ATTACHMENT J

PRE-CONSTRUCTION ROAD EVALUATION

Powell Creek Solar Project
Putnam County, Ohio

AET Report No. P-00025335A

Date:
September 7, 2023

Prepared for:

Westwood Professional Services, Inc.
12701 Whitewater Drive, Suite 300
Minnetonka, MN 55343

Geotechnical • Materials
Forensic • Environmental
Building Technology
Petrography/Chemistry

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September 7, 2023

Westwood Professional Services, Inc.
12701 Whitewater Drive, Suite 300
Minnetonka, MN 55343

Attn: Mr. Aditya Chivukula Venkata

RE: Report of Pre-construction Road Evaluation
Powell Creek Solar Project
Putnam County, Ohio
AET Report No. P-0025335A

Dear Mr. Venkata:

This report presents the results of the pavement testing and analysis project that AET performed on the proposed haul road for the pre-construction phase of the Powell Creek Solar Project in Putnam County, Ohio.

Sincerely,
American Engineering Testing, Inc.

Michael R. Anderson
Senior Project Manager, Pavement Division
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SIGNATURE PAGE

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1.0 INTRODUCTION

Powell Creek Solar, LLC (PCS), a subsidiary of Avangrid Renewables, LLC ("Avangrid"), is evaluating public roads for potential use as haul routes for the construction of the Powell Creek Solar Project ("Project") in Putnam County, Ohio. To aid in the evaluation, PCS has retained Westwood Professional Services, Inc, (WPS) and American Engineering Testing, Inc., (AET) to evaluate the proposed haul routes. AET was authorized to perform a geotechnical exploration and nondestructive pavement testing at the site and evaluate the suitability of the Project road as a construction haul route in Westwood Work Order No. PWO-0001 – Project Number: R0026093.01, dated 8/9/2023 (WO). This report (AET P-0025335A) describes our surface and structural condition evaluation of the Project road.

2.0 SCOPE OF SERVICES

The authorized scope consists of the following services, which were outlined in the Westwood WO:

- Pavement coring and hand auger soil sampling (referred to as "soil borings") along the Project road to a depth of approximately 1 foot
- Falling weight deflectometer (FWD) testing of the Project road
- Ground penetrating radar (GPR) testing on the Project road
- Digital video logging (DVL) of the Project road using a digital video camera
- Engineering evaluation of the Project road using DVL, GPR, FWD, and soil boring data to (a) assess ability of the road to sustain solar farm construction loads and (b) identify pre-construction road sections that are susceptible to severe damage
- Production of a report summarizing evaluations of the Project road

These services are exclusively intended to evaluate the Project road. The scope is not intended to explore for the presence or extent of environmental contamination in the soil or groundwater. Specific details on the analysis performed are described in the sections below and in appendices to this report.

3.0 PROJECT INFORMATION

3.1 Project location and road

The Project is located within approximately 1,350 acres of privately-owned land southeast of Miller City in Putnam County, Ohio (Figure 1). The project area is situated east of State Route SR 108, north of SR 15, south of County Highway CH E, and west of CH G.

3.2 Traffic on the Project road

The primary transportation arteries through the Project area in Putnam County include SRs and CRs. The following items describe the most current traffic data for the Project road and surrounding roads according to information from the Ohio Department of Transportation (ODOT)[1].

- The 2023 annual average daily traffic (AADT) for SR roads within the Project ranged from 1,269 to 3,029 vehicles with a business/commercial annual average daily traffic (BCADT) volume ranging from 137 to 302 trucks, or 10% to 13%.
- AADT and BCADT traffic records were not available for the CR within the Project. Therefore, we have used an AADT of 126 vehicles and 11% truck traffic for this road within the Project.

For Project road sections where published traffic and truck volumes are not available, we use the minimum design ESALs for CRs, when available, to back-calculate traffic volumes and truck percentages. In cases where minimum design ESALs are not available, we use common minimum daily ESALs to establish traffic volumes and truck percentages.

3.3 Anticipated traffic due to construction

We understand the Project will require public roads to deliver supplies and materials to the work sites during construction. Information related to construction hauling – including but not being limited to transportation plans and estimated truck traffic – does not materially affect our engineering evaluation of the road sections. Construction traffic, loads, and their impact on the Project road will be evaluated in AET Report No. P-0025335B.

4.0 SUBSURFACE EXPLORATION, ROAD TESTING, AND RESULTS

To facilitate testing, condition rating, and analysis, AET divided the Project road (totaling approximately 3.5 centerline miles) into 7 sections according to road type, road condition, and existing traffic. Tests and test results on the Project road are described in the subsections below and summarized in the appended Table 1. One road type was encountered at the Project, a road surfaced with a bituminous wearing course, or "bituminous pavement" (BP).

Our classification follows basic pavement engineering principles to help us organize field/lab activities, analysis, and evaluation. This general classification is not intended to conflict with or replace state agency road classifications, which rely on as-built information, road histories, agency material classifications, and other matters whose review are beyond the scope

[1] Ohio Department of Transportation (2023). Traffic Monitoring Management System - TMMS. Ohio Department of Transportation, Columbus, OH, Available from https://odot.public.ms2soft.com/tcds/tsearch.asp?loc=odot

described in Section 2.

4.1 Subsurface conditions

A total of 6 pavement cores and soil borings were performed along 3.5 centerline miles of Project road selected by WPS. A seventh boring was planned and attempted. However, our core equipment malfunctioned as we encountered pavement coring refusal, and the core and soil boring could not be performed. The number of and location of soil borings and pavement cores were selected by AET. The final locations were recorded with GPS equipment to submeter accuracy. AET contacted Ohio One-Call to avoid public underground utilities at the subsurface test locations.

Subsurface explorations at the Project took place on 8/8/2023, using hand auger sampling to depths of approximately 1 foot. The pavement cores were obtained with a diamond bit coring machine. After samples were obtained, the boreholes were backfilled with granular materials and surfaced with a cold patch asphalt to match the existing road profile. Collected samples were reviewed in our laboratory to evaluate surfacing material, soil layering, and classification. Detailed results of subsurface testing are provided in Appendix A, which includes descriptions of our geotechnical drilling procedure and boring logs. Detailed results of pavement coring are provided in Appendix B, which includes detailed descriptions of the pavement cores and core photographs. These results are summarized below by road type and structural layer.

<u>Bituminous pavement</u>. The road sections had an intact paved surface thickness of $2^3/_4$ to $7^1/_2$ inches, where the intact surface was composed of asphalt pavement. As noted previously, we were not able to determine pavement surfacing thickness at one (1) planned location (C-07) because of coring refusal, and we relied on later GPR analysis to determine the pavement thickness at this location. At two locations, we observed deteriorated pavement below the intact surfacing that ranged from 1 to 2 inches in thickness. Deterioration may be due to stripping, base erosion, and/or delamination in previously placed pavement layers. In two of the pavement cores, we observed medium to high severity stripping and the cores broke into several pieces.

<u>Layers directly supporting paved surfaces</u>. Underlying the intact pavement surfacing and the underlying deteriorated pavement materials, we saw what we consider granular base materials. These supporting base layers were observed to have a minimum thickness ranging from $4^1/_2$ to $9^1/_2$ inches. The soil borings did not penetrate the entire depth of the base material at all locations and actual base thicknesses could not be determined. We relied on GPR analysis to determine approximate base thicknesses for the Project road. All granular base materials were classified as either A-1-b, A-1-a, or A-2-4 according to the Association of State

Highway and Transportation Officials (AASHTO) soil classifications. Later structural analysis incorporated deteriorated pavement, where present, into a composite base layer with underlying aggregate materials. The following items describe base materials according to AASHTO soil classifications.

Laboratory tests were performed on three granular base samples. Moisture content tests yielded 5% to 8% moisture. Fines content tests (to quantify material passing the No. 200 sieve) showed 12% to 27% fines.

Subgrade soils. Native subgrade soils were not encountered in the soil borings due to the shallow depth of sampling. However, we reviewed soil data from the USDA Natural Resource Conservation Service's SSURGO (Soil Survey Geographic Database) which indicated that the primary soils in the upper subgrade zone on the Project road consist of lean and fat clays meeting the AASHTO A-6 and A-7 (plastic) soil categories. SSURGO also indicated some low and high plasticity silts along the Project road to a lesser extent (<10%).

4.2 Surface course thickness (ground penetrating radar)

The road layer thickness testing program uses a high-speed (air coupled) GPR antenna to collect pavement data later analyzed to evaluate layer thicknesses. AET performed GPR testing on approximately 7.0 lane miles of the Project road on 8/8/2023 using a 2 GHz antenna, which allows material layer measurements at depths of up to 18 inches with a resolution of approximately one-half inch. Our analysis of collected GPR data (summarized by road section in Table 1) includes statistical analysis to determine the 15th-percentile values for each section. Engineers often use the 15th percentile value – instead of an average or mean (the 50th percentile value) – as a structural "safety factor" to represent layer thickness for pavement design purposes, which is reported below.

- The thickness of intact pavement on the BP sections ranged from 2.7 to 6.5 inches.
- The thickness of deteriorated pavement and/or base material supporting the BP sections ranged from 3.6 to 6.4 inches.
- For one section (S06), where a soil boring was not successful, we chose what we observed to be the bottom of asphalt pavement materials. However, we judge (based on the condition of pavement cores along other sections of the road and later FWD analysis), that the surfacing thickness along this section includes deteriorated pavements that are weaker than intact pavements. Because of the similarity between materials and the lack of ground truth, the intact pavement could not be distinguished from the deteriorated pavements.

Assessing layer thicknesses is a matter of engineering judgement. The distinction between layers in the road is not always explicit. Factors influencing definition of radar scans include ambient electromagnetic interference, the presence of moisture, the presence of voids, and the similarity of material layer type between layers. More specific detail, including statistical analysis of GPR data describing average thickness and variability by section, is provided in Appendix C.

4.3 Pavement strength (falling weight deflectometer)

Deflection testing was performed on 3.5 centerline miles of the Project road on 8/8/2023, using a Dynatest 8002 falling weight deflectometer (FWD). FWD test locations are shown in Figure 1 (individual locations were performed at about 0.1 mile spacing). Collected FWD data – along with information about the pavement layer thicknesses (from Project boring logs and GPR analysis), materials (from Project boring logs), and ambient test conditions – are used to estimate the elastic stiffness of pavement layers using back-calculation analysis according to the American Association of State Highway and Transportation Officials (AASHTO). This analysis also accounts for allowable axle loads for a roadway (*AASHTO Guide for Design of Pavement Structures*, 1993).

Our back-calculation results were used to estimate the effective subgrade resilient modulus (MR), the AASHTO structural number (SN), and structural capacity of all Project road sections. As with GPR-based thickness analysis results, the results of back-calculation analysis of collected Project FWD data are summarized below (and in Table 1) using 15th-percentile values.

- The subgrade MR for all sections ranged from 4.1 to 5.0 ksi.
- The SN value for all sections ranged from 1.0 to 2.8 inches.
- The axle load capacity rating of all sections ranged from 4.4 to 10+ tons/axle.

More details of the FWD testing and analysis procedures, including field test data, are provided in Appendix D.

4.4 Road condition

High-resolution DVL data was collected on 8/8/2023 for 3.5 centerline miles of road in the Project. An AET pavement engineer used DVL data to rate the road in general accordance with ASTM D6433. This procedure results in a pavement condition index (PCI) that describes road condition on a scale of 0 to 100, where the index corresponds to qualitative descriptions of pavement condition: “Good” 70-100; “Fair” 55-69; “Poor” 40-54; “Very Poor” 25-39; “Serious” 10-24; and “Failed” 0-9.

- The BP sections had an average PCI rating of 79 (“Good”) except for three sections

(S01A, S03, and S04) with an average PCI rating of 28 (“Very Poor”).

- The predominant distresses encountered on BP sections with an average rating as “Good” were longitudinal/transverse cracking and weathering.
- The predominant distresses encountered on BP sections with an average rating as “Very Poor” were longitudinal/transverse cracking, edge cracking, alligator cracking, patching, and low to medium severity weathering.
- The paved road width varies from approximately 14 feet to 16 feet, with approximately 2-to-4-foot gravel shoulders, which may not accommodate two-way truck traffic. The edges of the pavement and gravel shouldering show edge cracking and deterioration. If two-way hauling is planned, it could lead to further distress and damage to the edge of pavement and gravel shouldering.

Table 1 indicates the condition rating for the evaluated sections. More detail on the surface condition rating by road section is provided in Appendix E.

4.5 Summary results of testing and road condition rating

As noted above, all road test and survey results, including summary analysis of test data, are reported in the attached Table 1 for 7 BP sections.

5.0 EVALUATION OF ROAD CONDITION

5.1 Summary evaluation

We evaluated the performance of the road as haul routes given our geotechnical exploration and engineering review of collected data, as summarized in Table 1. The items below and Appendix F provide essential information of risk management and proper use of this evaluation.

- Our evaluation of the load capacity is based on analytical procedures and calculations described in the AASHTO *Guide for Design of Pavement Structures* (1993). In addition, we rely on engineering judgement to evaluate the performance of the Project road and structural improvements to serve as functional haul routes for Project construction.
- Information regarding risk management and proper use of this evaluation is given in Appendix F, “Geotechnical Report Limitations and Guidelines for Use.”
- Should changes to the Project layout and use of the road be considered, please notify AET so that we can review the changes and determine if revisions to the evaluation report are necessary.

Based on engineering analysis of the collected survey and test data and the special items noted above, our evaluation has determined that a combination of surface and structural improvements will be required for some of the Project road sections to serve as functional haul routes for Project construction. The separate AET Report No. P-0025335B considers recommended road improvements for the project, where applicable.

5.2 Structural properties of road subgrade

The predominant subgrade type for the selected road is presumed to be lean to fat clays (A-6 or A-7) based on our review of SSURGO. Our FWD back-calculation analysis of the structural properties of the subgrade found that subgrade soils under the Project road had an average 15th-percentile MR value of 4.5 ksi. In our experience, subgrade MR values less than 4 ksi risk subgrade support issues during truck hauling. Therefore, our field evaluation and analysis found that the subgrade along the Project road is adequate.

5.3 Structural properties of road surface layers

We expect that the structural load bearing capacity of the road surfacing will vary with changes in subgrade support and surfacing thickness. Other variations may occur due to pavement conditions.

- The BP sections have a 15th-percentile SN of 1.6 inches, with minimum and maximum SN of 1.0 and 2.8 inches, respectively. A typical SN for low-volume roads ranges from 2 to 4 inches.
- The BP sections in the Project have a 15th-percentile axle load capacity of 5.3 tons per axle except for 2 sections with an axle load capacity of 9.0 and 10+ tons/axle. The axle load rating accounts for the structural capacity of both pavement and subgrade support.

5.4 Suitability of the road as a haul route

We judge that some of the selected road sections with thin surfacing, “Very Poor” or worse surface condition, low load bearing capacity, and narrow width will require improvements to serve as haul routes for Project construction. Our judgment considers (a) the condition and estimated structural capacity for the tested, evaluated road and (b) basic expectations of the levels of haul traffic associated with solar project construction. AET Report No. P-0025335B describes recommended structural improvements (where appropriate) to address predicted haul traffic from plans provided by WPS.

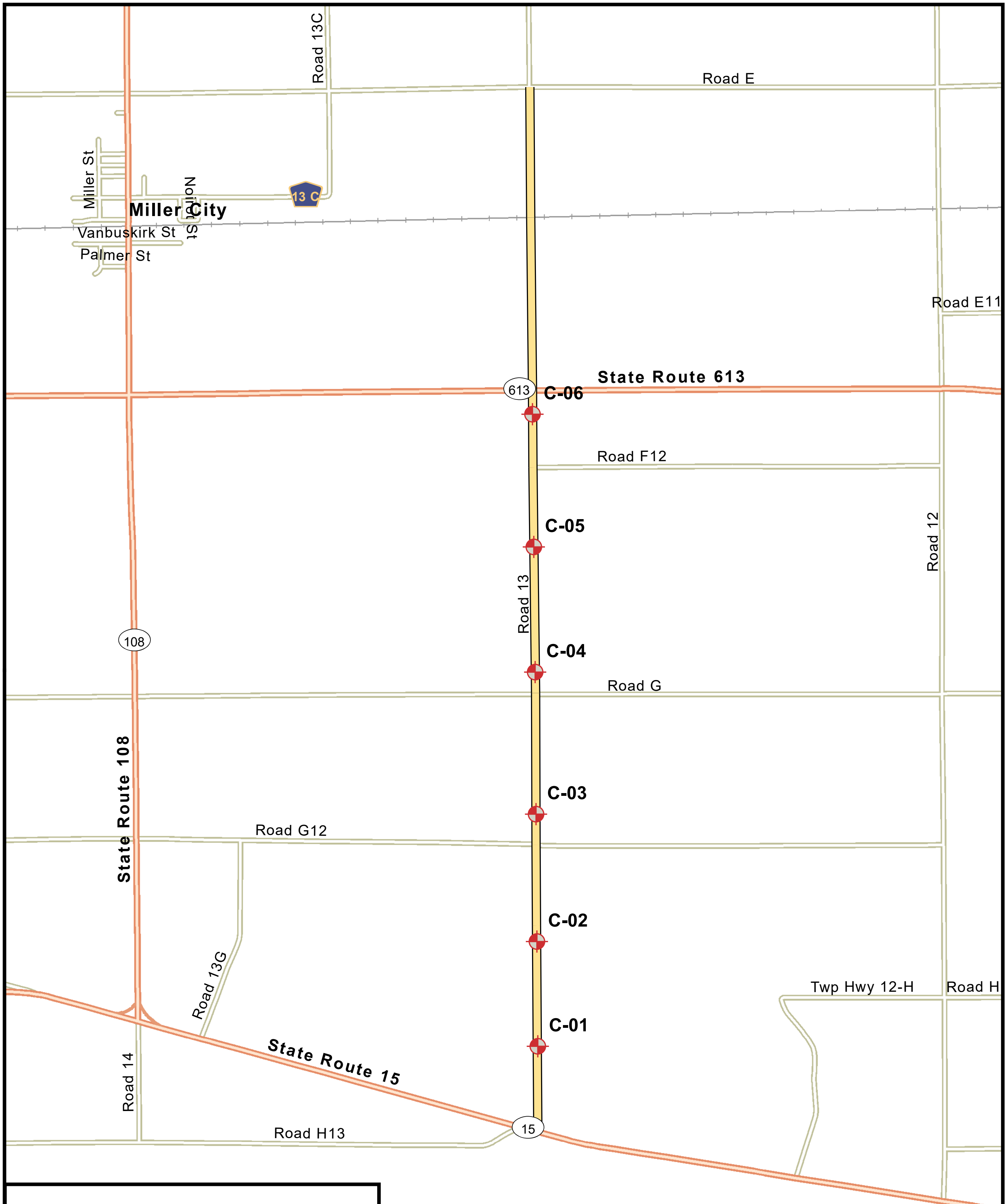
6.0 TEST STANDARDS

When we refer to a test standard (e.g., ASTM, AASHTO) in this report, we mean that our services were performed in general accordance with that standard. Compliance with any other standards referenced within the specified standard is neither inferred nor implied.

7.0 LIMITATIONS

Within the limitations of scope, budget, and schedule, we have endeavored to provide our services according to accepted geotechnical engineering practices at the present time and this location. Other than this, no warranty, express or implied, is intended. Essential information regarding risk management and proper use of this report is given in Appendix F, "Geotechnical Report Limitations and Guidelines for Use."

Figures and Tables



Legend

- Core/Bore
- FWD/DVL/GPR Testing

Map Reference: N

0 0.125 0.25 Miles

Figure 1
Testing Locations

Pre-Construction Road Evaluation

Powell Creek Solar Project
Putnam County, Ohio

Date: 09/07/2023 AET Project No. P-0025335

File: P-0025335A - 1.mxd Date: 09/07/2023

Figure 2
Surface Condition (PCI)

Pre-Construction Road Evaluation

Powell Creek Solar Project
Putnam County, Ohio

Date: 08/24/2023 AET Project No. P-0025335

File: P-0025335A - 2.mxd Date: 08/24/2023

File: P-0025335A - 3.mxd Date: 08/24/2023

Figure 4
Axle Load Capacity

Pre-Construction Road Evaluation

Powell Creek Solar Project
Putnam County, Ohio

Date: 08/24/2023 AET Project No. P-0025335

File: P-0025335A - 4.mxd Date: 08/24/2023

Section ID	Road	From	To	Length (mi)	Type	PCI	Surface Thickness (in)^	Base Thickness (in)^	Subgrade MR (ksi)^	Structural Number (in)^	Axle Load Capacity (ton/axle)^
S01A	CR 13	SH 15	0.26 Mi S of CR G-12	0.7	BP	26	2.7	5.1	5.0	1.1	6.5
S01B	CR 13	0.26 Mi S of CR G-12	CR G-12	0.3	BP	92	6.5	6.4	4.2	2.5	9.0
S02	CR 13	CR G-12	CR G	0.5	BP	93	6.4	5.8	4.6	2.8	10+
S03	CR 13	CR G	CR F-12	0.7	BP	22	3.7	4.5	4.5	1.1	4.5
S04	CR 13	CR F-12	SH 613	0.3	BP	37	4.7	3.6	4.1	1.0	5.4
S05	CR 13	CTH 613	RR X-ing	0.6	BP	66	3.3	4.8	5.0	1.1	5.7
S06	CR 13	RR X-ing	CTH E	0.4	BP	66	5.5	4.8	4.1	1.3	4.4

^15th Percentile Values

AMERICAN ENGINEERING TESTING

Table 1

Summary of evaluation results for the Project road

Pre-construction Road Evaluation

Powell Creek Solar Project

Putnam County, OH

Date: 8/23/2023 AET Project P-0025335

Appendix A

Geotechnical Field Exploration and Testing
Boring Log Notes
AASHTO Soil Classification System
Unified Soil Classification System
Pavement Core Photographs
Subsurface Boring Logs
Summary of Laboratory Results
AASHTO Gradation Curves

Appendix A
Geotechnical Field Exploration and Testing
AET Report No. P-0025335A

A.1 FIELD EXPLORATION

The subsurface conditions at the site were explored by drilling and sampling six (6) pavement cores and hand auger borings on the paved county roads. The locations of the borings appear on Figure 1, preceding the Subsurface Boring Logs in this appendix.

A.2 SAMPLING METHODS

A.2.1 Direct Push Samples (DP)

Sample types described as "DP" on the boring logs are continuous core samples collected by the direct push method. The method consists of a 2.125 inch OD outer casing with an inner 1.5-inch ID plastic tube driven continuously into the ground.

A.2.2 Hand Auger Sampling (HA)

Sample types described as "HA" on the boring logs are continuous core samples collected by the hand auger method, typically through a core hole or along the shoulder of the roadway. The method consists of a 3.25 inch OD hand auger tool that is manually twisted continuously into the ground to the desired depth or refusal.

A.2.3 Sampling Limitations

Unless observed in a sample, contacts between soil layers are estimated based on the spacing of samples and the action of drilling tools. Cobbles, boulders, and other large objects generally cannot be recovered from test borings, and they may be present in the ground even if they are not noted on the boring logs.

Determining the thickness of "topsoil" layers is usually limited, due to variations in topsoil definition, sample recovery, and other factors. Visual-manual description often relies on color for determination, and transitioning changes can account for significant variation in thickness judgment. Accordingly, the topsoil thickness presented on the logs should not be the sole basis for calculating topsoil stripping depths and volumes. If more accurate information is needed relating to thickness and topsoil quality definition, alternate methods of sample retrieval and testing should be employed.

A.3 CLASSIFICATION METHODS

Soil descriptions shown on the boring logs are based on the Unified Soil Classification (USC) system. The USC system is described in ASTM: D2487 and D2488. Where laboratory classification tests (sieve analysis or Atterberg Limits) have been performed, accurate classifications per ASTM: D2487 are possible. Otherwise, soil descriptions shown on the boring logs are visual-manual judgments. Charts are attached which provide information on the USC system, the descriptive terminology, and the symbols used on the boring logs.

Visual-manual judgment of the AASHTO Soil Group is also noted as a part of the soil description. A chart presenting details of the AASHTO Soil Classification System is also attached.

The boring logs include descriptions of apparent geology. The geologic depositional origin of each soil layer is interpreted primarily by observation of the soil samples, which can be limited. Observations of the surrounding topography, vegetation, and development can sometimes aid this judgment.

A.4 WATER LEVEL MEASUREMENTS

The ground water level measurements are shown at the bottom of the boring logs. The following information appears under "Water Level Measurements" on the logs:

- Date and Time of measurement
- Sampled Depth: lowest depth of soil sampling at the time of measurement
- Casing Depth: depth to bottom of casing or hollow-stem auger at time of measurement
- Cave-in Depth: depth at which measuring tape stops in the borehole
- Water Level: depth in the borehole where free water is encountered
- Drilling Fluid Level: same as Water Level, except that the liquid in the borehole is drilling fluid

The true location of the water table at the boring locations may be different than the water levels measured in the boreholes. This is possible because there are several factors that can affect the water level measurements in the borehole. Some of these factors include: permeability of each soil layer in profile, presence of perched water, amount of time between water level readings, presence of drilling fluid, weather conditions, and use of borehole casing.

A.5 LABORATORY TEST METHODS

A.5.1 Water Content Tests
Conducted per AET Procedure 01-LAB-010, which is performed in general accordance with ASTM: D2216 and AASHTO: T265.

A.5.2 Atterberg Limits Tests
Conducted per AET Procedure 01-LAB-030, which is performed in general accordance with ASTM: D4318 and AASHTO: T89, T90.

A.5.3 Sieve Analysis of Soils (thru #200 Sieves)
Conducted per AET Procedure 01-LAB-040, which is performed in general conformance with ASTM: D6913, Method A.

A.6 TEST STANDARD LIMITATIONS

Field and laboratory testing is done in general conformance with the described procedures. Compliance with any other standards referenced within the specified standard is neither inferred nor implied.

A.7 SAMPLE STORAGE

Unless notified to do otherwise, we routinely retain representative samples of the soils recovered from the borings for a period of 30 days.

BORING LOG NOTES

DRILLING AND SAMPLING SYMBOLS

Symbol	Definition
B,H,N:	Size of flush-joint casing
CA:	Crew Assistant (initials)
CAS:	Pipe casing, number indicates nominal diameter in inches
CC:	Crew Chief (initials)
COT:	Clean-out tube
DC:	Drive casing; number indicates diameter in inches
DM:	Drilling mud or bentonite slurry
DR:	Driller (initials)
DS:	Disturbed sample from auger flights
FA:	Flight auger; number indicates outside diameter in inches
HA:	Hand auger; number indicates outside diameter
HSA:	Hollow stem auger; number indicates inside diameter in inches
LG:	Field logger (initials)
MC:	Column used to describe moisture condition of samples and for the ground water level symbols
N (BPF):	Standard penetration resistance (N-value) in blows per foot (see notes)
NQ:	NQ wireline core barrel
PQ:	PQ wireline core barrel
RD:	Rotary drilling with fluid and roller or drag bit
REC:	In split-spoon (see notes) and thin-walled tube sampling, the recovered length (in inches) of sample. In rock coring, the length of core recovered (expressed as percent of the total core run). Zero indicates no sample recovered.
REV:	Revert drilling fluid
SS:	Standard split-spoon sampler (steel; 1⅜" is inside diameter; 2" outside diameter); unless indicated otherwise
SU	Spin-up sample from hollow stem auger
TW:	Thin-walled tube; number indicates inside diameter in inches
WASH:	Sample of material obtained by screening returning rotary drilling fluid or by which has collected inside the borehole after "falling" through drilling fluid
WH:	Sampler advanced by static weight of drill rod and 140-pound hammer
WR:	Sampler advanced by static weight of drill rod
94mm:	94 millimeter wireline core barrel
▼:	Water level directly measured in boring
▽:	Estimated water level based solely on sample appearance

TEST SYMBOLS

Symbol	Definition
CONS:	One-dimensional consolidation test
DEN:	Dry density, pcf
DST:	Direct shear test
E:	Pressuremeter Modulus, tsf
HYD:	Hydrometer analysis
LL:	Liquid Limit, %
LP:	Pressuremeter Limit Pressure, tsf
OC:	Organic Content, %
PERM:	Coefficient of permeability (K) test; F - Field; L - Laboratory
PL:	Plastic Limit, %
q_p:	Pocket Penetrometer strength, tsf (approximate)
q_c:	Static cone bearing pressure, tsf
q_u:	Unconfined compressive strength, psf
R:	Electrical Resistivity, ohm-cms
RQD:	Rock Quality Designation of Rock Core, in percent (aggregate length of core pieces 4" or more in length as a percent of total core run)
SA:	Sieve analysis
TRX:	Triaxial compression test
VSR:	Vane shear strength, remoulded (field), psf
VSU:	Vane shear strength, undisturbed (field), psf
WC:	Water content, as percent of dry weight
%-200:	Percent of material finer than #200 sieve

STANDARD PENETRATION TEST NOTES

The standard penetration test consists of driving the sampler with a 140 pound hammer and counting the number of blows applied in each of three 6" increments of penetration. If the sampler is driven less than 18" (usually in highly resistant material), permitted in ASTM:D1586, the blows for each complete 6" increment and for each partial increment is on the boring log. For partial increments, the number of blows is shown to the nearest 0.1' below the slash.

The length of sample recovered, as shown on the "REC" column, may be greater than the distance indicated in the N column. The disparity is because the N-value is recorded below the initial 6" set (unless partial penetration defined in ASTM:D1586 is encountered) whereas the length of sample recovered is for the entire sampler drive (which may even extend more than 18").

AASHTO SOIL CLASSIFICATION SYSTEM

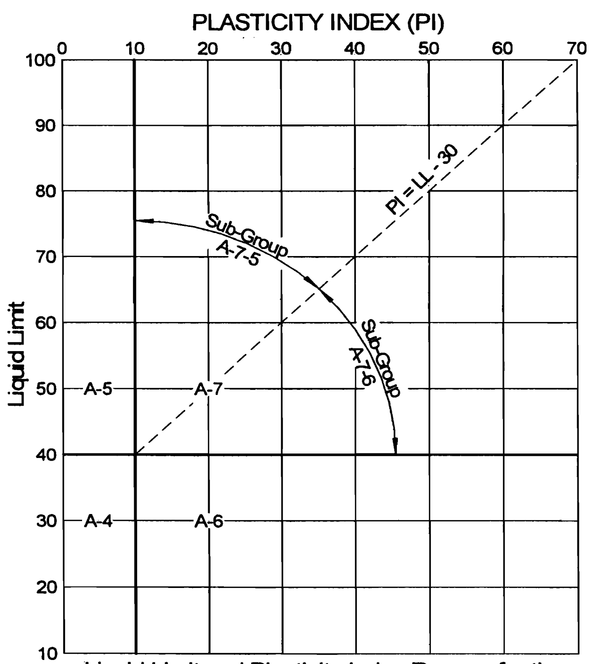
AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS

Classification of Soils and Soil-Aggregate Mixtures

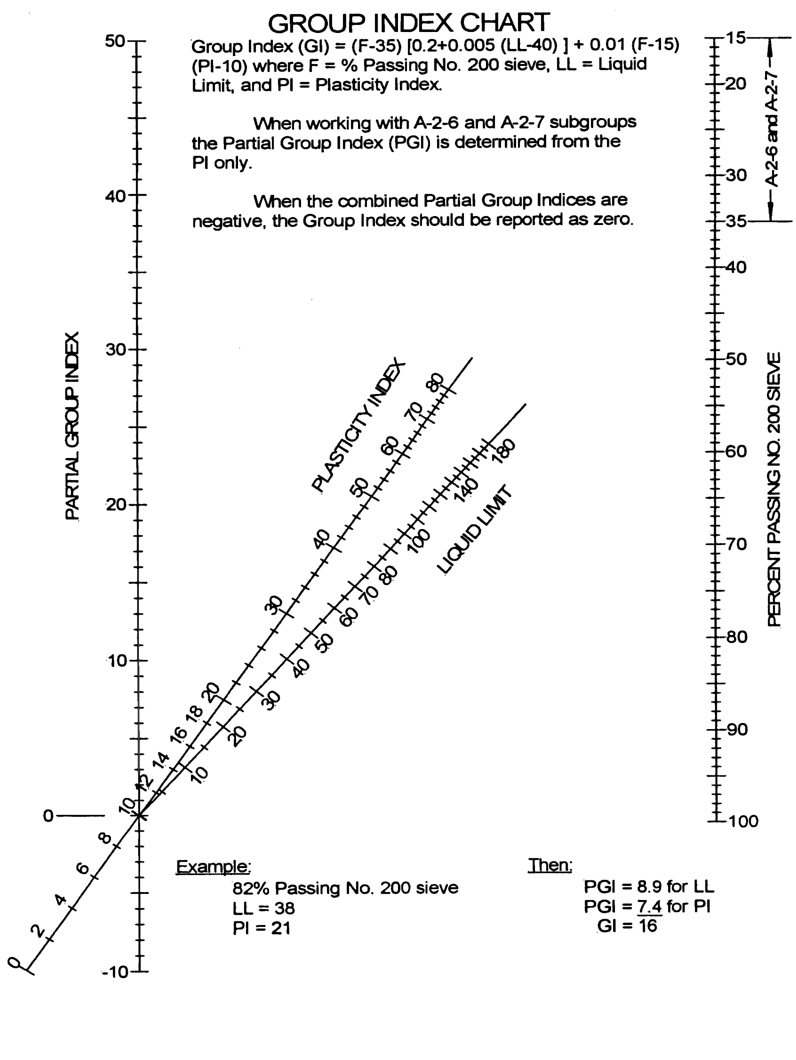
General Classification	Granular Materials (35% or less passing No. 200 sieve)							Silt-Clay Materials (More than 35% passing No. 200 sieve)			
Group Classification	A-1			A-2							A-7
	A-1-a	A-1-b	A-3	A-2-4	A-2-5	A-2-6	A-2-7	A-4	A-5	A-6	A-7-5 A-7-6
Sieve Analysis, Percent passing:											
No. 10 (2.00 mm)	50 max.	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
No. 40 (0.425 mm)	30 max.	50 max.	51 min.	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
No. 200 (0.075 mm)	15 max.	25 max.	10 max.	35 max.	35 max.	35 max.	35 max.	36 min.	36 min.	36 min.	36 min.
Characteristics of Fraction Passing No. 40 (0.425 mm)											
Liquid limit	. . . .		. . . .	40 max.	41 min.	40 max.	41 min.	40 max.	41 min.	40 max.	41 min.
Plasticity index	6 max.		N.P.	10 max.	10 max.	11 min.	11 min.	10 max.	10 max.	11 min.	11 min.
Usual Types of Significant Constituent Materials	Stone Fragments, Gravel and Sand		Fine Sand	Silty or Clayey Gravel and Sand				Silty Soils		Clayey Soils	
General Ratings as Subgrade	Excellent to Good							Fair to Poor			

The placing of A-3 before A-2 is necessary in the "left to right elimination process" and does not indicate superiority of A-3 over A-2.

Plasticity index of A-7-5 subgroup is equal to or less than LL minus 30. Plasticity index of A-7-6 subgroup is greater than LL minus 30.



Liquid Limit and Plasticity Index Ranges for the A-4, A-5, A-6 and A-7 Subgroups



Definitions of Gravel, Sand and Silt-Clay

The terms "gravel", "coarse sand", "fine sand" and "silt-clay", as determinable from the minimum test data required in this classification arrangement and as used in subsequent word descriptions are defined as follows:

GRAVEL - Material passing sieve with 3-in. square openings and retained on the No. 10 sieve.

COARSE SAND - Material passing the No. 10 sieve and retained on the No. 40 sieve.

FINE SAND - Material passing the No. 40 sieve and retained on the No. 200 sieve.

COMBINED SILT AND CLAY - Material passing the No. 200 sieve

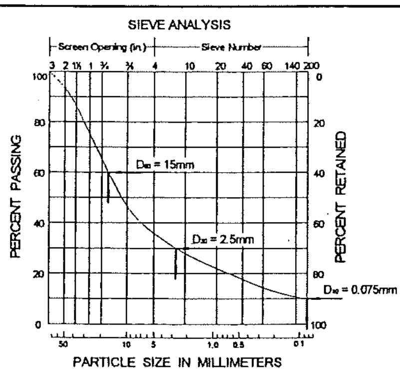
BOULDERS (retained on 3-in. sieve) should be excluded from the portion of the sample to which the classificaiton is applied, but the percentage of such material, if any, in the sample should be recorded.

The term "silty" is applied to fine material having plasticity index of 10 or less and the term "clayey" is applied to fine material having plasticity index of 11 or greater.

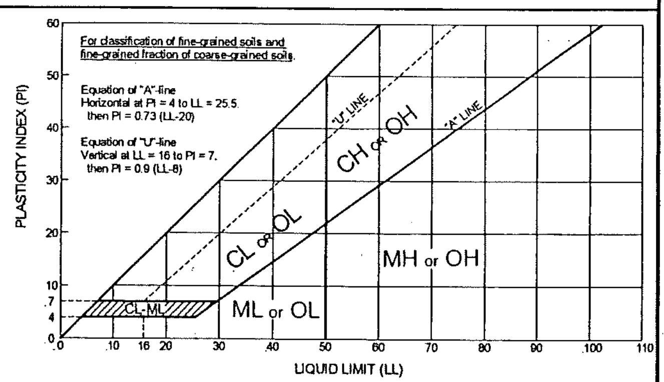
UNIFIED SOIL CLASSIFICATION SYSTEM
ASTM Designations: D 2487, D2488

AMERICAN ENGINEERING TESTING, INC.

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests[A]				Soil Classification: Group Symbol	Soil Classification: Group Name[B]
Coarse-Grained Soils More than 50% retained on No. 200 sieve	Gravels More than 50% coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines[C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$[E]	GW	Well graded gravel[F]
			$Cu<4$ and/or $1>Cc>3$[E]	GP	Poorly graded gravel[F]
		Gravels with Fines more than 12% fines[C]	Fines classify as ML or MH	GM	Silty gravel[F,G,H]
			Fines classify as CL or CH	GC	Clayey gravel[F,G,H]
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines[D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$[E]	SW	Well-graded sand[I]
			$Cu<6$ and/or $1>Cc>3$[E]	SP	Poorly-graded sand[I]
		Sands with Fines more than 12% fines[D]	Fines classify as ML or MH	SM	Silty sand[G,H,I]
			Fines classify as CL or CH	SC	Clayey sand[G,H,I]
Fine-Grained Soils 50% or more passes the No. 200 sieve (see Plasticity Chart below)	Silts and Clays Liquid limit less than 50	inorganic	PI>7 and plots on or above "A" line[J]	CL	Lean clay[K,L,M]
			PI<4 or plots below "A" line[J]	ML	Silt[K,L,M]
		organic	Liquid limit–oven dried / Liquid limit – not dried <0.75	OL	Organic clay[K,L,M,N] Organic silt[K,L,M,O]
	Silts and Clays Liquid limit 50 or more	inorganic	PI plots on or above "A" line	CH	Fat clay[K,L,M]
			PI plots below "A" line	MH	Elastic silt[K,L,M]
		organic	Liquid limit–oven dried / Liquid limit – not dried <0.75	OH	Organic clay[K,L,M,P] Organic silt[K,L,M,Q]
Highly organic soil			Primarily organic matter, dark in color, and organic in odor	PT	Peat[R]



$C_u = \frac{D_{60}}{D_{10}} = \frac{15}{0.075} = 200$ $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}} = \frac{2.5^2}{0.075 \times 15} = 5.6$



Plasticity Chart

Notes

[A]Based on the material passing the 3-in (75-mm) sieve.
[B]If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.
[C]Gravels with 5 to 12% fines require dual symbols:
- GW-GM well-graded gravel with silt
- GW-GC well-graded gravel with clay
- GP-GM poorly graded gravel with silt
- GP-GC poorly graded gravel with clay

[D]Sands with 5 to 12% fines require dual symbols:
- SW-SM well-graded sand with silt
- SW-SC well-graded sand with clay
- SP-SM poorly graded sand with silt
- SP-SC poorly graded sand with clay

[E]$Cu = D_{60}/D_{10}$, $Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$

[F]If soil contains ≥15% sand, add "with sand" to group name.
[G]If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.
[H]If fines are organic, add "with organic fines" to group name.
[I]If soil contains ≥15% gravel, add "with gravel" to group name.
[J]If Atterberg limits plot is hatched area, soils is a CL-ML silty clay.
[K]If soil contains 15 to 29% plus No. 200 add "with sand" or "with gravel", whichever is predominant.
[L]If soil contains ≥30% plus No. 200, predominantly sand, add "sandy" to group name.
[M]If soil contains ≥30% plus No. 200, predominantly gravel, add "gravelly" to group name.
[N]PI≥4 and plots on or above "A" line.
[O]PI<4 or plots below "A" line.
[P]PI plots on or above "A" line.
[Q]PI plots below "A" line.
[R]Fiber Content description shown below.

ADDITIONAL TERMINOLOGY NOTES USED BY AET FOR SOIL IDENTIFICATION AND DESCRIPTION

Grain Size

Term	Particle Size
Boulders	Over 12"
Cobbles	3" to 12"
Gravel	#4 sieve to 3"
Sand	#200 to #4 sieve
Fines (silt & clay)	Pass #200 sieve

Gravel Percentages

Term	Percent
A Little Gravel	3% - 14%
With Gravel	15% - 29%
Gravelly	30% - 50%

Consistency of Plastic Soils

Term	N-Value, BPF
Very Soft	less than 2
Soft	2 - 4
Firm	5 - 8
Stiff	9 - 15
Very Stiff	16 - 30
Hard	Greater than 30

Relative Density of Non-Plastic Soils

Term	N-Value, BPF
Very Loose	0 - 4
Loose	5 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	Greater than 50

Moisture/Frost Condition (MC Column)

- D (Dry): Absense of moisture, dusty, dry to touch.
- M (Moist): Damp, although free water not visible. Soil may still have a high water content (over "optimum").
- W (Wet/ Waterbearing): Free water visible intended to describe non-plastic soils. Waterbearing usually relates to sands and sand with silt.
- F (Frozen): Soil frozen

Layering Notes

- Laminations: Layers less than ½" thick of differing material or color.
- Lenses: Pockets or layers greater than ½" thick of differing material or color.

Peat Description

Term	Fiber Content (Visual Estimate)
Fibric Peat:	Greater than 67%
Hemic Peat:	33 – 67%
Sapric Peat:	Less than 33%

Organic Description (if no lab tests)

Soils are described as *organic*, if soil is not peat and is judged to have sufficient organic fines content to influence the Liquid Limit properties. *Slightly organic* used for borderline cases.

Root Inclusions

- With roots: Judged to have sufficient quantity of roots to influence the soil properties.
- Trace roots: Small roots present, but not judged to be in sufficient quantity to significantly affect soil properties.

SUBSURFACE BORING LOG

AMERICAN ENGINEERING TESTING

AET JOB NO: P-0025335 LOG OF BORING NO. C-01 (p. 1 of 1)

PROJECT: Powell Creek Solar Project; Putnam County, OH

SURFACE ELEVATION: ________ LATITUDE: 41.062196 LONGITUDE: -84.11167

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
	2.5" Bituminous pavement	FILL			CORE						
	9.5" FILL, mostly silty gravel with sand, gray (A-1-a)				HA		8				12
1	**END OF BORING**										

(FIELD & LABORATORY TESTS: WC, DEN, LL, PL, %-#200)

DEPTH:	DRILLING METHOD	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-1'	**Hand Auger**							

WATER LEVEL MEASUREMENTS

BORING COMPLETED: 8/8/2023

DR: **RS** LG: **NH** Rig: **584**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET_CORP W-LAT-LONG P-0025335.GPJ AET+CPT+WELL.GDT 8/23/23

SUBSURFACE BORING LOG

AET JOB NO: **P-0025335** LOG OF BORING NO. **C-02 (p. 1 of 1)**

PROJECT: **Powell Creek Solar Project; Putnam County, OH**

SURFACE ELEVATION: ________ LATITUDE: **41.067224** LONGITUDE: **-84.11170**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	%-#200
	6.5" Bituminous pavement	FILL			CORE						
1	5.5" FILL, mostly gravelly silty sand, gray (A-1-b)				HA		6				22
	END OF BORING										

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-1'	**Hand Auger**							
BORING COMPLETED:	8/8/2023							
DR: **RS** LG: **NH**	Rig: **584**							

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET_CORP W-LAT-LONG P-0025335.GPJ AET+CPT+WELL.GDT 8/23/23

SUBSURFACE BORING LOG

AET JOB NO: **P-0025335** LOG OF BORING NO. **C-03 (p. 1 of 1)**

PROJECT: **Powell Creek Solar Project; Putnam County, OH**

SURFACE ELEVATION: ________ LATITUDE: **41.073344** LONGITUDE: **-84.11175**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
	7.5" Bituminous pavement	FILL			CORE						
	4.5" FILL, mostly gravelly silty sand, gray (A-1-b)				HA						
1	**END OF BORING**										

FIELD & LABORATORY TESTS: WC, DEN, LL, PL, %-#200

DEPTH:	DRILLING METHOD	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-1'	**Hand Auger**							
BORING COMPLETED: 8/8/2023								
DR: **RS** LG: **NH** Rig: **584**								

WATER LEVEL MEASUREMENTS

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET_CORP W-LAT-LONG P-0025335.GPJ AET+CPT+WELL.GDT 8/23/23

AMERICAN ENGINEERING TESTING

SUBSURFACE BORING LOG

AET JOB NO: **P-0025335** LOG OF BORING NO. **C-04 (p. 1 of 1)**

PROJECT: **Powell Creek Solar Project; Putnam County, OH**

SURFACE ELEVATION: ________ LATITUDE: **41.080174** LONGITUDE: **-84.11180**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
	7" Bituminous pavement	FILL			CORE						
1	5" FILL, mostly gravelly silty sand, trace roots, pieces of bituminous, brown (A-2-4)				HA		5				27
	END OF BORING										

DEPTH:	DRILLING METHOD	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-1'	**Hand Auger**							
BORING COMPLETED: 8/8/2023								
DR: **RS** LG: **NH** Rig: **584**								

WATER LEVEL MEASUREMENTS

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET_CORP W-LAT-LONG P-0025335.GPJ AET+CPT+WELL.GDT 8/23/23

SUBSURFACE BORING LOG

AMERICAN ENGINEERING TESTING

AET JOB NO: **P-0025335** LOG OF BORING NO. **C-05 (p. 1 of 1)**

PROJECT: **Powell Creek Solar Project; Putnam County, OH**

SURFACE ELEVATION: ________ LATITUDE: **41.086182** LONGITUDE: **-84.11187**

DEPTH IN FEET	MATERIAL DESCRIPTION		GEOLOGY	N	MC	SAMPLE TYPE		REC IN.	FIELD & LABORATORY TESTS				
									WC	DEN	LL	PL	%-#200
	6" Bituminous pavement		FILL				CORE						
	6" FILL, mostly gravelly silty sand, gray (A-1-b)						HA						
1	**END OF BORING**												

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-1'	**Hand Auger**								
BORING COMPLETED: 8/8/2023									
DR: **RS** LG: **NH** Rig: **584**									

SUBSURFACE BORING LOG

AMERICAN ENGINEERING TESTING

AET JOB NO: **P-0025335** LOG OF BORING NO. **C-06 (p. 1 of 1)**

PROJECT: **Powell Creek Solar Project; Putnam County, OH**

SURFACE ELEVATION: ________ LATITUDE: **41.092547** LONGITUDE: **-84.11193**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
	6.5" Bituminous pavement	FILL			CORE						
1	5.5" FILL, mixture of clayey gravel and silty gravel, possible cobbles, gray to brown (A-1-b)				HA						
	END OF BORING										

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS						
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-1'	**Hand Auger**							

BORING COMPLETED: 8/8/2023

DR: **RS** LG: **NH** Rig: **584**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET_CORP W-LAT-LONG P-0025335.GPJ AET+CPT+WELL.GDT 8/23/23

Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	Class-ification	Water Content (%)	Dry Density (pcf)	Satur-ation (%)	Void Ratio
C-01	0.2				25	12	A-1-a	7.6			
C-02	0.5				25	22	A-1-b	6.2			
C-04	0.6				25	27	A-2-4	5.2			

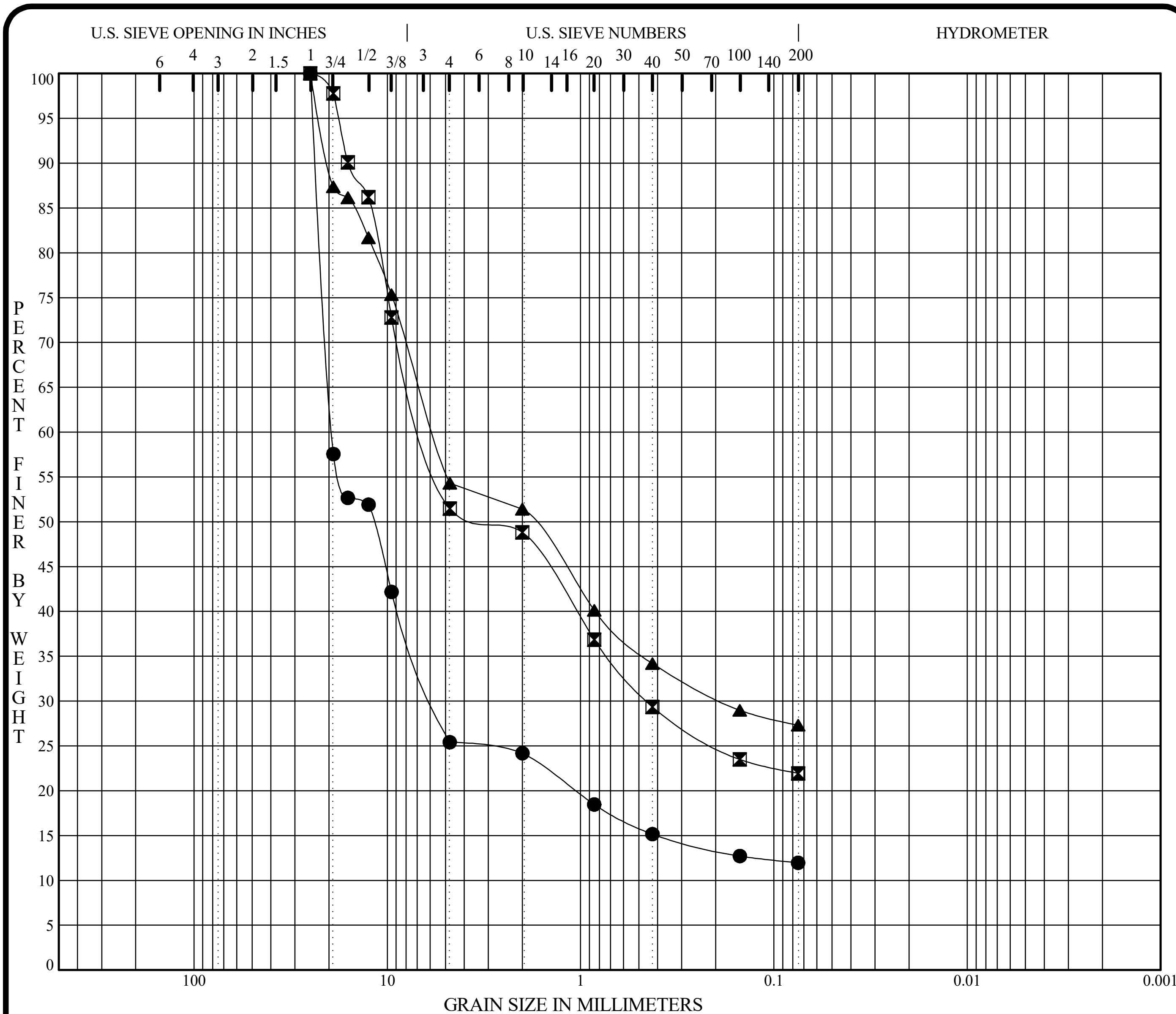
AMERICAN ENGINEERING TESTING

Summary of Laboratory Results

Project: Powell Creek Solar Project

Location: Putnam County, OH

Number: P-0025335



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	MC%	LL	PL	PI	Cc	Cu
●	**C-01**	**0.2**	**A-1-a**	**8**				**140.13**	**1583.5**
⧗	**C-02**	**0.5**	**A-1-b**	**6**					
▲	**C-04**	**0.6**	**A-2-4**	**5**					

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**C-01**	**0.2**	**25.00**	**19.30**	**5.742**		**75.8**	**12.2**	**12.0**	
⧗	**C-02**	**0.5**	**25.00**	**6.27**	**0.451**		**51.2**	**26.9**	**21.9**	
▲	**C-04**	**0.6**	**25.00**	**5.73**	**0.184**		**48.6**	**24.1**	**27.3**	

PROJECT **Powell Creek Solar Project; Putnam County, OH**

AET JOB NO. **P-0025335**

DATE

AMERICAN ENGINEERING TESTING

AET
550 Cleveland Avenue North
St. Paul, MN 55114
Telephone: (651) 659-9001
Fax: (651) 659-1347

AASHTO GRADATION CURVES

Appendix B

Pavement Coring Results Summary
Pavement Core Photographs

Core Field #	Core Location (Roadway)	Location*	Lane*	Core thickness (in)	DH measurment (in)	Remarks
C-01	CH 13	RWP	NB	2.25	2.50	41.062196, -84.111672 - bituminous pavement, low severity stripping below 1"
C-02	CH 13	RWP	NB	6.50	6.50	40.852926, -84.496851 - bituminous pavement, low severity stripping below 3.5"
C-03	CH 13	RWP	NB	7.50	7.50	41.073343, -84.111747 - bituminous pavement, low severity stripping below 2"
C-04	CH 13	RWP	NB	6.00	7.00	41.080173, -84.111801 - bituminous pavement, high severity stripping between 3 and 4.25", deteriorated pavement between 6" and 7"
C-05	CH 13	RWP	NB	4.00	6.00	41.086181, -84.111869 - bituminous pavement, medium to high severity stripping throughout, deteriorated pavement between 4" and 6"
C-06	CH 13	RWP	NB	6.25	6.50	41.092547, -84.111926 - bituminous pavement, low severity stripping below 4.5"

** - NB - Northbound; RWP - Right wheel path*

AMERICAN ENGINEERING TESTING

Summary of Pavement Cores

Cores C-01-06

Pre-construction Road Evaluation

Powell Creek Solar Project

Putnam County, OH

Date: 8/24/2023 AET Project P-0025335

C-01

C-02

C-03

AMERICAN ENGINEERING TESTING	**Pavement Core Photographs** Cores C-01-03
	Pre-construction Road Evaluation
	Powell Creek Solar Project Putnam County, OH
	Date: 8/24/2023 AET Project P-0025335

C-04

C-05

C-06

AMERICAN ENGINEERING TESTING	**Pavement Core Photographs** Cores C-04 - 06
	Pre-construction Road Evaluation
	Powell Creek Solar Project Putnam County, OH
	Date: 8/24/2023 AET Project P-0025335

Appendix C

Ground Penetrating Radar Field Exploration and Testing
GPR Results Plot

Appendix C
Ground Penetrating Radar Field Exploration and Testing
AET Project No. P-0025335A

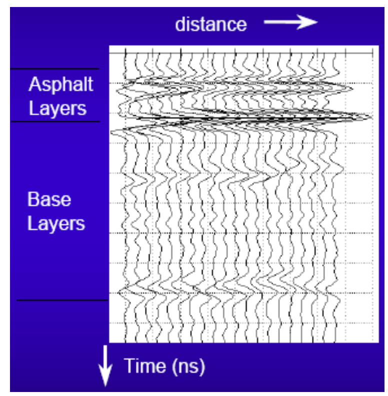
C.1 FIELD EXPLORATION

The pavement structural conditions at the site were evaluated nondestructively using Ground Penetrating Radar (GPR). The description of the equipment precedes the GPR Data and Analysis Results in this appendix.

C.2 EQUIPMENT DESCRIPTION

C.2.1 GSSI GPR Test System

The GPR test system owned by AET is a bumper-mounted, 2 GHz air-coupled antenna; dual-channel controller/data acquisition system; wheel-mounted DMI (Distance Measuring Instrument); and laptop with the GSSI controller software. AET uses GPR systems for testing and analysis that meets the ASTM D4748-10 Determining the Thickness of Bound Pavement Layers Using Short-Pulse Radar and D6087 Evaluating Asphalt-Covered Concrete Bridge Decks Using Ground Penetrating Radar test standards. Figure A1 provides an example of a vehicle outfitted with the air-coupled antenna and the raw GPR data prior to processing.



(a) **(b)**

Figure B1. (a) GSSI 2 GHz Air-coupled GPR Test System mounted to the rear of an AET survey vehicle and (b) example of raw data collected using the GPR test system

The GPR antenna emits a high-frequency electromagnetic wave into the material under investigation. The reflected energy caused by changes in the electromagnetic properties within the material is detected by a receiver antenna and recorded for subsequent analysis. The 2 GHz air-coupled GPR can collect radar waveforms at more than 100 signals per second, which allows for data to be collected at driving speeds along the longitudinal dimension of a road with the antennas fixed at the rear or in front of the vehicle.

AET prefers the 2 GHz antenna for road surveys as it combines excellent resolution with reasonable depth penetration (18-24 inches in pavement materials). As data collection is performed at normal driving speeds (45-55 mph), no lane closures are required. At this speed the 2 GHz antenna can collect data at 6-inch interval (2 scans/foot), however data collection varies by project. Specific data collection rates (in scans per foot) will be described in project reports. Vertical scans consist of 512 samples and the recorded length in time of each scan is 12 nanoseconds. Data acquisition uses 300 MHz high pass and 5,000 MHz low pass filters.

In a GPR test, the antenna is moved continuously across the test surface and the control unit collects data at a specified distance increment. In this way, the data collection rate is independent of the scan rate. Alternatively, scanning can be performed at a constant rate of time, regardless of the scan distance. Single point scans can be performed as well. Data is reviewed in the controller software in real-time during field testing to identify reflections and ensure proper data collection parameters.

B.2.2 System Calibrations

Prior to each use, the GPR test system is calibrated using metal plate and air calibration methods suggested by the GPR manufacturer. In addition, the DMI is calibrated to within +/- 1 foot/mile.

- Metal plate calibration is obtained with the antenna placed over a metal plate at the same elevation as a scan obtained over pavement. Time-based collection (as opposed to distance) is performed to provide the velocity of the radar energy in terms of reflection strengths (amplitudes) from a pavement layer interface relative to a perfect reflector (a metal plate).

- Air calibrations are also performed in time-based collection mode to account for the vertical travel of the antenna during vehicle-mounted testing. To approximate the range of travel encountered during testing, data is collected for fifteen seconds while an operator moves the vehicle vertically (by jumping up and down on the mounting point at the bumper) to record data. This information is used in later GPR analysis.
- The DMI is calibrated by laying out a long distance (typically 100 feet) with a tape measure, marking the termini, and traversing the known distance. Recorded distance in the controller software is confirmed against actual distance, and adjustments in the controller software are made to ensure that DMI information that is paired with GPR data is accurate.

C.2.3 Linear Distance and Spatial Reference System

The distance measuring instrument (DMI) is a trailer mounted two phase encoder system. When DMI is connected to the GPR controller it provides for automatic display and recording distance information in both English and metric units within a 1-foot (0.3 meters) resolution when calibrated using provided procedure in the controller software.

The spatial reference system is provided using either Trimble or EOS Arrow Global Positioning System (GPS) systems that consist of a fully integrated receiver, antenna, and battery unit to provide subfoot (30 cm) post processed accuracy. All GPS information is coupled with raw GPR data within the GPR controller software.

C.2.4 Camera Monitoring System

A truck-mounted, battery-operated independent 4K waterproof multi-functional digital camera with an SD card is used to capture digital video of the pavement surface during GPR data collection.

C.3 SAMPLING METHODS

Sampling methods using the GPR test system comply with the test standard (ASTM D4748-10). Sampling rates (i.e. scans per foot), sampling location (e.g. right wheel path, middle lane, both wheel paths), and the use of alternative equipment for GPR collection, if applicable (e.g. ground-coupled antennas), are described in the body of the project report.

C.4 QUALITY CONTROL (QC) AND QUALITY ASSURANCE (QA)

Beside the daily metal plate calibration, the DMI is also calibrated at regular intervals by driving the vehicle over a known distance to calculate the distance scale factor. The GPR will be monitored in real time in the data collection vehicle to minimize data errors. The GPR units will be identified with a unique number and that number will accompany all data reported from that unit as required in the QC/QA plan.

Scheduled preventive maintenance ensures proper equipment operation and helps identify potential problems that can be corrected to avoid poor quality or missing data that results if the equipment malfunctions while on site. The routine and major maintenance procedures established by the Federal Highway Administration's Long-Term Pavement Performance research program are adopted and any maintenance has been done at the end of the day after the testing is complete and become part of the routine performed at the end of each test/travel day and on days when no other work is scheduled.

As noted in the applicable test standard (ASTM D4748-10), quality assurance of GPR data is compromised when suboptimal test conditions exist. Such conditions may include wet surfaces (including standing water), ambient electromagnetic interference, or pavement distresses that can significantly scatter the GPR signal.

C.5 DATA ANALYSIS METHODS

C.5.1 Data Editing

Field acquisition is seldom so routine that no errors, omissions, or data redundancy occur. Data editing encompasses issues such as data re-organization, data file merging, data header or background information updates, repositioning, and inclusion of elevation information with the data.

C.5.2 Basic Processing

Basic data processing addresses some of the fundamental manipulations applied to data to make a more acceptable product for initial interpretation and data evaluation. In most instances this type of processing is already applied in real-time to generate the real-time display. The advantage of post survey processing is that the basic processing can be done more systematically and non-causal operators to remove or enhance certain features can be applied.

The Reflection Picking procedure is used to eliminate unwanted noise, detects significant reflections, and records the corresponding time and depth. It uses antenna calibration file data to calculate the radar signal velocity within the pavement.

C.5.3 Advanced Processing

Advanced data processing addresses the types of processing which require a certain amount of operator bias to be applied and which will result in data which are significantly different from the raw information which were input to the processing. This stage of analysis relies on supplementary resources (e.g. boring/coring logs, design plans, as-built records, historical records, conversations with road engineers/supervisors).

C.5.4 Data Interpretation

In some cases, automated layer interpretation modules within the analysis software can be used from preliminary analysis to map structural layers and calculate the corresponding velocities and depths. When used, the results from these modules require engineering review and approval.

C.6 TEST LIMITATIONS

C.6.1 Test Methods

The testing we performed identified pavement conditions only at those points where we measured pavement thicknesses and observed pavement surface conditions. Depending on the sampling methods and sampling frequency, every location may not be tested. Test conditions may limit the quality of the data collected, and some anomalies may be present in the pavement that compromise data and/or data collection at a given location.

Furthermore, because analysis procedures involve matters of engineering judgement, the final analysis developed represents our professional opinions about the subsurface conditions. More specifically, as relates to pavement systems, assessing layer thicknesses using GPR is a matter of engineering judgement. To enrich the analysis, we rely on supporting test methods and project information. However, even with supporting information, the distinction between layers in the road is not always explicit. Factors influencing definition of radar scans include ambient electromagnetic interference, the presence of moisture, the presence of voids, and the similarity of material layer type between layers.

Other factors external to related to methods and analysis data may require that we alter our conclusions and recommendations accordingly.

C.6.2 Test Standards

Pavement testing is performed in general conformance with the described procedures. Compliance with any other standards referenced within the specified standard is neither inferred nor implied.

C.7 SUPPORTING TEST METHODS

C.7.1 Soil Boring/Coring Field Exploration

If both pavement thicknesses and subgrade soil types and conditions are desired, pavement cores and soil borings are obtained. The limited number of cores and borings are necessary to verify the GPR layer thickness data.

C.7.2 Pavement Surface Condition

Certain pavement distresses may affect the electromagnetic signal to an extent that complicates the analysis of GPR data. The results of a pavement condition survey are useful to identify near-surface features (e.g. stripped asphalt) or sub-surface features (e.g. local saturated layers due to ingress of water at the surface) when reviewing GPR data.

When we do not perform a standard pavement condition survey alongside GPR data, we rely on GPR operators to note possible distresses as they traverse the pavement from about 1 ft (0.3 m) in front of vehicle to about 30 ft (9 m) ahead. These test notes are consulted during GPR analysis, however they are not a substitute for a conventional rigorous pavement condition survey.

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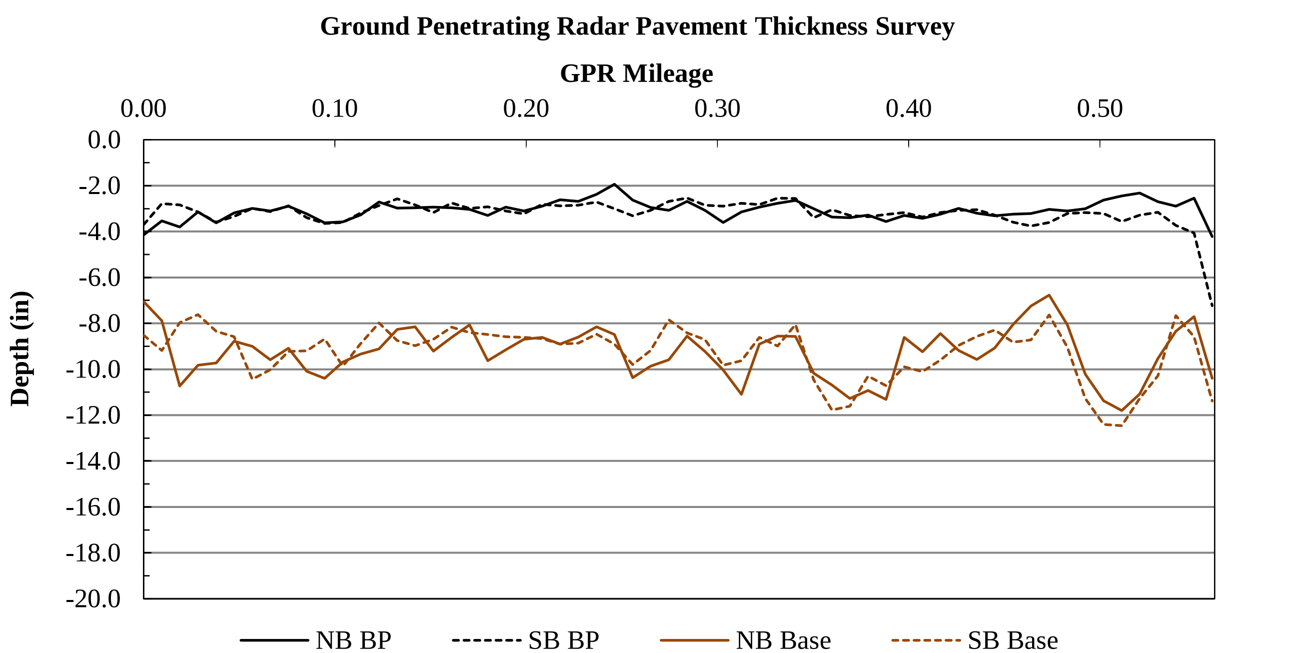
GENERAL INFORMATION: GROUND PENETRATING RADAR

Project:	Powell Creek Solar Project	**Date:**	8/22/23
AET Job No.:	P-0025335	**Test Date:**	8/8/23
Road:	CR 13	**Section/Grid:**	S01A
From:	SH 15	**To:**	0.26 Mi S of CR G-12

SUMMARY STATISTICS

Units: **inches**

Layer	NB				SB			
	Average	CV	15th	Min.	Average	CV	15th	Min.
BP	3.1	13%	2.7	1.9	3.2	20%	2.8	2.5
Base	6.2	19%	5.2	2.9	6.1	19%	5.0	3.9



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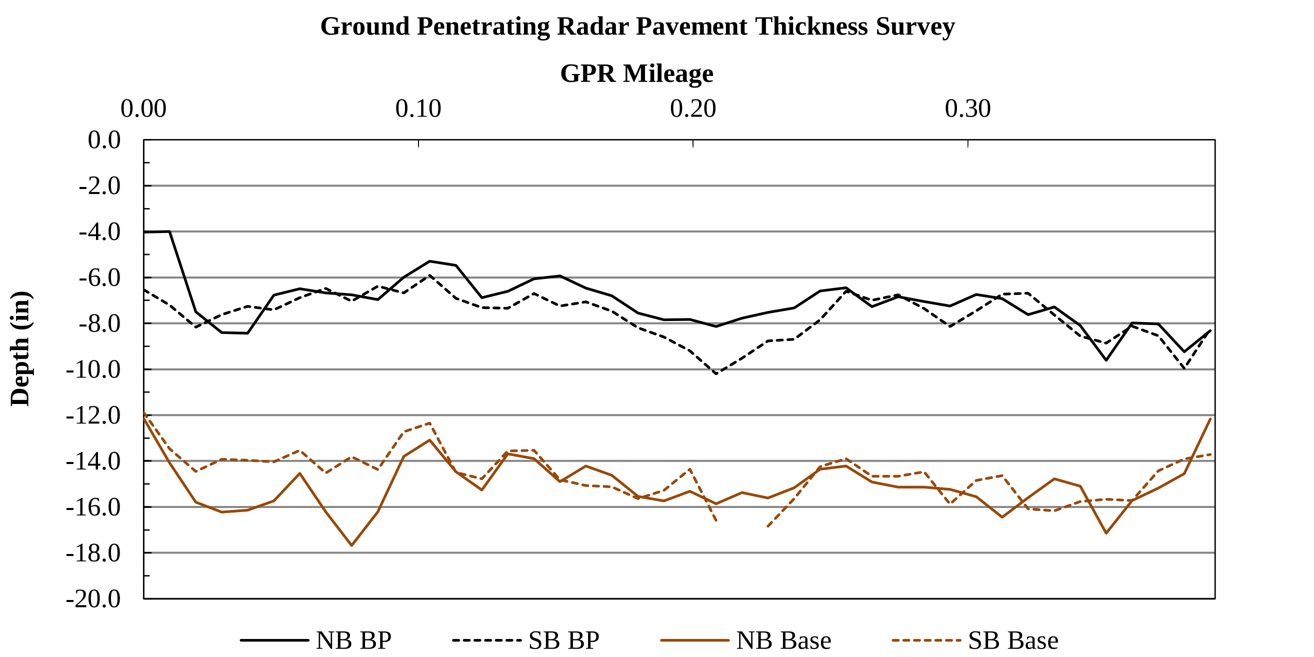
GENERAL INFORMATION: GROUND PENETRATING RADAR

Project: Powell Creek Solar Project
Date: 8/22/23
AET Job No.: P-0025335
Test Date: 8/8/23
Road: CR 13
Section/Grid: S01B
From: 0.26 Mi S of CR G-12
To: CR G-12

SUMMARY STATISTICS

Units: inches

Layer	NB				SB			
	Average	CV	15th	Min.	Average	CV	15th	Min.
BP	7.1	16%	6.1	4.0	7.6	13%	6.7	5.9
Base	8.0	14%	7.5	3.8	7.0	14%	6.2	4.0



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GENERAL INFORMATION: GROUND PENETRATING RADAR

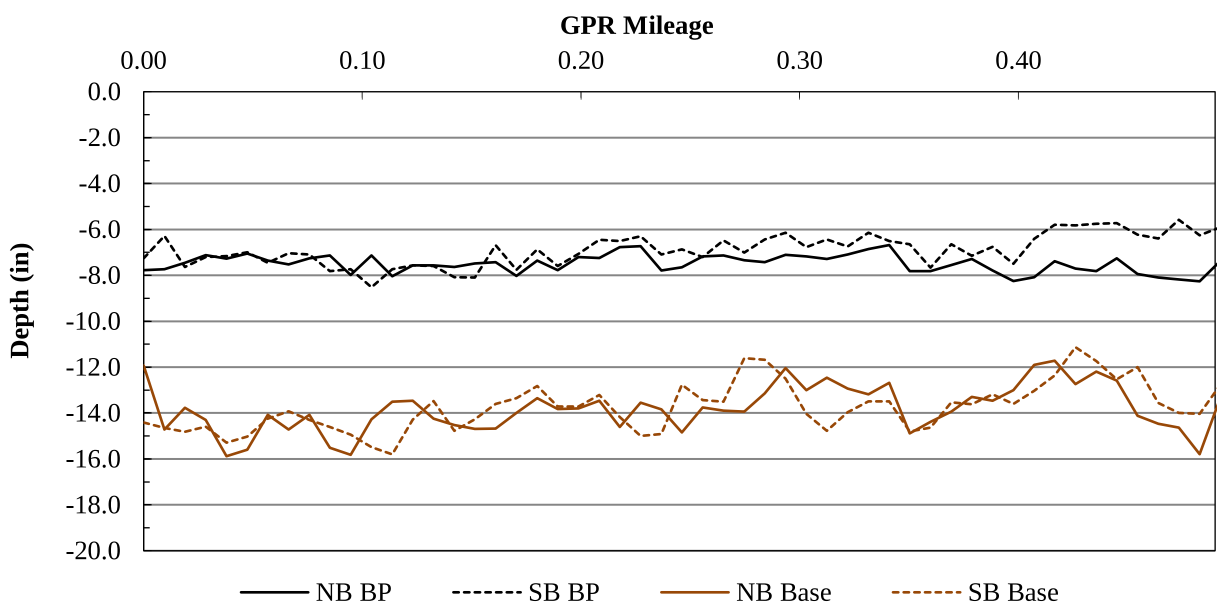
Project:	Powell Creek Solar Project	**Date:**	8/22/23
AET Job No.:	P-0025335	**Test Date:**	8/8/23
Road:	CR 13	**Section/Grid:**	S02
From:	CR G-12	**To:**	CR G

SUMMARY STATISTICS

Units: **inches**

Layer	NB				SB			
	Average	CV	15th	Min.	Average	CV	15th	Min.
BP	7.5	5%	7.1	6.7	6.9	10%	6.2	5.6
Base	6.3	17%	5.3	3.8	6.9	13%	6.0	4.6

Ground Penetrating Radar Pavement Thickness Survey



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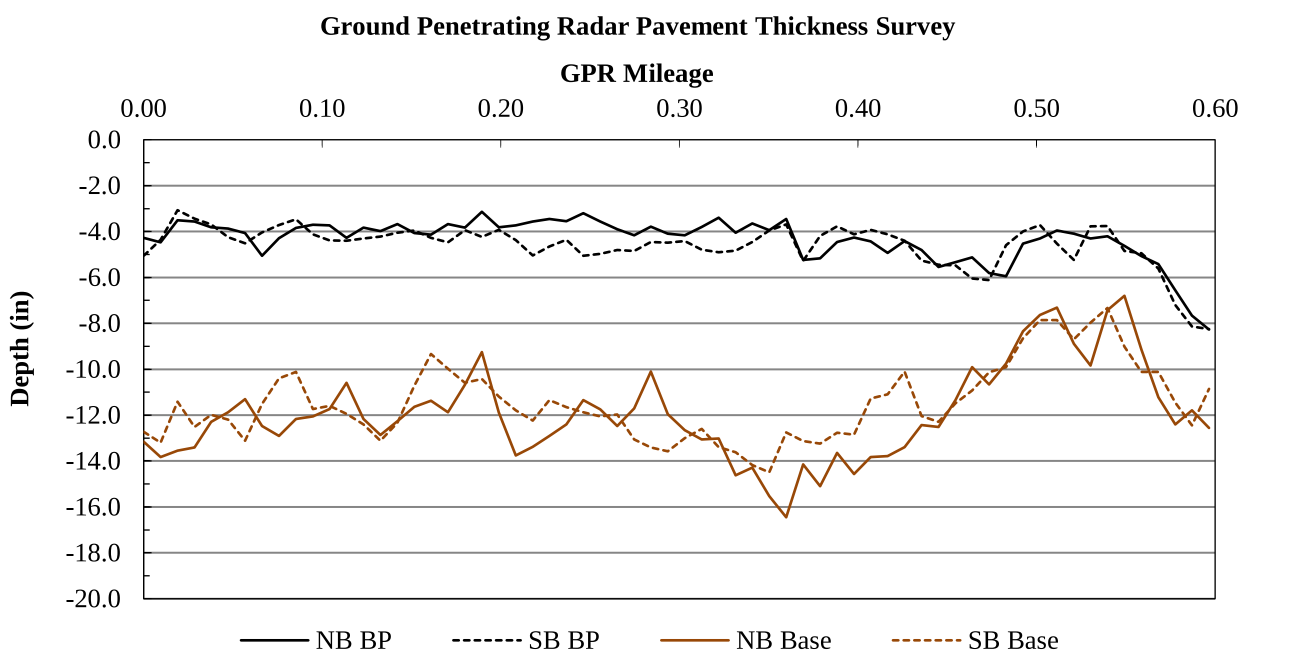
GENERAL INFORMATION: GROUND PENETRATING RADAR

Project: Powell Creek Solar Project
Date: 8/22/23
AET Job No.: P-0025335
Test Date: 8/8/23
Road: CR 13
Section/Grid: S03
From: CR G
To: CR F-12

SUMMARY STATISTICS

Units: **inches**

Layer	NB				SB			
	Average	CV	15th	Min.	Average	CV	15th	Min.
BP	4.4	22%	3.6	3.1	4.6	21%	3.8	3.1
Base	7.6	30%	4.8	2.2	6.9	27%	4.4	2.6



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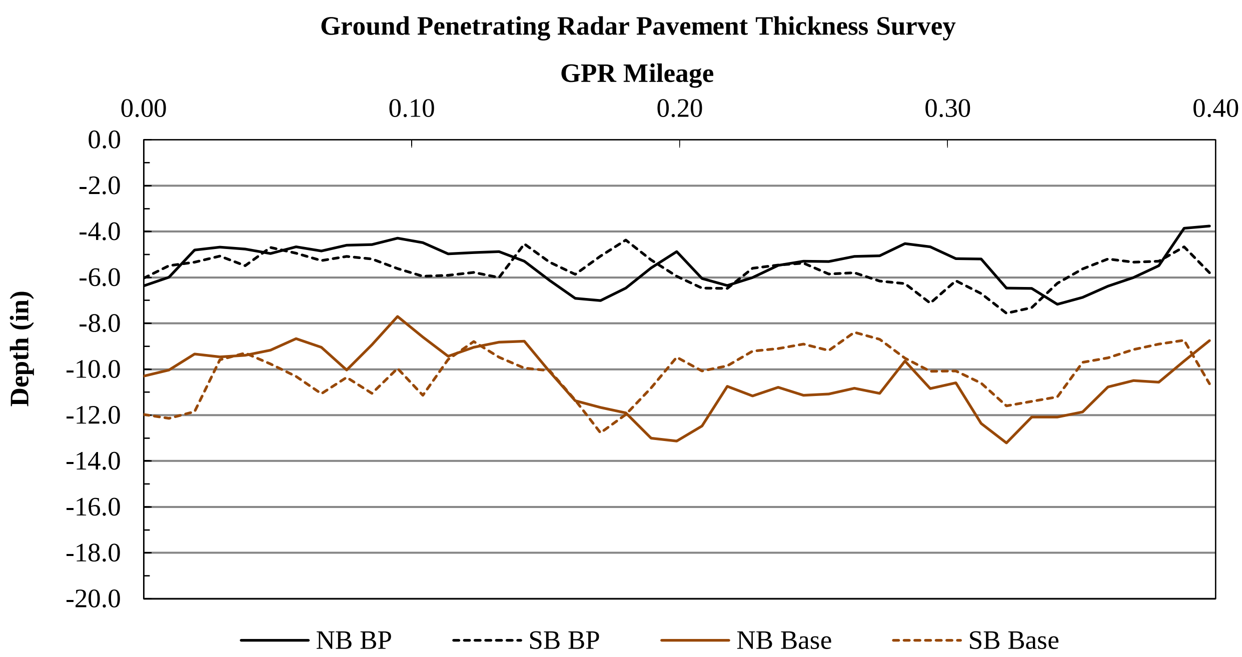
GENERAL INFORMATION: GROUND PENETRATING RADAR

Project:	Powell Creek Solar Project	**Date:**	8/22/23
AET Job No.:	P-0025335	**Test Date:**	8/8/23
Road:	CR 13	**Section/Grid:**	S04
From:	CR F-12	**To:**	SH 613

SUMMARY STATISTICS

Units: **inches**

Layer	NB				SB			
	Average	CV	15th	Min.	Average	CV	15th	Min.
BP	5.4	16%	4.6	3.8	5.7	12%	5.1	4.4
Base	5.1	21%	4.1	3.4	4.5	28%	3.4	2.5



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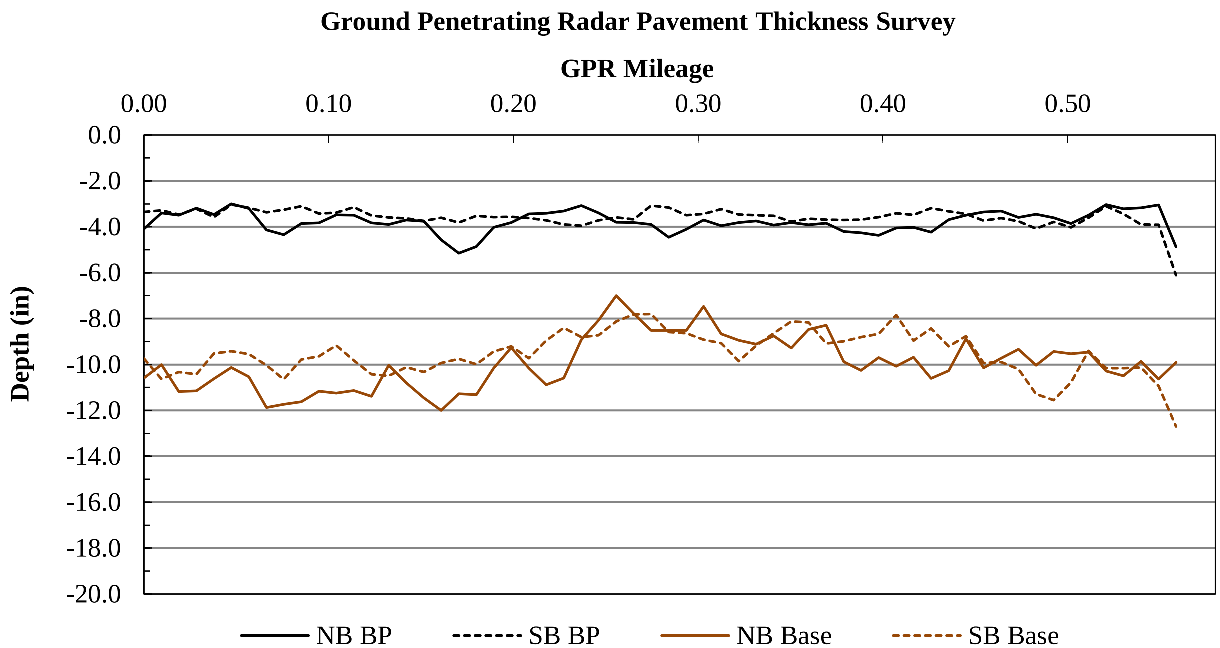
GENERAL INFORMATION: GROUND PENETRATING RADAR

Project:	Powell Creek Solar Project	**Date:**	8/22/23
AET Job No.:	P-0025335	**Test Date:**	8/8/23
Road:	CR 13	**Section/Grid:**	S05
From:	CTH 613	**To:**	RR X-ing

SUMMARY STATISTICS

Units: inches

Layer	NB				SB			
	Average	CV	15th	Min.	Average	CV	15th	Min.
BP	3.8	12%	3.3	3.0	3.6	12%	3.2	3.0
Base	6.2	19%	4.7	3.2	6.0	15%	5.1	4.2



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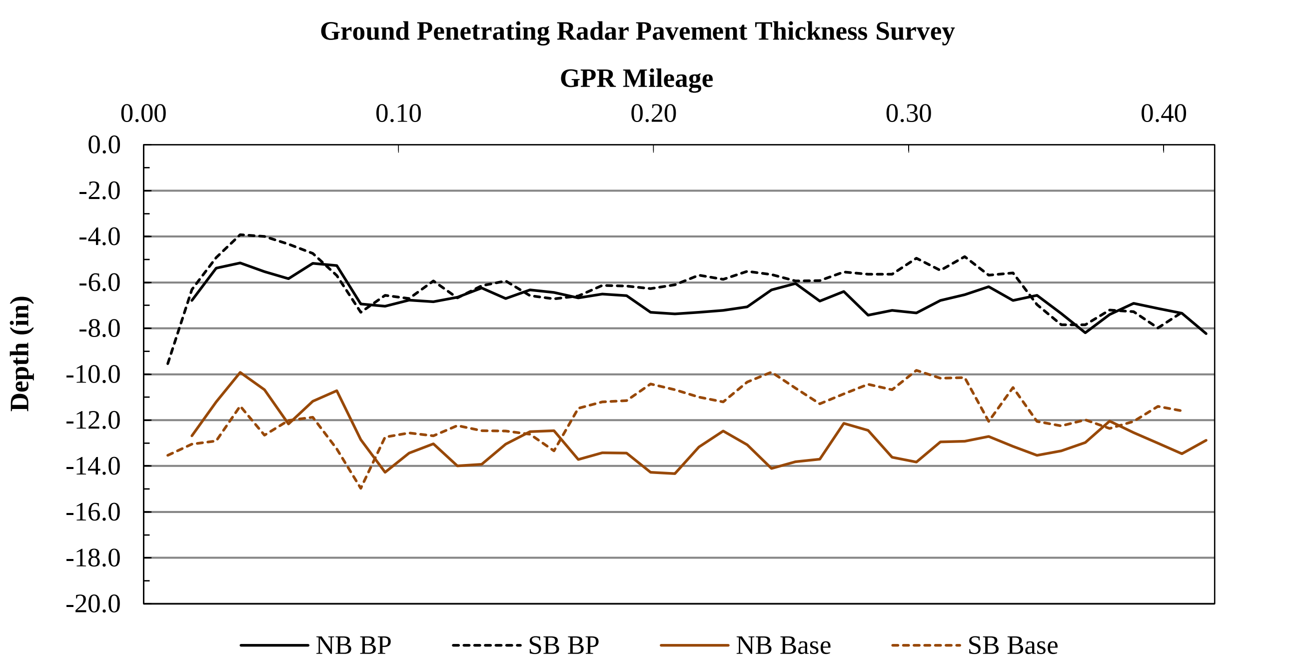
GENERAL INFORMATION: GROUND PENETRATING RADAR

Project:	Powell Creek Solar Project	**Date:**	8/22/23
AET Job No.:	P-0025335	**Test Date:**	8/8/23
Road:	CR 13	**Section/Grid:**	S06
From:	RR X-ing	**To:**	CTH E

SUMMARY STATISTICS

Units: **inches**

Layer	NB				SB			
	Average	**CV**	**15th**	**Min.**	**Average**	**CV**	**15th**	**Min.**
BP	6.7	11%	6.1	5.2	6.1	18%	5.1	3.9
Base	6.2	13%	5.3	4.6	5.6	22%	4.5	3.4



Appendix D

Falling Weight Deflectometer Field Exploration and Testing
FWD Data and Analysis Results Sheet

Appendix D
Falling Weight Deflectometer Field Exploration and Testing
Report No. P-0025335A

D.1 PAVEMENT TESTING

The pavement structural conditions at the site were evaluated nondestructively using Falling Weight Deflectometer (FWD). The testing locations appear in Figure 1, preceding Appendix A in this report.

D.2 EQUIPMENT DESCRIPTION

D.2.1 Dynatest 8000 FWD Test System

The FWD owned by AET is a Dynatest 8000 FWD Test System that consists of a Dynatest 8002 trailer and a third generation control and data acquisition unit developed in 2003, called the Dynatest Compact15, featuring fifteen (15) deflection channels. The new generation FWD, including a Compact15 System and a standard PC with the FwdWin field Program constitutes the newest, most sophisticated Dynatest FWD Test System, which fulfills or exceeds all requirements to meet ASTM-4694, ASTM D-4695 Standards. Figure C1 provides a view of this equipment.

Figure C1 Dynatest 8002 FWD Test System

The FWD imposes a dynamic impulse load onto the pavement surface through a load plate. Total pulse is an approximately half sine shape with a total duration typically between 25 to 30 ms. The FWD is capable of applying a variety of loads to the pavement ranging from 1,500 lbf (7 kN) to 27,000 ibf (120 kN) by dropping a variable weight mass from different heights to a standard, 11.8-inch (300-mm) diameter rigid plate.

The drop weights and the buffers are constructed so that the falling weight buffer subassembly may be quickly and conveniently changed between falling masses of 440 lbm (200 kg) for highways and 770 lbm (350 kg) for airports. With the 440 lbm (200 kg) package for highways three drop heights are used with the target load of 6,000 lbf (27 kN) at drop height 1, 9,000 lbf (40 kN) at drop height 2, and 12,000 lbf at drop height 3 (53 kN). The drop sequence consists of two seating drops from drop height 3 and 2 repeat measurements at drop height 1 and 1 measurement at drop height 2 for flexible pavements and 2 repeat measurements at drop height 2 and 1 measurement at drop height 3 for rigid pavements. The data from the seating drops is not stored.

The FWD is equipped with a load cell to measure the applied forces and nine geophones or deflectors to measure deflections up to 100 mils (2.5 mm). The load cell is capable of accurately measuring the force that is applied perpendicular to the loading plate with a resolution of 0.15 psi (1 kPa) or better. The force is expressed in terms of pressure, as a function of loading plate size.

Nine deflectors at the offsets listed in the following table in the Long Term Performance Program (LTPP) configuration are capable of measuring electronically discrete deflections per test, together with nine (9) separate deflection measuring channels for recording of the data. One (1) of the deflectors measures the deflection of the pavement surface through the center of the loading plate, while seven (7) deflectors are capable of being positioned behind the loading plate along the housing bar, up to a distance of 5 ft (2.5 m) from the center of the loading plate and one (1) being positioned in front of the loading plate along the bar.

Deflector	D1	D2	D3	D4	D5	D6	D7	D8	D9
Offset (in.)	0	8	12	18	24	36	48	60	72

Field testing is performed in accordance with the standard ASTM procedures as described in ASTM D 4695-96, “Standard Guide for General Pavement Deflection Measurements” and the calibration of our equipment is verified each year at the Long Term Pavement Performance Calibration Center in Maplewood, MN.

D.2.2 Linear Distance and Spatial Reference System

Distance measuring instrument (DMI) is a trailer mounted two phase encoder system. When DMI is connected to the Compact15 it provides for automatic display and recording distance information in both English and metric units with a 1 foot (0.3 meters) resolution and four percent accuracy when calibrated using provided procedure in the Field Program.

Spatial reference system is a Trimble ProXH Global Positioning System (GPS) that consists of fully integrated receiver, antenna and battery unit with Trimble's new H-Star™ technology to provide subfoot (30 cm) post-processed accuracy. The External Patch antenna is added to the ProXH receiver for the position of the loading plate. The External Patch antenna can be conveniently elevated with the optional baseball cap to prevent any signal blockage.

D.2.3 Air and Pavement Temperature Measuring System

A temperature monitoring probe, for automatic recording of air temperature, is an electronic (integrated circuit) sensing element in a stainless steel probe. The probe mounts on the FWD unit in a special holder with air circulation and connects to the Compact15. A non-contact Infra-Red (IR) Temperature Transmitter, for automatic recording of pavement surface temperature only, features an integrated IR-detector and digital electronics in a weather proof enclosure. The IR transmitter mounts on the FWD unit in a special holder with air circulation and connects to the Compact15. Both probe and IR transmitter have a resolution of 0.9 ºF (0.5 ºC) and accuracy within ± 1.8ºF (1 ºC) in the 0 to 158 ºF (-18 to +70ºC) range when calibrated using provided procedure.

D.2.4 Camera Monitoring System

A battery operated independent DC-1908E multi-functional digital camera with a SD card is used for easy positioning of the loading plate or of the pavement surface condition at the testing locations.

D.3 SAMPLING METHODS

At the project level, the testing interval is set at 0.1 mi. (maximum) or 10 locations per uniform section in the Outside Wheel Path (OWP) = 2.5 ft ± 0.25 ft (0.76 m ± 0.08 m) for nominal 12 ft (3.7 m) wide lanes. Where a divided roadbed exists, surveys will be taken in both directions if the project will include improvements in both directions. If there is more than one lane in one direction the surveys will be taken in the outer driving lane (truck lane) versus the passing lane of the highway. FWD tests are performed at a constant lateral offset down the test section.

At the network level, FWD tests on 20% mileage or three tests per mile are set with two deflection basins collected at only one load level, without statistically compromising the quality of the data collected. If FWD tests are for the in situ characterization of material stress sensitivity FWD data will be collected at multiple load levels.

D.4 QUALITY CONTROL (QC) AND QUALITY ASSURANCE (QA)

Beside the annual reference calibration the relative calibration of the FWD deflection sensors is conducted monthly but not to exceed 6 weeks during the months in which the FWD unit is continually testing. The DMI is also calibrated monthly by driving the vehicle over a known distance to calculate the distance scale factor. The accuracy of the FWD air temperature and infra-red (IR) sensors are checked on a monthly basis or more frequently if the FWD operator observes "suspicious" temperature readings.

Some care in the placement of the load plate and sensors is taken by the survey crew, especially where the highway surface is rutted or cracked to ensure that the load plate lays on a flat surface and that the load plate and all geophones lie on the same side of any visible cracks. Liberal use of comments placed in the FWD data file at the time of data collection is required. Comments pertaining to proximity to reference markers, bridge abutments, patches, cracks, etc., are all important documentation for the individual evaluating the data.

Scheduled preventive maintenance ensures proper equipment operation and helps identify potential problems that can be corrected to avoid poor quality or missing data that results if the equipment malfunctions while on site. The routine and major maintenance procedures established by the LTPP are adopted and any maintenance has been done at the end of the day after the testing is complete and become part of the routine performed at the end of each test/travel day and on days when no other work is scheduled.

D.5 DATA ANALYSIS METHODS

D.5.1 Inputs

The two-way AADT and HCADT are required to calculate the ESALs. The state average truck percent and truck type distribution are used when HCADT is not provided. The as-built pavement information (layer type, thickness, and construction year) are required and if not provided, GPR and/or coring and boring is needed.

D.5.2 Adjustments

Temperature adjustment to the deflections measured on bituminous pavements is determined from the temperature predicted at the middle depth of the pavement using the LTPP BELLS3 model that uses the pavement surface temperature and previous day mean air temperature. The predicted middle depth temperature and the standard temperature of 80 degrees Fahrenheit are used to calculate the temperature adjustment factor for deflection data analysis. Seasonal adjustment developed by Mn/DOT is also used.

D.5.3 Methods

For bituminous pavements, the deflection data were analyzed using the he American Association of State Highway and Transportation Officials' (AASHTO) method for determining the in-place (effective) subgrade and pavement strength and the Asphalt Institute method for determining allowable axle loads for a roadway. The Asphalt Institute method also uses the allowable deflection method for estimating Seasonal Load Capacity and Required Overlay, as described in the Asphalt Institute publication "Manual Series No. 17 Asphalt Overlays and Pavement Rehabilitation".

For gravel roads, the deflection data were analyzed using the American Association of State Highway and Transportation Officials' (AASHTO) method for determining the in-place (effective) subgrade and pavement strength, as well as allowable axle loads for a roadway as in the AASHTO Guide for Design of Pavement Structures, 1993.

For concrete pavements, the deflection data were analyzed using the FAA methods for determining the modulus of subgrade reaction (k-value), effective elastic modulus of concrete slabs, load transfer efficiency (LTE) on approach and leave slabs of a joint, slab support conditions (void analysis) and impulse stiffness modulus ratio (durability analysis) as in the FAA AC 150/5370-11A, Use of Nondestructive Testing Devices in the Evaluation of Airport Pavement, 2004.

D.6 TEST LIMITATIONS

D.6.1 Test Methods

The data derived through the testing program have been used to develop our opinions about the pavement conditions at your site. However, because no testing program can reveal totally what is in the subsurface, conditions between test locations and at other times, may differ from conditions described in this report. The testing we conducted identified pavement conditions only at those points where we measured pavement surface temperature, deflections, and observed pavement surface conditions. Depending on the sampling methods and sampling frequency, every location may not be tested, and some anomalies which are present in the pavement may not be noted on the testing results. If conditions encountered during construction differ from those indicated by our testing, it may be necessary to alter our conclusions and recommendations, or to modify construction procedures, and the cost of construction may be affected.

D.6.2 Test Standards

Pavement testing is done in general conformance with the described procedures. Compliance with any other standards referenced within the specified standard is neither inferred nor implied.

D.7 SUPPORTING TEST METHODS

D.7.1 GSSI Ground Penetrating Radar (GPR)

If the as-built pavement layer thicknesses are not available the thickness data are collected using a bumper-mounted, air-coupled 2-GHz radar unit from GSSI (RoadScan system) that consists of a SIR-20 dual channel data acquisition system, wheel-mounted DMI, ProXH GPS, air-launched (horn) antenna, horn antenna vehicle mounting kit, RADAN software with the Road Structure Module, and system accessories. The system provides continuous data at 1-ft spacing while traveling at highway speed.

D.7.2 Soil Boring/Coring Field Exploration

If both pavement thicknesses and subgrade soil types and conditions are desired the shallow coring/boring and sampling is used. The limited number of coring/boring is necessary to verify the GPR layer thickness data.

D.7.3 Pavement Surface Condition Survey

The type and severity of pavement distress influence the deflection response for a pavement. Therefore, FWD operators record any distress located from about 1 ft (0.3 m) in front of deflector D8 to about 3 ft (0.9 m) behind the load plate. This information is recorded in the FWD file using the comment line in the field program immediately following the test.

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36.5

AET Project No. P-0025335
County: Putnam
Test Date: Aug 8, 2023
Section: S01A
Roadway: CR 13
From: SH 15
To: 0.26 Mi S of CR G-12

Prev. Day's Avg. Air Temp.: 70 °F
Total AC: 3.1 in.
Daily ESALs: 6.0
PCI: 26
Haul ESALs: 0
Soil Type: P
Draught Adjustment Factor: 1.00
Seasonal Correction Factor: 1.20

Design Period: 10 Years
Projection Factor: 1.1
Growth Factor: 10.46
10-year Design ESALs: 22,911
Design Period: 20 Years
Projection Factor: 1.2
Growth Factor: 22.02
20-year Design ESALs: 48,218

															Effective Values		Overlay	Spring	
															Mr	SN	Thickness	Capacity	
Station	**Drop**	**Time**	**Air °F**	**Bit °F**	**Load**	**D1**	**D2**	**D3**	**D4**	**D4**	**D6**	**D7**	**D8**	**D9**	**ksi**	**inches**	**inches**	**tons/axle**	**Comments**
0.0																			START"
0.0	1	11:45	80.6	94.2	5982	29.3	22.6	17.6	11.4	7.2	3.0	1.9	1.6	1.3	5.9	1.6	0.8	9.7	
0.0	2	11:45	80.6	94.2	5982	28.4	22.0	17.2	11.2	7.1	3.0	1.9	1.6	1.3	5.9	1.6	0.7	10.0	
0.0	3	11:45	80.6	94.2	9022	44.2	34.5	27.2	18.1	11.6	4.8	3.0	2.6	2.2	5.6	1.6	0.8	9.7	
0.0	4	11:45	80.6	94.2	9033	45.1	35.6	28.0	18.7	12.0	4.8	3.0	2.6	2.2	5.5	1.6	0.8	9.5	
0.1	2	11:47	80.6	96.4	6004	30.4	23.8	18.4	11.9	7.4	3.3	2.0	1.7	1.6	5.4	1.6	0.9	9.5	
0.1	3	11:47	80.6	96.4	9132	47.2	36.9	29.1	19.3	12.3	5.4	3.3	2.8	2.5	5.0	1.6	0.9	9.3	
0.1	4	11:47	80.6	96.4	9142	48.2	37.9	30.0	19.9	12.6	5.4	3.3	2.8	2.6	5.0	1.6	1.0	9.1	
0.2	1	11:48	80.6	96.2	5971	35.9	27.9	20.6	11.9	6.9	2.9	1.9	1.6	1.4	6.1	1.3	1.3	8.1	
0.2	2	11:48	80.6	96.2	5982	34.4	27.0	20.0	11.7	6.7	2.9	2.0	1.6	1.4	6.0	1.4	1.2	8.4	
0.2	3	11:48	80.6	96.2	9186	51.4	40.8	31.1	19.0	11.3	4.8	3.2	2.7	2.3	5.6	1.4	1.1	8.7	
0.2	4	11:48	80.6	96.2	9197	53.1	42.0	32.1	19.6	11.4	4.8	3.2	2.7	2.3	5.7	1.4	1.2	8.4	
0.3	1	11:49	80.6	90.4	5927	19.1	15.1	12.3	9.1	6.8	4.1	2.6	1.9	1.4	4.2	2.6	0.0	13.8	
0.3	2	11:49	80.6	90.4	5938	18.5	14.7	12.0	8.9	6.7	4.1	2.6	1.9	1.5	4.3	2.7	0.0	14.2	
0.3	3	11:49	80.6	90.4	9077	30.1	23.8	19.7	14.6	11.0	6.6	4.2	2.9	2.3	4.1	2.6	0.0	13.5	
0.3	4	11:49	80.6	90.4	9088	30.6	24.4	20.2	15.0	11.3	6.7	4.3	3.0	2.3	4.0	2.6	0.0	13.3	
0.4	1	11:51	80.6	94.6	6004	45.3	35.1	26.8	16.5	9.0	2.9	2.0	2.1	1.5	6.1	1.1	1.7	6.5	
0.4	2	11:51	80.6	94.6	6015	43.7	34.0	26.0	16.1	9.0	3.0	2.0	2.0	1.5	5.9	1.2	1.7	6.8	
0.4	3	11:51	80.6	94.6	9033	66.4	52.1	40.8	26.0	15.0	4.7	3.1	3.2	2.5	5.6	1.2	1.7	6.7	
0.4	4	11:51	80.6	94.6	9000	68.1	53.7	42.2	26.8	15.3	4.6	3.1	3.3	2.5	5.7	1.1	1.8	6.5	
0.5	1	11:52	82.4	99.6	5916	42.1	32.6	24.3	12.7	7.4	2.7	1.8	1.7	1.5	6.5	1.2	1.5	7.0	
0.5	2	11:52	82.4	99.6	5971	40.9	31.9	23.8	12.6	7.4	2.8	2.0	1.7	1.5	6.3	1.2	1.5	7.3	
0.5	3	11:52	82.4	99.6	8836	59.1	46.7	35.8	20.4	12.3	4.3	2.8	2.7	2.4	6.1	1.2	1.5	7.4	
0.5	4	11:52	82.4	99.6	8869	61.6	48.5	37.4	21.1	12.6	4.3	2.9	2.7	2.4	6.1	1.2	1.5	7.2	
0.6	1	11:53	82.4	97.3	5960	49.8	35.3	26.7	14.4	7.2	2.1	1.8	1.6	1.5	8.5	1.0	1.5	6.1	
0.6	2	11:53	82.4	97.3	5982	48.2	34.3	26.1	14.2	7.2	2.2	1.8	1.6	1.6	8.0	1.0	1.6	6.3	
0.6	3	11:53	82.4	97.3	8847	70.0	51.0	39.2	23.1	12.0	3.3	2.7	2.6	2.5	7.9	1.0	1.5	6.4	
0.6	4	11:53	82.4	97.3	8847	73.0	53.1	40.9	24.0	12.2	3.2	2.7	2.6	2.4	8.1	1.0	1.6	6.1	

American Engineering Testing, Inc.
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AET Project No. P-0025335
County: Putnam
Test Date: Aug 8, 2023
Section: S01B
Roadway: CR 13
From: 0.26 Mi S of CR G-12
To: CR G-12

Prev. Day's Avg. Air Temp.: 70 °F
Total AC: 7.1 in.
Daily ESALs: 6.0
PCI: 92
Haul ESALs: 0
Soil Type: P
Draught Adjustment Factor: 1.00
Seasonal Correction Factor: 1.20

Design Period: 10 Years
Projection Factor: 1.1
Growth Factor: 10.46
10-year Design ESALs: 22,911
Design Period: 20 Years
Projection Factor: 1.2
Growth Factor: 22.02
20-year Design ESALs: 48,218

Station	Drop	Time	Air °F	Bit °F	Load	D1	D2	D3	D4	D4	D6	D7	D8	D9	Effective Values Mr ksi	Effective Values SN inches	Overlay Thickness inches	Spring Capacity tons/axle	Comments
0.7	1	11:54	82.4	101.1	6015	26.3	19.8	15.7	11.1	8.1	4.2	2.3	1.6	1.3	4.3	2.6	0.0	9.2	
0.7	2	11:54	82.4	101.1	6004	25.2	19.1	15.2	10.8	8.0	4.1	2.3	1.6	1.3	4.3	2.6	0.0	9.6	
0.7	3	11:54	82.4	101.1	9317	41.0	31.2	25.1	18.1	13.4	6.9	3.8	2.6	2.2	4.0	2.6	0.0	9.2	
0.7	4	11:54	82.4	101.1	9307	42.0	31.9	25.7	18.5	13.8	6.9	3.7	2.7	2.3	4.0	2.6	0.0	9.0	
0.8	1	11:55	82.4	101.5	5993	19.9	15.9	13.2	9.4	6.7	3.4	2.0	1.5	1.3	5.1	2.9	0.0	11.8	
0.8	2	11:55	82.4	101.5	6015	19.6	15.8	13.1	9.4	6.7	3.4	2.0	1.5	1.3	5.2	3.0	0.0	12.0	
0.8	3	11:55	82.4	101.5	9339	32.1	26.0	21.8	15.6	11.0	5.6	3.2	2.5	2.2	4.9	2.9	0.0	11.4	
0.8	4	11:55	82.4	101.5	9339	32.3	26.2	22.0	15.8	11.2	5.7	3.2	2.5	2.2	4.9	2.9	0.0	11.4	
0.9	1	11:56	82.4	99.9	5960	25.8	20.8	16.9	11.9	8.1	3.6	2.1	1.5	1.4	4.8	2.5	0.0	9.3	
0.9	2	11:56	82.4	99.9	6037	25.5	20.6	16.8	11.8	8.1	3.7	2.1	1.6	1.4	4.8	2.5	0.0	9.5	
0.9	3	11:56	82.4	99.9	9197	41.3	33.6	27.6	19.7	13.6	6.2	3.4	2.7	2.5	4.4	2.5	0.0	9.0	
0.9	4	11:56	82.4	99.9	9186	42.1	34.3	28.2	20.1	13.8	6.2	3.4	2.7	2.5	4.4	2.5	0.0	8.8	
0.9																			CH13,IC,G12,NB"

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AET Project No. P-0025335
County: Putnam
Test Date: Aug 8, 2023
Section: S02
Roadway: CR 13
From: CR G-12
To: CR G

Prev. Day's Avg. Air Temp.: 70 °F
Total AC: 7.5 in.
Daily ESALs: 6.0
PCI: 93
Haul ESALs: 0
Soil Type: P
Draught Adjustment Factor: 1.00
Seasonal Correction Factor: 1.20

Design Period: 10 Years
Projection Factor: 1.1
Growth Factor: 10.46
10-year Design ESALs: 22,911
Design Period: 20 Years
Projection Factor: 1.2
Growth Factor: 22.02
20-year Design ESALs: 48,218

Station	Drop	Time	Air °F	Bit °F	Load	D1	D2	D3	D4	D4	D6	D7	D8	D9	Effective Values Mr ksi	SN inches	Overlay Thickness inches	Spring Capacity tons/axle	Comments
0.9																			CH13,IC,G12,NB"
1.0	1	11:58	80.6	101.3	6015	20.8	16.7	13.7	9.7	6.9	3.7	2.3	1.7	1.4	4.8	2.8	0.0	11.4	
1.0	2	11:58	80.6	101.3	6037	20.3	16.4	13.4	9.5	6.8	3.7	2.3	1.7	1.4	4.8	2.8	0.0	11.7	
1.0	3	11:58	80.6	101.3	9383	32.4	26.2	21.7	15.6	11.2	6.0	3.8	2.8	2.4	4.6	2.8	0.0	11.4	
1.0	4	11:58	80.6	101.3	9361	32.9	26.7	22.1	15.9	11.4	6.1	3.8	2.8	2.4	4.6	2.8	0.0	11.2	
1.0	1	11:59	80.6	101.3	5971	14.7	11.9	9.8	7.5	5.8	3.3	2.2	1.6	1.2	5.3	3.5	0.0	15.2	
1.0	2	11:59	80.6	101.3	6004	14.5	11.7	9.7	7.5	5.8	3.4	2.2	1.6	1.2	5.2	3.5	0.0	15.4	
1.0	3	11:59	80.6	101.3	9482	23.7	19.3	16.1	12.4	9.6	5.6	3.5	2.6	2.0	5.0	3.5	0.0	15.0	
1.0	4	11:59	80.6	101.3	9471	23.9	19.5	16.2	12.5	9.6	5.6	3.5	2.6	2.0	5.0	3.5	0.0	14.8	
1.1	1	12:00	82.4	100.9	5982	20.3	15.9	13.4	9.8	7.0	3.6	2.2	1.6	1.4	4.9	2.8	0.0	11.6	
1.1	2	12:00	82.4	100.9	5993	19.9	15.7	13.1	9.6	6.9	3.6	2.2	1.6	1.4	4.9	2.8	0.0	11.8	
1.1	3	12:00	82.4	100.9	9328	32.2	25.7	21.7	16.0	11.5	6.0	3.6	2.7	2.3	4.6	2.8	0.0	11.4	
1.1	4	12:00	82.4	100.9	9317	32.6	26.0	22.0	16.2	11.7	6.1	3.7	2.7	2.3	4.5	2.8	0.0	11.2	
1.2	1	12:01	82.4	100.5	6004	25.0	19.7	15.8	10.9	7.4	3.8	2.2	1.6	1.4	4.7	2.4	0.0	9.6	
1.2	2	12:01	82.4	100.5	6026	24.5	19.3	15.5	10.7	7.3	3.7	2.2	1.6	1.3	4.7	2.5	0.0	9.8	
1.2	3	12:01	82.4	100.5	9307	39.3	31.2	25.3	17.6	12.2	6.2	3.6	2.6	2.2	4.4	2.5	0.0	9.5	
1.2	4	12:01	82.4	100.5	9296	40.0	31.9	25.9	18.1	12.4	6.3	3.6	2.6	2.3	4.4	2.4	0.0	9.3	
1.3	1	12:02	82.4	100.4	6004	15.7	13.0	11.1	8.2	5.8	3.2	2.0	1.5	1.2	5.5	3.3	0.0	14.4	
1.3	2	12:02	82.4	100.4	6037	15.7	12.9	10.9	8.2	5.7	3.3	2.1	1.5	1.2	5.5	3.3	0.0	14.5	
1.3	3	12:02	82.4	100.4	9449	25.5	21.1	18.1	13.5	9.5	5.4	3.4	2.4	2.0	5.2	3.2	0.0	14.0	
1.3	4	12:02	82.4	100.4	9438	25.6	21.3	18.3	13.6	9.6	5.4	3.4	2.5	2.0	5.1	3.2	0.0	14.0	
1.4	1	12:03	82.4	103.8	6004	16.4	13.3	10.7	7.8	5.7	3.2	2.0	1.5	1.2	5.5	3.2	0.0	14.1	
1.4	2	12:03	82.4	103.8	6015	16.1	13.1	10.6	7.7	5.6	3.2	2.1	1.5	1.3	5.6	3.2	0.0	14.3	
1.4	3	12:03	82.4	103.8	9482	25.6	20.9	17.2	12.6	9.3	5.3	3.5	2.6	2.1	5.3	3.3	0.0	14.2	
1.4	4	12:03	82.4	103.8	9482	26.0	21.2	17.4	12.9	9.4	5.3	3.5	2.6	2.1	5.2	3.2	0.0	14.0	
1.4	1	12:04	80.6	101.9	5982	14.2	11.4	9.6	7.2	5.4	3.1	2.0	1.4	1.1	5.7	3.5	0.0	15.7	
1.4	2	12:04	80.6	101.9	6037	14.0	11.3	9.5	7.2	5.4	3.1	2.0	1.4	1.1	5.7	3.5	0.0	16.0	
1.4	3	12:04	80.6	101.9	9460	22.5	18.2	15.5	11.8	8.9	5.1	3.2	2.3	1.9	5.5	3.5	0.0	15.7	
1.4	4	12:04	80.6	101.9	9460	22.6	18.4	15.7	11.9	9.0	5.2	3.2	2.3	1.9	5.4	3.5	0.0	15.6	
1.5																			CH13,IC,G,NB"

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AET Project No. P-0025335
County: Putnam
Test Date: Aug 8, 2023
Section: S03
Roadway: CR 13
From: CR G
To: CR F-12

Prev. Day's Avg. Air Temp.: 70 °F
Total AC: 4.4 in.
Daily ESALs: 6.0
PCI: 22
Haul ESALs: 0
Soil Type: P
Draught Adjustment Factor: 1.00
Seasonal Correction Factor: 1.20

Design Period: 10 Years
Projection Factor: 1.1
Growth Factor: 10.46
10-year Design ESALs: 22,911
Design Period: 20 Years
Projection Factor: 1.2
Growth Factor: 22.02
20-year Design ESALs: 48,218

															Effective Values		Overlay	Spring	
															Mr	SN	Thickness	Capacity	
Station	Drop	Time	Air °F	Bit °F	Load	D1	D2	D3	D4	D4	D6	D7	D8	D9	ksi	inches	inches	tons/axle	Comments
1.5																			CH13,IC,G,NB"
1.5	1	12:05	80.6	101.4	5741	62.4	50.1	37.1	21.1	10.4	2.9	1.7	1.8	1.8	5.9	1.2	1.7	4.8	
1.5	2	12:05	80.6	101.4	6091	65.7	52.8	39.5	22.7	11.4	3.3	2.0	2.0	1.9	5.4	1.2	1.8	4.8	
1.5	3	12:05	80.6	101.4	8355	87.1	70.6	53.7	31.9	16.8	4.7	2.8	2.8	2.7	5.2	1.2	1.8	4.9	
1.5	4	12:05	80.6	101.4	8268	89.2	72.2	54.8	32.5	16.7	4.6	2.8	2.9	2.7	5.3	1.2	1.8	4.8	
1.6	1	12:06	80.6	99.8	5993	71.1	55.4	41.9	22.9	10.7	2.2	1.9	2.1	1.9	8.0	1.1	1.4	4.4	
1.6	2	12:06	80.6	99.8	5960	68.9	54.1	41.1	22.6	10.7	2.4	1.9	2.1	1.9	7.4	1.1	1.5	4.5	
1.6	3	12:06	80.6	99.8	8618	95.7	75.7	58.8	34.1	16.6	3.6	2.9	3.3	2.9	7.0	1.1	1.5	4.7	
1.6	4	12:06	80.6	99.8	8596	98.5	77.7	60.2	34.7	16.9	3.5	2.9	3.3	2.9	7.3	1.1	1.5	4.5	
1.7	1	12:08	80.6	98.4	5971	61.1	47.2	34.5	18.4	8.9	3.1	2.1	1.9	1.6	5.6	1.2	1.7	5.0	
1.7	2	12:08	80.6	98.4	6004	59.6	46.2	33.8	18.3	9.0	3.2	2.1	1.9	1.7	5.5	1.2	1.7	5.1	
1.7	3	12:08	80.6	98.4	8869	84.5	66.6	50.4	28.8	15.0	5.0	3.2	3.0	2.6	5.2	1.3	1.7	5.3	
1.7	4	12:08	80.6	98.4	8836	87.0	68.8	52.0	29.5	15.1	4.9	3.2	3.0	2.7	5.3	1.2	1.7	5.2	
1.8	1	12:09	80.6	102.2	5654	19.5	14.6	10.6	5.8	3.2	1.7	1.3	1.3	1.0	9.7	2.0	0.0	13.9	
1.8	2	12:09	80.6	102.2	5698	19.2	14.3	10.3	5.7	3.1	1.8	1.3	1.2	1.0	9.5	2.1	0.0	14.3	
1.8	3	12:09	80.6	102.2	8902	31.8	24.2	17.8	10.1	5.7	2.7	2.2	2.0	1.9	9.6	2.0	0.0	13.5	
1.8	4	12:09	80.6	102.2	8935	32.0	24.5	18.1	10.3	5.9	2.7	2.2	2.0	1.9	9.7	2.0	0.0	13.5	
1.9	1	12:11	80.6	99.5	5763	60.8	47.2	35.9	20.4	10.6	3.3	2.0	2.0	1.8	5.2	1.2	1.8	4.9	
1.9	2	12:11	80.6	99.5	5840	60.7	47.5	35.9	20.5	10.8	3.5	2.1	2.1	1.9	5.0	1.2	1.9	4.9	
1.9	3	12:11	80.6	99.5	8202	81.7	64.8	49.4	29.3	15.8	5.0	3.1	2.9	2.6	4.9	1.2	1.8	5.1	
1.9	4	12:11	80.6	99.5	8202	83.2	66.1	50.7	29.9	15.9	4.9	3.2	2.8	2.5	5.0	1.2	1.8	5.0	
2.0	1	12:12	82.4	98.5	5971	74.7	59.2	46.6	28.9	16.4	4.1	1.9	2.1	2.1	4.3	1.1	2.3	4.1	
2.0	2	12:12	82.4	98.5	5905	73.5	58.5	46.0	28.7	16.3	4.2	1.9	2.1	2.0	4.2	1.1	2.4	4.1	
2.0	3	12:12	82.4	98.5	8388	99.5	80.5	63.8	41.2	24.2	6.5	2.9	3.3	3.1	3.8	1.2	2.4	4.3	
2.0	4	12:12	82.4	98.5	8322	100.5	81.3	64.4	41.6	24.3	6.3	2.8	3.2	3.1	3.9	1.2	2.4	4.2	
2.1	1	12:13	82.4	100.5	6048	31.1	23.7	18.6	11.6	7.4	3.7	2.5	2.0	1.6	4.8	1.9	0.3	9.5	
2.1	2	12:13	82.4	100.5	6004	30.3	23.1	18.2	11.4	7.3	3.7	2.5	2.0	1.6	4.8	1.9	0.3	9.7	
2.1	3	12:13	82.4	100.5	9197	45.2	35.0	28.1	18.2	11.9	5.9	4.0	3.1	2.7	4.6	2.0	0.2	9.9	
2.1	4	12:13	82.4	100.5	9219	46.3	35.9	28.8	18.5	12.0	5.9	4.0	3.2	2.7	4.6	2.0	0.3	9.7	
2.2	1	12:14	82.4	101.3	6004	31.4	24.7	19.6	12.7	8.3	3.7	2.3	1.8	1.5	4.7	1.9	0.4	9.4	
2.2	2	12:14	82.4	101.3	6037	30.6	24.1	19.1	12.4	8.1	3.7	2.3	1.8	1.5	4.8	1.9	0.3	9.6	
2.2	3	12:14	82.4	101.3	9077	45.8	36.3	29.3	19.6	13.1	5.9	3.6	2.9	2.5	4.5	2.0	0.3	9.7	
2.2	4	12:14	82.4	101.3	9088	47.3	37.5	30.3	20.2	13.5	5.9	3.6	2.9	2.5	4.5	1.9	0.4	9.4	
2.2																			CH13,IC,F12,NB"

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AET Project No. P-0025335
County: Putnam
Test Date: Aug 8, 2023
Section: S04
Roadway: CR 13
From: CR F-12
To: SH 613

Prev. Day's Avg. Air Temp.: 70 °F
Total AC: 5.4 in.
Daily ESALs: 6.0
PCI: 37
Haul ESALs: 0
Soil Type: P
Draught Adjustment Factor: 1.00
Seasonal Correction Factor: 1.20

Design Period: 10 Years
Projection Factor: 1.1
Growth Factor: 10.46
10-year Design ESALs: 22,911
Design Period: 20 Years
Projection Factor: 1.2
Growth Factor: 22.02
20-year Design ESALs: 48,218

Station	Drop	Time	Air °F	Bit °F	Load	D1	D2	D3	D4	D4	D6	D7	D8	D9	Effective Values Mr ksi	SN inches	Overlay Thickness inches	Spring Capacity tons/axle	Comments
2.2																			CH13,IC,F12,NB"
2.2	1	12:15	82.4	102.9	5927	43.6	33.2	25.3	15.5	9.2	3.6	2.0	1.7	1.4	4.9	1.4	1.5	6.9	
2.2	2	12:15	82.4	102.9	6015	43.3	33.0	25.2	15.6	9.5	3.7	2.0	1.8	1.5	4.8	1.4	1.5	7.0	
2.2	3	12:15	82.4	102.9	8847	65.0	49.9	38.5	24.3	14.8	5.7	3.2	2.7	2.4	4.6	1.4	1.6	6.9	
2.2	4	12:15	82.4	102.9	8793	66.6	51.2	39.5	24.9	15.0	5.6	3.1	2.8	2.4	4.6	1.4	1.6	6.7	
2.3	1	12:16	84.2	100.8	6037	30.5	23.4	18.4	11.6	7.1	3.0	1.9	1.5	1.3	5.9	1.7	0.5	9.7	
2.3	2	12:16	84.2	100.8	6059	29.7	22.8	18.0	11.4	7.0	3.1	1.9	1.5	1.3	5.8	1.7	0.4	10.0	
2.3	3	12:16	84.2	100.8	9142	45.9	35.5	28.3	18.4	11.5	4.8	2.8	2.4	2.2	5.6	1.7	0.5	9.7	
2.3	4	12:16	84.2	100.8	9186	47.4	36.7	29.3	19.0	11.8	4.8	2.8	2.4	2.3	5.6	1.7	0.6	9.5	
2.4	1	12:17	84.2	100.2	5949	28.0	22.6	18.9	13.2	9.4	4.3	2.4	1.6	1.5	4.1	2.0	0.3	10.2	
2.4	2	12:17	84.2	100.2	5960	27.4	22.2	18.5	13.0	9.2	4.3	2.4	1.6	1.5	4.1	2.1	0.2	10.4	
2.4	3	12:17	84.2	100.2	9033	43.1	35.4	29.8	21.4	15.3	7.1	3.8	2.7	2.4	3.8	2.1	0.3	10.1	
2.4	4	12:17	84.2	100.2	9066	44.2	36.3	30.6	22.0	15.7	7.2	3.7	2.8	2.4	3.7	2.1	0.4	9.9	
2.4	1	12:19	84.2	100.7	5949	59.6	46.3	34.8	19.1	9.9	2.1	1.2	1.5	1.5	8.5	1.0	1.4	5.2	
2.4	2	12:19	84.2	100.7	6015	58.2	45.6	34.4	19.0	10.0	2.2	1.3	1.6	1.5	8.0	1.0	1.5	5.4	
2.4	3	12:19	84.2	100.7	8803	84.4	66.8	51.5	30.0	16.2	3.4	1.7	2.4	2.5	7.7	1.0	1.5	5.4	
2.4	4	12:19	84.2	100.7	8782	88.0	69.7	53.8	31.0	16.5	3.2	1.6	2.4	2.5	8.2	1.0	1.5	5.2	

American Engineering Testing, Inc.
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AET Project No. P-0025335
County: Putnam
Test Date: Aug 8, 2023
Section: S05
Roadway: CR 13
From: SH 613
To: RR X-ing

Prev. Day's Avg. Air Temp.: 70 °F
Total AC: 3.8 in.
Daily ESALs: 6.0
PCI: 66
Haul ESALs: 0
Soil Type: P
Draught Adjustment Factor: 1.00
Seasonal Correction Factor: 1.20

Design Period: 10 Years
Projection Factor: 1.1
Growth Factor: 10.46
10-year Design ESALs: 22,911
Design Period: 20 Years
Projection Factor: 1.2
Growth Factor: 22.02
20-year Design ESALs: 48,218

															Effective Values		Overlay	Spring	
															Mr	SN	Thickness	Capacity	
Station	Drop	Time	Air °F	Bit °F	Load	D1	D2	D3	D4	D4	D6	D7	D8	D9	ksi	inches	inches	tons/axle	Comments
2.5	1	12:21	84.2	102.5	5971	48.5	37.8	29.0	17.8	10.2	3.9	2.1	1.8	1.6	4.6	1.3	1.9	6.2	
2.5	2	12:21	84.2	102.5	6004	47.1	36.8	28.4	17.5	10.3	3.9	2.2	1.8	1.6	4.5	1.3	1.8	6.5	
2.5	3	12:21	84.2	102.5	8913	70.9	56.0	44.1	28.1	16.8	6.3	3.3	2.8	2.6	4.2	1.3	1.9	6.4	
2.5	4	12:21	84.2	102.5	8891	73.3	58.1	45.8	29.1	17.4	6.3	3.2	2.9	2.7	4.1	1.3	2.0	6.1	
2.5	1	12:22	82.4	101.5	5993	55.5	42.0	31.5	17.7	8.9	2.3	1.6	1.7	1.5	7.7	1.0	1.6	5.6	
2.5	2	12:22	82.4	101.5	6015	54.0	41.1	31.0	17.6	9.0	2.4	1.7	1.8	1.5	7.4	1.0	1.6	5.8	
2.5	3	12:22	82.4	101.5	8793	78.9	61.1	47.0	27.9	14.7	3.6	2.6	2.7	2.4	7.2	1.0	1.6	5.8	
2.5	4	12:22	82.4	101.5	8782	81.3	63.2	48.6	28.7	14.9	3.5	2.5	2.7	2.5	7.5	1.0	1.6	5.6	
2.6	1	12:23	82.4	102.1	6004	47.4	35.8	26.6	15.5	8.7	3.0	1.6	1.7	1.5	6.0	1.2	1.6	6.5	
2.6	2	12:23	82.4	102.1	6048	46.4	35.2	26.3	15.5	8.7	3.1	1.8	1.9	1.7	5.8	1.2	1.6	6.6	
2.6	3	12:23	82.4	102.1	8793	68.7	52.8	40.1	24.4	14.2	4.6	2.6	2.9	2.6	5.7	1.2	1.6	6.5	
2.6	4	12:23	82.4	102.1	8803	71.0	54.5	41.5	25.1	14.5	4.6	2.6	3.0	2.5	5.7	1.2	1.7	6.3	
2.7	1	12:24	82.4	101.4	5873	50.3	38.3	28.8	16.1	8.2	2.6	1.7	1.6	1.5	6.8	1.1	1.6	6.0	
2.7	2	12:24	82.4	101.4	5982	49.5	38	28.5	16.0	8.3	2.7	1.8	1.6	1.5	6.6	1.1	1.6	6.2	
2.7	3	12:24	82.4	101.4	8694	71.8	55.6	42.8	25.2	13.6	4.1	2.5	2.5	2.4	6.3	1.1	1.6	6.2	
2.7	4	12:24	82.4	101.4	8672	74.5	57.7	44.5	26.1	13.8	4.0	2.6	2.6	2.4	6.4	1.1	1.7	6.0	
2.8	1	12:25	82.4	103.0	5905	53.1	43.4	33.3	18.9	9.8	3.0	1.9	1.8	1.6	5.7	1.1	1.9	5.7	
2.8	2	12:25	82.4	103.0	5905	53.2	42.5	32.6	18.7	9.8	3.1	2.0	1.8	1.6	5.5	1.1	1.9	5.7	
2.8	3	12:25	82.4	103.0	8541	74.6	60.9	47.6	28.6	15.7	4.7	2.8	2.6	2.5	5.4	1.1	1.9	5.9	
2.8	4	12:25	82.4	103.0	8475	76.9	62.9	49.2	29.4	15.7	4.6	2.7	2.6	2.5	5.5	1.1	1.9	5.7	
2.9	1	12:26	82.4	106.1	6026	41.5	32.4	24.3	14.1	8.0	2.6	1.6	1.5	1.4	6.8	1.3	1.2	7.5	
2.9	2	12:26	82.4	106.1	6004	39.9	31.2	23.5	13.7	7.9	2.7	1.7	1.5	1.4	6.6	1.3	1.2	7.8	
2.9	3	12:26	82.4	106.1	9066	59.2	46.8	35.8	21.9	13.0	4.2	2.5	2.4	2.3	6.4	1.3	1.1	7.9	
2.9	4	12:26	82.4	106.1	9033	61.3	48.7	37.4	22.8	13.3	4.1	2.5	2.4	2.3	6.5	1.3	1.2	7.6	
3.0	1	12:27	84.2	106.4	6004	32.6	25.1	19.3	11.7	7.2	3.3	2.0	1.7	1.3	5.3	1.6	0.8	9.3	
3.0	2	12:27	84.2	106.4	6015	31.7	24.5	18.8	11.5	7.2	3.3	2.0	1.6	1.3	5.3	1.7	0.7	9.5	
3.0	3	12:27	84.2	106.4	0:00	48.4	38	29.4	18.6	12.0	5.4	3.3	2.7	2.3	5.0	1.7	0.7	9.5	
3.0	4	12:27	84.2	106.4	9186	49.9	39.1	30.6	19.2	12.2	5.5	3.3	2.7	2.3	5.0	1.7	0.8	9.2	

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AET Project No. P-0025335
County: Putnam
Test Date: Aug 8, 2023
Section: S06
Roadway: CR 13
From: RR X-ing
To: CR E

Prev. Day's Avg. Air Temp.: 70 °F
Total AC: 6.7 in.
Daily ESALs: 6.0
PCI: 66
Haul ESALs: 0
Soil Type: P
Draught Adjustment Factor: 1.00
Seasonal Correction Factor: 1.20

Design Period: 10 Years
Projection Factor: 1.1
Growth Factor: 10.46
10-year Design ESALs: 22,911
Design Period: 20 Years
Projection Factor: 1.2
Growth Factor: 22.02
20-year Design ESALs: 48,218

															Effective Values		Overlay	Spring	
															Mr	SN	Thickness	Capacity	
Station	Drop	Time	Air °F	Bit °F	Load	D1	D2	D3	D4	D4	D6	D7	D8	D9	ksi	inches	inches	tons/axle	Comments
3.1	1	12:29	84.2	100.6	5905	60.2	45.4	34.3	20.6	10.9	2.8	1.4	1.6	1.6	6.2	1.3	1.3	4.3	
3.1	2	12:29	84.2	100.6	6004	59.5	45.2	34.3	20.7	11.1	3.0	1.5	1.7	1.6	5.9	1.3	1.4	4.4	
3.1	3	12:29	84.2	100.6	0:00	86.7	66	51.2	31.8	17.6	4.7	2.2	2.6	2.5	5.5	1.3	1.4	4.4	
3.1	4	12:29	84.2	100.6	8672	90.0	68.9	53.1	32.8	18.0	4.5	2.2	2.7	2.6	5.6	1.3	1.5	4.2	
3.2	1	12:30	84.2	102.6	5982	27.2	22.4	18.1	12.4	8.4	3.7	2.0	1.5	1.3	4.7	2.2	0.0	9.0	
3.2	2	12:30	84.2	102.6	6015	26.7	22.0	17.8	12.2	8.3	3.8	2.1	1.5	1.3	4.7	2.3	0.0	9.2	
3.2	3	12:30	84.2	102.6	9142	40.9	33.9	27.8	19.4	13.5	6.2	3.3	2.5	2.3	4.4	2.3	0.0	9.1	
3.2	4	12:30	84.2	102.6	9121	41.8	34.8	28.5	20.0	13.9	6.2	3.3	2.5	2.2	4.3	2.3	0.0	8.9	
3.3	1	12:31	82.4	101.9	5927	28.0	22.7	18.6	12.9	8.8	4.0	2.0	1.5	1.3	4.4	2.2	0.0	8.7	
3.3	2	12:31	82.4	101.9	5993	27.7	22.5	18.5	12.9	8.8	4.0	2.1	1.6	1.4	4.4	2.2	0.0	8.9	
3.3	3	12:31	82.4	101.9	8913	42.5	34.8	28.7	20.3	13.9	6.4	3.2	2.5	2.3	4.1	2.2	0.0	8.6	
3.3	4	12:31	82.4	101.9	8935	43.3	35.5	29.3	20.8	14.2	6.4	3.2	2.5	2.3	4.1	2.2	0.0	8.5	
3.4	1	12:32	82.4	102.0	5993	33.4	26.0	21.0	14.0	9.0	3.9	2.3	1.7	1.5	4.5	1.9	0.3	7.5	
3.4	2	12:32	82.4	102.0	6015	32.8	25.5	20.7	13.9	9.0	4.0	2.4	1.7	1.5	4.5	2.0	0.3	7.6	
3.4	3	12:32	82.4	102.0	9011	50.7	39.7	32.3	22.0	14.6	6.3	3.7	2.9	2.6	4.2	2.0	0.4	7.4	
3.4	4	12:32	82.4	102.0	0:00	51.9	41	33.2	22.6	14.7	6.3	3.7	2.8	2.5	4.2	1.9	0.5	7.2	
3.4	1	12:33	82.4	101.5	6037	22.3	18.5	15.5	11.4	8.4	4.3	2.5	1.8	1.5	4.1	2.7	0.0	10.8	
3.4	2	12:33	82.4	101.5	5982	21.8	18.1	15.2	11.3	8.2	4.2	2.4	1.7	1.4	4.2	2.7	0.0	10.9	
3.4	3	12:33	82.4	101.5	9066	33.6	28.1	23.7	17.7	12.9	6.7	3.8	2.8	2.3	4.0	2.8	0.0	10.7	
3.4	4	12:33	82.4	101.5	9077	34.1	28.6	24.1	17.9	13.0	6.7	3.8	2.8	2.4	4.0	2.7	0.0	10.6	
3.4																			END"

Appendix E

Pavement Condition Index Field Exploration and Testing
Distresses Data and Pavement Rating Results Sheet

E.1 FIELD WORK

The pavement surface conditions at the site were evaluated nondestructively using Digital Video Log (DVL) and Pavement Condition Index (PCI). The description of the equipment precedes the photos of Structures in this appendix.

E.2 EQUIPMENT DESCRIPTION

E.2.1 MicroPAVER™ PMS System

MicroPAVER™ -- The Pavement Maintenance Management (PMS) System -- originally was developed in the late 1970s to help the Department of Defense (DOD) manage M&R for its vast inventory of pavements. It uses inspection data and a pavement condition index (PCI™) rating from zero (failed) to 100 (excellent) for consistently describing a pavement's condition and for predicting its M&R needs many years into the future. The PCI™ for airports became an ASTM standard in 1993 (D5340-10). The PCI™ for roads and parking lots became an ASTM standard in 1999 (D6433-09). Figure A1 provides a view of this equipment.

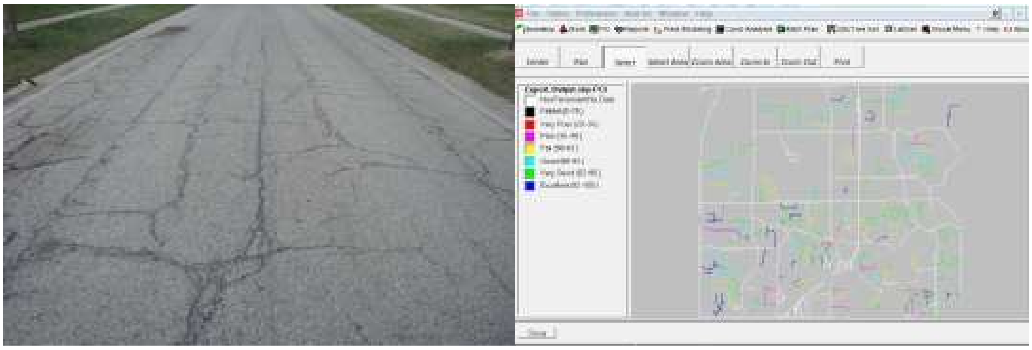

Figure D1 MicroPAVER™ PMS System

External indicators of pavement deterioration caused by loading, environmental factors, construction deficiencies, or a combination thereof. Typical distresses are cracks, rutting, and weathering of the pavement surface. Distress types and severity levels detailed in Inspection Manual must be used to obtain an accurate PCI value.

- A battery operated independent DC-1908E multi-functional digital camera with a SD card is used for easy positioning of the loading plate or of the pavement surface condition at the testing locations.
- Hand Odometer Wheel that reads to the nearest 0.1 ft. (30 mm).
- Straightedge or String Line, (AC only), 10 ft. (3 m).
  Scale, 12 in. (300 mm) that reads to 1⁄8 in. (3 mm) or better. Additional 12-in. (300 mm) ruler or straightedge is needed to measure faulting in PCC pavements.
- Layout Plan, for network to be inspected.

E.2.2 PCI Calibrations

Since the collection of the pavement distress data is such a critical component of any PMS implementation or update, AET has in place the PCI calibration as a quality control.

The PCI raters undergo internal calibrations every two months. This calibration exercise is conducted by our chief inspector and/or quality control engineer and is performed to ensure that the ratings of pavement distresses are consistent among the crews and in accordance with the ASTM D6344-07.

Survey wheel is calibrated by laying out a long distance (> 50 feet) with tape measure.

E.2.3 Linear Distance and Spatial Reference System

Distance measuring instrument (DMI) is a trailer mounted two phase encoder system. When DMI is connected to the HD Camera it provides for automatic display and recording distance information in both English and metric units with a 1 foot (0.3 meters) resolution and four percent accuracy when calibrated using provided procedure in the Field Program.

Spatial reference system is a Trimble ProXRT Global Positioning System (GPS) that consists of fully integrated receiver, antenna and battery unit with Trimble's new H-Star™ technology to provide sub foot (30 cm) post processed accuracy. The External Patch antenna is added to the ProXH receiver for the position of the loading plate. The External Patch antenna can be conveniently elevated with the optional baseball cap to prevent any signal blockage.

E.3 TRAFFIC CONTROL

Traffic control during the PCI data collection operation will be maintained in compliance with Manual on Uniform Traffic Control Devices (MUTCD) and part VI, "Field Manual for Temporary Traffic Control Zone Layouts," as shown in Appendix E. The PCI operation will be mobile in nature and will be moderately disruptive to traffic.

E.4 QUALITY CONTROL (QC) AND QUALITY ASSURANCE (QA)

Beside the daily metal plate calibration, the DMI is also calibrated monthly by driving the vehicle over a known distance to calculate the distance scale factor. The HD video camera will be monitored in real time in the data collection vehicle to minimize data errors. The HD video cameras will be identified with a unique number and that number will accompany all data reported from that unit as required in the QC/QA plan.

Scheduled preventive maintenance ensures proper equipment operation and helps identify potential problems that can be corrected to avoid poor quality or missing data that results if the equipment malfunctions while on site. The routine and major maintenance procedures established by AET are adopted and any maintenance has been done at the end of the day after the testing is complete and become part of the routine performed at the end of each test/travel day and on days when no other work is scheduled.

To insure quality data, the PCI assessments only took place in day light, and data was collected in one lane.

E.5 DATA ANALYSIS METHODS

E.5.1 Data Editing

Field acquisition is seldom so routine that no errors, omissions or data redundancy occur. Data editing encompasses issues such as video editing, video file merging, video log header or background information updates, repositioning and inclusion of elevation information with the video.

E.5.2 Sampling Methods

The sampling rate is set at 10 percent in on lane (OWP) = 500 ft. ± 50 ft. (23.6 m ± 2.4 m) for nominal 12 ft. (3.7 m) wide lanes at a survey speed of approximately 30 mph. Where a divided roadbed exists, surveys will be taken in both directions if the project will include improvements in both directions. If there is more than one lane in one direction the surveys will be taken in the outer driving lane (truck lane) versus the passing lane of the highway.

Basic data processing addresses some of the fundamental manipulations applied to data to make a more acceptable product for initial interpretation and data evaluation. In most instances this type of processing is already applied in real-time to generate the real-time display. The advantage of post survey processing is that the basic processing can be done more systematically and non-causal operators to remove or enhance certain features can be applied.

E.5.3 Advance Processing

Advanced data processing addresses the types of processing which require a certain amount of operator bias to be applied and which will result in data which are significantly different from the raw information which were input to the processing.

E.6 TEST LIMITATIONS

E.6.1 Test Methods

The data derived through the testing program have been used to develop our opinions about the pavement conditions at your site. However, because no testing program can reveal totally what is in the subsurface, conditions between test locations and at other times, may differ from conditions described in this report. The testing we conducted identified pavement conditions only at those areas where we observed pavement surface conditions. Depending on the sampling methods and sampling frequency, every location may not be rated, and some anomalies which are present in the pavement may not be noted on the testing results. If conditions encountered during construction differ from those indicated by our testing, it may be necessary to alter our conclusions and recommendations, or to modify construction procedures, and the cost of construction may be affected.

E.6.2 Test Standards
Pavement testing is done in general conformance with the described procedures. Compliance with any other standards referenced within the specified standard is neither inferred nor implied.

E.7 SUPPORTING TEST METHODS

E.7.1 Falling Weight Deflectometer (FWD)
If the pavement layer moduli and subgrade soil strength are desired the deflection data are collected using a Dynatest 8000 FWD Test System that consists of a Dynatest 8002 trailer and a third-generation control and data acquisition unit developed in 2003, called the Dynatest Compact15, featuring fifteen (15) deflection channels. The new generation FWD, including a Compact15 System and a standard PC with the FwdWin field Program constitutes the newest, most sophisticated Dynatest FWD Test System, which fulfills or exceeds all requirements to meet ASTM-4694 and ASTM D-4695 Standards. The system provides continuous data at pre-set spacing.

E.7.2 Ground Penetrating Radar
If the pavement layer thicknesses are desired the thickness data are collected using a GSSI air-coupled 2 GHz Test System that consists of a bumper-mounted, 2 GHz air-coupled antenna and a SIR-20 control and data acquisition processor, featuring dual channels. The GPR processor, including a SIR-20 data acquisition system, wheel-mounted DMI (Distance Measuring Instrument), and a tough book with the SIR-20 Field Program constitutes the newest, most sophisticated GSSI Test System, which fulfills or exceeds all requirements to meet ASTM-4748 and ASTM D-6087 Standards. The antenna used for Roadscan is the Horn Antenna Model 4105 (2 GHz). The 2 GHz antenna is the current antenna of choice for road survey because it combines excellent resolution with reasonable depth penetration (18-24 inches in pavement materials). The data collection is performed at normal driving speeds (45-55 mph), requiring no lane closures nor causing traffic congestion. At this peed the 2 GHz antenna can collect data at 1-foot interval (1 scan/foot).

E.7.2 Soil Boring/Coring Field Exploration
If both pavement thicknesses and subgrade soil types and conditions are desired the shallow coring/boring and sampling is used. The limited number of coring/boring is necessary to verify the GPR layer thickness data.

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GENERAL INFORMATION: PAVEMENT CONDITION INDEX

Project:	Powell Creek Solar Project	**Date:**	8/10/23
AET Job No.:	P-0025335	**Test Date:**	8/8/23
Road:	CR 13	**Section/Grid:**	S01A
From:	SH 15	**To:**	0.26 Mi S of CR G-12

SUMMARY DISTRESSES

Total Samples	**9**
Sample #	**2**
Sample Size	**6000**
Sample Length	**750**

PCI	**26**

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GENERAL INFORMATION: PAVEMENT CONDITION INDEX

Project:	Powell Creek Solar Project	**Date:**	8/10/23
AET Job No.:	P-0025335	**Test Date:**	8/8/23
Road:	CR 13	**Section/Grid:**	S01A
From:	SH 15	**To:**	0.26 Mi S of CR G-12

SUMMARY DISTRESSES

Total Samples	**9**
Sample #	**2**
Sample Size	**6000**
Sample Length	**750**

PCI	**26**

Distresses	Severity	Value	Distresses	Severity	Value
(1) Alligator	Low	9%	**(11) Patch/Ut Cut**	Low	
	Med	13%		Med	
	High	3%		High	
(2) Bleeding	Low		**(12) Polished Aggregate**	N/A	
	Med				
	High				
(3) Block Cracking	Low	1%	**(13) Pothole**	Low	
	Med			Med	
	High			High	
(4) Bumps/Sags	Low		**(14) RR Crossing**	Low	
	Med			Med	
	High			High	
(5) Corrugations	Low		**(15) Rutting**	Low	
	Med			Med	
	High			High	
(6) Depression	Low		**(16) Shoving**	Low	
	Med			Med	
	High			High	
(7) Edge Cracking	Low	2%	**(17) Slippages Cracking**	Low	
	Med	3%		Med	
	High			High	
(8) Joint Reflection Cracking	Low		**(18) Swell**	Low	
	Med			Med	
	High			High	
(9) Lane Shoulder Drop	Low		**(19) Raveling**	Med	
	Med				
	High			High	
(10) L & T Cracking	Low	4%	**(20) Weathering**	Low	
	Med	1%		Med	100%
	High	1%		High	

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GENERAL INFORMATION: PAVEMENT CONDITION INDEX

Project:	Powell Creek Solar Project	**Date:**	8/10/23
AET Job No.:	P-0025335	**Test Date:**	8/8/23
Road:	CR 13	**Section/Grid:**	S01B
From:	0.26 Mi S of CR G-12	**To:**	CR G-12

SUMMARY DISTRESSES

Total Samples	**4**
Sample #	**1**
Sample Size	**6000**
Sample Length	**750**

PCI	**92**

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St. Paul, Minnesota 55114

Phone: (651) 659-9001

Fax: (651) 659-1379

GENERAL INFORMATION: PAVEMENT CONDITION INDEX

Project:	Powell Creek Solar Project	**Date:**	8/10/23
AET Job No.:	P-0025335	**Test Date:**	8/8/23
Road:	CR 13	**Section/Grid:**	S01B
From:	0.26 Mi S of CR G-12	**To:**	CR G-12

SUMMARY DISTRESSES

Total Samples	**4**
Sample #	**1**
Sample Size	**6000**
Sample Length	**750**

PCI	**92**

Distresses	Severity	Value	Distresses	Severity	Value
(1) Alligator	Low		(11) Patch/Ut Cut	Low	
	Med			Med	
	High			High	
(2) Bleeding	Low		(12) Polished Aggregate	N/A	
	Med				
	High				
(3) Block Cracking	Low		(13) Pothole	Low	
	Med			Med	
	High			High	
(4) Bumps/Sags	Low		(14) RR Crossing	Low	
	Med			Med	
	High			High	
(5) Corrugations	Low		(15) Rutting	Low	
	Med			Med	
	High			High	
(6) Depression	Low		(16) Shoving	Low	
	Med			Med	
	High			High	
(7) Edge Cracking	Low	1%	(17) Slippages Cracking	Low	
	Med			Med	
	High			High	
(8) Joint Reflection Cracking	Low		(18) Swell	Low	
	Med			Med	
	High			High	
(9) Lane Shoulder Drop	Low		(19) Raveling	Med	
	Med				
	High			High	
(10) L & T Cracking	Low		(20) Weathering	Low	100%
	Med			Med	
	High			High	

American Engineering Testing, Inc.
550 Cleveland Avenue North
St. Paul, Minnesota 55114
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Fax: (651) 659-1379

AMERICAN
ENGINEERING TESTING

GENERAL INFORMATION: PAVEMENT CONDITION INDEX

Project: Powell Creek Solar Project
Date: 8/10/23
AET Job No.: P-0025335
Test Date: 8/8/23
Road: CR 13
Section/Grid: S02
From: CR G-12
To: CR G

SUMMARY DISTRESSES

Total Samples	**7**
Sample #	**2**
Sample Size	**6000**
Sample Length	**750**

PCI	**93**

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GENERAL INFORMATION: PAVEMENT CONDITION INDEX

Project:	Powell Creek Solar Project	**Date:**	8/10/23
AET Job No.:	P-0025335	**Test Date:**	8/8/23
Road:	CR 13	**Section/Grid:**	S02
From:	CR G-12	**To:**	CR G

SUMMARY DISTRESSES

Total Samples	**7**
Sample #	**2**
Sample Size	**6000**
Sample Length	**750**

PCI	**93**

Distresses	Severity	Value	Distresses	Severity	Value
(1) Alligator	Low		**(11) Patch/Ut Cut**	Low	
	Med			Med	
	High			High	
(2) Bleeding	Low		**(12) Polished Aggregate**	N/A	
	Med				
	High				
(3) Block Cracking	Low		**(13) Pothole**	Low	
	Med			Med	
	High			High	
(4) Bumps/Sags	Low		**(14) RR Crossing**	Low	
	Med			Med	
	High			High	
(5) Corrugations	Low		**(15) Rutting**	Low	
	Med			Med	
	High			High	
(6) Depression	Low		**(16) Shoving**	Low	
	Med			Med	
	High			High	
(7) Edge Cracking	Low		**(17) Slippages Cracking**	Low	
	Med			Med	
	High			High	
(8) Joint Reflection Cracking	Low		**(18) Swell**	Low	
	Med			Med	
	High			High	
(9) Lane Shoulder Drop	Low		**(19) Raveling**	Med	
	Med				
	High			High	
(10) L & T Cracking	Low		**(20) Weathering**	Low	100%
	Med			Med	
	High			High	

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GENERAL INFORMATION: PAVEMENT CONDITION INDEX

Project:	Powell Creek Solar Project	**Date:**	8/10/23
AET Job No.:	P-0025335	**Test Date:**	8/8/23
Road:	CR 13	**Section/Grid:**	S03
From:	CR G	**To:**	CR F-12

SUMMARY DISTRESSES

Total Samples	**9**
Sample #	**2**
Sample Size	**6000**
Sample Length	**857**

PCI	**22**

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GENERAL INFORMATION: PAVEMENT CONDITION INDEX

Project:	Powell Creek Solar Project	**Date:**	8/10/23
AET Job No.:	P-0025335	**Test Date:**	8/8/23
Road:	CR 13	**Section/Grid:**	S03
From:	CR G	**To:**	CR F-12

SUMMARY DISTRESSES

Total Samples	**9**
Sample #	**2**
Sample Size	**6000**
Sample Length	**857**

PCI	**22**

Distresses	Severity	%	Distresses	Severity	%
(1) Alligator	Low	3%	**(11) Patch/Ut Cut**	Low	9%
	Med	5%		Med	1%
	High			High	7%
(2) Bleeding	Low	30%	**(12) Polished Aggregate**	N/A	
	Med				
	High	2%			
(3) Block Cracking	Low		**(13) Pothole**	Low	
	Med			Med	
	High			High	
(4) Bumps/Sags	Low		**(14) RR Crossing**	Low	
	Med			Med	
	High			High	
(5) Corrugations	Low		**(15) Rutting**	Low	
	Med			Med	
	High			High	
(6) Depression	Low		**(16) Shoving**	Low	
	Med			Med	
	High			High	
(7) Edge Cracking	Low	2%	**(17) Slippages Cracking**	Low	
	Med	6%		Med	
	High	3%		High	
(8) Joint Reflection Cracking	Low		**(18) Swell**	Low	
	Med			Med	
	High			High	
(9) Lane Shoulder Drop	Low		**(19) Raveling**	Med	
	Med				
	High			High	
(10) L & T Cracking	Low	3%	**(20) Weathering**	Low	
	Med	2%		Med	100%
	High			High	

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GENERAL INFORMATION: PAVEMENT CONDITION INDEX

Project:	Powell Creek Solar Project	**Date:**	8/10/23
AET Job No.:	P-0025335	**Test Date:**	8/8/23
Road:	CR 13	**Section/Grid:**	S04
From:	CR F-12	**To:**	SH 613

SUMMARY DISTRESSES

Total Samples	**3**
Sample #	**1**
Sample Size	**6000**
Sample Length	**857**

PCI	**37**

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GENERAL INFORMATION: PAVEMENT CONDITION INDEX

Project: Powell Creek Solar Project
AET Job No.: P-0025335
Road: CR 13
From: CR F-12
Date: 8/10/23
Test Date: 8/8/23
Section/Grid: S04
To: SH 613

SUMMARY DISTRESSES

Total Samples	**3**
Sample #	**1**
Sample Size	**6000**
Sample Length	**857**

PCI	**37**

Distresses	Severity	Value	Distresses	Severity	Value
(1) Alligator	Low	5%	(11) Patch/Ut Cut	Low	19%
	Med			Med	
	High			High	
(2) Bleeding	Low	20%	(12) Polished Aggregate	N/A	
	Med	12%			
	High				
(3) Block Cracking	Low		(13) Pothole	Low	
	Med			Med	
	High			High	
(4) Bumps/Sags	Low		(14) RR Crossing	Low	
	Med			Med	
	High			High	
(5) Corrugations	Low		(15) Rutting	Low	
	Med			Med	
	High			High	
(6) Depression	Low		(16) Shoving	Low	
	Med			Med	
	High			High	
(7) Edge Cracking	Low	2%	(17) Slippages Cracking	Low	
	Med	5%		Med	
	High	3%		High	
(8) Joint Reflection Cracking	Low		(18) Swell	Low	
	Med			Med	
	High			High	
(9) Lane Shoulder Drop	Low	1%	(19) Raveling	Med	
	Med	1%			
	High			High	
(10) L & T Cracking	Low	2%	(20) Weathering	Low	19%
	Med	1%		Med	81%
	High			High	

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GENERAL INFORMATION: PAVEMENT CONDITION INDEX

Project:	Powell Creek Solar Project	**Date:**	8/10/23
AET Job No.:	P-0025335	**Test Date:**	8/8/23
Road:	CR 13	**Section/Grid:**	S05/S06
From:	CTH 613	**To:**	CTH E

SUMMARY DISTRESSES

Total Samples	**12**
Sample #	**2**
Sample Size	**6000**
Sample Length	**857**

PCI	**66**

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GENERAL INFORMATION: PAVEMENT CONDITION INDEX

Project:	Powell Creek Solar Project	**Date:**	8/10/23
AET Job No.:	P-0025335	**Test Date:**	8/8/23
Road:	CR 13	**Section/Grid:**	S05/S06
From:	CTH 613	**To:**	CTH E

SUMMARY DISTRESSES

Total Samples	**12**
Sample #	**2**
Sample Size	**6000**
Sample Length	**857**

PCI	**66**

Distresses			**Distresses**		
(1) Alligator	Low		**(11) Patch/Ut Cut**	Low	
	Med			Med	
	High			High	
(2) Bleeding	Low	30%	**(12) Polished Aggregate**	N/A	
	Med				
	High				
(3) Block Cracking	Low		**(13) Pothole**	Low	
	Med			Med	
	High			High	
(4) Bumps/Sags	Low		**(14) RR Crossing**	Low	
	Med			Med	
	High			High	
(5) Corrugations	Low		**(15) Rutting**	Low	
	Med			Med	
	High			High	
(6) Depression	Low		**(16) Shoving**	Low	
	Med			Med	
	High			High	
(7) Edge Cracking	Low	8%	**(17) Slippages Cracking**	Low	
	Med	6%		Med	
	High			High	
(8) Joint Reflection Cracking	Low		**(18) Swell**	Low	
	Med			Med	
	High			High	
(9) Lane Shoulder Drop	Low		**(19) Raveling**	Med	
	Med				
	High			High	
(10) L & T Cracking	Low	1%	**(20) Weathering**	Low	
	Med			Med	100%
	High			High	

Appendix F

Geotechnical Report Limitations and Guidelines for Use

Appendix F
Geotechnical Report Limitations and Guidelines for Use
Report No. P-0025335A

F.1 REFERENCE

This appendix provides information to help you manage your risks relating to subsurface problems which are caused by construction delays, cost overruns, claims, and disputes. This information was developed and provided by GBA[1], of which, we are a member firm.

F.2 RISK MANAGEMENT INFORMATION

F.2.1 Geotechnical Services are Performed for Specific Purposes, Persons, and Projects

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

F.2.2 Read the Full Report

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

F.2.3 A Geotechnical Engineering Report is Based on A Unique Set of Project-Specific Factors

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

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

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

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

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

F.2.4 Subsurface Conditions Can Change

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

1 Geoprofessional Business Association, 15800 Crabbs Branch Way, Suite 300, Rockville, MD 20855
Telephone: 301/565-2733: www.geoprofessional.org

F.2.5 Most Geotechnical Findings Are Professional Opinions
Site exploration identified subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ, sometimes significantly, from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

F.2.6 A Geotechnical Engineering Report Is Subject to Misinterpretation
Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

F.2.7 Do Not Redraw the Engineer's Logs
Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should never be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, but recognizes that separating logs from the report can elevate risk.

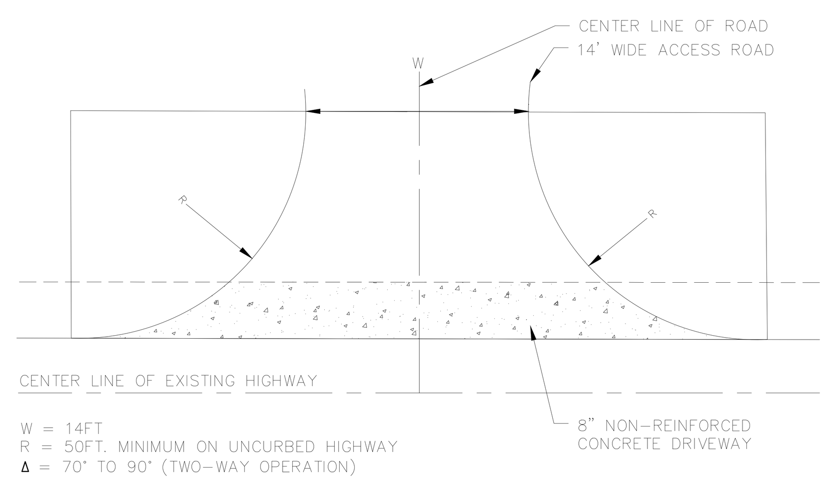
F.2.8 Give Contractors a Complete Report and Guidance
Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, but preface it with a clearly written letter of transmittal. In the letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. Be sure contractors having sufficient time to perform additional study. Only then might you be able to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

F.2.9 Read Responsibility Provisions Closely
Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their report. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. Read these provisions closely. Ask questions. Your geotechnical engineer should respond fully and frankly.

F.2.10 Geoenvironmental Concerns Are Not Covered
The equipment, techniques, and personnel used to perform a geoenvironmental study differ significantly from those used to perform a geotechnical study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. Unanticipated environmental problems have led to numerous project failures. If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. Do not rely on an environmental report prepared for someone else.

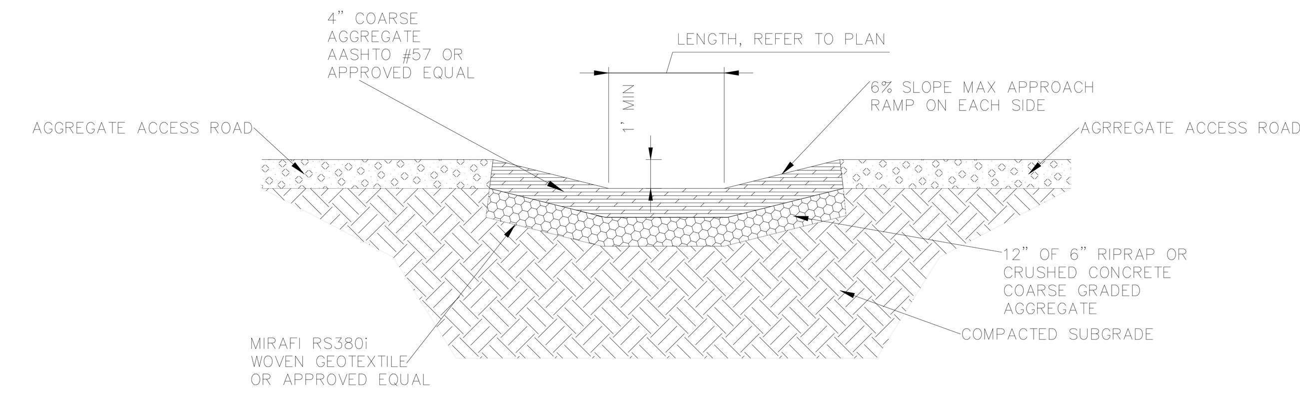
NOTES

ATTACHMENT K



UNCURBED DRIVEWAY ALONG UNCURBED HIGHWAY

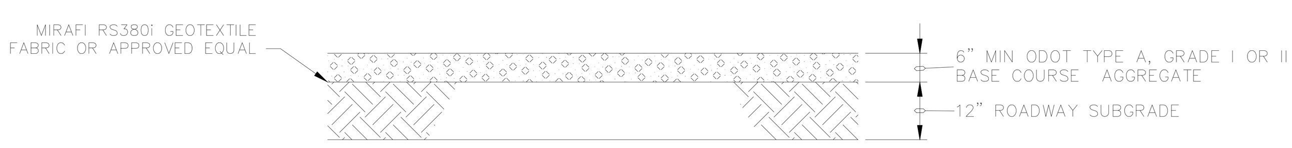
NO SCALE



DETAIL B

TYPICAL LOW WATER CROSSING PROFILE

NO SCALE

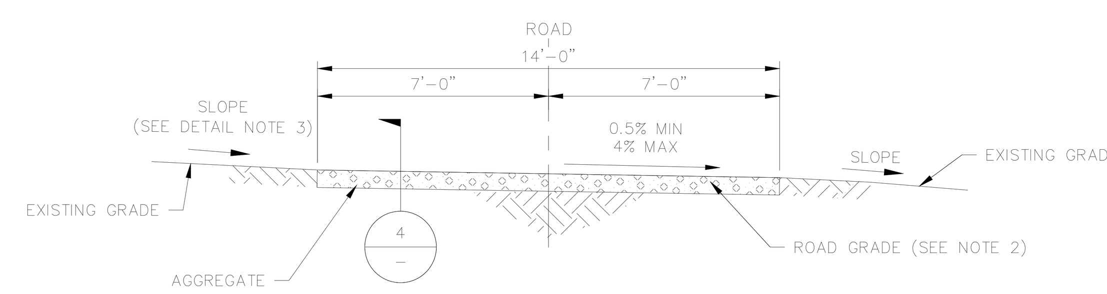


NOTES:
1. ADDITIONAL AGGREGATE MAY NEED ADDED AT THE COMPLETION OF THE PROJECT IF USED FOR CONSTRUCTION ACTIVITIES.
2. ORGANIC MATERIAL SHALL BE REMOVED PRIOR TO SUBGRADE PREPERATION.
3. LEVELING AND COMPACTING OF SUBGRADE MATERIAL AND PLACING AND COMPACTING AGGREGATE SHALL BE COMPLETED AS REQUIRED PER CONSTRUCTION SPECIFICATION 71.0201.

SECTION 4

AGGREGATE ACCESS ROAD

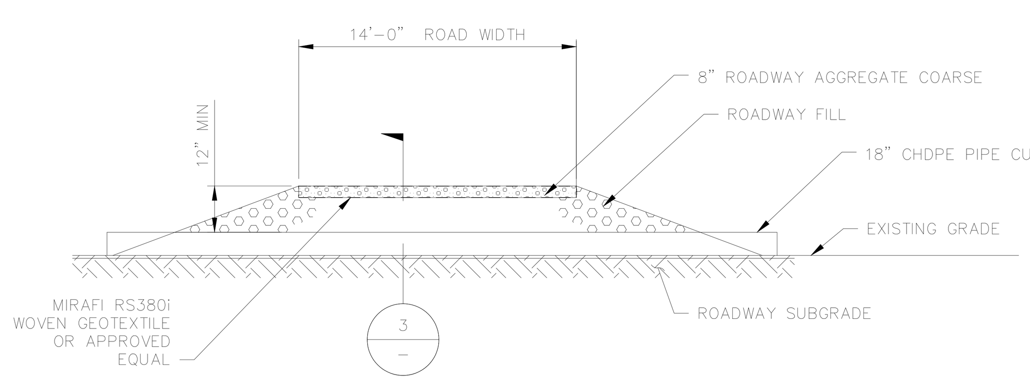
NO SCALE



NOTES:
1. REFER TO ROAD SECTION DETAIL 4 FOR ROAD SURFACE AND SUBGRADE REQUIREMENTS.
2. WHERE NO GRADING IS INDICATED ON THE PLAN DRAWINGS, ROAD GRADE SHALL BE CONSTRUCTED SUCH THAT LINEAR SURFACE LAYER SHALL FOLLOW EXISTING GRADE AS MUCH AS POSSIBLE WITHIN THE LIMITS DEFINED IN THE DETAILS.
3. GRADE FROM THE EDGES OF THE ROAD SHOULD BE SLOPED TO DRAIN TO PRVENT WATER FROM RUNNING PARALLEL TO THE ROADWAY.

TYPICAL CROSS SLOPE ROAD SECTION

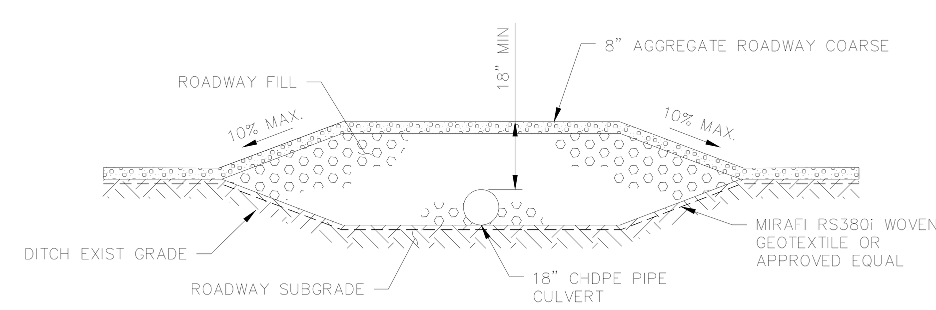
NO SCALE



ROAD CULVERT CROSSING

TYPICAL DETAIL

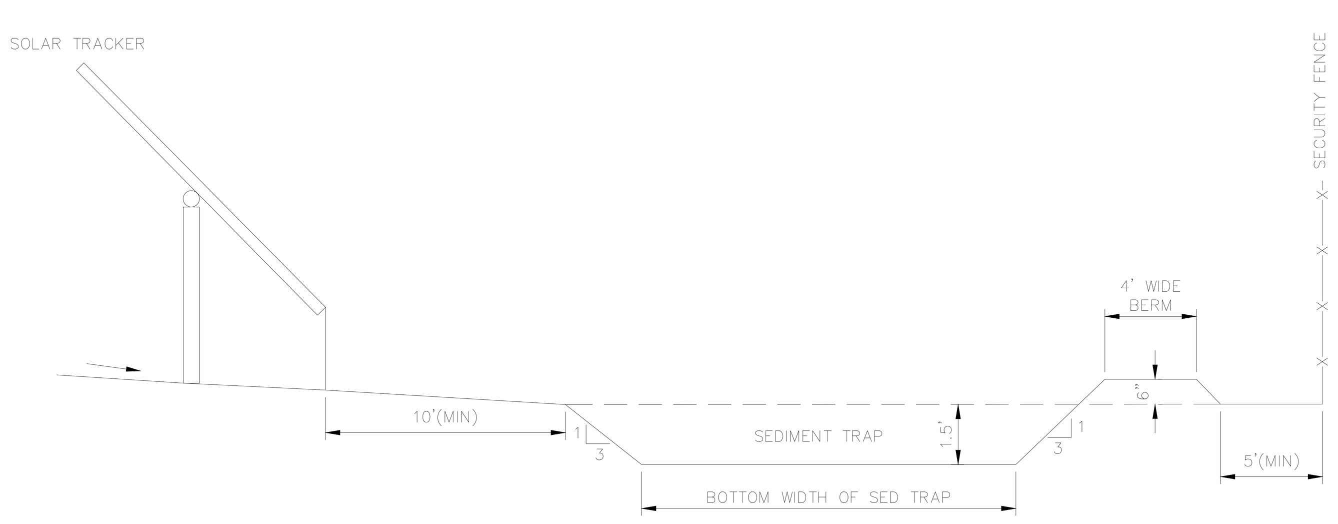
NO SCALE



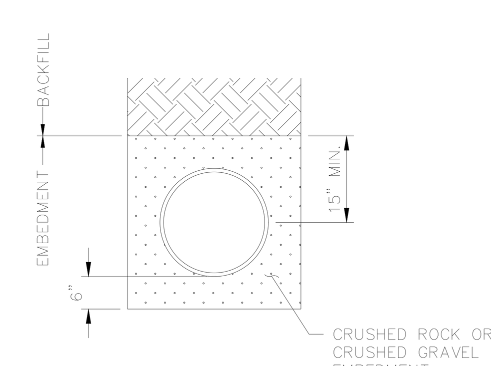
SECTION 3

14'-0" ROAD SECTION AT CULVERT CROSSING

NO SCALE



TYPICAL DETAIL OF SEDIMENT TRAP



TYPICAL PIPE BEDDING DETAIL

NO SCALE

NOT TO BE USED FOR CONSTRUCTION

THE DISTRIBUTION AND USE OF THE NATIVE FORMAT CAD FILE OF THIS DRAWING IS UNCONTROLLED. THE USER SHALL VERIFY TRACEABILITY OF THIS DRAWING TO THE LATEST CONTROLLED VERSION.

NO.	REVISIONS	DATE	BY	CHK	APR	NO.	REVISIONS	DATE	BY	CHK	APR
A	ISSUE FOR IN-HOUSE REVIEW	11/AUG/23	DAN	-	-						

BLACK & VEATCH
11401 LAMAR AVENUE
OVERLAND PARK, KANSAS 66211
OHIO ENGINEERING CREDENTIAL NUMBER COA.01645

I HEREBY CERTIFY THAT THIS DOCUMENT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY REGISTERED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF OHIO

SIGNED -

DATE - REG NO. -

AVANGRID RENEWABLES

ENGINEERING RECORD	DATE
DRAWN: MBN	-
DESIGNED: -	-
CHECKED: -	-
APPROVED: -	-

CADFILE: PCS-C-DS-820-04

POWELL CREEK SOLAR, LLC
POWELL CREEK PV SOLAR PROJECT
POWELL CREEK SOLAR DRIVEWAY
TYP DETAILS AND SECTIONS

SCALE: | DWG NO. PCS-C-DS-820-04 | SHEET 01 | REV. A