Ohio DOT Specification Updates

2008 Flexible Pavements of Ohio Annual Meeting
Ohio DOT
Specification Updates

- 448 Density 2007
- 2008 C&MS Overview of Changes
- 2008 Warm Mix Asphalt
Why create the change

- 2006 Strategic Initiative for Pavements
- A streamlined method for ensuring proper contractor control of the paving operations and adequate mat density is achieved.
- A better method to assure the mat’s density than
  - the number of rollers
  - Loading of rollers
  - capacity of rollers
448 Density - Development

ODOT/Asphalt Industry Committee

Wanted User Friendly methods for ODOT and Contractor Personnel

Uniform thickness of Courses

Minimum thickness of surface and Intermediate Courses (3/4 vs 1 Inch)

Projects Over 1 Lane Mile

Use nuclear or non-nuclear gauges

Minimum Level of acceptance/assurance
Ohio DOT 448 Density

STATE OF OHIO
DEPARTMENT OF TRANSPORTATION
SUPPLEMENT 1055
ASFHALT MAT DENSITY BY GAUGE TESTING
Ohio DOT 448 Density

Calibration

Nuclear and Non Nuclear

Testing Operations

Nuclear density gauge operation & calibration
Electronic density gauge operation & calibration

Reporting and Calibration Forms

TE – Min Density Target Nuclear
TE – Min Density Target Elec Gauge
TE – Mat Density QCQA
Ohio DOT 448 Density

Step One Gauge Calibration

Nuclear

Electro-magnetic
Ohio DOT 448 Density

Step Two: At job start obtain gauge readings and actual core results at same reading location.

<table>
<thead>
<tr>
<th>Nuclear Gauge Readings (PCF)</th>
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<tbody>
<tr>
<td>Location</td>
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<tr>
<td>PCF</td>
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</table>

<table>
<thead>
<tr>
<th>Core Density Test Results (see TE-199 for detail)</th>
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<tbody>
<tr>
<td>Location</td>
</tr>
<tr>
<td>% Density</td>
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</table>
Ohio DOT 448 Density

Step Three: Calculate a QC minimum density target (in PCF) using gauge and core results.

Apply the following to obtain the nuclear gauge Minimum Density Target:

Minimum Density Target (PCF) = 93 X Gauge Reading Average (a) / Average % Density of cores (b).

EXAMPLE - Gauge Avg is 145, Core avg % 92

Min Density for Gauge = 93 (145/92) = 146.8 PCF
Ohio DOT 448 Density

Step Four: For QC measure the actual mat with the gauge in PCF and record. Calculate % density and record.

### DAILY MAT DENSITY QCQA REPORT

**Gauge Readings** (contractor QC)

<table>
<thead>
<tr>
<th>#</th>
<th>Longitudinal Location</th>
<th>Transverse Location (circle)</th>
<th>Actual Gauge Reading (d), pcf</th>
<th>% Density = d/c X 93</th>
</tr>
</thead>
<tbody>
<tr>
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<td>L C R</td>
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</table>
### Ohio DOT 448 Density

Step Five: Take ODOT QA test readings at 2 locations per day chosen by the inspector. Calculate % density and record.

#### DAILY MAT DENSITY QCQA REPORT

<table>
<thead>
<tr>
<th>ODOT QA TESTS</th>
<th>PCFs L</th>
<th>C</th>
<th>R</th>
<th>AVE</th>
<th>% Density*</th>
<th>ODOT INITIALS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>148/147/146/</td>
<td>147</td>
<td></td>
<td></td>
<td>93.1</td>
<td></td>
</tr>
</tbody>
</table>

* Ave Gauge PCF / Minimum Density Target PCF X 93 = % Density

Tests performed by: ___________________________ Date Submitted: ___________________________
Ohio DOT 448 Density

2007 448 Specification Results

No. of projects placed: 52
Typical project size: 2-6 production days
Mix Types: 16 Superpave, 36 Type I Medium
Thicknesses: 0.75 to 1.75 in.
Ohio DOT 448 Density

2007 448 Specification Results

Density results:

• 92% of projects achieved minimum density with no deduction

• 8% of projects received some type of deduction even if part of one day.

• 9 of 12 districts reported no deductions.

• 73% of projects achieved a density of 94% (above the minimum target of 93%) in general.

• Densities ranged as high as 96 to 97% on about 38% of the projects.
Ohio DOT 448 Density

Average 448 QA density readings
Ohio DOT 448 Density

Recommendations and conclusions

• Applying to lift thicknesses less than 1 inch can create compaction result issues

• Use on projects with uniform thickness courses

• Initial learning curve for all involved (forms, spec, understanding, test equipment on site)

• ODOT expects deductions numbers to decrease with continued use

• Will continue to watch 1 inch lifts for consistency in density
Ohio DOT 448 Density
Recommendations and conclusions

• While 8% of projects did have deductions only two projects had more than one \( \frac{1}{2} \) day’s production with a deduction

• Both gauge types proved applicable and reliable

• Using Gage without calibrated against actual core samples has little meaning. Using those results have little meaning.

• The new forms proved user friendly and usable with minimal coaching
Ohio DOT 448 Density

Recommendations and conclusions

- Owners should initially review forms to help inspectors understand how to completely fill out the forms.

- Development of and the rapid Implementation (no real test projects) was very successful and shows what an owner – contractor can successfully produce.

- The specification has done what it was targeted for achieving more consistent density and thus a more consistent level of durability across the state for 448 mixes.
2008 C&MS Changes
Overview

- 401
- 407
- 441
2008 C&MS Changes

401

401.01 Description: Control all production processes to assure the Engineer that the mixture delivered to the paving site is uniform in composition, conforms to the specification requirements and that the placed mixture is free of any defect (ex. segregation, tenderness, lack of mixture and texture uniformity, raveling, flushing, rutting, holes, debris etc.) within the Contractor’s control at project completion.

401.04 RAP: consolidation, policies, table, stockpile management (ID, uniformity, approval, signage on complete piles)
401.12: Modify BK, Cedar Rapids or Cat pavers as required. DO NOT send list of pavers to Central Office. DO give a letter to the Engineer identifying modified spreaders with certification statement and signature.

401.15: Night Work: Engineer’s approval, luminance measure, all operating equipment

401.17: Longitudinal cold joint: seal with 702.01 PG binder or 702.13 rubberized emulsion. Transverse joint: seal with above or 702.04 emulsion. 100% coverage.
407.06: Engineers approval for dilution. No pay without approval. Minimum viscosity of 20 seconds Saybolt Furol.

Non uniform tack not corrected will be considered non-specification and by using square yards and gallons involved.
2008 C&MS Changes
441 Contractor Mix Design and Quality Control

441.02 Composition: Add mix design policies and update language.

441.07 Quality Control Program: Use approved QC technicians who work full time in the plant lab during mixture production.

441.09 Quality Control Tests: Immediately resolve problems indicated by an out of specification test and immediately retest to validate corrections.
441.10 Control Charts: Record the moving accumulative range for three tests under each test point on the chart for air voids and asphalt binder content. Accumulative range is defined as the positive total of the individual ranges of two consecutive tests in three consecutive tests regardless of the up or down direction tests take. If more than the minimum required testing (i.e. two tests per production day or night, 441.09 paragraph 2) is performed do not include the result in accumulative range calculations.
441.10 Control Charts: Stop production and notify the Monitoring Team when any of these occur:
A. Any two tests in a row or any two tests in two days are outside the specification limits of Table 441.10-1.
B. Any four consecutive moving accumulative ranges greater than specification limits of 2.50 percent for air voids or 0.60 percent for asphalt binder content occur.
2008 C&MS Changes

441 Contractor Mix Design and Quality Control

441.10 Control Charts: Do not restart production until discussing with the Monitoring Team and the team is satisfied an adequate correction to remedy problems is in place. Following a shutdown restart production in a manner acceptable to the DET. When production problems cannot be solved within one day after a plant shut down a Contractor’s representative holding a Level 3 Asphalt Department approval is required to be at the asphalt plant until a full production day is achieved with results satisfactory to the Monitoring Team.
441.10 Mixture Deficiencies: If any suspicion that other mixture composition or pavement problems exist the Monitoring Team will conduct an initial investigation thru review of data and sampling of the asphalt pavement. Should a Department investigation determine that the Contractor’s QCP is not controlling the mixture in a manner to achieve mixture quality as described above the Contractor quality control data may be rejected. In that case the Department will conduct a thorough test investigation based on samples from the roadway and use those test results in determining disposition of the material.
2008 Warm Mix Asphalt

Problem with additive technologies

- Possible EPA permitting
- Another additive-can be difficult to inject
- Cost-$2-$4 per ton of mix
2008 Warm Mix Asphalt

SOLUTION

CREATE A FOAMING ACTION IN THE BINDER WITHOUT A SPECIAL ADDITIVE
WATER IS THE ONLY ADDITIVE. WATER IS PUMPED FROM A TANK TO THE FOAM NOZZLES.
FOAM NOZZLE CLOSED

- Nozzle Valve Closed
- Adjustable Jet
- AC Manifold
- Water In
- Water Passage
- Boiling Chamber
- Spray Nozzle

FOAM NOZZLE OPEN

- Nozzle Valve Open
- Adjustable Jet
- AC Manifold
- Water In
- Water Passage 360°
- Boiling Chamber
- Spray Nozzle
07-163 Boggs Materials

Green Asphalt Control

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Diverted

Asphalt (Data)
- AC (GPM): 0.00
- H2O (GPM): 0.02
- AC (TPH): 0.00
- Target H2O (GPM): 0.00
- AC Spray Delays: 3.00
- AC Direct Delays: 2.00

Enable
Maintenance

Asphalt (Configuration)
- Signal Type: PMI/TO/I
- Hysteresis: 3.00
- AC Valve 6: 50.00
- AC Valve 2: 10.00
- AC Valve 7: 50.00
- AC Valve 8: 10.00
- New Flow Delays: 5.00
- Post Sprays Times: 60.00
- AC Valve 5: 30.00
- AC Valve 10: 80.00
- AC Valve 4: 40.00
- AC Valve 1: 90.00

Water (Configuration)
- H2O Signal: 0
- P: 30
- D: 0
- H2O Signal (Min): 0.00
- Gain: 2.00
- TM: 2000
- Deadband: 3.50
- TI: 0.10
- LV: 0.00
- TL: 1000
- TD: 20.00
- PI: 0.00
- LP: 0.00

Water (Configuration) (Manus)
- Manual Speed: 20.00

Motor Status
- Off

Plant OK

Alarms History
- S7 Program: Off
- 100: Off
- 150: Off
- 7: On
- 1: On

Start Up
- Alarm
2008 Warm Mix Asphalt

How much water?

About 1% of liquid AC by weight.

1 ton mix – 2,000 lb.
5.3% liquid – 106 lb.
1 lb H2O

Volume of liquid – 1.63 cu. ft.

1 lb. H2O when converted to steam = 30 cu. ft.
Expansion – $\frac{30}{1.63} = 18$
### 2008 Warm Mix Asphalt

#### Reduced Emissions

Volatile Organic Compounds (VOC)*

<table>
<thead>
<tr>
<th>Mix Temperature (°F)</th>
<th>Load-out Emissions (lb/yr)</th>
<th>Silo-filling Emissions (lb/yr)</th>
<th>% Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>325</td>
<td>2346</td>
<td>7312</td>
<td></td>
</tr>
<tr>
<td>275</td>
<td>669</td>
<td>2084</td>
<td>71.5</td>
</tr>
<tr>
<td>260</td>
<td>459</td>
<td>1430</td>
<td>80.4</td>
</tr>
</tbody>
</table>
2008 Warm Mix Asphalt

Benefits

• Improved Workability
• No Smoke – No Smell
• Longer Life Pavement
• 11% Less Fuel
• 11% Higher Production
• No increase in cost
2008 Warm Mix Asphalt

ODOT Plans

Sell some jobs in 2008 with the water injection WMA equipment to:

1) Determine emissions data on some.
2) Create projects with control sections of equivalent HMA mixes to compare performance and laydown.
3) On a couple sell as alternate to determine if realistic cost savings.
Thank You!

Dave Powers, P.E.
Office of Materials Management
614-275-1387