

Research Projects ND 2011-02, UND 2011-01, & NDSU 2011-02

Kyle Evert.
NDDOT - Materials & Research Division

Topics

- **MR 2011-02** - Evotherm 3G, Advera WMA and Foamed Asphalt Comparison
 - Objective
 - Scope
 - Evaluation
 - Construction
- **UND 2011-01** - Evaluation of the Rut Resistance Performance of Warm Mix Asphalts in North Dakota
- **NDSU 2011-02** - Warm Mix Asphalt Processes Applicable to North Dakota

MR 2011-02

Objective

- The objective of this project is to compare the performance of WMA produced using Evotherm 3G, Advera® WMA, and the foamed asphalt process.

Scope

- This research project will use thin lift paving projects to evaluate the WMA production processes and performance.
 - SS-3-015(010)060-Evotherm 3G WMA , Foamed Asphalt, & HMA
 - SS-3-015(018)073-Evotherm 3G WMA , Foamed Asphalt, & HMA
 - SS-4-003(011)159-Advera® WMA & HMA
 - SS-4-041(012)057-Advera® WMA & HMA
 - SCB-6-032(045)219-Evotherm 3G WMA with recycled asphalt & HMA
with recycled asphalt

Evaluation

Pavement Distress

- Rutting measurements
- Thermal cracks
- Cracking distresses caused by loading and traffic

Construction

- Density
- Temperature
- Fuel Consumption

SS-3-041(012)057

- 2" Thin Lift Overlay
- Advera® WMA
- Approximately 5 miles of WMA
- Approximately 5 miles of HMA for Control
- Blade Leveling



SS-3-041(012)057 Photos



Advera in tote.
Physical appearance
of powdered sugar.

SS-3-041(012)057 Photos



SS-3-041(012)057

Compaction Control

ND 41 - WMA Compaction Control

Date	Core Density	Maximum Theoretical Density	Compaction
Average	142.6	153.0	93.2%

ND 41 - HMA Compaction Control

Date	Core Density	Maximum Theoretical Density	Compaction
Average	141.2	153.7	91.9%

SS-3-041(012)057

Fuel Consumption

ND 41 - WMA Fuel Consumption

Type	Gallons of Burner Fuel	Total Tons of Mix	Gal/Ton
Total/ Average	13,564	9,674	1.39

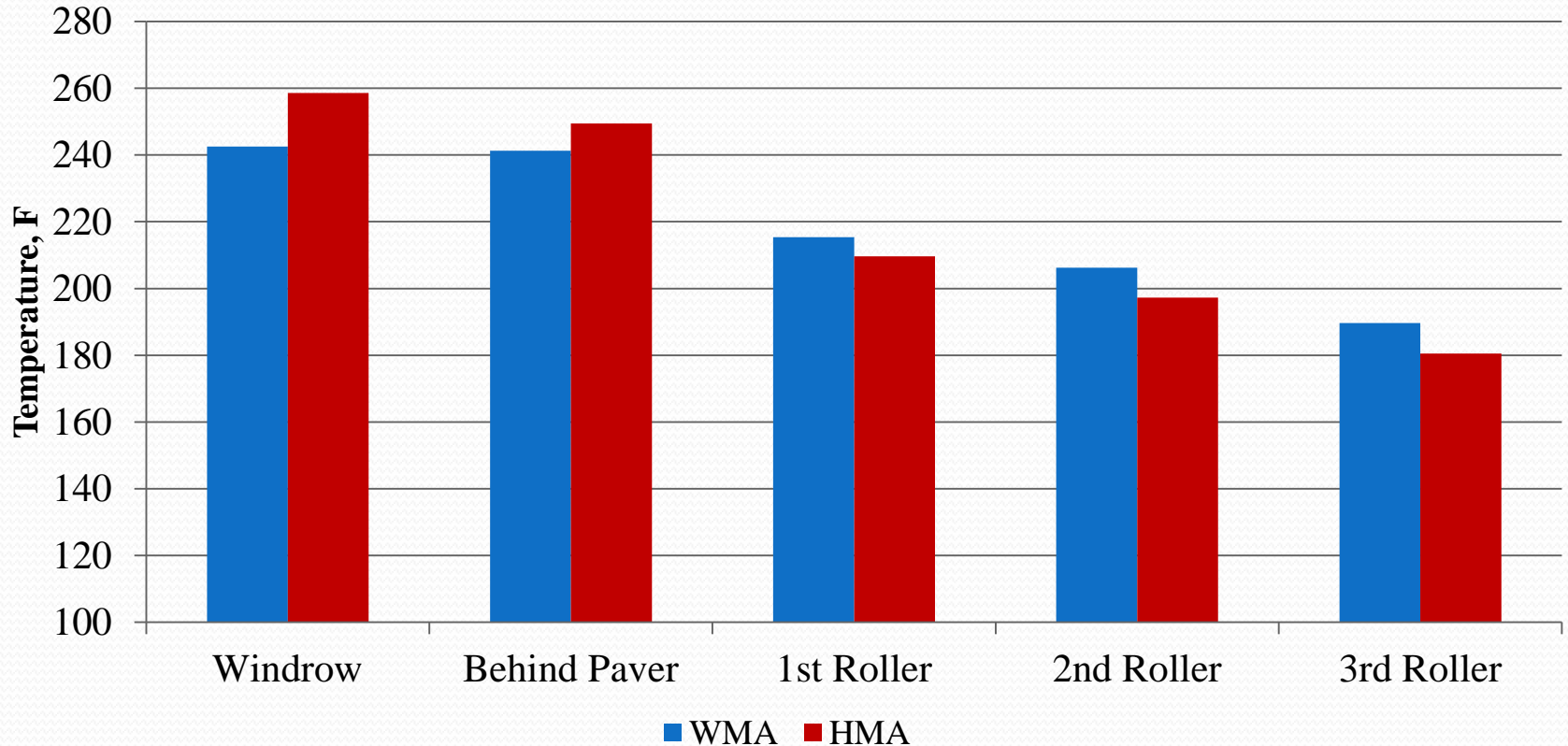
ND 41 - HMA Fuel Consumption

Type	Gallons of Burner Fuel	Total Tons of Mix	Gal/Ton
Total/ Average	17,315	11,995	1.44

SS-3-041(012)057

Field Temperatures

ND 41 Field Temperatures - WMA vs. HMA



SS-6-032(045)219

- 2” mill and fill
- Evotherm 3G
- Use of recycled asphalt
- Approximately 5 miles of WMA
- Approximately 5 miles of HMA used for control
- Evotherm mixed by supplier



SS-6-032(045)219



SS-6-032(045)219



SS-6-032(045)219

Compaction Control

ND 32 - WMA Compaction Control

Date	Core Density	Maximum Theoretical Density	Compaction
Average	138.8	150.1	92.5%

ND 32 - HMA Compaction Control

Date	Core Density	Maximum Theoretical Density	Compaction
Average	139.6	150.7	92.6%

SS-6-032(045)219 Fuel Consumption

ND 32 - WMA Fuel Consumption

Type	Gallons of Burner Fuel	Total Tons of Mix	Gal/Ton
Total/ Average	11,652	7,429	1.62

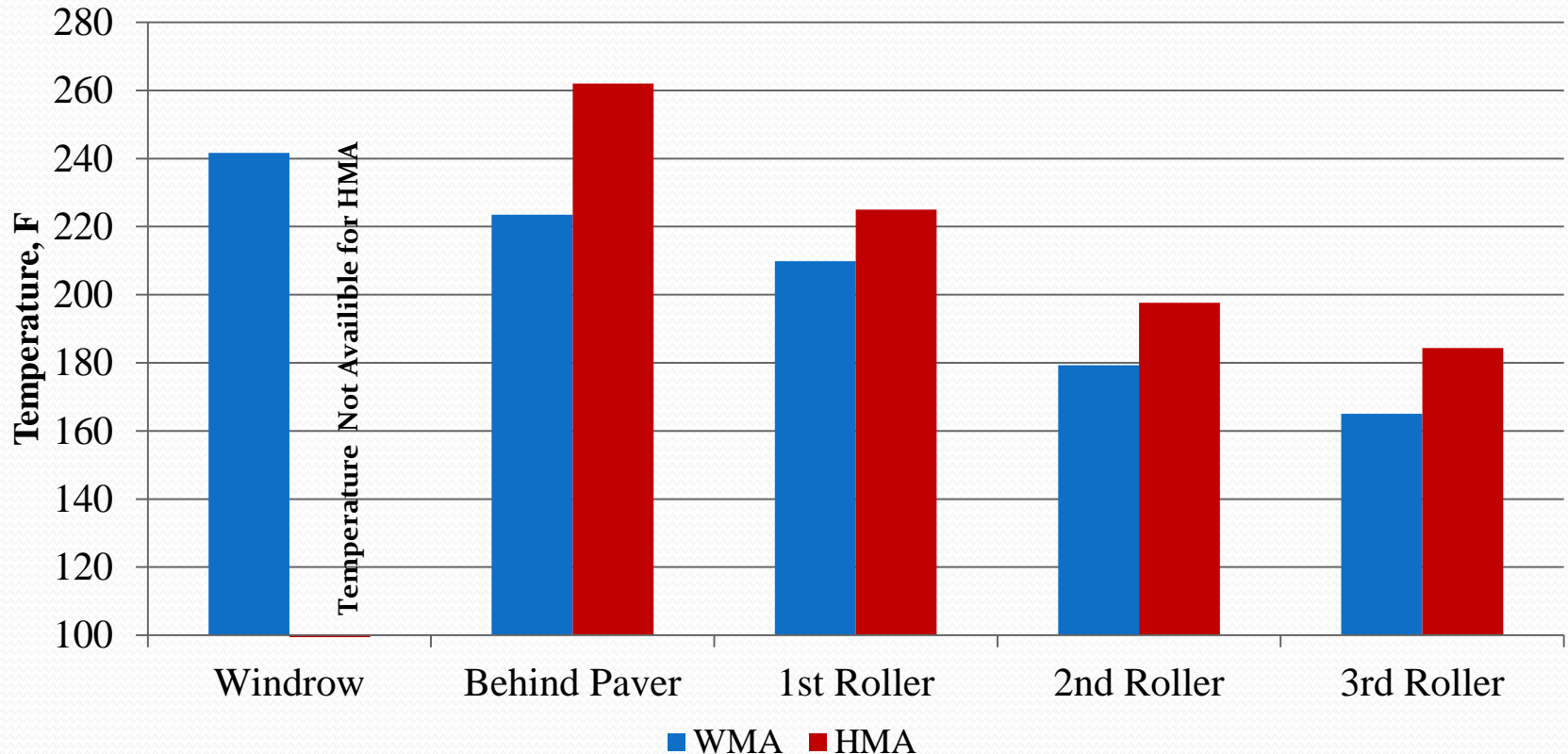
ND 32 - HMA Fuel Consumption

Type	Gallons of Burner Fuel	Total Tons of Mix	Gal/Ton
Total/ Average	15,232	8,958	1.72

SS-6-032(045)219

Field Temperatures

ND 32 Field Temperatures - WMA vs. HMA



SS-4-003(011)159

- 2” Thin Lift Overlay
- Advera® WMA
- Approximately 5 miles of WMA
- Approximately 5 miles of HMA used for control
- Blade Leveling

SS-4-003(011)159

Compaction Control

ND 3 - WMA Compaction Control

Date	Core Density	Maximum Theoretical Density	Compaction
Average	142.7	153.7	92.8%

ND 3 - HMA Compaction Control

Date	Core Density	Maximum Theoretical Density	Compaction
Average	141.7	153.8	92.1%

SS-4-003(011)159

Fuel Consumption

ND 3 - WMA Fuel Consumption

Type	Gallons	Total Tons	Gal/Ton
Total/ <i>Average</i>	13,168	9,467	<i>1.38</i>

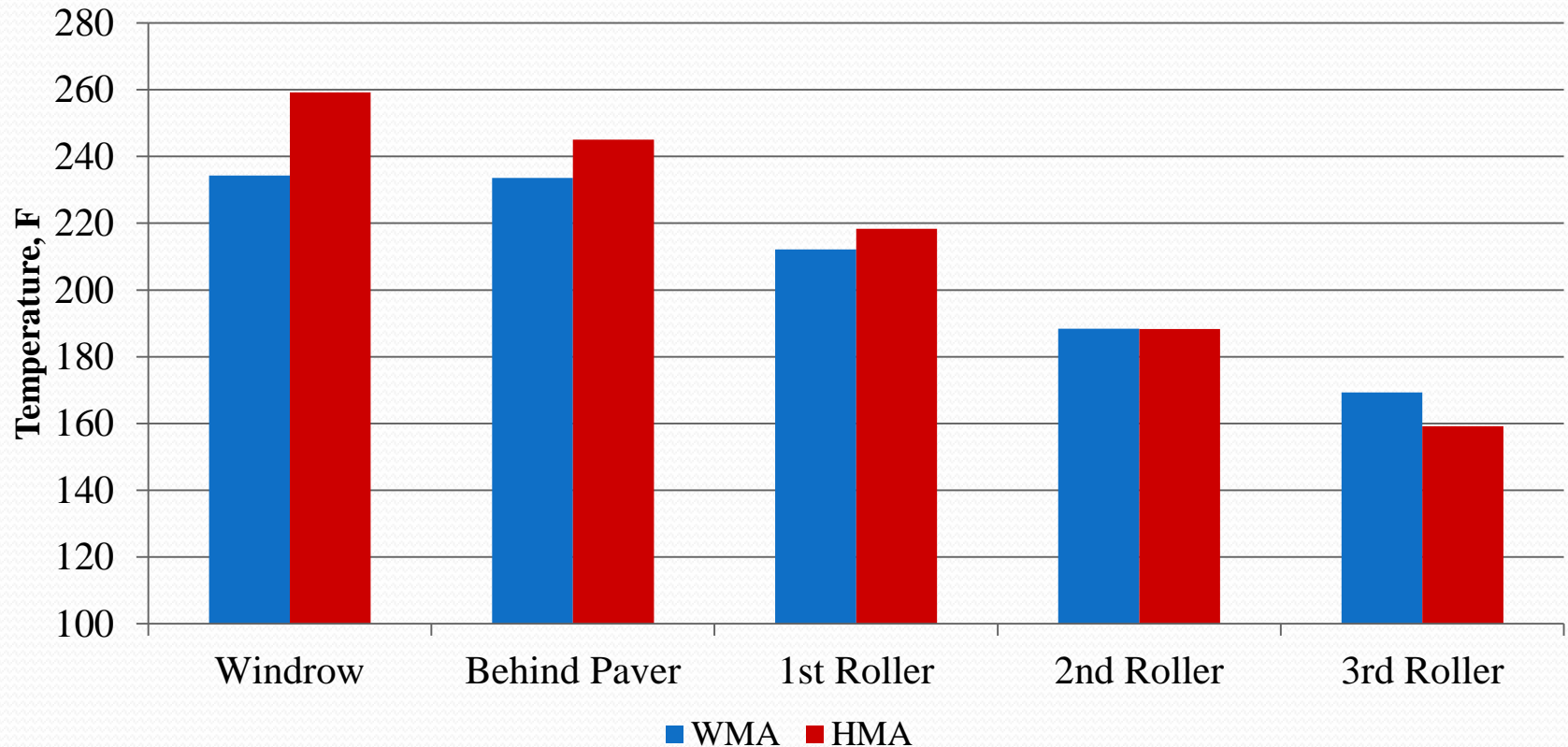
ND 3 - HMA Fuel Consumption

Type	Gallons	Total Tons	Gal/Ton
Total/ <i>Average</i>	14,473	8,861	<i>1.63</i>

SS-4-003(011)159

Field Temperatures

ND 3 Field Temperatures - WMA vs. HMA



Missing Data

- SS-3-015(010)060 & SS-3-015(018)073 – Project was pushed until 2012

Summary

- 26,569 tons of WMA in 2011.
- Compaction is not an issue.
- Fuel Consumption – 3.5% to 15.4% decrease in burner fuel with WMA.
- Field Temperature
 - Advera – WMA 10 degrees less HMA behind paver
 - Evotherm – WMA 25 degrees less HMA behind paver
- ND 15 project has been pushed until 2012 construction season.

UND - Evaluation of the Rut Resistance Performance of Warm Mix Asphalts in North Dakota

- Asphalt Pavement Analyzer (APA)
- 32 six inch ϕ cores collected from 2010 WMA projects
- 12 wet cores and 12 dry cores tested
- 8,000 Loading Cycles per test



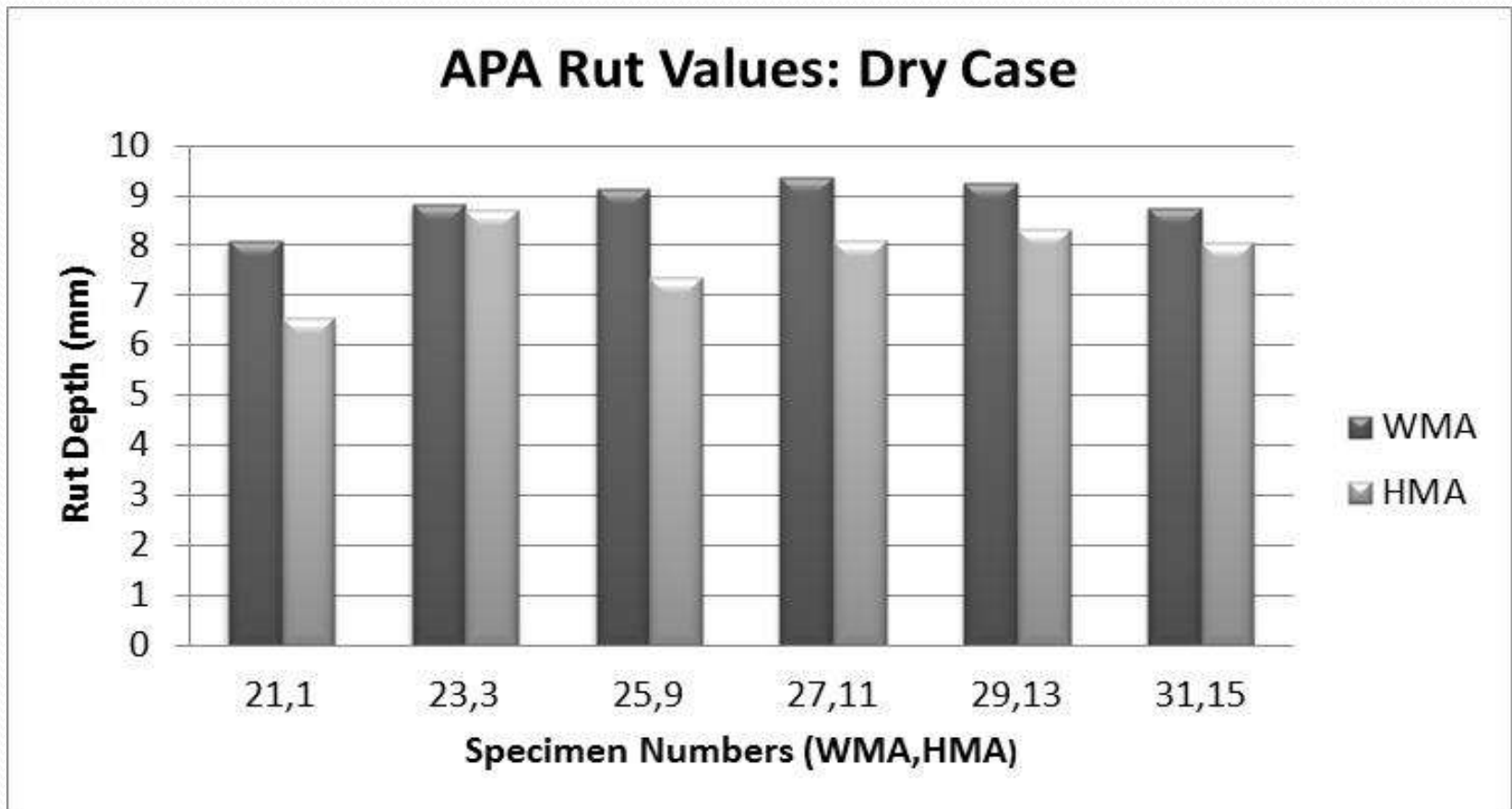
2010 WMA Projects

- ND 11- near Ashley ND
 - 8,319 tons of Evotherm WMA
 - 2” overlay
 - Crack Pattern returned but no rutting.
- ND 20 – Near Devils Lake
 - 15,113 tons of Evotherm WMA
 - 2” overlay
 - Crack Pattern returned but no rutting.
- Both Experimental projects have same distresses as control sections.

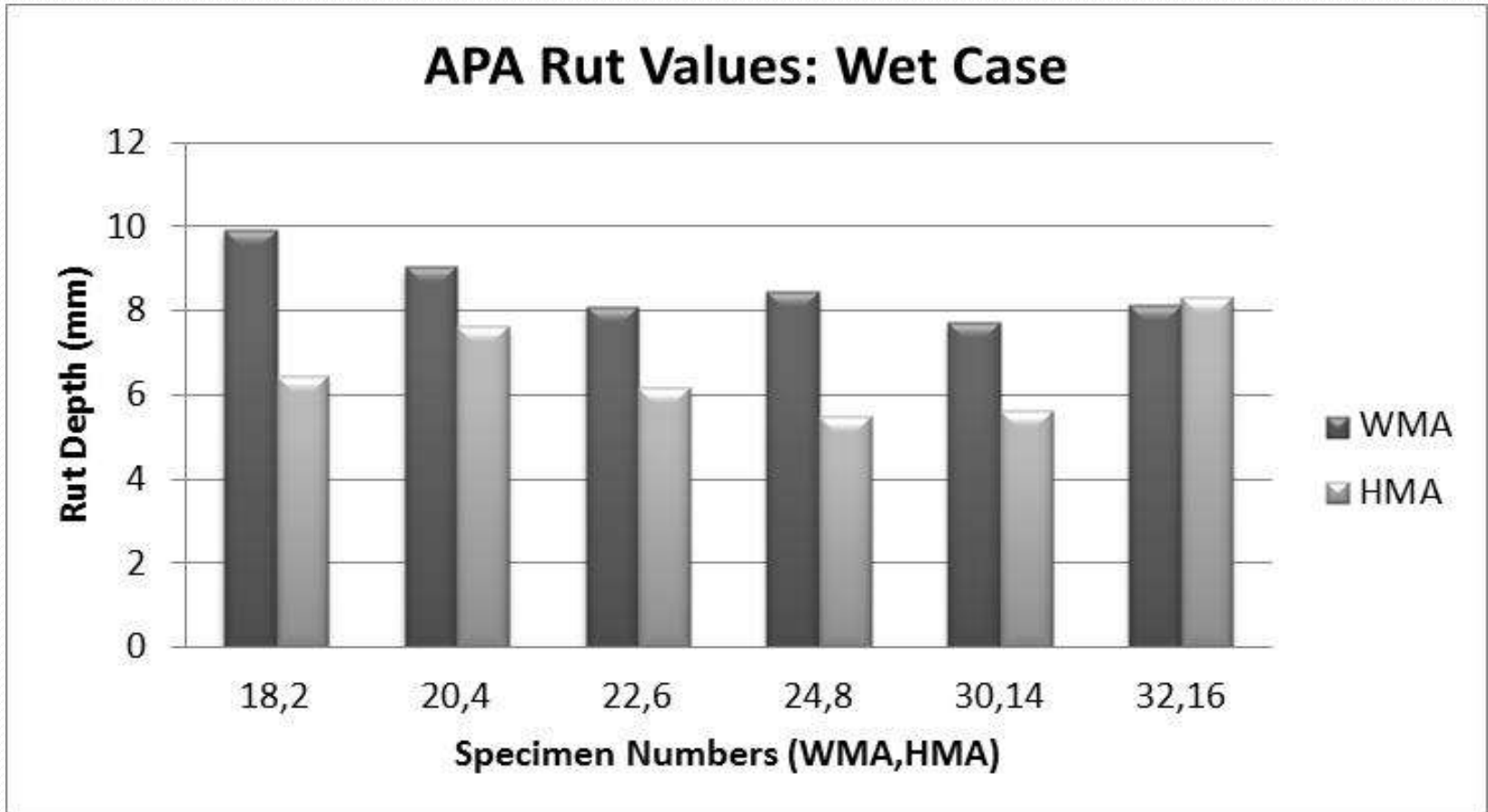
Asphalt Pavement Analyzer (APA)



UND - Evaluation of the Rut Resistance Performance of Warm Mix Asphalts in North Dakota



UND - Evaluation of the Rut Resistance Performance of Warm Mix Asphalts in North Dakota



UND - Evaluation of the Rut Resistance Performance of Warm Mix Asphalts in North Dakota

- Generally, WMAs had higher rut values in comparison with the HMA control specimens
 - Dry Condition: WMA higher by 13%
 - Wet Condition: WMA higher by 29%
- 19 specimens passed the 9.0 mm criterion
 - The failed 5 were WMA (3 dry & 2 wet)
 - 6 out of the 7 WMA specimens that passed had rut values > 8.0 mm

NDSU – Warm Mix Asphalt Processes Applicable to North Dakota

- Research by Magdy Abdelrahman
- Literature review and survey of surrounding states additives and processes.
- Recommendation of techniques, equipment, and additives are provided in this research.
- Available at
www.dot.nd.gov/divisions/materials/researchlist.htm

Questions?

