1 June 2009

Committee D04 on Road and Paving Materials
Subcommittee D04.21 on Specific Gravity and Density of Bituminous Mixtures

Research Report D04-1032

Interlaboratory Study to Establish Precision Statements for ASTM D2950-09, Density of Bituminous Concrete in Place by Nuclear Methods

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1. Introduction:

Interlaboratory Study 91 was conducted to establish a precision statement for D2950, Density of Bituminous Concrete in Place by Nuclear Methods.

One of the most commonly-measured properties of a completed bituminous pavement is the in-place density (or degree of compaction). Proper in-place density has long been recognized as vital to the ultimate performance of the pavement. It is generally accepted that the most accurate/precise method for estimating the density of a compacted asphalt layer in the field is by extracting a core sample for subsequent laboratory testing. However, this practice has two potential disadvantages: (1) the time involved in obtaining and testing a core specimen (typically 24 hours or more) renders the results unsuitable for many quality control/quality assurance activities, in which relatively rapid results are desired; and (2) the act of taking a core from a pavement creates a 'defect' in the pavement surface – in other words, the test is 'destructive' to the pavement.

Rapid, non-destructive methods for estimating bituminous pavement density have gained considerable popularity. Two such methods include the use of a "nuclear gauge", in which the pavement is subjected to irradiation by a low-level radioactive source (density is related to the deflection of gamma radiation as it passes through the material); and, an "electromagnetic gauge" device, in which density is estimated by the resistance to the passage of an electrical current through the bituminous mix. A number of researchers have investigated the ability of both nuclear and electromagnetic gauges to accurately estimate the in-place density of hot-mix asphalt pavements. However, there has not been a comprehensive effort to establish the precision of the in-place density measurement provided by such devices. The study described here was conceived to produce a precision statement for the nuclear gauges.

ASTM D2950 was re-approved in 2005 with the addition of a precision statement based several non-related paving projects. During the June, 2006 D04.21 subcommittee meeting, David Apkarian of TransTech Systems offered to allow ASTM to "piggyback" on an existing paving project which would yield ideal conditions to obtain testing data specifically intended to produce a precision statement. The subcommittee took two actions: 1) establish a task group which consists of Dick Reaves, subcommittee chair; Kevin Hall, University of Arkansas, committee member and project consultant; David Apkarian, TransTech Systems, committee member and project manager; Ken Brown, Troxler Labs; Ali Regimand, InstroTek Inc.; and Mahir Al-Nadaf, Humboldt Scientific; and, 2) approach D04 Executive requesting funding. D04 Executive did approve funding and subsequently, an Interlaboratory Study – ILS #0095 was registered with ASTM. The actual equipment testing and data collection occurred in September 2006.

2. Test Method:

The Test Method used for this ILS is D2950-09. To obtain a copy of D2950, go to ASTM's website, www.astm.org, or contact ASTM Customer Service by phone at 610-832-9585 (8:30 a.m. - 4:30 p.m. Eastern U.S. Standard Time, Monday through Friday) or by email at service@astm.org.

3. Participating Laboratories:

The following laboratories participated in this interlaboratory study

1. Municipal Testing
418 Shore Drive
Oakdale, NY
11769
US
Claude Jaycox
(516-516-9387) EX 02
cjay418@hotmail.com

2. QCQA Labs Inc
1594 State Street
Schenectady, NY
12304
US
Ron Berube
518-372-4067
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3. Rutgers University
93 Road 1, Rm 109
Piscataway, NJ
08854-803
US
Tom Bennert
732-445-8014
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4. Test Plan:

The objective of this study was to place four test strips of HMA, each having a distinct aggregate gradation. One section of each test strip will be used as a 'control strip' yielding HMA cores specimens for offsetting the D2950 method gauges. Remaining sections of each test strip were used for D2950 method testing.

- Test Strips will be HMA consisting of:

9.5mm mix - 99%passing 12.5, 65% passing 4.75, 5.8% AC, 3" mat depth	100	ft
12.5mm mix - 99% passing 19, 65% passing 4.75, 5.8%AC, 3" mat depth	100	ft
19mm mix - 100% passing 25, 54% passing 4.75, 5.3%AC, 3" mat depth	100	ft
37.5mm mix - 100% passing 50, 34% passing 4.75, 4.5%AC, 3" mat depth	100	ft

The mix design was approved by NY DOT, produced, placed, and compacted by Carver Construction Co.

- Test Strip zones were marked such that:
  Each test strip will be 100ft long
- 1st Zone (20-30 ft) of the test strip will be used to establish a roller pattern. A spotter will ensure that the following rolling instructions are carefully observed: