

# Warm Mix Asphalt at MnROAD

An aerial photograph of the Earle Brown Heritage Center at MnROAD. The building is a large, modern structure with a grey roof and light-colored walls. A large orange truck is parked on the road in front of the building. A white van is parked in the parking lot to the right of the building. The surrounding area is green and grassy.

*53rd Annual Asphalt Contractors' Workshop  
Wednesday, March 4, 2009  
Earle Brown Heritage Center, Brooklyn Center, MN*

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# Benefits of WMA

## Environmental

- ★ Lower greenhouse gas emissions
- ★ Lower fuel consumption
- ★ Reduced exposure of workers to fumes

## Performance

- ★ Reduced binder aging
- ★ More time for mixture compaction
- ★ Cold weather paving
- ★ Longer haul distances

# Early WMA Trials at MnROAD (Oil Gravel)

Cell 32 (1998) – Cold Mix Paving Practice

Cell 27 (1999) – Chip Seal / Large Stone Base

Cell 28 (1999) – Oil Gravel (luke warm mix) / Large Stone Base

Cell 26 (2000) – Oil Gravel (warm mix) / Reclaimed Base

Cell 27 (2000) – Oil Gravel (warm mix) / Large Stone Base

Several County Roads throughout Minnesota



- ★ Oil Gravel requires solid base
- ★ No Transverse Cracking or Rutting
- ★ Some Fatigue and Rough Ride
- ★ Similar to current WMA development

**After 12 years and a catchy name...**

# Warm Mix Asphalt

## WMA – Mathy Process

- ★ **Olmsted & Goodhue Counties (July 2007)**

## 2008 Planned Projectes

- ★ **Bituminous Roadways**
- ★ **Crow Wing County**
- ★ **MnROAD Mainline**  
**6 Cells, 1 process**



# 2008 MnROAD Construction

Warm Mix Asphalt						Control
15	16	17	18	19	23	24
3" WM	5" WM 58-34	5" WM 58-34	5" WM 58-34	5" WM 58-34	5" WM 58-34	3" 58-34
11.1" 64-22 1993 HMA	12" 100% recycle PCC	12" 50% RePCC 50% Class 5	12" 100% RAP	12" CI-5	12" Mesabi Ballast	4" CI6sp
Clay	12" CI3sp	12" CI3sp	12" CI3sp	12" CI3sp	12" CI3sp	Sand
58-34 Surface Binder	7" Select Gran	7" Select Gran	7" Select Gran	7" Select Gran	7" Select Gran	100' Fog Seal 2008
	Clay	Clay	Clay	Clay	Clay	100' Chip Seals 2009 2010 2011 2012

WAM-Foam



Rediset WMX



Low Emission Asphalt



Aspha-Min



Gencor



Advera



Terex



Sasobit



Stansteel



REVIX



Evotherm



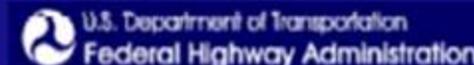
Double Barrel Green



Cecabase RT



Thanks to Matt Corrigan, FHWA



FHWA does not endorse any particular proprietary product or technology.

# Evotherm 3G – Revix

- Waterless - Reduced Temperature Technology
- Process is a co-development of Mathy Technology & Engineering Services and Paragon Technical Services, Inc
- A patent application has been filed on the technology

“It was our belief that if you could coat the aggregate you could compact the mix given current roller technology”

Thanks to Gerald Reinke, Mathy Construction

# Revix Summary

- Several different additives evaluated in the field, more in the lab.
- Temperature reductions range from 60 to 80°F below typical hot mix temperatures for the same mix.
- All additives necessary to produce the mix are typically added at the asphalt terminal.
  - ★ Additives can be added at the HMA plant.
  - ★ Binder preferably comes to contractor ready to use—all he does is run the plant as he normally does but at a lower temperature

# Revix Summary

- A mix design is necessary to adjust additive loading and check TSR properties
- Mathy demonstrated that irrespective of plant type or possible moisture content left from aggregate and/or RAP that this approach would work

# Sampling and Testing

## Samples Collected

- Asphalt Binder
- Mix Samples

## Testing Currently Underway

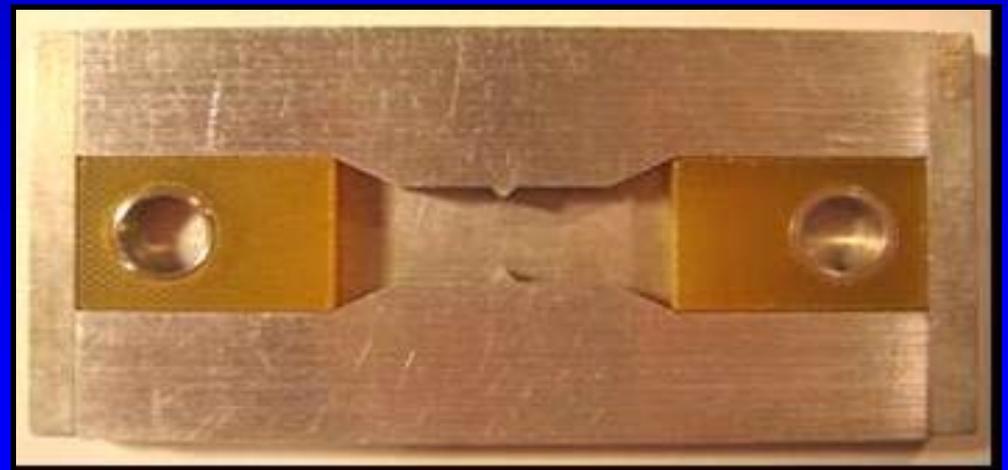
- NCAT
- FHWA
- Texas Transportation Institute
- Ohio University
- University of Minnesota
- Mn/DOT



# Asphalt Binder Testing

- PG Grade (Continuous)
- Direct Tension
- Double Edge Notched Tension
- Bending Beam Rheometer
- ABCD Binder Test
- DSR Master Curves
- Multi Stress Creep & Recovery

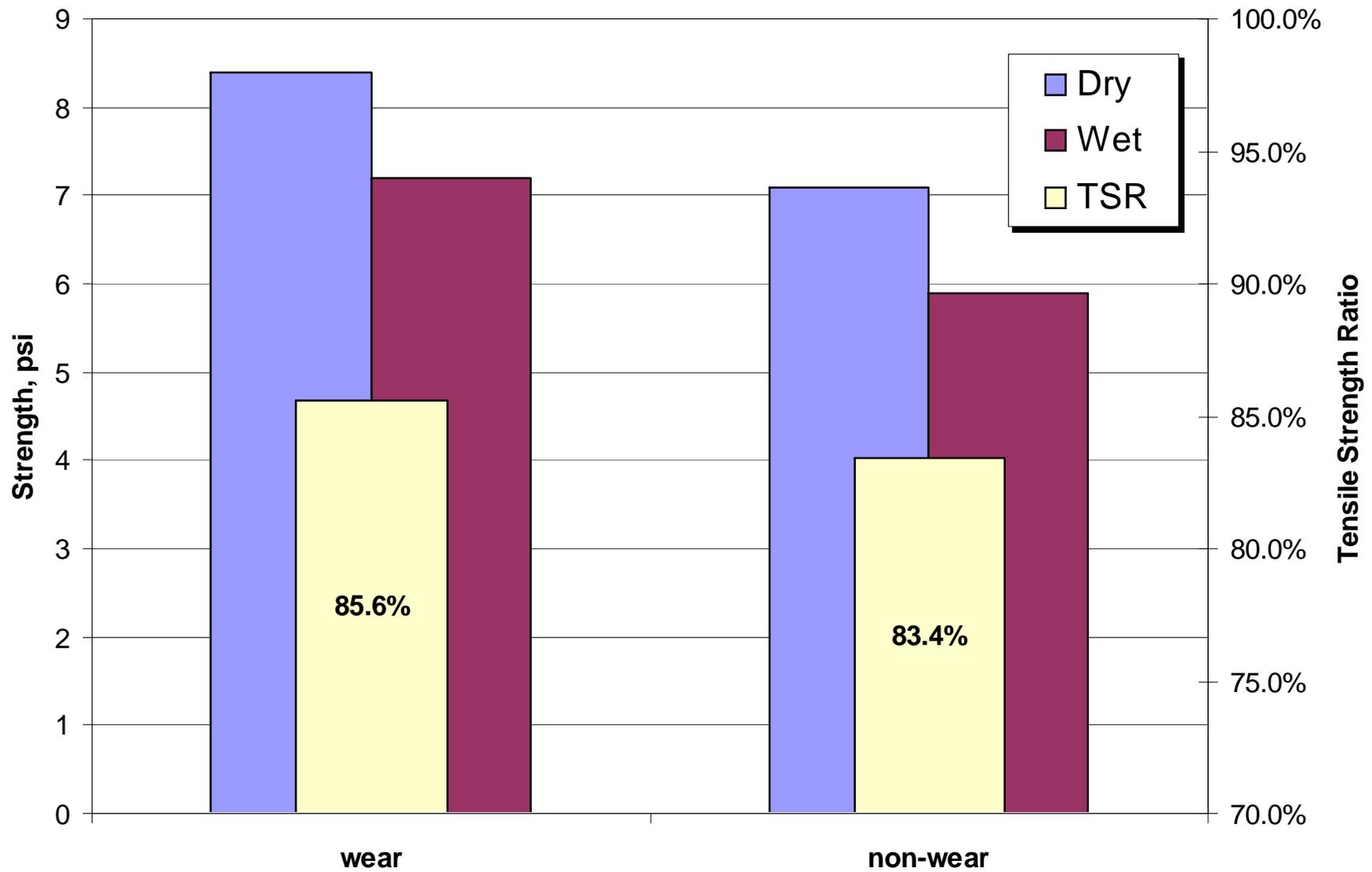
Neat & Extracted Binders



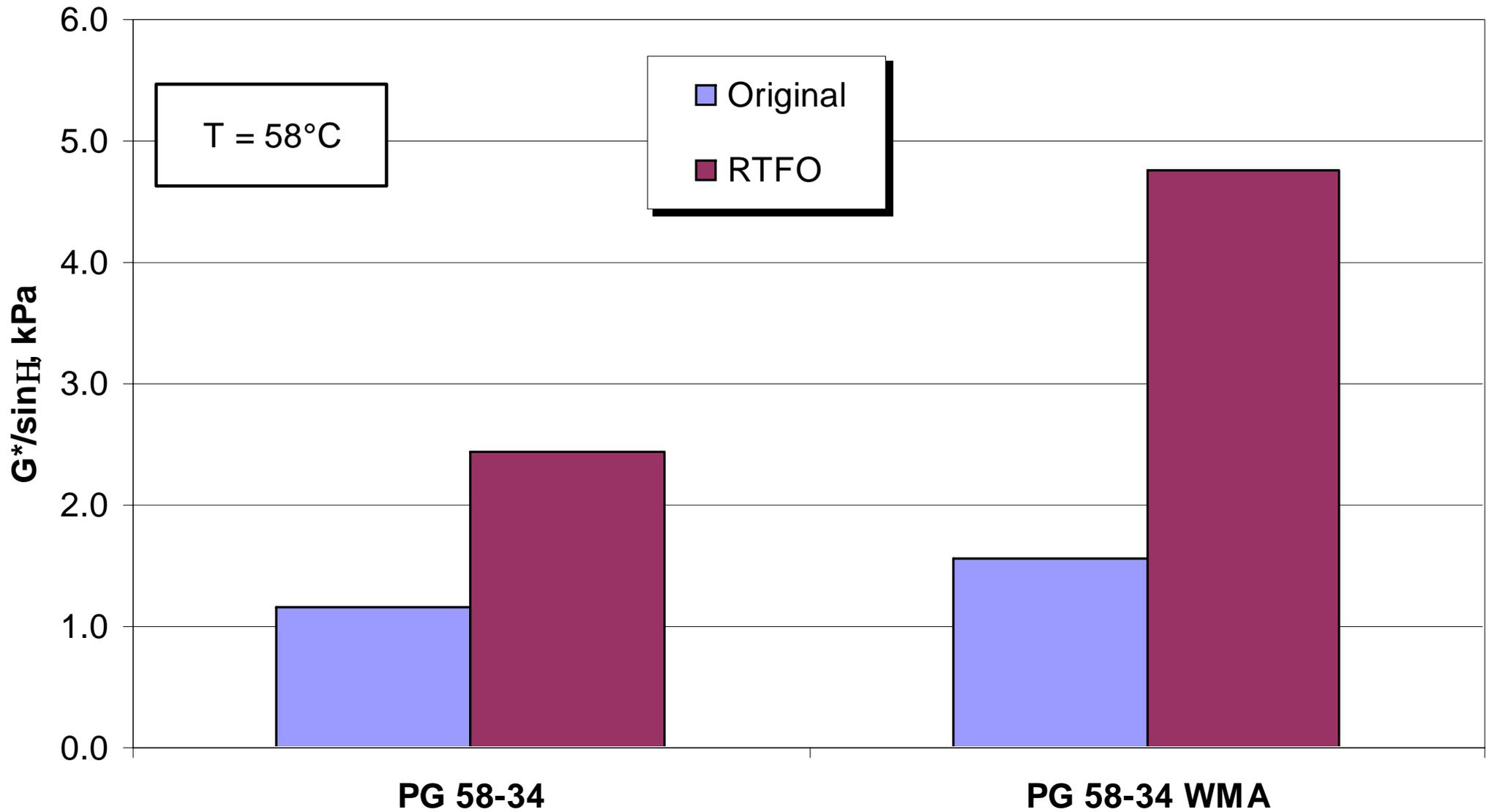
# HMA Mixture Testing

- Volumetrics Verification
- ABCD Mix Test
- TTI Overlay Test
- Hamburg Rut Test (wet)
- Dynamic Modulus
- Flow Number
- Permeability
- SemiCircular Bend Bending Beam
- Rheometer Mix Test
- Indirect Tensile Strength & Creep
- APA Rut Test
- Moisture Sensitivity (TSR)

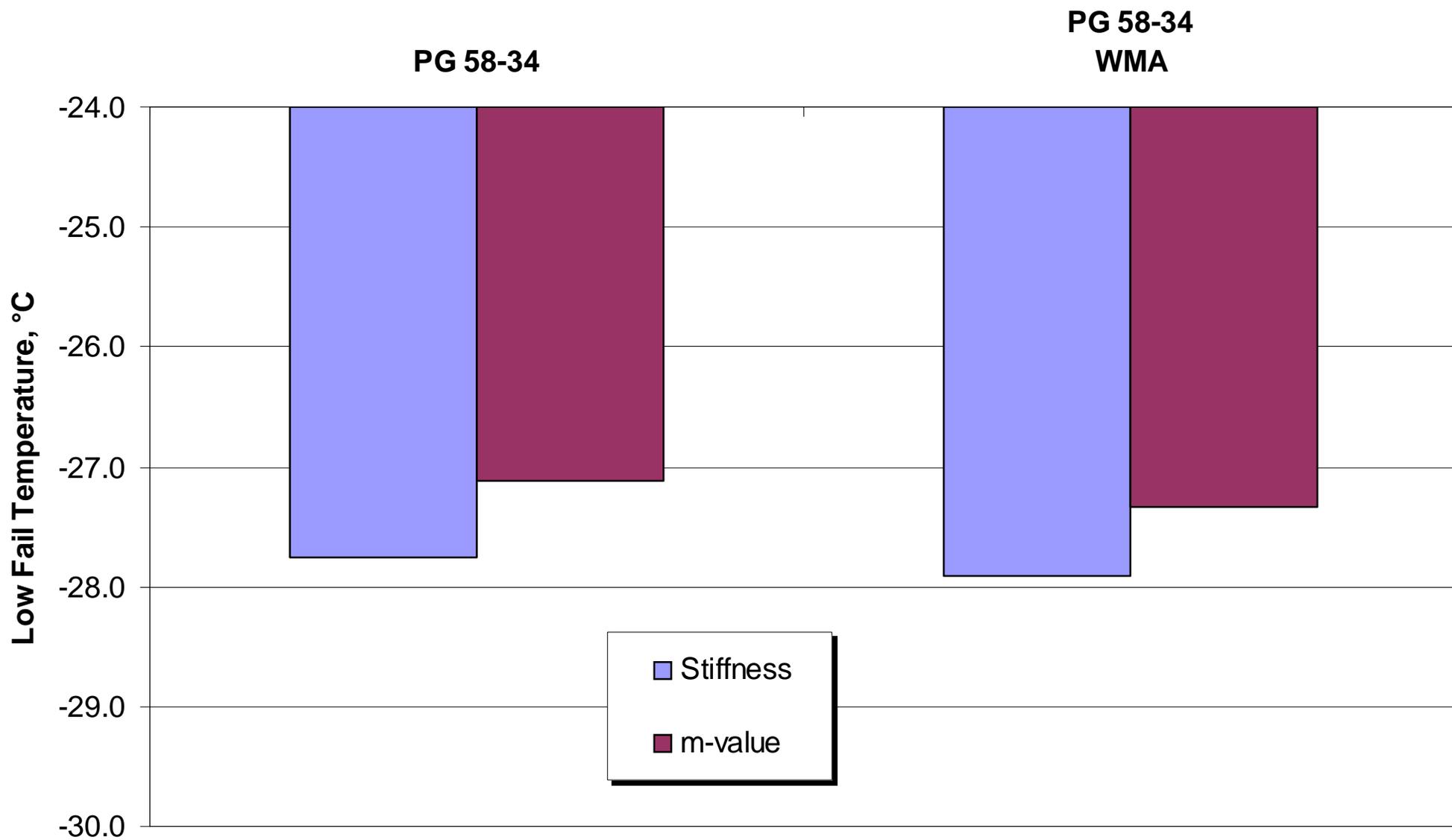
# Stripping Potential



# Binder DSR Testing



# Binder BBR Testing



# Performance Measures



FWD



ALPS



Saw



Faultmeter



Core Truck



Distress

# Surface Characteristics

Circular Texture Meter



Skid Trailer



OBSI



LISA



Pathways Van



Dynamic Friction Tester



# Load Testing, Sensor Monitoring



Squirrel SQL Client Version 2.5.1

Connect to: FWD Active Session: 1 - MNROAD as mnroad

SQL file: K:\SQL Files\TC31\_DATA.sql\*

```

SELECT cell, day, hour, qhr, seq_1, seq_2, seq_3, seq_4, seq_5, seq_6, seq_7, seq_8, seq_9, seq_10 FROM (SELECT cell, day, hour, qhr, MIN(DECODE(SEQ, '1', VALUE)) AS seq_1, MIN(DECODE(SEQ, '2', VALUE)) AS seq_2,
SELECT cell, day, hour, qhr,
  seq_1,
  seq_2,
  seq_3,
  seq_4,
  seq_5,
  seq_6,
  seq_7,
  seq_8,
  seq_9,
  seq_10
FROM
  (SELECT cell, day, hour, qhr,
    MIN(DECODE(SEQ, '1', VALUE)) AS seq_1,
    MIN(DECODE(SEQ, '2', VALUE)) AS seq_2,

```

Results \ Explain Plan

```

SELECT cell, da \ SELECT cell, da \
SELECT cell, day, hour, qhr, seq_1, seq_2, seq_3, seq_4, seq_5, seq_6, seq_7, seq_8, seq_9, seq_10 FROM (SELECT cell, day, hour, qhr, MIN(DECODE(SEQ, '1', VALUE)) AS seq_1, MIN(DECODE(SEQ, '2', VALUE)) AS seq_2,

```

CELL	DAY	HOUR	QHR	SEQ_1	SEQ_2	SEQ_3	SEQ_4	SEQ_5	SEQ_6	SEQ_7	SEQ_8	SEQ_9	SEQ_10
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31	2004-01-02 ...	9	0	-3.12061	<null>	-3.39023	-2.34066	-1.37966	-0.4207	1.121	2.43907	4.01879	<null>
31	2004-01-05 ...	2	0	-9.96312	<null>	-9.95537	-5.75004	-3.48438	-1.40752	0.80098	2.19536	3.76589	<null>
31	2004-01-05 ...	6	0	-11.94653	<null>	-11.85311	-6.75906	-3.87646	-1.52659	0.74048	2.13253	3.75588	<null>
31	2004-01-05 ...	12	0	-10.39215	<null>	-10.34561	-7.80386	-4.78417	-1.8992	0.71022	2.10739	3.68574	<null>
			0	-13.82991	<null>	-13.69436	-9.47775	-6.33109	-3.09773	0.47316	1.96158	3.6156	<null>
			0	-13.53279	<null>	-13.4338	-9.54484	-6.38233	-3.2732	0.41514	1.93392	3.60307	<null>

Seconds: Total: 23.204, SQL query: 21.454, Building output: 1.75

Logs: Errors 0, Warnings 0, Infos 9 26 of 44 MB 3:43:48 PM CST



# Plant and Construction Experiences

Chris Miller - Harddrives

