Alabama Dept. of Transportation
Bureau of Materials and Tests
Testing Manual

ALDOT Procedures
ALDOT-380
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ALDOT-380-93
FORMS AND EXAMPLES FOR SAMPLING AND
COMPUTING PAY FACTORS FOR HOT MIX ASPHALT

1.   **Scope**

1.1   This procedure shows how to sample Hot Mix Asphalt and calculate the pay factors as defined in Department Specification Section 106, Control of Materials.

2.   **Applicable Documents**

2.1   Specification Section 106, Control of Materials.

2.2   BMT-19, Work Sheet Summary of Lot Test Results for Air Voids and AC Content.

2.3   BMT-20, Asphalt Plant Mixture Test Report.

2.4   BMT-135, Work Sheet to Determine Pay Factors when they Cannot be Determined from Verification Samples.

2.5   ALDOT-210, Selecting Samples by the Random Numbers Method.

2.6   ALDOT-353, Field Method for Determining Air Void Content and Marshall Stability and Flow of Bituminous Mixtures.

2.7   AASHTO R-11, Indicating Which Places of Figures are to be Considered Significant in Specified Limiting Values.

2.8   AASHTO R-18, Establishing and Implementing a Quality System for Construction Materials Testing Laboratories.

2.9   AASHTO T-168, Sampling Bituminous Paving Mixtures.

3.   **Procedure**

3.1   Sampling and storage of the Hot Mix Asphalt by the contractor and the Department shall be in accordance with AASHTO T-168, Department Specifications Section 106, ALDOT-210, and ALDOT-353. Sample size of the mixture shall be adequate for each parameter required for each testing increment.

3.2   When notified by the Engineer, the contractor shall sample and test the HMA according to Department Specifications, Section 106.

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3.3   The Department and the contractor shall compute and compare tests results according to the following examples.

3.3.1   EXAMPLE I (424 SLAG MIX).

Bulk Specific Gravities of Compacted Specimens.

Lot 1 Sub-lot 1
2.468   2.476   2.481

$(2.468 + 2.476 + 2.480) / 3 = 2.475$

The average of the three specimens is 2.475. Because 2.481 is the furthest from the average, it is discarded (if by chance two values are equally distant from the average, discard both values or discard neither value). The remaining values are averaged.

$(2.468 + 2.476) / 2 = 2.472$

New Average = 2.472. This is the bulk specific gravity value used for this lot and sub-lot.

Both the State and contractor use this method when calculating slag mix bulk gravities.

3.3.2   EXAMPLE II.

Maximum (Rice) Specific Gravity Results.

Lot 1 Sub-lot 1	Lot 1 Sub-lot 2	Lot 1 Sub-lot 3	Lot 1 Sub-lot 4
2.575	2.562	2.561	2.570

Running Average Lot 1 Sub-lot 1
$2.575 / 1 = 2.575$

Running Average Lot 1 Sub-lot 2
$(2.575 + 2.562) / 2 = 2.568$

Running Average Lot 1 Sub-lot 3
$(2.575 + 2.562 + 2.561) / 3 = 2.566$

Running Average Lot 1 Sub-lot 4
$(2.575 + 2.562 + 2.561 + 2.570) / 4 = 2.567$

Lot 2 Sub-lot 1	Lot 2 Sub-lot 2	Lot 2 Sub-lot 3	Lot 2 Sub-lot 4
2.579	2.580	2.575	2.577

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Running Average Lot 2 Sub-lot 1
2.562 + 2.561 + 2.570 + 2.579) / 4 = 2.568

Running Average Lot 2 Sub-lot 2
(2.561 + 2.570 + 2.579 + 2.580) / 4 = 2.572

Running Average Lot 2 Sub-lot 3
(2.570 + 2.579 + 2.580 + 2.575) / 4 = 2.576

Running Average Lot 2 Sub-lot 4
(2.579 + 2.580 + 2.575 + 2.577) / 4 = 2.578

Only the contractor uses a running average. The State uses individual rice gravity values.

3.3.3   EXAMPLE III (SLAG BULK RUNNING AVERAGES).

Bulk Specific Gravity of Laboratory Compacted Mix Results.

Using slag as an aggregate, the bulk specific gravity value used to compute air voids is from a running average of the last four bulk specific gravity determinations and is calculated like the running average of the maximum gravity in the proceeding example.

When using slag, only the contractor uses a running average. The State uses individual bulk gravity values.

3.3.4   EXAMPLE IV (AIR VOID CALCULATION)

Bulk Specific Gravity Values (From the running average if slag was used).

Sub-lot 1	Sub-lot 2	Sub-lot 3	Sub-lot 4
2.472	2.469	2.486	2.464

Maximum Specific Gravity Running Average Values

Sub-lot 1	Sub-lot 2	Sub-lot 3	Sub-lot 4
2.575	2.568	2.566	2.567

Air Voids Sub-lot 1
$100 * (1 - 2.472 / 2.575) = 4.00\%$

Air Voids Sub-lot 2
$100 * (1 - 2.469 / 2.568) = 3.86\%$

Air Voids Sub-lot 3
$100 * (1 - 2.486 / 2.566) = 3.12\%$

Air Voids Sub-lot 4
$100 * (1 - 2.464 / 2.567) = 4.01\%$

3.3.5   REFEREE TESTING (EXAMPLE V).

3.3.5.1   The parameter in question is air voids.

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Testing Increment	1	2	3	4
Contractor	3.98	3.32	4.27	3.79

3.3.5.2   The Department randomly selects a time for the verification sample. This sample falls in testing increment two. The contractor chooses to sample enough to split with the Department.

3.3.5.3   The Departments' verification sample's result is 5.51.

This deviates more than 0.5 from the contractor's result. The contractor chooses to run the verification sample. The contractor's verification sample's result is 3.80. This result is for information only.

3.3.5.4   The contractor's original results and the referee samples are sent to the Materials and Tests central laboratory.

Testing Increment	1	2	3	4
Contractor	3.98	3.32	4.27	3.79
Materials & Tests	4.74	3.47	2.63	3.29

These results, air voids, are recorded on the lower left section of BMT-135.

3.3.5.5   The results of increment two and four are within tolerances; use contractor's results. Testing increments 1 and 3 are outside tolerance; use Materials & Tests results. The pay factor is computed as follows:

Testing Increment	1	2	3	4
Air Voids	3.98 (M&T)	3.96 (Contr.)	2.36 (M&T)	3.79 (Contr.)
Deviation	0.74	0.68	1.37	0.21

These results, air voids, are recorded on the lower right section of BMT-135.

These deviations are averaged and the appropriate pay factor from Table II of Article 410 is recorded.

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BMT-19
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ALABAMA DEPARTMENT OF TRANSPORTATION
WORK SHEET SUMMARY OF LOT TEST
RESULTS FOR AIR VOIDS AND AC CONTENT

Project No.	STPAA-208 (51)	Lot No.	1
County	Montgomery	Pay Item No.	416 A, B, C, AND D
Date	5-8-00	Mix No.	3

% AC CONTENT REQUIRED = **6.55**					
TESTING INCREMENT	**CONTRACTOR**	**STATE**	**REFERENCE**		**DEVIATION**
			CONTRACTOR	**STATE**	
1	6.87				0.32
2	6.55	6.62			0.00
3	6.23				0.32
4	6.82				0.27
5					
				AVERAGE	0.23
Remarks _____				**PAY FACTOR**	1.00

% AIR VOIDS REQUIRED = **4.00**					
TESTING INCREMENT	**CONTRACTOR**	**STATE**	**VERIFICATION**		**DEVIATION**
			CONTRACTOR	**STATE**	
1	3.98				0.02
2	3.32	4.46	4.61	3.42	
3	4.27				0.27
4	3.79				0.21
5					
				AVERAGE	
Remarks: _____				**PAY FACTOR**	

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NOTES: (1) If Pay Factor is determined on original state verification test, enter Pay Factor on QC/QA Form 1.

(2) If Pay Factor is determined on contractor verification test, enter Pay Factor on QC/QA Form 2; If not resolved on contractor verification test, use M & T referee tests and go to BMT-135 and ALDOT-380.

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ALABAMA DEPARTMENT OF TRANSPORTATION
WORK SHEET TO DETERMINE PAY FACTORS WHEN
THEY CANNOT BE DETERMINED FROM VERIFICATION SAMPLES

Project No. <u>STPAA-208 (51)</u>   <u>Date 5-8-00</u>   Lot No. <u> 1 </u>

% AC CONTENT REQUIRED = _____

TEST RESULTS (ORIGINAL/REFEREE)

TESTING INCREMENT	CONTRACTOR	STATE	M & T	USE TO COMPUTE PAY FACTOR TEST RESULTS/DEVIATION
1				
2				
3				
4				
5				
			AVERAGE DEVIATION =	
			PAY FACTOR =	

% AIR VOIDS REQUIRED = 4.00

TEST RESULTS (ORIGINAL/REFEREE)

TESTING INCREMENT	CONTRACTOR	STATE	M & T	USE TO COMPUTE PAY FACTOR TEST RESULTS/DEVIATION
1	3.98		4.74	4.74/0.74
2	3.32		3.47	3.32/0.68
3	4.27		2.63	2.63/1.37
4	3.79		3.29	3.79/0.21
5				
			AVERAGE DEVIATION =	0.75
			PAY FACTOR =	1.00

Note Engineer Pay Factor(s) on QC/QA Form 3

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FLOW CHART FOR PAY FACTOR DETERMINATION

Testing Increment 1   Testing Increment 2   Testing Increment i

| Begin Production | → | QC_1 / R_1 | → | QC_2 / R_2 | → | QC_i / R_i | ⇢ | Testing Increments Continue as Required | → | End Production |

SV_i / CV_i

KEY

$_i$ = Testing Increment Number
(1, 2, 3, 4, etc.)

QC_i = Quality Control Sample

R_i = Referee Sample

SV_i = State's Verification Sample Split with Contractor

CV_i = Contractor's Verification Sample Tested at Contractor's Option for His Information Only

Does $QC_i=SV_i$ Within Tolerances? — YES → Pay on QC_1, QC_2, QC_3, etc.

NO

Does Substituting SV_i for QC_i Change Pay Factors ? — NO → Pay on QC_1, QC_2, QC_3, etc.

YES

Using Individual Gravities for QC_i, Does $QC_i=SV_i$ — YES → Pay on QC_1, QC_2, QC_3, etc.

NO

Do the M&T's Referee Samples = the Contractor's QC Samples Within Tolerances? — YES → Pay on Contractor's QC Samples

NO

Pay on M&T's Referee Samples