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 transparency between people, businesses, and things...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 smart machine is a key trend—and will be one of the most disruptive class of technologies throughout the next 10 years due to near-endless amounts of data. Organizations with smart-machine technologies will harness data in order to adapt to new situations and solve problems. 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 shift from technical infrastructure to ecosystem-enabling platforms is laying the foundation for new business models that bridge humans and technology. 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 less time 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.
Increase customer value by achieving density and smoothness in the shortest possible time without waste.

**Technology Integration**

- **Reduce Waste**
  - Material
  - Fuel
  - Labor
  - Rework
  - Sustainability

- **Add Profitable Margin to Customer**
  - Production
  - Efficiencies
  - Bonus
  - Utilization

- **Improve Job Site Management**
  - Yield Management
  - Quality
  - Planning/Estimating
Technology Integration

• What does technology mean to the Paving Business?

• Is It Changing?
Technology is... Redefining industry standards

Telematics
- Products Condition
- External Environment
- Products Operation
- Products Usage

Performance
- Enhance product performance
- Allow predictive diagnostics
- Up and Down the Value Chain

Connectivity
- Enhance product performance
- Smart Connected Products part of a system of Product systems

Project Management
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

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

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

How much time do I have to compact this asphalt before it is too cold to compact?

How should I prioritize my time to do a good job in the shortest amount of time?

When can I start compacting newly laid asphalt?
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
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

“Let’s hold off making a decision until we have even more information we don’t really need.”
Where are we now

Telematics
- Products Condition
- External Environment
- Products Operation
- Products Usage

Performance
- Enhance product performance
- Allow predictive diagnostics

Connectivity
- Enhance product performance
- Through the Value Chain

Autonomy
- Full Jobsite Automation
- Machines (not robots)

Precise Project Management
- Compaction Mapping
  - AAC (Automatic Adjustable Compaction)
- Compaction Efficiency & Utilization
- Compaction Optimization
- Roller to Roller M2M Compaction Map Sharing
  - full documentation
- Mill to Truck data x-fer
- Plant to Truck data x-fer
- Truck to Paver data x-fer
- Paver to Roller data x-fer
- Roller to Roller data x-fer
- Rolling Pattern Optimizer
- Compaction Simulation
Data Analysis & Management
Wireless data near ‘real-time’
What’s next?

• Automated machine control & remote site management
• Connected Worksite = integration of ALL machines – beyond paving
• Integrating site inspection “e-Construction”
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
Thank you for your attention!