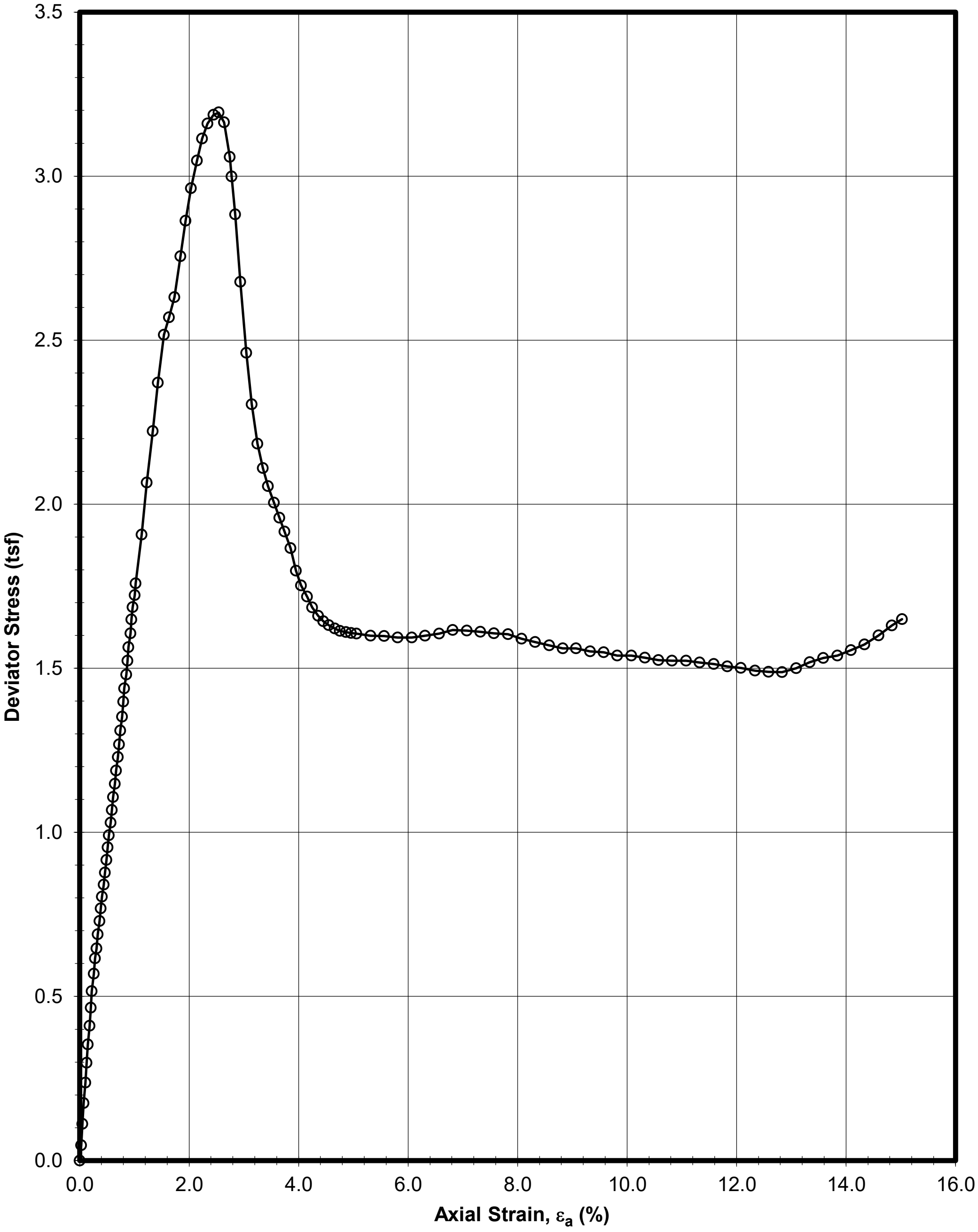
## UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST

ASTM D 2850
Project No.: J037781.01
Boring: B-9
Sample: ST-5 - Depth: 11 ft.



# UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST

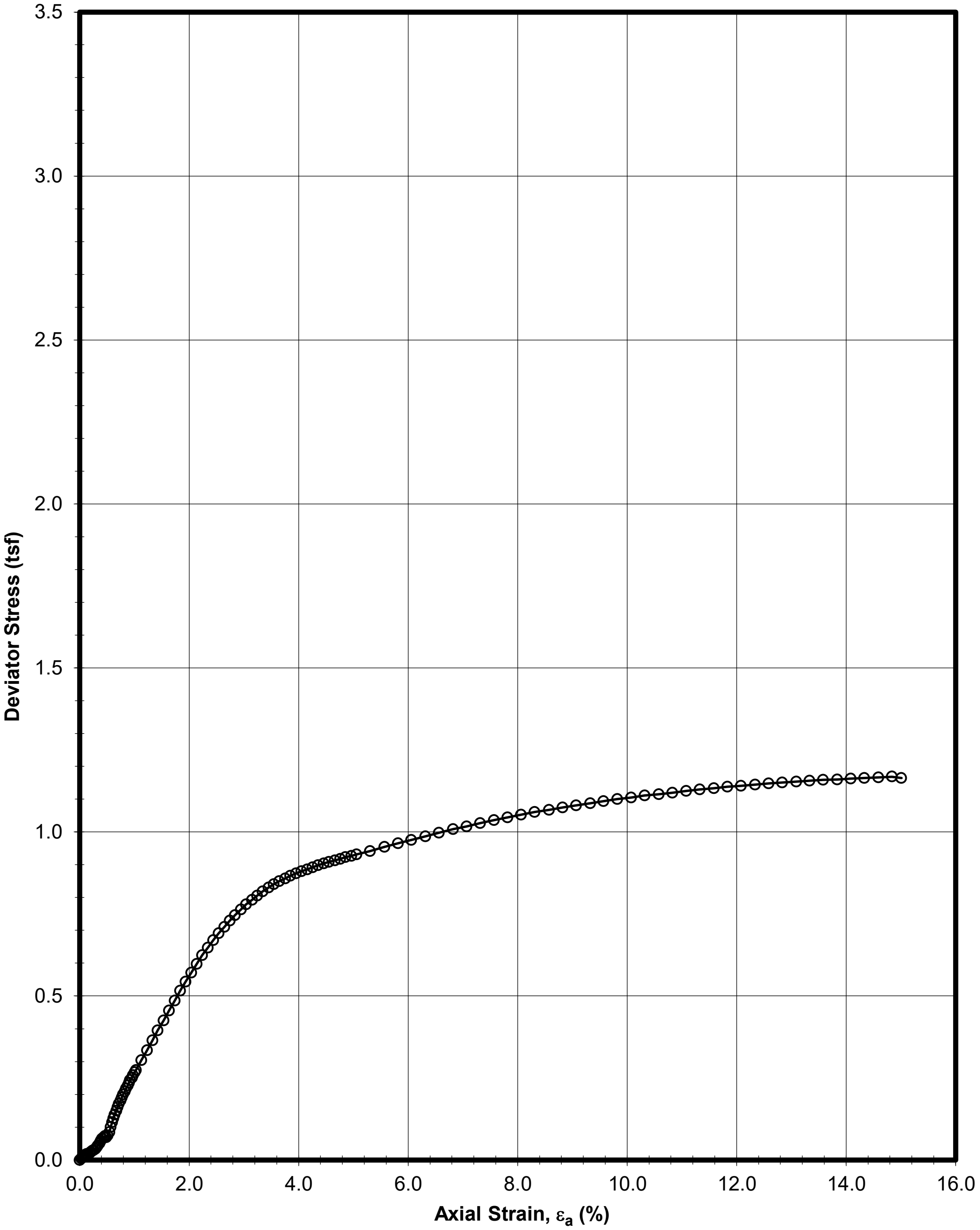
ASTM D 2850
Project No.: J037781.01
Boring: B-10
Sample: ST-6 - Depth: 15 ft.



## UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST

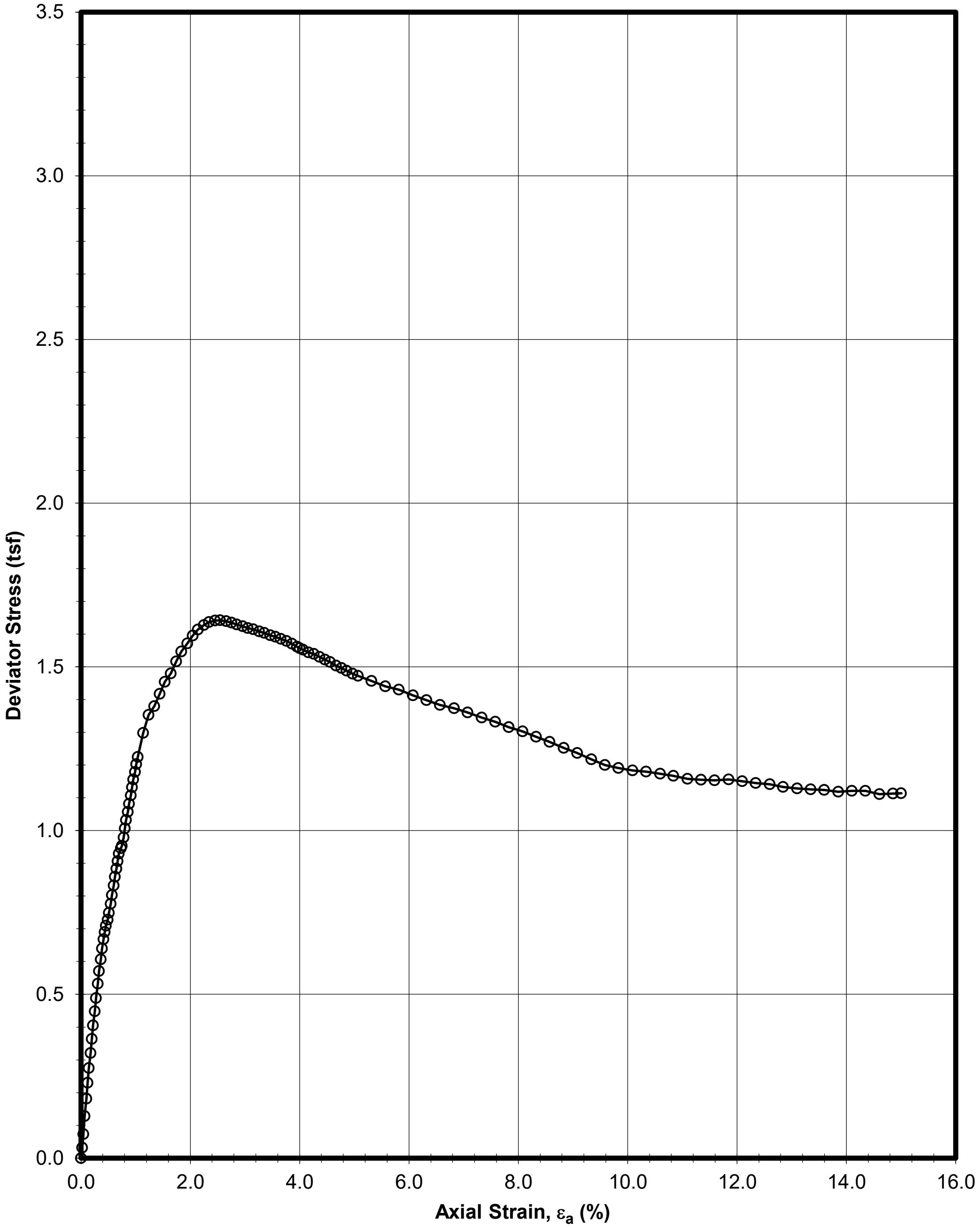
ASTM D 2850
Project No.: J037781.01
Boring: B-10
Sample: ST-7 - Depth: 20 ft.

GEOTECHNOLOGY
A Universal Engineering Sciences Company



**UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST**

ASTM D 2850
Project No.: J037781.01
Boring: B-11
Sample: ST-4 - Depth: 8 ft.



# UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST

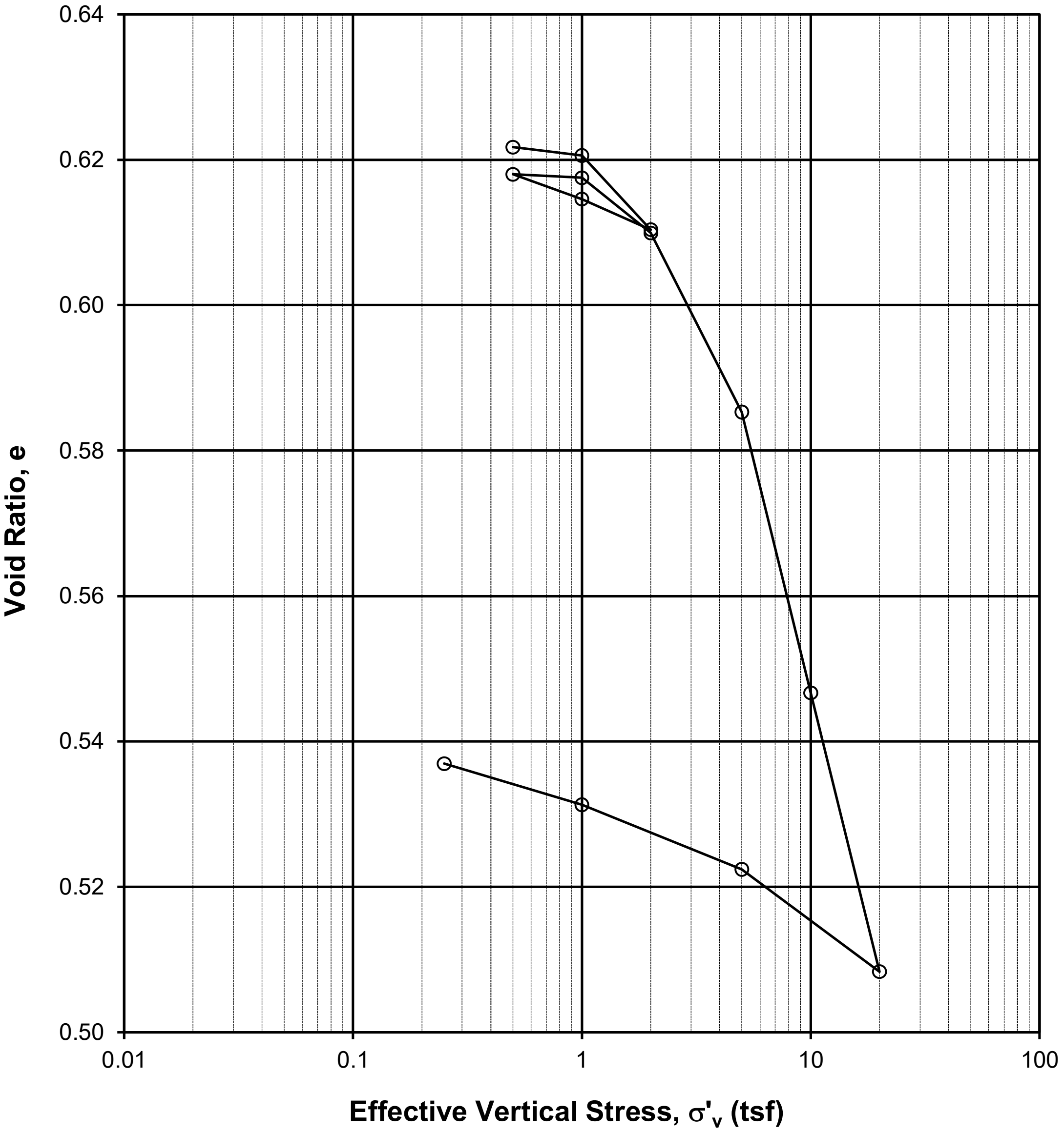
ASTM D 2850
Project No.: J037781.01
Boring: B-12
Sample: ST-6 - Depth: 15 ft.

GEOTECHNOLOGY
A Universal Engineering Sciences Company

Liquid Limit= 46 Plastic Limit= 17 Plasticity Index = 29 USCS: CL

Compression Index, $C_c$ = 0.13 Void Ratio, $e_o$ = 0.619

Recompression Index, $C_r$ = 0.01 Preconsolidation Pressure = 3.0 tsf



## 1-D CONSOLIDATION TEST: INCREMENTAL

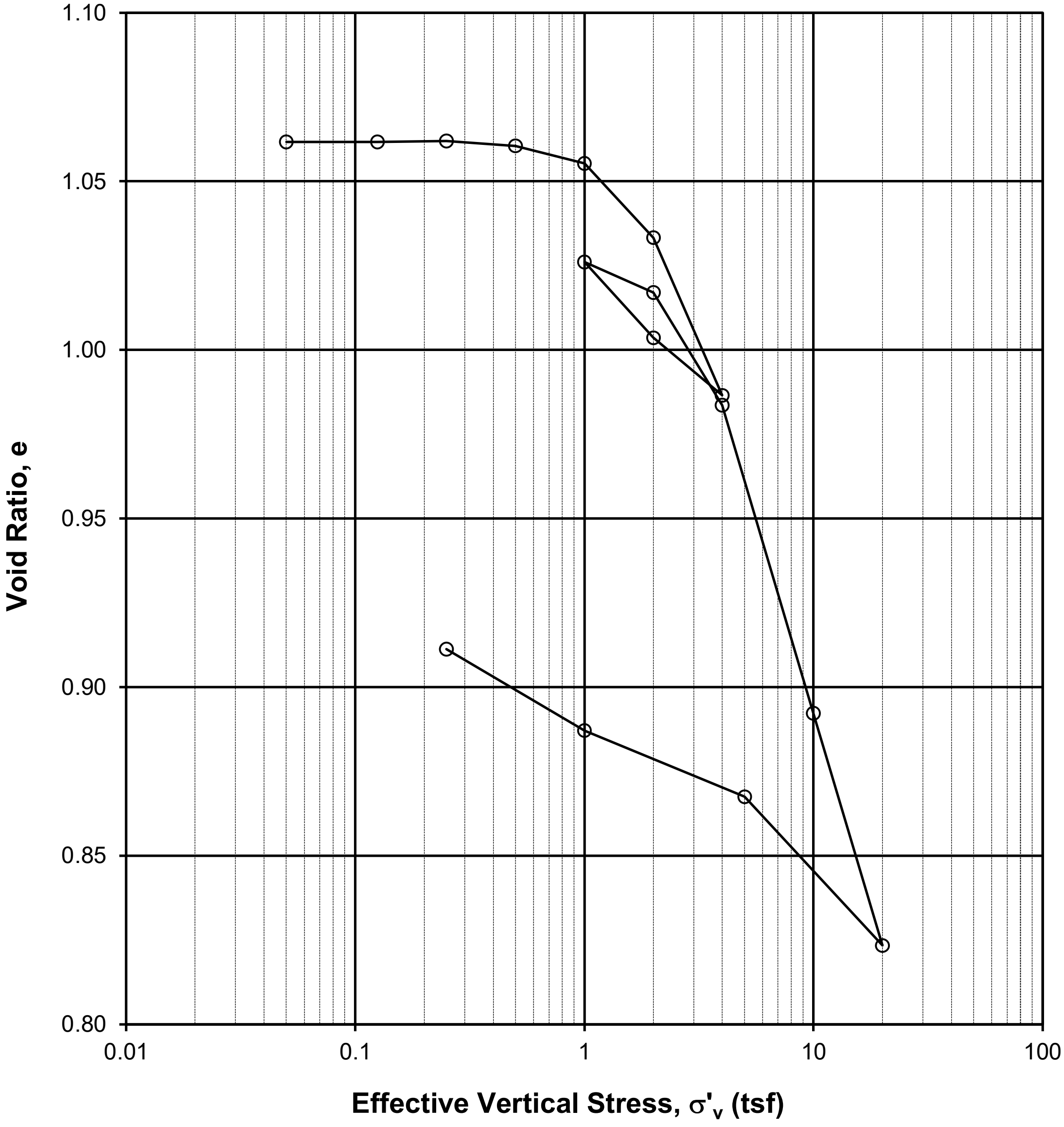
ASTM D 2435
Project No.: J037781.01
Boring: B-2
Sample: ST-2 - Depth: 3.0

**GEOTECHNOLOGY**
A Universal Engineering Sciences Company

Liquid Limit= 95 Plastic Limit= 31 Plasticity Index = 64 USCS: CH

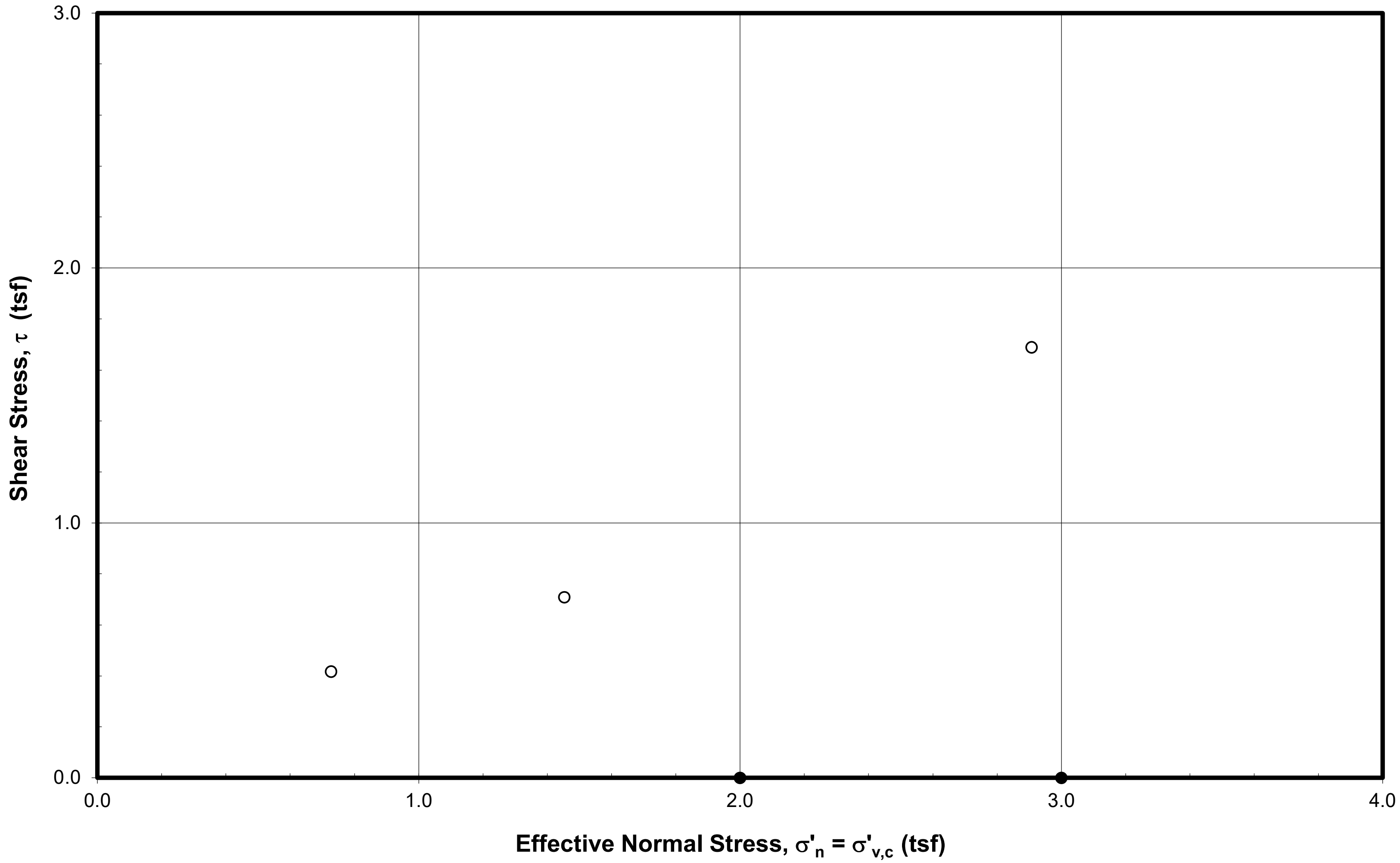
Compression Index, $C_c$ = 0.23 Void Ratio, $e_o$ = 1.06

Recompression Index, $C_r$ = 0.06 Preconsolidation Pressure = 2.25 tsf



## 1-D CONSOLIDATION TEST: INCREMENTAL

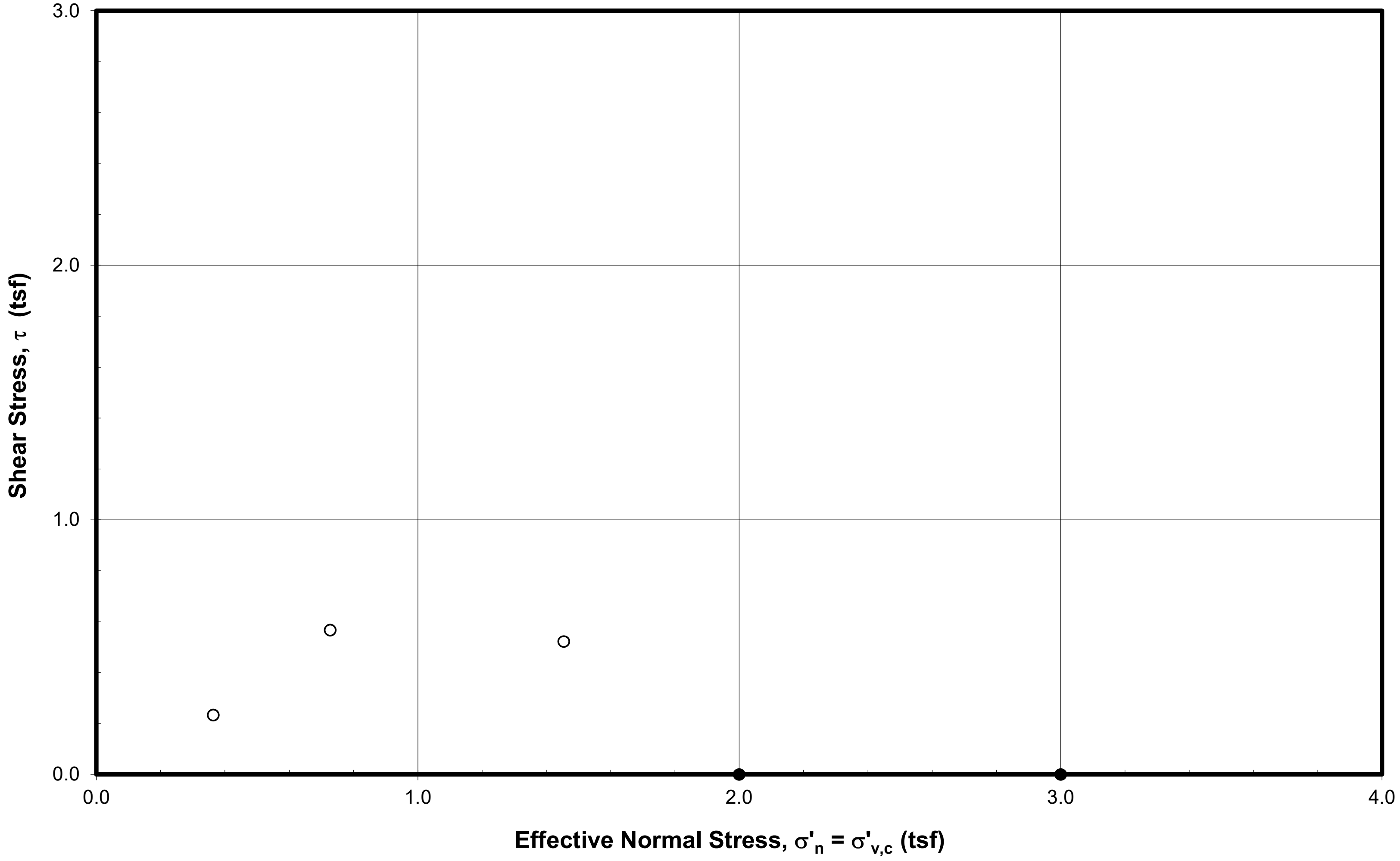
ASTM D 2435
Project No.: J037781.01
Boring: B-12
Sample: ST-6 - Depth: 15.0



**DRAINED DIRECT SHEAR TEST**

ASTM D 3080

Boring: B-2 Sample: ST-4 -Depth: 8.0ft



## DRAINED DIRECT SHEAR TEST

ASTM D 3080

Boring: B-13 Sample: ST-5 -Depth: 10.0ft

# TEST REPORT

**Prepared For:**
**Arkansas State Highway and Transportation Department**
**PO Box 2261**
**Little Rock, Arkansas 72203**

| | | |
|---|---|---|
| **Project No.:** | **J037781.01** | **December 1, 2021** |
| **Project Name:** | **ARDOT 020475, Monticello** | **Page 1 of 1** |
| **Boring Number:** | **B-2** | |
| **Sample ID:** | **SS-11** | |
| **Depth (ft):** | **43.5** | |

## MINIMUM LABORATORY SOIL RESISTIVITY
## AASHTO T288

| Reading | Resistance Measurement | Soil Box Factor (cm) | Soil Resistivity (ohms-cm) | Moisture Content (%) |
|---|---|---|---|---|
| #1 | 1,690 | 0.57 | 963.30 | 22.9 |
| #2 | 900 | 0.57 | 513.00 | 25.7 |
| #3 | 870 | 0.57 | 495.90 | 31.3 |
| #4 | 890 | 0.57 | 507.30 | 36.5 |

**Minimum Soil Resistivity** **495.90**

# TEST REPORT

**Prepared For:**
**Arkansas State Highway and Transportation Department**
**PO Box 2261**
**Little Rock, Arkansas 72203**

**Project No.:** J037781.01 — **November 19, 2021**
**Project Name:** ARDOT 020475, Monticello — **Page 1 of 1**
**Boring Number:** B-5
**Sample ID:** SS-11 – SS-12
**Depth (ft):** 43.5 – 48.5

## MINIMUM LABORATORY SOIL RESISTIVITY
## AASHTO T288

| Reading | Resistance Measurement | Soil Box Factor (cm) | Soil Resistivity (ohms-cm) | Moisture Content (%) |
|---|---|---|---|---|
| | | | | |
| #1 | 2,000 | 0.57 | 1,140.00 | 26.8 |
| #2 | 940 | 0.57 | 535.80 | 26.3 |
| #3 | 950 | 0.57 | 541.50 | 31.2 |
| | **Minimum Soil Resistivity** | | **535.80** | |

# TEST REPORT

**Prepared For:**
**Arkansas State Highway and Transportation Department**
**PO Box 2261**
**Little Rock, Arkansas 72203**

**Project No.:** **J037781.01** **November 19, 2021**
**Project Name:** **ARDOT 020475, Monticello** **Page 1 of 1**
**Boring Number:** **B-9**
**Sample ID:** **SS-13 – SS-16**
**Depth (ft):** **53.5 – 68.5**

## MINIMUM LABORATORY SOIL RESISTIVITY
## AASHTO T288

| Reading | Resistance Measurement | Soil Box Factor (cm) | Soil Resistivity (ohms-cm) | Moisture Content (%) |
|---|---|---|---|---|
| #1 | 1,400 | 0.57 | 798.00 | 20.2 |
| #2 | 980 | 0.57 | 558.60 | 27.8 |
| #3 | 830 | 0.57 | 473.10 | 31.8 |
| #4 | 870 | 0.57 | 495.90 | 36.3 |

**Minimum Soil Resistivity** **473.10**

# TEST REPORT

**Prepared For:**
**Arkansas State Highway and Transportation Department**
**PO Box 2261**
**Little Rock, Arkansas 72203**

| | | |
|---|---|---|
| **Project No.:** | **J037781.01** | **November 19, 2021** |
| **Project Name:** | **ARDOT 020475, Monticello** | **Page 1 of 1** |
| **Boring Number:** | **B-11** | |
| **Sample ID:** | **SS-10 – SS-11** | |
| **Depth (ft):** | **38.5 – 43.5** | |

## MINIMUM LABORATORY SOIL RESISTIVITY
## AASHTO T288

| Reading | Resistance Measurement | Soil Box Factor (cm) | Soil Resistivity (ohms-cm) | Moisture Content (%) |
|---|---|---|---|---|
| #1 | 1,890 | 0.57 | 1,077.30 | 22.9 |
| #2 | 960 | 0.57 | 547.20 | 30.7 |
| #3 | 710 | 0.57 | 404.70 | 38.5 |
| #4 | 750 | 0.57 | 427.50 | 42.4 |

**Minimum Soil Resistivity** **404.70**

# TEST REPORT

**Prepared For:**
**Arkansas State Highway and Transportation Department**
**PO Box 2261**
**Little Rock, Arkansas 72203**

| | | |
|---|---|---|
| **Project No.:** | **J037781.01** | **December 1, 2021** |
| **Project Name:** | **ARDOT 020475, Monticello** | **Page 1 of 1** |
| **Boring Number:** | **B-14** | |
| **Sample ID:** | **SS-13** | |
| **Depth (ft):** | **53.5** | |

## MINIMUM LABORATORY SOIL RESISTIVITY
## AASHTO T288

| Reading | Resistance Measurement | Soil Box Factor (cm) | Soil Resistivity (ohms-cm) | Moisture Content (%) |
|---|---|---|---|---|
| #1 | 1,220 | 0.57 | 695.40 | 30.3 |
| #2 | 980 | 0.57 | 558.60 | 29.9 |
| #3 | 780 | 0.57 | 444.60 | 33.8 |
| #4 | 790 | 0.57 | 450.30 | 40.3 |

**Minimum Soil Resistivity** **444.60**

## pH TESTS (ASTM D 4972 or AASHTO T-289)

GEOTECHNOLOGY
A Universal Engineering Sciences Company

| | | |
|---|---|---|
| DATE<br>11/19/2021 | PROJECT<br>NAME ARDOT 020475, Monticello | PROJECT<br>NO. J037781.01 |

General Test Information:
pH Meter: Humboldt Ph Testr H-4371 or ________
Distilled Water: required pH=5.5 to 7.5 Measured value:________
Soil/Water Ratio: Typically 1/1 or 1/2, but 1/5 for lime stabilized soils

| Boring No. | Sample No. | Depth (ft) | Visual Identification (Color, Group Name & Symbol) | Soil : Water Ratio (g/g) or (g/mL) | pH of Solution (Meter/ Paper)[1] | Tare No. Air Drying | Jar Number | Remarks |
|---|---|---|---|---|---|---|---|---|
| B-2 | SS-11 | 43.50 | | 1 / 1 | 8.03<br>-------<br>21.8 | | | |
| B-5 | SS-11 | 43.50 | | 1 / 1 | 7.55<br>-------<br>23.0 | | | |
| B-9 | SS-13 | 53.50 | | 1 / 1 | 7.74<br>-------<br>21.4 | | | |
| B-11 | SS-10 | 38.50 | | 1 / 1 | 7.43<br>-------<br>21.2 | | | |
| B-14 | SS-13 | 53.50 | | 1 / 1 | 8.02<br>-------<br>21.9 | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | ------------- | | | |
| | | | | | ------------- | | | |
| | | | | | ------------- | | | |

[1] pH by Meter is Method A; pH by Paper is Method B

Tested By: KS
Date: 11/22/21

Calculated By: HP
Date: 11/22/21

Checked By: JM
Date: 11/30/21

# APPENDIX F – AASHTO AND USCS CLASSIFICATIONS

Project: ARDOT 020475
Hwy. 83 Spur – Hwy. 278 Connector
(Monticello) (S)
Number: J037781.01

| Borehole | Depth | Liquid Limit (LL) | Plastic Limit (PL) | Plasticity Index (PI) | %<#10 Sieve | %<#40 Sieve | %<#200 Sieve | GI | AASHTO CLASS. | USCS CLASS. |
|---|---|---|---|---|---|---|---|---|---|---|
| B-1 | 6 | -- | -- | -- | 99 | 93.4 | 88.1 | -- | A-7-6 | CH |
| B-2 | 3 | 46 | 17 | 29 | -- | -- | -- | -- | A-7-6 | CL |
|  | 8 | 71 | 25 | 46 | -- | -- | -- | -- | A-7-6 | CH |
| B-3 | 10 | 81 | 37 | 44 | -- | -- | -- | -- | A-7-5 | MH |
|  | 15 | 90 | 30 | 60 | -- | -- | -- | -- | A-7-5 | CH |
| B-4 | 10 | 72 | 21 | 51 | -- | -- | -- | -- | A-7-6 | CH |
| B-6 | 8 | 51 | 18 | 33 | -- | -- | -- | -- | A-7-6 | CH |
| B-8 | 20 | 90 | 31 | 59 | -- | -- | -- | -- | A-7-5 | CH |
|  | 25 | 80 | 29 | 51 | -- | -- | -- | -- | A-7-6 | CH |
| B-9 | 11 | 39 | 19 | 20 | -- | -- | -- | -- | A-6 | CL |
|  | 15 | 37 | 20 | 17 | 47.4 | 34 | 25.8 | 1 | A-2-6 (1) | GC |
| B-10 | 13.5 | 41 | 16 | 25 | -- | -- | -- | -- | A-7-6 | CL |
|  | 15 | 83 | 25 | 58 | -- | -- | -- | -- | A-7-6 | CH |
|  | 20 | 96 | 29 | 67 | -- | -- | -- | -- | A-7-6 | CH |
|  | 43.5 | -- | -- | -- | 94.8 | 90.6 | 84.8 | -- | A-7-5 | CH |
| B-11 | 8 | 38 | 15 | 23 | -- | -- | -- | -- | A-6 | CL |
| B-12 | 15 | 95 | 31 | 64 | -- | -- | -- | -- | A-7-5 | CH |
| B-13 | 6 | 30 | 16 | 14 | -- | -- | -- | -- | A-6 | CL |
|  | 10 | 69 | 27 | 42 | -- | -- | -- | -- | A-7-6 | CH |
| B-14 | 6 | -- | -- | -- | 100 | 98.4 | 96.7 |  | A-7-6 | CH |
|  | 28.5 | 82 | 27 | 55 | 99.8 | 98.8 | 97 | 62 | A-7-6 (62) | CH |
|  | 38.5 | -- | -- | -- | 100 | 97.1 | 94.5 | -- | A-7-6 | CH |

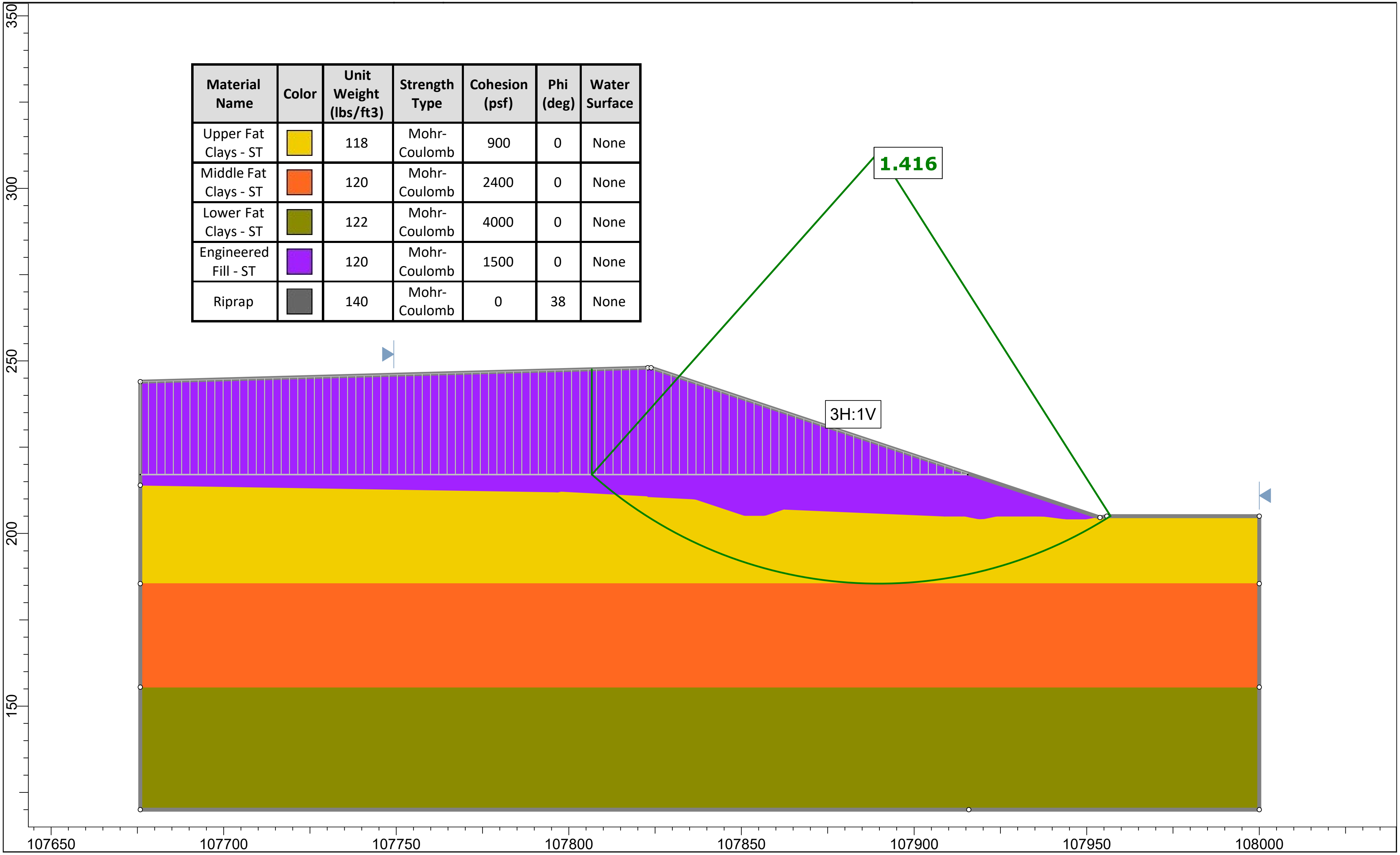
# APPENDIX G – GLOBAL STABILITY ANALYSES

GEOTECHNOLOGY
A Universal Engineering Sciences Company

File Name: ARDOT 020475 Monticello - Copy.slmd
Name: Southern Abutment
Description: Short Term Conditions
Method: Spencer
Date: 5/11/2022

Project Number: J037781.01
Client: ARODT
Project: ARDOT GO13, 020475
Hwy. 83 Spur - Hwy. 278
Connector (Monticello) (S)
South Abutment - STA 1078+22

SLIDEINTERPRET 9.022



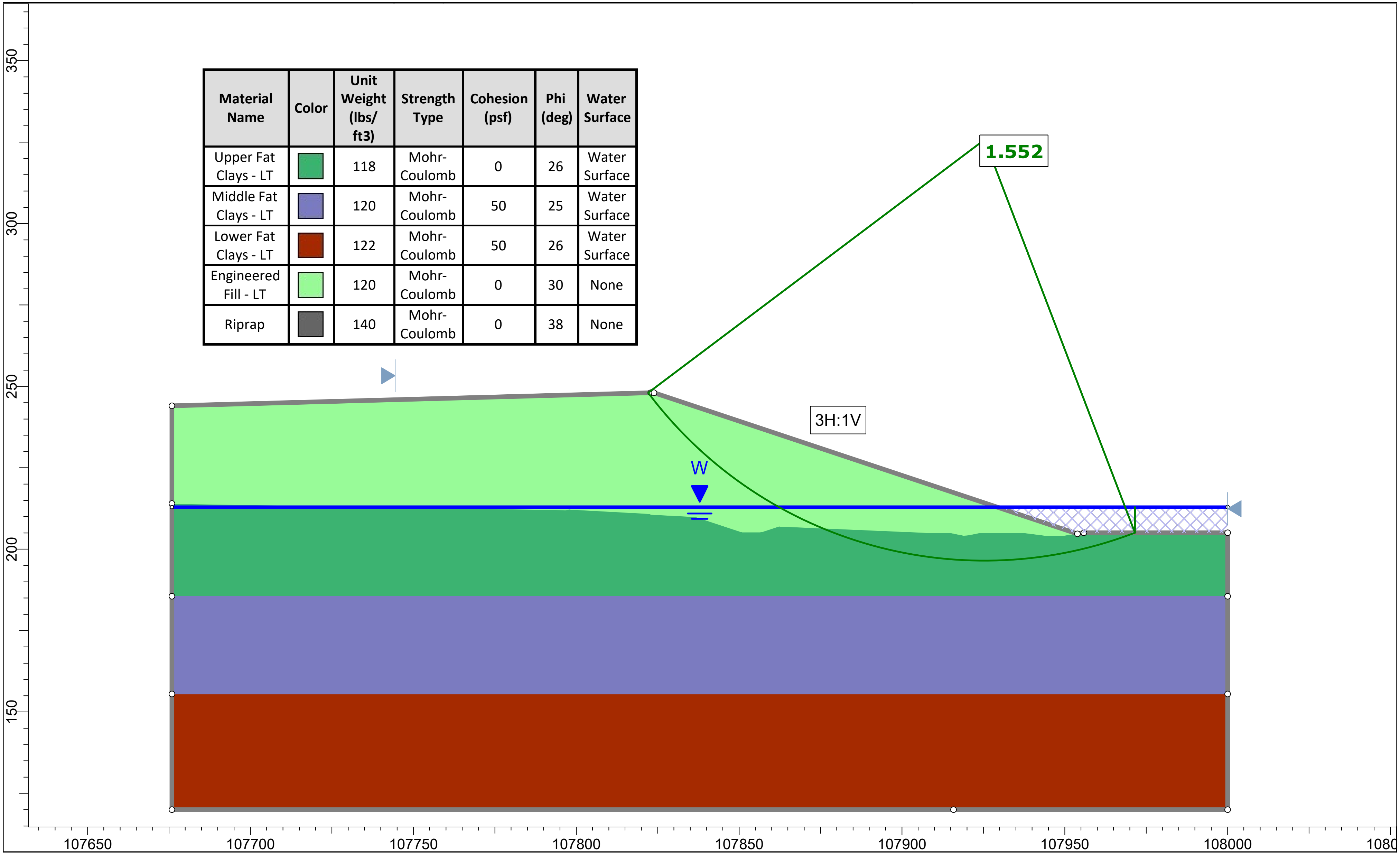
| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface |
|---|---|---|---|---|---|---|
| Upper Fat Clays - ST | 🟨 | 118 | Mohr-Coulomb | 900 | 0 | None |
| Middle Fat Clays - ST | 🟧 | 120 | Mohr-Coulomb | 2400 | 0 | None |
| Lower Fat Clays - ST | 🟩 | 122 | Mohr-Coulomb | 4000 | 0 | None |
| Engineered Fill - ST | 🟪 | 120 | Mohr-Coulomb | 1500 | 0 | None |
| Riprap | ⬛ | 140 | Mohr-Coulomb | 0 | 38 | None |

**GEOTECHNOLOGY**
A Universal Engineering Sciences Company

File Name: ARDOT 020475 Monticello - Copy.slmd
Name: Southern Abutment
Description: Long Term Conditions
Method: Spencer
Date: 5/11/2022

Project Number: J037781.01
Client: ARODT
Project: ARDOT GO13, 020475
Hwy. 83 Spur - Hwy. 278
Connector (Monticello) (S)
South Abutment - STA 1078+22

SLIDEINTERPRET 9.022



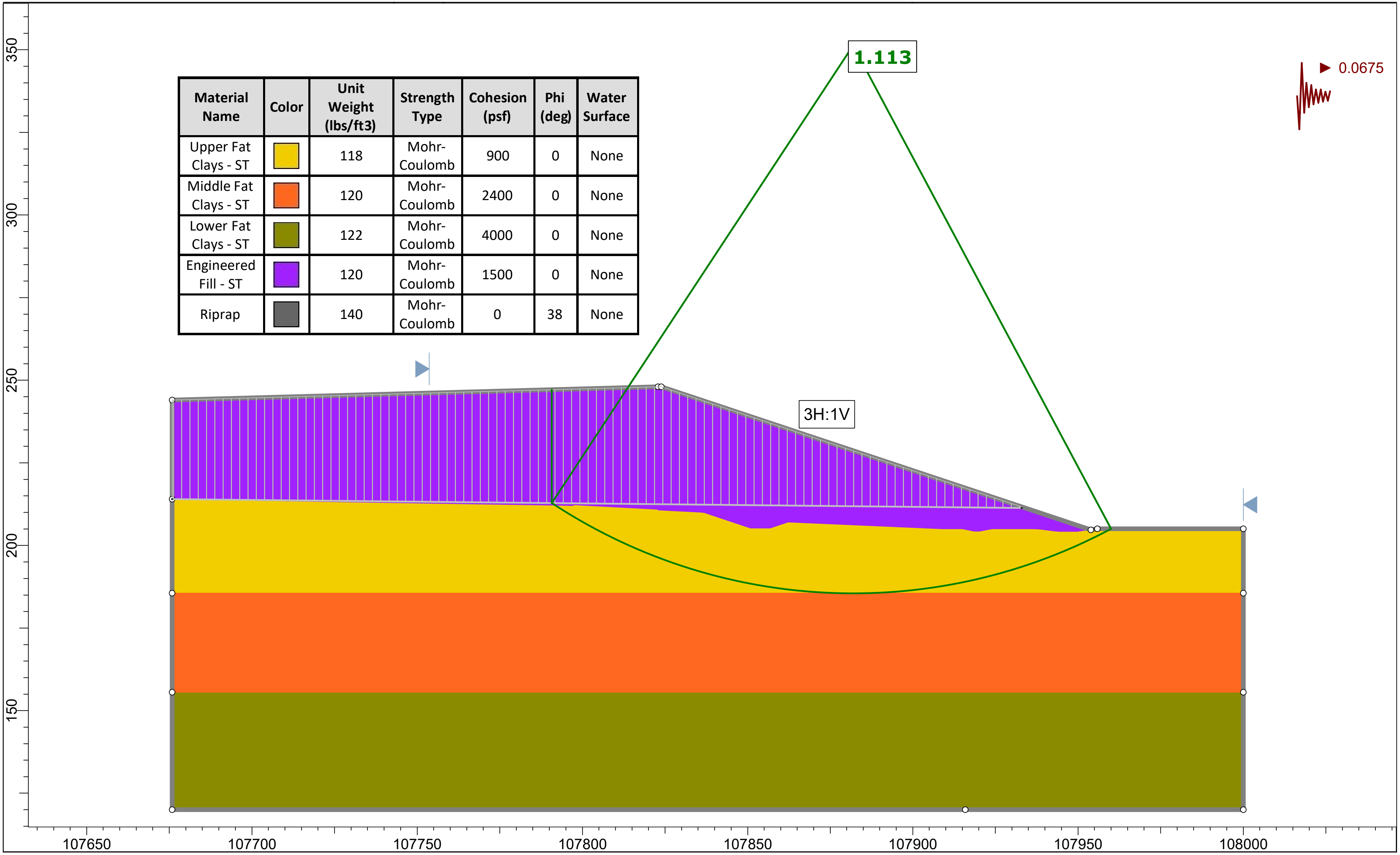
| Material Name | Color | Unit Weight (lbs/ ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface |
|---|---|---|---|---|---|---|
| Upper Fat Clays - LT | 🟩 | 118 | Mohr-Coulomb | 0 | 26 | Water Surface |
| Middle Fat Clays - LT | 🟪 | 120 | Mohr-Coulomb | 50 | 25 | Water Surface |
| Lower Fat Clays - LT | 🟥 | 122 | Mohr-Coulomb | 50 | 26 | Water Surface |
| Engineered Fill - LT | 🟩 | 120 | Mohr-Coulomb | 0 | 30 | None |
| Riprap | ⬛ | 140 | Mohr-Coulomb | 0 | 38 | None |

**GEOTECHNOLOGY**
A Universal Engineering Sciences Company

File Name: ARDOT 020475 Monticello - Copy.slmd
Name:  Southern Abutment
Description:  Seismic Conditions
Method: Spencer
Date: 5/11/2022

Project Number: J037781.01
Client: ARODT
Project: ARDOT GO13, 020475
Hwy. 83 Spur - Hwy. 278
Connector (Monticello) (S)
South Abutment - STA 1078+22

SLIDEINTERPRET 9.022



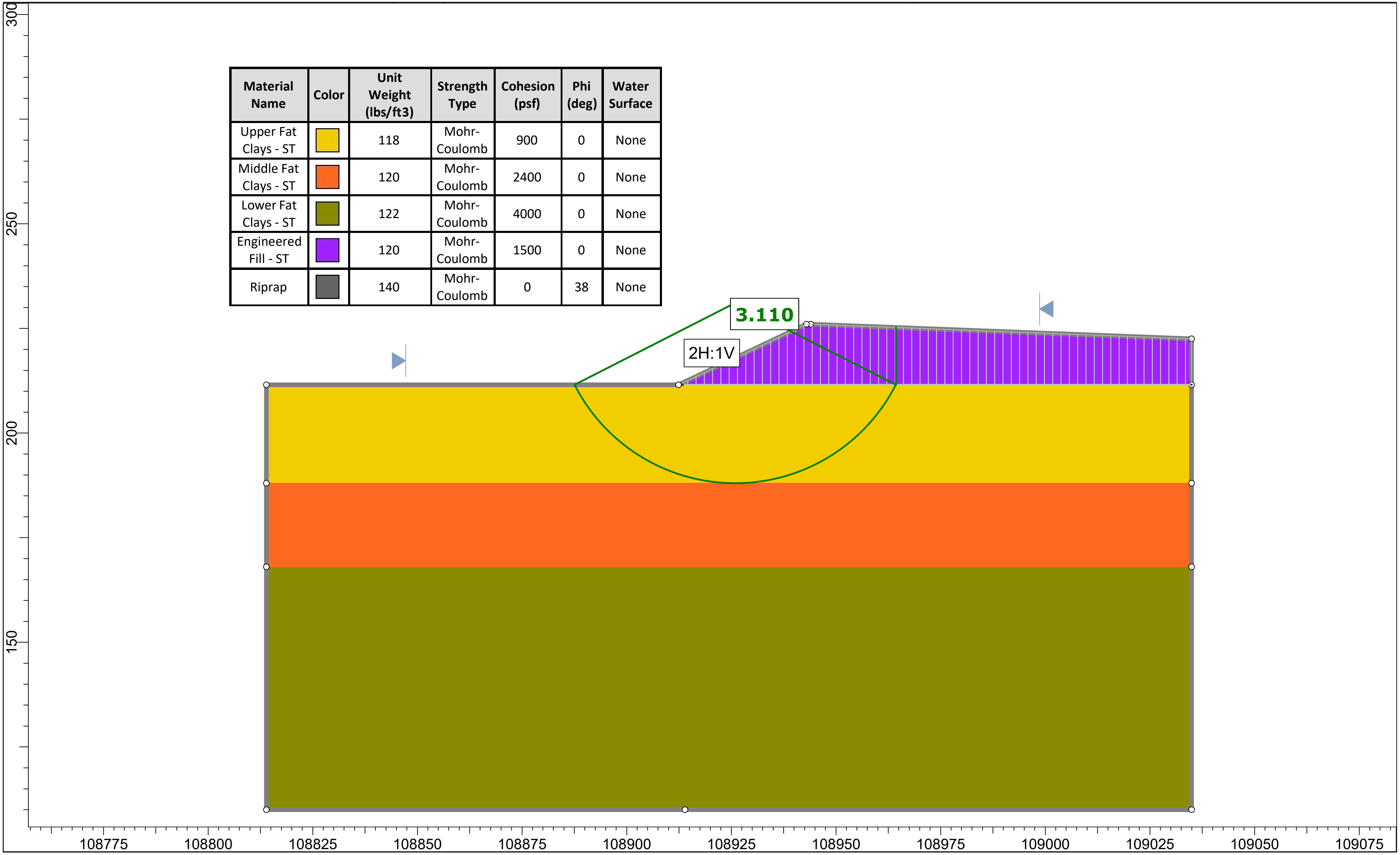
| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface |
|---|---|---|---|---|---|---|
| Upper Fat Clays - ST | 🟨 | 118 | Mohr-Coulomb | 900 | 0 | None |
| Middle Fat Clays - ST | 🟧 | 120 | Mohr-Coulomb | 2400 | 0 | None |
| Lower Fat Clays - ST | 🟩 | 122 | Mohr-Coulomb | 4000 | 0 | None |
| Engineered Fill - ST | 🟪 | 120 | Mohr-Coulomb | 1500 | 0 | None |
| Riprap | ⬛ | 140 | Mohr-Coulomb | 0 | 38 | None |

GEOTECHNOLOGY
A Universal Engineering Sciences Company

File Name: ARDOT 020475 Monticello - Copy.slmd
Name:  Northern Abutment
Description:  Short Term Conditions
Method: Spencer
Date: 5/11/2022

Project Number: J037781.01
Client: ARODT
Project: ARDOT GO13, 020475
Hwy. 83 Spur - Hwy. 278
Connector (Monticello) (S)
North Abutment - STA 1089+44

SLIDEINTERPRET 9.022



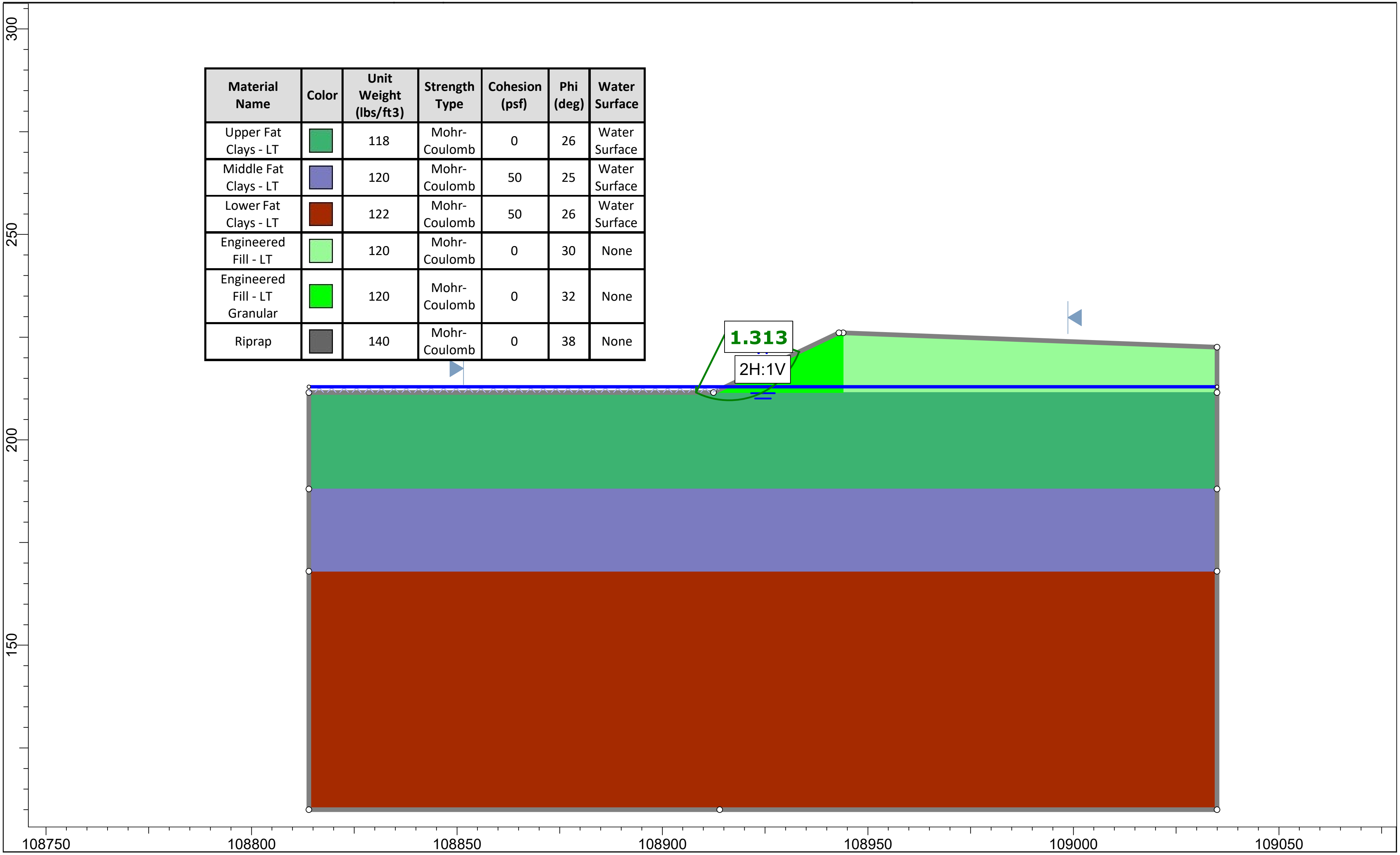
| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface |
|---|---|---|---|---|---|---|
| Upper Fat Clays - ST | 🟨 | 118 | Mohr-Coulomb | 900 | 0 | None |
| Middle Fat Clays - ST | 🟧 | 120 | Mohr-Coulomb | 2400 | 0 | None |
| Lower Fat Clays - ST | 🟩 | 122 | Mohr-Coulomb | 4000 | 0 | None |
| Engineered Fill - ST | 🟪 | 120 | Mohr-Coulomb | 1500 | 0 | None |
| Riprap | ⬛ | 140 | Mohr-Coulomb | 0 | 38 | None |

GEOTECHNOLOGY
A Universal Engineering Sciences Company

File Name: ARDOT 020475 Monticello - Copy.slmd
Name: Northern Abutment
Description: Long Term Conditions
Method: Spencer
Date: 5/11/2022

Project Number: J037781.01
Client: ARODT
Project: ARDOT GO13, 020475
Hwy. 83 Spur - Hwy. 278
Connector (Monticello) (S)
North Abutment - STA 1089+44

SLIDEINTERPRET 9.022



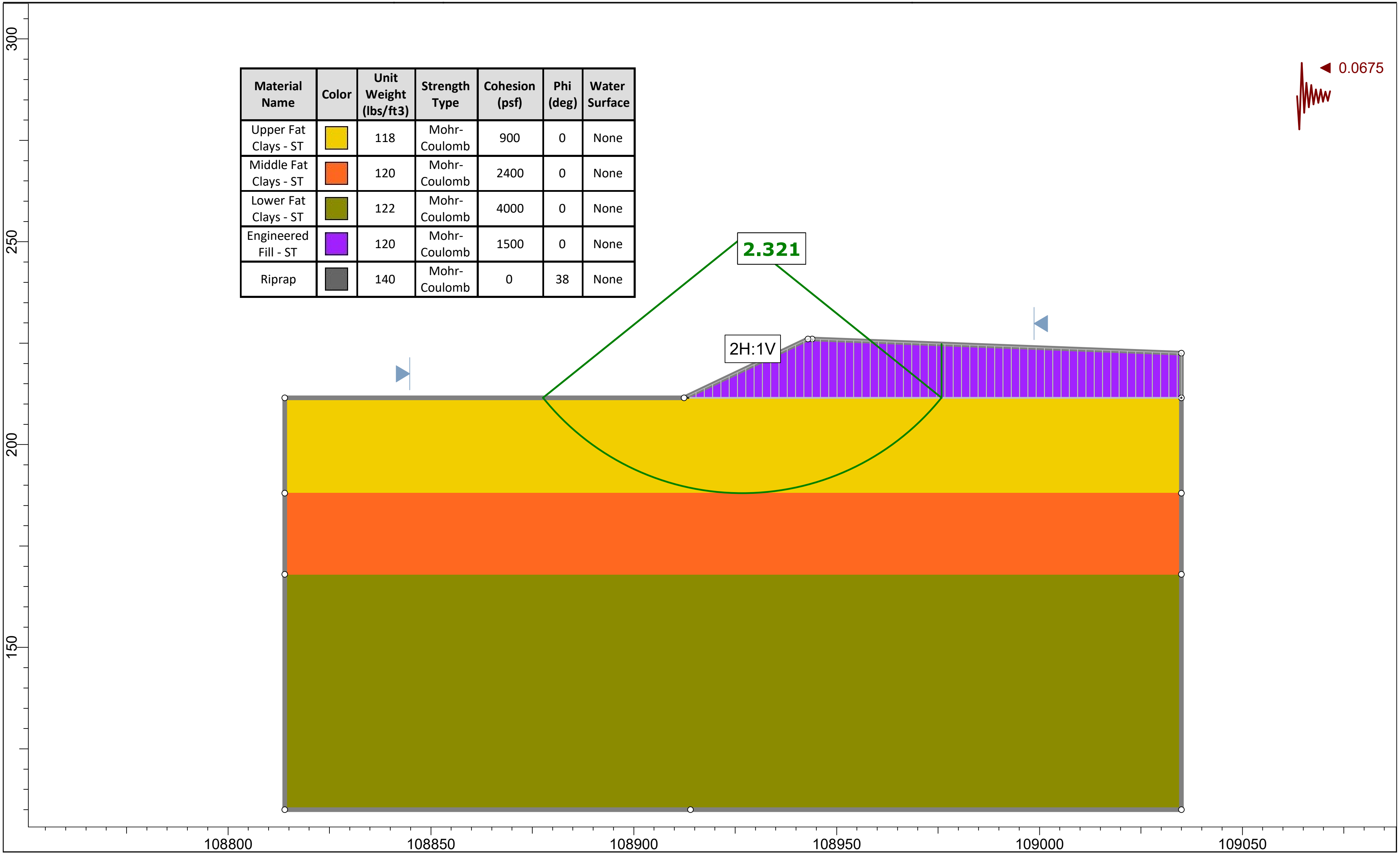
| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface |
|---|---|---|---|---|---|---|
| Upper Fat Clays - LT | 🟩 | 118 | Mohr-Coulomb | 0 | 26 | Water Surface |
| Middle Fat Clays - LT | 🟪 | 120 | Mohr-Coulomb | 50 | 25 | Water Surface |
| Lower Fat Clays - LT | 🟥 | 122 | Mohr-Coulomb | 50 | 26 | Water Surface |
| Engineered Fill - LT | 🟩 | 120 | Mohr-Coulomb | 0 | 30 | None |
| Engineered Fill - LT Granular | 🟩 | 120 | Mohr-Coulomb | 0 | 32 | None |
| Riprap | ⬛ | 140 | Mohr-Coulomb | 0 | 38 | None |

**GEOTECHNOLOGY**
A Universal Engineering Sciences Company

SLIDEINTERPRET 9.022

File Name: ARDOT 020475 Monticello - Copy.slmd
Name: Northern Abutment
Description: Seismic Conditions
Method: Spencer
Date: 5/11/2022

Project Number: J037781.01
Client: ARODT
Project: ARDOT GO13, 020475
Hwy. 83 Spur - Hwy. 278
Connector (Monticello) (S)
North Abutment - STA 1089+44



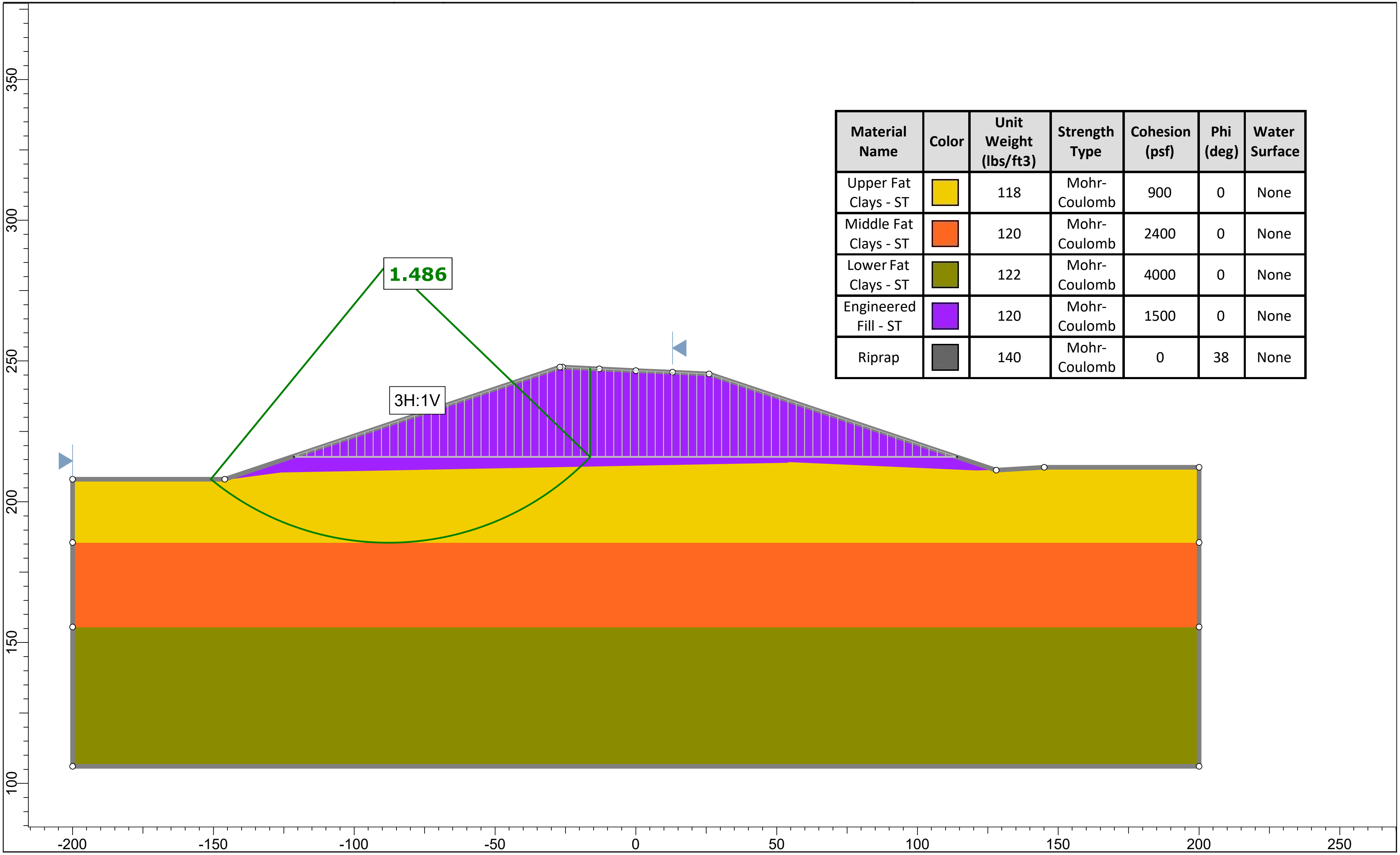
| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface |
|---|---|---|---|---|---|---|
| Upper Fat Clays - ST | 🟨 | 118 | Mohr-Coulomb | 900 | 0 | None |
| Middle Fat Clays - ST | 🟧 | 120 | Mohr-Coulomb | 2400 | 0 | None |
| Lower Fat Clays - ST | 🟩 | 122 | Mohr-Coulomb | 4000 | 0 | None |
| Engineered Fill - ST | 🟪 | 120 | Mohr-Coulomb | 1500 | 0 | None |
| Riprap | ⬛ | 140 | Mohr-Coulomb | 0 | 38 | None |

GEOTECHNOLOGY
A Universal Engineering Sciences Company

File Name: ARDOT 020475 Monticello - Copy.slmd
Name: STA 1077+55.84
Description: Short Term Conditions
Method: Spencer
Date: 5/11/2022

Project Number: J037781.01
Client: ARODT
Project: ARDOT GO13, 020475
Hwy. 83 Spur - Hwy. 278
Connector (Monticello) (S)
STA 1077+55.84

SLIDEINTERPRET 9.022



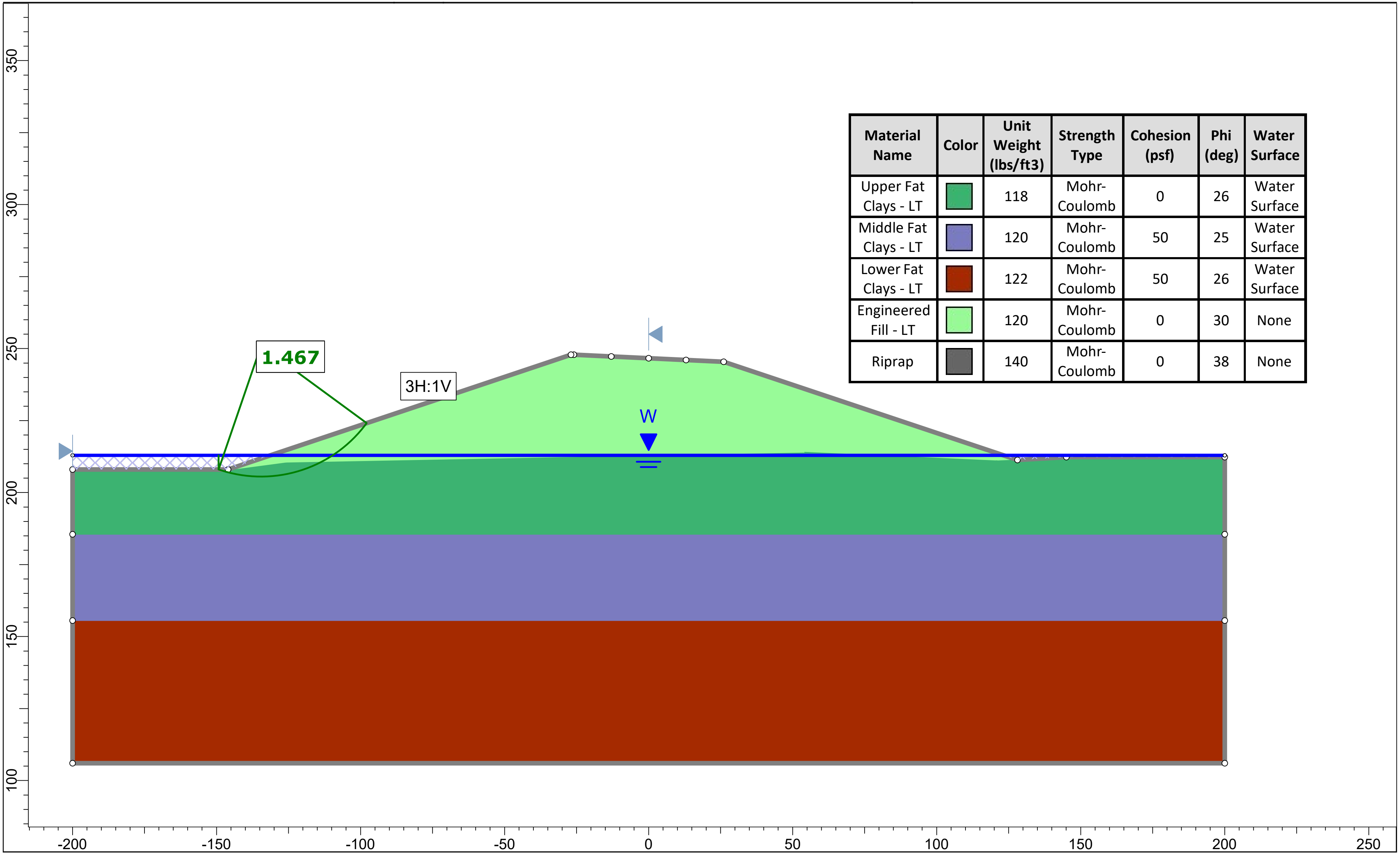
| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface |
|---|---|---|---|---|---|---|
| Upper Fat Clays - ST | 🟨 | 118 | Mohr-Coulomb | 900 | 0 | None |
| Middle Fat Clays - ST | 🟧 | 120 | Mohr-Coulomb | 2400 | 0 | None |
| Lower Fat Clays - ST | 🟩 | 122 | Mohr-Coulomb | 4000 | 0 | None |
| Engineered Fill - ST | 🟪 | 120 | Mohr-Coulomb | 1500 | 0 | None |
| Riprap | ⬛ | 140 | Mohr-Coulomb | 0 | 38 | None |

GEOTECHNOLOGY
A Universal Engineering Sciences Company

File Name: ARDOT 020475 Monticello - Copy.slmd
Name: STA 1077+55.84
Description: Long Term Conditions
Method: Spencer
Date: 5/11/2022

Project Number: J037781.01
Client: ARODT
Project: ARDOT GO13, 020475
Hwy. 83 Spur - Hwy. 278
Connector (Monticello) (S)
STA 1077+55.84

SLIDEINTERPRET 9.022



| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface |
|---|---|---|---|---|---|---|
| Upper Fat Clays - LT | 🟩 | 118 | Mohr-Coulomb | 0 | 26 | Water Surface |
| Middle Fat Clays - LT | 🟪 | 120 | Mohr-Coulomb | 50 | 25 | Water Surface |
| Lower Fat Clays - LT | 🟥 | 122 | Mohr-Coulomb | 50 | 26 | Water Surface |
| Engineered Fill - LT | 🟩 | 120 | Mohr-Coulomb | 0 | 30 | None |
| Riprap | ⬛ | 140 | Mohr-Coulomb | 0 | 38 | None |

GEOTECHNOLOGY
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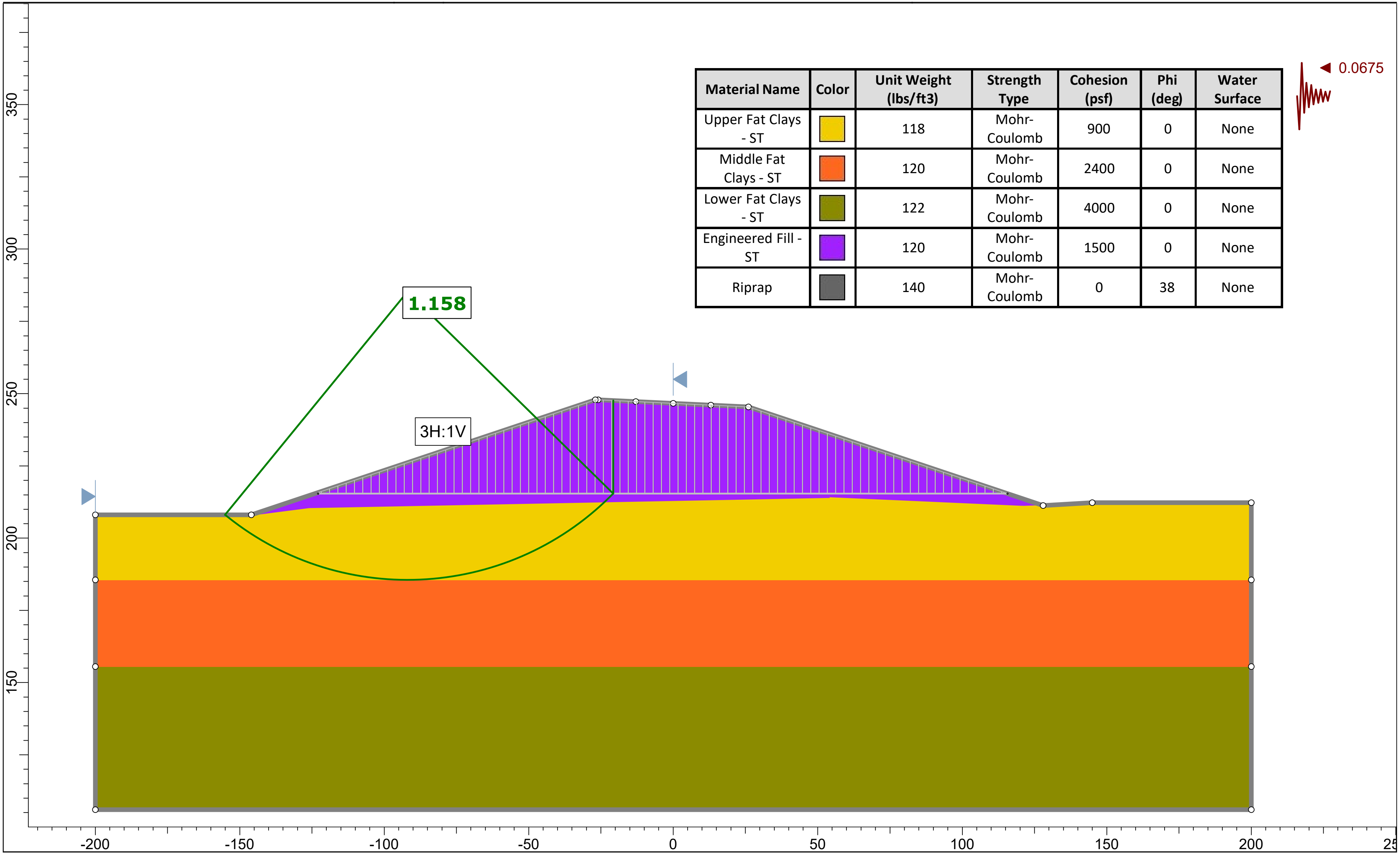
File Name: ARDOT 020475 Monticello - Copy.slmd
Name: STA 1077+55.84
Description: Seismic Conditions
Method: Spencer
Date: 5/11/2022

Project Number: J037781.01
Client: ARODT
Project: ARDOT GO13, 020475
Hwy. 83 Spur - Hwy. 278
Connector (Monticello) (S)
STA 1077+55.84

SLIDEINTERPRET 9.022



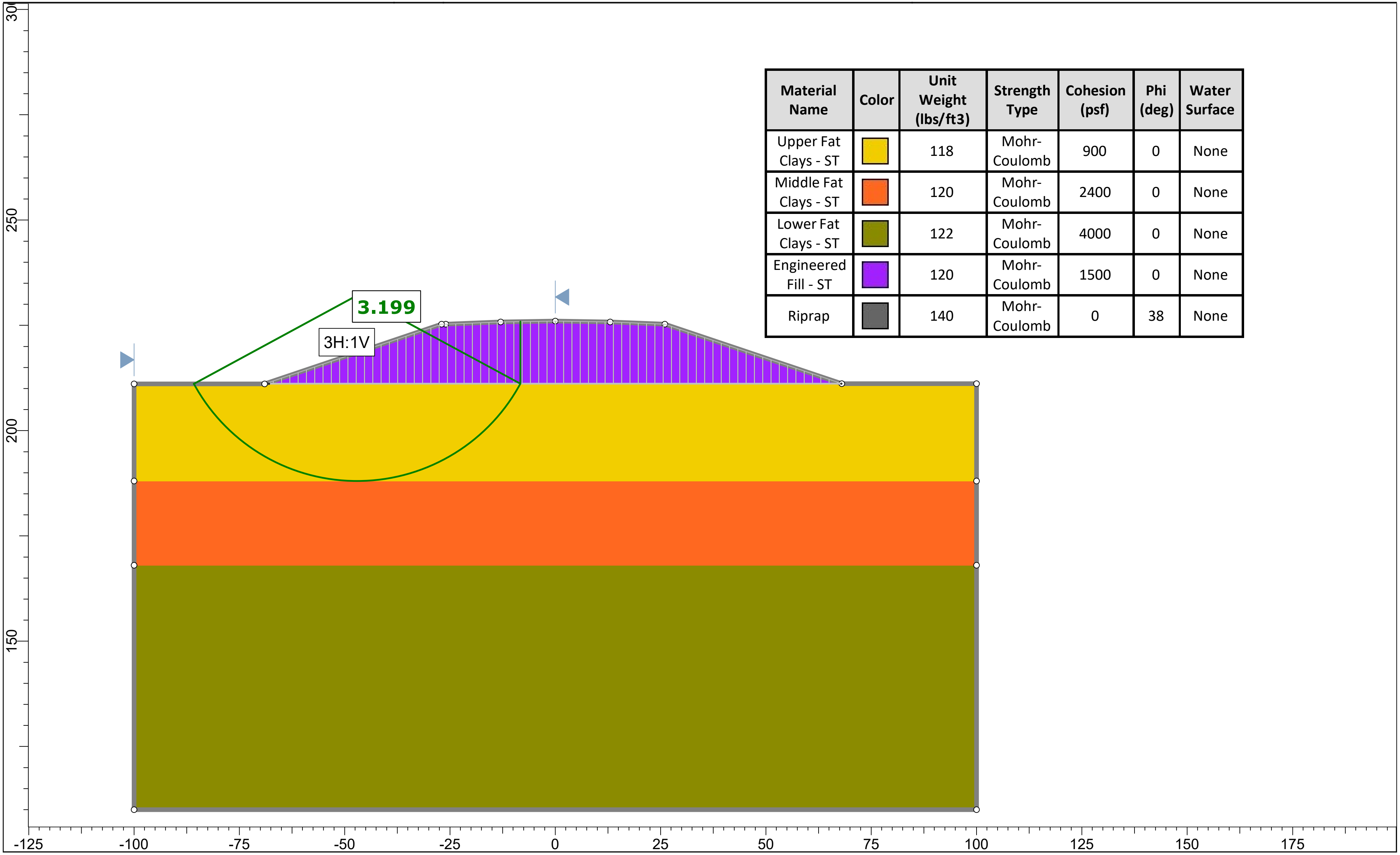
| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface |
|---|---|---|---|---|---|---|
| Upper Fat Clays - ST | 🟨 | 118 | Mohr-Coulomb | 900 | 0 | None |
| Middle Fat Clays - ST | 🟧 | 120 | Mohr-Coulomb | 2400 | 0 | None |
| Lower Fat Clays - ST | 🟩 | 122 | Mohr-Coulomb | 4000 | 0 | None |
| Engineered Fill - ST | 🟪 | 120 | Mohr-Coulomb | 1500 | 0 | None |
| Riprap | ⬛ | 140 | Mohr-Coulomb | 0 | 38 | None |

**GEOTECHNOLOGY**
A Universal Engineering Sciences Company

File Name: ARDOT 020475 Monticello - Copy.slmd
Name: STA 1089+45.84
Description: Short Term Conditions
Method: Spencer
Date: 5/11/2022

Project Number: J037781.01
Client: ARODT
Project: ARDOT GO13, 020475
Hwy. 83 Spur - Hwy. 278
Connector (Monticello) (S)
STA 1089+45.84

SLIDEINTERPRET 9.022



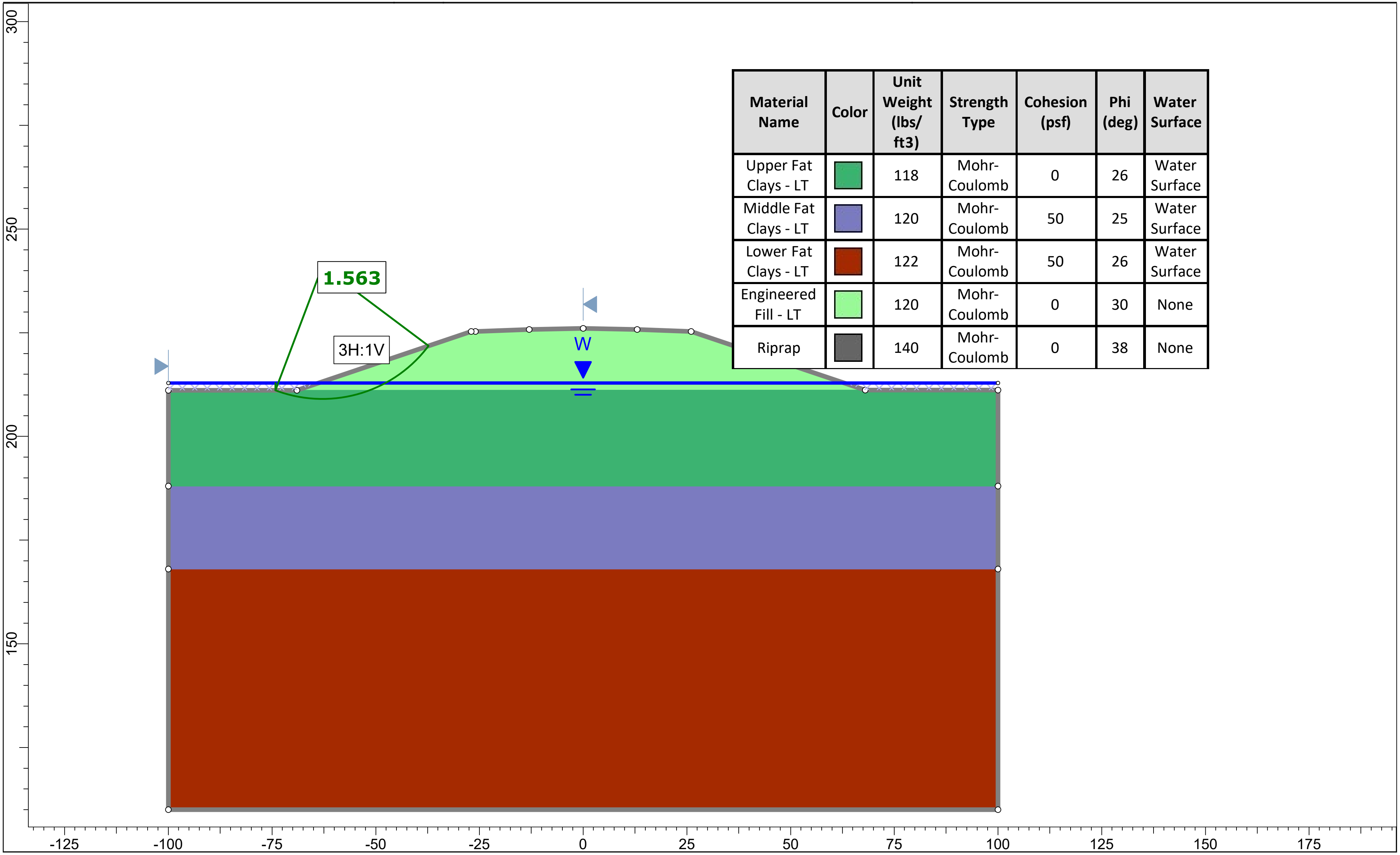
| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface |
|---|---|---|---|---|---|---|
| Upper Fat Clays - ST | 🟨 | 118 | Mohr-Coulomb | 900 | 0 | None |
| Middle Fat Clays - ST | 🟧 | 120 | Mohr-Coulomb | 2400 | 0 | None |
| Lower Fat Clays - ST | 🟩 | 122 | Mohr-Coulomb | 4000 | 0 | None |
| Engineered Fill - ST | 🟪 | 120 | Mohr-Coulomb | 1500 | 0 | None |
| Riprap | ⬛ | 140 | Mohr-Coulomb | 0 | 38 | None |

**GEOTECHNOLOGY**
A Universal Engineering Sciences Company

File Name: ARDOT 020475 Monticello - Copy.slmd
Name: STA 1089+45.84
Description: Long Term Conditions
Method: Spencer
Date: 5/11/2022

Project Number: J037781.01
Client: ARODT
Project: ARDOT GO13, 020475
Hwy. 83 Spur - Hwy. 278
Connector (Monticello) (S)
STA 1089+45.84

SLIDEINTERPRET 9.022



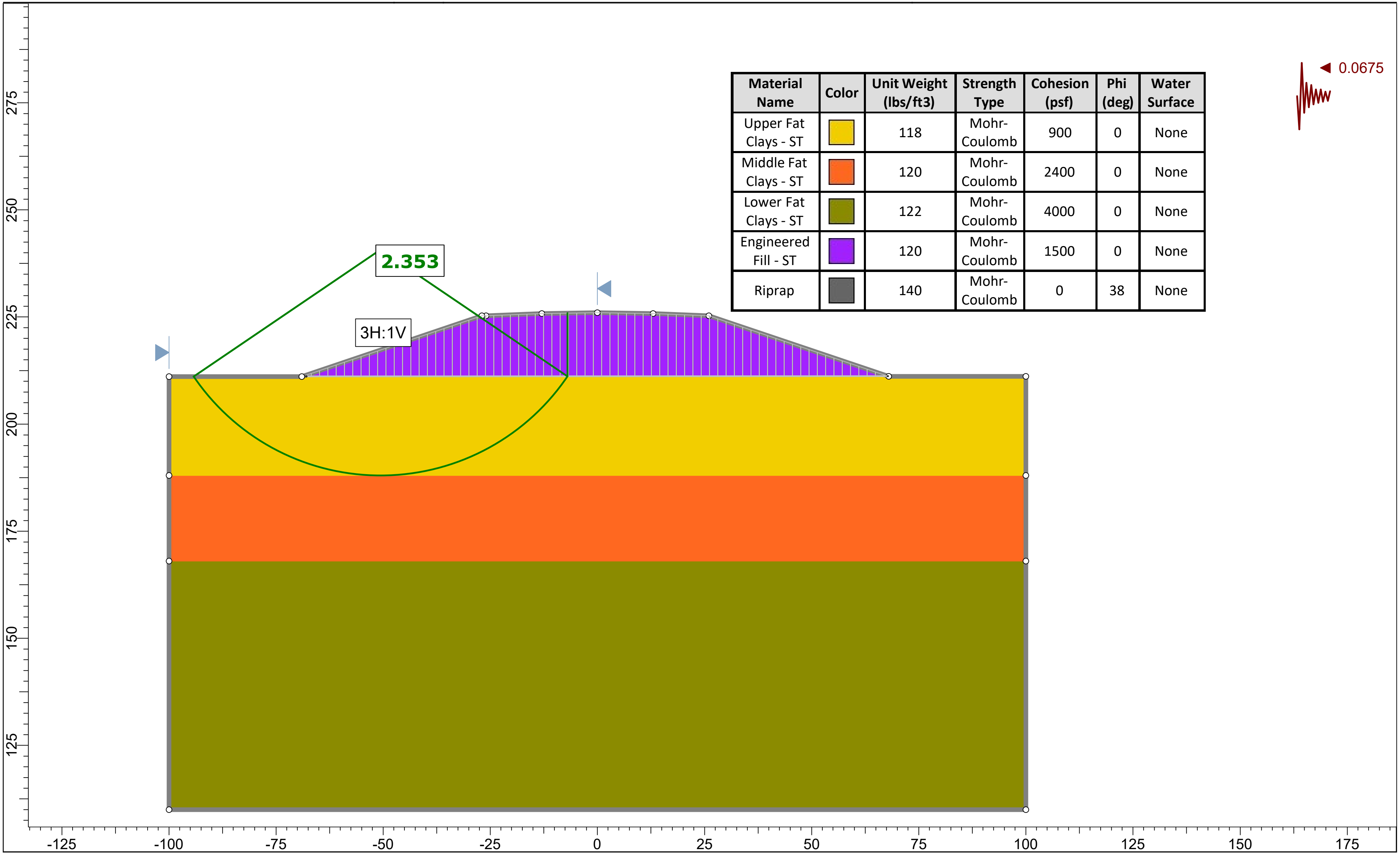
| Material Name | Color | Unit Weight (lbs/ ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface |
|---|---|---|---|---|---|---|
| Upper Fat Clays - LT | 🟩 | 118 | Mohr-Coulomb | 0 | 26 | Water Surface |
| Middle Fat Clays - LT | 🟪 | 120 | Mohr-Coulomb | 50 | 25 | Water Surface |
| Lower Fat Clays - LT | 🟥 | 122 | Mohr-Coulomb | 50 | 26 | Water Surface |
| Engineered Fill - LT | 🟩 | 120 | Mohr-Coulomb | 0 | 30 | None |
| Riprap | ⬛ | 140 | Mohr-Coulomb | 0 | 38 | None |

GEOTECHNOLOGY
A Universal Engineering Sciences Company

File Name: ARDOT 020475 Monticello - Copy.slmd
Name: STA 1089+45.84
Description: Seismic Conditions
Method: Spencer
Date: 5/11/2022

Project Number: J037781.01
Client: ARODT
Project: ARDOT GO13, 020475
Hwy. 83 Spur - Hwy. 278
Connector (Monticello) (S)
STA 1089+45.84

SLIDEINTERPRET 9.022



| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface |
|---|---|---|---|---|---|---|
| Upper Fat Clays - ST | 🟨 | 118 | Mohr-Coulomb | 900 | 0 | None |
| Middle Fat Clays - ST | 🟧 | 120 | Mohr-Coulomb | 2400 | 0 | None |
| Lower Fat Clays - ST | 🟩 | 122 | Mohr-Coulomb | 4000 | 0 | None |
| Engineered Fill - ST | 🟪 | 120 | Mohr-Coulomb | 1500 | 0 | None |
| Riprap | ⬛ | 140 | Mohr-Coulomb | 0 | 38 | None |

# APPENDIX H – SOIL PARAMETERS FOR SYNTHETIC PROFILES

ARDOT MONTICELLO BRIDGE – BENT 1 (BORING B-2)

APPROXIMATE GROUND SURFACE ELEVATION = EL 207

| ZONE | SOIL TYPES | DEPTH[a] (feet from ground surface) | | TOTAL UNIT WEIGHT (PCF) | SHEAR STRENGTH PARAMETERS | | | | LATERAL LOAD PARAMETERS[d] | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | UNDRAINED (SHORT TERM) | | DRAINED (LONG TERM) | | SOIL STRAIN, $E_{50}$ | STATIC SOIL MODULUS (PCI)[c] | LPILE SOIL MODEL |
| | | FROM | TO | | COHESION (PSF) | Φ (DEGREE) | EFFECTIVE COHESION (PSF) | Φ' (DEGREE) | | | |
| 1 | Medium Stiff Fat Clay / Lean Clay | 0[b] | 28.5 | 118 | 900 | -- | -- | 26 | 0.01 | 100 | Soft Clay |
| 2 | Stiff Fat Clay | 28.5 | 63.5 | 120 | 2,400 | -- | 50 | 25 | 0.005 | 1,000 | Stiff Clay without Free Water |
| 3 | Hard Fat Clay | 63.5 | 100 | 122 | 4,000 | -- | 50 | 26 | 0.004 | 2,000 | |

Note: Groundwater assumed to be deeper than 50 feet below existing ground surface elevation based on the water levels encountered in the borings. The effective unit weight should be used below the groundwater level. Subtract the density of water (62.4 pounds per cubic foot) from the total unit weight to calculate the effective unit weight.

[a] Depth in reference to ground surface at boring locations.

[b] Zero depth as measured at top of boring.

[c] Pounds per cubic inch.

[d] For lateral load analysis only.

ARDOT MONTICELLO BRIDGE – BENT 2 (BORING B-3)

APPROXIMATE GROUND SURFACE ELEVATION = EL 208

| ZONE | SOIL TYPES | DEPTH[a] (feet from ground surface) | | TOTAL UNIT WEIGHT (PCF) | SHEAR STRENGTH PARAMETERS | | | | LATERAL LOAD PARAMETERS[d] | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | UNDRAINED (SHORT TERM) | | DRAINED (LONG TERM) | | SOIL STRAIN, $E_{50}$ | STATIC SOIL MODULUS (PCI)[c] | LPILE SOIL MODEL |
| | | FROM | TO | | COHESION (PSF) | Φ (DEGREE) | EFFECTIVE COHESION (PSF) | Φ' (DEGREE) | | | |
| 1 | Medium Stiff Fat Clay / Lean Clay | 0[b] | 28.5 | 118 | 900 | -- | -- | 26 | 0.01 | 100 | Soft Clay |
| 2 | Stiff Fat Clay | 28.5 | 63.5 | 120 | 2,400 | -- | 50 | 25 | 0.005 | 1,000 | Stiff Clay without Free Water |
| 3 | Hard Fat Clay | 63.5 | 100 | 122 | 4,000 | -- | 50 | 26 | 0.004 | 2,000 | |

Note: Groundwater assumed to be deeper than 50 feet below existing ground surface elevation based on the water levels encountered in the borings. The effective unit weight should be used below the groundwater level. Subtract the density of water (62.4 pounds per cubic foot) from the total unit weight to calculate the effective unit weight.

[a] Depth in reference to ground surface at boring locations.

[b] Zero depth as measured at top of boring.

[c] Pounds per cubic inch.

[d] For lateral load analysis only.

ARDOT MONTICELLO BRIDGE – BENT 3 (BORING B-4)

APPROXIMATE GROUND SURFACE ELEVATION = EL 204

| ZONE | SOIL TYPES | DEPTH[a] (feet from ground surface) | | TOTAL UNIT WEIGHT (PCF) | SHEAR STRENGTH PARAMETERS | | | | LATERAL LOAD PARAMETERS[d] | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | UNDRAINED (SHORT TERM) | | DRAINED (LONG TERM) | | SOIL STRAIN, $E_{50}$ | STATIC SOIL MODULUS (PCI)[c] | LPILE SOIL MODEL |
| | | FROM | TO | | COHESION (PSF) | Φ (DEGREE) | EFFECTIVE COHESION (PSF) | Φ’ (DEGREE) | | | |
| 1 | Medium Stiff Fat Clay / Lean Clay | 0[b] | 28.5 | 118 | 900 | -- | -- | 26 | 0.01 | 100 | Soft Clay |
| 2 | Stiff Fat Clay | 28.5 | 58.5 | 120 | 2,400 | -- | 50 | 25 | 0.005 | 1,000 | Stiff Clay without Free Water |
| 3 | Hard Fat Clay | 58.5 | 100 | 122 | 4,000 | -- | 50 | 26 | 0.004 | 2,000 | |

Note: Groundwater assumed to be deeper than 50 feet below existing ground surface elevation based on the water levels encountered in the borings. The effective unit weight should be used below the groundwater level. Subtract the density of water (62.4 pounds per cubic foot) from the total unit weight to calculate the effective unit weight.

[a] Depth in reference to ground surface at boring locations.

[b] Zero depth as measured at top of boring.

[c] Pounds per cubic inch.

[d] For lateral load analysis only.

ARDOT MONTICELLO BRIDGE – BENT 4 (BORING B-5)

APPROXIMATE GROUND SURFACE ELEVATION = EL 210

| ZONE | SOIL TYPES | DEPTH[a] (feet from ground surface) | | TOTAL UNIT WEIGHT (PCF) | SHEAR STRENGTH PARAMETERS | | | | LATERAL LOAD PARAMETERS[d] | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | UNDRAINED (SHORT TERM) | | DRAINED (LONG TERM) | | SOIL STRAIN, $E_{50}$ | STATIC SOIL MODULUS (PCI)[c] | LPILE SOIL MODEL |
| | | FROM | TO | | COHESION (PSF) | Φ (DEGREE) | EFFECTIVE COHESION (PSF) | Φ’ (DEGREE) | | | |
| 1 | Medium Stiff Fat Clay / Lean Clay | 0[b] | 28.5 | 118 | 900 | -- | -- | 26 | 0.01 | 100 | Soft Clay |
| 2 | Stiff Fat Clay | 28.5 | 53.5 | 120 | 2,400 | -- | 50 | 25 | 0.005 | 1,000 | Stiff Clay without Free Water |
| 3 | Hard Fat Clay | 53.5 | 100 | 122 | 4,000 | -- | 50 | 26 | 0.004 | 2,000 | |

Note: Groundwater assumed to be deeper than 50 feet below existing ground surface elevation based on the water levels encountered in the borings. The effective unit weight should be used below the groundwater level. Subtract the density of water (62.4 pounds per cubic foot) from the total unit weight to calculate the effective unit weight.

[a] Depth in reference to ground surface at boring locations.

[b] Zero depth as measured at top of boring.

[c] Pounds per cubic inch.

[d] For lateral load analysis only.

ARDOT MONTICELLO BRIDGE – BENT 5 (BORING B-6)

APPROXIMATE GROUND SURFACE ELEVATION = EL 210

| ZONE | SOIL TYPES | DEPTH[a] (feet from ground surface) | | TOTAL UNIT WEIGHT (PCF) | SHEAR STRENGTH PARAMETERS | | | | LATERAL LOAD PARAMETERS[d] | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | UNDRAINED (SHORT TERM) | | DRAINED (LONG TERM) | | SOIL STRAIN, $E_{50}$ | STATIC SOIL MODULUS (PCI)[c] | LPILE SOIL MODEL |
| | | FROM | TO | | COHESION (PSF) | Φ (DEGREE) | EFFECTIVE COHESION (PSF) | Φ’ (DEGREE) | | | |
| 1 | Medium Stiff Fat Clay / Lean Clay | 0[b] | 28.5 | 118 | 900 | -- | -- | 26 | 0.01 | 100 | Soft Clay |
| 2 | Stiff Fat Clay | 28.5 | 58.5 | 120 | 2,400 | -- | 50 | 25 | 0.005 | 1,000 | Stiff Clay without Free Water |
| 3 | Hard Fat Clay | 58.5 | 100 | 122 | 4,000 | -- | 50 | 26 | 0.004 | 2,000 | |

Note: Groundwater assumed to be deeper than 50 feet below existing ground surface elevation based on the water levels encountered in the borings. The effective unit weight should be used below the groundwater level. Subtract the density of water (62.4 pounds per cubic foot) from the total unit weight to calculate the effective unit weight.

[a] Depth in reference to ground surface at boring locations.

[b] Zero depth as measured at top of boring.

[c] Pounds per cubic inch.

[d] For lateral load analysis only.

ARDOT MONTICELLO BRIDGE – BENT 6 (BORING B-7)

APPROXIMATE GROUND SURFACE ELEVATION = EL 210

| ZONE | SOIL TYPES | DEPTH[a] (feet from ground surface) | | TOTAL UNIT WEIGHT (PCF) | SHEAR STRENGTH PARAMETERS | | | | LATERAL LOAD PARAMETERS[d] | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | UNDRAINED (SHORT TERM) | | DRAINED (LONG TERM) | | SOIL STRAIN, $E_{50}$ | STATIC SOIL MODULUS (PCI)[c] | LPILE SOIL MODEL |
| | | FROM | TO | | COHESION (PSF) | Φ (DEGREE) | EFFECTIVE COHESION (PSF) | Φ’ (DEGREE) | | | |
| 1 | Medium Stiff Fat Clay / Lean Clay | 0[b] | 23.5 | 118 | 900 | -- | -- | 26 | 0.01 | 100 | Soft Clay |
| 2 | Stiff Fat Clay | 23.5 | 53.5 | 120 | 2,400 | -- | 50 | 25 | 0.005 | 1,000 | Stiff Clay without Free Water |
| 3 | Hard Fat Clay | 53.5 | 100 | 122 | 4,000 | -- | 50 | 26 | 0.004 | 2,000 | |

Note: Groundwater assumed to be deeper than 50 feet below existing ground surface elevation based on the water levels encountered in the borings. The effective unit weight should be used below the groundwater level. Subtract the density of water (62.4 pounds per cubic foot) from the total unit weight to calculate the effective unit weight.

[a] Depth in reference to ground surface at boring locations.

[b] Zero depth as measured at top of boring.

[c] Pounds per cubic inch.

[d] For lateral load analysis only.

ARDOT MONTICELLO BRIDGE – BENT 7 (BORING B-8)

APPROXIMATE GROUND SURFACE ELEVATION = EL 208

| ZONE | SOIL TYPES | DEPTH[a] (feet from ground surface) | | TOTAL UNIT WEIGHT (PCF) | SHEAR STRENGTH PARAMETERS | | | | LATERAL LOAD PARAMETERS[d] | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | UNDRAINED (SHORT TERM) | | DRAINED (LONG TERM) | | SOIL STRAIN, $E_{50}$ | STATIC SOIL MODULUS (PCI)[c] | LPILE SOIL MODEL |
| | | FROM | TO | | COHESION (PSF) | Φ (DEGREE) | EFFECTIVE COHESION (PSF) | Φ’ (DEGREE) | | | |
| 1 | Medium Stiff Fat Clay / Lean Clay | 0[b] | 23.5 | 118 | 900 | -- | -- | 26 | 0.01 | 100 | Soft Clay |
| 2 | Stiff Fat Clay | 23.5 | 48.5 | 120 | 2,400 | -- | 50 | 25 | 0.005 | 1,000 | Stiff Clay without Free Water |
| 3 | Hard Fat Clay | 48.5 | 100 | 122 | 4,000 | -- | 50 | 26 | 0.004 | 2,000 | |

Note: Groundwater assumed to be deeper than 50 feet below existing ground surface elevation based on the water levels encountered in the borings. The effective unit weight should be used below the groundwater level. Subtract the density of water (62.4 pounds per cubic foot) from the total unit weight to calculate the effective unit weight.

[a] Depth in reference to ground surface at boring locations.

[b] Zero depth as measured at top of boring.

[c] Pounds per cubic inch.

[d] For lateral load analysis only.

### ARDOT MONTICELLO BRIDGE – BENT 8 (BORING B-9)

### APPROXIMATE GROUND SURFACE ELEVATION = EL 209.5

| ZONE | SOIL TYPES | DEPTH[a] (feet from ground surface) | | TOTAL UNIT WEIGHT (PCF) | SHEAR STRENGTH PARAMETERS | | | | LATERAL LOAD PARAMETERS[d] | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | UNDRAINED (SHORT TERM) | | DRAINED (LONG TERM) | | SOIL STRAIN, $E_{50}$ | STATIC SOIL MODULUS (PCI)[c] | LPILE SOIL MODEL |
| | | FROM | TO | | COHESION (PSF) | Φ (DEGREE) | EFFECTIVE COHESION (PSF) | Φ’ (DEGREE) | | | |
| 1 | Medium Stiff Fat Clay / Lean Clay | 0[b] | 28.5 | 118 | 900 | -- | -- | 26 | 0.01 | 100 | Soft Clay |
| 2 | Stiff Fat Clay | 28.5 | 48.5 | 120 | 2,400 | -- | 50 | 25 | 0.005 | 1,000 | Stiff Clay without Free Water |
| 3 | Hard Fat Clay | 48.5 | 100 | 122 | 4,000 | -- | 50 | 26 | 0.004 | 2,000 | |

Note: Groundwater assumed to be deeper than 50 feet below existing ground surface elevation based on the water levels encountered in the borings. The effective unit weight should be used below the groundwater level. Subtract the density of water (62.4 pounds per cubic foot) from the total unit weight to calculate the effective unit weight.

[a] Depth in reference to ground surface at boring locations.

[b] Zero depth as measured at top of boring.

[c] Pounds per cubic inch.

[d] For lateral load analysis only.

ARDOT MONTICELLO BRIDGE – BENT 9 (BORING B-10)

APPROXIMATE GROUND SURFACE ELEVATION = EL 210

| ZONE | SOIL TYPES | DEPTH[a] (feet from ground surface) | | TOTAL UNIT WEIGHT (PCF) | SHEAR STRENGTH PARAMETERS | | | | LATERAL LOAD PARAMETERS[d] | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | UNDRAINED (SHORT TERM) | | DRAINED (LONG TERM) | | SOIL STRAIN, $E_{50}$ | STATIC SOIL MODULUS (PCI)[c] | LPILE SOIL MODEL |
| | | FROM | TO | | COHESION (PSF) | Φ (DEGREE) | EFFECTIVE COHESION (PSF) | Φ' (DEGREE) | | | |
| 1 | Medium Stiff Fat Clay / Lean Clay | 0[b] | 15 | 118 | 900 | -- | -- | 26 | 0.01 | 100 | Soft Clay |
| 2 | Stiff Fat Clay | 15 | 53.5 | 120 | 2,400 | -- | 50 | 25 | 0.005 | 1,000 | Stiff Clay without Free Water |
| 3 | Hard Fat Clay | 53.5 | 100 | 122 | 4,000 | -- | 50 | 26 | 0.004 | 2,000 | |

Note: Groundwater assumed to be deeper than 50 feet below existing ground surface elevation based on the water levels encountered in the borings. The effective unit weight should be used below the groundwater level. Subtract the density of water (62.4 pounds per cubic foot) from the total unit weight to calculate the effective unit weight.

[a] Depth in reference to ground surface at boring locations.

[b] Zero depth as measured at top of boring.

[c] Pounds per cubic inch.

[d] For lateral load analysis only.

ARDOT MONTICELLO BRIDGE – BENT 10 (BORING B-11)

APPROXIMATE GROUND SURFACE ELEVATION = EL 210

| ZONE | SOIL TYPES | DEPTH[a] (feet from ground surface) | | TOTAL UNIT WEIGHT (PCF) | SHEAR STRENGTH PARAMETERS | | | | LATERAL LOAD PARAMETERS[d] | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | UNDRAINED (SHORT TERM) | | DRAINED (LONG TERM) | | SOIL STRAIN, $E_{50}$ | STATIC SOIL MODULUS (PCI)[c] | LPILE SOIL MODEL |
| | | FROM | TO | | COHESION (PSF) | Φ (DEGREE) | EFFECTIVE COHESION (PSF) | Φ’ (DEGREE) | | | |
| 1 | Medium Stiff Fat Clay / Lean Clay | 0[b] | 13.5 | 118 | 900 | -- | -- | 26 | 0.01 | 100 | Soft Clay |
| 2 | Stiff Fat Clay | 13.5 | 48.5 | 120 | 2,400 | -- | 50 | 25 | 0.005 | 1,000 | Stiff Clay without Free Water |
| 3 | Hard Fat Clay | 48.5 | 100 | 122 | 4,000 | -- | 50 | 26 | 0.004 | 2,000 | |

Note: Groundwater assumed to be deeper than 50 feet below existing ground surface elevation based on the water levels encountered in the borings. The effective unit weight should be used below the groundwater level. Subtract the density of water (62.4 pounds per cubic foot) from the total unit weight to calculate the effective unit weight.

[a] Depth in reference to ground surface at boring locations.

[b] Zero depth as measured at top of boring.

[c] Pounds per cubic inch.

[d] For lateral load analysis only.

ARDOT MONTICELLO BRIDGE – BENT 11 (BORING B-12)

APPROXIMATE GROUND SURFACE ELEVATION = EL 210

| ZONE | SOIL TYPES | DEPTH[a] (feet from ground surface) | | TOTAL UNIT WEIGHT (PCF) | SHEAR STRENGTH PARAMETERS | | | | LATERAL LOAD PARAMETERS[d] | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | UNDRAINED (SHORT TERM) | | DRAINED (LONG TERM) | | SOIL STRAIN, $E_{50}$ | STATIC SOIL MODULUS (PCI)[c] | LPILE SOIL MODEL |
| | | FROM | TO | | COHESION (PSF) | Φ (DEGREE) | EFFECTIVE COHESION (PSF) | Φ' (DEGREE) | | | |
| 1 | Medium Stiff Fat Clay / Lean Clay | 0[b] | 23.5 | 118 | 900 | -- | -- | 26 | 0.01 | 100 | Soft Clay |
| 2 | Stiff Fat Clay | 23.5 | 53.5 | 120 | 2,400 | -- | 50 | 25 | 0.005 | 1,000 | Stiff Clay without Free Water |
| 3 | Hard Fat Clay | 53.5 | 100 | 122 | 4,000 | -- | 50 | 26 | 0.004 | 2,000 | |

Note: Groundwater assumed to be deeper than 50 feet below existing ground surface elevation based on the water levels encountered in the borings. The effective unit weight should be used below the groundwater level. Subtract the density of water (62.4 pounds per cubic foot) from the total unit weight to calculate the effective unit weight.

[a] Depth in reference to ground surface at boring locations.

[b] Zero depth as measured at top of boring.

[c] Pounds per cubic inch.

[d] For lateral load analysis only.

ARDOT MONTICELLO BRIDGE – BENT 12 (BORING B-13)

APPROXIMATE GROUND SURFACE ELEVATION = EL 210

| ZONE | SOIL TYPES | DEPTH[a] (feet from ground surface) | | TOTAL UNIT WEIGHT (PCF) | SHEAR STRENGTH PARAMETERS | | | | LATERAL LOAD PARAMETERS[d] | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | UNDRAINED (SHORT TERM) | | DRAINED (LONG TERM) | | SOIL STRAIN, $E_{50}$ | STATIC SOIL MODULUS (PCI)[c] | LPILE SOIL MODEL |
| | | FROM | TO | | COHESION (PSF) | $\Phi$ (DEGREE) | EFFECTIVE COHESION (PSF) | $\Phi'$ (DEGREE) | | | |
| 1 | Medium Stiff Fat Clay / Lean Clay | 0[b] | 28.5 | 118 | 900 | -- | -- | 26 | 0.01 | 100 | Soft Clay |
| 2 | Stiff Fat Clay | 28.5 | 48.5 | 120 | 2,400 | -- | 50 | 25 | 0.005 | 1,000 | Stiff Clay without Free Water |
| 3 | Hard Fat Clay | 48.5 | 100 | 122 | 4,000 | -- | 50 | 26 | 0.004 | 2,000 | |

Note: Groundwater assumed to be deeper than 50 feet below existing ground surface elevation based on the water levels encountered in the borings. The effective unit weight should be used below the groundwater level. Subtract the density of water (62.4 pounds per cubic foot) from the total unit weight to calculate the effective unit weight.

[a] Depth in reference to ground surface at boring locations.

[b] Zero depth as measured at top of boring.

[c] Pounds per cubic inch.

[d] For lateral load analysis only.

| ARDOT MONTICELLO BRIDGE – BENT 13 (BORING B-14) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| APPROXIMATE GROUND SURFACE ELEVATION = EL 210 | | | | | | | | | | | |
| ZONE | SOIL TYPES | DEPTH[a] (feet from ground surface) | | TOTAL UNIT WEIGHT (PCF) | SHEAR STRENGTH PARAMETERS | | | | LATERAL LOAD PARAMETERS[d] | | |
| | | | | | UNDRAINED (SHORT TERM) | | DRAINED (LONG TERM) | | SOIL STRAIN, $E_{50}$ | STATIC SOIL MODULUS (PCI)[c] | LPILE SOIL MODEL |
| | | FROM | TO | | COHESION (PSF) | Φ (DEGREE) | EFFECTIVE COHESION (PSF) | Φ’ (DEGREE) | | | |
| 1 | Medium Stiff Fat Clay / Lean Clay | 0[b] | 28.5 | 118 | 900 | -- | -- | 26 | 0.01 | 100 | Soft Clay |
| 2 | Stiff Fat Clay | 28.5 | 63.5 | 120 | 2,400 | -- | 50 | 25 | 0.005 | 1,000 | Stiff Clay without Free Water |
| 3 | Hard Fat Clay | 63.5 | 100 | 122 | 4,000 | -- | 50 | 26 | 0.004 | 2,000 | |

Note: Groundwater assumed to be deeper than 50 feet below existing ground surface elevation based on the water levels encountered in the borings. The effective unit weight should be used below the groundwater level. Subtract the density of water (62.4 pounds per cubic foot) from the total unit weight to calculate the effective unit weight.

[a] Depth in reference to ground surface at boring locations.

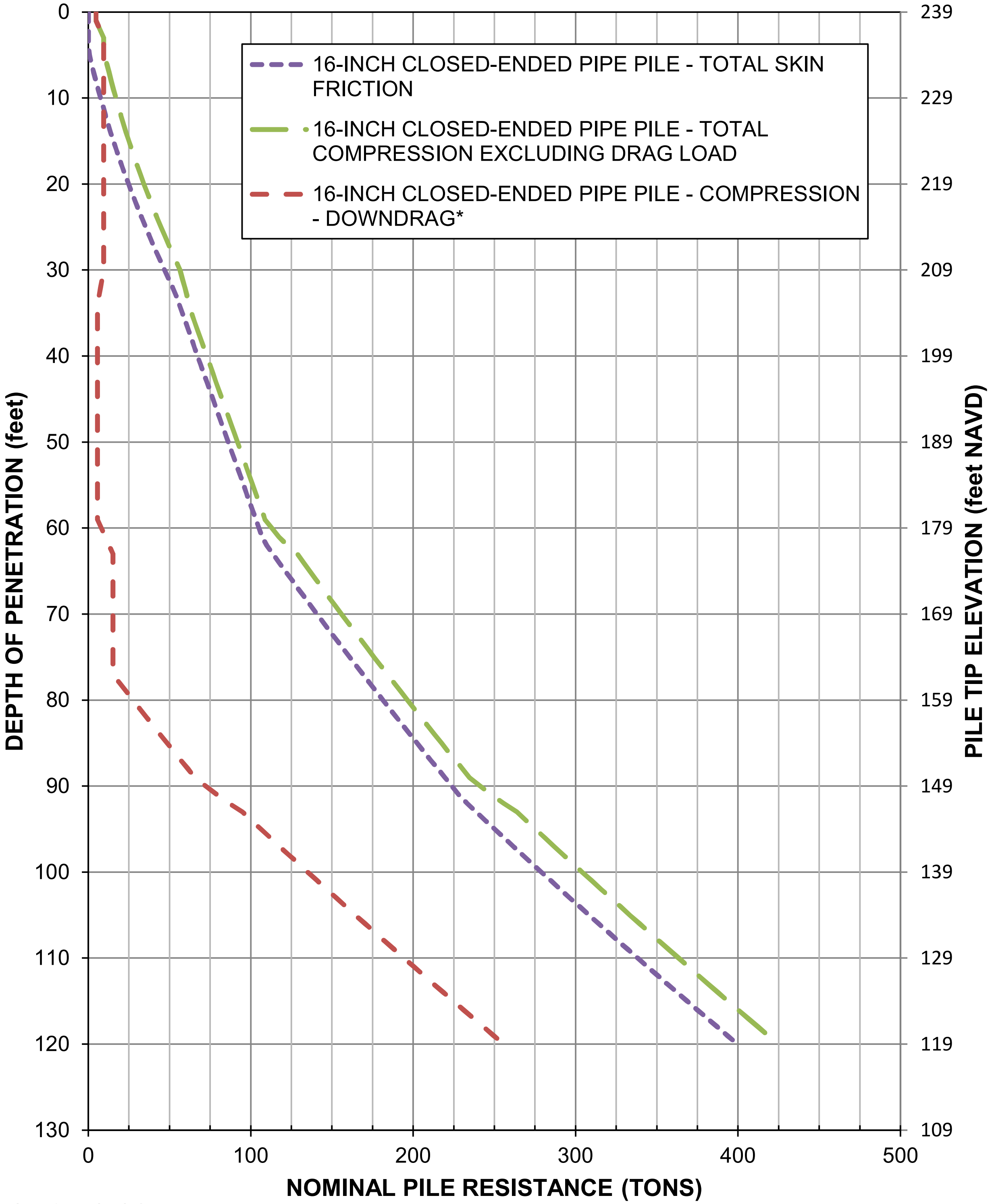
[b] Zero depth as measured at top of boring.

[c] Pounds per cubic inch.

[d] For lateral load analysis only.

# APPENDIX I – NOMINAL RESISTANCE CURVES

# NOMINAL RESISTANCE CURVES
# 16-INCH CLOSED-ENDED PIPE PILE
# ARDOT HWY. 83 SPUR - HWY. 278 CONNECTOR
# (MONTICELLO) (S), DREW COUNTY - BENT 1



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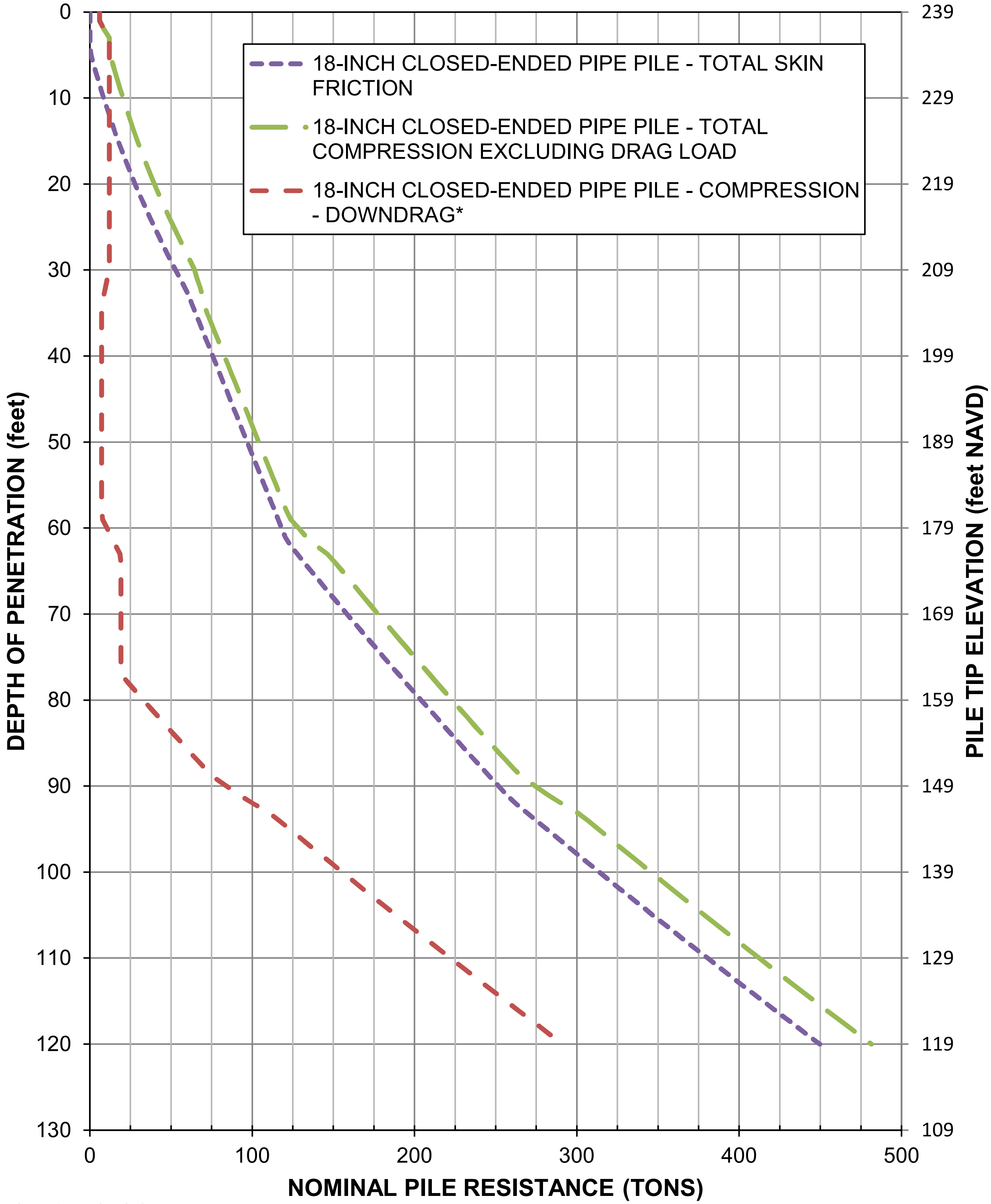
PROJECT NUMBER J037781.01

* Resistance curve based on igoring side friction resistance where downdrag is expected (Total side resistance - Drag load).

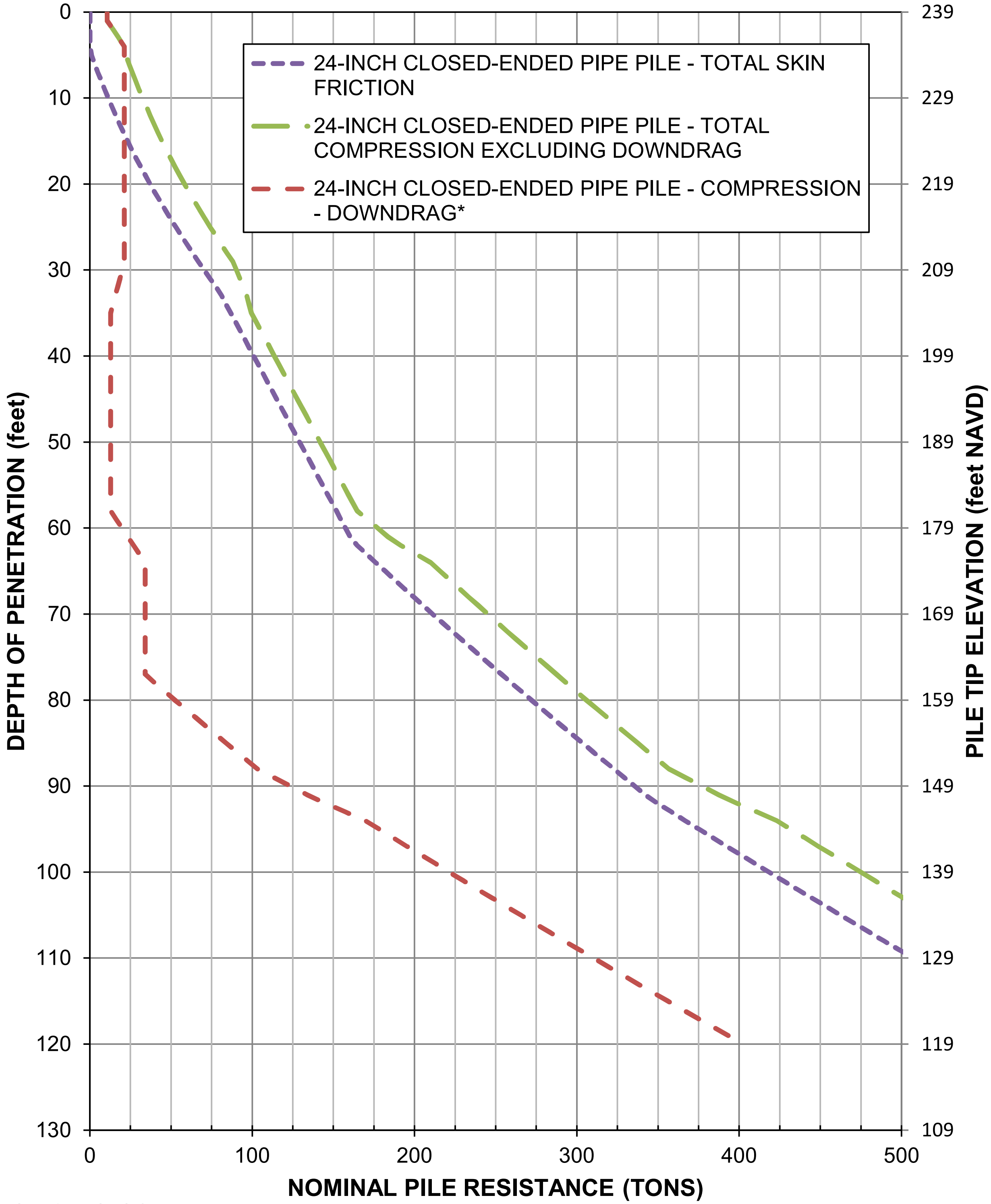
# NOMINAL RESISTANCE CURVES
# 18-INCH CLOSED-ENDED PIPE PILE
# ARDOT HWY. 83 SPUR - HWY. 278 CONNECTOR
# (MONTICELLO) (S), DREW COUNTY - BENT 1



GEOTECHNOLOGY
PROJECT NUMBER J037781.01

* Resistance curve based on igoring side friction resistance where downdrag is expected (Total side resistance - Drag load).

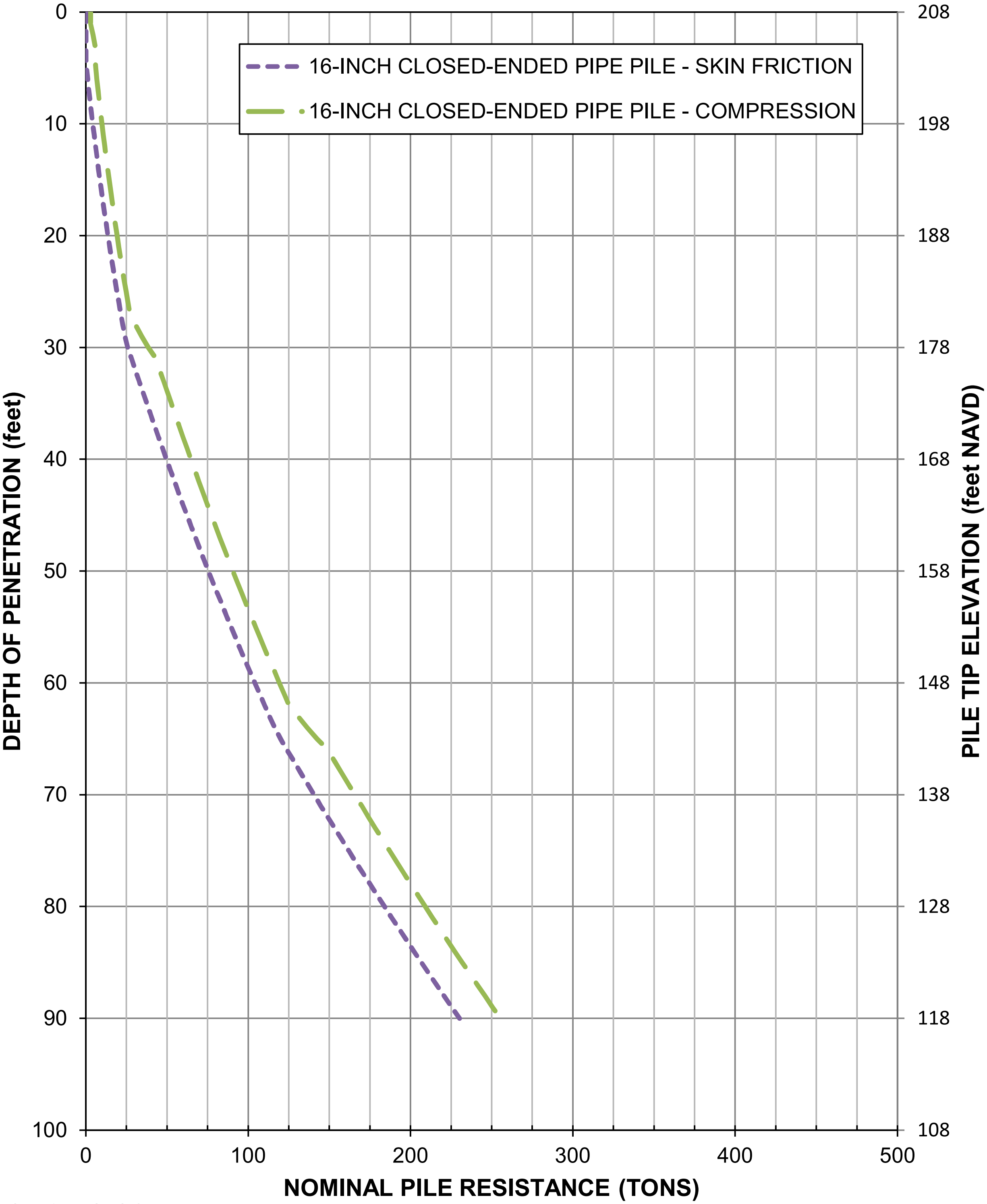
# NOMINAL RESISTANCE CURVES
# 24-INCH CLOSED-ENDED PIPE PILE
# ARDOT HWY. 83 SPUR - HWY. 278 CONNECTOR
# (MONTICELLO) (S), DREW COUNTY - BENT 1



GEOTECHNOLOGY
PROJECT NUMBER J037781.01

* Resistance curve based on igoring side friction resistance where downdrag is expected (Total side resistance - Drag load).

## NOMINAL RESISTANCE CURVES
## 16-INCH CLOSED-ENDED PIPE PILE
## ARDOT HWY. 83 SPUR - HWY. 278 CONNECTOR
## (MONTICELLO) (S), DREW COUNTY - BENT 2



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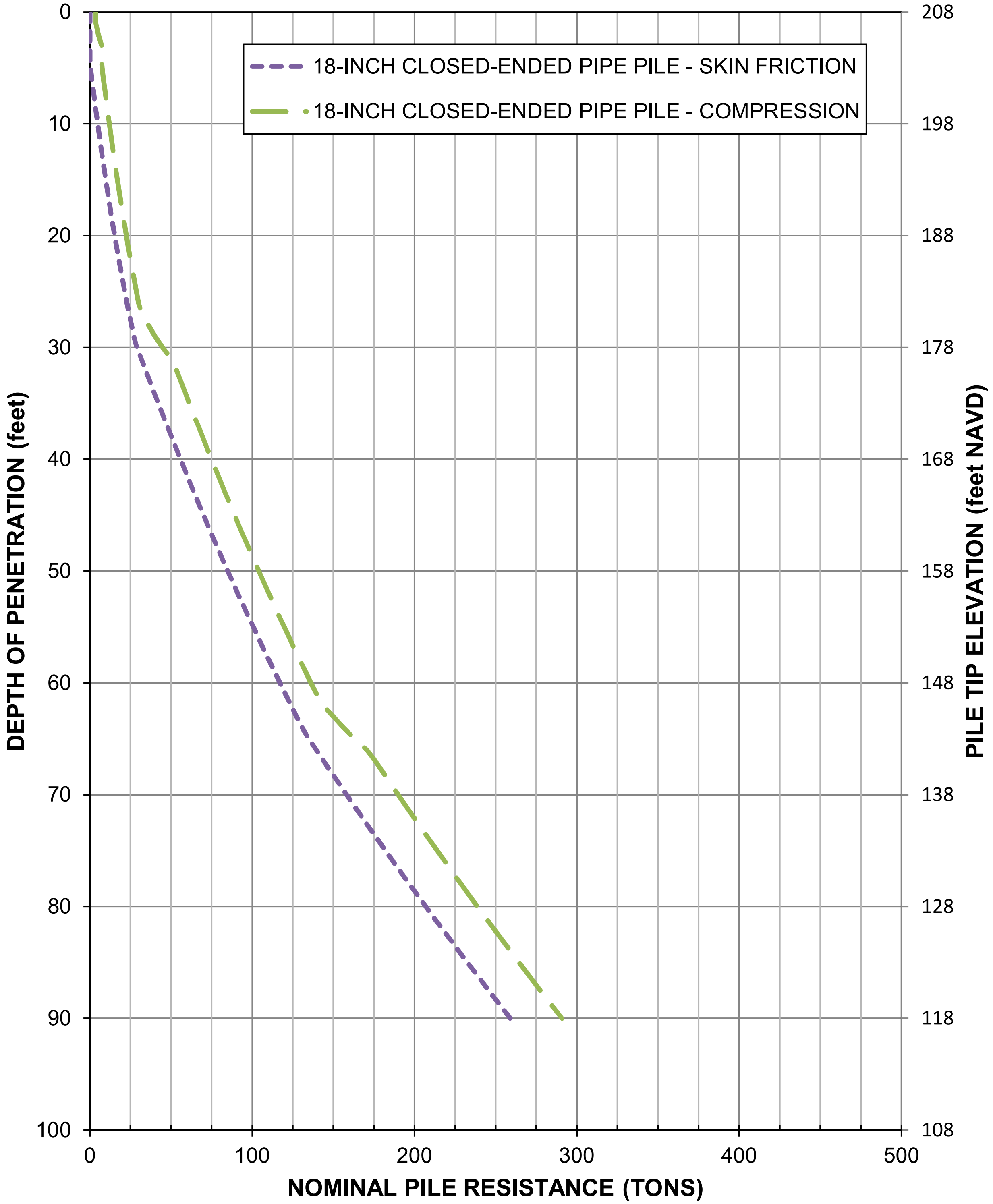
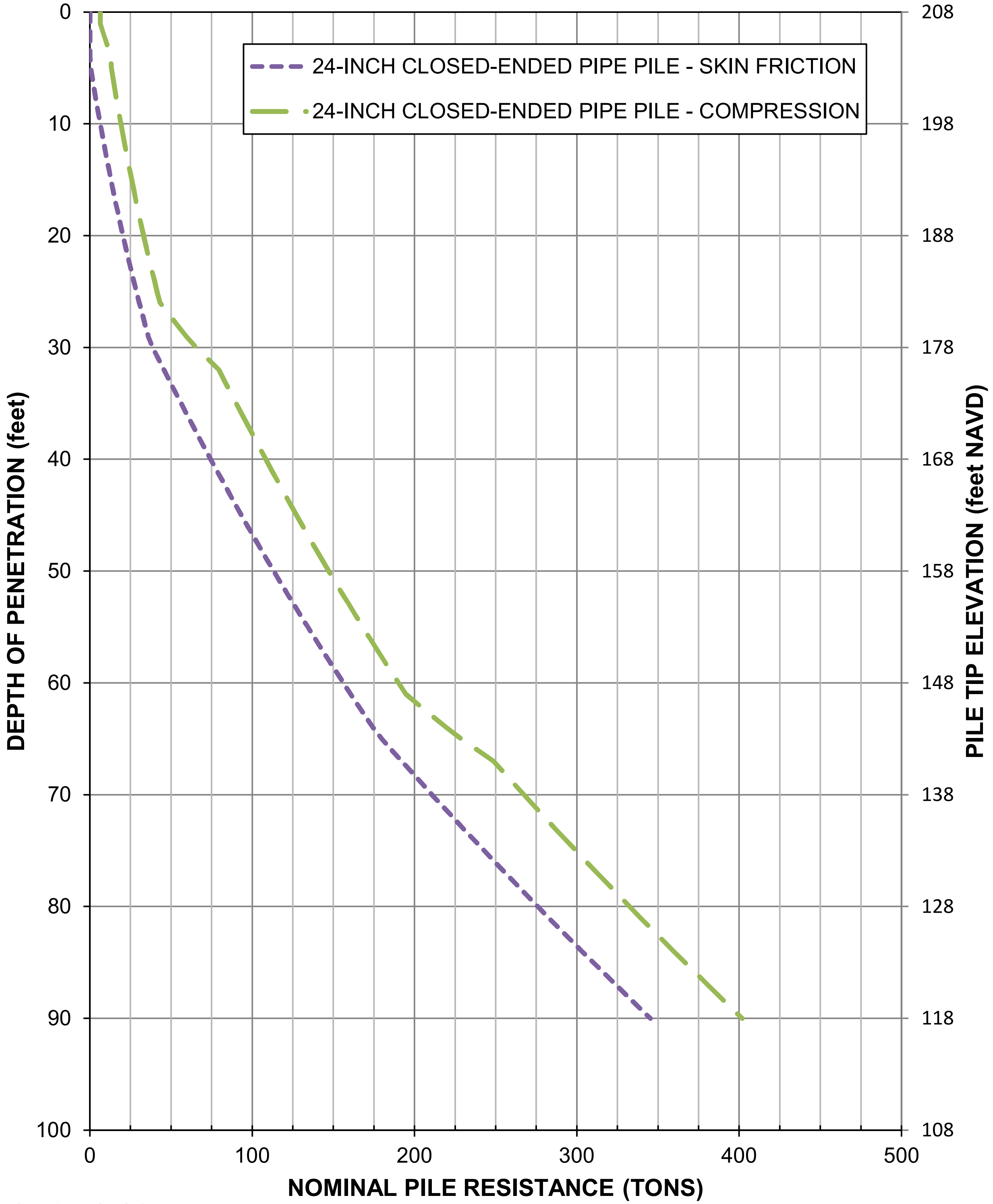
PROJECT NUMBER J037781.01

## NOMINAL RESISTANCE CURVES
## 18-INCH CLOSED-ENDED PIPE PILE
## ARDOT HWY. 83 SPUR - HWY. 278 CONNECTOR
## (MONTICELLO) (S), DREW COUNTY - BENT 2



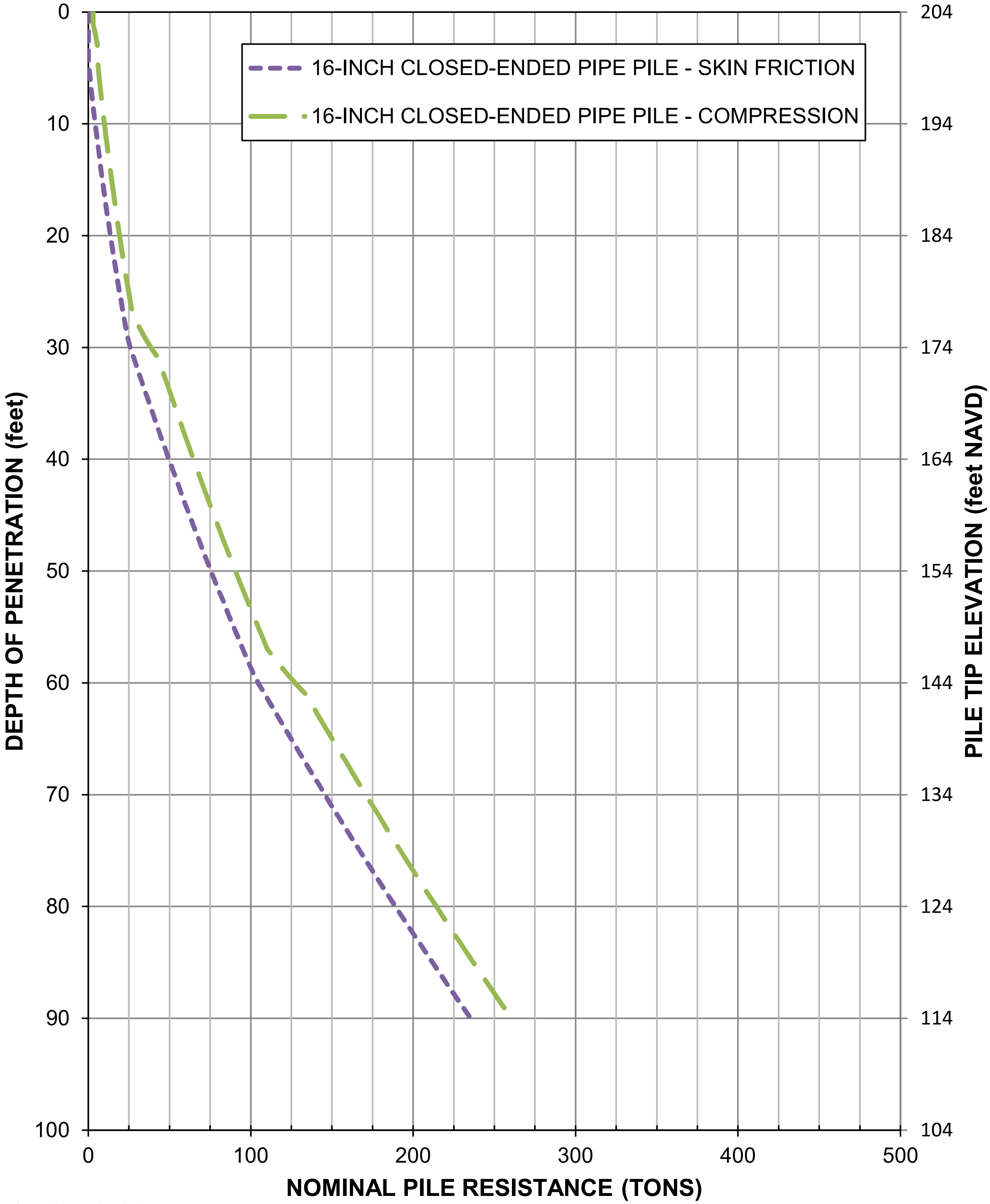
GEOTECHNOLOGY
PROJECT NUMBER J037781.01

# NOMINAL RESISTANCE CURVES
# 24-INCH CLOSED-ENDED PIPE PILE
# ARDOT HWY. 83 SPUR - HWY. 278 CONNECTOR
# (MONTICELLO) (S), DREW COUNTY - BENT 2



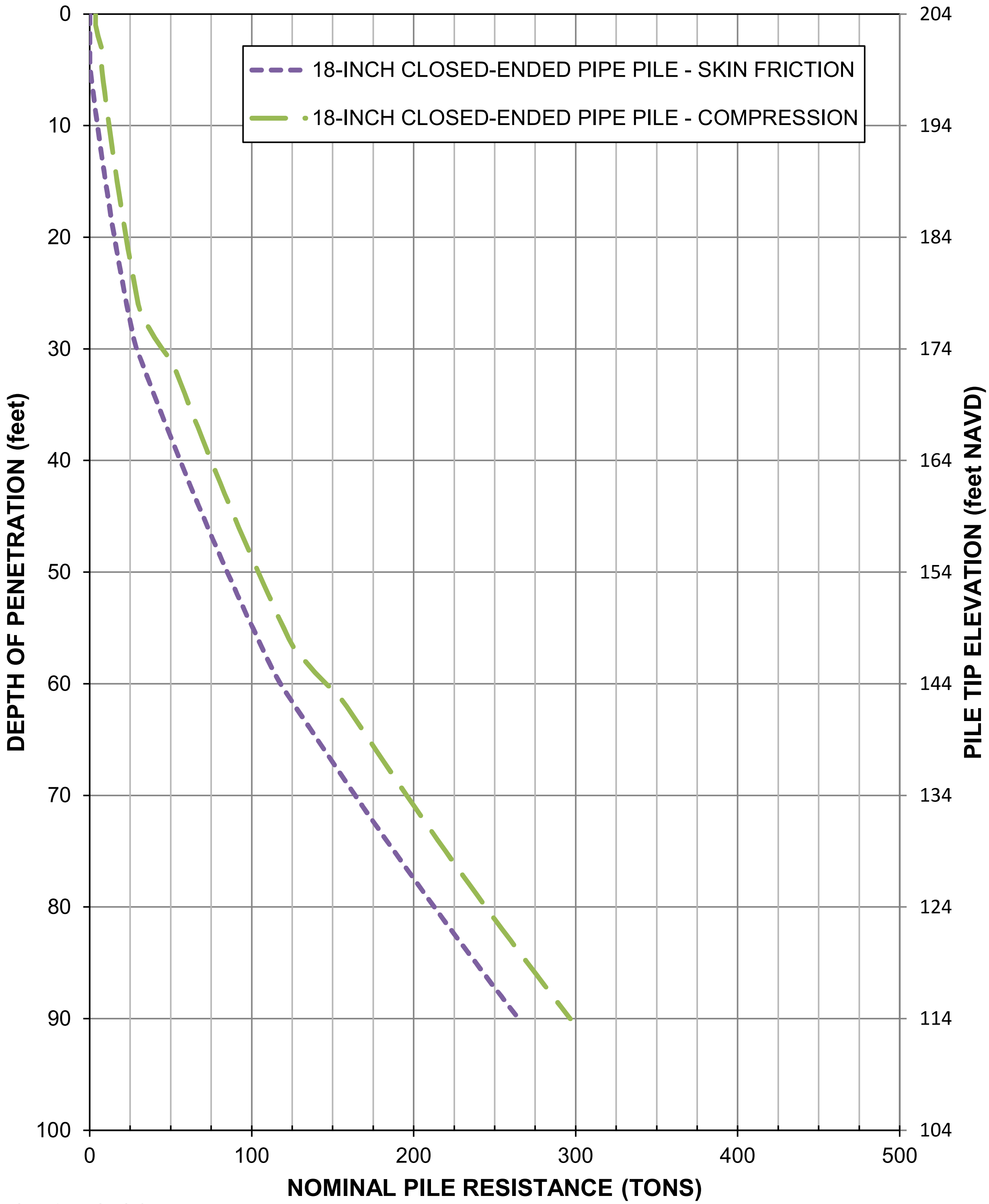
GEOTECHNOLOGY
PROJECT NUMBER J037781.01

# NOMINAL RESISTANCE CURVES
# 16-INCH CLOSED-ENDED PIPE PILE
# ARDOT HWY. 83 SPUR - HWY. 278 CONNECTOR
# (MONTICELLO) (S), DREW COUNTY - BENT 3



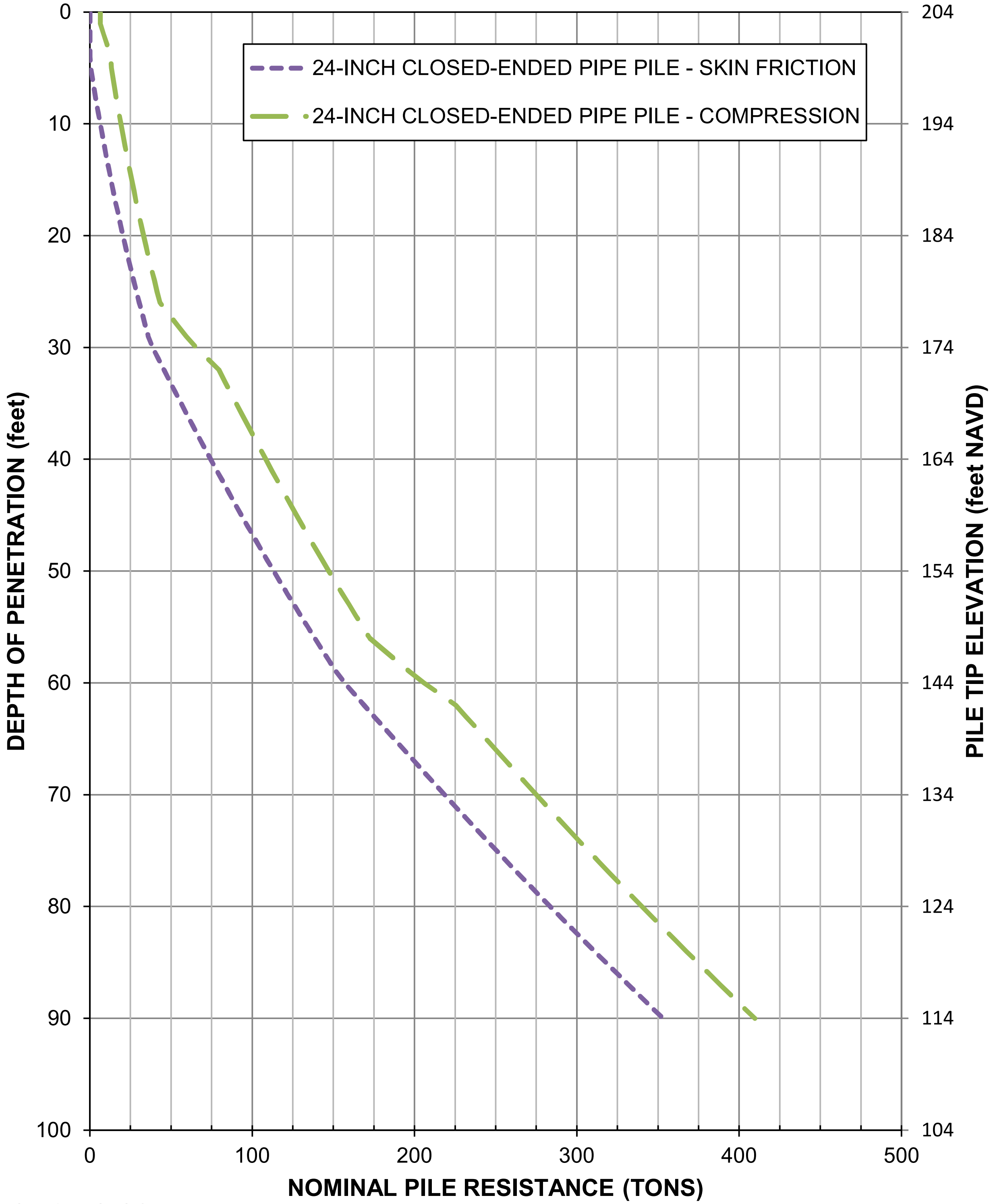
GEOTECHNOLOGY
PROJECT NUMBER J037781.01

# NOMINAL RESISTANCE CURVES
# 18-INCH CLOSED-ENDED PIPE PILE
# ARDOT HWY. 83 SPUR - HWY. 278 CONNECTOR
# (MONTICELLO) (S), DREW COUNTY - BENT 3



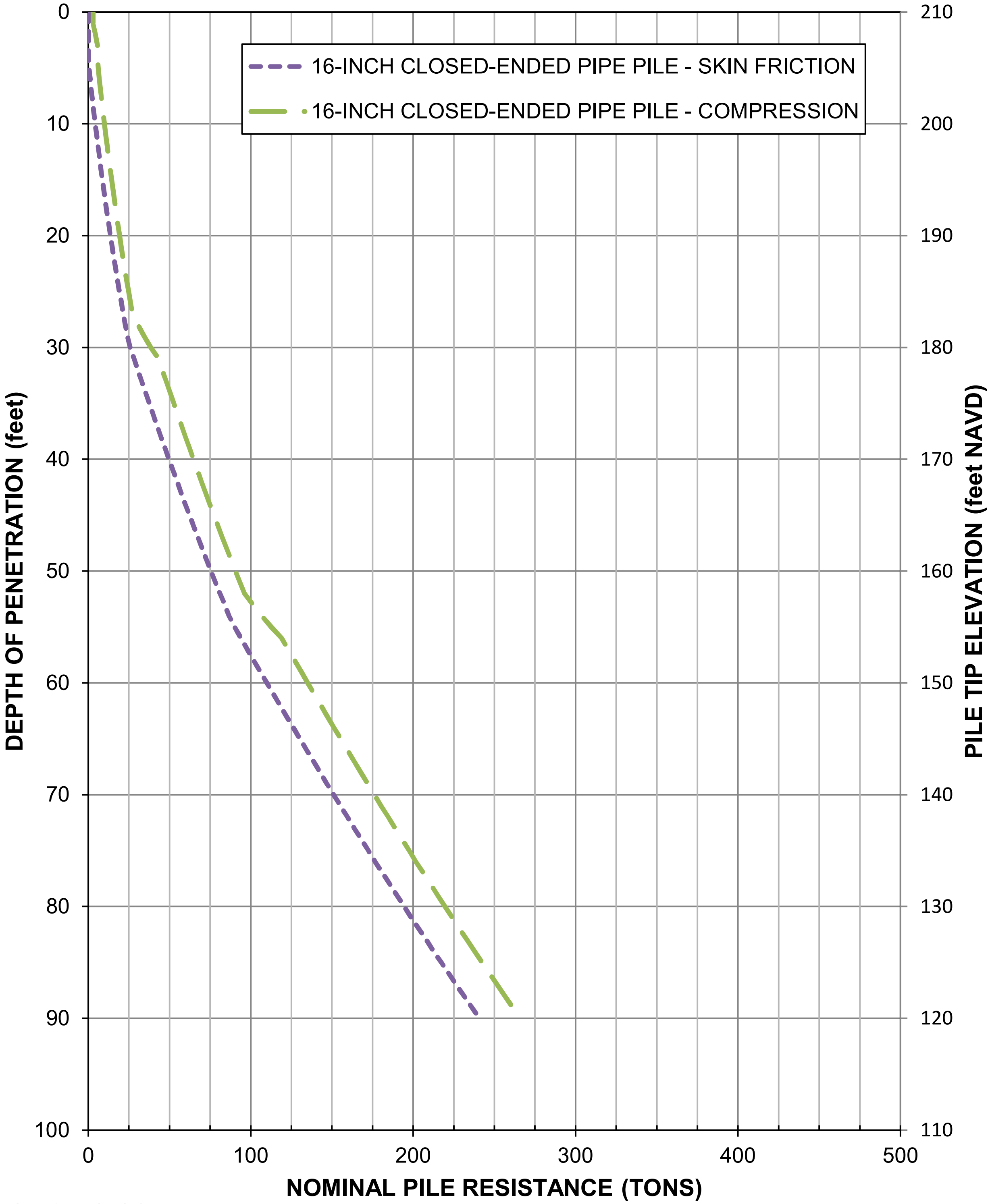
GEOTECHNOLOGY
PROJECT NUMBER J037781.01

# NOMINAL RESISTANCE CURVES
# 24-INCH CLOSED-ENDED PIPE PILE
# ARDOT HWY. 83 SPUR - HWY. 278 CONNECTOR
# (MONTICELLO) (S), DREW COUNTY - BENT 3



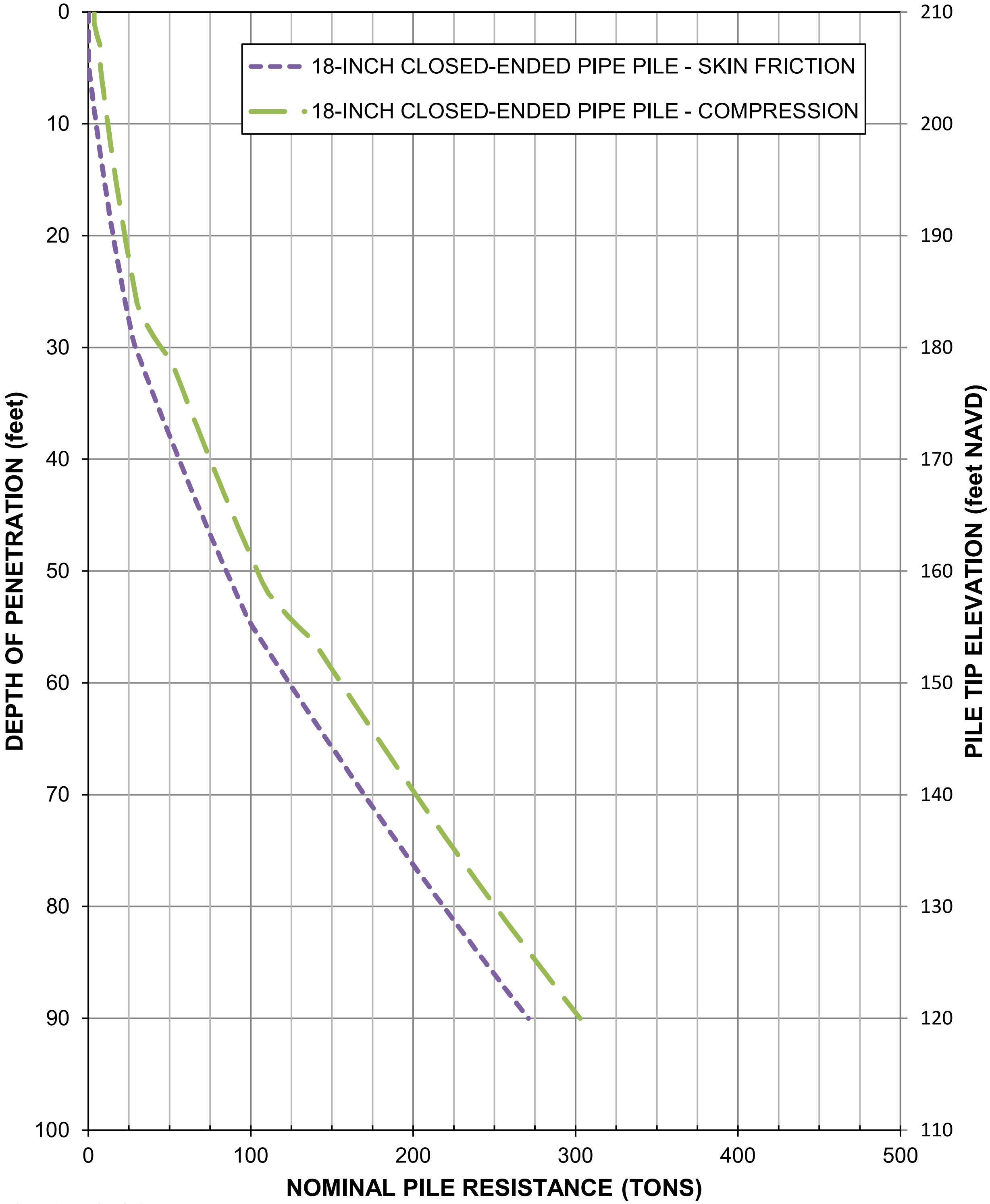
GEOTECHNOLOGY
PROJECT NUMBER J037781.01

# NOMINAL RESISTANCE CURVES
# 16-INCH CLOSED-ENDED PIPE PILE
# ARDOT HWY. 83 SPUR - HWY. 278 CONNECTOR (MONTICELLO) (S), DREW COUNTY - BENT 4



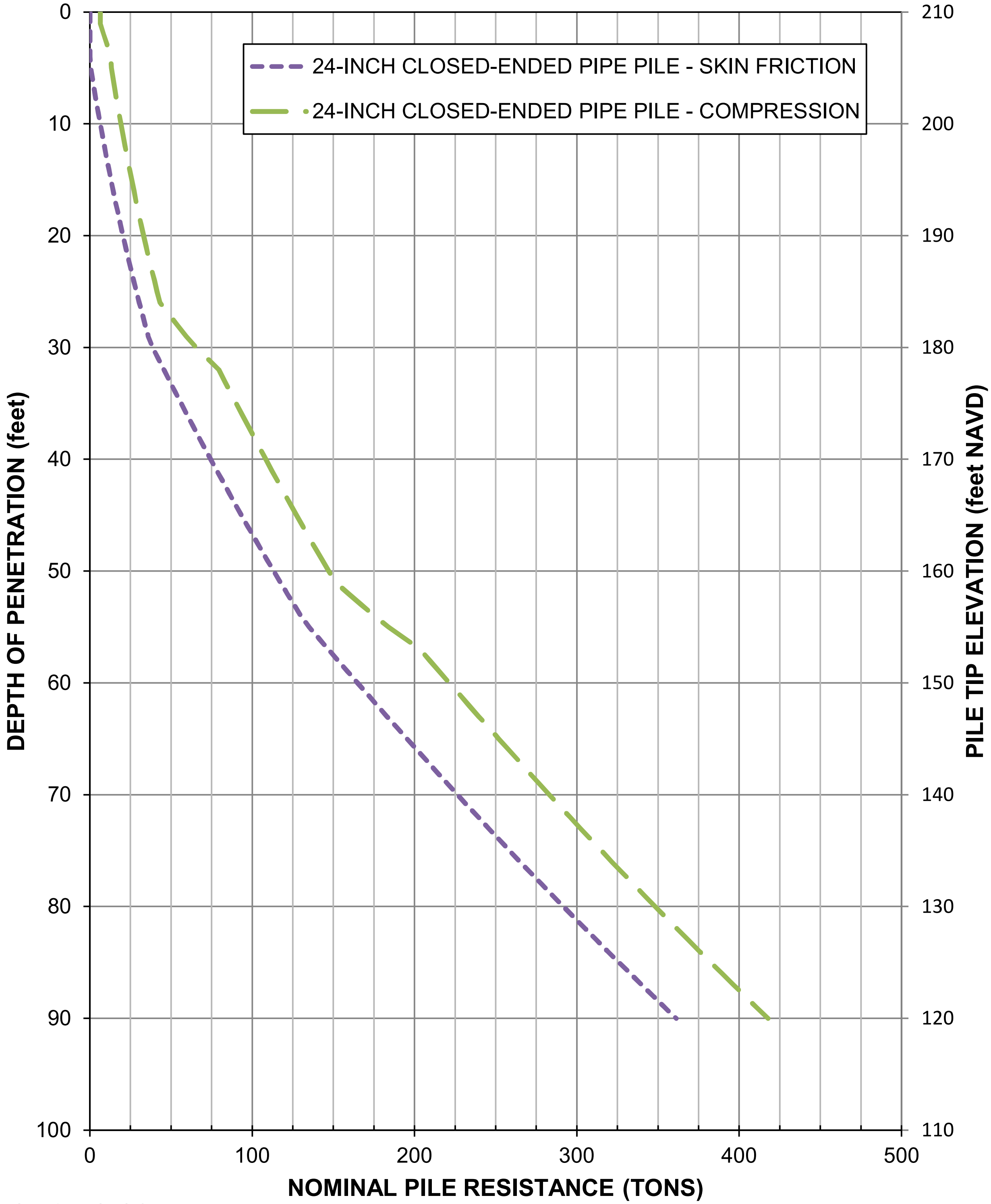
GEOTECHNOLOGY
PROJECT NUMBER J037781.01

## NOMINAL RESISTANCE CURVES
## 18-INCH CLOSED-ENDED PIPE PILE
## ARDOT HWY. 83 SPUR - HWY. 278 CONNECTOR
## (MONTICELLO) (S), DREW COUNTY - BENT 4



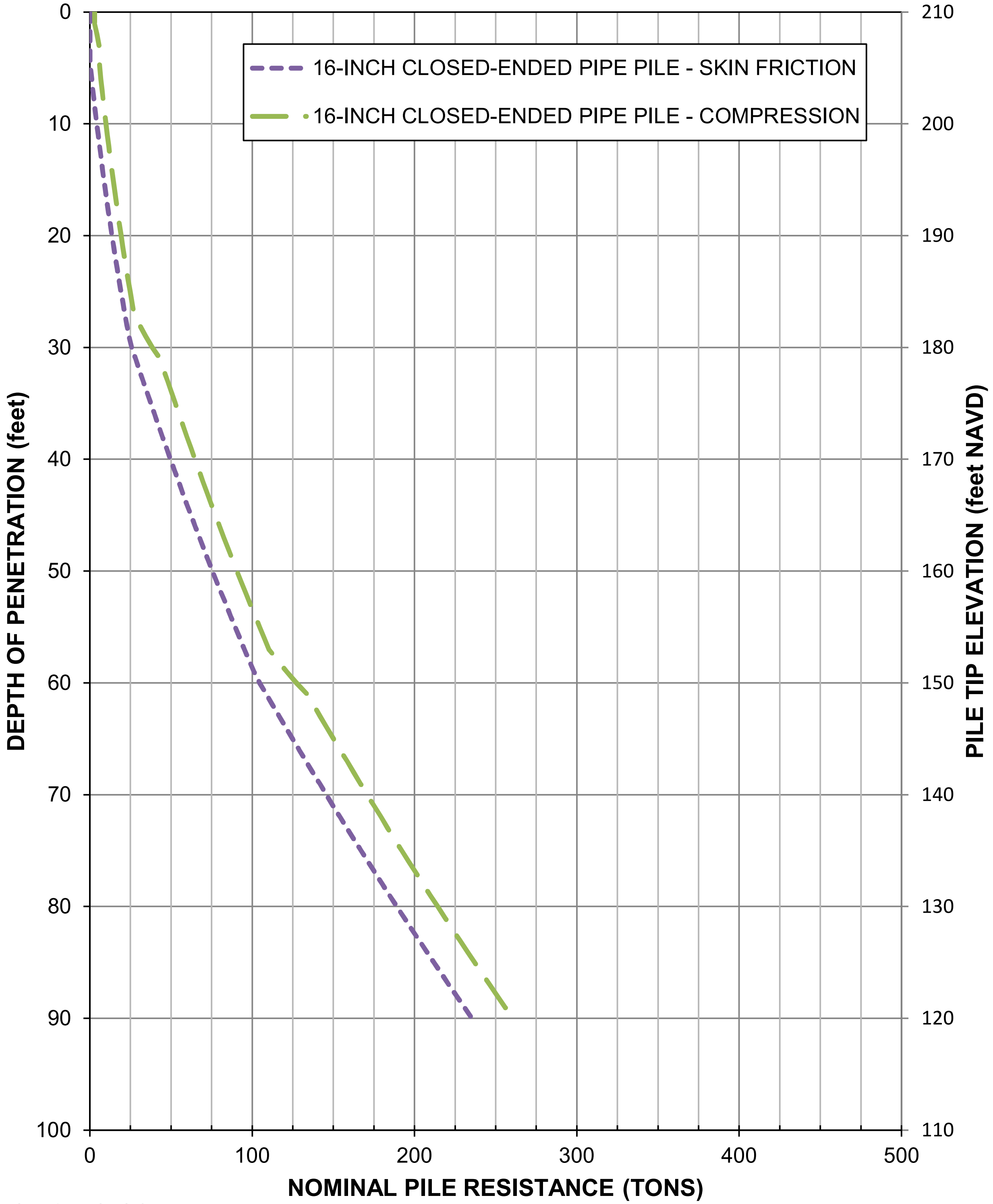
GEOTECHNOLOGY
PROJECT NUMBER J037781.01

# NOMINAL RESISTANCE CURVES
# 24-INCH CLOSED-ENDED PIPE PILE
# ARDOT HWY. 83 SPUR - HWY. 278 CONNECTOR
# (MONTICELLO) (S), DREW COUNTY - BENT 4



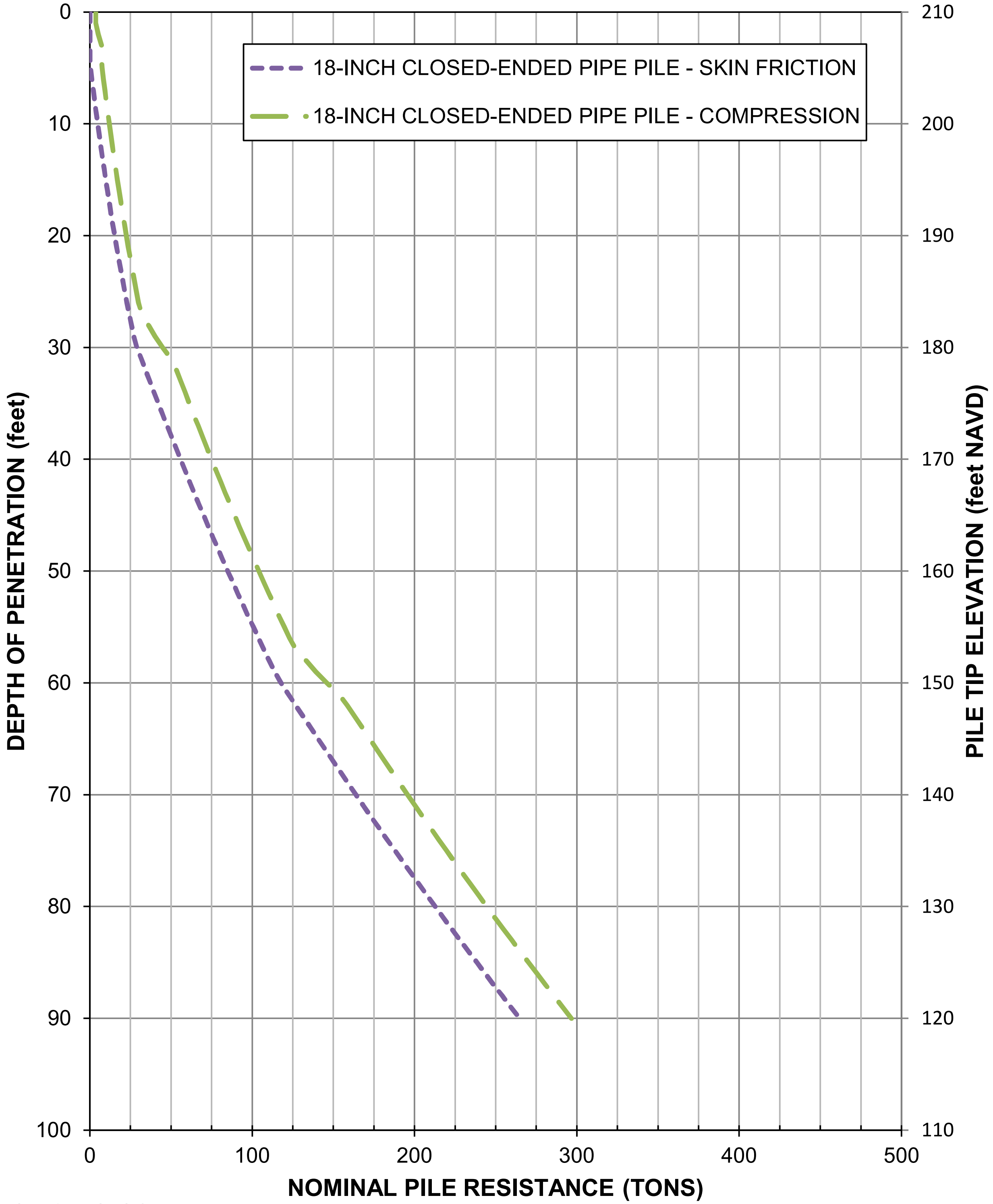
GEOTECHNOLOGY
PROJECT NUMBER J037781.01

## NOMINAL RESISTANCE CURVES
## 16-INCH CLOSED-ENDED PIPE PILE
## ARDOT HWY. 83 SPUR - HWY. 278 CONNECTOR
## (MONTICELLO) (S), DREW COUNTY - BENT 5



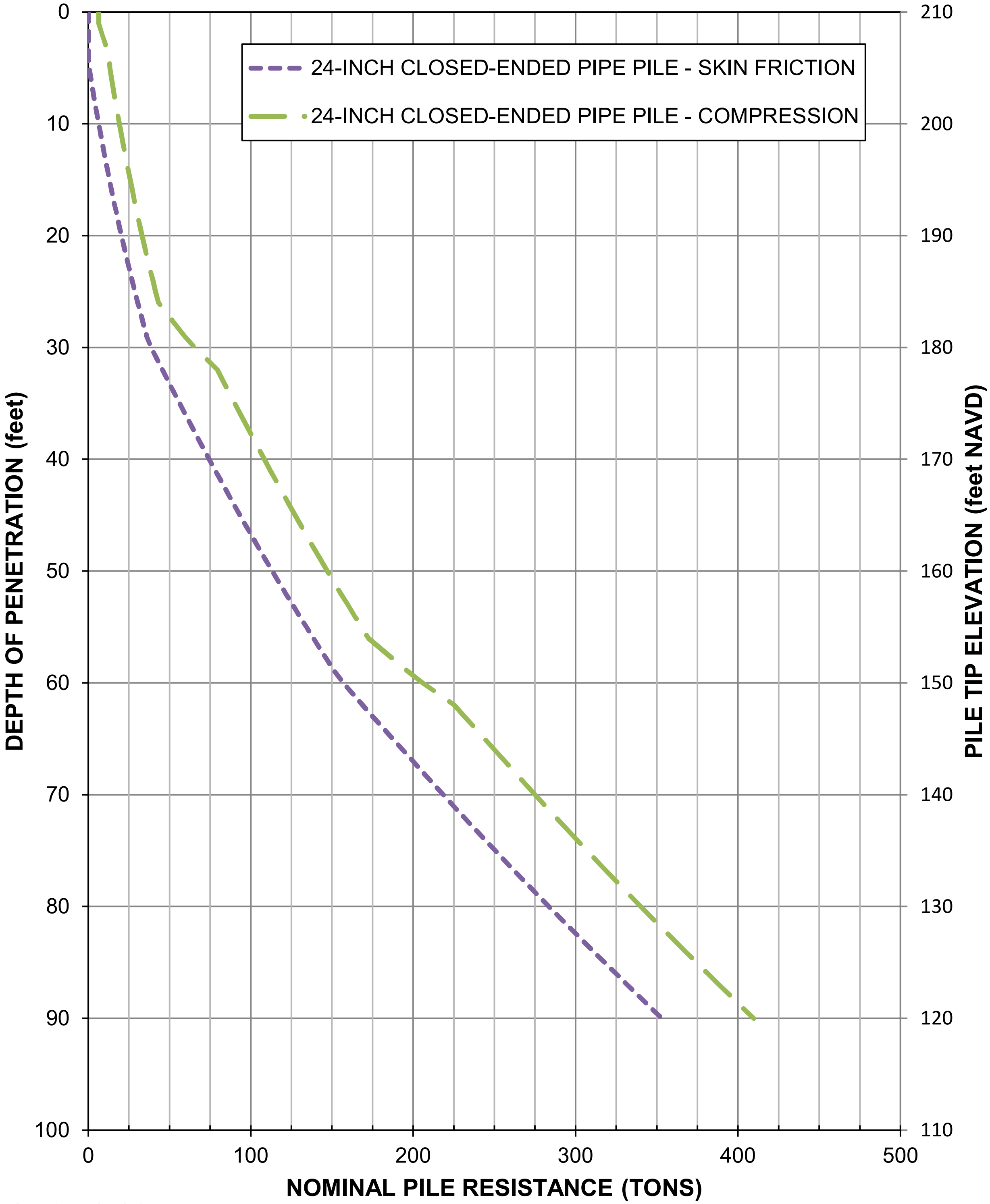
GEOTECHNOLOGY
PROJECT NUMBER J037781.01

## NOMINAL RESISTANCE CURVES
## 18-INCH CLOSED-ENDED PIPE PILE
## ARDOT HWY. 83 SPUR - HWY. 278 CONNECTOR (MONTICELLO) (S), DREW COUNTY - BENT 5



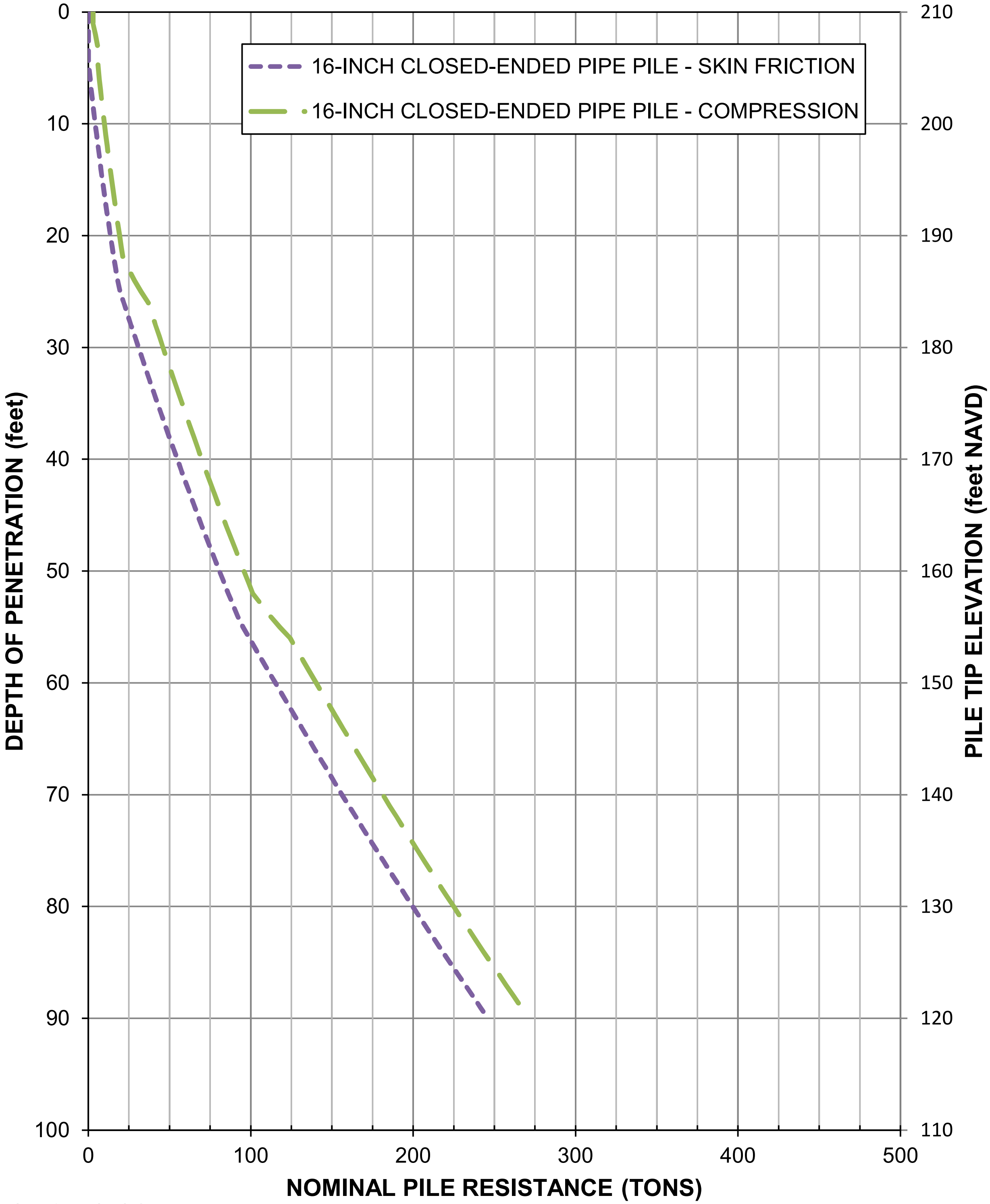
GEOTECHNOLOGY
PROJECT NUMBER J037781.01

# NOMINAL RESISTANCE CURVES
# 24-INCH CLOSED-ENDED PIPE PILE
# ARDOT HWY. 83 SPUR - HWY. 278 CONNECTOR
# (MONTICELLO) (S), DREW COUNTY - BENT 5



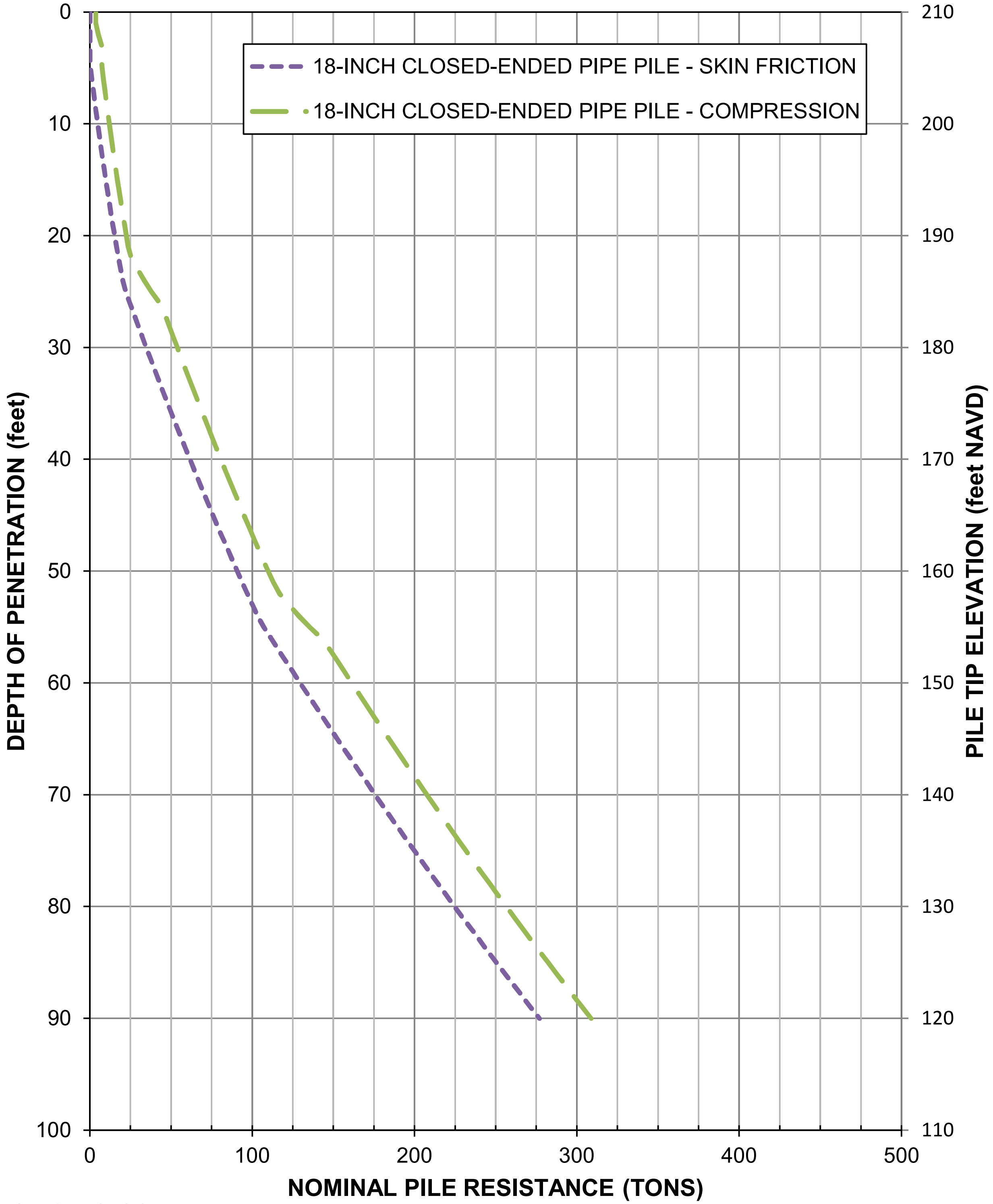
GEOTECHNOLOGY
PROJECT NUMBER J037781.01

# NOMINAL RESISTANCE CURVES
# 16-INCH CLOSED-ENDED PIPE PILE
# ARDOT HWY. 83 SPUR - HWY. 278 CONNECTOR
# (MONTICELLO) (S), DREW COUNTY - BENT 6

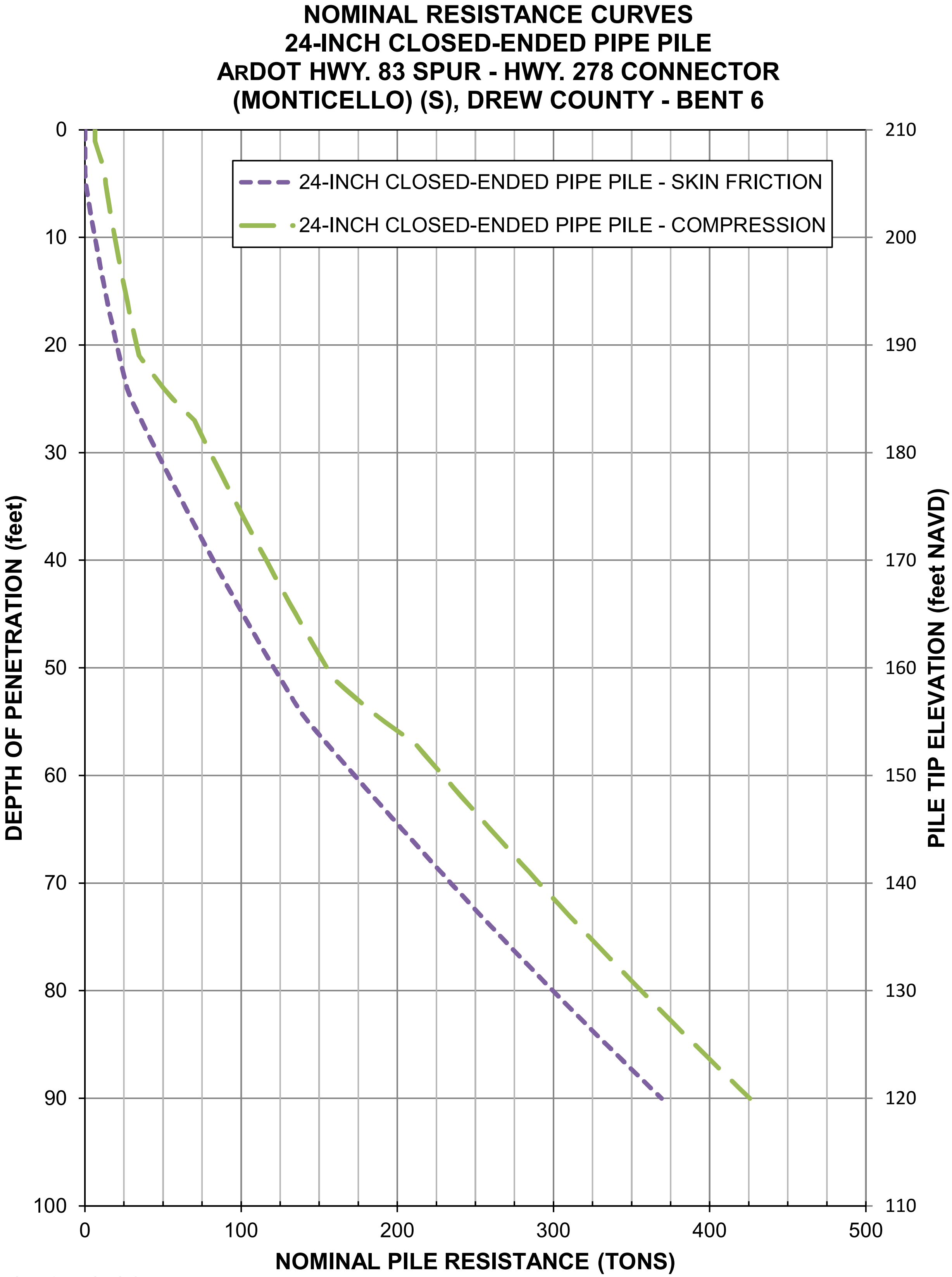


GEOTECHNOLOGY
PROJECT NUMBER J037781.01

# NOMINAL RESISTANCE CURVES
# 18-INCH CLOSED-ENDED PIPE PILE
# ARDOT HWY. 83 SPUR - HWY. 278 CONNECTOR
# (MONTICELLO) (S), DREW COUNTY - BENT 6

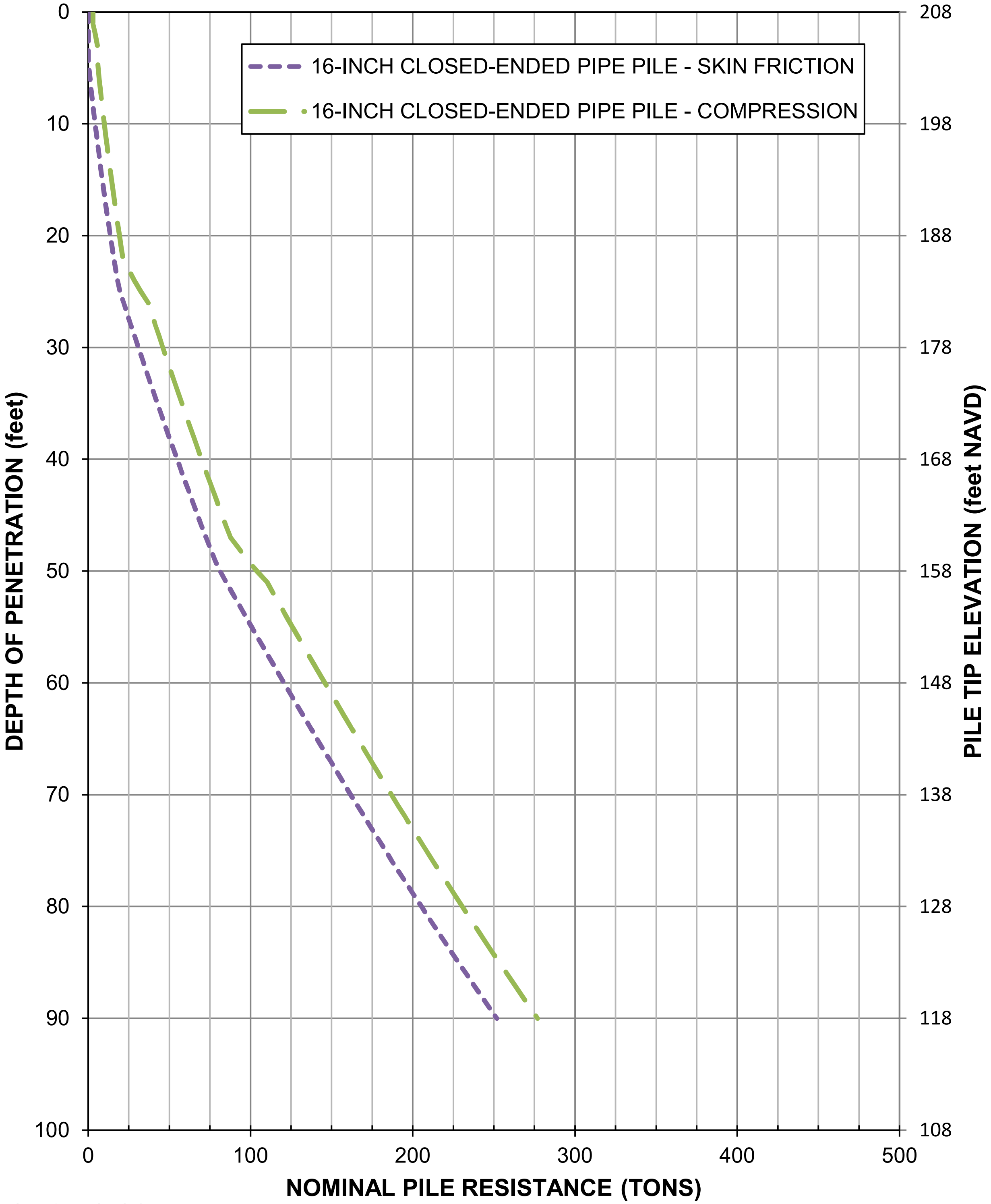


GEOTECHNOLOGY
PROJECT NUMBER J037781.01



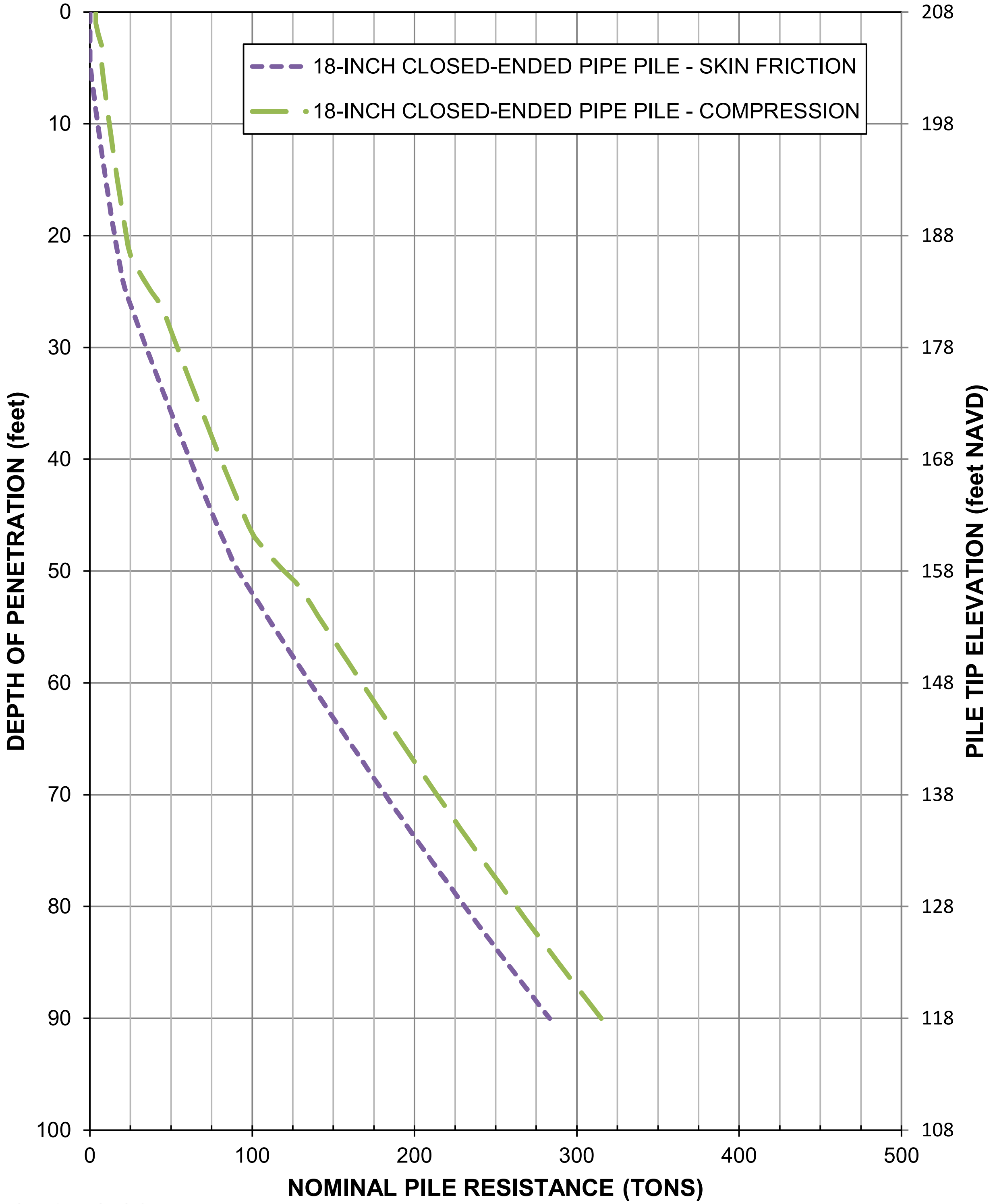
GEOTECHNOLOGY
PROJECT NUMBER J037781.01

# NOMINAL RESISTANCE CURVES
# 16-INCH CLOSED-ENDED PIPE PILE
# ARDOT HWY. 83 SPUR - HWY. 278 CONNECTOR
# (MONTICELLO) (S), DREW COUNTY - BENT 7



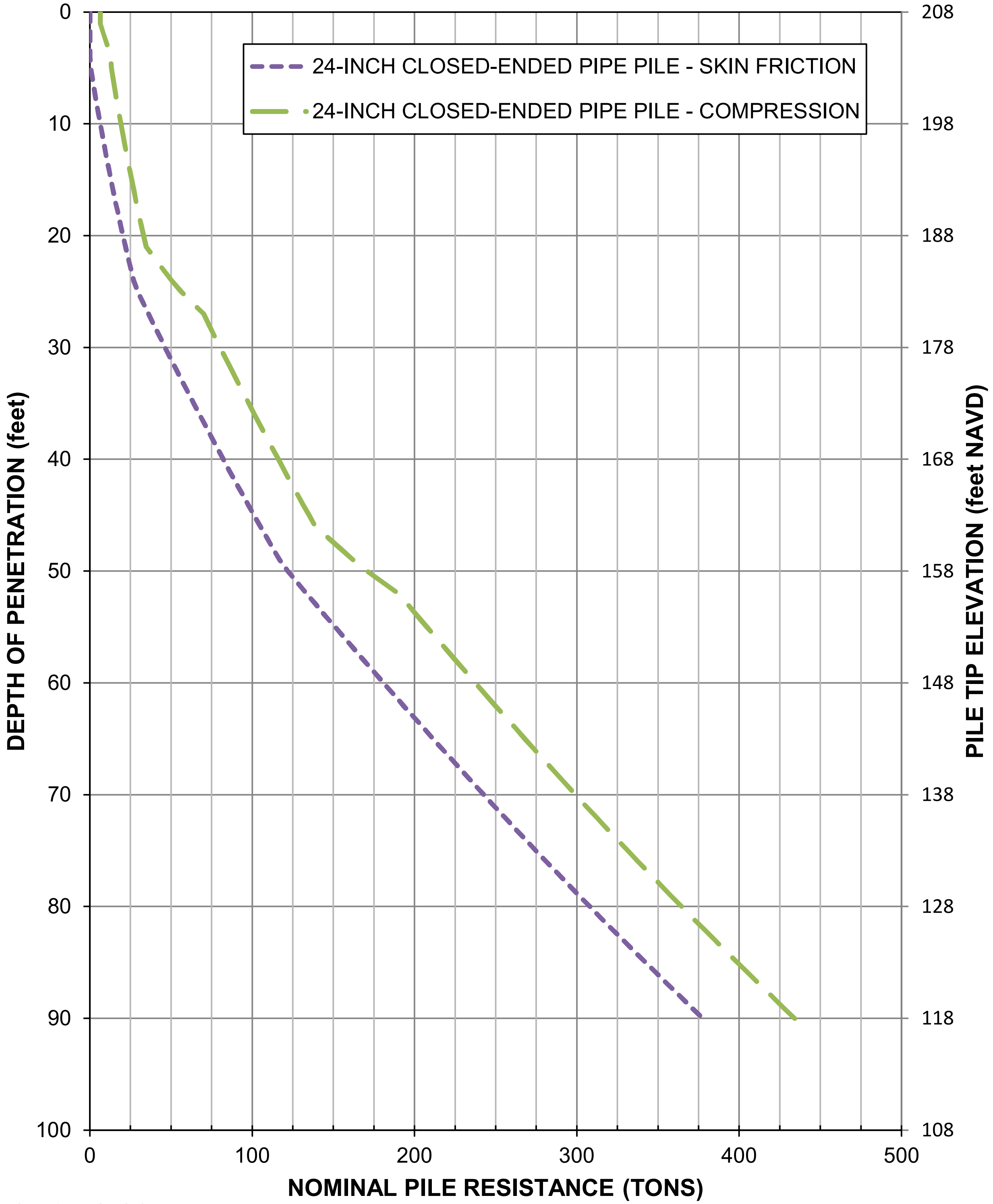
GEOTECHNOLOGY
PROJECT NUMBER J037781.01

# NOMINAL RESISTANCE CURVES
# 18-INCH CLOSED-ENDED PIPE PILE
# ARDOT HWY. 83 SPUR - HWY. 278 CONNECTOR
# (MONTICELLO) (S), DREW COUNTY - BENT 7



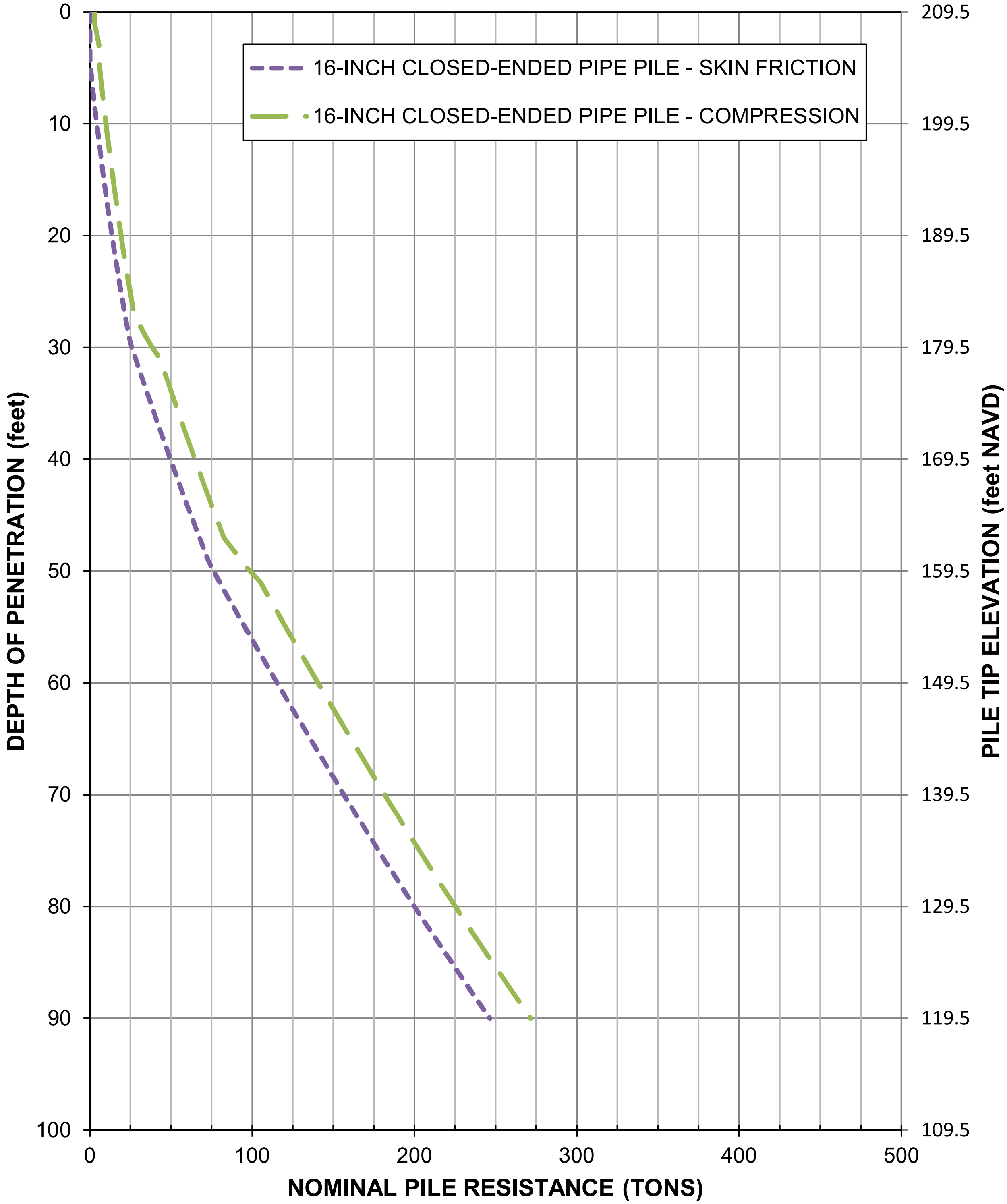
GEOTECHNOLOGY
PROJECT NUMBER J037781.01

# NOMINAL RESISTANCE CURVES
# 24-INCH CLOSED-ENDED PIPE PILE
# ARDOT HWY. 83 SPUR - HWY. 278 CONNECTOR
# (MONTICELLO) (S), DREW COUNTY - BENT 7



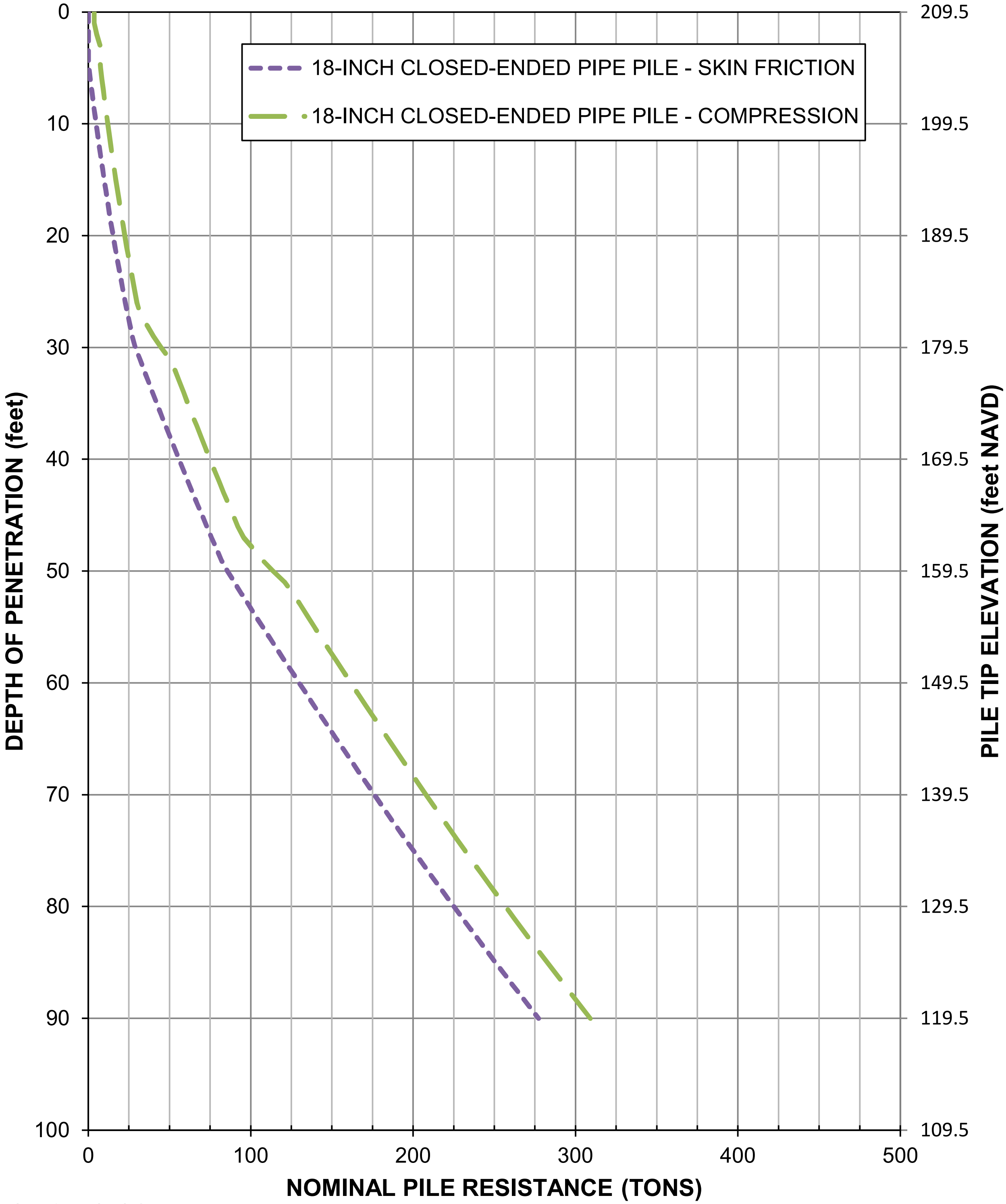
GEOTECHNOLOGY
PROJECT NUMBER J037781.01

## NOMINAL RESISTANCE CURVES
## 16-INCH CLOSED-ENDED PIPE PILE
## ARDOT HWY. 83 SPUR - HWY. 278 CONNECTOR
## (MONTICELLO) (S), DREW COUNTY - BENT 8



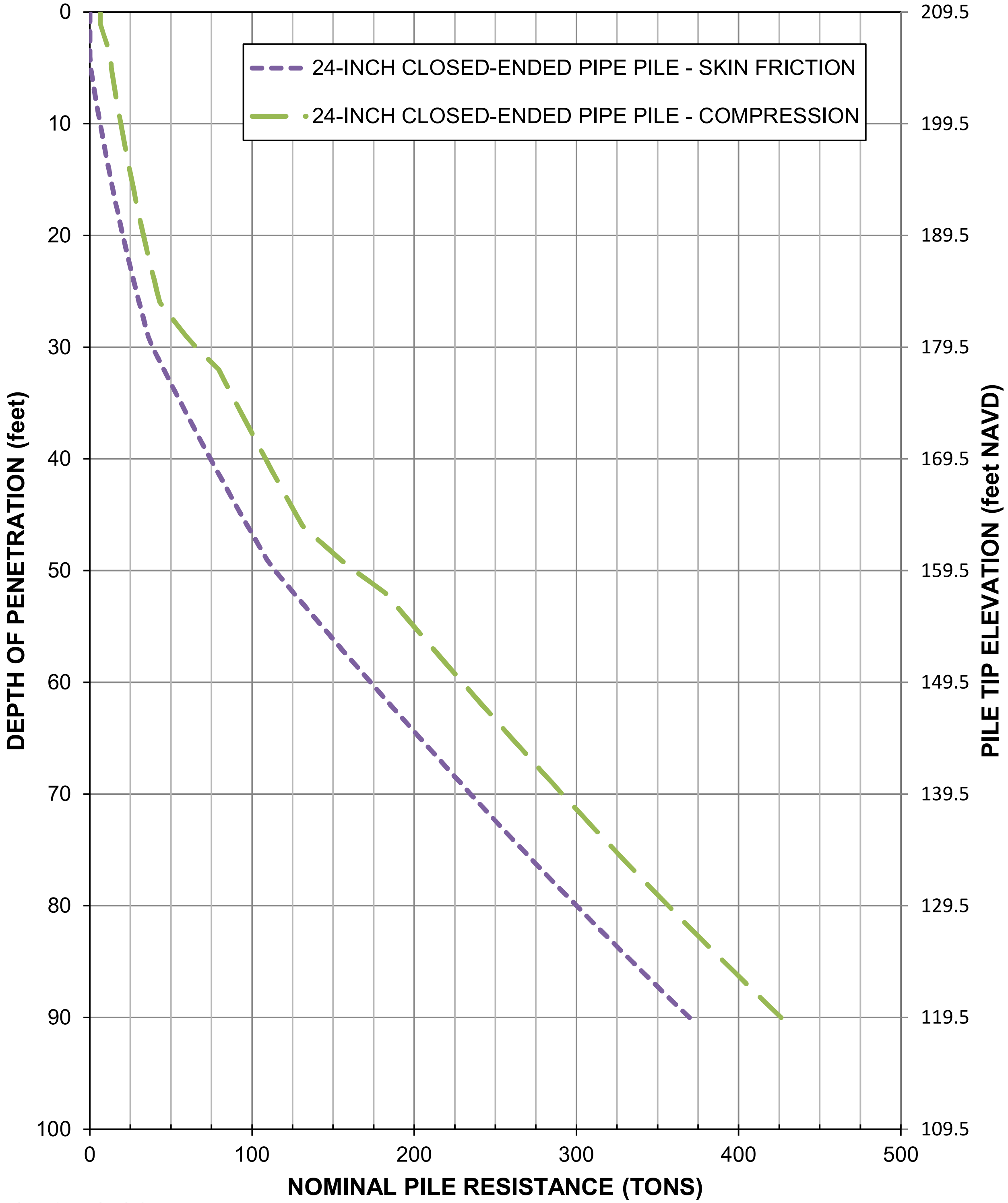
GEOTECHNOLOGY
PROJECT NUMBER J037781.01

# NOMINAL RESISTANCE CURVES
# 18-INCH CLOSED-ENDED PIPE PILE
# ARDOT HWY. 83 SPUR - HWY. 278 CONNECTOR
# (MONTICELLO) (S), DREW COUNTY - BENT 8



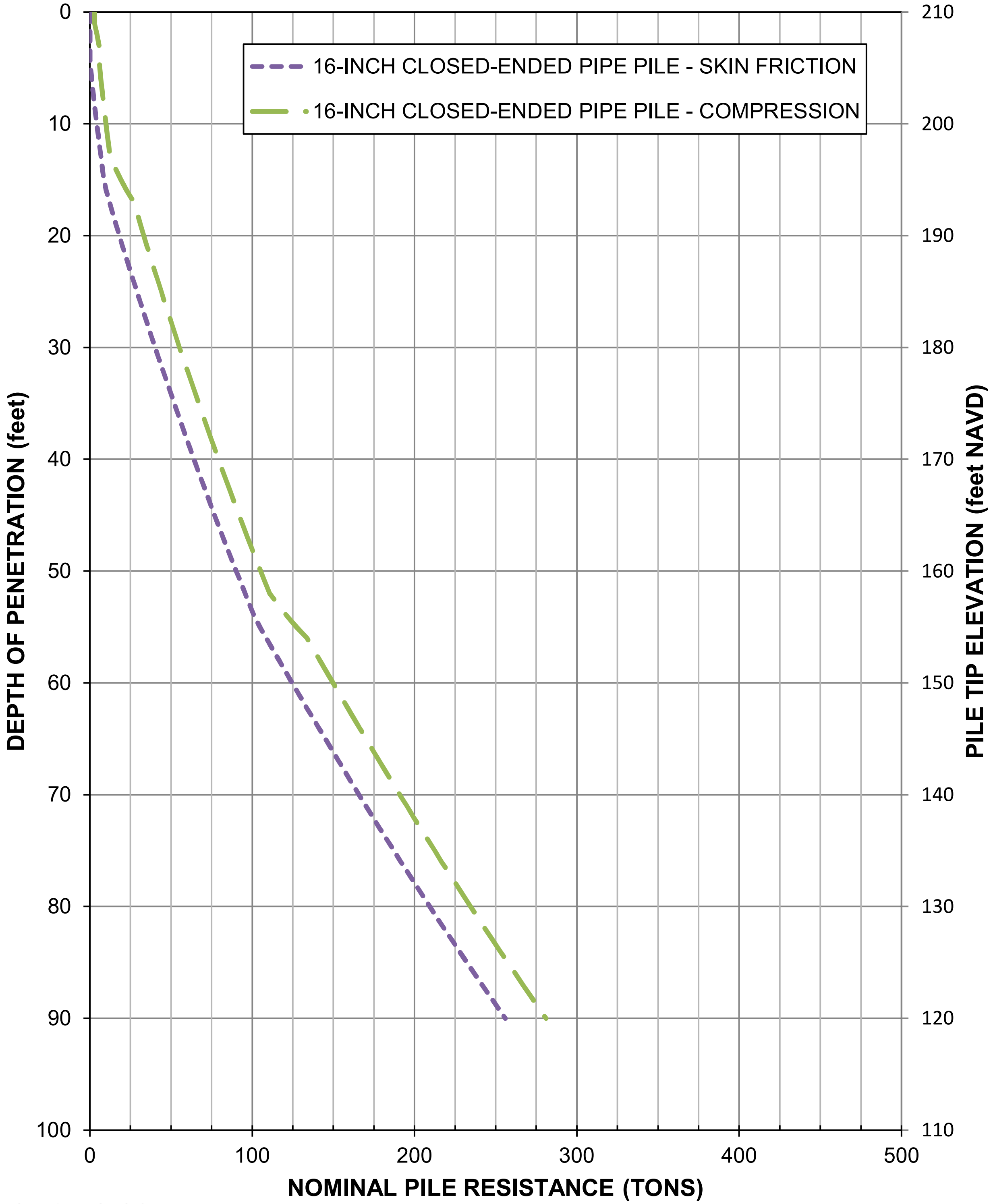
GEOTECHNOLOGY
PROJECT NUMBER J037781.01

# NOMINAL RESISTANCE CURVES
# 24-INCH CLOSED-ENDED PIPE PILE
# ARDOT HWY. 83 SPUR - HWY. 278 CONNECTOR
# (MONTICELLO) (S), DREW COUNTY - BENT 8



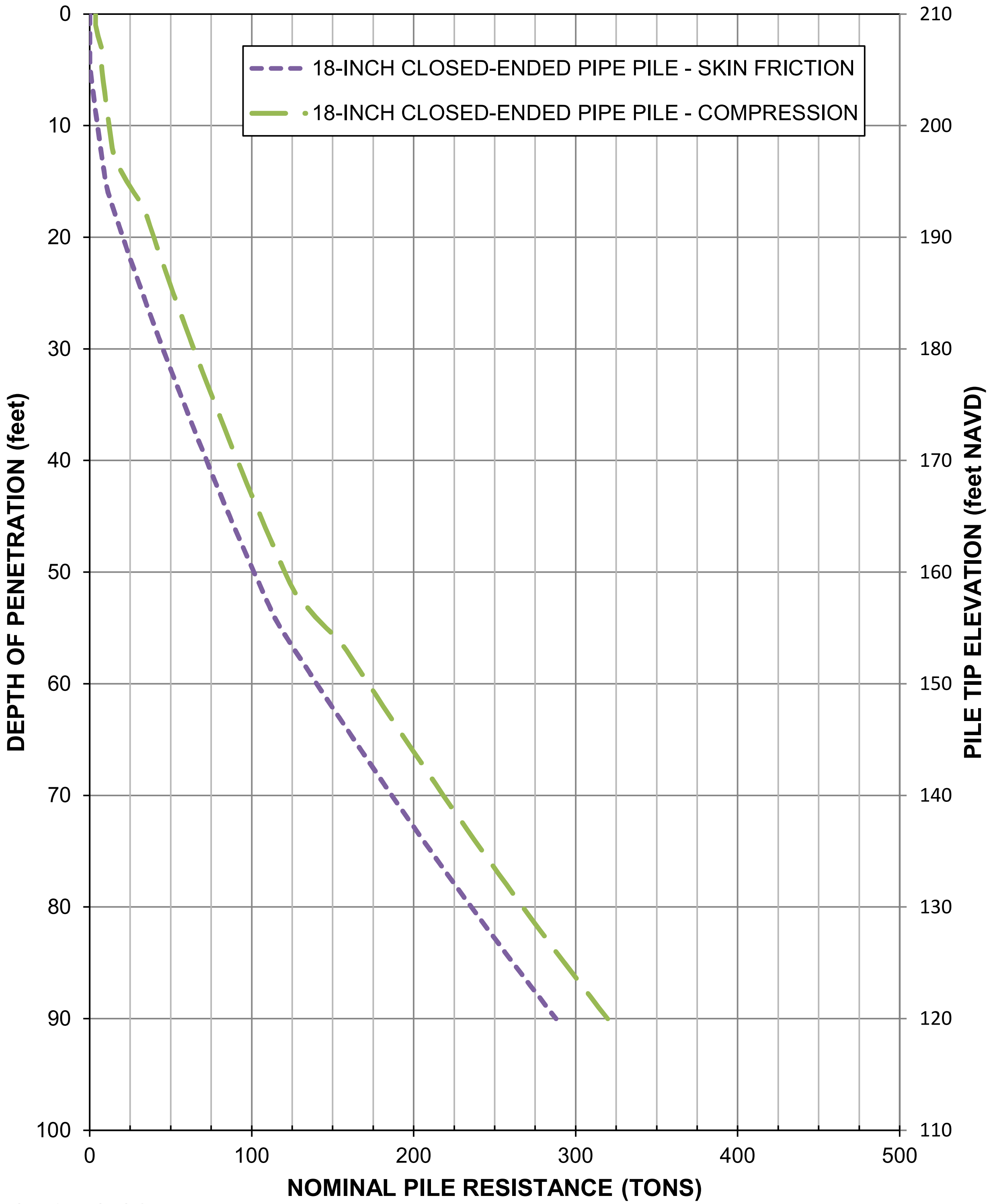
GEOTECHNOLOGY
PROJECT NUMBER J037781.01

# NOMINAL RESISTANCE CURVES
# 16-INCH CLOSED-ENDED PIPE PILE
# ARDOT HWY. 83 SPUR - HWY. 278 CONNECTOR
# (MONTICELLO) (S), DREW COUNTY - BENT 9



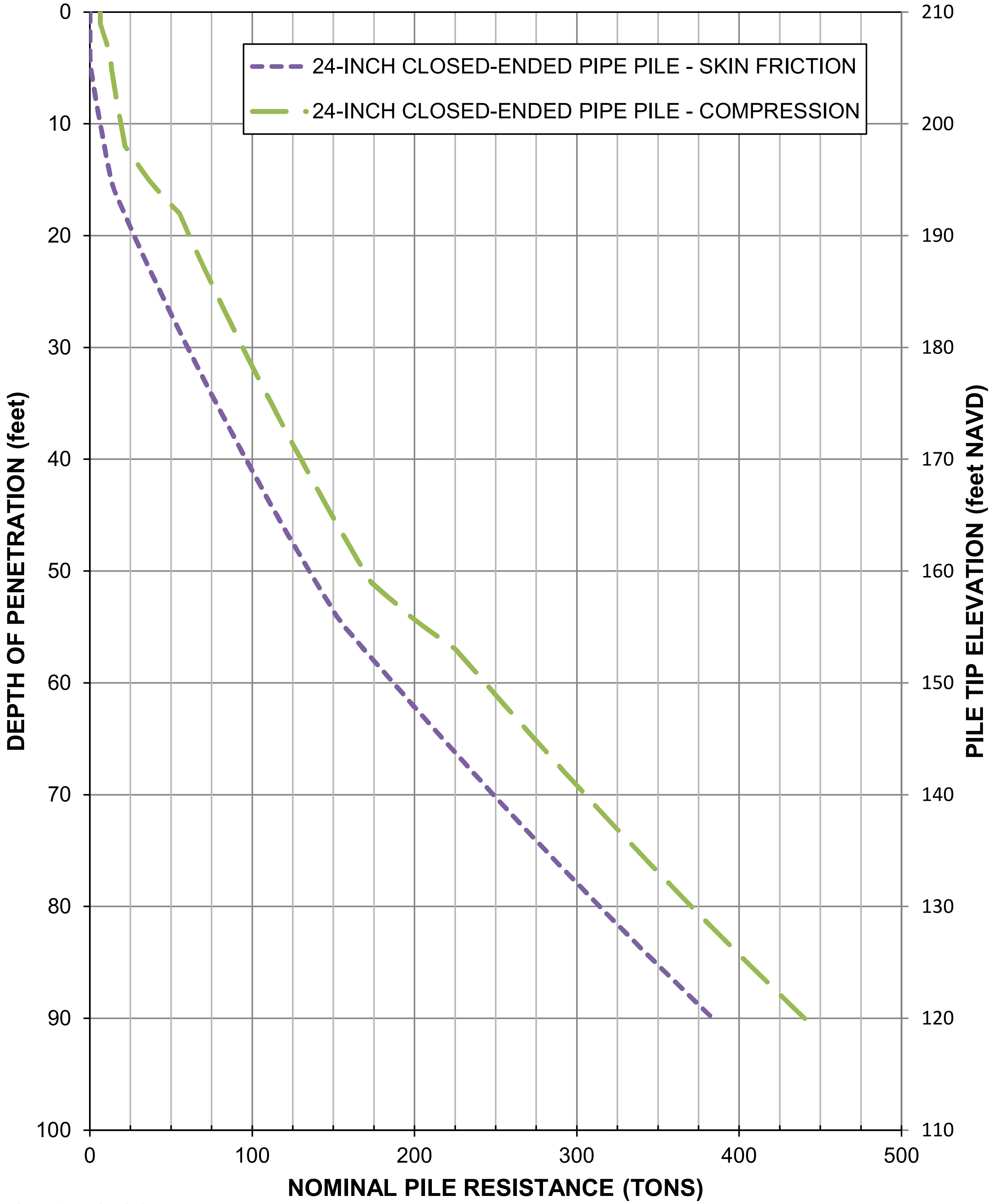
GEOTECHNOLOGY
PROJECT NUMBER J037781.01

## NOMINAL RESISTANCE CURVES
## 18-INCH CLOSED-ENDED PIPE PILE
## ARDOT HWY. 83 SPUR - HWY. 278 CONNECTOR
## (MONTICELLO) (S), DREW COUNTY - BENT 9



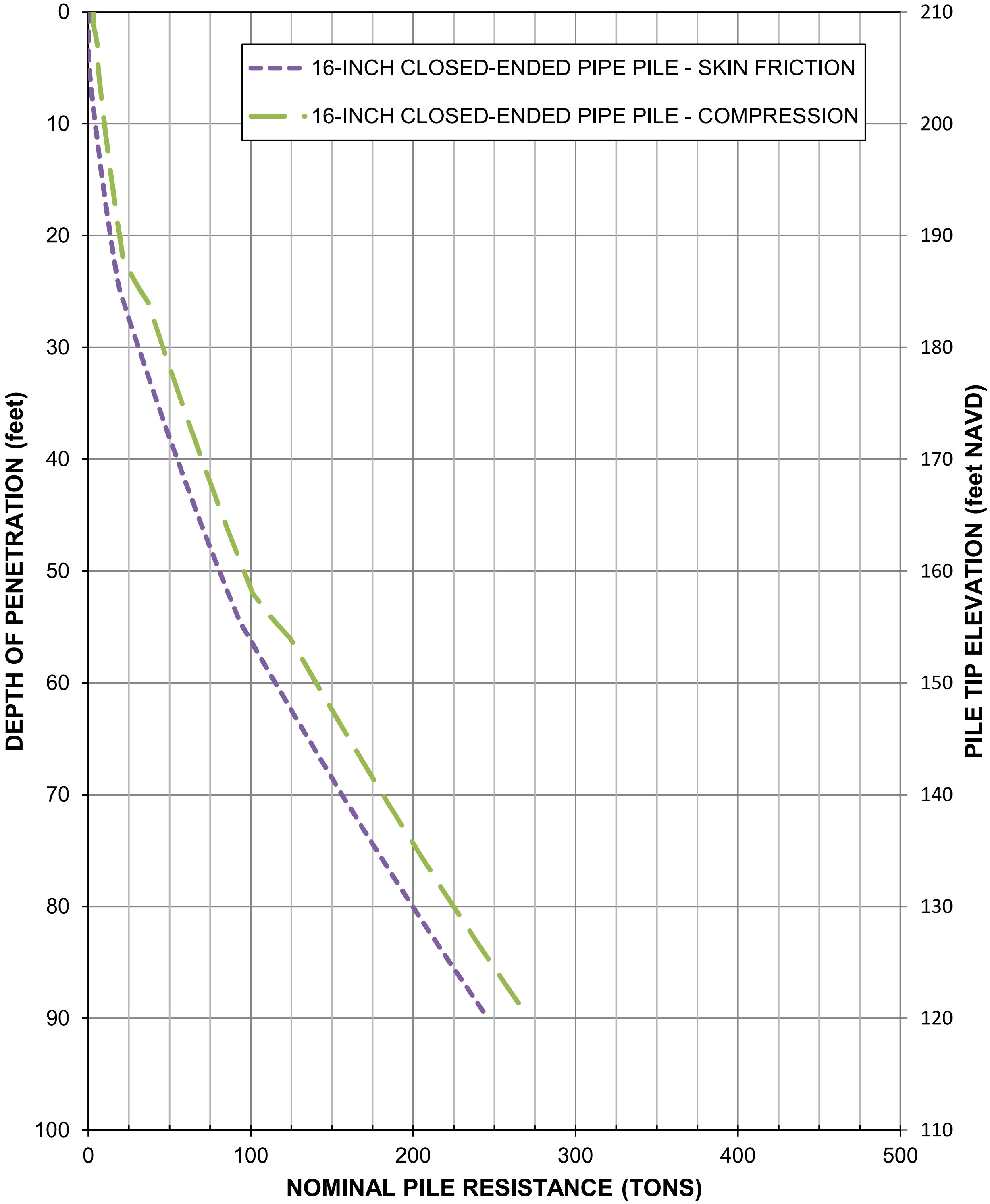
GEOTECHNOLOGY
PROJECT NUMBER J037781.01

# NOMINAL RESISTANCE CURVES
# 24-INCH CLOSED-ENDED PIPE PILE
# ARDOT HWY. 83 SPUR - HWY. 278 CONNECTOR (MONTICELLO) (S), DREW COUNTY - BENT 9



GEOTECHNOLOGY
PROJECT NUMBER J037781.01

## NOMINAL RESISTANCE CURVES
## 16-INCH CLOSED-ENDED PIPE PILE
## ARDOT HWY. 83 SPUR - HWY. 278 CONNECTOR
## (MONTICELLO) (S), DREW COUNTY - BENT 10



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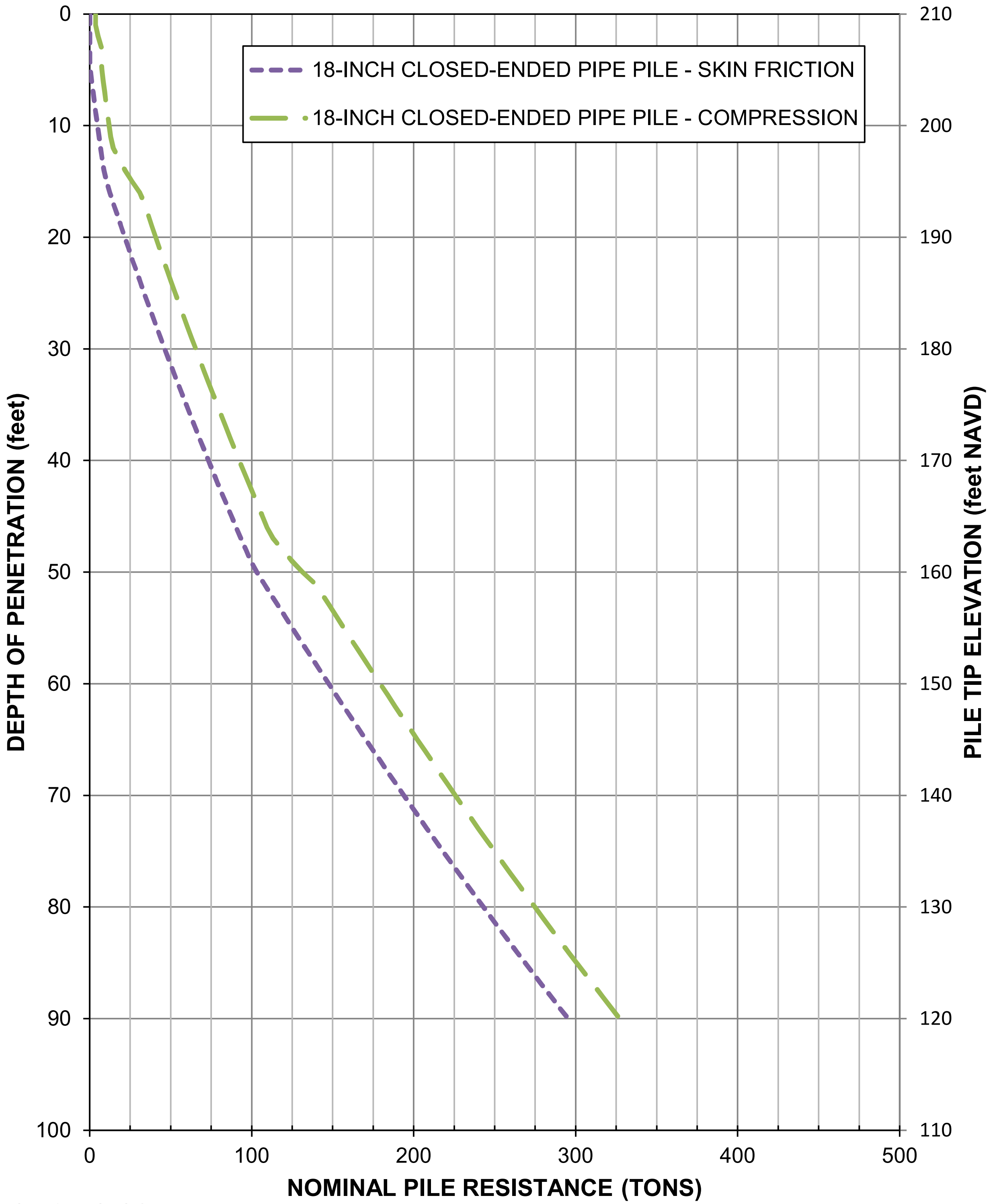
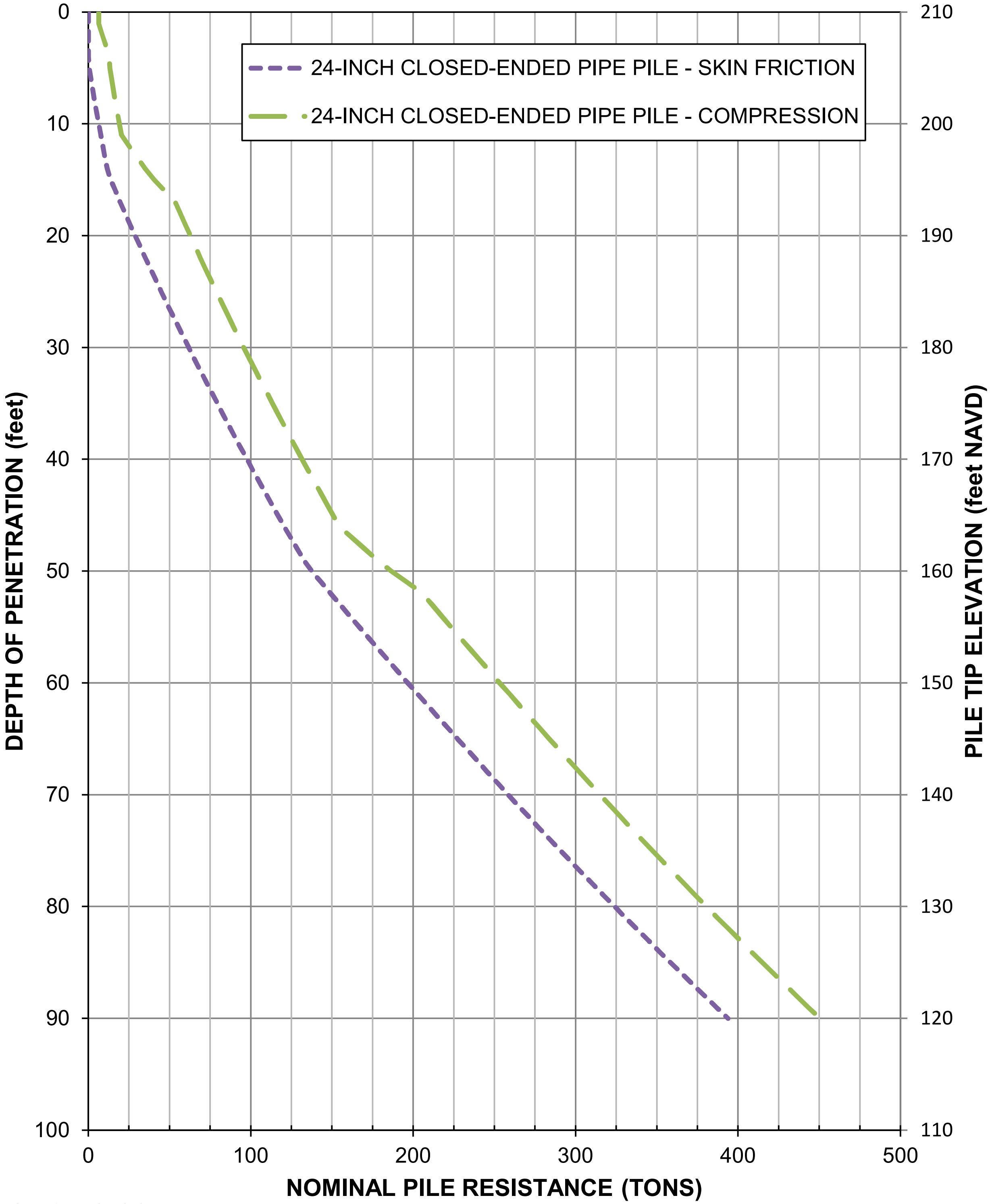
PROJECT NUMBER J037781.01

# NOMINAL RESISTANCE CURVES
# 18-INCH CLOSED-ENDED PIPE PILE
# ARDOT HWY. 83 SPUR - HWY. 278 CONNECTOR
# (MONTICELLO) (S), DREW COUNTY - BENT 10



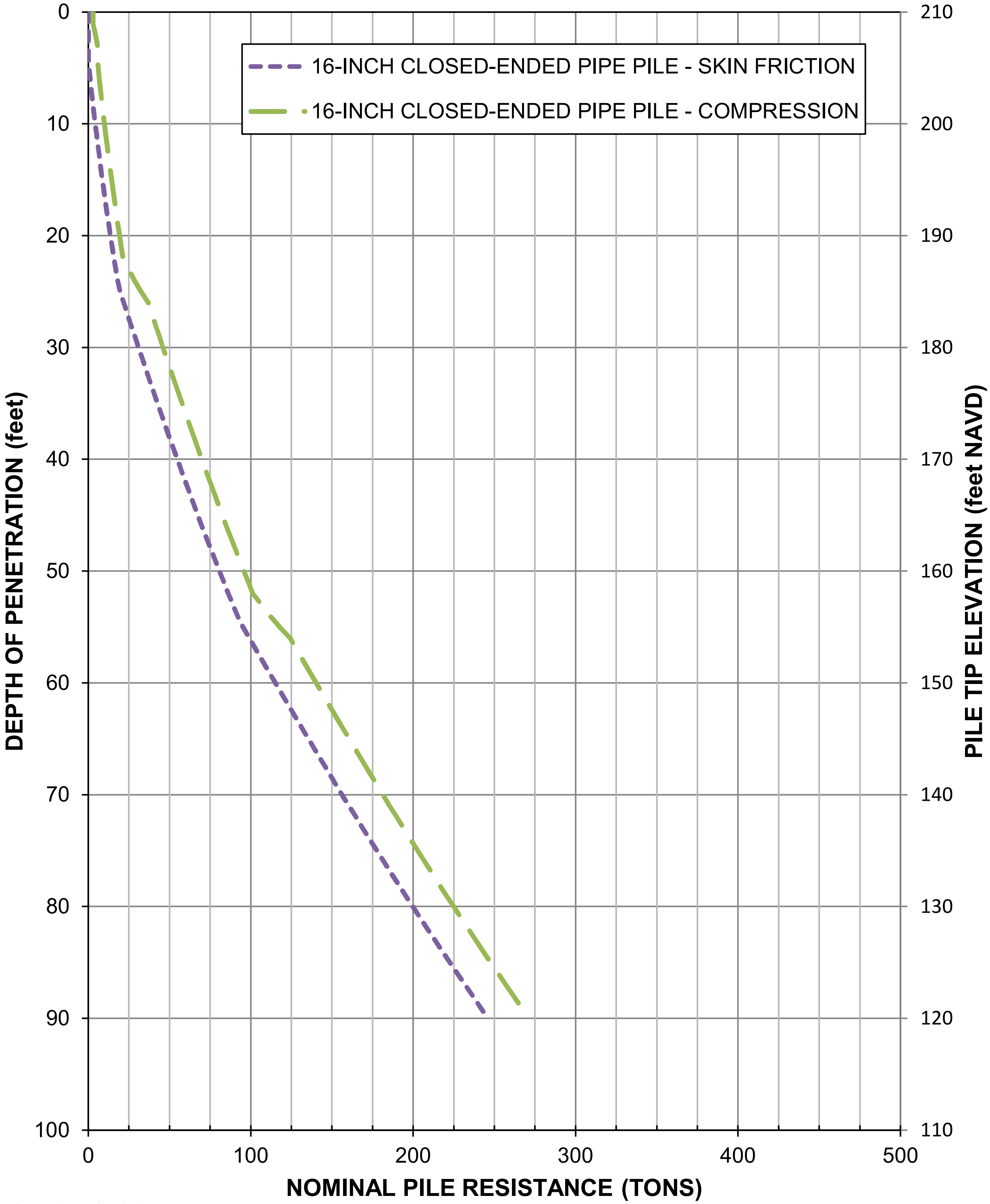
GEOTECHNOLOGY
PROJECT NUMBER J037781.01

# NOMINAL RESISTANCE CURVES
# 24-INCH CLOSED-ENDED PIPE PILE
# ARDOT HWY. 83 SPUR - HWY. 278 CONNECTOR
# (MONTICELLO) (S), DREW COUNTY - BENT 10



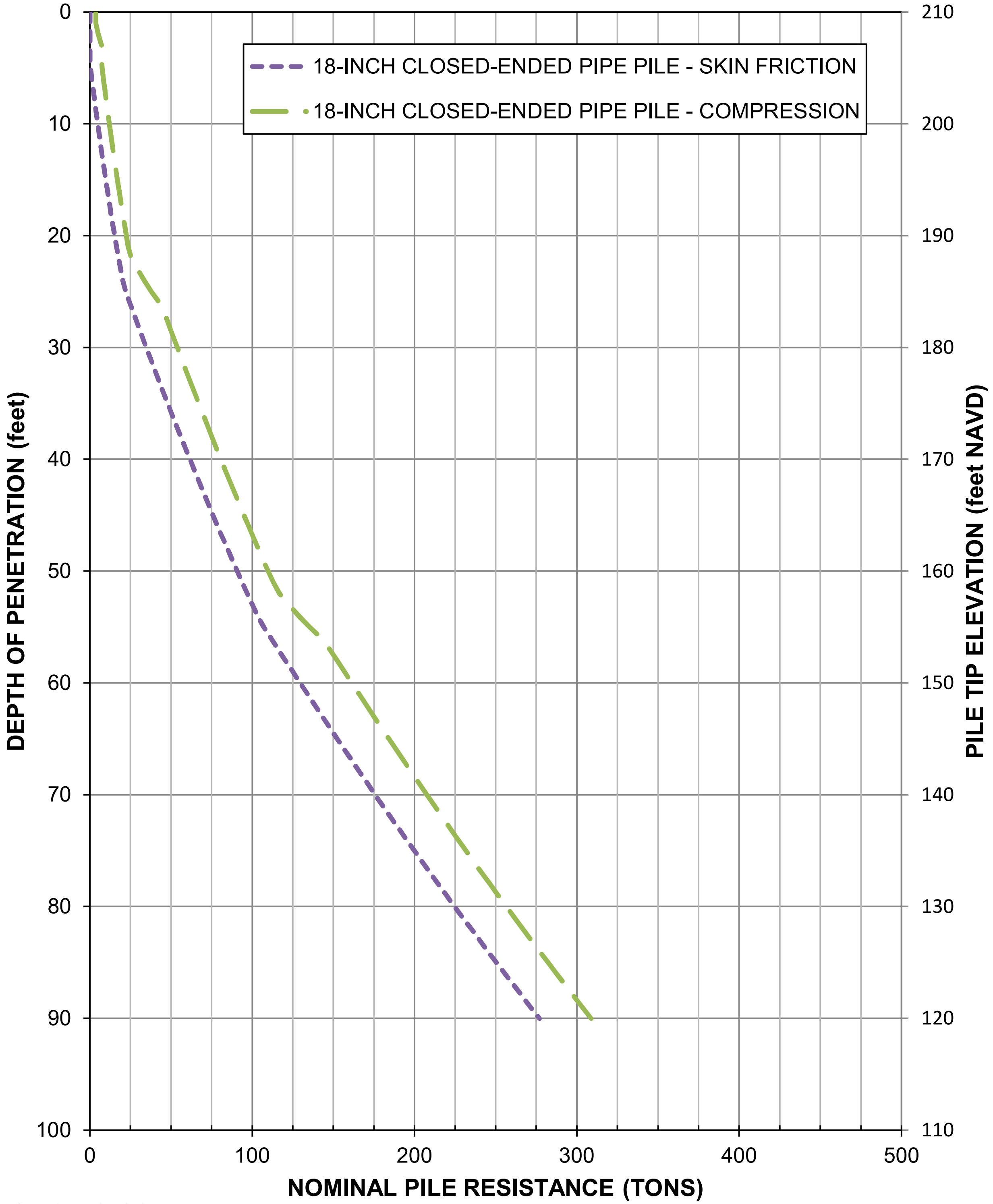
GEOTECHNOLOGY
PROJECT NUMBER J037781.01

## NOMINAL RESISTANCE CURVES
## 16-INCH CLOSED-ENDED PIPE PILE
## ARDOT HWY. 83 SPUR - HWY. 278 CONNECTOR
## (MONTICELLO) (S), DREW COUNTY - BENT 11



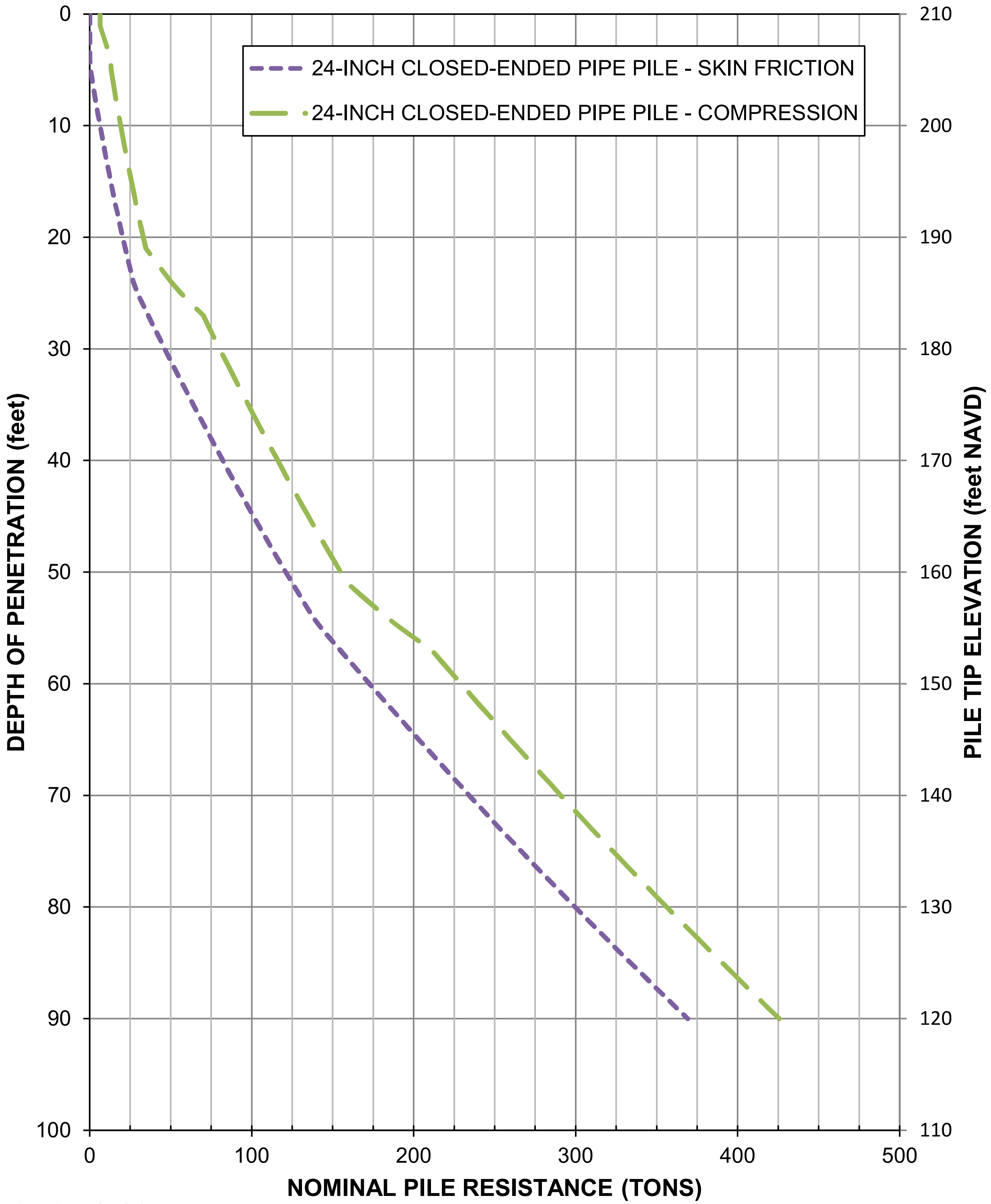
GEOTECHNOLOGY
PROJECT NUMBER J037781.01

# NOMINAL RESISTANCE CURVES
# 18-INCH CLOSED-ENDED PIPE PILE
# ARDOT HWY. 83 SPUR - HWY. 278 CONNECTOR
# (MONTICELLO) (S), DREW COUNTY - BENT 11



GEOTECHNOLOGY
PROJECT NUMBER J037781.01

# NOMINAL RESISTANCE CURVES
# 24-INCH CLOSED-ENDED PIPE PILE
# ARDOT HWY. 83 SPUR - HWY. 278 CONNECTOR
# (MONTICELLO) (S), DREW COUNTY - BENT 11



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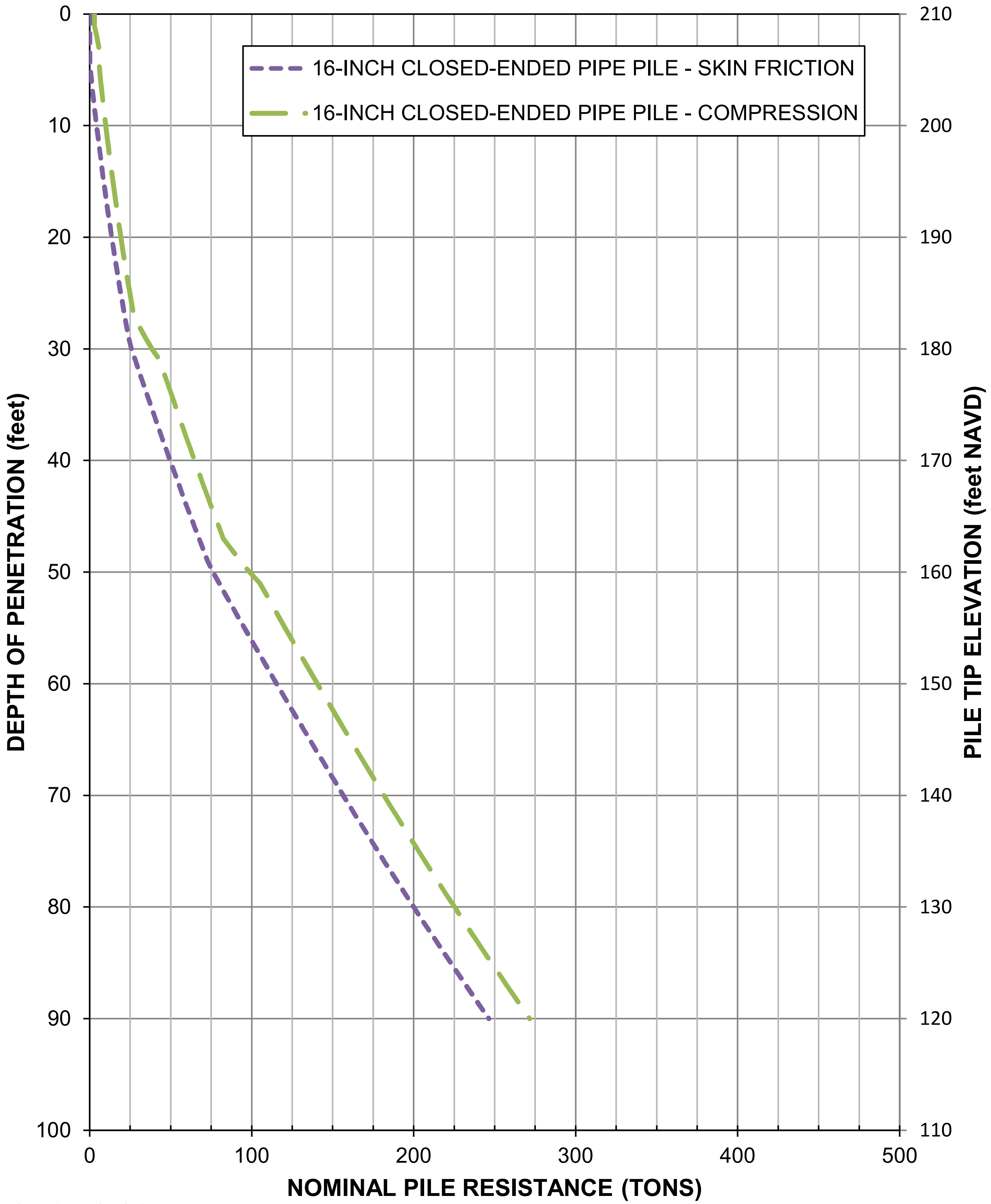
PROJECT NUMBER J037781.01

# NOMINAL RESISTANCE CURVES
# 16-INCH CLOSED-ENDED PIPE PILE
# ARDOT HWY. 83 SPUR - HWY. 278 CONNECTOR
# (MONTICELLO) (S), DREW COUNTY - BENT 12



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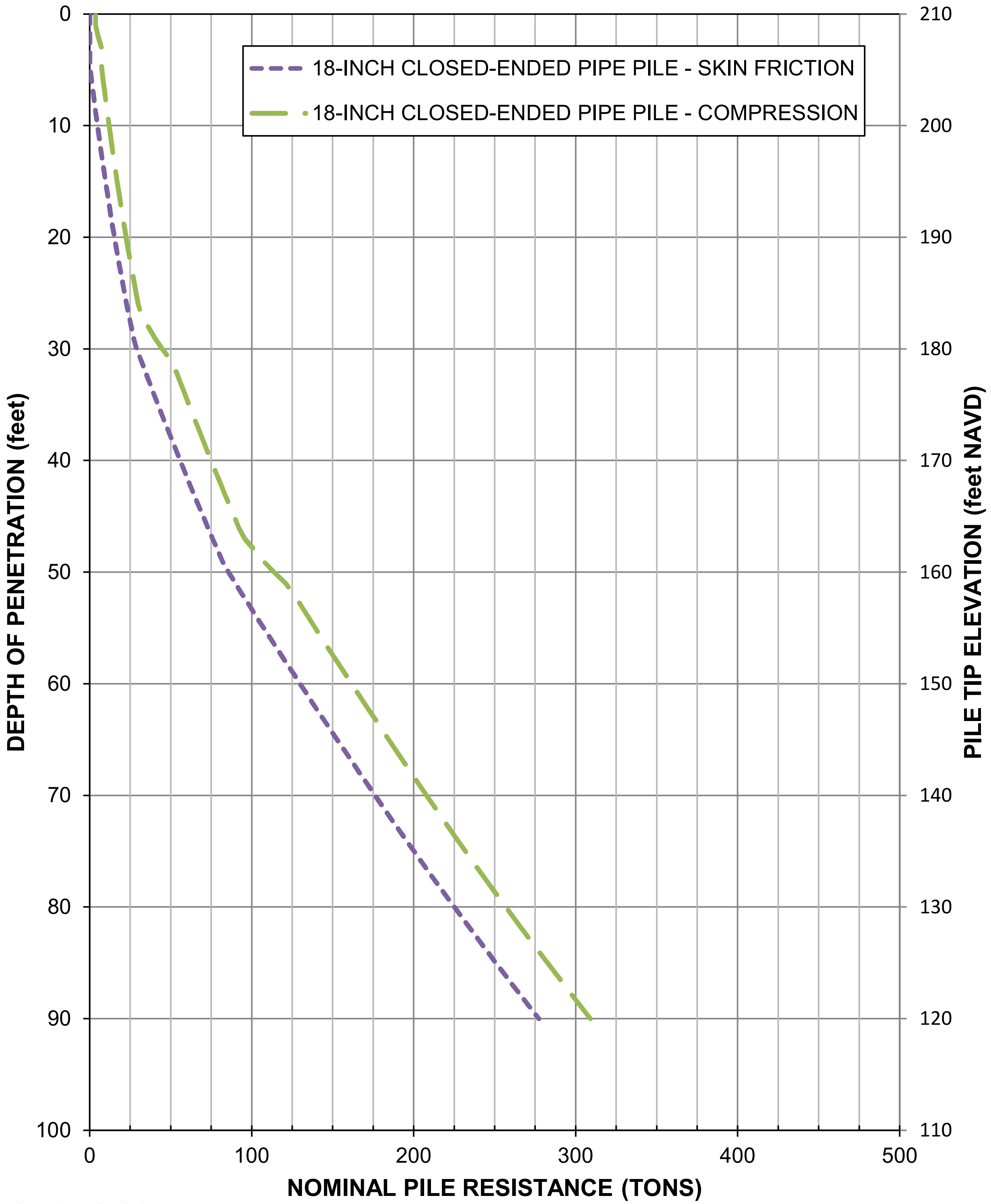
# NOMINAL RESISTANCE CURVES
# 18-INCH CLOSED-ENDED PIPE PILE
# ARDOT HWY. 83 SPUR - HWY. 278 CONNECTOR
# (MONTICELLO) (S), DREW COUNTY - BENT 12



GEOTECHNOLOGY
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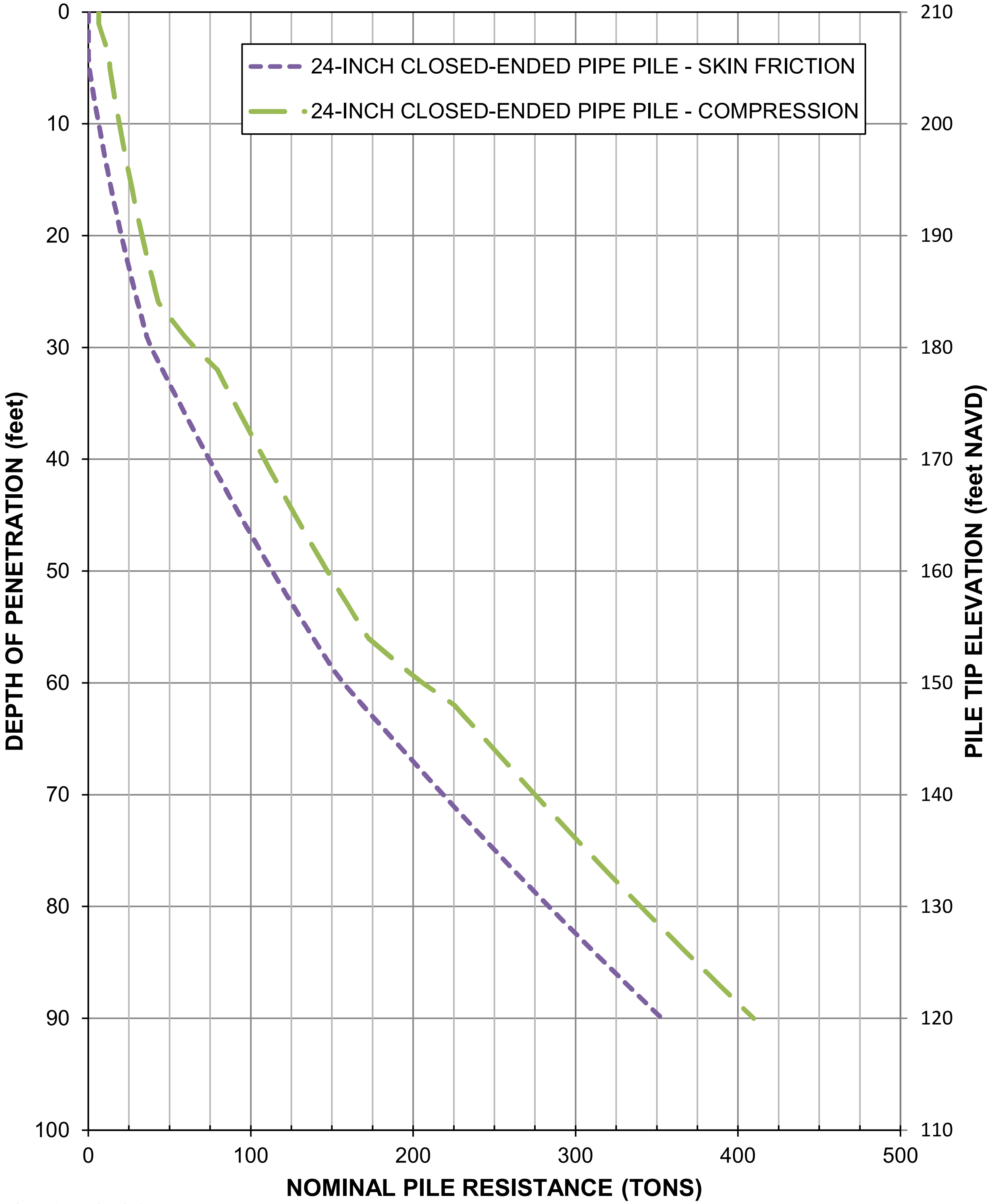
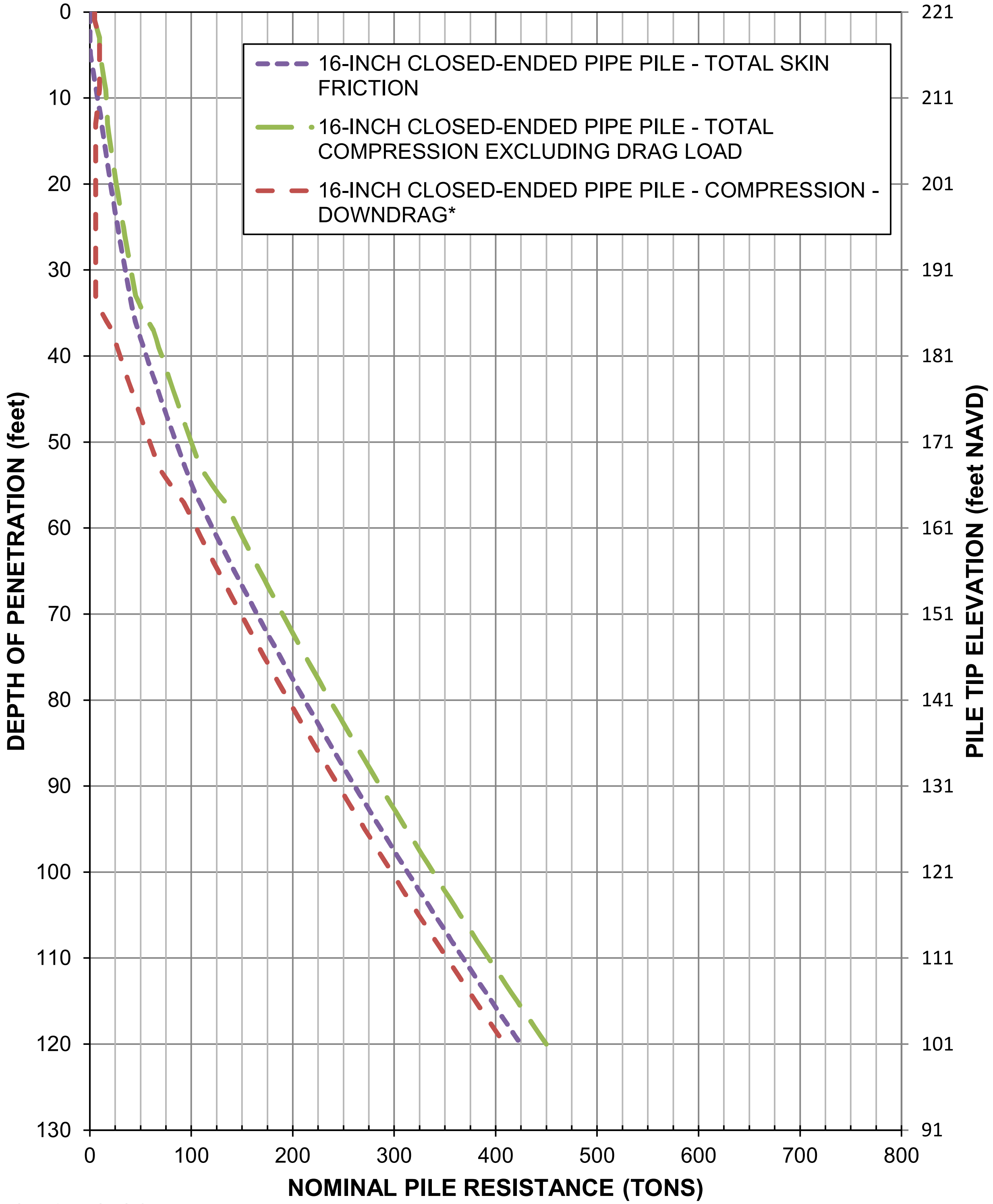
## NOMINAL RESISTANCE CURVES
## 24-INCH CLOSED-ENDED PIPE PILE
## ARDOT HWY. 83 SPUR - HWY. 278 CONNECTOR
## (MONTICELLO) (S), DREW COUNTY - BENT 12



GEOTECHNOLOGY
PROJECT NUMBER J037781.01

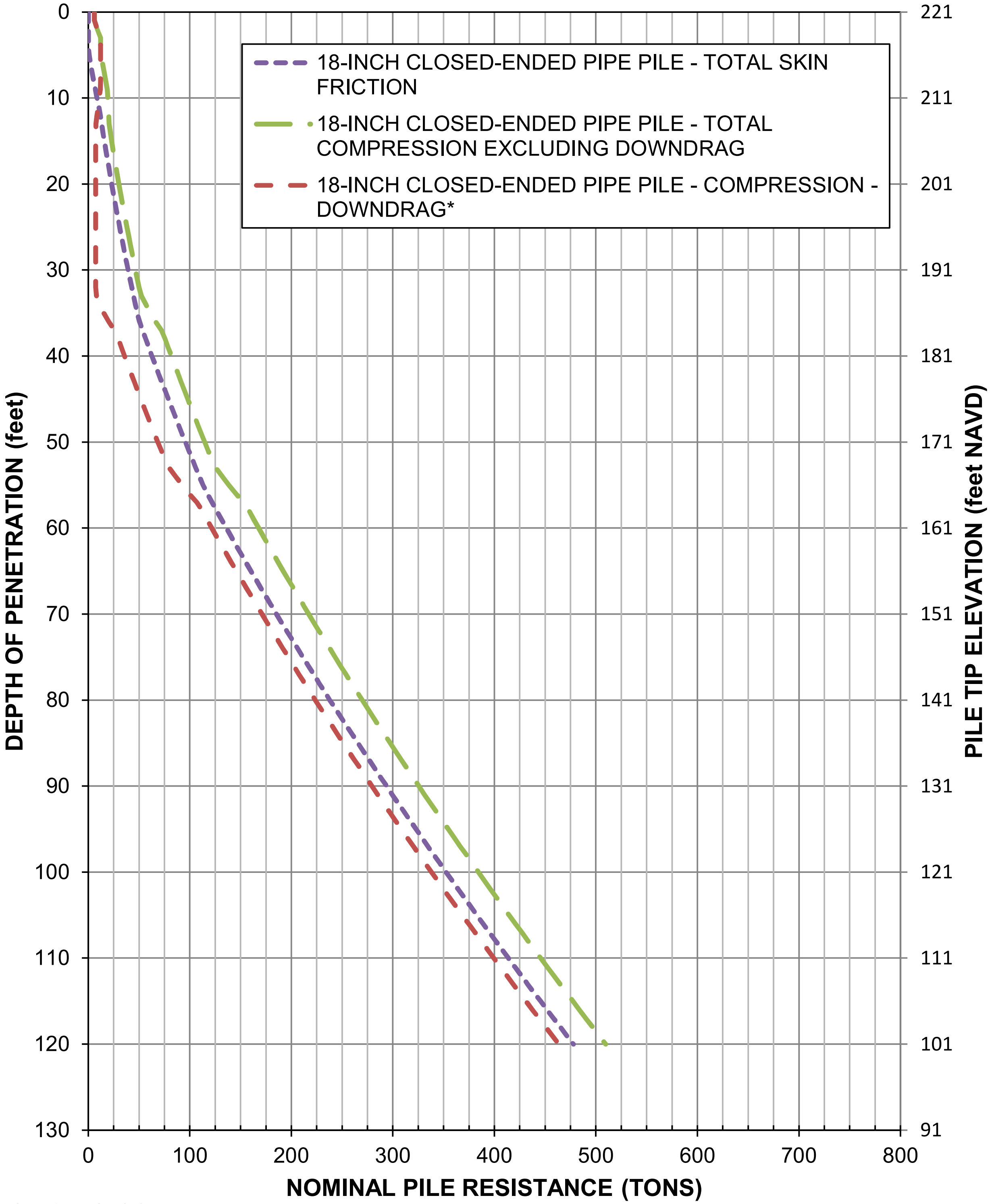
# NOMINAL RESISTANCE CURVES
# 16-INCH CLOSED-ENDED PIPE PILE
# ARDOT HWY. 83 SPUR - HWY. 278 CONNECTOR
# (MONTICELLO) (S), DREW COUNTY - BENT 13



GEOTECHNOLOGY
PROJECT NUMBER J037781.01

* Resistance curve based on igoring side friction resistance where downdrag is expected (Total side resistance - Drag load).

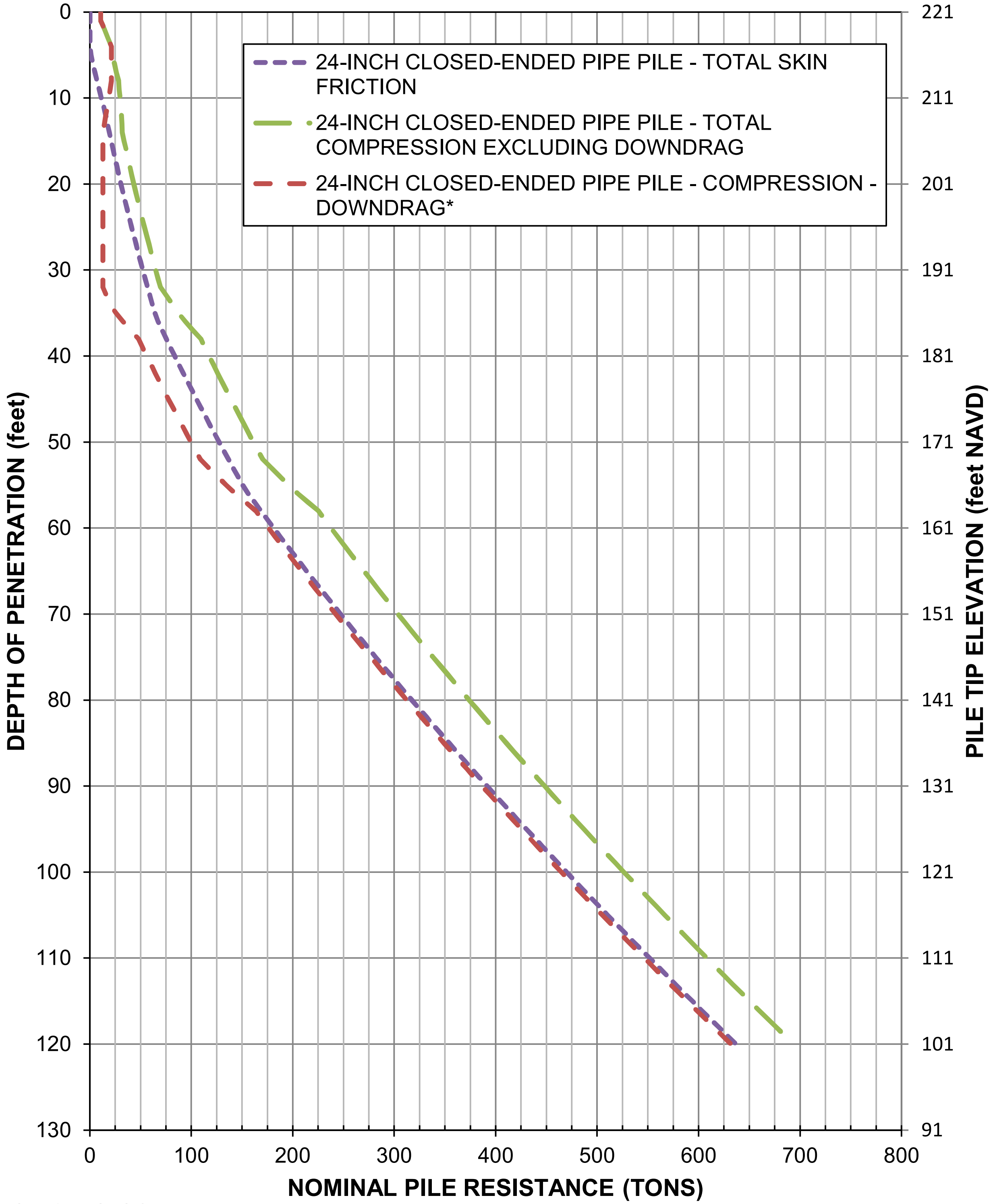
# NOMINAL RESISTANCE CURVES
# 18-INCH CLOSED-ENDED PIPE PILE
# ARDOT HWY. 83 SPUR - HWY. 278 CONNECTOR
# (MONTICELLO) (S), DREW COUNTY - BENT 13



GEOTECHNOLOGY
PROJECT NUMBER J037781.01

* Resistance curve based on igoring side friction resistance where downdrag is expected (Total side resistance - Drag load).

# NOMINAL RESISTANCE CURVES
# 24-INCH CLOSED-ENDED PIPE PILE
# ARDOT HWY. 83 SPUR - HWY. 278 CONNECTOR
# (MONTICELLO) (S), DREW COUNTY - BENT 13



GEOTECHNOLOGY
PROJECT NUMBER J037781.01

* Resistance curve based on igoring side friction resistance where downdrag is expected (Total side resistance - Drag load).