Trimble CCS900 Compaction Control System Overview

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Overview

- Compaction Controls Systems
- Product Introduction - CCS900
- On board Vibe Controller
- Compaction Measurements
- Basic Compaction Control
- Advanced Compaction Control and Documentation
- Office Software – Compaction Module
- Trimble CCS900 Customer Benefits
- Summary
Compaction Control Technology

• Can be referred to as
  – “Compaction Control System” (CCS)
  – “Intelligent Compaction” (IC)
  – “Continuous Compaction Control” (CCC)

• Derived from US and EU highway standards
  – US DOT / Federal Highway Administration
  – Germany – FDKV (Flächendeckende Verdichtungskontrolle)
  – Finland
  – Sweden – ATB Väg 2004
  – Austria – RVS 8S.02.6
Compaction Control Technology

- Government compaction control requirements are emerging
  - Federally funded highway projects require:
    - More stringent documentation
    - QA/QC data
    - Warranty provisions
  - Contractors are required to produce more detailed documentation
Accelerated Implementation of Compaction Control Technology

Source:
Innovations in Compaction Control and Testing
Intelligent Compaction
Mike Arasteh - Consultant - FHWA
Federal Highway Administration
www.fhwa.dot.gov/pavements/
Compaction Control Technology

- **Measures** soil stiffness as an indication of soil compaction
- **Controls** the machine compaction effort versus measurement data
- **Displays** compaction measurements, pass counts, provides guidance to the operator
- **Maps and records** compaction data
Introduction – Trimble CCS900 Compaction Control System

- Trimble’s initial entry into compaction
  - Builds on the Trimble GCS900 platform
  - First product showcase at BAUMA 2007

- Compaction control and documentation
  - On-machine and office software components
  - Wireless data transfer

- Basic and Advanced modes
  - Standard aftermarket and Trimble Ready™ options
On-board Vibe Controller

CMV - Compaction Meter Value
- Measure of soil stiffness
- Affected by machine direction, speed, machine weight

RMV - Resonance Meter Value
- Measure of decoupling or drum bounce

Frequency – Vibration frequency (impacts/min)

Amplitude – Impact force
Compaction Measurement

Machine Compaction Measurement

Traditional Compaction Measurement
Compaction Measurement

- Compaction Control System measurements
  - Not equivalent to traditional measurements
  - CCS ground penetration ~ 1 – 2 meters
  - Traditional density tests (e.g., Nuclear Density test) ~ 305mm
- CCS must be periodically calibrated
CMV Relative Measure

• CMV is a relative measure of soil stiffness
• CMV value is affected by a number of variables, for example:
  – Machine size
  – Material type
  – Material moisture
  – Direction of travel
  – Machine speed
• CMV represents the value across the entire drum width.
Basic Compaction Control – Standard Installation

- Real time display of pass counts and coverage mapping
- Primary components:
  - Trimble MS990
    - Smart GPS+GLONASS Antenna
  - Trimble SNR900/SiteNet450
    - On-machine Radio
  - Trimble CB430
    - Control Box
  - Trimble AS400
    - Slope Sensor (optional)
Basic Compaction Control and Documentation

• Provides base-level functionality
• No interface to OEM on-board vibratory control or compaction sensor systems
• Uses standard Trimble GCS900 v10 components
  – No new or special hardware
  – Standard system install on most OEM rollers
  – Single and Dual Trimble MS990 Smart GPS+GLONASS Antennas drum mount configurations
Basic Compaction Control and Documentation – On-machine Software

- **Pass count mapping and inspection**
  - View where compaction has taken place in real-time
  - Data displayed in job site coordinates
  - Reduces over/under-compaction of the work area

- **Layered Lifts**
  - Sub-material layers compacted in lifts
  - Defined in the office or cab
  - Allows faster, more balanced compaction
Basic Compaction Control and Documentation – On-machine Software

- Cut / Fill Coverage Mapping
  - QA / QC design grade specifications have been met, post-compaction
  - Catch errors prior to the start of paving operations

- Productivity reporting
  - Includes:
    - System usage
    - Compaction terrain logging
    - Machine productivity statistics
  - Logged to a new *.TAG file
    - Replaces the *.ST file
  - Analyzed in Trimble SiteVision® Office 7
Basic Compaction Control and Documentation – On-machine Software

- Wireless data transfer
  - Reduce site visits to update machine data files
  - Real-time machine productivity analysis
Advanced Compaction Control and Documentation – Standard Installation

• Uses standard Trimble GCS900 v10 components
• Real-time display of compaction data

- Trimble MS990 Smart GPS+GLONASS Antenna and Mast
- Trimble SNR900/SiteNet450 On-machine Radio
- Trimble CB430 Control Box
- Vibe Controller
- Trimble AS400 Slope Sensor
- Accelerometer
Advanced Compaction Control and Documentation– On-machine Software

- CMV View compaction levels in real-time
  - Detect where compaction does not meet design spec
  - On-screen inspection of coverage area
  - Immediate QA/QC of compaction
  - Reduce use of traditional methods for validation of problem areas
Advanced Compaction Control and Documentation – On-machine Software

• Proofing mode and summary
  – On-machine validation of final compaction runs
  – Increases the quality of the final compacted material
### Trimble Compaction Control System

#### Basic versus Advanced

<table>
<thead>
<tr>
<th>Functionality</th>
<th>Basic</th>
<th>Advanced</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Passes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Pass count spot checks</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Lift Detection</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>SBAS Support</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>CMV / CCV Mapping</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>CMV spot checks</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>RMV / Decoupling</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Frequency Indication (Vibratory)</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Proofing Mode</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Note: Trimble CCS900 provides the same feature set and functionality as CAT Accugrade on the CAT CS563 ARO roller.
Office Software Component

- Compaction data mapping
- Pass count mapping
- Detailed data views and reports
Compaction Reporting Module

• **Target customers**
  - Site Engineer & Project Manager
  - Clients (DOTs)
  - Contractors instructed to use this technology by clients in project specifications

• **This module provides**
  - A high level summary view to quickly quantify large areas and multiple layers of compaction data
  - Tools to view detailed pass by pass progress in areas of interest, including all the compaction data, not just a proofing pass

• **The customer gain is**
  - Improved detection of potential problems
  - Better utilization of machinery
  - Verification that target criteria have been met
Trimble SiteVision® Office v7 – Compaction Module

- Data referenced to job site coordinates
- Compaction meter value (CMV) mapping
- Pass count mapping
- Detailed data views and analysis
  - Target CMV
  - Target Lift Thickness
  - Actual CMV
  - Lift Thickness per pass
- Compaction and grade control QA/QC
- Design and compaction data archival
- Wireless data transfer to and from office
Detailed Data Viewer

Graphical displays for CMV/CMV % maps
Compaction Reporting UI

- Compaction menu
- Additional Display maps
- Proofing Run filters
- Additional Timeline data types
- Graphical pane in Detailed Data Viewer
- Summary Views & Compaction Options buttons
Graphical Views

Select required display type from drop down list.
Right click to edit legend settings.
Draw Profile.
Summary Views

- Quickly check against:
  - Target CMV
  - Target Lift Thickness

- Applies to:
  - Plan View Map
  - Profile View
  - Detailed Data Viewer

- Review large areas and multiple layers
Trimble Compaction Control System
Benefits to the Contractor

- Faster material inspections
- Reduction of human errors
- Improved in-place density
- More efficient compaction operations
- Better pavement performance
- Longer-life pavements
- Reduction in highway repair costs
- Clear data for archival and warranty work documentation
Trimble CCS900 – Looking forward

• Trimble initial entry into compaction
  – Product is in first stages
  – Builds on existing capabilities of Trimble GCS900
  – Focused on soil compaction, asphalt support planned
  – System enhancements planned

• Product line will mature over time
  – Maintain flexibility, scalability, portability
  – Support of additional OEM CCS measurements and systems planned

• Significant growth opportunities
  – Large world-wide compaction market space
  – More National, Federal CCS requirements emerging
  – Warranty work, documentation becoming prevalent
Thank you