Intelligent Compaction

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Overview

• What is Intelligent Compaction (IC)
  – Systems available

• APAC’s experience

• MODOT IC study
  – APAC’s 63 Boone County project
What is IC?

- Compaction of road materials using vibratory rollers equipped with
  - onboard computer reporting system
  - Global Positioning System (GPS) based mapping
- Facilitates real-time monitoring and adjustments to the compaction process
  - integrates measurement, documentation, and control systems
- Maintains a continuous record of color-coded plots of
  - precise location of the roller
  - number of roller passes
  - material stiffness measurements
- Compaction is one of the most important processes in roadway construction.
  - necessary to attain high quality and uniformity of pavement materials
  - Uniform densities are key
  - IC helps optimizing the compaction process
Asphalt IC equipped rollers

Double Drum IC Rollers

- Bomag
- HAMM-Wirtgen
- Caterpillar
- Sakai

Trimble®
Trimble CCS Flex

Operator control box

GPS

Temp sensor 1

Temp sensor 2

Accelerometer (not used)
Trimble CB450 operator view
Pass Count Mapping

- Takes guesswork out of asphalt compaction
  - More consistent compaction effort to target pass count
  - Increased productivity by using the most efficient rolling pattern
Temperature Mapping

Infrared Sensor

- Provides temperature maps
- User-defined high/low temp warnings
- Operator can watch pass counts and temperature warnings on the same screen
Compaction Meter Value (CMV)

- Trimble CM310 Accelerometer that measures stiffness of the mat
  - Important to note that it is *not* a measure of density
IC DATA analysis

• **VisionLink**
  – VisionLink by Trimble is the web application that displays data collected from a Product Link unit installed on a machine.

• **Veda**
  – Veda is a map-based tool for viewing and analyzing geospatial data, currently funded by MNDot
APAC’s experience

• 2013 Roller Demo
  – No investment to learn the system: hardware or software
    • No crew interest

• 2014
  – Backlog: ~$250,000 potential density bonus
  – New interest!
  – MODOT ICDM workshop
  – More control of compaction
  – High recycle mixes...compaction challenges
    • Keep up with mix changes
  – Eliminate “density checker?”
  – Trimble CCS Flex
2014 MODOT IC Study

• Proof of Concept
  – Hwy 63 Boone County
    • Mapping
      – 2 shifts covered, 2 uncovered
    • Trimble IC system
    • Veda
    • MOBA Pave IR
63 Boone County

- +80,000 tons SP125C mill/fill

- Night paving

- 3 double drum rollers, 1 pneumatic roller
  - 1 Volvo DD120 w/ Trimble IC System
  - 2 Cat CB64s w/ Trimble IC System
Roller Operator “cheat sheet”

1. Set up Design:
   - Press Menu
   - Highlight “Select Design”. Press OK
   - Using the softkey, select “new map”
   - **CAT 1: Select “use last”, press OK**
   - Key in design name (vymmd C1, C2, or V) using arrow keys
     - ← backspace, ⌤select characters, →next/space
   - Press OK then OK again to get back to main menu
   - Press Escape Key

2. Adjust Brightness
   - Hold Menu Key
   - Press Zoom-in/Zoom-out to adjust brighter or dimmer

3. Mapping
   - Press 2nd soft key from the bottom
   - Icon to the left will be color when mapping is on, gray when off
   - **Turn mapping off when not in a roller pattern**

4. Adjust Pass Count (only if instructed)
   - Press Menu
   - Highlight “mapping/recording”, press OK
   - Use arrow keys to change pass count
   - Press OK then press Escape to get to main view
VEDA screenshot study area

Pass count
Veda pass count 1
Veda pass count 2
Veda pass count 3
Missed roller pass!
Roller speed
Rolling temperature
Density results

\[ y = 0.26x - 20.50; R^2 = 0.71; n = 4 \]
Data loss
Business Loop 70, Columbia

Significant Data Loss, overhead lines, lights, etc.
Distribution of Placement Temperatures

Mean: 288 °F  
Median: 285 °F  
σ: 15.94 °F
Challenges with Intelligent Compaction

- **Cost**
  -+$10,000.00 (basic mapping only)
  -+$30,000.00 for some systems

- **GPS**
  -Must have clear view of sky

- **Roller patterns change**
  -Mix changes
  -Weather/moisture changes

- **NOT a true measurement of density**
Benefits of Intelligent Compaction

• Quality Control & Process Control
  – Consistency & Uniformity

• Increased operator awareness
  – pass count, temperature readings

• Improved density & smoothness
  – better understanding of mat/mix conditions

• Improve efficiencies
  – Cost savings

• Roller Operators LOVE IT!
www.intelligentcompaction.com

• Questions?