SUBSURFACE EXPLORATION REPORT
FOR
INSTALLATION OF SPAN TRUSS SUPPORTING DMS
ALONG OHIO TURNPIKE MAINLINE
OTIC PROJECT NO. 71-24-02, PGI PROJECT NO. G25003G

PREPARED FOR:

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1.0 EXECUTIVE SUMMARY

This report has been prepared for installation of Overhead Dynamic Message Signs (DMS) at various locations along the Ohio Turnpike Mainline. A total of 20 DMS structures are to be installed in various Counties: Williams, Fulton, Lucas, Wood, Sandusky, Erie, Lorain, Cuyahoga, Portage, and Mahoning Counties across Ohio. A total of 20 test borings identified as B-001-0-25 through B-020-0-25 were marked at the sites. All test borings except B-010-0-25 and B-017-0-25 were advanced through the outside paved shoulders along IR 80/IR 76 EB and WB for DMS structures foundation design purposes. Table 4.1.2 summarizes the latitude/longitude coordinates, surface elevation, and termination depth at each boring location. Refer to the "DMS Site and Boring Location Map" included in Appendix A for specific site and boring locations.

Table 4.1.2 – Boring Information

DMS No.	Boring No.	Elevation (ft)	Latitude Coordinates	Longitude Coordinates	Termination Depth (ft)
DMS #1 EB	B-001-0-25	1014±	41.6297788	-84.7981368	25.0
DMS #2 EB	B-002-0-25	718±	41.59131481	-84.3074362	25.0
DMS #9 WB	B-003-0-25	738±	41.5908518	-84.2487952	25.0
DMS #3 EB	B-004-0-25	669±	41.6007783	-83.835301	25.0
DMS #8 WB	B-005-0-25	626±	41.59217034	-83.7206841	25.0
DMS #4 EB	B-006-0-25	626±	41.5140053	-83.432392	25.0
DMS #7 WB	B-007-0-25	623±	41.49994378	-83.3891955	25.0
DMS #5 EB	B-008-0-25	604±	41.4125623	-83.1466675	30.0
DMS #6 EB	B-009-0-25	699±	41.33586164	-80.7147053	16.5
DMS #5 WB	B-010-0-25*	669±	41.327778	-82.508669	--
DMS #7 EB	B-011-0-25	787±	41.37287342	-82.2664901	25.0
DMS #10 WB	B-012-0-25	745±	41.39041977	-82.1489858	24.4
DMS #8 EB	B-013-0-25	741±	41.37798434	-82.0504528	25.0
DMS #4 WB	B-014-0-25	899±	41.31873471	-81.7740855	25.0
DMS #9 EB	B-015-0-25	1192±	41.298444	-81.694869	25.0
DMS #3 WB	B-016-0-25	1125±	41.24836836	-81.2882081	15.5
DMS #10 EB	B-017-0-25*	1184±	41.242331	-81.141058	--
DMS #11 EB	B-018-0-25	991±	41.10470561	-81.8339667	16.1
DMS #2 WB	B-019-0-25	1014±	40.07200778	-80.7930973	24.9
DMS #1 WB	B-020-0-25	1036±	40.91351344	-80.5221407	25.0

Latitude/Longitude coordinates and surface elevations were provided by MBI personnel, *Not Drilled

Based on the geology of each site, 10 of the 20 sites were located in Huron-Erie Lake Plains Section which is located within the Central Lowland Province of Ohio. Based on the Quaternary Geology of Ohio, the main geologic deposits of these sites consist of lacustrine sand deposited in glacial lakes as shallow-water deltas or nearshore bars and sheets and many small areas of dunes and very flat lake-planed moraine that was planed by waves in glacial lakes. The subsurface soils encountered in test boring locations were pre-dominantly cohesive in nature and consisted of both fill materials and natural soils. The embankment fills soils varying in thickness ranging from 3 feet to 16 feet were encountered above the natural soils in test borings. Bedrock consisting of shale was encountered below the natural soils in four test borings. The approximate depths of top bedrock range from 8.5 feet to 24.0 feet below the pavement surface. The relative density of non-cohesive/granular soils ranged from "very loose" to "very dense", but was primarily "loose" to "medium dense" and the consistency of cohesive soils above the bedrock ranged from "soft" to "hard", but was primarily "stiff" to "stiff".

Recommendations

Design information provided by MBI personnel indicates that the typical span length will be 70 feet for each proposed span truss supporting DMS structure to be installed at the 20 project sites. The width and height dimensions will be 7.92 feet and 24.83 feet, respectively for each proposed DMS to be installed at the 20 sites. The total area for each DMS sign will be 196.65 square feet. At two of the 20 DMS sites, Variable Speed Limit (VSL) signs will be mounted on the OH SS support poles on each side of the Ohio Turnpike mainline. The width and height dimensions for the proposed VSL signs will be 4.0 feet and 5.0 feet, respectively for a proposed VSL sign area of 20.0 square feet. Based on the span length and sign area of each span truss supporting DMS, Design No. 1 was selected from Figure 298-13. By comparing the span length of the span truss to the maximum span design numbers listed in Standard Drawing ITS-35.13, Design No. 1 was selected for each span truss supporting DMS. Based on Standard Drawing ITS-35.12, a minimum drilled shaft foundation length of 16 feet with a diameter of 3.0 feet was determined. Then the average shear strength of the soils over the proposed foundation length were estimated at each boring location. Based on the above, it was determined whether PGI needs to perform Standard Foundation Design or Special Foundation Design.

Special Foundation Design Analyses were performed at test boring locations B-001-0-25, B-002-0-25, B-003-0-25, B-005-0-25, B-00-6-25 and B-008-0-25 corresponding to DMS #1 EB, DMS #2 EB, DMS #9 WB, DMS #8 WB, DMS #4 EB, and DMS #5 EB Sites, respectively. Table 6.1.1 summarizes the ground elevation, soil excavation depth, top of rock depth, rock excavation depth, and proposed drilled shaft length.

Table 6.1.1 – Estimated Design Parameters for Drilled Shaft Foundation

DMS No.	Boring No.	Top Ground Elevation (feet)	Soil Excavation Depth (feet)	Top of Rock Depth (feet)	Rock Excavation Depth (feet)	Minimum Drilled Shaft Length (feet)
DMS #1 EB	B-001-0-25*	1014±	16.0	--	--	16.0
DMS #2 EB	B-002-0-25*	718±	16.0	--	--	16.0
DMS #9 WB	B-003-0-25*	738±	16.0	--	--	16.0
DMS #3 EB	B-004-0-25	669±	16.0	--	--	16.0
DMS #8 WB	B-005-0-25*	626±	16.0	--	--	16.0
DMS #4 EB	B-006-0-25*	626±	16.0	--	--	16.0
DMS #7 WB	B-007-0-25	623±	16.0	--	--	16.0
DMS #5 EB	B-008-0-25*	604±	16.0	--	--	16.0
DMS #6 EB	B-009-0-25	699±	8.5	8.5	3.75	12.25
DMS #5 WB	B-010-0-25**	669±	16.0	--	--	16.0
DMS #7 EB	B-011-0-25	787±	16.0	--	--	16.0
DMS #10 WB	B-012-0-25	745±	16.0	--	--	16.0
DMS #8 EB	B-013-0-25	741±	16.0	--	--	16.0
DMS #4 WB	B-014-0-25	899±	16.0	--	--	16.0
DMS #9 EB	B-015-0-25	1192±	16.0	--	--	16.0
DMS #3 WB	B-016-0-25	1125±	16.0	--	--	16.0
DMS #10 EB	B-017-0-25**	1184±	16.0	--	--	16.0
DMS #11 EB	B-018-0-25	991±	13.5	13.5	1.25	14.75
DMS #2 WB	B-019-0-25	1014±	16.0	--	--	16.0
DMS #1 WB	B-020-0-25	1036±	16.0	--	--	16.0

*Performed Special Foundation Design, **Not Drilled

2.0 INTRODUCTION

This report has been prepared for installation of Overhead Dynamic Message Signs (DMS) at various locations along the Ohio Turnpike Mainline. It represents the intent of Michael Baker International, Inc, (MBI) the design engineer, and the Ohio Turnpike and Infrastructure Commission (OTIC), the owner, to secure subsurface information at selected locations in accordance with the ODOT *Specifications for Geotechnical Explorations*, and to obtain recommendations regarding geotechnical factors pertaining to the design and construction of this project.

This report has been developed based on the field exploration program, laboratory testing and information provided by MBI personnel. It must be noted that, as with any exploration program, the site exploration identifies actual subsurface conditions only at those locations where samples were obtained. The data derived through sampling and laboratory testing is reduced by geotechnical engineers and geologists who then render an opinion regarding the overall subsurface conditions and their likely reaction on the site. The actual site conditions may differ from those inferred to exist. Therefore, although a fair amount of subsurface data has been assembled during this exploration, this report may not provide all of the geotechnical data needed for construction of this project. This report was prepared using English units.

2.1 Project Description

Present plans call for installing new span truss supporting Dynamic Message Sign (DMS) structures along the mainline of eastbound and westbound Interstate Routes (IR) IR 80 and IR 76. Design information provided by MBI personnel indicates that a total of 20 DMS structures are to be installed in various Counties: Williams, Fulton, Lucas, Wood, Sandusky, Erie, Lorain, Cuyahoga, Portage, and Mahoning Counties across Ohio. Eleven of these structures, identified as DMS #1 EB through DMS #11 EB, are to be installed along IR 80/IR 76 eastbound while nine (9) of these structures, as identified as DMS #1 WB through DMS #5 WB and DMS #7 WB through DMS #10 WB, are to be installed along IR 80/IR 76 westbound. Pro Geotech will provide foundation recommendations for these structures in accordance with the ODOT Geotechnical Design Manual, ODOT Bridge Design Manual which includes LRFD Bridge Design Specifications, ODOT Traffic Engineering Manual (TEM), and Office of Roadway Engineering's Standard Construction Drawings. The Site Location Map is shown in Figure 2.1 included in Appendix A.

2.2 Scope of Services

The scope of services for this project was in accordance with PGI Proposal No. PG24026 dated June 4, 2024, governed by *ODOT's Specifications for Geotechnical Explorations (SGE)* dated January 17, 2025*, ODOT's Geotechnical Design Manual dated* January 17, 2025, *ODOT's Bridge Design Manual*, issued in January 2020 and updated January 17, 2025, and *AASHTO LRFD specifications for Structural Supports for Highway Signs, Luminaries, and Traffic Signals* (LRFDLTS-1) current edition hereafter referred to as ODOT Specifications. Our scope of services consisted of the execution of the following tasks:

Task I - Reconnaissance and Planning, which primarily consisted of performing a site reconnaissance to evaluate the proposed project sites from a geotechnical standpoint, reviewing and compiling all existing geology of the project site obtained from ODOT and ODNR sources, and notifying The Ohio Utilities Protection Services (OUPS) about the proposed drilling operations. Stations, offsets, and top of the boring elevations were to be provided by others.

Task II - Test Boring and Sampling Program, which primarily consisted of field verification of the test boring locations with regards to underground utilities, advancing the test borings, conducting field tests, sampling the subsurface materials, and preparing field drilling logs.

Our scope of services included advancing a total of 20 test borings (Type E5); one (1) per span truss DMS Support structure at various locations along Ohio Turnpike mainline for foundation design purposes. Eleven of these test borings were advanced along IR 80/IR 76 eastbound mainline while nine (9) of these were advanced along IR 80/IR 76 westbound mainline. These DMS structure borings were to be advanced to an approximate depth of 25 feet each below the existing ground or pavement surface including 5 feet of rock core if bedrock encountered at shallow depth. Soil samples were to be obtained at 2.5-foot intervals for the entire depth of each test boring. All test borings were to be advanced in accordance with the ODOT Specifications for Geotechnical Explorations. The groundwater conditions were to be monitored during and upon completion of the drilling operations.

Task III – Laboratory Testing Program, which consisted of performing soil classification and engineering properties tests on selected soil samples and classifying the soils in accordance with the ODOT Soil Classification System.

Task IV - Geotechnical Exploration Report, which included the following:

- A brief description of the project and our exploration methods
- Typed drilling logs and laboratory test results
- A description of subsurface soil and groundwater conditions
- Discussion pertaining to earthwork considerations, groundwater management, and construction monitoring
- Foundation recommendations for the DMS structures including deep foundations

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

3.0 GEOLOGY AND OBSERVATIONS OF THE PROJECT

3.1 Geology

DMS #1 EB Site: Based on information obtained from the Physiographic Regions of Ohio, the project site lies at an approximate elevation of 1014 feet within the Steuben Till Plain District of the Till Plains Section. This Till Plains Section is located within the Central Lowland Province of Ohio. The Steuben Till Plain District is characterized as Hummocky terrain with rolling hills, interspersed flats and closed depressions; wetlands, few streams, deranged drainage; elevation is 950-1100 with moderately low relief. The geology of the Steuben Till Plain Wisconsin-age (latest Ice-age) loamy till from a northern source (Saginaw glacial lobe) over the Mississippian-age Coldwater Shale. According to Bulletin 44, *Geology of Water in Ohio,* the project site had both the Illinoian and Wisconsin ice sheets pass over the area, leaving a thick drift with a hummocky surface. The few measurements indicate 100 feet or more of drift. Based on the *Quaternary Geology of Ohio,* the main geologic deposit across the project site consists of end moraine which occurs as hummocky ridges higher than adjacent terrain. According to the *Web Soil Survey of Williams County, Ohio*, the soils in the vicinity of the project site consist primarily of layers of Rawson sandy loam, 2 to 6 percent slopes (RIB), Pewamo silty clay loam, 0 to 1 percent slopes (Pm), and Udorthents (Ud) which can be classified as A-6 and A-2-4 soils based on the AASHTO Soil Classification System. Based on information obtained from the Ohio Geological Survey, top of bedrock in the vicinity of the project site is anticipated to be present at an approximate elevation of 709 feet. At this elevation, bedrock is expected to consist of Mississippian-age Coldwater Shale. The Coldwater Shale is gray and thinly bedded with siderite nodules common. Based on the information obtained from the "Karst Interactive Map of Ohio", Williams County lies outside of the Karst Region in Ohio.

DMS # 2 EB Site: Based on information obtained from the Physiographic Regions of Ohio, the project site lies at approximate elevation of 718 feet within the Maumee Lake Plain Region of the Huron-Erie Lake Plains Section which is located within the Central Lowland Province of Ohio. The Maumee Lake Plains Region is characterized as flat-lying ice-age lake basin with beach ridges, bars, dunes, deltas, and clay flats; contained the former black swamp; slightly dissected by modern streams with elevations ranging from 570-800 feet with very low relief. The geology of the Maumee Lake Plain Region generally consists of Pleistocene-age silt, clay, and wave planed clayey till over Silurian- and Devonian-age carbonate rocks and shales. According to Bulletin 44, *Geology of Water in Ohio,* the project area was glaciated by both the Illinoian and Wisconsin ice sheets with the drift thickness ranging from 140 to 160 feet in thickness and containing adequate supplies of water. Based on the Quaternary Geology of Ohio, the main geologic deposits of the project site consist of lacustrine sand deposited in glacial lakes as shallow-water deltas or nearshore bars and sheets and many small areas of dunes. According to the *Web Soil Survey of Fulton County, Ohio*, the soils in the vicinity of the project site consist primarily of layers of Latty silty clay, till substratum, 0 to 1 percent slopes (Lc) which can be classified as A-7-5 soils based on the AASHTO Soil Classification System. Based on information obtained from the Ohio Geological Survey, top of bedrock in the vicinity of the project site is anticipated to be present at an approximate elevation of 620 feet. At this elevation, bedrock is expected to consist of Mississippian-age Sunbury Shale. Sunbury Shale is black to brownish black with very thin laminae which is consistent with carbonaceous shale. Based on the information obtained from the "Karst Interactive Map of Ohio", Fulton County lies outside of the Karst Region in Ohio.

DMS # 3 EB Site: Based on information obtained from the Physiographic Regions of Ohio, the project site lies at an approximate elevation of 669 feet within the Maumee Sand Plains Region of the Huron-Erie Lake Plains Section on the Central Lowland Province of Ohio. The Maumee Sand Plains Region is characterized as lacustrine plain mantled by sand which includes low dunes, interdunal pans, beach ridges, and sand sheets of glacial lake shores. This region is well to poorly drained and lies at elevations ranging from 600 to 800 feet with very low relief of 10 feet or less. The geology of the Maumee Sand Plains District generally consists of late Wisconsin-age sand over clay till and lacustrine deposits. The deeply buried bedrock consists of Silurian- and Devonian-age carbonate rocks and shale. According to Bulletin 44, *Geology of Water in Ohio,* both the Illinoian and Wisconsin ice sheets passed over the area. Regionally the glacial drift ranges in thickness from 60 to 100 feet. Based on the Quaternary Geology of Ohio, the main geologic deposit across the project site consists of lacustrine sand deposited in glacial lakes as shallow-water deltas or nearshore bars and sheets which include many small areas of dunes. According to the Web Soil Survey of Lucas County, Ohio, the soils in the vicinity of the project site consist primarily of Sloan loam, occasionally flooded (So), Tedrow fine sand, 0 to 3 percent slopes (TdA) and Udorthents, loamy (Uo), which can be classified as A-4 and A-2 soils based on the AASHTO Soil Classification System. Based on information obtained from the Ohio Geological Survey, top of bedrock in the vicinity of the project site is anticipated to be present at an approximate elevation of 617 feet. At this elevation, bedrock is expected to consist of Devonian-age Antrim Shale. Antrim Shale is dark brown to black, thinly laminated and consistent with carbonaceous shale. Based on the information obtained from the "Karst Interactive Map of Ohio", there are no field verified or suspected karst features in Lucas County.

DMS # 4 EB Site: Based on information obtained from the Physiographic Regions of Ohio, the project site lies at an approximate elevation of 626 feet within the Woodville Lake-Plain Reefs Region of the Huron-Erie Lake Plains Section which is located within the Central Lowland Province of Ohio. The Woodville Lake-Plain Reefs Region is characterized as a lacustrine plain with very low relief (10'), low dunes and lake-margin features punctuated by more than 75 ancient bedrock reefs rising 10' to 40' above the level of the plain and ranging in area from 0.1 to 3.0 square miles. The oblong reefs are thinly draped with drift at elevations ranging from 600 to 775 feet. The geology of the Woodville Lake-Plain Reefs generally consists thin to absent Wisconsin-age wave planed clay till, lacustrine deposits, and sand over Silurian-age reef consisting of Lockport Dolomite. According to Bulletin 44, *Geology of Water in Ohio,* both the Illinoian and Wisconsin glaciers passed over the area and in general left a medium coating of drift, from 30 to 100 feet. Based on the Quaternary Geology of Ohio, the main geologic deposit of the project site consists of very flat lake-planed Moraine that was planed by waves in glacial lakes. Small patches of sand, silt, or clay are present on the surface in many areas. According to the Web Soil Survey of Wood County, Ohio, the soils in the vicinity of the project site consist primarily of Hoytville silty clay loam, 0 to 1 percent slopes (HcA) which can be classified as A-7-5 soils based on the AASHTO Soil Classification System. Based on information obtained from the Ohio Geological Survey, top of bedrock in the vicinity of the project site is anticipated to be present at an approximate elevation of 600 feet. At this elevation, bedrock is expected to consist of Silurian-age Lockport Dolomite. Lockport Dolomite has shades of white to medium gray with medium to massive bedding. Based on the information obtained from the "Karst Interactive Map of Ohio", the nearest "suspected" karst feature is more than 6.5 miles from the project site.

DMS # 5 EB Site: Based on information obtained from the Physiographic Regions of Ohio, the project site lies at approximate elevation of 604 feet within the Woodville Lake-Plain Reefs Region of the Huron-Erie Lake Plains section which is located within the Central Lowland Province of Ohio. The Woodville Lake-Plain Reefs is characterized as a lacustrine plain with very low relief (10'), low dunes and lake-margin features punctuated by more than 75 ancient bedrock reefs rising 10' to 40' above the level of the plain and ranging in area from 0.1 to 3.0 square miles. The oblong reefs are thinly draped with drift at elevations ranging from 600 to 775 feet. The geology of the Woodville Lake-Plain Reefs generally consists thin to absent Wisconsin-age wave planed clay till, lacustrine deposits, and sand over Silurian-age reef consisting of Lockport Dolomite. According to Bulletin 44, *Geology of Water in Ohio,* both the Illinoian and Wisconsin ice sheets passed over the area. In the immediate vicinity, the drift is thin (20 to 30 feet in thickness) but provides small supplies of water. Based on the Quaternary Geology of Ohio, the main geologic deposit at the project site consists of mostly laminated lacustrine clay deposited in calm water of glacial lakes and covered in places with thin organic deposits. According to the Web Soil Survey of Sandusky County, Ohio, the soils in the vicinity of the project site consist primarily of Toledo silty clay, 0 to 1 percent slopes (To), which can be classified as A-7-5 soils based on the AASHTO Soil Classification System. Based on information obtained from the Ohio Geological Survey, top of bedrock in the vicinity of the project site is anticipated to be present at an approximate elevation of 555 feet. At this elevation, bedrock is expected to consist of Silurian-age Lockport Dolomite. Lockport Dolomite has shades of white to medium gray with medium to massive bedding. Based on the information obtained from the "Karst Interactive Map of Ohio", the nearest "suspected" karst feature is more than 3.2 miles from the project site.

DMS #6 EB Site: Based on information obtained from the Physiographic Regions of Ohio, the project site lies at an approximate elevation of 699 feet within the Erie Lake Plain Region within the Huron-Erie Lake Plains Section which is located within the Central Lowland Province of Ohio. The Erie Lake Plain is located on the edge of the very low relief (10') ice-age basin separated from modern Lake Erie by shoreline cliffs with major streams in deep gorges at elevations ranging from 570 to 800 feet. The geology of the Erie Lake Plain generally consists of Pleistocene-age lacustrine sand, silt, clay, and wave-planed till over Devonian- and Mississippian-age shales and sandstones. According to Bulletin 44, *Geology of Water in Ohio,* both Illinoian and Wisconsin ice sheets passed over the area. The drift is thin, typically 1 to 15 feet in thickness, and averages less than 10 feet. Based on the Quaternary Geology of Ohio, the main geologic deposit of the project site consists of very flat, lake-planed Moraine that was planed by waves in glacial lakes. Small patches of sand, silt, or clay are present on the surface in many areas. According to the Web Soil Survey of Sandusky County, Ohio, the soils in the vicinity of the project site consist primarily of Miner silt loam, shale substratum, 0 to 2 percent slopes (MsA) which can be classified as A-7-5 soils based on the AASHTO Soil Classification System. Based on information obtained from the Ohio Geological Survey, top of bedrock in the vicinity of project site is anticipated to be present at an approximate elevation of 699 feet. At this elevation, bedrock is expected to consist of Devonian-age Ohio Shale. Ohio Shale is brownish black to greenish gray that weathers brown and contains carbonite/siderite concretions and has medium to massive bedding. Based on the information obtained from the "Karst Interactive Map of Ohio", the nearest "suspected" karst feature is more than 0.65 miles from the project site.

DMS #7 EB Site: Based on information obtained from the Physiographic Regions of Ohio, the project site lies at an approximate elevation of 787 feet within the Berea Headlands of the Erie Lake Plain Region of the Huron-Erie Lake Plains Section which is located within the Central Lowlands Province of Ohio. The Berea Headlands of the Erie Lake Plain Region is characterized as a portion of the Erie Lake Plain underlain by resistant Berea Sandstone with several large sandstone headlands jutting into the Ice-Age Lake basin along with several streamlined "whalebacks" of Berea Sandstone that are 0.5 to 2.0 miles in length, 20 to 35 feet in height, and range in elevation from 670 to 800 feet. The geology of the Berea Headlands of the Erie Lake Plain generally consists of thin lacustrine deposits over thin, wave-planed, clayey, medium lime Wisconsin-age till that is underlain by resistant Berea sandstone. According to Bulletin 44, *Geology of Water in Ohio,* the project area was passed over by both the Illinoian and Wisconsin ice sheets that generally left only a thin and irregular layer of drift, averaging less than 25 feet in thickness. Based on the Quaternary Geology of Ohio, the main geologic deposit of the project site consists of very flat lake-planed Moraine with small patches of sand, silt, or clay on the surface in many areas. According to the Web Soil Survey of Lorain County, Ohio, the site soils in the vicinity of the project site consist primarily of Mahoning silt loam, 0 to 2 percent slopes (MgA) and Udorthents (Cz) which can be classified as A-6 soils based on the AASHTO Soil Classification System. Based on information obtained from the Ohio Geological Survey, top of bedrock in the vicinity of project site is anticipated to be present at an approximate elevation of 774 feet. At this elevation, bedrock is expected to consist of Mississippian-age Berea Sandstone and Bedford Shale. Berea Sandstone is brown with thin to thick planar to lenticular bedding. Bedford shale is gray to brown with thin to medium planar to lenticular bedding with interbedded siltstone and sandstone. Based on the information obtained from the "Karst Interactive Map of Ohio", there are no karst features in Lorain County.

DMS #8 EB Site: Based on information obtained from the Physiographic Regions of Ohio, the project site lies at an approximate elevation of 741 feet within the Berea Headlands of the Erie Lake Plain Region of the Huron-Erie Lake Plains Section which is located within the Central Lowlands Province of Ohio. The Berea Headlands of the Erie Lake Plain Region is characterized as a portion of the Erie Lake Plain underlain by resistant Berea Sandstone with several large sandstone headlands jutting into the Ice-Age Lake basin along with several streamlined "whalebacks" of Berea Sandstone that are 0.5 to 2.0 miles in length, 20 to 35 feet in height, and range in elevation from 670 to 800 feet. The geology of the Berea Headlands of the Erie Lake Plain generally consists of thin lacustrine deposits over thin, wave-planed, clayey, medium lime Wisconsin-age till that is underlain by resistant Berea sandstone. According to Bulletin 44, *Geology of Water in Ohio,* the project area was passed over by both the Illinoian and Wisconsin ice sheets that generally left only a thin and irregular layer of drift, averaging less than 20 feet in thickness. Based on the Quaternary Geology of Ohio, the main geologic deposit of the project site consists of very flat lake-planed Moraine with small patches of sand, silt, or clay on the surface in many areas. According to the Web Soil Survey of Lorain County, Ohio, the site soils in the vicinity of the bridge site area consist primarily of Miner silty clay loam, 0 to 2 percent slopes (Mr) and Udorthents (Cz) which can be classified as A-7-5 soils based on the AASHTO Soil Classification System. Based on information obtained from the Ohio Geological Survey, top of bedrock in the vicinity of project site is anticipated to be present at an approximate elevation of 680 feet. At this elevation, bedrock is expected to consist of Mississippian-age Berea sandstone and Bedford shale. Berea Sandstone is brown with thin to thick planar to lenticular bedding. Bedford shale is gray to brown with thin to medium planar to lenticular bedding with interbedded siltstone and sandstone. Based on the information obtained from the "Karst Interactive Map of Ohio", there are no karst features in Lorain County.

DMS #9 EB Site: Based on information obtained from the Physiographic Regions of Ohio, the project site lies at an approximate elevation of 1192 feet within the Killbuck-Glaciated Pittsburgh Plateau of the Glaciated Allegheny Plateaus section. This Section is located within the Appalachian Plateaus Province of

Ohio. The Killbuck-glaciated Pittsburgh Plateau is characterized as Ridges and flat uplands generally above 1200', covers with thin drift and dissected by steep valleys; valley segments alternate between broad and drift-filled and narrow rock-walled reaches; elevation 600'-1505', moderate relief (200'). The geology of the Killbuck-Glaciated Pittsburgh Plateau is generally thin to thick Wisconsian-age clay to loam till over Mississippian- and Pennsylvania- age shales, sandstones, conglomerates and coals. According to Bulletin 44, *Geology of Water in Ohio,* project area had the Wisconsin glacier passed over the area but in general left only a thin coating of drift, averaging not more than 25 feet. Based on the Quaternary Geology of Ohio, the main geologic deposit of the project site consists of ground moraine, flat to gently undulating. According to Web Soil Survey of Cuyahoga County, Ohio, the site soils in the vicinity of the bridge site area consist primarily of Mahoning silt loam, 2 to 6 percent slopes (MgB) and Udorthents, loamy (Ua) which can be classified as A-6 soils based on the AASHTO Soil Classification System. Based on information obtained from the Ohio Geological Survey, top of bedrock in the vicinity of bridge site is anticipated to be present at an approximate elevation of 1168 feet. At this elevation, bedrock is expected to consist of Pennsylvanian system Allegheny and Pottsville groups undivided. Allegheny and Pottsville groups are shades of brown to black, non-bedded to massive, and consistent shale, sandstone, siltstone, conglomerate, and subordinate amounts of limestone, clay, flint and coal. Based on the information obtained from the "Karst Interactive Map of Ohio", there are no karst features in Cuyahoga County.

DMS #10 EB Site: Based on information obtained from the Physiographic Regions of Ohio, the project site lies at an approximate elevation of 1179 feet within the Killbuck-Glaciated Pittsburgh Plateau Region of the Glaciated Allegheny Plateaus Section which is located within the Appalachian Plateaus Province of Ohio. The Killbuck-Glaciated Pittsburgh Plateaus Region is characterized by ridges and flat uplands covered with thin drift and dissected by steep valleys that alternate between broad, drift-filled and narrow, rock-walled with relief considered moderate, ranging by 200 feet. The geology of the Killbuck-Glaciated Pittsburgh Plateau Region consists of generally thin to thick Wisconsin-age clay to loam till over Mississippian- and Pennsylvania-age shales, sandstones, conglomerates and coals. According to Bulletin 44, *Geology of Water in Ohio,* the project area was glaciated by the Wisconsin ice sheet. Regionally the drift is thin, averaging less than 25 feet. Based on the Quaternary Geology of Ohio, the main geologic deposit at the project site consists of flat to gently undulating ground moraine. According to the Web Soil Survey of Portage County, Ohio, the soils in the vicinity of the project site consist primarily of Trumbull silt loam, 0 to 2 percent slopes (TrA) and Udorthents, (Ua) which can be classified as A-7-6 soils based on the AASHTO Soil Classification System. Based on information obtained from the Ohio Geological Survey, top of bedrock in the vicinity of the project site is anticipated to be present at an approximate elevation of 1082 feet. At this elevation, bedrock is expected to consist of Pennsylvanian-age Allegheny and Pottsville Groups undivided. Allegheny and Pottsville Groups consist of non-bedded to massively bedded shale, sandstone, siltstone, conglomerate, and subordinate amounts of limestone, clay, flint and coal generally in shades of brown to black. Based on the information obtained from the "Karst Interactive Map of Ohio", there are no karst features in Portage County.

DMS #11 EB Site: Based on information obtained from the Physiographic Regions of Ohio, the project site lies at an approximate elevation of 991 feet within the Killbuck-Glaciated Pittsburgh Plateau Region of the Glaciated Allegheny Plateaus Section which is located within the Appalachian Plateaus Province of Ohio. The Killbuck-Glaciated Pittsburgh Plateau Region is characterized by ridges and flat uplands covered with thin drift and dissected by steep valleys that alternate between broad, drift-filled and narrow, rock-walled with relief considered moderate, ranging by 200 feet. The geology of the Killbuck-Glaciated Pittsburgh Plateau Region consists of generally thin to thick Wisconsin-age clay to loam till over Mississippian- and Pennsylvania-age shales, sandstones, conglomerates and coals. According to Bulletin 44, *Geology of Water in Ohio,* the Wisconsin glacier passed over the area but in general left only a thin coating of drift, averaging less than 25 feet. Based on the Quaternary Geology of Ohio, the main geologic deposit of the project site consists of flat to gently undulating ground moraine. According to the Web Soil Survey of Mahoning County, Ohio, the site soils in the vicinity of the project site consist of Ellsworth silt loam, 2 to 6 percent slopes (EIB) and Udorthents loamy, 2 to 25 percent slopes, (Ua) which can be classified as A-6 soils based on the AASHTO Soil Classification System. Based on information obtained from the Ohio Geological Survey, top of bedrock in the vicinity of the project site is anticipated to be present at an approximate elevation of 943 feet. At this elevation, bedrock is expected to consist of Pennsylvanian-age Allegheny and Pottsville Groups undivided. Allegheny and Pottsville Groups consist of non-bedded to massively bedded shale, sandstone, siltstone, conglomerate, and subordinate amounts of limestone, clay, flint and coal generally in shades of brown to black. Based on the information obtained from the "Karst Interactive Map of Ohio", there are no karst features in Mahoning County.

DMS #1 WB Site: Based on information obtained from the Physiographic Regions of Ohio, the project site lies at an approximate elevation of 1036 feet within the Killbuck-Glaciated Pittsburgh Plateau Region of the Glaciated Allegheny Plateaus Section which is located within the Appalachian Plateaus Province of

Ohio. The Killbuck-Glaciated Pittsburgh Plateau Region is characterized by ridges and flat uplands covered with thin drift and dissected by steep valleys that alternate between broad, drift-filled and narrow, rock-walled with relief considered moderate, ranging by 200 feet. The geology of the Killbuck-Glaciated Pittsburgh Plateau Region consists of generally thin to thick Wisconsin-age clay to loam till over Mississippian- and Pennsylvania-age shales, sandstones, conglomerates and coals. According to Bulletin 44, *Geology of Water in Ohio,* the Wisconsin ice sheet passed over the project site depositing a thin layer of glacial debris averaging not more than 25 feet. Based on the Quaternary Geology of Ohio, the main geologic deposit of the project site consists of end moraine which occurs as hummocky ridges that are higher than adjacent terrain. According to the Web Soil Survey of Mahoning County, Ohio, the site soils in the vicinity of the project site consist of Jimtown loam, 2 to 6 percent slopes (JtB) and Udorthents, loamy, 2 to 25 percent slopes, (Ua) which can be classified as A-4 soils based on the AASHTO Soil Classification System. Based on information obtained from the Ohio Geological Survey, top of bedrock in the vicinity of project site is anticipated to be present at an approximate elevation of 985 feet. At this elevation, bedrock is expected to consist of Pennsylvanian-age Allegheny and Pottsville groups undivided. Allegheny and Pottsville Groups consist of non-bedded to massively bedded shale, sandstone, siltstone, conglomerate, and subordinate amounts of limestone, clay, flint and coal generally in shades of brown to black. Based on the information obtained from the "Karst Interactive Map of Ohio", there are no karst features in Mahoning County.

DMS #2 WB Site: Based on information obtained from the Physiographic Regions of Ohio, the project site lies at an approximate elevation of 1014 feet within the Killbuck-Glaciated Pittsburgh Plateau Region of the Glaciated Allegheny Plateaus Section which is located within the Appalachian Plateaus Province of Ohio. The Killbuck-Glaciated Pittsburgh Plateau Region is characterized by ridges and flat uplands covered with thin drift and dissected by steep valleys that alternate between broad, drift-filled and narrow, rock-walled with relief considered moderate, ranging by 200 feet. The geology of the Killbuck-Glaciated Pittsburgh Plateau Region consists of generally thin to thick Wisconsin-age clay to loam till over Mississippian- and Pennsylvania-age shales, sandstones, conglomerates and coals. According to Bulletin 44, *Geology of Water in Ohio,* the Wisconsin glacier passed over the area but in general left only a thin coating of drift, averaging less than 25 feet. Based on the Quaternary Geology of Ohio, the main geologic deposit of the project site consists of end moraines which occur as hummocky ridges that are higher than the adjacent terrain. According to the Web Soil Survey of Mahoning County, Ohio, the site soils in the vicinity of the project site consist of Remsen silt loam, 2 to 6 percent slopes (ReB) and Udorthents, loamy, 2 to 25 percent slopes, (Ua) which can be classified as A-4 soils based on the AASHTO Soil Classification System. Based on information obtained from the Ohio Geological Survey, top of bedrock in the vicinity of project site is anticipated to be present at an approximate elevation of 981 feet. At this elevation, bedrock is expected to consist of Pennsylvanian-age Allegheny and Pottsville groups undivided. Allegheny and Pottsville Groups consist of non-bedded to massively bedded shale, sandstone, siltstone, conglomerate, and subordinate amounts of limestone, clay, flint and coal generally in shades of brown to black. Based on the information obtained from the "Karst Interactive Map of Ohio", there are no karst features in Mahoning County.

DMS #3 WB Site: Based on information obtained from the Physiographic Regions of Ohio, the project site lies at an approximate elevation of 1125 feet within the Akron-Canton Interlobate Plateau Region of the Glaciated Allegheny Plateaus Section which is located within the Appalachian Plateaus Province of Ohio. The Akron-Canton Interlobate Plateau Region lies between elevations of 900 and 1200 feet and is characterized as a hummocky area with moderate relief (200 feet) between two converging glacial lobes dominated by kames, kame terraces, eskers, kettles, kettle lakes, and bogs/fens with deranged drainage and many natural lakes. The geology of the Akron-Canton Interlobate Plateau Region is sandy Wisconsian-age and older drift over Devonian- to Pennsylvanian-age sandstones, conglomerates, and shales. According to Bulletin 44, *Geology of Water in Ohio,* the Wisconsin glacier passed over the project area and left a thick but variable coating of drift, from 60 to 100 feet or more. It lies on the western part of the great mass of drift piled up by the impinging of the Killbuck glacial lobe with the Grand River glacial lobe. The drift provides much groundwater. Based on the Quaternary Geology of Ohio, the main geologic deposit of the project site consists of undifferentiated outwash deposited by meltwater in front of glacial ice that occurs as valley terraces or low plains of well sorted and stratified sand and gravel. According to the Web Soil Survey of Portage County, Ohio, the soils in the vicinity of the project site consist of Chili loam, 2 to 6 percent slopes (CnB) and Udorthents, (Ua) which can be classified as A-4 soils based on the AASHTO Soil Classification System. Based on information obtained from the Ohio Geological Survey, top of bedrock in the vicinity of project site is anticipated to be present at an approximate elevation of 1059 feet. At this elevation, bedrock is expected to consist of Pennsylvanian system Allegheny and Pottsville groups undivided. Allegheny and Pottsville Groups consist of non-bedded to massively bedded shale, sandstone, siltstone, conglomerate, and subordinate amounts of limestone, clay, flint and coal generally in shades of brown to black. Based on the information obtained from the "Karst Interactive Map of Ohio", there are no karst features in Portage County.

DMS #4 WB Site: Based on information obtained from the Physiographic Regions of Ohio, the project site lies at an approximate elevation of 899 feet within the Killbuck-Glaciated Pittsburgh Plateau Region of the Glaciated Allegheny Plateaus Section which is located within the Appalachian Plateaus Province of Ohio. The Killbuck-Glaciated Pittsburgh Plateau Region is characterized by ridges and flat uplands covered with thin drift and dissected by steep valleys that alternate between broad, drift-filled and narrow, rock-walled with relief considered moderate, ranging by 200 feet. The geology of the Killbuck-Glaciated Pittsburgh Plateau Region consists of generally thin to thick Wisconsin-age clay to loam till over Mississippian- and Pennsylvania-age shales, sandstones, conglomerates and coals. According to Bulletin 44, *Geology of Water in Ohio,* the Wisconsin glacier passed over the project area but in general, left only a thin coating of drift averaging not more than 25 feet. Based on the Quaternary Geology of Ohio, the main geologic deposit of the project site consists of flat to gently undulating ground moraine. According to the Web Soil Survey of Cuyahoga County, Ohio, the soils in the vicinity of the project site consist of Mahoning silt loam, 0 to 2 percent slopes (MgA) and Udorthents, (Ua) which can be classified as A-6 soils based on the AASHTO Soil Classification System. Based on information obtained from the Ohio Geological Survey, top of bedrock in the vicinity of project site is anticipated to be present at an approximate elevation of 713 feet. At this elevation, bedrock is expected to consist of Mississippian-age Berea sandstone and Bedford shale. Berea Sandstone is brown, thin to thick, planar to lenticular bedding and consistent with sandstone and minor shale. Berea Sandstone is brown with thin to thick planar to lenticular bedding. Bedford shale is gray to brown with thin to medium planar to lenticular bedding with interbedded siltstone and sandstone. Based on the information obtained from the "Karst Interactive Map of Ohio", there are no karst features in Cuyahoga County.

DMS #10 WB Site: Based on information obtained from the Physiographic Regions of Ohio, the project site lies at an approximate elevation of 745 feet within the Berea Headlands of the Erie Lake Plain Region of the Huron-Erie Lake Plains Section which is located within the Central Lowlands Province of Ohio. The Berea Headlands of the Erie Lake Plain Region is characterized as a portion of the Erie Lake Plain underlain by resistant Berea Sandstone with several large sandstone headlands jutting into the Ice-Age Lake basin along with several streamlined "whalebacks" of Berea Sandstone that are 0.5 to 2.0 miles in length, 20 to 35 feet in height, and range in elevation from 670 to 800 feet. The geology of the Berea Headlands of the Erie Lake Plain generally consists of thin lacustrine deposits over thin, wave-planed, clayey, medium lime Wisconsin-age till that is underlain by resistant Berea sandstone. According to

Bulletin 44, *Geology of Water in Ohio,* the Wisconsin glacier passed over the project site but left only a thin coating of drift, averaging less than 25 feet. Based on the Quaternary Geology of Ohio, the main geologic deposit of the project site consists of very flat lake-planed Moraine with small patches of sand, silt, or clay on the surface in many areas. According to the Web Soil Survey of Lorain County, Ohio, the soils in the vicinity of the project site consist of Miner silty clay loam, 0 to 2 percent slopes (Mr) and Udorthents, (Cz) which can be classified as A-7-5 soils based on the AASHTO Soil Classification System. Based on information obtained from the Ohio Geological Survey, top of bedrock in the vicinity of project site is anticipated to be present at an approximate elevation of 720 feet. At this elevation, bedrock is expected to consist of Mississippian-age Berea sandstone and Bedford shale. Berea Sandstone is brown with thin to thick planar to lenticular bedding. Bedford shale is gray to brown with thin to medium planar to lenticular bedding with interbedded siltstone and sandstone. Based on the information obtained from the “Karst Interactive Map of Ohio”, there are no karst features in Lorain County.

DMS #5 WB Site: Based on information obtained from the Physiographic Regions of Ohio, the project site lies at approximate elevation of 643 feet within the within the Erie Lake Plain Region within the Huron-Erie Lake Plain Section which is located within the Central Lowland Province of Ohio. The Erie Lake Plain is located on the edge of the very low relief (10’) ice-age basin separated from modern Lake Erie by shoreline cliffs with major streams in deep gorges at elevations ranging from 570 to 800 feet. The geology of the Erie Lake Plain generally consists of Pleistocene-age lacustrine sand, silt, clay, and wave-planed till over Devonian- and Mississippian-age shales and sandstones. According to Bulletin 44, *Geology of Water in Ohio,* both the Illinoian and Wisconsin ice sheets passed over the project area but left only a thin and patchy coating of drift, averaging less than 20 feet. Based on the Quaternary Geology of Ohio, the main geologic deposit of the project site consists of very flat lake-planed moraine with small patches of sand, silt or clay on the surface in many areas. According to the Web Soil Survey of Erie County, Ohio, the soils in the vicinity of the project site consist of Bennington silt loam, 0 to 2 percent slopes (BgA) which can be classified as A-7-5 soils based on the AASHTO Soil Classification System. Based on information obtained from the Ohio Geological Survey, top of bedrock in the vicinity of project site is anticipated to be present at an approximate elevation of 611 feet. At this elevation, bedrock is expected to consist of Devonian-age Ohio Shale. Ohio shale is brownish black to greenish gray carbonaceous shale that weathers brown and has medium to massive bedding with carbonite/siderite concretions. Based on the information obtained from the “Karst Interactive Map of Ohio”, the nearest “suspected” karst feature is more than 8.0 miles from the project site.

DMS #7 WB Site: Based on information obtained from the Physiographic Regions of Ohio, the project site lies at an approximate elevation of 623 feet within the Woodville Lake-Plain Reefs Region of the Huron-Erie Lake Plains District which is located within the Central Lowland Province of Ohio. . The Woodville Lake-Plain Reefs Region is characterized as a lacustrine plain with very low relief (10'), low dunes and lake-margin features punctuated by more than 75 ancient bedrock reefs rising 10' to 40' above the level of the plain and ranging in area from 0.1 to 3.0 square miles. The oblong reefs are thinly draped with drift at elevations ranging from 600 to 775 feet. The geology of the Woodville Lake-Plain Reefs generally consists thin to absent Wisconsin-age wave planed clay till, lacustrine deposits, and sand over Silurian-age reef consisting of Lockport Dolomite. According to Bulletin 44, *Geology of Water in Ohio,* both the Illinoian and Wisconsin glaciers passed over the area. The drift is thin, varying from 1 to 30 feet in thickness but averaging less than 20 feet. Based on the Quaternary Geology of Ohio, the main geologic deposit of the project site consists of very flat lake-planed moraine with small patches of sand, silt or clay on the surface in many areas. According to the Web Soil Survey of Sandusky County, Ohio, the soils in the vicinity of the project site consist of Hoytville silty clay loam, 0 to 1 percent slopes (HcA) which can be classified as A-7-5 soils based on the AASHTO Soil Classification System. Based on information obtained from the Ohio Geological Survey, top of bedrock in the vicinity of project site is anticipated to be present at an approximate elevation of 590 feet. At this elevation, bedrock is expected to consist of Silurian-age Lockport Dolomite. Lockport Dolomite has shades of white to medium gray with medium to massive bedding. Based on the information obtained from the "Karst Interactive Map of Ohio", the nearest "suspected" karst feature is more than 4.3 miles southeast of the project site.

DMS # 8 WB Site: Based on information obtained from the Physiographic Regions of Ohio, the project site lies at an approximate elevation of 626 feet within the Maumee Sand Plains Region of the Huron-Erie Lake Plains District that is located within the Central Lowland Province of Ohio. The Maumee Sand Plains Region is characterized as lacustrine plain mantled by sand which includes low dunes, interdunal pans, beach ridges, and sand sheets of glacial lake shores. This region is well to poorly drained and lies at elevations ranging from 600 to 800 feet with very low relief of 10 feet or less. The geology of the Maumee Sand Plains District generally consists of late Wisconsin-age sand over clay till and lacustrine deposits. The deeply buried bedrock consists of Silurian- and Devonian-age carbonate rocks and shale. According to Bulletin 44, *Geology of Water in Ohio,* the Illinoian and Wisconsin ice sheets passed over the project area. Regionally the drift is thick, from 60 to 100 feet. Based on the Quaternary Geology of

Ohio, the main geologic deposit of the project site consists of lacustrine sand, deposited in glacial lakes as shallow-water deltas or nearshore bars and sheets that include many small areas of dunes. According to the Web Soil Survey of Lucas County, Ohio, the soils in the vicinity of the project site consist of Lenawee silty clay loam, 0 to 1 percent slopes (Lf) and Udorthents, loamy (Uo) which can be classified as A-7-5 soils based on the AASHTO Soil Classification System. Based on information obtained from the Ohio Geological Survey, top of bedrock in the vicinity of the project site is anticipated to be present at an approximate elevation of 571 feet. At this elevation, bedrock is expected to consist of Silurian-age Salina undifferentiated dolomite which is gray and brown with thin bedding. Based on the information obtained from the "Karst Interactive Map of Ohio", there are no karst features in Lucas County.

DMS # 9 WB Site: Based on information obtained from the Physiographic Regions of Ohio, the project site lies at approximate elevation of 738 feet within the Maumee Lake Plain Region of the Huron-Erie Lake Plains Section located within the Central Lowland Province of Ohio. The Maumee Lake Plains Region is characterized as flat-lying ice-age lake basin with beach ridges, bars, dunes, deltas, and clay flats; contained the former black swamp; slightly dissected by modern streams with elevations ranging from 570-800 feet with very low relief. The geology of the Maumee Lake Plain Region generally consists of Pleistocene-age silt, clay, and wave planed clayey till over Silurian- and Devonian-age carbonate rocks and shales. According to Bulletin 44, *Geology of Water in Ohio,* the Illinoian and Wisconsin ice sheets passed over the project area. Locally the drift is thick, varying from 150 to 170 feet and is largely till, but contains sand and gravel lenses with some water directly above the bedrock. The water supply is not large. Based on the Quaternary Geology of Ohio, the main geologic deposit of the project site consists of flat to gently undulating ground moraine. According to the Web Soil Survey of Fulton County, Ohio, the soils in the vicinity of the project site consist of Shinrock-Tuscola complex, 3 to 8 percent slopes (SgB2) which can be classified as A-6 soils based on the AASHTO Soil Classification System. Based on information obtained from the Ohio Geological Survey, top of bedrock in the vicinity of the project site is anticipated to be present at an approximate elevation of 592 feet. At this elevation, bedrock is expected to consist of Mississippian-age Sunbury shale. Sunbury shale is black to brownish black with very thin laminae which is consistent with carbonaceous shale. Based on the information obtained from the "Karst Interactive Map of Ohio", there are no karst features in Fulton County.

3.2 Observations of the Project

The reconnaissance of the project site was performed by one of PGI's geotechnical engineers in April 2025. The most of the DMS structure sites are located in a rural area of Ohio. The IR 80/IR76 consists of three-lanes in each direction at each site location. The existing pavements surface in this section of sites consist of asphaltic concrete which appeared to be in fair condition with few longitudinal cracks and transverse cracks. The right shoulder of the sites where the test boring was advanced consists of asphaltic concrete which appeared to be in fair condition. Some of the sites are more or less flat with no guardrails while other sites consisted of embankment with slopes and guardrails.

4.0 EXPLORATION

4.1 Historic and Project Exploration Program

Historic geotechnical information was available from the ODOT *Transportation Information Mapping System (TIMS)* Website in the vicinity of structure site: DMS #11 EB. The DMS #11 EB site had a roadway subsurface exploration performed along ramps connecting Mahoning Avenue (C.R. 18) to the Ohio Turnpike in 1995 under project designation C.R. 18 Connection to Ohio Turnpike. A total of 50 historic field logs with soil profile sheets are available for this project. Note that many of the historic soil samples presented on the soil profile sheets in vicinity of sites were drilled to termination depth of 10 feet and some of them did not have SPT N_{60} values. Therefore, this information will not be utilized during the current design. Based on MBI's review of the historical soil boring information at DMS #5 WB (Test Boring B-010-0-25) and DMS #10 EB (Test Boring B-017-0-25) site locations, it was determined that the average shear strength of the soil either meets or exceeds Su = 2000 psf (for cohesive soils) over the determined foundation length at these locations. Based on this information, PGI will proceed with the foundation design of Span Truss supporting DMS structures at the DMS #5 WB and DMS #10 EB site locations.

Current Exploration: In order to explore the subsurface conditions at the project site, drilling, sampling, and field-testing operations were performed in April August 2025. A total of 20 test borings identified as B-001-0-25 through B-020-0-25 were marked at the sites. All test borings except B-010-0-25 and B-017-0-25 were advanced through the outside paved shoulders along IR 80/IR 76 EB and WB for DMS structures foundation design purposes. Test borings B-010-0-25 and B-017-0-25 were not advanced due to ongoing Ohio Turnpike construction in the vicinity of DMS sites: DMS #5 WB and DMS #10 EB, respectively. For each site, Table 4.1.1 summarizes the test boring numbers, county, nearest intersecting road, mile post, and approximate distance and direction from each intersecting road. Refer to the "Site and Boring Location Map" included in Appendix A for specific site and boring locations. Ten (10) test borings identified as B-001-0-25, B-002-0-25, B-004-0-25, B-006-0-25, B-008-0-25, B-009-0-25, B-011-0-25, B-013-0-25, B-015-0-25, and B-018-0-25 were advanced along EB IR 80/IR 76 through the right/outside paved shoulder in the vicinity of each proposed structure (DMS #1 EB through DMS #9 EB and DMS #11). Eight (8) test borings identified as B-003-0-25, B-005-0-25, B-007-0-25, B-012-0-25, B-014-0-25, B-016-0-25, B-019-0-25, and B-020-0-25 were advanced along WB IR 80/IR 76 through the outside paved shoulder in the vicinity of each respective proposed structure (DMS #9 WB, DMS #8 WB, DMS #7 WB, DMS #10 WB, DMS #4 WB, DMS #3 WB, DMS #2 WB, and DMS #17 WB). All test borings were advanced to approximate depths ranging from 16.5 to 30.0 feet below the existing ground or pavement surface. All test borings were advanced in accordance with ODOT Specifications for Geotechnical Explorations (SGE). Table 4.1.2 summarizes the latitude/longitude coordinates, surface elevation, and termination depth at each boring location.

Table 4.1.1 – DMS Site Information

DMS No.	Boring No.	County	Intersecting Road	Mile Post of Site	Approximante Distance (ft) & Direction
DMS #1 EB	B-001-0-25	Williams	County Road 1.50	0.40	2605' West
DMS #2 EB	B-002-0-25	Fulton	County Road 23	26.3	88'West
DMS #9 WB	B-003-0-25	Fulton	County Road 20	29.3	80'East
DMS #3 EB	B-004-0-25	Lucas	Wilkins Road	50.8	2492' East
DMS #8 WB	B-005-0-25	Lucas	Holloway Road	57.0	2045 West
DMS #4 EB	B-006-0-25	Wood	East of I-80 Bridge	73.3	947 East
DMS #7 WB	B-007-0-25	Sandusky	W. Camper Road	75.6	377 East
DMS #5 EB	B-008-0-25	Sandusky	Kingsway Road	89.7	1802 East
DMS #6 EB	B-009-0-25	Erie	Patten Tract Road	112.9	1906 East
DMS #5 WB	B-010-0-25	Erie	Chapin Road	123.1	53' East
DMS #7 EB	B-011-0-25	Lorain	Baumhart Road	136.9	517' East
DMS #10 WB	B-012-0-25	Lorain	Murray Ridge Road	143.4	239' East
DMS #8 EB	B-013-0-25	Cuyahoga	Race Road	148.9	1687' West
DMS #4 WB	B-014-0-25	Cuyahoga	Abby Road	164.4	163' East
DMS #9 EB	B-015-0-25	Cuyahoga	Broadview Road	169.5	3019' West
DMS #3 WB	B-016-0-25	Portage	Diagonal Road	191.2	1919' West
DMS #10 EB	B-017-0-25	Portage	SR 700	198.5	1968' East

DMS No.	Boring No.	County	Intersecting Road	Mile Post of Site	Approximante Distance (ft) & Direction
DMS #11 EB	B-018-0-25	Mahoning	NW of I-80/I-76	219.5	33’ NW
DMS #2 WB	B-019-0-25	Mahoning	S. Turner Road	222.6	790’ NW
DMS #1 WB	B-020-0-25	Mahoning	E. Garfield Road	241.0	950’ SE

Mile post information was provided by MBI personnel

Table 4.1.2 – Boring Information

DMS No.	Boring No.	Elevation (ft)	Latitude Coordinates	Longitude Coordinates	Termination Depth (ft)
DMS #1 EB	B-001-0-25	1014±	41.6297788	-84.7981368	25.0
DMS #2 EB	B-002-0-25	718±	41.59131481	-84.3074362	25.0
DMS #9 WB	B-003-0-25	738±	41.5908518	-84.2487952	25.0
DMS #3 EB	B-004-0-25	669±	41.6007783	-83.835301	25.0
DMS #8 WB	B-005-0-25	626±	41.59217034	-83.7206841	25.0
DMS #4 EB	B-006-0-25	626±	41.5140053	-83.432392	25.0
DMS #7 WB	B-007-0-25	623±	41.49994378	-83.3891955	25.0
DMS #5 EB	B-008-0-25	604±	41.4125623	-83.1466675	30.0
DMS #6 EB	B-009-0-25	699±	41.33586164	-80.7147053	16.5
DMS #5 WB	B-010-0-25*	669±	41.327778	-82.508669	--
DMS #7 EB	B-011-0-25	787±	41.37287342	-82.2664901	25.0
DMS #10 WB	B-012-0-25	745±	41.39041977	-82.1489858	24.4
DMS #8 EB	B-013-0-25	741±	41.37798434	-82.0504528	25.0
DMS #4 WB	B-014-0-25	899±	41.31873471	-81.7740855	25.0
DMS #9 EB	B-015-0-25	1192±	41.298444	-81.694869	25.0
DMS #3 WB	B-016-0-25	1125±	41.24836836	-81.2882081	15.5
DMS #10 EB	B-017-0-25*	1184±	41.242331	-81.141058	--
DMS #11 EB	B-018-0-25	991±	41.10470561	-81.8339667	16.1
DMS #2 WB	B-019-0-25	1014±	40.07200778	-80.7930973	24.9
DMS #1 WB	B-020-0-25	1036±	40.91351344	-80.5221407	25.0

Latitude/Longitude coordinates and surface elevations were provided by MBI personnel, *Not Drilled

The test borings were staked in the field by PGI personnel based on the Google Earth kmz extension file provided by the MBI personnel. Site geometry and underground utility locations were also taken into account when locating the test borings. At the time of test boring location selection, the vertical soil sampling intervals were determined based on the needs for design and construction of the project. A truck-mounted Mobile 57 drill rig was used to advance the test borings using 3.25-inch inside diameter, continuous flight hollow stem augers (HSA). Representative disturbed soil samples were collected at intervals in accordance with ODOT Specifications. A standard 2.0-inch outside diameter split-barrel sampler was driven into the soil by means of a 140-lb hammer falling freely through a distance of 30-inches in accordance with the Standard Penetration Test (ASTM D 1586). A total of four (4) undisturbed Shelby Tube samples were obtained from selected test borings in accordance with "Thin-Walled Tube Sampling of Soils" (ASTM D 1587). All test borings were monitored for the presence of groundwater during drilling operations and upon completion. These test boring holes were backfilled with a mixture of bentonite and soil cuttings, and pavement sections were filled with compacted cold patch asphalt.

The N-values (N_m) as measured in the field have been corrected to an equivalent rod energy ratio of 60% (N_{60}) in accordance with ODOT's *Specifications for Geotechnical Explorations*. The drill rig hammer system was calibrated by energy testing in accordance with ASTM D4633 and drill rod energy ratio (ER) was determined. The automatic hammer for this CME truck-mounted drill rig was calibrated on 1/08/2025 with a Drill Rod Energy Ratio of 98.0%. The measured N-values (N_m) were corrected to the equivalent rod energy ratio of 60 percent, N_{60}, using the equation: $N_{60} = N_m \times (ER/60)$.

4.2 Laboratory Testing Program

All soil/rock samples obtained during the drilling and sampling operations were returned to PGI's geotechnical soils laboratory in Cleveland, Ohio. Upon arrival, the samples were visually examined and classified by a geotechnical engineer to verify the classifications made in the field and to note any additional characteristics, which may not have been observed in the field.

Moisture content determination tests were performed on all soil samples as per ODOT specifications. Additional laboratory soil tests were performed on selected soil samples for the purpose of soil classification and for analysis of engineering characteristics. These tests consisted of Particle-Size Analysis, Liquid and Plastic Limit, and Plasticity Index Determination of Soils, and Unconfined Compressive Strength of Cohesive Soils. All other laboratory tests were performed in accordance with the ASTM or other standards listed in "Laboratory Test Standards" located in Appendix B. The results of the laboratory tests are also included in Appendix B. The soils were classified in accordance with the ODOT Soil Classification System, a description of which is also included in Appendix B.

Upon completion of the laboratory testing, all samples were placed in storage at PGI's Cleveland facility. Unless otherwise requested in writing, the soil samples will be retained through completion and OTIC approval of Stage 2 plans.

5.0 FINDINGS

5.1 Subsurface Soil Conditions

For the DMS structures located along IR 80/IR 76 EB, the surficial and subsurface soil conditions were determined from the soil information obtained from test borings B-001-0-25, B-002-0-25, B-004-0-25, B-006-0-25, B-008-0-25, B-009-0-25, B-011-0-25, B-013-0-25, B-015-0-25, and B-018-0-25. For the DMS structures located along IR 80/IR 76 WB, the surficial and subsurface soil conditions were determined from the soil information obtained from test boring B-003-0-25, B-005-0-25, B-007-0-25, B-012-0-25, B-014-0-25, B-016-0-25, B-019-0-25, and B-020-0-25.

DMS #1 EB Site: The surficial and subsurface soil conditions were determined from the soil information obtained from test boring B-001-0-25 which was advanced to an approximate depth of 25 feet**.** Test boring B-001-0-25 was advanced through 14 inches of asphalt pavement and 22 inches of crushed limestone aggregate base. The subsurface soils encountered below the aggregate base consisted of natural soils. These natural soils consisted of clay (A-7-6), non-plastic sandy silt (A-4a), sandy silt (A-4a), coarse and fine sand (A-3a) and plastic silt (A-4b) to termination depth. The laboratory test results indicated that the moisture contents of the tested non-plastic/granular soils ranged from 11% to 13% and the relative density of these soils ranged from “medium dense” to “loose”. The laboratory test results indicated that the moisture contents of the tested cohesive soil samples ranged from 9% to 25% and the consistency of these soils ranged from "stiff" to "very stiff” but was primarily “very stiff”. Three (3) cohesive soil samples were tested for Atterberg limits which had natural moisture contents less than or equal to their plastic limits. Bedrock was not encountered at this test boring location.

DMS # 2 EB Site: The surficial and subsurface soil conditions were determined from the soil information obtained from test boring B-002-0-25 which was advanced to an approximate depth of 25 feet**.** Test boring B-002-0-25 was advanced through 11 inches of asphalt pavement and through 7 inches of crushed limestone aggregate base**.** The subsurface soils encountered at this test boring location were cohesive in nature and consisted of both fill materials and natural soils. Fill materials consisting of clay (A-7-6) soils were encountered below the pavement to a depth of 6.0 feet. Natural soils encountered below the fill material consisted of clay (A-7-6) and silty clay (A-6b). The laboratory test results indicated that the moisture contents of the tested cohesive soil samples ranged from 12% to 36% and the consistency of these soils ranged from "medium stiff" to "very stiff ". The four (4) cohesive soil samples that were tested for Atterberg limits were in a plastic state due to their moisture contents being above their plastic limits, but below their liquid limits, therefore, deformation may occur under loading. Bedrock was not encountered at this test boring location.

DMS # 3 EB Site: The surficial and subsurface soil conditions were determined from the soil information obtained from test boring B-004-0-25 which was advanced to an approximate depth of 25 feet**.** Test boring B-004-0-25 was advanced through 24 inches of crushed limestone aggregate berm material. The subsurface soils encountered at this test boring location were non-cohesive in nature and consisted of both fill materials and natural soils. The fill material encountered below the berm material consisted of coarse and fine sand (A-3a) to an approximate depth of 8.5 feet below the ground surface. Natural soils encountered below the fill material consisted of coarse and fine sand (A-3a), non-plastic sandy silt (A-4a), and non-plastic silt (A-4b). The laboratory test results indicated that the moisture content of the tested non-plastic/granular soils ranged from 11% to 26% and the relative density of these soils ranged from "medium dense to “loose" to "very dense", but was primarily “medium dense” to “dense”. Bedrock was not encountered at this test boring location.

DMS # 4 EB Site: The surficial and subsurface soil conditions were determined from the soil information obtained from test boring B-006-0-25 which was advanced to an approximate depth of 25 feet**.** Test boring B-006-0-25 was advanced through 6.5 inches of asphalt pavement and through 12 inches of crushed limestone aggregate base**.** The subsurface soils encountered were cohesive in nature at this test boring location and consisted of both fill materials and natural soils. Fill materials were encountered below the road base to an approximate depth of 11.0 feet below the ground surface and consisted of silt and clay (A-6a). Natural soils encountered below the fill material consisted of clay (A-7-6) and silty clay (A-6b) to termination depth. The laboratory test results indicated that the moisture content of the tested cohesive soil samples ranged from 12% to 19% and the consistency of these soils ranged from “medium stiff” to "hard” but was primarily “stiff”. Three (3) of the four (4) cohesive soil samples that were tested for Atterberg limits contain natural moisture content less than theirs plastic limits. One cohesive sample (at 16.0 feet) had a natural moisture content 1% above its plastic limit which means it is in a plastic state and deformation may occur under loading. Bedrock was not encountered at this test boring location.

DMS # 5 EB Site: The surficial and subsurface soil conditions were determined from the soil information obtained from test boring B-008-0-25 which was advanced to an approximate depth of 30 feet**.** Test boring B-008-0-25 was advanced through 10.5 inches of asphalt pavement and through 13.0 inches of crushed limestone aggregate road base. The subsurface soils encountered were predominantly cohesive in nature at this test boring location and consisted of both fill materials and natural soils. The fill materials encountered below road base consisted of clay (A-7-6) and silty clay (A-6b) encountered to an approximate depth of 8.5 feet. Natural soils encountered below the fill material consisted of plastic silt (A-4b), non-plastic silt (A-4b), silty clay (A-6b), and silt and clay (A-6a) to termination depth. The laboratory test results indicated that the moisture content of the tested non-plastic/granular soils ranged from 28% to 31%. The relative density of the non-plastic soils ranged from "loose" to "very loose". The laboratory test results indicated that the moisture contents of the tested cohesive soil samples ranged from 17% to 32% and the consistency of these soils ranged from “stiff” to "very soft". The four (4) cohesive soil samples that were tested for Atterberg limits were in a plastic state due to their moisture contents being equal to or above their plastic limits, but below their liquid limits. Bedrock was not encountered at this test boring location.

DMS #6 EB Site: The surficial and subsurface conditions were determined from the soil and rock information obtained from test boring B-009-0-25 which was advanced to an approximate depth of 16.5 feet**.** Test boring B-009-0-25 was advanced through 8.0 inches of asphalt pavement and 16.0 inches of crushed limestone aggregate road base. The subsurface soils encountered at this test boring location consisted of cohesive fill materials and natural soils. The fill materials encountered below road base consisted of clay (A-7-6) soils encountered to an approximate depth of 6.0 feet below the ground surface. The natural soils encountered below the fill material also consisted of clay (A-7-6) to an approximate depth of 8.5 feet. At 8.5 feet, severely weathered gray shale was encountered. The shale became less weathered with depth and was classified as highly weathered from 13.5 feet to termination depth at 16.5 feet. The laboratory test results indicated that the moisture contents of the tested cohesive soil samples ranged from 24% to 28% and the consistency of these soils ranged from "stiff" to "medium stiff". Both cohesive soil samples that were tested for Atterberg limits were in a plastic state due to their natural moisture content being greater than their plastic limits, but below their liquid limits. This boring was terminated at 16.5 feet due to auger refusal.

DMS #7 EB Site: The surficial and subsurface conditions were determined from the soil and rock information obtained from test boring B-011-0-25 which was advanced to an approximate depth of 25 feet**.** Test boring B-011-0-25 was advanced through 13.0 inches of asphalt pavement and 7.0 inches of crushed limestone aggregate road base. The subsurface soils encountered at this test boring location consisted of both fill materials and natural soils. The fill materials encountered below road base consisted of silt and clay (A-6a) to an approximate depth of 3.5 feet, sandstone fragments (A-1-a) to an approximate depth of 6.0 feet, and clay to an approximate depth of 8.5 feet. Natural soils encountered below the fill material consisted of silty clay (A-6b), sandy silt (A-4a), non-plastic silt (A-4b), and plastic silt (A-4b). Highly weathered shale bedrock was encountered below the natural soils at an approximate depth of 23.5 feet below the ground surface. The laboratory test results indicated that the moisture contents of the tested cohesive soil samples ranged from 10% to 22% and the consistency of these soils was primarily “stiff” to “hard”. Three cohesive soil samples were tested for Atterberg limits. The natural moisture contents of all three samples were below their plastic limits.

DMS #8 EB Site: The surficial and subsurface soil conditions were determined from the soil information obtained from test boring B-013-0-25 which was advanced to an approximate depth of 25 feet. Test boring B-013-0-25 was advanced through 13.5 inches of asphalt pavement and through 4.5 inches of crushed limestone aggregate road base. The subsurface soils encountered were cohesive in nature at this test boring location and consisted of both fill materials and natural soils. The fill materials encountered below the aggregate road base consisted of sandy silt (A-4a) to an approximate depth of 3.5 feet below the ground surface. Natural soils encountered below the fill materials consisted of clay (A-7-6), silty clay (A-6b), sandy silt (A-4a), and silt and clay (A-6a) to termination depth. Bedrock was not encountered below the natural soils at this boring location. The laboratory test results indicated that the moisture content of the tested cohesive soil samples ranged from 9% to 24% and the consistency of these soils ranged from "medium stiff” to "hard", but was primarily “hard”. Two (2) of the four (4) cohesive soil samples that were tested for Atterberg limits contained natural moisture contents greater than their plastic limits which means they are in a plastic state and deformation of the soils could occur under loading.

DMS #9 EB Site: The surficial and subsurface soil conditions were determined from the soil information obtained from test boring B-015-0-25 which was advanced to an approximate depth of 25 feet. Test boring B-015-0-25 was advanced through topsoil which measured four 12 inches. The subsurface soils encountered were cohesive in nature at this test boring location. Natural soils encountered consisted of silty clay (A-6b), Plastic Silt (A-4a), sandy silt (A-6a) to termination depth. Bedrock was not encountered below the natural soil at this boring location. The laboratory test results indicated that the moisture contents of the tested cohesive soil samples ranged from 11% to 19% and the consistency of these soils ranged from "stiff" to "hard" but was primarily "very stiff". Two of the cohesive soil samples that were tested for Atterberg limits contain natural moisture content equal to their plastic limits.

DMS #10 EB Site: Boring B-017-0-25 was not drilled.

DMS #11 EB Site: The surficial and subsurface soil conditions were determined from the soil and rock information obtained from test boring B-018-0-25 which was advanced to an approximate depth of 16.1 feet. Test boring B-018-0-25 was advanced through 1.5 inches of topsoil and through 22.5 inches of sand and gravel berm material. The subsurface soils encountered at the test boring location consisted of both fill materials and natural soils. The fill materials encountered below the sand and gravel berm material consisted of clay (A-7-6) to an approximate depth of 3.5 feet. Natural soils encountered below the fill material consisted of silty clay (A-6b) and silt and clay (A-6a). Severely weathered gray shale bedrock was encountered below the natural soils to termination depth of 16.1 feet below the ground surface. The laboratory test results indicated that the moisture contents of the tested cohesive soil samples ranged from 9% to 24% and the consistency of these soils ranged from "stiff" to "hard". One of the three cohesive soil samples that was tested for Atterberg limits had a natural moisture content greater than its plastic limit which means the clay (A-7-6) fill soils at 2.0 feet were in a plastic state. This boring was terminated at 16.1 feet due to auger refusal.

DMS #1 WB Site: The surficial and subsurface soil conditions were determined from the soil information obtained from test boring B-020-0-25 which was advanced to an approximate depth of 25 feet. Test boring B-020-0-25 was advanced through 12 inches of asphalt pavement and through 6 inches of crushed limestone aggregate base. The subsurface soils encountered at this test boring location consisted of both fill materials and natural soils. The fill materials encountered below aggregate base consisted of sandy silt (A-4a) and silt and clay (A-6a). These fill materials were encountered at approximate depth of 16 feet below the ground surface. Natural soils encountered below the fill materials consisted of silt and clay (A-6a), non-plastic silt (A-4b), gravel and stone fragments with sand and silt (A-2-4) and sandy silt (A-4a) to termination depth. Bedrock was not encountered at this boring location. The laboratory test results indicated that the moisture contents of the tested non-plastic/granular soils were 16%. The relative density of these non-plastic/granular soils was "medium dense". The laboratory test results indicated that the moisture contents of the tested cohesive soil samples ranged from 9% to 18% and the consistency of these soils ranged from "hard" to "stiff". One of the three cohesive soil samples that was tested for Atterberg limits had a natural moisture content greater than its plastic limit which means the silt and clay (A-6a) soils from approximately 16.0 to 18.5 feet were in a plastic state.

DMS #2 WB Site: The surficial and subsurface soil conditions were determined from the soil and rock information obtained from test boring B-019-0-25 which was advanced to an approximate depth of 24.4 feet. Test boring B-019-0-25 was advanced through 12.5 inches of asphalt pavement and through 11.5 inches of granular slag and cinder base material. The subsurface soils encountered at this test boring location consisted of cohesive fill materials and natural soils. The fill materials consisted of silty clay (A-6b) and silt and clay (A-6a) which was encountered to an approximate depth of 16.0 feet. Natural soils encountered below the fill consisted of silty clay (A-6b) and silt and clay (A-6a) to an approximate depth of 24.0 feet. Highly weathered reddish brown shale bedrock was encountered from approximately 24.0 feet to termination depth. The laboratory test results indicated that the moisture contents of the tested cohesive soils ranged from 15% to 19%. All three of the cohesive soil samples that were tested for Atterberg limits had natural moisture contents greater than their plastic limits but less than their liquid limits which means they are in a plastic state and deformation may occur under loading.

DMS #3 WB Site: The surficial and subsurface soil conditions were determined from the soil information obtained from test boring B-016-0-25 which was terminated to an approximate depth of 15.5 feet due to auger refusal due to possible boulder**.** Test boring B-016-0-25 was advanced through 13 inches of asphalt pavement and through 11 inches of crushed limestone aggregate base. The subsurface soils encountered at this test boring location consisted of granular natural soils. The natural soils encountered consisted of gravel and stone fragments with sand (A-1-b), gravel and stone fragments (A-1-a), and stone fragments with sand and silt (A-2-4) to termination depth. Bedrock was not encountered at this boring location. The laboratory test results indicated that the moisture contents of the tested non-plastic/granular soils ranged from 5% to 10%. The relative density of these soils ranged from "very dense" to "medium dense", but was primarily "very dense".

DMS #4 WB Site: The surficial and subsurface soil conditions were determined from the soil information obtained from test boring B-014-0-25 which was advanced to an approximate depth of 25 feet**.** Test boring

B-014-0-25 was advanced through 13 inches of asphalt pavement and through 11 inches of crushed limestone aggregate base. The subsurface soils encountered at this test boring location consisted of cohesive fill materials and natural soils. The fill materials consisted of silty clay (A-6b) and silt and clay (A-6a) to an approximate depth of 6.0 feet. Natural soils encountered in this test boring consisted of silt and clay (A-6a) and silty clay (A-6b) to termination depth. Laboratory test results indicated that the moisture contents of the tested cohesive soil samples ranged from 15% to 19% and the consistency of these soils ranged from "stiff" to "hard", but were primarily "stiff". All of the cohesive soil samples that were tested for Atterberg limits contained natural moisture contents greater than their plastic limits but less than their liquid limits. This means that all of the tested samples are in a plastic state and deformation may occur under loading. Bedrock was not encountered at this boring location.

DMS #10 WB Site: The surficial and subsurface soil conditions were determined from the soil information obtained from test boring B-012-0-25 which was advanced to an approximate depth of 24.3 feet**.** Test boring B-012-0-25 was advanced through 14 inches of asphalt pavement and through 6 inches of sand and gravel base material. The subsurface soils encountered at this test boring location consisted of both fill materials and natural soils. The fill materials consisted of silt and clay (A-6a) and clay (A-7-6) which were encountered below the sand and gravel base to an approximate depth of 8.5 feet. Natural soils encountered below the fill material consisted of clay (A-7-6), silt and clay (A-6a) and non-plastic silt (A-4b). The laboratory test results indicated that the moisture contents of the tested cohesive soil samples ranged from 8% to 27% and the consistency of these soils ranged from "medium stiff" to "hard". Two (2) of the four (4) cohesive soil samples that were tested for Atterberg limits contain natural moisture content greater than their plastic limits but less than their liquid limits. This means that the cohesive soils at 3.5 and 8.5 feet are in a plastic state. Very dense non-plastic silt (A-4b) was encountered from 23.5 feet to termination depth and contained a natural moisture content of 10%. Bedrock was not encountered at this boring location.

DMS #5 WB Site: Boring B-010-0-25 was not drilled.

DMS #7 WB Site: The surficial and subsurface soil conditions were determined from the soil information obtained from test boring B-007-0-25 which was advanced to an approximate depth of 25 feet**.** Test boring B-007-0-25 was advanced through 11 inches of asphalt pavement and through 18 inches of crushed limestone aggregate base**.** The subsurface soils encountered were cohesive in nature at this test boring location and consisted of both fill materials and natural soils. The fill materials encountered below the aggregate base consisted of silt and clay (A-6a) and clay (A-7-6) to an approximate depth of 6.0 feet. Natural soils encountered below the fill materials to termination depth consisted of silty clay (A-6b), sandy silt (A-4a) and silt and clay (A-6a). Laboratory test results indicated that the moisture contents of the tested cohesive soil samples ranged from 12% to 27% and the consistency of these soils ranged from “stiff” to “hard” but were primarily “very stiff”. Two (2) of the four (4) cohesive soil samples tested for Atterberg limits contained natural moisture contents greater than their plastic limits but less than their liquid limits which means they were in a plastic state and deformation may occur under loading. Bedrock was not encountered at this boring location.

DMS # 8 WB Site: The surficial and subsurface soil conditions were determined from the soil information obtained from test boring B-005-0-25 which was advanced to an approximate depth of 25 feet. Test boring B-005-0-25 was advanced through 13 inches of asphalt pavement and through 8 inches of crushed limestone aggregate base. The subsurface soils encountered were cohesive in nature at this test boring location and consisted of both fill materials and natural soils. The fill soils encountered below aggregate base consisted of silt and clay (A-6a) to an approximate depth of 6.0 feet. Natural soils encountered below the fill soils consisted of silty clay (A-6b), plastic silt (A-4b) and silt and clay (A-6a) to termination depth. The laboratory test results indicated that the moisture contents of the tested cohesive soil samples ranged from 10% to 29%. The consistency of these soils ranged from "stiff" to "soft". All four (4) cohesive soil samples tested for Atterberg limits contained natural moisture contents greater than their plastic limits but less than their liquid limits. This means that these four soil samples were in a plastic state and deformation may occur under loading. Bedrock was not encountered at this boring location.

DMS # 9 WB Site: The surficial and subsurface soil conditions were determined from the soil information obtained from test boring B-003-0-25 which was advanced to an approximate depth of 25 feet. Test boring B-003-0-25 was advanced through 12 inches of asphalt pavement. The subsurface soils encountered at this test boring location consisted of both fill materials and natural soils. The fill materials encountered below asphalt pavement consisted of silt and clay (A-4a) to a depth of 3.5 feet. Natural soils encountered below the fill soils consisted of silt and clay (A-6a) and non-plastic silt (A-4b) to termination depth. The laboratory test results indicated that the moisture contents of the tested non-plastic/granular soils ranged from 21% to 23%. The relative density of these soils ranged from "medium dense" to "loose” but was primarily “medium dense”. The laboratory test results indicated that the moisture contents of the tested cohesive soil samples ranged from 18% to 19% and the consistency of the natural silt and clay (A-6a) soil was "stiff". Both cohesive soil samples tested for Atterberg limits contained natural moisture contents greater than their plastic limits but less than their liquid limits. This means that these soils are in a plastic state and deformation may occur under loading. Bedrock was not encountered at this boring location.

General: For specific conditions at various depths, please refer to the individual test boring logs located in Appendix A of this report. For complete moisture contents and Atterberg limit test results, please refer to the laboratory test results in Appendix B.

5.2 Bedrock Conditions

Bedrock was encountered in test borings B-009-0-25 (DMS #6 EB), B-011-0-25 (DMS #7 EB), B-018-0-25 (DMS #11 EB) and B-019-0-25 (DMS #2 WB). Bedrock was not cored in any of these four tests borings, but was augered and split spoon sampled until 50+ N-values were obtained. In test boring B-009-0-25 (DMS #6 EB), bedrock consisted of gray, severely to highly weathered shale between approximate depths of 8.5 and 16.5 feet. In test boring B-011-0-25 (DMS #7 EB), bedrock consisted of reddish-brown, highly weathered shale between approximate depths of 23.5 and 25.0 feet. In test boring B-018-0-25 (DMS #11 EB), bedrock consisted of gray, severely weathered shale between approximate depths of 13.5 and 16.1 feet. In test boring B-019-0-25 (DMS #2 WB), bedrock consisted of reddish-brown, highly weathered shale between approximate depths of 24.0 and 24.9 feet.

5.3 Groundwater Conditions

The test borings were monitored for the presence or absence of the groundwater at the test boring locations during and upon completion of the drilling operations. Table 5.3.1 summarizes the groundwater readings at the boring locations where groundwater was encountered. The bore holes were backfilled using bentonite/auger cutting mixture immediately upon completion for safety purposes. It should be noted that groundwater elevations are subject to seasonal fluctuations.

Table 5.3.1 – Groundwater Information

DMS No.	Boring Number	Surface Elevation (ft.)	Groundwater Depth (ft.)		Groundwater Elevation (ft.)	
			D.D.	U.C.	D.D.	U.C.
DMS #1 EB	B-001-0-25	1014.0±	13.5	NR	1000.5	NR
DMS #2 EB	B-002-0-25	718.0±	16.0	NR	702.0	NR
DMS #9 WB	B-003-0-25	738.0±	NR	NR	NR	NR
DMS #3 EB	B-004-0-25	741.0±	11.0	NR	730.0	NR
DMS #8 WB	B-005-0-25	626.0±	13.5	NR	612.5	NR
DMS #4 EB	B-006-0-25	626.0±	NR	NR	NR	NR
DMS #7 WB	B-007-0-25	623.0±	NR	NR	NR	NR
DMS #5 EB	B-008-0-25	604.0±	13.5	NR	590.5	NR
DMS #6 EB	B-009-0-25	699.0±	NR	NR	NR	NR
DMS #5 WB	B-010-0-25*	669.0±	--	--	--	--
DMS #7 EB	B-011-0-25	787.0±	10.0	9.0	777.0	778.0
DMS #10 WB	B-012-0-25	745.0±	NR	NR	NR	NR
DMS #8 EB	B-013-0-25	741.0±	NR	NR	NR	NR
DMS #4 WB	B-014-0-25	899.0±	NR	NR	NR	NR
DMS #9 EB	B-015-0-25	1192.44±	NR	NR	NR	NR
DMS #3 WB	B-016-0-25	1125.0±	NR	NR	NR	NR
DMS #10 EB	B-017-0-25*	1184.0±	--	--	--	--
DMS #11 EB	B-018-0-25	991.0±	NR	NR	NR	NR
DMS #2 WB	B-019-0-25	1014.0±	NR	NR	NR	NR
DMS #1 WB	B-020-0-25	1036.0±	NR	NR	NR	NR

Note: Elevations were provided by MBI personnel; D.D. = During drilling U.C. = Upon Completion, *Not Drilled

6.0 ANALYSIS AND RECOMMENDATIONS

Based upon the findings of the field exploration program, laboratory testing, and subsequent engineering analysis, the following sections have been prepared to address geotechnical aspects related to the design and construction of the proposed overhead span truss supporting Dynamic Message Sign (DMS) structures at various locations along the Ohio Turnpike Mainline. The foundation recommendations for the above structures are provided in accordance with the *ODOT Geotechnical Engineering Manual (GDM), Section 1200 issued in January 2025, Bridge Design Manual issued in 2020 and updated in January 2025 which include AASHTO LRFD Bridge Design Specifications, AASHTO LRFD specifications for Structural Supports for Highway Signs, Luminaries, and Traffic Signals (LRFDLTS-1), and ODOT Traffic Engineering Manual (TEM), and Office of Roadway Engineering (ORE) standard drawings*. Based on PGI's and the ODOT Office of Geotechnical Engineering's experience with similar soils and similar subsurface conditions, the HP (penetrometer) values within the fill/disturbed soils at most test boring locations, do not reasonably correlate with the SPT N_{60} values. Therefore, the HP values within the fill/undisturbed soils, as shown on the boring logs, are not considered to be reliable, and more confidence should be placed on the SPT N_{60} values which were obtained in the field using a calibrated SPT hammer. It should be noted that fill/undisturbed soils are typically less homogenous than natural/undisturbed soils and may have stone or gravel or organic inclusions which can more acutely affect penetrometer vs. STP N_{60} values.

6.1 Foundation Systems for Span Truss Supporting DMS

According to GDM Section 1204.5, the drilled shaft foundations should be used to support the span truss carrying DMS, catwalks, and any other appurtenances. Two (2) drilled shaft foundation units (Shaft 1 and Shaft 2) will be installed, one on outside shoulder and another one on median. On each side, the two drilled shafts will be installed parallel to the roadway and will be connected with one tie beam. The foundation design was performed in accordance with TEM Sections 240-4.5(2) or 1303-5 and Standard Drawings, TC-21.11, TC-21.21, ITS-30.12, ITS-35.12, and ITS-36.12. If the average shear strength of the soils over the determined foundation length, L, meets or exceeds either Su = 2000 psf (for cohesive soils) or ϕ_f = 30° (for granular soils), a Standard Foundation Design must be performed for each span truss supporting DMS by comparing span length and sign area with the design numbers listed in TEM Figure 298-13 or for DMS support foundations by comparing span length with the maximum span for the design numbers listed in Standard Drawing ITS-35.13. Then, Standard Drawing TC-21.21, ITS-35.12, or

ITS-36.12 must be consulted to determine the appropriate foundation dimensions and details for the appropriate design number. However, if the sign area or the span length exceeds the limits for the design numbers in Figure 298-13 or Standard Drawing ITS-35.13, or if the soil shear strength values are below the minimum requirements for a Standard Foundation Design according to TC-21.11, ITS-35.12, or ITS-36.12, a Special Foundation Design must be performed.

Design information provided by MBI personnel indicates that the typical span length will be 70 feet for each proposed span truss supporting DMS structure to be installed at the 20 project sites. The width and height dimensions will be 7.92 feet and 24.83 feet, respectively for each proposed DMS to be installed at the 20 sites. The total area for each DMS sign will be 196.65 square feet. At two of the 20 DMS sites, Variable Speed Limit (VSL) signs will be mounted on the OH SS support poles on each side of the Ohio Turnpike mainline. The width and height dimensions for the proposed VSL signs will be 4.0 feet and 5.0 feet, respectively for a proposed VSL sign area of 20.0 square feet. Based on the span length and sign area of each span truss supporting DMS, Design No. 1 was selected from Figure 298-13. By comparing the span length of the span truss to the maximum span design numbers listed in Standard Drawing ITS-35.13, Design No. 1 was selected for each span truss supporting DMS. Based on Standard Drawing ITS-35.12, a drilled shaft foundation minimum length of 16 feet with a diameter of 3.0 feet was determined. The following paragraphs provide foundation recommendations for span truss supported DMS structures at each site location.

DMS #1 EB Site: Soil information obtained from test boring B-001-0-25 was used to design the drilled shaft foundation for DMS #1 EB. As per this boring log, the subsurface soils encountered were predominantly cohesive in nature. The calculated average SPT N_{60} value was 12.4 along the proposed length of the 16-foot shaft foundation. Based on GDM Section 404.1, the average undrained shear strength (S_u) of the cohesive soils encountered along the proposed length of the shaft foundation was 1550 psf. Based on GDM Section 404.2, an angle of internal friction (ϕ_f) of the non-cohesive/granular soils encountered along the proposed length of the shaft foundation was equal to 29°. Based on GDM Section 405, Table 404-4, the wet density for the soils encountered along the proposed shaft foundation length was equal to 120.9 pcf. Since the average undrained shear strength (S_u) for cohesive soils encountered along the proposed length of the shaft foundation was less than 2000 psf, the soil parameter value was below the required minimum criteria for Standard Foundation Design specifications. Therefore, Special Foundation Design analyses must be performed.

DMS #2 EB Site: Soil information obtained from test boring B-002-0-25 was used to design the drilled shaft foundation for DMS #2 EB. As per this boring log, the subsurface soils encountered were cohesive in nature. The calculated average SPT N_{60} value was 11.6 along the proposed 16-foot shaft foundation length. Based on GDM Section 404.1, the average undrained shear strength (S_u) of the cohesive soils encountered along the proposed shaft foundation length was 1462.5 psf. Based on GDM Section 405, Table 404-4, the wet density of the soils encountered along the proposed shaft foundation length was 119.4 pcf. The above soil parameter values were below the required minimum criteria for Standard Foundation Design specifications. Therefore, Special Foundation Design analyses must be performed.

DMS #3 EB Site: Soil information obtained from test boring B-004-0-25 was used to design the drilled shaft foundation for DMS #3 EB. As per this boring log, the subsurface soils encountered were non-cohesive/granular in nature. The calculated average SPT N_{60} value was 28 along the proposed 16-foot shaft foundation length. Based on GDM Section 404.2, the average angle of internal friction (ϕ_f) of the non-cohesive/granular soils encountered along the proposed shaft foundation length was more than 30°. Based on GDM Section 405, Table 404-4, the average wet density of the soils encountered along the proposed shaft foundation length was more than 126.3 pcf. Therefore, these soil parameter values were above the required minimum criteria for Standard Foundation Design specifications and the recommended minimum length of the drilled shaft to be used will be 16 feet. Table 6.1.1 summarizes the ground elevation, soil excavation depth, top of rock depth, rock excavation depth, and proposed drilled shaft length.

DMS #4 EB Site: Soil information obtained from test boring B-006-0-25 was used to design the drilled shaft foundation for DMS #4 EB. As per this boring log, the subsurface soils encountered were cohesive in nature. The calculated average SPT N_{60} value was 10.6 along the proposed 16-foot shaft foundation length. Based on GDM Section 404.1, the average undrained shear strength (S_u) of the cohesive soils encountered along the proposed shaft foundation length was 1375 psf. Based on GDM Section 405, Table 404-4, the average wet density of the soils encountered along the proposed shaft foundation length was 119.4 pcf. These soil parameter values were below the required minimum criteria for Standard Foundation Design specifications. Therefore, Special Foundation Design analyses must be performed.

DMS #5 EB Site: Soil information obtained from test boring B-008-0-25 was used to design the drilled shaft foundation for DMS #5 EB. As per this boring log, the subsurface soils encountered were predominantly cohesive in nature. The calculated average SPT N_{60} value was 9.3 along the proposed 16-foot shaft foundation length. Based on GDM Section 404.1, the average undrained shear strength (S_u) of the cohesive soils encountered along the proposed shaft foundation length was 1164.4 psf. Based on GDM Section 405, Table 404-4, the average wet density of the soils encountered along the proposed shaft foundation length was 116.9 pcf. These soil parameter values were below the required minimum criteria for Standard Foundation Design specifications. Therefore, Special Foundation Design analyses must be performed.

DMS #6 EB Site: Soil information obtained from test boring B-009-0-25 was used to design the drilled shaft foundation for DMS #6. As per this boring log, the subsurface soils encountered above the bedrock were cohesive in nature. Bedrock was encountered at an approximate depth of 8.5 feet below the pavement surface. Based on GDM Section 404.1, the average undrained shear strength (S_u) of the cohesive soils encountered along the proposed 16-foot shaft foundation length was 1272.7 psf. Based on GDM Section 405, Table 404-4, the average wet density of the soils encountered above the bedrock was 115 pcf. Therefore, the required minimum criteria for Standard Foundation Design specifications were not met. However, bedrock was encountered before reaching the required depth of 16 feet and the remaining foundation must be decreased by 50 percent. The recommended minimum length of the drilled shaft to be used will be 12.25 feet. Table 6.1.1 summarizes the ground elevation, soil excavation depth, top of rock depth, rock excavation depth, and proposed drilled shaft length.

DMS #7 EB Site: Soil information obtained from test boring B-011-0-25 was used to design the drilled shaft foundation for DMS #7 EB. As per this boring log, the subsurface soils consisted of both cohesive and non-cohesive/granular in nature. The calculated average SPT N_{60} value was 22.2 along the proposed 16-foot shaft foundation length. Based on the GDM Section 404.1, the average undrained shear strength (S_u) of cohesive soils encountered over the proposed shaft foundation length was 2625 psf. Based on GDM Section 404.2, the angle of internal friction (ϕ_f) of the non-cohesive/granular soils encountered along the proposed 16-foot shaft foundation length was more than 30°. Based on GDM Section 405, Table 404-4, the average wet density of soils encountered along the proposed shaft foundation length was 120.4 pcf. Therefore, these soil parameter values were above the required minimum criteria for Standard Foundation Design specifications and the recommended minimum length of the drilled shaft to be used will be 16 feet. Table 6.1.1 summarizes the ground elevation, soil excavation depth, top of rock depth, rock excavation depth, and proposed drilled shaft length.

DMS #8 EB Site: Soil information obtained from test boring B-013-0-25 was used to design the drilled shaft foundation for DMS#8 EB. As per this boring log, the subsurface soils encountered were cohesive in nature. The calculated average SPT N_{60} value was 16.3 along the proposed 16-foot shaft foundation length. Based on GDM Section 404.1, the average undrained shear strength (S_u) of the cohesive soils encountered along the proposed shaft foundation length was 2389.4 psf. Based on GDM Section 405, Table 404-4, the average wet density of soils encountered along the proposed shaft foundation length was 120.9 pcf. These soil parameter values were above the required minimum criteria for Standard Foundation Design specifications and the recommended minimum length of the drilled shaft to be used will be 16 feet. Table 6.1.1 summarizes the ground elevation, soil excavation depth, top of rock depth, rock excavation depth, and proposed drilled shaft length.

DMS #9 EB Site: Soil information obtained from test boring B-015-0-25 was used to design the drilled shaft foundation for DMS #9 EB. As per this boring log, the subsurface soils encountered were cohesive in nature. The calculated average SPT N_{60} value was 15.0 along the proposed 16-foot shaft foundation length. Based on GDM Section 404.1, the average undrained shear strength (S_u) of the cohesive soils encountered along the shaft foundation length was approximately 2000 psf. Based on GDM Section 405, Table 404-4, the average wet density of the soils encountered along the proposed shaft foundation length was approximately 120 pcf. Therefore, these soil parameter values met the required minimum criteria for Standard Foundation Design specifications, and the recommended minimum length of the drilled shaft to be used will be 16 feet. Table 6.1.1 summarizes the ground elevation, soil excavation depth, top of rock depth, rock excavation depth, and proposed drilled shaft length.

DMS #10 EB Site: Based on our review of the historical soil boring information, it was assumed that the average undrained shear strength (Su) of the cohesive soils encountered along the shaft foundation length was 2000 psf. Therefore, based on the soil parameter values meeting the required minimum criteria for Standard Foundation Design specifications, the recommended minimum length of the drilled shaft to be used will be 16 feet. Note that there is potential for encountering bedrock before reaching the required depth of 16 feet. If this occurs, PGI recommends that the shafts be extended to full depth based on the MBI request.

DMS #11 EB Site: Soil information obtained from test boring B-018-0-25 was used to design the drilled shaft foundation for DMS #11 EB. As per this boring log, the subsurface soils encountered above the bedrock were cohesive in nature. Bedrock was encountered at an approximate depth of 13.5 feet below the ground surface. The calculated average SPT N_{60} value was 33.2 along the proposed 16-foot shaft foundation length. Based on GDM Section 404.1, the average undrained shear strength (S_u) of the cohesive soils encountered along the proposed shaft foundation length was more than 2000 psf. Based on GDM Section 405, Table 404-4, the wet density of soils encountered along the proposed shaft foundation length was more than 120 pcf. Therefore, these soil parameter values were above the required minimum criteria for Standard Foundation Design specifications. Since bedrock was encountered before reaching the required depth of 16 feet, the remaining foundation may be decreased by 50 percent and the length of the drilled shaft to be used will be 14.75 feet. Table 6.1.1 summarizes the ground elevation, soil excavation depth, top of rock depth, rock excavation depth, and proposed drilled shaft length.

DMS #1 WB Site: Soil information obtained from test boring B-020-0-25 was used to design the drilled shaft foundation for DMS #1 WB. As per this boring log, the subsurface soils encountered were predominantly cohesive in nature. The calculated average SPT N_{60} value was 16.8 along the proposed 16-foot shaft foundation length. Based on GDM Section 404.1, the average undrained shear strength (S_u) of the cohesive soils encountered along the proposed shaft foundation length was 2115.4 psf. Based on GDM Section 405, Table 404-4, the average wet density of the soils encountered along the proposed shaft foundation length was more than 120.8 pcf. Therefore, these soil parameter values were above the required minimum criteria for Standard Foundation Design specifications, and the recommended minimum length of the drilled shaft to be used will be 16 feet. Table 6.1.1 summarizes the ground elevation, soil excavation depth, top of rock depth, rock excavation depth, and proposed drilled shaft length.

DMS #2 WB Site: Soil information obtained from test boring B-019-0-25 was used to design the drilled shaft foundation for DMS #2 WB. As per this boring log, the subsurface soils encountered were predominantly cohesive in nature. The calculated average SPT N_{60} value was 14.0 along the proposed 16-foot shaft foundation length. Based on GDM Section 404.1, the average undrained shear strength (S_u) of the cohesive soils encountered along the proposed shaft foundation length was approximately 2000 psf. Based on GDM Section 405, Table 404-4, the average wet density of soils encountered along the proposed shaft foundation length was 120.2 pcf. Therefore, these soil parameter values were above the required minimum criteria for Standard Foundation Design specifications and the recommended minimum length of the drilled shaft to be used will be 16 feet. Table 6.1.1 summarizes the ground elevation, soil excavation depth, top of rock depth, rock excavation depth, and proposed drilled shaft length.

DMS #3 WB Site: Soil information obtained from test boring B-016-0-25 was used to design the drilled shaft foundation for DMS #3 WB. As per this boring log, the subsurface soils encountered were non-cohesive/granular in nature. The calculated average SPT N_{60} value was 34 along the 16-foot shaft foundation length. Based on GDM Section 404.2, the average angle of internal friction (ϕ_f) of the non-cohesive/granular soils encountered along the proposed shaft foundation length was more than 30°. Based on GDM Section 405, Table 404-4, the average wet density of the soils encountered along the proposed 16 foot shaft foundation length was 128.7 pcf. Therefore, these soil parameter values were above the required minimum criteria for Standard Foundation Design specifications and the recommended length of the drilled shaft to be used will be 16 feet. Note that this boring was not advanced to a depth of 25 feet due to auger refusal at a depth of 15.5 feet below the pavement surface. Table 6.1.1 summarizes the ground elevation, soil excavation depth, top of rock depth, rock excavation depth, and proposed drilled shaft length.

DMS #4 WB Site: Soil information obtained from test boring B-014-0-25 was used to design the drilled shaft foundation for DMS #4 WB. As per this boring log, the subsurface soils encountered were cohesive in nature. The calculated average SPT N_{60} value was 15.8 along the proposed 16-foot shaft foundation length. Based on GDM Section 404.1, the average undrained shear strength (S_u) of the cohesive soils encountered along the proposed shaft foundation length was approximately 2000 psf. Based on GDM Section 405, Table 404-4, the average wet density of soils encountered along the proposed shaft foundation length was 120.8 pcf. Therefore, these soil parameter values meet the required minimum criteria for Standard Foundation Design specifications and the recommended minimum length of the drilled shaft to be used will be 16 feet. Table 6.1.1 summarizes the ground elevation, soil excavation depth, top of rock depth, rock excavation depth, and proposed drilled shaft length.

DMS #10 WB Site: Soil information obtained from test boring B-012-0-25 was used to design the drilled shaft foundation for DMS #10 WB. As per this boring log, the subsurface soils encountered were predominantly cohesive in nature. The calculated average SPT N_{60} value was 17.2 along the proposed 16-foot shaft foundation length. Based on GDM Section 404.1, the average undrained shear strength (S_u) of the cohesive soils encountered along the proposed shaft foundation length was 2105.7 psf. Based on

GDM Section 405, Table 404-4, the average wet density of the soils encountered along the proposed shaft length was 120.5 pcf. Therefore, these soil parameter values were above the required minimum criteria for Standard Foundation Design specifications, and the recommended minimum length of the drilled shaft to be used will be 16 feet. Table 6.1.1 summarizes the ground elevation, soil excavation depth, top of rock depth, rock excavation depth, and proposed drilled shaft length.

DMS #5 WB Site: Based on our review of the historical soil boring information, it was assumed that the average undrained shear strength (Su) of the cohesive soils encountered along the shaft foundation length was 2000 psf. Therefore, based on the soil parameter values meeting the required minimum criteria for Standard Foundation Design specifications, the recommended minimum length of the drilled shaft to be used will be 16 feet. Note that there is potential for encountering bedrock before reaching the required depth of 16 feet. If this occurs, PGI recommends that the shafts be extended to full depth based on the MBI request.

DMS #7 WB Site: Soil information obtained from test boring B-007-0-25 was used to design the drilled shaft foundation for DMS #7 WB. As per this boring log, the subsurface soils encountered were cohesive in nature. The calculated average SPT N_{60} value was 21 along the proposed 16-foot shaft foundation length. Based on GDM Section 404.1, the average undrained shear strength (S_u) of the cohesive soils encountered along the proposed shaft foundation length was 2572.1 psf. Based on GDM Section 405, Table 404-4, the average wet density of soils encountered along the proposed the shaft length was equal to 125.2 pcf. Therefore, these soil parameter values were above the required minimum criteria for Standard Foundation Design specifications, and the recommended minimum length of drilled shaft to be used will be 16 feet. Table 6.1.1 summarizes the ground elevation, soil excavation depth, top of rock depth, rock excavation depth, and proposed drilled shaft length.

DMS #8 WB Site: Soil information obtained from test boring B-005-0-25 was used to design the drilled shaft foundation for DMS #8 WB. As per this boring log, the subsurface soils encountered were cohesive in nature. The calculated average SPT N_{60} value was 9.8 along the proposed 16-foot shaft foundation length. Based on GDM Section 404.1, the average undrained shear strength (S_u) of the cohesive soils encountered along the proposed shaft foundation length was 1134.6 psf. Based on GDM Section 405, Table 404-4, the average wet density of soils encountered along the proposed shaft length was equal to

118.5 pcf. These soil parameter values were below the required minimum criteria for Standard Foundation Design specifications. Therefore, Special Foundation Design analyses must be performed.

DMS #9 WB Site: Soil information obtained from test boring B-003-0-25 was used to design the drilled shaft foundation DMS #9 WB. As per this boring log, the subsurface soils were both cohesive and non-cohesive/granular in nature. The calculated average SPT N_{60} value was 12.8 along the proposed 16-foot shaft foundation length. Based on the pocket penetrometer readings, the average undrained shear strength (S_u) of the cohesive soils encountered along the proposed shaft foundation length was 1250 psf. Based on GDM Section 404.2, an angle of internal friction (ϕ_f) of the non-cohesive/granular soils encountered along the proposed 16 foot shaft foundation length was 30°. Based on GDM Section 405, Table 404-4, the average wet density of soils encountered along the proposed shaft foundation length was 120.6 pcf. Since the average undrained shear strength (S_u) of the cohesive soils encountered along the proposed shaft foundation length was less than 2000 psf, the soil parameter value was below the required minimum criteria for Standard Foundation Design specifications. Therefore, Special Foundation Design analyses must be performed.

Table 6.1.1 – Estimated Design Parameters for Drilled Shaft Foundation

DMS No.	Boring No.	Top Ground Elevation (feet)	Soil Excavation Depth (feet)	Top of Rock Depth (feet)	Rock Excavation Depth (feet)	Minimum Drilled Shaft Length (feet)
DMS #1 EB	B-001-0-25*	1014±	16.0	--	--	16.0
DMS #2 EB	B-002-0-25*	718±	16.0	--	--	16.0
DMS #9 WB	B-003-0-25*	738±	16.0	--	--	16.0
DMS #3 EB	B-004-0-25	669±	16.0	--	--	16.0
DMS #8 WB	B-005-0-25*	626±	16.0	--	--	16.0
DMS #4 EB	B-006-0-25*	626±	16.0	--	--	16.0
DMS #7 WB	B-007-0-25	623±	16.0	--	--	16.0
DMS #5 EB	B-008-0-25*	604±	16.0	--	--	16.0
DMS #6 EB	B-009-0-25	699±	8.5	8.5	3.75	12.25
DMS #5 WB	B-010-0-25**	669±	16.0	--	--	16.0
DMS #7 EB	B-011-0-25	787±	16.0	--	--	16.0
DMS #10 WB	B-012-0-25	745±	16.0	--	--	16.0
DMS #8 EB	B-013-0-25	741±	16.0	--	--	16.0
DMS #4 WB	B-014-0-25	899±	16.0	--	--	16.0
DMS #9 EB	B-015-0-25	1192±	16.0	--	--	16.0
DMS #3 WB	B-016-0-25	1125±	16.0	--	--	16.0
DMS #10 EB	B-017-0-25**	1184±	16.0	--	--	16.0

DMS No.	Boring No.	Top Ground Elevation (feet)	Soil Excavation Depth (feet)	Top of Rock Depth (feet)	Rock Excavation Depth (feet)	Minimum Drilled Shaft Length (feet)
DMS #11 EB	B-018-0-25	991±	13.5	13.5	1.25	14.75
DMS #2 WB	B-019-0-25	1014±	16.0	--	--	16.0
DMS #1 WB	B-020-0-25	1036±	16.0	--	--	16.0

*Performed Special Foundation Design, **Not Drilled

6.2 Special Foundation Design Analyses for Span Truss Supporting DMS

Special Foundation Design Analyses were performed at test boring locations B-001-0-25, B-002-0-25, B-003-0-25, B-005-0-25, B-00-6-25 and B-008-0-25 corresponding to DMS #1 EB, DMS #2 EB, DMS #9 WB, DMS #8 WB, DMS #4 EB, and DMS #5 EB Sites, respectively. Table 6.2.1 summarizes reaction loads information acting on top of drilled shaft for ITS-35.13 Design No. 1, provided by MBI personnel. The lateral deflection, moment, and shear analyses checks must be performed at the Extreme I, Strength I, and Service I Limit States in accordance with AASHTO LRFD Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals (LRFDLTS).

Table 6.2.1 – Factored Reaction Design Loads on top of Drilled Shafts

LRFD Limit States		Strength Limit State			Extreme Limit State		
Shaft Location		Fz (lb.)	Fy (lb.)	Mx (lb.-in)	Fz (lb.)	Fy (lb.)	Mx (lb.-in)
Median Column 1	Shaft 1	27790.00	10.00	138120.00	46960.00	3120.00	29880.00
Median Column 2	Shaft 2	24090.00	-20.00	140880.00	-5160.00	6800.00	247440.00
Shoulder Column 1	Shaft 1	19550.00	30.00	70680.00	60280.00	9900.00	111120.00
Shoulder Column 2	Shaft 2	14170.00	-20.00	69960.00	-32880.00	3300.00	155880.00

The SHAFT Program (Version 2012.7.8) was used to calculate drilled shaft side and tip resistance values used for bearing and uplift checks. A drilled shaft axial geotechnical static analysis was performed in accordance with AASHTO LRFD Bridge Design Specifications Article 10.8, BDM Section 305.4, and GDM Section 1306. The soil parameters used for the SHAFT analyses were obtained from the field and laboratory test results for the soil profiles at each test boring. For the loads and deflections to be used in lateral, moment, and shear analyses checks, p-y analysis was performed using LPILE program (Version 2022.12.12) with shafts having rotationally fixed head boundary condition. Structural moments and shear resistance of the drilled shafts were checked in accordance with AASHTO LRFD Bridge Design

Specifications Section 5 and Article 10.8. Table 6.2.2 summarizes the soil parameters used in the LPILE analyses. Based on the Special Foundation Design analysis, Table 6.1.1 summarizes the ground elevation, minimum soil excavation depth, top of rock depth, rock excavation depth, and proposed drilled shaft length.

Table 6.2.2 – Estimated Soil Parameters for Lateral Load Analysis

Depth Below Pavement Surface (feet)	Average Bulk Unit Weight (γ, pcf)	Submerged Unit Weight (γ', pcf)	Ave. Angle of Internal Friction (degrees)	Undrained Shear Strength (psf)	Soil Modulus (k) (pci)	Soil Strain (E50 for clays)
Boring B-001-0-25						
0.0 to 3.0	120.0	--	0	250	--	0.03
3.0 to 6.0	121.0	58.6	0	1875	450	0.0074
6.0 to 8.5	125.0	62.6	29.0	--	30	--
8.5 to 14.0	119.0	56.6	0	1250	200	0.0093
14.0 to 16.0	121.0	58.6	29.5	--	20	--
16.0 to 18.5	121.0	58.6	0	2000	500	0.007
18.5 to 25.0	122.0	59.6	0	2292	1073	0.0067
Boring B-002-0-25						
0.0 to 3.0	119.0	--	0	250	--	0.03
3.0 to 6.0	118.0	55.6	0	1000	100	0.01
6.0 to 8.5	119.0	56.6	0	1250	200	0.0093
8.5 to 16.0	120.0	57.6	0	1667	367	0.008
16.0 to 25.0	117.0	54.6	0	1063	125	0.0098
Boring B-003-0-25						
0.0 to 3.0	120.0	--	0	250	--	0.03
3.0 to 8.5	123.0	60.6	30.0	--	34	--
8.5 to 16.0	119.0	56.6	0	1250	100	0.01
16.0 to 25.0	121.0	58.6	31	--	36	--
Boring B-005-0-25						
0.0 to 3.0	120.0	--	0	250	--	0.03
3.0 to 6.0	120.0	57.6	0	1750	400	0.0076
6.0 to 13.5	118.0	55.6	0	1000	100	0.01
13.5 to 18.5	118.0	55.6	0	1000	100	0.01
18.5 to 23.5	113.0	50.6	0	625	47.5	0.0175
23.5 to 25.0	112.0	49.6	0	500	30	0.02
Boring B-006-0-25						
0.0 to 3.0	119.0	--	0	250	--	0.03
3.0 to 11.0	120.0	57.6	0	1375	250	0.0089
11.0 to 16.0	120.0	57.6	0	1375	250	0.0089
16.0 to 18.5	121.0	58.6	0	2250	562.5	0.0068
18.5 to 25.0	127.0	64.6	0	7000	1750	0.0043
Boring B-008-0-25						
0.0 to 3.0	118.0	--	0	250	--	0.03
3.0 to 6.0	118.0	55.6	0	1125	150	0.0096
6.0 to 8.5	118.0	55.6	0	1250	200	0.0093
8.5 to 11.0	118.0	55.6	0	1126	150	00096
11.0 to16.0	115.0	52.6	27	--	20	--

Depth Below Pavement Surface (feet)	Average Bulk Unit Weight (γ, pcf)	Submerged Unit Weight (γ', pcf)	Ave. Angle of Internal Friction (degrees)	Undrained Shear Strength (psf)	Soil Modulus (k) (pci)	Soil Strain (E50 for clays)
16.0 to 27.0	110.0	47.6	0	375	15	0.03
27.0 to 30.0	110.0	47.6	0	250	5	0.035

Note: Groundwater Table was assumed at 3.0 feet below the ground surface.

6.3 Groundwater Management

Groundwater was encountered in test borings B-001-0-25, B-002-0-25, B-004-0-25, B-005-0-25, B-008-0-25, and B-011-0-25 and was measured at approximate depths of 13.5 feet, 16.0 feet, 11.0 feet, 13.5 feet,13.5 feet, and 10.0 feet below the pavement and roadbase surface during drilling operations. Groundwater was measured in test boring B-011-0-25 at approximate depth of 9.0 feet upon completion of drilling operations. If structure foundation excavations extend below the water level encountered in these test boring locations, water infiltration is anticipated in the proposed excavations. Therefore, low to moderate volume pumping or dewatering may be required during excavation of structure foundations. Please note that the groundwater levels may vary due to seasonal fluctuations and groundwater may appear during excavation where it was not previously encountered.

6.4 Earthwork and Construction Monitoring

All DMS site locations where the existing slope is 6:1 or greater, the buried depth foundation shaft should apply to the low side of the slope. The top of the shaft foundation should be set 2 inches above existing surface on the high side of the slope. The additional depth of shaft foundation necessary to meet these requirements should be added to the formed top. These drilled shafts are to be installed in one (1) row with spacing less than three (3) drilled shaft diameters from center to center. Therefore, the nominal resistance of the drilled shaft group in cohesive soils must be evaluated in accordance with Article 10.8.3.6.1 of the *AASHTO LRFD Bridge Design Specifications*. Selecting the construction method for installing the drilled shafts is the responsibility of the contractor. During installation of drilled shaft holes, water seepage into the holes will occur below the water level encountered in test borings. Therefore, the using casing method may be required to support the overburden soils. Drilled shaft bottoms should be free of all loose material prior to placement of concrete. The successful performance of a drilled shaft depends on the construction method used as well as the quality of workmanship during installation. Therefore, qualified geotechnical personnel should be present during construction for inspection in order to assure the quality of the drilled shafts and to verify that the rock conditions are as per the boring logs. For detailed drilled shaft construction, refer to Item 524 – “Drilled Shafts” of the ODOT *Construction and Material Specifications* issued in July 2025.

All excavations should comply with all current and applicable local, state, and federal safety codes, regulations and practices, including the Occupational Safety and Health Administration (OSHA). If proposed cut slopes for the bridge pile caps excavations are to be exposed for an extended period of time, they must be constructed using a two (2) horizontal to one (1) vertical slope for excavation in cohesive soils and a three (3) horizontal to one (1) vertical slope for excavation in non-cohesive/granular soils.

7.0 LIMITATIONS

This report is subject to the following conditions and limitations:

7.1 The subsurface conditions described are based on an examination of soil samples at the sampling intervals. Varying soil deposits, including fill material, may exist between the sampling intervals and between or beyond the test boring locations. Variation in subsurface conditions from those indicated in this report may become apparent during the earthwork and/or installation of the foundations. Such variations may require changes and/or modifications in our recommendations. Such changes may cause time delays and/or additional costs. Owners must be made aware of these limitations and must incorporate them in the design budget and scheduling of the project.

7.2 The design of the proposed project does not vary from the technical information provided and specified in this report. All changes in the design must be reviewed by our geotechnical engineers. PGI cannot assume any responsibility for interpretations made by others of the subsurface conditions and their behavior based on this report.

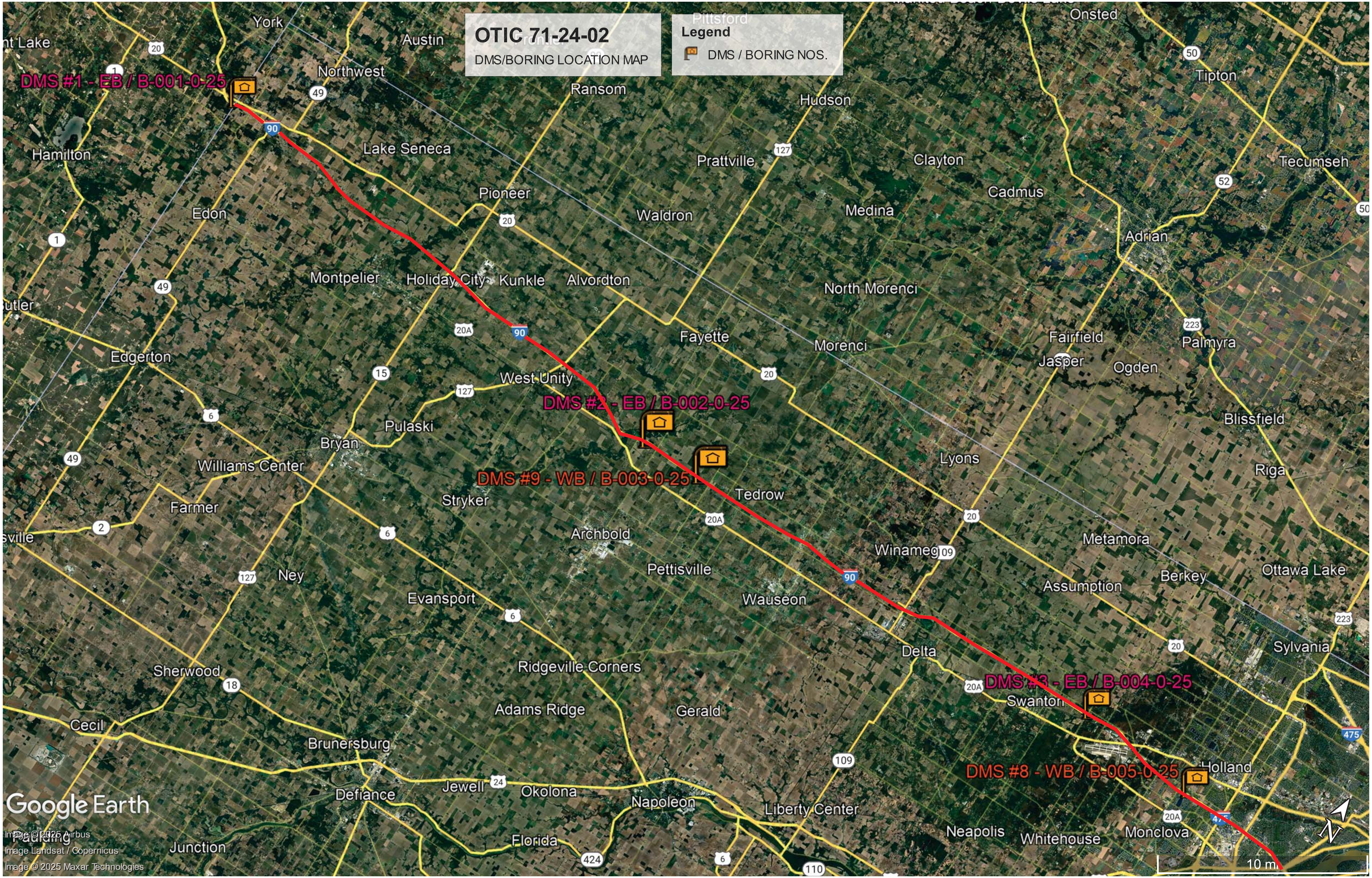
7.3 All earthwork and foundation construction must be performed under the supervision of a Professional Engineer in accordance with ODOT Construction Specifications.

7.4 The subsurface exploration for this project is strictly from a geotechnical standpoint. An environmental site assessment was not included in the scope of these geotechnical services.

7.5 All sheeting, shoring, and bracing of trenches, pits and excavations should be made the responsibility of the contractor and should comply with all current and applicable local, state and federal safety codes, regulations and practices, including the Occupational Safety and Health Administration (OSHA).

APPENDICES

APPENDIX A


OTIC 71-24-02
DMS/BORING LOCATION MAP
Legend
DMS / BORING NOS.
DMS #1 - EB / B-001-0-25
DMS #2 - EB / B-002-0-25
DMS #9 - WB / B-003-0-25
DMS #3 - EB / B-004-0-25
DMS #8 - WB / B-005-0-25
York
Austin
Pittsford
Onsted
Northwest
Ransom
Hudson
Tipton
Hamilton
Lake Seneca
Prattville
Clayton
Tecumseh
Pioneer
Cadmus
Edon
Waldron
Medina
Adrian
Montpelier
Holiday City
Kunkle
Alvordton
North Morenci
Fayette
Morenci
Fairfield
Palmyra
Edgerton
Jasper
Ogden
West Unity
Blissfield
Pulaski
Bryan
Lyons
Riga
Williams Center
Stryker
Tedrow
Farmer
Archbold
Winameg
Metamora
Ney
Pettisville
Berkey
Ottawa Lake
Assumption
Evansport
Wauseon
Sylvania
Delta
Sherwood
Ridgeville Corners
Swanton
Adams Ridge
Gerald
Cecil
Brunersburg
Holland
Defiance
Jewell
Okolona
Napoleon
Liberty Center
Neapolis
Whitehouse
Monclova
Junction
Florida
Google Earth
Image © 2025 Airbus
Image Landsat / Copernicus
Image © 2025 Maxar Technologies
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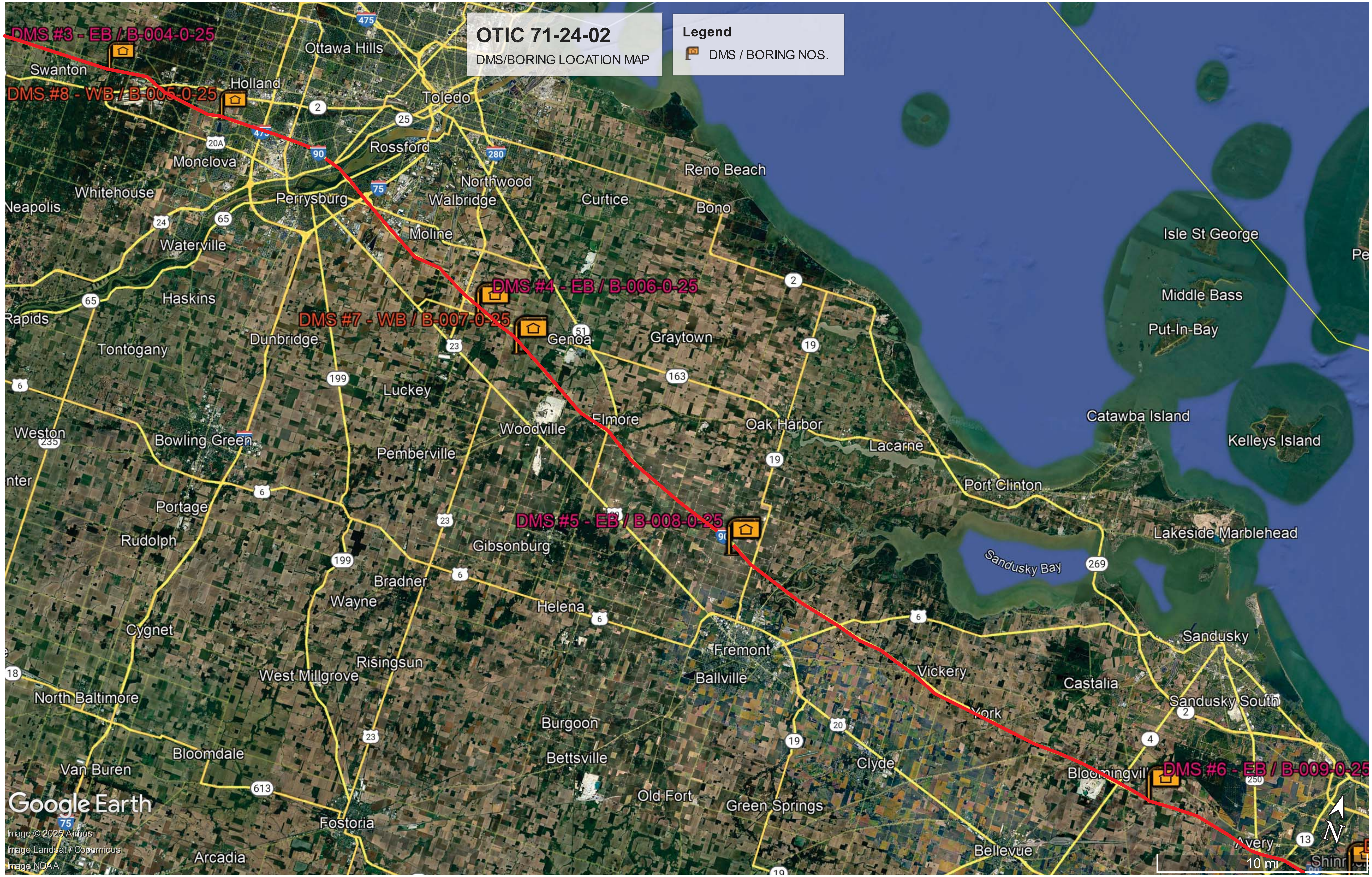
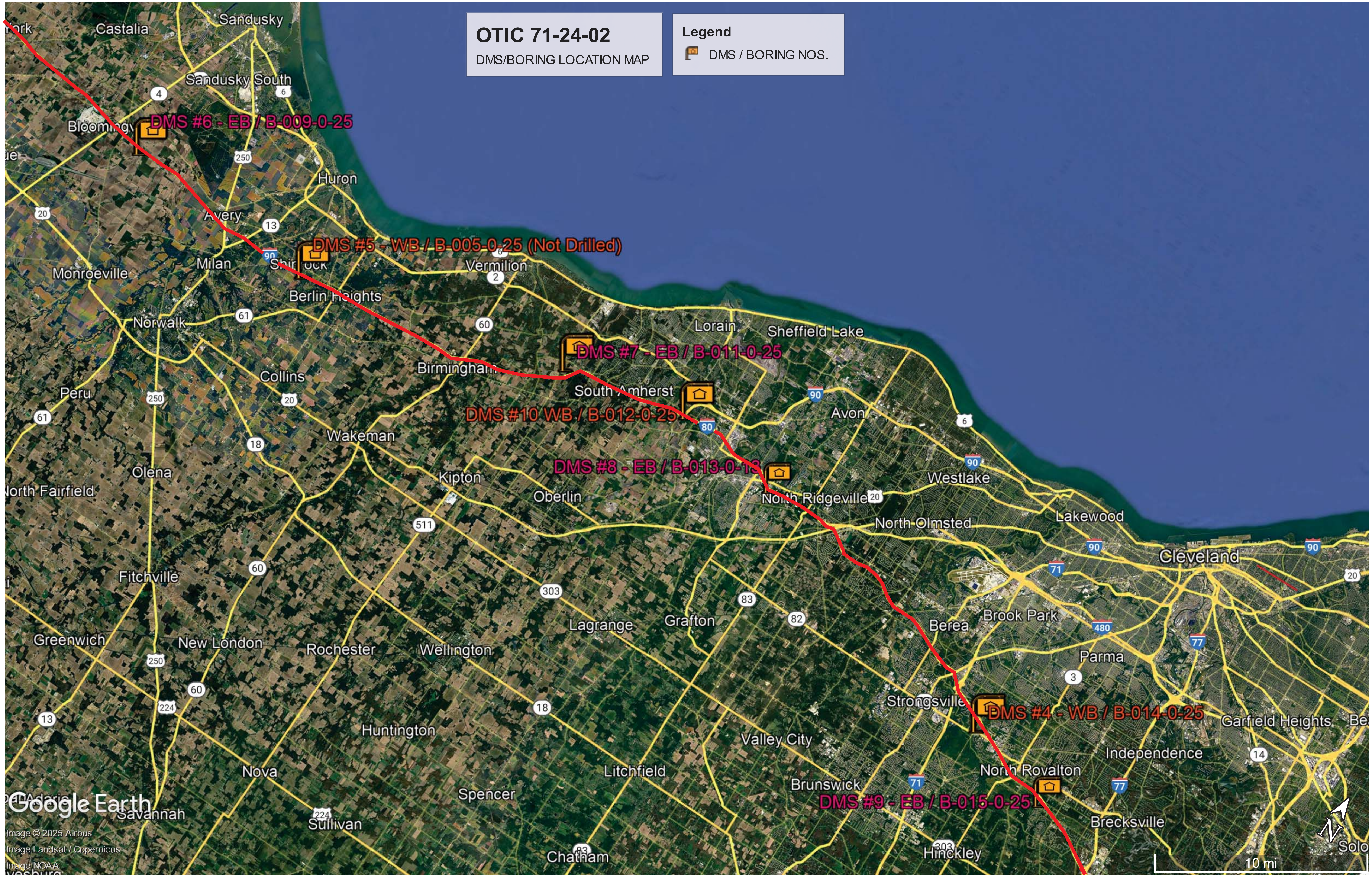
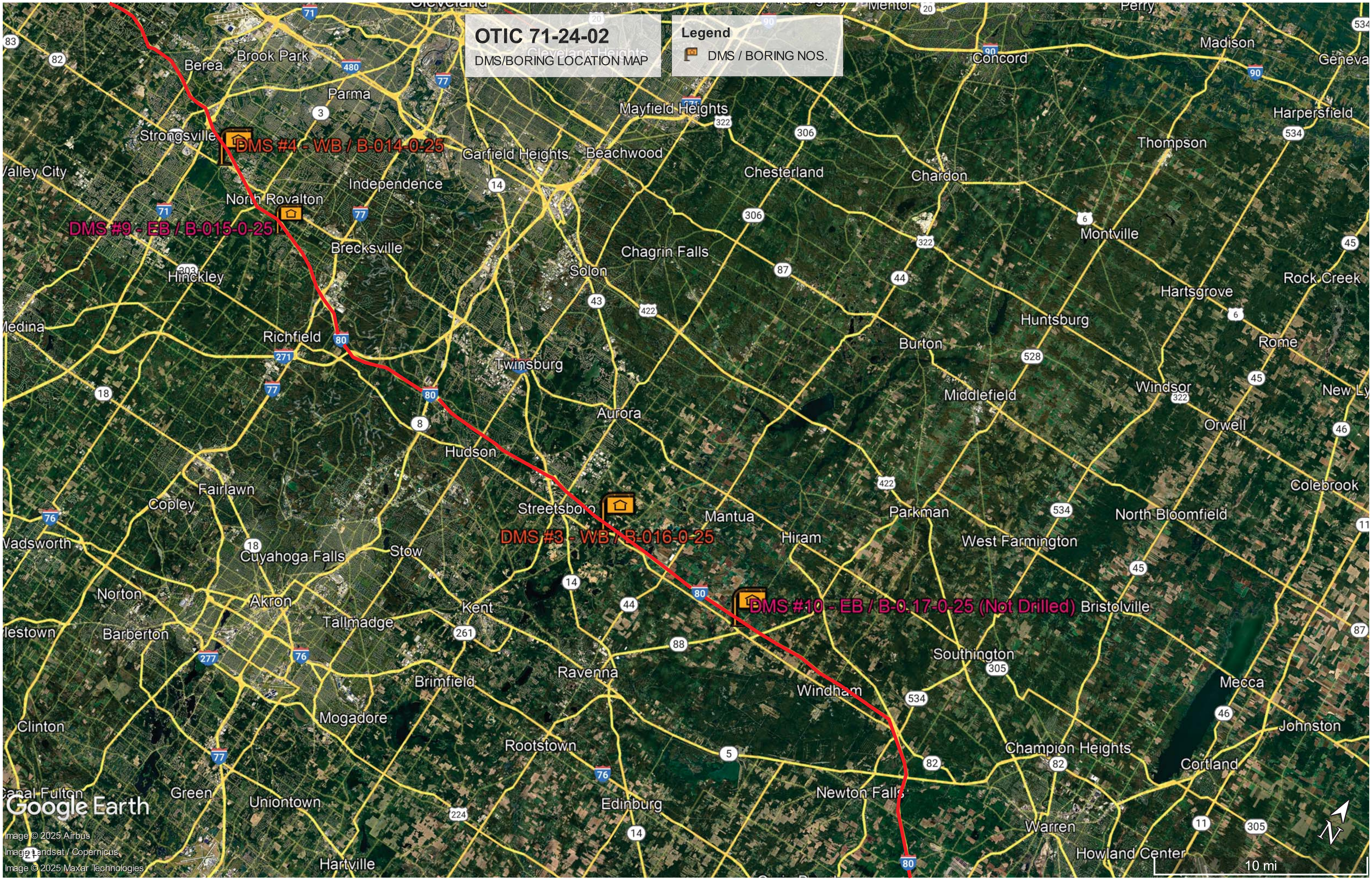
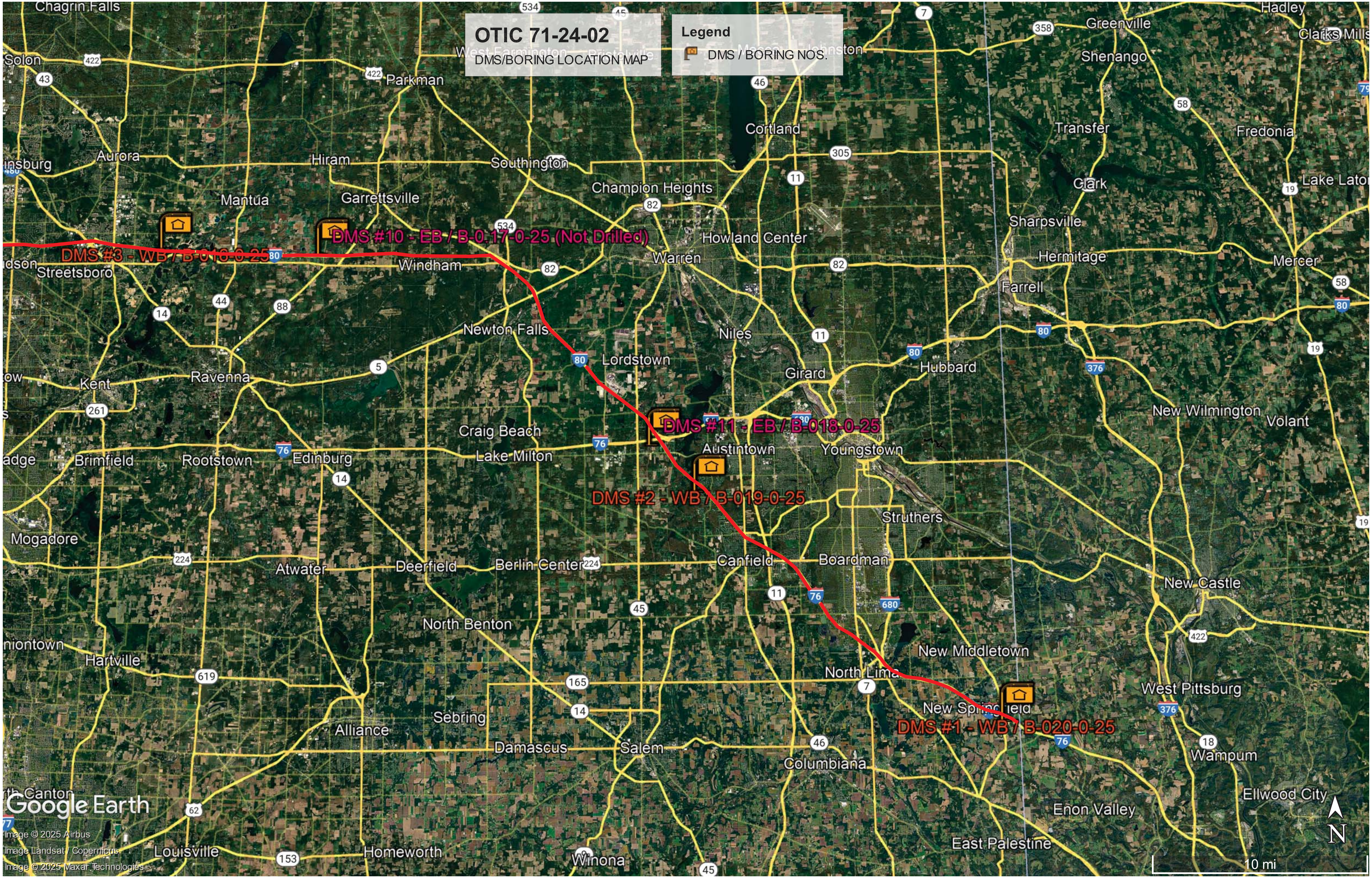


OTIC 71-24-02
DMS/BORING LOCATION MAP
Legend
DMS / BORING NOS.
DMS #3 - EB / B-004-0-25
DMS #8 - WB / B-005-0-25
DMS #4 - EB / B-006-0-25
DMS #7 - WB / B-007-0-25
DMS #5 - EB / B-008-0-25
DMS #6 - EB / B-009-0-25
Ottawa Hills
Swanton
Holland
Toledo
Rossford
Monclova
Northwood
Walbridge
Perrysburg
Whitehouse
Curtice
Reno Beach
Bono
Moline
Waterville
Haskins
Tontogany
Dunbridge
Genoa
Graytown
Luckey
Woodville
Elmore
Oak Harbor
Lacarne
Port Clinton
Catawba Island
Kelleys Island
Isle St George
Middle Bass
Put-In-Bay
Weston
Bowling Green
Pemberville
Portage
Rudolph
Gibsonburg
Bradner
Wayne
Helena
Sandusky Bay
Lakeside Marblehead
Sandusky
Cygnet
Risingsun
West Millgrove
Fremont
Ballville
Vickery
Castalia
York
Sandusky South
North Baltimore
Burgoon
Bettsville
Bloomdale
Van Buren
Clyde
Old Fort
Green Springs
Fostoria
Arcadia
Bellevue
Avery
Google Earth
Image © 2025 Airbus
Image Landsat / Copernicus
Image NOAA
10 mi
N


OTIC 71-24-02
DMS/BORING LOCATION MAP
Legend
DMS / BORING NOS.
DMS #6 - EB / B-009-0-25
DMS #5 - WB / B-005-0-25 (Not Drilled)
DMS #7 - EB / B-011-0-25
DMS #10 WB / B-012-0-25
DMS #8 - EB / B-013-0-18
DMS #4 - WB / B-014-0-25
DMS #9 - EB / B-015-0-25
Sandusky
Castalia
Sandusky South
Huron
Avery
Milan
Monroeville
Vermilion
Berlin Heights
Norwalk
Lorain
Sheffield Lake
Birmingham
Collins
South Amherst
Avon
Peru
Wakeman
Westlake
Kipton
Oberlin
North Ridgeville
Olena
North Fairfield
North Olmsted
Lakewood
Cleveland
Fitchville
Lagrange
Grafton
Berea
Brook Park
Greenwich
New London
Rochester
Wellington
Parma
Strongsville
Garfield Heights
Huntington
Valley City
Independence
Nova
Litchfield
North Royalton
Brunswick
Spencer
Savannah
Sullivan
Brecksville
Chatham
Hinckley
10 mi
Google Earth
Image © 2025 Airbus
Image Landsat / Copernicus
Image NOAA


OTIC 71-24-02
DMS/BORING LOCATION MAP
Legend
DMS / BORING NOS.
DMS #4 - WB / B-014-0-25
DMS #9 - EB / B-015-0-25
DMS #3 - WB / B-016-0-25
DMS #10 - EB / B-0 17-0-25 (Not Drilled)
Google Earth
Image © 2025 Airbus
Image Landsat / Copernicus
Image © 2025 Maxar Technologies
10 mi


OTIC 71-24-02
DMS/BORING LOCATION MAP
Legend
DMS / BORING NOS.
DMS #10 - EB / B-0.17-0-25 (Not Drilled)
DMS #3 - WB / B-016-0-25
DMS #11 - EB / B-018-0-25
DMS #2 - WB / B-019-0-25
DMS #1 - WB / B-020-0-25
Google Earth
Image © 2025 Airbus
Image Landsat / Copernicus
Image © 2025 Maxar Technologies
N
10 mi

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 8/15/25 17:13 - \\GEOTECHSERVER\SHARED FOLDERS\COMPANY\PUBLIC\PROJECT FILES\25 PROJECTS\G25003G BAKER-OTIC 71

PROJECT: OTIC 71-24-02	DRILLING FIRM / OPERATOR: OTB / COREY	DRILL RIG: MOBILE 57/TRUCK MOUNT	STATION / OFFSET:
TYPE: OVERHEAD SIGNS INSTALLATION	SAMPLING FIRM / LOGGER: PGI / W. NAJJAR	HAMMER: SAFETY HAMMER	ALIGNMENT: **IR 80 EB - DMS #1**
PID: STR ID:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 1/8/25	ELEVATION: 1014.0 (MSL) EOB: 25.0 ft.
START: 3/24/25 END: 3/24/25	SAMPLING METHOD: SPT	ENERGY RATIO (%): 90	LAT / LONG: 41.629378, -87.798137

EXPLORATION ID B001-0-25

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 1014.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GR	CS	FS	SI	CL	LL	PL	PI	WC	ODOT CLASS (GI)
ASPHALT PAVEMENT (14" IN THICKNESS)	1012.8																
ROADBASE: CRUSHED LIMESTONE AGG. (22" IN THICKNESS)	1011.0																
VERY STIFF, BROWN, **CLAY**, TRACE SAND, TRACE STONE FRAGMENTS, MOIST	1008.0		2 5 5	15	94	SS-1	3.50	-	-	-	-	-	-	-	-	25	A-7-6 (V)
MEDIUM DENSE, BROWN, **NON-PLASTIC SANDY SILT**, SOME CLAY, TRACE STONE FRAGMENTS, MOIST	1005.5		3 5 5	15	89	SS-2	-	5	9	32	28	26	NP	NP	NP	13	A-4a (4)
STIFF, BROWN, **SANDY SILT**, LITTLE CLAY, TRACE STONE FRAGMENTS, DAMP			3 3 4	10	100	SS-3	4.5+	-	-	-	-	-	-	-	-	10	A-4a (V)
	1000.0	W	3 4 4	12	100	SS-4	4.5+	1	11	26	42	20	17	11	6	10	A-4a (5)
LOOSE, BROWN, **COARSE AND FINE SAND**, TRACE GRAVEL, WET	998.0		3 3 4	10	67	SS-5	-	-	-	-	-	-	-	-	-	11	A-3a (V)
VERY STIFF, GRAY, **PLASTIC SILT**, LITTLE CLAY, TRACE GRAVEL, DAMP	995.5		4 4 7	16	89	SS-6	4.5+	9	0	0	77	14	16	10	6	10	A-4b (8)
VERY STIFF, GRAY, **SANDY SILT**, LITTLE CLAY. LITTLE STONE FRAGMENTS, DAMP TO MOIST			3 6 7	20	100	SS-7	4.5+	-	-	-	-	-	-	-	-	10	A-4a (V)
			5 5 8	20	100	SS-8	4.5+	12	10	22	39	17	17	10	7	9	A-4a (4)
@23.5'; MOIST	989.5		4 4 6	15	83	SS-9A	4.5+	-	-	-	-	-	-	-	-	11	A-4a (V)
MEDIUM DENSE, LIGHT GRAY, **COARSE AND FINE SAND**, SOME STONE FRAGMENTS. LITTLE FINES, WET	989.0	EOB 25				SS-9B	-	26	22	38	10	4	NP	NP	NP	12	A-3a (0)

NOTES: GROUNDWATER WAS ENCOUNTERED AT 13.5' DUING DRILLING AND NO WATER WAS ENCOUNTERED DURING OR UPON COMPLETION OF DRILLING OPERATIONS.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PAVEMENT WAS REPLACED WITH 0.3 BAG ASPHALT PATCH; BACKFILLED WITH 0.25 BAG SOIL CUTTINGS/BENTONITE PELLETS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 8/15/25 17:13 - \\GEOTECHSERVER\SHARED FOLDERS\COMPANY\PUBLIC\PROJECT FILES\25 PROJECTS\G25003G BAKER-OTIC 71

PROJECT: OTIC 71-24-02	DRILLING FIRM / OPERATOR: OTB / COREY	DRILL RIG: MOBILE 57/TRUCK MOUNT	STATION / OFFSET:	**EXPLORATION ID B002-0-25**
TYPE: OVERHEAD SIGNS INSTALLATION	SAMPLING FIRM / LOGGER: PGI / W. NAJJAR	HAMMER: SAFETY HAMMER	ALIGNMENT: **IR 80 EB - DMS #2**	
PID: STR ID:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 1/8/25	ELEVATION: 718.0 (MSL) EOB: 25.0 ft.	PAGE 1 OF 1
START: 3/24/25 END: 3/24/25	SAMPLING METHOD: SPT	ENERGY RATIO (%): 90	LAT / LONG: 41.591315, -84.307436	

MATERIAL DESCRIPTION AND NOTES	ELEV. 718.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
ASPHALT PAVEMENT (11" IN THICKNESS)	717.1																	
ROADBASE: CRUSHED LIMESTONE AGG. (7" IN THICKNESS)	716.5																	
STIFF, GRAY, **SILT AND CLAY**, LITTLE SAND, TRACE STONE FRAGMENTS, FILL, DAMP	714.5		2 5 3	12	67	SS-1	2.00	-	-	-	-	-	-	-	-	12	A-6a (V)	
MEDIUM STIFF, DARK BROWN, **CLAY**, TRACE SAND, TRACE STONE FRAGMENTS, FILL, MOIST	712.0		2 2 3	8	89	SS-2	2.00	-	-	-	-	-	-	-	-	32	A-7-6 (V)	
STIFF, BROWN, MOTTLED GRAY, **CLAY**, TRACE SAND, TRACE STONE FRAGMENTS, MOIST	709.5		2 3 4	10	100	SS-3	3.00	6	2	2	24	66	43	15	28	22	A-7-6 (16)	
MEDIUM STIFF TO VERY STIFF, BROWN, **SILTY CLAY**, TRACE SAND, MOIST			11 2 3	8	100	SS-4	2.50	-	-	-	-	-	-	-	-	26	A-6b (V)	
@11.0'; VERY STIFF			3 6 7	20	100	SS-5	4.5+	-	-	-	-	-	-	-	-	22	A-6b (V)	
@13.5'; STIFF	702.0	W	2 3 5	12	100	SS-6	4.5+	0	0	1	32	67	39	16	23	23	A-6b (13)	
STIFF TO MEDIUM STIFF, GRAY, **CLAY**, NO TO TRACE SAND, MOIST			2 3 4	10	100	SS-7	1.00	-	-	-	-	-	-	-	-	30	A-7-6 (V)	
@18.5'; MEDIUM STIFF, TRACE SAND			1 2 3	8	100	SS-8	1.50	0	1	0	4	95	51	20	31	36	A-7-6 (18)	
@21.0'; MEDIUM STIFF, TRACE SAND			2 2 2	6	100	SS-9	1.00	-	-	-	-	-	-	-	-	32	A-7-6 (V)	
@23.5'; STIFF, TRACE SAND	693.0	EOB 25	2 3 4	10	100	SS-10	1.75	0	0	1	24	75	42	17	25	25	A-7-6 (14)	

NOTES: GROUNDWATER WAS ENCOUNTERED AT 16' DUING DRILLING AND NO WATER WAS ENCOUNTERED DURING OR UPON COMPLETION OF DRILLING OPERATIONS.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PAVEMENT WAS REPLACED WITH 0.3 BAG ASPHALT PATCH; BACKFILLED WITH 0.25 BAG SOIL CUTTINGS/BENTONITE PELLETS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 8/15/25 17:13 - \\GEOTECHSERVER\SHARED FOLDERS\COMPANY\PUBLIC\PROJECT FILES\25 PROJECTS\G25003G BAKER-OTIC 71

PROJECT: OTIC 71-24-02	DRILLING FIRM / OPERATOR: OTB / COREY	DRILL RIG: MOBILE 57/TRUCK MOUNT	STATION / OFFSET:
TYPE: OVERHEAD SIGNS INSTALLATION	SAMPLING FIRM / LOGGER: PGI / W. NAJJAR	HAMMER: SAFETY HAMMER	ALIGNMENT: **IR 80 WB - DMS #9**
PID: STR ID:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 1/8/25	ELEVATION: 738.0 (MSL) EOB: 25.0 ft.
START: 3/24/25 END: 3/24/25	SAMPLING METHOD: SPT	ENERGY RATIO (%): 90	LAT / LONG: 41.590852, -84.248795

EXPLORATION ID B003-0-25

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 738.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GR	CS	FS	SI	CL	LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
ASPHALT PAVEMENT (12" IN THICKNESS)	737.0																	
STIFF, DARK BROWN, **SILT AND CLAY**, TRACE SAND, TRACE STONE FRAGMENTS, FILL, MOIST	734.5	1–2	1 3 6	14	56	SS-1	1.75	-	-	-	-	-	-	-	-	14	A-6a (V)	
MEDIUM DENSE, BROWN, **NON-PLASTIC SILT**, LITTLE SAND, MOIST		4–5	3 5 5	15	78	SS-2	-	0	0	14	70	16	NP	NP	NP	21	A-4b (8)	
	729.5	6–7	2 5 7	18	100	SS-3	-	-	-	-	-	-	-	-	-	21	A-4b (V)	
STIFF, BROWN TO GRAY, **SILT AND CLAY**, TRACE SAND, MOIST		9–10	4 4 4	12	94	SS-4	4.50	0	0	1	47	52	31	16	15	19	A-6a (10)	
@11.0'; CHANGE TO GRAY		11–12	2 3 4	10	100	SS-5	3.00	-	-	-	-	-	-	-	-	18	A-6a (V)	
	722.0	14–15	2 3 3	9	100	SS-6	1.75	0	0	1	53	46	28	16	12	19	A-6a (9)	
MEDIUM DENSE TO LOOSE, GRAY, **NON-PLASTIC SILT**, MOIST		16–17	6 9 4	20	100	SS-7	-	-	-	-	-	-	-	-	-	22	A-4b (V)	
		19–20	4 5 5	15	83	SS-8	-	0	1	0	86	13	NP	NP	NP	23	A-4b (8)	
@21.0'; LOOSE		21–22	2 3 4	10	100	SS-9	-	-	-	-	-	-	-	-	-	21	A-4b (V)	
@23.5'; MEDIUM DENSE	713.0	24–25 EOB	4 10 7	26	89	SS-10	-	-	-	-	-	-	-	-	-	23	A-4b (V)	

NOTES: GROUNDWATER WAS NOT ENCOUNTERED DURING OR UPON COMPLETION OF DRILLING OPERATIONS.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PAVEMENT WAS REPLACED WITH 0.3 BAG ASPHALT PATCH; BACKFILLED WITH 0.25 BAG SOIL CUTTINGS/BENTONITE PELLETS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 8/15/25 17:14 - \\GEOTECHSERVER\SHARED FOLDERS\COMPANY\PUBLIC\PROJECT FILES\25 PROJECTS\G25003G BAKER-OTIC 71

PROJECT: OTIC 71-24-02	DRILLING FIRM / OPERATOR: OTB / COREY	DRILL RIG: MOBILE 57/TRUCK MOUNT	STATION / OFFSET:
TYPE: OVERHEAD SIGNS INSTALLATION	SAMPLING FIRM / LOGGER: PGI / W. NAJJAR	HAMMER: SAFETY HAMMER	ALIGNMENT: IR 80 EB - DMS #3
PID: STR ID:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 1/8/25	ELEVATION: 741.0 (MSL) EOB: 25.0 ft.
START: 3/24/25 END: 3/24/25	SAMPLING METHOD: SPT	ENERGY RATIO (%): 90	LAT / LONG: 41.600778, -83.835301

EXPLORATION ID B004-0-25

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 741.0	DEPTHS	SPT/RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GR	CS	FS	SI	CL	LL	PL	PI	WC	ODOT CLASS (GI)
CRUSHED LIMESTONE AGG. ROAD BASE (24" IN THICKNESS)	739.0	0–2															
MEDIUM DENSE TO LOOSE, DARK BROWN, **COARSE AND FINE SAND**, LITTLE FINES, FILL, MOIST		4–5.5	4 8 8	24	78	SS-1	-	-	-	-	-	-	-	-	-	11	A-3a (V)
@6.0'; LOOSE	732.5	6–7.5	2 2 2	6	89	SS-2	-	-	-	-	-	-	-	-	-	18	A-3a (V)
MEDIUM DENSE TO DENSE, LIGHT BROWN, **COARSE AND FINE SAND**, LITTLE FINES, WET		8.5–10	4 6 10	24	61	SS-3	-	0	0	89	6	5	NP	NP	NP	22	A-3a (0)
@11.0'; DENSE	727.5	W 11; 11–12.5	8 10 13	34	89	SS-4	-	-	-	-	-	-	-	-	-	21	A-3a (V)
VERY DENSE, LIGHT BROWN, **NON-PLASTIC SANDY SILT**, TRACE STONE FRAGMENTS, WET	725.0	13.5–15	10 14 21	52	78	SS-5	-	2	1	52	39	6	NP	NP	NP	21	A-4a (2)
DENSE TO MEDIUM DENSE, LIGHT BROWN TO GRAY, **NON-PLASTIC SILT**, TRACE SAND, WET		16–17.5	9 14 19	50	67	SS-6	-	0	0	7	92	1	NP	NP	NP	25	A-4b (8)
@18.5'; MEDIUM DENSE, CHANGE TO GRAY		18.5–20	5 6 7	20	83	SS-7	1.25	-	-	-	-	-	-	-	-	25	A-4b (V)
@21.0'; MEDIUM DENSE		21–22.5	8 8 7	22	89	SS-8	-	-	-	-	-	-	-	-	-	26	A-4b (V)
@23.5'; MEDIUM DENSE	716.0	23.5–25 EOB	3 4 6	15	72	SS-9	1.50	0	0	1	83	16	NP	NP	NP	22	A-4b (8)

BACK FILL

NOTES: GROUNDWATER WAS ENCOUNTERED AT 11' DUING DRILLING AND NO WATER WAS ENCOUNTERED DURING OR UPON COMPLETION OF DRILLING OPERATIONS.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PAVEMENT WAS REPLACED WITH 0.3 BAG ASPHALT PATCH; BACKFILLED WITH 0.25 BAG SOIL CUTTINGS/BENTONITE PELLETS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 8/15/25 17:14 - \\GEOTECHSERVER\SHARED FOLDERS\COMPANY\PUBLIC\PROJECT FILES\25 PROJECTS\G25003G BAKER-OTIC 71

PROJECT: OTIC 71-24-02	DRILLING FIRM / OPERATOR: OTB / COREY	DRILL RIG: MOBILE 57/TRUCK MOUNT	STATION / OFFSET:	EXPLORATION ID B-005-0-25
TYPE: OVERHEAD SIGNS INSTALLATION	SAMPLING FIRM / LOGGER: PGI / W. NAJJAR	HAMMER: SAFETY HAMMER	ALIGNMENT: **IR 80 WB - DMS #8**	
PID: STR ID:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 1/8/25	ELEVATION: 626.0 (MSL) EOB: 25.0 ft.	PAGE 1 OF 1
START: 3/24/25 END: 3/24/25	SAMPLING METHOD: SPT / ST	ENERGY RATIO (%): 90	LAT / LONG: 41.593170, -83.720684	

MATERIAL DESCRIPTION AND NOTES	ELEV. 626.0
ASPHALT PAVEMENT (13" IN THICKNESS)	624.9
ROADBASE: CRUSHED LIMESTONE AGG. (8" IN THICKNESS)	624.3
STIFF, GRAY TO BROWN, **SILT AND CLAY**, LITTLE SAND, TRACE STONE FRAGMENTS, FILL, DAMP TO MOIST @3.5'; BROWN, MOIST	620.0
STIFF TO MEDIUM STIFF, BROWN, **SILTY CLAY**, LITTLE SAND, NO TO INTERBEDDED SILT SEAMS, TRACE STONE FRAGMENTS, MOIST @8.5'; MEDIUM STIFF, INTERBEDDED SILT SEAMS	615.0
STIFF TO MEDIUM STIFF, GRAY, **SILT AND CLAY**, TRACE SAND, WITH INTERBEDDED WET SILT SEAMS, MOIST	607.5
SOFT TO MEDIUM STIFF, GRAY, **PLASTIC SILT**, "AND" CLAY TRACE SAND, WET TO MOIST @21.0'; MEDIUM STIFF, MOIST	602.5
SOFT, GRAY, **SILT AND CLAY**, LITTLE SAND, TRACE STONE FRAGMENTS, MOIST	601.0

DEPTHS: W (groundwater) at 13.5'; EOB at 25'.

SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GR	CS	FS	SI	CL	LL	PL	PI	WC	ODOT CLASS (GI)
3 4 5	14	78	SS-1	4.5+	-	-	-	-	-	-	-	-	10	A-6a (V)
5 5 4	14	83	SS-2	4.25	-	-	-	-	-	-	-	-	16	A-6a (V)
2 3 3	9	94	SS-3	3.50	1	2	11	42	44	38	13	25	18	A-6b (14)
1 2 2	6	100	SS-4	1.25	-	-	-	-	-	-	-	-	29	A-6b (V)
		100	ST-5	2.75	-	-	-	-	-	-	-	-	23	A-6a (V)
2 3 4	10	100	SS-6	2.75	0	0	2	65	33	30	17	13	24	A-6a (9)
1 2 2	6	100	SS-7	2.50	-	-	-	-	-	-	-	-	23	A-6a (V)
1 2 1	4	100	SS-8	0.50	0	1	1	57	41	27	17	10	25	A-4b (8)
1 1 3	6	100	SS-9	1.25	-	-	-	-	-	-	-	-	18	A-4b (V)
1 1 2	4	100	SS-10	1.00	2	7	13	36	42	24	13	11	17	A-6a (8)

NOTES: GROUNDWATER WAS ENCOUNTERED AT 13.5' DUING DRILLING AND NO WATER WAS ENCOUNTERED DURING OR UPON COMPLETION OF DRILLING OPERATIONS.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PAVEMENT WAS REPLACED WITH 0.3 BAG ASPHALT PATCH; BACKFILLED WITH 0.25 BAG SOIL CUTTINGS/BENTONITE PELLETS

PROJECT: OTIC 71-24-02	DRILLING FIRM / OPERATOR: OTB / COREY	DRILL RIG: MOBILE 57/TRUCK MOUNT	STATION / OFFSET:	EXPLORATION ID B-006-0-25
TYPE: OVERHEAD SIGNS INSTALLATION	SAMPLING FIRM / LOGGER: PGI / W. NAJJAR	HAMMER: SAFETY HAMMER	ALIGNMENT: **IR 80 EB - DMS #4**	PAGE
PID: STR ID:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 1/8/25	ELEVATION: 626.0 (MSL) EOB: 25.0 ft.	1 OF 1
START: 4/22/25 END: 4/22/25	SAMPLING METHOD: SPT	ENERGY RATIO (%): 90	LAT / LONG: 41.514001, -83.432392	

MATERIAL DESCRIPTION AND NOTES	ELEV. 626.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
ASPHALT PAVEMENT (6.5" IN THICKNESS)	625.5																	
ROADBASE: CRUSHED LIMESTONE AGG. (12" IN THICKNESS)	624.5	1																
VERY STIFF TO MEDIUM STIFF, GRAY, **SILT AND CLAY**, LITTLE SAND, TRACE STONE FRAGMENTS, FILL, DAMP TO MOIST		2–3	3 3 4	10	100	SS-1	4.5+	-	-	-	-	-	-	-	-	13	A-6a (V)	
@3.5'; VERY STIFF		4–5	5 5 6	16	78	SS-2	4.5+	5	6	13	34	42	25	13	12	12	A-6a (9)	
@6.0'; MEDIUM STIFF, MOIST		6–7	3 2 2	6	67	SS-3	2.50	-	-	-	-	-	-	-	-	14	A-6a (V)	
@8.5'; STIFF, MOIST	615.0	8–10	2 3 3	9	61	SS-4	3.00	-	-	-	-	-	-	-	-	16	A-6a (V)	
STIFF, GRAY, **SILTY CLAY**, LITTLE SAND, TRACE STONE FRAGMENTS, DAMP		11–12	2 3 5	12	83	SS-5	4.50	6	5	12	32	45	33	17	16	16	A-6b (10)	
	610.0	13–15	2 3 4	10	78	SS-6	4.00	-	-	-	-	-	-	-	-	16	A-6b (V)	
VERY STIFF, GRAY, **CLAY**, LITTLE SAND, MOIST	607.5	16–18	4 5 7	18	100	SS-7	3.50	0	3	11	26	60	50	18	32	19	A-7-6 (18)	
VERY STIFF TO HARD, BROWN, MOTTLED GRAY TO BROWN, **SILTY CLAY**, LITTLE SAND, TRACE STONE FRAGMENTS, MOIST TO DAMP		19–20	3 4 7	16	89	SS-8	2.50	-	-	-	-	-	-	-	-	17	A-6b (V)	
@21.0'; HARD, BROWN, DAMP		21–22	3 9 12	32	94	SS-9	4.5+	3	5	12	32	48	33	14	19	13	A-6b (12)	
@23.5'; HARD, BROWN, DAMP	601.0	23–25 (EOB)	7 11 20	46	89	SS-10	4.5+	-	-	-	-	-	-	-	-	13	A-6b (V)	

NOTES: GROUNDWATER WAS NOT ENCOUNTERED DURING OR UPON COMPLETION OF DRILLING OPERATIONS.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PAVEMENT WAS REPLACED WITH 0.3 BAG ASPHALT PATCH; BACKFILLED WITH 0.25 BAG SOIL CUTTINGS/BENTONITE PELLETS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 8/15/25 17:14 - \\GEOTECHSERVER\SHARED FOLDERS\COMPANY\PUBLIC\PROJECT FILES\25 PROJECTS\G25003G BAKER-OTIC 71

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 8/15/25 17:14 - \\GEOTECHSERVER\SHARED FOLDERS\COMPANY\PUBLIC\PROJECT FILES\25 PROJECTS\G25003G BAKER-OTIC 71

PROJECT: OTIC 71-24-02	DRILLING FIRM / OPERATOR: OTB / COREY	DRILL RIG: MOBILE 57/TRUCK MOUNT	STATION / OFFSET:
TYPE: OVERHEAD SIGNS INSTALLATION	SAMPLING FIRM / LOGGER: PGI / W. NAJJAR	HAMMER: SAFETY HAMMER	ALIGNMENT: **IR 80 WB - DMS #7**
PID: STR ID:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 1/8/25	ELEVATION: 623.0 (MSL) EOB: 25.0 ft.
START: 3/24/25 END: 3/24/25	SAMPLING METHOD: SPT	ENERGY RATIO (%): 90	LAT / LONG: 41.499944, -83.389196

EXPLORATION ID B-007-0-25

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 623.0
ASPHALT PAVEMENT (11" IN THICKNESS)	622.0
ROADBASE: CRUSHED LIMESTONE AGG. (18" IN THICKNESS)	621.5
STIFF, BROWN, **SILT AND CLAY**, LITTLE SAND, TRACE STONE FRAGMENTS, FILL, DAMP	619.5
STIFF, BROWN, **CLAY**, LITTLE SAND, TRACE STONE FRAGMENTS, FILL, MOIST	617.0
STIFF TO HARD, BROWN, MOTTLED GRAY TO GRAY, **SILTY CLAY**, LITTLE SAND, TRACE STONE FRAGMENTS, MOIST TO DAMP @8.5'; VERY STIFF, DAMP @11.0'; HARD, DAMP @13.5'; VERY STIFF, CHANGED TO GRAY, MOIST	607.0
VERY STIFF, GRAY, **SANDY SILT**, "AND" CLAY, TRACE STONE FRAGMENTS, DAMP TO MOIST @18.5'; MOIST	602.0
VERY STIFF, GRAY, **SILT AND CLAY**, LITTLE SAND TRACE STONE FRAGMENTS, MOIST	598.0

EOB — 25

SPT/RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GR	CS	FS	SI	CL	LL	PL	PI	WC	ODOT CLASS (GI)
2-2-4	9	50	SS-1	4.5+	-	-	-	-	-	-	-	-	14	A-6a (V)
1-3-4	10	50	SS-2	4.5+	3	4	14	26	53	42	16	26	19	A-7-6 (15)
2-3-4	10	89	SS-3	4.5+	-	-	-	-	-	-	-	-	16	A-6b (V)
4-6-10	24	100	SS-4	4.5+	-	-	-	-	-	-	-	-	13	A-6b (V)
5-9-14	34	100	SS-5	4.5+	5	5	13	34	43	33	15	18	12	A-6b (11)
5-7-11	27	100	SS-6	4.5+	-	-	-	-	-	-	-	-	27	A-6b (V)
4-6-8	21	94	SS-7	4.5+	3	5	12	37	43	21	14	7	13	A-4a (8)
3-5-8	20	100	SS-8	4.5+	-	-	-	-	-	-	-	-	14	A-4a (V)
3-5-6	16	94	SS-9	4.5+	-	-	-	-	-	-	-	-	14	A-6a (V)
3-4-7	16	100	SS-10	3.00	3	6	12	36	43	29	14	15	15	A-6a (10)

NOTES: GROUNDWATER WAS NOT ENCOUNTERED DURING OR UPON COMPLETION OF DRILLING OPERATIONS.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PAVEMENT WAS REPLACED WITH 0.3 BAG ASPHALT PATCH; BACKFILLED WITH 0.25 BAG SOIL CUTTINGS/BENTONITE PELLETS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 8/15/25 17:14 - \\GEOTECHSERVER\SHARED FOLDERS\COMPANY\PUBLIC\PROJECT FILES\25 PROJECTS\G25003G BAKER-OTIC 71

PROJECT: OTIC 71-24-02	DRILLING FIRM / OPERATOR: OTB / COREY	DRILL RIG: MOBILE 57/TRUCK MOUNT	STATION / OFFSET:
TYPE: OVERHEAD SIGNS INSTALLATION	SAMPLING FIRM / LOGGER: PGI / W. NAJJAR	HAMMER: SAFETY HAMMER	ALIGNMENT: **IR 80 EB - DMS #5**
PID: STR ID:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 1/8/25	ELEVATION: 604.0 (MSL) EOB: 30.0 ft.
START: 4/22/25 END: 4/22/25	SAMPLING METHOD: SPT / ST	ENERGY RATIO (%): 90	LAT / LONG: 41.412056, -83.146668

EXPLORATION ID B-008-0-25

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 604.0
ASPHALT PAVEMENT (10.5" IN THICKNESS)	603.1
ROADBASE: CRUSHED LIMESTONE AGG.	602.0
MEDIUM STIFF TO STIFF, BROWN TO GRAY, **CLAY**, TRACE SAND, FILL, MOIST @3.5'; GRAY	598.0
STIFF, BROWN, MOTTLED GRAY, **SILTY CLAY**, TRACE SAND, TRACE STONE FRAGMENTS, FILL, MOIST	595.5
STIFF, BROWN, **PLASTIC SILT**, TRACE SAND WITH INTERBEDED NP SILT SEAMS, MOIST	593.0
LOOSE TO VERY LOOSE, BROWN, **NON-PLASTIC SILT**, TRACE SAND, WET @13.5'; VERY LOOSE	588.0
VERY SOFT TO SOFT, BROWN, **SILTY CLAY**, TRACE SAND WITH INTERBEDDED SILT SEAMS, MOIST @21.0'; SOFT @23.5'; SOFT	577.0
SOFT, BROWN, **SILT AND CLAY**, SOME SAND, LITTLE STONE FRAGMENTS, MOIST	574.0

DEPTHS: 1 – 30; W (groundwater) at 13.5; EOB at 30

SPT/RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)
6-3-2	8	78	SS-1	2.75	-	-	-	-	-	-	-	-	21	A-7-6 (V)
2-3-3	9	67	SS-2	2.75	0	0	3	43	54	51	18	33	22	A-7-6 (18)
2-3-4	10	89	SS-3	3.75	-	-	-	-	-	-	-	-	21	A-6b (V)
1-3-3	9	61	SS-4	4.5+	0	0	1	70	29	30	20	10	20	A-4b (8)
2-2-3	8	133	SS-5	-	-	-	-	-	-	-	-	-	28	A-4b (V)
1-1-1	3	89	SS-6	-	-	-	-	-	-	-	-	-	31	A-4b (V)
0-0-0	0	94	SS-7	0.50	0	0	1	41	58	39	18	21	32	A-6b (12)
		100	ST-8	0.50	-	-	-	-	-	-	-	-	28	A-6b (V)
0-0-2	3	100	SS-9	0.25	-	-	-	-	-	-	-	-	27	A-6b (V)
1-1-1	3	89	SS-10	0.25	-	-	-	-	-	-	-	-	28	A-6b (V)
0-0-2	3	89	SS-11	0.25	12	8	14	27	39	25	13	12	17	A-6a (7)

BACK FILL

NOTES: GROUNDWATER WAS ENCOUNTERED AT 13.5 DUING DRILLING AND NO WATER WAS ENCOUNTERED DURING OR UPON COMPLETION OF DRILLING OPERATIONS.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PAVEMENT WAS REPLACED WITH 0.3 BAG ASPHALT PATCH; BACKFILLED WITH 0.25 BAG SOIL CUTTINGS/BENTONITE PELLETS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 8/15/25 17:14 - \\GEOTECHSERVER\SHARED FOLDERS\COMPANY\PUBLIC\PROJECT FILES\25 PROJECTS\G25003G BAKER-OTIC 71

PROJECT: OTIC 71-24-02	DRILLING FIRM / OPERATOR: OTB / COREY	DRILL RIG: MOBILE 57/TRUCK MOUNT	STATION / OFFSET:
TYPE: OVERHEAD SIGNS INSTALLATION	SAMPLING FIRM / LOGGER: PGI / W. NAJJAR	HAMMER: SAFETY HAMMER	ALIGNMENT: **IR 80 EB - DMS #6**
PID: STR ID:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 1/8/25	ELEVATION: 699.0 (MSL) EOB: 16.5 ft.
START: 3/24/25 END: 3/24/25	SAMPLING METHOD: SPT	ENERGY RATIO (%): 90	LAT / LONG: 41.335862, -82.714705

EXPLORATION ID B-009-0-25

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 699.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
ASPHALT PAVEMENT (8" IN THICKNESS)	698.3																	
ROADBASE: CRUSHED LIMESTONE AGG.	697.0	1																
STIFF, GRAY TO BROWN, **CLAY**, LITTLE SAND, TRACE ORGANICS, FILL, MOIST		2–3	6 6 4	15	100	SS-1	1.75	-	-	-	-	-	-	-	-	28	A-7-6 (V)	
@3.5'; BROWN	693.0	4–5	3 3 4	10	100	SS-2	3.00	0	1	15	30	54	48	14	34	24	A-7-6 (18)	
MEDIUM STIFF, BROWN, MOTTLED GRAY, **CLAY**, LITTLE SAND, TRACE STONE FRAGMENTS, MOIST	690.5	6–8	2 2 3	8	100	SS-3	2.25	1	3	14	31	51	44	17	27	25	A-7-6 (16)	
SHALE, GRAY, SEVERELY TO HIGHLY WEATHERED, VERY WEAK.		TR 9	50	-	100	SS-4	-	-	-	-	-	-	-	-	-	6	Rock (V)	
		10–11	50/3"	-	67	SS-5	-	-	-	-	-	-	-	-	-	1	Rock (V)	
@13.5'; HIGHLY WEATHERED		12–14	43 50/2"	-	88	SS-6	-	-	-	-	-	-	-	-	-	3	Rock (V)	
@16.0'; HIGHLY WEATHERED	682.5	15–16 EOB	50	-	83	SS-7	-	-	-	-	-	-	-	-	-	2	Rock (V)	
AUGER REFUSAL @16.5'																		

NOTES: GROUNDWATER WAS NOT ENCOUNTERED DURING OR UPON COMPLETION OF DRILLING OPERATIONS.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PAVEMENT WAS REPLACED WITH 0.3 BAG ASPHALT PATCH; BACKFILLED WITH 0.25 BAG SOIL CUTTINGS/BENTONITE PELLETS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 8/15/25 17:14 - \\GEOTECHSERVER\SHARED FOLDERS\COMPANY\PUBLIC\PROJECT FILES\25 PROJECTS\G25003G BAKER-OTIC 71

PROJECT: OTIC 71-24-02	DRILLING FIRM / OPERATOR: OTB / COREY	DRILL RIG: MOBILE 57/TRUCK MOUNT	STATION / OFFSET:	EXPLORATION ID B-010-0-25
TYPE: OVERHEAD SIGNS INSTALLATION	SAMPLING FIRM / LOGGER: PGI / W. NAJJAR	HAMMER: SAFETY HAMMER	ALIGNMENT: **IR 80 WB - DMS #5**	
PID: STR ID:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 1/8/25	ELEVATION: (MSL) EOB: 25.0 ft.	PAGE 1 OF 1
START: 3/24/25 END: 3/24/25	SAMPLING METHOD: SPT	ENERGY RATIO (%): 90	LAT / LONG: Not Recorded	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	ABAN-DONED
NOT DRILLED		1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 EOB 25																

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PAVEMENT WAS REPLACED WITH 0.3 BAG ASPHALT PATCH; BACKFILLED WITH 0.25 BAG SOIL CUTTINGS/BENTONITE PELLETS

PROJECT: OTIC 71-24-02	DRILLING FIRM / OPERATOR: OTB / COREY	DRILL RIG: MOBILE 57/TRUCK MOUNT	STATION / OFFSET:	EXPLORATION ID B-011-0-25
TYPE: OVERHEAD SIGNS INSTALLATION	SAMPLING FIRM / LOGGER: PGI / W. NAJJAR	HAMMER: SAFETY HAMMER	ALIGNMENT: **IR 80 EB - DMS #7**	
PID: STR ID:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 1/8/25	ELEVATION: 787.0 (MSL) EOB: 25.0 ft.	PAGE 1 OF 1
START: 4/16/25 END: 4/16/25	SAMPLING METHOD: SPT	ENERGY RATIO (%): 90	LAT / LONG: 41.372873, -82.266490	

MATERIAL DESCRIPTION AND NOTES	ELEV. 787.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
ASPHALT PAVEMENT (13" IN THICKNESS)	785.9																	
ROADBASE: CRUSHED LIMESTONE AGG. (7" IN THICKNESS)	785.3																	
STIFF, GRAY AND BROWN, **SILT AND CLAY**, LITTLE SAND, TRACE STONE FRAGMENTS, FILL, MOIST	783.5		3 4 5	14	56	SS-1	3.00	-	-	-	-	-	-	-	-	18	A-6a (V)	
MEDIUM DENSE, LIGHT BROWN, **STONE FRAGMENTS WITH SAND**, (SANDSTONE FRAGMENTS), FILL, DAMP	781.0		6 4 4	12	33	SS-2	-	-	-	-	-	-	-	-	-	10	A-1-a (V)	
STIFF, DARK GRAY, **CLAY**, TRACE SAND, TRACE STONE FRAGMENTS, FILL, MOIST	778.5		3 4 5	14	44	SS-3	1.75	-	-	-	-	-	-	-	-	22	A-7-6 (V)	
STIFF, BROWN, **SILTY CLAY**, LITTLE SAND, TRACE OF STONE FRAGMENT, DAMP	776.0	▼ W	3 3 4	10	78	SS-4	-	2	6	14	50	28	36	19	17	15	A-6b (11)	
HARD, BROWN, **SANDY SILT**, SOME CLAY, LITTLE STONE FRAGMENTS, DAMP	773.5		5 8 18	39	94	SS-5	3.00	11	9	22	33	25	19	14	5	12	A-4a (5)	
DENSE TO VERY DENSE, GRAY, **NON-PLASTIC SILT**, SOME SAND, TRACE STONE FRAGMENTS, WET			10 11 13	36	100	SS-6	-	-	-	-	-	-	-	-	-	13	A-4b (V)	
@16.0'; VERY DENSE			12 15 20	52	100	SS-7	-	5	5	23	50	17	NP	NP	NP	11	A-4b (6)	
@18.5'; VERY DENSE	766.0		15 18 18	54	89	SS-8	-	-	-	-	-	-	-	-	-	11	A-4b (V)	
HARD, DARK GRAY, **PLASTIC SILT**, SOME CLAY, LITTLE STONE FRAGMENTS, TRACE SAND, DAMP	763.5	TR	5 16 12	42	89	SS-9	4.5+	18	2	4	53	23	26	16	10	10	A-4b (8)	
SHALE, REDDISH BROWN, HIGHLY WEATHERED, VERY WEAK.	762.0	EOB 25	5 15 18	50	100	SS-10	-	-	-	-	-	-	-	-	-	7	Rock (V)	

NOTES: GROUNDWATER WAS ENCOUNTERED AT 10.0' DUING DRILLING AND 9' UPON COMPLETION DRILLING OPERATIONS.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PAVEMENT WAS REPLACED WITH 0.3 BAG ASPHALT PATCH; BACKFILLED WITH 0.25 BAG SOIL CUTTINGS/BENTONITE PELLETS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 8/15/25 17:14 - \\GEOTECHSERVER\SHARED FOLDERS\COMPANY\PUBLIC\PROJECT FILES\25 PROJECTS\G25003G BAKER-OTIC 71

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 8/15/25 17:14 - \\GEOTECHSERVER\SHARED FOLDERS\COMPANY\PUBLIC\PROJECT FILES\25 PROJECTS\G25003G BAKER-OTIC 71

PROJECT: OTIC 71-24-02 TYPE: OVERHEAD SIGNS INSTALLATION PID: STR ID: START: 4/16/25 END: 4/16/25	DRILLING FIRM / OPERATOR: OTB / COREY SAMPLING FIRM / LOGGER: PGI / W. NAJJAR DRILLING METHOD: 3.25" HSA SAMPLING METHOD: SPT	DRILL RIG MOBILE 57/TRUCK MOUNT HAMMER: SAFETY HAMMER CALIBRATION DATE: 1/8/25 ENERGY RATIO (%): 90	STATION / OFFSET: ALIGNMENT: **IR 80 WB - DMS #10** ELEVATION: 745.0 (MSL) EOB: 24.4 ft. LAT / LONG: 41.390420, -82.148986

EXPLORATION ID B-012-0-25

MATERIAL DESCRIPTION AND NOTES	ELEV. 745.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
ASPHALT PAVEMENT (14" IN THICKNESS)	743.8	1																
ROADBASE: SAND AND GRAVEL AGG. (6" IN THICKNESS)	743.3																	
STIFF TO MEDIUM STIFF, DARK BROWN, **SILT AND CLAY**, LITTLE SAND, TRACE STONE FRAGMENTS, FILL, MOIST		2–3	5 3 3	9	50	SS-1	4.5+	-	-	-	-	-	-	-	-	16	A-6a (V)	
@3.5'; MEDIUM STIFF	739.0	4–5	3 2 3	8	72	SS-2	2.25	3	4	15	31	47	31	16	15	18	A-6a (10)	
MEDIUM STIFF, DARK GRAY, **CLAY**, TRACE SAND, TRACE STONE FRAGMENTS, FILL, MOIST	736.5	6–8	2 2 2	6	67	SS-3	1.00	-	-	-	-	-	-	-	-	27	A-7-6 (V)	
MEDIUM STIFF, BROWN, MOTTLED GRAY, **CLAY**, LITTLE SAND, TRACE STONE FRAGMENTS, MOIST	734.0	9–10	2 2 3	8	89	SS-4	1.50	1	2	11	29	57	43	18	25	26	A-7-6 (15)	
HARD, BROWN TO GRAY, **SILT AND CLAY**, LITTLE TO SOME SAND, TRACE STONE FRAGMENTS, MOIST TO DAMP		11–12	4 9 12	32	56	SS-5	4.5+	-	-	-	-	-	-	-	-	16	A-6a (V)	
@13.5'; CHANGE TO GRAY, SOME SAND, MOIST		13–15	6 9 12	32	67	SS-6	4.5+	-	-	-	-	-	-	-	-	9	A-6a (V)	
@16.0'; SOME SAND, DAMP		16–17	10 16 19	52	94	SS-7	4.5+	8	10	12	36	34	25	13	12	9	A-6a (8)	
@18.5'; SOME SAND, DAMP		18–20	11 22 22	66	83	SS-8	4.5+	-	-	-	-	-	-	-	-	8	A-6a (V)	
@21.0'; LITTLE SAND, DAMP	721.5	21–23	24 12 15	40	100	SS-9	4.5+	4	6	10	34	46	27	15	12	11	A-6a (9)	
VERY DENSE, GRAY, **NON-PLASTIC SILT**, LITTLE SAND, TRACE STONE FRAGMENTS, DAMP	720.6	24 EOB	36 50/4"	-	70	SS-10	-	-	-	-	-	-	-	-	-	10	A-4b (V)	

NOTES: GROUNDWATER WAS NOT ENCOUNTERED DURING OR UPON COMPLETION OF DRILLING OPERATIONS.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PAVEMENT WAS REPLACED WITH 0.3 BAG ASPHALT PATCH; BACKFILLED WITH 0.25 BAG SOIL CUTTINGS/BENTONITE PELLETS

PROJECT: OTIC 71-24-02	DRILLING FIRM / OPERATOR: OTB / COREY	DRILL RIG: MOBILE 57/TRUCK MOUNT	STATION / OFFSET:
TYPE: OVERHEAD SIGNS INSTALLATION	SAMPLING FIRM / LOGGER: PGI / W. NAJJAR	HAMMER: SAFETY HAMMER	ALIGNMENT: IR 80 EB - DMS #8
PID: STR ID:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 1/8/25	ELEVATION: 899.0 (MSL) EOB: 25.0 ft.
START: 4/16/25 END: 4/16/25	SAMPLING METHOD: SPT / ST	ENERGY RATIO (%): 90	LAT / LONG: 41.377984, -82.050453

EXPLORATION ID B-013-0-25

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 899.0
ASPHALT PAVEMENT (13.5" IN THICKNESS)	897.9
ROADBASE: CRUSHED LIMESTONE AGG. (4.5" IN THICKNESS)	897.5
HARD, BROWN, **SANDY SILT**, LITTLE CLAY, TRACE STONE FRAGMENTS, FILL, MOIST	895.5
STIFF TO MEDIUM STIFF, REDDISH BROWN, MOTTLED GRAY, **CLAY**, TRACE SAND, MOIST @6.0'; MEDIUM STIFF	890.5
STIFF, BROWN, **SILTY CLAY**, LITTLE SAND, TRACE STONE FRAGMENTS, MOIST	888.0
VERY STIFF TO HARD, GRAY, **SANDY SILT**, SOME CLAY, TRACE STONE FRAGMENTS, DAMP @13.5'; HARD @16.0'; HARD @18.5'; HARD	878.0
HARD TO VERY STIFF, GRAY, **SILT AND CLAY**, TRACE SAND, TRACE STONE FRAGMENTS, MOIST TO DAMP @23.5'; VERY STIFF, DAMP	874.0

EOB — 25

SPT/RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GR	CS	FS	SI	CL	LL	PL	PI	WC	ODOT CLASS (GI)
20 19 27	69	94	SS-1	4.5+	-	-	-	-	-	-	-	-	17	A-4a (V)
4 6 4	15	67	SS-2	1.75	-	-	-	-	-	-	-	-	23	A-7-6 (V)
2 2 3	8	78	SS-3	2.00	0	1	6	36	57	44	18	26	24	A-7-6 (15)
3 3 3	9	89	SS-4	2.50	4	6	9	40	41	35	18	17	19	A-6b (11)
		100	ST-5	4.25	-	-	-	-	-	-	-	-	15	A-4a (V)
6 8 14	33	100	SS-6	4.5+	-	-	-	-	-	-	-	-	10	A-4a (V)
14 16 19	52	72	SS-7	4.5+	10	9	11	41	29	24	16	8	9	A-4a (7)
11 12 15	40	78	SS-8	4.5+	-	-	-	-	-	-	-	-	10	A-4a (V)
9 9 12	32	83	SS-9	4.5+	-	-	-	-	-	-	-	-	17	A-6a (V)
5 7 9	24	89	SS-10	4.5+	1	0	1	45	53	31	17	14	16	A-6a (10)

NOTES: GROUNDWATER WAS NOT ENCOUNTERED DURING OR UPON COMPLETION OF DRILLING OPERATIONS.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PAVEMENT WAS REPLACED WITH 0.3 BAG ASPHALT PATCH; BACKFILLED WITH 0.25 BAG SOIL CUTTINGS/BENTONITE PELLETS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 8/15/25 17:14 - \\GEOTECHSERVER\SHARED FOLDERS\COMPANY\PUBLIC\PROJECT FILES\25 PROJECTS\G25003G BAKER-OTIC 71

PROJECT: OTIC 71-24-02	DRILLING FIRM / OPERATOR: OTB / COREY	DRILL RIG: MOBILE 57/TRUCK MOUNT	STATION / OFFSET:
TYPE: OVERHEAD SIGNS INSTALLATION	SAMPLING FIRM / LOGGER: PGI / W. NAJJAR	HAMMER: SAFETY HAMMER	ALIGNMENT: **IR 80 WB - DMS #4**
PID: STR ID:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 1/8/25	ELEVATION: 741.0 (MSL) EOB: 25.0 ft.
START: 4/15/25 END: 4/15/25	SAMPLING METHOD: SPT / ST	ENERGY RATIO (%): 90	LAT / LONG: 41.318735, -81.774086

EXPLORATION ID B-014-0-25

MATERIAL DESCRIPTION AND NOTES	ELEV. 741.0
ASPHALT PAVEMENT (13" IN THICKNESS)	739.9
ROADBASE: CRUSHED LIMESTONE AGG. (11" IN THICKNESS)	739.0
STIFF, GRAY, **SILTY CLAY**, LITTLE SAND, TRACE STONE FRAGMENTS, FILL, MOIST	737.5
HARD, BROWN, **SILT AND CLAY**, LITTLE SAND, TRACE STONE FRAGMENTS, FILL, DAMP	735.0
VERY STIFF TO STIFF, GRAY, **SILT AND CLAY**, LITTLE SAND, TRACE STONE FRAGMENTS, MOIST @8.5'; VERY STIFF @11.0'; STIFF @13.0'; STIFF @16.0'; STIFF @18.5'; STIFF @21.0'; STIFF	717.5
VERY STIFF, GRAY, **SILTY CLAY**, LITTLE SAND, TRACE STONE FRAGMENTS, MOIST	716.0
EOB (25 ft)	

SPT/RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GR	CS	FS	SI	CL	LL	PL	PI	WC	ODOT CLASS (GI)
3-4-5	14	67	SS-1	2.50	-	-	-	-	-	-	-	-	18	A-6b (V)
12-14-37	76	78	SS-2	4.5+	-	-	-	-	-	-	-	-	15	A-6a (V)
2-4-6	15	67	SS-3	2.25	6	6	9	30	49	31	16	15	19	A-6a (10)
2-4-8	18	83	SS-4	2.00	-	-	-	-	-	-	-	-	17	A-6a (V)
2-3-6	14	78	SS-5	1.50	5	6	10	32	47	28	16	12	17	A-6a (9)
		100	ST-6	2.00	-	-	-	-	-	-	-	-	18	A-6a (V)
3-3-5	12	89	SS-7	1.75	-	-	-	-	-	-	-	-	18	A-6a (V)
2-4-6	15	100	SS-8	1.75	5	5	9	29	52	30	16	14	18	A-6a (10)
3-4-6	15	89	SS-9	2.50	-	-	-	-	-	-	-	-	19	A-6a (V)
5-6-8	21	100	SS-10	3.50	2	6	9	37	46	35	14	21	16	A-6b (12)

NOTES: GROUNDWATER WAS NOT ENCOUNTERED DURING OR UPON COMPLETION OF DRILLING OPERATIONS.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PAVEMENT WAS REPLACED WITH 0.3 BAG ASPHALT PATCH; BACKFILLED WITH 0.25 BAG SOIL CUTTINGS/BENTONITE PELLETS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 8/15/25 17:14 - \\GEOTECHSERVER\SHARED FOLDERS\COMPANY\PUBLIC\PROJECT FILES\25 PROJECTS\G25003G BAKER-OTIC 71

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 8/15/25 17:14 - \\GEOTECHSERVER\SHARED FOLDERS\COMPANYPUBLIC\PROJECT FILES\25 PROJECTS\G25003G BAKER-OTIC 71

PROJECT: OTIC 71-24-02	DRILLING FIRM / OPERATOR: OTB / COREY	DRILL RIG: MOBILE 57/TRUCK MOUNT	STATION / OFFSET:
TYPE: OVERHEAD SIGNS INSTALLATION	SAMPLING FIRM / LOGGER: PGI / W. NAJJAR	HAMMER: SAFETY HAMMER	ALIGNMENT: **IR 80 EB - DMS #9**
PID: STR ID:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 1/8/25	ELEVATION: 1192.0 (MSL) EOB: 25.0 ft.
START: 4/15/25 END: 4/15/25	SAMPLING METHOD: SPT	ENERGY RATIO (%): 90	LAT / LONG: 41.298444, -81.694869

EXPLORATION ID B-015-0-25

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 1192.0
TOP SOIL (12" IN THICKNESS)	1191.0
HARD TO VERY STIFF, BROWN, **SILTY CLAY**, LITTLE SAND, TRACE STONE FRAGMENTS, DAMP TO MOIST @3.5'; MOIST @8.5'; VERY STIFF	1181.0
STIFF, GRAY, **PLASTIC SILT**, SOME CLAY, LITTLE SAND, TRACE STONE FRAGS, DAMP	1178.5
HARD, GRAY, **SANDY SILT**, LITTLE CLAY, LITTLE STONE FRAGMENTS, DAMP	1176.0
VERY STIFF, GRAY, **SILT AND CLAY**, LITTLE SAND, TRACE STONE FRAGMENTS, DAMP	1167.0

EOB — 25

DEPTHS	SPT/RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GR	CS	FS	SI	CL	LL	PL	PI	WC	ODOT CLASS (GI)
1–2.5	1 3 4	10	56	SS-1	4.5+	-	-	-	-	-	-	-	-	15	A-6b (V)
3.5–5	4 4 6	15	100	SS-2	4.5+	4	4	9	45	38	35	18	17	19	A-6b (11)
6–7.5	2 4 7	16	100	SS-3	4.5+	-	-	-	-	-	-	-	-	14	A-6b (V)
8.5–10	2 4 5	14	100	SS-4	4.00	-	-	-	-	-	-	-	-	16	A-6b (V)
11–12.5	3 3 4	10	89	SS-5	1.75	7	8	11	53	21	24	16	8	16	A-4b (8)
13.5–15	4 5 7	18	89	SS-6	4.5+	13	12	14	41	20	21	15	6	11	A-4a (5)
16–17.5	4 4 5	14	94	SS-7	3.50	-	-	-	-	-	-	-	-	14	A-6a (V)
18.5–20	2 4 4	12	83	SS-8	3.00	-	-	-	-	-	-	-	-	15	A-6a (V)
21–22.5	3 3 6	14	100	SS-9	3.00	4	5	7	47	37	29	15	14	15	A-6a (10)
23.5–25	3 4 5	14	89	SS-10	3.75	-	-	-	-	-	-	-	-	15	A-6a (V)

NOTES: GROUNDWATER WAS NOT ENCOUNTERED DURING OR UPON COMPLETION OF DRILLING OPERATIONS.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH 0.25 BAG SOIL CUTTINGS/BENTONITE PELLETS

PROJECT: OTIC 71-24-02	DRILLING FIRM / OPERATOR: OTB / COREY	DRILL RIG: MOBILE 57/TRUCK MOUNT	STATION / OFFSET:	EXPLORATION ID B-016-0-25
TYPE: OVERHEAD SIGNS INSTALLATION	SAMPLING FIRM / LOGGER: PGI / W. NAJJAR	HAMMER: SAFETY HAMMER	ALIGNMENT: **IR 80 WB - DMS #3**	
PID: STR ID:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 1/8/25	ELEVATION: 1125.0 (MSL) EOB: 15.5 ft.	PAGE
START: 4/15/25 END: 4/15/25	SAMPLING METHOD: SPT	ENERGY RATIO (%): 90	LAT / LONG: 41.248368, -81.774086	1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 1125.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
ASPHALT PAVEMENT (13" IN THICKNESS)	1123.9	1																
ROADBASE: CRUSHED LIMESTONE AGG. (11" IN THICKNESS)	1123.0	2																
VERY DENSE, BROWN, **GRAVEL AND STONE FRAGMENTS WITH SAND**, LITTLE FINES, DAMP	1121.5	3	13 50 5	82	33	SS-1	-	-	-	-	-	-	-	-	-	8	A-1-b (V)	
DENSE TO VERY DENSE, BROWN, **GRAVEL AND STONE FRAGMENTS**, SOME SAND, LITTLE FINES, DAMP		4 / 5	12 15 12	40	78	SS-2	-	-	-	-	-	-	-	-	-	5	A-1-a (V)	
@6.0'; VERY DENSE	1116.5	6 / 7 / 8	20 20 16	54	89	SS-3	-	57	18	11	- 14 -		NP	NP	NP	6	A-1-a (0)	
MEDIUM DENSE, REDDISH BROWN, **STONE FRAGMENTS WITH SAND**, LITTLE FINES, DAMP		9 / 10	5 7 8	22	50	SS-4	-	-	-	-	-	-	-	-	-	8	A-1-b (V)	
	1111.5	11 / 12 / 13	5 7 9	24	78	SS-5	-	48	24	17	- 11 -		NP	NP	NP	8	A-1-b (0)	
VERY DENSE, BROWN, **STONE FRAGMENTS WITH SAND AND SILT**, DAMP		14	15 50/5"	-	82	SS-6	-	-	-	-	-	-	-	-	-	10	A-2-4 (V)	
@15.5'; AUGER REFUSAL	1109.5	15 EOB																

NOTES: GROUNDWATER WAS NOT ENCOUNTERED DURING OR UPON COMPLETION OF DRILLING OPERATIONS.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PAVEMENT WAS REPLACED WITH 0.3 BAG ASPHALT PATCH; BACKFILLED WITH 0.25 BAG SOIL CUTTINGS/BENTONITE PELLETS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 8/15/25 17:14 - \\GEOTECHSERVER\SHARED FOLDERS\COMPANY\PUBLIC\PROJECT FILES\25 PROJECTS\G25003G BAKER-OTIC 71

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 8/15/25 17:14 - \\GEOTECHSERVER\SHARED FOLDERS\COMPANY\PUBLIC\PROJECT FILES\25 PROJECTS\G25003G BAKER-OTIC 71

PROJECT: OTIC 71-24-02	DRILLING FIRM / OPERATOR: OTB / COREY	DRILL RIG: MOBILE 57/TRUCK MOUNT	STATION / OFFSET:	**EXPLORATION ID B-017-0-25**
TYPE: OVERHEAD SIGNS INSTALLATION	SAMPLING FIRM / LOGGER: PGI / W. NAJJAR	HAMMER: SAFETY HAMMER	ALIGNMENT: **IR 80 EB - DMS #10**	
PID: STR ID:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 1/8/25	ELEVATION: (MSL) EOB: 25.0 ft.	PAGE 1 OF 1
START: 3/24/25 END: 3/24/25	SAMPLING METHOD: SPT	ENERGY RATIO (%): 90	LAT / LONG: Not Recorded	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	ABAN-DONED
NOT DRILLED		1 – 24, EOB 25																

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PAVEMENT WAS REPLACED WITH 0.3 BAG ASPHALT PATCH; BACKFILLED WITH 0.25 BAG SOIL CUTTINGS/BENTONITE PELLETS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 8/15/25 17:14 - \\GEOTECHSERVER\SHARED FOLDERS\COMPANY\PUBLIC\PROJECT FILES\25 PROJECTS\G25003G BAKER-OTIC 71

PROJECT: OTIC 71-24-02	DRILLING FIRM / OPERATOR: OTB / COREY	DRILL RIG: MOBILE 57/TRUCK MOUNT	STATION / OFFSET:
TYPE: OVERHEAD SIGNS INSTALLATION	SAMPLING FIRM / LOGGER: PGI / W. NAJJAR	HAMMER: SAFETY HAMMER	ALIGNMENT: **IR 76 EB - DMS #11**
PID: STR ID:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 1/8/25	ELEVATION: 991.0 (MSL) EOB: 16.1 ft.
START: 4/14/25 END: 4/14/25	SAMPLING METHOD: SPT	ENERGY RATIO (%): 90	LAT / LONG: 41.104706, -80.833967

EXPLORATION ID B-018-0-25

MATERIAL DESCRIPTION AND NOTES	ELEV. 991.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
TOP SOIL (1.5 THICKNESS)	990.9																	
ROADBASE: SAND AND GRAVEL AGG. (22.5" THICKNESS)	989.0																	
STIFF, BROWN, **CLAY**, TRACE SAND, TRACE STONE FRAGMENTS, FILL, MOIST	987.5		2 3 5	12	50	SS-1	3.00	2	3	7	39	49	41	20	21	24	A-7-6 (13)	
STIFF TO VERY STIFF, BROWN, **SILTY CLAY**, TRACE TO LITTLE SAND, TRACE STONE FRAGMENTS, DAMP			3 5 5	15	78	SS-2	4.5+	-	-	-	-	-	-	-	-	16	A-6b (V)	
@6.0'; VERY STIFF, LITTLE SAND	982.5		5 6 8	21	72	SS-3	4.5+	1	3	8	38	50	35	17	18	16	A-6b (11)	
VERY STIFF TO HARD, YELLOWISH BROWN TO GRAY, **SILT AND CLAY**, SOME SAND, TRACE STONE FRAGMENTS, DAMP			7 9 11	30	83	SS-4	4.5+	-	-	-	-	-	-	-	-	11	A-6a (V)	
@11.0'; HARD, GRAY	977.5	TR	15 27 40	100	100	SS-5	4.5+	4	16	18	42	20	33	20	13	10	A-6a (7)	
SHALE, GRAY, SEVERELY WEATHERED, VERY WEAK.			50	-	100	SS-6	-	-	-	-	-	-	-	-	-	9	Rock (V)	
	975.0	EOB 16	50/1"	-	-	SS-7	-	-	-	-	-	-	-	-	-	4	Rock (V)	

NOTES: GROUNDWATER WAS NOT ENCOUNTERED DURING OR UPON COMPLETION OF DRILLING OPERATIONS.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH 0.25 BAG SOIL CUTTINGS/BENTONITE PELLETS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 8/15/25 17:14 - \\GEOTECHSERVER\SHARED FOLDERS\COMPANY\PUBLIC\PROJECT FILES\25 PROJECTS\G25003G BAKER-OTIC 71

PROJECT: OTIC 71-24-02	DRILLING FIRM / OPERATOR: OTB / COREY	DRILL RIG: MOBILE 57/TRUCK MOUNT	STATION / OFFSET:
TYPE: OVERHEAD SIGNS INSTALLATION	SAMPLING FIRM / LOGGER: PGI / W. NAJJAR	HAMMER: SAFETY HAMMER	ALIGNMENT: **IR 76 WB - DMS #2**
PID: STR ID:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 1/8/25	ELEVATION: 1014.0 (MSL) EOB: 24.9 ft.
START: 4/14/25 END: 4/14/25	SAMPLING METHOD: SPT	ENERGY RATIO (%): 90	LAT / LONG: 41.072008, -80.793097

EXPLORATION ID B-019-0-25

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 1014.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GR	CS	FS	SI	CL	LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
ASPHALT PAVEMENT (12.5" IN THICKNESS)	1013.0	1																
ROADBASE: SLAG AND CINDERS AGG. (11.5" IN THICKNESS)	1012.0	2																
STIFF TO VERY STIFF, BROWN, **SILTY CLAY**, LITTLE SAND, TRACE STONE FRAGMENTS, FILL, MOIST		3	3 3 3	9	67	SS-1	2.00	-	-	-	-	-	-	-	-	19	A-6b (V)	
@3.5'; VERY STIFF		4–5	6 6 6	18	78	SS-2	4.5+	4	7	11	39	39	34	15	19	16	A-6b (12)	
	1008.0	6																
STIFF, BROWN, **SILT AND CLAY**, LITTLE SAND, TRACE STONE FRAGMENTS, FILL, DAMP TO MOIST		7	3 3 4	10	78	SS-3	4.5+	-	-	-	-	-	-	-	-	17	A-6a (V)	
@8.5'; MOIST		8–9	3 3 6	14	67	SS-4	2.75	3	3	8	48	38	31	18	13	19	A-6a (9)	
@11.0'; MOIST		10–12	3 4 5	14	78	SS-5	1.75	-	-	-	-	-	-	-	-	18	A-6a (V)	
@13.5'; DAMP		13–15	3 3 6	14	83	SS-6	4.5+	-	-	-	-	-	-	-	-	17	A-6a (V)	
	998.0	16																
VERY STIFF, GRAY, **SILTY CLAY**, SOME SAND, LITTLE STONE FRAGMENTS, TRACE ROOTS, MOIST		17	3 3 14	26	44	SS-7	1.75	13	8	15	30	34	32	16	16	19	A-6b (8)	
	995.5	18																
VERY STIFF TO HARD, BROWN, **SILT AND CLAY**, LITTLE SAND, TRACE STONE FRAGMENTS, DAMP		19–20	9 9 11	30	50	SS-8	4.5+	-	-	-	-	-	-	-	-	15	A-6a (V)	
@21.0'; HARD		21–23	6 9 12	32	72	SS-9	4.5+	-	-	-	-	-	-	-	-	16	A-6a (V)	
	990.0	TR 24																
SHALE, REDDISH BROWN, HIGHLY WEATHERED, VERY WEAK.	989.1	EOB	9 24 50/5"	-	100	SS-10	-	-	-	-	-	-	-	-	-	8	Rock (V)	

NOTES: GROUNDWATER WAS NOT ENCOUNTERED DURING OR UPON COMPLETION OF DRILLING OPERATIONS.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PAVEMENT WAS REPLACED WITH 0.3 BAG ASPHALT PATCH; BACKFILLED WITH 0.25 BAG SOIL CUTTINGS/BENTONITE PELLETS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 8/15/25 17:14 - \\GEOTECHSERVER\SHARED FOLDERS\COMPANY\PUBLIC\PROJECT FILES\25 PROJECTS\G25003G BAKER-OTIC 71

PROJECT: OTIC 71-24-02	DRILLING FIRM / OPERATOR: OTB / COREY	DRILL RIG: MOBILE 57/TRUCK MOUNT	STATION / OFFSET:
TYPE: OVERHEAD SIGNS INSTALLATION	SAMPLING FIRM / LOGGER: PGI / W. NAJJAR	HAMMER: SAFETY HAMMER	ALIGNMENT: **IR 76 WB - DMS #1**
PID: STR ID:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 1/8/25	ELEVATION: 1036.0 (MSL) EOB: 25.0 ft.
START: 4/14/25 END: 4/14/25	SAMPLING METHOD: SPT	ENERGY RATIO (%): 90	LAT / LONG: 40.913513, -80.522141

EXPLORATION ID B-020-0-25

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 1036.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
ASPHALT PAVEMENT (12" IN THICKNESS)	1035.0	0–1																
ROADBASE: CRUSHED LIMESTONE AGG. (6" IN THICKNESS)	1034.5	1–1.5																
HARD, GRAY, **SANDY SILT**, SOME CLAY, TRACE STONE FRAGMENTS, FILL, DAMP	1032.5	1.5–3.5	27 22 17	58	83	SS-1	4.5+	-	-	-	-	-	-	-	-	13	A-4a (V)	
VERY STIFF TO STIFF, BROWN, **SILT AND CLAY**, SOME SAND, TRACE OF STONE FRAGMENTS, FILL, DAMP		3.5–5	7 5 8	20	89	SS-2	4.5+	7	9	26	39	19	25	13	12	11	A-6a (5)	
@6.0'; STIFF		6–7.5	4 5 6	16	67	SS-3	3.00	-	-	-	-	-	-	-	-	11	A-6a (V)	
@8.5'; VERY STIFF	1025.0	8.5–10	5 8 8	24	78	SS-4	4.5+	5	6	20	41	28	26	15	11	14	A-6a (7)	
STIFF, BROWN, **SANDY SILT**, SOME CLAY, TRACE STONE FRAGMENTS, FILL, MOIST		11–12.5	3 4 5	14	89	ST-5	1.25	-	-	-	-	-	-	-	-	12	A-4a (V)	
	1020.0	13.5–15	2 4 3	10	72	SS-6	1.00	-	-	-	-	-	-	-	-	14	A-4a (V)	
STIFF, BROWN, **SILT AND CLAY**, SOME SAND, TRACE STONE FRAGMENTS, MOIST	1017.5	16–17.5	2 2 4	9	100	SS-7	1.50	9	6	15	44	26	27	15	12	18	A-6a (8)	
MEDIUM DENSE, BROWN, **NON-PLASTIC SILT**, LITTLE SAND, TRACE STONE FRAGMENTS, MOIST	1015.0	18.5–20	6 9 8	26	100	SS-8	-	-	-	-	-	-	-	-	-	16	A-4b (V)	
MEDIUM DENSE, BROWN, **GRAVEL AND STONE FRAGMENTS WITH SAND AND SILT**, MOIST	1012.5	21–22.5	4 3 10	20	89	SS-9	-	32	16	25	17	10	NP	NP	NP	16	A-2-4 (0)	
VERY STIFF, GRAY, **SANDY SILT**, SOME CLAY, TRACE STONE FRAGMENTS, DAMP	1011.0	23.5–25 (EOB)	4 6 8	21	61	SS-10	4.5+	-	-	-	-	-	-	-	-	9	A-4a (V)	

NOTES: GROUNDWATER WAS NOT ENCOUNTERED DURING OR UPON COMPLETION OF DRILLING OPERATIONS.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PAVEMENT WAS REPLACED WITH 0.3 BAG ASPHALT PATCH; BACKFILLED WITH 0.25 BAG SOIL CUTTINGS/BENTONITE PELLETS

APPENDIX B

Boring Number	Sample Number	Depth (ft)	Water Content %	Liquid Limit %	Plastic Limit %	Plast. Index	Specific Gravity	Agg. %	Coarse Sand %	Fine Sand %	Silt %	Silt&Clay Comb. %	Clay %	Soil Description	Class. Symbol
B001-0-25	SS-1	3.5	25											BROWN CLAY, TRACE SAND, TRACE STONE FRAGMENTS	A-7-6 (V)
B001-0-25	SS-2	6.0	13	NP	NP	NP		5	9	32	28	54	26	BROWN, NON-PLASTIC SANDY SILT, TRACE STONE FRAGMENTS	A-4a (4)
B001-0-25	SS-3	8.5	10											BROWN SANDY SILT, LITTLE CLAY	A-4a (V)
B001-0-25	SS-4	11.0	10	17	11	6		0	11	26	42	62	20	BROWN SANDY SILT, LITTLE CLAY	A-4a (5)
B001-0-25	SS-5	13.5	11											BROWN COARSE AND FINE SAND, TRACE GRAVEL	A-3a (V)
B001-0-25	SS-6	16.0	10	16	10	6		9	0	0	77	91	14	GRAY PLASTIC SILT, LITTLE CLAY, TRACE GRAVEL	A-4b (8)
B001-0-25	SS-7	18.5	10											GRAY SANDY SILT, LITTLE CLAY, LITTLE STONE FRAGMENTS	A-4a (V)
B001-0-25	SS-8	21.0	9	17	10	7		11	10	22	39	56	17	GRAY SANDY SILT, LITTLE CLAY, LITTLE STONE FRAGMENTS	A-4a (4)
B001-0-25	SS-9A	23.5	11											GRAY SANDY SILT, LITTLE CLAY, LITTLE STONE FRAGMENTS	A-4a (V)
B001-0-25	SS-9B	24.5	12	NP	NP	NP		26	22	38	11	14	4	LIGHT GRAY COARSE AND FINE SAND, SOME STONE FRAGS, LITTLE FINES	A-3a (0)
B002-0-25	SS-1	1.5	12											GRAY SILT AND CLAY, LITTLE SAND, TRACE STONE FRAGMENTS, FILL	A-6a (V)
B002-0-25	SS-2	3.5	32											DARK BROWN CLAY, TRACE SAND, TRACE STONE FRAGMENTS, FILL	A-7-6 (V)
B002-0-25	SS-3	6.0	22	43	15	28		4	2	2	25	90	66	BROWN, MOTTLED GRAY CLAY, TRACE SAND, TRACE STONE FRAGMENTS	A-7-6 (16)
B002-0-25	SS-4	8.5	26											BROWN SILTY CLAY, TRACE SAND	A-6b (V)
B002-0-25	SS-5	11.0	22											BROWN SILTY CLAY, TRACE SAND	A-6b (V)
B002-0-25	SS-6	13.5	23	39	16	23		0	0	1	32	99	67	BROWN SILTY CLAY, TRACE SAND	A-6b (13)
B002-0-25	SS-7	16.0	30											GRAY CLAY	A-7-6 (V)
B002-0-25	SS-8	18.5	36	51	20	31		0	0	0	4	99	95	GRAY CLAY	A-7-6 (18)
B002-0-25	SS-9	21.0	32											GRAY CLAY, TRACE SAND	A-7-6 (V)
B002-0-25	SS-10	23.5	25	42	17	25		0	0	1	24	99	75	GRAY CLAY, TRACE SAND	A-7-6 (14)
B003-0-25	SS-1	1.0	14											DARK BROWN SILT AND CLAY, TRACE SAND, TRACE STONE FRAGMENTS, FILL	A-6a (V)
B003-0-25	SS-2	3.5	21	NP	NP	NP		0	0	14	70	86	16	BROWN, NON-PLASTIC SILT, LITTLE SAND	A-4b (8)
B003-0-25	SS-3	6.0	21											BROWN, NON-PLASTIC SILT, LITTLE SAND	A-4b (V)
B003-0-25	SS-4	8.5	19	31	16	15		0	1	1	47	99	52	BROWN SILT AND CLAY, TRACE SAND	A-6a (10)
B003-0-25	SS-5	11.0	18											GRAY SILT AND CLAY, TRACE SAND	A-6a (V)
B003-0-25	SS-6	13.5	19	28	16	12		0	0	1	53	99	46	GRAY SILT AND CLAY, TRACE SAND	A-6a (9)
B003-0-25	SS-7	16.0	22											GRAY, NON-PLASTIC SILT	A-4b (V)
B003-0-25	SS-8	18.5	23	NP	NP	NP		0	0	0	86	99	13	GRAY, NON-PLASTIC SILT	A-4b (8)
B003-0-25	SS-9	21.0	21											GRAY, NON-PLASTIC SILT	A-4b (V)

Pro Geotech, Inc.

TR.-TRACE, BR.-BROWN, LI.-LITTLE, S/F-STONE FRAGMENTS, SO.-SOME, RB-ROADBASE, NP-NON-PLASTIC, POSS-POSSIBLE

Summary of Laboratory Results

Client: MICHAEL BAKER INTERNATIONAL
Project: OTIC 71-24-02
Location: OHIO TURNPIKE
Pro. Number: G25003G

PRO US LAB ODOT SUMMARY ODOT - OH DOT.GDT - 8/12/25 16:18 - \\GEOTECHSERVER\SHARED FOLDERS\COMPANY\PUBLIC\PROJECT FILES\25 PROJECTS\G25003G BAKER-OTIC 71-24-02\LAB

Boring Number	Sample Number	Depth (ft)	Water Content %	Liquid Limit %	Plastic Limit %	Plast. Index	Specific Gravity	Agg. %	Coarse Sand %	Fine Sand %	Silt %	Silt&Clay Comb. %	Clay %	Soil Description	Class. Symbol
B003-0-25	SS-10	23.5	23											GRAY, NON-PLASTIC SILT	A-4b (V)
B004-0-25	SS-1	3.5	11											DARK BROWN COARSE AND FINE SAND, LITTLE FINES, FILL	A-3a (V)
B004-0-25	SS-2	6.0	18											DARK BROWN COARSE AND FINE SAND, LITTLE FINES, FILL	A-3a (V)
B004-0-25	SS-3	8.5	22	NP	NP	NP		0	0	89	6	11	5	LIGHT BROWN COARSE AND FINE SAND, LITTLE FINES	A-3a (0)
B004-0-25	SS-4	11.0	21											LIGHT BROWN COARSE AND FINE SAND, LITTLE FINES	A-3a (V)
B004-0-25	SS-5	13.5	21	NP	NP	NP		1	1	52	39	45	6	LIGHT BROWN NON-PLASTIC SANDY SILT, TRACE STONE FRAGS	A-4a (2)
B004-0-25	SS-6	16.0	25	NP	NP	NP		0	0	7	93	93	1	LIGHT BROWN, NON-PLASTIC SILT, TRACE SAND	A-4b (8)
B004-0-25	SS-7	18.5	25											GRAY, NON-PLASTIC SILT, TRACE SAND	A-4b (V)
B004-0-25	SS-8	21.0	26											GRAY, NON-PLASTIC SILT, TRACE SAND	A-4b (V)
B004-0-25	SS-9	23.5	22	NP	NP	NP		0	0	1	83	99	16	GRAY NON-PLASTIC SILT, TRACE SAND	A-4b (8)
B-005-0-25	SS-1	1.5	10											GRAY SILT AND CLAY, LITTLE SAND, TRACE STONE FRAGMENTS, FILL	A-6a (V)
B-005-0-25	SS-2	3.5	16											BROWN SILT AND CLAY, LITTLE SAND, TRACE STONE FRAGMENTS, FILL	A-6a (V)
B-005-0-25	SS-3	6.0	18	38	13	25		0	2	11	42	86	44	BROWN SILTY CLAY, LITTLE SAND	A-6b (14)
B-005-0-25	SS-4	8.5	29											BROWN SILTY CLAY, LITTLE SAND WITH INTERBEDDED SILT SEAMS	A-6b (V)
B-005-0-25	ST-5	11.0	23											GRAY SILT AND CLAY, TRACE SAND WITH INTERBEDDED SILT SEAMS	A-6a (V)
B-005-0-25	SS-6	13.5	24	30	17	13		0	0	2	65	98	33	GRAY SILT AND CLAY, TRACE SAND WITH INTERBEDDED SILT SEAMS	A-6a (9)
B-005-0-25	SS-7	16.0	23											GRAY SILT AND CLAY, TRACE SAND WITH INTERBEDDED SILT SEAMS	A-6a (V)
B-005-0-25	SS-8	18.5	25	27	17	10		0	1	1	58	98	41	GRAY PLASTIC SILT, "AND" CLAY, TRACE SAND	A-4b (8)
B-005-0-25	SS-9	21.0	18											GRAY PLASTIC SILT, "AND" CLAY, TRACE SAND	A-4b (V)
B-005-0-25	SS-10	23.5	17	24	13	11		3	7	13	36	78	42	GRAY SILT AND CLAY, LITTLE SAND, TRACE STONE FRAGMENTS	A-6a (8)
B-006-0-25	SS-1	1.5	13											GRAY SILT AND CLAY, LITTLE SAND, TRACE STONE FRAGMENTS, FILL	A-6a (V)
B-006-0-25	SS-2	3.5	12	25	13	12		4	6	13	34	76	42	GRAY SILT AND CLAY, LITTLE SAND, TRACE STONE FRAGMENTS, FILL	A-6a (9)
B-006-0-25	SS-3	6.0	14											GRAY SILT AND CLAY, LITTLE SAND, TRACE STONE FRAGMENTS, FILL	A-6a (V)
B-006-0-25	SS-4	8.5	16											GRAY SILT AND CLAY, LITTLE SAND, TRACE STONE FRAGMENTS, FILL	A-6a (V)
B-006-0-25	SS-5	11.0	16	33	17	16		5	5	12	32	77	45	GRAY SILTY CLAY, LITTLE SAND, TRACE STONE FRAGMENTS	A-6b (10)
B-006-0-25	SS-6	13.5	16											GRAY SILTY CLAY, LITTLE SAND, TRACE STONE FRAGMENTS	A-6b (V)
B-006-0-25	SS-7	16.0	19	50	18	32		0	2	11	27	86	60	GRAY CLAY, LITTLE SAND	A-7-6 (18)
B-006-0-25	SS-8	18.5	17											BROWN, MOTTLED GRAY SILTY CLAY, LITTLE SAND, TRACE STONE FRAGMENTS	A-6b (V)
B-006-0-25	SS-9	21.0	13	33	14	19		3	5	12	32	80	48	BROWN SILTY CLAY, LITTLE SAND, TRACE STONE FRAGMENTS	A-6b (12)

Pro Geotech, Inc.

TR.-TRACE, BR.-BROWN, LI.-LITTLE, S/F-STONE FRAGMENTS, SO.-SOME, RB-ROADBASE, NP-NON-PLASTIC, POSS-POSSIBLE

Summary of Laboratory Results

Client: MICHAEL BAKER INTERNATIONAL
Project: OTIC 71-24-02
Location: OHIO TURNPIKE
Pro. Number: G25003G

PRO US LAB ODOT SUMMARY ODOT - OH DOT.GDT - 8/12/25 16:18 - \\GEOTECHSERVER\SHARED FOLDERS\COMPANY\PUBLIC\PROJECT FILES\25 PROJECTS\G25003G BAKER-OTIC 71-24-02\LAB

Boring Number	Sample Number	Depth (ft)	Water Content %	Liquid Limit %	Plastic Limit %	Plast. Index	Specific Gravity	Agg. %	Coarse Sand %	Fine Sand %	Silt %	Silt&Clay Comb. %	Clay %	Soil Description	Class. Symbol
B-006-0-25	SS-10	23.5	13											BROWN SILTY CLAY, LITTLE SAND, TRACE STONE FRAGMENTS	A-6b (V)
B-007-0-25	SS-1	1.5	14											BROWN SILT AND CLAY, LITTLE SAND, TRACE STONE FRAGS, FILL	A-6a (V)
B-007-0-25	SS-2	3.5	19	42	16	26		3	4	14	27	79	53	BROWN CLAY, LITTLE SAND, TRACE STONE FRAGMENTS, FILL	A-7-6 (15)
B-007-0-25	SS-3	6.0	16											BROWN, MOTTLED GRAY SILTY CLAY, LITTLE SAND, TRACE STONE FRAGMENTS	A-6b (V)
B-007-0-25	SS-4	8.5	13											BROWN SILTY CLAY, LITTLE SAND, TRACE STONE FRAGMENTS	A-6b (V)
B-007-0-25	SS-5	11.0	12	33	15	18		5	5	13	34	77	43	BROWN SILTY CLAY, LITTLE SAND, TRACE STONE FRAGMENTS	A-6b (11)
B-007-0-25	SS-6	13.5	27											GRAY SILTY CLAY, LITTLE SAND, TRACE STONE FRAGMENTS	A-6b (V)
B-007-0-25	SS-7	16.0	13	21	14	7		2	5	12	37	80	43	GRAY SANDY SILT, "AND" CLAY, TRACE STONE FRAGMENTS	A-4a (8)
B-007-0-25	SS-8	18.5	14											GRAY SANDY SILT, "AND" CLAY, TRACE STONE FRAGMENTS	A-4a (V)
B-007-0-25	SS-9	21.0	14											GRAY SILT AND CLAY, LITTLE SAND, TRACE STONE FRAGMENTS	A-6a (V)
B-007-0-25	SS-10	23.5	15	29	14	15		2	6	12	37	79	43	GRAY SILT AND CLAY, LITTLE SAND TRACE, STONE FRAGMENTS	A-6a (10)
B-008-0-25	SS-1	1.5	21											BROWN CLAY, TRACE SAND, FILL	A-7-6 (V)
B-008-0-25	SS-2	3.5	22	51	18	33		0	0	3	42	97	54	GRAY CLAY, TRACE SAND, FILL	A-7-6 (18)
B-008-0-25	SS-3	6.0	21											BROWN, MOTTLED GRAY, SILTY CLAY, TRACE SAND, TRACE STONE FRAGS	A-6b (V)
B-008-0-25	SS-4	8.5	20	30	20	10		0	0	1	70	99	29	BROWN PLASTIC SILT , TRACE SAND, WITH INTERBEDDED SILT SEAMS	A-4b (8)
B-008-0-25	SS-5	11.0	28											BROWN NON-PLASTIC SILT, TRACE SAND	A-4b (V)
B-008-0-25	SS-6	13.5	31											GRAY, NON-PLASTIC SILT, TRACE SAND	A-4b (V)
B-008-0-25	SS-7	16.0	32	39	18	21		0	0	1	41	99	58	GRAY SILTY CLAY, TRACE SAND, WITH INTERBEDDED SILT SEAMS	A-6b (12)
B-008-0-25	ST-8	18.0	28											GRAY SILTY CLAY, TRACE SAND, WITH INTERBEDDED SILT SEAMS	A-6b (V)
B-008-0-25	SS-9	21.0	27											GRAY SILTY CLAY, TRACE SAND, WITH INTERBEDDED SILT SEAMS	A-6b (V)
B-008-0-25	SS-10	23.5	28											GRAY SILTY CLAY, TRACE SAND, WITH INTERBEDDED SILT SEAMS	A-6b (V)
B-008-0-25	SS-11	28.5	17	25	13	12		11	8	14	28	66	39	BROWN SANDY SILT, "AND" CLAY, LITTLE STONE FRAGMENTS	A-6a (7)
B-009-0-25	SS-1	1.5	28											GRAY CLAY, LITTLE SAND, TRACE ORGANICS, FILL	A-7-6 (V)
B-009-0-25	SS-2	3.5	24	48	14	34		0	1	15	30	84	54	BROWN CLAY, LITTLE SAND, TRACE ORGANICS, FILL	A-7-6 (18)
B-009-0-25	SS-3	6.0	25	44	17	27		0	3	14	31	82	51	BROWN, MOTTLED GRAY CLAY, LITTLE SAND	A-7-6 (16)
B-009-0-25	SS-4	8.5	6											GRAY SEVERELY WEATHERED SHALE	Rock (V)
B-009-0-25	SS-5	11.0	1											GRAY SEVERELY WEATHERED SHALE	Rock (V)
B-009-0-25	SS-6	13.5	3											GRAY HIGHLY WEATHERED SHALE	Rock (V)
B-009-0-25	SS-7	16.0	2											GRAY HIGHLY WEATHERED SHALE	Rock (V)

Pro Geotech, Inc.

TR.-TRACE, BR.-BROWN, LI.-LITTLE, S/F-STONE FRAGMENTS, SO.-SOME, RB-ROADBASE, NP-NON-PLASTIC, POSS-POSSIBLE

Summary of Laboratory Results

Client: MICHAEL BAKER INTERNATIONAL
Project: OTIC 71-24-02
Location: OHIO TURNPIKE
Pro. Number: G25003G

PRO US LAB ODOT SUMMARY ODOT - OH DOT.GDT - 8/12/25 16:18 - \\GEOTECHSERVER\SHARED FOLDERS\COMPANY\PUBLIC\PROJECT FILES\25 PROJECTS\G25003G BAKER-OTIC 71-24-02\LAB

Boring Number	Sample Number	Depth (ft)	Water Content %	Liquid Limit %	Plastic Limit %	Plast. Index	Specific Gravity	Agg. %	Coarse Sand %	Fine Sand %	Silt %	Silt&Clay Comb. %	Clay %	Soil Description	Class. Symbol
B-011-0-25	SS-1	1.5	18											GRAY AND BROWN, SILT AND CLAY, LITTLE SAND, TRACE STONE FRAGS, FILL	A-6a (V)
B-011-0-25	SS-2	3.5	10											LIGHT BROWN SANDSTONE FRAGMENTS, FILL	A-1-a (V)
B-011-0-25	SS-3	6.0	22											DARK GRAY CLAY, TRACE SAND, TRACE STONE FRAGMENTS, FILL	A-7-6 (V)
B-011-0-25	SS-4	8.5	15	36	19	17		1	6	14	50	78	28	BROWN SILTY CLAY, LITTLE SAND, TRACE STONE FRAGMENTS	A-6b (11)
B-011-0-25	SS-5	11.0	12	19	14	5		9	9	22	33	58	25	BROWN SANDY SILT, SOME CLAY, LITTLE STONE FRAGMENTS	A-4a (5)
B-011-0-25	SS-6	13.5	13											GRAY NON-PLASTIC, SILT, SOME SAND, TRACE STONE FRAGMENTS	A-4b (V)
B-011-0-25	SS-7	16.0	11	NP	NP	NP		3	5	23	50	67	17	GRAY NON-PLASTIC, SILT, SOME SAND, TRACE STONE FRAGMENTS	A-4b (6)
B-011-0-25	SS-8	18.5	11											GRAY NON-PLASTIC, SILT, SOME SAND, TRACE STONE FRAGMENTS	A-4b (V)
B-011-0-25	SS-9	21.0	10	26	16	10		18	2	4	53	76	23	DARK GRAY PLASTIC SILT, SOME CLAY, LITTLE STONE FRAGS, TRACE SAND	A-4b (8)
B-011-0-25	SS-10	23.5	7											REDDISH BROWN, HIGHLY WEATHERED SHALE	Rock (V)
B-012-0-25	SS-1	1.5	16											DARK BROWN SILT AND CLAY, LITTLE SAND, TRACE STONE FRAGMENTS, FILL	A-6a (V)
B-012-0-25	SS-2	3.5	18	31	16	15		3	4	15	31	78	47	DARK BROWN SILT AND CLAY, LITTLE SAND, TRACE STONE FRAGMENTS, FILL	A-6a (10)
B-012-0-25	SS-3	6.0	27											DARK GRAY CLAY, TRACE SAND SAND, TRACE STONE FRAGMENTS, FILL	A-7-6 (V)
B-012-0-25	SS-4	8.5	26	43	18	25		1	2	11	28	86	57	BROWN, MOTTLED GRAY CLAY, LITTLE SAND, TRACE STONE FRAGMENTS	A-7-6 (15)
B-012-0-25	SS-5	11.0	16											BROWN SILT AND CLAY, LITTLE SAND, TRACE STONE FRAGMENTS	A-6a (V)
B-012-0-25	SS-6	13.5	9											GRAY SILT AND CLAY, SOME SAND, TRACE STONE FRAGMENTS	A-6a (V)
B-012-0-25	SS-7	16.0	9	25	13	12		9	10	12	36	70	34	GRAY SILT AND CLAY, SOME SAND, TRACE STONE FRAGMENTS	A-6a (8)
B-012-0-25	SS-8	18.5	8											GRAY SILT AND CLAY, LITTLE SAND, TRACE STONE FRAGMENTS	A-6a (V)
B-012-0-25	SS-9	21.0	11	27	15	12		3	6	10	34	80	46	GRAY SILT AND CLAY, LITTLE SAND, TRACE STONE FRAGMENTS	A-6a (9)
B-012-0-25	SS-10	23.5	10											GRAY, NON PLASTIC SILT, LITTLE SAND, TRACE STONE FRAGMENTS	A-4b (V)
B-013-0-25	SS-1	1.5	17											BROWN SANDY SILT, LITTLE CLAY, TRACE STONE FRAGMENTS, FILL	A-4a (V)
B-013-0-25	SS-2	3.5	23											REDDISH BROWN, MOTTLED GRAY CLAY, TRACE SAND	A-7-6 (V)
B-013-0-25	SS-3	6.0	24	44	18	26		0	1	6	36	93	57	REDDISH BROWN, MOTTLED GRAY CLAY, TRACE SAND	A-7-6 (15)
B-013-0-25	SS-4	8.5	19	35	18	17		4	6	9	40	81	41	BROWN SILTY CLAY, LITTLE SAND, TRACE STONE FRAGMENTS	A-6b (11)
B-013-0-25	ST-5	11.0	15											GRAY SANDY SILT, SOME CLAY, TRACE STONE FRAGMENTS	A-4a (V)
B-013-0-25	SS-6	13.5	10											GRAY SANDY SILT, SOME CLAY, TRACE STONE FRAGMENTS	A-4a (V)
B-013-0-25	SS-7	16.0	9	24	16	8		7	9	11	41	70	29	GRAY SANDY SILT, SOME CLAY, TRACE STONE FRAGMENTS	A-4a (7)
B-013-0-25	SS-8	18.5	10											GRAY SANDY SILT, SOME CLAY, TRACE STONE FRAGMENTS	A-4a (V)
B-013-0-25	SS-9	21.0	17											GRAY SILT AND CLAY, TRACE SAND, TRACE STONE FRAGMENTS	A-6a (V)

Pro Geotech, Inc.

TR.-TRACE, BR.-BROWN, LI.-LITTLE, S/F-STONE FRAGMENTS, SO.-SOME, RB-ROADBASE, NP-NON-PLASTIC, POSS-POSSIBLE

Summary of Laboratory Results

Client: MICHAEL BAKER INTERNATIONAL
Project: OTIC 71-24-02
Location: OHIO TURNPIKE
Pro. Number: G25003G

PRO US LAB ODOT SUMMARY ODOT - OH DOT.GDT - 8/12/25 16:18 - \\GEOTECHSERVER\SHARED FOLDERS\COMPANY\PUBLIC\PROJECT FILES\25 PROJECTS\G25003G BAKER-OTIC 71-24-02\LAB

PRO US LAB ODOT SUMMARY ODOT - OH DOT.GDT - 8/12/25 16:18 - \\GEOTECHSERVER\SHARED FOLDERS\COMPANY\PUBLIC\PROJECT FILES\25 PROJECTS\G25003G BAKER-OTIC 71-24-02\LAB

Boring Number	Sample Number	Depth (ft)	Water Content %	Liquid Limit %	Plastic Limit %	Plast. Index	Specific Gravity	Agg. %	Coarse Sand %	Fine Sand %	Silt %	Silt&Clay Comb. %	Clay %	Soil Description	Class. Symbol
B-013-0-25	SS-10	23.5	16	31	17	14		0	0	1	45	98	53	GRAY SILT AND CLAY, TRACE SAND, TRACE STONE FRAGMENTS	A-6a (10)
B-014-0-25	SS-1	2.0	18											GRAY SILTY CLAY, LITTLE SAND, TRACE STONE FRAGMENTS, FILL	A-6b (V)
B-014-0-25	SS-2	3.5	15											BROWN SILT AND CLAY, LITTLE SAND, TRACE STONE FRAGMENTS, FILL	A-6a (V)
B-014-0-25	SS-3	6.0	19	31	16	15		5	6	9	30	79	49	GRAY SILT AND CLAY, LITTLE SAND, TRACE STONE FRAGMENTS	A-6a (10)
B-014-0-25	SS-4	8.5	17											GRAY SILT AND CLAY, LITTLE SAND, TRACE STONE FRAGMENTS	A-6a (V)
B-014-0-25	SS-5	11.0	17	28	16	12		3	6	10	32	79	47	GRAY SILT AND CLAY, LITTLE SAND, TRACE STONE FRAGMENTS	A-6a (9)
B-014-0-25	ST-6	13.0	18											GRAY SILT AND CLAY, LITTLE SAND, TRACE STONE FRAGMENTS	A-6a (V)
B-014-0-25	SS-7	16.0	18											GRAY SILT AND CLAY, LITTLE SAND, TRACE STONE FRAGMENTS	A-6a (V)
B-014-0-25	SS-8	18.5	18	30	16	14		5	5	9	30	81	52	GRAY SILT AND CLAY, LITTLE SAND, TRACE STONE FRAGMENTS	A-6a (10)
B-014-0-25	SS-9	21.0	19											GRAY SILT AND CLAY, LITTLE SAND, TRACE STONE FRAGMENTS	A-6a (V)
B-014-0-25	SS-10	23.5	16	35	14	21		3	6	9	36	83	46	GRAY SILTY CLAY, LITTLE SAND, TRACE STONE FRAGMENTS	A-6b (12)
B-015-0-25	SS-1	1.0	15											BROWN, SILTY CLAY, LITTLE SAND, TRACE STONE FRAGMENS	A-6b (V)
B-015-0-25	SS-2	3.5	19	35	18	17		3	4	9	45	83	38	BROWN, SILTY CLAY, LITTLE SAND, TRACE STONE FRAGMENS	A-6b (11)
B-015-0-25	SS-3	6.0	14											BROWN, SILTY CLAY, LITTLE SAND, TRACE STONE FRAGMENS	A-6b (V)
B-015-0-25	SS-4	8.5	16											BROWN, SILTY CLAY, LITTLE SAND, TRACE STONE FRAGMENS	A-6b (V)
B-015-0-25	SS-5	11.0	16	24	16	8		4	8	11	52	74	21	GRAY PLASTIC SILT, SOME CLAY, LITTLE SAND, TRACE STONE FRAGS	A-4b (8)
B-015-0-25	SS-6	13.5	11	21	15	6		13	12	14	41	61	20	GRAY SANDY SILT, LITTLE CLAY, LITTLE STONE FRAGMENTS	A-4a (5)
B-015-0-25	SS-7	16.0	14											GRAY, SILT AND CLAY, LITTLE SAND, TRACE STONE FRAGMENTS	A-6a (V)
B-015-0-25	SS-8	18.5	15											GRAY, SILT AND CLAY, LITTLE SAND, TRACE STONE FRAGMENTS	A-6a (V)
B-015-0-25	SS-9	21.0	15	29	15	14		4	5	7	46	84	37	GRAY, SILT AND CLAY, LITTLE SAND, TRACE STONE FRAGMENTS	A-6a (10)
B-015-0-25	SS-10	23.5	15											GRAY, SILT AND CLAY, LITTLE SAND, TRACE STONE FRAGMENTS	A-6a (V)
B-016-0-25	SS-1	2.0	8											BROWN GRAVEL AND STONE FRAGMENTS WITH SAND, LITTLE FINES	A-1-b (V)
B-016-0-25	SS-2	3.5	5											BROWN GRAVEL AND STONE FRAGMENTS, LITTLE SAND, LITTLE FINES	A-1-a (V)
B-016-0-25	SS-3	6.0	6	NP	NP	NP		57	18	11		14		BROWN GRAVEL AND STONE FRAGMENTS, LITTLE SAND, LITTLE FINES	A-1-a (0)
B-016-0-25	SS-4	8.5	8											REDDISH BROWN STONE FRAGMENTS WITH SAND, LITTLE FINES	A-1-b (V)
B-016-0-25	SS-5	11.0	8	NP	NP	NP		48	24	17		11		REDDISH BROWN STONE FRAGMENTS WITH SAND, LITTLE FINES	A-1-b (0)
B-016-0-25	SS-6	13.5	10											BROWN GRAVEL AND STONE FRAGMENTS WITH SAND AND SILT	A-2-4 (V)
B-018-0-25	SS-1	2.0	24	41	20	21		1	3	7	39	88	49	BROWN CLAY, TRACE SAND, TRACE STONE FRAGMENTS, FILL	A-7-6 (13)
B-018-0-25	SS-2	3.5	16											BROWN SILTY CLAY, TRACE SAND, TRACE STONE FRAGMENTS	A-6b (V)

Pro Geotech, Inc.

TR.-TRACE, BR.-BROWN, LI.-LITTLE, S/F-STONE FRAGMENTS, SO.-SOME, RB-ROADBASE, NP-NON-PLASTIC, POSS-POSSIBLE

Summary of Laboratory Results

Client: MICHAEL BAKER INTERNATIONAL
Project: OTIC 71-24-02
Location: OHIO TURNPIKE
Pro. Number: G25003G

PRO US LAB ODOT SUMMARY ODOT - OH DOT.GDT - 8/12/25 16:18 - \\GEOTECHSERVER\SHARED FOLDERS\COMPANY\PUBLIC\PROJECT FILES\25 PROJECTS\G25003G BAKER-OTIC 71-24-02\LAB

Boring Number	Sample Number	Depth (ft)	Water Content %	Liquid Limit %	Plastic Limit %	Plast. Index	Specific Gravity	Agg. %	Coarse Sand %	Fine Sand %	Silt %	Silt&Clay Comb. %	Clay %	Soil Description	Class. Symbol
B-018-0-25	SS-3	6.0	16	35	17	18		1	3	8	38	88	50	BROWN SILTY CLAY, LITTLE SAND, TRACE STONE FRAGMENTS	A-6b (11)
B-018-0-25	SS-4	8.5	11											YELLOWISH BROWN, SILT AND CLAY, SOME SAND, TRACE STONE FRAGS	A-6a (V)
B-018-0-25	SS-5	11.0	10	33	20	13		4	16	18	41	62	20	GRAY SILT AND CLAY, SOME SAND, TRACE STONE FRAGMENTS	A-6a (7)
B-018-0-25	SS-6	13.5	9											GRAY SEVERELY WEATHERED SHALE	Rock (V)
B-018-0-25	SS-7	16.0	4											GRAY SEVERELY WEATHEDED SHALE	Rock (V)
B-019-0-25	SS-1	2.0	19											BROWN SILTY CLAY, LITTLE SAND, TRACE STONE FRAGMENTS, FILL	A-6b (V)
B-019-0-25	SS-2	3.5	16	34	15	19		3	7	11	39	78	39	BROWN SILTY CLAY, LITTLE SAND, TRACE STONE FRAGMENTS, FILL	A-6b (12)
B-019-0-25	SS-3	6.0	17											BROWN SILT AND CLAY, LITTLE SAND, TRACE STONE FRAGMENTS, FILL	A-6a (V)
B-019-0-25	SS-4	8.5	19	31	18	13		3	3	8	48	86	38	BROWN SILT AND CLAY, LITTLE SAND, TRACE STONE FRAGMENTS, FILL	A-6a (9)
B-019-0-25	SS-5	11.0	18											BROWN SILT AND CLAY, LITTLE SAND, TRACE STONE FRAGMENTS, FILL	A-6a (V)
B-019-0-25	SS-6	13.5	17											BROWN SILT AND CLAY, LITTLE SAND, TRACE STONE FRAGMENTS, FILL	A-6a (V)
B-019-0-25	SS-7	16.0	19	32	16	16		13	8	15	30	64	34	GRAY SILTY CLAY, SOME SAND, LITTLE STONE FRAGS, TRACE ROOTS	A-6b (8)
B-019-0-25	SS-8	18.5	15											BROWN, SILT AND CLAY, LITTLE SAND, TRACE STONE FRAGMENTS	A-6a (V)
B-019-0-25	SS-9	21.0	16											BROWN, SILT AND CLAY, LITTLE SAND, TRACE STONE FRAGMENTS	A-6a (V)
B-019-0-25	SS-10	23.5	8											REDDISH BROWN, HIGHLY WEATHERED SHALE	Rock (V)
B-020-0-25	SS-1	1.5	13											GRAY SANDY SILT, SOME CLAY, TRACE STONE FRAGMENTS, FILL	A-4a (V)
B-020-0-25	SS-2	3.5	11	25	13	12		8	9	26	38	58	19	BROWN SILT AND CLAY, SOME SAND, TRACE STONE FRAGMENTS, FILL	A-6a (5)
B-020-0-25	SS-3	6.0	11											BROWN SILT AND CLAY, SOME SAND, TRACE STONE FRAGMENTS, FILL	A-6a (V)
B-020-0-25	SS-4	8.5	14	26	15	11		5	6	20	42	69	28	BROWN SILT AND CLAY, SOME SAND, TRACE STONE FRAGMENTS, FILL	A-6a (7)
B-020-0-25	ST-5	11.0	12											BROWN SANDY SILT, SOME CLAY, TRACE STONE FRAGMENTS, FILL	A-4a (V)
B-020-0-25	SS-6	13.5	14											BROWN SANDY SILT, SOME CLAY, TRACE STONE FRAGMENTS, FILL	A-4a (V)
B-020-0-25	SS-7	16.0	18	27	15	12		9	6	15	44	70	26	BROWN SILT AND CLAY, SOME SAND, TRACE STONE FRAGMENTS	A-6a (8)
B-020-0-25	SS-8	18.5	16											BROWN, NON-PLASTIC SILT, LITTLE SAND, TRACE STONE FRAGS	A-4b (V)
B-020-0-25	SS-9	21.0	16	NP	NP	NP		31	16	25	17	27	10	BROWN GRAVEL AND STONE FRAGS WITH SAND AND SILT	A-2-4 (0)
B-020-0-25	SS-10	23.5	9											GRAY SANDY SILT, SOME CLAY, TRACE STONE FRAGMENTS	A-4a (V)

Pro Geotech, Inc.

TR.-TRACE, BR.-BROWN, LI.-LITTLE, S/F-STONE FRAGMENTS, SO.-SOME, RB-ROADBASE, NP-NON-PLASTIC, POSS-POSSIBLE

Summary of Laboratory Results

Client: MICHAEL BAKER INTERNATIONAL
Project: OTIC 71-24-02
Location: OHIO TURNPIKE
Pro. Number: G25003G

Project: OTIC 71-24-02 **Site Location:** DMS #1 EB - Shoulder Drilled Shafts, B-001-0-25
Calculated By: SS **Checked by:** WN
Date: 9/15/2025

SPECIAL FOUNDATION DESIGN ANALYSIS

Span Truss:		
Span Length =	70.00	ft
Truss Hight (H) =		ft
Drilled Shaft:		
Diameter (D) =	3.00	ft
Total Foundation Length (L)	16.00	ft
The Above Grade Length =	0.00	ft
Drilled Shaft Volume =	113.10	cubic ft.
Concrete Unit Weight =	150.00	Pcf

Soil Properties:	Foundation Soil	Units
Ave. Soil Unit Weight =	120.90	Pcf
Internal Friction Angle ϕ (degs) =		degrees
Ave. Shear Strength of Soil (C_u) =	1550	psf
K_p =		
Groundwater Level Depth BGS =	3.000	ft.
Resistance Factors		
Side Resistance Factor in Clay φ_{stat} =	0.45	BDM Table 305-1
Tip Resistance Factor in Clay φ_{stst} =	0.40	BDM Table 305-1
Uplift Resistance Factor in Clay φ_{up} =	0.35	BDM Table 305-1
Passive Resistance Factor (Extreme I)	0.75	AASHTO Table 11.5.7-1
Passive Resistance Factor (Strength I)	0.75	AASHTO Table 11.5.7-1
Passive Resistance Factor (Service I)	1.00	AASHTO Table 11.5.7-1

AASHTO LRFDLTS Table. 3.4-1

		Permanent		Transient		
Limit State	**Reference Articles**	**Dead Load (DC) Max/Min**	**Dead Load (DC) Mean**	**Live Load (LL)**	**Wind (W)**	
Strength I - Gravity	**3.5, 3.6, and 3.7**	**1.25**	**1.60**			
Extreme I - Wind	**3.5, 3.8, and 3.9**	**1.1/0.9**			**1.0[a]**	
Service 1 - Translation	**10.40**		**1.00**		**1.0[b]**	
a. Use Figures 3.8-1, 3.8-2, or 3.8-3 (for appropriate return period) b. Use wind map 3.8-4 (service)						

The Following are Reaction Factored Loads for ITS-3513 Design No. 1, at the top of the Drilled Shafts 1 & 2 to be installed at the Shoulder

Limit State	**Shaft**	**Fz (lb.)**	**Fy (lb.)**	**MX(in-lb.)**	
Shoulder Column 1 and 2					
Strength I	1	19550.00	30.00	70680.00	
Strength I	2	14170.00	-20.00	69960.00	
Extreme I	1	60280.00	9900.00	111120.00	
Extreme I	2	-32880.00	3300.00	155880.00	
Service I	1				
Service I	2				

Bearing Resistance Check **AASHTO LRFD Section 10.8.3.5**

Check on Shoulder Column		**Strength I**	**Extreme I**	**Service I**	
Axial Factored Design Load:		19550.00	60280.00		lb.
Nominal Side Resistance :		104780.00	104780.00		lb.
Side Resistance Factor in Clay:	φ_{stat}	0.45	1.00	1.00	
Nominal Tip Resistance:		140760.00	140760.00		lb.
Tip Resistance Factor in Clay:	φ_{stat}	0.40	1.00	1.00	
Factored Side Resistance :		47151.00	104780.00		lb.
Factored Tip Resistance:		56304.00	140760.00		lb.
Total Factored Bearing Resistance:		103455.00	245540.00		lb.
Capacity: Demand Ratio (CDR):		5.29	4.07		**OK**

Uplift Resistance Check **AASHTO LRFD Section 10.8.3.7.2**

		Strength I	**Extreme I**	**Service I**	
Uplift Factored Design Load:			-32880.00		lb.
Nominal Side Resistance :			104780.00		lb.
Uplift Resistance Factor:	Reduction Factor = 0.8 as per LRFD 10.5.5.3.3	φ_{up} = 0.35	1.00	1.00	
Factored Side Resistance :			83824.00		
Drilled Shaft Concrete Weight:			16965.00		lb.
DC Load Factor:			0.90	1.00	
Factored Concrete Weight:			15268.50		lb.
Total Resistance:			99092.50		lb.
Capacity: Demand Ratio (CDR):			3.01		**OK**

Brom's Method with Strength Limit State Load Factors and Resistance Factors , in accordance with the commentary in LRFD C11.8.4.1.

Drilled Shaft Passive Resistance is calculated as $9c_uD$ over the Length excluding a top length equal to 1.5D where

D = drilled shaft Diameter L-1.5D = 11.50 ft.

	Strength I	Extreme I	Service I	
Shaft 1 Back Row				
Wind Factored Load (Fy:	30.00	9900.00		lb.
Moment of Force Fy as MA_{Fy} , Moment about the base (L)= 16'				ft
MA_{Fy} =	480.00	158400.00		lb.-ft
Passive Resistance (R) along the Fo. length (L-1.5D)	481275.00	481275.00		9CuD*(L-1.5D) lb.
Passive Resistance Factor	0.75	0.75	1.00	
Average Shear Strength of Soil = 1550 psf:				psf
Factored Passive Resistance (R) along the Fo. Lengt	360956.25	360956.25		lb.
Moment of Force R as MA_R , Moment about the base= (L-1.5D)/2=5.75'				ft
Moment MA_R =	2075498.44	2075498.44		lb.-ft
Capacity: Demand Ratio (CDR) =	4323.96	13.10		**OK**

	Strength I	Extreme I	Service I	
Shaft 2 Front Row				
Wind Factored Load (Fy):	-20.00	3300.00		lb.
Moment of Force Fv as MA_{Fy} , Moment about the base (L)= 16'				ft
MA_{Fy} =	-320.00	52800.00		lb.-ft
Passive Resistance (R) along the Fo. length (L-1.5D)	481275.00	481275.00		9CuD*(L-1.5D) lb.
Passive Resistance Factor	0.75	0.75	1.00	
Average Shear Strength = 1550 psf:				
Factored Passive Resistance (R) along the Fo. Lengt	360956.25	360956.25		lb.
Moment of Force R as MA_R , Moment about the base= (L-1.5D)/2=5.75'				ft
Moment MA_R =	2075498.44	2075498.44		lb.-ft
Capacity: Demand Ratio (CDR) =	6485.93	39.31		**OK**

Lateral Resistance Check **AASHTO LRFD Section 10.8.3.9**

		Extreme I	Service I	
Shaft 1 Back Row				
Lateral Deflection at Minimum Length of Drilled Shaft:	4.0'	0.15033		inch
p-multiplier (P_m) as per AASHTO LRFD BDS 10.7.2.4		0.4	0.4	
		0.0601		
Lateral Deflection at Full Length of Drilled Shaft:	16.0'	0.01724		inch
Capacity: Demand Ratio (CDR_L) to provide Lateral Restraint:		3.49		**OK**
Shaft 2 Front Row				
Lateral Deflection at Minimum Length of Drilled Shaft:	3.2'	0.06774		inch
p-multiplier (P_m) as per AASHTO LRFD BDS 10.7.2.4		0.8	0.8	
		0.0542		
Lateral Deflection at Full Length of Drilled Shaft:	16.0'	0.00339		inch
Capacity: Demand Ratio (CDR_L) to provide Lateral Restraint:		15.99		**OK**

Flexural Moment Resistance Chec **AASHTO LRFD Section 10.8.3.9**

	Strength I	Extreme I	Service I	
Shaft 1 Back Row				
Maximum Moment:		-849122		inch-lbs.
Nominal Moment Capacity		8709733		inch-lbs.
Flexural Resistance Factor	0.90	1.00	1.00	
Factored Moment Capacity		8709733		inch-lbs.
Capacity: Demand Ratio:		10.26		**OK**
Shaft 2 Front Row				
Maximum Moment		-229003		inch-lbs.
Nominal Moment Capacity		7653856		inch-lbs.
Flexural Resistance Factor	0.90	1.00	1.00	
Factored Moment Capacity		7653856		inch-lbs.
Capacity: Demand Ratio:		33.42		**OK**

Shear Resistance Check **AASHTO LRFD Section 10.8.3.9**

	Strength I	Extreme I	Service I	
Shaft 1 Back Row				
Maximum Shear		9900		lbs.
Nominal Structural Shear Capacity as per AASHTO LRFD BDS Article 5.7		183980		lbs.
Strength Reduction Factor	0.90	1.00	1.00	
Factored Structural Shear Capacity		183980		lbs.
Capacity: Demand Ratio:		18.58		**OK**
Shaft 2 Front Row				
Maximum Shear		3300		lbs.
Nominal Structural Shear Capacity as per AASHTO LRFD BDS Article 5.7		183980		lbs.
Strength Reduction Factor	0.90	1.00	1.00	
Factored Structural Shear Capacity		183980		lbs.
Capacity: Demand Ratio:		55.75		**OK**

Since Capacity/Demand Ratio of all the Checks were greater than 1.0, the proposed length of the drilled shaft to be used is 16'.

Project: OTIC 71-24-02 **Site Location:** DMS #1 EB - Median Drilled Shafts, B-001-0-25
Calculated By: SS **Checked by:** WN
Date: 9/15/2025

SPECIAL FOUNDATION DESIGN ANALYSIS

Span Truss:			**Soil Properties:**	Foundation Soil	Units
Span Length =	70.00	ft	Ave. Soil Unit Weight =	120.90	Pcf
Truss Hight (H) =		ft	Internal Friction Angle ϕ (degs) =		degrees
			Ave. Shear Strength of Soil (C_u) =	1550	psf
			K_p =		
Drilled Shaft:			Groundwater Level Depth BGS =	3.000	ft.
Diameter (D) =	3.00	ft	**Resistance Factors**		
Total Foundation Length (L)	16.00	ft	Side Resistance Factor in Clay φ_{stat} =	0.45	BDM Table 305-1
The Above Grade Length =	0.00	ft	Tip Resistance Factor in Clay φ_{stst} =	0.40	BDM Table 305-1
Drilled Shaft Volume =	113.10	cubic ft.	Uplift Resistance Factor in Clay φ_{up} =	0.35	BDM Table 305-1
Concrete Unit Weight =	150.00	Pcf	Passive Resistance Factor (Extreme I)	0.75	AASHTO Table 11.5.7-1
			Passive Resistance Factor (Strength I)	0.75	AASHTO Table 11.5.7-1
			Passive Resistance Factor (Service I)	1.00	AASHTO Table 11.5.7-1

AASHTO LRFDLTS Table. 3.4-1

		Permanent		Transient		
Limit State	**Reference Articles**	**Dead Load (DC) Max/Min**	**Dead Load (DC) Mean**	**Live Load (LL)**	**Wind (W)**	
Strength I - Gravity	**3.5, 3.6, and 3.7**	**1.25**	**1.60**			
Extreme I - Wind	**3.5, 3.8, and 3.9**	**1.1/0.9**			**1.0[a]**	
Service 1 - Translation	**10.40**		**1.00**		**1.0[b]**	
a. Use Figures 3.8-1, 3.8-2, or 3.8-3 (for appropriate return period) b. Use wind map 3.8-4 (service)						

The Following are Reaction Factored Loads for ITS-3513 Design No. 1, at the top of the Drilled Shafts 1 & 2 to be installed at the Median

Limit State	**Shaft**	**Fz (lb.)**	**Fy (lb.)**	**Mu(in-lb.)**	
Median Column 1 and 2					
Strength I	1	27790.00	10.00	138120.00	
Strength I	2	24090.00	-20.00	140880.00	
Extreme I	1	46960.00	3120.00	29880.00	
Extreme I	2	-5160.00	6800.00	247440.00	
Service I	1				
Service I	2				

Bearing Resistance Check **AASHTO LRFD Section 10.8.3.5**

		Strength I	**Extreme I**	**Service I**	
Check on Median Column					
Axial Factored Design Load:		27790.00	46960.00		lb.
Nominal Side Resistance :		104780.00	104780.00		lb.
Side Resistance Factor in Clay:	φ_{stat}	0.45	1.00		
Nominal Tip Resistance:		140760.00	140760.00		lb.
Tip Resistance Factor in Clay:	φ_{stat}	0.40	1.00		
Factored Side Resistance :		47151.00	104780.00		lb.
Factored Tip Resistance:		56304.00	140760.00		lb.
Total Factored Bearing Resistance:		103455.00	245540.00		lb.
Capacity: Demand Ratio (CDR):		3.72	5.23		**OK**

Uplift Resistance Check **AASHTO LRFD Section 10.8.3.7.2**

		Strength I	**Extreme I**	**Service I**	
Uplift Factored Design Load:			-5160.00		lb.
Nominal Side Resistance :			104780.00		lb.
Uplift Resistance Factor:	Reduction Factor = 0.8 as per LRFD 10.5.5.3.3	φ_{up} = 0.35	1.00		
Factored Side Resistance :			83824.00		
Drilled Shaft Concrete Weight:			16965.00		lb.
DC Load Factor:			0.90		
Factored Concrete Weight:			15268.50		lb.
Total Resistance:			99092.50		lb.
Capacity: Demand Ratio (CDR):			19.20		**OK**

Brom's Method with Strength Limit State Load Factors and Resistance Factors , in accordance with the commentary in LRFD C11.8.4.1.

Drilled Shaft Passive Resistance is calculated as $9c_uD$ over the Length excluding a top length equal to 1.5D where D = drilled shaft Diameter L-1.5D = 11.50 ft.

	Strength I	Extreme I	Service I	
Shaft 1 Back Row				
Wind Factored Load (Fy:	10.00	3120.00		lb.
Moment of Force Fy as MA_{Fy} , Moment about the base (L)= 16'				ft
MA_{Fy} =	160.00	49920.00		lb.-ft
Passive Resistance (R) along the Fo. length (L-1.5D)	481275.00	481275.00		9CuD*(L-1.5D) lb.
Passive Resistance Factor	0.75	0.75		
Average Shear Strength = 1550 psf:				psf
Factored Passive Resistance (R) along the Fo. Lengt	360956.25	360956.25		lb.
Moment of Force R as MA_R , Moment about the base= (L-1.5D)/2=5.75'				ft
Moment MA_R =	2075498.44	2075498.44		lb.-ft
Capacity: Demand Ratio (CDR) =	12971.87	41.58		**OK**

	Strength I	Extreme I	Service I	
Shaft 2 Front Row				
Wind Factored Load (Fy):	-20.00	6800.00		lb.
Moment of Force Fv as MA_{Fy} , Moment about the base (L)= 16'				ft
MA_{Fy} =	-320.00	108800.00		lb.-ft
Passive Resistance (R) along the Fo. length (L-1.5D)	481275.00	481275.00		9CuD*(L-1.5D) lb.
Passive Resistance Factor	0.75	0.75		
Average Shear Strength = 1550 psf:				
Factored Passive Resistance (R) along the Fo. Lengt	360956.25	360956.25		lb.
Moment of Force R as MA_R , Moment about the base= (L-1.5D)/2=5.75'				ft
Moment MA_R =	2075498.44	2075498.44		lb.-ft
Capacity: Demand Ratio (CDR) =	6485.93	19.08		**OK**

<u>Lateral Resistance Check</u> **AASHTO LRFD Section 10.8.3.9**

		Extreme I	Service I	
Shaft 1 Back Row				
Lateral Deflection at Minimum Length of Drilled Shaft:	3.2'	0.24048		inch
p-multiplier (P_m) as per AASHTO LRFD BDS 10.7.2.4		0.4		
		0.0962		
Lateral Deflection at Full Length of Drilled Shaft:	16.0'	0.00523		inch
Capacity: Demand Ratio (CDR_L) to provide Lateral Restraint:		18.39		**OK**
Shaft 2 Front Row				
Lateral Deflection at Minimum Length of Drilled Shaft:	3.2'	0.3164		inch
p-multiplier (P_m) as per AASHTO LRFD BDS 10.7.2.4		0.8		
		0.2531		
Lateral Deflection at Full Length of Drilled Shaft:	16.0'	0.00732		inch
Capacity: Demand Ratio (CDR_L) to provide Lateral Restraint:		34.58		**OK**

<u>Flexural Moment Resistance Chec</u> **AASHTO LRFD Section 10.8.3.9**

	Strength I	Extreme I	Service I	
Shaft 1 Back Row				
Maximum Moment:		-259621		inch-lbs.
Nominal Moment Capacity		8561256		inch-lbs.
Flexural Resistance Factor	0.90	1.00		
Factored Moment Capacity		8561256		inch-lbs.
Capacity: Demand Ratio:		32.98		**OK**
Shaft 2 Front Row				
Maximum Moment		-488874		inch-lbs.
Nominal Moment Capacity		7976223		inch-lbs.
Flexural Resistance Factor	0.90	1.00		
Factored Moment Capacity		7976223		inch-lbs.
Capacity: Demand Ratio:		16.32		**OK**

<u>Shear Resistance Check</u> **AASHTO LRFD Section 10.8.3.9**

	Strength I	Extreme I	Service I	
Shaft 1 Back Row				
Maximum Shear		3120		lbs.
Nominal Structural Shear Capacity as per AASHTO LRFD BDS Article 5.7		183980		lbs.
Strength Reduction Factor	0.90	1.00		
Factored Structural Shear Capacity		183980		lbs.
Capacity: Demand Ratio:		58.97		**OK**
Shaft 2 Front Row				
Maximum Shear		6800		lbs.
Nominal Structural Shear Capacity as per AASHTO LRFD BDS Article 5.7		183980		lbs.
Strength Reduction Factor	0.90	1.00		
Factored Structural Shear Capacity		183980		lbs.
Capacity: Demand Ratio:		27.06		**OK**

Since Capacity/Demand Ratio of all the Checks were greater than 1.0, the proposed length of the drilled shaft to be used is 16'.

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

                 SHAFT for Windows, Version 2012.7.8

                  Serial Number :  292797964

               VERTICALLY LOADED DRILLED SHAFT ANALYSIS
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                      All Rights Reserved

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


     Path to file locations      : M:\Project Files\25 Projects\G25003G Baker-OTIC
71-24-02\Analysis File Folder\Drilled Shaft Folder\DMS #1 EB B-001-0-25\
     Name of input data file     : B-001Shaft.sfd
     Name of output file         : B-001Shaft.sfo
     Name of plot output file    : B-001Shaft.sfp
     Name of runtime file        : B-001Shaft.sfr


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

          Date:  July 23, 2025     Time:  15:24:57

     OTIC 71-24-02 - B-001-0-25


     PROPOSED DEPTH =      16.0 FT
     ----------------


     NUMBER OF LAYERS =    7
     ------------------


     WATER TABLE DEPTH =       3.0 FT.
     -------------------




     SOIL INFORMATION
     ---------------

     LAYER NO 1----CLAY

       AT THE TOP
```

```
  STRENGTH REDUCTION FACTOR-ALPHA                       = 0.550E+00
  END BEARING COEFFICIENT-Nc                            = 0.600E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                    = 0.250E+03
  INTERNAL FRICTION ANGLE, DEG.                         = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST         = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                            = 0.120E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT              = 0.100E+11
  DEPTH, FT                                             = 0.000E+00


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                       = 0.550E+00
  END BEARING COEFFICIENT-Nc                            = 0.720E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                    = 0.250E+03
  INTERNAL FRICTION ANGLE, DEG.                         = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST         = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                            = 0.120E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT              = 0.100E+11
  DEPTH, FT                                             = 0.300E+01


  LRFD RESISTANCE FACTOR (SIDE FRICTION)                = 0.450E+00
  LRFD RESISTANCE FACTOR (TIP RESISTANCE)               = 0.400E+00


LAYER NO 2----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                       = 0.550E+00
  END BEARING COEFFICIENT-Nc                            = 0.720E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                    = 0.188E+04
  INTERNAL FRICTION ANGLE, DEG.                         = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST         = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                            = 0.121E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT              = 0.100E+11
  DEPTH, FT                                             = 0.300E+01


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                       = 0.550E+00
  END BEARING COEFFICIENT-Nc                            = 0.840E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                    = 0.188E+04
  INTERNAL FRICTION ANGLE, DEG.                         = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST         = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                            = 0.121E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT              = 0.100E+11
```

```
  DEPTH, FT                                           = 0.600E+01


  LRFD RESISTANCE FACTOR (SIDE FRICTION)              = 0.450E+00
  LRFD RESISTANCE FACTOR (TIP RESISTANCE)             = 0.400E+00


LAYER NO 3----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                     = 0.117E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                  = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                       = 0.290E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST       = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                          = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT            = 0.100E+11
  DEPTH, FT                                           = 0.600E+01


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                     = 0.111E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                  = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                       = 0.290E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST       = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                          = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT            = 0.100E+11
  DEPTH, FT                                           = 0.850E+01


  LRFD RESISTANCE FACTOR (SIDE FRICTION)              = 0.450E+00
  LRFD RESISTANCE FACTOR (TIP RESISTANCE)             = 0.400E+00


LAYER NO 4----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                     = 0.550E+00
  END BEARING COEFFICIENT-Nc                          = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                  = 0.125E+04
  INTERNAL FRICTION ANGLE, DEG.                       = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST       = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                          = 0.119E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT            = 0.100E+11
  DEPTH, FT                                           = 0.850E+01


  AT THE BOTTOM
```

```
  STRENGTH REDUCTION FACTOR-ALPHA                      = 0.550E+00
  END BEARING COEFFICIENT-Nc                           = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                   = 0.125E+04
  INTERNAL FRICTION ANGLE, DEG.                        = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST        = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                           = 0.119E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT             = 0.100E+11
  DEPTH, FT                                            = 0.140E+02


  LRFD RESISTANCE FACTOR (SIDE FRICTION)               = 0.450E+00
  LRFD RESISTANCE FACTOR (TIP RESISTANCE)              = 0.400E+00


LAYER NO 5----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                      = 0.995E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                   = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                        = 0.295E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST        = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                           = 0.121E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT             = 0.100E+11
  DEPTH, FT                                            = 0.140E+02


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                      = 0.960E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                   = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                        = 0.295E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST        = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                           = 0.121E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT             = 0.100E+11
  DEPTH, FT                                            = 0.160E+02


  LRFD RESISTANCE FACTOR (SIDE FRICTION)               = 0.450E+00
  LRFD RESISTANCE FACTOR (TIP RESISTANCE)              = 0.400E+00


LAYER NO 6----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                      = 0.550E+00
  END BEARING COEFFICIENT-Nc                           = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                   = 0.200E+04
```

```
  INTERNAL FRICTION ANGLE, DEG.                         = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST         = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                            = 0.121E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT              = 0.100E+11
  DEPTH, FT                                             = 0.160E+02


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                       = 0.550E+00
  END BEARING COEFFICIENT-Nc                            = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                    = 0.200E+04
  INTERNAL FRICTION ANGLE, DEG.                         = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST         = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                            = 0.121E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT              = 0.100E+11
  DEPTH, FT                                             = 0.185E+02


  LRFD RESISTANCE FACTOR (SIDE FRICTION)                = 0.450E+00
  LRFD RESISTANCE FACTOR (TIP RESISTANCE)               = 0.400E+00


LAYER NO 7----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                       = 0.550E+00
  END BEARING COEFFICIENT-Nc                            = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                    = 0.229E+04
  INTERNAL FRICTION ANGLE, DEG.                         = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST         = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                            = 0.122E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT              = 0.100E+11
  DEPTH, FT                                             = 0.185E+02


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                       = 0.550E+00
  END BEARING COEFFICIENT-Nc                            = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                    = 0.229E+04
  INTERNAL FRICTION ANGLE, DEG.                         = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST         = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                            = 0.122E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT              = 0.100E+11
  DEPTH, FT                                             = 0.250E+02


  LRFD RESISTANCE FACTOR (SIDE FRICTION)                = 0.450E+00
```

LRFD RESISTANCE FACTOR (TIP RESISTANCE) = 0.400E+00

DRILLED SHAFT INFORMATION

DIAMETER OF STEM	=	3.000	FT.
DIAMETER OF BASE	=	3.000	FT.
END OF STEM TO BASE	=	0.000	FT.
ANGLE OF BELL	=	0.000	DEG.
IGNORED TOP PORTION	=	0.000	FT.
IGNORED BOTTOM PORTION	=	0.000	FT.
AREA OF ONE PERCENT STEEL	=	10.180	SQ.IN.
ELASTIC MODULUS, Ec	=	0.360E+07	LB/SQ IN
VOLUME OF UNDERREAM	=	0.000	CU.YDS.

PREDICTED RESULTS

QS = ULTIMATE SIDE RESISTANCE;
QB = ULTIMATE BASE RESISTANCE;
WT = WEIGHT OF DRILLED SHAFT (UPLIFT CAPACITY ONLY);
QU = TOTAL ULTIMATE RESISTANCE;
LRFD QS = TOTAL SIDE FRICTION USING LRFD RESISTANCE FACTOR TO THE ULTIMATE SIDE RESISTANCE;
LRFD QB = TOTAL BASE BEARING USING LRFD RESISTANCE FACTOR TO THE ULTIMATE BASE RESISTANCE
LRFD QU = TOTAL CAPACITY WITH LRFD RESISTANCE FACTOR.

LENGTH (FEET)	VOLUME (CU.YDS)	QS (TONS)	QB (TONS)	QU (TONS)	LRFD QS (TONS)	LRFD QB (TONS)	LRFD QU (TONS)
1.0	0.26	0.65	37.69	38.34	0.29	15.08	15.37
2.0	0.52	1.30	29.40	30.70	0.58	11.76	12.34
3.0	0.79	1.94	14.94	16.89	0.87	5.98	6.85
4.0	1.05	6.80	13.50	20.30	3.06	5.40	8.46
5.0	1.31	11.66	18.08	29.74	5.25	7.23	12.48
6.0	1.57	16.52	28.92	45.45	7.44	11.57	19.00
7.0	1.83	19.58	36.15	55.73	8.81	14.46	23.27
8.0	2.09	22.90	39.77	62.66	10.30	15.91	26.21
9.0	2.36	26.47	31.33	57.80	11.91	12.53	24.44
10.0	2.62	29.71	21.69	51.40	13.37	8.68	22.05
11.0	2.88	32.95	24.34	57.29	14.83	9.74	24.56
12.0	3.14	36.19	32.54	68.73	16.29	13.01	29.30
13.0	3.40	39.43	46.27	85.70	17.74	18.51	36.25
14.0	3.67	42.67	59.81	102.48	19.20	23.92	43.13

15.0	3.93	47.44	67.85	115.29	21.35	27.14	48.49
16.0	4.19	52.39	70.38	122.78	23.58	28.15	51.73

RESULT FROM TREND (AVERAGED) LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.7874E-02	0.1053E-04	0.1544E-02	0.1000E-04
0.3937E-01	0.5266E-04	0.7722E-02	0.5000E-04
0.7874E-01	0.1053E-03	0.1544E-01	0.1000E-03
0.3937E+01	0.5266E-02	0.7722E+00	0.5000E-02
0.5906E+01	0.7900E-02	0.1158E+01	0.7500E-02
0.7874E+01	0.1053E-01	0.1544E+01	0.1000E-01
0.1969E+02	0.2633E-01	0.3861E+01	0.2500E-01
0.3468E+02	0.5240E-01	0.7722E+01	0.5000E-01
0.4604E+02	0.7826E-01	0.1158E+02	0.7500E-01
0.5572E+02	0.1040E+00	0.1544E+02	0.1000E+00
0.7939E+02	0.2562E+00	0.3232E+02	0.2500E+00
0.9349E+02	0.5078E+00	0.4708E+02	0.5000E+00
0.9718E+02	0.6332E+00	0.5201E+02	0.6250E+00
0.1047E+03	0.9091E+00	0.6088E+02	0.9000E+00
0.1120E+03	0.1810E+01	0.6827E+02	0.1800E+01

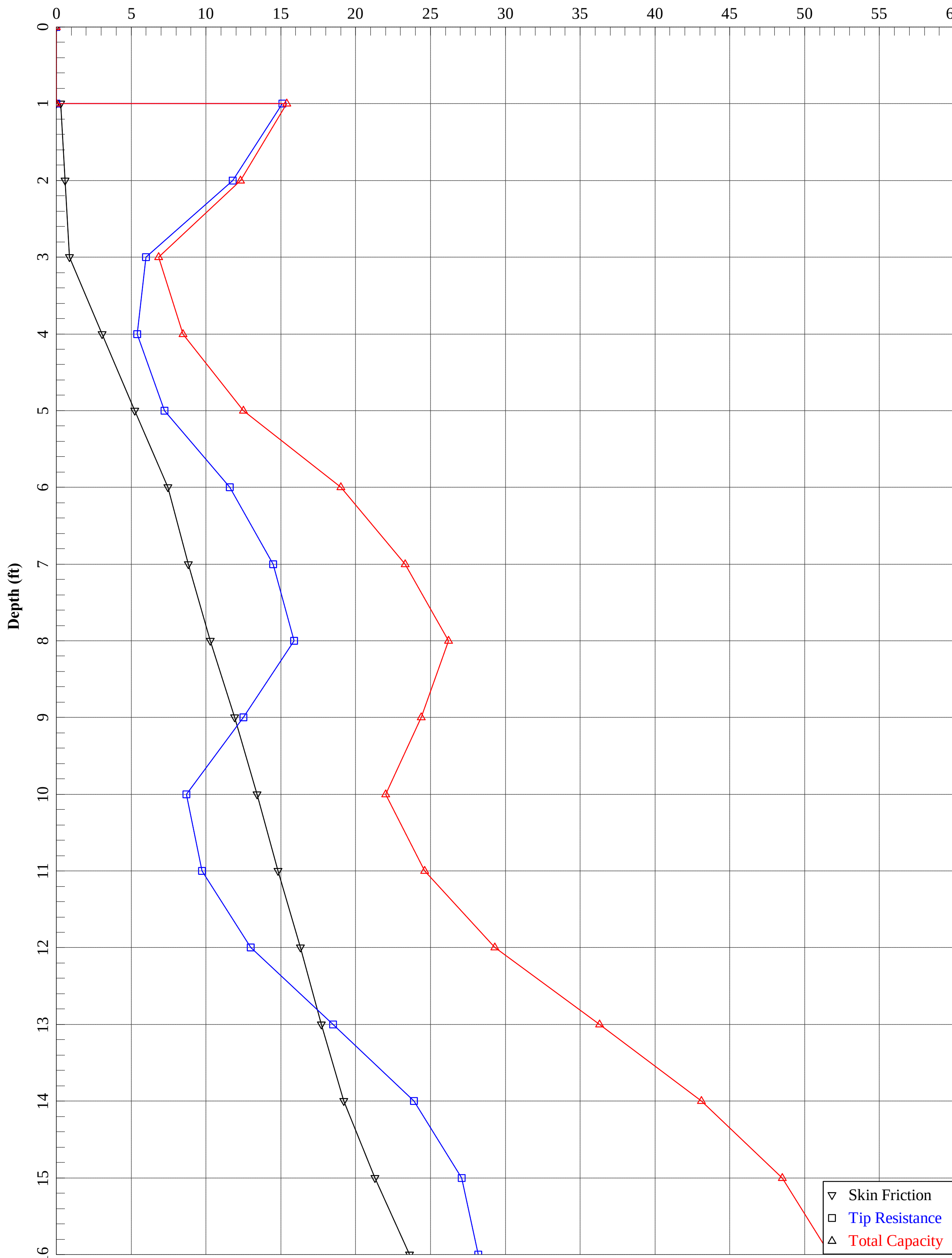
RESULT FROM UPPER-BOUND LINE

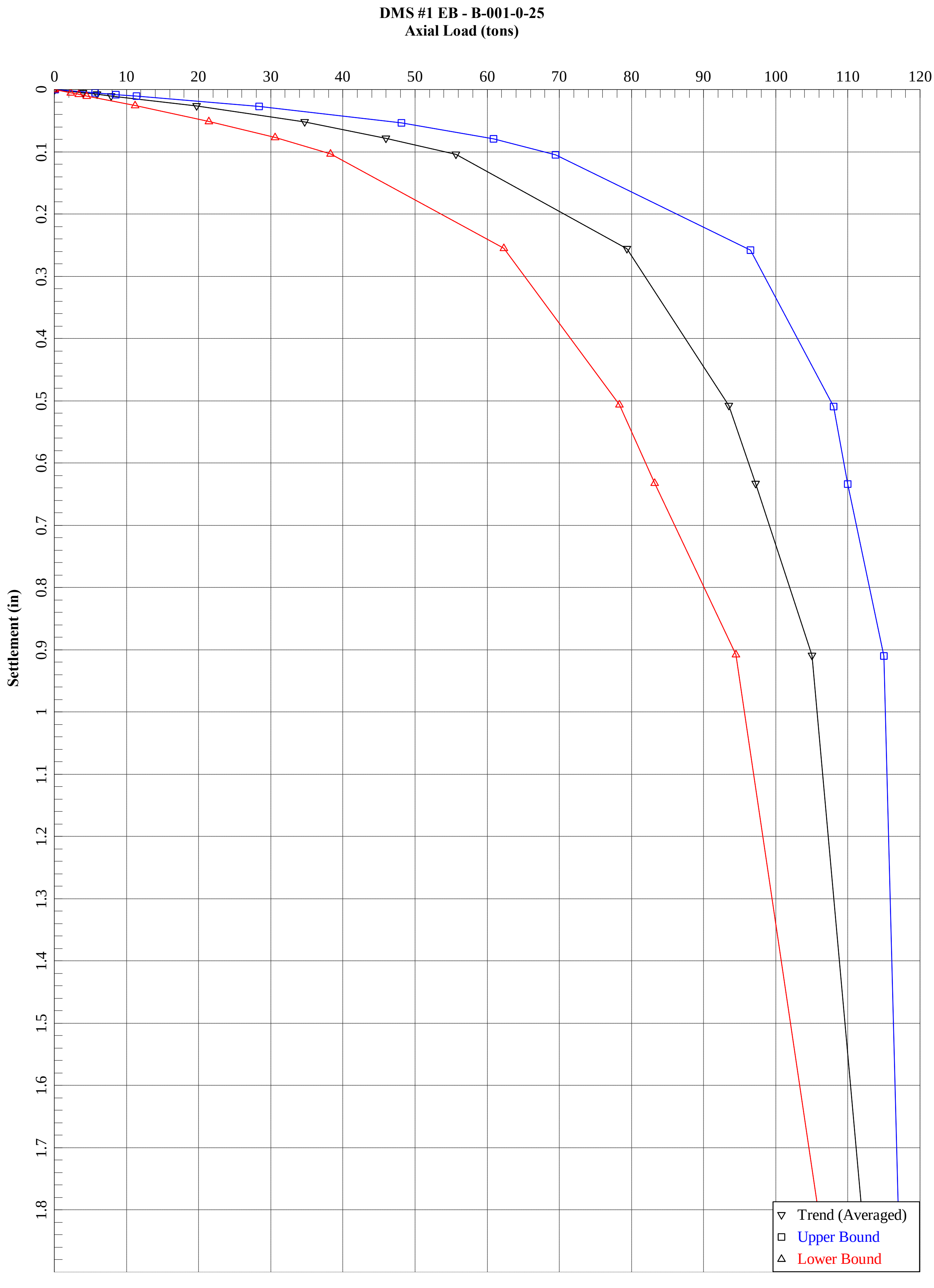
TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.1138E-01	0.1077E-04	0.2307E-02	0.1000E-04
0.5689E-01	0.5385E-04	0.1153E-01	0.5000E-04
0.1138E+00	0.1077E-03	0.2307E-01	0.1000E-03
0.5689E+01	0.5385E-02	0.1153E+01	0.5000E-02
0.8534E+01	0.8077E-02	0.1730E+01	0.7500E-02
0.1138E+02	0.1077E-01	0.2307E+01	0.1000E-01
0.2845E+02	0.2692E-01	0.5767E+01	0.2500E-01
0.4814E+02	0.5337E-01	0.1153E+02	0.5000E-01
0.6094E+02	0.7942E-01	0.1730E+02	0.7500E-01
0.6955E+02	0.1052E+00	0.2307E+02	0.1000E+00
0.9647E+02	0.2579E+00	0.4590E+02	0.2500E+00
0.1081E+03	0.5091E+00	0.5881E+02	0.5000E+00
0.1103E+03	0.6344E+00	0.6219E+02	0.6250E+00
0.1149E+03	0.9100E+00	0.6757E+02	0.9000E+00
0.1173E+03	0.1810E+01	0.7003E+02	0.1800E+01

RESULT FROM LOWER-BOUND LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.4499E-02	0.1030E-04	0.7820E-03	0.1000E-04
0.2250E-01	0.5151E-04	0.3910E-02	0.5000E-04
0.4499E-01	0.1030E-03	0.7820E-02	0.1000E-03
0.2250E+01	0.5151E-02	0.3910E+00	0.5000E-02
0.3374E+01	0.7727E-02	0.5865E+00	0.7500E-02
0.4499E+01	0.1030E-01	0.7820E+00	0.1000E-01
0.1125E+02	0.2576E-01	0.1955E+01	0.2500E-01
0.2143E+02	0.5145E-01	0.3910E+01	0.5000E-01
0.3058E+02	0.7708E-01	0.5865E+01	0.7500E-01
0.3834E+02	0.1026E+00	0.7820E+01	0.1000E+00
0.6229E+02	0.2546E+00	0.1873E+02	0.2500E+00
0.7826E+02	0.5063E+00	0.3535E+02	0.5000E+00
0.8323E+02	0.6319E+00	0.4183E+02	0.6250E+00
0.9451E+02	0.9082E+00	0.5419E+02	0.9000E+00
0.1064E+03	0.1809E+01	0.6616E+02	0.1800E+01

DMS #1 EB - B-001-0-25
LRFD Resistance (tons)





DMS #1 EB - B-001-0-25
Axial Load (tons)
0
10
20
30
40
50
60
70
80
90
100
110
120
Settlement (in)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1.1
1.2
1.3
1.4
1.5
1.6
1.7
1.8
Trend (Averaged)
Upper Bound
Lower Bound

Project: OTIC 71-24-02 **Site Location:** DMS #2 EB - Shoulder Drilled Shafts, B-002-0-25
Calculated By: SS **Checked by:** WN
Date: 9/16/2025

SPECIAL FOUNDATION DESIGN ANALYSIS

Span Truss:		
Span Length =	70.00	ft
Truss Hight (H) =		ft
Drilled Shaft:		
Diameter (D) =	3.00	ft
Total Foundation Length (L)	16.00	ft
The Above Grade Length =	0.00	ft
Drilled Shaft Volume =	113.10	cubic ft.
Concrete Unit Weight =	150.00	Pcf

Soil Properties:	Foundation Soil	Units
Ave. Soil Unit Weight =	119.40	Pcf
Internal Friction Angle ϕ (digs) =		degrees
Ave. Shear Strength of Soil (C_u) =	1462.5	psf
K_p =		
Groundwater Level Depth BGS =	3.000	ft.
Resistance Factors		
Side Resistance Factor in Clay φ_{stat} =	0.45	BDM Table 305-1
Tip Resistance Factor in Clay φ_{stst} =	0.40	BDM Table 305-1
Uplift Resistance Factor in Clay φ_{up} =	0.35	BDM Table 305-1
Passive Resistance Factor (Extreme I)	0.75	AASHTO Table 11.5.7-1
Passive Resistance Factor (Strength I)	0.75	AASHTO Table 11.5.7-1
Passive Resistance Factor (Service I)	1.00	AASHTO Table 11.5.7-1

AASHTO LRFDLTS Table. 3.4-1

		Permanent		Transient		
Limit State	**Reference Articles**	**Dead Load (DC) Max/Min**	**Dead Load (DC) Mean**	**Live Load (LL)**	**Wind (W)**	
Strength I - Gravity	**3.5, 3.6, and 3.7**	**1.25**	**1.60**			
Extreme I - Wind	**3.5, 3.8, and 3.9**	**1.1/0.9**			**1.0[a]**	
Service 1 - Translation	**10.40**		**1.00**		**1.0[b]**	
a. Use Figures 3.8-1, 3.8-2, or 3.8-3 (for appropriate return period) b. Use wind map 3.8-4 (service)						

The Following are reaction Factored Loads for ITS-3513 Design No. 1, at the top of the Drilled Shaft 1 & 2 to be installed at the Shoulder

Limit State	**Shaft**	**Fz (lb.)**	**Fy (lb.)**	**Mu(in-lb.)**				
Strength I	1	19550.00	30.00	70680.00				
Strength I	2	14170.00	-20.00	69960.00				
Extreme I	1	60280.00	9900.00	111120.00				
Extreme I	2	-32880.00	3300.00	155880.00				
Service I	1							
Service I	2							

Bearing Resistance Check **AASHTO LRFD Section 10.8.3.5**

		Strength I	**Extreme I**	**Service I**	
Check on Shoulder Column					
Axial Factored Design Load:		19550.00	60280.00		lb.
Nominal Side Resistance :		99380.00	99380.00		lb.
Side Resistance Factor in Clay:	φ_{stat}	0.45	1.00		
Nominal Tip Resistance:		67640.00	67640.00		lb.
Tip Resistance Factor in Clay:	φ_{stat}	0.40	1.00		
Factored Side Resistance :		44721.00	99380.00		lb.
Factored Tip Resistance:		27056.00	67640.00		lb.
Total Factored Bearing Resistance:		71777.00	167020.00		lb.
Capacity: Demand Ratio (CDR):		3.67	2.77		**OK**

Uplift Resistance Check **AASHTO LRFD Section 10.8.3.7.2**

		Strength I	**Extreme I**	**Service I**	
Uplift Factored Design Load:			-32880.00		lb.
Nominal Side Resistance :			99380.00		lb.
Uplift Resistance Factor:	Reduction Factor = 0.8 as per LRFD 10.5.5.3.3	φ_{up} = 0.35	1.00		
Factored Side Resistance :			79504.00		
Drilled Shaft Concrete Weight:			16965.00		lb.
DC Load Factor:			0.90		
Factored Concrete Weight:			15268.50		lb.
Total Resistance:			94772.50		lb.
Capacity: Demand Ratio (CDR):			2.88		**OK**

Brom's Method with Strength Limit State Load Factors and Resistance Factors , in accordance with the commentary in LRFD C11.8.4.1.

Drilled Shaft Passive Resistance is calculated as $9c_uD$ over the Length excluding a top length equal to 1.5D where

D = drilled shaft Diameter L-1.5D = 11.50 ft.

	Strength I	Extreme I	Service I	
Shaft 1 Back Row				
Wind Factored Load (Fy):	30.00	9900.00		lb.
Moment of Force Fv as MA_{Fy} , Moment about the base (L)= 16'				ft
MA_{Fy} =	480.00	158400.00		lb.-ft
Passive Resistance (R) along the Fo. length (L-1.5D)	454106.25	454106.25		9CuD*(L-1.5D) lb.
Passive Resistance Factor	0.75	0.75		
Average Shear Strength = 1462.5 psf:				psf
Factored Passive Resistance (R) along the Fo. Lengt	340579.69	340579.69		lb.
Moment of Force R as MA_R , Moment about the base= (L-1.5D)/2=5.75'				ft
Moment MA_R =	1958333.20	1958333.20		lb.-ft
Capacity: Demand Ratio (CDR) =	4079.86	12.36		**OK**

	Strength I	Extreme I	Service I	
Shaft 2 Front Row				
Wind Factored Load (Fy):	-20.00	3300.00		lb.
Moment of Force Fv as MA_{Fy} , Moment about the base (L)= 16'				ft
MA_{Fy} =	-320.00	52800.00		lb.-ft
Passive Resistance (R) along the Fo. length (L-1.5D)	454106.25	454106.25		9CuD*(L-1.5D) lb.
Passive Resistance Factor	0.75	0.75		
Average Shear Strength = 1462.5 psf:				
Factored Passive Resistance (R) along the Fo. Lengt	340579.6875	340579.6875		lb.
Moment of Force R as MA_R , Moment about the base= (L-1.5D)/2=5.75'				ft
Moment MA_R =	1958333.20	1958333.20		lb.-ft
Capacity: Demand Ratio (CDR) =	6119.79	37.09		**OK**

<u>Lateral Resistance Check</u> **AASHTO LRFD Section 10.8.3.9**

		Extreme I	Service I	
Shaft 1 Back Row				
Lateral Deflection at Minimum Length of Drilled Shaft:	4.8'	0.24558		inch
p-multiplier (P_m) as per AASHTO LRFD BDS 10.7.2.4		0.4		
		0.0982		
Lateral Deflection at Full Length of Drilled Shaft:	16.0'	0.0196		inch
Capacity: Demand Ratio (CDR_L) to provide Lateral Restraint:		5.01		**OK**
Shaft 2 Front Row				
Lateral Deflection at Minimum Length of Drilled Shaft:	4.0'	0.06003		inch
p-multiplier (P_m) as per AASHTO LRFD BDS 10.7.2.4		0.8		
		0.0480		
Lateral Deflection at Full Length of Drilled Shaft:	16.0'	0.00417		inch
Capacity: Demand Ratio (CDR_L) to provide Lateral Restraint:		11.52		**OK**

<u>Flexural Moment Resistance Chec</u> **AASHTO LRFD Section 10.8.3.9**

	Strength I	Extreme I	Service I	
Shaft 1 Back Row				
Maximum Moment:		-996520		inch-lbs.
Nominal Moment Capacity		8709733		inch-lbs.
Flexural Resistance Factor	0.90	1.00		
Factored Moment Capacity		8709733		inch-lbs.
Capacity: Demand Ratio:		8.74		**OK**
Shaft 2 Front Row				
Maximum Moment		-266503		inch-lbs.
Nominal Moment Capacity		7653856		inch-lbs.
Flexural Resistance Factor	0.90	1.00		
Factored Moment Capacity		7653856		inch-lbs.
Capacity: Demand Ratio:		28.72		**OK**

<u>Shear Resistance Check</u> **AASHTO LRFD Section 10.8.3.9**

	Strength I	Extreme I	Service I	
Shaft 1 Back Row				
Maximum Shear		9900		lbs.
Nominal Structural Shear Capacity as per AASHTO LRFD BDS Article 5.7		183980		lbs.
Strength Reduction Factor	0.90	1.00		
Factored Structural Shear Capacity		183980		lbs.
Capacity: Demand Ratio:		18.58		**OK**
Shaft 2 Front Row				
Maximum Shear		3300		lbs.
Nominal Structural Shear Capacity as per AASHTO LRFD BDS Article 5.7		183980		lbs.
Strength Reduction Factor	0.90	1.00		
Factored Structural Shear Capacity		183980		lbs.
Capacity: Demand Ratio:		55.75		**OK**

Since Capacity/Demand Ratio of all the Checks were greater than 1.0, the proposed length of the drilled shaft to be used is 16'.

Project: OTIC 71-24-02 **Site Location:** DMS #2 EB - Median Drilled Shafts, B-002-0-25
Calculated By: SS **Checked by:** WN
Date: 9/16/2025

SPECIAL FOUNDATION DESIGN ANALYSIS

Span Truss:
Span Length = 70.00 ft
Truss Hight (H) = ft

Drilled Shaft:
Diameter (D) = 3.00 ft
Total Foundation Length (L) 16.00 ft
The Above Grade Length = 0.00 ft
Drilled Shaft Volume = 113.10 cubic ft.
Concrete Unit Weight = 150.00 Pcf

Soil Properties: Foundation Soil Units
Ave. Soil Unit Weight = 119.40 Pcf
Internal Friction Angle ϕ (digs) = degrees
Ave. Shear Strength of Soil (C_u) = 1462.5 psf
K_p =
Groundwater Level Depth BGS = 3.000 ft.

Resistance Factors
Side Resistance Factor in Clay φ_{stat} = 0.45 BDM Table 305-1
Tip Resistance Factor in Clay φ_{stst} = 0.40 BDM Table 305-1
Uplift Resistance Factor in Clay φ_{up} = 0.35 BDM Table 305-1
Passive Resistance Factor (Extreme I) 0.75 AASHTO Table 11.5.7-1
Passive Resistance Factor (Strength I) 0.75 AASHTO Table 11.5.7-1
Passive Resistance Factor (Service I) 1.00 AASHTO Table 11.5.7-1

AASHTO LRFDLTS Table. 3.4-1

Limit State	Reference Articles	Permanent Dead Load (DC) Max/Min	Transient Dead Load (DC) Mean	Live Load (LL)	Wind (W)	
Strength I - Gravity	**3.5, 3.6, and 3.7**	**1.25**	**1.60**			
Extreme I - Wind	**3.5, 3.8, and 3.9**	**1.1/0.9**			**1.0[a]**	
Service 1 - Translation	**10.40**		**1.00**		**1.0[b]**	
a. Use Figures 3.8-1, 3.8-2, or 3.8-3 (for appropriate return period) b. Use wind map 3.8-4 (service)						

The Following are reaction Factored Loads for ITS-3513 Design No. 1, at the top of the Drilled Shaft 1 & 2 to be installed at the Shoulder

Limit State	Shaft	Fz (lb.)	Fy (lb.)	Mu(in-lb.)				
Strength I	1	27790.00	10.00	138120.00				
Strength I	2	24090.00	-20.00	140880.00				
Extreme I	1	46960.00	3120.00	29880.00				
Extreme I	2	-5160.00	6800.00	247440.00				
Service I	1							
Service I	2							

Bearing Resistance Check **AASHTO LRFD Section 10.8.3.5**

Check on Shoulder Column		**Strength I**	**Extreme I**	**Service I**	
Axial Factored Design Load:		27790.00	46960.00		lb.
Nominal Side Resistance :		99380.00	99380.00		lb.
Side Resistance Factor in Clay:	φ_{stat}	0.45	1.00		
Nominal Tip Resistance:		67640.00	67640.00		lb.
Tip Resistance Factor in Clay:	φ_{stat}	0.40	1.00		
Factored Side Resistance :		44721.00	99380.00		lb.
Factored Tip Resistance:		27056.00	67640.00		lb.
Total Factored Bearing Resistance:		71777.00	167020.00		lb.
Capacity: Demand Ratio (CDR):		2.58	3.56		**OK**

Uplift Resistance Check **AASHTO LRFD Section 10.8.3.7.2**

		Strength I	**Extreme I**	**Service I**	
Uplift Factored Design Load:			-5160.00		lb.
Nominal Side Resistance :			99380.00		lb.
Uplift Resistance Factor:	Reduction Factor = 0.8 as per LRFD 10.5.5.3.3	φ_{up} = 0.35	1.00		
Factored Side Resistance :			79504.00		
Drilled Shaft Concrete Weight:			16965.00		lb.
DC Load Factor:			0.90		
Factored Concrete Weight:			15268.50		lb.
Total Resistance:			94772.50		lb.
Capacity: Demand Ratio (CDR):			18.37		**OK**

Brom's Method with Strength Limit State Load Factors and Resistance Factors , in accordance with the commentary in LRFD C11.8.4.1.

Drilled Shaft Passive Resistance is calculated as $9c_uD$ over the Length excluding a top length equal to 1.5D where D = drilled shaft Diameter L-1.5D = 11.50 ft.

	Strength I	Extreme I	Service I	
Shaft 1 Back Row				
Wind Factored Load (Fy):	10.00	3120.00		lb.
Moment of Force Fv as MA_{Fy} , Moment about the base (L)= 16'				ft
MA_{Fy} =	160.00	49920.00		lb.-ft
Passive Resistance (R) along the Fo. length (L-1.5D)	454106.25	454106.25		9CuD*(L-1.5D) lb.
Passive Resistance Factor	0.75	0.75		
Average Shear Strength = 1462.5 psf:				psf
Factored Passive Resistance (R) along the Fo. Lengt	340579.69	340579.69		lb.
Moment of Force R as MA_R , Moment about the base= (L-1.5D)/2=5.75'				ft
Moment MA_R =	1958333.20	1958333.20		lb.-ft
Capacity: Demand Ratio (CDR) =	12239.58	39.23		**OK**

	Strength I	Extreme I	Service I	
Shaft 2 Front Row				
Wind Factored Load (Fy):	-20.00	6800.00		lb.
Moment of Force Fv as MA_{Fy} , Moment about the base (L)= 16'				ft
MA_{Fy} =	-320.00	108800.00		lb.-ft
Passive Resistance (R) along the Fo. length (L-1.5D)	454106.25	454106.25		9CuD*(L-1.5D) lb.
Passive Resistance Factor	0.75	0.75		
Average Shear Strength = 1462.5 psf:				
Factored Passive Resistance (R) along the Fo. Lengt	340579.6875	340579.6875		lb.
Moment of Force R as MA_R , Moment about the base= (L-1.5D)/2=5.75'				ft
Moment MA_R =	1958333.20	1958333.20		lb.-ft
Capacity: Demand Ratio (CDR) =	-6119.79	18.00		**OK**

Lateral Resistance Check **AASHTO LRFD Section 10.8.3.9**

		Extreme I	Service I	
Shaft 1 Back Row				
Lateral Deflection at Minimum Length of Drilled Shaft:	4.0'	0.12678		inch
p-multiplier (P_m) as per AASHTO LRFD BDS 10.7.2.4		0.4		
		0.0507		
Lateral Deflection at Full Length of Drilled Shaft:	16.0'	0.00597		inch
Capacity: Demand Ratio (CDR_L) to provide Lateral Restraint:		8.49		**OK**
Shaft 2 Front Row				
Lateral Deflection at Minimum Length of Drilled Shaft:	4.0'	0.14004		inch
p-multiplier (P_m) as per AASHTO LRFD BDS 10.7.2.4		0.8		
		0.1120		
Lateral Deflection at Full Length of Drilled Shaft:	16.0'	0.00896		inch
Capacity: Demand Ratio (CDR_L) to provide Lateral Restraint:		12.50		**OK**

Flexural Moment Resistance Che **AASHTO LRFD Section 10.8.3.9**

	Strength I	Extreme I	Service I	
Shaft 1 Back Row				
Maximum Moment:		-304493		inch-lbs.
Nominal Moment Capacity		8561256		inch-lbs.
Flexural Resistance Factor	0.90	1.00		
Factored Moment Capacity		8561256		inch-lbs.
Capacity: Demand Ratio:		28.12		**OK**
Shaft 2 Front Row				
Maximum Moment		-567776		inch-lbs.
Nominal Moment Capacity		7976223		inch-lbs.
Flexural Resistance Factor	0.90	1.00		
Factored Moment Capacity		7976223		inch-lbs.
Capacity: Demand Ratio:		14.05		**OK**

Shear Resistance Check **AASHTO LRFD Section 10.8.3.9**

	Strength I	Extreme I	Service I	
Shaft 1 Back Row				
Maximum Shear		3120		lbs.
Nominal Structural Shear Capacity as per AASHTO LRFD BDS Article 5.7		183980		lbs.
Strength Reduction Factor	0.90	1.00		
Factored Structural Shear Capacity		183980		lbs.
Capacity: Demand Ratio:		58.97		**OK**
Shaft 2 Front Row				
Maximum Shear		6800		lbs.
Nominal Structural Shear Capacity as per AASHTO LRFD BDS Article 5.7		183980		lbs.
Strength Reduction Factor	0.90	1.00		
Factored Structural Shear Capacity		183980		lbs.
Capacity: Demand Ratio:		27.06		**OK**

Since Capacity/Demand Ratio of all the Checks were greater than 1.0, the proposed length of the drilled shaft to be used is 16'.

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

                  SHAFT for Windows, Version 2012.7.8

                   Serial Number :  292797964

                VERTICALLY LOADED DRILLED SHAFT ANALYSIS
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=============================================================================


Path to file locations      : M:\Project Files\25 Projects\G25003G Baker-OTIC
71-24-02\Analysis File Folder\Drilled Shaft Folder\DMS #2 EB folder\
Name of input data file     : B-002Shaft.sfd
Name of output file         : B-002Shaft.sfo
Name of plot output file    : B-002Shaft.sfp
Name of runtime file        : B-002Shaft.sfr


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

          Date:  July 30, 2025     Time:  17:47:23

OTIC 71-24-02 -  B-002 -0-25


PROPOSED DEPTH =      16.0 FT
----------------


NUMBER OF LAYERS =    5
------------------


WATER TABLE DEPTH =       3.0 FT.
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SOIL INFORMATION
---------------

LAYER NO 1----CLAY

  AT THE TOP
```

```
  STRENGTH REDUCTION FACTOR-ALPHA                      = 0.550E+00
  END BEARING COEFFICIENT-Nc                           = 0.600E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                   = 0.250E+03
  INTERNAL FRICTION ANGLE, DEG.                        = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST        = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                           = 0.120E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT             = 0.100E+11
  DEPTH, FT                                            = 0.000E+00


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                      = 0.550E+00
  END BEARING COEFFICIENT-Nc                           = 0.720E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                   = 0.250E+03
  INTERNAL FRICTION ANGLE, DEG.                        = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST        = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                           = 0.120E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT             = 0.100E+11
  DEPTH, FT                                            = 0.300E+01


  LRFD RESISTANCE FACTOR (SIDE FRICTION)               = 0.450E+00
  LRFD RESISTANCE FACTOR (TIP RESISTANCE)              = 0.400E+00


LAYER NO 2----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                      = 0.550E+00
  END BEARING COEFFICIENT-Nc                           = 0.720E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                   = 0.100E+04
  INTERNAL FRICTION ANGLE, DEG.                        = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST        = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                           = 0.118E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT             = 0.100E+11
  DEPTH, FT                                            = 0.300E+01


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                      = 0.550E+00
  END BEARING COEFFICIENT-Nc                           = 0.840E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                   = 0.100E+04
  INTERNAL FRICTION ANGLE, DEG.                        = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST        = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                           = 0.118E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT             = 0.100E+11
```

```
  DEPTH, FT                                          = 0.600E+01


  LRFD RESISTANCE FACTOR (SIDE FRICTION)             = 0.450E+00
  LRFD RESISTANCE FACTOR (TIP RESISTANCE)            = 0.400E+00


LAYER NO 3----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
  END BEARING COEFFICIENT-Nc                         = 0.840E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.125E+04
  INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.119E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.600E+01


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
  END BEARING COEFFICIENT-Nc                         = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.125E+04
  INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.119E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.850E+01


  LRFD RESISTANCE FACTOR (SIDE FRICTION)             = 0.450E+00
  LRFD RESISTANCE FACTOR (TIP RESISTANCE)            = 0.400E+00


LAYER NO 4----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
  END BEARING COEFFICIENT-Nc                         = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.167E+04
  INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.120E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.850E+01
```

```
  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                     = 0.550E+00
  END BEARING COEFFICIENT-Nc                          = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                  = 0.167E+04
  INTERNAL FRICTION ANGLE, DEG.                       = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST       = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                          = 0.120E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT            = 0.100E+11
  DEPTH, FT                                           = 0.160E+02


  LRFD RESISTANCE FACTOR (SIDE FRICTION)              = 0.450E+00
  LRFD RESISTANCE FACTOR (TIP RESISTANCE)             = 0.400E+00


LAYER NO 5----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                     = 0.550E+00
  END BEARING COEFFICIENT-Nc                          = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                  = 0.106E+04
  INTERNAL FRICTION ANGLE, DEG.                       = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST       = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                          = 0.117E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT            = 0.100E+11
  DEPTH, FT                                           = 0.160E+02


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                     = 0.550E+00
  END BEARING COEFFICIENT-Nc                          = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                  = 0.106E+04
  INTERNAL FRICTION ANGLE, DEG.                       = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST       = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                          = 0.117E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT            = 0.100E+11
  DEPTH, FT                                           = 0.250E+02


  LRFD RESISTANCE FACTOR (SIDE FRICTION)              = 0.450E+00
  LRFD RESISTANCE FACTOR (TIP RESISTANCE)             = 0.400E+00



DRILLED SHAFT INFORMATION
```

DIAMETER OF STEM	= 3.000	FT.
DIAMETER OF BASE	= 3.000	FT.
END OF STEM TO BASE	= 0.000	FT.
ANGLE OF BELL	= 0.000	DEG.
IGNORED TOP PORTION	= 0.000	FT.
IGNORED BOTTOM PORTION	= 0.000	FT.
AREA OF ONE PERCENT STEEL	= 10.180	SQ.IN.
ELASTIC MODULUS, Ec	= 0.360E+07	LB/SQ IN
VOLUME OF UNDERREAM	= 0.000	CU.YDS.

PREDICTED RESULTS

QS = ULTIMATE SIDE RESISTANCE;
QB = ULTIMATE BASE RESISTANCE;
WT = WEIGHT OF DRILLED SHAFT (UPLIFT CAPACITY ONLY);
QU = TOTAL ULTIMATE RESISTANCE;
LRFD QS = TOTAL SIDE FRICTION USING LRFD RESISTANCE FACTOR TO THE ULTIMATE SIDE RESISTANCE;
LRFD QB = TOTAL BASE BEARING USING LRFD RESISTANCE FACTOR TO THE ULTIMATE BASE RESISTANCE
LRFD QU = TOTAL CAPACITY WITH LRFD RESISTANCE FACTOR.

LENGTH (FEET)	VOLUME (CU.YDS)	QS (TONS)	QB (TONS)	QU (TONS)	LRFD QS (TONS)	LRFD QB (TONS)	LRFD QU (TONS)
1.0	0.26	0.65	28.43	29.08	0.29	11.37	11.66
2.0	0.52	1.30	33.14	34.44	0.58	13.26	13.84
3.0	0.79	1.94	36.19	38.14	0.87	14.48	15.35
4.0	1.05	4.54	41.10	45.64	2.04	16.44	18.48
5.0	1.31	7.13	45.47	52.60	3.21	18.19	21.40
6.0	1.57	9.72	49.33	59.05	4.37	19.73	24.11
7.0	1.83	12.96	51.83	64.79	5.83	20.73	26.56
8.0	2.09	16.20	53.03	69.23	7.29	21.21	28.50
9.0	2.36	19.44	53.03	72.47	8.75	21.21	29.96
10.0	2.62	23.76	53.03	76.79	10.69	21.21	31.91
11.0	2.88	28.08	48.96	77.04	12.64	19.58	32.22
12.0	3.14	32.40	44.30	76.70	14.58	17.72	32.30
13.0	3.40	36.73	39.06	75.78	16.53	15.62	32.15
14.0	3.67	41.05	35.56	76.61	18.47	14.23	32.70
15.0	3.93	45.37	33.82	79.18	20.42	13.53	33.94
16.0	4.19	49.69	33.82	83.51	22.36	13.53	35.89

RESULT FROM TREND (AVERAGED) LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.7550E-02	0.1052E-04	0.7421E-03	0.1000E-04
0.3775E-01	0.5262E-04	0.3710E-02	0.5000E-04
0.7550E-01	0.1052E-03	0.7421E-02	0.1000E-03
0.3775E+01	0.5262E-02	0.3710E+00	0.5000E-02
0.5662E+01	0.7893E-02	0.5566E+00	0.7500E-02
0.7550E+01	0.1052E-01	0.7421E+00	0.1000E-01
0.1887E+02	0.2631E-01	0.1855E+01	0.2500E-01
0.3196E+02	0.5225E-01	0.3710E+01	0.5000E-01
0.4065E+02	0.7789E-01	0.5566E+01	0.7500E-01
0.4849E+02	0.1035E+00	0.7421E+01	0.1000E+00
0.6067E+02	0.2546E+00	0.1553E+02	0.2500E+00
0.6600E+02	0.5052E+00	0.2262E+02	0.5000E+00
0.6668E+02	0.6304E+00	0.2499E+02	0.6250E+00
0.6893E+02	0.9057E+00	0.2925E+02	0.9000E+00
0.7248E+02	0.1806E+01	0.3280E+02	0.1800E+01

RESULT FROM UPPER-BOUND LINE

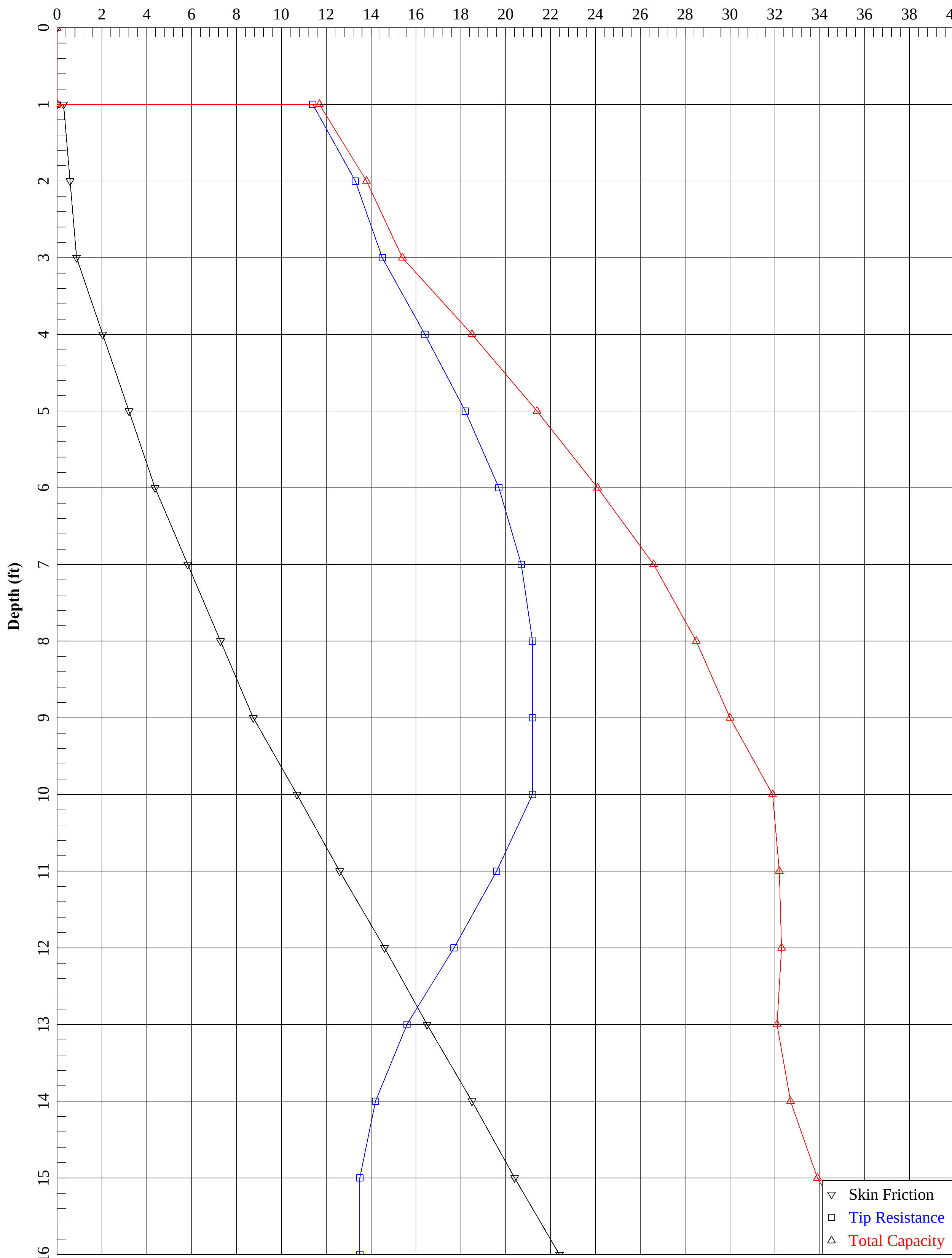
TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.1104E-01	0.1077E-04	0.1108E-02	0.1000E-04
0.5518E-01	0.5383E-04	0.5542E-02	0.5000E-04
0.1104E+00	0.1077E-03	0.1108E-01	0.1000E-03
0.5518E+01	0.5383E-02	0.5542E+00	0.5000E-02
0.8278E+01	0.8075E-02	0.8313E+00	0.7500E-02
0.1104E+02	0.1077E-01	0.1108E+01	0.1000E-01
0.2759E+02	0.2692E-01	0.2771E+01	0.2500E-01
0.4421E+02	0.5312E-01	0.5542E+01	0.5000E-01
0.5229E+02	0.7877E-01	0.8313E+01	0.7500E-01
0.5672E+02	0.1042E+00	0.1108E+02	0.1000E+00
0.7053E+02	0.2555E+00	0.2206E+02	0.2500E+00
0.7486E+02	0.5060E+00	0.2826E+02	0.5000E+00
0.7483E+02	0.6311E+00	0.2988E+02	0.6250E+00
0.7618E+02	0.9063E+00	0.3246E+02	0.9000E+00
0.7737E+02	0.1806E+01	0.3365E+02	0.1800E+01

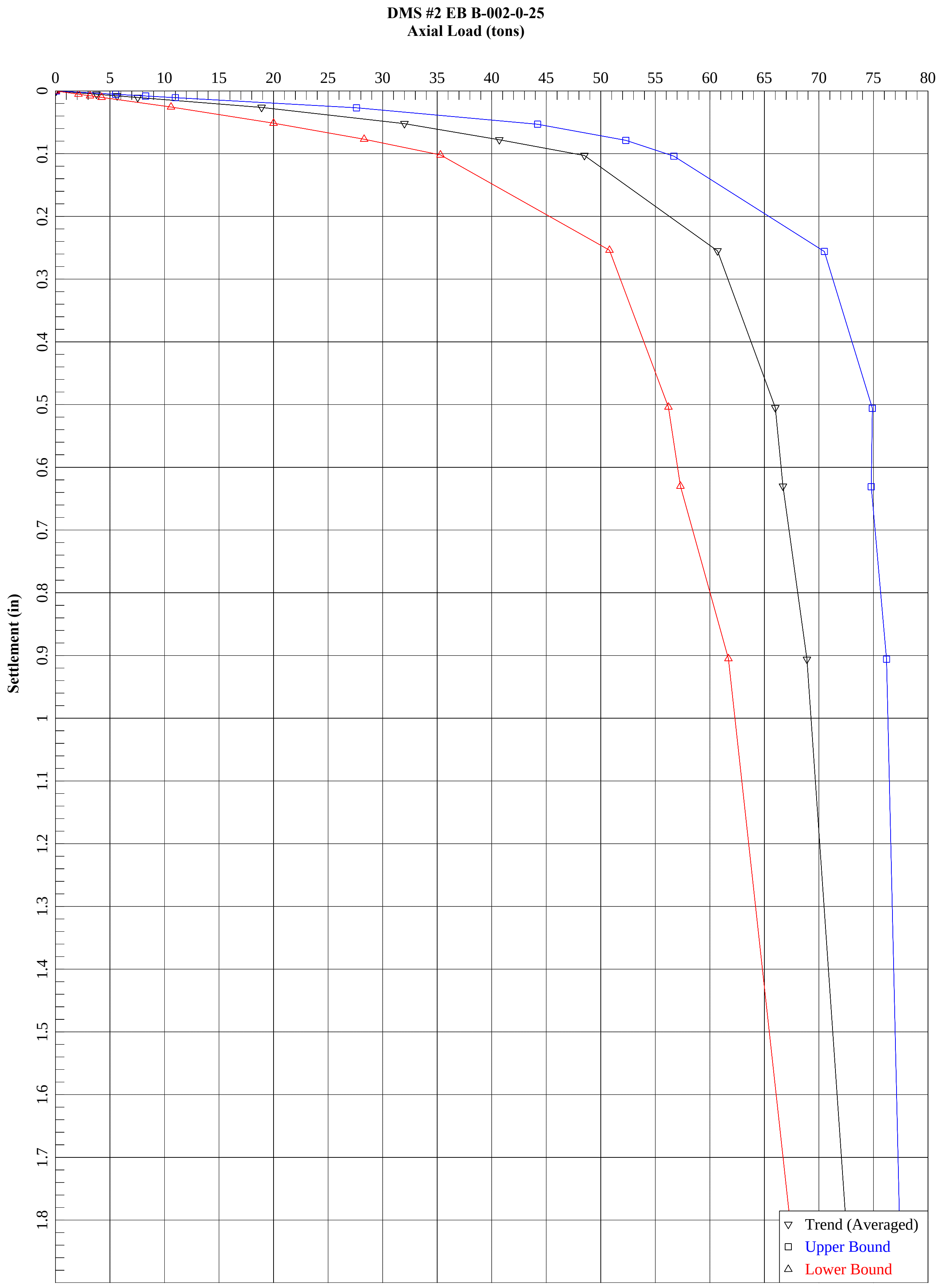
RESULT FROM LOWER-BOUND LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.4228E-02	0.1029E-04	0.3757E-03	0.1000E-04
0.2114E-01	0.5146E-04	0.1879E-02	0.5000E-04
0.4228E-01	0.1029E-03	0.3757E-02	0.1000E-03

0.2114E+01	0.5146E-02	0.1879E+00	0.5000E-02
0.3171E+01	0.7719E-02	0.2818E+00	0.7500E-02
0.4228E+01	0.1029E-01	0.3757E+00	0.1000E-01
0.1057E+02	0.2573E-01	0.9394E+00	0.2500E-01
0.2000E+02	0.5139E-01	0.1879E+01	0.5000E-01
0.2834E+02	0.7697E-01	0.2818E+01	0.7500E-01
0.3525E+02	0.1025E+00	0.3757E+01	0.1000E+00
0.5080E+02	0.2537E+00	0.8999E+01	0.2500E+00
0.5624E+02	0.5044E+00	0.1698E+02	0.5000E+00
0.5729E+02	0.6296E+00	0.2010E+02	0.6250E+00
0.6168E+02	0.9051E+00	0.2604E+02	0.9000E+00
0.6743E+02	0.1806E+01	0.3179E+02	0.1800E+01

DMS #2 EB B-002-0-25
LRFD Resistance (tons)





DMS #2 EB B-002-0-25
Axial Load (tons)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
Settlement (in)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1.1
1.2
1.3
1.4
1.5
1.6
1.7
1.8
Trend (Averaged)
Upper Bound
Lower Bound

Project: OTIC 71-24-02 **Site Location:** DMS #4 EB - Shoulder Drilled Shaft, B-006-0-25
Calculated By: SS **Checked by:** WN
Date: 9/17/2025

SPECIAL FOUNDATION DESIGN ANALYSIS

Span Truss:
Span Length = 70.00 ft
Truss Hight (H) = ft

Drilled Shaft:
Diameter (D) = 3.00 ft
Total Foundation Length (L) 16.00 ft
The Above Grade Length = 0.00 ft
Drilled Shaft Volume = 113.10 cubic ft.
Concrete Unit Weight = 150.00 Pcf

Soil Properties: Foundation Soil Units
Ave. Soil Unit Weight = 119.40 Pcf
Internal Friction Angle ϕ (digs) = degrees
Ave. Shear Strength of Soil (C_u) = 1375 psf
K_p =
Groundwater Level Depth BGS = 3.000 ft.

Resistance Factors
Side Resistance Factor in Clay φ_{stat} = 0.45 BDM Table 305-1
Tip Resistance Factor in Clay φ_{stst} = 0.40 BDM Table 305-1
Uplift Resistance Factor in Clay φ_{up} = 0.35 BDM Table 305-1
Passive Resistance Factor (Extreme I) 0.75 AASHTO Table 11.5.7-1
Passive Resistance Factor (Strength I) 0.75 AASHTO Table 11.5.7-1
Passive Resistance Factor (Service I) 1.00 AASHTO Table 11.5.7-1

AASHTO LRFDLTS Table. 3.4-1

Limit State	Reference Articles	Permanent Dead Load (DC) Max/Min	Dead Load (DC) Mean	Transient Live Load (LL)	Wind (W)	
Strength I - Gravity	**3.5, 3.6, and 3.7**	**1.25**	**1.60**			
Extreme I - Wind	**3.5, 3.8, and 3.9**	**1.1/0.9**			**1.0[a]**	
Service 1 - Translation	**10.40**		**1.00**		**1.0[b]**	
a. Use Figures 3.8-1, 3.8-2, or 3.8-3 (for appropriate return period) b. Use wind map 3.8-4 (service)						

The Following are reaction Factored Loads for ITS-3513 Design No. 1, at the top of the Drilled Shaft 1 & 2 to be installed at the Shoulder

Limit State	Shaft	Fz (lb.)	Fy (lb.)	Mu(in-lb.)				
Strength I	1	19550.00	30.00	70680.00				
Strength I	2	14170.00	-20.00	69960.00				
Extreme I	1	60280.00	9900.00	111120.00				
Extreme I	2	-32880.00	3300.00	155880.00				
Service I	1							
Service I	2							

Bearing Resistance Check **AASHTO LRFD Section 10.8.3.5**

		Strength I	Extreme I	Service I	
Check on Shoulder Column					
Axial Factored Design Load:		19550.00	60280.00		lb.
Nominal Side Resistance :		96560.00	96560.00		lb.
Side Resistance Factor in Clay:	φ_{stat}	0.45	1.00		
Nominal Tip Resistance:		362960.00	362960.00		lb.
Tip Resistance Factor in Clay:	φ_{stat}	0.40	1.00		
Factored Side Resistance :		43452.00	96560.00		lb.
Factored Tip Resistance:		145184.00	362960.00		lb.
Total Factored Bearing Resistance:		188636.00	459520.00		lb.
Capacity: Demand Ratio (CDR):		9.65	7.62		**OK**

Uplift Resistance Check **AASHTO LRFD Section 10.8.3.7.2**

		Strength I	Extreme I	Service I	
Uplift Factored Design Load:			-32880.00		lb.
Nominal Side Resistance :			96560.00		lb.
Uplift Resistance Factor:	Reduction Factor = 0.8 as per LRFD 10.5.5.3.3	φ_{up} = 0.35	1.00		
Factored Side Resistance :			77248.00		
Drilled Shaft Concrete Weight:			16965.00		lb.
DC Load Factor:			0.90		
Factored Concrete Weight:			15268.50		lb.
Total Resistance:			92516.50		lb.
Capacity: Demand Ratio (CDR):			2.81		**OK**

Brom's Method with Strength Limit State Load Factors and Resistance Factors , in accordance with the commentary in LRFD C11.8.4.1.

Drilled Shaft Passive Resistance is calculated as $9c_uD$ over the Length excluding a top length equal to 1.5D where D = drilled shaft Diameter L-1.5D = 11.50 ft.

	Strength I	Extreme I	Service I	
Shaft 1 Back Row				
Wind Factored Load (Fy):	30.00	9900.00		lb.
Moment of Force Fv as MA_{Fy} , Moment about the base (L)= 16'				ft
MA_{Fy} =	480.00	158400.00		lb.-ft
Passive Resistance (R) along the Fo. length (L-1.5D)	426937.50	426937.50		9CuD*(L-1.5D) lb.
Passive Resistance Factor	0.75	0.75		
Average Shear Strength of Soil = 1375 psf:				psf
Factored Passive Resistance (R) along the Fo. Lengt	320203.13	320203.13		lb.
Moment of Force R as MA_R , Moment about the base= (L-1.5D)/2=5.75'				ft
Moment MA_R =	1841167.97	1841167.97		lb.-ft
Capacity: Demand Ratio (CDR) =	3835.77	11.62		**OK**

	Strength I	Extreme I	Service I	
Shaft 2 Front Row				
Wind Factored Load (Fy):	-20.00	3300.00		lb.
Moment of Force Fv as MA_{Fy} , Moment about the base (L)= 16'				ft
MA_{Fy} =	-320.00	52800.00		lb.-ft
Passive Resistance (R) along the Fo. length (L-1.5D)	426937.50	426937.50		9CuD*(L-1.5D) lb.
Passive Resistance Factor	0.75	0.75		
Average Shear Strength = 1375 psf:				
Factored Passive Resistance (R) along the Fo. Lengt	320203.125	320203.125		lb.
Moment of Force R as MA_R , Moment about the base= (L-1.5D)/2=5.75'				ft
Moment MA_R =	1841167.97	1841167.97		lb.-ft
Capacity: Demand Ratio (CDR) =	5753.65	34.87		**OK**

Lateral Resistance Check **AASHTO LRFD Section 10.8.3.9**

		Extreme I	Service I	
Shaft 1 Back Row				
Lateral Deflection at Minimum Length of Drilled Shaft:	4.0'	0.41554		inch
p-multiplier (P_m) as per AASHTO LRFD BDS 10.7.2.4		0.4		
		0.1662		
Lateral Deflection at Full Length of Drilled Shaft:	16.0'	0.01737		inch
Capacity: Demand Ratio (CDR_L) to provide Lateral Restraint:		9.57		**OK**
Shaft 2 Front Row				
Lateral Deflection at Minimum Length of Drilled Shaft:	4.0'	0.0262		inch
p-multiplier (P_m) as per AASHTO LRFD BDS 10.7.2.4		0.8		
		0.0210		
Lateral Deflection at Full Length of Drilled Shaft:	16.0'	0.00355		inch
Capacity: Demand Ratio (CDR_L) to provide Lateral Restraint:		5.90		**OK**

Flexural Moment Resistance Chec **AASHTO LRFD Section 10.8.3.9**

	Strength I	Extreme I	Service I	
Shaft 1 Back Row				
Maximum Moment:		-903859		inch-lbs.
Nominal Moment Capacity		8709733		inch-lbs.
Flexural Resistance Factor	0.90	1.00		
Factored Moment Capacity		8709733		inch-lbs.
Capacity: Demand Ratio:		9.64		**OK**
Shaft 2 Front Row				
Maximum Moment		-241031		inch-lbs.
Nominal Moment Capacity		7653856		inch-lbs.
Flexural Resistance Factor	0.90	1.00		
Factored Moment Capacity		7653856		inch-lbs.
Capacity: Demand Ratio:		31.75		**OK**

Shear Resistance Check **AASHTO LRFD Section 10.8.3.9**

	Strength I	Extreme I	Service I	
Shaft 1 Back Row				
Maximum Shear		9900		lbs.
Nominal Structural Shear Capacity as per AASHTO LRFD BDS Article 5.7		183980		lbs.
Strength Reduction Factor	0.90	1.00		
Factored Structural Shear Capacity		183980		lbs.
Capacity: Demand Ratio:		18.58		**OK**
Shaft 2 Front Row				
Maximum Shear		3300		lbs.
Nominal Structural Shear Capacity as per AASHTO LRFD BDS Article 5.7		183980		lbs.
Strength Reduction Factor	0.90	1.00		
Factored Structural Shear Capacity		183980		lbs.
Capacity: Demand Ratio:		55.75		**OK**

Since Capacity/Demand Ratio of all the Checks were greater than 1.0, the proposed length of the drilled shaft to be used is 16'.

Project: OTIC 71-24-02 **Site Location:** DMS #4 EB - Median Drilled Shaft, B-006-0-25
Calculated By: SS **Checked by:** WN
Date: 9/17/2025

SPECIAL FOUNDATION DESIGN ANALYSIS

Span Truss:
Span Length = 70.00 ft
Truss Hight (H) = ft

Drilled Shaft:
Diameter (D) = 3.00 ft
Total Foundation Length (L) 16.00 ft
The Above Grade Length = 0.00 ft
Drilled Shaft Volume = 113.10 cubic ft.
Concrete Unit Weight = 150.00 Pcf

Soil Properties: Foundation Soil Units
Ave. Soil Unit Weight = 119.40 Pcf
Internal Friction Angle ϕ (digs) = degrees
Ave. Shear Strength of Soil (C_u) = 1375 psf
K_p =
Groundwater Level Depth BGS = 3.000 ft.

Resistance Factors
Side Resistance Factor in Clay φ_{stat} = 0.45 BDM Table 305-1
Tip Resistance Factor in Clay φ_{stst} = 0.40 BDM Table 305-1
Uplift Resistance Factor in Clay φ_{up} = 0.35 BDM Table 305-1
Passive Resistance Factor (Extreme I) 0.75 AASHTO Table 11.5.7-1
Passive Resistance Factor (Strength I) 0.75 AASHTO Table 11.5.7-1
Passive Resistance Factor (Service I) 1.00 AASHTO Table 11.5.7-1

AASHTO LRFDLTS Table. 3.4-1

		Permanent		Transient		
Limit State	**Reference Articles**	**Dead Load (DC) Max/Min**	**Dead Load (DC) Mean**	**Live Load (LL)**	**Wind (W)**	
Strength I - Gravity	**3.5, 3.6, and 3.7**	**1.25**	**1.60**			
Extreme I - Wind	**3.5, 3.8, and 3.9**	**1.1/0.9**			**1.0[a]**	
Service 1 - Translation	**10.40**		**1.00**		**1.0[b]**	
a. Use Figures 3.8-1, 3.8-2, or 3.8-3 (for appropriate return period) b. Use wind map 3.8-4 (service)						

The Following are reaction Factored Loads for ITS-3513 Design No. 1, at the top of the Drilled Shaft 1 & 2 to be installed at the Shoulder

Limit State	**Shaft**	**Fz (lb.)**	**Fy (lb.)**	**Mu(in-lb.)**				
Strength I	1	27790.00	10.00	138120.00				
Strength I	2	24090.00	-20.00	140880.00				
Extreme I	1	46960.00	3120.00	29880.00				
Extreme I	2	-5160.00	6800.00	247440.00				
Service I	1							
Service I	2							

Bearing Resistance Check **AASHTO LRFD Section 10.8.3.5**

		Strength I	**Extreme I**	**Service I**	
Check on Shoulder Column					
Axial Factored Design Load:		27790.00	46960.00		lb.
Nominal Side Resistance :		96560.00	96560.00		lb.
Side Resistance Factor in Clay:	φ_{stat}	0.45	1.00		
Nominal Tip Resistance:		362960.00	362960.00		lb.
Tip Resistance Factor in Clay:	φ_{stat}	0.40	1.00		
Factored Side Resistance :		43452.00	96560.00		lb.
Factored Tip Resistance:		145184.00	362960.00		lb.
Total Factored Bearing Resistance:		188636.00	459520.00		lb.
Capacity: Demand Ratio (CDR):		6.79	9.79		**OK**

Uplift Resistance Check **AASHTO LRFD Section 10.8.3.7.2**

		Strength I	**Extreme I**	**Service I**	
Uplift Factored Design Load:			-5160.00		lb.
Nominal Side Resistance :			96560.00		lb.
Uplift Resistance Factor:	Reduction Factor = 0.8 as per LRFD 10.5.5.3.3	φ_{up} = 0.35	1.00		
Factored Side Resistance :			77248.00		
Drilled Shaft Concrete Weight:			16965.00		lb.
DC Load Factor:			0.90		
Factored Concrete Weight:			15268.50		lb.
Total Resistance:			92516.50		lb.
Capacity: Demand Ratio (CDR):			17.93		**OK**

Brom's Method with Strength Limit State Load Factors and Resistance Factors , in accordance with the commentary in LRFD C11.8.4.1.

Drilled Shaft Passive Resistance is calculated as $9c_uD$ over the Length excluding a top length equal to 1.5D where D = drilled shaft Diameter L-1.5D = 11.50 ft.

	Strength I	Extreme I	Service I	
Shaft 1 Back Row				
Wind Factored Load (Fy):	10.00	3120.00		lb.
Moment of Force Fv as MA_{Fy} , Moment about the base (L)= 16'				ft
MA_{Fy} =	160.00	49920.00		lb.-ft
Passive Resistance (R) along the Fo. length (L-1.5D)	426937.50	426937.50		9CuD*(L-1.5D) lb.
Passive Resistance Factor	0.75	0.75		
Average Shear Strength = 1375 psf:				psf
Factored Passive Resistance (R) along the Fo. Lengt	320203.13	320203.13		lb.
Moment of Force R as MA_R , Moment about the base= (L-1.5D)/2=5.75'				ft
Moment MA_R =	1841167.97	1841167.97		lb.-ft
Capacity: Demand Ratio (CDR) =	11507.30	36.88		**OK**

	Strength I	Extreme I	Service I	
Shaft 2 Front Row				
Wind Factored Load (Fy):	-20.00	6800.00		lb.
Moment of Force Fv as MA_{Fy} , Moment about the base (L)= 16'				ft
MA_{Fy} =	-320.00	108800.00		lb.-ft
Passive Resistance (R) along the Fo. length (L-1.5D)	426937.50	426937.50		9CuD*(L-1.5D) lb.
Passive Resistance Factor	0.75	0.75		
Average Shear Strength of Soil= 1375 psf:				
Factored Passive Resistance (R) along the Fo. Lengt	320203.125	320203.125		lb.
Moment of Force R as MA_R , Moment about the base= (L-1.5D)/2=5.75'				ft
Moment MA_R =	1841167.97	1841167.97		lb.-ft
Capacity: Demand Ratio (CDR) =	5753.65	16.92		**OK**

Lateral Resistance Check **AASHTO LRFD Section 10.8.3.9**

		Extreme I	Service I	
Shaft 1 Back Row				
Lateral Deflection at Minimum Length of Drilled Shaft:	4.0'	0.05375		inch
p-multiplier (P_m) as per AASHTO LRFD BDS 10.7.2.4		0.4		
		0.0215		
Lateral Deflection at Full Length of Drilled Shaft:	16.0'	0.005529		inch
Capacity: Demand Ratio (CDR_L) to provide Lateral Restraint:		3.89		**OK**
Shaft 2 Front Row				
Lateral Deflection at Minimum Length of Drilled Shaft:	4.0'	0.05931		inch
p-multiplier (P_m) as per AASHTO LRFD BDS 10.7.2.4		0.8		
		0.0474		
Lateral Deflection at Full Length of Drilled Shaft:	16.0'	0.0076		inch
Capacity: Demand Ratio (CDR_L) to provide Lateral Restraint:		6.24		**OK**

Flexural Moment Resistance Chec **AASHTO LRFD Section 10.8.3.9**

	Strength I	Extreme I	Service I	
Shaft 1 Back Row				
Maximum Moment:		-277554		inch-lbs.
Nominal Moment Capacity		8561256		inch-lbs.
Flexural Resistance Factor	0.90	1.00		
Factored Moment Capacity		8561256		inch-lbs.
Capacity: Demand Ratio:		30.85		**OK**
Shaft 2 Front Row				
Maximum Moment		-512147		inch-lbs.
Nominal Moment Capacity		7976223		inch-lbs.
Flexural Resistance Factor	0.90	1.00		
Factored Moment Capacity		7976223		inch-lbs.
Capacity: Demand Ratio:		15.57		**OK**

Shear Resistance Check **AASHTO LRFD Section 10.8.3.9**

	Strength I	Extreme I	Service I	
Shaft 1 Back Row				
Maximum Shear		3120		lbs.
Nominal Structural Shear Capacity as per AASHTO LRFD BDS Article 5.7		183980		lbs.
Strength Reduction Factor	0.90	1.00		
Factored Structural Shear Capacity		183980		lbs.
Capacity: Demand Ratio:		58.97		**OK**
Shaft 2 Front Row				
Maximum Shear		6800		lbs.
Nominal Structural Shear Capacity as per AASHTO LRFD BDS Article 5.7		183980		lbs.
Strength Reduction Factor	0.90	1.00		
Factored Structural Shear Capacity		183980		lbs.
Capacity: Demand Ratio:		27.06		**OK**

Since Capacity/Demand Ratio of all the Checks were greater than 1.0, the proposed length of the drilled shaft to be used is 16'.

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

                 SHAFT for Windows, Version 2012.7.8

                  Serial Number :  292797964

               VERTICALLY LOADED DRILLED SHAFT ANALYSIS
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                      All Rights Reserved

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


Path to file locations      : M:\Project Files\25 Projects\G25003G Baker-OTIC
71-24-02\Analysis File Folder\Drilled Shaft Folder\DMS #4 EB B-006-0-25\
Name of input data file     : B-006Shaft.sfd
Name of output file         : B-006Shaft.sfo
Name of plot output file    : B-006Shaft.sfp
Name of runtime file        : B-006Shaft.sfr


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

          Date:  August 14, 2025     Time:  16:06:38

DMS #4 EB B-006-0-25


PROPOSED DEPTH =      16.0 FT
----------------


NUMBER OF LAYERS =    5
------------------


WATER TABLE DEPTH =       3.0 FT.
-------------------




SOIL INFORMATION
---------------

LAYER NO 1----CLAY

  AT THE TOP
```

```
  STRENGTH REDUCTION FACTOR-ALPHA                        = 0.550E+00
  END BEARING COEFFICIENT-Nc                             = 0.600E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                     = 0.250E+03
  INTERNAL FRICTION ANGLE, DEG.                          = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST          = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                             = 0.119E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT               = 0.100E+11
  DEPTH, FT                                              = 0.000E+00


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                        = 0.550E+00
  END BEARING COEFFICIENT-Nc                             = 0.720E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                     = 0.250E+03
  INTERNAL FRICTION ANGLE, DEG.                          = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST          = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                             = 0.119E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT               = 0.100E+11
  DEPTH, FT                                              = 0.300E+01


  LRFD RESISTANCE FACTOR (SIDE FRICTION)                 = 0.450E+00
  LRFD RESISTANCE FACTOR (TIP RESISTANCE)                = 0.400E+00


LAYER NO 2----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                        = 0.550E+00
  END BEARING COEFFICIENT-Nc                             = 0.720E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                     = 0.138E+04
  INTERNAL FRICTION ANGLE, DEG.                          = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST          = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                             = 0.120E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT               = 0.100E+11
  DEPTH, FT                                              = 0.300E+01


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                        = 0.550E+00
  END BEARING COEFFICIENT-Nc                             = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                     = 0.138E+04
  INTERNAL FRICTION ANGLE, DEG.                          = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST          = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                             = 0.120E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT               = 0.100E+11
```

```
  DEPTH, FT                                          = 0.110E+02


  LRFD RESISTANCE FACTOR (SIDE FRICTION)             = 0.450E+00
  LRFD RESISTANCE FACTOR (TIP RESISTANCE)            = 0.400E+00


LAYER NO 3----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
  END BEARING COEFFICIENT-Nc                         = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.138E+04
  INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.120E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.110E+02


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
  END BEARING COEFFICIENT-Nc                         = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.138E+04
  INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.120E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.160E+02


  LRFD RESISTANCE FACTOR (SIDE FRICTION)             = 0.450E+00
  LRFD RESISTANCE FACTOR (TIP RESISTANCE)            = 0.400E+00


LAYER NO 4----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
  END BEARING COEFFICIENT-Nc                         = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.225E+04
  INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.121E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.160E+02
```

```
  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                        = 0.550E+00
  END BEARING COEFFICIENT-Nc                             = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                     = 0.225E+04
  INTERNAL FRICTION ANGLE, DEG.                          = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST          = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                             = 0.121E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT               = 0.100E+11
  DEPTH, FT                                              = 0.185E+02


  LRFD RESISTANCE FACTOR (SIDE FRICTION)                 = 0.450E+00
  LRFD RESISTANCE FACTOR (TIP RESISTANCE)                = 0.400E+00


LAYER NO 5----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                        = 0.550E+00
  END BEARING COEFFICIENT-Nc                             = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                     = 0.700E+04
  INTERNAL FRICTION ANGLE, DEG.                          = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST          = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                             = 0.127E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT               = 0.100E+11
  DEPTH, FT                                              = 0.185E+02


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                        = 0.550E+00
  END BEARING COEFFICIENT-Nc                             = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                     = 0.700E+04
  INTERNAL FRICTION ANGLE, DEG.                          = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST          = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                             = 0.127E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT               = 0.100E+11
  DEPTH, FT                                              = 0.250E+02


  LRFD RESISTANCE FACTOR (SIDE FRICTION)                 = 0.450E+00
  LRFD RESISTANCE FACTOR (TIP RESISTANCE)                = 0.400E+00



DRILLED SHAFT INFORMATION
```

DIAMETER OF STEM	=	3.000	FT.
DIAMETER OF BASE	=	3.000	FT.
END OF STEM TO BASE	=	0.000	FT.
ANGLE OF BELL	=	0.000	DEG.
IGNORED TOP PORTION	=	0.000	FT.
IGNORED BOTTOM PORTION	=	0.000	FT.
AREA OF ONE PERCENT STEEL	=	10.180	SQ.IN.
ELASTIC MODULUS, Ec	=	0.360E+07	LB/SQ IN
VOLUME OF UNDERREAM	=	0.000	CU.YDS.

PREDICTED RESULTS

QS = ULTIMATE SIDE RESISTANCE;
QB = ULTIMATE BASE RESISTANCE;
WT = WEIGHT OF DRILLED SHAFT (UPLIFT CAPACITY ONLY);
QU = TOTAL ULTIMATE RESISTANCE;
LRFD QS = TOTAL SIDE FRICTION USING LRFD RESISTANCE FACTOR TO THE ULTIMATE SIDE RESISTANCE;
LRFD QB = TOTAL BASE BEARING USING LRFD RESISTANCE FACTOR TO THE ULTIMATE BASE RESISTANCE
LRFD QU = TOTAL CAPACITY WITH LRFD RESISTANCE FACTOR.

LENGTH (FEET)	VOLUME (CU.YDS)	QS (TONS)	QB (TONS)	QU (TONS)	LRFD QS (TONS)	LRFD QB (TONS)	LRFD QU (TONS)
1.0	0.26	0.65	34.91	35.56	0.29	13.96	14.26
2.0	0.52	1.30	38.61	39.90	0.58	15.44	16.03
3.0	0.79	1.94	39.70	41.64	0.87	15.88	16.75
4.0	1.05	5.51	40.79	46.30	2.48	16.32	18.80
5.0	1.31	9.07	41.89	50.96	4.08	16.75	20.84
6.0	1.57	12.64	42.75	55.39	5.69	17.10	22.79
7.0	1.83	16.20	43.34	59.55	7.29	17.34	24.63
8.0	2.09	19.77	43.64	63.41	8.89	17.46	26.35
9.0	2.36	23.33	43.74	67.07	10.50	17.50	28.00
10.0	2.62	26.89	43.74	70.64	12.10	17.50	29.60
11.0	2.88	30.46	49.65	80.10	13.71	19.86	33.56
12.0	3.14	34.02	56.40	90.42	15.31	22.56	37.87
13.0	3.40	37.59	63.99	101.57	16.91	25.59	42.51
14.0	3.67	41.15	101.10	142.25	18.52	40.44	58.96
15.0	3.93	44.71	140.27	184.98	20.12	56.11	76.23
16.0	4.19	48.28	181.48	229.76	21.73	72.59	94.32

RESULT FROM TREND (AVERAGED) LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.1073E-01	0.1083E-04	0.3982E-02	0.1000E-04
0.5365E-01	0.5415E-04	0.1991E-01	0.5000E-04
0.1073E+00	0.1083E-03	0.3982E-01	0.1000E-03
0.5365E+01	0.5415E-02	0.1991E+01	0.5000E-02
0.8048E+01	0.8123E-02	0.2987E+01	0.7500E-02
0.1073E+02	0.1083E-01	0.3982E+01	0.1000E-01
0.2683E+02	0.2708E-01	0.9956E+01	0.2500E-01
0.4775E+02	0.5380E-01	0.1991E+02	0.5000E-01
0.6445E+02	0.8026E-01	0.2987E+02	0.7500E-01
0.8034E+02	0.1067E+00	0.3982E+02	0.1000E+00
0.1275E+03	0.2615E+00	0.8333E+02	0.2500E+00
0.1638E+03	0.5153E+00	0.1214E+03	0.5000E+00
0.1748E+03	0.6416E+00	0.1341E+03	0.6250E+00
0.1958E+03	0.9188E+00	0.1570E+03	0.9000E+00
0.2149E+03	0.1821E+01	0.1760E+03	0.1800E+01

RESULT FROM UPPER-BOUND LINE

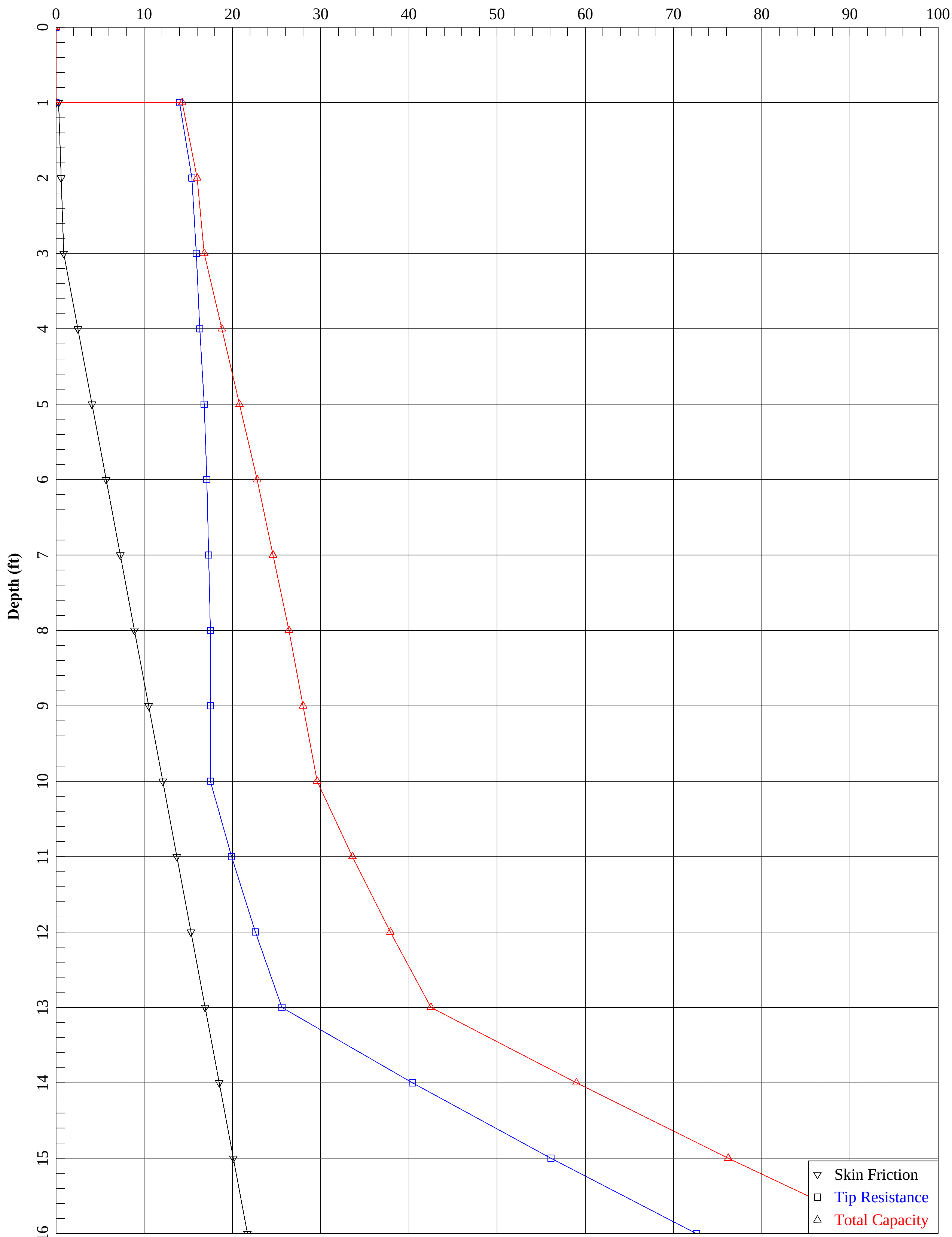
TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.1585E-01	0.1123E-04	0.5948E-02	0.1000E-04
0.7926E-01	0.5614E-04	0.2974E-01	0.5000E-04
0.1585E+00	0.1123E-03	0.5948E-01	0.1000E-03
0.7926E+01	0.5614E-02	0.2974E+01	0.5000E-02
0.1189E+02	0.8421E-02	0.4461E+01	0.7500E-02
0.1585E+02	0.1123E-01	0.5948E+01	0.1000E-01
0.3966E+02	0.2807E-01	0.1487E+02	0.2500E-01
0.6782E+02	0.5546E-01	0.2974E+02	0.5000E-01
0.8774E+02	0.8233E-01	0.4461E+02	0.7500E-01
0.1043E+03	0.1090E+00	0.5948E+02	0.1000E+00
0.1658E+03	0.2653E+00	0.1184E+03	0.2500E+00
0.1972E+03	0.5187E+00	0.1516E+03	0.5000E+00
0.2043E+03	0.6445E+00	0.1604E+03	0.6250E+00
0.2170E+03	0.9209E+00	0.1742E+03	0.9000E+00
0.2233E+03	0.1822E+01	0.1806E+03	0.1800E+01

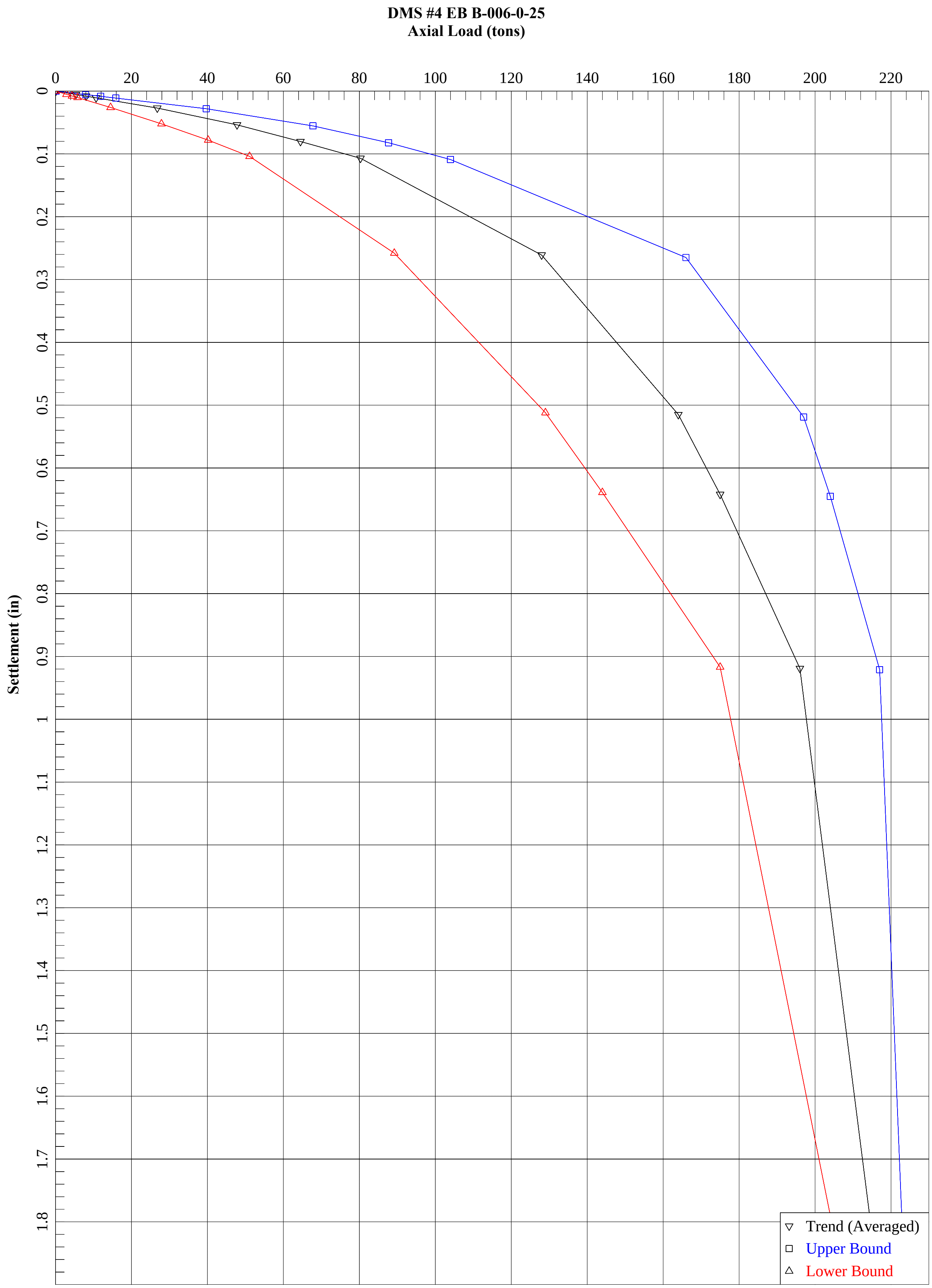
RESULT FROM LOWER-BOUND LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.5810E-02	0.1044E-04	0.2016E-02	0.1000E-04
0.2905E-01	0.5222E-04	0.1008E-01	0.5000E-04
0.5810E-01	0.1044E-03	0.2016E-01	0.1000E-03

0.2905E+01	0.5222E-02	0.1008E+01	0.5000E-02
0.4357E+01	0.7833E-02	0.1512E+01	0.7500E-02
0.5810E+01	0.1044E-01	0.2016E+01	0.1000E-01
0.1452E+02	0.2611E-01	0.5041E+01	0.2500E-01
0.2791E+02	0.5215E-01	0.1008E+02	0.5000E-01
0.4022E+02	0.7813E-01	0.1512E+02	0.7500E-01
0.5115E+02	0.1040E+00	0.2016E+02	0.1000E+00
0.8921E+02	0.2576E+00	0.4829E+02	0.2500E+00
0.1295E+03	0.5119E+00	0.9114E+02	0.5000E+00
0.1442E+03	0.6385E+00	0.1079E+03	0.6250E+00
0.1746E+03	0.9168E+00	0.1397E+03	0.9000E+00
0.2055E+03	0.1820E+01	0.1706E+03	0.1800E+01

DMS #4 EB B-006-0-25
LRFD Resistance (tons)




DMS #4 EB B-006-0-25
Axial Load (tons)
Settlement (in)
Trend (Averaged)
Upper Bound
Lower Bound

Project: OTIC 71-24-02 **Site Location:** DMS #5 EB - Shoulder Drilled Shaft, B-008-0-25
Calculated By: SS **Checked by:** WN
Date: 9/17/2025

SPECIAL FOUNDATION DESIGN ANALYSIS

Span Truss:			**Soil Properties:**	Foundation Soil	Units
Span Length =	70.00	ft	Ave. Soil Unit Weight =	116.90	Pcf
Truss Hight (H) =		ft	Internal Friction Angle ϕ (digs) =		degrees
			Ave. Shear Strength of Soil (C_u) =	1164.4	psf
			K_p =		
Drilled Shaft:			Groundwater Level Depth BGS =	3.000	ft.
Diameter (D) =	3.00	ft	**Resistance Factors**		
Total Foundation Length (L)	16.00	ft	Side Resistance Factor in Clay φ_{stat} =	0.45	BDM Table 305-1
The Above Grade Length =	0.00	ft	Tip Resistance Factor in Clay φ_{stst} =	0.40	BDM Table 305-1
Drilled Shaft Volume =	113.10	cubic ft.	Uplift Resistance Factor in Clay φ_{up} =	0.35	BDM Table 305-1
Concrete Unit Weight =	150.00	Pcf	Passive Resistance Factor (Extreme I)	0.75	AASHTO Table 11.5.7-1
			Passive Resistance Factor (Strength I)	0.75	AASHTO Table 11.5.7-1
			Passive Resistance Factor (Service I)	1.00	AASHTO Table 11.5.7-1

AASHTO LRFDLTS Table. 3.4-1

		Permanent		Transient		
Limit State	**Reference Articles**	**Dead Load (DC) Max/Min**	**Dead Load (DC) Mean**	**Live Load (LL)**	**Wind (W)**	
Strength I - Gravity	**3.5, 3.6, and 3.7**	**1.25**	**1.60**			
Extreme I - Wind	**3.5, 3.8, and 3.9**	**1.1/0.9**			**1.0[a]**	
Service 1 - Translation	**10.40**		**1.00**		**1.0[b]**	
a. Use Figures 3.8-1, 3.8-2, or 3.8-3 (for appropriate return period) b. Use wind map 3.8-4 (service)						

The Following are reaction Factored Loads for ITS-3513 Design No. 1, at the top of the Drilled Shaft 1 & 2 to be installed at the Shoulder

Limit State	**Shaft**	**Fz (lb.)**	**Fy (lb.)**	**Mu(in-lb.)**				
Strength I	1	19550.00	30.00	70680.00				
Strength I	2	14170.00	-20.00	69960.00				
Extreme I	1	60280.00	9900.00	111120.00				
Extreme I	2	-32880.00	3300.00	155880.00				
Service I	1							
Service I	2							

Bearing Resistance Check **AASHTO LRFD Section 10.8.3.5**

Check on Shoulder Column		**Strength I**	**Extreme I**	**Service I**	
Axial Factored Design Load:		19550.00	60280.00		lb.
Nominal Side Resistance :		96060.00	96060.00		lb.
Side Resistance Factor in Clay:	φ_{stat}	0.45	1.00		
Nominal Tip Resistance:		23860.00	23860.00		lb.
Tip Resistance Factor in Clay:	φ_{stat}	0.40	1.00		
Factored Side Resistance :		43227.00	96060.00		lb.
Factored Tip Resistance:		9544.00	23860.00		lb.
Total Factored Bearing Resistance:		52771.00	119920.00		lb.
Capacity: Demand Ratio (CDR):		2.70	1.99		**OK**

Uplift Resistance Check **AASHTO LRFD Section 10.8.3.7.2**

		Strength I	**Extreme I**	**Service I**	
Uplift Factored Design Load:			-32880.00		lb.
Nominal Side Resistance :			96060.00		lb.
Uplift Resistance Factor:	Reduction Factor = 0.8 as per LRFD 10.5.5.3.3	φ_{up} = 0.35	1.00		
Factored Side Resistance :			76848.00		
Drilled Shaft Concrete Weight:			16965.00		lb.
DC Load Factor:			0.90		
Factored Concrete Weight:			15268.50		lb.
Total Resistance:			92116.50		lb.
Capacity: Demand Ratio (CDR):			2.80		**OK**

Brom's Method with Strength Limit State Load Factors and Resistance Factors , in accordance with the commentary in LRFD C11.8.4.1.

Drilled Shaft Passive Resistance is calculated as $9c_uD$ over the Length excluding a top length equal to 1.5D where D = drilled shaft Diameter L-1.5D = 11.50 ft.

	Strength I	Extreme I	Service I	
Shaft 1 Back Row				
Wind Factored Load (Fy):	30.00	9900.00		lb.
Moment of Force Fv as MA_{Fy} , Moment about the base (L)= 16'				ft
MA_{Fy} =	480.00	158400.00		lb.-ft
Passive Resistance (R) along the Fo. length (L-1.5D)	361546.20	361546.20		9CuD*(L-1.5D) lb.
Passive Resistance Factor	0.75	0.75		
Average Shear Strength of Soil = 1164.4 psf:				psf
Factored Passive Resistance (R) along the Fo. Lengt	271159.65	271159.65		lb.
Moment of Force R as MA_R , Moment about the base= (L-1.5D)/2=5.75'				ft
Moment MA_R =	1559167.99	1559167.99		lb.-ft
Capacity: Demand Ratio (CDR) =	3248.27	9.84		**OK**

	Strength I	Extreme I	Service I	
Shaft 2 Front Row				
Wind Factored Load (Fy):	-20.00	3300.00		lb.
Moment of Force Fv as MA_{Fy} , Moment about the base (L)= 16'				ft
MA_{Fy} =	-320.00	52800.00		lb.-ft
Passive Resistance (R) along the Fo. length (L-1.5D)	361546.20	361546.20		9CuD*(L-1.5D) lb.
Passive Resistance Factor	0.75	0.75		
Average Shear Strength = 1164.4 psf:				
Factored Passive Resistance (R) along the Fo. Lengt	271159.65	271159.65		lb.
Moment of Force R as MA_R , Moment about the base= (L-1.5D)/2=5.75'				ft
Moment MA_R =	1559167.99	1559167.99		lb.-ft
Capacity: Demand Ratio (CDR) =	-4872.40	29.53		**OK**

<u>Lateral Resistance Check</u> **AASHTO LRFD Section 10.8.3.9**

		Extreme I	Service I	
Shaft 1 Back Row				
Lateral Deflection at Minimum Length of Drilled Shaft:	4.8'	0.17483		inch
p-multiplier (P_m) as per AASHTO LRFD BDS 10.7.2.4		0.4		
		0.0699		
Lateral Deflection at Full Length of Drilled Shaft:	16.0'	0.02377		inch
Capacity: Demand Ratio (CDR_L) to provide Lateral Restraint:		2.94		**OK**
Shaft 2 Front Row				
Lateral Deflection at Minimum Length of Drilled Shaft:	4.0'	0.04168		inch
p-multiplier (P_m) as per AASHTO LRFD BDS 10.7.2.4		0.8		
		0.0333		
Lateral Deflection at Full Length of Drilled Shaft:	16.0'	0.00464		inch
Capacity: Demand Ratio (CDR_L) to provide Lateral Restraint:		7.19		**OK**

<u>Flexural Moment Resistance Chec</u> **AASHTO LRFD Section 10.8.3.9**

	Strength I	Extreme I	Service I	
Shaft 1 Back Row				
Maximum Moment:		-895539		inch-lbs.
Nominal Moment Capacity		8709733		inch-lbs.
Flexural Resistance Factor	0.90	1.00		
Factored Moment Capacity		8709733		inch-lbs.
Capacity: Demand Ratio:		9.73		**OK**
Shaft 2 Front Row				
Maximum Moment		-261390		inch-lbs.
Nominal Moment Capacity		7653856		inch-lbs.
Flexural Resistance Factor	0.90	1.00		
Factored Moment Capacity		7653856		inch-lbs.
Capacity: Demand Ratio:		29.28		**OK**

<u>Shear Resistance Check</u> **AASHTO LRFD Section 10.8.3.9**

	Strength I	Extreme I	Service I	
Shaft 1 Back Row				
Maximum Shear		9900		lbs.
Nominal Structural Shear Capacity as per AASHTO LRFD BDS Article 5.7		183980		lbs.
Strength Reduction Factor	0.90	1.00		
Factored Structural Shear Capacity		183980		lbs.
Capacity: Demand Ratio:		18.58		**OK**
Shaft 2 Front Row				
Maximum Shear		3300		lbs.
Nominal Structural Shear Capacity as per AASHTO LRFD BDS Article 5.7		183980		lbs.
Strength Reduction Factor	0.90	1.00		
Factored Structural Shear Capacity		183980		lbs.
Capacity: Demand Ratio:		55.75		**OK**

Since Capacity/Demand Ratio of all the Checks were greater than 1.0, the proposed length of the drilled shaft to be used is 16'.

Project: OTIC 71-24-02 **Site Location:** DMS #5 EB - Median Drilled Shaft, B-008-0-25
Calculated By: SS **Checked by:** WN
Date: 8/17/2025

SPECIAL FOUNDATION DESIGN ANALYSIS

Span Truss:
Span Length = 70.00 ft
Truss Hight (H) = ft

Drilled Shaft:
Diameter (D) = 3.00 ft
Total Foundation Length (L) 16.00 ft
The Above Grade Length = 0.00 ft
Drilled Shaft Volume = 113.10 cubic ft.
Concrete Unit Weight = 150.00 Pcf

Soil Properties: Foundation Soil Units
Ave. Soil Unit Weight = 116.90 Pcf
Internal Friction Angle ϕ (digs) = degrees
Ave. Shear Strength of Soil (C_u) = 1164.4 psf
K_p =
Groundwater Level Depth BGS = 3.000 ft.

Resistance Factors
Side Resistance Factor in Clay φ_{stat} = 0.45 BDM Table 305-1
Tip Resistance Factor in Clay φ_{stst} = 0.40 BDM Table 305-1
Uplift Resistance Factor in Clay φ_{up} = 0.35 BDM Table 305-1
Passive Resistance Factor (Extreme I) 0.75 AASHTO Table 11.5.7-1
Passive Resistance Factor (Strength I) 0.75 AASHTO Table 11.5.7-1
Passive Resistance Factor (Service I) 1.00 AASHTO Table 11.5.7-1

AASHTO LRFDLTS Table. 3.4-1

Limit State	Reference Articles	Permanent Dead Load (DC) Max/Min	Transient Dead Load (DC) Mean	Live Load (LL)	Wind (W)	
Strength I - Gravity	**3.5, 3.6, and 3.7**	**1.25**	**1.60**			
Extreme I - Wind	**3.5, 3.8, and 3.9**	**1.1/0.9**			**1.0[a]**	
Service 1 - Translation	**10.40**		**1.00**		**1.0[b]**	
a. Use Figures 3.8-1, 3.8-2, or 3.8-3 (for appropriate return period) b. Use wind map 3.8-4 (service)						

The Following are reaction Factored Loads for ITS-3513 Design No. 1, at the top of the Drilled Shaft 1 & 2 to be installed at the Shoulder

Limit State	Shaft	Fz (lb.)	Fy (lb.)	Mu(in-lb.)				
Strength I	1	27790.00	10.00	138120.00				
Strength I	2	24090.00	-20.00	140880.00				
Extreme I	1	46960.00	3120.00	29880.00				
Extreme I	2	-5160.00	6800.00	247440.00				
Service I	1							
Service I	2							

Bearing Resistance Check **AASHTO LRFD Section 10.8.3.5**

		Strength I	Extreme I	Service I	
Check on Shoulder Column					
Axial Factored Design Load:		27790.00	46960.00		lb.
Nominal Side Resistance :		96060.00	96060.00		lb.
Side Resistance Factor in Clay:	φ_{stat}	0.45	1.00		
Nominal Tip Resistance:		23860.00	23860.00		lb.
Tip Resistance Factor in Clay:	φ_{stat}	0.40	1.00		
Factored Side Resistance :		43227.00	96060.00		lb.
Factored Tip Resistance:		9544.00	23860.00		lb.
Total Factored Bearing Resistance:		52771.00	119920.00		lb.
Capacity: Demand Ratio (CDR):		1.90	2.55		**OK**

Uplift Resistance Check **AASHTO LRFD Section 10.8.3.7.2**

		Strength I	Extreme I	Service I	
Uplift Factored Design Load:			-5160.00		lb.
Nominal Side Resistance :			96060.00		lb.
Uplift Resistance Factor:	Reduction Factor = 0.8 as per LRFD 10.5.5.3.3	φ_{up} = 0.35	1.00		
Factored Side Resistance :			76848.00		
Drilled Shaft Concrete Weight:			16965.00		lb.
DC Load Factor:			0.90		
Factored Concrete Weight:			15268.50		lb.
Total Resistance:			92116.50		lb.
Capacity: Demand Ratio (CDR):			17.85		**OK**

Brom's Method with Strength Limit State Load Factors and Resistance Factors , in accordance with the commentary in LRFD C11.8.4.1.

Drilled Shaft Passive Resistance is calculated as $9c_uD$ over the Length excluding a top length equal to 1.5D where

D = drilled shaft Diameter L-1.5D = 11.50 ft.

	Strength I	Extreme I	Service I	
Shaft 1 Back Row				
Wind Factored Load (Fy):	10.00	3120.00		lb.
Moment of Force Fv as MA_{Fy} , Moment about the base (L)= 16'				ft
MA_{Fy} =	160.00	49920.00		lb.-ft
Passive Resistance (R) along the Fo. length (L-1.5D)	361546.20	361546.20		9CuD*(L-1.5D) lb.
Passive Resistance Factor	0.75	0.75		
Average Shear Strength of Soil = 1164.4 psf:				psf
Factored Passive Resistance (R) along the Fo. Lengt	271159.65	271159.65		lb.
Moment of Force R as MA_R , Moment about the base= (L-1.5D)/2=5.75'				ft
Moment MA_R =	1559167.99	1559167.99		lb.-ft
Capacity: Demand Ratio (CDR) =	9744.80	31.23		**OK**

	Strength I	Extreme I	Service I	
Shaft 2 Front Row				
Wind Factored Load (Fy):	-20.00	6800.00		lb.
Moment of Force Fv as MA_{Fy} , Moment about the base (L)= 16'				ft
MA_{Fy} =	-320.00	108800.00		lb.-ft
Passive Resistance (R) along the Fo. length (L-1.5D)	361546.20	361546.20		9CuD*(L-1.5D) lb.
Passive Resistance Factor	0.75	0.75		
Average Shear Strength = 1164.4 psf:				
Factored Passive Resistance (R) along the Fo. Lengt	271159.65	271159.65		lb.
Moment of Force R as MA_R , Moment about the base= (L-1.5D)/2=5.75'				ft
Moment MA_R =	1559167.99	1559167.99		lb.-ft
Capacity: Demand Ratio (CDR) =	-4872.40	14.33		**OK**

Lateral Resistance Check **AASHTO LRFD Section 10.8.3.9**

		Extreme I	Service I	
Shaft 1 Back Row				
Lateral Deflection at Minimum Length of Drilled Shaft:	4.0'	0.08696		inch
p-multiplier (P_m) as per AASHTO LRFD BDS 10.7.2.4		0.4		
		0.0348		
Lateral Deflection at Full Length of Drilled Shaft:	16.0'	0.00723		inch
Capacity: Demand Ratio (CDR_L) to provide Lateral Restraint:		4.81		**OK**
Shaft 2 Front Row				
Lateral Deflection at Minimum Length of Drilled Shaft:	4.0'	0.09597		inch
p-multiplier (P_m) as per AASHTO LRFD BDS 10.7.2.4		0.8		
		0.0768		
Lateral Deflection at Full Length of Drilled Shaft:	16.0'	0.00997		inch
Capacity: Demand Ratio (CDR_L) to provide Lateral Restraint:		7.70		**OK**

Flexural Moment Resistance Che **AASHTO LRFD Section 10.8.3.9**

	Strength I	Extreme I	Service I	
Shaft 1 Back Row				
Maximum Moment:		-274747		inch-lbs.
Nominal Moment Capacity		8561256		inch-lbs.
Flexural Resistance Factor	0.90	1.00		
Factored Moment Capacity		8561256		inch-lbs.
Capacity: Demand Ratio:		31.16		**OK**
Shaft 2 Front Row				
Maximum Moment		-557373		inch-lbs.
Nominal Moment Capacity		7976223		inch-lbs.
Flexural Resistance Factor	0.90	1.00		
Factored Moment Capacity		7976223		inch-lbs.
Capacity: Demand Ratio:		14.31		**OK**

Shear Resistance Check **AASHTO LRFD Section 10.8.3.9**

	Strength I	Extreme I	Service I	
Shaft 1 Back Row				
Maximum Shear		3120		lbs.
Nominal Structural Shear Capacity as per AASHTO LRFD BDS Article 5.7		183980		lbs.
Strength Reduction Factor	0.90	1.00		
Factored Structural Shear Capacity		183980		lbs.
Capacity: Demand Ratio:		58.97		**OK**
Shaft 2 Front Row				
Maximum Shear		6800		lbs.
Nominal Structural Shear Capacity as per AASHTO LRFD BDS Article 5.7		183980		lbs.
Strength Reduction Factor	0.90	1.00		
Factored Structural Shear Capacity		183980		lbs.
Capacity: Demand Ratio:		27.06		**OK**

Since Capacity/Demand Ratio of all the Checks were greater than 1.0, the proposed length of the drilled shaft to be used is 16'.

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

                 SHAFT for Windows, Version 2012.7.8

                  Serial Number :  292797964

               VERTICALLY LOADED DRILLED SHAFT ANALYSIS
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=========================================================================


Path to file locations      : M:\Project Files\25 Projects\G25003G Baker-OTIC
71-24-02\Analysis File Folder\Drilled Shaft Folder\DMS #5 EB B-008-0-25\
Name of input data file     : B-008Shaft.sfd
Name of output file         : B-008Shaft.sfo
Name of plot output file    : B-008Shaft.sfp
Name of runtime file        : B-008Shaft.sfr


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

          Date:  August 14, 2025     Time:  15:47:45

DMS #5 EB B-008-0-25


PROPOSED DEPTH =      16.0 FT
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NUMBER OF LAYERS =    7
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WATER TABLE DEPTH =       3.0 FT.
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SOIL INFORMATION
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LAYER NO 1----CLAY

  AT THE TOP
```

```
  STRENGTH REDUCTION FACTOR-ALPHA                        = 0.550E+00
  END BEARING COEFFICIENT-Nc                             = 0.600E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                     = 0.250E+03
  INTERNAL FRICTION ANGLE, DEG.                          = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST          = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                             = 0.118E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT               = 0.100E+11
  DEPTH, FT                                              = 0.000E+00


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                        = 0.550E+00
  END BEARING COEFFICIENT-Nc                             = 0.720E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                     = 0.250E+03
  INTERNAL FRICTION ANGLE, DEG.                          = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST          = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                             = 0.118E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT               = 0.100E+11
  DEPTH, FT                                              = 0.300E+01


  LRFD RESISTANCE FACTOR (SIDE FRICTION)                 = 0.450E+00
  LRFD RESISTANCE FACTOR (TIP RESISTANCE)                = 0.400E+00


LAYER NO 2----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                        = 0.550E+00
  END BEARING COEFFICIENT-Nc                             = 0.720E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                     = 0.112E+04
  INTERNAL FRICTION ANGLE, DEG.                          = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST          = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                             = 0.118E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT               = 0.100E+11
  DEPTH, FT                                              = 0.300E+01


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                        = 0.550E+00
  END BEARING COEFFICIENT-Nc                             = 0.840E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                     = 0.112E+04
  INTERNAL FRICTION ANGLE, DEG.                          = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST          = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                             = 0.118E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT               = 0.100E+11
```

```
  DEPTH, FT                                             = 0.600E+01


  LRFD RESISTANCE FACTOR (SIDE FRICTION)                = 0.450E+00
  LRFD RESISTANCE FACTOR (TIP RESISTANCE)               = 0.400E+00


LAYER NO 3----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                       = 0.550E+00
  END BEARING COEFFICIENT-Nc                            = 0.840E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                    = 0.125E+04
  INTERNAL FRICTION ANGLE, DEG.                         = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST         = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                            = 0.118E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT              = 0.100E+11
  DEPTH, FT                                             = 0.600E+01


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                       = 0.550E+00
  END BEARING COEFFICIENT-Nc                            = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                    = 0.125E+04
  INTERNAL FRICTION ANGLE, DEG.                         = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST         = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                            = 0.118E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT              = 0.100E+11
  DEPTH, FT                                             = 0.850E+01


  LRFD RESISTANCE FACTOR (SIDE FRICTION)                = 0.450E+00
  LRFD RESISTANCE FACTOR (TIP RESISTANCE)               = 0.400E+00


LAYER NO 4----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                       = 0.550E+00
  END BEARING COEFFICIENT-Nc                            = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                    = 0.113E+04
  INTERNAL FRICTION ANGLE, DEG.                         = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST         = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                            = 0.118E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT              = 0.100E+11
  DEPTH, FT                                             = 0.850E+01
```

```
  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                     = 0.550E+00
  END BEARING COEFFICIENT-Nc                          = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                  = 0.113E+04
  INTERNAL FRICTION ANGLE, DEG.                       = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST       = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                          = 0.118E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT            = 0.100E+11
  DEPTH, FT                                           = 0.110E+02


  LRFD RESISTANCE FACTOR (SIDE FRICTION)              = 0.550E+00
  LRFD RESISTANCE FACTOR (TIP RESISTANCE)             = 0.500E+00


LAYER NO 5----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                     = 0.105E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                  = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                       = 0.270E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST       = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                          = 0.115E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT            = 0.100E+11
  DEPTH, FT                                           = 0.110E+02


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                     = 0.960E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                  = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                       = 0.270E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST       = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                          = 0.115E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT            = 0.100E+11
  DEPTH, FT                                           = 0.160E+02


  LRFD RESISTANCE FACTOR (SIDE FRICTION)              = 0.450E+00
  LRFD RESISTANCE FACTOR (TIP RESISTANCE)             = 0.400E+00


LAYER NO 6----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                     = 0.550E+00
```

```
    END BEARING COEFFICIENT-Nc                         = 0.900E+01
    UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.375E+03
    INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
    BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
    SOIL UNIT WEIGHT, LB/CU FT                         = 0.110E+03
    MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
    DEPTH, FT                                          = 0.160E+02


    AT THE BOTTOM

    STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
    END BEARING COEFFICIENT-Nc                         = 0.900E+01
    UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.375E+03
    INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
    BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
    SOIL UNIT WEIGHT, LB/CU FT                         = 0.110E+03
    MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
    DEPTH, FT                                          = 0.270E+02


    LRFD RESISTANCE FACTOR (SIDE FRICTION)             = 0.450E+00
    LRFD RESISTANCE FACTOR (TIP RESISTANCE)            = 0.400E+00


  LAYER NO 7----CLAY

    AT THE TOP

    STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
    END BEARING COEFFICIENT-Nc                         = 0.900E+01
    UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.250E+03
    INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
    BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
    SOIL UNIT WEIGHT, LB/CU FT                         = 0.110E+03
    MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
    DEPTH, FT                                          = 0.270E+02


    AT THE BOTTOM

    STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
    END BEARING COEFFICIENT-Nc                         = 0.900E+01
    UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.250E+03
    INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
    BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
    SOIL UNIT WEIGHT, LB/CU FT                         = 0.110E+03
    MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
    DEPTH, FT                                          = 0.300E+02
```

LRFD RESISTANCE FACTOR (SIDE FRICTION) = 0.450E+00
LRFD RESISTANCE FACTOR (TIP RESISTANCE) = 0.400E+00

DRILLED SHAFT INFORMATION

DIAMETER OF STEM	= 3.000	FT.
DIAMETER OF BASE	= 3.000	FT.
END OF STEM TO BASE	= 0.000	FT.
ANGLE OF BELL	= 0.000	DEG.
IGNORED TOP PORTION	= 0.000	FT.
IGNORED BOTTOM PORTION	= 0.000	FT.
AREA OF ONE PERCENT STEEL	= 10.180	SQ.IN.
ELASTIC MODULUS, Ec	= 0.360E+07	LB/SQ IN
VOLUME OF UNDERREAM	= 0.000	CU.YDS.

PREDICTED RESULTS

QS = ULTIMATE SIDE RESISTANCE;
QB = ULTIMATE BASE RESISTANCE;
WT = WEIGHT OF DRILLED SHAFT (UPLIFT CAPACITY ONLY);
QU = TOTAL ULTIMATE RESISTANCE;
LRFD QS = TOTAL SIDE FRICTION USING LRFD RESISTANCE FACTOR TO THE ULTIMATE SIDE RESISTANCE;
LRFD QB = TOTAL BASE BEARING USING LRFD RESISTANCE FACTOR TO THE ULTIMATE BASE RESISTANCE
LRFD QU = TOTAL CAPACITY WITH LRFD RESISTANCE FACTOR.

LENGTH (FEET)	VOLUME (CU.YDS)	QS (TONS)	QB (TONS)	QU (TONS)	LRFD QS (TONS)	LRFD QB (TONS)	LRFD QU (TONS)
1.0	0.26	0.65	30.91	31.56	0.29	12.36	12.65
2.0	0.52	1.30	35.10	36.40	0.58	14.04	14.62
3.0	0.79	1.94	37.19	39.13	0.87	14.88	15.75
4.0	1.05	4.86	37.79	42.65	2.19	15.12	17.30
5.0	1.31	7.78	37.65	45.43	3.50	15.06	18.56
6.0	1.57	10.69	29.22	39.91	4.81	11.69	16.50
7.0	1.83	13.93	19.90	33.83	6.27	7.96	14.23
8.0	2.09	17.17	9.77	26.94	7.73	3.91	11.64
9.0	2.36	20.41	3.26	23.67	9.19	1.63	10.81
10.0	2.62	23.33	0.00	23.33	10.79	0.00	10.79
11.0	2.88	26.25	2.53	28.78	12.40	1.01	13.41
12.0	3.14	30.27	5.42	35.69	14.20	2.17	16.37

13.0	3.40	34.46	8.68	43.13	16.09	3.47	19.56
14.0	3.67	38.82	10.85	49.66	18.05	4.34	22.39
15.0	3.93	43.35	11.93	55.27	20.09	4.77	24.86
16.0	4.19	48.03	11.93	59.96	22.20	4.77	26.97

RESULT FROM TREND (AVERAGED) LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.5835E-02	0.1037E-04	0.2618E-03	0.1000E-04
0.2917E-01	0.5183E-04	0.1309E-02	0.5000E-04
0.5835E-01	0.1037E-03	0.2618E-02	0.1000E-03
0.2917E+01	0.5183E-02	0.1309E+00	0.5000E-02
0.4376E+01	0.7774E-02	0.1963E+00	0.7500E-02
0.5835E+01	0.1037E-01	0.2618E+00	0.1000E-01
0.1459E+02	0.2591E-01	0.6545E+00	0.2500E-01
0.2529E+02	0.5162E-01	0.1309E+01	0.5000E-01
0.3286E+02	0.7715E-01	0.1963E+01	0.7500E-01
0.3870E+02	0.1025E+00	0.2618E+01	0.1000E+00
0.4846E+02	0.2534E+00	0.5478E+01	0.2500E+00
0.5065E+02	0.5036E+00	0.7980E+01	0.5000E+00
0.5049E+02	0.6287E+00	0.8816E+01	0.6250E+00
0.5087E+02	0.9038E+00	0.1032E+02	0.9000E+00
0.5207E+02	0.1804E+01	0.1157E+02	0.1800E+01

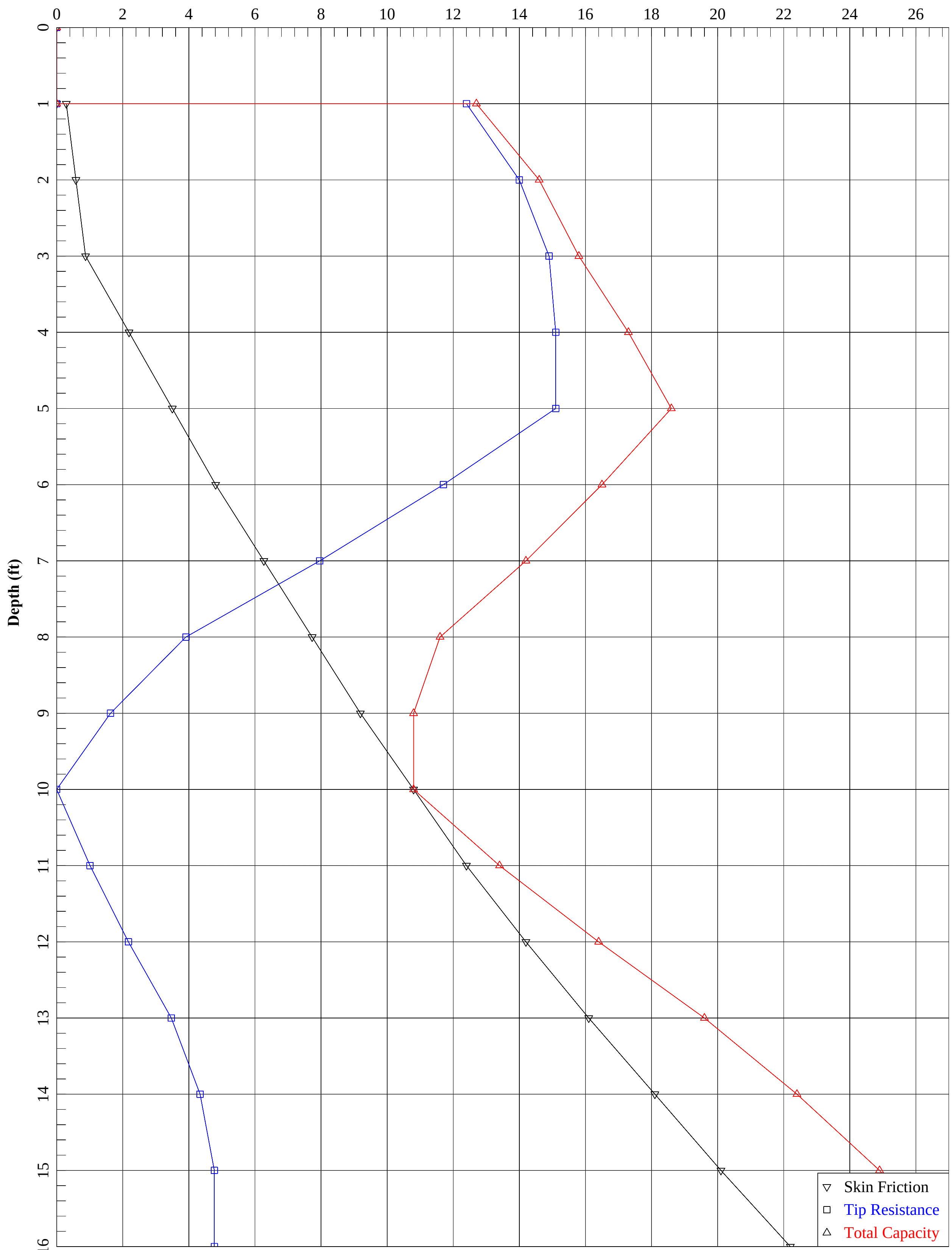
RESULT FROM UPPER-BOUND LINE

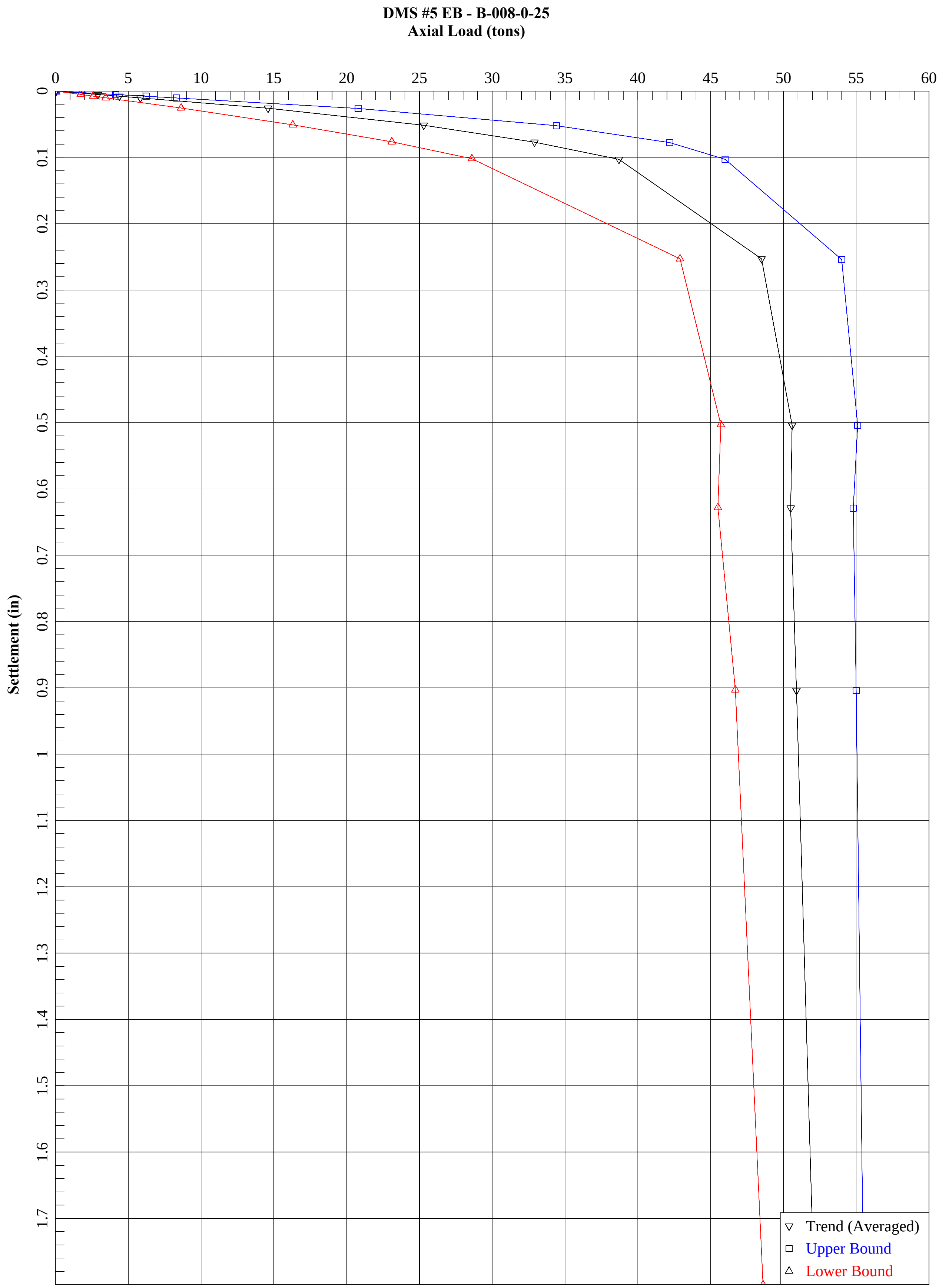
TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.8308E-02	0.1052E-04	0.3910E-03	0.1000E-04
0.4154E-01	0.5258E-04	0.1955E-02	0.5000E-04
0.8308E-01	0.1052E-03	0.3910E-02	0.1000E-03
0.4154E+01	0.5258E-02	0.1955E+00	0.5000E-02
0.6231E+01	0.7886E-02	0.2933E+00	0.7500E-02
0.8308E+01	0.1052E-01	0.3910E+00	0.1000E-01
0.2077E+02	0.2629E-01	0.9776E+00	0.2500E-01
0.3441E+02	0.5220E-01	0.1955E+01	0.5000E-01
0.4223E+02	0.7779E-01	0.2933E+01	0.7500E-01
0.4601E+02	0.1031E+00	0.3910E+01	0.1000E+00
0.5399E+02	0.2538E+00	0.7781E+01	0.2500E+00
0.5514E+02	0.5040E+00	0.9968E+01	0.5000E+00
0.5480E+02	0.6290E+00	0.1054E+02	0.6250E+00
0.5503E+02	0.9041E+00	0.1145E+02	0.9000E+00
0.5545E+02	0.1804E+01	0.1187E+02	0.1800E+01

RESULT FROM LOWER-BOUND LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.3451E-02	0.1022E-04	0.1326E-03	0.1000E-04
0.1725E-01	0.5110E-04	0.6628E-03	0.5000E-04
0.3451E-01	0.1022E-03	0.1326E-02	0.1000E-03
0.1725E+01	0.5110E-02	0.6628E-01	0.5000E-02
0.2588E+01	0.7665E-02	0.9941E-01	0.7500E-02
0.3451E+01	0.1022E-01	0.1326E+00	0.1000E-01
0.8627E+01	0.2555E-01	0.3314E+00	0.2500E-01
0.1632E+02	0.5104E-01	0.6628E+00	0.5000E-01
0.2310E+02	0.7648E-01	0.9941E+00	0.7500E-01
0.2862E+02	0.1018E+00	0.1326E+01	0.1000E+00
0.4294E+02	0.2529E+00	0.3175E+01	0.2500E+00
0.4565E+02	0.5033E+00	0.5991E+01	0.5000E+00
0.4550E+02	0.6283E+00	0.7090E+01	0.6250E+00
0.4671E+02	0.9035E+00	0.9186E+01	0.9000E+00
0.4862E+02	0.1804E+01	0.1121E+02	0.1800E+01

DMS #5 EB - B-008-0-25
LRFD Resistance (tons)




DMS #5 EB - B-008-0-25
Axial Load (tons)
0
5
10
15
20
25
30
35
40
45
50
55
60
Settlement (in)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1.1
1.2
1.3
1.4
1.5
1.6
1.7
Trend (Averaged)
Upper Bound
Lower Bound

Project: OTIC 71-24-02 **Site Location:** DMS #8 WB - Shoulder Drilled Shaft, B-005-0-25
Calculated By: SS **Checked by:** WN
Date: 9/18/2025

SPECIAL FOUNDATION DESIGN ANALYSIS

Span Truss:
Span Length = 70.00 ft
Truss Hight (H) = ft

Drilled Shaft:
Diameter (D) = 3.00 ft
Total Foundation Length (L) 16.00 ft
The Above Grade Length = 0.00 ft
Drilled Shaft Volume = 113.10 cubic ft.
Concrete Unit Weight = 150.00 Pcf

Soil Properties:	Foundation Soil	Units
Ave. Soil Unit Weight =	118.50	Pcf
Internal Friction Angle ϕ (digs) =		degrees
Ave. Shear Strength of Soil (C_u) =	1134.6	psf
K_p =		
Groundwater Level Depth BGS =	3.000	ft.
Resistance Factors		
Side Resistance Factor in Clay φ_{stat} =	0.45	BDM Table 305-1
Tip Resistance Factor in Clay φ_{stst} =	0.40	BDM Table 305-1
Uplift Resistance Factor in Clay φ_{up} =	0.35	BDM Table 305-1
Passive Resistance Factor (Extreme I)	0.75	AASHTO Table 11.5.7-1
Passive Resistance Factor (Strength I)	0.75	AASHTO Table 11.5.7-1
Passive Resistance Factor (Service I)	1.00	AASHTO Table 11.5.7-1

AASHTO LRFDLTS Table. 3.4-1

		Permanent	Transient			
Limit State	**Reference Articles**	**Dead Load (DC) Max/Min**	**Dead Load (DC) Mean**	**Live Load (LL)**	**Wind (W)**	
Strength I - Gravity	**3.5, 3.6, and 3.7**	**1.25**	**1.60**			
Extreme I - Wind	**3.5, 3.8, and 3.9**	**1.1/0.9**			**1.0[a]**	
Service 1 - Translation	**10.40**		**1.00**		**1.0[b]**	
a. Use Figures 3.8-1, 3.8-2, or 3.8-3 (for appropriate return period) b. Use wind map 3.8-4 (service)						

The Following are reaction Factored Loads for ITS-3513 Design No. 1, at the top of the Drilled Shaft 1 & 2 to be installed at the Shoulder

Limit State	**Shaft**	**Fz (lb.)**	**Fy (lb.)**	**Mu(in-lb.)**				
Strength I	1	19550.00	30.00	70680.00				
Strength I	2	14170.00	-20.00	69960.00				
Extreme I	1	60280.00	9900.00	111120.00				
Extreme I	2	-32880.00	3300.00	155880.00				
Service I	1							
Service I	2							

Bearing Resistance Check **AASHTO LRFD Section 10.8.3.5**

		Strength I	**Extreme I**	**Service I**	
Check on Shoulder Column					
Axial Factored Design Load:		19550.00	60280.00		lb.
Nominal Side Resistance :		82940.00	82940.00		lb.
Side Resistance Factor in Clay:	φ_{stat}	0.45	1.00		
Nominal Tip Resistance:		46280.00	46280.00		lb.
Tip Resistance Factor in Clay:	φ_{stat}	0.40	1.00		
Factored Side Resistance :		37323.00	82940.00		lb.
Factored Tip Resistance:		18512.00	46280.00		lb.
Total Factored Bearing Resistance:		55835.00	129220.00		lb.
Capacity: Demand Ratio (CDR):		2.86	2.14		**OK**

Uplift Resistance Check **AASHTO LRFD Section 10.8.3.7.2**

		Strength I	**Extreme I**	**Service I**	
Uplift Factored Design Load:			-32880.00		lb.
Nominal Side Resistance :			82940.00		lb.
Uplift Resistance Factor:	Reduction Factor = 0.8 as per LRFD 10.5.5.3.3	φ_{up} = 0.35	1.00		
Factored Side Resistance :			66352.00		
Drilled Shaft Concrete Weight:			16965.00		lb.
DC Load Factor:			0.90		
Factored Concrete Weight:			15268.50		lb.
Total Resistance:			81620.50		lb.
Capacity: Demand Ratio (CDR):			2.48		**OK**

Brom's Method with Strength Limit State Load Factors and Resistance Factors , in accordance with the commentary in LRFD C11.8.4.1.

Drilled Shaft Passive Resistance is calculated as $9c_uD$ over the Length excluding a top length equal to 1.5D where D = drilled shaft Diameter L-1.5D = 11.50 ft.

	Strength I	Extreme I	Service I	
Shaft 1 Back Row				
Wind Factored Load (Fy):	30.00	9900.00		lb.
Moment of Force Fv as MA_{Fy} , Moment about the base (L)= 16'				ft
MA_{Fy} =	480.00	158400.00		lb.-ft
Passive Resistance (R) along the Fo. length (L-1.5D)	352293.30	352293.30		9CuD*(L-1.5D) lb.
Passive Resistance Factor	0.75	0.75		
Average Shear Strength of Soil= 1134.6 psf:				psf
Factored Passive Resistance (R) along the Fo. Lengt	264219.98	264219.98		lb.
Moment of Force R as MA_R , Moment about the base= (L-1.5D)/2=5.75'				ft
Moment MA_R =	1519264.86	1519264.86		lb.-ft
Capacity: Demand Ratio (CDR) =	3165.14	9.59		**OK**

	Strength I	Extreme I	Service I	
Shaft 2 Front Row				
Wind Factored Load (Fy):	-20.00	3300.00		lb.
Moment of Force Fv as MA_{Fy} , Moment about the base (L)= 16'				ft
MA_{Fy} =	-320.00	52800.00		lb.-ft
Passive Resistance (R) along the Fo. length (L-1.5D)	352293.30	352293.30		9CuD*(L-1.5D) lb.
Passive Resistance Factor	0.75	0.75		
Average Shear Strength = 1134.6 psf:				
Factored Passive Resistance (R) along the Fo. Lengt	264219.975	264219.975		lb.
Moment of Force R as MA_R , Moment about the base= (L-1.5D)/2=5.75'				ft
Moment MA_R =	1519264.86	1519264.86		lb.-ft
Capacity: Demand Ratio (CDR) =	-4747.70	28.77		**OK**

Lateral Resistance Check **AASHTO LRFD Section 10.8.3.9**

		Extreme I	Service I	
Shaft 1 Back Row				
Lateral Deflection at Minimum Length of Drilled Shaft:	4.0'	0.1775		inch
p-multiplier (P_m) as per AASHTO LRFD BDS 10.7.2.4		0.4		
		0.0710		
Lateral Deflection at Full Length of Drilled Shaft:	16.0'	0.01902		inch
Capacity: Demand Ratio (CDR_L) to provide Lateral Restraint:		3.73		**OK**
Shaft 2 Front Row				
Lateral Deflection at Minimum Length of Drilled Shaft:	3.2'	0.075		inch
p-multiplier (P_m) as per AASHTO LRFD BDS 10.7.2.4		0.8		
		0.0600		
Lateral Deflection at Full Length of Drilled Shaft:	16.0'	0.00363		inch
Capacity: Demand Ratio (CDR_L) to provide Lateral Restraint:		16.53		**OK**

Flexural Moment Resistance Chec **AASHTO LRFD Section 10.8.3.9**

	Strength I	Extreme I	Service I	
Shaft 1 Back Row				
Maximum Moment:		-838620		inch-lbs.
Nominal Moment Capacity		8709733		inch-lbs.
Flexural Resistance Factor	0.90	1.00		
Factored Moment Capacity		8709733		inch-lbs.
Capacity: Demand Ratio:		10.39		**OK**
Shaft 2 Front Row				
Maximum Moment		-225194		inch-lbs.
Nominal Moment Capacity		7653856		inch-lbs.
Flexural Resistance Factor	0.90	1.00		
Factored Moment Capacity		7653856		inch-lbs.
Capacity: Demand Ratio:		33.99		**OK**

Shear Resistance Check **AASHTO LRFD Section 10.8.3.9**

	Strength I	Extreme I	Service I	
Shaft 1 Back Row				
Maximum Shear		9900		lbs.
Nominal Structural Shear Capacity as per AASHTO LRFD BDS Article 5.7		183980		lbs.
Strength Reduction Factor	0.90	1.00		
Factored Structural Shear Capacity		183980		lbs.
Capacity: Demand Ratio:		18.58		**OK**
Shaft 2 Front Row				
Maximum Shear		3300		lbs.
Nominal Structural Shear Capacity as per AASHTO LRFD BDS Article 5.7		183980		lbs.
Strength Reduction Factor	0.90	1.00		
Factored Structural Shear Capacity		183980		lbs.
Capacity: Demand Ratio:		55.75		**OK**

Since Capacity/Demand Ratio of all the Checks were greater than 1.0, the proposed length of the drilled shaft to be used is 16'.

Project: OTIC 71-24-02 **Site Location:** DMS #8 WB - Median Drilled Shaft, B-005-0-25
Calculated By: SS **Checked by:** WN
Date: 9/18/2025

SPECIAL FOUNDATION DESIGN ANALYSIS

Span Truss:

Span Length =	70.00	ft
Truss Hight (H) =		ft

Drilled Shaft:

Diameter (D) =	3.00	ft
Total Foundation Length (L)	16.00	ft
The Above Grade Length =	0.00	ft
Drilled Shaft Volume =	113.10	cubic ft.
Concrete Unit Weight =	150.00	Pcf

Soil Properties:	Foundation Soil	Units
Ave. Soil Unit Weight =	118.50	Pcf
Internal Friction Angle ϕ (digs) =		degrees
Ave. Shear Strength of Soil (C_u) =	1134.6	psf
K_p =		
Groundwater Level Depth BGS =	3.000	ft.
Resistance Factors		
Side Resistance Factor in Clay φ_{stat} =	0.45	BDM Table 305-1
Tip Resistance Factor in Clay φ_{stst} =	0.40	BDM Table 305-1
Uplift Resistance Factor in Clay φ_{up} =	0.35	BDM Table 305-1
Passive Resistance Factor (Extreme I)	0.75	AASHTO Table 11.5.7-1
Passive Resistance Factor (Strength I)	0.75	AASHTO Table 11.5.7-1
Passive Resistance Factor (Service I)	1.00	AASHTO Table 11.5.7-1

AASHTO LRFDLTS Table. 3.4-1

		Permanent		Transient		
Limit State	**Reference Articles**	**Dead Load (DC) Max/Min**	**Dead Load (DC) Mean**	**Live Load (LL)**	**Wind (W)**	
Strength I - Gravity	**3.5, 3.6, and 3.7**	**1.25**	**1.60**			
Extreme I - Wind	**3.5, 3.8, and 3.9**	**1.1/0.9**			**1.0[a]**	
Service 1 - Translation	**10.40**		**1.00**		**1.0[b]**	
a. Use Figures 3.8-1, 3.8-2, or 3.8-3 (for appropriate return period) b. Use wind map 3.8-4 (service)						

The Following are reaction Factored Loads for ITS-3513 Design No. 1, at the top of the Drilled Shaft 1 & 2 to be installed at the Shoulder

Limit State	**Shaft**	**Fz (lb.)**	**Fy (lb.)**	**Mu(in-lb.)**				
Strength I	1	27790.00	10.00	138120.00				
Strength I	2	24090.00	-20.00	140880.00				
Extreme I	1	46960.00	3120.00	29880.00				
Extreme I	2	-5160.00	6800.00	247440.00				
Service I	1							
Service I	2							

Bearing Resistance Check **AASHTO LRFD Section 10.8.3.5**

		Strength I	**Extreme I**	**Service I**	
Check on Shoulder Column					
Axial Factored Design Load:		27790.00	46960.00		lb.
Nominal Side Resistance :		82940.00	82940.00		lb.
Side Resistance Factor in Clay:	φ_{stat}	0.45	1.00		
Nominal Tip Resistance:		46280.00	46280.00		lb.
Tip Resistance Factor in Clay:	φ_{stat}	0.40	1.00		
Factored Side Resistance :		37323.00	82940.00		lb.
Factored Tip Resistance:		18512.00	46280.00		lb.
Total Factored Bearing Resistance:		55835.00	129220.00		lb.
Capacity: Demand Ratio (CDR):		2.01	2.75		**OK**

Uplift Resistance Check **AASHTO LRFD Section 10.8.3.7.2**

		Strength I	**Extreme I**	**Service I**	
Uplift Factored Design Load:			-5160.00		lb.
Nominal Side Resistance :			82940.00		lb.
Uplift Resistance Factor:	Reduction Factor = 0.8 as per LRFD 10.5.5.3.3	φ_{up} = 0.35	1.00		
Factored Side Resistance :			66352.00		
Drilled Shaft Concrete Weight:			16965.00		lb.
DC Load Factor:			0.90		
Factored Concrete Weight:			15268.50		lb.
Total Resistance:			81620.50		lb.
Capacity: Demand Ratio (CDR):			15.82		**OK**

Brom's Method with Strength Limit State Load Factors and Resistance Factors , in accordance with the commentary in LRFD C11.8.4.1.

Drilled Shaft Passive Resistance is calculated as $9c_uD$ over the Length excluding a top length equal to 1.5D where D = drilled shaft Diameter L-1.5D = 11.50 ft.

	Strength I	Extreme I	Service I	
Shaft 1 Back Row				
Wind Factored Load (Fy):	10.00	3120.00		lb.
Moment of Force Fv as MA_{Fy} , Moment about the base (L)= 16'				ft
MA_{Fy} =	160.00	49920.00		lb.-ft
Passive Resistance (R) along the Fo. length (L-1.5D)	352293.30	352293.30		9CuD*(L-1.5D) lb.
Passive Resistance Factor	0.75	0.75		
Average Shear Strength = 1134.6 psf:				psf
Factored Passive Resistance (R) along the Fo. Lengt	264219.98	264219.98		lb.
Moment of Force R as MA_R , Moment about the base= (L-1.5D)/2=5.75'				ft
Moment MA_R =	1519264.86	1519264.86		lb.-ft
Capacity: Demand Ratio (CDR) =	9495.41	30.43		**OK**

	Strength I	Extreme I	Service I	
Shaft 2 Front Row				
Wind Factored Load (Fy):	-20.00	6800.00		lb.
Moment of Force Fv as MA_{Fy} , Moment about the base (L)= 16'				ft
MA_{Fy} =	-320.00	108800.00		lb.-ft
Passive Resistance (R) along the Fo. length (L-1.5D)	352293.30	352293.30		9CuD*(L-1.5D) lb.
Passive Resistance Factor	0.75	0.75		
Average Shear Strength of Soil = 1134.6 psf:				
Factored Passive Resistance (R) along the Fo. Lengt	264219.975	264219.975		lb.
Moment of Force R as MA_R , Moment about the base= (L-1.5D)/2=5.75'				ft
Moment MA_R =	1519264.86	1519264.86		lb.-ft
Capacity: Demand Ratio (CDR) =	-4747.70	13.96		**OK**

Lateral Resistance Check **AASHTO LRFD Section 10.8.3.9**

		Extreme I	Service I	
Shaft 1 Back Row				
Lateral Deflection at Minimum Length of Drilled Shaft:	3.2'	0.28706		inch
p-multiplier (P_m) as per AASHTO LRFD BDS 10.7.2.4		0.4		
		0.1148		
Lateral Deflection at Full Length of Drilled Shaft:	16.0'	0.00576		inch
Capacity: Demand Ratio (CDR_L) to provide Lateral Restraint:		19.93		**OK**
Shaft 2 Front Row				
Lateral Deflection at Minimum Length of Drilled Shaft:	4.0'	0.03719		inch
p-multiplier (P_m) as per AASHTO LRFD BDS 10.7.2.4		0.8		
		0.0298		
Lateral Deflection at Full Length of Drilled Shaft:	16.0'	0.00782		inch
Capacity: Demand Ratio (CDR_L) to provide Lateral Restraint:		3.80		**OK**

Flexural Moment Resistance Chec **AASHTO LRFD Section 10.8.3.9**

	Strength I	Extreme I	Service I	
Shaft 1 Back Row				
Maximum Moment:		-256164		inch-lbs.
Nominal Moment Capacity		8561256		inch-lbs.
Flexural Resistance Factor	0.90	1.00		
Factored Moment Capacity		8561256		inch-lbs.
Capacity: Demand Ratio:		33.42		**OK**
Shaft 2 Front Row				
Maximum Moment		-481067		inch-lbs.
Nominal Moment Capacity		7976223		inch-lbs.
Flexural Resistance Factor	0.90	1.00		
Factored Moment Capacity		7976223		inch-lbs.
Capacity: Demand Ratio:		16.58		**OK**

Shear Resistance Check **AASHTO LRFD Section 10.8.3.9**

	Strength I	Extreme I	Service I	
Shaft 1 Back Row				
Maximum Shear		3120		lbs.
Nominal Structural Shear Capacity as per AASHTO LRFD BDS Article 5.7		183980		lbs.
Strength Reduction Factor	0.90	1.00		
Factored Structural Shear Capacity		183980		lbs.
Capacity: Demand Ratio:		58.97		**OK**
Shaft 2 Front Row				
Maximum Shear		6800		lbs.
Nominal Structural Shear Capacity as per AASHTO LRFD BDS Article 5.7		183980		lbs.
Strength Reduction Factor	0.90	1.00		
Factored Structural Shear Capacity		183980		lbs.
Capacity: Demand Ratio:		27.06		**OK**

Since Capacity/Demand Ratio of all the Checks were greater than 1.0, the proposed length of the drilled shaft to be used is 16'.

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

                 SHAFT for Windows, Version 2012.7.8

                  Serial Number :  292797964

               VERTICALLY LOADED DRILLED SHAFT ANALYSIS
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================================================================================


     Path to file locations      : M:\Project Files\25 Projects\G25003G Baker-OTIC
71-24-02\Analysis File Folder\Drilled Shaft Folder\DMS #8 WB B-005-0-25\
     Name of input data file     : B-005Shaft.sfd
     Name of output file         : B-005Shaft.sfo
     Name of plot output file    : B-005Shaft.sfp
     Name of runtime file        : B-005Shaft.sfr


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

          Date:  July 30, 2025     Time:  18:24:22

     DMS #8 WB B-005-0-25


     PROPOSED DEPTH =      16.0 FT
     ----------------


     NUMBER OF LAYERS =    6
     ------------------


     WATER TABLE DEPTH =       3.0 FT.
     -------------------




     SOIL INFORMATION
     ---------------

     LAYER NO 1----CLAY

       AT THE TOP
```

```
  STRENGTH REDUCTION FACTOR-ALPHA                       = 0.550E+00
  END BEARING COEFFICIENT-Nc                            = 0.600E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                    = 0.250E+03
  INTERNAL FRICTION ANGLE, DEG.                         = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST         = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                            = 0.120E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT              = 0.100E+11
  DEPTH, FT                                             = 0.000E+00


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                       = 0.550E+00
  END BEARING COEFFICIENT-Nc                            = 0.720E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                    = 0.250E+03
  INTERNAL FRICTION ANGLE, DEG.                         = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST         = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                            = 0.120E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT              = 0.100E+11
  DEPTH, FT                                             = 0.300E+01


  LRFD RESISTANCE FACTOR (SIDE FRICTION)                = 0.450E+00
  LRFD RESISTANCE FACTOR (TIP RESISTANCE)               = 0.400E+00


LAYER NO 2----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                       = 0.550E+00
  END BEARING COEFFICIENT-Nc                            = 0.720E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                    = 0.175E+04
  INTERNAL FRICTION ANGLE, DEG.                         = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST         = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                            = 0.120E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT              = 0.100E+11
  DEPTH, FT                                             = 0.300E+01


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                       = 0.550E+00
  END BEARING COEFFICIENT-Nc                            = 0.840E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                    = 0.175E+04
  INTERNAL FRICTION ANGLE, DEG.                         = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST         = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                            = 0.120E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT              = 0.100E+11
```

```
  DEPTH, FT                                            = 0.600E+01


  LRFD RESISTANCE FACTOR (SIDE FRICTION)               = 0.450E+00
  LRFD RESISTANCE FACTOR (TIP RESISTANCE)              = 0.400E+00


LAYER NO 3----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                      = 0.550E+00
  END BEARING COEFFICIENT-Nc                           = 0.840E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                   = 0.100E+04
  INTERNAL FRICTION ANGLE, DEG.                        = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST        = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                           = 0.118E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT             = 0.100E+11
  DEPTH, FT                                            = 0.600E+01


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                      = 0.550E+00
  END BEARING COEFFICIENT-Nc                           = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                   = 0.100E+04
  INTERNAL FRICTION ANGLE, DEG.                        = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST        = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                           = 0.118E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT             = 0.100E+11
  DEPTH, FT                                            = 0.135E+02


  LRFD RESISTANCE FACTOR (SIDE FRICTION)               = 0.450E+00
  LRFD RESISTANCE FACTOR (TIP RESISTANCE)              = 0.400E+00


LAYER NO 4----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                      = 0.550E+00
  END BEARING COEFFICIENT-Nc                           = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                   = 0.100E+04
  INTERNAL FRICTION ANGLE, DEG.                        = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST        = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                           = 0.118E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT             = 0.100E+11
  DEPTH, FT                                            = 0.135E+02
```

```
  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                        = 0.550E+00
  END BEARING COEFFICIENT-Nc                             = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                     = 0.100E+04
  INTERNAL FRICTION ANGLE, DEG.                          = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST          = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                             = 0.118E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT               = 0.100E+11
  DEPTH, FT                                              = 0.185E+02


  LRFD RESISTANCE FACTOR (SIDE FRICTION)                 = 0.450E+00
  LRFD RESISTANCE FACTOR (TIP RESISTANCE)                = 0.400E+00


LAYER NO 5----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                        = 0.550E+00
  END BEARING COEFFICIENT-Nc                             = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                     = 0.625E+03
  INTERNAL FRICTION ANGLE, DEG.                          = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST          = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                             = 0.113E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT               = 0.100E+11
  DEPTH, FT                                              = 0.185E+02


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                        = 0.550E+00
  END BEARING COEFFICIENT-Nc                             = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                     = 0.625E+03
  INTERNAL FRICTION ANGLE, DEG.                          = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST          = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                             = 0.113E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT               = 0.100E+11
  DEPTH, FT                                              = 0.235E+02


  LRFD RESISTANCE FACTOR (SIDE FRICTION)                 = 0.450E+00
  LRFD RESISTANCE FACTOR (TIP RESISTANCE)                = 0.400E+00


LAYER NO 6----CLAY

  AT THE TOP
```

```
  STRENGTH REDUCTION FACTOR-ALPHA                       = 0.550E+00
  END BEARING COEFFICIENT-Nc                            = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                    = 0.500E+03
  INTERNAL FRICTION ANGLE, DEG.                         = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST         = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                            = 0.112E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT              = 0.100E+11
  DEPTH, FT                                             = 0.235E+02


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                       = 0.550E+00
  END BEARING COEFFICIENT-Nc                            = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                    = 0.500E+03
  INTERNAL FRICTION ANGLE, DEG.                         = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST         = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                            = 0.112E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT              = 0.100E+11
  DEPTH, FT                                             = 0.250E+02


  LRFD RESISTANCE FACTOR (SIDE FRICTION)                = 0.450E+00
  LRFD RESISTANCE FACTOR (TIP RESISTANCE)               = 0.400E+00



DRILLED SHAFT INFORMATION
-------------------------

 DIAMETER OF STEM          =    3.000  FT.
 DIAMETER OF BASE          =    3.000  FT.
 END OF STEM TO BASE       =    0.000  FT.
 ANGLE OF BELL             =    0.000  DEG.
 IGNORED TOP PORTION       =    0.000  FT.
 IGNORED BOTTOM PORTION    =    0.000  FT.
 AREA OF ONE PERCENT STEEL =   10.180  SQ.IN.
 ELASTIC MODULUS, Ec       = 0.360E+07 LB/SQ IN
 VOLUME OF UNDERREAM       =    0.000  CU.YDS.



PREDICTED RESULTS
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QS       = ULTIMATE SIDE RESISTANCE;
QB       = ULTIMATE BASE RESISTANCE;
```

WT = WEIGHT OF DRILLED SHAFT (UPLIFT CAPACITY ONLY);
QU = TOTAL ULTIMATE RESISTANCE;
LRFD QS = TOTAL SIDE FRICTION USING LRFD RESISTANCE FACTOR TO THE ULTIMATE SIDE RESISTANCE;
LRFD QB = TOTAL BASE BEARING USING LRFD RESISTANCE FACTOR TO THE ULTIMATE BASE RESISTANCE
LRFD QU = TOTAL CAPACITY WITH LRFD RESISTANCE FACTOR.

LENGTH (FEET)	VOLUME (CU.YDS)	QS (TONS)	QB (TONS)	QU (TONS)	LRFD QS (TONS)	LRFD QB (TONS)	LRFD QU (TONS)
1.0	0.26	0.65	41.57	42.22	0.29	16.63	16.92
2.0	0.52	1.30	41.12	42.41	0.58	16.45	17.03
3.0	0.79	1.94	35.91	37.85	0.87	14.36	15.24
4.0	1.05	6.48	32.33	38.81	2.92	12.93	15.85
5.0	1.31	11.02	30.57	41.58	4.96	12.23	17.18
6.0	1.57	15.55	30.83	46.39	7.00	12.33	19.33
7.0	1.83	18.15	31.10	49.24	8.17	12.44	20.60
8.0	2.09	20.74	31.36	52.10	9.33	12.55	21.88
9.0	2.36	23.33	31.57	54.90	10.50	12.63	23.13
10.0	2.62	25.92	31.72	57.64	11.66	12.69	24.35
11.0	2.88	28.51	31.79	60.30	12.83	12.72	25.55
12.0	3.14	31.11	31.81	62.92	14.00	12.73	26.72
13.0	3.40	33.70	31.81	65.51	15.16	12.73	27.89
14.0	3.67	36.29	29.28	65.57	16.33	11.71	28.04
15.0	3.93	38.88	26.39	65.27	17.50	10.56	28.05
16.0	4.19	41.47	23.14	64.61	18.66	9.25	27.92

RESULT FROM TREND (AVERAGED) LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.6255E-02	0.1038E-04	0.5077E-03	0.1000E-04
0.3128E-01	0.5189E-04	0.2539E-02	0.5000E-04
0.6255E-01	0.1038E-03	0.5077E-02	0.1000E-03
0.3128E+01	0.5189E-02	0.2539E+00	0.5000E-02
0.4691E+01	0.7784E-02	0.3808E+00	0.7500E-02
0.6255E+01	0.1038E-01	0.5077E+00	0.1000E-01
0.1564E+02	0.2595E-01	0.1269E+01	0.2500E-01
0.2641E+02	0.5162E-01	0.2539E+01	0.5000E-01
0.3345E+02	0.7708E-01	0.3808E+01	0.7500E-01
0.3977E+02	0.1025E+00	0.5077E+01	0.1000E+00
0.4878E+02	0.2533E+00	0.1062E+02	0.2500E+00
0.5215E+02	0.5037E+00	0.1548E+02	0.5000E+00
0.5234E+02	0.6288E+00	0.1710E+02	0.6250E+00
0.5356E+02	0.9040E+00	0.2001E+02	0.9000E+00
0.5599E+02	0.1804E+01	0.2244E+02	0.1800E+01

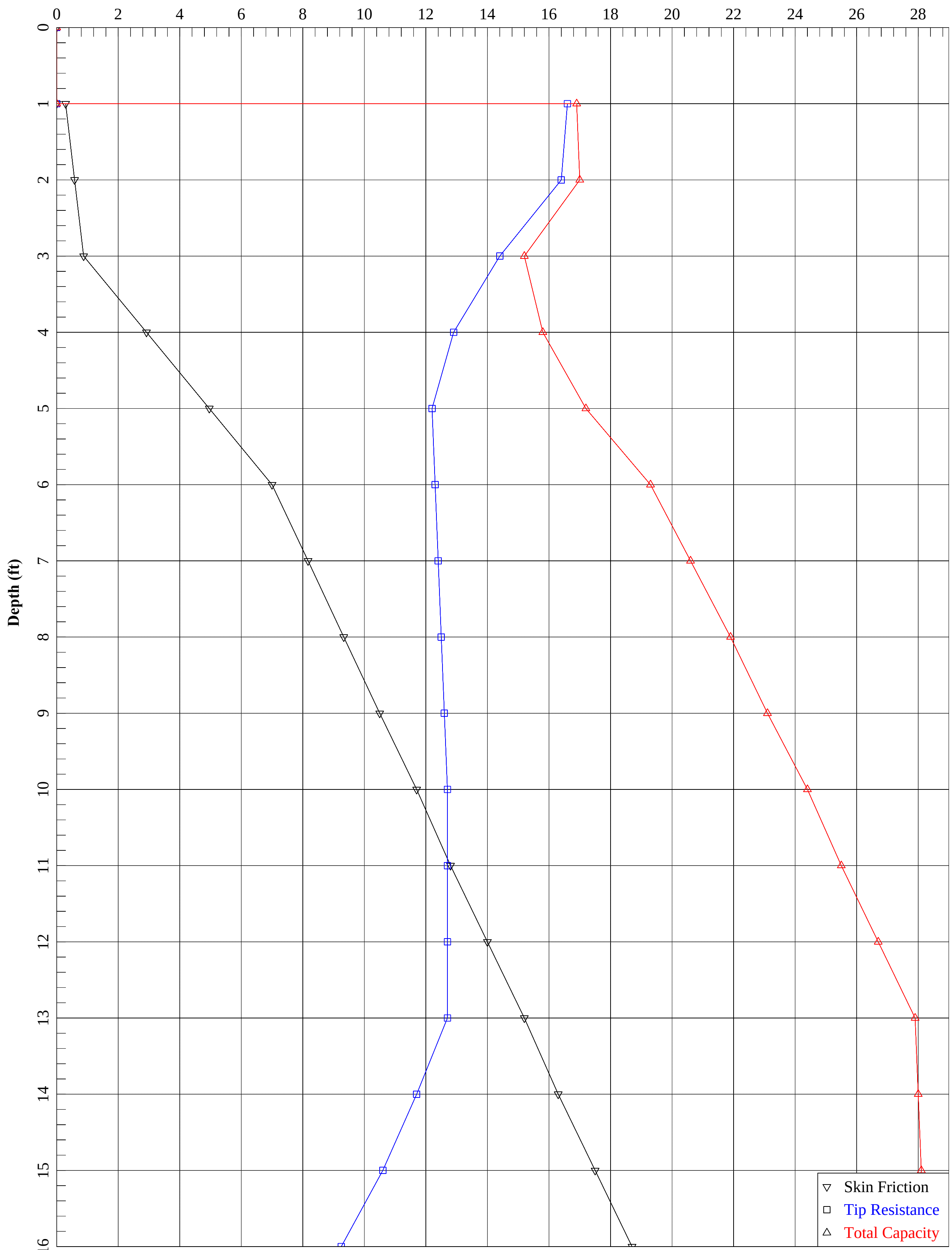
RESULT FROM UPPER-BOUND LINE

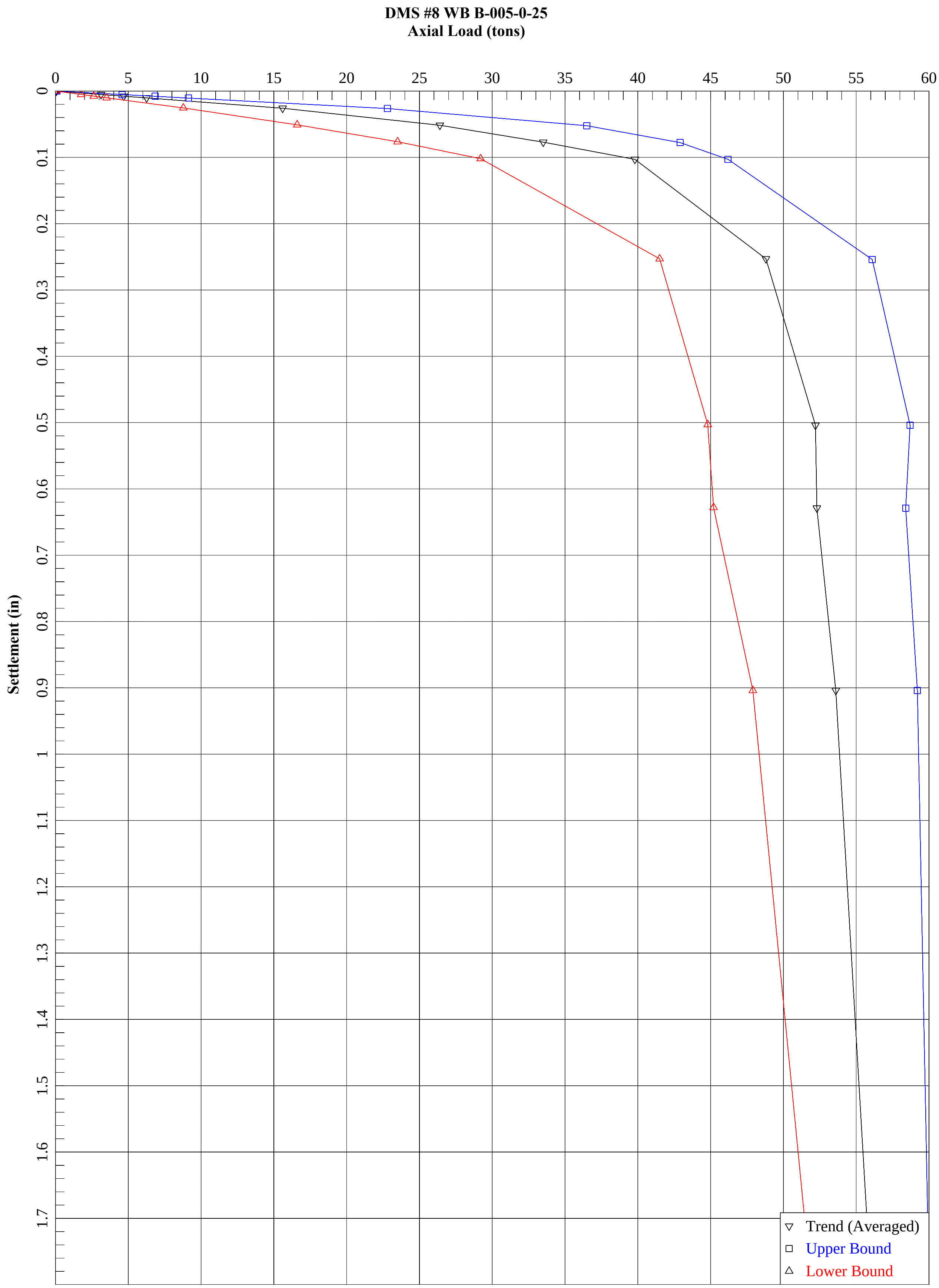
TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.9136E-02	0.1055E-04	0.7584E-03	0.1000E-04
0.4568E-01	0.5277E-04	0.3792E-02	0.5000E-04
0.9136E-01	0.1055E-03	0.7584E-02	0.1000E-03
0.4568E+01	0.5277E-02	0.3792E+00	0.5000E-02
0.6852E+01	0.7915E-02	0.5688E+00	0.7500E-02
0.9136E+01	0.1055E-01	0.7584E+00	0.1000E-01
0.2284E+02	0.2638E-01	0.1896E+01	0.2500E-01
0.3646E+02	0.5225E-01	0.3792E+01	0.5000E-01
0.4286E+02	0.7771E-01	0.5688E+01	0.7500E-01
0.4616E+02	0.1030E+00	0.7584E+01	0.1000E+00
0.5607E+02	0.2539E+00	0.1509E+02	0.2500E+00
0.5873E+02	0.5043E+00	0.1933E+02	0.5000E+00
0.5845E+02	0.6293E+00	0.2044E+02	0.6250E+00
0.5917E+02	0.9044E+00	0.2221E+02	0.9000E+00
0.5998E+02	0.1805E+01	0.2302E+02	0.1800E+01

RESULT FROM LOWER-BOUND LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.3511E-02	0.1021E-04	0.2571E-03	0.1000E-04
0.1755E-01	0.5106E-04	0.1285E-02	0.5000E-04
0.3511E-01	0.1021E-03	0.2571E-02	0.1000E-03
0.1755E+01	0.5106E-02	0.1285E+00	0.5000E-02
0.2633E+01	0.7659E-02	0.1928E+00	0.7500E-02
0.3511E+01	0.1021E-01	0.2571E+00	0.1000E-01
0.8777E+01	0.2553E-01	0.6427E+00	0.2500E-01
0.1660E+02	0.5100E-01	0.1285E+01	0.5000E-01
0.2350E+02	0.7643E-01	0.1928E+01	0.7500E-01
0.2918E+02	0.1018E+00	0.2571E+01	0.1000E+00
0.4150E+02	0.2527E+00	0.6157E+01	0.2500E+00
0.4480E+02	0.5031E+00	0.1162E+02	0.5000E+00
0.4519E+02	0.6282E+00	0.1375E+02	0.6250E+00
0.4795E+02	0.9036E+00	0.1782E+02	0.9000E+00
0.5188E+02	0.1804E+01	0.2175E+02	0.1800E+01

DMS #8 WB B-005-0-25
LRFD Resistance (tons)




DMS #8 WB B-005-0-25
Axial Load (tons)
0
5
10
15
20
25
30
35
40
45
50
55
60
Settlement (in)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1.1
1.2
1.3
1.4
1.5
1.6
1.7
Trend (Averaged)
Upper Bound
Lower Bound

Project: OTIC 71-24-02 **Site Location:** DMS #9 WB - Shoulder Drilled Shaft, B-003-0-25
Calculated By: SS **Checked by:** WN
Date: 9/18/2025

SPECIAL FOUNDATION DESIGN ANALYSIS

Span Truss:
Span Length = 70.00 ft
Truss Hight (H) = ft

Drilled Shaft:
Diameter (D) = 3.00 ft
Total Foundation Length (L) 16.00 ft
The Above Grade Length = 0.00 ft
Drilled Shaft Volume = 113.10 cubic ft.
Concrete Unit Weight = 150.00 Pcf

Soil Properties: Foundation Soil Units
Ave. Soil Unit Weight = 120.60 Pcf
Internal Friction Angle ϕ (digs) = degrees
Ave. Shear Strength of Soil (C_u) = 1250 psf
K_p =
Groundwater Level Depth BGS = 3.000 ft.

Resistance Factors
Side Resistance Factor in Clay φ_{stat} = 0.45 BDM Table 305-1
Tip Resistance Factor in Clay φ_{stst} = 0.40 BDM Table 305-1
Uplift Resistance Factor in Clay φ_{up} = 0.35 BDM Table 305-1
Passive Resistance Factor (Extreme I) 0.75 AASHTO Table 11.5.7-1
Passive Resistance Factor (Strength I) 0.75 AASHTO Table 11.5.7-1
Passive Resistance Factor (Service I) 1.00 AASHTO Table 11.5.7-1

AASHTO LRFDLTS Table. 3.4-1

Limit State	Reference Articles	Permanent Dead Load (DC) Max/Min	Transient Dead Load (DC) Mean	Live Load (LL)	Wind (W)	
Strength I - Gravity	**3.5, 3.6, and 3.7**	**1.25**	**1.60**			
Extreme I - Wind	**3.5, 3.8, and 3.9**	**1.1/0.9**			**1.0[a]**	
Service 1 - Translation	**10.40**		**1.00**		**1.0[b]**	
a. Use Figures 3.8-1, 3.8-2, or 3.8-3 (for appropriate return period) b. Use wind map 3.8-4 (service)						

The Following are reaction Factored Loads for ITS-3513 Design No. 1, at the top of the Drilled Shaft 1 & 2 to be installed at the Shoulder

Limit State	Shaft	Fz (lb.)	Fy (lb.)	Mu(in-lb.)				
Strength I	1	19550.00	30.00	70680.00				
Strength I	2	14170.00	-20.00	69960.00				
Extreme I	1	60280.00	9900.00	111120.00				
Extreme I	2	-32880.00	3300.00	155880.00				
Service I	1							
Service I	2							

Bearing Resistance Check **AASHTO LRFD Section 10.8.3.5**

		Strength I	Extreme I	Service I	
Check on Shoulder Column					
Axial Factored Design Load:		19550.00	60280.00		lb.
Nominal Side Resistance :		84380.00	84380.00		lb.
Side Resistance Factor in Clay:	φ_{stat}	0.45	1.00		
Nominal Tip Resistance:		25520.00	25520.00		lb.
Tip Resistance Factor in Clay:	φ_{stat}	0.40	1.00		
Factored Side Resistance :		37971.00	84380.00		lb.
Factored Tip Resistance:		10208.00	25520.00		lb.
Total Factored Bearing Resistance:		48179.00	109900.00		lb.
Capacity: Demand Ratio (CDR):		2.46	1.82		**OK**

Uplift Resistance Check **AASHTO LRFD Section 10.8.3.7.2**

		Strength I	Extreme I	Service I	
Uplift Factored Design Load:			-32880.00		lb.
Nominal Side Resistance :			84380.00		lb.
Uplift Resistance Factor:	Reduction Factor = 0.8 as per LRFD 10.5.5.3.3	φ_{up} = 0.35	1.00		
Factored Side Resistance :			67504.00		
Drilled Shaft Concrete Weight:			16965.00		lb.
DC Load Factor:			0.90		
Factored Concrete Weight:			15268.50		lb.
Total Resistance:			82772.50		lb.
Capacity: Demand Ratio (CDR):			2.52		**OK**

Brom's Method with Strength Limit State Load Factors and Resistance Factors , in accordance with the commentary in LRFD C11.8.4.1.

Drilled Shaft Passive Resistance is calculated as $9c_uD$ over the Length excluding a top length equal to 1.5D where D = drilled shaft Diameter L-1.5D = 11.50 ft.

	Strength I	Extreme I	Service I	
Shaft 1 Back Row				
Wind Factored Load (Fy):	30.00	9900.00		lb.
Moment of Force Fv as MA_{Fy} , Moment about the base (L)= 16'				ft
MA_{Fy} =	480.00	158400.00		lb.-ft
Passive Resistance (R) along the Fo. length (L-1.5D)	388125.00	388125.00		9CuD*(L-1.5D) lb.
Passive Resistance Factor	0.75	0.75		
Average Shear Strength of Soil = 1250 psf:				psf
Factored Passive Resistance (R) along the Fo. Lengt	291093.75	291093.75		lb.
Moment of Force R as MA_R , Moment about the base= (L-1.5D)/2=5.75'				ft
Moment MA_R =	1673789.06	1673789.06		lb.-ft
Capacity: Demand Ratio (CDR) =	3487.06	10.57		**OK**

	Strength I	Extreme I	Service I	
Shaft 2 Front Row				
Wind Factored Load (Fy):	-20.00	3300.00		lb.
Moment of Force Fv as MA_{Fy} , Moment about the base (L)= 16'				ft
MA_{Fy} =	-320.00	52800.00		lb.-ft
Passive Resistance (R) along the Fo. length (L-1.5D)	388125.00	388125.00		9CuD*(L-1.5D) lb.
Passive Resistance Factor	0.75	0.75		
Average Shear Strength = 1250 psf:				
Factored Passive Resistance (R) along the Fo. Lengt	291093.75	291093.75		lb.
Moment of Force R as MA_R , Moment about the base= (L-1.5D)/2=5.75'				ft
Moment MA_R =	1673789.06	1673789.06		lb.-ft
Capacity: Demand Ratio (CDR) =	-5230.59	31.70		**OK**

Lateral Resistance Check **AASHTO LRFD Section 10.8.3.9**

		Extreme I	Service I	
Shaft 1 Back Row				
Lateral Deflection at Minimum Length of Drilled Shaft:	5.6'	0.72827		inch
p-multiplier (P_m) as per AASHTO LRFD BDS 10.7.2.4		0.4		
		0.2913		
Lateral Deflection at Full Length of Drilled Shaft:	16.0'	0.03787		inch
Capacity: Demand Ratio (CDR_L) to provide Lateral Restraint:		7.69		**OK**
Shaft 2 Front Row				
Lateral Deflection at Minimum Length of Drilled Shaft:	4.0'	0.14169		inch
p-multiplier (P_m) as per AASHTO LRFD BDS 10.7.2.4		0.8		
		0.1134		
Lateral Deflection at Full Length of Drilled Shaft:	16.0'	0.00796		inch
Capacity: Demand Ratio (CDR_L) to provide Lateral Restraint:		14.24		**OK**

Flexural Moment Resistance Che **AASHTO LRFD Section 10.8.3.9**

	Strength I	Extreme I	Service I	
Shaft 1 Back Row				
Maximum Moment:		-1222609		inch-lbs.
Nominal Moment Capacity		8709733		inch-lbs.
Flexural Resistance Factor	0.90	1.00		
Factored Moment Capacity		8709733		inch-lbs.
Capacity: Demand Ratio:		7.12		**OK**
Shaft 2 Front Row				
Maximum Moment		-336909		inch-lbs.
Nominal Moment Capacity		7653856		inch-lbs.
Flexural Resistance Factor	0.90	1.00		
Factored Moment Capacity		7653856		inch-lbs.
Capacity: Demand Ratio:		22.72		**OK**

Shear Resistance Check **AASHTO LRFD Section 10.8.3.9**

	Strength I	Extreme I	Service I	
Shaft 1 Back Row				
Maximum Shear		9900		lbs.
Nominal Structural Shear Capacity as per AASHTO LRFD BDS Article 5.7		183980		lbs.
Strength Reduction Factor	0.90	1.00		
Factored Structural Shear Capacity		183980		lbs.
Capacity: Demand Ratio:		18.58		**OK**
Shaft 2 Front Row				
Maximum Shear		3300		lbs.
Nominal Structural Shear Capacity as per AASHTO LRFD BDS Article 5.7		183980		lbs.
Strength Reduction Factor	0.90	1.00		
Factored Structural Shear Capacity		183980		lbs.
Capacity: Demand Ratio:		55.75		**OK**

Since Capacity/Demand Ratio of all the Checks were greater than 1.0, the proposed length of the drilled shaft to be used is 16'.

Project: OTIC 71-24-02 **Site Location:** DMS #9 WB - Median Drilled Shaft, B-003-0-25
Calculated By: SS **Checked by:** WN
Date: 9/18/2025

SPECIAL FOUNDATION DESIGN ANALYSIS

Span Truss:

Span Length =	70.00	ft
Truss Hight (H) =		ft

Drilled Shaft:

Diameter (D) =	3.00	ft
Total Foundation Length (L)	16.00	ft
The Above Grade Length =	0.00	ft
Drilled Shaft Volume =	113.10	cubic ft.
Concrete Unit Weight =	150.00	Pcf

Soil Properties: Foundation Soil Units

Ave. Soil Unit Weight =	120.60	Pcf
Internal Friction Angle ϕ (digs) =		degrees
Ave. Shear Strength of Soil (C_u) =	1250	psf
K_p =		
Groundwater Level Depth BGS =	3.000	ft.

Resistance Factors

Side Resistance Factor in Clay φ_{stat} =	0.45	BDM Table 305-1
Tip Resistance Factor in Clay φ_{stst} =	0.40	BDM Table 305-1
Uplift Resistance Factor in Clay φ_{up} =	0.35	BDM Table 305-1
Passive Resistance Factor (Extreme I)	0.75	AASHTO Table 11.5.7-1
Passive Resistance Factor (Strength I)	0.75	AASHTO Table 11.5.7-1
Passive Resistance Factor (Service I)	1.00	AASHTO Table 11.5.7-1

AASHTO LRFDLTS Table. 3.4-1

		Permanent		Transient		
Limit State	**Reference Articles**	**Dead Load (DC) Max/Min**	**Dead Load (DC) Mean**	**Live Load (LL)**	**Wind (W)**	
Strength I - Gravity	**3.5, 3.6, and 3.7**	**1.25**	**1.60**			
Extreme I - Wind	**3.5, 3.8, and 3.9**	**1.1/0.9**			**1.0[a]**	
Service 1 - Translation	**10.40**		**1.00**		**1.0[b]**	
a. Use Figures 3.8-1, 3.8-2, or 3.8-3 (for appropriate return period) b. Use wind map 3.8-4 (service)						

The Following are reaction Factored Loads for ITS-3513 Design No. 1, at the top of the Drilled Shaft 1 & 2 to be installed at the Shoulder

Limit State	**Shaft**	**Fz (lb.)**	**Fy (lb.)**	**Mu(in-lb.)**				
Strength I	1	27790.00	10.00	138120.00				
Strength I	2	24090.00	-20.00	140880.00				
Extreme I	1	46960.00	3120.00	29880.00				
Extreme I	2	-5160.00	6800.00	247440.00				
Service I	1							
Service I	2							

Bearing Resistance Check **AASHTO LRFD Section 10.8.3.5**

Check on Shoulder Column		**Strength I**	**Extreme I**	**Service I**	
Axial Factored Design Load:		27790.00	46960.00		lb.
Nominal Side Resistance :		84380.00	84380.00		lb.
Side Resistance Factor in Clay:	φ_{stat}	0.45	1.00		
Nominal Tip Resistance:		25520.00	25520.00		lb.
Tip Resistance Factor in Clay:	φ_{stat}	0.40	1.00		
Factored Side Resistance :		37971.00	84380.00		lb.
Factored Tip Resistance:		10208.00	25520.00		lb.
Total Factored Bearing Resistance:		48179.00	109900.00		lb.
Capacity: Demand Ratio (CDR):		1.73	2.34		**OK**

Uplift Resistance Check **AASHTO LRFD Section 10.8.3.7.2**

		Strength I	**Extreme I**	**Service I**	
Uplift Factored Design Load:			-5160.00		lb.
Nominal Side Resistance :			84380.00		lb.
Uplift Resistance Factor:	Reduction Factor = 0.8 as per LRFD 10.5.5.3.3	φ_{up} = 0.35	1.00		
Factored Side Resistance :			67504.00		
Drilled Shaft Concrete Weight:			16965.00		lb.
DC Load Factor:			0.90		
Factored Concrete Weight:			15268.50		lb.
Total Resistance:			82772.50		lb.
Capacity: Demand Ratio (CDR):			16.04		**OK**

Brom's Method with Strength Limit State Load Factors and Resistance Factors , in accordance with the commentary in LRFD C11.8.4.1.

Drilled Shaft Passive Resistance is calculated as $9c_uD$ over the Length excluding a top length equal to 1.5D where D = drilled shaft Diameter   L-1.5D = 11.50 ft.

		Strength I	Extreme I	Service I	
Shaft 1	Back Row				
Wind Factored Load (Fy):		10.00	3120.00		lb.
Moment of Force Fv as MA_{Fy} , Moment about the base (L)= 16'					ft
MA_{Fy} =		160.00	49920.00		lb.-ft
Passive Resistance (R) along the Fo. length (L-1.5D)		388125.00	388125.00		9CuD*(L-1.5D) lb.
Passive Resistance Factor		0.75	0.75		
Average Shear Strength of Soil = 1250 psf:					psf
Factored Passive Resistance (R) along the Fo. Lengt		291093.75	291093.75		lb.
Moment of Force R as MA_R , Moment about the base= (L-1.5D)/2=5.75'					ft
Moment MA_R =		1673789.06	1673789.06		lb.-ft
	Capacity: Demand Ratio (CDR) =	10461.18	33.53		**OK**

		Strength I	Extreme I	Service I	
Shaft 2	Front Row				
Wind Factored Load (Fy):		-20.00	6800.00		lb.
Moment of Force Fv as MA_{Fy} , Moment about the base (L)= 16'					ft
MA_{Fy} =		-320.00	108800.00		lb.-ft
Passive Resistance (R) along the Fo. length (L-1.5D)		388125.00	388125.00		9CuD*(L-1.5D) lb.
Passive Resistance Factor		0.75	0.75		
Average Shear Strength = 1250 psf:					
Factored Passive Resistance (R) along the Fo. Lengt		291093.75	291093.75		lb.
Moment of Force R as MA_R , Moment about the base= (L-1.5D)/2=5.75'					ft
Moment MA_R =		1673789.06	1673789.06		lb.-ft
	Capacity: Demand Ratio (CDR) =	-5230.59	15.38		**OK**

<u>Lateral Resistance Check</u>   **AASHTO LRFD Section 10.8.3.9**

			Extreme I	Service I	
Shaft 1	Back Row				
Lateral Deflection at Minimum Length of Drilled Shaft:		4.0'	0.32284		inch
p-multiplier (P_m) as per AASHTO LRFD BDS 10.7.2.4			0.4		
			0.1291		
Lateral Deflection at Full Length of Drilled Shaft:		16.0'	0.01133		inch
Capacity: Demand Ratio (CDR_L) to provide Lateral Restraint:			11.40		**OK**
Shaft 2	Front Row				
Lateral Deflection at Minimum Length of Drilled Shaft:		4.0'	0.41208		inch
p-multiplier (P_m) as per AASHTO LRFD BDS 10.7.2.4			0.8		
			0.3297		
Lateral Deflection at Full Length of Drilled Shaft:		16.0'	0.01747		inch
Capacity: Demand Ratio (CDR_L) to provide Lateral Restraint:			18.87		**OK**

<u>Flexural Moment Resistance Che</u> **AASHTO LRFD Section 10.8.3.9**

		Strength I	Extreme I	Service I	
Shaft 1	Back Row				
Maximum Moment:			-369044		inch-lbs.
Nominal Moment Capacity			8561256		inch-lbs.
Flexural Resistance Factor		0.90	1.00		
Factored Moment Capacity			8561256		inch-lbs.
Capacity: Demand Ratio:			23.20		**OK**
Shaft 2	Front Row				
Maximum Moment			-732051		inch-lbs.
Nominal Moment Capacity			7976223		inch-lbs.
Flexural Resistance Factor		0.90	1.00		
Factored Moment Capacity			7976223		inch-lbs.
Capacity: Demand Ratio:			10.90		**OK**

<u>Shear Resistance Check</u>   **AASHTO LRFD Section 10.8.3.9**

		Strength I	Extreme I	Service I	
Shaft 1	Back Row				
Maximum Shear			3120		lbs.
Nominal Structural Shear Capacity as per AASHTO LRFD BDS Article 5.7			183980		lbs.
Strength Reduction Factor		0.90	1.00		
Factored Structural Shear Capacity			183980		lbs.
Capacity: Demand Ratio:			58.97		**OK**
Shaft 2	Front Row				
Maximum Shear			6800		lbs.
Nominal Structural Shear Capacity as per AASHTO LRFD BDS Article 5.7			183980		lbs.
Strength Reduction Factor		0.90	1.00		
Factored Structural Shear Capacity			183980		lbs.
Capacity: Demand Ratio:			27.06		**OK**

Since Capacity/Demand Ratio of all the Checks were greater than 1.0, the proposed length of the drilled shaft to be used is 16'.

===

SHAFT for Windows, Version 2012.7.8

Serial Number : 292797964

VERTICALLY LOADED DRILLED SHAFT ANALYSIS
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Path to file locations : M:\Project Files\25 Projects\G25003G Baker-OTIC 71-24-02\Analysis File Folder\Drilled Shaft Folder\DMS #9 B-003-0-25\
Name of input data file : B-003Shaft.sfd
Name of output file : B-003Shaft.sfo
Name of plot output file : B-003Shaft.sfp
Name of runtime file : B-003Shaft.sfr

Time and Date of Analysis

Date: August 14, 2025 Time: 16:15:08

DMS #9 WB - B-003-0-25

PROPOSED DEPTH = 16.0 FT

NUMBER OF LAYERS = 4

WATER TABLE DEPTH = 3.0 FT.

SOIL INFORMATION

LAYER NO 1----CLAY

AT THE TOP

```
  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
  END BEARING COEFFICIENT-Nc                         = 0.600E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.250E+03
  INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.120E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.000E+00


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
  END BEARING COEFFICIENT-Nc                         = 0.720E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.250E+03
  INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.120E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.300E+01


  LRFD RESISTANCE FACTOR (SIDE FRICTION)             = 0.450E+00
  LRFD RESISTANCE FACTOR (TIP RESISTANCE)            = 0.400E+00


LAYER NO 2----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                    = 0.120E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.300E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.123E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.300E+01


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                    = 0.111E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.300E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.123E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.850E+01
```

```
  LRFD RESISTANCE FACTOR (SIDE FRICTION)              = 0.550E+00
  LRFD RESISTANCE FACTOR (TIP RESISTANCE)             = 0.500E+00


LAYER NO 3----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                     = 0.550E+00
  END BEARING COEFFICIENT-Nc                          = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                  = 0.125E+04
  INTERNAL FRICTION ANGLE, DEG.                       = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST       = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                          = 0.119E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT            = 0.100E+11
  DEPTH, FT                                           = 0.850E+01


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                     = 0.550E+00
  END BEARING COEFFICIENT-Nc                          = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                  = 0.125E+04
  INTERNAL FRICTION ANGLE, DEG.                       = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST       = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                          = 0.119E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT            = 0.100E+11
  DEPTH, FT                                           = 0.160E+02


  LRFD RESISTANCE FACTOR (SIDE FRICTION)              = 0.450E+00
  LRFD RESISTANCE FACTOR (TIP RESISTANCE)             = 0.400E+00


LAYER NO 4----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                     = 0.960E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                  = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                       = 0.310E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST       = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                          = 0.121E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT            = 0.100E+11
  DEPTH, FT                                           = 0.160E+02


  AT THE BOTTOM
```

SKIN FRICTION COEFFICIENT- BETA = 0.825E+00
UNDRAINED SHEAR STRENGTH, LB/SQ FT = 0.000E+00
INTERNAL FRICTION ANGLE, DEG. = 0.310E+02
BLOWS PER FOOT FROM STANDARD PENETRATION TEST = 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT = 0.121E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT = 0.100E+11
DEPTH, FT = 0.250E+02

LRFD RESISTANCE FACTOR (SIDE FRICTION) = 0.550E+00
LRFD RESISTANCE FACTOR (TIP RESISTANCE) = 0.450E+00

DRILLED SHAFT INFORMATION

DIAMETER OF STEM = 3.000 FT.
DIAMETER OF BASE = 3.000 FT.
END OF STEM TO BASE = 0.000 FT.
ANGLE OF BELL = 0.000 DEG.
IGNORED TOP PORTION = 0.000 FT.
IGNORED BOTTOM PORTION = 0.000 FT.
AREA OF ONE PERCENT STEEL = 10.180 SQ.IN.
ELASTIC MODULUS, Ec = 0.360E+07 LB/SQ IN
VOLUME OF UNDERREAM = 0.000 CU.YDS.

PREDICTED RESULTS

QS = ULTIMATE SIDE RESISTANCE;
QB = ULTIMATE BASE RESISTANCE;
WT = WEIGHT OF DRILLED SHAFT (UPLIFT CAPACITY ONLY);
QU = TOTAL ULTIMATE RESISTANCE;
LRFD QS = TOTAL SIDE FRICTION USING LRFD RESISTANCE FACTOR TO THE ULTIMATE SIDE RESISTANCE;
LRFD QB = TOTAL BASE BEARING USING LRFD RESISTANCE FACTOR TO THE ULTIMATE BASE RESISTANCE
LRFD QU = TOTAL CAPACITY WITH LRFD RESISTANCE FACTOR.

LENGTH (FEET)	VOLUME (CU.YDS)	QS (TONS)	QB (TONS)	QU (TONS)	LRFD QS (TONS)	LRFD QB (TONS)	LRFD QU (TONS)
1.0	0.26	0.65	0.58	1.23	0.29	0.23	0.52
2.0	0.52	1.30	0.00	1.30	0.58	0.00	0.58
3.0	0.79	1.94	0.00	1.94	0.87	0.00	0.87
4.0	1.05	4.15	8.44	12.59	2.09	4.22	6.31

5.0	1.31	6.70	18.08	24.77	3.49	9.04	12.53
6.0	1.57	9.52	28.92	38.44	5.04	14.46	19.50
7.0	1.83	12.60	36.15	48.75	6.73	18.08	24.81
8.0	2.09	15.93	39.77	55.70	8.57	19.88	28.45
9.0	2.36	19.51	39.77	59.28	10.54	15.91	26.44
10.0	2.62	22.75	39.77	62.52	11.99	15.91	27.90
11.0	2.88	25.99	33.60	59.59	13.45	13.44	26.89
12.0	3.14	29.23	26.68	55.91	14.91	10.67	25.58
13.0	3.40	32.47	19.03	51.51	16.37	7.61	23.98
14.0	3.67	35.71	14.20	49.92	17.83	5.68	23.51
15.0	3.93	38.95	12.13	51.08	19.28	4.85	24.14
16.0	4.19	42.19	12.76	54.95	20.74	5.74	26.48

RESULT FROM TREND (AVERAGED) LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.5049E-02	0.1034E-04	0.1241E-03	0.1000E-04
0.2524E-01	0.5170E-04	0.6203E-03	0.5000E-04
0.5049E-01	0.1034E-03	0.1241E-02	0.1000E-03
0.2524E+01	0.5170E-02	0.6203E-01	0.5000E-02
0.3786E+01	0.7754E-02	0.9304E-01	0.7500E-02
0.5049E+01	0.1034E-01	0.1241E+00	0.1000E-01
0.1262E+02	0.2585E-01	0.3101E+00	0.2500E-01
0.2187E+02	0.5146E-01	0.6203E+00	0.5000E-01
0.2829E+02	0.7687E-01	0.9304E+00	0.7500E-01
0.3320E+02	0.1022E+00	0.1241E+01	0.1000E+00
0.4124E+02	0.2527E+00	0.3077E+01	0.2500E+00
0.4369E+02	0.5030E+00	0.5792E+01	0.5000E+00
0.4369E+02	0.6280E+00	0.6656E+01	0.6250E+00
0.4420E+02	0.9031E+00	0.8166E+01	0.9000E+00
0.4893E+02	0.1804E+01	0.1295E+02	0.1800E+01

RESULT FROM UPPER-BOUND LINE

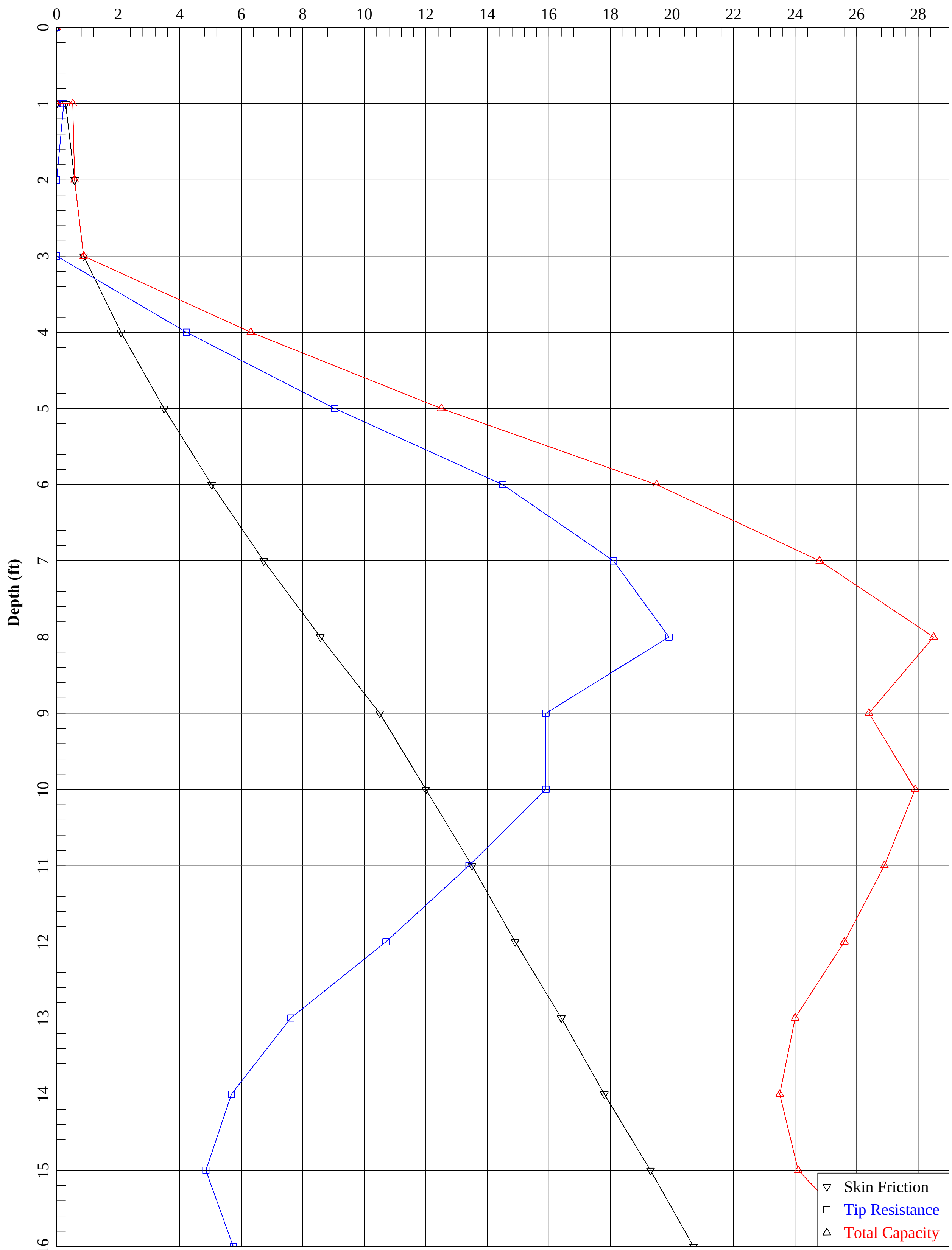
TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.7165E-02	0.1048E-04	0.1772E-03	0.1000E-04
0.3582E-01	0.5242E-04	0.8861E-03	0.5000E-04
0.7165E-01	0.1048E-03	0.1772E-02	0.1000E-03
0.3582E+01	0.5242E-02	0.8861E-01	0.5000E-02
0.5374E+01	0.7863E-02	0.1329E+00	0.7500E-02
0.7165E+01	0.1048E-01	0.1772E+00	0.1000E-01
0.1791E+02	0.2621E-01	0.4431E+00	0.2500E-01
0.2967E+02	0.5199E-01	0.8861E+00	0.5000E-01
0.3620E+02	0.7739E-01	0.1329E+01	0.7500E-01

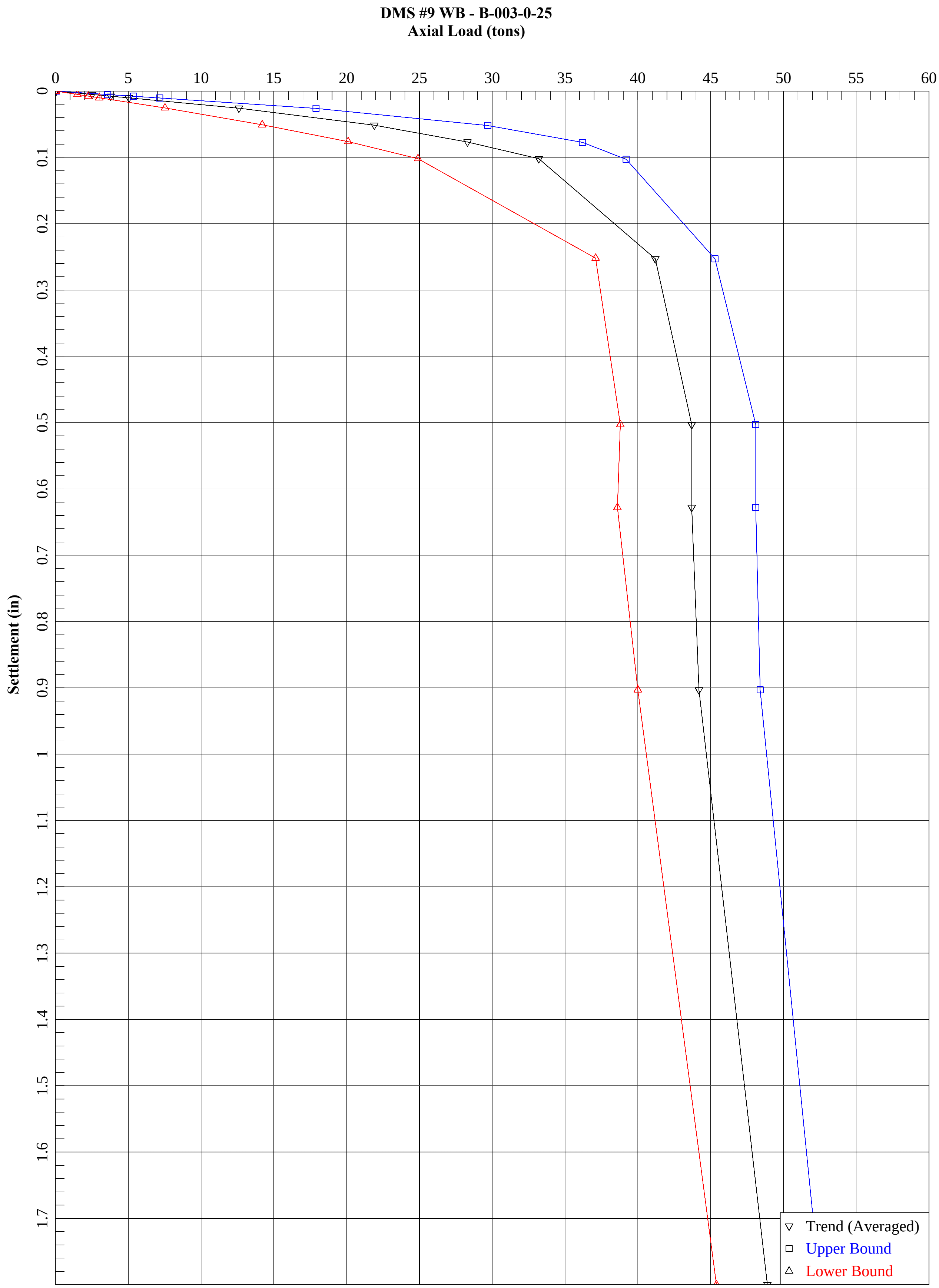
0.3915E+02	0.1026E+00	0.1772E+01	0.1000E+00
0.4534E+02	0.2530E+00	0.4331E+01	0.2500E+00
0.4813E+02	0.5034E+00	0.8010E+01	0.5000E+00
0.4814E+02	0.6284E+00	0.8820E+01	0.6250E+00
0.4841E+02	0.9034E+00	0.9698E+01	0.9000E+00
0.5249E+02	0.1804E+01	0.1378E+02	0.1800E+01

RESULT FROM LOWER-BOUND LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.3008E-02	0.1020E-04	0.7089E-04	0.1000E-04
0.1504E-01	0.5099E-04	0.3544E-03	0.5000E-04
0.3008E-01	0.1020E-03	0.7089E-03	0.1000E-03
0.1504E+01	0.5099E-02	0.3544E-01	0.5000E-02
0.2256E+01	0.7649E-02	0.5317E-01	0.7500E-02
0.3008E+01	0.1020E-01	0.7089E-01	0.1000E-01
0.7520E+01	0.2550E-01	0.1772E+00	0.2500E-01
0.1422E+02	0.5094E-01	0.3544E+00	0.5000E-01
0.2011E+02	0.7633E-01	0.5317E+00	0.7500E-01
0.2488E+02	0.1016E+00	0.7089E+00	0.1000E+00
0.3712E+02	0.2524E+00	0.1822E+01	0.2500E+00
0.3882E+02	0.5026E+00	0.3573E+01	0.5000E+00
0.3864E+02	0.6276E+00	0.4491E+01	0.6250E+00
0.3999E+02	0.9027E+00	0.6635E+01	0.9000E+00
0.4538E+02	0.1803E+01	0.1212E+02	0.1800E+01

DMS #9 WB - B-003-0-25
LRFD Resistance (tons)




DMS #9 WB - B-003-0-25
Axial Load (tons)
0
5
10
15
20
25
30
35
40
45
50
55
60
Settlement (in)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1.1
1.2
1.3
1.4
1.5
1.6
1.7
Trend (Averaged)
Upper Bound
Lower Bound

LABORATORY TEST STANDARDS

STANDARD **REFERENCE NUMBER**

I. Soil/Rock Testing

Description and Identification of Soils (Visual-Manual Procedures) .... ASTM D 2488
Classification of Soils for Engineering Purposes (USCS). .. .. ASTM D 2487
Laboratory Determination of Water (Moisture) Content of Soil and Rock.............. ASTM D 2216
Classification for Sizes of Aggregate for Road and Bridge Construction .... ASTM D 488
Liquid Limit, Plastic Limit, and Plasticity Index of Soils .... ASTM D 4318
Shrinkage Factors of Soils by Mercury Method .... ASTM D 427
Moisture, Ash, and Organic Matter of Peat and Other Organic Soils .... ASTM D 2974
Specific gravity of Soils.. ASTM D 854
Direct Shear Test of Soils under Consolidated Drained Conditions......................... .ASTM D 3080
Particle-Size Analysis of Soils .... ASTM D 422
Unconfined Compressive Strength of Cohesive Soils... .... ASTM D 2166
Compressive Strength of Intact Rock Core Specimens .... ASTM D 7012
Slake Durability Index of Shale/Similar Weak Rock Test .... ASTM D 4644
Point Load Test of Rock Core Specimens .. .. ISRM* / ASTM D5731
CBR (California Bearing Ration) of Laboratory-Compacted Soils.......................... ASTM D 1883
Laboratory Compaction Characteristics of Soil using Standard Effort .... ASTM D 698
Laboratory Compaction Characteristics of Soil using Modified Effort.................... ASTM D 1557
One-Dimensional Consolidation Properties of Soils .... ASTM D 2435
One-Dimensional Swell or Settlement Potential of Cohesive Soils .... ASTM D 4546
Ph of Soil…………………………………………………………………………ASTM D 4972

*ISRM – International Society for Rock Mechanics

II. Concrete Testing

Compressive Strength for Cylindrical Concrete Specimens…………………………..ASTM C-39
Acid-Soluble Chloride in Mortar and Concrete…………………………………….ASTM C 1152

CLASSIFICATION OF SOILS

Ohio Department of Transportation

(The classification of a soil is found by proceeding from top to bottom of the chart. The first classification that the test data fits is the correct classification.)

SYMBOL	DESCRIPTION	Classifcation AASHTO	Classifcation OHIO	LL_O/LL x 100*	% Pass #40	% Pass #200	Liquid Limit (LL)	Plastic Index (PI)	Group Index Max.	REMARKS
	Gravel and/or Stone Fragments	A-1-a			30 Max.	15 Max.		6 Max.	0	Min. of 50% combined gravel, cobble and boulder sizes
	Gravel and/or Stone Fragments with Sand	A-1-b			50 Max.	25 Max.		6 Max.	0	
	Fine Sand	A-3			51 Min.	10 Max.	NON-PLASTIC		0	
	Coarse and Fine Sand	--	A-3a			35 Max.		6 Max.	0	Min. of 50% combined coarse and fine sand sizes
	Gravel and/or Stone Fragments with Sand and Silt	A-2-4				35 Max.	40 Max.	10 Max.	0	
		A-2-5					41 Min.			
	Gravel and/or Stone Fragments with Sand, Silt and Clay	A-2-6				35 Max.	40 Max.	11 Min.	4	
		A-2-7					41 Min.			
	Sandy Silt	A-4	A-4a	76 Min.		36 Min.	40 Max.	10 Max.	8	Less than 50% silt sizes
	Silt	A-4	A-4b	76 Min.		50 Min.	40 Max.	10 Max.	8	50% or more silt sizes
	Elastic Silt and Clay	A-5		76 Min.		36 Min.	41 Min.	10 Max.	12	
	Silt and Clay	A-6	A-6a	76 Min.		36 Min.	40 Max.	11 - 15	10	
	Silty Clay	A-6	A-6b	76 Min.		36 Min.	40 Max.	16 Min.	16	
	Elastic Clay	A-7-5		76 Min.		36 Min.	41 Min.	≤LL-30	20	
	Clay	A-7-6		76 Min.		36 Min.	41 Min.	>LL-30	20	
	Organic Silt	A-8	A-8a	75 Max.		36 Min.				W/o organics would classify as A-4a or A-4b
	Organic Clay	A-8	A-8b	75 Max.		36 Min.				W/o organics would classify as A-5, A-6a, A-6b, A-7-5 or A-7-6

MATERIAL CLASSIFIED BY VISUAL INSPECTION

- Sod and Topsoil
- Pavement or Base
- Uncontrolled Fill (Describe)
- Bouldery Zone
- Peat, S-Sedimentary W-Woody F-Fibrous L-Loamy & etc

* Only perform the oven-dried liquid limit test and this calculation if organic material is present in the sample.

APPENDIX A.1 - ODOT Quick Reference for Visual Description of Soils

1) STRENGTH OF SOIL:

Non-Cohesive (granular) Soils - Compactness

Description	Blows Per Ft.
Very Loose	≤ 4
Loose	5 – 10
Medium Dense	11 – 30
Dense	31 – 50
Very Dense	> 50

Cohesive (fine grained) Soils - Consistency

Description	Qu (TSF)	Blows Per Ft.	Hand Manipulation
Very Soft	<0.25	<2	Easily penetrates 2" by fist
Soft	0.25-0.5	2 - 4	Easily penetrates 2" by thumb
Medium Stiff	0.5-1.0	5 - 8	Penetrates by thumb with moderate effort
Stiff	1.0-2.0	9 - 15	Readily indents by thumb, but not penetrate
Very Stiff	2.0-4.0	16 - 30	Readily indents by thumbnail
Hard	>4.0	>30	Indent with difficulty by thumbnail

2) COLOR :

If a color is a uniform color throughout, the term is single, modified by an adjective such as light or dark. If the predominate color is shaded by a secondary color, the secondary color procedes the primary color. If two major and distinct colors are swirled throughout the soil, the colors are modified by the term "mottled"

3) PRIMARY COMPONENT

Use **DESCRIPTION** from ODOT Soil Classification Chart on Back

4) COMPONENT MODIFIERS:

Description	Percentage By Weight
Trace	0% - 10%
Little	10% - 20%
Some	20% - 35%
"And"	35% -50%

5) Soil Organic Content

Description	% by Weight
Slightly Organic	2% - 4%
Moderately Organic	4% - 10%
Highly Organic	> 10%

6) Relative Visual Moisture

Description	Criteria	
	Cohesive Soil	**Non-cohesive Soils**
Dry	Powdery; Cannot be rolled; Water content well below the plastic limit	No moisture present
Damp	Leaves very little moisture when pressed between fingers; Crumbles at or before rolled to $^{1}/_{8}$"; Water content below plastic limit	Internal moisture, but no to little surface moisture
Moist	Leaves small amounts of moisture when pressed between fingers; Rolled to $^{1}/_{8}$" or smaller before crumbling; Water content above plastic limit to -3% of the liquid limit	Free water on surface, moist (shiny) appearance
Wet	Very mushy; Rolled multiple times to $^{1}/_{8}$" or smaller before crumbles; Near or above the liquid limit	Voids filled with free water, can be poured from split spoon.

APPENDIX A.2 - ODOT Quick Reference Guide for Rock Description

1) **ROCK TYPE:** Common rock types are: Claystone; Coal; Dolomite; Limestone; Sandstone; Siltstone; & Shale.

2) **COLOR:** To be determined when rock is wet. When using the GSA Color charts use only Name, not code.

3) **WEATHERING**

Description	Field Parameter
Unweathered	No evidence of any chemical or mechanical alternation of the rock mass. Mineral crystals have a bright appearance with no discoloration. Fractures show little or no staining on surfaces.
Slightly weathered	Slight discoloration of the rock surface with minor alterations along discontinuities. Less than 10% of the rock volume presents alteration.
Moderately weathered	Portions of the rock mass are discolored as evident by a dull appearance. Surfaces may have a pitted appearance with weathering "halos" evident. Isolated zones of varying rock strengths due to alteration may be present. 10 to 15% of the rock volume presents alterations.
Highly weathered	Entire rock mass appears discolored and dull. Some pockets of slightly to moderately weathered rock may be present and some areas of severely weathered materials may be present.
Severely weathered	Majority of the rock mass reduced to a soil-like state with relic rock structure discernable. Zones of more resistant rock may be present, but the material can generally be molded and crumbled by hand pressures.

4) **RELATIVE STRENGTH**

Description	Field Parameter
Very Weak	Core can be carved with a knife and scratched by fingernail. Can be excavated readily with a point of a pick. Pieces 1 inch or more in thickness can be broken by finger pressure.
Weak	Core can be grooved or gouged readily by a knife or pick. Can be excavated in small fragments by moderate blows of a pick point. Small, thin pieces can be broken by finger pressure.
Slightly Strong	Core can be grooved or gouged 0.05 inch deep by firm pressure of a knife or pick point. Can be excavated in small chips to pieces about 1-inch maximum size by hard blows of the point of a geologist's pick.
Moderately Strong	Core can be scratched with a knife or pick. Grooves or gouges to ¼" deep can be excavated by hand blows of a geologist's pick. Requires moderate hammer blows to detach hand specimen.
Strong	Core can be scratched with a knife or pick only with difficulty. Requires hard hammer blows to detach hand specimen. Sharp and resistant edges are present on hand specimen.
Very Strong	Core cannot be scratched by a knife or sharp pick. Breaking of hand specimens requires hard repeated blows of the geologist hammer.
Extremely strong	Core cannot be scratched by a knife or sharp pick. Chipping of hand specimens requires hard repeated blows of the geologist hammer.

5) **TEXTURE**

Component		Grain Diameter
Boulder		>12"
Cobble		3"-12"
Gravel		0.08"-3"
Sand	**Coarse**	0.02"-0.08"
	Medium	0.01"-0.02"
	Fine	0.005"-0.01"
	Very fine	0.003"-0.005"

6) **BEDDING**

Description	Thickness
Very Thick	>36"
Thick	18" – 36"
Medium	10" – 18"
Thin	2" – 10"
Very Thin	0.4" – 2"
Laminated	0.1" – 0.4"
Thinly Laminated	<0.1"