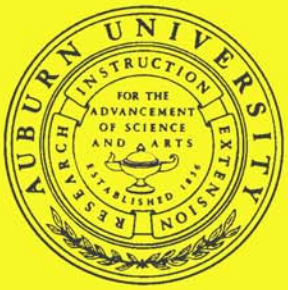

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DISCLAIMER

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LIMITED ROUND ROBIN ASPHALT CONTENT TEST USING TROXLER FURNACE

Rajib Mallick and E.R. Brown

BACKGROUND

The Asphalt Content by Ignition test can be used to determine the asphalt content of a hot mix asphalt (HMA). This test, developed by the National Center for Asphalt Technology (NCAT), burns the asphalt binder from a mix and thus allows the determination of the amount of asphalt binder in the mix. Troxler, Inc. is one company that has developed an ignition oven for this test. There was a need to determine the accuracy and precision of the test method using the Troxler furnace. A round robin study using the Thermolyne furnace had been previously conducted (NCAT report No. 95-3). This work with the Troxler was performed in 1997.

OBJECTIVE

The objective of this study was to determine the accuracy and precision values for asphalt content determined by the ignition test with the Troxler furnace.

SCOPE

This limited round robin study was carried out with five participating laboratories. Collection and analysis of data were done according to ASTM C802. The laboratories included one state department of transportation laboratory, three commercial asphalt laboratories, and one research laboratory.

Each laboratory was provided with Troxler ignition oven, and three sets of material for testing. Three different sets of materials consisted of aggregates and mixes for three types of aggregates. The laboratories had no knowledge of the asphalt content of the HMA samples. A test procedure and summary data sheets were sent along with the test samples to each laboratory. Each laboratory was asked to follow the test procedure provided and report the results back to NCAT for analysis.

TEST PLAN

HMA mixtures were prepared with three different types of aggregate and one type of asphalt binder. The aggregate gradations and asphalt content for each type of mixture are shown in Table1. For each type of aggregate, calibration samples were also made. The asphalt contents for the mixtures ranged from 5 to 6 percent.

The approximate batch weight of each type of aggregate was 1200 grams. The specific gravity and absorption values for each aggregate blend are shown in Table 1. After aggregates were batched, HMA samples were prepared by mixing the aggregates with the required amount of asphalt binder.

TEST PROCEDURE

A test procedure for the interlaboratory test program was developed and provided to each participant. This test procedure was developed specifically for the Troxler ignition oven used in this study. The test procedure was written so that the operator would perform the test easily in a step by step process and so that each laboratory would perform the test in an identical manner.

Table 1. Aggregate Type, Aggregate Properties, Aggregate Gradation, and Asphalt Content for Mixes Used in Round Robin Study

Aggregate	Granite	Limestone	Traprock
Absorption (%)	0.44	0.94	0.83
Bulk Specific Gravity	2.704	2.687	2.942
AC Content (%)	6.00	5.00	5.50
Aggregate Gradation			
Sieve Size	Percent Passing		
19 mm	100	100	100
12.5 mm	98	97	97
9.5 mm	89	86	84
4.75 mm	67	61	57
2.36 mm	50	44	40
1.18 mm	36	31	29
0.60 mm	25	22	20
0.30 mm	16	15	14
0.15 mm	11	9	8
0.075 mm	7.7	6.7	5.3

Note: Aggregate was also provided with the same gradation, but with no asphalt binder, for calibration.

Initially, each laboratory was provided with two extra aggregates and HMA samples to familiarize the operator with the test procedure and to ensure that the equipment was functioning properly before testing of the round robin samples.

RESULTS OF INTERLABORATORY TEST PROGRAM

Asphalt content data from five laboratories were analyzed to determine the precision and accuracy of the ignition test method with the Troxler ignition oven. One of the five laboratories did not report results for one type of aggregate. The measured asphalt contents are shown in Table 2. The components of variance, variances and standard deviations were calculated according to ASTM C802.

Each laboratory conducted ignition testing on eight HMA samples. At least two replicates were tested for each AC content. The measured asphalt content for granite mix (true asphalt content: 6.0 percent) ranged from 5.83 to 6.26 percent. For limestone mix (true asphalt content: 5.0 percent) ranged from 4.91 to 5.28 percent. The measured asphalt content for traprock mix (true asphalt content: 5.5 percent) ranged from 5.34 to 5. 92 percent. So for a total of 37 tests, the worst test result was 0.42 percent from 5.34 to 5.92 percent. However, the test result with 5.92 percent asphalt content was discarded as an outlier. Hence, the worst test result was 0.37 percent (5.87 percent for the traprock mix) from the true asphalt content.

The measured asphalt contents from each laboratory were averaged for each mixture type. The average measured asphalt contents are shown in Table 3. Each number shown is the average of at least 2 test results. The data shows that the difference between the measured and actual asphalt content (bias) ranges from -0.11 to +0.27 percent.

The within laboratory and between laboratory standard deviations for the measured asphalt content are shown in Table 4 for each mix type. The within laboratory standard deviation ranged from 0.09 to 0.10 percent. The overall within laboratory standard deviation was 0.09 percent. The between laboratory standard deviation ranged from 0.14 to 0.21 percent. The average between laboratory standard deviation was 0.17 percent.

Table 2. Measured Asphalt Content

Lab	Sample	Granite Mix	Limestone Mix	Traprock Mix
Arkansas DOT	1	5.98	5.01	5.92
	2	5.83	5.04	5.34
	3	**	4.91	5.44
Asphalt Technologies	1	6.22	5.00	5.68
	2	6.24	5.01	5.63
	3	**	5.01	5.68
Couch, Inc.	1	6.26	5.25	5.56
	2	6.02	5.25	5.87
	3	**	4.95	5.87
NCAT	1	6.02	5.24	5.69
	2	5.91	5.28	5.62
	3	**	5.19	5.60
Sloan Construction	1	5.96	4.98	**
	2	6.03	5.01	**
	3	**	2.09	**

Note: ** Results not reported

Table 3. Average Asphalt Content Results

Laboratory	Average Asphalt Content		True Asphalt Content	Bias
Arkansas DOT	Granite Mix	5.91	6.00	-0.09
	Limestone Mix	4.99	5.00	-0.01
	Traprock Mix	5.39	5.50	-0.11
Asphalt Technologies	Granite Mix	6.23	6.00	0.23
	Limestone Mix	5.02	5.00	0.01
	Traprock Mix	5.66	5.50	0.16
Couch Inc.	Granite Mix	6.14	6.00	0.14
	Limestone Mix	5.15	5.00	0.15
	Traprock Mix	5.77	5.50	0.27
NCAT	Granite Mix	5.97	6.00	-0.03
	Limestone Mix	5.24	5.00	0.24
	Traprock Mix	5.64	5.50	0.14
Sloan Construction	Granite Mix	6.00	6.00	0.00
	Limestone Mix	5.03	5.00	0.03
	Traprock Mix	**	5.50	

Note: ** Data not reported.

Table 4. Components of Variance, Variances and Standard Deviations for Asphalt Content

Material	Components of Variance		Variance		Standard Deviation	
	Within Lab	Between Lab	Within Lab	Between Lab	Within Lab	Between Lab
Granite	0.00975	0.01306	0.00975	0.02281	0.09874	0.15103
Limestone	0.00799	0.00893	0.00799	0.02052	0.08939	0.14325
Traprock	0.01002	0.00221	0.01002	0.04761	0.10010	0.21819

CONCLUSIONS

Based on this limited study, it can be concluded that the average within laboratory and between laboratory standard deviations for asphalt content as determined with a Troxler ignition oven are 0.09 and 0.17, respectively.