ALABAMA DEPARTMENT OF TRANSPORTATION

DATE: March 3, 2005 Special Provision No. 02-0553(2)

✳ EFFECTIVE DATE: April 1, 2005

SUBJECT: Density Requirements for Compaction.

Alabama Standard Specifications, 2002 Edition, shall be amended by replacing Section 306 with the following:

SECTION 306
DENSITY REQUIREMENTS FOR COMPACTION

306.01 Description.

The density requirements for earth work, subbase, base, shoulders, surface, and pavement layers are given in this Section. Compensation for obtaining the required densities shall be included in the contract price for the material being compacted.

This Section shall also cover the work of furnishing a Portable Nuclear Moisture-Density Testing Device ("Nuclear Testing Device") for use by Department personnel.

306.02 Materials.

(a) MATERIALS SUBJECT TO COMPACTION REQUIREMENTS.

The compaction requirements given in this Section shall be applicable to materials required to be furnished under other Sections when a reference to the compaction requirements is given in those Sections.

(b) NON-DESTRUCTIVE TESTING DEVICES.

1. UTILIZATION OF NON-DESTRUCTIVE TESTING DEVICES.

Non-destructive density testing of Hot Mix Asphalt (HMA) will be allowed for "quality control testing" purposes only and will not be used for acceptance testing. All acceptance density testing of HMA will be done by coring the pavement (AASHTO T 166).

2. NUCLEAR TESTING DEVICE.

The Department has established a list of acceptable nuclear testing devices. Devices that are not shown on this list shall not be used. The list is List II-21, "Nuclear Testing Devices" and is given in the Department's manual, "MATERIAL, SOURCES AND DEVICES WITH SPECIAL ACCEPTANCE REQUIREMENTS." Information concerning this list is given in Subarticle 106.01(f) and ALDOT-355.

✳ 3. ELECTRONIC SURFACE CONTACT DEVICE.

An electronic surface contact device will be allowed for the measurement of the density of hot mix asphalt (HMA) pavement layers.

The test method and apparatus described in AASHTO TP 68-04, "Density of In-Place Hot Mix Asphalt (HMA) Pavement by Electronic Surface Contact Devices", Method C (Core Calibration Method), shall be used for this testing.

306.03 Construction Requirements.

(a) CONTRACTOR'S RESPONSIBILITY FOR COMPACTION.

The materials (soils, hot mix asphalt) selected by the Contractor will be sampled and tested to establish the density requirements for compaction. The Contractor shall compact the materials to the required density.

(b) EMBANKMENT LAYERS.

1. DETERMINATION OF MAXIMUM DENSITY AND OPTIMUM MOISTURE CONTENT.

The maximum density and optimum moisture content for the compaction of materials for embankments will be determined in accordance with the test methods given in AASHTO T 99 "Moisture-Density of Soils Using a 2.5 kg (5.5 pound) Rammer and a 305 mm (12 inch) Drop".

Method A will be used when 10 % or less of the embankment material is retained on the Number 4 {4.75 mm} sieve.

Method C will be used when more than 10 % is retained on the Number 4 {4.75 mm} sieve, and less than 20 % is retained on the 3/4 inch {19.0 mm} sieve.

Method D will be used when 20 % or more is retained on the 3/4 inch {19.0 mm} sieve.

2. REQUIRED IN-PLACE DENSITY.

The Contractor shall compact the embankment layers to within 95 % of the maximum density. The in-place density will be measured for acceptance in accordance with the requirements given in AASHTO T 310, "In-Place Density and Moisture Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)", Direct Transmission Method only.

There will not be a measurement of the in-place density of embankment layers that are composed predominantly of rock (approximately 70 % or greater). These layers shall be rolled until firm as determined by the Engineer.

3. REQUIRED MOISTURE CONTENT.

Strict moisture control will not be required. Compaction in a semi-dry condition will not be permitted.

(c) MODIFIED AND IMPROVED ROADBED LAYERS.

1. DETERMINATION OF MAXIMUM DENSITY AND OPTIMUM MOISTURE CONTENT.

The maximum density and optimum moisture content for the compaction of materials for modified and improved roadbed layers will be determined in accordance with the test methods given in AASHTO T 99.

Method A will be used when 10 % or less of the modified and improved roadbed material is retained on the Number 4 {4.75 mm} sieve.

Method C will be used when more than 10 % is retained on the Number 4 {4.75 mm} sieve, and less than 20 % is retained on the 3/4 inch {19.0 mm} sieve.

Method D will be used when 20 % or more is retained on the 3/4 inch {19.0 mm} sieve.

2. REQUIRED IN-PLACE DENSITY.

The Contractor shall compact the modified and improved roadbed layers to 100 % of the maximum density. The in-place density will be measured for acceptance in accordance with the requirements given in AASHTO T 310, Direct Transmission Method only.

3. REQUIRED MOISTURE CONTENT.

The moisture content during compaction shall be within ± 2 % of the optimum moisture content.

(d) ROADBED OR LIME STABILIZATION.

1. DETERMINATION OF MAXIMUM DENSITY AND OPTIMUM MOISTURE CONTENT.

The maximum density and optimum moisture content for the compaction of materials selected for the construction of a roadbed utilizing materials without lime additive will be determined in accordance with the test methods given in AASHTO T 99.

The test methods given in ALDOT-223, "Establishing Moisture-Density Controls for Soils and/or Aggregates with Chemical Additives (Excluding Bituminous Materials)", will be used for lime stabilized roadbeds.

Method A will be used when 10 % or less of the modified and improved roadbed material is retained on the Number 4 {4.75 mm} sieve.

Method C will be used when more than 10 % is retained on the Number 4 {4.75 mm} sieve, and less than 20 % is retained on the 3/4 inch {19.0 mm} sieve.

Method D will be used when 20 % or more is retained on the 3/4 inch {19.0 mm} sieve.

2. REQUIRED IN-PLACE DENSITY.

The Contractor shall compact the roadbed or lime stabilized layers to 100 % of the maximum density. The in-place density will be measured for acceptance in accordance with the requirements given in AASHTO T 310, Direct Transmission Method only.

3. REQUIRED MOISTURE CONTENT.

The moisture content during compaction shall be within ± 5 % of the optimum moisture content.

(e) SUBBASE AND BASE LAYERS.

1. DETERMINATION OF MAXIMUM DENSITY AND OPTIMUM MOISTURE CONTENT.

a. Materials Containing Natural Soil Binders without Chemical Additives.

The maximum density and optimum moisture content will be determined in accordance with the test methods given in AASHTO T 180 "Moisture-Density of Soils Using a 4.54-kg (10-lb) Rammer and a 467-mm (18-in.) Drop".

Method A will be used when 10 % or less of the modified and improved roadbed material is retained on the Number 4 {4.75 mm} sieve.

Method C will be used when more than 10 % is retained on the Number 4 {4.75 mm} sieve, and less than 20 % is retained on the 3/4 inch {19.0 mm} sieve.

Method D will be used when 20 % or more is retained on the 3/4 inch {19.0 mm} sieve.

b. Materials Containing Natural Soil Binders With Portland Cement, Calcium Chloride or Other Chemical Additives, Excluding Bituminous Materials.

The maximum density and optimum moisture content will be determined in accordance with the requirements given in ALDOT-223.

c. Materials Composed of All Crushed Aggregates With or Without Chemical Additives, Excluding Bituminous Materials.

The maximum density and optimum moisture content will be determined in accordance with the requirements given in AASHTO T 180 for Method D.

d. Bituminous Mixtures.

The maximum density will be determined in accordance with the requirements given in AASHTO T 209, "Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures".

e. All Soil or Aggregate Base Layers, With or Without Chemical Additives, Excluding Bituminous Materials - CONTROL STRIP METHOD.

The CONTROL STRIP METHOD may be allowed for establishing a target maximum density and target optimal moisture if allowed in writing by the Engineer. The target maximum density and optimum moisture content shall be determined in accordance with the requirements given in ALDOT-225, "Construction of Moisture-Density Control Strips for Soil and/or Aggregate Base Layers".

2. REQUIRED IN-PLACE DENSITY.

a. Materials Containing Natural Soil Binders without Chemical Additives.

The Contractor shall compact the materials to within 95 % of the maximum density for Method A, and to 100 % of maximum density for Methods C and D (AASHTO T 180). The in-place density will be measured in accordance with the requirements given in AASHTO T 310, Direct Transmission Method only.

b. Materials Containing Natural Soil Binders With Portland Cement, Calcium Chloride or Other Chemical Additives, Excluding Bituminous Materials.

The Contractor shall compact the materials to within 98 % of the maximum density measured using Method A of ALDOT-223, and to 100 % of maximum density measured using Method B of ALDOT-223. The in-place density will be measured in accordance with the requirements given in AASHTO T 310.

c. Materials Composed of All Crushed Aggregates With or Without Chemical Additives, Excluding Bituminous Materials.

The Contractor shall compact the roadbed or lime stabilized layers to 100 % of the maximum density (ALDOT-140). The in-place density will be measured in accordance with the requirements given in AASHTO T 310, Direct Transmission Method only.

d. Bituminous Mixtures.

The Contractor shall compact the bituminous mixtures to the density that is given in Section 410. The in-place density will be measured for acceptance in accordance with the requirements given in AASHTO T 166.

e. All Soil or Aggregate Base Layers, With or Without Chemical Additives, Excluding Bituminous Materials - CONTROL STRIP METHOD.

The Contractor shall compact the roadbed or lime stabilized layers to 100 % of the maximum density (ALDOT-225). The in-place density will be measured in accordance with the requirements given in AASHTO T 310, Direct Transmission Method only.

3. REQUIRED MOISTURE CONTENT.

Moisture content during compaction shall be within ± 2 % of the optimum moisture content. This moisture content requirement shall not apply to bituminous materials for base and subbase.

4. CONTROL STRIP FOR SOIL AND AGGREGATE LAYERS ONLY.

The CONTROL STRIP METHOD, ALDOT-225, shall only be used for soil and aggregate layers. It shall only be used if it is shown to be required in the contract or if it is requested by the Contractor and allowed by the Engineer.

The Contractor shall make a substantial effort to achieve the required density prior to requesting a control strip.

The request for a control strip shall be submitted by the Contractor to the Engineer in writing. The Engineer will forward this request to the Materials and Tests Engineer for approval. The written request shall include a description of the efforts made to achieve the required density. The description shall include the types, size, settings of rollers, rolling patterns for each roller and the results of compaction for each roller. The description shall also include all results of laboratory and field testing (soil analysis, maximum density, optimum moisture content, actual densities and moisture contents). Any other pertinent information concerning the material, other equipment used, and actions taken in an effort to achieve the required density shall be included.

Each control strip, constructed to acceptable density and surface tolerances, shall remain in place and become a section of the completed roadway. Unacceptable control strips shall be corrected or removed and replaced at the Contractor's expense.

The cost of the construction of the control strip is considered incidental to the testing method and shall be done without extra compensation.

(f) BLANK.

(g) DENSITY FOR BITUMINOUS PAVEMENT LAYERS.

The maximum theoretical density will be determined in accordance with the requirements given in AASHTO T 209.

The required in-place density is given in Section 410. The in-place density will be measured for acceptance in accordance with the requirements given in AASHTO T 166.

A percentage density is not given for layers that are required to be placed at a rate of 124 pounds or less per square yard {67 kg or less per square meter}. These layers shall be thoroughly compacted as directed by the Engineer.

(h) PORTABLE NUCLEAR MOISTURE-DENSITY TESTING DEVICE.

1. CONTRACTOR FURNISHED NUCLEAR TESTING DEVICE.

The Contractor may be required to furnish a nuclear moisture-density testing device or recondition a device for use by ALDOT personnel. This will be required if a pay item for a nuclear testing device is a part of the contract.

2. RADIOLOGICAL SAFETY MANUAL.

The operation of the nuclear moisture-density testing device shall be in accordance with the requirements given in the ALDOT "RADIOLOGICAL SAFETY MANUAL FOR THE USE OF NUCLEAR MOISTURE/DENSITY AND ASPHALT CONTENT GAUGES".

3. LICENSE FOR OWNING RADIOACTIVE MATERIALS.

The Alabama State Department of Public Health requires a license for owning radioactive materials. A nuclear testing device will not be returned to the Contractor (when returning the device is a contract requirement) until the Contractor obtains this license.

4. SERVICE WARRANTY FOR CONTRACTOR FURNISHED DEVICE (NEW AND RECONDITIONED).

The Contractor shall provide a Service Warranty from the manufacturer of the nuclear testing device, or an authorized service center, for parts and services required for the continuous serviceability of the device furnished by the Contractor. A Service Warranty shall be furnished for all

devices, new or reconditioned. The Service Warranty shall not be voided by ALDOT employees removing, repairing, and exchanging modules.

5. INOPERABLE CONTRACTOR FURNISHED NUCLEAR TESTING DEVICE.

The Contractor shall be responsible for all delays to the prosecution of the work that are due to a malfunctioning device that was furnished by the Contractor. This responsibility extends to all devices, new or reconditioned.

The Engineer will order the replacement of a continually malfunctioning device. The contract price for a Contractor furnished device will be reduced by a prorated amount that is calculated from the amount of time that the Contractor furnished device is inoperable.

The Contractor shall immediately replace a malfunctioning nuclear testing device without extra compensation when the work is delayed because of the malfunction. The compensation for the device will be reduced by a percentage amount calculated from the number of days that the device was not suitable for use and the total number of days in the contract.

6. SERVICEABILITY AND OWNERSHIP OF CONTRACTOR FURNISHED NUCLEAR TESTING DEVICE.

The final ownership of the nuclear testing device will be based on the requirements given for the Pay Item for the device. When the Engineer determines that the device is no longer needed it shall be transferred to the Department, or the Contractor will be notified by certified letter to pick up the device.

The Contractor shall retain ownership of a device if the device is furnished under Pay Item 306-A, "Portable Nuclear Moisture-Density Testing Device".

The Contractor shall retain ownership of a device for the duration of the need of the device if it is furnished under Pay Item 306-B, "State Retained Portable Nuclear Moisture-Density Testing Device". This device shall be a new Nuclear Moisture-Density Testing Device. When the device is no longer needed the Contractor shall be responsible for the reconditioning, verification, and, if necessary, recalibration of the device and the transfer of device and title of ownership to the Department.

The Contractor shall retain ownership of a device for the duration of the need of the device if it is furnished under Pay Item 306-E, "State Retained Portable Nuclear Moisture-Density Testing Device (Includes Disposal of Existing Device)". This device furnished by the Contractor shall be a new Nuclear Moisture-Density Testing Device. When the device is no longer needed, the Contractor shall be responsible for the reconditioning, verification, and, if necessary, recalibration of the device and the transfer of device and title of ownership to the Department. A Department owned device will be designated for disposal. The Contractor shall take ownership of the device designated for disposal and shall pick up the device at the ALDOT Central Laboratory. The Department will pack the device and have it ready for transport. The title of ownership will be transferred to the Contractor. Transfer of the device will be in accordance with Health Department regulations and under no circumstances will a nuclear device be transferred to an unlicensed agent or company.

If the Contractor is required to take possession of a device that is not designated for disposal, 30 calendar days will be allowed from the date of the notification for the Contractor to present a valid license for owning radioactive material from the Alabama State Department of Public Health and then obtain possession of the device. The device shall become ALDOT property and the title of ownership shall be transferred to the ALDOT if the Contractor fails to present the proper license and obtain possession of the device within the 30 calendar days.

306.04 Method of Measurement.

Nuclear Testing Devices will be measured per each device.

306.05 Basis of Payment.

(a) COMPACTION.

Separate payment will not be made for the work of compaction to meet the density requirements given in this Section. This work shall be incidental to the requirements of the placement of the material for which density requirements are given.

(b) PORTABLE NUCLEAR MOISTURE-DENSITY TESTING DEVICE.

1. PAY ITEM 306-A, PORTABLE NUCLEAR MOISTURE-DENSITY TESTING DEVICE.

The contract price for a device shall be full compensation for the furnishing of the device with all required accessories and services. This contract price shall be for exclusive use of the

device for the duration of the contract or until Engineer determines that there will be no further need for the device.

2. PAY ITEM 306-B, STATE RETAINED PORTABLE NUCLEAR MOISTURE-DENSITY TESTING DEVICE.

The contract price for a device shall be full compensation for the furnishing of the device with all required accessories and services and for the exclusive use of the device by the Department. The contract price shall also be full compensation for the maintenance of the device, the reconditioning, verification, and, if necessary, recalibration and transfer of the device and title of ownership to the Department.

3. PAY ITEM 306-E, STATE RETAINED PORTABLE NUCLEAR MOISTURE-DENSITY TESTING DEVICE (INCLUDES DISPOSAL OF EXISTING DEVICE).

The contract price for a device shall be full compensation for the furnishing of the device with all required accessories and services and for the exclusive use of the device by the Department. The contract price shall also be full compensation for the maintenance of the device, the reconditioning, verification, and, if necessary, recalibration and transfer of the device and title of ownership to the Department. The contract price shall also be full compensation for the Contractor to take ownership of a device designated for disposal by the Department.

(c) PAYMENT WILL BE MADE UNDER ITEM NO.:

306-A Portable Nuclear Moisture-Density Testing Device - per each
306-B State Retained Portable Nuclear Moisture-Density Testing Device - per each
306-E State Retained Portable Nuclear Moisture-Density Testing Device (Includes Disposal of Existing Device) - per each