

Intelligent Compaction

Intelligent Compaction:
Fifty years of Development

50th Annual Idaho Asphalt Conference

Moscow, Idaho

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FHWA-HQ - Office of Pavement Technology
October 28, 2010



IS IC READY FOR PRIME TIME?

- IC FOR SOILS
– YES
- IC FOR GRANULAR BASES
– YES
- IC FOR HOT MIX ASPHALT
– YES



Intelligent Compaction

----Definition----

What is “Intelligence?”

- Oxford Dictionary: “...able to vary behavior in response to varying situations and requirements”
- Ability to:
 - Collect information
 - Analyze information
 - Make an appropriate decision
 - Execute the decision

3000-4000 TIMES A MINUTE



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Shortcomings Density Acceptance...



Limited Number of Locations

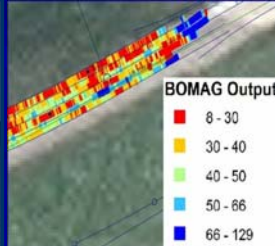


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Benefits of Intelligent Compaction

We have found-----

- Improve density....better performance
- Improve efficiency....cost savings
- Increase information...better QC/QA



Soil/Bases Rollers

Ammann/Case



Caterpillar



Dynapac



Bomag America



Sakai America



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HMA Rollers

Ammann/Case



Dynapac



Caterpillar



Bomag America



Sakai America



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What IC rollers need to have to be IC

- ❑ Vibratory Roller;
- ❑ Real time Kinematics (RTK) GPS system for roller positioning measurement computer systems;
- ❑ Integrated measurement computer systems to collect & analyze roller and pavement response information;
- ❑ Accelerometers mounted in or about the drum to monitor applied compaction efforts;
- ❑ Temperature instrumentation (HMA)
- ❑ GPS – based documentation system

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GPS Base Station



GPS Radio & Receiver

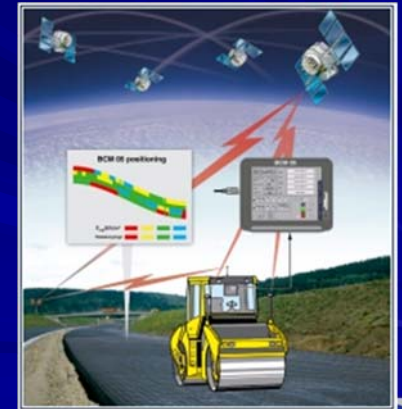


GPS Rover



Real Time Kinematic (RTK) GPS Precision

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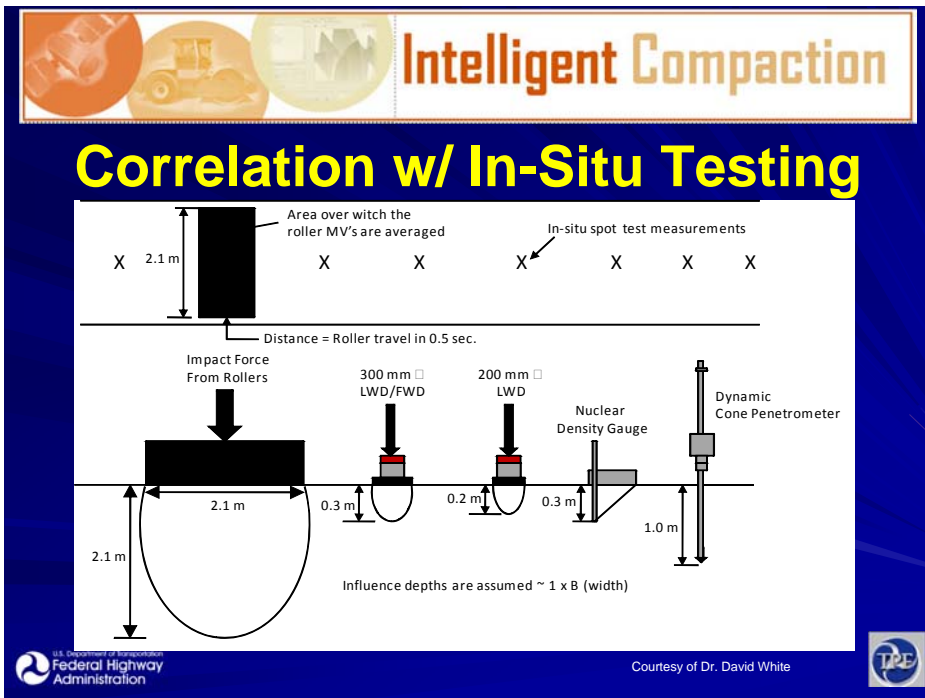
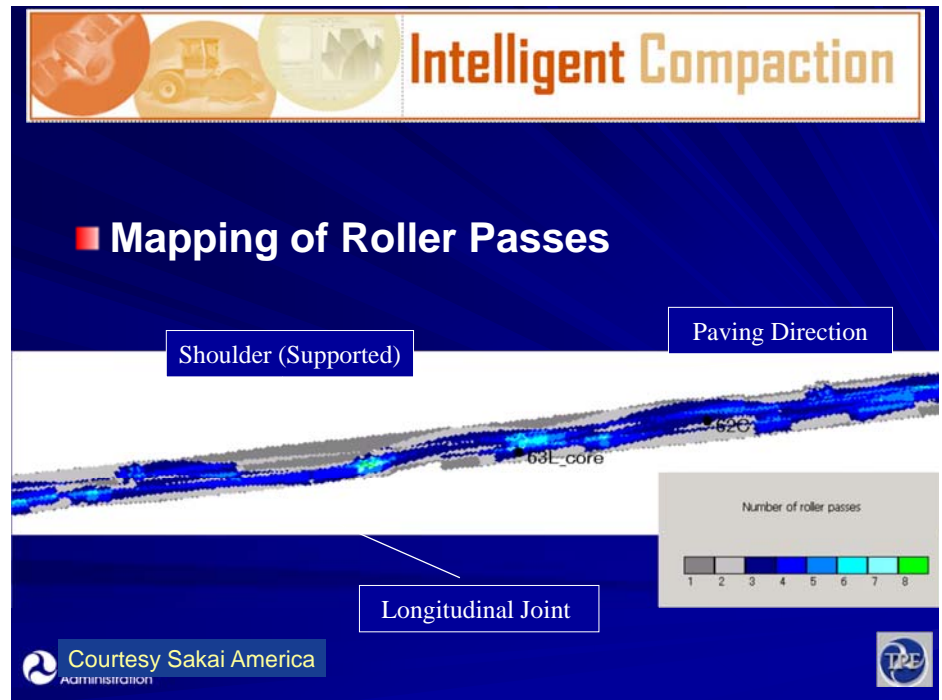
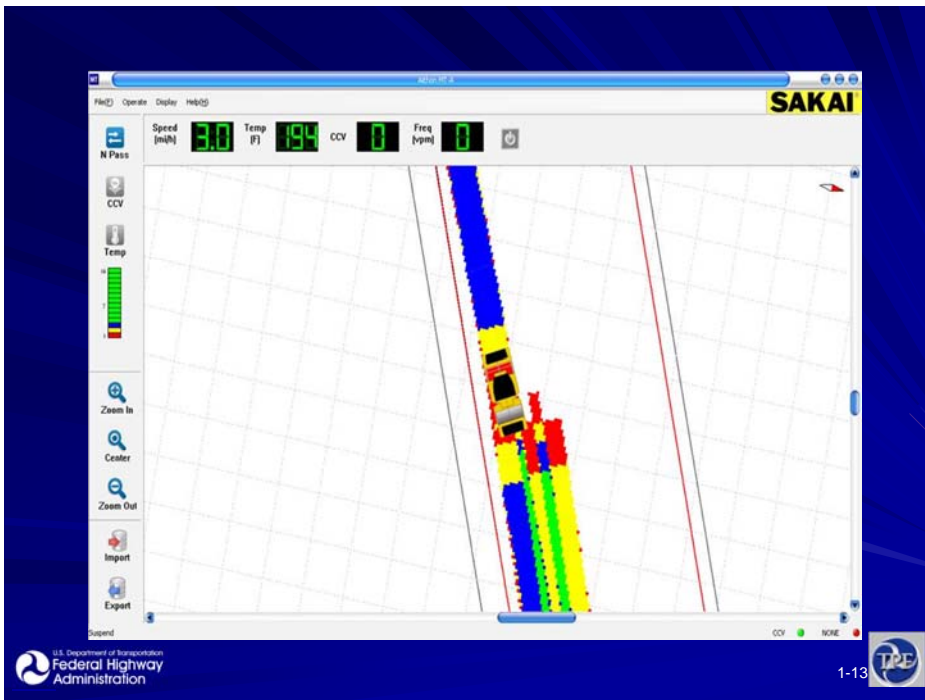


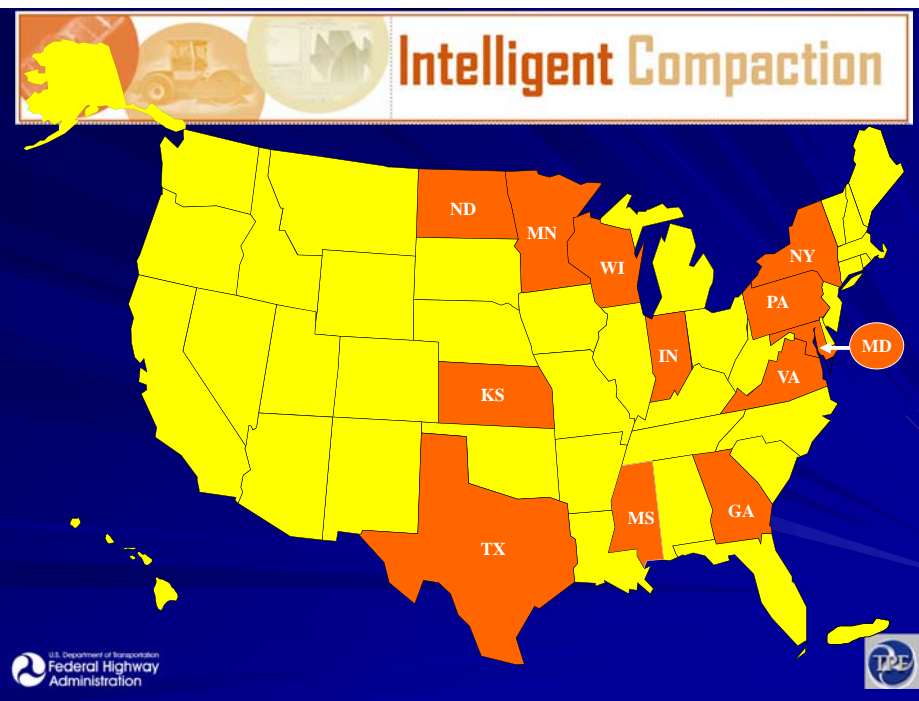
(Courtesy of Sakai America, Inc.)

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(Courtesy of Bomag America, Inc.)







- ## Intelligent Compaction
- **Objectives:** Based on data obtained from field studies:
 - Accelerated development of QC/QA specifications for granular and cohesive subgrade soils, aggregate base and Hot Mix Asphalt (HMA) pavement materials...
 - Short, Long and Future Term Goals
 - 3-year IC study for all the above materials
 - 12 participating States
 - 12+ field demonstration
- U.S. Department of Transportation
Federal Highway Administration

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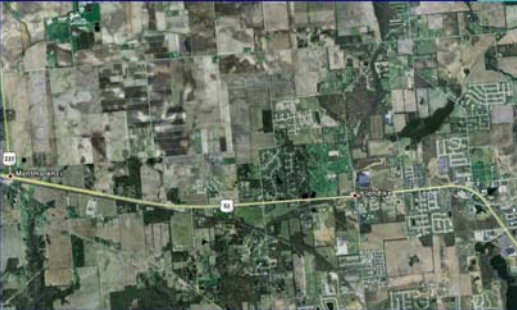
- US 52, West Lafayette, IN
- Mapping milled HMA surface
- New HMA overlay



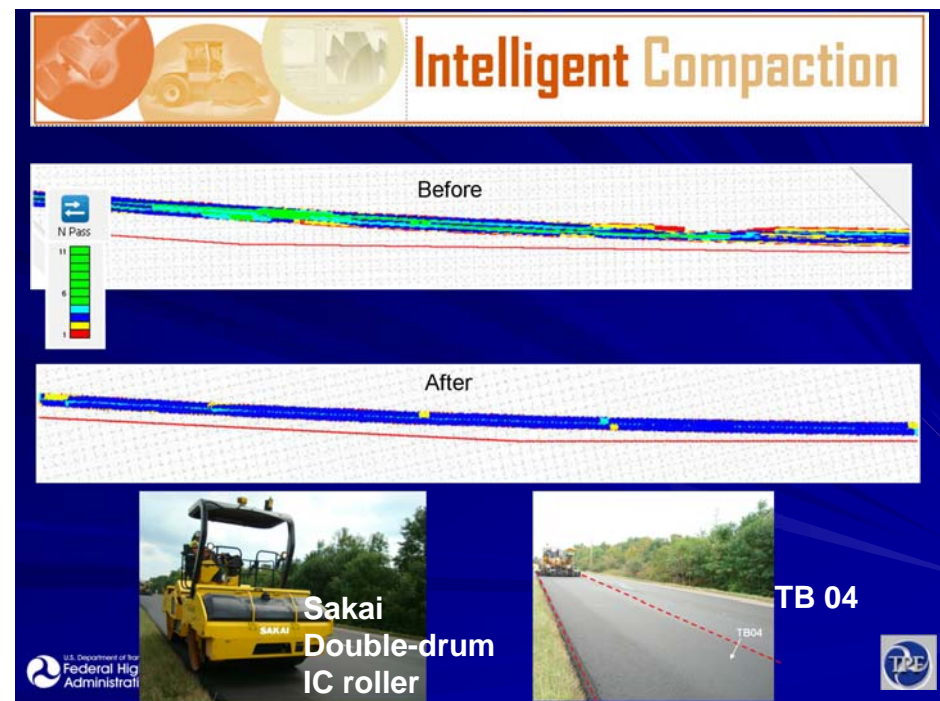
Sakai



Bomag

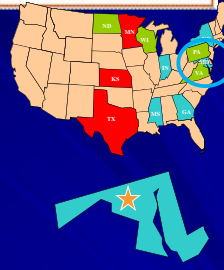


U.S. Department of Transportation
Federal Highway Administration



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- US 340EB, Frederick, MD
- SMA overlay
- Mapping milled HMA surface



Bomag double-drum IC roller



Sakai double-drum IC roller



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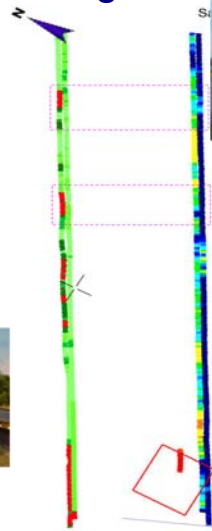
Test bed 02 Mapping Bomag Sakai

Bomag Evib

Gene	6502		
Start date	12/26/17 PM 7:21:0909		
End date	12/28/17 PM 7:21:0909		
AVI0 (Min)	208	101	350
EVib (Inch)	0.3	10.2	0.8
Frequency (Hz)	50	16	67
Speed (km/h)	5.5	1.0	6.6

EVib (M/min)	> 200	13 %
	113 - 200	20 %
	276 - 113	21 %
	230 - 276	7 %
	200 - 230	6 %
	< 200	16 %
	200 - 260	65 %

AVI0-value (Inch)	200
Increase	0
Standard deviation	65



Mapping Milled HMA

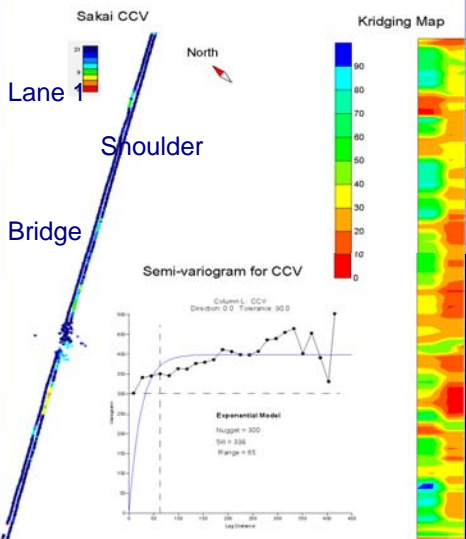


US 340 EB



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TB 03A Mapping on Exiting HMA Pavement



Mapping Milled HMA

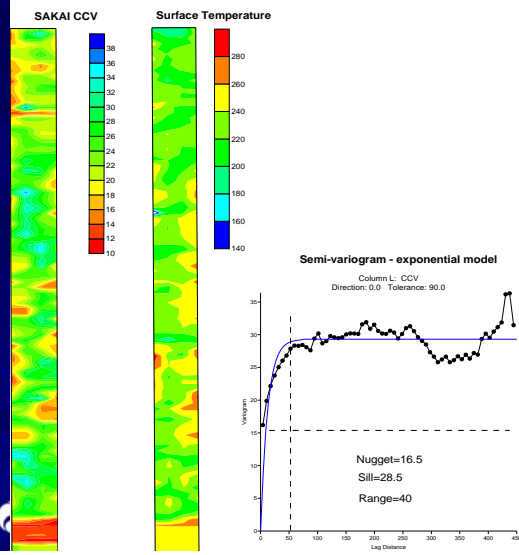


Sakai double-drum IC roller



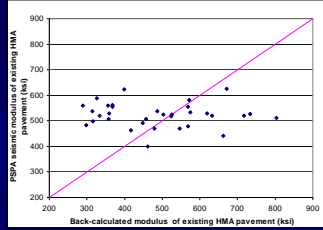
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TB 03B SMA overlay (distance 0 to 684 m)



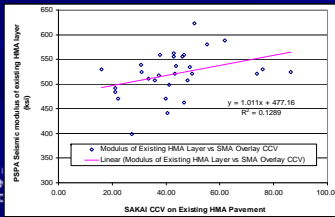
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Existing pavements



PSPA
VS
FWD

New SMA construction

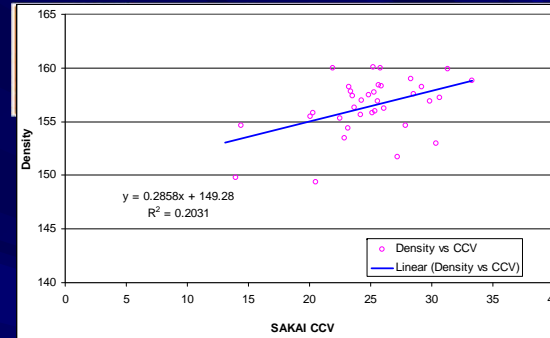


PSPA
VS
IC

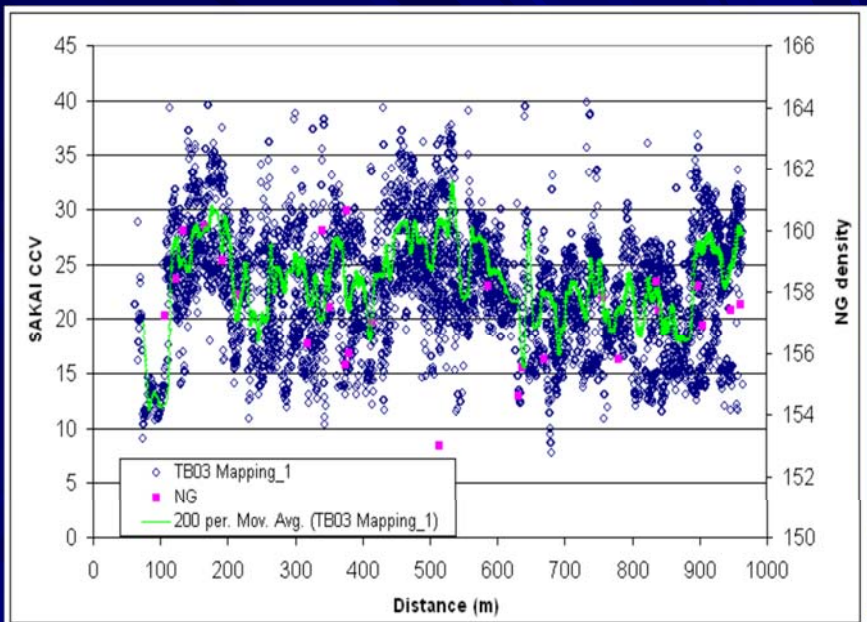
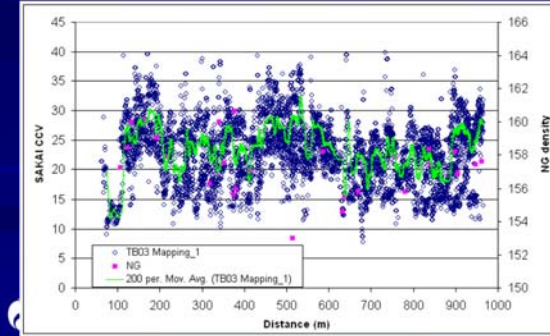


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IC RMV vs NG

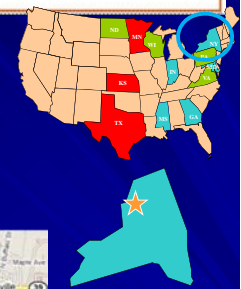


Sakai
Double-drum
IC roller

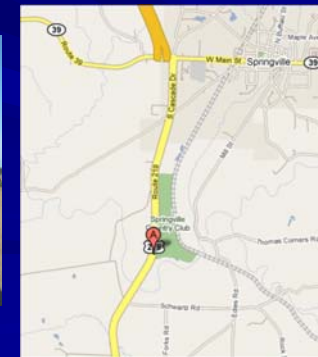


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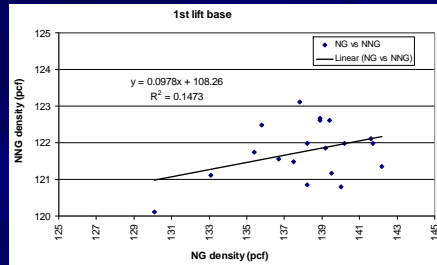
- Peter's Road, Springville, NY
- Mapping existing subbase
- New HMA construction



Sakai double-drum
IC roller



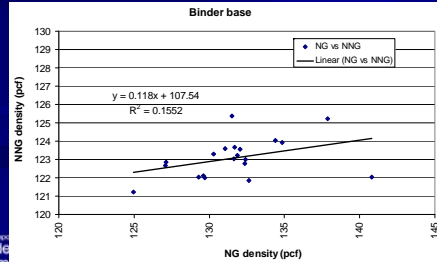
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NG



NNG (PQI)



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Future Initiatives:

- Regional Conferences – that target practitioners
- Establishment of Optimum Measurement Values
- Guidance Manual/Best Practices for both Soils and Hot Mix Asphalt Materials
- Mini-IC Demo's: Limited support for field trials with Non-TPF States
- Web-Page Continuation
- Specification development
- National and International Conferences



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Implementation of IC for Contractors and Agencies

- Validating RTK-GPS on each IC roller
- Target IC RMV with the optimum number of roller passes on a test strip to density
- Mapping underlying materials prior to paving
- Utilize IC roller-integrated temperature measurements to facilitate compaction at the optimum temperature ranges
- Utilize IC roller location capabilities to facilitate complete coverage of the HMA and to assist the roller operations, particularly at night
- Report and monitor RMV in segments to identify weak areas and facilitate agency acceptance

Thank you

