

# Ohio DOT 448 Density



2008 Ohio Asphalt Paving Conference



# Ohio DOT 448 Density

## PRESENTATION GOALS

- **Why the specification changed?**
- **What was the development process?**
- **What are the changes to and how does the specification work ?**
- **What results has ODOT had?**
- **Recommendations and Conclusions**



# 448 Density

## 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 - 1 inch or greater**

**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  
ASPHALT 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 Gage Calibration

Nuclear



Electro-magnetic



# Ohio DOT 448 Density

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

Nuclear Gauge Readings (PCF)				
Location	1	2	3	Average
PCF				

a

Core Density Test Results (see TE-199 for detail)				
Location	1	2	3	Average
% Density				

b





# 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).

Minimum Density Target = 93 X (a) / (b) EQUALS (c) PCF

**EXAMPLE - Gage Avg is 145 – Core avg % 92**

**Min Density for Gage = 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)

<u>#</u>	Longitudinal Location	Transverse Location (circle)	Actual Gauge Reading ( <u>d</u> ), pcf	% Density = $\frac{d}{c} \times 93$
		L C R		
		L C R		
		L C R		
		L C R		



# 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

ODOT QA TESTS	PCFs L	C	R	AVE	% Density*	ODOT INITIALS
	148	147	146	147	93.1	
	/	/	/			

\* 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:

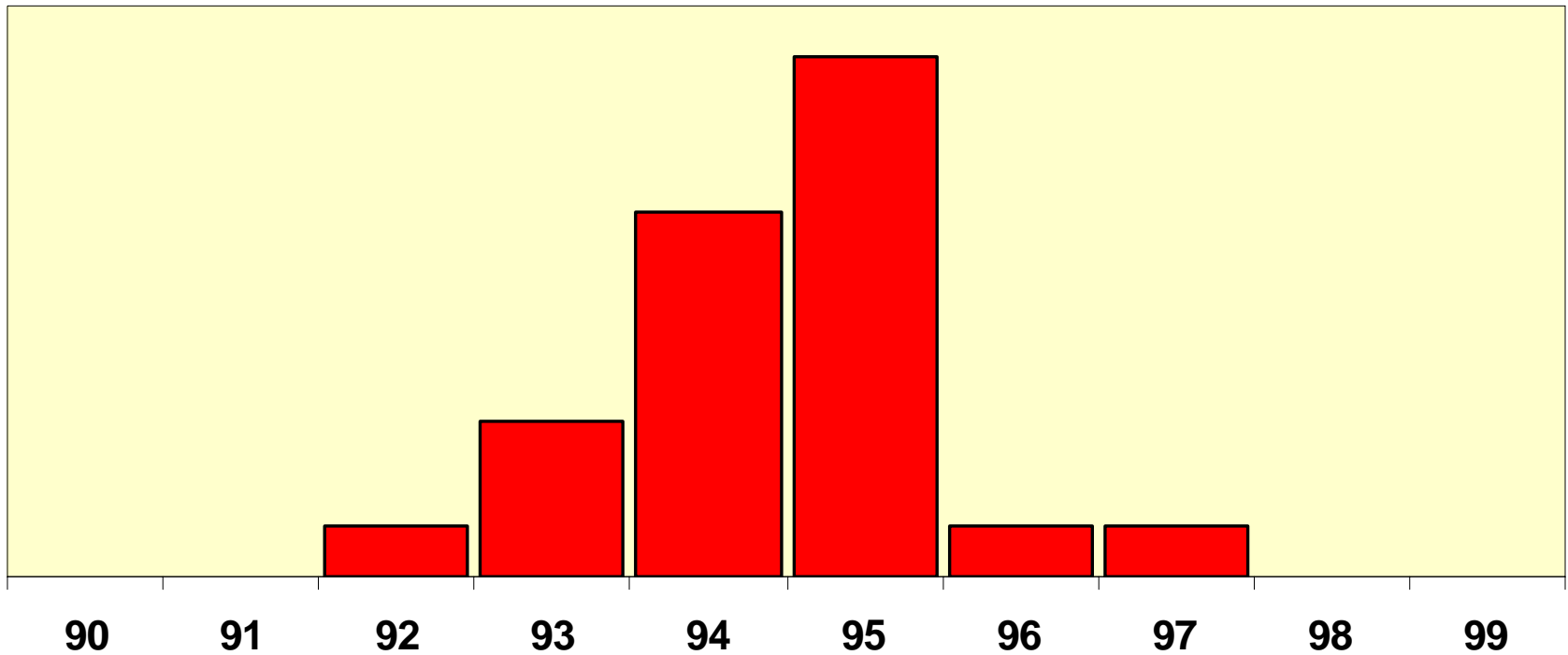
- 92% of projects achieved minimum density with no deduction
- 8% of projects received some type of deduction even if part of one day.
- 9 of 12 districts reported no deductions.
- 73% of projects achieved a density of 94% (above the minimum target of 93%) in general.
- Densities ranged as high as 96 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 ½ 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.



**Thank You!**



**Lloyd Welker, P.E.**

**Administrator**

**Office of Materials Management**

**614-275-1302**