**Intelligent Compaction for HMA**

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### Why Intelligent Compaction?

**Why Do We Need IC?**

- Proper in-place density is vital for good performance
- Conventional compaction equipment and procedures have shortcomings and too often produce poor results
- Intelligent compaction technology appears to offer “a better way”

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### What is Intelligent Compaction?

- Vibratory Single Drum
  - Soil Roller
- Vibratory Tandem Drum
  - Asphalt Roller

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### IC Pooled Fund (ICPF)

ICPF States / Year

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Tandem Drum IC Roller Suppliers

- Ammann/Case
- Volvo
- Dynapac
- Bomag America
- Caterpillar
- Sakai America

IC Roller Requirements

- Roller Measurement Value (RMV)
- GPS-Based documentation system
- Color-coded display (on-board)
- Surface temperature measurement system
- Optional: automatic feedback system

Available Tandem Drum IC Rollers

- Bomag
- Sakai

Mat Surface Temperature Measurement

- Infrared Thermal Gauge

Surface Temp vs Internal Temp

- Color-Coded On Board Display
**Special Issues for IC on HMA**

- Thin lift construction
- Allowable temperature ranges to eliminate binder viscosity stiffening
- Surface vs. internal mat temperature measurement
- Non-destructive, in-situ stiffness / modulus companion tests

**How Does GPS Work?**

- High Precision RTK GPS used on projects
- GPS base station at fixed location
- GPS receiver and radio on mobile IC rollers
- Both base and rollers get GPS location
- Roller receives radio signal of base location; compares to its location; corrects roller location
- Typical nominal accuracy of 1 cm ± horizontally and 2 cm ± vertically

**In Situ Test Devices / Methods**

- LWD/FWD
- Nuclear Density Gauge
- Dynamic Cone Penetrometer

**Correlation w/ In-Situ Testing**

![Correlation Diagram](chart)

*Courtesy of Dr. David White*
Key Questions to Answer

- Are the IC compaction results improved over conventional compaction?
- Is the IC compaction more efficient than conventional compaction?
- Does the IC measurement values correlate well with properties measured using other independent testing?

Preliminary Findings

- Use and acceptance by roller operators
- Improved roller patterns / passes
- Use of IC rollers for “mapping” of underlying materials (Soils, GAB, Existing Asphalt Pavements)
- Underlying support affects compactability of subsequent layer
- Correlations of RMV to in situ test results is challenging

Roller Operator Training

- Georgia HMA Demo

Improved Rolling Patterns

- Indiana ICPF Project

Mapping of underlying layers

- Minnesota ICPF Project
  - Mapping of the subgrade / agg. base layer

Mapping of HMA layers

- Minnesota ICPF Project
  - Compaction/mapping of HMA base course layer
Correlations of RMV vs Density

- Still analyzing data from 2009 ICPF projects
- Results to date indicate many variables that can adversely affect correlation
  - Mat temperature (min. 220º F?)
  - Mat temperature variations
  - Underlying material support / variability
  - Accuracy / calibration of density gauges

Issues with IC Data Management

- Data format
- Data collection
- Data storage
- Data processing
- Develop independent software tool
  - Efficient
  - Accurate
  - Fast

Benefits of IC for HMA

- Improve density....better performance
- Improve efficiency....cost savings
- Increase information....better QC/QA
- Overall Benefit: Improved Pavement Performance!