IC Implementation in US

ICDM / Veta WORKSHOP

April 16, 2018

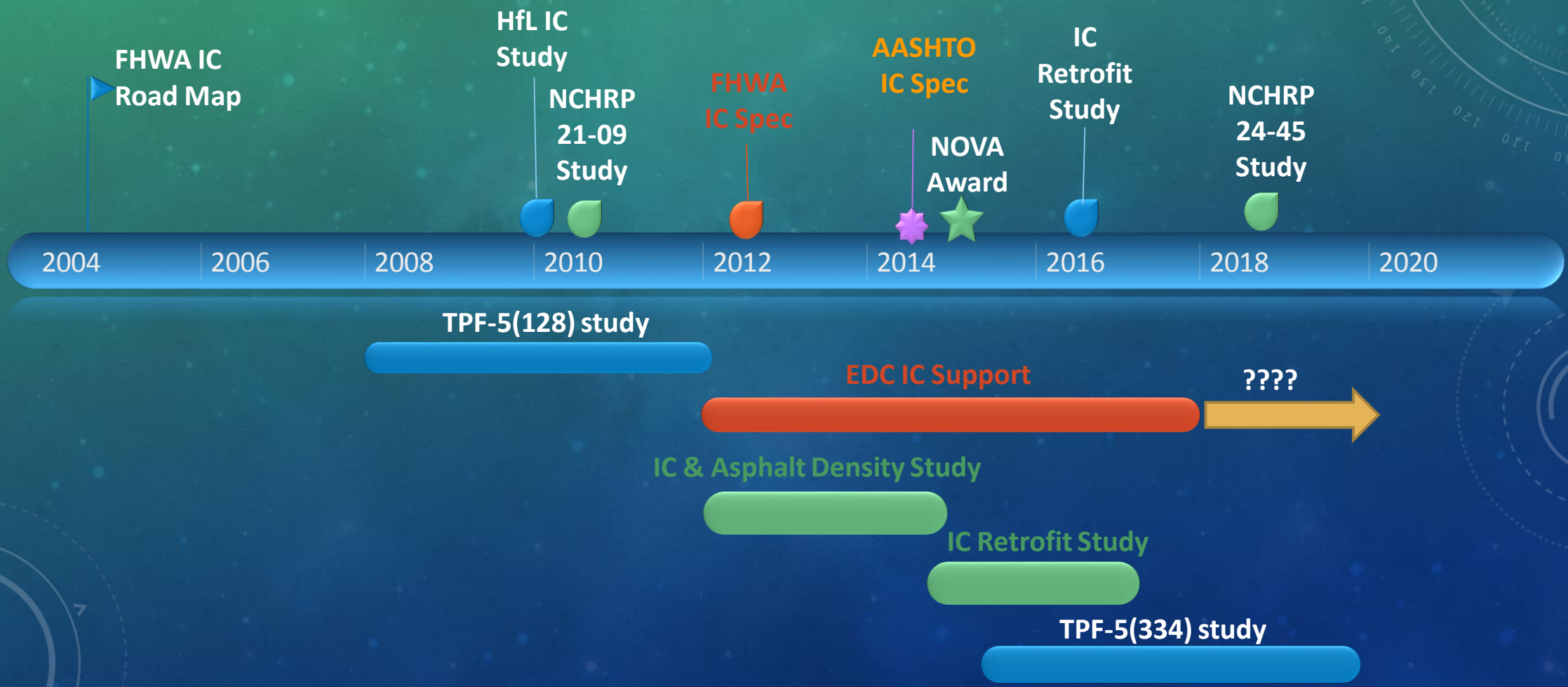
Ohio DOT Computer Lab

1606 W. Broad St., Columbus, OH 43223

Michael M. Arasteh
Pavement and Materials Engineer
FHWA, OTS, Baltimore Resource Center

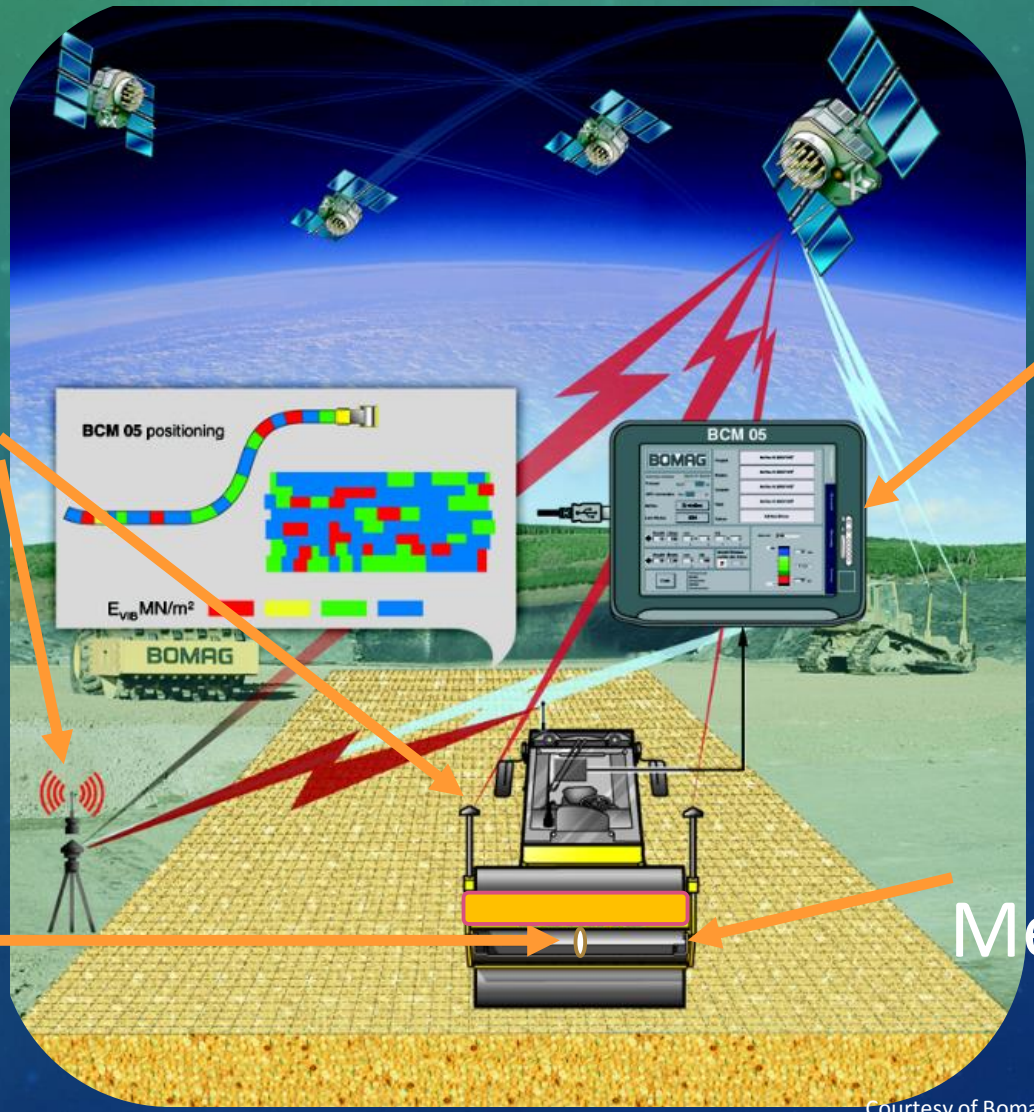
Importance of Compaction

A BRIEF HISTORY OF IC IN US



IC DEFINITION

Global Positioning System GPS

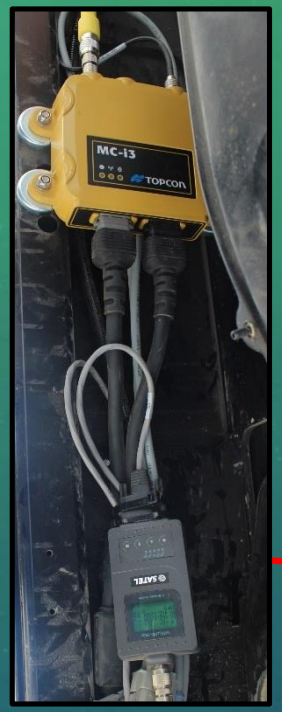


Onboard Report System

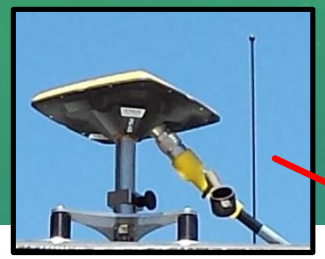
Temperature Sensors

Continuous Measurement System

Courtesy of Bomag



DQQ and Radio



GPS Antenna

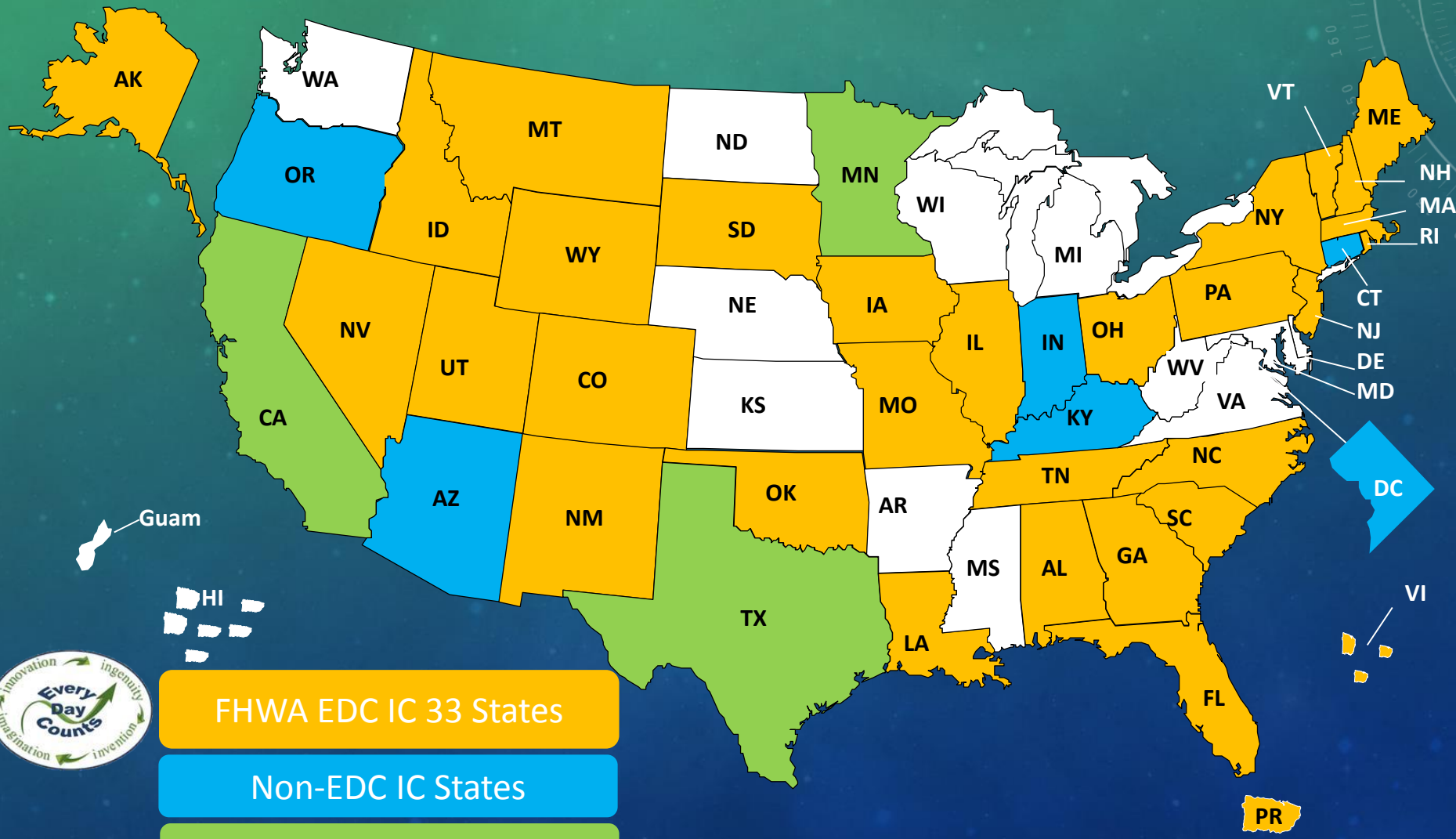
Onboard Display

Infrared Temperature Sensor

Accelerometer

Courtesy of Topcon/RDO

US IC NATIONAL IMPLEMENTATION



FHWA EDC IC 33 States

Non-EDC IC States

National Leaders

FHWA TECH BRIEF

TECHNICAL BRIEF

U.S. Department of Transportation
Federal Highway Administration

INTELLIGENT COMPACTION FOR PRE-MAPPING

TECHNICAL BRIEF

A double drum IC roller pre-mapping the Route 4, MN under the TPF-FHWA

DEFINITION OF PRE-MAPPING

Pre-mapping is defined as measuring base line stiffness of existing support materials using an IC roller. The IC measurement value (ICMV) system is used to estimate stiffness based on acceleration signals caused by roller drum rebound.

The pre-mapping ICMV and its measurement depths–typically 3 to 5 feet–depend on the roller type, weight, drum dimension, vibration frequency and amplitude, speed, direction of travel, and the stiffness of the mapped materials.

Candidate support materials for pre-mapping include granular full-depth reclamation materials or their equivalent. Typically, the IC machines used to pre-map existing pavement subsurface structural support are the same as those used to construct subsequent layers. In order to prevent "double jump" during pre-mapping, the IC machine settings (including speed, vibration frequency, and amplitude) must be carefully selected.

With IC, teams can identify soft spots during construction and make corrective actions. If the soft spot was caused by excess moisture in the soil, the materials can be disked and aired out before recompaction. If the soft spot occurred due to insufficient moisture, water can be added to the materials before recompaction.

BACKGROUND

Intelligent compaction (IC) is an equipment-based technology to i
vibratory rollers are equipped with a high precision global position
sensors, an accelerometer-based measurement system, and an on
used to improve compaction control for various pavement materia
subbase materials, and asphalt materials.

Pre-mapping originated as a research activity on the 2008 FHWA
team used a Sakai double-drum IC roller to measure the baseline s
materials at low vibration frequency and amplitude prior to the as
during paving, construction traffic caused the asphalt layer to fail p
the team later realized they could identify the soft spot in the pre-
industry now recognizes the value of pre-mapping; the data collect
team identify potential soft spots before pavement failure.

As of today, several state department of transportation (DOT) IC sp
option or requirement. This tech brief intends to provide the best a
pre-mapping in order to clarify its advantages and limitations.

TECHNICAL BRIEF

U.S. Department of Transportation
Federal Highway Administration

WHAT IS VETA?

Veta is a map-based software tool for viewing and analyzing geospatial data. Currently, Veta can import data from various IC machines and PMTP scanners to perform editing, filtering, spot test correlation, and statistical analysis as a post-processing tool.

One of the salient features of Veta is to view IC and PMTP data as color-coded maps on top of geographical road or aerial maps to facilitate quantitative interpretation.

Key examples are to evaluate consistency of rolling patterns, to identify cold blobs or streaks of temperature segregation, etc. Veta can allow users to select any specific passes to be viewed, including the last pass or final coverage.

The FHWA Veta Software was developed with funding from the FHWA, MnDOT, and the TPF-5(334) pooled fund study.

QUALITY ASSURANCE STATEMENT

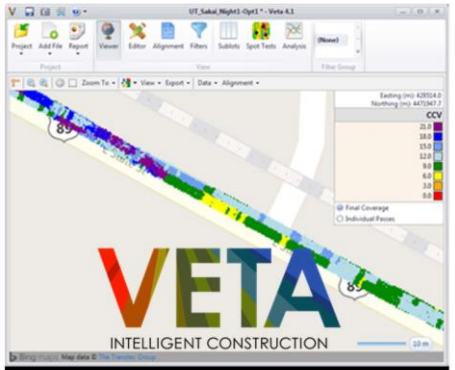
The Federal Highway Administration (FHWA) provides high-quality information to serve Government, industry, and the public in a manner that promotes public understanding. Standards and policies are used to ensure and maximize the quality, objectivity, utility, and integrity of its information. FHWA periodically reviews quality issues and adjusts its programs and processes to ensure continuous quality improvement.

COLOR-CODED IC MAPS

CONSISTENT VISUAL DATA INTERPRETATION

TECHNICAL BRIEF

SUMMER 2017



A screen shot of Veta – a map-based software tool for viewing and analyzing geospatial data.

BACKGROUND

Intelligent compaction (IC) and paver-mounted thermal profiler (PMTP) systems have been gaining popularity across the USA in the past 10 years to improve compaction quality and detect temperature segregation behind pavers. On IC and PMTP systems, color-coded maps from their onboard displays are used extensively for monitoring and visual inspection of collected field data and machine operation.

IC and PMTP systems gather a tremendous amount of complex geospatial data that poses challenges for data management, analysis, and reporting. These issues have become the main hurdles during implementation. To address the above issues, the Minnesota Department of Transportation and the FHWA have funded the development of the Veta software tool for IC and PMTP data viewing and analysis. Currently, the Transportation Pooled Fund (TPF) study "TPF-5(334) Enhancement to the Intelligent Construction Data Management System (Veta) and Implementation" is leading the effort for enhancing and maintaining Veta to facilitate the national IC/PMTP implementation.

This Tech Brief will provide guidelines for IC color-coded maps in order to ensure clear field inspection of IC maps and interpretation of IC results.

TECHNICAL BRIEF

U.S. Department of Transportation
Federal Highway Administration

ELEMENTS OF IC SPECIFICATIONS

The common elements of IC specifications include the following:

1. IC System Requirements
2. Quality Control Plan
3. Training
4. Field Operation Requirements
5. Data Requirements and Submission
6. Measures and Payment

QUALITY ASSURANCE STATEMENT

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SPECIFICATION FOR INTELLIGENT COMPACTION

A REVIEW ON NATIONAL AND STATE SPECIFICATIONS

TECHNICAL BRIEF

SUMMER 2017

FHWA IC and In-Place Asphalt Density Field Study in Ida

BACKGROUND

Adequate and uniform compaction of road materials, such as soils, aggregate bases, materials, is one of the most important requirements in roadway construction. It is i for high quality of compaction to ensure long-lasting performance. Intelligent Comp modern vibratory rollers equipped with an integrated measurement system, an onb system, Global Positioning System (GPS) based mapping, and optional feedback co implementation stage to help improve compaction quality control. The FHWA and national IC guide specifications. An increasing number of state agencies have also d specifications. This Tech Brief will provide a review on those specifications and reco enhancements.

Standard IC Data Viewing and Analysis using Veta

TECHNICAL BRIEF

U.S. Department of Transportation
Federal Highway Administration

WHAT IS ICMV?

Intelligent Compaction Measurement Value (ICMV) is a generic term for accelerometer-based measurement system instrumented on vibratory rollers as a key components of intelligent compaction systems. ICMV is based on the acceleration signals that represent the rebound force from the compacted materials to the roller drums. ICMV are in different forms of metrics with various levels of correlation to compacted material's mechanical and physical properties, such as stiffness, modulus, and density.

QUALITY ASSURANCE STATEMENT

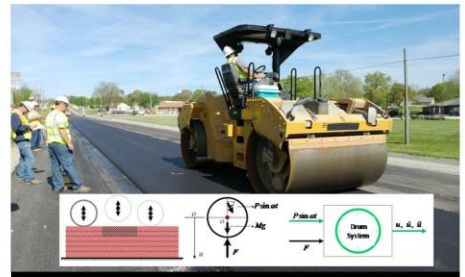
The Federal Highway Administration (FHWA) provides high-quality information to serve Government, industry, and the public in a manner that promotes public understanding. Standards and policies are used to ensure and maximize the quality, objectivity, utility, and integrity of its information. FHWA periodically reviews quality issues and adjusts its programs and processes to ensure continuous quality improvement.

INTELLIGENT COMPACTION MEASUREMENT VALUES (ICMV)

A ROAD MAP

TECHNICAL BRIEF

SUMMER 2017



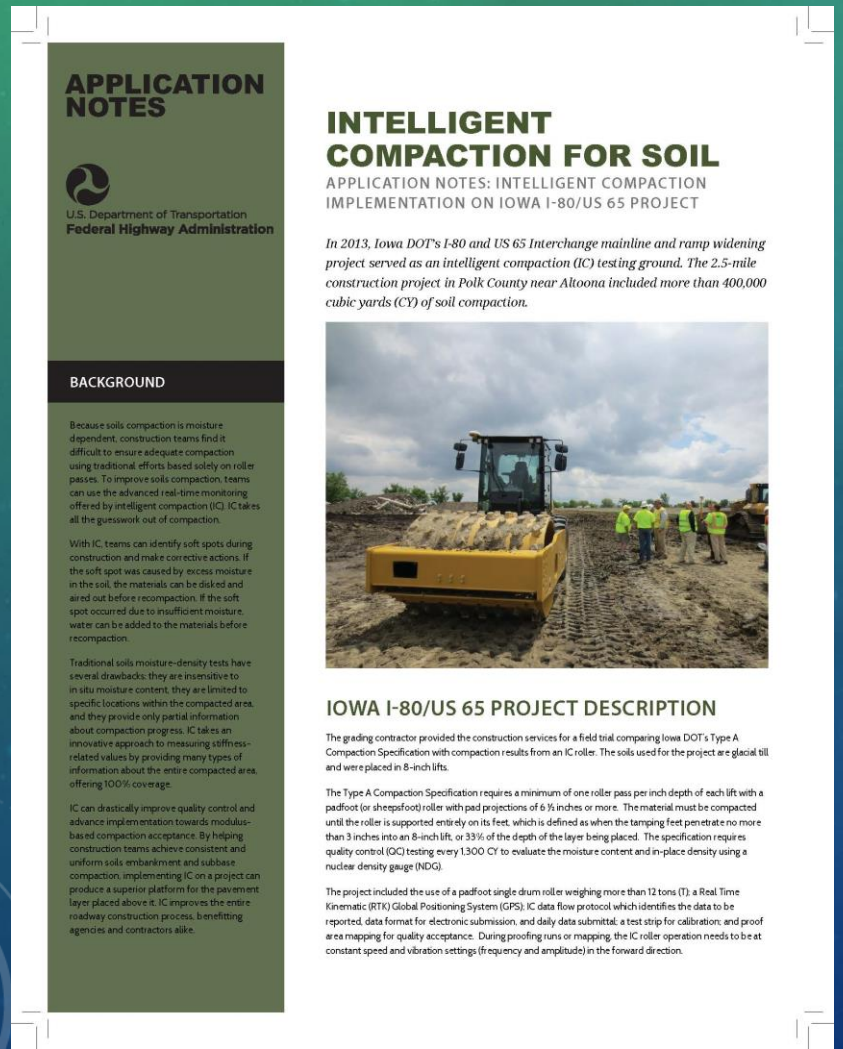
A Double IC Roller and A Diagram of ICMV Dynamic Model

BACKGROUND

Intelligent compaction (IC) is an equipment-based technology to improve quality control of compaction. IC vibratory rollers are equipped with a high precision global positioning system (GPS), infrared temperature sensors, an accelerometer-based measurement system, and an onboard color-coded display. IC is used to improve compaction control for various pavement materials including granular and clayey soils, subbase materials, and asphalt materials. The accelerometer-based measurement system is a core IC technology that was invented in the early 80's and is still evolving today.

Intelligent Compaction Measurement Value (ICMV) is a generic term for an accelerometer-based measurement system instrumented on vibratory rollers as a key part of IC systems. ICMV are in different forms of metrics with various levels of correlation to compacted material's mechanical and physical properties. The purpose of this document is to demystify ICMV by providing a comprehensive description on the mechanisms of ICMV and various levels of solutions as the road map for using ICMV towards compaction monitoring, control, and acceptance.

FHWA APPLICATION NOTES



APPLICATION NOTES

U.S. Department of Transportation
Federal Highway Administration

BACKGROUND

Because soils compaction is moisture dependent, construction teams find it difficult to ensure adequate compaction using traditional efforts based solely on roller passes. To improve soils compaction, teams can use the advanced real-time monitoring offered by intelligent compaction (IC). IC takes all the guesswork out of compaction.

With IC, teams can identify soft spots during construction and make corrective actions. If the soft spot was caused by excess moisture in the soil, the materials can be disked and aired out before recompaction. If the soft spot occurred due to insufficient moisture, water can be added to the materials before recompaction.

Traditional soils moisture-density tests have several drawbacks: they are insensitive to in situ moisture content, they are limited to specific locations within the compacted area, and they provide only partial information about compaction progress. IC takes an innovative approach to measuring stiffness-related values by providing many types of information about the entire compacted area, offering 100% coverage.

IC can drastically improve quality control and advance implementation towards modulus-based compaction acceptance. By helping construction teams achieve consistent and uniform soils embankment and subbase compaction, implementing IC on a project can produce a superior platform for the pavement layer placed above it. IC improves the entire roadway construction process, benefitting agencies and contractors alike.

INTELLIGENT COMPACTION FOR SOIL

APPLICATION NOTES: INTELLIGENT COMPACTION IMPLEMENTATION ON IOWA I-80/US 65 PROJECT

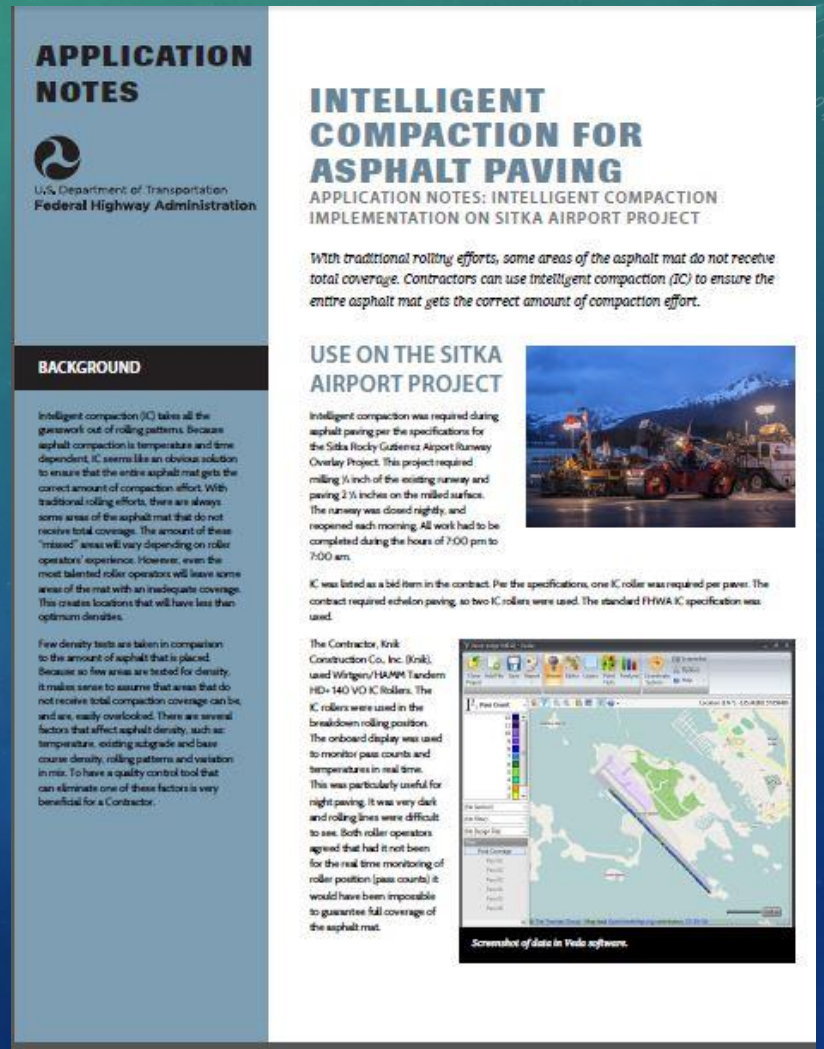
In 2013, Iowa DOT's I-80 and US 65 Interchange mainline and ramp widening project served as an intelligent compaction (IC) testing ground. The 2.5-mile construction project in Polk County near Altoona included more than 400,000 cubic yards (CY) of soil compaction.

IOWA I-80/US 65 PROJECT DESCRIPTION

The grading contractor provided the construction services for a field trial comparing Iowa DOT's Type A Compaction Specification with compaction results from an IC roller. The soils used for the project are glacial till and were placed in 8-inch lifts.

The Type A Compaction Specification requires a minimum of one roller pass per inch depth of each lift with a padfoot (or sheepsfoot) roller with pad projections of 6 ½ inches or more. The material must be compacted until the roller is supported entirely on its feet, which is defined as when the tamping feet penetrate no more than 3 inches into an 8-inch lift, or 33% of the depth of the layer being placed. The specification requires quality control (QC) testing every 1,300 CY to evaluate the moisture content and in-place density using a nuclear density gauge (NDG).

The project included the use of a padfoot single drum roller weighing more than 12 tons (T); a Real Time Kinematic (RTK) Global Positioning System (GPS); IC data flow protocol which identifies the data to be reported, data format for electronic submission, and daily data submittal; a test strip for calibration; and proof area mapping for quality acceptance. During proofing runs or mapping, the IC roller operation needs to be at constant speed and vibration settings (frequency and amplitude) in the forward direction.



APPLICATION NOTES

U.S. Department of Transportation
Federal Highway Administration

BACKGROUND

Intelligent compaction (IC) takes all the guesswork out of rolling patterns. Because asphalt compaction is temperature and time dependent, IC seems like an obvious solution to ensure that the entire asphalt mat gets the correct amount of compaction effort. With traditional rolling efforts, there are always some areas of the asphalt mat that do not receive total coverage. The amount of these "missed" areas will vary depending on roller operators' experience. However, even the most talented roller operators will leave some areas of the mat with an inadequate coverage. This creates locations that will have less than optimum densities.

Few density tests are taken in comparison to the amount of asphalt that is placed. Because so few areas are tested for density, it makes sense to assume that areas that do not receive total compaction coverage can be, and are, easily overlooked. There are several factors that affect asphalt density, such as: temperature, existing subgrade and base course density, rolling patterns and variation in mix. To have a quality control tool that can eliminate one of these factors is very beneficial for a Contractor.

INTELLIGENT COMPACTION FOR ASPHALT PAVING

APPLICATION NOTES: INTELLIGENT COMPACTION IMPLEMENTATION ON SITKA AIRPORT PROJECT

With traditional rolling efforts, some areas of the asphalt mat do not receive total coverage. Contractors can use intelligent compaction (IC) to ensure the entire asphalt mat gets the correct amount of compaction effort.

USE ON THE SITKA AIRPORT PROJECT

Intelligent compaction was required during asphalt paving per the specifications for the Sitka Rocky Gutierrez Airport Runway Overlay Project. This project required milling ½ inch of the existing runway and paving 2 ½ inches on the milled surface. The runway was closed nightly, and reopened each morning. All work had to be completed during the hours of 7:00 pm to 7:00 am.

IC was listed as a bid item in the contract. Per the specifications, one IC roller was required per paver. The contract required echelon paving, so two IC rollers were used. The standard FHWA IC specification was used.

The Contractor, Knik Construction Co., Inc. (Knik), used Wirtgen/HAMM Tandem HD+ 140 VO IC Rollers. The IC rollers were used in the breakdown rolling position. The onboard display was used to monitor pass counts and temperatures in real time. This was particularly useful for night paving, it was very dark and rolling lines were difficult to see. Both roller operators agreed that had it not been for the real time monitoring of roller position (pass counts) it would have been impossible to guarantee full coverage of the asphalt mat.

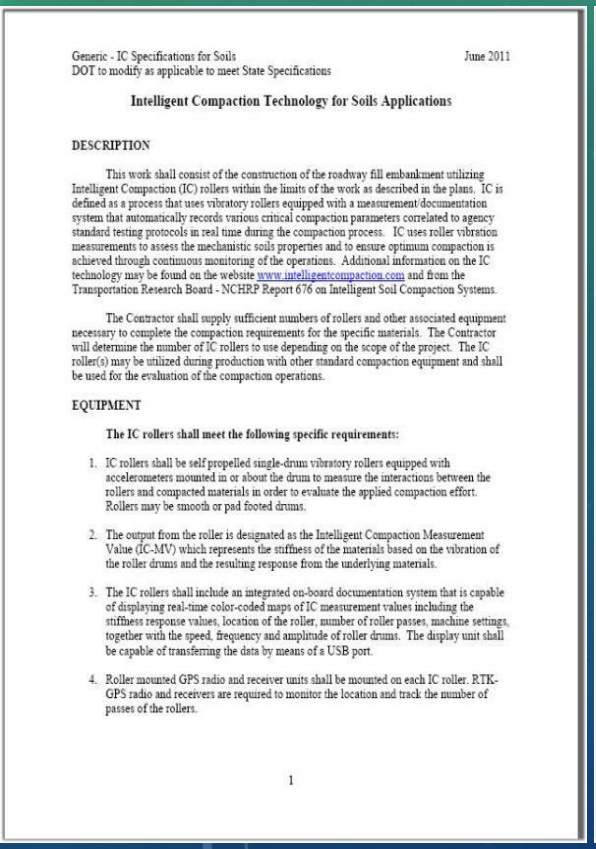
Screenshot of data in Veda software.

FHWA IC WORKSHOPS

FHWA IC EQUIPMENT DEMO

US NATIONAL IC GUIDE SPECS

FHWA Soils/Asphalt IC



Generic - IC Specifications for Soils
DOT to modify as applicable to meet State Specifications

June 2011

Intelligent Compaction Technology for Soils Applications

DESCRIPTION

This work shall consist of the construction of the roadway fill embankment utilizing Intelligent Compaction (IC) rollers within the limits of the work as described in the plans. IC is defined as a process that uses vibratory rollers equipped with a measurement/documentation system that automatically records various critical compaction parameters correlated to agency standard testing protocols in real time during the compaction process. IC uses roller vibration measurements to assess the mechanistic soils properties and to ensure optimum compaction is achieved through continuous monitoring of the operations. Additional information on the IC technology may be found on the website www.intelligentcompaction.com and from the Transportation Research Board - NCHRP Report 676 on Intelligent Soil Compaction Systems.

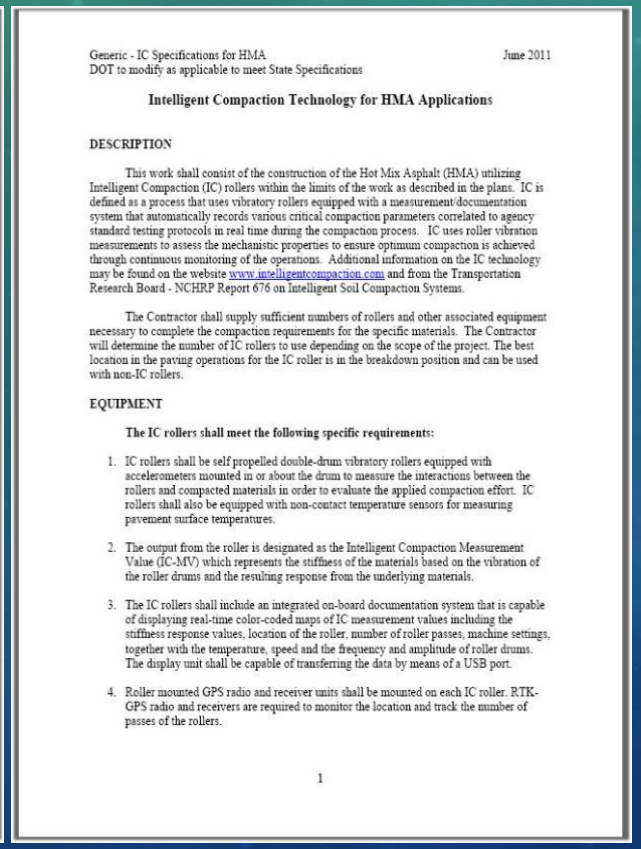
The Contractor shall supply sufficient numbers of rollers and other associated equipment necessary to complete the compaction requirements for the specific materials. The Contractor will determine the number of IC rollers to use depending on the scope of the project. The IC roller(s) may be utilized during production with other standard compaction equipment and shall be used for the evaluation of the compaction operations.

EQUIPMENT

The IC rollers shall meet the following specific requirements:

1. IC rollers shall be self propelled single-drum vibratory rollers equipped with accelerometers mounted in or about the drum to measure the interactions between the rollers and compacted materials in order to evaluate the applied compaction effort. Rollers may be smooth or pad footed drums.
2. The output from the roller is designated as the Intelligent Compaction Measurement Value (IC-MV) which represents the stiffness of the materials based on the vibration of the roller drums and the resulting response from the underlying materials.
3. The IC rollers shall include an integrated on-board documentation system that is capable of displaying real-time color-coded maps of IC measurement values including the stiffness response values, location of the roller, number of roller passes, machine settings, together with the speed, frequency and amplitude of roller drums. The display unit shall be capable of transferring the data by means of a USB port.
4. Roller mounted GPS radio and receiver units shall be mounted on each IC roller. RTK-GPS radio and receivers are required to monitor the location and track the number of passes of the rollers.

1



Generic - IC Specifications for HMA
DOT to modify as applicable to meet State Specifications

June 2011

Intelligent Compaction Technology for HMA Applications

DESCRIPTION

This work shall consist of the construction of the Hot Mix Asphalt (HMA) utilizing Intelligent Compaction (IC) rollers within the limits of the work as described in the plans. IC is defined as a process that uses vibratory rollers equipped with a measurement/documentation system that automatically records various critical compaction parameters correlated to agency standard testing protocols in real time during the compaction process. IC uses roller vibration measurements to assess the mechanistic properties to ensure optimum compaction is achieved through continuous monitoring of the operations. Additional information on the IC technology may be found on the website www.intelligentcompaction.com and from the Transportation Research Board - NCHRP Report 676 on Intelligent Soil Compaction Systems.

The Contractor shall supply sufficient numbers of rollers and other associated equipment necessary to complete the compaction requirements for the specific materials. The Contractor will determine the number of IC rollers to use depending on the scope of the project. The best location in the paving operations for the IC roller is in the breakdown position and can be used with non-IC rollers.

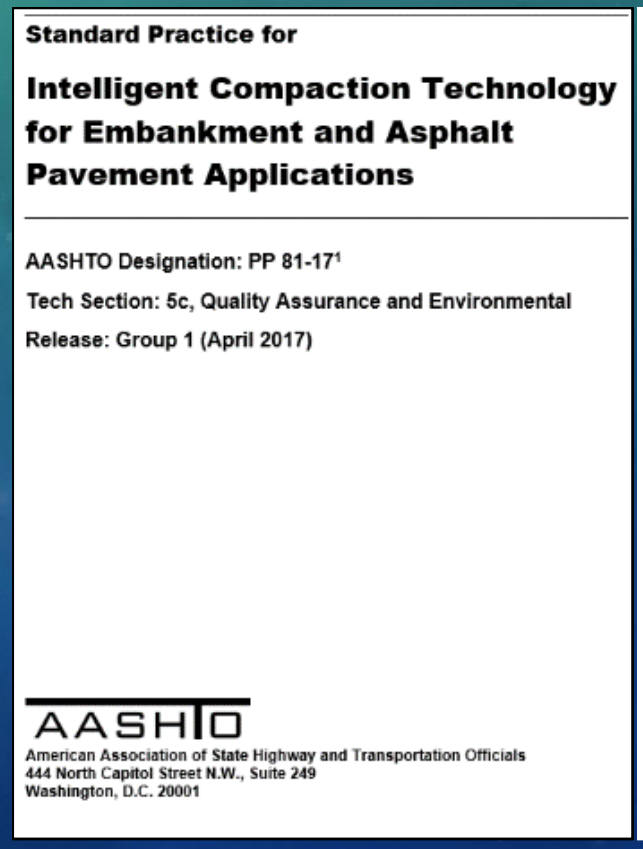
EQUIPMENT

The IC rollers shall meet the following specific requirements:

1. IC rollers shall be self propelled double-drum vibratory rollers equipped with accelerometers mounted in or about the drum to measure the interactions between the rollers and compacted materials in order to evaluate the applied compaction effort. IC rollers shall also be equipped with non-contact temperature sensors for measuring pavement surface temperatures.
2. The output from the roller is designated as the Intelligent Compaction Measurement Value (IC-MV) which represents the stiffness of the materials based on the vibration of the roller drums and the resulting response from the underlying materials.
3. The IC rollers shall include an integrated on-board documentation system that is capable of displaying real-time color-coded maps of IC measurement values including the stiffness response values, location of the roller, number of roller passes, machine settings, together with the temperature, speed and the frequency and amplitude of roller drums. The display unit shall be capable of transferring the data by means of a USB port.
4. Roller mounted GPS radio and receiver units shall be mounted on each IC roller. RTK-GPS radio and receivers are required to monitor the location and track the number of passes of the rollers.

1

AASHTO PP 81-17 & Data Spec.



Standard Practice for

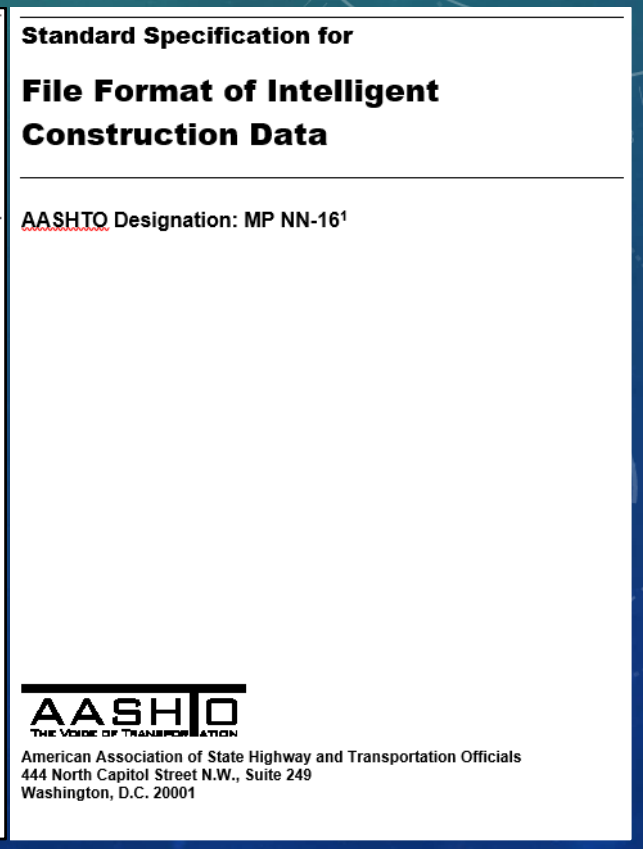
Intelligent Compaction Technology for Embankment and Asphalt Pavement Applications

AASHTO Designation: PP 81-17[1]

Tech Section: 5c, Quality Assurance and Environmental

Release: Group 1 (April 2017)

AASHTO
American Association of State Highway and Transportation Officials
444 North Capitol Street N.W., Suite 249
Washington, D.C. 20001



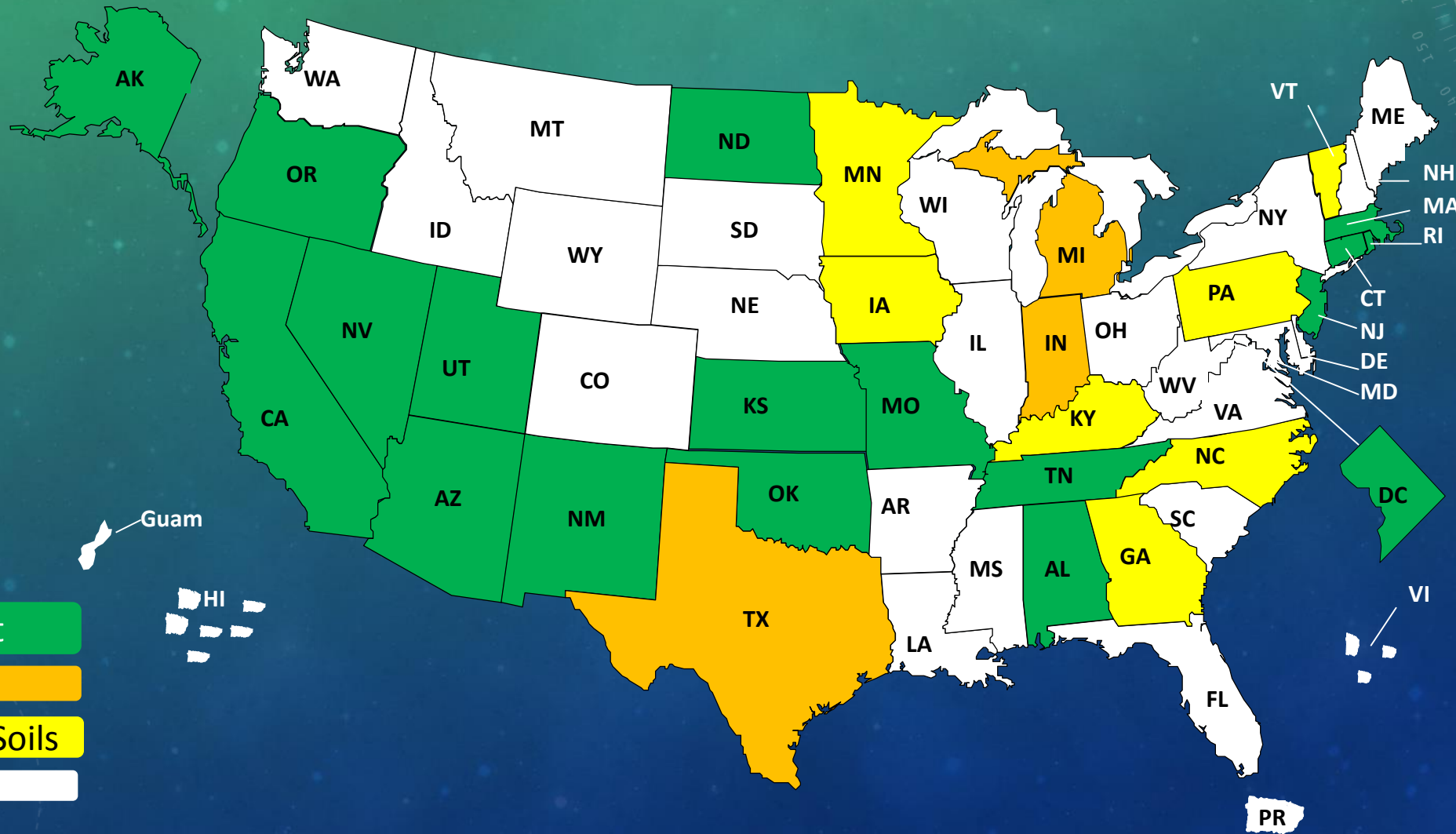
Standard Specification for

File Format of Intelligent Construction Data

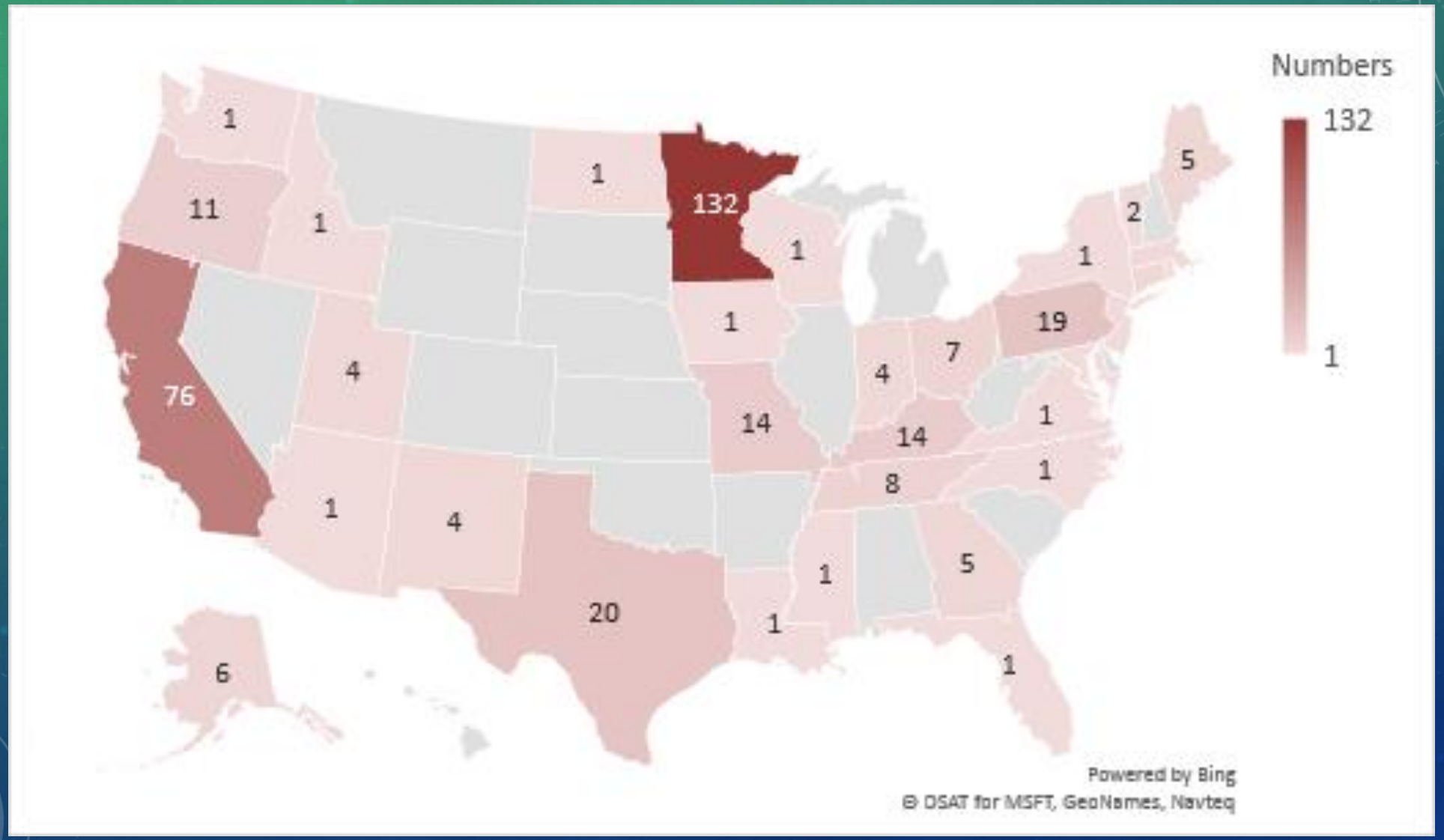
AASHTO Designation: MP NN-16[1]

AASHTO
THE VOICE OF TRANSPORTATION
American Association of State Highway and Transportation Officials
444 North Capitol Street N.W., Suite 249
Washington, D.C. 20001

US DOT IC SPECS



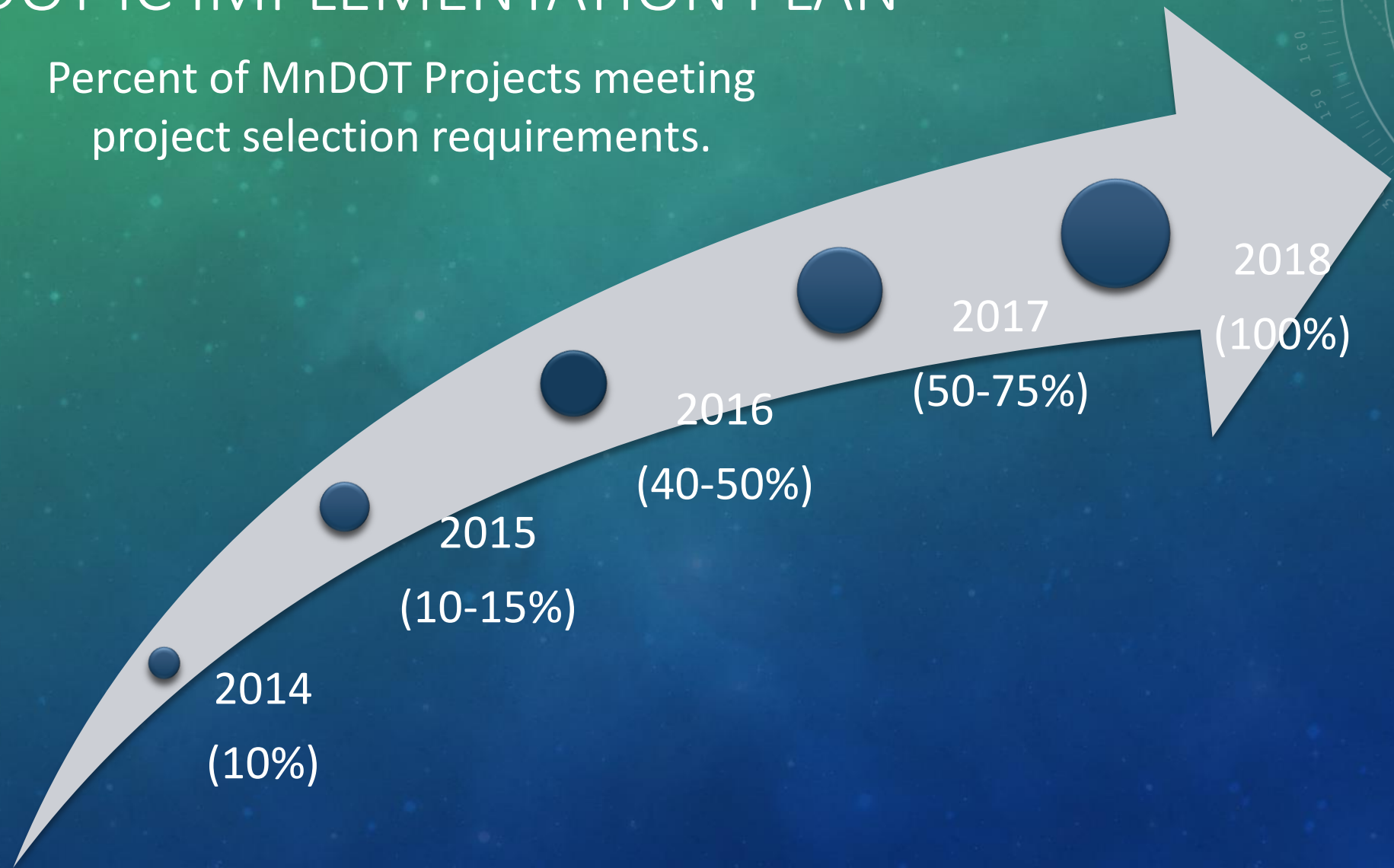
US DOT IC PROJECTS



Limited survey 2017

MNDOT IC IMPLEMENTATION PLAN

Percent of MnDOT Projects meeting project selection requirements.



IICTG – September 26-28, 2018
Minneapolis, MN

International
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CONSTRUCTION INNOVATION NOVA AWARD

TPF STUDY - IC DATA MANAGEMENT

TRANSPORTATION POOLED FUND PROGRAM

TPF-5(334)

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Home > Home > Search Solicitations and Studies > Study Detail View Study Detail View

Study Detail View

Enhancement to the Intelligent Construction Data Management System (Veta) and Implementation

General Information

Study Number: TPF-5(334)
Status: Cleared by FHWA
Contract/Other Number:
Lead Agency: Minnesota Department of Transportation
Last Updated: Sep 19, 2016
Contract Start Date:
Est. Completion Date:
Contract End Date:
Partners: x , AK , AL , CA , CT , GA , ME , MN , MO , MS , NY , OR , PA

Contact Information:

Lead Agency Contact(s):

Debra Fick
deb.fick@state.mn.us
Phone: 651-366-3759

FHWA Technical Liaison(s):

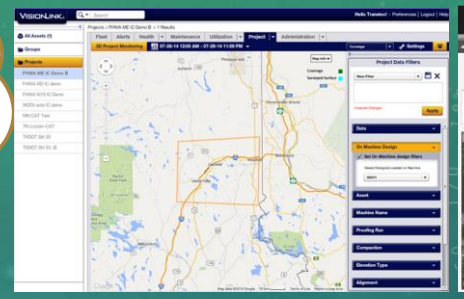
Richard Duval
Richard.Duval@dot.gov

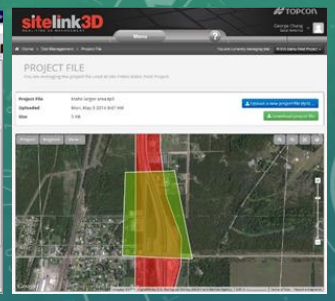
IC/TP data

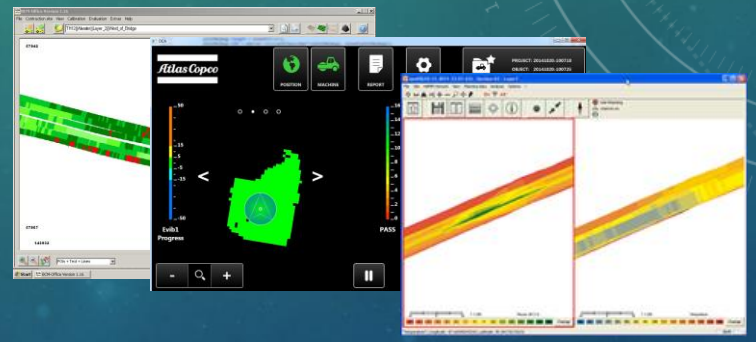
Vendor's cloud Server

Automatic

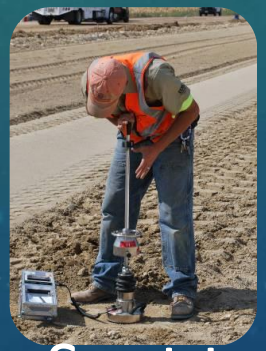
Manual USB





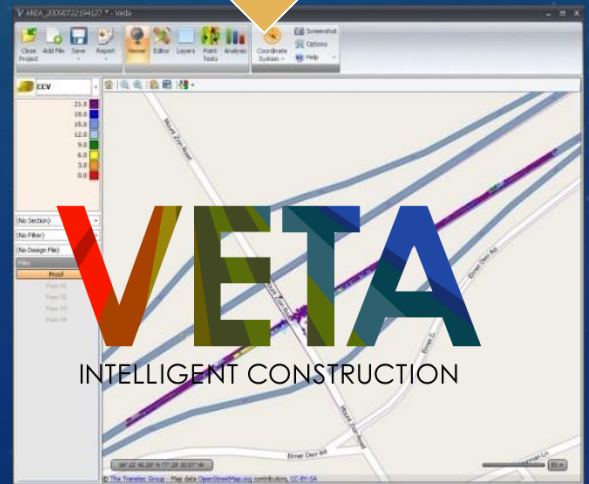


Data Export USB, email, etc.

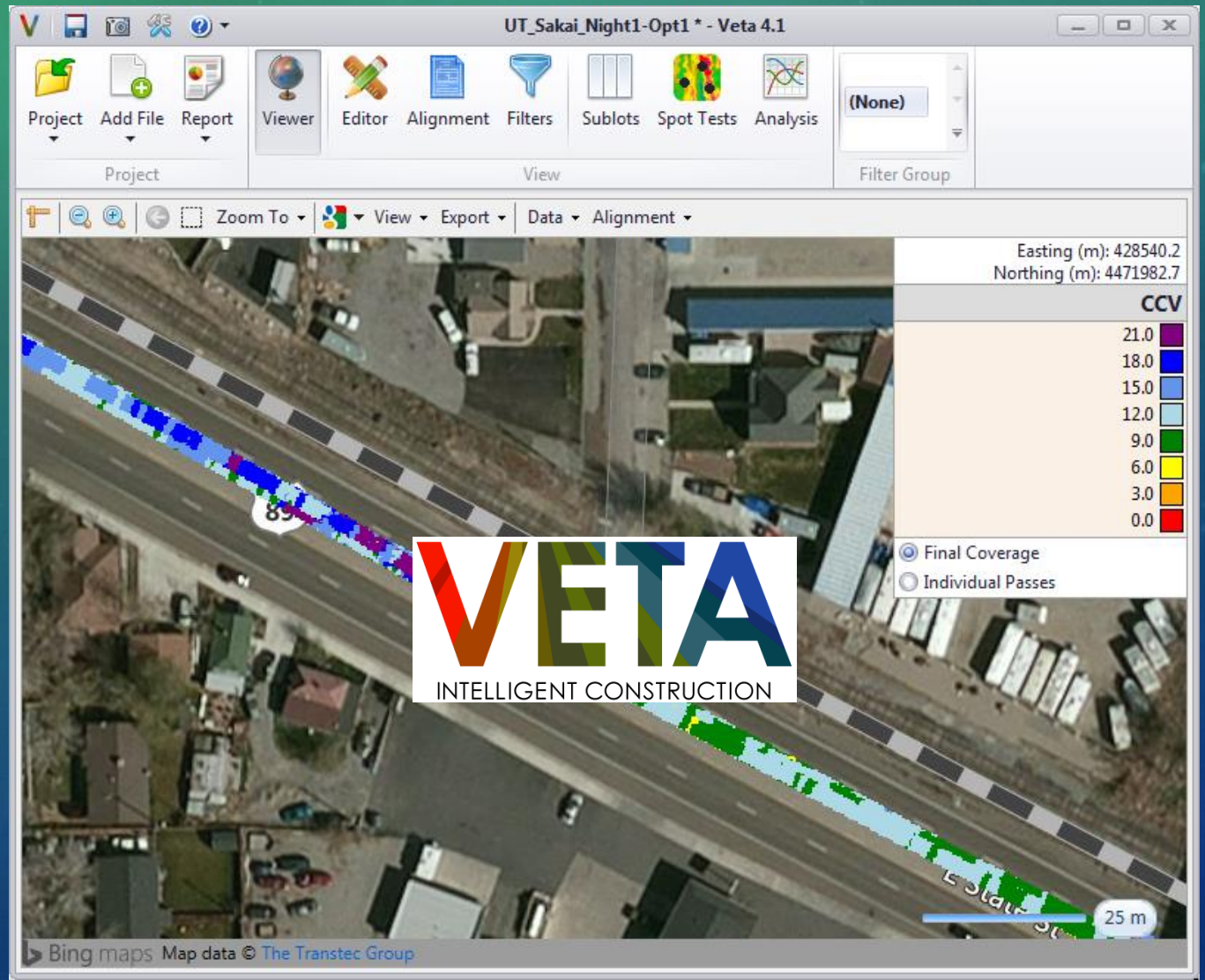


Spot test data

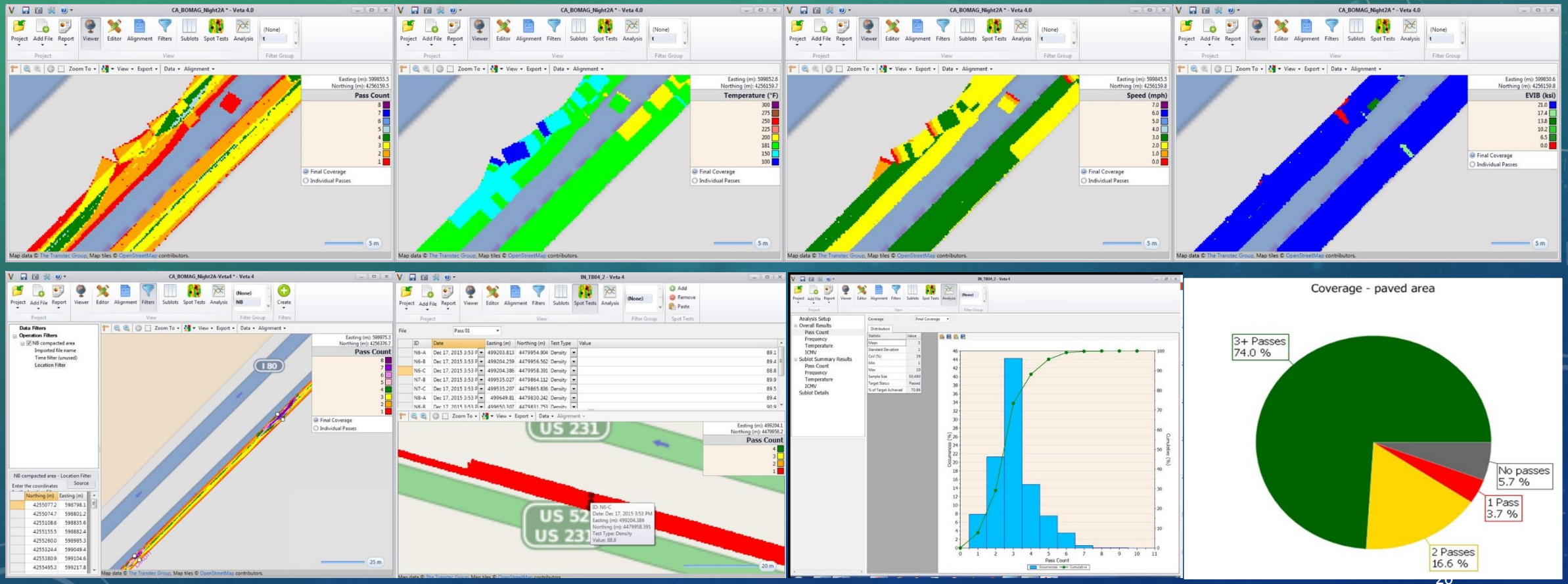
Manual



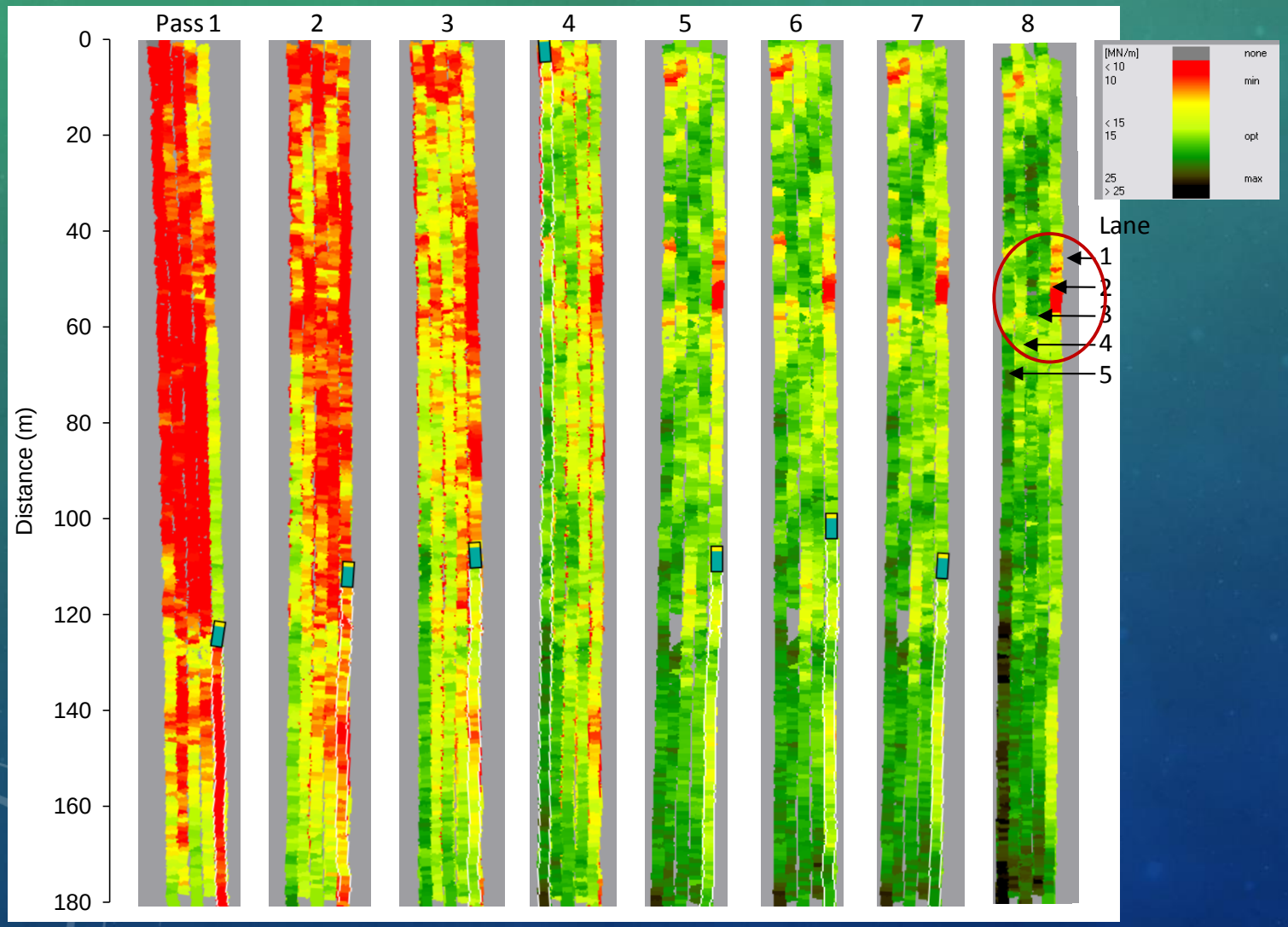
STANDARD IC SOFTWARE - VETA



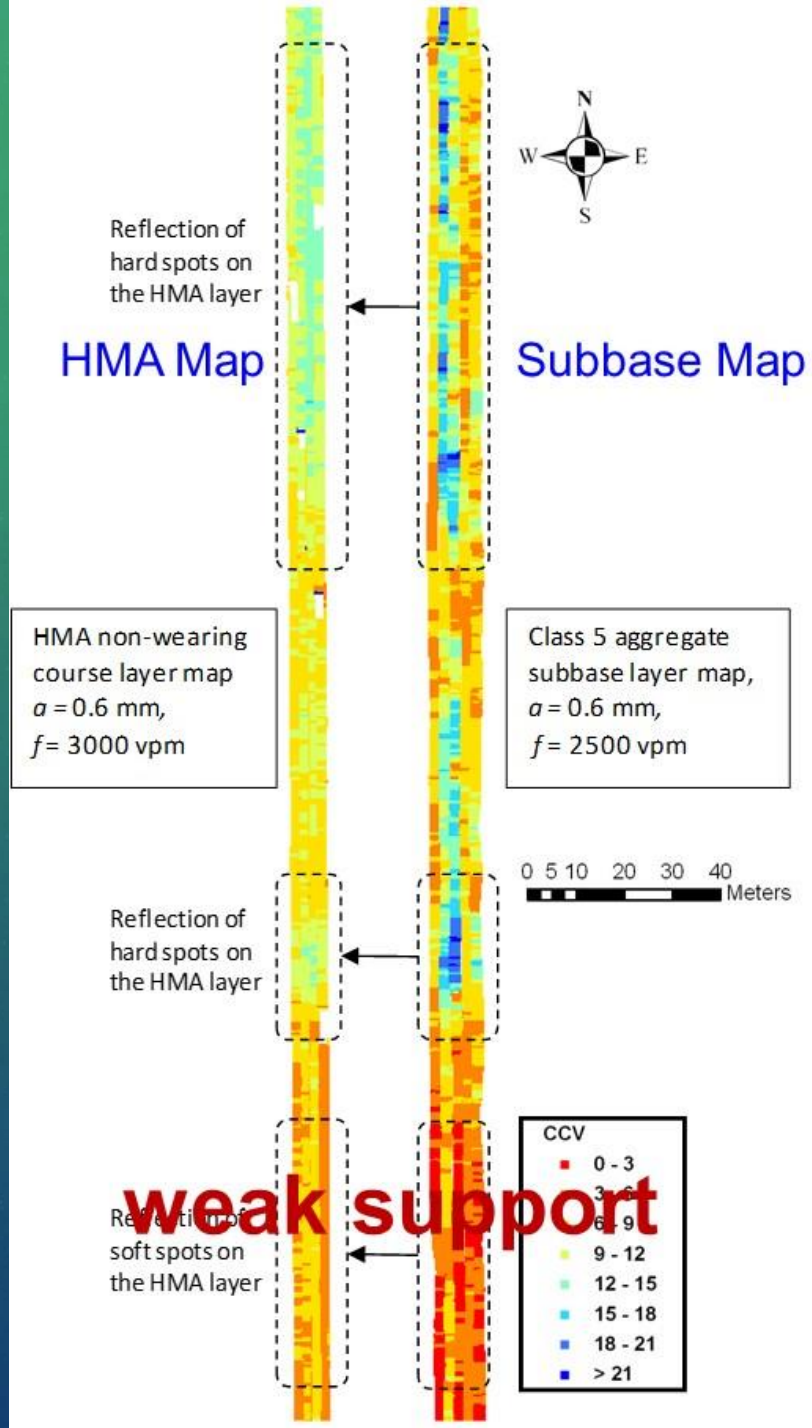
STANDARD VETA ANALYSIS



IDENTIFY WEAK AREAS



TPF IC project at TxDOT

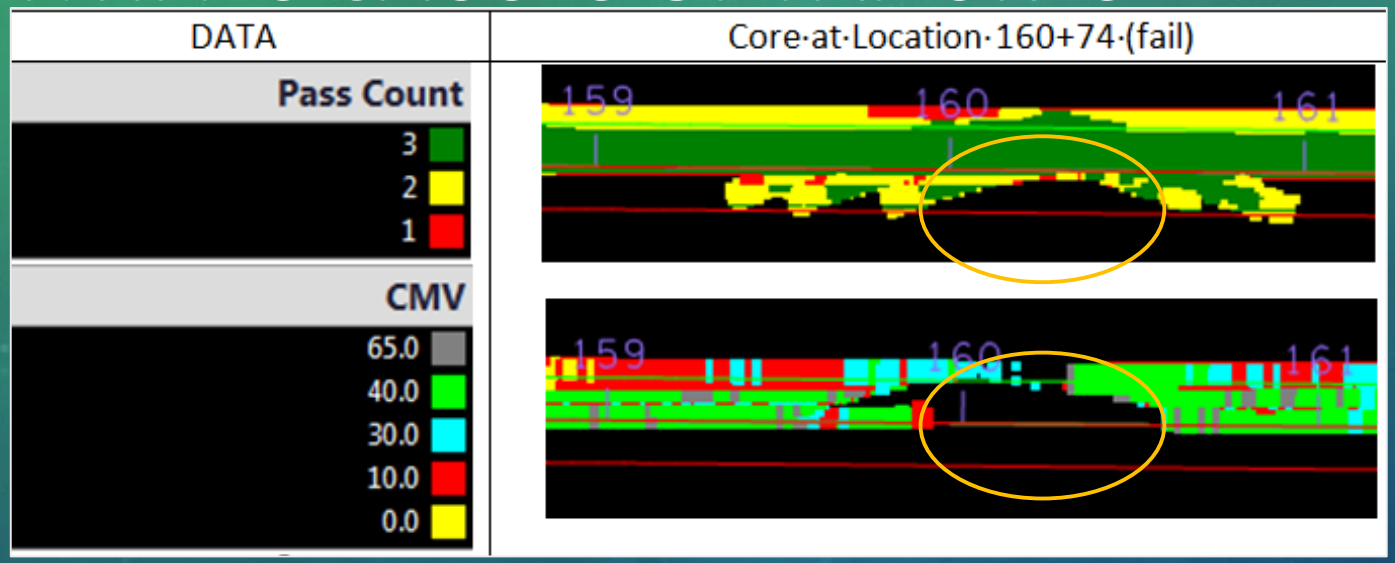


Pre-Mapping Subbase

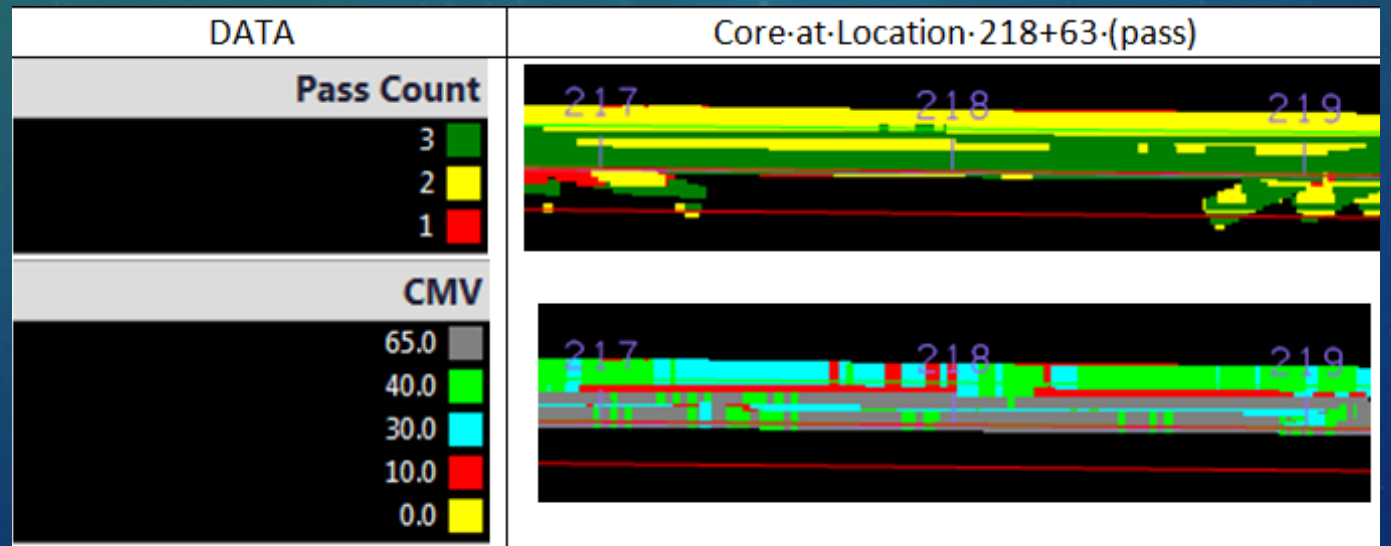
Asphalt Compaction

TPF IC MNDOT Project

IC IDENTIFIES CAUSES OF FAILURES



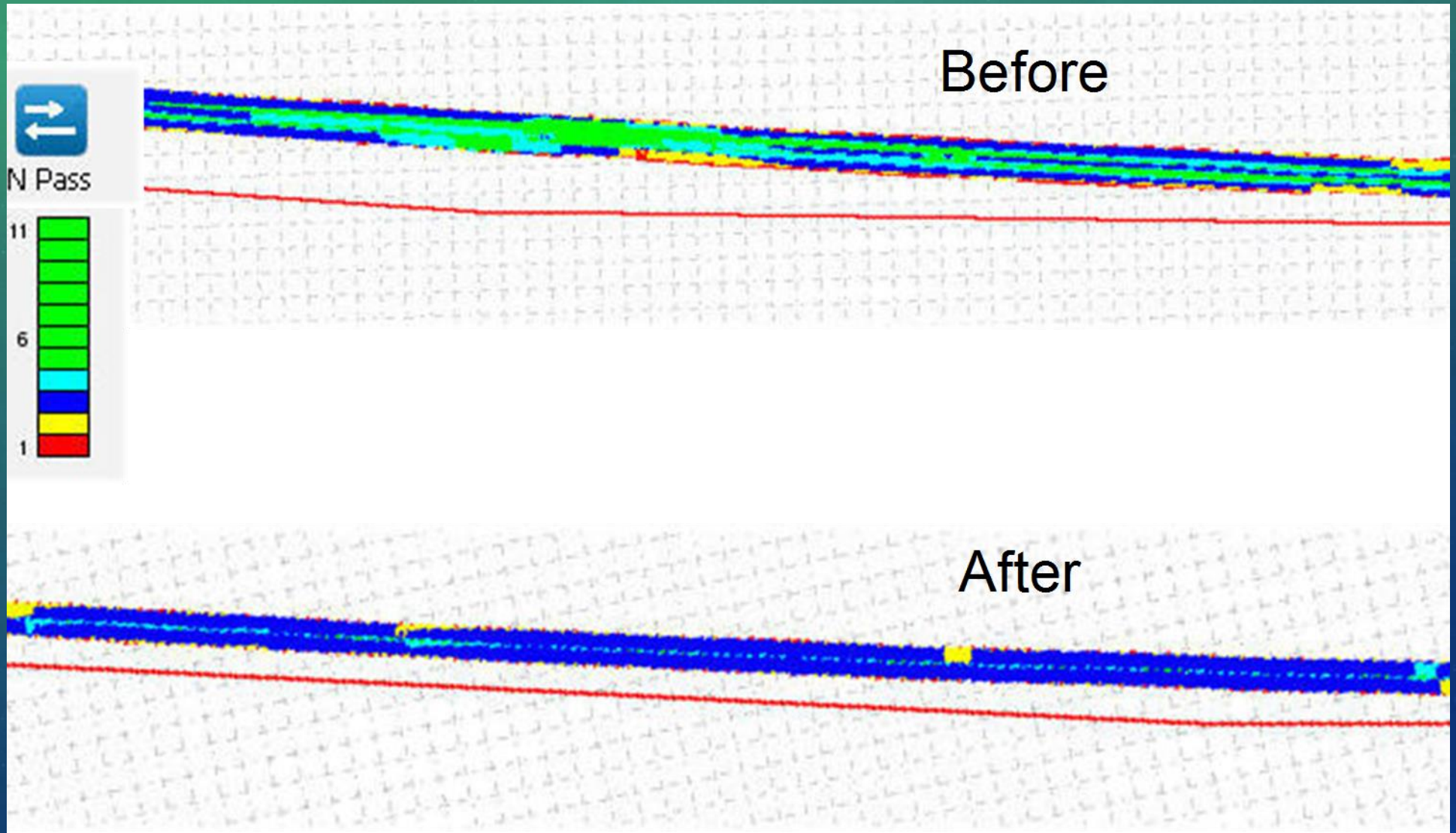
Failed density due to static passes



Passed density with vib passes Aided using IC

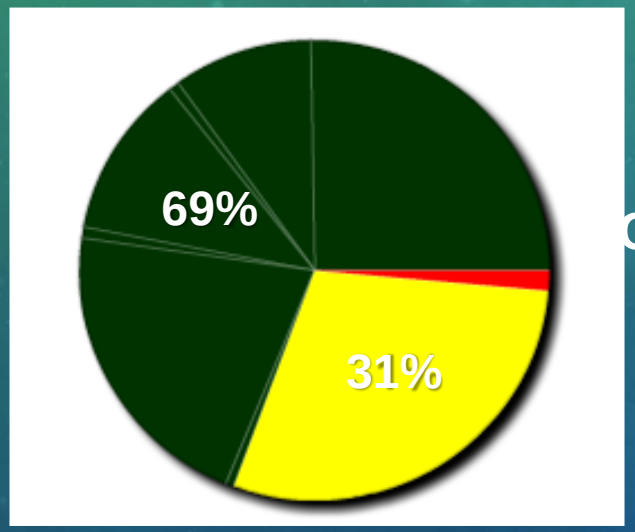
Courtesy of Rebecca Embacher, MnDOT

IC IMPROVE ROLLING PATTERNS



TPF IC Study – IN Site

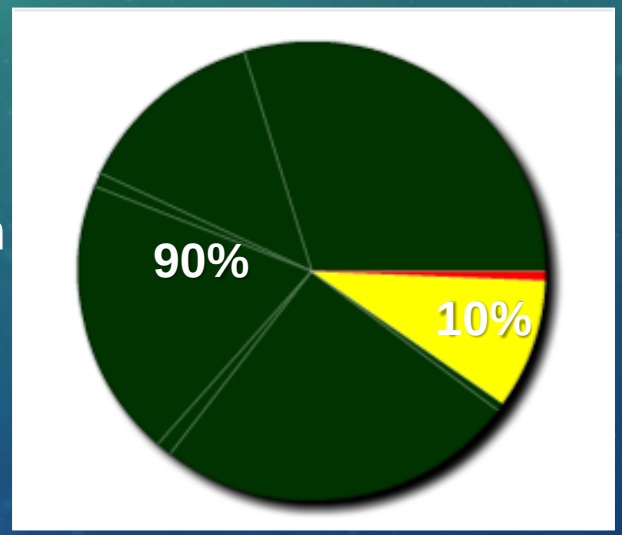
IC IMPROVES CONSISTENCY OF COVERAGE



Lift 1 without IC

< 3 Passes: 31 %
≥ 3 Passes: 69 %
COV : 71%

30% Increase in Compaction Efforts



Lift 2 with IC

< 3 Passes: 10 %
≥ 3 Passes: 90 %
COV: 55%

Courtesy of Rebecca Embacher, MnDOT

INTELLIGENTCOMPACTION.COM

THE FHWA TSSC WEBSITE

FHWA IC SUPPORT

- Technical Support Service Center (TSSC)
- http://www.IntelligentCompaction.com/Support/
- Phone: +1 (512) 659-1231
- Email: ICSupport@TheTranstecGroup.com
- 5 days a week (Monday - Friday)
- 8:00am to 5:00pm CST

U.S. Department of Transportation
Federal Highway Administration

AASHTO

SHRP2 Pavement Solutions
R06C Rapid Technologies to Enhance Quality Control of Asphalt Mixes Roadway Workshop

DESCRIPTION
The Federal Highway Administration (FHWA) and the American Association of State Highway and Transportation Officials (AASHTO) are pleased to offer your state DOT the opportunity to host a half-day workshop to highlight the use of paver mounted thermal profiler technology to improve the uniformity of asphalt concrete mixtures being placed in your state. The agenda for this workshop event will include project team presentations, agency and contractor perspectives highlighting the application, benefits, and lessons learned from several field demonstration projects. This outreach activity will disseminate information about the techniques and methods successfully used by State DOTs to increase the uniformity of asphalt concrete mats to extend the life of asphalt pavements.

TARGET AUDIENCE
The target audience is State Highway personnel, contractors, and others involved in the placement of asphalt concrete mixtures.

OUTCOMES
At the end of the event, workshop participants will be familiar with:

- The SHRP2 R06C research and products, including the paver mounted thermal profiler
- State DOT's construction practices
- The various R06C field demonstration projects built around the U.S.
- Contractor and Agency perspectives on the use of thermal profilers for QA and QC

Participants will also have the opportunity to participate in Q&A sessions with the project team and local officials.

Infrared Scanner: Paver Mounted Thermal Profiler Field Demonstration Project

INFORMATION
For more information about the Workshop and other R06C opportunities, please contact:

FHWA: Steve Cooper
Tel: 443-257-7145
Stephen.J.Cooper@dot.gov

AASHTO: Kate Kurgan
Tel: 202-624-3635
kkurgan@aashto.org

ARA: Harold Von Quintus
R06C Subject Matter Expert
Tel: 512-218-5088
hvonquintus@ara.com

ARA: Joe Reiter
R06C Project Team
Tel: 217-356-4500
jreiter@ara.com

SHRP2 SOLUTIONS
STRATEGIC HIGHWAY RESEARCH PROGRAM

Paver Mounted Thermal Profiler

Figure 5- Accumulated Number of State IC Projects in 2017
Courtesy of MnDOT
Figure 6- Numbers of MnDOT IC and PMTP Projects

Preliminary Agenda

Objectives of the R06C – Paver Mounted Thermal Profiler Workshop are to: (1) discuss the value added by using Thermal Profiler technology (what it is, why should you care, how this affects your bottom line, how do you get there), and (2) present a summary of the results from the field demonstration projects. The workshop is targeted both to contractor and agency personnel.

Time	Topic/Presentation	Speaker
8:00	**Registration**	
8:30	**Call to Order**	Host Agency
8:30 to 8:40	**Welcome and Introductions**	Host Agency, FHWA and AASHTO
8:40 to 9:15	**Introduction to Infrared Technology: What is it and Why is it Needed?**	ARA
9:15 to 9:45	**Equipment and Software Demonstration: Getting Real Time Information for Decision Making**	Equipment Supplier and/or ARA
9:45 to 10:30	**Field Demonstration Projects: What was Learned?** 1. Application and Use 2. Comparison of Differing Paving Operations/Equipment	ARA
10:30 to 11:45	Break	
10:45 to 11:15	**Perspectives of the IR Scanner as a QA Tool:** 1. Reducing Risks 2. Trouble Shooting Tool 3. Training	ARA
11:15 to 11:45	**Implementation:** 1. Lead Agency Strategies/Specifications 2. QC Plan and Paving Operation Management 3. Comments from Contractor and Agency Personnel	Contractor/Agency and/or ARA
11:45 to 12:10	**Products from Study:** 1. Primer for Paver Mounted Thermal Profiler 2. Case Study Reports from Demonstration Projects 3. Updated Specification: Improving the Mat. 4. Lessons Learned	ARA
12:10 to 12:30	**Questions/Answers and Closing Comments and Wrap-up**	Host Agency, FHWA, and ARA
12:30 to 1:00	**Ground Penetrating Radar Presentation and Demonstration (Optional)**	GSSI

GAPS - concerns, goals, potential solutions

1. Return on Investment
2. Train-the-trainer
3. Field Demo
4. Retrofit Optimization
5. Field data (Error recognition, solution protocol, and corrective action)
6. VETA implementation
7. Forensic Investigation

GAPS - concerns, goals, potential solutions

- Even though there are 29 States have implemented IC at different paces and levels, most DOTs still faced many obstacles when starting, or during the process of incorporating IC in to their specifications.
- The main obstacle is lack of understating of technology, technical support and training for IC, PMTP, and Veta.
- Veta is an essential software tool for managing IC data as required in the national standard AASHTO PP81, and several state DOT specifications.

GAPS - concerns, goals, potential solutions

- Examples of DOTs who have started implementation and in need of training are AL, AZ, CT, IL, KY, ME, MO, MS, ND, NY, OH, OK, TN.
- Example of DOTs who started the implementation of IC/PMTP, but have been stagnated are NM, PA, TX, VT.
- Caltrans, as a national leader, is challenged with the IC certification/qualification process and further implementation of the technology due to lack of training and technical support.

GAPS - concerns, goals, potential solutions

- The “GOAL” Under the leadership of FHWA, to implement IC similar to programs such as International Roughness Index (IRI) for smoother roads.

Ongoing Research

- NCHRP 24-45 “Evaluating Mechanical Properties of Earth Material During Intelligent Compaction.”
- Goal - To develop procedure(s) that measure mechanical properties of earth materials to facilitate adoption of IC technologies for field acceptance.
- OH, MI, MN, and IL Field Projects
- This project anticipated to be completed by end of year 2019.

Future Research

- “Evaluation of high levels of Intelligent Compaction Measurement Values (ICMV)” as per Road Map described in the FHWA ICMV Tech Brief.

- **GOAL** - To create a research product that will elevate the usage of IC with higher quality of measurements and lay the foundation for future IC certification, and the overall technology.

Future Research

- “Evaluation of Reference/Standard Intelligent Compaction Rollers.”

- **GOAL** - To identify and qualify reference and standard IC rollers capable of directional vibration for the use in future IC certification programs.

AASHTO IC related specifications

- AASHTO PP81-17: Standard Practice for Intelligent Compaction Technology for Embankment and Asphalt Pavement Applications.
- AASHTO MPNN-18: Standard Specification for File Format of Intelligent Construction Data. It is a draft standard as a companion standard to PP81-17 to provide a standard for data exchange and storage.
- AASHTO TCCC Courses

Future AASHTO Activities

- “Development and Implementation of IC Certification Programs and associated AASHTO specifications.”
  - IC equipment/system Certification
  - IC setup,
  - IC operators,
  - IC data management/analysis/report with Veta.
- “Train-the-Trainers Program.” An intensive program to equip DOT engineers with IC knowledge and hands-on experience in order for them to train their staff and contractors.

Thank you!

Michael Arasteh

Technical Committee member of IICT

PAVEMENT AND MATERIALS TEAM, FHWA

Michael.Arasteh@dot.gov