Intelligent Compaction
Pooled Fund Project

INTELLIGENT COMPACTION

For Hot Mix Asphalt

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What is Intelligent Compaction?

An Innovation in Compaction Control and Acceptance
INTELLIGENT COMPACTION for HMA

Currently Available Tandem Drum IC Rollers

Bomag America

Sakai America
INTELLIGENT COMPACTION for HMA

HMA Surface Temperature

Roller Passes
INTELLIGENT COMPACTION for HMA

Infrared Thermal Gauge
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Typical GPS Setup

On roller

Base station
"THE IMPORTANCE OF COMPACTION in highway construction has long been recognized. Recent laboratory and field investigation have repeatedly emphasized the value of thorough consolidation in both the base and surfacing courses. Thorough compaction is known to produce the following desirable results:

1. It increases interlocking of the aggregate particles, which is the primary factor in developing a high degree of stability. 2. It retards the entrance of moisture, thus preventing excessive loss of stability under adverse service conditions. 3. It reduces the flow of air and water through bituminous mixtures and is therefore an effective means of lessening damage from weathering and film stripping."

Reference -- "Public Roads, May 1939, authors J.T. Pauls and J.F. Goode"
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”
INTELLIGENT COMPACTION for HMA

- Shortcomings in the Compaction Process…

Limited “On The Fly” Feedback

Over or Under-Compaction Can Occur
• Shortcomings in Density Acceptance Process…

Limited Number of Locations

After Compaction is Complete
Mapping of underling layers

Minnesota ICPF Project

Mapping of the subgrade / agg. base layer
Mapping of HMA layers

Minneapolis ICPF Project

Compaction/mapping of HMA base course layer
Approximate location of subgrade section failed during test rolling (~ Sta. 134+00 to 144+00)

Approximate location of subgrade section failed during test rolling (~ Sta. 134+00 to 144+00)

Approximate location of HA+MA non-wearing course layer failure due to construction traffic (~ Sta. 140+12 to 142+61)

Approximate location of HA+MA non-wearing course layer failure due to construction traffic (~ Sta. 140+12 to 142+61)
Reflection of hard spots on the HMA layer

Class 5 aggregate subbase layer map,
\( a = 0.6 \text{ mm}, \ f = 2500 \text{ vpm} \)

Reflection of soft spots on the HMA layer

**MN ICPF Project**

Sakai IC roller
Wisconsin ICPF Project
IC Mapping (SB passing lane)

Soil subgrade mean CCV ~ 5

Rubblized PCCP mean CCV ~ 14

Soil subgrade mean CCV ~ 6

Crack&Seat PCCP mean CCV ~ 18
• Roller Passes

Shoulder (Supported)

Paving Direction

Longitudinal Joint

Number of roller passes

1 2 3 4 5 6 7 8

Courtesy Sakai America
Improved Rolling Pattern

Before

After

Sakai Tandem Drum IC roller

TB 04
Roller Operator Training

Georgia HMA Demo
What’s Next?

New / Improved IC Technology

Caterpillar Remote Wireless Capabilities
INTELLIGENT COMPACtion for HMA

What is Intelligent Compaction?

Vibratory Single Drum Soil Roller

Vibratory Tandem Drum Asphalt Roller
INTELLIGENT COMPACTATION for HMA

Subsurface Layer (1)

Region of soft subsurface layer condition reflecting through surface compaction layer

Final Layer (2)

Hard subsurface layer reflecting through surface compaction layer

Courtesy of Dr. David White
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
Benefits of IC for HMA

• Improve density….better performance
• Improve efficiency….cost savings
• Increase information…better QC/QA

• Overall Benefit:
  Improved Pavement Performance!
INTELLIGENT COMPACTION for HMA

Yesterday

Buffalo Springfield Steam Roller
INTELLIGENT COMPACTION for HMA

Today
IC – The Future of Compaction Technology

The image shows a webpage from Intelligent Compaction (www.intelligentcompaction.com), which is an online resource for learning about intelligent compaction technology. The page features a list of contents including:

- IC 101
  - What is IC?
  - How IC Rollers Work
  - Benefits of IC
  - Issues

There are also sections for forums, contact, and links, as well as a section titled "Pooled Fund."
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Thank you!