

INTELLIGENT COMPACTION

More Science Than Art

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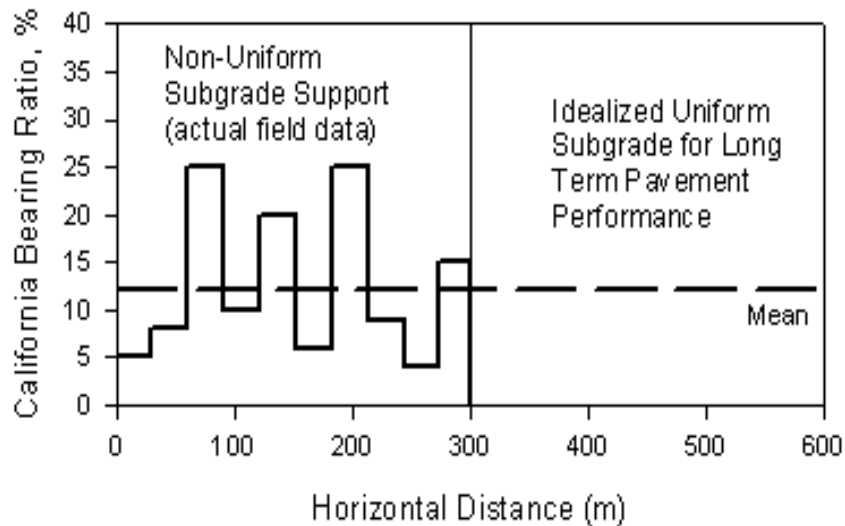
San Antonio, TX, Mar. 23, 2015

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Why use IC?

- Good pavement requires a uniform foundation to build on
- Current compaction methods do not meet the needs



Fatigue life increases **70%** on average with uniform support

Current Practice - Density



< 1% Coverage

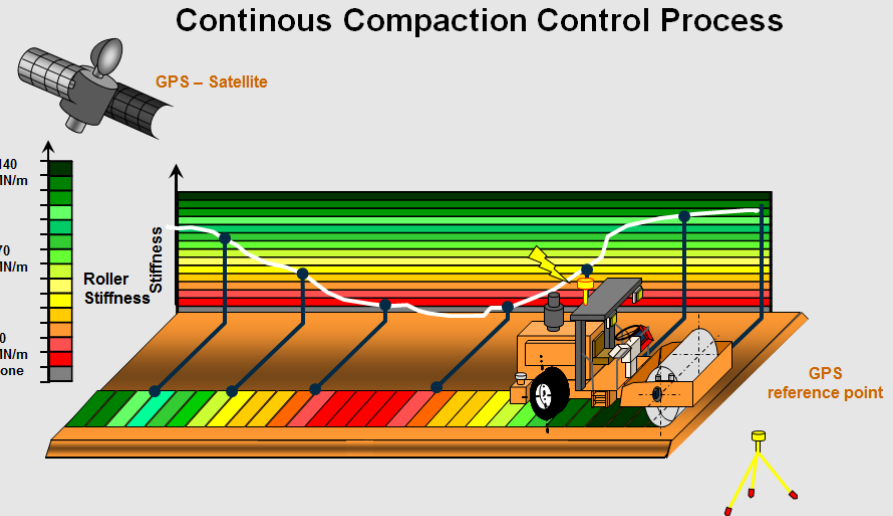
Intelligent Compaction - Stiffness



100% Coverage

What is it?

- A vibratory roller with a stiffness measurement system that records the material's stiffness in real time
- A GPS system that tracks the roller's position and pass counts in real time
- An in-cab display panel showing a color-coded map of stiffness, roller's position, and pass counts in real time



Display Panel



GPS Receiver

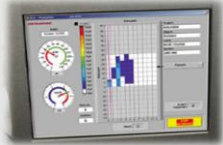


Accelerometer

What is it? - IC Rollers and Measurements



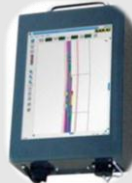
Caterpillar: CMV, MDP



Dynapac: CMV



Bomag: E_{VIB} (MN/m²)



Sakai: CCV



Case/Ammann: k_b (MN/m)



Hamm: HMV

What is it? - TxDOT IC Retrofit Kit

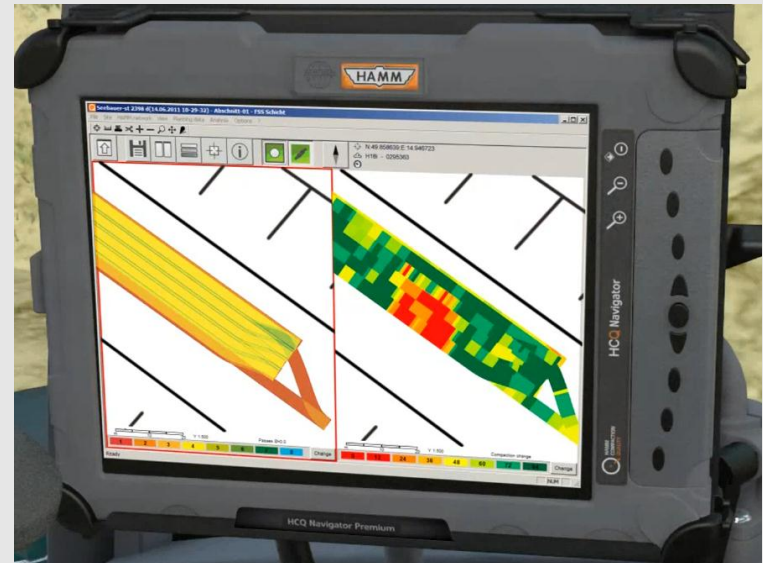
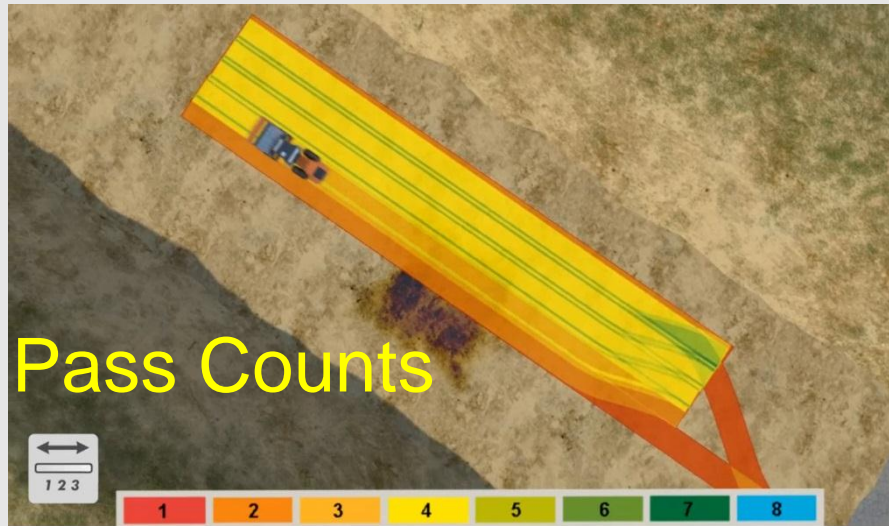
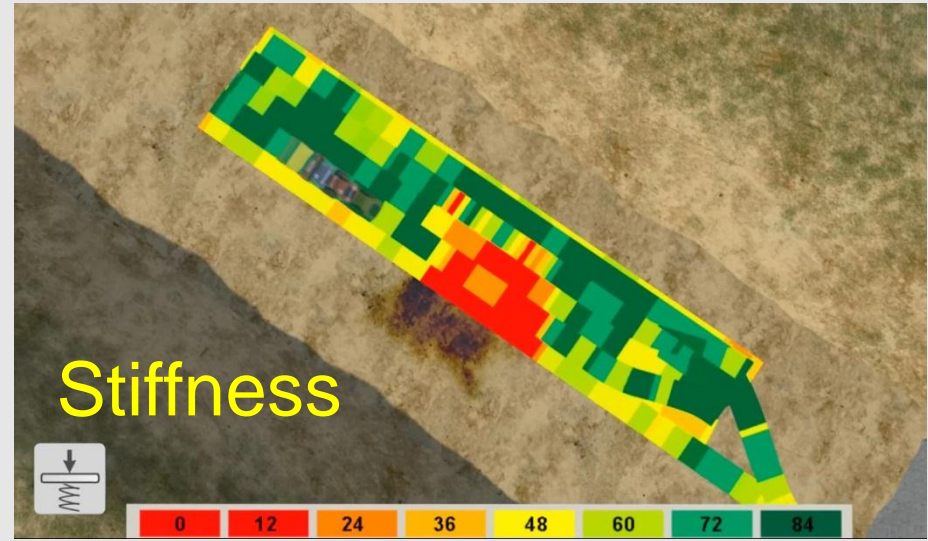


IC
Retrofit
Kit



What information does IC provide?

- ✓ Stiffness
- ✓ Pass Counts



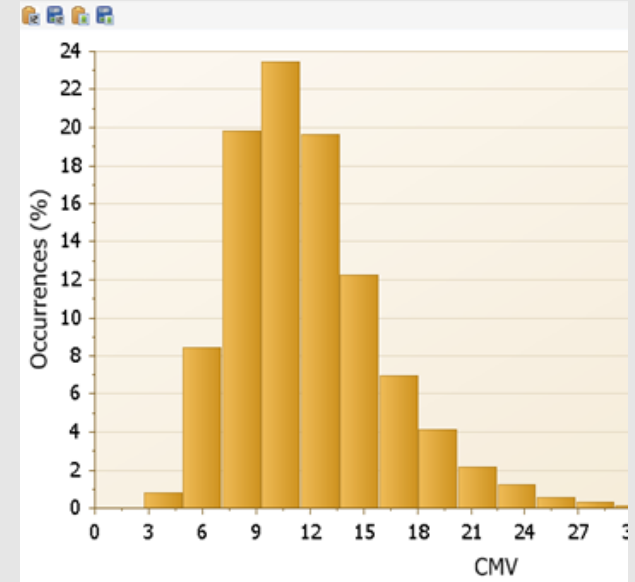
What information does IC provide?

- IC provides stiffness and pass counts in two separate data files:
 - All Passes Data: IC data (stiffness and pass counts) for all passes for a given area
 - Final Coverage Data: IC data (stiffness and pass counts) only for last pass for a given area

How to use the IC information?

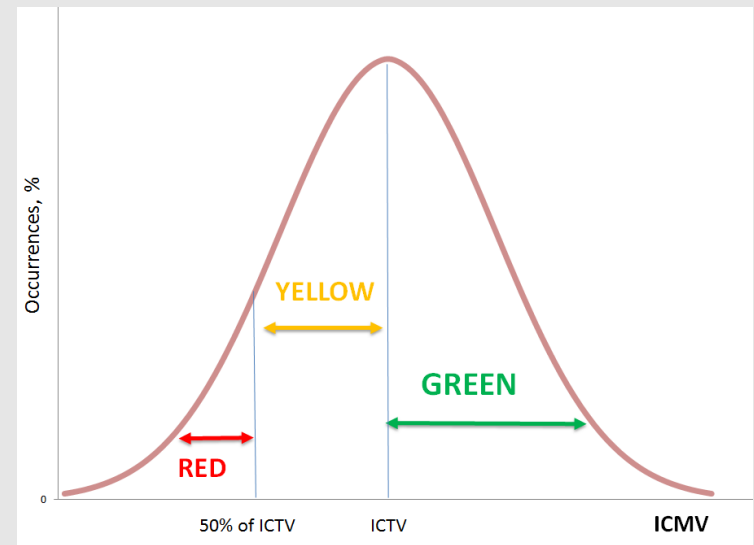
■ ICMV (IC Measurement Values)

- A whole set of IC data collected in a given area
- ICMV is assumed in normal distribution



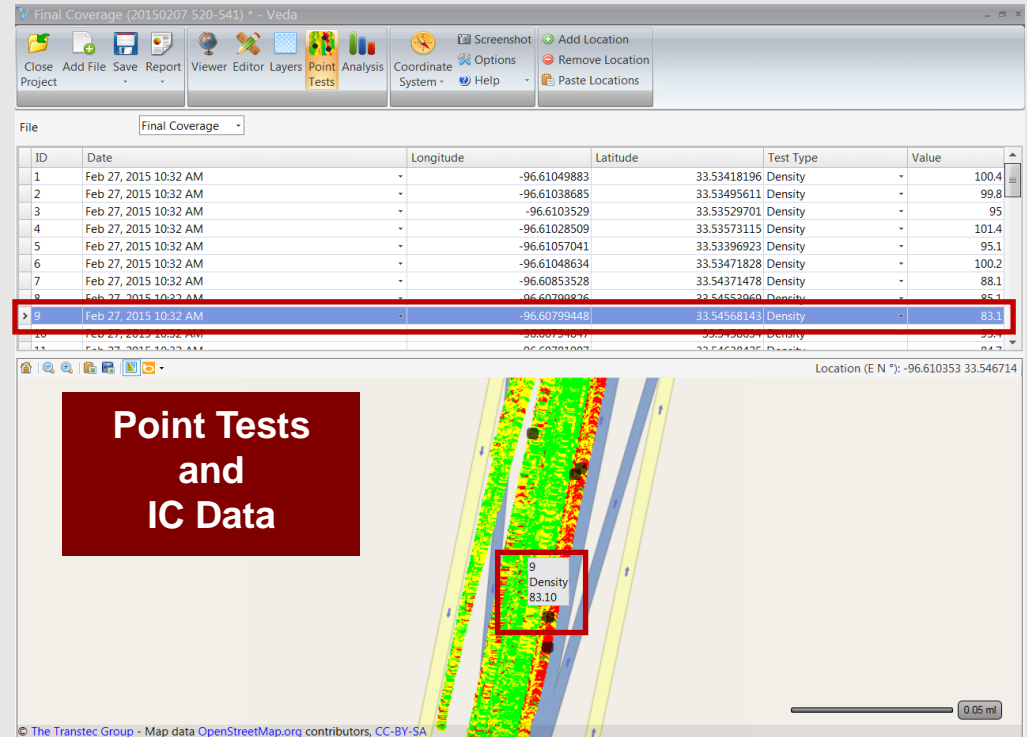
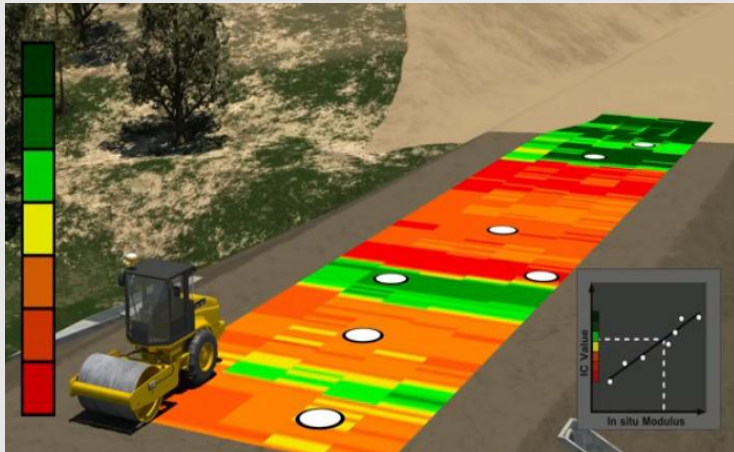
■ ICTV (IC Target Value)

- The average of ICMV
- Color codes are based on ICTV

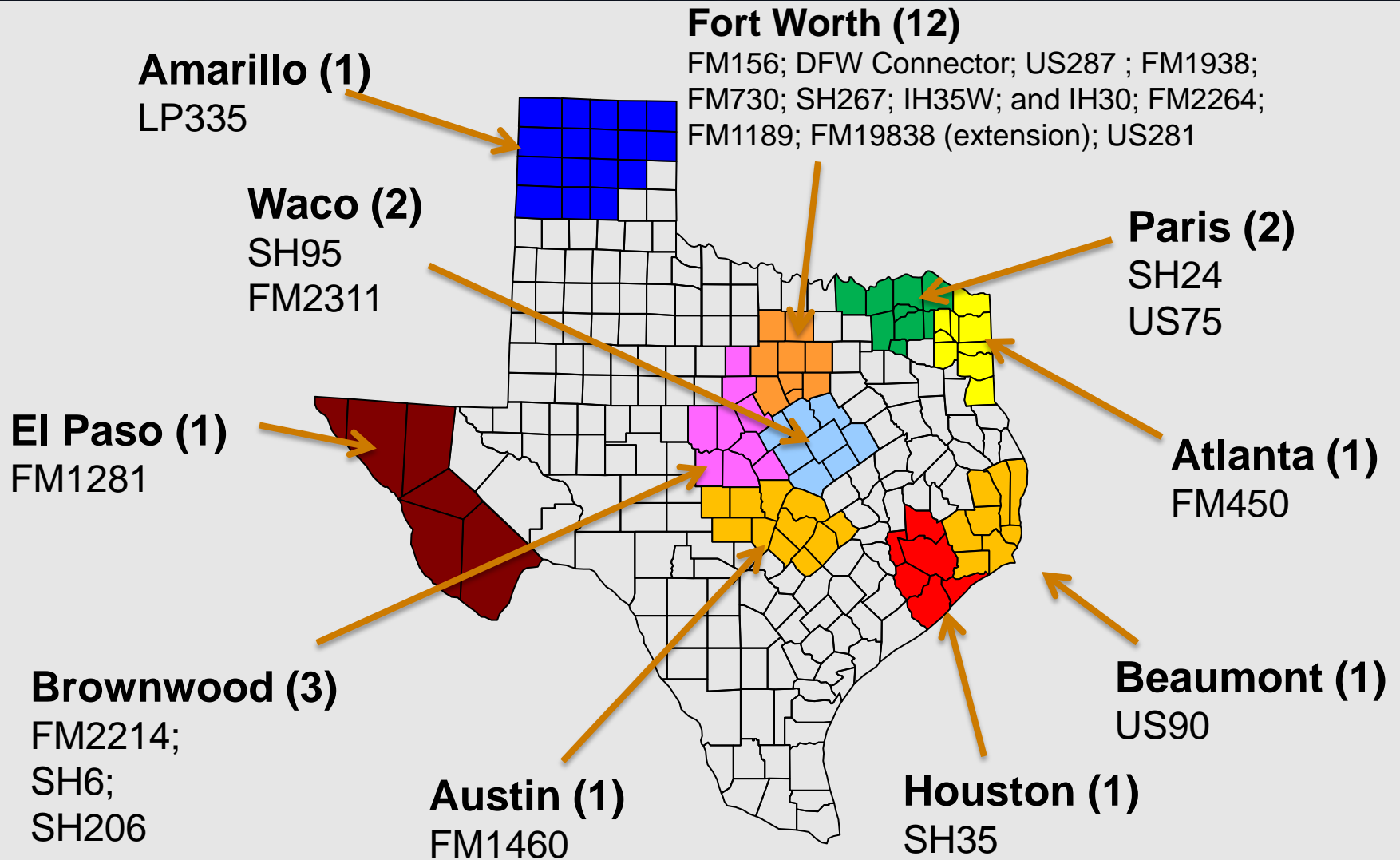


How to use the IC information?

In-situ point tests such as NDG and DCP are performed based on the color-coded maps



TxDOT IC Projects

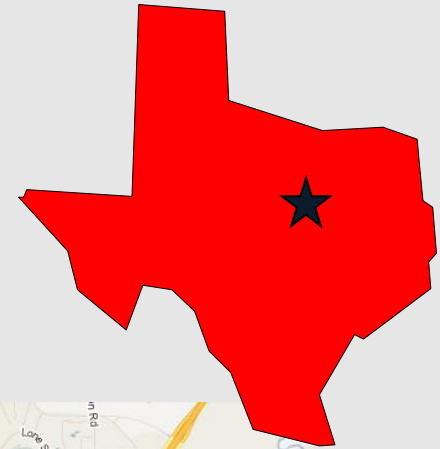


TXDOT Fort Worth District IC Projects

- [FM156 \(FHWA Demonstration Project\)](#)
 - FHWA/Pooled-fund study IC demonstration
- [FM1938 \(Highway for Life Project\)](#)
 - TxDOT retrofit kit implementation
- [DFW Connector Design-Build Project](#)
- [US 287 in Mansfield](#)
- [FM 731 at Lake Weatherford](#)
- [US 67 Bypass north of Cleburne](#)
- [IH 35W in North Fort Worth](#)
- [SH 267 Bypass around Dublin](#)

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- FM 156 (North Fort Worth at Alliance Airport)
- FHWA/TPF IC Study
- Cohesive subgrade, Lime treated subgrade, and Aggregate Base (Flex Base)

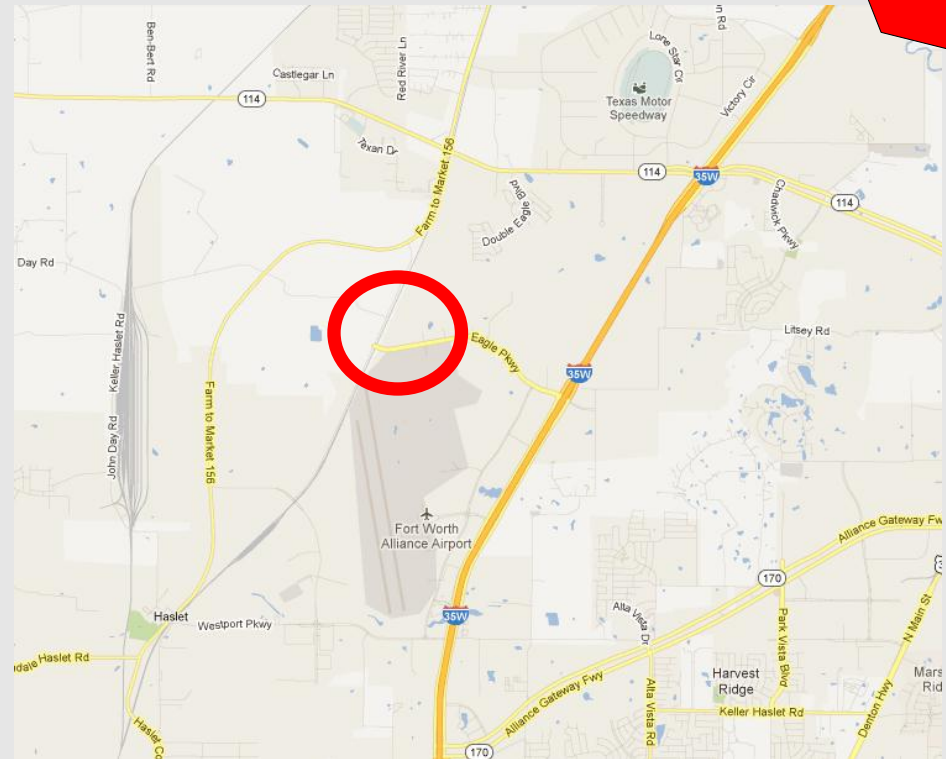


**padfoot drum
IC roller**

**smooth drum
IC roller**

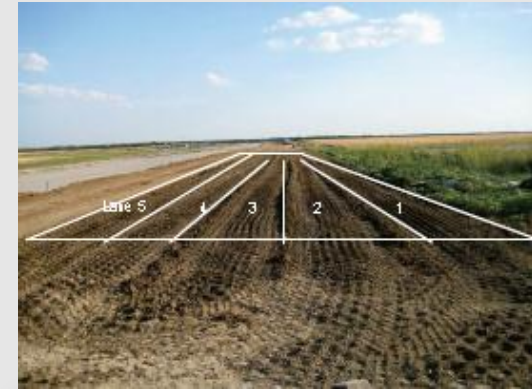
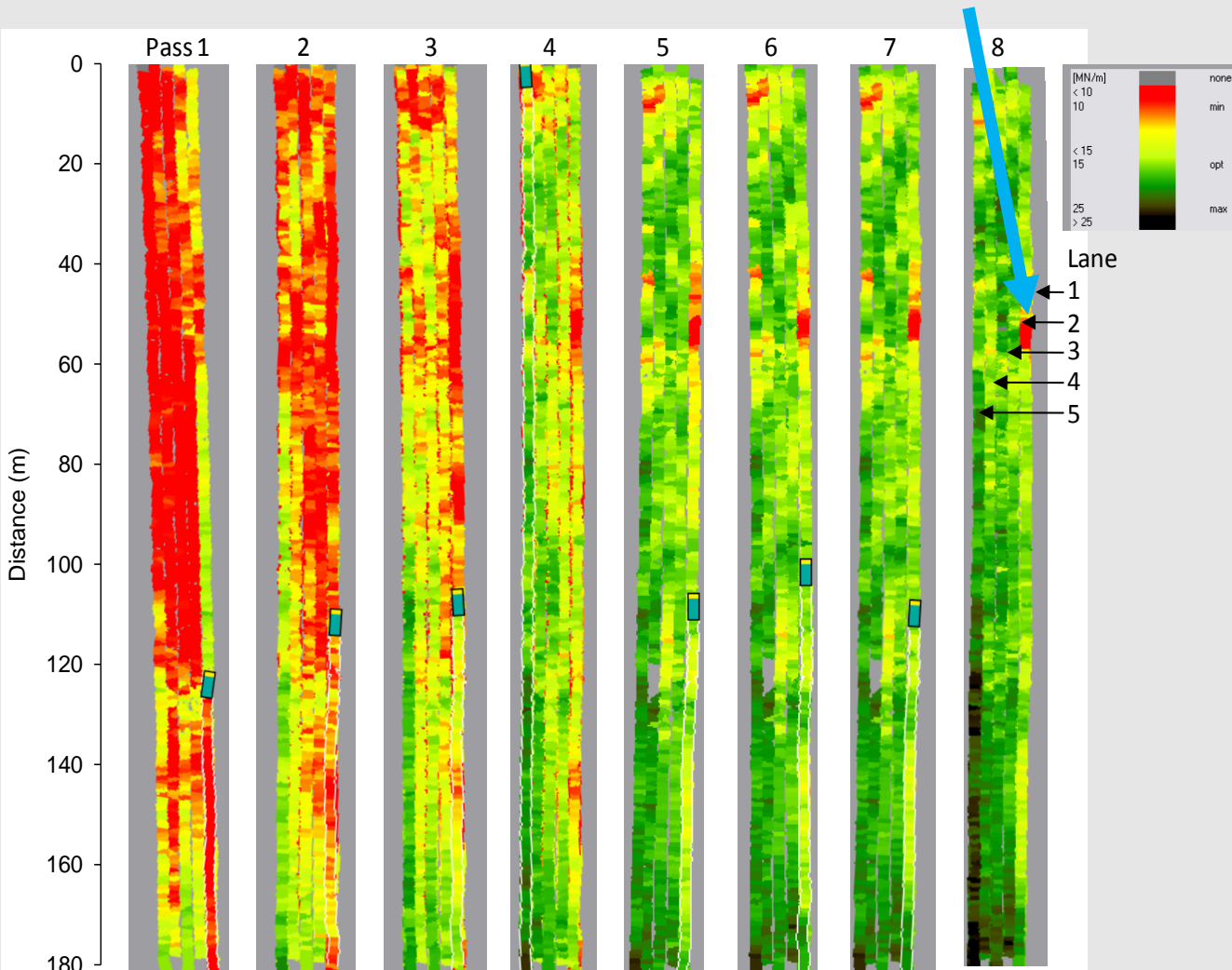


**Dynapac
Single
Smooth drum
IC roller**



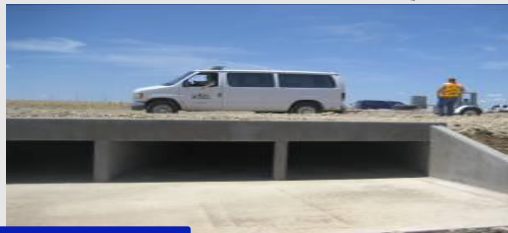
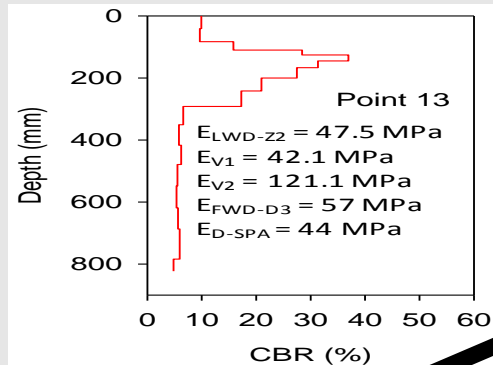
Intelligent Compaction

K_s shows compaction progress and a soft area

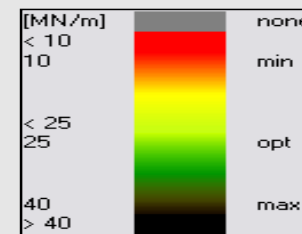
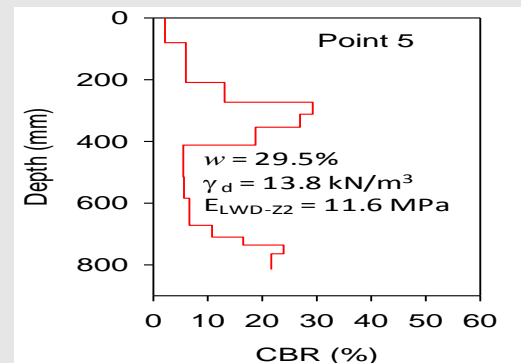
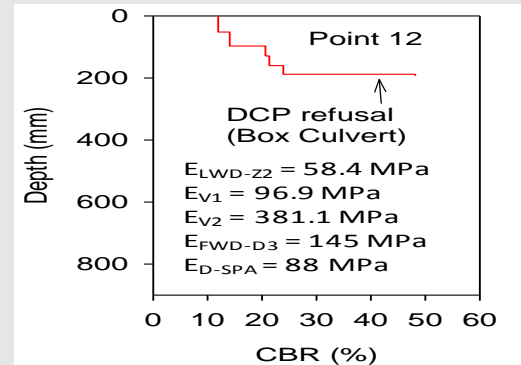
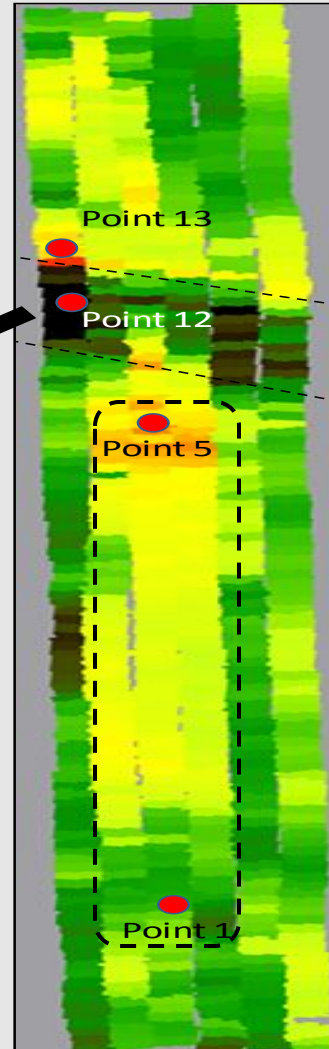
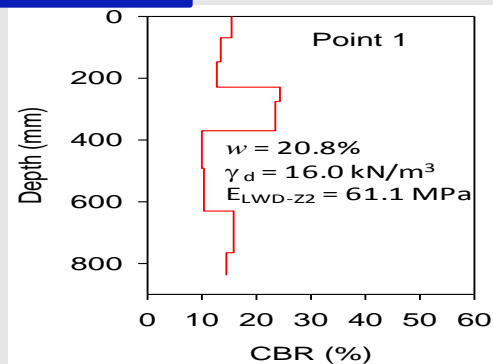


**Case/Ammann
Single-drum
padfoot IC roller**

Detect Underground Structures

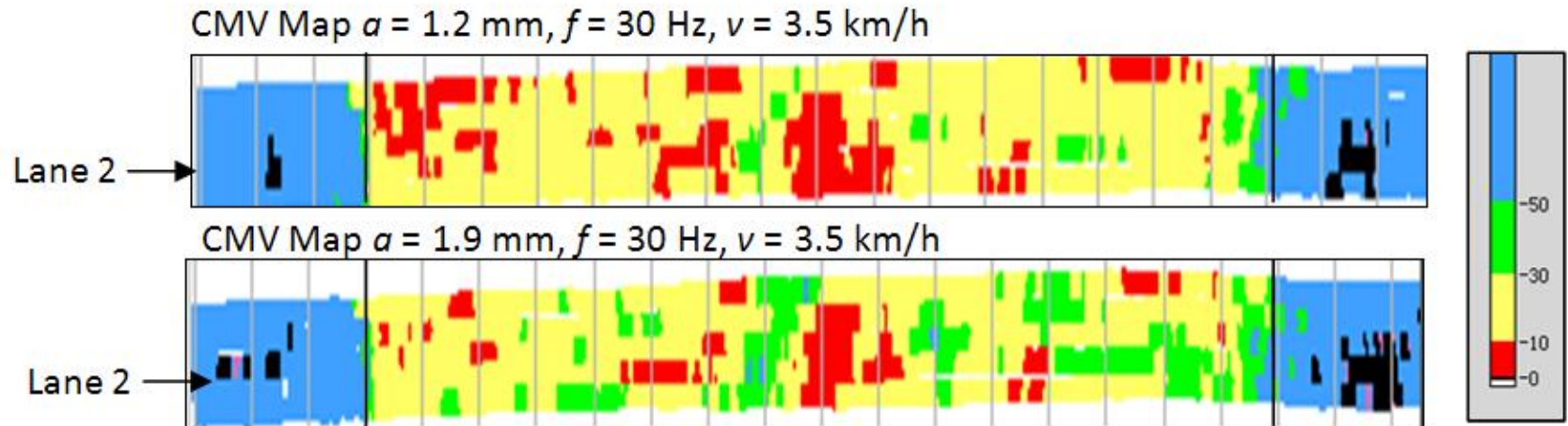


Box Culvert



Intelligent Compaction

Differentiate Different Materials



Flex Base

Lime Treated Subgrade

Flex Base

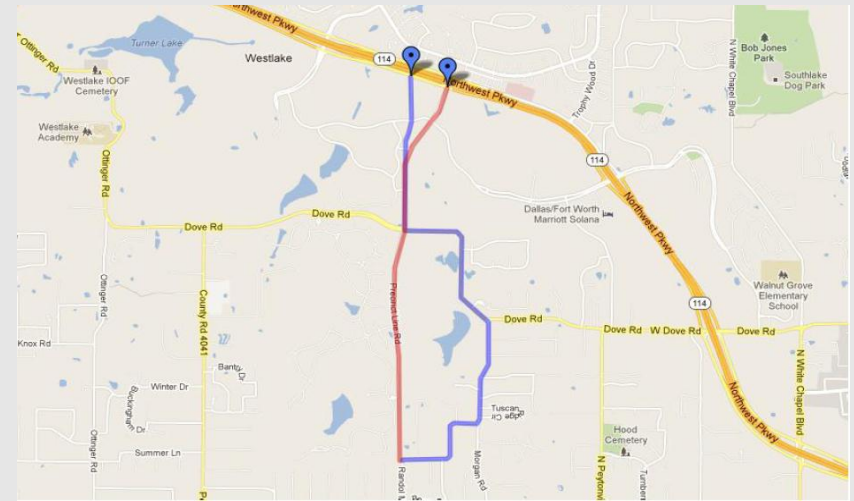
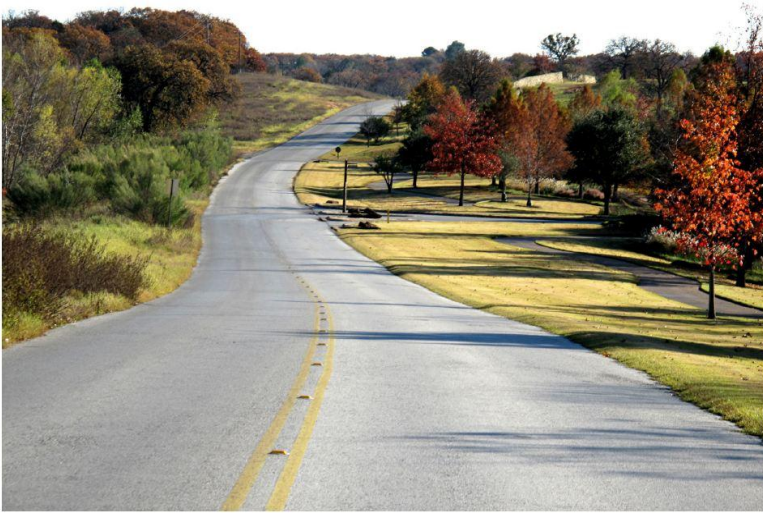


Dynapac
Single
Smooth drum
IC roller



Intelligent Compaction

- **Project Length : 2.205 Miles**
Estimated Cost: \$16.5M
Estimated Duration: 367 Working Days



- Provides a more complete picture of the area being worked
- Less labor required
- Less time required due to testing

DFW Connector Design-Build Project

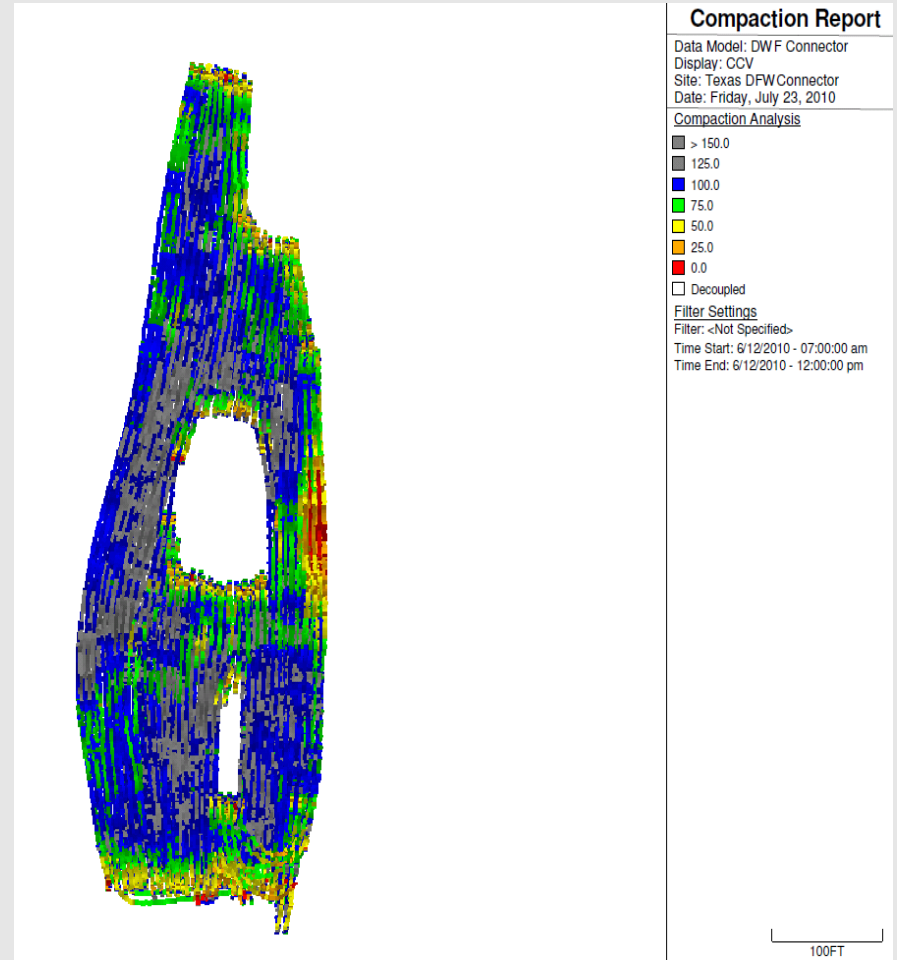
- \$1.1 billion CDA Design-Build project
- Groundbreaking Feb. 17, 2010
- Expected completion 2014; complete 2013
- Approximately half the construction time needed for traditional contracts



Dallas/Fort Worth Connector



Courtesy Dr. David White Iowa State University



Courtesy Mark Morrow NorthGate Constructors

July 2010

DFW Connector Project

Compaction Target Value (CTV) = 42

% Target

CCV

IC Data

>130%

55

26%

90-130%

38 - 55

68%

80-90%

34 - 38

4%

70-80%

29 - 34

1%

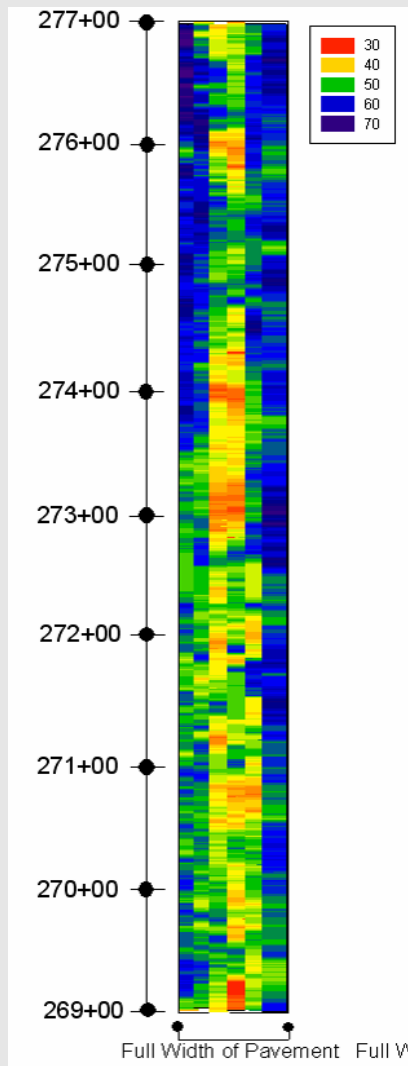
<70%

< 20

} 94%

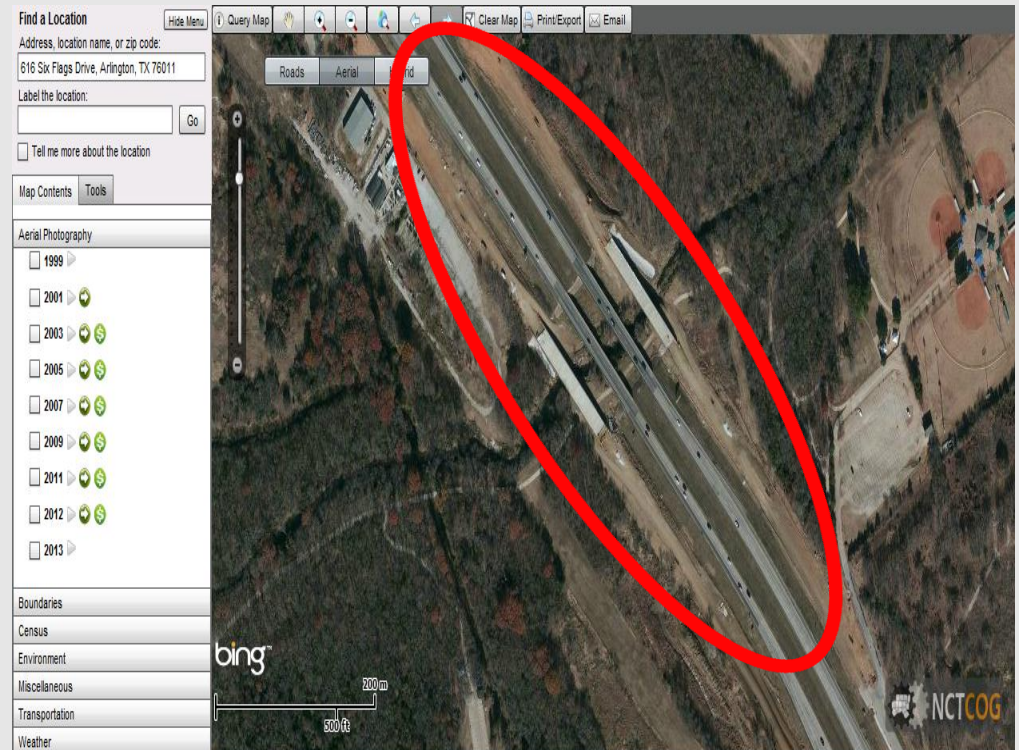
Current TxDOT QA Criteria:

>90% of IC Data should be equal to or greater than the CTV



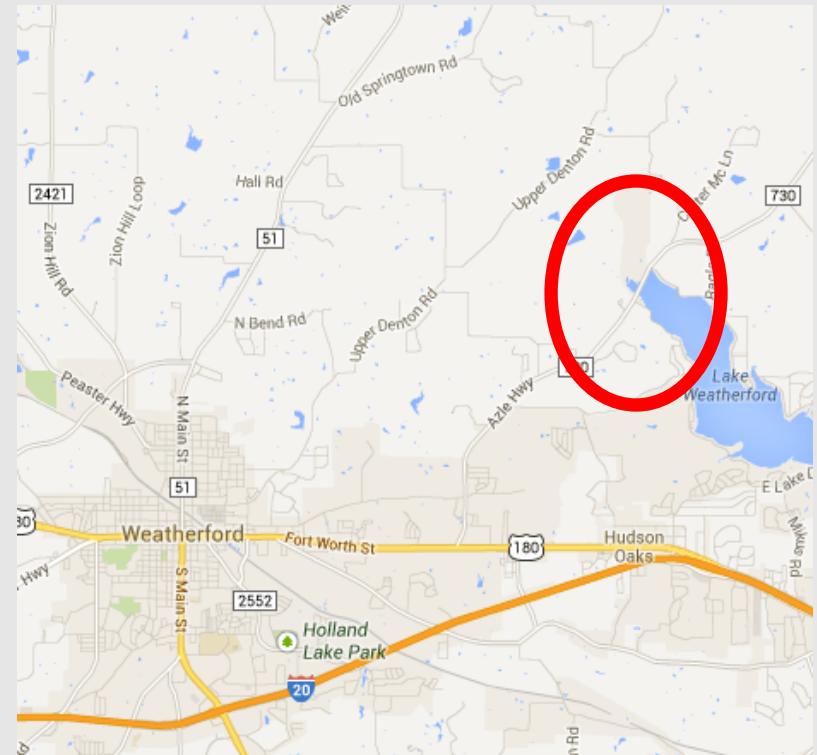
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- US 287 (Mansfield TX)
- New frontage roads and bridges
- Lime treated subgrade
- Testing of 4 separate locations with DCP, DSPA, IC, and NDG



Intelligent Compaction

- FM 730 (over Lake Weatherford headwaters)
- New bridge on roadway realignment
- Wet to inundated natural ground, 5' rockfill embankment, low PI soil embankment, lime treated subgrade, and flex base

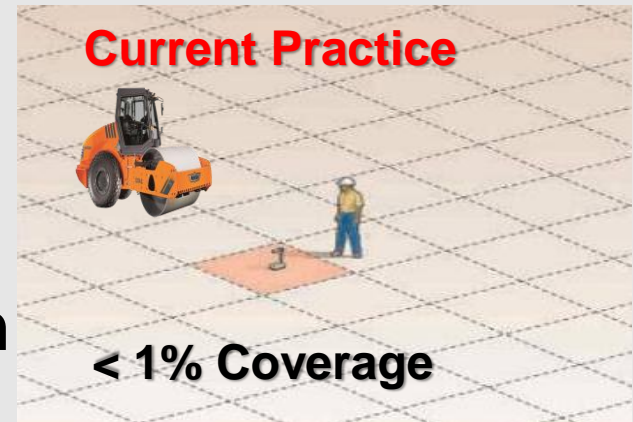


Intelligent Compaction

- US 67 (widen to 4 lane divided section) –
- SH 267 (construction of a new 4 lane divided bypass)
- IH 35W (Reconstruction of a freeway section)
- Natural field crushed rock, lime treated subgrade, and flex base



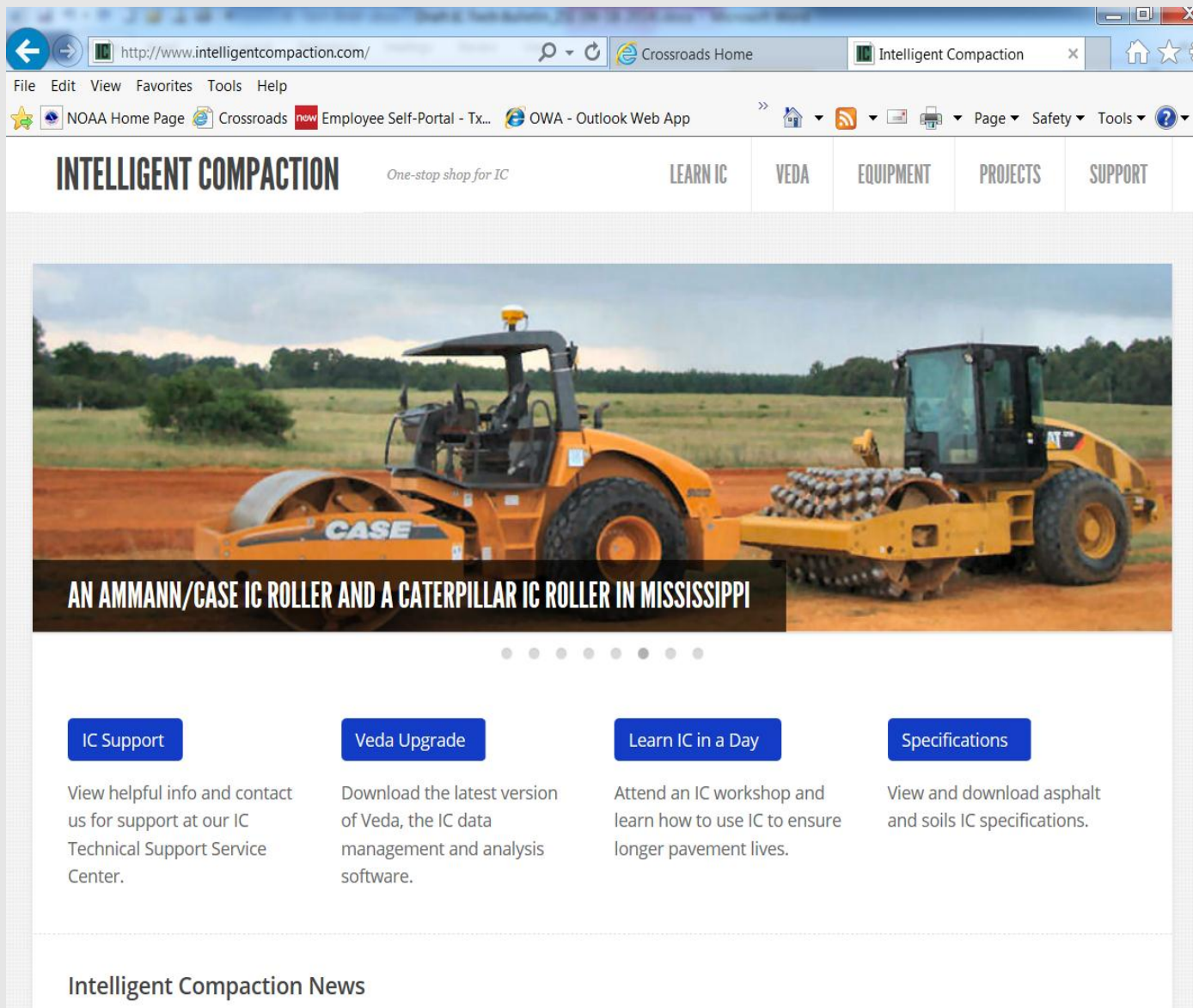
- Provides uniformity information
 - ✓ Covers 100% of the compacted area
 - ✓ Tracks roller's position and pass counts
- Identifies areas of poor compaction
- Selects areas to test for QC/QA
- Eliminates guesswork and reduces risk of rework
- Optimizes efficiency, maximizes productivity and minimizes costs
- Improves safety in construction zones



IC Challenges

- Executive leadership and champions
- Extensive training for both DOT's staff and contractors
- GPS system setup
- Data management including data collection, conversion, and analysis





The screenshot shows the homepage of the Intelligent Compaction website. The browser window displays the URL <http://www.intelligentcompaction.com/>. The website header includes the logo "INTELLIGENT COMPACTION" with the tagline "One-stop shop for IC", and navigation links for "LEARN IC", "VEDA", "EQUIPMENT", "PROJECTS", and "SUPPORT". A large banner image features two yellow rollers, a Case IC roller and a Caterpillar IC roller, working on a dirt road. Below the banner is a carousel of four featured resources, each with a blue button and a description:

- IC Support**: View helpful info and contact us for support at our IC Technical Support Service Center.
- Veda Upgrade**: Download the latest version of Veda, the IC data management and analysis software.
- Learn IC in a Day**: Attend an IC workshop and learn how to use IC to ensure longer pavement lives.
- Specifications**: View and download asphalt and soils IC specifications.

At the bottom of the page, there is a section titled "Intelligent Compaction News".



Questions?



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