ROAD USE AGREEMENT

This Roads Use Agreement ("***Agreement***"), dated as of_________________, 20___, is by and between Ragsdale Solar, LLC ("***Developer***") and Madison County, Mississippi (the "***County***"). Developer and the County are referred to herein, collectively, as the "***Parties***" and, individually, as a "***Party***".

Background

A. Developer desires to pursue the construction of a solar-powered electric generating facility (the "***Project***"), consisting of solar panels and related facilities, including, but not limited to, solar power generation facilities, underground electrical systems, communication systems, transmission lines, switchyards, meteorological stations, access roads, laydown and staging yards, construction and related facilities (collectively, the "***Project Facilities***") for an approximately 100 megawatt development in the County.

B. As part of the construction of the Project, Developer will use a certain County owned and/or maintained road, bridge(s), and right(s)-of way located in the County as shown on **Exhibit A** attached hereto (collectively, the "***Roads***").

C. Developer's use of the Roads, including use by its contractors, subcontractors and suppliers, will include the operation of heavy trucks and other heavy equipment in excess of the weight of vehicles that customarily use the Roads to transport parts, components, facilities, materials, and equipment and to carry out other related activities during the construction of the Project.

D. The County, through its County Engineer and Road Department and pursuant to Mississippi law, controls the roads and certain rights-of-way within the unincorporated areas of the County and may place reasonable restrictions on the use of roads and rights-of-way for the public's health, safety and welfare, including but not limited to weight restrictions and the placement of poles or other structures in the right-of-way.

E. In consideration of the benefits provided to the County by the Project, the County agrees to provide Developer (and its assigns) a right to use the Roads as provided herein.

NOW, THEREFORE, in consideration of the forgoing, the mutual promises contained herein, and other good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, the Parties agree as follows:

Section 1. ***Use of Roads.***

(a) The County hereby grants Developer and its contractors and subcontractors the right to use, improve, upgrade, construct and repair the Roads as more fully set forth herein for the planning, construction, operations and decommissioning phases of its planned Project to transport parts, facilities, materials and equipment and to carry out other activities related thereto (collectively, "***Developer Road Operations***"). Developer Road Operations may include the operation of extremely heavy trucks, cranes and transports on the Roads.

(b) Attached hereto as **Exhibit A** is the map of Roads to be used by Developer (the "***Roads Map***"). If Developer desires to amend or change the Roads to be used by Developer, then the Developer shall submit a revised Roads Map to the Madison County Engineer or his/her designee (together, the "***County Engineer***"), and such map shall be deemed approved if written objection is not delivered by the County Engineer within ten (10) days of submission to the County Engineer. Upon approval or deemed approval, as applicable, the Parties shall amend this Agreement to attach the map as a new **Exhibit A**. If the County Engineer delivers written objection to any proposed amended Roads Map within the time period set forth above, Developer and the County Engineer shall work in good faith to resolve any such objections identified by the County Engineer within ten (10) days of delivery of the County Engineer's notice of objection. In the event the Parties cannot resolve any of the objections within such ten (10) day period, any dispute or disagreement shall be resolved pursuant to the terms of Section 28.

(c) The County hereby grants Developer the right to use the Roads for the purposes of installing below and above ground electric collection, distribution and transmission lines and fiber optics and communication lines and associated poles and infrastructure (collectively, "***Collection Facilities***") within, under and across the public right-of-way in the locations set forth in **Exhibit B-1** attached hereto (the "***Collection Facilities Map***"). In the event Developer desires to revise the Collection Facilities Map, Developer shall submit the proposed revised Collection Facilities Map to the County Engineer, which map shall be deemed approved if written notice of objection is not delivered within ten (10) days after submission to the County Engineer. If written notice of objection is delivered by the County Engineer within such ten (10) day period, the Parties shall work in good faith to resolve any such objections identified by the County Engineer within ten (10) days of delivery of the notice of objection. In the event the Parties cannot resolve any of the objections within such ten (10) day period, any dispute or disagreement shall be resolved pursuant to the terms of Section 28. Upon approval or deemed approval of the revised Collection Facilities Map, the Parties shall amend this Agreement to attach the revised Collection Facilities Map as **Exhibit B-1** hereto. The County agrees that the right to use of the Roads approved by the County Engineer for the Collection Facilities shall be irrevocable, but shall terminate in upon the cessation of operation of the Project and the electrical substation serving the Project. Notwithstanding the foregoing, Developer shall not be required to remove any Collection Facilities from the Roads after cessation of operation of the Project.

(d) The County hereby grants Developer the right to use the Roads for the purposes of installing overhead transmission lines and fiber optics and communication lines, poles and related facilities ("***Transmission Facilities***") within, over and across the public right-of-way in the locations set forth in **Exhibit B-2** attached hereto (the "***Transmission Facilities Map***"). In the event Developer desires to revise the Transmission Facilities Map, Developer shall submit the proposed revised Transmission Facilities Map to the County Engineer, which map shall be deemed approved if written notice of objection is not delivered within ten (10) days after submission to the County Engineer. If written notice of objection is delivered by the County Engineer within such ten (10) day period, the Parties shall work in good faith to resolve any such objections identified by the County Engineer within ten (10) days of delivery of the notice of objection. In the event the Parties cannot resolve any of the objections within such ten (10) day period, any dispute or disagreement shall be resolved pursuant to the terms of Section 28. Upon approval or deemed approval of the revised Transmission Facilities Map, the Parties shall amend this Agreement to attach the revised Transmission Facilities Map as **Exhibit B-2** hereto. The County agrees that the right to use of the Roads for the Transmission Facilities shall be irrevocable, but shall terminate in upon the cessation of operation of the Project and the electrical substation serving the Project.

(e) Collection Facilities and Transmission Facilities are referred to herein, collectively, as the "***Project Road Facilities***". The County agrees that the right to use the area along or across the Roads for poles and lines associated with Project Road Facilities shall be irrevocable. If, from time to time, the County should determine, in its sole discretion, that it will widen a Road within the existing right of way, it shall provide notice to Developer. Upon notice from County, Developer shall, at Developer's sole cost, as soon as reasonably possible, relocate any of the above ground Project Road Facilities (including poles and above ground lines) and/or underground Project Road Facilities installed pursuant to this Agreement to the extent necessary for the widening.

Section 2. ***Health, Safety, Security, and Environment.***

(a) Vehicles driven by Developer's employees, contractors and subcontractors will abide by local, state, and federal speed limit guidelines.

(b) In compliance with the then-current Mississippi Manual on Uniform Traffic Control Devices, certain safety signs (as determined by the County Engineer in his/her reasonable discretion) ("***Safety Signs***") will be put up by Developer at all times within a reasonable distance of current construction activities when Developer's crews are working on the Roads.

(c) The County acknowledges that track mounted equipment, including cranes, may be used on the Roads and for crossing the Roads.

Section 3. ***Communication and Local Traffic Coordination***. Developer will appoint a designated person to coordinate the following functions during construction of the Project Facilities (the "***Transportation Coordinator***"):

(a) In order to facilitate communication between the Developer, and its contractors and subcontractors, and the County, the Transportation Coordinator shall meet, at least weekly, with the County Engineer to discuss planned work for the upcoming week ahead, as well as any issues regarding work done during the previous week. This meeting shall primarily be for information sharing purposes and to facilitate the fulfillment of the requirements in Section 3(c) and 3(d) below. Should weekly meetings not be mutually desired by the County Engineer and the Transportation Coordinator, they may arrange a mutually agreeable alternative method of sharing information related to the Project. The Transportation Coordinator shall provide information and updates as necessary to the County Engineer.

(b) If there is a road closure or limited access to a Road, the Transportation Coordinator shall notify the County Engineer by email or telephone (in increasing order of preference) at least one (1) business days prior to the road closure or limited access event. In the event it is necessary for Developer to perform an emergency road closure, the Transportation Coordinator shall notify the County Engineer as soon as such a need is identified. Any road closure or limited access to a Road shall be approved in advance by the County Engineer, which approval shall not be unreasonably withheld, with the understanding that road closures will be likely and that the Developer shall be responsible for providing timely notice thereof as provided for in this paragraph. The County Engineer, in his/her reasonable discretion, may provide notice of such road closures to local residents and local authorities including but not limited to emergency medical services, fire and rescue, police, and schools.

(c) The County Engineer, Developer and its contractors and subcontractors will monitor the Roads during the construction of the Project Facilities for any road safety issues, road damage during construction that need immediate repairs, safety signs needing replacement, or other activity requiring actions to alleviate transportation restrictions on county roads. The County Engineer will communicate to the Transportation Coordinator any road safety issues, road damages during construction that need immediate repairs, safety signs needing replacement, or other activity that needs to be resolved by Developer, its contractors and subcontractors and follow-up activities will be monitored by Developer.

(d) The County Engineer will communicate any necessary issues associated with this Agreement with the Transportation Coordinator. Transportation Coordinator will work with the County Engineer to reach agreement on how to cure issues in a timely manner.

Section 4. ***Establishing Roads Pre-Construction Condition.*** Prior to "***Commencement of Construction***" (defined as the earlier of the first steel pile driven or the commencement of construction of access to and within the Project), at the expense of Developer, Developer shall have a third-party engineer create a detailed video visual record and summary textual narrative of the pre-existing condition of the Roads covered under this Agreement (the "***Road Condition Report***") that is reasonably acceptable to the County Engineer. Developer shall deliver a copy of the Road Condition Report to the County Engineer within sixty (60) days of its issuance. If the County Engineer does not give written notice of any objection to the completeness and accuracy of the Road Condition Report within ten (10) business days after receipt, the Road Condition Report shall be deemed accepted by the County Engineer. If written notice of objection is delivered by the County Engineer within such ten (10) day period, the Parties shall work in good faith to resolve any such objections within ten (10) days of delivery of the notice of objection. In the event the Parties cannot resolve any of the objections within such ten (10) day period, any dispute or disagreement shall be resolved pursuant to the terms of Section 28. In connection with the Road Condition Report, Developer shall have the right, but not the obligation, to bore and take core samples of the Roads and perform other testing as deemed appropriate by the Developer for the purposes of determining the Road condition and composition and shall repair any damage caused by such boring activities.

Section 5. ***Transportation Permits***. No over-weight or over-size permits will be required from the County for use of the Roads identified on **Exhibit A** by Developer or its contractors or subcontractors.

Section 6. ***Driveways.*** Developer may install driveways or entrances from the Roads, including areas necessary for turning radii (each, a "***Driveway Entrance***" and collectively, the "***Driveway Entrances***") as shown on **Exhibit B-3** (attached hereto) (the "***Driveway Entrances Map***"), subject to the following:

(a) All expenses for the construction of the Driveway Entrances will be the responsibility of Developer.

(b) Each Driveway Entrance shall be constructed as may be necessary to maintain proper drainage of the Roads, the right-of-way, and other adjoining property located outside the right-of-ways, including the installation of a culvert pipe upon reasonable request of the County Engineer.

(c) Developer shall have the right to re-install any Driveway Entrances at any time during the construction, operation, maintenance and decommissioning of the Project.

(d) Developer shall have the right to install temporary drainage facilities as needed during the construction, operation, maintenance and decommissioning of the Project.

If Developer desires to amend the Driveway Entrances Map, Developer shall submit the proposed revised Driveway Entrances Map to the County Engineer. If the County Engineer does not deliver written objection to the proposed revised Driveway Entrances Map within ten (10) days of submission by Developer, then such map shall be deemed approved by the County Engineer and the Developer and the County shall amend this Agreement to attach the revised Driveway Entrances Map as **Exhibit B-3** hereto. If the County Engineer delivers written objection of the proposed revised Driveway Entrances Map within ten (10) days of submission by Developer, then Developer and the County Engineer shall work in good faith to resolve any such objections within ten (10) days of delivery of the County Engineer's notice of objection. In the event the Parties cannot resolve any of the objections within such ten (10) day period, any dispute or disagreement shall be resolved pursuant to the terms of Section 28.

Section 7. ***Upgrade Plan; Improvements; Turning Radii; Backfill; Eminent Domain.***

(a) If following Commencement of Construction, Developer decides it would be prudent to upgrade the Roads, Developer shall prepare and submit a Road Upgrade Plan (the "***Upgrade Plan***") to the County Engineer. If approved by the County, such Upgrade Plan shall be attached hereto as **Exhibit C**. The Upgrade Plan shall include the planned road and intersection upgrades (if any) for each section of the Roads to be used by Developer (including the proposed upgraded width and aggregate to be added). The Upgrade Plan shall only include such portion of the Roads as are used by Developer, its agents, employees and contractors and shall not apply to any portion of the Roads not actually used by Developer, its agents, employees and contractors.

(b) Improvements to existing intersections or additions of intersections along the Roads may be completed by Developer in Developer's reasonable discretion so long as such improvements or additions are completed in accordance with the County's regulations and ordinances.

(c) Separate permits or agreements from the County Engineer for wide-outs, turning radii, and improved corners of existing intersections are not required.

(d) The Parties acknowledge that the Developer shall address crop damage with landowners pursuant to the terms of their applicable lease or other agreement.

(e) After the installation of the Project Road Facilities is complete, Developer shall back-fill any trenches or holes (including as may be subsequently required to address any effects of settling), remove excess dirt, materials, and debris, and reseed disturbed areas along the Roads.

(f) Upon completion of construction of the Project Facilities, any wide-outs, turning radii, improved corners of existing intersections, and temporary drainage facilities installed by Developer shall be removed unless the County Engineer specifically requests, in writing, that such improvements remain, or for turning radii located on private property, the applicable landowner requests that the turning radii remain.

(g) Nothing in this Agreement shall be construed as requiring County to exercise the power of eminent domain to acquire any right-of-way that Developer may need or desire.

<u>Section 8.</u> ***Road Crossings.***

(a) <u>Underground Crossings</u>. Any underground Project Road Facilities installed pursuant to Section 1(c) or Section 1(d), shall be subject to the following:

(i) Developer will bore under paved roads, and all boring pits and ditch excavation will be backfilled, compacted and raked to return it to conditions similar to those prior to commencement of work.

(ii) Each boring or cut across a Road will be identified by general location and also by centerline coordinate, and upon the completion of construction, Developer will provide an as-built location.

(b) <u>Overhead Crossings</u>. Developer may install overhead transmission lines across the Roads as shown on **<u>Exhibit B-2</u>**, subject to the overhead crossing transmission lines being designed in and installed in accordance with National Electric Safety Code ("***<u>NESC</u>***") governing the clearance requirements above the roadway.

(c) Transmission Line Poles and Lines Within County Road Rights of Way (Longitudinal Occupation). As set out in Section 1, Developer may install overhead transmission poles and underground transmission lines within the right of way of certain Roads as shown on **Exhibit B-2** attached hereto (when available), subject to the following:

i. Overhead transmission lines will be designed in accordance with NESC governing the clearance requirements above the roadway.

ii. Overhead transmission line poles, if permitted under the NESC, will be situated on the "back side of the side ditch" away from the roadway and as close to the edge of the Road right-of-way as is practicable in accordance with County ordinances. Wires suspended from such poles may occupy the airspace near or above the roadway surface.

iii. If transmission line poles are already situated within a County Road right-of-way where Developer intends to locate its poles, Developer may arrange with the owner of the transmission line for co-location, including replacement, repairs and upgrades to the poles.

Section 9. ***Repairing Roads and Sign Damage; Dust Control.***

(a) During construction of the Project Facilities, Developer is responsible at its expense for repairing the Roads, and Safety Signs as necessary, to the extent of damage caused by Developer. With respect to the Roads and Safety Signs, such repairs will be completed in a manner to ensure the continued safe passage of the public and Developer vehicles, while construction is ongoing. At the end of each day, Developer shall check for damage to the Roads that were used that day. In the event that the damage imposes a danger to the safety of the public or traffic (i.e. damaged or removed Safety Signs), the repair and appropriate safety measures will commence and completed as soon as possible.

(b) During construction of the Project Facilities, Developer is responsible at its expense for dust control on gravel roads using commercially reasonable measures such as water or a dust palliative. The County Engineer may request that dust control be applied, in which instance the measure shall be applied within five (5) days. Upon expiration of the five (5) day cure period, the County may, without additional notice to Developer, apply the dust control at Developer's expense.

(c) If the necessary repair is not promptly undertaken by Developer within the timeframe required by this Agreement, the County may initiate the necessary repair under the terms of this Section 9 and Developer shall reimburse the County for the reasonable costs of such repairs.

Section 10. ***Post-Construction Restoration.*** Developer shall promptly notify the County upon the completion of construction activities at the project site (the "***Notice of Final Completion of Construction***") or, at Developer's sole option, upon the completion of construction activities at portions of the project site (the "***Notice of Completion of Construction***"). Developer or County, at Developer's election in Developer's sole discretion, shall maintain and restore the Roads to at least their pre-construction condition as established in the Road Condition Report and/or based on the specifications set out in the Upgrade Plan, if applicable. In the event the Parties disagree as to the restored condition of the Roads, the Parties will engage a third-party engineer to prepare a post construction Road Condition Report analyzing the restored conditions. The third-party engineer's analysis will determine whether Developer must further restore the Roads to bring them back to the preconstruction condition as established in the original Road Condition Report. Upon completion of the restoration work, as mutually agreed upon by the Parties or the third-party engineer, as the case may be, the Performance Bond (as defined below) shall be extinguished and shall be of no further effect; and the County shall return to Developer any original instrument (or the cash deposit) evidencing such Performance Bond. Thereafter, the County is fully responsible for all costs and expenses required to maintain, restore, and repair any damage to the Roads.

Section 11. ***Performance Bond.*** Within forty-five (45) days of the execution of the Agreement, Developer shall secure and provide to the County, for the benefit of the County, a performance bond in the amount of Fifty Thousand Dollars ($50,000.00) (the "***Performance Bond***"). The Performance Bond shall be in the form reasonably acceptable to the County as attached hereto as **Exhibit D**; provided, however, in lieu of the Performance Bond, Developer may provide a guaranty in a form satisfactory to the County.

Section 12. ***Miscellaneous.*** Any material changes in the use of Roads must be approved by the County Engineer, in his or her sole discretion, and will be subject to the terms of this Agreement.

Section 13. ***Assignment.***

(a) This Agreement shall (i) remain in full force and effect until the expiration or termination hereof; and (ii) be binding upon and inure to the benefit of the respective successors and assigns of the Parties.

(b) Developer may, without the consent of the County or the County Engineer, assign, collaterally assign or transfer this Agreement or any or all of its rights, interests, and obligations under this Agreement at any time, and/or encumber, hypothecate, mortgage or pledge as security for the repayment of any indebtedness.

(c) Any assignment pursuant to this Section shall be subject to the assignee agreeing in writing to be bound by the terms of this Agreement.

Section 14. ***Notices.*** All notices, claims, certificates, requests, demands and other communications hereunder shall be (a) in writing, (b) deemed given (i) when personally delivered to the recipient, (ii) five (5) days after deposit in the United States mail, certified and postage prepaid or (iii) one (1) day after delivery to a reputable overnight courier (provided receipt is obtained and charges prepaid by the delivering Party) and (c) addressed as follows:

If to the County:

Madison County, Mississippi
125 W North Street
Canton, Mississippi 39046
Attention: Greg Higginbotham

With a copy to:

____
____
____

If to Company:

By FedEx, UPS, courier and personal delivery:

Ragsdale Solar, LLC
c/o EDP Renewables North America LLC
1501 McKinney Street, Suite 1300
Houston, Texas 77010
Attention: Chief Legal Officer

By U.S. Postal Service:

Ragsdale Solar, LLC
c/o EDP Renewables North America LLC
P.O. Box 3827
Houston, Texas 77253
Attention: Chief Legal Officer

Section 15. ***Force Majeure Event.*** Whenever performance is required of a Party hereunder, such Party shall use all diligence and take all necessary measures in good faith to perform; provided, however, that if a Party's performance of its obligations under this Agreement is prevented, delayed, or otherwise impaired at any time due to any of the following causes, then the time for performance as herein specified shall be appropriately extended by the time of the delay actually caused by such circumstances: acts of God, extreme weather, war, civil commotion, riots, or damage to work in progress by reason of fire or other casualty, strikes, lock outs or other labor disputes; delays in transportation; inability to secure labor or materials in the open market; war, terrorism, sabotage, civil strife or other violence; the effect of any law, proclamation, action, demand or requirement of any government agency; or litigation contesting all or any portion of the right, title and interest of Developer or the County under this Agreement. If either Party experiences, or anticipates that it will experience, an event that, pursuant to this Section 15, shall extend the time of performance by such Party of any obligation under this Agreement, then such Party shall provide prompt written notice to the other Party of the nature and the anticipated length of such delay.

Section 16. ***Governing Law and Venue.*** This Agreement shall be governed by, and construed in accordance with, the laws of the State of Mississippi, without regard to the conflict of laws provisions in such state. Any disputes arising under this Agreement between the Parties shall be decided by a court of competent jurisdiction in Madison County, Mississippi.

Section 17. ***Amendments and Integration.*** This Agreement (including Exhibits) shall constitute the complete and entire agreement between the Parties with respect to the subject matter hereof. No prior statement or agreement, oral or written, shall vary or modify the written terms hereof. Except as set forth in this Agreement, this Agreement may be amended only by a written agreement signed by the Parties. Any amendments to the Exhibits shall be subject to the approval of the Developer and the County or its designee, which approval will not be unreasonably withheld, delayed or conditioned, with the Parties recognizing that time is of the essence.

Section 18. ***Exercise of Rights and Waiver.*** The failure of a Party to exercise any right under this Agreement shall not, unless otherwise provided or agreed to in writing, be deemed a waiver thereof; nor shall a waiver by a Party of any provisions hereof be deemed a waiver of any future compliance therewith, and such provisions shall remain in full force and effect.

Section 19. ***Independent Contractor, Relation of the Parties.*** The status of Developer under this Agreement shall be that of an independent contractor and not that of an agent, and in accordance with such status, Developer and its officers, agents, employees, and representatives shall at all times during the term of this Agreement conduct themselves in a manner consistent with such status and by reason of this Agreement shall neither hold themselves out as, nor claim to be acting in the capacity of, officers, employees, agents, or representatives of the County.

Section 20. ***Severability.*** In the event that any clause, provision or remedy in this Agreement shall, for any reason, be deemed invalid or unenforceable, the remaining clauses and provisions shall not be affected, impaired or invalidated and shall remain in full force and effect.

Section 21. ***Headings and Construction.*** The section headings in this Agreement are inserted for convenience of reference only and shall in no way effect, modify, define, or be used in construing the text of the Agreement. Where the context requires, all singular words in the Agreement shall be construed to include their plural and all words of neuter gender shall be construed to include the masculine and feminine forms of such words. Notwithstanding the fact that this Agreement may have been prepared by one of the Parties, the Parties confirm that they and their respective counsel have reviewed, negotiated and adopted this Agreement as the joint agreement and understanding of the Parties. This Agreement is to be construed as a whole and any presumption that ambiguities are to be resolved against the primary drafting Party shall not apply. All Exhibits referenced in this Agreement are incorporated in and form a part of this Agreement.

Section 22. ***Counterparts.*** This Agreement may be executed in counterparts, each of which shall be deemed an original, but all of which together shall constitute one and the same agreement.

Section 23. ***No Third-Party Beneficiary.*** No provisions of this Agreement shall in any way inure to the benefit of any person or third party so as to constitute any such person or third party as a third-party beneficiary under this Agreement, or of any one or more of the terms of this Agreement or otherwise give rise to any cause of action in any person not a Party hereto.

Section 24. ***Confidentiality***.

All data and information acquired by the County from Developer (or its affiliates, representatives, agents or contractors) in connection with the performance by Developer of its obligations hereunder, including information regarding the Project, shall be confidential and will not be disclosed by the County to any third party, and upon request of Developer will be returned thereto, except that the County will not be obligated to return any such information contained in documents generated by the County that are stored electronically by the County. With respect to any such retained electronically stored confidential information, the County will continue to comply with the obligations of this Section 24.

Notwithstanding the foregoing, the Parties acknowledge and agree that such confidential information may be disclosed to third parties as may be necessary for Developer and the County to perform their respective obligations under this Agreement and as may be required by law. This provision will not prevent the County from providing any confidential information if required to do so in response to a request under the Mississippi Access to Public Records Act; provided, that if feasible, the County will give prior notice to Developer of such disclosure if required by law. The Parties acknowledge that the County will be required to provide copies of this Agreement in response to a request under the Mississippi Access to Public Records Act.

Section 25. ***Extraordinary Events.***

The Parties acknowledge that during the expected life of the Project, circumstances may arise under which it will be necessary or advisable for Developer to replace major solar panel components or make repairs to panels beyond ordinary maintenance ("***Extraordinary Events***"), and that transportation of major solar panel components on overweight or oversize vehicles on or across the Roads may be necessary. The Parties agree that it is impossible to predict the timing, nature, or extent to which the Roads may be damaged beyond the normal amount of wear and tear by such transportation. The Parties agree that at any time during the life of Project, when Developer determines Extraordinary Events reasonably, during any sixty (60) day period, require activities which will involve more than ten (10) movements of overweight or oversize vehicles on the Roads, Developer will give advance written notice of the intended movements to the County Engineer for his/her approval, such approval not to be unreasonably withheld. Upon such approval, Developer agrees to reasonably coordinate such activities in substantially the same manner provided for in this Agreement. Based on the extent of the movements required as a result of Extraordinary Events, the Developer may be required to provide additional Financial Assurance, in such amount as is reasonably agreed to by the County Engineer and Developer.

Section 26. ***Indemnity.*** Developer shall indemnify, defend, and hold the County harmless for any and all claims, demands, suits, actions, proceedings, or causes of actions brought against the County, its officers, Board of Commissioners, affiliates, and employees and permitted assignees of any of the foregoing for any judgments, liabilities, obligations, fines, penalties, or expenses, including reasonable attorneys' fees and expenditures pertaining to third party personal injury or property damage ("***Losses***"), but only to the extent that such Losses arise directly from the acts of Developer in the course of performance by Developer under or in relation to or connection with this Agreement and excluding such Losses to the extent caused by the negligence of the County. The indemnity by Developer expressly excludes and the County waives, any indemnity for any claims, demands, suits, actions, proceedings and causes of action related to any Road Repairs performed by the County.

Section 27. ***Limitation on Damages.*** The Parties waive all claims against each other (and against each other's parent company and affiliates and their respective members, shareholders, officers, directors, and employees) for any consequential, incidental, indirect, special, exemplary or punitive damages (including loss of actual or anticipated profits, revenues or product loss by reason of shutdown or non-operation; increased expense of operation, borrowing or financing; loss of use or productivity; or increased cost of capital); and, regardless of whether any such claim arises out of breach of contract or warranty, tort, product liability, indemnity (other than the indemnity obligations of Developer as set forth in Section 26 with respect to Losses that arise from personal injury to third persons), contribution, strict liability or any other legal theory.

Section 28. ***Disputes***. If Developer and the County Engineer disagree as to the condition of the Roads, the Road Repairs or the completion of the Road Repairs and the Developer and the County Engineer are unable after a good faith attempt to resolve the dispute as set forth above, then the Parties shall retain within thirty (30) days a mutually agreed upon neutral third-party licensed engineer or licensed structural engineer, as applicable, to resolve the dispute. If the Parties cannot agree upon the neutral third party, each Party shall select a neutral third party and such neutral third parties shall in turn select a third neutral third party and such neutral third party shall make the determination. The determination of the neutral third party shall be binding upon the Parties. The costs of the neutral third parties will be paid equally by the Parties. If Developer and County Engineer cannot agree upon any amendment to the Roads Map, the Collection Facilities Map, the Transmission Facilities Map or the Driveway Entrances Map within the applicable ten (10) day period, then the County Engineer shall choose an independent third party to make a determination as to the requested amendment who shall make a recommendation which shall be binding on the County Engineer. Developer shall have the right to either accept the recommendation of the independent third party or shall have the right to withdraw the proposed amendment.

[*Signatures and Exhibits on Following Pages*]

IN WITNESS WHEREOF, each party hereto has caused its duly authorized representative to sign this Agreement on its behalf as of the date first set forth above.

"**COUNTY**"
Madison County, Mississippi

By:
____
Name: ______________________________
Title: _______________________________

"**DEVELOPER**"
Ragsdale Solar, LLC

By: _________________________________
Name: ______________________________
Title: _______________________________

LE_5/230146

List of Exhibits:

Exhibit A – Roads Map

Exhibit B-1 – Collection Facilities Map

Exhibit B-2 – Transmission Facilities Map

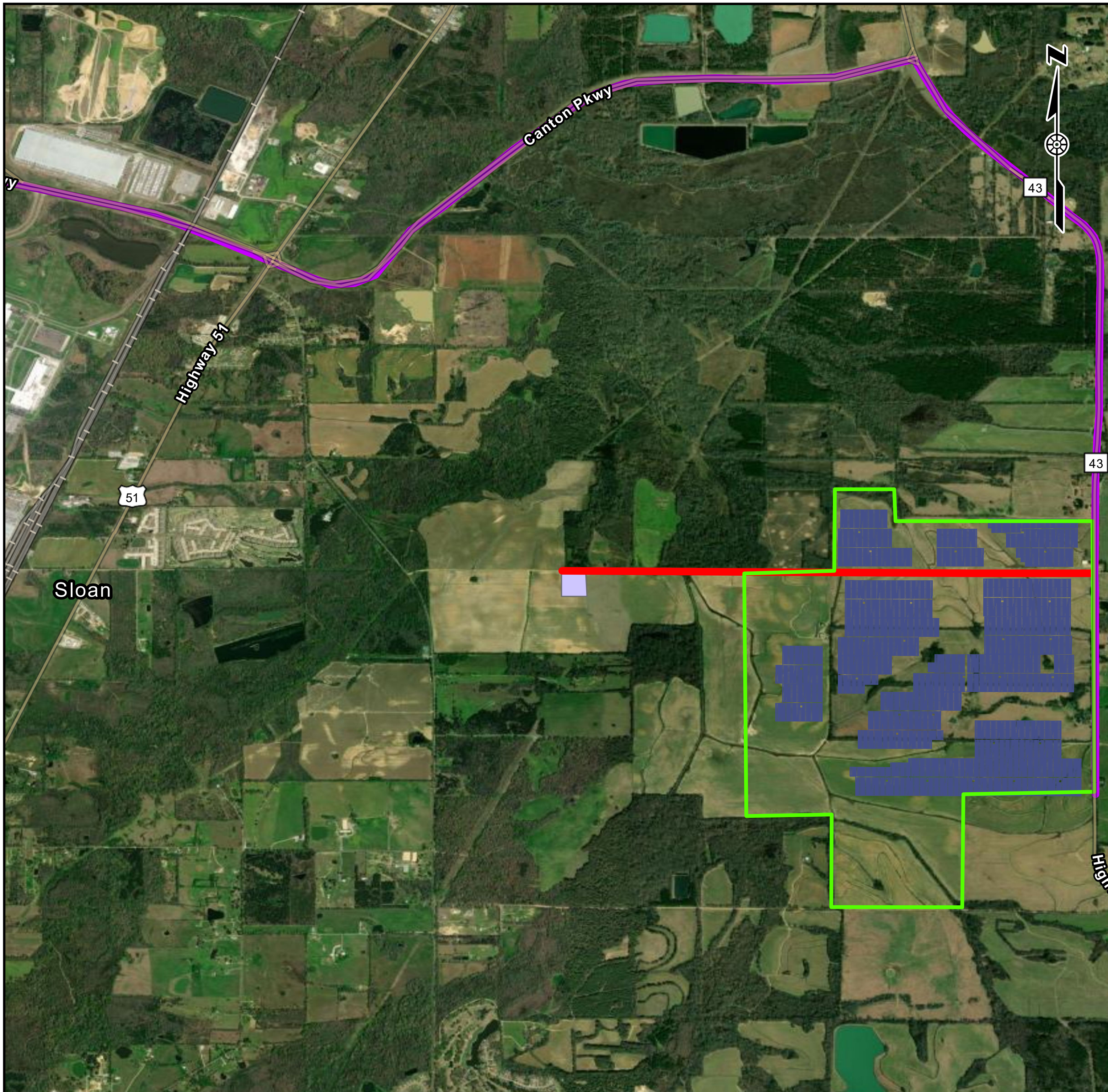
Exhibit B-3 – Driveway Entrances Map

Exhibit C – Upgrade Plan

Exhibit D – Performance Bond

<u>EXHIBIT A</u>

ROADS MAP



edp Renewables

Exhibit A Roads Map

Date: 10/4/2023

Legend

- Project Area
- Panel Infrastructure
- County Road (Endris Road)
- State Routes
- Substation

EXHIBIT B-1

COLLECTION FACILITIES MAP

[*To be attached, if applicable*]

edp Renewables

Exhibit B-1 Collection Facilities

Date: 10/4/2023

0 0.03 0.06 0.11 Miles

Legend

- Roads
- Panel Infrastructure
- O&M
- MV Homerun 1
- MV Homerun 3

EXHIBIT B-2

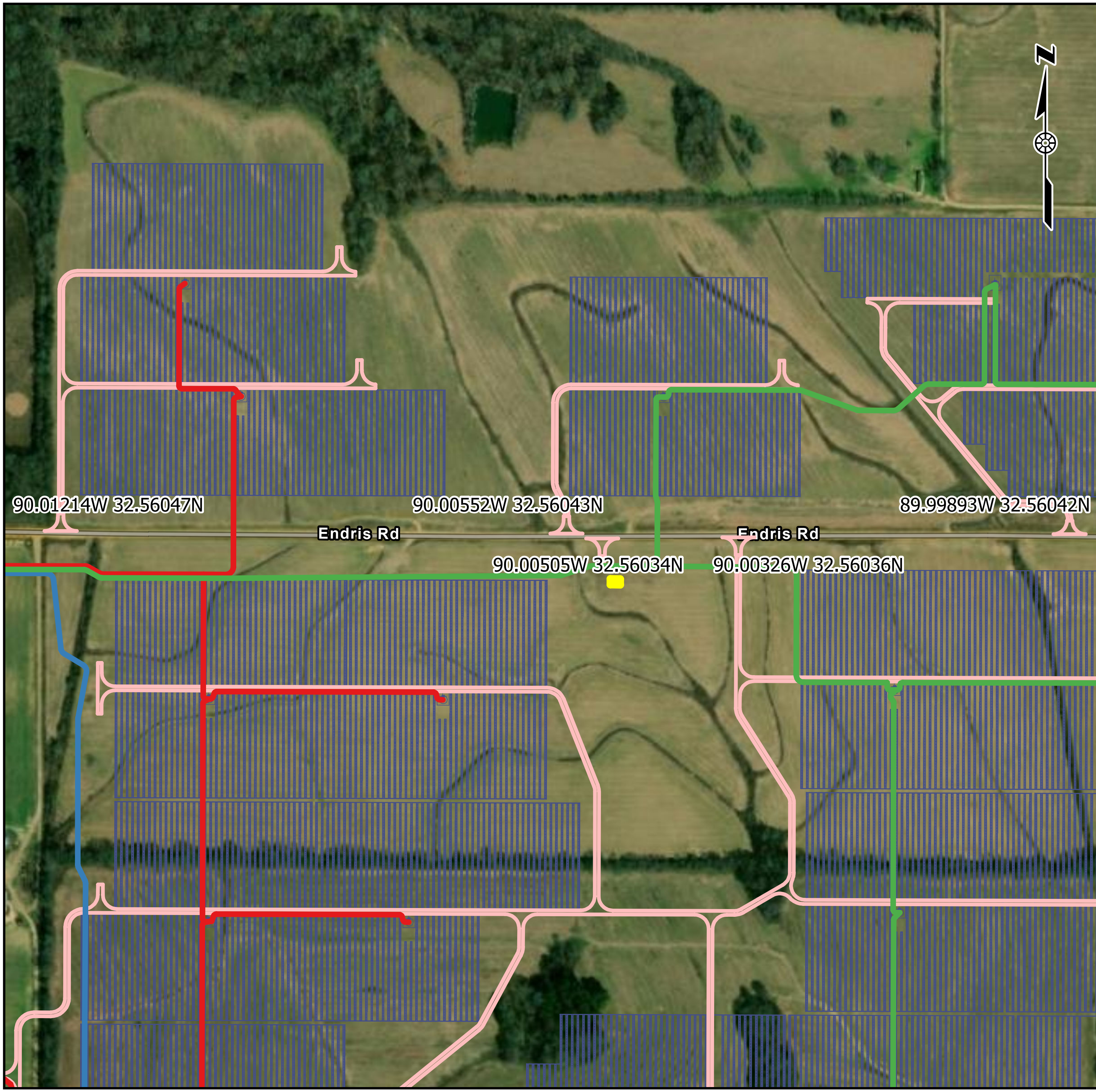
TRANSMISSION FACILITIES MAP

[*To be attached, if applicable*]

EXHIBIT B-3

DRIVEWAY ENTRANCES MAP

[*To be attached, if applicable*]



edp Renewables

Exhibit B-3 Driveway Entrances

Date: 10/4/2023

0 0.05 0.1 0.2 Miles

Legend

- MV Homerun 1
- MV Homerun 2
- MV Homerun 3
- Roads
- Panel Infrastructure
- O&M

<u>EXHIBIT C</u>

UPGRADE PLAN

[*To be attached, if applicable*]

EXHIBIT D

FORM OF PERFORMANCE BOND

AMERICAN
ENGINEERING TESTING

PRE-CONSTRUCTION SURFACE CONDITION OF ROADS

Ragsdale Solar Project
Madison County, Mississippi

AET Report No. P-0010936A

Date:
June 24, 2022

Prepared for:

EDP Renewables North America LLC
1501 McKinney Street, Suite 1300
Houston, TX 77010

Geotechnical • Materials
Forensic • Environmental
Building Technology
Petrography/Chemistry

American Engineering Testing
550 Cleveland Avenue North
St. Paul, MN 55114-1804
TeamAET.com • 800.792.6364

June 24, 2022

EDP Renewables North America LLC
1501 McKinney Street, Suite 1300
Houston, TX 77010

Attn: Mr. Jeremy Kight

RE: Report of Pre-construction Surface Condition of Roads
Ragsdale Solar Project
Madison County, Mississippi
AET Project No. P-0010936

Dear Mr. Kight:

This report presents the results of the road condition surveys that AET performed on the proposed haul roads for the pre-construction phase of the Ragsdale Solar Project in Madison County, Mississippi.

Per your request, we are submitting this report to you electronically.

Please contact me if you have any questions about this report.

Sincerely,
American Engineering Testing, Inc.

Chunhua Han, Ph.D.
Principal Engineer, Pavement Division
E-mail: chan@teamaet.com
Phone: (651) 603-6631, Fax: (651) 659-1347

AMERICAN ENGINEERING TESTING

SIGNATURE PAGE

Prepared for

EDP Renewables North America LLC
1501 McKinney Street, Suite 1300
Houston, TX 77010

Attn: Mr. Jeremy Kight

Prepared by

American Engineering Testing, Inc.
550 Cleveland Avenue North
St. Paul, MN 55114
(651) 659-9001

Project Manager

Chunhua Han, Ph.D.
Principal Engineer

Report Reviewer

DEREK TOMPKINS
LICENSED PROFESSIONAL
6/24/22
ENGINEER
31760
STATE OF MISSISSIPPI

Derek Tompkins, Ph.D., P.E.
Principal Civil Engineer

TABLE OF CONTENTS

1.0 INTRODUCTION

Ragsdale Solar Project, LLC (RSP), a subsidiary of EDP Renewables North America, LLC (EDPR), has retained American Engineering Testing, Inc. (AET) to test and evaluate public roads for use as haul routes for the construction of the Ragsdale Solar Project ("Project") in Madison County, Mississippi. AET performed geotechnical exploration and nondestructive pavement testing at the Project to evaluate the roads as construction haul routes. This report (AET P-0010936A) describes the surface condition of the Project roads.

2.0 SCOPE OF SERVICES

The authorized scope consists of the following services, which were outlined in a Task Order Agreement from EDPR dated 4/12/22.

- Pavement condition index testing of the Project roads using a digital video camera for Digital Video Logging (DVL)
- Preparation of a report that describes the rated condition of Project roads and other issues related to the ability of Project roads to withstand construction truck traffic.

These services are exclusively intended to evaluate the Project roads. 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 locations and roads

The Project is located within approximately 1,570 acres of agricultural land southeast of the City of Canton in Madison County, Mississippi (Figure 1). The project area is generally situated east of United States Route US-51, south of Mississippi State Route MS-16 (Canton Parkway), west of MS-43, and north of Yandell Road as shown in the figures attached to this report.

3.2 Traffic on Project roads

The primary transportation arteries through the project area in Madison County include United States Route US-51, MS-16, MS-43, and North Old Canton Road. The following items describe the most current traffic data for Project roads according to information from the Mississippi Department of Transportation (MDOT)[1].

- The 2019 annual average daily traffic (AADT) for US roads within the Project was 7,000 to 7,300 vehicles.
- The 2019 AADT for state roads within the Project was 3,600 to 10,000 vehicles.

[1] Mississippi Department of Transportation (2022). *MDOT Traffic Count Application.* Mississippi Department of Transportation, Jackson, MS, Available from https://mdot.ms.gov/applications/trafficcounters/

- The 2019 AADT for county roads within the Project was 60 to 1,600 vehicles.
- The 2019 AADT was not available for Cottom Blossom Road within the Project. Therefore, we have assumed an AADT of 80 vehicles for Cottom Blossom Road.
- Truck traffic records were not available for Project roads. Therefore, we have assumed 10 percent trucks and a rate of 0.675 equivalent single axle load (ESAL) applications per truck in accordance with Section 3.3.3.2 of the Mississippi Office of State Aid Road Construction *Roadway Design Manual*[2].

3.3 Anticipated traffic due to construction

We understand that the Project will require the use of public roads to deliver supplies and materials to the work sites during construction. Information related to construction hauling – including but not limited to transportation plans and estimated truck traffic – does not materially affect our engineering evaluation of the road sections.

4.0 SUBSURFACE EXPLORATION, ROAD TESTING, AND RESULTS

To facilitate testing, condition rating, and analysis, AET allocated the Project roads (totaling approximately 8.3 centerline miles) into 7 sections according to road type, road condition, and anticipated construction traffic. Tests and test results on Project roads are described in the subsections below and summarized in the appended Table 1. Three road types were encountered at the Project.

- A road surfaced with a bituminous wearing course, or “bituminous pavement” (BP)
- A road surfaced with a chip seal or seal coat wearing course, or “chip seal” (CS)
- A road surfaced with an aggregate wearing course, or “gravel road” (GR)

Our classifications of road sections follow basic pavement engineering principles to help us organize field/lab activities, analysis, and evaluation. These general classifications are not intended to conflict with or replace road owner or state DOT specific road classifications, which rely on as-built information, road histories, agency material classifications, and other matters whose review are beyond the scope described in Section 2.

4.1 Road Condition

High-resolution DVL data was collected on 5/24/22 along 16.6 lane miles of Project roads. An AET pavement engineer used DVL data to survey and rate the surface condition of paved and unpaved roads in general accordance with the ASTM D6433-20 and Department of Army (DA) TM 5-626 standard procedures, respectively. Each procedure associated cumulative observations of distress with a pavement condition index or unsurfaced road condition index (PCI or URCI, respectively). The condition index describes surface condition on a scale of 0 to 100. Both test procedures prescribe qualitative descriptions of pavement condition to the index as follows: “Good” 70-100; “Fair” 55-69;

[2] Mississippi Office of State Aid Road Construction (2021). *Roadway Design Manual*. Office of State Aid Road Construction, Jackson, MS. Available from https://www.osarc.ms.gov/Docs/roadway_review/OSARC_Roadway_Design_Manual_2021-02-01.pdf

"Poor" 40-54; "Very Poor" 25-39; "Serious" 10-24; and "Failed" 0-9. More details on the road surface condition rating procedures can be found in Appendix A.

5.0 TEST RESULTS

Table 1 and 2 provides results of the condition rating for selected paved and unpaved roads in the Project. Project roads were tested using the standard procedures described in Section 4. In total, the testing and analysis was performed on 3 BP sections, 1 CS section, and 3 GR sections.

5.1 Road surface condition

The results of road surface condition rating according to the procedures discussed in Section 4.1 are summarized by road section type. Tables 1-2 and Figure 2 appended to this report provide the condition ratings by sections.

Bituminous (paved) roads. BP sections were rated an average PCI of 55 ("Fair"). The predominant distresses observed on BP sections were longitudinal, transverse, and alligator cracking. Figure 3 illustrates low-severity longitudinal and transverse cracking within Section ID 01 (S01) along North Old Canton Road.

Chip sealed (paved) roads. The CS section was rated a PCI of 16 ("Failed"). The predominant distress observed on CS sections was alligator cracking of varying severity. Figure 4 illustrates high severity alligator cracking within Section ID 04A (S04A) along East Cotton Blossom Road.

GR (unpaved) sections. GR sections were rated an average URCI of 62 ("Fair"). The predominant distresses encountered on GR sections were poor drainage and a lack of crown. Figure 5 illustrates rutting and loose aggregates observed within Section ID 04C (S04C) along East Cottom Blossom Road.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 Observed road distress

The average surface condition of the four paved roads was "Poor". The average surface condition of the three unpaved roads was "Fair". A general pavement engineering rule is that road sections with a PCI of 54 ("Poor") or worse risk rapid condition loss under construction traffic. Three paved sections (S02, S03, and S04A), totaling 1.9 centerline miles, were rated an PCI of 54 or less (i.e., "Poor" or worse).

6.2 Road condition maintenance and construction timing

Practices to repair distress along possible Project haul roads should be considered alongside the Project construction schedule and planned structural improvements to haul roads, which are described in more detail for this Project in AET reporting to follow. For example, maintenance practices or structural improvements can be timed within the construction schedule in such a way to improve surface condition while minimizing loss of condition, a safe, drivable road for haul traffic.

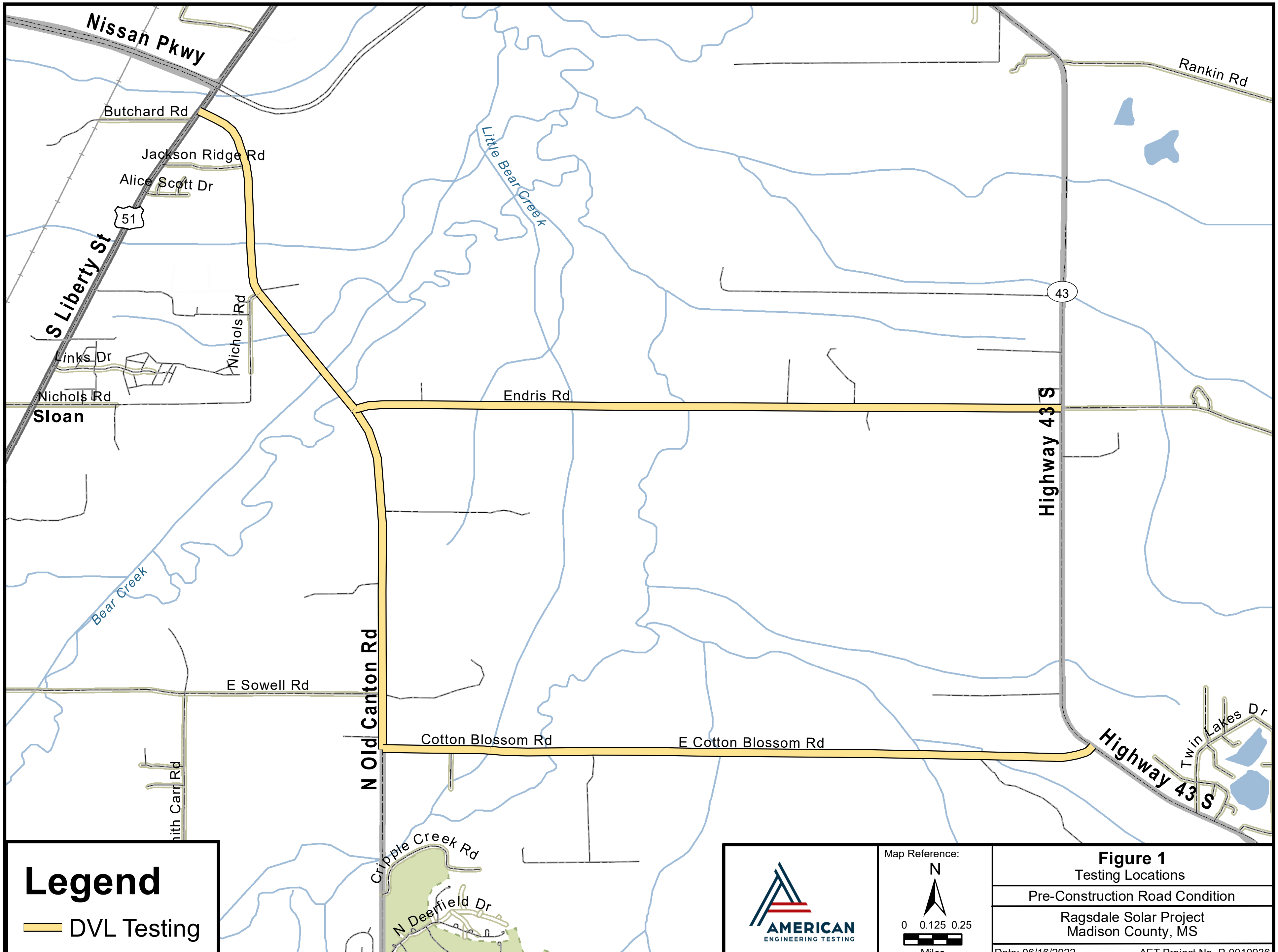
6.0 TEST STANDARDS

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 generally accepted geotechnical engineering practices at present time and this location. Other than this, no warranty, express or implied, is intended. Important information regarding risk management and proper use of this report is given in Appendix E, “Geotechnical Report Limitations and Guidelines for Use.”

Figures and Tables



Legend

DVL Testing

Map Reference:
N
0 0.125 0.25
Miles

Figure 1
Testing Locations

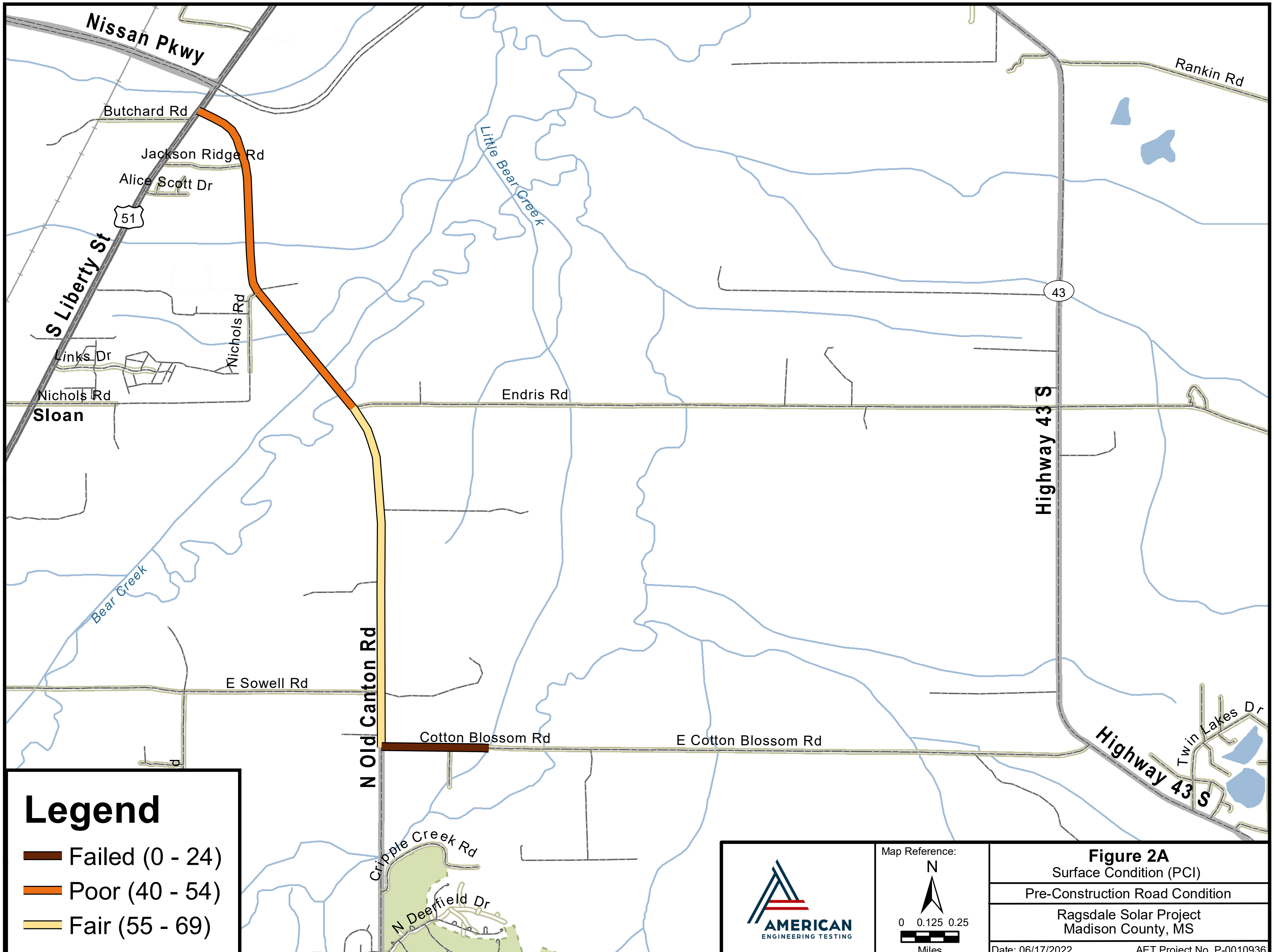
Pre-Construction Road Condition

Ragsdale Solar Project
Madison County, MS

Date: 06/16/2022 AET Project No. P-0010936

AMERICAN ENGINEERING TESTING

File: P-0010936A - 1.mxd Date: 06/16/2022



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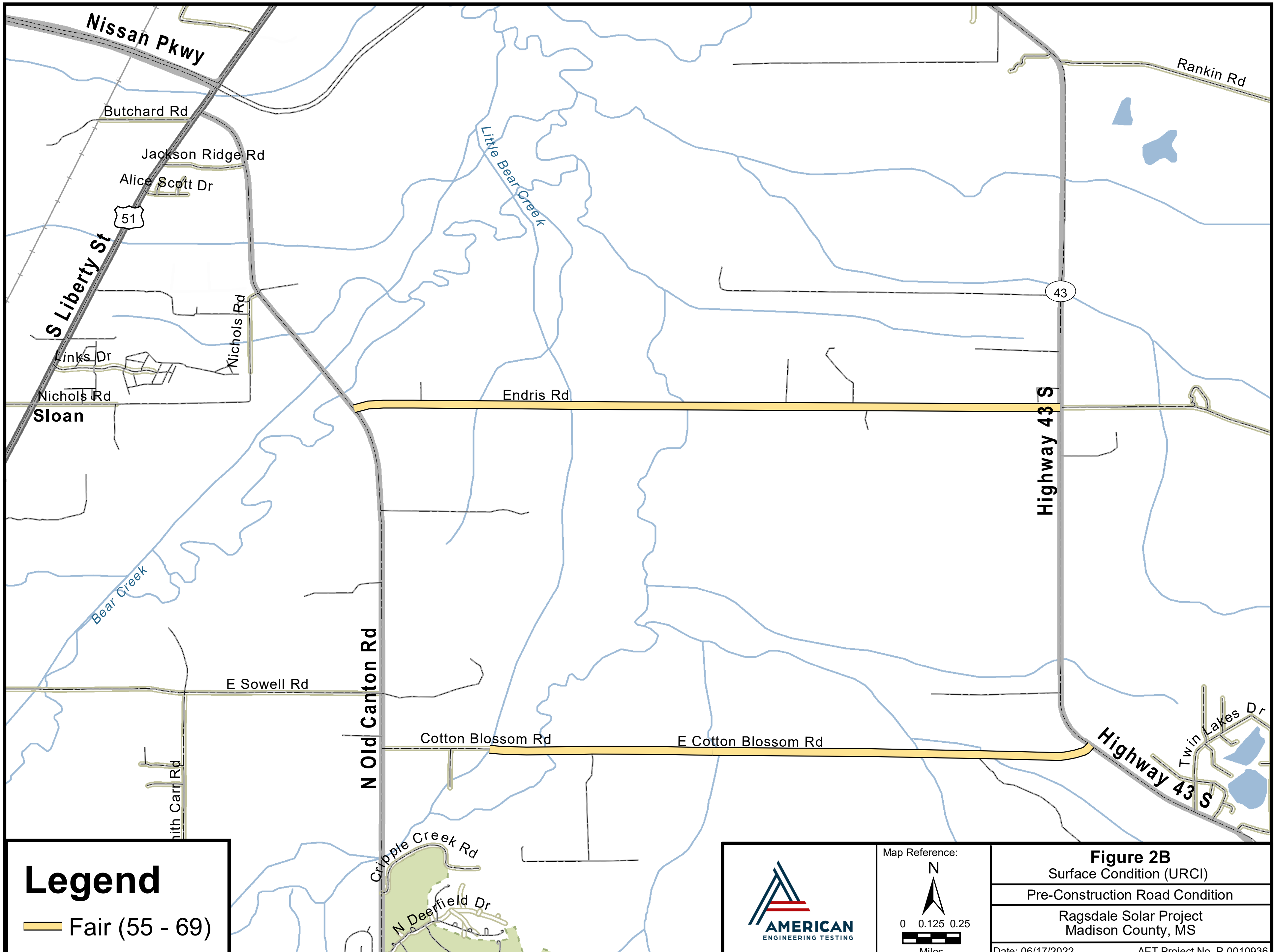

Legend

Fair (55 - 69)

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Map Reference:
N
0 0.125 0.25
Miles

Figure 2B
Surface Condition (URCI)

Pre-Construction Road Condition

Ragsdale Solar Project
Madison County, MS

Date: 06/17/2022 AET Project No. P-0010936

File: P-0010936A - 2B.mxd Date: 06/17/2022

Figure 3

Longitudinal and transverse cracking in S01

Pre-Construction Road Condition

Ragsdale Solar Project
Madison County, MS

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Date: 06/16/2022 AET Project No. P-0010936

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Figure 4

Alligator cracking in S04A

Pre-Construction Road Condition

Ragsdale Solar Project
Madison County, MS

Date: 06/16/2022 AET Project No. P-0010936

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Figure 5

Rutting and loose aggregates in S04C

Pre-Construction Road Condition

Ragsdale Solar Project
Madison County, MS

Date: 06/16/2022 AET Project No. P-0010936

Section ID	Road	From	To	Length (mi)	Type	PCI
S01	N Old Canton Rd	Cotton Blossom Rd	Endris Rd	1.5	BP	63
S02	N Old Canton Rd	Endris Rd	Nichols Rd	0.6	BP	48
S03	N Old Canton Rd	Nichols Rd	US 51	0.9	BP	53
S04A	E Cotton Blossom Rd	N Old Canton Rd	0.39 mi E	0.4	CS	16

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Table 1

Summary of paved surface condition

Pre-construction Surface Condition of Roads

Ragsdale Solar Project

Madison County, MS

Date: 06/23/2022 AET Project P-0010936

Section ID	Road	From	To	Length (mi)	Type	URCI
S04B	E Cotton Blossom Rd	2.24 mi W of Hwy 43	1.3 mi W of Hwy 43	0.9	GR	65
S04C	E Cotton Blossom Rd	1.3 mi W	Hwy 43	1.3	GR	56
S05	Endris Rd	N Old Canton Rd	Hwy 43	2.6	GR	65

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Table 2

Summary of unpaved surface condition

Pre-construction Surface Condition of Roads

Ragsdale Solar Project

Madison County, MS

Date: 06/23/2022 AET Project P-0010936

Appendix A

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

Appendix A
Pavement Condition Survey
Report No. P-0010936A

A.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.

A.2 EQUIPMENT DESCRIPTION

A.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.

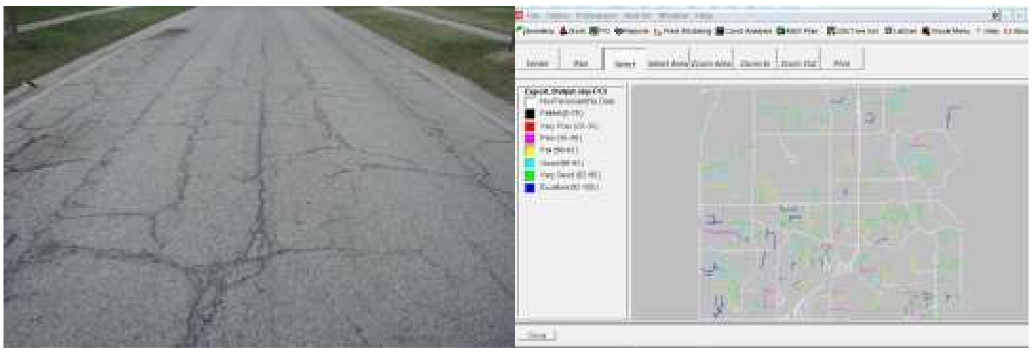

Figure D1 MicroPAVER™ PMS System

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.

A.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.

A.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.

A.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 A. The PCI operation will be mobile in nature and will be moderately disruptive to traffic.

A.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.

A.5 DATA ANALYSIS METHODS

A.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.

A.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.

A.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.

A.6 TEST LIMITATIONS

A.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.

A.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.

A.7 SUPPORTING TEST METHODS

A.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.

A.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).

A.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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St. Paul, Minnesota 55114
Phone: (651) 659-9001
Fax: (651) 659-1379

AMERICAN ENGINEERING TESTING

GENERAL INFORMATION: PAVEMENT CONDITION INDEX

Project:	Ragsdale Solar Project, MS	**Date:**	6/1/22
AET Job No.:	P-0010936	**Test Date:**	5/26/22
Road:	N Old Canton Rd	**Section/Grid:**	S01
From:	Cotton Blossom Rd	**To:**	Endris Rd

SUMMARY DISTRESSES

Total Samples	**26**
Sample #	**2**
Sample Size	**6000**
Sample Length	**600**

PCI	**65**

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GENERAL INFORMATION: PAVEMENT CONDITION INDEX

Project:	Ragsdale Solar Project, MS	**Date:**	6/1/22
AET Job No.:	P-0010936	**Test Date:**	5/26/22
Road:	N Old Canton Rd	**Section/Grid:**	S01
From:	Cotton Blossom Rd	**To:**	Endris Rd

SUMMARY DISTRESSES

Total Samples	**26**
Sample #	**2**
Sample Size	**6000**
Sample Length	**600**

PCI	**65**

Distresses	Severity		Distresses	Severity	
(1) Alligator	Low	1%	**(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	17%	**(20) Weathering**	Low	
	Med			Med	100%
	High			High	

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Fax: (651) 659-1379

GENERAL INFORMATION: PAVEMENT CONDITION INDEX

Project:	Ragsdale Solar Project, MS	**Date:**	6/1/22
AET Job No.:	P-0010936	**Test Date:**	5/26/22
Road:	N Old Canton Rd	**Section/Grid:**	S01
From:	Cotton Blossom Rd	**To:**	Endris Rd

SUMMARY DISTRESSES

Total Samples	**26**
Sample #	**12**
Sample Size	**6000**
Sample Length	**600**

PCI	**61**

American Engineering Testing, Inc.

550 Cleveland Avenue North

St. Paul, Minnesota 55114

Phone: (651) 659-9001

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GENERAL INFORMATION: PAVEMENT CONDITION INDEX

Project:	Ragsdale Solar Project, MS	**Date:**	6/1/22
AET Job No.:	P-0010936	**Test Date:**	5/26/22
Road:	N Old Canton Rd	**Section/Grid:**	S01
From:	Cotton Blossom Rd	**To:**	Endris Rd

SUMMARY DISTRESSES

Total Samples	**26**
Sample #	**12**
Sample Size	**6000**
Sample Length	**600**

PCI	**61**

Distresses			Distresses		
(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	3%	**(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	12%	**(20) Weathering**	Low	
	Med	2%		Med	100%
	High			High	

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Fax: (651) 659-1379

GENERAL INFORMATION: PAVEMENT CONDITION INDEX

Project:	Ragsdale Solar Project, MS	**Date:**	6/1/22
AET Job No.:	P-0010936	**Test Date:**	5/26/22
Road:	N Old Canton Rd	**Section/Grid:**	S02
From:	Endris Rd	**To:**	Nichols Rd

SUMMARY DISTRESSES

Total Samples	**11**
Sample #	**2**
Sample Size	**6000**
Sample Length	**600**

PCI	**48**

American Engineering Testing, Inc.

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St. Paul, Minnesota 55114

Phone: (651) 659-9001

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GENERAL INFORMATION: PAVEMENT CONDITION INDEX

Project: Ragsdale Solar Project, MS
AET Job No.: P-0010936
Road: N Old Canton Rd
From: Endris Rd

Date: 6/1/22
Test Date: 5/26/22
Section/Grid: S02
To: Nichols Rd

SUMMARY DISTRESSES

Total Samples	**11**
Sample #	**2**
Sample Size	**6000**
Sample Length	**600**

PCI	**48**

Distresses			Distresses		
(1) Alligator	Low	7%	(11) Patch/Ut Cut	Low	
	Med	4%		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	4%	(20) Weathering	Low	
	Med			Med	100%
	High			High	

American Engineering Testing, Inc.
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St. Paul, Minnesota 55114
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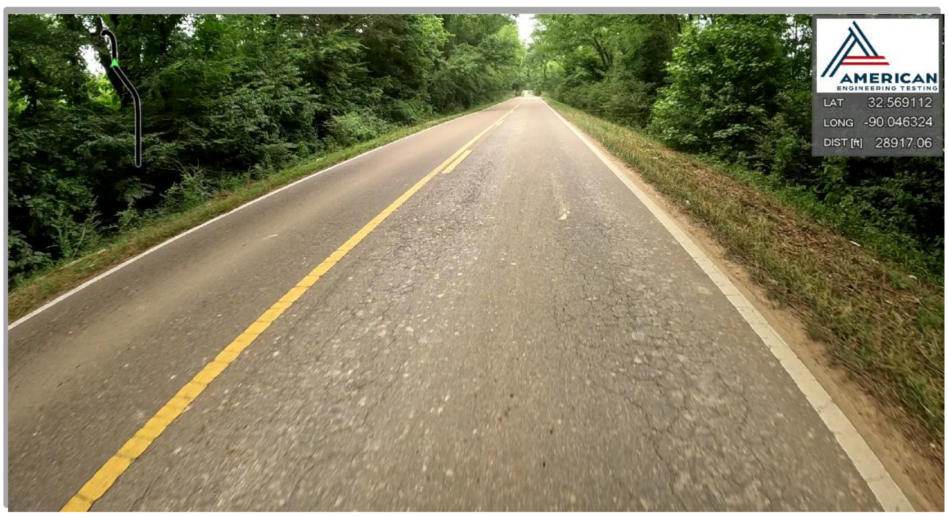
GENERAL INFORMATION: PAVEMENT CONDITION INDEX

Project:	Ragsdale Solar Project, MS	**Date:**	6/1/22
AET Job No.:	P-0010936	**Test Date:**	5/26/22
Road:	N Old Canton Rd	**Section/Grid:**	S03
From:	Nichols Rd	**To:**	US 51

SUMMARY DISTRESSES

Total Samples	**16**
Sample #	**2**
Sample Size	**6000**
Sample Length	**600**

PCI	**53**



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GENERAL INFORMATION: PAVEMENT CONDITION INDEX

Project:	Ragsdale Solar Project, MS	**Date:**	6/1/22
AET Job No.:	P-0010936	**Test Date:**	5/26/22
Road:	N Old Canton Rd	**Section/Grid:**	S03
From:	Nichols Rd	**To:**	US 51

SUMMARY DISTRESSES

Total Samples	**16**
Sample #	**2**
Sample Size	**6000**
Sample Length	**600**

PCI	**53**

Distresses			Distresses		
(1) Alligator	Low		**(11) Patch/Ut Cut**	Low	
	Med	4%		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	1%
	Med				
	High			High	
(10) L & T Cracking	Low	3%	**(20) Weathering**	Low	
	Med	1%		Med	100%
	High			High	

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GENERAL INFORMATION: PAVEMENT CONDITION INDEX

Project:	Ragsdale Solar Project, MS	**Date:**	6/1/22
AET Job No.:	P-0010936	**Test Date:**	5/26/22
Road:	E Cotton Blossom Rd	**Section/Grid:**	S04A
From:	N Old Canton Rd	**To:**	0.39 mi E

SUMMARY DISTRESSES

Total Samples	**8**
Sample #	**2**
Sample Size	**6000**
Sample Length	**500**

PCI	**16**

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GENERAL INFORMATION: PAVEMENT CONDITION INDEX

Project:	Ragsdale Solar Project, MS	**Date:**	6/1/22
AET Job No.:	P-0010936	**Test Date:**	5/26/22
Road:	E Cotton Blossom Rd	**Section/Grid:**	S04A
From:	N Old Canton Rd	**To:**	0.39 mi E

SUMMARY DISTRESSES

Total Samples	**8**
Sample #	**2**
Sample Size	**6000**
Sample Length	**500**

PCI	**16**

Distresses			Distresses		
(1) Alligator	Low	1%	**(11) Patch/Ut Cut**	Low	
	Med	32%		Med	
	High	8%		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	2%	**(20) Weathering**	Low	
	Med			Med	100%
	High			High	

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GENERAL INFORMATION: PAVEMENT CONDITION INDEX

Project:	Ragsdale Solar Project, MS	**Date:**	6/1/22
AET Job No.:	P-0010936	**Test Date:**	5/26/22
Road:	E Cotton Blossom Rd	**Section/Grid:**	S04B
From:	2.24 mi W of Hwy 43	**To:**	1.3 mi W of Hwy 43

SUMMARY DISTRESSES

Total Samples	20
Sample #	2
Sample Size	6000
Sample Length	250

URCI	**65**

Distress	Low	Med	High
(81) Improper Cross Section	4%		
(82) Inadequate Roadside Drainage		8%	
(83) Corrugation			
(84) Dust	100%		
(85) Pothole			
(86) Rutting	13%		
(87) Loose Aggregates	13%		

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GENERAL INFORMATION: PAVEMENT CONDITION INDEX

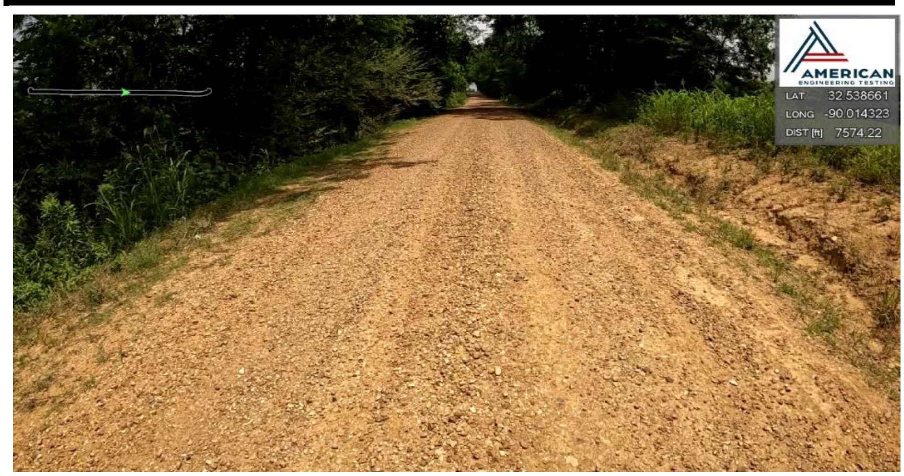
Project:	Ragsdale Solar Project, MS	**Date:**	6/1/22
AET Job No.:	P-0010936	**Test Date:**	5/26/22
Road:	E Cotton Blossom Rd	**Section/Grid:**	S04C
From:	1.3 mi W	**To:**	Hwy 43

SUMMARY DISTRESSES

Total Samples	21
Sample #	2
Sample Size	6000
Sample Length	333

URCI	**56**

Distress	Low	Med	High
(81) Improper Cross Section		6%	
(82) Inadequate Roadside Drainage		6%	6%
(83) Corrugation			
(84) Dust	100%		
(85) Pothole			
(86) Rutting	17%		
(87) Loose Aggregates	17%		



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GENERAL INFORMATION: PAVEMENT CONDITION INDEX

Project: Ragsdale Solar Project, MS
Date: 6/1/22
AET Job No.: P-0010936
Test Date: 5/26/22
Road: Endris Rd
Section/Grid: S05
From: N Old Canton Rd
To: Hwy 43

SUMMARY DISTRESSES

Total Samples	55
Sample #	2
Sample Size	6000
Sample Length	250

URCI	**69**

Distress	Low	Med	High
(81) Improper Cross Section	4%		
(82) Inadequate Roadside Drainage	8%		
(83) Corrugation			
(84) Dust		100%	
(85) Pothole			
(86) Rutting	13%		
(87) Loose Aggregates	13%		

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GENERAL INFORMATION: PAVEMENT CONDITION INDEX

Project:	Ragsdale Solar Project, MS	**Date:**	6/1/22
AET Job No.:	P-0010936	**Test Date:**	5/26/22
Road:	Endris Rd	**Section/Grid:**	S05
From:	N Old Canton Rd	**To:**	Hwy 43

SUMMARY DISTRESSES

Total Samples	55
Sample #	20
Sample Size	6000
Sample Length	250

URCI	**61**

Distress	Low	Med	High
(81) Improper Cross Section	4%		
(82) Inadequate Roadside Drainage		8%	
(83) Corrugation			
(84) Dust		100%	
(85) Pothole			
(86) Rutting	17%		
(87) Loose Aggregates	17%		

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AMERICAN ENGINEERING TESTING

GENERAL INFORMATION: PAVEMENT CONDITION INDEX

Project:	Ragsdale Solar Project, MS	**Date:**	6/1/22
AET Job No.:	P-0010936	**Test Date:**	5/26/22
Road:	Endris Rd	**Section/Grid:**	S05
From:	N Old Canton Rd	**To:**	Hwy 43

SUMMARY DISTRESSES

Total Samples	55
Sample #	38
Sample Size	6000
Sample Length	250

URCI	**65**

Distress	Low	Med	High
(81) Improper Cross Section		4%	
(82) Inadequate Roadside Drainage		4%	4%
(83) Corrugation			
(84) Dust		100%	
(85) Pothole			
(86) Rutting	13%		
(87) Loose Aggregates	13%		

Appendix B

Geotechnical Report Limitations and Guidelines for Use

Appendix B
Geotechnical Report Limitations and Guidelines for Use
Report No. P-0011456A

B.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.

B.2 RISK MANAGEMENT INFORMATION

B.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.

B.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.

B.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.

B.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

B.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.

B.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.

B.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.

B.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.

B.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.

B.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.

PRE-CONSTRUCTION ROAD EVALUATION
Ragsdale Solar Project
Madison County, Mississippi

AET Report No. P-0010936B

Date:
June 24, 2022

Prepared for:

EDP Renewables North America LLC
1501 McKinney Street, Suite 1300
Houston, TX 77010

Geotechnical ● Materials
Forensic ● Environmental
Building Technology
Petrography/Chemistry

American Engineering Testing
550 Cleveland Avenue North
St. Paul, MN 55114-1804
TeamAET.com • 800.792.6364

June 24, 2022

EDP Renewables North America LLC
1501 McKinney Street, Suite 1300
Houston, TX 77010

Attn: Mr. Jeremy Kight

RE: Report of Pre-construction Road Evaluation
Ragsdale Solar Project
Madison County, Mississippi
AET Project No. P-0010936

Dear Mr. Kight:

This report presents the results of the pavement testing and analysis project that AET performed on the proposed haul roads for the pre-construction phase of the Ragsdale Solar Project in Madison County, Mississippi.

Per your request, we are submitting this report to you electronically.

Please contact me if you have any questions about this report.

Sincerely,
American Engineering Testing, Inc.

Chunhua Han, Ph.D.
Principal Engineer, Pavement Division
E-mail: chan@teamaet.com
Phone: (651) 603-6631, Fax: (651) 659-1347

SIGNATURE PAGE

Prepared for

EDP Renewables North America LLC
1501 McKinney Street, Suite 1300
Houston, TX 77010

Attn: Mr. Jeremy Kight

Prepared by

American Engineering Testing, Inc.
550 Cleveland Avenue North
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Project Manager

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6/24/22
ENGINEER
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STATE OF MISSISSIPPI

Derek Tompkins, Ph.D., P.E.
Principal Civil Engineer

TABLE OF CONTENTS

1.0 INTRODUCTION

Ragsdale Solar Project, LLC (RSP), a subsidiary of EDP Renewables North America, LLC (EDPR), has retained American Engineering Testing, Inc. (AET) to test and evaluate public roads for use as haul routes for the construction of the Ragsdale Solar Project ("Project") in Madison County, Mississippi. AET performed geotechnical exploration and nondestructive pavement testing along Project roads selected by RSP for evaluation. This report (AET P-0010936B) describes our subsurface and structural condition evaluation of Project roads.

2.0 SCOPE OF SERVICES

The authorized scope consists of the following services, which were outlined in a Task Order Agreement from EDPR dated 4/12/22.

- Direct push soil sampling (referred to as "soil borings") along the County Project roads to a depth of approximately 4 feet.
- Falling weight deflectometer (FWD) testing of the Project roads.
- Ground penetrating radar (GPR) testing on the Project roads.
- Engineering evaluation of the Project roads using our surface condition assessment (AET Report No. P-0010936A), GPR, FWD, and soil boring data to (a) assess ability of the roads to sustain solar farm construction loads and (b) identify pre-construction road sections that are susceptible to significant damage.
- Production of the report summarizing evaluations of Project roads.

These services are exclusively intended to evaluate the Project roads. 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 locations and roads

The Project is located within approximately 1,570 acres of agricultural land southeast of the City of Canton in Madison County, Mississippi (Figure 1). The project area is generally situated east of United States Route US-51, south of Mississippi State Route MS-16 (Canton Parkway), west of MS-43, and north of Yandell Road as shown in the figures attached to this report.

3.2 Traffic on Project roads

The primary transportation arteries through the project area in Madison County include United States Route US-51, MS-16, MS-43, and North Old Canton Road. The following items describe the most current traffic data for Project roads according to information from the Mississippi Department of

Transportation (MDOT)[1].

- The 2019 annual average daily traffic (AADT) for US roads within the Project was 7,000 to 7,300 vehicles.
- The 2019 AADT for state roads within the Project was 3,600 to 10,000 vehicles.
- The 2019 AADT for county roads within the Project was 60 to 1,600 vehicles.
- The 2019 AADT was not available for Cottom Blossom Road within the Project. Therefore, we have assumed an AADT of 80 vehicles for Cottom Blossom Road.
- Truck traffic records were not available for Project roads. Therefore, we have assumed 10 percent trucks and a rate of 0.675 equivalent single axle load (ESAL) applications per truck in accordance with Section 3.3.3.2 of the Mississippi Office of State Aid Road Construction *Roadway Design Manual*[2].

3.3 Anticipated traffic due to construction

We understand that the Project will require the use of public roads to deliver supplies and materials to the work sites during construction. Information related to construction hauling – including but not limited to transportation plans and estimated truck traffic – does not materially affect our engineering evaluation of the road sections.

4.0 SUBSURFACE EXPLORATION, ROAD TESTING, AND RESULTS

To facilitate testing, condition rating, and analysis, AET allocated the Project roads (totaling approximately 8.3 centerline miles) into 7 sections according to road type, road condition, and anticipated construction traffic. Tests and test results on Project roads 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)
- A road surfaced with a chip seal or seal coat wearing course, or “chip seal” (CS)
- A road surfaced with an aggregate wearing course, or “gravel road” (GR)

Our classifications of road sections follow basic pavement engineering principles to help us organize field/lab activities, analysis, and evaluation. These general classifications are not intended to conflict with or replace road owner or state DOT specific road classifications, which rely on as-built information, road histories, agency material classifications, and other matters whose review are beyond the scope described in Section 2.

4.1 Road condition

Our engineering services for the Project also included digital video logging (DVL) and engineering

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[1] Mississippi Department of Transportation (2022). *MDOT Traffic Count Application*. Mississippi Department of Transportation, Jackson, MS, Available from https://mdot.ms.gov/applications/trafficcounters/
[2] Mississippi Office of State Aid Road Construction (2021). *Roadway Design Manual*. Office of State Aid Road Construction, Jackson, MS. Available from https://www.osarc.ms.gov/Docs/roadway_review/OSARC_Roadway_Design_Manual_2021-02-01.pdf

review of DVL data to assess road surface condition. Details of these tests, associated analysis, and our evaluation of the condition of Project roads are provided in AET Report P-0010936A.

4.2 Subsurface conditions

Sixteen (16) direct push soil borings were performed along selected Project roads. Subsurface explorations at the Project took place on 6/1/22 using direct push sampling to a depth of approximately 4 feet. After samples were obtained, boring holes were backfilled with a similar surfacing material to match the existing road profile. Collected samples were analyzed in our laboratory to evaluate surfacing material and 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. These results are summarized below by road type and structural layer.

Bituminous pavement. BP sections had a bituminous pavement thickness of 2-1/2 to 4 inches.

Chip seal. The CS section had a chip seal pavement thickness of 1-1/2 inches

Layers directly supporting paved surfaces. We observed layers immediately below paved surfaces (i.e., base layers) that varied in composition and thickness. These supporting layers were observed to have thickness of 3-1/2 to 14-1/2 inches in thickness. We class materials composing those layers as follows.

- At 1 location, the base layer contained granular materials that met the AASHTO A-1-b classification.
- In remaining samples, we observed combinations of recycled asphalt and granular base materials directly underneath the pavement.

Laboratory tests were performed on one base sample: moisture content test yielded 5 percent moisture and fines content (material passing the No. 200 sieve) test indicated 6 percent fines.

Surface aggregate. Samples of aggregate surfacing material encountered on the GR sections were classified as A-1-b, A-2-4, or A-4. Unbound aggregate surface layers were observed to have a thickness of between 2 and 15 inches. Laboratory tests were performed on one aggregate surfacing sample: moisture content test yielded 10 percent moisture and fines content tests indicated 45 percent fines.

Subgrade soils. We observed that the primary soils within the upper subgrade zone on selected Project roads consisted of silty sand with gravel, silty sand, sandy silt, silt with sand, silt, silty clay, lean clay with sand, lean clay, meeting the A-1-b, A-2-4 (non-plastic), A-4 (semi-plastic), and A-6 (plastic) soil categories. Laboratory testing was performed on subgrade samples: eighteen moisture content tests indicated between 18 and 27 percent water content; two Atterberg limits tests indicated a plasticity index (PI) value of 10 and 15; and two fines content tests indicated 92 and 99 percent fines.

4.3 Surface course thickness (ground penetrating radar)

The road layer thickness testing program involves the use of a high-speed (air coupled) GPR antenna to collect pavement data that is later analyzed to evaluate layer thicknesses. AET performed GPR testing on approximately 16.6 lane miles of Project roads on 5/24/22 using a 2 GHz antenna, which allows material layer measurements at depths of 18 inches with a resolution of approximately one-half inch. Our analysis of collected GPR data (summarized by road section in Tables 1 and 2) included statistical analysis to determine 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.

- The thickness of pavement on BP sections ranged from of 2.4 to 3.2 inches. The thickness of composite base (reclaimed asphalt and aggregate) on the BP sections ranged from 8.4 to 11.1 inches.
- The thickness of pavement on the CS section was 1.5 inches. The thickness of aggregate base on the CS section was 6.9 inches.
- The thickness of aggregate surfacing on the three GR sections was 0.9, 9.1, and 9.9 inches. The section with apparent thin surfacing (S05) was associated with a coefficient of variation of 0.79. This variation may be due to moisture, subgrade settlement, and/or contamination of surface gravel with fine materials from subgrade soils. Regardless, as illustrated in later testing and analysis, the gravel surfacing in S05 is unlikely to contribute significantly to the structural response of the road under loading.

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 B.

4.4 Pavement strength (falling weight deflectometer)

Deflection testing was performed on 8.3 centerline miles of Project roads on 5/24/2022, using a Dynatest 8002 falling weight deflectometer (FWD). Locations of FWD tests are indicated in Figure 1. Collected FWD data – along with information described in the sections above – are used to estimate the elastic stiffness of pavement layers using backcalculation analysis according to the American Association of State Highway and Transportation Officials (AASHTO) method. This analysis also accounts for allowable axle loads for a roadway (*AASHTO Guide for Design of Pavement Structures*, 1993). Our backcalculation results were used to estimate the effective subgrade resilient modulus (MR) for all road sections, the AASHTO structural number (SN) for paved roads, effective granular equivalency (GE) for unpaved sections, and structural capacity of all Project roads. As with GPR-based thickness analysis results, the results of backcalculation analysis of collected Project FWD data are summarized below (and in Tables 1 and 2) using 15th-percentile values.

- The subgrade MR for all sections ranged from 3.5 to 5.3 ksi.

- The SN value for the paved sections ranged from 1.2 to 2.8 inches. The axle load capacity rating of paved sections ranged from 7.7 to 10+ tons/axle.
- The GE value for the unpaved sections ranged from 0.9 to 4.8 inches. The axle load capacity rating of the unpaved sections ranged from 2.8 to 7.3 tons/axle.

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

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 Tables 1 and 2 for four (4) paved and three (3) unpaved sections.

5.0 EVALUATION OF ROAD CONDITION

5.1 Summary evaluation

We evaluated the performance of the roads as haul routes given the results of testing and analysis (summarized in Tables 1 and 2) and our surface condition report (AET Report No. P-0010936A). Our evaluation is described in additional detail in the sections below, which correspond to important features of roads.

- Our evaluation of the load capacity is based on analytical procedures and calculations described in the AASHTO *Guide for Design of Pavement Structures* (1993) and the Federal Highway Administration (FHWA) *Gravel Roads Maintenance and Design Manual* (2002). In addition, we rely on engineering judgement to evaluate the performance of Project roads and structural improvements to serve as functional haul routes for wind farm construction.
- Information regarding risk management and proper use of this evaluation is given in Appendix D, "Geotechnical Report Limitations and Guidelines for Use."
- Should changes to the Project layout and use of roads be considered, please notify AET so that we can review the changes and determine if revisions to the evaluation report are necessary.

We anticipate that a some of the paved and most of the unpaved Project roads will require structural improvements to serve as functional haul routes for Project construction. AET Report P-0010936C considers recommended road improvements for the project, where applicable.

5.2 Structural properties of road subgrade

The predominant subgrade type for the selected roads is silt and lean clay (A-4 and A-6). Our FWD backcalculation analysis of the structural properties of the subgrade determined that subgrade soils under Project roads had an average 15th-percentile value of 4.3 ksi. In our experience, subgrade MR values less than 4 ksi risk subgrade support issues during truck hauling. Therefore, our field evaluation and analysis determined that the subgrade along Project roads is generally adequate.

5.3 Structural properties of road surface layers

We anticipate that the structural capacity of the road surfacing will vary with changes in subgrade support and surfacing thickness. Additional variation may occur due to pavement condition.

- The paved sections have an average 15th-percentile effective SN of 2.0 inches, with minimum and maximum SN of 1.2 and 2.8 inches, respectively. A typical SN for low-volume roads ranges from 2 to 4 inches.
- The unpaved sections have an average 15th-percentile effective GE of 2.5 inches with minimum and maximum GE of 0.9 and 4.8 inches, respectively. Pavement engineers target a GE value of 7 inches or more for unpaved roads due to receive low volumes of trucks.
- The axle load rating accounts for the combined structural capacity of the pavement and foundation. The paved sections in the Project have an average 15th-percentile axle load capacity of 9.3 tons per axle. The unpaved sections have a 15th-percentile ton rating of 5.3 tons/axle.

As discussed in Section 3, we observed a high degree of variability in surface gravel thickness within the section along Endris Road (S05). The structural rating and capacity of this road may be compromised further under adverse conditions (e.g., when saturated) and heavy loads (e.g., construction truck hauling).

5.4 Suitability of roads as haul routes

Some of the paved and unpaved road sections should require structural improvements prior to Project construction hauling. Furthermore, local repairs should be performed to improve sections with a poor surface condition to reduce the risk of rapid progression of surface distress under haul traffic. All road sections will require regular maintenance during Project construction.

Our estimation of future needs considers surface condition rating, estimated structural capacity, and preliminary estimates of haul traffic for the tested, evaluated roads. More information on the use of the selected paved road sections as haul routes and structural improvements (where appropriate) is discussed in AET Report No. P-0010936C.

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 generally accepted geotechnical engineering practices at present time and this location. Other than this, no warranty, express or implied, is intended. Important information regarding risk management and proper use of this report is given in Appendix D, “Geotechnical Report Limitations and Guidelines for Use.”

Figures and Tables

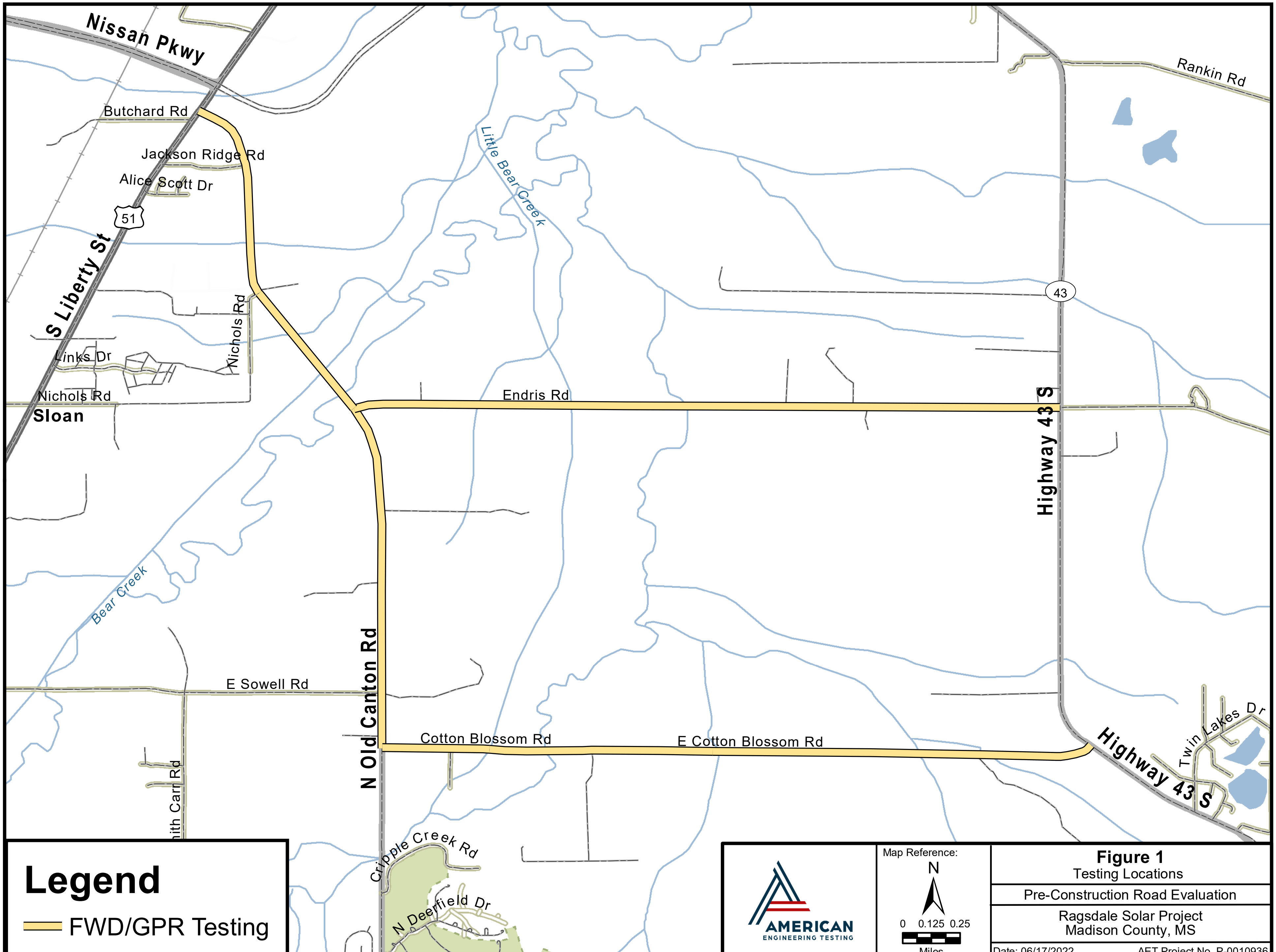


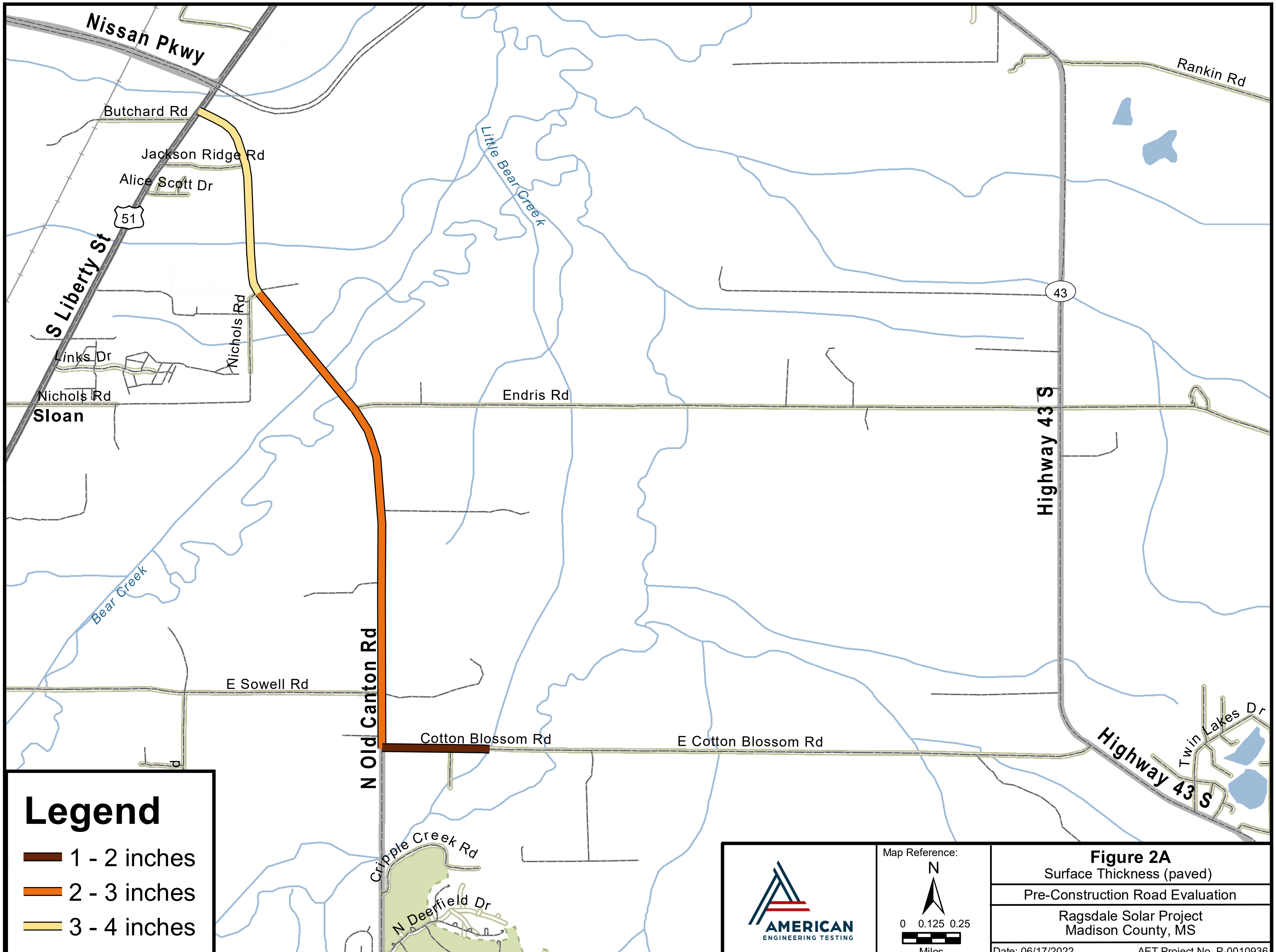
Figure 1
Testing Locations

Pre-Construction Road Evaluation

Ragsdale Solar Project
Madison County, MS

Date: 06/17/2022 AET Project No. P-0010936

File: P-0010936B - 1.mxd Date: 06/17/2022



File: P-0010936B - 2.mxd Date: 06/17/2022

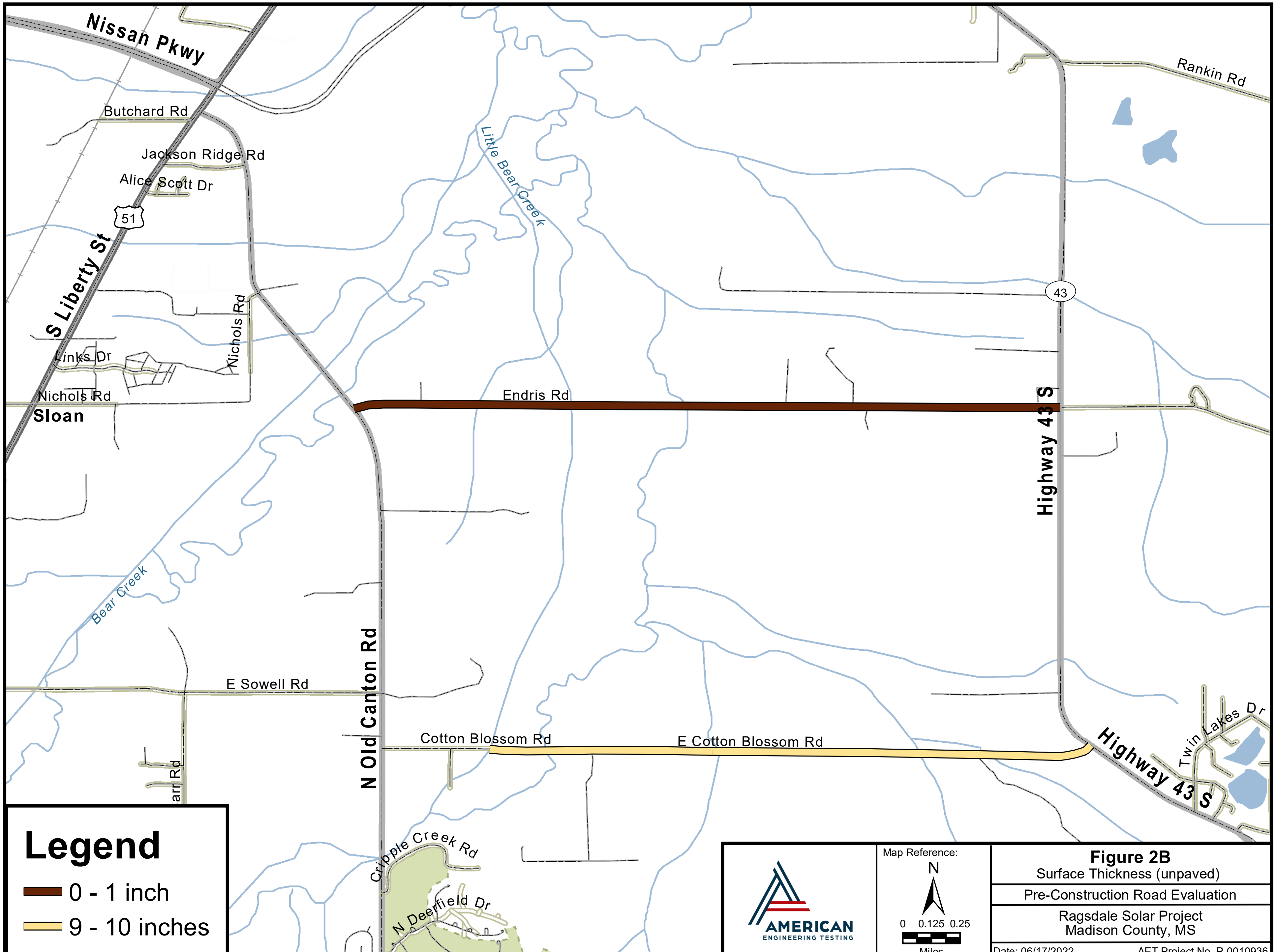
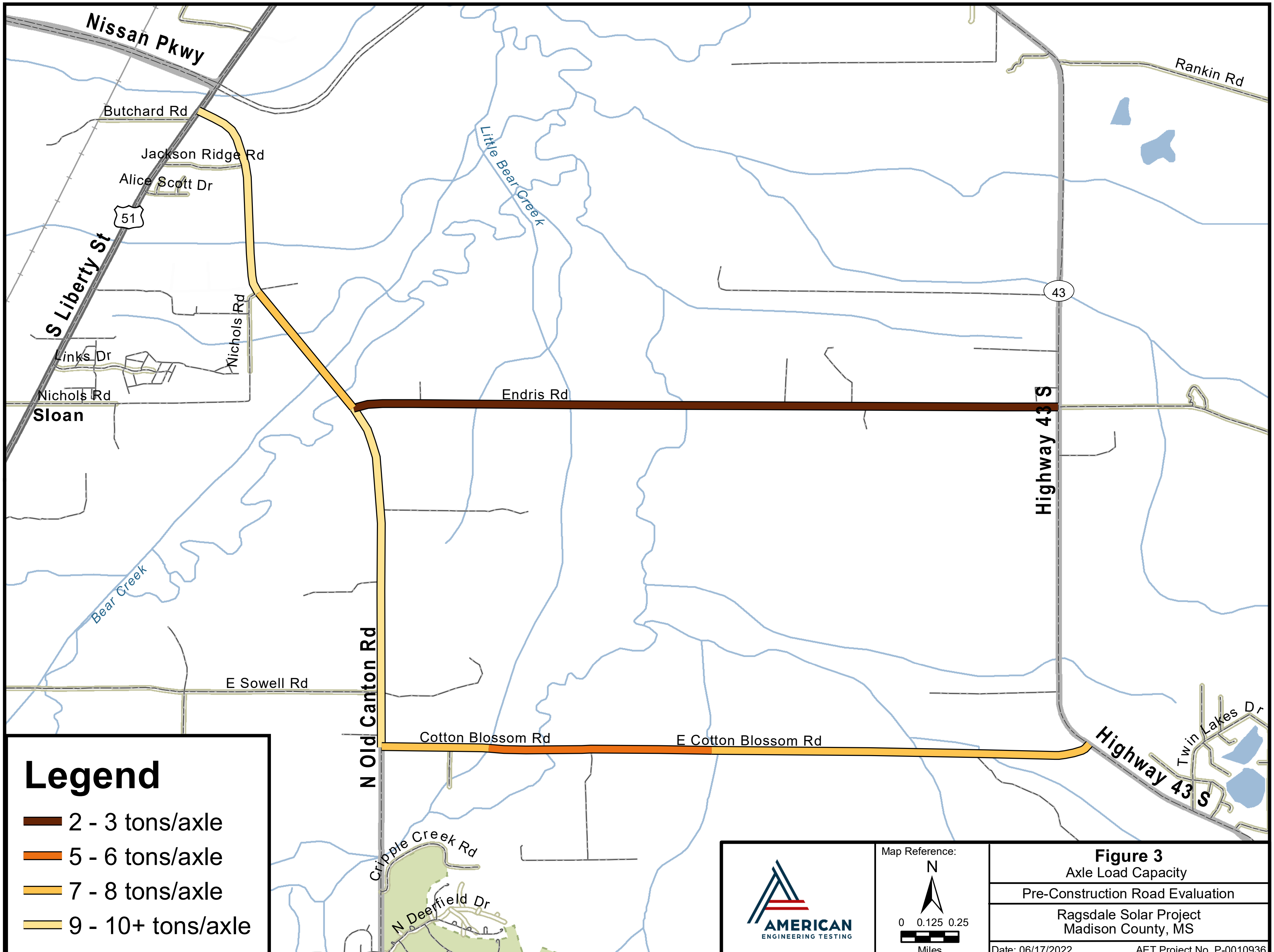


Figure 2B
Surface Thickness (unpaved)

Pre-Construction Road Evaluation

Ragsdale Solar Project
Madison County, MS

Date: 06/17/2022 AET Project No. P-0010936



File: P-0010936B - 3.mxd Date: 06/17/2022

Section ID	Road	From	To	Length (mi)	Type	PCI	Surface Thickness (in)*	Base Thickness (in)*	Subgrade MR*	Structure Number (in)*	Axle Load Capacity (ton/axle)*
S01	N Old Canto	Cotton Bloss	Endris Rd	1.5	BP	63	2.4	8.4	4.4	2.0	9.8
S02	N Old Canto	Endris Rd	Nichols Rd	0.6	BP	48	2.4	11.1	3.6	2.0	7.7
S03	N Old Canto	Nichols Rd	US 51	0.9	BP	53	3.2	10.5	3.5	2.8	11.5
S04A	E Cotton Blo	N Old Canto	0.39 mi E	0.4	CS	16	1.5	6.9	4.9	1.2	8.0

-

** - 15th Percentile Values*

AMERICAN ENGINEERING TESTING

Table 1

Summary of paved road evaluation

Pre-construction Road Evaluation

Ragsdale Solar Project

Madison County, MS

Date: 06/23/2022 AET Project P-0010936

Section ID	Road	From	To	Length (mi)	Type	URCI	Surface Thickness (in)*	Subgrade MR*	Granular Equivalenc y (in)*	Axle Load Capacity (ton/axle)*
S04B	E Cotton Blo	2.24 mi W of	1.3 mi W of I	0.9	GR	65	9.9	5.3	1.8	5.7
S04C	E Cotton Blo	1.3 mi W	Hwy 43	1.3	GR	56	9.8	4.5	4.8	7.3
S05	Endris Rd	N Old Canto	Hwy 43	2.6	GR	65	0.9	3.6	0.9	2.8

-

** - 15th Percentile Values*

AMERICAN ENGINEERING TESTING

Table 2

Summary of unpaved road evaluation

Pre-construction Road Evaluation

Ragsdale Solar Project

Madison County, MS

Date: 06/23/2022 AET Project P-0010936

Appendix A

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

Appendix A
Geotechnical Field Exploration and Testing
AET Report No. P-0010936B

A.1 FIELD EXPLORATION

The subsurface conditions at the site were explored by drilling and sampling sixteen (16) direct push soil borings on the 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 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

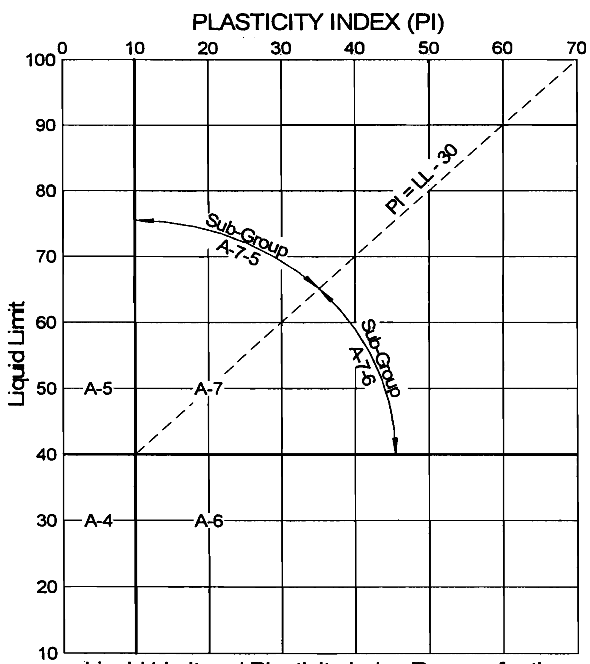
AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS

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.

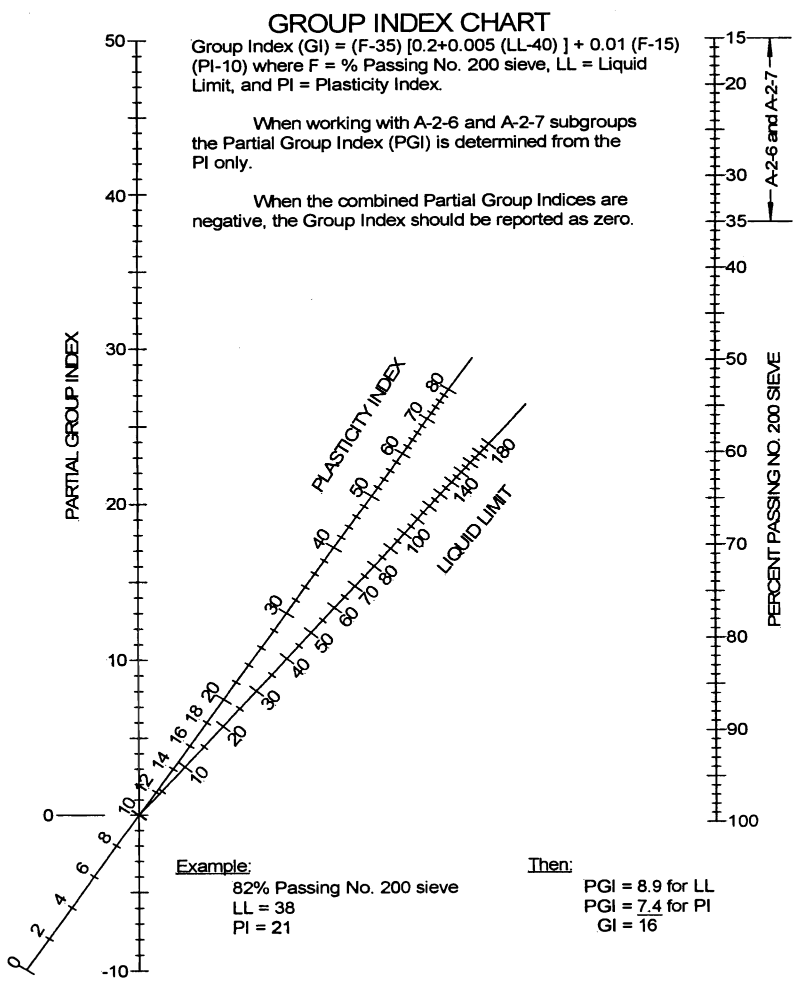
The term "silty" is applied to fine material having plasticity index of 10 or less and the term "clayey" is applied to fine material having plasticity index of 11 or greater.

GROUP INDEX CHART

Group Index (GI) = (F-35) [0.2+0.005 (LL-40)] + 0.01 (F-15) (PI-10) where F = % Passing No. 200 sieve, LL = Liquid Limit, and PI = Plasticity Index.

When working with A-2-6 and A-2-7 subgroups the Partial Group Index (PGI) is determined from the PI only.

When the combined Partial Group Indices are negative, the Group Index should be reported as zero.



Example:

82% Passing No. 200 sieve
LL = 38
PI = 21

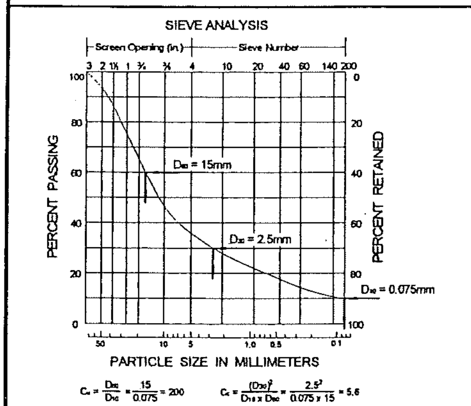
Then:

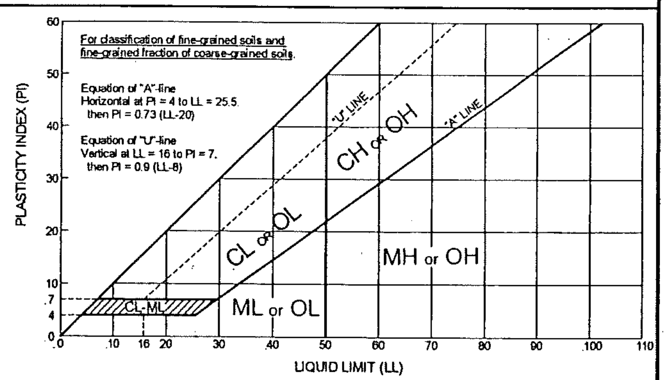
PGI = 8.9 for LL
PGI = 7.4 for PI
GI = 16

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]





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-0010936** LOG OF BORING NO. **B-01 (p. 1 of 1)**

PROJECT: **Ragsdale Solar Project; Madison County, MS**

SURFACE ELEVATION: ________ LATITUDE: **32.53882931** LONGITUDE: **-90.03220397**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
	1.5" Chip seal	FILL									
	3.5" FILL, mostly sand with gravel, brown (A-1-b)										
1	FILL, mostly silty sand, a little gravel, brown (A-2-4)										
	LEAN CLAY WITH SAND, a little gravel, pieces of wood, brown, a little gray mottled to gray, laminations of silty sand (CL) (A-6) (possible fill)	FINE ALLUVIUM OR FILL									
2					DP	44					
	LEAN CLAY, gray and brown mottled to light brown and brown mottled, laminations of sandy silt (CL) (A-6)	FINE ALLUVIUM									
3							22				
4	**END OF BORING**										

DEPTH:	DRILLING METHOD	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-4'	**Direct Push**							

WATER LEVEL MEASUREMENTS

BORING COMPLETED: **6/1/22**

DR: **RS** LG: **AH** Rig: **441**

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

AET_CORP W-LAT-LONG P-0010936.GPJ AET+CPT+WELL.GDT 6/17/22

SUBSURFACE BORING LOG

AET JOB NO: **P-0010936** LOG OF BORING NO. **B-02 (p. 1 of 1)**

PROJECT: **Ragsdale Solar Project; Madison County, MS**

SURFACE ELEVATION: ________ LATITUDE: **32.53869416** LONGITUDE: **-90.02446711**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
	2" FILL, mostly gravelly sand, brown (A-1-b)	FILL									
	FILL, mostly silty sand, light brown, a little gray (A-2-4)										
1	FILL, mostly silty sand with gravel, brown and dark brown (A-1-b)										
	SILT WITH SAND, gray, moist to wet (ML) (A-4)	FINE ALLUVIUM									
2					DP	39					
							25				
3											
4	**END OF BORING**										

DEPTH:	DRILLING METHOD	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-4'	**Direct Push**							

WATER LEVEL MEASUREMENTS

BORING COMPLETED: **6/1/22**

DR: **RS** LG: **AH** Rig: **441**

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

AET_CORP W-LAT-LONG P-0010936.GPJ AET+CPT+WELL.GDT 6/17/22

SUBSURFACE BORING LOG

AMERICAN ENGINEERING TESTING

AET JOB NO: **P-0010936** LOG OF BORING NO. **B-03 (p. 1 of 1)**

PROJECT: **Ragsdale Solar Project; Madison County, MS**

SURFACE ELEVATION: ________ LATITUDE: **32.5386016** LONGITUDE: **-90.01729508**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
	2" FILL, mostly gravelly sand, light brown (A-1-b)	FILL									
	9" FILL, mostly silty sand with gravel, light brown (A-1-b)										
1	SILT WITH SAND, gray, moist (ML) (A-4)	FINE ALLUVIUM									
2	SILTY CLAY, gray (CL-ML) (A-4)				DP	38					
3							19				
4	**END OF BORING**										

DEPTH:	DRILLING METHOD	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-4'	**Direct Push**							

WATER LEVEL MEASUREMENTS

BORING COMPLETED: **6/1/22**

DR: **RS** LG: **AH** Rig: **441**

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

AET_CORP W-LAT-LONG P-0010936.GPJ AET+CPT+WELL.GDT 6/17/22

SUBSURFACE BORING LOG

AMERICAN ENGINEERING TESTING

AET JOB NO: **P-0010936** LOG OF BORING NO. **B-04 (p. 1 of 1)**

PROJECT: **Ragsdale Solar Project; Madison County, MS**

SURFACE ELEVATION: ________ LATITUDE: **32.53860883** LONGITUDE: **-90.00852164**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
	15" FILL, mostly silt with sand and gravel, a little sandy silt, light brown and brown (A-4)	FILL					10				45
1											
	FILL, mostly silty sand, a little gravel, gray (A-2-4)										
	LEAN CLAY, gray (CL) (A-6)	FINE ALLUVIUM									
2					DP	38					
							27				
3											
4	**END OF BORING**										

DEPTH:	DRILLING METHOD	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-4'	**Direct Push**							
BORING COMPLETED:	**6/1/22**							
DR: **RS** LG: **AH**	Rig: **441**							

WATER LEVEL MEASUREMENTS

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

AET_CORP W-LAT-LONG P-0010936.GPJ AET+CPT+WELL.GDT 6/17/22

SUBSURFACE BORING LOG

AMERICAN ENGINEERING TESTING

AET JOB NO: **P-0010936** LOG OF BORING NO. **B-05 (p. 1 of 1)**

PROJECT: **Ragsdale Solar Project; Madison County, MS**

SURFACE ELEVATION: ________ LATITUDE: **32.53840156** LONGITUDE: **-89.99918351**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
	3" FILL, mostly gravelly sand with silt, brown (A-1-b)	FILL									
	9.5" FILL, mostly silty sand with gravel, brown (A-1-b)										
1	LEAN CLAY WITH SAND, brown and gray, laminations of sandy silt (CL) (A-6)	FINE ALLUVIUM									
2					DP	39					
							22				
3											
4	**END OF BORING**										

DEPTH:	DRILLING METHOD
0-4'	Direct Push

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL

BORING COMPLETED: **6/1/22**

DR: **RS** LG: **AH** Rig: **441**

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

AET_CORP W-LAT-LONG P-0010936.GPJ AET+CPT+WELL.GDT 6/17/22

SUBSURFACE BORING LOG

AET JOB NO: **P-0010936** LOG OF BORING NO. **B-06 (p. 1 of 1)**

PROJECT: **Ragsdale Solar Project; Madison County, MS**

SURFACE ELEVATION: ________ LATITUDE: **32.56038162** LONGITUDE: **-89.99894098**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
	8" FILL, mostly silty sand with gravel, brown (A-1-b)	FILL									
1	FILL, mostly silty sand, a little gravel, light brown and brown (A-2-4)										
2	SANDY SILT, light brown and brown, moist (ML) (A-4)	FINE ALLUVIUM			DP	43					
3	LEAN CLAY, brown and gray mottled (CL) (A-6)						25				
4	**END OF BORING**										

DEPTH:	DRILLING METHOD
0-4'	**Direct Push**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL

BORING COMPLETED: **6/1/22**

DR: **RS** LG: **AH** Rig: **441**

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

AET_CORP W-LAT-LONG P-0010936.GPJ AET+CPT+WELL.GDT 6/17/22

SUBSURFACE BORING LOG

AMERICAN ENGINEERING TESTING

AET JOB NO: **P-0010936** LOG OF BORING NO. **B-07 (p. 1 of 1)**

PROJECT: **Ragsdale Solar Project; Madison County, MS**

SURFACE ELEVATION: ________ LATITUDE: **32.56043326** LONGITUDE: **-90.00791815**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
	2" FILL, mostly gravelly silty sand, brown (A-1-b)	FILL									
	SILTY SAND, a little gravel, fine grained, light brown, a little light gray, moist (SM) (A-2-4) (possible fill)	COARSE ALLUVIUM OR FILL									
1	SANDY SILT, light brown, a little dark brown, moist (ML) (A-4)	FINE ALLUVIUM									
2					DP	42					
	LEAN CLAY, brown and gray mottled (CL) (A-6)										
3							19				
4	**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
0-4'	**Direct Push**							

WATER LEVEL MEASUREMENTS

BORING COMPLETED: **6/1/22**

DR: **RS** LG: **AH** Rig: **441**

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

AET_CORP W-LAT-LONG P-0010936.GPJ AET+CPT+WELL.GDT 6/17/22

SUBSURFACE BORING LOG

AMERICAN ENGINEERING TESTING

AET JOB NO: **P-0010936** LOG OF BORING NO. **B-08 (p. 1 of 1)**

PROJECT: **Ragsdale Solar Project; Madison County, MS**

SURFACE ELEVATION: ________ LATITUDE: **32.5604434** LONGITUDE: **-90.0162545**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
	2.5" FILL, mostly silty sand with gravel, brown (A-1-b)	FILL									
	SANDY SILT, light brown, moist (ML) (A-4)	FINE ALLUVIUM									
1											
2	SILTY CLAY, brown and gray mottled (CL-ML) (A-4)				DP	37	23				
3	SILTY SAND, a little gravel, fine to medium grained, brown, a little dark brown, moist (SM) (A-2-4)	COARSE ALLUVIUM									
4	**END OF BORING**										

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS						
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-4'	**Direct Push**							

BORING COMPLETED: **6/1/22**

DR: **RS** LG: **AH** Rig: **441**

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

AET_CORP W-LAT-LONG P-0010936.GPJ AET+CPT+WELL.GDT 6/17/22

SUBSURFACE BORING LOG

AET JOB NO: **P-0010936** LOG OF BORING NO. **B-09 (p. 1 of 1)**

PROJECT: **Ragsdale Solar Project; Madison County, MS**

SURFACE ELEVATION: ______ LATITUDE: **32.56053233** LONGITUDE: **-90.02415162**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
	2.5" FILL, mostly gravelly sand with silt, brown (A-1-b)	FILL									
	SANDY SILT, light brown and brown mottled, moist (ML) (A-4)	FINE ALLUVIUM									
1	LEAN CLAY, brown to brown and grayish brown mottled (CL) (A-6)										
2					DP	38					
							24		36	21	92
3											
4	**END OF BORING**										

DEPTH:	DRILLING METHOD	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-4'	**Direct Push**							
BORING COMPLETED: **6/1/22**								
DR: **RS** LG: **AH** Rig: **441**								

WATER LEVEL MEASUREMENTS

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

SUBSURFACE BORING LOG

AET JOB NO: **P-0010936** LOG OF BORING NO. **B-10 (p. 1 of 1)**

PROJECT: **Ragsdale Solar Project; Madison County, MS**

SURFACE ELEVATION: ______ LATITUDE: **32.56056137** LONGITUDE: **-90.03286381**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	%-#200
	3" FILL, mostly sand with silt and gravel, brown (A-1-b)	FILL									
	FILL, mostly clayey sand with gravel, brown (A-2-6)										
1	LEAN CLAY WITH SAND, grayish brown, a little light brown, laminations of sandy silt (CL) (A-6)	FINE ALLUVIUM									
2	LEAN CLAY, brown and gray mottled (CL) (A-6)				DP	42					
3							24				
4	**END OF BORING**										

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-4'	**Direct Push**							
BORING COMPLETED:	**6/1/22**							
DR: **RS** LG: **AH**	Rig: **441**							

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

AET_CORP W-LAT-LONG P-0010936.GPJ AET+CPT+WELL.GDT 6/17/22

SUBSURFACE BORING LOG

AMERICAN ENGINEERING TESTING

AET JOB NO: **P-0010936** LOG OF BORING NO. **B-11 (p. 1 of 1)**

PROJECT: **Ragsdale Solar Project; Madison County, MS**

SURFACE ELEVATION: ________ LATITUDE: **32.54402337** LONGITUDE: **-90.03805663**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
	3" Bituminous pavement	FILL									
	2.25" RAP										
	5.75" FILL, mostly silty sand with gravel, brown (A-1-b)										
1	SILTY SAND, fine to medium grained, light brown, moist (SM) (A-2-4) (possible fill)	COARSE ALLUVIUM OR FILL									
	SILT, brown and gray, a little light brown, laminations of sandy silt (ML) (A-4)	FINE ALLUVIUM									
2					DP	44					
							22		34	24	99
3							22				
	SANDY SILT, gray, moist (ML) (A-4)	COARSE ALLUVIUM									
4	**END OF BORING**										

DEPTH:	DRILLING METHOD	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-4'	**Direct Push**							

WATER LEVEL MEASUREMENTS

BORING COMPLETED: **6/1/22**

DR: **RS** LG: **AH** Rig: **441**

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

AET_CORP W-LAT-LONG P-0010936.GPJ AET+CPT+WELL.GDT 6/17/22

SUBSURFACE BORING LOG

AMERICAN ENGINEERING TESTING

AET JOB NO: **P-0010936** LOG OF BORING NO. **B-12 (p. 1 of 1)**

PROJECT: **Ragsdale Solar Project; Madison County, MS**

SURFACE ELEVATION: ________ LATITUDE: **32.55052388** LONGITUDE: **-90.03810166**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
	3" Bituminous pavement	FILL									
	7" RAP										
1	6" FILL, mostly silty sand with gravel, brown (A-1-b)										
	SILTY SAND, fine to medium grained, light brown, moist (SM) (A-2-4) (possible)	COARSE ALLUVIUM OR FILL									
2	LEAN CLAY, brown and gray (CL) (A-6) (possible fill)	FINE ALLUVIUM OR FILL			DP	45					
	SILTY SAND WITH GRAVEL, fine to medium grained, brown, moist (SM) (A-1-b) (possible)	COARSE ALLUVIUM OR FILL									
3	SILTY SAND, fine to medium grained, brown, moist (SM) (A-2-4) (possible fill)										
	LEAN CLAY, brown and light brown, laminations of silt (CL) (A-6)	FINE ALLUVIUM					18				
4	**END OF BORING**										

DEPTH:	DRILLING METHOD	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-4'	**Direct Push**							
BORING COMPLETED:	**6/1/22**							
DR: **RS** LG: **AH**	Rig: **441**							

WATER LEVEL MEASUREMENTS

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

SUBSURFACE BORING LOG

AMERICAN ENGINEERING TESTING

AET JOB NO: **P-0010936** LOG OF BORING NO. **B-13 (p. 1 of 1)**

PROJECT: **Ragsdale Solar Project; Madison County, MS**

SURFACE ELEVATION: ________ LATITUDE: **32.55746202** LONGITUDE: **-90.03844793**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
	3" Bituminous pavement	FILL									
	6.5" RAP										
1	5.5" FILL, mostly silty sand, fine to medium grained, brown (A-2-4)										
	LEAN CLAY, brown and gray, a little dark brown, laminations of silt (CL) (A-6) (possible fill)	FINE ALLUVIUM OR FILL									
2	LEAN CLAY, brown and gray mottled, laminations of silt (CL) (A-6)	FINE ALLUVIUM			DP	44					
3							23				
4	**END OF BORING**										

DEPTH:	DRILLING METHOD	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-4'	**Direct Push**							

WATER LEVEL MEASUREMENTS

BORING COMPLETED: **6/1/22**

DR: **RS** LG: **AH** Rig: **441**

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

AET_CORP W-LAT-LONG P-0010936.GPJ AET+CPT+WELL.GDT 6/17/22

AMERICAN ENGINEERING TESTING

SUBSURFACE BORING LOG

AET JOB NO: **P-0010936** LOG OF BORING NO. **B-14 (p. 1 of 1)**

PROJECT: **Ragsdale Solar Project; Madison County, MS**

SURFACE ELEVATION: ________ LATITUDE: **32.56346525** LONGITUDE: **-90.04245383**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
	2.5" Bituminous pavement	FILL									
	2.5" RAP										
1	12" FILL, mostly silty sand with gravel, brown (A-1-b)										
2	LEAN CLAY, brown and gray mottled, a little dark brown, laminations of sandy silt and silt (CL) (A-6)	FINE ALLUVIUM			DP	45					
3							21				
4	**END OF BORING**										

DEPTH:	DRILLING METHOD
0-4'	**Direct Push**

BORING COMPLETED: **6/1/22**

DR: **RS** LG: **AH** Rig: **441**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL

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

AET_CORP W-LAT-LONG P-0010936.GPJ AET+CPT+WELL.GDT 6/17/22

SUBSURFACE BORING LOG

AMERICAN ENGINEERING TESTING

AET JOB NO: **P-0010936** LOG OF BORING NO. **B-15 (p. 1 of 1)**

PROJECT: **Ragsdale Solar Project; Madison County, MS**

SURFACE ELEVATION: ______ LATITUDE: **32.57120067** LONGITUDE: **-90.04636545**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
	4" Bituminous pavement	FILL									
	2.5" RAP										
1	9.5" FILL, mostly silty sand, a little gravel, light brown (A-2-4)										
2	LEAN CLAY, brown and gray mottled, a little light brown, laminations of silt and sandy silt (CL) (A-6)	FINE ALLUVIUM			DP	43					
3							20				
4	**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	
0-4'	**Direct Push**								
BORING COMPLETED: **6/1/22**									
DR: **RS** LG: **AH** Rig: **441**									

AET_CORP W-LAT-LONG P-0010936.GPJ AET+CPT+WELL.GDT 6/17/22

SUBSURFACE BORING LOG

AMERICAN ENGINEERING TESTING

AET JOB NO: **P-0010936** LOG OF BORING NO. **B-16 (p. 1 of 1)**

PROJECT: **Ragsdale Solar Project; Madison County, MS**

SURFACE ELEVATION: ________ LATITUDE: **32.57738672** LONGITUDE: **-90.0472689**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
	4" Bituminous pavement	FILL			CORE						
	2.25" RAP										
1	10.75" FILL, mostly sand with silt and gravel, light brown (A-1-b)						5				6
2	LEAN CLAY, trace roots, gray, a little dark gray, laminations of silt (CL) (A-6)	FINE ALLUVIUM									
3	LEAN CLAY, gray, a little light gray, laminations of silt (CL) (A-6)				DP	38	20				
4	**END OF BORING**										

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS						
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-4'	**Direct Push**							

BORING COMPLETED: **6/1/22**

DR: **RS** LG: **AH** Rig: **441**

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

AET_CORP W-LAT-LONG P-0010936.GPJ AET+CPT+WELL.GDT 6/17/22

Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	Class-ification	Water Content (%)	Dry Density (pcf)	Satur-ation (%)	Void Ratio
B-01	3.1							22.3			
B-02	2.6							25.1			
B-03	2.9							18.6			
B-04	0.6				19	45		10.0			
B-04	2.8							27.1			
B-05	2.5							22.0			
B-06	3.1							24.8			
B-07	3.1							18.6			
B-08	2.4							22.9			
B-09	2.5	36	21	15	0.075	92	CL	24.3			
B-10	3.0							23.7			
B-11	2.4	34	24	10	0.075	99	ML	22.1			
B-11	3.0							22.1			
B-12	3.7							17.6			
B-13	2.9							22.6			
B-14	2.7							20.7			
B-15	2.7							20.0			
B-16	1.0				19	6		5.1			
B-16	3.1							19.6			

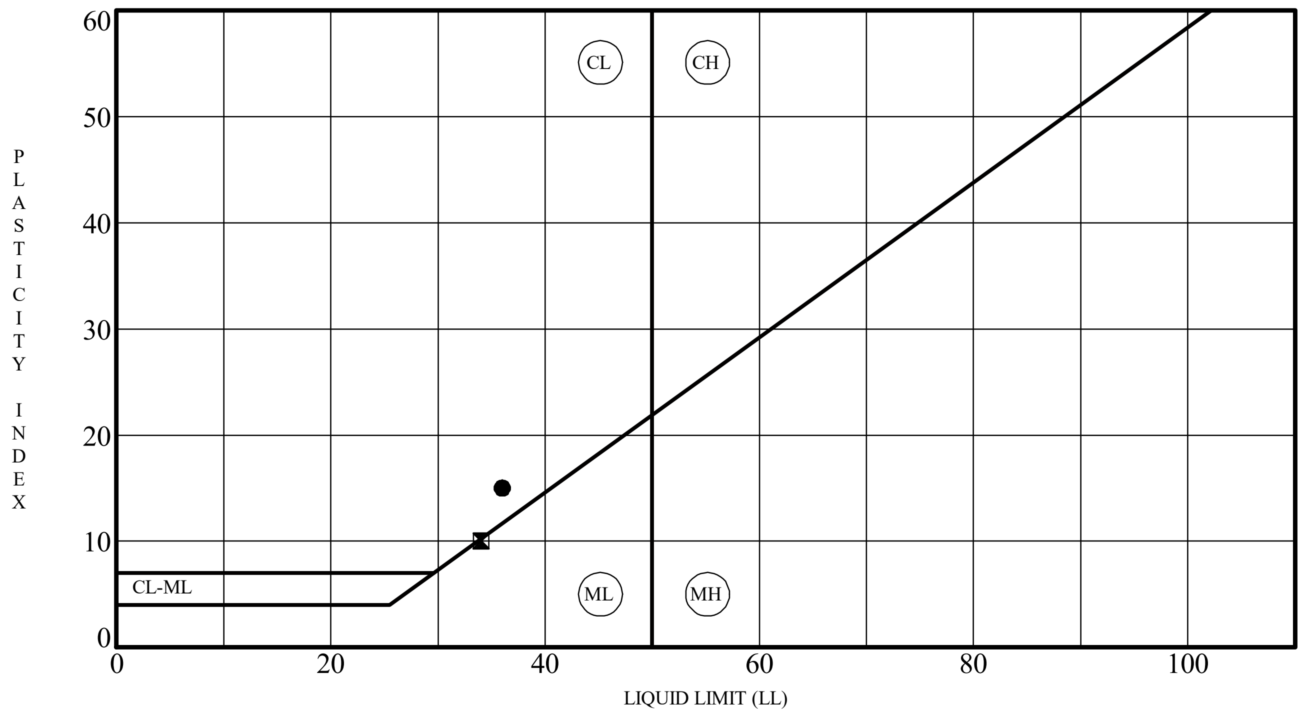
AMERICAN ENGINEERING TESTING

Summary of Laboratory Results

Project: Ragsdale Solar Project

Location: Madison County, MS

Number: P-0010936



	Specimen Identification		LL	PL	PI	Fines	Classification
●	**B-09**	**2.5'**	**36**	**21**	**15**	**91.5**	**LEAN CLAY**
⊠	**B-11**	**2.4'**	**34**	**24**	**10**	**98.6**	**SILT**

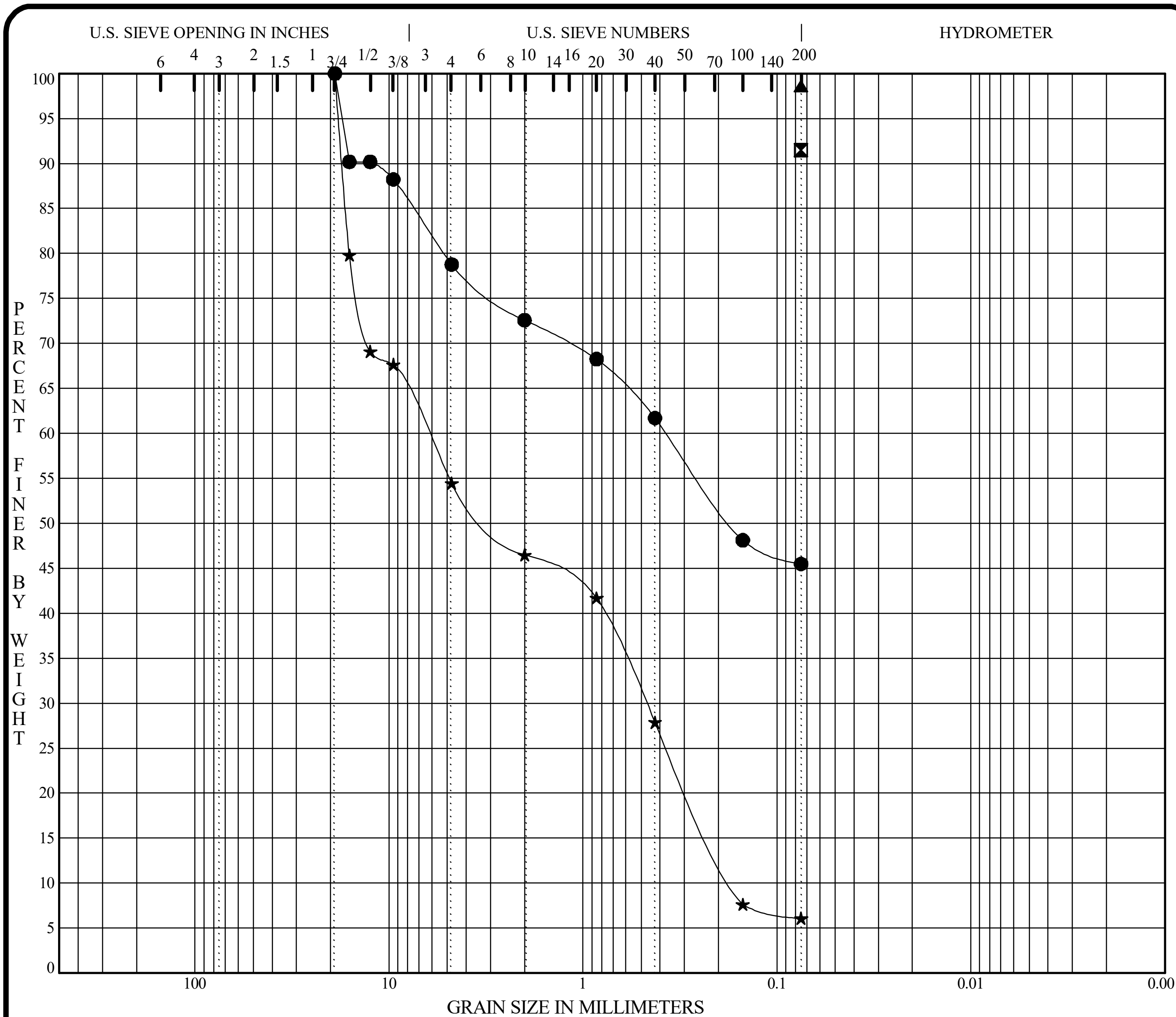
PROJECT **Ragsdale Solar Project; Madison County, MS**

AET JOB NO. **P-0010936**

DATE **6/1/22**

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

ATTERBERG LIMITS RESULTS



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			Classification	MC%	LL	PL	PI	Cc	Cu
●	**B-04**	**0.6**		**10**					
⧗	**B-09**	**2.5**	**LEAN CLAY**	**24**	**36**	**21**	**15**		
▲	**B-11**	**2.4**	**SILT**	**22**	**34**	**24**	**10**		
★	**B-16**	**1.0**		**5**				**0.21**	**37.5**

Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt / %Clay
●	**B-04**	**0.6**	**19.00**	**0.37**			**27.4**	**27.1**	**45.5**
⧗	**B-09**	**2.5**	**0.08**				**0.0**	**0.0**	**91.5**
▲	**B-11**	**2.4**	**0.08**				**0.0**	**0.0**	**98.6**
★	**B-16**	**1.0**	**19.00**	**6.36**	**0.473**	**0.1694**	**53.5**	**40.4**	**6.1**

PROJECT **Ragsdale Solar Project; Madison County, MS**

AET JOB NO. **P-0010936**
DATE **6/1/22**

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AASHTO GRADATION CURVES

Appendix B

Ground Penetrating Radar Field Exploration and Testing
GPR Results Plot

Appendix B
Ground Penetrating Radar Field Exploration and Testing AET Project No. P-0010936B

B.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.

B.2 EQUIPMENT DESCRIPTION

B.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.

B.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.

B.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.

B.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.

B.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.

B.5 DATA ANALYSIS METHODS

B.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.

B.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.

B.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).

B.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.

B.6 TEST LIMITATIONS

B.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.

B.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.

B.7 SUPPORTING TEST METHODS

B.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.

B.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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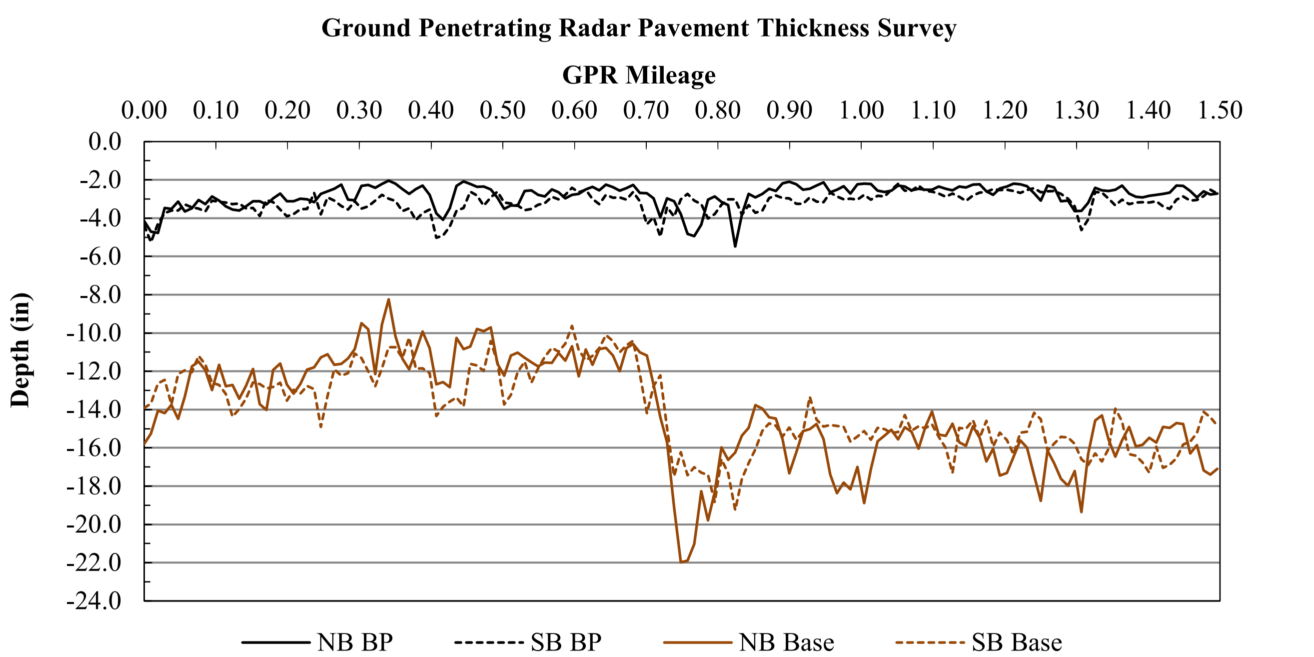
GENERAL INFORMATION: GROUND PENETRATING RADAR

Project: Ragsdale Solar Project, MS
Date: 6/1/22
AET Job No.: P-0010936
Test Date: 5/26/22
Road: N Old Canton Rd
Section/Grid: S01
From: Cotton Blossom Rd
To: Endris Rd

SUMMARY STATISTICS

Units: inches

Layer	NB				SB			
	Average	CV	15th	Min.	Average	CV	15th	Min.
BP	2.8	21%	2.3	2.0	3.2	17%	2.7	2.2
Base	11.3	24%	8.5	6.2	10.8	20%	8.2	6.8



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AMERICAN ENGINEERING TESTING

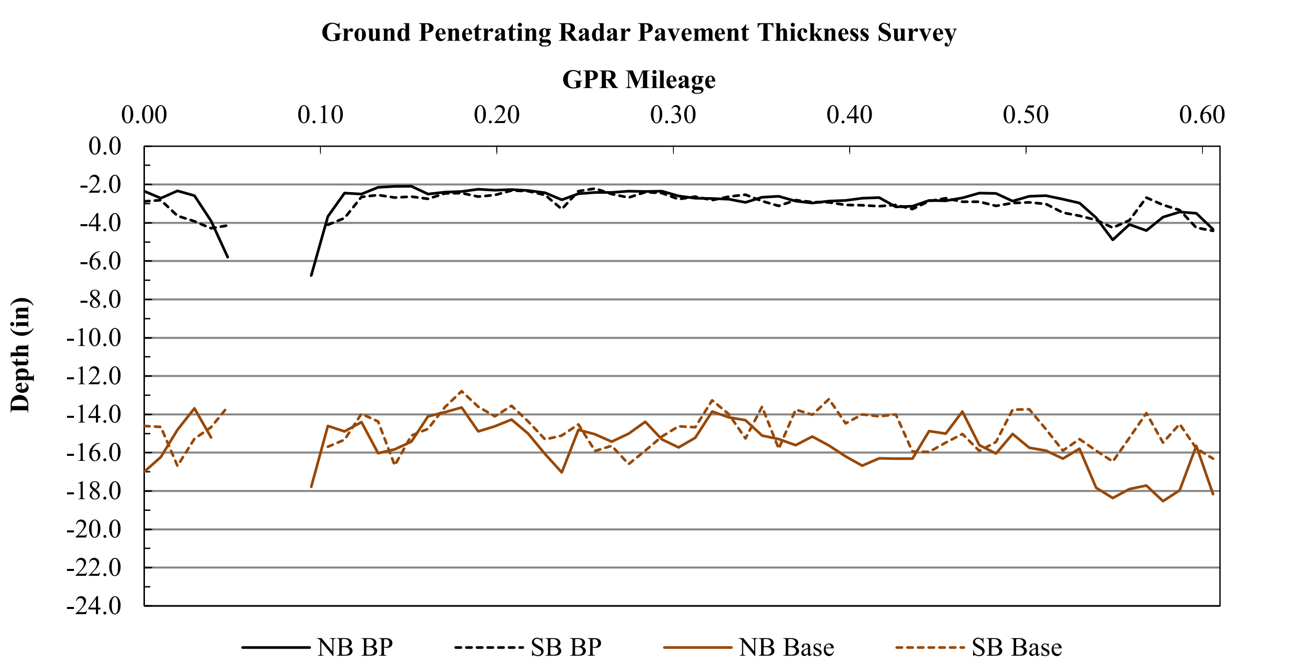
GENERAL INFORMATION: GROUND PENETRATING RADAR

Project:	Ragsdale Solar Project, MS	**Date:**	6/1/22
AET Job No.:	P-0010936	**Test Date:**	5/26/22
Road:	N Old Canton Rd	**Section/Grid:**	S02
From:	Endris Rd	**To:**	Nichols Rd

SUMMARY STATISTICS

Units: **inches**

	NB				SB			
Layer	**Average**	**CV**	**15th**	**Min.**	**Average**	**CV**	**15th**	**Min.**
BP	2.9	29%	2.4	2.1	3.0	19%	2.5	2.2
Base	12.7	8%	11.5	10.9	11.8	8%	10.9	9.5



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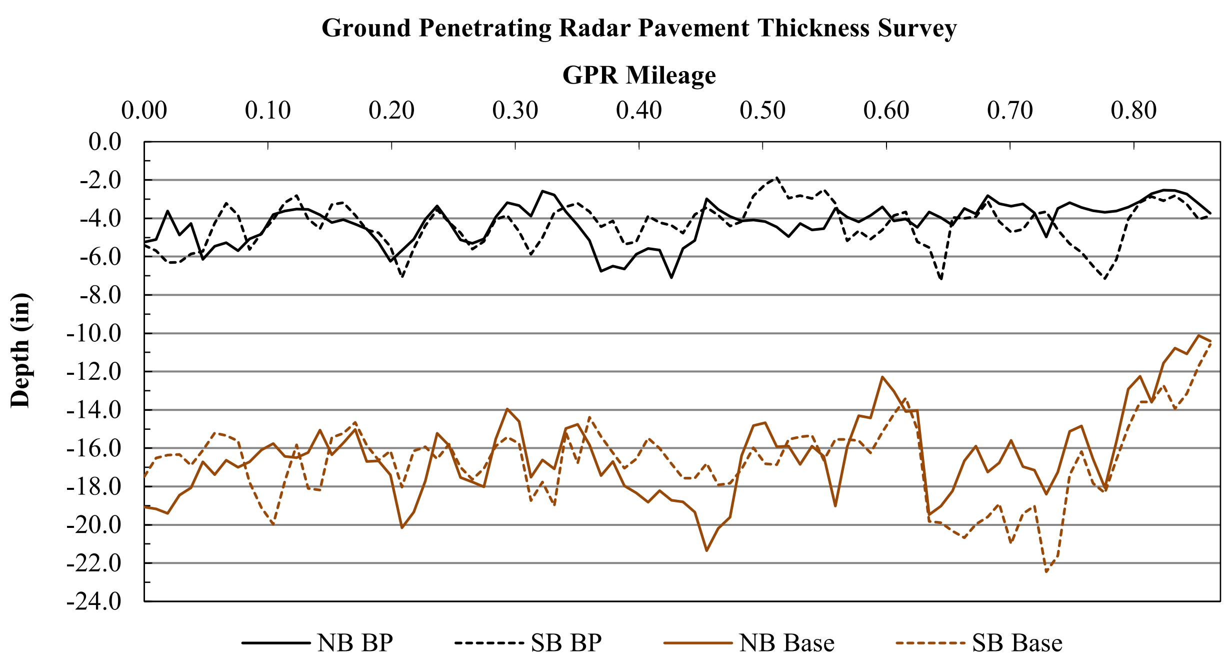
GENERAL INFORMATION: GROUND PENETRATING RADAR

Project: Ragsdale Solar Project, MS
Date: 6/1/22
AET Job No.: P-0010936
Test Date: 5/26/22
Road: N Old Canton Rd
Section/Grid: S03
From: Nichols Rd
To: US 51

SUMMARY STATISTICS

Units: inches

Layer	NB				SB			
	Average	CV	15th	Min.	Average	CV	15th	Min.
BP	4.2	24%	3.3	2.5	4.3	26%	3.2	1.9
Base	12.1	17%	10.5	6.7	12.3	17%	10.5	6.7



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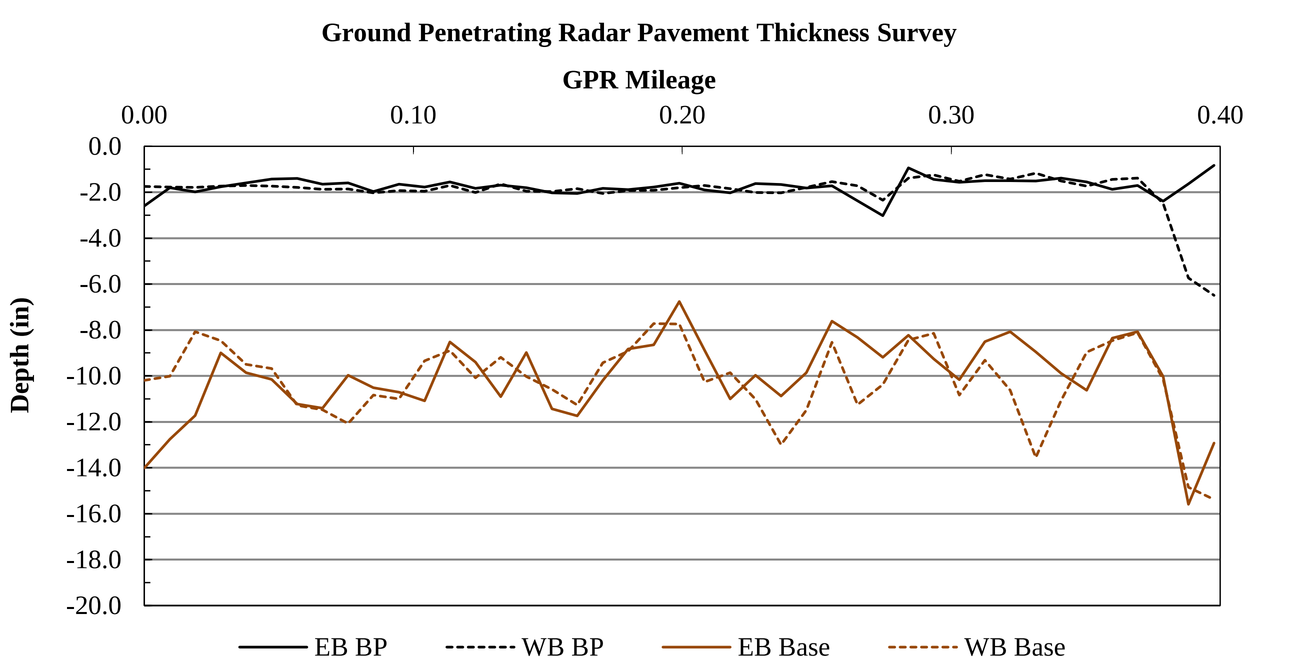
GENERAL INFORMATION: GROUND PENETRATING RADAR

Project:	Ragsdale Solar Project, MS	**Date:**	6/13/22
AET Job No.:	P-0010936	**Test Date:**	5/26/22
Road:	E Cotton Blossom Rd	**Section/Grid:**	S04A
From:	N Old Canton Rd	**To:**	0.39 mi E

SUMMARY STATISTICS

Units: inches

	EB				WB			
Layer	**Average**	**CV**	**15th**	**Min.**	**Average**	**CV**	**15th**	**Min.**
BP	1.7	22%	1.5	0.8	2.0	49%	1.5	1.2
Base	8.3	21%	6.7	5.2	8.3	16%	7.0	5.8



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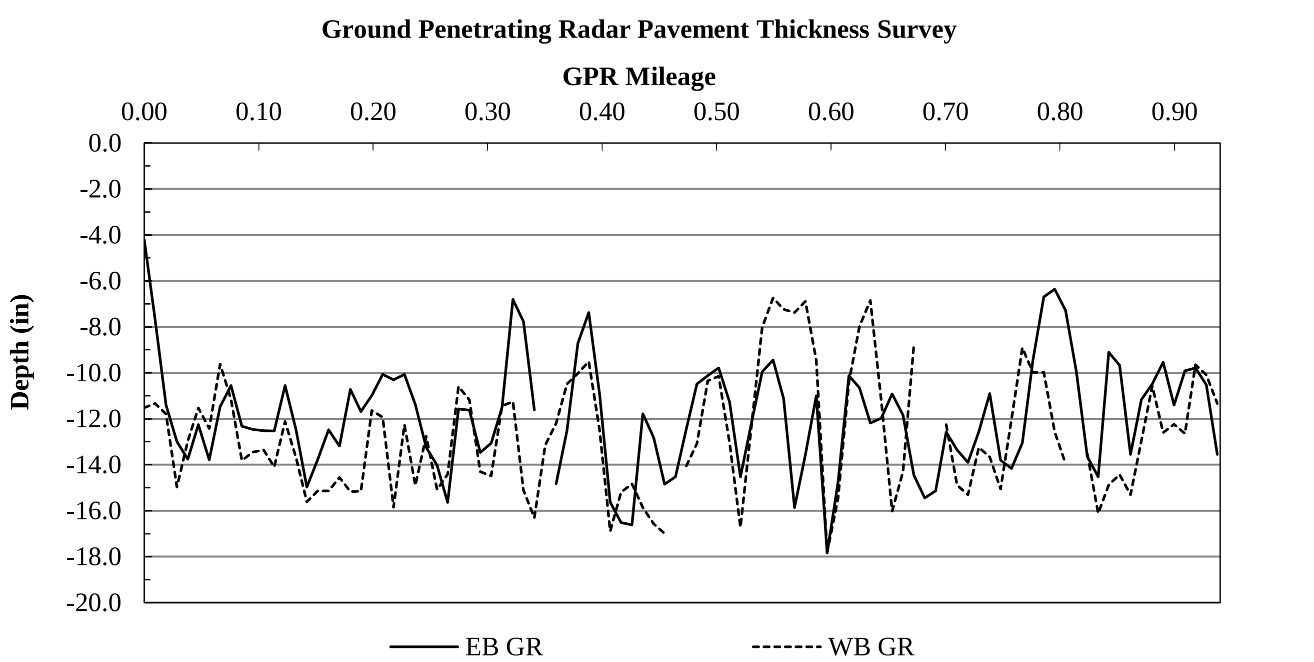
GENERAL INFORMATION: GROUND PENETRATING RADAR

Project:	Ragsdale Solar Project, MS	**Date:**	6/13/22
AET Job No.:	P-0010936	**Test Date:**	5/26/22
Road:	E Cotton Blossom Rd	**Section/Grid:**	S04B
From:	2.24 mi W of Hwy 43	**To:**	1.3 mi W of Hwy 43

SUMMARY STATISTICS

Units: **inches**

Layer	EB				WB			
	Average	**CV**	**15th**	**Min.**	**Average**	**CV**	**15th**	**Min.**
GR	11.9	20%	9.8	4.2	12.7	21%	10.0	6.7



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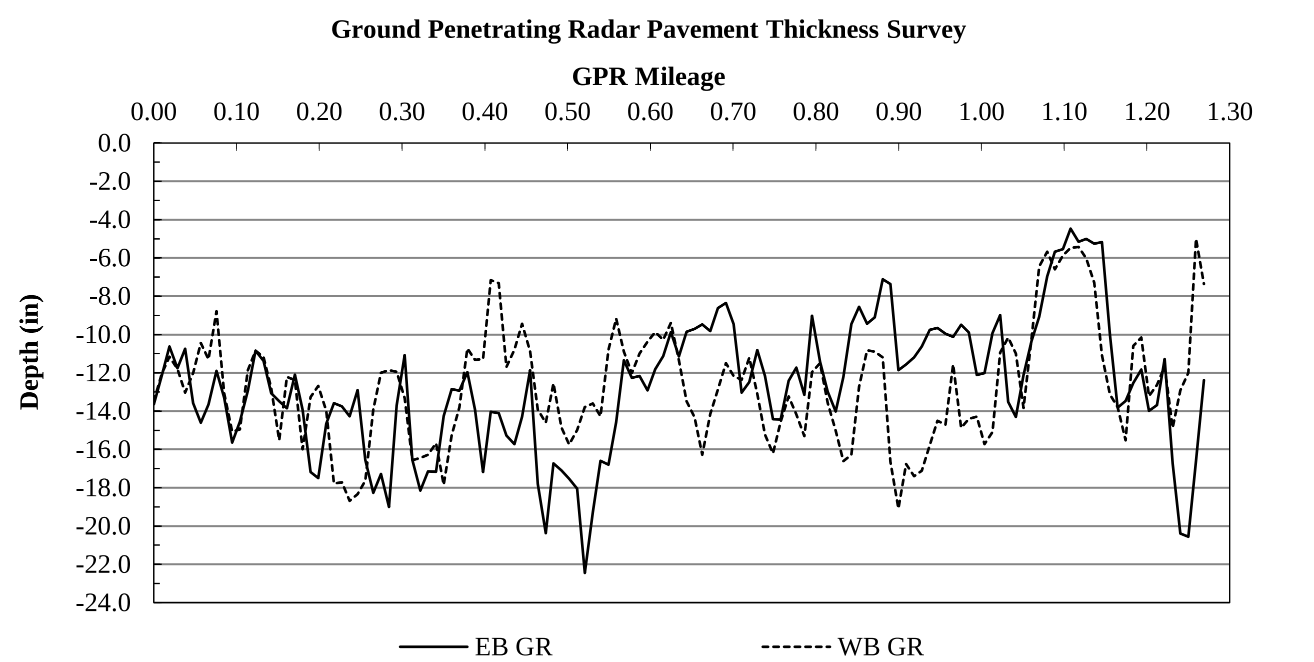
GENERAL INFORMATION: GROUND PENETRATING RADAR

Project: Ragsdale Solar Project, MS
AET Job No.: P-0010936
Road: E Cotton Blossom Rd
From: 1.3 mi W
Date: 6/13/22
Test Date: 5/26/22
Section/Grid: S04C
To: Hwy 43

SUMMARY STATISTICS

Units: inches

Layer	EB				WB			
	Average	CV	15th	Min.	Average	CV	15th	Min.
GR	12.7	27%	9.5	4.5	12.7	24%	10.3	5.0



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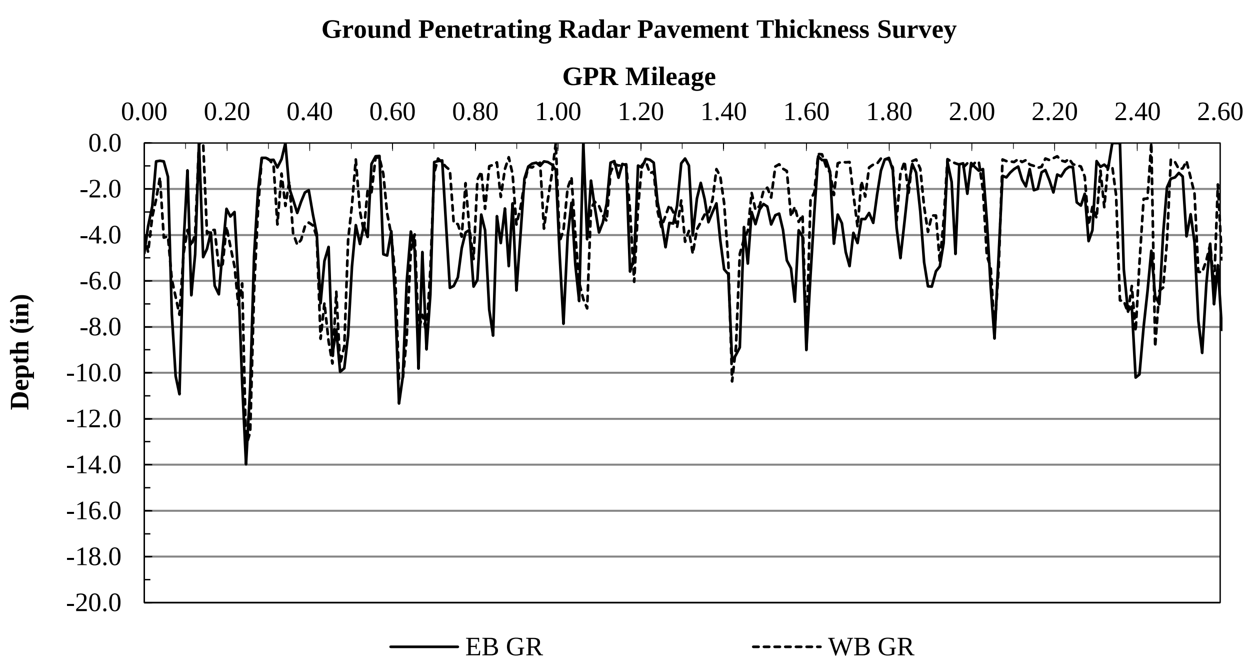
GENERAL INFORMATION: GROUND PENETRATING RADAR

Project:	Ragsdale Solar Project, MS	**Date:**	6/1/22
AET Job No.:	P-0010936	**Test Date:**	5/26/22
Road:	Endris Rd	**Section/Grid:**	S05
From:	N Old Canton Rd	**To:**	Hwy 43

SUMMARY STATISTICS

Units: inches

Layer	EB				WB			
	Average	CV	15th	Min.	Average	CV	15th	Min.
GR	3.8	70%	1.0	0.6	3.1	79%	0.8	0.5



Appendix C

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

Appendix C
Falling Weight Deflectometer Field Exploration and Testing
Report No. P-0010936B

C.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.

C.2 EQUIPMENT DESCRIPTION

C.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.

C.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.

C.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.

C.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.

C.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.

C.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.

C.5 DATA ANALYSIS METHODS

C.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.

C.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.

C.5.3 Methods

For bituminous pavements, 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 required bituminous overlay thickness. The computer program, Modulus 7, per the Texas Department of Transportation (TxDOT) method was also used for estimating the remailing life of pavement. The allowable deflections were used for estimating Axle Load Capacity, 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.

C.6 TEST LIMITATIONS

C.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.

C.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.

C.7 SUPPORTING TEST METHODS

C.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.

C.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.

C.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.

American Engineering Testing, Inc.
550 Cleveland Avenue North
St. Paul, Minnesota 55114
Phone: (651) 659-9001
Fax: (651) 659-1379

AET Project No. P-0010936
County: MADISON
Test Date: May 24, 2022
Section: S01
Roadway: N Old Canton Rd
From: Cotton Blossom Rd
To: Endris Rd

Prev. Day's Avg. Air Temp.: 73 °F
Total AC: 3.2 in.
Daily ESALs: 5.1
PCI: 63
Haul ESALs: 0
Soil Type: P
Draught Adjustment Factor: 1.00
Seasonal Correction Factor: 1.17

Design Period: 10 Years
Projection Factor: 1.1
Growth Factor: 10.46
10-year Design ESALs: 19,479
Design Period: 20 Years
Projection Factor: 1.2
Growth Factor: 22.02
20-year Design ESALs: 40,995

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
1.5																			N OLD CANTON RD, IC, ENDRIS RD, SB"
1.5	1	12:40	89.6	95.7	5402	21.1	14.5	10.5	7.1	5.0	2.8	1.9	1.5	1.2	5.8	2.3	0.0	12.3	
1.5	2	12:40	89.6	95.7	5413	21.0	14.5	10.5	7.1	5.0	2.8	2.0	1.5	1.3	5.8	2.4	0.0	12.3	
1.5	3	12:40	89.6	95.7	8716	32.8	23.1	17.3	11.8	8.4	4.8	3.3	2.6	2.1	5.4	2.4	0.0	12.7	
1.5	4	12:40	89.6	95.7	8836	32.4	23.2	17.3	11.9	8.5	4.8	3.3	2.6	2.2	5.5	2.5	0.0	12.9	
1.6	1	12:41	89.6	85.6	5851	20.2	13.7	9.5	6.4	4.3	2.6	2.0	1.6	1.3	6.7	2.4	0.0	13.3	
1.6	2	12:41	89.6	85.6	5829	19.9	13.5	9.5	6.4	4.3	2.6	2.0	1.6	1.3	6.7	2.4	0.0	13.4	
1.6	3	12:41	89.6	85.6	0:00	31.4	22	16.0	11.0	7.6	4.5	3.5	2.7	2.2	6.2	2.5	0.0	13.7	
1.6	4	12:41	89.6	85.6	9460	31.3	22.4	16.1	11.1	7.6	4.6	3.5	2.7	2.2	6.2	2.5	0.0	13.8	
1.7	1	12:42	89.6	95.0	5457	24.7	18.5	12.4	8.1	5.1	2.3	1.6	1.3	1.1	7.1	2.0	0.0	10.8	
1.7	2	12:42	89.6	95.0	5468	24.4	18.4	12.5	8.1	5.1	2.3	1.6	1.3	1.1	7.2	2.0	0.0	10.9	
1.7	3	12:42	89.6	95.0	8957	38.7	29.3	20.2	13.2	8.5	4.2	2.8	2.5	2.0	6.4	2.1	0.0	11.2	
1.7	4	12:42	89.6	95.0	8989	38.8	29.6	20.5	13.4	8.6	4.2	3.0	2.4	2.0	6.4	2.1	0.0	11.2	
1.8	1	12:43	89.6	93.4	5654	35.5	25.7	19.1	12.2	8.1	4.2	2.9	2.2	1.9	4.1	1.9	0.7	7.9	
1.8	2	12:43	89.6	93.4	5621	34.8	25.3	18.8	12.1	7.9	4.1	2.9	2.1	1.9	4.1	1.9	0.7	8.0	
1.8	3	12:43	89.6	93.4	8946	53.8	40.3	30.7	20.3	13.5	7.1	5.0	3.8	3.2	3.8	2.0	0.6	8.2	
1.8	4	12:43	89.6	93.4	8913	53.9	40.5	30.9	20.4	13.5	7.1	5.1	3.8	3.2	3.7	2.0	0.6	8.2	
1.9	1	12:44	89.6	97.5	6059	6.1	5.0	4.6	4.0	3.5	2.4	1.7	1.2	0.9	7.4	6.2	0.0	35.8	
1.9	2	12:44	89.6	97.5	6113	6.1	5.0	4.6	4.1	3.5	2.4	1.7	1.2	0.9	7.5	6.2	0.0	36.0	
1.9	3	12:44	89.6	97.5	9842	10.1	8.4	7.7	6.8	5.8	4.1	2.9	2.0	1.4	7.1	6.2	0.0	35.3	
1.9	4	12:44	89.6	97.5	0:00	10.0	8	7.7	6.8	5.8	4.1	2.9	2.0	1.4	7.1	6.2	0.0	35.4	
2.0	1	12:45	89.6	97.6	5709	18.2	12.8	9.6	6.6	4.4	2.6	1.9	1.4	1.1	6.6	2.6	0.0	14.8	
2.0	2	12:45	89.6	97.6	5730	18.0	12.7	9.6	6.6	4.4	2.6	1.9	1.4	1.1	6.6	2.6	0.0	15.0	
2.0	3	12:45	89.6	97.6	9307	28.5	20.6	15.9	11.0	7.5	4.4	3.2	2.3	2.0	6.3	2.7	0.0	15.3	
2.0	4	12:45	89.6	97.6	9274	28.2	20.5	15.9	11.0	7.5	4.4	3.2	2.4	2.0	6.2	2.7	0.0	15.4	
2.1	1	12:46	89.6	96.5	5763	15.8	11.0	8.7	6.3	4.7	3.2	2.4	1.9	1.5	5.5	3.1	0.0	16.7	
2.1	2	12:46	89.6	96.5	5807	15.6	11.1	8.7	6.3	4.8	3.2	2.4	1.9	1.5	5.5	3.1	0.0	16.9	
2.1	3	12:46	89.6	96.5	9296	24.2	17.6	13.9	10.3	7.8	5.2	3.9	3.0	2.5	5.4	3.2	0.0	17.4	
2.1	4	12:46	89.6	96.5	9328	24.0	17.6	13.9	10.3	7.8	5.2	4.0	3.0	2.5	5.3	3.3	0.0	17.5	
2.2	1	12:48	89.6	93.9	5916	7.1	5.4	4.6	3.8	3.0	2.0	1.4	1.1	0.9	8.8	4.8	0.0	31.6	
2.2	2	12:48	89.6	93.9	5971	7.1	5.4	4.6	3.8	3.1	2.0	1.4	1.1	0.9	8.9	4.8	0.0	31.6	
2.2	3	12:48	89.6	93.9	9711	11.5	9.0	7.7	6.3	5.2	3.4	2.3	1.8	1.5	8.6	4.9	0.0	31.7	
2.2	4	12:48	89.6	93.9	9733	11.5	9.0	7.7	6.3	5.2	3.4	2.3	1.8	1.5	8.6	5.0	0.0	31.8	
2.3	1	12:49	91.4	96.7	5413	25.7	20.3	16.2	12.0	8.8	5.2	3.5	2.7	2.3	3.1	2.5	0.0	10.2	
2.3	2	12:49	91.4	96.7	5402	25.4	20.1	16.1	12.0	8.8	5.2	3.5	2.8	2.3	3.1	2.5	0.0	10.3	
2.3	3	12:49	91.4	96.7	8869	40.8	32.1	25.8	19.3	14.2	8.5	5.8	4.6	3.9	3.1	2.6	0.0	10.5	
2.3	4	12:49	91.4	96.7	8782	40.7	32.3	26.0	19.4	14.4	8.6	5.9	4.7	3.9	3.0	2.6	0.0	10.4	
2.4	1	12:50	91.4	94.3	5566	24.1	15.4	11.3	7.7	5.2	2.9	2.0	1.5	1.3	5.8	2.2	0.0	11.2	
2.4	2	12:50	91.4	94.3	5643	24.0	15.4	11.3	7.7	5.3	2.9	2.1	1.6	1.3	5.8	2.2	0.0	11.4	
2.4	3	12:50	91.4	94.3	9121	37.4	24.9	18.5	12.7	9.0	4.9	3.4	2.6	2.1	5.6	2.3	0.0	11.7	
2.4	4	12:50	91.4	94.3	9011	36.8	24.6	18.4	12.7	8.9	4.9	3.4	2.6	2.1	5.5	2.3	0.0	11.7	
2.5	1	12:51	91.4	99.8	5993	12.2	9.6	8.2	6.6	5.0	2.9	1.9	1.4	1.2	6.1	3.7	0.0	21.5	
2.5	2	12:51	91.4	99.8	6026	12.2	9.6	8.3	6.6	5.0	3.0	1.9	1.4	1.2	6.1	3.7	0.0	21.6	
2.5	3	12:51	91.4	99.8	9722	20.2	16.1	14.0	11.1	8.6	5.0	3.2	2.3	2.0	5.8	3.8	0.0	21.1	
2.5	4	12:51	91.4	99.8	9755	20.2	16.2	14.0	11.1	8.6	5.1	3.2	2.3	2.0	5.8	3.8	0.0	21.2	
2.6	1	12:52	91.4	94.5	5905	22.2	15.9	11.3	8.1	5.5	3.1	2.2	1.7	1.5	5.7	2.4	0.0	12.6	
2.6	2	12:52	91.4	94.5	5916	21.9	15.8	11.3	8.0	5.5	3.1	2.2	1.7	1.5	5.8	2.4	0.0	12.8	
2.6	3	12:52	91.4	94.5	9427	34.9	25.5	18.3	13.2	9.2	5.2	3.7	2.9	2.5	5.4	2.5	0.0	12.8	
2.6	4	12:52	91.4	94.5	9482	34.4	25.6	18.4	13.4	9.4	5.2	3.7	2.9	2.4	5.4	2.5	0.0	13.0	
2.7	1	12:53	91.4	94.4	5730	30.6	22.9	16.2	11.0	7.1	3.8	2.7	2.1	1.7	4.4	2.0	0.2	9.2	
2.7	2	12:53	91.4	94.4	5752	30.1	22.8	16.2	11.0	7.1	3.9	2.7	2.1	1.7	4.4	2.1	0.1	9.4	
2.7	3	12:53	91.4	94.4	9252	46.0	35.7	26.4	18.8	12.2	6.8	4.7	3.7	3.1	4.1	2.2	0.0	9.8	
2.7	4	12:53	91.4	94.4	9285	45.9	35.7	26.5	18.9	12.4	6.8	4.7	3.8	3.1	4.0	2.2	0.0	9.8	
2.8	1	12:53	91.4	97.0	5938	19.9	14.3	11.0	7.9	5.9	3.6	2.5	2.0	1.5	4.9	2.7	0.0	14.0	
2.8	2	12:53	91.4	97.0	5927	19.4	14.1	10.9	7.9	5.8	3.6	2.5	1.9	1.5	4.9	2.8	0.0	14.3	
2.8	3	12:53	91.4	97.0	9471	31.0	23.0	18.1	13.3	10.0	6.2	4.2	3.2	2.5	4.6	2.9	0.0	14.3	
2.8	4	12:53	91.4	97.0	9525	30.8	23.0	18.2	13.4	10.0	6.2	4.3	3.2	2.6	4.6	2.9	0.0	14.4	
2.8																			N OLD CANTON RD, IC, E SOWELL RD, SB"
2.8	1	12:55	91.4	99.1	5741	19.8	14.6	11.2	7.8	5.2	2.9	2.0	1.6	1.2	6.0	2.5	0.0	13.9	
2.8	2	12:55	91.4	99.1	5752	19.7	14.6	11.2	7.8	5.3	2.9	1.9	1.5	1.2	6.0	2.5	0.0	14.0	
2.8	3	12:55	91.4	99.1	9307	32.5	24.5	18.7	13.1	8.9	5.0	3.6	2.8	2.3	5.6	2.6	0.0	13.7	
2.8	4	12:55	91.4	99.1	9339	32.5	24.6	18.8	13.2	8.9	5.0	3.5	2.8	2.3	5.6	2.6	0.0	13.7	
2.9	1	12:56	93.2	98.9	5807	21.3	15.9	11.5	7.8	5.1	2.5	1.5	1.1	1.0	6.9	2.3	0.0	13.2	
2.9	2	12:56	93.2	98.9	5851	21.0	15.7	11.6	7.8	5.1	2.4	1.5	1.0	1.0	7.2	2.3	0.0	13.5	
2.9	3	12:56	93.2	98.9	9416	33.7	25.5	19.1	13.3	8.9	4.3	2.7	2.0	1.7	6.6	2.4	0.0	13.5	

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
2.9	4	12:56	93.2	98.9	9416	33.3	25.3	19.2	13.3	8.9	4.3	2.7	2.0	1.8	6.6	2.4	0.0	13.6	
3.0	1	12:57	93.2	96.6	5260	30.9	20.7	14.5	8.9	5.4	3.1	2.2	1.7	1.4	5.0	1.9	0.3	8.5	
3.0	2	12:57	93.2	96.6	5337	30.3	20.6	14.5	9.0	5.5	3.2	2.2	1.7	1.4	5.0	1.9	0.2	8.8	
3.0	3	12:57	93.2	96.6	8497	48.3	33.2	23.7	15.0	9.3	5.6	3.8	2.9	2.5	4.5	2.0	0.3	8.7	
3.0	4	12:57	93.2	96.6	8672	47.7	33.4	24.0	15.3	9.4	5.6	3.8	2.9	2.5	4.6	2.0	0.2	9.0	
3.0																			END"

American Engineering Testing, Inc.
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St. Paul, Minnesota 55114
Phone: (651) 659-9001
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AET Project No. P-0010936
County: MADISON
Test Date: May 24, 2022
Section: S02
Roadway: N Old Canton Rd
From: Endris Rd
To: Nichols Rd

Prev. Day's Avg. Air Temp.: 73 °F
Total AC: 3.0 in.
Daily ESALs: 5.1
PCI: 48
Haul ESALs: 0
Soil Type: P
Draught Adjustment Factor: 1.00
Seasonal Correction Factor: 1.17

Design Period: 10 Years
Projection Factor: 1.1
Growth Factor: 10.46
10-year Design ESALs: 19,479
Design Period: 20 Years
Projection Factor: 1.2
Growth Factor: 22.02
20-year Design ESALs: 40,995

															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
0.9																			N OLD CANTON RD, IC, NICHOLAS RI
0.9	1	12:32	86.0	95.0	5260	34.2	25.6	20.0	13.5	9.3	4.7	2.9	2.1	1.8	3.3	2.0	0.8	7.6	
0.9	2	12:32	86.0	95.0	5238	33.7	25.2	19.7	13.4	9.3	4.7	2.9	2.2	1.9	3.3	2.0	0.8	7.7	
0.9	3	12:32	86.0	95.0	8541	53.6	41.3	32.7	22.4	15.7	8.2	5.1	4.0	3.4	3.1	2.1	0.7	7.9	
0.9	4	12:32	86.0	95.0	8497	53.7	41.2	32.8	22.4	15.7	8.2	5.1	3.9	3.3	3.1	2.1	0.7	7.8	
1.0	1	12:33	87.8	92.9	5818	26.0	16.6	11.1	6.8	4.4	2.2	1.7	1.4	1.2	7.9	2.1	0.0	10.9	
1.0	2	12:33	87.8	92.9	5862	25.8	16.6	11.1	6.9	4.4	2.2	1.7	1.4	1.2	7.9	2.1	0.0	11.0	
1.0	3	12:33	87.8	92.9	9394	41.7	27.5	18.8	11.7	7.5	3.8	2.9	2.4	2.1	7.3	2.1	0.0	10.9	
1.0	4	12:33	87.8	92.9	9383	41.2	27.5	18.8	11.8	7.5	3.9	2.9	2.4	2.1	7.2	2.1	0.0	11.0	
1.1	1	12:34	87.8	91.5	5391	28.7	20.8	14.9	9.4	6.2	2.9	2.0	1.6	1.3	5.6	2.0	0.0	9.2	
1.1	2	12:34	87.8	91.5	5337	28.2	20.6	14.9	9.4	6.2	2.9	2.0	1.6	1.3	5.5	2.0	0.0	9.2	
1.1	3	12:34	87.8	91.5	8694	46.3	34.1	25.2	16.7	10.5	5.1	3.5	2.9	2.3	5.1	2.0	0.0	9.2	
1.1	4	12:34	87.8	91.5	8836	46.0	34.3	25.5	16.3	10.7	5.2	3.6	2.9	2.4	5.1	2.1	0.0	9.4	
1.2	1	12:35	87.8	91.3	5763	25.9	16.6	11.8	7.3	5.1	2.7	1.8	1.4	1.1	6.4	2.2	0.0	10.7	
1.2	2	12:35	87.8	91.3	5752	25.5	16.4	11.7	7.3	5.1	2.7	1.8	1.4	1.1	6.4	2.2	0.0	10.9	
1.2	3	12:35	87.8	91.3	9285	40.7	27.8	20.0	12.8	9.0	4.7	3.1	2.3	1.9	5.9	2.2	0.0	10.9	
1.2	4	12:35	87.8	91.3	9263	40.5	27.7	20.0	12.8	9.0	4.7	3.1	2.3	1.9	5.9	2.2	0.0	10.9	
1.3	1	12:37	87.8	88.6	5818	26.4	18.6	12.6	8.2	5.4	2.7	1.8	1.4	1.2	6.5	2.1	0.0	10.5	
1.3	2	12:37	87.8	88.6	5851	26.1	18.5	12.7	8.2	5.4	2.7	1.9	1.4	1.3	6.4	2.2	0.0	10.7	
1.3	3	12:37	87.8	88.6	9339	42.7	30.3	20.8	13.5	9.2	4.7	3.2	2.4	1.9	6.0	2.2	0.0	10.5	
1.3	4	12:37	87.8	88.6	9350	42.6	30.7	21.1	13.8	9.3	4.7	3.2	2.5	1.9	5.9	2.2	0.0	10.5	
1.4	1	12:38	87.8	95.3	5227	33.6	24.6	18.0	11.7	7.6	4.1	2.7	2.2	1.6	3.8	2.0	0.6	7.7	
1.4	2	12:38	87.8	95.3	5195	33.4	24.7	18.0	11.8	7.7	4.2	2.8	2.1	1.6	3.7	2.0	0.7	7.7	
1.4	3	12:38	87.8	95.3	8421	53.8	40.0	29.1	19.3	12.7	6.8	4.8	3.5	2.8	3.7	2.0	0.6	7.8	
1.4	4	12:38	87.8	95.3	8355	54.3	40.2	29.4	19.5	12.7	6.9	4.8	3.4	2.8	3.6	2.0	0.7	7.6	
1.4																			N OLD CANTON RD, J-, START, SI
1.5																			N OLD CANTON RD, J-, END SB'
1.5	1	12:39	87.8	93.7	5446	26.0	18.4	13.8	9.8	6.9	4.1	2.7	2.0	1.7	3.9	2.4	0.0	10.1	
1.5	2	12:39	87.8	93.7	5490	25.5	18.2	13.7	9.7	6.9	4.1	2.7	2.0	1.6	4.0	2.4	0.0	10.4	
1.5	3	12:39	87.8	93.7	8913	40.7	29.9	22.9	16.2	11.7	6.9	4.6	3.4	2.8	3.9	2.4	0.0	10.5	
1.5	4	12:39	87.8	93.7	8847	40.7	30.0	23.1	16.4	11.8	6.9	4.6	3.5	2.8	3.8	2.4	0.0	10.5	
1.5																			N OLD CANTON RD, IC, ENDRIS RD,

American Engineering Testing, Inc.
550 Cleveland Avenue North
St. Paul, Minnesota 55114
Phone: (651) 659-9001
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AET Project No. P-0010936
County: MADISON
Test Date: May 24, 2022
Section: S03
Roadway: N Old Canton Rd
From: Nichols Rd
To: US 51

Prev. Day's Avg. Air Temp.: 73 °F
Total AC: 4.3 in.
Daily ESALs: 5.1
PCI: 53
Haul ESALs: 0
Soil Type: P
Draught Adjustment Factor: 1.00
Seasonal Correction Factor: 1.14

Design Period: 10 Years
Projection Factor: 1.1
Growth Factor: 10.46
10-year Design ESALs: 19,479
Design Period: 20 Years
Projection Factor: 1.2
Growth Factor: 22.02
20-year Design ESALs: 40,995

															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	12:18	91.4	98.5	5479	25.2	19.7	15.1	10.9	8.1	4.8	3.4	2.5	2.0	3.5	2.8	0.0	10.9	
0.0	2	12:18	91.4	98.5	5435	24.9	19.4	14.9	10.7	8.0	4.7	3.3	2.5	1.9	3.5	2.8	0.0	10.9	
0.0	3	12:18	91.4	98.5	8585	39.7	31.0	23.8	17.3	13.0	7.8	5.3	4.0	3.2	3.4	2.8	0.0	10.8	
0.0	4	12:18	91.4	98.5	9044	40.1	31.5	24.4	17.7	13.2	7.9	5.5	4.2	3.3	3.4	2.8	0.0	11.2	
0.1	1	12:19	91.4	97.6	5818	13.3	9.0	6.9	5.1	3.8	2.4	1.8	1.4	1.1	7.3	3.5	0.0	20.0	
0.1	2	12:19	91.4	97.6	5698	12.9	8.8	6.7	5.0	3.8	2.4	1.8	1.4	1.1	7.3	3.6	0.0	20.2	
0.1	3	12:19	91.4	97.6	9285	20.6	14.2	11.1	8.2	6.3	4.0	2.9	2.3	1.9	7.0	3.6	0.0	20.6	
0.1	4	12:19	91.4	97.6	9241	20.4	14.1	11.1	8.2	6.3	4.0	2.9	2.3	1.9	7.1	3.7	0.0	20.7	
0.2	1	12:20	91.4	96.7	5785	17.1	12.9	10.5	8.2	6.3	4.1	3.0	2.3	1.9	4.3	3.5	0.0	16.0	
0.2	2	12:20	91.4	96.7	5796	16.9	12.8	10.4	8.1	6.2	4.0	2.9	2.3	1.9	4.4	3.5	0.0	16.2	
0.2	3	12:20	91.4	96.7	9230	27.0	20.9	17.2	13.4	10.4	6.8	5.0	4.0	3.3	4.1	3.6	0.0	16.1	
0.2	4	12:20	91.4	96.7	9219	26.9	20.8	17.1	13.4	10.4	6.8	5.0	4.0	3.3	4.1	3.6	0.0	16.1	
0.3	1	12:21	91.4	95.6	5851	25.4	19.5	15.2	11.1	8.1	4.8	3.4	2.6	2.1	3.7	2.8	0.0	11.4	
0.3	2	12:21	91.4	95.6	5873	25.1	19.4	15.1	11.1	8.1	4.8	3.4	2.6	2.2	3.7	2.8	0.0	11.5	
0.3	3	12:21	91.4	95.6	9361	40.2	31.4	24.8	18.3	13.5	8.0	5.5	4.3	3.7	3.6	2.9	0.0	11.5	
0.3	4	12:21	91.4	95.6	9383	40.1	31.5	25.0	18.5	13.7	8.1	5.6	4.4	3.7	3.5	2.9	0.0	11.5	
0.3																			N OLD CANTON RD, IC, JACKSON RIDGE RD, SB"
0.3	1	12:24	89.6	94.9	5829	23.3	18.5	15.5	12.0	9.1	5.7	4.0	3.0	2.3	3.1	3.1	0.0	12.2	
0.3	2	12:24	89.6	94.9	5807	22.7	18.2	15.2	11.8	9.1	5.6	3.9	3.0	2.3	3.1	3.2	0.0	12.4	
0.3	3	12:24	89.6	94.9	9317	37.3	30.1	25.2	19.6	15.1	9.3	6.6	5.0	4.0	3.0	3.2	0.0	12.2	
0.3	4	12:24	89.6	94.9	9296	36.9	30.0	25.2	19.6	15.1	9.4	6.6	5.0	4.0	3.0	3.2	0.0	12.2	
0.4	1	12:25	87.8	90.3	6069	14.3	11.4	9.8	7.8	6.0	3.5	2.2	1.5	1.1	5.2	3.8	0.0	19.0	
0.4	2	12:25	87.8	90.3	6048	14.0	11.3	9.6	7.6	5.9	3.5	2.2	1.5	1.1	5.3	3.8	0.0	19.3	
0.4	3	12:25	87.8	90.3	9624	23.1	18.9	16.2	12.8	9.9	5.8	3.6	2.5	1.9	5.0	3.8	0.0	18.7	
0.4	4	12:25	87.8	90.3	9591	23.0	18.7	16.1	12.8	9.9	5.9	3.6	2.5	1.9	5.0	3.8	0.0	18.7	
0.5	1	12:27	87.8	89.1	5435	21.5	15.3	12.1	8.6	6.1	3.4	2.3	1.8	1.5	4.9	2.7	0.0	12.2	
0.5	2	12:27	87.8	89.1	5413	21.2	15.1	11.9	8.4	6.0	3.3	2.3	1.8	1.4	4.9	2.7	0.0	12.3	
0.5	3	12:27	87.8	89.1	8902	34.6	25.4	20.3	14.5	10.3	5.8	4.0	3.1	2.6	4.6	2.8	0.0	12.4	
0.5	4	12:27	87.8	89.1	8793	34.2	25.0	20.0	14.4	10.2	5.8	3.9	3.1	2.5	4.6	2.8	0.0	12.4	
0.6	1	12:28	87.8	91.3	5905	11.0	7.6	5.7	4.0	3.0	1.7	1.2	1.0	0.8	10.4	3.6	0.0	23.2	
0.6	2	12:28	87.8	91.3	5927	10.9	7.6	5.8	4.1	3.0	1.7	1.2	0.9	0.8	10.4	3.6	0.0	23.4	
0.6	3	12:28	87.8	91.3	9646	19.0	13.1	10.0	7.2	5.3	3.0	2.1	1.7	1.3	9.6	3.6	0.0	22.2	
0.6	4	12:28	87.8	91.3	9613	18.6	13.0	10.0	7.2	5.3	3.0	2.1	1.7	1.3	9.6	3.6	0.0	22.4	
0.7																			N OLD CANTON RD, J-, START, SE
0.7																			N OLD CANTON RD, J-, END, SB"
0.7	1	12:29	87.8	89.5	5884	19.3	12.8	9.6	6.5	4.4	2.3	1.5	1.2	1.0	7.6	2.7	0.0	14.4	
0.7	2	12:29	87.8	89.5	5938	19.4	12.8	9.7	6.6	4.4	2.3	1.6	1.2	1.0	7.7	2.7	0.0	14.5	
0.7	3	12:29	87.8	89.5	9416	30.5	21.1	16.0	11.0	7.6	4.0	2.7	2.1	1.8	7.1	2.8	0.0	14.6	
0.7	4	12:29	87.8	89.5	9438	30.6	21.1	16.1	11.1	7.6	4.1	2.7	2.1	1.8	7.0	2.8	0.0	14.6	
0.8	1	12:30	86.0	92.6	6026	4.2	3.3	3.0	2.7	2.3	1.8	1.4	1.0	0.8	10.2	7.6	0.0	45.5	
0.8	2	12:30	86.0	92.6	6037	4.1	3.3	3.0	2.7	2.3	1.8	1.4	1.0	0.8	10.4	7.6	0.0	45.8	
0.8	3	12:30	86.0	92.6	9886	6.8	5.5	5.0	4.5	4.0	3.0	2.3	1.7	1.3	9.9	7.7	0.0	45.3	
0.8	4	12:30	86.0	92.6	9853	6.8	5.4	4.9	4.4	3.9	3.0	2.3	1.7	1.3	10.0	7.7	0.0	45.6	
0.9																			N OLD CANTON RD, IC, NICHOLAS RI

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AET Project No. P-0010936
County: MADISON
Test Date: May 24, 2022
Section: S04A
Roadway: E Cotton Blossom Rd
From: N Old Canton Rd
To: 0.39 mi E

Prev. Day's Avg. Air Temp.: 73 °F
Total AC: 1.7 in.
Daily ESALs: 3.1
PCI: 16
Haul ESALs: 0
Soil Type: P
Draught Adjustment Factor: 1.00
Seasonal Correction Factor: 1.12

Design Period: 10 Years
Projection Factor: 1.1
Growth Factor: 10.46
10-year Design ESALs: 11,878
Design Period: 20 Years
Projection Factor: 1.2
Growth Factor: 22.02
20-year Design ESALs: 24,997

															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	13:02	93.2	95.0	5413	18.3	9.6	6.0	3.6	2.4	1.6	1.1	0.9	0.7	10.3	1.7	0.0	16.8	
0.0	2	13:02	93.2	95.0	5402	18.0	9.4	5.9	3.5	2.3	1.6	1.1	0.9	0.7	10.6	1.7	0.0	17.0	
0.0	3	13:02	93.2	95.0	8858	29.5	16.4	10.5	6.3	4.2	2.7	1.9	1.6	1.3	9.9	1.8	0.0	17.0	
0.0	4	13:02	93.2	95.0	8803	29.2	16.2	10.4	6.3	4.2	2.7	1.9	1.6	1.3	10.0	1.8	0.0	17.1	
0.1	1	13:04	93.2	88.9	5227	36.2	21.5	13.9	8.2	5.6	3.3	2.4	1.7	1.5	4.9	1.3	1.3	8.6	
0.1	2	13:04	93.2	88.9	5227	35.8	21.6	14.0	8.3	5.6	3.3	2.4	1.7	1.5	4.8	1.3	1.3	8.7	
0.1	3	13:04	93.2	88.9	8421	57.5	36.6	24.6	14.6	9.8	5.8	4.1	3.0	2.6	4.5	1.4	1.3	8.7	
0.1	4	13:04	93.2	88.9	8311	57.0	36.8	24.8	14.8	9.9	5.8	4.1	3.0	2.5	4.4	1.4	1.4	8.6	
0.2	1	13:05	93.2	88.6	5577	34.5	21.1	12.4	5.8	3.5	2.2	1.7	1.3	1.1	7.8	1.2	0.8	9.6	
0.2	2	13:05	93.2	88.6	5621	33.7	21.0	12.5	5.8	3.5	2.2	1.6	1.4	1.1	7.9	1.2	0.7	9.8	
0.2	3	13:05	93.2	88.6	9077	54.8	34.8	21.5	10.3	6.0	3.7	2.9	2.3	1.9	7.5	1.3	0.7	9.8	
0.2	4	13:05	93.2	88.6	9044	53.9	34.8	21.6	10.4	6.1	3.8	2.8	2.3	1.9	7.4	1.3	0.7	9.9	
0.3	1	13:06	91.4	99.7	5282	40.5	20.6	10.0	6.1	4.2	2.7	2.2	1.8	1.2	6.0	1.2	1.3	7.9	
0.3	2	13:06	91.4	99.7	5282	40.0	20.5	10.1	6.1	4.2	2.7	2.1	1.9	1.2	6.0	1.2	1.3	8.0	
0.3	3	13:06	91.4	99.7	8475	66.6	37.6	16.8	10.2	7.1	4.5	3.7	3.0	2.1	5.7	1.1	1.4	7.7	
0.3	4	13:06	91.4	99.7	8377	65.9	37.5	17.2	10.4	7.1	4.4	3.8	3.1	2.1	5.8	1.1	1.4	7.7	
0.4	1	13:07	93.2	98.3	5665	20.4	12.4	8.0	5.2	3.6	2.2	1.6	1.1	1.0	8.0	1.8	0.0	15.9	
0.4	2	13:07	93.2	98.3	5720	20.2	12.4	8.1	5.2	3.6	2.2	1.6	1.1	1.0	7.9	1.8	0.0	16.1	
0.4	3	13:07	93.2	98.3	9241	34.0	21.6	14.4	9.2	6.4	3.8	2.7	2.0	1.7	7.4	1.8	0.0	15.5	
0.4	4	13:07	93.2	98.3	9296	34.2	21.9	14.6	9.4	6.5	3.9	2.8	2.1	1.7	7.3	1.8	0.0	15.6	
0.4																			COTTON BLOSSOM RD, PC, BIT-GR,

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AET Project No. P-0010936
County: MADISON
Test Date: May 24, 2022
Section: S04B
Roadway: E Cotton Blossom Rd
From: 2.24 mi W of Hwy 43
To: 1.3 mi W of Hwy 43

Allowable Rut: 2 inches
Allowable Serviceability Loss: 2.5
Daily ESALs: 3.0
Haul ESALs: 0
Annual Growth: 2.0%
Surface Condition Rating: 65.0
Soil Type: P
Seasonal Correction Factor: 1.10

Design Period: 5 Years
Projection Factor: 1.1
Growth Factor: 5.20
5-year Design ESALs: 5,699
Design Period: 10 Years
Projection Factor: 1.2
Growth Factor: 10.95
10-year Design ESALs: 11,995

															Effective Values		Overlay	Load	
															Mr	GE	Thickness	Capacity	
Station	**Drop**	**Time**	**Air °F**	**Surf °F**	**Load**	**D1**	**D2**	**D3**	**D4**	**D5**	**D6**	**D7**	**D8**	**D9**	**ksi**	**inches**	**inches**	**tons/axle**	**Comments**
0.4																			COTTON BLOSSOM RD, PC, BIT-GR, EB"
0.4	1	13:09	93.2	95.0	6255	11.6	7.7	6.0	5.0	3.5	2.6	1.9	1.3	1.3	8.7	23.6	0.0	33.3	
0.4	2	13:09	93.2	95.0	6288	11.6	7.7	6.1	4.9	3.5	2.6	1.8	1.3	1.5	8.8	23.6	0.0	33.5	
0.4	3	13:09	93.2	95.0	9908	20.2	13.4	10.9	8.3	6.0	4.4	3.1	2.3	1.8	8.1	22.1	0.0	30.4	
0.4	4	13:09	93.2	95.0	9853	20.4	13.2	10.7	8.2	6.3	4.3	3.1	2.4	1.7	8.1	21.9	0.0	29.9	
0.5	1	13:10	95.0	99.8	6124	14.4	10.0	7.7	5.7	4.1	2.6	1.9	1.4	1.2	8.6	20.0	0.0	26.3	
0.5	2	13:10	95.0	99.8	6408	14.4	10.3	7.9	5.8	4.2	2.6	2.0	1.5	1.2	8.8	20.7	0.0	27.6	
0.5	3	13:10	95.0	99.8	9733	23.7	17.8	13.7	10.1	7.2	4.4	3.2	2.4	2.0	7.9	19.7	0.0	25.5	
0.5	4	13:10	95.0	99.8	9799	23.8	17.8	13.7	10.5	7.2	4.4	3.2	2.4	2.0	7.9	19.7	0.0	25.5	
0.6	1	13:11	95.0	97.1	5435	26.2	17.8	13.0	9.0	6.5	3.6	2.6	1.6	1.5	5.4	12.0	0.0	12.9	
0.6	2	13:11	95.0	97.1	5501	26.3	18.1	13.2	9.2	6.6	3.7	2.6	1.8	1.6	5.3	12.4	0.0	13.0	
0.6	3	13:11	95.0	97.1	8880	43.0	31.6	24.1	15.7	11.4	6.5	4.4	3.2	2.7	4.9	13.4	0.0	12.3	
0.6	4	13:11	95.0	97.1	8782	44.3	31.7	24.3	15.9	11.5	6.5	4.4	3.3	2.7	4.8	12.4	0.0	11.6	
0.7	1	13:13	96.8	97.4	5621	28.4	13.3	8.8	7.0	4.9	3.0	2.3	1.8	1.5	6.7	8.4	0.0	12.3	
0.7	2	13:13	96.8	97.4	5654	28.2	13.6	8.9	7.1	4.9	3.1	2.3	1.9	1.5	6.6	8.9	0.0	12.4	
0.7	3	13:13	96.8	97.4	8825	46.8	26.6	16.6	12.9	8.8	5.4	4.1	3.1	2.7	5.8	8.9	0.0	10.8	
0.7	4	13:13	96.8	97.4	8803	46.6	26.1	17.0	13.1	8.9	5.5	4.1	3.1	2.7	5.8	9.0	0.0	10.9	
0.8	1	13:16	98.6	88.5	5260	57.8	25.9	12.8	7.0	4.9	3.2	2.0	1.7	1.2	6.0	1.0	5.9	3.9	
0.8	2	13:16	98.6	88.5	5304	58.3	26.1	12.7	7.1	4.8	3.2	1.8	1.8	1.2	6.0	1.0	5.9	3.9	
0.8	3	13:16	98.6	88.5	8377	89.3	50.1	25.6	12.8	8.5	5.1	3.8	3.0	2.5	5.8	1.2	5.7	4.1	
0.8	4	13:16	98.6	88.5	8410	90.0	49.2	25.8	12.9	9.2	5.2	3.7	3.0	2.5	5.8	1.2	5.7	4.1	
0.8	1	13:16	98.6	90.7	5490	37.9	21.6	14.2	8.3	5.4	3.5	2.4	1.8	1.5	5.6	5.4	1.6	9.0	
0.8	2	13:16	98.6	90.7	5490	38.1	21.9	13.5	8.6	5.4	3.4	2.5	1.8	1.8	5.7	5.3	1.6	8.9	
0.8	3	13:16	98.6	90.7	8639	61.2	41.0	31.2	15.3	9.5	6.1	4.3	3.1	2.7	5.0	5.9	1.1	7.2	
0.8	4	13:16	98.6	90.7	8563	60.5	40.7	26.0	14.8	9.5	6.3	4.2	3.1	2.7	4.9	6.3	1.2	7.2	
0.9	1	13:18	96.8	99.0	5741	31.3	17.1	11.0	6.8	4.9	2.9	2.4	1.9	1.3	7.2	7.5	0.0	11.4	
0.9	2	13:18	96.8	99.0	5730	31.4	17.5	11.2	6.7	5.0	2.9	2.3	1.8	1.4	7.1	7.5	0.0	11.3	
0.9	3	13:18	96.8	99.0	9000	51.3	31.3	20.0	12.9	8.9	5.0	4.0	3.0	2.3	6.4	6.8	0.1	9.8	
0.9	4	13:18	96.8	99.0	8989	50.7	30.6	19.8	12.4	12.7	5.0	3.9	3.0	2.2	6.4	6.9	0.0	9.9	
1.0	1	13:20	98.6	98.6	5260	50.8	21.6	15.6	6.3	4.4	2.2	1.8	1.4	1.2	8.5	1.1	5.3	4.7	
1.0	2	13:20	98.6	98.6	5293	49.5	21.5	15.8	6.5	4.5	2.4	2.0	1.5	1.3	7.9	1.2	5.2	4.9	
1.0	3	13:20	98.6	98.6	8585	71.7	35.2	25.8	10.9	7.7	3.9	3.1	2.5	2.1	7.9	1.8	4.6	5.7	
1.0	4	13:20	98.6	98.6	8585	70.4	35.1	25.6	10.8	7.7	4.2	3.2	2.5	2.2	7.3	2.0	4.8	5.9	
1.0	1	13:20	98.6	97.8	5096	42.8	18.3	11.4	7.1	4.5	2.7	0.5	1.7	1.0	6.9	1.8	5.1	5.7	
1.0	2	13:20	98.6	97.8	5140	43.1	18.6	11.5	7.1	4.5	2.6	0.7	1.7	1.2	7.0	1.8	5.0	5.7	
1.0	3	13:20	98.6	97.8	8125	69.6	35.1	19.3	11.9	7.5	4.4	3.9	2.9	2.0	6.7	1.8	5.1	5.5	
1.0	4	13:20	98.6	97.8	8180	68.0	37.5	19.8	12.0	7.5	4.5	5.2	2.8	2.1	6.6	2.3	4.6	5.8	
1.1	1	13:21	100.4	99.8	0:00	13.8	7	5.6	4.2	3.7	2.5	1.8	1.4	1.1	9.0	20.7	0.0	27.7	
1.1	2	13:21	100.4	99.8	6288	13.9	7.2	5.7	4.3	3.7	2.5	1.4	1.4	1.0	9.1	20.9	0.0	28.0	
1.1	3	13:21	100.4	99.8	9427	24.3	12.6	9.9	7.6	6.4	4.3	3.2	2.4	1.9	7.8	19.0	0.0	24.1	
1.1	4	13:21	100.4	99.8	9711	24.6	13.0	10.1	7.7	6.4	4.3	3.2	2.3	1.9	8.0	19.1	0.0	24.4	
1.2	1	13:22	100.4	99.7	6102	19.3	12.5	9.4	6.6	5.1	3.0	2.1	1.6	1.3	7.2	16.7	0.0	19.6	
1.2	2	13:22	100.4	99.7	6223	19.6	14.1	9.9	7.0	5.2	3.1	2.1	1.6	1.3	7.2	16.7	0.0	19.7	
1.2	3	13:22	100.4	99.7	9591	31.6	24.3	18.8	17.5	8.9	5.2	3.4	2.8	1.9	6.6	16.4	0.0	18.8	
1.2	4	13:22	100.4	99.7	9558	31.4	22.6	18.1	13.2	9.3	5.2	3.4	2.7	2.1	6.6	16.4	0.0	18.9	
1.2	1	13:23	100.4	100.4	5774	21.1	13.4	10.5	7.8	5.8	4.1	2.4	1.4	1.3	5.1	16.6	0.0	17.0	
1.2	2	13:23	100.4	100.4	5730	21.1	13.5	10.5	8.0	5.7	3.8	2.3	0.6	1.3	5.4	16.2	0.0	16.8	
1.2	3	13:23	100.4	100.4	9142	36.8	25.8	18.5	14.3	9.4	6.9	4.4	3.9	2.2	4.7	15.9	0.0	15.4	
1.2	4	13:23	100.4	100.4	9175	36.7	24.9	18.6	14.1	9.5	9.1	4.2	4.5	2.3	3.6	17.5	0.0	15.5	
1.3	1	13:24	100.4	88.7	6069	11.9	7.3	5.1	3.4	2.6	1.9	1.3	1.2	0.8	11.5	22.7	0.0	31.7	
1.3	2	13:24	100.4	88.7	6080	12.1	7.1	5.2	3.5	2.5	1.9	1.1	1.5	0.8	11.6	22.4	0.0	31.0	
1.3	3	13:24	100.4	88.7	9722	19.0	12.5	8.7	6.2	4.7	3.4	2.5	2.2	1.6	10.3	22.8	0.0	31.8	
1.3	4	13:24	100.4	88.7	9842	20.0	12.7	8.9	6.2	4.7	3.4	2.5	2.3	1.6	10.4	22.2	0.0	30.5	

American Engineering Testing, Inc.
550 Cleveland Avenue North
St. Paul, Minnesota 55114
Phone: (651) 659-9001
Fax: (651) 659-1379

AET Project No. P-0010936
County: MADISON
Test Date: May 24, 2022
Section: S04C
Roadway: E Cotton Blossom Rd
From: 1.3 mi W
To: Hwy 43

Allowable Rut: 2 inches
Allowable Serviceability Loss: 2.5
Daily ESALs: 3.0
Haul ESALs: 0
Annual Growth: 2.0%
Surface Condition Rating: 56.0
Soil Type: P
Seasonal Correction Factor: 1.10

Design Period: 5 Years
Projection Factor: 1.1
Growth Factor: 5.20
5-year Design ESALs: 5,699
Design Period: 10 Years
Projection Factor: 1.2
Growth Factor: 10.95
10-year Design ESALs: 11,995

Station	Drop	Time	Air °F	Surf °F	Load	D1	D2	D3	D4	D5	D6	D7	D8	D9	Effective Values Mr ksi	Effective Values GE inches	Overlay Thickness inches	Load Capacity tons/axle	Comments
1.4	1	13:26	100.4	90.4	5632	31.3	16.0	10.8	7.4	5.4	3.0	2.2	1.4	1.4	6.7	7.5	0.0	11.2	
1.4	2	13:26	100.4	90.4	5654	31.3	16.0	11.0	7.4	5.4	3.0	1.5	1.2	0.9	6.7	7.5	0.0	11.2	
1.4	3	13:26	100.4	90.4	8957	50.7	26.5	19.8	12.6	9.0	5.2	3.3	2.5	1.9	6.1	7.3	0.0	9.9	
1.4	4	13:26	100.4	90.4	8902	50.7	26.2	19.5	12.5	8.9	5.1	3.5	2.1	2.1	6.3	6.9	0.0	9.8	
1.5	1	13:27	100.4	88.1	5938	29.6	14.0	7.6	4.8	3.5	2.3	1.6	1.2	1.3	9.3	8.4	0.0	12.4	
1.5	2	13:27	100.4	88.1	5884	29.2	13.9	7.5	4.9	3.5	2.2	1.6	1.3	1.2	9.4	8.4	0.0	12.5	
1.5	3	13:27	100.4	88.1	9241	47.1	27.1	13.0	8.4	6.1	3.7	2.6	2.0	2.3	8.8	8.0	0.0	11.5	
1.5	4	13:27	100.4	88.1	9164	46.4	27.1	12.8	8.4	6.0	3.8	2.6	2.0	2.3	8.7	8.3	0.0	11.6	
1.6	1	13:32	98.6	96.7	5348	35.5	23.9	19.3	13.0	9.4	5.1	2.9	2.0	3.2	3.8	9.3	0.0	9.3	
1.6	2	13:32	98.6	96.7	5326	35.7	23.4	19.4	12.9	8.3	4.8	2.9	1.9	3.6	3.9	8.8	0.0	9.2	
1.6	3	13:32	98.6	96.7	8464	56.1	36.9	33.1	22.9	14.6	8.8	5.1	3.6	3.8	3.4	10.3	0.0	7.9	
1.6	4	13:32	98.6	96.7	8421	56.9	37.9	33.5	22.8	14.9	8.2	5.1	3.7	3.1	3.7	9.3	0.0	7.7	
1.6	1	13:33	98.6	97.6	5096	34.5	27.5	20.3	12.9	8.8	4.5	3.0	2.5	2.1	4.0	8.4	0.0	9.2	
1.6	2	13:33	98.6	97.6	5195	34.6	27.1	20.5	13.1	8.9	4.5	3.0	2.6	2.0	4.1	8.4	0.0	9.3	
1.6	3	13:33	98.6	97.6	8355	57.1	43.4	34.6	22.1	15.4	8.1	5.4	4.6	3.8	3.7	8.9	0.0	7.6	
1.6	4	13:33	98.6	97.6	8443	57.5	45	51.4	22.2	15.5	8.4	5.4	4.8	4.0	3.6	9.3	0.0	7.6	
1.7	1	13:35	98.6	102.0	5960	21.0	12	7.3	4.8	4.9	2.5	1.7	2.2	1.1	8.6	15.6	0.0	17.6	
1.7	2	13:35	98.6	102.0	6004	21.3	12	7.1	4.7	4.7	2.4	1.7	2.0	1.0	8.9	15.6	0.0	17.5	
1.7	3	13:35	98.6	102.0	9711	34.5	21	13.3	8.1	7.9	4.1	3.0	3.4	1.7	8.6	15.6	0.0	17.4	
1.7	4	13:35	98.6	102.0	9656	35.0	20	12.6	8.3	6.2	4.0	3.0	2.5	1.7	8.6	15.4	0.0	17.1	
1.8	1	13:36	98.6	99.4	5588	41.4	24.3	14.3	7.8	5.1	2.9	2.0	1.8	1.4	6.8	3.2	3.7	6.8	
1.8	2	13:36	98.6	99.4	5577	41.2	24.5	14.3	7.8	5.1	2.9	2.0	1.7	1.4	6.8	3.3	3.6	6.8	
1.8	3	13:36	98.6	99.4	8771	64.4	45.8	28.7	13.3	8.6	4.9	3.4	2.7	2.3	6.3	3.8	3.1	6.9	
1.8	4	13:36	98.6	99.4	8705	65.3	43.0	26.5	13.4	8.9	5.0	3.4	2.7	2.3	6.3	3.8	3.1	6.7	
1.9	1	13:38	100.4	99.3	5818	25.8	12.3	8.2	5.8	5.0	3.2	2.1	1.8	1.3	6.6	11.5	0.0	14.0	
1.9	2	13:38	100.4	99.3	5807	25.4	12.2	8.1	5.7	4.9	3.3	2.0	1.8	1.4	6.3	12.9	0.0	14.2	
1.9	3	13:38	100.4	99.3	9372	41.7	23.4	13.3	10.8	9.1	5.1	3.6	2.7	2.2	6.6	11.5	0.0	13.8	
1.9	4	13:38	100.4	99.3	9339	42.0	23.4	13.5	10.3	8.3	5.1	3.6	2.8	2.4	6.6	11.4	0.0	13.6	
2.0	1	13:40	100.4	90.9	5730	39.3	32.1	16.8	11.3	7.7	3.6	2.6	2.0	1.5	5.6	5.4	1.6	9.0	
2.0	2	13:40	100.4	90.9	5676	39.0	33.0	17.1	11.0	7.9	3.7	2.5	2.1	1.4	5.6	5.5	1.5	9.0	
2.0	3	13:40	100.4	90.9	8847	71.6	71.5	32.7	19.8	14.0	6.3	4.6	3.1	2.5	5.0	4.7	2.3	6.0	
2.0	4	13:40	100.4	90.9	8650	60.1	53.4	30.2	19.5	15.4	6.3	4.7	3.0	2.6	4.9	6.4	1.1	7.4	
2.1	1	13:41	100.4	88.7	5523	28.5	12.2	8.9	6.1	4.2	2.3	1.5	1.3	0.9	8.7	7.9	0.0	12.0	
2.1	2	13:41	100.4	88.7	5446	28.2	11.9	8.6	5.9	3.9	2.2	1.6	1.1	0.9	8.7	7.8	0.0	12.0	
2.1	3	13:41	100.4	88.7	8705	45.2	21.1	15.5	10.3	6.9	3.9	2.7	2.0	1.6	7.9	7.8	0.0	11.1	
2.1	4	13:41	100.4	88.7	8607	45.2	21.3	15.6	10.5	7.0	3.9	2.7	2.0	1.6	8.0	7.4	0.0	11.0	
2.2	1	13:42	100.4	89.1	5829	25.0	16.0	10.1	6.0	4.1	2.4	1.8	1.4	0.9	8.6	12.4	0.0	14.5	
2.2	2	13:42	100.4	89.1	5818	24.6	15.9	10.0	6.0	4.1	2.5	1.9	1.4	1.1	8.4	12.9	0.0	14.7	
2.2	3	13:42	100.4	89.1	9219	43.8	31.6	17.6	10.7	7.4	4.4	3.3	2.5	2.2	7.5	9.4	0.0	12.6	
2.2	4	13:42	100.4	89.1	9175	43.3	30.9	17.7	10.9	7.3	4.4	3.3	2.5	2.0	7.4	9.5	0.0	12.7	
2.3	1	13:44	100.4	95.7	5741	37.3	26.1	18.1	11.2	6.6	3.2	2.0	1.4	1.3	6.5	4.9	2.0	9.5	
2.3	2	13:44	100.4	95.7	5785	36.8	26.0	17.7	11.4	6.8	3.1	1.9	1.1	1.1	6.8	4.9	2.0	9.7	
2.3	3	13:44	100.4	95.7	9022	58.9	44.0	32.2	20.7	12.1	5.5	3.6	2.5	2.1	5.8	5.8	1.1	8.1	
2.3	4	13:44	100.4	95.7	9066	59.3	44.2	32.2	20.8	12.3	5.6	4.2	2.8	2.0	5.8	5.8	1.1	8.1	
2.4	1	13:45	98.6	91.6	5282	30.2	19.4	13.1	8.1	5.3	2.5	1.3	1.6	0.5	7.6	7.3	0.0	10.9	
2.4	2	13:45	98.6	91.6	5271	30.1	18.5	13.0	8.1	5.2	2.6	1.4	1.1	1.0	7.3	7.3	0.0	10.8	
2.4	3	13:45	98.6	91.6	8180	51.3	34.6	24.3	15.1	9.5	5.0	3.1	2.8	1.6	5.9	6.3	0.6	8.5	
2.4	4	13:45	98.6	91.6	8213	51.1	34.1	24.3	15.0	9.6	5.0	3.0	2.7	1.7	5.9	6.3	0.6	8.6	
2.5	1	13:47	98.6	94.3	5566	37.7	19.8	12.4	7.2	4.6	3.3	1.1	1.5	1.5	6.0	5.3	1.6	9.1	
2.5	2	13:47	98.6	94.3	5599	37.9	20.0	12.5	7.3	4.6	3.2	1.8	1.2	1.5	6.3	4.8	2.1	9.2	
2.5	3	13:47	98.6	94.3	8836	58.0	34.8	23.7	12.0	7.9	5.2	2.8	2.9	2.0	6.1	5.3	1.6	8.0	
2.5	4	13:47	98.6	94.3	8924	57.1	34.3	22.4	12.2	7.8	5.2	2.8	2.8	2.1	6.1	5.5	1.4	8.3	
2.5	1	13:48	98.6	99.6	5304	63.4	40.0	19.9	8.9	6.3	3.4	2.0	1.9	0.8	5.6	0.9	6.1	3.5	
2.5	2	13:48	98.6	99.6	5282	63.0	39.2	21.1	9.4	6.3	3.3	2.2	1.8	1.3	5.6	0.9	6.1	3.5	
2.5	3	13:48	98.6	99.6	8464	88.3	61.0	43.8	26.4	10.9	6.7	3.9	5.2	2.5	4.5	3.2	4.3	4.2	
2.5	4	13:48	98.6	99.6	8377	87.3	59.8	40.9	18.8	10.9	7.1	4.0	4.7	2.9	4.2	3.5	4.1	4.2	
2.6	1	13:49	98.6	97.9	5916	26.1	18.5	12.5	6.2	4.0	2.5	1.4	1.1	1.0	8.6	11.4	0.0	14.0	
2.6	2	13:49	98.6	97.9	5938	26.2	18.8	12.4	6.1	3.9	2.4	1.6	1.1	0.9	8.8	11.4	0.0	14.0	
2.6	3	13:49	98.6	97.9	9121	41.4	32.4	21.2	10.6	6.3	3.5	2.4	1.8	1.5	9.2	10.5	0.0	13.4	
2.6	4	13:49	98.6	97.9	9132	42.0	31.7	22.2	10.4	6.5	3.5	2.4	1.9	1.4	9.3	10.4	0.0	13.2	
2.7																			COTTON BLOSSOM RD, PC, GR-BIT, EB"

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Phone: (651) 659-9001
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AET Project No. P-0010936
County: MADISON
Test Date: May 24, 2022
Section: S05
Roadway: Endris Rd
From: N Old Canton Rd
To: Hwy 43

Allowable Rut: 2 inches	**Design Period: 5 Years**
Allowable Serviceability Loss: 2.5	**Projection Factor: 1.1**
Daily ESALs: 3.0	**Growth Factor: 5.20**
Haul ESALs: 0	**5-year Design ESALs: 5,699**
Annual Growth: 2.0%	**Design Period: 10 Years**
Surface Condition Rating: 65.0	**Projection Factor: 1.2**
Soil Type: P	**Growth Factor: 10.95**
Seasonal Correction Factor: 1.10	**10-year Design ESALs: 11,995**

															Effective Values		Overlay	Load	
															Mr	GE	Thickness	Capacity	
Statio	Drop	Time	Air °F	Surf °F	Load	D1	D2	D3	D4	D5	D6	D7	D8	D9	ksi	inches	inches	tons/axle	Comments
0.0																			START"
0.0	1	14:14	95.0	95.0	5238	49.4	33.6	25.0	17.3	9.1	5.4	3.3	2.3	1.8	3.5	5.7	2.6	4.8	
0.0	2	14:14	95.0	95.0	5271	49.7	33.5	25.0	17.4	9.0	5.5	3.4	2.6	1.8	3.4	5.7	2.6	4.8	
0.0	3	14:14	95.0	95.0	8289	77.7	53.0	39.3	30.8	16.0	9.9	7.3	4.3	3.2	3.0	6.7	2.4	4.9	
0.0	4	14:14	95.0	95.0	8169	77.1	57.5	40.0	28.5	15.0	10.0	5.5	4.0	3.1	2.9	6.8	2.3	4.8	
0.1	1	14:16	95.0	95.5	5184	58.0	46.8	25.8	14.6	7.9	3.1	2.0	1.5	1.4	6.0	0.9	6.0	3.8	
0.1	2	14:16	95.0	95.5	5206	58.1	48.2	26.0	15.1	7.8	3.1	2.0	1.6	1.4	6.0	1.0	5.9	3.8	
0.1	3	14:16	95.0	95.5	8202	90.7	75.0	44.4	30.9	19.3	5.1	3.5	2.7	2.5	5.8	1.1	5.8	3.9	
0.1	4	14:16	95.0	95.5	8268	93.9	71.1	44.4	24.8	13.0	5.7	3.5	2.8	2.5	5.2	1.4	5.6	3.7	
0.2	1	14:17	96.8	96.9	5698	47.9	30.1	22.1	14.5	10.2	5.7	3.7	2.8	2.3	3.6	6.5	1.8	5.7	
0.2	2	14:17	96.8	96.9	5741	48.0	30.0	22.2	15.0	10.5	5.9	3.7	2.8	2.4	3.5	6.8	1.5	5.7	
0.2	3	14:17	96.8	96.9	9066	73.0	47.8	39.0	23.8	17.0	9.4	6.4	4.6	3.9	3.5	7.3	1.0	6.0	
0.2	4	14:17	96.8	96.9	9110	71.0	47.6	38.0	24.1	18.0	9.5	6.3	4.7	4.0	3.4	7.8	0.5	6.3	
0.3	1	14:18	96.8	97.3	5140	62.5	36.9	24.0	11.4	6.6	3.1	2.2	1.5	1.2	5.9	0.8	6.1	3.4	
0.3	2	14:18	96.8	97.3	5118	62.5	37.4	24.2	11.5	6.6	3.1	2.1	1.4	1.3	5.9	0.8	6.1	3.4	
0.3	3	14:18	96.8	97.3	8169	95.8	61.5	44.6	21.9	11.4	5.2	3.4	2.5	2.1	5.6	1.0	6.0	3.6	
0.3	4	14:18	96.8	97.3	8213	96.4	61.3	46.5	21.7	11.7	5.1	3.4	2.6	2.1	5.8	0.9	6.0	3.6	
0.4	1	14:20	98.6	97.3	5326	56.6	27.1	19.0	11.7	8.3	4.1	2.5	1.9	1.6	4.6	2.8	4.7	4.1	
0.4	2	14:20	98.6	97.3	5315	56.0	27.0	18.9	11.8	8.3	4.2	2.5	2.0	1.5	4.6	2.9	4.6	4.1	
0.4	3	14:20	98.6	97.3	8322	86.4	46.4	36.2	20.0	13.9	7.1	4.5	3.2	3.0	4.2	3.7	3.9	4.2	
0.4	4	14:20	98.6	97.3	8268	86.2	46.0	40.5	19.8	13.9	7.1	4.4	3.2	3.0	4.2	3.7	3.9	4.2	
0.5	1	14:21	100.4	99.3	5173	49.9	29.4	15.8	9.4	5.2	2.6	2.3	1.6	2.2	7.2	1.1	5.7	4.7	
0.5	2	14:21	100.4	99.3	5118	48.9	29.0	15.3	9.0	5.2	2.6	1.5	1.7	1.0	7.2	1.1	5.7	4.7	
0.5	3	14:21	100.4	99.3	8213	74.4	45.7	27.5	15.8	10.4	4.8	3.1	2.5	2.6	6.2	1.9	5.0	5.1	
0.5	4	14:21	100.4	99.3	8224	74.5	47.9	27.5	15.5	10.5	4.9	3.9	3.2	1.8	6.0	2.2	4.7	5.1	
0.6	1	14:23	100.4	99.0	4735	98.3	63.3	34.9	13.5	5.3	2.5	2.0	1.6	1.2	6.7	0.5	6.4	1.6	
0.6	2	14:23	100.4	99.0	4801	99.2	63.7	34.3	15.6	5.5	3.5	2.0	1.6	1.2	4.9	0.5	6.5	1.6	
0.6	3	14:23	100.4	99.0	7415	103.7	103.6	60.1	35.5	10.0	6.6	3.7	2.9	2.1	4.0	1.6	6.0	2.8	
0.6	4	14:23	100.4	99.0	7458	104.1	104.0	59.9	41.6	10.1	4.9	3.8	2.9	2.2	5.4	0.7	6.3	2.8	
0.6	1	14:24	100.4	99.6	4724	94.3	69.6	41.4	20.4	13.4	3.3	2.2	1.8	1.7	5.2	0.5	6.5	1.7	
0.6	2	14:24	100.4	99.6	4768	93.9	67.8	41.3	19.2	14.8	6.2	2.1	1.6	1.6	2.8	1.6	7.6	1.7	
0.6	3	14:24	100.4	99.6	7688	100.1	100.0	65.8	30.9	20.6	19.6	3.9	2.9	2.7	1.4	8.3	1.6	3.1	
0.6	4	14:24	100.4	99.6	7830	98.0	97.9	65.6	32.3	20.1	6.2	4.0	3.0	2.8	4.5	1.6	5.9	3.3	
0.7	1	14:25	102.2	100.2	0:00	84.5	48	29.5	15.1	5.8	2.9	1.7	1.5	1.3	5.9	0.5	6.4	2.0	
0.7	2	14:25	102.2	100.2	4834	84.4	46.2	28.1	17.8	6.0	2.4	1.8	1.6	1.1	7.1	0.5	6.3	2.0	
0.7	3	14:25	102.2	100.2	7677	89.6	77.2	54.5	32.9	9.9	4.0	3.1	2.5	2.3	6.9	0.7	6.2	3.6	
0.7	4	14:25	102.2	100.2	7699	91.4	72.9	47.3	29.4	14.3	4.2	3.1	2.7	2.3	6.6	0.7	6.2	3.5	
0.8	1	14:26	102.2	100.1	5730	43.1	33.7	23.3	14.3	9.1	5.3	3.5	2.6	2.5	3.9	7.3	0.3	6.6	
0.8	2	14:26	102.2	100.1	5774	43.1	33.8	23.0	14.4	9.2	5.4	3.3	2.6	2.2	3.8	7.4	0.3	6.7	
0.8	3	14:26	102.2	100.1	8924	67.1	52.7	39.6	25.6	15.9	8.6	5.8	4.4	4.1	3.7	7.8	0.5	6.6	
0.8	4	14:26	102.2	100.1	8913	65.0	52.5	38.0	29.0	15.1	8.6	5.8	4.4	4.0	3.7	7.9	0.0	6.9	
0.9	1	14:28	100.4	98.0	5588	46.1	28.0	18.5	11.6	7.4	4.1	2.9	2.3	1.7	4.9	4.7	2.8	5.8	
0.9	2	14:28	100.4	98.0	5468	45.6	27.7	18.1	11.4	7.4	4.1	2.7	2.1	1.8	4.8	4.7	2.8	5.7	
0.9	3	14:28	100.4	98.0	8574	72.9	46.5	30.4	20.0	12.6	7.1	4.9	3.8	3.0	4.3	5.2	2.4	5.6	
0.9	4	14:28	100.4	98.0	8618	73.2	48.0	31.2	20.0	12.7	7.1	4.9	3.7	3.0	4.3	5.2	2.4	5.6	
1.0	1	14:29	100.4	99.5	5151	71.8	51.7	36.5	17.8	9.8	4.4	3.0	2.0	1.0	4.2	1.3	6.3	2.8	
1.00	2	14:29	100.4	99.5	5107	71.6	53.4	36.8	17.9	9.9	4.3	2.9	2.1	1.8	4.2	1.3	6.3	2.8	
1.00	3	14:29	100.4	99.5	7885	99.3	84.2	61.7	31.9	17.1	7.5	4.5	3.5	2.8	3.8	2.8	4.9	3.2	
1.00	4	14:29	100.4	99.5	7830	101.7	82.5	62.2	32.6	16.7	7.5	4.6	3.5	3.6	3.7	2.7	5.0	3.1	
1.06																			ENDRIS RD, J-, START, EB"
1.1																			ENDRIS RD, J-, END, EB"
1.1	1	14:32	95.0	96.4	5796	36.4	14.1	9.2	5.5	3.9	2.3	2.0	1.6	1.5	9.0	4.9	1.4	9.9	
1.1	2	14:32	95.0	96.4	5763	36.3	13.7	9.1	5.3	3.6	2.4	2.0	1.5	1.3	8.7	4.9	1.4	9.9	
1.1	3	14:32	95.0	96.4	9296	52.0	21.0	49.8	9.6	6.4	3.8	3.3	2.5	2.6	8.7	6.4	0.0	10.0	
1.1	4	14:32	95.0	96.4	9274	51.8	20.8	14.8	9.6	6.6	3.7	3.4	2.6	2.7	9.0	6.5	0.0	10.1	
1.2																			ENDRIS RD, RC, HEAVY RAIN"
1.2	1	14:33	87.8	94.9	5435	51.1	30.5	16.4	10.9	9.1	5.4	3.8	2.5	2.7	3.6	5.4	2.9	4.9	
1.2	2	14:33	87.8	94.9	5523	51.8	30.1	17.5	10.9	8.3	5.3	3.6	3.0	2.4	3.7	5.3	2.4	4.9	

Statio	Drop	Time	Air °F	Surf °F	Load	D1	D2	D3	D4	D5	D6	D7	D8	D9	Effective Values Mr ksi	Effective Values GE inches	Overlay Thickness inches	Load Capacity tons/axle	Comments
1.2	3	14:33	87.8	94.9	8858	78.1	50.4	38.8	19.6	13.7	8.8	5.9	4.1	5.9	3.6	6.0	2.3	5.3	
1.2	4	14:33	87.8	94.9	8705	77.2	50.3	33.0	19.6	13.6	8.9	5.9	4.0	4.4	3.5	6.2	2.1	5.3	
1.3	1	14:35	82.4	94.2	5293	59.3	37.8	23.0	13.7	7.1	3.2	2.7	1.9	1.7	5.9	1.0	5.9	3.8	
1.3	2	14:35	82.4	94.2	5304	59.6	37.3	23.1	14.0	7.2	3.4	2.7	2.0	1.8	5.5	1.2	5.8	3.8	
1.3	3	14:35	82.4	94.2	8147	97.9	61.2	40.6	27.9	13.1	6.9	4.4	3.6	2.6	4.2	2.4	5.2	3.4	
1.3	4	14:35	82.4	94.2	8224	92.1	60.5	41.5	26.5	13.0	7.2	4.4	3.7	2.8	4.1	3.2	4.4	3.8	
1.4	1	14:36	78.8	93.2	5862	37.5	21.5	12.6	8.4	5.9	3.7	2.6	1.7	1.7	5.6	6.4	0.6	9.7	
1.4	2	14:36	78.8	93.2	5730	36.5	21.1	12.4	8.7	5.9	3.7	2.6	1.9	1.5	5.5	6.5	0.5	9.7	
1.4	3	14:36	78.8	93.2	8957	52.9	34.8	24.3	15.3	10.2	6.1	4.2	3.8	2.5	5.3	8.0	0.0	9.3	
1.4	4	14:36	78.8	93.2	8978	52.6	36.0	23.6	15.1	10.4	6.1	4.1	3.2	2.5	5.3	8.3	0.0	9.4	
1.5	1	14:37	77.0	91.6	5096	80.0	46.0	20.6	9.9	5.9	4.2	2.8	3.3	1.8	4.3	0.8	6.8	2.4	
1.5	2	14:37	77.0	91.6	5118	79.9	43.1	21.7	9.5	6.3	4.3	3.5	3.2	1.6	4.3	0.9	6.7	2.4	
1.5	3	14:37	77.0	91.6	8169	91.2	57.2	36.0	17.9	12.4	18.3	5.0	4.1	3.7	1.6	9.2	0.5	3.8	
1.5	4	14:37	77.0	91.6	8136	91.4	58.8	39.9	20.7	11.9	6.8	4.4	4.7	2.1	4.3	2.9	4.7	3.8	
1.6	1	14:39	75.2	90.3	5402	47.5	29.0	14.7	8.6	6.0	3.3	2.4	1.9	1.5	5.8	2.8	4.1	5.3	
1.6	2	14:39	75.2	90.3	5402	47.4	30.0	14.8	8.6	5.9	3.4	2.5	1.9	1.5	5.7	2.9	4.0	5.3	
1.6	3	14:39	75.2	90.3	8311	75.8	50.9	26.8	15.8	10.2	5.8	4.2	3.3	2.8	5.2	3.3	3.7	5.1	
1.6	4	14:39	75.2	90.3	8344	74.6	51.3	27.2	15.5	10.3	5.9	4.2	3.3	2.7	5.1	3.7	3.3	5.2	
1.7	1	14:40	75.2	88.2	5195	69.7	48.6	31.8	22.8	9.8	2.7	1.6	1.6	1.4	6.9	0.6	6.3	3.0	
1.7	2	14:40	75.2	88.2	5085	68.7	47.8	31.1	17.0	9.3	2.8	1.5	1.5	1.4	6.6	0.6	6.3	2.9	
1.7	3	14:40	75.2	88.2	8049	101.5	72.2	49.2	28.9	15.5	4.4	3.1	4.4	2.5	6.5	0.7	6.2	3.2	
1.7	4	14:40	75.2	88.2	8115	101.7	74.5	50.3	28.9	14.8	4.6	3.2	2.8	2.7	6.4	0.7	6.2	3.2	
1.8	1	14:42	77.0	87.0	5326	47.3	27.7	18.1	11.3	7.4	4.3	2.5	1.7	1.6	4.4	4.5	3.1	5.2	
1.8	2	14:42	77.0	87.0	5348	48.8	27.8	18.1	11.2	7.3	4.5	2.6	1.8	4.1	4.3	4.7	2.9	5.1	
1.8	3	14:42	77.0	87.0	8322	77.4	50.1	32.6	19.4	12.1	7.3	4.3	3.1	2.9	4.1	4.8	2.8	4.9	
1.8	4	14:42	77.0	87.0	8333	77.6	49.5	32.5	19.4	12.2	7.0	4.2	3.2	2.8	4.3	4.4	3.2	4.9	
1.9	1	14:44	75.2	83.5	5391	80.3	56.3	25.2	10.6	6.1	4.4	3.3	2.2	2.0	4.4	0.9	6.7	2.5	
1.9	2	14:44	75.2	83.5	5446	80.7	56.3	23.9	12.0	5.8	4.5	3.2	2.2	2.0	4.4	0.9	6.7	2.6	
1.9	3	14:44	75.2	83.5	8454	121.1	74.9	45.7	24.4	11.1	8.1	6.1	3.8	3.4	3.7	1.8	5.9	2.7	
1.9	4	14:44	75.2	83.5	8464	114.0	68.1	43.8	23.4	11.1	7.7	6.0	3.8	4.3	3.9	2.1	5.5	2.9	
1.9	1	14:45	75.2	84.2	4965	96.0	39.3	18.7	12.4	4.5	12.5	3.4	15.4	8.7	1.4	4.9	5.0	1.8	
1.9	2	14:45	75.2	84.2	5063	97.0	42.1	21.4	11.5	5.3	5.7	2.5	12.3	4.7	3.2	1.1	7.3	1.8	
1.9	3	14:45	75.2	84.2	7950	90.5	64.9	34.6	22.0	10.4	10.5	6.7	14.0	1.9	2.7	5.4	3.8	3.7	
1.91	4	14:45	75.2	84.2	7983	91.3	61.9	31.4	18.3	8.6	9.4	0.0	12.5	2.3	3.0	4.8	3.6	3.7	
2.00	1	14:47	77.0	84.0	5588	48.8	22.3	13.3	8.3	5.6	3.4	2.3	1.8	1.6	5.9	2.7	4.2	5.4	
2.0	2	14:47	77.0	84.0	5610	50.6	22.3	13.5	8.6	5.6	3.5	2.3	1.8	1.7	5.7	2.7	4.2	5.1	
2.0	3	14:47	77.0	84.0	8782	73.7	39.4	22.8	14.5	9.6	5.8	4.0	3.0	2.6	5.4	3.8	3.2	5.7	
2.0	4	14:47	77.0	84.0	8814	71.2	39.7	22.8	14.7	10.9	6.7	4.0	3.2	2.0	4.7	5.0	2.5	6.0	
2.0	1	14:47	77.0	83.2	5741	47.6	21.1	12.9	7.3	4.8	3.0	2.0	1.7	1.6	6.8	1.9	5.0	5.8	
2.0	2	14:47	77.0	83.2	5720	46.3	20.2	12.9	7.3	4.9	3.2	2.1	1.7	1.5	6.4	2.8	4.1	6.0	
2.0	3	14:47	77.0	83.2	8891	69.2	36.5	21.6	13.1	7.8	4.9	3.4	2.8	2.4	6.5	2.9	4.0	6.3	
2.0	4	14:47	77.0	83.2	8891	68.5	34.7	21.8	12.8	8.0	4.9	3.5	2.8	2.4	6.5	3.2	3.7	6.4	
2.1	1	14:52	80.6	83.4	5184	62.6	37.0	20.6	11.1	7.2	4.5	3.5	2.6	2.2	4.1	2.5	5.1	3.4	
2.1	2	14:52	80.6	83.4	5216	62.0	35.9	20.5	10.6	7.2	4.5	3.3	2.6	2.1	4.1	2.7	4.9	3.5	
2.1	3	14:52	80.6	83.4	8180	92.7	60.0	36.0	20.7	12.6	7.8	5.6	4.5	3.9	3.8	3.7	4.0	3.7	
2.1	4	14:52	80.6	83.4	8300	93.2	64.2	35.1	21.9	12.6	7.8	5.7	4.6	3.9	3.8	3.7	4.0	3.8	
2.3	1	14:56	82.4	83.2	5545	53.5	25.1	12.9	8.6	6.0	4.2	3.0	2.3	2.0	4.8	3.4	4.1	4.7	
2.3	2	14:56	82.4	83.2	5555	53.7	26.0	12.9	8.0	6.1	4.2	3.0	2.4	2.0	4.8	3.4	4.1	4.7	
2.3	3	14:56	82.4	83.2	8694	80.7	41.6	23.8	13.4	10.2	7.1	5.1	4.0	3.4	4.4	4.3	3.3	4.9	
2.3	4	14:56	82.4	83.2	8705	81.7	42.4	24.1	13.6	10.3	7.4	4.9	4.0	3.4	4.2	4.4	3.2	4.9	
2.3	1	14:57	82.4	82.5	5370	61.3	37.3	22.8	13.3	8.6	4.1	2.6	2.0	1.6	4.7	2.2	5.3	3.7	
2.3	2	14:57	82.4	82.5	5337	61.5	37.3	23.0	13.4	8.6	4.2	2.6	2.0	1.6	4.6	2.2	5.3	3.7	
2.3	3	14:57	82.4	82.5	8541	86.9	59.1	43.1	24.5	15.9	7.4	4.6	3.5	3.0	4.1	3.9	3.7	4.3	
2.3	4	14:57	82.4	82.5	8508	86.8	61.3	41.0	25.1	15.3	7.4	4.6	3.5	3.0	4.1	3.8	3.8	4.3	
2.4	1	14:58	82.4	83.8	5391	50.2	34.8	23.1	11.9	7.4	4.4	2.9	2.3	1.8	4.4	4.2	3.4	4.9	
2.4	2	14:58	82.4	83.8	5468	51.3	36.0	24.0	12.2	7.6	4.6	3.0	2.4	1.8	4.2	4.4	3.2	4.9	
2.4	3	14:58	82.4	83.8	8858	73.9	59.7	41.1	21.2	13.9	7.9	5.0	3.8	3.3	4.0	5.9	1.7	5.7	
2.4	4	14:58	82.4	83.8	8683	72.5	57.4	39.5	20.8	14.0	7.8	5.1	3.8	3.4	4.0	5.9	1.7	5.7	
2.5	1	15:00	82.4	83.6	5381	77.9	32.3	17.1	10.5	7.4	5.2	4.3	3.2	2.0	3.7	1.8	5.9	2.7	
2.5	2	15:00	82.4	83.6	5435	80.5	33.0	17.3	10.6	7.6	5.3	4.3	3.3	2.2	3.7	1.7	6.6	2.6	
2.5	3	15:00	82.4	83.6	8311	93.0	60.1	29.3	17.9	12.3	8.3	6.5	4.8	3.6	3.6	3.9	4.4	3.8	
2.5	4	15:00	82.4	83.6	8322	91.7	58.9	30.0	18.6	12.5	8.3	6.3	4.9	3.3	3.6	4.2	4.1	3.9	
2.5	1	15:00	82.4	84.2	5905	27.8	13.5	10.5	8.6	5.0	4.3	3.3	2.5	1.7	5.0	13.9	0.0	13.2	
2.5	2	15:00	82.4	84.2	5949	28.8	13.9	10.6	8.1	4.7	4.2	3.3	2.6	1.5	5.1	12.5	0.0	12.8	
2.5	3	15:00	82.4	84.2	9230	45.4	23.3	18.4	13.3	9.2	6.9	5.1	3.9	2.9	4.8	12.9	0.0	12.0	
2.5	4	15:00	82.4	84.2	9099	45.6	27.0	18.5	13.1	9.4	6.8	5.0	3.9	3.0	4.8	12.4	0.0	11.7	
2.6	1	15:02	82.4	84.3	4976	81.5	24.0	36.8	16.7	7.0	4.8	3.8	4.9	1.9	3.7	1.1	6.6	2.2	
2.6	2	15:02	82.4	84.3	5063	82.1	24.0	35.8	15.6	7.1	4.9	4.3	4.5	1.8	3.7	1.2	7.1	2.3	
2.6	3	15:02	82.4	84.3	7808	93.2	37.3	68.6	27.9	12.8	8.2	7.5	7.3	4.0	3.4	3.8	4.6	3.5	
2.6	4	15:02	82.4	84.3	7819	95.9	40.0	72.2	22.4	12.9	8.2	7.9	6.0	3.8	3.4	3.7	4.7	3.3	
2.6	1	15:02	82.4	83.0	4965	85.0	58.0	33.3	15.6	8.5	4.3	3.1	2.4	2.1	4.1	0.8	6.8	2.1	
2.6	2	15:02	82.4	83.0	4856	83.4	56.7	34.2	14.8	8.3	4.2	3.0	2.5	2.0	4.1	0.7	6.9	2.1	
2.6	3	15:02	82.4	83.0	7775	96.5	95.7	57.1	25.7	14.6	7.2	5.4	4.2	3.6	3.9	2.8	4.8	3.3	
2.6	4	15:02	82.4	83.0	7666	98.8	93.0	58.6	27.3	15.1	7.3	5.4	4.3	3.7	3.7	2.7	5.0	3.1	
2.6																			END"

Appendix D

Geotechnical Report Limitations and Guidelines for Use

Appendix D
Geotechnical Report Limitations and Guidelines for Use
Report No. P-0010936B

D.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.

D.2 RISK MANAGEMENT INFORMATION

D.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.

D.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.

D.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.

D.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

D.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.

D.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.

D.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.

D.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.

D.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.

D.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.