

Paving the Way for Quality-A View into Intelligent Compaction

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2025 FLORIDA ASPHALT
EXPO & CONFERENCE

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“The best investment is in the tools of one’s own trade.”

-Benjamin Franklin



What is intelligent compaction?

Intelligent Compaction (IC) refers to the compaction of road materials, such as:

- soils
- aggregate bases
- asphalt pavement materials

using modern vibratory rollers equipped with an integrated measurement system, an **onboard computer reporting system**, **Global Positioning System (GPS)** based mapping, and **optional feedback control**



Advancements in intelligent compaction technology over the last decade

Tedious daily installation and tear down. Components were bulky



Quick daily installation and tear down. Components are becoming more compact

Data USB transfer. No real time visibility in a portal



Data transfer via cloud into a portal. Real time visibility via portal

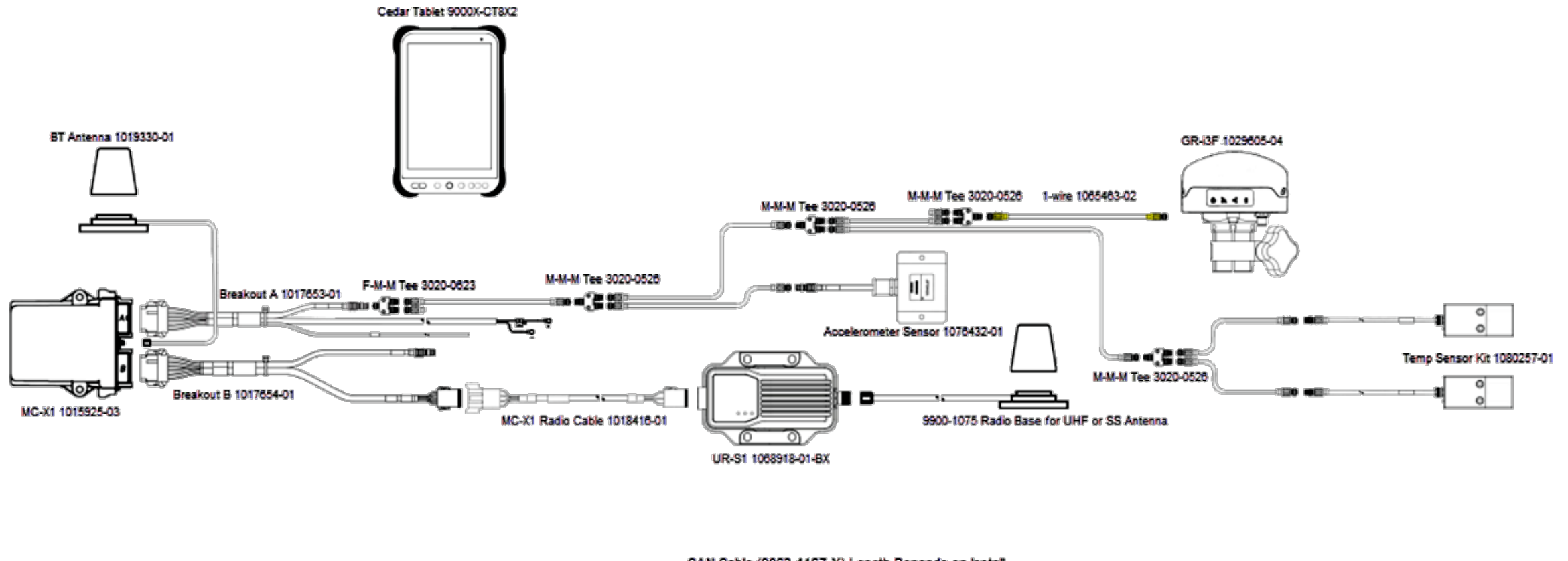
Machine monitors were fixed plug in. GPS was less accurate



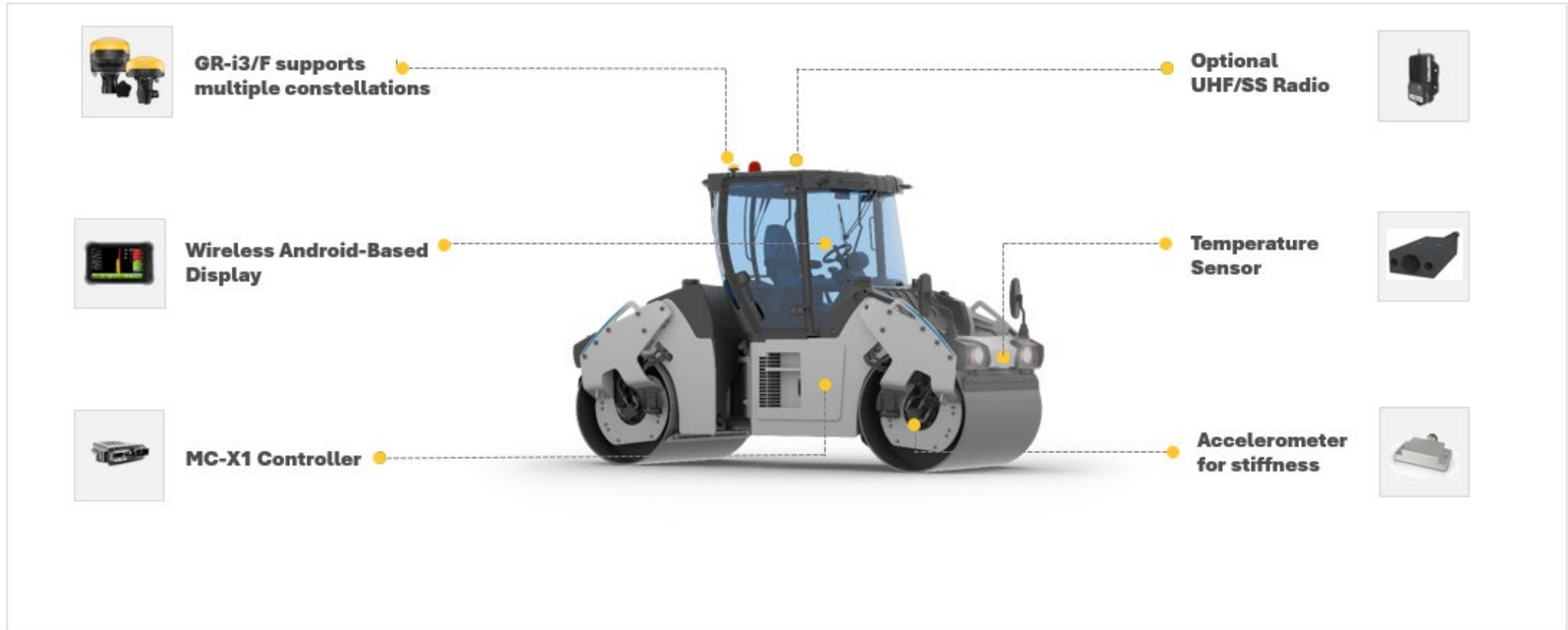
Machine monitors are becoming Bluetooth. GPS is more accurate



Intelligent compaction machine components



Machine component layout

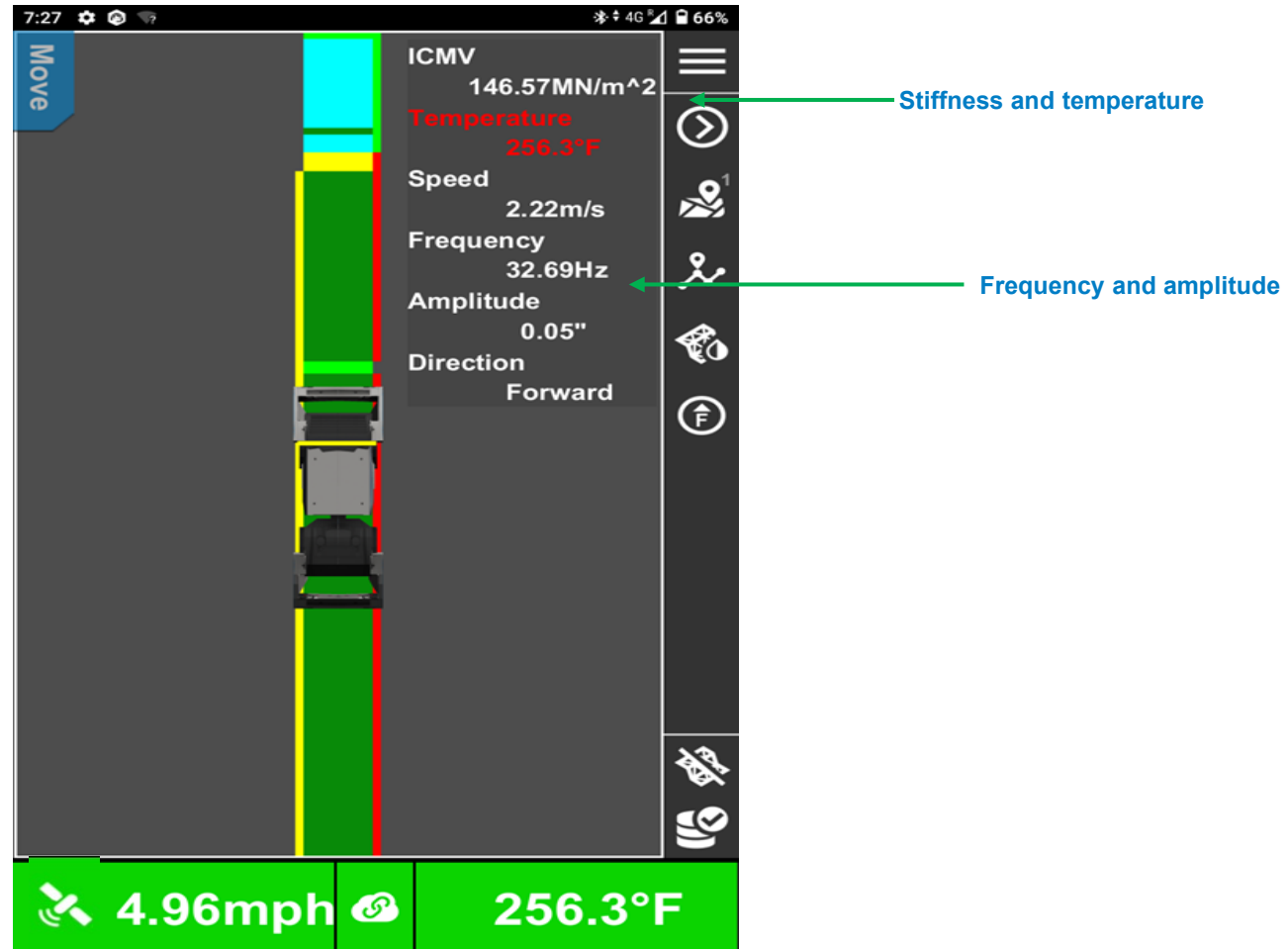


What data does intelligent compaction collect?

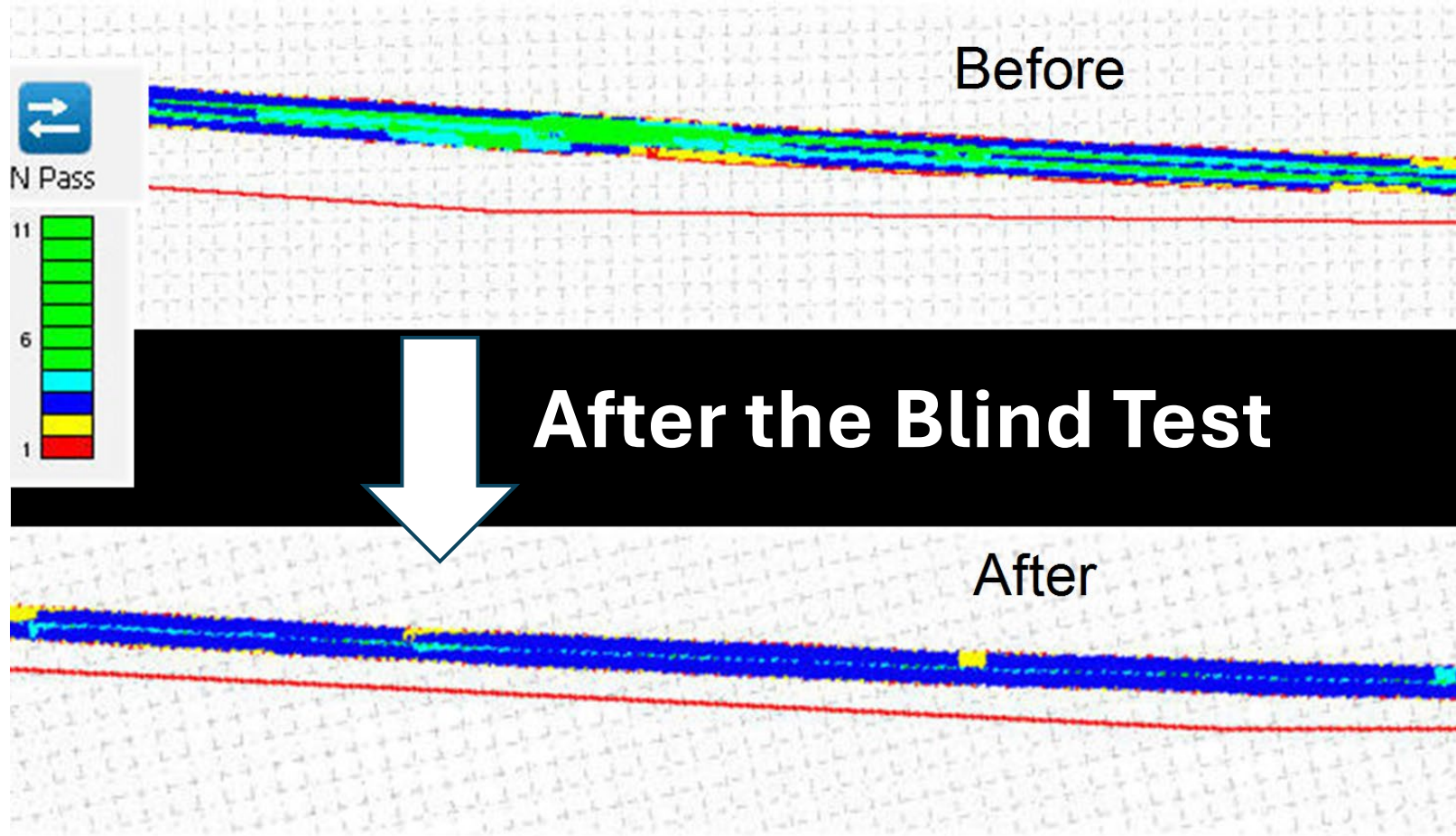
- Roller coverage
- Count of roller passes
- Roller speed
- Vibration settings
 - Amplitude
 - Frequency
- Temperature
- Material stiffness measurements



Display with speed, amplitude, frequency and temperature example

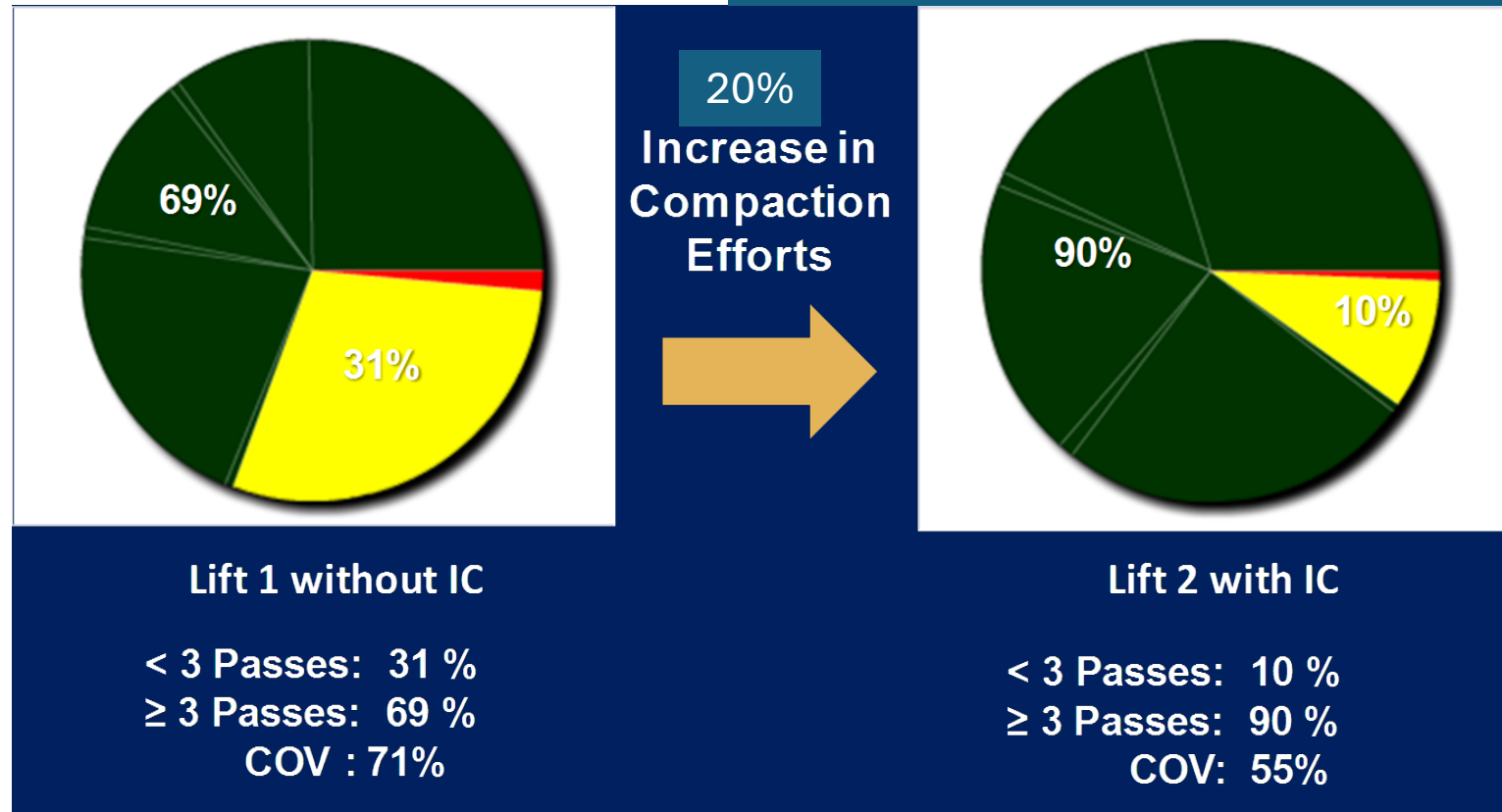


Roller coverage and pass count example



Roller coverage statistics

First Time Use of IC

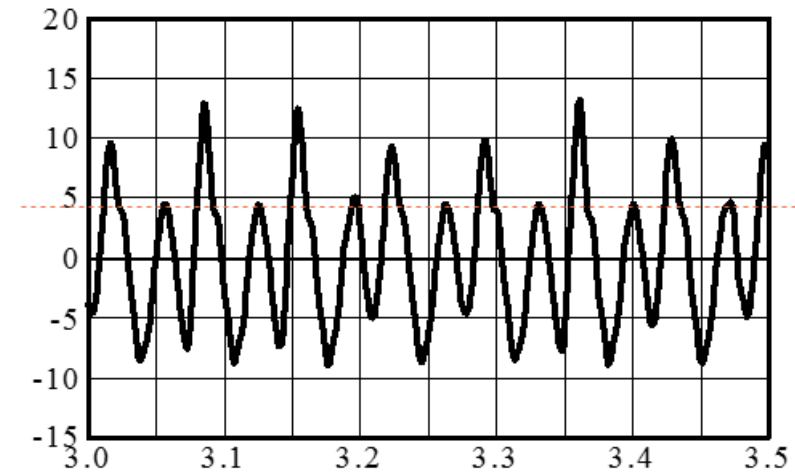
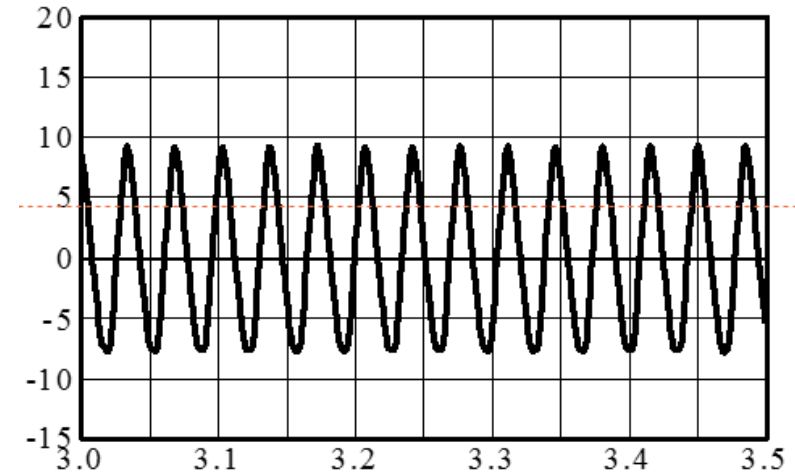


Improved Consistency



Material stiffness

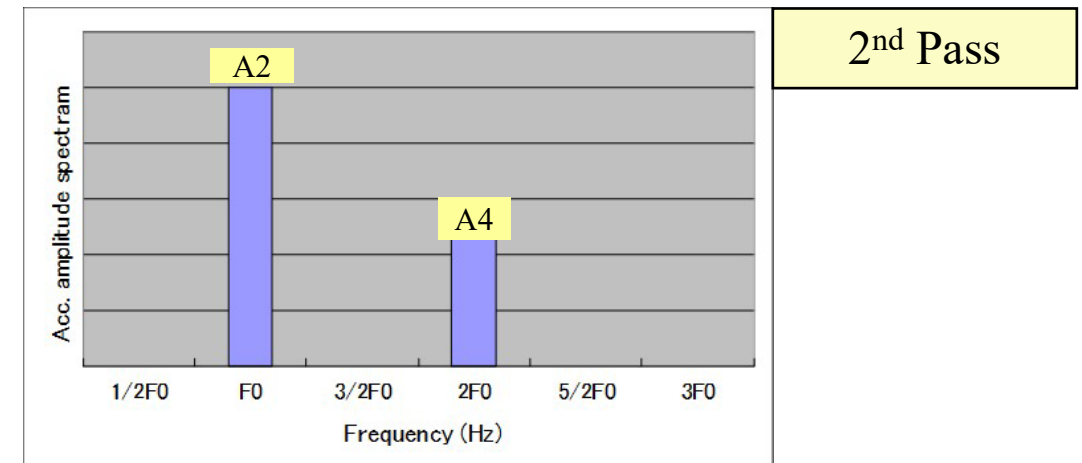
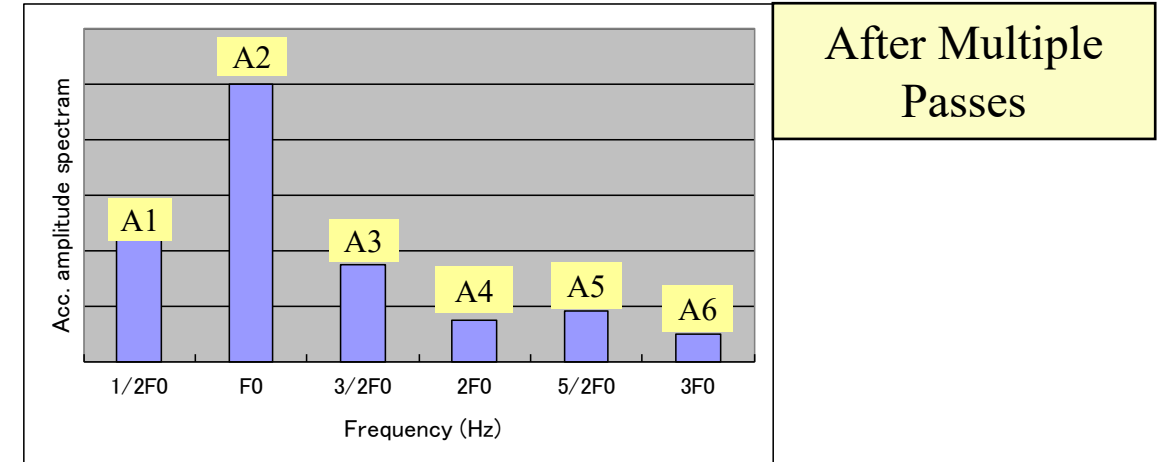
- Drum frequency and amplitude deflection are being measured by mounted accelerometer
- As the asphalt mat stiffens the measured wave begins to progressively become interrupted
- Manufacturers have different stiffness (ICMV) measurements



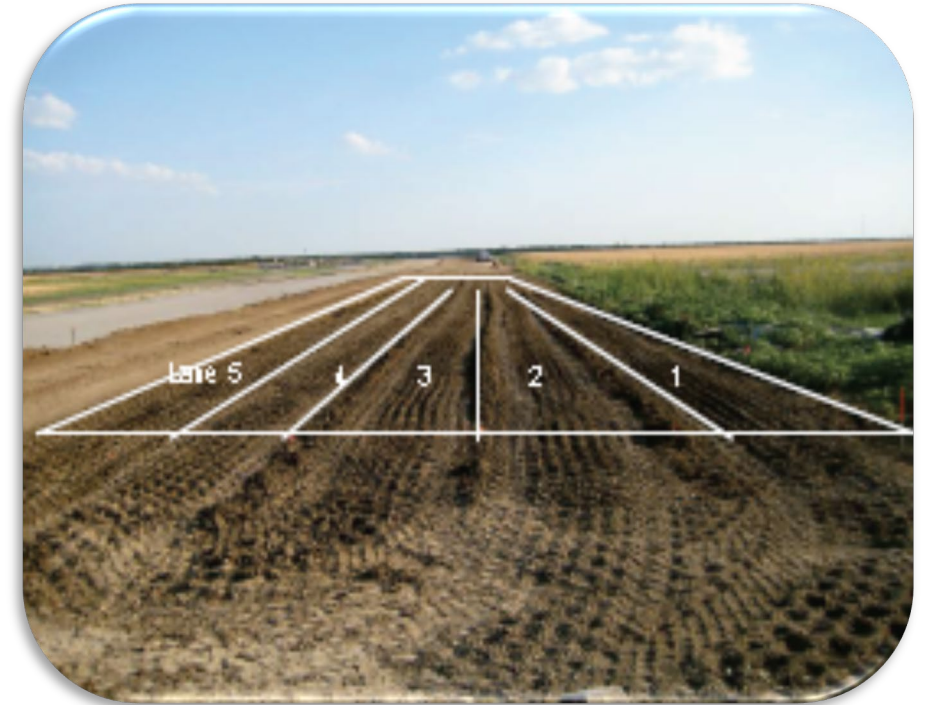
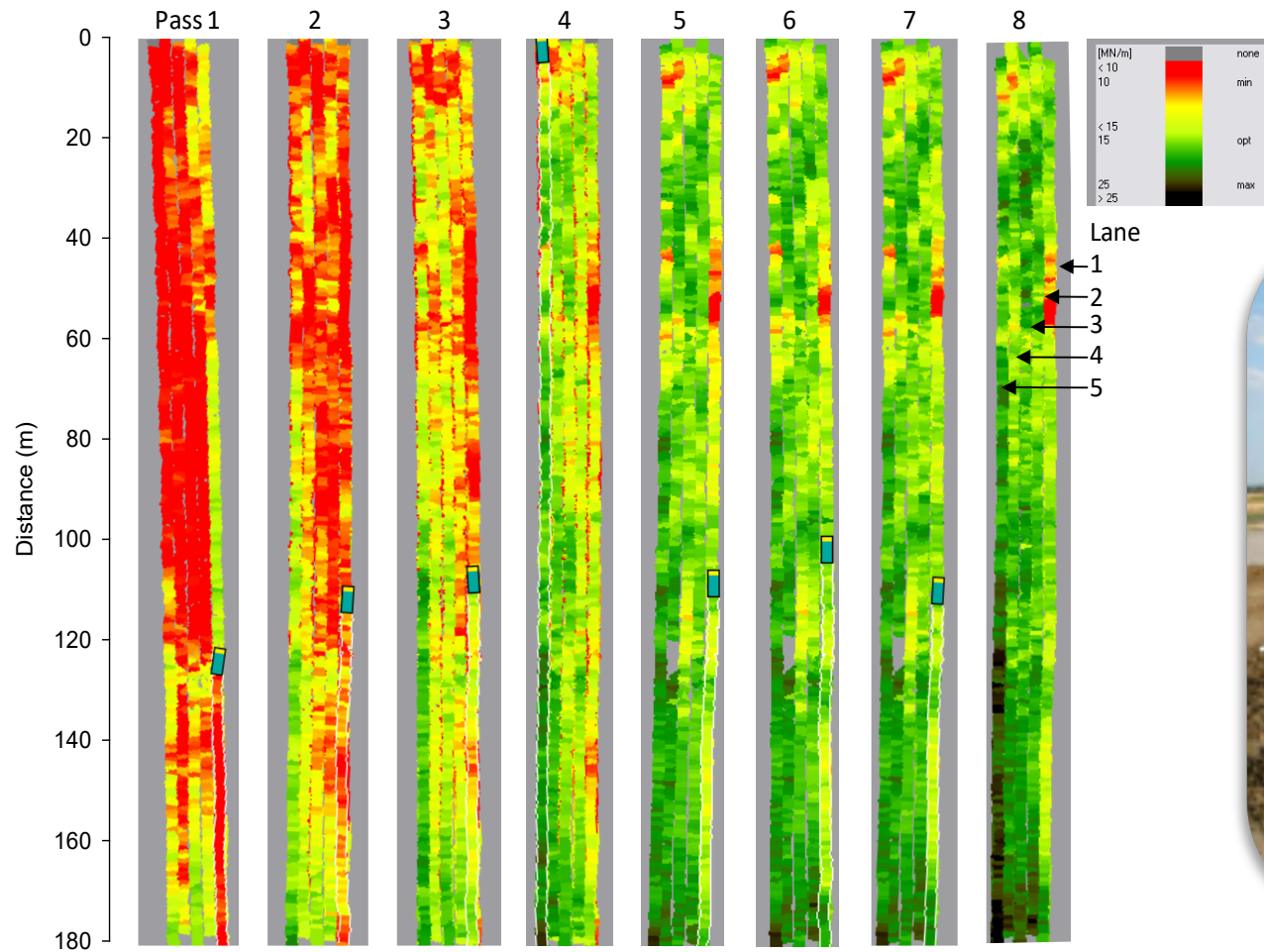
Intelligent compaction measurement value examples

$$CCV = \frac{A_1 + A_3 + A_4 + A_5 + A_6}{A_1 + A_2} \times 100$$

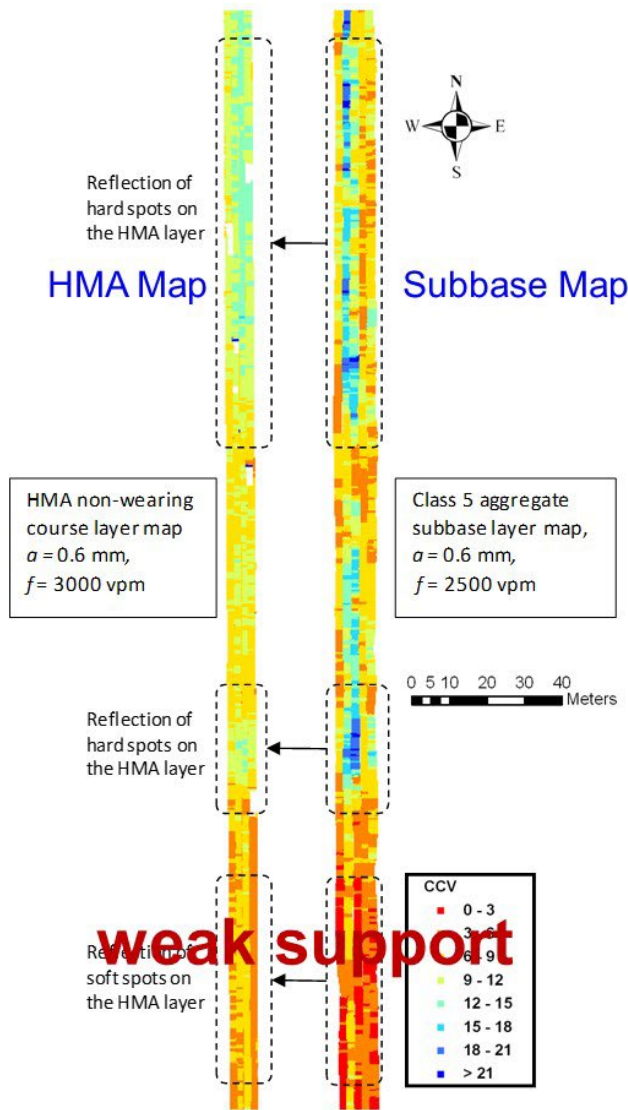
$$CMV = \frac{A_4}{A_2} \times 100$$



Sub base with low stiffness example



Subbase with hma overlay example



Pre-Mapping Subbase



Asphalt Compaction

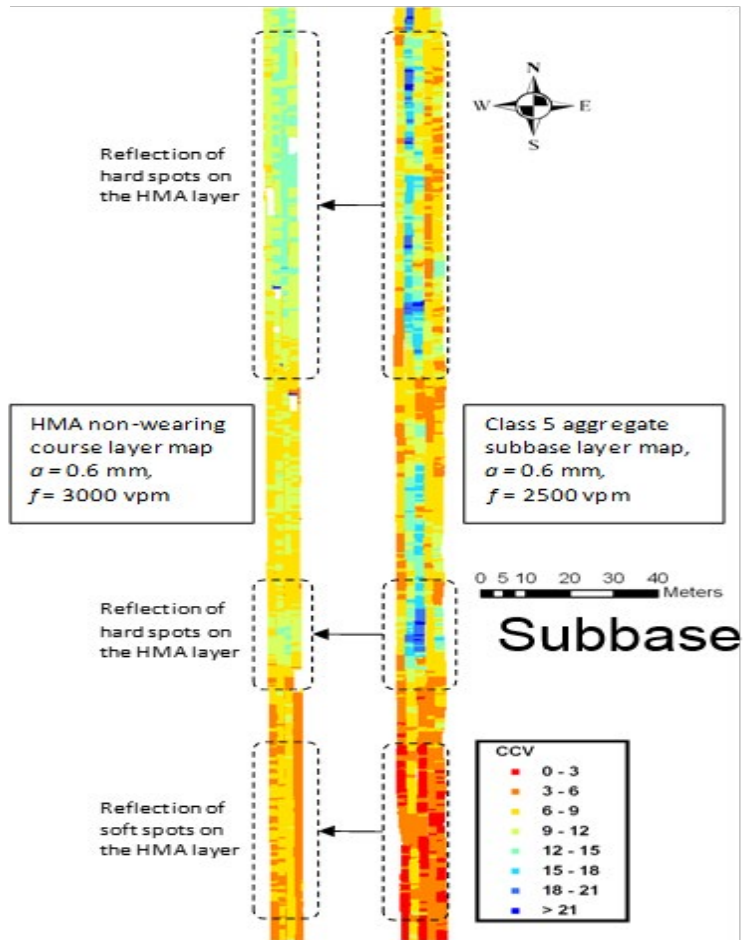


TPF IC MNDOT Project

TPF IC Project in MN



Sub base with hma overlay example (cont.)

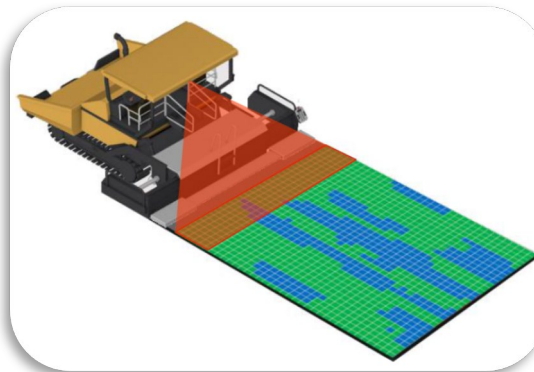


TPF IC Project in MN



What is Veta

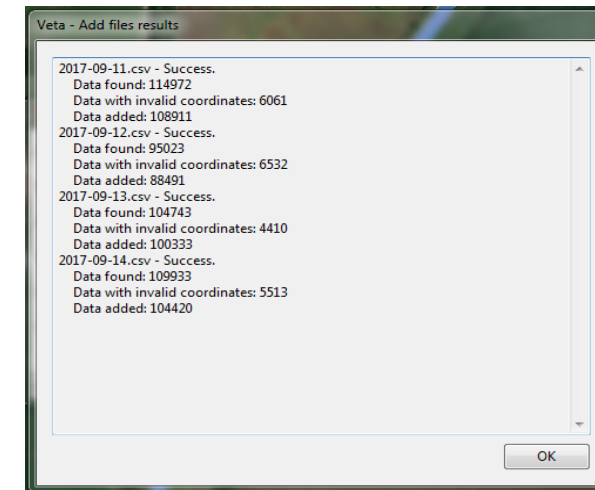
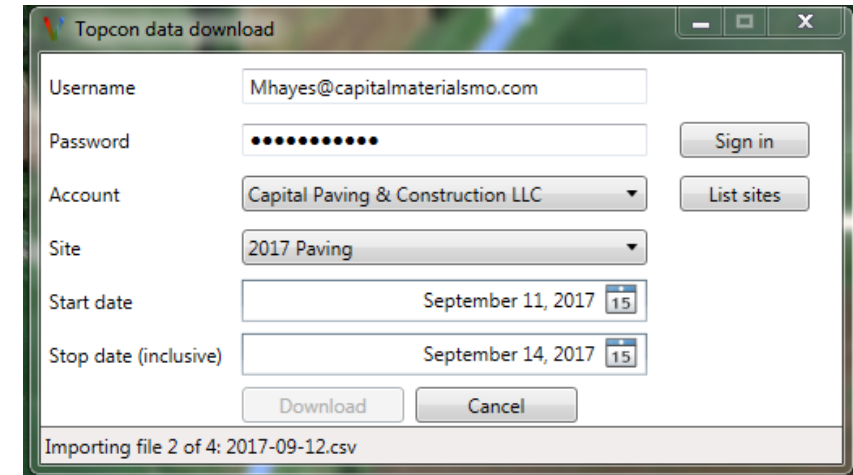
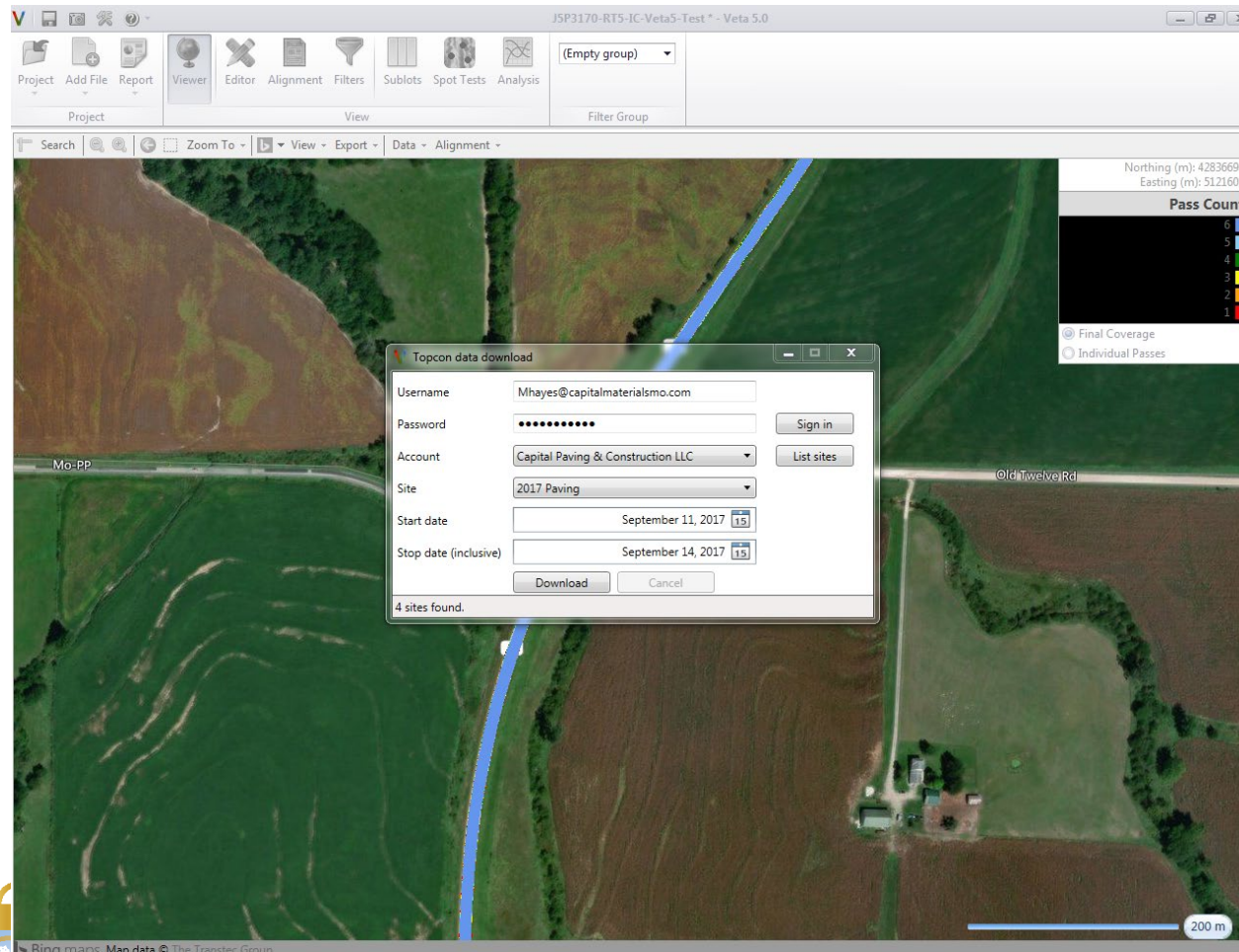
- Intelligent **C**onstruction **D**ata **M**anagement (ICDM) Software
- Funded by FHWA and TPF Pooled Fund Study
- Map-based Standard Post-Processing Tool for Geospatial Data
 - Intelligent **C**ompaction (IC)
 - **P**aver-**M**ounted **T**hermal **P**rofile (PMTP) or IR
 - **D**ielectric **P**rofile **S**ystems (e.g. Rolling Density Meter – RDM; Asphalt Pavement Scanner - APS)



Courtesy of Trantec Group



Download data from the cloud into Veta

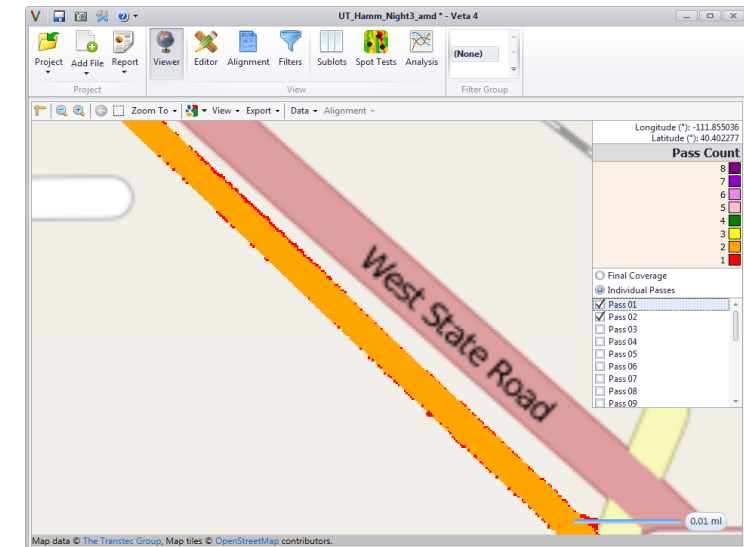
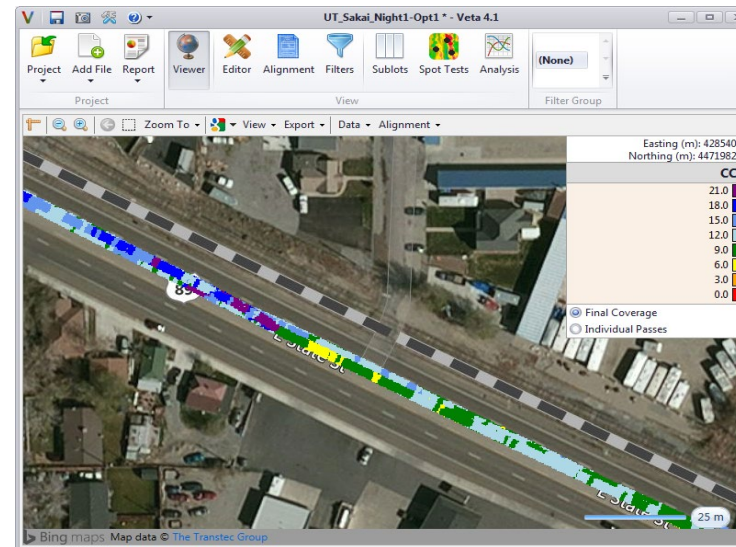
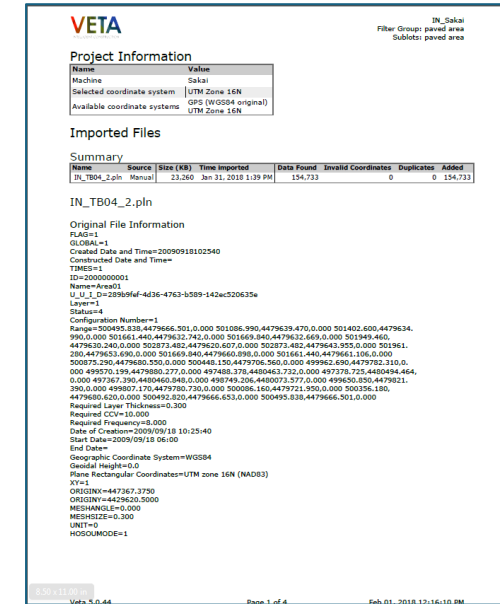
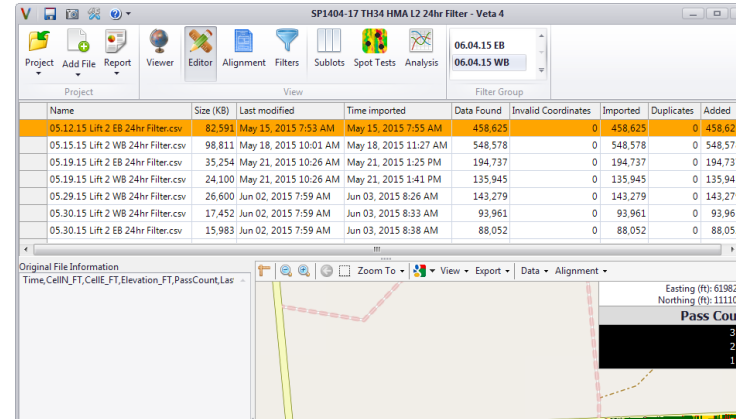


Courtesy of Trantec Group



Veta

- Analyze the data
- Generate Reports



Courtesy of the Transtec Group



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Connecticut Advanced Pavement Laboratory study on uniform compaction

- Results show that the use of the UC equipment did, in fact, significantly improve the uniformity of the pavement from a density perspective
- The quality and accuracy of the mapping software should be improved prior to using the equipment for locating areas of distress and deficiency
- Given the results of the reviewed literature, the stiffness values do not correlate well with pavement density

Validation of Uniform Compaction of Hot-Mix
Asphalt Pavements in Connecticut

Prepared by: Scott Zinke and James Mahoney
Report Number: CT-2288-F-16-1
June 30, 2016

FINAL REPORT

Project No. SPR 2288

Submitted to the Connecticut Department of Transportation

Connecticut Advanced Pavement Laboratory
Connecticut Transportation Institute
School of Engineering
University of Connecticut

Prepared for:
Connecticut Department of Transportation
Bureau of Policy and Planning
Roadway Information Systems Research Section

Michael Connors
Assistant Planning Director



Connecticut using intelligent compaction

- Connecticut has an IC job specification where they are not normally performing core tests
 - Ultra thin bonded overlays
 - Thin friction wear coarse
- To the right is a photo from one of these ultra thin bonded overlay jobs using IC equipped rollers
- 2 IC rollers rolling in line with a roller static rolling finishing the mat. The contractor was feeding the paver with material to keep it moving and they were getting on the mat with IC rollers at or above 290 degrees



Benefits of intelligent compaction

Increased Operator Awareness

- Real-time compaction, temperature, pass count data, early notice of problem areas, etc.

Improved Rolling Pattern

- Optimized pass coverage; easier night-time operation

Improved Density & Smoothness

- Better understanding of mat conditions

Lower Operating Costs

- Maximized machine utilization with better efficiency

Documentation

- 100% jobsite documentation
- Reduced in-field quality control measurement
- Potential real time data analysis



Additional DOT IC resources example

- Minnesota DOT has a special provision for Intelligent construction technologies (IC and PMTP)
- Resources provided:
 - Forms
 - Checklists
 - YouTube videos
 - Contacts

Quality management - intelligent construction technology methods

Quality management - intelligent construction technology (ICT) consists of using ICTs to monitor compaction and placement operations during grading, reclamation and asphalt paving operations. It includes technologies such as intelligent compaction (IC) and paver-mounted thermal profiling (PMTP).

[Inspector's Job Guide](#)

[Forms](#)

[Contractor Checklist](#)

[Report cards](#)

[Veta](#)



What can possibly advance IC further

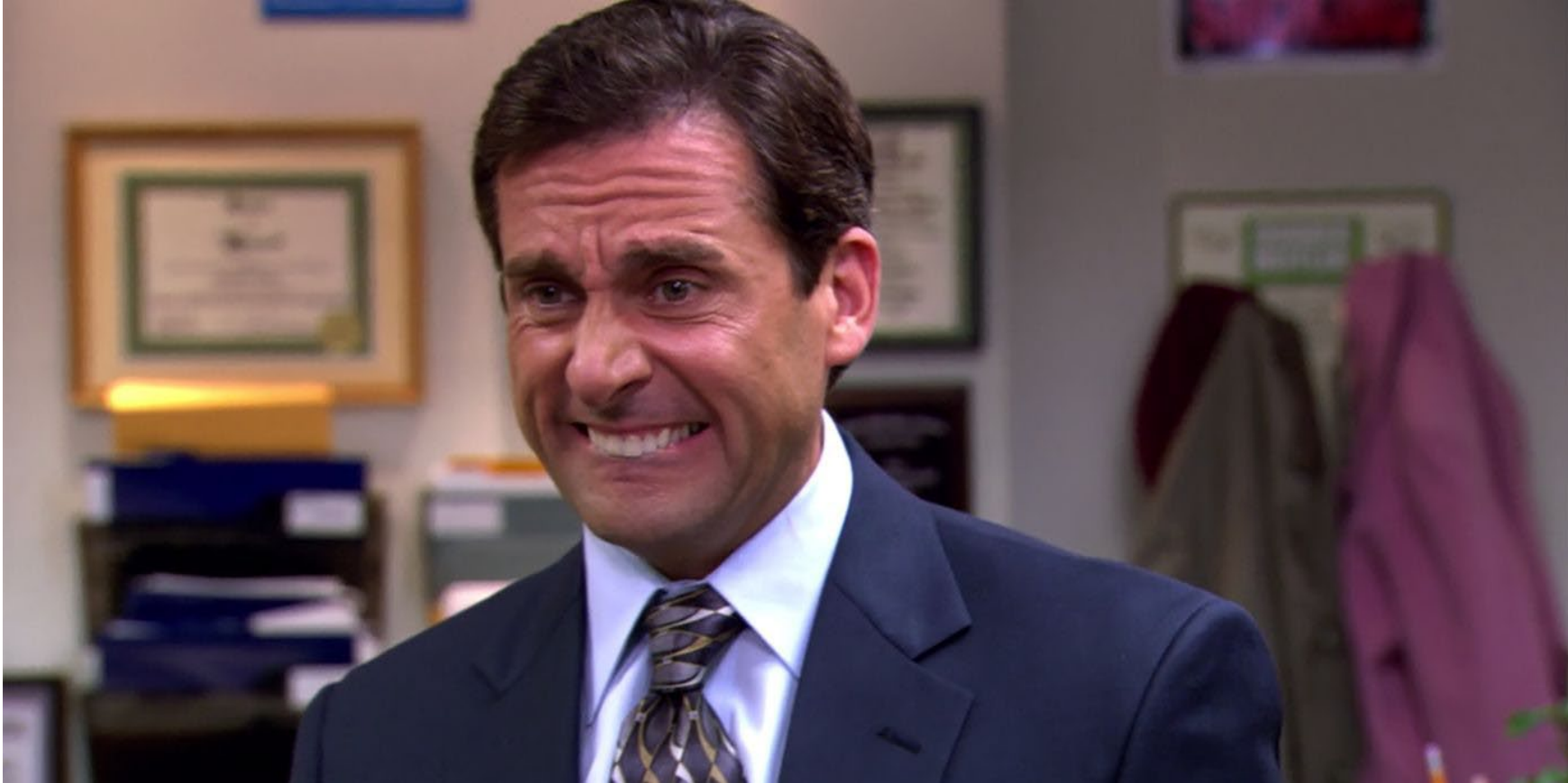
- Ground penetrating radar
- Drones
- Autonomous
- AI for analyzing data faster with more accuracy
- Machine learning



The ultimate goal to help make consistent quality easier and possibly limit the amount of conventional spot testing required



Questions



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