

ALDOT-390
PROCEDURE FOR PREPARING MATERIALS REPORTS
AND CONDUCTING SOIL SURVEYS

1. 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 ALDOT. 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.

This document was originally developed to provide guidance to consultants on how to perform soil surveys and to prepare materials report for the Regions. This procedure also applies to those Regions that perform soil surveys and prepare materials reports in-house. For those instances where consultants are not included in the chain of events, the Area Materials Engineer (AME) will seek advice directly from the State Materials Engineer (SME).

2. Abbreviations and Acronyms

AADT	Annual Average Daily Traffic
AASHTO	American Association of State Highway and Transportation Officials
AD/AB	Alternative Design Alternative Bid
ADEM	Alabama Department of Environmental Management
AGE	Assistant Geotechnical Engineer
ALDOT	Alabama Department of Transportation
AME	Area Materials Engineer
ASTM	American Society for Testing Materials
CBMPP	Construction Best Management Practices Plan
DARWin	Design, Analysis and Rehabilitation for Windows
EA	Environmental Assessment
ESALs	Equivalent Single Axle Loads
FHWA	Federal Highway Administration
FONSI	Finding of No Significant Impact
FWD	Falling Weight Deflectometer
GN	General Notes
GPS	Global Positioning System
HSA	Hollow Stem Auger
Kip	1000 Pounds-force
kN	Kilonewton

Mpa	Megapascal
M _R	Resilient Modulus
MUTCD	Manual on Uniform Traffic Control Devices
N	The uncorrected blow count from the SPT and Split Barrel Sampling of Soil
NHI	National Highway Institute
NPDES	National Pollutant Discharge Elimination System
PATB	Permeable Asphalt Treated Base
PI	Plasticity Index
PSI	Pounds per Square Inch
ROE	Right of Entry
ROW	Right of Way
SI	International Systems of Units
SME	State Materials Engineer
SN	Structural Number
SPT	Standard Penetration Test
US	United States

3. Referenced Documents

ALDOT Standard Specification

- Section 650 Topsoil

ALDOT Procedures

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

ALDOT Special and Standard Highway Drawings

- GN-2 Standard Design Notes for Plan Assemblies

AASHTO Publications

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

AASHTO Standards

- 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

ASTM Standards

- ASTM D 5268 Standard Specification for Topsoil used for Landscaping and Construction Purposes
- ASTM D 2974 (Method C) Standard Test Methods for Moisture, Ash, and Organic Matter of Peat and other Organic Soils

FHWA Publications

- MUTCD Manual on Uniform Traffic Control Devices for Streets and Highways
- NHI-06-088 Soils and Foundations Reference Manual (Volume 1)
- NHI-06-089 Soils and Foundations Reference Manual (Volume 2)

Environmental Requirements

- ADEM NPDES

4. Materials Reports

4.1 Contractual Comments

- The Consultant shall obtain and review copies of the current versions of the ALDOT Testing Manual, Standard Drawings, Standard Specifications, etc. These publications may be accessed from ALDOT website at www.dot.state.al.us.
- Pavement Design shall be determined using DARWin™ AASHTOWARE in tandem with the 1993 AASHTO Guide for design of Pavement Structures.
- ALDOT will provide the Consultant with any in-house amendments and policies concerning the application of the AASHTO Guide for Design of Pavement Structures.
- The DARWin™ AASHTOWare is a proprietary product. An ALDOT computer with DARWin™ installed can be made available for consultant use.
- The Consultant shall supply the AME and the SME with a copy of all M_R tests results and shall discuss with them the selection of the design M_R value.
- When requested by ALDOT, the Consultant shall deliver the samples specified by the AME to the Bureau of Materials and Tests or to the Area Materials Laboratory for testing by an ALDOT laboratory.

4.2 General Information

- Prior to beginning any work on the project, The Consultant shall review the ALDOT procedures and inspect the project site. If possible, the project site inspection team shall include the AME.
- The Consultant shall ensure that ROE forms from property owners have been obtained from the ROW Office before entering private property for any drilling operations.
- 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 of the Design Bureau via the ALDOT webpage.
- The Consultant shall request and obtain a copy of the FONSI and/or any EA or reevaluation documents for the project, either from the Bureau of Materials & Tests, Environmental Services Division 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 the 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 storm water permit per ADEM Regulations will be required. For stormwater permit coverage, the CBMPP 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 impact defined wetlands, waters of the US or a stream crossing (s). Should the work activity impact any of the aforementioned sites, 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 request and obtain the appropriate project traffic data from the AME and furnish a copy of the traffic data to the SME. 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 2020, the requested traffic data would be for 2020 and 2040.
- Once the traffic data is received, determine/confirm with the AME 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.
- 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, inertial profilers, materials remixing devices, and soils/structures laboratories. Recommendations with justification for inclusions or deletions shall be included in the final materials report.

4.3 New Location (Grade and Drain Projects)

- 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 AME and the State 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.

4.4 Base and Pave Projects

- All items listed in Section 4.3 shall be completed prior to base and pave type projects.
- Determine the availability of suitable local materials for use in subbase and base construction on the project and make cost comparisons to optimize the pavement structural design.
- For new construction or reconstruction, the project may fall under ALDOT's current AD/AB guidelines for operation.
- Make recommendations for the pavement structural design for detours, cross-overs and tie-ins to adjoining roads along the project.

4.5 Resurfacing Projects

- A "Materials Report Checklist for Resurfacing Projects" is included in Appendix G.
- Perform a pavement distress (condition) survey of the project and report the distresses according to ALDOT-392.
- Submit to the AME the proposed sample site locations for coring. The coring frequency shall be in accordance with ALDOT-392. The AME may direct that additional cores be taken at locations that vary from the specified coring frequency.
- 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.
- Request and obtain FWD testing/analysis from the Pavement Management Division of the Bureau of Materials and Tests.
- Using information obtained from the pavement distress survey, the results of the FWD analysis, the coring log, and sound engineering judgment make recommendations for rehabilitative treatments to the project.

4.6 Bridge Replacement and Short Widening Projects

- Core the existing pavement structure to determine layer type, thickness and condition.
- If the pavement is performing satisfactorily, make recommendations for the pavement structural design based on the ALDOT "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 ALDOT and using the DARWin™ AASHTOWare.
- Equivalent Build-Up Method determines the SN of the in-place pavement by the following equation: $SN_{in} = d_1a_1 + d_2a_2m_2 + d_3a_3m_3 + \dots + d_ia_im_i$

Where:

SN_{in} = SN of in-place pavement

a = layer structural coefficient

d = layer thickness

m = 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.

4.7 Long Widening Projects

- In general, long widening projects will be treated as new location projects and will be investigated as required by Section 4.3.
- Boring spacing may be adjusted according to historical soils data for the existing alignment. The AME shall be contacted at the beginning of long widening projects to determine appropriate boring spacing.

4.8 Grade, Drain, Base, and Pave Projects

- All items listed in the Sections 4.3 and 4.4 shall be required for a grade, drain, base, and pave type project.
- Note 104 of GN-2 shall be included on the typical section sheets

4.9 Report Submittal

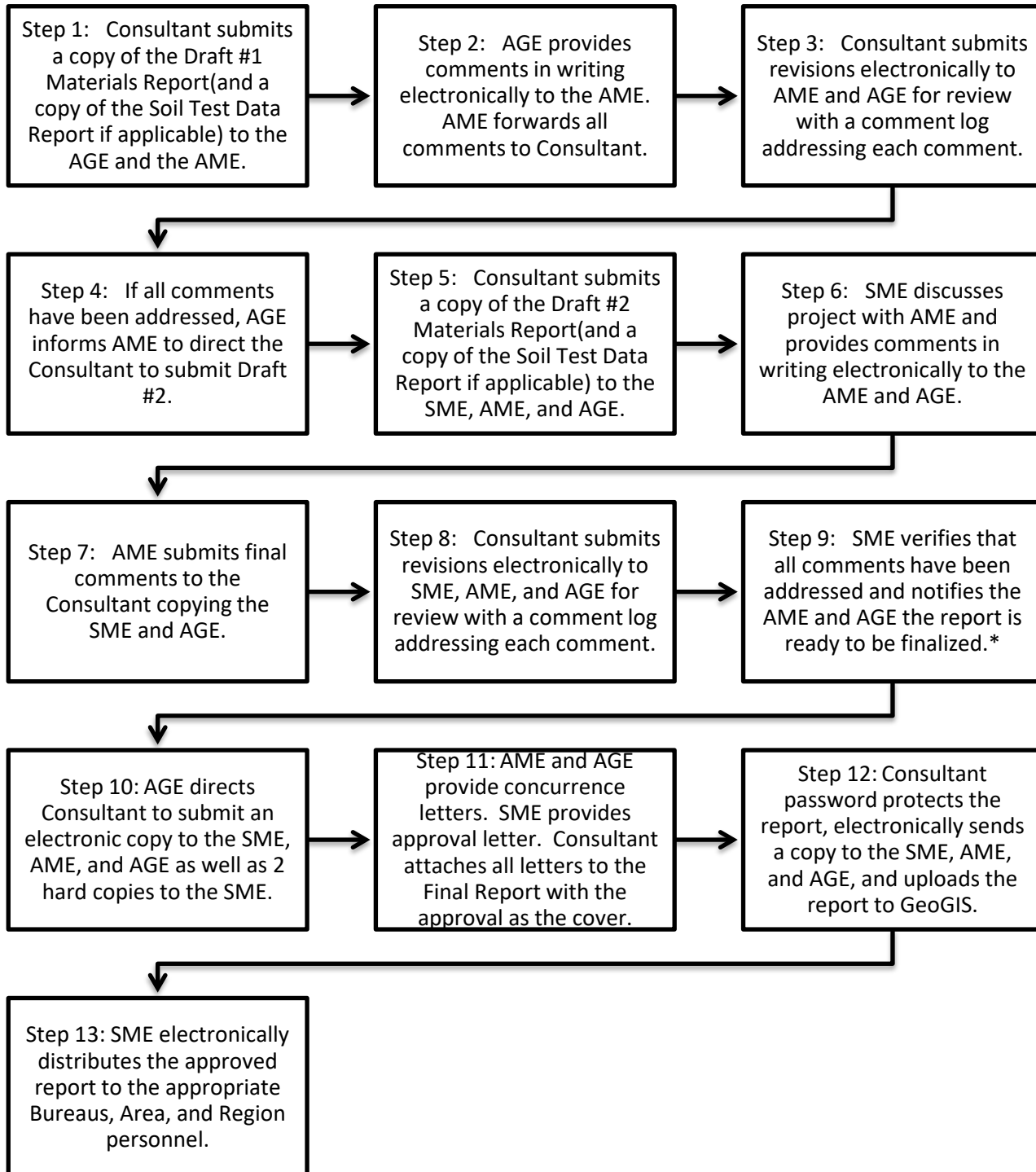
- Materials Reports shall include but not be limited to the following:
 - A description of the project
 - Project location map
 - DARWin™ pavement structural design software printouts
 - MR Calculations Summary
 - Legible typical section drawings on 8 ½" X 11" (ANSI "A") paper, if needed
 - Coring reports (color photographic log)
 - Thickness, type and condition of existing pavement layers
 - FWD test results and analysis
 - Traffic data
 - Location of areas that may require subgrade stabilization and recommended method of stabilization
 - Pavement distress survey information
- After the sampling, testing, and engineering analysis has been completed, the report will be submitted for review in accordance with the review process shown in either

Figure 1 or Figure 2.

- The SME will distribute the approved report as follows:

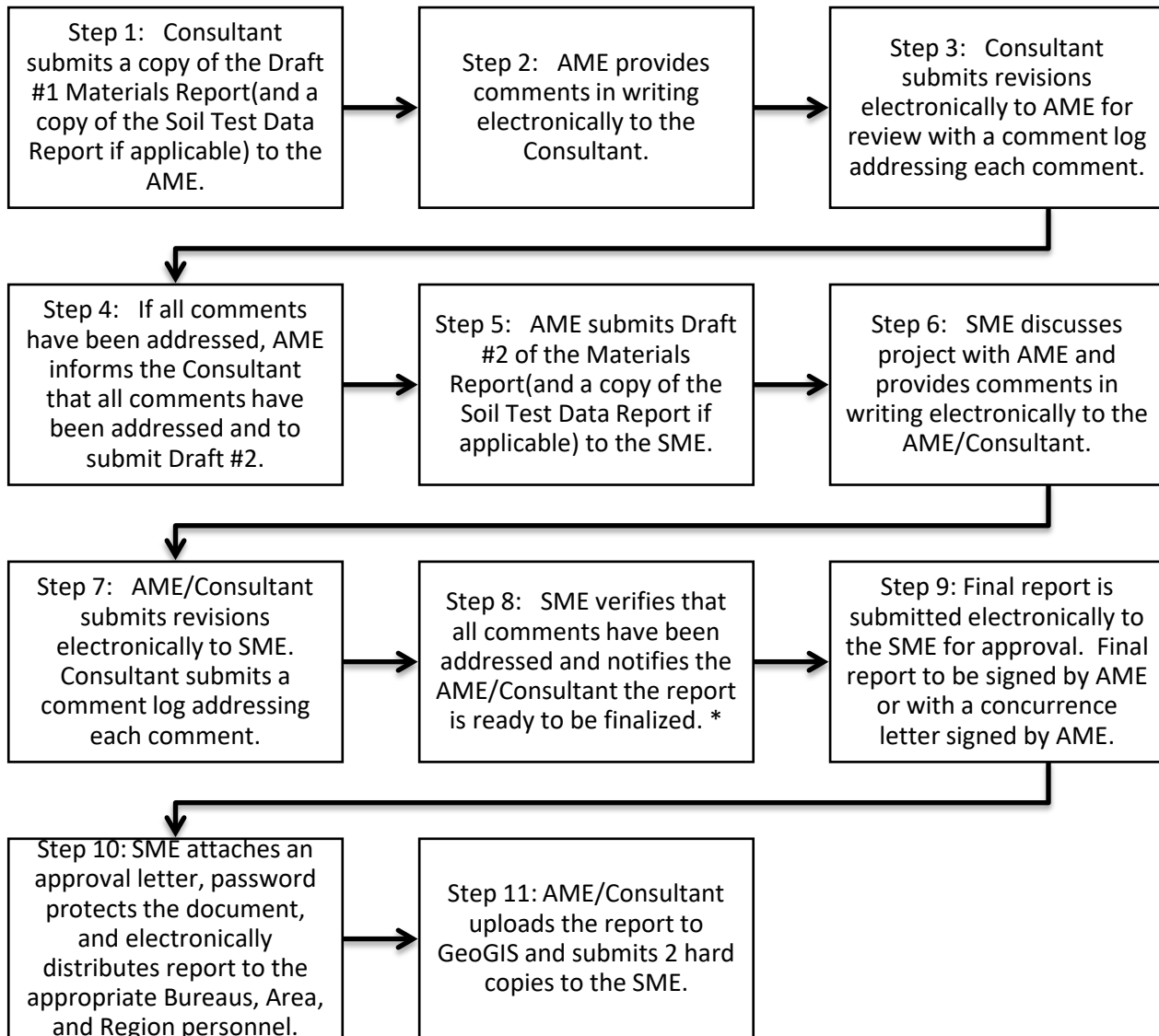
Construction	1 copy
M&T Project File	1 copy
Quality Control	electronic copy
FHWA	electronic copy
Maintenance	electronic copy
Region and Area Personnel	electronic copy
Materials Engineer	electronic copy
- Note: All Soil Survey and Partial Materials Reports will be locally approved by the AME under a separate cover letter. Locally approved Soil Survey and Partial Materials Reports shall be retained until all remaining engineering data has been prepared by the AME and submitted as a complete Materials Report. Only complete Materials Reports will be approved and distributed by the SME.
- Note: All Materials Reports prepared in-house, by ALDOT personnel, shall have two (2) hard copies of the report and an electronic copy submitted for final approval and distribution. If the report/addenda is greater than 10 pages, the copies will be provided by the Area.
- Note: Any formatting issues or changes requested in the comments log by the AME or the SME which was not addressed in the final report by the Consultant will be changed at the Consultant's expense.
- 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., M_R data, sieve and Atterberg data, topsoil data, etc.), as well as the Soil Classification Summary, the M_R Calculations Summary, and other applicable tables used in the Materials Report.
- Note: For projects to be let to contract utilizing English units of measurement, the materials report and all 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 the supporting documentation and test results shall be in SI units of measurement. Dual units of measurement are not allowed.

Figure 1: Materials Report Approval Process
Report prepared by Consultant hired through Geotechnical Division



*Any additional comments made after Step 9 will be addressed in an addendum.

Figure 2: Materials Report Approval Process
Report prepared In-House or Consultant prepared hired and through Area



*Any additional comments made after Step 8 will be addressed in an addendum.

Note: All Materials Reports prepared in-house by ALDOT personnel begin at Step #5.

5. Soil Surveys

5.1 Contractual Comments

- The Consultant shall obtain and review copies of the current versions of ALDOT Testing Manual, Standard Drawings, Standard Specifications, etc. These publications may be accessed from ALDOT website at www.dot.state.al.us.
- ALDOT will provide the Consultant with any in-house amendments and policies concerning the application of the current AASHTO Guide for Design of Pavement Structures.
- The Consultant shall provide the State 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 AME 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 AME. 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 State Materials and Tests Engineer's office. Deletion of borings or offsets shall be coordinated with the AME. A list of deletions and offsets with a justification shall be included in the final report.
- The boring logs shall be submitted to the State Materials and Tests Engineer for approval for completeness before being submitted to the AME.
- The submission of boring logs for approval shall be on an 11 X 17 sheet of regular paper. Boring log sheets shall contain a space for the AME signature.
- The Consultant shall supply the AME and the SME with a copy of all M_R tests results and shall discuss with them the selection of the design M_R value.
- When requested by ALDOT, the Consultant shall deliver the samples specified by the AME to the Bureau of Materials and Tests or to the Area Materials Laboratory for testing by an ALDOT Laboratory.

5.2 General Information

- Prior to beginning any work on the project, The Consultant shall review ALDOT procedures and inspect the project site. If possible, the project site inspection team shall include the AME.
- The Consultant shall ensure that ROE forms from property owners have been obtained from the ROW Office before entering private property for any drilling operations.
- 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 of the Design Bureau via the ALDOT webpage.

- The Consultant shall request and obtain a copy of the FONSI and/or any EA or reevaluation documents for the project, either from the Bureau of Materials & Tests, Environmental Services Division 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 storm water permit per ADEM Regulations will be required. For stormwater permit coverage, the CBMPP 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 impact defined wetlands, waters of the US or a stream crossing (s). Should the work activity impact any of the aforementioned sites, 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 noted. A table listing soft soil areas shall be included in the materials report. The soft soils table shall include but not limited to station numbers, anticipated depth of excavation or other method of remediation, and if removal is recommended, include the 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 utilized in attempting to locate soft soil areas.
- 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, inertial profilers, materials remixing devices, and soils/structures

laboratories.

5.3 New Location (Grade and Drain Projects)

- 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-croppings, potential slide areas, and underwater embankment requirements. Investigate the possibility of sinkholes (limesinks) in areas that are prone to sinkholes. 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. 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 to be included in the final plan assembly.
- 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 understand 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 AME will accompany the Consultant in the walk through to ensure that all potential areas of concern are investigated. The Bureau of Materials and Tests Chief Geologist will be available, upon written request by the AME, 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 or 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.
- 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 $N \geq 15$). 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.

- 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.
- 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.
- Determine shrinkage and/or swell values for the project.
- 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.
- 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 AME and the State 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.
- 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 AME and the State Materials and Tests Engineer in writing.
- Consultant shall conduct topsoil survey and provide 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 AME and estimate the average topsoil depth within 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 5268 and ASTM D 2974(Method C). Topsoil shall meet the requirements of Section 650 of the Standard Specifications for Highway Construction.
- Where unsuitable material, soft soils, and/or muck are encountered, notify the AME in writing. Upon approval from the AME take soundings (or, boring and samplings as directed in writing by the AME) 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 AME and State Materials and Tests Engineer in writing for further guidance on the need for additional investigations. The AME shall notify the Consultant and the AGE - Consultant Management in writing on the need for more work.

- 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 soil survey. The final percent of lime before construction shall be determined and reported in accordance with ALDOT-292 by ALDOT 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.
- In areas where remediation is required, 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.
- 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. The elevation to set the drains shall be included in the sketch. A drawing of the required underdrain system will be provided by the AME or the Geotechnical Consultant. This drawing should include the recommended locations of the underdrain systems, pipe sizes for main lines and lateral lines and any other needed information pertaining to the placement of the underdrain system.
- 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 AME 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-06-088 and NHI-06-089. 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 report.
- Rock coring shall be performed in accordance with AASHTO T 225. Rock cores shall be stored at the Materials & Tests Bureau Drill Crew Warehouse.
- 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.
- 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 State Materials and Tests Engineer for approval for completeness. Consultant will sign and send the final boring log electronically to the Geotechnical Division. The Geotechnical Division will then forward the boring logs to the Bridge Bureau contact for inclusion in the final plan assembly with a copy of the transmittal letter sent to the State Materials and Tests Engineer's office.

- 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 soil classification summary sheet as shown in Appendix D. 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 $\frac{1}{4}$ points along the centerline of the cut. Conduct M_R sampling and testing according to AASHTO T 307.
- Supply the AME and the SME 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 DARWin™ AASHTOWare and shall be determined in accordance with AASHTO T 207 using the testing criteria as noted above. Conversion to an M_R value from other types of subgrade strength tests will not be allowed.
- 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 value) or Lime Stabilization or Stabilization with Aggregate.

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

5.4 Base and Pave Projects

- Collect finished subgrade laboratory M_R samples. The sampling frequency shall be one sample per ½ mile (0.8 kilometer) per roadway or at each soil change per roadway. Perform M_R sampling and testing in accordance with AASHTO T 307.
- All items listed in Section 5.3 shall be completed prior to base and pave type projects.
- Determine the availability of suitable local materials for use in subbase and base construction on the project and make cost comparisons to optimize the pavement structural design.
- Make recommendations for the pavement structural design for detours, cross-overs and tie-ins to adjoining roads along the project.

5.5 Bridge Replacement and Short Widening Projects

- Core the existing pavement structure to determine layer type, thickness and condition.
- If the pavement is performing satisfactorily, make recommendations for the pavement structural design based on the ALDOT “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 ALDOT and using the DARWin™ AASHTOWare.
- For Bridge Foundation Design Requirements see ALDOT-398 for drilling, sampling and reporting requirements pursuant to completion of a bridge foundation investigation.

5.6 Long Widening Projects

- In general, long widening projects will be treated as new location projects and will be investigated as required by Section 5.3.
- Boring spacing may be adjusted according to historical soils data for the existing alignment. The AME shall be contacted at the beginning of long widening projects to determine appropriate boring spacing.

5.7 Grade, Drain, Base and Pave Projects

- All items listed in the Sections 5.3 and 5.4 shall be required for a grade, drain, base and pave type project.

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

5.8 Report Submittal

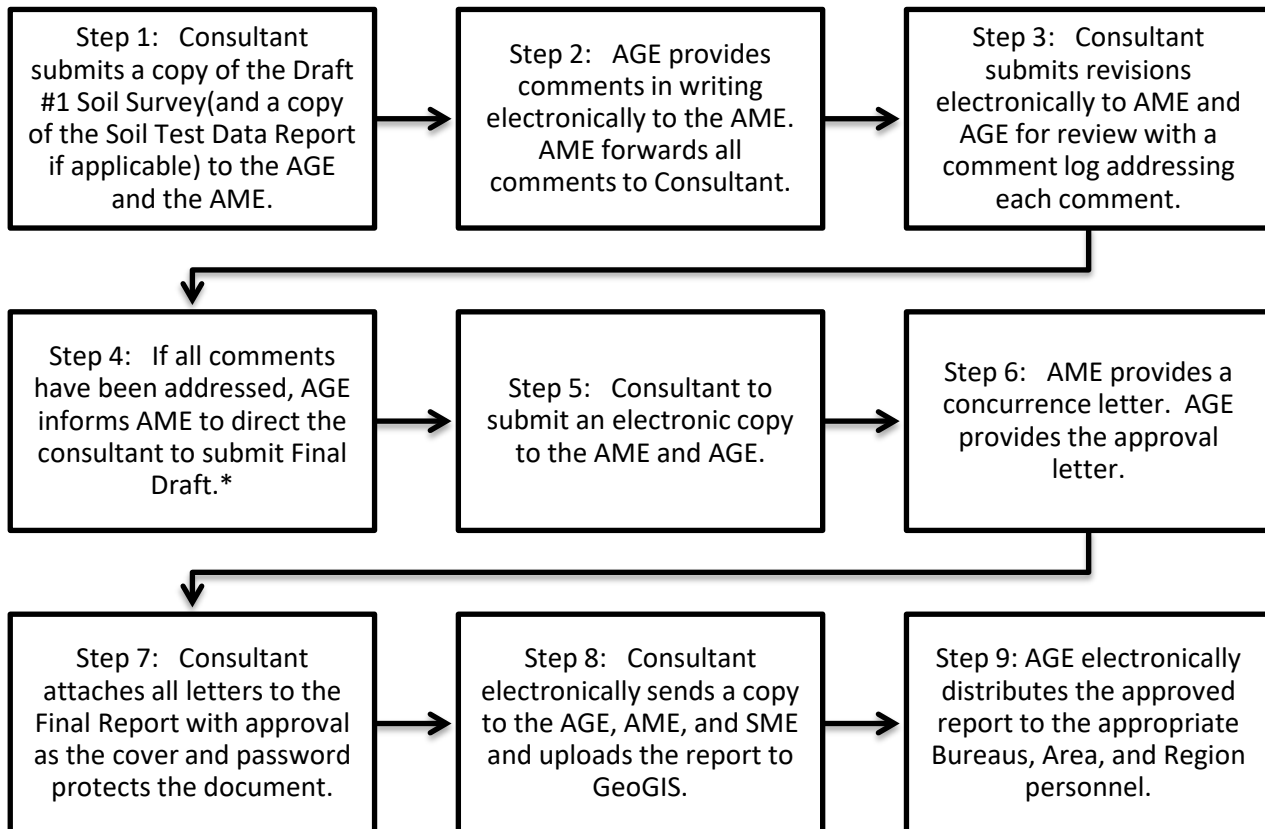
- Soils Surveys shall include but not be limited to the following:
 - A description of the project.
 - Project location map
 - Geologic, topographic, and hydraulic maps of the vicinity of the project with begin/ end project station numbers indicated
 - Description of the geology, topography, and water resources in the vicinity of the project
 - Boring location maps
 - Site soil profiles
 - Cross-sections with borings
 - Soils Classification Summary
 - M_R Calculations Summary
 - 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 ground water level by station number
 - Location of rock
 - Locations of areas that may require subgrade stabilization and recommended method of stabilization
- After the sampling, testing, and engineering analysis has been completed, the report will be submitted for review in accordance with the review process shown in either Figure 3.
- The AGE will approve the soil survey and distribute copies as follows:

Construction	1 copy
M&T Project File	1 copy
State Materials Engineer	electronic copy
- Note: On Interstate Maintenance Projects (IM), an electronic copy will be furnished to the Maintenance Bureau.
- Note: All Soil Survey and Partial Materials Reports will be locally approved by the AME under a separate cover letter. Locally approved Soil Survey and Partial Materials Reports shall be retained until all remaining engineering data has been prepared by the AME and submitted as a complete Materials Report. Only complete

Materials Reports will be approved and distributed by the SME.

- Note: All Soil Surveys prepared in-house, by ALDOT personnel, shall have two (2) 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 AME or the SME which was not addressed in the final report by the Consultant will be changed at the Consultant's expense.
- Note: 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., M_R data, sieve and Atterberg data, topsoil data, etc.), as well as the Soil Classification Summary, the M_R Calculations Summary, and other applicable tables used in the Soil Survey.
- Note: For projects to be let to contract utilizing English units of measurement, the soil survey and all 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 soil survey and all the supporting documentation and test results shall be in SI units of measurement. Dual units of measurement are not allowed.

Figure 3: Soil Survey Approval Process
Consultant written hired through Geotechnical Division



*Any additional comments made after Step 4 will be addressed in an addendum.

Note: All combination Soil Survey and Materials Reports will be submitted in the same fashion as a Materials Report.

6. Appendix A

**Pre-Construction Investigation Activities
 Environmental Permits Checklist**

ALDOT Project Number:
 County:

Date:

1. ADEM NPDES STORMWATER PERMIT				
1.1 Will the soil disturbance with the project activity be 1 or more acres? (If no, skip to Section 2)	<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
1.2 If Yes, Has NPDES stormwater permit coverage been requested and obtained from ADEM?	<input type="checkbox"/>	Yes	<input type="checkbox"/>	No <input type="checkbox"/> N/A
1.3 List the permit number issued by ADEM for the project activity, if applicable.				
1.4 Will mulching be utilized as the method of clearing (above the soil line)?	<input type="checkbox"/>	Yes	<input type="checkbox"/>	No <input type="checkbox"/> N/A
1.5 Is the project area considered to be a Priority Construction Site per ADEM Regulations?	<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
1.6 Has CBMPP for Pre-Construction Investigation Activities template been completed for the project activity?	<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
2. US ARMY COPRS OF ENGINEERS PERMIT				
2.1 Will work activity involve defined wetlands, waters of the US or a stream crossing? (If no, skip to Section 3)	<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
2.2 If Yes, Has a Corps of Engineers permit been requested and obtained? If no, explain.	<input type="checkbox"/>	Yes	<input type="checkbox"/>	No <input type="checkbox"/> N/A
2.3 List the permit(s) issued for the project activity, if applicable.				
3. OTHER ENVIRONMENTAL CONCERNS OR CONSIDERATIONS				
3.1 Has coordination with the Environmental Technical Section (ETS) been conducted for known resources in the area? If no, contact ETS to identify any impacts that may be in the area.	<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
3.2				

Appendix C

Results Summary

Boring No.	Station	Depth	AASHTO Classification	Dry Density (pcf)	Moisture Content, %	% Compaction	M _r values at 4 psi confining pressure, psi					Ave.
							Seq6	Seq7	Seq8	Seq9	Seq10	
Boring No.	Station	Depth	AASHTO Classification	Dry Density (pcf)	Moisture Content, %	% compaction	M _r values at 2 psi confining pressure, psi					Ave.
							Seq11	Seq12	Seq13	Seq14	Seq15	
										AVG		
										StDev		
										(AVG-2 x StDev)		
										85th percentile		
										90th percentile		
										100th percentile		
			M_R Calculation Summary						Notes: Tests performed at Boudreau Engineering on 1/15-18/2011.			
			Alabama Department of Transportation Project Number: Project Name: County:									

Appendix E

Design Resilient Modulus by AASHTO Soil Classification

Design Resilient Modulus by AASHTO Soil Classification

AASHTO Group Classification	A-1		A-3	A-2				A-4	A-5	A-6	A-7 A-7-5 A-7-6
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				
Confining Pressure for Design Sample Moisture Content	4 psi	4 psi	4 psi	4 psi	4 psi	2 psi	2 psi	2 psi	2 psi	2 psi	2 psi
	Optimum	Optimum	Optimum	Optimum	Optimum	Optimum	Optimum	Optimum	Wet side of Optimum	Wet side of Optimum	Wet side of Optimum

Appendix F

February 1, 2020

From: Area Materials Engineer, P.E.
East Central Materials Engineer

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

Consultant June 20, 2020
Assistant Geotechnical Engineer June 21, 2020

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

3. Boring Location Plans and Profiles.

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 2/01/2020. If you have any questions, please do not hesitate to contact this o

Appendix G

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 written 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:
- Unique Pay Item Numbers
- Pay Item Descriptions
- 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.
- Additional Project Requirements
- Materials Remixing Device
- Inertial Profiler

6. 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

Appendix H

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 M_R 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
 - Addition of Comments Log as Appendix D, Section 15
 - Changed the “Materials Report Checklist” to Appendix E, Section 16.
- February 2020
 - Changed document format to more closely resemble ALDOT Procedures.
 - Updated Abbreviations.
 - Updated Reference Documents.
 - Separated Materials Report and Soil Survey Requirements in preparation of a future Geotechnical Manual.

- Updated DARWin™ AASHTOWare references.
- Removed LCCA references in response to the adoption of AD/AB practices.
- Updated Materials Report review Process to reflect electronically transmitted comments and copies.
- Updated Soil Survey Review process.
- Updated Appendices.