MSCR/Jnr Taskforce Report

PCCAS 2016 Conference (May 10 & 11)

Progress report of the Paving Asphalt Committee's MSCR/Jnr Taskforce

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MSCR/Jnr Taskforce Report Agenda

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1) Summary overview of the two years of TF charges and activities. (5 min, RH)

2) Summary of the 2014 and 2015 MSCR/Jnr data collection results (variabilities overview). (30 min, RH)

3) How grades transform from M320 to M332. (15 min, Shauna)

4) The possibility of adjusting G*sin δ (PAV) for S,H,V.
And National impediments to M332 implementation (30 min, Mike Anderson)

5) Latest ETG developments on MSCR/Jnr and M332, and status of Implementation by other User-Producer Groups. (15 min, Mike Anderson)

6) Where do we go from here? Possible TF Charge. (5 min, RH)

History of Taskforce Charges

Charges for the Task Force:

1. **In March 2014: Compile and bundle the nationally and regionally available (relevant) information of MSCR/Jnr and the M332 Specification, and conduct a Survey of PCCAS Members positions on M332.**

2. **In October 2014: Conduct a Collection of retroactive 2014 season Test Data, relevant to the issue of M332 Test variability.**

3. **In March 2015: Redo the 2014 MSCR Test Data Collection for the 2015 paving season, in a more comprehensive fashion, and report this at the PCCAS meeting in October 2015.**

MSCR TF Info History (PCCAS Region)

- **Many past MSCR presentations were heard by FHWA, AI, and Others**
- **3rd PCCAS ILS with AI support in 2013**
  - **Seven Binders, and 16 Labs (repeatability & Reproducibility)**
- **MSCR/Jnr Task Group** ***started in March 2014*** to; *collect and present to the Asphalt Binder Committee the national and PCCAS region specific information in order to move the issue forward,*
- **Overview of national MSCR/Jnr information (4/30/2014 Tele Conference, with 6 attached Docs)**
- **Surveys were conducted in 2014 of Users' and Producers' position;**
  - **Result: 1) All except one User Agency and one Producer were against implementing M332, and 2) all favored %ER to be replaced by %MSCR Recovery.**
- **Because several Users and Producers had been "shadow testing" M332 since 2008, a retroactive collection of 2014 data was conducted and reported in April 2015.**
  - **Result: 1) It gave a first indication of variability to be expected when testing on an ongoing project, 2) It got everyone serious about trying M332, and 3) It helped set up the data collection system.**
- **In May (2015), a comprehensive MSCR/Jnr Test Data Collection was started for the 2015 paving season.**
  - **Twelve (12) weeks of test data was to be submitted by each participant for one predominant Neat Binder and one predominant Modified Binder. (Several Labs did more and a few Labs did less.)**

2015 PCCAS MSCR/Jnr Data Collection

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Industry is concerned about the relatively large variability in the Jnr test results.
(As a "purchase spec" it puts the supplier/contractor at risk.)

The purpose of the 2015 MSCR Test Data Collection is; to get an indication of the "to be expected" variability of an "identical" binder tested within a Supplier's or a DOT's lab during 12 weeks of binder production.
[Determining the Coefficients of Variability; CoVs.]

Fifteen Labs submitted 47 sets of 12 weeks of testing data, representing 9 different neat grades and 7 different modified binder grades.

The 2015 MSCR/Jnr Test Data Collection results are here summarized.

Summary of the 2015 PCCAS MSCR/Jnr Data Collection

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To allow a more clear comparison of the M320 and M332 variabilities, the average CoVs are here tabulated.

Abbreviated

CoVs Statistical Analysis:

	Tests on ORIGINAL Asphalt						Tests on RTFO Asphalt				
Each Data set is for one grade from one Supplier (Asphalt considered identical). Once per week one sample should be completely tested and reported.	Flash Point °C (T48)	Rotational Visc, Pa.s (T316)	DSR Temp °C	DSR G*	DSR δ, °	DSR kPa (G*/Sinδ, 10 rad./sec) T315	Mass Change, % (T240)	DSR Temp °C	DSR G*	DSR δ, °	DSR kPa (G*/Sinδ, 10 rad./sec) (T315)
Average CoV per column NEAT	3.1%	4.1%		5.6%	0.7%	5.5%	-28.2%		6.2%	0.8%	6.6%
Average CoV per column MODIFIED	2.0%	10.2%		10.3%	3.4%	11.6%	-28.4%		9.2%	2.5%	10.0%

AASHTO/ASTM Precision Statements		(T316)			(T315)					(T315)
Single Operator CoV = Std Dev/Average) in %		1.2%			2.3%					3.2%
Multi-Lab CoV = Std Dev/Average) in %		3.5%			6.0%					7.8%

Summary of the 2015 PCCAS MSCR/Jnr Data Collection

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RTFO MSCR (AASHTO T350)						
Temp °C	% Rec. 0.1 kPa	% Rec., 3.2 kPa	% Rec. Diff., %	Jnr, 0.1 kPa	Jnr, 3.2 kPa	Jnr diff, %
NEAT	17.8%	34.6%	6.6%	10.8%	10.7%	17.2%
MOD	10.0%	20.8%	28.2%	36.4%	38.8%	25.3%
RTFO MSCR (AASHTO T350), at 6 °C lower temperature						
NEAT	13.3%	18.1%	9.7%	10.6%	10.1%	15.1%
MOD	9.3%	14.8%	26.7%	34.6%	32.0%	29.0%
RTFO MSCR (AASHTO T350), at 12 °C lower temperature						
NEAT	11.1%	13.8%	10.5%	15.0%	13.5%	14.9%
MOD	5.0%	6.4%	18.1%	20.1%	19.2%	17.5%

AASHTO/ASTM Precision Statements (T350)

No Precision Statement for T350 at present
No Precision Statement for T350 at present

Summary of the 2015 PCCAS MSCR/Jnr Data Collection

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Tests on PAV Asphalt						
DSR Temp °C	DSR G*	DSR δ, °	DSR kPa (G* Sinδ, at 10 rad/sec) (T315)	BBR Temp °C	Creep Stiffness MPa (T313)	M-Value (T313)
NEAT	11.1%	2.5%	10.9%		8.4%	2.1%
MOD	12.5%	2.6%	12.3%		10.8%	2.6%
Tests on PAV Asphalt, at 3 °C lower						
NEAT	10.2%	1.8%	10.4%			
MOD	10.6%	1.9%	10.7%			
Tests on PAV Asphalt, at 6 °C lower						
NEAT	12.6%	1.5%	12.3%			
MOD	11.1%	2.2%	10.5%			

AASHTO/ASTM Precision Statements					
			(T315)	(T313)	
			4.9%	2.5%	1.0%
			14.2%	6.3%	2.4%

Conclusions regarding the Average Variabilities (CoVs)

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To compare the M320 and M332 variabilities, the focus is on the test criteria which are different for the two specifications:

The following average CoV values (the variability) resulted for:

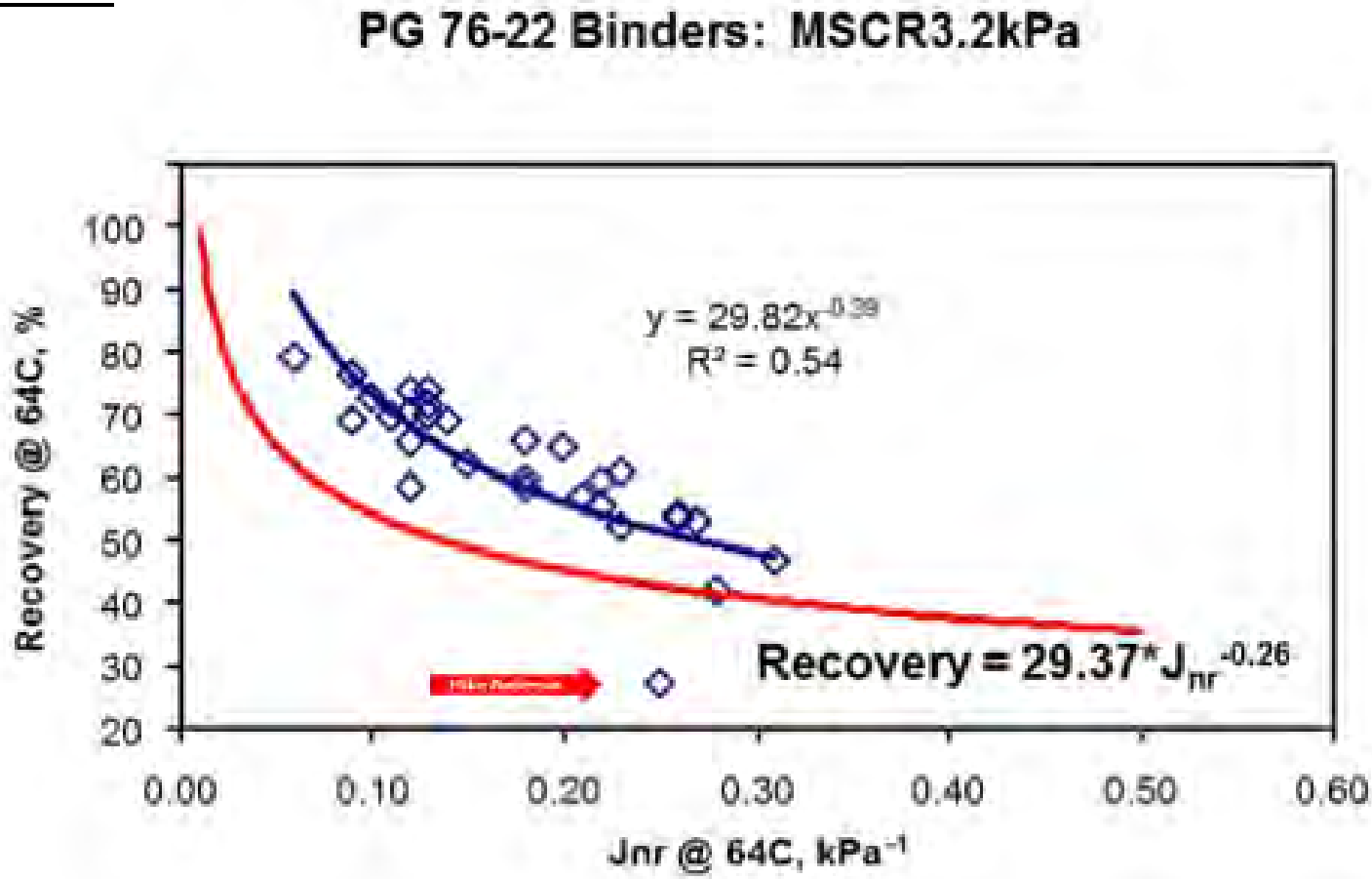
- **DSR G*/sin δ after RTFO, as 6.6% for Neat and 10.0% for Modified binders.**

- **MSCR Jnr, 3.2 kPa^{-1} after RTFO, as 10.7% for Neat and 28.8% for Modified binders, and**
- **MSCR Jnr, %Diff after RTFO, as 17.2% for Neat and 25.3% for Modified binders.**

Considering these test variabilities, the M332 results for Jnr and Jnr %Diff are more than twice as variable as the M320 test results for G*/Sin δ.

Jnr as Indicator of Elastic Property

Example Jnr-line



Jnr as Indicator of Elastic Property

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Comparing Elastic Property Indicators — Based on the Set Averages

Test Set	PG Grade	Delta of Original	% ER on Original	%ER on RTFO	% Rec at 3.2 kPa on RTFO	%Jnr Diff	Jnr-Line value	(Under) or Above the Jnr-Line by:	Elastic (Mod) or Non-Elastic
Un-Modified (Based on Delta > approx. 78 degrees and as submitted)									
#1	PG 64-22	85.73		8.22	0.94	14.65	22.29		
	CoV	0.4%		29%	53%	8%		(21.34)	Non-Elastic
#2	PG 64-22	87.64			0.4271	9.9217	21.67		
	CoV	0.3%			37%	10%		(21.25)	Non-Elastic
#3	PG 64-22	86.81			1.44	11.60	23.48		
	CoV	1.1%			53%	10%		(22.05)	Non-Elastic
#4	PG 64-22	85.30							
	CoV	0.4%							
#5	PG 64-22	86.14			4.35	12.45	28.78		
	CoV	0.1%			9%	10%		(24.43)	Non-Elastic
#6	PG 64-16	89.38				2.66	20.39		
	CoV	0.1%				36%			
#7	PG 64-16				1.21	9.94	21.77		
	CoV				34%	37%		(20.56)	Non-Elastic
#8	PG 64-10	87.48			0.55	6.18	22.96		
	CoV	0.3%			33%	15%		(22.42)	Non-Elastic
#9	PG 64-28	85.69			1.24	15.29	21.38		
	CoV	0.6%			62%	13%		(20.14)	Non-Elastic
#10	PG 70-10				0.95	8.79	21.58		
	CoV				28%	27%		(20.62)	Non-Elastic

Jnr as Indicator of Elastic Property

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Comparing Elastic Property Indicators — Based on the Set Averages

Test Set	PG Grade	Delta of Original	% ER on Original	%ER on RTFO	% Rec at 3.2 kPa on RTFO	%Jnr Diff	Jnr-Line value	(Under) or Above the Jnr-Line by:	Elastic Jnr-Line ?
Modified (Based on Delta < approx. 78 degrees and as submitted))									
#20	PG 64-28PM	64.62		84.22	81.20	38.04	41.78		
		4.9%		4%	16%	31%		39.41	ELASTIC
#21	PG 64-28	75.89	72.00	72.75	25.66	39.56	26.00		
	CoV	1.0%	4%	4%	12%	20%		(0.34)	Non-Elastic
#22	PG 64-28NV	73.27			27.11	62.48	24.24		
	CoV	0.9%			11%	16%		2.87	ELASTIC
#23	PG 64-28NV	70.68			46.86	100.55	26.91		
	CoV	1.9%			14%	17%		19.95	ELASTIC
#24	PG 64-28NV	70.65			44.53	108.65	25.99		
	CoV	1.5%			19%	17%		18.54	ELASTIC
#25	PG 64-28P	76.59		74.08	17.42	52.65	23.31		
	CoV	1.7%		4%	32%	7%		(5.90)	Non-Elastic
#26	PG 64-28NV	70.54			43.16	61.18	26.11		
	CoV	2.3%			32%	25%		17.05	ELASTIC
#27	PG 64-28	79.97	65.89		3.53	30.69	21.16		
	CoV	5.0%	7%		36%	26%		(17.63)	Non-Elastic
#28	PG 64-28PM	62.98	92.71		54.55	82.96	28.40		
	CoV	0.3%	2%		2%	6%		26.15	ELASTIC

Jnr as Indicator of Elastic Property

Test Set numbers, PG-Grades, Delta Original, and below (neg=Non-Elastic) or above the Jnr-line (Elas)

Test Set #	PG Grade	Ave Delta	Modified Difference w/ Jnr-line	Test Set #	PG Grade	Ave Delta	Modified Difference w/ Jnr-line	
Un-Mod				MOD				
#1	PG 64-22	85.7	-21.41	#20	PG 64-28PM	64.6	38.63	
#2	PG 64-22	87.6	-21.30	#21	PG 64-28	75.9	-0.48	Non
#3	PG 64-22	86.8	-22.19	#22	PG 64-28NV	73.3	2.82	
#4	PG 64-22	85.3		#23	PG 64-28NV	70.7	19.78	
#5	PG 64-22	86.1	-24.45	#24	PG 64-28NV	70.7	18.37	
				#25	PG 64-28 P	76.6	-5.97	Non
#6	PG 64-16	89.4		#26	PG 64-28NV	70.5	15.29	
#7	PG 64-16		-20.50	#27	PG 64-28	80.0	-17.72	Non
#8	PG 64-10	87.5	-22.42	#28	PG 64-28PM	63.0	26.10	
#9	PG 64-28	85.7	-20.18					
				#29	PG 70-28	72.4	13.14	
#10	PG 70-10		-20.71	#30	PG 70-28	67.1	25.57	
#11	PG 70-10	87.6	-21.44	#31	PG 70-28ER	68.8	23.25	
				#32	PG 70-28ER	71.1	16.53	
#12	PG 58-28	87.2	-21.98					
#13	PG 58-28	80.1	-16.85	#33	PG 70-22ER	74.4	-0.79	Non
#14	PG 58-22	86.1	-23.02	#34	PG 70-22ER	77.8	-8.53	Non
#15	PG 58-22	88.4		#35	PG 70-22 ER	73.5	4.37	
#16	PG 52-28		-22.61	#36	PG 70-22ER	74.5	-2.12	Non
				#37	PG 70-22	74.0		
#17	PG 70-22	79.6	-15.24					
#18	PG 70-22	81	-18.66	#38	PG 76-22	63.2	28.38	
#19	PG 70-22	78.7	-6.47	#39	PG 76-22NV	62.0	33.82	

MSCR/Jnr 2015 Data Collection Summary

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What is an "identical" binder:

- **For a Supplier, this is a particular grade batched and kept for the duration of a large project, or a grade which is constantly backfilled in the tank.**
- **For a DOT, this is one grade from one Supplier used on one large job, or several smaller jobs during the same time period.**

- **Elaborate instructions accompanied the MSCR/Jnr Test Data Collection Excel Spreadsheet.**
- **The instructions for DOTs and for Producers were slightly different to account for the differences of securing that each of their data sets truly represented a single "identical" binder during the 12 weeks testing period.**

Discussion Items

- **Grouping the variability of different binder grades together is considered justified, because regardless of grade the variability should remain similar. All PG grades need to meet the same physical requirements according to the M320 Specification".**

- **The variabilities reported here include both the single operator test variability and the production variability of a particular "identical" binder grade during a 12 week paving period. This is different than the official AASHTO/ASTM Test precision Statements. However, it does represent the real average binder test variability on a paving project.**

The purpose of this report is to provides the data for the readers to make their own conclusions regarding the increased variability (and spec compliance risks) when switching from M320 to M332.

MSCR/Jnr TF Report

3) How grades transform from M320 to M332. (15 min, Shauna)

4) The possibility of adjusting G*sin δ (PAV) for S,H,V.
And National impediments to M332 implementation (30 min, Mike Anderson)

5) Latest ETG developments on MSCR/Jnr and M332, and status of Implementation by other User-Producer Groups. (15 min, Mike Anderson)

M332 Implementation Status per August 2015

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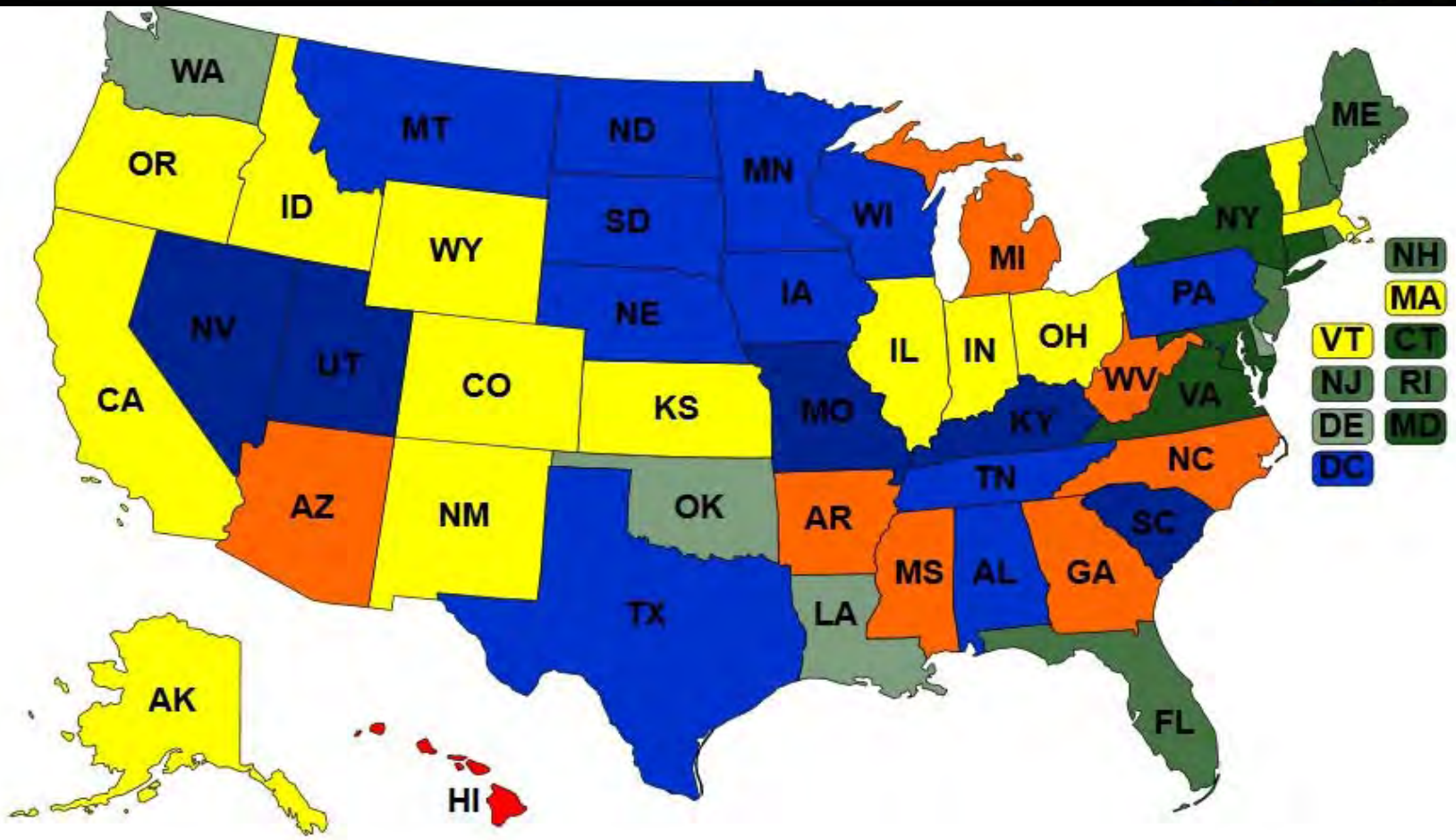
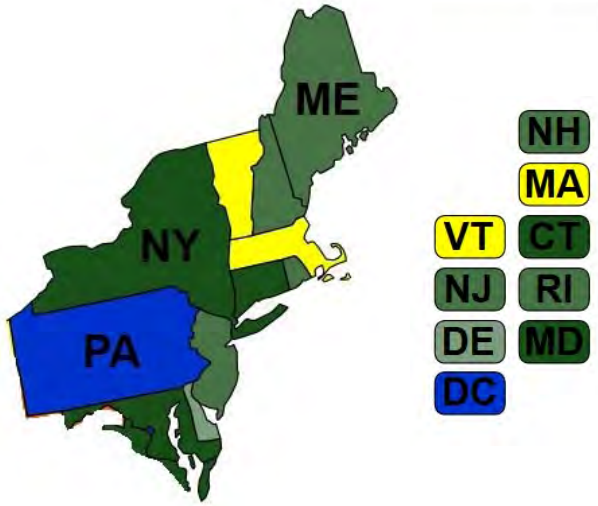


State Color Key

- Full Implementation
- Full Implementation Modified Grades Only
- Planned Full Implementation (12 months)
- Partial Implementation
- Planned Partial Implementation (12 months)
- Considering Implementation (No TIme Frame)
- Testing/Evaluation
- No Activity
- To Be Posted Soon

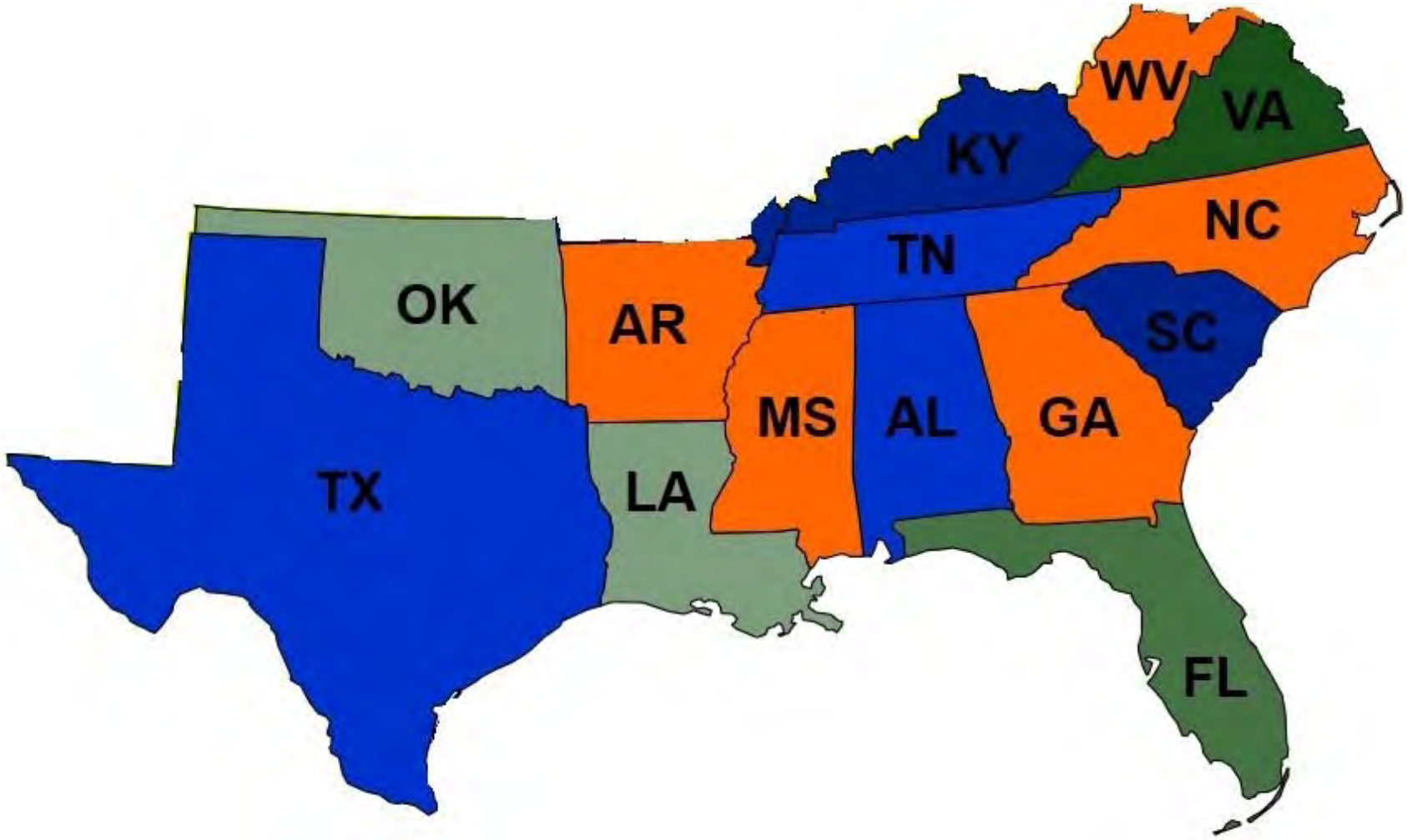
Northeastern Asphalt UPG Status

- NEAUPG leads the nation in MSCR implementation
- NEAUPG agreed to uniform implementation of MSCR in 2013 using M 332 grade designations



- While not all NEAUPG States have fully implemented M 332 at this time, all states have agreed to stick with this approach (including using the curve for % Rec)
- NY, MD, CT – fully implemented for all grades
- NH, ME, RI, NJ – fully implemented for modified grades only
- PA and DE are allowing substitution of PG 64-22 for PG 76-22 in 2015

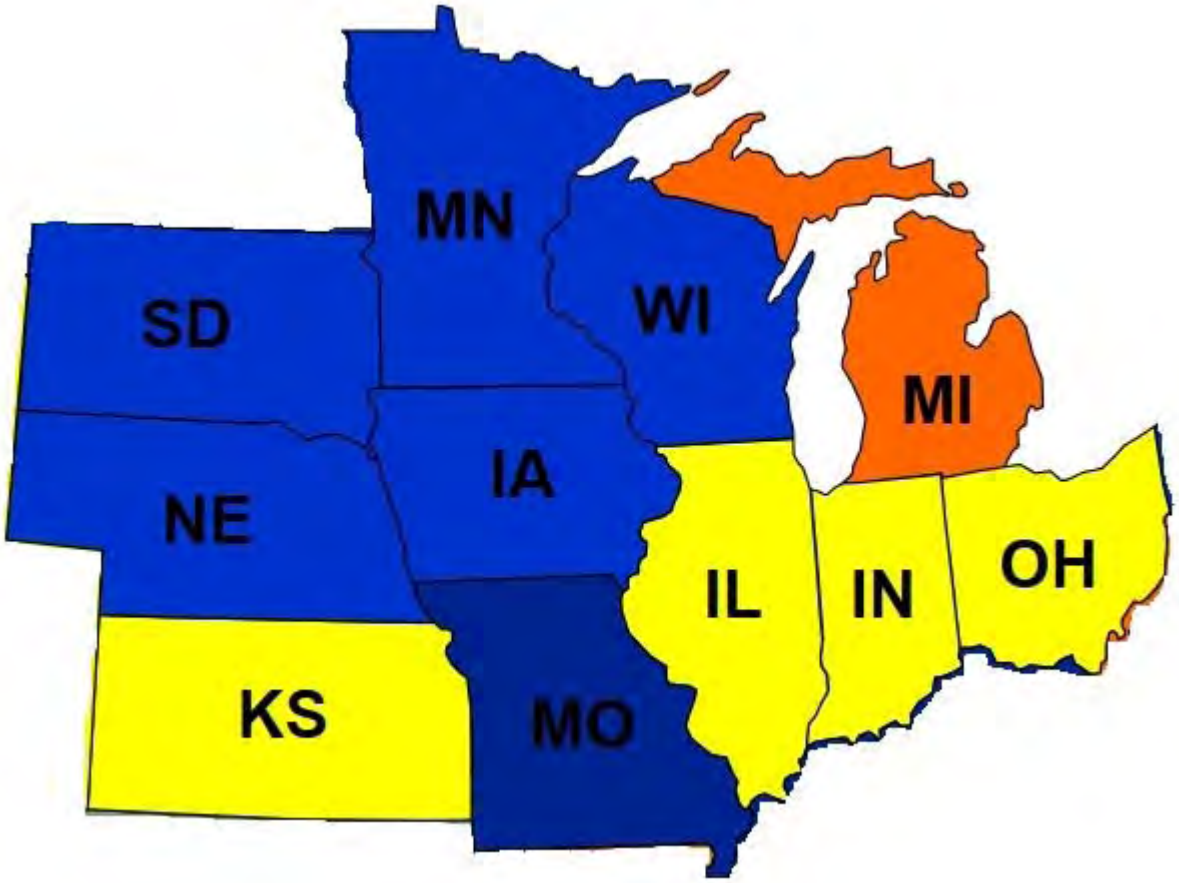
Southeastern Asphalt UPG (SEAUPG)



SEAUPG Status

- VA only state with full adoption of M 332 for all grades; OK will implement fully in 2016
- FL implemented for modified grades in 2013; LA will implement for modified grades in 2016
- KY, SC, TN replaced PG-Plus test with % Rec
- AL, TX, GA, MS, NC, WV, AR "considering" implementation but currently lag behind
- Concern in SEAUPG: Non-uniform implementation
  - FL and LA have already adopted MSCR using current designations (PG 76-22); several other states have said they will do the same
  - Different Jnr and MSCR Recovery % criteria being used
    - Curve versus minimum MR % criteria (KY adopted 60% min for 76 grade)

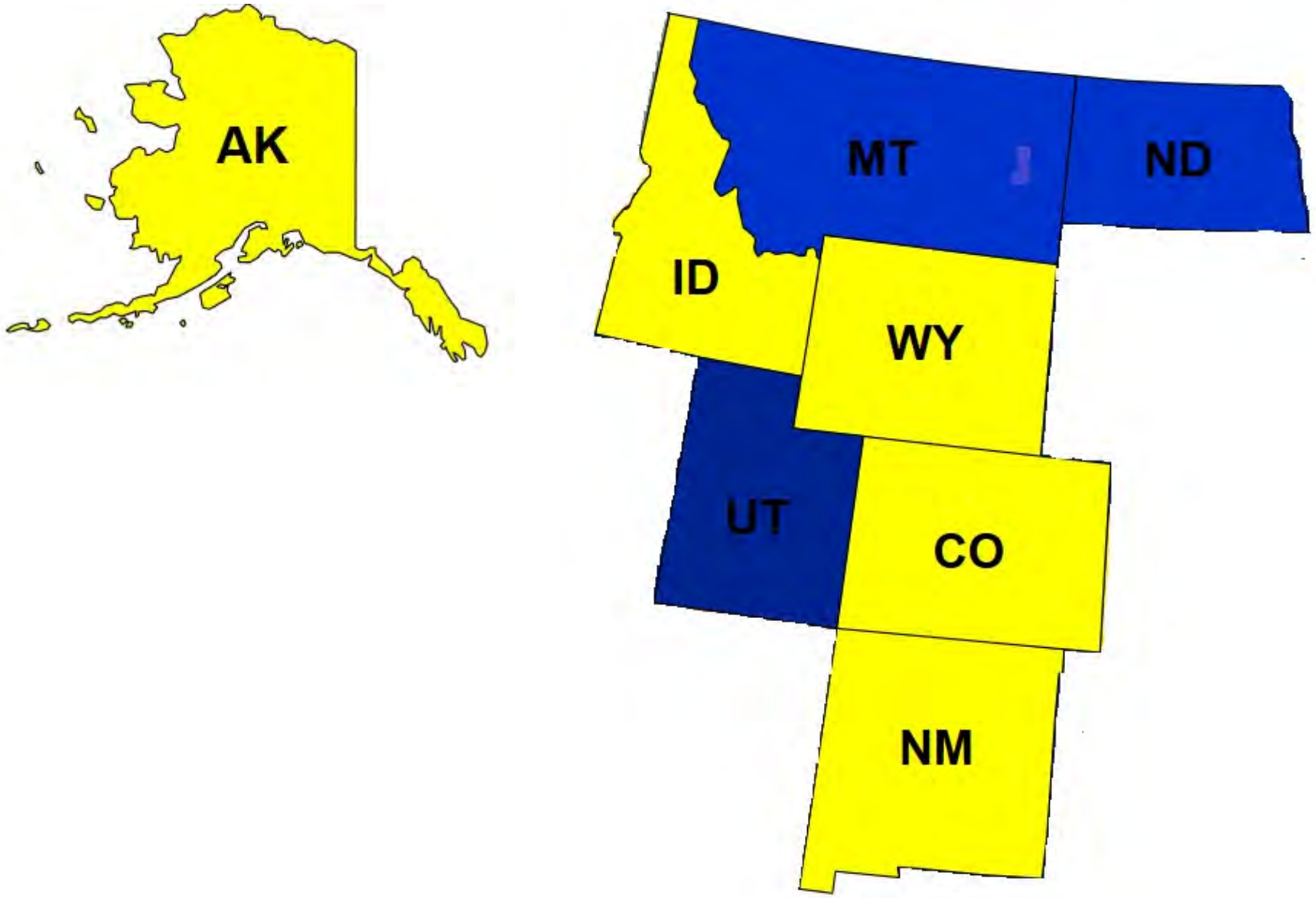
North Central Asphalt UPG (NCAUPG)



NCAUPG Status

- MO specifies M 320 grades but allows substitution of M 332 for all binder grades
  - When M 332, no testing for elastic behavior is required
- CSBG States make up the NW segment of the NCAUPG (ND, SD, NE, IA, MN, WI)
- In 2015, CSBG States adopted % Rec in lieu of E.R.
  - % Rec minimum based on M320 grade
- CSBG also agreed to move towards full implementation of M332 in 2016
  - AI will work with the six States to hold regular WebEx meetings with industry participation
  - Need to map M320 grades over to M332 grades

Rocky Mountain AUPG (RMAUPG)



RMAUPG Status

- All states still testing and evaluating through Western Cooperative Test Group (WCTG)
  - On-going round robin testing with states and suppliers
    - Analysis performed by Univ. of WI-Madison
  - Variability still high but improving
    - Especially for non-standard J_{nr} of 10 kPa round robin testing
- Industry hesitant on implementation
  - Concern over variability
    - Higher variability with % Rec versus current PG-Plus tests
- No form of MSCR adoption for binders at this time
- Exception: UT uses % Rec on micro surfacing emulsion spec, min % on residue
  - MT wants to do the same

Pacific Coast Conference for Asphalt Specs

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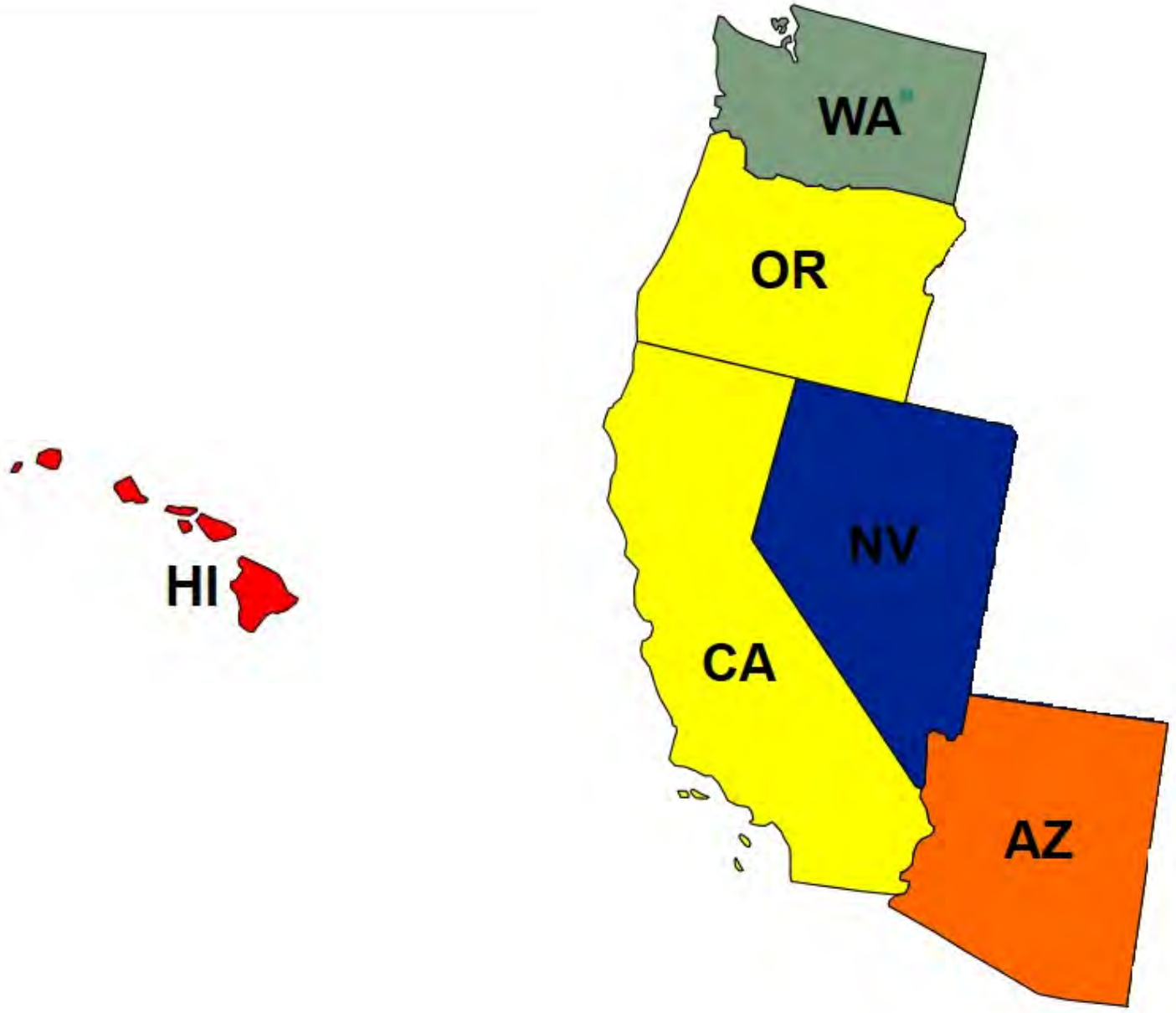

PCCAS Status

- NV started in Jan 2014 to require test results for M332 for their PG 76-22NV grade
  - Test temp = 76^{o} C; J_{nr}= 2.0; % $Rec_{3.2}$= 30%
- WA plans to implement M332 in 2018 for modified binders only (H,V and E grades)
- MSCR/J_{nr} Task Group formed in mid-2014

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Discussion!

<u>Where do we go from here?</u>