# Paver, Roller & Cold Planer Innovations







### Technology – How is it emerging in construction?

- "First, technology will continue to become more human-centric where it will increase <u>transparency between</u> <u>people, businesses, and things</u>...this relationship will become much more entwined as the evolution of technology becomes more adaptive, contextual, and fluid within the workplace, home, and interacting with businesses and other people...
- Second, the age of the perceptual <u>smart machine is a key trend</u>—and will be one of the most disruptive class of technologies throughout the next 10 years due to near-endless amounts of data. <u>Organizations with smart-</u> <u>machine technologies will harness data in order to adapt to new situations and solve problems</u>. Such technologies include virtual personal assistants, smart robots, drones, autonomous vehicles, personal analytics, machine learning, and more...
- Finally, the platform revolution is a trend as well, with emerging technologies changing the concepts of how
  platforms are defined and used. The analyst firm says the <u>shift from technical infrastructure to ecosystemenabling platforms is laying the foundation for new business models that bridge humans and technology</u>. Key
  technologies include quantum processing, IoT (Internet of Things) platforms, software-defined security, and
  more. In order to leverage this, organizations need to proactively understand and redefine their strategy to create
  platform-based business models, and exploit algorithms in order to generate value." Gartner 2016



### Technology

### "the use of science in industry, engineering, etc., to invent useful things or to solve problems"





### Technology & Innovation: More than just iron



- Real-time information
- Telematics
  - Monitor all facets of equipment
- Better information = better decisions
- Faster information = faster decisions
- Faster decisions results in improvements in
  - Quality
  - Efficiency/profit
  - Value for owner



### What allows this new age of information?



- Positioning systems (GPS)
- Computing speeds/capacity
- CANbus technology
- Wireless data transmission







How Technology will make the World's Most Sustainable Industry More Sustainable



### **Sustainability**

- Pavement preservation and recycling are invaluable for our future.
- We cannot ignore the opportunities to build longer-lasting roads and to maintain or improve roads using fewer resources.
- We must be ever vigilant in finding ways to do our work in <u>less time</u> so interruptions to the movement of people and goods are minimized.
- Manufactures need to apply innovation and technology to improve the sustainability performance of our products, services, solutions and operations
- We must keep nonrenewable resources in circulation for multiple life cycles. Reclaim and Reuse. Continue to master the art of recycling ... You all have been leaders in recycling and deserve a lot of credit





# **Technology Integration**

Increase customer value by achieving density and smoothness in the shortest possible time without waste.





# **Technology Integration**

- What does technology mean to the Paving Business?
- Is It Changing?







### Technology is... Redefining industry standards





### Established, but growing technologies



- Telematics
- Infrared temperature reading
- Intelligent Compaction
- Automatic grade & slope
- 3D Paving/Milling
- Paving & Compaction calculators
- AMG & AMC

### **Asphalt Paver Innovations - Today**



- Integrated G&S control
- Pre-set paving speed
- Telematics
- Auto-fill
- 3D screed control

### Infrared temperature measurement











### **Automatic Grade & Slope control**



- Existed since the 1950s
- New features
  - Cross coupling
  - Easier interface
  - Sonic systems most popular today





### **3D Paving/Milling**

 New Android App raw GNSS data

 Power bands on receivers



# **3D Paving**

### • Precise material lay down

- Precise control of material material savings
- Precise control of elevations and profile
- Accurate within 1/24"–1/8" (1-3 mm)
- Less chance of operator error with complex designs
- Transitions
- Super-elevated curves
- Frequently changing cross slopes
- Smoothness
  - 3D equipment and controls facilitates less screed adjustments delivering the smoothest application of asphalt.
  - Maintain production rate No stopping/starting









### **Paving Calculators**









- Provide information based on inputs
- Actual changes are still done "manually" by operators – a form of AMG
- Future changes are automatic if desired = AMC





### **Asphalt Paver Innovations - Future**

- Guidance systems
- Automated paving speed balanced with plant & trucking
- Full autonomy no operator



### Automated machine setup



- One-button setup per job conditions
- Example: Paver, 14-ft wide, 2" lift compacted





### Automated Machine Guidance & Control (AMG/AMC)



- Precise grading to elevation
- Precise material quantities
- Stakeless surveys
  - Efficiency
  - safety



### **Asphalt Roller Innovations - Today**



- Intelligent Compaction
  - Pass count mapping
  - Temperature mapping
  - Stiffness measurements
- M2M communication
- Auto-Adjustable Drums



### Intelligent Compaction on Soils and Asphalt [

Performance

### Make every pass count!





# With the conventional compaction measurement, what percentage of the surface is actually tested?

## Less than 1%

### **Intelligent Compaction on Asphalt**

### • Pass count, Temperature, ICMV

- Some specs written around pass count %
- ICMV ≠ Density
- Experience indicates that initial breakdown temperature correlates well with final density

- Real-time information that is "actionable" reduced rework
- Increased Operator Awareness self training tool
- Improved Density & Smoothness uniform passes
- Operator productivity reduced number of passes
- Night work knowing where you're at!
- Documentation of 100% of job!!





# **Intelligent Compaction on Asphalt**

### Performance

- Coverage
- Pass Count
- Temperature
- Vibe on or Off
- Frequency
- Amplitude
- Quality Control (Mapping)







### **Customer Need – Temperature Mapping**

Performance





### Adaptive Compaction systems



# Machine-to-machine (M2M) communication



- Machine position and pass count allows multiple machines to perform the work as one (interactive mapping)
   -- echelon breakdown rolling
- Temperature can be used to start/finish compaction and to avoid tender temperature zones where damage can occur
- Complete operator understanding







### Future roller technology

- Density on-the-run
- Smoothness on-the-run
- Automated machine setup
- Autonomous machine control
- More connected worksite
- Learning systems that adapt to changing conditions





### Smoothness & Density "on the run" (OTR)



- Drones for smoothness?
- Real-time density measurement continues to be investigated
- Measure smoothness behind screed with scanner similar to IR-temperature scanner? LIDAR
  - Behind finish roller?



### **Asphalt Roller Innovations - Future**



- Rolling pattern optimizer
- Smart rollers learn & adapt
- Full Autonomy



### **Cold Planer Innovations - Today**



- Ventilation systems
- Automated functions ramp in/ramp out & jump/hold features
- Integrated 2D grade control
- 3D grade control



### **Dual fan ventilation system**



- Ventilation system
  - >4" spray w/ surfactant & ventilation
  - <4" spray w/ surfactant</p>



### Ramp in/ramp out



- Automated functions
  - Ramp in/ramp out
  - Set depth & distance



### Integrated 2D grade controls & 3D grade control



### **Obstacle Jump**



- Machine Raised to Clear the Obstacle
  - ✓ When the machine is raised to clear the obstacle, the grade system will suspend (1)
  - ✓ When returning into the cut, a caution message
     (2) will appear
  - ✓ Press OK (3) to confirm

### **Cold Planer Innovations - Future**



- Ventilation on all sizes moving forward
- 3D will be more common
- Object detection
- Automated setup & control features
- Measure quantities in real-time
- Monitoring wear in real-time for cost/estimating



### Other emerging technologies



- Drones
  - Road condition surveys
  - Site reconnaissance
  - Stockpile management
  - Plant maintenance
  - Thermal images
  - LIDAR



### Autonomous, semi-autonomous, remote control



- No operator, remote operator
- Already exists in mining
- Safety, efficiency, workforce "gap"
- Autonomous car testing is happening now!



### Learning systems



- "Intelligent Construction" where machines can record and share information (M2M) and adapt to changing site conditions
- Example: Paver and roller speeds adjust automatically based on trucking/plant/traffic information to maximize smoothness and density bonuses, quality

### Where are we now?



- Technology components exist
- Starting to connect the pieces
  - Software packages
- Customer value: Cost vs. ROI
  - Costs high, but decreasing
- Technology continues to evolve
- Collecting more & more data

### Where are we now





### **Data Analysis & Management**

#### Project Management

35





2013/Aug/0/14153669.1/ 1029887.277 2013/Aug/0/14153670.2/ 1029887.277

2013/Aug/06 14153671.30 1029887.27

2013/Aug/08 14153672 51 1029887 277 2013/Aug/08 14153673 62 1029887 277

0 080813TEST: 6.54E+14 2.2mph 0 080813TEST: 6.54E+14 2.0mph 0 080813TEST: 6.54E+14 2.0mph 0 080813TEST: 6.54E+14 1.9mph

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### Wireless data near 'real-time'

### **Project Management**









### What's next?

- Automated machine control & remote site management
- Connected Worksite = integration of ALL machines beyond paving
- Integrating site inspection "e-Construction"





### **Paving Connected Worksite**

### Connectivity

**Goal:** Increase customer value by achieving asphalt road density, smoothness (quality, efficiency) in the shortest possible time (cost) with no waste (sustainability) through a connected worksite.





### Information at all levels of management...







### "Houston, we have a problem"





### **Customer Value**

### **Project Management**

- Brings together *Telematics, Performance and Connectivity* to make fact-based decisions in near real-time to better manage operations.
- Technology on construction equipment is all about access to INFORMATION that can be utilized in near Real-Time to assist managers in making sound decisions to improve the quality, efficiency and competitiveness of their business
- Technology collects and delivers information, allowing managers make quicker, more informed decisions than ever before





### Challenges...







- Mixed fleet software solutions
- Compatibility among OEMs
- Information security
- Information overload
- Data ownership
- Data privacy



OVELE

### Thank you for your attention!



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