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November 14, 2022

GEOTECHNICAL ENGINEERING REPORT

DELAWARE TRANSIT CORPORATION SOLAR ARRAYS AT DOVER OPERATIONS AND ADMINISTRATION FACILITY

DOVER, DELAWARE

Prepared For:

Delaware Transit Corporation
119 Lower Beech Street
Wilmington, Delaware 19805

Prepared By:

November 14, 2022

Deputy Chief Operating Officer, Support Services
Delaware Transit Corporation
119 Lower Beech Street
Wilmington, Delaware 19805

Reference: **Geotechnical Engineering Report for Delaware Transit Corporation Solar Arrays**
Dover Operations and Administration Facility
900 Public Safety Boulevard
Dover, Delaware

Dear Mr.,

The consultant is pleased to submit this Geotechnical Engineering Report for

the above referenced project. This report contains a discussion of our understanding of the project, results of the subsurface exploration and the recommendations for the design and construction of the proposed Solar Arrays at the Dover Operations and Administration Facility in the city of Dover, Kent County, Delaware.

It has been our pleasure to be of service to the Delaware Transit Corporation. If you have any questions or need further information, please do not hesitate to contact us at this office.

Very truly yours,

Table of Contents

1.0 INTRODUCTION, OBJECTIVE AND SCOPE

This report was prepared for Delaware Transit Corporation in accordance with our agreement. The consultant has completed this Geotechnical Engineering Report for the geotechnical design and construction of the foundation for the proposed solar arrays at the Dover Operations and Administration Facility located at 900 Public Safety Boulevard in Dover, Kent County, Delaware.

1.1 SITE DESCRIPTION

The project site is located at 900 Public Safety Boulevard in Dover, Delaware. A project location plan is included in Appendix A. The existing site is used primarily as a maintenance yard and operations complex. The existing site is generally flat with one paved entrance. The existing asphalt pavement is in fair condition.

The main building is centrally located on the site with various smaller structures located throughout the site. The rear portion of the site is not accessible to the public. The front portion of the site includes a landscaped lawn along with a paved parking lot that is publicly accessible.

1.2 PROPOSED CONSTRUCTION

The existing main building faces southwest as it fronts on Public Safety Boulevard. The rear portion of the site includes the area for bus parking, drive thru bus wash and electric bus charging stations. The potential solar array location would cover the single bus parking row at the back edge of the facility and the dual parking area located midway between the office building and the back parking row and would encompass the area surrounding the bus washing facility.

The new array coverage areas would measure approximately 580 feet long, with the back coverage area being approximately 50 feet wide and the central coverage area being approximately 75 feet wide. The pre-engineered Array system supported by columns and spread footings. The column loads are anticipated to produce bearing stress on the order of 2 kips per square foot.

1.3 SCOPE OF WORK

The scope of the consultant’s services on this project consists of the management of the subsurface exploration program performed by consultant, evaluating the subsurface conditions encountered at the location of the proposed structures, development of geotechnical recommendations and submittal of our findings in this report.

1.4 PURPOSE OF REPORT

The purpose of this report is to provide the results of the general subsurface exploration at the project location and the evaluation of those conditions with respect to geotechnical engineering recommendations to aid in design and construction. The geotechnical engineering recommendations presented in this report are based on the consultant's geotechnical engineering analysis of the subsurface conditions indicated by the test borings.

2.0 SUBSURFACE EXPLORATION

2.1 GEOLOGIC SETTING

The state of Delaware is located within two physiographic provinces: The Atlantic Coastal Plain and The Appalachian Piedmont. This project site is within the Atlantic Coastal Plain. The terrain is gentle and surface drainage is generally to the southwest and the Saint Jones River. The site is paved, and a thin fill layer exists between the pavement section and the native soils. According to the *Geologic Map of Kent County, Delaware, Ramsey K.W., 2007,* the material immediately below the fill is the Upper Pleistocene (Quaternary) Age Lynch Heights Formation. The Lynch Heights is generally described as a fluvial to estuarine deposit of medium to fine sand with discontinuous beds of coarse sand, gravel, silt, silty sand, and clayey silt. The materials are typically brown to light yellowish brown. The formation is up to 50 feet thick.

In this area, the Lynch Heights rests directly on the Calvert Formation which is Miocene (Tertiary) age. The Calvert does not appear at the surface (outcrop) in any part of Delaware. The Calvert is a marine deposit generally described as clayey silt to silty clay interbedded with silty fine to coarse sands. The materials of the Calvert are typically gray in color.

Note that the material color in all four borings made for this exploration changed from brown to gray or black between EL -0.5 and EL -3.0. The clay layer encountered in this narrow elevation range may be interpreted to be the weathered surface of the Calvert that existed as the Lynch Heights was deposited.

A portion of the referenced geologic map is reproduced as the site geology map included in Appendix A of this report.

2.2 SOIL BORINGS AND LABORATORY TESTING

2.2.1 Soil Borings

The subsurface exploration was performed by the consultant's sub-consultant and consisted of four (4) soil test borings performed to investigate the subsurface conditions. Borings B-1 to B-4 were completed on September 23 to 27, 2022. Borings ranged in depth from 60 feet to 70 feet below existing ground surface. The boring location map is included in Appendix B.

The SPT soil test borings were performed with a truck-mounted drill rig, using continuous-flight, hollow-stem augers to advance the boreholes. Representative soil samples were obtained by means of the split-barrel sampling procedure in general accordance with ASTM D 1586. In the split-barrel sampling procedure, a 2-inch O.D. split-barrel sampler is driven into the soil a distance of 24 inches by means of an automatic 140-pound hammer falling 30 inches. The number of hammer blows required to drive the sampler through a 12-inch interval is termed the Standard Penetration Test (SPT) value (blow count, or N value). The SPT was

performed using an automatic hammer. A representative portion of each SPT sample was placed in a glass jar and appropriately marked.

All soil samples were transported to CGC's office for further visual examination by an experienced geotechnical engineer. Representative samples were selected for laboratory testing. Logs of the test borings and included in Appendix B.

Table 2.1 Summary of Subsurface Exploration		
Boring ID	**Existing Ground Surface Elevation (feet)**	**Approximate Boring Depth (feet)**
B-1	25.5	60
B-2	24.0	60
B-3	24.0	60
B-4	23.0	70

2.2.2 Groundwater

Groundwater levels were measured in borings during and after completion of drilling. Groundwater was encountered in all borings. The results of the groundwater readings are shown on the test boring logs. Analysis of groundwater data is discussed further in Section 3.2 of this report.

2.2.3 Classification

All soil samples recovered from the borings were examined by an experienced Geologist or Geotechnical Engineer and are visually classified per ASTM D 2488. The classifications were based on texture and plasticity in accordance with the Unified Soil Classification System (USCS). A brief explanation of the USCS is included in Appendix B. The USCS group symbol for each soil type is indicated on the boring logs. Representative samples were selected and tested for their natural water content, grain size distribution and Atterberg limits. All tests were conducted in accordance with applicable ASTM procedures. The results of laboratory tests are included in Appendix B and are summarized in Table 3-1.

Table 3-1: Summary of Index Laboratory Test Results								
Boring	**Sample**	**Depth (Ft)**	**Moisture Content (%)**	**Atterberg Limits**			**Fines (%)**	**USCS Classification**
				LL	**PL**	**PI**		
B-1	S-4	7	7.4					
B-1	S-6	15	37.0					
B-1	S-8	25	17.6					
B-1	S-10	35	68.6	79	31	48	80	CH
B-1	S-13	50	31.6					

Table 3-1: Summary of Index Laboratory Test Results								
Boring	Sample	Depth (Ft)	Moisture Content (%)	Atterberg Limits			Fines (%)	USCS Classification
				LL	PL	PI		
B-2	S-3	5	9.8				34	SM
B-2	S-6	15	22.6					
B-2	S-10	35	33.6	43	20	23		CL
B-2	S-13	50	23.3					
B-3	S-2	3	8.3					
B-3	S-6	15	21.1				12	SM
B-3	S-9	30	58.3	88	35	53	67	CH
B-4	S-3	5	13.7	22	14	8	54	CL
B-4	S-4	7	5.5					
B-4	S-5	9	14.2	NP	NP	NP	19	SM
B-4	S-6	15	26.1				13	SM
B-4	S-8	25	21.7					
B-4	S-9	30	52.2	75	31	44	87	CH

3.0 SUBSURFACE CONDITIONS

3.1 SUBSOIL CONDITIONS/STRATIGRAPHY

The subsurface conditions at the site were evaluated by using the data from the soil borings performed within the project limits. Logs of the soil borings, boring location plan indicating the location of the soil borings, and interpreted profiles between each set of borings are included in Appendix B. The stratification lines shown on the boring logs represent approximate transitions between material types. In-situ strata changes could occur gradually or at slightly different levels. Also, the borings depict conditions at the boring location and particular times indicated. Some conditions, particularly groundwater conditions, between borings could vary from the conditions encountered at the particular boring locations. This report does not reflect any variations which may occur between the borings. The nature and extent of the variations between borings may not become evident until the time of construction.

All borings were drilled in a paved area and encountered approximately 8 to 15 inches of asphalt and 4 to 6 inches of graded aggregate base. The borings indicated the subsurface conditions below the pavement consisted of the following materials:

Stratum A – FILL: Silty SAND (SM) and SAND (SPG) were encountered below pavement at all borings, to a depth ranging from 2 to 4 feet below existing grade. The N values in Stratum A ranged from 16 to 23 blows per foot (bpf) indicating medium dense condition.

Stratum B – SANDS with Fines (SC-SM): SANDS with traces of Clay and Silt (SC-SM) were encountered immediately below Stratum A in all borings, except for B-4, which encountered a 4-foot-thick layer of Lean CLAY (CL) between Stratum A and Stratum B. The N values in the Stratum B coarse grained material ranged from 3 to 32 bpf indicating very loose to very dense condition. The N values for the fine-grained material found in B-4 ranged from 17 to 22 bpf, indicating a very stiff consistency.

Stratum C – Lean and Fat CLAYS (CL-CH): Fat CLAY (CH) was encountered immediately below Stratum B in B-1, B-3, and B-4, while Lean CLAY (CL) was encountered immediately below Stratum B in Boring B-2. The thickness of Stratum C ranges from 5 to 15 feet. The N values in Stratum C ranged from weight of hammer to 6 bpf indicating very soft to medium stiff consistencies.

Stratum D - SANDS with Fines (SC-SM): SANDS with traces of Clay or Silt (SC-SM) were encountered immediately below Stratum C in all borings and extended to the bottom of each boring. This SAND consisted mostly of gray or brown fine to coarse Sand. The N values in Stratum D ranged from 8 bpf to 50 blows per 3 inches indicating loose to very dense condition.

3.2 GROUNDWATER CONDITIONS

Groundwater levels were measured during the drilling operations. The groundwater was encountered in all borings at the depth ranging from 9.5 to 18.8 feet or about EL 6.3 to EL 13.5. It should be noted that groundwater levels could fluctuate with changes in seasonal conditions. The recorded water levels, or

absence of water, reflect the conditions at the time of this exploration only. Fluctuations in the location of hydrostatic groundwater level and perched water levels can occur as a result of seasonal variations in evaporation, precipitation, surface water run-off, and other factors. Table 3.1 presents the groundwater measurements obtained in the borings:

Table 3.1 Summary of Groundwater Observations

Boring ID	Existing Ground Surface Elevation (feet)	Groundwater Encountered		Short-Term Groundwater (1)	
		Depth (feet)	Elevation (feet)	Depth (feet)	Elevation (feet)
B-1	25.5	18.8	6.7	--	--
B-2	24.0	17.7	6.3	--	--
B-3	24.0	11.1	12.9	--	--
B-4	23.0	9.5	13.5	11.25	11.75

(1) Measurement obtained after 24 hrs.

4.0 GEOTECHNICAL ENGINEERING ANALYSIS AND RECOMMENDATIONS

The available geotechnical data as discussed previously in this report was analyzed with reference to the proposed design and construction of aspects of the project and are discussed below.

4.1 ANALYSES FOR SOLAR PANEL ARRAY COLUMN FOUNDATIONS

Square spread footing for column was evaluated. The applied loads are assumed to include the footing concrete weight. Analyses were performed at each boring location and included settlement under the spread footings and allowable bearing pressures. A factor of safety of 3 was used for the spread footing allowable bearing capacity. The elevation at the bottom of the footings was EL 20. Calculations are included in Appendix C.

4.1.1 Spread Footing Analyses

The soils encountered on this project were mostly coarse grained in consistency and are subject to elastic (immediate) settlement. Very stiff Clay material is encountered in Boring B-4 at EL 20 to EL. 17, immediately below the assumed bottom of foundation. This fine-grained material is subject to consolidation settlement. The fine-grained soils encountered approximately 20 to 23 feet below the bottom of footings are subjected to a small increase in pressure. Concerning equal bearing pressures, this increase in pressure on the lower fine-grained material becomes greater and extends deeper as the footing size gets larger.

Foundations should be designed to impart a maximum allowable net bearing pressure of 2,000 psf. The total and differential settlements of the foundation are anticipated to be on the order of 1 inch and ½ inch respectively. Regardless of loading conditions, the proposed column footings should be sized no greater than 6 feet by 6 feet, and bear at a minimum depth of three (3) feet below the lowest adjacent final ground surface to provide adequate protection against frost heave. Regardless of loading conditions, proposed foundations should be sized no less than minimum dimensions of three (3) feet for isolated column footings.

Foundations for the array column should be designed to resist uplift loading. Uplift wind loads can be resisted by the effective dead weight of the foundation plus the weight of any soil above the foundation extending upward at a 30° angle from the vertical as measured from the bottom of the footing. For design purposes, compacted soil above the foundation should be assumed to have a unit weight of 120 pcf above the groundwater.

Lateral loads acting on the foundations may be resisted by sliding friction acting on the base of the foundation and passive resistance of the soils around the perimeter of the footing. Sliding resistance for foundations can be computed using a coefficient of friction of 0.3 between the foundation soils and the base of a concrete footing. Additional resistance to sliding from passive earth pressure resistance also can be used, if the soil materials considered for passive resistance will remain in place. Equivalent fluid pressures above the groundwater for passive earth pressure resistance can be computed as 270 D, in units of pounds per square foot, where D is the depth of undisturbed natural soil or engineered fill that will remain in place above the base of the column footing. Because the frictional and passive earth pressure resistances are based on limit

strength conditions, appropriate factors of safety of at least 1.5 should be applied to the designs considering these resistances.

4.1.2 Groundwater

Short-term groundwater was measured at all four borings at depths ranging from 9.5 to 18.8 feet or about EL 6.3 to EL 13.5. The bottom of the column footing was assumed at EL 20 or about 6.5 to 13.7 feet above the short-term groundwater elevations. Based on the groundwater observations, it is not expected that groundwater will impact the column footing excavations.

4.2 SEISMIC SITE CLASSIFICATION

Section 1613 in the 2012 IBC references Table 20.3-1 in Chapter 20 of ASCE 7, which presents Soil Site Class Definitions based on various criteria, which includes Average Standard Penetration Tests *(N_{bar})*, Average Shear Wave Velocity, (v_{bar}), and Average Undrained Shear Strength (Su_{bar}). The table provides correlations for Soil Site Classes "C", "D", and "E" with various ranges of Standard Penetration Tests *(N_{bar})*, Shear Wave Velocity, (v_{bar}), and Undrained Shear Strength (Su_{bar}) to be calculated for the top 100 feet of the subsurface materials at a site in accordance with procedures described in Chapter 20 of ASCE 7. In addition, the section presents criteria related to various soil properties for Site Classes "E" and "F". Table 20.3-1 and the procedures outlined in Chapter 20 have been used to evaluate the Soil Site Class for this project site.

Based on the test borings results, the average N-values, $N_{bar,}$ for the proposed site is about 13 bpf. This average N value includes some extrapolated data down to a depth of 100 feet. Based on this N_{bar} value the project site should be within Site Classification "E" according to Table 20.3-1 of ASCE 7. Therefore, this project site should be classified as Class "E". Seismic calculations can be found in Appendix C.

5.0 EARTHWORK RECOMMENDATIONS

5.1 SUBGRADE PREPARATION

Earthwork operations should commence with the stripping of existing asphalt, concrete pavement, concrete pads and foundations and debris, etc. within the construction area for the array panels. Following stripping, the exposed subgrade soils should undergo the required compaction effort.

Prior to construction, existing underground utility lines within the construction area should be located and properly removed or abandoned, if not planned for use.

After cutting to the proposed subgrades and prior to placing any footings, the exposed subgrade soils should be examined by an experienced Geotechnical Engineer or an authorized representative. The exposed soils should be thoroughly proof rolled by a vehicle having an axle weight of at least 10 tons, such as a loaded tandem-axle dump truck. This procedure is intended to assist in identifying any localized loose or yielding materials. Areas that are not considered suitable for support of fill, footings, concrete slabs, and pavements should be undercut and replaced with suitable compacted structural fill or, if less than about 12 inches, densified in place by scarifying, drying, and compacting the soils.

5.2 FILL PLACEMENT AND COMPACTION

Soils placed as structural fill material should consist of well graded sand or gravel with a maximum particle size of three (3) inches in diameter and less than 15 percent of material passing the number 200 sieve. These materials should be free of objectionable debris (clay clumps, organic and/or deleterious material, etc.) and within moisture contents suitable for compaction. It is anticipated that the structural fill would need to be imported.

All structural fills should be placed in loose lifts which do not exceed 6 to 8 inches in thickness. We recommend that all structural fills be compacted to at least 95 percent of the maximum dry density, as determined by the Standard Proctor Compaction Test (ASTM D-698). The moisture content of the fill materials should be maintained within ±2 percent of the optimum moisture content, as determined by ASTM D-698. However, moisture contents outside this range may be considered acceptable provided, in the opinion of the geotechnical engineer, they are not excessively yielding.

Before any filling operations begin, representative samples of each proposed fill material should be collected. The samples should be tested to determine the maximum dry density, optimum moisture content, natural moisture content, gradation, and plasticity of the soil. These tests are needed for quality control during compaction and to determine if the fill material is acceptable. The placement of all fills and backfill should be monitored by a geotechnical engineer or technician to ensure that the specified material and lift thicknesses are properly installed. A sufficient number of in-place density tests should be performed during fill placement to ensure that the specified compaction is achieved throughout the height of the fill or backfill.

At the end of each workday, all fill areas should be graded to facilitate positive drainage of any free water associated with precipitation and surface run-off and sealed by use of a smooth-drum roller to limit infiltration of surface water.

Fill materials should not be placed on frozen soils or frost-heaved soils and/or on soils, which have been saturated by precipitation. Borrow fill materials shall not contain frozen materials at the time of placement. All frozen or frost-heaved soils should be removed prior to placement of controlled compacted structural fill, and construction of the foundations.

If any problems are encountered during the earthwork operations, or if site conditions deviate from those encountered during our subsurface investigation, the Geotechnical Engineer should be notified immediately.

5.3 TEMPORARY EXCAVATION SUPPORT

All temporary excavation should be constructed in accordance with OSHA and DelDOT regulations. All excavations deeper than four (4) feet should be sloped in accordance with these regulations, unless designed by a geotechnical engineer, or be supported by a designed and approved earth retaining system. The retaining system should naturally be installed prior to the excavations. The types of excavation support systems that are considered feasible for the site at this time are: mules or other methods such as sheeting and shoring.

5.4 CONSTRUCTION GROUNDWATER CONTROL

Ground water is not expected to be encountered during footing excavations. The construction excavations should be kept dry at all time and surficial rainwater should be prevented from entering the excavation. The Contractor should make provisions to dewater, as required. The method and means to control groundwater that may be due to static groundwater, perched water or surficial water or other sources should be determined by the Contractor.

5.5 PROTECTION OF EXISTING UTILITIES

There may be below grade utilities in the project area. Underground utilities or obstructions will need to be marked and located via hand digging or soft digging techniques prior to any excavations. Some of these utilities may need to be relocated or protected in order to construct the new structures. Existing underground utilities or obstructions that will not be relocated during construction should be clearly marked and protected during construction. If any existing utilities are abandoned, the materials generated from clearing and demolitions of such utilities should be removed and disposed of at an approved disposal site.

5.6 CONSTRUCTION CONSIDERATIONS

Proper construction techniques are important to retain the bearing qualities of the founding materials. The on-site soils, especially any silts or clays, may be sensitive to excessive moisture and disturbance and will be susceptible to loss of strength upon exposure to precipitation during construction activity. Therefore, all

footing excavations should be protected to prevent the disturbance of the founding materials and minimize any potential loss of supportive capacity. Whenever possible, concrete should be placed for foundations the same day that they are excavated. Should excavating and placing the foundation concrete the same day not be practical, we recommend that a concrete mud mat, 2 to 3 inches thick, be placed to protect the founding soils from moisture changes (i.e. wetting/drying), and disturbance during construction activity. If protection of the founding soils is not provided, then undercutting of soft or loose soils and replacement with controlled fill may be necessary prior to the placement of reinforcing steel and foundation concrete. Prior to placing any foundation concrete (or mud mat), the founding soils must be carefully examined and tested to confirm the availability of the design soil bearing capacity. To minimize disturbance to the founding soils during excavation, we recommend that a non-tooth bucket and hand excavation be utilized during the final phases of the excavation for the foundations. A plate vibrator should be made available to densify any granular founding materials disturbed as a result of excavation.

6.0 CLOSING

This report has been prepared to aid in the evaluation of the site and to assist the Design Team with the design of the proposed foundations for the Bus Canopy Solar Panels at the Dover Operations and Administration Facility, 900 Public Safety Boulevard, Dover, Kent County, Delaware. The report scope is limited to recommendations pertaining to the specific project and location described. The project description represents our current understanding of the significant aspects of the proposed improvements relevant to the geotechnical considerations. Should the contractor encounter water during the making of any excavations, the contractor should stop excavation and contact the design engineer.

The analysis and recommendations submitted contained in this report are based upon the data obtained from the test borings performed at the locations indicated on the boring location plan. This report does not reflect any variations which may occur between the borings. The nature and extent of the variations between borings may not become evident until the course of construction. If subsurface conditions different from those described are noted during construction, recommendation in this report must be re-evaluate.

Plans and specifications should be established to account for possible additional costs that may be required for construction or foundations and/or excavation as recommended in this report. Additional costs may be incurred for various reasons, including extra foundation depth, possible footing redesign, unsuitable fill material, disturbance of subgrades, etc.

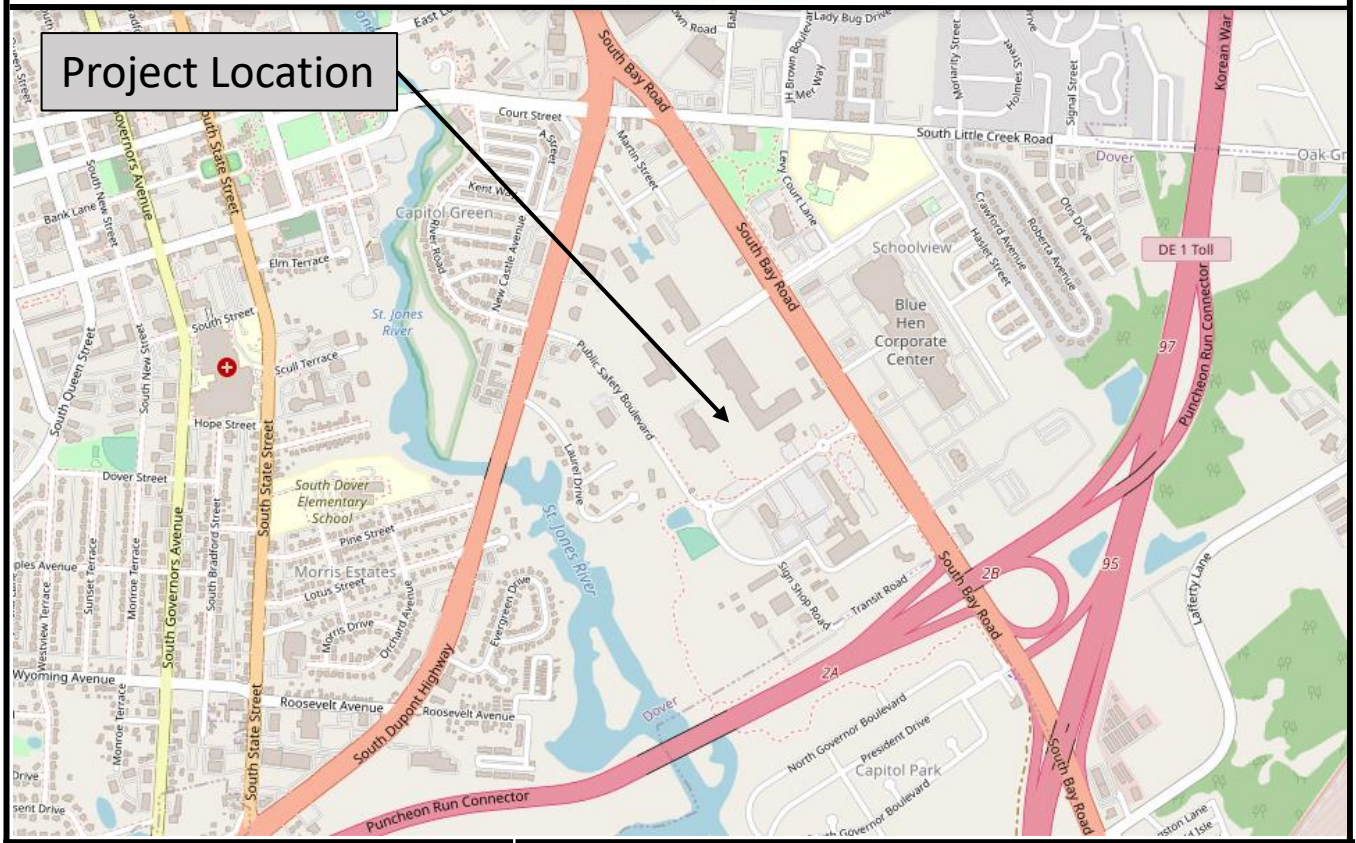
Appendix A

- **Project Location Plan**
- **Geologic Map**

Project Location Map

State of Delaware

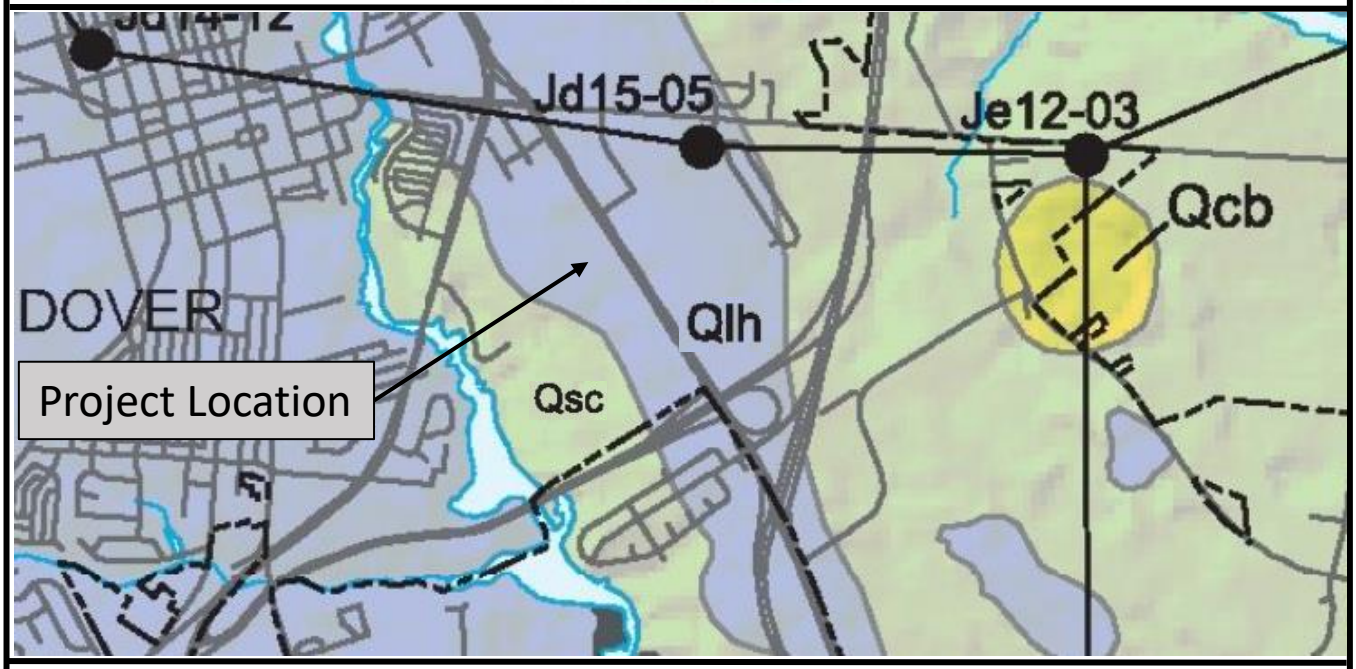
N



Delaware Transportation Corporation
Solar Arrays
Dover Operations and Administration Facility
Kent County, Delaware

Site Geologic Map

State of Delaware



Qsc Scotts Corner Formation

Qlh Lynch Heights Formation

Delaware Transportation Corporation
Solar Arrays
Dover Operations and Administration Facility
Kent County, Delaware

Site Geologic Map
Formation Descriptions

Qsc

Scotts Corners Formation (upper Pleistocene)
Heterogeneous unit of light-gray to brown to light-yellowish-brown, coarse to fine sand, gravelly sand and pebble gravel with rare discontinuous beds of organic-rich clayey silt, clayey silt, and pebble gravel. Sands are quartzose with some feldspar and muscovite. Commonly capped by one to two feet of silt to fine sandy silt. Laminae of opaque heavy minerals are common. Unit underlies a terrace parallel to the present Delaware River that has elevations less than 25 feet. Interpreted to be a transgressive unit consisting of swamp, marsh, estuarine channel, beach, and bay deposits. Climate during the time of deposition was temperate to warm temperate as interpreted from fossil pollen assemblages (Ramsey, 1997). Overall thickness of the unit rarely exceeds 20 feet.

Qlh

Lynch Heights Formation (upper Pleistocene)
Heterogeneous unit of light-gray to brown to light-yellowish brown, medium to fine sand with discontinuous beds of coarse sand, gravel, silt, fine to very fine sand, and organic-rich clayey silt to silty sand. Upper part of the unit commonly consists of fine, well-sorted sand. Small-scale cross-bedding within the sands is common. Some of the interbedded clayey silts and silty sands are burrowed. Beds of shell are rarely encountered. Sands are quartzose and slightly feldspathic, and typically micaceous where very fine to fine grained. Unit underlies a terrace parallel to the present Delaware Bay that has elevations between 50 and 30 feet. Interpreted to be a fluvial to estuarine unit of fluvial channel, tidal flat, tidal channel, beach, and bay deposits (Ramsey, 1997). Overall thickness ranges up to 50 feet.

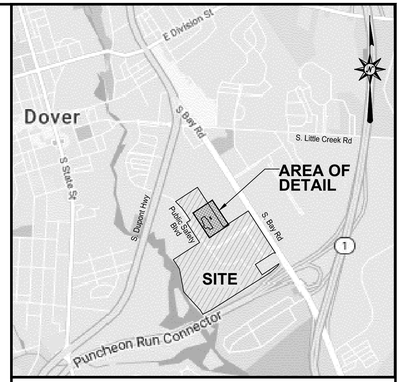
Source: Geologic Map of Kent County, Delaware, Ramsey, K.W. , 2007
Delaware Geological Survey

Delaware Transportation Corporation
Solar Arrays
Dover Operations and Administration Facility
Kent County, Delaware

Appendix B

Geotechnical Data

- **Boring Location Plan**
- **Profiles**
- **General Notes**
- **USCS Sheet**
- **Boring Logs**
- **Lab Data**



LOCATION MAP SCALE: 1" = 2000'

PLAN DATA

TAX PARCEL NUMBER: 2-05-07700-01-1800-00001

OWNER: STATE OF DELAWARE

PROPERTY LINES SHOWN ON PLAN ARE BASED ON DEED REFERENCE 456-154.

ADDRESS: 900 PUBLIC SAFETY BOULEVARD
DOVER, DE 19901

ZONING: IO

HORIZONTAL DATUM: DELAWARE STATE PLANE COORDINATES (NAD83 2011, USFT)

VERTICAL DATUM: NAVD88 - GEOID 2018

SITE BENCHMARKS: SET CONTROL AS SHOWN ON PLAN

LEGEND

- EXISTING CONTOUR
- EXISTING INDEX CONTOUR
- EXISTING SPOT GRADE
- DEPRESSION CONTOUR
- SANITARY MANHOLE
- SANITARY CLEANOUT
- SANITARY SEWER PIPE
- CATCH BASIN
- FLARED END SECTION
- STORM PIPE & FLOW ARROW
- WATER VALVE
- FIRE HYDRANT
- EXISTING GAS LINE*
- UTILITY BOX
- TRANSFORMER
- MISC. MANHOLE
- LIGHT POLE BASE
- CANOPY/DRIP LINE
- SIGN
- STEEL BOLLARD
- FENCELINE
- GUARD RAIL
- SURVEY BENCHMARK

*UNDERGROUND UTILITY LINES ARE DEPICTED ON THIS PLAN IN THEIR APPROXIMATE LOCATION BASED ON OBSERVED SURFACE FEATURES AND UTILITY MARKINGS. UNDERGROUND FEATURES CANNOT BE ACCURATELY, COMPLETELY, AND RELIABLY DEPICTED LACKING EXCAVATION.

B-1 *Boring Location*

TOPOGRAPHIC SURVEY PLAN FOR PART OF LANDS NOW OR FORMERLY OF THE STATE OF DELAWARE

DART FIRST STATE

SITUATE IN: EAST DOVER HUNDRED, KENT COUNTY, DELAWARE

DATE OF SURVEY	revisions	date	checked
		05/04/2021	RAD / CAB

SURVEY BY: R.A.D. / C.A.B.	SCALE: 1" = 30' (0, 30', 60')
DESIGNED BY:	
DRAWN BY: J.L.B.	DATE: 05-06-2021 SHEET: 1 OF 1
CHECKED BY: J.J.J.	DWG. NO.: 3099_ExistingSurvey_DART-Dover.dwg

ESTIMATED SUBSURFACE PROFILE

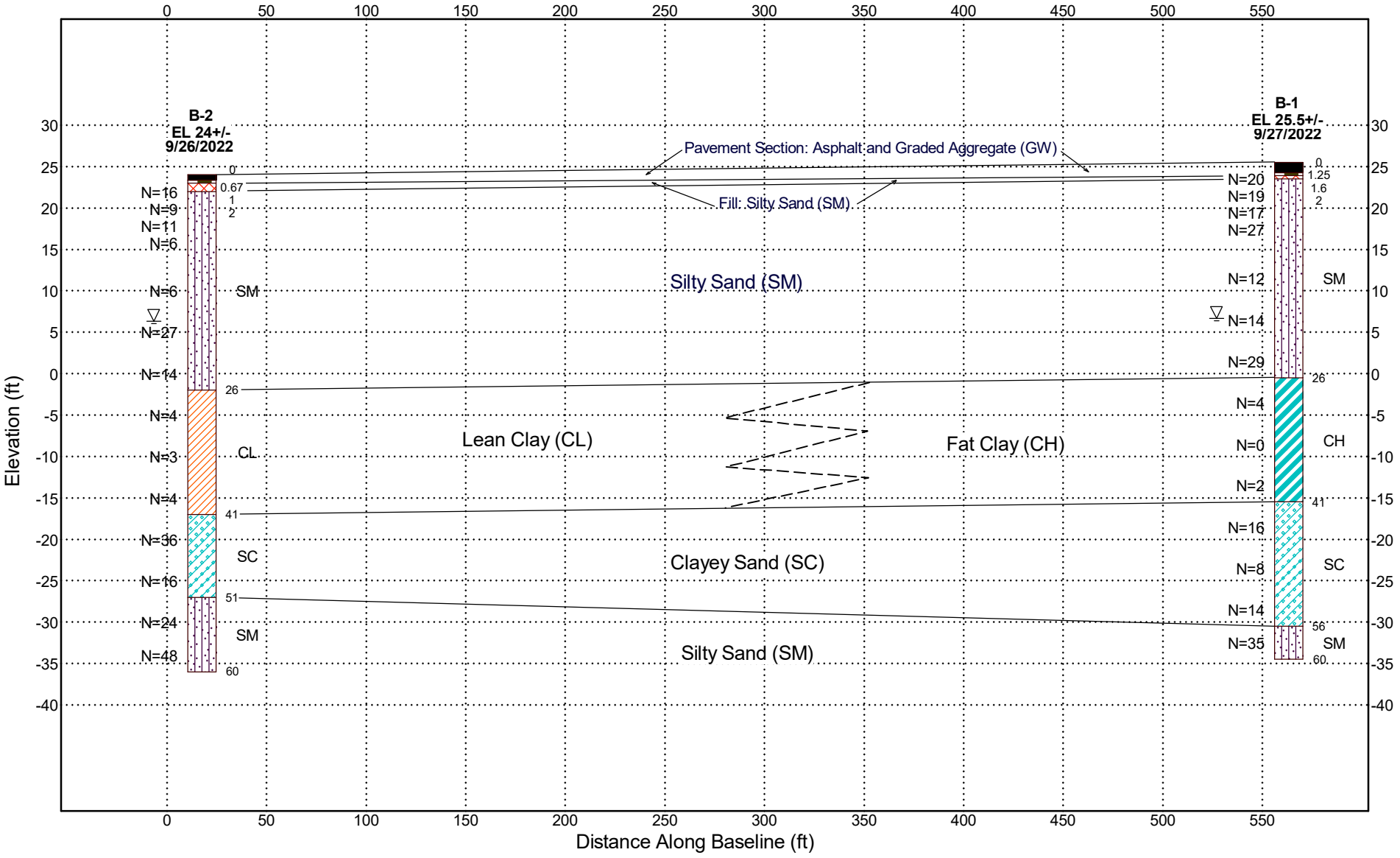
B-1 - B-2

CLIENT Delaware Transit Corporation

PROJECT NUMBER 18-02769-26A

PROJECT NAME Dover Bus Canopy Solar Panels

PROJECT LOCATION Dover, Kent County, Delaware



8.5 X 11 WITH BORDER DELDOT DOVER BUS CANOPY SOLAR PANELS.GPJ JSTANDARD DATA TEMPLATE 02-13-14.GDT 10/26/22

ESTIMATED SUBSURFACE PROFILE

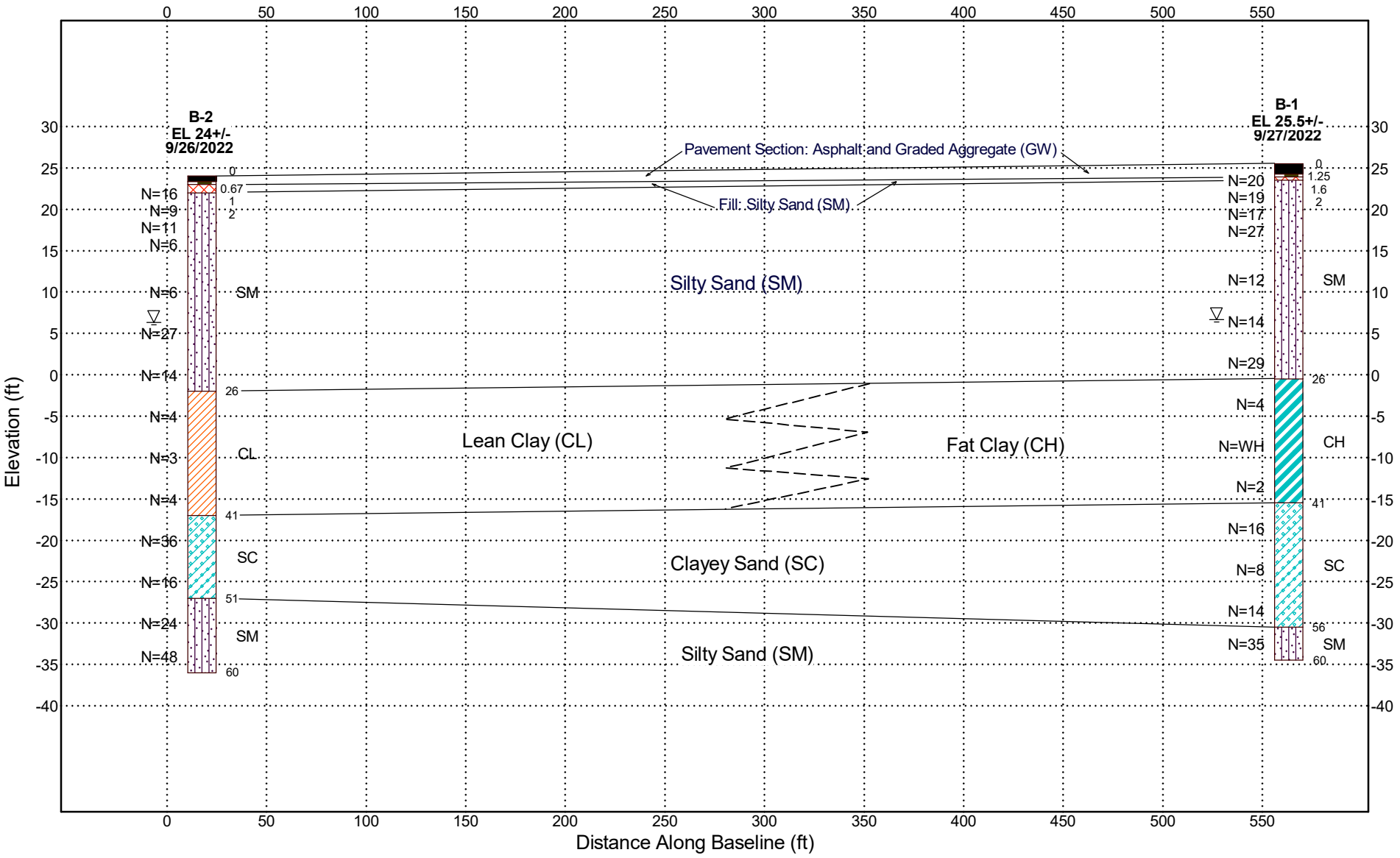
B-1 - B-2

CLIENT Delaware Transit Corporation

PROJECT NUMBER 18-02769-26A

PROJECT NAME Dover Bus Canopy Solar Panels

PROJECT LOCATION Dover, Kent County, Delaware



8.5 X 11 WITH BORDER DELDOT DOVER BUS CANOPY SOLAR PANELS.GPJ STANDARD DATA TEMPLATE 02-13-14.GDT 10/26/22

ESTIMATED SUBSURFACE PROFILE

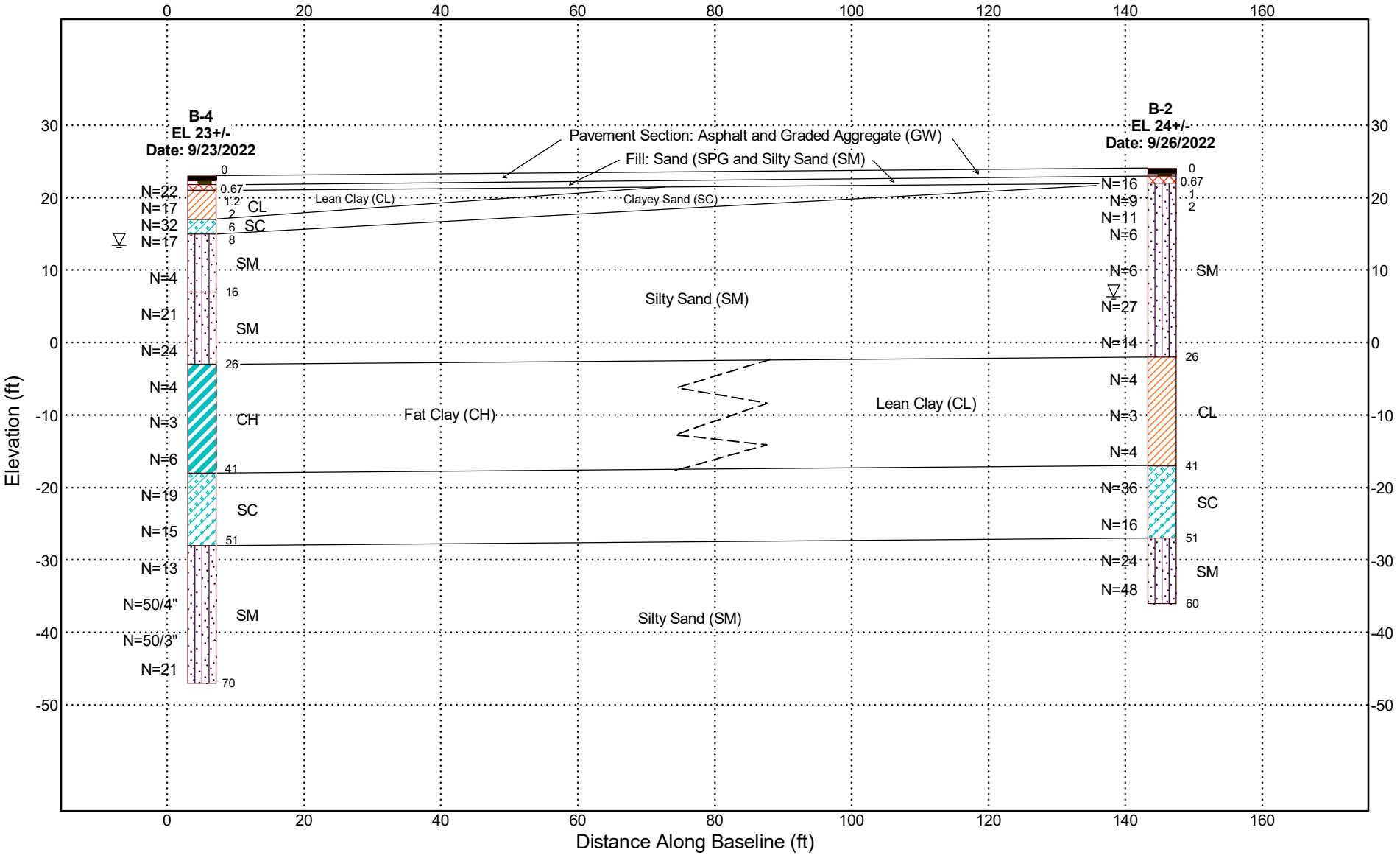
B-2 - B-4

CLIENT Delaware Transit Corporation

PROJECT NUMBER 18-02769-26A

PROJECT NAME Dover Bus Canopy Solar Panels

PROJECT LOCATION Dover, Kent County, Delaware



8.5 X 11 WITH BORDER DELDOT DOVER BUS CANOPY SOLAR PANELS.GPJ STANDARD DATA TEMPLATE 02-13-14.GDT 10/26/22

ESTIMATED SUBSURFACE PROFILE

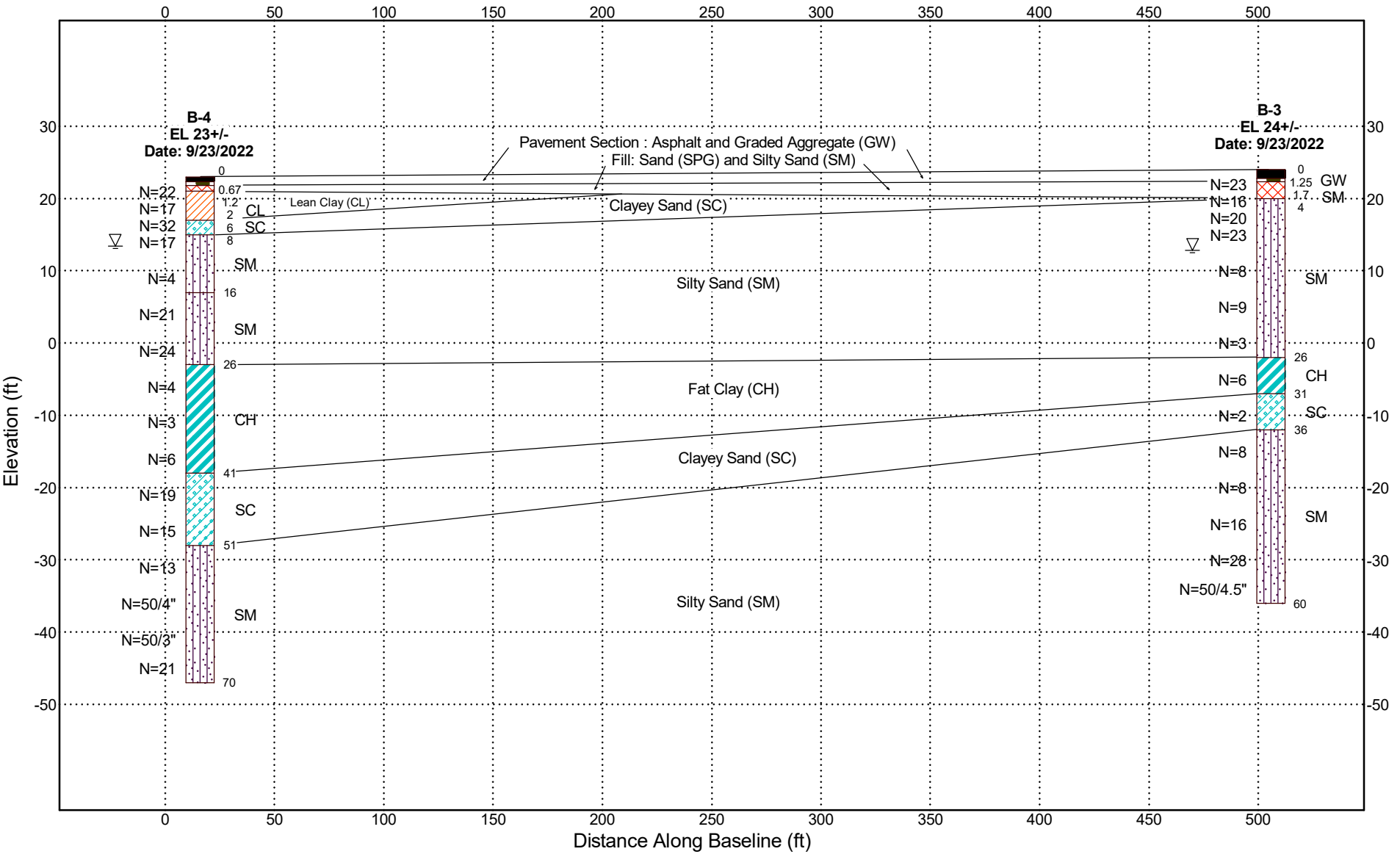
B-3 - B-4

CLIENT Delaware Transit Corporation

PROJECT NUMBER 18-02769-26A

PROJECT NAME Dover Bus Canopy Solar Panels

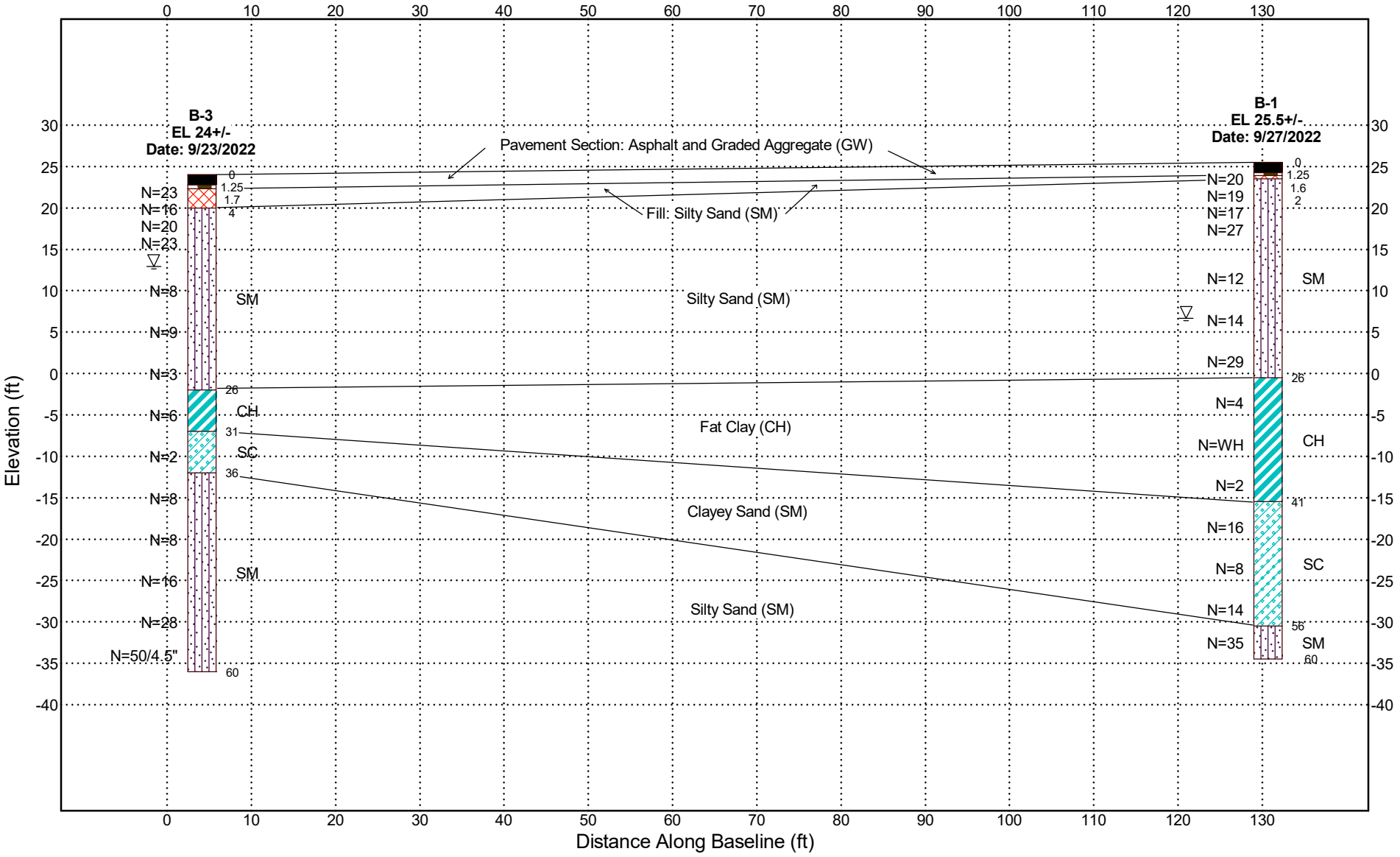
PROJECT LOCATION Dover, Kent County, Delaware



8.5 X 11 WITH BORDER DELDOT DOVER BUS CANOPY SOLAR PANELS.GPJ STANDARD DATA TEMPLATE 02-13-14.GDT 10/26/22

ESTIMATED SUBSURFACE PROFILE
B-1 - B-3

CLIENT Delaware Transit Corporation
PROJECT NUMBER 18-02769-26A
PROJECT NAME Dover Bus Canopy Solar Panels
PROJECT LOCATION Dover, Kent County, Delaware



8.5 X 11 WITH BORDER DELDOT DOVER BUS CANOPY SOLAR PANELS.GPJ STANDARD DATA TEMPLATE 02-13-14.GDT 10/26/22

GENERAL NOTES

VISUAL UNIFIED CLASSIFICATIONS: The soil samples are described by color, major constituent, modifiers (by percentage), and density (or consistency). Coarse Grained or Granular Soils have more than 50% of their dry weight retained on a No. 200 sieve; they are described as: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a No. 200 sieve; they are described as: clays or clayey silts if they are cohesive and silts if they are noncohesive. In addition to gradation, granular soils are defined on the basis of their relative in-place density and fine grained soils on the basis of their strength or consistency and their plasticity.

The Unified Soil Classification symbols are:

COARSE GRAINED SOILS

GW - Well graded gravels
GP - Poorly graded gravels
GM - Silty gravels
GC - Clayey gravels
SW - Well graded sands
SP - Poorly graded sands
SM - Silty sands
SC - Clayey sands

FINE GRAINED SOILS

ML - Silts of low plasticity
CL - Clays of low to medium plasticity
OL - Organic silt clays of low plasticity
MH - Silts of high plasticity
CH - Clays of high plasticity
OH - Organic silt clays of high plasticity
PT - Peat and highly organic soils

SIZE DESCRIPTION

F - Fine
M - Medium
C - Coarse
G - Gravel

MODIFIERS (PERCENTAGE)

Tr -	Trace	1 - 10%
Ltl -	Little	11 - 20%
Some		21 - 35%
& -	And	36 - 50%

COLOR

Or - Orange
Yel - Yellow
Br - Brown
Blk - Black
Gr - Gray
R - Red
Vc - Varicolored
Dk - Dark
Lt - Light

DENSITY: COARSE GRAINED SOILS

Very loose	4 blows/ft or less
Loose	5 to 10 blows/ft
Medium	11 to 30 blows/ft
Dense	31 to 50 blows/ft
Very Dense	51 blows/ft or more

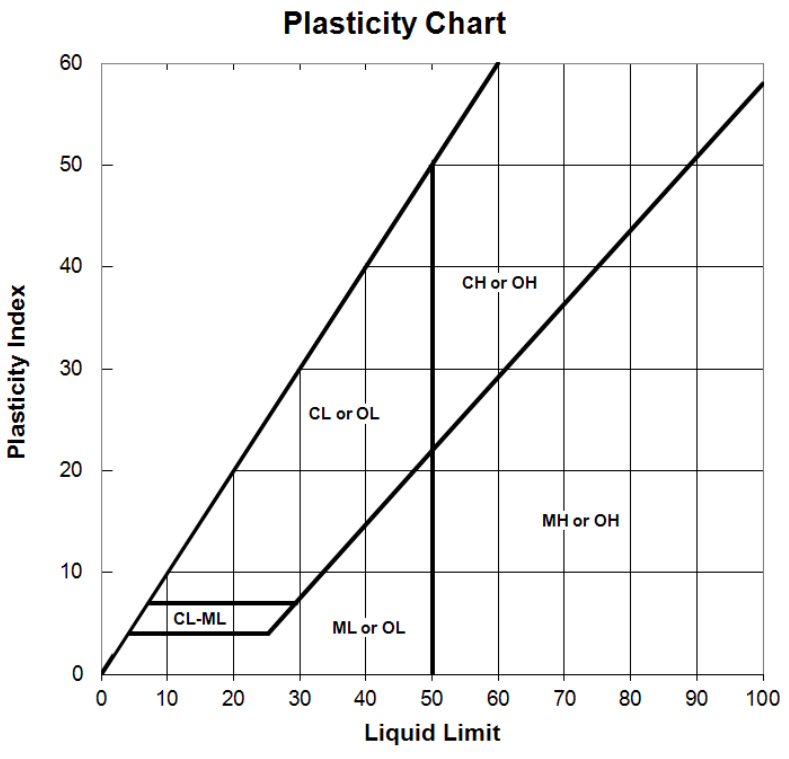
CONSISTENCY: FINE GRAINED SOILS

Very soft	2 blows/ft or less
Soft	3 to 4 blows/ft
Medium	5 to 8 blows/ft
Stiff	9 to 15 blows/ft
Very stiff	16 to 30 blows/ft
Hard	31 blows/ft or more

NOTE: The Standard Penetration Test "N" value is the number of blows per foot of a 140 pound hammer falling 30 inches on a 2 inch O.D. split spoon sampler, except where otherwise noted.

Unified Soil Classification System (ASTM D-2487)

Major Divisions			Group Symbols	Typical Names	Laboratory Classification Criteria		
Coarse-Grained Soils Grained Soils More Than 50 % Retain	Gravels (More Than 50 % of Coarse Fraction Retained on the No. 4 Sieve)	Clean Gravels (Trace to No Fines)	GW	Well-Graded Gravels, Gravel-Sand Mixtures, Trace To No Fines	Determine percentages of sands and gravel from grain size curve. Depending on percentage of fines (Fraction smaller than No. 200 sieve), coarse-grained soils are classified as follows: Less than 5 percent: GW, GP, SW, SP More Than 12 percent; GM, GC, SM, SC 5 to 12 Percent: Borderline cases requiring dual symbols	$C_U = D_{60}/D_{10}$ Greater Than or Equal to 4 $C_c = (D_{30})^2/(D_{10} \times D_{60})$ Between 1 and 3	
			GP	Poorly Graded Gravels, Gravel-Sand Mixtures, Trace To No Fines		Not Meeting Requirements of GW for C_U and C_c	
		Gravels with Fines (Appreciable amount of Fines)	GM	Silty Gravels, Gravel-Sand-Silt Mixtures		Atterberg Limits Below "A" line or PI Less Than 4	Above "A" Line with PI Between 4 and 7 are Borderline cases Requiring use of Dual Symbol
			GC	Clayey Gravels, Gravel-Sand-Clay Mixtures		Atterberg Limits Below "A" line or PI Greater Than 7	
	Sands (More Than 50 % of Coarse Fraction Passing the No. 4 Sieve)	Clean Sands (Trace to No Fines)	SW	Well Graded Sands, Gravelly sands, Trace to no Fines		$C_U = D_{60}/D_{10}$ Greater Than or Equal 6 $C_c = (D_{30})^2/(D_{10} \times D_{60})$ Between 1 and 3	
			SP	Poorly Graded Sands, Gravelly sands, Trace to no Fines		Not Meeting Requirements of SW for C_U and C_c	
		Sands with Fines (Appreciable amount of Fines)	SM	Silty Sands, Sand-silt Mixtures		Atterberg Limits Below "A" line or PI Less Than 4	Above "A" Line with PI Between 4 and 7 are Borderline cases Requiring use of Dual Symbol
			SC	Silty Sands, Sand-silt Mixtures		Atterberg Limits Below "A" line or PI Greater Than 7	
Fine-Grained Soils (More Than 50 % Passing the No. 200 Sieve)	Silts and Clay Mixtures (Liquid Limit Less Than 50)		ML	Inorganic Silts, Gravelly Silts, Sandy Silts,			
			CL	Inorganic Clays of low to Medium Plasticity, Gravelly Clays, Sandy Clays, Silty Clays and Lean Clays			
			OL	Organic Silts and Silty Clays			
	Silts and Clay Mixtures (Liquid Limit Greater Than 50)		MH	Inorganic Clayey Silts, Gravelly Clayey Silts, Sandy Clayey Silts, Elastic Silts			
			CH	Inorganic Clays of high Plasticity, Fat Clays			
			OH	Organic Clays of medium to high Plasticity, organic Clayey Silts			
	Highly Organic Soils		Pt	Peat and Highly Organic Soils			



TEST BORING B-1

Solar Panel Project
Delaware Transit Corporation
Dover, Delaware
DelDOT Task 26AR1, Agreement 1911F
JA

Date Started	: September 23, 2022	Drilling Equipment	: CME 55
Date Completed	: September 27, 2022	Drilling Methods	: HSA, SPT
Logged by	: D. Burt	Surface Elevation	: 25.5 feet
Weather	: Sunny, 70s	Northing	: 630,039.7861
Driller/Agency	:	Easting	: 419,232.3373

Sample Condition: Auger Cuttings; Remolded
Water Levels: During Drilling

Depth in feet	Surf. Elev. 25.5 ft	GRAPHIC	USCS	DESCRIPTION	SAMPLES	Sample Number	Blows per 6 inches	Recovery (ft)	Moisture Content (%)	Percent Passing 200 Sieve	WATER LEVEL
0				Bituminous Concrete (15 inches)							
	24.3		GW	Graded aggregate base (4 inches)							
	23.9			FILL: Moist, medium dense, brown silty SAND, some gravel		S-1					
	23.5			Moist, medium dense, brown fine SAND, little gravel, little silt		S-2	4-8-12-13	2.0			
5				Moist, medium dense, brown fine SAND, little gravel, little silt		S-3	2-9-10-6	2.0			
				Moist, medium dense, gray fine SAND, some silt, trace gravel		S-4	4-6-11-10	2.0	7.4		
				Moist medium dense, gray fine SAND, some silt, little clay, trace gravel		S-5	14-13-14-13	2.0			
10											
			SM								
15				Wet, medium dense orange fine to med SAND, little silt, trace gravel		S-6	2-2-10-12	1.2	37.0		
											▼
20				Wet, medium dense orange fine to med SAND, little silt, trace gravel		S-7	13-7-7-6	2.0			
25				Wet, medium dense, orange fine to med SAND, little silt, trace gravel		S-8	7-10-19-20	2.0	17.6		
	-0.5										
			CH								
30				Saturated, very soft, gray silty fat CLAY, trace fine sand		S-9	1-2-2-2	2.0			

NOTES:
1. Groundwater observed through augers at 18.8 feet below grade during drilling. at surface.
2. Boring terminated at 60 feet below grade.
3. Upon auger removal at completion, borehole caved and dry at 17.3 feet below grade.
4. Borehole backfilled with cuttings and patched with bituminous concrete cold patch

TEST BORING B-1

Solar Panel Project
Delaware Transit Corporation
Dover, Delaware
DelDOT Task 26AR1, Agreement 1911F
J

Date Started	: September 23, 2022	Drilling Equipment	: CME 55
Date Completed	: September 27, 2022	Drilling Methods	: HSA, SPT
Logged by	: D. Burt	Surface Elevation	: 25.5 feet
Weather	: Sunny, 70s	Northing	: 630,039.7861
Driller/Agency	:	Easting	: 419,232.3373

Sample Condition: Auger Cuttings; Remolded
Water Levels: During Drilling

Depth in feet	Surf. Elev. 25.5 ft	GRAPHIC	USCS	DESCRIPTION	SAMPLES	Sample Number	Blows per 6 inches	Recovery (ft)	Moisture Content (%)	Percent Passing 200 Sieve	WATER LEVEL
35			CH	Saturated, very soft, gray silty fat CLAY, little fine sand LL = 79 PI = 48		S-10	WH/24"	2.0	68.6	80.0	
40	-15.5			Saturated, very soft, gray silty fat CLAY, trace fine sand		S-11	1-1-1-3	2.0			
45			SC	Saturated, medium dense, gray fine to coarse SAND, little clay		S-12	2-6-10-12	1.8			
50				Saturated, loose, gray fine to coarse SAND and clay		S-13	6-4-4-5	1.8	31.6		
55	-30.5			Saturated, med dense, gray fine to coarse SAND, some clay, trace gravel		S-14	4-6-8-10	1.9			
60	-34.5		SM	Saturated, dense, fine to coarse SAND, trace silt, trace gravel		S-15	11-17-18-29	1.4			

NOTES:
1. Groundwater observed through augers at 18.8 feet below grade during drilling.
2. Boring terminated at 60 feet below grade.
3. Upon auger removal at completion, borehole caved and dry at 17.3 feet below grade.
4. Borehole backfilled with cuttings and patched with bituminous concrete cold patch at surface.

TEST BORING B-2

Solar Panel Project
Delaware Transit Corporation
Dover, Delaware
DelDOT Task 26AR1, Agreement 1911F

Date Started	: September 26, 2022	Drilling Equipment	: CME 55
Date Completed	: September 26, 2022	Drilling Methods	: HSA, SPT
Logged by	: R. Ferguson	Surface Elevation	: 24 feet
Weather	: Sunny, 80s	Northing	: 630,344.9712
Driller/Agency	:	Easting	: 418,779.9789

Sample Condition: Auger Cuttings; Remolded
Water Levels: During Drilling

Depth in feet	Surf. Elev. 24 ft	GRAPHIC	USCS	DESCRIPTION	SAMPLES	Sample Number	Blows per 6 inches	Recovery (ft)	Moisture Content (%)	Percent Passing 200 Sieve	WATER LEVEL
0	23.3			Bituminous Concrete (8 inches)							
	23.0		GW	Graded aggregate base (4 inches)							
	22.0			FILL: Moist, medium dense, gray silty fine SAND		S-1					
				Moist, medium dense, silty fine to coarse SAND		S-2	10-9-7-6	1.3			
5				Moist, loose, brown fine to coarse SAND, and silt		S-3	6-5-4-3	1.3	9.8	34.0	
				Moist, medium dense, brown, fine to coarse SAND, little silt		S-4	8-7-4-4	1.3			
				Moist, loose, gray fine to coarse SAND, little silt, trace gravel		S-5	5-3-3-3	1.3			
10											
			SM								
15				Wet, loose, brown fine to coarse SAND, litlte silt		S-6	2-3-3-4	1.5	22.6		▼
				Saturated, medium dense, brown, fine to coarse SAND, trace silt		S-7	15-12-15-14	1.8			
20											
				Saturated, medium dense, brown fine to coarse SAND, trace silt		S-8	21-9-5-5	1.7			
25											
	-2.0										
			CL								
30				Saturated, very soft, gray silty lean CLAY, trace fine sand		S-9	11-3-1-3	1.1			

NOTES:
1. Groundwater observed through augers at 17.7 feet below grade during drilling.
2. Boring terminated at 60 feet below grade.
3. Upon auger removal at completion, borehole caved and dry at 15.5 feet below grade.
4. Borehole backfilled with cuttings and patched with bituminous concrete cold patch at surface.

TEST BORING B-2

Solar Panel Project
Delaware Transit Corporation
Dover, Delaware
DelDOT Task 26AR1, Agreement 1911F

Date Started	: September 26, 2022	Drilling Equipment	: CME 55
Date Completed	: September 26, 2022	Drilling Methods	: HSA, SPT
Logged by	: R. Ferguson	Surface Elevation	: 24 feet
Weather	: Sunny, 80s	Northing	: 630,344.9712
Driller/Agency	:	Easting	: 418,779.9789

Sample Condition: Auger Cuttings; Remolded
Water Levels: During Drilling

Depth in feet	Surf. Elev. 24 ft	GRAPHIC	USCS	DESCRIPTION	SAMPLES	Sample Number	Blows per 6 inches	Recovery (ft)	Moisture Content (%)	Percent Passing 200 Sieve	WATER LEVEL
35			CL	Saturated, very soft, gray silty lean CLAY, trace fine sand LL = 43 PI = 23		S-10	6-1-2-2	0.9	33.6		
40	-17.0			Saturated, firm, gray silty lean CLAY, trace fine sand		S-11	WR/12"-4-4	2.0			
45			SC	Saturated, dense, gray, fine to coarse SAND and clay		S-12	WR/6"-18-18-19	1.5			
50				Saturated, medium dense, gray fine to coarse SAND,and clay		S-13	5-7-9-11	1.4	23.3		
55	-32.0			Saturated, medium dense, gray fine to coarse SAND, trace clay		S-14	8-10-14-15	1.5			
60	-36.0		SM	Saturated, dense, gray, fine to coarse SAND, trace silt		S-15	15-20-28-34	1.8			

NOTES:
1. Groundwater observed through augers at 17.7 feet below grade during drilling.
2. Boring terminated at 60 feet below grade.
3. Upon auger removal at completion, borehole caved and dry at 15.5 feet below grade.
4. Borehole backfilled with cuttings and patched with bituminous concrete cold patch at surface.

TEST BORING B-3

Solar Panel Project
Delaware Transit Corporation
Dover, Delaware
DelDOT Task 26AR1, Agreement 1911F

Date Started	: September 23, 2022	Drilling Equipment	: CME 55
Date Completed	: September 23, 2022	Drilling Methods	: HSA, SPT
Logged by	: D. Burt	Surface Elevation	: 24 feet
Weather	: Sunny, 70s	Northing	: 629,934.9111
Driller/Agency	:	Easting	: 419,161.5854

Sample Condition: Auger Cuttings; Remolded
Water Levels: During Drilling

Depth in feet	Surf. Elev. 24 ft	GRAPHIC	USCS	DESCRIPTION	SAMPLES	Sample Number	Blows per 6 inches	Recovery (ft)	Moisture Content (%)	Percent Passing 200 Sieve	WATER LEVEL
0				Bituminous Concrete (15 inches)							
	22.8		GW	Graded aggregate base (6 inches)							
	22.3			FILL: Moist, medium dense, brown silty SAND		S-1					
				FILL: Moist, medium dense, brown fine to coarse SAND and silt, little gravel		S-2	7-9-14-13	1.8	8.3		
	20.0			Moist, medium dense, brown fine to coarse SAND, little silt, trace gravel		S-3	4-7-9-8	1.8			
5				Moist, medium dense, brown fine to coarse SAND, little gravel, trace to little silt		S-4	7-7-13-18	1.5			
				Moist, medium dense, brown fine to coarse SAND, little silt, trace clay, trace gravel		S-5	14-11-12-14	2.0			
10											▼
15			SM	Moist, loose, brown fine to med SAND, little silt, trace gravel		S-6	6-4-4-5	1.5	21.1	12.0	
20				Wet, loose, brown/ orange, fine to med SAND, little gravel, trace silt		S-7	2-3-6-7	2.0			
25				Wet, very loose, brown, fine to med SAND, little silt, trace clay		S-8	4-1-2-1	1.6			
	-2.0		CH								
30				Wet, soft , black fat CLAY, and fine sand LL= 88, PI = 53		S-9	2-3-3-3	1.8	58.3	67.0	
	-7.0		SC								

NOTES:
1. Groundwater observed through augers at 11.1 feet below grade during drilling. at surface.
2. Boring terminated at 60 feet below grade.
3. Upon auger removal at completion, borehole caved and dry at 14.3 feet below grade.
4. Borehole backfilled with cuttings and patched with bituminous concrete cold patch

TEST BORING B-3

Solar Panel Project
Delaware Transit Corporation
Dover, Delaware
DelDOT Task 26AR1, Agreement 1911F

Date Started	: September 23, 2022	Drilling Equipment	: CME 55
Date Completed	: September 23, 2022	Drilling Methods	: HSA, SPT
Logged by	: D. Burt	Surface Elevation	: 24 feet
Weather	: Sunny, 70s	Northing	: 629,934.9111
Driller/Agency	:	Easting	: 419,161.5854

Sample Condition: Auger Cuttings; Remolded
Water Levels: During Drilling

Depth in feet	Surf. Elev. 24 ft	GRAPHIC	USCS	DESCRIPTION	SAMPLES	Sample Number	Blows per 6 inches	Recovery (ft)	Moisture Content (%)	Percent Passing 200 Sieve	WATER LEVEL
35			SC	Wet, very loose, black fine SAND, trace clay		S-10	1-1-1-3	2.0			
	-12.0										
40				Wet, loose, gray fine to medium SAND, some silt, trace clay		S-11	2-3-5-6	2.0			
45				Wet, loose, gray fine to medium SAND, some silt, trace clay		S-12	2-3-5-6	1.5			
50			SM	Wet, medium dense, gray, fine to medium SAND, trace silt		S-13	4-7-9-9	2.0			
55				Wet, medium dense, gray, fine to medium SAND and silt		S-14	6-12-16-17	2.0			
60	-36.0			Wet, medium dense, gray, fine to medium SAND and silt, little gravel		S-15	27-50/4.5"				

NOTES:
1. Groundwater observed through augers at 11.1 feet below grade during drilling.
2. Boring terminated at 60 feet below grade.
3. Upon auger removal at completion, borehole caved and dry at 14.3 feet below grade.
4. Borehole backfilled with cuttings and patched with bituminous concrete cold patch at surface.

TEST BORING B-4

Solar Panel Project
Delaware Transit Corporation
Dover, Delaware
DelDOT Task 26AR1, Agreement 1911F

Date Started	: September 22, 2022	Drilling Equipment	: CME 55
Date Completed	: September 23, 2022	Drilling Methods	: HSA, SPT
Logged by	: R. Ferguson	Surface Elevation	: 23 feet
Weather	: Cloudy, 70s	Northing	: 630,207.0976
Driller/Agency	:	Easting	: 418,754.3794

Sample Condition: Auger Cuttings; Remolded
Water Levels: During Drilling; 9/26 at 0830

Depth in feet	Surf. Elev. 23 ft	GRAPHIC	USCS	DESCRIPTION	SAMPLES	Sample Number	Blows per 6 inches	Recovery (ft)	Moisture Content (%)	Percent Passing 200 Sieve	WATER LEVEL
0	22.4			Bituminous Concrete (8 inches)							
	21.8		GW	Graded aggregate base (6 inches)							
	21.0			FILL: Moist, medium dense, brown, fine to coarse SAND and gravel		S-1		1.0			
				Moist, very stiff, gray, silty lean CLAY, trace sand, trace gravel		S-2	13-13-9-11	1.8			
			CL								
5				Moist, very stiff, gray, silty lean CLAY, and sand, trace gravel LL = 22, PI = 8		S-3	8-8-9-8	1.8	13.7	54.0	
	17.0										
			SC	Moist, dense, gray fine to coarse SAND, and clay		S-4	12-16-16-18	1.5	5.5		
	15.0										
				Wet, medium dense, brownish gray fine SAND, little silt, trace coarse sand		S-5	11-7-10-10	2.0	14.2	19.0	▼
10											▽
			SM								
15				Saturated, very loose, brown fine to coarse SAND, little silt		S-6	5-2-2-7	1.5	26.1	13.0	
	7.0										
				Saturated, medium dense, brown fine to coarse SAND, little gravel, little silt		S-7	5-10-11-19	1.5			
20			SM								
				Saturated, medium dense, brown, fine to coarse SAND, trace silt		S-8	7-13-11-15	1.5	21.7		
25	-3.0										
			CH								
				Saturated, very soft, dark gray, silty fat CLAY, little fine sand LL = 75, PI = 44		S-9	2-2-2-2	1.9	52.2	87.0	
30											

NOTES:
1. Groundwater observed through augers at 9.5 feet below grade during drilling.
2. Boring terminated at 70 feet below grade.
3. Temporary piezometer installed in borehole. Water level on 9/26 at 0830 was 11.25 feet below grade.
4. Borehole backfilled with cuttings and patched with bituminous concrete cold patch at surface.

TEST BORING B-4

Solar Panel Project
Delaware Transit Corporation
Dover, Delaware
DelDOT Task 26AR1, Agreement 1911F

Date Started	: September 22, 2022	Drilling Equipment	: CME 55
Date Completed	: September 23, 2022	Drilling Methods	: HSA, SPT
Logged by	: R. Ferguson	Surface Elevation	: 23 feet
Weather	: Cloudy, 70s	Northing	: 630,207.0976
Driller/Agency	:	Easting	: 418,754.3794

Sample Condition: Auger Cuttings; Remolded
Water Levels: During Drilling; 9/26 at 0830

Depth in feet	Surf. Elev. 23 ft	GRAPHIC	USCS	DESCRIPTION	SAMPLES	Sample Number	Blows per 6 inches	Recovery (ft)	Moisture Content (%)	Percent Passing 200 Sieve	WATER LEVEL
35			CH	Saturated, very soft, dark gray, silty fat CLAY, trace fine sand		S-10	1-2-1-3	1.5			
40				Saturated, firm, dark gray, silty fat CLAY, trace fine sand		S-11	2-3-3-5	2.0			
	-18.0										
45			SC	Saturated, medium dense, dark gray, fine to coarse SAND, trace clay		S-12	3-7-12-14	1.4			
50				Saturated, medium dense, dark gray clayey fine to coarse SAND		S-13	6-7-8-11	1.3			
	-28.0										
55			SM	Saturated, medium dense, brown fine to medium SAND, little silt		S-14	3-6-7-11	1.8			
60				Saturated, very dense, brown fine SAND, little silt		S-15	14-37-50/4"	0.8			

NOTES:
1. Groundwater observed through augers at 9.5 feet below grade during drilling. at surface.
2. Boring terminated at 70 feet below grade.
3. Temporary piezometer installed in borehole. Water level on 9/26 at 0830 was 11.25 feet below grade.
4. Borehole backfilled with cuttings and patched with bituminous concrete cold patch

TEST BORING B-4

Solar Panel Project
Delaware Transit Corporation
Dover, Delaware
DelDOT Task 26AR1, Agreement 1911F

Date Started	: September 22, 2022	Drilling Equipment	: CME 55
Date Completed	: September 23, 2022	Drilling Methods	: HSA, SPT
Logged by	: R. Ferguson	Surface Elevation	: 23 feet
Weather	: Cloudy, 70s	Northing	: 630,207.0976
Driller/Agency	:	Easting	: 418,754.3794

Sample Condition: Auger Cuttings; Remolded
Water Levels: During Drilling; 9/26 at 0830

Depth in feet	Surf. Elev. 23 ft	GRAPHIC	USCS	DESCRIPTION	SAMPLES	Sample Number	Blows per 6 inches	Recovery (ft)	Moisture Content (%)	Percent Passing 200 Sieve	WATER LEVEL
65			SM	Saturated, very dense, brown fine SAND, little silt		S-16	8-19-50/3"	1.2			
70	-47.0			Saturated, medium dense, brown fine SAND, little silt, trace clay		S-17	13-11-10-10	2.0			
75											
80											
85											
90											
95											

NOTES:
1. Groundwater observed through augers at 9.5 feet below grade during drilling.
2. Boring terminated at 70 feet below grade.
3. Temporary piezometer installed in borehole. Water level on 9/26 at 0830 was 11.25 feet below grade.
4. Borehole backfilled with cuttings and patched with bituminous concrete cold patch at surface.

Project: Delaware Transit Corporation Solar Panel Project
Project No.: 60692563

SUMMARY OF LABORATORY TEST RESULTS

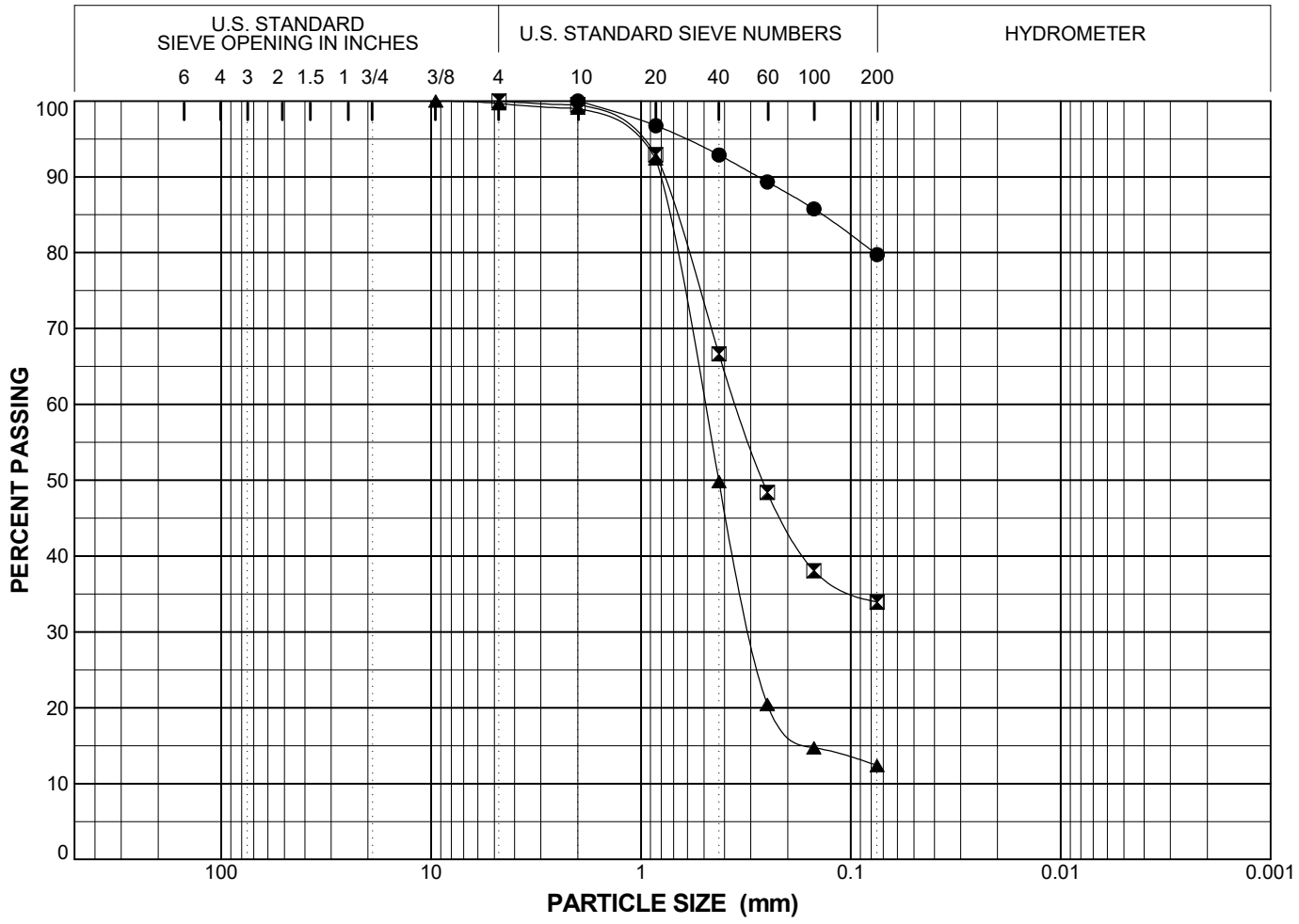
Boring and Sample Number	Depth (feet)	Classification	USCS Symbol	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits		Specific Gravity	Organic Content (%)	Grain Size		Compaction	Consolidation	Unconfined Compression		Triaxial Compression		Permeability (cm/sec)	Special Tests
						Liquid Limit	Plastic Limit			<#200 (%)	<2μ (%)			Stress (psi)	Strain (%)	UU	CIU		
B-1 S-4	7.0			7.4															
B-1 S-6	15.0			37.0															
B-1 S-8	25.0			17.6															
B-1 S-10	35.0	Gray FAT CLAY with SAND	CH	68.6		79	31			80									
B-1 S-13	50.0			31.6															
B-2 S-3	5.0	Brown SILTY SAND	SM	9.8						34									
B-2 S-6	15.0			22.6															
B-2 S-10	35.0			33.6		43	20												
B-2 S-13	50.0			23.3															
B-3 S-2	3.0			8.3															
B-3 S-6	15.0	Brown SILTY SAND	SM	21.1						12									
B-3 S-9	30.0	Gray SANDY FAT CLAY	CH	58.3		88	35			67									
B-4 S-3	5.0	Gray SANDY LEAN CLAY	CL	13.7		22	14			54									
B-4 S-4	7.0			5.5															
B-4 S-5	9.0	Brown SILTY SAND	SM	14.2		NP	NP			19									
B-4 S-6	15.0	Brown SILTY SAND	SM	26.1						13									
B-4 S-8	25.0			21.7															
B-4 S-9	30.0	Gray FAT CLAY	CH	52.2		75	31			87									

Note: The soil classification is based partially on visual classification unless both grain size and Atterberg limits are performed.

* Refer to Laboratory Test Curves

Project File Path:

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



SYMBOL	●	⊠	▲
Boring	B-1	B-2	B-3
Sample	S-10	S-3	S-6
Spec			
Depth (ft)	35.0	5.0	15.0
% +3"	0.0	0.0	0.0
% Gravel	0.0	0.0	0.3
% Sand	20.3	66.1	87.3
% Fines	79.7	33.9	12.4
% -2μ			
Cc			4.80
Cu			13.67
LL	79		
PL	31		
PI	48		
USCS	CH	SM	SM
w (%)	68.6	9.8	21.1

Particle Size (Sieve #)	PERCENT FINER ●	⊠	▲
2"			
1 1/2"			
1"			
3/4"			
1/2"			
3/8"			100.0
4		100.0	99.7
10	100.0	99.5	99.1
20	96.8	92.9	92.4
40	92.9	66.7	49.8
60	89.3	48.4	20.5
100	85.8	38.1	14.7
200	79.7	33.9	12.4

SYMBOL	DESCRIPTION AND REMARKS
●	Gray FAT CLAY with SAND (CH)
⊠	Brown SILTY SAND (SM)
▲	Brown SILTY SAND (SM)

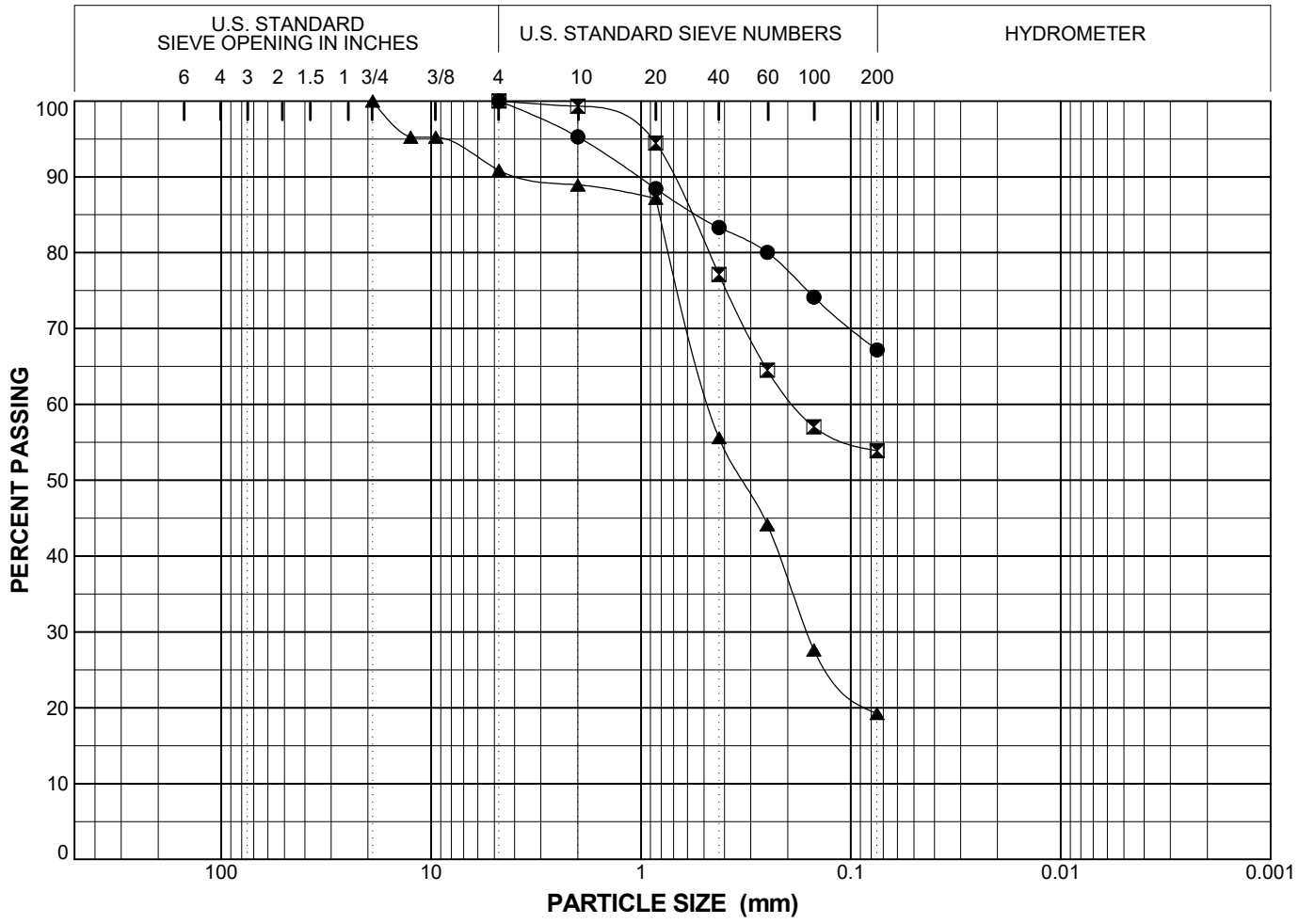
PARTICLE SIZE DISTRIBUTION

Delaware Transit Corporation Solar Panel Project

Project Number 60692563	October 2022	Figure 1

SIEVE_BLUEBELL_NEW 60692563_2022-10-07_DELAWARE TRANSIT.GPJ URS_BLUE.GDT 10/13/22

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



SYMBOL	●	⊠	▲
Boring	B-3	B-4	B-4
Sample	S-9	S-3	S-5
Spec			
Depth (ft)	30.0	5.0	9.0
% +3"	0.0	0.0	0.0
% Gravel	0.0	0.0	9.1
% Sand	32.8	46.1	71.6
% Fines	67.2	53.9	19.3
% -2μ			
Cc			
Cu			
LL	88	22	NP
PL	35	14	NP
PI	53	8	NP
USCS	CH	CL	SM
w (%)	58.3	13.7	14.2

Particle Size (Sieve #)	PERCENT FINER		
	●	⊠	▲
2"			
1 1/2"			
1"			
3/4"			100.0
1/2"			95.2
3/8"			95.2
4	100.0	100.0	90.9
10	95.3	99.3	88.9
20	88.4	94.4	87.2
40	83.3	77.1	55.6
60	80.0	64.5	44.2
100	74.1	57.0	27.6
200	67.2	53.9	19.3

SYMBOL	DESCRIPTION AND REMARKS
●	Gray SANDY FAT CLAY (CH)
⊠	Gray SANDY LEAN CLAY (CL)
▲	Brown SILTY SAND (SM)

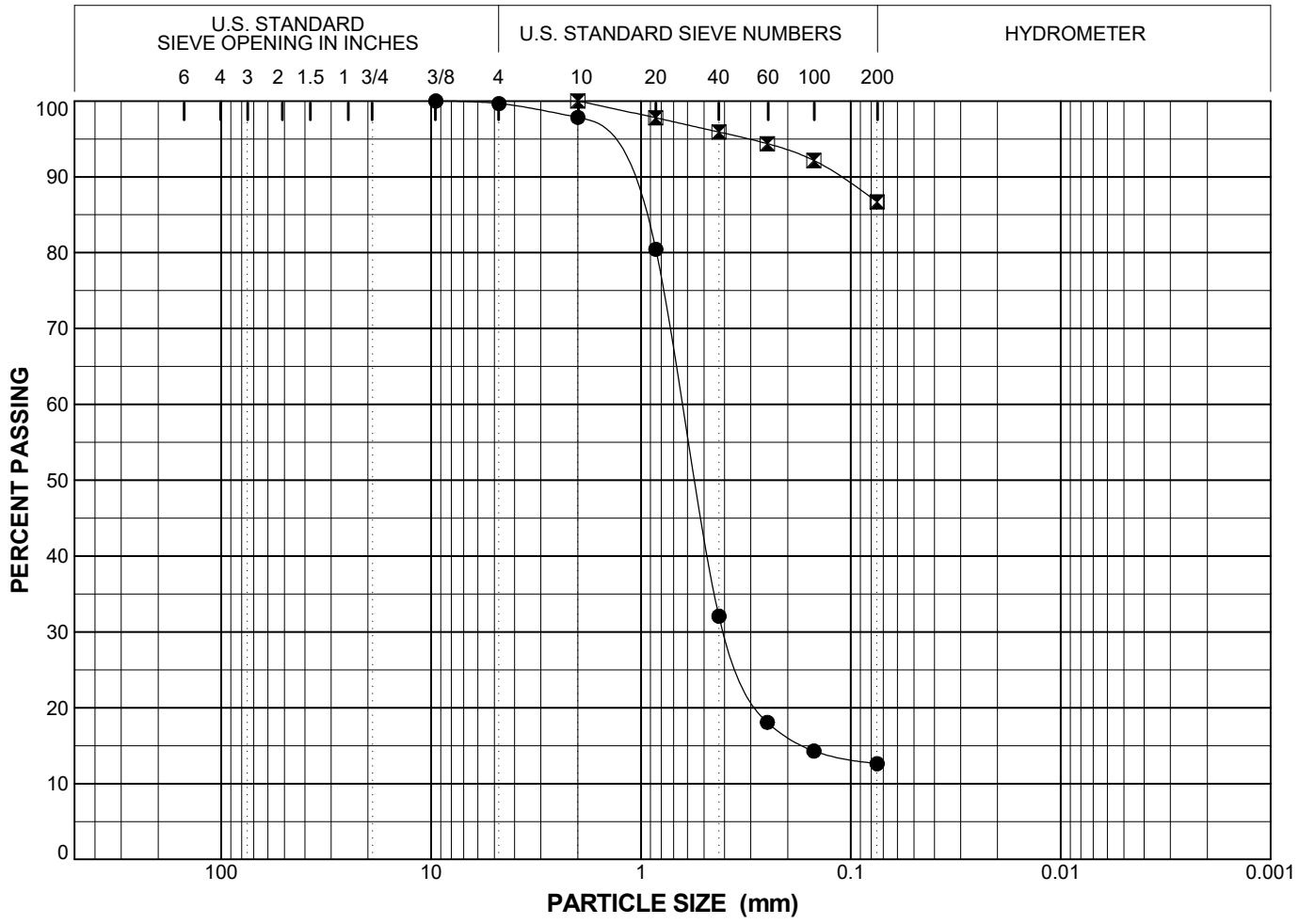
PARTICLE SIZE DISTRIBUTION

Delaware Transit Corporation Solar Panel Project

Project Number 60692563	October 2022	Figure 2

SIEVE_BLUEBELL_NEW 60692563_2022-10-07_DELAWARE TRANSIT.GPJ URS_BLUE.GDT 10/13/22

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



SYMBOL	●	⊠	
Boring	B-4	B-4	
Sample	S-6	S-9	
Spec			
Depth (ft)	15.0	30.0	
% +3"	0.0	0.0	
% Gravel	0.3	0.0	
% Sand	87.0	13.3	
% Fines	12.6	86.7	
% -2μ			
Cc			
Cu			
LL		75	
PL		31	
PI		44	
USCS	SM	CH	
w (%)	26.1	52.2	

Particle Size (Sieve #)	PERCENT FINER ●	PERCENT FINER ⊠	
2"			
1 1/2"			
1"			
3/4"			
1/2"			
3/8"	100.0		
4	99.7		
10	97.8	100.0	
20	80.4	97.8	
40	32.1	95.9	
60	18.1	94.4	
100	14.3	92.2	
200	12.6	86.7	

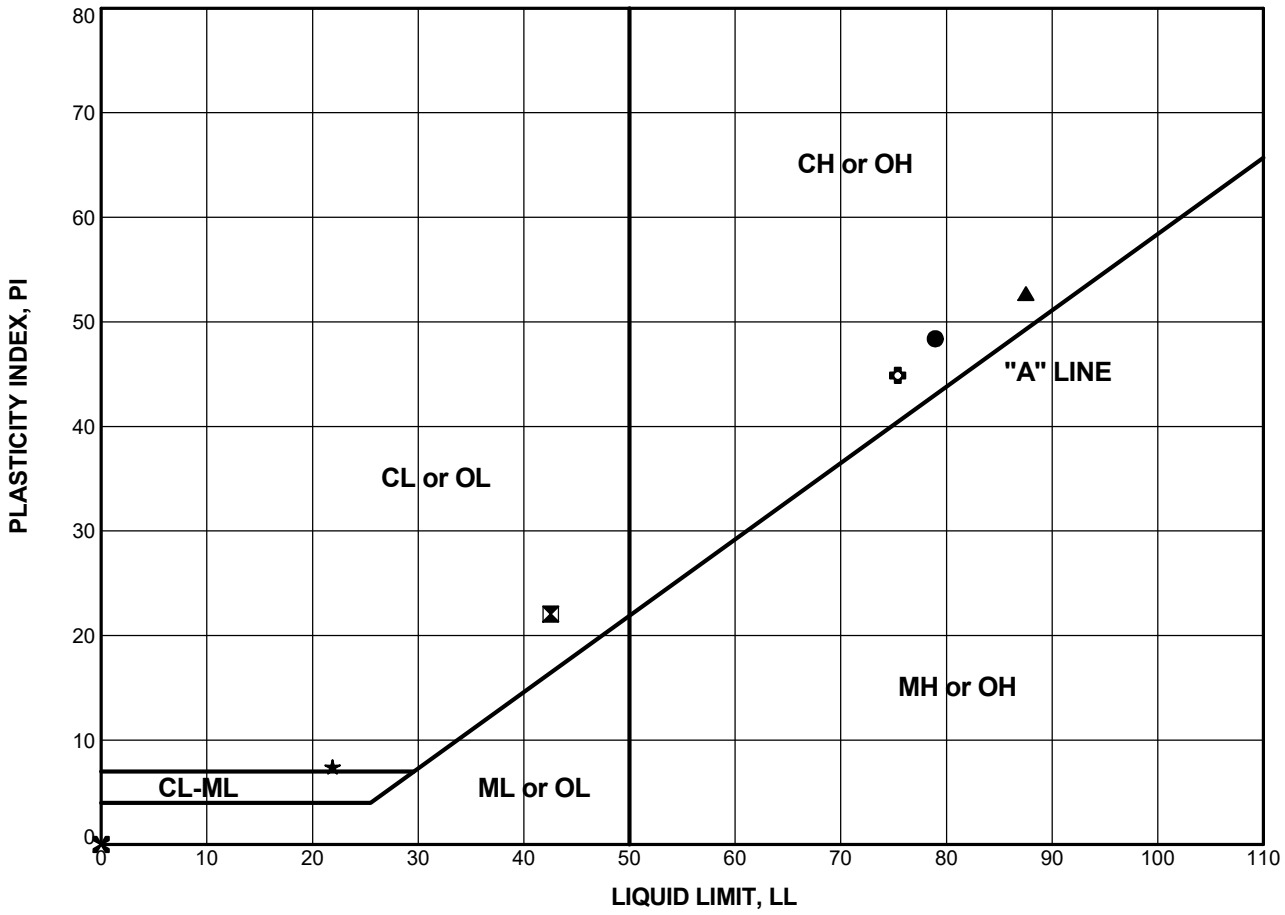
SYMBOL	DESCRIPTION AND REMARKS
●	Brown SILTY SAND (SM)
⊠	Gray FAT CLAY (CH)

PARTICLE SIZE DISTRIBUTION

Delaware Transit Corporation Solar Panel Project

Project Number 60692563	October 2022	Figure 3

SIEVE_BLUEBELL_NEW 60692563_2022-10-07_DELAWARE TRANSIT.GPJ URS_BLUE.GDT 10/13/22



Boring Number	Sample Number	Depth (feet)	Test Symbol	Water Content (%)	LL	PL	PI	Classification
B-1	S-10	35.0	●	69	79	31	48	Gray FAT CLAY with SAND
B-2	S-10	35.0	⊠	34	43	20	23	Gray
B-3	S-9	30.0	▲	58	88	35	53	Gray SANDY FAT CLAY
B-4	S-3	5.0	★	14	22	14	8	Gray SANDY LEAN CLAY
B-4	S-5	9.0	✕	14	NP	NP	NP	Brown SILTY SAND
B-4	S-9	30.0	✿	52	75	31	44	Gray FAT CLAY

Plasticity Chart

Project: Delaware Transit Corporation Solar Panel Project

Location:

Project Number: 60692563 Figure B-1

Appendix C
Design Computations

- **Bearing Capacity**
- **Settlements**
- **Seismic Site Classification**

ALLOWABLE BEARING CAPACITY

Performed By: **Date: 10/24/22** **Checked By:** **Date: 11/8/22**

PROJECT: **DelDOT Bus Solar Panels B-1, 3x3'**

INPUTS:		INPUTS: (BEARING CAPACITY FACTORS)	
C = COHESION (PSF) =	0	Nc =	44.03572
PHI = SOIL FRIC. ANGLE =	32	Nq =	28.516572
Q = GAMMA * Df =	360	Ngamma =	25.318844
GAMMA = SOIL UNIT WT. =	120	ESTIMATE PHI FROM N-VALUE	
Df = DEPTH OF EMBED. (FT.) =	3	N =	16
B = LEAST FT. WIDTH OR DIA. =	3	PHI EST=	32

CALCULATE ULTIMATE CAPACITY:

Qult. CONTINUOUS FOOTING =	**14,823.36**	PSF
Qult. SQUARE FOOTING =	**13,911.88**	PSF
Qult. ROUND FOOTING =	**13,000.40**	PSF

RECALCULATE WITH APPROPRIATE FACTOR OF SAFETY Fs = ***3***

Qall. CONTINUOUS FOOTING =	**4,941.12**	PSF
Qall. SQUARE FOOTING =	**4,637.29**	PSF
Qall. ROUND FOOTING =	**4,333.47**	PSF

ALLOWABLE BEARING CAPACITY

Performed By: **Date: 10/24/22** **Checked By:** **Date: 11/8/22**

PROJECT: **DelDOT Bus Solar Panels B-2, 3x3'**

INPUTS:		INPUTS: (BEARING CAPACITY FACTORS)	
C = COHESION (PSF) =	0	Nc =	37.162435
PHI = SOIL FRIC. ANGLE =	30	Nq =	22.455742
Q = GAMMA * Df =	360	Ngamma =	19.726134
GAMMA = SOIL UNIT WT. =	120	ESTIMATE PHI FROM N-VALUE	
Df = DEPTH OF EMBED. (FT.) =	3	N =	10
B = LEAST FT. WIDTH OR DIA. =	3	PHI EST=	30

CALCULATE ULTIMATE CAPACITY:

Qult. CONTINUOUS FOOTING =	**11,634.77**	PSF
Qult. SQUARE FOOTING =	**10,924.63**	PSF
Qult. ROUND FOOTING =	**10,214.49**	PSF

RECALCULATE WITH APPROPRIATE FACTOR OF SAFETY Fs = ***3***

Qall. CONTINUOUS FOOTING =	**3,878.26**	PSF
Qall. SQUARE FOOTING =	**3,641.54**	PSF
Qall. ROUND FOOTING =	**3,404.83**	PSF

AASHTO LRFD FACTORED BEARING RESISTANCE

Performed By: **Date: 10/24/22** **Checked By:** **Date: 11/8/22**

PROJECT: **DelDOT Bus Solar Panels B-3, 3x3'**

INPUTS:		INPUTS: (BEARING CAPACITY FACTORS)	
C = COHESION (PSF) =	0	Nc =	44.03572
PHI = SOIL FRIC. ANGLE =	32	Nq =	28.516572
Q = GAMMA * Df =	360	Ngamma =	25.318844
GAMMA = SOIL UNIT WT. =	120	ESTIMATE PHI FROM N-VALUE	
Df = DEPTH OF EMBED. (FT.) =	3	N =	17
B = LEAST FT. WIDTH OR DIA. =	3	PHI EST=	32

CALCULATE ULTIMATE CAPACITY:

Qult. CONTINUOUS FOOTING =	**14,823.36**	PSF
Qult. SQUARE FOOTING =	**13,911.88**	PSF
Qult. ROUND FOOTING =	**13,000.40**	PSF

RECALCULATE WITH APPROPRIATE FACTOR OF SAFETY Fs = ***3***

Qall. CONTINUOUS FOOTING =	**4,941.12**	PSF
Qall. SQUARE FOOTING =	**4,637.29**	PSF
Qall. ROUND FOOTING =	**4,333.47**	PSF

ALLOWABLE BEARING CAPACITY

Performed By: **Date: 10/24/22** **Checked By:** **Date: 11/8/22**

PROJECT: **DelDOT Bus Solar Panels B-4,3x3'**

INPUTS:		INPUTS: (BEARING CAPACITY FACTORS)	
C = COHESION (PSF) =	2000	Nc =	5.7123893
PHI = SOIL FRIC. ANGLE =	0	Nq =	1.0000001
Q = GAMMA * Df =	360	Ngamma =	8.552E-08
GAMMA = SOIL UNIT WT. =	120	ESTIMATE PHI FROM N-VALUE	
Df = DEPTH OF EMBED. (FT.) =	3	N =	20
B = LEAST FT. WIDTH OR DIA. =	3	PHI EST=	33

CALCULATE ULTIMATE CAPACITY:

Qult. CONTINUOUS FOOTING =	**11,784.78**	PSF
Qult. SQUARE FOOTING =	**15,212.21**	PSF
Qult. ROUND FOOTING =	**15,212.21**	PSF

RECALCULATE WITH APPROPRIATE FACTOR OF SAFETY Fs = ***3***

Qall. CONTINUOUS FOOTING =	**3,928.26**	PSF
Qall. SQUARE FOOTING =	**5,070.74**	PSF
Qall. ROUND FOOTING =	**5,070.74**	PSF

DTC Solar Panels 72 K 6x6 B-1

PROJECT IDENTIFICATION

Title: DTC Solar Panels 72 K 6x6 B-1
Project Number: -
Client:
Designer: SAS
Station Number: NA

Description:

Company's information:

Name:
Street:
,
Telephone #:
Fax #:
E-Mail:

Original file path and name: C:\Users\s ..... Thompson\Desktop\DTC Solar Panels 72 K 6x6 B-1.2ST
Original date and time of creating this file: Mon Oct 31 06:58:17 2022

GEOMETRY: Analysis of a Multiple Footings

1) Maximum Elastic Settlement = 0.09 inches
2) Maximum Consolidation Settlement = 0.72 inches
3) Maximum Total Settlement = 0.81 inches

INPUT DATA – FOUNDATION LAYERS – 4 layers

	Wet Unit Weight, γ [lb/ft³]	Poisson's Ratio μ	Description of Soil
1	120.00	0.30	Medium Dense Sand
2	120.00	0.30	Saturated Sand
3	110.00	0.30	Very Soft Clay
4	120.00	0.30	Sand

INPUT DATA – MULTIPLE FOOTINGS – 1 footings

INPUT DATA OF WATER

Point #	Coordinates (X, Z) : (X) [ft.]	(Z) [ft.]
1	100.00	7.00
2	200.00	7.00

Version 2.0 FoSSA Version 2.0 FoSSA Version 2.0 FoSSA

IMMEDIATE SETTLEMENT, Si

Node #	Settlement along section: X [ft.]	Y [ft.]	Layer (k)	Young's Modulus, E [lb/ft ²]	Poisson's Ratio, μ	Settlement of each layer, Si(k) [ft.]	Initial Z [ft.]	Final Z * [ft.]	Total Settlement Sum of Si(k), [ft.]
1	140.00	0.00	1	1200000	0.3000	0.0002	20.00	20.00	0.00
			2	1100000	0.3000	0.0004			
			3	2000000	0.3000	0.0003			
			4	2000000	0.3000	0.0000			
2	142.50	0.00	1	1200000	0.3000	0.0006	20.00	20.00	0.00
			2	1100000	0.3000	0.0005			
			3	2000000	0.3000	0.0003			
			4	2000000	0.3000	0.0000			
3	145.00	0.00	1	1200000	0.3000	0.0017	20.00	20.00	0.00
			2	1100000	0.3000	0.0007			
			3	2000000	0.3000	0.0004			
			4	2000000	0.3000	0.0001			
4	147.50	0.00	1	1200000	0.3000	0.0064	20.00	19.99	0.01 0.09"
			2	1100000	0.3000	0.0008			
			3	2000000	0.3000	0.0004			
			4	2000000	0.3000	0.0001			
5	150.00	0.00	1	1200000	0.3000	0.0082	20.00	19.99	0.01 0.11"
			2	1100000	0.3000	0.0009			
			3	2000000	0.3000	0.0004			
			4	2000000	0.3000	0.0001			
6	152.50	0.00	1	1200000	0.3000	0.0066	20.00	19.99	0.01 0.09"
			2	1100000	0.3000	0.0009			
			3	2000000	0.3000	0.0004			
			4	2000000	0.3000	0.0001			
7	155.00	0.00	1	1200000	0.3000	0.0018	20.00	20.00	0.00
			2	1100000	0.3000	0.0007			
			3	2000000	0.3000	0.0004			
			4	2000000	0.3000	0.0001			
8	157.50	0.00	1	1200000	0.3000	0.0007	20.00	20.00	0.00
			2	1100000	0.3000	0.0006			
			3	2000000	0.3000	0.0003			
			4	2000000	0.3000	0.0000			
9	160.00	0.00	1	1200000	0.3000	0.0003	20.00	20.00	0.00
			2	1100000	0.3000	0.0004			
			3	2000000	0.3000	0.0003			
			4	2000000	0.3000	0.0000			

*Note: Final Z is calculated assuming only 'Immediate Settlement' exists.

Elastic settlement of clay layer is considered in consolidation settlement

ULTIMATE SETTLEMENT, Sc

Node #	X [ft.]	Y [ft.]	Original Z [ft.]	Settlement Sc [ft.]	Final Z * [ft.]
1	140.00	0.00	20.00	0.04	19.96
2	142.50	0.00	20.00	0.05	19.95
3	145.00	0.00	20.00	0.05	19.95
4	147.50	0.00	20.00	0.06	19.94
5	150.00	0.00	20.00	0.06	19.94
6	152.50	0.00	20.00	0.06	19.94
7	155.00	0.00	20.00	0.06	19.94
8	157.50	0.00	20.00	0.05	19.95
9	160.00	0.00	20.00	0.04	19.96

*Note: Final Z is calculated assuming only 'Ultimate Settlement' exists.

TABULATED GEOMETRY: INPUT OF FOUNDATION SOILS

Found. Soil #	Point #	Coordinates (X, Z) : (X) [ft.]	(Z) [ft.]	DESCRIPTION
1	1	100.00	20.00	Medium Dense Sand
	2	150.00	20.00	
	3	200.00	20.00	
2	1	100.00	7.00	Saturated Sand
	2	200.00	7.00	
3	1	100.00	0.00	Very Soft Clay
	2	200.00	0.00	
4	1	100.00	-15.00	Sand
	2	200.00	-15.00	

TABULATED GEOMETRY: INPUT OF MULTIPLE FOOTINGS – 1 footings

Footing #	L (in X direction) [ft]	B (in Y direction) [ft]	X of center [ft]	Y of center [ft]	q [ft]l [lb/ft²]
1	6.00	6.00	150.00	0.00	2000.00

DTC Solar Panels 72 K 6x6 B-2

PROJECT IDENTIFICATION

Title: DTC Solar Panels 72 K 6x6 B-2
Project Number: -
Client:
Designer: SAS
Station Number: NA

Description:

Company's information:

Name:
Street:
,
Telephone #:
Fax #:
E-Mail:

Original file path and name: C:\Users\s ..... Thompson\Desktop\DTC Solar Panels 72 K 6x6 B-2.2ST
Original date and time of creating this file: Mon Oct 31 06:58:17 2022

GEOMETRY: Analysis of a Multiple Footings

1) Maximum Elastic Settlement = 0.16 inches
2) Maximum Consolidation Settlement = 0.6 inches
3) Maximum Total Settlement = 0.76 inches

INPUT DATA – FOUNDATION LAYERS – 4 layers

	Wet Unit Weight, γ [lb/ft³]	**Poisson's Ratio μ**	**Description of Soil**
1	115.00	0.30	Loose to Medium Dense Sand
2	120.00	0.30	Saturated Sand
3	110.00	0.30	Very Soft Clay
4	120.00	0.30	Sand

INPUT DATA – MULTIPLE FOOTINGS – 1 footings

INPUT DATA OF WATER

Point #	**Coordinates (X, Z) : (X) [ft.]**	**(Z) [ft.]**
1	100.00	6.50
2	200.00	6.50

Version 2.0 FoSSA Version 2.0 FoSSA Version 2.0 FoSSA

IMMEDIATE SETTLEMENT, Si

Node #	Settlement along section: X [ft.]	Y [ft.]	Layer (k)	Young's Modulus, E [lb/ft ²]	Poisson's Ratio, μ	Settlement of each layer, Si(k) [ft.]	Initial Z [ft.]	Final Z * [ft.]	Total Settlement Sum of Si(k), [ft.]
1	140.00	0.00	1	800000	0.3000	0.0004	20.00	20.00	0.00
			2	1200000	0.3000	0.0004			
			3	2000000	0.3000	0.0003			
			4	2000000	0.3000	0.0000			
2	142.50	0.00	1	800000	0.3000	0.0011	20.00	20.00	0.00
			2	1200000	0.3000	0.0005			
			3	2000000	0.3000	0.0003			
			4	2000000	0.3000	0.0000			
3	145.00	0.00	1	800000	0.3000	0.0027	20.00	20.00	0.00
			2	1200000	0.3000	0.0006			
			3	2000000	0.3000	0.0003			
			4	2000000	0.3000	0.0000			
4	147.50	0.00	1	800000	0.3000	0.0098	20.00	19.99	0.01 0.13"
			2	1200000	0.3000	0.0008			
			3	2000000	0.3000	0.0004			
			4	2000000	0.3000	0.0000			
5	150.00	0.00	1	800000	0.3000	0.0126	20.00	19.99	0.01 0.16"
			2	1200000	0.3000	0.0008			
			3	2000000	0.3000	0.0004			
			4	2000000	0.3000	0.0001			
6	152.50	0.00	1	800000	0.3000	0.0101	20.00	19.99	0.01 0.13"
			2	1200000	0.3000	0.0008			
			3	2000000	0.3000	0.0004			
			4	2000000	0.3000	0.0000			
7	155.00	0.00	1	800000	0.3000	0.0029	20.00	20.00	0.00
			2	1200000	0.3000	0.0007			
			3	2000000	0.3000	0.0003			
			4	2000000	0.3000	0.0000			
8	157.50	0.00	1	800000	0.3000	0.0011	20.00	20.00	0.00
			2	1200000	0.3000	0.0005			
			3	2000000	0.3000	0.0003			
			4	2000000	0.3000	0.0000			
9	160.00	0.00	1	800000	0.3000	0.0005	20.00	20.00	0.00
			2	1200000	0.3000	0.0004			
			3	2000000	0.3000	0.0003			
			4	2000000	0.3000	0.0000			

*Note: Final Z is calculated assuming only 'Immediate Settlement' exists.

Elastic settlement of clay layer is considered in consolidation settlement

ULTIMATE SETTLEMENT, Sc

Node #	X [ft.]	Y [ft.]	Original Z [ft.]	Settlement Sc [ft.]	Final Z * [ft.]
1	140.00	0.00	20.00	0.04	19.96
2	142.50	0.00	20.00	0.04	19.96
3	145.00	0.00	20.00	0.04	19.96
4	147.50	0.00	20.00	0.05	19.95
5	150.00	0.00	20.00	0.05	19.95
6	152.50	0.00	20.00	0.05	19.95
7	155.00	0.00	20.00	0.05	19.95
8	157.50	0.00	20.00	0.04	19.96
9	160.00	0.00	20.00	0.04	19.96

*Note: Final Z is calculated assuming only 'Ultimate Settlement' exists.

TABULATED GEOMETRY: INPUT OF FOUNDATION SOILS

Found. Soil #	Point #	Coordinates (X, Z) : (X) [ft.]	(Z) [ft.]	DESCRIPTION
1	1	100.00	20.00	Loose to Medium Dense Sand
	2	150.00	20.00	
	3	200.00	20.00	
2	1	100.00	6.00	Saturated Sand
	2	200.00	6.00	
3	1	100.00	-2.00	Very Soft Clay
	2	200.00	-2.00	
4	1	100.00	-17.00	Sand
	2	200.00	-17.00	

TABULATED GEOMETRY: INPUT OF MULTIPLE FOOTINGS – 1 footings

Footing #	L (in X direction) [ft]	B (in Y direction) [ft]	X of center [ft]	Y of center [ft]	q [ft]l [lb/ft²]
1	6.00	6.00	150.00	0.00	2000.00

DTC Solar Panels 72 K 6x6 B-3

PROJECT IDENTIFICATION

Title: DTC Solar Panels 72 K 6x6 B-3
Project Number: -
Client:
Designer: SAS
Station Number: NA

Description:

Company's information:

Name:
Street:
,
Telephone #:
Fax #:
E-Mail:

Original file path and name: C:\Users\s ..... Thompson\Desktop\DTC Solar Panels 72 K 6x6 B-3.2ST
Original date and time of creating this file: Mon Oct 31 06:58:17 2022

GEOMETRY: Analysis of a Multiple Footings

1) Maximum Elastic Settlement = 0.13 inches
2) Maximum Consolidation Settlement = 0.36 inches
3) Maximum Total Settlement = 0.49 inches

INPUT DATA – FOUNDATION LAYERS – 4 layers

	Wet Unit Weight, γ [lb/ft³]	Poisson's Ratio μ	Description of Soil
1	115.00	0.30	Medium Dense Sand
2	120.00	0.30	Saturated Sand
3	110.00	0.30	Very Soft Clay
4	110.00	0.30	Very Loose Sand

INPUT DATA – MULTIPLE FOOTINGS – 1 footings

INPUT DATA OF WATER

Point #	Coordinates (X, Z) : (X) [ft.]	(Z) [ft.]
1	100.00	13.00
2	200.00	13.00

INPUT DATA FOR CONSOLIDATION -- $\alpha = 1/2$

Layer #	Underging Consolidation [Yes/No]	OCR = Pc / Po	Cc	Cr	e0	Cv [ft ²/day]	Drains at :
1	No	N/A	N/A	N/A	N/A	N/A	N/A
2	No	N/A	N/A	N/A	N/A	N/A	N/A
3	Yes	1.00	0.600	0.060	0.530	0.2153	Top & Bot.
4	No	N/A	N/A	N/A	N/A	N/A	N/A

IMMEDIATE SETTLEMENT, Si

Node #	Settlement along section: X [ft.]	Y [ft.]	Layer (k)	Young's Modulus, E [lb/ft ²]	Poisson's Ratio, μ	Settlement of each layer, Si(k) [ft.]	Initial Z [ft.]	Final Z * [ft.]	Total Settlement Sum of Si(k), [ft.]
1	140.00	0.00	1	1200000	0.3000	-0.0000	20.00	20.00	0.00
			2	800000	0.3000	0.0010			
			3	2000000	0.3000	0.0001			
			4	700000	0.3000	0.0002			
2	142.50	0.00	1	1200000	0.3000	0.0001	20.00	20.00	0.00
			2	800000	0.3000	0.0016			
			3	2000000	0.3000	0.0001			
			4	700000	0.3000	0.0003			
3	145.00	0.00	1	1200000	0.3000	0.0008	20.00	20.00	0.00
			2	800000	0.3000	0.0026			
			3	2000000	0.3000	0.0001			
			4	700000	0.3000	0.0003			
4	147.50	0.00	1	1200000	0.3000	0.0050	20.00	19.99	0.01
			2	800000	0.3000	0.0036			0.11"
			3	2000000	0.3000	0.0002			
			4	700000	0.3000	0.0003			
5	150.00	0.00	1	1200000	0.3000	0.0066	20.00	19.99	0.01
			2	800000	0.3000	0.0040			0.13"
			3	2000000	0.3000	0.0002			
			4	700000	0.3000	0.0003			
6	152.50	0.00	1	1200000	0.3000	0.0051	20.00	19.99	0.01
			2	800000	0.3000	0.0037			0.11"
			3	2000000	0.3000	0.0002			
			4	700000	0.3000	0.0003			
7	155.00	0.00	1	1200000	0.3000	0.0008	20.00	20.00	0.00
			2	800000	0.3000	0.0027			
			3	2000000	0.3000	0.0002			
			4	700000	0.3000	0.0003			
8	157.50	0.00	1	1200000	0.3000	0.0001	20.00	20.00	0.00
			2	800000	0.3000	0.0017			
			3	2000000	0.3000	0.0001			
			4	700000	0.3000	0.0003			
9	160.00	0.00	1	1200000	0.3000	-0.0000	20.00	20.00	0.00
			2	800000	0.3000	0.0011			
			3	2000000	0.3000	0.0001			
			4	700000	0.3000	0.0003			

*Note: Final Z is calculated assuming only 'Immediate Settlement' exists.

Elastic settlement of clay layer is considered in consolidation settlement

ULTIMATE SETTLEMENT, Sc

Node #	X [ft.]	Y [ft.]	Original Z [ft.]	Settlement Sc [ft.]	Final Z * [ft.]
1	140.00	0.00	20.00	0.02	19.98
2	142.50	0.00	20.00	0.02	19.98
3	145.00	0.00	20.00	0.02	19.98
4	147.50	0.00	20.00	0.03	19.97
5	150.00	0.00	20.00	0.03	19.97
6	152.50	0.00	20.00	0.03	19.97
7	155.00	0.00	20.00	0.03	19.97
8	157.50	0.00	20.00	0.02	19.98
9	160.00	0.00	20.00	0.02	19.98

*Note: Final Z is calculated assuming only 'Ultimate Settlement' exists.

TABULATED GEOMETRY: INPUT OF FOUNDATION SOILS

Found. Soil #	Point #	Coordinates (X, Z) : (X) [ft.]	(Z) [ft.]	D E S C R I P T I O N
1	1	100.00	20.00	Medium Dense Sand
	2	150.00	20.00	
	3	200.00	20.00	
2	1	100.00	13.00	Saturated Sand
	2	200.00	13.00	
3	1	100.00	-2.00	Very Soft Clay
	2	200.00	-2.00	
4	1	100.00	-7.00	Very Loose Sand
	2	200.00	-7.00	

TABULATED GEOMETRY: INPUT OF MULTIPLE FOOTINGS – 1 footings

Footing #	L (in X direction) [ft]	B (in Y direction) [ft]	X of center [ft]	Y of center [ft]	q [ft]l [lb/ft²]
1	6.00	6.00	150.00	0.00	2000.00

DTC Solar Panels 72 K 6x6 B-4

PROJECT IDENTIFICATION

Title: DTC Solar Panels 72 K 6x6 B-4
Project Number: -
Client:
Designer: SAS
Station Number: NA

Description:

Company's information:

Name:
Street:
,
Telephone #:
Fax #:
E-Mail:

Original file path and name: C:\Users\s ..... Thompson\Desktop\DTC Solar Panels 72 K 6x6 B-4.2ST
Original date and time of creating this file: Mon Oct 31 06:58:17 2022

GEOMETRY: Analysis of a Multiple Footings

1) Maximum Elastic Settlement = 0.09 inches
2) Maximum Consolidation Settlement = 0.84 inches
3) Maximum Total Settlement = 0.93 inches

INPUT DATA – FOUNDATION LAYERS – 7 layers

	Wet Unit Weight, γ [lb/ft³]	Poisson's Ratio μ	Description of Soil
1	125.00	0.30	Very Stiff Clay
2	125.00	0.30	Dense Sand
3	120.00	0.30	Medium Dense Sand
4	110.00	0.30	Saturated Loose Sand
5	115.00	0.30	Saturated Medium Dense Sand
6	110.00	0.30	Very Soft Clay
7	125.00	0.30	Saturated Sand

INPUT DATA – MULTIPLE FOOTINGS – 1 footings

INPUT DATA OF WATER

Point #	Coordinates (X, Z) : (X) [ft.]	(Z) [ft.]
1	100.00	12.00
2	200.00	12.00

INPUT DATA FOR CONSOLIDATION -- $\alpha = 1/2$

Layer # Underging Consolidation [Yes/No]		$(\sigma'_p - \sigma'_o)$ given at layer's boundaries in [lb/ft²] at Top	Bottom	Cc	Cr	e0	Cv [ft ²/day]	Drains at :
1	Yes	2100.0	1800.0	0.100	0.010	0.600	0.2153	Top & Bot.
2	No	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3	No	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4	No	N/A	N/A	N/A	N/A	N/A	N/A	N/A
5	No	N/A	N/A	N/A	N/A	N/A	N/A	N/A
6	Yes	0.0	0.0	0.600	0.060	0.530	0.2153	Top & Bot.
7	No	N/A	N/A	N/A	N/A	N/A	N/A	N/A

IMMEDIATE SETTLEMENT, Si

Node #	Settlement along section: X [ft.]	Y [ft.]	Layer (k)	Young's Modulus, E [lb/ft ²]	Poisson's Ratio, μ	Settlement of each layer, Si(k) [ft.]	Initial Z [ft.]	Final Z * [ft.]	Total Settlement Sum of Si(k), [ft.]
1	140.00	0.00	1	2000000	0.3000	-0.0000	20.00	20.00	0.00
			2	1700000	0.3000	-0.0000			
			3	1100000	0.3000	0.0001			
			4	500000	0.3000	0.0005			
			5	1300000	0.3000	0.0004			
			6	2000000	0.3000	0.0002			
			7	2000000	0.3000	0.0000			
2	142.50	0.00	1	2000000	0.3000	-0.0000	20.00	20.00	0.00
			2	1700000	0.3000	0.0000			
			3	1100000	0.3000	0.0002			
			4	500000	0.3000	0.0011			
			5	1300000	0.3000	0.0006			
			6	2000000	0.3000	0.0003			
			7	2000000	0.3000	0.0000			
3	145.00	0.00	1	2000000	0.3000	0.0000	20.00	20.00	0.00
			2	1700000	0.3000	0.0003			
			3	1100000	0.3000	0.0007			
			4	500000	0.3000	0.0019			
			5	1300000	0.3000	0.0008			
			6	2000000	0.3000	0.0003			
			7	2000000	0.3000	0.0000			
4	147.50	0.00	1	2000000	0.3000	0.0018	20.00	19.99	0.01 0.0744"
			2	1700000	0.3000	0.0010			
			3	1100000	0.3000	0.0015			
			4	500000	0.3000	0.0028			
			5	1300000	0.3000	0.0009			
			6	2000000	0.3000	0.0003			
			7	2000000	0.3000	0.0000			
5	150.00	0.00	1	2000000	0.3000	0.0022	20.00	19.99	0.01 0.0912"
			2	1700000	0.3000	0.0015			
			3	1100000	0.3000	0.0019			
			4	500000	0.3000	0.0032			
			5	1300000	0.3000	0.0010			
			6	2000000	0.3000	0.0003			
			7	2000000	0.3000	0.0000			
6	152.50	0.00	1	2000000	0.3000	0.0018	20.00	19.99	0.01 0.0768"
			2	1700000	0.3000	0.0011			
			3	1100000	0.3000	0.0015			
			4	500000	0.3000	0.0029			
			5	1300000	0.3000	0.0009			
			6	2000000	0.3000	0.0003			
			7	2000000	0.3000	0.0000			
7	155.00	0.00	1	2000000	0.3000	0.0000	20.00	20.00	0.00
			2	1700000	0.3000	0.0003			
			3	1100000	0.3000	0.0007			
			4	500000	0.3000	0.0020			
			5	1300000	0.3000	0.0008			
			6	2000000	0.3000	0.0003			
			7	2000000	0.3000	0.0000			

*Note: Final Z is calculated assuming only 'Immediate Settlement' exists.

IMMEDIATE SETTLEMENT, Si

Node #	Settlement along section: X [ft.]	Y [ft.]	Layer (k)	Young's Modulus, E [lb/ft ²]	Poisson's Ratio, μ	Settlement of each layer, Si(k) [ft.]	Initial Z [ft.]	Final Z * [ft.]	Total Settlement Sum of Si(k), [ft.]
8	157.50	0.00	~~1~~	~~2000000~~	~~0.3000~~	~~-0.0000~~	20.00	20.00	0.00
			2	1700000	0.3000	0.0000			
			3	1100000	0.3000	0.0003			
			4	500000	0.3000	0.0012			
			5	1300000	0.3000	0.0006			
			~~6~~	~~2000000~~	~~0.3000~~	~~0.0003~~			
			7	2000000	0.3000	0.0000			
9	160.00	0.00	~~1~~	~~2000000~~	~~0.3000~~	~~-0.0000~~	20.00	20.00	0.00
			2	1700000	0.3000	-0.0000			
			3	1100000	0.3000	0.0001			
			4	500000	0.3000	0.0006			
			5	1300000	0.3000	0.0004			
			~~6~~	~~2000000~~	~~0.3000~~	~~0.0003~~			
			7	2000000	0.3000	0.0000			

*Note: Final Z is calculated assuming only 'Immediate Settlement' exists.

~~Elastic settlement of clay layer is considered in consolidation settlement~~

ULTIMATE SETTLEMENT, Sc

Node #	X [ft.]	Y [ft.]	Original Z [ft.]	Settlement Sc [ft.]	Final Z * [ft.]
1	140.00	0.00	20.00	0.04	19.96
2	142.50	0.00	20.00	0.05	19.95
3	145.00	0.00	20.00	0.05	19.95
4	147.50	0.00	20.00	0.07	19.93
5	150.00	0.00	20.00	0.07	19.93
6	152.50	0.00	20.00	0.07	19.93
7	155.00	0.00	20.00	0.05	19.95
8	157.50	0.00	20.00	0.05	19.95
9	160.00	0.00	20.00	0.04	19.96

*Note: Final Z is calculated assuming only 'Ultimate Settlement' exists.

TABULATED GEOMETRY: INPUT OF FOUNDATION SOILS

Found. Soil #	Point #	Coordinates (X, Z) : (X) [ft.]	(Z) [ft.]	DESCRIPTION
1	1	100.00	20.00	Very Stiff Clay
	2	150.00	20.00	
	3	200.00	20.00	
2	1	100.00	17.00	Dense Sand
	2	200.00	17.00	
3	1	100.00	15.00	Medium Dense Sand
	2	200.00	15.00	
4	1	100.00	12.00	Saturated Loose Sand
	2	200.00	12.00	
5	1	100.00	7.00	Saturated Medium Dense Sand
	2	200.00	7.00	
6	1	100.00	-3.00	Very Soft Clay
	2	200.00	-3.00	
7	1	100.00	-18.00	Saturated Sand
	2	200.00	-18.00	

TABULATED GEOMETRY: INPUT OF MULTIPLE FOOTINGS – 1 footings

Footing #	L (in X direction) [ft]	B (in Y direction) [ft]	X of center [ft]	Y of center [ft]	q [ft]l [lb/ft²]
1	6.00	6.00	150.00	0.00	2000.00

Project:	18-02769-26A Dover Bus Canopy Solar Panels								
	Boring No.:	**B-1**	**B-2**	**B-3**	**B-4**				
Depth	Depth (d_i)	N	N	N	N	N	N	N_{AVG}	d_i/N
5	5	20	12	23	19			19	0.27
10	5	17	8	20	25			18	0.29
15	5	12	6	8	4			8	0.67
20	5	14	27	9	21			18	0.28
25	5	29	14	3	24			18	0.29
30	5	4	4	6	4			5	1.11
35	5	0	3	2	3			2	2.50
40	5	2	4	8	6			5	1.00
45	5	16	36	8	19			20	0.25
50	5	8	16	16	15			14	0.36
55	5	14	24	28	13			20	0.25
60	5	35	48	50	100			58	0.09
65	5	100	100	100	80			95	0.05
70	5	100	100	100	21			80	0.06
75	5	100	100	100	100			100	0.05
80	5	100	100	100	100			100	0.05
85	5	100	100	100	100			100	0.05
90	5	100	100	100	100			100	0.05
95	5	100	100	100	100			100	0.05
100	5	100	100	100	100			100	0.05
Sum	100							977	7.77

N_{bar}= 13 Seismic Site Class = E