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

![Image of AccuGrade Compaction for Soil](image_url)
# Measurement Methods

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

- The system maps temperature & pass count using GPS
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?