Density Testing for Inspectors

Things to look for and questions to ask

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Topics

- JMF
- Rice/MAMD
- Control Strips
- Density testing with the nuke gauge
- ODOT compaction specs
- What to look for
- What questions to ask

JMF

- Correct JMF for the project?
- Why? Temps (Compaction and Mix)

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Contract No.: C99989 **EA:** F.A. No **Lab No.** 13-MD0147

Project Name: Riverbend S & G (Private Mix Design)
Highway: County:
Begin MP: End MP:
Contractor:
Project Manager:

Amendment 1 Date:
Amendment 2 Date:
Amendment 3 Date:

Use: Level 3 1/2" Dense Mix

BITUMINOUS MIX DESIGN REVIEW

Lab Name: APAO
Mix Producer: Riverbend S&G
Asphalt Supplier: McCall
Asphalt Grade: PG64-22
Gb (60°/60° F): 1.030

Certified Mix Design Technician: Kevin Berklund
Contractor Mix Design No.: KB-2013-01
Transferred from Lab No.:
Antistrip Information: %

'Dryback' Rices are required for production testing.

Stockpile Information

Stockpile Size	1/2" - #4	#4 - #8	#8 - 0	RAP			
Stockpile Source	27-032-2	27-032-2	27-032-2	Stkpile			
Stockpile Percentage	15.0	25.0	30.0	30.0	0.0	0.0	0.0
Bulk Specific Gravity (Gsb)	2.614	2.556	2.500	2.627	0.100	0.100	0.100

Job Mix Formula

Sieve	% Pass
3/4" (19mm)	100
1/2" (12.5mm)	99
3/8" (9.5mm)	89
1/4" (6.25mm)	71
No. 4 (4.75mm):	60
No. 8 (2.36mm):	41
No. 16 (1.18mm):	26
No. 30 (0.60mm):	19
No. 50 (0.30mm):	13
No. 100 (0.15mm):	9
No. 200 (0.075mm):	6.7

Paving Course	
Wearing	☑
Base	☑
Leveling	☑
Temporary	☑

% Asphalt by Wt. of Mixture (Pb)	Maximum Specific Gravity (Gmm):
6.2	2.408

VMA:	15.6	VFA:	74
Percent A/C in Rap:	5.9	Combined Aggregate Gravity (Gsb):	2.568
Number of Gyrations:	80	Gmb Sample Weight:	4570
Void Target (Va):	4.0	Mixing Temp Range:	305-315 F
Tensile Strength Ratio:	86	Placement Temp Range:	285-293 F

Compliance Statement: Based on the information submitted for review, this mix design does comply with specifications.

Total Lab Charges: $0.00

Reviewed by Signature Date

C: Files; FHWA; Project Manager; Mike Stennett, Pavements; Bituminous; Region QA Coord; Larry Ilg, Pavements

Rice vs. MAMD

- Rice is a single test, it gives you maximum density of the mix for that day only.

- MAMD (Moving Average Maximum Density) gives you an average of the latest five days of production rice tests.

Rice vs. MAMD

- Rice maximum density = Rice X 62.4

  Example: 2.511 X 62.4 = 156.7

  MDT (Maximum Density Test) is 156.7

Rice vs. MAMD

- MAMD = average of latest 5 MDT tests.

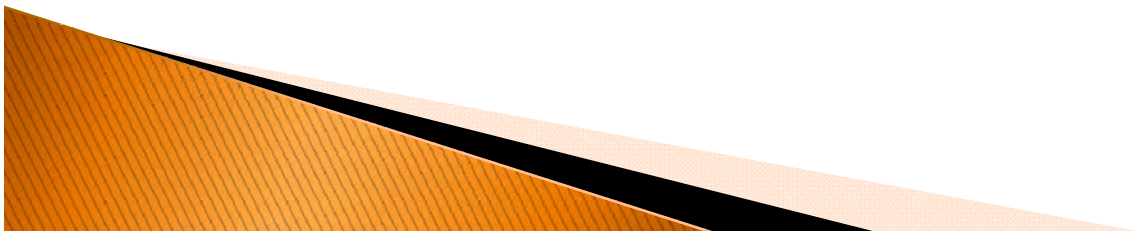
Example:

MDT Date	MDT	MAMD
3/18/15	168.3	168.3
3/19/15	167.8	168.1
3/20/15	168.5	168.2
3/21/15	168.0	168.2
3/22/15	167.3	168.0
3/23/15	167.7	167.9

Control Strip

- Field procedure that provides data to establish roller patterns to achieve the maximum density possible.
- Done first day of paving when specs call for one.
- Extremely time consuming.

  (May want to have a second tech up with the breakdown and intermediate rollers).



NOTE: LENGTH OF CONTROL STRIP IS ALWAYS THE LENGTH OF CONTRACTOR'S ROLLING PATTERN (MAXIMUM 500ft)

DENSITY TEST CANNOT BE TAKEN BEHIND PNEUMATIC ROLLER WHEN USED IN THE BREAKDOWN POSITION.

INDICATE IF VIBRATION USED AND DIRECTION BY CIRCLING (F) FORWARD OR (B) BACK.

ROLLER →	Breakdown			1st Intermediate				2nd Intermediate		
PASSES ↓	MIX TEMP °F	DENSITY		MIX TEMP °F	DENSITY		MIX TEMP °F	DENSITY		
1	298	P	F B	268	139.7	F B		F B	219	143.7	F B
2	295	P	F B	262	142.9	F B		F B	208	145.1	F B
3	284	P	F B	255	143.1	F B		F B	198	144.7	F B
4			F B	250	143	F B		F B	190	143	F B

"INITIAL POINT" (SANDED) DENSITY READING

1 | 139.8 | lb/ft³

2 | 139 | lb/ft³

If correlation applies enter A = AVE x Correlation

AVE = **A** = **139.4** lb/ft³

NOTE: IF **A** IS LESS THAN **C** , MOVE AHEAD, CHANGE ROLLING PATTERN AND START OVER.

		1.0 Ft from LEFT	MIDPOINT LEFT	CENTER	MIDPOINT RIGHT	1.0 Ft from LEFT
	STATION	625+50	626+10	627+90	628+25	629+15
1	DENSITY lb/ft³	138.3	138.6	139.2	139.1	138.9
2	DENSITY lb/ft³	138.5	138.8	139	140.3	138.7
3	AVERAGE DENSITY (DENS 1+ DENS 2) / 2	**138.4**	**138.7**	**139.1**	**139.7**	**138.8**
Cf	CORRELATION FACTOR LINE 3 X 0	**138.4**	**138.7**	**139.1**	**139.7**	**138.8**
4	% COMPACTION DENSITY / MAMD	**91.3**	**91.5**	**91.8**	**92.2**	**91.6**

TARGET AVE = **B1** = **138.9** lb/ft³

AVE = **B2** = **91.7** %

Note: If any single value in row 4 is above 95% of **MAMD** contact the Project Manager

MAMD **151.6** lb/ft³ **X** PERCENT COMPACTION REQUIRE **91.0** % = C = **138** lb/ft³

REMARKS

CONTROL STRIP IS VALID ONLY IF:

	YES	NO
1. B1 is => C	X	
2. Individual Results in Row 4 are all within ± 1.5 of **B2**	X	

Density Testing with the Nuke Gauge

- Calibration:

  Per manufacturer's recommended procedure.
  Every 12 months at approved facility (ODOT).

- Standardization:

  Standardize at the construction site at the start of each day. Daily variations in standard counts shall not exceed the limits established by the manufacturer of the gauge. If the daily limits are exceeded after repeating the standardization procedure, the gauge should be repaired and/or recalibrated.


TROXLER

Density Testing with the Nuke Gauge

- Select a test location randomly. Test sites should be relatively smooth and flat and should be at least:
  a. 30 ft away from other sources of radioactivity
  b. 10 ft away from large objects
  c. 24 inches from a vertical mass and 12 inches away from edge of pavement unless corrected by the manufacturer's procedure

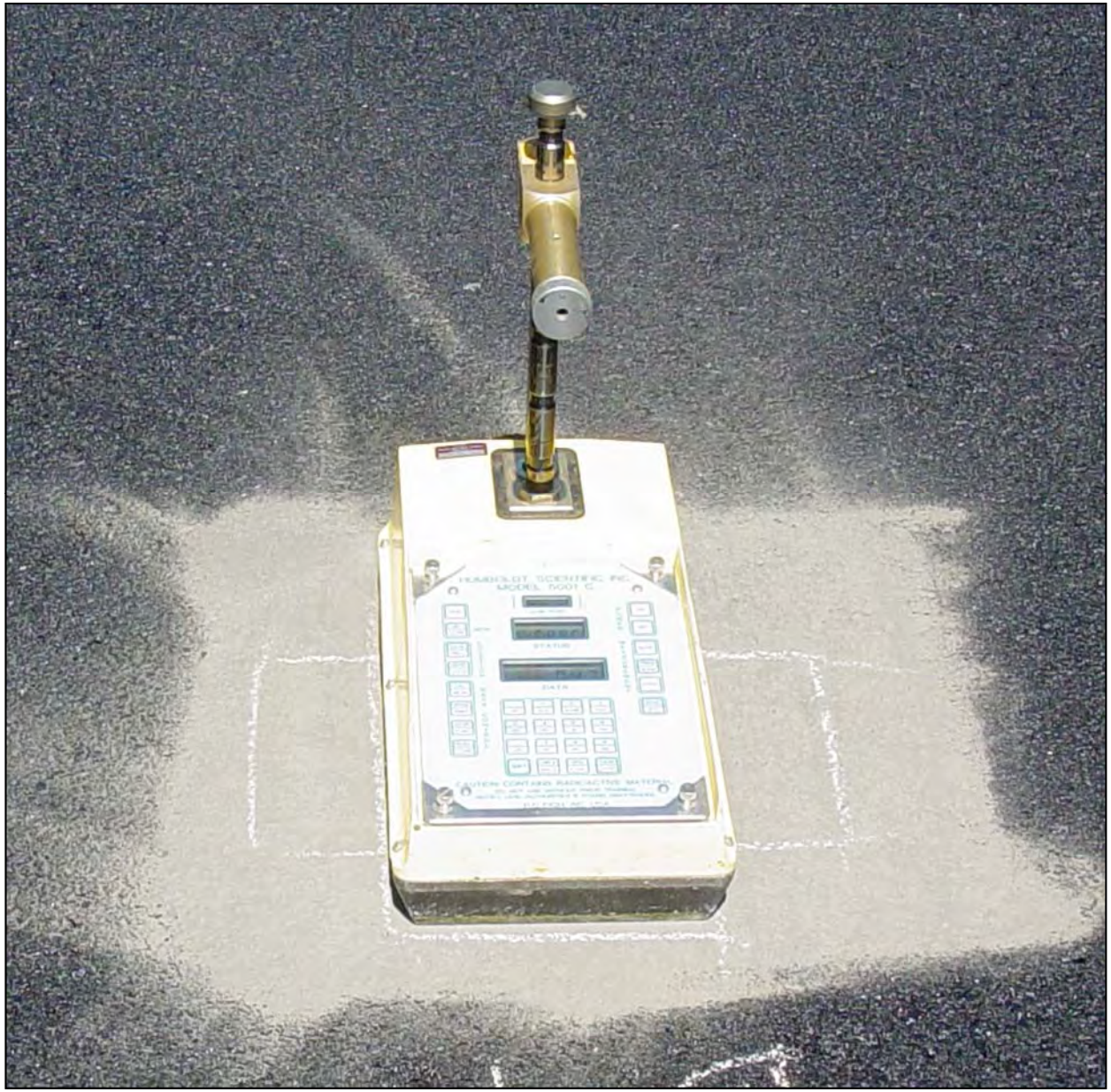
Density Testing with the Nuke Gauge

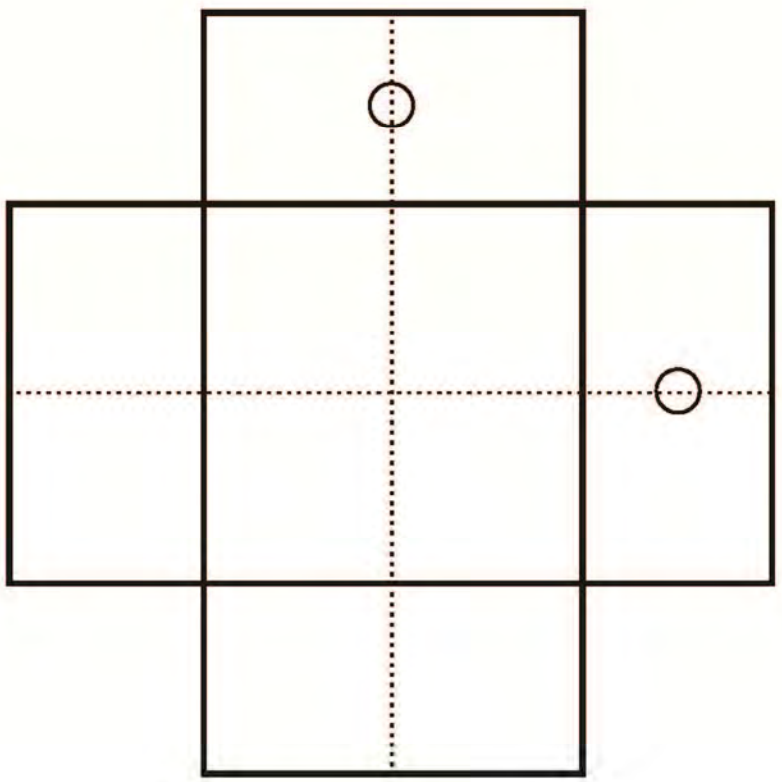
- Maintain maximum contact between the base of the gauge and the surface. Use mineral filler to fill surface voids. Spread a small amount of filler material over the test site and distribute evenly. Strike off with a straight edge to remove excess material.

- Place the gauge on the test site. Using a crayon, mark the footprint of the gauge. Extend the probe to the backscatter position

Density Testing with the Nuke Gauge

- Take a one-minute test and record the wet density.
- Rotate the gauge 90° about the center of the gauge. Mark the footprint of the gauge.
- Take another one-minute test and record the wet density.


HARSHAW SCIENTIFIC INC.
MODEL 5001 C
CAUTION CONTAINS RADIOACTIVE MATERIAL



Density Testing with the Nuke Gauge

- If the difference between the two tests is greater than 2.5 lb/ft^3, retest in both directions. If the difference of the retest is still greater than 2.5 lb/ft^3 test at 180 and 270 degrees.

- The density reported is the average of the two one minute wet density readings.

TEST NUMBER			3-2-1	3-2-2	3-2-3	3-2-4	3-2-5
DATE OF TEST			11/9/2011	11/9/2011	11/9/2011	11/9/2011	11/9/2011
TEST LOCATION (STATION)			203+64	205+46	206+81	211+78	215+64
DISTANCE LT. OR RT. OF CENTERLINE FEET			3.4 Lt	1.2 Lt	11.0 Lt	8.8 Lt	6.1 Lt
LIFT	DIST BELOW GRADE	LIFT THICKNESS	2/2"/2"	2/2"/2"	2/2"/2"	2/2"/2"	2/2"/2"
DENSITY lb/ft³		1	143.2	144.7	144.9	144.4	143.7
Max difference 2.5 lb/ft³		2	142.8	144.1	145.1	144.8	144.1
AVERAGE DENSITY (LINE 1 + LINE 2) / 2		3	143	144.4	145	144.6	143.9
CORE TO NUCLEAR CORRELATION	LINE 3 +	4	143	144.4	145	144.6	143.9
X MAMD TARGET DENSITY	lb/ft³	5	156.6	156.6	156.6	156.6	156.6
% COMPACTION FOR INDIVIDUAL TESTS (LINE 3 OR 4 / LINE 5) X 100		6	91.3%	92.2%	92.6%	92.3%	91.9%
SUBLOT OR SECTION LINE 6 AVERAGE	% REQUIRED 92.0%		92.1%				

REPRESENTS MATERIAL INCORPORATED

FROM STATION	203+08	TO STATION	217+24
FROM OFFSET	CL	TO OFFSET	12 ft Lt CL

REMARKS

Specification

Know what they are.

- ODOT ?
- Local Agency?

Specification

- ODOT 745.49

  MAMD Method:

  First HMAC lift less than 3 inches placed on aggregate base: 91.0%

  All others : 92.0%

What To Look For

- The QC Tech. *(Are they on site ?)*
- Is the tech working with all the rollers and not just staying back with the finish roller.
- Make sure compaction average behind all rollers stay consistent.
- Are they using proper filler material.

What To Look For

- Is the gauge being rotated correctly.
- The most recent Rice or MAMD is being used.
- Are the test being taken in a random fashion.
- Do the numbers make sense.
- If all is good let it go as is.

What Questions To Ask

- Do you have a copy of the approved mix design?
- Do you know what we are paving today?
- Are you using the correct Rice or MAMD?
- What are your random numbers/locations?
- Has the gauge be calibrated with in the last year?

What Questions To Ask

- Are you having any problems with the rollers?
- What is the density behind the breakdown roller?
- What are the density numbers and compaction numbers?

DON'T SETTLE FOR THE THUMBS UP

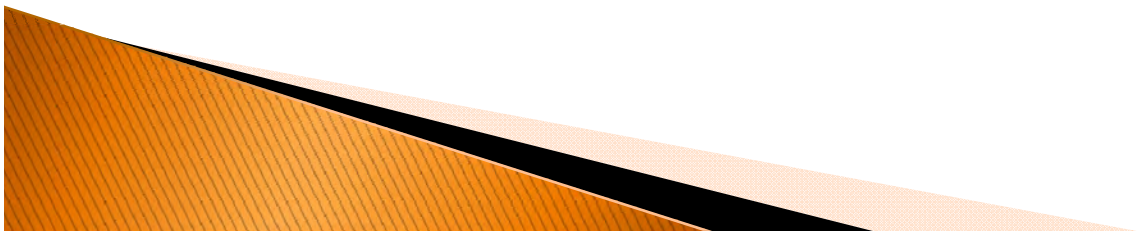
- Has QA been out to check compaction?
- Do you need me to do anything?

Important Factors

- Mix Temperature
- Paver Speed
- Trucking Consistency
- Weather Conditions

QA/QC Interaction

- Be honest – share any problems
- Work together to get a quality product



Questions???????