ODOT'S EARLY RESULTS WITH THE ROLLING DENSITY METER

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Current Sampling Rate:

446 Coring: ~ 10 cores / 2000T ~ 0.004% Sample Area

RDM Scan: ~ 54,000 samples / 2000T ~ 17% Sample Area

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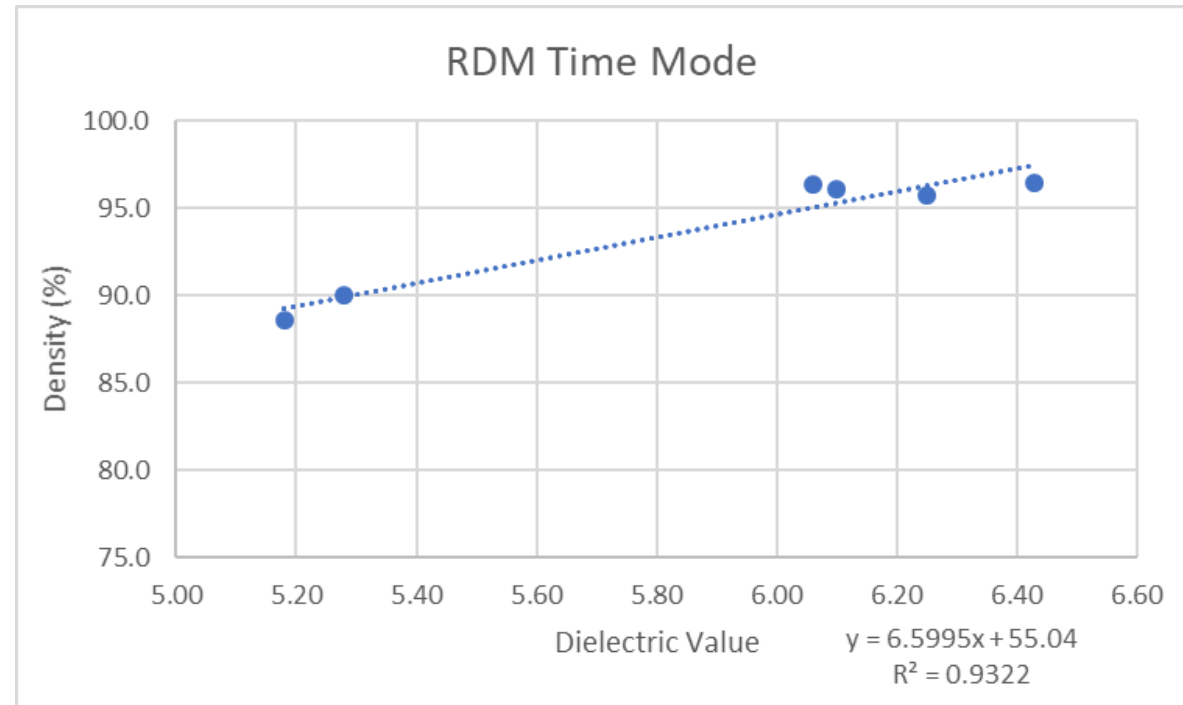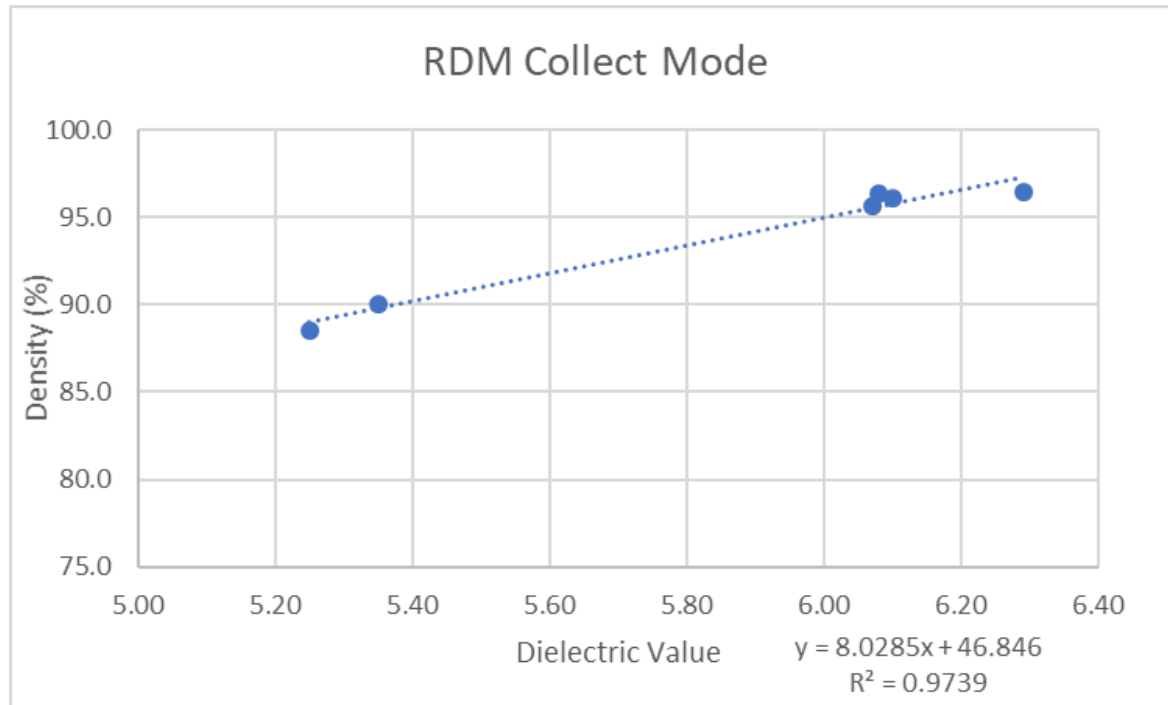
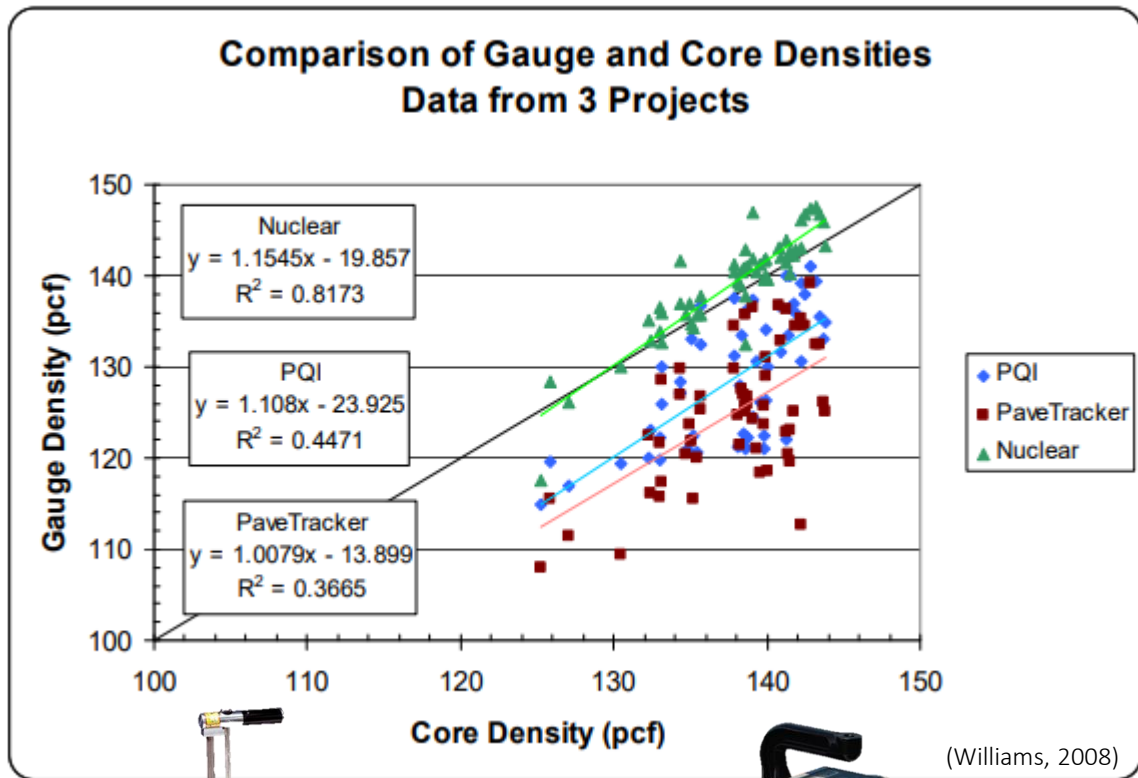OHIO DEPARTMENT OF **TRANSPORTATION**

Basic RDM Procedure

o Scan Calibration area ~1000ft

o Identify Core Calib. Locations

o Scan core areas

o Cut/Test Core Density

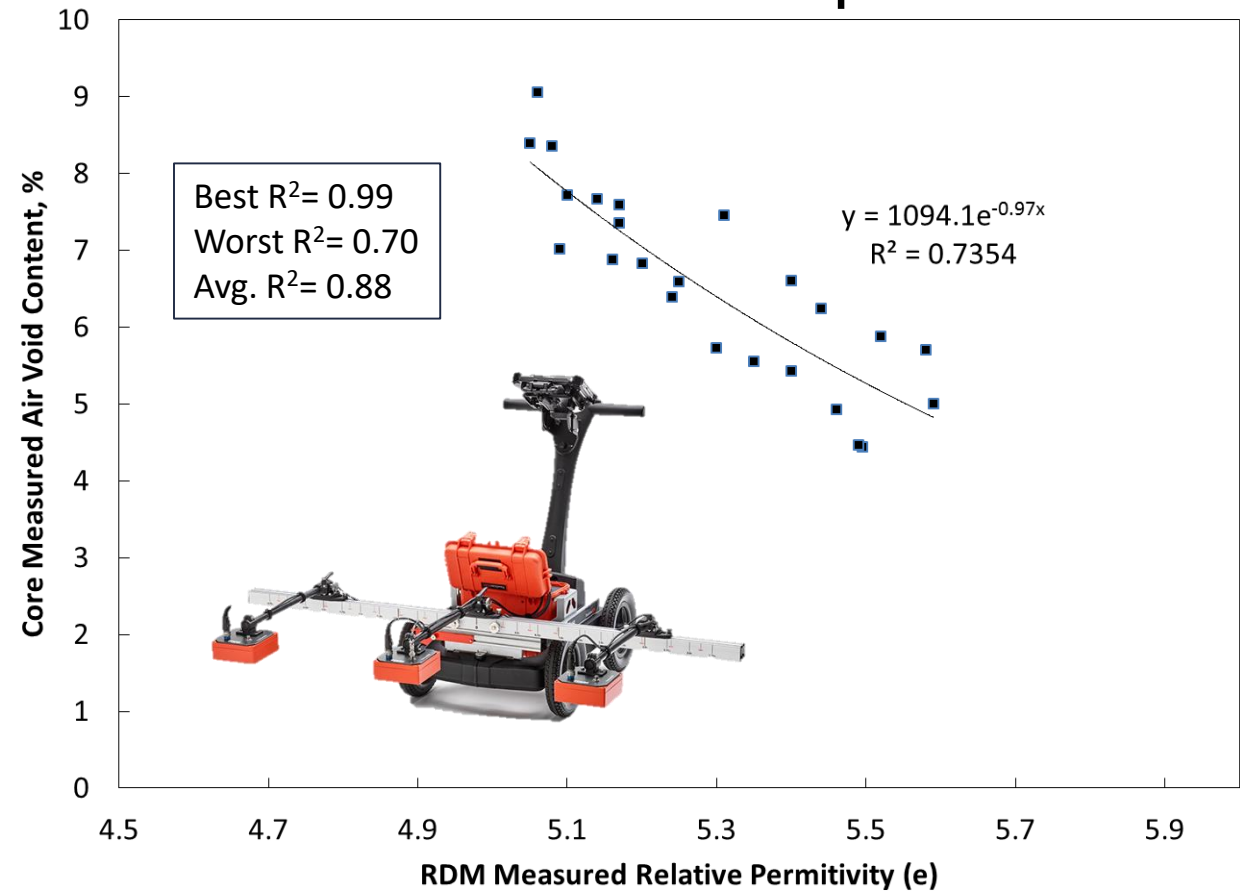o Develop Correlation Curve

o Perform Density Data Analysis

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CORRELATION CURVE

RDM Collect Mode

$y = 8.0285x + 46.846$
$R^2 = 0.9739$

RDM Time Mode

$y = 6.5995x + 55.04$
$R^2 = 0.9322$

Comparison of Gauge and Core Densities Data from 3 Projects

Nuclear
$y = 1.1545x - 19.857$
$R^2 = 0.8173$

PQI
$y = 1.108x - 23.925$
$R^2 = 0.4471$

PaveTracker
$y = 1.0079x - 13.899$
$R^2 = 0.3665$

Gauge Density (pcf) vs Core Density (pcf)

- PQI
- PaveTracker
- Nuclear

(Williams, 2008)

RDM Correlation Comparison

Best $R^2 = 0.99$
Worst $R^2 = 0.70$
Avg. $R^2 = 0.88$

$y = 1094.1e^{-0.97x}$
$R^2 = 0.7354$

Core Measured Air Void Content, % vs RDM Measured Relative Permitivity (e)

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DATA DISPLAY

Station	Offset CL (Ft)								
	-5	-3	-1	1	3	5	7	9	11
0+0.00	97.1	94.7	93.7	95.3	94.9	93.6	91.6	90.4	87.7
0+0.50	95.3	94.5	93.4	96.0	94.7	93.3	93.3	91.9	90.5
0+1.00	94.5	94.7	93.4	95.6	95.1	93.5	94.1	94.7	94.1
0+1.50	94.1	93.9	92.4	95.3	95.4	92.5	93.7	93.4	93.6
0+2.00	93.4	95.2	93.3	95.3	95.1	92.1	93.0	94.5	93.0
0+2.50	95.3	94.9	93.3	96.4	94.9	91.9	92.8	92.7	92.0
0+3.00	94.0	94.8	93.3	96.5	96.5	93.5	93.3	93.3	93.8
0+3.50	93.7	94.9	92.1	96.3	95.7	92.3	93.3	93.3	92.7
0+4.00	93.8	95.4	92.8	93.4	94.1	92.2	93.6	94.6	92.1
0+4.50	94.5	94.9	94.5	93.7	94.8	92.5	93.3	93.0	93.4
0+5.00	94.5	95.2	94.5	93.7	95.2	92.6	93.4	94.2	93.5
0+5.50	94.2	95.5	93.1	93.6	95.3	92.4	93.1	92.5	92.4
0+6.00	94.2	95.3	93.3	93.2	95.3	92.4	92.9	92.3	92.7
0+6.50	93.3	94.8	93.3	92.8	95.0	93.3	92.7	92.0	93.3
0+7.00	93.4	94.9	93.1	92.4	95.1	93.2	92.5	92.4	93.1
0+7.50	94.1	94.8	93.6	94.9	95.7	93.3	93.2	92.3	93.9
0+8.00	94.5	95.3	94.3	94.1	96.2	94.2	93.3	92.0	93.7
0+8.50	95.6	96.4	96.8	93.8	95.8	93.3	91.6	92.5	93.6
0+9.00	96.5	93.7	94.6	93.3	96.4	93.0	92.4	92.8	93.8
0+9.50	95.6	94.3	95.2	92.5	94.4	94.0	92.3	93.3	94.0
0+10.00	97.2	94.5	93.6	92.9	94.3	92.7	92.2	92.8	93.2
0+10.50	96.7	95.2	93.7	93.6	94.1	92.6	92.8	92.4	92.9
0+11.00	96.7	95.5	94.5	93.3	94.5	93.3	92.6	92.4	92.5
0+11.50	96.5	96.6	94.0	94.3	93.3	93.3	92.7	92.4	93.5
0+12.00	97.3	95.6	94.5	94.2	95.0	93.7	92.7	92.6	93.5

Scale	
	89.0
	90.0
	91.0
	92.0
	93.0
	94.0
	95.0
	96.0
	97.0
	98.0
	99.0

2018 Projects
o FRA 270

o SAN 6
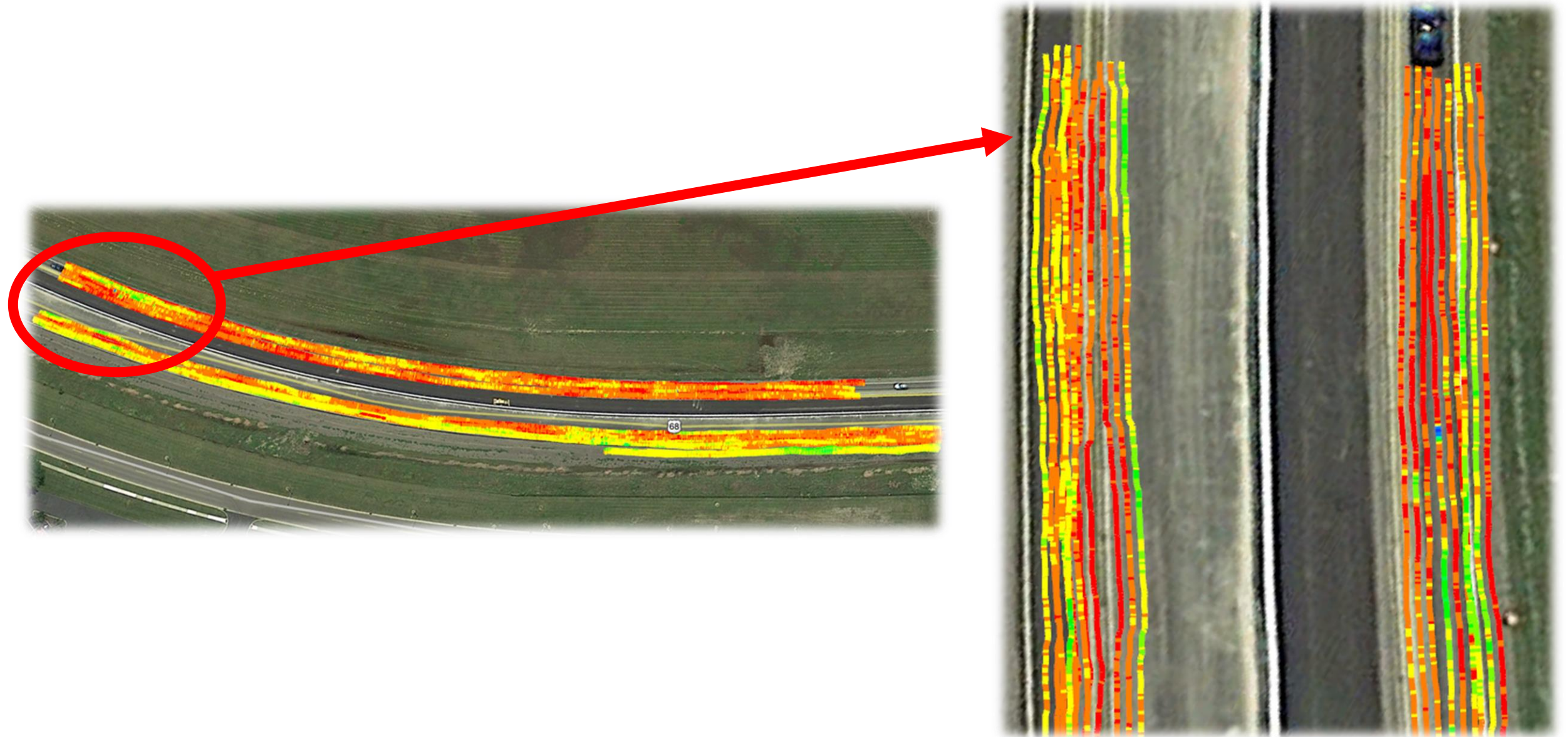
o HAN 75/68

o VIN 50

2019 Projects
o WIL 191

o GUE 77

o FRA 71

o ALL 75

o ROS 35

"The streets were paved with gold... before the last government sold it all off."

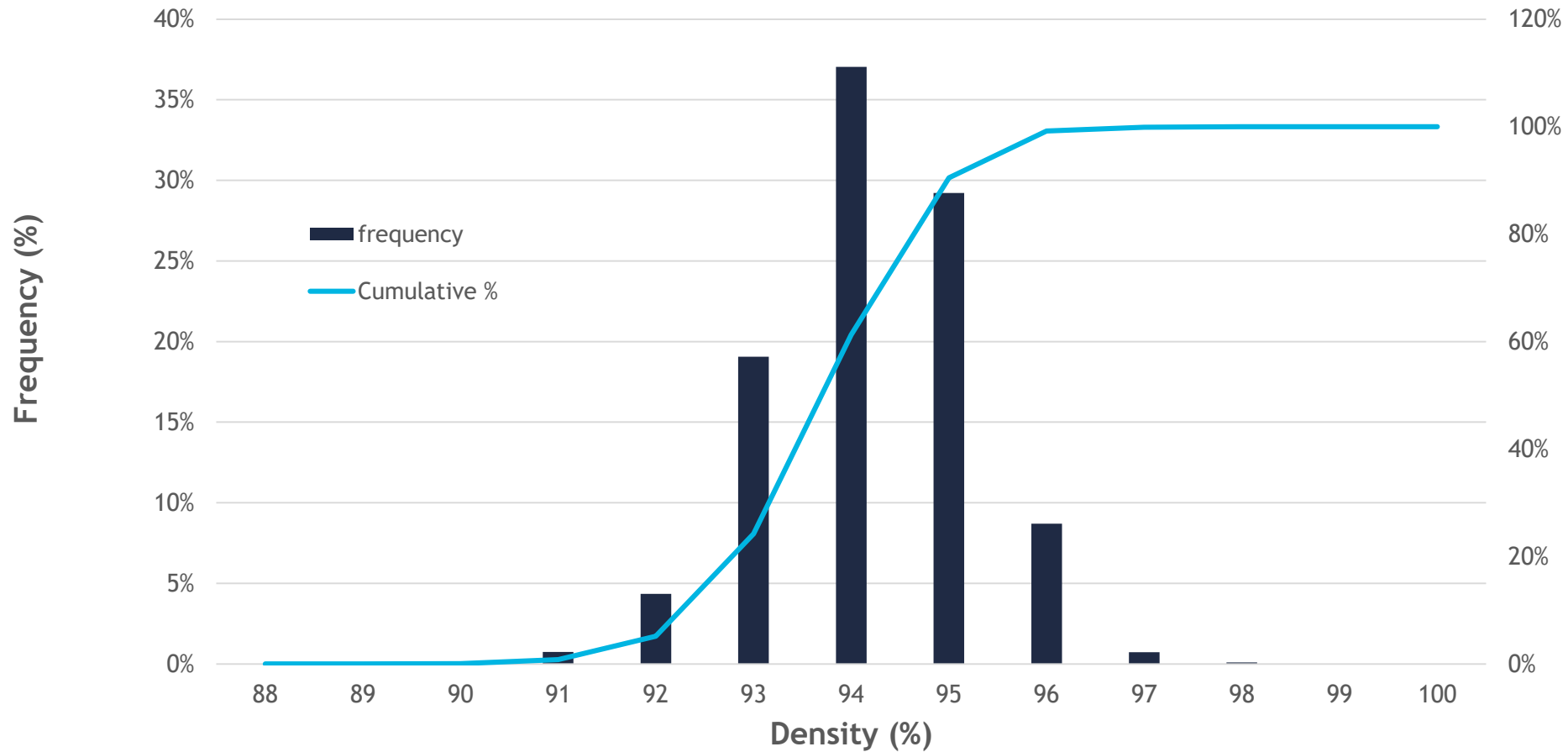OHIO DEPARTMENT OF **TRANSPORTATION**

FRA 270 (17-0004)

District 6: Project 17-0004

Core #	Relative Dialectric	Dialectric Value	% Density	Production Day
1	High	6.048	95.3	Lot 52/Day 54
2	Low	5.274	90.6	Lot 52/Day 54
3	Low	5.247	90.9	Lot 52/Day 54
4	Mid	5.829	93.8	Lot 52/Day 54
5	Mid	5.851	93.8	Lot 52/Day 54
6	High	6.099	95.6	Lot 52/Day 54

17-0004 FRA 270 Calibration Curve

$y = 5.7029x + 60.664$
$R^2 = 0.9898$

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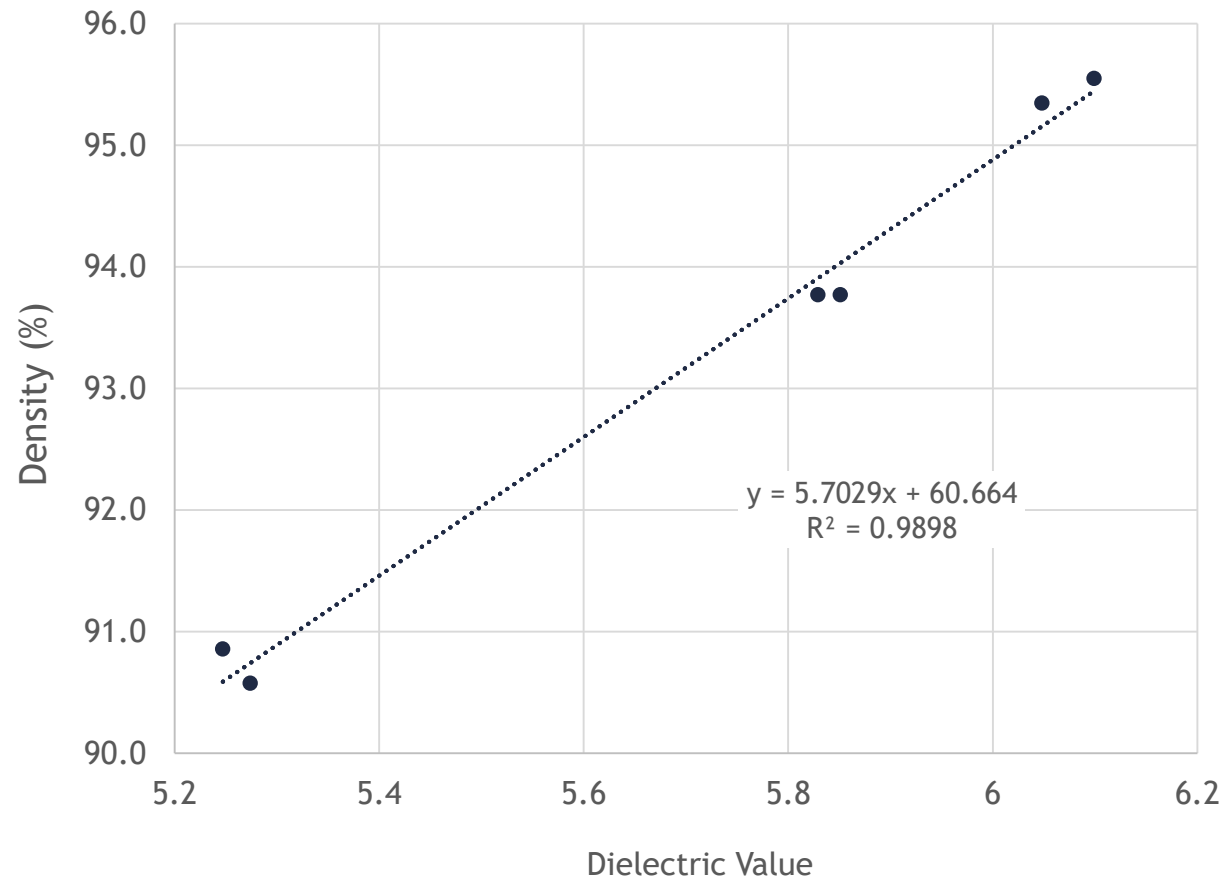
RDM Density FRA 270, Intermediate

Core Collection Mode Calibration

$y = 0.0471x + 0.6603$
$R^2 = 0.8751$
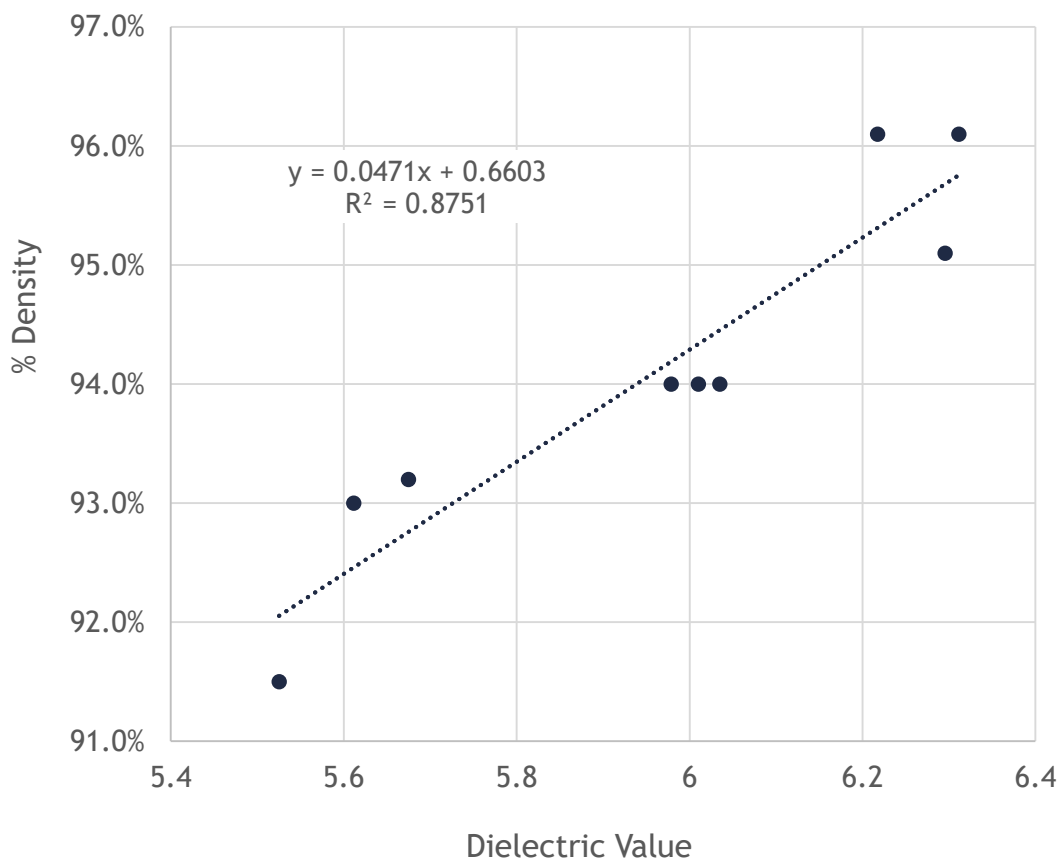
RDM Density FRA I-71, Intermediate

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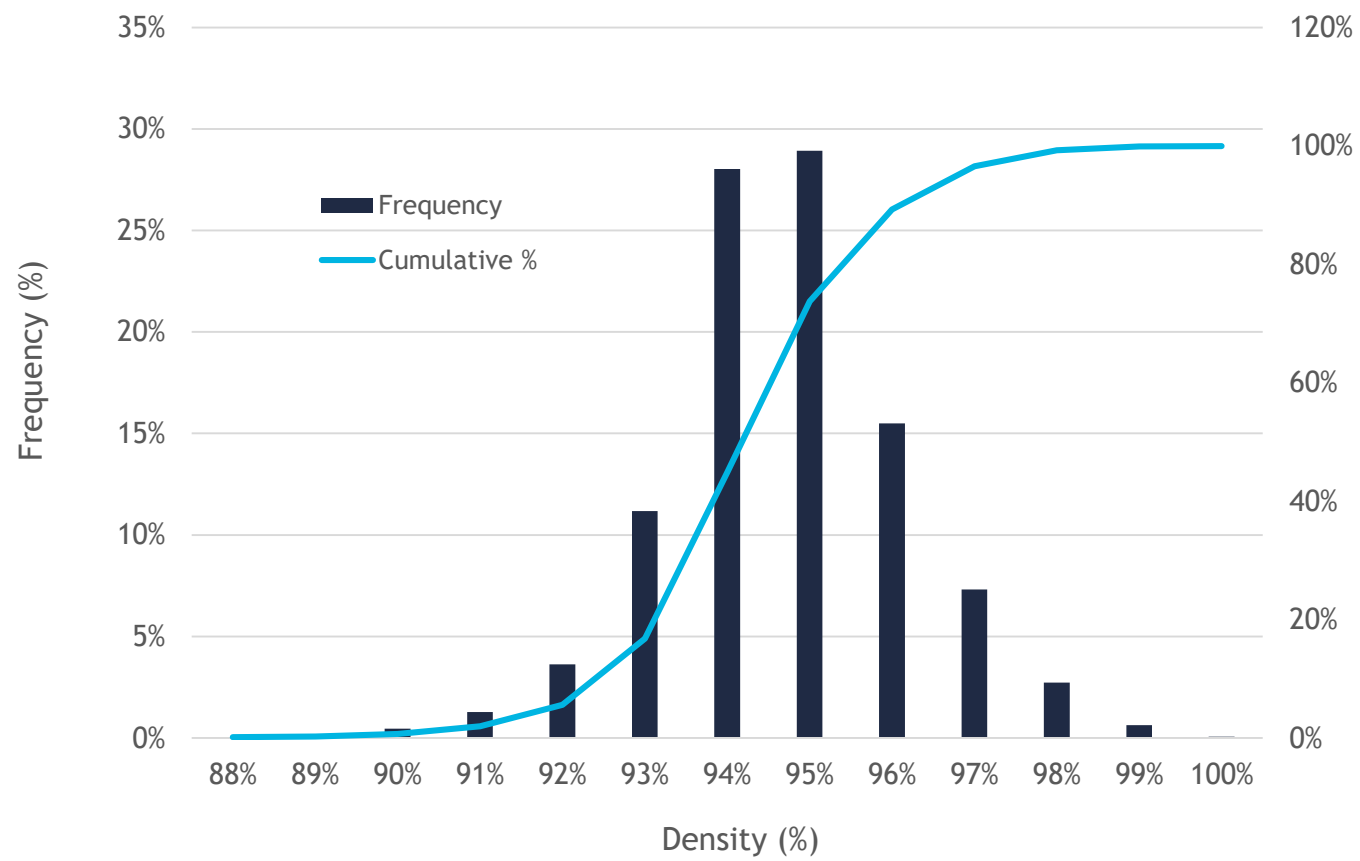
FRA I-71 19.0mm Density Data

	Lot 1	Lot 2	Lot 3	Lot 4	Lot 5	Lot 6	Lot 7	Lot 8
Core	97.5%	81.7%	72.2%	64.1%	40.8%	40.8%	59.7%	66.4%
RDM	85.1%	75.7%	95.9%	91.2%	78.6%	95.9%	90.4%	90.0%
Core Avg.	93.2%	92.9%	93.6%	92.0%	90.9%	90.9%	91.9%	92.3%
RDM Avg.	94.2%	92.9%	93.1%	92.9%	92.1%	93.0%	92.5%	93.3%
Pay Factor	1.00	1.00	1.00	1.00	0.94	0.94	1.00	1.00

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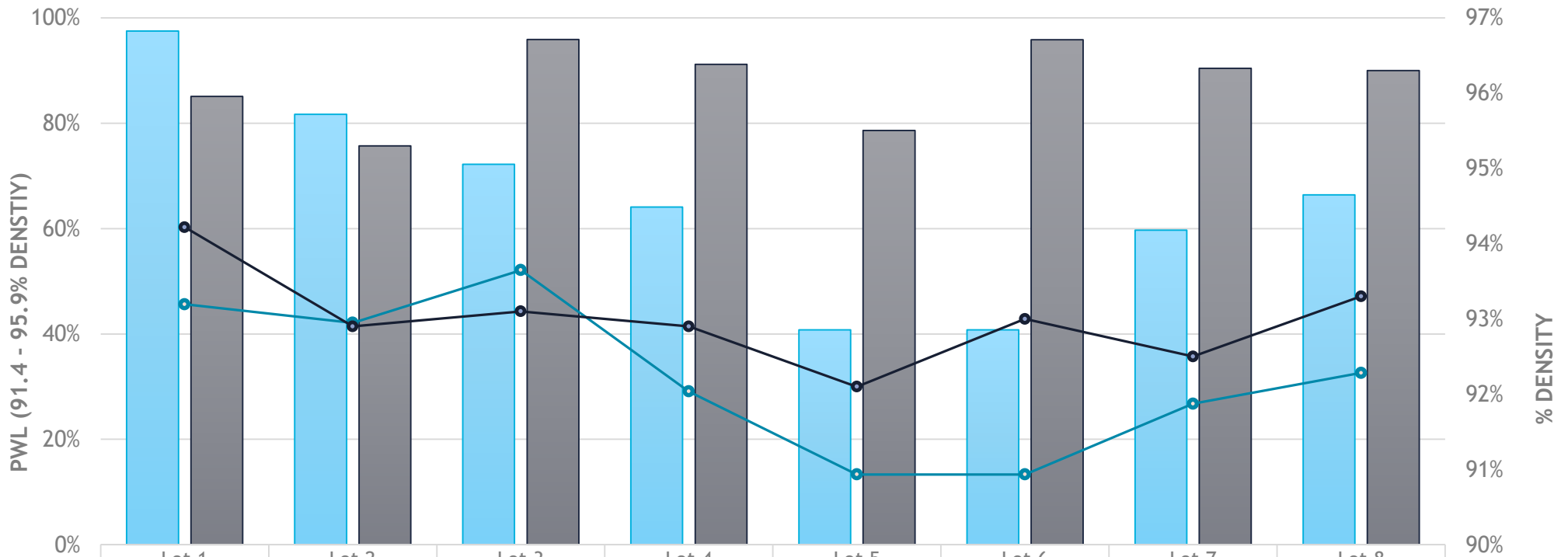
ALL 75 (18-0555)

Core Collection Mode Calibration

$$y = 0.0554x + 0.6033$$
$$R^2 = 0.8791$$
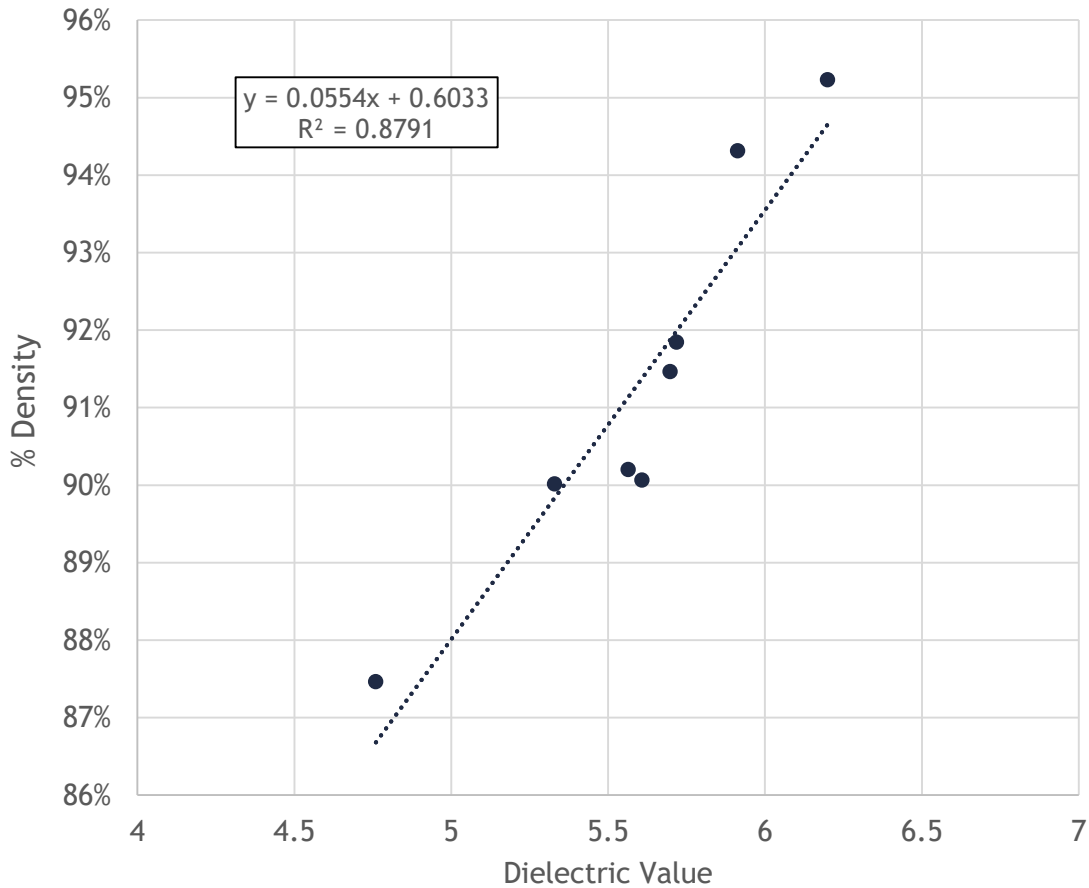
ALL I-75 180555, Intermediate

OHIO DEPARTMENT OF TRANSPORTATION
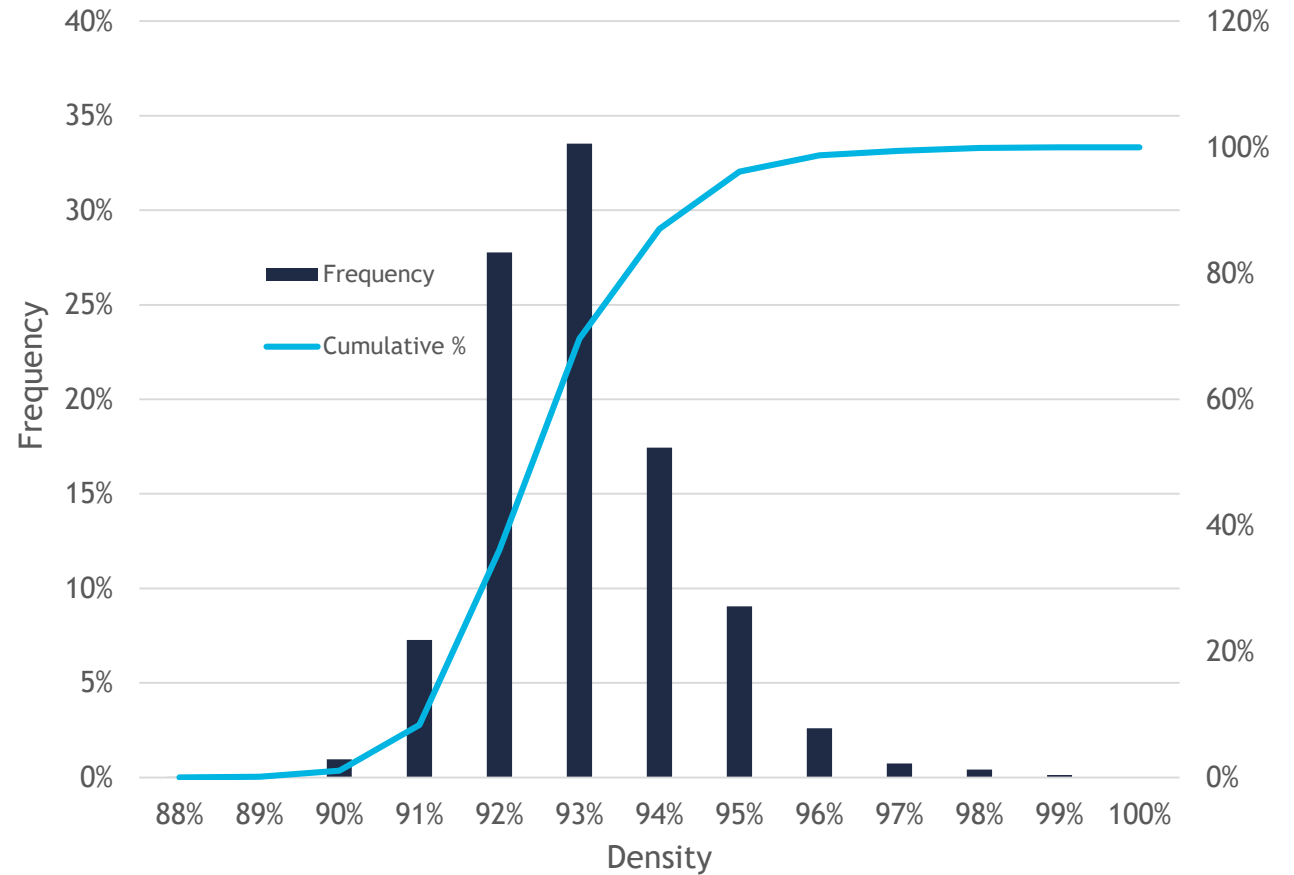
ALL I-75 19.0mm Density Data
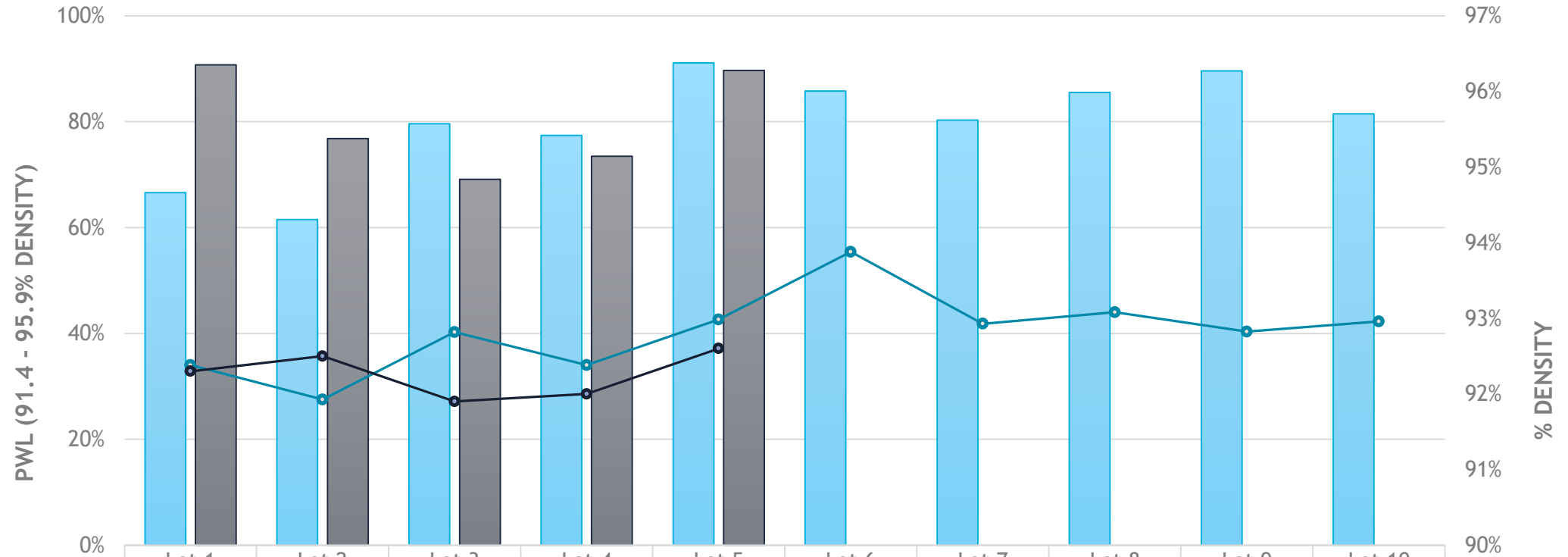
	Lot 1	Lot 2	Lot 3	Lot 4	Lot 5	Lot 6	Lot 7	Lot 8	Lot 9	Lot 10
Core PWL	66.6%	61.5%	79.6%	77.4%	91.1%	85.8%	80.3%	85.5%	89.6%	81.5%
RDM PWL	90.8%	76.8%	69.1%	73.5%	89.7%					
Core Avg	92.4%	91.9%	92.8%	92.4%	93.0%	93.9%	92.9%	93.1%	92.8%	93.0%
RDM Avg.	92.3%	92.5%	91.9%	92.0%	92.6%					
Pay Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

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GUE I-77 19.0mm Density Data

	Lot 1	Lot 2	Lot 3	Lot 4
Core PWL	81.4%	88.0%	77.7%	80.2%
RDM PWL	65.2%		81.1%	67.2%
Core Avg.	93.7%	94.0%	94.7%	93.3%
RDM Avg.	94.2%	92.9%	93.1%	92.9%
Pay Factor	1.00	1.00	1.00	1.00

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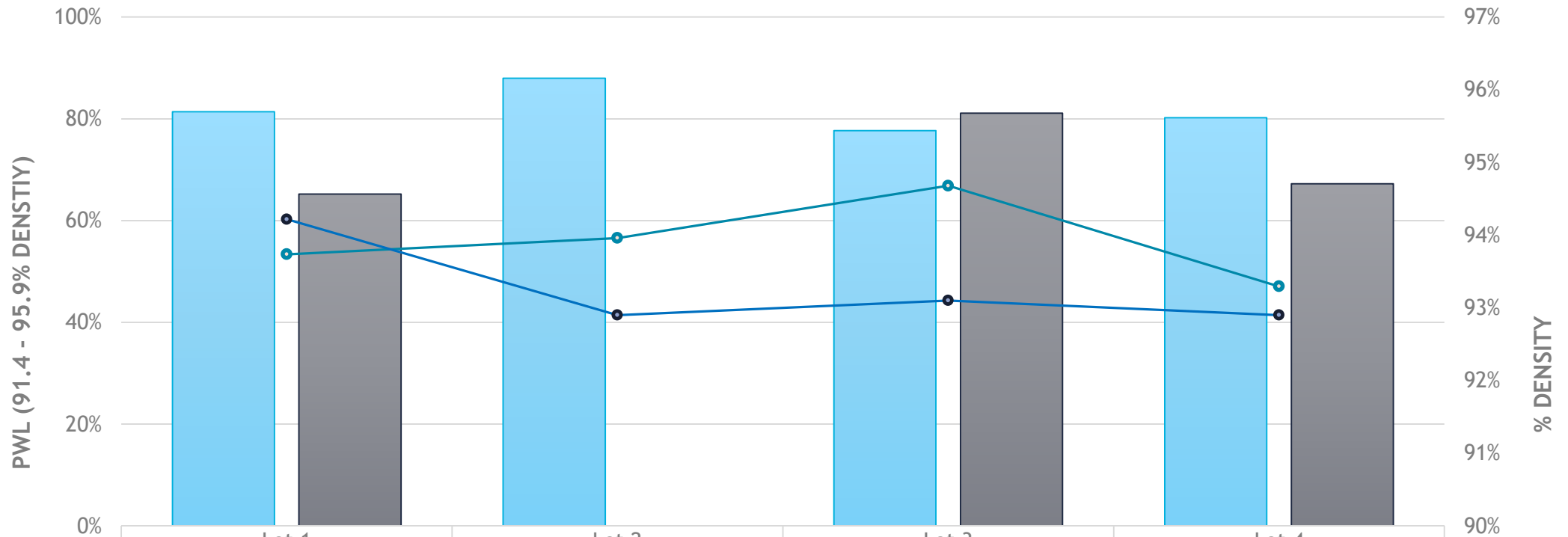
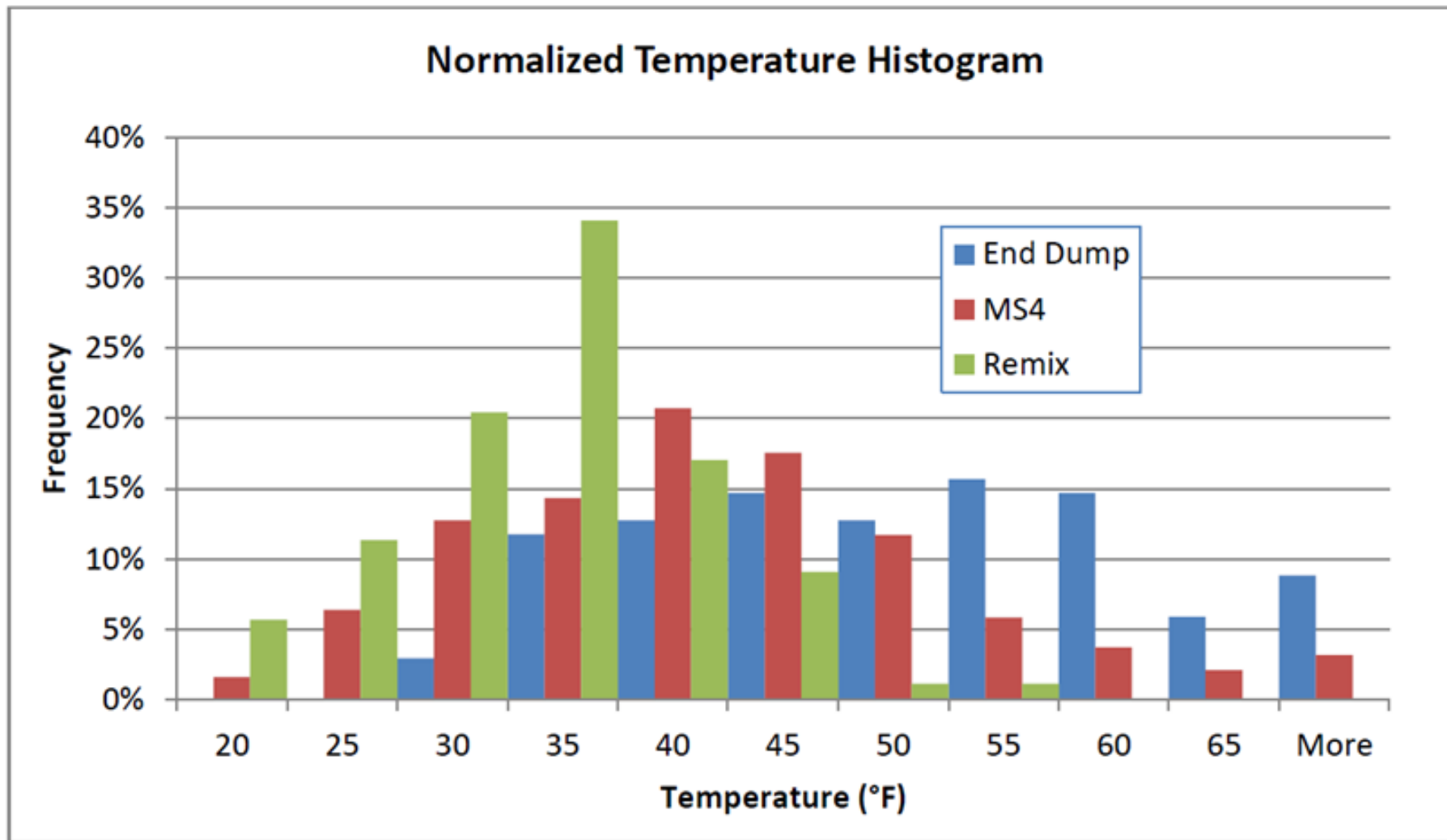# PAVER MOUNTED THERMAL PROFILING (PMTP)

New Intermediate Project Locations:

- GUE I-77
- SAN SR6
- WIL SR6
- GUE I-77/2
- ALL I-75

Location	PID	Price	Average Density	Average Pay Factor
GUE 77	93017	$ 8,093,223.28	94.4%	1.00
SAN 6	95769	$ 4,230,739.39	92.8%	0.99
WIL 6	102827	$ 6,425,675.81	93.2%	1.00
GUE 77	93022	$ 3,042,424.93	93.9%	1.00
ALL 75	94206	$ 5,688,484.21	92.8%	1.00

Ohio Department of Transportation

Normalized Temperature Histogram

ALL-75 PMTP DATA

PMTP Temperature Data

Latitude (°): 40.774647
Longitude (°): -84.066602

Temperature (°F)

350	
325	
300	
275	
250	
225	
200	
150	
0	

PMTP Paver Speed Data

Latitude (°): 40.787991
Longitude (°): -84.040700

Speed (ft/min)

100	
90	
80	
70	
60	
50	
40	
30	
20	
10	
0	
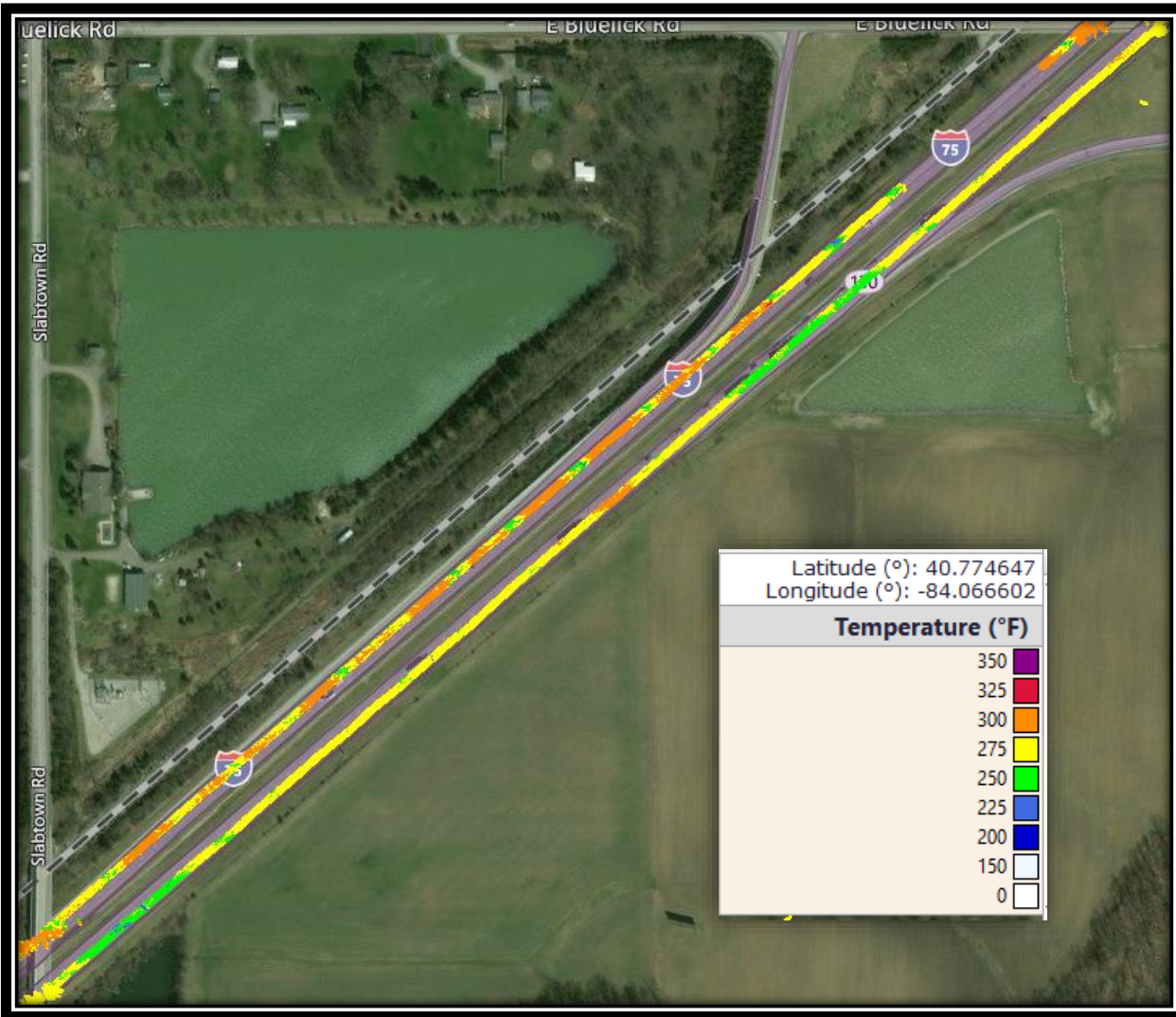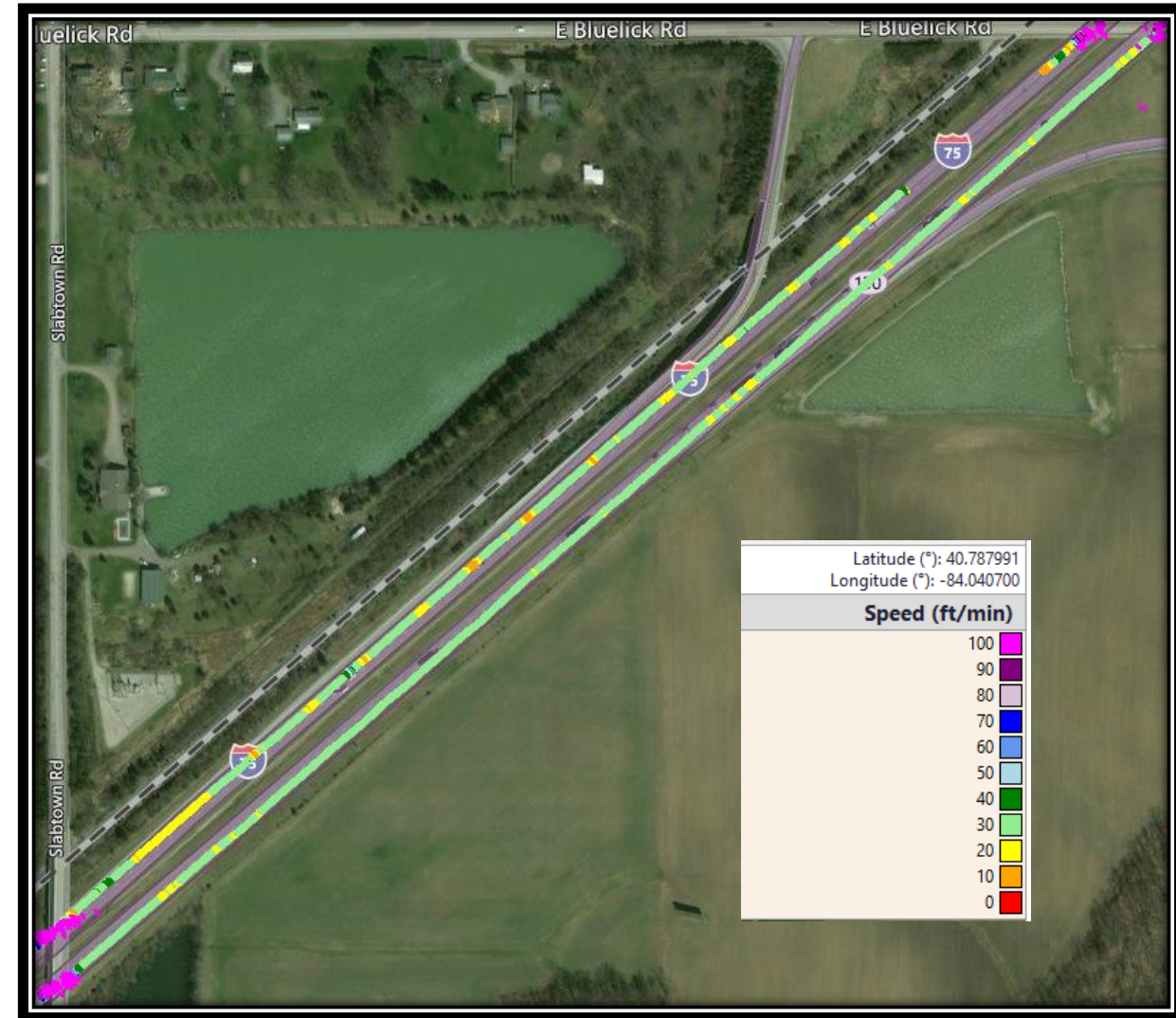
ALL-75 PMTP DATA

PMTP Temperature Data
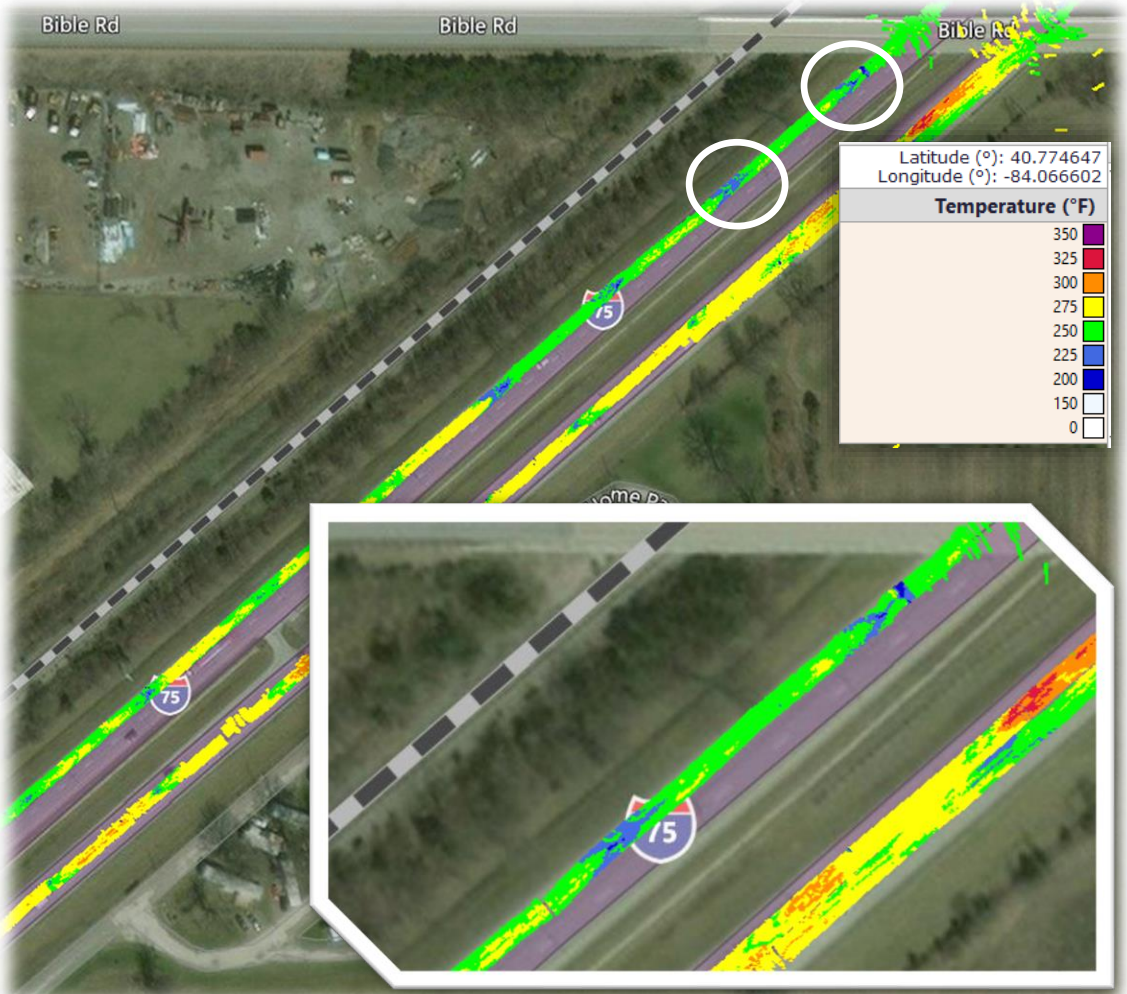
RDM Density Data

o Accurate density measurements/ Higher sample rates.

o Real time info.

o Daily calibration verification.

o RDM has the potential to change how ODOT inspects and accepts asphalt pavements.

o Better Value for our tax dollars.

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ODOT:

o Continue to Develop standard procedures

o Collect more data

- Mix types, materials, districts

- Comparison to current standards

Pooled Fund Study:

o Evaluate precision and bias

o Evaluate mixture adjustments

o Evaluate moisture effects

o Evaluate gyrated specimens

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QUESTIONS

Last updated 1/10/2020

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