FHWA Asphalt Binder ETG

Fall River, MA

May 10, 2018

Implementation of AASHTO

T 350 & M 332 by WSDOT

Washington State Department of Transportation

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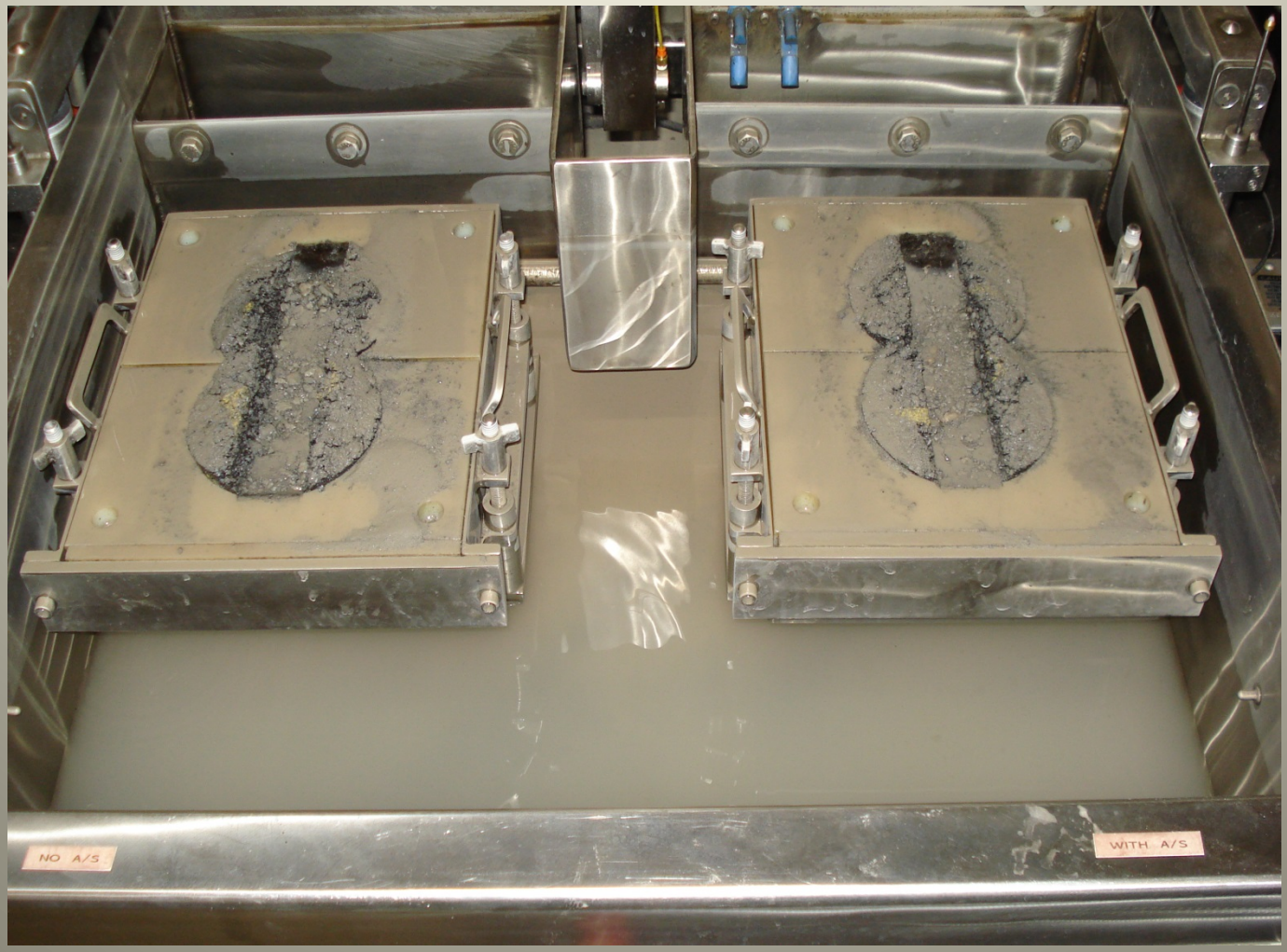
- Background
  - How we got to where we are
    - SHRP efforts - 1995
    - PG Binders - 1999
    - Superpave Volumetric Mix Design - 2004
    - PG Plus AASHTO T 301 - 2012
    - Hamburg & IDT - 2014
    - MSCR - 2018

- Background
  - What have we learned?
    - Asphalt and Anti-Strip Compatibility
    - Asphalt Modification – Products and Processes
    - Benefits of Polymer Modification
      - Note: Dual testing AASHTO T 315 & T 350 since 2008


Shown with optional Crane Lift

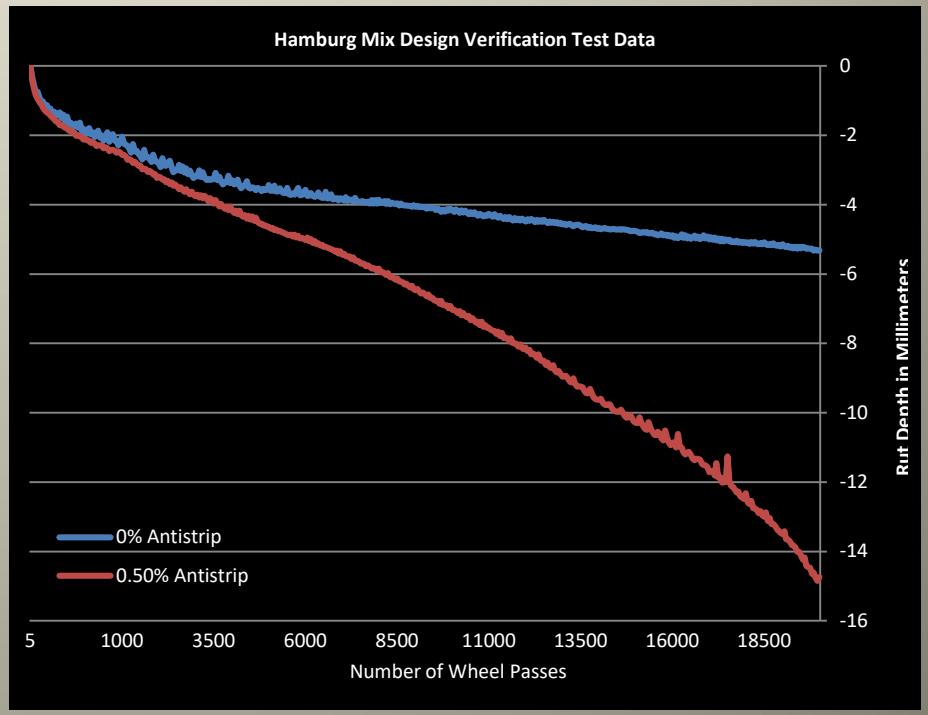
- Hamburg Testing

- Hamburg Testing



- Hamburg Testing

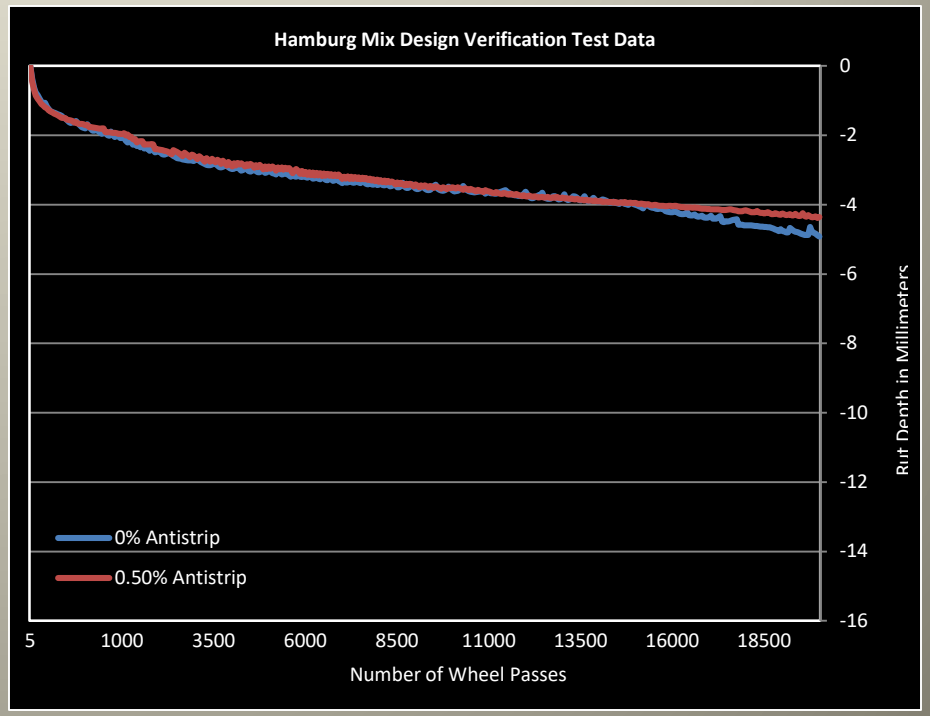
- Hamburg Testing
  - Asphalt & Anti-Strip Compatibility



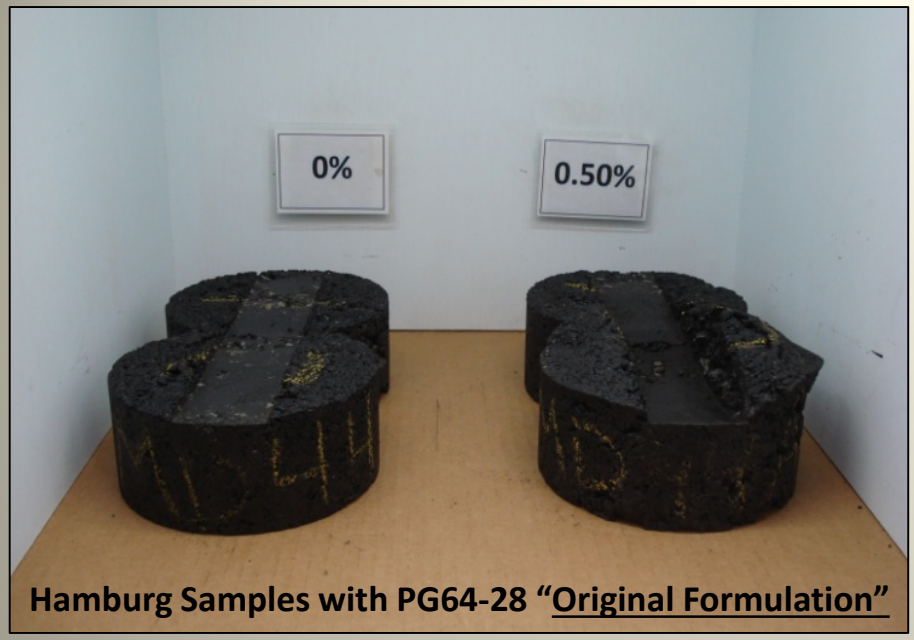
Hamburg Samples with PG64-28 "Original Formulation"

- Hamburg Testing
  - Asphalt & Anti-Strip Compatibility
    - Asphalt Binder – PG64-28
      - AASHTO M 320 – binder met specification
    - Mixture – HMA Class ½”
      - Lottman – improved TSR with anti-strip
      - Hamburg – significant rutting with anti-strip

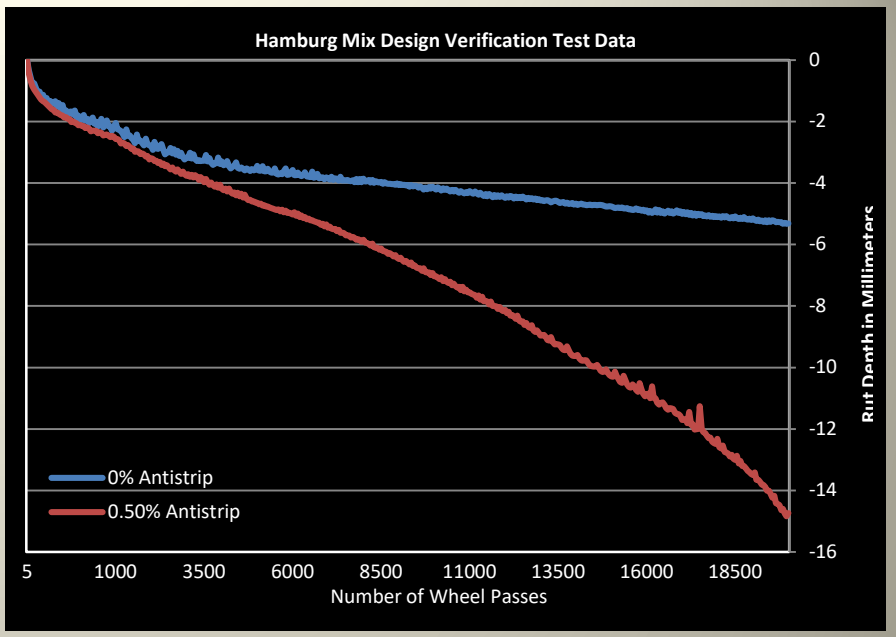
- Hamburg Testing
  - ➢ Asphalt & Anti-Strip Compatibility

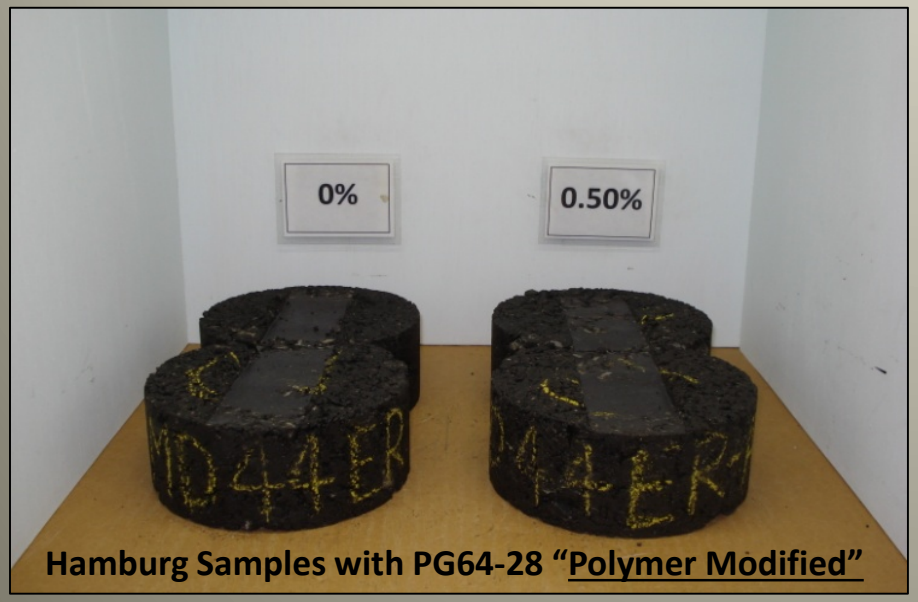


Hamburg Samples with PG64-28 "Polymer Modified"

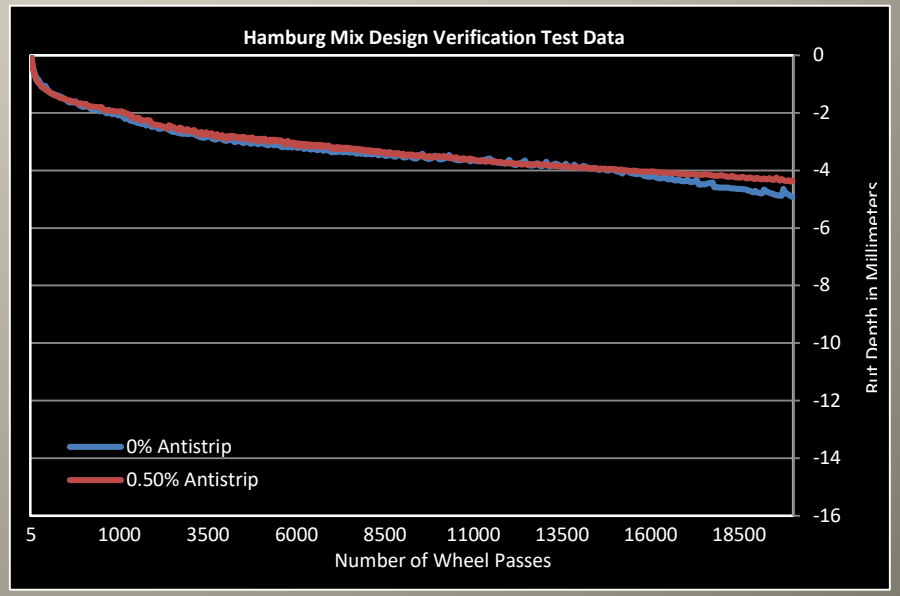


Hamburg Samples with PG64-28 "Original Formulation"





Hamburg Samples with PG64-28 "Polymer Modified"



• Asphalt Binder Testing

➢ Data Analysis

Original Formulation

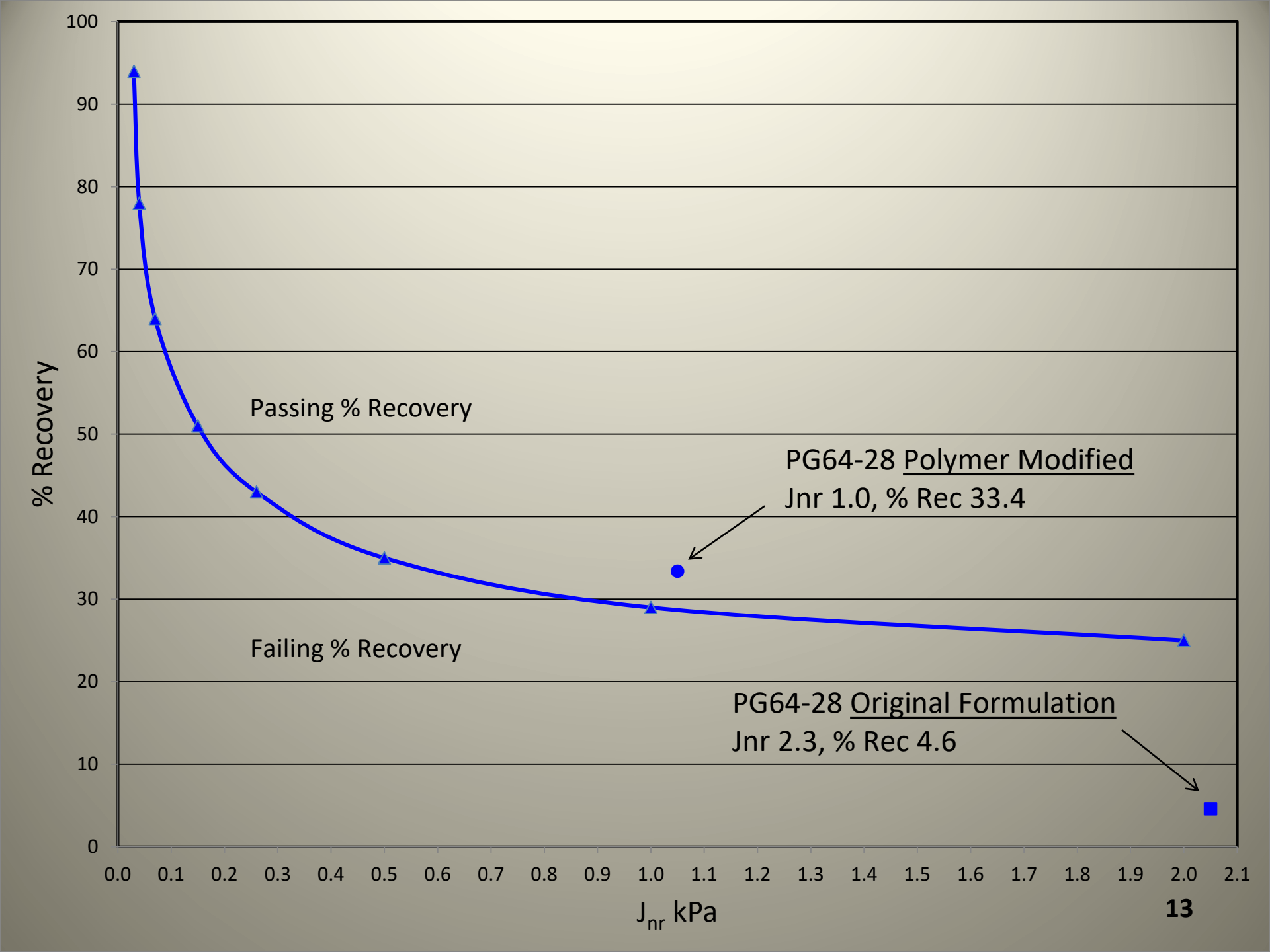
- Met Conventional PG Specs (AASHTO - M 320)
- Met MSCR Specs * (AASHTO - M 332)
- Elastic Recovery = 25% (AASHTO - T 301)

*Excluding Appendix X1

Polymer Modified

- Met Conventional PG Specs (AASHTO - M 320)
- Met MSCR Specs ** (AASHTO - M 332)
- Elastic Recovery = 74% (AASHTO - T 301)

**Including Appendix X1


100
90
80
70
60
50
40
30
20
10
0
% Recovery
Passing % Recovery
Failing % Recovery
PG64-28 Polymer Modified
Jnr 1.0, % Rec 33.4
PG64-28 Original Formulation
Jnr 2.3, % Rec 4.6
0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0 2.1
Jnr kPa

- Asphalt Binder Testing
  - Data Analysis
    - Typical Modified PG Binders
      - Met all requirements (AASHTO - M 320)
      - Passed MSCR (AASHTO - M 332) *

        *Excluding Appendix X1 (% recovery)
      - Tested elastic recovery (AASHTO - T 301)

- Asphalt Binder Grades - WA
  - Western WA
    - PG58-22
    - PG64-22
    - PG70-22
  - Eastern WA
    - PG64-28
    - PG70-28
    - PG76-28

- Resulting Changes
  - Implementation
    - Elastic Recovery Specification - 2012

Elastic Recovery Specification

Property	Test Method	Additional Requirements by Performance Grade (PG) Asphalt Binders					
		PG 58-22	PG 64-22	PG 64-28	PG 70-22	PG 70-28	PG 76-28
RTFO Residue:							
Elastic Recovery[1]	AASHTO T 301[2]	--	--	60% Min.	60% Min.	60% Min.	60% Min.
Notes:							

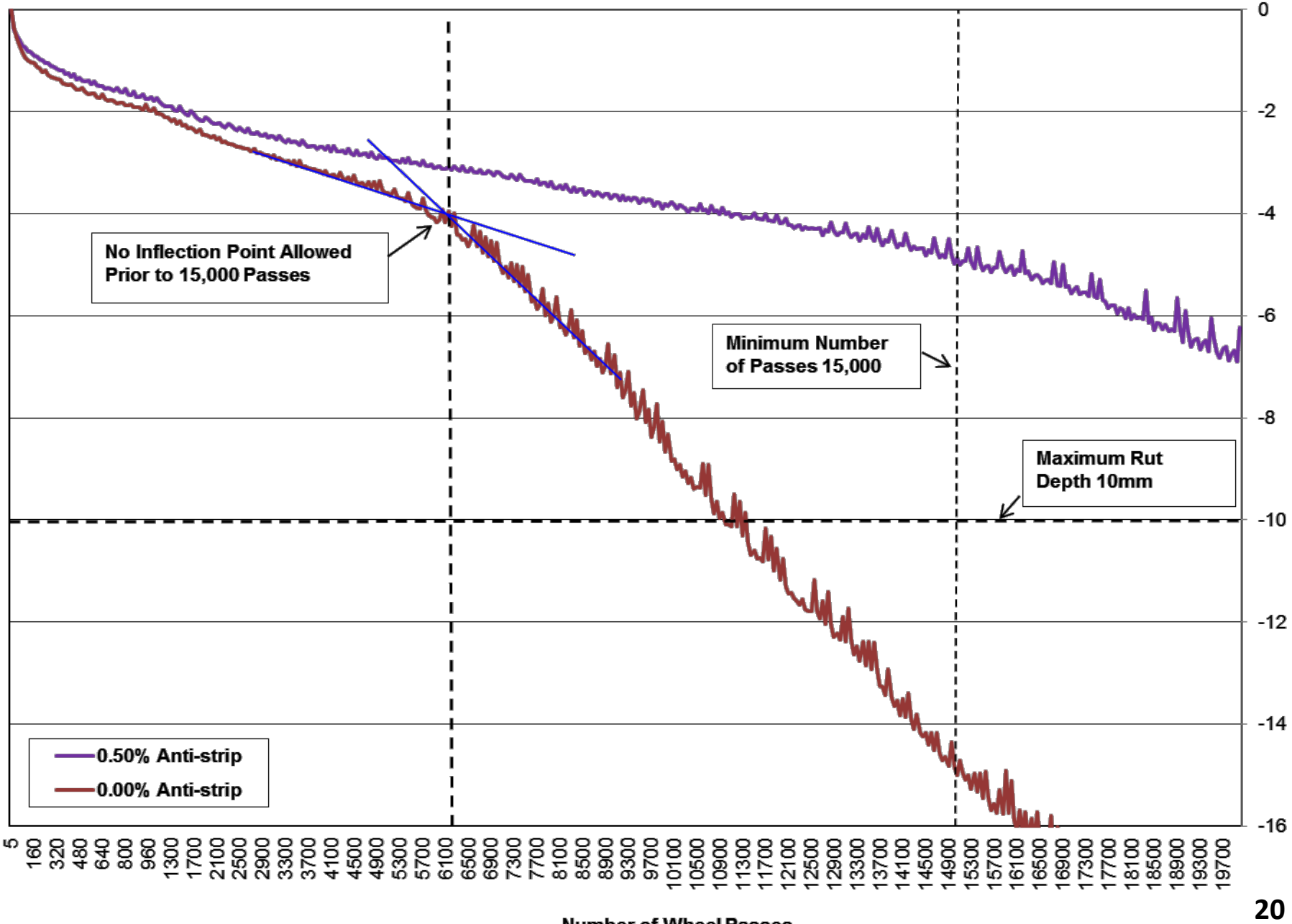
1. Elastic Recovery @ 25°C ± 0.5°C
2. Specimen conditioned in accordance with AASHTO T 240 – RTFO

- Resulting Changes
  - Implementation
    - Elastic Recovery Specification - 2012
    - Hamburg and IDT Specification - 2014

Hamburg and IDT Specification

Mix Criteria	HMA Class							
	⅜ inch		½ inch		¾ inch		1 inch	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
Hamburg Wheel-Track Testing, WSDOT FOP for AASHTO T 324 Rut Depth (mm) @ 15,000 Passes		10		10		10		10
Hamburg Wheel-Track Testing, WSDOT FOP for AASHTO T 324 Minimum Number of Passes With no Stripping Inflection Point	15,000		15,000		15,000		15,000	
Indirect Tensile (IDT) Strength (psi) of Bituminous Materials WSDOT FOP for ASTM D 6931		175		175		175		175

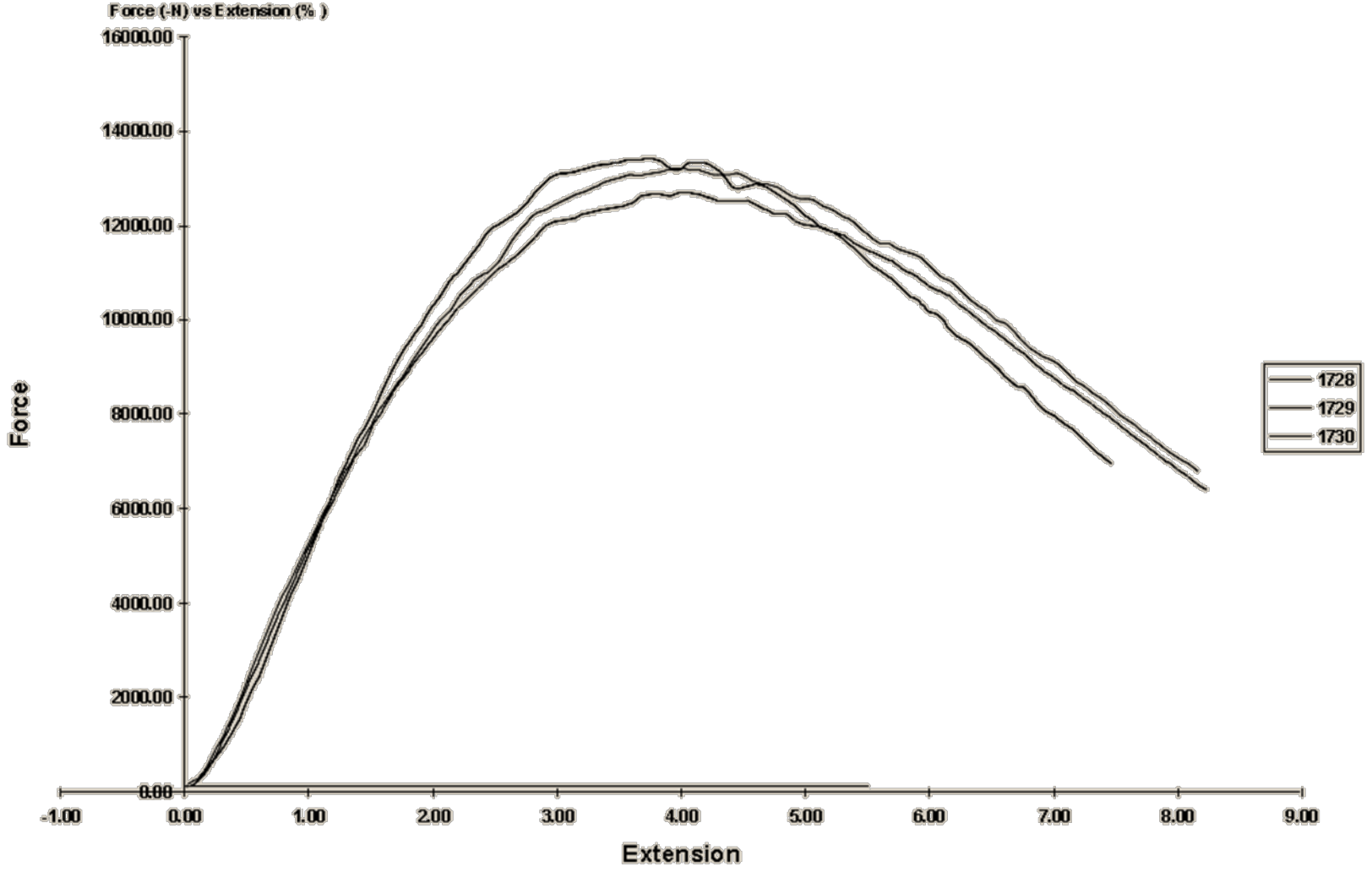
Hamburg Mix Design Test Data



WSDOT HQ Materials Laboratory

Report No

Indirect Tensile Strength (IDT) - Mix Design



Template 102 Testing Machine STM-100K 04

- Multiple Stress Creep Recovery

  - Where are we now?

    - Multiple Stress Creep Recovery - 2018

      * Worked with PCCAS, Regional Task Group & WAPA

    - Included percent recovery - M 332

    - ER (T 301) as referee - 1 year

MSCR Specification - WA

9-02.1(4) Performance Graded (PG) Asphalt Binder

PG asphalt binder meeting the requirements of AASHTO M 332 Table 1 of the grades specified in the Contract shall be used in the production of HMA. For HMA with greater than 20 percent RAP by total weight of HMA or any amount of RAS the new asphalt binder, recycling agent and recovered asphalt (RAP and/or RAS) when blended in the proportions of the mix design shall meet the PG asphalt binder requirements of AASHTO M 332 Table 1 for the grade of asphalt binder specified by the Contract.

In addition to AASHTO M 332 Table 1 specification requirements, PG asphalt binders shall meet the following requirements:

		Additional Requirements by Performance Grade (PG) Asphalt Binders					
Property	**Test Method**	**PG58S-22**	**PG58H-22**	**PG58V-22**	**PG64S-28**	**PG64H-28**	**PG64V-28**
RTFO Residue: Average Percent Recovery @ 3.2 kPa	AASHTO T 350[1]			30% Min.	20% Min.	25% Min.	30% Min.
[1]Specimen conditioned in accordance with AASHTO T 240 – RTFO.							

The RTFO Jnrdiff and the PAV direct tension specifications of M 332 are not required.

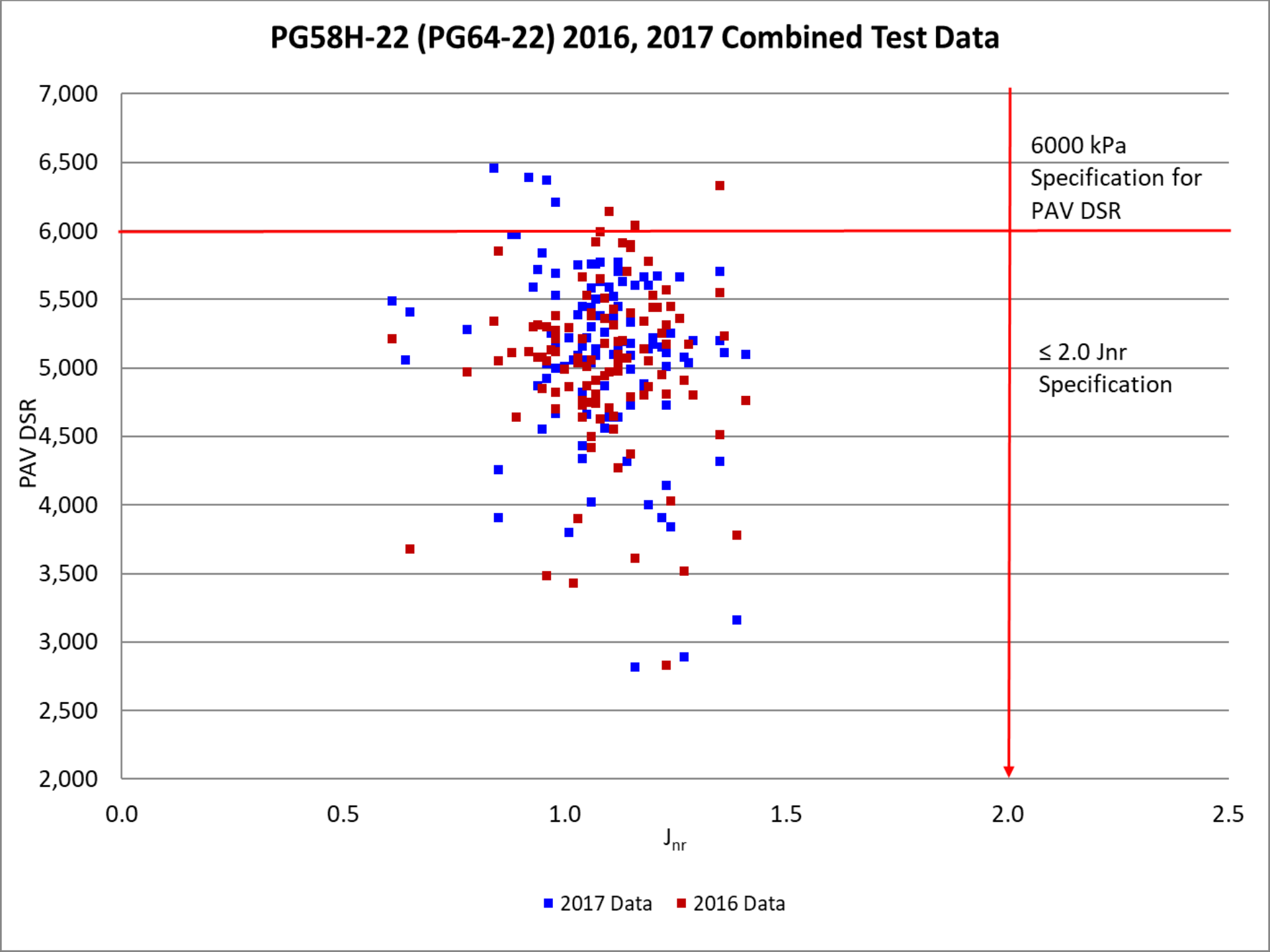
* 2018 T 301 ER referee specification minimum of 65% if failing percent recovery.

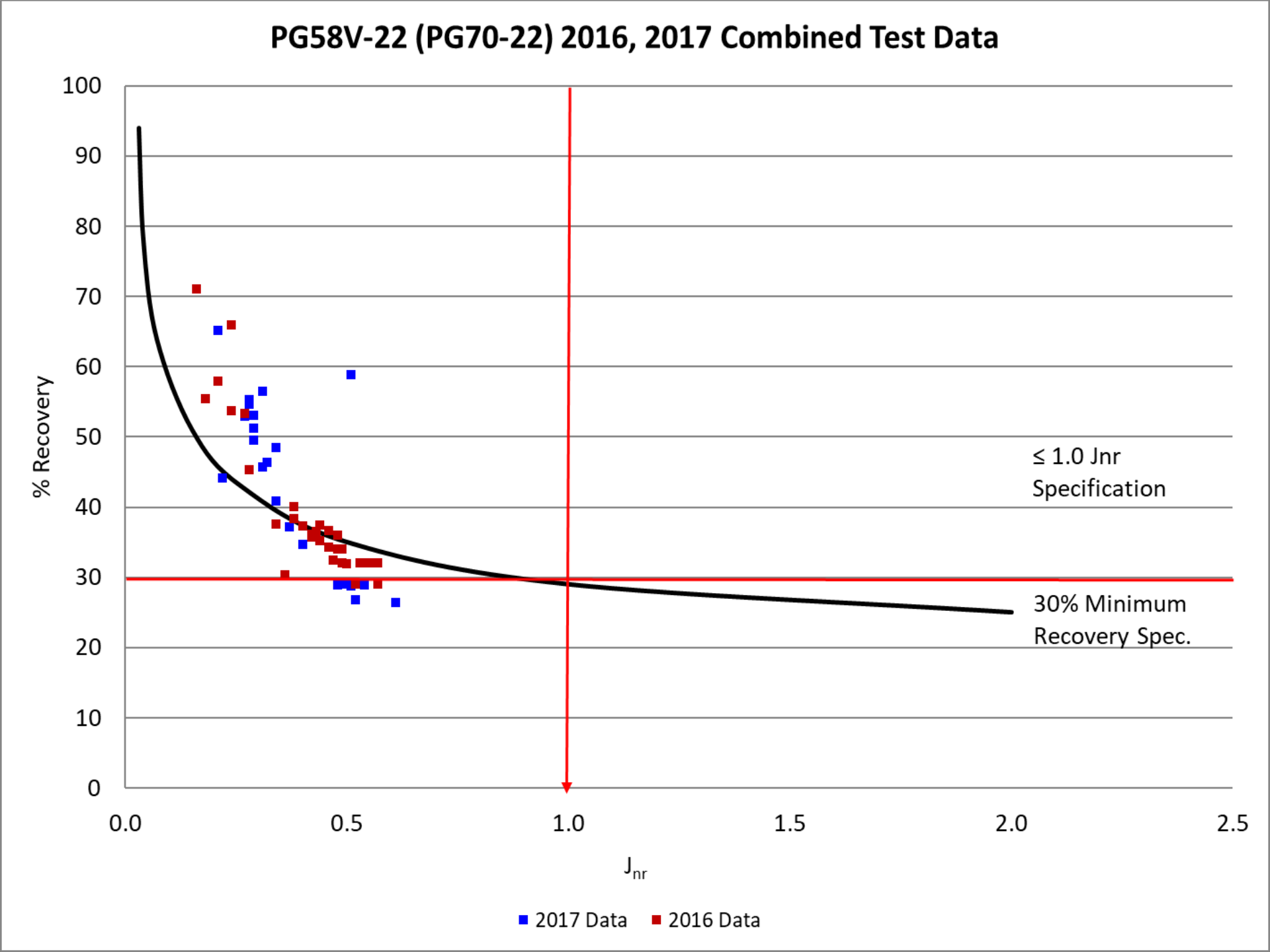
• Asphalt Binder Grades - WA

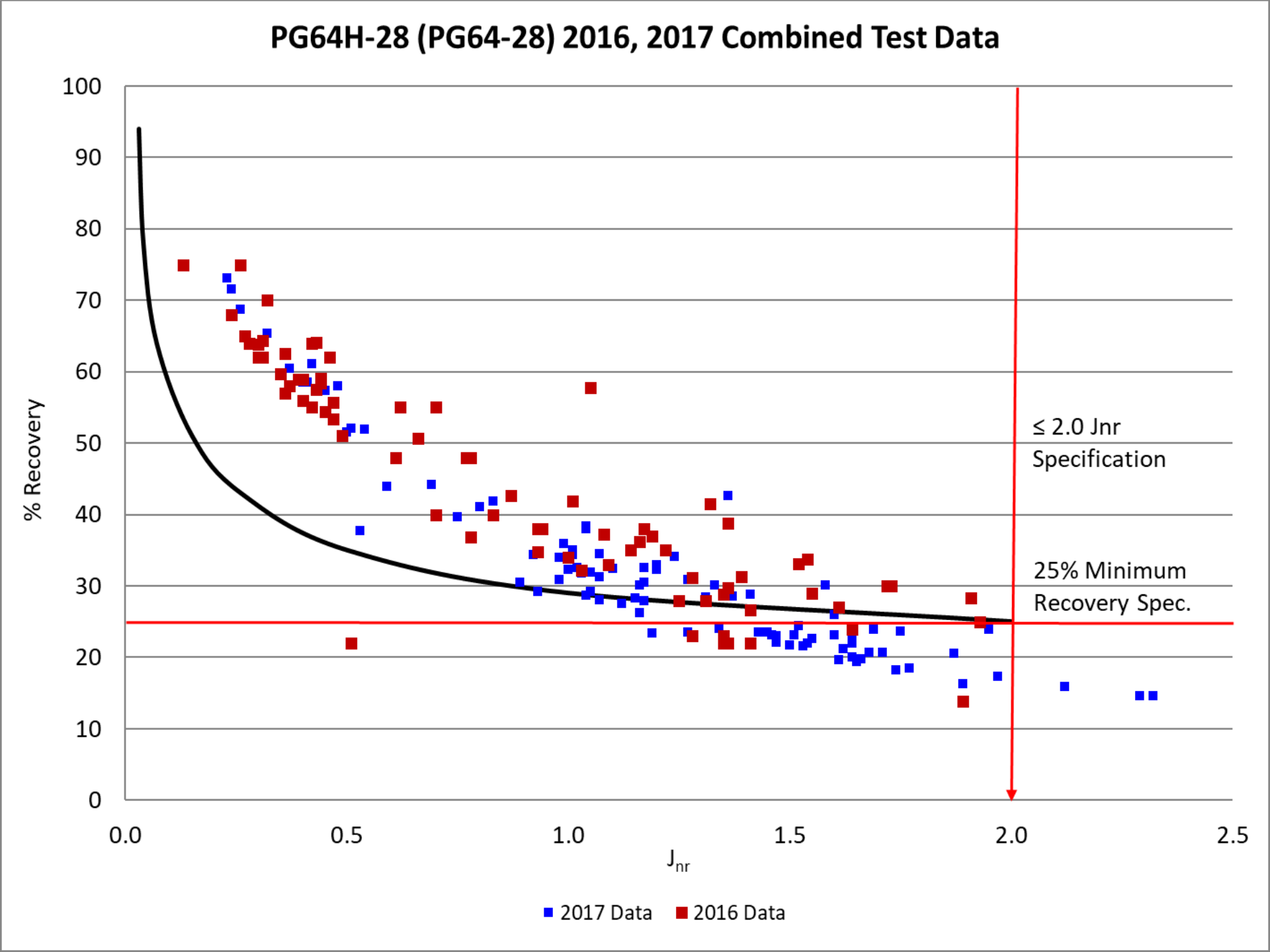
- Previous Grading System
  - PG58-22 → PG58S-22 (Standard)
  - PG64-22 → PG58H-22 (Heavy)
  - PG70-22 → PG58V-22 (Very Heavy)
  - PG64-28 → PG64S-28
  - PG70-28 → PG64H-28
  - PG76-28 → PG64V-28
- MSCR Grading System

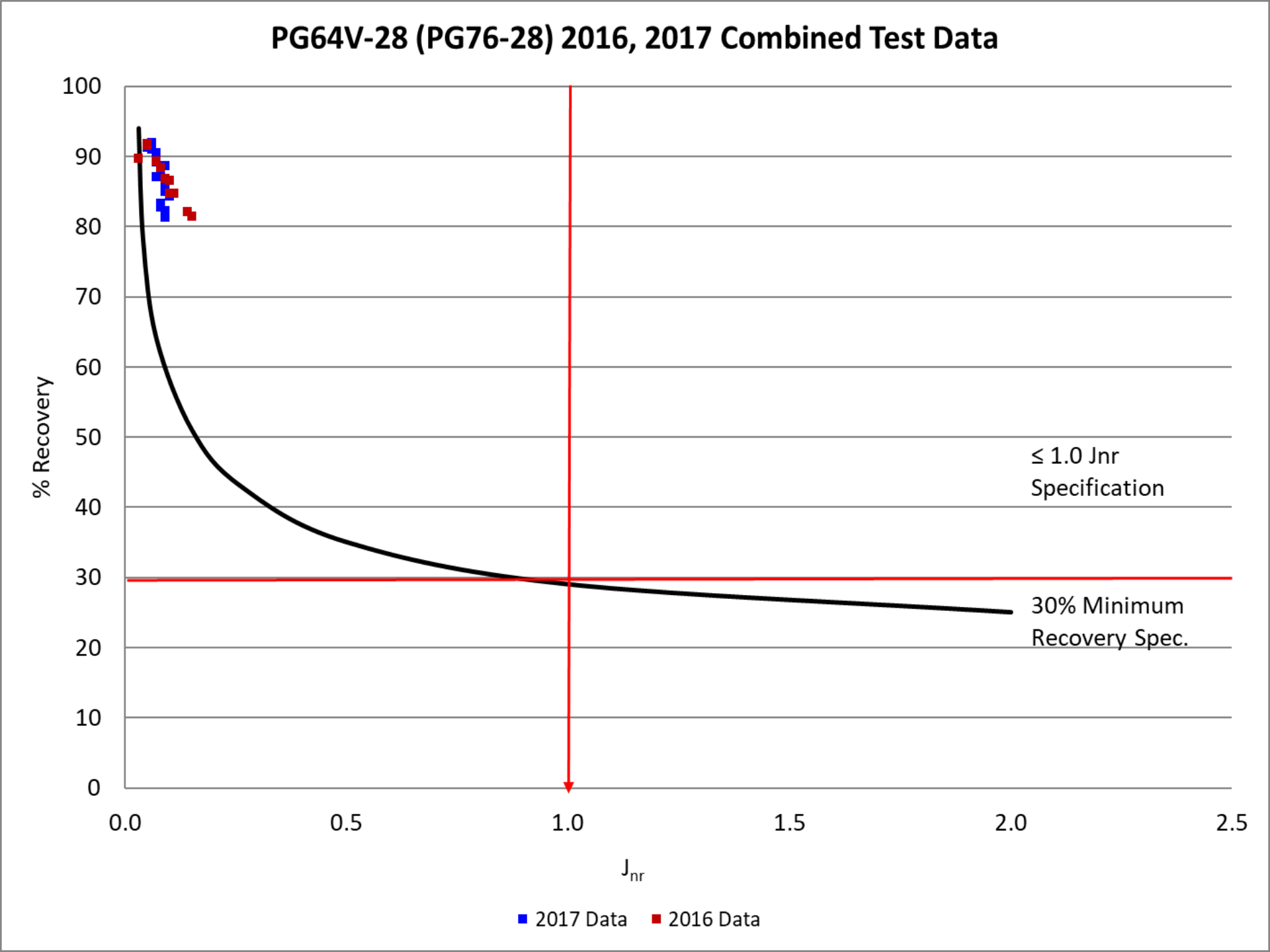
• Asphalt Binder Grading - 101

- Previous Grading System
  - ~~PG58-22~~
  - PG64-22 → PG58H-22 (Heavy)
  - PG70-22 → PG58V-22 (Very Heavy)
  - ~~PG64-28~~
  - PG70-28 → PG64H-28
  - PG76-28 → PG64V-28
- MSCR Grading System
  - ~~PG58S-22 (Standard)~~
  - ~~PG64S-28~~


PG58H-22 (PG64-22) 2016, 2017 Combined Test Data
7,000
6,500
6,000
5,500
5,000
4,500
4,000
3,500
3,000
2,500
2,000
PAV DSR
0.0
0.5
1.0
1.5
2.0
2.5
Jnr
6000 kPa
Specification for
PAV DSR
≤ 2.0 Jnr
Specification
2017 Data
2016 Data


PG58V-22 (PG70-22) 2016, 2017 Combined Test Data
100
90
80
70
60
50
40
30
20
10
0
% Recovery
0.0
0.5
1.0
1.5
2.0
2.5
J_{nr}
≤ 1.0 Jnr
Specification
30% Minimum
Recovery Spec.
2017 Data
2016 Data


PG64H-28 (PG64-28) 2016, 2017 Combined Test Data
% Recovery
100
90
80
70
60
50
40
30
20
10
0
0.0
0.5
1.0
1.5
2.0
2.5
J_{nr}
≤ 2.0 Jnr
Specification
25% Minimum
Recovery Spec.
2017 Data
2016 Data


PG64V-28 (PG76-28) 2016, 2017 Combined Test Data
100
90
80
70
60
50
40
30
20
10
0
% Recovery
0.0
0.5
1.0
1.5
2.0
2.5
J_{nr}
≤ 1.0 Jnr
Specification
30% Minimum
Recovery Spec.
2017 Data
2016 Data

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Questions?

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