59th Idaho Asphalt Conference

INCREASING SERVICE LIFE of HMA in WASHINGTON STATE

Joe DeVol, Asst. State Materials Engineer
October 24, 2019

Background

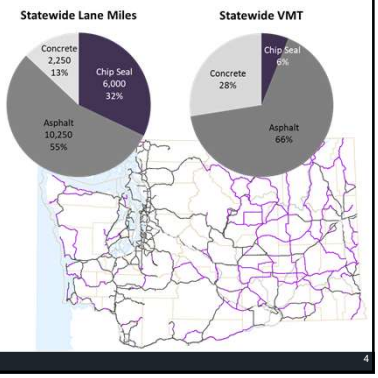
- How we got to where we are
  - SHRP efforts - 1995
  - Implemented PG Binders - 2000
  - Superpave Volumetric Mix Design - 2004
  - Elastic Recovery Specification - 2012

Background

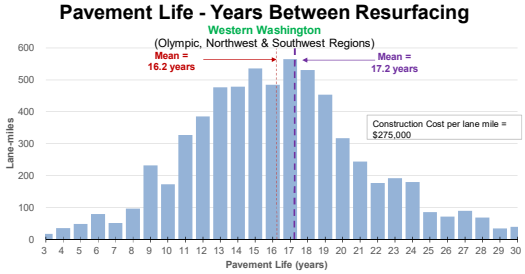
- How we got to where we are
  - Hamburg and IDT Specification - 2014
  - Multiple Stress Creep Recovery - 2018*
  - Included percent recovery - T 350 (R-92)
    - * Worked with PCCAS, AI, Regional Task Group & WAPA

Pavement Management Perspective

- 18,500 lane-miles
- $16 billion pavement replacement cost



Pavement Life - Years Between Resurfacing



WW - Change of Life (years)	0	1	2	3
Average Life (years)	16.2	17.2	18.2	19.2
Annual Cost Per Lane-mile	$25,648	$24,190	$22,985	$21,963
$ Change in Total Annual Cost	$0	-$9,438,403	-$17,235,754	-$23,850,009
% Change Annual Cost	0%	-6%	-10%	-14%

2017 - Met w/Industry Open Discussion and Dialogue

WSDOT	WAPA
Chris Christopher	Dave Gent, WAPA
Jon Deffenbacher	Kenton Hill, Granite Construction
Kurt Williams	Chris Pedersen, CTL
Joe DeVol	Dave Bell, Lakeside Industries
Jeff Uhlmeyer	Brad Griffith, Miles Resources
Bob Dyer	

Two Areas of Focus:

1) **Increase Asphalt Content**

2) **Increase Density**

1) Increase Asphalt Content

- Initial Discussions:
  - Add asphalt binder to all mixes (0.3% Pb)
  - Use air void regression (4.0% to 3.5% Va)
  - Revise voids in mineral aggregate (VMA) requirements
  - Tighten percent binder (Pb) tolerance
  - Tighter gradation control

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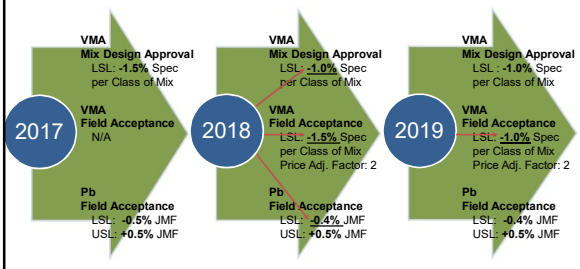
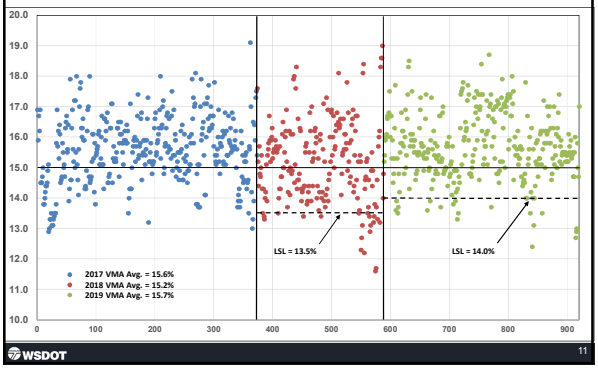
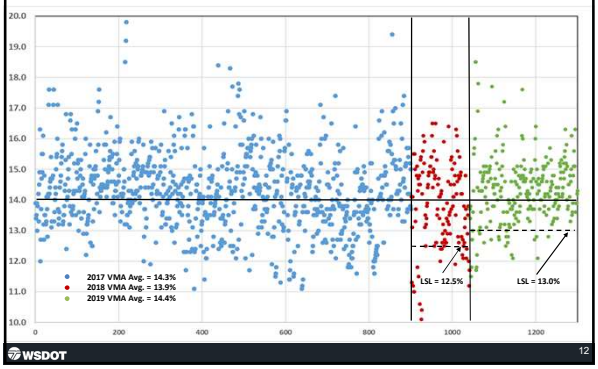
VMA & Pb SPECIFICATION REVISIONS



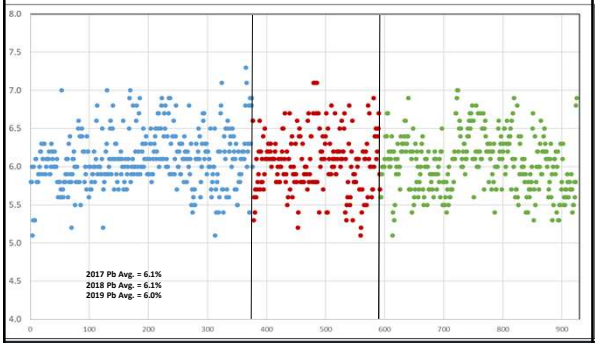
2017-2019 – 3/8 Inch VMA Production Data



2017-2019 – 1/2 Inch VMA Production Data



2017-2019 – 3/8 Inch Percent Binder (Pb) Production Data



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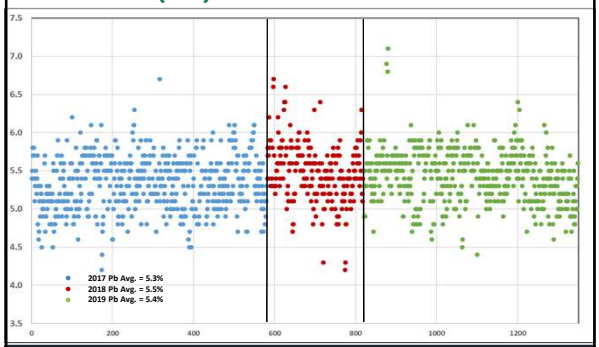
2017-2019 – 1/2 Inch Percent Binder (Pb) Production Data



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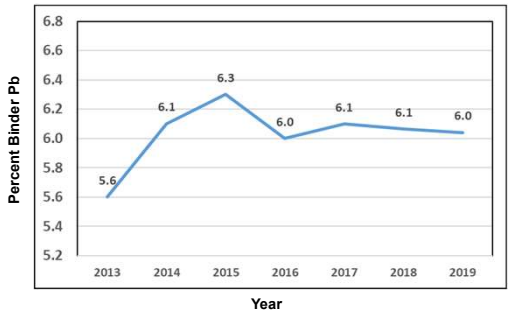
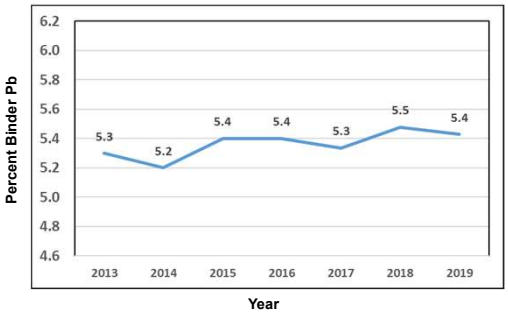
3/8 Inch HMA Percent Binder (Pb) Production Average



WSDOT 15

1/2 Inch HMA Percent Binder (Pb) Production Average



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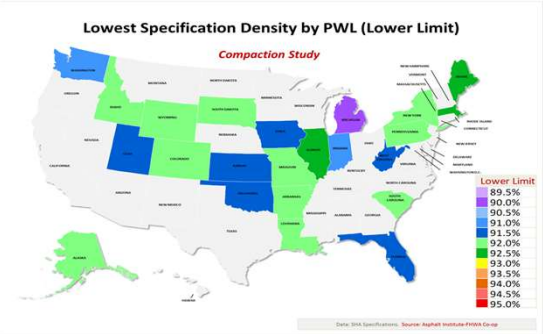
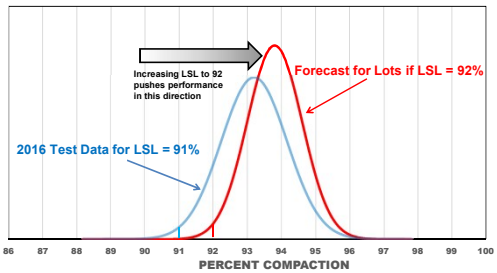
2) Increase Density



WSDOT 17

2017 COMPACTION SUBLOTS

LSL of 91% and Forecast with LSL of 92%



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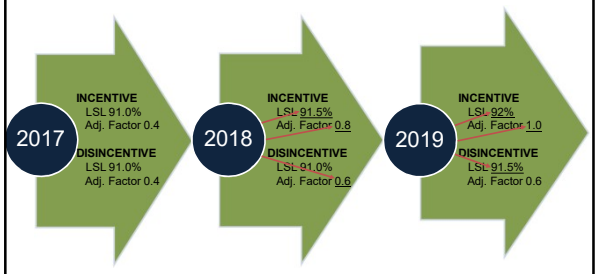
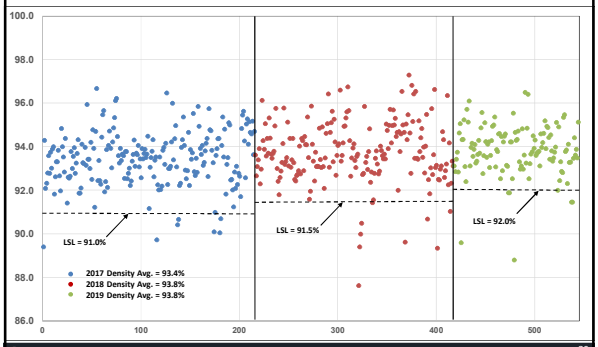
COMPACTION SPECIFICATION



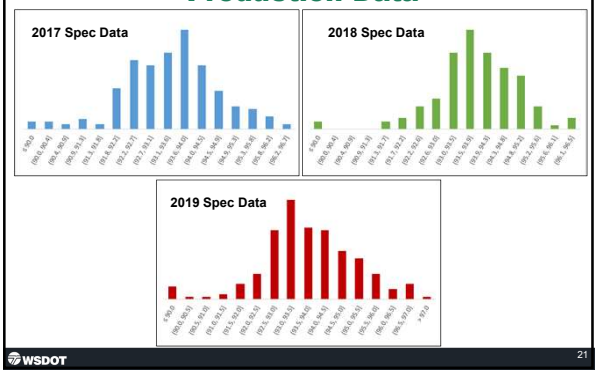
WSDOT 19

2017-2019 – 3/8 Inch Compaction Production Data



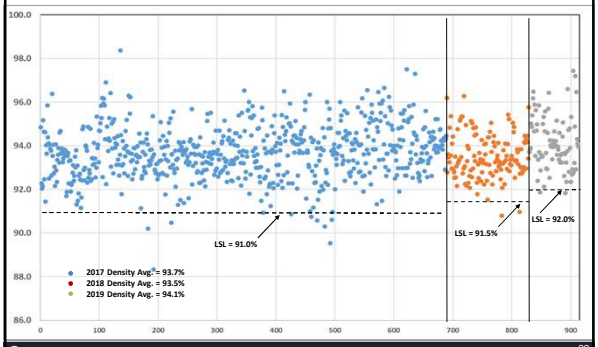
WSDOT 20

2017-2019 – 3/8 Inch Compaction Production Data



WSDOT 21

2017-2019 – 1/2 Inch Compaction Production Data



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2017-2019 – 1/2 Inch Compaction Production Data

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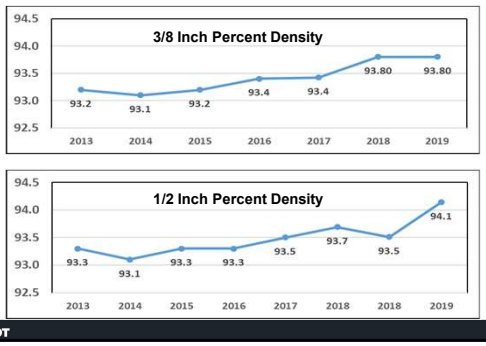
2013 - 2019 HMA Percent Density Production Average



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Questions?

Contact Information:
Joe DeVol
jdevol@wsdot.wa.gov
(360) 709-5421

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Other Efforts to Increase Service Life of HMA in Washington State

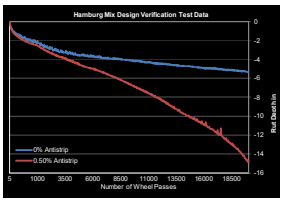
What We Learned?

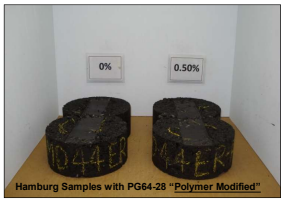
- Hamburg – 2010
  - Asphalt and Anti-Strip Compatibility
  - Asphalt Modification – Products and Processes
  - Benefits of Polymer Modification

*Note: Dual testing AASHTO T 315 & T 350 since 2008

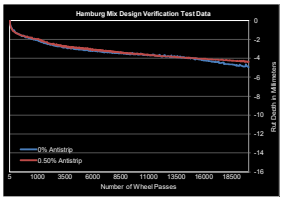
Hamburg Wheel Track Testing

Hamburg Samples with PG64-28 "Original Formulation"





Hamburg Samples with PG64-28 "Polymer Modified"



Asphalt Binder Testing

Original Formulation

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

*Excluding R 92

Polymer Modified

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

**Including R 92

2018 Standard Specifications Asphalt Binder Changes

- **M 320 Grading System**
  - PG58-22
  - PG64-22
  - PG70-22 (60% ER)
  - PG64-28 (60% ER)
  - PG70-28 (60% ER)
  - PG76-28 (60% ER)
- **M 332 Grading System**
  - PG58S-22*
  - PG58H-22
  - PG58V-22 (30% Rec)
  - PG64S-28* (20% Rec)
  - PG64H-28 (25% Rec)
  - PG64V-28 (30% Rec)

* "S" Grade not used by WSDOT

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2018 Standard Specifications

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.

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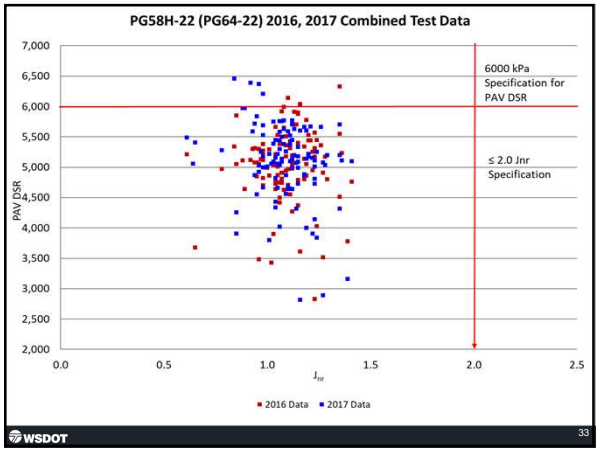
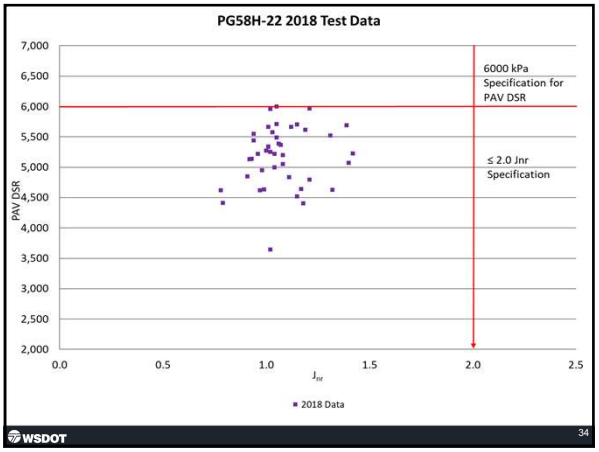
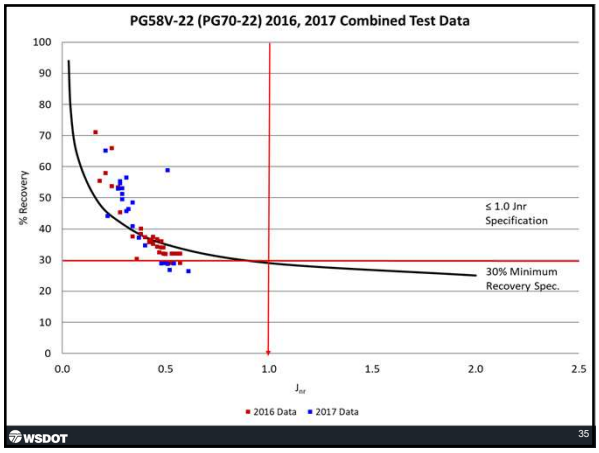


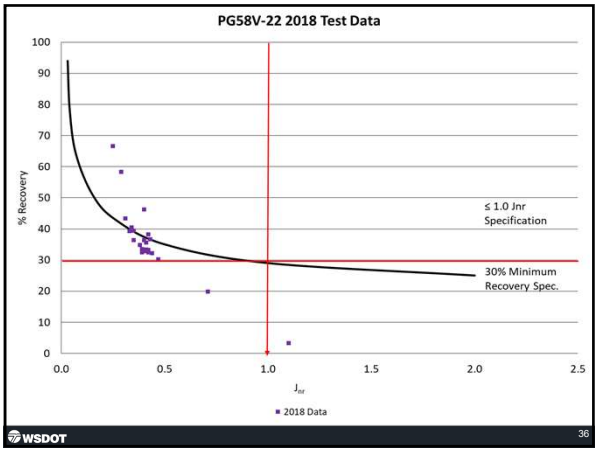
WSDOT 33



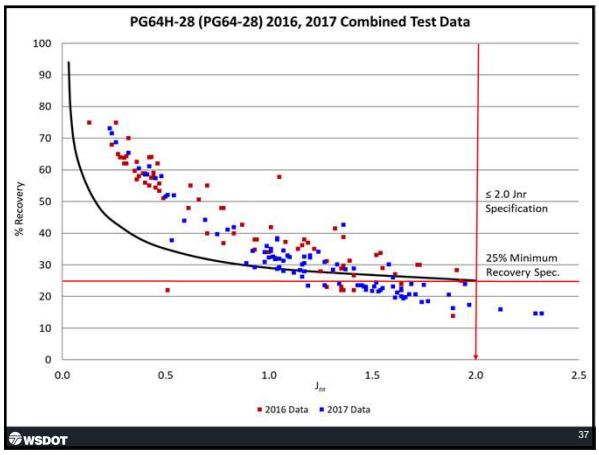
WSDOT 34

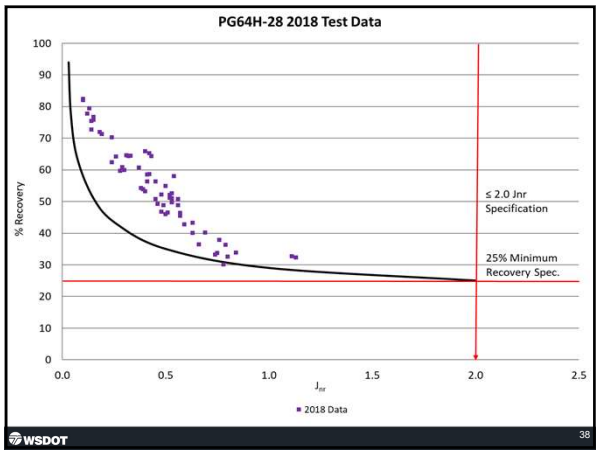


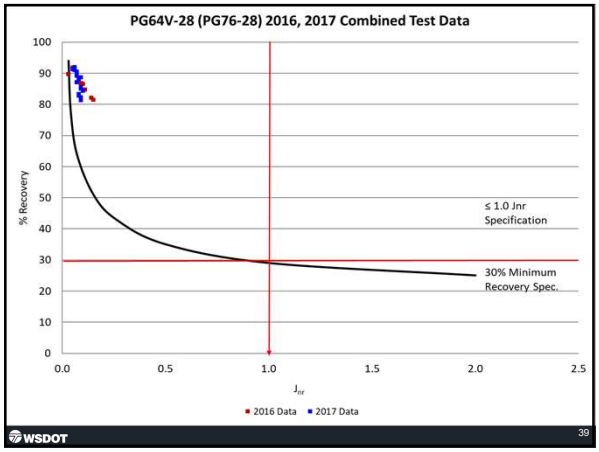
WSDOT 35

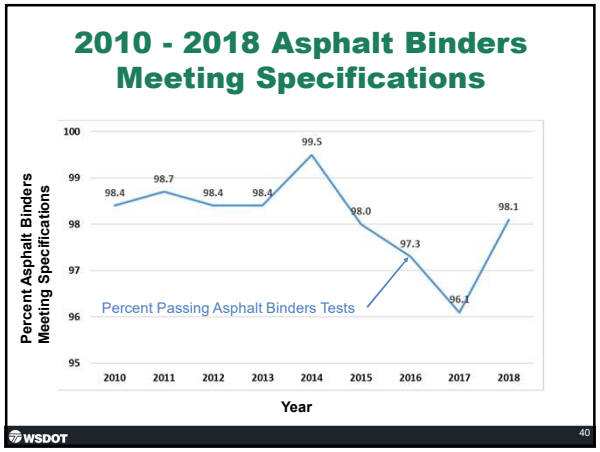


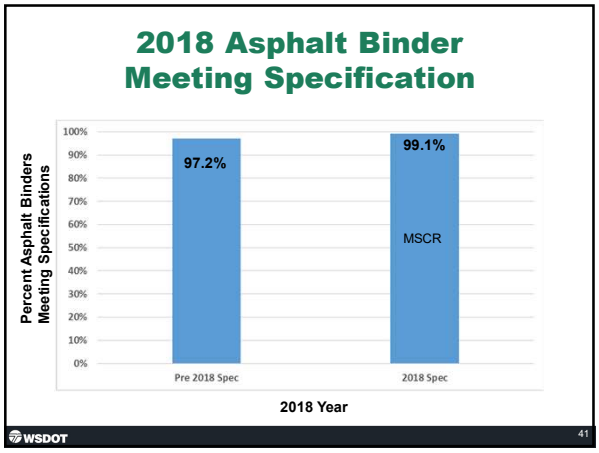
WSDOT 36

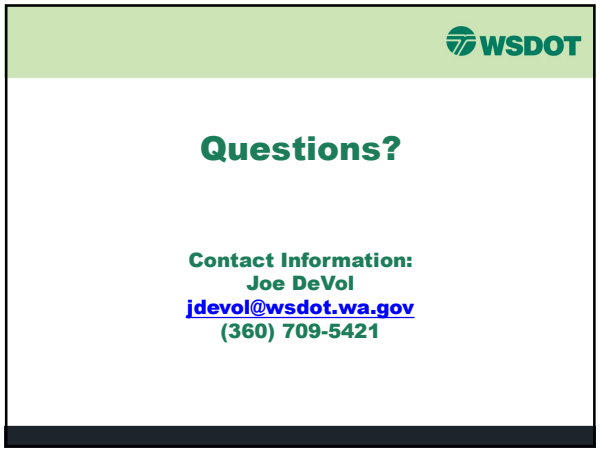

PG64H-28 (PG64-28) 2016, 2017 Combined Test Data
% Recovery
≤ 2.0 Jnr Specification
25% Minimum Recovery Spec.
2016 Data
2017 Data
WSDOT
37


PG64H-28 2018 Test Data
% Recovery
≤ 2.0 Jnr Specification
25% Minimum Recovery Spec.
2018 Data
WSDOT
38


PG64V-28 (PG76-28) 2016, 2017 Combined Test Data
% Recovery
≤ 1.0 Jnr Specification
30% Minimum Recovery Spec.
2016 Data
2017 Data
WSDOT
39


2010 - 2018 Asphalt Binders Meeting Specifications
Percent Asphalt Binders Meeting Specifications
98.4
98.7
98.4
98.4
99.5
98.0
97.3
96.1
98.1
Percent Passing Asphalt Binders Tests
2010
2011
2012
2013
2014
2015
2016
2017
2018
Year
WSDOT
40


2018 Asphalt Binder Meeting Specification
Percent Asphalt Binders Meeting Specifications
97.2%
99.1%
MSCR
Pre 2018 Spec
2018 Spec
2018 Year
WSDOT
41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Questions?
Contact Information:
Joe DeVol
jdevol@wsdot.wa.gov
(360) 709-5421