



PMA Experience in Nevada

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Nevada DOT

Overview

- State of Nevada
- NDOT facts & figures
- Motivation for use of PMA
- Implementation
- Usage rates
- Specifications

Overview

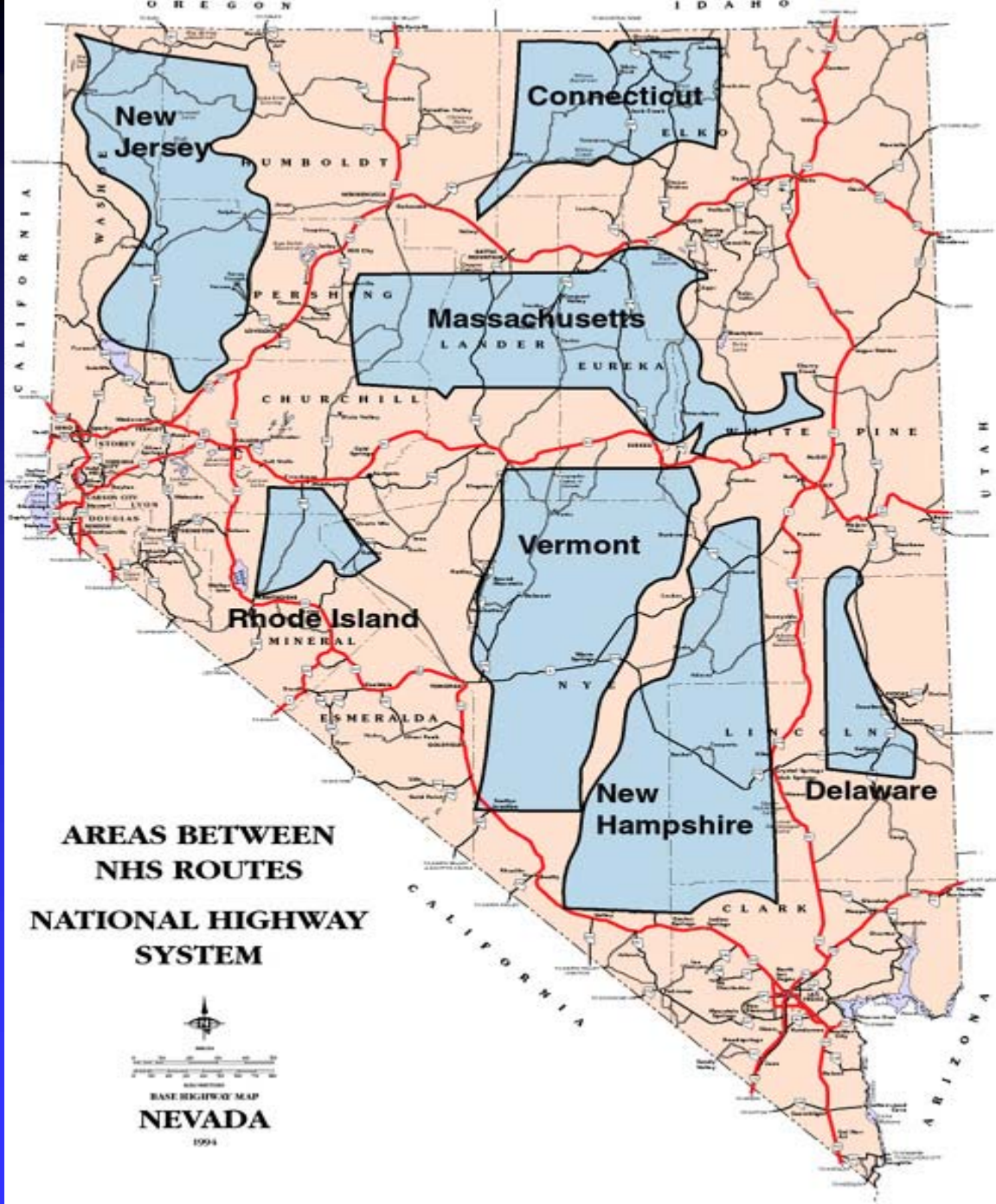
- PMA research
- PMA issues
- Construction issues
- PMA performance
- Pavement conditions
- Combination of changes
- Future issues

State Notes

- Population - 2.2 million
- 7th Largest- 110,540 sq. mi.
- Highest peak - 13,134 ft.
- 42 summits - 11,000 ft.
- Most mountainous - 314 ranges/hills

NDOT Facts & Figures

- Center lane miles(95/5) - 5,472 miles
- 81% of all truck traffic
- Full time employees - 1,730
- 2002 budget - 424 M
- 2006 budget - 600 M



Motivation for Use of PMA



Motivation (Cont.)



Motivation (Cont.)



Motivation (Cont.)



I-15 – ADT 235,700

Motivation (Cont.)



Intersections ADT – 151,800

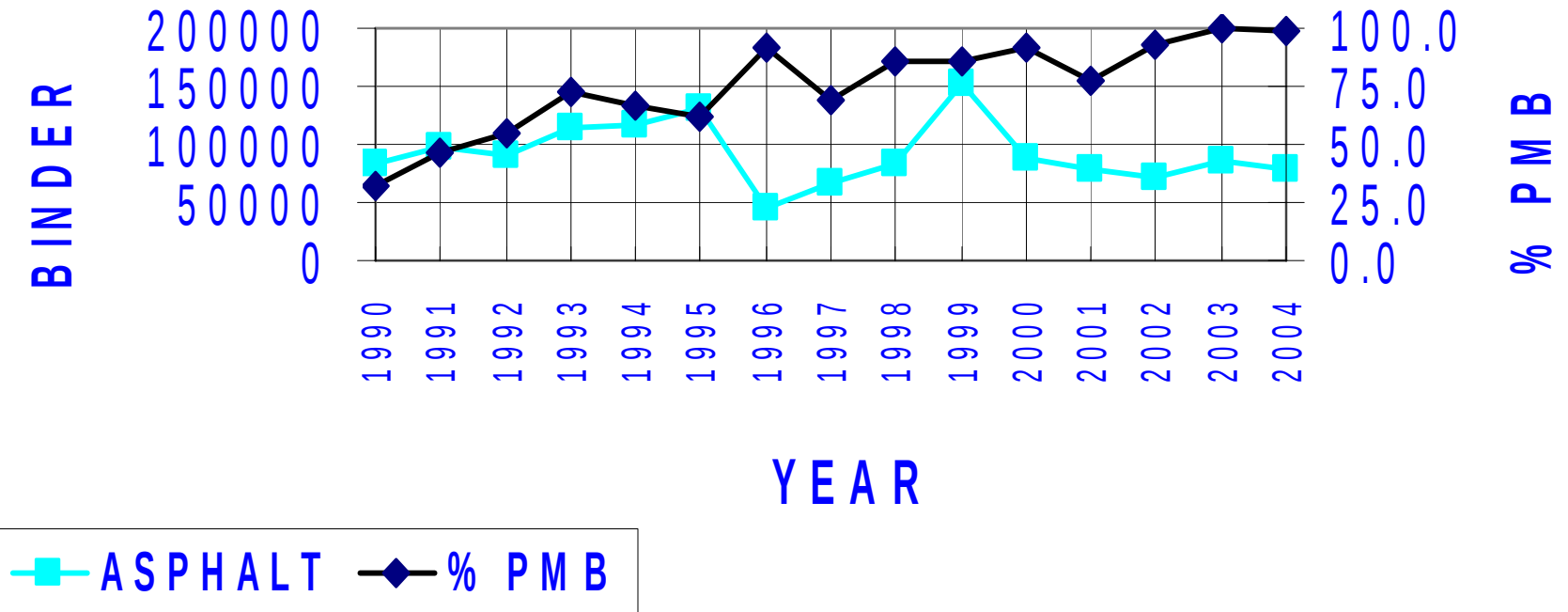
Implementation

- 1974 pen graded to AR graded
- 1986 1st AC-20R project
- 1988 AC-20R specification
- 1989 AR graded to AC grading
- 1990 AC-20R to AC-20P

Implementation

- 1992 Full depth AC-20P
- 1995 AC-30 in Las Vegas
- 2002 PG76-22NV Las Vegas/South
- 2004 PG64-28NV North

ASPHALT USAGE RATES



Specifications

■ PG64-28NV

Ductility @ 4°C, 5 cm/min	50 min.
Sieve	pass
Toughness, inch-lbs	110 min.
Tenacity, inch-lbs	75 min.
RTFO ductility	25 min.
RTFO mass loss, %	0.50 max.

Specifications

■ PG76-22NV

Dynamic Shear, $G^*/\sin \delta$	1.3 Min.
Ductility @ 4°C, 5 cm/min	20 Min.
Sieve	Pass
Polymer Content, % by mass	3.0 Min.
RTFO Ductility	10 Min.
RTFO Mass Loss, %	0.50 Max.

Specifications

- PMA blend at source of supply
- Do not transport PMA by railroad car
- Sample location at hot plant
- 1 sample per 25 tons of binder
- NDOT performs all testing
- All tests have demerit schedule
- NDOT Hveem mix design

PMA Research

- WesTrack – 1997
- I-80 Test Sections - 1998
- I-15 Test Sections - 2000
- AC-20P Research - 2003

WesTrack - 1997

- FHWA contract
- Experimental road test facility - Nevada
- Develop PRS for HMA
- Field verification of SHRP Superpave

WesTrack – (Cont.)

- Two NDOT replacement sections
- AC-20P & PG64-28
- Result – PMA outperformed PG62-22

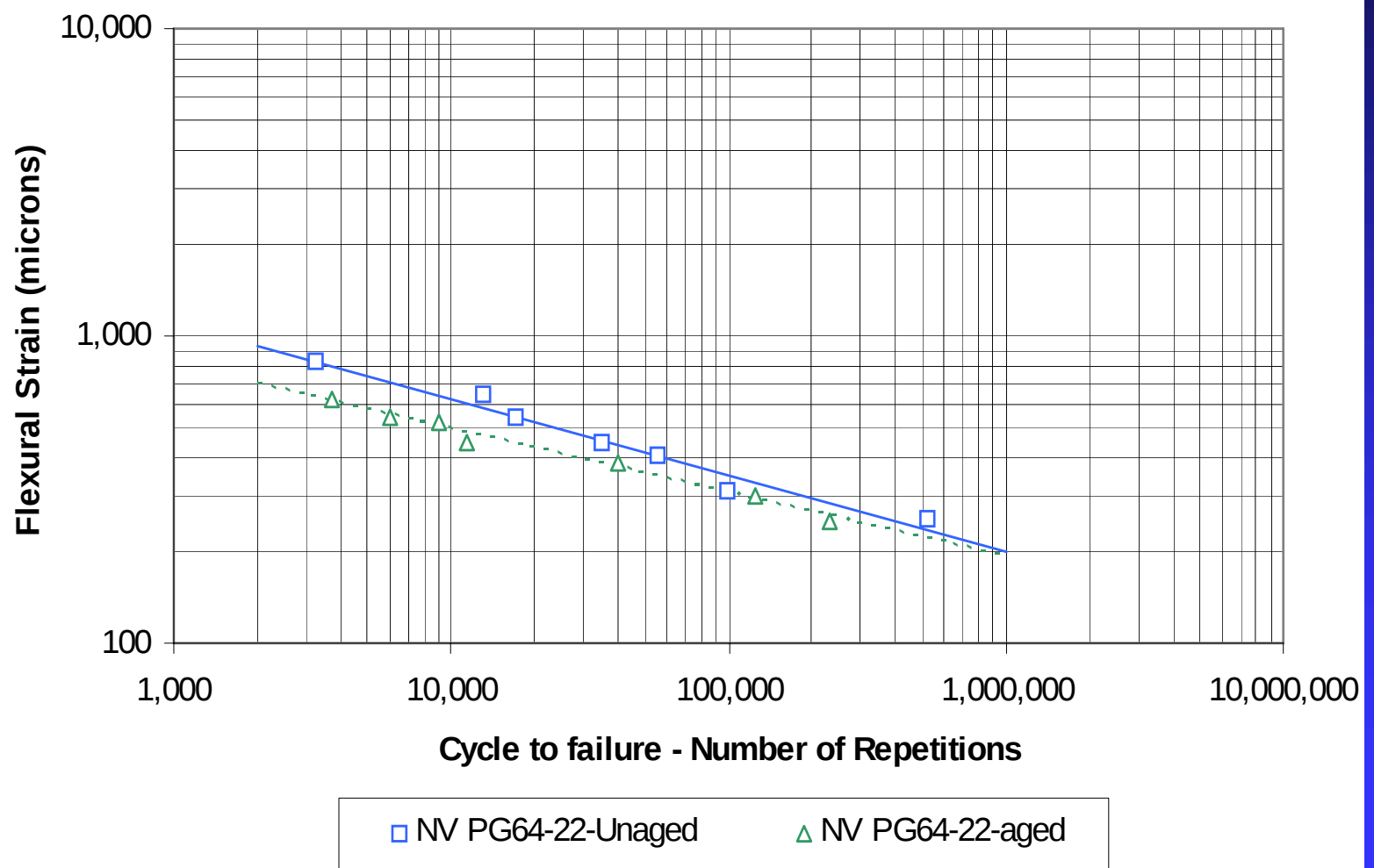
I-80 Test Sections 1998

- Purpose was to verify performance of WesTrack under “real conditions”
- Compare Hveem mix design to Gyratory mix design
- Compare polymer modified binder to neat binder
- Use same materials from WesTrack

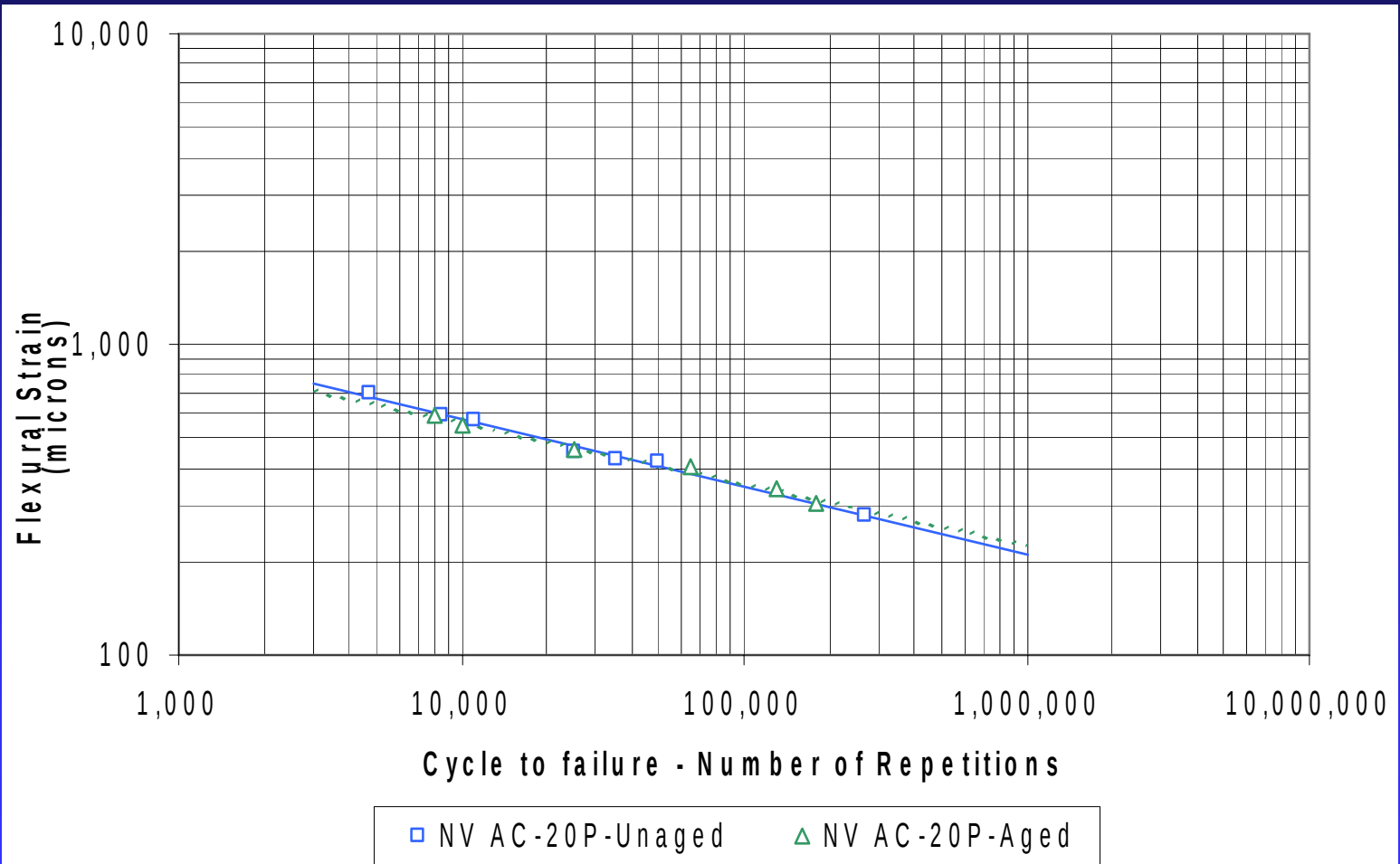
I-80 Test Sections (Cont.)

- 4 – 1000 ‘ Test Sections
- Binders – AC-20P & PG64-22
- Hveem & Superpave mix designs
- Result –
 - ◆ Verified WesTrack performance
 - ◆ PMA outperformed neat asphalt

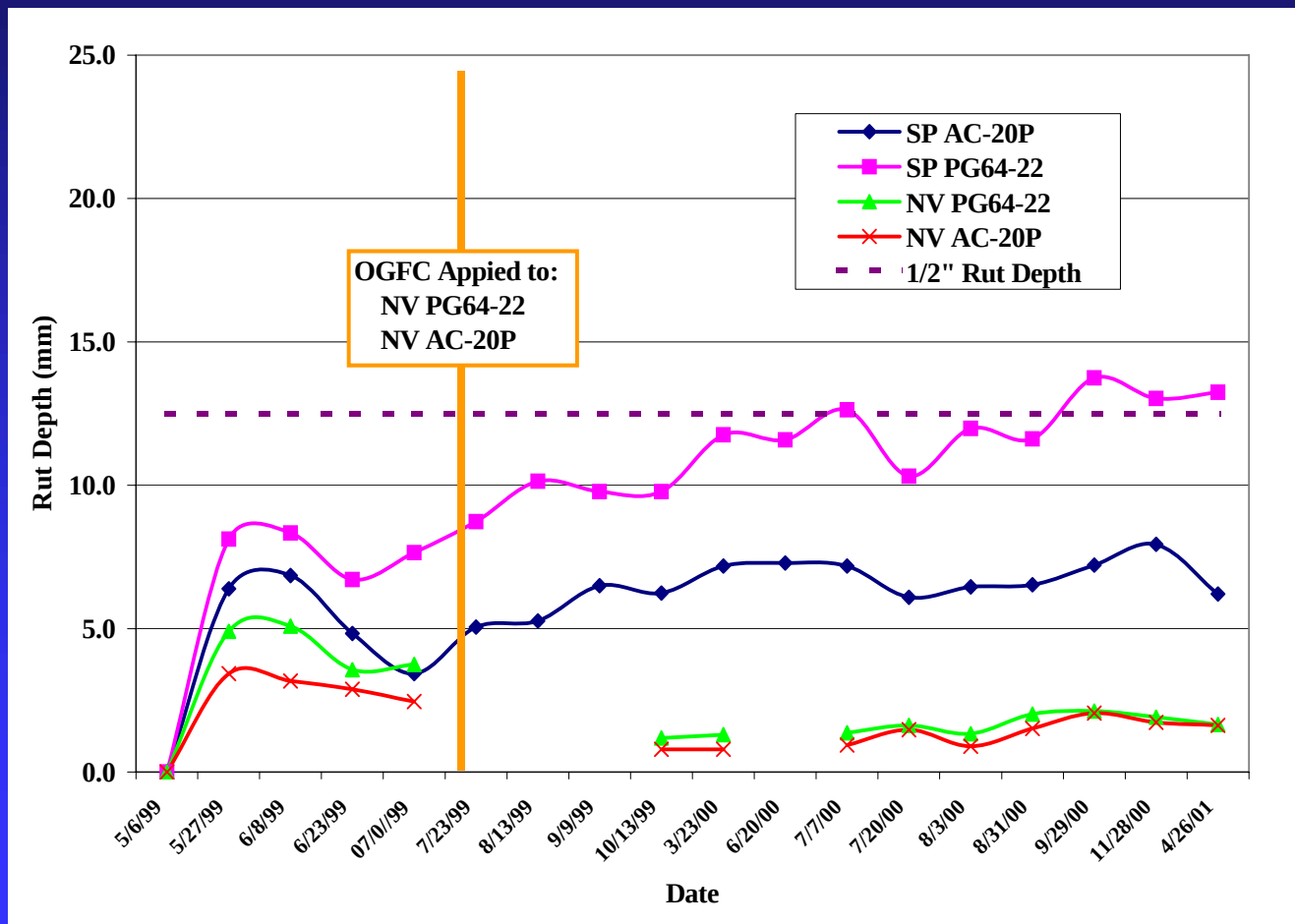
I-80 Lab Fatigue Properties



I-80 Lab Fatigue Properties



I-80 Field Rut Measurements



I-15 Test Sections - 2000

■ Purpose –

- ◆ Evaluate field performance of PG grading with ductility and T& T
- ◆ Evaluate the performance of different binder grades under the same traffic and environmental exposure
- ◆ PG 76-16, PG76-22S, PG76-28S

AC-20P Research - 2003

■ Purpose

- ◆ Determine physical properties
- ◆ Determine lab performance differences
- ◆ Revise specifications based on performance
- ◆ Use results to implement PG+ spec.

AC20P Research (Cont.)

- Five AC-20P binders
- One PG64-22 (Unmodified)
- Single aggregate source

AC20P Research (Cont.)

- Tests performed
 - ◆ PG binder tests
 - ◆ Conventional binder tests
 - ◆ APA
 - ◆ TSRST
 - ◆ Beam fatigue

AC-20P Research (Cont.)

Asphalt Producer	Temperature, °C
# 3	-42.5
# 4	-38.2
# 5	-35.9
# 2	-34.3
# 1	-32.2
# 6	-26.0

TSRST Summary

AC-20P Research (Cont.)

Tests	# 3	# 4	# 5	# 2	# 1	# 6
TSRST, °C	-42.5	-38.2	-35.9	-34.3	-32.2	-26.0
DT @ -18°C	9.13	4.79	3.49	1.34	2.10	0.67
PG Grade (MP-1)	64-34	64-28	64-28	58-28	58-28	64-22
PG Grade (MP-1a)	64-34	64-34	64-28	58-28	58-28	64-22
PG Low Limit Temp.	-34.7	-32.4	-30.1	-29.0	-28.6	-25.7
Critical Cracking Temp.	-38.6	-35.2	-32.4	-28.4	-29.8	-26.0
T _{cr} +3°C	2.54	2.48	2.66	3.28	2.55	1.63

Asphalt Properties vs TSRST Summary

AC-20P Research (Cont.)

Tests	# 3	# 4	# 5	# 2	# 1	# 6
TSRST, °C	-42.5	-38.2	-35.9	-34.3	-32.2	-26.0
Orig Duct @ 4°C	70	80	69	70	57	N/A
Res Duct @ 4°C	38	38	37	62	38	N/A
PAV DSR @ 22°C	1125	1538	1805	2499	3074	5150
Mpa, -18° C	101.4	132.0	164.0	346.5	269.0	367.0
M-Value @ -18°C	0.364	0.341	0.322	0.313	0.306	0.364

Asphalt Properties vs TSRST Summary

AC-20P Research (Cont.)

Asphalt Producer	Rut Depth, mm
# 5	2.3
# 1	3.0
# 2	3.8
# 4	4.8
# 3	6.1
# 6	6.9

APA Summary

AC-20P Research (Cont.)

Tests	# 5	# 1	# 2	# 4	# 3	# 6
APA Data	2.3	3.0	3.8	4.8	6.1	6.9
Orig. DSR, kPa @ 64°C	1.85	1.22	1.04	1.29	1.41	1.47
Phase Angle @ 64°C, °C	69.2	72.9	69.3	73.5	68.2	87.4
PAV DSR, kPa @ 22°C	1805	3074	2499	1538	1125	5150
PG Grade, °C (MP-1)	64-28	58-28	58-28	64-28	64-34	64-22
PG Grade, °C (MP-1a)	64-28	58-28	58-28	64-34	64-34	64-22
PG High Limit Temp., °C	66.9	62.6	59.7	64.9	66.4	67.1

Asphalt Properties vs APA Summary

AC-20P Research (Cont.)

Tests	# 5	# 1	# 2	# 4	# 3	# 6
APA Data	2.3	3.0	3.8	4.8	6.1	6.9
O. Visc. @ 135°C, mm ²	1048	650	541	725	848	N/A
R. Visc. @ 135°C mm ²	1247	686	654	988	1162	N/A
O. Pen. @ 25°C, dm	104	106	115	112	132	N/A
R. Pen. @ 25°C, dmm	68	72	86	75	83	N/A
Rot. Visc. @ 135°C, Pa·s	0.84	0.58	0.47	0.70	0.78	0.42

Asphalt Properties vs APA Summary

AC-20P Research (Cont.)

- Repeat with another aggregate source
- Repeat with other binder grades
- Repeat with long term aged mixtures

PMA Issues

- Low temperature cracking
- Moisture sensitivity
- Aging at elevated temperatures
- Increased binder stiffness
- Will not solve all problems

PMA Construction Issues

- Smoking
- Coating
- Hand work
- Elevated placement temperatures
- “Tender Zone” – No
- Mix and compaction temperatures

PMA Construction Issues (Cont.)

- It's always the PMA's faults



PMA Performance



Stewart St. – ADT 13,400

PMA Performance (Cont.)



US 50 – ADT 13,000

PMA Performance (Cont.)



I-15 – ADT 139,000

PMA Performance (Cont.)



I-15 Reflective Cracking - 2002

PMA Performance (Cont.)



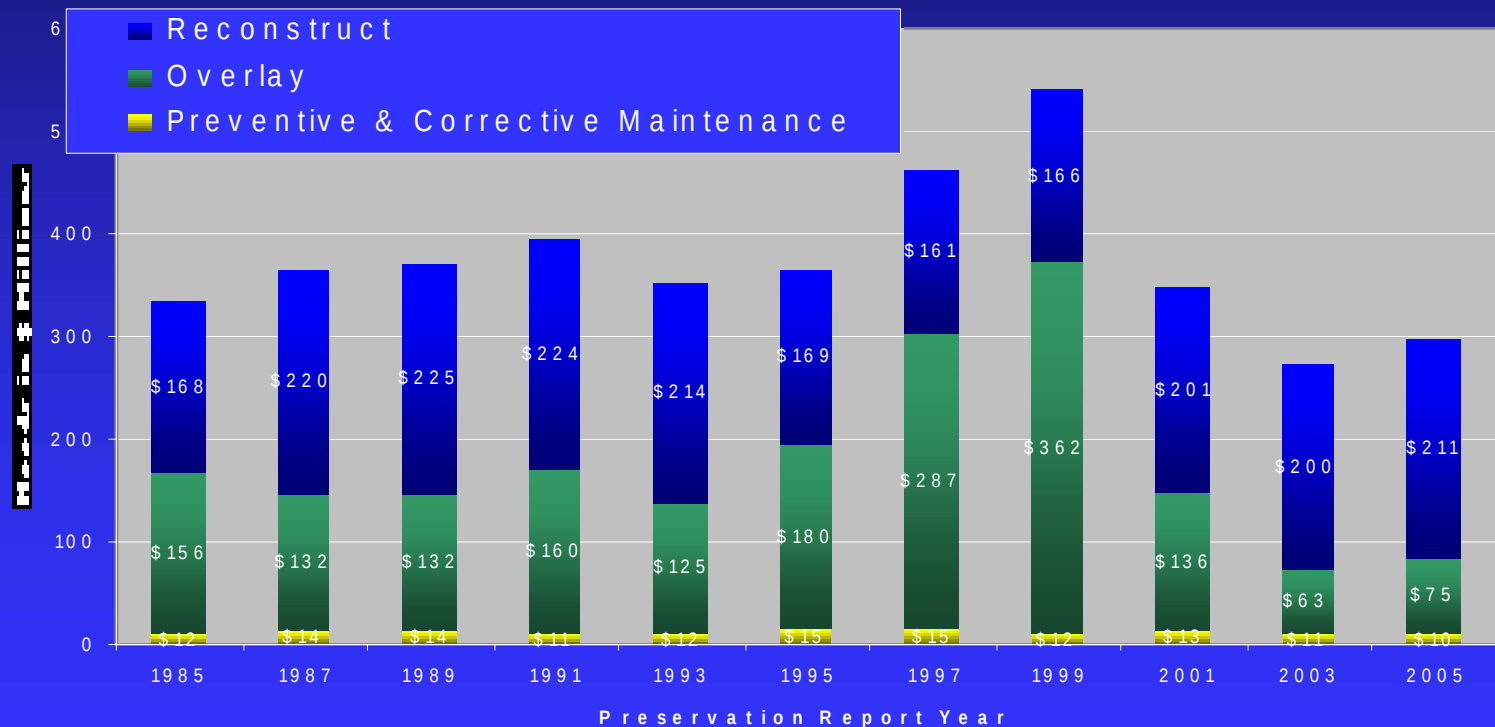
US93 PG64-34 vs AC-20P

Condition of NDOT's System

	Very Smooth	Smooth	Fair	Mediocre	Poor
Entire System	46	31	20	2	1
NHS	75	20	3	2	0

Condition of NDOT's System

Pavement Condition on the State-Maintained System
By Cost of Repair Strategy Needed - 1985-2005



The John Lock Foundation Rating on Pavement Condition on Rural Interstate and Principal Arterials

YEAR	RANK
1992	39
1996	17
2000	12
2004	4

Combination of Changes

- Preservation/prioritization program
- Improved construction practices
- Improved binders (PMA)
- Addition of lime
- Pavement recycling
- Improved specifications

Future Issues

- Field performance monitoring
- Construction issues
- PMA binder tests
- Technician training
- Contractor training
- Optimize polymer type and percent

Final Thought!

**Its not whether you can
afford to use PMA but,**

Can you afford not to use it.

Thank You!



Questions?