

REPORT ON LONG TERM OUTDOOR  
AGING STUDY OF WARM MIX  
SAMPLES  
MTE SERVICES, INC

WARM MIX TECHNICAL WORKING GROUP MEETING  
DECEMBER 15-16, 2009  
SEATTLE, WA

by

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# BACKGROUND

WARM MIX PRODUCED USING PG 58-28 + 0.65%  
EVOTHERM 3G + 35% RAP 8/26/2008

PAVED ON COUNTY ROAD IN WISCONSIN with a  
1 MILLION ESAL MIX

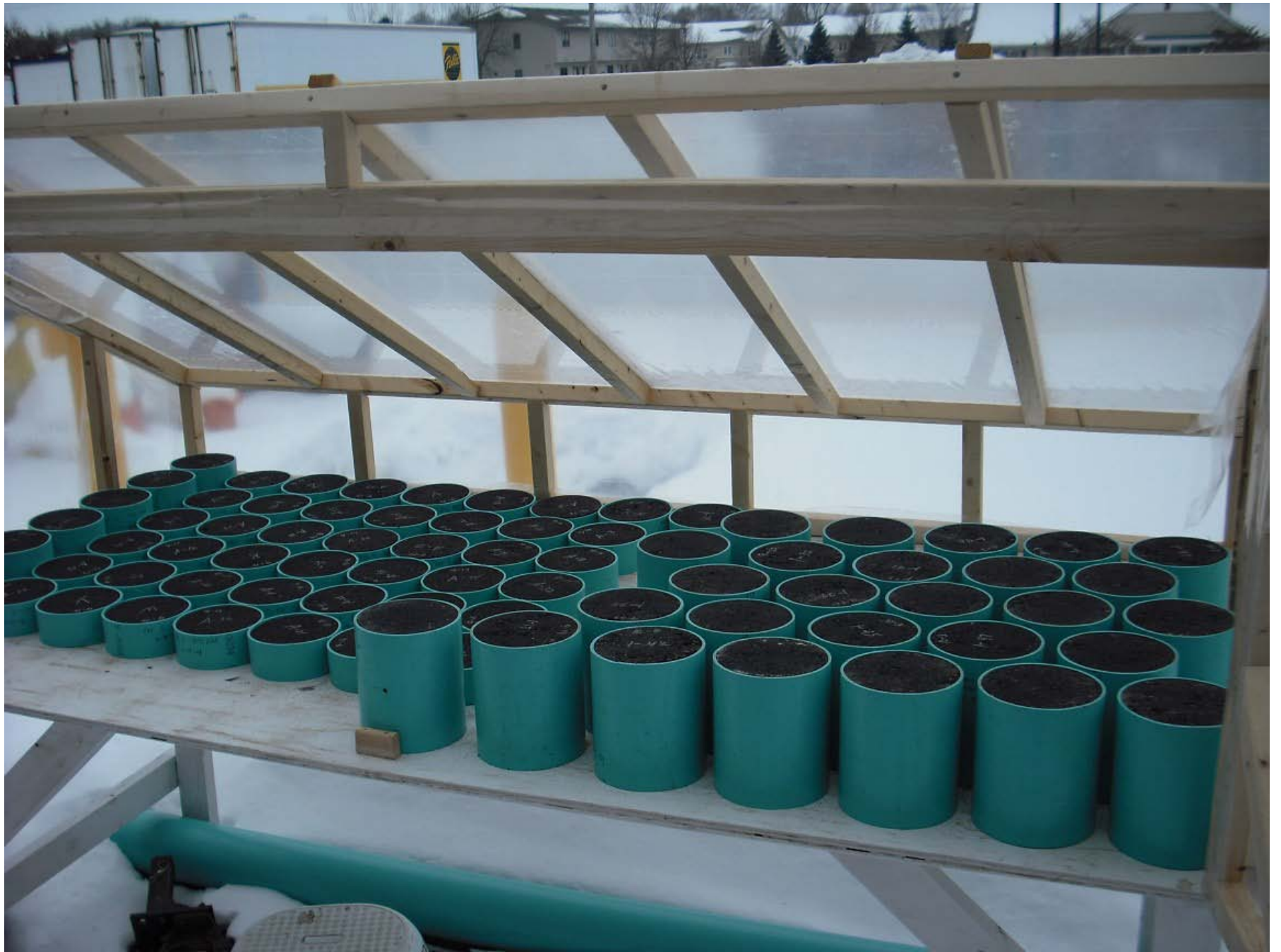
30 FIVE GALLON PAILS OF MIX TAKEN TO COMPACT  
RUT PILLS, AMPT PILLS, 95 mm PILLS

COMPACTED PILLS STORED OUTSIDE TO AGE

PERIODICALLY SAMPLES DRAWN AND TESTED

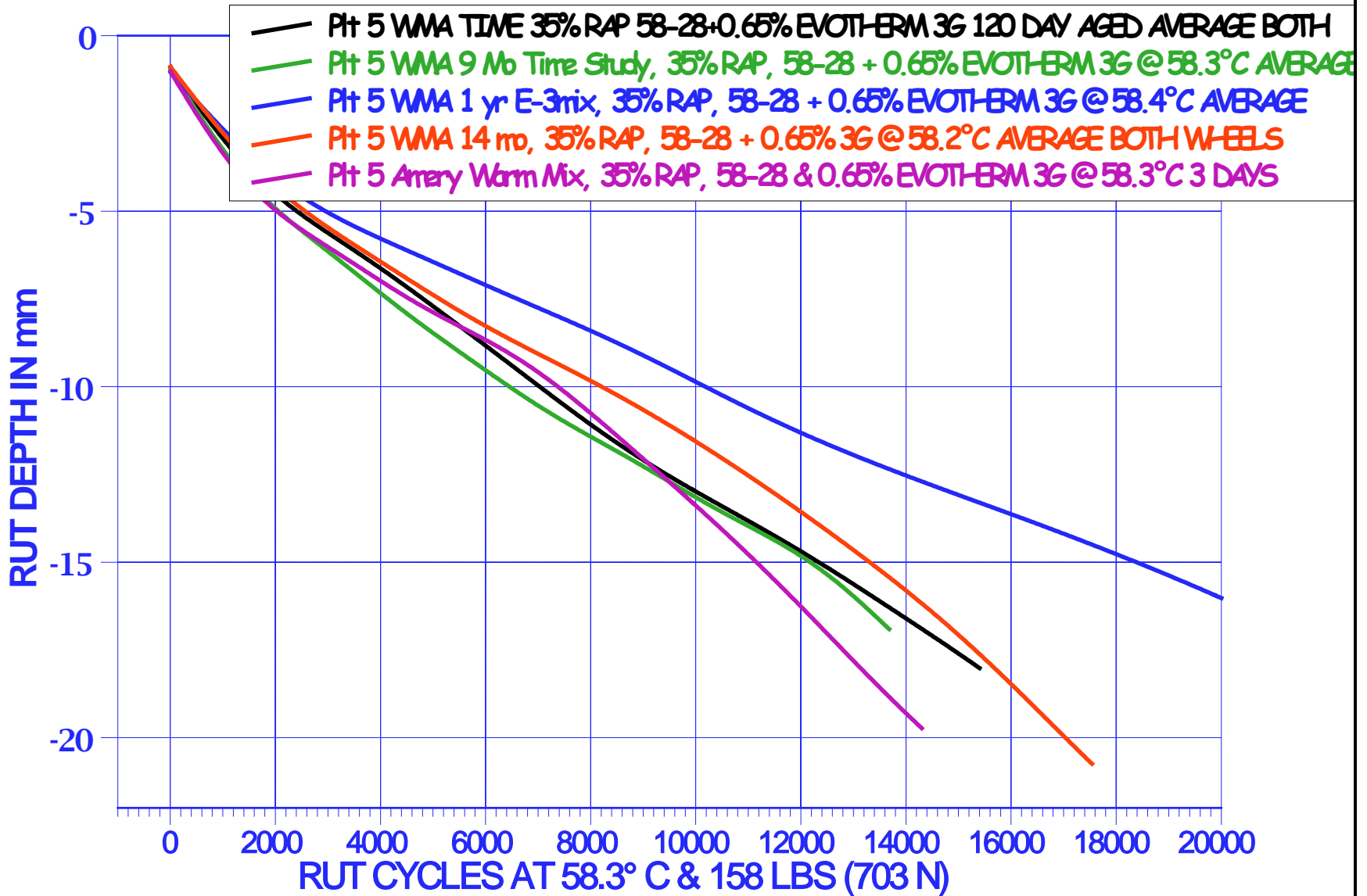
UNCOMPACTED MIX STORED AT 40°F FOR FUTURE  
WORK





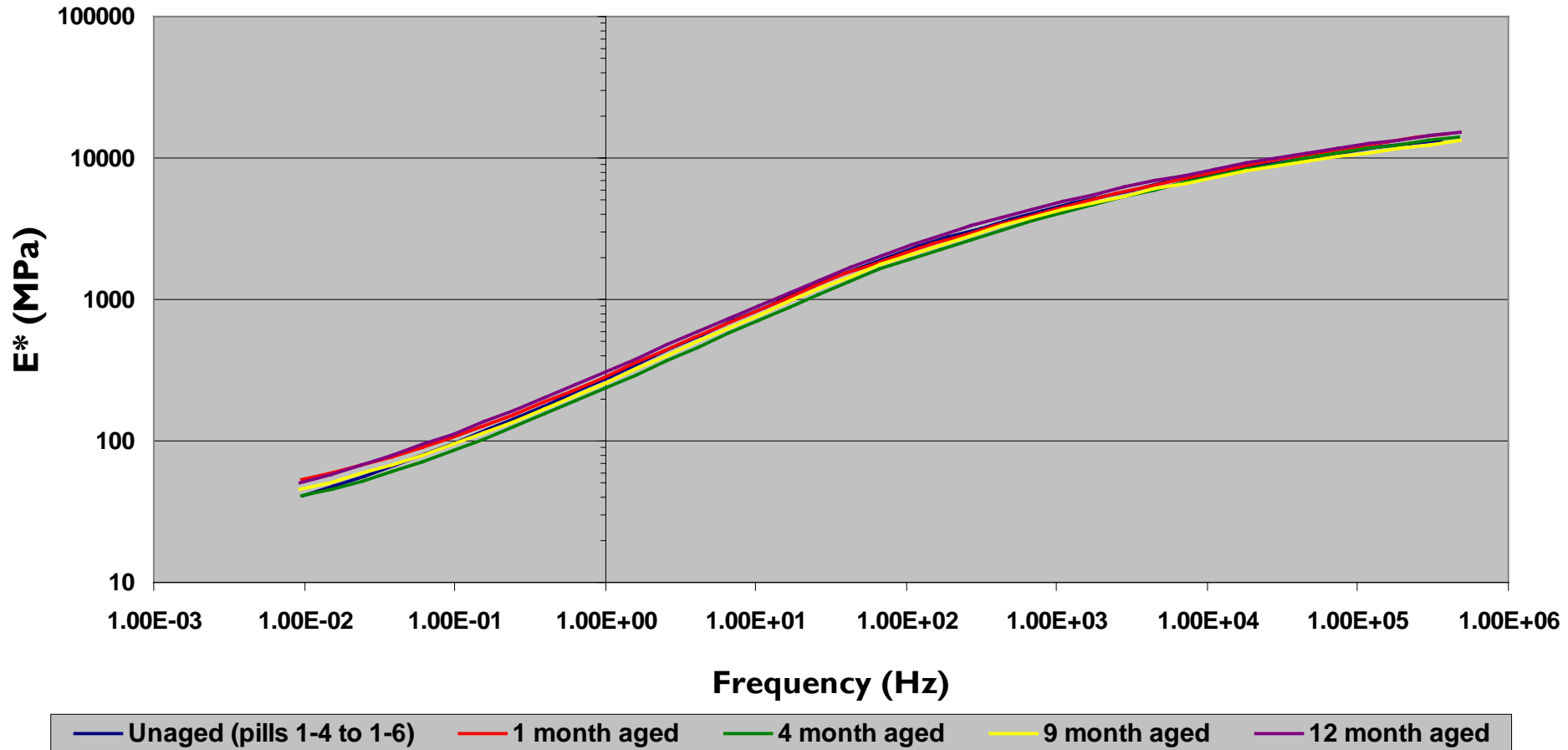


PLT 5 WARM MIX TIME STUDY PG 58-28 + 0.65% EVOTHERM 3G  
 TESTED IN HAMBURG DRY AT 58.3° C, 158# LOAD  
 PLANT MIX CONDITIONED OUTSIDE FROM 9/19/08 TO ONGOING

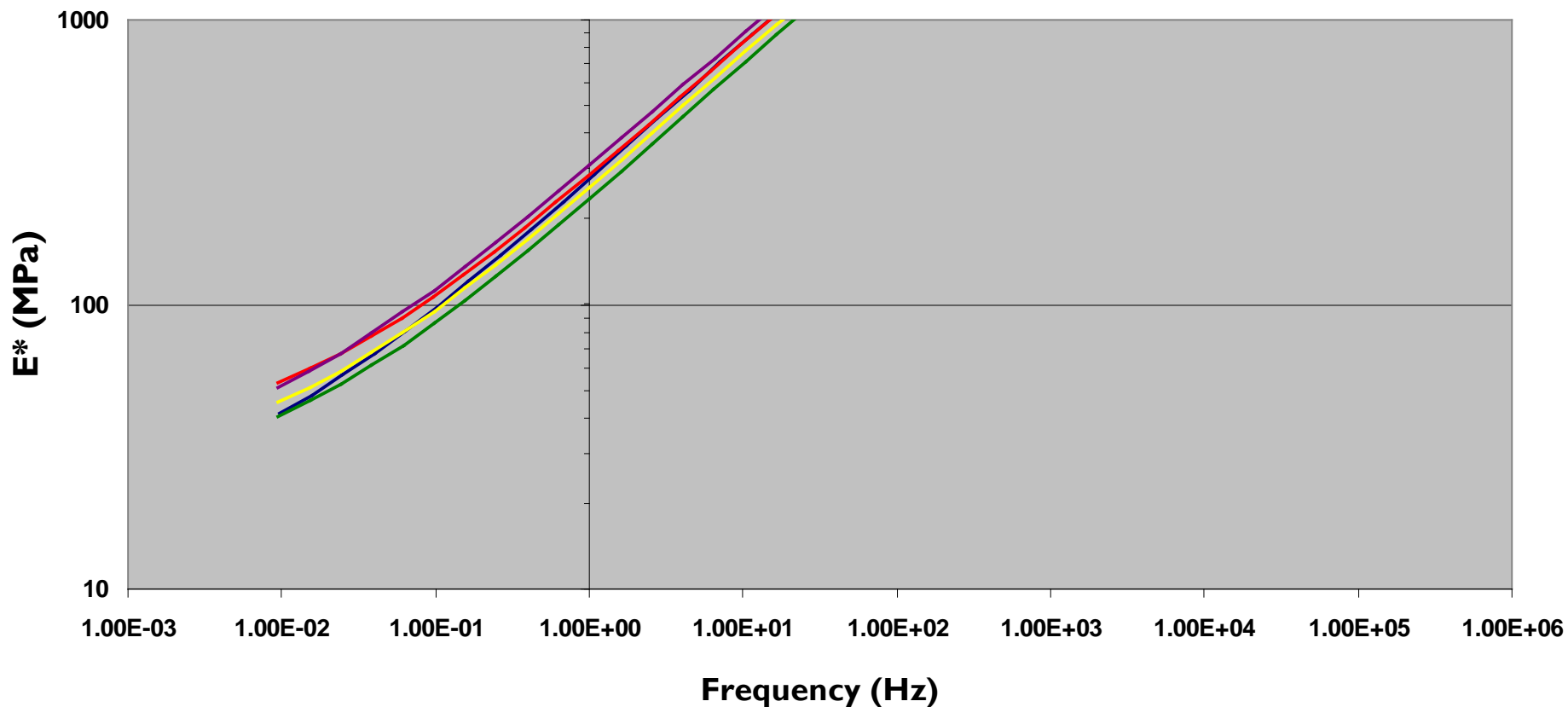


PLANT 5 WARM MIX, 35% RAP, 0.65% EVOTHERM 3G			
AGE	PG GRADE RECOVERED AC	PG GRADE PAV OF REC AC	CHANGE IN LOW TEMP GRADE
ZERO DAY	65.1-33.4	65.1-30.4	3.0
ZERO DAY	66.2-33.0	66.2-29.9	3.1
2 WEEK	68.1-32.1	68.1-29.4	2.7
7 MONTH	68.8-32.1		
9 MONTH	69.5-31.9		
12 MONTH	69.5-31.6	69.5-28	3.6
14 MONTH	70.1-31.1	70.1-28.4	2.7
9 MO LOOSE MIX STORED @ 40 F	65.9-33	65.9-30.3	2.7
2 DAY @ 60 C	67.9-32.3	67.9-29.5	2.8
4 DAY @ 60 C	68.3-32.5	68.3-29.0	3.5
			<b>AVERAGE CHANGE IN LOW TEMP GRADE</b>
			3.0

## Comparison of Mix Stiffness with Time at 40°C

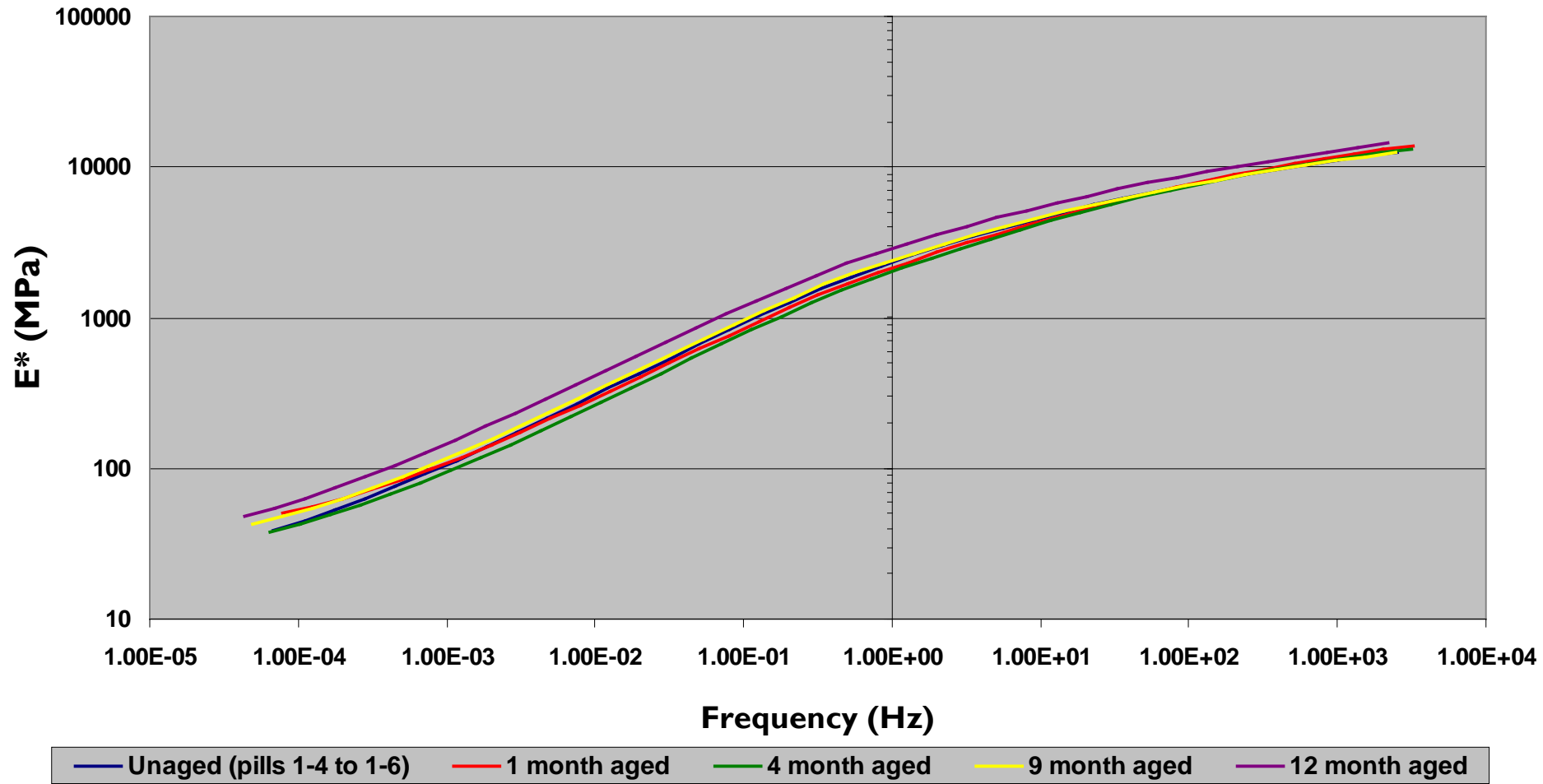


## Comparison of Mix Stiffness with Time at 40°C

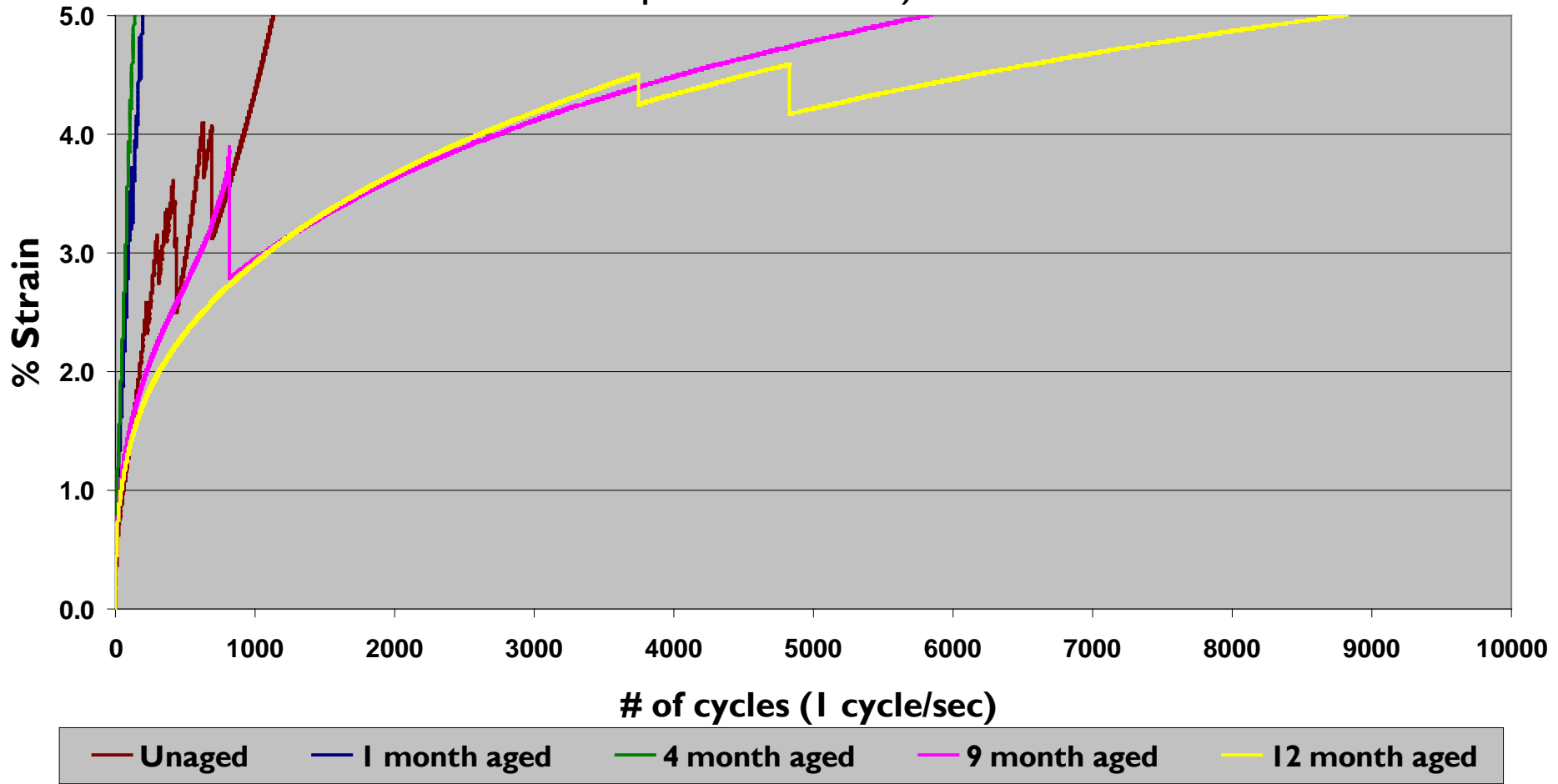


— Unaged (pills 1-4 to 1-6)    — 1 month aged    — 4 month aged    — 9 month aged    — 12 month aged

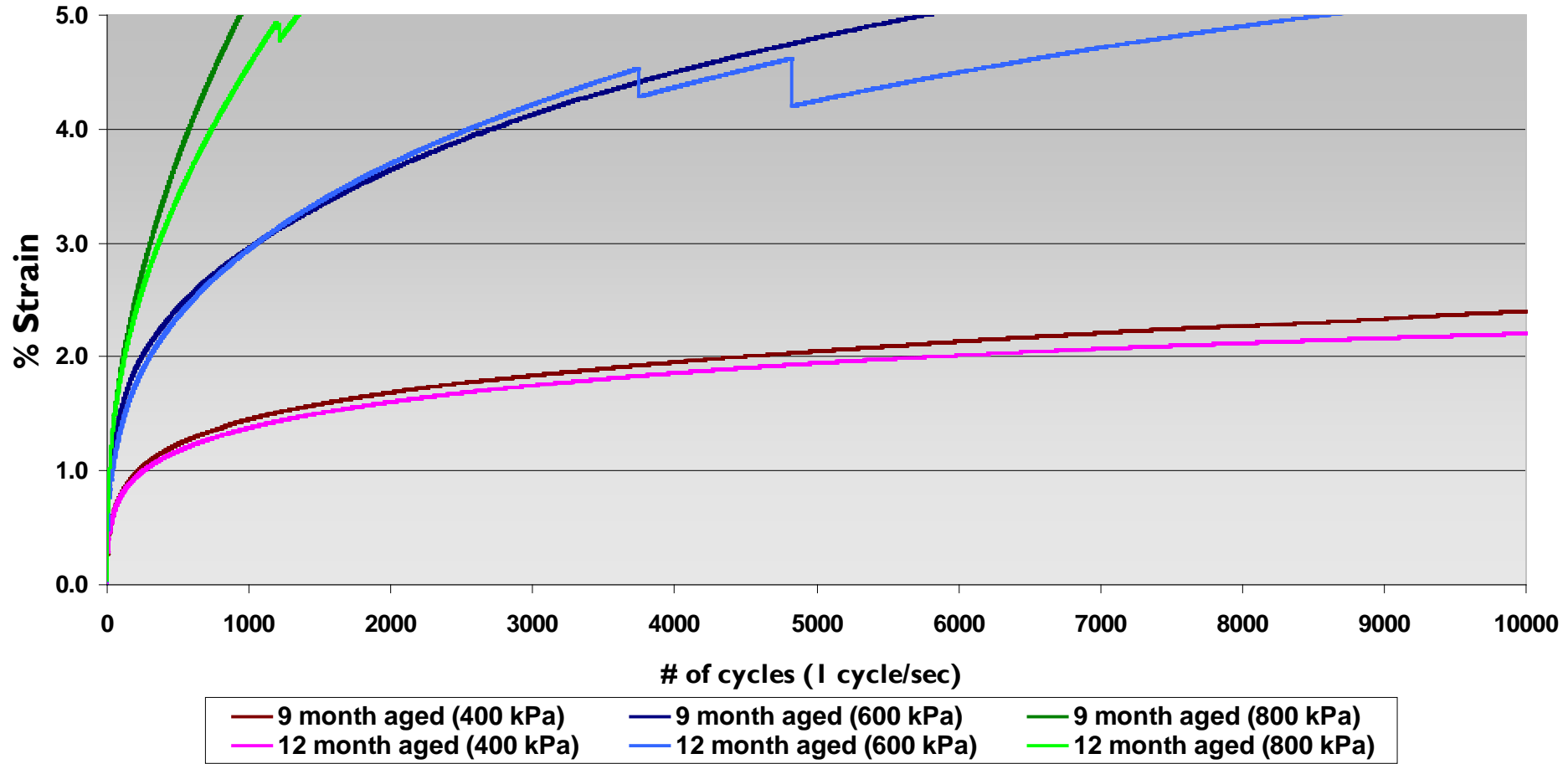
## Comparison of mix stiffness with aging time at 20°C



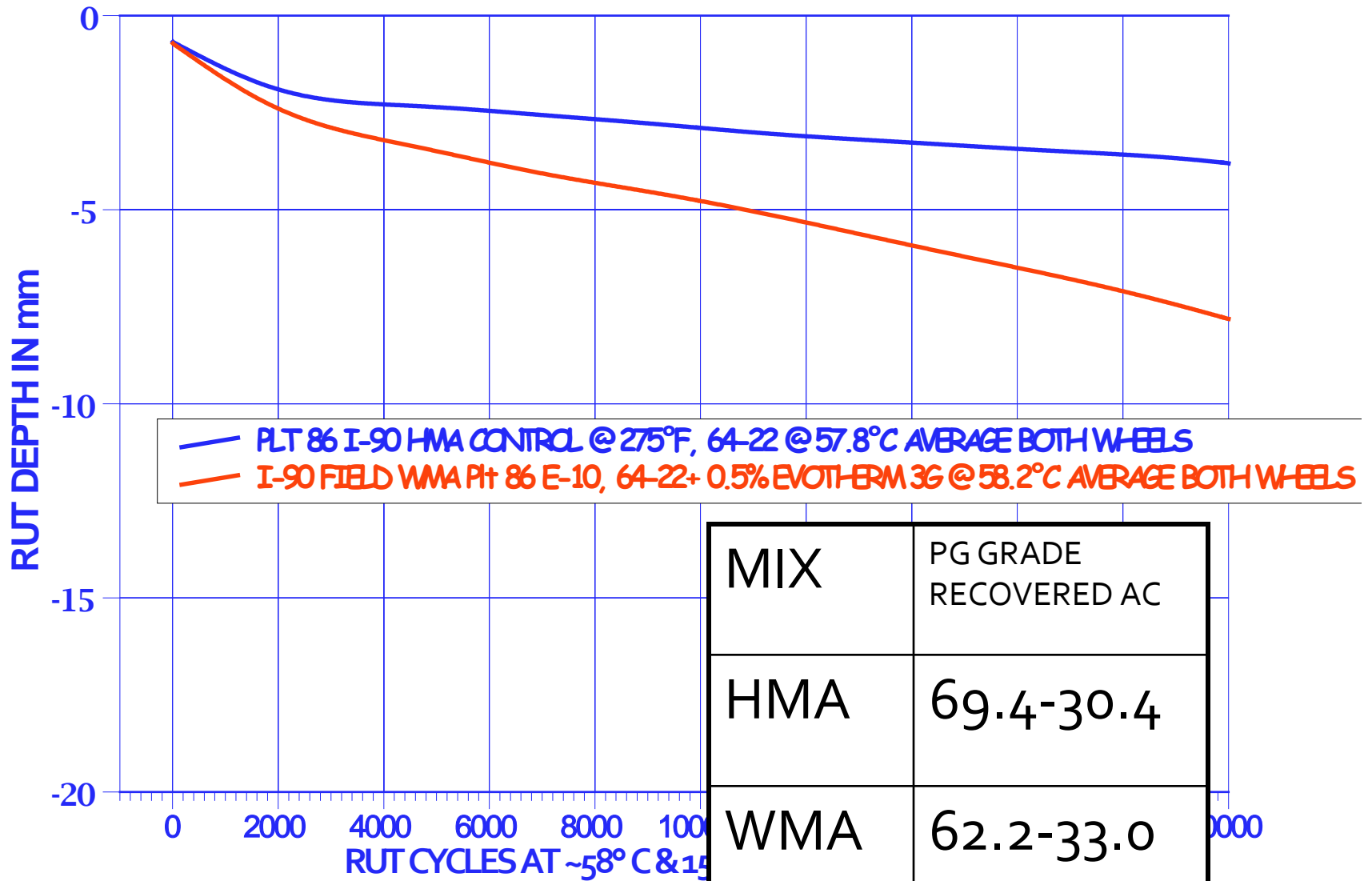
**% Strain vs. Time Comparison (modified asphalt flow comparison at 600 kPa stress no confining pressure < 9 months)**



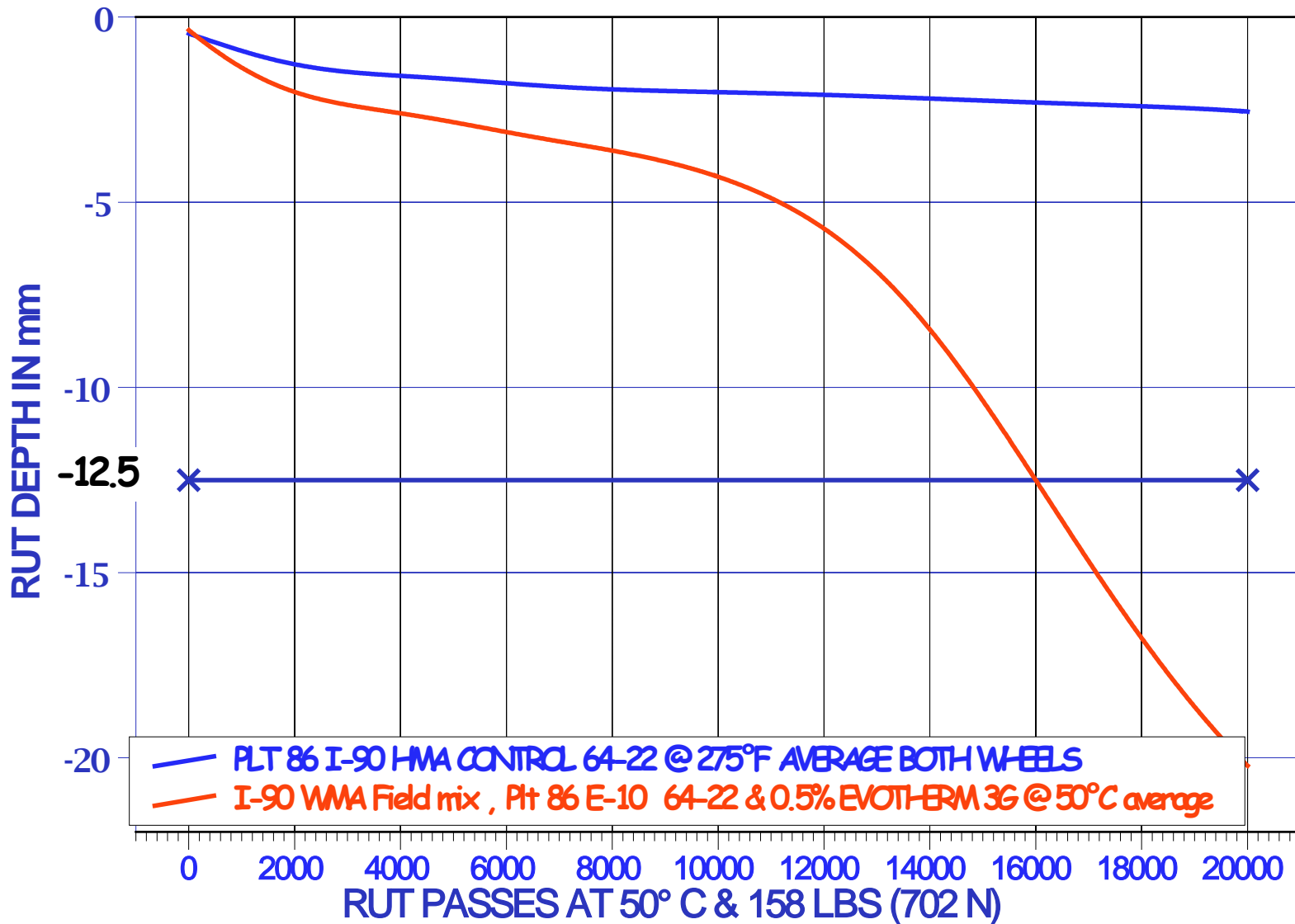
# % Strain vs. Time Comparison (flow comparison at 52°C) 69 kPa confining pressure



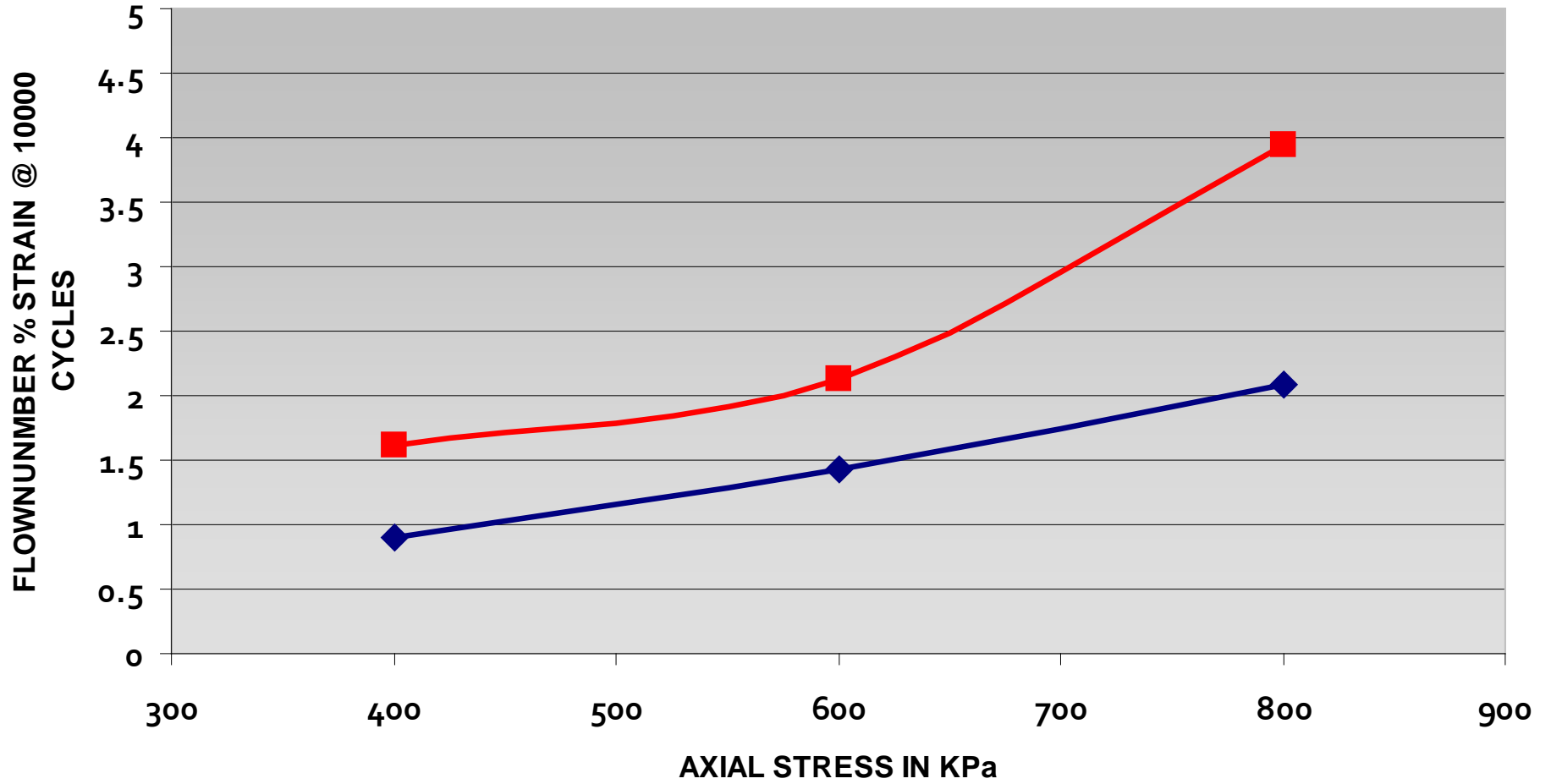
COMPARE I-90 HMA CONTROL AND WMA WARM MIX  
 PG 64-22 NO RAP, HMA MIXED AT 275°F, WMA MIXED AT 235°F  
 TESTED IN HAMBURG DRY AT 58° C, 158# LOAD  
 PLANT MIX LAB COMPACTED AFTER REHEAT



# PLANT 86 HMA CONTROL MIX PG 64-22 AT 275°F MIX TEMP TESTED IN HAMBURG AT 50° C WET

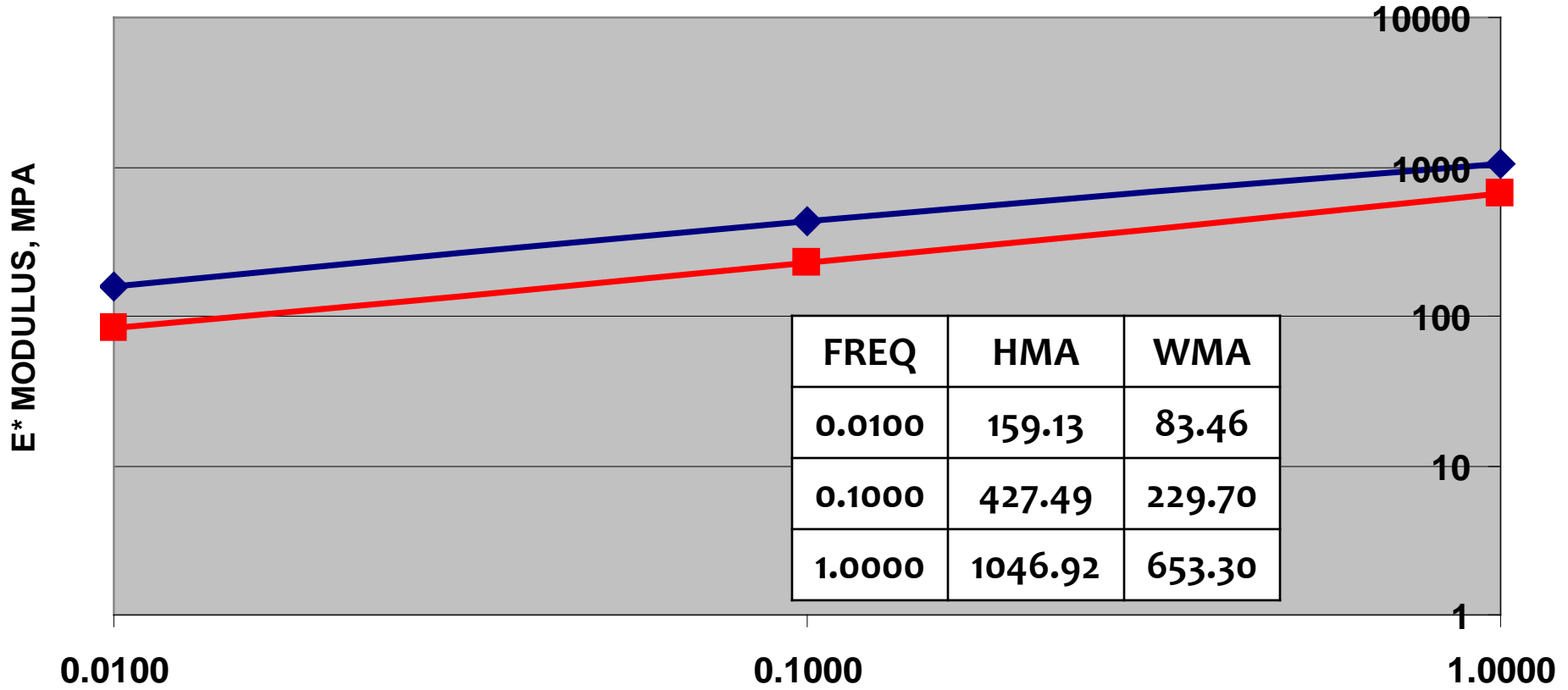


# I-90 HMA & WMA COMPARISON PG 64-22



◆ HMA FLOWNUMBER RESULTS    ■ WMA FLOWNUMBER STRAIN RESULTS

# I-90 HMA & WMA COMPARISON PG 64-22 VIRGIN MIX



FREQUENCY IN HZ FROM 40°C MASTERCURVE

◆ HMA E\* MODULUS    ■ WMA E\* MODULUS

**QUESTIONS**

**DISCUSSION**