AccuGrade ® Compaction

GPS Mapping & Measurement

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Agenda

1. FHWA Update
2. Caterpillar AccuGrade Compaction systems
   a) Soil
   b) Asphalt
3. Operator Display Simulation
4. Jobsite #1 – Soil
5. Jobsite #2 – Asphalt
6. Summary and takeaways

Involvement with IC Testing

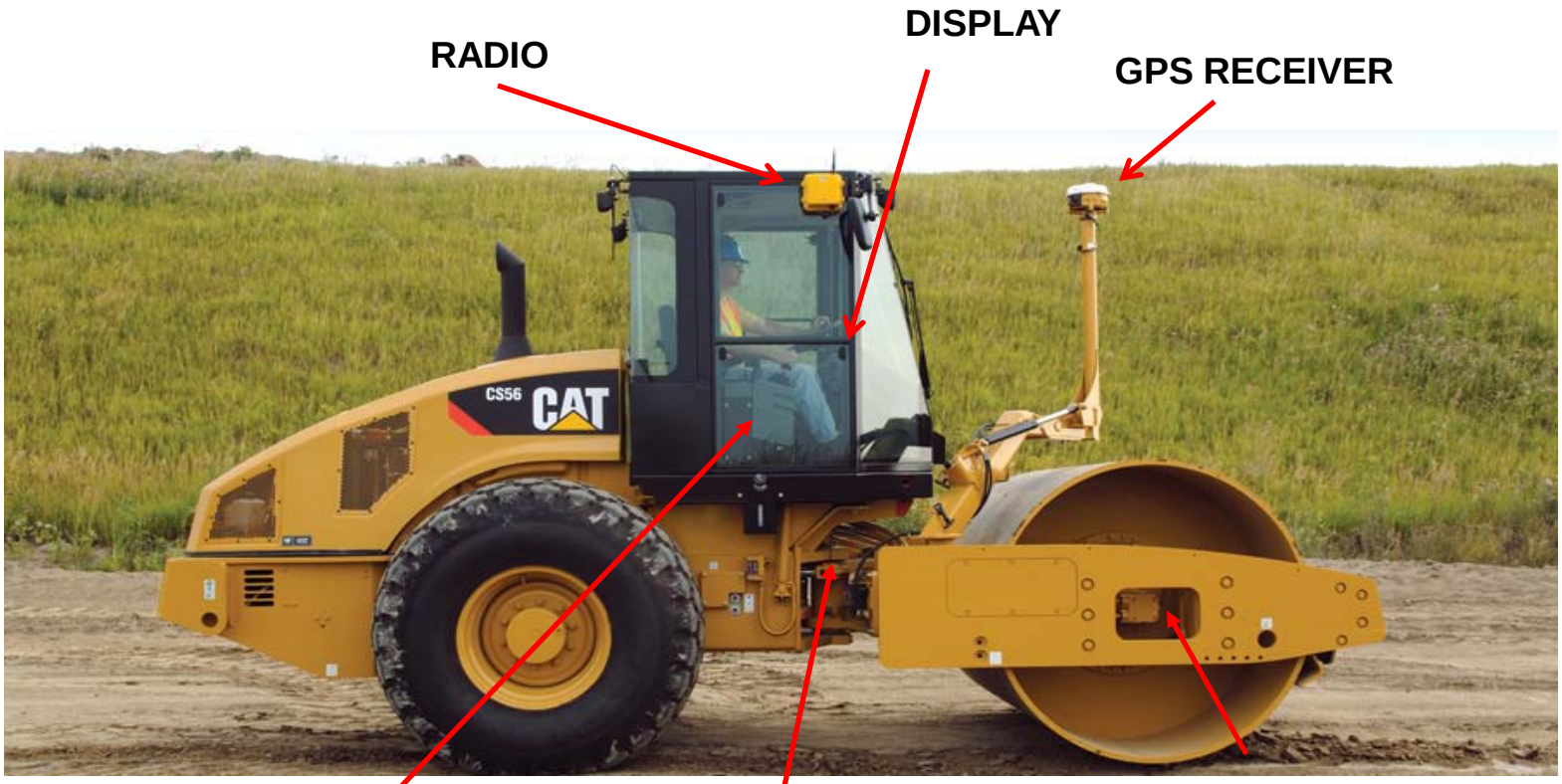
2005 TH14 Mankato, MN
2005 TH53 Duluth, MN
2006 TH64 MN
2006 MnRoad Test Facility
2007 Colorado School of Mines and Technology
2007 TH36 MN
2007 TH60 Bigelow, MN
2008 University of Delaware
2008 FHWA Kansas
2008 MnRoad Test Facility
2008 TH3 Rochester
2008 TH60 Bigelow, MN
2009 FHWA NY
2009 FHWA MSDOT
2010 FHWA / NDDOT
2010 FHWA / INDOT

What is AccuGrade?

- AccuGrade is Caterpillar's Machine Control and Guidance Solution.
  - Delivers factory-integrated machine controls
  - Leverages positioning technologies (Sonic, Laser, GPS and ATS) to provide solutions in different applications
  - Increases productivity and profitability

AccuGrade Compaction for Soil

- The system maps soil stiffness measurements using GPS



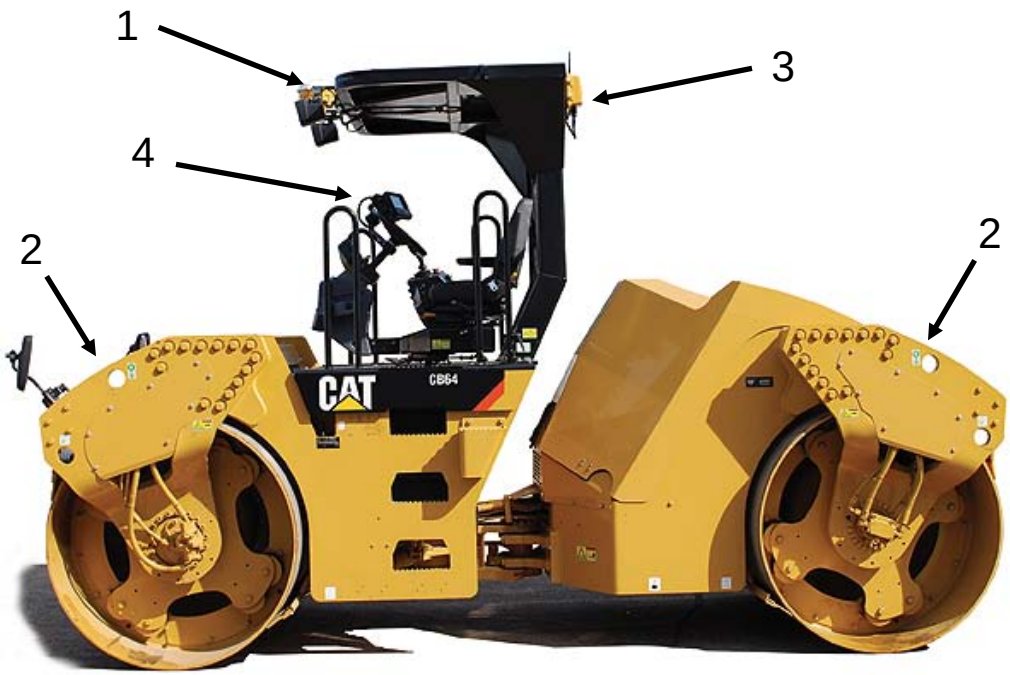
Measurement Methods

Currently Available	Future: Cat Proprietary "Machine Drive Power"
– Based on industry standard technology – Uses measurements to provide an indication of soil stiffness – displays as CCV (Caterpillar Compaction Value) – Works well in non-cohesive soil, on smooth drum compactors – Measures up to 4' deep	– Expected production in January 2012 – Uses rolling resistance to measure compaction – Only measures to the depth that is being compacted –Works in all soil types, on smooth drum, padfoot or smooth drum with shell kit – Measures ~1' deep

AccuGrade Compaction for Asphalt

- The system maps temperature & pass count using GPS

Display (4)



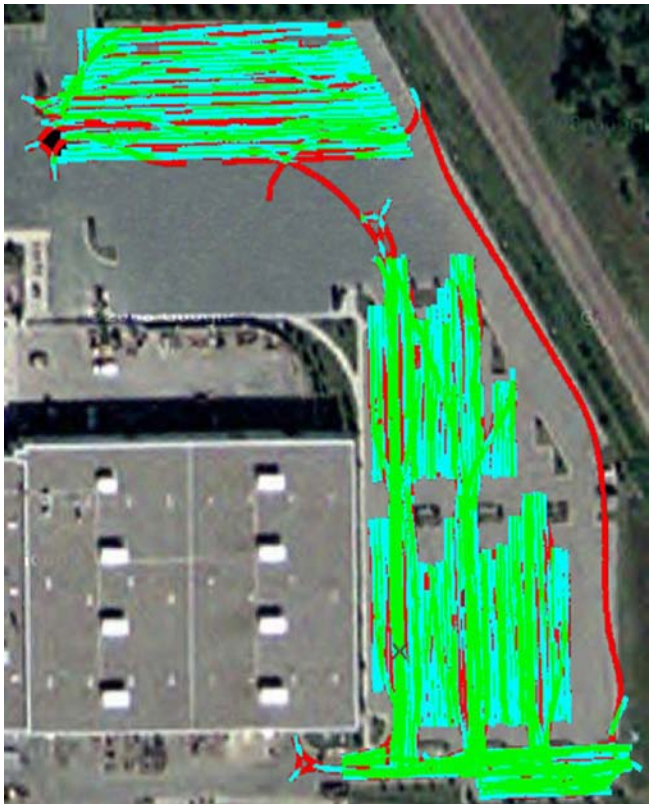
Radio (3)

Receiver & Angle Sensor (1)

Temperature Sensor (2)

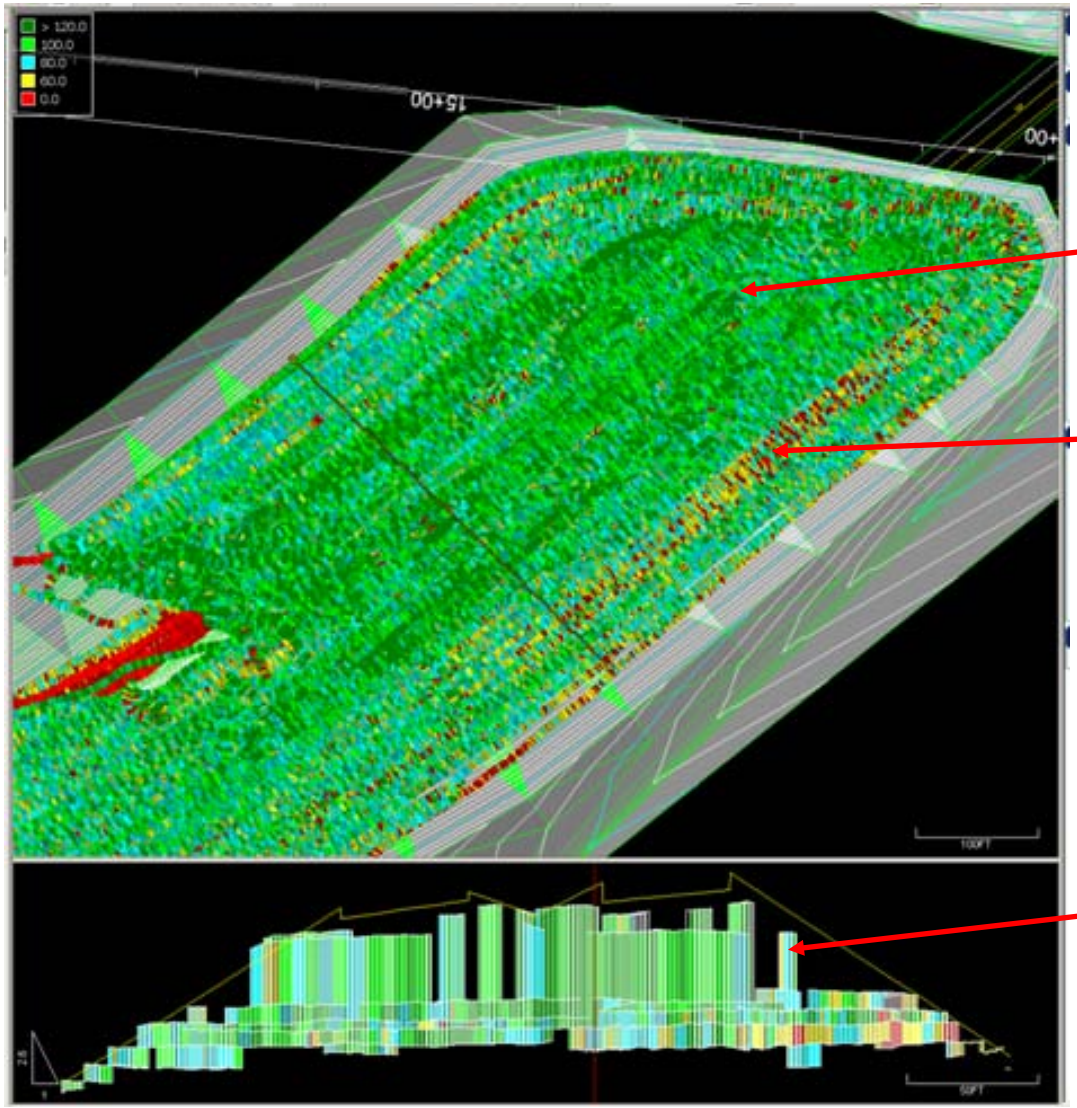
Asphalt System Measurements

- Focusing on process control to start
  - Asphalt temperature
  - Pass count
  - Vibe frequency
  - Vibe status (on/off/rear/both)
  - Ground speed
  - Position (northing, easting, elevation)
  - Compaction width
  - Direction (forward, rearward)



Simulation…

#1 - Highway 380 in Greenville, Texas



Dark green is higher compaction level (roadway)

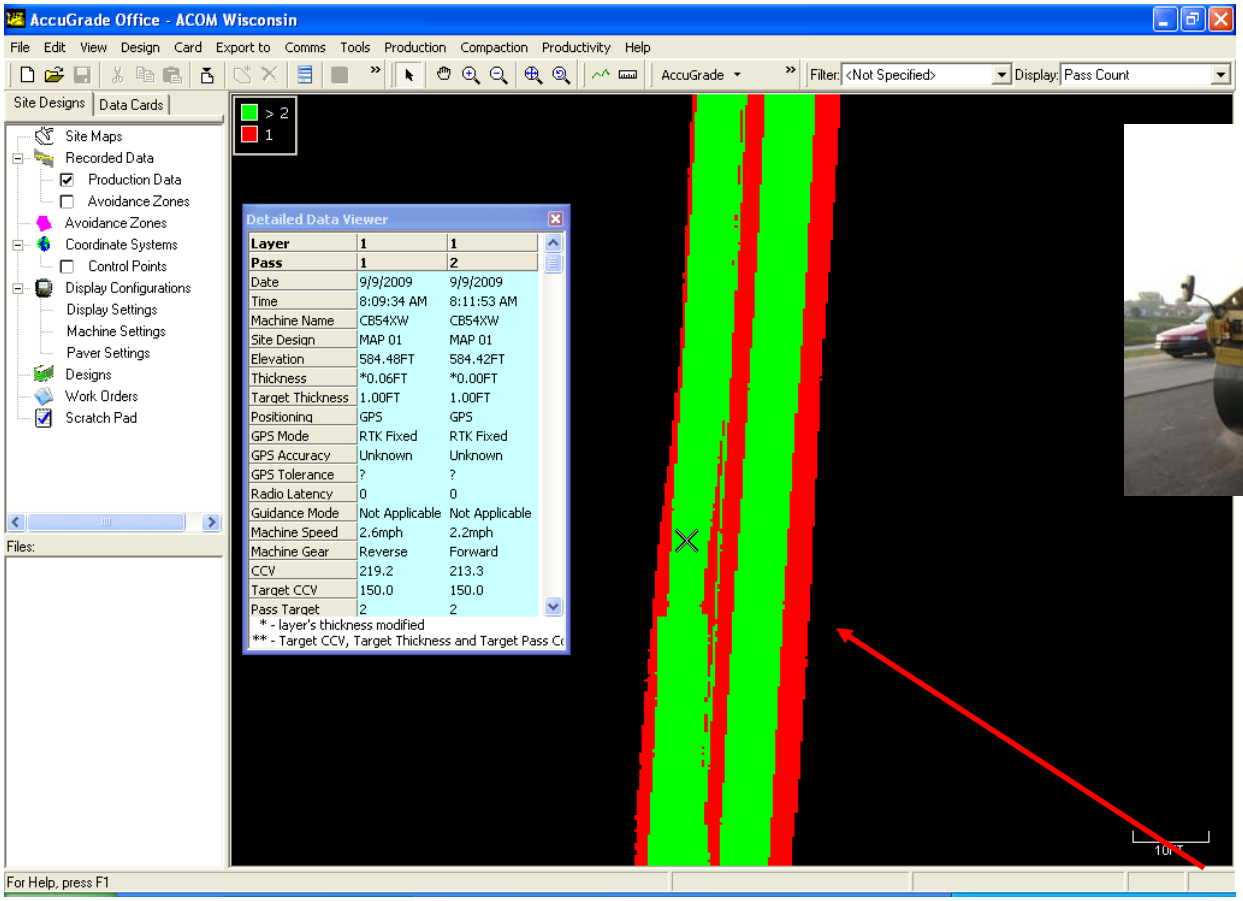
Yellow/red indicates lower compaction level (embankment)

+20’ of fill, compaction and elevation of each layer shown

#1 - Highway 380 in Greenville, Texas

- Key Takeaways
  - Had 825 and CP56 compactors on site
  - Imported design files to the machine display, giving operator clear boundaries to work within
  - After a night's rain, soil would not compact – the system helped identify the problem early
  - CP56 outputs indicated that 1x pass by the 825 was enough
  - Clearly showed that scraper traffic had a big impact on compaction and should be controlled
  - Provided accurate lift thickness, compaction coverage, **uniformity**
  - As-built elevations versus design showed bridge elevation that was 3' off
  - Operator understood measurements

#2 – Asphalt Demo in Wisconsin



Green = 2 passes (Target)

Red = 1 pass

Performance without system guidance (75% coverage)

#2 – Asphalt Demo in Wisconsin

- Takeaways
  - Ran first passes without operator paying attention to display – inconsistent coverage (missed 25%)
  - Ran successive passes with display in front of operator & found coverage & consistency increase dramatically
  - Foreman mentioned night paving as a big challenge for roller coverage, saw system as solution
  - High interest in ability to control the process and prove method was consistent

Summary and take-aways

- What we see as benefits
  - Real time information to attack problem areas
  - Delivers as-built condition, quantifies placed and compacted fill
  - Will minimize effort, fuel, and manhours on compaction – put effort where it is needed to achieve final spec
  - Lower overall production costs

- What we see as challenges
  - Acceptance standards are higher/more test results generated
  - Knowledge/training and communication with roller operator is key

Questions?