

FOP FOR WAQTC TM 8

In-Place Density of Hot Mix Asphalt Using the Nuclear Moisture-Density Gauge

Scope

This test method describes a test procedure for determining the density of Hot Mix Asphalt (HMA) by means of a nuclear gauge employing either direct transmission or backscatter methods. Correlation with densities determined under the FOP for AASHTO T 166 is required by some agencies.

Radiation Safety

This method does not purport to address all of the safety problems associated with its use. This test method involves potentially hazardous materials. The gauge utilizes radioactive materials that may be hazardous to the health of the user unless proper precautions are taken. Users of this gauge must become familiar with the applicable safety procedures and governmental regulations. All operators will be trained in radiation safety prior to operating nuclear density gauges. Some agencies require the use of personal monitoring devices such as a thermoluminescent dosimeter or film badge. Effective instructions together with routine safety procedures such as source leak tests, recording and evaluation of personal monitoring device data, etc., are a recommended part of the operation and storage of this gauge.

Apparatus

- Nuclear density gauge with the factory matched standard reference block.
- Drive pin, guide, scraper plate, and hammer for testing in direct transmission mode.
- Transport case for properly shipping and housing the gauge and tools.
- Instruction manual for the specific make and model of gauge.
- Radioactive materials information and calibration packet containing:
 - Daily Standard Count Log
 - Factory and Laboratory Calibration Data Sheet
 - Leak Test Certificate
 - Shippers Declaration for Dangerous Goods
 - Procedure Memo for Storing, Transporting and Handling Nuclear Testing Equipment
 - Other radioactive materials documentation as required by local regulatory requirements.

Material

- ~~Filler material: Fine graded sand from the source used to produce the asphalt pavement or other agency approved materials.~~

Calibration

1. WSDOT has deleted this section, WSDOT performs calibrations according to the manufacturer's Operators Manual.

Standardization

1. Turn the gauge on and allow it to stabilize (approximately 10 to 20 minutes) prior to standardization. Leave the power on during the day's testing.
2. Standardize the nuclear gauge at the construction site at the start of each day's work and as often as deemed necessary by the operator or agency. Daily variations in standard count shall not exceed the daily variations established by the manufacturer of the gauge. If the daily variations are exceeded after repeating the standardization procedure, the gauge should be repaired and or recalibrated.
3. Record the standard count for both density and moisture in the Daily Standard Count Log. The exact procedure for standard count is listed in the manufacturer's Operators Manual.

Test Site Location

1. Select a test location(s) randomly and in accordance with WSDOT Test Method T 716. Test sites should be relatively smooth and flat and meet the following conditions:
 - a. At least 33 ft (10 m) away from other sources of radioactivity
 - b. At least 10 ft (3 m) away from large objects
 - c. No closer than 24 in. (600 mm) to any vertical mass, or less than 18 in. (450 mm) ~~300 mm (12 in.)~~ from a vertical pavement edge.

Overview

There are two methods for determining in-place density of HMA. See agency requirements for method selection.

- Direct Transmission -The standard for WSDOT is to run density tests in "Direct Transmission mode."
- Backscatter - When the depth of Hot Mix Asphalt is less than 0.11 foot or when the driving of the drive pin is not possible to achieve the required depth for the gauge probe (i.e., underlying concrete) then a "Thin Lift Density gauge" or a Moisture Density Gauge in the "Thin Layer mode" will be allowed.

Procedure

Direct Transmission Mode

1. Maintaining maximum contact between the base of the gauge and the surface of the material under test is critical.
2. Use the guide and scraper plate as a template and drill a hole to a depth of at least $\frac{1}{4}$ in. (7 mm) deeper than the measurement depth required for the gauge.
3. Place the gauge on the prepared surface so the source rod can enter the hole. Insert the probe in the hole and lower the source rod to the desired test depth using the handle and trigger mechanism. Position the gauge with the long axis of the gauge parallel to the direction of paving. Pull the gauge so that the probe is firmly against the side of the hole.

WSDOT Note: For alignment purposes, the user may expose the source rod for a maximum of ten seconds.

4. Take one four-minute test and record the wet density (WD) reading.

Backscatter (THIN LIFT) MODE

WSDOT has removed this section and replaced it with the following:

- a. Place the gauge on the test site and extend the probe to the backscatter position.
- b. Take tests in accordance with manufacturer's recommendation. Contact the materials laboratory for direction.

Calculation of Results

See WSDOT SOP 729 to determine the percent compaction. It should be stressed that the numbers obtained with the nuclear gauge are simply in-place densities and tell the operator nothing in regard to relative compaction. In-place densities are to be compared with theoretical maximum density as determined by the FOP for AASHTO T 209.

~~The density reported for each test site shall be the average of the two individual one-minute tests. Percent compaction is determined by comparing the in-place wet density as determined by this method to the appropriate agency density standard. See appropriate agency policy for use of density standards.~~

Correlation with Cores

WSDOT has deleted this section, refer to WSDOT SOP 730.

Report

Report the test results for each subplot on WSDOT Form 350-092 or other report approved by the State Materials Engineer.

~~Results shall be reported on standard forms approved by the agency. Include the following information:~~

- ~~• Location of test and thickness of layer tested~~
- ~~• Mixture type~~
- ~~• Make, model and serial number of the nuclear moisture-density gauge~~
- ~~• Mode of measurement, depth, calculated wet density of each measurement and any adjustment data~~
- ~~• Standard density~~
- ~~• Percent compaction and/or percent air voids~~
- ~~• Name and signature of operator~~

Tester Qualification Practical Exam Checklist

In-place Density of Hot Mix Asphalt (HMA) Using the Nuclear Moisture-Density Gauge FOP for WAQTC TM 8

Participant Name _____ Exam Date _____

Procedure Element	Yes	No	
1. The tester has a copy of the current procedure on hand?	<input type="checkbox"/>	<input type="checkbox"/>	
2. All equipment is functioning according to the test procedure, and if required, has the current calibration/verification tags present?	<input type="checkbox"/>	<input type="checkbox"/>	
3. Gauge turned on?	<input type="checkbox"/>	<input type="checkbox"/>	
4. Gauge <u>standardized</u> and standard count recorded?	<input type="checkbox"/>	<input type="checkbox"/>	I
5. Test location selected appropriately?	<input type="checkbox"/>	<input type="checkbox"/>	
6. Direct Transmission Mode:			
a. Hole made a minimum of ¼ inch deeper than measurement depth?	<input type="checkbox"/>	<input type="checkbox"/>	
b. Gauge placed parallel to direction of paving, probe extended, gauge pulled back so probe against hole?	<input type="checkbox"/>	<input type="checkbox"/>	
c. For alignment purposes did not expose the source rod for more than 10 seconds.	<input type="checkbox"/>	<input type="checkbox"/>	
d. One four-minute test made?	<input type="checkbox"/>	<input type="checkbox"/>	
e. Wet density recorded?	<input type="checkbox"/>	<input type="checkbox"/>	
7. Backscatter Mode (Thin Lift):			
a. Gauge placed, probe extended to backscatter position?	<input type="checkbox"/>	<input type="checkbox"/>	
b. <u>One four</u> minute test made; gauge placed as described in the manufacture recommendations?	<input type="checkbox"/>	<input type="checkbox"/>	I
c. Wet Densities <u>recorded</u> ?	<input type="checkbox"/>	<input type="checkbox"/>	I
8. All calculations performed correctly?	<input type="checkbox"/>	<input type="checkbox"/>	
9. Nuclear Gauge secured in a manner consistent with current DOH requirements?	<input type="checkbox"/>	<input type="checkbox"/>	

First attempt: Pass Fail

Second attempt: Pass Fail

Signature of Examiner _____

Comments: