ALDOT - 390

Procedure for Conducting Soil Surveys and Preparing Materials Reports

Bureau of Materials and Tests
Revised February 14, 2012
SCOPE

The purpose of this procedure is to present guidelines for gathering information, of engineering significance, pertaining to the subsurface conditions of a specific construction area used by the Alabama Department of Transportation. These guidelines will address a range of topics such as visual inspections, collection of samples, and final material reports to be used during the construction of a project.
# TABLE OF CONTENTS

1. ABBREVIATIONS .................................................................................................................. 4

2. REFERENCED DOCUMENTS ............................................................................................... 5

3. CONTRACTUAL COMMENTS .............................................................................................. 7

4. GENERAL INFORMATION .................................................................................................. 8

5. NEW LOCATION (GRADE AND DRAIN PROJECTS) .......................................................... 11

6. BASE AND PAVE PROJECTS ............................................................................................. 19

7. RESURFACING PROJECTS ................................................................................................. 20

8. BRIDGE REPLACEMENT AND SHORT WIDENING PROJECTS .......................................... 21

9. LONG-WIDENING PROJECTS ........................................................................................... 22

10. GRADE, DRAIN, BASE, AND PAVE PROJECTS ............................................................... 22

11. REPORT SUBMITTAL .......................................................................................................... 22

12. APPENDIX A- ENVIRONMENTAL PROCESS CHECKLIST ............................................ 27

13. APPENDIX B- SUMMARY TABLES .................................................................................. 28

14. APPENDIX C- DESIGN RESILIENT MODULUS ............................................................ 31

15. APPENDIX D-SAMPLE COMMENTS LOG ....................................................................... 32

16. APPENDIX E-CHECKLIST FOR RESURFACING PROJECTS ........................................ 33

17. REVISION CHRONOLOGY ................................................................................................. 34
1. ABBREVIATIONS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AADT</td>
<td>Annual Average Daily Traffic</td>
</tr>
<tr>
<td>AASHTO</td>
<td>American Association of State Highway and Transportation Officials</td>
</tr>
<tr>
<td>ADEM</td>
<td>Alabama Department of Environmental Management</td>
</tr>
<tr>
<td>AGE</td>
<td>Assistant Geotechnical Engineer</td>
</tr>
<tr>
<td>ALDOT</td>
<td>Alabama Department of Transportation</td>
</tr>
<tr>
<td>ASTM</td>
<td>American Society for Testing and Materials</td>
</tr>
<tr>
<td>CBMPP</td>
<td>Construction Best Management Practices Plan</td>
</tr>
<tr>
<td>DARWin</td>
<td>Design, Analysis and Rehabilitation for Windows</td>
</tr>
<tr>
<td>DME</td>
<td>Division Materials Engineer</td>
</tr>
<tr>
<td>EA</td>
<td>Environmental Assessment</td>
</tr>
<tr>
<td>ESALs</td>
<td>Equivalent Single Axle Loads</td>
</tr>
<tr>
<td>FHWA</td>
<td>Federal Highway Administration</td>
</tr>
<tr>
<td>FONSI</td>
<td>Finding of No Significant Impact</td>
</tr>
<tr>
<td>FWD</td>
<td>Falling Weight Deflectometer</td>
</tr>
<tr>
<td>GN</td>
<td>General Notes</td>
</tr>
<tr>
<td>GPS</td>
<td>Global Positioning System</td>
</tr>
<tr>
<td>HSA</td>
<td>Hollow Stem Auger</td>
</tr>
<tr>
<td>kip</td>
<td>1000 pounds-force</td>
</tr>
<tr>
<td>kN</td>
<td>Kilo Newtons</td>
</tr>
<tr>
<td>LCCA</td>
<td>Life-Cycle Cost Analysis</td>
</tr>
<tr>
<td>MPa</td>
<td>Mega-Pascal</td>
</tr>
<tr>
<td>M_R</td>
<td>Resilient Modulus</td>
</tr>
<tr>
<td>MUTCD</td>
<td>Manual on Uniform Traffic Control Devices</td>
</tr>
<tr>
<td>N</td>
<td>The uncorrected blow count from the SPT and Split-Barrel Sampling of Soil</td>
</tr>
<tr>
<td>NHI</td>
<td>National Highway Institute</td>
</tr>
<tr>
<td>NPDES</td>
<td>National Pollutant Discharge Elimination System</td>
</tr>
<tr>
<td>PATB</td>
<td>Permeable Asphalt Treated Base</td>
</tr>
<tr>
<td>PI</td>
<td>Plasticity Index</td>
</tr>
<tr>
<td>PSI</td>
<td>Pounds per Square Inch</td>
</tr>
<tr>
<td>ROE</td>
<td>Right of Entry</td>
</tr>
<tr>
<td>ROW</td>
<td>Right of Way</td>
</tr>
</tbody>
</table>
2. REFERENCED DOCUMENTS

2.1. ALDOT STANDARD SPECIFICATIONS – Requirements for the materials and processes required for conducting soil surveys and preparing materials reports are given in the following Sections contained in the Standard Specifications for Highway Construction. (Web Link: STANDARD SPECIFICATIONS)

- 650 Topsoil

2.2. ALDOT PROCEDURES – Requirements for the materials and processes required for conducting soil surveys and preparing materials reports are given in the following ALDOT Procedures contained in the Testing Manual: (Web Link: ALDOT PROCEDURES)

- 292 Method of Test for Determining Optimum Lime Content for Use in Lime Stabilized Roadbed
- 392 Pavement Evaluation and Distress (Condition) Survey Procedure
- 398 ALDOT Guidance for Preconstruction Activities

2.3. ALDOT GUIDELINES FOR OPERATION – Consist of guidelines on different areas of construction: (Web Link: GUIDELINES FOR OPERATIONS)

- 3-11 Preliminary Design of Earthwork
- 3-13 Contingency Pay Items in Limesink Prone Areas
- 3-22 Selection of Type of Roadway Pipe
- 6-10 Bituminous Plant Mixes
2.4. ALDOT SPECIAL AND STANDARD HIGHWAY DRAWINGS – Supplementary requirements for conducting soil surveys are given in the following standard drawings: (Web Link: SPECIAL AND STANDARD HIGHWAY DRAWINGS)

- GN-2 Standard Design Notes for Plan Assemblies

2.5. AASHTO STANDARDS – Requirements for the specifications and testing required for conducting soil surveys are given in the following AASHTO Standard Specifications and Test Methods for:

- M 145 Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes
- T 206 Penetration Test and Split-Barrel Sampling of Soils
- T 207 Thin-walled Tube Sampling of Soils
- T 225 Diamond Core Drilling for Site Investigation
- T 307 Determining the Resilient Modulus of Soils and Aggregate Materials

2.6. AASHTO PUBLICATIONS – Supplementary requirements and tools for conducting soil surveys are given in the following AASHTO publications:

- Guide for Design of Pavement Structures
- AASHTOWare DARWin™ – Pavement Design and Analysis System

2.7. FHWA PUBLICATIONS - Supplementary requirements for conducting soil surveys are given in the following FHWA publications:

- MUTCD Manual on Uniform Traffic control Devices for Streets and Highways

2.8. ENVIRONMENTAL REQUIREMENTS – Regulatory requirements for ADEM NPDES Stormwater Permit and Corps of Engineers Permit: (Web Links: ADEM NPDES PERMIT REGULATIONS and US ARMY CORPS OF ENGINEERS REGULATIONS)
3. CONTRACTUAL COMMENTS

- The Consultant shall obtain and review copies of the current versions of the Department’s Testing Manual, Guidelines for Operation, Standard Drawings, and Standard Specifications. These publications may be accessed from the Department’s web site at www.dot.state.al.us.

- The Department will provide the Consultant with any Departmental amendments and policies concerning the application of the current AASHTO Guide for Design of Pavement Structures.

- The DARWin™ AASHTOWare is a proprietary product and shall be licensed through AASHTO or its marketing agent. The Department will not furnish the DARWin™ software or the current AASHTO Guide for Design of Pavement Structures.

- The Consultant shall provide the Materials and Tests Engineer with a boring layout on plan/profile sheets. The boring layout shall include the proposed boring locations and depths and shall be submitted as part of the proposal.

- The Division Materials Engineer will have final approval of boring locations. Boring locations which are deleted during field operations shall have a written explanation of rationale behind the deletion and shall be presented in a table in the final report.

- Before any additional borings are done, approval for the additional borings shall be obtained in writing from the Division Materials Engineer. If additional borings will result in the Consultant’s initial cost proposal being exceeded, then the additional work will need to be approved through the Materials and Tests Engineer’s office. Deletion of borings or offsets shall be coordinated with the Division Materials Engineer. A list of deletions and offsets with a justification shall be included in the final report.

- The boring logs shall be submitted to the Materials and Tests Engineer for approval for completeness before being submitted to the Division Materials Engineer.

- The submission of boring logs for approval shall be on an 11 X 17 sheet of regular paper. Mylar shall be required upon final approval and shall not be submitted during the draft phase. The boring log sheets shall contain a space for the Division Materials Engineer’s signature.
• The Consultant shall supply the Division Materials Engineer and the State Materials Engineer with a copy of all $M_R$ tests results. The Consultant shall discuss with them the selection of the design $M_R$ value.

• When requested by the Department, the Consultant shall deliver the samples specified by the Division Materials Engineer to the Bureau of Materials and Tests or to the Division Materials Laboratory for testing by the Department’s laboratory.

4. GENERAL INFORMATION

• Prior to beginning any work on the project, The Consultant shall review the Department’s procedures and inspect the project site. If possible, the project site inspection team shall include the Division Materials Engineer.

• The Consultant shall ensure that Right-of-Entry forms from property owners have been obtained from the Division Right of Way Office before entering private property for drilling.

• The Consultant shall obtain aerial photographs and topographic maps of the area to aid in the project walk-over and the field work. Aerial photographs can be obtained by contacting the Assistant Location Engineer at the Design Bureau at (334)242-6139, or via internet sources.

• The Consultant shall request and obtain a copy of the FONSI and/or any EA or Re-Evaluation documents for the project, either from the Bureau of Materials & Tests, Hazardous Materials Section or from the Design Bureau, Environmental Technical Section. The Consultant shall review these documents to determine if wetlands have been delineated. If so, plan to provide probing and/or boring in these areas to determine depth of soft soils/unsuitable materials or muck. This work needs to be done as a part of the project field work.

• Prior to beginning any work on the project, the Consultant must determine if an ADEM NPDES Stormwater and/ or Corps of Engineers Permit are required for the project activity. The Consultant must determine the area of soil disturbance in order to
perform the work. Should the sum of all soil disturbance areas equal one or more acres, a stormwater permit per ADEM Regulations will be required. For stormwater permit coverage, the Construction Best Management Practices Plan for Pre-Construction Investigation Activities template (Appendix A), supplied by the Geotechnical Division, shall be completed for the project. The Consultant shall also prepare pertinent documentation and follow Priority Construction Site Regulations if the project area is considered as such by ADEM Regulations. The Consultant must determine if the work activity will involve defined wetlands, waters of the US or a stream crossing(s). Should the work activity include any of the mentioned activities, a Corps of Engineers Permit will be required. The Consultant shall prepare all pertinent applications and documentation for a NPDES Stormwater Permit and a Corps of Engineers Permit, as applicable, and submit that information along with the correct fees to the appropriate departments. Once approval of the permits is received, field work can commence. It shall be the responsibility of the Consultant to perform all site inspections and documentation required to maintain the permits in good standing and to terminate the permits, as applicable, once the field work is complete and the soil disturbance has been reclaimed.

- The Consultant shall include with the soil survey a written description of the soft soil areas noted. Soft soils are cohesive soils (i.e., silts and clays) which have low blow-counts ($N \leq 6$) and low bearing capacity. Soft soils can cause long term settlement under load and post construction instability of structures. Engineering judgment shall be observed while determining soft soil areas. All conditions (drought, wet, etc.) incurred at the time of the survey shall be included. A table listing soft soil areas shall be included in the materials report and at a minimum it shall include station number, anticipated depth of excavation or other method of remediation, and if removal is recommended, an estimated quantity to be removed. In the event no soft soils are located within the project limits, the consultant shall submit a written statement outlining the level of effort in locating soft soil areas.
The Consultant shall request and obtain the appropriate project traffic data from the Division Materials Engineer and furnish a copy of the traffic data to the State Materials Engineer. Request traffic data for the calendar year that the project is to be let to contract as well as future traffic projections for 20 years thereafter. For example, if a project were to be let to contract in 2010, the requested traffic data would be for 2010 and 2030. If a LCCA is required, then the 12 year traffic data shall also be requested; therefore, in the previous example data for the year 2022 would also be needed. Guidelines for the requirements of LCCA can be located on the Materials and Tests Intranet page or by contacting the Materials Engineer at the Bureau of Materials and Tests.

Once the traffic data is received, determine/confirm with the Division Materials Engineer that the data is correct for use in the pavement structural design on the project. In general, the AADT used for the pavement structural design will be the AADT that most nearly represents the average number of trucks on the project. The number of twenty year 18 kip (80 kN) ESALs for bituminous plant mix ESAL Range designations will be calculated in accordance with Guidelines for Operation 6-10.

Provide traffic control when it is warranted and abide by the guidelines set forth in the most current version of the FHWA MUTCD manual accepted by ALDOT. Determine the type and amount of traffic control required according to the above referenced manual.

The Consultant shall assess the need for nuclear testing devices, gyratory compactors, profilographs, materials remixing devices, and soils/structures laboratories. Recommendations with justification for inclusions or deletions shall be included in the final materials report.

Once the report(s) have been approved, the Consultant will be required to submit an electronic copy of the report(s) to the Bureau of Materials Tests - Geotechnical Division.
5. NEW LOCATION (GRADE AND DRAIN PROJECTS)

5.1. Provide geo-hydraulic settings for the project. Describe the geology and include the geological maps of the project vicinity. Describe the general topography of the project and identify such pertinent features as wet areas, rock out-cropping, potential slide areas, and underwater embankment requirements. Investigate the possibility of sinkholes (limesinks) in areas that are prone to sinkholes, as defined in Guidelines for Operation 3-13. Drainage requirements shall also be investigated and recommendations for the use of culverts, underdrain pipe, cross drain pipe and pavement edge drains provided. If recommendations are made for the use of pavement edge drains, a PATB layer, normally 4 inches (100 mm) thick, will be incorporated in the pavement structural design. There must be a minimum of 6 inches (150 mm) of asphalt cover over the PATB, which renders its applicability to mostly high traffic volume designs. Selection of roadway pipe will be in accordance with Guidelines for Operation 3-22 which states that concrete roadway pipe will be used on all roads that comprise the State Highway System. Soil and water testing will not be required for concrete pipe. If underdrain pipe is recommended, a sketch showing the elevation where the underdrain shall be placed in the field and a typical section shall be included in the report. The designer of record shall size the pipe and develop the plan sheets for the plans.

5.2. Conduct a soil survey along the centerline of the project. The intent of the borings is to determine the type of materials that will be encountered along the project so that prospective bidders on the project will have an understanding of what is involved as pertains to earthwork on the project. A site inspection to include walking the alignment from one end to the other and from right-of-way to right-of-way to look for areas which may be wet and/or may contain soft soils shall be performed as part of the soil survey. The Division Materials Engineer will accompany the Consultant in the walk through to ensure all potential areas of concern are investigated. The Materials and Tests Soft Soils Engineer will be available, upon written request by the Division Materials Engineer, to participate in the walk through of the site. Areas of wet and/or
soft soils identified during the site walk through will require probing during the soil survey to determine the depth of soft soils. If the soil survey is completed during a drought, look for areas with vegetation which would indicate the area would be wet, and thus soft, during wetter periods. These areas shall be delineated and a note added to the plans stating that removal of unsuitable materials may be required in these areas. If the survey is done during a drought, the report should clearly state this condition and should also state that conditions may change significantly with the resumption of normal weather functions. If any water bodies (ponds, streams, etc.) crossing the alignment are located on the project, provide recommendations for drainage from the roadway alignment/embankment (drain, backfill, etc.) and details where the water is to be drained. Include a typical cross-section along with pay items.

5.3. Perform borings in fill areas every 300 ft (90 m). Extend the boring to 1.5 times the proposed fill height or to auger refusal, whichever is shallowest, but no more than 10 ft (3 m) into competent material (A competent material shall be defined as having $N \geq 15$). Should soft soils be encountered, follow the guidelines under Subarticle 11, below. If uniform conditions are encountered while drilling every 300 ft (90m), then the boring interval may be extended to 500 feet (150 m). Perform additional borings if there is a noticeable change in the soil between borings.

5.4. Perform borings in cut areas every 200 ft (60 m) along and on centerline and extend the boring approximately 3 ft (1 m) below the ditch line. For every third boring along centerline, perform a boring in the left and right ditch lines, extending these borings approximately 3 ft (1 m) below the ditch line. Perform additional borings if there is a noticeable change in the soil between borings.

5.5. Perform SPT in overburden soils at each boring location in both cut and fill areas for every 5 ft (1.5 m) of boring depth. Perform SPT in accordance with AASHTO T 206.

5.6. Determine shrinkage and/or swell values for the project in accordance with the Departments Guidelines for Operation 3-11.
5.7. If water is encountered during the boring operations, determine and report the elevation of the water table. Standpipe piezometers shall be constructed at regular intervals along the alignment so that the contractor can determine the depth to ground water, particularly in areas where soft soils may be present.

5.8. If conditions are encountered during the soil survey investigations that indicate a slope stability problem could occur in either the back slopes or the front slopes (especially soft soils in the front slope foundation soils), notify the Division Materials Engineer and the Materials and Tests Engineer in writing so that consideration may be given to performing a slope study. Generally, if slopes are steeper than 3:1 (H:V) or if slopes have to be engineered for stability or drainage, a slope study will be prepared in accordance with ALDOT-398.

5.9. If conditions exist on the project that indicate that it would not be appropriate to adhere to the earth slope criteria as outlined in GN-2, Notes 106, 107, and 108, notify the Division Materials Engineer and the Materials and Tests Engineer in writing.

5.10. Consultant shall conduct topsoil survey; providing topsoil depths, location, estimated quantities, and test results. Quantify the area within the construction limits of the project. Measure topsoil depths utilizing methods directed by the Division Materials Engineer and estimate the average topsoil depth with the construction limits. If topsoil depths vary considerably across the project, the area within the construction limits may need to be broken into sections. Calculate the estimated available topsoil and determine the number of samples required (one sample shall be required for every 5000 cu. yd. of available topsoil). Obtain samples from representative locations across the site (minimum of 25 pounds typically needed for analysis). Test samples in accordance with ASTM D 5268 and ASTM D 2974 (Method “C”). Topsoil shall meet the requirements of Section 650 of the Standard Specifications for Highway Construction.

5.11. Where unsuitable material, soft soils, and/or muck are encountered, notify the Division Materials Engineer in writing. Upon approval from the Division Materials Engineer take soundings (or, boring and sampling as directed in writing by the
Division Materials Engineer) along the centerline and right and left of centerline out to the limits of construction to determine the depth and extent of the unsuitable material, soft soils, and/or muck. Undisturbed samples for consolidation testing may be required to perform settlement calculations. Make recommendations, including estimated quantities and pay items, for removal and/or treatment of any unsuitable material, soft soils, and/or muck encountered. If unusual circumstances are encountered, such as high groundwater table or the potential for differential settlement beneath embankments or structures, then further investigations may be needed. Immediately notify the Division Materials Engineer and Materials and Tests Engineer in writing for further guidance on the need for additional investigations. The Division Materials Engineer shall notify the Consultant and the Assistant Geotechnical Engineer - Consultant Management in writing on the need for more work.

5.12. Identify any areas where the subgrade may require stabilization or removal and replacement and recommend the remediation. If lime stabilization is recommended, the Consultant will recommend the percentage of lime based on laboratory soil testing results and the results shall be included in the materials report. The final percent of lime before construction shall be determined and reported in accordance with ALDOT-292 by the Department’s laboratory. If ground improvement methods or geosynthetic stabilization is recommended, provide a sketch of locations to include an elevation view, plan view, typical sections, pay items, and estimated quantities.

5.13. In areas where remediation is recommended the recommendations shall also include a long-term settlement analysis for cost comparison between removal and/or treatment during construction and pavement leveling during future maintenance activities.

5.14. The Consultant shall delineate areas of high groundwater. If groundwater should be drained to stabilize the roadbed, a sketch of the underdrain shall be included. The elevation to set the drains shall be included in the sketch. If more than one area exists, include a table of all areas showing high groundwater where underdrain shall be installed.
Identify, by using boring logs, the locations where underdrains will be needed or required to remove groundwater from subgrade. A drawing will be provided by the Division Materials Engineer or the Geotechnical Consultant of the required underdrain system. Included in this drawing should be the recommended locations of underdrain systems, pipe sizes for main lines and lateral lines, depth and elevation of the underdrain systems, and any other needed information pertaining to the placement of the underdrain system.

5.15. If during the course of obtaining the soil borings necessary to complete a soil survey, a stream crossing is encountered that will possibly require construction of a culvert, borings appropriate for the subsequent design of the culvert foundation shall be obtained as outlined below. Use the tables “Earth Slopes Horizontal to Vertical for Types of Terrain”, found in Notes 106, 107 and/or 108 of GN-2 in conjunction with the applicable “typical roadway section” and planned roadway profile to establish the probable inlet and outlet locations of the culvert.

**NOTE:** For large stream crossings which are longer than 20 feet (6 m) along centerline, where the use of a bridge culvert will be likely, refer to ALDOT-398 for investigation, engineering analysis, and report development.

- For non-bridge culverts, regardless of fill height, where soft soils can reasonably be expected, the following drill patterns shall be used.
  - Culverts having a length of 300 feet (90 m) or less shall be drilled at mid-length and at each end.
  - Culverts exceeding 300 feet (90 m) in length shall be drilled so that the distance between inlet and outlet borings is equally divided into approximately 150 linear foot (45 m) increments.

Extend borings to a depth equal to 1.5 times the expected fill height or 5 vertical feet (1.5 m) into competent rock, whichever occurs first. Conduct SPT in accordance with AASHTO T 206 every 5 feet (1.5 m) for the full depth of the boring at each boring location. The Division Materials Engineer will sign these boring logs and ensure that they are included in the final plan.
assembly. Sufficient undisturbed samples obtained in accordance with AASHTO T 207 should be recovered and tested to permit calculation of the soil bearing capacity and expected settlement of the assumed culvert(s) as outlined in NHI-00-045, Chapter 6. The above process shall also be used for performing foundation investigations for large diameter pipes normally greater than 48 in (1.2 m) which will have fills in excess of 60 ft (18 m) placed above them. Consideration should be given to investigating any cross drains in areas of concern as well.

- A brief foundation report shall be prepared for each investigated culvert and/or pipe location. The report shall include the expected site soil profile(s), the results of soil bearing capacity calculations, and the expected settlement analyses. The report should also include recommendations for subgrade improvement(s) should the available bearing capacity appear to be inadequate and/or the expected differential settlement exceeds 2 in (50 mm). The foundation recommendations for a non-bridge culvert shall be developed as a standalone document which can also be included in the materials write-up.

- Rock coring shall be performed in accordance with AASHTO T 225. Rock cores shall be stored at the nearest Division or District Office so any prospective bidder can inspect them.

5.16. The Consultant shall be responsible for staking the boring locations if they are not provided by ALDOT. When a boring is not located on the centerline, the stationing, offset, and elevation of the exact boring location must be shown. The level of accuracy in roadway staking shall be ± 1 ft. (0.30 m) for stationing and offset, and ± 0.5 ft. (0.15 m) for elevation. The level of accuracy in bridge and/or culvert staking shall be ± 0.1 ft. (0.03 m) for stationing, offset, and elevation. The use of GPS or an engineering team in the staking of boring locations will be acceptable as long as the prescribed accuracy levels are maintained.

5.17. Maintain field boring records and provide a soil boring log sheet, a soil profile and soil cross-sections for the entire project. On the boring logs sheet, show the soils
properties (Atterberg limits, percent of fines, etc.) for tested samples and the AASHTO soil classification including a group index. AASHTO soil classifications shall also be shown on boring logs placed on profiles and cross-sections. The final soil boring log sheets shall be provided on mylar for inclusion in the final plan assembly. The soil profile and soil cross-sections shall be provided as paper plots with the boring logs printed on both the profile and cross-sections at the appropriate station location to include the water table. The type of drilling equipment (brand and model) shall be reported on the boring logs along with the type of hammers used for the SPT sampling and the method of drilling used, HSA, etc. Consultants shall submit draft copies of the boring log sheets to the Materials and Tests Engineer for approval for completeness. Consultant will send the final boring log in mylar to the Geotechnical Division. The Geotechnical Division will review and forward the final logs to the Division Materials Engineer for signature. The Division Materials Engineer will then forward the boring logs to the lead bureau/division contact for inclusion in the final plan assembly with a copy of the transmittal letter sent to the Materials and Tests Engineer’s office.

5.18. Sample each soil strata encountered and furnish a soil analysis and AASHTO soil classification. AASHTO soil classifications, PI’s and moisture content results shall be placed on the boring logs and in the laboratory summary sheet as shown in Appendix B. Collect laboratory $M_R$ samples from each non-structure boring in the cut areas along centerline and any designated borrow sources. Along the centerline, a laboratory $M_R$ test shall be conducted on a composite sample of soil collected from the boring above the proposed finished subgrade elevation and on a sample of soil collected from within the top 1 ft (0.30 m) below the proposed finished subgrade elevation. In large cuts where the borings indicate that uniform conditions exist in the cut, collect $M_R$ samples at approximate ¼ points along the centerline of the cut. Conduct $M_R$ sampling and testing according to AASHTO T 307.

Supply the Division Materials Engineer and the State Materials Engineer with a copy of all $M_R$ tests results. Select the design $M_R$ value as per the table in Appendix C and the following discussion. The design $M_R$ for soils classified as A-1, A-3, A-
2-4, and A-2-5 shall be the average of the \( M_R \) values generated at a confining pressure of 4 psi (0.03 MPa). For all other AASHTO soil classes, the design \( M_R \) shall be the average of the \( M_R \) values generated at a confining pressure of 2 psi (0.015 MPa). Samples of soils that fall within the A-6 and A-7 groups shall be remolded to a moisture content on the wet side of optimum. Moisture content on the wet side of optimum will be determined at 96% of the proctor density. All other soils shall be remolded at optimum moisture content. The \( M_R \) values generated at both confining pressures shall be averaged to determine the design \( M_R \) value. Upon computing the average \( M_R \) value, if there are any values in the \( M_R \) data set that exceed the mean value by ± 2 standard deviations, these values shall be discarded and the remaining values shall be re-averaged to determine the final average \( M_R \) value to be used in the pavement structural design analysis. The resulting design \( M_R \) value shall be in psi (MPa) units and it shall be rounded to the nearest 100 psi (0.1 MPa). The subgrade \( M_R \) value is the required input in the AASHTOware DARWin™. Therefore, \( M_R \) is the preferred subgrade strength test.

5.19. The pavement structural design for the project shall be determined using the current AASHTO Guide for Design of Pavement Structures as amended by the Department and the specified thickness design procedure contained in the DARWin™ AASHTOware.

5.20. Review the soil profile data in the cut areas to determine if the material is suitable for use as Improved Roadbed. Cut areas where there is suitable material for Improved Roadbed shall be identified in a table in the materials report. The table shall include the station where the material is located and the approximate amount of material available for the Improved Roadbed layers. The report should also state that this material is to be stockpiled for later use in the Improved Roadbed layers. If there is not sufficient material to build the Improved Roadbed layers, then a quantity of borrow shall be specified to complete the Improved Roadbed layers. If there is not suitable material on the project for Improved Roadbed, then borrow shall be specified for the entire amount of Improved Roadbed material required. A recommendation should be made as to the availability of suitable material for
borrow before final borrow is set up. If there is not locally available material, then specify Roadbed Processing of the subgrade which would be Modified Roadbed (no SN) or Lime Stabilization or Stabilization with Aggregate.

5.21. Determine if a borrow pit location is to be included in the plan assembly for the project.

6. BASE AND PAVE PROJECTS

6.1. Collect finished subgrade laboratory M<sub>R</sub> samples. The sampling frequency shall be one sample per ½ mile (1 kilometer) per roadway or at each soil change per roadway. Perform M<sub>R</sub> sampling and testing in accordance with AASHTO T 307.

6.2. All items listed in Section 5 shall be completed prior to base and pave type projects.

6.3. Determine the availability of suitable local materials for use in sub-base and base construction on the project and make cost comparisons to optimize the pavement structural design.

6.4. When required by the Department, perform a LCCA comparing alternate pavement structural designs, flexible pavement vs. rigid pavement. It is the Department’s policy that an LCCA be performed when the required flexible pavement SN is 6.00 in (150 mm), or greater, based upon a three-stage 28 year analysis period. It is also the Department’s policy to perform a LCCA when reconstruction is proposed for an existing rigid pavement structure. If additional guidance is needed on when to perform a LCCA, please contact the State Materials Engineer. For the flexible pavement alternate, the 28 year analysis period will consist of an initial performance period of 12 years (initial structural design for 12 years) followed by two overlay designs, each with a performance period of eight years, for a total of 28 years.

The rigid pavement alternate design shall be determined using the current AASHTO Guide for Design of Pavement Structures as amended by the Department and the rigid pavement design procedure contained in the rigid pavement design module of DARWin™ AASHTOWare. For the rigid pavement alternate, the 28 year analysis
period will consist of an initial performance period of 20 years (initial structural
design for 20 years) followed by a major rehabilitation at the end of 20 years to
extend the service life another eight years, for a total of 28 years. Additional
guidance concerning the LCCA may be obtained from the Division Materials
Engineer.

6.5. Make recommendations for the pavement structural design for detours, cross-overs
and tie-ins to adjoining roads along the project.

7. RESURFACING PROJECTS

7.1. A “Materials Report Checklist for Resurfacing Projects” is included in Section 16,
Appendix E.

7.2. Perform a condition (pavement distress) survey of the project and report the distresses
according to ALDOT-392.

7.3. Submit to the Division Materials Engineer the proposed sample site locations for
coring. The coring frequency shall be in accordance with ALDOT-392. The Division
Materials Engineer may direct that additional cores be taken at locations that vary
from the specified coring frequency.

7.4. Coring information obtained from the condition survey shall be submitted to the
Pavement Management Division of the Bureau of Materials and Tests to be applied to
the FWD testing/analysis.

7.5. Request and obtain FWD testing/analysis from the Pavement Management Division
of the Bureau of Materials and Tests.

7.6. Using information obtained from the pavement condition survey, the results of the
FWD analysis, the coring log, and sound engineering judgment make
recommendations for rehabilitative treatments to the project.
8. BRIDGE REPLACEMENT AND SHORT WIDENING PROJECTS

8.1. Core the existing pavement structure to determine layer type, thickness and condition.

8.2. If the pavement is performing satisfactorily, make recommendations for the pavement structural design based on the Department’s “equivalent build-up” method. If the pavement is not performing satisfactorily, the pavement structural design shall be determined from soil strength and applicable traffic data according to the procedures outlined in the current AASHTO Guide for Design of Pavement Structures as amended by the Department and DARWin™ AASHTOWare.

8.3. Equivalent Build-Up Method

- Determine the SN of the in-place pavement by the following equation:

\[ SN_{in} = d_1a_1 + d_2a_2m_2 + d_3a_3m_3 + \ldots + d_ia_im_i \]

Where:

\[ SN_{in} = \text{SN of in-place pavement} \]
\[ a = \text{layer structural coefficient} \]
\[ d = \text{layer thickness} \]
\[ m = \text{layer drainage coefficient} \]

- The SN for the new pavement buildup shall be equivalent to the in-place pavement SN plus the structural value of any overlay that is to be placed on the existing pavement.

- Full structural coefficient values shall be applied to the in-place pavement layers in this method of design. The structural coefficient values shall not be reduced because of the age or condition of the pavement structure.

8.4. Bridge Foundation Design Requirements - See ALDOT-398 for drilling, sampling and reporting requirements pursuant to completion of a bridge foundation investigation.
9. **LONG WIDENING PROJECTS**

9.1 In general, long widening projects will be treated as new location projects and will be investigated as required by Section 5.

9.2 Boring spacing may be adjusted according to historical soils data for the existing alignment. The Division Materials Engineer shall be contacted at the beginning of long widening projects to determine appropriate boring spacing.

10. **GRADE, DRAIN, BASE, AND PAVE PROJECTS**

10.1 All items listed in the Sections 5 and 6 shall be required for a grade, drain, base, and pave type project.

10.2 Note 104 of GN-2 shall be included on the typical section sheets.

11. **REPORT SUBMITTAL**

11.1 Depending upon the type of project, the materials report shall include but not be limited to:

- A description of the project
- Project location map
- Geologic, topographic, and hydraulic maps of the vicinity of the project with Begin/End project station numbers indicated
- Description of the geology, topography, and water resources in the vicinity of the project
- Boring location maps
- Site soil profiles
- Cross-sections with borings
- DARWin™ pavement structural design software printouts
- Soils Classification Summary
- $M_R$ Calculations Summary
- Legible typical section drawings on 8 ½” X 11” (ANSI “A”) paper, if needed
• Coring reports (color photographic log)
• Thickness, type and condition of existing pavement layers
• FWD test results and analysis
• Traffic data
• Roadway pipe recommendations
• Shrink and/or swell values
• Topsoil Testing Table with depths and location
• Location of unsuitable materials, soft soils, and/or muck and recommendations for treatment
• Soft Soil delineation tables
• Table indicating high groundwater level by station number.
• Location of rock
• Location of areas that may require subgrade stabilization and recommended method of stabilization
• Life-Cycle Cost Analysis
• Condition survey information

11.2. After the sampling, testing, and engineering analysis has been completed, the report will be submitted for review according the following review process:

• Step 1: The Consultant will submit two (2) copies of Draft #1 of the Soil Survey and/or Materials Report to the Geotechnical Division, along with two (2) copies of the Soil Test Data Report. One copy of each will be reviewed by the Assistant Geotechnical Engineer - Consultant Management (AGE) for completeness/conformance with ALDOT 390. One copy of each will be transmitted to the Division Materials Engineer (DME) for technical review.

• Step 2: Comments will be provided in writing to the DME from the Geotechnical Division. The DME will send their comments along with the Geotechnical Division comments to the consultant.
Step 3: The consultant will make edits and submit the pertinent revisions electronically to the DME and the AGE for review. Additionally, the consultant will submit a written response (comments log) to each comment. (See Example in Appendix D)

Step 4: The DME and AGE will verify that all their respective comments have been addressed. The AGE will inform the DME that the Geotech Division comments have been addressed and the DME will direct the consultant (via acceptance letter) to proceed with Draft # 2.

Step 5: The Consultant will submit two copies of Draft # 2 along with the acceptance letter of the Soil Survey and/or Materials Report and an electronic copy of the Soil Test Data Report to the Geotechnical Division. One copy will be submitted to the State Materials Engineer (SME) for review. The second copy will be transmitted to the DME.

Step 6: The SME will review and submit comments in writing to both the DME and the AGE. The DME will review and coordinate with the SME on comments. At the conclusion of coordination with the DME, the SME will submit final requested changes in writing to the DME and copy the AGE.

Step 7: The DME will submit the approved changes to the Consultant copying the AGE and SME. The consultant will make the required changes and submit the pertinent revisions and comments log electronically to the SME and copy the DME and AGE.

Step 8: The SME will verify that all changes have been made and will electronically notify the AGE that the report is acceptable and ready to be finalized.

Any new changes requested by the DME or the SME to the Materials Report after Step 8 will be addressed in an addendum.
Step 9: The AGE directs the consultant to submit the two (2) final copies of the Soil Survey and/or Materials Report to the AGE. The AGE will compare the final report to the comments log and distribute one (1) copy of the final report to the DME.

Step 10: Upon receipt of the final report, the DME will submit a concurrence letter to the AGE.

Step 11: As soon as the AGE receives the concurrence letter from the DME, the AGE will then request that the Consultant submit the final ten (10) hard copies and an electronic copy of the report. Any changes requested by the DME or the SME to the Materials Report after Step 11 will be addressed in a subsequent addendum.

Step 12: The AGE will furnish the final ten (10) hard copies and an electronic copy of the report to the SME. The SME will approve the report and distribute copies as stated:

<table>
<thead>
<tr>
<th></th>
<th>4 copies + 1 electronic copy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Lead</td>
<td>4 copies + 1 electronic copy</td>
</tr>
<tr>
<td>Construction</td>
<td>1 copy</td>
</tr>
<tr>
<td>FHWA</td>
<td>1 copy</td>
</tr>
<tr>
<td>Quality Control</td>
<td>1 copy</td>
</tr>
<tr>
<td>M&amp;T Project File</td>
<td>1 copy</td>
</tr>
<tr>
<td>SME File</td>
<td>1 copy</td>
</tr>
<tr>
<td>*Maintenance Bureau/DME</td>
<td>1 copy</td>
</tr>
</tbody>
</table>

* Interstate Maintenance Projects (IM) a copy will be furnished to the Maintenance Bureau, otherwise the copy will be returned to the DME

Note: All Soil Survey Reports and/or Soil Survey and Partial Materials Reports will be locally approved by the SME under a separate cover letter. Locally approved Soil Survey Reports and/or Soil Survey and Partial Materials Reports shall be retained until all remaining engineering data has been prepared by the
DME and submitted as a complete Materials Report. Only complete Materials Reports will be approved and distributed by the SME.

**All Materials Reports prepared in-house, by ALDOT personnel, shall have ten (10) hard copies of the report and an electronic copy submitted for final approval and distribution.**

*Note:* Any formatting issues or changes requested in the comments log by the DME or the SME which was not addressed in the final report by the Consultant will be changed at the Consultant’s expense.

- Step 13: The SME will scan and attach the approval cover letter to the electronic file copy. The SME will provide the DME and Design Lead an electronic copy of the report containing the approval letter.

11.3. In conjunction with the first draft submittal, two copies of a Soil Test Data Report shall be furnished for review. The Soil Test Data Report shall include all applicable soil test data (e.g., MR data, sieve and Atterburg data, topsoil data, etc.), as well as the Soil Classification Summary, the MR Calculations Summary, and other applicable tables used in the Materials Report.

11.4. For projects to be let to contract utilizing English units of measurement, the materials report and all of the supporting documentation and test results shall be in English units of measurement. For projects to be let to contract utilizing SI units of measurement, the materials report and all of the supporting documentation and test results shall be in SI units of measurement. Dual units of measurement are not allowed.
## APPENDIX A

### ALABAMA DEPARTMENT OF TRANSPORTATION

Pre-Construction Investigation Activities
Environmental Permits Checklist

ALDOT Project Number:  
County:  
Date:  

<table>
<thead>
<tr>
<th>1. ADEM NPDES STORMWATER PERMIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 Will the soil disturbance associated with the project activity be 1 or more acres? (If no, skip to Section 2)</td>
</tr>
<tr>
<td>Yes ☐ No ☐</td>
</tr>
<tr>
<td>1.2 If Yes, Has NPDES stormwater permit coverage been requested and obtained from ADEM?</td>
</tr>
<tr>
<td>Yes ☐ No ☐ N/A ☐</td>
</tr>
<tr>
<td>1.3 List the permit number issued by ADEM for the project activity, if applicable.</td>
</tr>
<tr>
<td>1.4 Will mulching be utilized as the method of clearing (above the soil line)?</td>
</tr>
<tr>
<td>Yes ☐ No ☐ N/A ☐</td>
</tr>
<tr>
<td>1.5 Is the project area considered to be a Priority Construction Site per ADEM Regulations?</td>
</tr>
<tr>
<td>Yes ☐ No ☐</td>
</tr>
<tr>
<td>1.6 Has the CRMP for Pre-Construction Investigation Activities template been completed for the project activity?</td>
</tr>
<tr>
<td>Yes ☐ No ☐</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2. US ARMY CORPS OF ENGINEERS PERMIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1 Will the work activity involve defined wetlands, waters of the US or a stream crossing? (If no, skip to Section 2)</td>
</tr>
<tr>
<td>Yes ☐ No ☐</td>
</tr>
<tr>
<td>2.2 If Yes, Has a Corps of Engineers permit been requested and obtained? If no, explain.</td>
</tr>
<tr>
<td>Yes ☐ No ☐ N/A ☐</td>
</tr>
<tr>
<td>2.3 List the permit(s) issued for the project activity, if applicable.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3. OTHER ENVIRONMENTAL CONCERNS OR CONSIDERATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1</td>
</tr>
</tbody>
</table>
## 13. APPENDIX B

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>Sample Collected Date</th>
<th>Representative Beginning Station</th>
<th>Representative Ending Station</th>
<th>Average Topsoil Depth (ft)</th>
<th>Estimated Topsoil Volume (yd³)</th>
<th>Deleterious Materials (7% max)</th>
<th>Organic Material (2-20%)</th>
<th>Sand Content (10-90%)</th>
<th>Silt and Clay Content (10-90%)</th>
<th>PH (5-7)</th>
<th>Meets ALDOT Specification of Special Provision 08-0120</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Results Summary

<table>
<thead>
<tr>
<th>Boring No.</th>
<th>Station</th>
<th>Depth</th>
<th>AASHTO Classification</th>
<th>Dry Density (pcf)</th>
<th>Moisture Content, %</th>
<th>% Compaction</th>
<th>M&lt;sub&gt;r&lt;/sub&gt; values at 4 psi confining pressure, psi</th>
<th>Ave.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Seq6 Seq7 Seq8 Seq9 Seq10</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Boring No.</th>
<th>Station</th>
<th>Depth</th>
<th>AASHTO Classification</th>
<th>Dry Density (pcf)</th>
<th>Moisture Content, %</th>
<th>% compaction</th>
<th>M&lt;sub&gt;r&lt;/sub&gt; values at 2 psi confining pressure, psi</th>
<th>Ave.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Seq11 Seq12 Seq13 Seq14 Seq15</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AVG</th>
<th>StDev</th>
<th>(AVG-2 x StDev)</th>
<th>85th percentile</th>
<th>90th percentile</th>
<th>100th percentile</th>
</tr>
</thead>
</table>

### M<sub>R</sub> Calculation Summary

Alabama Department of Transportation  
Project Number:  
Project Name:  
County:  

Notes: Tests performed at Boudreau Engineering on 1/15-18/2011.
14. APPENDIX C

**Design Resilient Modulus by AASHTO Soil Classification**

<table>
<thead>
<tr>
<th>AASHTO Group Classification</th>
<th>A-1</th>
<th>A-3</th>
<th>A-2</th>
<th>A-4</th>
<th>A-5</th>
<th>A-6</th>
<th>A-7 A-7-5 A-7-6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Confining Pressure for Design</td>
<td>4 psi</td>
<td>4 psi</td>
<td>4 psi</td>
<td>4 psi</td>
<td>2 psi</td>
<td>2 psi</td>
<td>2 psi</td>
</tr>
<tr>
<td></td>
<td>Optimum</td>
<td>Optimum</td>
<td>Optimum</td>
<td>Optimum</td>
<td>Optimum</td>
<td>Optimum</td>
<td>Wet side of Optimum</td>
</tr>
<tr>
<td></td>
<td>Optimum</td>
<td>Optimum</td>
<td>Optimum</td>
<td>Optimum</td>
<td>Optimum</td>
<td>Optimum</td>
<td>Wet side of Optimum</td>
</tr>
</tbody>
</table>
15. APPENDIX D

June 16, 2011

Comments Log
To: Mr. Joe Cox
   Cox Geotechnical Services

From: Mr. Tony Channell, P.E.
   4th Division Materials Engineer

RE: Project Number: STPAA-231 (2)
   Additional Lanes on US-231 from
   CR-59 to CR-49
   Coosa County

Joe Cox       June 20, 2011
Shane Trippany June 21, 2011

Joe,
I have reviewed the Soil Survey and Materials Report for the above referenced project and my comments are as follows:
   1. Page 1. Please change stationing in accordance with the new plans.
      Corrected
      Okay
   2. On the maps please put Begin/End Project station numbers.
      Corrected
      Okay

      Please place the boring logs on the profiles, provided by the Design Bureau, so I could see the proposed grade line and the existing ground line.
      Plan and Profiles sheets used in the 2nd draft were provided on 7/06/2011.
      If you have any questions, please do not hesitate to contact this office.
16. APPENDIX E

MATERIALS REPORT CHECKLIST FOR RESURFACING PROJECTS

1. Project Information
   • Specify the Project Number, County, and CPMS Number (if available)
   • Specify the Route
   • Specify the number of lanes, divided or undivided roadway
   • Specify the project setting: Urban, Rural, Curb and Gutter
   • Specify the length of project, beginning and ending mileposts
   • Provide verbal description of project location
   • Specify the proposed resurfacing: Functional, Structural
   • Provide information on previous project resurfacing: Date of last resurfacing, milling depth, mixes used, placement rates, etc.
   • Provide information on previous resurfacing materials: Job Mix formula, LA Abrasion of aggregates

2. Pavement Inspection and Condition Survey
   • Specify the overall condition of the roadway
   • Specify the type of cracking: Alligator, Block, Transverse, etc.
   • Specify the extent of the cracking: Isolated, Entire project, etc.
   • Specify the severity of the cracking: Level 1, 2, 3
   • Specify the location of rutting: Outside lane wheel path, Stop/Start movements at intersections, etc.
   • Specify the extent of rutting depth: Maximum rut depth, range, and overall average rutting depth
   • Specify any pavement failures
   • Specify the type and condition of the shoulders: Paved, Unpaved, Good – Poor

3. Traffic Data Analysis
   • Specify highest ESAL count for selection of bituminous pavement ESAL range designation
   • Specify average ESAL count for pavement overlay design

4. Overlay Thickness Design
   • Determined from FWD analysis worksheet and sound engineering judgment

5. Scope of Work (See Supporting Documentation)
   • Identify Scope Review Team Members by Name/Title.
   • Identify the depth of milling to be performed and areas that would require extra depth milling.
     (A written justification must be furnished if milling is not recommended for the project)
   • List in detail the recommended rehabilitation to be performed to include the following:
     o Unique Pay Item Numbers
     o Pay Item Descriptions
     o Application Rates
   • Widening
   • Cross-slope/Superelevation corrections – provide data/information indicating the amount (thickness) of required corrections
   • Patching and Leveling
   • Shoulder Treatments
   • Any additional areas requiring specific work, i.e. removal of a concrete island, Bridge End Slab related issues, etc.
   • Decisions that were made on the scope of work inspection and why they were made.

6. Additional Project Requirements
   • Materials Remixing Device
   • Profilographs

7. Supporting Documentation
   • Scope of Work Report (Signed and Dated with Division Engineer Approval)
   • Traffic Data Information furnished by Transportation Planning /Modal Programs Bureau
   • ESAL Range Calculations Worksheet
   • FWD Analysis Worksheet with associated Load Cell Deflections Printout and Design Subgrade Resilient Modulus Printout
   • Typical Section Drawings
   • Pavement Condition Survey Report
   • Core Report to include: Thickness, Milepost location, Roadway, Depth of Cracking, Condition of core
     (Include photographs of the cores and the roadway where the cores were taken. This is optional, but it is strongly recommended and highly encouraged.)
   • Any Additional Supporting Documentation to Justify Recommended Rehabilitation
17. REVISION CHRONOLOGY

- Pre 1997
  - No formal written, guidelines for conducting a soil survey or culvert study. Each division performed the work as they deemed appropriate.

- July 31, 1997
  - First guidelines for conducting a soil survey and materials report were written in order for Consultants to be able to assist in this function. The emphasis was for the Consultant to assist in developing the materials report and pavement design.
  - Minimal discussion regarding unsuitable materials was included in this document and no guidance for conducting a culvert investigation was included.

- March 18, 1999
  - The traffic data required for ESAL calculations was changed from 12yr to 20yr.
  - Added a requirement that the Consultants provide a boring layout, with locations and depths noted, when they submit the proposal for review and approval.
  - Added a further explanation of Guidelines for Operation 3-22.
  - Further clarified where, how, and to what depths the borings were to be taken, but did not reference culverts.

- October 20, 1999
  - The section on culverts was added.
  - Referred to ALDOT 398 for bridge foundation investigation guidelines.

- January 24, 2001
  - Added a statement that “Wherever “the Consultant” is mentioned in this document, this requirement may also apply to the Division Materials Engineer.”
  - Reverted back to English units as the standard form of measurement.
  - Required M&T Engineer’s approval before exceeding the cost proposal, if additional borings are required.
  - Required the type of hammer used in SPT sampling be included on the boring logs and the boring logs be approved by the M&T Engineer before distribution.
  - Clarified the sample location for MR samples.
  - Added a statement that the “Department will provide to the Consultant any Departmental amendments/policies concerning the application of the 1993 AASHTO Guide for Design of Pavement Structures.
• July 19, 2004
  • Rearranged information so that contractual information is pulled to the beginning and the general project information is pulled out as a separate section.
  • Added instructions and table for choosing the appropriate $M_R$ value.
  • Strengthened the statement that the Division Materials Engineer should follow these guidelines.
  • Deleted redundant statements.

• October 2007
  • Deleted the height of fill requirement on non-bridge culverts for investigation.
  • Corrected the section list in item B under Base and Pave projects and in the section on Grade, Drain, Base, and Pave projects.
  • Corrected the chronology date of last revision.
  • Drop the twelve year traffic data request, except in cases where a LCCA is required.
  • Changed to the color ALDOT seal.
  • Added a requirement for a walk through of the project alignment to look for soft soils or other potential unsuitable materials.
  • Added a review of available environmental documents for wetlands delineation
  • Requested a copy of the soil profile be sent to the State Materials Engineer.
  • Clarified lime stabilization testing.

• September 2009
  • Change document format.
  • Addition of Section 1, Abbreviations.
  • Addition of Section 2 Referenced Documents.
  • Rearrange Sections 3 and 4 to provide information continuity.
  • Define Soft Soils and Competent Material.
  • Addition of testing topsoil samples.
  • Addition of Article 5.9, Underdrain, in Section 5.
  • Addition of “Materials Report Checklist” as Appendix A, Section 12.

• February 2012
  • Changed document format.
  • Addition of Stormwater Requirements in General Information, Section 4.
  • Addition of Long Widening Projects, Section 9.
  • Significantly changed the Report Submittal, Section 11.
  • Addition of Pre-Construction Investigation Checklist-as Appendix A, Section 12.
  • Addition of Topsoil Test Results Table, $M_R$ Calculation Summary, and Soil Classification Summary as Appendix B, Section 13.
  • Changed the Design Resilient Modulus by AASHTO Soil Classification Appendix C, Section 14.
- Addition of Comments Log as Appendix D, Section 15.
- Changed the “Materials Report Checklist” to Appendix E, Section 16.