Implementation of Intelligent Compaction Technology for Improving Compaction Quality of Soil and Base in Texas

Training Module
Fundamental Concepts of IC Technology

History of Continuous Compaction Control (CCC)

- The first research on CCC was initiated in Swedish Highway Administration
- Geodynamik and Dynapac introduced the Compaction Meter Value (CMV)
- Bomag introduced the Omega value (a measure of compaction energy and time) and Terrameter
- 1974
- 1978 Geodynamik was founded to continue development of roller-mounted compaction meter
- 1978
- 1980 A number of roller manufacturers began offering CMV systems
- 1982
**History of Continuous Compaction Control (CCC)**

- **1999**: Ammann introduced the Soil Stiffness Parameter
- **1999**: Bomag introduced Vibration Modulus (a measure of dynamic soil stiffness)
- **2004**: Sakai introduced Compaction Control Value (CCV)
- **After 2004**: Improvement of IC systems and data analysis algorithms

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**Definition of Intelligent Compaction (IC)**

IC is a fast-developing technology for quality control:
- Ensure appropriate coverage
- Identify weak spots
- Improve uniformity of compacted layers

Proof rolling using IC rollers can
Implementation of Intelligent Compaction Technology for Improving Compaction Quality of Soil and Base in Texas

Student’s Manual

Features of Intelligent Compaction (IC)

- **Stiffness Map**
- **Pass Count Map**
- **Roller Speed Map**

Components of Intelligent Compaction

<table>
<thead>
<tr>
<th><strong>Roller Equipment</strong></th>
<th><strong>Vendor’s Software</strong></th>
<th><strong>Geospatial-Enabled Software</strong></th>
<th><strong>Trained Personnel</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Appropriate IC Sensor</td>
<td>Monitoring IC activity and converting IC data to appropriate formats in real-time</td>
<td>Collect data properly and analyze results</td>
<td>Collect data properly and interpret quality of work promptly</td>
</tr>
<tr>
<td>GPS Unit</td>
<td></td>
<td></td>
<td>Analyze results and report</td>
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<tr>
<td>Real-time Monitor</td>
<td></td>
<td></td>
<td>Locate areas with unacceptable performance</td>
</tr>
<tr>
<td>Data Storage/Transmission</td>
<td></td>
<td></td>
<td>Conduct Statistical Analysis to ensure QCA</td>
</tr>
</tbody>
</table>

Components of Intelligent Compaction

- In-Cab Control Box
- GPS System
- Vibration Sensor (Accelerometer)
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How the Intelligent Compaction works

Real-time On-Site Monitoring of the Compaction Process

Image Courtesy of Case-Amman

How the Intelligent Compaction works

Compaction Improvement

Image Courtesy of Case-Amman

How the Intelligent Compaction works

Dependent on Soil Characteristics

Good Compactibility

Poor Compactibility

Image Courtesy of Case-Amman
Benefits and Implications of Intelligent Compaction

Current Practice in Quality Control of Soil and Base

- Base Materials (Tex-113-E)
- Soil & Earthwork (Tex-114-E)

Field Compaction

- Compaction with Appropriate Roller

Laboratory MD Curve

Field Quality Control

- Nuclear Density Gauge (Density and/or Moisture)

Benefits and Implications of Intelligent Compaction

Challenges with Current Density-Based Practice

- Density is not used in Design
- Moisture Content is not Strictly Controlled
- Number of spot tests is very limited compared to project area

Benefits and Implications of Intelligent Compaction

Advantages of IC Technology

- Obtain 100% Coverage
- Avoid Over/Under Compaction
- Improve Uniformity

Current Practice in Quality Control of Soil and Base

- Base Materials (Tex-113-E)
- Soil & Earthwork (Tex-114-E)

Field Compaction

- Compaction with Appropriate Roller

Laboratory MD Curve

Field Quality Control

- Nuclear Density Gauge (Density and/or Moisture)
End of Training Module

Thank You
Implementation of Intelligent Compaction Technology for Improving Compaction Quality of Soil and Base in Texas

Training Module
IC Roller Retrofit Kit Installation and Calibration

Introduction to the IC retrofit kit
Components of IC roller kits
How the IC retrofit kit works
Features, benefits and limitations of IC retrofit kit
Comparison of retrofitted with OEM IC rollers
Operational steps for installation of retrofit kit
Calibration of retrofitted IC roller

Introduction to IC retrofit kit
Two Types of IC Rollers

Retrofit IC components are installed on an existing roller

OEM roller is equipped with Factory-Installed IC components

Original Equipment Manufacturer (OEM) IC Roller
Performance of retrofitted IC-Rollers are dependent on following factors:

- The roller model and make (physical configuration of drums)
- Position of vibration sensor (accelerometer) on the roller
- Accuracy of retrofit kit GPS system
- Availability of local coordinate system
- The units of Measurement Values (MVs) used by retrofit kit
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Introduction to IC retrofit kit
IC Retrofit (After Market) Kit is a more affordable Compaction Control System (CCS) as an alternative to OEM IC rollers.

It can be installed on almost any vibratory compactor.

Components of IC roller kit
- GPS Position information is used to display a pass count coverage map in real time on in-cab control box
- Vibration Sensor (Accelerometer) is used to collect roller vibration data for further stiffness estimation
- In-Cab Control Box provides visual understanding of pass count and compaction using a color-map

Image Courtesy of Trimble
Features of IC Retrofit Kit

Maps
- Pass Count
- Compaction Measurement Value (CMV)

Real-Time Info
- Speed
- Location (GPS)
- Amplitude
- Frequency

Reports
- Compaction Measurement Value (CMV)
- Coverage Map
- CMS Data
- Position (GPS) Data

Real-Time Visualization of Compaction Process
(providing color-coded maps of stiffness, pass count, roller speed and roller vibration)

In-field compaction reports

Avoiding over/under-compaction and identification of soft spots

Limitations of IC Retrofit Kit

GPS Precision
- Precision of positioning system should be adequate

Verification
- Location of roller needs regular verification

Measurement Values (MVs)
- Measurement Values are different for various roller manufacturers
Operational Steps for Installation of IC Retrofit Kit

Initial Set-Up of Retrofit IC Roller Kits

Initial Set-Up of Retrofit IC Roller Kits

Things to Remember

Employ a certified Technician to install IC Retrofit Kit is recommended.

Transfer IC data to Engineer and Inspector through:
- Local thumb drive
- Cloud Storage

Ensure the system is collecting appropriate data on a daily basis

Verification of data collection process after operation

Ensure the system is collecting appropriate data on a daily basis
End of Training Module B

Thank You
Implementation of Intelligent Compaction Technology for Improving Compaction Quality of Soil and Base in Texas

Training Module
GPS installation and calibration

- Introduction to application of Positioning Systems in IC technology
- Accuracy and precision of GPS for IC
- Base station and calibration of roller GPS
- Recommended configuration to avoid GPS data shift and offset

Introduction to Application of Positioning System in IC

Global Positioning System (GPS)
- space-based satellite navigation system

GPS provides location and time information
- in all weather conditions, anywhere ON or NEAR the Earth
- needs an unobstructed line of sight to four or more GPS satellites
Application of GPS in IC

- Recording geographical location of roller
- Vibration data is tied with location through GPS
- Compaction values at different locations within job site

Application of GPS in IC

- Provision of spatial distribution of stiffness
- Identification of soft areas (poorly compacted)
- Real-time compaction coverage map
- Availability of data for further geostatistical analysis

Accuracy and precision of GPS for IC

- Accuracy:
  - Reporting IC data at 1 ft interval
- Precision:
  - Sub-meter
- GNSS:
  - Global Navigation Satellite System
Coordination and Installation of Local Base Stations and Calibration of Roller GPS

- GPS Base Station
- Virtual Reference System (VRS)
- Stand Alone Station
- On a Bench Mark (BM)
- Monitoring with known Horizontal Position
- As a new BM with Post-Processing

Local Base Station

Coordination and Installation of Local Base Stations and Calibration of Roller GPS

- Communication between Roller GPS and Base Station
- Cellular Modem
- Radio Frequency
- Projection System and Datum of Base Station and Roller GPS
- UTM
- State Plane
- Geographic (NAD83 or WGS84)

Rover Fixed Signal with Base Station before Data Collection

Roller GPS Calibration

- Importance of Calibration
  - Avoiding Data Offset
  - Correcting shift in location

- Concerns
  - Roller GPS records the location of the center of the Drum

- Calibration Process
  - Record the left and right side of the drum with the geometrical rover
  - Calculate the coordinates of the Drum Center
  - Compare the calculated coordinates to the roller GPS readings
Roller GPS Calibration

- Performing a Dry Run to make sure that appropriate data is collected
- Checking calibration data both on the In-Cab Control box and vendor’s software
- Training operators to check collected calibration data before operation

Recommended configuration to avoid GPS data shift and offset

- Same configuration on GPS base station and roller GPS
- Survey job-site boundaries with an independent survey grade GPS
- Compare the independent GPS data with the Roller GPS
End of Training Module C

Thank You
**Implementation of Intelligent Compaction Technology for Improving Compaction Quality of Soil and Base in Texas**

**Training Module**

**IC Roller/Retrofit Kit Operation and Maintenance**

- Begin Working with IC Rollers/Retrofit Kits
- IC Roller/Retrofit Kit Operation
- IC Roller/Retrofit Kit Maintenance

**Begin Working with IC Rollers/Retrofit Kits**

- Proper Job Site
- Need for Compaction Control
- Availability of Equipment
- Improving Compaction Quality
- Improving Information Management
- Base
- Subgrade and Earthwork
- OEM IC Roller
- IC Retrofit Kit
IC Roller/Retrofit Kit Operation

**GPS System**
- Set-up the GPS antenna/receiver
- Select GPS base station (local or VRS)
- Check GPS connections

**IC Vibration Sensors**
- Check sensor location and installation
- Check sensor connections

**In-Cab Control Box**
- Set-up project details
- Upload GPS configuration file
- Setup display options

**Data Transfer**
- Local transfer (to thumb drive)
- Cloud storage

**Daily Check for Continuous Data Collection**
- Set-up Color-Coded Maps (e.g., Coverage Map, Number of Passes, IC Measurement Value (ICMV), Speed, Vibration Frequency and Amplitude)
In-Cab Control Box Set-Up, Machine Settings:

In-Cab Control Box Set-Up, Units:

In-Cab Control Box Set-Up, Machine Settings:
**IC Roller/Retrofit Kit Operation Flow Chart**

**Contractor’s Check List**
- Checking that the IC system works properly
- Avoid mounting the accelerometer on non-vibrating parts
- Creating a new data folder for each day of operation
- Check the GPS communication to avoid data shift
- Distinguishing pre-mapping and mapping processes
- Maintaining the required overlap between passes
- Monitoring the color map for overlapping and identification of soft spots
- Transferring the IC data to the storage (thumb drive or cloud) on a daily basis

**DOT Inspector Check List**
- Receive IC data from contractor/operator on a daily basis
- Check for possible data shift after each day of operation
- Check IC data quality and quantity for acceptance
- Transferring IC data to database
- Check for possible zero and negative numbers in IC data

**IC Roller/Retrofit Kit Maintenance**

**Daily Maintenance Check-List**
- Check whether Vibration Sensor working properly
- Check whether GPS antenna and receiver are functioning
- Check IC Settings of In-Cab Control Box
- Perform a Dry Run to Ensure Proper Data Collection
- Report any Malfunction to Engineer before Starting the Operation
IC Roller/Retrofit Kit Maintenance

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End of Training Module D

Thank You
Implementation of Intelligent Compaction Technology for Improving Compaction Quality of Soil and Base in Texas

Training Module E
IC Data Analysis and Report

- Evaluating and interpreting different Measurement Values (MVs)
- Correlation between different Measurement Values
- Correlation analyses between MV and in-situ spot test data
- Geostatistical and geospatial applications in IC technology
- Introduction to IC data analysis, interpretation and reporting tools
- Using color-coded map to monitor compaction
- IC data formats and deployment options
- Quality Control (QC) with IC technology

Evaluating and interpreting different Measurement Values (MVs)

<table>
<thead>
<tr>
<th>Commercially Available Roller MVs</th>
<th>DYNAPAC</th>
<th>SAKAI</th>
<th>HAMM</th>
<th>CASE-AMMANN</th>
<th>BOMAG</th>
<th>CAT</th>
<th>VOLVO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compaction Meter Value (CMV)</td>
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<td>Compaction Control Value (CCV)</td>
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<td>HAMM Measurement Value (HMV)</td>
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<tr>
<td>Stiffness (Ks)</td>
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<tr>
<td>Vibration Modules (k)</td>
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<tr>
<td>Machine Drive Force (MDF)</td>
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</tbody>
</table>
**Evaluating and interpreting different Measurement Values (MVs)**

**Parameters Affecting MV**

- Frequency
- Amplitude
- Speed
- MV

---

**Evaluating and interpreting different Measurement Values (MVs)**

**Concept of Compaction Amplitude and Frequency**

*Image courtesy of VOLVO*

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**Evaluating and interpreting different Measurement Values (MVs)**

*Image courtesy of VOLVO*
Evaluating and interpreting different Measurement Values (MVs)

**Machine Drive Power**

Soft ground condition = hard to push

Firm ground condition = easy to push

*Courtesy of CAT*

---

Evaluating and interpreting different Measurement Values (MVs)

**CAT Machine Drive Power (MDP)**

A new compaction measurement technology, only from Caterpillar.

*Courtesy of CAT*

---

Evaluating and interpreting different Measurement Values (MVs)

**Interpretation of MDP**

\[
MDP = P_g - W/V \left( \frac{\sin \theta + a'}{g} \right) - (mV + b)
\]

- \(P_g\) = Gross power needed to move the machine (kJ/s)
- \(W\) = Roller Weight (kN)
- \(a'\) = Machine Acceleration (m/s²)
- \(\theta\) = Slope angle (roller pitch)
- \(V\) = Roller Velocity (m/s)
- \(m\) (kJ/m) and \(b\) (kJ/s) = Machine internal loss coefficients

---
Interpretation of CMV

\[ \text{CMV} = 300 \times \frac{2F}{F} \]

2F = Acceleration of the first harmonic of the vibration
F = Acceleration of the fundamental component of the vibration

Interpretation of SAKAI CCV

\[ \text{CCV} = 100 \times \frac{A_3 + A_4 + A_5 + A_6}{A_1 + A_2} \]
Correlation analyses between MV and in-situ spot test data

Density/Moisture-Based Spot Tests

Nuclear Density Gauge (NDG)

---

Geostatistical and geospatial applications in the IC technology

- statistical techniques to analyze and predict spatially distributed values
- tools for spatially distributed data
- identification of trends in spatial data
- evaluation of errors in spatial data modeling
- statistical analyses of spatial data
- visualization of spatial data
Geostatistical and geospatial applications in IC technology

IC Data Interpolation - Kriging

- Spatial interpolation
- Ability to access quality of prediction (with estimated error)
- Uses Semivariogram to measure spatially correlated data
- Optimized estimates of the property across the area of interest

IC Data Analysis, Interpretation and Reporting

Veda

ArcGIS

IC Data Analysis, Interpretation and Reporting

Software Tool for Intelligent Construction Data Management (ICDM)

IC data

Veda's software

Point Tests and GPS data

www.intelligentcompaction.com

Images courtesy of Veda User Guide
IC Data Analysis, Interpretation and Reporting

Color Maps of IC Data (Number of Passes, ICMVs, Vibration Frequency, and Amplitude)

Statistical Distribution of IC Data

Semivariograms

Correlation of ICMVs and Spot Tests

Images courtesy of Veda User Guide

IC Data Analysis, Interpretation and Reporting

IC Data (from vendor software) → .csv format → Importing to ArcGIS

Convert tabular data to feature class → Set coordinate system → Display IC data at correct location

Extract IC data within areas of interest → Data processing → Interpreting results

Geospatial Processing

Roller Data

Minimum Boiling Geometry

Extract Mask

GPS Mapping

Extract values

Generate Data File
IC Data Analysis, Interpretation and Reporting

- ICMV distribution
- Identification of soft spots
- Geostatistical reports
- Pre-Mapping of underlying layer

Using Color-coded Maps to Monitor Compaction Process with IC

- Stiffness (ICMV)
- Coverage
- Roller Speed
- Vibration Frequency and Amplitude

Using Color-coded Maps to Monitor Compaction Process with IC

- Distribution of ICMV Data

Center for Transportation Infrastructure Systems - ctis.utep.edu
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Quality Control (QC) with IC Technology

TXDOT IC Specification

Embankment, Subgrade and Flexible Base

TXDOT IC Measurement Value (ICMV)

Quality Control (QC) with IC Technology

TXDOT Specifications

Materials

- Uncontaminated
- Uniform Quality
- Excavation
- Embankment
- Flexible Base
- Reworking Base Course
- Lime Treatment
- Cement Treatment
- Fly Ash / Lime - Fly Ash Treatment

Equipment

- IC Rollers (TXDOT List)
- Capability to export in *.csv format
- Requirements of IC data file:
  - Roller Model and Type
  - Drum Width, Diameter and Weight
  - File Name
  - Date and Time Stamp
  - GPS Coordinates
  - Roller Pass Count, Travel Direction and Speed
  - Vibration Settings (Frequency and Amplitude)
  - IC Measurement Value (ICMV)
  - IC Target Value (ICTV)

Quality Control (QC) with IC Technology

TXDOT Specifications

Construction

- Preparation of Subgrade or existing Base
- Placing
- Pulverization
- Application of Additives
- Mixing
- Compaction
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Student’s Manual

End of Training Module

Thank You
Implementation of Intelligent Compaction Technology for Improving Compaction Quality of Soil and Base in Texas

Training Module
IC Operator Certification Program
- Planning and preparing for IC operation
- Pre- and post-operational check list
- Start-up and shut down process
- GPS calibration and operation process
- Roller settings and data collection process
- Operator maintenance check list
- List of frequently asked questions (FAQ)

Planning and Preparing for IC Operation
- Identification of job site
- Investigating the possibility of using Intelligent Compaction
- Availability of local GPS base stations
- Availability of IC rollers (OEM or Retrofitted)
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**Pre-Operation Inspections**

- Check GPS Connections
- Check IC Box Connections
- Turn on the IC Box
- Input Project Details
- Input Layer Type
- Input GPS Coordinate System (UTM, state plane)
- Select Vibration Parameters

**Post-Operation Inspections**

**Check and Review Collected Data after Mapping**

- Check CMV Color Map on Screen
- Check that speed, frequency and amplitude are reasonably uniform

**Report any Errors or Missing Data to Engineer**

- GPS Error (disconnected from base station, loss of satellite signal)
- Decoupling Error (stiff spots, high amplitude, high speed)

**Field Operation Process**

- Turn on IC Kit and check if it is working
- Enter Project Details
- Perform Proof Mapping of the Compacted Area
- Check Data Quality
- Transfer Data to Inspector/Engineer
**GPS Calibration and Operation Process**

- Set up a local GPS base station if possible
- Collect coordinates of the drum sides
- Match local coordinates with IC kit GPS

---

**Roller settings and data collection process**

- **Vibration**
  - Low Amplitude
  - Low Frequency

- **Roller Speed**
  - 2 mph

---

**Data collection process**

- Identify soft spots
- Cover the whole area and review the process from IC kit
- Transfer the IC data from the kit to the Engineer
Operator maintenance check list

- GPS Unit
  - GPS antenna
  - GPS receiver
  - GPS connection

- IC Display Unit
  - Display unit connections
  - Display unit settings

- IC Sensors
  - Position of accelerometer(s)
  - Sensor connections

List of frequently asked questions (FAQ)

End of Training Module

Thank You
Implementation of Intelligent Compaction Technology for Improving Compaction Quality of Soil and Base in Texas

Managing IC Data with VisionLink

Introduction to VisionLink

Trimble® VisionLink is an online tool to view, manage, visualize and export the construction site data (including IC data).

To access VisionLink:
- Go to www.myvisionlink.com
- Enter your username and password and click “Login”.

Introduction to VisionLink
Introduction to VisionLink

With VisionLink, you will be able to:
• See your equipment location
• Know when your equipment is working
• Get progress reports every 10 minutes

Options for Managing IC Data

• To select data and see project boundaries click project and select “3D Project Monitoring” to open a new window.

• The main filter to manage IC data are:
  • Date
  • On Machine Design and
  • Machine Name

• Click the dropdown “Date” filter to open the filter window

• Click “Set Date Range” to apply a filter
  (Once the filter is applied, the tab color will turn yellow from blue)
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Options for Managing IC Data

Date

Select the desired date from the menu. There are two options to select the date:

1. Select Day: Click the “Current Week” dropdown menu to view different options (e.g., today, yesterday, current month, previous month, among others).
2. Calendar: Click on the calendar icons to select the desired dates.

Options for Managing IC Data

On Machine Design

- Click the “On Machine Design” dropdown filter to open the window.
- Select “Set On Machine design filters” to apply the filter. (Once the filter is on, the tab will turn yellow from blue)
- Click on “All Designs” to select a specific file (the selected file should be within the period of time of the Date filter selected previously).

Options for Managing IC Data

Machine Name

- Click the “Machine Name” dropdown menu to open the filter.
- Select “Set Machine filters” to apply the filter. (once the filter is selected, the tab will turn into yellow from blue)
- Select the desired machine name. When the machine is selected a green check mark will be displayed right next to it.
- Click “Apply” to apply the filters.
Options for Managing IC Data

Project Data Filters

- Once you applied the filters, check whether you have any data within the project site boundary limits.
  - Zoom In for better identification of data

Exporting IC Data Files

- To export IC data,
  - Select “Administration” from the main menu, and
  - Click on “Exports”

A new window to “Manage Exports” will be displayed.

Exporting IC Data Files (cont.)

- Select “Export to Veda”
  - Make sure proper Coordinate setting (Northings/Eastings or Latitude/Longitude) is selected.
  - Select Output data type (Final Coverage or All Passes)
  - Click Next - Details
The University of Texas at El Paso (UTEP) – Center for Transportation Infrastructure Systems (CTIS)

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Exporting IC Data Files (Cont.)

- Select same date that you used in Date Filter for “Date Range”
- Select default “File Name” or change file name as you see fit.
- Click Next - Summary

Exporting IC Data Files (cont.)

- Inspect the selected filters and settings in “Summary” screen
- Click “Back – Details,” if the settings need to be modified
- Click “Export,” if the filters and settings are correct

Exporting IC Data Files (cont.)

- Once you click “Export”
  - A new window will appear and
  - A *.csv file will be downloaded.
- If the download process does not start, you might have to unblock the pop-ups as shown here.
Exporting IC Data Files (cont.)

- The exported file will be in *.zip format
- The zip file could be found in downloads folder on your PC
- Extract the zip file to access the *.csv file

Overview of VisionLink
Instructional Video

End of Training Module
Thank You
Implementation of Intelligent Compaction Technology for Improving Compaction Quality of Soil and Base in Texas

Training Module
IC Data Management with Veda

Importing Data Into Veda
Customizing Color Maps
User-Defined Sections
IC Data Analysis
Veda Instructional Video

Introduction
Veda is a tool to import, manage, visualize, analysis and report Intelligent Compaction (IC) data.

Note: If Veda is not yet installed on your PC, download it from: http://www.intelligentcompaction.com
Importing Data into Veda

To start analyzing data in Veda 2.1 open the program. The recent projects can be accessed from the main screen. To remove the list of Recent Projects, click Clear Files.

Importing Data into Veda

Click on Import Data. Locate and select the *.csv file and click Open.

Importing Data into Veda

Select proper Coordinate system, UTM Zone, and Hemisphere (e.g., UTM Zone 14, meters, north). Select proper State Plane Zone if applicable. To continue, click Next.
Importing Data into Veda

Under "Files" area, select desired pass number or Final Coverage to display IC data

Use "Base Map" icon to show background map
Customizing Color Maps

Customize color legend by right clicking on left upper window.

Click "Customize" to open color legends window.

Modify colors and Lower Bounds in color palette.

To add or delete a color, click "Add" or "Remove".
TXDOT specification requires only three colors to display IC data based on the "Mean" value.

Customized IC data with three color codes

User-Defined Sections

Use "Layer" icon to add plan, design files, sections and filters
User-Defined Sections

Add a new layer

- Click “Add” located on “Layers” tab to add design files, sections or filters.

User-Defined Sections

Add a location-based section

- A user-defined section allows user to isolate a specific section within project site.
- Click “Section (Location-Based)” to create a user-defined section.
- Note: A section could also be defined from time periods.

User-Defined Sections

Defining section name

- Assign a name to the section.
- Click “OK” to create the section.
Right click on the map and select “Add Location” to define coordinates of starting point of the desired section.

A green flag marks the starting location.

Add at least four points to create a rectangular area. The green and white flags show the starting and finishing locations. The coordinates of the selected points are shown in the window on top of the map.
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User-Defined Sections
Isolating the defined section

Note: Once a section is selected, it will appear on the map

IC Data Analysis
Analysis options

Select desired section to perform analysis

“Mean” value obtained from analysis can be used to define ranges of colors in the map

IC Data Analysis
Statistical analysis

Note: If no sections is selected, Veda will analyze the entire data file

Click “Analyze”
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IC Data Analysis
Color-coding the defined section

Final color-coded map of user-defined section

Veda Instructional Video

End of Training Module

Thank You