Intelligent Compaction overview

IDAHO ASPHALT CONFERENCE
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Caterpillar Paving Territory Manager
Steven Ryan

Asphalt IC roller

Equipped with a video display box that is capable of continuously recording, storing, and wirelessly transmitting data while displaying 4 color-coded maps in real time:

1. Roller position, number of roller passes & total coverage area
2. Mat temperature
3. Compaction Meter Value (CMV)
4. Percent change in CMV between passes

– Other machine operating parameters such as speed, direction of travel, frequency and amplitude settings, are displayed and recorded

– VisionLink web-based software is used for viewing and analyzing data

CAT IC roller hardware

IC roller

Equipment required

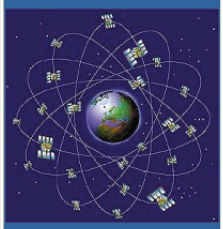
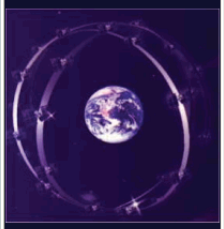
1. Positioning system
   - GPS – global positioning system (RTK or SBAS)
   - UTS – universal total station - Good for obstructed views
   - VRS – virtual reference station - No base stations
   - IBSS – internet based satellite system – Uses internet to extend coverage

2. Asphalt roller with color-coded display, temp sensors, accelerometer, positioning system antenna/radios

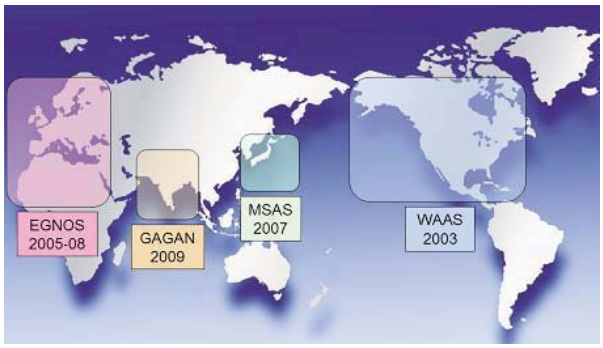
3. Office software
   - VisionLink (Caterpillar/Trimble) – web-based with subscription
   - VEDA-compatible (data must be imported to VEDA)

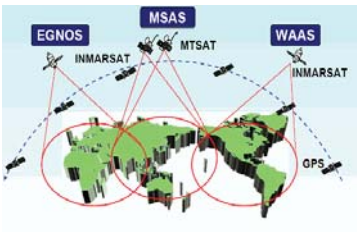
Introduction to GNSS

Navigation Systems

System	GPS	GLONASS	GALILEO
			
Owner	USA	RUSSIA	UE

Augmentation Systems- SBAS

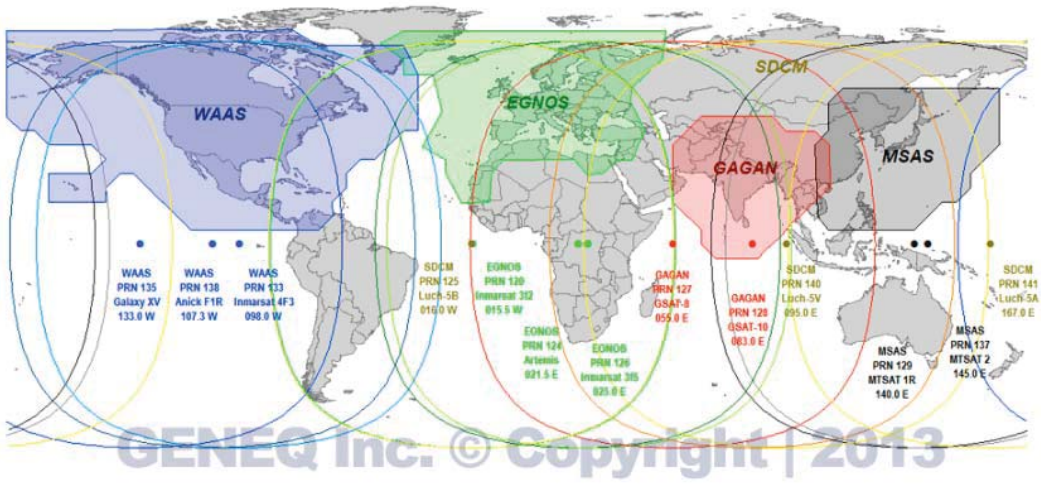




Positioning: GPS

- Utilizes US Global Positioning System
- Correlates all measurements to latitude/longitude
- Choice of position accuracy
  - RTK (1 to 3mm accuracy)
  - SBAS (1 to 3m accuracy)

Satellite-**B**ased **A**ugmentation **S**ystems



Positioning: Universal Total Station

- Reads directly via laser
- Correlates all measurements to a location
- 1 to 3mm accuracy

Universal Total Station

- Accurate to 3mm

Asphalt compactor

Asphalt compactor

Intelligent Compaction on asphalt is currently used as a process control tool and is ***not a direct measure of compaction***.

1. Count and record the number of passes over the entire job

2. Measure and record the temperature of the mat

3. Measure and record a Compaction Meter Value (CMV) which is an accelerometer-based Integrated Compaction Measurement Value (ICMV)

Operator display

- Real-time pass-count
- Real-time mat temperature
- Real-time location information

- Operator can determine when to begin rolling and when to end, based on mat temperature and CMV value

- Visible and audible warnings alert the operator if the asphalt temperature exceeds or falls below the target temperature

Data collection

- Position
- Pass count/coverage
- Compaction Meter Value (CMV)
- Vibration on/off
- Frequency
- Amplitude
- Roller speed
- Direction (forward/reverse)

In-field reporting: Printer option

CB54XW_JLM00885_CompactorReport_2014...

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AccuGrade In-Field Report
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Machine          : CB54XW  JLM00885
Start Time       : 12:56:19
Start Date       : 2014/08/26
End Time         : 14:02:23
End Date         : 2014/08/26
Duration         : 68 Minutes
Site Design      : CAT DAY 23
UTM Zone         : 18 N
Start Station    :
End Station      :
Total Area Covered     : 10643.8 FT²
Layer                  : 13

Target Lift Thickness: 8.000 FT
Average Lift Thickness:
Max. Lift Thickness:
Min. Lift Thickness:
Over Lift Ratio ( 10%):  0%

Target Pass Count: 3
Average Pass Count: 3.2

Pass Count Percentages:
 =1 Passes:     11%
 =2 Passes:     18%
 =3 Passes:     11%
 >3 Passes:     59%

Target CMV: 30
Average CMV: 42.6
CMV Percentages
   < 6:          0%
  6- 21:         0%
 21- 27:         1%
 27- 33:         4%
   > 33:        95%

Minimum Temperature: 98°F
Maximum Temperature: 262°F
Average Temperature: 203°F
Temperature Percentages:
  < 180°F:      18%
180-240°F:      73%
  > 240°F:      10%

Weak Areas
Low CMV Areas: (10.0 FT²)
None.

Low Temp. Areas: (<180°F, 10.0 FT²)
None.

Low Pass Count Areas: (<4, 10.0 FT²)
None.

Approval
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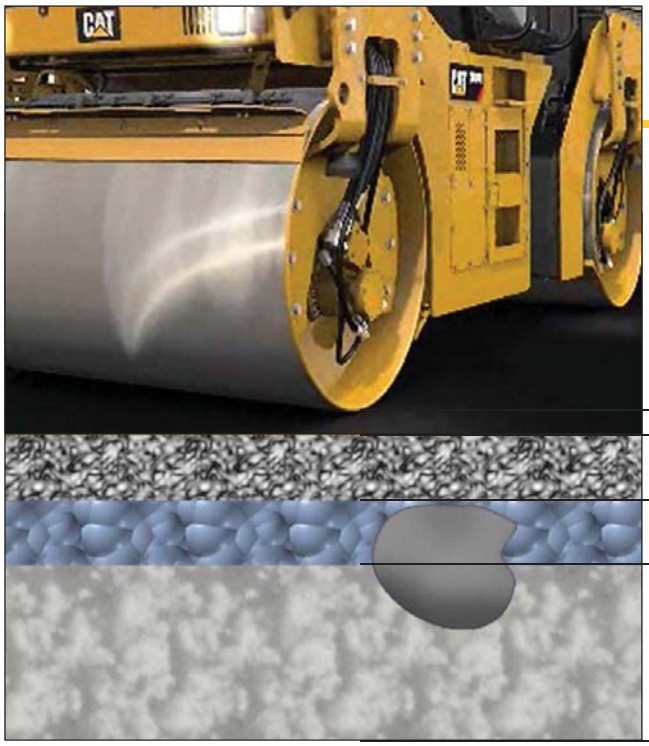
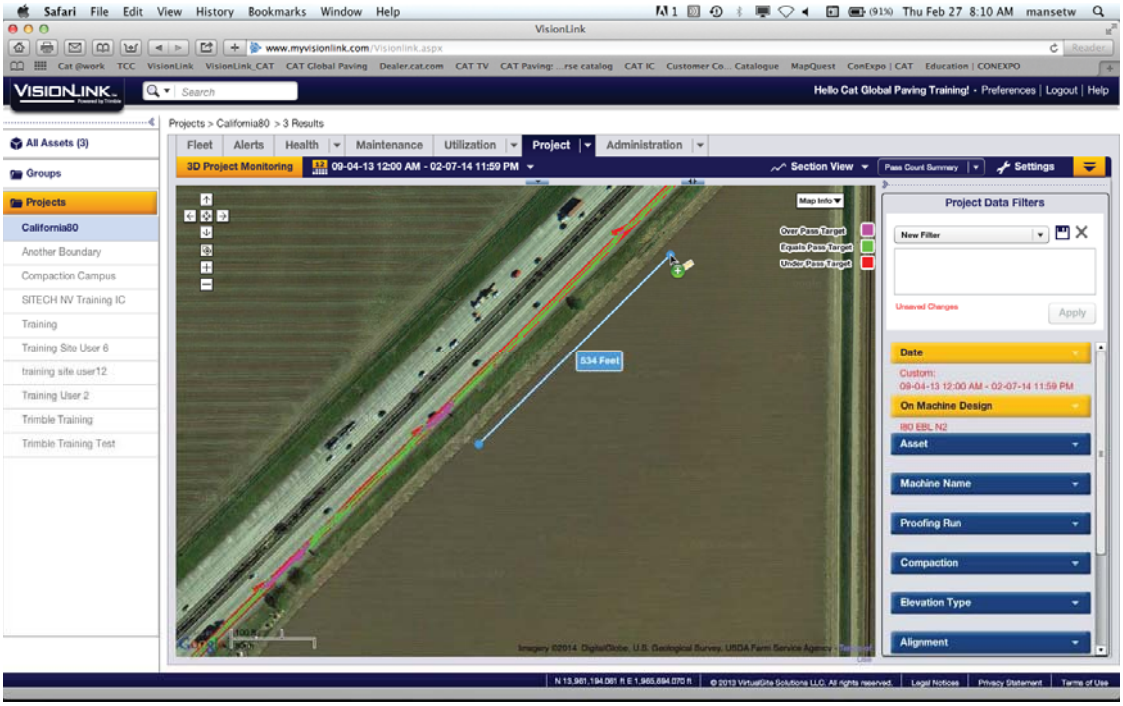
Accelerometer – front drum only



Accelerometer based technology measures deeper than the freshly laid lift of asphalt.

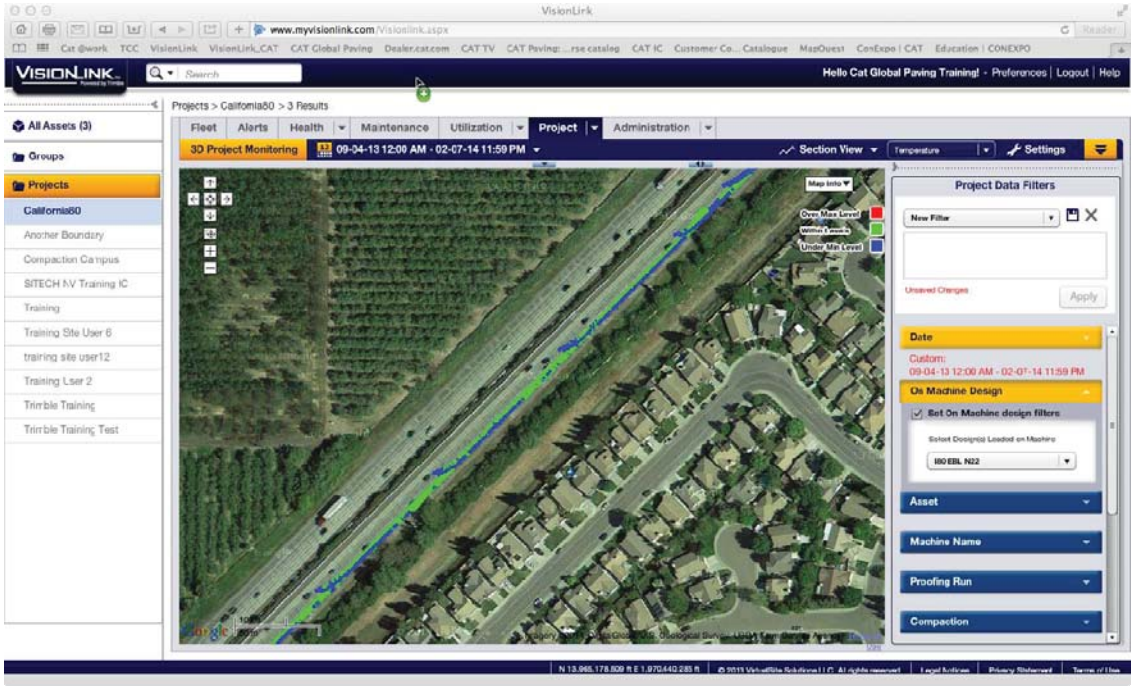
CMV value is a ***composite of the current lift and the layers below it.***

Satellite map view of pass count



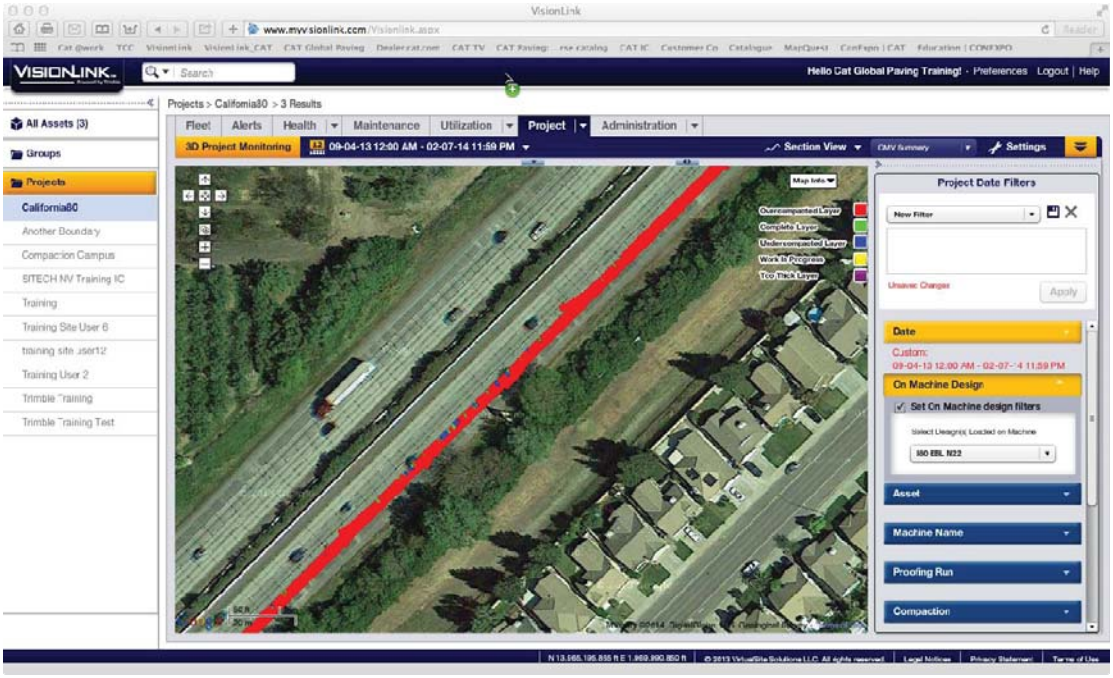
Pass count map

Satellite map view of temperature



Temperature map

Satellite map view of CMV

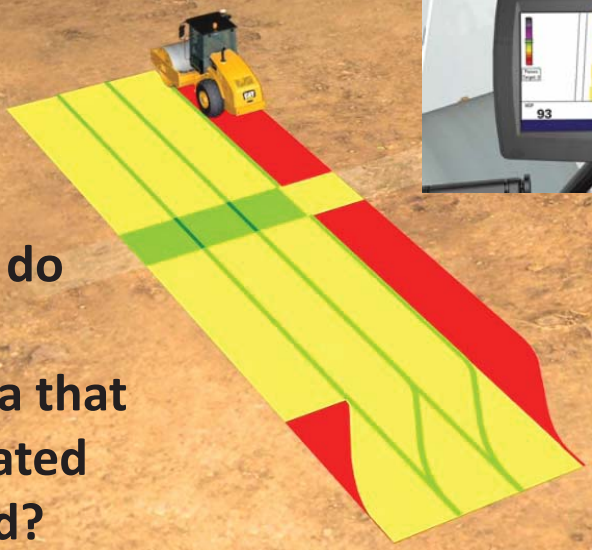


CMV map

What are the benefits of IC?

- **Increased Operator Awareness**
  - Real-time compaction, temperature, pass count data providing the operator the ability to make changes in real-time while asphalt is hot
- **Improved Density & Smoothness (asphalt)**
  - improved uniformity of compaction
- **Night-time operation (asphalt)**
  - coverage on back pass
- **Lower Operating Costs**
  - Optimized pass coverage, better efficiency
- **Documentation**
  - Quality control and post-process data analysis
  - View opportunities for improvement

Data Management

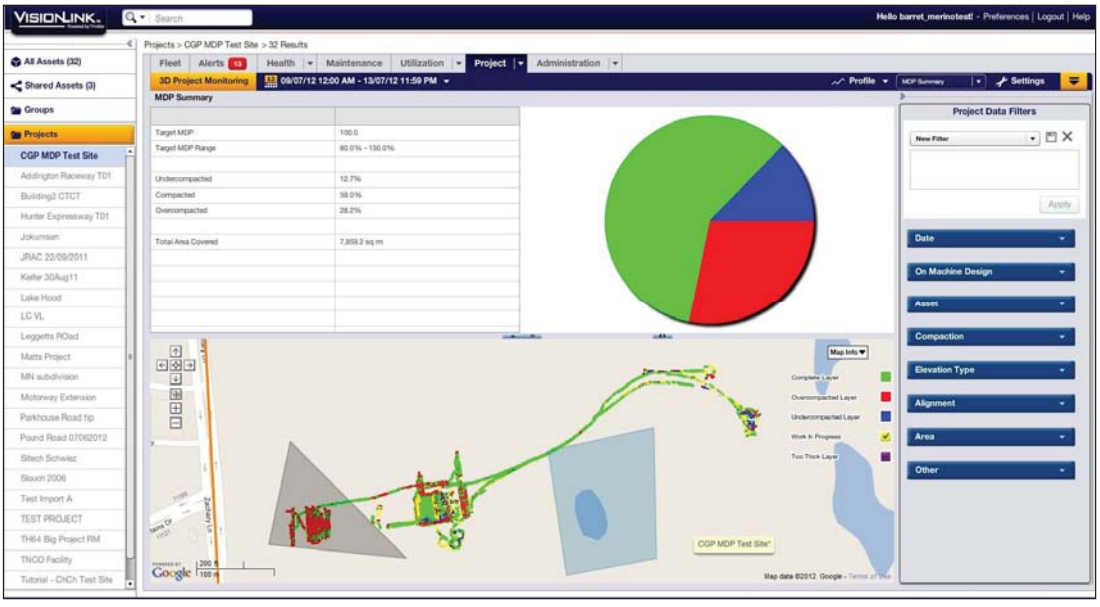


What do we do with all the valuable data that we have created and collected?

VisionLink Software

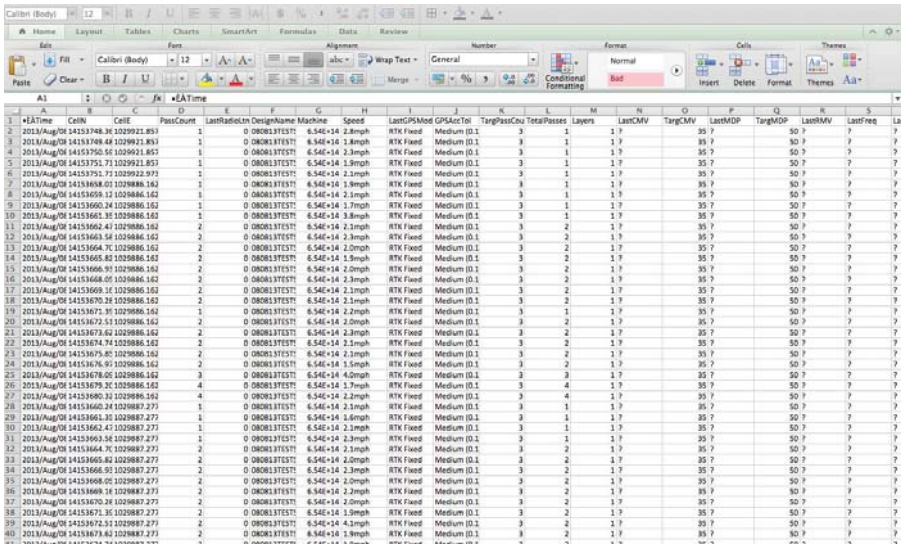
- Compaction module called “3D Project Monitoring”
- Internet-based software program
- Data can be uploaded wirelessly from machine or via USB drive
- Must have a paid subscription and user-account and register each machine
- Login at www.myvisionlink.com

Data: VisionLink



Data: VisionLink

Data can be exported in *.csv (MS Excel) format



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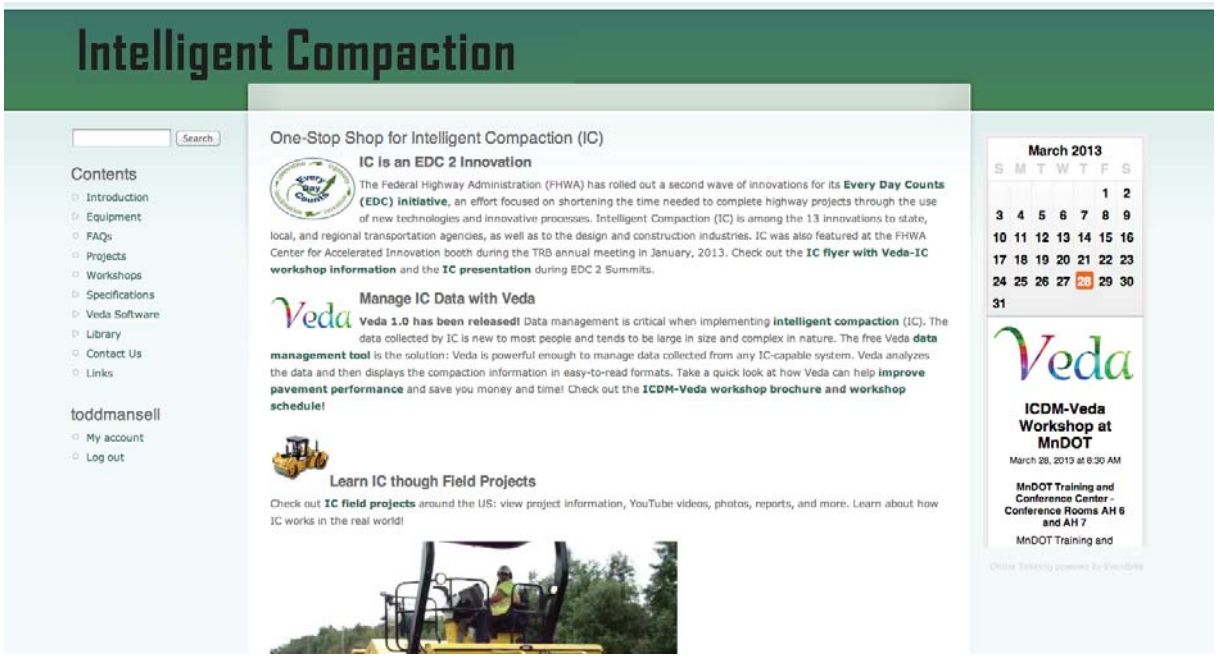

IC Summary

1. Intelligent Compaction (IC) provides benefits over traditional testing methods:
   i. Increased operator awareness – “self training”
   ii. Improved density & smoothness – real time actionable info
   iii. Improved rolling pattern – real time
   iv. Lower operating costs by more efficient rolling patterns
   v. Documentation – for the Owner and the Contractor
2. IC includes:
   i. Compactor integrated data measurement
   ii. GPS positioning tied to collected data
   iii. Ability to analyze & document data

3. IC on Soils is more a direct measure of compaction
4. IC on Asphalt is more process control at this point

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